

BIOLOGICAL SOCIETY OF PAKISTAN

**Monograph No. 3**

# Grasses of West Pakistan

**SULTAN AHMAD**

*Government College, Lahore*

&

**R.R. STEWART**

*Gordon College, Rawalpindi*

**First Edition**

PUBLISHED BY THE SOCIETY  
AT THE BIOLOGICAL LABORATORIES, GOVERNMENT COLLEGE  
LAHORE, PAKISTAN.

*Part I. Published 1958*

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## Introduction

This flora includes the grasses of West Pakistan and those parts of old state of Kashmir which are now administered by the Government of Azad Kashmir. The districts of Kashmir included in this work are Poonch, Mirpur, Muzaffarabad, the Kishenganga Valley, the whole of the Gilgit Agency and Baltistan. The frontier areas of Baluchistan, the Kurram, Chitral, Dir and Swat are also included. The area covered is a large one with many kinds of climate, from the desert of Sind which are near sea level to the well watered Himalayan valleys and the high level deserts of Gilgit and Baltistan in the north.

West Pakistan is bounded on the west by the Arabian Sea and Iran, on the north by Afghanistan and a small corner of the U.S.S.R., on the east by Kashmir and on the south by India. As most of the area is arid and much of it desert, only about 4% of the country is covered by forests so grasses are abundant and of the greatest importance. They are found at all altitudes from the seacoast to the alpine pastures of the Himalayas and the Karakorum Mts. They are found in all environments, on sand dunes, in stony deserts, in shallow water, by roadsides and as weeds in fields, in rock crevices and in rich deep soil.

As might be expected from the geographical position of the area our grasses are related to those of all of the neighbouring regions and there are not many endemics. Many of our grasses are the same as those in North Africa and the Near East. There is a large Central Asian element along the northern frontier. Many Himalayan grasses extend from Nepal to the Nuristan region of Afghanistan. Tropical and subtropical grasses flourish in the plains during the monsoon and ascend to about 7,000' in the mountains. In the temperate and alpine regions of the mountains there are grasses which are found in many parts of the northern hemisphere and about cultivation there are many widespread ruderals. 375 grasses are listed in this work and as this is the first attempt to list all of the grasses which are found in this country there are probably many of the rarer grasses which have escaped our notice.

Our work is based on the collections which we have made ourselves and are preserved at the Punjab University and at Gordon College, Rawalpindi. They are also based on the collections of our students, colleagues and various collectors who have submitted specimens to us for

naming. One of us (R.R.S) has studied the grass collections at Kew, Dehra Dun and at the New York Botanical Garden and have taken advantage of the relevant literature. Most of our puzzles have been sent to Dr. N. L. Bor, Asstt. Director of the Royal Botanic Gardens at Kew who has recently completed a revision of Volume 7 of the Flora of British India, adding hundreds of species which are not included in that fine pioneer work which was published in 1896. Dr. Bor has examined many hundreds of specimens which we have sent him and has helped us in many ways.

It is unfortunate that the old historic collections of grasses made in our area during the last 120 years are preserved in many different places in Europe, America and India and none of them are in Pakistan. There is no national herbarium which the student can consult and there is little literature available. Dr. Bor's book, unfortunately, is still awaiting a publisher. Hundreds of people have collected grasses in Pakistan but so little has been published on our grasses that no one knows where all these collections are or what they contain.

Strangely enough much more collecting has been done in certain out of the way areas than in more accessible places. Scores of expeditions have gone to Nanga Parbat, to Baltistan and the Gilgit Agency to climb mountains and on the side have collected plants. Chitral has been fairly well known for many years because several of the officers of the Chitral Relief Expedition, including the commander, Gen. Gatacre, were interested in botany. On the other hand hardly anything was known of the plants of Swat and Poonch until after 1947 when Pakistan came into existence. There may not be many new species awaiting discovery but we still know little about the distribution and ecology of our grasses and a surprising number have been reported only once or twice. It is hoped that this study will encourage others to correct and supplement our work.

The rainfall of a region is the chief factor in determining what plants can exist. As West Pakistan has a great variety of climates the rainfall varies tremendously. Nor only does it vary from place to place but it varies from year to year. Our monsoons are very fickle and may cause famine from floods one year and from drought the next. There are places in the Sind desert with as little as two inches of rain in a year and the rainfall of Baluchistan averages about 8.6 inches a year. Taking a twelve year period the total rainfall of Rawalpindi varied from 20.75 to 55.07 inches. This variation is typical of our whole area. Most of this rain falls in July and August with a second period when rain can be expected



in the winter. The time of the winter rains is much more variable than is that of the summer rains. Two thirds of the total rainfall of Rawalpindi falls during the summer monsoon. The precipitation during the monsoon varies from one inch in Quetta, 4.7" in Peshawar, 14.8" in Lahore, 22.5" in Rawalpindi to an average of 36.2" in Murree.

Because of the seasonal nature of the rainfall there are only two seasons when collecting can be done to advantage. The first is from about the first of March to the middle of April and the second from the middle of August to the middle of September. This applies to the plains. In the hills the altitude affects the beginning of spring and the onset of winter. Little grows in Murree at 7,000 ft. before the middle of April, and in the Kagan Valley snow still lies in many places until after the first of July so that the growing season only lasts from eight to ten weeks each year in the higher mountains.

Extremes of temperature are also to be found in Pakistan. In Rawalpindi at 1700 ft., at the base of the foothills, the maximum temperatures vary each year from 108 to 118°F while there are places in the Sind deserts where the maximums are ten degrees higher. In Rawalpindi the minimum temperatures range from 26 to 32°F. Snow rarely falls below 3,000' and if it does it does not lie long. Snowfall in the higher mountains is very heavy and in the Nanga Parbat region and in the Karakorum Mts. of Gilgit and Baltistan we find many of the largest glaciers outside of the arctic. All of this variation in climate is reflected in the flora and there are grasses suited to all of these differing climatic conditions.

Man and his domestic animals and his engineering has profoundly altered the original flora of West Pakistan. Overgrazing, merciless wood cutting due to ignorance, poverty and over population has rapidly altered the ground cover with disastrous results. Millions of acres of irrigated land in the Punjab and Sind have been reclaimed from the desert and foothill and other vegetation of a more mesophytic type has moved in. Large areas which were fertile some years ago are now water logged and other areas have become infertile through salt accumulation. These conditions affect the grass flora encouraging the less valuable types. Annuals get their chance in disturbed soil and many of our plains and desert grasses are annuals. The worst effects of erosion are to be seen in the foothill zone.

A few of the more important collectors of grasses should be noted. First place should probably be given to John Firminger Duthie (1845-1922) Supdt. of the Saharanpur Botanical Garden (which later became a part of

the Forest Research Institute at Dehra Dun where one set of his specimens is preserved). His Fodder Grasses of Northern India, 1888, is still useful although many of the names he used are not now in current use. He himself collected widely and his collector, Inayat, was the first to do important work in Hazara.

The first important collector was Hugh Falconer (1808-65) who collected in Gilgit and Baltistan and sent collectors there from 1834 to 1838. The next collector was William Griffiths of the Calcutta Botanical Garden who was the first to collect in Baluchistan accompanying the Army on the expedition to Afghanistan in 1839. The next collector for whom many Sind and Baluchi plants are named was Dr. J. E. Stocks who collected between 1848-1850. In 1848 Thomas Thomson who collaborated for many years with Sir Joseph Hooker in preparing the Flora of British India accompanied the Tibetan Boundary Commission and discovered many novelties as did Charles Baron Clarke in 1879. Clarke did important work in the field collecting more than 30,000 numbers and then spent years at Kew on the sedges, composites etc.

Another very important collector was J. E. T. Aitchison who collected in Jhelum and Rawalpindi Districts and on the frontier especially in the Kurram Valley and accompanied the army into Afghanistan collecting there in 1879. Many species have been named for him. J. L. Stewart, author of Punjab Plants, 1869, was another industrious collector as were R. N. Parker, Chief Conservator of Forests and author of the valuable Forest Flora of the Punjab, Hazara and Delhi. J. R. Drummond of the I.C.S. and Capt. G. Wingate of the Indian Army were also good collectors and their collections are at Kew. One of us (R.R.S.) began collecting in 1912 in Ladak, the Punjab and Kashmir and his last trip was to Baluchistan in 1957. The other author (S.A.) has been collecting in the Punjab, Swat, Hazara and the Murree Hills.

The authors wish to make grateful acknowledgements to Dr. N. L. Bor for his kind help in the determination of the specimens of grasses ; to all those colleagues who have furnished material ; to Messers M. Aslam Khan and Muhammad Shafi for assistance in making the diagrams.

S. A.

R. R. S.

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## Family : Gramineae

Annual or perennial herbs, rarely shrubs or trees. Culms cylindrical, jointed, hollow or solid in the internodes. Leaves alternate, 2-ranked, consisting of a blade, sheath and ligule; blades generally linear to lanceolate, convolute or involute or terete; sheaths encircling the culms with the margins free and overlapping or more or less connate; ligule membranous or reduced to a ridge of hairs or absent. Flowers usually bisexual, sometimes unisexual, usually consisting of 2 or 3 fleshy scales (lodicules), stamens and pistil, subsessile between two bracts (lemma and palea), the whole forming a floret. Florets one to many, distichous, sessile on a minute axis (rachilla) and bearing at the base two empty bracts (upper and lower glume), the florets and glumes forming a spikelet. Spikelets pedicelled or sessile, arranged in open or contracted panicles or racemes or spikes. Stamens 1-6, usually 3. Gynaecium tricarpellary; ovary 1-celled, ovule one, anatropous, often adnate to the adaxial side of the carpel; styles usually 2, rarely 1 or 3; stigmas papillate or more frequently plumose. Fruit mostly a caryopsis, rarely a nut or berry (in some Bambuseae), or utricle (Sporoboleae, *Eleusine* etc.). Seed with copious endosperm and a small embryo at the base on the abaxial face.

### KEY TO THE SUBFAMILIES

- Spikelets 2-flowered, falling entire at maturity, usually with the upper floret fertile and the lower male or barren and in the latter case often reduced to the lemma, frequently dorsally compressed; rachilla not produced.....I. **Panicoideae**
- Spikelets 1-to many-flowered, breaking up at maturity above the more or less persistent glumes, or if falling entire then not 2-flowered with the lower floret male or barren and the upper hermaphrodite, usually more or less laterally compressed or terete; rachilla produced.....II. **Pooideae**

### I. Subfamily : Panicoideae

#### KEY TO THE TRIBES

1. Spikelets bisexual, if unisexual, not in sharply distinct parts of the same inflorescence.....2
- Spikelets unisexual, the male and female in different inflorescences or on different parts of the same inflorescence.....3. **Maydeae**

2. Lower glume smaller, or very small or absent ; glumes and sterile lemma membranous ; fertile lemma and palea firmer in texture..... 1. **Paniceae**
- Lower glume longer than the second or lemmas, indurated, with edges folding round and embracing the spikelet...2. **Andropogoneae**

### Tribe 1. **Paniceae**

Spikelets usually similar, hermaphrodite or rarely unisexual, usually falling entire at maturity, 2-flowered, with the lower floret male or neuter, and the upper bisexual. Spikelets arranged on a continuous rachis forming solitary or scattered spikes, racemes or panicles. Glumes usually membranous, lower usually smaller than the upper. Sterile lemma similar to the upper glume, awnless or with straight, short awn arising from the apex. Stamens generally 3.

#### KEY TO THE GENERA

1. Spikelets sunken in the cavities of the flat, corky, tardily disarticulating rachis..... 1. *Stenotaphrum*
- Spikelets not sunken in the cavities of the rachis .....2
2. Spikelets not surrounded by an involucre formed of soft hairs or bristles .....3
- Spikelets surrounded by an involucre formed of either soft hairs or rigid bristles.....14
3. Both florets perfect, or if the lower male or barren, then its lemma indurated (hardened) like that of the upper floret ..... 2. *Isachne*
- Upper floret only perfect; sterile lemma membranous.....4
4. Fertile lemma thinly cartilaginous, with hyaline flat margins.....5
- Margins of the fertile lemma not hyaline, of the same texture as the rest of the lemma, mostly inrolled.....6
5. Spikelets awnless .....3. *Digitaria*
- Spikelets awned..... 4. *Alloteropsis*
6. Spikelets with a ring-like basal callus ..... 5. *Eriochloa*
- Spikelets without a ring-like basal callus.....7
7. Spikelets in spike-like, usually one-sided racemes, adaxial (the lower glume turned away from the rachis) or abaxial (the lower glume turned towards the rachis) ..... 8
- Spikelets arranged in open or contracted panicles, without definite orientation towards the rachis.....6. *Panicum*

8. Glumes saccate-inflated..... 7. *Sacciolepis*  
 Glumes not saccate-inflated ..... 9
9. Spikelets abaxial..... 8. *Brachiaria*  
 Spikelets adaxial.....10
10. Lower glume wanting ; fertile lemma with 5-7 curved nerves.....  
 .....9. *Paspalum*  
 Lower glume present ; fertile lemma with indistinct nerves.....11
11. Glumes obtuse or acute, awnless ..... 12  
 Glumes awned, rarely acuminate only ..... 13
12. Fertile lemma acute or apiculate but emucronate..... 10. *Paspalidium*  
 Fertile lemma obtuse, mucronate.....11. *Urochloa*
13. Longest awn on the sterile lemma or glumes acuminate.....  
 .....12. *Echinochloa*  
 Longest awn on the lower glume.....13. *Oplismenus*
14. Involucre formed of soft hairs ; lower glume absent ; the upper  
 lemma and palea shorter than the lower lemma.....14. *Tricholaena*  
 Involucre formed of rigid bristles ; lower glume present ; the upper  
 lemma and palea about as long as the lower lemma.....15
15. Involucre unilateral ; bristles persisting after the spikelets have  
 fallen.....15. *Setaria*  
 Involucre completely enveloping the spikelets ; bristles falling with  
 the spikelets at maturity.....16
16. Bristles united at the base.....16. *Cenchrus*  
 Bristles free at the base.....17. *Pennisetum*

### 1. *Stenotaphrum* Trin.

Stoloniferous perennials with compressed sheaths and short, obtuse blades. Racemes spike-like, few flowered, embedded in one side of an enlarged corky common axis disarticulating at maturity. Spikelets remaining attached, abaxial, sessile. Spikelets 2-flowered ; lower floret male or reduced to a sterile lemma. Lower glume small, obtuse ; upper glume nearly as long as the spikelet. Lower floret ; lemma coriaceous, as long as the spikelet, 3-to 7-nerved ; palea 2-keeled, as long as the lemma or absent. Upper floret ; lemma 3- to 5-nerved ; palea of the same texture and subequal.

#### 1. *Stenotaphrum dimidiatum* Brongn.

*Stenotaphrum dimidiatum* Brongn. in Duperr., Bot. Voy. Coq. 127 (1827).

Perennial. Culms ascending from a creeping and prostrate base, up to 30 cm. high; internodes compressed, glabrous. Leaf-blades folded in

vernation afterwards flat, linear, 2.5-12.5 cm. long, 0.4-2.4 mm. wide, glabrous, margin smooth; *sheaths* compressed, keeled, glabrous or ciliate upwards; *ligule* a fringe of short hairs. *False spikes* solitary, terminal on the primary and secondary culms, 4-12 cm. long, borne on a slender, glabrous peduncle; common axis glabrous, flat on the back and acutely keeled on the face, lateral angles winged, when seen from the back alternately toothed, 2-5 mm. wide. *Receses* sessile, sunk in the chamber, 3- to 5-spiculate; rachis wavy or zig-zag ending in a subulate point; pedicel reduced to a very short, ciliate stump. *Glumes* dissimilar; lower ovate-obtuse, membranous, nerveless, 1-1.5 mm. long, ciliolate at the tip; upper convex to boat-shaped, acute, shorter than the spikelet, 7-(9-11-) nerved, glabrous or ciliolate towards the tip. *Lower floret* male; lemma as long as the spikelet, 5- to 7- nerved, glabrous or ciliate near the tip; palea shorter than the lemma. *Upper floret* bisexual; lemma lanceolate-acute, thinly cartilaginous, 5-nerved.

Sind.

## 2. *Isachne* R. Br.

Annual or perennial, often aquatic grasses with ovate or linear-lanceolate leaves. Spikelets in open or contracted panicles, subglobose or obovoid, awnless, 1- to 2-flowered; rachilla not or very rarely produced beyond the upper floret, disarticulating between the florets, the glumes also at length deciduous. Glumes equal or nearly so, more or less similar; lower dorsally flattened, membranous or thinly coriaceous, prominently nerved but the upper usually wider, subequal to nearly as long as the spikelet, convex. Lower floret perfect, if staminate or neuter then its lemma hardened like that of the upper floret; lemma as long as the spikelet; palea equalling the lemma. Upper floret bisexual or male; lemma jointed and often stipitate on the short rachilla, hemispheric; palea similar in texture.

### 1. *Isachne himalaica* Hook. f.

*Isachne himalaica* Hook. f., Fl. Brit. Ind. 7 : 23 (1896).

Annual or perennial; innovation shoots intravaginal. Culms 30-60 cm. high, erect, branched at the base, slender or stout, smooth, glabrous. Leaf-blades flat, linear or linear-lanceolate, strict, scaberulous above, 3-13 cm. long, up to 5 mm. broad, margins above the middle densely ciliate; *sheaths* smooth, with a stiffly ciliate mouth; *ligule* a tuft of long slender erect stiff hairs up to 2.5 mm. long. Panicle pyramidal, up to 10 cm. long, with strict branches, 3-5 cm. long; axis and branches smooth and



glabrous. Spikelets green or purplish, 2.5-1.8 mm. long, subglobose, pedicels long, capillary, tips hardly thickened. Glumes about equalling the lemmas, ovate, many-nerved, scabrid or bristly. Florets 2, almost contiguous (not separated by a minute rachilla joint), lower male; upper bisexual. Lower lemma as long as the spikelet, ovate-hemispherical and indurated. Upper lemma similar in size, shape and texture; stamens 3; anthers 0.5 mm. long.

Wah, Attock Dist.; Poonch; Haripur Hazara.

### 3. *Digitaria* Heist.

Perennial or annual grasses, with linear or linear-lanceolate, often flat leaves. Racemes often in clusters, digitate or more or less spaced on a common axis; rachis triquetrous or flat, with angles often herbaceous, winged; pedicels unequal. Spikelets 2-nate, 2-flowered, the lower represented by a lemma, the upper bisexual. Lower glume often small (sometimes absent), hyaline; upper membranous, mucicous, shorter than the spikelet, rarely longer, 3- to 5-nerved, rarely nerveless. Lower floret neuter; lemma often like the upper glume, 3- to 9-nerved, straight, parallel; palea very small. Upper floret bisexual; lemma papyraceous, 1- to 3- (rarely 5-) nerved; palea almost as large and of the same texture, 2-nerved, the margins of the lemma spread over the face of the palea leaving little of it exposed.



Fig. 1.—*Isachne himalaica*

## KEY TO THE SPECIES

1. Racemes long-peduncled, devoid of spikelets at their base over a long distance.....1. *D. pennata*  
Racemes sessile, if apparently bare at the base then with traces of arrested spikelets .....2
2. Hairs on the spikelets verrucose.....3  
Hairs on the spikelets not verrucose.....4
3. Annual ; spikelets 1.6-1.8 mm. long ..... 2. *D. violascens*  
Perennial ; spikelets less than 1.5 mm. long..... 3. *D. preslii*
4. Hairs on spikelets clavate.....5  
Hairs on spikelets not clavate.....7
5. Tips of the pedicels cupuliform with hairs on the rim and below.....  
.....4. *D. stricta*  
Tips of the pedicels somewhat thickened, without a rim of hairs.....6
6. Caryopsis distinctly apiculate and protruding above the lower lemma  
.....5. *D. granularis*  
Caryopsis not protruding above the lower lemma.....6. *D. ischaemum*
7. Perennial, stoloniferous ; culms bulbous at the base and covered with dense silky villous hairs ; spikelets silky.....7. *D. nodosa*  
Annual ; culms neither bulbous nor villous at the base.....8
8. Racemes densely pubescent in the lower axils with or without a few long hairs ; lower glume wanting ; upper less than 1/2 the length of the spikelet.....8. *D. setigera*  
Upper glume well developed, mostly 1/2-3/4 the length of the spikelet ; lower glume present.....9
9. Spikelets of each pair heteromorphous (sessile spikelets glabrous ; the pedicelled coated with long hairs spreading at maturity).....10  
Spikelets of each pair homomorphous (both spikelets with the same type of indumentum) .....11
10. Racemes rather stout, very stiff, often only 2 ; upper glume 1/2-2/3 the length of the spikelet ; lower lemma of the sessile spikelet with very prominent nerves, the internerve spaces often slit-like .....  
.....9. *D. bicornis*  
Racemes thin and flexible, nodding, usually more than 3; upper glume 2/3-3/4 the length of the spikelet ; lower lemma of the sessile spikelet without very prominent nerves ..... 10. *D. biformis*
11. Caryopsis distinctly apiculate and protruding above the lower lemma; spikelets loosely arranged on the rachis ; upper glume often broad and rounded at the apex.....11. *D. cruciata*  
Caryopsis not apiculate, acute only ; spikelets not turgid, lanceolate, elliptic or narrow; upper glume narrow, triangular, acute.....12

12. Nerves of the sterile lemma with scabridities over their whole length or at least upwards.....12. *D. sanguinalis*  
 Nerves of the sterile lemma smooth, without minute triangular spines on the nerves.....13
13. Spikelets narrowly linear-lanceolate with apparently only 3 nerves visible on the sterile lemma ; upper glume half as long as the spikelet or less.....  
 .....13. *D. timorensis*  
 Spikelets broadly linear-lanceolate, with at least 5 nerves visible on the sterile lemma ; upper glume more than half the length of the spikelet.....  
 .....14. *D. adscendens*

1. ***Digitaria pennata*** (Hochst.)  
 T. Cooke

*Digitaria pennata* (Hochst.) T. Cooke,  
 Fl. Bomb. 2 : 941 (1908).

*Panicum pennatum* Hochst. in Flora, 13 : 197  
 (1855).

*Paspalum pennatum* (Hochst.) Hook. f., Fl.  
 Brit. Ind. 7 : 16 (1896).

Perennial. Culms prostrate at the base, rarely erect, with clusters of buds at the base covered with silky cataphylls, smooth and glabrous, branched below. Leaf-blades 3-15 cm. long, 3-6 mm. broad, linear-lanceolate, finely acuminate, smooth or minutely scaberulous, glabrous or sparsely hairy with bulbous based hairs ; sheaths loose and scarious in the lower part of the culms, in the upper part tighter, smooth and glabrous ; ligules truncate, up to 2 mm. long, membranous. Recemes 6-12

in a whorl or on a short common axis, 7.5-15 (-30) cm. long ; rachis devoid of spikelets for about half of its length, plumose all along with



Fig. 2.—*Digitaria pennata*

soft white hairs, then bearing up to 20 paired or upwards solitary spikelets. *Spikelets* lanceolate or linear-oblong, acute, 2.6-3 mm. long. *Lower glume* a minute, hyaline rounded scale. *Upper glume* linear or oblong, tapering to an obtuse or truncate tip, as long as the spikelet, 3-nerved, covered with dense appressed white hairs between the nerves. *Sterile lemma* membranous, conspicuously 5- to 7-nerved, densely hairy between the nerves and along the margins. *Fertile lemma* 2.5 mm. long, narrowly elliptic-oblong, acute to acuminate, turning brown at maturity; *palea* similar but smaller.

Karachi, *Stocks*; Baluchistan, R. R. Stewart; Thatta, *Blatter & McCann*.

## 2. *Digitaria violascens* Link

*Digitaria violascens* Link, Hort. Berol. 1 : 229 (1827).

Annual. *Culms* erect or decumbent and rooting at the lower nodes, up to 80 cm. high, simple or branched from the base, terete, smooth and glabrous; nodes glabrous. *Leaf-blades* linear, acute, up to 20 cm. long and 6 mm. broad, scabrous villous above or glabrescent; *sheaths* loose and slipping from the culms below, tight above, smooth and glabrous, the lower densely hairy; *ligules* 2 mm. long, truncate, membranous. *Racemes* arranged on a very short

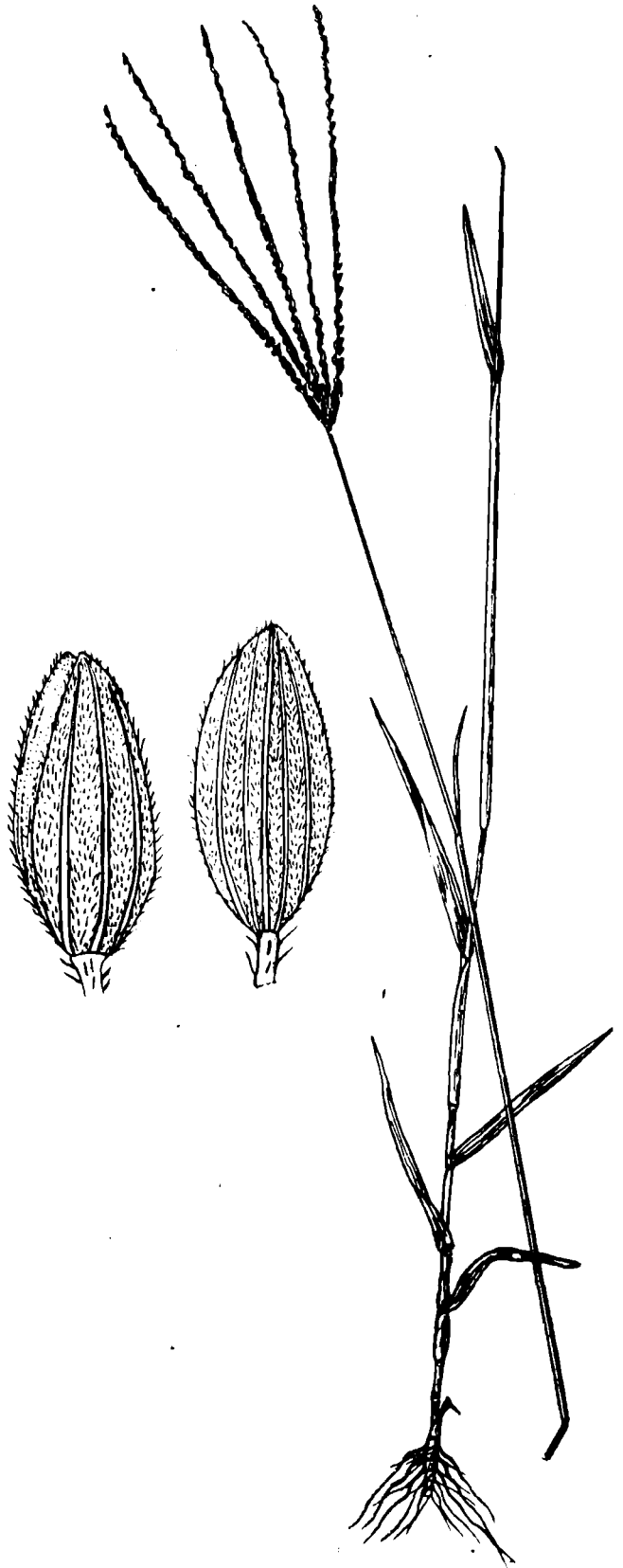


Fig. 3.—*Digitaria violascens*

axis (2-4 cm. long), 2-6 rarely up to 13, 2- or 3-nate or verticillate, the lowermost one often solitary, up to 14 cm. long. *Spikelets* mostly 1.6-1.8 mm. long, rarely up to 2 mm. long; elliptic or elliptic-oblong, acute. *Lower glume* absent. *Upper glume* as long as the spikelet, 3-nerved, the interspaces covered with verrucose hairs. *Sterile lemma* as long as the spikelet, 5-nerved, interspaces with verrucose hairs. *Fertile lemma* 1.7 mm. long, elliptic-acute, not acuminate, longitudinally striate, very dark at maturity; palea of the same texture and colour.

Chakdara, Chitral, *Harris*; Lahore, *M. Zahur*; Sheikhpura, *S. Ahmad*; Rawalpindi, *R. R. Stewart*; Abbottabad; Swat; Baltistan.

### 3. *Digitaria preslii* (Kunth) Henr.

*Digitaria preslii* (Kunth) Henr., Monogr. Gen. Digitaria, 589 (1950).

*Paspalum preslii* Kunth, Enumer. Pl. I : 47 (1833).

Perennial with widely creeping leafy stolons and forming a rhizomatous woody rootstock. *Culms* tufted, up to 20 cm. high, smooth, glabrous; nodes of the erect culms glabrous rarely villous, those of the stolons villous. *Leaf-blades* lanceolate, acute, 1-3.5 cm. long, up to 6 mm. broad, glabrous or pilose; *sheaths* at the base very short, overlapping, densely soft hirsute, those of erect culms longer, somewhat keeled, glabrous or villous; *ligules* membranous, lacerate, 1-1.5 mm. long. *Racemes* 2-3, somewhat distant, 4-6 cm. long, borne on the tip of a long exerted peduncle. *Spikelets* oblong-ovate or elliptic-oblong, acute, about 1.5 mm. long. *Lower glume* absent. *Upper glume* as long as the spikelet and as wide, 3-nerved, hairy in all the interspaces, shortly ciliate at the apex. *Sterile lemma* similar in shape and size to the spikelet, evenly 7-nerved, shortly hairy between all the interspaces; the hairs verrucose. *Fertile lemma* elliptic, acute, smooth, becoming brownish at maturity.

Punjab; Banks of Chenab, *T. Thomson*.

### 4. *Digitaria stricta* Roth

*Digitaria stricta* Roth ex Roem. et Schult., Syst. Veg. 2 : 474 (1817).

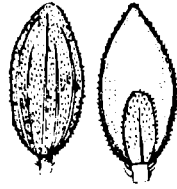
*Paspalum royleanum* Nees ex Thw., Enum. Plant. Zeyl. 358 (1864), nomen et in Hook. f., Flor. Brit. Ind. 7 : 18 (1896) description.

*Digitaria royleana* (Nees) Prain, Beng. Plants, 1181 (1903).

*Digitaria puberula* Link, Hort. Berol. 1 : 223 (1827).

Annual. *Culms* erect, simple or branched below, 30-60 cm. high, smooth and glabrous; nodes glabrous. *Leaf-blades* linear, up to 30 cm. long, 5 mm. broad, scabrid on the margins and both surfaces, densely hairy

with long tubercle-based hairs in the lower third on the upper surface ; sheaths rather loose below and slipping from the culms, tight and clasping above, somewhat keeled, glabrous or somewhat hairy with tubercle-based hairs ;



*ligules* membranous, lacerate, 1.25 mm. long. *Racemes* 3-12, up to 18 cm. long ; subdigitate on a short axis ; spikelets 3-nate. *Spikelets* 1.35 mm. long, ovate, obtuse or slightly acuminate ; pedicels with hairs at the top forming a ring. *Lower glume* absent. *Upper glume* absent or varying from a minute scale to about one-third the length of the spikelet, covered all over with clavate hairs. *Sterile lemma* similar in shape and size to the spikelet, 5-nerved, with broad lines of hairs in the interspaces, densely hairy along the margin. *Sterile lemma* elliptic or oblong, acute or apiculate, becoming black or purple at maturity.

var. **denudata** (Link) Henr.

*Digitaria stricta* Roth var. *denudata* (Link) Henr., Monogr. Gen.

*Digitaria*, 175 (1950).

*Digitaria denudata* Link, Hort. Berol. 1 : 222 (1827).

*Panicum denudatum* (Link) Kunth, Rev. Gram. 1 : 32 (1829).

Upper glume wanting or represented by a rim.

Rawalpindi, R. R. Stewart ; Punjab, J. R. Drummond ; Swat ; Hazara ; Murree Hills ; Lahore ; Sheikhpura.

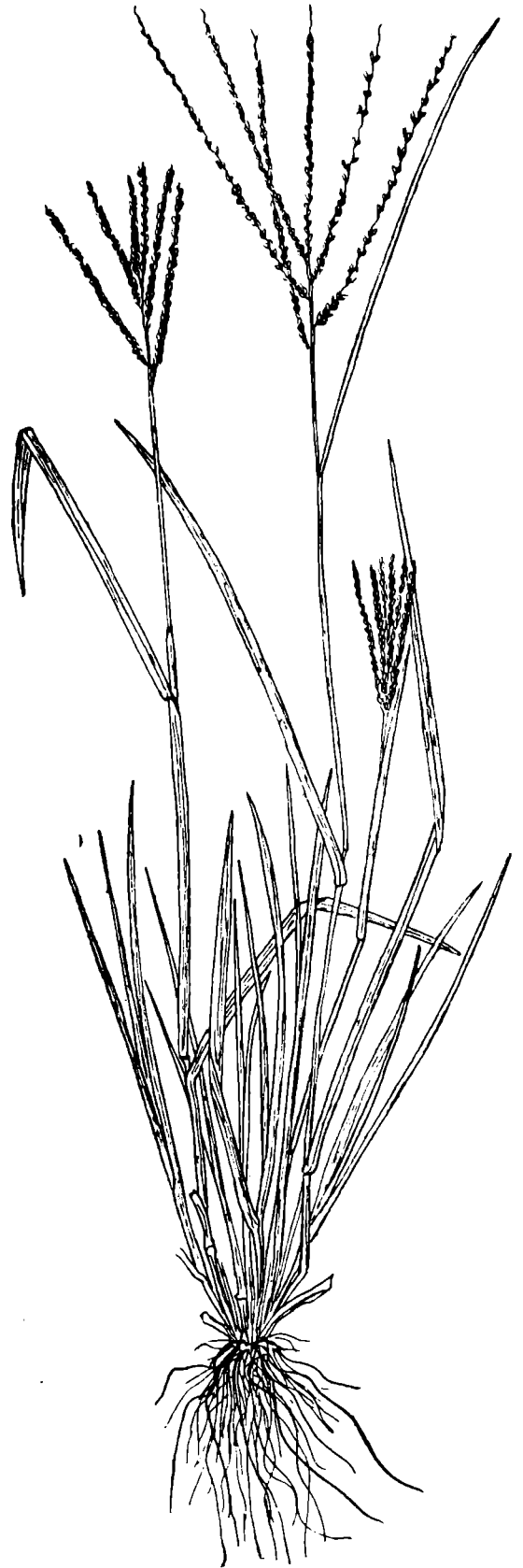


Fig. 4.—*Digitaria stricta*

5. ***Digitaria granularis*** (Trin.) Henr.

*Digitaria granularis* (Trin.) Henr., Monogr. Gen. Digitaria, 302 (1950).

*Paspalum granulare* Trin. ex Spreng., Neue Entdeck. 2 : 47 (1821).

*Paspalum pedicellare* Trin. ex Steud. in Hook. f., Flor. Brit. Ind. 7 : 19 (1896).

*Digitaria pedicellaris* (Trin.) Prain, Beng. Plants, 1181 (1903).

Annual. Culms erect or geniculate-ascending, simple or branched below, 15-60 cm. high, smooth and glabrous. Leaf-blades linear or lanceolate, scabrid, glabrous, 5-15 cm. long, 2.5-5 mm. wide; sheaths loose and slipping from the culms below, tight and clasping above, smooth and glabrous; ligules membranous, truncate or convex, 1-2 mm. long. Racemes 3-5, solitary or opposite, ascending to spreading, up to 10 cm. long, arranged along a short axis; spikelets rather distant, 2- or 3-nate; pedicels slender, long in comparison with the length of the spikelets and spreading widely at maturity. Spikelets broadly ovate, 1.3-1.5 mm. long, 0.7 mm. broad, acute. Lower glume absent. Upper glume as long as the sterile lemma, 3- to 5-nerved, shortly hairy with clavate tipped hairs between the nerves. Sterile lemma a little shorter than the spikelet, rounded at the tip, strongly 5-nerved, hairy between all the nerves. Fertile lemma pale brown, becoming brownish black at maturity, distinctly apiculate and protruding beyond the lower lemma.

Lahore; Burban, Murree Hills, 6000 ft.; Muzaffarabad, 2000 ft.

6. ***Digitaria ischaemum*** (Schreb.) Schreb.

*Digitaria ischaemum* (Schreb.) Schreb. ex Muehl., Descr. Gram. Plant. Calam. 131 (1817).

*Panicum ischaemum* Schreb. ex Schw., Flor. Erlang. 16 (1804).

Annual. Culms 10-20 cm. high, often geniculate at the base, terete, smooth and glabrous; nodes glabrous or sparsely villous. Leaf-blades lanceolate or linear-lanceolate, 11 cm. long, 2-6 mm. wide, glabrous; sheaths rather loose and inflated, often overlapping, minutely scaberulous; ligules membranous, lacerate, 2 mm. long. Racemes 2-3, rarely more, borne on a very short axis; spikelets 2- or 3-nate. Spikelets 2 mm. long, up to 0.9 mm. broad, ovate-oblong, acute. Lower glume a minute delicate hyaline scale. Upper glume as long as the spikelet, 3-nerved, with the nerves joining at the tip and anastomosing below it, densely shortly pubescent in the lines between the nerves and along the margins. Sterile lemma the length and shape of the spikelet, 5-nerved, the 2 central interspaces mostly glabrous. Fertile lemma dark purplish at maturity, smooth and glossy, very acute; palea similar.

Baltistan, R. R. Stewart; Gilgit, Shigar, Skardu, R. R. Stewart.

7. *Digitaria nodosa* Parl.

*Digitaria nodosa* Parl., Plant. Nov. 39 (1842).

*Panicum pabulare* Aitchis.  
in Jour. Linn. Soc. Bot.  
19: 190 (1882).

*Paspalum sanguinale* (Linn.)  
Lamk. var. *pabulare*  
(Aitchis.) Hook. f., Flor.  
Brit. Ind. 7: 15 (1896).

*Panicum parlatoresi* Steud.,  
Syn. Pl. Glum. 40 (1854).

A caespitose perennial with a stout woody rhizome. Culms up to 50 cm. high, swollen at the base, and covered with dense silky hairs, simple or branched below, smooth and glabrous. Leaf-blades up to 28 cm. long, 2-5 mm. wide, narrowly linear, long acuminate, rather glaucous, glabrous and minutely scabrid on both surfaces, sometimes finely pubescent; sheaths somewhat keeled, tight, glabrous or sparsely hairy; ligules membranous, truncate, 3 mm. long. Racemes 6-15 (or more), sessile or pedunculate, digitate or whorled on a common axis up to 5 cm. long, the racemes 2- to 3-nate, 5-18 cm. long, very hairy at their junction

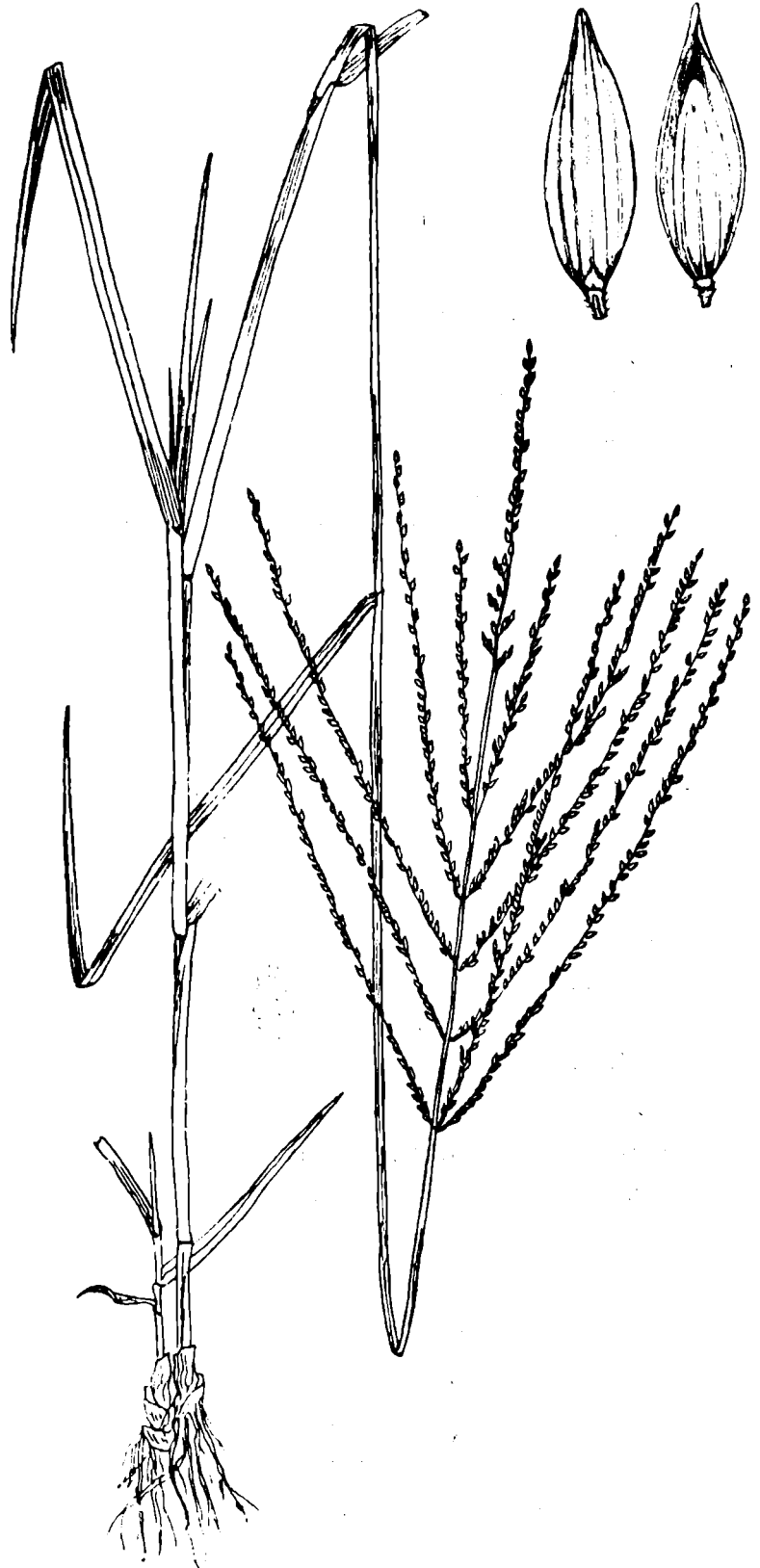


Fig. 5.—*Digitaria nodosa*



with the axis; spikelets 2- or 3-nate. *Spikelets* 3-3.5 mm. long, lanceolate-elliptic, silky but very variable as to the indumentum. *Lower glume* a minute glabrous nerveless scale. *Upper glume* as long as the sterile lemma, narrowly triangular or linear, 3-nerved, appressed-villous all over and along the margins. *Sterile lemma* length and shape of the spikelet, equidistantly 7-nerved, the central interspaces glabrous, the other ones alternately villous and glabrous. *Fertile lemma* narrowly oblong-elliptic, acutely acuminate, yellowish brown; *palea* similar.

Shahpur, J. R. Drummond; Rawalpindi, R. R. Stewart; Sind, Dr. Stocks; Baluchistan, B. S. Hartland; Jhelum, Asghar Ali Beg; Sakesar, Iftikhar; Sind, A. R. Beg; Hassan Abdal; Kohat; Attock Dist. Not rare. A plant of arid regions.

### 8. *Digitaria setigera* Roth

*Digitaria setigera* Roth apud Roem. et Schult., Syst. Veg. 2: 474 (1817).

*Digitaria corymbosa* (Roxb.) Merr., Philipp. Flower. Plant. 1: 53 (1923).

*Panicum corymbosum* Roxb., Flor. Ind. 1: 292 (1820).

*Paspalum sanguinale* Lamk. var. *extensum* Hook. f., Flor. Brit. Ind. 7: 15 (1896).

Annual or perennial. *Culms* erect or decumbent and long creeping at the base, smooth and glabrous, simple, 30 cm. to 1.5 m. high; nodes glabrous. *Leaf-blades* linear, 25 cm. long, 10 mm. wide, glabrous and very scabrid on both surfaces or with few scattered hairs; *sheaths* somewhat compressed, covered with spreading or downwardly directed white tuberclebased hairs, or the upper glabrous or all glabrescent; *ligules* membranous, truncate or convex, 1-2 mm. long. *Racemes* 2-7, borne on a 3-7 cm. long central axis, the lower whorled, up to 16 cm. long; spikelets 2-nate or solitary upwards; *raceme bases* very hairy, with tufts of long white hairs in the axils and rarely along the rachis. *Spikelets* 2-2.5 mm. long, elliptic, acute. *Lower glume* absent. *Upper glume* triangular, acute, 0.3-0.5 mm. long, 3-nerved, with short hairs from the tip and the interspaces and margins. *Sterile lemma* shape and size of the spikelet, 5-nerved, the lateral pairs close together, ciliate on the margins outside the nerves but with occasionally a few hairs between the outer two nerves. *Fertile lemma* white, narrowly elliptic, acute, yellowish; *palea* similar.

Lahore, Changa Manga, S. Ahmad.

### 9. *Digitaria bicornis* (Lamk.) Roem. et Schult.

*Digitaria bicornis* (Lamk.) Roem. et Schult. ex Loud. Hort. Britt. 24 (1830).

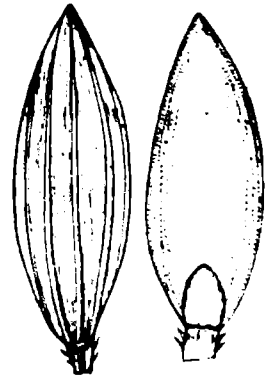


Fig. 6.—*Digitaria setigera*

*Paspalum bicorne* Lamk., Tab. Encyl. 1 : 176 (1791).

*Digitaria barbata* Willd., Enumer. Plant. Berol. 91 (1809).

*Digitaria rottleri* Roem. et Schult., Syst. Veg. 2 : 471 (1817).

*Panicum heteranthum* Hook. f., Flor. Brit. Ind. 7 : 16 (1896) non Nees et Mayen (1843)  
non Link (1823).

Annual. Culms decumbent and rooting at the nodes, finally erect, 10-35 cm. high, repeatedly branched at the base, smooth and glabrous. Leaf-blades linear, acute, 3-10 cm. long, 3-4 mm. wide, finely scaberulous on both surfaces ; sheaths glabrous, at the lower nodes loose and slipping from the culms, those of the upper tight ; ligules membranous, truncate, lacerate, 2 mm. long. Racemes 2, rarely more, rather stout, stiffly erect, the rachis thick, not flexible ; axils puberulous. Spikelets of two kinds, the sessile glabrous, or at least much less hairy than the pedicelled, the pedicelled with spreading hairs at maturity, narrowly elliptic, acute, 3-3.5 mm. long. Sessile spikelet ; lower glume a short triangular obtuse scale, hardly 0.5 mm. long. Upper glume 1/2 as long as the spikelet or sometimes up to 2/3 its length, 3-nerved, hairy along the margins, particularly at the tip and between the nerves. Sterile lemma as long as the spikelet, equidistantly 5- to 7-nerved, nearly totally glabrous, the nerves somewhat raised and separated by deep furrows, which are sometimes almost slit-like. Fertile lemma elliptic or lanceolate-elliptic, acute, smooth and glabrous, polished, turning brown at maturity ; palea similar, Pedicelled spikelet ; upper glume with long hairs spreading at right angles to the glume ; sterile lemma extremely hairy in all nerve spaces except those on each side of the central nerve.

Lahore ; Sialkot ; Rawalpindi . Very common.

#### 10. *Digitaria biformis* Willd.

*Digitaria biformis* Willd., Enumer. Pl. Hort. Berol. 92 (1809).

*Panicum biforme* (Willd.) Kunth, Rev. Gram. 1 : 33 (1829).

*Panicum sanguinale* Linn. var. *biforme* (Willd.) Hack. ex Dur. et Schinz, Consp. Fl. Afr., 5 : 962 (1894).

Annual. Culms geniculate-ascending, smooth and glabrous, up to 60 cm. high, often branched at the base. Leaf-blades linear, up to 12 cm. long, 8 mm. wide; scabrid or with scattered, bulbous-based hairs ; sheaths loose and slipping from the culms, keeled near the top, glabrous or covered with stiff bristles ; ligules membranous, truncate; often lacerate, up to 3 mm. long. Racemes 3-9, digitately arranged at the tip of a peduncle or

on a short common axis; up to 15 cm. long, soft and flexuous. *Spikelets* 2.5-3 mm. long, of each pair dissimilar; the sessile not conspicuously hairy, the pedicelled much more hairy and bristly than the other. *Lower glume* a minute triangular nerveless scale. *Upper glume*  $2/3$ - $3/4$  the length of the spikelet or longer, acuminate, 3-nerved, covered with long, appressed hairs between the nerves. *Sterile lemma* of the sessile spikelet 5- to 7-nerved with nerves prominent, hairy with appressed hairs along the margin; of the pedicelled spikelet 7-nerved, furnished on the marginal nerves with long white hairs and bristles which ultimately spread out at right angles. *Fertile lemma* white or yellowish, elliptic, acuminate; *palea* similar.

Lahore, S. Ahmad; Hazara: Shinkhari, Saran Range, Inayat.

#### 11. *Digitaria cruciata* (Nees) A. Camus

*Digitaria cruciata* (Nees) A. Camus in Lecomte, Fl. Gen. de l'Indo-Chine, 7: 399 (1922).

*Panicum cruciatum* Nees ex Steud., Syn. Pl. Glum. 39 (1854).

*Paspalum sanguinale* Lamk. var. *cruciatum* Hook. f., Flor. Brit. Ind. 7: 14 (1896).

Annual. *Culms* erect or geniculate-ascending, finally erect, up to 1 m. high but very usually much shorter, often branched below, smooth and glabrous; nodes hairy. *Leaf-blades* linear, 4-8 or sometimes up to 20 cm. long, 3-8 mm. wide, glabrous and minutely scaberulous on both surfaces; *sheaths* loose and slipping from the lower internodes, those above tight, slightly inflated, glabrous or sparsely hairy; *ligule* biauriculate, membranous, up to 3 mm. long. *Receses* 3-10, borne along a 1-4 cm. long common axis, solitary or 2-nate, sometimes sub-whorled, minutely pubescent at the axils. *Spikelets* turgid, 2.5-3 mm. long, 1.2-1.5 mm. broad, broadly elliptic, apiculate, pale sometimes purplish. *Lower glume* a very short, nerveless scale. *Upper glume* about  $1/2$  the length of the spikelet, broadly elliptic to linear-oblong, truncate, very lacerate or rounded at the tip, 3-nerved, the nerves not running up to the top, hairy at the tip or quite glabrous. *Sterile lemma* slightly shorter than the spikelet, broadly elliptic, 7-nerved, the 3 lateral quite close together, smooth and glabrous except for few hairs on the margin. *Fertile lemma* elliptic, acuminately apiculate, yellowish turning purplish at maturity; *palea* entirely enclosing the floret.

Hazara: Thandiani, R. N. Parker; Murree; Kaghan Valley; Swat State: Kulali; Baluchistan; Poonch; Gilgit; Baltistan, etc. Common in the temperate Himalaya from 5-8000 ft.

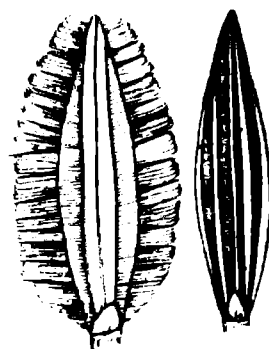


Fig. 7.—*Digitaria biformis*; a pedicelled and a sessile spikelet



Fig. 8.—*Digitaria cruciata*

12. **Digitaria sanguinalis** (Linn.) Scop.

*Digitaria sanguinalis* (Linn.) Scopoli, Fl. Carn. ed. 2, 1: 52 (1772).

*Panicum sanguinale* Linn., Sp. Pl. ed. 1, 1: 57 (1753).

*Paspalum sanguinale* (Linn.) Lamk., Tab. Encycl., 176 (1791) n. 938.

Annual. *Culms* decumbent at the base and creeping widely and rooting at the nodes, up to 90 cm. high but often much smaller, not branched; nodes villous or glabrescent. *Leaf-blades* linear, 15 cm. long, 6 mm. wide, hairy with tubercle-based hairs; *sheaths* somewhat keeled, the lower glabrous or hirsute; *ligules* membranous, truncate, 2.5-3 mm. long. *Racemes* very variable in size, 5-15 cm. long, digitate or arranged on a short axis up to 2 cm. long. *Spikelets* 3-3.5 mm. long, lanceolate-elliptic, acute. *Lower glume* a narrow, triangular, nerveless scale. *Upper glume* 1/2 as long as the spikelet, narrowly lanceolate, 3-nerved, glabrous or with short pubescence between the nerves. *Sterile lemma* as long as the spikelet, 5- to 7-nerved, scabrid on the lateral nerves at least in the upper third, smooth on the midnerve, glabrous on the two central interspaces, shortly villous on the other interspaces. *Fertile lemma* lead coloured at maturity, as long as the spikelet; *palea* similar.

ssp. **vulgaris** (Schrad.) Henr. var. **rottleriana** Henr.

*Digitaria sanguinalis* (Linn.) Scop. subsp. *vulgaris* (Schrad.) Henr. var. *rottleriana* Henr., Monogr. Gen. Digitaria, 490 (1950).

Upper glume 1/2 the length of the spikelet (about 3/8 its length), the 7-nerved sterile lemma is apparently quite glabrous with broader interspaces along the smooth midnerve, the lateral ones are more congested and spiny on the marginal nerves, the inflexed margins are distinctly pubescent, and the upper glume is shortly pubescent all over.

Lahore; Sheikhpura; Lyallpur. Apparently common in the plains.

13. **Digitaria timorensis** (Kunth) Bal.

*Digitaria timorensis* (Kunth) Balansa in Morot, Jour. Bot. 4: 138 (1890).

*Panicum timorense* Kunth, Enumer. Plant. 1: 83 (1833).

*Paspalum sanguinale* Lamk. var. *debile* Hook. f., Flor. Brit. Ind. 7: 16 (1896).

*Panicum sanguinale* (Linn.) Scop. var. *timorense* (Kunth) Hack. in Bull. Herb. Boiss. 2: 4, 528 (1904).

Annual. *Culms* creeping and rooting at the lower nodes, finally erect and up to 30 cm. high, branched at the base, smooth and glabrous.

*Leaf-blades* narrowly lanceolate, 8 cm. long, 8 mm. wide, smooth and glabrous or scaberulous below or covered with scattered bulbous-based hairs; *sheaths* rather loose on the creeping and tight on the erect culms, smooth and glabrous or more or less tomentose; *ligules* very short, membranous, truncate. *Racemes* 2-4, digitate on a very short 1-1.5 cm. long central axis, 4-9 cm. long, puberulous at the axils. *Spikelets* 3-3.7 mm. long and 0.6-0.75 mm. broad at the middle, narrowly lanceolate, very acute or prominently acuminate. *Lower glume* minute, nerveless scale or absent. *Upper glume*  $1/2$ - $1/3$  the length of the spikelet, very narrow, oblong, truncate, 3-nerved, slightly pubescent between the nerves and along the margins. *Sterile lemma* shape and size of the spikelet, 5-nerved, the two on each side of the mid-nerve being so far apart that they and mid-nerve are the only ones visible from in front, the interspaces along the midnerve glabrous, shortly hairy along the margins. *Fertile lemma* yellowish; *palea* similar.

Lahore, Changa Manga Forest, S. Ahmad.

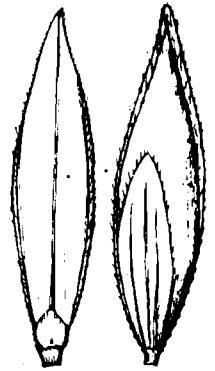


Fig. 9.  
*Digitaria timorensis*

#### 14. *Digitaria adscendens* (H. B. & K.) Henr.

*Digitaria adscendens* (H. B. & K.) Henr. in *Blumea* 1: 92 (1934).

*Panicum adscendens* H. B. & K., *Nov. Gen. et Sp. Pl.*, 1: 97 (1815).

Annual or perennial. *Culms* tufted, geniculate-ascending or prostrate, often rooting at the lower nodes and much branched, up to 80 cm. high, smooth and glabrous. *Leaf-blades* lanceolate to linear, up to 30 cm. long, 4-12 mm. wide, scabrid and covered with scattered tubercle-based hairs; *sheaths* very loose below, tighter above, often hairy from tubercle-based hairs; *ligules* membranous, truncate or lacerate, 1.5-3 mm. long. *Racemes* 4-9, rarely more, sessile, digitate or subwhorled, arranged on a very short axis, up to 15 cm. long. *Spikelets* 3-3.5 mm. long, elliptic or lanceolate-elliptic, acute. *Lower glume* distinct, a small triangular, hyaline scale. *Upper glume* 2-2.5 mm. long, exceeding  $1/2$  the length of the spikelet, often  $2/3$ - $3/4$  its length, narrowly triangular, 3-nerved, with fine lines of hairs between the nerves and along the margins. *Sterile lemma* shape and size of the spikelet, gradually narrowed upwards, acute, with 7 quite smooth nerves, the central interspaces broad glabrous, the two outer always with hairs, which may be short or long and spreading. *Fertile lemma* oblong-elliptic, apiculate, smooth and glabrous, yellowish or brownish purple; *palea* similar.

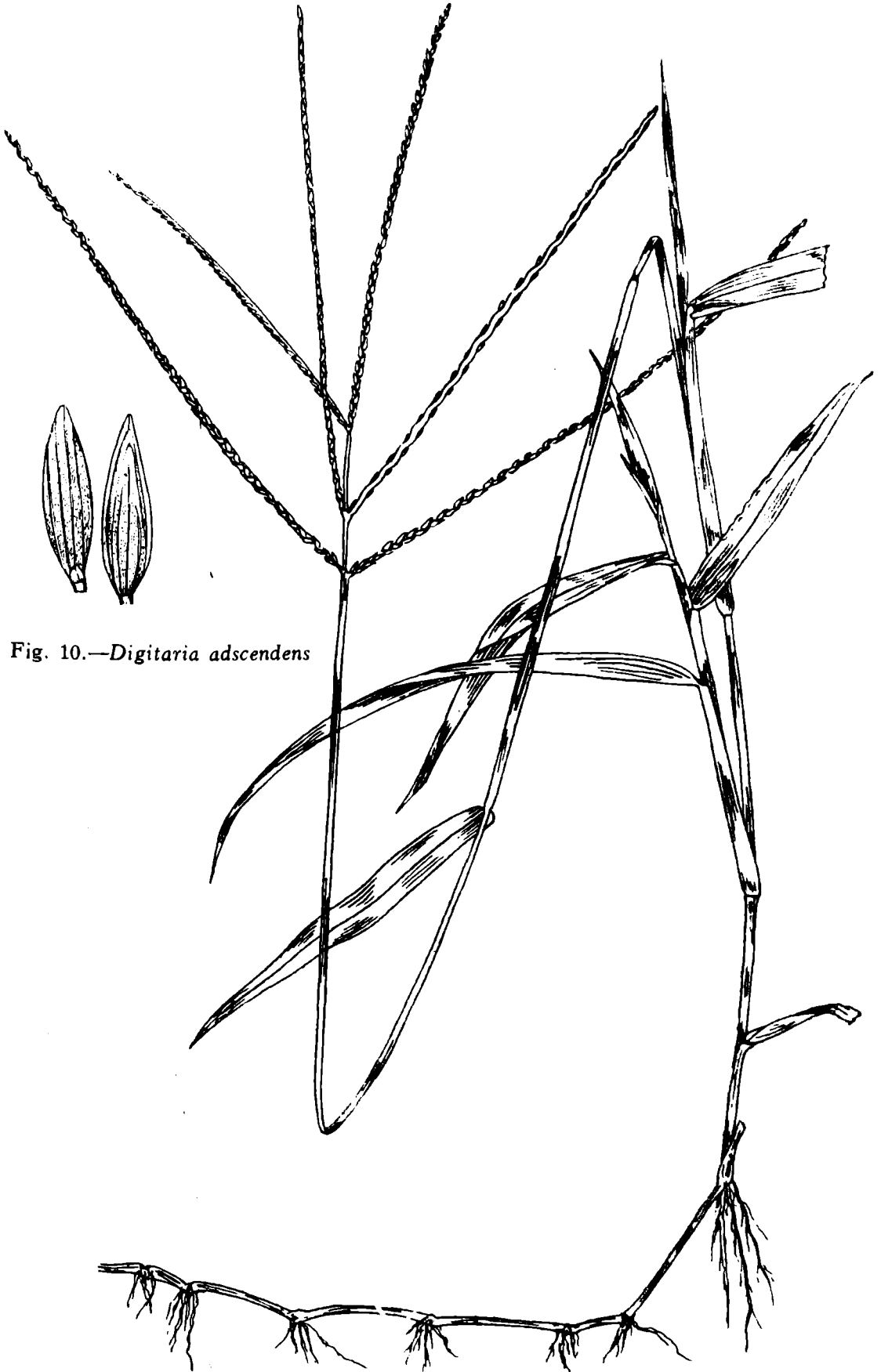


Fig. 10.—*Digitaria adscendens*

## KEY TO THE SUBSPECIES

Spikelets, at least the pedicelled ones, or sometimes both of each pair with a sterile lemma, provided along the lateral nerves and the margins with soft hairs, intermixed with yellowish, stiff, smooth and shining bristles, from tubercles, spreading at maturity .....  
 .....ssp. *chrysolephara*

Spikelets without such stiff, tubercle-based bristles along the margins of the sterile lemma.....ssp. *marginata*

ssp. **chrysolephara** (Fig. et de Not.) Henr.

*Digitaria adscendens* ssp. *chrysolephara* (Fig. et de Not.) Henr..

Monogr. Gen. *Digitaria*, 998 (1950).

Mt. Ilam, Swat State, R. R. Stewart.

ssp. **marginata** (Link) Henr.

*Digitaria adscendens* ssp. *marginata* (Link) Henr., Monogr. Gen. *Digitaria*, 998 (1950).

This subspecies is represented by two varieties which may be distinguished as follows:

var. **typica** Henr. Hairs of the sterile lemma rather short.

*Digitaria adscendens* ssp. *marginata* var. *typica* Henr., Monogr. Gen. *Digitaria*, 999 (1950).

*Digitaria marginata* Link, Hort. Berol. 1: 102 (1821).

Lahore ; Lyallpur.

var. **criniformis** Henr. Hairs of the sterile lemma rather long and often spreading at maturity.

*Digitaria adscendens* ssp. *marginata* var. *criniformis* Henr., Monogr. Gen. *Digitaria*, 999 (1950).

*Digitaria fimbriata* Link, Hort. Berol., 1: 226 (1821).

*Digitaria marginata* Link var. *fimbriata* (Link) Stapf in Prain, Flor. Trop. Afr. 9: 440 (1919).

Lahore; Sangla Hill; Karachi; Hyderabad; Rawalpindi.

#### 4. **Alloteropsis** Presl emend. Hitchc.

Perennial or annual grasses with flat or more or less convolute leaves. Spikelets awned, 2-nate or fascicled, subsecund and abaxial on the rachis of digitate recemes ; lower floret male ; upper bisexual. Glumes unequal, lower smaller, 3- to 1-nerved, very acute often mucronulate ; upper equal



or subequal to the spikelet, 5-nerved with the outer nerves submarginal, densely ciliate along them. Lower lemma similar to the upper glume but ciliate, the tip minutely truncate; palea short, deeply 2-fid with conspicuous, auricled flaps. Upper lemma chartaceous, glabrous, 5-nerved, produced into a straight awn or mucronate; palea equal to the lemma, 2-keeled, with broadly auricled flaps.

### 1. *Alloteropsis cimicina* (Linn.) Stapf

*Alloteropsis cimicina* (Linn.) Stapf in Prain, Flor. Trop. Afr. 9 : 487 (1919).

*Milium cimicinum* Linn., Mant. Alt. 184 (1771).

*Axonopus cimicinus* (Linn.) Beauv., Ess. Agrost. 12 (1812); Hook. f., Flor. Brit. Ind. 7 : 64 (1896).

Annual. Culms tufted, erect or ascending, up to 60 cm. high; nodes hairy. Leaf-blades ovate or ovate-lanceolate, acute, 4-6 cm. long, 1-10 mm. broad, flat, glabrous or hairy, margins ciliate; sheaths loose, glabrous or hairy with bulbous-based hairs; ligule a row of hairs. Panicle of 3-10, digitate racemes, 5-15 cm. long; rachis angular, scaberulous. Spikelets solitary or fascicled, 3-6 mm. long, erect, subsecund. Lower glume rather more than 2.5 mm. long, narrowly ovate-lanceolate, aristately acuminate, hyaline, with 3 slender green nerves, of which the 2 lateral arch to join the midrib below the tip. Upper glume 5 mm. long, broadly ovate, cuspidately acuminate, thinly membranous, 5-nerved, the 3 central nerves green, the 2 lateral nerves marginal, bristly with long coarse hairs. Lower lemma 4 mm. long, ovate-oblong, obtuse, male; palea short, 2-partite. Upper lemma ovate, acute, 6 mm. long, including the awn which is nearly as long as the lemma, thinly cartilaginous; palea similar but subobtuse.

Lahore. A doubtful record based on a single sheet in the Herb. Panjab University.

### 5. *Eriochloa* H. B. & K.

Perennial or annual grasses with more or less flat leaf-blades. Spikelets 2-nate or solitary, secund and adaxial on the triquetrous

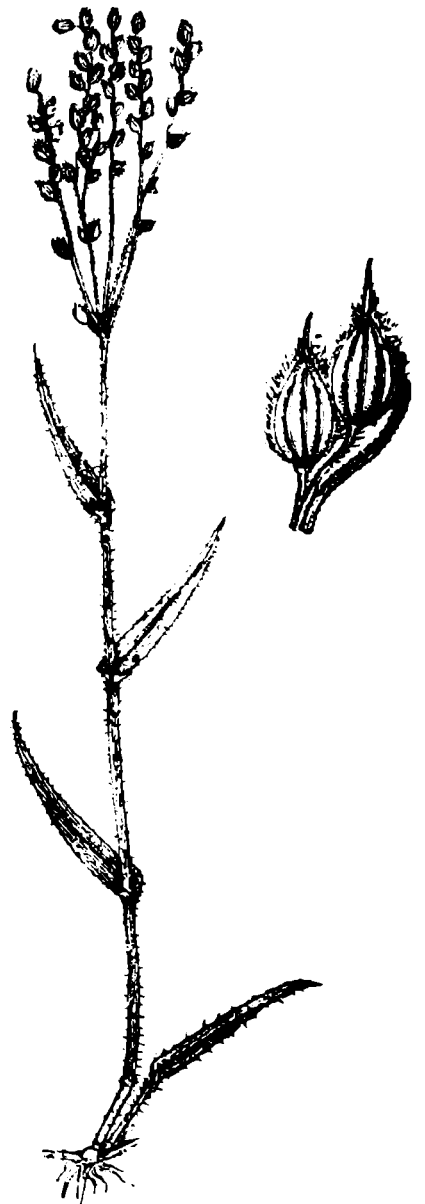
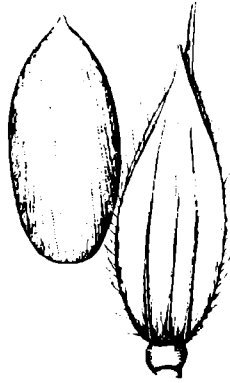


Fig. 10a.--*Alloteropsis cimicina*

rachis of more or less spiciform, simple or compound, racemously arranged racemes ; pedicel swollen to form an annular disc at the top. Glumes very unequal, the lower reduced to a minute cupular rim ; upper as long as the spikelet, faintly 5-nerved. Lower floret male or barren ; lemma similar to the upper glume ; palea subequal, 2-keeled or reduced. Upper floret bisexual ; lemma chartaceous to almost crustaceous, faintly 5-nerved ; palea as long as the lemma, 2-keeled.



1. ***Eriochloa procera*** C. E. Hubb.

*Eriochloa procera* C. E. Hubbard,  
Kew Bull. 256 (1930).

*Eriochloa polystachya* H. B. & K., Nov. Gen.  
et. Sp. 1 : 95 (1815).

*Eriochloa ramosa* Kze., Rev. Gen. Pl. 2 : 775  
(1891).

Perennial, with a short creeping rootstock. Culms tufted, up to 1.5 m. high, ascending from a creeping base, simple or branched, glabrous ; nodes bearded. Leaf-blades linear or linear-lanceolate, acuminate, glabrous, up to 20 cm. long, 5 mm. wide ; sheaths glabrous ; ligule a row of hairs. Panicle up to 12 cm. long ; racemes 2.5-5 cm. long, alternate, suberect. Spikelets silvery, solitary or 2-nate, 3-4 mm. long, loosely imbricate, shortly pedicelled ; pedicel swollen to form an annular disc at the top. Lower glume absent. Upper glume oblong-lanceolate, acuminate, obscurely 3-nerved, silkily hairy.

Fig. 11.—*Eriochloa procera*

*Lower lemma* similar to the upper glume. *Upper lemma* much shorter, elliptic-oblong, obtuse, mucronate, coriaceous, pale shining; *palea* oblong, margins inflexed.

Lahore, S. *Ahmad*; Tando Jam, J. J. *Norris*; Karachi, A. R. *Beg*.

## 6. *Panicum* Linn.

Annual or perennial grasses. Panicle open rarely contracted. Spikelets generally long-pedicelled, without any definite orientation towards the axis. Glumes unequal; lower shorter than the upper, rarely equalling it; upper as long as the spikelet, rounded on the back, 5- to many-nerved. Lower floret male or barren; lemma similar to the upper glume, usually paleate rarely epaleate. Upper floret bisexual; lemma subcoriaceous to coriaceous, faintly nerved; palea subequal, of a similar texture, enclosed by the involute margins of lemma.

### KEY TO THE SPECIES

1. Fertile lemma transversely rugose.....1. *P. maximum*  
Fertile lemma quite smooth.....2
2. Lower glume about as long as the spikelet.....2. *P. turgidum*  
Lower glume shorter than the spikelet.....3
3. Spikelets 4-5 mm. long, sharply acute, ovate to elliptic in back view...  
.....3. *P. miliaceum*  
Spikelets less than 4 mm. long.....4
4. Spikelets 1.5-1.8 mm. long.....5  
Spikelets over 2 mm. in length.....6
5. Lower glume 3-nerved.....4. *P. austroasiaticum*  
Lower glume 5-nerved.....5. *P. atrosanguineum*
6. Lower glume 1/4-1/2 the length of the spikelet.....7  
Lower glume 1/2-3/4 the length of the spikelet.....10
7. Annuals; spikelets oblong, ovate-oblong to elliptic.....8  
Perennials; spikelets narrowly lanceolate to lanceolate.....9
8. Spikelets persistent, panicle contracted.....6. *P. miliare*  
Spikelets deciduous; panicle effuse.....7. *P. psilopodium*
9. Terrestrial; spikelets 2.5 mm. long.....8. *P. repens*  
Aquatic; Spikelets 3-4 mm. long.....9. *P. paludosum*
10. Lower glume cuspidate-acuminate.....10. *P. trypheron*  
Lower glume subobtuse.....11. *P. antidotale*

## 1. *Panicum maximum* Jacq.

*Panicum maximum* Jacq., Coll. Bot. 1 : 76 (1786) ; Hook. f., Flor. Brit. Ind. 7 : 49 (1896).

A caespitose perennial with a short stout rhizome; innovation shoots intravaginal. Culms erect or geniculate, up to 2.5 m. high, sub-simple or more or less branched; nodes glabrous or hirsute. Leaf-blades flat, linear, up to 70 cm. long and 1-3.5 cm. wide, glabrous or papillose-pilose towards the base above; sheaths shorter than the internodes, the lower compressed, papillose-hirsute to glabrous; ligules membranous, about 4 mm. long, long-ciliate behind. Panicle erect or nodding, contracted or open, 20-50 cm. long, the branches suberect or spreading, the lower verticillate, divided almost from the base or undivided for 3-6 cm. Spikelets oblong, 3-3.8 mm. long, acute, puberulous. Lower glume obtuse, 0.8-2.4 mm. long, faintly 3-nerved to almost nerveless. Upper glume oblong, acute or obtuse, 3.5 mm. long, 5-nerved. Lower lemma similar to and slightly shorter than the upper glume. Upper lemma oblong, obtuse, 5-nerved, transversely rugose, puberulent at the apex.

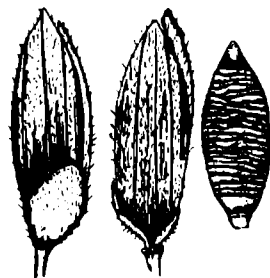


Fig. 12.—*Panicum maximum*

Jhelum, A. A. Beg; Salt Range, Iftikhar.

## 2. *Panicum turgidum* Forsk.

*Panicum turgidum* Forsk., Fl. Aegypt.-Arab. 18 (1775) ; Hook. f., Flor. Brit. Ind. 7 : 44 (1896).

Perennial. Culms erect or prostrate-ascending, bearing oval or oblong, whitish and finely pubescent sheaths at the base, glabrous and smooth, up to 1.4 m. high and 2-4 mm. thick; fastigiately branched at the nodes, the branches again producing clusters of branchlets; nodes glabrous. Leaf-blades linear, flat or convolute, up to 20 cm. long, 7 mm. wide but usually much shorter, pungent, glabrous, margins spinulose-scabrid. Panicle oblong, terminal, at the end of the branches and culms, usually shorter but sometimes as long as 22 cm.; branches short, erect or slightly spreading; spikelets pedicelled, pedicels short, about 4 mm. long. Spikelets ovoid, turgid, about 4 mm. long. Lower glume nearly as long as the spikelet, oval, acute, 7-nerved. Upper glume similar but 9-nerved.



Fig. 13—*Panicum turgidum*

*Lower lemma* similar to the upper glume but slightly longer; *palea* oval, shortly 2-dentate at the apex, 2-keeled. *Upper lemma* oblong or lanceolate, acute, 3 mm. long, glabrous, brown at maturity; *palea* similar.

Karachi, I. I. Chaudhri; Quetta; Sind, Duthie teste Cooke; Sehwan Hills, Bhide.

### 3. *Panicum miliaceum* Linn.

*Panicum miliaceum* Linn., Sp. Pl. 58 (1753); Hook. f., Flor. Brit. Ind. 7: 45 (1896).

Annual. Culms up to 1.2 m. high, tufted, stout, pubescent at the base, leafy throughout; nodes bearded. *Leaf-blades* linear, finely acuminate, rounded at the base, margins scaberrulous with long tubercle-based hairs; *sheaths* deeply grooved, split loose, subcompressed, glabrous or hairy with tubercle-based hairs; *ligule* of long hairs. *Panicle* thyriform, up to 30 cm. long, nodding or decurved; branches crowded, long, suberect, bare at the base, divided at the summit. *Spikelets* ovate, acute, 4-5 mm. long; pedicel longer or shorter than the spikelet. *Lower glume* 2-3.2 mm. long, convex, clasping at the base, broadly ovate, acute or acuminate, 5- to 7 nerved. *Upper glume* 4-5 mm. long, broadly ovate, cuspidately acuminate, 7- to 11-nerved, nearly as long as the spikelet. *Lower lemma* similar to the upper glume, 3.7-4.7 mm. long. *Upper lemma* ovate, obtuse, 5- to 7-nerved, 3.5-4.5 mm. long.

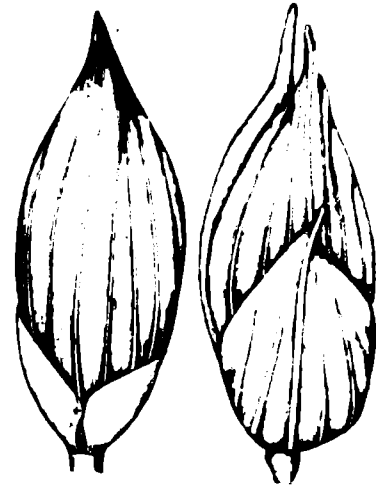


Fig. 14—*Panicum miliaceum*

Chitral; Swat; Baltistan; Gilgit; Rawalpindi. Cultivated as a rainy season crop.

### 4. *Panicum austroasiaticum* Ohwi

*Panicum austroasiaticum* Ohwi in Act. Phytotax. et Geobot. 2, 1: 45 (1942).

*Panicum humile* Nees ex Steud., Syn. Pl. Glum. 84 (1854) non Thunb.; Hook. f., Flor. Brit. Ind. 7: 48 (1896).

Annual. Culms densely tufted, erect or geniculately-ascending, branched from all or most nodes, leafy throughout, up to 5-30 cm. high; nodes glabrous. *Leaf-blades* linear, acuminate, 5-15 cm. long, 3-4 mm. wide, flat, glabrous, margins smooth; *sheaths* somewhat loose, often hirsute sometimes glabrous, hairy at the mouth; *ligule* a rim of soft hairs. *Panicle*

up to 5 cm. long, effuse; branches subsolitary, spreading, few-spiculate. *Spikelets* 1.5 mm. long, ovate or ellipsoid, acute, glabrous. *Lower glume* obliquely lanceolate, acuminate, 0.7-1 mm. long, 3-nerved. *Upper glume* orbicular-ovate, acuminate, 3- to 5-nerved, lateral nerves short. *Lower lemma* similar to the upper glume, 5-nerved; *palea* broad, obtuse. *Upper lemma* shorter than the sterile lemma, oblong, obtuse, shining, pale; *palea* thinly coriaceous.

Rawalpindi; Murree Hills.

### 5. *Panicum atrosanguineum* Hochst.

*Panicum atrosanguineum* Hochst. ex A. Rich., Tent. Fl. Abyss. 2: 375 (1851).

*Panicum hydaspicum* Edgew. in Jour. Linn. Soc. 6: 207 (1862); Hook., f., Flor. Brit. Ind. 7: 48 (1896).

Annual. *Culms* geniculate-ascending, branched from near the base, 15-45 cm. high. *Leaf-blades* linear-lanceolate, acute, 2.5-5 cm. long, 4-5 mm. wide, hirsute; *sheaths* tight or inflated, hirsute; *ligule* a rim of hairs. *Panicle* effuse, 5-10 cm. long; branches solitary rarely opposite, smooth. *Spikelets* 1.5-1.8 mm. long, ovate, acute, glabrous. *Lower glume* ovate, acuminate, 5-nerved. *Upper glume* ovate, subacute, 5- to 7-nerved. *Lower lemma* similar to the upper glume; *palea* oblong, shorter than the lemma. *Upper lemma* elliptic, obtuse, brown, shining; *palea* similar.

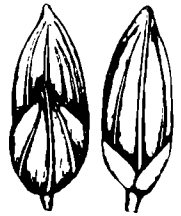


Fig. 15—*Panicum atrosanguineum*

Lahore; Rawalpindi; Multan.

### 6. *Panicum miliare* Lamk.

*Panicum miliare* Lamk., Illustr. 1: 173 (1791); Hook. f., Flor. Brit. Ind. 7: 46 (1896).

Annual. *Culms* up to 1 m. high, erect or geniculately-ascending, simple or branched, glabrous, leafy throughout. *Leaf-blades* erect, linear, acuminate, flat, hairy with tubercle-based hairs, 30-50 cm. long, 4 mm. wide; *sheaths* tight, hairy; *ligule* a ridge of hairs. *Panicle* oblong, contracted or thyriform, up to 25 cm. long, erect or nodding; branches slender, erect, solitary. *Spikelets* solitary or 2-nate, ovoid or ellipsoid, acute, 2.5-3.5 mm. long. *Lower glume* 0.7-1.7 mm. long, broadly ovate, acute, 3- to 5-nerved, clasping at the base. *Upper glume* 2-3.5 mm. long, ovate-lanceolate, subacuminate, 11- to 13-nerved. *Lower lemma* similar to

the upper glume, 9-nerved; palea as long as the lemma. *Upper lemma* 1.8-3.2 mm. long, oblong to broadly ovate, acute, shining; palea oblong-elliptic, margins much inflexed.

Cultivated within the area.

### 7. *Panicum psilopodium* Trin.

*Panicum psilopodium* Trin., Gram. Panic. 217 (1826); Hook. f., Flor. Brit. Ind. 7: 46 (1896).

Annual. Culms often tufted, erect or ascending, leafy throughout, 30-60 cm. high. *Leaf-blades* linear, acuminate, glabrous, and smooth, 7-30 cm. long, 4-8 mm. wide, margins cartilaginous; *sheaths* loose, compressed, smooth and glabrous; *ligule* a lacerate, membranous ring. *Panicle* 5-20 cm. long; branches finally spreading, filiform, scaberulous, solitary rarely 2-nate, naked at the base. *Spikelets* solitary or 2-nate, ovate-lanceolate or ovate-oblong, 2-3 mm. long. *Lower glume* orbicular, apiculate, 3- to 5-nerved, clasping at the base. *Upper glume* as long as the spikelet, 11-nerved. *Lower lemma* similar to the upper glume, 9-nerved; palea hyaline, 2-keeled. *Upper lemma* oblong, obtuse, apiculate, coriaceous, shining; palea slightly shorter.

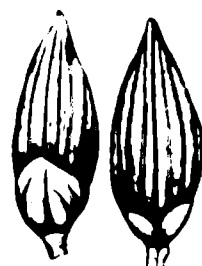


Fig. 16.—*Panicum psilopodium*

Lahore; Sargodha; Sialkot; Gujrat; Multan; Rawalpindi. Very common in cultivated fields during summer.

### 8. *Panicum repens* Linn.

*Panicum repens* Linn., Sp. Pl. ed. 2: 87 (1762); Hook. f., Flor. Brit. Ind. 7: 49 (1896).

A perennial grass with a creeping stoloniferous rootstock. Culms erect or ascending, simple or branched, up to 1.5 m. high. *Leaf-blades* linear-lanceolate, acuminate, 7-15 cm. long, 6-9 mm. wide, glaucous, smooth, margins toothed towards the base; *ligule* a coriaceous ridge. *Panicle* contracted, irregularly branched, 7-20 cm. long, branches 2- to 3-nate. *Spikelets* ovate-lanceolate, acute, glabrous, 2.5 mm. long, sessile or shortly pedicelled. *Lower glume* orbicular, nerveless or 3-nerved. *Upper glume* ovate, acute, 5-nerved. *Lower lemma* similar to the upper glume, slightly shorter; palea short, truncate. *Upper lemma* ovate, acute, smooth, shortly stipitate; palea as long as the lemma.

Lahore, J. L. Stewart.

9. ***Panicum paludosum*** Roxb.

*Panicum paludosum* Roxb., Hort. Beng. 8 (1814).

*Panicum proliferum* Hook. f., Flor. Brit. Ind. 7: 50 (1896) non Lamk.

*Panicum proliferum* var. *paludosum* Cooke, Fl. Bomb. 2: 937 (1908) non Stapf.

A perennial, aquatic grass with creeping stolons. Culms erect or ascending, simple or branched, leafy throughout, up to 90 cm. high; nodes glabrous. Leaf-blades linear, acuminate, 8-12 cm. long, 5-8 mm. wide, glabrous, scabrid, margins scabrid; sheaths terete, loose, glabrous and smooth; ligule a rim of hairs. Panicle 10-25 cm. long, very short-peduncled; axis stout, scaberulous; branches stout, fasciculate below solitary above, branched near the base; axils glabrous. Spikelets solitary or 2-nate, ovate-lanceolate, acuminate, 3-4 mm. long. Lower glume 0.6-0.8 mm. long, orbicular, nerveless. Upper glume 3-4 mm. long, ovate, acuminate, 7- to 9-nerved. Lower lemma similar to the upper glume, 9-nerved; palea very short or absent. Upper lemma 2.5-3.5 mm. long, oblong, acute, smooth; palea as long as the lemma.

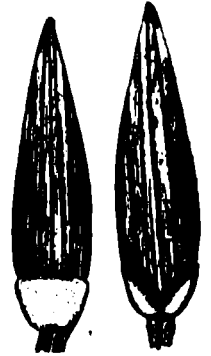


Fig. 17—*Panicum paludosum*

In marshy places or actually in water. Lahore, J. L. Stewart; Topi Park, Rawalpindi, A. R. Beg, R. R. Stewart.

10. ***Panicum trypheron*** Schult.

*Panicum trypheron* Schult., Syst. Veg. Mantiss. 2: 244 (1824); Hook. f., Flor. Brit. Ind. 7: 47 (1896).

*Panicum tenellum* Roxb., Fl. Ind. 1: 306 (1820) non Lamk.

*Panicum roxburgii* Spreng., Syst. 1: 320 (1825).

Perennial. Culms up to 50 cm. high, tufted, erect or geniculate-ascending; nodes glabrous. Leaf-blades linear, acuminate, softly hairy at least on the lower surface, up to 25 cm. long, 4-6 mm. wide; sheaths long, glabrous or hairy, the margins ciliate; ligules short, fimbriate. Panicle erect or nodding, very effuse, 10-20 cm. long; axis filiform, scaberulous; branches solitary or the lower fascicled, few-spiculate, glabrous in the axils. Spikelets ovoid, acuminate, 2.5-3 mm. long, gaping at the mouth. Lower glume 1.5-2.5 mm. long, broadly ovate, cuspidately-acuminate, 5-nerved. Upper glume as long as the spikelet, broadly ovate, recurved, subcuspidate, 7- to 9-nerved. Lower lemma similar to the upper glume but shorter, 7-nerved; palea oblong,



obtuse, 2-toothed. *Upper lemma* 2.5-3 mm. long, linear-oblong or oblong-elliptic, obtuse, dorsally rounded, smooth, shining; *palea* similar in texture, as long as the lemma.

Sialkot ; Murree ; Lahore.

### 11. *Panicum antidotale* Retz.

*Panicum antidotale* Retz., Obs. 4 : 17 (1786) ; Hook. f., Flor. Brit. Ind. 7 : 52 (1896).

A tall perennial grass with a creeping, thick rootstock. *Culms* up to 1.5 m. high, solid, woody, smooth; nodes thickened, the lower sometimes rooting. *Leaf-blades* up to 60 cm. long, flat, linear, finely acuminate, smooth and glabrous; *sheaths* tight, glabrous; *ligules* short, membranous, ciliate. *Panicle* effuse, pyramidal, up to 30 cm. long; axis slender, smooth or slightly scaberulous; branches usually fascicled, upper sometimes solitary, filiform, spreading, 7.5-10 cm. long. *Spikelets* loosely crowded on the branches, 2.4-3 mm. long, ovoid-acute, glabrous. *Lower glume* broadly-ovate, subobtuse, 1.5 mm. long, 3-nerved. *Upper glume* broadly ovate, acuminate, 7- to 9-nerved. *Lower lemma* similar to the upper glume; *palea* as long as the lemma. *Upper lemma* coriaceous, elliptic, obtuse; *palea* similar in texture, as long as the lemma.

Karachi to Landi, Burns; Laki, Bhide; Sukkur, Woodrow; Clifton near Karachi, Sabnis; Umarkot, sand dunes, Sabnis; Mirpur Khas,



Fig. 18.—*Panicum antidotale*

*Bhide*; Jamesabad, *Sabnis*; Sanghar, *Sabnis*; Gharo, *Blatter & McCann*; Lahore; Sheikhpura; Sargodha; Jhelum; Multan; Quetta; Kohat; Bannu; Attock; Rawalpindi, etc.

### 7. **Sacciolepis** Nash

Annual or perennial grasses. Inflorescence a contracted, spike-like terminal panicle. Spikelets subterete or laterally compressed, obliquous, lower floret male or barren; upper floret bisexual. Glumes unequal; lower much shorter than the spikelet; upper gibbous at the base, always much concave, mostly 7- or 9-nerved, rarely 5- or 13-nerved. Lower floret; lemma similar to the upper glume but with a straight back; palea hyaline, finely 2-keeled. Upper floret; lemma very convex, with firm, narrowly involute margins, obscurely 5-nerved; palea almost as long as the lemma, slightly embraced by it all along.

#### 1. **Sacciolepis interrupta** (Willd.) Stapf

*Sacciolepis interrupta* (Willd.) Stapf in Prain, *Flor. Trop. Afr.* 9 : 757 (1919).

*Panicum interruptum* Willd., *Sp. Pl.* 1 : 341 (1797); Hook. f., *Flor. Brit. Ind.* 7 : 40 (1896).

A large perennial grass. *Culms* arising from a stout rootstock, up to 2 m. high. *Leaf-blades* up to 30 cm. long, 6-12 mm. broad, glabrous; *ligules* short, broad, membranous. *Panicle* spiciform, up to 30 cm. long. *Spikelets* 4-5 mm. long, densely crowded in small fascicles, subsessile. *Lower glume* about 1.5 mm. long, broadly ovate, obtuse, hyaline, 3- to 5-nerved. *Upper glume* ovate, acute, membranous, 9-nerved. *Lower lemma* as long as the upper glume, ovate, 7-nerved, paleate, male or barren. *Upper lemma* shorter than the lower, thinly coriaceous, ovate-oblong; palea thinly coriaceous, as long as the lemma.

Sind, *Woodrow teste Cooke*.

### 8. **Brachiaria** Grisebach

Perennial or annual grasses with linear to lanceolate, flat leaves. Spikelets 1- or 2-nate, more rarely in fascicles, secund and adaxial on the triquetrous or flat rachis of moderately slender or stout, mostly spiciform racemes. Glumes dissimilar; lower very short; upper membranous, as long as the spikelet, 5- to 7-nerved. Lower floret male or barren; lemma similar to the upper glume, 5- or rarely 7-nerved; palea as long as the lemma. Upper floret bisexual; lemma narrowly involute, faintly 5-nerved; palea as long as the lemma.

KEY TO THE SPECIES

1. Spikelets less than 2.5 mm. in length.....3  
Spikelets 2.5-5 mm. long.....4
2. Panicle linear, with erect racemes ; rachis pubescent...1. *B. eruciformis*  
Panicle lanceolate or oblong with spreading racemes ; rachis with scattered hairs.....3
3. Spikelets solitary, 1.8-2.5 mm. long, often densely hairy as well as the rachis and pedicels ; upper lemma ovate-oblong.....2. *B. villosa*  
Spikelets 2-nate or upwards solitary, 1.25-1.8 mm. long ; hairs on the spikelets longer than the spikelets ; upper lemma obovate or elliptic.....3. *B. reptans*
4. Spikelets whitish and more or less glossy, almost like ivory.....  
.....4. *B. ovalis*  
Spikelets green.....5
5. Spikelets turgid, broadly elliptic or broadly obovate-elliptic, apiculate.....5. *B. ramosa*  
Spikelets not turgid.....6
6. Spikelets ovate to lanceolate ; rachis hairy.....6. *B. setigera*  
Spikelets elliptic to obovate ; rachis glabrous.....7
7. Spikelets 2.5-3 mm. long ; peduncle hairy below the inflorescence.....  
.....7. *B. distachya*  
Spikelets 3.5-5 mm. long, peduncle glabrous below the inflorescence...  
..... (*B. miliiformis*)

1. **Brachiaria eruciformis** Griseb.

*Brachiaria eruciformis* Griseb. in Ledeb., Fl. Ross. 4 : 469 (1833).

*Panicum eruciformis* Sibth. & Sm., Prodr. 1 : 40.

*Panicum isachne* Roth, Nov. Pl. Sp. 54 (1821) : Hook. f., Flor. Brit. Ind. 7 : 28 (1896).

*Brachiaria isachne* (Roth) Stapf in Prain, Flor. Trop. Afr. 9 : 552 (1919).

Annual. Culms 30-60 cm. high, loosely tufted, geniculate-ascending from a rooting base, slender, much branched below, glabrous. Leaf-blades linear-lanceolate, acute, 2-6 cm. long, 2.5 mm. wide, flat, glabrous or hairy ; sheaths rather tight, terete or subterete ; ligule a fringe of hairs. Racemes 2-10, dense, 1.25-2.5 cm. long, secund or subsecund, usually appressed to the filiform, scabrid axis ; rachis filiform,

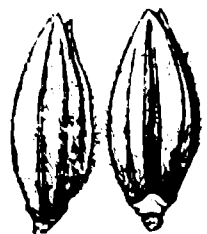


Fig. 19.  
*Brachiaria eruciformis*

pubescent. *Spikelets* 2-seriate, imbricate, oblong, obtuse or subacute, flat on the back, 2-2.5 mm. long, softly pubescent. *Lower glume* 0.3 mm. long, hyaline, truncate, 1-nerved. *Upper glume* size and shape of the spikelet, minutely hairy, 5-nerved. *Lower lemma* similar to the upper glume; palea subequal, very obtuse, much reduced in neuter florets. *Upper lemma* elliptic-oblong, obtuse, 1.5-1.6 mm. long; palea similar.

Hyderabad; Abbottabad; Rawalpindi, Quetta; Loralai; Pishin; Chitral. Often in poorly drained soil or fields.

### 2. *Brachiaria villosa* (Lamk.) A. Camus

*Brachiaria villosa* (Lamk.) A. Camus in Lecomte, Fl. Gen. de l'IndoChine 7 : 433 (1922).

*Panicum villosum* Lamk., Illustr. 1 : 173 (1791); Hook. f., Flor. Brit. Ind. 7 : 34 (1896).

*Panicum vestitum* Nees ex Steud., Syn. Pl. Gram. 62 (1885).

Annual. *Culms* 20-40 cm. high, rooting at the base, slender, softly hairy, glabrous at the top, many-noded, velvety. *Leaf-blades* spreading, ovate-lanceolate, acute, rounded at the base, flat, 1-3 cm. long, 4-7 mm. wide, softly pubescent on both surfaces; margins white, denticulate, ciliate; *sheaths* shorter than the internodes, hairy; *ligule* a rim of hairs. *Racemes* 5-10, upright or somewhat spreading, alternate, sessile or subsessile, rather distant, 6-15 mm. long, the upper shorter; common axis tiquetrous, pubescent; rachis more slender, densely hairy; pedicels silky. *Spikelets* crowded, 2-seriate, ovate, apiculate, pubescent, 1.8-2.5 mm. long. *Lower glume* 0.7 mm. long, clasping at the base, ovate-orbicular, 1- to 3-nerved, hispid. *Upper glume* 1.5-2.5 mm. long, ovate, subacute, 5- to 7-nerved, hispid. *Lower lemma* up to 2.5 mm. long, similar to the upper glume; palea hyaline, linear-oblong, shorter than the lemma. *Upper lemma* 2.4 mm. long, very convex, ovate or ovate-oblong, acute or shortly apiculate, delicately pitted; palea similar.

Peshawar; Multan, J. L. Stewart.

### 3. *Brachiaria reptans* (L.) Gard. & Hubb.

*Brachiaria reptans* (Linn.) Gard. & Hubb. in Hooker, Icon. Pl. sub tab. 3363 (1938).

*Panicum reptans* Linn., Syst. Nat. ed. 10, 870 (1759).

*Panicum prostratum* Lamk., Illustr. 1 : 171 (1791); Hook. f., Flor. Brit. Ind. 7 : 33 (1896).

*Urochloa reptans* (Linn.) Stapf in Prain, Flor. Trop. Afr. 9 : 601 (1919).

Annual. *Culms* prostrate or ascending from a long creeping base, 15-60 cm. high; nodes pubescent. *Leaf-blades* 3-8 cm. long, 2-17 mm. wide, ovate-

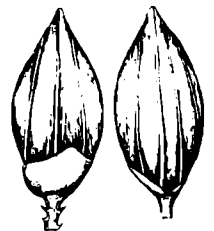


Fig. 20.  
*Brachiaria reptans*

lanceolate, acuminate, base cordate, glabrous; *sheaths* glabrous, margins hairy; *ligule* a fringe of hairs. *Racemes* 5-8, sessile or sessile, nearly distichous, 1-2.5 cm. long. *Spikelets* 2-seriate, 1.25-1.8 mm. long, glabrous. *Lower glume* 1/4 the length of the spikelet, semilunate, nerveless. *Upper glume* broadly ovate, acute, pubescent, 7-nerved. *Lower lemma* similar to the upper glume, 5-nerved; *palea* short, hyaline. *Upper lemma* elliptic, apiculate, dorsally rounded.

Lahore; Multan; Jhelum; Rawalpindi; Peshawar; Attock Dist.; Mingora, Swat; Tando Jam. Very common in cultivated fields, etc.

#### 4. *Brachiaria ovalis* (R. Br.) Stapf

*Brachiaria ovalis* (R. Br.) Stapf in Prain, Flor. Trop. Afr. 9: 546 (1919).

*Panicum ovale* R. Br. in Salt, Voy. Abyss. App. 4: 62 (name only); Durand & Schinz., Consp. Fl. Afr. 5: 758.

Annual. *Culms* tufted, up to over 30 cm. high, erect or geniculately ascending, about 4-noded, branched below (sometimes copiously), pubescent below the nodes, terete or compressed below. *Leaf-blades* linear, tapering to a fine point, up to 17.5 cm. long, 7.5 mm. wide, flat, very finely and softly pubescent all over; *sheaths* rather loose, softly pubescent all over; *ligule* a dense fringe of short hairs. *Panicle* 5-7.5 cm. long, of 5-8 very lax suberect or spreading, ultimately deflexed racemes; common axis slender, loosely pubescent with some longer hairs intermixed. *Racemes* simple, secund or subsecund, the lower up to 1.8 cm. or rarely 2.5 cm. long, the upper rapidly decreasing and reduced to 4- to 2-nate or solitary spikelets which arrange themselves into a terminal raceme; rachis flexuous, filiform, up to 4 mm. wide, pubescent with some longer hairs intermixed; internodes 3.7-10 mm. long; lowermost pedicels 2-nate, the other solitary and short, the longer of a pair rarely up to 5 mm. long, puberulous with long hairs upwards. *Spikelets* distant, broadly ovate or elliptic-oblong, obtuse to subobtuse, 3.7-5 mm. long, whitish and more or less glossy, almost like ivory. *Lower glume* very broadly obovate, subacute, usually contracted at the base, very white, faintly 3- to 5-nerved. *Upper glume* obtuse, very slightly shorter than the lower floret, 5-nerved, nerves greenish, somewhat vanishing downwards. *Lower lemma* similar to the upper glume; *palea* shorter, truncate with narrow flaps; anthers 1.6 mm. long. *Upper lemma* broad-elliptic, subacute, 3-3.6 mm. long, shortly constricted at the base, smooth, at length brownish; *palea* similar.

Sind, *Stocks*.

5. *Brachiaria ramosa* (Linn.) Stapf

*Brachiaria ramosa*  
(Linn.) Stapf in  
Prain, Flor. Trop.  
Afr. 9:542 (1919).

*Panicum ramosum*,  
Linn. Mantiss. 1: 29  
(1767); Hook. f.,  
Flor. Brit. Ind. 7: 36  
(1896) p.p.

*Panicum petiverii* Trin., Gram. Panic. 144.

Annual. Culms erect or ascending, much branched from the base or upwards; nodes pubescent. Leaf-blades linear-lanceolate, finely acuminate, base narrow or rounded, glabrous or hairy; sheaths glabrous or pubescent with tubercle-based hairs; ligule a fringe of short hairs. Panicle sub-pyramidal, 8-15 cm. long; racemes 8-12, distant, spreading, alternate or the upper opposite, 3-6 cm. long; rachis of the racemes angular, puberulous. Spikelets solitary or in pairs, alternate or crowded, turgid, broadly elliptic or broadly obovate-elliptic, apiculate, 2.5-2.8 mm. long. Lower glume  $1/2$  as long as the spikelet, broadly ovate, subacute, 3- to 5-nerved, clasping at the base. Upper glume broadly obovate-elliptic, acute, 5-nerved. Lower lemma similar to the upper glume, 5-nerved. Upper lemma oblong, apiculate, rugulose; palea similar.

Hyderabad; Quetta; Lahore;  
Rawalpindi; Kagan; Swat, etc. Very  
common, usually below 3000 ft

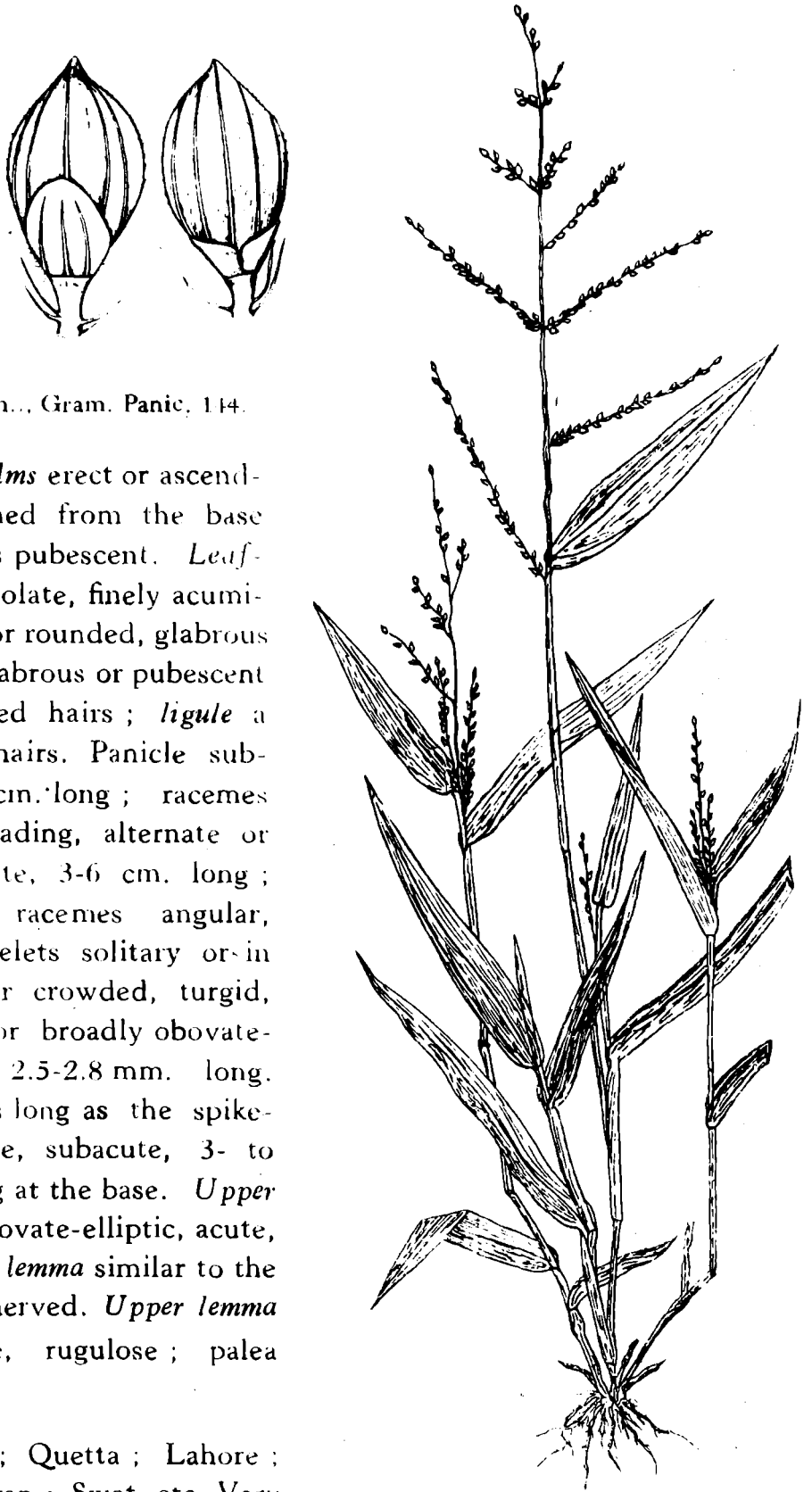


Fig. 21.—*Brachiaria ramosa*

6. **Brachiaria setigera** (Retz.) C. E. Hubb.

*Brachiaria setigera* (Retz.) C. E. Hubb. in Hooker, Icon. Pl. sub tab. 3363 (1938).

*Panicum setigerum* Retz., Obs. Fasc. 4 : 16 (1786); Hook. f., Flor. Brit. Ind. 7 : 36 (1896).

*Urochloa setigera* (Retz.) Stapf in Prain, Flor. Trop. Afr. 9 : 598 (1919).

Perennial; innovations extravaginal bearing long thin pubescent cataphylls. Culms up to 1 m. high, ascending from a prostrate, straggling base, simple or sparingly branched; nodes pubescent to silky-bearded. Leaf-blades lanceolate with a rounded or subcordate base, up to 15 cm. long and 2.5 cm. wide, flat, glabrous and smooth or with a few tubercle-based hairs, margins densely villously-ciliate; ligule reduced to a densely ciliate rim. Racemes 4-9, obliquely erect and spreading; lower 5 cm. long, upper shorter; common axis 5-7.5 cm. long, scaberulous on the angles, glabrous or with a few scattered hairs; rachis 2-4 mm. wide, hairy at the base, angles scabrid; pedicels up to 1.5 mm. long. Spikelets ovate to lanceolate, acutely acuminate, 5 mm. long, usually pubescent. Lower glume broadly ovate, clasping at the base, acute, 1.5 mm. long, 3- to 5-nerved. Upper glume as long as the spikelet, 7- to 9-nerved. Lower lemma similar to the upper glume, 5-nerved; palea broad-oblong, acuminate, a little shorter than the lemma. Upper lemma broad-elliptic, 2.5 mm. long, pale, with a scaberulous mucro, up to 0.9 mm. long.

Mirpur Sakro, Blatter & McCam.



Fig. 22.  
*Brachiaria setigera*

7. **Brachiaria distachya** (Linn.) Stapf

*Brachiaria distachya* (Linn.) Stapf in Prain, Flor. Trop. Afr. 9: 565 (1919).

*Panicum distachyum* Linn., Mantiss. 1: 138 (1767); Hook. f., Flor. Brit. Ind. 7: 37 (1896).

Annual. Culms prostrate or ascending, branched from the base, up to 40 cm. high. Leaf-blades linear-lanceolate, acuminate, 5-15 cm. long, 3-5 mm. wide, glabrous; sheaths hairy; ligule a rim of long hairs. Racemes 2-4, distant, erect or slightly spreading, up to 5 cm. long; rachis slender, glabrous. Spikelets elliptic to obovate, 3-4 mm. long, 1- or 2-seriate. Lower glume 1/2 as long as the spikelet, orbicular, hyaline,

5- to 7-nerved, clasping at the base. *Upper glume* elliptic, acute, 7-nerved. *Lower lemma* similar to the upper glume, 5-nerved. *Upper lemma* ellipsoid, obtuse, striolate ; *palea* similar.

Likely to occur within the area.

**9. Paspalum Linn.**

Perennial or annual grasses. Racemes 2-nate, digitate or paniced. Spikelets secund and usually 2-nate on the flattened or triquetrous rachis of the racemes. Lower glume minute or absent. Upper glume as long as the spikelet, rarely shorter or obsolete, usually with 1-2 side nerves, rarely nerveless. Lower floret barren; lemma similar to the upper glume, usually 3- to 5-nerved. Upper floret bisexual; lemma chartaceous to subcoriaceous, faintly 5 to 7-nerved; palea subequal, of the same texture as the lemma, 2-nerved.

KEY TO THE SPECIES

- 1. Spikelets glabrous.....2  
    Spikelets with a fringe of white hairs along the margin.....  
    .....1. *P. dilatatum*
- 2. Perennial aquatic grasses with a long creeping base; spikelets elliptic-oblong, minutely pubescent on the upper glume.....  
    .....2. *P. distichum*
- Annual, erect grasses; spikelets elliptic-orbicular.....  
    .....3. *P. scrobiculatum*

**1. Paspalum dilatatum Poir**

*Paspalum dilatatum* Poir in Lamk., Encycl. 5: 35 (1804).

Annual. *Culms* geniculately ascending, smooth ; nodes glabrous. *Leaf-blades* linear, 15-20 cm. long, smooth and glabrous ; *sheaths* tight, striate, smooth, as long as the inter-nodes; *ligules* membranous, rounded. *Racemes* 2-4, digitate or alternate on a very short common axis ; nodes with very long silky hairs. *Spikelets* ovate, acuminate, 2.5-3 mm. long, solitary or 2-nate, appressed to the rachis. *Lower glume* absent. *Upper glume* ovate, acute, 4-nerved, with a marginal fringe of long hairs. *Lower lemma* similar to the upper glume but glabrous. *Upper lemma* thick, hard, firm and minutely punctate; *palea* similar.

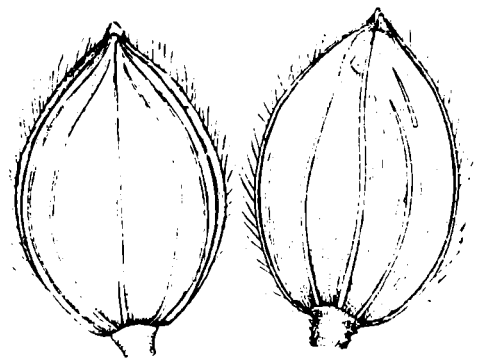


Fig. 23.—*Paspalum dilatatum*

Botanic Garden, Lahore; Tando Jam. Introduced.



2. *Paspalum distichum* Linn.

*Paspalum distichum* Linn., Syst. Nat. ed. 10, 855 (1759); Hook. f., Flor. Brit. Ind. 7: 12 (1896).

*Paspalum vaginatum* Blatter & McCann, Bomb. Grasses, 139 (1935) non Swartz.

*Paspalum vaginatum* Swartz var. *pubescens* Doell in Mart., Fl. Bras. 2: 75 (1877)

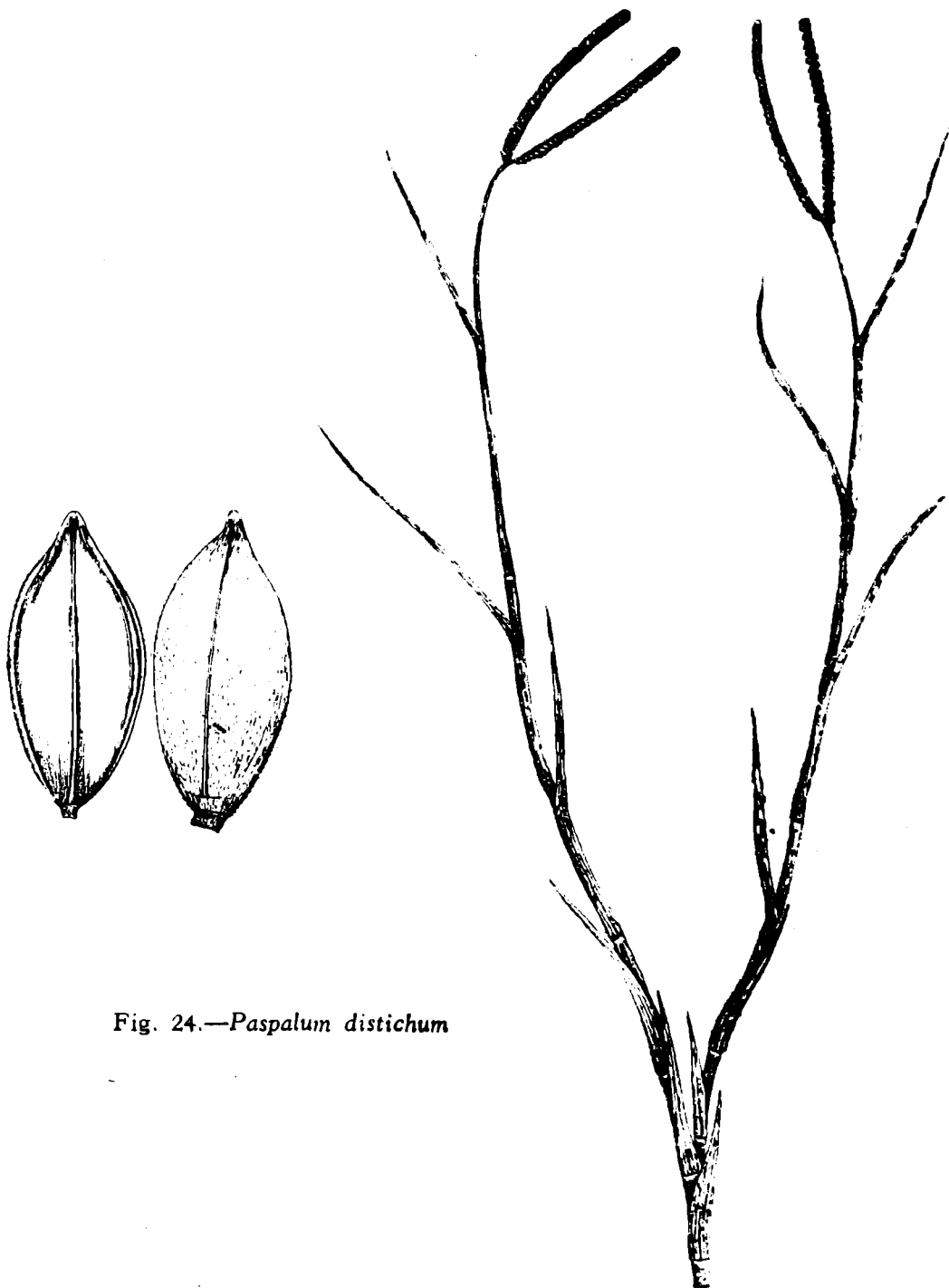


Fig. 24.—*Paspalum distichum*

Perennial, with an extensively creeping rootstock. Culms erect or ascending, up to 50 cm. high. Leaf-blades flat, rounded and ciliate at the

base, otherwise glabrous, up to 10 cm. long and 3-6 mm. wide; *sheaths* loose, keeled, ciliate on the margins above; *ligules* membranous, about 0.5 mm. long. *Racemes* 2, conjugate at the apex of the culm, rarely 3 or 4, 3-6 cm. long; one of the racemes short peduncled; rachis 1-2 mm. wide, with a tuft of hairs at the base, not winged. *Spikelets* solitary, imbricate, elliptic, acute, depressed, 3 mm. long. *Lower glume* occasionally developed. *Upper glume* as long as the spikelet, 3- to 5-nerved, minutely pubescent. *Lower lemma* similar to the upper glume but glabrous. *Upper lemma* brown, smooth.

Very common in moist places and in marshes, usually below 4000 ft.

### 3. *Paspalum scrobiculatum* Linn.

*Paspalum scrobiculatum* Linn., Mant. 1: 29 (1767); Hook. f., Flor. Brit. Ind. 7: 10 (1896).

Annual. *Culms* tufted, erect or shortly decumbent at the base, up to 1.5 m. high, leafy. *Leaf-blades* nearly erect, linear, flat, 14-45 cm. long, 2-8 mm. broad, finely acuminate, glabrous or hairy; *sheaths* compressed, loose, the mouth hairy; *ligules* membranous, very short. *Racemes* 2-6, sessile, spreading, up to 15 cm. long. *Spikelets* 2-nate, broadly elliptic, imbricate, glabrous, 2.5-3.5 mm. long. *Lower glume* absent. *Upper glume* as long as the spikelet, 5- to 7-nerved, glabrous, membranous. *Lower lemma* similar to the upper glume. *Upper lemma* thickly coriaceous, brownish, shining, scarcely punctate or striate; *palea* orbicular, tumid, dorsally convex, ventrally strongly inflexed below the middle and forming 2 broad membranous auricles that embrace the margin.

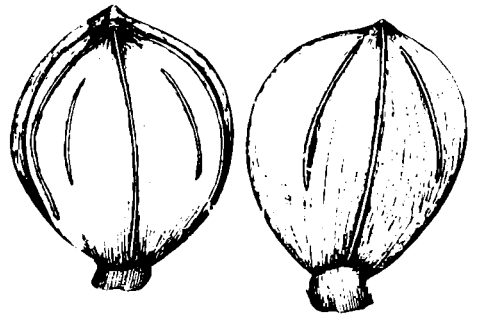


Fig. 25.—*Paspalum scrobiculatum*

Cultivated as a hot weather crop, below 6000 ft.

var. **Commersoni** (Lamk.) Stapf

*Paspalum scrobiculatum* var. *commersoni* (Lamk.) Stapf in Prain, Fl. Trop. Afr. 9: 573 (1919).

*Paspalum commersoni* Lamk., Illustr. 1: 175 (1783).

*Racemes* 3-4; spikelets smaller than in the type species, brownish at maturity with dark brown lemma, rounded and obtuse at the summit; upper glume 5- to 7-nerved; styles dark purple.

Lahore.

## 10. *Paspalidium* Stapf

Perennial, semi-aquatic or terrestrial grasses. Racemes sessile or subsessile and secund on the alternate nodes of a common axis of a false compound spike. Spikelets secund and abaxial on the triquetrous rachis of slender sessile, spiciform racemes. Glumes very unequal; lower reduced to a scale or about 1/2 as long as the spikelet; upper glume as long as the spikelet, 5- to 7-nerved. Lower floret; lemma similar to the upper glume. Upper floret bisexual; lemma crustaceous, with firm involute margins, 5-nerved; palea as long as the lemma and of the same texture.

### KEY TO THE SPECIES

1. Upper glume as long as the spikelet; fertile lemma transversely rugose..... 1. *P. geminatum*  
Upper glume shorter than the spikelet; fertile lemma smooth or nearly so.....2
2. Racemes shorter than the internodes..... 2. *P. flavidum*  
Racemes as long as or longer than the internodes.....  
..... 3. *P. punctatum*

### 1. *Paspalidium geminatum* (Forsk.) Stapf

*Paspalidium geminatum* (Forsk.) Stapf in Prain, Flor. Trop. Afr. 9: 583 (1919).

*Panicum geminatum* Forsk., Fl. Aegypt.-Arab. 18 (1755).

*Panicum fluitans* Retz., Obs. Fasc. 3: 8 (1789).

*Panicum paspaloides* Hook. f., Flor. Brit. Ind. 7: 30 (1896) non Pers.

Perennial. Culms spreading from a decumbent base or sometimes erect, glabrous, up to 80 cm. high. Leaf-blades linear, 10-25 cm. long and up to 1 cm. wide, glabrous; sheaths terete, mostly overlapping, glabrous; ligule a ridge of hairs. Panicle 5-20 cm. long; racemes 6-20, up to 4 cm. long, appressed, sessile; the rachis setulose, ending in a short sterile point. Spikelets obovate, apiculate, glabrous, 2-2.6 mm. long. Lower glume 1.2 mm. long, nerveless, broader than long, white, truncate. Upper glume slightly shorter or nearly as long as the spikelet, 5- to 7-nerved, nerves green. Lower floret male or neuter; lemma subcoriaceous, 5- to 7-nerved, paleate; palea subequal. Upper floret bisexual; lemma broadly ovate, apiculate, transversely rugose.



Fig. 26.—*Paspalidium geminatum*

Sind, Munchar Lake, Stocks; Thatta, Blatter & McCann.

2. *Paspalidium flavidum* (Retz.) A. Camus

*Paspalidium flavidum*  
(Retz.) A. Camus  
in Lecomte, Fl.  
Gen. de l'Indo-  
Chine 7:419 (1922).

*Panicum flavidum* Retz.,  
Obs. fasc. 4 : 15 (1786);  
Hook. f., Flor. Brit. Ind.  
7 : 28 (1896).

*Panicum brizoides* Jacq.,  
Eclog. Gram. 2 (1813).

Annual. Culms up  
to 90 cm. high, de-  
cumbent at the base,  
slender, somewhat



compressed, glabrous.  
Leaf-blades 8-12 cm.  
long, 4-6 mm. wide,  
ascending, rigid, linear-  
lanceolate, acuminate,  
flat or rolled, glabrous;  
sheaths longer than  
the internodes, com-  
pressed, glabrous or  
hairy at the mouth,  
those of the lower  
leaves dilated; ligule  
absent or represented  
by a row of hairs.  
Racemes 6-9, distant,



Fig. 27.—*Paspalidium flavidum*

erect, arranged racemosely on a common axis, shorter than the internodes. *Spikelets* closely imbricate, 2-ranked, 1.8-2.5 mm. long, ovate-oblong, acute, glabrous. *Lower glume* up to 1.7 mm. long, ovate, obscurely 3-nerved, clasping at the base. *Upper glume* 1.25-2.5 mm. long, convex, ovate, 7-nerved. *Lower floret* male or neuter; lemma 1.8-2.5 mm. long, convex, subcoriaceous, ovate-oblong, 3-nerved, embracing the upper floret. *Upper floret* bisexual; lemma 1.5-2.2 mm. long, strongly convex, coriaceous, broadly ovate, slightly mucronate, delicately foveolate; palea similar in texture.

In moist shady places; common below 3000 ft.

### 3. *Paspalidium punctatum* (Burm.) A. Camus

*Paspalidium punctatum* (Burm.) A. Camus in Lecomte, Fl. Gen. de l'Indo-Chine, 7: 419 (1922).

*Panicum punctatum* Burm., Fl. Ind. 26 (1768); Hook. f., Flor. Brit. Ind. 7: 29 (1896).

Perennial. *Culms* geniculately ascending, rooting at the lower nodes, 30-60 cm. high. *Leaf-blades* linear, acuminate, 10-20 cm. long, 6-9 mm. wide; lower sheaths dilated, glabrous; *ligule* a row of hairs. *Racemes* appressed, longer than the internodes; rachis glabrous. *Spikelets* 2-seriate, sessile, ovate-oblong, imbricate, 2-2.5 mm. long. *Lower glume* orbicular, 1.2-1.5 mm. long, rounded or retuse at the tip. *Upper glume* sub-orbicular, rounded or truncate at the apex, 3- to 5-nerved, as long as the spikelet. *Lower floret* neuter; lemma ovate, acute, 3- to 5-nerved, as long as the spikelet. *Upper floret* bisexual; lemma ovate, cuspidately acuminate, granulate; palea coriaceous, inflexed.

Lahore, J. L. Stewart; Baluchistan, R. R. Stewart.

## 11. *Urochloa* Beauv.

Perennial or annual grasses with linear to lanceolate, flat leaves. *Racemes* sessile or subsessile on a common axis. *Spikelets* solitary or 2-nate, secund and abaxial on the rachis of slender or stout spiciform racemes. *Glumes* similar and subequal or very unequal in length; lower shorter, the upper as long as the spikelet. *Lower floret*; lemma very similar to the upper glume but flat or slightly depressed, 5- to 7-nerved. *Upper floret*; lemma very obtuse with a scabrid or barbellate mucro, crustaceous; palea as long as the lemma.

## 1. *Urochloa panicoides* Beauv.

*Urochloa panicoides* Beauv., Ess. Agrost. 52 (1812).

*Panicum javanicum* Poir, Encycl. Suppl. 4: t. 274 (1816); Hook. f., Flor. Brit. Ind. 7: 35 (1896).

*Panicum hirsutum* Koen. ex Roxb., Hort. Beng. 7 (1814).

*Urochloa helopus* Stapf in Prain, Flor. Trop. Afr. 9: 595 (1919).

Annual. Culms erect or geniculately ascending, up to 60 cm. high; nodes pubescent. Leaf-blades ovate-lanceolate, acuminate, glabrous above, hairy below, base rounded or cordate; sheaths softly hairy, mouth villous; ligule a rim of hairs. Panicle erect; racemes 5-10, rather distant; rachis glabrous or pubescent. Spikelets 2-seriate, 3.5-4 mm. long, secund, loosely imbricate. Lower glume  $1/2$  as long as the spikelet, broadly ovate, acute or obtuse, 3- to 5-nerved. Upper glume as long as the spikelet, ovate, acute, 7-nerved. Lower lemma similar to the upper glume, 5-nerved. Upper lemma broadly ovate or oblong, abruptly mucronate, rugulose; palea similar in texture.

Quetta; Lahore; Rawalpindi, and in the hills up to 5000 ft. Common during the rains.

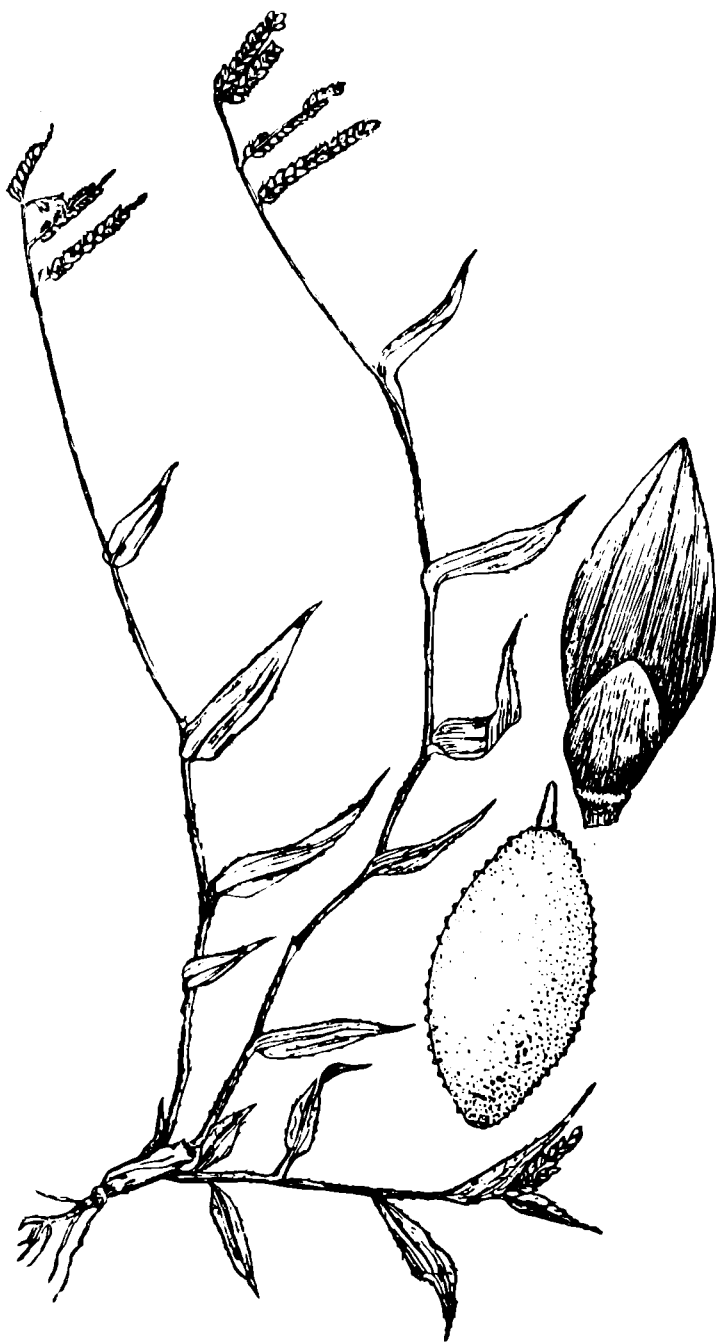


Fig. 28.—*Urochloa panicoides*

## 12. *Echinochloa* Beauv.

Perennial or annual grasses with flat leaves. Leaves without ligules or the ligule represented by a fringe of hairs. Panicle erect or nodding, formed of a few to many scattered or clustered spike-like racemes. Spikelets more or less dorsally compressed, crowded, in pairs or in clusters on one side of the rachis. Glumes membranous, unequal; the lower much shorter than the upper, 3- to 5-nerved, nerves more or less hispid, acute or cuspidate rarely produced into a short awn. Lower floret male or neuter; lemma resembling the upper glume, but more prominently cuspidate or awned; palea reduced or as long as the lemma. Upper floret bisexual; lemma coriaceous, smooth, apiculate or obtuse, obscurely 5-nerved; palea as long as the lemma.

### KEY TO THE SPECIES

1. Ligule a fringe of stiff hairs.....1. *E. stagnina*  
Ligule absent.....2
2. Spikelets 5-6 mm. long.....2. *E. frumentacea*  
Spikelets up to 4 mm. long.....3
3. Upper glume and the lower lemma equally acute or cuspidate; racemes distant, 3-4 mm. broad, more or less erect; axis and rachis not silky; glumes not ciliate.....3. *E. colonum*  
Upper glume less cuspidate or awned than the lower lemma; racemes crowded, 4-8 mm. broad, more or less spreading; axis and rachis with long bristles; glumes long-ciliate.....4. *E. crus-galli*

### 1. *Echinochloa stagnina* (Retz.) Beauv.

*Echinochloa stagnina* (Retz.) Beauv., Ess. Agrost. 161 (1812).

*Panicum stagninum* Retz., Obs. fasc. 4: 17 (1789).

*Oplismenus stagninus* (Retz.) Kunth, Rev. Gram. 1: 44 (1827).

*Panicum crus-galli* var. *stagninum* (Retz.) Trim. ex Hook. f. in Trim., Fl. Ceyl. 5: 136 (1885).

Annual or perennial. Culms erect from a geniculate or prostrate base, up to 1.5 m. high. Leaf-blades 15-45 cm. long, 3-12 mm. wide, linear, tapering to a fine point; sheaths smooth, glabrous; ligule a fringe of stiff hairs. Panicle 10-20 cm. long; axis slender, more or less flexuous, angular, scabrid on the ridges and with scattered bristles; racemes few to many, distant or close, alternate, usually suberect, 2.5-5 cm. long, sessile or nearly so, with a tuft of hairs at the base; rachis angular,

grooved, clothed with bulbous-based hairs. *Spikelets* crowded, ovoid-lanceolate, 4-5 mm. long, hairy. *Lower glume* 2.5 mm. long, broadly ovate or suborbicular, cuspidate, 3-nerved, hairy and ciliate. *Upper glume* as long as the spikelet, broadly ovate, concave, hairy and ciliate, 7-nerved, acuminate or awned. *Lower lemma* male, similar to the upper glume, awned; awn 5-25 mm. long; palea hyaline, as long as the lemma. *Upper lemma* ovate-lanceolate, mucronate, shining, faintly striolate; palea similar.

Rawalpindi, A. R. Beg, no. 24852 in Herb. Gordon College.

## 2. *Echinochloa frumentacea* (Roxb.) Link

*Echinochloa frumentacea* (Roxb.) Link, Enum. Hort. Berol. 1 : 204 (1821).

*Panicum frumentaceum* Roxb., Hort. Beng. 7 (1814) name only ; Fl. Ind. 1 : 307 (1820).

*Panicum stagninum* var. *frumentacea* Cooke, Fl. Bomb. 2 : 931 (1908).

*Panicum crus-galli* var. *frumentaceum* Trim., Cat. Cey. Fl. 104 (1885) ; Hook. f., Fl. Brit. Ind. 7 : 31 (1896).

*Echinochloa crus-galli* var. *frumentacea* Haines in Bot. Bih. and Or. 998 (1924).

*Echinochloa colona* var. *frumentacea* Blatter & McCann in Jour. Bomb. Nat. Hist. Soc. 32 : 647 (1928).

Annual. *Culms* densely tufted, up to 1.5 m. high, terete, smooth and glabrous, much branched from the lower nodes. *Leaf-blades* linear-lanceolate, acuminate, up to 60 cm. long, 1.2 cm. wide, smooth and glabrous on both surfaces ; *sheaths* loose, membranous, longer than the internodes, slipping from the culms, smooth and glabrous, compressed and keeled in the upper half ; *ligule* a glabrous, fleshy ring. *Panicle* made up of alternate, 2-nate or 3-nate, closely spiculate racemes, rather distant on a central axis ; axis branched, scabrid on the angles, villous at the insertion of the branches ; branches scabrid ; branchlets 2- to 3-spiculate. *Spikelets* 5-6 mm. long, obovate or ovate, cuspidate, turgid. *Lower glume* 3 mm. long, clasping at the base, apiculate, 5-nerved, minutely hispid in the interspaces. *Upper glume* as long as the spikelet, cuspidate, 5-nerved, minutely hispid in the interspaces. *Lower lemma* similar to the upper glume, 7-nerved ; palea 3 mm. long, broadly ovate, obtuse, ciliolate on the margins with 2 inflexed flaps. *Upper lemma* elliptic, acute, crustaceous, tip minutely ciliolate ; palea broadly elliptic, acute, crustaceous, rounded on the margins, broadly inflexed.

Cultivated for fodder, up to 5000 ft.

## 3. *Echinochloa colona* (Linn.) Link

*Echinochloa colona* (Linn.) Link, Hort. Berol. 2 : 209 (1833).

*Panicum colona* Linn., Syst. ed. 10, 870 (1759) ; Hook. f., Flor. Brit. Ind. 7 : 32 (1896).



Annual. Culms densely tufted, up to 60 cm. high, erect or geniculately ascending, simple or branched from the base, glabrous and smooth; nodes glabrous or puberulous. Leaf-blades linear, gradually narrowed to



Fig. 29.—*Echinochloa colonum*. Plant and two views of the spikelet.

the apex, up to 20 cm. long, 8 mm. wide, glabrous, margins scaberulous ; *sheaths* loose in the lower part of the culm, rather tighter above, as long as the internode or slightly shorter, more or less compressed ; *ligule* absent. *Panicle* erect, narrow, more or less exserted, up to 12 cm. long ; racemes 6-10, rather distant, solitary rarely 2-nate, erect and often appressed to the rachis, scabrid, without hairs or with hairs at the base. *Spikelets* crowded, usually 4-ranked, on one side of the rachis, ovate to ovate-elliptic, 2.5-3.7 mm. long, 1.3 mm. broad, acute or shortly cuspidate. *Lower glume* broadly ovate, acute to cuspidate, 1.25 mm. long or less. *Upper glume* elliptic-ovate, acute or cuspidate, as long as the spikelet, 5- to 7-nerved, minutely pubescent, scabrid. *Lower lemma* similar to the upper glume ; *palea* oblong, acute, as long as the lemma or slightly shorter. *Upper lemma* elliptic-ovate, rounded on the back, more or less cuspidate, about 2.5 mm. long, whitish, coriaceous, longitudinally striolate ; *palea* similar.

Very common in cultivated fields during monsoon rains. Hyderabad ; Quetta ; Peshawar ; Lahore ; Sheikhpura ; Sargodha ; Rawalpindi, etc.

#### 4. *Echinochloa crus-galli* (Linn.) Beauv.

*Echinochloa crus-galli* (Linn.) Beauv., Ess. Agrost. 161 (1812).

*Panicum crus-galli* Linn., Sp. Pl. 56 (1753) ; Hook. f., Fl. Brit. Ind. 7 : 30 (1896).

Annual. *Culms* densely tufted, up to 1 m. high, erect or spreading, rather stout, usually much branched from the base, smooth. *Leaf-blades* linear-lanceolate, flat, 8-35 cm. long, 8-20 mm. wide, smooth, scabrid along the margins ; *sheaths* loose, compressed and keeled in the upper half, smooth and glabrous ; *ligule* absent. *Panicle* lanceolate to ovate, erect or nodding, 6-20 cm. long, up to 8 cm. wide ; axis with tufts of hairs at the nodes ; racemes very dense, few to many, scattered or clustered, up to 8 cm. long, 4-8 mm. broad ; rachis bristly and scabrid. *Spikelets* crowded, in pairs or clusters on one side of the rachis, ovate-elliptic in back view, semi-elliptic in side view, 3.5-4 mm. long, 2 mm. broad, acuminate or awned. *Lower glume* broad, about 1.4 mm. long or less, 3-nerved. *Upper glume* as long as the spikelet, 5-nerved, the nerves bearing numerous short bristles. *Lower lemma* similar to the upper glume but flat or depressed on the back, 5- to 7-nerved, pointed, or abruptly short cuspidate or awned ; awn up to 5 cm. long ; *palea* shorter than the lemma. *Upper lemma* as long as the spikelet, rounded on the back, cuspidate, white or yellowish, longitudinally striolate ; *palea* as long as the lemma. *Anthers* less than 1 mm. long.

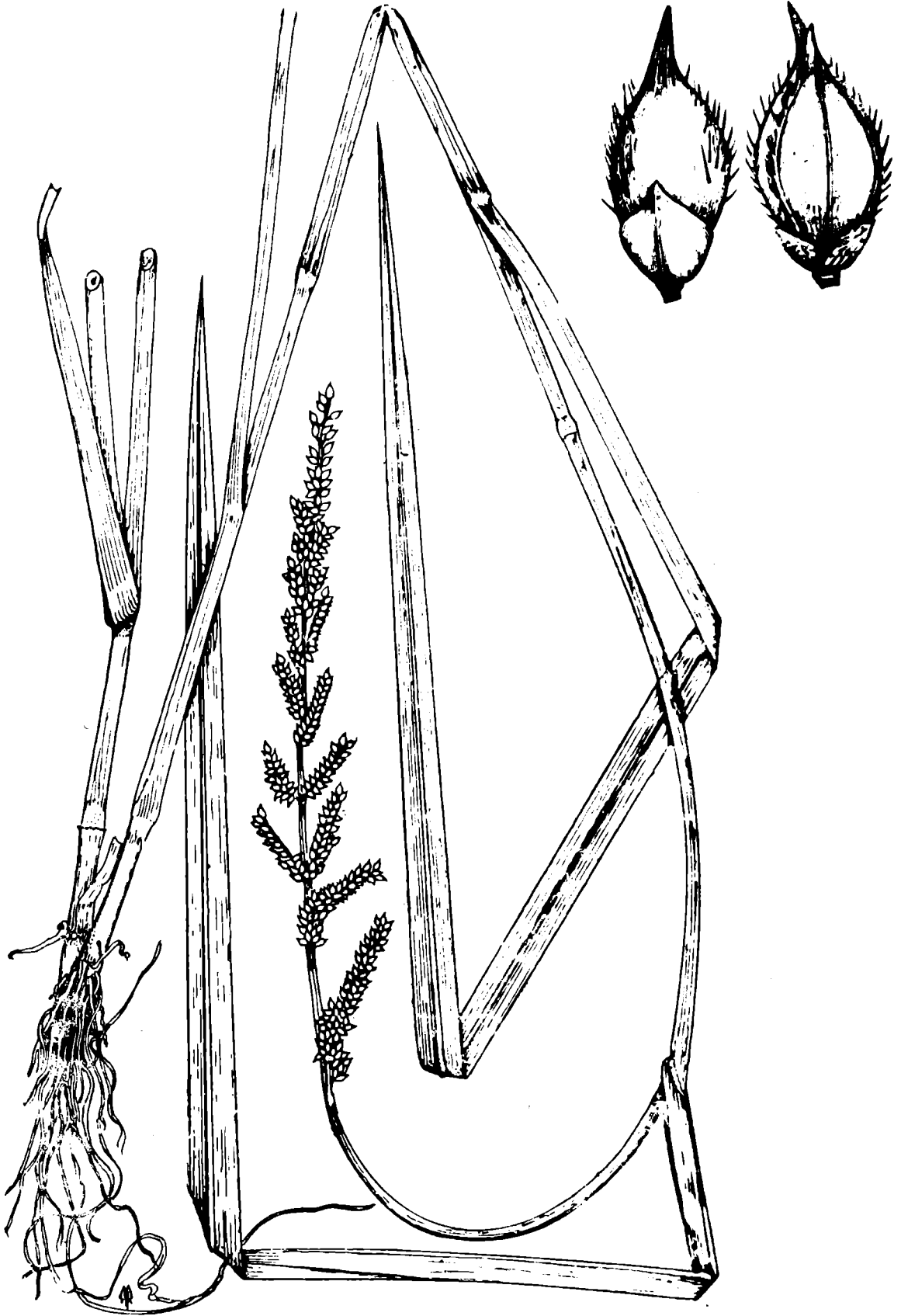


Fig. 30. *Echinochloa crus-galli*. Plant and two views of the spikelet.

Very common in marshy places and in rice fields, up to 8000 ft.

————— var. **longiseta** (Doell) Neilr. Fl. N. Oest. 31 (1859).  
*Panicum crus-galli* var. *longisetum* Doell., Fl. Bad. 1 : 232 (1857). Lower lemma with a long awn.

Quetta, Asghar Ali ; Swat, Shaukat Ali ; Sangla Hill, etc.

————— var. **submutica** Neilr. l.c.- *Panicum crus-galli* var. *muticum* Wirtg. Herb. Fl. Rhen. 3 : 125 a (1865). Lower lemma awnless.  
Lahore ; Peshawar ; Sheikhpura, etc.

### 13. **Oplismenus** Beauv.

Annual or more usually perennial grasses. Spikelets solitary, secund and abaxial on the rachis of racemosely arranged, densely or more rarely interruptedly spiciform racemes. Glumes similar in shape and texture, subequal, both or at least the lower awned. Lower floret exceeding the glumes; lemma similar to the glumes, muticous or mucronate or very shortly awned. Upper floret; lemma muticous, chartaceous to subcoriaceous ; palea as long as the lemma and enclosed by it.

#### KEY TO THE SPECIES

1. Inflorescence a simple terminal spike.....1. *O. undulatifolius*  
Inflorescence a panicle of spike-like racemes.....2
2. Awn smooth, viscid, filiform.....2. *O. compositus*  
Awn minutely scaberulous ; rachis with long white hairs  
..... 3. *O. burmannii*

#### 1. **Oplismenus undulatifolius** Beauv.

*Oplismenus undulatifolius* Beauv., Ess. Agrost. 54 (1812) ; Hook. f., Flor. Brit. Ind. 7 : 66 (1896).

Perennial. Culms up to 60 cm. high, usually very slender and ascending from a long creeping base, simple or branched below ; nodes glabrous or softly hairy. Leaf-blades 5-12 cm. long, 10-15 mm. wide, ovate to linear-lanceolate, finely acuminate, glabrous or sparsely hairy, smooth or scabrid; sheaths rather loose, shorter than the internodes, glabrous or hairy, densely ciliate along the margins. Inflorescence a simple terminal spike, 5-12.5 cm. long; axis glabrous or pilose with spreading hairs. Spikelets solitary or in clusters of 2-6, sessile or very shortly pedicelled, 3-5 mm. long, more or less hairy and rough. Lower glume ovate, 3-to 5-nerved, 2 mm. long, ciliate, awned ; awn 1.8 cm. long.



Fig. 31.—  
*Oplismenus undulatifolius*.  
Spikelet.

*Upper glume* slightly longer, usually awned, 5-nerved. *Lower floret* neuter; lemma as long as the spikelet, acute or shortly awned, 7- to 9-nerved; palea short or 0. *Upper floret* bisexual; lemma elliptic, mucronate, 3 mm. long, smooth, shining; palea similar, margins infolded.

Kagan Valley; Swat State;  
Murree Hills; Poonch.

2. ***Oplismenus compositus***  
(Linn.) Beauv.

*Oplismenus compositus* (Linn.)  
Beauv., Ess. Agrost. 54 (1812);  
Hook. f., Flor. Brit. Ind. 7:  
66 (1896).

*Panicum compositum* Linn., Sp. Pl. 57  
(1753).

Perennial. *Culms* up to 1 m. high, arising from a decumbent base, stout or slender, branched from the base and sometimes upwards; nodes usually pubescent. *Leaf-blades* 5-15 cm. long, 3.5-4.5 cm. wide, lanceolate to linear-lanceolate, base rounded, minutely hairy to velvety below, sometimes with scattered hairs above; *sheaths* glabrous, pilose or hirsute, densely ciliate along the margins. *Panicle* formed of secund or subsecund, spike-like racemes; racemes distant, 1.5-7.5 cm. long, erect or spreading. *Spikelets* 3-5 mm. long, solitary or 2-nate, glabrous or with few or many bristles, rarely softly hairy. *Lower glume* 3 mm. long, 3-nerved, ciliate, awned; awn 6-12 mm. long, smooth, viscid, filiform. *Upper glume* longer or shorter than the lower, 5- to 7-nerved, acute, awn if present, 2.5-3 mm. long. *Lower floret* neuter; lemma similar to the upper glume, apiculate, mucronate or with a short awn,



Fig. 32.—

*Oplismenus compositus*.  
Plant and a spikelet.

7- to 9-nerved, tip hispid; palea reduced or absent. *Upper floret* bisexual; lemma oblong, terete, acuminate, subcoriaceous; palea similar, yellowish, shining.

Murree Hills; Kagan valley; Swat State; Rawalpindi.

### 3. *Oplismenus burmannii* (Retz.) Beauv.

*Oplismenus burmannii* (Retz.) Beauv., Ess. Agrost. 54 (1812); Hook. f., Flor. Brit. Ind. 7 : 68 (1896).

*Panicum burmannii* Retz., Obs. fasc. 3 : 16 (1783).

Annual. *Culms* decumbent, branched, up to 50 cm. high; nodes pubescent. *Leaf-blades* ovate-lanceolate or lanceolate, acuminate, 2-5 cm. long, 5-13 mm. wide, with long scattered white hairs; *sheaths* somewhat loose, ciliate along the margins, otherwise glabrous or more or less hairy; *ligule* very short, truncate. *Panicle* consisting of 3-8 more or less secund, very dense, spike-like racemes; axis glabrous or finely pubescent; racemes rather distant, subsessile, up to 1.5 cm. long; rachis slender, angular, clothed with long silky hairs.

*Spikelets* solitary or 2-nate, 2.5-3

mm. long. *Lower glume* ciliate, 1.8-2 mm. long, 3- to 5-nerved,

awned; awn capillary, minutely scaberulous, 4-10 mm.

long. *Upper glume* subequal, similar, 5- to 7-nerved.

*Lower floret* neuter; lemma broadly ovate, concave, silkily hairy and ciliate, 5- to 9-nerved, awned; awn about 2 mm. long. *Upper floret* bisexual; lemma oblong, acute, subcoriaceous, 7-nerved, with incurved margins; palea similar.

Murree Hills; Lahore, Changa Manga Forest and Jinnah Gardens.

### 14. *Tricholaena* Schrad.

Perennial grasses with narrow leaves. Ligule reduced to a fringe of hairs. Panicle loose, the spikelets



Fig 33.—

*Oplismenus burmannii*.  
Plant and spikelet

solitary, laterally compressed, 2-flowered. Glumes very unequal, the lower reduced to a scale or absent; the upper as long as the spikelet; clothed with long silky hairs in the lower part, mucicous or aristate. Lower floret male or neuter; lemma as long as the upper glume and similar to it; palea rarely absent. Upper floret bisexual; lemma smaller than the lower lemma, thinly cartilaginous, glabrous, shining; palea similar.

1. ***Tricholaena teneriffae*** (Linn.) Parl.

*Tricholaena teneriffae* (Linn.) Parl. in Webb. & Berth., Fl. Canar. 3 : 425 (1836-50); Hook. f., Fl. Brit. Ind. 7 : 65 (1896).

*Saccharum teneriffae* Linn. f., Suppl. 106 (1781).

*Panicum teneriffae* (Linn. f.) R. Br., Prodr. 189 (1810).

Perennial; rootstock caespitose, more or less woody. Culms erect

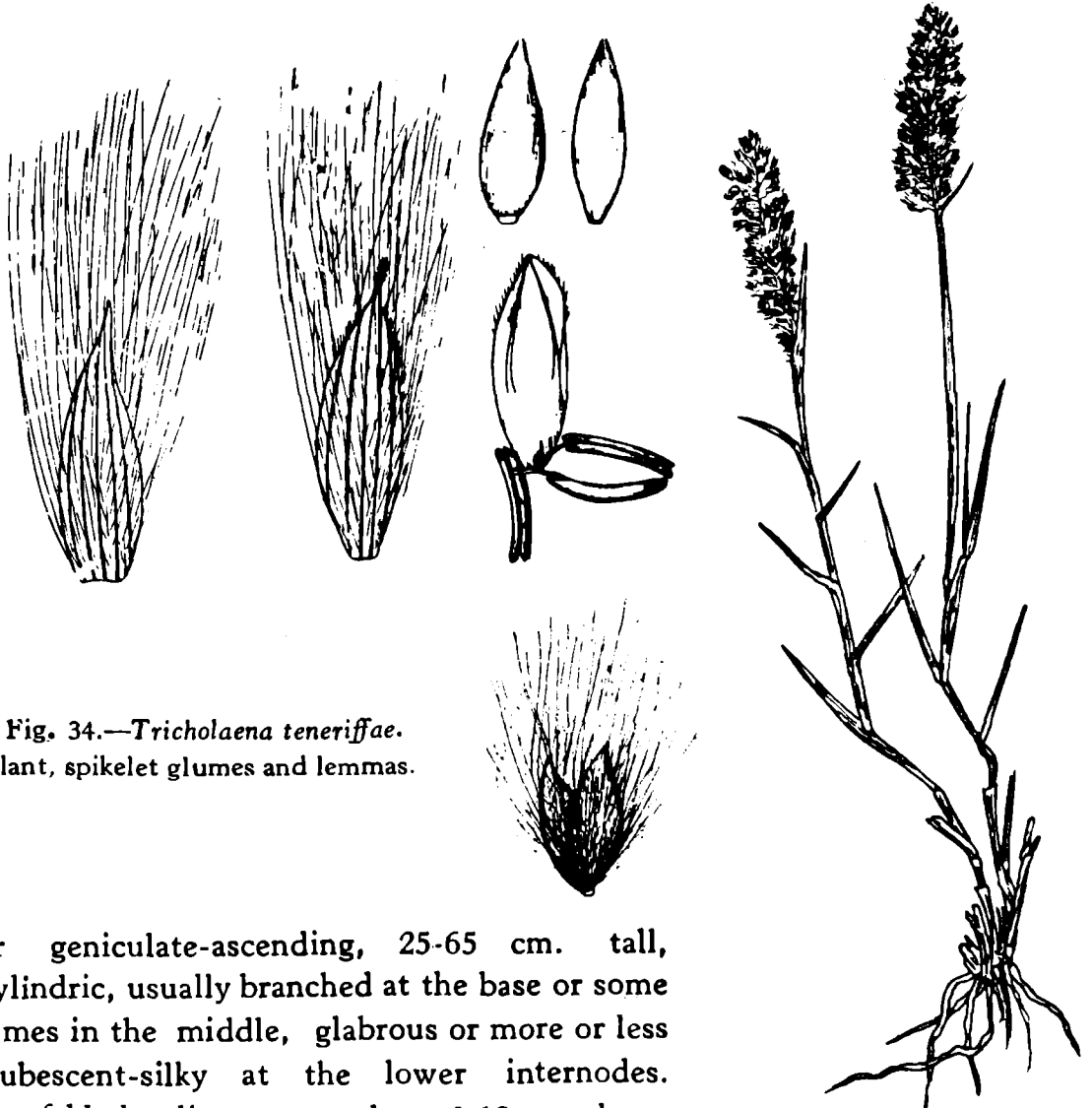


Fig. 34.—*Tricholaena teneriffae*.  
Plant, spikelet glumes and lemmas.

or geniculate-ascending, 25-65 cm. tall, cylindrical, usually branched at the base or some times in the middle, glabrous or more or less pubescent-silky at the lower internodes. Leaf-blades linear, convolute, 2-18 cm. long,

1-3 mm. broad, glabrous or pubescent; *sheaths* not compressed, finely striate, glabrous, bearded at the mouth; *ligule* a narrow softly hairy ridge. *Panicle* oval or oblong, more or less open, 5-10×2.5 cm.; the primary axis more or less hairy at the nodes; branches semi-verticillate or geminate, rarely solitary, once or twice furcate, filiform, glabrous, flexuous. *Spikelets* ovoid or oblong, 2.5-3.5 mm. long, whitish or purplish, silky with long (up to 4 mm.) white, spreading hairs. *Lower glume* very minute or absent. *Upper glume* ovate, acute or mucronate, 5-nerved, lower half with long hairs the upper glabrous, ciliate along the margins. *Lower floret* male; lemma similar to the upper glume but sometimes slightly broader, apiculate; palea subequal, 2-keeled, lanceolate, ciliate along the margins and the keels; anthers 1.4 mm. long. *Upper floret* bisexual; lemma ovoid, acuminate, about 2 mm. long, thinly cartilaginous, glabrous, shining; palea similar, as long as the lemma, glabrous.

Attock, Malakand; Swat; Sakhi Sarwar, Dera Ghazi Khan; Quetta; Sind: Laki, *Bhide*; Thano Bullo Khan, *Woodrow*; Ziarat Kaka Sahib, *Mian M. Yusuf*. In rocky places.

### 15. *Setaria* Beauv.

Annual or perennial grasses with narrow, flat leaves. Panicle spiciform or more or less open. Spikelets subtended by one to many persistent bristles (modified branchlets). Glumes unequal, membranous, the lower much smaller with a clasping base, 3- to 5-nerved; upper as long as the spikelet or shorter, 5-nerved. Lower floret male or neuter; lemma membranous, 5- to 7-nerved, as long as the upper glume. Upper floret bisexual; lemma convex on the back, more or less apiculate, crustaceous, finely pitted or transversely rugose; palea as long as the lemma and similar in texture.

#### KEY TO THE SPECIES

1. Leaf-blades plicate between the veins; inflorescence a loosely spiculate panicle; spikelets solitary.....1. *S. palmifolia*  
 Leaf-blades flat; inflorescence a false spike or a narrow panicle; spikelets clustered.....2
2. Bristles retrorsely barbed.....2. *S. verticillata*  
 Bristles antrorsely barbed.....3
3. Upper glume as long as the spikelet.....4  
 Upper glume shorter than the spikelet.....5



4. Spikelets persistent, fruit only deciduous; lower lemma epaleate; cultivated.....3. *S. italica*  
 Spikelets deciduous; lower lemma paleate, ; wild.....4. *S. viridis*
5. Panicle dense cylindric ; spikelets more than 3 mm. long.....5. *S. glauca*  
 Panicle narrow, lobed in the lower part, tapering upwards; spikelets 2-2.5 mm. long.....6 *S. tomentosa*

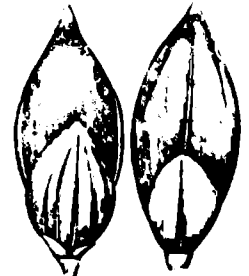
1. **Setaria palmifolia** Stapf

*Setaria palmifolia* Stapf in Jour. Linn. Soc. 42 : 186 (1914)

*Panicum plicatum* Willd., Enumer. Pl. 1033 (1809) non Lamk. ; Hook. f., Flor. Brit. Ind. 7 : 55 (1896).

*Setaria plicata* (Willd.) T. Cooke, Fl. Bomb. 2 : 919 (1908).

Perennial. *Culms* 0.5-2 m. high, erect or ascending from a branching woody rootstock ; nodes strigillose. *Leaf-blades* linear-lanceolate, finely acuminate, 16-60 cm. long, plicate between the veins, 1.3-5.7 cm. wide, glabrous, scaberulous ; *sheaths* smooth, densely ciliate only near the collar; *ligule* of long hairs. *Panicle* open, erect or nodding, 30-60 cm. long; branches alternate, distant, 1-4 cm. long. *Spikelets* solitary, ovoid, acute or apiculate, 3 mm. long, sessile or shortly pedicelled, glabrous. *Lower glume* broadly ovate, obtuse, 1/2 as long as the spikelet. *Upper glume* more than 1/2 as long as the spikelet, ovate, obtuse, 7 nerved. *Lower floret* barren; lemma longer than the lemma of the upper floret, ovate, shortly apiculate, 5-nerved ; palea present or absent. *Upper floret* bisexual ; lemma ovate-oblong, shortly apiculate, crustaceous, transversely striate ; palea ovate, acute, as long as the lemma.



35. Fig.—  
*Setaria palmifolia*.

Cultivated in gardens.

2. **Setaria verticillata** (Linn.) Beauv.

*Setaria verticillata* (Linn.) Beauv., Ess. Agrost. 51 (1812) ; Hook. f., Flor. Brit. Ind. 7 : 80 (1896).

*Panicum verticillatum* Linn., Sp. Pl. 82 (1753).

Annual. *Culms* geniculately ascending, up to 60 cm. high, branched from the base, smooth, glabrous. *Leaf-blades* lanceolate or linear-lanceolate, acuminate, 20 cm. long, 2 cm. broad, flat, finely hairy, margin and surface scabrid ; *sheaths* compressed, keeled, glabrous, margins hyaline,

densely ciliate-pubescent; *ligules* membranous, lacerate, ciliate. *Panicle* cylindrical or oblong, coarsely bristly, up to 10 cm. long; bristles 1 or few, provided with reversed barbs. *Spikelets* ovoid, 2 mm long. *Lower glume* hyaline, ovate, acute. 3-nerved, up to 1 mm. long. *Upper glume* ovate, subacute, 5-nerved, as long as the spikelet. *Lower floret* neuter; lemma similar to the upper glume; palea very small or absent. *Upper floret* bisexual; lemma coriaceous, elliptic-oblong, sub-obtuse, minutely rugulose.

Very common throughout the plains. Lahore; Sheikhpura; Rawalpindi; Peshawar; Quetta; Karachi; Hyderabad; Multan; Swat.

3. ***Setaria italica*** (Linn.) Beauv.

*Setaria italica* (Linn.) Beauv., Ess.

Agrost. 51 (1812); Hook. f.,

Flor. Brit. Ind. 7: 78 (1896).

*Panicum italicum* Linn., Sp. Pl. 56 (1753).

Annual. *Culms* erect, tufted, up to 1.2 m. high. *Leaf-blades* linear-lanceolate, 15-20 cm. long, 1.5-3 cm. wide; scabrid on the surfaces and along the margins; *sheaths* densely ciliate along the margins. *Panicle* cylindrical or lobed, up to 22 cm. long, 1.5 cm. broad, usually nodding. *Spikelets* oval, 2-2.5 mm. long. Involucral bristles 2-3, with suberect or spreading barbs. *Lower glume* oblong, hyaline, smooth. *Upper glume* ovate, obtuse, as long as the spikelet, 5-nerved. *Lower floret* neuter; lemma elliptic, hyaline, 4- to 5-nerved. *Upper floret* bisexual; lemma oval or elliptic, concave, coriaceous, smooth.



Fig. 36.—*Setaria verticillata*.

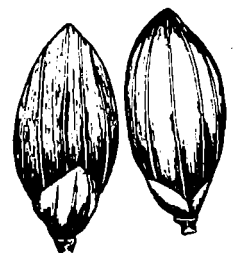


Fig. 37.—*Setaria italica*.

Cultivated throughout the plains and the hills.

4. **Setaria viridis** (Linn.) Beauv.

*Setaria viridis* (Linn.) Beauv., Ess. Agrost. 51 (1812); Hook. f., Flor. Brit. Ind. 7 : 80 (1896).

*Panicum viridis* Linn., Sp. Pl. 83 (1753).

A loosely tufted annual, 10-60 cm. high. *Culms* erect or usually decumbent at the base, 3- to 5-noded, branched or not, rough below the panicle. *Leaf-blades* linear, or linear-lanceolate, finely pointed, up to 12 cm. long, 4-18 mm. wide, smooth or finely scaberulous. *Panicle* spiciform, very bristly, erect, very dense, cylindric, 1-5 cm. long, 4-8 mm. broad; bristles 1-3 beneath each spikelet, up to 10 mm. long, minutely antrorsely scabrid. *Spikelets* elliptic-oblong, 2-3 mm. long. *Lower glume* 1/3 the length of the spikelet, ovate, 1- to 3-nerved. *Upper glume* size and shape of the spikelet, 5-nerved. *Lower lemma* resembling the upper glume, 5- to 7-nerved; palea up to 1/2 its length. *Upper lemma* as long as the spikelet, elliptic-oblong, blunt, very finely wrinkled.

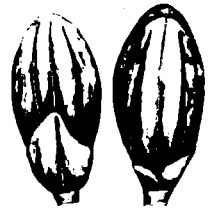


Fig. 38.—*Setaria viridis*.

Quetta ;  
Kalat; Murree  
Hills; Abbot-  
tabad ; Swat,  
Mingora.  
Very com-  
mon from  
4-11000 ft.

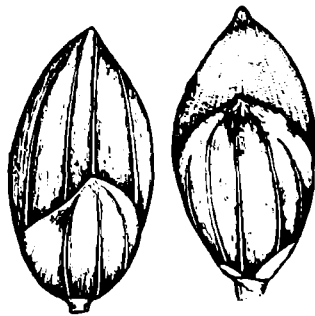


Fig. 39. - *Setaria glauca*.

5. **Setaria glauca** (Linn.) Beauv.

*Setaria glauca* (Linn.) Beauv., Ess. Agrost. 51 (1812); Hook. f., Flor. Brit. Ind. 7 : 78 (1896).



*Panicum glaucum* Linn., Sp. Pl. 83 (1753).

*Setaria lutescens* (Weig.) F. T. Hubbard in Rhodora 18 : 232 (1916).

Annual. Culms 6-75 cm. high, loosely tufted or solitary, erect or geniculately ascending, 2- to 4-noded, smooth but scabrid below the panicle. glabrous. Leaf-blades linear, finely pointed, up to 30 cm. long, 10 mm. wide, hairy towards the base or glabrous, margins minutely scabrid; lower sheaths compressed and keeled, upper terete, smooth and glabrous; ligule truncate, lacerate, ciliate. Panicle spiciform, very dense and bristly, erect, cylindrical, up to 14 cm. long, 4-8 mm. broad; branches usually bearing a single spikelet and beneath it 5-10 bristles; bristles slender, rigid, minutely antrorsely scabrid, up to 10 mm. long. Spikelets broadly elliptic, 3-3.5 mm. long, falling entire at maturity. Lower glume broadly ovate,  $1/3-1/2$  the length of the spikelet, 3-nerved. Upper glume similar,  $2/3$  the length of the spikelet, 3-nerved. Lower lemma as long as the spikelet, flat or slightly depressed on the back, 5-nerved; palea as long as the lemma. Upper lemma as long as the spikelet, broadly boat-shaped, rounded on the back, prominently transversely rugose; palea as long as the lemma.

Peshawar;  
Quetta; Mirpur  
Khas; Hyder-  
abad; Lahore;  
Sheikhupura;  
Multan; Sar-  
godha; Rawal-  
pindi. Very common through-  
out the plains and in the hills  
up to 8000 ft.

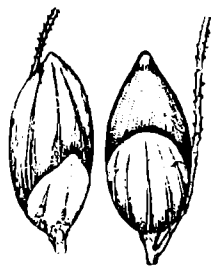


Fig. 40.—  
*Setaria tomentosa*.



6. ***Setaria tomentosa***  
(Roxb.) Kunth

*Setaria tomentosa* (Roxb.)  
Kunth, Rev. Gram. 47 (1829).

*Panicum tomentosum* Roxb., Hort. Beng. 7 (1814) ; Fl. Ind. 1 : 304 (1820).

*Setaria intermedia* (Roth) Roem. et Schult. Syst. 2 : 489 (1817) ; Hook. f. Flor. Brit. Ind. 7 : 79 (1896).

*Panicum intermedium* Roth, Nov. Sp. 47 (1821) non Vahl ex Horn 1813.

Annual. Culms slender, densely tufted, erect or geniculately ascending, simple or branched, up to 50 cm. high. Leaf-blades linear, acuminate, up to 20 cm. long, 5 mm. wide, scaberulous, sparsely hairy, margins scabrid ; sheaths compressed, glabrous, margins hairy ; ligule membranous, lacerate, ciliate. Panicle narrowly pyramidal or subspiciform, very slender, with segregate clusters of involucre, 2-6 cm. long, 2-5 mm. in diameter ; axis scabrid. Spikelets ovoid, 2-2.5 mm. long, with 3-6 bristles beneath it ; bristles rigid, antrorsely scabrid, up to 10 mm. long. Lower glume about 0.8 mm. long, 3-nerved. Upper glume about 1.2 mm. long, broadly ovate, 5-nerved. Lower lemma broadly ovate, 5-nerved, as long as the spikelet ; palea hyaline, thin. Upper lemma broadly ovate, as long as the spikelet, transversely rugose.

Lahore ; Rawalpindi ; Sheikhpura ; Lyallpur ; Karachi.

## 16. *Cenchrus* Linn.

Annual or perennial grasses with narrow leaves. Inflorescence a simple spike, spike-like raceme or a panicle. Spikelets 2-flowered, solitary or 2-3 enclosed in an involucre formed of bristles and spines united at the base and deciduous with the spikelets. Glumes unequal, the lower smaller, the upper as long as the spikelet. Lower floret male, neuter or entirely suppressed ; lemma 3- to 5-nerved, paleate ; palea narrowly lanceolate. Upper floret bisexual ; lemma rigid, 3- to 5-nerved ; palea lanceolate.

### KEY TO THE SPECIES

1. Involucre formed of fine bristles connate at the base.....2  
     Involucre formed of subulate hard spines connate to a longer distance...3
2. Involucre forming a broad cupule ; internal bristles subequal, 12-22 mm. long.....1. *C. prieurii*  
     Involucre forming a narrow cupule ; inner bristles subequal, less than 12 mm. long or with one up to 16 mm. long.....2. *C. pennisetiformis*
3. Inner bristles erect, not ciliate.....3. *C. setigerus*  
     Inner bristles squarrosely spreading, ciliate at the base and retrorsely barbed at the tip.....4 *C. biflorus*

1. *Cenchrus pennisetiformis* Hochst.

*Cenchrus pennisetiformis* Hochst. ex Steud., Nom. ed. 2, 1 : 317 (1840).

*Pennisetum cenchroides* Rich. var. *echinoides* Hook. f., Flor. Brit. Ind. 7 : 88 (1896).

*Pennisetum ciliare* Blatter & McCann, Bomb. Grasses, 181 (1935) non Link.

Annual or perennial. *Culms* densely tufted, erect or geniculately ascending from a branching often nodose rootstock, the sheaths of which

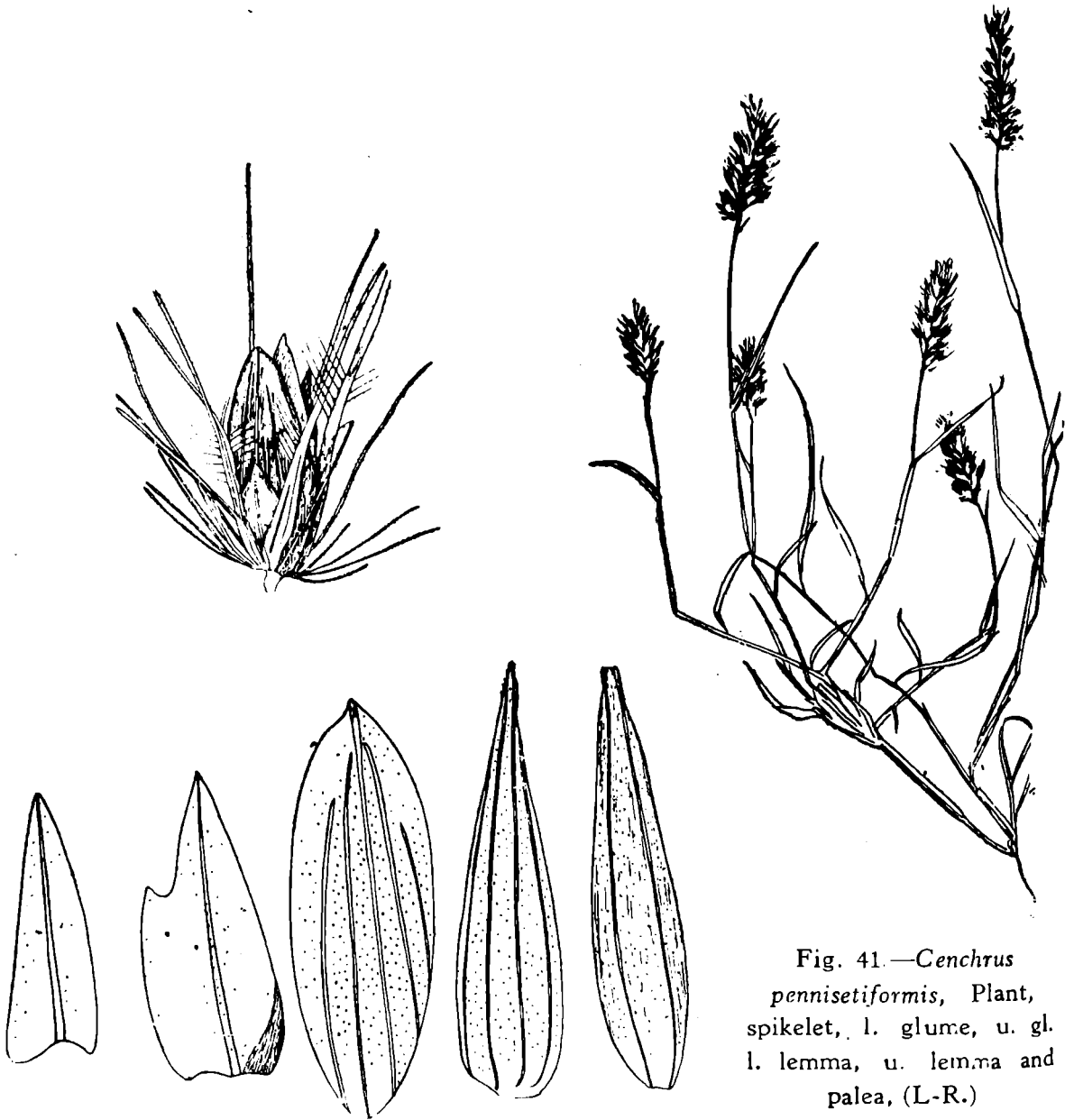


Fig. 41.—*Cenchrus pennisetiformis*, Plant, spikelet, l. glume, u. gl. l. lemma, u. lemma and palea, (L-R.)

are often woolly, much branched from the base. *Leaf-blades* linear, 15-25 cm. long, 3-4 mm. wide, glabrous, hairy or villous. *Panicle* cylindrical, 4-20 cm. long, purplish ; peduncle and axis glabrous ; involucre sessile ; outer bristles slender, short, scabrid but not ciliate, inner about 9 mm. long (1 conspicuously longer, about 12 mm. long), dilated and ciliate

below; connate into a ring at the base. *Spikelets* 3-1 in each involucre, 4-5 mm. long. *Lower glume* 2.5-3 mm. long, ovate, acute, 1-nerved, hyaline, scabrid. *Upper glume* 3-4 mm. long, ovate, acuminate, 1-nerved, hyaline, scabrid. *Lower floret* male or female; lemma 4-5 mm. long, oblong, cuspidately acuminate, 3- to 5-nerved, scabrid; palea narrowly lanceolate, as long as the lemma. *Upper floret* bisexual; lemma 4-5 mm. long, lanceolate, 3- to 5-nerved, scabrid, truncate or cuspidate. *Anthers* 2.5 mm. long.

Karachi; Hyderabad; Lahore; Gujrat; Rawalpindi, etc. Very common throughout the plains in arid regions.

## 2. *Cenchrus prieurii* (Kunth) Maire

*Cenchrus prieurii* (Kunth) Maire in Bull. Nat. Hist. Paris, 3 : 523 (1931).

*Pennisetum prieurii* Kunth, Rev. Gram. 2 : 411 (1829); Hook. f., Flor. Brit. Ind. 7 : 89 (1896).

*Cenchrus macrostachyus* Hochst. ex Steud., Syn. Pl. Gram. 109 (1854).

Annual. *Culms* erect or geniculately ascending, up to 75 cm. high, branching at the base, smooth and glabrous, slightly scabrid below the panicle. *Leaf-blades* linear, with filiform tips, 10-25 cm. long, 5-10 mm. wide, scabrid towards the apex, hairy towards the base; *sheaths* glabrous or slightly scabrid, compressed, keeled; *ligule* a row of hairs. *Panicle* dense, white or purple, 6-14 cm. long, 2-4 cm. broad; axis flexuous, scabrid. *Involucral bristles* numerous, united at the base into a disc, 3-4 mm. in diameter, the outer erect or finally spreading, slender, scabrid, more than 10 mm. long, the inner longer, thick and ciliate-plumose at the base, scabrid near the apex, subequal, 12-22 mm. long (1 conspicuously longer, about 28 mm. long). *Spikelets* 2, more rarely 3 or 1 in an involucre, ovate-acuminate, glabrous. *Lower glume* 2 mm. long, obtuse, 1-nerved or nerveless or absent. *Upper glume* oval, acute or obtuse, 3-4 mm. long, 3- to 5-nerved. *Lower floret* barren; lemma similar to the upper glume but cuspidately acuminate, 5-nerved; palea absent. *Upper floret* bisexual; lemma oval-obtuse or ovate-lanceolate, cuspidately acuminate, 5-nerved; palea slightly shorter.

Punjab, J. R. Drummond.

## 3. *Cenchrus biflorus* Roxb.

*Cenchrus biflorus* Roxb., Hort. Beng. 8 (1814); Fl. Ind. 1 : 238 (1820).

*Cenchrus catharticus* Del., Cat. Hort. Monsp. 4 (1839); Hook. f., Flor. Brit. Ind. 7 : 90 (1896).

*Cenchrus barbatus* Schum., Besker. Guin. Pl. 43 (1827).

Annual. *Culms* erect or ascending, branched from the base, glabrous and smooth. *Leaf-blades* linear, finely acuminate, 20-30 cm. long, 4-6

mm. wide, scaberulous ; *sheaths* inflated, glabrous ; *ligule* a row of hairs. *Panicle* cylindrical, up to 8 cm. long ; axis scaberulous. Inner involucre bristles rigid, squarrosely spreading, dorsally deeply grooved, ciliate at the base, spiny at the tip with the spines directed backwards ; outer spreading or reflexed. *Spikelets* usually 2 in each involucre, 3 mm. long. *Lower glume* 2 mm. long, membranous, lanceolate, 1-nerved. *Upper glume* ovate, acuminate, 5 mm. long, hyaline, 5-nerved. *Lower floret* neuter ; lemma 4 mm. long, ovate, acuminate, hyaline, 5-nerved ; *palea* hyaline, 3 mm. long. *Upper floret* bisexual ; lemma ovate-lanceolate, cuspidately acuminate, 4 mm. long ; *palea* similar.

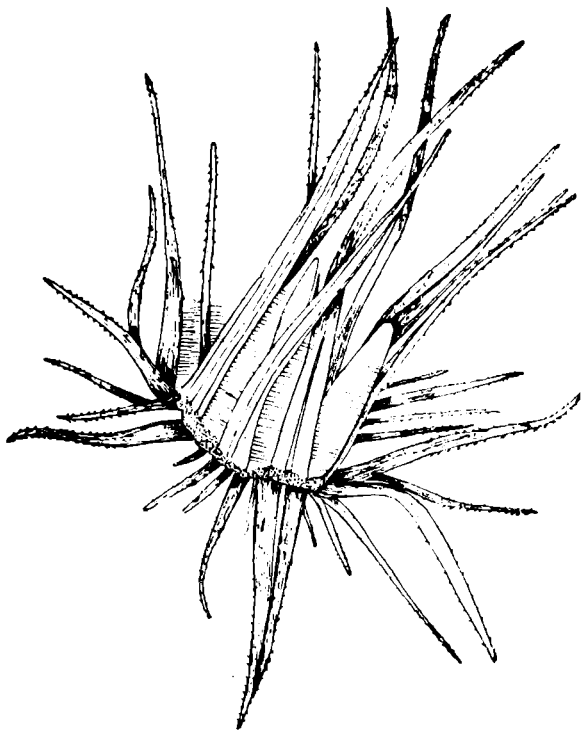


Fig. 42.—*Cenchrus biflorus*. Involucre.

A troublesome weed of cultivation, throughout the plains.

#### 4. *Cenchrus setigerus* Vahl

*Cenchrus setigerus* Vahl, Enum. 2 : 395 (1804).

*Cenchrus biflorus* Hook. f., Flor. Brit. Ind. 7 : 89 (1896) non Roxb.

Perennial. *Culms* tufted, several from a common rootstock, erect or decumbent, branched from the base, smooth and glabrous, 25-40 cm. high. *Leaf-blades* linear, 10 cm. long, 3-5 mm. wide, hairy above, glabrous below, margins scabrid ; *sheaths* glabrous, hairy only near the collar ; *ligule* short, membranous, ciliate. *Panicle* cylindrical, up to 5 cm. long ; axis scaberulous. *Spikelets* usually 2 in each involucre, ovate-acute, about 4 mm. long. *Involucral bristles* subulate, erect, those of the inner whorl united at the base. *Lower glume* lanceolate, acute, hyaline, 2.5 mm. long, 1-nerved. *Upper glume* lanceolate-acute, hyaline, 3-nerved, 3.2 mm. long. *Lower floret* male ; lemma ovate-acute, 2.5 mm. long. *Upper floret* hermaphrodite ; lemma 4 mm. long, 5-nerved ; *palea* as long as the lemma.

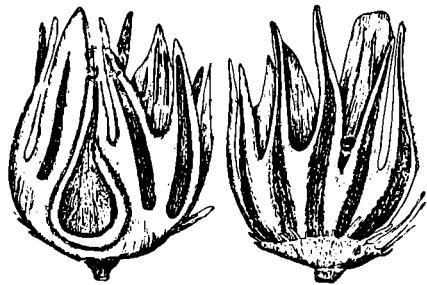


Fig. 43.—*Cenchrus setigerus*.  
Two views of the Involucre



Very common throughout the plains and the lower hills. It is considered as a very fine fodder grass.

**17. Pennisetum Rich.**

Caespitose or stoloniferous, perennial or annual grasses with simple or profusely branched culms. Leaves flat, folded or convolute. Inflorescence a spike-like raceme. Spikelets 2-flowered, sessile or shortly pedicelled, solitary or clustered, 2-5 in a deciduous involucre. Involucral bristles few to many, scabrid or plumose, simple or branched, free at the base. Glumes subequal ; lower small, sometimes absent ; upper 5-nerved, shorter than the spikelet, rarely absent. Lower floret male or neuter ; lemma as long as or shorter than the spikelet, 5 nerved ; palea narrow, 2-keeled. Upper floret bisexual ; lemma as long as or shorter than the spikelet, 3- to 7-nerved, papyraceous or coriaceous ; palea similar in texture, small, sometimes absent.

**KEY TO THE SPECIES**

- 1. Anthers bearing a tuft of hairs at the apex.....2  
    Anthers naked at the tip.....3
- 2. Palea of the fertile lemma truncate.....1. *P. typhoideum*  
    Palea of the fertile lemma 2-toothed.....2. *P. purpureum*
- 3. Involucral bristles branched.....3. *P. lanatum*  
    Involucral bristles unbranched.....4
- 4. Bristles not or sparingly ciliate.....5  
    Bristles copiously ciliate or lanate.....7
- 5. Spikelets 4-5 mm. long ; lower glume very small or 0 ; upper glume  
    2/3 the fertile lemma ; lemmas 5-nerved.....4. *P. flaccidum*  
    Spikelets 7-8 mm. long.....6
- 6. Lower glume minute ; upper 1/2 as long as the spikelet, 1- to  
    3-nerved ; lower lemma 7- to 11-nerved.....5. *P. alopecuros*  
    Lower glume 2/3 the upper ; upper glume as long as the spikelet, 5-  
    to 7-nerved.....6. *P. divisum*
- 7. Perennial ; rachis hairy ; involucre stipitate ; lower glume 1/3-1/2 as  
    long as the spikelet.....7. *P. orientale*  
    Annual ; rachis glabrous ; involucre sessile ; lower glume minute  
    or 0.....8. *P. polystachyum*

1. **Pennisetum typhoides** (Burm.) Stapf et Hubb.

*Pennisetum typhoides* (Burm.) Stapf et Hubb. in Kew Bull. 271 (1933).

*P. typhoideum* L. Rich. in Pers., Syn. 1 : 72 (1805) ; Hook. f., Flor. Brit. Ind. 7 : 82 (1896).

*Panicum americanum* Linn., Sp. Pl. 56 (1753).

*Pennisetum spicatum* (Roxb.) Koern. in Koern. et Werner, Handb. Getreid. 1 : 284 (1885).

*Penicillaria spicata* (Linn.) Willd., Enum. Hort. Berol. 1037 (1809).

*Panicum spicatum* Roxb., Fl. Ind. 283 (1820).

*Pennisetum glaucum* (Linn.) R. Br., Prodr. 195 (1810).

*Panicum glaucum* Linn., Sp. Pl. 56 (1753) p p., nomem confusum.

*Alopecurus typhoides* Burm. f., Fl. Ind. 27 (1768).

Annual. Culms erect, simple or usually branched from the base, solid, up to 2 m. high ; nodes villose. Leaf-blades linear-lanceolate, acuminate, flat, sparsely hairy, 45 cm. long, 10 cm. broad, margins scabrid ; sheaths glabrous or hairy, usually hairy at the mouth ; ligule a row of hairs. Panicle cylindric, very dense, 15-35 cm. long ; peduncle and axis more or less villous ; branchlets 1- to 8-flowered. Involucral bristles as long as the spikelets or longer, scabrid and ciliate. Spikelets usually solitary in the involucre, 4-5 mm. long, oblong-ovate-lanceolate ; involucre on a ciliate pedicel. Lower glume minute or 0. Upper glume very short, 1/2 - 2/3 the spikelet, oblong, truncate, ciliate, 3- to 5-nerved, sometimes absent. Lower floret male or neuter ; lemma ovate-cuspidate, 5-nerved. Upper floret bisexual ; lemma ovate, obtuse, mucronate, 5- to 7-nerved ; palea very broad, truncate, ciliate at the tip and dorsally. Anthers ciliate at the tip.

Cultivated throughout the plains for fodder and grain. Vern. Bajra.

2. **Pennisetum purpureum** Schum. et Thonn.

*Pennisetum purpureum* Schum. et Thonn. in Beskr., Guin. Pl. 44 (1827).

A perennial with a creeping rootstock. Culms densely tufted, up to 7 m. high ; branches terete, smooth, glabrous excepting the uppermost internode which is hairy or tomentose. Leaf-blades up to 80 cm. long and 2.5 cm. wide, margins spinulosely scabrid ; sheaths smooth, glabrous or pubescent ; ligule a ridge of hairs. Panicle cylindric, dense, 8-20 cm. long, 1.5-3 cm. broad. Spikelets sessile or if in clusters of 2-4 the lateral pedicelled, lanceolate, acuminate, 5-7 mm. long. Involucral bristles 5-8 mm. long, one usually much longer. Lower glume minute or 0. Upper glume ovate to ovate-lanceolate, acute, 0.5-1 mm. rarely up to 2 mm. long, subhyaline, 1-nerved or nerveless. Lower lemma lanceolate, acute or acuminate, 1/2 or almost as long as the upper glume, 3-nerved,

rarely 1- 5- or even 7-nerved. *Upper lemma* lanceolate, scaberulous upwards, 5-nerved; *palea* subequal, tip minutely 2-toothed. *Anthers* 2.5-3 mm. long, ciliate at the tip.

Introduced as fodder grass. (*Elephant Grass*).

### 3. *Pennisetum lanatum* Klotz.

*Pennisetum lanatum* Koltzsch in Bot. Ergeb. Waldem. Reise, 65; Hook. f., Flor. Brit. Ind. 7: 84 (1896).

Perennial. Rootstock often stout, woody, creeping. *Culms* erect, 30-90 cm. high, terete, smooth and glabrous. *Leaf-blades* linear, 15-45 cm. long, 4-12 mm. wide, flat, glabrous, hairy or silkily villous. *Panicle* cylindrical, 5-15 cm. long, 1.2-1.8 cm. in diameter, very dense, pale green; peduncle and axis more or less hairy. *Spikelets* solitary in the involucre, 5 mm. long. *Involucral bristles* branched, scabrid and sparsely ciliate, longer than the spikelets. *Lower glume* 1/4 as long as the spikelet, ovate, acute. *Upper glume* oblong, obtuse, 3-nerved, 1/2 as long as the spikelet. *Lower floret* neuter; *lemma* lanceolate, acuminate, 5-nerved, as long as the spikelet. *Upper floret* bisexual; *lemma* similar to the sterile lemma; *palea* similar.

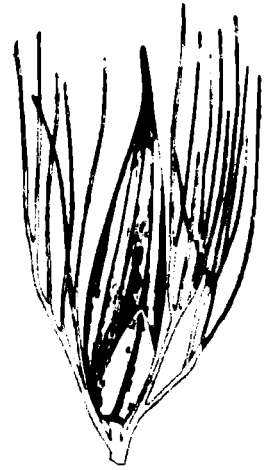


Fig. 44.—  
*Pennisetum lanatum*.  
Spikelet

Kagan Valley; Gilgit; Swat; Chitral. Common on dry sunny hill sides from 5-11,000 ft.

### 4. *Pennisetum flaccidum* Griseb.

*Pennisetum flaccidum* Griseb. in Goett. Nachr. 16 (1868); Hook. f., Flor. Brit. Ind. 7: 84 (1896).

Perennial. *Culms* densely tufted, creeping below, branching at the base, 15-60 cm. high; smooth but rough below the panicle. *Leaf-blades* linear, 12-24 cm. long, 3-5 mm. wide, flat, glabrous or densely hairy; *sheaths* ciliate, bearded at the mouth; *ligule* a rim of hairs. *Panicle* cylindrical, slender, flexuous, 5-15 cm. long, 5-8 mm. in diameter; peduncle and axis glabrous; involucre on a short finely hairy pedicel. *Spikelets* 4-5 mm. long, solitary in the involucre, ovate-lanceolate. *Involucral bristles* unbranched, scaberulous, not or very sparingly ciliate, nearly straight or flexuous, one often very much the longest. *Lower glume* very small or absent. *Upper*

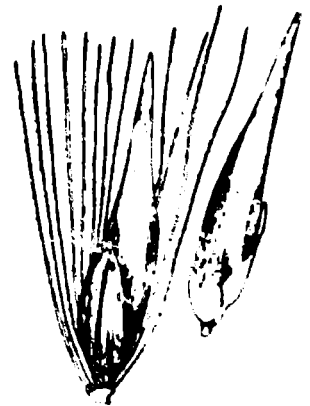


Fig. 45 —  
*Pennisetum flaccidum*.  
Spikelet

*glume* lanceolate, 1/2-2/3 as long as the spikelet, 5-nerved. *Lower floret* neuter; lemma ovate-lanceolate, subsetaceously acuminate, 5-nerved. *Upper floret* bisexual; lemma similar to the sterile lemma.

Kagan Valley; Swat State; Murree Hills; Quetta. Usually 6-10,000 ft.

### 5. *Pennisetum alopecuroides* Nees

*Pennisetum alopecuroides* Nees ex Steud., Syn. Pl. Glum. 102 (1855); Hook. f., Flor. Brit. Ind. 7: 84 (1896).

Perennial. *Culms* densely tufted, erect, 60-90 cm. high, subdistichously branched above, branches erect. *Leaf-blades* linear-lanceolate, 30-45 cm. long, 2.5-4 mm. wide, coriaceous, convolute, glabrous; *sheaths* compressed, often villous; *ligule* a row of hairs. *Panicle* 12-16 cm. long, pale green; peduncle and axis glabrous. *Involucral bristles* few, very unequal, straight, the longest 2-3 times longer than the spikelet, unbranched, scaberulous. *Spikelets* 9 mm. long, solitary in the involucre, narrowly lanceolate. *Lower glume* 1.2 mm. long, orbicular. *Upper glume* 4 mm. long, oblong, acuminate, 1- to 3-nerved. *Lower floret* neuter; lemma 8 mm. long, lanceolate, acuminate, 7- to 11-nerved. *Upper floret* bisexual; lemma slightly longer than the sterile lemma, subulate-lanceolate, 5-nerved; palea lanceolate, as long as the lemma.

Sind, Dalzell teste Cooke; Quetta.

### 6. *Pennisetum divisum* (Forsk.) Henr.

*Pennisetum divisum* (Forsk. ex F. Gmelin) Henrard in Blumea 3: 162 (1938).

*Pennisetum dichotomum* (Forsk.) Delile, Fl. Aegypt. 159 (1812); Hook. f., Flor. Brit. Ind. 7: 85 (1896).

*Panicum divisum* Forsk. ex F. Gmelin, Syst. 156 (1896).

*Panicum dichotomum* Forsk., Fl. Aeg.-Arab. 20 (1775).

Perennial. Rhizome short, clothed with numerous leaf-sheaths. *Culms* erect or geniculately ascending, up to 1.8 m. high, woody at the base, glabrous, glaucous, slightly scabrid below the panicle. distantly branched, the branches often fascicled, erect. *Leaf-blades* narrowly linear, glaucous, 1-15 cm. long, 0.3-0.5 mm. wide, more or less involute or convolute after drying, very scabrid on the upper surface, tapering to a subulate point; *sheaths* shorter than the internodes, rigid, glabrous, terete, prominently striate, the lower without blades; *ligule* a rim of hairs. *Panicle* cylindric, 5-13 cm. long, 1-1.3 cm. in diameter, whitish; axis flexuous, scabrid. *Involucral bristles* very numerous, unequal, the inner ciliate in the lower half



Fig. 46 --  
*Pennisetum*  
*divisum*

or wholly scabrid, the longer twice as long as the spikelets. *Spikelets* solitary and sessile within the involucre, lanceolate, 7-8 mm. long, glabrous. *Lower glume* 4.5-6 mm. long, 1- to 3-nerved, acuminate, hyaline. *Upper glume* as long as the spikelet or slightly shorter than the spikelet, acuminate, 5- to 7-nerved. *Lower floret* male; lemma as long as the upper glume, ovate-lanceolate, cuspidately acuminate, 5-nerved; palea as long as the lemma. *Upper floret* bisexual; lemma as long as the lower lemma, membranous, acuminate-mucronate, 5-nerved; palea similar, slightly shorter. Anthers 4-4.5 mm. long.

Tando Jam, J. J. Norris; Peshawar; Quetta; Dera Ismail Khan; Kohat.

### 7. *Pennisetum orientale* Rich.

*Pennisetum orientale* Rich. in Pers., Syn. 1: 72 (1805); Hook. f., Flor. Brit. Ind. 7: 86 (1896).

*Pennisetum sinaicum* Dcne. in Ann. Sc. Nat. ser. 2, 2: 11 (1834).

*Pennisetum araneosum* Edgew. in Jour. As. Soc. Bengal 21: 180 (1852).

*Pennisetum setaceum* (Forsk.) Chiov. ssp. *orientale* (Rich.) Maire., Flor. de l'Afr. du Nord 1: 383 (1952).

Perennial. Culms erect or arising from a densely tufted often stout, woody and branched rootstock, 60-120 cm. high, leafy, smooth and glabrous; nodes glabrous or finely bearded. *Leaf-blades* narrowly linear, 30-60 cm. long, 5-10 mm. wide, flat or subconvolute, glabrous or hairy, margins scaberulous; *sheaths* equalling or shorter than the internodes, not or slightly keeled, smooth and glabrous or ciliate along the margins, hairy at the collar; *ligule* a row of hairs. *Panicle* cylindrical, dense, 12-30 cm. long, 1.5 cm. in diameter, pale or purple; axis stout, hairy; involucre on long ciliate pedicels. *Spikelets* 2-5 in each involucre, 4-6 mm. long, lanceolate. *Involucral bristles* many, slender; flexuous, unequal, 16-18 mm. long (one conspicuously long and up to 25 mm.), unbranched, the inner copiously ciliate or lanate below the middle. *Lower glume* ovate-oblong, obtuse, 1.3-2 mm. long, hyaline, nerveless. *Upper glume* as long as the spikelet, lanceolate, acuminate, 3-nerved. *Lower floret* male or neuter; lemma ovate-lanceolate, aristately acuminate, 6 mm. long, 5-nerved; palea about 5 mm. long, oblong, obtuse, often 2-fid. *Upper floret* bisexual;

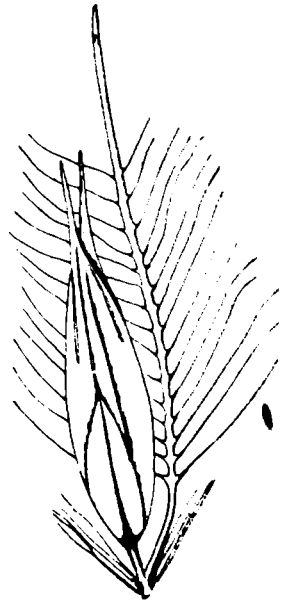


Fig. 47.—*Pennisetum orientale*

lemma ovate-lanceolate, 5 mm. long, awned, 5-nerved ; palea about 4 mm. long, lanceolate, acuminate, with involute margins.

Hyderabad, *Woodrow* ; Mirpur Khas, *Mankad* ; Peshawar, *J. L. Stewart* ; Murree Hills ; Kagan Valley ; Swat State ; Quetta ; Sakesar, *Iftikhar*. Very common from 2-7000 ft.

### 8. *Pennisetum polystachyum* Schult.

*Pennisetum polystachyum* Schult., Mant. Syst. Veg. 2 : 146 (1824).

*Pennisetum setosum* Hook. f., Flor. Brit. Ind. 7 : 87 (1896).

Annual. *Culms* erect, often fastigiately branched at the nodes, green or purplish. *Leaf-blades* linear, flat, 15-25 cm. long, 6-18 mm. wide, flaccid, glabrous or hairy. *Panicle* cylindric, 5-10 cm. long, usually purplish brown ; peduncle and axis glabrous the latter deeply pitted. *Spikelets* 4 mm. long, solitary in the sessile involucre. *Involucral bristles* slender, unequal, 6-8 mm. long, the outer not ciliate, short, the inner longer, copiously ciliate below the middle up to the base. *Lower glume* minute or wanting. *Upper glume* as long as the spikelet, oblong, suddenly or gradually cuspidate, 5-nerved, hyaline. *Lower floret* male or neuter ; lemma 3 mm. long, oblong, truncate, 3-toothed, 5-nerved ; palea slightly shorter than the lemma. *Upper floret* bisexual ; lemma 2.5 mm. long, ovoid, truncate, ciliate at the apex ; palea shorter than the lemma. *Anthers* 2 mm. long.

Hyderabad, *Woodrow*.

### Tribe 2. *Andropogoneae*

Spikelets 1- or 2-flowered, with a barren lemma (as in Paniceae), arranged in pairs, one sessile the other pedicelled, very rarely both pedicelled ; those of each pair may be both bisexual or one bisexual and the other male or female or neuter. Spikelets rarely solitary or 3-nate. Lower glume indurated and longer than the upper glume or lemmas, its edges folding round and embracing the spikelet ; lemmas membranous or hyaline, the fertile with a geniculate awn ; rachilla not continued above the upper floret ; palea shorter than the lemmas, frequently the lower or both suppressed.

#### KEY TO THE GENERA

1. Internodes of the spikelets slender filiform, if thickened upwards, spikelets 1-flowered, awned .....2  
Internodes of the rachis usually stout and thickened upwards or throughout, or flattened ; spikelets 1- or 2-flowered.....22

2. Spikelets of each node alike in sex or shape or if different in sex then the female pedicelled.....3  
 Spikelets of each pair different in sex or shape or both, or if similar then with thickened or stout pedicels and joints.....10
3. Spikelets all pedicelled.....4  
 Spikelets paired, one pedicelled the other sessile.....5
4. Spikelets awnless; racemes in a spiciform or contracted silvery panicle.....1. *Imperata*  
 Spikelets awned; racemes on an elongated axis, rarely subdigitate...  
 .....2. *Miscanthus*
5. Racemes solitary; upper glume and lower lemma both awned.....  
 .....3. *Pogonatherum*  
 Racemes in a much branched panicle, or digitate or subdigitate.....6
6. Racemes in a much branched panicle.....7  
 Racemes digitate or subdigitate .....5
7. Glumes coriaceous or chartaceous throughout; panicle narrow, villous to tomentose.. .....(*Narenga*)  
 Glumes membranous, at most slightly coriaceous at the base; panicle wide, silky-hairy.....4. *Saccharum*
8. Leaf-blades lanceolate to linear-lanceolate, often contracted at the base; lower glume rarely villous, with a narrow median groove.....  
 .....5. *Microstegium*  
 Leaf-blades linear, usually gradually passing into sheaths; lower glume villous, without a median groove.....9
9. Spikelets 2-flowered; lower glume 2- to 3-toothed.....6. *Eulaliopsis*  
 Spikelets 1-flowered; lower glume not 2- to 3-toothed.....7. *Eulalia*
10. Racemes paired, digitate, scattered or in panicles.....11  
 Racemes solitary.....19
11. Racemes not supported by a spathe.....12  
 Racemes supported by a boat-shaped spathe.....18
12. Upper lemma of the sessile spikelet awned from the tip or from the sinus of a 2-lobed tip.....13  
 Upper lemma of the sessile spikelet awned from the back.....  
 .....8. *Arthraxon*
13. Racemes arranged in panicles.....14  
 Racemes digitate, subdigitate or arranged on a common axis.....17

14. Pedicels with a median translucent line ; upper lemma awned from the tip.....9. *Capillipedium*  
 Pedicels without a translucent line : upper lemma awned from the sinus of 2-lobes.....15
15. Spikelets dorsally compressed ; lower glume flattened on the back.....  
 10. *Sorghum*  
 Spikelets more or less laterally compressed ; lower glume rounded on the back, often muriculate.....16
16. Racemes of many pairs of spikelets.....11. *Vetiveria*  
 Racemes reduced to 1 sessile and 2 pedicelled spikelets.....  
 12. *Chrysopogon*
17. Sessile spikelets of all pairs perfect, awned, not closely imbricate.....  
 13. *Bothriochloa*  
 Sessile spikelets of the lowest 1-3 pairs male or neuter, awnless and closely imbricate.....14. *Dicanthium*
18. Aromatic ; lower glume of sessile spikelet 2-keeled ; column of awn glabrous.....15. *Cymbopogon*  
 Non aromatic ; lower glume of sessile spikelet rounded on the sides ; column of awn hairy.....16 *Hyparrhenia*
19. Racemes of several pairs of spikelets, evenly spaced.....20  
 Racemes of a few pairs of spikelets, much contracted ; spikelets in two superposed series, the lower four forming an involucre.....21
20. Racemes slender, with pairs of spikelets all caducous ; lower glume of the sessile spikelet 2-keeled, foveolate on the back ; awn glabrous or scabrid.....17. *Eremopogon*  
 Racemes stout, with lower pairs of spikelets not caducous ; lower glume of the fertile spikelet neither 2-keeled nor foveolate ; awn hirsute.....18. *Heteropogon*
21. Involucral spikelets persistent, the bisexual alone deciduous.....  
 19. *Themeda*  
 Involucral spikelets deciduous along with the bisexual spikelet.....  
 20. *Iseilema*
22. Fertile spikelets 2-flowered, usually awned (sometimes awnless in *Apluda*)..... 23  
 Fertile spikelets 1- or 2-flowered; always awnless.....26
23. Racemes reduced to a terminal joint, with three heteromorphous spikelets, enclosed by a boat-shaped spathe.....21. *Apluda*  
 Racemes several to many-noded, solitary, in pairs or digitate.....24



24. Pedicelled spikelets developed, flower bearing.....25  
 Pedicelled spikelets rudimentary or reduced to a joint...22. *Thelepogon*
25. Racemes paired, digitate or subdigitate ; lower glume of the sessile spikelet not grooved.....23. *Ischaemum*  
 Racemes solitary ; lower glume of the sessile spikelet deeply grooved .....24. *Sehima*
26. Racemes very slowly disarticulating ; spikelets 3-nate, 2 sessile and 1 rudimentary pedicelled, at each node.....25. *Mnesithea*  
 Racemes readily disarticulating; spikelets paired.....27
27. Spikelets all alike.....28  
 Spikelets of each pair unlike, the pedicelled male, neuter or suppressed .....29
28. Each internode of the rachis with 2 sessile spikelets, at least in the lower part of the spike.....26. *Hemarthria*  
 Each internode of the rachis with one sessile and one pedicelled spikelet .....27, *Phacelurus*
29. Sessile spikelets small, globose, pitted, the pedicelled very dissimilar .....28. *Hackelochloa*  
 Sessile spikelets not as above.....30
30. Racemes villous all over.....31  
 Racemes glabrous ; pedicels and joints fused.....29. *Rottboellia*
31. Spikelets 2-flowered, very villous on their whole surface...30. *Lasiurus*  
 Spikelets 1-flowered , villous on the joints and on the margins, the rest glabrous ; lower glume bearing a line of balsamine gland close to the penicillate keels.....31. *Elionurus*

## 1. *Imperata* Cyrillo

Perennial; basal leaves crowded, long. Inflorescence a silvery spike-like, narrowly thyriform panicle. Spikelets all alike, one short, the other long-pedicelled, disarticulating from the pedicels. Florets 2, the lower reduced to an empty lemma. Glumes unequal, enveloped by very long silky hairs from the obscure callus and the lower portion of both glumes. Sterile lemma much smaller than the glumes, hyaline. Fertile lemma hyaline, awnless, rarely absent; palea broad, hyaline, nerveless. Lodicules 0. Stamens 1-2. Styles connate below; stigmas exerted from the tip of the floret.

### 1. *Imperata cylindrica* (Linn.) Beauv.

*Imperata cylindrica* (Linn.) Beauv., Ess. Agrost. 165 (1812).

*Imperata arundinacea* Cyrillo, Pl. Rar. Neap. fasc. 2: 26 (1792); Hook. f., Flor. Brit. Ind. 7: 106 (1896).

*Lagurus cylindricus* Linn., Syst. Nat. ed. 10: 878 (1759).

*Saccharum cylindricum* (Linn.) Lamk., Encycl. 1: 594 (1783).

Perennial. Rhizome long, creeping or oblique. Culms solid, glabrous, fistular at the base, rigid, erect, 30-50 cm. high, covered at the base with sheaths of dead leaves; nodes densely bearded with erect white hairs. Leaf-blades linear, narrowed towards the base, tapering to a acuminate tip, very variable in size, margins scabrid, convolute when dry; sheaths rather loose, glabrous or slightly pubescent; ligules membranous, ciliate, dorsally silky, erose or cleft. Panicle spiciform, cylindrical, dense, erect, silky white; rachis joints 1.4 mm. long; pedicels about 0.9 mm. long, swollen at the tips, covered with long fine hairs. Spikelets lanceolate, 3 mm. long, both spikelets of each pair similar; callus hairs white, soft, 2-3 times as long as the spikelets. Glumes subequal, lanceolate, 3- to 9-nerved, dorsally villous, hairs 2-3 times as long as the glumes. Lower floret empty; lemma nerveless, hyaline, acute, ciliate, epaleate. Upper floret bisexual; lemma 1.5-2 mm. long, ovate-lanceolate, hyaline, nerveless, acute or toothed, minutely ciliate or glabrous. Anthers 2, orange, 2.5-3 mm. long.

Common on damp or water logged soil in the plains and lower hills.  
*Cotton Grass.*

## 2. *Miscanthus* Anderss.

Perennial. Inflorescence a glabrous or silky large panicle or corymb, formed of numerous long spiciform racemes; rachis glabrous, rough, bearing numerous spikelets; pedicels glabrous, callus often with long hairs. Spikelets 2-nate at each node, one long the other shortly pedicelled, awned

or muticous, slightly dorsally compressed. Lower glume almost flat with more or less inturned margins, often 2- to 4-nerved. Upper glume similar but more convex, 1-3-5-nerved. Lower floret; lemma hyaline, empty, more or less 2-fid. Upper floret bisexual; lemma hyaline, 2-toothed or bifid, awned from the sinus, very rarely entire or muticous, palea shorter, narrow, hyaline, nerveless, sometimes absent. Stamens 2-3. Styles free; stigmas rather short.

### 1. *Miscanthus nepalensis* (Trin.) Hack.

*Miscanthus nepalensis* (Trin.) Hack., Monogr. Andropog. 104 (1889).

*Eulalia nepalensis* Trin. in Mem. Acad. Petersb. ser. vi, 2: 333 (1833).

*Pollinia nepalensis* Benth. ex Duthie, Grasses N.W. Ind. 16 (1889).

Perennial. Culms up to 1.5 m. high, terete, puberulous below the panicle, elsewhere glabrous. Leaf-blades 30-50 cm. long, linear from a narrowed base, 6-10 mm. wide, flat, rigid, erect or spreading; sheaths terete, often hairy below the collar; ligules 2 mm. long, truncate, membranous. Panicle 10-15 cm. long, spreading; the common axis glabrous except at the nodes, shorter than the branches. Racemes corymbose-fastigiate, capillary, nodding, fulvous-haired; rachis subcapillary, scaberulous. Spikelets 2-2.5 mm. long, ovate-lanceolate. Lower glume 2-2.5 mm. long, chartaceous, membranous, obtuse, apex hyaline, emarginate, hairy on the lower half of the margins with hairs of unequal length, the longer about 2-3 times the length of the glume, margins hardly inflexed; dorsum minutely scaberulous. Upper glume 2.75 mm. long, ovate-lanceolate, acute or subacute, 1-nerved; keel very scabrid; margins hyaline, scaberulous. Lower floret empty; lemma 2.5-3 mm. long, broadly oblong, usually lanceolate, obtuse, often denticulate, nerveless, glabrous. Upper floret bisexual; lemma equal to the lower lemma, linear-lanceolate, acutely 2-toothed, 1-nerved, glabrous; awn slender, 9-10 mm. long; palea lanceolate, acute, nerveless, glabrous.

Serimang, Azad Kashmir, A. Rashid Khan

### 3. *Pogonatherum* Beauv.

Perennial, densely caespitose grasses with slender culms and linear or linear-lanceolate leaves. Inflorescence a solitary raceme at the summit of the culm and of its branches. Spikelets 2-nate, the pedicelled female, the sessile bisexual, both 1- to 2-flowered, long-awned. Glumes membranous, the lower keel-less, the upper keeled. Lower floret; lemma hyaline and empty sometimes absent and the palea persisting; the floret

male with 2 stamens or more rarely bisexual. Upper floret bisexual; lemma narrow, dentate or 1-fid, hyaline, awned; the awn arising from the sinus, capillary, long; palea equalling the lemma in length or shorter, hyaline, nerveless.

#### KEY TO THE SPECIES

Sessile spikelets 2.5-3 mm. long; callus hairs 1-1.5 mm. long; awn 12-14 mm. long; lower floret present.....1. *P. paniceum*  
 Sessile spikelets 2 mm. long; callus hairs 2 mm. long; awn 18-22 mm. long; lower floret absent .....2 *P. crinitum*

#### 1. *Pogonatherum paniceum* Hack.

*Pogonatherum paniceum* Hack., All. Bot. Zeit. 12: 178.

*Pogonatherum saccharoideum* Beauv., Agrost. 176 (1812) t. 11. f. 7.

A caespitose perennial. Culms densely tufted, up to 50 cm. high, primary branches solitary and rarely simple, glabrous. Leaf-blades linear-lanceolate, acuminate, scabrid; sheaths loose, terete, smooth, mouth fimbriate; ligule absent. Racemes terminal, solitary, 1.5-3 cm. long; joints and pedicels 1-1.5 mm. long, margins with white hairs, the hairs about 3 times as long as the joints. Sessile spikelets linear-oblong, fulvous, 2.5-3 mm. long; callus short with a few short hairs. Lower glume 2-3 mm. long, broadly linear-oblong, slightly truncate at the tip, 2- to 3-nerved, rounded on the back, scaberulous, often ciliate below the apex, sometimes hispid. Upper glume 2.5-3 mm. long, broadly lanceolate, obtuse, keels hispid or scabrid, very hairy at the apex, awn 12-14 mm. long, slender. Lower floret male with 2 stamens, very rarely bisexual; lemma hyaline, oblong-ovate, nerveless, ciliate at the top, 1.5-2.5 mm. long; palea linear-oblong, 2-toothed, rarely absent. Upper floret bisexual; lemma 1.5-2.5 mm. long, hyaline, narrow, linear or linear-oblong, keeled, toothed, glabrous, nerveless. Stamens 2, very rarely 1. Pedicelled spikelets usually smaller than the sessile, rounded; lower floret absent. Upper floret female or very rarely male or neuter.

Chitral; Swat State; Samli, Murree Hills; Jaba, Hazara; Kotli, Mirpur; 2-6000 ft. often in damp soil below springs.

#### 2. *Pogonatherum crinitum* Kunth

*Pogonatherum crinitum* Kunth, Enumer. Pl. 1: 478 (1833); Hook. f., Flor. Brit. Ind. 7: 141 (1896).

Perennial. Culms 15-30 cm. high, densely tufted. Leaf-blades 2.5-7.5 cm. long, 2.5-5 mm. wide, linear-lanceolate, acuminate, more or less hairy; sheaths loose, glabrous, hairy at the mouth; ligule of long hairs.

*Racemes* terminating the branches, 1.8-2.5 cm. long ; joints short, ciliate. *Sessile spikelets* bisexual, 2 mm. long ; callus hairs much longer than the



Fig. 48.—*Pogonatherum crinitum*

spikelet. *Lower glume* oblong, hyaline, nerveless, dorsally rounded, ciliate and rounded, or retuse at the tip. *Upper glume* longer than the lower, ovate, keeled, 2-fid, the lobes ciliate, awned in the sinus; awn up to 2.3 cm. long, antrorsely scabrid. *Lower lemma* absent, if present as long as the upper glume but awnless. *Upper lemma* toothed to the middle into 2 ciliate lobes, awnless or with 1.8-2.2 cm. long awn ; palea  $\frac{2}{3}$  the length of the lemma. Stamen 1, rarely 2. *Pedicelled spikelets* male or neuter, smaller than the sessile. *Lower lemma* absent. *Upper lemma*  $\frac{1}{2}$  as long as the upper glume, 2-toothed to the middle into 2 ciliate lobes, awned in the sinus ; awn up to 2 cm. long, antrorsely scabrid.

Lahore.

4. **Saccharum** Linn.

Perennial. Culms very tall, erect, rounded with narrow, flat leaves often rolled in drying. Inflorescence a silvery-silky panicle. Spikelets all alike, surrounded by hairs, one sessile the other pedicelled, the pedicelled falling from their pedicels, the sessile deciduous together with the contiguous joint of the rachis and pedicel. Florets 2; lower reduced to an empty lemma; upper bisexual. Glumes equal, membranous, at most slightly coriaceous at the base; lower with inflexed margins in the sessile spikelet. Lemmas hyaline, awnless or awned.

## KEY TO THE SPECIES

1. Awn of the upper lemma not or scarcely exerted from the spikelet or absent.....2  
     Awn of the upper lemma distinctly exerted from the spikelet.....5
2. Callus hairs about 4 times as long as the spikelet.....3  
     Callus hairs as long as or slightly longer than the spikelet.....4
3. Peduncle hairy below the panicle; lower glume dorsally villous.....  
     1. *S. spontaneum*  
     Peduncle glabrous below the panicle; lower glume dorsally glabrous....  
     2. *S. officinarum*
4. Upper glume of the sessile spikelet dorsally villous.....3. *S. griffithii*  
     Upper glume of the sessile spikelet dorsally glabrous.....4. *S. bengalense*
5. Panicle decomposed; ultimate branches very short, of 3-4 joints; awn 2.5-6 mm. long.....5. *S. ravennae*  
     Panicle branches long, simple, sparingly divided; racemes many-jointed; awn of the upper lemma more than 1 cm. in length.....6
6. Upper lemma entire, narrowed into the awn; spikelets 2-2.5 mm. long; callus hairs much longer; glumes hyaline above the middle....,.....  
     6. *S. rufipilus*  
     Upper lemma 2-toothed or 2-lobed.....7
7. Spikelets 8-9 mm. long; awn 3-4 cm. long.....7. *S. macrantherus*  
     Spikelets 4-6 mm. long; awn 1-1.5 cm. long.....8
8. Lower glume of the sessile spikelet 6- to 7-nerved; callus hairs shorter than the spikelet; lower glume of the sessile spikelet membranous, keels scabrid.....8. *S. filifolium*  
     Lower glume of the pedicelled spikelet 3-nerved between the keels; callus hairs longer than the spikelet; lower glume of the sessile spikelet variegated, chartaceous below, reddish and membranous above; keels smooth..... (*S. versicolor*)

## 1. *Saccharum spontaneum* Linn.

*Saccharum spontaneum* Linn., Mantiss. 2 : 183 (1771) ; Hook. f., Flor. Brit. Ind. 7 : 119 (1896).

Perennial. Culms erect, up to 6 m. high, arising from a very stout rootstock, smooth, polished, silky beneath the panicle. Leaf-blades 30-75 cm. long, 3-6 mm. wide, narrowly linear, finely acuminate, rigid, coriaceous, usually glabrous, often convolute ; sheaths smooth, with fimbriate mouth ; ligules ovate, membranous. Panicle lanceolate, 20-60 cm. long, silky-hairy ; axis slender ; branches 3-to 5-nate, 5-10 cm. long ; rachis almost capillary, fragile. Spikelets 4 mm. long, lanceolate ; callus minute, bearded with spreading silky hairs, up to 12 mm. long. Lower glume lanceolate-subulate, acuminate. Upper glume equal to the lower, lanceolate, keeled, 1-nerved. Lower lemma ovate-lanceolate, subacute, ciliate, hyaline, nerveless. Upper lemma very slender, ciliate ; palea minute, ciliate.



Fig. 49. *Saccharum spontaneum*

Very common along river banks and in water logged areas.

## 2. *Saccharum officinarum* Linn.

*Saccharum officinarum* Linn., Sp. Pl. 54 (1753).

Perennial. Culms erect, solid, 2-6 m. high, glabrous or appressed hairy below the panicle, simple or branched. Leaf-blades rigid, 1.5 m. long, 6 cm. wide ; margins scabrid ; sheaths pubescent towards the throat or at first covered with appressed hairs ; ligules very short, membranous, ciliate. Panicle ovate-pyramidal, spreading, dense ; axis glabrous, nodes bearded, smooth, rarely with appressed pubescence, channelled ; primary branches slender, 5-10 cm. long, more or less verticillate, filiform, pubescent at the base, glabrous, minutely scaberulous at the top, bearded towards the nodes ; secondary branches simple, distant ; internodes fragile, equalling and exceeding the spikelets in length ; pedicels glabrous. Spikelets linear-oblong, muticous, 3.5-4 mm. long, surrounded by dense white hairs 1.5-2 mm. long ; callus covered with dense white silky hairs 7-12 mm. long. Lower glume 3.5-4 mm. long, acute, entire, very obscurely nerved or nerveless. Upper glume of the same size, lanceolate, acute, 1- to 3- nerved ; glabrous or ciliate ; keels scabrous above. Lower lemma as long as the spikelet, lanceolate, acute, hyaline, nerveless. Upper lemma

very much reduced or absent ; palea lanceolate, rather acute, ciliate at the apex.

Cultivated. *Sugar cane*.

### 3. *Saccharum griffithii* Munro

*Saccharum griffithii* Munro ex Aitchis. in Jour. Linn. Soc. Bot. 19 : 191 (1822) name only ; Boiss., Fl. Orient. 5 : 453 (1884).

*Saccharum sara* Aitchis., l c. 191 non Roxb.

*Erianthus griffithii* Hook. f., Flor. Brit. Ind. 7 : 122 (1896) p.p.

A perennial caespitose grass. *Culms* about 2 m. high, solid. *Leaf-blades* narrow, about 8 mm. wide ; *sheaths* not hirsute ; nodes not bearded.

*Panicle* oblong, 30-90 cm. long, erect, clothed with silky white hairs ; branches spreading, becoming appressed after anthesis ; axis acabrid on the ridges, more or less glabrous ; primary branches subverticillate ; secondary branches triquetrous, more or less villous with long white

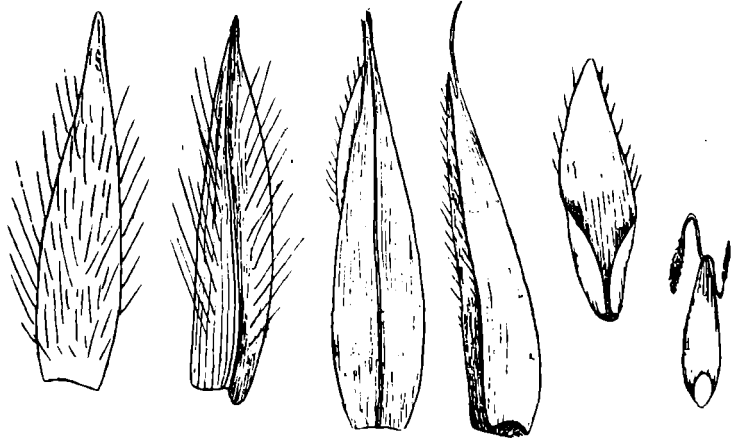


Fig. 50.—*Saccharum griffithii*

hairs on angles and on the two faces. *Spikelets* 4-6 mm. long, muticous ; pedicel  $\frac{1}{3}$ - $\frac{2}{3}$  the length of the sessile spikelet ; joint  $\frac{1}{4}$ - $\frac{2}{3}$  the length of the sessile spikelet ; callus hairs yellow, shorter or nearly as long as the spikelets ; hairs of the joints once or twice the length of the joint. *Sessile spikelets* ; lower glume dorsally villous in the basal  $\frac{2}{3}$ , hairs as long as or slightly longer than the glume. *Upper glume* dorsally villous in basal  $\frac{1}{2}$  or  $\frac{2}{3}$  of its length. *Lower lemma* sometimes sparsely villous dorsally. *Upper lemma* with a short mucro, about 1.5 mm. long, not exerted beyond the apex of the spikelet. *Pedicelled spikelets* ; glumes dorsally villous in basal  $\frac{1}{2}$ - $\frac{2}{3}$  ; lemmas absent.

Hyderabad, *Blatter & McCann* ; west of Thatta, *Blatter & McCann* ; Fort Munro, *Iftikhar* ; Chitral ; Karachi ; Peshawar ; Kohat ; Quetta. Very common on dry hills from the plains to 8000 ft. in Astor, Gilgit.



4. *Saccharum bengalense* Retz.

*Saccharum bengalense* Retz., Obs. 5 : 16 (1789).

*Saccharum munja* Roxb., Fl. Ind. 1 : 246 (1832).

*Saccharum arundinaceum* Hook. f., Fl. Brit. Ind. 7 : 119 (1896) p.p. non Retz.

Perennial. Culms up to 5 m. tall, smooth, solid. Leaf-blades up to 2.4 m. long, 15 mm. wide, margins scabrid ; sheaths shortly silky at the base, otherwise smooth, striate, villous on the margins at the apex with long white hairs, usually much longer than the internodes ; ligules truncate, membranous, up to 3 mm. long, minutely silky dorsally and ciliate. Panicle up to 90 cm. long, lanceolate ; branches spreading, becoming appressed after anthesis ; axis glabrous, sulcate, more or less scabrid on the ridges ; primary branches subverticillate, compound ; secondary branches triquetrous, more or less villous with long white hairs on angles and on two faces.

Sessile spikelets lanceolate, up to 5 mm. long ; joints 1/2 the length of the spikelet ; pedicel 1/3-3/4 the length of the spikelet, villous with long white hairs on two faces and on the angles. Lower glume lanceolate, with 2 strong lateral nerves and usually 1-4 more or less distinct additional nerves, dorsally long-villous on basal half or two-thirds, the hairs overtopping the

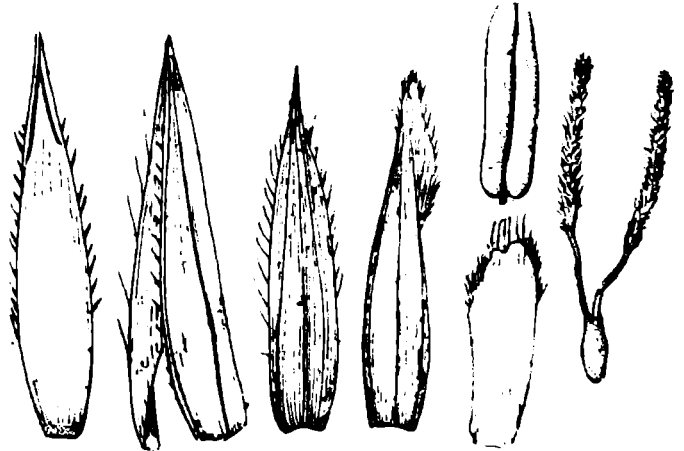


Fig. 51.—*Saccharum bengalense*

glume by about the length of glume, scabrid dorsally on keels, margins inflexed, sparsely ciliate above, apex entire or minutely 2-toothed. Upper glume subequal, lanceolate, keeled with one strong central nerve and usually 2-4 more or less distinct additional nerves, glabrous dorsally, scabrid on the keels, margins incurved, ciliate, apex acute or shortly mucronate. Lower floret ; lemma oblong-lanceolate, hyaline-membranous, 1-to 3-nerved, margins incurved, ciliate, apex acute or shortly mucronate. Upper floret ; lemma broad-lanceolate to elliptic, hyaline, 1- to 3-nerved, mucronate, ciliate, mucro 1.25 mm. long but not exerted beyond the apex of the spikelet. Pedicelled spikelets similar but the glumes are dorsally long-villous and usually with 3-5 strong nerves.

On the flood plains of the rivers. Multan ; Khyber pass ; Sheikhpura ; Gilgit. Common.

5. **Saccharum ravennae** (Linn.) Murr.

*Saccharum ravennae* (Linn.) Murr., Syst. ed. 13, p. 18.

*Andropogon ravennae* Linn., Sp. Pl. ed. 2 : 1481 (1762).

*Erianthus ravennae* (Linn.) Beauv., Agrost. 14 (1812); Hook. f., Flor. Brit. Ind. 7 : 121 (1896).

Perennial. *Culms* up to 5 m. high, smooth, solid; nodes glabrous. *Leaf-blades* linear, up 90 cm. long, 3.8 cm. wide, scaberulous on both surfaces, margins very scabrid; *sheaths* hairy; *ligule* a narrow silky band. *Panicle* oblong, up to 90 cm. long, erect, clothed with silky hairs; branches many. *Spikelets* pale, 5 mm. long (excl. the awn), linear-lanceolate; pedicels with two opposite rows of very long silky hairs; callus short, with silky hairs, as long as or longer than the spikelet. *Lower glume* 5 mm. long, membranous, lanceolate, aristately acuminate, with slightly scaberulous margins. *Upper glume* slightly longer than the lower, lanceolate, aristately acuminate, obscurely 3-nerved. *Lower lemma* 3 mm. long, narrowly lanceolate, very acute with inflexed margins, hyaline. *Upper lemma* 2.5 mm. long, ovate-lanceolate, tapering to a whitish awn; awn 2.5-6 mm. long.

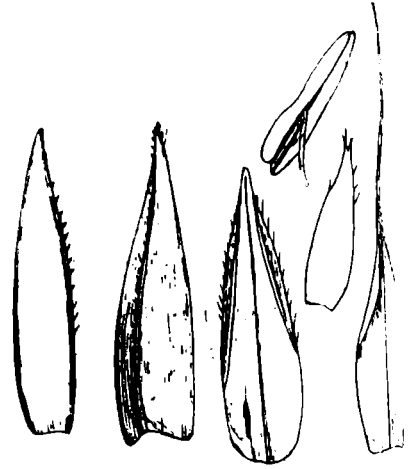


Fig. 52.—*Saccharum ravennae*

Karachi, *Cooke, Woodrow*; Larkana, *Cooke*; Peshawar; Chitral. Very common throughout the area, especially on the sides of the rivers.

6. **Saccharum rufipilus** Steud.

*Saccharum rufipilus* Steud., Syn. Gram. 409 (1854).

*Erianthus rufipilum* (Steud.) Griseb. in Goett. Nachbr. 93 (1868).

*Erianthus fulvus* Nees ex Steud., l.c.; Hook. f., Flor. Brit. Ind. 7 : 123 (1896).

Perennial. *Culms* robust, 1-2 m. high, silkily pubescent below the panicle. *Leaf-blades* linear, setaceous-acuminate, 30-70 cm. long, 8-16 mm. broad, flat, glabrous, scabrid below, smooth above; margins scabrid; *sheaths* striate, glabrous, collar silkily pubescent; nodes sometimes bearded; *ligules* membranous, rotund-truncate, 1-2 mm. long, fuscous, long-ciliate. *Panicle* erect, oblong, 20-25 cm. long, very dense at first, mauve purple then fulvous, decomposed; common axis villous; primary branches solitary, up to 7 cm. long, spikelets crowded; joints 8-10, villous, 2 mm. long; pedicels villous, 2 mm. long. *Sessile spikelets* 2.5-3 mm. long, lanceolate, brownish; callus hairs 1 cm. long. *Lower glume*

coriaceous-membranous, the hyaline tip abruptly acuminate, entire, margins inflexed below the apex or not; back flat, very glabrous, 2-nerved, 2.5 mm. long. *Upper glume* 2.5-3 mm. long, acute or mucronulate, glabrous, margins ciliate. *Lower lemma* 3 mm. long, linear-lanceolate, acute, ciliate; *palea* absent. *Upper lemma* 2 mm. long, ovate-lanceolate, glabrous, 1-nerved, awn 6-8 (-14) mm. long; *palea* as long as the lemma or shorter or entirely absent. *Pedicelled spikelets* similar to the sessile but lower glume sometimes with spinose hairs.



Fig. 64.—*Saccharum rufipilus*

Hazara, Siran Range, *Inayat*; Swat, below Kulali, R. R. *Stewart*; Kagan Valley, Naran.

### 7. *Saccharum macrantherus* (Pilger)

*Saccharum macrantherus* (Pilger) comb. nov.

*Erianthus macrantherus* Pilger in Notizbl. Bot. Gart. Berlin 14 : 347 (1939).

Perennial with a much branched rhizome. *Culms* up to 2 m. high, provided with numerous intravaginal branches; nodes with white shining hairs. *Leaf-blades* narrowly linear, folded, glabrous; *ligules* membranous, sufficiently long. *Panicle* long exserted, dense, up to 20 cm. long, spikelets and joints densely pilose with long, white or brown silky hairs; joints and pedicels about 4 mm. long, pilose along the margins, the hairs twice as long. *Sessile spikelets* 8-9 mm. long, straw coloured; callus hairs longer than the spikelet. *Lower glume* coriaceous membranous, dorsally flattened, margins narrowly inflexed, broadly ovate-lanceolate, obtuse, apex slightly toothed, 2-keeled, the nerves of the keels percurrent; besides these there are 4 other nerves which anastomose with the nerves of the keels. *Upper glume* membranous, cymbiform, keeled, margins hyaline and shortly villose, ovate lanceolate, 5-nerved, the lateral nerves not percurrent. *Lower lemma* barren, thinly hyaline, narrowly ovate, 7 mm. long, ciliolate, inconspicuously 2-nerved. *Upper lemma* bisexual, thinly hyaline, narrowly lanceolate, ciliolate, 7 mm. long, narrowly 2-lobed, awned from the sinus; awn rigid, scabrid, erect, neither geniculate nor twisted, exserted from 3 to 4 cm. beyond the apex of the spikelet; *palea* short, narrow, hyaline, nerveless. *Stamens* 3; anthers yellowish, 5 mm. long.

Chitral: Gilgit, Astor Dist., I. I. *Chaudhri*.

### 8. *Saccharum filifolium* Steud.

*Saccharum filifolium* Steud., Syn. Gram. 409 (1854).

*Erianthus filifolius* Nees ex Steud., Syn. Gram. 409 (1854); Hook. f., Flor. Brit. Ind. 7: 123 (1896).

Perennial. Culms 40-90 cm. high, arising from a woody rootstock,

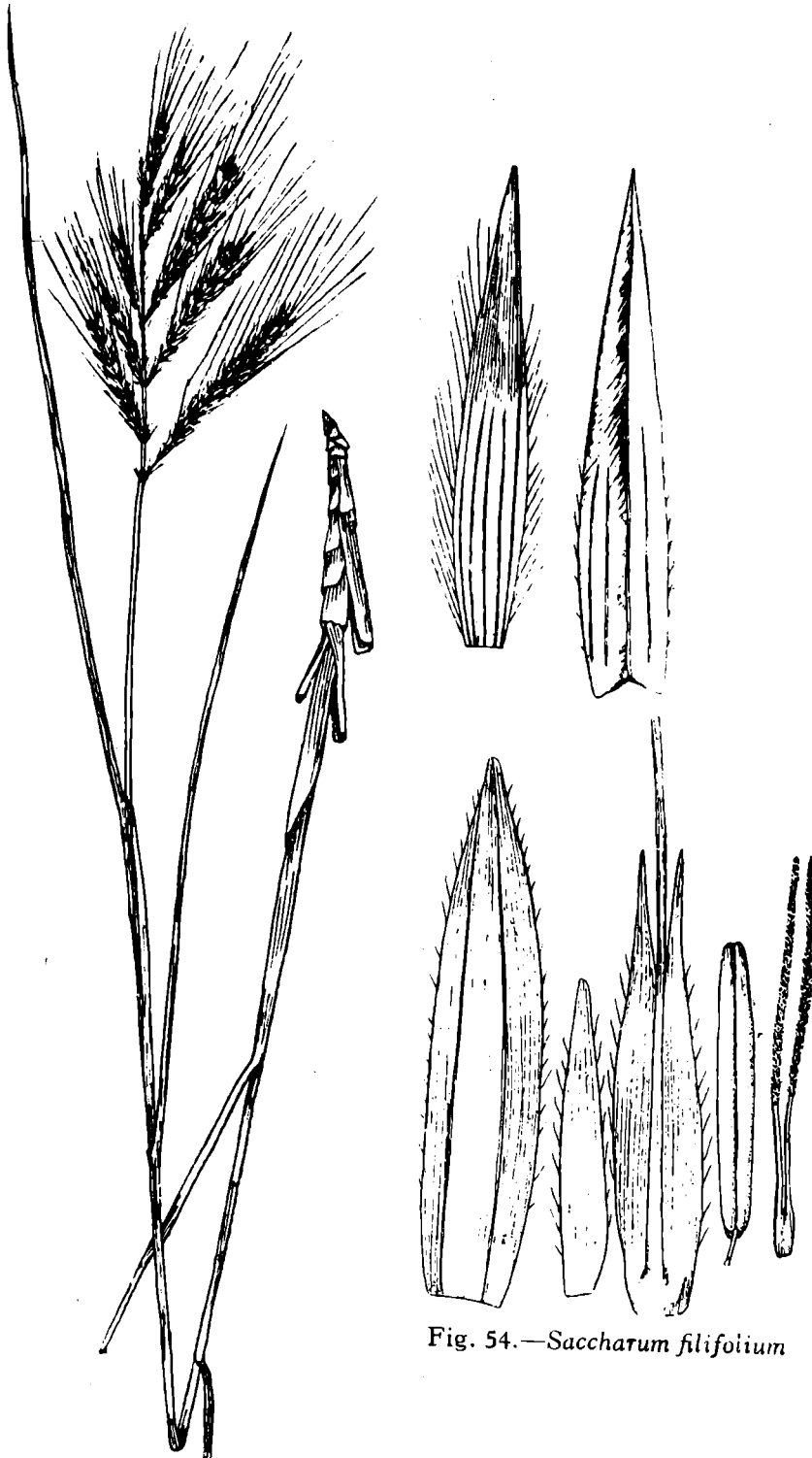


Fig. 54.—*Saccharum filifolium*

pubescent below the narrow panicle ; nodes pubescent. *Leaf-blades* filiform, 20-30 cm. long, rigid, glabrous, convolute below; *sheaths* glabrous; *ligules* very short, obtuse, ciliate. *Panicle* narrow, 15-20 cm. long, red-purple ; joints and pedicels 2-3 mm. long. *Spikelets* 4-6 mm. long, lanceolate ; callus with dense hairs ; hairs shorter than the spikelets. *Lower glume* minutely 2-toothed, membranous, acute, keel scabrid, margins broadly inflexed, dorsally glabrous with 3-4 unequal intracarinal nerves. *Upper glume* similar to the lower but 3-nerved, keel smooth. *Lower lemma* lanceolate, 2-mucronulate, sub 2-nerved, margins inflexed, ciliate. *Upper lemma* entire or minutely 2-toothed, linear-lanceolate, 1-nerved, glabrous ; awn much longer than the spikelet ; palea short, lanceolate, glabrous. *Pedicelled spikelets* similar ; lower glume 6- to 7-nerved.

Murree Hills ; Poonch ; Peshawar. Common from 4500 to 9000 ft.

### 5. *Microstegium* Nees.

Annual or perennial grasses with lanceolate to linear-lanceolate leaf-blades, conspicuously contracted at the base or petioled. Spikelets 2-nate, one sessile, the other pedicelled or both pedicelled, in subdigitate or fascicled racemes. Glumes subequal ; lower membranous or coriaceous, dorsally deeply grooved or concave, rarely villous, truncate or 2-toothed, the margins narrowly inflexed throughout their length ; the upper usually laterally compressed, keeled, acute. Lower floret male or barren ; lemma hyaline or absent, ciliate, paleate or not (when the lemma is absent the palea may be as long as the lower glume, male or neuter). Upper floret bisexual ; lemma usually very short, hyaline, entire, 2-fid or 2-auricled or reduced to the dilated base of the long awn ; palea small or absent.

#### 1. *Microstegium nudum* (Trin.) A. Camus

*Microstegium nudum* (Trin.) A. Camus, Fl. Gen. de l'Indochine 7: 261 (1922).

*Pollinia nuda* Trin. in Mem. Acad. Petersb. ser. 2, 407 (1833); Hook. f., Flor. Brit. Ind. 7: 117 (1896).

Annual. *Culms* decumbent, rooting at the base, up to 90 cm. high, many-noded, channelled on one side, glabrous. *Leaf-blades* lanceolate, contracted at the base, acuminate, 2.5-10 x 3-9 mm., glabrous or with a few scattered hairs, margins minutely scabrid; *sheaths* tight, terete, hairy; *ligules* short, glabrous. *Racemes* 3-6, rather distant on the common axis, finally spreading, 4.5-10 cm. long, narrow, soft, flexuous, glabrescent ; joints slender, filiform, rounded, inner face grooved, the outer convex or obtusely

keeled, glabrous. *Spikelets* narrowly lanceolate, 3-4 mm. long, sometimes distant; callus naked, obtuse, shortly bearded. *Lower glume* membranous, very narrow, rarely truncate or obtuse, often strongly divided, back

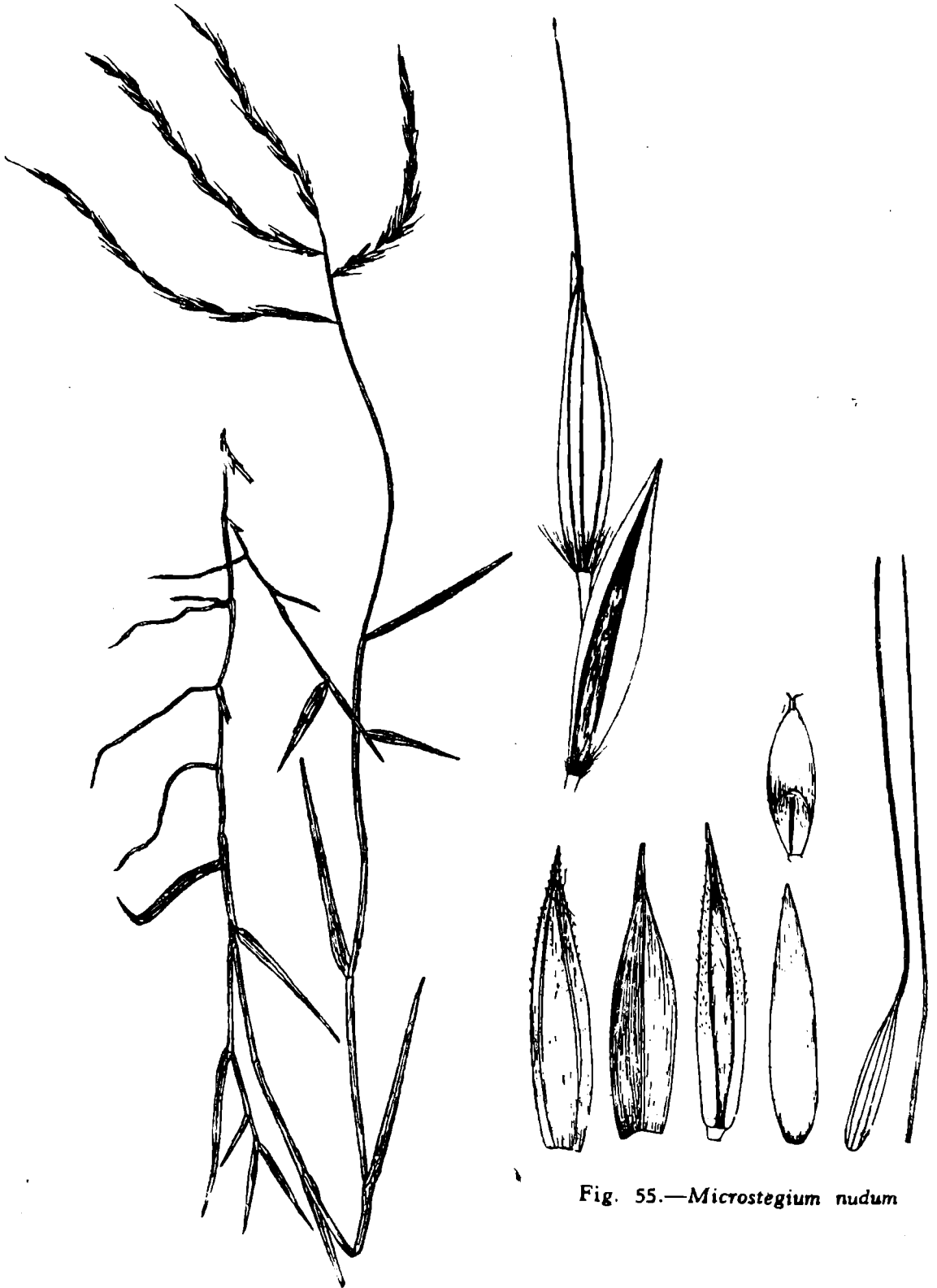


Fig. 55.—*Microstegium nudum*

concave, 2-keeled ; keels scaberulous or ciliate. *Upper glume* lanceolate, laterally compressed, navicular, acuminate or mucronulate, keel obtuse, scabrous, margins hyaline above, ciliate, rest glabrous, nerveless or 3-nerved, lateral nerves anastomosing. *Lower floret* barren ; lemma usually absent, when present linear, 2-4 mm. long, obtuse, glabrous or almost so, nerveless ; palea absent, when present like the lower glume. *Upper floret* bisexual ; lemma usually reduced to the dilated base of the awn, 3-nerved, margins hyaline ; awn 15-18 mm. long, imperfect, capillary, very flexuous, scabrous ; palea absent. *Pedicelled* spikelets similar to the sessile ; lower glume shallowly concave with 2 carinal and 2 nerves close to the carinals.

Swat State ; Murree, Changla Gali, etc. Common in shady places in the hills from 4000-8000 ft.

## 6. *Eulaliopsis* Honda

Densely tufted perennials with a woolly rootstock and basal leaves. Leaf-blades convolute when old, wiry ; mouth of the sheaths ciliate. Spikelets 2-nate, one sessile the other pedicelled, similar, seated on the articulate, fragile, compressed, slender rachis of digitate or fascicled false spikes ; fascicles with filiform peduncles in a more or less branched panicle ; callus densely clothed with long brown hairs. Lower glume flattened, 2- to 3-toothed, dorsally hairy at the base, 5- to 7-nerved, margins inflexed. Upper glume boat-shaped, minutely cuspidate, 3- to 5-nerved, with a slender awn. Lower floret male or neuter ; lemma hyaline, sparsely ciliate, elliptic ; palea finely ciliate. Upper floret bisexual ; lemma narrow, conduplicate, entire or 2-toothed, shortly awned from the tip or minute sinus ; palea broad and nearly as long as the glume, densely ciliate on top.

### 1. *Eulaliopsis binata* (Retz.) C. E. Hubb.

*Eulaliopsis binata* (Retz.) C.E. Hubb. in Hook. Ic. Pl. sub t. 3262 (1935).

*Andropogon binatus* Retz., Obs. fasc. 5: 21 (1789).

*Pollinidium binatum* (Retz.) C.E. Hubb. in Kew Bull. 72 (1932).

*Ischaemum angustifolium* Hack., Monogr. Andropog. 241 (1889) ; Hook. f., Flor. Brit. Ind. 7: 129 (1896).

A perennial caespitose grass. Culms erect, 3- to 4-noded, up to 90 cm. high, somewhat compressed, channelled along one side, very glabrous, sending out flower bearing branches at the upper 2 or 3 nodes, often solitary, very tomentose at the base. Leaf-blades linear, flat, 30-60 cm. x 2-3 mm., rigid, almost erect, the base fimbriate ; margins scaberulous ; lower sheaths crowded, dilated at the base, covered with a dense white tomentum,

persistent, surrounding the base of the culms, the upper terete, shorter than the internodes ; nodes hairy or glabrous ; *ligule* a ridge of short hairs. *Reccemes* spiciform, 2-4, sessile, unequal, 2-4 cm. long, somewhat thick,



Fig. 56.—*Eulaliopsis binata*



dense, covered with a golden or dark yellow pubescence; axis glabrous; joints of the rachis and pedicels 2-angled, linear, filiform; hairs at the base as long as the joint, the remainder laxly and shortly ciliate. *Spikelets* 3.5-4.5 mm. long, lanceolate; callus very short, obtuse, with rusty hairs, 1/4-1/2 the length of the spikelet. *Lower glume* 3-4 mm. long, obtuse or acute, 2- to 3-toothed, margins not hyaline, not inflexed, back convex, without a groove, 5-nerved, densely ciliate towards the base and on the margins, with hairs equal to the glume in length, tufts of hairs on the back, scabrid at the apex. *Upper glume* 3.5-4.5 mm. long, lanceolate, obtuse, 2-toothed and mucronate or with an awn 1-2.5 mm. long, keel scabrid at the apex, bearded at the base, 3- to 5-nerved. *Lower floret* male; lemma hyaline, oblong, obtuse, 2-toothed, nerveless, glabrous or ciliate at the top; palea shorter. *Upper floret* bisexual; lemma 3.4-4.3 mm. long, hyaline, linear, 1-nerved, glabrous, 2-toothed; awn imperfect, 6-9 mm. long; palea shorter, top fimbriate.

Jhelum; Rawalpindi; Kala Chitta Hills; Swat State; Poonch; Quetta. Very common in the dry hills of the Himalayan foot hills to 4000 ft. *Babbar* or *Baggar*. Elsewhere it is used for rope and paper making.

## 7. *Eulalia* Kunth

Perennial grasses with convolute then flat narrow leaves. Inflorescence a digitate or fascicled spike-like racemes. Spikelets all alike, 2-nate, one sessile the other pedicelled. Glumes equal, rigidly membranous to coriaceous; lower dorsally flattened or shallowly concave (not grooved), more or less 2-keeled with inflexed margins; upper 1- to 3-nerved, keeled. Lower floret reduced to an empty lemma or represented by a minute scale or quite suppressed, the upper always bisexual. Lemmas hyaline; lower muticous, sometimes much reduced or quite suppressed; upper very short, 2-lobed, awned.

### 1. *Eulalia trispicata* (Schult.) Henr.

*Eulalia trispicata* (Schult.) Henr. in *Blumea* 3: 453 (1940).

*Andropogon trispicatus* Schult., *Mant.* 2: 452 (1824).

*Eulalia tristachya* (Roxb.) Kze., *Rev. Gen. Pl.* 2: 775 (1891).

*Andropogon tristachyus* Roxb., *Fl. Ind.* 1: 256 (1820).

*Pollinia argentea* Trin. in *Bull. Soc. Acad. Petersb.* 1: 71 (1836); *Hook. f., Flor. Brit. Ind.* 7: 111 (1896).

Perennial. Culms up to 1.2 m. high, erect, tufted, dense, terete, smooth, simple or branched, very glabrous. *Leaf-blades* rigid, erect, linear, acuminate, 10-45 cm. long, 1.5 mm. broad, very glabrous or with

appressed pubescence near the top and on the margins; *ligules* 0.3 mm. long, truncate, bearded. *Panicle* of 2-12 racemes; racemes slender, 4-15 cm. long; joints and pedicels 1.7-3 mm. long, linear, filiform; hairs white, long. *Spikelets* oblong, 2.5-3 mm. long; callus obtuse. *Lower glume* 2.5-3 mm. long, papyraceous and hard at the base, membranous hyaline at the top, linear-oblong, depressed on the back, pale brown below the middle, pale yellow above, narrowly truncate, no central nerve; apex entire or keel nerves excurrent and 2-mucronate, margins inflexed, stiff ciliate above, elsewhere hairs soft, white, erect. *Upper glume* 2.5-3 mm. long, hyaline and emarginate at the top, broadly oblong, obtusely carinate, 1-nerved, margins similar to those of the lower glume but shortly ciliate. *Lower lemma* barren, 2-3 mm. long, hyaline, whitish linear-oblong, obtuse, nerveless, ciliate. *Upper lemma* bisexual, 1.25-2.25 mm. long, very narrow, linear-oblong, divided into 2 subulate lobes; awn slender, 10-20 mm. long; palea absent. Anthers 2.5 mm. long.



Fig. 57.—*Eulalia trispicata*.

Azad Kashmir, Bangran, Rashid Khan.

### 8. *Arthraxon* Beauv.

Annual or perennial grasses with branched, decumbent culms. Leaf-blades ovate-lanceolate or cordate-amplexicaul. Racemes 2 to many, digitate, fasciculate or subpanicked at the top of the culms or branches. Spikelets solitary at each node of the rachis or 2-nate, one pedicelled, rarely developed and male, often barren, sometimes reduced to a pedicel, the other sessile, 2-flowered, bisexual, very often awned, often laterally compressed. Lower glume large, with inflexed margins or not, often mucronate, tubercular, mucicous, not embracing the upper glume. Upper glume narrow, lanceolate, keeled, mucicous or mucronate, 3-nerved. Lower floret neuter; lemma hyaline. Upper floret bisexual; lemma shorter than that of the lower floret and firm at the base, entire or 2-toothed, awned from the dorsal surface just above the base; palea small or absent.

## KEY TO THE SPECIES

1. Stamens 2.....2  
    Stamens 3.....3
2. Pedicelled spikelets suppressed, pedicels more or less reduced or almost completely suppressed. ....1. *A. hispidus*  
    Pedicelled spikelets usually present at upper nodes of the racemes, sometimes at lower, neuter, usually much reduced, pedicels distinctly developed, like the joints conspicuously villous; lower glume 2-dentate.....2. *A. lancifolius*
3. Pedicelled spikelets male; anthers about as long as the spikelet .....3. *A. serrulatus*  
    Pedicelled spikelets quite suppressed; pedicels present; anthers minute.....4. *A. nudus*

1. *Arthraxon hispidus* (Thunb.) Makino

*Arthraxon hispidus* (Thunb.) Makino in Bot. Mag. Tokyo 26 : 214 (1942).

*Arthraxon ciliaris* Beauv., Agrost. 3 (1812).

*Phalaris hispida* Thunb., Fl. Jap. 14 (1784).

*Digitaria hispida* (Thunb.) Spreng., Syst. Veg. 1 : 271 (1825).

Annual. Culms densely tufted, creeping and rambling over the ground, finally ascending, leafy to the panicle. *Leaf-blades* ovate or lanceolate, acute or acuminate, sparsely hairy on both surfaces with tubercle-based hairs, distantly ciliate on the rounded margins at the base; *sheaths* hairy on the back with tubercle-based hairs, smooth, ciliate on one margin, rather loose or inflated; *ligules* ciliate, membranous, lacerate, 1 mm. long. Panicle emerging from the sheath of the uppermost leaf which is furnished with a rudimentary blade; peduncle glabrous below the racemes. Racemes many, 2.5-3 cm. long; pedicels completely suppressed; joints of the rachis  $\frac{2}{3}$  the length of the spikelets. Spikelets solitary, about 3 mm. long, dimidiate-lanceolate. *Lower glume* 3 mm. long, convex on the back, tip entire, 7- to 10-nerved, nerves scabrid or echinate especially above the middle. *Upper glume* keeled, acute or acuminate, scabrid towards the top. *Lower floret* barren; lemma usually absent. *Upper floret* bisexual; lemma 2 mm. long, awned from the base, awn up to 9 mm. long. *Anthers* purple, 0.75 mm. long.

Abbottabad, R. R. Stewart; Murree Hills, Shaukat Ali; Poonch, R. R. Stewart.

2. *Arthraxon lancifolius* (Trin.) Hochst.

*Arthraxon lancifolius* (Trin.) Hochst. in Flora 39 : 188 (1856).

*Arthraxon microphyllum* Hochst, l. c. ; Hook. f., Flor. Brit. Ind. 7 : 147 (1896).

*Batratherum molle* Nees & Arn. in Edinb. New Phil. Jour. 18 : 181 (1835).

Annual. Culms sub-decumbent at the base, then ascending, terete, puberulous below the panicle ; upper branches very slender. Leaf-blades lanceolate with a cordate, amplexicaul base, slightly acuminate, 1.5-3 cm. long, 6-9 mm. broad, softly hairy, margins with tubercle-based cilia ; sheaths terete, shorter than the internodes ; ligules 1.2 mm. long, truncate, membranous, ciliate. Panicle with a long peduncle ; racemes 2-10, densely spiculate, 7-14 mm. long ; joints 1.3-1.7 mm. long, filiform, ciliate on both sides, 1/2 as long as the spikelets. Sessile spikelets 2.5-3 mm. long, linear-lanceolate, compressed laterally. Lower glume lanceolate or linear-oblong, narrowed towards the base, very acute, margins not inflexed, tip 2-toothed or 2-aristate, 5- to 7-nerved, nerves scaberulous above the middle. Upper glume lanceolate, 1-nerved, awned ; awn 2 mm. long, scabrid. Lower floret ; lemma 1-1.75 mm. long, lanceolate, acute, glabrous. Upper floret ; lemma linear-oblong, obtusely 2-toothed, 2-nerved, awned ; awn geniculate, twisted, slender, column 3 mm. long, bristle 6 mm. long. Anthers 0.4 mm. long. Pedicelled spikelets 2 mm. long, scabrid along the nerves, ovate-lanceolate ; pedicel 1 mm. long, like joints conspicuously ciliate.

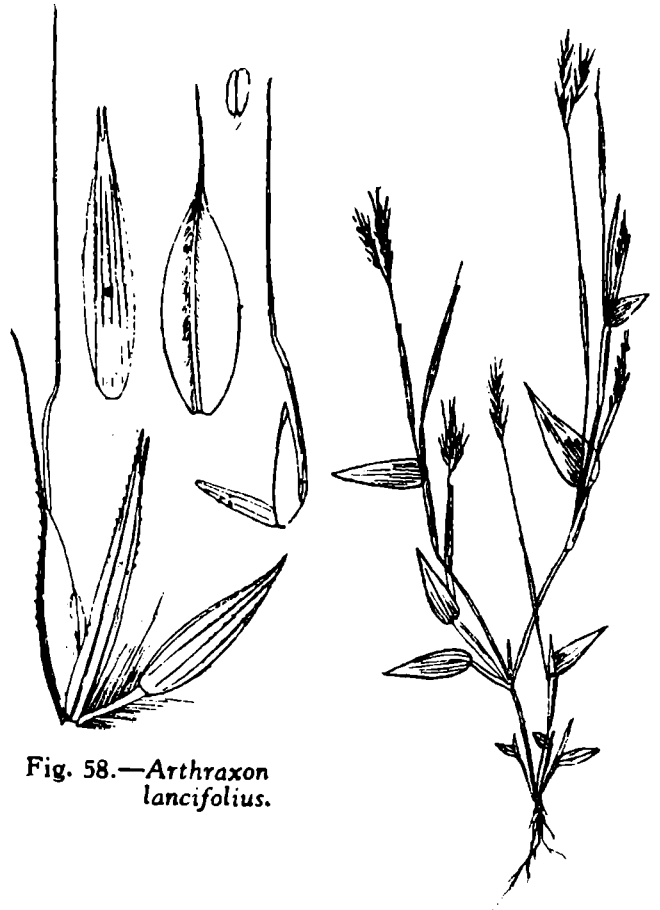


Fig. 58.—*Arthraxon lancifolius*.

Murree Hills, 2000-8000 ft. ; Poonch ; Gilgit, Chalt to Nomal, Skardu. A very common monsoon annual.

### 3. *Arthraxon serrulatus* (Link) Hochst.

*Arthraxon serrulatus* (Link) Hochst in Flora 39 : 188 (1856).

*Andropogon serrulatus* Link, Hort. Berol. 241 (1809).

*Arthraxon lanceolatus* (Roxb.) Hochst, l. c. ; Hook. f., Flor. Brit. Ind. 7 : 143 (1896) p.p.

*Andropogon lanceolatus* Roxb., Fl. Ind. 1 : 257 (1832).

Perennial ; rhizome at the time of flowering with densely tomentose innovation buds. Culms slender, decumbent, rooting at the lower nodes, up to 80 cm. high. Leaf-blades ovate-lanceolate to linear-lanceolate, up to 9 cm. long, 5-15 mm. broad, margins spinulose, base cordate, amplicaul ; ligules 3.5 mm. long, decurrent into the sheaths, membranous,

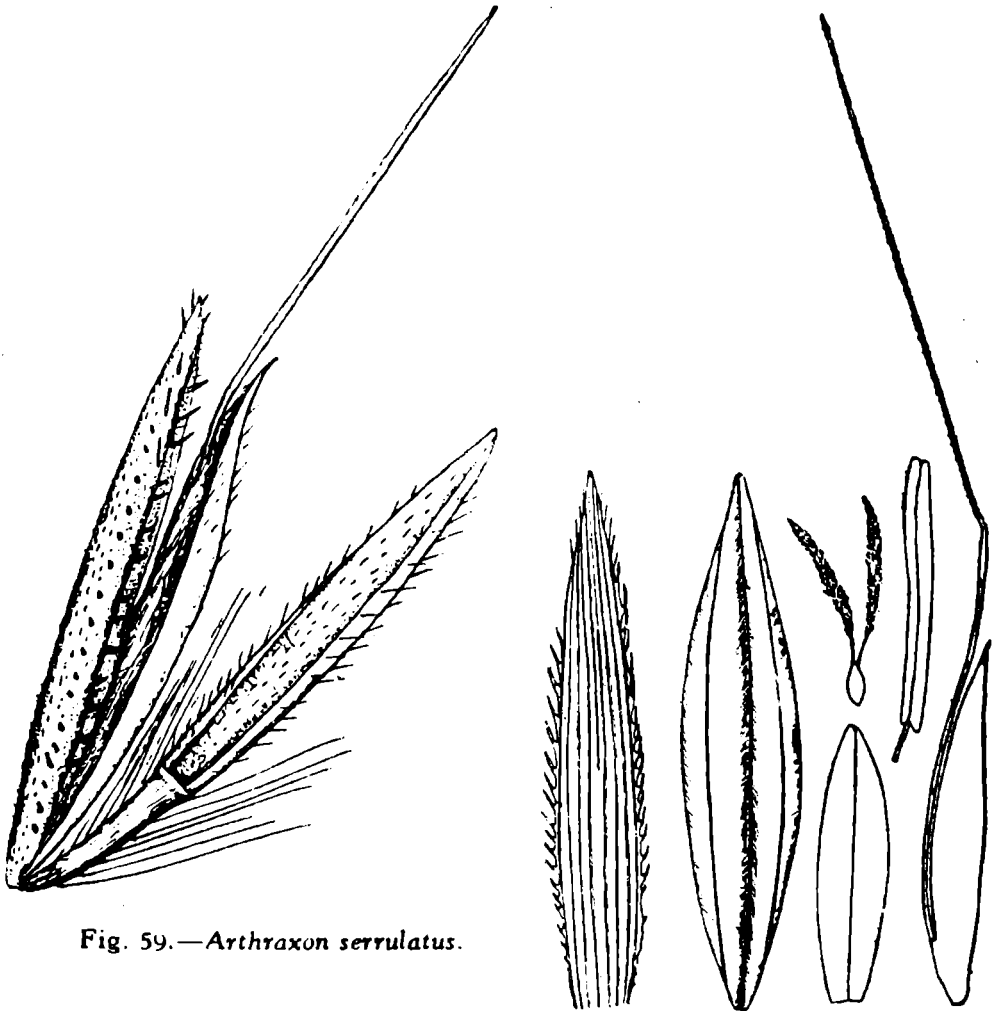


Fig. 59.—*Arthraxon serrulatus*.

glabrous or ciliate. Racemes few to many, 1.5-5 cm. long ; rachis sparsely hairy ; joints about  $\frac{1}{2}$  as long as the spikelets, margins ciliate. Sessile spikelets linear-lanceolate, 6-7 mm. long ; callus shortly puberulous. Lower glume coriaceous-chartaceous, acute, with the apex entire or minutely 2-toothed, 5- to 7-nerved, dorsally rounded, glabrous or muriculate. Upper glume lanceolate, acuminate or mucronulate, 3-nerved,

glabrous. *Lower floret*; lemma linear-oblong, acute, glabrous. *Upper floret*; lemma hyaline, awned from the base; awn 2.6 cm. long or less. *Pedicelled spikelets* linear-lanceolate, keels hispidulous; stamens 3; anthers 2.5-3 mm. long.

Deoli, Siran Range, Hazara, *Inayat*; Malkandi, Kagan, *J. F. Duthie*; Choa Saidan Shah, Salt Range, *Iftikhar*; Poonch, *R. K. Stewart*; Kagan Valley, *M. Zahur*; Chitral; Swat. Very common during monsoon from 2000-10,000 ft.

#### 4. *Arthraxon nudus* Hochst.

*Arthraxon nudus* Hochst. in Flora 24 : 188 (1856).

*Arthraxon ciliaris* Beauv., Agrost. 111 (1812) p.p.; Hook. f., Fl. Brit. Ind. 7 : 145 (1896).

Annual. *Culms* arising from a prostrate, widely rambling and rooting base, up to 60 cm. high; nodes smooth and glabrous. *Leaf-blades* ovate-acuminate, base cordate amplexicaul, smooth above, scabrid below, margins with long, tubercle-based hairs, 3-8 cm. long, 5-20 mm. broad; *sheaths* terete, smooth, hirsute with tubercle-based hairs, margins ciliate; *ligules* 2 mm. long, membranous, decurrent into the sheaths. *Racemes* many, shortly exserted or spathaceously sheathed. *Spikelets* linear-lanceolate in profile, 3 mm. long; callus naked; joints of the racemes and pedicels glabrous. *Lower glume* lanceolate, 7- to 10-nerved, without muriculations except on the outer nerves. *Upper glume* papyraceous, membranous, compressed, scabrid on the upper 1/3 of the keel, 3-nerved. *Lower floret*; lemma lanceolate, hyaline, 2 mm. long. *Upper floret*; lemma 2 mm. long, lanceolate, hyaline, glabrous, awned from near the base; awn 8 mm. long. Stamens 3; anthers minute. *Pedicelled spikelets* quite suppressed; pedicels present, 1.5 mm. long.

Swat; Chitral.

#### 9. *Capillipedium* Stapf

Annual or perennial grasses with simple or branched slender culms and bearded nodes. Leaf-blades with a rather conspicuous midrib. Panicle delicate, loose, formed of 1-2 jointed racemes at the ends of capillary branches. Spikelets 2-nate or 3-nate, one sessile the other pedicelled; joints and pedicels longitudinally grooved and hyaline in the grooves. Sessile spikelets dorsally compressed, awned. Glumes equal, membranous to subherbaceous; lower 2-keeled with narrow inflexed margins; upper boat-shaped, 3-nerved, keeled, grooved on both sides of the obtuse keel. Lower lemma hyaline, nerveless. Upper lemma reduced to a hyaline, linear stipe, passing upwards into a slender awn. Pedicelled spikelets awnless, the upper floret male or neuter; lemma, if present nerveless, hyaline.

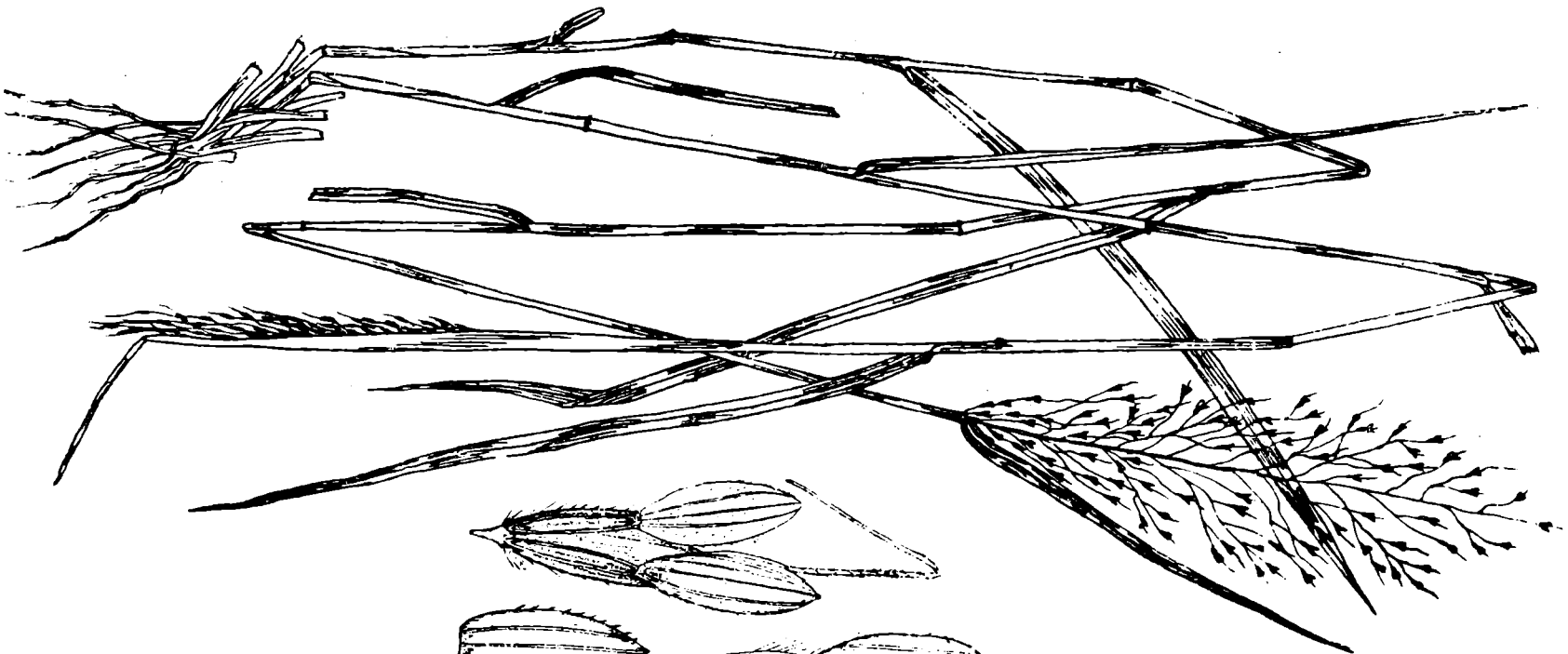


Fig. 60.—*Capillipedium parviflorum*

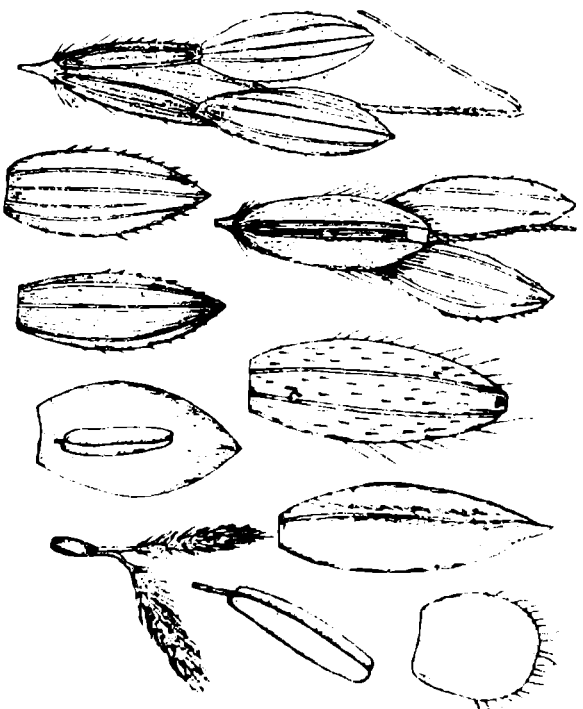
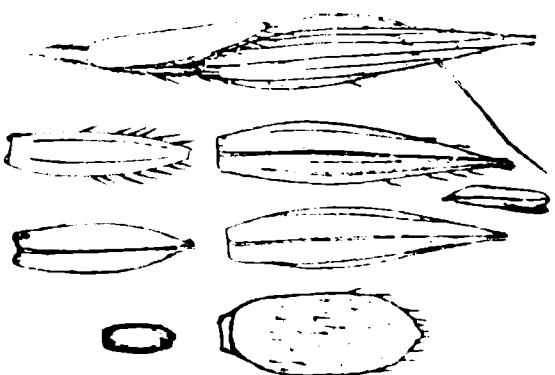


Fig. 61.—*Capillipedium assimile*



## KEY TO THE SPECIES

- Lower glume of the sessile spikelet dorsally channelled; base of the blade hardly narrowed; spikelets obtuse-oblong.....1. *C. parviflorum*
- Lower glume of the sessile spikelets flat; leaf-bases much narrowed and gradually tapering; spikelets lanceolate.....2. *C. assimile*

### 1. *Capillipedium parviflorum* (R. Br.) Stapf

*Capillipedium parviflorum* (R. Br.) Stapf in Prain, Flor. Trop. Afr. 9 : 169 (1917).

*Holcus parviflorus* R. Br., Prodr. 199 (1810).

*Andropogon micranthus* Kunth, Rev. Gram. 1 : 165 (1829); Hook. f., Flor. Brit. Ind. 7: 178 (1896).

Perennial; innovation shoots extravaginal, cataphylls more or less hairy, at length glabrescent. *Culms* tufted, 1 m. high, erect or shortly ascending at the base, simple or sparingly branched, terete. *Leaf-blades* linear, base contracted, apex acuminate, 30 cm. x 2.5 mm., glabrous or pubescent, sometimes even hirsute, margins scabrid. *Panicle* oblong, 10-25 x 2.5-6 cm., erect, more or less decomposed; primary branches subverticillate, often 4-7 or more from the lowest nodes, unequal, and divided from lower down and up to the 3rd degree, glabrous or hairy at the point of insertion, minutely puberulous all along, ultimate branches 12-20 mm. long, shortly ciliate or sometimes glabrous. *Sessile spikelets* oblong, 2.8-5 mm. long. *Lower glume* minutely truncate, very shallowly concave along the middle on the back, 6-nerved, scabrid all over, ciliate upwards on the keels. *Upper glume* scaberulous upwards on the keel. *Lower lemma* 2-2.5 mm. long. *Upper lemma* reduced to a hyaline linear stipe, passing upwards into a slender awn; awn incl. stipe 1.25-1.9 mm. long, fine. *Anthers* 1.6-1.8 mm. long. *Pedicelled spikelets* usually male, very similar to the sessile or somewhat smaller, narrow. *Lower glume* acute, 7-nerved, keels ciliolate upwards. Upper floret suppressed.

Kagan Valley: Shogran, Naran; Hazara, Dadar; Swat State: Kalam, Bahrain; Murree Hills; Poonch. Common in wet soil from 3000 to 7000 ft.

### 2. *Capillipedium assimile* (Steud.) A. Camus

*Capillipedium assimile* (Steud.) A. Camus, Fl. Gen. de l'Indo-Chine 7 : 314 (1922).

*Andropogon assimilis* Steud., Syn. Pl. Glum. 397 (1854); Hook. f., Flor. Brit. Ind. 7 : 179 (1896).

*Chrysopogon glaucopsis* Steud., Syn. Pl. Glum. 397 (1854).

Perennial. *Culms* up to 3.5 m. high, decumbent and rooting at the base, branched; nodes pubescent. *Leaf-blades* lanceolate-linear, narrowed



to the base, 6-15 cm. x 3-6 mm., glabrous or hispidulous, often scaberulous, margins spinous toothed; *sheaths* somewhat compressed, shortly bearded in the mouth; *ligules* short, truncate, ciliolate or hairy. *Panicle* up to 12 cm. long, ovate-oblong; common axis slender; the primary branches solitary rarely opposite and divided up to the 3rd degree, branches and branchlets bearded in the axils, naked at the base, ultimate branches 7-10 mm. long, margins ciliate or glabrescent. *Sessile spikelets* linear-oblong, 2-3 mm. long. *Lower glume* dorsally compressed, margins narrowly inflexed, 2-keeled, very narrowly truncate at the top, somewhat depressed on the back, keels with stiff cilia, delicately 2- to 5-nerved; callus shortly bearded. *Upper glume* broadly lanceolate, 2-3 mm. long, ciliolate at the apex, acute or mucronate, sub-depressed towards the obtuse keel, margins glabrous, 3-nerved. *Lower lemma* barren, 0.75-1.25 mm. long, hyaline, ovate, obtuse, nerveless, glabrous. *Upper lemma* bisexual, as long as the lower, narrow, glabrous; awn 6-12 mm. long, slender. *Pedicelled spikelets* male or neuter, 3.5-4 mm. long, linear-lanceolate. *Lower glume* similar in shape, acute, keel ciliolate, the remainder glabrous, 7-nerved. *Upper glume* as long as the spikelet, acute, 3- to 5-nerved, ciliolate. *Lower lemma* oblong, obtuse, nerveless, glabrous. *Upper lemma* suppressed.

Siran Range, Hazara, *Inayat*; Jhelum Valley Road, *Levinge*; Nawal Nadi, Poonch, *R. R. Stewart*.

### 10. *Sorghum* Pers.

Annual or perennial grasses with flat leaves, convolute in the bud. Panicle loose or contracted, erect or nodding with whorled or scattered branches. Spikelets 2-nate, one sessile the other pedicelled; 2-flowered, the upper floret bisexual in the sessile, male or neuter in the pedicelled spikelets, the lower reduced to an empty lemma. Sessile spikelets; glumes equal, coriaceous, often shining, margins narrowly inflexed above involute below. Lower lemma hyaline, 2-nerved; upper 2-toothed, rarely entire, awned from the sinus, 1- to 13-nerved; palea hyaline, often minute or absent. Pedicelled spikelets; lower floret much narrower than that of the sessile, the upper male or neuter or almost suppressed. Glumes membranous, 1- to 2-nerved, awnless.

#### KEY TO THE SPECIES

- |                    |                      |
|--------------------|----------------------|
| 1. Cultivated..... | 1. <i>S. vulgare</i> |
| Wild.....          | 2                    |

2. Annual ; spikelets 5.5-7 mm. long.....2. *S. pugionifolium*  
Spikelets 4-5 mm. long.....3
3. Primary branches of the panicle undivided, up to 10 cm. long ; sessile  
spikelet very dark brown or black.....3. *S. nitidum*  
Primary branches of the panicle branched, up to 20 cm. long ; sessile  
spikelets green or purple .....4. *S. halepense*

### 1. *Sorghum vulgare* Pers.

*Sorghum vulgare* Pers., Syn. 1: 101 (1805).

*Andropogon sorghum* (Linn.) Brot., Fl. Lus. 1: 88 (1804) ; Hook. f., Fl. Brit. Ind. 7: 183 (1896).

*Holcus sorghum* Linn., Sp. Pl. 1047 (1753).

Annual or perennial. *Culms* robust, up to 3 m. tall, unbranched, erect, about 1 cm. in diameter, solid, glabrous. *Leaf-blades* about 7 cm. broad, smooth, margins scabrid ; *sheaths* glabrous ; *ligules* membranous, ciliate, about 2 mm. long, hairy on the back. *Panicle* decomposed, thyriform, up to 50 cm. long, erect or nodding, dense or loose, the branches and branchlets in crowded whorls, not jointed. *Sessile spikelets* oblong, ovoid, obovate, subglobose, etc. *Glumes* glabrous or hairy, straw yellow or dark brown. *Fertile lemma* muticous or aristate. *Caryopsis* very variable as to colour and size. *Pedicelled spikelets* male or neuter, linear-lanceolate, with pedicels very short.

Cultivated throughout the area as a fodder crop. *Jowar* or *Chari*.

### 2. *Sorghum pugionifolium* Snowden

*Sorghum pugionifolium* Snowden, Jour. Linn. Soc. Bot. 55: 240 (1955).

A loosely tufted annual. *Culms* up to 60 cm. tall, 1-2 mm. thick, slender, usually unbranched. *Leaf-blades* narrow, dagger-shaped, long-acuminate, up to 10 cm. long, 9 mm. broad, glabrous; uppermost *sheaths* usually clasping the stem and 3-5 times as long as the blades, somewhat pubescent near the nodes and the junction with the blades ; *ligules* membranous, subdeltoid, 2-3 mm. long, hairy at the base. *Panicle* narrow, oblong, up to 12 cm. long, 2 cm. wide, long exserted from the uppermost leaf-sheaths ; axis slender, terete, finally striate, branches 1- to 3-nate, slender, 1-7 cm. long ; internodes and pedicels slender, similar, 2.5-4 mm.

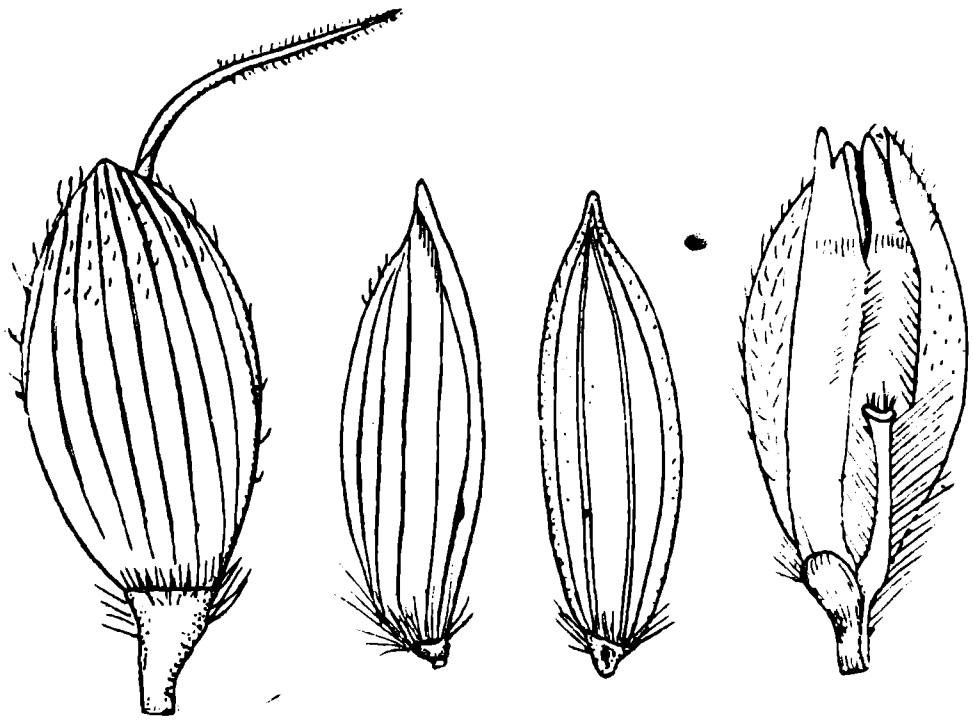


Fig. 62.—*Sorghum vulgare*. Two views of the sessile and pedicelled spikelets.

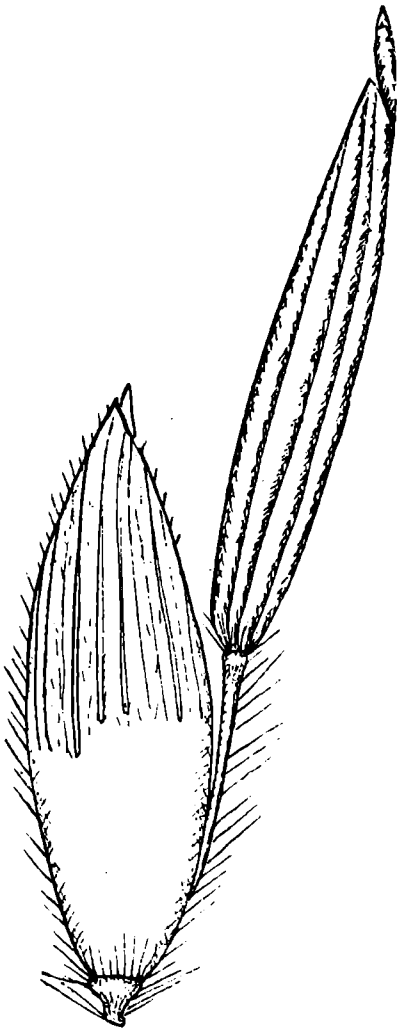


Fig. 63.—*Sorghum pugionifolium*.

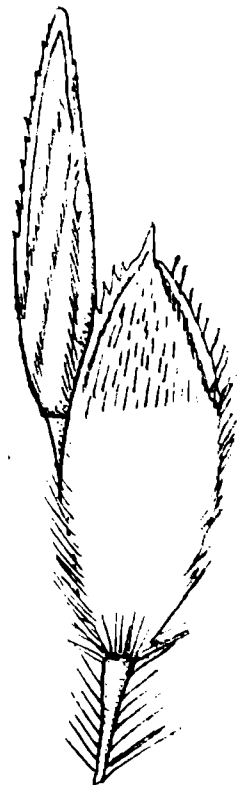


Fig. 64.—*Sorghum halepense*.

long, ciliate with whitish hairs 0.5-1 mm. long. *Sessile spikelets* oblong-lanceolate, acuminate, 5.6-6.5 mm. long, 1.5-2 mm. broad, awned, sparsely whitish or fulvously hairy, at length glabrescent except along the sides; callus shortly bearded. *Lower glume* 12- to 13-nerved (5-6 evident near the tip), 2-keeled from near the middle, keels spinulosely ciliolate. *Upper glume* 7-nerved, slightly scabrid on the keel in upper third. *Lower lemma* elliptic-lanceolate, 5.5 mm. long, finely 2-nerved. *Upper lemma* elliptic-ovate, 3.5-4 mm. long, faintly 1- to 3-nerved, 2-lobed with an awn 12-14 mm. long. *Anthers* 3.5 mm. long. *Pedicelled spikelets* usually male, linear-lanceolate to subulate, 6-7 mm. long; lower glume 9- to 12-nerved; anthers 3-3.5 mm. long.

Quetta, Asghar Ali.

### 3. *Sorghum nitidum* (Vahl) Pers.

*Sorghum nitidum* (Vahl) Pers., Syn. Pl. 1 : 101 (1805).

*Holcus nitidus* Vahl, Symb. 2 : 102 (1791).

*Andropogon nitidus* Kunth, Rev. Gram. 1 : 166 (1829).

*Andropogon serratus* Thunb., Fl. Jap. 41 (1784).

*Chrysopogon fuscus* Trin. ex Steud., Nom. ed. 2 : 360 (1840).

A tufted erect grass up to 2.5 m. high. *Culms* densely villous at the nodes. *Leaf-blades* up to 60 cm. long, 1 cm. broad, glabrous or sparsely hairy; *sheaths* terete below, subkeeled above, glabrous or more or less hairy with a silky-villous mouth; *ligules* membranous, 1-1.5 mm. long, truncate. *Panicle* oblong; lower branches distantly whorled, upper alternate; primary branches undivided, up to 10 cm. long, flexuous, delicately scabrid, naked below. *Recemes* at the ends of the branches few-spiculate. *Spikelets* 2-nate, the pedicelled often represented by the pedicel only or a rudimentary spikelet; joints and pedicels ciliate on the margins,  $\frac{2}{3}$  the length of the sessile spikelet; callus densely hairy. *Sessile spikelets* broadly oblong, elliptic, acute, 4 mm. long, callus rounded. *Lower glume* brown, hairy and hispid on the keels, 5- to 7-nerved, very dark brown or black, polished acuminate; hispid at the top; margins hyaline, ciliate. *Lower lemma* barren, 3.5 mm. long, hyaline, margins inflexed, clasping the base of the upper floret, 2-keeled, ciliate. *Upper lemma* ovate, 2 mm. long, hyaline, ciliate on the margins, shortly awned or not.

Below Murree, *Bhatti*, *Levinge*; Siran Range, Hazara, *Inayat*; Garhi Habibullah, *Trotter*; Baluchistan, *Nasir*. Common from 3000 to 6000 ft.

#### 4. *Sorghum halepense* (Linn.) Pers.

*Sorghum halepense* (Linn.) Pers., Syn. 1: 101 (1805).

*Holcus halepense* Linn., Sp. Pl. 1047 (1753).

*Andropogon halepense* (Linn.) Brot., Fl. Lusit. 1: 89 (1804); Hook. f., Flor. Brit. Ind. 7: 182 (1896).

A perennial grass with a long creeping stoloniferous rootstock. Culms up to 2.5 m. high, erect, simple or sparingly branched, leafy; nodes finely silky-villous. *Leaf blades* broadly linear-lanceolate, setaceously acuminate, base sub-amplexicaul, glabrous, smooth, margins scabridly serrulate; *sheaths* somewhat loose, glabrous, smooth; *ligules* short, membranous, erose, strigose behind. *Panicle* 15-30 cm. long; branches 1- to 3-nate, distant, suberect, often scaberulous on one of the angles, villous at the axils, naked for half their length, ultimate branches 10-25 mm. long; joints and pedicels nearly as long as the spikelets. *Sessile spikelets* ovate-lanceolate or elliptic, acute, 4-5 mm. long, dorsally compressed; callus short, shortly bearded. *Lower glume* dorsally flattened or convex, ovate-acute, more or less silky hairy, 5- to 12-nerved, margins inflexed. *Upper glume* as long as the lower, lanceolate, acuminate, chartaceous, shining, 5- to 7-nerved. *Lower lemma* as long as the upper glume, broadly lanceolate, hyaline, obtuse, ciliate, margins inflexed. *Upper lemma* 2.5-3 mm. long, obtuse, ciliate, 2-lobed, awned awn up to 12 mm. long, sometimes reduced to a bristle or suppressed. *Pedicelled spikelets* as long as the sessile, but narrower and awnless. *Lower glume* herbaceous, narrow-lanceolate, 7-nerved, dorsally grooved, keels hispid. *Upper glume* cymbiform, lanceolate, acuminate, 3- to 5-nerved. *Lower lemma* 2-keeled, glabrous, sparsely ciliate. *Upper lemma* suppressed.

Rawalpindi; Peshawar; Lahore; Hyderabad; Sargodha; Multan; etc. Common during the summer in jowar and maize fields. Vern. *Baru*.

#### 11. *Vetiveria Thours*.

Perennial, glabrous grasses with short rhizomes. Culms stout, more or less compressed below. Panicle long, erect, of many whorls

of slender, simple or rarely compound racemes. Spikelets paired, one sessile the other pedicelled, heterogamous. Spikelets 2-flowered, the lower reduced to an empty lemma, upper bisexual in the sessile, male in the pedicelled one. Sessile spikelets slightly compressed laterally, awned or not. Glumes equal; lower more or less coriaceous, rounded on the back, margins sub-inflexed, usually muticous; upper boat-shaped, keeled upwards with broad, hyaline, ciliate margins, muticous or mucronate with a perfect or imperfect awn from the sinus. Palea minute, hyaline, nerveless. Pedicelled spikelets dorsally compressed; glumes much thinner than those in the sessile spikelet.

### 1. *Vetiveria zizanioides* (Linn.) Nash

*Vetiveria zizanioides* (Linn.) Nash, Jour. Pharm. ser. 1, 13: 491 (1827).

*Phalaris zizanioides* Linn., Mant. 2: 183 (1771).

*Andropogon muricatus* Retz., Obs. fasc. 3: 43 (1783).

*Andropogon squarrosus* Hook. f., Fl. Brit. Ind. 7: 186 (1896) non Linn. f.

Perennial. *Culms* stout, up to 2 m. high, arising from an aromatic rhizome, usually sheathed all along. *Leaf-blades* linear, acute, up to 20 cm. long, 20 mm. broad, erect, rigid, firm, usually glabrous rarely hairy; *sheaths* compressed, lower sharply keeled, imbricate, very smooth; *ligule* reduced to a scarious rim. *Panicle* oblong, over 30 cm. long, usually contracted; axis 6-10-noded, branches in whorls of 10-20, oblique to suberect, filiform, slightly scaberulous. Racemes 6.5 cm. long, slender, joints as long as or slightly longer than the sessile spikelet; pedicels similar but shorter. *Sessile spikelets* linear-lanceolate, acute or subacute, 4-4.5 mm. long, yellowish; callus obtuse, less than 1 mm. long, glabrous. *Glumes* acute, coriaceous; lower muriculate all over the base, 5-nerved, lateral nerves close, very firm; upper glume spinulosely muriculate on the keel. *Lower lemma* as long as the glumes, acute, retrorsely ciliate. *Upper lemma* up to 3 mm. long, narrow, oblong-lanceolate, mucronulate, eciliate. *Anthers* 2-3 mm. long. *Pedicelled spikelets* sparingly aculeolate or almost smooth; lemma of the upper floret entire, acute.

Lahore; Gujranwala; Rawalpindi; Sialkot. *Khaskhas* grass is a plant of wet places in the plains.

VETIVERIA

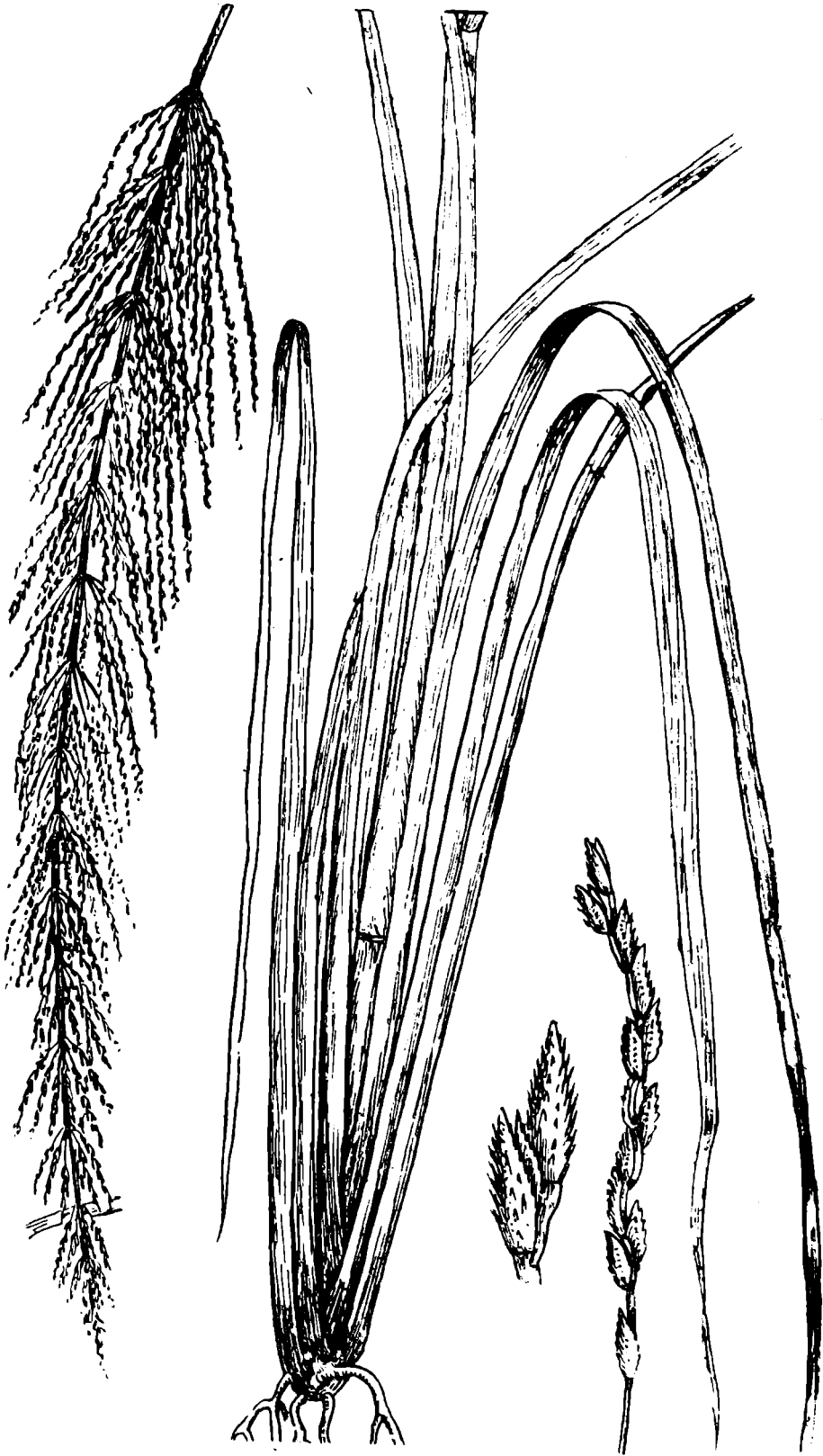


Fig. 64.—*Vetiveria zizanioides*

12. **Chrysopogon Trin.**

Perennial grasses with narrow leaf-blades. Inflorescence a terminal panicle of whorls of simple or basally divided filiform branches, rarely the branches 2-nate or solitary. Spikelets in threes at the ends of branches, one sessile the other pedicelled, the two kinds falling entire from the thickened, nearly always bearded, oblique tips of the peduncles. Sessile spikelets laterally compressed, awned, 2-flowered; lower floret reduced to an empty lemma, upper bisexual. Glumes subequal; lower coriaceous or chartaceous, involute with a rounded back, or complicate and keeled upwards. Upper glume boat-shaped, more or less keeled. Lemmas hyaline; lower 2-nerved; upper linear, entire or 2-dentate, with a perfect awn from the sinus. Pedicelled spikelets dorsally compressed, awnless or aristate; lower floret reduced to an empty lemma; upper male or neuter.

## KEY TO THE SPECIES

1. Pedicels of the pedicelled spikelets smooth, half as long as the sessile spikelets or longer.....2
  - Pedicels of the pedicelled spikelets hairy, not half as long as the sessile spikelets.....3
2. Callus about 3 mm. long, hairs rusty brown; awn 2.5-3.8 cm. long, stout.....1. *C. gryllus*
  - Callus about 1 mm. long; hairs pale yellow; awn 1.2-1.8 cm. long, slender.....2. *C. echinulatus*
3. Lower sheaths compressed; pedicels of the pedicelled spikelets densely ciliate on both margins.....3. *C. montanus*
  - Lower sheaths terete; pedicels silky-villous from base to apex.....4. *C. aucheri*

1. **Chrysopogon gryllus** (Linn.) Trin.

*Chrysopogon gryllus* (Linn.) Trin., Fund. Agrost. 188 (1820).

*Andropogon gryllus* Linn., Cent. Pl. 2: 33 (1756); Hook. f., Flor. Brit. Ind. 7: 187 (1896).

A perennial, densely caespitose grass; innovations extra- and intravaginal. Culms erect, simple, up to 1.6 m. high, terete or compressed, scaberulous or glabrous. Leaf-blades 12-38 cm. long, 4-8 mm. broad, linear, acute, glabrous or hirsute; sheaths of innova-



tions compressed, dilated at the base, often with appressed hairs ; of culms slightly compressed, keeled above, smooth or scaberulous, glabrous or hairy ; *ligule* a narrow ciliate membranous ring. *Panicle* 7.5-20 cm. long, branches whorled, 5-8 cm. long, usually many, densely bearded ; main axis angular, scabrid on the angles, axils bearded or glabrous. *Sessile spikelets* linear ; callus straight acute, about 3 mm. long. *Lower glume* coriaceous, shining, smooth or scaberulous ; margins broadly inflexed, 7 mm. long. *Upper glume* 7.25 mm. long, chartaceous, lanceolate, hyaline, margins ciliate ; awn 2.5-3.8 cm. long. *Lower floret* ; lemma 5-6 mm. long, obtuse, nerveless, margins ciliate. *Upper floret* bisexual ; lemma as long as the lower lemma, minutely 2-toothed, 1-nerved, glabrous or ciliate ; awn up to 3.5 cm. long. Anthers 4 mm. long. *Pedicelled spikelets* slightly longer than the sessile, linear-lanceolate ; pedicels glabrous. *Lower glume* acuminate or aristulate, 5- to 9-nerved, keel ciliate above. *Upper glume* lanceolate-acuminate, ciliate. *Lower lemma* equal to the upper lemma, 6-8 mm. long ; *palea* as long.

Government College Botanic Garden, Lahore. Cultivated.

## 2. *Chrysopogon echinulatus* (Steud.) Bor

*Chrysopogon echinulatus* (Steud.) Bor comb. nov.

*Andropogon echinulatus* Steud., Syn. Gram. 395 (1885).

*Andropogon gryllus* L. ssp. *echinulatus* Hack., Monog. Androp. 550 (1889); Hook. f., Flor. Brit. Ind. 7: 188 (1896).

A densely tufted perennial, up to 2 m. tall. *Culms* erect, simple, glabrous, 3- to 5-noded ; nodes glabrous. *Leaf blades* linear, acute ; 15-25 cm. long, 4-8 mm. wide, hirsute with tubercle-based hairs ; *sheaths* shorter than the internodes, keeled above, pubescent, especially along the margins ; *ligule* a hairy rim. *Panicle* 7.5-20 cm. long, peduncle long exserted, smooth or finely scaberulous ; axis scabrid, glabrous at the nodes ; branches usually many in a whorl, sometimes solitary, 1- 3.5 cm. long, spreading, at length erect ; racemes reduced to a single sessile and 2 pedicelled spikelets. *Sessile spikelets* linear, laterally compressed, 7 mm. long ; callus straight, acute, 1 mm. long, densely bearded with white hairs. *Lower glume* coriaceous, shining, scabrid or echinate along the keels, margins broadly inflexed, 2-toothed at the apex, 5-nerved. *Upper glume* chartaceous, lanceolate, scaberulous along the keels, aristulate, arista up to 2.5 mm. long. *Lower lemma*

linear--oblong, obtuse, nerveless. *Upper lemma* linear, minutely 2-toothed, awned; awn 12-18 mm. long; bristle 9 mm. long. Anthers yellow, 3 mm. long. *Pedicelled spikelets* male, 8-10 mm. long, terete, lanceolate, aristulate; pedicel glabrous, scaberulous, 3.5 mm. long. *Lower glume* slightly inflexed, tightly enclosing the upper glume, 5-nerved, keels scaberulous. *Upper glume* strongly inflexed, lanceolate, acuminate. *Lemmas* narrow, ciliate, hyaline. *Anthers* 3.5 mm. long.

Throughout the hills from 6- 10,000 ft. Hazara; Murree Hills; Swat State, Kagan Valley; Gilgit, etc.

### 3. *Chrysopogon montanus* Trin.

*Chrysopogon montanus* Trin. in Spreng. Nue. entdeck. 2 : 93 (1920-22).

*Chrysopogon serrulatus* Trin. in Mem. Acad. Petersb. ser. iv, 2 : 318 (1833).

*Chrysopogon monticola* Schult., Mant. 3 : 665 (1884); Hook. f., Flor. Brit. Ind. 7 : 192 (1896).

Perennial. Culms densely tufted, up to 1.2 m. high, erect, simple or branched, leafy chiefly at the base; nodes glabrous. *Leaf-blades* 5-45 cm. x



Fig. 65. — *Chrysopogon echinulatus*

3-6 mm., linear, acute, glabrous, smooth or scaberulous; upper *sheaths* terete, the lower compressed; *ligule* very short, membranous, ciliate. *Panicle* 5-12.5 cm. long, ovate or oblong; common axis slender, smooth or scaberulous; branches whorled, 2.5-5 cm. long, spreading, at length erect; racemes reduced to a single sessile and two pedicelled spikelets. *Sessile spikelets* 4.5-6 mm. long; callus 0.8 mm. long, bearded on one side with rufous hairs. *Lower glume* 4-5 mm. long, linear, complicate, 2-toothed at the apex, chartaceous, 4-nerved, more or less scaberulous. *Upper glume* 4.5-6 mm. long, ovate-lanceolate, concave, much broader than lower, ciliate on the keel with rufous hairs, very shortly toothed at the apex with broadly hyaline margins, 3 nerved, awned; awn 17 mm. long, the bristle up to 12 mm. long. *Lower lemma* oblong, obtuse, ciliate. *Upper lemma* narrowly linear, hyaline, awn 1.8 cm. long. *Pedicelled spikelets* as long as the sessile; pedicels 2 mm. long, ciliate with rufous hairs, flattened. *Lower glume* lanceolate, acute or awned, 7-nerved, scaberulous. *Upper glume* lanceolate, acuminate, acute or shortly awned. *Lemmas* smaller, oblong, hyaline, ciliate.



Fig. 66.—*Chrysopogon montanus*

Baluchistan, *Stocks*; Qilla Abdullah; Salt Range; Jhelum; Rawalpindi; Kagan Valley; Swat State; Dir, etc. Very common in the plains and the lower hills. Very variable in the size of the spikelets and may be a collective species.

#### 4. *Chrysopogon aucheri* (Boiss.) Stapf

*Chrysopogon aucheri* (Boiss.) Stapf in Kew Bull. 211 (1907).

*Andropogon aucheri* Boiss., *Diagn. ser.* 1, 5: 7 (1844); Hook. f., *Flor. Brit. Ind.* 7: 195 (1896).

*Chrysopogon ciliolatus* Nees ex Steud. var. *aucheri* Boiss., *Fl. Orient.* 5: 458 (1884).

Perennial. *Culms* densely tufted, up to 50 cm. high, slender, erect or geniculately ascending, simple or branched; nodes glabrous. *Leaf-blades* 5-10 cm. long, 2.5-6 mm. broad, linear, acute or acuminate, pubescent, often ciliate near the base with bulbous-based hairs; *sheaths* usually glabrous, pale, with a few hairs at the mouth; *ligule* a hairy ridge. *Panicle* 5-7.5

cm. long ; branches in whorls of 4-6, spreading then suberect ; racemes usually crowded, rarely 2-nate on a branch. *Sessile spikelets* 6-9 mm. long ; callus 1.5 mm. long, villous all over with long silky hairs. *Lower glume* 5-8 mm. long, linear, setaceously 2-toothed at the tip, minutely ciliate on the margins, obscurely 5-nerved, chartaceous. *Upper glume* as long as the lower, oblong, obtuse, 1-nerved, with hyaline margins, the keel ciliate above the middle with long hairs, awned ; awn slender, 1-2.5 cm. long, ciliate. *Lower lemma* linear, obtuse, hyaline. *Upper lemma* represented by the dilated base of the awn ; awn 2-2.5 cm. long, column 1 cm. long and bristle 1.5 cm. long, geniculate, twisted, ciliate below the middle. *Pedicelled spikelets* up to 10 mm. long, linear-lanceolate, acute ; pedicels less than  $\frac{1}{2}$  as long as the sessile spikelet, silky villous from base to apex. *Lower glume* lanceolate, acute, 4 mm. long, 7-nerved. *Upper glume* lanceolate, acuminate, 3-nerved. *Lower lemma* hyaline, oblong, acute. *Upper lemma* lanceolate, acute, 1-nerved, hyaline.

Hindu Bagh, *M. Nath* ; Bolan Pass, *J. J. Norris* ; Karachi, *R. R. Stewart* ; Gizri, *Sabnis*. Sind Plains to 6,000 ft. in Baluchistan.

### 13. *Dicanthium* Willemet

Perennial, very rarely annual grasses with simple or branched culms. Panicle of 2-many, subdigitate or racemously arranged racemes ; rachis jointed, disarticulating at maturity. Spikelets 2-nate, one sessile the other pedicelled, different as to sex except the lowermost 1 or 2 pairs of each raceme which are homogamous, male or neuter. Sessile spikelets imbricate, 2-flowered, lower reduced to an empty lemma, upper bisexual, dorsally compressed, awned except the basal homogamous pair. Glumes equal, thinly chartaceous ;



Fig. 67.—*Chrysopogon aucheri*

lower 2-keeled, with sharply inflexed margins ; upper boat-shaped, 3-nerved, acute, keeled. Lemma of the lower floret hyaline, nerveless ; of the upper floret reduced to a hyaline, firm, linear stalk passing into a slender awn. Pedicelled spikelets 2-flowered, male, neuter or suppressed.

1. **Dicanthium annulatum** (Forsk.) Stapf

*Dicanthium annulatum* (Forsk.) Stapf in Prain, Flor. Trop. Afr. 9 : 178 (1918).

*Andropogon annulatus* Forsk., Fl. Aegypt.-Arab., 173 (1775) ; Hook. f., Flor. Brit. Ind. 7 : 196 (1896).

*Andropogon bladhii* Retz., Obs. fasc. 2 : 27 (1781).

Perennial. Culms up to 1 m. high, geniculate-ascending or erect, simple or branched, subcylindric with a prominent groove along one side ; nodes long hairy. Leaf-blades up to 25 cm. long, 4 mm. wide, glabrous and smooth on the lower surface, bearing scattered, tubercle-based hairs on the upper surface, margins scabrid ; sheaths rounded, glabrous ; ligule scarious, 2 mm. long, obtuse or truncate, glabrous. Panicle digitate with a short primary axis 6-15 mm. long, slightly hairy in the axils ; racemes solitary or geminate, 3-10, joints long-ciliate, as well as the callus of the spikelets. Sessile spikelets oblong, obtuse, 3-4 mm. long, the lower 1-3 pairs muticous, neuter or male. Lower glume 3.2 mm. long, slightly concave above, rounded or truncate at the apex, glabrous or more or less hairy on the back, 2-keeled, with keels scabrid and long-ciliate, 9-nerved, the lateral nerves not reaching the tip, the median nerve scabrid near the apex. Upper glume lanceolate, acute, keeled, glabrous or ciliate, 3-nerved. Lower lemma linear-oblong, obtuse, nerveless, glabrous, as long as or slightly shorter than the glumes. Upper lemma reduced to a hyaline, flattened base of the awn ; awn twisted, geniculate, 1.6-2 cm. long, scabrid. Anthers about 1 mm. long. Pedicelled spikelets as long as the sessile, male or neuter ; pedicel half as long. Lower glume 7- to 11-nerved, obtuse, the keels with tubercle-based hairs, scabrid near the tip. Upper glume narrow, 3-nerved, dorsally compressed. Lower lemma 1-4 mm. long, ciliate. Upper lemma suppressed.

Lahore ; Gujranwala ; Jhelum ; Rawalpindi ; Peshawar ; Kagan Valley ; Swat State ; Dir ; Chitral ; Quetta ; Karachi ; Hyderabad, etc. Very common from the Plains to 5,000 ft.



Fig. 68.—*Dicanthium annulatum*

14. *Bothriochloa* Ktze.

Similar to *Dicanthium* but the sessile spikelets not closely imbricate, of all pairs hermaphrodite, awned and with the lower glume narrow.

## KEY TO THE SPECIES

1. Primary axis elongated, much longer than the lowest raceme ; the lowest branches or at least the stronger sparingly divided, but not beyond the second degree.....1. *B. intermedia*  
Primary axis short, much overtopped by the racemes.....2
2. Sheaths terete ; lower glume pitted.....2. *B. pertusa*  
Sheaths compressed ; lower glume not pitted....3. *B. pseudo-ischaemum*

1. *Bothriochloa intermedia* (R. Br.) A. Camus

*Bothriochloa intermedia* (R. Br.) A. Camus in Ann. Soc. Linn. Lyons, 76 : 164 (1931).

*Andropogon intermedius* R. Br., Prodr. 1 : 202 (1810); Hook. f., Flor. Brit. Ind. 7 : 175 (1896).

Perennial. Culms tufted, erect or geniculate-ascending, 60-120 cm. high, slightly flattened, glabrous, 5- to 7-noded, simple or sparingly branched ; nodes glabrous or the upper bearded. Leaf-blades linear, 15-45 cm. long, 3-8 mm. broad, glabrous or ciliate towards the base, margins scabrid; sheaths terete, smooth and glabrous ; ligules truncate, very short, membranous. Panicle thyriform or subcorymbose, narrowly oblong, 10-23 cm. long by 2.5-4 cm. broad, erect ; primary axis much longer than the lowest raceme, shortly bearded at the branch axils, otherwise glabrous and smooth ; branches whorled, up to 6 in a whorl, or semiverticillate, or 2-nate or solitary, straight, 2.5-7.5 cm. long, the longer divided from 1.6 cm. above the base, 3- to 7-nerved, secondary branches simple. Racemes 1.25-3.75 cm. long, conspicuously white villous ; joints and pedicels 2-3 mm. long, ciliate, with a translucent centre. Sessile spikelets 3-3.5 mm. long ; callus very short, bearded. Lower glume obtuse or truncate, slightly concave on the back, chartaceous-mem-

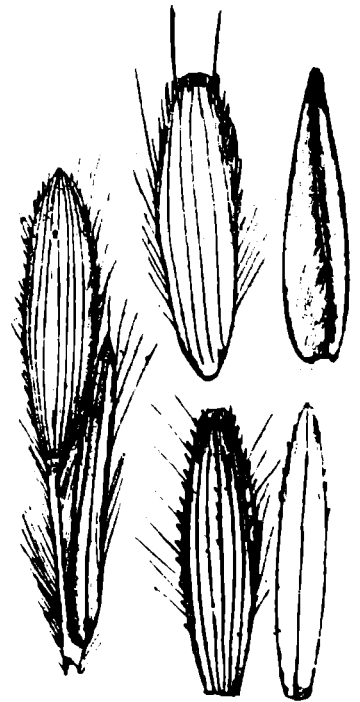


Fig. 69.—  
*Bothriochloa intermedia*

branous, glabrous or hairy below the middle, keels rigidly ciliolate upwards, intracarinial nerves 4-5, very fine, evanescent upwards with or without a pit in the middle. *Upper glume* oblong-lanceolate, acute, 3-nerved, keel scabrid upwards, margins sparingly ciliate. *Lower lemma* oblong, obtuse, 2.5 mm. long, hyaline, nerveless. *Upper lemma* represented by the hyaline, slightly flattened base of the awn; awn up to 15 mm. long; palea absent. *Pedicelled spikelets* neuter, mostly reduced to the glumes, narrowly linear-oblong to lanceolate, 2.5-2.75 mm. long, narrower than the sessile; pedicel 2.5 mm. long, with a translucent centre, usually ciliate. *Lower glume* rigidly and minutely ciliolate, 5- to 9-nerved, often rolled and not pitted; *upper glume* hyaline, nerveless, often minute.

Murree; Kagan Valley: Naran; Swat: Kulali; Abbottabad. Lower hills to 7,000 ft.

## 2. *Bothriochloa pertusa* (Linn.) A. Camus

*Bothriochloa pertusa* (Linn.) A. Camus in Ann. Soc. Linn. Lyons, 76: 164 (1931).

*Holcus pertusus* Linn., Mant. 2: 301 (1771)

*Andropogon pertusus* (Linn.) W lld., Sp. Pl. 4: 922 (1805); Hook. f., Flor. Brit. Ind. 7: 173 (1896).

*Amphilophis pertusus* (Linn.) Stapf in Prain, Flor. Trop. Afr. 9: 175 (1917).

Perennial. *Culms* erect or geniculate-ascending, glabrous, simple or rarely branched; nodes glabrous. *Leaf-blades* linear, up to 15 cm. long, 3-4 mm. wide, glabrous or more or less hairy, margins scabrid; *sheaths* of the innovation shoots compressed, more or less keeled; those of the culms terete, glabrous, long-ciliate at the mouth; *ligules* short, membranous, truncate, ciliate. *Panicle* subdigitate, 5-7 cm. long; the primary axis 1-3 cm. long with hairy nodes, glabrous between the nodes. *Racemes* 2-nate or solitary in superposed whorls, naked at their bases for 2-4 mm.; rachis simple, jointed, fragile, glabrous or villous between the nodes, 2-3 cm. long; nodes long silky-villous, as well as the pedicels of the spikelets; joints of the rachis grooved. *Sessile spikelets* oblong, 4 mm. long; callus short, bearded with the hairs exceeding the middle of the glumes. *Lower glume* slightly 2-toothed

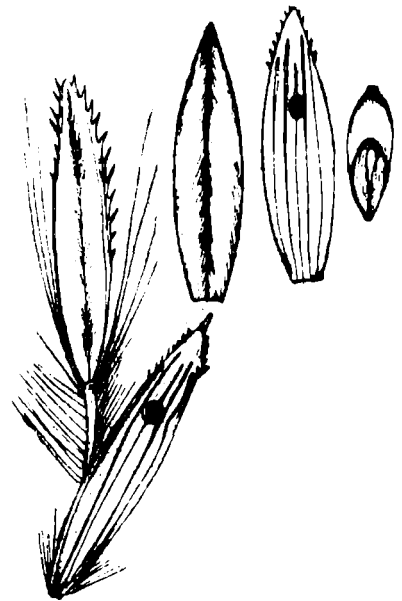


Fig. 70.—*Bothriochloa pertusa*.



at the apex, flattened on the back, 2-keeled, hairy below the middle, the keels scabrid or ciliate-scabrid towards the apex, with 5-7 intracarpal nerves, pitted. *Upper glume* lanceolate, acute, 3-nerved, 1-keeled, keels scabrid at the margins, more or less ciliate towards the apex. *Lower lemma* oblong, 2 mm. long, hyaline, nerveless, finely ciliolate at the apex. *Upper lemma* reduced to the base of the awn; awn geniculate, twisted above the knee, 12-20 mm. long. Anthers 1.5 mm. long. *Pedicelled spikelets* like the sessils but narrower, muticous, male or neuter, usually linear; pedicel exceeding the middle of the sessile spikelet. *Lower glume* acute, usually without a pit, 7- to 13-nerved, ciliate. *Upper glume* ovate-lanceolate, acute, 5-nerved, with incurved margins. *Lower lemma* linear-oblong, obtuse, hyaline, glabrous, usually more or less reduced; *upper lemma* suppressed.

Sangla Hill; Lahore; Swat: Kulali; Rawalpindi; Murree Hills; Multan. Plains to 6,500 ft.

### 3. *Bothriochloa pseudo-ischaemum* (Nees) Henr.

*Bothriochloa pseudo-ischaemum* (Nees) Henr. in *Blumea* 3 : 457 (1940).

*Andropogon pseudo-ischaemum* Nees ex Steud., *Syn. Gram.* 380 (1854).

*Bothriochloa ischaemum* (Linn.) Mansfeld, *Repert. Sp. Nov.* 45 : 231 (1938) et Henrard in *Blumea* 3 : 457 (1940).

*Andropogon ischaemum* Linn., *Sp. Pl.* 1047 (1753); Hook. f., *Flor. Brit. Ind.* 7 : 171 (1896)

*Amphilophis ischaemum* (Linn.) Nash, *N. Amer. Fl.* 17 : 124 (1912).

Perennial. *Culms* usually geniculate at the base, erect, up to 40 cm. high, 3- to 4-noded, simple rarely branched, rounded, glabrous; nodes glabrous. *Leaf-blades* linear, up to 8 cm. long, 3 mm. wide, glabrous or with scattered hairs towards the apex, margins denticulate scabrid, bearing numerous tubercle-based hairs; *sheaths* of the innovation shoots compressed, keeled, pubescent then glabrous, ciliate at the mouth, of the culms not much compressed; *ligules* very short, ciliate-fimbriate. *Panicle* at first enclosed by the upper dilated sheath then soon long-exserted, with 2-8 (rarely more) subdigitate racemes. Racemes 2-4 cm. long, 2-nate or solitary, naked at their bases for 2-4 mm.; rachis simple, jointed, glabrous or villous between the nodes, long silky-villous, as well as the pedicels of the spikelets. *Sessile spikelets* 5 mm. long, oblong-lanceolate, awned; callus short, ciliate. *Lower glume* flattened on the back, 2-keeled, many-nerved, without any pit, covered by more or less appressed hairs below the middle, glabrous upwards except for a few hairs along the keels.

*Upper glume* narrower, 3-nerved. *Lower lemma* hyaline, nerveless, glabrous, not much shorter than the glume. *Upper lemma* reduced to the stalk of an awn; awn geniculate, twisted, 15 mm. long; palea absent or very short. Anthers 2 mm. long. *Pedicelled spikelets* linear-lanceolate, mucous, neuter; pedicel  $1/2$  as long as the sessile spikelet. *Lower glume* many-nerved, striate; lemmas suppressed.

Murree Hills; Swat: Madian, R. R. Stewart; Astor, Gilgit, R. R. Stewart; Kagan Valley, M. Zahur; Quetta, Asghar Ali; Loralai town, Aslam; Abbottabad, R. R. Stewart; Brimbret, Chitral, Rehman & Siddique. Very common from the foothills to 11,000 ft.

### 15. *Cymbopogon* Spreng.

Perennial, densely tufted and usually aromatic grasses with coarse leaves. Inflorescence an erect panicle varying from an almost simple raceme of pedunculate raceme pairs to a fairly complicated panicle with branches rebranching up to the third and fourth degree; axis straight, each internode enveloped in spathes with rudimentary blade, each ultimate branch bearing 2 small, few jointed racemes; raceme pairs supported by a spatheole; racemes usually divaricate, one sessile the other shortly pedicelled; lowest pair of spikelets in the sessile raceme homogamous. Bisexual spikelet dorsally compressed, awned, 2-flowered, the lower reduced to a lemma, upper bisexual. Glumes equal or subequal, subchartaceous; lower flat, slightly depressed or narrowly grooved on the back, 2-keeled; upper boat-shaped, keeled upwards, 1-nerved. Lemmas ciliate or ciliolate; lower hyaline, 2-nerved, upper 2-toothed, hyaline, nearly stipiform, awned. Pedicelled spikelet neither depressed nor grooved on the back. Glumes mucous, the lower chartaceous or subchartaceous, the upper membranous. Lemma of the lower floret present, hyaline, 2-nerved; that of the upper represented by a naked male floret, rarely suppressed.

#### KEY TO THE SPECIES

1. Panicle contracted, dense, joints and pedicels villous; hairs concealing the sessile spikelets.....2
- Panicle rather loose, not conspicuously villous; hairs not concealing the sessile spikelets.....4
2. Lower glume of the sessile spikelets pubescent in the groove; pedicel of the lowest pedicelled spikelet in the sessile raceme swollen, hard, shining or hairy; basal sheaths woolly; pedicelled spikelets hairy on the nerves.....1. *C. parkeri*

- Lower glume of the sessile spikelets smooth and glabrous ; pedicel of the lowest pedicelled spikelet not enlarged ; basal sheaths not woolly ; pedicelled spikelets glabrous.....3
3. Leaf-blades more or less filiform and flexuous ; sheaths widened and thickened below ; the old ones never curled..... 2. *C. schoenanthus*  
 Leaf-blades flat ; basal sheaths when old slipping from the culm and becoming curled in a characteristic manner.....3. *C. jwarancusa*
4. Lower glume of the sessile spikelet with a slot-like groove occupying most of its length.....4. *C. stracheyi*  
 Lower glume either flat, convex, shallowly concave or with a deep narrow groove in the lower half.....5
5. Lower glume of the sessile spikelet with a narrow slit-like groove in the lower half ; pedicel of the lowest pedicelled spikelet swollen ; pedicelled spikelet glabrous ; leaves cordate and amplexicul at the base.....5. *C. martini*  
 Lower glume of the sessile spikelet flat, slightly convex, shallowly concave in the lower half ; pedicel of lowest pedicelled spikelet not swollen ; leaves linear to almost filiform.....6. *C. distans*

### 1. *Cymbopogon parkeri* Stapf

*Cymbopogon parkeri* Stapf in Kew Bull. 10 (1929).

Perennial. Culms erect, unbranched, terete, glabrous. Leaf-blades narrowly linear or filiform, up to 20 cm. long, 3 mm. wide ; sheaths of the culms smooth, glabrous and tight, those at the base woolly below, glabrous above, long persistent ; ligules membranous, rotundate-truncate, 1.5 mm. long. Panicle spatheate, narrow, up to 40 cm. long, 6- to 7-noded ; spatheoles pale stramineous or reddish, glabrous ; peduncles 1 cm. long, glabrous, filiform. Racemes 2, divaricate, one of which is epinastically deflexed, up to 2.5 cm. long, silky hairy ; one sessile the other short peduncled ; the lowest joint of the sessile raceme with adjacent pedicel swollen, hard, dark coloured. Sessile spikelets linear-lanceolate, acuminate, 4.6 mm. long ; callus very short, slightly bearded. Lower glume chartaceous, more or less concave between the scabrid keels, deeply depressed and slightly villous towards the base, 2-toothed at the top. Upper glume boat-shaped, linear-lanceolate in profile view, mucronulate, 1-nerved, scaberulous on the keels, margins hyaline, ciliate above, pilose on the back towards the base. Lower lemma hyaline, lanceolate-linear, ciliate, nerveless, 3-5 mm. long. Upper lemma 3-4.5 mm. long, cleft to

the middle, with hayline lobes ; awn 9-13 mm. long, geniculate ; column 3-6 mm. long, twisted, bristle smooth. *Anthers* 2 mm. long. *Pedicelled spikelets* linear-lanceolate, 5.5-6.5 mm. long, glabrous, gaping at anthesis. *Glumes* hairy on the nerves, the lower 7- to 9-nerved between the keels, the upper 3-nerved. *Lemma* subulate-involute, nerveless, ciliate. *Anthers* 3 mm. long.

Quetta, Asghar Ali.

## 2. *Cymbopogon schoenanthus* (Linn.) Spreng.

*Cymbopogon schoenanthus* (Linn.) Spreng., Pug. 2 : 15 (1815).

*Andropogon schoenanthus* Linn., Sp. Pl. 1046 (1753) ; Hook. f., Flor. Brit. Ind. 7 : 204 (1896).

*Andropogon Laniger* Desf., Pl. Atl. 3 : 379 (1800) ; Boiss. Fl. Or. 5 : 465.

Perennial. *Culms* erect, terete, simple, smooth and glabrous. *Leaf-blades* filiform, wiry, flexuous, semiterete, rounded on the back, channelled on the upper surface, up to 30 cm. long, 2 mm. wide ; *sheaths* of the culms smooth, glabrous, tight, those at the base loose, slipping from the culms, long-persistent ; *ligules* membranous, oblong-truncate, about 2.5 mm. long. *Panicle* narrow, up to 30 cm. long ; axis smooth and glabrous ; peduncle shortly villous below the racemes ; *racemes* 1.5 cm. long, divaricate, ultimately deflexed, white-villous ; joints of the racemes 2 mm. long, compressed, long-ciliate on the angles, with hairs up to 3.5 mm. long. *Sessile spikelets* elliptic-lanceolate, 4-5 mm. long ; callus short, bearded. *Lower glume* shallowly concave on the back, 2-keeled in the upper half, scabrid on the keels ; dorsally smooth and glabrous. *Upper glume* boat-shaped, keeled in the upper half, rounded below, scabrid on the keels, 3-nerved, ciliate on the margins above. *Lower lemma* 4 mm. long, hyaline, oblong, acute. *Upper lemma* linear, hyaline, cleft into subulate lobes ; awn 10 mm. long, column 3 mm. long. *Anthers* 1.5 mm. long. *Pedicelled spikelets* narrowly oblong, 4.5 mm. long. *Lower glume* 4.5 mm. long, 2-keeled in the upper half, with 4 intracarinial nerves. *Upper glume* 3-nerved, minutely puberulous on the dorsal surface or glabrous. *Lemma* reduced to a hyaline, 4 mm. long scale, ciliate on the margin in the upper half, wrapped rounded the 3 stamens. *Anthers* 1.5-3 mm. long.

Kurrum Valley : Parachinar ; Gilgit ; Baltistan ; Chitral : Drosh ; Waziristan ; Torkhum, Barwand ; Hazara, Kagan ; Sind ; Bolan Pass. Very xerophytic and very common from the Plains to Gilgit and Baltistan



Fig. 71.—*Cymbopogon schoenanthus*

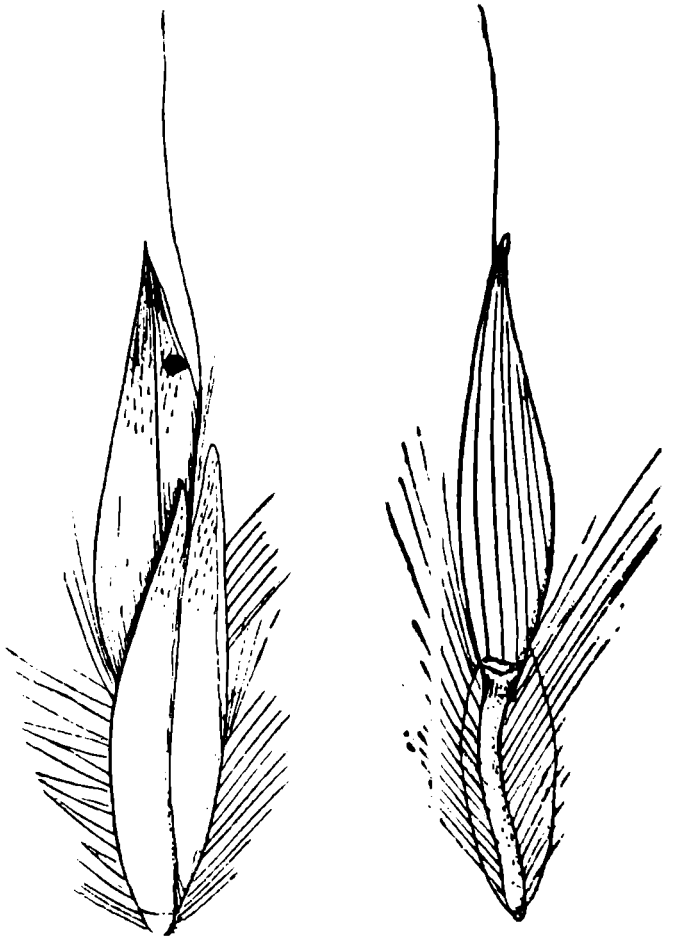


Fig. 72.—*Cymbopogon jwarancusa*

### 3. *Cymbopogon jwarancusa* (Jones) Schult.

*Cymbopogon jwarancusa* (Jones) Schult., Mant. 2 : 58 (1824).

*Andropogon jwarancusa* Jones, Asiat. Res. 4 : 109 (1795); Hook. f., Flor. Brit. Ind. 7 : 203 (1896).

*Andropogon arriani* Edgew. in Jour. Linn. Soc. 6 : 201 (1862).

Perennial. Culms up to 120 cm. high, erect, terete, smooth and glabrous on both surfaces, margins scabrid; sheath of the culms smooth and glabrous, tight, those at the base closely crowded, ultimately flattening out and becoming strongly curled; ligules membranous, chartaceous, 2-3 mm. long. Panicle up to 25 cm. long, axis smooth and glabrous; peduncle shortly villous below the racemes; racemes 1.4-2 cm. long, joints of the racemes 2.5 mm. long, ciliate with hairs up to 5 mm. long. Sessile spikelets linear or narrowly elliptic, 5 mm. long. Lower glume shallowly concave on the back, 2-keeled in the upper half, 4-nerved, 2-fid at the apex, shortly ciliate on the keels, otherwise smooth and glabrous. Upper glume boat-shaped, 4.5 mm. long, compressed and keeled in the upper half, rounded below, smooth and glabrous on the dorsal surface, scabrid on the keels, 3-nerved, the midnerve produced into a very short awn. Lower lemma 4 mm. long, hyaline, 2-nerved, ciliate on the margins. Upper lemma 3 mm. long, hyaline, cleft to the middle into two narrow ciliate lobes; awn 10 mm. long, hardly differentiated into column and bristle. Anthers 2 mm. long. Pedicelled spikelets 5.5 mm. long, oblong-elliptic. Lower glume dorsally convex, 2-keeled with 9 intracardinal nerves, smooth and glabrous except the scabrid keels. Upper glume shallowly boat-shaped, 3-nerved, ciliate on the margins above, smooth and glabrous. Lemma lanceolate, 5 mm. long. Anthers 2 mm. long.

Chitral : Warai ; Lahore ; Shakhot Hills ; Sangla Hill ; Sargodha ; Dera Ismail Khan ; Rawalpindi ; Jhelum ; Bahawalpur ; Multan. Plains to 5,000 ft.

### 4. *Cymbopogon stracheyi* (Hook. f.) Raizada & Jain

*Cymbopogon stracheyi* (Hook. f.) Raizada & Jain ex Bor in Jour. Bomb. Nat. Hist. Soc. 52 : 159 (1954).

*Andropogon nardus* var. *stracheyi* Hook. f., Flor. Brit. Ind. 7 : 207 (1896).

Perennial. Culms terete, erect or slightly decumbent at the base, smooth and glabrous, up to 1 m. high. Leaf-blades linear, folded, convolute, up to 30 cm. long, 2-3 mm. wide; ligules membranous, 3 mm. long, lacerate. Panicle simple or decomposed, up to 35 cm. long; peduncle

short, rarely more than 1 cm. long ; racemes 12-22 mm. long ; joints 2 mm. long, compressed, ciliate on the edges. *Sessile spikelets* 4.5 mm. long ; callus short, bearded. *Lower glume* linear, keeled in the upper half, keels narrowly winged in the upper half, definitely depressed on the back with indications of a boss at the lower end of the groove, glabrous or with minute wool on the dorsal surface. *Upper glume* boat-shaped, 3-nerved, the lateral marginal and faint, rounded on the back in the lower half, keeled above, with the keels scabrid, otherwise smooth and glabrous. *Lower lemma* 4 mm. long, hyaline, 2-keeled. *Upper lemma* very narrow, cleft to the middle into 2 ciliate lobes ; awn 12 mm. long. *Anthers* 2 mm. long. *Pedicelled spikelets* 4.5-5.5 mm. long, lanceolate or elliptic, dorso-ventrally compressed ; callus glabrous. *Lower glume* flat or slightly convex on the back, many-nerved, 2-keeled in the upper half, scabrid or even ciliate on the keels. *Upper glume* shallowly boat-shaped, smooth and glabrous, 3-nerved, scabrid on the nerves in the upper third. *Lemma* hyaline, oblong, with infolded ciliate flaps. *Anthers* 2 mm. long.  
 Gilgit : Naltar Valley.

#### 8. *Cymbopogon martini* (Roxb.) Watson

*Cymbopogon martini* (Roxb.) Watson in Atkinson, Gaz. N. W. Prov. Ind. 392 (1882).

*Andropogon martini* Roxb., Fl. Ind. 1 : 277 (1820).

*Andropogon schoenanthus* var. *martini* Hook f., Flor. Brit. Ind. 7 : 264 (1896).

Perennial. *Culms* erect, terete, simple or sparingly branched, up to 3 m. high, smooth and glabrous. *Leaf-blades* linear-lanceolate or lanceolate, cordate or rounded and amplexicaul at the base, flat, up to 50 cm. long, 1-3 cm. wide, glabrous, scaberulous on the surface, strongly scabrid on the margins ; *sheaths* auriculate, smooth and glabrous, those of the culms tight, those below loose and ultimately breaking up into fibres ; *ligules* oblong, scarious, 2-3 mm. long. *Panicle* linear-oblong, decom-pound, up to 30 cm. long, branches 2-3 at each node ; axis smooth and glabrous ; peduncle smooth and glabrous ; racemes 15-18 mm. long, joints 1.5-2 mm. long, flattened on one face, densely ciliate along the margins. *Sessile spikelets* elliptic-oblong or oblong, 4-4.5 mm. long ; callus short, bearded. *Lower glume* 2-keeled in the upper half, winged on the keels, flat on the back above, but with a narrow slit-like furrow in the lower half which appears as a rib on the inner surface, 2-lobed at the tip, smooth and glabrous. *Upper glume* boat-shaped, rounded below keeled above, with a broad wing on the keel, smooth and glabrous. *Lower lemma* 3 mm. long, hyaline, nerveless or indistinctly 2-nerved, ciliate on the margins in



Fig. 73.—*Cymbopogon martini*

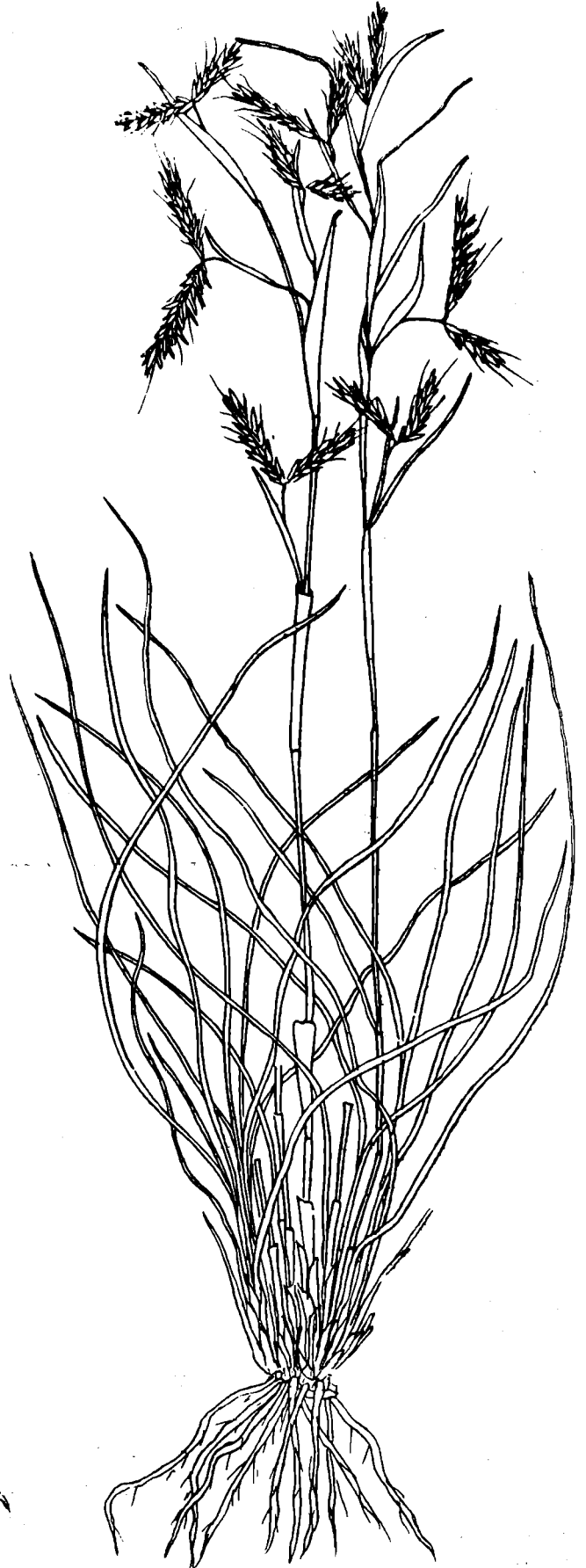


Fig. 74.—*Cymbopogon distans*



the upper half. *Upper lemma* 3 mm. long, hyaline, cleft to the middle ; awn 16 mm. long, column 8 mm. long, twisted. *Anthers* 1-1.5 (2) mm. long. *Pedicelled spikelets* elliptic, 3.5-4 mm. long. *Lower glume* many-nerved, smooth and glabrous, 2-keeled in the upper half and scabrid on the keels. *Upper glume* 3-nerved, smooth and glabrous. *Lemma* oblong, hyaline, 2-nerved, ciliate on the flaps, wrapped round the stamens. *Anthers* 1-2.25 mm. long.

Rawalpindi ; Sakesar ; Hazara ; Kagan ; Quetta, Harnai. *Rusa Grass* is much the largest of the genus and grows from the Plains to 5,000 ft.

### 6. *Cymbopogon distans* (Nees) Watson

*Cymbopogon distans* (Nees) Watson in Atkinson, Gaz. N.W. Prov. Ind. 392 (1882).

*Andropogon distans* Nees ex Steud., Syn. Pl. Glum. 387 (1854) ; Hook f., Flor. Brit. Ind. 7 : 287 (1896).

Perennial. *Culms* up to 45 cm. high, erect, terete, simple, smooth and glabrous. *Leaf-blades* linear, folded, involute, twisted, finally almost filiform, up to 50 cm. long, 3 mm. wide, glabrous, minutely scabrid on both surfaces or smooth ; *sheaths* of the culms tight, glabrous, minutely scabrid, auricled, the lower very short, coriaceous, smooth and glabrous, long-persistent, finally breaking up into tough fibres ; *ligules* membranous, 2-3 mm. long. *Panicle* narrow, up to 20 cm. long ; axis and peduncle smooth and glabrous ; racemes divaricate, ultimately forming a straight line, 2.5-3.5 cm. long ; joints 2 mm. long, densely ciliate on the edges. *Bisexual spikelets* 6-8 mm. long, oblong, or oblong-elliptic, often oblique. *Lower glume* 2-keeled, broadly winged on the keels in the upper half with 3 intracarinial nerves, smooth and glabrous on the flat shallowly depressed back, 2-fid above, scabrid on the keels. *Upper glume* boat-shaped, compressed and keeled above, rounded below, smooth and glabrous. *Lower lemma* elliptic, 2-keeled, ciliate on the flaps, 5 mm. long. *Upper lemma* 3.5 mm. long, cleft to the middle ; awn 18 mm. long. *Anthers* 2.5 mm. long. *Pedicelled spikelets* lanceolate, 7-9 mm. long. *Lower glume* many-nerved, broad and wrapped round the upper glume, smooth and glabrous. *Upper glume* 3-nerved, ciliate on the margins above. *Lemma* lanceolate, hyaline. *Anthers* 3 mm. long.

Kagan Valley : Malkandi ; Nathia Gali.

16. *Hyparrhenia* Anders.

Non aromatic, annual or perennial, coarse grasses. Racemes paired, few to many-jointed, at the apices of the culms and their branches; raceme pairs supported by a spatheole, collected into simple or compound spatheate panicles. Spikelets 2-nate, one sessile and the other pedicelled, those of each pair differing in sex or those of the lower pair or pairs homogamous (male or neuter). Florets 2, lower reduced to an empty lemma, upper bisexual in the sessile spikelet of the heterogamous pair, male or neuter in those of the homogamous pairs and of the pedicelled spikelets. Fertile spikelet flattened dorsally but with rounded sides, awned. Glumes equal more or less chartaceous; the lower narrowly truncate or 2-dentate, sometimes with a very shallow longitudinal groove, with very narrow involute margin up to 2/3rds or more, then equally narrowly inflexed from the very fine short or obscure keels; the upper narrowly and shallowly boat-shaped, rounded on the back below, finely keeled towards the tips only, 3-nerved. Lower lemma hyaline, faintly 2-nerved or rarely nerveless. Upper lemma stipiform, produced into minute teeth between which arises the geniculate awn. Pedicelled spikelets 2-keeled (often below the middle), lemma of both florets developed, rarely the upper or both suppressed.

1. *Hyparrhenia hirta* (Linn.) Stapf

*Hyparrhenia hirta* (Linn.) Stapf in Prain, Flor. Trop. Afr. 9 : 315 (1918).

*Andropogon hirtus* Linn., Sp. Pl. 1046 (1753).

Perennial. Culms densely tufted, up to 60 cm. high, terete, simple or branched, glabrous, 3- to 4-noded; nodes glabrous. Leaf blades narrowly-linear, 1.5-4 mm. wide, glaucous, glabrous; sheaths of the culms tight, glabrous, rounded below but keeled at the summit, those of the innovation shoots compressed and keeled; ligules membranous, more or less lacerate, ciliate, up to 4 mm. long. Panicle elongate, up to 30 cm. long; primary branches simple or more or less branched, branchlets terminated by a pair of racemes borne on a common peduncle, supported by a spatheole; spatheole linear-lanceolate, attenuated to a sharp point, glabrous; peduncle of the geminate racemes filiform, shorter than the spatheole or equalling it or sometimes even longer, finely puberulent with usually long erect hairs. Racemes slightly divaricate, not reflexed, 3-4 cm. long, the lower sessile the upper pedicelled; pedicel 3-4 mm. long; joints and pedicels of the spikelets filiform, long-villose on one side. Spikelets of the lower pair homogamous, male. Sessile spikelets of the upper pairs linear-oblong, 4-5 mm. long, the callus barbed, channelled, more or less

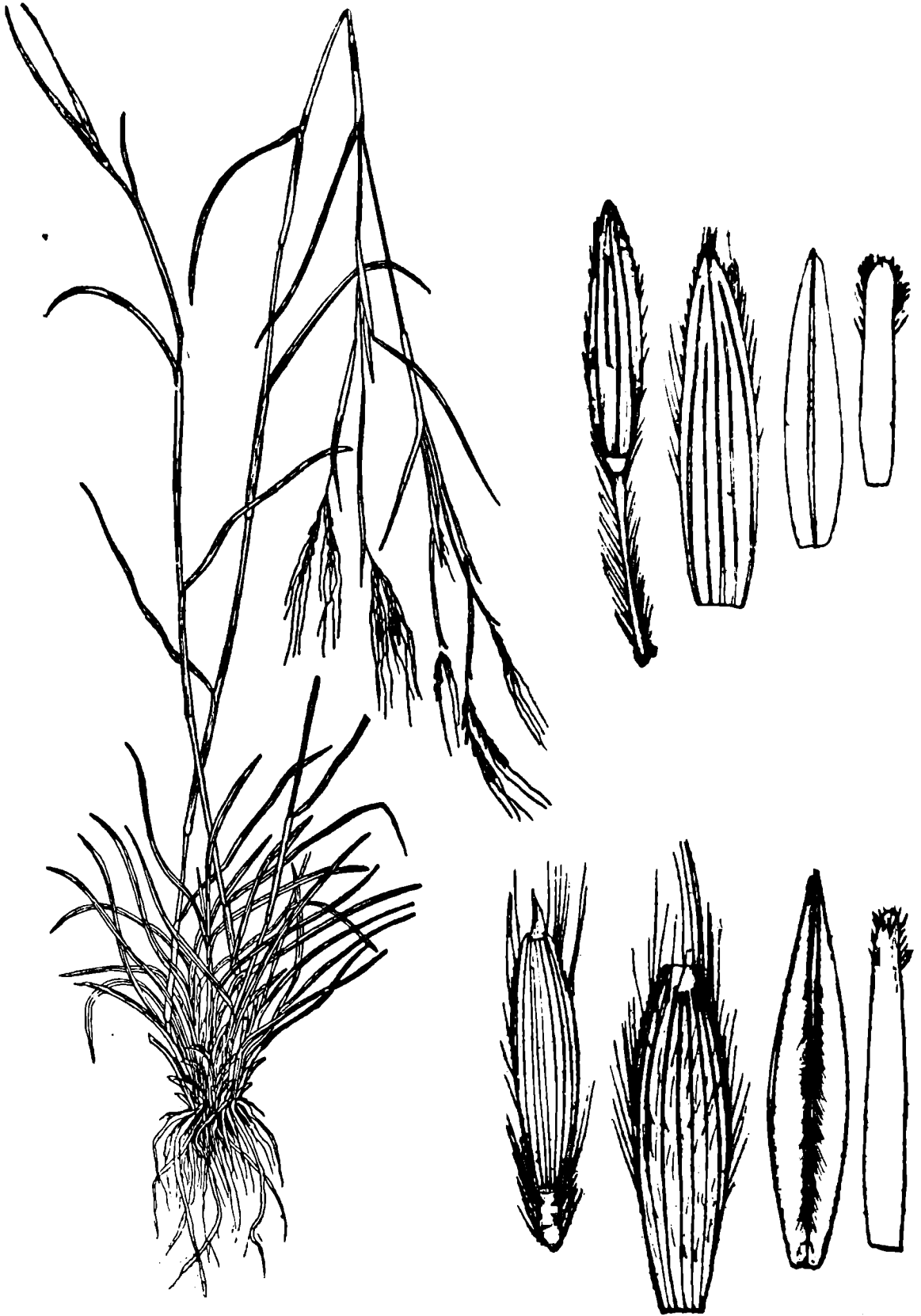


Fig. 75.—*Hyparrhenia hirta*

pointed, 1 mm. long. *Glumes* equal, the lower usually membranous, flattened on the back, truncate at the apex, 9- to 11-nerved, obscurely 2-keeled, long villose externally; the upper 3-nerved, obtuse or subtruncate, 1-keeled, long ciliate externally below the apex. *Lower lemma* hyaline, 2-nerved, obtuse, ciliate. *Upper lemma* linear, hyaline, 2-rid, awned; awn 1.5-3.5 cm. long, little or not geniculate, very slightly twisted, more or less villose. *Anthers* 1.5-2.5 mm. long. *Pedicelled spikelets* male, narrowly linear-lanceolate, 5-6 mm. long, villose, mucicous.

Chitral; Swat State: Mingora, Miana; Cherat, Abbottabad.

### 17. *Eremopogon* Stapf

Culms densely tufted, simple or fastigiately branched above, the branches terminated by a solitary raceme; leaves narrow, rigid; sheaths shorter than the internodes, the basal silkily villous. Racemes 3-6; peduncle capillary, erect, usually far exerted beyond the very slender spathe; joints and pedicels very slender, villous. Spikelets in pairs, one sessile the other pedicelled, the sessile bisexual and the pedicelled male or neuter. Sessile spikelets 2-flowered; lower floret reduced to a sterile lemma; the upper floret bisexual. Glumes equal, more or less membranous, lower 2-keeled, the upper 3-nerved with a pointed keel. Sterile lemma hyaline, nerveless. Fertile lemma reduced to a pedicel of a slender awn. Pedicelled spikelets; the lower floret male or neuter, the upper neuter or suppressed.

#### 1. *Eremopogon foveolatus* (Del.) Stapf

*Eremopogon foveolatus* (Del.) Stapf in Prain, *Flor. Trop. Afr.* 9: 183 (1918).

*Andropogon foveolatus* Del., *Fl. Aegypte*, p. 16, t. 8, f. 2 (1812). Hook. f., *Flor. Brit. Ind.* 7: 168 (1896).

Perennial. Culms densely tufted, usually decumbent at the base then geniculately ascending, slender, glabrous, up to 60 cm. high; nodes bearded. *Leaf-blades* linear, smooth above, scaberulous below, 8-16 cm. long, 1.5-2.5 mm. wide; *sheaths* shorter than the internodes, glabrous, scaberulous, the lower sheaths silky-villous; *ligules* short, truncate, hyaline, ciliate. *Racemes* 2.5-4 cm. long, solitary; peduncles capillary, erect, usually far exerted beyond the slender spathe; joints and pedicels slender, ciliate on the margins with long silky hairs, shorter than the sessile spikelets. *Sessile spikelets* 4 mm. long, oblong-lanceolate, glabrous; callus small, shortly hairy. *Lower glume* shape and size of the spikelet, subobtuse, margins narrowly inflexed, 4-nerved, foveolate on the back in the middle. *Upper glume* equal in size, lanceolate, acute, obscurely

3-nerved. *Lower lemma* shorter, oblong-lanceolate, glabrous, nerveless. *Upper lemma* reduced to an awn 1.2-1.5 cm. long. *Pedicelled spikelets*

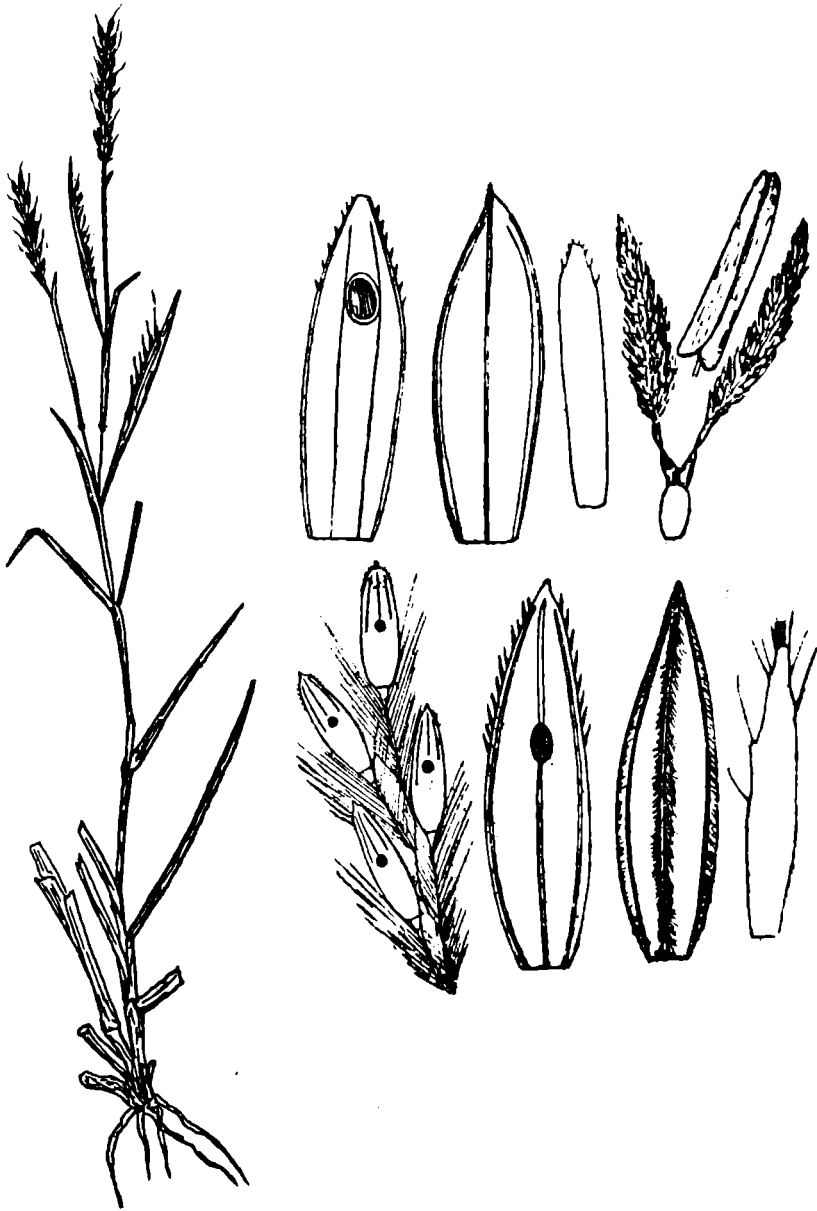


Fig. 76.—*Eremopogon foveolatus*

4 mm. long; pedicel 2.5 mm. long. *Lower glume* lanceolate, with slightly inflexed margins, the keels above aculeately scabrid, 5-nerved, foveolate or not. *Upper glume* equalling the lower, linear-lanceolate, acute, 3-nerved.

Hyderabad; Karachi; Baluchistan; Rawalpindi; Jhelum and Attock Dist.

18. *Heteropogon* Pers.

Annual or perennial grasses with simple or often branched culms terminating in simple, solitary racemes. Spikelets 2-nate, those of the lower 3-10 pairs homogamous, male or neuter, of the upper pairs heterogamous. Spikelets of the homogamous pairs inarticulate, those of the heterogamous pairs falling separately, the pedicelled with pedicels, the sessile with the contiguous joint of the rachis. Spikelets 2-flowered, the lower reduced to an empty lemma ; upper female or bisexual in the sessile spikelets of the heterogamous pairs, male or neuter in all the other spikelets. Female spikelets terete or subterete, awned. Glumes equal, the lower coriaceous, more or less tightly involute, nearly keel-less ; the upper coriaceous, 3-nerved. Lemma of the lower floret hyaline, nerveless, of the upper floret stipiform, hyaline, slender below cartilaginous upwards and continued into a stout, geniculate awn. Male (or neuter) spikelets dorsally flattened, muticous, imbricate. Lower glume membranous, many-nerved, winged upwards from one or both keels ; upper membranous, acute, 3-nerved. Lemma hyaline, 1-nerved, well developed or reduced.

1. *Heteropogon contortus* (Linn.) Beauv.

*Heteropogon contortus* (Linn.) Beauv. ex. Roem. & Schult., Syst. Veg. 2 : 836 (1817).

*Andropogon contortus* Linn., Sp. Pl. 1045 (1753) ; Hook. f., Flor. Brit. Ind. 7 : 199 (1896).

Perennial. Culms densely tufted, up to 1.5 m. high, erect or decumbent below, slender, leafy chiefly at the base. *Leaf-blades* linear, shortly acuminate, 15-30 cm. long, 2.5-5 mm. wide, suberect, often sparsely ciliate towards the base, sometimes with scattered bulbous based hairs on the upper surface, scaberulous below ; *sheaths* compressed, keeled, glabrous, the mouth shortly auricled ; *ligules* short, truncate, ciliolate. *Racemes* 3.8-8 cm. long ; internodes very short with rufous hairs on the sides, the lower inarticulate ; spikelets closely imbricating, subsecund, the lower 2-6 or more sessile spikelets awnless, male or neuter, the upper sessile spikelets narrow, long-awned, female. *Female* or *hermaphrodite spikelets* cylindrical, 6 mm. long ; callus long, acute, pungent, bearded with reddish brown hairs. *Lower glume* coriaceous, linear-oblong, truncate, many-nerved, minutely pubescent, margins tightly involute, tip membranous. *Upper glume* linear, obtuse, rigidly coriaceous, sides much thinner than the hispidulous, coriaceous, very obtuse dorsal keel. *Lower lemma* 3 mm. long, oblong, truncate, nerveless, ciliolate. *Upper*



Fig. 77.—*Heteropogon contortus*

*lemma* represented by the subulate base of an awn; awn hirsute with a dark brown column up to 8 cm. long. *Male* or *neuter spikelets* oblong-lanceolate, 8-10 mm. long, the sessile almost symmetrical, the pedicelled somewhat asymmetric and contorted. *Lower glume* lanceolate, usually obliquely twisted, herbaceous, glabrous or hairy with hairs tubercle-based, many-nerved, the margins more or less unequally winged upwards, the wings serrulate. *Upper glume* oblong-lanceolate, membranous, acute or acuminate, 3- or 5-nerved, ciliate upwards, margins hyaline. *Lower lemma* hyaline, 6-7 mm. long, oblong, 1-nerved, ciliate. *Upper lemma* shorter, obovate-oblong, ciliate, nerveless. Anthers 3 mm. long.

Very common throughout, ascending to 6,000 ft. *Spear Grass*.

### 19. *Themeda* Forsk.

Annual or perennial grasses with long narrow leaves. Racemes many, short, crowded in spatheate panicles, with very short peduncles. Spikelets 6-11; 4 lowest male or neuter, involucriform, awnless, in superposed pairs or whorled round a jointed rachis which bears one or more sessile bisexual or female awned spikelets. Spikelets 2-nate (the terminal 3-nate), those of the lower two pairs alike in shape and sex, male or neuter, sessile or subsessile, enveloping the upper 1-3 pairs, each of which consists of a sessile bisexual, and a pedicelled male spikelet, the latter usually resembling those of the involucre. Florets 2, the lower reduced to an empty lemma, the upper bisexual in the sessile upper spikelets, male in the involucrial and pedicelled spikelets. Bisexual spikelets terete, awned or awnless. Glumes equal, coriaceous; lower tightly involute, quite keelless; upper with a longitudinal groove on each side, 3-nerved, margins thin. Lower lemma hyaline, nerveless. Upper lemma stipiform, passing into a geniculate awn or hyaline and 1-nerved throughout, with nerve becoming stouter upwards and passing into a narrow, more or less reduced awn. Involucrial and pedicelled spikelets lanceolate, dorsally compressed. Glumes equal or subequal; lower herbaceous, 2-keeled, many-nerved; upper lanceolate, membranous, 3-nerved with ciliate margins; lower lemma hyaline, 1-nerved, sometimes suppressed.

#### 1. *Themeda anathera* (Nees) Hack.

*Themeda anathera* (Nees) Hack.. Monog. Andropog. 669 (1889).

*Anthistiria anathera* Nees ex Steud., Syn. Pl. Glum. 402 (1854); Hook. f., Flor. Brit. Ind. 7: 215 (1896).

Perennial. *Culms* densely tufted, up to 1.2 m. high, erect or geniculate-ascending, decumbent at the base, slender, subcompressed,



glabrous. *Leaf-blades* up to 30 cm. long, 4 mm. wide, rigid, glabrous, scaberulous below, scabrous on the upper surface and margins; *sheaths* subcompressed, obtusely keeled, very glabrous or hairy at the mouth; *ligules* obtuse, membranous, glabrous, 2 mm. long. *Panicle* elongate, loose, primary branches solitary or 2-nate, elongate, suberect, many-noded with distant nodes, the secondary branches short, capillary ending in

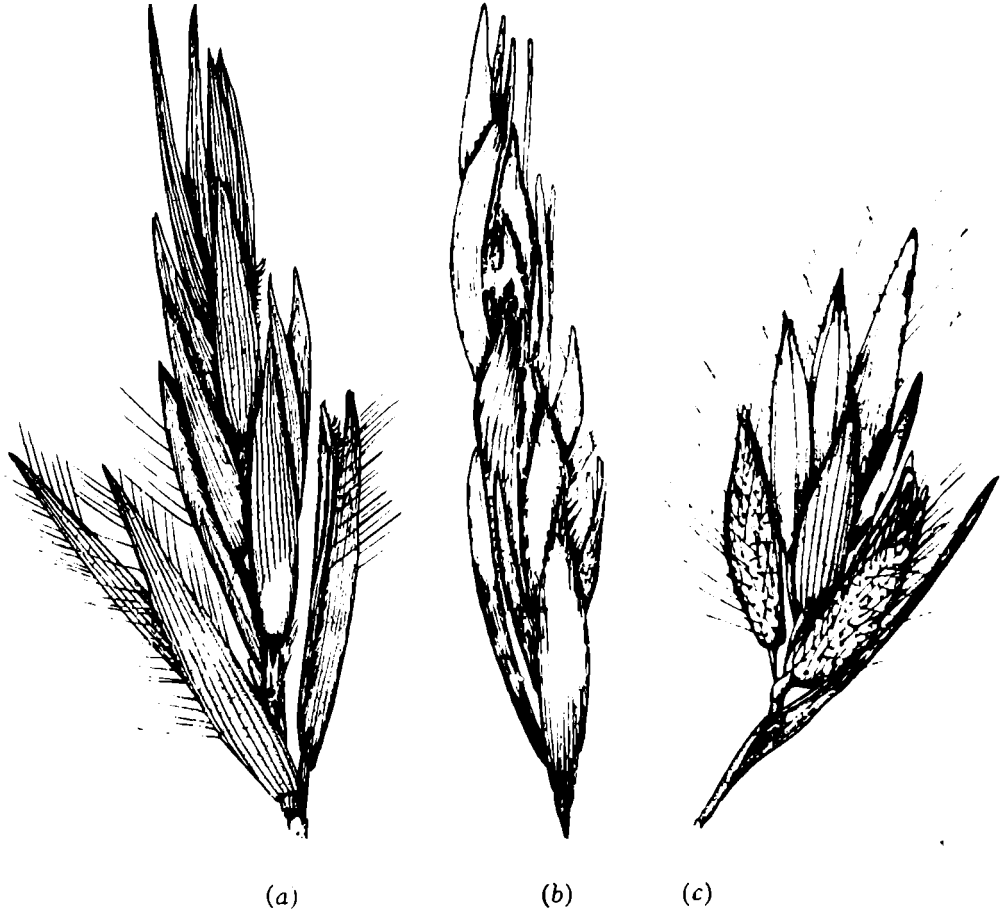


Fig. 78.—*Themeda anathera*; (a) var. *hirsuta*; (b) var. *glabrescens*; (c) var. *submarginata*;

racemes. Proper spathes 1.5-2 cm. long, linear-lanceolate, acute, compressed, sub-carinate, keel scabrid, margins scarious; racemes 1-2 cm. long, much imbricate, hairy; joints between the bisexual spikelets 1 mm. long, disarticulating obliquely. *Involucral spikelets* 8 mm. long; lower glume scabrous above; upper glume as long as the lower, 4-nerved, ciliolate on the margins. Lemma hyaline; palea 3 mm. long, ciliate. *Fertile spikelet* 6-7 mm. long, linear-lanceolate; callus 1 mm. long, bearded. *Lower glume* acute, entire, with the margins narrowly inflexed below the apex, involute below, eciliate on the keels, scabrid below, smooth above, 5-nerved, nerves disappearing below the middle. *Upper glume* lanceolate, acute, 3-nerved, scabrid on the keel above; margins hyaline, ciliolate, 6-7 mm. long. *Lower lemma* 4 mm. long, hyaline. *Upper lemma* shorter than the

lower lemma, linear, muticous, obtuse, awnless. *Pedicelled spikelets* similar to the involucral but without the bulbous-based hairs on the keels.

Very common in the foothills and ascending to 7,500 ft.

The involucral spikelets vary with regard to their hairiness, and three varieties may be recognized as follows :—

Involucral spikelets dorsally hispidly ciliate with tubercle-based hairs.....  
..... var. *hirsuta*

Involucral spikelets glabrous... .. var. *glabrescens*

Involucral spikelets provided with submarginal bulbous-based hairs.....  
..... var. *submarginata*

## 20. *Iseilema* Anders.

Perennial grasses with erect or ascending culms and flat leaves. Panicle long and narrow with clusters of spikelets subtended by boat-shaped bracts ; each group of spikelets consisting of a whorl of four male spikelets, within the whorl are one or more awned sessile bisexual spikelets and several pedicelled male. Lower whorled spikelets forming an involucre round the sessile and the pedicelled spikelets and deciduous all together. Involucral spikelets shortly pedicelled; pedicels flattened. Lower glume oblong-lanceolate, 2- to 5-nerved ; upper similar, 3-nerved ; lemma hyaline, 1-nerved. Pedicelled spikelets on long, slender pedicels, similar to the involucral. Sessile spikelets 2-flowered, lower represented by a lemma, the upper as long as the lower, muticous, hyaline ; lower lemma hyaline, sometimes absent ; upper reduced to a hyaline base of the awn.

### KEY TO THE SPECIES

- Keel and submarginal nerves of the spathe granulate or tubercled.....  
.....1. *I. prostratum*
- Keels and submarginal nerves of the spathe not granulate or tubercled.....  
.....2. *I. laxum*

#### 1. *Iseilema prostratum* (Linn.) Anders.

*Iseilema prostratum* (Linn.) Anders., Nov. Act. Soc. Upsal. ser. iii, 2 : 261 (1853).

*Iseilema wightii* Anders., l.c., p. 251 ; Hook. f., Fl. Brit. Ind. 7 : 218 (1896).

Perennial. Culms often prostrate and rooting at the base, finally ascending, 20-80 cm. high, branched below. *Leaf-blades* up to 12 cm.

long, 3 mm. wide, glabrous, smooth below scabrid above; *sheaths* loose, more or less bearded at the nodes, glabrous or scaberulous; *ligules* short, truncate, membranous, ciliate. *Panicle* 10-40 cm. long, linear-oblong, erect, decomposed; proper spathes 8-13 mm. long, linear-lanceolate, always scabrid, with keels more prominently tubercled. *Involucral spikelets* male or neuter, 3-3.5 mm. long, shortly pedicelled, strongly compressed, lanceolate-oblong; pedicels bearded at the base. *Lower glume* subacute, with 5 elevated ribs on the back, sulcate between the ribs. *Upper glume* glabrous with broadly inflexed margins, 1-nerved. *Lower lemma* much shorter, oblong, 2- to 3-toothed, nerveless, glabrous. *Pedicelled spikelets* male or neuter, resembling the involucral; pedicels slender, as long as the sessile spikelets. *Sessile spikelets* bisexual, 1.5-3 mm. long, lanceolate. *Lower glume* acute, obscurely 4-nerved, margins broadly inflexed, keel scaberulous, glabrous. *Upper glume* as long as the lower, elliptic-lanceolate, acute or obtuse or mucronate, obliquely carinate dorsally; keels scabrid. *Lower lemma* narrowly linear, hyaline. *Upper lemma* reduced to the base of a stout awn.



Fig. 79.—  
*Iseilema prostratum*

Gujranwala; Shahpur; Lahore; Sialkot.

## 2. *Iseilema laxum* Hack.

*Iseilema laxum* Hack., Monogr. Andropog. 682 (1889); Hook. f., Fl. Brit. Ind. 7: 218 (1896).

Perennial. *Culms* very slender, 15-60 cm. high, ascending from a stout, sometimes shortly creeping rootstock, simple or branched. *Leaf-blades* all cauline or the lower radical, linear, up to 15 cm. long, 3 mm. wide, glabrous but often ciliate near the base, scaberulous above, smooth below, the margins scabrid; *sheaths* loose, quite glabrous; *ligules* short, truncate, membranous, ciliate. *Panicle* up to 25 cm. long; racemes firm, narrow, 6-12 mm. long; proper spathes 8-12 mm. long, elliptic-lanceolate, smooth, glabrous. *Involucral spikelets* whorled, 4 mm. long, pedicelled, oblong-lanceolate; pedicels short, flattened, bearded at the base. *Lower glume* acute, sparsely ciliate, 3- to 5-nerved. *Upper glume* similar. *Lower lemma* linear, glabrous, hyaline. *Pedicelled spikelets* lanceolate, glabrous, on long ciliate pedicels. *Sessile spikelets* bisexual, narrowly lanceolate, 5 mm. long, glabrous. *Lower glume* coriaceous, 2-fid or truncate at the tip, margins scaberulous in the upper thirds, thin, faintly 3- to 5-nerved.

*Upper glume* lanceolate, 1-nerved, tip scaberulous. *Lower lemma* small or absent. *Upper lemma* reduced to the hyaline base of a very slender geniculate awn, 8-12 mm. long, the column equalling the subulate part.

Lahore ; Rawalpindi, J. F. Duthie.

## 21. *Apluda* Linn.

Annual or perennial grasses with erect or ascending culms and narrow flat leaves. Panicle leafy consisting of simple racemes or false spikes. Spikelets in threes, enclosed in a spathe ; one sessile (bisexual) two pedicelled ; one of the pedicelled (male) on a broad strap-shaped glabrous pedicel, the other represented by the pedicel with or without the rudiments of the glume upon it. Racemes deciduous as a whole together with its bulbous joint. Sessile and lateral pedicelled spikelets similar in shape, both muticous or the former awned, 2-flowered, the lower male, upper bisexual or usually male in the laterally pedicelled spikelets. Glumes equal, subcoriaceous at the base, lower convolute, upper keeled. Lemmas hyaline, of the lower floret muticous, of the upper deeply 2-fid and awned from the sinus or entire and muticous ; palea hyaline.

### KEY TO THE SPECIES

- Lemma of the sessile spikelets awned ; upper glume obtuse and hairy.....  
 ..... 1. *A. aristata*
- Lemma of the sessile spikelet awnless ; upper glume acute and glabrous....  
 ..... 2. *A. mutica*

### 1. *Apluda aristata* Linn.

*Apluda aristata* Linn., Cent. Pl.

2 : 7 (1756).

*Apluda varia* Hack. ssp. *aristata* Hack.,  
 Monogr. Andropog. 196 (1889) ;  
 Hook. f., Fl. Brit. Ind. 7 : 150  
 (1896).

*Apluda communis* Nees et Arn. in Nov.  
 Act. Nat. Cur. Suppl. i, 19 : 194  
 (1843).

Perennial. *Culms* erect or geniculately ascending, up to 2.5 m. high, terete, smooth and glabrous. *Leaf-blades* linear-lanceolate, up to 35 cm. long, 3



Fig. 80. *Apluda aristata*



Fig. 81.—*Apluda mutica*

mm. wide, base usually petioled, upper surface scabrid, lower smooth; *sheaths* glabrous, upper shorter and dilated into spathes; *ligules* membranous, short, rounded. Spikelets in threes; one sessile, two pedicelled; one of the pedicelled is seated upon a broad, strap-like, glabrous pedicel, the other is represented by the pedicel, with or without the rudiments of the glume upon it. *Sessile spikelet* bisexual, seated upon the bulbous base of the rachis. *Lower glume* 4.5 mm. long, many-nerved, somewhat convolute, margins not inflexed, obtuse. *Upper glume* boat-shaped, often 2-mucronate, compressed, 4.5 mm. long, keeled; keel glabrous, dorsally gibbous, depressed above, 5- to 7-nerved. *Lower floret* male; lemma ovate-lanceolate, hyaline, 4 mm. long; palea similar. *Upper floret* bisexual; lemma ovate, 3.5 mm. long, hyaline, cleft half way down, lobes ovate-acute, awned in the cleft; awn 9 mm. long, twisted. *Terminal pedicelled spikelet* male. *Lower glume* 4.75 mm. long, lanceolate, many-nerved, dorsally rounded. *Upper glume* similar. *Lower floret* male; lemma 4 mm. long, ovate-lanceolate, hyaline, scaberulous above, shortly ciliate on the margins. *Upper floret* male; lemma 4 mm. long, ovate-acute, hyaline.

One of the commonest grasses of the foothills to 7,000 ft. in Hazara and the Murree Hills.

## 2. *Apluda mutica* Linn.

*Apluda mutica* Linn., Sp. Pl. 82 (1753).

*Apluda varia* Hack. ssp. *mutica* (Linn.) Hack., Monogr. Andropog. 196 (1889).

*Apluda geniculata* Roxb., Hort. Beng. 8 (1814).

Differs from *Apluda aristata* Linn. in that the upper lemma of the sessile spikelet is awnless and the upper glume is glabrous and acute. The leafy bracts of the inflorescence are longer and narrower.

A plant of damp soil. Peshawar; Lahore; Murree; Mingora, Swat; Wah, Attock Dist.; Bagh, Poonch.

## 22. *Thelepogon* Roth

A coarse perennial grass. Leaf-blades lanceolate, base cordate, amplexicaul. Spikes few or many, corymbosely fascicled, peduncled, lower whorled, upper distant; rachis flexuous, fragile; joints more or less deeply excavated. Spikelets solitary at the joints, with the rigid pedicel only of the upper, ovoid, acute. Lower glume thickly coriaceous, convex, beaked, transversely rugose ridged or tubercled. Upper glume sunk in the cavity of the joint, rigid, sparingly tubercled, acuminate. Lower lemma shorter, hyaline, paleate, usually male. Upper lemma bisexual, hyaline, deeply 2-fid, with a long twisted awn in the sinus; palea narrow.

1. **Thelepogon elegans** Roth

*Thelepogon elegans* Roth ex Roem. & Schult., Syst. 2: 788 (1817); Hook. f., Flor. Brit. Ind. 7: 148 (1896).

Annual. *Culms* tufted and branched at the base, up to 1 m. high, erect or geniculately ascending, glabrous. *Leaf-blades* linear, acuminate, up to 25 cm. wide, cordate, amplexicaul, usually hispid with bulbous based hairs or sometimes only tuberculately scabrid, the margins cartilaginously ciliate; *sheaths* loose, hispid above with bulbous-based hairs and with ciliate margins; *ligule* narrow, membranous. *Racemes* 2.5-5 cm. long, corymbose; peduncles slender, stiff; joints of the rachis as long as the spikelets, subclavate, scaberulous, the top orbicular, cupular. *Spikelets* 6 mm. long, yellowish-white, ovate, beaked; callus small, annular, minutely bearded. *Lower glume* thickly coriaceous, ovate, acuminate, with a membranous 2-dentate beak, the back convex with transverse much elevated ridges. *Upper glume* slightly longer than the lower, broadly lanceolate, chartaceous, with a long acumen, the back flat or subconvex, with 5-7 short transverse ridges. *Lower floret* male; lemma 5 mm. long, lanceolate, hyaline, 2-nerved, glabrous; palea narrow, acute, nerveless. *Upper floret* bisexual; lemma 5 mm. long, ovate-lanceolate, hyaline, cleft to the middle, glabrous, 3-nerved, the lateral nerves running into the acute lanceolate lobes; awn inserted at the sinus, 1.8-2.5 cm. long, the column brown, twisted, equalling the yellow subulate portion; palea equalling the glume, oblong, acuminate. *Pedicel* of the obsolete upper spikelet longer than the sessile spikelet, linear, obtuse, curved, flat, ciliate on one margin.

Sangla Hill. A single specimen was collected from a cotton field.

23. **Ischaemum** Linn.

Perennial or annual grasses with narrow or broad leaves. Panicle of solitary, digitate or subdigitate, spiciform racemes; rachis thick, many-jointed, fragile, compressed; joints and pedicels 3-gonous. Spikelets 2-nate, one sessile the other pedicelled, all 2-flowered; lower floret often male rarely bisexual, the upper bisexual often male in the pedicelled spikelets, both spikelets awned or mucicous. Sessile spikelets 2-flowered, the lower male and the upper bisexual. Glumes equal: lower membranous or coriaceous, margins inflexed, 2-keeled, flat on the back; upper similar in texture, concave, keeled at least at the top, sometimes awned. Lower floret male; lemma membranous, hyaline, mucicous; palea narrow, often ciliate. Upper floret bisexual; lemma hyaline or membranous, 2-toothed, awned or mucronate, 3-nerved; palea hyaline, nerveless or 2-nerved. Pedicelled spikelets 2-flowered, both male, often broader and rudimentary.

## KEY TO THE SPECIES

1. Lower glume of the sessile spikelet transversely grooved.....

1. *I. rugosum*

Lower glume of the sessile spikelet not grooved ..... 2

2. Lower glume of the sessile spikelet winged above the middle ; upper glume keeled and winged ; spikelets 4-5.5 mm. long.....(*I. aristatum*)

Lower glume of the sessile spikelet wingless ; upper glume keeled but not winged ; spikelets 2.5-4 mm. long.....  
.....2. *I. timorense*

1. ***Ischaemum rugosum*** Salisb.

*Ischaemum rugosum* Salisb., Ic. Stirp. Rar. 1 (1721) ; Hook. f., Flor. Brit. Ind. 7 : 127 (1896).

Annual. Culms tufted, about 1 m. high, erect or ascending, branching at the base, compressed, glabrous, swollen just below the inflorescence. Leaf-blades linear or linear-lanceolate, acuminate, up to 25 cm. long, 5 mm. wide, glabrous or with scattered hairs ; sheaths loose, auricles at the throat passing into the ligule, compressed, keeled, glabrous : ligules often oblong, obtuse, glabrous or ciliolate: Racemes often oblong, obtuse, glabrous or ciliolate, 2 rarely one, up to 8 cm. long, erect ; rachis fragile ; joints 2.5-4 mm. long, thick, subclavate, 3-gonous. Sessile spikelets ovate-oblong, obliquely obtuse, 3.5-6 mm. long ; callus thick, silky. Lower glume flattened, thin at the top, coriaceous at the base, rolled, back transversely rugose, margins inflexed, scabrid-ciliate, winged in the membranous part, 5- to 7-nerved. Upper glume 3.5-6 mm. long, ovate, acute or obtuse,

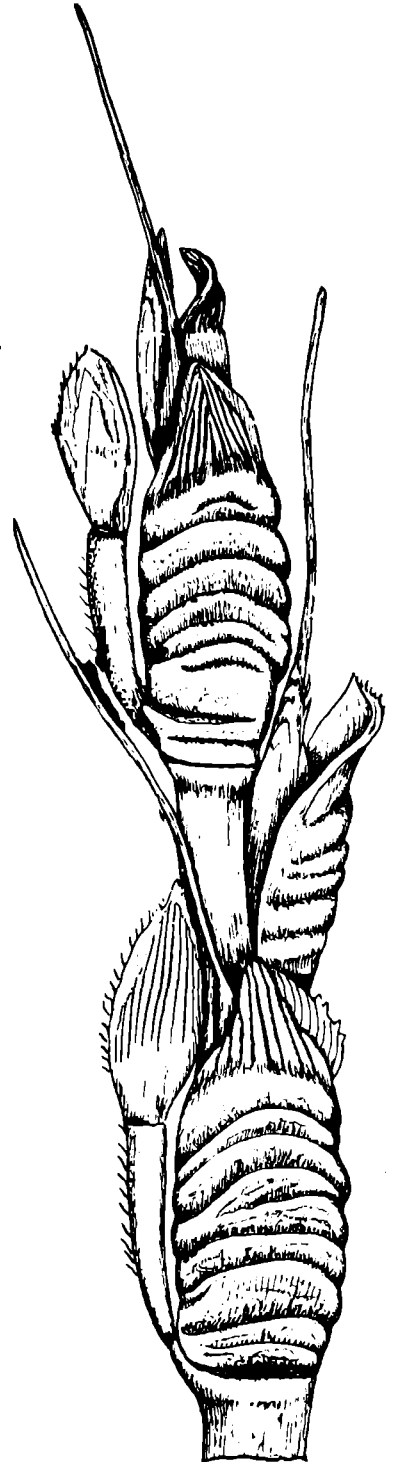


Fig. 82.—*Ischaemum rugosum*



laterally compressed, keel acute, slightly winged and ciliate at the top, 3-nerved, scabrid. *Lower floret* neuter; lemma 2.5-5.5 mm. long, hyaline, lanceolate, acute, margins inflexed, glabrous; palea similar, slightly shorter. *Upper floret* bisexual; lemma 2.2-3 mm. long, ovate-oblong, hyaline, 2-fid for  $1/3$ - $1/2$  the lemma, 3-nerved; awn short or long; palea ovate-lanceolate, glabrous. *Pedicelled spikelets* variable, rather shorter than the sessile. *Lower glume* with obscure transverse ridges, the upper half of the glume broader and more oblique. *Upper glume* similar to that of the sessile spikelet but not keeled. *Lower lemma* as in the sessile. *Upper lemma* oblong, obtuse, awnless.

Lahore, Kala Shah Kaku. Common in rice fields.

## 2. *Ischaemum timorense* Kunth

*Ischaemum timorense* Kunth, Rev. Gram. 1 : 369 (1829); Hook. f., Flor. Brit. Ind. 7 : 136 (1896).

*Culms* rooting at the base, almost compressed, simple or branched. *Leaf-blades* lanceolate or linear-lanceolate, up to 10 cm. long, 7 mm. wide, smooth or scaberulous, petiole 5 mm. long, glabrous or with appressed hairs; *sheaths* compressed, loose, throat not auricled, glabrous; *ligules* very short, membranous, rounded, truncate. *Racemes* 2, up to 7 cm. long, one sessile the other pedicelled; joints up to 5 mm. long, outer angle with long rigid hairs, interior angle shortly ciliate; joints and pedicels excavated towards the inner angle. *Sessile spikelets* ovate-lanceolate, 2.5-4 mm. long, acuminate. *Lower glume* ovate-lanceolate, 2-cuspidate, margins involute near the base, broadly rounded, auricled at the base, 5- to 9-nerved, slightly coriaceous at the base thinner above. *Upper glume* lanceolate, acuminate or aristate, 4 mm. long, recurved, obscurely 2-toothed, keel obscure in the lower half, margins inflexed, ciliate, 3- to 5-nerved. *Lower floret* barren; lemma lanceolate, acute, 2.5-3.5 mm. long, margins hyaline, membranous, 1-nerved; palea 2.5 mm. long. *Upper floret* bisexual; lemma ovate-oblong, 3 mm. long, 2-lobed, lobes lanceolate, acute or acuminate, margins ciliolate; awn slender, 6-9 mm. long. *Pedicelled spikelets* small, elliptic-lanceolate, awned.

Sukkur.

## 24. *Sehima* Forsk.

Perennial or annual grasses with flat or convolute leaf-blades. *Racemes* solitary; spikelets 2-nate, those of each pair differing in sex and also much in shape, one sessile the other pedicelled; pedicelled tardily

separating from the pedicels, the sessile deciduous together with adjacent joint of the rachis and the pedicel. Florets 2 ; lower male, upper bisexual in the sessile, male or neuter in the pedicelled spikelets. Sessile spikelets ; lower glume deeply grooved, 2-dentate or 2-mucronate, upwards acutely 2-keeled with inflexed margins, keels winged ; upper glume boat-shaped, keeled upwards with a bristle-like awn. Lemmas hyaline, of the lower floret entire, of the upper 2-fid and awned from the sinus ; palea as long as the lemma, hyaline. Pedicelled spikelets flat, with a strongly nerved or ribbed lower glume, and two florets resembling the lower floret of the sessile spikelets, the lower or both more or less reduced, barren.

### 1. *Sehima ischaemoides* Forsk.

*Sehima ischaemoides* Forsk., Fl. Aegypt.-Arab. 178 (1775).

*Ischaemum laxum* R. Br., Prodr. 205 (1810) ; Hook. f., Flor. Brit. Ind. 7 : 136 (1896).

Annual. Culms usually in small tufts, up to 40 cm. high, slender, terete, simple, 2- to 3-noded, smooth and glabrous. Leaf-blades linear, tapering to a fine point, up to 12 cm. long, 4 mm. wide, firm, more or less scabrid ; sheaths tight, terete or the upper slightly inflated, smooth or scaberulous, glabrous ; ligule a fringe of stiff hairs. Racemes solitary or sometimes with additional one or two from the upper nodes, 3.5-7.5 cm. long, erect or slightly nodding ; joints and pedicels sublinear, slightly compressed, 4 mm. long, margin densely ciliate, rest glabrous. Sessile spikelets linear, 8-13 mm. long ; callus shortly bearded. Lower glume chartaceous, unequally 2-toothed at the top, the lobes mucronate, deeply channelled below the middle, acutely 2-keeled, the outer keel winged upwards, 3- to 5-nerved, scabrid. Upper glume slightly shorter, boat-shaped, keeled above, with the keel widened at the apex and continued into a fine bristle above, 21 mm. long, 5-nerved, with fine transverse veins, ciliate. Lower floret male ; lemma faintly 2-nerved, hyaline, ciliate, 6.3 mm. long ; palea equal in length. Upper floret bisexual ; lemma oblong-lanceolate, 5 mm. long, 2-fid, with narrow lobes, hyaline, 3-nerved, ciliate, awn up to 4.5 cm. long, slender, column twisted, brown, long-ciliate ; palea equal in length. Anthers 4 mm. long. Pedicelled spikelets narrowly lanceolate, long-acuminate (acumen up to 6 mm. long), up to 17 mm. long, glabrous. Lower glume with 2 long setaceous teeth, sparsely hairy on the back, keels very narrowly or obscurely winged, wings rigidly ciliate, 5-nerved. Upper glume lanceolate, long and finely acuminate, hyaline, ciliate, 3-nerved. Lower floret as in the sessile spikelet. Upper floret similar to the lower.

Karachi, R. R. Stewart.

SEHIMA



Fig. 83.—*Sehima ischaemoides*

25. *Mnesithea* Kunth

Perennial grasses with linear, narrow stiff leaves solitary at the apex of the culms and of its branches, cylindrical. Rachis very fragile, joints fused to, or embracing the pedicel; articulation straight or slightly oblique, concave; two excavations at each joint in which are lodged the spikelets. Spikelets 3, one pedicelled aborted, often represented by a scale, seated between two others which are sessile; pedicel tightly appressed to the rachis or fused with it; the sessile spikelets are 1-flowered and fit exactly into the excavations in the rachis. Sessile spikelets; lower glume coriaceous or cartilaginous, not keeled. Lower floret male or neuter; lemma hyaline, lanceolate; palea like the lemma but shorter. Upper floret bisexual; lemma hyaline, nerveless; palea similar.

1. *Mnesithea laevis* (Retz.) Kunth

*Mnesithea laevis* (Retz.) Kunth, Rev. Gram. 1 : 154 (1829).

*Rottboellia perforata* Roxb., Pl. Coromend. 2 : 43; Hook. f., Fl. Brit. Ind. 7 : 158 (1896).

*Ophiurus perforatus* Trin., Mem. Acad. Petersb. ser. vi, 2 : 245 (1833).

Perennial. Culms erect, up to 1 m. high, terete, 4- to 5-noded, rather slender, often branched. Leaf-blades linear, flat, up to 35 cm. long, 5 mm. wide, glabrous except at the base, smooth above scabrid below; sheaths rounded, not auricled, keeled, glabrous; ligules short. Racemes hardly exerted from the upper sheaths, 10-20 cm. long; joints at the base of the racemes rarely throughout, carrying geminate sessile spikelets with a median pedicelled spikelet; towards the top of the raceme one sessile and one pedicelled spikelet to each joint; joints half cylindrical, 3-5 mm. long, very glabrous, channelled towards the tip. Sessile spikelets in twos, placed in two contiguous excavations; the common wall often perforated; the pedicel of the pedicelled spikelets is placed between these two excavations and is adnate to the joint, and carries the rudimentary spikelet. Sessile spikelets obliquely oblong, 3.5-5 mm. long, very glabrous. Lower glume very coriaceous, obtuse, back convex, more or less foveolate, obscurely 5- to 7-nerved. Upper glume 3.5-5 mm. long, sub-keeled, nerveless. Lower floret male or neuter; lemma 2-4.5 mm. long, oblong-lanceolate. Upper floret bisexual; lemma 2.5-4 mm. long, hyaline, oblong-lanceolate. Pedicelled spikelets rudimentary, reduced to a glume.

Hazara, Siran Range, Duthie; Mansera, R. R. Stewart; Kagan Valley; Kagan, M. Zahur; Swat; Chitral; Rawalpindi; Murree Hills. Foothills to 4,500 ft.

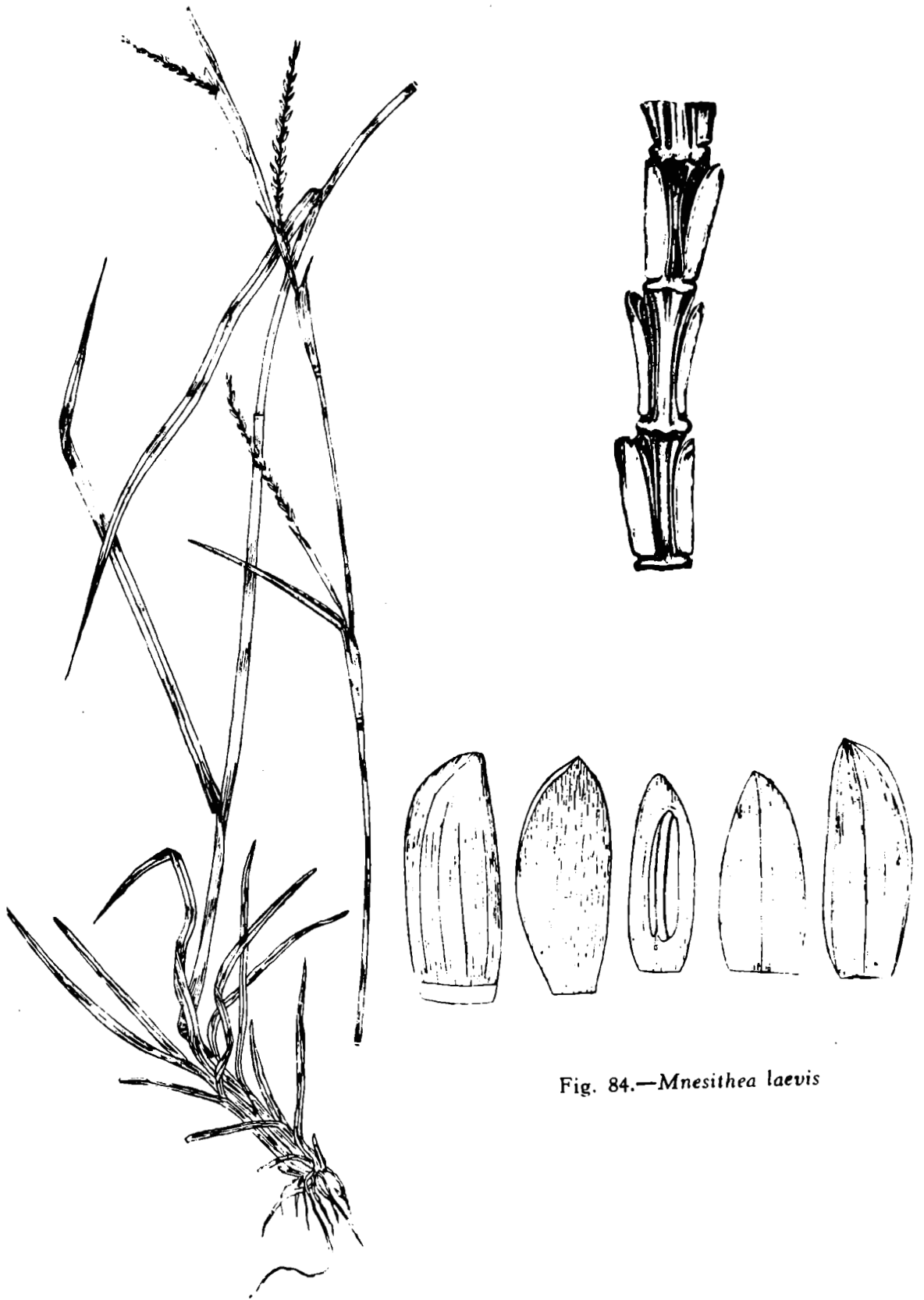


Fig. 84.—*Mnesithea laevis*

26. *Hemarthria* R. Br.

Perennial grasses with leaves conduplicate in bud. Racemes solitary or fascicled, subulate, compressed, curved ; rachis fused with the pedicels of the pedicelled spikelets. Spikelets 2-nate, one sessile the other pedicelled, both perfect. Lower glume coriaceous, obtuse or acute, 7- to 9-nerved. Upper glume membranous, keeled. Lower floret neuter or male ; lemma 2-nerved. Upper floret bisexual ; lemma hyaline, nerveless or 1- to 3-nerved ; palea 2-nerved.

1. *Hemarthria compressa* (Linn. f.) R. Br.

*Hemarthria compressa* (Linn. f.) R. Br., Prodr. Nov. Holl. 207 (1810).

*Rottboellia compressa* Linn. f., Suppl. 114 (1781) ; Hook. f., Fl. Brit. Ind. 7 : 153 (1896).

Perennial. *Culms* up to 1 m. high, compressed, erect or decumbent, often branching. *Leaf-blades* smooth, glabrous ; *sheaths* not auricled or hairy in the throat, compressed or keeled, somewhat loose, much shorter than the internodes ; *ligules* very short, truncate, membranous, ciliate. *Racemes* 5-10 cm. long, compressed, erect, the upper often fascicled, sometimes somewhat incurved, exerted slightly from the sheath ; joints of the rachis glabrous, thickened by the fusing of the pedicel, and shorter than the spikelets, with the back slightly and front deeply excavated. *Sessile spikelets* 4-4.5 mm. long, linear-lanceolate ; callus small, distinct, smooth, glabrous. *Lower glume* with a flat back, margins somewhat reflexed, linear-oblong or obtuse, emarginate or 2-toothed, often sub-oblique and narrowly winged, marginal fold smooth to the tip 7- to 9-nerved in the narrow grooves. *Upper glume* as long as the lower, concave, sub-keeled, very thin, membranous, closely applied and often adnate to the excavation in the rachis, elliptic-lanceolate or ovate, acuminate or very shortly subulate, aristate, 3- to 5-nerved. *Lower floret* ; lemma oblong, obtuse, hyaline, 2-nerved. *Upper floret* bisexual ; lemma shorter than that of the lower floret, ovate-oblong, almost nerveless ; palea much shorter, linear, obtuse, nerveless, rarely absent. *Pedicelled spikelets* male, or if bisexual, with rudimentary anthers, scarcely longer than the sessile or equal to them in length, but narrower, linear-lanceolate, 7-nerved. *Upper glume* free, a little longer than the lower, hyaline and somewhat firm, acuminate or shortly aristate, 7- to 9-nerved. Terminal spikelets with a long pedicel and with glumes longer acuminate than the others.

Very common in moist places throughout the plains and ascending to 5,000 ft. in the hills.

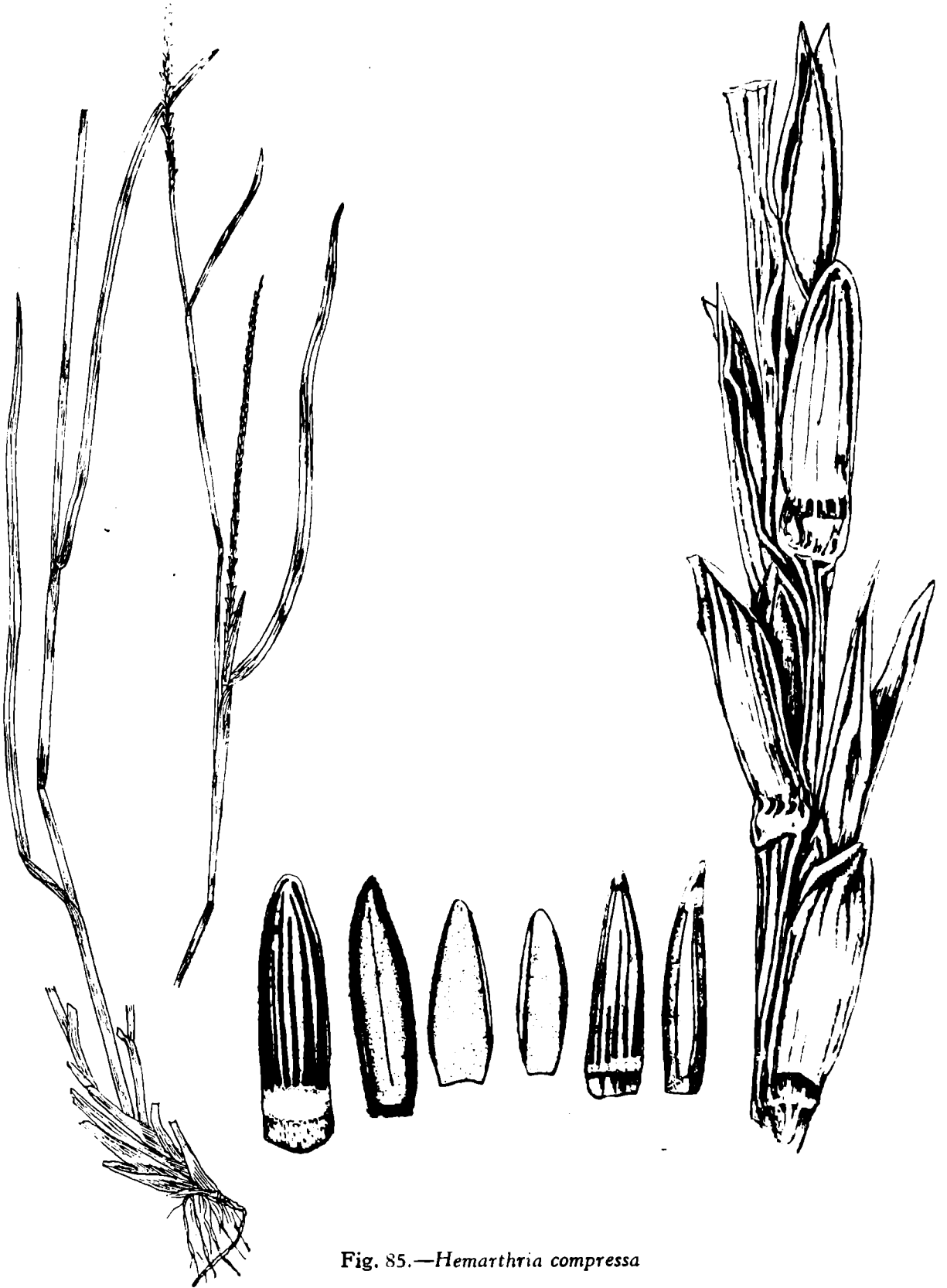


Fig. 85.—*Hemarthria compressa*

27. *Phacelurus* Griseb.

Perennial grasses with stout woody rootstock. Leaf-blades broad or narrow, glabrous. Racemes digitately arranged along a short or long central axis, rachis tardily disarticulating. Spikelets 2-nate, the sessile spikelets 2-flowered. Sessile spikelet; lower glume firm, broadly lanceolate, obtuse, flat or convex on the back; upper boat-shaped, ovate, acute. Lower lemma hyaline, enclosing a staminate floret; upper lemma hyaline, enclosing a perfect floret. Pedicelled spikelets 2-flowered, both male.

1. *Phacelurus speciosus* (Steud.) C. E. Hubb.

*Phacelurus speciosus* (Steud.) C. E. Hubb. in Kew Bulletin, 15 (1928).

*Andropogon speciosus* Steud., Syn. Gram. 1 : 375 (1855).

*Rottboellia speciosa* Hack. in Hook. f., Flor. Brit. Ind. 7 : 152 (1896).

Perennial; rootstock very stout, almost woody, covered with numerous shining sheaths. Culms tufted or solitary, up to 1.5 m. high, stout or slender, terete, smooth and glabrous, stout or slender, often creeping and prostrate, often branched below simple above. Leaf-blades linear, very variable in size, hispid or glabrous, margins scabrid; sheaths glabrous or very hirsute, the margins hairy above; ligule a ciliate rim. Racemes 3-7, rarely solitary on a short axis, internodes 1-2 cm. long, alternate or subdigitately fascicled, 7.4-15 cm. long, glabrous, green or purplish; joints about as long as the sessile spikelets, clavate, 3-gonous, angles shortly ciliate. Sessile spikelets broadly lanceolate, glabrous, 4-6 mm. long, exceeding the cavity in the rachis. Lower glume 11- to 13-nerved, oblique, obtuse at the tip, margins narrowly inflexed, keels scaberulous, spinulosely ciliate, narrowly winged at the top. Upper glume as long as the lower, ovate, cymbiform, acute, keel scabrid, 5- to 7-nerved. Lower floret male; lemma 6 mm. long, lanceolate-acute, 3- to 5-nerved; palea shorter, 2-nerved; anthers 2 mm. long. Upper floret bisexual; lemma 3-4 mm. long, elliptic-lanceolate, acute, 1 nerved, hyaline; palea as long, obtuse, hyaline, nerveless. Pedicelled spikelets 5 mm. long, lanceolate, glabrous. Lower glume obtuse, 2-keeled above, many-nerved; remainder as in the sessile spikelet except that the upper floret is either male or female.

One of the commonest grasses in the hills, abundant from 4-11,000 ft.



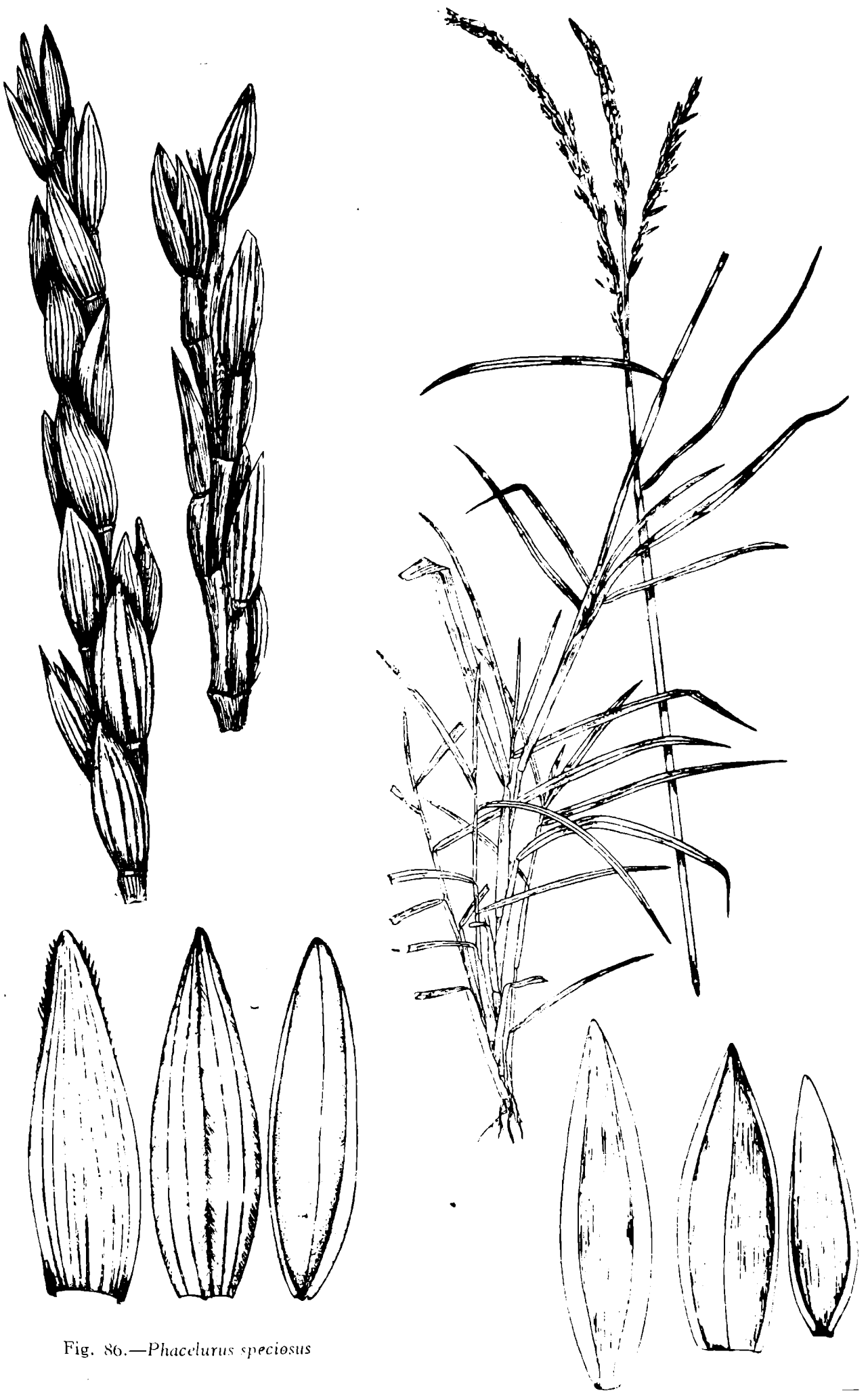


Fig. 86.—*Phacelurus speciosus*

## 28. *Hackelochloa* Ktze.

Annual grasses with flat leaves. Raceme spike-like, borne singly at the apex of the culms or its branches ; rachis disarticulating. Spikelets in pairs, 2-flowered, one sessile in an excavation of the joint, the other pedicelled but its pedicel fused with the joint. Sessile spikelet ; lower glume coriaceous, globose, foveolate ; upper glume chartaceous, concave, 1-nerved. Lower lemma hyaline; empty ; upper lemma hyaline, enclosing a bisexual floret. Pedicelled spikelet ; lower glume ovate, chartaceous, flattened on the back, smooth, 5- to 7-nerved ; upper glume keeled, 5- to 7-nerved. Lemma hyaline, the upper enclosing a male floret or neuter.

### 1. *Hackelochloa granularis* (Linn.) Ktze.

*Hackelochloa granularis* (Linn.) Ktze., Rev. Gen. Pl. 776 (1891).

*Manisurus granulatus* Linn. f., Nov. Gram. Gen. 40 (1779) ; Hook. f., Fl. Brit. Ind. 7 : 159 (1896).

*Culms* 10-75 cm. high, slender, compressed, softly hairy, leafy ; nodes hairy. *Leaf-blades* 4-20 cm. long, 6-13 mm. wide, linear-lanceolate, acute or acuminate, hairy on both surfaces or on the lower only with bulbous-based hairs, margins ciliate, base cordate ; *sheaths* much shorter than the internodes, hispid with bulbous-based hairs ; *ligules* very short, membranous, densely ciliate. *Racemes* 6-25 cm. long, resembling strings of small beads, solitary or seemingly fascicled in the axils of leaves, but individually from shortened axillary branches. *Sessile spikelets* 1.5-2 mm. long, subglobose ; callus tumid, glabrous. *Lower glume* irregularly foveolate on the back. *Upper glume* closing the cavity of the lower lemma, elliptic-oblong, obtuse, 1-nerved. *Lower lemma* hyaline, shorter than the upper glume. *Upper lemma* as long as the lower, ovate, obtuse. *Pedicelled spikelets* equal in length to the sessile or longer. *Lower glume* 2.5 mm. long, broadly ovate or suborbicular, obtuse or sub-acute, 5- to 7-nerved, one margin narrowly folded, the other with a hyaline wing. *Upper glume* equal in length, boat-shaped, laterally compressed, the keel with a dorsal hyaline, ciliolate wing.



Fig. 87.—  
*Hackelochloa*  
*granularis*

Karachi ; Sakesar ; Rawalpindi.

## 29. *Rottboellia* Linn. f.

Annual grasses with flat leaf-blades. Racemes spike-like, borne singly at the apex of the stem and branches ; rachis disarticulating. Spikelets in pairs, the sessile spikelet 2-flowered in an excavation of the joint ; pedicel of the pedicelled spikelet adnate to the joint. Sessile spikelet ; lower glume coriaceous flattened on the back, obsolete many-nerved ; upper glume coriaceous, keeled, 11-nerved. Lower lemma membranous, enclosing a male floret. Upper lemma hyaline, enclosing a bisexual floret. Pedicelled spikelet with one or two staminate florets or neuter.

### 1. *Rottboellia exaltata* Linn. f.

*Rottboellia exaltata* Linn. f., Suppl. 114 (1781) ; Hook. f., Flor. Brit. Ind. 7 : 156 (1896).

Perennial. Culms erect, up to 3 m. high, branched, branches more or less erect, smooth or hairy, terete. Leaf-blades linear, lanceolate, up to 45 cm. long, 2.5 cm. wide, smooth below scabrid above ; sheaths terete, tight or widened upwards, hirsute sometimes glabrous ; ligules membranous, brown, rounded, ciliolate. Racemes up to 15 cm. long, stiff ; joints stiff, 5-7.5 mm. long, rounded on the back, concave on the inner face. Sessile spikelets 6-8 mm. long, ovate-lanceolate, glabrous. Lower glume coriaceous, entire or slightly 2-toothed, smooth or slightly scabrid. Upper glume as long as the lower, cymbiform, very broad in profile, obliquely acute, about 11-nerved. Lower floret ; lemma oblong-lanceolate, acute, glabrous ; palea similar in shape and size but more firm. Upper floret ; lemma cymbiform, obliquely ovate in profile ; palea narrowly oblong, nerveless, almost as long as the lemma. Pedicelled spikelets as long as the sessile but more compressed and with 2 male florets, more or less reduced.

Tret, Murree ; Kagan Valley ; Swat State. Common in the hills up to 5,000 ft.

## 30. *Lasiurus* Boiss.

Perennial densely tufted, caespitose grasses. Leaves linear, flat or convolute : sheaths cylindric, long-persistent ; ligule reduced to a fringe or hairs. Spikelets 2-nate or the lower 3-nate, muticous, forming a solitary spike. Sessile spikelets bisexual ; the pedicelled male, the pedicel appressed to the rachis but not adnate. Rachis robust, articulate, fragile, with internodes enlarged, flattened or excavate, thickened at the apex and long-villose externally and on the nodes. Sessile spikelets ; lower

glume prominently ciliate, acuminate, flattened, 2-dentate ; upper glume shorter, membranous, 1-keeled, especially towards the apex. Lower floret reduced to a sterile, sub-hyaline lemma and a palea. Upper floret bisexual ; lemma hyaline, 2-nerved ; palea hyaline, 2-nerved. Pedicelled spikelets with 2 male florets, the lower having a lemma and a palea, the upper more or less reduced.

#### KEY TO THE SPECIES

Internodes and peduncles glabrous.....1. *L. hirsutus*  
 Internodes and peduncles villose-pubescent.....2. *L. scindicus*

#### 1. *Lasiurus hirsutus* (Forsk.) Boiss.

*Lasiurus hirsutus* (Forsk.) Boiss., Dign. Ser. 2, 4 : 146 (1859).

*Saccharum hirsutum* Forsk., Fl. Aegypt.-Arab. 16 (1775).

*Rottboellia hirsuta* (Forsk.) Vahl, Symb. 1 : 11 (1790).

*Elionurus hirsuta* (Forsk.) Munro ex Benth., Jour. Linn. Soc. 19 : 78 (1881) ; Hook. f., Flor. Brit. Ind. 7 : 162 (1896).

Perennial, more or less caespitose plant with a woody root-stock. *Culms* erect, branched at the base and clothed with hirsute sheaths or their remains, 60 cm. high, rigid ; nodes more or less hairy. *Leaf-blades* linear, long attenuated to a setaceous point, up to 30 cm. long, 6 mm. wide, flat or convolute ; glabrous or slightly hairy, the margins scabrid and bearing long tubercle-based hairs towards the base ; *sheaths* cylindric, long-persistent, smooth, glabrous or more or less hairy towards the apex ; *ligule* reduced to a fringe of hairs. *Spikes* cylindric, up to 14 cm. long, 6 mm. wide, silvery-silky all over. Spikelets imbricate, appressed to the rachis. *Sessile spikelet* ; lower glume 1 cm. long, divergent, narrowed into a long narrow flat, 2-fid beak, narrowly lanceolate, villous along the margin, coriaceous, 7-to 9-nerved. *Upper glume* 6 mm. long, ovate, dorsally rounded, chartaceous, 3- to 5-nerved, aristately acuminate, acumen scabrid, ciliate at the tip. *Lower floret* barren ; lemma hyaline, ovate, as long as the upper glume, ovate-oblong, faintly 3-nerved, paleate ; palea lanceolate, acute, as long as the lemma. *Upper floret* bisexual ; lemma ovate-oblong, glabrous, with incurved margins, 5-nerved ; palea resembling that of the upper lemma but smaller, nerves scaberulous. *Pedicelled spikelets* rather shorter than the sessile ones ; pedicel about 4 mm. long, shorter than the joints, subclavate, hairy on the back and with ciliate margins. Florets 2, male, the lower having a lemma and a palea, the upper reduced.

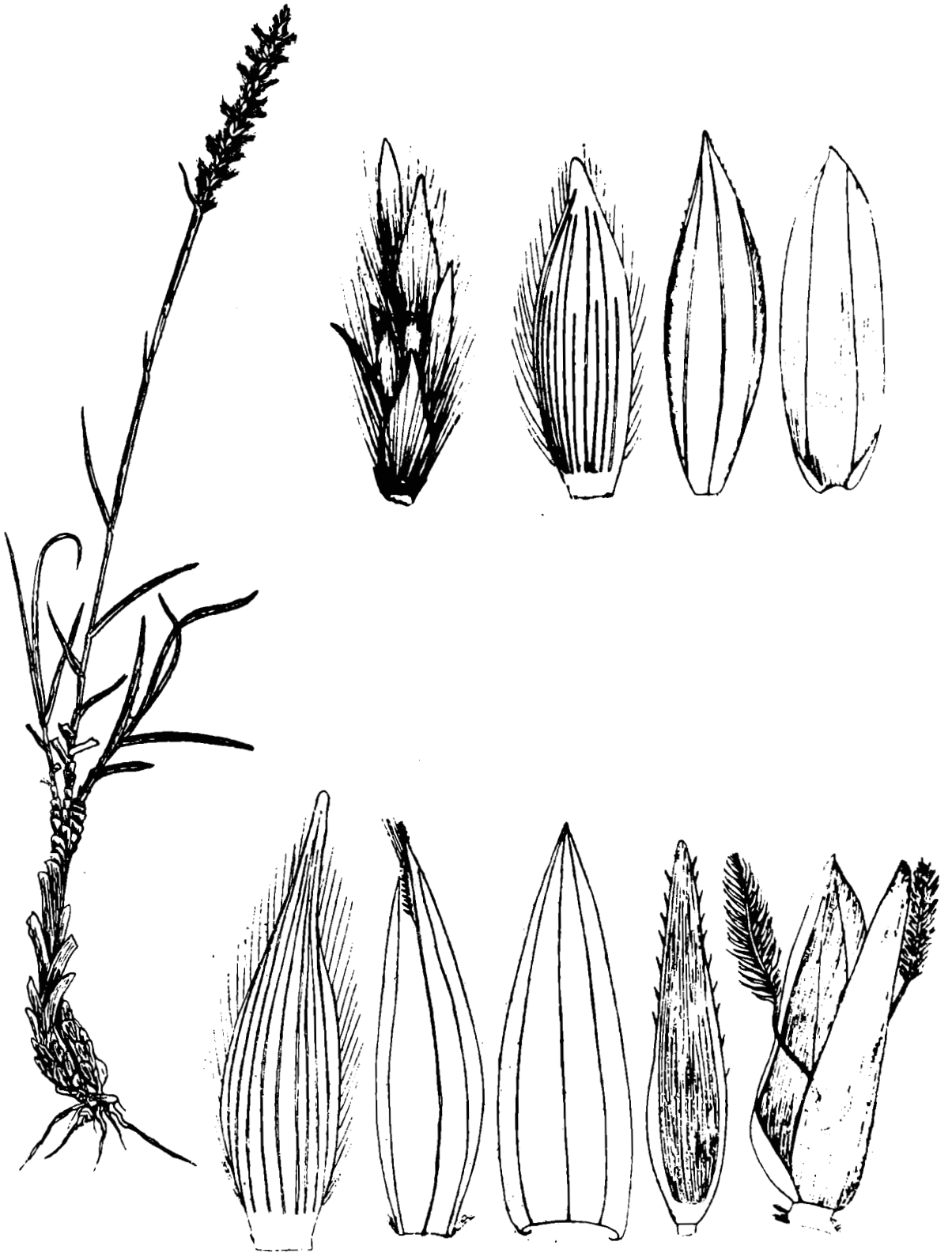


Fig. 88.—*Lasiurus hirsutus*

Multan ; Bahawalpur ; Salt Range ; Karachi ; Hyderabad ; Qeutta ; Peshawar ; Swat ; Jalalpur ; Kohat ; Shakhkot Hills ; Rawalpindi, etc. Common in the arid parts of the plains.

## 2. *Lasiurus scindicus* Henr.

*Lasiurus scindicus* Henrard in Blumea 4 : 514 (1941).

Differs from the previous in that the internodes and the peduncles below the panicle are villose-pubescent.

Sind, without locality.

## 31. *Elionurus* Humb. & Bonpl.

Annual or perennial, aromatic grasses. Leaf-blades flat or narrow, often convolute ; ligules membranous, very short. Racemes spike-like, corymbose, each provided with a sheath. Rachis disarticulating with compressed, pilose joints. Spikelets in pairs, awnless ; the sessile spikelets deciduous together with the joint and pedicel of the pedicelled spikelet ; pedicel free. Sessile spikelet ; lower glume subcoriaceous, often deeply 2-fid, with narrowly inflexed margins and a line of transparent balsamine glands close to the penicillate keels, 7- to 11- nerved. Upper glume herbaceous, acute, 1-nerved. Lower floret barren ; lemma hyaline, nerveless, epaleaté. Upper floret bisexual ; lemma hyaline, 1-nerved or nerveless, epaleate. Pedicelled spikelets similar, more or less reduced, barren or male.

### 1. *Elionurus royleanus* Nees

*Elionurus royleanus* Nees in Rich., Fl. Abyss. 2 : 471 (1851) ; Hook. f., Flor. Brit. Ind. 7 : 161 (1896).

Annual. Culms up to 25 cm. high, leafy ; nodes pubescent. Leaf-blades linear-lanceolate, acute or acuminate, subterete, at first green then turning red, fimbriate at the base ; lower sheaths terete, upper spathiform ; ligule shortly membranous, densely ciliate. Raceme erect, 5-10 cm. long, enclosed in a long narrow flattened sheath ; joints bearded below the tip. Sessile spikelets 6 mm. long ; callus densely bearded. Lower glume lanceolate, coriaceous, 13 mm. long incl. a 6 mm. long deeply 2-fid ciliate beak, lobes linear, divergent, ciliate, the margins of the glume below the beak with a row of large violet-coloured tubercles each carrying a pencil of whitish hairs, 7- to 11-nerved. Upper glume 7 mm. long, linear-lanceolate, membranous, acuminate, finely mucronate, 1-nerved. Lower floret barren ; lemma slightly shorter than the upper glume, oblong, acute, nerveless, glabrous, epaleate. Upper floret bisexual ; lemma much shorter than the lower, oblong, obtuse, 1-nerved or nerveless, epaleate. Pedicelled spikelet linear-subulate ; pedicel 3 mm. long, ciliate on one margin. Lower glume 1 cm. long,



Fig. 89.—*Elionurus royleanus*

narrowed from the base into a long subulate ciliate blade. *Upper glume* 6 mm. long, ovate-lanceolate, concave, membranous, narrowed into a short scabrid awn. *Lemmas* suppressed.

Karachi, R. R. Stewart, I. I. Chaudhri; Thano Bullo Khan, J. J. Norris.

### Tribe III. **Maydeae**

Spikelets unisexual, dissimilar, awnless, the sexes in different inflorescences or in different parts of the same inflorescence with the male above the female. Male spikelets 2-flowered, one sessile, the other or both pedicelled; glumes membranous to chartaceous, enclosing the florets; lemma hyaline. Female spikelets 2-flowered with the lower floret barren, solitary or in pairs; glumes hardened or thin; lemma hyaline.

## KEY TO THE GENERA

1. Male and female spikelets in the same inflorescence.....2  
     Male spikelets in a terminal panicle, female in the axils of leaves.....  
     .....1. *Zea*
2. Caryopsis enclosed in a strong polished nut-like involucre.....2. *Coix*  
     Caryopsis enclosed in the lower hardened glume.....3. *Chionachne*

1. *Zea* Linn.

Tall, stout annual grasses with large leaves. Inflorescence monoecious with male spikelets in large terminal panicles of racemes or subdigitately arranged racemes ; female inflorescence consisting of numerous female spikelets, seated upon a spongy axis representing the fused axes of several spikes. Male spikelets 2-nate, one sessile, the other pedicelled, 2-flowered. Glumes subequal, membranous, convex, obscurely 2-keeled ; lemmas and paleas alike. Female spikelets 2-nate in 4-11 longitudinal rows, slightly immersed in the axis, with a lower barren and an upper fertile floret, awnless. Glumes similar, very broad, fleshy below, hyaline above, nerveless, ciliate. Lower floret barren ; lemma resembling the glumes, paleate or not. Upper floret female ; lemma similar to the lower lemma, paleate ; lodicules absent ; styles very long, plumose, slightly 2-fid at the apex.

1. *Zea mays* Linn.

*Zea mays* Linn., Sp. Pl. 971 (1753); Hook. f., Fl. Brit. Ind. 7 : 102 (1896).  
 Characters of the genus.

Cultivated throughout the area.

2. *Coix* Linn.

Tall branched, perfectly glabrous grasses with broad flat leaves. Inflorescence consisting of long peduncled, false spikes clustered in the axils of leaves ; each raceme consisting of a solitary female spikelet and several males. The female is enclosed in an ovoid bead-like very hard, tardily deciduous involucre ; the male spikelets are borne in a raceme which protrudes through an orifice at the apex. The staminate portion is early deciduous and consists of several clusters of staminate spikelets. Spikelets unisexual ; male 2-flowered ; glumes membranous, obscurely nerved ; lemma and palea hyaline. Female spikelets ovoid, entirely surrounded by the hardened involucre, 6-11 mm. long. Lower glume papyraceous, coriaceous above ; upper narrower than the lower. Lower



floret female or empty; lemma resembling the upper glume. Upper floret; lemma hyaline, as long as the spikelet; palea similar, slightly shorter. Sterile spikelet consisting of a single narrow tubular glume as long as the fertile spikelet.

### 1. *Coix lacryma-jobi* Linn.

*Coix lacryma-jobi* Linn., Sp. Pl. 972 (1753); Hook. f., Fl. Brit. Ind. 7: 100 (1896).

Annual. Culms erect, glabrous, polished, up to 2 m. high, branched at the base. Leaf-blades up to 50 cm. long, 2-5 cm. wide, cordate at the base; sheaths smooth; ligule membranous, glabrous, lacerate, 1 mm. long. Peduncle 4-8 cm. long; male spikelets 2- or 3-nate, dense imbricate; rachis slender, 8-18 mm. long. Male spikelets; lower glume ovate, many-nerved, shortly winged along the inflexed margins; shortly and densely ciliate; upper glume thin, oblong-lanceolate, acuminate, 9-nerved. Lower floret male; lemma membranous, hyaline, acuminate, faintly 5-nerved; palea 2-keeled. Upper floret male or barren; lemma 5-nerved, acute. Female spikelet; lower glume ovate-oblong, acute, papyraceous. Upper glume ovate, narrowed at the tip. Caryopsis ovoid or globose.

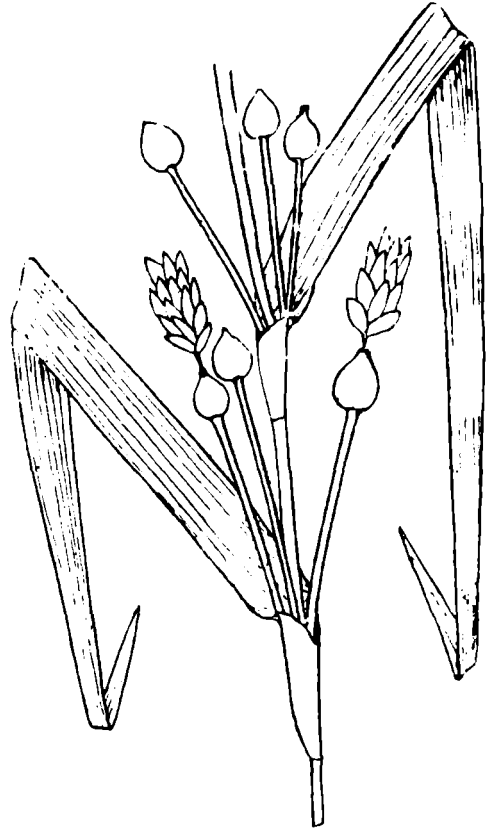


Fig. 90.—*Coix lacryma-jobi*

Wah near Hasan Abdal; Indus River; Mirpur Sakro; Gharo; Umarkot. Not common. Grows in wet soil.

### 3. *Chionachne* R. Br.

Annual or perennial, usually hairy grasses with flat narrow leaves. Racemes consisting of several males with one female spikelet at the base, at first enclosed in spathiform bracts. Rachis disarticulating at the base and above each female spikelet. Male spikelet 2-flowered, solitary or 2-nate and then one pedicelled and the other sessile. Glumes dissimilar, lower herbaceous, shallowly concave with a narrow membranous wing on each side; upper chartaceous or rarely herbaceous, narrower. Lower

floret male ; lemma membranous, paleate. Upper floret male or barren ; lemma delicately hyaline, paleate. Female spikelets oblong, dorsally compressed, 2-flowered. Glumes very dissimilar; lower thickly coriaceous, enclosing but not concealing the rachis between the inflexed margins, enclosing the upper glume and floret ; upper membranous or chartaceous. Lower floret barren ; lemma delicately hyaline, paleate or not. Upper floret female ; lemma narrow, its palea wrapped round the pistil.

1. ***Chionachne koenigii*** (Spreng.) Thw.

*Chionachne koenigii* (Spreng.) Thw., Enumer. Pl. Zeyl. 369 (1864).

*Coix koenigii* Spreng., Syst. 1 : 228 (1825).

*Chionachne barbata* (Roxb.) R. Br. in Benn., Pl. Rar. Jav. 18 (1832).

*Coix barbata* Roxb., Fl. Ind. 1 : 599 (1832).

*Polytoca barbata* (Roxb.) Stapf in Hook. f., Fl. Brit. Ind. 7 : 102 (1896).

Perennial. Culms erect, up to 1.5 m. high, smooth, terete ; nodes bearded. Leaf-blades linear, scabrid above, glabrous or hirsute below, 26-60 cm. long, 6-18 mm. wide ; sheaths glabrous or hairy ; ligules tomentose. Inflorescence a panicle of racemes ; racemes 2.5-4 cm. long, male at the top and a solitary female below ; rachis fragile below the female spikelet and between the male spikelets ; spathiform sheaths swollen, broad above the base, mucronate. Male spikelets solitary or 2-nate, 6-8.5 mm. long. Lower glume as long as the spikelet, lanceolate-oblong, obtuse, acute or apiculate, many-nerved, glabrous or hairy. Upper glume shorter and narrower, dorsally compressed, papyraceous, ovate-acuminate, 6- to 9-nerved. Lower floret male ; lemma oblong-acuminate, 5-7 mm. long, 3- to 5-nerved ; palea slightly shorter. Upper floret male or empty ; lemma delicately hyaline ; palea as long. Female spikelets sessile,



Fig. 91.—*Chionachne koenigii*

often solitary at the base of each partial inflorescence ; the pedicelled often absent. *Lower glume* 4-5 mm. long, embracing the spikelets and the rachis, oblong, keeled, very firm, obscurely many-nerved, finally hardening to form a white coriaceous outer covering. *Upper glume* as long, membranous, ovate-oblong or oblong, with rounded ciliate margins. *Lower floret* barren ; lemma oblong, 3- to 5-nerved ; palea narrow. *Upper floret* female ; lemma narrow, truncate, 3-nerved ; palea narrow, truncate.

Poonch, *A. Rashid* ; Tret Hills below Murree, *R. R. Stewart*. Not Common.

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BIOLOGICAL SOCIETY OF PAKISTAN

**Monograph No. 3**

**Grasses of West Pakistan**

**Part II. Subfamily Pooideae**

**SULTAN AHMAD**

*Government College, Lahore*

**&**

**R.R. STEWART**

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## II. Subfamily : Pooidae

Spikelets 1- to many-flowered, breaking up at maturity above the more or less persistent glumes, or if falling entire then not 2-flowered with the lower floret male or barren and the upper hermaphrodite, usually more or less laterally compressed or terete; rachilla produced beyond the upper floret.

### KEY TO THE TRIBES

(After C. E. Hubbard)

1. Shrubs or trees with woody often tall persistent culms ..... 1. **Bambuseae**  
 Perennial or annual herbs. .... 2
2. Spikelets borne in open or contracted or spike-like panicles, less often in racemes or spikes, and then with the lower or both glumes suppressed if on opposite sides of the rachis, or with two or more fertile florets if on the same side of the rachis ..... 3  
 Spikelets sessile along one side of the rachis of solitary, digitate or scattered spikes or spike-like racemes (with one fertile floret and 1- to 3-nerved lemma), or on opposite side of the rachis of solitary spikes or racemes ..... 15
3. Spikelets usually with 2 or more fertile florets or if with one fertile floret then with sterile florets above it ..... 4  
 Spikelets with one fertile floret and with or without 1 or 2 male or barren florets below it ..... 8
4. Lemma and rachilla glabrous or hairy, the hairs not enveloping the lemmas, if so then with the lemmas bearing a geniculate awn.....5  
 Lemmas or rachilla bearing long silky hairs which envelop the lemmas ..... 4. **Arundineae**
5. Glumes usually shorter than the lowest floret rarely longer and then usually with firm dull margins ..... 6  
 Glumes usually as long as or longer than the lowest floret, often as long as the spikelet, glumes or lemmas or both with thin hyaline margins; awn usually geniculate ..... 8. **Aveneae**
6. Lemmas usually 5- to many-nerved ..... 7

- Lemmas 1- to 3- nerved.....5. **Eragrosteae**
7. Lemmas entire or shortly 2- to 5-toothed at the apex .....3. **Festuceae**  
 Lemmas cleft into 3- many subulate lobes ..... 2. **Pappophoreae**
8. Glumes minute or wanting; stamens 6; palea 3- to 9- nerved .....  
 ..... 14. **Oryzeae**  
 Glumes well developed ; stamens 3; palea 2- nerved... .. 9
9. Spikelets 3- flowered, the lower 2 male or neuter, the upper bisexual;  
 palea 1- nerved .....13. **Phalarideae**  
 Spikelets 1- or 2-flowered .. ..... 10
10. Spikelets 2- flowered, the lower represented by a lemma..... 11  
 Spikelets 1-flowered,..... 12
11. Spikelets disarticulating below the glumes and falling entire; glumes  
 half as long as the spikelet... .. 15. **Thysanolaenae**  
 Spikelets disarticulating above the glumes and not falling entire ;  
 upper glume as long as the spikelet ..... 16. **Arundinellae**
12. Spikelets not falling entire, if so then with firmly membranous, 5-  
 nerved lemmas ..... 13  
 Spikelets falling entire at maturity, either singly or in clusters;  
 lemma delicate, 1- to 3- nerved ..... 12. **Zoysiaeae**
13. Lemmas hyaline or membranous at maturity; rarely indurated and  
 then laterally compressed. ....14  
 Lemma indurated and rigid at maturity, terete or dorsally compressed,  
 with involute or convolute margins, tightly embracing the grain .....  
 ..... 11. **Stipeae**
14. Lemma usually 3- to 5- nerved, usually awned ; glumes longer and  
 firmer than the hyaline lemma or if shorter then the lemma herb-  
 aceous, membranous and dull; grain with an adhering pericarp .....  
 ..... 9. **Agrosteae**  
 Lemma 1- to 3- nerved, awnless; glumes and lemmas similar in texture,  
 hyaline or membranous, shining; grain with a free pericarp .....  
 ..... 6. **Sporoboleae**
15. Spikelets on opposite sides of the rachis of solitary spikes or  
 spike-like racemes ..... 10. **Hordeaeae**  
 Spikelets in one or two rows on one side of the continuous rachis  
 of solitary, digitate or scattered spikes. .... 7. **Chlorideae**

## Tribe 1. **Bambuseae**

Perennial woody grasses with short, thick, knotted rhizome. Leaf-blades usually with a petiole-like base which is articulated with the sheath. Spikelets homomorphous, few- to many-flowered. Glumes differentiated or passing below into more or less numerous bracts and sometimes having flowering branchlets or spikelets in their axils, and at the same time resembling the lemmas. Lemmas subherbaceous to subcoriaceous, 5- to many-nerved, generally awnless. Lodicules 3. Stamens 3, 6 or more. Styles 2 or 3.

### KEY TO THE SPECIES

1. Small bamboos ; culms less than 2.5 cm. in diameter.....  
.....1. *Arundinaria*  
Large bamboos ; culms over 2.5 cm. in diameter ; stamens 6 .....2
2. Culms with the lower branches thorny or culm sheaths with large fringed auricles ; pericarp fused with testa .....2. *Bambusa*  
Culms without thorny branches ; culm sheaths without large fringed auricles ; pericarp free from the testa .....3. *Dendrocalamus*

### 1. **Arundinaria** Michx.

Erect or climbing shrubs. Culms slender, less than 2.5 cm. in diameter, internodes rather short ; nodes usually prominent ; branches short fascicled. Culm sheaths papery, straw coloured, blade subulate. Leaves usually small, jointed on the sheath. Inflorescence paniculate or racemose, terminal on leafy culms or on separate culms or mixed with the leafy branches. Spikelets 1- to many - flowered, compressed, all the florets usually bisexual, except sometimes the terminal. Glumes unequal, membranous. Lemmas longer, obtuse, acute or mucronate, many-nerved ; palea 2-keeled. Lodicules 3, ciliate. Stamens 3.

### 1. **Arundinaria falcata** Nees

*Arundinaria falcata* Nees in Linnaea 9 : 473 (1834) ; Hook. f., Fl. Brit. Ind. 7 : 381. (1836) ; Parker, For. Fl. Panjab, 530 (1918).

*Culms* erect, 1.8-3 m. high, up to 1.3 cm. in diam., densely tufted, often glaucous ; nodes swollen ; internodes smooth, 15 - 30 cm. long. *Culm-sheaths* as long as or longer than the internodes, gradually narrowed from the middle to a narrow truncate tip ; imperfect blade 1.2 - 5 cm.

long, subulate. Leaves 7.5-10 cm. long, 5-7 mm. broad, sometimes up to 30 cm. by 2.5 cm. on young shoots; glandular between the nerves; sheaths glabrous; ligule membranous, dentate or lacerate. Inflorescence on separate leafless culms, consisting of falcate fascicled racemes subtended by short linear or lanceolate bracts less than 2.5 cm. long. *Spikelets* 1.2-1.7 cm. long, 2-, sometimes 1-flowered, some sessile, others on long slender pedicels, rachilla cuneate, tip hairy. *Lower glume* 8 mm. long, 3- to 5-nerved. *Upper glume* longer, 7- to 9-nerved acute, ciliate. *Lemma* 1.2 cm. long, mucronate, scabrous. *Palea* as long as the lemma.

Poonch : Nirgil, Kotli, R.R. Stewart.

## 2. *Bambusa* Schreb.

Shrubs or trees, usually large and caespitose, rarely climbing; culm-sheaths broad, blade often triangular. Leaf-blades shortly petioled, not tessellated by nervules but sometimes having pellucid glands; sheaths variously auricled. Inflorescence generally a large leafless panicle bearing heads on spiciform branches, or of leafy panicles, or paniced spikes. *Spikelets* 1- to many-flowered. Lemmas ovate-lanceolate, lower two empty or gemmiferous, uppermost imperfect; palea 2-keeled. Stamens 6.

### 1. *Bambusa bambos* (Linn.) Voss

*Bambusa bambos* (Linn.) Voss in Vilmorins Blumeng. ed. 3, Sieb. & Voss, 1: 1189 (1895).

*Arundo bambos* Linn. Sp Pl. 81 (1753).

*Bambusa arundinacea* Retz Obs. 5 : 24 (1789); Hook. f., Fl. Brit. Ind. 7 : 395 (1896); Parker, For Fl. Panjab, 532 (1918).

*Culms* up to 24 m. high, 10-17 cm. in diam., in very congested clumps, the lower nodes with numerous stiff leafless branches armed with 2-3 strong curved thorns, bright green; upper nodes very prominent; internodes 30-45 cm. long. *Culm-sheaths* 22.5-30 cm. long, striate, orange yellow and thickly ciliate with golden hairs when young, otherwise glabrous; imperfect blade triangular, sharply pointed, concave with involute margins, densely felted within with dark bristly hairs, the margins decurrent on the sheath, wavy, plaited, long and thickly ciliated but hardly auricled; ligule narrow, entire or fringed with white hairs. *Leaves* usually not over 20 cm. long, 1.7 cm. broad, secondary longitudinal nerves 4-6 on either side of the midrib. *Spikelets* 1.2-2.5 cm. long,

glabrous; empty glumes 0 or 1-2; florets 3-7, the lower bisexual, the upper male, followed by 1-3 imperfect ones.

Cultivated in gardens.

### 3. *Dendrocalamus* Nees

Arborescent unarmed bamboos, with densely branching rootstock. Leaves shortly petioled, transverse nervules represented by pellucid glands. Spikelets in globose clusters on the long branches of a compound panicle, ovate, 2- to 6-flowered. Glumes ovate acute, many nerved. Lemmas similar, the lowest sometime empty; palea of the lower lemmas keeled, of the upper dorsally rounded, eciliate. Stamens 6.

#### 1. *Dendrocalamus strictus* Nees

*Dendrocalamus strictus* Nees in *Linnaea* 9: 476 (1834); Hook. f., *Fl. Brit Ind.* 7: 404 (1896); Parker, *For. Fl. Panjab*, 533 (1918).

*Culms* densely tufted, 6-12 m. high, 2.5-7.5 cm. in diameter, glaucous when young and covered with white scurf, often solid or nearly so near the base, internodes 25-40 cm. long. *Culm-sheaths* a little shorter than the internodes, glabrous or with blackish stiff hairs, striate, ciliate at the edges, very slightly auricled: imperfect blade elongate triangular, hairy esp. within. *Leaves* 2.5-25 cm long, 5-30 mm. broad, nerves 3-6 pairs with interposed pellucid glands. Sheaths striate, hairy, ending in prominent callus and short auricles with deciduous hairs. *Spikelets* 12 mm. long, in dense globular heads which are up to 10 cm. apart, 2.5-3.7 cm. in diameter; internodes 5 cm. long. Glumes 2 or more, ovate, spinescent, many-nerved. *Lemma* ovate, spinescent at the tip, pubescent. *Palea* of the lower lemma 6- to 7-nerved: keels ciliate.

Margalla; Rawalpindi, *R.N. Parker*, *R.R. Stewart*; Salt Range, *R.N. Parker*; Shahpur Kandi, *R.N. Parker*.

#### Tribe 2. *Pappophoreae*

Spikelets 3- to 6 flowered, arranged in dense, spike-like panicles; rachilla disarticulating above the glumes and between the lemmas. Glumes persistent, subequal, 3- to 9 nerved. Lemmas membranous to coriaceous, 9- to many-nerved, cleft into 3 to many subulate lobes, awned; awns terminal or dorsal, scabrid or plumose in the lower half.

#### KEY TO THE GENERA

- Lemmas awned from the tip.....1. *Enneapogon*  
 Lemmas awned from the back.....2. *Boissiera*

1. **Enneapogon** Desv.

Perennial grasses with narrow often convolute leaves; ligules reduced to a fringe of hairs. Panicle contracted or spiciform. Spikelets 3-flowered; rachilla disarticulating above the glumes; lowest floret hermaphrodite, the intermediate barren, the uppermost rudimentary. Glumes persistent, membranous, acute, obtuse or minutely truncate, 3- to 9-nerved. Bisexual floret; lemma broad, much shorter than the glumes, 9-nerved, 9-awned, the awns subulate, subequal or equal, plumose, ciliate or scaberulous; callus minute, short; palea ovate-oblong, 2-keeled. Intermediate floret similar but the lemma shorter, ovary suppressed. Uppermost floret rudimentary or reduced to a tuft of hairs.

## KEY TO THE GENERA

- Lower glume 9-nerved, upper 7-nerved; awns three times as long as the lemma, equal.....1. *E. elegans*
- Lower and upper glumes 7-nerved; awns 3-4 times as long as the lemma, 4 much shorter than the others.....2. *E. persicus*
- Lower glume faintly 3- to 5-nerved; awns twice as long as the lemma .....3. *E. brachystachyum*

1. **Enneapogon elegans** (Nees) Stapf

*Enneapogon elegans* (Nees) Stapf in Dyer's Fl. Cap. 7: 653 (1900).

*Pappophorum elegans* Nees in Wight, Cat. no. 1771 (1833); Hook. f., Fl. Brit. Ind. 7: 301 (1897).

Perennial. Culms 7.5-45 cm. high, slender, wiry, erect or ascending from a subwoody often thickened base; nodes glabrous or tomentose. Leaf blades 1.2-12.5 cm. long, usually convolute, pungently pointed, more or less softly pubescent; sheaths softly puberulous; ligule a fringe of hairs. Panicle 2.5-7.5 cm. long; axis villous; branches very short. Spikelets 4-6 mm. long (incl. the awns) sessile or pedicellate, softly tomentose, nearly white. Lower glume 4 mm. long, oblong-lanceolate, acute, 9-nerved; upper glume 5 mm. long, lanceolate, acute, 7-nerved. Fertile lemma orbicular below, cleft above into 9 subulate awn-like lobes which are plumose in the lower half; palea ovate, 2-keeled, the keels pubescent.

Karachi, *Woodrow* Sind : Laki, *Stocks* ; Peshawar, *J.L. Stewart* ; Mt. Tilla in Salt Range, *MacDonell*.—

## 2. *Enneapogon persicus* Boiss.

*Enneapogon persicus* Boiss., *Diagn. ser. I. fasc. v* : 71 (1844).

*Pappophorum persicum* Steud. *Syn. Pl. Gram.* 200 (1854).

*Pappophorum aucheri* Jaub. et Spach, *Ill. Pl. Orient.* 4 : 32 (1850).

Perennial. Culms 15-30 cm. high, erect or geniculate-ascending,

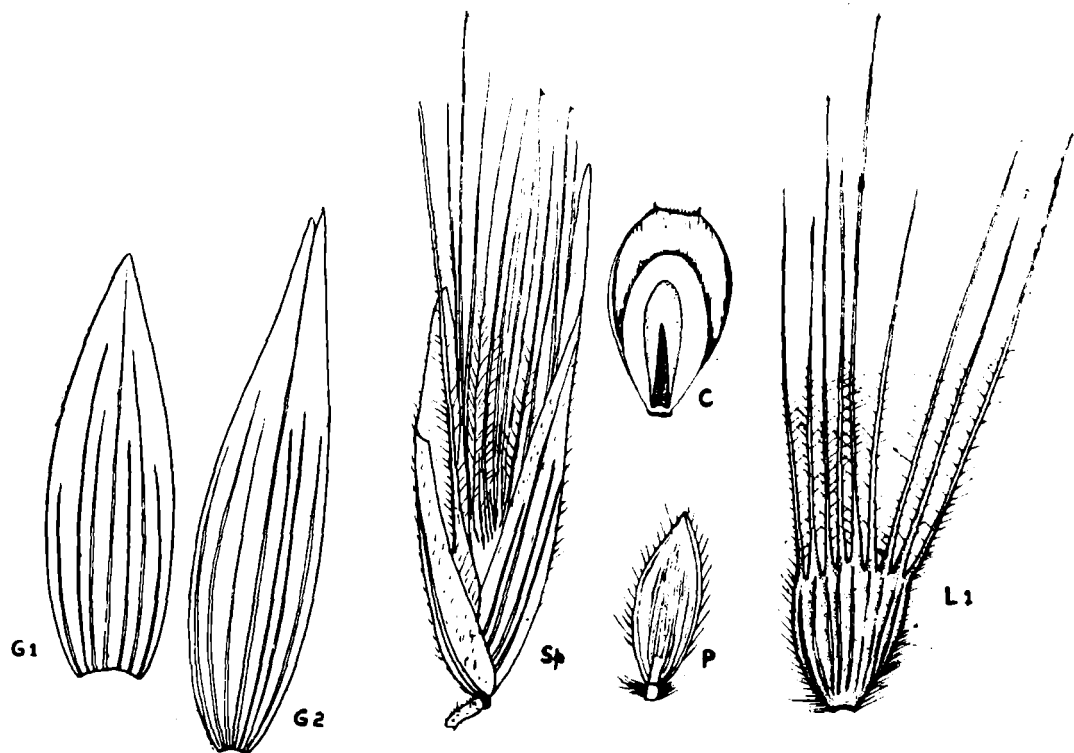


Fig. 92.—*Enneapogon persicus*

puberulous, simple or branched ; nodes tomentose. *Leaf-blades* 5-20 cm. long, narrow, flat or convolute and filiform ; *sheaths* smooth or the lower tomentose ; *ligule* a hairy ridge. *Panicle* 5-125 cm. long, cylindric, silvery yellow with sometimes purple awns ; axis pubescent ; branches short or elongate, villous ; pedicels short ; villous. *Spikelets* 8-12 mm. long (incl. the awns), 3-flowered. *Glumes* narrowly lanceolate, acute, finely pubescent, both 7-nerved ; lower 6-7 mm. long, upper 8-9 mm. long. *Lemma* 2.25 mm. long, villous ; awns softly silky below the middle, three to four times as long as the lemma, four much shorter, up to 10 mm. long. *Palea* ovate, up to 3 mm. long, 2-keeled, the keels pubescent. *Anthers* 1.5 mm. long.

Bolan Pass, *Griffith* ; Quetta, Ziarat, Hindu Bagh ; Karachi ;

Shahkot Hills, *Edgeworth* ; Sangla Hill ; Kirana Hill near Sargodha ; Salt Range ; Peshawar ; Gilgit ; Rawalpindi. Very common.

### 3. *Enneapogon brachystachyum* (J. & S.) Stapf

*Enneapogon brachystachyum* (J. & S.) in Dyer's Fl. Capensis 7 : 654 (1900).

*Pappophorum brachystachyum* Jaub. & Spach, Ill. Pl. Orient, 4 : 34 (1850-53).

*Pappophorum arabicum* Hochst. in Steud. Syn. Pl. Gram. 199 (1854).

Perennial. *Culms* tufted, villous, nodes tomentose. *Leaf blades* 2-10 cm. long, 1-1.3 mm. broad, usually convolute, villous ; *sheaths* tight, more or less keeled, the basal somewhat inflated ; *ligule* a fringe of short hairs. *Panicle* spiciform, dense, up to 5 cm. long, cylindric ; axis villous ; branches short and little branched, erect, villous ; pedicels shorter than the spikelets, pubescent. *Glumes* membranous, 3- to 5 nerved below the middle, oblong, obtuse or slightly emarginate, more or less pubescent on the back, the lower 3.5 mm. long, upper 4.5 mm. long. *Lemma* papyraceous, 1.5-2 mm. long villous, 9 nerved, 9-awned, awns plumose in the lower half and scabrid above, 2-4 mm long, 4 shortest. *Palea* subequal, 2 mm. long, 2-keeled, with keels shortly pubescent. *Caryopsis* 1.2 mm. long.

Multan, *Edgeworth* ; Boran Bridge, Sind, 25. 11. 56, *J.J. Norris*.

### 2. *Boissiera* Hochst.

Annual grasses with narrow, usually flat leaves. Panicle dense, spiciform. Spikelets cylindric, 5- to 6- flowered, the florets closely imbricate, the lower 2 or 3 fertile, the upper reduced to sterile lemmas. Glumes membranous, many-nerved, occasionally subequal, much shorter than the lower floret. Lemma (fertile) coriaceous, linear, concave, many nerved, truncate-lacerate with 5-8 dorsal awns, the awns dilated and contorted at the base ; palea as long as the lemma but narrower, 2-keeled, 2-dentate. Ovary hirsute at the angles ; stigmas 2, sessile, plumose.

#### 1. *Boissiera squarrosa* (Soland ) Nevski

*Boissiera squarrosa* (Soland.) Nevski in Acta Univ. As. Med. ser. VIII b, Bot. Fasc. 17, 30 (1934).

*Boissiera bromoides* Hochst ex Steud. in Flora 21 : 1 (1838).



*Pappophorum squarrosum* Soland. Russ. Allep. ed. II. ii, 244 (1794).

*Boissiera pumilio* (Trin.) Hack. in Denkschr. Acad. Wien 1 : 9 (1885).

*Pappophorum pumilio* Trin. Act. Petr. 92 (1830).

Annual. Culms solitary or densely tufted, 5-15 cm. high erect or geniculate-ascending, simple or branched, leafy up to the middle; nodes glabrous. Leaf-blades linear, up to 15 cm. long, 5 mm. broad, flat, striate, villous on both surfaces, margins scabrid; sheaths tight, terete, striate, sparsely hairy; ligules short, truncate-lacerate. Panicle subcapitate, obovate, spiciform, dense, up to 4 cm. long; axis villous; branches short, hairy, little branched; pedicels shorter than the spikelets, pubescent. Spikelets 5- to 6-flowered, wedge-shaped, up to 15 mm. long, the two upper florets rudimentary. Glumes subequal, subulate-lanceolate, 8 mm. long or the lower slightly shorter; lower acute, upper obtuse, usually mucronate. Lemma 8 mm. long, 7-nerved, more or less hirsute on the dorsal surface, 7-awned, awns dorsal, flat at the base, subcontorted, antorsely scabrid throughout, at length divergent, subequal to the lemma; awns of the sterile lemmas much shorter. Palea subequal, hairy along the keels and on the surface. Anthers 0.5 mm. long. Caryopsis 6.5 mm long.



Fig. 93. —*Boissiera squarrosa*

Killa Abdullah, Duthie; Hindu Bagh, Harsukh; Quetta. M. Nawaz, Asghar Ali.

### Tribe 3. Festuceae

Spikelets usually all alike, hermaphrodite rarely unisexual, 2- to many-flowered, laterally compressed, arranged in loose, contracted or spike-like panicles, rarely in spikes or racemes; rachilla usually disarticulating above the glumes and between the lemmas, rarely below the glumes. Glumes persistent, similar or the lower smaller, usually shorter than the lowest lemma; lemmas membranous to coriaceous, often herbaceous-membranous, usually 5- to many-nerved, rarely 3-nerved, awnless or awned from the entire or 2-lobed tip or just below the tip, rarely several-awned, the awn straight or curved, not geniculate.

KEY TO THE GENERA

1. Stigmas 2, covered with whorls of very short hairs, on an elongated free style protruding from the summit of the lemmas. Spikelets 1- to 3- fld. Inflorescence spike-like, cylindrical .....1. *Fingerhuthia*  
 Stigmas 2, plumose, relatively short, sessile or on a short style, protruding laterally from the lemmas .....2
2. Lemmas essentially uniform, the upper ones not forming a convolute mass. .... 3  
 Lemmas dissimilar, the 2 or 3 uppermost empty and convolute into a single club shaped mass ; spikelets plump ; tip of lemma 2-fid ; sheaths closed .....2. *Melica*
3. Spikelets of two forms, fertile spikelet of each fascicle of spikelets 1- to 3-fld., terminal ; the sterile spikelets with obtuse lemmas and forming a sort of involucre around the fertile spikelet .....  
 ..... 3. *Lamarckia*  
 Spikelets uniform, all fertile.....4
4. Spikelets and lemmas about as broad as long, more or less cordate at the base, awnless ; florets closely imbricate, horizontally spreading ..... 4. *Eriza*  
 Spikelets different, narrow.....5
5. Stigmas 2, inserted below the hairy apex of the ovary.....6  
 Stigmas 2, inserted at the top of the ovary.....7
6. Spikelets strongly flattened, the lemmas compressed-keeled .....5. *Ceratochloa*  
 Spikelets terete or somewhat flattened, but the lemmas rounded on the back, at the most keeled towards the apex .....6. *Bromus*
7. Lemmas keeled on the back.....8  
 Lemmas rounded on the back, at least in the lower half. .... 11
8. Spikelets in more or less lax panicles.....9  
 Spikelets crowded in dense inflorescences.....10
9. Lemmas acute, mostly with a web of long hairs at the base...7. *Poa*  
 Lemmas acuminate or awned, 3-nerved; glabrous at the base.....  
 .....8. *Eremopoa*
10. Spikelets borne in dense, one-sided clusters, those united in a lobed panicle.....9. *Dactylis*

- Spikelets very closely imbricate in short spikes, those united into racemes or heads.....10. *Aeluropus*
11. Spikelets borne on very short pedicels on opposite sides of a spike-like raceme ; lemmas awned.....12  
Spikelets arranged in panicles or spike-like racemes, but in the latter case spikelets awnless.....13
12. Spikelets with 2 glumes.....11. *Brachypodium*  
Spikelets with the inner glume suppressed.....12
13. Nerves of the lemma parallel, not converging at apex or but slightly so. Spikelets awnless.....14  
Nerves of lemma converging towards the summit, the lemmas narrowed at the apex.....17
14. Spikelets in a simple or compound spike, sessile or subsessile, inserted in two rows on one side of the axis.....15  
Spikelets in open or contracted panicles.....16
15. Florets divergent at the summit ; lemma 2-dentate, mucronate-aristate at the tip.....13. *Nardurus*  
Florets not divergent ; lemma truncate at the apex ; spikelets subsessile ; culms leafy up to the spike.....14. *Sclerochloa*
16. Nerves prominent ; lodicules united ; styles distinct.....(*Glyceria*)  
Nerves faint ; lodicules distinct ; stigmas sessile.....15. *Puccinellia*
17. Hilum punctate ; spikelets awnless, smooth, on short thick pedicels in stiff panicles.....16. *Scleropoa*  
Hilum linear.....18
18. Spikelets in a panicle. Lemmas awned or pointed, not covered with tubercles.....19  
Spikelets in a simple or compound spike. Lemmas awnless, covered with coarse hyaline tubercles.....17. *Castellia*
19. Perennial. Glumes subequal. Pedicels of the spikelets short, slender. Stigmas long, laterally exerted during flowering.....20  
Annual, as a rule. Glumes unequal. Pedicels of the spikelets thickened and compressed. Stigmas short, remaining included during flowering.....18. *Vulpia*
20. Glumes white membranous.....19. *Leucopoa*  
Glumes green herbaceous.....20. *Festuca*

1. **Fingerhuthia** Nees

Erect, rigid, annual or perennial grasses, with the habit of *Phleum*. Inflorescence a dense, cylindrical or oblong, solitary spiciform panicle; the fertile spikelets falling entire at maturity, the basal sterile spikelet persistent and reduced to subulate glumes. Spikelets strongly laterally compressed, 1- to 3-flowered, the lower floret bisexual or female, the intermediate, if present, male, the uppermost reduced to an empty lemma. Glumes subequal, rigidly membranous, keeled, 1-nerved, aristate. Lemma as long as the upper glume, oblong-lanceolate, obtuse, 5-nerved, mucronate or dorsally shortly awned; palea rigid, 2-keeled. Stamens 3. Lodicules obcordate. Stigmas covered with whorls of very short hairs, terminally exserted.

1. **Fingerhuthia affghanica** Boiss.

*Fingerhuthia affghanica* Boiss. Fl. Orient. 5 : 569 (1884) ; Hook. f., Fl. Brit. Ind. 7 : 306 (1896).

Perennial. Culms tufted, up to 40 cm. high, erect, 3 noded, simple, glabrous; nodes glabrous. *Leaf-blades* linear, up to 12 cm. long, 3 mm. broad, flat but rolled in drying, long acuminate, striate, glabrous, smooth; *sheaths* slipping from the culms, upper tight-terete, smooth, glabrous, sometimes turning purple, half as long as the internode; *ligule* represented by a short hairy rim. *Panicle* oblong, spiciform, 2.5-3 cm. long, 1 cm. wide, sometimes with a purplish tinge in the upper half; peduncle 2.5-7.5 cm. long, scab-

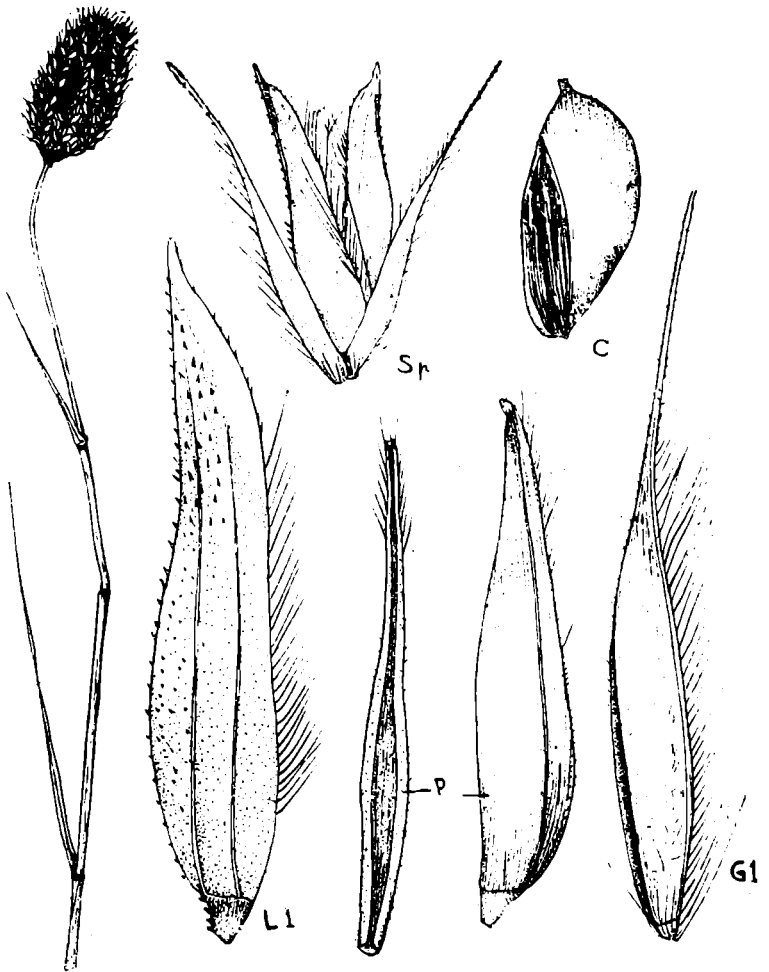


Fig. 94—*Fingerhuthia affghanica*

rid below the panicle; axis finely hairy, appearing tubercular after the spikelets have fallen off. *Spikelets* imbricate, flattened, 5 mm. long, 3-flowered, the lowest floret female, the middle male and the upper represented by an empty lemma; rachilla joints conspicuous, glabrous. *Glumes* subequal, rigidly membranous, lanceolate, keeled, 1-nerved, awned, awn straight, 2 mm. long; keel and margins long-ciliate. *Female floret*; lemma chartaceous, 5 mm. long, 5 nerved, mucronate, scabrid on the surface; keel glabrous but scabrid; margins ciliate in the lower half, scabrid towards the apex, hyaline along the margins and at the tip. *Palea* 4 mm. long, 2-keeled, keels scabrid below, ciliate above, and between the keels. *Caryopsis* 1.8 mm. long. *Male floret*; lemma similar but shorter, obsoletely mucronulate. *Anthers* 2 mm. long.

Peshawar, *J. L. Stewart*; Pab in Jhalawan, *Hughes-Buller*; Kohat, near Thal; Fort Munro, October, 1957!

## 2. *Melica* Linn.

Perennial grasses with narrow flat leaves and closed sheaths. Panicle spiciform or with spreading branches. Spikelets rather large, 2- to several-flowered, with one or two fertile florets; rachilla disarticulating below or above the glumes, produced beyond the perfect floret or florets and bearing 2 or 3 approximate gradually smaller empty lemmas, each enclosing the one above. Glumes somewhat unequal, thin membranous, scarious margined, obtuse or acute, sometimes nearly as long as the lower floret, 3- to 5-nerved, the nerves usually prominent. Lemmas convex, many-nerved, membranous to rather firm, scarious margined, awnless or sometimes awned between the 2-fid tip; callus not bearded. *Palea* 2-keeled, 2-dentate at the tip.

### KEY TO THE SPECIES

1. Panicle with spreading branches; rachilla jointed above the glumes ..... 1. *M. scaberrima*  
    Panicle spiciform; rachilla jointed below the glumes..... 2
2. Fertile lemmas quite glabrous; spikelets broadly oblong, few and distant..... 2. *M. nutans*  
    Fertile lemmas one or two, the lower with long spreading hairs on the back; spikelets crowded..... 3

3. Sheaths and both sides of the leaves with whitish hairs  
 .....3. *M. perisca*
- Sheaths and leaves completely glabrous.....4
4. Spikelets 8-9 mm. long ; lower glume  $\frac{1}{2}$  the upper.....  
 .....4. *M. inaequiglumis*
- Spikelets 6 mm. long; lower glumes  $\frac{2}{3}$ — $\frac{3}{4}$  the upper.....  
 .....5. *M. jacquemontii*

1. **Melica scaberrima** (Nees) Hook. f.

*Melica scaberrima* (Nees) Hook. f., Fl. Brit. Ind. 7 : 330 (1896).

*Festuca scaberrima* Nees ex Steud. Syn. Pl. Gram. 316 (1854).

*Glyceria scaberrima* Steud. Syn. Pl. Gram. 316 (1854).

Perennial. Culms up to 1.5 m. high, cylindrical, smooth ; nodes glabrous. Leaf-blades up to 25 cm. long, 8 mm. broad, flaccid, more or less scabrid. glabrous, margins scabrid ; sheaths tight, terete, margins hirsute ; ligules short, membranous, truncate, 2-auricled. Panicle open, occasionally contracted, rarely reduced to a subsimple raceme ; axis filiform, scabrid; branches 1- or 3 nate, distant, 5-12 cm. long, simple or branched and then bearing clusters of spikelets, horizontal, filiform, scabrid. Spikelets 3 to 5-flowered, 6-12 mm. long, pale green ; rachilla scaberulous. Lower glume 3.5 mm. long, ovate-lanceolate, 1 nerved. Upper glume 5 mm. long, ovate-lanceolate, 3-nerved. Lemma (fertile) 6-7 mm. long, narrowly lanceolate, 7- to 9-nerved. Palea 5.5 mm. long, scaberulous along the keels and on the surface. Anthers 1.5 mm. long.

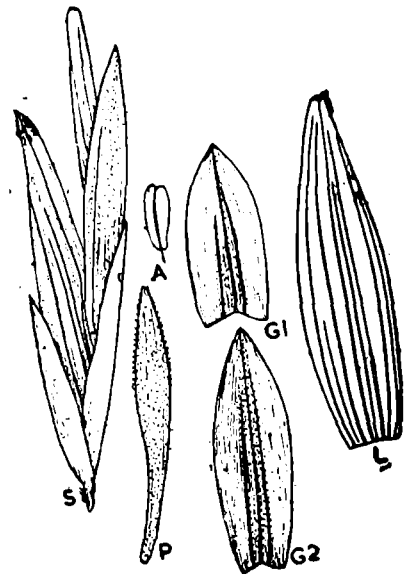


Fig 95. *Melica scaberrima*

Panther Hill, Thandiani, Hazara, 7000 ft., August 15, 1956, E. Nasir & R.R. Stewart ! Kagan ; Kalapani.

2. **Melica nutans** Linn.

*Melica nutans* Linn. Sp. Pl. 66 (1753); Hook. f., Fl. Brit. Ind. 7 : 330 (1896).

Perennial. Culms up to 45 cm. high. slender, inclined from a long

stoloniferous rootstock. *Leaf-blades* up to 25 cm. long, very narrow acuminate, sparsely hairy; *ligule* very short or 0. *Panicle* long racemiform, very lax, nodding or drooping; branches capillary, secund. *Spikelets* 2-flowered, broadly oblong, 6 mm. long, few, distant, very shortly pedicelled, pendulous. *Lower glume* cymbiform, 1-nerved, very obtuse. *Upper glume* cymbiform, 3-nerved, very obtuse. *Lemma* oblong, strongly many nerved, quite glabrous, scaberulous.

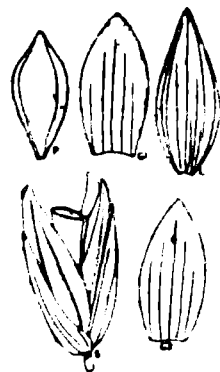


Fig. 96.—*Melica nutans*

It has been collected from Gulmarg by R.R. Stewart and is likely to occur on this side of the border as well.

### 3. *Melica persica* Kunth

*Melica persica* Kunth, Rev. Gram. 1 : 351 (1829).

*Melica cupani* var. *vestita* Boiss, Fl. Orient. 5 : 591 (1884).

Perennial. *Culms* densely tufted, 2- or 3-noded, erect or curved at the base, up to 40 cm. high, smooth and glabrous; nodes glabrous. *Leaf-blades* linear-acuminate, rather firm, flat, densely hairy on both surfaces, up to 15 cm. long and 2-3 mm. broad; *sheaths* tight, densely hairy, as long as or much longer than the internodes; *ligules* membranous, hyaline, 2 mm. long. *Panicle* spiciform, erect, up to 12 cm. long; axis very minutely scabrid; branches 1- or 2-nate, distant or crowded, erect, up to 3 cm. long. *Spikelets* 8-9 mm. long, with one or two fertile florets; rachilla smooth. *Lower glume* 4.5-5 mm. long, ovate-acuminate, 3-nerved, smooth and glabrous except on the keel in the upper half which is scabrid. *Upper glume* 7-9 mm. long, lanceolate, 5-nerved, smooth and glabrous. *Lower lemma* 6 mm. long, elliptic, many-nerved, scabrid along the keel in the lower half, dorsally hairy, hairs as long as the spikelet. *Palea* 4.5 mm. long, scabrid along the keels in the upper half. *Caryopsis* 2 mm. long; embryo 0.5 mm. long; hilum linear. Second lemma (when fertile) shorter and glabrous. *Sterile lemmas* forming a convolute mass at the tip of the rachilla.

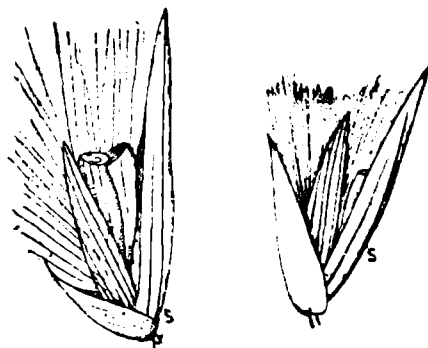


Fig 97.—*Melica persica*.

Quetta, M. Nawaz; Asghar Ali.

4. **Melica inaequiglumis** Boiss.

*Melica inaequiglumis* Boiss., Diagn. ser. I. vii, 124 (1846) ; Hook. f., Fl. Brit. Ind. 7 : 329 as Syn.

*Melica cupani* var. *inaequiglumis* Boiss. Fl. Orient. page 5 : (1884).

Perennial. *Culms* erect or geniculate-ascending, 2- or 3-noded, glabrous and smooth ; nodes glabrous. *Leaf-blades* linear-acuminate, up to 10 cm. long, 1.5 mm. broad, glabrous and rough, the *basal sheaths* loose and scarious, culm-sheaths as long as or shorter than the internode, rough and glabrous ; *ligule* membranous, hyaline, 2 mm. long. Panicle 6 cm. long, unilateral ; axis short, scabrid ; branches short, pubescent. *Spikelets* 8-9 mm. long, many-flowered, the two lower florets fertile ; rachilla joints distinct, smooth. *Lower glume* 4.5 mm. long, 2.4 mm. broad, ovate acute, 3 nerved, hyaline, smooth and glabrous. *Upper glume* lanceolate-acuminate 8-9 mm. long, 5-nerved, glabrous, more or less scabrid. *Fertile lemma* (lower) elliptic, 6 mm. long, many-nerved, dorsally hairy, hairs as long as the spikelet. *Palea* 4.5 mm. long ; keels scabrid in the upper half. *Caryopsis* 2 mm. long. Upper fertile lemma shorter, glabrous, 4 mm. long.

Kagan Valley, M.S. Zahoor.

4. **Melica jacquemontii** Dcne.

*Melica jacquemontii* Dcne. in Jacquem. Voy. Bot. 174 (1844) t. 175; Hook. f., Fl. Brit. Ind. 7 : 329 (1898) as Syn.

*Melica cupani* var. *breviflora* Boiss. Diagn. ser. I. vii, 124 (1844).

Perennial. *Culms* densely tufted, erect or geniculate-ascending, glabrous and smooth. *Leaf-blades* linear-acuminate, scabrid, up to 10 cm. long, 1.5 mm. broad ; *sheaths* tight, glabrous and rough ; *ligule* membranous, hyaline, 3-4.5 mm. long. *Panicle* 6.5 cm. long ; branches 1- or 2-nate, erect. *Spikelets* up to 6 mm. long, the lowest floret only fertile ; rachilla smooth. *Lower glume* 4 mm. long, 3-nerved, glabrous. *Upper glume* 6 mm. long, 5-nerved, glabrous. *Lemma* elliptic, 5 mm. long, many-nerved, dorsally hairy, hairs as long as the spikelet.

Chitral ; Zapotili, Shokor Shal, *Per Wendelbo* ; Ziarat.

3. **Lamarckia** Moench.

A small annual, tufted grass with flat leaves. Panicle unilateral,



rather dense. Spikelets dimorphic, fertile, crowded on the drooping branches of a simple secund nodding panicle; terminal spikelet of each branchlet fertile, few-flowered, surrounded by the empty glumes and by neuter spikelets consisting of many obovate convolute erose lemmas. Fertile spikelet; glumes subequal, subulate-lanceolate, 1-nerved subaristate, persistent. Lemma shorter, ovate, convolute, dorsally awned below the 2-fid tip; upper lemma terminating the slender rachilla, neuter, long-awned. Palea narrow, 2-fid, 2-keeled.

1. **Lamarckia aurea** (Linn.) Moench.

*Lamarckia aurea* (Linn.) Moench., Meth. 201 (1794); Hook. f., Fl. Brit. Ind. 7: 307 (1896).

*Cynosurus aureus* Linn., Sp. Pl. 72 (1753).

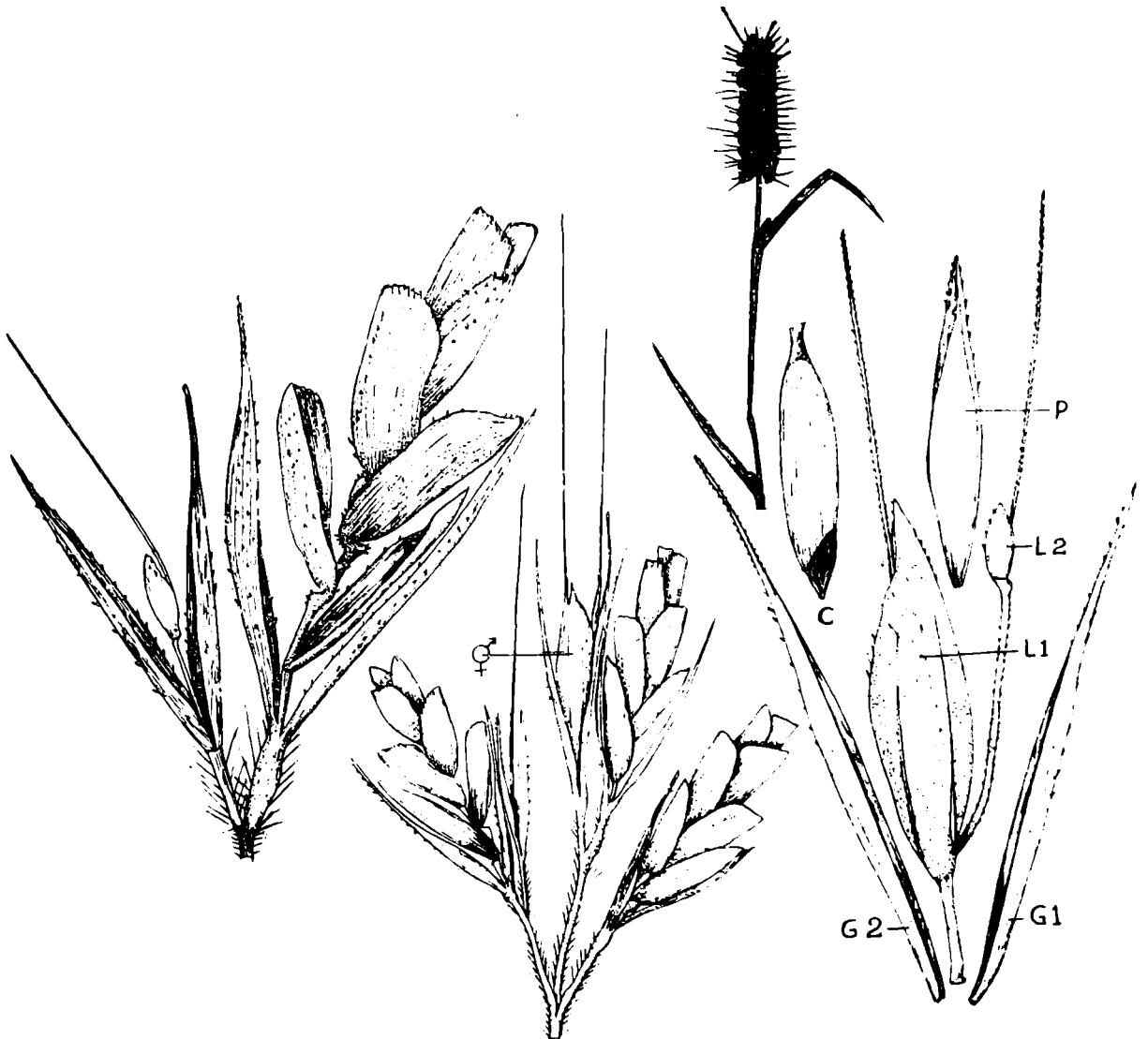


Fig. 98.—*Lamarckia aurea*.

Annual. Culms densely tufted, up to 25 cm. high, erect or geniculate-ascending, glabrous and smooth, occasionally scabrid below the panicle. Leaf-blades up to 14 cm. long, 1 cm. broad, glabrous, margins scabrid; sheaths compressed, keeled, the lower loosely imbricate, the upper slightly dilated, glabrous and rough; ligule oblong, up to 10 mm. long, glabrous, obtuse, lacerate. Panicle more or less unilateral, oval or oblong, up to 10 cm. long, 3 cm. wide, rather dense; axis erect, smooth or slightly scabrid; branches short, solitary, branched at the base; branchlets bearing clusters of spikelets; each cluster formed of 4 sterile spikelets surrounding a single fertile spikelet. Sterile spikelets linear, 6-7 mm. long, formed of 2 membranous, lanceolate glumes and 10-12 distichous lemmas; lemmas imbricate, oboval, membranous, 3-nerved, rounded and denticulate at the apex; one of the sterile spikelets in each cluster formed of 2 glumes and very shortly pedicelled, 1-nerved, oblong, 2-fid lemma which is long-awned from the sinus. Fertile spikelet; glumes subequal, 4.5-5 mm. long, linear-lanceolate, membranous, scabrid on the keels, acuminate or aristulate at the apex. Florets 2, the lower bisexual and the upper rudimentary. Bisexual floret pedicelled, by the elongation of the rachilla by 1 mm. above the glumes. Lemma oval-lanceolate, shortly hispid towards the apex, the rest glabrous and smooth, membranous, 5-nerved, 3 mm. long, awned from the sinus; awn 7 mm. long. Palea equalling the lemma, 2-keeled; keels pubescent-scabrid towards the apex. Caryopsis 2 mm. long. Upper floret rudimentary, long-pedicelled by the elongation of the internode, scabrid; lemma very much reduced, 1-nerved, oblong, 2-fid, awned from the sinus; awn 5 mm. long.

Peshawar, 22. 4. 56, S. Ahmad! Khyber Pass, Akhlaq Ahmad!  
Attock, Jhalar, R.R. Stewart.

#### 4. **Briza** Linn.

Annual or perennial grasses with convolute leaves. Spikelets many-flowered, laterally compressed, pendulous in a lax or contracted panicle. Glumes subequal, 3- to 5-nerved, persistent. Lemmas boat-shaped or saccate, closely imbricate, obtuse or acute or shortly awned, 5- to many-nerved, terminal often empty; palea hyaline, broad, 2-nerved. Caryopsis closely invested by the palea.

## KEY TO THE SPECIES

- Spikelets 3-4 mm. long, 4-5 mm. broad .....1. *B. minor*  
 Spikelets 5-7 mm. long, 4-7 mm. broad ..... 2. *B. media*  
 Spikelets 15-20 mm. long, 10 mm. broad ..... 3. *B. maxima*

1. **Briza minor** Linn.

*Briza minor* Linn. Sp. Pl. 70 (1753).

A loosely tufted annual, 10-45 cm. high. *Culms* erect or slightly geniculate at the base. *Leaf-blades* 5-8 cm. long, 2-4 mm. broad, glabrous; *sheaths* terete, smooth and glabrous; *ligules* 3-6 mm. long, membranous, hyaline. *Panicle* open, erect, broadly oval, 5-15 cm. long. *Spikelets* 4- to 8-flowered, 3-4 mm. long, 4-5 mm. broad, orbicular to triangular ovate. *Lemmas* very broad, cordate at the base, rounded at the apex and on the back, 7- to 9-nerved. *Palea* with 2 narrowly winged keels. *Anthers* 0.6 mm. long.

Lahore; Gujranwala, etc. In wheat fields.

2. **Briza media** Linn.

*Briza media* Linn. Sp. Pl. 70 (1753).

Perennial, with short rhizomes bearing vegetative shoots. *Culms* erect up to 50 cm. high. *Leaf-blades* 5-10 cm. long, 2-3 mm. broad, scabrid; *sheaths* tight, smooth; *ligules* 1-2 mm. long, membranous, hyaline. *Panicle* loose, more or less pyramidal, up to 15 cm. long. *Spikelets* very broadly elliptic to broadly ovate, 5-7 mm. long and 4-7 mm. wide, 5- to 9-flowered. *Lemmas* about 4 mm. long, cordate at the base, 7- to 9-nerved. *Anthers* 2-2.5 mm. long.

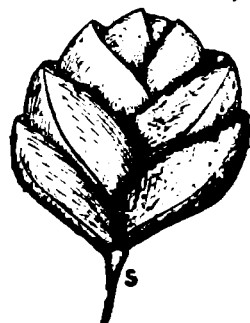


Fig. 99.—*Briza media*.

Kishanganga valley, near Bhagtaur, July 26, 1939, R.R. & I.D. Stewart.

3. **Briza maxima** Linn.

*Briza maxima* Linn. Sp. Pl. 70 (1753).

Annual. *Culms* loosely tufted, erect, up to 50 cm. high. *Leaf-blades* 5-20 cm. long, 3-8 mm. wide; *sheaths* rounded, smooth; *ligules* 3-5 mm. long. *Panicle* loose, nodding, 3-10 cm. high, branches bearing 1-3 spikelets. *Spikelets* ovate to oblong, 15-20 mm. long, 10 mm. wide, 8- to 10-flowered. *Lemmas* 8 mm. long, sparsely hairy on the back, 11-nerved. *Anthers* up to 2 mm. long. Cultivated in gardens.

5. **Ceratochloa** Beauv.

Annual or perennial grasses with flat, linear leaves. Inflorescence

an erect or nodding panicle. Spikelets strongly flattened, many-flowered; rachilla jointed above the glumes and between the lemmas. Glumes and lemmas compressed-keeled, 5- to many-nerved, awned or awnless. Caryopsis deeply furrowed ventrally. Ovary bearing a lobed hairy apical appendage, with the two stigmas inserted on one side at the base of the latter.

1. ***Ceratochloa unioides* (Willd.) DC.**

*Ceratochloa unioides* (Willd.) DC. Cat. Hort. Monsp. 92.

*Bromus unioides* H.B. & K. Nov. Gen. et Sp. 1 : 151 (1815).

*Ceratochloa cathartica* (Vahl) Henrard in Blumea 4 : 498 (1911).

*Bromus catharticus* Vahl, Symb. Bot. 2 : 22 (1791).

Annual. Culms tufted, erect or more often geniculate-ascending.

*Leaf-blades* linear, acute, up to 20 cm. long, 5 mm. broad minutely scabrid on both surfaces, glabrous, margins cartilaginous, minutely toothed; *sheaths* tight, glabrous and smooth; *ligule* 3-4 mm. long, membranous, convex or slightly erose. *Panicle* few-flowered, lax; rachis and branches scabrid; branches rarely divided, each crowned with a solitary spikelet. *Spikelets* strongly compressed, ovate to ovate-lanceolate, up to 2.5 cm. long, 7 mm. broad, 3- to 6- flowered. *Lower glume* lanceolate, 8-9 mm. long, 5-nerved, keeled; keels scabrid. *Upper glume* 10-12 mm. long, 9-nerved, tip blunt, keel scabrid. *Lemmas* 12-15 mm. long, broadly lanceolate, chartaceous, strongly keeled, shortly awned, 11- to 13-nerved; callus shortly hairy; rachilla ciliate on the



Fig. 100.—*Ceratochloa unioides*.

frontal angle, produced and crowned with a sterile floret. *Palea* 4-10 mm. long, keeled ; keels scabrid. *Anthers* 6 mm. long.

Introduced, now occasionally found as an escape in gardens and shady places. It has been collected from Lahore and Murree.

6. **Bromus** Linn.

Annual or perennial grasses with narrow, usually flat leaves. Panicle loose or contracted. Spikelets many-flowered, terete or somewhat flattened ; uppermost usually imperfect ; rachilla jointed above the glumes and between the lemmas, not produced beyond the uppermost floret. Glumes persistent, unequal, acute to lanceolate ; lower 1 - to 7-nerved; upper 3- to 9-nerved. Lemmas acuminate or shortly cleft, rounded on the back, at most keeled towards the top, 5- to 13 nerved, usually awned ; awns several, rarely 3 (*B. danthoniae*), terminal or subterminal, straight or curved rarely geniculate. *Palea* 2-fid or 2-toothed, with ciliate keels, as long as or shorter than the lemma. Ovary bearing a lobed hairy apical appendage, with the 2 stigmas inserted on one side at the base of the latter.

KEY TO THE SPECIES

1. Lower glume 1-nerved, upper 3-nerved.....2  
     Lower glume 3- to 5-nerved, upper 5- to 9-nerved ..... 4
2. Annuals with long-awned spikelets ..... 3  
     Perennials with short-awned spikelets ..... 4. *B. inermis*
3. Spikelets 4-6 mm. long.....1. *B. gracillimus*  
     Spikelets more than 12 mm, long.....3. *B. tectorum*
4. Awn geniculate, twisted at the base ; lemmas all or the upper only  
     3-awned.....2. *B. danthoniae*  
     Awn straight or divaricate, not twisted and geniculate ; lemmas  
     always 1-awned.....5
5. Panicle open, the branches spreading, lax or flexuous .....  
     .....; .....5. *B. japonicus*  
     Panicle contracted, rather dense, the branches short, erect or  
     ascending..... 6
6. Panicle axis smooth ; lemmas 6 mm. long .. ..... 6. *B. scoparius*  
     Panicle axis hairy ; lemmas more than 6 mm. long.....7
7. Lemmas 7-8 mm. long, awn as long as the lemma.....7. *B. mollis*  
     Lemmas 12-18 mm. long, awn 18-25 mm. long.....8. *B. oxyodon*

1. *Bromus gracillimus* Bunge

*Bromus gracillimus* Bunge in Mem. Sav. Etr. Petersb. 7 : 527 (1851).

*Bromus crinitus* Boiss., & Hoehn. in Boiss. Diagn. ser. I. xiii, 64 (1852) ; Hook. f., Fl. Brit. Ind. 7 : 359 (1896).

*Neuskiella gracillima* (Bge.) K. & Vved. in Acta Univ. As. Med. ser. VIII b, Bot. Fasc., 17, 22 (1934).

Annual. Culms 15-45 cm. high, erect, smooth and glabrous. Leaf-blades 4-10 cm. long, 2-2.5 mm. broad, pilose or velvety ; sheaths velvety ; ligules ovate, lacerate. Panicle 10 cm. long, erect ; axis smooth ; branches 3- to 5-nate, capillary, erect or spreading, up to 5 cm. long. Spikelets 4-5 mm. long, elliptic-oblong, 2- to 5-flowered ; rachilla scabrid. Lower glume 3-3.5 mm. long, 1-nerved, hyaline except along the middle. Upper glume 4-5 mm. long, 3-nerved, broadly lanceolate, tip and margins hyaline. Lemmas clavate, not imbricating, 4 mm. long, oblong, strongly involute, faintly 5-nerved, awned ; awn 12-17 mm. long, straight. Anthers 3-3.5 mm. long.

Quetta, Asghar Ali ; Baltistan.

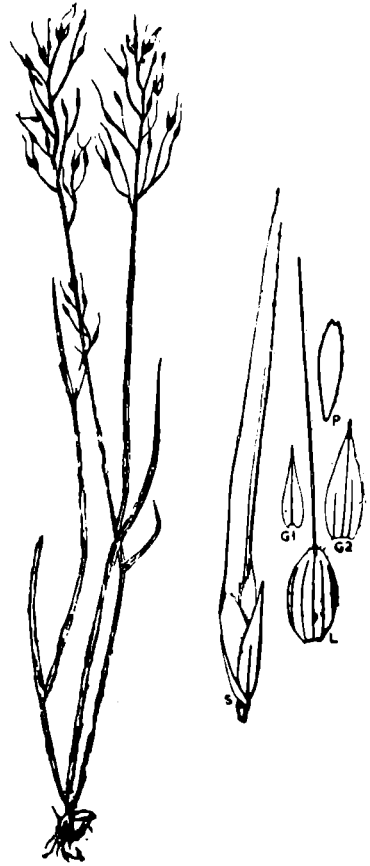


Fig. 101.—*Bromus gracillimus*.

2. *Bromus danthoniae* Trin.

*Bromus danthoniae* Trin. in C. A. Mey., Pfl. Cauc. 24 (1831) ; Hook. f., Fl. Brit. Ind. 7 : 362 (1896) sub *macrostachys*.

*Boissiera danthoniae* A. Br., Ind. Sem. Hort. Berol. 3 (1857).

*Triniusia danthoniae* Steud., Syn. Pl. Gram. 328 (1854).

Annual. Culms 15-45 cm. high, erect or ascending, glabrous or

pubescent. *Leaf-blades* 5-15 cm. long, narrowly linear, acute, more or less hairy or velvety; young sheaths villous or velvety; *ligules* ovate, lacerate. *Panicle* up to 12.5 cm. long; axis glabrous or pubescent; branches solitary or the lower 3- to 4-nate, unequal, rarely 2.5 cm. long, simple, 1- to 2-spiculate, strict, suberect, scabrid. *Spikelets* 2.5-4.5 cm. long, 5-7 mm. broad, elliptic to linear-oblong, densely 6- to 20-flowered; rachilla pubescent. *Lower glume* 5-7 mm. long, broadly lanceolate,

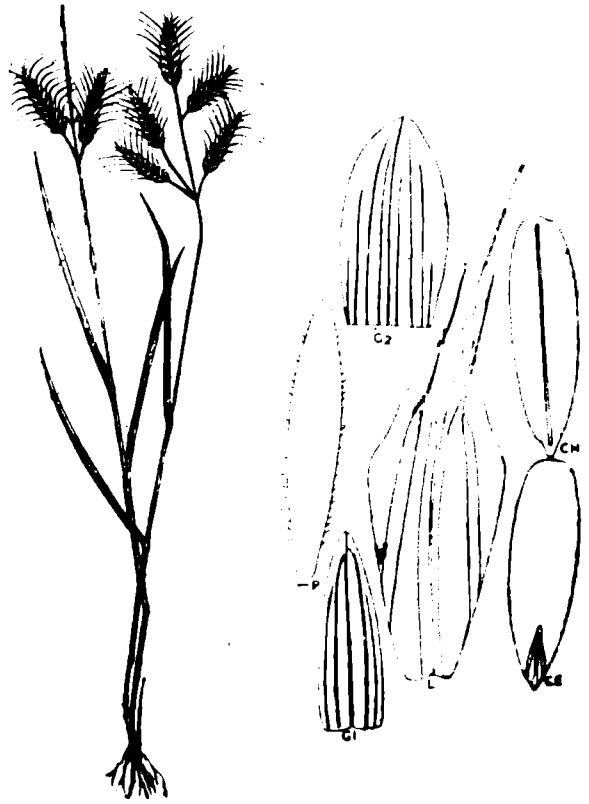


Fig. 102.—*Bromus danthoniae*.

5-nerved, villous velvety or scabrid, tips and margins usually scarious and dull white. *Upper glume* similar, oblong, 8.5 mm. long, 7- to 9-nerved. *Lemmas* 10-12 mm. long elliptic to obovate-oblong, subacute, 2-toothed, 9- to 11-nerved, margins inflexed from above the middle, all or the upper only 3-awned; lateral awns 3-4 mm. long, the median 12-18 mm. long, infra apical, base stout, finally twisted and strongly recurved. *Palea* 9 mm. long, with keels long ciliate. *Anthers* 1.5-1.8 mm. long. *Caryopsis* 8 mm. long.

Quetta, Hamilton, Munro, Asghar; Tor Shor near Quetta, J.J. Norris, M. Nawaz.

### 3. *Bromus tectorum* Linn.

*Bromus tectorum* Linn., Sp. Pl. 77 (1753); Hook. f., Fl. Brit. Ind. 7: 359 (1896).

Annual. *Culms* up to 45 cm. high, erect or ascending, glabrous or pubescent. *Leaf-blades* 7.5 cm. long, 3 mm. wide, linear, acute, flaccid,

hairy; *sheaths* hairy rarely glabrous; *ligule* ovate, lacerate. *Panicle* flaccid, nodding, up to 12.5 cm. long; axis smooth; branches 3- to 6-nate, capillary, flexuous, often decurved with erect tips, sparingly divided. *Spikelets* green, somewhat cuneiform in shape, 1.25-2 cm. long, loosely few to many-flowered; rachilla joints 3 mm. long, scabrid. *Lower glume* lanceolate, acute, 5-8.5 mm. long, 1-nerved, tip and margins hyaline. *Upper glume* oblong-lanceolate, 3-nerved, 8-12.5 mm. long, 2-fid at the apex. *Lemma* 12.5-14 mm. long, oblong-lanceolate, acutely 2-fid, lobes 3 mm. long, 7-nerved, puberulous or scabrid all over, tips and margins hyaline, awned from the tip or below it; awn up to 2 cm. long, straight or slightly curved. *Palea* 10 mm. long, 2-keeled, loosely long-ciliate on the keels. *Anthers* 1 mm. long.



Fig. 103.—*Bromus tectorum*.

Bolan Pass, *Griffith, Stocks*; Quetta, *Lace, Hamilton, Duthie, M. Nawaz*; Shebo near Quetta, *Munro*; Kanozoi Murgha, *Harsukh*; Harboi Hills, *Hughes Buller*; Chitral: Barum Gol; Gilgit; Astor; Baltistan; Rawalpindi, *Wingate*. Common usually above 6000 ft.

### ***Bromus inermis* Hook. f.**

*Bromus inermis* Hook. f., Fl. Brit. Ind. 7: 357 (1896) non Leyss.

Perennial, with a short creeping rhizome. *Culms* up to 1.2 m. high, erect or geniculate-ascending, smooth and glabrous. *Leaf-blades* flat, flaccid, linear-acuminate, 30-45 cm. long, 4-15 mm. broad, covered with scattered hairs on the upper surface, lower surface scaberulous; *sheaths*



more or less keeled, tight; *ligule* very short, truncate, lacerate. *Panicle* large 15-20 cm. long, open or contracted, erect or nodding; axis smooth; lower branches 3- to 4-nate, simple or sparingly branched, 5-12.5 cm. long. *Spikelets* linear-oblong, up to 5 cm. long, pale green rarely purplish, loosely 5- to 12-flowered; rachilla pubescent. *Lower glume* lanceolate, keeled, 6-8 mm. long, 1-nerved. *Upper glume* 8-10 mm. long, oblong-lanceolate, sub-acute, 3-nerved. *Lemmas* 8-12 mm. long, oblong-lanceolate, obtuse, 5- sub 7-nerved, hairy on the back, tip and upper margins hyaline; awn up to 4 mm. long or absent. *Palea* 10 mm. long, densely hairy along the keels and on the surface. *Anthers* 4-5 mm. long.



Fig. 104. — *Bromus inermis*.

Kagan Valley : Kagan, Sharhan ; Gilgit ; Chitral.

### 1. *Bromus japonicus* Thunb.

*Bromus japonicus* Thunb., F<sup>l.</sup> Jap. 52 (1784).

*Bromus patulus* Mert. & Koch in Roehl, Deutschl.-Fl. 1 : 685 (1829) ; Hook. f., Fl. Brit. Ind. 7 : 361 (1896).

*Bromus arvensis* Duthie, Grasses N. W. India, 43 (1883).

*Bromus japonicus* var. *vestitus* (Schrud.) Henr. in Blumea 4 : 502 (1941).

Annual. *Culms* 30-60 cm. high, erect, glabrous or puberulous. *Leaf-blades* up to 30 cm. long, 6 mm. wide, pilose; *sheaths* pilose; *ligules* short, ovate, toothed. *Panicle* broadly pyramidal, up to 20 cm. long, somewhat drooping; axis glabrous or pubescent; branches solitary or 3- to 5-nate, 1- to 4-spiculate, slender, flexuous, lower up to 15 cm. long.

simple or branched, spreading or nodding. *Spikelets* turgid, densely or loosely 7- to 12- flowered, 1.8-2.5 cm. long; rachilla joints distinct, 1.15 mm. long, scabrid. *Lower glume* 6-8 mm. long, lanceolate, acute, pubescent, 3-nerved, tip and upper margins hyaline. *Upper glume* 8-10 mm. long, lanceolate, acute, pubescent, 3-nerved, tip and upper margins hyaline. *Upper glume* 8-10 mm. long, obtuse, pubescent,

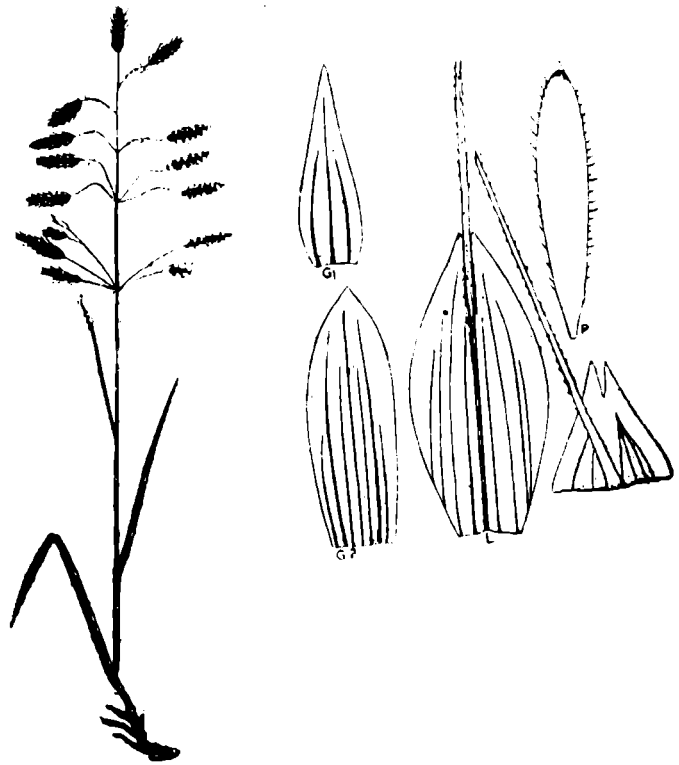


Fig. 105— *Bromus japonicus*.

7-nerved. *Lemmas* broad, obtuse, hairy, 8-10 mm. long, 7-nerved, 2-toothed, awned; flexuous, usually somewhat divergent in drying, 8-16 mm. long. *Palea* long and loosely ciliate on the keels. *Anthers* 1-1.13 mm. long.

Very common in the lower hilly parts.

## 6. *Bromus scoparius* Linn.

*Bromus scoparius* Linn., Cent. Pl. 1 : 6 (1755); Hook. f., Fl. Brit. Ind. 7 : 360 (1896).

Annual. *Culms* 8-45 cm. high, erect, slender, glabrous. *Leaf-blades* 5-9 cm. long, 4 mm. broad, linear with scattered stiff hairs; *sheaths* tight, glabrous, hairy at the mouth; *ligule* short, truncate, toothed. *Panicle* erect, compact, 2.5-4.5 cm. long, oblong to obovate; axis smooth; branches solitary or 2-nate, short, crowded, scaberulous. *Spikelets* densely fascicled, 8-12 mm. long, 2.5-3.5 mm. broad, 5- to 8-flrd.; rachilla scaberulous. *Lower glume* ovate lanceolate, 3.5 mm. long, acute, 3- to 5-nerved. *Upper glume* 6 mm. long, 5- to 7-nerved. *Lemmas* oblong-obtuse, 6 mm. long, minutely 2-fid, 7- sub 9-nerved; awn slender, about 6 mm. long, at

length spreading. *Palea* obtuse; keels loosely long-ciliate. *Anthers* 0.5-0.6 mm. long.

Gilgit.

### 7. *Bromus mollis* Linn.

*Bromus mollis* Linn. Sp. Pl. ed. 2, 112 (1762); Hook. f., Fl. Brit. Ind. 7: 369 (1836).

*Serrafalcus mollis* (Linn.) Parl. Pl. Rar. Sic. 2: 11 (1840).

Annual. *Culms* 15-45 cm high, erect or ascending, villous to glabrous.

*Leaf blades* 37-10 cm. long, linear acute, flaccid, subhirsute above, pubescent below; *sheaths* velvety or softly hairy; *ligules* very short, glabrous or hairy, denticulate. *Panicle* compact or loose but contracted, ovate to oblong, 2.5-15 cm. long, erect; axis hairy; branches 3- to 6-nate, scabrid or softly pubescent. *Spikelets* ovate oblong to elliptic,



Fig. 106.—*Bromus mollis*.

12-18 mm. long, 5-6 mm. broad, densely 5- to 12- flowered; rachilla scaberulous. *Lower glume* 6-7.5 mm. long, ovate-lanceolate, acute or mucronate, 5-nerved, midrib percurrent. *Upper glume* 8 mm. long, elliptic-oblong, 7- to 9-nerved. *Lemmas* 7.5-8 mm. long, broadly subobovate, obtuse, pubescent, shortly 2-lobed, 7-nerved; awn subterminal, as long as or somewhat shorter than the lemma. *Palea* obtusely 2-lobed; keels loosely long-ciliate. *Anthers* 1.5-2 mm. long.

Swat, May 1953, *Shaukat*! Murree, Sep. 1957, *Asghar*!

8. **Bromus Oxyodon** Schrenk

*Eromus oxyodon* Schrenk, Enumer. Pl. Nov. 2 : 1 ; Hook. f., Fl. Brit. Ind. 7 : 361 (1896).

Annual. Culms 15-45 cm. high, erect or ascending, pubescent. Leaf-blades 5-12 cm. long, linear, hairy or velvety ; sheaths villous ; ligules ovate, lacerate. Panicle up to 12.5 cm. long, contracted, erect ; axis pubescent ; branches 2- to 5-nate, unequal, suberect, rarely nodding, scabrid, simple, 1- to 3-spiculate. Spikelets 3.7 cm. long, 3-4 mm. wide, densely 5- to 10-flowered ; rachilla puberulous. Lower glume narrow lanceolate, scabrid with appressed hairs, 8-10 mm. long, 1- to 3-nerved. Upper glume oblong, lanceolate, 11-14 mm. long, 5-nerved, glistening with appressed hairs. Lemmas 12-18 mm. long, 3-3.5 mm. broad, oblong-lanceolate, margins inflexed below the middle, subacute, 2-toothed, 7- to 9-nerved ; awn 18-25 mm. long, infra-apical, nearly straight or moderately curved. Palea with loosely long-ciliate keels.

Gilgit : Kalapani Hills, 13.8.52, A.H. Khan ! Baltistan.

7. **Poa** Linn.

Annual or perennial grasses. Spikelets 2- to 6-flowered, in loose or contracted panicles ; rachilla jointed above the glumes and between the lemmas, Glabrous or minutely hairy. Florets all bisexual or the upper imperfect or female. Glumes thin, membranous, sometimes keeled, acute or obtuse, 1- to 3-nerved. Lemmas membranous, sometimes rather firm, 5- to 7-nerved, awnless ; callus short, obtuse, often with a tuft of long wool. Paleas shorter than the lemmas, 2-keeled. Ovary glabrous ; styles short, free ; stigmas plumose, laterally exerted. Caryopsis often grooved, free or adherent to the palea ; hilum punctiform, basal.

## KEY TO THE SPECIES

1. Culms without a bulbous thickening at the base.....2  
Culms with a bulbous thickening at the base.....21
2. Keels of palea pilose.....3  
Keels of palea simipilose or scabrid .....6
3. Wool copious : lemmas hairy between the nerves.....1. *P. nepalensis*  
Wool absent ; lemmas not hairy between the nerves.....4

4. Lemmas ciliate on the lateral nerves and on the keel ; anthers 1.2-1.6 mm. long .....2. *P. supina*  
 Lemmas ciliate along all the nerves and on the keel.....5
5. Anthers 0.2-0.3 mm. long.....3. *P. infirma*  
 Anthers 0.6-0.8 mm. long.....4. *P. annua*
6. Keels of palea semipilose.....7  
 Keels of palea scabrid.....9
7. Lemmas silky between the nerves ; lower glume 3-nerved ; perennials.....8  
 Lemmas glabrous between the nerves ; anthers 1 mm. long ; lower glume 1-nerved ; a slender annual.....5. *P. stewartiana*
8. Spikelets broadly ovate ; leaves all collected at the base of the plant..... 6. *P. alpina*  
 Spikelets oblong ; panicle spreading : a stoloniferous perennial with leafy culms... ..7. *P. stapfiana*
9. Anthers 2 mm. long or over.....10  
 Anthers under 2 mm. long.....15
10. Ligule of the topmost leaf not over 1 mm. ; lemma conspicuously 5-nerved.....11  
 Ligule of the topmost leaf over 2 mm. long ; lemma inconspicuously 5-nerved.....13
11. Lower glume 3-nerved ; ligule 0.5 mm. long.....8. *P. nemoralis*  
 Lower glume 1-nerved ; ligule over 1.5 mm. long.....12
12. Lemmas perfectly glabrous.....9. *P. aitchisoni*  
 Lemma ciliate, at least along the nerves.....10. *P. polycolea*
13. Lemmas smooth, shining ; lower glume 3-nerved ; culms scabrid below the panicle ; lower branches of the panicle 2-nate .....11. *P. sterilis*  
 Lemmas 4-5 mm. long, scabrid in the upper half, pubescent below ; glumes and lemmas dull .....14
14. Upper glume 3-3.5 mm. long ; basal leaves setaceous ; rachilla joints not conspicuous.....12. *P. pagophila*  
 Upper glume 4-5.5 mm. long ; basal leaves flat ; rachilla joints conspicuous.....13. *P. falconeri*

- 15 Lower glume longer than the spikelet or atleast the lower lemma ; anthers less than 1 mm. long.....14. *P. setulosa*  
 Lower glume definitely shorter than the lower lemma.....16
16. Panicle narrow ; lowest branches 2- rarely 3-nate .....17  
 Panicle spreading ; lowest branches of the panicle 3- to 5-nate ;  
 rhizome extensive .....18
17. Plants very glaucous.....15. *P. litwinoviana*  
 Plants not at all glaucous ; rhizomatous .....16. *P. araratica*
18. Plants erect from the base.....19  
 Plants conspicuously curved at the base.....17. *P. alpigena*
19. Basal leaves narrow, almost setaceous ; lemmas ; 2.5-3 mm. long ;  
 anthers 1.5 mm. long.....18. *P. angustifolia*  
 Basal leaves broad, flat ; lemmas 3-4.5 mm. long.....20
20. Ligules not more than 2 mm. long ; lemmas 3-3.5 mm.  
 long, granular-punctate ; anthers 1.5-2 mm. long...19. *P. pratensis*  
 Ligules 2.5-6 mm. long ; lemmas 3.5-4.5 mm. long, smooth ;  
 anthers 1 mm. long...20. *P. jaunsarensis*
21. Lemmas 3.5-4 mm. long ; spikelets rarely proliferating.....  
 .....21. *P. sinaica*  
 Lemmas 2.5-3 mm. long ; spikelets always proliferating.....  
 .....22. *P. bulbosa*

### 1. *Poa nepalensis* Wall.

*Poa nepalensis* Wall. ex Duthie, Grass. of North-Western India, p. 40, 1883.

*Poa annua* Linn. var. *nepalensis* Griseb. in Goett. Nachbr., 75 (1868).

Perennial with a creeping rhizome. *Culms* geniculately ascending, up to 50 cm. high, smooth and glabrous, long exerted from the uppermost leaf sheath, 2-3-noded. *Leaf-blades* up to 15 x 0.4 cm. ; *sheaths* rather loose, smooth and glabrous, ultimately slipping from the culms ; *ligule* up to 1.5 mm. long. *Panicle* large, pyramidal, up to 14 x 10 cm. ; *axis* smooth and glabrous ; *branches* 2-nate, one much longer than the other, smooth, and glabrous, naked at the base for 1/3-1/2 their total length. *Spikelets* whitish, 4-flowered, 3.5-4 mm. long, elliptic ; rachilla smooth and glabrous. *Lower glume* 1.5-2 x 0.6 mm. curved on the back, 1-nerved, hyaline on the margins, scabrid in the upper half of the keel. *Upper glume* 2.25-2.5 x 1.4 mm, broadly elliptic or elliptic-ovate, 3-nerved,

curved on the back, hyaline on the margin, scabrid in the upper half of the keel. *Lemna* 2.5 x 2 mm, oblong-elliptic, narrowly hyaline on the

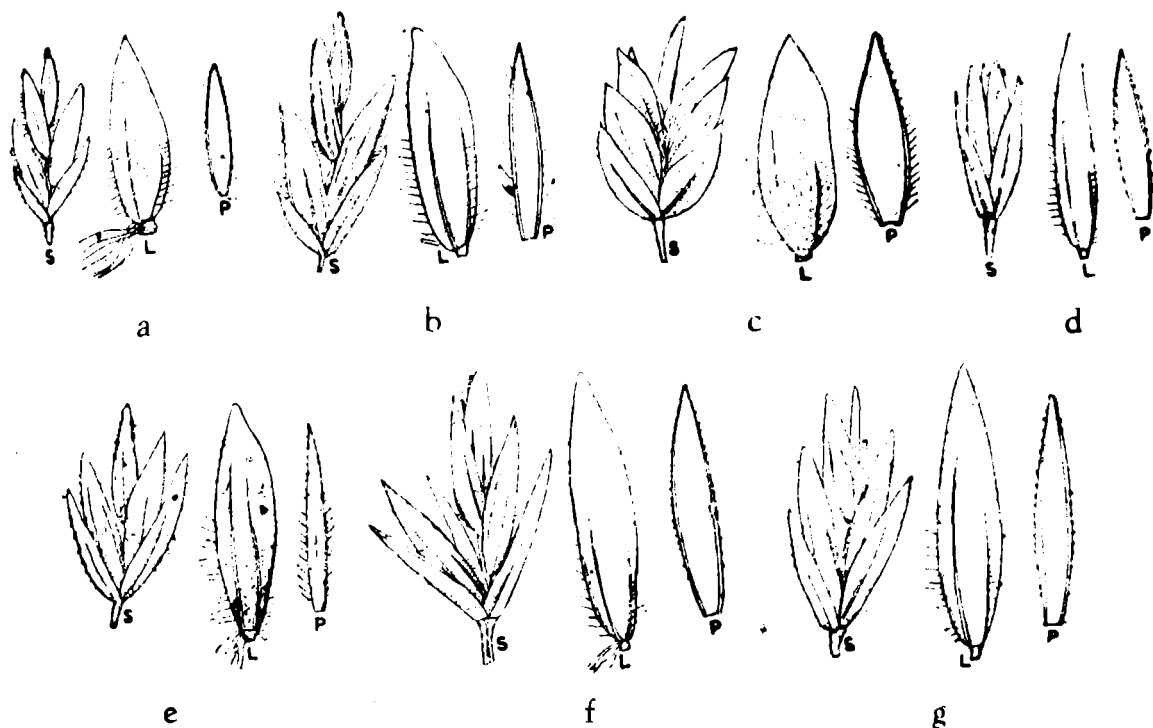


Fig. 107.—*Poa* spp. a. *P. nepalensis*; b. *P. annua*; c. *P. alpina*  
d. *P. stapfiana*; e. *P. nemoralis*; f. *P. polycolea*; g. *P. sterilis*.

margins, 5-nerved, the intermediate nerves inconspicuous, hairy on the lateral nerves and on the keel, faintly punctate all over the dorsal surface, minutely scaberulous in the lower third. *Wool* copious. *Anthers* 0.75 mm. long. *Palea* shorter than the lemma, pilose on the keel.

Trarkhel, Poonch, April 25, 1953, leg. R.R. Stewart & A. Rashid.

## 2. *Poa supina* Schrad.

*Poa supina* Schrad., Fl. Germ. I: 289 (1805); Bor. l.c. 50: 822.

Perennial with leafy runners. *Culms* decumbent at the base, upto 15 cm. high, leafy to the panicle. *Leaf-blades* 1-2.5 x 0.2-0.3 cm., flaccid, scabrid along the margins; *sheaths* longer than the internodes, very loose or tight, smooth and glabrous; *ligules* up to 1.5 mm. long, rounded at the apex. *Panicle* at first dense, then spreading, pyramidal; axis smooth and glabrous; branches 2-nate or solitary, horizontal or deflexed. *Spikelets* 5- to 6-flowered, 4-5 mm. long, clustered at the ends of thin branchlets; rachilla smooth and glabrous. *Lower glume* 1.5 x 0.8 mm., oblong. 1-nerved, narrowly hyaline along the margins, smooth and glabrous. *Upper*

*glume* 2.5 x 1.2-1.3 mm., elliptic, 3-nerved, narrowly to broadly hyaline on the margins, minutely scabrid along the keel. *Lemma* 2.5-3.0 x 2-3 mm., broadly elliptic, 5-nerved, ciliate on the keel in the lower 1/2-1/3, scabrid on the keel above, ciliate on the marginal nerves, otherwise smooth and glabrous. *Wool* absent. *Anthers* 1.2-2 mm. long. *Palea* shorter than the lemma, ciliate on the keels.

Hazara : Siran Valley, *Inayat* ; Chitral : Barum Gol, Shokor Shal, *Per Wendelbo*. Thandiani, A. R. Beg.

### 3. *Poa infirma* H. B. K.

*Poa infirma* H.B.K., Nov. Gen. et Sp. 1 : 158 (1815) ; Bor, l. c. 50 : 818.

Annual. *Culms* slender, smooth and glabrous, up to 15 cm. high, leafy to the panicle. *Leaf-blades* soft, flaccid, up to 6 cm. long, 5 mm. broad, scabrid on the margins and on the midrib below ; *sheaths* rather loose, smooth and glabrous ; *ligules* 1-2 mm. long, rounded or obtuse at the apex. *Panicle* narrow, oblong, rather spreading ; branches 2-nate, often a longer accompanied by a shorter ; ascending, rarely horizontal and never deflexed ; axis smooth and glabrous, angled ; *Spikelets* 4-4.5 mm. long, 3- to 5-flowered, oblong ; rachilla smooth and glabrous. *Lower glume* 1.25 x 0.6 mm., oblong, acute, 1-nerved, broadly hyaline on the margins, smooth and glabrous. *Upper glume* 1.5 x 1 mm., broadly elliptic, 3-nerved, broadly hyaline on the margins, smooth and glabrous. *Lemma* 2.5 x 1.5 mm., oblong-ovate, rounded at the apex, faintly 5-nerved, broadly hyaline on the margins, almost straight on the back, ciliate on all nerves. *Wool* 0. *Palea* shorter than the lemma ; keels pilose. *Anthers* 0.22-0.33 mm. long.

Rawalpindi, R. R. Stewart.

### 4. *Poa annua* Linn.

*Poa annua* Linn., Sp. Pl. 68 (1753) ; Bor, l. c. 51 : 72.

Annual. *Culms* geniculate-ascending, up to 30 cm. high, *Leaf-blades* 2-3.5 cm. long, 0.5 cm. broad, flaccid, scaberulous on the margins ; *sheaths* somewhat compressed, smooth and glabrous, shorter or longer than the nodes ; *ligules* of the uppermost leaf up to 3 mm. long. *Panicle* loose, pyramidal, cm. 10 long, 4 cm. broad ; axis smooth and glabrous ; *branches* 2-nate, rarely more or solitary, spreading, ultimately deflexed, 2-8 mm.



long before branching, smooth and glabrous ; pedicels scabrid. *Spikelets* 3- to 5- flowered, ovate or ovate-elliptic, 4-6 mm. long, green ; rachilla smooth and glabrous. *Lower glume* 1.5-2 x 1 mm., lanceolate, 1-nerved, hyaline on the margins, scabrid on the keel. *Upper glume* 2-2.5 x 1.5 mm., elliptic, 3-nerved, hyaline on the margins, scabrid on the keel. *Lemma* 3 x 1.5 mm., oblong, broadly hyaline on the margins, 5-nerved, ciliate on the keel for 3/4 of its length, ciliate on the lateral nerves below, the rest smooth and glabrous. *Wool* absent. *Palea* long ciliate on the keels. *Anthers* 0.6-0.8 mm. long.

Through out the plains during winter ; also reported from Lowari Pass, Quetta, Peshawar, Rawalpindi, Murree, and Swat, Khaza Khela.

### 5. *Poa stewartiana* Bor

*Poa stewartiana* Bor in Kew Bull. 1951 : 185 (1951).

Annual. *Culms* very slender, erect, up to 30 cm. high, smooth and glabrous. *Leaf blades* up to 15 cm. long, 0.3-0.4 cm. broad, flaccid, scaberulous on the margins, smooth and glabrous on both surfaces ; *sheaths* tight, smooth and glabrous, longer than the internodes ; *ligules* silky, 2.5-3 mm. long. *Panicle* spreading, often nodding, upto 20 cm. long, 10 cm. broad ; axis angled, scaberulous ; *branches* 2-nate, erect, spreading or finally deflexed, flexuous, scaberulous, naked for 3-4 cm. and then rebranching and carrying a few spikelets at the tips. *Spikelets* 3-5 mm. long, broadly elliptic, 3- to 4-flowered ; rachilla smooth. *Lower glume* 2.5-3 x 0.75-1 mm., lanceolate, 1-nerved, smooth and glabrous except on the keel in the upper part which is scabrid. *Upper glume* 2.5-4 x 1-2 mm., oblong or oblong-elliptic, 3-nerved, hyaline on the margins, smooth and glabrous, except on the keel in the upper half which is scabrid. *Lemma* 2.5-3 x 1.75-2 mm., oblong-elliptic, 5-nerved, ciliate on the keel in the lower half and on the marginal nerves, scabrid on the keel in the upper half. *Wool* copious. *Palea* ciliate on the keels in the lower half, scabrid above. *Anthers* 1 mm. long.

Swat : Beyond Bishigram, July 11, 1953, R. R. Stewart & A. Rehman.

### 6. *Poa alpina* Linn.

*Poa alpina* Linn., Sp. Pl. 67 (1753) ; Bor, l.c. 51 : 91.

Perennial. *Culms* densely tufted, erect or slightly geniculate below,

2-noded, up to 40 cm. high. *Leaf-blades* 5 cm. long, 4 mm. broad, mostly crowded at the base of the stem, flat, firm, glabrous. *Lowest sheaths* short, distichous; the upper tight, covering the nodes and much longer than the blades; *ligules* usually 2 mm. long, rarely up to 4 mm. long. *Panicle* dense, or occasionally lax; peduncle long-exserted; basal branches 2-nate, naked at the base, erect or spreading, smooth and glabrous, branched usually only once; branchlets often rough; pedicels scabrid. *Spikelets* crowded, broadly ovate, 4-6 mm. long, 3- to 6-flowered, rachilla smooth and glabrous. *Lower glume* 3-3.5 x 2 mm., curved on the back, ovate-acute, 3-nerved, hyaline along the margins, smooth and glabrous except for the upper part of the keel which is scabrid. *Upper glume* 3.5-4 x 2.5 mm., elliptic-acute, 3-nerved, strongly curved on the back, which is scabrid in the upper part. *Lemma* 4 mm. long, 2 mm. broad, curved on the back, ovate-oblong or oblong, broadly hyaline on the margins, 5-nerved, shortly hairy on the dorsal surface in the lower half, punctate all over the dorsal surface, long ciliate on the keel in the lower half, scabrid in the upper half, long ciliate on the lateral nerves. *Wool* absent. *Palea* with keels long ciliate in the lower half, scabrid in the upper half. *Anthers* 1.5 mm. long.

Hazara : Kagan Valley, *Duthie* ; Deosai Plains, 12400 ft., August 16, 1952, *I. A. Siddique*; Samosar Lake, 11000 ft. July 27, 1952, *I. A. Siddique*; Babusar Pass, 13500 ft. ; upper Swat, *M. Aslam Khan* ; Kagan valley, *M.S. Zahur* ; Saiful Maluk, *Shaukat*.

### 7. *Poa stapfiana* Bor

*Poa stapfiana* Bor in Kew Bull. 1949 : 233 (1949).

*Poa tremula* Stapf in Hook. f., Fl. Brit. Ind. 7 : 344 (1896) non Lam.

A perennial, stoloniferous grass. *Culms* erect or geniculate, up to 60 cm. high, leafy up to the panicle, smooth and glabrous. *Leaf-blades* 5-14 cm. long, 1-4 mm. broad, flaccid or occasionally firm, glabrous, distinctly toothed on the cartilaginous margins, smooth or minutely scabrid on the upper surface; *sheaths* longer than the internodes, rather loose, smooth and glabrous; *ligules* up to 5 mm. long, obtuse. *Panicle* lax, loose, widely spreading, pyramidal, up to 25 cm. long; axis smooth and glabrous; *branches* long and flexuous, lowest 2-nate, very rarely 1- or 3-nate up to 15 cm. long, smooth, glabrous; branchlets

rough, glabrous; *pedicels* scabrid. *Spikelets* 3-6-flowered, 4-6 mm. long, elliptic-oblong, green or somewhat glaucous; rachilla hairy. *Lower glume* 2.75-3.75 x 1-1.5 mm., oblong-lanceolate or even lanceolate, 3-nerved, glabrous, coarsely scabrid on the keel. *Upper glume* 3-4.5 x 1.5-1.75 mm. oblong or elliptic, 3-nerved, glabrous, coarsely scabrid on the keel and occasionally on the side nerves. *Lemma* (lowest) 3-4.5 mm. long, oblong, dorsal surface glandular-punctate, ciliate on the keel to the middle and scabrid above, ciliate on the lateral nerves, silky-hairy in between the nerves. *Wool* copious or scanty but definite. *Palea* long ciliate on the keels in the lower half. *Anthers* 1-1.5 mm. long.

Swat : beyond Ushu, July 27, 1953, R. R. Stewart & A. Rehman.

#### 8. *Poa nemoralis* Linn.

*Poa nemoralis* Linn., Sp. Pl. ed. I, 69 (1753); Bor, l. c. 50 : 832.

Perennial, with short stolons. Culms erect or geniculate-ascending, up to 80 cm. high, smooth and glabrous. *Leaf-blades* up to 20 cm. long, 2 mm. broad, scabrid on both surfaces and on the margins, flaccid; *sheaths* tight but slipping from the culms at the base, smooth and glabrous; *ligules* often absent, at the most a narrow, membranous ring, not more than 0.5 mm. long. Panicle loose, up to 10 cm. long; axis smooth and glabrous; branches widely spreading, scabrid, 1-to 4 nate, the branchlets few-spiculate. *Spikelets* 4-6 mm. long, narrowly elliptic or lanceolate, 2- to 5-flowered; rachilla minutely hairy. *Lower glume* 2.5-3 x 1 mm., lanceolate, broadly or narrowly hyaline on the margins, 3-nerved, smooth and glabrous, scabrid on the keel. *Upper glume* 3-3.5 x 1.5 mm., elliptic-lanceolate, 3-nerved, broadly or narrowly hyaline on the margins; the keel scabrid. *Lemmas* 3-3.25 x 1.5 mm., narrowly oblong, acute or sub-obtuse, 5-nerved, broadly hyaline at tip and on the margins ciliate on the keel in the lower half and scabrid in the upper half, ciliate on the marginal nerves. *Wool* present, often scanty. *Palea* scabrid on the keels. *Anthers* 1.2-1.5 mm. long.

Kagan Valley : Sharhan, M. S. Zahur; Naran, Shaukat; Gujar, A. R. Beg; Dir, A. R. Beg.

#### 9. *Poa aitchisoni* Boiss.

*Poa aitchisoni* Boiss., Fl. Orient. 5 : 602 (1884); Bor, l. c. 50 : 835.

Perennial. Culms geniculate, rooting at the nodes, up to 30 cm.

high, leafy, covered at the base with the scarious remains of old sheaths. *Leaf-blades* up to 8 cm. long, 4 mm. broad, flaccid, scabrid on both surfaces and on the margins; *sheaths* finely pubescent when young becoming glabrous and smooth in age, rather loose and slipping from the culms, more or less keeled; *ligules* about 1 mm. long. Panicle up to 9 cm. long, at first contracted then spreading; axis smooth and glabrous, angled; branches 2-nate, erect at first then spreading, smooth and glabrous, branched once or twice. *Spikelets* 4- to 5-flowered, widely opening; *rachilla* smooth and glabrous, long-jointed, joints from below upward: 1, 1, 1.5, 1; pedicels scabrid. *Lower glume* 3 x 1 mm., lanceolate, 1-nerved, hyaline on the margins, scabrid on the keel and on the upper half of the dorsal surface, *Upper glume* 3.5 x 1.2 mm., lanceolate, 3-nerved, hyaline on the margins and scaberulous on the dorsal surface in the upper third. *Lemmas* 3.5-3.75 x 1.5 mm., oblong, conspicuously 5-nerved, glabrous on the dorsal surface including the nerves, minutely granular all over the dorsal surface, shortly ciliate on the keel, broadly hyaline along the margins. *Wool* scanty, consisting of one or two hairs. *Palea* with scabrid keels. *Anthers* 2-2.5 mm. long.

Kurram Valley: Aina Mela, *Harsukh*; Waziristan, Pir Ghal, *Duthie*.

#### 10. *Poa polycolea* Stapf

*Poa polycolea* Stapf in Hook. f., Fl. Brit. Ind. 7: 342 (1896); Bor., l. c. 50: 834.

A perennial, stoloniferous grass. *Culms* slender, wiry, erect or with a geniculate or creeping base, up to 30 cm. high, clothed at the base with numerous, scarious, pale straw coloured sheaths. *Leaf-blades* up to 8 cm. long, 4 mm. broad, smooth and glabrous on the upper surface, minutely scaberulous on the lower surface and along the margins; *sheaths* tight (except basal), smooth and glabrous, upper sheath much longer than its leaf-blade; *ligule* short, up to 1 mm. long. *Panicle* effuse, sometimes more or less contracted, 5-10 cm. long, nodding or erect; peduncle long exerted; branches whorled, the lower in groups of 2-5, flexuous, slender, smooth, branched to the first degree and there more often giving rise to a whorl (up to 3) of scabrid branchlets which are ultimately spiculate; pedicels

scabrid. *Spikelets* 2- to 4-flowered, up to 7 mm. long, elliptic then wedge-shaped ; rachilla glabrous and smooth, minutely gland-pitted, long jointed. *Lower glume* 3-3.75 x 1 mm., linear or lanceolate, 1-nerved, the keel scabrid in the upper half, otherwise smooth and glabrous, hyaline on the margins. *Upper glume* 3-4 x 2 mm., ovate or elliptic, 3-nerved, scabrid on the upper half of the keel, otherwise smooth and glabrous, broadly hyaline along the margins. *Lemma* (lowest) 3.5- 5.5 mm. long, oblong or elliptic-oblong, 5-nerved, broadly hyaline along the margins, gland pitted all over the dorsal surface, scabrid along the nerves on the dorsal surface to almost smooth, silky-ciliate along the keel and the lateral nerves or glabrous all over the nerves, softly tomentose between the nerves. *Wcol* absent or very scanty. *Palea* with antrorsely scabrid keels. *Anthers* 2-2.5 mm. long.

Kagan Valley : Nadi Kund, M.S. Zahur.

#### 11. *Poa sterilis* M. B.

*Poa sterilis* M. B., Fl. Taur. Cauc. 1 : 62 (1805) ; Bor, l. c. 51 : 61.

Perennial. *Culms* densely tufted, erect, scabrid below the panicle, up to 40 cm. high, leafy to the panicle, covered at the bases with the scarious remains of the sheaths. *Leaf-blades* up to 15 cm. long, 1-2 mm. broad, flaccid, flat or rolled, glabrous, margins scabrid ; *sheaths* tight, smooth or scabrid, glabrous, somewhat keeled ; *ligules* 2.5-3 mm. long, rounded or truncate at the apex, scabrid on the outer surface. *Panicle* rather lax, sometimes almost strict, 15 x 5 cm. ; axis smooth and glabrous ; branches 2-3, not flexuous, ascending or spreading, very scabrid, sparsely rebranched. *Spikelets* 4-6 mm. long, 2- to 3-flowered ; rachilla almost always warty, glabrous or slightly hairy. *Lower glume* 3.5 x 1.5 mm., lanceolate or elliptic-oblong, 3-nerved, hyaline on the margins, smooth or glabrous, scabrid on the keel in the upper part. *Upper glume* 3.5-4 x 1.8 mm., elliptic or elliptic-oblong, 3-nerved, smooth and glabrous, hyaline on the margins, rough on the keel in the upper part. *Lemma* 3-4 x 1.8 mm., oblong, obscurely 5-nerved, broadly or narrowly hyaline on the margins, glabrous between the nerves, ciliate on the keel and along the lateral nerves in the lower half. *Wcol* very scanty or absent. *Palea* finely pectinate along the keels. *Anthers* 1.5-2.5 mm. long.

Chitral : Mirza, Drosh ; Gilgit ; Kagan valley : Kagan, Sharhan ; Swat : Madian. Bahrain.

## 12. *Poa pagophila* Bor

*Poa pagophila* Bor in Kew Bull. 1949 : 239 (1949).

*Poa flexuosa* Hook. f., Fl. Bri. Ind. 7 : 342 (1896) non Sm. nec Vahl.

Perennial. *Culms* densely tufted with numerous innovation shoots at the base, up to 30 cm. high, smooth and glabrous. *Leaf-blades* (lower) linear, tapering to a stout point, scabrid on the margins and on both surfaces ; upper much shorter than their sheaths ; *sheaths* tight or loose, scabrid and glabrous ; *ligules* up to 3.5 mm. long. *Panicle* pyramidal, up to 10 cm. long, 4-5 cm. wide ; axis smooth and glabrous ; branches 2-nate, at first erect but ultimately one or both becoming deflexed, one of the pair shorter, smooth or scaberulous, sparsely branching and carrying a few crowded spikelets at the tips. *Spikelets* up to 5.5 mm. long, 3- to 4-flowered ; rachilla smooth or warty or even minutely hairy. *Lower glume* 2.5-3 x 1 mm., narrowly elliptic, 1-nerved, narrowly hyaline on the margin, scabrid on the keel. *Upper glume* 3-3.5 x 1.6 mm., elliptic, slightly curved on the back, 3-nerved, hyaline on the margin, smooth and glabrous, except for the scabrid keel. *Lemma* 4-4.5 x 2 mm., obscurely 5-nerved, almost straight on the back, hyaline along the margins, scabrid all over the dorsal surface and often with a few short hairs below or with felty pubescence. *Wool* scanty or rarely absent. *Palea* scabrid on the keels. *Anthers* 2- 3 mm. long.

Beyond Bishigram, Swat, July 11, 1953, R. R. Stewart & A. Rehman.

## 13. *Poa falconeri* Hook. f.

*Poa falconeri* Hook. f., Fl. Brit. Ind. 7 : 342 (1896) ; Bor, l.c. 51 : 76.

Perennial. *Culms* geniculately ascending, leafy up to the panicle, up to 75 cm. high, clothed at the base by short leathery sheaths. *Leaf-blades* up to 20 cm. long, 4 mm. broad, scabrid along the margins and on both surfaces ; *sheaths* rather loose, slipping from the culms, smooth and glabrous ; *ligules* up to 4 mm. long, rounded or truncate at the apex. *Panicle* narrow, lax, 8-12 cm. long with few branches and spikelets ; branches flexuous, erect, 1- to 2-nate at the basal node, often branching once, each branchlet ending in a raceme of spikelets. *sikelets* 2- or occasionally 3-flowered, when 2-flowered the long prolongation of the rachilla is

very characteristic ; florets diverging widely at anthesis ; rachilla minutely hairy or warty. *Lower glume* 3.5-4 x 2 mm., linear-oblong, 1-occasionally 3-nerved, gland pitted on the dorsal surface, keel scabrid, narrowly hyaline on the margins or not at all. *Upper glume* 4.5-5 x 2 mm., 3-nerved, elliptic or subovate-oblong, gland-pitted on the dorsal surface, keel scabrid in the upper half, only slightly hyaline along the margins. *Lemma* (lowest) 4-5 x 2 mm., inconspicuously 5 nerved, oblong or elliptic-oblong, scabrid on the upper half of the keel, ciliate in the lower half, narrowly hyaline along the margins, gland pitted all over the dorsal surface and silky in the lower half. *Wool* quite absent. *Palea* scabrid on the keels with rather short teeth, surface hairy between the nerves. *Anthers* 3 mm. long.

Kagan valley.

#### 14. *Poa setulosa* Bor

*Poa setulosa* Bor in Kew Bull. 1948 : 142 (1949).

Perennial. *Culms* slender, erect or slightly geniculate at the base, up to 25 cm. high, glabrous, scabrid below the panicle. *Leaf-blades* up to 7 cm. long, 15 mm. broad, scabrid on both surfaces and on the margins, flaccid ; *sheaths* tight, scaberulous, glabrous ; *ligules* up to 3 mm. long. *Panicle* narrow, up to 9 cm. long ; axis scabrid ; branches 1- or 2-nate at the basal node, up to 2.5 cm. long, naked at the base, few-spiculate, scabrid. *Spikelets* 4- to 5-flowered, 4.5 mm. long ; rachilla with a few hairs. *Lower glume* 3.5-4 x 0.8 mm., awl-shaped in profile, almost setulose at the tip, very narrowly hyaline on the margins, 3-nerved, scabrid along the keel. *Upper glume* 3.75-4 x 1 mm., 3-nerved, narrowly hyaline on the margins, awl-shaped in profile, scabrid on the keel. *Lemma* 2.75-3 x 1 mm., oblong, upper 1/4 hyaline, margins narrowly hyaline, long ciliate on the keel in the lower half and on the marginal nerves, inconspicuously 5-nerved, punctate but glabrous on the dorsal surface. *Wool* scanty but distinct. *Palea* scabrid along the keels. *Anthers* 0.6-0.75 mm. long.

Kagan Valley : Naran, *Shaukat* ; Swat, Mt. Ilam, August 12, 1952, R. R. Stewart.

15. ***Poa litwinoviana*** Ovcz.

*Poa litwinoviana* Ovcz. in Bull. Tadjik. Acad. Sci. 1 : 22 (1933) ; Bor, loc. cit. 51 : 64.

A tufted perennial without rhizomes or stolons, the whole plant very glaucous. *Culms* up to 20 cm. high, scabrid below the panicle. *Leaf-blades* glaucous, flat or rolled, rather firm, scabrid on the surfaces and the margins, up to 4 cm. long and 1-1.5 mm. broad, glabrous ; *sheaths* tight, glaucous, finely scabrid ; *ligules* membranous, up to 3 mm. long. *Panicle* narrow, contracted, up to 4 cm. long, 8 mm. broad ; branches 3-10 mm. long, 2-nate, simple, only rarely rebranching, few-spiculate. *Spikelets* 3-4 mm. long, 2- to 3 flowered. *Lower glume* 2.5-3 x 1 mm., elliptic, acute, 3-nerved. *Upper glume* 3-3.5 x 1.8 mm., broadly elliptic, 3-nerved, scabrid in the upper half of the keel. *Lemma* 3.5-4 mm. long, 1.8 mm. broad, oblong or elliptic-oblong, obtuse, 5-nerved, hairy on the keel and the marginal nerves in the lower half, punctate on the dorsal surface. *Wool* present but scanty. *Palea* 2.5 mm. long ; keel antrorsely scabrid. *Anthers* 1.5-2 mm. long.

Chitral : Barum Gol, Shokor Shal, *Per Wendelbo.*

16. ***Poa araratica*** Trautv.

*Poa araratica* Trautv. in Acta Hort. Petrop. 2 : 486 (1873) ; Bor, l. c. 51 : 62.

A perennial, densely tufted grass with many stems arising from a stout rootstock, 3-4 cm. long. *Culms* up to 30 cm. high, more or less scabrid below the panicle, otherwise smooth and glabrous. *Leaf-blades* very narrow when dry and almost filiform, up to 7 cm. long, glabrous but scabrid along the margins and on the nerves beneath ; *lower sheaths* very loose, slipping from the culms, the upper tight, smooth and glabrous ; *ligules* 1.5-2.5 mm. long, truncate. *Panicle* narrow, up to 9 cm. long, 5-8 mm. wide, erect ; branches 1- to 3 nate, not more than 2.5 cm. long, ascending, scabrid, flexuous rarely rebranching. *Spikelets* 4-4.5 mm. long, 3- to 4-flowered ; rachilla minutely bristly or verrucose. *Lower glume* 3.5-3.75 x 1.5 mm., oblong or elliptic, 3-nerved, hyaline on the margins, smooth and glabrous, except on the keel which is scabrid. *Upper glume* 3.75-4.5



$\times 1.5$  mm. elliptic or ovate-elliptic, 3-nerved, hyaline outside the lateral nerves, keel scaberulous near the tip, otherwise smooth and glabrous. *Lemma* 3.5-4  $\times$  1.5-1.75 mm, oblong or elliptic-oblong, 5-nerved, hyaline outside the side nerves, ciliate on the keel in the lower half and on the marginal nerves. *Wool* very scanty. *Palea* finely scabrid along the keels, mostly minutely gland dotted between the keels and on the flaps. *Anthers* 1.5 mm. long.

Chitral: Barum Gol, Shohor Shal, *Per Wendelbo*; Kagan Valley: Babusar Pass, *Dr. Metz*; Gujjar, *A. R. Beg*; upper Kagan, *Shaukat*; upper Swat, *M. Aslam*.

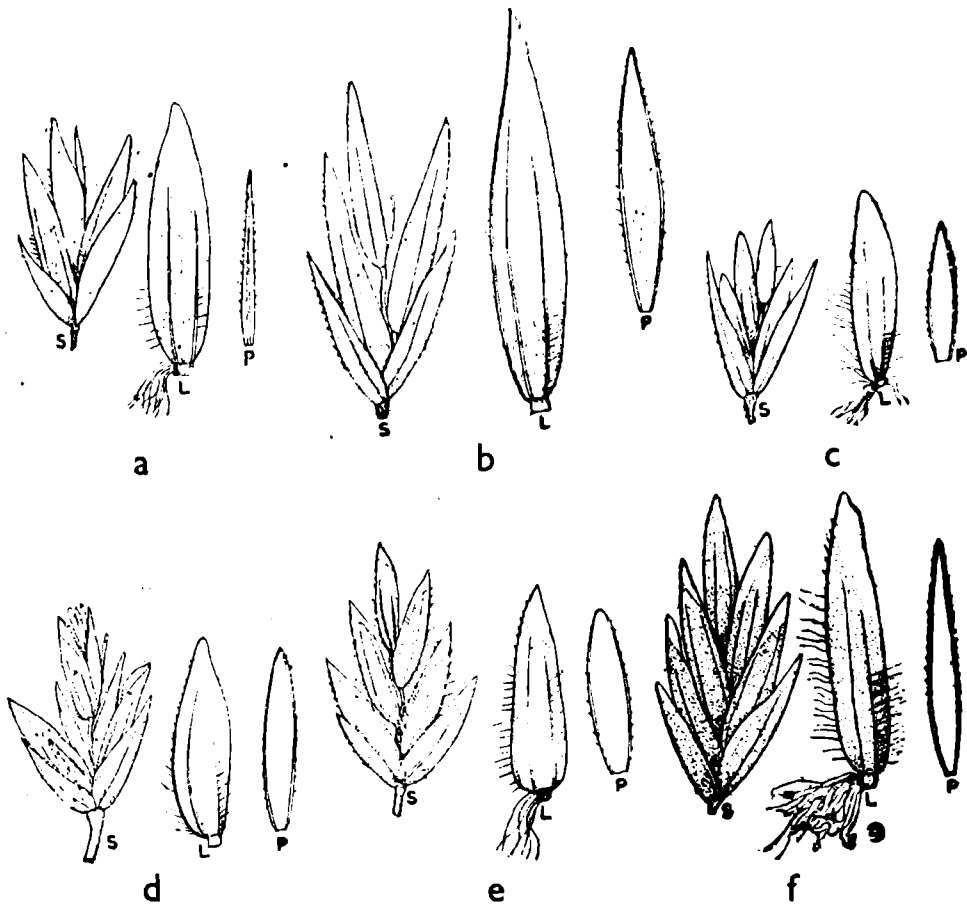


Fig. 108. *Poa* spp. a. *P. pagophila*; b. *P. falconeri*; c. *P. setulosa*; d. *P. araratlica*; e. *P. pratensis*; f. *P. jaunsarensis*.

### 17. *Poa alpigena* (Blytt) Lindm.

*Poa alpigena* (Blytt) Lindm., Svensk. Fanerogam. fl. 91 (1918).

*Poa pratensis* Linn. var. *alpigena* Blytt, Norg. Flora 130 (1861).

A perennial rhizomatous grass with a characteristic curved under-

ground stem. *Culms* up to 35 cm. high, smooth and glabrous. *Leaf-blades* flat, up to 12 cm. long, 1.5-2 mm. broad, smooth and glabrous; *sheaths* terete, as long as the internode, the basal loose and scarious, smooth, glabrous; *ligule* over 1.5 mm. long, hyaline, membranous. Panicle rather dense, erect, 7 x 2.5 cm.; lower branches 2-nate, the upper solitary, slightly scabrid, rebranching and few-spiculate. *Spikelets* elliptic-lanceolate or wedge-shaped, up to 4 mm. long, 3- to 4-flowered; rachilla smooth and glabrous. *Lower glume* elliptic-oblong, 2.5-3 x 1-1.6 mm., 3-nerved, narrowly hyaline along the margins, smooth and glabrous except for the upper half of the keel which is scabrid. *Upper glume* elliptic-oblong, 2.5-3 x 1.5-2 mm., 3-nerved, broadly hyaline on the margins, smooth and glabrous except for the upper half of the keel which is scabrid. *Lemma* (lowest) oblong, 3.75 x 2.25 mm., hyaline at the tip and on the margins, 5-nerved, the intermediate nerves obscure, very long ciliate on the keel in the lower half or two-thirds, and on the lateral nerves, scabrid on the keel above, smooth and glabrous on the dorsal surface. *Wool* present, very long and copious. *Palea* 3.25 mm. long; keels antrorsely scabrid. *Anthers* 1.5 mm. long.

Upper Swat, August 1958. *M. Aslam*.

#### 18. *Poa angustifolia* Linn.

*Poa angustifolia* Linn., Sp. Pl. ed. I, 99 (1753); Bor, l. c. 51 : 70.

A perennial tufted grass with widely spreading scaly rhizomes. *Culms* up to 90 cm. high, erect, covered at the base with the remains of the old sheaths. *Leaf-blades* narrow, up to 20 cm. long, slightly rough, glabrous; *sheaths* tight, smooth and glabrous; *ligules* up to 2 mm. long, usually much shorter, truncate. *Panicle* 5-10 cm. long; branches 2 to 5-nate at the lowest node, scabrid, flexuous, spreading and somewhat erect, sparingly branched and few-spiculate. *Spikelets* 2- to 4-flowered, 3-3.5 mm. long; rachilla glabrous. *Lower glume* 2 x 0.8 mm., lanceolate, 1-nerved, narrowly hyaline on the margins, scabrid on the keel in the upper half. *Upper glume* 2.5 x 1.5 mm., 3-nerved, hyaline on the margins, scabrid on the keel in the upper half. *Lemma* 2.5-3 mm. long, oblong, 5-nerved, ciliate on the keel and on the lateral nerves in the lower half, keel scabrid in the upper half.

*Wool* present, copious. *Palea* with fine antrorse teeth on the keels. *Anthers* 1.5 mm. long.

Swat : Kagan, M. S. Zahur ; Thandiani A. H. Khan ; Nathia Gali, Dunga Gali, A. H. Khan ; Murree, Asghar.

### 19. *Poa pratensis* Linn.

*Poa pratensis* Linn., Sp. Pl. 67 (1753) ; Bor, l. c 51 : 72.

A perennial grass with widely creeping, scaly rhizomes. *Culms* densely tufted with intravaginal shoots, up to 80 cm. high, leafless above. *Leaf-blades* of basal leaves up to 25 cm. long, those of the culms up to 5 cm. long, both up to 4 mm. broad, scabrid on the margins and on the nerves below ; *lower sheaths* much shorter than the internodes the upper sheaths longer, smooth and glabrous ; *ligules* short, not more than 2 mm., scabrid on the back. *Panicles* short, not more than 2 mm., scabrid on the back. *Panicle* very compact and dense at first but widely spreading at anthesis, up to 10 cm. long ; lowest whorl of branches most often 5-nate occasionally 4-nate and rarely 2- or 3-nate ; branches scabrid, bare for half their length, rebranching and carrying crowded spikelets. *Spikelets* oblong-elliptic, 5.5 mm. long, 2- to 5-flowered ; rachilla glabrous. *Lower glume* 2-2.5 x 0.8-2 mm lanceolate, 1-nerved but occasionally 3-nerved, hyaline on the margins, scabrid on the keel. *Upper glume* elliptic or ovate, 2.5-3 x 2 mm., hyaline on the margins, 3-nerved, keels scabrid in the upper half. *Lemma* 3-3.5 x 2 mm., oblong, 5-nerved, hyaline along the margins, the keel and marginal nerves ciliate in the lower half, dorsal surface granular-punctate. *Wool* extremely copious. *Palea* with scabrid keels and granular-punctate surface. *Anthers* 1.5-2 mm. long

Gilgit ; Kagan Valley : Naran, Kagan, M. S. Zahur ; Swat : Kalam, Shaukat ; Dir ; Quetta, Asghar Ali ; Nathia Gali, A. H. Khan ; Gujar, A. R. Beg ; Chitral, A. R. Beg ; Shaudiana, A. H. Khan ; Murree, R.R. Stewart. very common.

### 20. *Poa jaunsarensis* Bor.

*Poa jaunsarensis* Bor in Kew Bull. 1948 : 143 (1948).

A perennial grass with creeping rhizomes. *Culms* decumbent and covered at the base with the remains of old sheaths, leafy. *Leaf-*

*blades* stiff, erect, up to 20 cm. long, 3-4 mm. broad, scabrid on the margins and on the surfaces near the tip; *sheaths* slightly inflated, the lower slipping from the culms, smooth and glabrous, upper sheaths enclosing the base of the panicle; *ligules* 2.5-4.5 mm. long, scabrid on the back. *Panicle* up to 10 cm. long, 2.5 cm. wide; branches 2-nate at the lowest node, sometimes 1-nate and then immediately branching, scabrid, glabrous. *Spikelets* 5 mm. long, 2- to 3-flowered; rachilla smooth and glabrous. *Lower glume* 2.75-3.5 x 1 mm., lanceolate or oblong, 1-nerved, occasionally 3-nerved, keel scabrid, the rest smooth and glabrous, broadly hyaline on the margins. *Upper glume* 3.5-3.75 x 2 mm., elliptic-oblong, 3-nerved, broadly hyaline on the margins, keel scabrid, the rest smooth and glabrous. *Lemma* 3.5-4.5 x 2 mm., oblong-elliptic, 5-nerved, ciliate on the keel and side nerves, otherwise glabrous. *Wool* present, fairly copious. *Palea* shorter than the lemma; keels scabrid. *Anthers* about 1 mm. long.

Murree, May 17, 1889, *E. W. Trotter*. There is only one sheet in Herbarium Gordon College. It has not been collected since.

## 21. *Poa sinaica* Steud.

*Poa sinaica* Steud., Syn. Pl. Gram. 256 (1854).

Perennial. *Culms* erect or decumbent at the base, distinctly swollen at the base and covered with the remains of the old leaf-sheaths. *Leaf-blades* up to 6 cm. long, 1.5-2 mm. broad, almost filiform, scabrid on the margins; *basal sheaths* with broad hyaline margins; *ligule* up to 4 mm. long. *Panicle* dense, up to 8 cm. long, 4 cm. wide: lower branches 2- to 4-nate, ascending, scaberulous; pedicels scabrid, short. *Spikelets* oblong-elliptic, 7-8 mm. long, 7-flowered; rachilla slightly bristly. *Lower glume* 3-4 x 1.5 mm., elliptic, broadly hyaline on the margins, 3-nerved, smooth and glabrous except for the upper half of the keel which is scabrid. *Upper glume* 4.5 x 2 mm., 3-nerved, scabrid on the upper half of the keel, otherwise glabrous and smooth. *Lemma* 4.5-5 x 2 mm., 5-nerved, oblong, broadly hyaline in the upper half along the margins, very thickly ciliate on the lower half of the keel and on the lateral nerves in the lower halves, usually distinctly scabrid on the dorsal surface and glandular punctate all over. *Wool* absent. *Palea* armed on the keels with long spines. *Anthers* 2 mm. long.

Quetta, *Duthie* ; *M. Nawaz* ; Killa Abdullah, *Duthie*.

——— *f. vivipara*, Quetta, *Asghar Ali*.

## 22. *Poa bulbosa* Linn.

*Poa bulbosa* Linn., Sp. Pl. 70 (1753) ; Bor, l. c. 51 : 100.

Perennial. Culms densely tufted, geniculate at the basal nodes, up to 45 cm. high, glabrous and smooth. Leaf-blades 2-8 cm. long, 2.5 mm. broad, flat but sometimes rolled, scabrid on the margins and on both surfaces ; sheaths tight, smooth and glabrous, the basal sheaths sometimes loose with scarios margins ; ligules 1-3 mm. long. Panicle 2-9 cm. long, rather dense ; branches 2- or 3-nate. Spikelets ovate-oblong, 4-5 mm. long, 3- to 6-flowered, almost always proliferating.

Chitral : Jambatai, *Harris* ; Dir : Chakdara, *S. Ahmad* ; Quetta valley Mas ung, Kalat, *Hughes Buller* ; Zhob District, Bolan, Quetta, *M Nawaz, Asghar Ali* ; Kagan valley ; Swat State. Very common.

## 8 *Eremopoa* Roshev.

Spikelets elliptic, 2- to many- rarely 1-flowered ; rachilla somewhat geniculate and finely pulverulent. Glumes unequal, the lower 1-nerved, the upper 3-nerved. Lemma obscurely keeled, with indistinct lateral nerves, membranous in the upper part, acuminate or shortly awned, glabrous at the base or with long hairs. Stamens 3. Stigmas plumose. Caryopsis slightly forked at the tip, the fertile lemma adhering to the palea.

### KEY TO THE SPECIES

- Spikelets 3- to 5-flowered ; lemma with narrowly scarios margins.....1. *E. persica*  
 Spikelets 1- to 3-flowered ; lemmas with broadly scarios margins..... 2. *E. soongarica*

### 1 *Eremopoa persica* (Trin.) Roshev.

*Eremopoa persica* (Trin.) Roshev. in Komarov. Fl. URSS. 2 : 430 (1934).

*Poa persica* Trin. in Mem. Acad. Sc. Petersb. ser. VI. 1 : 373 (1831).

*Festuca persica* C. Koch in Linnaea 21 : 409 (1848).

Annual. Culms erect, slender, glabrous, 2.5-40 cm. high. Leaf-blades narrowly linear, 7.5 cm. long, 3 mm. broad, quite smooth and glabrous; sheaths tight, terete, margins glabrous; ligule membranous, lanceolate. Panicle very variable in shape and size, usually pyramidal or oblong, about 15 cm. long and 7.5 cm. across the spreading branches; axis scabrid; branches semiverticillate or geminate, up to 6 cm. long, simple or branched from above the middle, each branchlet ending

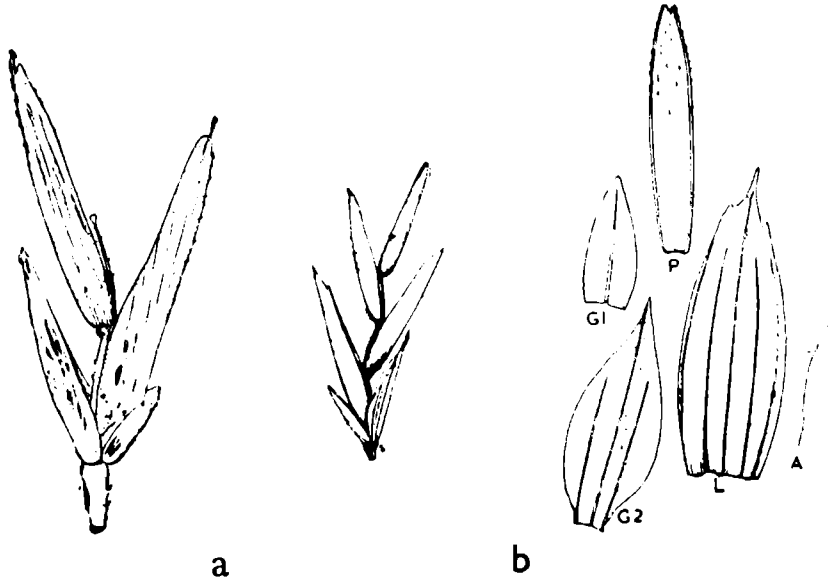


Fig 109. a. *Eremopoa soongarica*; b. *E. persica*.

in a spikelet; branches, branchlets and pedicels scabrid. Spikelets 5.5 mm. long 3- to 5-flowered, green; rachilla slender, glabrous, scabrid. Lower glume 1.5 mm. long, 1-nerved, lanceolate-acuminate, smooth. Upper glume 2.5 mm. long, linear-oblong, 3-nerved, smooth. Lemma linear-oblong, 3.4 mm. long, acuminate or obtuse and mucronate, dorsally scabrid, 3-nerved, sometimes with 2 obscure laterals.

Kagan, 21. 6. 51, I. I. Chaudhri; Naran, 9.7.54, Shaukat.

## 2. *Eremopoa soongarica* (Schrenk) Roshev.

*Eremopoa soongarica* (Schrenk) Roshev. in Komarov. Fl. URSS. 2: 431 (1934).

*Glyceria soongarica* Schrenk in Fisch. & Mey. Enumer. Pl. Schrenk, 1: 1.

Slender, erect annuals. Leaves narrowly linear; ligule lanceolate. Panicle oblong, with capillary branches; lower branches 3-7 at each node, upper geminate or solitary, 2 cm. long, 2- to 3-spiculate; pedicels up to 1 cm. long, scabrid. Spikelets elliptic, 4-6 mm. long, 1- to

3 flowered; rachilla joints well developed, scabrid. *Glumes* narrowly lanceolate, unequal, the lower 0.75 mm. long 1-nerved the upper 2 mm. long, 3-nerved, scabrid on the back. *Lower lemma* 2 mm. long, mucronate, scabrid.

Chitral: Lowari Pass; Quetta, *M. Nawaz*; Tirich Mir, Shokor Shal, *Per Wendelbo*; Naran, July 10, 1952, *I. I. Chaudhri*.

### 9. *Dactylis* Linn.

Perennial, tufted grasses with flat leaves. Spikelets 3- to 7-flowered, compressed, subdistichously crowded in short unilateral spike-forming terminal unilateral panicle and jointed at the base; rachilla very tardily disarticulating above the glumes and between the lemmas or quite continuous, glabrous. Glumes unequal scarious, acuminate or mucronate, strongly keeled, persistent; lower 1 nerved; upper 3-nerved. Lemmas exerted from the glumes, rigid, sub-herbaceous, mucronate or subaristate, keels ciliate. Palea 2-fid. Keels ciliate. Lodicules 2, 2-lobed. Styles distinct, terminal; stigmas plumose, laterally exerted.

#### 1. *Dactylis glomerata* Linn.

*Dactylis glomerata* Linn. Sp. Pl. 71 (1753); Hook. f., Fl. Brit. Ind. 7: 335 (1896).

Perennial. Culms shortly ascending, geniculate or not, tufted, arising from short, oblique rhizome, 30-60 cm. high, simple, glabrous, smooth or slightly rough below the panicle, 2- to 3-noded. *Leaf-blades* 10-45 cm. long, 2-14 mm. broad, scabrid on both surfaces and on the margins; *sheaths* keeled, scabrid and glabrous; *ligules* membranous, oblong, acute, up to 8 cm. long. *Panicle* erect, 2.5-15 cm. long; clusters of spikelets crowded into a dense terminal false spike with or without 1-4 distant branches below it; axis branches and branchlets scabrid. *Spikelets* in dense one sided masses at the ends of branches, compressed, oblong or wedge-shaped, 5-8 mm long, 2- to 5-flowered, nearly sessile. *Glumes* persistent, lanceolate to ovate, finely pointed, membranous; lower 3.5 mm. long, 1-nerved; upper 4-5.5 mm. long, 3-nerved. *Lemmas* 3-5.5 mm. long, pointed or rather blunt, tipped with a rigid awn

up to 2 mm. long, 5 nerved, scabrid or pilose along the nerves. *Palea* shorter or as long as the lemma, the keels minutely hairy or scabrid. *Anthers* 2.5-3.5 mm. long. *Carvopsis* tightly enclosed between the lemma and the palea, 0.75 mm., reddish trigonous.

Kagan Valley ; Swat ; Chitral ; Murree Hills. Very common in the hills, usually above 6000 ft.

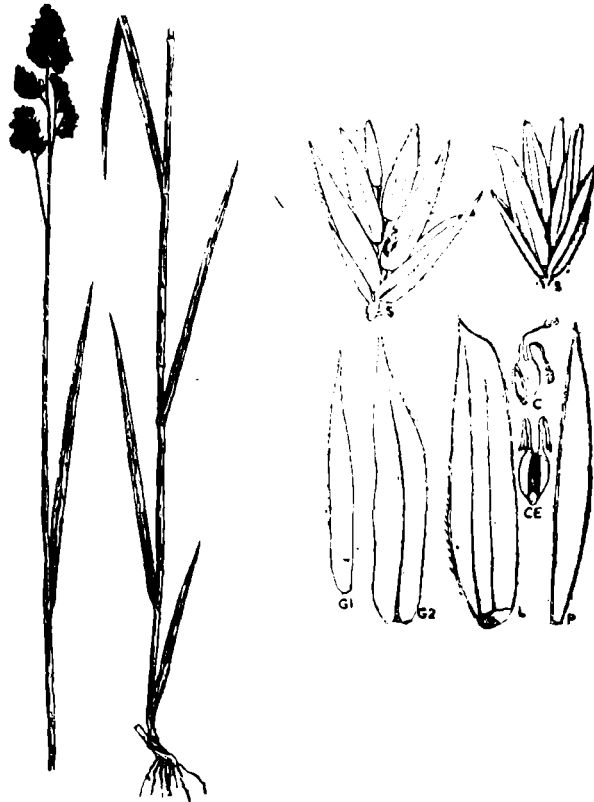


Fig. 110. *Dactylis glomerata*.

### 10. *Aeluropus* Trin p. p.

Perennial, much branched erect or prostrate grasses. Leaves convolute, rigid and pungent, rarely flat. Spikelets 6- to many-flowered, sessile or subsessile in elongated or oblong spiciform panicles, densely crowded laterally compressed villous; rachilla jointed at the base and between the lemmas. Glumes shorter than the lemmas, lower 1- to 3-nerved, upper 5 to 7-nerved. Lemmas closely imbricate, 7- to 11-nerved, dorsally rounded, apiculate-cuspidate or mucronate. Palea as long as but broader than its lemma, truncate; keels ciliate. Styles free, stigmas plumose.

#### KEY TO THE SPECIES

- Panicle compact, ovoid or oblong, up to 3 cm. long.....1. *Ae. lagopoides*  
 Panicle elongate, interrupted, 8-12 cm. long.....2. *Ae. macrostachyus*

#### 1. *Aeluropus lagopoides* (Linn.) Trin.

*Aeluropus lagopoides* (Linn.) Trin. ex Thw., Enumer. Pl. Zeyl. 374 (1864).



*Poa lagopoides* Linn., Mantiss. 1 : 33 (1767).

*Aeluropus villosus* Trin., Fund. Agrost. 143 (1820); Hook. f., Fl. Brit. Ind. 7 : 354 (1896).

*Aeluropus littoralis* var. *repens* Duthie, Grass. N. W. Ind. 67 (1883).

*Aeluropus repens* (Desf.) Parl., Fl. Ital. 1 : 462 (1848).

*Aeluropus brevifolius* Wall., Cat. no. 8897 (1829).

Perennial. Culms 15-30 cm. long, densely tufted, branched, many-noded, rigid, smooth, erect or prostrate with long creeping stolons, base slightly swollen, clothed with rigid glabrous or hairy sheathing scales. Leaf-blades 0.4-2.5 cm. long, erect or spreading and recurved, subulate-lanceolate or acicular, coriaceous, pungent, convolute, base rounded, glabrous or sparsely hairy; sheaths short, much overlapping, terete, inflated or dilated, glabrous or ciliate; ligule a fringe of short hairs. Spikelets very closely imbricate in short spikes, which unite into dense globose, ovoid or oblong head, 0.6-1.8 cm. in diameter. Spikelets

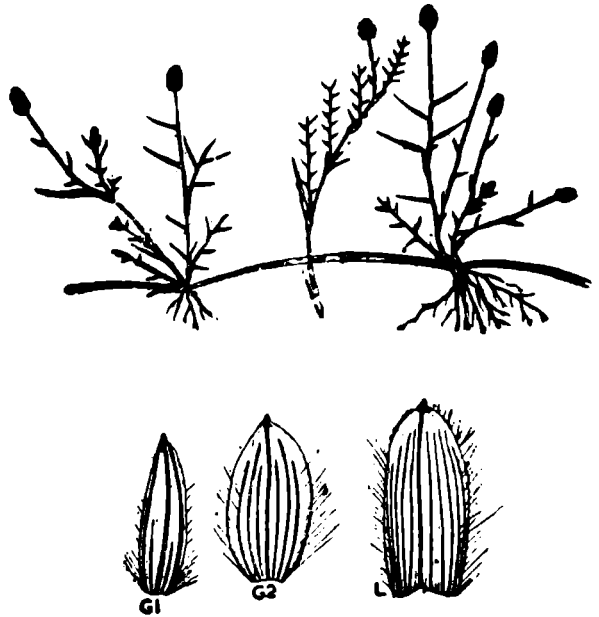


Fig. 111.—*Aeluropus lagopoides*.

4-flowered, 1.6-2.5 mm. long, sessile, villous. Glumes 1.5 mm. long, ovate-oblong, apiculate, margins hyaline; lower 3- to 5-nerved; upper longer, 7- to 9-nerved. Lemma 2 mm. long, dorsally long-villous, 7- to 9-nerved, the lower 2-4 sometimes neuter. Palea broadly truncate or 3-lobed; keels villous. Anthers 1 mm. long.

Choa Saidan Shah; Uchali near Sakesar; Khewra, Drummond; Piranawala, Multan; Shorkot; Kharan, Hughes Buller; Karachi, S. R. Kashyap. Very common in saline soil.

#### 10. *Aeluropus macrostachyus* Hack.

*Aeluropus macrostachyus* Hack. in Oesterr. Bot. Zeitschr., 374 (1902).

A perennial rhizomatous grass. Culms erect or geniculate-ascending, upto 35 cm. tall, glabrous, with numerous basal innovation shoots,

*Leaf-blades* 3-6 cm. long, 2-3.5 mm. broad, flat or folded in drying, tapering towards a pungent apex, margins scaberulous; *sheaths* terete, as long as or shorter than the internodes, glabrous; *ligule* reduced to a ridge of short hairs. Panicle long-peduncled, 6-10 cm. long, interrupted, the branches distant, 1-3 cm. long, and bearing 3 to 7 spikelets. *Spikelets* 13 mm. long, 3.5 mm. broad, 8-12 flowered. *Glumes* villous, oval with the margins scarious; the lower 1.5 mm. long, 1- to 3-flowered, keeled, with the keels scabrid; usually inaequilateral, apiculate; the upper 2.5 mm. long, 3- to 5-nerved, mucronate, keeled, the keels scabrid. *Lemmas* 4 mm. long, closely imbricate, 11-nerved, the nerves evanescent below, villous, ovate-oblong, hyaline on the margins. keeled, the keels scabrid or villous, apiculate. *Palea* 3 mm. long, 2-keeled, the keels long-ciliate.

Quetta, May 1957, M. Nawaz, R. R. Stewart.

### 11. *Brachypodium* Beauv.

Annual or perennial grasses with flat or convolute leaves. Inflorescence a terminal simple spike-like raceme. Spikelets with very short stalks, terete, 5- to many-flowered, alternating in two rows on opposite sides of the rachis, and with their edges towards it; rachilla glabrous, disarticulating above the glumes and between the lemmas. Glumes 2, persistent, unequal, strongly 3- to 7-nerved. Lemmas closely imbricate at first then more or less spreading and rolling inwards in fruit, oblong-lanceolate, acuminate, with a terminal straight awn or mucro, 7-nerved. Palea oblong, rather broad, obtuse or truncate; keels pectinately ciliate. Lodicules 2, ciliolate. Ovary with villous appendage at the top; styles distinct; stigmas plumose, laterally exerted.

#### KEY TO THE SPECIES

Annuals. Anthers 0.75-1 mm. long..... 1. *B. distachyon*  
 Perennial. Anthers 3.5-4 mm. long..... 2. *B. sylvaticum*

#### 1. *Brachypodium distachyon* (L.) Beauv.

*Brachypodium distachyon* (Linn.) Beauv., Essai Agrost. 101 (1812).

*Bromus distachyos* Linn., Cent. Pl. II: 8 (1756).

*Festuca distachyos* (Linn.) Roth, Cat. Bot. Fasc. 1: 11 (1797).

Annual. Culms tufted, rarely solitary, geniculate-ascending, rarely erect, 2-45 cm. high, glabrous, smooth or scabrid, 3- to 4-noded, nodes

densely pubescent. *Leaf-blades* up to 12 cm. long, 4 mm. broad, acuminate, scabrid and more or less hairy; *sheaths* glabrous or with a few scattered hairs, smooth or scabrid; *ligules* 1.5 mm. long, rounded or truncate, ciliolate at the margin, pubescent. *Raceme* simple, formed of 2-6 spikelets, 3-8 cm. long; rachis scabrid. *Spikelets* appressed to the rachis, compressed, linear-lanceolate, lanceolate or oval, 2-3 cm. long, 10- to 16-flowered; rachilla joints 1.5 mm. long, minutely hairy. *Lower glume* lanceolate, scabrid on the back, glabrous or rarely slightly hairy, rigid, narrowly scarious along the margins, 5-6 mm. long, acute, 5-nerved. *Upper glume* similar, 7-8 mm. long, 7-nerved, acuminate or aristate. *Lemmas* 8-10 mm. long, lanceolate, coriaceous, glabrous, narrowly scarious on the margins, awned from the entire tip; awn as long as the lemma in the upper floret, mucronate in the lower, 7-nerved. *Palea* slightly shorter; leels pectinate-ciliate. *Anthers* 0.75-1 mm. long.

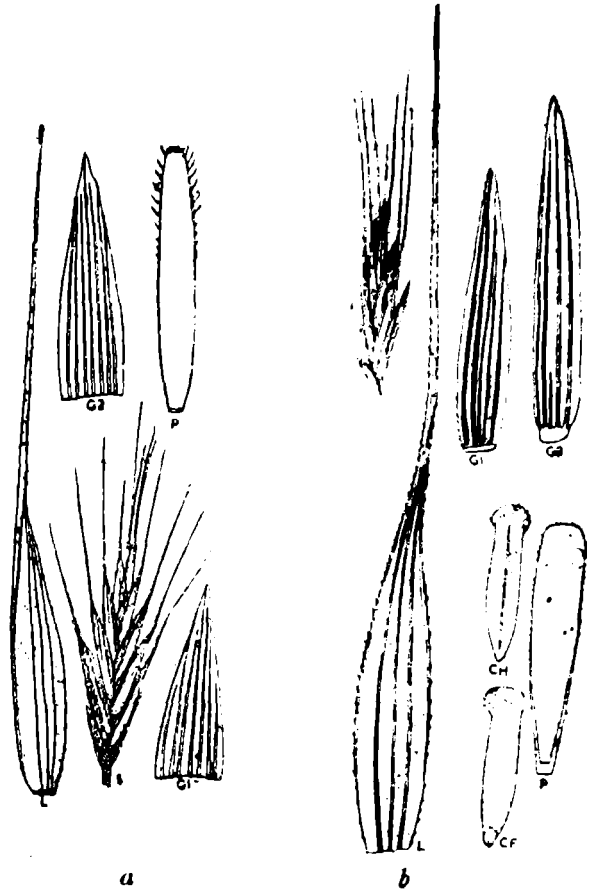


Fig. 112. *Brachypodium distachyon*;  
b. *B. sylvaticum*.

Swat State: Khaṛa Khela, S. Ahmad; Dir, July 14, 1956, A. R. Beg; Jhalar, Attock Distt., R. R. Stewart; Kohala, R. R. Stewart.

## 2. *Brachypodium sylvaticum* Beauv.

*Brachypodium sylvaticum* Beauv., Essai Agrost. 161 (1812); Hook. f., Fl. Brit. Ind. 7: 362 (1896).

Perennial. *Culms* up to 1.5 m. high, smooth and glabrous; nodes woolly or quite glabrous. *Leaf-blades* linear, firm or flaccid, flat or convolute, tapering to a fine point 8-20 cm. long, up to 1 cm. broad;

*sheaths* more or less villous, often quite glabrous, hairy on the margins; *ligules* membranous, 1-6 mm. long, lacerate. *Rachemes* simple, of a few to numerous, shortly pedicelled or sessile spikelets, 6-20 cm. long, nodding. *Spikelets* 2-4 cm. long, 8- to 16-flowered, at first cylindrical then becoming compressed. *Lower glume* lanceolate, 6 mm. long and 1 mm. broad at the base, 5-nerved, tapering to a blunt tip. *Upper glume* 11 mm. long by 1.5 mm. broad, 7-nerved. *Lowest lemma* 7-11 mm. long by 2 mm. broad broadly lanceolate rounded on the back, hairy, rarely rough or quite smooth, awned from the entire tip; awn scabrid, up to 12 mm. long; callus glabrous. *Palea* nearly as long as the lemma with short-haired keels. *Anthers* 3-4 mm. long.

Chitral: Lowari Pass; Kafirstan; Swat: Kulali. *Shaukat*; Dir, *A. R. Beg*; Kagan Valley: *Sharhan, M. S. Zahur*; Murree, *Asghar*; Nathiagali, *R. R. Stewart*.

## 12. *Lolium* Linn.

Annual or perennial grasses. Spikelets usually more or less compressed, 2-ranked, alternate, sessile in the hollows of the rachis of a simple spike; rachilla glabrous, jointed above the glumes and between the lemmas. Spikelets 3- to many-flowered. Glumes of the terminal spikelet equal and similar, lower suppressed in the lateral spikelets, coriaceous, 7- to 9-nerved. Lemmas minutely toothed, more or less chartaceous, 5-nerved, muticous or awned from close to the tip. Palea as long as the lemma, 2-keeled, keels more or less crested. Ovary glabrous; styles distinct; stigmas plumose, laterally exerted. Caryopsis tightly enclosed by lemma and palea.

### KEY TO THE SPECIES

1. Glumes shorter than the spikelets .....2  
    Glumes as long as or longer than the spikelets .....3
2. Lemmas nearly awnless; culms subcompressed; leaf-blades folded about the midrib when young; auricles at the summit of the sheath obsolete ..... 1. *L. perenne*  
    Lemmas at least the upper awned; culms cylindrical; leaf-blades rolled when young; auricles at the summit of the sheath pro-

- minent ..... 2. *L. multiflorum*  
 3. Lemmas elliptic to ovate, plump, 7-8 mm. long, rounded on the  
 back, awnless or awned ..... 3. *L. temulentum*  
 Lemmas dorsally compressed, narrow, long-awned, 9-10 mm. long ;  
 culms branching at the lower nodes ..... 4. *L. persicum*

### 1. *Lolium perenne* Linn.

*Lolium perenne* Linn., Sp. Pl. 83 (1753) ; Hook. f., Fl. Brit. Ind. 7 :  
 365 (1896).

A perennial grass with densely tufted culms. *Culms* erect or decumbent, 30-60 cm. high. *Leaf-blades* linear to linear-lanceolate, up to 7 cm. long, 2-4 mm. wide, smooth and glossy on the lower surface, dull with distinct nerves above ; *sheaths* tight when young, slipping from the culms when old, not keeled, very slightly auricled at the mouth ; *ligule* short, membranous, truncate. *Spikes* terminal, simple, solitary often subfalcate ; rachis smooth and glabrous, 15-25 cm. long. *Spikelets* solitary, usually more or less compressed, 10 mm. long, 6-12 or more-flowered. *Lower glume* (of terminal spikelet) linear to oblong-lanceolate, obtuse, 5 or more ribbed on the outside, thick, opaque, shorter than the spikelet. *Upper glume* (of all spikelets) similar in shape and texture, many-nerved, 7 mm. long. *Lemmas* chartaceous, oblong, longer than the glumes, obtuse, acute or awned, 5-7 mm. long, rounded on the back, 5- to 7- or more-nerved. *Palea* truncate ; keels minutely scabrid. *Anthers* 2.5 mm. long.

Murree, Asghar Ali ; Parachinar, R. R. Stewart ; Fort Sandeman ; Quetta ; Kagan Valley ; Swat. Very common.

### 2. *Lolium multiflorum* Lamk.

*Lolium multiflorum* Lamk., Fl. Fr. 3 : 621 (1778).

Annual or perennial. *Culms* tufted, geniculate-ascending or erect, up to 1 m. high, smooth and glabrous, 4- to 5-noded, simple or branched at the base. *Leaf-blades* linear, 10-20 cm. long, 2.5-5 mm. broad, flat, scabrid on both surfaces ; *sheaths* smooth with prominent auricles at the summit ; *ligule* very short, truncate from an auricled base. *Spikes* erect, 15-30 cm. long ; rachis scabrid along the margins ; internodes (except the lowest) distinctly shorter than the spikelets. *Spikelets* laterally strongly compressed, elliptic-oblong,

15-25 mm. long, 10- to 20-flowered. *Upper glume* narrow, oblong, subobtuse, somewhat rounded on the back, shorter than the spikelets, strongly 7-nerved. *Lemmas* oblong, 7-8 mm. long, 5-nerved, awn (when present) straight, 6-10 mm. long. *Palea* with crested and scabrid keels. *Anthers* 3-5 mm. long.

Murree Hills, Nathia Gali.

### 3. *Lolium temulentum* Linn.

*Lolium temulentum* Linn., Sp. Pl. 83 (1758); Hook. f., Fl. Brit. Ind. 7 : 364 (1896).

Annual. *Culms* solitary or tufted, erect, 30-90 cm. high, 2- to 4-noded, glabrous. *Leaf-blades* linear, acute, 15-30 cm. long, 3-6 mm. broad, scabrid on both the surfaces, glabrous; *sheaths* rather tight; *ligule* very short, truncate. *Spikes* erect, 15-25 cm. long, slightly rough on the back. *Spikelets* as long as the internodes or the lower shorter and more distant, 12-20 mm. long, 5- to 7-flowered, turgid. *Upper glume* oblong, 2-2.5 cm. long, equalling or somewhat exceeding the uppermost floret, subobtuse to acute, very rigid, flat, glabrous and smooth 7- to 9-nerved. *Lemmas* elliptic-oblong, obtuse or sub-obtuse, mucicous or awned, 7-8 mm. long, rounded on the back, smooth, 5-nerved; awn 6-12 mm. long. *Anthers* 2.5 mm. long.

Quetta : Ziarat ; Hyderabad ; Lahore ; Rawalpindi ; Murree ; Peshawar. Very common.

### 4. *Lolium persicum* Boiss. & Hoehn.

*Lolium persicum* Boiss. & Hoehn. in Boiss. Pl. Orient Nov. I. ii : 66 (1853); Fl. Orient. 5 : 680 (1884).

An annual resembling small plants of *L. temulentum* with culms branching at the lower nodes; the spikes 8-12 cm. long and the spikelets more distant than in that species. The glumes are  $\frac{3}{4}$  as long as the spikelet and the lemmas are dorsally compressed, long-awned (9-10 mm) and 9-10 mm. long; the palea is slightly longer than the lemma.

Quetta, *Stocks teste Boissier*.

### 5. *Lolium remotum* Schrank.

*Lolium remotum* Schrank, Bayer. Fl. 1 : 382 ( 788).

A slender annual, closely resembling *L. temulentum* but differing

in the smaller spikelets (8-10 mm.) and smaller awnless lemmas (4-5 mm.).

Jhelum, R.R. Stewart; Rawalpindi, A. R. Beg.

### 13. *Nardurus* Rchb

Annual grasses with simple culms and wiry leaf-blades; sheaths tight; ligule membranous. Inflorescence a simple spike with the spikelets arranged in two rows on one side of the rachis which is shallowly concave opposite the spikelets. Floret 3-5, divergent at the apex. Glumes equal or subequal, 3-nerved, membranous, Lemmas rounded on the back, 5-nerved, the lowest pubescent but the subsequent less so, 2-dentate, mucicous or aristate. Palea 2-keeled, the keels scabrid.

#### *Nardurus orientalis* Boiss.

*Nardurus orientalis* Boiss., Diagn. ser. I. vii: 127 (1846).

*Lolium orientale* v. Krecz. et Bobror, Fl. URSS, 2: 544 (1934).

Annual. Culms simple or branched at the base, erect or geniculate-ascending, 2- to 3-noded, 6-20 cm. high, solitary or tufted, glabrous, smooth; nodes glabrous, purple. Leaf-blades narrow, 1.5-4 cm. long, glabrous, scaberulous; sheaths shorter than the internodes, terete, tight, striate, smooth; ligule membranous, lacerate, 0.5 mm. long. Spikes solitary, straight or falcate, 2-4 cm. long, about 4 mm. wide, bearing 10-22 sessile spikelets arranged alternately in the excavation of the rachis; internodes 2-3 mm. long, shorter than the spikelets; rachis winged, pubescent, terminated by a spikelet; peduncle hairy below the spike, very short to 4 cm. long. Spikelets sessile, 3- to 5-flowered, up to 5 mm. long. Glumes subequal, 4-5 mm.

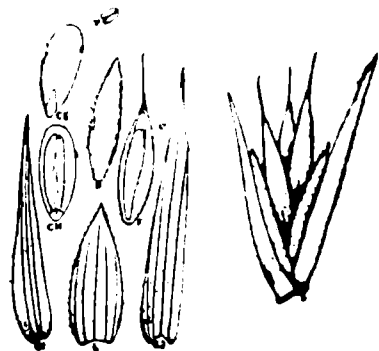


Fig. 113.—*Nardurus orientalis*.

long, acuminate, rounded on the back, scabrid, as long as or exceeding the florets. Lemma 2.5-3 mm. long, elliptic, 2-dentate, mucronate, rounded on the back, 5-nerved, the lowest especially pubescent, shortly aristate below the tip; awn 1-1.5 mm. long. Palea 2.5 mm. long, ciliate along the keels. Anthers 0.3-0.5 mm. long. Caryopsis 2 mm. long.

Quetta, May 1957, M. Nawaz; May 6, 1956, J. J. Norris.

14. *Sclerochloa* Beauv.

Low tufted annuals. Inflorescence a dense spike-like raceme. Spikelets sessile, imbricate in 2 rows on one side of the broad thick rachis; florets 5-9, the upper sterile; rachilla continuous, broad, thick, the spikelets falling entire. Glumes broad, obtuse, rather firm, with hyaline margins, the lower 3-nerved, upper 7-nerved. Lemmas rounded on the back, obtuse, with 5 prominent, parallel nerves and hyaline margins. Palea 2-fid, hyaline, sharply keeled; keels spinulose ciliate. Styles free, short; stigmas plumose.

1. *Sclerochloa dura* (Linn.) Beauv.

*Sclerochloa dura* (Linn.) Beauv., Essai Agrost. 98 (1812); Hook. f., Fl. Brit. Ind. 7: 325 (1896).

*Cynosurus durus* Linn., Sp. Pl. 72 (1753).

*Poa dura* Scop., Fl. Carn. ed. 2, 1: 70 (1772).

*Catapodium durum* Link in Linnaea 17: 399 (1843).

Annual. Culms erect to spreading, 5-15 cm. high, leafy throughout. Leaves glabrous, the lower very small, the upper increasingly larger with broad overlapping sheaths, 7-18 mm. long, 1-3 mm. broad, the upper exceeding the racemes; ligule membranous, oblong, 1.5 mm. long. Racemes ovate or ovate-oblong, up to 5 cm. long, 2 mm wide, at first enclosed in the terminal sheath but later more or less exerted; rachis flattened, thick, glabrous and smooth; branches very short, solitary, disposed in two rows on one side of the axis, bearing 1, rarely 2 spikelets, thick, glabrous and smooth. Spikelets 6-9 mm. long; rachilla thick, glabrous and smooth, continuous. Glumes unequal, submembranous with broadly hyaline margins, obtuse, glabrous; the lower oval, 3-nerved, 2-3 mm. long; the upper oblong, more or

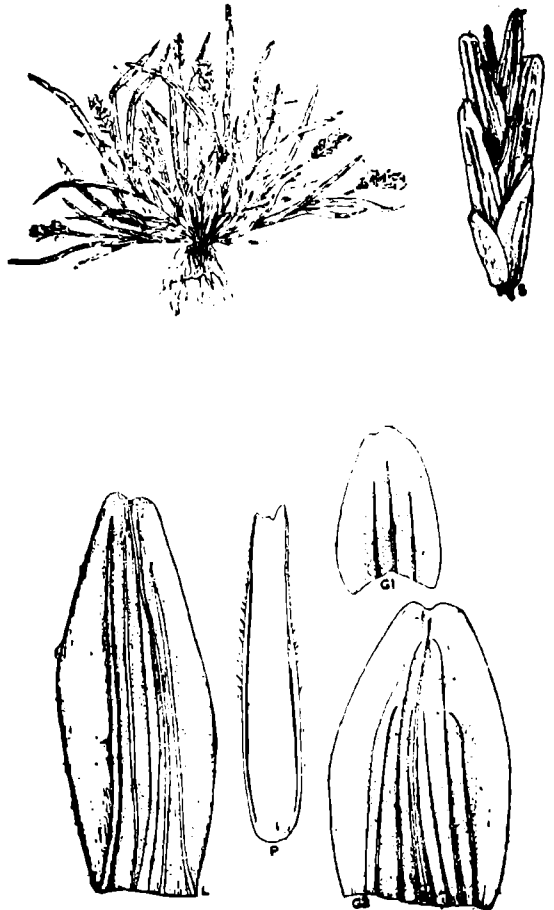


Fig. 114.—*Sclerochloa dura*.



less emarginate at the summit, 7- to 9-nerved, unequal sided, 4-5 mm. long. *Lemma* oblong-lanceolate, indurated, 5-6 mm. long, 5-nerved, keeled, glabrous and smooth, broadly hyaline on the margins, obtuse and very shortly mucronate. *Palea* truncate-retuse, spinulosely ciliate along the keels. *Anthers* 1.5 mm. long.

Swat State : Khaza Khela ; Abbottabad ; Wah ; Uri, Kashmir Road.

### 15. *Puccinellia* Parl.

Low tufted annual or perennial grasses with narrow to open panicles. Spikelets many-flowered, usually terete or subterete ; rachilla disarticulating above the glumes and between the lemmas. Glumes unequal, shorter than the first lemma, obtuse or acute, rather firm, often scarious at the tip ; lower 1-nerved or sometimes 3-nerved ; the upper 3-nerved. Lemmas usually firm, rounded on the back, obtuse or acute, rarely acuminate, usually scarious and often erose at the tip, glabrous or puberulous towards the base, rarely pubescent on the nerves, 5-nerved, the nerves parallel, indistinct, rarely rather prominent. *Palea* nearly as long as the lemma or somewhat shorter.

#### KEY TO THE SPECIES

Culms up to 5 cm. high ; lower glume 0.75 mm. long ; upper

1 mm. long ; lemmas glabrous..... 1. *P. minuta*

Culms 20-40 cm. high ; lower glume 1-1.5 mm. and the upper 2-2.5 mm. long ; lemmas hairy at the base..... 2. *P. distans*

#### 1. *Puccinellia minuta* Bor

*Puccinellia minuta* Bor ex Wendelbo in Nytt Magasin f. Bot. 1 : 19 (1952).

Perennial. *Culms* up to 5 cm. high, smooth, glabrous, bases covered with old leaf-sheaths, erect, densely caespitose. *Leaf-blade* linear-obtuse, convolute, setaceous, flat, up to 1.5 cm. long, 1 mm. broad, lower smooth, glabrous, the upper minutely rough along the margins ; *sheaths* tight ; *ligule* 0.5 mm. long, membranous, lacerate. *Panicle* short, up to 2 cm. long, stiff, 3-5 mm. wide, branches shortly ascending, smooth and glabrous. *Spikelets* 2- to 3- flowered, up to 3.5 mm. long ; rachilla 1 mm. long, glabrous. *Lower glume* 0.75 mm. long, oblong, acute or obtuse, 1-

nerved, keeled, margins narrowly hyaline, purple towards the apex, smooth, glabrous. *Upper glume* 1 mm. long, elliptic-acute, keeled, 1-nerved, smooth, glabrous, purple along the margins and at the apex. *Lemma* 2.5 mm. long, 1.5 mm. broad, 2-nerved, smooth, glabrous, rounded on the back below, keeled above, margins narrowly hyaline, purple at the margin and towards the tip. *Palea* 2 mm. long, oblong, acute, 2-keeled, with scabrid keels. *Anthers* 1 mm. long.

Chitral : Tirich Mir : Barum Gol, *Per Wendelto*.

## 2. *Puccinellia distans* (Linn.) Parl.

*Puccinellia distans* (Linn.) Parl., Fl. Ital. 1 : 367 (1848).

*Glyceria distans* Wahlenb., Fl. Upsal. 36 (1820); Hook. f., Fl. Brit. and. 7 : 347 (1896).

*Poa distans* Linn., Mantiss. I. 33 (1767).

*Atropis distans* (Linn.) Griseb. Fl. Ross. 4 : 388 (1853).

Perennial. *Culms* tufted, 10-60 cm. high, erect, spreading or prostrate, 2- to 4-noded, smooth. *Leaf-blades* 2-10 cm. long, flat or convolute, glabrous, 1.5-4 mm. wide, scabrid above; *sheaths* rounded on the back, smooth; *ligules* 1-2 mm. long, membranous. *Panicles* narrowly to broadly ovate, usually very loose and open, 3-18 cm. long, up to 14 cm. wide; branches fascicled, naked up to half their length, deflexed, scabrid; pedicels very short. *Spikelets* narrowly oblong 3-7 mm. long, 3- to 9-flowered, greenish or purp'ish; rachilla jointed below each lemma. *Glumes* persistent, ovate to elliptic, unequal, blunt; lower

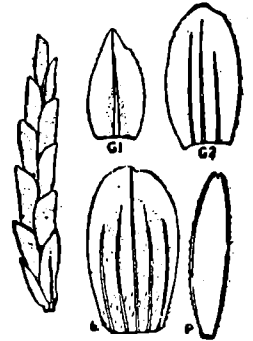


Fig 115. *Puccinellia distans*.

1-1.5 mm. long, 1-nerved; upper 1.5-2 mm. long, 3-nerved. *Lemmas* overlapping, rounded on the back, 2-2.5 mm. long, broadly oblong-elliptic, very blunt, minutely hairy at the base, 5-nerved, the nerves not reaching the broad white or yellowish membranous tips. *Paleas* about as long as the lemmas, the 2 keels minutely hairy. *Anthers* 0.8-1 mm. long.

Quetta, April 12, 1954, *Asghar Ali*.

## 16. *Scleropoa* Griseb.

Annual grasses with slightly branched one-sided panicles. *Spikelets* many-flowered, linear, somewhat compressed, the thick rachilla disarticulating above the glumes and between the lemmas, remaining as small

stipes to the florets above. Glumes unequal, short, acute, strongly nerved; lower 1-nerved, upper 3-nerved. Lemmas rarely terete, obscurely 5-nerved, obtuse, slightly scarious at the tip.

### 1. *Scleropoa rigida* (Linn.) Griseb.

*Scleropoa rigida* (Linn.) Griseb. Spicil. Fl. 2 : 431 (1844).

*Poa rigida* Linn., Cent. Pl. I: 5 (1756).

Annual. Culms erect or decumbent, densely tufted, rarely solitary, 10-30 cm. high. Leaf-blades flat, up to 10 cm. long, 3 mm broad, scabrid along the nerves and on the margins, glabrous; ligule 3 mm. long, truncate and lacerate, glabrous. Panicle narrow, stiff condensed, 5-10 cm long; branches solitary, erect or spreading the lower branched the upper simple, spiculate to the base, these and the thick pedicels somewhat spreading in anthesis; axis scabrid along the angles; pedicels very short, subtriquetrous, thick, not swollen at the apex, scabrid. Spikelets 5-8 mm. long, 5-to 10-flowered, linear-lanceolate, laterally compressed; rachilla tardily disarticulating, scabrid, joints 1 mm. long. Glumes coriaceous, scarious at the margins, oval-lanceolate, acute, keeled; keel scabrid; lower 1.5 mm. long, 1-nerved; upper 2 mm. long, 3-nerved. Lemmas 2.5 mm. long, oblong, more or less obtuse, very shortly mucronate, glabrous, finely punctate-scabrid, slightly keeled, coriaceous with scarious margins, 3-nerved or obscurely 5-nerved, the lateral nerves submarginal. Palea as long as the lemma, lanceolate, obtuse; keels scabrid. Anthers 0.8 mm. long.



Fig. 116. - *Scleropoa rigida*.

Chitral: Barum Gol, Shokor Shal, Per Wendelbo; Gilgit, June 5, 1951, I. I. Chaudhri.

### 17. *Castellia* Tineo

Annual grasses with narrow leaf-blades. Inflorescence a simple spike or a raceme of spikes. Spikelets sessile, alternating in two rows on opposite sides of the rachis which is shallowly concave opposite the spikelets. Florets many, cleistogamous. Glumes unequal, 3-nerved, coriaceous. Lemmas slightly keeled when young, rounded on the back

at maturity, 5-nerved, thin membranous, covered all over the back with hyaline tubercles. Ovary provided with a fleshy process covered with short hairs; hilum linear. Palea with scabrid keels.

### 1. *Castellia tuberculosa* (Moris) Bor

*Castellia tuberculosa* (Moris) Bor in Ind. Forester 74 : 90 (1948).

*Catopodium tuberosum* Moris in Atti Terz. Riur. Sc. Ital. 481 (1841).

*Castellia tuberculosa* Tineo, Pl. Rar. Sicil 2 : 18 (1846).

*Festuca tuberculosa* Coss. et Dur., Fl. Alger. Glum. 189 (1856).

*Festuca tuberculata* Benth. in Jour. Linn. Soc. 19 : 128 (1851).

*Desmazeria tuberculosa* (Moris) Battand et Trabut, Fl. Alger. Monocots, 100 (1884).

Annual Culms simple, up to 30 cm. high, smooth and glabrous. Leaf-blades 10 cm. long, 3 mm. broad, glabrous; sheaths rather inflated; ligules membranous, hyaline, 1.5 mm. long, lacerate. Spikelets 9- to 15-flowered, 0-13 mm. long. Lower glume 3.5 mm. long, lanceolate, hyaline along the margins, glabrous, 3-nerved. Upper glume 4 mm. long, oblong, 3-nerved, coriaceous. Lemmas 4.5 mm. long, ovate-elliptic, 5-nerved, rather delicate and translucent, covered on the back with coarse tubercles. Anthers 0.3-0.6 mm. long. Top of the ovary with a fleshy process covered with short sparse hairs; hilum linear. Palea scabrid on the keels and in the intervening space.



Fig. 118.-*Castellia tuberculosa*.

Campbellpur, April 2, 1949, A. R. Eeg.

### 13. *Vulpia* Gmelin

Annual grasses with narrow, involute or convolute leaves. Panicles contracted. Spikelets usually more or less secund, seated on clavate pedicels, laterally compressed, 1- to 7-flowered; rachilla jointed above the glumes and between the lemmas. Glumes very unequal, the lower minute or 0 or like the upper, subulate to subulate-lanceo-

late but much shorter, 1-nerved, the upper usually 3-nerved. Lemmas subulate-lanceolate, tapering into a straight awn, rounded on the back, faintly 5-nerved. Palea entire or minutely 2-toothed. Stamens 1-3, often only 1. Ovary glabrous; styles free, stigma short, remaining included during flowering.

KEY TO THE SPECIES

Lemmas never ciliate; all lemmas fertile. Lower glume  $1/8-2/3$  the upper glume .....1. *V. myuros*  
 Lemmas long-ciliate; the lower alone fertile the rest sterile.  
 Lower glume  $1/6-1/2$  the upper glume .....2. *V. ciliata*

1. *Vulpia myuros* (Linn.) Gmelin

*Vulpia myuros* (Linn.) Gmelin. Fl. Bad. 1: 8 (1805).

*Festuca myuros* Linn., Sp. Pl. 74 (1753); Hook. f., Fl. Brit. Ind. 7: 356 (1896).

Annual. Culms tufted, geniculate at the base, up to 30 cm. high. Leaf-blades 25-12 cm. long, 1.25-2.5 mm. broad, puberulous or scabrid on the upper surface, otherwise glabrous and smooth; sheaths rather loose; ligules very short, often obscurely auricled. Panicle spike-like,



Fig. 119.-*Vulpia myuros*.

erect or nodding and flexuous, narrow and often secund, 5-25 cm. long; filiform, branches fascicled or 2-nate and very unequal, or solitary, branched from near the base. Spikelets 8-12.5 mm long, loosely 3- to 6-flowered. Lower glume reduced to a minute scale or subulate like the upper, up to 25 mm. long. Upper glume subulate-lanceolate, 3-5.5 mm. long, 3-nerved. Lemma linear-lanceolate, acuminate in profile; awn 7.5-25 mm. long, fine, scabrid. Stamens 1 or 2. Anthers 0.4-1 mm. long

*Palea* 5 mm. long, scabrid along the keels.

Swat State: Khara Khela, April 16, 1954, S. Ahmad; Quetta, M. Nawaz; Kila Abdullah, Lace.

## 2. *Vulpia ciliata* Link

*Vulpia ciliata* Link, Hort Bot. Berol. 1: 147 (1827).

*Vulpia myuros* var. *ciliata* (Link) B. & B., Cat. Tun. 48) (1896).

Annual. Culms solitary or tufted, erect or geniculate-ascending, 5-40 cm. high, often completely covered by the sheaths. Leaf-blades up to 15 cm long, 1.5 mm. broad glabrous and more or less scabrid; sheaths rounded, tight, glabrous and smooth; ligules less than 0.5 mm. long, ciliate-dentate. Panicle up to 15 cm. long, unilateral, more or less dense, usually enclosed at the base by the uppermost sheath; axis pubescent; branches erect, appressed, the lower 2- or 3-nate; pedicels pubescent. Spikelets oblong-cuneiform, 6 mm. long, 3- to 7-flowered, the lower one or two only fertile; rachilla villous, fragile. Glumes very unequal, glabrous and smooth, the lower linear-lanceolate, 0.3-0.73 mm. long, nerveless or 1-nerved; the upper 1.5-3 mm. long, obtuse or subacute, margins

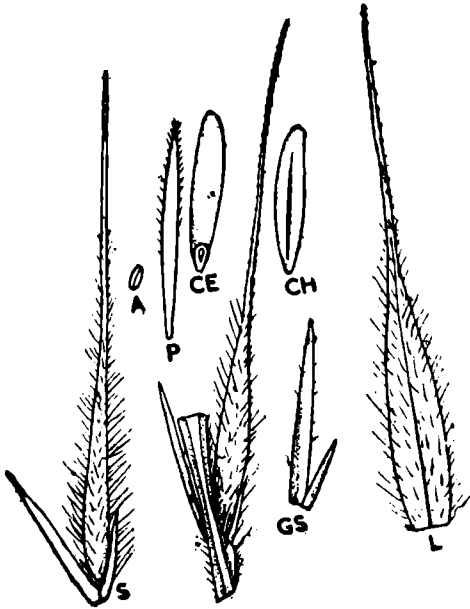


Fig. 120 *Vulpia ciliata*.

broadly scariosus. Lemma lanceolate-linear, tapering to a scabrid awn, 5-nerved, villous. Palea with scabrid keels. Anthers 0.4-0.5 mm. long.

Quetta, May 1956. J. J. Norris.

## 19. *Leucopoa* Griseb.

Perennial, tufted grasses with flat, convolute or setaceous leaves. Spikelets laterally compressed 2- to many-flowered, in open or contracted panicles; florets dioecious; rachilla disarticulating above the glumes and between the florets. Glumes unequal, white, membranous, the lower lanceolate and the upper ovate, 1- to 3-nerved. Lemmas ovate or ovate-oblong, 5-nerved, tip and margins broadly hyaline. Palea oblong with

scabrid keels. Grain dorsally subconvex, ventrally flat; hilum reaching above the middle.

1. **Leucopoa albida** (Turcz.) Krecz. & Bobr.

*Leucopoa albida* (Turcz.) Krecz. & Bobr. in Komarov, Fl. URSS. 2 : 495 (1934).

*Poa albida* Turcz. ex Trin. in Mem. Acad. Petersb. ser. VI, 1 : 387 (1831); Hook. f., Fl. Brit. Ind. 7 : 355 (1896) sub *Festuca sibirica*.

Perennial. Culms tufted, up to 45 cm. high, erect, leafy up to the panicle, smooth and glabrous. Leaf-blades firm, linear, 15-25 cm. long, 2.5-3.5 mm. broad, acuminate, scabrid; sheaths of the innovation shoots open to the base, terete, basal crowded, cauline smooth; ligules very short, membranous, truncate, ciliate. Panicle 7.5-15 cm. long, very narrow or effuse, stiff or flexuous; lower branches 1- or 2-nate, erect or spreading, simple or divided beyond middle and bearing 1-4 spikelets; pedicels short. Spikelets ovate-oblong, 4- to 6-flowered, 7.5-10 mm. long; rachilla minutely scabrid, internodes 0.6 mm. long. Lower glume ovate, subacute, 2.5-3 mm. long, 1-nerved or 3-nerved at the base, white and hyaline except along the green nerve. Upper glume ovate, 5 mm. long, usually 3-nerved, white and hyaline except along the nerves. Lemma 5-8 mm. ovate or ovate-oblong, subobtusate, scaberulous, margins subciliate or denticulate, awnless or the tip setiform, 5-nerved, tip and margins broadly hyaline. Palea oblong, acute, 2-dentate, with scabrid keels. Anthers 3-3.5 mm. long, reduced or completely empty in the female plants. Grain 3.5 mm. long.

Tirich Mir, Camp 2, Per Wendelbo; Gilgit: Bahushtar Nala, August 8, 1957, M. S. Zahur.

20, **Festuca** Linn.

Tufted, perennial grasses. Leaves flat, convolute or setaceous. Spikelets laterally compressed, 2- to many-flowered, in open or contracted sometimes spiciform panicles; uppermost floret imperfect; rachilla jointed above the glumes and between the lemmas, not produced beyond the uppermost imperfect floret. Glumes nearly equal, herbaceous, keeled, acute, lower 1- to 3-nerved, the upper 3- rarely 5-nerved. Lemmas narrow, awnless, mucronate or with a straight awn from the tip, 5- to 7-nerved, dorsally rounded or keeled towards the tip only; palea 2-keeled. Stamens 3. Ovary glabrous or minutely pubescent on the top; styles terminal; stigmas plumose, laterally exerted.

## KEY TO THE SPECIES

1. Vernation of leaves convolute..... 2  
Vernation of leaves conduplicate.....4
2. Lemmas awned, awn twice as long as the lemma ; ovary glabrous ;  
sheaths with auricles..... 1. *F. gigantea*  
Lemmas awnless..... 3
3. Lower glume 3.5 mm. long ; upper 5 mm. long ; lemmas 7.5 mm.  
long ; anthers 2.5 mm long ..... 2. *F. modesta*  
Lower glume 8 mm., upper 10-12 mm. long ; lemmas 12-15 mm. long ;  
anthers 8 mm. long ..... 3. *F. lucida*
4. Ovary densely hairy at the top..... 5  
Ovary glabrous..... 7
5. Panicle branches solitary ; spikelets 8-10 mm. long ; lemmas 5-6 mm.  
long, awn 1/2 the lemma or longer..... 4. *F. kashmiriana*  
Panicle branches 2-nate..... 6
6. Sheaths not auricled ; Panicle loose and open, the branches 7.5 cm.  
long, with 1-2 subterminal spikelets ..... 5. *F. altaica*  
Sheaths auricled ; panicle contracted, the branches short, bearing  
more than 3 spikelets..... 6. *F. arundinacea*
7. Lemmas hairy ; anthers 3 mm. long..... 7. *F. rubra*  
Lemmas glabrous ; anthers 1-2 mm. long..... 8. *F. ovina*

1. ***Festuca gigantea*** (Linn.) Vill.

*Festuca gigantea* (Linn.) Vill., Hist. Pl. Dauph. 2 : 110 (1786) ; Hook. f. Fl. Brit. Ind. 7 : 353 (1896).

Perennial. Culms 60-80 cm. high, 3- to 5-noded, glabrous. Leaf-blades 12.5-30 cm. long, 4-5 mm. broad, smooth and glabrous ; sheaths smooth, terete ; ligule very short, truncate, glabrous. Panicle ovate to ovate-oblong, 10-35 cm. long, nodding ; branches solitary or the lower 2-nate, spreading, flexuous, scabrid ; branchlets few-spiculate, spreading or appressed, pedicels short or the lower sometimes equal to the spikelets in length. Spikelets 3-flowered, pale green, linear-lanceolate, 1.25 cm. long. Lower glume membranous, 3.5-4 mm. long, subulate-lanceolate, 1-nerved or obscurely 3-nerved at the base, margins hyaline. Upper glume 6 mm. long, lanceolate, 3 nerved, broadly hyaline on the margins. Lemmas 6-8 mm. long, oblong-lanceolate, acute or the tip shortly 2-rid, margins



narrowly hyaline, minutely puberulous below the tip, awned; awn subterminal, straight or sub flexuous, up to 12 mm. long. *Palea* oblong-lanceolate, 2-toothed, keels scaberulous. *Anthers* 2.5-3.5 mm. long. Grain 5 mm. long.

Swat : Sheo Nala, 7-8000 ft., Aug. 20, 1955, A.R. Beg ; Gujar, July 15, 1956, A.R. Beg ; Chitral : Ziarat, July 30, 1956, A.R. Beg.

## 2. *Festuca modesta* Steud.

*Festuca modesta* Steud., Syn. Pl. Gram. 316 (1854); Hook. f., Fl. Brit. Ind. 7 : 354 (1896).

Perennial. *Culms* up to 1.5 m. high, loosely tufted, innovations ascending or stoloniferous. *Leaf-blades* up to 60 cm. long, 1.2-1.5 cm wide, rough or smooth, many-nerved, cauline leaves up to 15 cm. long, 6 mm. wide ; *sheaths* open to the base, strongly striate, smooth



Fig. 121.—*Festuca* spp. a. *F. gigantea*; b. *F. modesta*; c. *F. lucida*; d. *F. altaica*; e. *F. rubra*; f. *F. ovina*, all x 3.

or the lower rough; *ligules* 3.5 mm. long, truncate, ciliolate. *Panicle* up to 30 cm. long, loose, open; axis scabrid; lower branches very long, 2-nate, sparingly branched beyond the middle, lateral pedicels short. *Spikelets* 3- to 4-flowered, 1.2 cm. long; rachilla scabrid, internodes up to 2.5 mm. long. *Lower glume* 3.5 mm. long, subulate-lanceolate, hyaline except along the percurrent nerve. *Upper glume* 5 mm. long, oblong-lanceolate, acute, 3-nerved. *Lemma* oblong, acute, 5- to 7-nerved, 7.5-8 mm. long, scaberulous, margins narrowly hyaline. *Anthers* 2.5 mm. long. Ovary hispid at the top.

Azad Kashmir, Nakial, Kotli District, beyond Mirpur, April 21, 1954, R. R. Stewart.

### 3. *Festuca lucida* Stapf

*Festuca lucida* Stapf in Hook. f., Fl. Brit. Ind. 7 : 356 (1896).

Perennial. *Culms* 2-noded, up to 90 cm. high. *Leaf-blades* up to 30 cm. long, 1.2-1.8 mm. wide, flat except the involute, scaberulous margins, firm, smooth, glaucous, many-nerved; *sheaths* long, tight, pale, glaucous; *ligules* 1-1.5 mm. long, white, split to the middle into fine fibres. *Panicle* up to 17.5 cm. long, lax; branches simple to beyond the middle, rough, lowest 10 cm. long; lateral pedicels 8-12 mm. long. *Spikelets* 20-22.5 mm. long, glistening, pale green; rachilla scabrid, internodes 2.5-5 mm. long. *Lower glume* 8 mm. long, ovate, acute or subacute, hyaline, except at the base, 1-nerved. *Upper glume* similar, 10-12 mm. long, 3-nerved, the central nerve percurrent, the 2 side nerves very short. *Lemma* oblong, acute or subobtuse, 12-15 mm. long, membranous, pale green, scaberulous, 5- to 7-nerved, tip and margins hyaline, side nerves prominent. *Anthers* 8 mm. long. Ovary with a slightly oblique hispidulous top.

Baltistan: Ghondokoro Glacier, 14050 ft., July 19, 1955, E. Nasir & G.L. Webster.

### 4. *Festuca kashmiriana* Stapf

*Festuca kashmiriana* Stapf in Hook. f., Fl. Brit. Ind. 7 : 351 (1896).

Perennial. *Culms* 1- to 2-noded, up to 60 cm. high. *Leaf-blades* (cauline) setaceous, shorter than those of the innovation shoots, more or less puberulous above, smooth below, sulcate between the 5-7 nerves. bands of sclerenchyma distinct; *sheaths* of intravaginal shoots closed to the middle or 3/4; *ligules* short, truncate, ciliolate. *Panicle* 5-12.5 cm.

long, usually contracted, rather stiff, scaberulous or smooth below ; branches solitary, lower rarely 2-nate, erect, filiform, scaberulous, sparingly branched from below the middle, lateral pedicels 1/2 the spikelet or shorter. *Spikelets* 8-10 mm. long, elliptic-oblong, 3-to 5-flowered ; rachilla minutely scaberulous, internodes 1.2 mm. long. *Lower glume* 2-2.5 mm. long, lanceolate, 1-nerved. *Upper glume* 3.5 mm. long, lanceolate or ovate-lanceolate, 3-nerved. *Lemma* oblong-lanceolate, 5-6 mm. long ; 5-nerved ; awn 2.5-5 mm. long. *Anthers* 2-3 mm. long. Ovary densely hispid at the top. *Caryopsis* 3 mm. long, hilum linear, as long as the grain.

Kagan Valley : Saiful Maluk, July 26, 1954, *Shaukat Ali*.

#### 5. *Festuca altaica* Trin.

*Festuca altaica* Trin. ex Ledeb., Fl. Alt. 1 : 109 (1829) ; Hook. f., Fl. Brit. Ind. 7 : 351 (1896).

Perennial. *Culms* tufted, up to 70 cm. high, 1- to 2-noded. *Leaf-blades* up to 22.5 cm. long, sub-setaceous ; *sheaths* crowded, open to the middle and ultimately to the base ; *ligules* very short. *Panicle* ovate, 10-5 cm. long, axis slender, smooth ; branches up to 7.5 cm. long, subflexuous, capillary. *Spikelets* oblong, 5- to 6-flowered, 8-13 mm. long, rachilla scaberulous, internodes 1.25 mm. long. *Lower glume* 3.5-4 mm. long, lanceolate, acute, 1-nerved. *Upper glume* 4-5 mm. long, 3-nerved. *Lemma* oblong-lanceolate, 6-7.5 mm. long, smooth or scaberulous towards the tip, apex mucronate or with a very short awn, 5-nerved, nerves faint. *Palea* as long as the lemma ; keels minutely scaberulous. *Anthers* 3.5-4 mm. long.

Kagan valley : Gitidas. August 27, 1954, *Dr. Metz* ; Above Chogolisa Glacier, Baltistan, July 22, 1955, *E. Nasir & G. L. Webster*.

#### 6. *Festuca arundinacea* Schreb.

*Festuca arundiacea* Schreb, Spic. Fl. Lips., 57 (1771).

*Festuca elatior* Linn. ssp. *arundinacea* (Schreb.) Hack., Monogr. Fest., 153 (1882).

A densely tufted perennial. *Culms* erect or geniculate-ascending, 2- to 4-noded, up to 1.5 m. high. *Leaf-blades* 10-40 cm. long, 3-10 mm. broad, flat, glabrous, smooth or scabrid above ; *sheaths* split to the base, glabrous, smooth or scabrid, the basal sheaths purple, marcescent, auricled at the apex, the auricles hairy ; *ligule* membranous, up to 2 mm. long. *Panicle* erect, 10-30 cm. long, contracted ; the lower branches

2-nate, the shorter one bearing 3 or more spikelets. *Spikelets* 8-12 mm. long, elliptic-oblong, 4- to 5-flowered, shortly pedicelled. *Lower glume* 3-6 mm. long, 1-nerved. *Upper glume* 4.5-7 mm long, 3-nerved. *Lemma* overlapping, rounded on the back, 5-7 mm. long, 5-nerved, the nerves more or less prominent at least towards the summit, awnless or with the middle nerve produced into a short awn, scabrid especially on the nerves. *Palea* as long as the lemma with scabrid keels. *Anthers* 3-4 mm. long. Ovary hairy at the summit.

Quetta, May, 1957 *M. Nawaz*. Probably introduced.

It closely resembles *Festuca pratensis* Huds, but differs in having hairy auricles, and in bearing 3 or more spikelets on the shorter of each pair of panicle branches. It has been listed by Burkill as *Festuca elatior* Linn.

#### 7. *Festuca rubra* Linn.

*Festuca rubra* Linn., Sp. Pl. 74 (1753); Hook. f., Fl. Brit. Ind. 7: 352 (1896).

*Culms* erect or ascending from a geniculate base, 1-noded; extra-vaginal innovations frequent. *Leaf-blades* setaceous, 8-12 cm. long, 5 mm. broad, smooth; *sheaths* of innovations tight, closed almost to the mouth, smooth, those of the culms split; *ligules* very short, truncate, exauricled. *Panicle* 8-12 cm. long, narrow, nodding and secund or erect, rather dense and ovate; branches solitary or the lowest 2-nate, divided from near the base. *Spikelets* 1-1.6 cm. long, oblong, loose, 4-to 9-flowered, glabrous or hairy and ciliate. *Lower glume* lanceolate, acuminate, 1-nerved, nerves percurrent or sub-excurrent, 9 mm. long. *Upper glume* 8 mm. long, ovate-lanceolate. *Lemmas* strongly involute, oblong-lanceolate, broadly hyaline at the margins above, faintly 5-nerved; awn up to 12.5 mm long. *Palea* as long as the lemma, shortly 2-fid; keels ciliolate. *Anthers* 2-3 mm. long. Ovary glabrous. *Caryopsis* 3.5 mm. long.

Hazara: Thandiani, August 1956, *R. R. Stewart*; Kagan Valley: Sharhan, July 24, 1951, *M. S. Zahur*.

#### 8. *Festuca ovina* Linn.

*Festuca ovina* Linn., Sp. Pl. 73 (1753) sensu lato.  
*Festuca valesiaca* Hook. f., Fl. Brit. Ind. 7: 384 (1895) non Schleich.

Perennial. Culms up to 30 cm. high, 2-noded, both in the lower portion. Leaf-blades 5-15 cm. long, setaceous, smooth; sheaths of the innovation shoots tight, smooth, open to near the base, persistent; ligules short, obscurely auricled. Panicle short, stiff, contracted; branches erect, solitary or 2-nate. Spikelets 4-5 mm. long, 3- to 4-flowered, borne on short pedicels. Lower glume lanceolate, 1.25-1.5 mm. long, 1-nerved. Upper glume 3 mm. long, 3-nerved. Lemmas strongly involute, 3-4 mm. long, 5-nerved: awn shorter than the lemma. Palea 2-toothed, scabrid on the keels. Ovary glabrous. Anthers 0.75-1.5 mm. long. Caryopsis 1.5 mm. long.

Kagan Valley : Saiful Maluk, July 23, 1954, *Shaukat* ; Nadi-Kund, M.S. Zahur ; Gilgit, August 6, 1952, A.H. Khan ; Upper Swat, Aslam Khan ; Chitral : Zapotili ; Ochanzog, *Per Wendelbo*.

#### Tribe 4. **Arundineae**

Spikelets bisexual or unisexual with the sexes on different plants, 2- to 10-flowered, arranged in large panicles; rachilla disarticulating above the glumes or lowest floret and between the lemmas. Glumes hyaline or membranous. Lemmas somewhat similar to the glumes, acuminate, awnless or awned from the tip, 1- to 5- (rarely more) nerved, enveloped by long hairs either from the rachilla or from the back of the lemmas (at least in the fertile florets).

#### KEY TO THE GENERA

- Lower floret similar to the other florets; lemmas long hairy in the lower part; rachilla naked ..... 1. *Arundo*  
 Lower floret male or barren; lemmas glabrous; rachilla hairy..... 2. *Phragmites*

#### 1. **Arundo** Linn.

Perennial grasses with creeping rhizomes, extravaginal shoots, and very tall and stout culms. Leaves broad, flat. Panicle very large, decomposed. Spikelets 2- to 7-flowered, laterally compressed; rachilla jointed above the glumes and between the lemmas, glabrous. Floret all hermaphrodite or the uppermost reduced. Glumes equal, shortly acuminate, keeled, 3- to 5-nerved. Lemmas as long as the glumes, acuminate, finely 2-fid or entire, long hairy below, 5- to 9-nerved, 3 nerves more or less percurrent or excurrent, the rest

short, the middle nerve often produced into a short fine bristle; callus short, shortly bearded. Palea slightly more than 1/2 the lemma, 2-keeled.

## KEY TO THE SPECIES

- Leaves lanceolate, 1-8 cm. broad; panicle oblong, much broad, 40-60 cm. long; spikelets 10-15 mm. long; lemma 2-fid, with hairs as long as the glumes ... *A. donax*
- Leaves linear, 1-2 cm. broad; panicle narrow, 30-50 cm. long; spikelets 8 mm. long; lemma entire, acuminate, with hairs shorter than the glumes.....(*A. plinii*)

1. *Arundo donax* Linn.

*Arundo donax* Linn., Sp. Pl. 81 (1753); Hook. f., Fl Brit. Ind. 7: 302 (1896).

Perennial. Culms erect, up to 5 m. high, terete, hollow, very many-noded, simple or sparingly branched, glabrous, smooth. Leaf-blades conspicuously distichous, lanceolate-linear, up to 60 cm. broad, glabrous and smooth. Panicle erect, contracted and dense, up to 60 cm. long; axis stout; branches scaberulous, mostly erect. Spikelets 10-15 mm. long, light brown or tinged with purple. Glumes glabrous, as long as the spikelets 3- to 5-nerved, the lower 1/2-2/3 the length of the upper. Lemmas 10.5-15 mm. long, long hairy all over on the back below the middle. Palea densely ciliolate on the keels.

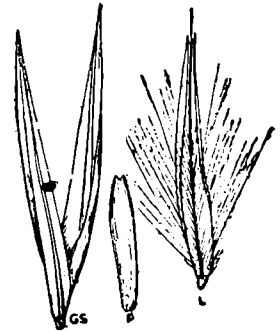


Fig. 122.—*Arundo donax*.

Cultivated in gardens. Very common.

2. *Phragmites* Trin. p. p.

Perennials with creeping rhizomes, extravaginal shoots and stout culms. Panicle loose, usually very large and much divided. Spikelets 3- to 10-flowered, awnless, silky, rachilla disarticulating above the lowest and between the following lemmas, jointed with long silky hairs; Lowest floret male or abortive: the following bisexual, the uppermost reduced. Glumes persistent, unequal to subequal, more or less rounded on the back, 3- to 5-nerved. Lemmas caudate-acuminate, 3-nerved, middle nerve percurrent, side nerves fine, short;

callus long, slender, with long silky hairs Palea about 1/2 as long as the lemma.

## KEY TO THE SPECIES

- Ligular hairs 1-1.5 mm. long; lowest lemma 15-17 mm. long ..... 1. *Ph. communis*.  
 Ligular hairs up to 0.5 mm. long; lowest lemma 9-13 mm. long ..... 2. *Ph. karka*

1. *Phragmites communis* Trin

*Phragmites communis* Trin., Fund. Agrost. 134 (1820); Hook. f., Fl. Brit. Ind. 7: 303 (1896).

Perennial, with creeping rhizomes, the latter clothed with broad, smooth cataphylls. Culms erect, up to 3.5 m. high, 4.5-8.5 mm. in diameter, terete, many-noded, usually simple, glabrous and smooth. Leaf-sheaths overlapping or finally shorter than the inter-

nodes, smooth and glabrous; ligule a short, hairy rim; hairs 1-1.5 mm. long; leaf-blades linear to linear-lanceolate, up to 40 cm. long, 3 cm. wide, flat-firm, glabrous or pilose near the ligule. Panicle oblong to ovate-oblong, erect or finally nodding and more or less secund, dense,

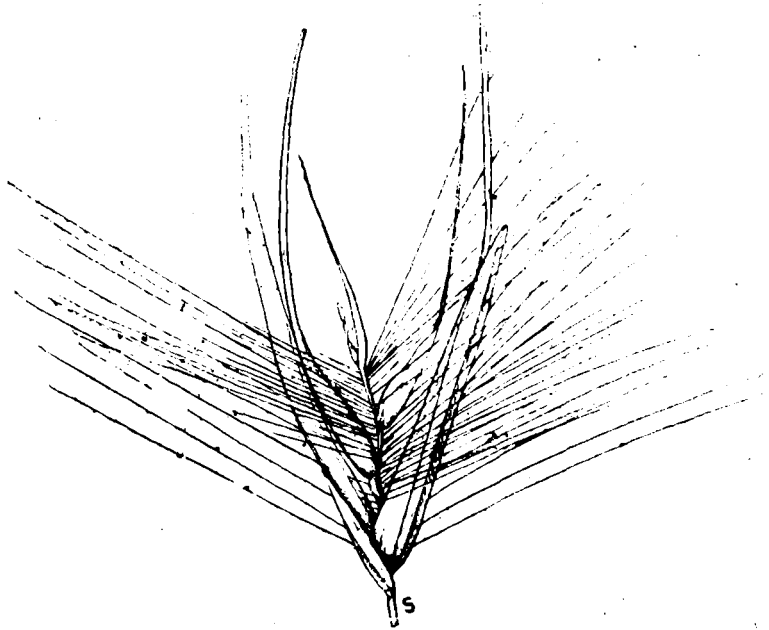


Fig. 123.—*Phragmites communis*.

12-35 cm. long, 4-7 cm. wide; rachis hairy at the nodes; branches fascicled or the upper solitary, slender, repeatedly branched; Spikelets 12 mm. long. Glumes very unequal, acute, 3- to 5-nerved; lower narrowly ovate to ovate-oblong, 7 mm. long; upper lanceolate-oblong to narrowly oblong, 10 mm. long. Lowest lemma linear-lanceolate to linear-oblong, acuminate, 15-17 mm. long, 3-nerved. Fertile lemma linear-lanceolate, acuminate, 3-5 mm. long, 3-nerved;

callus 1-1.5 mm. long, bearded with long hairs, 7-10 mm. long. *Palea* linear-oblong, 3-5 mm. long; keels scabrid. Anthers 2 mm. long.

Quetta *Asghar Ali*; Quetta Valley, *Lace*; Hyderabad. Widely distributed within the area.

According to Hooker f., in dry situations the stems are very short, straggling, with ovate-subulate concave rigid pungent leaves, 2.5-5 cm. long, and a reduced panicle.

## 2. *Phragmites karka* Trin.

*Phragmites karka* Trin. ex Steud., Nom. ed. 2, 324 (1841); Hook. f., Fl. Brit. Ind. 7: 304 (1896).

Extremely variable in habit and size. Perennial with creeping rhizomes. *Culms* erect, up to 3 m. high, 8 mm. in diameter, hollow terete, many-noded, usually simple, glabrous and smooth. *Leaf blades* linear to linear-lanceolate, up to 60 cm. long, 4 cm. wide, flat, distichous, firm, glabrous, smooth on both surfaces and along the margins; sheaths shorter than the internodes, terete, firm, striate, smooth, glabrous; *ligule* a short, hairy rim with hairs up to 0.5 mm. long. *Panicle* large, decomposed, oblong, erect, dense, up to 60 cm. long, 10 cm. broad; axis hairy at the nodes; branches fascicled or the upper solitary, slender, filiform, repeatedly branched, scaberulous or nearly smooth; pedicel scabrid. *Spikelets* many-flowered, 15-18 mm. long; rachilla penicillate with long silky hairs. *Lower-glume* oblong-lanceolate, 5-7 mm. long, 3- to 5-nerved. *Upper glume* lanceolate-oblong to narrowly oblong, 9-11 mm. long. *Lowest lemma* linear-lanceolate to linear-oblong, acuminate, convolute, 9-13 mm. long, 3-nerved, male or neuter. *Fertile lemmas* subulate-lanceolate, subaristate, successively shorter than the lower, 10 mm. long, 3- to 1-nerved; callus hairs 12 mm. long. *Palea* up to 3 mm. long; keels scabrid. *Anthers* 2 mm. long.

Very common through out the plains.

## Tribe 5: *Eragosteae*

Spikelets 2- to many flowered, usually laterally compressed, pedicelled, in open or contracted panicles, or secund and sessile or subsessile in



spikes or spike-like racemes ; rachilla usually disarticulating above the glumes and between the florets, rarely persistent or disarticulating below the glumes and the spikelets then falling entire. Glumes usually persistent, membranous or coriaceous, usually shorter than the lowest lemma. Lemmas mostly exerted from the glumes, rarely enclosed by them, membranous to coriaceous, scarcely changed at maturity, 1- to 3-nerved, entire, emarginate or 2- to 4-lobed at the tip, awnless or with a straight awn from the tip or sinus, rarely with three nerves running out into awns.

## KEY TO THE GENERA

1. Cleistogamous spikelets present in the axils of the upper sheaths..... 1. *Cleistogenes*  
 Cleistogamous spikelets absent.....2
2. Lemmas entire or slightly lobed at the apex.....3  
 Lemmas toothed or more or less deeply lobed at the apex... 15
3. Spikelets in loose or contracted panicles .....4  
 Spikelets in spikes or spike-like racemes .....8
4. Glumes and lemmas rounded on the back . . . . .5  
 Glumes and lemmas keeled ; lemmas entire or acuminate.....6
5. Annuals, Lemmas indurated, acuminate. Panicle branches short but spreading and stout . . . . . 2. *Cutandia*  
 Perennial aquatics. Lemmas truncate. Panicle diffuse with long slender branches . . . . .3. *Catabrosa*
6. Upper glume 3-nerved... 4. *Eragrostis*  
 Upper glume 1-nerved or 5-nerved... 7
7. Upper glume 1-nerved..... 5. *Desmostachya*  
 Upper glume 5-nerved, the lower 3-nerved ; rachilla joints stiffly hairy at the upper end..... 6. *Halopyrum*
8. Spikelets in short, dense turbinate spikes arranged loosely on a narrow, angular axis ..... 7. *Melanocenchris*  
 Spikelets in one or two rows on one side of a flattened rachis ..... 9
9. Spikes solitary, terminal, rarely more and then approximate.....  
 ..... 8. *Tetrapogon*  
 Spikes many, digitate or in a raceme.....10
10. Glumes awned, longer than the spikelet..... 9. *Dinebra*

- Glumes awnless, shorter than the spikelet... ..11
11. Spikes racemosely arranged..... 10. *Leptochloa*  
 Spikes digitate or in pseudo-whorls ..... 12
12. Lemmas rounded on the back ..... 11. *Coelachyrum*  
 Lemmas strongly keeled..... 13
13. Keel with 4-2 additional nerves ..... 12. *Eleusine*  
 Keel with out any additional nerves... .. 14
14. Rachis ending in a mucro ..... 13. *Dactyloctenium*  
 Rachis ending in a spikelet...., ..... 14. *Acrachne*
15. Spikelets in solitary spikes..... 15. *Tripogon*  
 Spikelets not arranged in solitary spikes .. . . . . 16
16. Spikelets in panicles ; lemmas long-ciliate along the nerves... . . . .  
 ..... 16. *Neyraudia*  
 Spikelets arranged in compound racemes : lateral nerves of the  
 lemma without hairs ..... 17. *Diplachne*

### 1. *Cleistogenes* Keng

Perennial grasses with linear-lanceolate leaves ; upper sheaths enclosing cleistogamous spikelets. Inflorescence a panicle of spreading or narrow spiciform racemes. Spikelets 1- to many-flowered, laterally compressed, shortly pedicelled ; rachilla joints pubescent at the apex, disarticulating above the glumes and between the lemmas. Glumes unequal usually shorter than the first floret, membranous, 1-nerved ; the lower 3- to 5-nerved, acuminate or obtuse. Lemmas short, 3- to 5-nerved, minutely 2-toothed, the teeth usually mucronate or aristate, rarely entire and acuminate, glabrous or ciliolate-scaberulous. Palea 2-keeled, keels ciliolate-scaberulous. Stamens 3 ; anthers linear. Styles short, distinct ; stigmas plumose, purple, laterally exerted.

#### 1. *Cleistogenes gatacrei* (Stapf) Bor

*Cleistogenes gatacrei* (Stapf) Bor comb. nov.

*Diplachne gatacrei* Stapf in Kew Bull. 1898 : 229 (1899).

Perennial. Culms tufted or rarely solitary, many-noded, up to 60 cm. high, innovation shoots numerous, densely leafy. Leaf-blades linear-lanceolate, acute, up to 8 cm. long, flat, glaucous, scaberulous ; sheaths of the culms tight shorter or longer than the internodes ; ligule

reduced to a ciliate rim. *Panicle* loose, up to 7 cm. long; branches slender, simple, up to 4.5 cm. long bearing 2-3 spikelets besides a solitary terminal spikelet; pedicel as long as the spikelet. *Spikelets* 4- to 6- flowered, 10-15 mm. long, rachilla minutely hairy. *Lower glume* lanceolate, acute, up to 5 mm. long, hyaline, 1-nerved. *Upper glume* similar but broadly oblong and obtuse. *Lemma* ovate-oblong, obtuse, obscurely emarginate, 5 mm. long, glabrous, pale green, frequently purple towards the apex, distinctly 3-nerved, mucronate.



Fig. 124.—*Cleistogenes gatacrei*.

Chitral: Warai, 4500 ft., *Gatacre*; Swat: Kulali, 19.8. 52, *Shaukat Ali*.

## 2. *Cutandia* Willk.

Annual grasses with narrow, flat or rolled leaves. Panicle with short, distichous branches which are very short and spreading. Spikelets 2- to many-flowered, laterally compressed, with the bisexual, florets jointed on the rachilla. Glumes indurated, unequal, 1- to 3-nerved shorter than the florets. Lemmas with three strong nerves, keeled, mucicous. Palea shorter, 2-keeled, narrow. Lodicules 2, glabrous. Stamens 3. Ovary glabrous; styles 2, apical, short; stigmas plumose. Caryopsis oblong, more or less compressed dorsally.

### 1. *Cutandia memphitica* (Spr.) Richt.

*Cutandia memphitica* (Spr.) Richt. Pl. Europ. I: 77 (1889).

*Dactylis memphytica* Spreng. Bot. Gart. Halle, Nachtr. 1: 20 (1801).

Annual. Culms tufted, rarely solitary, branched, 10-30 cm. high, 3- to 5-noded. *Leaf-blades* up to 9 cm. long, 1.5 mm. broad, flat or more or less rolled, glabrous, striate, lower surface smooth, upper surface and margins scabrid; *sheaths* dilated, rounded on the back, striate, glabrous and smooth; *ligules* membranous, truncate-lacerate, 2-4 mm. long. *Panicle* enclosed at the base, by the terminal sheath, finally more or less exserted, loose and divaricate, 5-10x1.5-5 cm.; axis angular, more or less scabrid, zigzag; branches solitary or geminate, divaricate or reflexed, scabrid, few-spiculate; pedicels very

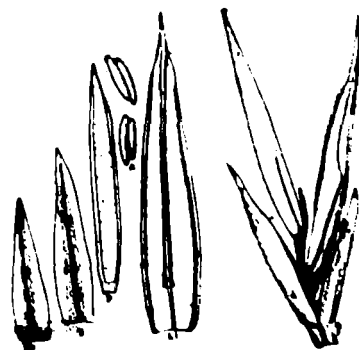


Fig. 125.—*Cutandia memphitica*.

short and thick, slightly scabrid. *Spikelets* 2- to 4-flowered, linear, 7-10 mm. long 1-1.5 mm. broad; rachilla joints distinct, scabrid, produced beyond the terminal floret. *Glumes* indurated with margins broadly scarious, 1-nerved, acute, unequal, keeled, scabrid on the back; lower oval-lanceolate, about 3 mm. long; upper lanceolate, 4-4.5 mm. long. *Lemma* (lower) indurated, 6.5 mm. long with 3 strong nerves, smooth or scabrid on the back, esp. towards the apex, acute or long-acuminate. Upper lemma similar, 5 mm. long. *Palea* narrow, lanceolate, 5 mm. long, 2-keeled; keels antrossely scabrid near the tip. *Anthers* 1.5-2 mm. long.  
Nushki, M. Sharif.

### 3. *Catabrosa* Beauv.

Perennial aquatic grasses with branching and creeping root-stocks. Culms erect or creeping below; innovation shoots extra-vaginal. Leaf-blades flat. Panicle loose; spikelets 1- to 7-flowered, awnless, subarticulate on their pedicels; rachilla jointed at the base, produced beyond the terminal floret. Glumes very unequal, the lower much reduced or absent, nerveless or 3-nerved, keel-less, obtuse or truncate and irregularly dentate at the apex. Lemmas broad, longer than the upper glume, with 3 distinct nerves; apex rounded, sub-truncate, scarious. Palea as long as the lemma, scarious at the summit, 2-keeled; keels smooth, glabrous or hairy. Stigma sessile, plumose.

#### 1. *Catabrosa aquatica* (Linn.) Beauv.

*Catabrosa aquatica* (Linn.) Beauv., Essai Agrost. 97 (1812); Hook. f. Fl. Brit. Ind. Ind 7: 310 (1896).

An aquatic perennial with very long and creeping rhizomes. Culms erect or geniculate-ascending, glabrous and smooth, up to 80 cm. high; nodes black, glabrous. Leaf-blades flat, up to 20 cm. long, 1 cm. broad, glabrous and smooth on both surfaces; sheaths keeled, loosely tight, glabrous and smooth; ligule up to 4 mm. long, glabrous. Panicle ovate to oblong, loose, up to 30 cm. long and 10 cm. wide; axis glabrous and smooth; branches semiverticillate, erect then spreading, unequal, naked at the base, smooth or scaberulous; pedicels slender. *Spikelets* ovate-oblong, 2-flowered, 4 mm. long; rachilla glabrous, disarticulating below each floret. *Glumes* persistent, membranous, unequal, glabrous; lower

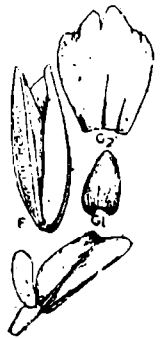


Fig. 126 — *Catabrosa aquatica*.

oval, up to 1 mm. long, rounded at the apex, nerveless or with a short nerve at the base ; the upper obovate, 1.8 mm. long, much broader, subtruncate and denticulate at the apex with 3 short nerves. *Lemmas* elliptic-oblong to oblong, rounded on the back, truncate, 3 mm. long, 3-keeled by the 3 prominent nerves, smooth or the nerves shortly hairy, scarious at the apex, 2-keeled ; keels glabrous or minutely hairy.

Quetta, *Duthie*.

#### 4. *Eragrostis* Beauv.

Annual or perennial grasses with narrow, flat leaves. Inflorescence an open or contracted panicle. Spikelets laterally compressed, awnless ; rachilla disarticulating between the florets and above the glumes, disarticulating or tough and persistent, glabrous, rarely minutely hairy. Florets 2 to many, bisexual or the upper rudimentary. Glumes equal or unequal, membranous, 1-nerved or the upper 3-nerved. Lemmas loosely to densely imbricate, acute or obtuse, awnless, membranous to thinly coriaceous, 3-nerved. Paleas as long as or shorter than the lemmas, 2-keeled, deciduous or persistent with the rachilla.

##### KEY TO THE SPECIES

1. Palea pectinately ciliate on the keels..... 2  
    Palea scaberulous or smooth on the keels.....3
2. Panicle spiciform ; lemmas mucronate, lateral nerves submarginal  
    ..... 1. *E. ciliaris*  
    Panicle effuse ; lemmas not mucronate, nerves remote from the  
    margin..... 2. *E. tenella*
3. Spikelets narrow linear or oval ; rachilla zigzag, tough, not dis-  
    articulating, lemma falling off without the palea ; grain free . . . . 4  
    Spikelets very small (2-3.5 mm.) ; rachilla disarticulating ; grain  
    enclosed between the lemma and palea ..... 11
4. Leaf margins and keels of lemmas glandular .....5  
    Leaf margins and keels of the lemmas eglandular ..... 6
5. Spikelets more than 2.5 mm. wide..... 3. *E. megastachya*  
    Spikelets not more than 2 mm. wide ..... 4. *E. poaeoides*
6. Spikelets broadly ovate to broadly oblong, 3 mm. broad ; lateral  
    nerves of lemmas prominent, percurrent, palea deciduous with the  
    lemma... ..... 5. *E. unioloides*  
    Spikelets lanceolate or narrowly oblong ; nerves of the lemmas not  
    prominent or if so then with persistent paleas .....7

7. Lemmas closely imbricate with flat margins .. . . . . 6. *E. tremula*  
 Lemmas loosely imbricate or contiguous with closely incurved  
 margins..... 8
8. Spikelets 2-2.5 mm. wide, oblong..... 7. *E. chariis*  
 Spikelets 1-1.5 mm. wide, linear to lanceolate..... 9
9. Perennials..... 8. *E. papposa*  
 Annuals ..... 10
10. Spikelets ca. 1 mm. wide ; lower branches of the panicle verti-  
 cillate..... 9. *E. pilosa*  
 Spikelets ca. 1.5 mm. wide ; lower branches of the panicle solitary  
 ..... 10. *E. nutans*
11. Panicle branches usually whorled, spreading, branched from the  
 base ; spikelets loose, scattered..... 11. *E. japonica*  
 Panicle contracted, branches more or less solitary or 2-3 in a  
 whorl..... 12
12. Panicle short, peduncle long exerted, branches more or less solitary,  
 branched from near the base, branches spiculate to the base. ....  
 ..... 12. *E. diarrhena*  
 Panicle very long, peduncle short ; branches solitar or 2-3 in a  
 whorl, long, flexuous, branched at some distance from the base ;  
 branchlets bare at the base ..... 13. *E. diplachnoides*

### 1. *Eragrostis ciliaris* (Linn.) Link

*Eragrostis ciliaris* (Linn.) Link, Hort. Reg. Berol. 1 : 192 (1827) ; Hook f.,  
 Fl. Brit. Ind. 7 : 314 (1896).

*Eragrostis plumosa* Boiss., Fl. Orient. 5 : 523 (1884) non Link.

*Eragrostis arabica* Jaub. et Spach, Ill. Pl. Orient. 4 : 31, t. 322.

*Poa ciliaris* Linn., Sp. Pl. 102 (1753).

Annual. Culms tufted, branched, erect or geniculate-ascending, up to 25 cm. high, slender, glabrous and smooth. Leaf-blades linear, flat or convolute, up to 15 cm. long ; sheaths usually bearded at the mouth with long hairs ; ligule a fringe of short hairs. Panicle spiciform, 1-5 cm. long, compact and cylindric, appearing hairy from the long cilia of the paleas ; branches very short, suberect, branched from the base, glabrous, axis glabrous ; pedicels very short, glabrous. Spikelets 2-4 mm. long, crowded, 6- to 10-flowered, strongly compressed, very pale ;

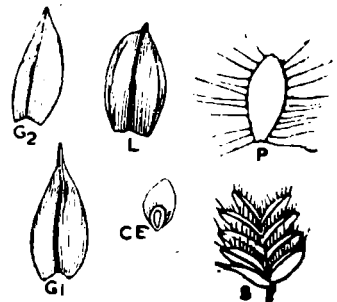


Fig. 127.—*Eragrostis ciliaris*

*rachilla* disarticulating. Lower glume 1.5 mm. long, ovate-lanceolate, acute. Upper glume similar but slightly longer. Lemmas 1 mm. long, oblong, subtruncate, mucronulate, spreading, lateral nerves submarginal. Palea as long as the lemma and deciduous with it; keels with long rigid cilia. Caryopsis 0.5 mm. long, enclosed between the lemma and palea.

Karachi; Mirpur Khas; Jamesabad; Sanghar; Lahore; Quetta. Very common.

## 2. *Eragrostis tenella* (Linn.) R. et S.

*Eragrostis tenella* (Linn.) Roem. et Schult., Syst. 2 : 576 (1817).

*Eragrostis tenella* var. *plumosa* Stapf in Hook. f., Fl. Brit. Ind. 7 : 315 (1896).

*Eragrostis plumosa* Link, Enumer. Hort Berol. 1 : 192 (1827) non Boiss

*Poa tenella* Linn., Sp. Pl. 69 (1753).

Annual. Culms loosely tufted, erect or geniculate-ascending, 3- to 5-noded, up to 40 cm. high, simple or branched, glabrous and smooth. Leaf-blades narrowly linear, acuminate, up to 12 cm. long, 1-2 mm. broad, flat or involute when dry, glabrous and smooth; sheaths tight, terete, glabrous, long-ciliate at the mouth with soft spreading hairs; ligule reduced to a rim of short hairs. Panicle open or contracted, ovate to oblong, 5-13 cm. long, 1.5-3.5 cm. wide; branches solitary, capillary, glabrous; up to 3 cm. long; branchlets bearing 2 or 3 distant spikelets; axis bearded at the nodes; pedicels distinct, 1.5 mm. long. Spikelets oblong, 1.5-2 mm. long, 3- to 9-flowered; rachilla disarticulating, breaking up from above downwards. Glumes ovate-oblong, obtuse or slightly acute, 1-nerved; lower 0.5-1 mm. long the upper 0.7-1.3 mm. long. Lemmas oblong, very obtuse, up to 1.2 mm. long. Palea as long as the lemma; keels pectinately ciliate with long rigid hairs. Grain enclosed between the lemma and the palea.



Fig. 128.—*Eragrostis tenella*.

Mirpur Khas; Lahore; Changa Manga; Gujrat; Jhelum.

## 3. *Eragrostis megastachya* (Koel.) Link.

*Eragrostis megastachya* (Koel.) Link, Enumer. Hort. 1: 187 (1887).

*Poa megastachya* Koel., Descr. Gram. 181.

*Eragrostis cilianensis* (All.) Lutati in Malpighia 18 : 386 (1902).

*Poa cilianensis* All., Fl Pedem. 2 : 246.

*Eragrostis major* Host, Gram. Austr. 4: 14 (1809); Hook. f., Fl. Brit. Ind. 7: 820 (1896).

Annual. Culms tufted, up to 90 cm. high, branched, leafy, erect or geniculate-ascending, smooth and glabrous. Leaf-blades linear, up to 15 cm. long, 8 mm. broad, smooth and glabrous or sparsely hairy; glandular along the margins; sheaths smooth and glabrous, bearded at the mouth; ligule reduced to a ciliolate ridge. Panicle up to 20 cm. long, open or sometimes contracted; axis rather stout, smooth; branches spreading or sub-erect, capillary, stiff or flexuous, branching to the second degree from near the base; pedicels shorter than the spikelets. Spikelets usually crowded, ovate to linear-oblong, 15 mm. long, 2.5-3 mm. broad, many-flowered, yellowish or olive-

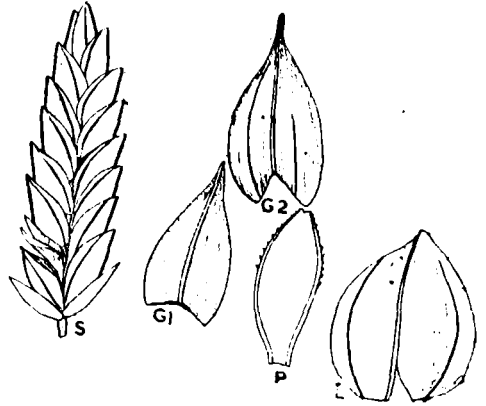


Fig. 129.—*Eragrostis megastachya*.

grey, rachilla tough, zigzag, with smooth, short internodes. Lower glume 1.2 mm. long ovate, acute with scabrid keels, 1-nerved. Upper glume similar, 1.5 mm. long slightly larger, 3-nerved. Lemmas 2 mm. long, broadly ovate sometimes apiculate, 3-nerved: keels glandular. Palea obovate, much curved, shorter than its lemma, keels ciliolate.

Sanghar, Mirpur Khas; Quetta; Multan; Lahore; Sialkot.

#### 4. *Eragrostis poaeoides* Beauv.

*Eragrostis poaeoides* Beauv., Essai Agrost. 162 (1812),

*Eragrostis minor* Host, Fl. Austr. 1: 135 (1827); Hook. f., Fl. Brit. Ind. 7: 321 (1896).

Annual. Culms densely tufted, up to 45 cm. high, branched, smooth and glabrous, rooting at the lower nodes. Leaf-blades linear, acute, up to 9 cm. long, 8 mm. broad, glandular along the margins; sheaths keeled, loose, shortly bearded at the mouth; ligule a pubescent ridge. Panicle oblong or ovate, rather stiff, up to 15 cm. long; axis glabrous; branches solitary or 2-nate, rather stiff, up to 15 cm. long, spreading when mature, branched from the base; pedicels shorter than the spikelets. Spikelets alternate, linear to ovate, up to 10 mm. long, 2 mm. broad, up to 15-flowered, pale, green or purplish; rachilla tough. Lower glume 1.2-1.5 mm. long, ovate, 1-nerved. Upper glume similar, 1.5-2

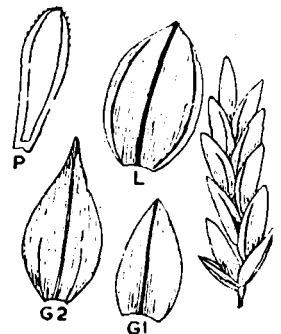


Fig. 130.—*Eragrostis poaeoides*.



mm. long. Lemmas about 1.5-2 mm. long, ovate, acute strongly 3-nerved. *Palea* obovate-oblong, about 1-1.5 mm. long, the keels scabrid or ciliolate.

Peshawar ; Multan ; Karachi ; Hyderabad ; Quetta ; Lahore ; Swat ; Kalam ; Kagan Valley ; Chitral. Very common.

### 5. *Eragrostis unioloides* (Retz.) Nees

*Eragrostis unioloides* (Retz.) Nees ex Steud., Syn. Pl. Gram. 264 (1854).

*Eragrostis amabilis* Wight et Arn. ex Nees in Hook & Arn., Bot. Beech. Voy. 251 (1838); Hook. f., Fl. Brit. Ind. 7 : 317 (1896).

Annual. Culms loosely tufted, erect or geniculate-ascending, up to 50 cm. high, smooth and glabrous. *Leaf-blades* linear, acute, up to 9 cm. long, 4 mm. broad, glabrous or with few scattered hairs; *sheaths* smooth, glabrous; *ligule* absent. Panicle oblong or ovoid, up to 10 cm. long, sparingly branched, effuse or contracted; axis and nodes glabrous; branches solitary, ramifying from near the base; pedicels short. *Spikelets* 4-6 mm. long, ovate-elliptic or oblong, 20- to 30-flowered, shortly pedicellate, often purple; rachilla tough, internodes very short; the glumes and lemmas elegantly distichous, spreading, keeled, falling from below upwards. *Glumes* subequal, 1-1.5 mm. long, ovate, acute, 1-nerved. *Lemmas* broadly ovate or sub-orbicular, mucronulate, 2 mm. long, punctulate. *Palea* shorter than its glume and deciduous with it; keels winged, scabrid.

Mirpur Sakro. Blatter & McCann.

### 6. *Eragrostis tremula* (Lamk.) Hochst.

*Eragrostis tremula* (Lamk.) Hochst. in Flora I. Beibl. 134 (1842); Hook. f., Fl. Brit. Ind. 7 : 320 (1896).

*Eragrostis multiflora* Trin., Mem. Acad. Petersb. ser. VI, 1 : 401 (1841).

*Poa tremula* Lamk., Tabl. Encycl. 1 : 185 (1791).

Annual. Culms densely tufted, erect or geniculate ascending, up to 60 cm. high, smooth and glabrous. *Leaf-blades* linear-lanceolate, acuminate, up to 12.5 cm. long, 4 mm. broad, glabrous or sparsely

hairy, margins eglandular and finely serrate; sheaths smooth and glabrous, bearded at the mouth; ligule a minutely hairy rim. Panicle large, ovate, much spreading: axis glabrous, bearded at the nodes: branches solitary, filiform; branchlets capillary, with long white hairs in all their axils; pedicels very slender, 1.2-3 cm. long. Spikelets up to 2.5 cm. or more long, linear, 10- to 60-flowered. Lower glume 1.2-1.5 mm. long, subobtusate, thin, 1-nerved, keeled; keels scaberulous. Upper glume similar but slightly longer. Lemmas broadly ovate, subobtusate, 1.5-2 mm. long, with 3 strong nerves. Palea obovate-oblong, slightly shorter than the lemma, persistent; keels scabrid.

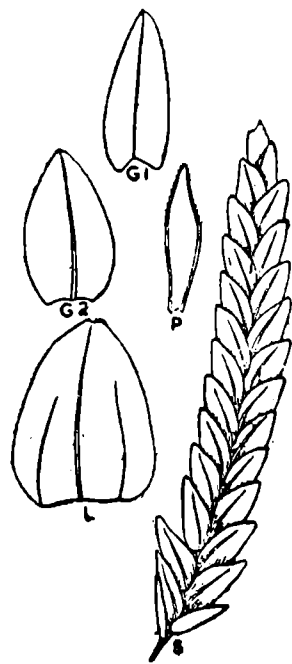


Fig. 131.—*Eragrostis tremula*.

Bahawalpur; Multan; Gujrat; Lahore. In sandy places. Common.

### 7. *Eragrostis chariis* (Schult.) Hitchc.

*Eragrostis chariis* (Schult.) Hitchc., Lingnan Sci. Jour. 7: 193 (1931).

*Eragrostis gangetica* (Roxb.) Steud., Syn. Pl. Gram. 266 (1854).

*Eragrostis elegantula* (Kunth) Nees ex Steud., Syn. Pl. Gram. 266 (1854).

*Eragrostis Brownei* Nees ex Wight, Cat. no. 1780 (1833) p p.

*Poa chariis* Schult., Mantiss. 2: 314 (1824).

*Poa elegantula* Kunth, Rev. Gram. 1: 114 (1829).

Perennial. Culms densely tufted, 30-90 cm. high, stout, smooth, shining, simple or branched. Leaf-blades few, 5-20 cm. long, very narrow, convolute, rigid, quite smooth, glaucous, linear, acuminate; sheaths glabrous except the mouth which is bearded; ligule a minutely ciliolate rim. Panicle oblong, 5-15 cm. long, nodding; branches solitary, rather distant, often long, suberect or the lower spreading; axis glabrous; pedicels short. Spikelets 4-6 mm. long, linear to linear-oblong, 10- to 30-flowered; rachilla tough, glabrous, persistent, the internodes short. Lower glume 1.5 mm. long, ovate-oblong, acute, 1-nerved. Upper glume slightly larger, 1-nerved. Lemmas

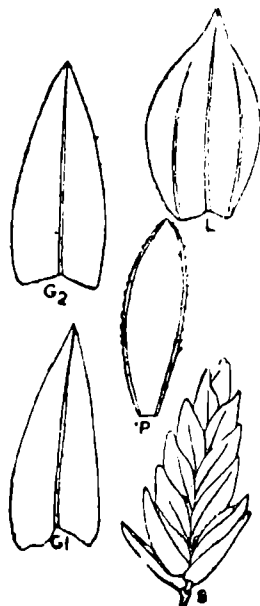


Fig. 132. *Eragrostis chariis*.

broadly ovate, subacute, 2.5 mm. long, 3-nerved. *Palea* deciduous, shorter than its lemma; keels scaberulous. Anthers about 1 mm. long. *Caryopsis* oblong, 0.8 mm. long, brown.

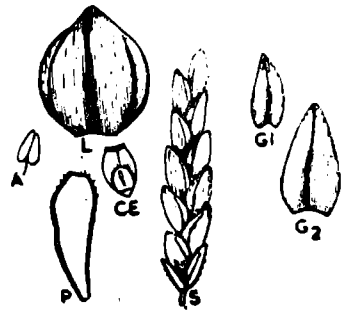
Sheikhupura; Lyallpur; Lahore; Multan; Jhelum. Along the sides of water courses. Very common.

### 8. *Eragrostis papposa* (Desf.) Steud.

*Eragrostis papposa* (Desf.) Steud., Nom. ed. 2 : 564 (1840); Hook. f., Fl. Brit. Ind. 7 : 322 (1896).

*Poa papposa* Desf. in Roem. et Schult., Syst. 2 : 585 (1817).

Perennial. Culms 30-50 cm. high, very slender, simple, smooth and glabrous. Leaf-blades short, strict, very narrow, convolute; mouth of the sheath bearded with long silky hairs. Panicle 10-20 cm. long, ovoid, very delicate, loose, open; axis filiform, glabrous; branches solitary, alternate, rarely 2-nate, spreading, capillary, naked below. loosely branched beyond the middle; branchlets capillary, stiff; pedicels long, capillary. Spikelets 4-8 mm.



long, linear, 7- to 23-flowered, very pale yellow or dark or olive-grey; rachilla tough. Lower glume 1 mm. long, hyaline, nerveless. Upper glume slightly longer, 1-nerved. Lemmas broadly ovate, ca. 1.5 mm. long, 3-nerved. *Palea* obtuse, denticulate, persistent; keels scabrid. *Caryopsis* obovoid, ca. 0.5 mm. long, dorsally grooved.

Quetta; Kohat; Sakesar; Peshawar; Rawalpindi; Swat; Mingora; Kala Bagh; Sanghar; Sibi. Common in the dry hilly areas.

### 9. *Eragrostis pilosa* (Linn.) Beauv.

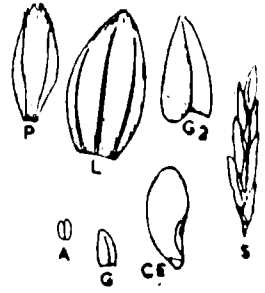
*Eragrostis pilosa* (Linn.) Beauv., Essai Agrost. 71 (1812); Hook. f., Fl. Brit. Ind. 7 : 323 (1896).

*Poa pilosa* Linn., Sp. Pl. 68 (1753).

*Eragrostis verticillata* Roem. et Schult., Syst. 2 : 575 (1817).

Annual. Culms tufted, erect or geniculate-ascending, up to 45 cm. high, slender, flaccid. Leaf-blades usually short and narrowly linear, often convolute, scabrid above and on the margins, glabrous; sheaths tight, bearded at the mouth where the small auricles are hairy; ligule

represented by a softly hairy ridge. *Panicle* 5-20 cm. long, erect or nodding, broadly elliptic, open or contracted; axis glabrous or hairy, slender, nodes sometimes hairy; branches fascicled or whorled, capillary, much divided, bare at the base; pedicels as long as the spikelets. *Spikelets* ovate,



scattered (not fascicled), 3-5 mm. long, 0.8-1 mm. broad, linear, 5- to 12-flowered, often purplish; rachilla tough, smooth, glabrous. *Lower glume* ovate, 0.3-0.5 mm. long, nerveless. *Upper glume* 0.9-1 mm. long, ovate-lanceolate, acute, 1-nerved, hyaline. *Lemmas* thin, hyaline, 1.2-1.5 mm. long, ovate, subacute, 3-nerved, nerves short. *Palea* subsistent; keels nearly smooth. *Caryopsis* 1 mm. long, laterally compressed, free.

Fig. 134. *Eragrostis pilosa*.

Quetta; Peshawar; Hyderabad; Lahore; Karachi; Balakot; Swat; Kagan; Chitral. Very common from the plains to 5000 ft. in the hills.

#### 10. *Eragrostis nutans* (Retz.) Nees

*Eragrostis nutans* (Retz.) Nees ex Steud., Nom. ed. 2: 563 (1840).

*Eragrostis stenophylla* Hook. f., Fl. Brit. Ind. 7: 318 (1896) non Hochst.

*Eragrostis Brownei* Nees in Wight, cat. no. 1781 (1833) p.p.

Perennial. *Culms* densely tufted, 30-45 cm. high, erect or geniculate-ascending, simple or branched; upper internodes long. *Leaf-blades* 7.5-12 cm. long, very narrow, strict, rather stiff, usually convolute, smooth, quite flat, glabrous, not glaucous; *sheaths* smooth; *ligule* a narrow membranous rim. *Panicle* ovate or oblong, suberect or nodding; branches rather distant, alternate, obliquely spreading at maturity, much divided upwards; axis slender, smooth; pedicels of spikelets filiform. *Spikelets* 4-6 mm. long, linear-oblong, 20- to 30-flowered; rachilla zigzag, tough. *Lower glume* 0.8 mm. long, ovate-oblong, subacute, hyaline, 1-nerved. *Upper glume* similar but slightly longer, 3-nerved. *Lemmas* broadly ovate, subacute, about 1.5 mm. long, with smooth keels. *Palea* linear-oblong, deciduous with the lemmas; keels scabrid. *Anthers* minute. *Caryopsis* globose or globose-ellipsoid, 2.5 mm. long, reddish brown, smooth, free.

Likely to occur within the area.

11. *Eragrostis japonica* (Thunb.) Trin.

*Eragrostis japonica* (Thunb.) Trin. in Mem. Acad. Petersb. ser. VI, 1: 405 (1831).

*Poa japonica* Thunb., Fl. Jap. 3. (1784).

*Eragrostis interrupta* var. *tenuissima* (Schrad.) Stapf in Hook. f., Fl. Brit. Ind. 7: 316 (1896).

Annual. Culms densely tufted, 15-70 cm. high, erect or geniculate-ascending, simple or branched, 1- to 4-noded, glabrous and smooth. Leaf-blades linear, acute, 2-29 cm. long, 1.5-4 mm. broad, firm or flaccid, flat or convolute; glabrous and smooth; sheaths tight, glabrous; ligule reduced to a ciliolate rim. Panicle linear, lanceolate to ovate-oblong in outline, open and loose or contracted, narrow, 6-25 cm. long, 2-3 cm. wide, usually stiff; branches in whorls or clusters or



Fig. 135.—*Eragrostis japonica*.

solitary, divided from near the base; branchlets and pedicels divaricate, filiform to capillary; branches very slender but rigid, scaberulous, 0.8-8 cm. long; pedicels up to 2 mm. long. Spikelets ovate, compressed, few-flowered, 2-3.5 mm. long, 1 mm. broad; rachilla; disarticulating. Lower glume lanceolate to ovate, acute or obtuse, hyaline, 1-nerved, 0.6-0.8 mm. long. Upper glume ovate to oblong, 0.8-1 mm. long. Lemmas lanceolate-oblong in profile, very obtuse, 0.75-1 mm. long, 3-nerved, usually purplish. Palea as long as the lemma; keels scaberulous or smooth. Anthers 0.2 mm. long. Caryopsis ovoid or ellipsoid, 0.3-0.5 mm. long, enclosed between the lemma and palea.

Lahore, September, 1954, S. Ahmad; Sialkot, October, 1958, M. Shafi.

12. *Eragrostis diarrhena* (Schult.) Steud.

*Eragrostis diarrhena* (Schult.) Steud., Syn. Pl. Gram. 266 (1854).

*Eragrostis interrupta* var. *diarrhena* (Steud.) Stapf in Hook. f., Fl. Brit. Ind. 7: 316 (1896).

*Poa diarrhena* Schult. Mantiss. 2: 616 (1824).

Annual or perennial. Culms densely tufted, up to 80 cm. high, erect or geniculate-ascending, simple or branched, smooth and glabrous; nodes glabrous. Leaf-blades up to 15 cm. long, 1.5-3 mm. broad, flat or convolute, glabrous, linear, acuminate, scabrid on the upper surface and margins; sheaths rather loose, slipping from the culms, smooth and

glabrous, scarious on the margins; *ligule* membranous, short. *Panicle* contracted, long and narrow, linear-oblong, made up of numerous fascicled, spiculate branches giving the panicle a lobed appearance; branches numerous, filiform, 2.5-5 cm. long, closely spiculate almost to the base, usually erect. *Spikelets* linear, up to 3 mm. long, 1 mm. broad, 10- to 14-flowered, disarticulating, smooth. *Lower glume* 0.75 mm. long, acute, 1-nerved. *Upper glume* similar to the lower. *Lemmas* 1 mm. long, very obtuse almost truncate, nerves slender, green or pale brown. *Palea* shorter than the lemma; keels scaberulous. *Caryopsis* obovoid.

Kala Shah Kaku, September 1953, S. *Ahmad*.

### 13. *Eragrostis diplachnoides* Steud.

*Eragrostis diplachnoides* Steud., Syn. Pl. Gram. 268 (1854).

*Eragrostis interrupta* var. *diplachnoides* (Steud.) Stapf in Hook. f., Fl. Brit. Ind. 7: 816 (1896).

Annual. *Culms* stout, tall, branched, up to 1 m. high. *Leaf-blades* linear, acute, up to 15 cm. long, 5 mm. broad, glabrous but slightly scaberulous; *sheaths* tight, smooth, the basal sometimes loose and slipping from the culms; *ligule* very short, membranous. *Panicle* up to 45 cm. long, effuse or contracted, flaccid; branches 2- or 3-nate, sometimes solitary, branched at some distance from the base, 5-12.5 mm. long, ascending, never spreading or divaricate. *Spikelets* linear, 2-3 mm. long, 6- to 12-flowered. *Lower glume* lanceolate to ovate, hyaline, 0.6-0.8 mm. long, 1-nerved. *Upper glume* ovate, 0.8-1 mm. long, 3-nerved. *Lemmas* 0.75-1 mm. long, very obtuse, lanceolate-oblong, 3-nerved. *Palea* with scaberulous keels.

Hyderabad, November, 1955, M. *Ahmad*; Karachi, Sep. 16, 1956, I.I. *Chaudhri*; Lahore, October, 1952, *Shaukat Ali*.

It is a much more robust plant as compared to *E. diarrhena*. The panicle is very long and very slightly exserted from the uppermost sheath; the branches are longer, more flexuous and not branched from near the base.

### 5. *Desmostachya* Stapf

Perennial grasses with creeping rootstocks and flat leaves. *Spikelets* strongly laterally compressed, closely imbricate, alternate, sessile or subsessile on the slender rachis of secund more or less distinctly 2-ranked spikes which are crowded into long narrow, spike-like panicles.

florets many, hermaphrodite. Glumes very unequal, membranous, 1-nerved, keeled. Lemmas rigidly membranous, 3-nerved, acutely keeled, side nerves evanescent upwards. Caryopsis loosely enclosed by the lemma and palea, triquetrous,

### 1. *Desmostachya bipinnata* (Linn.) Stapf

*Desmostachya bipinnata* (Linn.) Stapf in Dyer's Fl. Capensis 7: 632 (1900).

*Briza bipinnata* Linn. Syst. Nat. ed. 10, 875 (1759).

*Eragrostis cynosuroides* (Retz.) P. Beauv., Essai Agrost. 71 (1812); Hook. f., Fl. Brit. Ind. 7: 342 (1896).

*Poa cynosuroides* Retz., Obs. 4: 20 (1786).

*Eragrostis bipinnata* (Linn.) K. Schum. in Engl. Pflanzenf. Ost-Afr. C, 113 (1895); Muschler in Verh. Bot. Ver. Brand. 1907, 49: 74 (1908).

*Stapfiola bipinnata* (Linn.) Ktze. in Post et Ktze., Lexic. 532 (1903).

Perennial with a stout, creeping rootstock emitting thick stolons covered with polished, shining sheaths. Culms tufted, erect, up to 1 m. high, smooth and glabrous. Leaf-blades linear, acuminate, 15-40 cm. long, 4-10 mm. broad, glabrous, margins scabrid; sheaths loose and slipping from the culms, hairy at the mouth; ligule a ciliolate membranous rim. Panicle 15-45 cm. long, 1.3-8 cm. broad, narrowly pyramidal or columnar, often interrupted; axis puberulous; branches very short, about 2 cm. long, crowded from the base with sessile, imbricating spikelets; branchlets rigid, spreading, glabrous or hispidulous. Spikelets sessile, 13 mm. long, up to 30-flowered; rachilla tough, internodes very short. Glumes very unequal, 1-nerved; lower 0.5 mm. long, obtuse. Lemmas 1.6-2 mm. long, ovate, acute, coriaceous. Palea shorter, subcoriaceous with minutely scabrid keels. Anthers 0.8 mm. long.

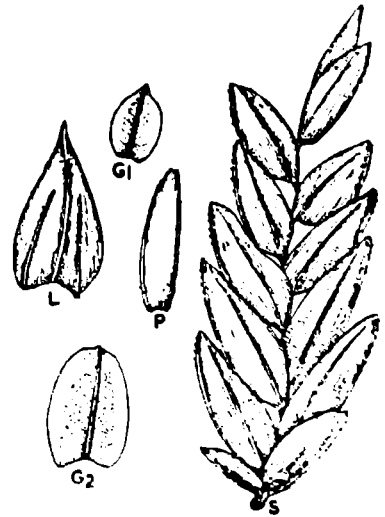


Fig 136. *Desmostachya bipinnata*.

Hyderabad; Multan; Karachi; Lahore; Jhelum; Rawalpindi; Peshawar; Dera Ismail Khan; Quetta. Very common throughout the plains.

6. **Halopyrum** Stapf

Perennial grasses with narrow, rigid convolute leaves. Spikelets large, many-flowered, sessile or shortly pedicelled on the short branches of an elongated panicle. Spikelets strongly compressed laterally; rachilla disarticulating above the glumes and between the florets, silkily hairy. Glumes subequal, Lower 3-nerved, upper 5-nerved. Lemmas 3-nerved; palea as long as the lemma.

1. **Halopyrum mucronatum** (Linn.) Stapf

*Halopyrum mucronatum* (Linn.) Stapf in Hook. Icon. Pl. tab. 2448 (1896); Hook. f. Fl. Brit. Ind. 7: 328 (1896).

*Uniola mucronata* Linn. sec. Kunth, Enum. Pl. I: 425 (1833)

Perennial with a creeping, branched rhizome. Culms hard woody, 30-45 cm. high, smooth, shining, the branches often fascicled and clothed at the base with pale,

coriaceous, mucronate sheaths. Leaf-blades 20-30 cm. long, 3-4 mm. broad, convolute, very narrow, glaucous, coriaceous, striate, quite smooth; sheaths terete, hard, with villous mouth; ligule a few hairs. Panicle

30-45 cm. long, erect or nodding; axis and branches quite smooth, angular. Spikelets

12-15 mm. long, flat, sessile or with a short pedicel, 10- to 15-flowered, smooth, pale yellowish; rachilla very short, hairy, the hairs 3-5 mm. long. Lower glume 6 mm. long, scarcely longer than the lowest lemma, ovate-lanceolate, 3-nerved. Upper glume 8 mm. long, strongly 5-nerved. Lemmas mucronulate, 3-nerved, 6.5 mm. long. Palea as long as the lemma, subacute, 2-keeled. Grain ellipsoid, compressed, deeply furrowed on the hilum side; embryo 1/2 as long.

Karachi. Common.



Fig. 137. *Halopyrum mucronatum*.



7. **Melanocenchrus** Nees

Annual or perennial grasses with short, narrow leaves rolled in drying. Spikelets in short, dense, turbinate spikes which are distantly arranged on one side of the narrow axis of the spike-like panicle; the spikes shortly stalked, disarticulating as a whole, formed of 5-8 spikelets, of which two are bisexual, the rest male or sterile and reduced to lemmas. Fertile spikelet with one perfect floret followed by one male and one sterile floret or by two sterile lemmas only; rachilla not jointed, sometimes produced and bearing an imperfect lemma. Glumes narrow, linear, rigid, plumose with long hairs and narrowed into a long, rigid, scabrid awn. Lemma broad, ovate, smooth or slightly hairy, 3-nerved, narrowed, cuspidate or 3-lobed, the lobes aristate, the lateral shorter than the middle and somewhat broader at the base. Palea as long as the lemma, 2-cuspidate, 2-keeled; keels hairy. Stamens 3. Caryopsis obovate-ellipsoid, somewhat depressed on the back; embryo  $1/2$  as long as the grain; hilum punctate.

1. **Melanocenchrus royleana** Nees

*Melanocenchrus royleana* Nees in Proc. Linn. Soc. 1: 95 (1841).

*Gracilia royleana* var. *plumosa* Hook f., Fl. Brit. Ind. 7: 284 (1896).

*Melanocenchrus jacquemontii* Jaub. et Spach, Illustr. Pl. Orient. IV: 36-39 (1850-53) t. 325, 326.

Annual. Culms densely tufted, very slender, 7-20 cm. high. Leaf-blades 2.5-5 cm. long, 1.5 mm. broad, more or less convolute, linear-lanceolate, acute, glabrous or nearly so, the margins ciliate; sheaths with a few, long, scattered hairs; ligule a hairy rim. Spikes borne on an elongated axis which is

narrow, angular, filiform, 1.2-5 cm. long and often recurved. Spikes 5-10, 1.2 cm. long (incl. the awns), dense, turbinate, disarticulating as a whole. Spikelets 5-8 in a spike, of which two are

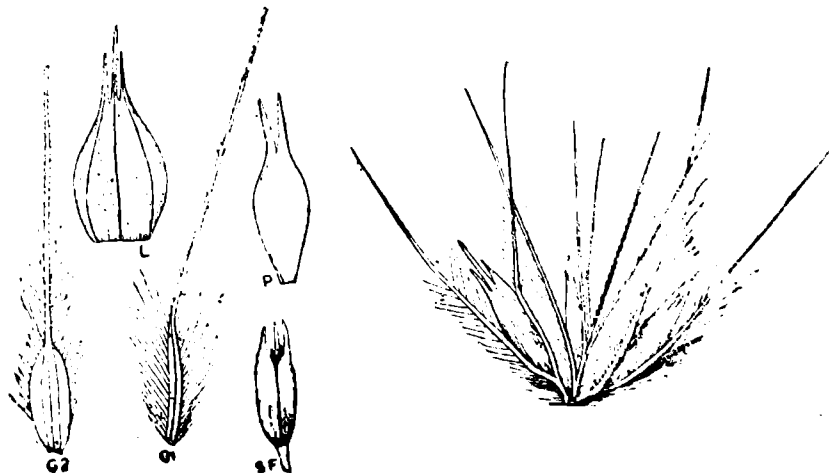


Fig. 138.—*Melanocenchrus royleana*.

bisexual, the rest male or sterile. Fertile spikelet 2-flowered; rachilla produced beyond the upper lemma, filiform, scaberulous. *Glumes* persistent, elongate-subulate, 2.5-3 mm. long, rigid, plumose at the base and ending in rigid, scabrid 6-7 mm. long awns; the lower glume without hyaline margins but the upper with rather wide hyaline margins. *Lower floret* bisexual; lemma 4.5 long, chartaceous, ovate-oblong, cymbiform, 3-aristate, 3-nerved. *Palea* as long as the lemma, 2-cuspidate; keels scaberulous. *Upper floret* male; lemma resembling the lemma of the fertile floret but much smaller, 3-cuspidate. Rachilla sometimes bearing 2 empty lemmas at the tip.

Hyderabad; Karachi; Pabbi Hills near Jhelum.

### 8. *Tetrapogon* Desf.

Annual or perennial grasses with solitary or geminate, long silky-villous spikes. Spikelets arranged in two rows on one side of the rachis. Florets many, the lower 2 or more bisexual and the upper neuter or rudimentary. Glumes subequal. Lemmas (fertile) long-villous on the back, truncate or 2-lobed, awned above the summit. Palea very short, 2-keeled; muticous. Lodicules 2. Stamens 3. Caryopsis oblong fusiform, slightly compressed dorsally; hilum basal, punctiform.

#### KEY TO THE SPECIES

Perennial. Lemma ovoid, hirsute all over.....1. *T. villosus*  
Annual. Lemma cuneiform, glabrous (except the keel) .... 2. *T. tenella*

#### 1. *Tetrapogon villosus* Desf.

*Tetrapogon villosus* Desf. Fl. Atl. 2 : 389 (1799) t. 255.

*Chloris villosa* (Desf.) Pers., Syn. 1 : 87 (1805).

Perennials with caespitose rootstocks, producing dense tufts of sterile innovations and fertile culms. Culms 10-40 cm. high, erect, glabrous, smooth, more or less compressed in the lower half. Leaf-blades linear, acute, flat or convolute, up to 15 cm. long, 3 mm. broad; sheaths compressed, keeled, smooth or hairy at the mouth; of the basal leaves overlapping, dilated; ligules membranous, very short (less than 0.5 mm.), finely and shortly ciliate. Spikes solitary or with one or two additional close to it, more or less long-peduncled, 2.5-6 cm. long; rachis villous. Spikelets sessile, 3- to 6-flowered, the two lower bisexual the rest reduced

to lemmas ; all the florets awned ; rachilla disarticulating above the glumes. *Glumes* lanceolate, 1-nerved, membranous, glabrous, slightly scabrid along the keel, the lower 3 mm. long, acute or mucronate, the upper 4 mm. long, broader, aristulate. *Fertile lemma* 3 mm. long, obovate, very obtuse, slightly emarginate at the summit, 3-nerved, dorsally long-villous,

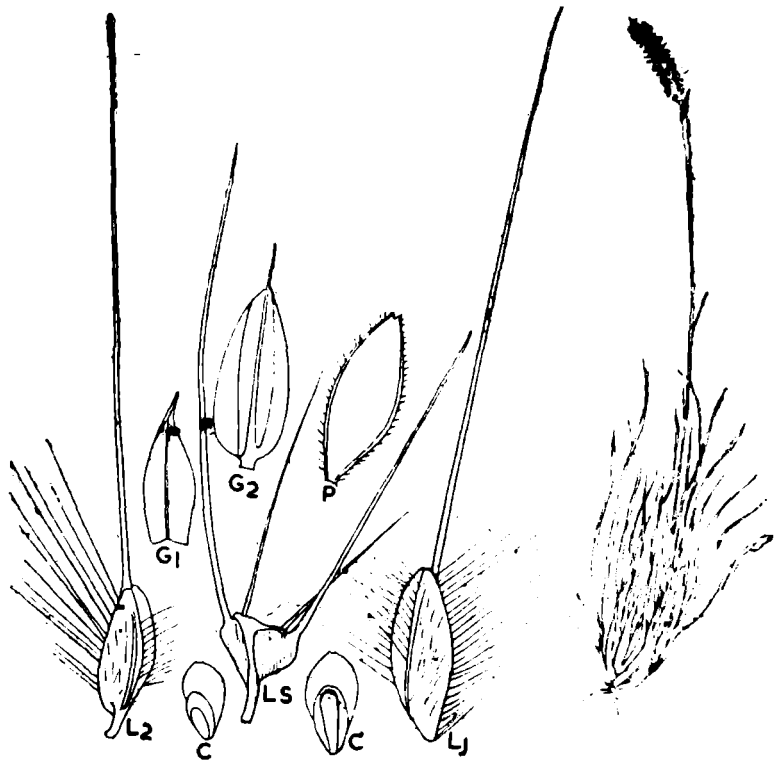


Fig. 139.—*Tetrapogon villosus*.

the hairs twice as long as the lemma ; awn arising from the sinus, up to 1 cm. long, scabrid. *Palea* narrow, 2-keeled, truncate or retuse, ca. 2.5 mm. long ; keels ciliolate. *Sterile lemmas* shorter than the fertile, long-villous, long-awned, becoming successively shorter upwards. *Caryopsis* with a loose pericarp, 1.5-2 mm. long.

Sangla hill ; Shakhot Hills ; Kirana Hill ; Sakesar ; Rawalpindi ; Swat ; Kagan ; Quetta ; Fort Munro. Very common.

## 2. *Tetrapogon tenellus* (Roxb.) Chiovenda

*Tetrapogon tenellus* (Roxb.) Chiovenda in *Ann. Inst. Bot. Roma* 8 : 352 (1908).

*Chloris tenellus* Roxb. *Hort. Beng.* 82 (1814) ; Hook. f., *Fl. Brit. Ind.* 7 : 290 (1896).

*Chloris triangulata* Hochst. ex A. Rich. *Tent. Fl. Abyss.* 2 : 409 (1851).

*Chloris macrantha* Jaub. et Spach, *Illustr. Pl. Orient.* 4 : 42 (1850-53).

Annual. *Culms* slender, branched from the base, geniculate-ascending and rooting from the nodes, up to 45 cm. high. *Leaf-blades* linear-

lanceolate, finely acuminate, 7.5-20 cm. long, 3-6 mm. broad, flat or convolute, margins more or less ciliate towards the base; *sheaths* glabrous; *ligule* membranous, truncate, large. Spikes solitary, 2.5-5 cm. long, erect, flat. *Spikelets* 6-flowered, with 3 fertile florets 4.5-6 mm. long, cuneate, 3-awned. *Glumes* shorter than the lowest lemma, lanceolate; lower 3.5-4 mm., strongly 1-nerved, hairy along the midrib; upper 4.5-5 mm. long, the midrib produced into a short awn, scabrid

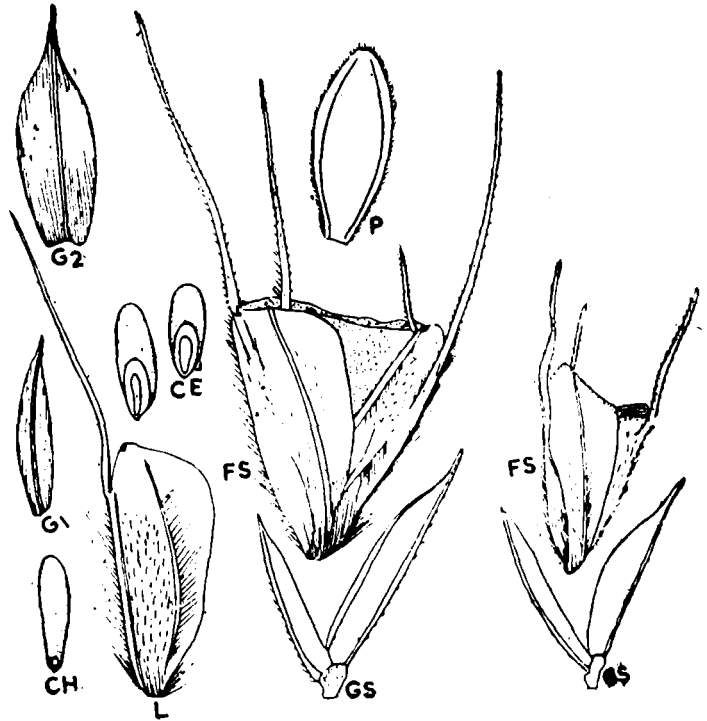


Fig. 140.—*Tetrapogon tenellus*.

along the midrib. *Fertile lemma* 5 mm. long, broadly cuneate, cymbiform, the upper margin truncated, stiffly hairy on the nerves and at the base; awn 4 mm. long, scaberulous. *Palea* elliptic, narrowed towards the apex with ciliate margins and densely hairy callus. *Sterile lemma* or lemmas smaller but similar, awned and with similar paleas.

Karachi; Khewra.

The spikelets in the Khewra specimens are shorter (4.5 mm.) as compared to those from Karachi in which they are 6 mm. long.

## 9. *Dinebra* Jacq.

Annual, leafy grasses with flat leaves. Spikelets 2- to 3-flowered, arranged in two rows on one side of the slender, spreading or deflexed spikes which are arranged in narrow pyramidal racemes. Rachilla slender, jointed at the base and produced above the fertile floret and bearing an imperfect lemma. Glumes firm, as long as or much longer than the spikelet, lanceolate, awned, 1-nerved, keeled; upper  $\frac{1}{4}$  longer than the lower; awn terminal. Lemmas very small, broadly ovate, subacute, hyaline, keeled, with a median nerve and 2 indistinct lateral nerves. Caryopsis narrowly ovate, obtuse, 3-angled with a deciduous pericarp; embryo  $\frac{1}{2}$  as long as the grain; hilum small.

1. *Dinebra retroflexa* (Vahl) Panzer

*Dinebra retroflexa* (Vahl) Panzer in Denkschr. Akad. Wissensch. Muench. 1813 : 270 (1814).

*Cynosurus retroflexus* Vahl, Symb. Bot. 2 : 20 (1791).

*Dinebra arabica* Jacq. Fragm. Bot. 77 (1809) ; Hook. f., Fl. Brit. Ind. 7 : 297 (1896).

Annual. Culms tufted, erect or geniculate-ascending, up to 40 cm. high, leafy throughout ; nodes glabrous. Leaf-blades flat, linear lanceolate, acuminate, flaccid, 7.5-20 cm. long, 3-5 mm. broad, glabrous or sparsely hairy ; sheaths loose, glabrous ; ligule membranous, lacerate. Spikes 2-5 cm. long, racemosely arranged along 10-30 cm. long axis, solitary or in fascicles of 2-3 together ; rachis dorsally flattened, ventrally 3-gonous. Spikelets 5 mm. long (incl. the awns). alternate, sessile. Glumes 7 mm long, much longer than the lemmas, hyaline, keeled, with slightly recurved, minutely scaberulous awn, 1-nerved ; lower shorter than the upper. Lemmas 2.5 mm. long, shortly hairy, ovate-oblong, subacute, hyaline, 1-nerved. Palea shorter, hyaline, with finely ciliolate keels.



Fig. 141. *Dinebra retroflexa*.

Gujrat ; Jhelum ; Multan ; Hyderabad.

10. *Leptochloa* Beauv.

Annual grasses with flat leaves. Inflorescence consisting of several racemes scattered along the common axis. Spikelets very minute, alternate and unilaterally biseriate on the rachis of very slender spiciform racemes : rachilla jointed at the base and between the lemmas, produced between each lemma and beyond the terminal floret. Glumes equal or unequal, 1-nerved. Lemmas 3-nerved ; palea shorter, 2-keeled.

## KEY TO THE SPECIES

- Spikelets 2-to 3-flowered, less than 2.5 mm. long ; upper glume longer than the lowest lemma . . . . . 1. *L. panicea*  
 Spikelets 4- to 6-flowered, more than 2.5 mm. long ; upper glume shorter than the lowest lemma . . . . . 2. *L. chinensis*

1. *Leptochloa panicea* (Retz.) Ohwi

*Leptochloa panicea* (Retz.) Ohwi in Bot. Mag. Tokyo, 55 : 311 (1941).

*Poa panicea* Retz. Obs. 3 : 11 (1783).

*Leptochloa filiformis* Roem. et Schuit. Syst. 2 : 580 (1817) ; Hook. f., Fl. Brit. Ind. 7 : 298 (1896).

*Leptochloa contracta* (Retz.) Blatter & McCann, Bomb. Grasses, 243 (1935).

*Poa contracta* Retz., Obs. 3 : 11 (1783.)

A very slender annual grass. *Culms* tufted, geniculate-ascending at the base, up to 90 cm. high. *Leaf-blades* linear, acuminate, up to 25 cm. long, 8 mm. broad, sparsely hairy ; *sheaths* glabrous or sparsely hairy ; *ligules* short, lacerate, 0.5 mm. long. Inflorescence a compound raceme, 3-15 cm. long, effuse or contracted. *Racemes* 1-7.5 cm. long, filiform ; rachis flattened, bearing spikelets in two rows on one side. *Spikelets* 2-to 3-flowered, 1.5 mm. long, as long as the internode, very shortly pedicelled. *Lower glume* 0.75 mm. long, linear-lanceolate. *Upper glume* similar, 1.25 mm. long. *Lemma* a little shorter than the upper glume, broadly ovate, obtuse, 3-nerved, the nerves microscopically hairy. *Palea* shorter, about 1 mm. long. *Caryopsis* filiform-oblong, deeply grooved on one side, slightly produced at each end.

Lahore ; Gujrat ; Rawalpindi. In cultivated fields and in shady places in lawns and gardens. Very common.

## 2. *Leptochloa chinensis* (Linn.) Nees

*Leptochloa chinensis* (Linn.) Nees in Syll. Ratisb. 1 : 4 (1824) ; Hook. f. Fl. Brit. Ind. 7 : 299 (1896).

*Poa chinensis* Linn., Sp. Pl. 69 (1753).

Annual. *Culms* tufted, geniculate-ascending, up to 1 m. high. *Leaf-blades* up to 40 cm. long, quite firm, narrow, flat ; *ligule* short, lacerate. Inflorescence 15-40 cm. long ; *racemes* thin, spreading, up to 7.5 cm. long. *Spikelets* 4-to 6-flowered, about 2.5 mm. long. *Lower glume* lanceolate-subulate, 0.7 mm. long ; *upper* lanceolate, up to 1.3 mm. long. *Lemmas* broad, lanceolate, 1.2 mm. 3-nerved, mucronate or obtuse, keeled, nerves hairy towards the base. *Palea* broadly elliptic, side flaps as broad as the middle, obtusely 3-gonous, keels hairy. *Caryopsis* 1/2 as long as the lemma, subrugose ; embryo side convex, the hilum surface flat ; hilum small, rounded, somewhat above the base,

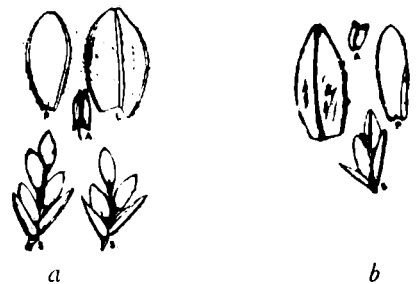


Fig. 142.—*Leptochloa chinensis* ;  
b. *L. panicea*.

Multan ; Gujrat ; Lahore ; Lyallpur.

### 11. *Coelachyrum* Hochst.

Annual or rarely perennial, small grasses. Ligule short, fimbriate. Spikelets very short-stalked, in short, one-sided racemes. Spikelets small, broad, compressed but the lemmas not keeled ; rachilla disarticulating. Glumes membranous, lanceolate-ovate to ovate, obtuse, lower somewhat shorter, 1-nerved, the upper 3-nerved. Lemmas 5-8 (-14), membranous, ovate to rounded, obtuse, not keeled, naked or hairy along the nerves, 3-nerved, side nerves marginal, the margins incurved. Palea elliptic, with narrow, incurved marginal flaps. Stamens 3. Grain dark reddish-brown ; embryo  $1/2$  as long as the grain ; hilum small.

#### 1. *Coelachyrum piercei* (Benth.) Bor

*Coelachyrum piercei* (Benth.) Bor in Kew Bull. 225 (1952).

*Eragrostis piercei* Benth. in Hook. f., Icon. Pl. sub tab. 1370 ; Boiss. Fl. Orient. 5 : 583 (1884).

Perennial. Culms geniculate-ascending, usually branched and leafy below, 30-45 cm. high, glabrous. Leaf-blades 2.5-5 cm. long, subulate-acuminate ; ligules very short, fimbriate. Panicle long-peduncled, loose, pyramidal, 7.5-17.5 cm. long ; racemes 3-7, almost filiform, elongate, erecto-patent, lower solitary, 7.5-12.5 cm. long, the upper shorter, ca. 7.5 cm. long, subgeminate. Spikelets ovate, 8- to 16-flowered, 7.5 mm. long, 5 mm. broad ; rachilla disarticulating. Glumes lanceolate, broadly membranous, keeled, obtuse or rarely mucronate, glabrous. Lemmas oblong, obtuse, subdenticulate, lateral nerves submarginal, very prominent. Caryopsis oblong, compressed, smooth.

Coast of Baluchistan, *E. Pierce*.

### 12. *Eleusine* Gaertn.

Annual or perennial grasses with flat or convolute leaves. Racemes many, digitate at the end of the peduncle, rarely with one or more additional ones lower down. Spikelets laterally compressed, sessile, densely overlapping in two rows on one side of the flattened rachis ; the rachis terminating in a spikelet ; rachilla jointed above the glumes and between the lemmas, tough. Florets 3-12, hermaphrodite or the uppermost reduced. Glumes persistent, slightly unequal, keeled,

membranous, obtuse or acute ; lower 1-nerved, the upper 1- to 5-nerved, with the nerves close to the keel. Lemma similar to the glumes, 3-nerved or with an additional 1-2 nerves near the keel, the lateral nerves sometimes prominent only near the base. Palea shorter than the lemma. 2-keeled with keels narrowly winged. Caryopsis free between the lemma and the palea, with a loose delicate pericarp.

KYE TO THE SPECIES

- 1. Annual ; glumes glabrous .....2
- Perennial ; glumes hairy ..... 1. *E. flagellifera*
- 2. Racemes slender, nearly glabrous at the base ; grain oblong..... 2. *E. indica*
- Racemes thick, incurved, pubescent at the base ; grain globose ..... 3. *E. coracana*

1. **Eleusine flagellifera** Nees

*Eleusine flagellifera* Nees in Linnaea 16 : 220 (1842) ; Hook. f., Fl. Brit. Ind. 7 : 294 (1896).

*Eleusine arabica* Hochst. ex Steud., Syn. Pl. Gram. 211 (1854).

Perennials, with thick root stocks. *Culms* prostrate at the base but sending out divaricate branches which are sub-bulbous and branched at the nodes, glabrous, smooth but scabrid below the inflorescence. *Leaf-blades* up to 10 cm. long, 3 mm. broad, flat then more or less convolute on drying, bearing long spreading bulbous based hairs along the margins and on the upper surface ; *basal sheaths* loose, inflated, with a reduced blade, very velutinate, the upper sheaths tight, slightly keeled, glabrous and smooth with villous mouth ; *ligule* reduced to a ciliolate rim. Inflorescence shortly peduncled, formed of 3-5 digitate spikes, 2.5-3 cm. long ; rachis velutinatanose at the base, the rest scaberulous ; the spikelets densely imbricate, arranged in two rows on one side of

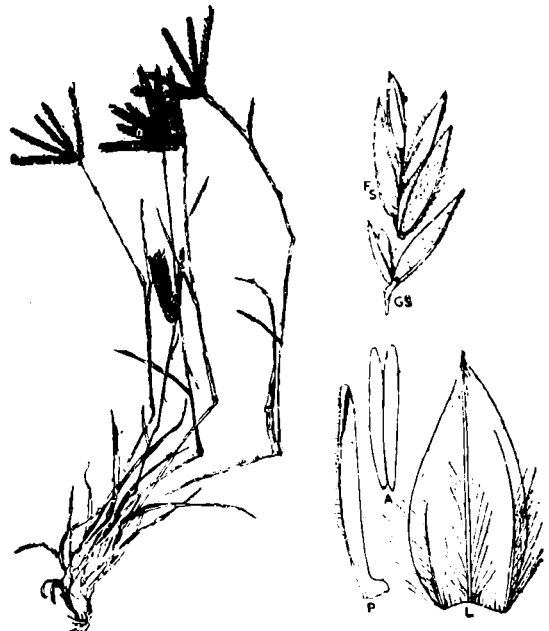


Fig. 143.—*Eleusine flagellifera*



the flattened rachis. *Spikelets* strongly compressed laterally, oval, ca. 5 mm. long, 2.5 mm. broad, 3- to 8-flowered. *Glumes* lanceolate, smooth, acute. 1-nerved, with the keel green, scabrid; lower 2.5 mm. and the upper 4 mm. long. *Lemmas* lanceolate-acuminate, mucronate, 3-nerved, villous externally in the lower half with long appressed hairs, slightly scabrid on the keels, with lateral nerves near the margin. *Palea* shorter, 3 mm. long, 2-toothed at the apex, the keels ciliate.

Very common through out the area.

## 2. *Eleusine indica* (Linn.) Gaertn.

*Eleusine indica* (Linn.) Gaertn. Fruct. 1: 8 (1788); Hook. f., Fl. Brit. Ind. 7: 293 (1896).

*Cynosurus indicus* Linn., Sp. Pl. 72 (1753).

Annual. *Culms* tufted, erect from a decumbent base, glabrous and smooth, up to 60 cm. high. *Leaf-blades* 10-30 cm. long, 3-4 mm. broad, flat, linear, acuminate, glabrous or with scattered hairs; *sheaths* compressed, keeled, glabrous or long and loosely ciliate along the margin, with a hairy mouth; *ligule* membranous, ciliate. Inflorescence more or less long-peduncled, formed of a terminal whorl of 2-4 sessile spikes with ordinarily 1-2 solitary spikes below the whorl, or without solitary spikes. *Spikes* 5-12 cm. long, erect or slightly decurved; rachis flat, green, scabrid along the margins, ending in a terminal spikelet, pubescent or villous at the base. *Spikelets* up to 6 mm. long, imbricate, secund and pointing forward, 3-to 6-flowered, 2-seriate. *Lower glume* 3 mm. long, lanceolate, acute, 3-nerved, keeled, scabrid along the keel. *Upper glume* 5 mm. long, 3- to 5-nerved, shortly apiculate, keeled, the keel scabrid. *Lemmas* ovate-lanceolate, shortly apiculate or acute, 3-nerved, cymbiform, 4-5 mm. long, margins broadly hyaline. *Palea* shorter, 2-toothed, with 2 winged keels, very finely ciliate. *Caryopsis* ovoid or oblong, more or less truncate at the base, very rugose.



Fig. 144.—*Eleusine indica*.

Lahore; Rawalpindi; Balakot; Swat. Common.

3. **Eleusine coracana** (Linn.) Gaertn.

*Eleusine coracana* (Linn.) Gaertn., Fruct. 1 : 8 (1788) ; Hook. f., Fl. Brit. Ind. 7 : 294 (1896).

*Cynosurus coracana* Linn., Syst. ed. 10, 875 (1759).

A robust annual, up to 1.5 m. high. *Leaf-blades* overtopping the culms, up to 6 mm. broad ; *sheaths* compressed, loose ; *ligule* a fringe of hairs. *Spikes* 4-7, suberect, with their ends or the whole spikes incurved ; rachis pubescent at the base. *Spikelets* overlapping, 3- to 6-flowered, 6 mm. long. *Lemmas* up to 5 mm. long. *Grain* globose, dark brown, smooth or rugose.

Cultivated on poor soil in the plains and chiefly used as a fodder.

13. **Dactyloctenium** Willd.

Annual or perennial grasses with flat leaves. Spikes in a terminal digitate cluster. Spikelets laterally compressed, densely imbricate, sessile in two rows on one side of a narrow, flattened rachis ; the rachis projecting in a mucro beyond the spikelets ; rachilla tardily disarticulating above the glumes and between the lemmas. Florets 3-5, hermaphrodite or the uppermost reduced. Glumes slightly unequal, keeled, 1-nerved, persistent ; the upper mucronate or short awned. Lemma ovate, subacuminate, mucronate or awned, 3-nerved, deciduous with the grain. Palea as long as the lemma, 2-keeled. Caryopsis enclosed in a thin pericarp which disappears early.

## KEY TO THE SPECIES

- |                                |                        |
|--------------------------------|------------------------|
| Annual ; grain subglobose..... | 1. <i>D. aegyptium</i> |
| Perennial ; grain ovoid.....   | 2. <i>D. scindicum</i> |

1. **Dactyloctenium aegyptium** (Linn.) Beauv.

*Dactyloctenium aegyptium* (Linn.) Beauv., Essai Agrost. 72 (1812).

*Cynosurus aegyptius* (Linn.) Sp. Pl. 72 (1753).

*Dactyloctenium aegyptiacum* Willd., Enumer. Pl. 1029 (1809).

*Eleusine aegyptiaca* Desf., Fl. Atl. 1 : 85 (1798) ; Hook. f., Fl. Brit. Ind. 7 : 295 (1896).

Annual. *Culms* up to 50 cm. high, erect or decumbent or nearly prostrate, branched from the base. *Leaf-blades* 10-15 cm. long, linear, flat, smooth and glabrous or with scattered hairs, margins smooth with stiff tubercle-based hairs ; *sheaths* compressed, almost smooth ; *ligule* reduced

to a ciliolate rim. *Spikes* 2-6, digitate, 2-5 cm. long; rachis keeled, pubescent at the base, the tip projecting as a stout mucro. *Spikelets* up to 5 mm. long, densely crowded, many-flowered. *Lower glume* 1.5-2.5 mm. long, cuspidate. *Upper glume* 2 mm. long, mucronate or awned with an awn up to 2 mm. long. *Lemmas* 3-4 mm. long, gibbously ovate, mucronate or very shortly awned, awn recurved. *Palea* 2-keeled, keels narrowly or broadly winged, ciliate. *Grain* subglobose, 1-1.5 mm. long, very rugose. *Anthers* 0.3-0.5 mm. long.



Fig. 145. *Dactyloctenium*  
*aegyptium*. b. *D. scindicum*.

Cosmopolitan. Found throughout the plains and the lower hills. A very good fodder grass for cattle.

## 2. *Dactyloctenium scindicum* Boiss.

*Dactyloctenium scindicum* Boiss., Diagn. ser. 2, fasc. 4 : 131 (1859).

*Eleusine scindica* (Boiss.) Duthie, Grasses N.W. India, 58 (1883).

*Eleusine glaucophylla* Munro ex Benth. in Journ. Linn. Soc. 19 : 107 (1881).

*Dactyloctenium glaucophyllum* Courbon in Ann. Si. Nat. ser. IV, 18: 133 (1862).

*Eleusine aristata* Ehrenb. ex Boiss., Fl. Orient. 5 : 557 (1884) non Link.

Perennial with creeping shoots bearing clusters of short, stiff leaves at the nodes; flowering culms erect, almost leafless, 6-18 cm. high. *Leaf-blades* 2.5-10 cm. long, 1.5-2.5 mm. broad, acuminate or pungent, glaucous, sparsely hairy, the margins with stiff bulbous-based hairs; *sheaths* glabrous or sparsely hairy; *ligule* absent. *Spikes* 3 or more, 6-12 cm. long, spreading or decurved, bearded at the base; rachis excurrent into a pungent point. *Spikelets* 4 mm. long, 3- to 5-flowered. *Lower glume* 2.5 mm. long, ovate, acute or apiculate, 1-nerved, with ciliate keel. *Upper glume* 3 mm. long, suborbicular, shortly awned, awn 0.8 mm. long. *Lemmas* ca. 4 mm. long, broadly ovate, acute, cuspidate, glabrous, keeled, membranous, with a strong midnerve and weak lateral nerves. *Palea* broad, the keels scaberulous. *Caryopsis* ovoid, rugose.

Karachi; Hyderabad; Lahore; Peshawar.

## 14. *Acrachne* Wight and Arn.

Annual or perennial grasses with narrow flat leaves. Spikes usually in pseudowhorls or scattered. Spikelets laterally compressed, 8- to 20-

flowered, sessile or subsessile, imbricate, 2-seriate on one side of a flattened rachis, terminating in a spikelet ; rachilla disarticulating above the glumes and between the lemmas. Glumes easily falling off, oval, mucronate, 1-nerved, the upper somewhat longer. Lemma lanceolate in profile, oval when flattened, mucronate, the side nerves also ending in short teeth. Palea narrow, curved, persistent. Grain closely rugose, grooved or hollowed on the hilum side, with an early deciduous pericarp.

1. ***Acrachne verticillata*** (Roxb.) Wight et Arn.

*Acrachne verticillata* (Roxb.) Wight et Arn. ex Lind 1. Nat. Syst. Bot. ed. 2 : 381 (1836).

*Acrachne racemosa* (Heyne) Ohwi in Bull. Tokyo Sci. Mus. No. 18, 1 (1947).

*Eleusine racemosa* Heyne in Roth, Nov. Sp. 80 (1821).

*Eleusine verticillata* Roxb., Hort. Beng. 8 (1814) ; Fl. Ind. 1 : 346 (1832) ; Hook. f., Fl. Brit. Ind. 7 : 295 (1896).

*Leptochloa verticillata* Kunth, Rev. Gram. 1 : 91 (1829).

*Dinebra verticillata* Wight ex Steud., Syn. Pl. Gram. 209 (1854).

Annual. Culms up to 90 cm. high, erect, simple or branched, glabrous and smooth ; nodes glabrous. Leaf-blades linear, flaccid, up to 20 cm. long, 7 mm. broad, glabrous and smooth ; sheaths compressed and keeled, glabrous and smooth ; ligule truncate, ciliate, about 1 mm. long. Spikes many, whorled or the lower solitary or opposite, suberect, 2-9 cm. long, spiculate up to the base ; rachis hairy at the base. Spikelets ovate or oblong, 8- to 12-flowered, 4-6 mm. long, pale green. Lower glume 3 mm. long, broadly ovate, finely acute. Upper glume 4 mm. long, broadly ovate, finely acuminate or aristulate. Lemma 3-4 mm. long, very broadly ovate, acute or acuminate, 3-nerved, keel excurrent, lateral nerves ending in short teeth. Grain oblong, rugose, pericarp early deciduous.

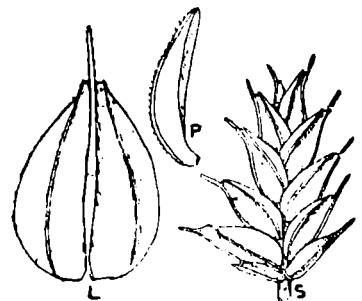


FIG. 146. *Acrachne verticillata*.

Lahore ; Sialkot ; Multan ; Balakot ; Poonch. Common

15. **Tripogon** Roem. et Schult.

Slender, densely tufted grasses with convolute leaves. Spikelets 4- to many-flowered, 2-seriate and unilateral on a very slender terminal spike, not jointed at the base ; rachilla produced between the lemmas, jointed at the base. Glumes unequal, 1-nerved, persistent ; lower usually lodged in a furrow of the rachis and toothed and lobed on one side, upper entire or notched below the mucronate or apiculate tip. Lemmas ovate, dorsally convex, 2-fid and awned in the cleft, or 4-fid with outer lobes awned, the inner membranous rarely awned. Palea broad or narrow, complicate. Caryopsis free.

KEY TO THE SPECIES

- 1. Lemmas 2-fid with an interposed awn.....2
- Lemmas 4-fid, with three long awns..... 1. *T. filiformis*
- 2. Spikelets 2-, rarely 3- flowered..... 2. *T. purpurascens*
- Spikelets 6- to 8-flowered... .. 3. *T. hookerianus*

1. **Tripogon filiformis** Nees

*Tripogon filiformis* Nees ex Steud. Syn. Pl. Gram. 301 (1854) ; Hook. f., Fl. Brit. Ind. 7 : 288 (1896).

*Catapodium filiformis* Nees ex Duthie, Grasses N. W. Ind. 33 (1883).

A densely tufted perennial. Culms up to 15 cm. high, smooth and glabrous. Leaf-blades convolute, filiform, setaceous, smooth and glabrous except for a few hairs at the base, as long as the whole plant ; sheaths papery, persistent ; ligules minute. Inflorescence a simple spike, of many spikelets which are usually secund on the simple rachis. Spikelets up to 8 mm. long, 5-to 8-flowered. Lower glume lanceolate, 2.5 mm. long, lobed on one side, membranous, 1-nerved. Upper glume narrowly lanceolate, membranous, 1-nerved, 4.5 mm. long, nerve produced into a short arista. Lemma 3.5 mm. long, 4-fid, 3-nerved, the side nerves also produced into awns ; awns 7-8 mm. long.

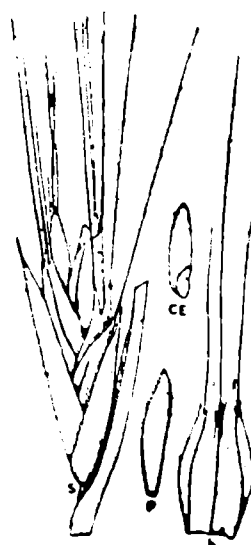


Fig. 147. *Tripogon filiformis*.

Kagan Valley . Naran, Batakundi M. S. Zahur.

## 2. *Tripogon purpurascens* Duthie

*Tripogon purpurascens* Duthie in Ann. Bot. Gard. Calcutta 9: 74 (1901).

A densely tufted perennial. *Culms* simple, up to 20 cm. high, smooth and glabrous. *Leaf-blades* setaceous, convolute, scabrid, margins ciliate towards their bases; *sheaths* short; *ligules* minute, pilose. *Spikes* simple, erect, flattened, 5-7.5 cm. long, on rather short, brittle sulcate scapes; rachis scabrid. *Spikelets* ca. 4 mm. long, glabrous, arranged in two rows in the excavations of the rachis, usually 2-flowered with occasionally a third male floret at the summit. *Lower glume* very minute and narrow, sunk in the hollow of the rachis, hyaline, 1-nerved. *Upper glume* lanceolate, acuminate, 1-nerved, keeled on the back, with hyaline margins. *Lemma* nearly as long as the upper glume, hyaline, 3-nerved, obliquely 2-fid, awned from the sinus; awn slender, minute. *Palea* truncate or 2-fid, hyaline, 2-nerved.

Kohat-Hangu, R.R. Stewart; Kalachitta Hills, A. H. Khan; Salt Range: Choa Saidan Shah, S. Ahmad.

## 3. *Tripogon hookerianus* Bor

*Tripogon hookerianus* Bor nom. Nov.; Syn. *Tripogon abyssinicus* Hook. f., Fl. Brit. Ind. 7: 287 (1896) non Nees.

Annual. *Culms* slender, 15-25 cm. high, smooth and glabrous. *Leaf-blades* filiform, 5-15 cm. long; *sheaths* papery, persistent; *ligule* very short. *Spikelets* 6- to 8-flowered, 7.5 mm. long. *Lower glume* ovate or subulate-lanceolate, membranous, 1 mm. long, 1-nerved. *Upper glume* linear-oblong, 2- to 3-toothed below the tip, with a narrow membranous margin, base bearded. *Lemma* 3 mm. long, 2-toothed at the truncate tip; awn minute,

Kagan Valley: Naran, M. S. Zahur; Swat: Miana, Mingora, Asghar; Sakesar.

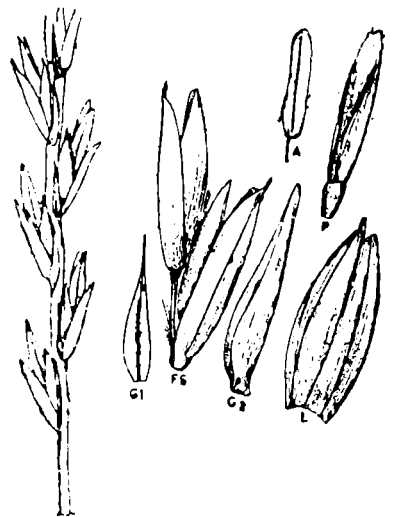


Fig. 148.—*Tripogon hookerianus*

## 16. *Neyraudia* Hook. f.

Perennial, leafy grasses with long, flat leaves. Spikelets small, 4- to 8-flowered, in an effuse, decomposed nodding panicle, laterally compressed; lowest lemma sometimes glabrous, sterile; rachilla shortly bearded below the lemmas, jointed at the base (above the empty lemma if present) and between the lemmas. Glumes and lemmas membranous; upper and lower glumes unequal, lanceolate, 1-nerved; lemmas elongate-subulate, more or less recurved, ending in a very slender tip with two setaceous points and a scabrid interposed awn, 3-nerved, lateral nerves submarginal, penicillate with long hairs; palea oblong, keels scaberulous.

### 1. *Neyraudia arundinacea* (Linn.) Henr.

*Neyraudia arundinacea* (Linn.) Henr. in Meded. Herb. Leid. No. 58 : 8 (1929).

*Aristida arundinacea* Linn. Mantiss 186 (1771).

*Neyraudia madagascariensis* Hook f. var. *zollingeri* (Buse) Henr. l.c.

Perennial, densely caespitose, leafy almost to the panicle. Culms up to 2.5 m. high, smooth, terete, glabrous, solid. Leaf-blades up to 1 m. long, 2.5 cm. broad, flat, smooth; sheaths smooth and glabrous; ligule a villous ridge. Panicle effuse, decomposed, nodding, up to 90 cm. long; branches fascicled and whorled, filiform, smooth; axis smooth or scaberulous. Spikelets laterally compressed, 6-8 mm. long, shortly pedicelled, pale brown, 4- to 8-flowered with all the florets fertile; rachilla shortly bearded below the lemmas, jointed at the base and between the lemmas. Lower glume lanceolate, 1-nerved, 2.5 mm. long. Upper glume similar. Lemmas elongate-subulate, 3-nerved, 4 mm. long, densely penicillate with long hairs on the two marginal nerves, narrowed into a recurved awn, about 1 mm. long with two bristles at the base; palea hyaline, 2-toothed; keels minutely ciliolate; callus densely and shortly bearded.



Fig. 149.—*Neyraudia arundinacea*.

Thal, Kohat; Sakesar; Fort Munro.

17. *Diplachne* Beauv.

Tall, perennial grasses with flat or convolute, narrow leaves. Spikelets almost linear, many-flowered, uniseriate on spike-like racemes arranged in simple, laterally compressed panicle; rachilla disarticulating above the glumes and between the lemmas, not produced beyond the uppermost floret. Glumes unequal, obtuse, membranous; lower 1-nerved, upper 1- to 3-nerved, persistent. Lemmas longer than the glumes, oblong, 2- to 4-toothed at the tip, mucronate or awned, 1- to 3-nerved, lateral nerves submarginal; palea linear, as long as the lemma. Caryopsis free within the lemma and the palea.

1. *Diplachne fusca* (Linn.) Beauv.

*Diplachne fusca* (Linn.) Beauv., Essai Agrost. 163 (1812); Hook. f., Fl. Brit. Ind. 7 : 329 (1896).

*Festuca fusca* Linn., Sp. Pl. ed. 2, 109 (1762).

Perennial. Culms robust, erect or geniculate-ascending, usually branched at the base, 30-80 cm. high. Leaf-blades 6-12 cm. long, 2-3 mm. broad, flat or more or less convolute, rigid, striate and scabrid; sheaths keeled, the upper tight, lower loose; ligule membranous, oblong, 5 mm. long. Panicle erect or curved, linear-lanceolate or obovate-oblong, contracted or diffuse, 15-20 cm. long; axis scabrid at the angles; branches solitary or in fascicles of 2-3, more or less flexuous, up to 8 cm. long, scabrid, spiculate to the base; pedicels scabrid, very short. Spikelets linear, 6-10 mm. long, 1.2-1.4 mm. broad, 10 to 20-flowered. Glumes oblong-linear, emarginate and mucronate, slightly scabrid on the keel; the lower 3 mm. long, the upper 4 mm. long. Lemmas oblong, obtuse, mucronate, 3.5-4 mm. long, the lateral nerves ciliate at the base. Palea 2-dentate, ciliate along the keel. Anthers 1 mm. long. Caryopsis oblong, compressed dorsally, 0.8-1 mm. long; embryo  $1/2$  as long.

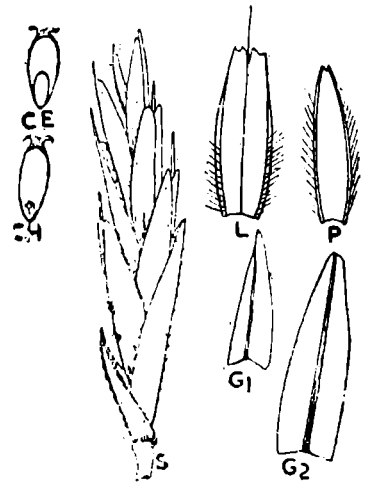


Fig. 150.—*Diplachne fusca*.

Lahore; Gujranwala; Hafizabad; Thatta; Kullian Kote Lake.



Tribe 6. **Sporoboleae**

Spikelets all alike, bisexual, 1-flowered, small, pedicelled in open or contracted panicles ; rachilla jointed above the glumes, very rarely produced beyond the floret. Glumes with the lower or both shorter, nerveless or 1-nerved. Lemmas awnless, thinly membranous at maturity, 1- to 3- nerved with the side nerves, when present , delicate, shining. Caryopsis loose between the lemma and the palea, the pericarp often deciduous.

## KEY TO THE GENERA

1. Spikelets laterally compressed, in cylindric, spike-like panicles.....2  
Spikelets not laterally compressed, in effuse or contracted panicles...  
..... 3. *Sporobolus*
3. Caryopsis rostrate. Perennials with stout, up to 90 cm. tall culms...  
..... 2. *Urochondra*  
Caryopsis not rostrate. Annuals with prostrate culms.....3
3. Palea 2-nerved ; stamens 3..... 1. *Heleochloa*  
Palea 1-nerved ; stamens 2... .. ( *Crypsis* )

1. **Heleochloa** Host

Annual or perennial grasses with rigid, prostrate culms and narrow, convolute leaves. Spikelets laterally compressed, 1-flowered, densely imbricate in a cylindric spike or spiciform panicle ; rachilla jointed above the glumes, not produced above the floret. Glumes hyaline-membranous, keeled, awl-shaped to lanceolate, 1-nerved. Lemma somewhat longer than the glumes, membranous, 1-nerved. Palea as long as the lemma, 2-nerved. Stamens 3 with short, linear anthers. Pericarp early deciduous ; embryo as long as the grain ; hilum small, basal.

1. **Heleochloa Schoenoides** (L.) Host

*Heleochloa schoenoides* (L.) Host, Ic. Gram. Austr. 1 : 23 (1801) t. 29, 30 ; Hook. f., Fl. Brit. Ind. 7 : 235 (1896).

*Crypsis schoenoides* (Linn.) Lam. Tabl. Encycl. 1 : 166 (1791) t. 42, f. 1.

*Crypsis aculeata* Duthie, Grasses N.W. India, 25 (1883) non Ait.

*Phleum schoenoides* Linn., Sp. Pl. 60 (1753).

Annual, densely tufted and much branched grass. Culms mostly prostrate, up to 30 cm. long, smooth and glabrous. Leaf-blades lan-

ceolate, firm, up to 6 cm. long, flat or convolute; uppermost sheath dilated, elliptic, enclosing the base of the panicle. *Spikelets* short, oval-lanceolate or cylindric, up to 3 mm. long. *Glumes* somewhat shorter than the lemma, firm, broadly hyaline along the margin, 1-nerved, scabrid along the keel; lower lanceolate, the upper somewhat longer, broad-lanceolate, mucronate. *Lemma* broadly elliptic-ovate, keeled, laterally compressed, strongly 1-nerved. *Palea* thin, hyaline, elliptic, 2-nerved, nerves close together; sometimes weak to almost absent. *Caryopsis* narrowly elliptic; hilum small.

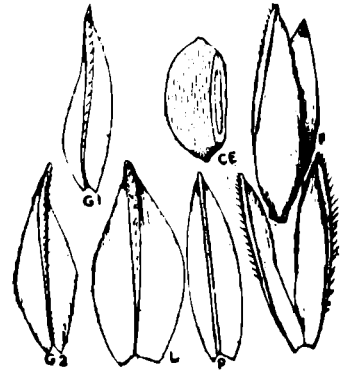


Fig. 152. *Helochoa schmidii*

Lahore; Hyderabad; Skardu, Baltistan, In saline soils.

## 2. *Urochondra* C. E. Hubb.

Perennial grasses with rigid culms and linear, convolute or flat leaves. Inflorescence a long narrow cylindric spike-like panicle with very short branches. Spikelets 1-flowered, strongly laterally compressed; rachilla jointed above the glumes. Glumes keeled, membranous, 1-nerved, often shorter than the spikelet. Lemma larger than the upper glume, mucronate or with a very short awn; palea shorter or as long as the lemma, compressed, hyaline, 2-nerved. Lodicules 0. Stamens 2 or 3; filaments enlarged at the base; stigmas plumose, exerted from the apex. Caryopsis ellipsoid, subcylindric, obtuse, shortly rostrate; pericarp free, membranous, thin; hilum punctate, sub-basal.

### 1. *Urochondra setulosa* (Trin.) C. E. Hubb.

*Urochondra setulosa* (Trin.) C. E. Hubb. in Hook. Icon. tab. 3457 (1947).

*Vilfa setulosa* (Trin.) Mem. Acad. Petersb. ser vi, 2: 55 (1840).

*Helochoa setulosa* (Trin.) Blatter & McCann, Bomb. Grasses 205 (1935).

*Helochoa dura* Boiss., Fl. Orient. 5: 477 (1884).

*Crypsis dura* Boiss., Diagn. ser, II. iv, 125 (1859).

*Crypsis phalaroides* Duthie, Grasses N.W. India, 25 (1883) Non M. Bieb.

Perennial with a short rhizome, clothed all over with minute velvety pubescens. Culms ascending, stout, up to 90 cm. high, 1- to 3-noded,

densely fastigiata from a woody inclined base which is clothed with leaf-sheaths, about 2.5 mm. in diameter, hard, few leaved ; nodes glabrous. *Leaf blades* up to 30 cm. long and 8 mm. broad, involute, terete, rigid, pungent ; sheaths short, coriaceous, the basal sheaths persistent ; *ligule* a narrow ridge of hairs. *Panicle* cylindrical, 9-16 cm. long, 4-8 mm. in diameter. *Spikelets* densely imbricate, 2.5-3 mm. long. *Glumes* 1-nerved, keeled ; keels ciliate. *Lower glume* 1.6 mm long, linear-lanceolate, acute, apiculate. *Lemma* 2.5 mm. long, obtuse, mucronate or with a very short awn. *Palea* 2 mm. long, compressed,



Fig. 152. *Urochondra setulosa*.

hyaline, 2-fid, with obtuse ciliate lobes. *Anthers* 1-1.5 mm. long. *Grain* about 2 mm. long, the apical process up to 7 mm. long.

Karachi ; Gholam in Indus Delta ; Makran Coast. In salt water Creeks, *Stocks*.

### 3. *Sporobolus* R. Br.

Perennial, rarely annual grasses with flat or convolute leaves. Spikelets very minute, variously paniced ; rachilla readily disarticulating above the glumes, not produced. Glumes membranous ; lower usually smaller and nerveless ; upper 1-nerved. Lemma similar to the upper glume, 1-nerved or more or less distinctly 3-nerved ; palea almost as long as the lemma, 2-nerved, folded between the nerves, often split by the developing grain. Stamens 3, rarely 2. Caryopsis free, falling out or retained and dehiscent ; pericarp thin usually swelling in water, rigid, dehiscent or the inner layers mucilaginous when wetted and adherent, or the whole pericarp adnate and indistinct ; hilum small, punctiform, basal.

## KEY TO THE SPECIES

1. Glumes much shorter than the lemma..... 2  
     Lower glume shorter or as long as the upper glume or lemma.....5
2. Stamens 2..... 3  
     Stamens 3 . . . . .4
3. Spikelets 1.2-1.5 mm. long ; panicle open, branches bare at the base  
     ..... 1. *S. diander*  
     Spikelets 1.5-2 mm. long : panicle contracted ..... 2. *S. scindicus*
4. Panicle contracted ; branches spiculate to the base .. 3. *S. indicus*  
     Panicle open .. ..... 4. *S. stocksii*
5. Lower glume equalling the upper glume and the lemma ..... 6  
     Lower glume shorter than the upper glume and the lemma .....7
6. Spikelets 2-2.5 mm. long ; panicle effuse ..... 5. *S. virginicus*  
     Spikelets 1.5-2 mm. long ; panicle contracted.....,..... 6. *S. helvolus*
7. Panicle contracted.....8  
     Panicle open, effuse .....10
8. Annual..... 7. *S. piliferous*  
     Perennials.....9
9. Leaf margins entire ..... 8. *S. tremulus*  
     Leaf margins serrulate ..... 9. *S. orientalis*
10. A stoloniferous perennial ; spikelets 2.5 mm. long.....  
     ..... 10. *S. marginatus*  
     Annual ; spikelets 1.25 mm. long... . . . . . 11. *S. coromandelianus*

1. *Sporobolus diander* Beauv.

*Sporobolus diander* Beauv., Ess. Agrost. 26 (1812) ; Hook. f., Fl. Brit. Ind. 7 : 247 (1896) ;

A slender, perennial grass with tufted stems. *Culms* 25-80 cm. high, smooth and glabrous. *Leaf-blades* very narrow, up to 25 cm. long, 2-3 mm. 2-3 mm. broad, glabrous with entire margins ; *sheaths* smooth, the lower short, the upper long ; *ligule* a line of hairs. *Panicle* pyramidal, with spreading or suberect, solitary or fascicled branches, somewhat flexuous,

often without spikelets at the base. *Spikelets* 1.5 mm. long or less. *Lower glume* ovate-truncate, nerveless, less than 0.5 mm. long. *Upper glume* ovate-lanceolate (not truncate), sometimes erose, up to 1 mm. long, nerveless. *Lemma* 1.5 mm. long, ovate, obscurely 1-nerved; *palea*

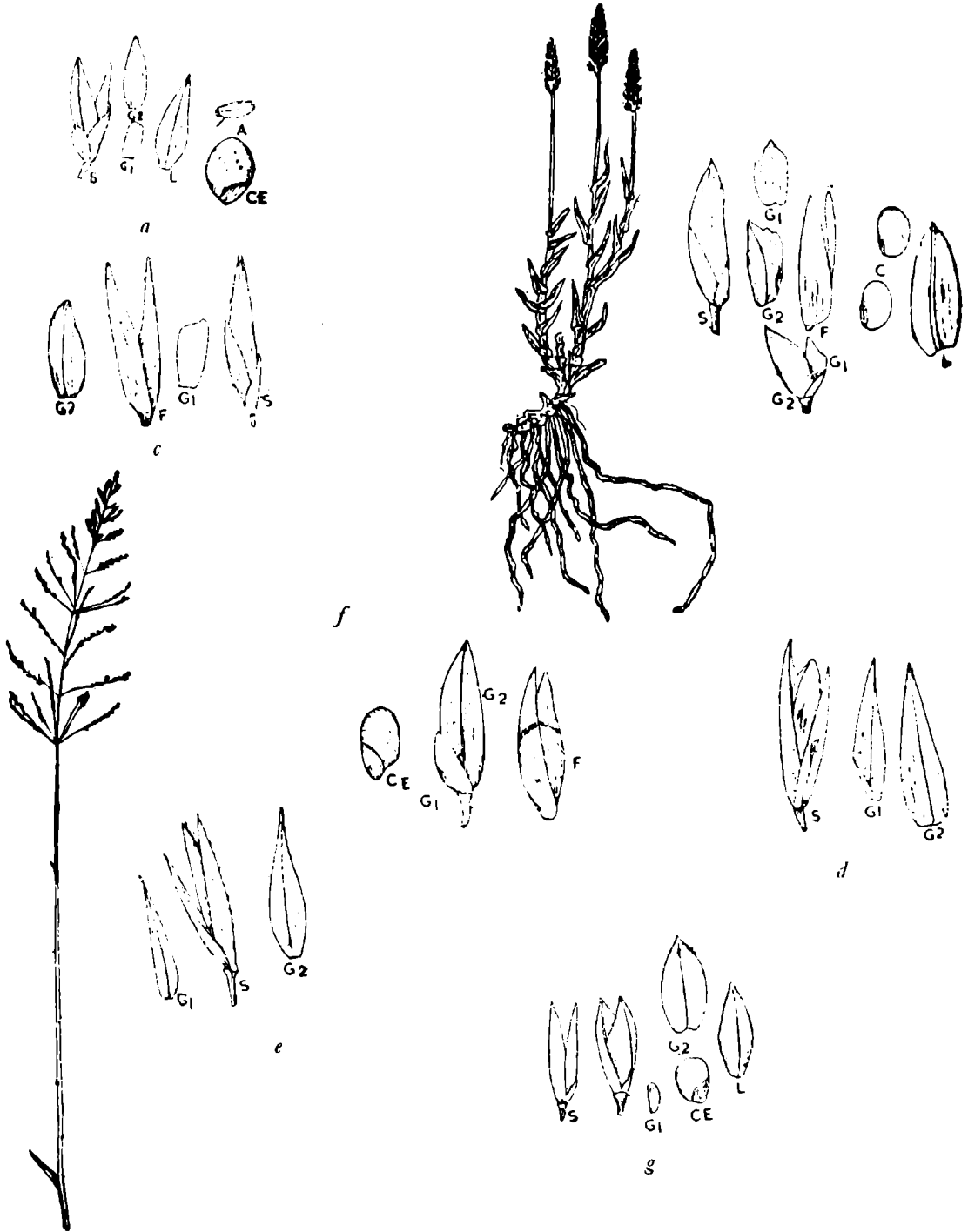


Fig. 153. *Sporobolus* Spp. a. *S. diander*; b. *S. scindicus*; c. *S. indicus*; d. *S. virginicus*; e. *S. helvolus*; f. *S. marginatus*; g. *S. coromandelianus*,

equally long. Grain obovoid, subtruncate, obtusely quadrangular, umbonate by the loose.

Lahore ; Gujranwala ; Shahpur ; Rawafpindi ; Jamesabad, *Sabnis*,

## 2. *Sporobolus scindicus* Stapf

*Sporobolus scindicus* Stapf ex T. Cooke, Fl. Bombay 2 : 1018 (1908).

A perennial, densely tufted grass, 10-12.5 cm. high ; sterile shoots subwoody, 2 mm. in diam., clothed below with numerous withered leaf-sheaths, the culms arising laterally from the sterile ones, slender. *Leaf-blades* pungent, those of the barren stems crowded, short, ovate-lanceolate, 6-12 mm. long, with spinous margins, those of the culms narrowly linear, acuminate, distant, often with distantly spinous margins ; *sheaths* closely appressed to the stem, ribbed ; *ligule* a very narrow ciliate membrane. *Panicle* 1.8-2.5 cm. long, contracted, often spike-like ; branches erect or ascending, filiform, densely clothed with spikelets. *Spikelets* 1.5-2 mm. long, ovoid, acute. *Lower glume* 1 mm. long, ovate, acute, nerveless. *Upper glume* 1.25 mm. long, oblong, obtuse, nerveless. *Lemma* as long as the spikelet, ovate, obtuse (acute when folded), 1-nerved ; *palea* shorter than the lemma, oblong, truncate. Stamens 2. Grain 0.8 mm. long, broadly obovoid, compressed, reddish brown.

20 miles from Karachi, *Woodrow* ; Thano Bullokhan, *J. J. Norris*, Oct. 10, 1955 !

## 3. *Sporobolus indicus* R. Br.

*Sporobolus indicus* R. Br., Prodrum 170 (1810) ; Hook. f., Fl. Brit. Ind. 7 : 248 (1896).

Perennial. *Culms* 50-120 cm. high, tufted, rather slender, erect, glabrous and smooth ; the filiform leaves at the base often as long as the plant. *Leaf-blades* 15-50 cm. long, 1.5-3 mm. broad, flat at the base or involute towards the long-attenuate filiform tip ; *sheaths* longer than the internodes, the junction with the blade often very obscure often with a small tuft of hairs at the throat ; *ligule* a line of very short hairs. *Panicle* 6-40 cm. long, included at the base or long-exserted, sub-cylindric, 3-6 mm. wide, pale green, the branches commonly less than 2.5 cm. long, erect or appressed ; the spikelets crowded on one side of the branch or branchlets. *Spikelets* 1.5-2 mm. long, pale green ; pedicels shorter than the spikelets. *Lower glume* 0.5 mm. long, broadly oblong, hyaline, nerveless. *Upper glume*

1 mm. long, broadly oblong, hyaline, nerveless. *Lemma* broadly-ovate, obtuse, 1-nerved. *Grain* 1.5 mm. long, obovoid, quadrangular, truncate, umbonate by the loose pericarp, red-brown, rugulose.

Lahore ; Gujranwala ; Rawalpindi.

#### 4. *Sporobolus stocksii* Bor

*Sporobolus stocksii* Bor in Kew Bull. 1948 : 45 (1948).

*Sporobolus ioclados* Hook. f., Fl. Brit. Ind. 7 : 249 (1896) non Nees.

An elegant perennial grass. *Culms* 25-50 cm. high, densely tufted, rather stout, erect, smooth, glabrous. *Leaf-blades* linear, tapering to a fine point, 5-10 cm. long, 2.5-3 mm. broad, flat or convolute ; *sheaths* ribbed, glabrous, smooth ; *ligule* a pubescent ridge. *Panicle* ovate or sub-pyramidal, 10-20 cm. long, 5-7.5 cm. broad, effuse ; branches opposite, or alternate, or the lower whorled, spreading, remotely branched, filiform, smooth. *Spikelets* 1.56-2 mm. long, oblong-lanceolate. *Lower glume* 0.8 mm. long, oblong-lanceolate, hyaline. *Upper glume* oblong - lanceolate, obtuse, 1.3 mm. long, 1-nerved. *Lemma* ovate-lanceolate, acute, 1-nerved ; *palea* slightly shorter. *Grain* linear-oblong, truncate, 0.8 mm. long. *Stamens* 3.

Sind ; Rawalpindi, R.R. Stewart.

#### 5. *Sporobolus virginicus* (Linn.) Kunth

*Sporobolus virginicus* (Linn.) Kunth, Rev. Gram. I : 67 (1829) ; Hook. f., Fl. Brit. Ind. 7 : 249 (1896).

*Agrostis virginica* Linn. Sp. II. 63 (1753).

Perennial. *Culms* ascending from a decumbent woody creeping base, 15-30 cm. high. *Leaf-blades* very narrow and rolled, up to 7.5 cm. long, stiff, pungent, glabrous ; *sheaths* rounded ; *ligule* represented by a fringe of hairs. *Panicle* subspiciform, very pale, up to 10 cm. long ; branches very short. *Spikelets* up to 2.5 mm. long, subsessile, crowded. *Lower glume* as long as the spikelet, 1-nerved, glabrous, smooth. *Upper glume* similar to the lower glume, but slightly longer. *Lemma* as long as the spikelet, oblong-lanceolate, acute, 1-nerved. *Palea* oblong, truncate. *Grain* broadly obovoid, with a loose pericarp.

Lahore , September 1953, S. Ahmad.

6. **Sporobolus helvolus** Th. Dur & Schinz.

*Sporobolus helvolus* (Trin.) Th. Dur. and Schinz., Consp. Fl. Afr. 5 : 826 (1895).

*Sporobolus glaucifolius* Hook. f., Fl. Brit. Ind. 7 : 250 (1896).

*Vilfa scabrifolia* Hochst ex Edgew., Jour. Linn. Soc. Bot. 6 : 196 (1862).

Perennial. Culms 30-45 cm. high, densely tufted, leafy. Leaf-blades 3.5-12 cm. long, 2-3 mm. broad, narrowed from a subcordate base to an acuminate tip, strict, glaucous, flat or undulate, not pungent; sheaths ribbed, glabrous; ligule a rim of hairs. Panicle 7-12.5 cm. long, contracted, interrupted, pale yellowish-white; branches short, whorled or not, erect. Spikelets crowded, 2 mm. long; pedicels very short. Lower glume 1.5 mm. long, lanceolate, hyaline, acutely acuminate, 1-nerved. Upper glume 2 mm. long, ovate-lanceolate, broader than the lower, 1-nerved. Lemma 1.55 mm. long, ovate, acute, 1-nerved; palea as long as the lemma. Stamens 2.

Sind, stocks; Karachi, Woodrow; Quetta; Multan, Edgeworth; Dera Ismail Khan, Duthie; Mirpur Khas, Bhide; Jacobabad, Bhide; Magar Peer near Karachi, Sabnis; Quetta, Hughes-Buller; Lyallpur; Kohat.

7. **Sporobolus piliferous** Kunth

*Sporobolus piliferous* Kunth, Enumer. Pl. 1 : 211 (1838); Hook. f., Fl. Brit. Ind. 7 : 251 (1896).

Annual. Culms densely tufted, up to 30 cm. high, erect. Leaf-blades mostly basal, flat or convolute, up to 7.5 cm. long, margins scabrid or subserrulate; sheaths hairy at the mouth; ligule a minute narrow line. Panicle linear, up to 8 cm. long, stiff, erect, dense flowered; branches very short, erect. Spikelets 1.5-2 mm. long, very shortly pedicelled. Lower glume 1.2 mm. long, ovate-lanceolate, nerveless. Upper glume 2 mm. long, oblong-lanceolate, 1-nerved, slightly longer than the lemma. Lemma 1.6 mm. long, oblong, obtuse, 1-nerved. Grain ellipsoid, compressed, with a loose pericarp.

Likely to occur within the area.

8. **Sporobolus tremulus** Kunth

*Sporobolus tremulus* Kunth, Rev. Gram. 1 : 67 (1829); Hook. f., Fl. Brit. Ind. 7 : 250 (1896).

*Sporobolus geniculatus* Nees ex Aitchs., Cat. Panjab Pl. 165 (1896).

A perennial grass, erect or prostrate from a hard, knotted, stoloniferous rootstock; stolons 15-45 cm. long, stout or slender, leafy, flexu-



ous. *Culms* 2.5-20 cm. long, wiry, smooth and glabrous. *Leaf-blades* short, 1.5 cm. long, often rigid, tapering to a sharp, pungent point, hairy at the base, flat or convolute ; *sheaths* striate, glabrous ; *ligule* a ring of hairs. *Panicle* narrow, sub-spiciform, 2.5-12 cm. long, often included in the uppermost sheath ; branches erect, very rarely a few spreading, sometimes flexuous. *Spikelets* aggregated, dense, seated on very short pedicels, pale green or white in colour, 1.6-2.5 mm. long. *Lower glume* hyaline, lanceolate, 1-1.6 mm. long. *Upper glume* 1.5-2 mm. long, lanceolate, a little broader than the lower, 1-nerved. *Lemma* 1.5-2.5 mm long, 1-nerved, similar to the upper glume, subtruncate ; *palea* as long. Grain oblong. Stamens 3.

Lahore. In saline soil. Common.

### **Sporobolus orientalis** Kunth

*Sporobolus orientalis* Kunth, Enumer. Pl. 1 : 211 (1833) ; Hook. f., Fl. Brit. Ind. 7 : 251 (1896).

Stoloniferous ; stolons stout or slender, rooting at the nodes. *Culms* 15-46 cm. high, stout at the base, hard, branching ; branches and flowering stems usually geniculate below. *Leaf-blades* coriaceous, 2.5-20 cm. long, 2.5-4 mm. broad, usually more or less pungent, tapering to the tip, glabrous or hairy above and with scabrous or subserrulate margins ; *sheaths* close, glabrous ; *ligule* a delicate ciliate membrane. *Panicle* narrow, oblong ; branches 12-18 mm. long, suberect. *Spikelets* 2.5 mm. long. *Lower glume* 0.7 mm. long, ovate-oblong, obtuse, nerveless. *Upper glume* 2.5 mm. long, ovate, subobtuse, 1-nerved. *Lemma* ovate-oblong, obtuse, scarcely longer than the upper glume ; *palea* slightly shorter.

In saline soil.

### **Sporobolus marginatus** Hochst.

*Sporobolus marginatus* Hochst. ex A. Rich., Tent. Fl. Abyss. 2 : 397.

*Sporobolus pallidus* Boiss., Fl. Orient. 5 : 514 (1884) non Lindl.

*Sporobolus arabicus* Boiss., Diagn Pl. Or. ser. I, 13 : 47 (1853) ; Hook. f. Fl. Brit. Ind. 7 : 252 (1896).

Perennial. *Culms* many from a woody stoloniferous base, and sending out rigid often geniculate stolons and stout or slender flowering branches, 15-60 cm. high. *Leaf-blades* 2.5- 25 cm. long, 3-4 mm. broad,

rigid, narrowed to the tip from the rounded base, flat or convolute, scaberulous above, with finely ciliato serrulate margins; *sheaths* glabrous; *ligule* a fringe of hairs. *Panicle* pyramidal, 5-15 cm. long, effuse; branches whorled, capillary, reaching 3.8 cm. long, naked below, with spikelets spicately arranged on short branchlets. *Spikelets* 1.7 mm. long; pedicels short. *Lower glume* 0.8 mm. long, ovate, subobtuse, hyaline, nerveless. *Upper glume* 2.5 mm. long, ovate-oblong, acute, 1-nerved, Lemma as long as the upper glume, oblong, obtuse, 1-nerved; *palea* as long as the lemma. Grain subglobose.

Laki, *Bhide*; Mirpur Sakro, *Blatter & McCann*; Gharo, *Blatter & McCann*; Thatta, *Blatter & McCann*; Jemadar ka Landa near Karachi, *Stocks*; Karachi, *Woodrow*; between Karachi and Magar Peer, *Wykeham* Quetta, *Nawaz*; Lahore; Gujranwala; Sargodha; Multan; Lyallpur.

### 11. *Sporobolus coromandelianus* (Retz.) Kunth

*Sporobolus coromandelianus* (Retz.) Kunth, Rev. Gram. 1: 68 (1829);  
Hook f., Flor. Brit. Ind. 7: 252 (1896).

*Agrostis coromandelianus* Retz., Obs. IV: 19 (1786).

Annual. Culms densely tufted, 10-30 cm. high, erect, ascending or often spreading, copiously leafy at the base. *Leaf-blades* 2.5 cm. long, 3-6 mm. broad, linear-lanceolate, narrowed from the subcordate base to the acuminate tip, spinulosely toothed especially towards the base; *sheaths*: lower short, terete or compressed, the upper long, hairy at the mouth; *ligule* a narrow membrane, fringed with long fine hairs. *Panicle* 5-10 cm. long, 2.5-5.5 cm. broad, ovate or pyramidal; branches capillary, in rather distant whorls of 3-6, horizontally spreading, naked below, sparingly shortly divided upwards; branchlets drooping, 1- to 2.5 Cm. long. *Spikelets* subglobose, minute, green, about 1.2 mm. long, on short pedicels. *Lower glume* 1.25 mm. long, ovate-oblong, acuminate or subacute, 1-nerved. *Lemma* as long as the upper glume, oblong, obtuse, 1-nerved; *palea* as long as the lemma. Grain obovate.

Lahore; Multan; Quetta; Hyderabad; Jamadar ka Landa near Karachi, *Stocks*; Baluchistan, without locality, *Stocks*.

### Tribe 7. Chlorideae

Spikelets usually compressed, 1- to few-flowered with the floret bisexual and with or without imperfect florets above or below it, sessile or

subsessile, in one or two rows on one side of the continuous rachis of solitary, digitate or scattered spikes or spike-like racemes, or in a fascicle of few spikelets ; rachilla disarticulating above the glumes, rarely below them. Glumes usually persistent. Lemma membranous to chartaceous, entire, emarginate or 2- to 4-lobed, awnless or awned, 1- to 3-nerved, with the lateral nerves near the margins and often ciliate.

## KEY TO THE GENERA

- |                                                               |                        |
|---------------------------------------------------------------|------------------------|
| 1. Spikelets more or less sunk in the rachis.....             | 1. <i>Oropetium</i>    |
| Spikelets not sunk in the rachis .....                        | 2                      |
| 2. Fertile floret with one to many empty florets above it. .. | 2. <i>Chloris</i>      |
| Fertile floret without any empty florets.....                 | 3                      |
| 3. Spikelets long-awned....                                   | 3. <i>Schoenfeldia</i> |
| Spikelets awnless .....                                       | 4. <i>Cynodon</i>      |

1. *Oropetium* Trin.

A very small, densely tufted, erect annual with filiform leaves. Spikelets sessile, 1-flowered, very small, half sunk in the alternating distichous notches of a simple, tough rachis ; rachilla produced beyond the lemma. Lower glume minute, hyaline, persistent. Upper glume linear-lanceolate, rigid, recurved in fruit, tip subobtusate or emarginate. Lemma concealed by the upper glume, ovate or elliptic, hyaline, 1-nerved ; callus bearded ; palea as long as the lemma, keel smooth.

1. *Oropetium thomaeum* Trin.

*Oropetium thomaeum* Trin. Fund. Agrost. 98 (1820) ; Fl. Brit. Ind., 7 : 366 (1896).

Annual. Culms very densely tufted, compressed, 5-8.5 cm. tall. Leaf blades filiform, erect, margin ciliate ; sheaths open, compressed ; ligule a lacerate membrane. Spike 2.5-3.8 cm., straight or slightly curved ; rachis undulating, tetragonous, with a broad central nerve on the faces. Spikelets 1 flowered, 1.5 mm. long, acute. Lower glume minute, hyaline, lodged within the hollow of the rachis. Upper glume linear-lanceolate, recurved in fruit, semi-circular in profile, rigid, obtuse. Lemma broadly lanceolate, obtuse or truncate, 1-nerved, keel scabrid.

Lahore,

## 2. **Chloris** Swartz

Annual or perennial grasses with flat or convolute leaves. Spikes few to many, digitate, sessile or shortly stalked. Spikelets more or less laterally compressed, with one bisexual floret followed by one to many, awned or awnless empty lemmas which are often truncate and the upper are enclosed by the lower. Lower glume shorter than the upper, narrow, acute; the upper narrow, cuspidate or broader and truncate. Lemma papyraceous, keeled, narrow or broad and then often very obtuse to truncate, scarcely 2-toothed to 2-lobed, 3-nerved, the midnerve and the margins villous to long-ciliate, with a short or long awn; callus short, hairy. Palea lanceolate to elliptic, obtuse with 2 rough keels. Grain broad to narrowly oblanceolate, compressed, 2-angled; embryo half as long as the fruit; hilum very small.

### KEY TO THE SPECIES

1. Empty lemmas above the fertile floret 2 to 4 ... .. 2  
Empty lemmas above the fertile floret solitary ... .. 4
2. Spikelets 3 mm. long..... .. 3  
Spikelets 2-2.5 mm. long, 3-awned ... .. 1. *C. inflata*
3. Spikelets 5-awned ... .. 2. *C. quinquesetica*  
Spikelet 2-awned ... .. 3. *C. gayana*
4. Spikes narrow, very long; lemma narrow, glabrous... ..  
..... 4. *C. dolichostachya*  
Spikes rather broad, shorter; lemma broad, ciliate along the  
midnerve and the side nerves... .. 5. *C. virgata*

### 1. **Chloris inflata** Link

*Chloris inflata* Link, Enumer. Hort. Berol. 1 : 105 (1821)

*Chloris barbata* Swartz, Fl. Ind. Occ. 1 : 200 (1797); Hook f., Fl. Brit. Ind. 7 : 292 (1896).

Perennial; Culms tufted, rather stout. 60-90 cm. high, geniculately ascending, branching upwards, leafy, quite smooth; lower internodes 5-7.4 cm. long, shining; upper very long, slender; nodes often bearing

equitant tufts of leaves. Leaf-blades narrowly linear, flat or folded, finely acuminate, 15-45 cm. long; sheaths smooth, the lower open; ligule a very narrow membrane. Spikes 5-20, digitately arranged in a truncate fascicle, 1.3-10 cm. long, on a slender peduncle, often purplish. Spikelets 2.5-3 mm. long (excl. the awns), green or purple, 3-awned; rachilla produced but not beyond the fertile lemma, bearing two small turgid obovate awned, barren lemmas 1.6 mm. long, the awns 3.2-4 mm. long. Glumes hyaline, lanceolate, acute (not awned); lower 1.5 mm. long; upper 2.5 mm. long. Fertile lemma 2.5 mm. long, broadly elliptic, shortly apiculate, with a slender awn 3.2-4 mm. long and with densely bearded margin above the middle; palea nearly as long as the lemma, oblanceolate. Upper florets (two) barren, smaller and rounded, awned.



Fig. 154.—*Chloris inflata*.

Mirpur Sakro, *Blatter & McCann*; Thatta, *Blatter & McCann*; Fort Munro, *Iftikhar*; Karachi, *I. I. Chaudhri*; Peshawar, *Faridi*; Rawalpindi, *A.R. Beg*; Fort Sandeman, *J. J. Norris*.

## 2. *Chloris quinquesetica* Bhide

*Chloris quinquesetica* Bhide in Jour. and Proc. Asiatic Soc. Beng. n.s. 8: 311 (1912); *Blatter & McCann*, Bomb. Grasses, 257 (1935).

A glabrous, perennial grass, creeping and rooting at the lower nodes and there forming small tufts of leaves and an erect flowering stem 60 cm. high; nodes glabrous. Leaf-blades 2-15 cm. long and 3-5 mm. broad, sparsely and delicately long-ciliate when young, ultimately glabrous, lanceolate, acuminate, truncate at the base, margins minutely scabrid; ligule a narrow, fimbriate membrane. Spikes 5-18, 2.5-5 cm. long, crowded in a very short racemose fascicle the branches of which are often decurrent into the peduncle for a short distance and form ridges on it which are also studded with stray spikelets; peduncle below the spikes and rachises hairy. Spikelets 3 mm. long (excl. the awns), 5-awned. Lower glume 1.5 mm. long, elliptic-lanceolate, membranous, strongly 1-nerved,

slightly oblique. *Upper glume* 2.25 mm. long, elliptic-oblong, membranous, shortly mucronate, strongly 1-nerved. *Lower floret* bisexual; lemma as long as the upper glume (excl. the awn) elliptic-obovate, cuneate, coriaceous, 3-nerved, and with a dorso-terminal awn 5 mm. long, lateral nerves densely bearded with long white hairs nearly from the base. *Palea* as long as the lemma but narrower, slightly hairy at the back, very shortly bifid at the apex, 2-keeled, keels minutely ciliate. *Upper florets* four, barren, epaleate, gradually smaller and rounder, all awned.

Jamesabad, *Sabnis*.

### 3. *Chloris gayana* Kunth

*Chloris gayana* Kunth, Rev. Gram. 1 : 89, 293 (1929.)

Perennial. *Culms* up to 1.2 m. high, erect or geniculate-ascending or prostrate at the base, glabrous, smooth. *Leaf-blades* up to 30 cm. long, 8 mm. broad, flat or folded, glabrous or hirsute near the base; *sheaths* glabrous or hairy near the mouth, the lower strongly compressed, keeled; *ligules* very short, membranous, long, hairy. *Spikes* 6-15, umbelled, suberect, rarely spreading, 5-8 cm. long. *Spikelets* 3 mm. long, 3- to 4-flowered, 2-awned. *Glumes* unequal; the lower ovate-lanceolate, acute, 1-1.5 mm. long; the upper oblong, obtuse, mucronate, 2-3 mm. long, scaberulous. *Fertile lemma* oblong, sub-obtuse or acute, minutely 2-toothed, ciliolate along the marginal nerves and shortly bearded below the tip or almost glabrous; awn as long as the lemma; callus minutely bearded. *Palea* scabrid along the keels. *Anthers* 1.5 mm. long. *Upper lemma* like the lower but glabrous, 2 mm. long, awned; awn 2 mm. long. *Uppermost lemma* rudimentary, awnless.

Introduced as a fodder grass.

### 4. *Chloris dolichostachya* Lagasca

*Chloris dolichostachya* Lagasca, Gen. et Sp. Pl. 5 (1816).

*Chloris incompleta* Roth, Nov. Sp. 60 (1811); Hook. f., Flor. Brit. Ind. 7 : 29 (1896).

*Chloris digitata* Steud., Syn. Pl. Glum. 207 (1854).

*Cynodon elongatus* Trin. in Spreng., Neu. Entdeck. 2 : 64 (1920-22).

Perennial. *Culms* usually erect but sometimes decumbent, stout or slender, 15-90 cm. high. *Leaf-blades* 10-25 cm. long, 4-6 mm. broad,

flat, linear, tapering to a fine point, glabrous, scabrid; sheath glabrous, sometimes with a fringe of hairs along the outer margin, mouth hairy; *ligule* a ridge of long hairs. *Spikes* 4-10, digitate, 10-25 cm. long, spreading; rachis scabrid. *Spikelets* 5 mm. long (excl. the awns), narrowly fusiform, imbricating, erect, closely appressed; rachilla slender, bearing 1.5 mm. from its base a tuft of hairs, a little above which is a barren lemma terminated by a long awn reaching 8 mm. in length. *Lower glume* linear-lanceolate, acute, 2-2.5 mm. long, 1-nerved, scabrid on the keel. *Upper glume* lanceolate, membranous, 5-6 mm. long, 1-nerved, 2-toothed at the apex, with the nerve produced between the teeth into a short awn 1-2 mm. long, scabrid on the keel. *Fertile lemma* oblong-lanceolate, 5-5.5 mm. long, scabrid on the back and margins, 2-toothed at the apex, awned with a median scabrid awn up to 9 mm. long; callus bearded; *palea* hardly as long as the lemma, oblong, acute or truncate at the apex, scaberulous on the keels; rachilla produced to half the length of the lemma, bearing a very minute, long-awned lemma that is bearded at the base.

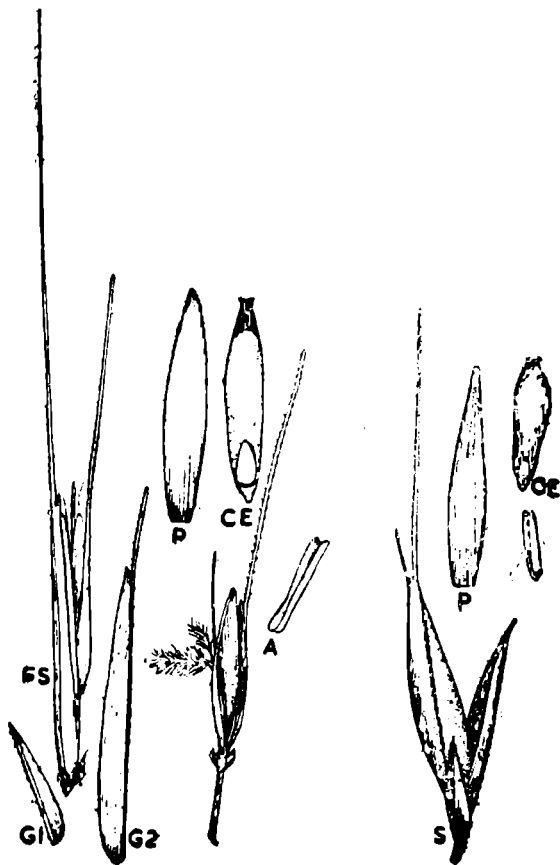


Fig. 155.—*Chloris dolichostachya*.

between the teeth into a short awn 1-2 mm. long, scabrid on the keel. *Fertile lemma* oblong-lanceolate, 5-5.5 mm. long, scabrid on the back and margins, 2-toothed at the apex, awned with a median scabrid awn up to 9 mm. long; callus bearded; *palea* hardly as long as the lemma, oblong, acute or truncate at the apex, scaberulous on the keels; rachilla produced to half the length of the lemma, bearing a very minute, long-awned lemma that is bearded at the base.

Montgomery ; Sakesar ; Rawalpindi.

##### 5. *Chloris virgata* Swartz

*Chloris virgata* Swartz, Fl. Ind. Occ. 1 : 203 (1797) ; Hook. f., Fl. Brit. Ind. 7 : 291 (1896).

Annual. Culms densely tufted, up to 60 cm. high, erect, leafy, smooth and glabrous. Leaf-blades linear, flat, sparsely hairy when young becoming glabrous in age, up to 20 cm. long, 5 mm. broad; sheaths compressed, glabrous, the upper somewhat inflated, mouth long hairy in the sheaths of the innovations; ligule a narrow membranous ridge. Spikes 6-many, crowded at the end of the peduncle, up to 6 cm. long. Spikelets 2.5 mm. long, 2-awned, shortly penicelled. Lower glume subulate, glabrous, 1-nerved, half as long as the upper. Upper glume oblong-lanceolate, glabrous, excepting the keel which is scabrid, apex 2-fid, with an awn arising from the sinus. Lemma (fertile) oblong-ovate, cymbiform, 2-fid at the apex and awned from the sinus, margins slightly ciliate in the lower half but long ciliate in the upper half; grooved on each side of the dorsal nerve and bearing short appressed hairs; awn up to 5 mm. long. Palea much narrower and rather shorter, 2-toothed at the apex; rachilla joint short, bearing a semi-tubular, truncate lemma with an awn up to 8 mm. long.

Quetta; Fort Monro.

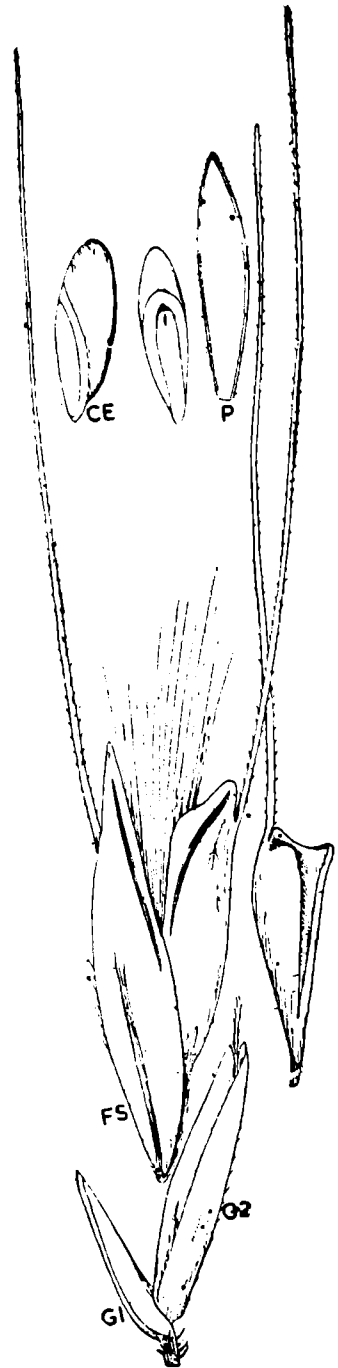


Fig. 156.—*Chloris virgata*.

### 3. *Schoenfeldia* Kunth

Annual grasses with filiform, flat or convolute leaves. Spikes 1-3, digitate, closely pectinate with the two rows of erecto-patent, long-awned spikelets. Spikelets 2-seriate, 1-flowered, without any rudimentary upper lemma, narrow, sessile; rachilla disarticulating above the



glumes, not produced beyond the fertile floret. Glumes unequal, membranous, 1 nerved, mucronate ; keels ciliate. Lemma much shorter than the glumes, membranous, 3-nerved, hairy, base bearded, minutely notched at the apex, long-awned ; palea narrower, much shorter, 2-keeled, keels ciliate, apex 2-toothed. Lodicules 2, cuneate, glabrous. Stamens 2-3. Styles 2, apical, naked at the base. Caryopsis oblong-fusiform, smooth, free, slightly compressed laterally, not grooved.

#### 1. *Schoenfeldia gracilis* Kunth

*Schoenfeldia gracilis* Kunth, Rev. Gram. 1 : 283 (1829).

*Schoenfeldia pallida* Edgew. in Jour. As. Soc. Beng. 21 : 161 (1832).

*Chloris pallida* Hook. f., Fl. Brit. Ind. 7 : 289 (1896).

Annual. Culms tufted, erect or geniculate-ascending, 20-90 cm. high, simple or branched at the base, glabrous and smooth, almost filiform. Leaf-blades linear, flat or convolute, 10-20 cm. long, 2 mm. broad, sparsely hairy towards the base ; sheaths striate, glabrous, loosely tight, naked at the mouth ; ligule membranous, less than a millimeter long, shortly ciliate. Spikes 1-4, erect, digitate, greenish then pale, 7-15 cm. long, up to 5 mm. broad, closely pectinate with the two rows of erecto-patent, long-awned spikelets ; rachis more or less triquetrous, keeled, villous at the base, glabrous and slightly scabrid above. Spikelets narrow, tapering, 2 mm. long (excl. the awn), subsessile, 1-flowered, 2-seriate, densely imbricate. Glumes ovate-lanceolate, subaristately acuminate, 1-nerved, strongly keeled ; keels scabrid ; Lemma slightly longer than the upper glume, sessile, ovate, 1-nerved, hairy, base bearded, tip minutely notched, awn 15-25 mm. long, capillary, curved ; palea shorter, lanceolate, obtuse, 2-nerved, ciliate along the keels.

Multan, J. L. Stewart ; Hyderabad, I. I. Chaudhri.

#### 4. *Cynodon* Pers.

Creeping, perennial grasses with erect culms and narrow flat or complicate leaves. Spikelets laterally compressed, alternately 2-seriate, imbricate, not jointed at the base, 1-flowered, secund on a slender rachis of which 2-8 are fascicled or umbelled to form the inflorescence ; rachilla jointed above the glumes, produced or not. Glumes subequal, thin, keeled, acute or mucronate, persistent or separately deciduous. Lemma broader than the glumes, firmly membranous, boat-shaped, 3-nerved, awnless ; palea 2-keeled.

1. *Cynodon dactylon* Pers.

*Cynodon dactylon* Pers., Syn. 1 : 85 (1805).

A perennial grass extensively creeping by scaly rhizomes or by strong, flat stolons. Culms up to 30 cm. high, glabrous, smooth. Leaves linear, acute, 2-15 cm. long, up to 3 mm. broad, rigid or flaccid, glabrous or hairy, smooth below, scaberulous above; *ligule* a ring of white hairs. *Inflorescence* a cluster of 4-5 spikes, 1.5-5 cm. long; rachis pubescent at the base, keels and margins scabrid, or the margins smooth. *Spikelets* 2-2.8 cm. long. *Glumes* lanceolate, acute to subulate-mucronate; the lower 1.25-1.8 mm. long; the upper usually longer, keels scabrid or smooth, *Lemma* firm, obliquely-oblong to semi-ovate, subobtuse or minutely apiculate, about 2.5 mm. long, ciliate on the keel; keels of palea scaberulous; rachilla often prolonged beyond the palea as a slender naked bristle, sometimes bearing a rudimentary lemma.

Very common in plains and hills, ascending to 6,000 ft.

Tribe 8. *Aveneae*

Spikelets 2- to 7- (rarely 1-) flowered, with all the florets bisexual or the uppermost often barren or male, pedicelled in open or contracted panicles, rarely in racemes or spikes; rachilla disarticulating above the glumes and usually between the florets. Glumes persistent, rarely deciduous, mostly similar, usually as long as the lowest lemma and often as long as the spikelet and enclosing the florets, membranous to chartaceous, frequently with hyaline, shining margins, 5- or more-nerved, awnless or more often awned from the back or from the sinus of the 2-lobed tip; the awn usually geniculate and twisted below the knee.

## KEY TO THE GENERA

1. Spikelets 2-flowered, the lower florets male..... 1. *Arrhenatherum*
- Spikelets 2- or more-flowered, the florets all alike.....2
2. Lemma awned from the back... .. 3
- Lemma awned from the sinus ..... 7
3. Awn placed more than one-third the length of the lemma below the tip; ovary hairy ... .. 4
- Awn placed below the tip; ovary glabrous or hairy-topped  
... .. 3. *Trisetum*
4. Spikelets nodding, 2-flowered or with a rudimentary third; glumes  
2-3.5 cm. long, 7- to 9-nerved... .. 3. *Avena*

- Spikelets erect ; glumes not more than 1.5 cm. long, 1- to 5-nerved  
 ... .. 5
5. Spikelets 3- to many-flowered, 1-1.5 cm. long. ... ..  
 ... .. 4. *Helictotrichon*  
 Spikelets 2-flowered, less than 1 cm. long .. .. 6
6. Perennials. Lemmas truncate and erose-dentate at the apex ; rachilla  
 prolonged ... .. 5. *Deschampsia*  
 Annuals. Lemmas tapering into two slender teeth ; rachilla not  
 prolonged ... .. 6. *Aira*
7. Style single ; lodicules 0 ... .. 7. *Duthiea*  
 Styles two ; lodicules 2 ... .. 6
8. Spikelets one centimeter or more long ; awn conspicuous, flat,  
 geniculate ... .. 8. *Danthonia*  
 Spikelets not more than 5 mm. long ; awn conspicuous, short,  
 slender, rounded ... .. 9
9. Lower glume 5- to 7-nerved ; lemmas much shorter than the  
 glumes ... .. 9 *Schismus*  
 Lower glume 1-nerved ; lemmas about as long as the glumes ... ..  
 ... .. 10. *Koeleria*

### 1. *Arrhenatherum* Beauv.

Tall, perennial grasses with flat leaves and narrow panicles. Spikelets 2-flowered, the lower floret male the upper bisexual ; rachilla disarticulating above the glumes, produced beyond the uppermost floret. Glumes rather broad and papery, the lower 1-nerved, the upper 3-nerved. Lemmas 5-nerved, hairy on the callus, the lower bearing near the base, a twisted, exserted geniculate awn ; the upper bearing a short, slender awn just below the tip.

#### 1. *Arrhenatherum kotschyi* Boiss.

*Arrhenatherum kotschyi* Boiss., Diagn. ser. I, 7 : 122 (1846) ; Fl. Orient.  
 5 : 550 (1884) ; Burkill, List Fl. Pl. Baluchistan, 81 (1909).

Baluchistan, Gwal, *Lace*.

#### 2. *Trisetum* Pers.

Annual or perennial grasses with flat leaves. Spikelets 2.5-10 mm. long, in close, often spike-like panicles ; rachilla ciliate or long hairy, very rarely glabrous, jointed above the glumes and between the lemmas,

produced. Florets 2-6, bisexual or the uppermost reduced. Glumes persistent; lower 1- to 3-nerved, upper 3-nerved. Lemmas equalling or exceeding the glumes, membranous with hyaline tips and broad margins, acutely 2-toothed, sometimes with fine, short bristles from the lobes, faintly or obscurely 5- to 11-nerved, awned; awn arising from the back above the middle, fine, straight or geniculate and twisted below; callus short, glabrous or hairy. Palea shorter than the lemma, 2-keeled, 2-toothed, hyaline. Ovary glabrous; styles distinct; stigmas plumose, laterally exerted.

## KEY TO THE SPECIES

1. Annual lemmatal nerves produced into awns..... 1. *T. cavanillesii*  
 Perennials. Lemmatal nerves not produced into awns ..... 2
2. Panicle open; spikelets pedicelled; rachilla scaberulous.. ..... 2. *T. flaccidum*  
 Panicle spiciform; rachilla hairy or penicillate ... .. 3
3. Spikelets 6-8 mm. long, pale brown, shining... .. 3. *T. aeneum*  
 Spikelets 4-6 mm. long, yellowish green or pale brown..... 4
4. Ligules very short; peduncle hairy; lemmas hairy..... 4. *T. spicatum*  
 Ligules 0.5 mm. long; peduncle glabrous; lemmas scabrid... . 5. *T. clarkei*

1. *Trisetum cavanillesii* Trin.

*Trisetum cavanillesii* Trin. in Mem. Acad. Petersb. ser. VI, 1: 63.

*Trisetaria cavanillesii* (Trin.) Maire in Bull. Soc. Hist. Nat. Afr. Nord. 33: 92 (1942).

*Avena cavanillesii* Koch, Syn. Pl. Germ. ad. 1, 1: 797.

Annual. Culms densely tufted, erect or geniculate-ascending, up to 15 cm. high, glabrous below but pubescent above. Leaf-blades up to 2.5 cm. long, 0.8 mm. broad, flat or convolute, pubescent; sheaths pubescent; ligules 1.5-mm. long, fimbriate, hairy. Panicle 2.5-5 cm. long, spiciform; axis flexuous, scaberulous; branches very short with antrorse scabrescence, 2- to 3-nate or whorled; pedicels slightly dilated at the tip, shorter than the spikelets, scabrid. Spikelets 2-flowered; rachilla disarticulating below the florets, long-villose, hairs longer than the glumes. Glumes exceeding the florets, unequal, mucronate; the lower 1-nerved, linear-lanceolate, 3.5-4 mm,



Fig. 157.—*Trisetum* spp. a. *T. cavanillesii* ; b. *T. spicatum* ; c. *T. clarkei* ; d. *T. akneum*.

long ; much broader than the lower, oblong-lanceolate, 3-nerved. *Lemma* (lower) 3-3.5 mm. long, lanceolate, obscurely 3-nerved, the nerves ending in 2.5 mm. long, scabrid awn ; callus short, obtuse, hairy, hairs 0.5 mm. long ; awn dorsal, inserted 1-1.5 mm. below the tip, geniculate, twisted and brown, column 3 mm. long, bristle 6 mm. long. *Upper lemma* more hairy, slightly shorter with the bristle of the awn up to 2.5 mm. long. *Palea* narrow, linear, nerveless, 2-lobed, 1.5 mm. long. *Anthers* 0.5 mm. long.

Peshawar, *J. L. Stewart* ; Qilla Abdullah, *Duthie* ; near Quetta, *J. J. Norris*.

## 2. *Trisetum flaccidum* (Hack.) R.R. Stewart

*Trisetum flaccidum* (Hack.) R. R. Stewart in *Brittonia* 5 : 431 (1945).

*Avena flaccida* Hack. ex Hook. f., *Fl. Brit. Ind.*, 7 : 280 (1896).

*Culms* up to 60 cm. high, very slender, quite glabrous. *Leaves* 10-18 cm. long, 4-6 mm. broad, quite glabrous ; *ligule* short, rounded. *Panicle* 7.5 cm. long, open ; branches few, rather distant, capillary, spreading. *Spikelets* few, pedicelled, erect, 3-flowered, 6 mm. long, white and rose coloured ; rachilla, long, slender, scaberulous. *Glumes* very unequal, subulate-lanceolate, 3-nerved. *Lemma* ovate-lanceolate, acute, 5-nerved, smooth, glabrous, chartaceous, white in the lower half, rose in the upper, margins and tip hyaline, nerves very slender ; awn inserted a little below the tip, very delicate, as long as the lemma, straight, column not twisted. *Palea* narrow, with smooth keels. *Lodicules* lanceolate. *Ovary* pyriform, quite smooth ; style bases rather distant.

The Panjab ; Black Mts., 8-9000 ft., *Duthie*.

## 3. *Trisetum aeneum* (Hack.) R. R. Stewart

*Trisetum aeneum* (Hack.) R. R. Stewart in *Brittonia* 5 : 431 (1945).

*Avena aenea* Hack. ex Hook. f., *Fl. Brit. Ind.*, 7 : 279 (1896).

Perennial. *Culms* erect, stout or slender, up to 60 cm. high. *Leaf-blades* linear, up to 25 cm. long, 6 mm. broad, scabrid ; *sheaths* terete, glabrous and smooth ; *ligule* membranous, short, rounded. *Panicle* spiciform, densely spiculate, oblong or linear, simple or lobed, branches very short, 7.5-10 cm. long, erect, stiff ; branches very short, 7.5-10 cm. long, erect, stiff ; branches and pedicels glabrous. *Spikelets* 6-8 mm. long, 2- to 3- flowered, densely overlapping, almost sessile, dark or pale

brown, shining ; rachilla penicillate. *Lower glume* hyaline, lanceolate, 7 mm. long, 1-nerved. *Upper glume* hyaline, oblong-lanceolate, 8 mm. long, 3-nerved. *Lemma* ovate, 6 mm. long, faintly 5-nerved, tip acuminate or 2-aristate ; awn dorsal, twice as long as the lemma, column twisted. *Anthers* 15 mm. long.

Gilgit : Kamri Pass, 13. 8. 52, I. I. Chaudhri.

#### 4. *Trisetum spicatum* (Linn.) Richt

*Trisetum spicatum* (Linn) Richt, Pl. Eur. 1 : 50 (1890).

*Avena subspicata* Clairv., Man. Herb. 17 ; Hook. f., Fl. Brit. Ind. 7 : 278 (1896).

*Trisetum subspicatum* Beauv., Ess. Agrost. 88 (1872).

*Aira spicata* Linn. Sp. Pl. ed. II. 95 (non ed. 1).

Perennial. *Culms* densely tufted, up to 60 cm. high, stout or slender, always pubescent or tomentose. *Leaf-blades* soft, flat, hairy ; *lower sheaths* loose, hairy ; *ligule* oblong, membranous. *Panicle* spiciform or ovoid, stiff, erect, dense flowered, 5-10 cm. long, oblong to cylindrical, rarely lobed. *Spikelets* ovoid-oblong, 4-6 mm. long, 2- to 3-flowered, yellowish green, purplish or white, densely overlapping ; rachilla short, hairy. *Glumes* subequal with scaberulous keels ; lower 5 mm. long, 3-nerved ; upper 6 mm. long, 3-nerved. *Lemma* 6 mm. long, ovate- or ovate-lanceolate, 2-cuspidate or 2-aristate, hairy, 1- to 3-nerved ; callus bearded ; awn inserted 1/3-1/6 way below the tip, column twisted or sometimes awn shorter and straight. *Palea* 4 mm. long, hairy along the keels. *Anthers* 1.5 mm. long.

Chitral : Jamishi Ghochar, *P. Wendelbo* ; Gilgit : Deosai Plains ; Kagan Valley : Saiful Maluk, Babusar Pass.

#### *Trisetum clarkei* (Hook. f.) R.R. Stewart

*Trisetum clarkei* (Hook. f.) R. R. Stewart in Brittonia 5 : 431 (1945).

*Avena clarkei* Hook. f., Fl. Brit. Ind. 7 : 278 (1896).

Perennial. *Culms* slender, erect, up to 60 cm. high. *Leaf-blades* up to 20 cm. long, flaccid, softly hairy on both surfaces ; *sheaths* with spreading or reflexed soft hairs ; *ligule* very short. *Panicle* spiciform, interrupted, erect, 15 cm. long ; axis slender ; lower branches solitary or fascicled, rarely 2.5 cm. long. *Spikelets* 4-6 mm. long, 2- to 3-flowered, glabrous, sessile or shortly pedicelled, pale brown, shining ; rachilla joints hairy. *Glumes* hyaline, unequal, shining ; lower 5 mm. long, 1-nerved ;

upper 6 mm. long, 3-nerved. *Lemma* 4.5-5 mm. long, narrowly lanceolate, scabrid, 2-aristate at the apex, 1- or sub 3-nerved ; callus hairy ; awned 2 mm. below the tip ; awn longer than the lemma, column not twisted. *Palea* 4 mm. long, scabrid along the keels. *Anthers* 1 mm. long.

Chitral : Tirich Mir, *P. Wendelbo* ; Kagan Valley : Sharhan.

### 3. *Avena* Linn.

Annual grasses with linear, flat leaves. Spikelets up to 4 cm. long, pendulous in open, very lax panicles ; rachilla hairy or glabrous, jointed above the glumes and between the lemma, or not at all in cultivated forms, usually terminated by a rudimentary floret. Florets 3-5, the lower two or three hermaphrodite, the upper reduced. Glumes equal, rounded on the back, 7- to 11-nerved. Lemmas shorter or equalling the glumes, 5- to 9- nerved, lower 1- to 3-awned ; awn dorsal, arising from the middle or slightly above it, geniculate and twisted below ; callus short, villous (glabrous in cultivated forms). *Palea* shorter than the lemma, 2-keeled, 2-toothed or 2-fid. Ovary densely villous from the base ; styles very short or absent. Grain enclosed by the lemma and the palea.

#### KEY TO THE SPECIES

Spikelets mostly 2-flowered, not disarticulating at maturity ; lemmas glabrous ; callus glabrous.....1. *A. sativa*  
 Spikelets mostly 3-flowered, not disarticulating at maturity ; lemmas hairy ; callus villous.....2. *A. fatua*

### 1. *Avena sativa* Linn.

*Avena sativa* Linn., Sp. Pl. 79 (1753) ; Hook. f., Fl. Brit. Ind. 7 : 273 (1896).

Annual. *Culms* tufted, erect or geniculate-ascending, up to 1.8 m. high. *Leaf-blades* flat, upto 30 cm. long and 15 mm. broad, scabrid on both surfaces and on the margins ; *sheaths* smooth, striate, terete, tight ; *ligules* membranous, truncate, 1-3 mm. long, toothed, decurrent along the margins of the sheaths. *Panicle* effuse, erect or usually nodding ; branches verticillate ; axis very scabrid. *Spikelets* pendulous, up to 30 mm. long, green, 2- to 3-flowered, the upper usually rudimentary, tardily disarticulating. *Glumes* broad-lanceolate, 7- to 11-nerved, longer than the spikelets, membranous, acuminate, scabrous. *Lemma* lanceolate, acuminate, shortly 2-fid or 2- to 4-toothed, glabrous, smooth, 17-25



mm, long, dorsally awned ; awn often present only on the lower lemma, geniculate, twisted. *Palea* enclosed by the involute margins of the lemma, 2-keeled, the keels densely short-ciliate. Ovary hairy all over.

Cultivated for fodder.

## 2. *Avena fatua* Linn.

*Avena fatua* Linn., Sp. Pl. 80 (1753) ; Hook. f., Fl. Brit. Ind. 7 : 275 (1896).

Annual. *Culms* up to 1.5 m. high, erect or geniculate-ascending, 3- to 5-noded, smooth. *Leaf-blades* linear, finely pointed, up to 45 cm. long, 15 mm. broad, flat, scabrid ; *sheaths* rounded on the back, the basal usually loosely hairy, the rest smooth ; *ligules* membranous, blunt, up to 6 mm. long. *Panicle* nodding, narrowly to broadly pyramidal, loose, up to 35 cm. long, 20 cm. wide ; branches spreading, in whorls, loosely divided, scabrid, pedicels unequal, scabrid. *Spikelets* loosely scattered, pendulous, narrowly oblong or gaping, 18-25 mm. long, usually 3 flowered, with all lemmas awned ; rachilla disarticulating below the lemmas. *Glumes* persistent, lanceolate, finely pointed, as long as the spikelet, equal, smooth, 7- to 11-nerved, becoming papery except for the thinner margins. *Lemmas* narrowly oblong-lanceolate in side view, shortly 2- to 4-toothed at the apex, 14-20 mm. long, rounded on the back, becoming tough and rigid, stiffly hairy in the lower half, scabrid above, 7- to 9-nerved, finally brown, with a dense beard 1.5-4 mm. long around the horse-shoe shaped basal scar, awned from the middle of the back, with a stout awn 2.5-4 cm. long, geniculate, twisted. *Palea* shorter than the lemma, densely minutely hairy on the keels. *Anthers* 3 mm. long.

A common weed of cultivation throughout the area.

## 4. *Helictotrichon* Bess.

Perennial grasses with usually flat leaves. Inflorescence a narrow, erect or nodding, open or contracted panicle. Spikelets laterally compressed, erect or suberect ; rachilla slender, more or less hairy, jointed above the glumes and between the lemmas, produced into a short bristle beyond the uppermost floret or ending in a rudimentary lemma. Florets 2-6, bisexual or the uppermost reduced ; callus short or elongated, villous. Glumes persistent, more or less equal ; lower shorter, 1- to 3-nerved ;

upper 3- to 5-nerved. Lemmas as long as or longer than the glumes, more or less herbaceous, with hyaline tips and margins, 2-fid, with or without bristle from the lobes, 5- to 11-nerved, awned from the middle or above the middle of the back ; awn usually geniculate and twisted below the bend. Palea shorter than the lemma, 2-keeled, membranous. Ovary hairy from the middle upwards or only at the top ; styles distinct ; stigmas plumose, laterally exerted.

## KEY TO THE SPECIES

Spikelets green ; keels of palea with long close set cilia 1. *H. virescens*  
Spikelets golden brown ; keels of palea glabrous ... 2. *H. pratense*

1. ***Helictotrichon virescens* (Nees) Henr.**

*Helictotrichon virescens* (Nees ex Steud.) Henrard in *Blumea* 3 : 425 (1940).

*Helictotrichon asperum* (Munro) Bor in Ind. For. Rec. 68 (1938).

*Avena aspera* Munro ex Thw. Enum. Pl. Zeyl. p. 372 ; Hook f., Fl. Brit. Ind. 7 : 277 (1896) as var. *Roylei*.

*Avenastrum asperum* (Munro) Fischer, Fl. of Madras pt. X, p. 1802.

Perennial. Culms up to 1 m. high, rather stout, erect, glabrous or nodes slightly pubescent. Leaf-blades 15-25 cm. long, 1 cm. broad, flat ; sheaths glabrous or softly pubescent ; ligules short, truncate, membranous. Panicle up to 30 cm. long, usually nodding ; lower branches solitary, 2-nate or semiverticillate, 2.5-15 cm. long ; axis and branches smooth or scaberulous. Spikelets 8-15 mm. long, ovate or ovate-oblong, green, erect ; rachilla slender, penicillate. Lower glume narrowly lanceolate, 7 mm. long, acuminate, 1- to 3-nerved, keel strongly scabrid below the tip. Upper glume ovate-lanceolate, acute, 9.5 mm. long, 5-nerved, scaberulous near the tip. Lemma (lowest) 11 mm. long, ovate-lanceolate, dorsally scaberulous with short distant hairs along the margins, 7-nerved, the central nerve being continued out into strongly geniculate awn which arises from the dorsal surface, the next two nerves are produced upwards into two arisate ; awn 2-5 cm. long, often recurved, scabrid. Upper lemmas successively smaller and not showing prominent aristae. Palea 8 mm. long ; keels pectinately ciliate. Anthers 2.5-3.25 mm. long.

Kagan Valley : Shogran, Sharhan ; Swat State : Kalam ; Thandiani ; Murree Hills. Very common.

2. **Helictotrichon pratense** (Linn.) Pilger

*Helictotrichon pratense* (Linn.) Pilger in Fedde Rep. Sp. Nov. 45 : 6 (1938).

*Avena pratensis* Linn. Sp. Pl. 80 (1753) ; Hook. f., Fl. Brit. Ind. 7 : 276 (1896).

Perennial. *Culms* densely tufted, 30-90 cm. high, erect, slender, stiff, 1- to 2-noded in the lower part. *Leaf-blades* glabrous with blunt tips, stiff to rigid, folded when young, opening out, 1-5 mm. wide, scabrid on the margins, smooth beneath, the basal 4-30 cm. long ; *sheaths* rounded on the back or keeled upwards, smooth or minutely scabrid ; *ligules* membranous, the upper 2-5 mm. long, the lower shorter. *Panicle* erect, narrow, contracted, 4-18 cm. long, golden brown, shining ; branches scabrid, solitary or geminate with 1-2 spikelets, the lower up to 3.5 cm. long, the upper shorter. *Spikelets* narrowly oblong, 14-25 mm. long, 3- to 6-flowered ; rachilla breaking up at maturity beneath each lemma. *Glumes* persistent, lanceolate to oblong-lanceolate, finely pointed, firm except for the translucent margins, 3-nerved ; lower 10-15 mm. long ; upper 12-20 mm. long. *Lemmas* narrowly oblong-lanceolate in side view, 10-17 mm. long, rounded on the back, toothed at the tip, tough except for the thin upper part and margins, 5-nerved, minutely scabrid upwards, bearded at the base with hairs 1-2 mm. long, awned from just above the middle, with the awn bent or twisted in the lower part, 12-22 mm. long. *Palea* with glabrous or minutely hairy keels. *Anthers* 5-8 mm. long.

Gilgit : Burzil Pass, A. H. Khan.

5. **Deschampsia** Beauv.

Perennial grasses with flat or convolute leaves. Spikelets 2- (rarely 3-) flowered, with both flowers perfect ; rachilla jointed at the base, produced beyond the uppermost lemma as a naked or penicillate tip. Glumes subequal, persistent, keeled, shining. Lemmas sub-hyaline, truncate and erose-dentate at the apex ; awn dorsal, slender, straight or twisted. Palea narrow, 2-nerved.

KEY TO THE SPECIES

- Panicle effuse or contracted ; spikelets not imbricate ; lemmas truncate, crenate or irregularly toothed ; culms leafy throughout ..... 1. *D. caespitosa*
- Panicle condensed, short ovoid or subspiciform ; spikelets imbricate ; lemmas 2-lobed ; leaves basal.....2. *D. koelerioides*

1. *Deschampsia caespitosa* Beauv.

*Deschampsia caespitosa* Beauv., Agrost. 91 (1812) t. 18, f. 3; Hook. f., Fl. Brit. Ind. 7 : 273 (1896).

A densely tufted perennial. *Culms* up to 2 m high, erect or slightly geniculate at the base, slender or stout, 1- to 3-noded, smooth. *Leaf-blades* glabrous, up to 60 cm. long, flat or convolute, 2-5 mm. wide, coarse, ribbed above, with the ribs and margins very scabrid, smooth below; *sheaths* rounded on the back, or somewhat keeled, smooth or scabrid upwards; *ligules* narrow, up to 15 mm. long. *Panicle* open, loose, rarely contracted, erect or nodding, ovate to oblong, up to 50 cm. long, up to 20 cm. wide, green, silvery, golden, purple or variegated with these colours; branches very slender, spreading, scabrid, bare below; pedicels 1-6 mm. long. *Spikelets* loosely clustered or scattered, white and silvery or fulvous-purplish, lanceolate to narrowly oblong, 4-6 mm. long, 2-flowered; rachilla disarticulating below each lemma, hairy. *Glumes* persistent, 4.5 mm. long lower narrowly keeled membranous, shining, equal or nearly so, dorsally scabrid; lanceolate, 1-nerved, slightly notched at the tip; upper wider 3-nerved, notched at the apex. *Lemmas* enclosed in the glumes or with their tips protruding, rounded on the back, 4 mm. long, oblong, with a broad toothed tip, membranous, finely 5-nerved, bearded at the base. *Palea* 3 mm. long, 2 lobed. *Anthers* 1.5 mm. long.



Fig. 158.—*Deschampsia caespitosa*.

Burzil Chowki, R. R. & I. D. Stewart.

2. *Deschampsia koelerioides* Regel.

*Deschampsia koelerioides* Regel in Bull. Soc. Nat. Mosc. 41 : 299 (1868); Hook. f., Fl. Brit. Ind. 7 : 273 (1896).

Perennial. *Culms* leafy at the base, rather stout, stiff, erect, geniculate at the nodes, up to 35 cm. high, 1-noded; nodes glabrous. *Leaf-blades* 4.5-6 cm. long, 2.5-3 mm. broad, linear, acute, flat, glabrous and smooth; blades of the upper sheaths suppressed; *ligule* membranous,

oblong, 5 mm. long. *Panicle* short ovoid or subspiciform, 1.5-2.5 cm. long, 1 cm. wide, erect. *Spikelets* 2-flowered, very shortly pedicelled, imbricating, brownish yellow, 4-5 mm. long. *Lower glume* 3-3.5 mm. long, 0.8 mm. broad, 1-nerved, notched at the tip. *Upper glume* 3.5-4 mm. long, 1.5 mm. broad, keeled, 3-nerved, broadly hyaline along the margins. *Lemma* 4 mm. long, 1.5 mm. broad, 2-lobed, lobes irregularly toothed, awned from below the middle; awn 3.5 mm. long, scabrid; callus long hairy. *Palea* as long as the lemma, keels antrorsely scabrid. *Anthers* 1.5 mm. long.

Gitidas to Babusar, 11000 ft; Baltistan, Dras and Iskardu.

## 6. *Aira* Linn.

Annual or perennial grasses with narrow or setaceous leaves. *Panicle* broad, erect, capillary, trichotomously branched. *Spikelets* 2-flowered with both florets perfect; rachilla jointed above the glumes, not produced beyond the upper lemma. *Glumes* subequal, 3-nerved, acute, persistent. *Lemmas* smaller, often 2-toothed; awn dorsal, capillary, usually twisted below; callus naked. *Palea* hyaline, 2-nerved.

### 1. *Aira caryophyllea* Linn.

*Aira caryophyllea* Linn. Sp. Pl. 66 (1753); Hook. f., Fl. Brit. Ind. 7: 272 (1896).

Annual. *Culms* tufted or solitary, 3-40 cm. high, erect or spreading, very slender, 2- to 3-noded below the middle, smooth. *Leaf-blades* glabrous, filiform, blunt, 0.5-5 cm. long, inrolled, about 0.3 mm. wide, minutely scabrid on the nerves; *sheaths* minutely scabrid upwards; *ligules* toothed, up to 5 mm. long, membranous. *Panicle* very loose, with widely spreading branches, 1-12 cm. long; axis often wavy; branches naked at the base, usually loosely divided in to threes at intervals; pedicels 1-10 mm. long. *Spikelets* in small, loose clusters at the tips of the branches, ovate to oblong, 2-flowered, silvery or tinged with purple, 2.5-3.5 mm. long. *Glumes* persistent, similar, obliquely lanceolate and pointed in profile, minutely scabrid on the keel, shining, thinly membranous, 1- to 3-nerved. *Lemma* slightly shorter than and enclosed by the glumes, narrowly ovate, finely

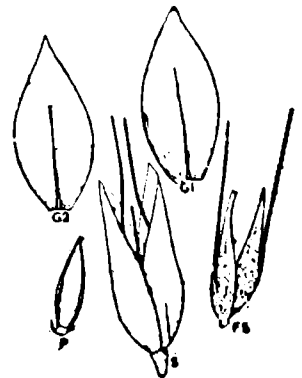


Fig. 159. *Aira caryophyllea* a.

2-toothed, minutely rough above, with a tuft of short hairs at the base; the awn twisted and bent below the middle, projecting from the tips of the glumes. *Palea* shorter than the lemma. *Anthers* 0.3-0.6 mm. long.

Kohat, teste *Hooker f.*

### 7. *Duthiea* Hack.

Perennial tufted grasses. Leaves linear, subconvolute. Spikelets 3- to 5-flowered, often bracteate in a short, simple and uni lateral raceme, laterally subcompressed, uppermost floret imperfect; rachilla jointed above the glumes and between the lemmas. Glumes lanceolate, acuminate, 7- to 11-nerved, dorsally rounded. Lemmas herbaceous, 7- to 11-nerved, 2-fid, awned in the sinus, margins membranous, awn half twisted; palea 2-keeled; keels scabrid, excurrent. Lodicules 0. Ovary obovoid, lobed at the top, densely hirsute all over, except on the hilum and the embryo; style single, tomentose, longer or shorter than the stigmas, very long, papillose. exerted together with the anthers from the top of the spikelet.

#### 1. *Duthiea bromoides* Hack.

*Duthiea bromoides* Hack. in Verhandl. zool. Bot. Ges. Wien 200 (1895);  
Hook. f., Fl. Brit. Ind. 7: 282 (1896).

Perennial. *Culms* up to 80 cm. high, erect from a decumbent base, 2- to 3-noded, glabrous, scabrid below the panicle. *Leaf-blades* up to 4 cm. long, 1 cm. wide, lanceolate, glabrous, scaberulous on the lower surface; those of the innovation shoots very long and narrow; *sheaths* very loose below, scarious, shining, slipping from the culms, those on the culms tighter, scabrid; *ligules* 6 mm. long, lacerate. Raceme 2.5-4 cm long, 2- to 4-spiculate; pedicels 2-5 mm. long. Spikelets rather turgid, ovate-oblong, 10-22 mm. long. 4 to 5-flowered. *Lower glume* oblong-lanceolate, mucronate, 1.6 cm. long, 4 mm. broad, rounded on the back, 5- to 6-nerved, rounded above with sinuate toothed margin. *Upper glume* similar but broader, with 7-10 anastomosing nerves, scaberulous all over, margins hyaline. *Lower lemma* 1.4 cm. long, 5.5-6 mm. wide, elliptic with a few blunt teeth on each side of the apical fissure, 10- to 11-nerved, nerves anastomosing, hyaline on the margins, scabrid all over the back, villous in the lower quarter; awn 1.5-2.5 cm. long. *Palea* about 1.2 cm. long, 2-aristulate, 2-keeled, scabrid and shortly pilose. *Style* one,

densely hairy. *Anthers* 7 mm. long.

Kagan Valley : Saiful Maluk, Giti Das ; Hazara : Siran Valley.

### 8. *Danthonia* Lam.

Annual or perennial grasses. Spikelets 2- or more-flowered ; florets all perfect or the uppermost male, erect ; rachilla jointed above the glumes and between the lemmas, produced beyond the uppermost floret. Glumes subequal, as long as the spikelet, persistent, keeled, acute or acuminate. 3- to 9-nerved. Lemmas dorsally round, ciliate, 7- to 9-nerved, 2-fid, lobes acute or awned and with a rigid twisted awn in the sinus ; palea broad. Lodicules 2. Styles 2, free ; stigmas plumose, laterally exerted.

#### KEY TO THE SPECIES

- Lemmas with tufts of hairs at the base of the lobes between the nerves ; anthers less than 2 m.m. long ..... 1. *D. cachemyriana*  
 Lemmas without tufts of hairs on the dorsal surface or occasionally one just below the the insertion of the awn ; anthers about 4 mm. long ..... 2. *D. jacquemontii*.

### 1. *Danthonia cachemyriana* J. & S.

*Danthonia cachemyriana*. Jaub. & Spach, Illustr. Pl. Orient 7 : 46.

*Danthonia axilis* Hook. f., Fl. Brit. Ind. 7 : 281 (1896).

Perennial. *Culms* up to 25 cm. high, slender, densely tufted. *Leaf-blades* filiform, up to 25 cm. long, convolute ; *ligule* short. *Panicle* short, contracted, 1.2-2.5 cm. long, erect, 6- to 10-spiculate, green or brownish ; branches and pedicels very short, smooth. *Spikelets* erect, 1.25 cm. long, 3- to 5-flowered ; rachilla very short between the upper lemmas. *Glumes* unequal, 1- to 3-nerved, scarious, lanceolate, acuminate. *Lemmas* villous, shorter than the glumes, oblong, coriaceous, faintly 7-ner-

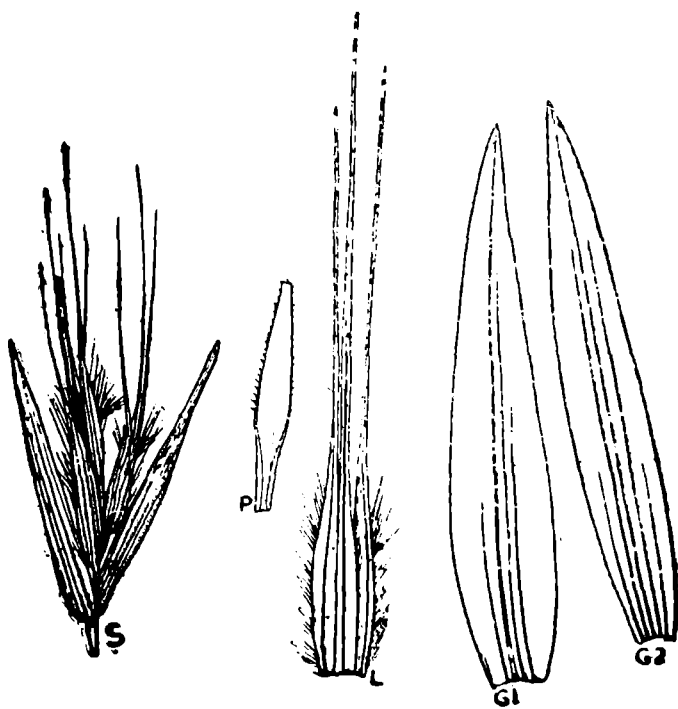


Fig. 160. *Danthonia cachemyriana*.

ved, cleft to the middle, with tufts of hairs at the base of the lobes between the nerves, lateral awns as long as the lemmas, median twice as long, erect; callus densely bearded. *Palea* linear-lanceolate, 2-toothed, sparsely hairy; scabrid along the keels. *Anthers* 2 mm. long.

Ulter nullah, Hunza (Gilgit), R. R. Stewart.

## 2. *Danthonia jacquemontii* Bor

*Danthonia jacquemontii* Bor, Kew Bull. 1952 : 80 (1952)

*Danthonia cachemyriana* Hook. f., Fl. Brit. Ind. 7 : 281 (1896) non J. & S.

Perennial. *Culms* up to 80 cm. high, densely tufted, ascending from a stout woody rootsock. *Leaf-blades* 25 cm. long, 2 mm. broad, narrow, convolute, flexuous, glabrous; *sheaths* glabrous or the lower rarely tomentose; *ligules* represented by a ciliate rim. Panicle contracted, 10-12.5 cm. long, upper part racemose with spikelets singly pedicelled on the axis; lower branches in pairs and branched; branches and pedicels smooth, hairy or scabrid. *Spikelets* 1.5-1.8 cm. long, 4- to 5-flowered, erect, pale rather shining; rachilla more or less hairy. *Glumes* subequal, 5- to 7-nerved, rarely sparsely hairy, keels smooth. *Lemmas* sparsely hairy, linear-lanceolate, cleft about one-third way down, 9-nerved, without tufts of hairs on the dorsal surface or occasionally one tuft below the insertion of the awn, 3-awned; lateral awns as long as or longer than the lemma, exerted, median awn strongly twisted. *Palea* as long as the lemma, linear-obtuse, with smooth keels. *Anthers* 4 mm. long.

Swat State : Mt. Ilam, 12.8.52, R. R. Stewart.

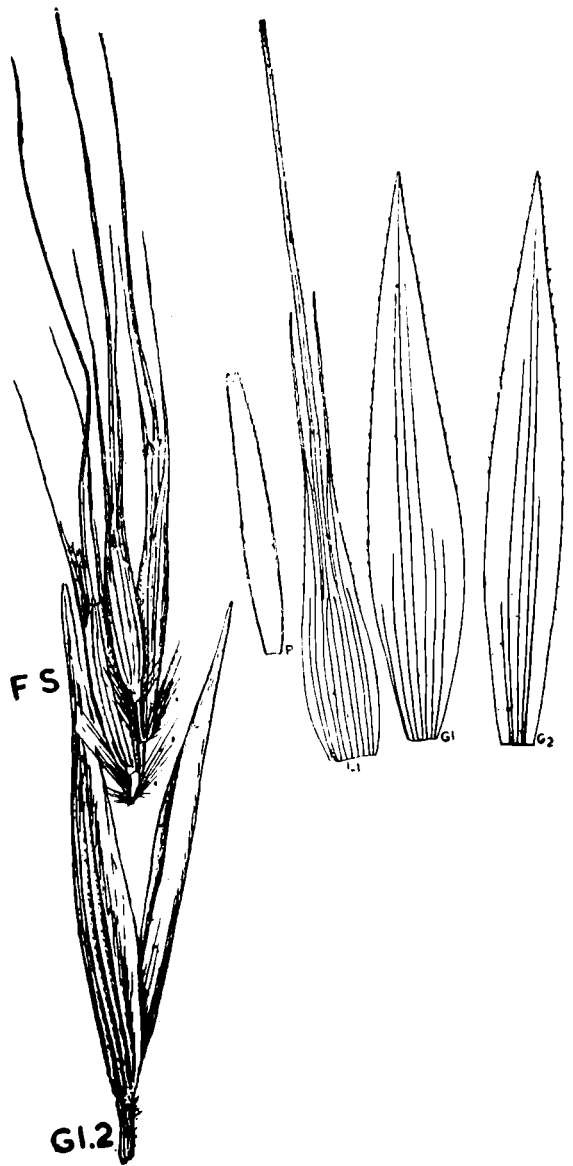


Fig. 161. *Danthonia jacquemontii*.



9. **Schismus** Beauv.

Small annual grasses with narrow leaves. Spikelets many-flowered, in a subspiciform panicle, with very short erect branches and pedicels not jointed at the base; rachilla elongate, jointed at the base and between the lemmas. Glumes large, subequal, acute, persistent, herbaceous, margins scarious; lower broad, 5- to 7-nerved; upper 3- to 5-nerved, 2 fid, many-nerved, mucronate or not between the hyaline lobes; palea spatulate with 2 submarginal diverging basal nerves.

## KEY TO THE SPECIES

Glumes 5-6 mm. long; lemmas 2.5-3 mm. long, the apex with two acute hyaline lobes; palea acute, shorter than the lemma.....1. *S. arabicus*  
 Glumes 4-5 mm. long; lemmas about 2 mm. long, rounded and emarginate at the apex; palea rounded, as long as the lemma.....2. *S. barbatus*

1. **Schismus arabicus** Nees.

*Schismus arabicus* Nees, Fl. Afr. Aust. 422 (1841).

*Schismus marginatus* Hook. f., Fl. Brit. Ind. 7: 236 (1896) non Beauv.

Annual. Culms tufted, geniculate-ascending, occasionally spreading, rarely erect, up to 30 cm. high, glabrous, smooth. Leaf-blades linear, very narrow, up to 8 cm. long, 1.5 mm. broad, flat or convolute and filiform, slightly scabrid on both surfaces, glabrous or with few scattered hairs; sheaths rounded on the back, the lower inflated and broadly membranous at the margins, the upper herbaceous, tight, mouth long hairy; ligule a fringe of hairs. Panicle dense, ovate or oblong lanceolate, up to 5 cm. long, 1 cm. broad; axis smooth; branches short, branched at the base, erect, scabrid; pedicels short, scabrid. Spikelets 5-6 mm. long, 5- to 7-flowered. Glumes persistent, slightly unequal, lanceolate, broadly scarious-margined, green in the lower half, 5-6 mm. long, obtuse or acute, 5- to 7-nerved. Lemmas broadly oval or elliptic, 2.5-3 mm. long, the apex with 2 acute hyaline lobes, 9-nerved, mucronate in the sinus, villous in the lower half. Palea acute, shorter than the lemma.



Fig. 162.—*Schismus arabicus*.

'Sangla Hill ; Daud Khel ; Dargai ; Peshawar ; Campbellpur ; Swat ; Barikot ; Quetta ; Khyber Pass ; Gilgit.

## 2. *Schismus barbatus* (Linn.) Thell.

*Schismus barbatus* (Linn.) Thell., Bull. Herb. Boiss. II, 7 : 391 (1907).

*Festuca barbata* Linn., Demonstr. Pl. Hort. Upsal. 3 (1753).

*Schismus marginatus* Beauv., Ess. Agrost. 117 (1812).

*Schismus calycinus* (Linn.) C. Koch In Linnaea 21 : 397 (1848).

*Festuca calycina* Linn., Amoen. 3 : 400 (1756).

*Schismus fasciculatus* Beauv. Ess. Agrost. 74, 177 (1812).

Very similar to *S. arabicus*, but the glumes are 4-5 mm. long and the lemmas about 2 mm. long, rounded and emarginate at the apex.

Baluchistan, without precise locality, *Lace*.

## 10. *Koeleria* Pers.

Annual or perennial tufted grasses with flat or narrow convolute leaves. Panicle spiciform ; branches distichous, usually branched again at the base. Spikelets laterally compressed, 2- to 5-flowered, glabrous or hairy ; rachilla jointed above the glumes and between the lemmas, produced beyond the uppermost floret. Florets all hermaphrodite or the uppermost rudimentary. Glumes unequal, persistent, keeled, acuminate ; lower 1-nerved, upper 3-nerved. Lemmas broadly scarious, 3- to 1-nerved, mucronate or 2-fid and awned from the sinus ; awn straight, scabrid ; palea hyaline, 2-fid.

### KEY TO THE SPECIES

1. Lemmas entire, awnless.....1. *K. cristata*  
Lemmas 2-fid, awned.....2
2. Lower glume smooth.....2. *K. phleoides*  
Lower glume densely hairy.....3. *K. pumila*

### 1. *Koeleria cristata* (Linn.) Pers.

*Koeleria cristata* (Linn.) Pers. Syn. Pl. 1 : 97 (1805).

*Poa cristata* Linn., Syst. Nat. ed. 12. 94 (1767).

*Koeleria gracilis* Pers. Syn. Pl. 1 : 97 (1805).

Perennial. Culms densely tufted, up to 60 cm. high, erect or slightly geniculate at the base, slender, stiff, 1- to 3-noded, hairy below the panicle. Leaf-blades up to 20 cm. long, 1-2.5 mm. broad, flat or involute, finely hairy or glabrous and smooth ; sheaths rounded on the back.

densely hairy or the upper glabrous; *ligules* up to 1 mm. long, membranous. *Panicle* erect, spiciform, dense, often lobed or interrupted in the lower part, narrowly oblong, 4-15 cm. long, 5-20 mm wide, silvery green or purplish; branches short, hairy. *Spikelets* densely clustered, oblong or wedge-shaped, compressed, 4-5 mm. long 2- to 3-flowered, glabrous or hairy; rachilla jointed below the lemmas. *Glumes* persistent, with thin membranous margins, 3-4 mm. long, scaberulous; lower the length of the upper, narrowly oblong, 1-nerved; upper oblong or elliptic-oblong, 3-nerved. *Lemmas* as long as the upper glume or with their tips exerted, pointed, keeled upwards, oblong, 3-nerved, scaberulous. *Paleas* about as long as the lemmas, 2-keeled. *Anthers* 2 mm. long.

Quetta; Gilgit; Murree Hills; Upper Swat; Kagan Valley, etc.

## 2. *Koeleria phleoides* (Vill.) Pers.

*Koeleria phleoides* (Vill.) Pers., Syn. Pl. 1: 97 (1805); Hook. f., Fl. Brit. Ind. 7: 309 (1896).

*Festuca phleoides* Vill., Flor. Delph. 7 (1785).

*Lophoclea phleoides* (Vill.) Richenb., Fl. Germ. 42 (1830).

*Festuca cristata* Linn., Sp. Pl. 76 (1753).

*Koeleria cristata* (Linn.) Betol., Amoen. 67 (1819) non Pers.

*Trisetaria phleoides* (Vill.) Nevski in Acta Inst. Bot. Acad. Sc., URSS., Ser. I. Fasc. 4: 339 (1937)

Annual. *Culms* densely tufted, rarely solitary, erect or geniculate-ascending, simple or rarely branched, 5-60 cm. high, glabrous and smooth, leafy up to the apex. *Leaf-blades* up to 18 cm. long, 8 mm. broad, loosely hirsute on both the surfaces; *sheaths* rounded on the back, tight, smooth, more or less hirsute, with



Fig 163. *Koeleria* spp. a. *K. phleoides*; b. *K. pumila*; c. *K. cristata*.

long hairs at the mouth; *ligule* less than 2 mm. long, truncate, dentate and lacerate, glabrous. *Panicle* cylindric, dense and entire or more loose, oblong or lanceolate, more or less lobed and interrupted at the base,

1-12 cm. long ; axis scabrid ; branches short, scabrid, branched at the base ; pedicels short or very short. *Spikelets* 2- to 5-flowered, 3-5 mm. long ; rachilla jointed below the lemmas. *Glumes* unequal, acute or acuminate, glabrous or hirsute, broadly herbaceous with the margins scarious ; the lower ca. 4 mm. long, narrowly lanceolate, 1-nerved ; the upper ca. 5 mm. long, broadly lanceolate, 3-nerved. *Lemma* lanceolate, acuminate, herbaceous with hyaline margins, glabrous, smooth or tuberculate-papillose, 5-nerved, usually shortly 2-dentate at the summit. *Palea* much shorter than the palea, 2-dentate or 2-fid with lobes more or less aristulate, keeled, with the keels scabrid. *Anthers* 0.5-0.6 mm. long.

Very common throughout the area in moist shady places.

### 3. *Koeleria pumila* (Desf.) Domin

*Koeleria pumila* (Desf.) Domin in Fedde, Repert. 2 : 31 (1906).

*Avena pumila* Desf., Fl. Atl. 1 : 103 (1798).

*Trisetum pumilum* (Desf.) Kunth, Enum. 1 : 102 (1729).

*Trisetaria pumila* (Desf.) Maire, Fl. de l'Afrique du Nord, 261 (1953).

Annual. *Culms* solitary or tufted, erect or geniculate-ascending, 5-30 cm. high, usually branched at the base, glabrous, lower nodes villous. *Leaf-blades* up to 6 cm. long, 3 mm. broad, more or less hirsute on both surfaces, often more or less glabrous ; *sheaths* rounded on the back, tight, retrorsely scabrid, the upper often glabrous ; *ligules* membranous, 0.8-1 mm. long, truncate, fimbriate-ciliate. *Panicle* more or less long-peduncled, oval-oblong to lanceolate, 1.5-6 cm. long, 0.5-1 cm. wide, slightly dense ; axis more or less pubescent ; branches short, usually 2-nate, erect, branched at the base, villous ; pedicels villous. *Spikelets* 3- to 4-flowered ; rachilla jointed below each lemma, the internodes short, long-villose, with the hairs longer than the internodes. *Glumes* 3 mm. long, subequal, usually much shorter than the florets oval-lanceolate, acute, membranous, 3-nerved ; the lower villous on the back and along the margins ; the upper villous in the lower half or on the back, shortly 2-dentate at the apex, with the teeth not prolonged into bristles, awned  $\frac{1}{3}$ - $\frac{1}{4}$  below the apex ; awn shorter in the lower lemma but longer in the upper lemma. *Palea* narrow, linear, 2-dentate, 2-keeled with the keels scabrid. *Anthers* 0.24 mm. long.

Baluchistan. Khyber pass ; Swat ; Barikot, etc. Common.

Tribe 9 : **Agrostae**

Spikelets usually alike and hermaphrodite, 1-flowered, small, mostly laterally compressed, pedicelled in open or contracted or spike-like panicles, very rarely in racemes ; rachilla disarticulating above the glumes, very rarely below the glumes or at the bases of the branches, not produced beyond the floret or only as a point or bristle. Glumes usually persistent, as long as the spikelet and enclosing the floret or sometimes shorter, rarely very small or suppressed. Lemmas hyaline or membranous, thinner than the glumes or similar in texture, not or slightly changed at maturity, rarely indurated, mostly 3- to 5-nerved, awnless or awned from the back or less often from the entire or 2-lobed tip ; awn geniculate or straight.

KEY TO THE GENERA

1. Spikelets disarticulating above the glumes see *A. (semiverticillata* and *A. stewartii*)..... 2  
     Spikelets disarticulating below the glumes.....6
2. Inflorescence spiciform ; pedicels minute .....1. *Phleum*  
     Inflorescence not spiciform ; pedicels not minute.....3
3. Glumes equal or nearly so, longer than the lemma ; lemma awned from the back or awnless.....4  
     Glumes equal or unequal, as long as the lemma or shorter ; lemma awned from the tip .....2. *Muehlenbergia*
4. Lemma glabrous or nearly so, with a few short hairs at the base ; glumes not long acuminate..... 5  
     Lemma hairy or glabrous ; callus long bearded ; glumes long acuminate.....3. *Calamagrostis*
5. Rachilla not produced ..... 4. *Agrostis*  
     Rachilla produced, pectinate-ciliate .....5. *Deyeuxia*
6. Glumes awnless ..... 6. *Alopecurus*  
     Glumes awned .....7. *Polygogon*

1. **Phleum** Linn.

Annual or perennial grasses with flat leaves. Inflorescence a dense cylindric or oblong spiciform panicle. Spikelets 1-flowered, laterally compressed ; rachilla disarticulating above the glumes ; pedicels very short. Glumes equal, membranous, keeled, abruptly awned or mucronate or gradually acute. Lemma shorter than the glumes, hyaline, broadly truncate, 3- to 5-nerved ; palea narrow, as long as the lemma.

## KEY TO THE SPECIES

1. Perennial ; glumes truncate, as long as their awns ; keels hispid.... ..... 1. *Ph. alpinum*  
 Annuals ; glumes not as above .. ..... 2
2. Glumes lanceolate acuminate keels ciliate .. .. 2. *Ph. himalaicum*  
 Glumes cuneately obovate, truncate-cuspidate, keels scabrid above ..  
 ..... 3. *Ph. paniculatum*

1. **Phleum alpinum** Linn.

*Phleum alpinum* Linn., Sp. Pl. 59 (1753); Hook. f., Flor. Brit. Ind. 7 : 236 (1896).

Perennial. Culms 15-45 cm. long, ascending from a creeping base, smooth stiff. Leaf-blades short, spreading, up to 15 cm. long, 5 mm. wide; sheaths terete, smooth and glabrous, the upper sheaths inflated; ligule white, membranous, up to 1.5 mm. long. Panicle cylindric, 1-3.5 cm. long green or purplish. Spikelets densely crowded, seated upon very short erect, scaberulous branches, 1-flowered, 6 mm. long (incl. the awns). Lower glume 4 mm. long, truncate, keeled, hispid, central nerve produced into an awn like point, about 2 mm. long. Upper glume similar. Lemma hyaline, 2.5 mm. long, 3-nerved; palea narrow, hyaline, 2 mm. long.

Gilgit : Jhaba, M. S. Zahur ; near Saiful Maluk, Kagan Valley, Shaukat ; Basal, M. S. Zahur.



Fig. 164. *Phleum alpinum*

2. **Phleum himalaicum** Mez

*Phleum himalaicum* Mez in Fedde, Repert. 17 : 293 (1921).

*Phleum arenarium* Hook. f., Flor. Brit. Ind. 7 : 237 (1896) non Linn.

A densely tufted annual. Culms 15-35 cm. high, smooth and glab-

rous spreading or geniculate-ascending. *Leaf-blades* linear, spreading, 4 cm. long, 3 mm. wide, smooth and glabrous; *sheaths* terete, smooth, glabrous close fitting, upper inflated; *ligule* elongate, oblong, up to 2 mm. long. *Panicle* cylindrical or oblong, narrowed at the base, 2.5-6.5 cm. long, 0.8-1.5 cm. in diameter. *Spikelets* 3-4 mm. long; *rachilla* produced beyond the lemma. *Glumes* similar, as long as the spikelet, lanceolate, finely acuminate, hardly awned, keels ciliate above. *Lemma* 1.3 mm. long, hairy, 3-nerved.



Fig. 165. *Phleum himalaicum*

Swat State: Khaza Khela, S. Ahmad; Dir, A. R. Beg; Chitral: Drosh, A. R. Beg; Abbottabad, R. R. Stewart; Kohala, R. R. Stewart.

### 3. *Phleum paniculatum* Huds.

*Phleum paniculatum* Huds., Fl. Angl. 23 (1762).

*Phleum asperum* Jacq., Collectan 1: 110 (1786); Hook. f., Flor. Brit. Ind. 7: 237 (1896).

Annual. *Culms* tufted, stout, rigid, 15-45 cm. long. *Leaf-blades* linear, spreading, smooth and glabrous, up to 7 cm. long, 6 mm. wide; *sheaths* terete, smooth and glabrous, close fitting, the uppermost inflated; *ligule* white, membranous, up to 3 mm. long. *Panicle* cylindrical 3-12 cm. long, 6-8 mm. in diameter. *Spikelets* green, 2-3 mm. long. *Lower glume* cuneately obovate, truncate-cuspidate, glabrous or scabrid, keels scabrid above, 3-nerved, 2-3 mm. long; *upper glume* similar. *Lemma* membranous, 2/3 the glumes, oblong, obtuse, pubescent, 1.5 mm. long, 3-nerved; *palea* narrow, hyaline, as long as the lemma.



Fig. 166. *Phleum paniculatum*

Salt Range: Ucchali, S. Ahmad; Dir, A. R. Beg; Thandiani, A. H.

*Khan* ; Abbottabad, *A. H. Khan* ; Kohala, *R. R. Stewart* ; Ghora Gali, *R. R. Stewart* ; Poonch, *R. R. Stewart* ; Kagan Valley : *Kawai*.

## 2. *Muehlenbergia* Schreb. ex Gmel.

Annual or perennial slender grasses with narrow flat leaves. Spikelets small, 1-flowered ; rachilla jointed above the glumes not produced. Glumes shorter than or as long as the lemma, firmly membranous, 3-nerved, short, glabrous or sparsely hairy, acute, awned from the tip or from between very short lobes, the awn straight or flexuous ; palea as long as the lemma ; lodicules 2 ; styles free ; stigmas short, laterally exerted. Anthers short to minute.

### KEY TO THE SPECIES

1. Lemma twice as long as the glumes, the latter 1-1.5 mm. long ..... 1. *M. huegelii*  
 Lemma as long as or nearly about as long as the glumes ..... 2  
 2. Glumes 3-4 mm. long ; awn up to 2.5 cm. long... 2. *M. himalayana*  
 Glumes 2-2.5 mm. long ; awn up to 1.25 cm. long .. 3. *M. duthieana*

### 1. *Muehlenbergia huegelii* Trin.

*Muehlenbergia huegelii* Trin. in Mem. Acad. Petersb. ser. VI, 2 : 293 (1895).

*Muehlenbergia viridissima* Nees ex Steud., Syn. Pl. Glum. 178 (1854) ; Hook. f., Flor. Brit. Ind. 7 : 59 (1896).

Perennial, rhizomatous. Culms rather weak, up to 1.6 m. high. Leaf-blades flat, 8-15 cm. long, 4-8 mm. broad, scabrid, linear, acuminate ; sheaths loose ; ligule a membranous ring, lacerate. Panicle elongate, much fastigiately branched, up to 20 cm. long, flexuous, interrupted ; branches and pedicels slender. Spikelets up to 2 mm. long ; pedicels scabrid. Lower glume 1 mm. long, strongly 1-nerved, ovate-lanceolate, keel scabrid. Upper glume 1.5 mm. long, hairy below the middle, 3-nerved, the central nerve produced into a long, slender flexuous awn 2 cm. long ; palea as long as the lemma, ovate-lanceolate, 2-nerved, 2-keeled, hairy below the middle.



Fig. 167. *Muehlenbergia* spp. a. *M. duthieana* ; b. *M. huegeli* ; c. *M. himalayana*.

Kagan Valley : Shogran, *M. S. Zahur* ; Korakorum, *Shaukat*.



## 2. *Muehlenbergia himalayana* Hack.

*Muehlenbergia himalayana* Hack. in erb. ; Hook. f., Fl. Brit. Ind. 7 : 259 (1896).

*Culms* 30-45 cm. high, very stout, decumbent or ascending, branched. *Leaf-blades* narrow, flaccid ; *ligule* oblong. *Panicle* 7.5-15 cm. long, very narrow, slender, flexuous, flaccid, elongate and fastigiately branched, interrupted ; branches slender, distant ; pedicels slender. *Spikelets* 3-4 mm. long, bright green, glistening. *Glumes* 3-4 mm. long, lanceolate, acuminate, or subaristate. *Lemma* as long as the glumes ; awn 1.2-2.5 mm. long.

Murree Hills, M. S. Zahur ; Hazara, R. R. Stewart.

## 3. *Muehlenbergia duthieana* Hack.

*Muehlenbergia duthieana* Hack. in Herb.

*Muehlenbergia sylvatica* Hook. f., Fl. Brit. Ind. 7 : 259 (1896) non Torr.

*Culms* 30-90 cm. high, very slender, branched, decumbent and creeping below. *Leaf-blades* 7.5-12.5 cm. long, 2.5-4 mm. broad, smooth or scaberulous ; *ligule* very short, lacerate. *Panicle* 10-15 cm. long, pale green or violet, erect, contracted, interrupted ; branches very short, flowering to the base, scabrid. *Spikelets* crowded, erect, very shortly pedicelled, 2-2.5 mm. long. *Glumes* subequal, 2-2.5 mm. long, lanceolate, acuminate, 1-3-nerved, keels scabrid. *Lemma* as long as the glumes, minutely notched at the tip, awn 4-12 mm. long, hairs much longer than the lemma. *Palea* about as long as the lemma.

Kagan Valley : Shogran, M. S. Zahur ; Karakoram, *Shaukat* ; Murree, Mokushpuri, Poonch, Swat.

## 3. *Calamagrostis* Adans.

Stout or slender grasses, often tall with long flat leaves. Panicle effuse or contracted, often silky, shining. Spikelets crowded on the numerous scaberulous or smooth branchlets ; rachilla jointed above the glumes and not produced (or very occasionally produced). Glumes unequal ; the lower 1-nerved ; the upper 3-nerved, scaberulous on the keels. Lemma hyaline, much shorter than the glumes, 5-nerved, often cleft at the apex, glabrous or hairy on the dorsal surface ; callus hairy, hairs longer than the lemma.

## KEY TO THE SPECIES

1. Lemma dorsally awned at the middle or below it ..... 2  
    Lemma awned in the upper third or near the tip ..... 3
2. Awn sub-basal, exserted ; palea as long as the lemma ..... 1. *C. decora*  
    Awn at or near the middle, not exserted ; palea  $\frac{1}{2}$ - $\frac{3}{4}$  as long as  
    the lemma ..... 2. *C. epigejos*
3. Lemma  $\frac{1}{2}$  the lower glume, cleft to about  $\frac{1}{3}$  : awn exserted ..... 3. *C. emodensis*  
    Lemma more than  $\frac{1}{2}$  the lower glume, tip truncate-erose or  
    toothed ; awn not exserted ; palea  $\frac{3}{4}$  lemma ..... 4. *C. pseudophragmites*

1. **Calamagrostis decora** Hook. f.

*Calamagrostis decora* Hook f., Flor. Brit. Ind. 7 : 260 (1896).

*Culms* tall, tufted, very slender, up to 1.5 m. high. *Leaf-blades* 30-45 cm. long, 6 mm. broad, flat, scaberulous, pale green ; *sheaths* smooth *ligule* large, oblong, rounded. *Panicle* 7.5-20 cm. long, loosely branched ; branches fascicled, scaberulous, naked below. Spikelets shortly pedicelled, suberect, 5 mm. long. *Glumes* subequal, lanceolate, finely acuminate, keels scaberulous, 1-3-nerved. *Lemma* glabrous,  $\frac{2}{3}$ - $\frac{3}{4}$  the lower glume, truncate, 4-cuspidate, awn subbasal, exserted ; callus hairs rather longer than the lemma ; *palea* as long as the glume.

Gilgit : Astor Valley, *Duthie*.

2. **Calamagrostis epigejos** Roth

*Calamagrostis epigejos* Roth, Tent. Fl. Germ. 1 : 34 ; Hook. f., Fl. Brit. Ind. 7 : 260 (1896).

Perennial. *Culms* erect, stout, up to 1.3 m. high. *Leaf-blades* scaberulous, long narrow, finely acuminate, glaucous : *ligule* oblong, rather long, acute. *Panicle* oblong or lanceolate, up to 30 cm. long, much branched ; branches usually erect. Spikelets shortly pedicelled, 5-6 mm. long, or dark purple. *Glumes* sub- or unequal, subulate-lanceolate, keels and margins scaberulous ; lower 1-nerved, the upper 1-to 3-nerved. *Lemma*  $\frac{1}{2}$  the upper glume, tip 2-fid ; awn dorsal, at or near the middle, as long as the lemma, smooth or scaberulous.

Baltistan : Indus Valley, near Katzma, *Duthie*.

### 3. *Calamagrostis emodensis* Griseb.

*Calamagrostis emodensis* Griseb., Goett. Nachr. 80 (1868); Hook. f., Fl. Brit. Ind. 7 : 261 (1896).

*Culms* stout, erect from a creeping, geniculate base, up to 1.5 m. high, bases of the culms clothed with the remains of old sheaths. *Leaf-blades* 30-40 cm. long, up to 8 mm. broad, flat, flaccid or thinly coriaceous scaberulous on both surfaces, long tapering to a fine point, many-nerved, glabrous; *sheath* scaberulous, striate, rather loose *ligule*, oblong membranous. *Panicle* effuse, soft, shining up to 20 cm. long; branches whorled,

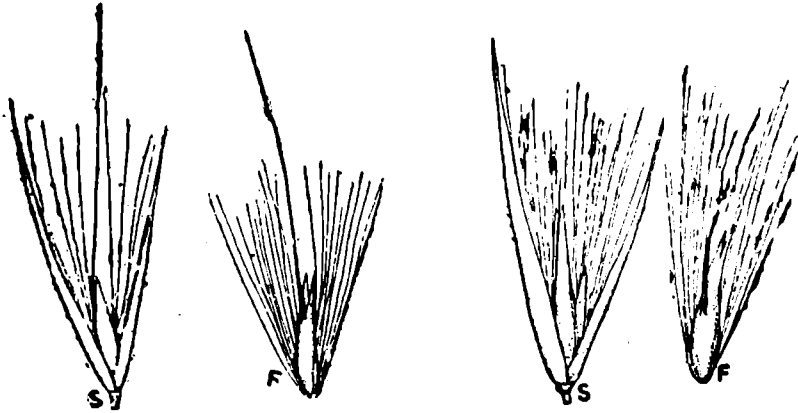


Fig. 168. a. *Calamagrostis emodensis*; b. *C. epigejos*.

naked for half their length; branches and branchlets scaberulous or smooth. Spikelets numerous, crowded. *Lower glume* 6 mm. long, lanceolate, long acuminate, 1-nerved, scarious on the margins, scabrid on the keel. *Upper glume* 6.5-7 mm. long, lanceolate, long acuminate, scabrid on the keel, scarious on the margins. *Lemma* glabrous on the dorsal surface, 2.5 mm. long, overtopped by the long (4 mm.) callus hairs, awned from below the tip, faintly 5-nerved; awn up to 7 mm. long; *palea* 2 mm. long, lanceolate. Grain spindle shaped, 1 mm. long.

Chitral : Shokor Shal, Per *Wendelbo*.

### 4. *Calamagrostis pseudophragmites* (Hk. f.) Koel.

*Calamagrostis pseudophragmites* (Hook. f.) Koeler. Des. Gram. 106.

*Calamagrostis littorea* Hook. f., Flor. Brit. Ind. 7 : 261 (1896) non DC.

*Calamagrostis lanceolata* Aitchis. in Jour. Linn. Soc 18 : 107 (1880) non Roth.

Perennial. *Culms* stout, thick, erect or ascending from a creeping base, up to 1.5 m. high. *Leaf-blades* up to 45 cm. long, 4 mm. wide, firm, smooth or scaberulous, flat or convolute; *sheaths* smooth, tight; *ligule* linear-oblong. *Panicle* dense or effuse, more or less erect, green

or purple ; branches and pedicels scaberulous. Spikelets 3-5 (-6) mm. long. *Glumes* un-or subequal subulate lanceolate, keels scaberulous ; lower longer than upper, 1-nerved, upper 3-nerved at the base, but sometimes both 3-nerved. *Lemma*  $\frac{1}{2}$ - $\frac{2}{3}$  as long as the spikelet, smooth or faintly scaberulous, faintly 5-nerved, truncate, erose or toothed, awn terminal in a notch or dorsal below the tip, not exerted.

Quetta Valley, *Lace*; Kagan Valley: Batakundi, Burwai, *M.S. Zahur*; Upper Swat, *Aslam Khan* ; Karakorum, *Shaukat* ; Quetta, *M. Nawaz, Asghar* ; Gilgit : Pishwari, *I.I. Chaudhri*.

### Agrostis Linn.

Annual or perennial grasses with usually flat leaves. Inflorescence an effuse or contracted panicle, usually much divided, rarely spikelike. Spikelets small, 1-flowered ; rachilla glabrous or finely hairy, not produced beyond the floret or produced into a fine point, usually disarticulating above the glumes, (in *A. semiverticillata* the spikelets fall entire; in *A. stewartii* the spikelets also fall entire but the disarticulation is carried further to the bases of the branches so that the whole panicle breaks up leaving the peduncle behind). Glumes equal or subequal, longer than the lemma, usually 1-nerved, keeled Lemma much shorter than the glumes, membranous, glabrous or hairy, usually truncate, 5- (rarely 3-) nerved, awned from the back or awnless, side nerves evanescent below often excurrent into fine mucros or bristles ; callus very short, glabrous or minutely hairy ; palea variable in size, hyaline.

#### KEY TO THE SPECIES

1. Glumes awned.....1. *A. subaristata*  
    Glumes awnless..... 2
2. Rhizomatous.....3  
    Non rhizomatous .....4
3. Ligules of the vegetative shoots 1.5-2 mm. long .....2. *A. gigantea*  
    Ligules of the vegetative shoots 0.5-2 mm. long .....3. *A. tenuis*
4. Palea short or 0, always less than  $\frac{1}{2}$  the lemma .....5  
    Palea more than  $\frac{1}{2}$  the length of the lemma .. .....7
5. Lemma hairy ; anthers 0.8-1.25 mm. long .....4. *A. pilosula*  
    Lemma glabrous.....6

6. Lemma awned ; anthers 1-1.25 mm. long... ..4. *A. canina*  
 Lemma awnless ; anthers 0.5 mm. long... ..6. *A. nervosa*
- 7 Lemma hairy ; anthers less than 1 mm. long... ..7. *A. munroana*  
 Lemma glabrous .....8
8. Rachilla disarticulating above the glumes ; plants with leafy stolons  
 ..... 8 *A. stolonifera*  
 Rachilla disarticulating below the glumes . . . . . 9
9. Spikelets falling entire, leaving the pedicels behind ... ..  
 ..... 9. *A. semiverticillata*  
 Spikelets falling with the pedicels ; branches and branchlets also  
 deciduous . . . . . 10. *A. stewartii*

### 1. *Agrostis subaristata* Aitchis. & Hemsl.

*Agrostis subaristata* Aitchis. & Hemsl. in Jour. Linn. Soc. Bot. 19: 192  
 (1882) ; Hook. f., Fl. Brit. Ind. 7 : 255 (1896).

Perennial. *Culms* up to 60 cm. high, geniculate-ascending, glabrous and smooth. *Leaf-blades* linear-acute, up to 12.5 cm. long, 6 mm. wide, flat, glabrous, scabrid on the nerves above and along the margins ; *sheaths* smooth ; *ligule* oblong, lacerate, 5-7 mm. long. *Panicle* linear-oblong, contracted, erect, up to 15 cm. long ; axis stiff, smooth ; branches semiverticillate, dense, unequal, up to 5 cm. long, hispidulous. Spikelets oblong, at length gaping, up to 2.5 mm. long. *Glumes* subequal, aristate, membranous, 1-nerved, scabrid. *Lemma* broadly elliptic-oblong, about 1.45 mm. long, 5-nerved, glabrous, shortly awned from the apex ; callus glabrous. *Palea* ovate-oblong, 1 mm. long.

Quetta ; Dir ; Swat ; Murree.

### 2. *Agrostis gigantea* Roth.

*Agrostis gigantea* Roth, Fl. Germ. 1 : 31 (1788).

*Agrostis alba* Linn., Sp. Pl. 93 (1753) ; Hook. f., Fl. Brit. Ind. 7 : 254 (1896).

Perennial with creeping rhizomes *Culms* tufted, 40-120 cm. high, erect or ascending from a decumbent base, rooting and branching from the lower nodes, slender to stout, 3-6-noded, smooth. *Leaf-blades* dull green, glabrous, rolled when young, upwards flat, firm, scabrid, finely pointed. 5-20 cm. long, 2-8 mm. wide ; *sheaths* rounded on the back,

smooth or scabrid ; *ligules* 1.5-6 mm. long, membranous, toothed. Panicle erect, oblong to ovate, usually open and very loose, 8-25 cm. long, 3-15 cm. wide, much branched, green or purplish; branches whorled, spreading, divided above the naked base, scabrid ; pedicels 0.5-3 mm. long ; rachilla disarticulating above the glumes at maturity. *Glumes* persistent, lanceolate in side view, finely pointed, as long as the spikelet, equal or slightly unequal; with upper shorter membranous, 1-nerved, scabrid on the keels. *Lemma*  $\frac{2}{3}$ - $\frac{3}{4}$  the length of the glumes, ovate-oblong or oblong, very blunt, 3-5-nerved, minutely hairy at the base, thin, awnless, rarely with a short awn from near the tip. *Palea*  $\frac{1}{2}$ - $\frac{2}{3}$  the length of the lemma. *Anthers* 1-1.5 mm. long.

Kagan Valley : Kagan ; Sharhan *M. S. Zahur* ; Baluchistan, without locality, *Lace. Thandiani, A. R. Beg* ; Chitral : Bumbrait, *A. R. Beg. Gujar, Dir, A. H. Khan* ; Murree. *Asghar Ali.*

## 2. *Agrostis tenuis* Sibth.

*Agrostis tenuis* Sibth. Fl. Oxon. p. 36.

A perennial, with short rhizomes or stolons. *Culms* up to 60 cm. high, erect, smooth. *Leaf-blades* up to 12 cm. long, 4 mm. wide, flat, smooth ; *sheaths* terete, smooth ; *ligules* 0.5-2 mm. long, mostly shorter than broad. *Panicle* pyramidal, usually lax, rarely somewhat dense, erect, up to 15 cm. long ; branches clustered, spreading, naked in the lower part, branched above. Spikelets lanceolate to narrowly oblong, 2-3.5 mm. long. *Glumes* equal or subequal, lanceolate, 1-nerved. *Lemma* 1.4-2.3 mm. long, ovate or elliptic, 5-nerved, awnless or shortly awned on the back. *Palea* more than  $\frac{1}{2}$  the length of the lemma. *Anthers* 1.5 mm. long.

Chitral, Bumbrait, *A. R. Beg.*

## 4. *Agrostis pilosula* Trin.

*Agrostis pilosula* Trin. in Mem. Acad. Petersb. ser. vi, 2 : 372 (1845).

*Calamagrostis pilosula* (Trin.) Hook. f., Fl. Brit. Ind. 7 : 263 (1896).

Annual. *Culms* 30-90 cm. high, tufted, erect from a short, inclined base *Leaf-blades* narrow, flat, up to 6 mm. broad, flaccid, smooth or sub-scaberulous ; *sheaths* shorter than the internodes, smooth ; *ligules* 1-2 mm. long, membranous. *Panicle* effuse or contracted ; branches long or short, suberect or spreading, 2.5-10 cm. long, naked below and with

loosely crowded spikelets at the extremities, or contracted with sub-erect shorter branches; branches, branchlets and pedicels minutely scabrid. Spikelets green or purple, 2.5-5.5 mm. long. *Glumes* subequal, oblong-lanceolate, acute or acuminate, 1-nerved, smooth, keels

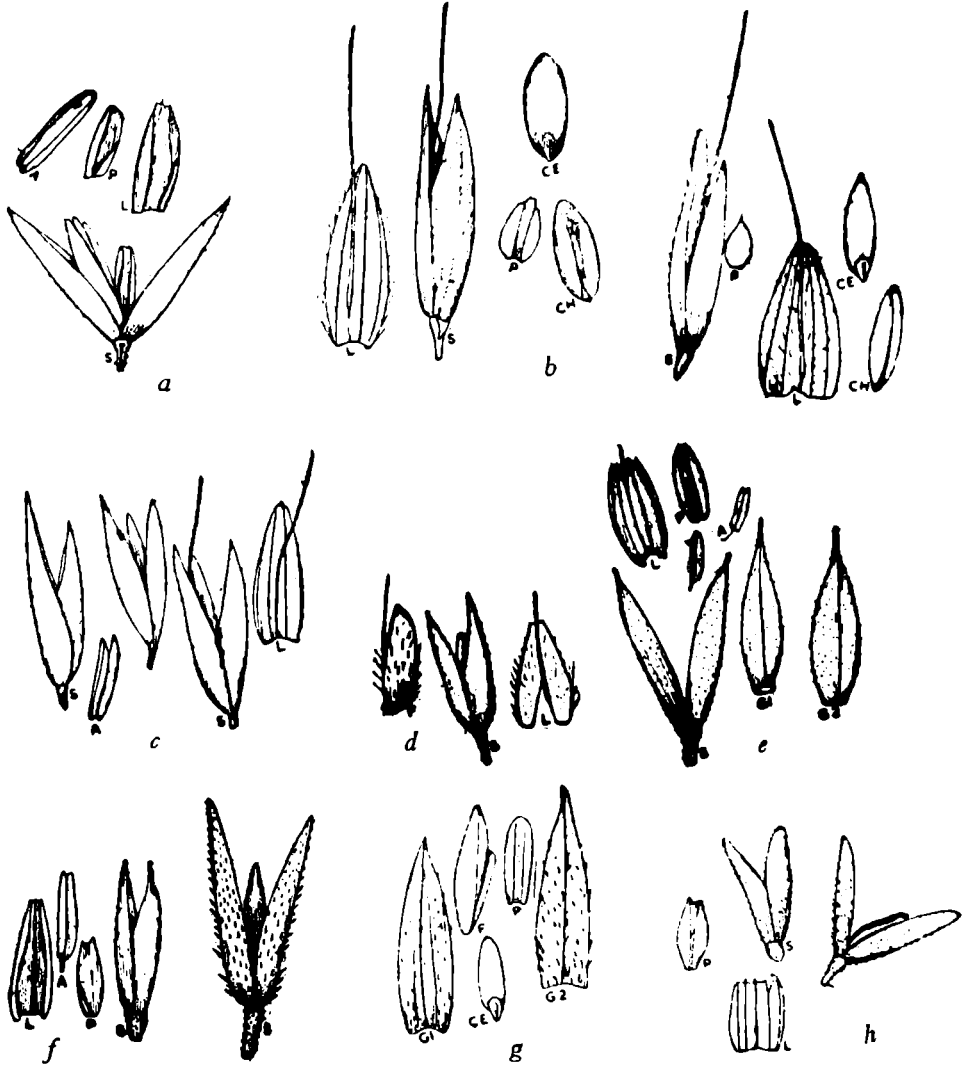


Fig. 169. *Agrostis* spp. a. *A. gigantea*; b. *A. pilosula*; c. *A. canina*; d. *A. munroana*; e. *A. subaristata*; f. *A. stolonifera*; g. *A. stewartiana*; h. *A. semiverticillata*.

smooth, rarely scaberulous; lower as long as the spikelet; upper slightly shorter. *Lemma*  $\frac{1}{4}$ - $\frac{1}{3}$  shorter than the lower glume, hyaline, hairy all over, lateral nerves often produced as short points at the top. *Palea* usually very minute, but never exceeding  $\frac{1}{2}$  the lemma; awn more or less exserted, arising from the lower  $\frac{1}{3}$ - $\frac{1}{4}$ . *Anthers* 0.75-1 mm. long.

KEY TO THE VARIETIES

1. Glumes 4.5-5.5 mm. long, twice or more than twice as long as the lemma..... var. *ciliata*
- Glumes at the most 4 mm. long, not twice as long as the lemma .... 2

2. Panicle effuse, branches 6-10 cm. long, bare in the lower half  
 ... .. var. *pilosula*

Panicle contracted or moderately spreading; branches short or very short ..... 3

3. Panicle more or less dense, interrupted, with short branches 1-2 cm. long..... var. *royleana*

Panicle more open, branches less than 6 cm. long; leaves at the base filiform..... var. *filifolia*

— var. *ciliata* (Nees) Bor in Kew Bull. 1954 : 459 (1954).

Dir-Gujar, A. R. Beg; Thandiani, A. H. Khan.

— var. *pilosula* Bor, l.c. 458.—*Calamagrostis pilosula* var. *scabra* Hook. f., Brit. Ind. 7 : 264 (1896).

Hazara : Siran Valley; Duthie, R. N. Parker; Kagan Valley : Kagan, M. S. Zahur; Murree, Asghar; Swat : Madian, Shaukat.

— var. *royleana* (Trin) Bor, l.c. 459.

Hazara : Shadal, Inayat.

— var. *filifolia* Bor, l.c. 459.

Nathiagali, Murree Hills, A. R. Beg.

### 5. *Agrostis canina* Linn.

*Agrostis canina* Linn., Sp. Pl. 92 (1753); Hook. f., Brit. Ind. 7 : 255 (1896).

Perennial, with slender creeping stolons, rooting at the nodes and producing tufts of fine leaf-shoots. Culms erect or ascending from a prostrate base, sometimes branching and rooting at the lower nodes, slender, 2-4 noded, smooth. Leaf-blades glabrous, finely pointed, 2-15 cm. long, flat or rolled, 1-3 mm. wide, soft, finely ribbed above, scabrid; sheaths rounded on the back, scabrid upwards or usually smooth; ligules membranous, often pointed, 2-4 mm. long. Panicle lanceolate to broadly ovate, usually rather loose and open, or becoming somewhat dense, erect or nodding 3-16 cm. long. up to 7 cm. wide, purplish, reddish or green; branches whorled, naked in the lower part, branched upwards, minutely scabrid, spreading in anthesis; pedicels 1-3 mm long. Spikelets lanceolate or narrowly oblong, 1.7-3 mm. long; rachilla disarticulating above the the glumes at maturity. Glumes persistent, lanceolate, pointed,



1-nerved, membranous, the lower as long as the spikelet, minutely scabrid on the keel; the upper slightly shorter, scabrid only near the tip. *Lemma*  $\frac{2}{3}$  the length of the glumes, ovate-oblong, blunt, 4-5-nerved, minutely hairy at the base, awned from near the base, the awn exerted from the glumes, or often awnless. *Palea* minute. *Anthers* 1-1.5 mm. long.

Kagan Valley: Sharhan, Babusar Pass; Gilgit, I. I. Cahudhri! Chitral: Shokor Shal, P. Wendelbo; Chitral, A.R. Beg.

#### 6. *Agrostis nervosa* Nees

*Agrostis nervosa* Nees ex Trin. in Mem. Acad. Sci. Petersb. ser. VI, 6, 2 328 (1841).

*Agrostis clarkei* Hook. f., Fl. Brit. Ind. 7: 257 (1896).

*Culms* very slender, 15-35 cm. high, erect or geniculate-ascending. Lowest leaves filiform, upper flat, all very narrow, scaberulous; *ligules* 2.4 mm. long. Panicle broadly pyramidal, 3.7-10 cm. long; branches spreading in anthesis and fruiting, sparingly branched, smooth or nearly so, naked below, lower geminate or in whorls of 3-5. *Spikelets* 2-2.5 mm. long, green, purplish or very dark purple. *Glumes* subequal; lower 2.75-3 mm. long, acuminate; upper 2.5-2.75 mm. long, narrowly lanceolate, acuminate. *Lemma* 1.8-2 mm., long, glabrous, truncate; awnless, 5-nerved, nerves slender, *Palea* very minute or 0. *Anthers* 0.6 mm. long.

Hazara; Thandiani; Mokhshpuri, R. R. Stewart. Usually above 8,000 ft.

#### 7. *Agrostis munroana* Aitchis. & Hemsl.

*Agrostis munroana* Aitchis. & Hemsley in Jour. Linn. Soc. Bot. 19: 192 (1882).

*Calamagrostis munroana* (Aitchis. & Hemsl.) Boiss., Fl. Orient. 5: 523 (1884); Hook. f., Fl. Brit. Ind. 7: 263 (1896.)

*Culms* 15-45 cm. high, tufted, very slender. *Leaf-blades* 5-20 cm. long, narrow, scaberulous or nearly smooth, flaccid; *sheaths* nearly smooth; *ligule* variable. *Panicle* oblong or pyramidal, 5-12.5 cm. long; branches erect or spreading, lower fascicled or 2-3-nate, smooth or minutely scaberulous, lower often long spreading and naked below. *Spikelets* 1.6-2.5 mm. long, pedicelled, green or purplish. *Glumes* subequal, oblong-lanceolate, acute, 1-nerved, keels nearly smooth. *Lemma*  $\frac{3}{4}$  the glumes, broadly truncate, hairy all over; awn infra-median,

included or 0; callus shortly hairy. *Palea* as long as the lemma or  $\frac{1}{2}$  shorter. *Anthers* less than 1 mm. long.

Kagan Valley: Sharhan, M. S. Zahur; Murree Hills. A fairly common grass usually above 5,000 ft.

### 8. *Agrostis stolonifera* Linn.

*Agrostis stolonifera* Linn., Sp. Pl. 62 (1753).

*Agrostis verticillata* Hook. f., Fl. Brit. Ind. 7: 254 (1896) non Vill.

A perennial, non rhizomatous grass with numerous creeping surface stolons, the latter rooting at the nodes. *Culms* slender, ascending from a prostrate base, up to 50 cm. high. *Leaf-blades* linear, flat, 1-0 cm. long, usually 1-3 mm. wide, minutely scabrid on the lower surface; *sheaths* smooth or glabrous, without auricles; *ligule* membranous, 1-6 mm. long. Panicle oblong, up to 15 cm. long, somewhat loose but afterwards contracted; branches whorled, closely divided, all or some of them spiculate from the base. *Spikelets* 2-2.5 mm. long. *Glumes* persistent, as long as the spikelet, equal or slightly unequal, narrowly lanceolate to oblong-lanceolate in side view, pointed, 1-nerved, scabrid upwards on the keel. *Lemma* up to  $\frac{3}{4}$  the length of the glumes, ovate or oblong, very blunt, finely 5-nerved, usually awnless, rarely with a short awn from near the tip; *palea* up to  $\frac{2}{3}$  the length of the lemma. *Anthers* 1-1.5 mm. long.

Baluchistan, *Stocks*; Swat, Kalam; Kagan Valley: Kagan, Batakundi, M. S. Zahur; Thandiani, A. R. Beg; Murree, R. R. Stewart; Poonch.

### 9. *Agrostis semiverticillata* (Forsk.) Christ.

*Agrostis semiverticillata* (Forsk.) Christensen in Dansk Bot. Archiv, 4: 12 (1922).

*Phalaris semiverticillata* Forsk., Fl. Aeg.-Arab, 17 (1775).

*Polygogon semiverticillata* Forsk. Hulten in Uppsala Univ. Arsskr. no. 7: 74 (1945).

*Agrostis verticillata* Vill., Pl. Dauph. 2: 74.

Perennial. *Culms* 15-46 cm. high, loosely tufted or more or less creeping at the base then geniculate and ascending, often rooting and branching at the lower nodes, glabrous, more or less striate, smooth. *Leaf-blades* up to 15 cm. long and 2-8 mm. wide, flat, pointed, scaberulous on both surfaces and along the margins; *sheaths* terete, rather loose, striate, smooth or upwards scaberulous; *ligule* 2.5-5 mm. long, truncate or obtuse, more or less dentate, asperulous on the back. *Panicle* ovate or oblong, up to 7.5 cm. long, erect, dense, contracted or spreading; axis rigid, glabrous, smooth to slightly scabrid; branches

semiverticillate, more or less scabrid ; primary branches long naked at the base ; pedicels shorter than the spikelets, scabrid ; secondary branches with numerous crowded spikelets. Spikelets 1.8-2.5 mm. long. *Glumes* 1.8-2.5 mm. long, equal or subequal, membranous, lanceolate, subacute, 1-nerved, scaberulous, keel strongly scabrid, minutely ciliolate on the margins. *Lemma*  $\frac{1}{2}$  the length of the glumes, oval, truncate, membranous, smooth, faintly 5-nerved, awnless. *Palea* equalling the lemma. Anthers 0.5-0.7 mm. long.

Kagan Valley ; *M. S. Zahur* ; Swat : Mingora ; *Shaukat Ali* ; Quetta, Hanna Valley, *Asghar* ; Dir, *A. R. Beg* ; Potha ; Kuldana, *R. R. Stewart*.

#### 10. *Agrostis stewartii* Bor

*Agrostis stewartii* Bor in Kew Bull. 1956 : 255 (1956).

Perennial. *Culms* erect or decumbent, rooting from the lower nodes, up to 65 cm. high, smooth and glabrous. *Leaf-blades* linear-acuminate, flaccid, rounded at the base, scabrid on the surfaces and along the margins ; *sheaths* longer than the internodes, loose, glabrous, the basal separating from the internodes, the lower smooth, the upper scabrid ; *ligule* membranous, 4-6 mm. long, scabrid on the back. *Panicle* up to 18 cm. long, 5 cm. wide ; axis smooth and glabrous below but scabrid towards the top ; branches densely whorled at the nodes ; branchlets also in whorls on the nodes of the branches ; the branches branchlets and pedicels all deciduous. *Glumes* similar, lower 3.5 mm. long, upper slightly shorter, elliptic-acute when expanded, navicular, scabrid or muriculate on the dorsal surface. *Lemma* oblong-elliptic, hyaline, 3 mm. long, 5-nerved, glabrous, smooth, nerves attenuated into 5 short teeth. *Palea* hyaline, 1-1.25 mm. long, oblong, lacerate at the tip. *Anthers* 1-1.5 mm. long.

Swat State : Kalam, *R. R. Stewart* ; Kagan : Nuri, *Inayat*.

#### 5. *Deyenxia* Clar.

Perennial grasses, often stout but sometimes slender. Inflorescence a panicle often large and effuse, occasionally small and contracted. Spikelets disarticulating above the glumes, 1-flowered, subterete. Glumes unequal, scaberulous, lower, 1-nerved, upper 3-nerved. Lemma shorter than the glumes, hyaline, truncate, crenate or cleft, paleate, 5-nerved, awned from the base or above the middle, never from the tip, nerves parallel, the middle produced into an awn ; palea hyaline, oblong, narrow ;

rachilla produced beyond the lemma, penicillate with long white hairs often as long as the lemma. Stamens 3 : lodicules 2 ; styles 2 ; stigmas plumose.

## KEY TO THE SPECIES

Awn of lemma inserted above the middle... .. 1. *D. scabrescens*  
 Awn of lemma basal or sub-basal... .. 2. *D. arundinacea*

1. *Deyeuxia scabrescens* (Griseb.) Munro

*Deyeuxia scabrescens* (Griseb) Munro ex Duthie in Atkins, Gaz. North-West Prov. Ind 628 1882) ; Hook. f., Flor. Brit. Ind. 7 : 267 (1996).

*Calamagrostis scabrescens* Griseb in Goett Nackr. (1868) 79.

A stout grass up to 1.5 m. high. *Leaf-blades* flat or convolute, 15-45 cm. long, up to 8 mm. broad ; *sheaths* rather loose, minutely scaberulous ; *ligule* very long, membranous, lacerate. *Panicle* contracted, up to 20 cm. long ; branches and branchlets scaberulous. Spikelets 6-6.5 mm. long. *Lower glume* 5.5-6 mm. long, 1-nerved, keeled, lanceolate, scabrid on the

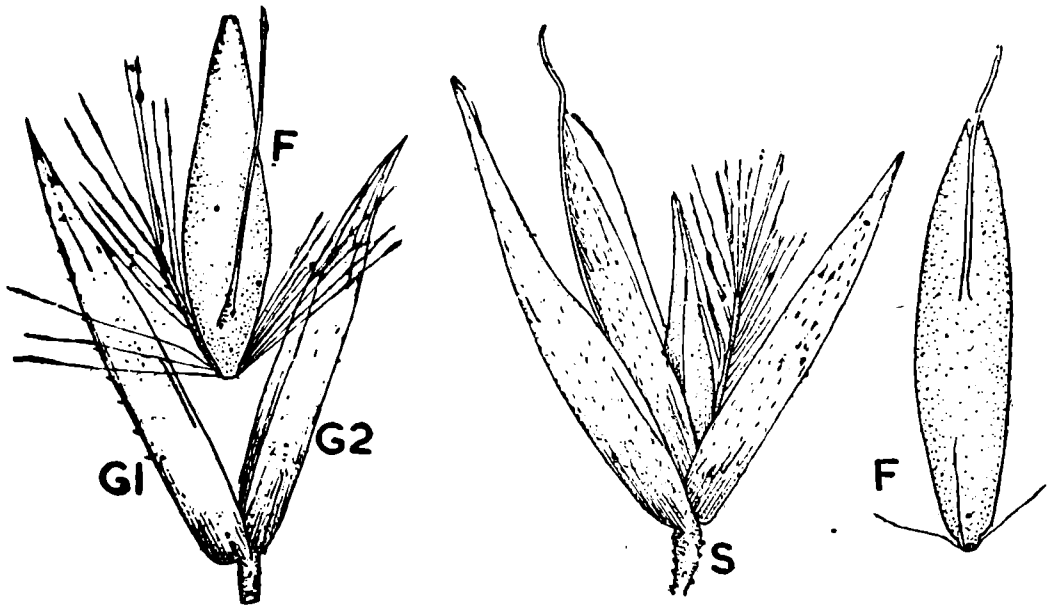


Fig. 170. *Deyeuxia* spp. a. *D. scabrescens* ; b. *D. arundinacea*.

keel and on the dorsal surface. *Upper glume* 6-6.5 mm. long, lanceolate, acute, 3-nerved, scabrid on the keel and on the dorsal surface and minutely toothed on the margins near the apex. *Lemma* 5 mm. long, ovate-lanceolate, 5-nerved, very minutely scabrid, awned from the back about  $\frac{1}{3}$  the way down from the tip ; awn scabrid, 6 mm. long ; *palea* 3 mm. long. *Anthers* 2 mm. long. *Ovary* smooth and glabrous, 1.5 mm. long.

Beyond Bishigram, Swat, R. R. Stewart & A. R. Beg ; Baltistan, Ghondokoro Glacier, E. Nasir and G. L. Webster.

## 2. *Deyeuxia arundinacea* (Linn.) Bor

*Deyeuxia arundinacea* (Linn.) Bor

*Agrostis arundinacea* Linn., Sp. Pl. 61 (1753).

*Deyeuxia sylvatica* Kunth, Rev. Gram. 1 : 77 (1829) Hook. f., Flor. Brit. Ind. 7 : 266 (1896).

*Culms* 90-150 cm. high, arising from a creeping base. *Leaf-blades* linear, finely acuminate, 30-60 cm. long, 6-12 mm. broad, scabrid beneath ; ligule short. *Panicle* erect or drooping, contracted, at length open, 40 cm. long. *Spikelets* 4 mm. long, green or purplish. *Glumes* subequal, ovate-lanceolate ; lower 1-nerved ; upper 3-nerved. *Lemma* rather shorter than the lower glume, tip shortly lacerate ; callus loosely bearded ; awn basal or sub-basal, shortly exserted, about twice as long as the lemma ; *palea* rather shorter than its lemma ; rachilla shortly bearded.

Kishenganga Valley, Deosai Pass, R. R. & I. D. Stewart.

## 6. *Alopecurus* Linn.

Annual or perennial usually densely tufted grasses. Inflorescence a dense, cylindric to oblong, solitary, spiciform panicle or raceme. Spikelets strongly laterally compressed, usually awned, falling entire ; rachilla jointed below the glumes and between the floret, not produced beyond the floret. Glumes equal or subequal, awnless, cuspidate and shortly awned, keeled, usually connate by their margins in the lower part or up to the middle, 3-nerved, membranous to herbaceous, scabrid or ciliate on the keels, with keels narrowly winged or wingless. Lemma apiculate to truncate, 3- to 5-nerved, with the nerves more prominent upwards, usually connate along its margins towards the base, awned from the back below the middle, 3-nerved, membranous to herbaceous, scabrid or ciliate on the keels, with keels narrowly wingless, rarely from above the middle ; awn exserted or enclosed ; palea rarely present. Ovary glabrous, styles usually more or less connate ; stigmas shortly plumose, terminally exserted. Grain free between the lemma and palea,

1. Awn enclosed by the glumes .....2  
     Awn conspicuous, projecting from the glumes..... 3
2. Margins of glumes united only near the base, keels of glumes long-ciliate..... 1. *A. aequalis*  
     Margins of glumes united to the middle, keels of glumes scabrid.....  
     ..... 2. *A. nepalensis*
3. Spikelets 2.5-3.5 mm. long..... 3. *A. geniculatus*  
     Spikelets 4.5-7 mm. long .....4
4. Margins of glumes united up to  $\frac{1}{2}$  their length ; keels of glumes minutely hairy..... 4. *A. myosuroides*  
     Margins of glumes united only near the base, keels of glumes fringed with long fine hairs..... 5
5. Glumes aristately acuminate, densely woolly ..... 5. *A. himalaicus*  
     Glumes acute, conspicuously ciliate only along the keels.....  
     ..... 6. *A. arundinaceus*

### 1. *Alopecurus aequalis* Sobol.

*Alopecurus aequalis* Sobol., Fl. Petropol. 16 (1799).

*Alopecurus aristulatus* Michx., Fl. Bor. Amer. 1 : 43 (1803) ; Hook. f., Flor. Brit. Ind. 7 : 238 (1896).

*Alopecurus geniculatus* L. ssp. *fulvus* (Sm.) Trabut in B. & T., Fl. Alg. Mon. 146 ; Maire, Fl. de l'Afrique du Nord, 2 : 100 (1953).

Annual, biennial or a short-lived perennial. *Culms* 10-35 cm. high, usually ascending from a geniculate or creeping base, slender, smooth. *Leaf-blades* glabrous, pointed. 2-10 cm. long, 2-5 mm. wide, flat, nerves scabrid ; *sheaths* smooth, upper sometimes inflated ; *ligules* membranous, blunt, up to 5 mm. long. *Spikelets* elliptic or oblong, very blunt, 2-2.5 mm. long, flattened, 1-flowered, falling entire at maturity. *Glumes* similar, keeled, with the margins free nearly, to the base, narrowly oblong, blunt, thinly membranous, 3-nerved with a fringe of silky hairs on the keels and shorter ones on the sides. *Lemma* as long as or very slightly longer than the glumes, keeled, broadly elliptic, very blunt, thinly membranous, 4-nerved. smooth with the margins united for up to half their length, awned on the back just below the middle, with the awn included in the glumes or very slightly protruding from them. *Palea*

absent. *Anthers* 1-1.3 mm. long, bright orange or golden yellow at maturity.

Kagan valley: Lulusar, M. S. Zahur ; Basal, I. I. Chaudhri.

## 2 *Alopecurus nepalensis* Trin

*Alopecurus nepalensis* Trin. ex Steud., Syn. Pl. Gram. 148 (1854); Hook. f., Fl. Brit. Ind. 7 : 239 (1896).

Annual. *Culms* slender, simple, erect or geniculately ascending, up to 30 cm. high. *Leaf-blades* linear, acute, 5-10 cm. long, 4-6 mm. broad.



Fig. 171. *Alopecurus* spp. a. *A. nepalensis* ; b. *A. myosuroides* ; c. *A. aequalis* ; d. *A. geniculatus*.

glabrous ; *sheaths* glabrous ; *ligule* membranous. *Panicle* cylindrical, 5-7.5 cm. long, 3-4 mm. wide, compact. *Spikelets* obovate, subacute, 2.5-3 mm.

long, much compressed. *Glumes* connate to the middle, keeled, keels narrowly winged, not ciliate, scabrid. *Lemma* narrowly oblong, tip truncate, exerted; awn subbasal, very short or 0.

Common throughout the plains.

### 3. *Alopecurus geniculatus* Linn.

*Alopecurus geniculatus* Linn., Sp. Pl. 60 (1753); Hook. f., Fl. Brit. Ind. 7: 239 (1896).

Perennial. *Culms* 15-45 cm. high, ascending from a geniculate or prostrate base and rooting at the nodes, slender, smooth. *Leaf-blades* glabrous, pointed, 2-12 cm. long, 2-7 mm. wide, scabrid on the nerves or smooth below; *sheaths* smooth, the upper somewhat inflated; *ligules* blunt, 2-5 mm long, membranous. *Spikelets* oblong, 2.5-3.3 mm. long, flattened. *Glumes* narrowly oblong, blunt, keeled, with the margins free nearly to the base, thinly membranous, 3-nerved, fringed with silky hairs on the keel and with appressed hairs on the sides. *Lemma* slightly shorter than or as long as glumes, broadly oblong or ovate, very blunt, keeled, with the margins united near the base, smooth, 4-nerved, awned just above the base, with the awn exceeding the glumes by 2-3 mm. *Palea* absent. *Anthers* 1.5-2 mm. long, yellow or purple.

Kagan Valley; Swat.

### 4. *Alopecurus myosuroides* Huds.

*Alopecurus myosuroides* Huds., Fl. Angl. 23 (1762).

*Alopecurus agrestis* Linn., Sp. Pl. ed. 2, 89 (1762); Hook. f., Fl. Brit. Ind. 7: 239 (1896).

Annual. *Culms* 20-80 cm. high, tufted, or sometimes solitary, erect or geniculate at the base, slender, few-noded, smooth. *Leaf-blades* 3-16 cm. long, 3-6 mm. wide, narrowly cylindrical, tapering upwards, glabrous; *sheaths* smooth, the uppermost somewhat inflated; *ligules* blunt, membranous, 2-5 mm. long. *Spikelets* narrowly oblong or lanceolate-oblong, 4.5-7 mm. long, flattened, 1-flowered, falling entire at maturity. *Glumes* united by their margins for one-third to half their length, narrowly oblong to lanceolate, pointed, 3-nerved, firm, narrowly winged on the keels, minutely hairy there and on the nerves near the base. *Lemma* as long as or slightly longer than the glumes, ovate, blunt, keeled, with the margins united for one-third above the base, membranous, 4-nerved, smooth, awned on the back from near the base, with the awn exceeding the tip of the lemma by 4-8 mm. *Palea* absent. *Anthers* 3-4 mm. long.

Sangla Hill; Lahore; Swat State; Khaza Khela; Kagan Valley;



Parachinar ; Peshawar ; Fort Sandeman ; Abbottabad.

5. ***Alopecurus himalaicus* Hook. f.**

*Alopecurus himalaicus* Hook. f., Fl. Brit Ind. 7 : 238 (1896).

Perennial. Culms 15-45 cm. high, subsolitary, erect from a creeping base, rather stout. Leaf-blades 7.5-12.5 cm. long, erect or spreading, upper shorter, lanceolate-acuminate ; upper sheaths inflated, 7.5-12.5 cm.

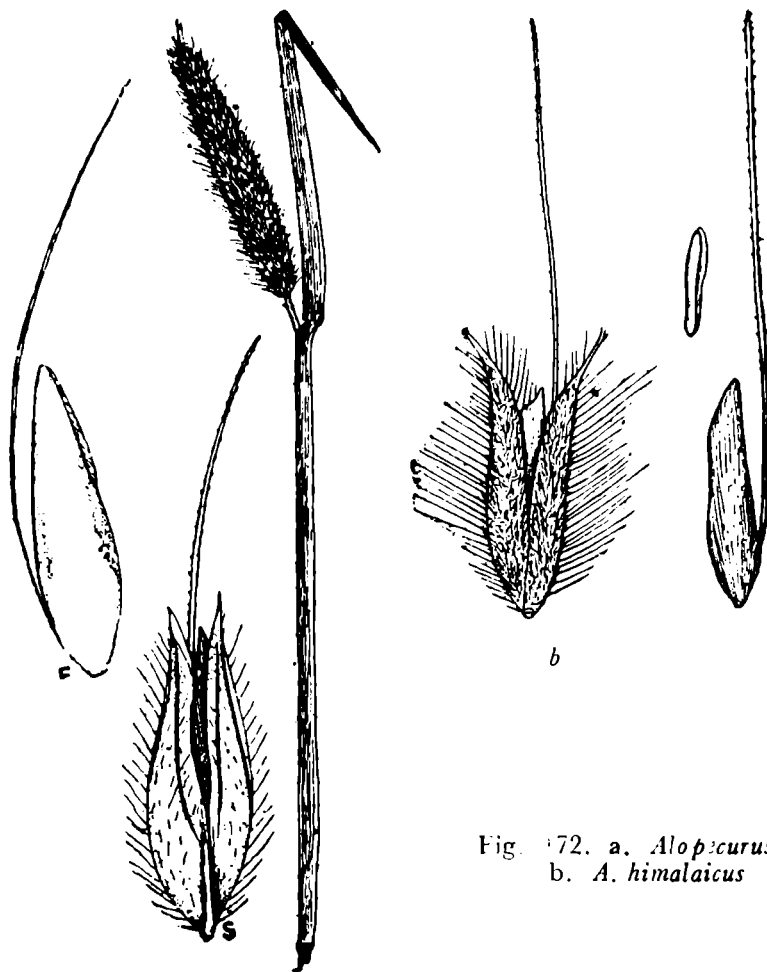


Fig. 172. a. *Alopecurus arundinaceus*  
b. *A. himalaicus*

long, lower appressed ; *ligule* large, scarious, toothed. Panicle oblong or subcapitate, 2.5-3.7 cm long, grey-green or purplish. Spikelets 5-6 mm. long. *Glumes* lanceolate, subaristately acuminate, hirsute with spreading hairs longer than the spikelet is broad, connate below, tips dark. *Lemma* 1/4 shorter than the glumes, obtuse, apiculate ; awn twice as long as the spikelet or more.

Chitral : Och Anzog, Arne Randers-Heen ; south Barum Glacier,  
I. I. Chaudhri.

6. **Alopecurus arundinaceus** Poir.

*Alopecurus arundinaceus* Poir., Encycl. 8 : 776 (1808) ; Hook. f., Fl. Brit. Ind. 7 : 238 (1896).

*Alopecurus pratensis* Aitchis Cat. Panjab Pl. 188 (1869) non Linn.

*Alopecurus pratensis* Linn. ssp. *arundinaceus* (Poiret) Husnot, Gram. 5 (1896).

A perennial with a creeping rootstock. Culms 60-120 cm. high, erect, slender. Leaf-blades 15-25 cm. long, acuminate ; upper sheaths slightly inflated, 10-15 cm. long ; ligule rounded. Panicle cylindrical, 2.5-7.5 cm. long, 6-8 mm. wide, green, soft. Spikelets 5-7 mm. long, subsilky. Glumes lanceolate, connate at the base or up to 1/3 keel ciliate with long hairs. Lemma 6 mm. long, acute, margins united for 3/4 above the base ; awn sub-basal, scabrid, up to 8 mm. long, inserted 1.5 mm. above the base. Anthers 3.5 mm. long, yellow.

Peshawar ; Quetta ; Gilgit, Sunji Valley ; Kagan Valley, Naran ; Saiful Maluk ; Kamri Pass, Deosai Plain.

7. **Polypogon** Desf.

Annual tufted grasses with flat leaves. Inflorescence a dense spikelike, often lobed panicle. Spikelets disarticulating from the pedicels ; rachilla not produced beyond the floret. Glumes subequal, awned from the entire or 2-lobed tips. Lemma shorter than the glumes, very thin to hyaline, glabrous, truncate, faintly 5-nerved, awn very fine usually deciduous, sometimes reduced to a mucro or absent. Palea 2-keeled, slightly shorter than the lemma. Ovary glabrous ; styles distinct, stigmas laterally exerted, loosely plumose.

## KEY TO THE SPECIES

1. Glumes hardly emarginate, shortly ciliate along the margin with hairs at the base not squamigerous ; lemma aristate... .. 2  
 Glumes deeply 2-fid, long-ciliate along the margin with hairs at the base squamigerous ; lemma muticous ... .. 1. *P. maritimus*
2. Awns 3-9 mm. long..... 2. *P. monspeliensis*  
 Awns 1.5-3.5 mm. long ..... 3. *P. fugax*

1. **Polypogon maritimus** Willd.

*Polypogon maritimus* Willd., N. Schr. Ges. Naturf. Fr. Berlin, 3 : 422 (1801) ; Boiss., Fl. Orient. 5 : 521 (1884).

Annual. *Culms* slender, 10-30 cm. high, solitary or fascicled, erect or geniculate-ascending, glabrous, smooth. *Leaf-blades* 5 cm. long, 4 mm. broad, slightly scabrid; *sheaths* rounded on the back, tight or slightly inflated; *ligules* up to 6 mm. long, obtuse, more or less lacerate, slightly scabrid. *Panicle* more or less long-peduncled, cylindrical or oblong, up to 5 cm. long, 1 cm. broad, not or slightly lobed; axis smooth; branches fascicled, erect, much branched, slightly scabrid; pedicels shorter than the spikelets, pubescent-scabrid. *Glumes* subequal, lanceolate, ca. 2-2.5 mm. long, 1-nerved, hyaline, long-ciliate along the margins, with hairs on the base squamigerous, deeply 2-fid with acute lobes, bearing in the sinus an awn about 7 mm. long. *Lemma* ca. 0.7 mm. long, oval, hyaline, glabrous, truncate and denticulate at the apex, obscurely 5-nerved, muticous. *Palea* subequal, 2 nerved, more or less 2-dentate. *Anthers* 0.45 mm. long.

Baluchistan, *Stocks*.

## 2. *Polypogon monspeliensis* (L.) Desf.

*Polypogon monspeliensis* (Linn.) Desf., Fl. Atlant. 1 : 67 (1738); Hook. f., Fl. Brit. Ind. 7 : 245 (1896).

*Alopecurus monspeliensis* Linn., Sp. Pl. 61 (1753).

Annual. *Culms* solitary or more often fascicled, erect or geniculate-ascending, often more or less creeping and rooting at the base, up to 1 m. high, glabrous, slightly scabrid below panicle, often more or less branched. *Leaf-blades* flat, up to 30 cm. long, 13 mm. broad, tapering to a fine point, scabrid on the two surfaces and along the margins; *sheaths* rounded, tight, scabrid; *ligules* up to 1 cm. long, obtuse, often lacerate, slightly scabrid. *Panicle* long-peduncled, ovoid or oblong, up to 16 cm. long and 4 cm. broad, more or less lobed; axis slightly scabrid; branches fascicled, much branched, erect or spreading-erect; pedicels scabrid, shorter than the spikelets. *Glumes* subequal, linear-oblong, ca. 2 mm. long, 1-nerved, bearing on their back in the lower half, short, coarse hairs, slightly arcuate, short-hairy along the margins, scaberulous and more shortly hairy in the upper half, slightly emarginate, awned from the sinus; awn up to 9 mm. long. *Lemma* hyaline, short, ca. 1 mm. long, oval, obtuse and denticulate at the apex, obscurely 5-nerved, the median nerve produced into an awn which is two or three times longer than the lemma. *Palea* hyaline, 2-nerved, subequal, 2-dentate. *Anthers* 0.4 mm, long.

Throughout the plains and hills in marshes.

### 3. *Polypogon fugax* Nees

*Polypogon fugax* Nees ex Steud., Pl. Gram. 184 (1854).

Annual. Culms up to 50 cm. high, geniculate-ascending, glabrous, smooth. Leaf-blades up to 15 cm. long, 10 mm. wide, flat, glabrous on both surfaces; sheaths somewhat loose, smooth; ligules oblong, 5-8 mm. long. Panicle oblong or ovate-oblong, usually more or less lobed and interrupted below, up to 12 cm. long. Spikelets oblong, 2.5-3 mm. long, green. Glumes subequal or the lower somewhat longer than the upper, lanceolate, slightly 2-lobed at the tip, ciliate on the margins below the middle; awn 1.2-3.7 mm. long. Lemma broadly elliptic-oblong, 1.2-1.8 mm. long, minutely 4-toothed, obscurely 5-nerved, awned at or near the apex; awn up to 2.5 mm. long. Palea as long as the lemma, finely 2-nerved. Anthers 0.6-0.8 mm. long.

Lahore; Rawalpindi; Quetta; Swat; Mingora. Very common.

### Tribe 10: Hordeae

Spikelets 1- to many-flowered, solitary or in clusters of 2-6, mostly bisexual and sessile or the lateral spikelets of a cluster sometimes shortly pedicelled and male or neuter, alternating on opposite sides of the continuous or jointed rachis of solitary spikes or spike-like racemes; rachilla disarticulating above the glumes and between the florets or continuous in cultivated races; glumes well developed; lemmas at length indurated, 5- to 9-nerved, awnless or awned from the tip.

#### KEY TO THE GENERA

1. Ovary glabrous; lodicules glabrous; grain not grooved with the hilum; hilum small; lemmas 1- to 3-nerved..... 1. *Parapholis*  
 Ovary hairy; lodicules hairy; grain longitudinally grooved with the linear hilum as long as the grain; lemmas 3- to 5- or more-nerved..... 2
2. Lemma membranous, slightly shorter than the glumes, 3 to 5-nerved  
 ..... 2. *Henrardia*  
 Lemma indurated, usually exceeding the glumes, 5 or more-nerved..... 3
3. Spikelets solitary at each node of the rachis..... 4

- Spikelets more than one at each node of the rachis .....10
4. Lemmas without a callus ..... 5  
 Lemmas with a distinct callus, furrowed at the base... .....7
5. Spikelets rounded on the back, usually terminated by awns .....  
 ..... 3. *Aegilops*  
 Spikelets compressed ; glumes keeled, not terminated by awn.... 6
6. Glumes ovate, ventricose at the base, 3-nerved..... 4. *Triticum*  
 Glumes linear, subulate-aristate, 1-nerved ..... 5. *Secale*
7. Spikelets dimorphic..... 6. *Heteranthelium*  
 Spikelets all fertile..... 8
8. Glumes not keeled, many-nerved ; awns 4-7 cm. long ; rachilla joints  
 distinct, 3-4 mm. long..... 7. *Anthosachne*  
 Not combining the above characters... ..... 9
9. Perennial ; spikes long, with a terminal spikelet ; lemmas rounded on  
 the back ; glumes 3- to 11-nerved..... 8. *Agropyron*  
 Annual ; spikes short, very dense without a terminal spikelet ;  
 lemmas keeled ; glumes 1- rarely indistinctly 5-nerved... ..  
 ..... 2. *Eremopyrum*
10. Spikelets 1- flowered, 3 at each node of the rachis, the median sessile  
 and the two lateral pedicelled male or neuter ..... 10. *Hordeum*  
 Spikelets 2-to 6-flowered, 2 or 3 at each node of the rachis.....11
11. Spikelets with all the florets bisexual ..... 11. *Elymus*  
 Spikelets with the lower floret bisexual, the upper rudimentary ;  
 glumes connate at the base ..... 12. *Taeniatherum*

### 1. *Parapholis* C. E. Hubb.

Low annual with slender cylindric spikes. Spikelets 1- to 2-flowered, embedded in the cylindric articulate rachis and falling attached to the joints. Glumes two, placed in front of the spikelet and enclosing it, coriaceous, 5-nerved, acute, asymmetric, appearing like halves of a single split glume. Lemma with its back to the rachis, smaller than the glumes, hyaline, 1-nerved ; palea a little shorter than the lemma, hyaline, 1-nerved ; lodicules glabrous. Ovary glabrous. Grain not grooved with the hilum ; hilum small, basal or sub-basal.

#### 1. *Parapholis incurva* (Linn.) C. E. Hubb.

*Parapholis incurva* (Linn.) C.E. Hubb. in *Blumea* Suppl. 3 (Hennard Jubilee Vol.) 14 (1946).

*Aegilops incurva* Linn. Sp. Pl. 1051 (1753).

*Rottboellia incurvata* Linn. f., Suppl. 114 (1781).

*Ophiurus incurvatus* Beauv., Ess. Agrost. 116 (1812).

*Lepturus incurvatus* Trin. Fund. Agrost. 123 (1820).

*Pholiurus incurva* (Linn) Hitchc U. S. Dept. Agr. Bull. 772 : 106 (1920).

Annual. Culms densely tufted, 2-20 cm. long, prostrate, curved

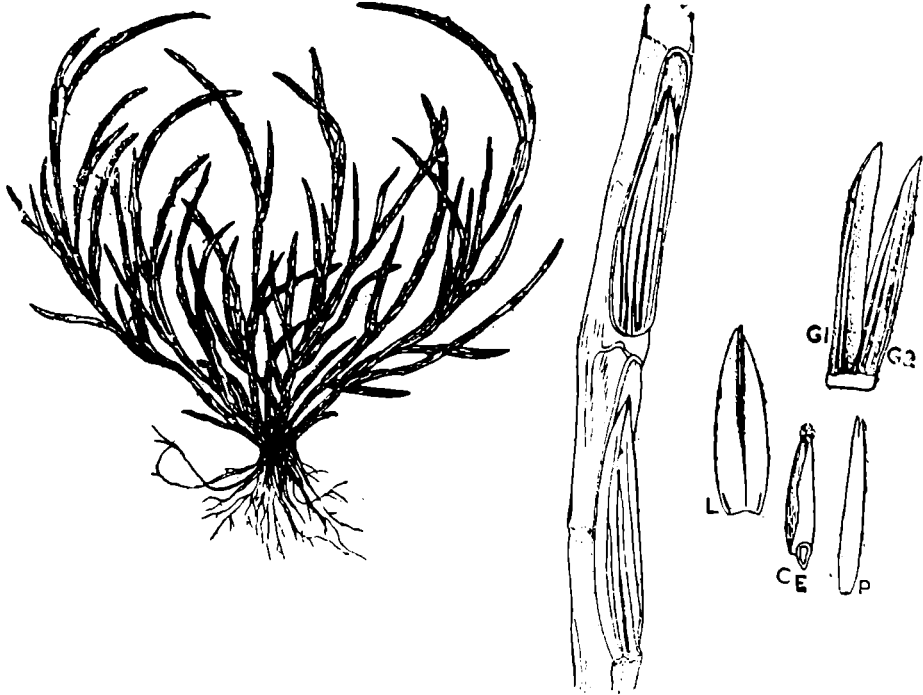


Fig. 173. *Parapholis incurva*.

and ascending or erect, very slender, rigid, usually much branched in the lower part, smooth, few - to many-noded. *Leaf-blades* glabrous, finely pointed, 4-30 mm. long, 1-3 mm. wide, flat or rolled, smooth beneath, scabrid on the nerves above and on the margins; *sheaths* rounded on the back, smooth; *ligule* 0.5-1 mm. long, membranous. *Spikes* rigid, curved, slender, cylindrical, 1-8 cm. long, 1-2 mm. in diameter; axis smooth, jointed, the joints shorter than the spikelets, deeply hollowed out on one side, 2.5-5 mm. long, disarticulating horizontally beneath each spikelet at maturity. *Spikelets* embedded in the hollows in the spike-axis, solitary and alternating on opposite sides of the axis and closely pressed to it, 4-6 mm. long, oblong, 1-flowered, falling with the joints of the axis and closely pressed to it, 4-6 mm. long, oblong, 1-flowered, falling with the joints of the axis at maturity.

*Glumes* as long as the spikelet, placed side by side and closing the cavity in the axis, narrowly oblong-subulate, pointed, thick and rigid, glabrous, 3- to 4-nerved. *Lemma* slightly shorter than the glumes, lanceolate to narrowly ovate, thinly membranous, finely 3-nerved. *Palea* nearly as long as the lemma. *Anthers* 0.5-1 mm. long.

Peshawar, *S. Ahmad*.

## 2. *Henrardia* C. E. Hubb.

Tufted annuals with few-noded culms and narrow leaf-blades. Spikelets alternate, distichous, sessile, solitary at each node and closely appressed to the internodes on opposite sides of the articulated rachis of solitary spikes. Florets 1-2, hermaphrodite, dorsally compressed, slightly shorter than the glumes. Glumes equal or subequal, obtuse or acute, thickened and indurated except for the narrow inflexed membranous margin, those of the lateral spikelets nearly opposite, more or less asymmetrical. Lemma nearly as long as the glumes, membranous, 3- to 5-nerved; palea nearly as long as the lemma. Lodicules ciliolate. Ovary densely and minutely hairy at the apex. Caryopsis narrowly grooved in front; hilum narrowly linear, extending the whole length of the grain.

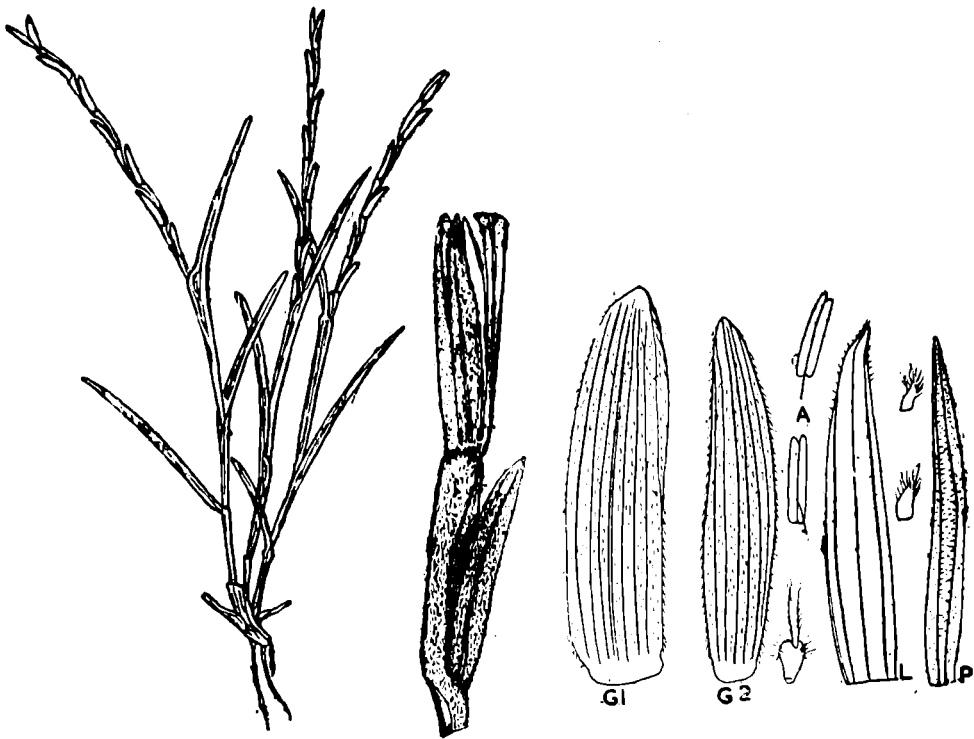
### 1. *Henrardia persica* (Boiss.) C. E. Hubb.

*Henrardia persica* (Boiss.) C.E. Hubb. in *Blumea* Suppl. 3 (Henrard Jubilee Vol.) : 17 (1946).

*Lepturus persicus* Boiss. *Diagn. Pl. Or. Nov. Ser. I*, no. 13 : 71 (1853); *Fl. Orient.* 5 : 685 (1884).

Annual. *Culms* tufted or solitary, up to 15 cm. high, erect or geniculate ascending, branched in the lower part, few noded. *Leaf-blades* villous with reversed hairs, 2.5 cm. long, 1 mm. wide, flat or rolled; *sheaths* rounded on the back, hirsute; ligules short, membranous. Spikes rigid, solitary, cylindrical, 3 cm. long, 1.5 mm. in diameter; axis hairy, jointed, internodes rounded on the back, flat or slightly concave in front, gradually thickened upwards, transversely disarticulating at the nodes and falling with the spikelet. *Spikelets* appressed to the internodes on opposite sides of the axis, 7.5 mm. long, oblong, 2 flowered; rachilla continuous, produced beyond the terminal perfect floret, minutely hairy and bearing a rudimentary floret. *Glumes* as long as the spikelet, equal or subequal, those of the lateral spikelets nearly opposite,

thick and indurated, thinly membranous at the inflexed margins, villous with reversed hairs. *Lemna* nearly as long as the glumes, lanceolate to oblong in back view, lanceolate-oblong when expanded, membranous,



174.—*Henrardia persica*.

3- to 5-nerved, flat or rounded on the back and with margins inflexed along the outer nerves. *Palea* as long as the lemma, 2 keeled, minutely pubescent between the keels. *Caryopsis* densely and minutely hairy at the apex, tightly enveloped by the lemma and the palea. *Anthers* 1.75 mm. long.

—var. *erecta* (Griseb.) C. E. Hubbard, l. c.

Upper Baluchistan, *Stocks*; Kharan, Quetta, *Hughe-Buller*; Quetta, R. R. *Stewart*, M. *Nawaz*.

### 3. *Aegilops* Linn.

Annual grasses with linear, flat leaf-blades. Spikes elongate, cylindric, fragile. Spikelets 2- to 5-flowered, solitary, oblong turgid or cylindric, half sunk in the hollows of the rachis, the joints thickened at the summit, the spikelets usually not reaching the one above on the same side, exposing the rachis; spikes usually disarticulating near the base at maturity, falling entire, or finally disarticulating between the spikelets. Glumes similar, oblong-quadrate, many-nerved; lemmas rather longer, awnless or in the upper spikelets with one or three strict awns.



## KEY TO THE SPECIES

- Both the glumes muticous ..... 1. *Ae. squarrosa*  
 Glumes aristate ..... 2. *Ae. triuncialis*

1. *Aegilops squarrosa* Linn.

*Aegilops squarrosa* Linn. Sp. Pl. 1051 (1753).

*Triticum aegilops* Beauv. Ess. Agrost. 180 (1812); Hook. f., Fl. Brit. Ind. 7: 367 (1896).

Annual. Culms erect or geniculate-ascending, stiff, leafy. Leaf-blades linear, flat, acuminate, smooth or slightly scabrid; sheaths smooth, the upper subventricose; ligule very short. Spikes elongate-cylindric, fragile, 3.7-12.5 cm. long; rachis stout. Spikelets oblong, turgid, 4-6 mm. long, half sunk in the hollows of the rachis, alternating in close succession. Glumes similar, oblong quadrate, many-nerved, coriaceous, tip truncate, often crenulate. Lemmas rather longer, truncate or retuse, awnless or in the upper spikelets with one strict erect awn; awn 1.2-3.5 cm. long.

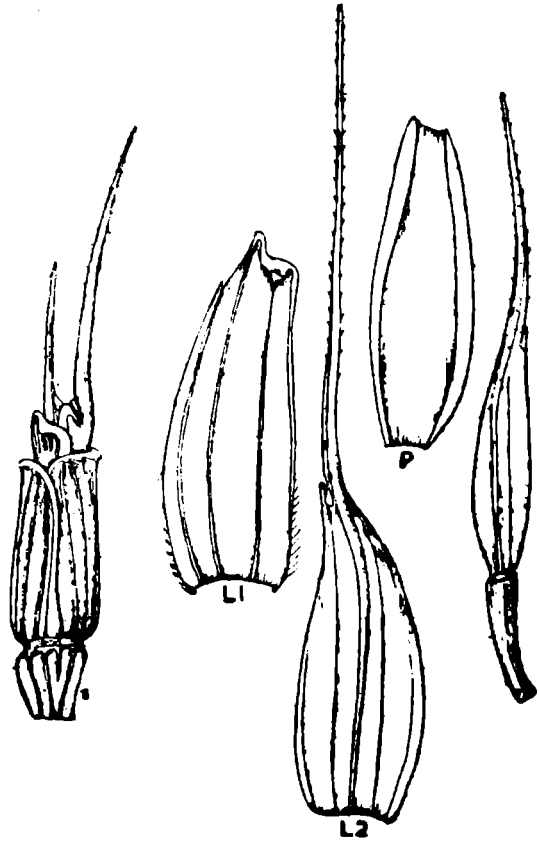


Fig-175. *Aegilops squarrosa*.

Quetta, Asghar Ali, M. Nawaz; Urak, Lace; Kalat, Duke; Baluchistan, without locality, Stocks.

2. *Aegilops triuncialis* Linn.

*Aegilops triuncialis* Linn., Sp. Pl. 1051 (1753).

*Triticum triunciale* (Linn.) Raspail in Ann. Sci. Nat. Bot. 5: 435 (1825).

Annual. Culms tufted, branching and spreading at the base, 20-40 cm. high; erect or geniculate ascending, glabrous and smooth. Leaf-blades rather rigid, sharp pointed, spreading, 10 cm. × 3 mm, flat becoming rolled in drying, acute, surface and margins hairy or scabrid; sheaths terete, more or less compressed or slightly dilated, the lower with scattered

hairs the upper glabrous and smooth ; mouth with auricles ciliate ; *ligule* very short, less than 0.8 mm., glabrous, truncate, erose. Spikes slender, elongated, dense, 3-4 cm. long, spikelets 4-5, with 2 or 3 of the lower spikelets often reduced ; rachis strongly compressed, not flexuous, scabrid

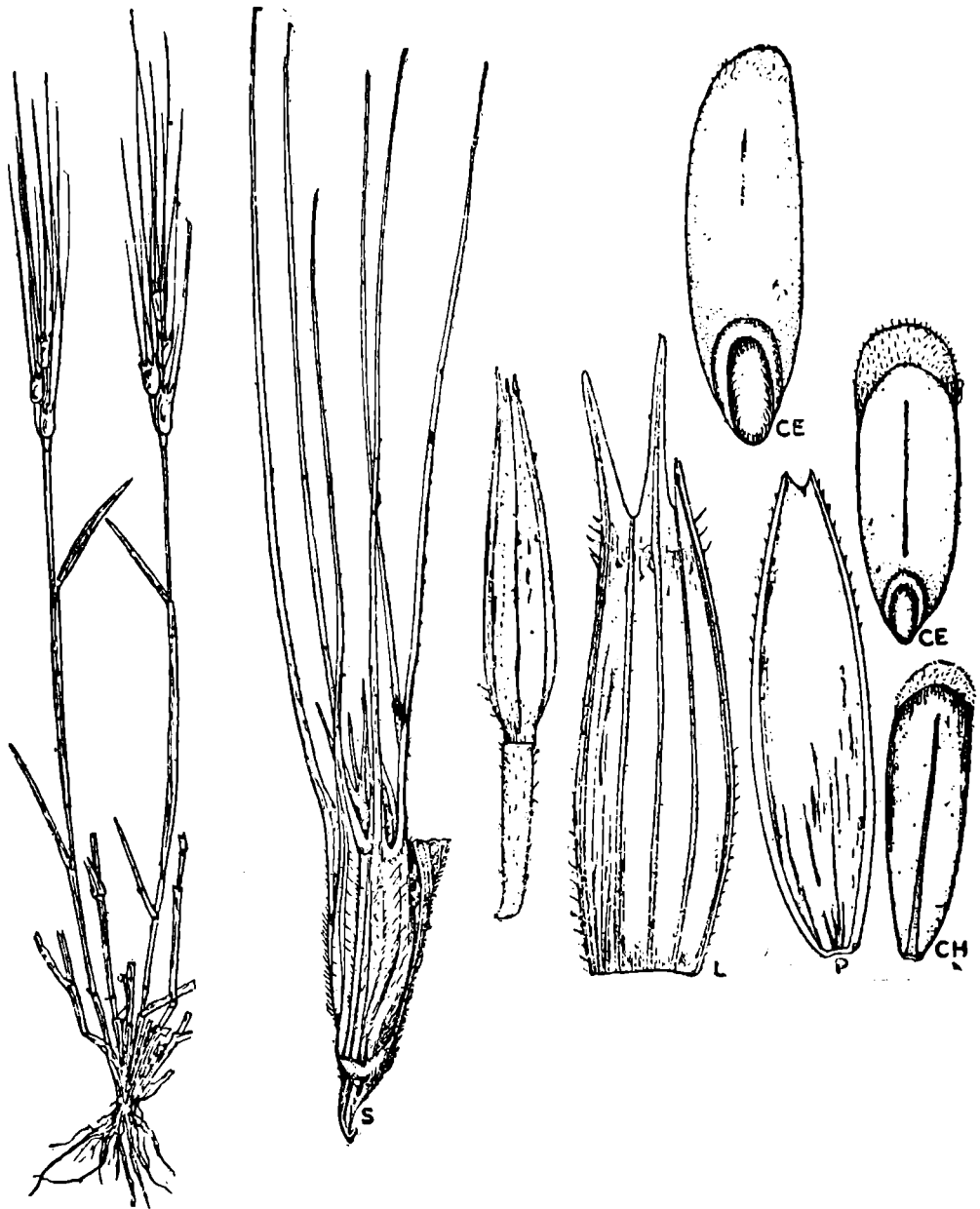


Fig. 176. *Aegilops triuncialis*.

along the margins, the rest glabrous or more or less hairy, internodes shorter than the spikelets. *Spikelets* oblong, the lateral usually 4 flowered having 2 lower sessile fertile and 2 upper pedicelled, sterile florets ; the terminal spikelet ordinarily 3 flowered having only one fertile or rarely all sterile florets ; rachilla flattened, villose. *Glumes* 7-10 x 3-5 mm ; coriaceous, scabrid or villous, prominently nerved, unequally

broad, often slightly arcuate, truncate bearing 2-3 awns in the lateral spikelets and 3 awns in the terminal spikelet ; awn compressed, glabrous and smooth at the base, antrorsely scabrid above, up to 7 cm. long ; median awn of the lateral spikelets shorter than the laterel awn, sometimes reduced to a tooth or absent. *Lemmas* membranous, indurate at the apex, lanceolate, villous at the base, along the margins and at the apex, the rest scabrid, rounded on the back with 5-nerves, 3-toothed or 3-awned in the lateral spikelets. *Palea* subequal, truncate, 2-mucronate, 2-keeled ; keels ciliate. *Anthers* 5 mm. long. *Ovary* hispid at the top. *Caryopsis* 8 x 2 mm., grooved on the ventral side : embryo 2 mm. long.

Quetta, May 1957, *M. Nawaz*.

#### 4. *Triticum* Linn.

Annual or perennial grasses with flat leaves and thick spikes. Spikes terminal, solitary ; rachis excavated opposite the spikelets, articulate or inarticulate. Spikelets solitary, distichous, tumid, few flowered. Glumes persistent, rigid, often unequal sided, obtuse or shortly awned. Lemmas oblong or ventricose, back rounded or keeled upwards, muticous or 1- to 3-awned, 5- to 9-nerved ; *palea* equalling the lemma, 2-keeled ; keels ciliate. Lower floret hermaphrodite, upper male or barren. Lodicules 2. Stamens 3. Styles 2.

##### 1. *Triticum aestivum* Linn.

*Triticum aestivum* Linn., Sp. Pl. (1753) 85.

Annual. *Culms* densely tufted, erect, upto 1.5 m high, smooth, hollow. *Leaf-blades* linear-lanceolate or broadly linear, acuminate, flat, somewhat scabrid ; *sheaths* tight, terete, smooth ; *ligule* short, membranous, truncate. *Spikes* erect, irregularly 4-sided, compact ; rachis continuous, hairy on the margins. *Spikelets* solitary, imbricate on the opposite sides of the rachis, laterally compressed, ovoid, glabrous or hairy, 3- to 5- flowered, the uppermost sterile. *Glumes* about 1. cm. long, subequal, broad, oval, oblong, ventricose, back rounded or keeled upwards, muticous or 1- to 3-awned. *Palea* as long as the lemmas, 2-keeled ; keels ciliate.

Cultivated throughout the area.

5. **Secale** Linn.

Erect, mostly annual grasses with flat leaf-blades and dense spikes. Spikelets usually 2-flowered, solitary, placed flat-wise against the rachis; rachilla disarticulating above the glumes and produced beyond the upper floret as a minute stipe. Glumes narrow, rigid, acuminate or subulate-pointed. Lemmas broader, sharply keeled, 5-nerved, ciliate on the keel and exposed margin, tapering into a long awn.

1. **Secale cereale** Linn.

*Secale cereale* Linn., Sp. Pl. 87 (1753).

Annual. Culms tufted or solitary, erect, upto 1.5 m. high, glabrous and smooth below, more or less villous below the spike. *Leaf-blades* flat, more or less flaccid, tapering to a more or less acute apex, glabrous or pubescent with hairs retrorse in the lower leaves; scabrid on the lower surface, margin slightly scabrid; *sheaths* rounded on the back, glabrous, mouth with short auricles; *ligule* short, truncate, lacerate. *Spike* dense, distichous, up to 20 cm. long; rachis tough, with short internodes, densely villous along the margins and occasionally on the sides. *Spikelets* 1.3-1.5 cm. (excl. the awns) with 2 (rarely 3) flowers; two fertile and sessile, the third sessile or rudimentary at the apex of an elongated internode of the rachilla. *Glumes* 11-14 mm. long, linear-lanceolate, tapering to a short awn, shorter than the adjacent lemma, margin narrowly scarious, subequilateral, longitudinally plicate, strongly

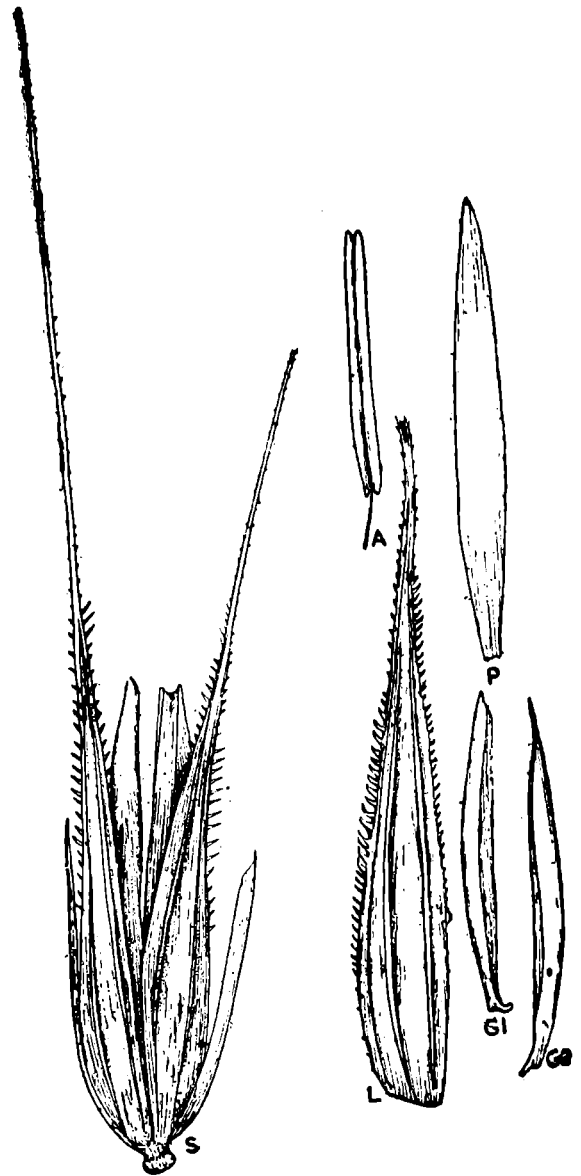


Fig.-177. *Secale cereale*.

keeled, scabrid along the keels. *Lemma* coriaceous, lanceolate, longitudinally folded, strongly keeled, 15 mm. long, bearing an awn 2.5 cm. long, 5-nerved, nerves not very conspicuous, shortly pectinate-ciliate along the keel, the rest glabrous and smooth; awn 2.5 cm. long. *Palea* as long as or slightly shorter than the lemma, narrowly lanceolate, truncate, the keel hardly scabrid at the summit. *Anthers* 9 mm. long. *Ovary* hispid at the top. *Caryopsis* 7 mm. long, 2 mm. wide, grooved on the ventral face, dorsal surface strongly convex; embryo 2.5-3 mm. long.

Swat State : Khaza Khela, S. Ahmad; Quetta, Asghar Ali; Abbottabad, A. H. Khan.

## 6. *Heterantheium* Hochst.

An annual tufted grass with flat leaves and geniculate-ascending, leafy culms. Spikes oblong or cylindric, composed of 20-25 sessile spikelets arranged in two rows. Spikelets solitary at the nodes; *fertile spikelets* 5-6-awned, with the lower 1-2 florets perfect and the rest rudimentary, represented by lemmas. Glumes 2, subulate, rigid, coriaceous, ventricose, long-awned. Lemmas of the bisexual florets hairy and verrucose, long-awned; palea 2-keeled, each [keel prolonged into a short awn, *Caryopsis* oblong, slightly tomentose, 2-dentate at the apex, deeply furrowed. *Sterile spikelets* occupying especially the base and apex of the spike, florets all sterile, neuter, represented by long-awned lemmas.

### 1. *Heterantheium piliferum* Hochst.

*Heterantheium piliferum* Hochst. in Kotschy, Pl. Alepp. exs. 1843; Jaub. et Spach, Illustr. 4 : 23 (1850), Boiss Fl. Orient. 5 : 672 (1888).

*Elymus pilifer* Soland in Russell, Besch. von Aleppo ed. II, 2 : 149 (1794).

An annual tufted grass with flat leaves, *Culms* geniculate-ascending,

upto 30 cm high, 2-noded, leafy, hairy, smooth; nodes glabrous. *Leaf-blades* linear, acuminate, villose, up to 8 cm. long, 1.5 mm. broad; *sheaths* shorter than the internodes, villose, tight or the lower slipping from the culms and scarious; *ligule* membranous, hyaline. Spikes oblong or cylindric, upto 5 cm. long; peduncle longexserted from the uppermost sheath; axis hairy. *Spikelets* dimorphic, solitary at each node, one perfect spikelet alternating with 3 sterile ones. *Fertile spikelets* 5-6 flowered, with the lower 1 or 2 perfect florets sessile, the rest rudimentary and seated on the prolongation of the rachilla joint, represented by awned lemmas. *Glumes* subulate, rigid coriaceous, ventricose, long awned, up to 1.5 cm. long (incl. the awn), plumose in the lower half; awn scabrid. *Lemma* (fertile) hairy and verrucose, coriaceous, 2.5 cm. long (incl. the awn); awn scabrid, *Palea* 6 mm. long, 2 keeled, the keels prolonged into short awns. Caryopsis 6 mm. long.

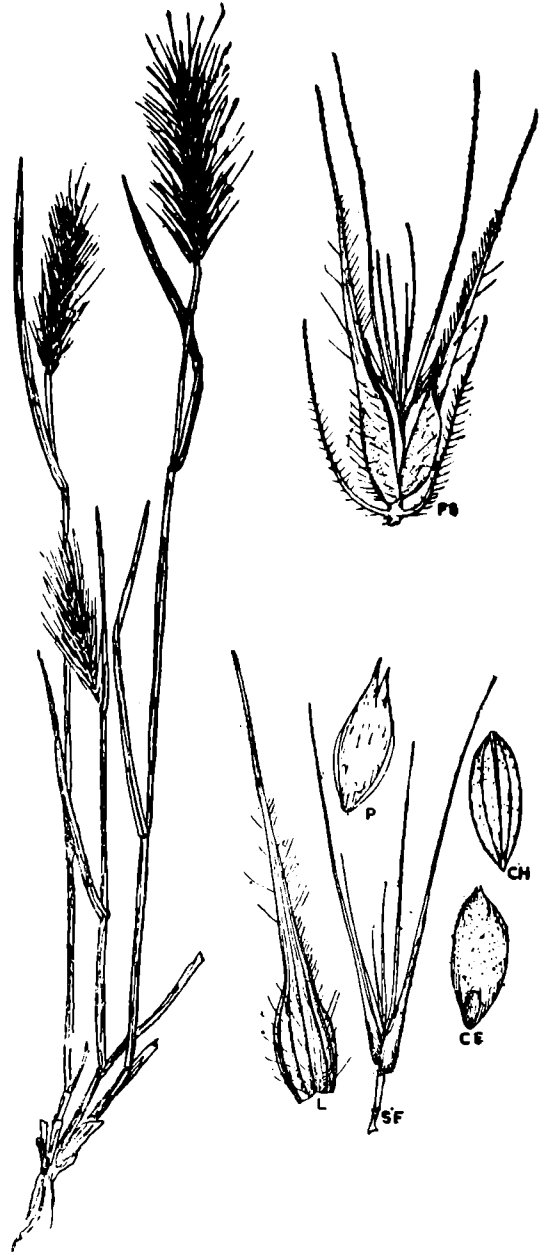


Fig. 178. *Heteranthelium piliferum*.

Baluchistan, without locality, *Lace*; Hindu bagh, *I. I. chaudhri*; Quetta, *J. J. Norris*.

## 7. *Anthosachne* Steud.

Differs from *Agropyron* in its very long awns, (3) 4-7 (-8) cm. long and in its not keeled, several-nerved glumes. The spikelets are

distantly flowered with the joints of the rachilla 3-4 mm. long ; the rachilla breaking up at maturity beneath each lemma.

1. ***Anthosachne longearistata*** (Boiss.) Nevski

*Anthosachne longearistata* (Boiss.) Nevski in Acta Univ. As. Med. ser. VIII b., bot. fasc. 17 : 64 (1934).

*Agropyron longearistatum* Boiss., Fl. Orient 5 : 660 (1888) ; Hook. f., Flor. Brit. Ind. 7 : 368 (1896).

*Roegneria longearistata* (Boiss.) Drobov in Fl. Uzbek ist., ed. Schredes, 1 : 280 (1941).

Perennial. Culms tufted, up to 90 cm. high, erect or ascending, leafy. Leaf-blades 15-25 cm. long, 3-4 mm. broad, flat rarely convolute, sheaths smooth ; ligule very short. Spikes 7.5-12.5 cm. long, erect or nodding, the spikelets remote or approximate, loosely imbricating. Spikelets laterally flattened, 6-12 flowered, sessile, 12-18 mm.

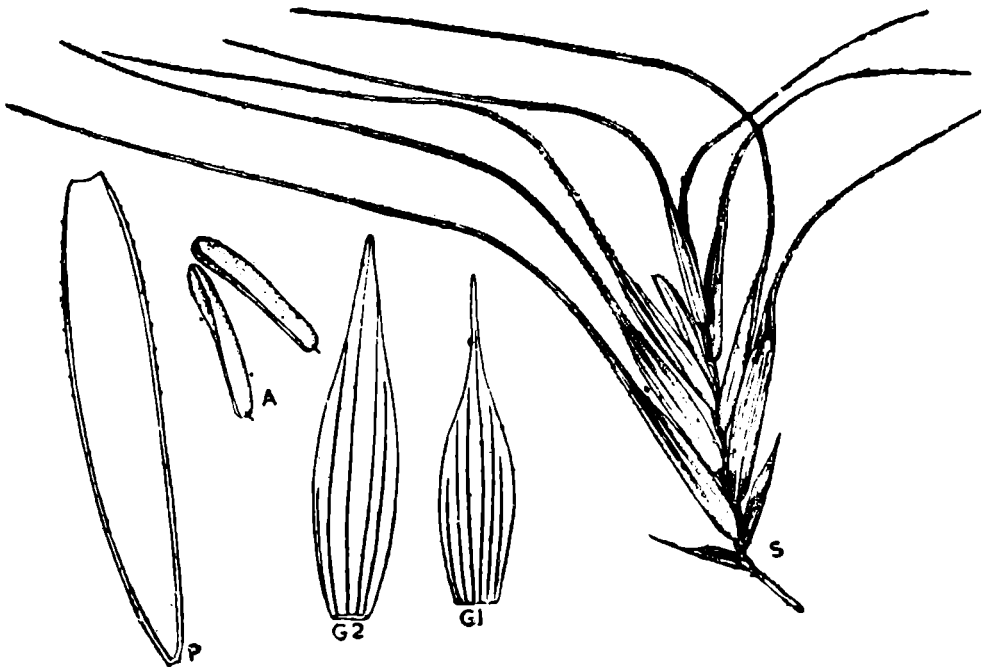


Fig. 179—*Anthosachne longearistata*<sup>a</sup>.

long (excl. the awns), disarticulating above the glumes and between the lemmas. Lower glume  $\frac{1}{4}$ - $\frac{3}{4}$  the length of the lowest lemma, 3- to 5- nerved, elliptic-ovate to narrowly setaceous, awned or not, tip sometimes notched on one side. Lemma spreading, linear-lanceolate, 3- to 5- nerved, smooth or scabrid, narrowed into an awn 4-7 cm. long. Palea coriaceous, keels ciliolate with erect teeth above the middle. Anthers short.

Kagan Valley : Saiful Maluk, *Shaukat Ali* ; Babusar Pass, Dr Metz ; Kagan, M. S. Zahur,

### 8. *Agropyron* Gaertn.

Perennial grasses, often with creeping rhizomes. Culms usually erect ; leaf-blades flat or convolute. Spikes simple, erect. Spikelets all perfect, 2- to several-flowered, solitary at each node, sessile, in two rows alternating on opposite sides of the axis with broader sides adjacent to it, their glumes placed laterally ; rachis continuous rarely disarticulating ; rachilla disarticulating below the glumes or above the glumes and beneath each lemma. Glumes equal, firm, 5- to many nerved, with a distinct callus furrowed at the base, usually shorter than the first lemma, acute or awned, rarely obtuse or notched. Lemmas rounded on the back, rather firm, 5- to 7-nerved, acute or awned from the apex ; palea about as long as the lemma.

The species of *Agropyron* closely resemble those of *Brachypodium*, but differ in the arrangement of the spikelets on the spike-axis ; the spikelets in *Agropyron* are borne with their broader sides adjacent to the axis, while in *Brachypodium* the narrower edges face the axis.

#### KEY TO THE SPECIES

1. Plants with creeping rhizomes ; spikelets awnless.....2  
Plants without creeping rhizomes ; spikelets awned .....4
2. Spikelets rather distant ; glumes shorter than the spikelet..... 3  
Spikelets closely imbricating ; glumes nearly as long as the spikelet, many-nerved..... 1. *A. dentatum*
3. Glumes 5-nerved, attenuated at the apex ; leaf-bases not or slightly auricled ; anthers 4 mm. long..... 2. *A. repens*  
Glumes 9-nerved, obtuse or truncate at the apex ; leaf-base not or slightly auricled ; anthers 6-7 mm. long .....3. *A. junceum*
4. Glumes 3- to 5 nerved ; anthers 2-3 mm. long ..... 4. *A. caninum*  
Glumes 7- to many-nerved ; anthers 3.5-6 mm. long... ..... 5
5. Spikelets distant.....5. *A. semicostatum*  
Spikelets imbricating... ..... 6. *A. striatum*



### 1. *Agropyron dentatum* Hook. f.

*Agropyron dentatum* Hook. f., Flor. Brit. Ind. 7 : 370 (1896).

Perennial : rhizome creeping as in *A. repens* but the spikelets imbricating, 3- to 5-flowered, quite glabrous or sparsely pubescent. Spikes slender, margins of the hollows of the rachis scaberulous or ciliolate. *Glumes* as long as the spikelet, large, subequal, oblong obtuse, obliquely truncate, 1-dentate or mucronate rarely awned, very strongly 7- to 9-nerved. *Lemma* linear oblong, obtuse, acute or acuminate, strongly 5-nerved above the middle.

Karakoram, 14,000 ft:

### 2. *Agropyron repens* (Linn.) Beauv.

*Agropyron repens* (Linn.) Beauv., Ess. Agrost. 146 (1812).

*Triticum repens* Linn., Sp. Pl. 86 (1753).

*Elytrigia repens* (Linn.) Nevski in Acta Inst. Bot. Acad. Sci. URSS, Ser. 1. Fasc. 1, 14 (1933).

Perennial, with a long, creeping rhizome. *Culms* erect or ascending, up to 1 m. high, glabrous and smooth. *Leaf-blades* up to 30 cm. long, 9 mm. wide, flat, without prominent ribs, glabrous and smooth ; *sheaths* glabrous and smooth, auricled at the apex ; *ligule* reduced to a row of cilia. Spike long-peduncled, 5-15 cm long, with spikelets longer than the internoded ; rachis non fragile, glabrous or hairy, more or less scabrid at the angles. *Spikelets* 10-20 mm. long, 3- to 8-flowered, oval-lanceolate, falling entire at maturity. *Glumes* 7-12 mm long, attenuated at the summit and more or less acute, frequently mucronate, 5-nerved, glabrous and smooth or slightly scabrid on the keel. *Lemma* lanceolate-oblong, 5-nerved, 8-13 mm. long, acute, or obtuse-mucronate, rarely shortly aristate, rounded on the back at the base, more or less keeled upwards. *Palea* subequal, keels ciliate-scabrid. *Anthers* 3.5-6 mm. long.

Gilgit ; Hindu Bagh, Baluchistan ; Kalat.

### 3. *Agropyron junceum* (Linn.) Beauv.

*Agropyron junceum* (Linn.) Beauv., Ess. Agrost. 102 (1812).

*Triticum junceum* Linn., Cent. 1 : 725 (1755).

Perennial, with a long, much branched rhizome. *Culms* up to 1 m. high, erect, glabrous and smooth, branching at the base. *Leaf-blades* up to 30 cm. long, 8 mm. wide, flat becoming rolled, glabrous and smooth

or densely pilose ; *sheaths* glabrous and smooth or pubescent, not or very slightly auricled at the mouth ; *ligule* less than 0.5 mm. long, membranous, lacerate. Spike more or less long-peduncled, 4-25 cm. long ; rachis smooth and glabrous, showing at the base of each internode an annular depression. *Spikelets* 5- to 8-flowered, appressed to the rachis, oval-rhomboid to lanceolate, 1.7-3 cm. long, falling entire at maturity, the lower shorter than the internodes, the upper equalling the internodes or slightly longer. *Glumes* 13-20 mm long linear-lanceolate, very obtuse or retuse, sometimes submucronate, 5-nerved, glabrous and smooth. *Palea* slightly shorter than the lemma ; keels ciliate. *Anthers* 6-7 mm. long.

Baluchistan, Juniper tract, *Lace*.

#### 4. *Agropyron caninum* (Linn.) Beauv.

*Agropyron caninum* (Linn.) Beauv., Ess. Agrost. 102 (1812).

*Triticum caninum* Linn., Sp. Pl. 86 (1753).

Perennial, without rootstock. *Culms* caespitose, slender, erect or decumbent, smooth, up to 90 cm. high. *Leaf-blades* 10-25 cm long, thin, flat, 5-12 mm. wide, scabrid on both surfaces, acuminate ; *sheaths* smooth, sometimes pubescent, auricles rudimentary or absent ; *ligule* membranous, 1.5 mm. long. Spikes erect, finally nodding, slender, 8-15 cm. long ; rachis non fragile and scabrid along the margins. *Spikelets* not much distant but not imbricate, occasionally the lower shorter than the internodes 10-20 mm. long, 3- to 5-flowered, elliptic-lanceolate, breaking up at maturity below the lemmas, the glumes persisting on the spike axis. *Glumes* subequal, 7-10 mm long, lanceolate to narrowly oblong, 2- to 5-nerved, nerves scabrid, sharply pointed and sometimes short-awned, with scarious-winged margins above. *Lemmas* lanceolate-oblong, acute or aristate, 9-13 mm. long, 5-nerved, minutely hairy at the base, often with minute scattered hairs in the upper part, or smooth there ; awn 7-18 mm. long, flexuous. *Palea* lanceolate-oblong, as long as the lemma ; keels scabrid. *Anthers* 2-3 mm. long.

Baluchistan, without locality, *Lace* ; Chitral, A. R. *Beg*.

#### 5. *Agropyron semicostatum* Nees.

*Agropyron semicostatum* Nees ex Steud., Syn. Pl. Gram. 346 (1854).

Perennial. *Culms* 30-90 cm. high, slender, tufted, erect or ascending.

*Leaf-blades* flat, up to 8 mm. broad, acuminate, smooth or scaberulous; *sheaths* smooth; *ligules* very short. Spikes nodding, 10-20 cm. long; axis slender or rather stout, scabrid. Spikelets distant, 7- to 8-flowered, 2.5-5 cm. long, internodes of rachilla short. *Glumes* 10-14 mm. long, linear-lanceolate, acute or acuminate, but scarcely awned, smooth or scaberulous, strongly 5- to 7-nerved, much shorter than the spikelet. *Lemmas* not at all spreading, 9 mm. long, lanceolate, scaberulous above, tip entire or 1- to 2-toothed, awned; awn flexuous or finally divergent, 14 mm. long or shorter. *Palea* 8 mm. long; keels scabrid. *Anthers* 5 mm. long.

Murree; Swat State, Madian, *Shaukat Ali*, Chitral: Ayun to Bumrait, A. R. Beg.

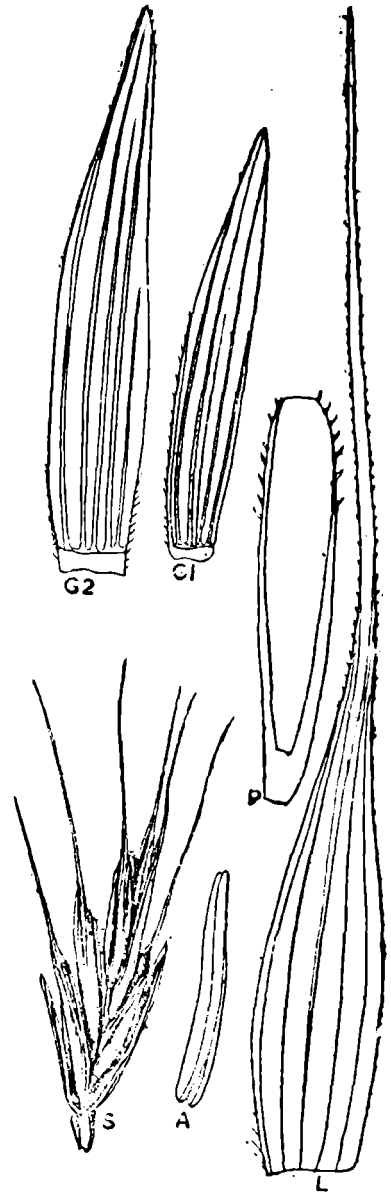


Fig. 180. *Agropyron semicostatum*.

### 6. *Agropyron striatum* Nees

*Agropyron striatum* Nees ex Steud., Syn. Pl. Gram. 346 (1854). Hook. f., Fl. Brit. Ind. 7: 369 (1896).

*Triticum striatum* Steud., Syn. Pl. Gram. 346 (1854).

Perennial. *Culms* tall, robust, 60-120 cm. high. *Leaf-blades* flat or involute, *sheaths* smooth with the mouth auricled; *ligule* very short. 6-16 mm. broad, scaberulous above. Spikes 7.5-20 cm. long; axis stout, glabrous with ciliolate margins of the hollows or puberulous. Spikelets many, large 1.2-2.5 cm. long, imbricating. *Glumes* subequal, very cor-

iaceous, linear-oblong or oblong-lanceolate, not spreading, 8-16 mm. long, as long as the lower floret, acute or obtuse, strongly 7-nerved. Lemmas ovate-lanceolate, 5-nerved, puberulous or glabrous, margins usually ciliate, tip notched or entire; awn straight, up to 17 mm. long.

Kagan Valley : Naran, *Shukat Ali*; Burwai, *I. I. Chaudhri*.

### 9. *Eremopyrum* (Ledeb.) Jaub. & Spach.

It differs from *Agropyron* in having short, more or less dense pectinate spikes, ordinarily without a terminal spikelet; the rachis tenaceous or fragile. Glumes nearly equal sided, 1-nerved or indistinctly 5-nerved and keeled. Spikelets distichous, broad, spreading, densely imbricate.

#### KEY TO THE SPECIES

1. Perennial; glumes dilated scarious at the base; lemmas rather abruptly contracted into an awn ..... 1. *E. cristatum*  
Annual; glumes not dilated-scarious at the base; lemmas attenuated to a point at the apex..... 2
2. Glumes and lemmas terminating in a short point; glumes shorter than the adjacent lemma ..... 3  
Glumes and lemmas aristate; glumes at most equalling the adjacent lemma..... 2. *E. orientale*
3. Spikelets hirsute ..... 3. *E. hirsutum*  
Spikelets glabrous..... 4. *E. buonapartis*

### 1. *Eremopyrum cristatum* (Linn.) Willkomm

*Eremopyrum cristatum* (Linn.) Willkomm, Prodr. Fl. Hisp. 1 : 108 (1861).

*Agropyron cristatum* (Linn.) Gaertn., Nov. Comm. Acad. Petrop. 14 : 540 (1770)

*Bromus cristatus* Linn., Sp. Pl. 78 (1753).

Perennial; rhizome caespitose, producing a dense tuft of innovations and flowering branches. Culms erect or geniculate ascending, 20-50 cm. high, glabrous and smooth; nodes brown. Leaf-blades 12 cm. × 3 mm., rigid, flat then rolled in drying, attenuated at the apex, obtuse or subacute, lower surface glabrous and smooth, upper grooved and scabrid; sheaths rounded striate, glabrous and smooth, the lower densely and very shortly puberulous, with retrorse hairs; ligules very short (less than 0.5 mm), membranous-papyraceous, brown, truncate, erose-den-

ticulate. *Spike* long peduncled, dense, 2-5 cm. long, flattened, oblong-linear to ovate 0.7-2.5 cm broad with distichous spikelets, spreading-erect; *rachis* tenaceous, flattened and flexuous, scabrid or pubescent-scabrid. *Spikelets* 8-15 mm. long (excl. the awns), 3- to 6-flowered, the upper most floret usually sterile; rachilla distarticulating at maturity below the floret; internodes short and thick, glabrous or bearing on the back appressed, very short hairs. *Glumes* persistent, 6 mm. long, slightly unequal coriaceous, narrowly lanceolate, margins broadly-scarious, attenuated from the broadened geniculate base, apex acuminate, prolonged into a subule keel marked by a strong median nerve glabrous, scabrid on the keel of the subule. *Lemmas* 7-9 mm. long, (incl the awn) lanceolate coriaceous, narrowed at the summit into more or less long awn, keeled, 5-nerved, the 2 lateral nerves indistinct towards the apex. *Palea* 4.5 mm. long, lanceolate, 2-dentate at the apex, 2-keeled, keels scabrid. *Anthers* 2.5-3.5 mm. long.

Baluchistan, Harboi hills.

## 2. *Eremopyrum orientale* (Linn.) Jaub. & Spach.

*Eremopyrum orientale* (Linn.) Jaub. & Spach., Ill. Pl. Or. 4: 26 (1850-1853) t. 319.

*Secale orientale* Linn., Sp. Pl. 84 (1753).

*Agropyron orientale* Roem & Schul., Syst. 2: 757 (1817).

Annual. *Culms* tufted, rarely solitary, spreading, geniculate-ascending, glabrous and smooth below, covered at the apex with retrorse pubescens. *Leaf-blades* flat, upto 12 cm. long, 4 mm. broad, long attenuated to a fine point, margin scabrid; *sheaths* rounded inflated (esp. the upper), striate, the lower covered with a very short, retrorse pubes-

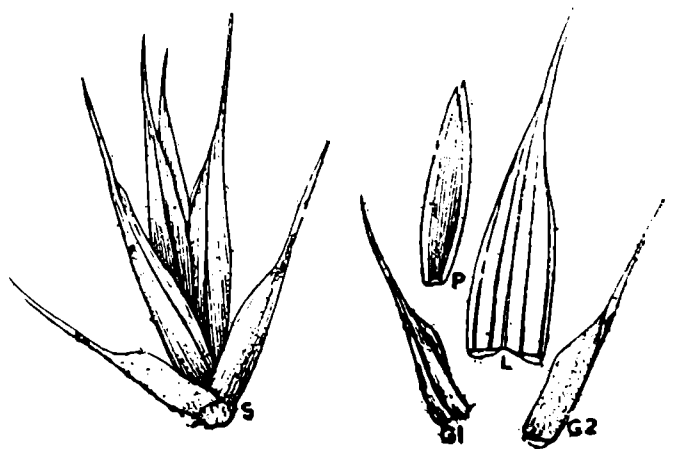


Fig. 181. *Eremopyrum cristatum*.

cence; *ligule* about 1 mm. long, glabrous, truncate, erose-dentate. *spikes* long-peduncled, ovate or ovate-oblong, flattened, 1.5-3.5 × 1-2.5 cm. villose, dense; *rachis* fragile at maturity, internodes very short, villous. *Spikelets* hirsute or lanate, 3- to 5-flowered the uppermost becoming reduced; *rachilla* with thick, very short internodes, glabrous. *Glumes* 10 mm. long, lanceolate-linear, keeled,

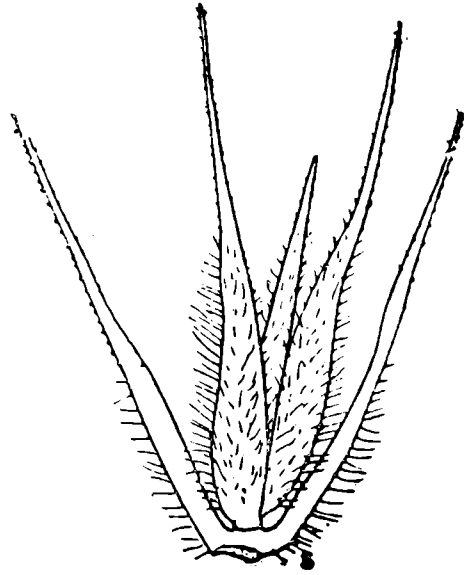


Fig. 182. *Eremopyrum*.

hirsute, thickened, the base ultimately slightly geniculate. *Lemmas* up to 12 mm. long, lanceolate, long attenuate-subulate, keeled at the apex, 5-nerved, hirsute or lanate at the back. *Palea* shorter than half the lemma, papyraceous, lanceolate, 2 dentate at the apex, 2-keeled, green, strongly scabrid. *Anthers* ca. 1 mm. long.

Baluchistan, without locality, *Stocks, Lace*; Fort Sandeman, Konazai-Murga, *Harsukh*; Quetta Urak, *R. R. Stewart, A. H. Khan*.

### ***Eremopyrum hirsutum* (Bertol.) Nevski**

*Eremopyrum hirsutum* (Bertol.) Nevski in *Acta Univ. As. Med.* ser. VIII b, Bot. Fasc. 17: 52 (1934); et in *Komarov, Fl. URSS* 2: 663 (1934).

*Hordeum hirsutum* Bertol., *Misc. Bot.* 1, p. 11.

Annual. *Culms* densely tufted, 1- or 2-noded, geniculate-ascending, up to 30 cm. high, smooth and glabrous. *Leaf-blades* up to 6 cm. long, 4 mm. wide, scabrid, glabrous; *sheaths* terete, tight, shorter than the

internode, smooth and glabrous; *ligule* membranous, hyaline, about 1 mm. long. Spikes compressed, 2-2.5 cm. long, 1.5 cm. broad, ovate-

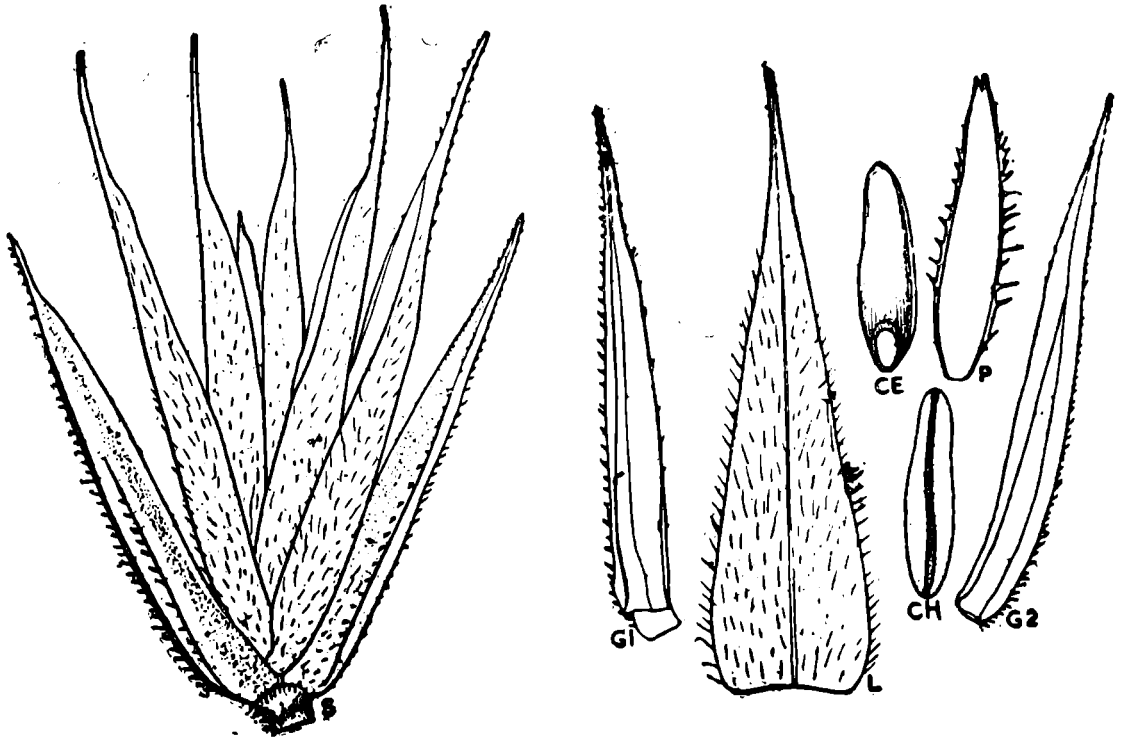


Fig. 183.—*Eremopyrum hirsutum*.

oblong, truncate at the apex; rachis fragile. *Spikelets* 15 mm. long, 4- to 6 flowered, pilose; rachilla joints glabrous, 1 mm. long. *Glumes* 6-12 mm. long, scabrid along the keel and along the margin near the apex, attenuate-acuminate, with long white hairs, 1-nerved, the keel with two prominent lateral grooves. *Lemma* lanceolate-linear, coriaceous, 8-14 mm. long, rounded on the back, aristately-acuminate, hirsute, indistinctly 5-nerved. *Palea* 6.5 mm. long. with scabrid keels. *Caryopsis* 4.5 mm. long.

Quetta, I.I Chaudhri, Asghar Ali, M. Nawaz.

4 *Eremopyrum buonapartis* (Spreng.) Nevski

*Eremopyrum buonapartis* (Spreng.) Nevski, Fl. URSS. 2 : 653 (1934).

*Triticum buonapartis* Spreng., Erst. Nachtr. Bot. Gart. Halle, 40 (1018).

*Agropyron buonapartis* (Spreng.) Th. Dur. & Schinz. Consp. Fl. Afr. 5 : 936 (1894.)

Annual. *Culms* tufted very rarely solitary unequal, the central erect or ascending, very short, the peripheral elongated, spreading or ascending, upto 35 cm. high, very striate upwards, glabrous and smooth below, pubescent below the spike. *Leaf-blades* flat, rolled in drying,

attenuated to a sharp point, 10 cm. long, 4 mm. broad, glabrous and smooth, margins scabrid, usually prolonged at the base into a unilateral membranous auricle; *sheaths* rounded on the back, inflated, striate, glabrous and smooth; *ligule* membranous, very short (0.5 mm.), truncate, erose-dentate. *Spike* long-peduncled, 1.5-3 cm. long. and 1.2-1.8 cm. broad, dense, obtuse; rachis not fragile, the internodes very short, pubescent. Spikelets distichous spreading, glabrous, 3- to 5-flowered, with the upper floret usually rudimentary; rachilla short, tenacious, thick and glabrous. *Glumes* slightly unequal, coriaceous, shorter than the florets. Inceolate-linear, strongly keeled, geniculate at the base, inequilateral, acute, broadly scarious at the margins, glabrous, scabrid towards the summit, with a strong median and 2 indistinct lateral nerves. *Lemma* lanceolate-linear, coriaceous, not geniculate at the base, rounded on the back, glabrous, more or less scabrid at the apex, acute or obtuse and mucronate in the lower florets, shortly acuminate subulate in the upper, with 5 indistinct nerves, narrowly scarious at the margins. *Palea* 1/2-2/3 the lemma, linear-lanceolate, 2-dentate, papyraceous, 2-keeled, green, strongly scabrid. *Anthers* 0.75 mm long.

Baluchistan: Zahri, *Stocks teste Boissier*; Quetta, *J. J. Norris*.

#### 10. **Hordeum** Linn.

Annual or perennial grasses with flat leaves. Spikelets in groups of three at each node of the disarticulating rachis (except in cultivated races) of a dense spike; rachilla tough, produced as a bristle beyond the floret, sometimes bearing a rudimentary lemma. Florets bisexual in the median spikelet, male or barren in the lateral; in cultivated barleys the lateral spikelets are sometimes bisexual. Glumes subulate or bristle-like or narrowly linear or awned, rigid, 1- to 3-nerved, persistent, more or less collateral. Lemmas lanceolate, subinvolute, rounded on the back, gradually produced into a bristle-like awn, 5-nerved. Palea about as long as the lemma, 2-keeled. Lodicules 2, ciliate or ciliolate. Ovary villous at the top; style very short, terminal.

#### KEY TO THE SPECIES

1. Lateral spikelets fertile; rachis tough; lemmas aristate.....  
..... 2. *H. vulgare*
- Lateral spikelets male or neuter, muticous or aristate... ..2
2. Rachis tough, continuous..... 1. *H. distichon*



- Rachis disarticulating, fragile .....3
3. Lateral spikelets muticous, male ; the awn of the median spikelet  
10-15 cm. long ..... 3. *H. spontaneum*  
Lateral spikelets aristate ; awn of the median spikelet shorter .. ....4
4. Glumes of the median spikelet hairy ; lemmas of the three spikelets  
of each group awned, the awn longer than the lemma .....  
..... 4. *H. murinum*  
Glumes of all the spikelets hairless ; awn of the lemma of the median  
spikelet alone exceeding the lemma in length.....  
..... 5. *H. nodosum*

### 1. *Hordeum distichon* Linn.

*Hordeum distichon* Linn., Sp. Pl. 85 (1753).

Annual. Culms solitary or tufted, erect, 60-90 cm. high, striate, glabrous and smooth. Leaf-blades flat, attenuated to an acute point, glabrous and scabrid ; sheaths with large auricles at the mouth ; ligule short and truncate. Spike erect then nodding, compressed, distichous, 6-12 cm. long, dense ; rachis compressed, jointed, tough, sparsely ciliate, along the margin. Spikelets 3-nate, the median sessile and fertile, the lateral shortly pedicelled and sterile, the fertile floret easily disarticulating and falling singly at maturity leaving behind the glumes and the lateral spikelets on the rachis. Fertile spikelet : glumes linear-lanceolate, glabrous or slightly villous, attenuated to a scabrid awn. Lemma lanceolate, more or less coriaceous, 5-nerved, nerves prominent, scarcely scabrid on the nerves towards the summit, tapering into a stout, straight awn, up to 12 cm. long and 1 mm. wide at the base, scabrid. Palea lanceolate, embraced by the lemma, obtuse at the tip, 2-keeled. Lateral spikelet : pedicel and glumes more or less villose by appressed hairs ; resembling those of the fertile spikelet ; lemma 3-nerved, obtuse and muticous ; palea slightly shorter than the lemma.

Quetta ; Lahore.

### 2. *Hordeum vulgare* Linn.

*Hordeum vulgare* Linn., Sp. Pl. 84 (1753).

*Hordeum sativum* ssp. *polystychem* (Doell.) Aschr. and Gr., Syn. 2 : 72 (1902).

Similar to *H. distichon* in culms and leaves. *Spikes* more or less long peduncled, erect then nodding, 6-10 cm. long (excl. the awns), tetra- or hexagonous; rachis jointed, tough, compressed, silkily villous at the margins. *Spikelets* 3-nate at each node, all the three alike, bisexual, fertile and awned; the florets easily falling and leaving the glumes on the spike. Rachilla prolonged above the florets into a villous or scabrid collar. *Glumes* linear-lanceolate, more or less villous, tapering to a fine and scabrid awn equalling or exceeding the lemmas. *Lemmas* more or less coriaceous, broadly lanceolate, embracing the palea, with 5 prominent nerves, slightly scabrid at the summit, tapering to a stout, flattened awn scabrid along the margins, up to 15 cm. long and 1 mm. broad at the base. *Palea* subequal, truncate at the tip, 2-keeled, keels slightly scabrid towards the summit. *Anthers* about 3 mm. long.

Spikelets arranged in 4 rows; spikes tetragonous. ....ssp. *vulgare*

Spikelets disposed in 6 rows; spikes hexagonous.....

.....ssp. *hexastichon*

—ssp. *vulgare* (Linn.) Hackel in Engl. et Prantl. Nat. Pflanzenfam. 2, 2, p. 86 (1887), sub *H. sativum*.

Cultivated.

—ssp. *hexastichon* (Linn.) Husnot, Gram. 75 (1899) —*Hordeum hexastichon* Linn. Sp. Pl. 85 (1753).

Cultivated.

### 3. *Hordeum spontaneum* K. Koch

*Hordeum spontaneum* K. Koch, Linnaea 21 : 300 and 430 (1848); Hook. f., Flor. Brit. Ind. 7 : 372 (1896).

Annual. *Culms* solitary or in a little tuft, erect or geniculate-ascending, 25-70 cm. high, more or less striate, glabrous and smooth, with brown nodes. *Leaf-blades* up to 13 cm. long, 8 mm. broad, flat, attenuated to a sharp point, glabrous or with a few scattered hairs, scaberulous. margin scabrous; *sheaths* terete, tight, striate, glabrous and smooth; mouth with two large auricles; *ligule* short (less than 2 mm.), glabrous, truncate, more or less lacerate. *Spike* long-peduncled, erect. dense, 4-5 cm. long (excl. the awns); rachis flattened, densely villous silky along the margins, jointed and very fragile. *Spikelets* 3-nate, the lateral sterile, pedicelled,

the median fertile and sessile. *Fertile spikelet* : glumes linear-lanceolate, silkily-villous, attenuated into a fine and scabrid awn exceeding much the base of the lemma ; rachilla prolonged above the floret into a long ciliate-plumose collar. *Lemma* coriaceous, lanceolate, with 5 distinct nerves, scabrid at the summit along the nerves, the rest glabrous and smooth, prolonged into an awn which is 10-15 cm. long and 1.5 mm. wide at the base, antrorsely scabrid along the margins ; palea subequal, lanceolate, obtuse, 2-keeled, keels scabrid at the summit only. Anthers 2-3 mm. long. *Sterile spikelet* : glumes resembling those of the median spikelet. *Lemma* muticous, obtuse, scabrid at the summit, 3-nerved ; rachilla prolonged into a short and slightly ciliate bristle.

Quetta, Stocks ; Harboi Hills, Hughes-Buller.

#### 4. *Hordeum murinum* Linn.

*Hordeum murinum* Linn., Sp. Pl. 85 (1753) ; Hook. f., Flor. Brit. Ind 7 : 372 (1896).

Annual. *Culms* tufted, erect or geniculate-ascending, 10-50 cm. high, striate, glabrous and smooth. *Leaf-blades* flat, up to 25 cm. long, 8 mm. broad, attenuated to a point, villous, margins scabrid : *sheaths* terete, tight, the upper more or less inflated, striate, glabrous and smooth, the mouth bearing auricles ; *ligule* very short (less than 1 mm.), truncate and more or less erose-denticulate. *Spike* 5-12 cm. long (excl. the awns), remaining enclosed in the upper sheath for a long time then more or less long peduncled, cylindric, dense ; rachis very much flattened, with scabrid margins, glabrous, articulated and very fragile at maturity. *Spikelets* 1-1.8 cm. long (excl. the awns). *Median-spikelet*, fertile and sessile : glumes linear-lanceolate, prolonged at the apex into a long awn (ca. 2.5 cm.), attenuated at the base in a terete pedicel, coriaceous and scabrid, pubescent-scabrid on the back, long ciliate along the margins, 3-nerved. *Lemma* lanceolate, papyraceous, nerves 5, distinct upwards, more or less scabrid towards the summit, attenuated into a scabrid. 3 cm.

long awn ; *palea* subequal, narrowly lanceolate, acute and slightly 2-dentate at the apex, 2-keeled, keels scabrid upwards *Anthers* 1.5-2 mm.



Fig. 184. *Hordeum murinum*.

long. *Lateral spikelets* pedicelled, male ; glumes unequal, the inner linear to linear-lanceolate, 3-nerved, more or less ciliate, insensibly passing into a long narrow awn, the outer reduced to a scabrid shorter awn ; lemma and palea similar to the lemma and palea of the fertile spikelet.

Muree ; Swat ; State Khaza Khela ; Peshawar ; Kagan Valley ; Rawalpindi ; Quetta, *Nawaz* ; Beluchistan, without locality, *Lace*. Very common.

5. *Hordeum nodosum* Linn.

*Hordeum nodosum* Linn., Sp. Pl. ed. 2, 152 (1762).

Perennial; rhizome densely caespitose, producing more or less numerous innovations and fertile culms. *Culms* 30-80 cm. high, geniculate-ascending, thin, striate, glabrous and smooth. *Leaf-blades* flat then involute, up to 12 cm. long, 4 mm. broad, glabrous and smooth or scabrid towards the summit, margins scabrid and with a few hairs; *sheaths* (lower) slightly dilated, subpersistent (withering), membranous or at last coarsely fibrillose, surrounding the slightly thick but not distinctly bulbous base of the culms and the innovations, villous with long (ca. 1 mm.) more or less retrorse hairs, or very shortly pubescent; upper sheaths terete, appressed, striate, glabrous and smooth, auricled at

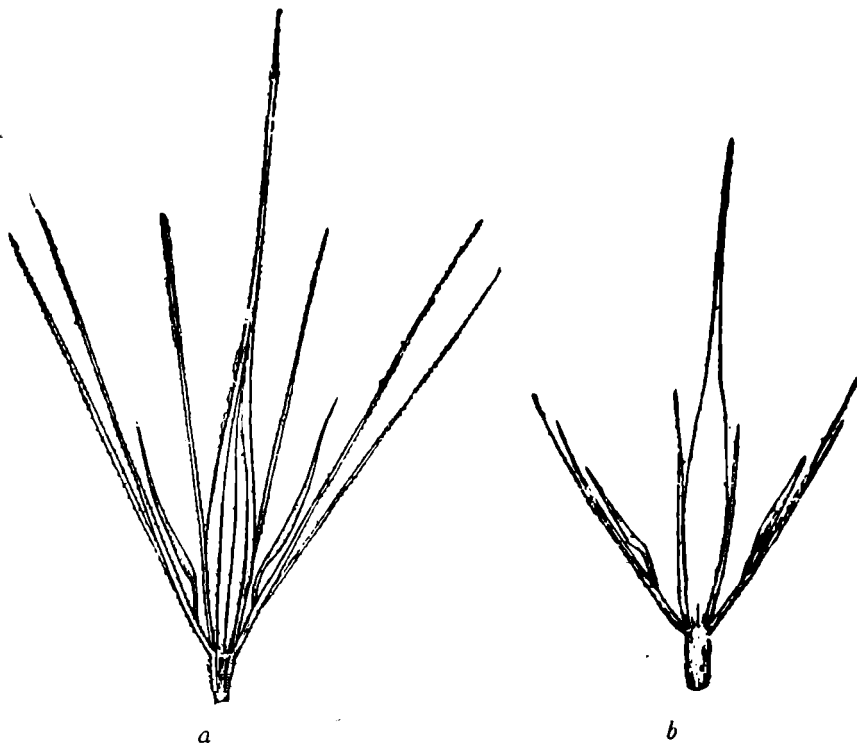


Fig. 185. a. *Hordeum nodosum* ;  
b. var. *brevisubulatum*.

the mouth, *ligule* less than 0.5 mm, truncate, more or less erose-denticulate. *Spike* borne on a 10-20 cm. long peduncle, rather dense, 2.5-5 cm. long, 5 mm. wide (excl. the awns) more or less attenuated at the base; rachis flattened with ciliate margins, articulate, very fragile. *Fertile spikelet*: glumes reduced to two scabrid awns, up to 12 mm. long; rachilla with internodes not distinct above the

glumes, prolonged above the floret in a scabrid bristle. Lemma ca. 7 mm. long, papyraceous, lanceolate, scabrid near the tip with indistinct 5 nerves, tapering towards the apex into a short awn as long as the lemma; *palea* subequal, lanceolate, subacute, 2 keeled, keels scabrid at the tip. *Anthers* ca. 4 mm. long.

Baluchistan Hindu Bag, *Lace. I. I. Chaudhri*; Baltistan, Skardu, 7700 ft., *Duthie*.

—var. *brevisubulatum*; median spikelet 8 mm. (incl the awn) and the glumes 5 mm. long. *H. brevisubulatum* (Trin.) Link in *Linnaea* 17: 391.

Quetta, *I. I. Chaudhri*.

### 11. *Elymus* Linn.

Erect, usually rather tall perennials with flat or rarely convolute blades and slender or bristly spikes. Spikelets usually crowded, sometimes distant, 2- to 6-flowered, in pairs (3 or solitary in a few species) At each node of a usually continuous rachis, placed as in *Agropyron* but the rachilla distorted at the base, bringing the florets more or less dorsiventral to the rachis; rachilla disarticulating above the glumes and between the florets. Glumes equal, somewhat asymmetric, usually rigid, sometimes indurate below, narrow to subulate, 1- to several-nerved, acute to aristate; lemmas rounded on the back or nearly terete, obscurely 5-nerved, acute or awned from the tip.

#### KEY TO THE SPECIES

1. Glumes collateral, as long as the spikelet .. . . . . . 2. *E. dahuricus*  
Glumes collateral or subopposite, shorter than the spikelet .. . . . . . 2
2. Glumes collateral; lemma notched towards the subulate or shortly-  
awned tip..... 3. *E. dasystachys*  
Glumes subopposite; lemma narrowed into a slender awn much  
longer than the lemma... . . . . . 1. *E. sibiricus*

#### 1. *Elymus sibiricus* Linn.

*Elymus sibiricus* Linn., Sp. Pl. 3 (1753); Hook. f., Fl. Brit. Ind. 7: 373 (1896).

*Culms* densely tufted, up to 60 cm. high, ascending, smooth. *Leaf-*

*blades* up to 25 cm. long, 4-8 mm. wide. nearly smooth ; *sheaths* smooth ; *ligule* very short. Spike short or elongate, up to 25 cm. long, straight, curved or flexuous ; rachis smooth or slightly scabrid. *Spikelets* geminate and fascicled, 1.2-2.5 cm. long, sessile and pedicelled ; rachilla slender, minutely scaberulous ; internodes long or short. *Glumes* subopposite, much shorter than the spikelet, narrowly lanceolate or almost setaceous, acute or acuminate or the upper only awned, never notched, 3 nerved. *Lemma* lanceolate, 5-nerved, narrowed into a slender erect or recurved awn, tip toothed or quite entire, glabrous smooth or scaberulous ; awn up to 2.5 cm. long. *Palea* with keels ciliate toothed above the middle.

Gilgit, 10-14000 ft.

### 2. *Elymus dahuricus* Turc.

*Elymus dahuricus* Turc. in Bull. Soc. Nat. Mosc. 105 (1838) ; Hook f., Fl. Brit. Ind. 7 : 374 (1896).

*Culms* up to 60 cm. high, rather stout and leafy, or shorter more slender and leafy at the base chiefly. *Leaf-blades* 7.5-20 cm. long, 8-4 mm. wide, flat, finely acuminate, nearly smooth or scaberulous above ; *sheaths* smooth ; *ligule* very short. Spikes narrow, strict or subflexuous, 7.5-20 cm. long ; rachis glabrous or nodes pubescent. *Spikelets* geminate, 2- to 3-flowered, 8-12 mm long, green, imbricating. *Glumes* collateral, linear-lanceolate, acuminate or subaristate, as long as the spikelet, strongly 3- to 5-nerved, smooth or scaberulous, rarely toothed on one side towards the tip. *Lemma* lanceolate, more or less distinctly notched at the tip, 5-nerved, glabrous to scaberulous, with minutely ciliate nerves ; awn 8-12 mm. long. *Palea* with keels strongly shortly ciliate.

Karakorum, 7-12000 ft.

### 3. *Elymus dasystachys* Trin.

*Elymus dasystachys* Trin in Ledeb. Fl. Alt. 1 : 120 ; Hook. f., Fl. Brit. Ind. 7 : 374 (1896).

*Culms* up to 60 cm. high, stout or slender. *Leaf-blades* 15-30 cm. long, 4-8 mm. wide, or narrow with margins involute, smooth or scaberulous. Spikes stout, strict, 15-20 cm. long ; rachis stout, pubescent, sparsely villous or nearly glabrous. *Spikelets* geminate, 2- to 5 flowered,

12 mm. long. *Glumes* collateral, unequal, subulate-lanceolate, 1- to 3-nerved, aristately acuminate; upper nearly as long as lowest floret. *Lemma* lanceolate, more or less silky, rarely almost glabrous, 5-nerved, top notched towards the subulate or shortly awned tip. *Palea* with stoutly ciliate keels.

Gilgit, 8-12000 ft.

## 12. **Taeniatherum** Nevski

A segregate of *Elymus*, differing in having spikes dilated at the apex by the divergence of the awns; rachis tough, glabrous; spikelets geminate, sessile, 1-flowered with a second floret rudimentary; glumes connate at the base; lemmas with very long awns, flattened at the base.

### 1. **Taeniatherum crinitus** (Schreb.) Nevski

*Taeniatherum crinitus* (Schreb.) Nevski in Acta Univ. As. Med. Ser. VIII b, Bot. Fasc. 17 : 38 (1934).

Annual. *Culms* tufted or slightly pubescent below the spike. *Leaf-blades* flat becoming rolled in drying, usually 12 cm. long and 5 mm. wide hairy and smooth; *sheaths* terete, glabrous, more or less tight, the lower slipping from the culms, 2-auricled at the apex; *ligules* membranous, less than 0.7 mm. long, glabrous, truncate. Spikes erect, enclosed at the base in the uppermost sheath or finally more or less long peduncled, 1.5-5 cm. long (excl. the awns); rachis tough, compressed with faces keeled, glabrous. *Spikelets* 2-nate at each node, sessile, 2-flowered, with the upper floret reduced, *Glumes* similar, coriaceous, up to 6 cm. long (incl. the awn), subulate, strongly thickened and indurated at the base where they are shortly united together and with those of the neighbouring spikelet, attenuated into a long scabrid awn. *Lower lemma* lanceolate, rounded dorsally, scabrid, 0.8-1.25 cm. long, with 5 indistinct nerves, tapering at the summit into a flattened awn; awn scabrid, 7-12 cm. long. *Palea* subequal, narrowly lanceolate.



truncate or retuse ; keels scabrid. Upper lemma sterile, very much



Fig. 186. *Taeniatherum crinitus*.

reduced.

Quetta, 7.5.56, *J. J. Norris* ; 15. 6. 59, *A. H. Khan*.

### Tribe 11. **Stipeae**

Spikelets all alike, bisexual, 1-flowered, arranged in open or contracted panicles, very rarely solitary ; rachilla jointed above the glumes, not produced beyond the floret. Glumes mostly persistent, one or both usually as long as or longer than the floret. Lemma usually terete with convolute or involute margins, rarely dorsally compressed, becoming rigid and

indurated at maturity, 3-to 7-nerved, with the nerves close together at the apex, often with a bearded basal callus. awned from the entire or 2-toothed tip ; awn simple or divided into 3 branches, rarely suppressed.

## KEY TO THE GENERA

1. Lemma hyaline, not indurated with a median awn; the two lateral nerves produced on each side of awn in two stout, scabrid bristles...  
..... 1. *Trikeriaia*  
Lemma indurated, awnless or awned but the lateral nerves not produced into scabrid awns ..... 2
2. Lemma awnless: fruit dorsally compressed, indurated, smooth and shining ..... 2. *Milium*  
Lemma awned, terete with convolute or involute margins ..... 3
3. Awn simple ..... 4  
Awn tripartite, the lateral branches sometimes short ... 3. *Aristida*
4. Lemma cylindrical or linear-oblong; awn geniculate or hirsute below the knee ; callus sharp pointed, usually narrow and acuminate.....  
..... 4. *Stipa*  
Lemma broader ; awn very fine, straight, caducous ; callus short, usually obtuse ..... 5. *Cryzopsis*

1. ***Trikeriaia*** Bor

Perennial, rhizomatous grasses. Panicle contracted or effuse with short or long branches. Spikelets pedicelled, 1-flowered ; rachilla jointed above the glumes, not produced. Glumes equal, more or less similar, membranous, 3-nerved. Lemma 5- to 7-nerved, dorsally pilose, apex with a median awn but in addition the lateral nerves are produced on each side of the awn into two rather stout scabrid bristles.

1. ***Trikeriaia hookeri*** (Stapf) Bor

*Trikeriaia hookeri* (Stapf) Bor in Kew Bulletin 1954 : 555 (1954).

*Stipa hookeri* Stapf in Jour. Linn. Soc. Bot. 30 : 120 (1894) ; Hook. f., Fl. Brit. Ind. 7 : 238 (1896).

Perennial, rhizomatous grass. Culms robust, densely tufted, hard,

leafy upwards, 90-120 cm. high. *Leaf-blades* 30-60 cm. long, involute, setaceous, sulcate, smooth or scaberulous; *ligules* membranous, oblong, 8 mm. long. Panicle oblong, contracted or effuse, loosely branched, 7.5-25 cm. long, inclined; branches 2- to 4-nate, many-spiculate, suberect: axis and pedicels smooth. *Spikelets* elliptic-acute, 4-6 mm. long, yellowish. *Glumes* equal, more or less similar, oblong-lanceolate, acute, minutely scaberulous, 3-nerved. *Lemma* shorter than the upper glume, hyaline, oblong-elliptic, 5- to 7-nerved, dorsally pilose, apex with a median awn, the lateral nerves produced on each side of the awn into two stout, scabrid bristles more or less curved, slender, hardly twisted towards the base. *Palea* hyaline, nearly as long as the lemma, 2-nerved, dorsally pilose. *Callus* short, conical, bearded.

Chitral : Gujar.

## 2. *Milium* Linn.

Moderately tall grasses with flat blades and open panicles. Spikelets 1-flowered; rachilla jointed above the glumes. Glumes equal, obtuse, rounded on the back. Lemma a little shorter than the glumes, obtuse, obscurely nerved, rounded on the back, dorsally compressed, in fruit becoming indurated, smooth and shining, the margins enclosing the palea.

### 1. *Milium effusum* Linn.

*Milium effusum* Linn., Sp. Pl. 61 (1753); Hook. f., Fl. Brit. Ind. 7: 235 (1896).

Perennial. *Culms* loosely tufted, slender, erect or ascending, 3- to 5-noded below the middle, 45-150 cm. high. *Leaf-blades* 10-30 cm. long, flat, 5-15 mm. broad, glabrous, margins scabrid; *sheaths* rounded on the back, smooth; *ligule* membranous, 3-10 mm. long. Panicle lanceolate to ovate or oblong, very loose, nodding, up to 40 cm. long; branches whorled, flexuous, spreading or deflexed; axis smooth. *Spikelets* narrowly elliptic to ovate, 3-4 mm. long, dorsally compressed. *Glumes* persistent, ovate to elliptic-ovate, as long as the spikelet, green, minutely scabrid, 3-nerved. *Lemma* lanceolate to elliptic in back view, as long as the glumes, dorsally rounded, indurated, smooth and shining, finely 5-nerved. *Palea* as long as the lemma and similar in texture. *Anthers* 2-3 mm. long.

Gilgit, 7-11000 ft., *A. H. Khan.*

### 3. *Aristida* Linn,

Annual or perennial grasses with usually convolute leaves and spike-like or effuse panicle. Spikelets 1-flowered; rachilla jointed above the glumes, not produced. Glumes persistent, 1- to 3-nerved. Lemma convolute, cylindrical, 2-fid or entire at the apex, villous or shortly bearded, awn always tripartite, continuous with the lemma or jointed to it; column straight or twisted, bristles plumose or the lateral or all naked.

#### KEY TO THE SECTIONS

1. Column present, articulated with the lemma.....2  
 Column absent; awn tripartite from the base, not articulated, persistent, glabrous..... 1. *Chaetaria*
2. Column articulated at its base with the apex of the lemma.....3  
 Column articulated at its summit below the trifurcation of the awn ..... 11. *Pseudarthratherum*
3. Column of the awn long, twisted; branches of the awn glabrous.....  
 ..... III. *Arthratherum*  
 Column twisted or not; branches of the awn, at least the median long-plumose ..... IV. *Stipagrostis*

#### Section I. CHAETARIA

1. Glumes awned; the median branch of the lemmatal awn up to 5 cm. long... .. 1. *A. cyanantha*  
 Glumes awnless, acuminate or mucronate; the median branch of the lemmatal awn not exceeding 2.5 cm. in length ..... 2
2. Lower glume more than 2/3 the upper..... 2. *A. adscencionis*  
 Lower glume not 2/3 the upper..... 3. *A. depressa*

#### Section II. PSEUDARTHATHERUM

- Single species ..... 4. *A. mu tabilis*

#### Section III. ARTHRATHERUM

- Callus notched at the base ..... 5. *A. hystriacula*

- Callus not notched at the base ; lower glume longer than the upper .....2
2. Lower glume up to 1.2 cm. long ; column 18 mm. long.....  
 .. 6. *A. royleana*  
 Lower glume more than 1.2 cm. long ; column 33 mm. long.....  
 ..... 7. *A. funiculata*

## Section IV. STIPAGROSTIS

1. All branches of the awn plumose, subequal.....8. *A. pennata*  
 Median branch alone plumose, the lateral naked, short ... .. 2
2. Column plumose, twisted ; lemma muriculate..... 3  
 Column glabrous, hardly twisted ; lemma glabrous, smooth ; basal sheaths lanate ... .. 9. *A. plumosa*
3. Glumes glabrous ; central awn without a naked tip .....  
 ..... 10. *A. paradisea*  
 Glumes hairy ; central awn with a naked tip ..... 11. *A. hirtigluma*

1. *Aristida cyanantha* Steud.

*Aristida cyanantha* Steud., Nom. ed. 2, 131 (1840) ; Hook. f., Fl. Brit. Ind. 7 : 225 (1896).

Perennial. *Culms* 90-180 cm. high, 5 mm. in diameter, smooth, glabrous. *Leaf-blades* 5-30 cm. long, 5-8 mm. broad, at length convolute, articulate with the sheath, smooth, glaucous ; *sheaths* smooth ; *ligule* represented by a ridge of hairs. *Panicle* large, effuse, 30-45 cm. long ; branches flexuous, widely spreading, solitary or 2- to 3-nate, 10-30 cm. long, usually naked for 5-15 cm., scaberulous. *Spikelets* (excl. awns) 8-12 mm. long, 1-flowered, usually dark purple. *Glumes* shortly awned, 1-nerved, keels smooth ; lower 9 mm. long, scaberulous on the keel, awn 1-1.5 mm. long ; upper 11 mm. long, smooth, awn 2 mm. long. *Lemma* chartaceous, convolutely folded, glabrous, 3-nerved, 7.5-10 mm. long ; callus shortly villous, up to 0.4 mm. long. *Awn* 3-partite, not articulated with the lemma, branches subequal, minutely scaberulous, the middle up to 50 mm. long. *Anthers* 5 mm. long.

Murree Hills ; Quetta. Common.

2. **Aristida adscencionis** Linn.

*Aristida adscencionis* Linn, Sp. Pl. 32 (1753).

Annual. Culms up to 60 cm. high, densely tufted, erect or ascending, simple or branched; branches erect, smooth. Leaf-blades up to 30 cm. long, 1-2 mm. broad, convolute, filiform, smooth or scaberulous; sheaths smooth, with rounded auricles; ligule a row of fine hairs. Panicle up to 30 cm. long, contracted, subsecund; axis filiform, smooth; branches short; pedicels short, capillary. Spikelets erect, 6-8 mm. long. Lower glume 4 mm. long, oblong-lanceolate, truncate and finely mucronate at the apex, membranous, often purple, scabrid along the keel, 1-nerved. Upper glume lanceolate, 6 mm. long, emarginate or 2-toothed and apiculate at the tip, the keels usually smooth. Lemma linear, compressed, convolute, 8 mm. long or longer, 3-nerved, more or less scabrid. Awn 3-partite, not articulated on the lemma, 10-15 mm. long, the middle branch longer than the laterals. Callus long, pointed, hairy at the base. Palea minute, oblong, hyaline, retuse.

Lahore; Quetta; Peshawar; Bolan Pass; Harnai; Ziarat; Fort Sandeman; Hyderabad.

———var. *pumila* (Dec.) Coss. et Dur. Lemma scabrid on the whole of its surface, 17 mm. long, much compressed.

Magharpir near Karachi, I. I. Chaudhri.

3. **Aristida depressa** Retz.

*Aristida depressa* Retz., Obs. fasc. 4 : 22 (1786).

Annual. Culms erect or ascending from a decumbent base, densely tufted, simple or branched, up to 60 cm. high. Leaf-blades convolute, filiform, smooth or scaberulous, up to 25 cm. long, 1-2 mm. broad; sheaths smooth; ligule a ridge of short hairs. Panicle narrowly contracted but more or less lax, sometimes effuse and 3 cm. wide at the base and open; branches 1- to 2-nate, branched to the base or simple to the middle, erect or nodding or flexuous, filiform, scabrid. Spikelets 7-8 mm. long, glabrous and punctulate or glabrous only below and scabrid from the middle to the summit; upper 9-10 mm. long, smooth on the keel, very obtuse, distinctly 2-fid at the apex with a mucro from the sinus. Lemma linear, 8-9 mm. long, subacute or subobtuse, scabrous, on the keel; callus 0.75 mm. long. Awn continuous with the lemma,

3-fid, central branch up to 18 mm. but lateral branches shorter.

Lahore ; Swat State ; Dera Ismail Khan.

#### 4. *Aristida mutabilis* Trin. & Rupr.

*Aristida mutabilis* Trin. & Rupr. in Msm. Acad. Petersb. ser. IV, 150 (1842); Hook. f., Fl. Brit. Ind. 7 : 226 (1896).

Annual. *Culms* tufted, erect or geniculate-ascending, simple or branched, 15-40 cm high, scabrid. *Leaf-blades* convolute, up to 10 cm. long, finely pointed at the tip, glabrous and smooth below scabrid above ; *sheaths* compressed, keeled, slightly scabrid, with long-ciliate auricles ; *ligules* reduced to rim of hairs. Panicle 7-16 cm. long ; branches solitary bearing at their tips dense clusters of spikelets ; axis smooth, glabrous at the nodes ; branches, branchlets and peduncle scabrid. *Glumes* unequal, 1-nerved ; the lower scabrid, 5-6 mm long (excl. the awns), attenuated into an awn ; the upper smooth, 2-fid with a mucro or a short awn in the sinus, 6.5-7.5 mm. long. *Lemma* cylindrical, convolute, 3-5 mm. long, scabrid at the summit ; callus shortly bearded. *Awn* obscurely articulate with the lemma ; column scabrid, tortuose, equalling the lemma or shorter, usually 1-5 times as long ; median branches about 12 mm. long.

Sangla Hill ; Hyderabad ; Multan ; Quetta ; Kalachitta Hills ; Gilgit

#### 5. *Aristida hystricula* Edgew.

*Aristida hystricula* Edgew. in Jour. Linn Soc. 6 : 208 (1852) ; Hook. f., Fl. Brit. Ind. 7 : 227 (1896).

Annual *Culms* 2.5-7.5 cm. high, many from the base, densely tufted ; nodes glabrous. *Leaf-blades* subulate, curved, convolute, acuminate, glabrous, up to 2.5 cm. long ; *sheaths* glabrous ; *ligule* a rim of fine hairs. Panicle 1.2-2.5 cm long, narrow, few-flowered ; branches few, short, erect. *Spikelets* 9-12 mm. long. *Lower glume* 4-5 mm. long, much shorter than the upper, ovate-lanceolate, acute, apiculate. *Upper glume* 9-12 mm. long, linear, cleft at the tip into two subulate lobes, 1.5 mm long, with a short awn in the sinus. *Lemma* 4 mm. long ; callus densely hairy, notched at the base. *Awn* bipartite, continuous with the lemma ; column 1.2 (-2) cm long, twisted, scabrid or pubescent below and scabrid above ; the branches subequal, slender, 1.2-1.8 (-3.2) cm long.

Karachi ; Hyderabad ; Quetta ; Multan.

6. **Aristida royleana** Trin. & Rupr.

*Aristida royleana* Trin. & Rupr. in Mem. Acad. Petersb. ser. VI. 7 : 160 (1849).

Annual. *Culms* up to 60 cm. high, many, geniculute-ascending. *Leaf-blades* 5-15 cm. high, 1.2-2 mm. broad, flat or convolute, ciliate at the base ; *sheaths* glabrous ; *ligule* a small ciliate membrane. Panicle 10-25 cm. long, lax, narrow ; axis angular ; branches short, erect, capillary. Spikelets 12-18 mm. long. *Lower glume* up to 17 mm. long, linear-lanceolate, acute, 1-nerved, tapering into a slender awn. *Upper glume* 14 mm. long, similar to the lower glume. *Lemma* 5 mm. long, smooth, awned. *Awn* articulate on the lemma ; column 18 mm. long, twisted, 3-partite, the middle branch 5.5 cm. long.

Quetta ; Hyderabad ; Lahore ; Salt Range ; Sheikhpura.

7. **Aristida funiculata** Trin. & Rupr.

*Aristida funiculata* Trin. & Rupr. in Mem. Acad. Petersb. ser. VI. 7 : 159 (1849).

Annual. *Culms* simple, densely fascicled, erect, up to 30 cm. high, slightly scabrid, glabrous. *Leaf-blades* flat, then more or less convolute, glabrous, smooth ; *sheaths* glabrous, smooth ; *ligule* a short ciliate membrane. Panicle 10-25 cm. long, narrow ; axis angular ; branches short, erect. Spikelets up to 3 cm. long. *Lower glume* linear, 3-nerved, with a scabrid keel, 20-50 mm. long. *Upper glume* linear, 1-nerved, usually much shorter. *Lemma* cylindric, glabrous, punctate-papillose at the summit, up to 4 mm. long ; callus 1-2 mm. long, densely hairy with a naked and fine point. *Awn* with subequal branches, 4-7 cm long ; column scabrid, tortuose, 3-4.5 cm. long. Anthers 0.5 mm. long.

Karachi ; Mirpur Khas ; Thatta.

8. **Aristida pennata** Trin.

*Aristida pennata* Trin. in Mem. Acad. Peteresb. 6 : 488 (1815).

A robust perennial with a much branched more or less creeping rhizome. *Culms* erect, simple or branched, at the base, few-noded, terete, smooth, *Leaf-blades* up to 25 cm. long, 2-3 mm. wide, convolute, acute, scabrid on both surfaces ; longer than the internodes, tight,



terete or slightly compressed, the lower ones more or less gaping, distinctly scabrid all over, with hyaline margins; auricles shortly but densely bearded; *ligule* a short, ciliate membrane. Panicle erect, shortly exerted or sheathed by the uppermost leaf, at first contracted then effuse, 20 cm. long, 15 cm. wide; axis glabrous, angular; branches solitary, branched from near the base; axils glabrous or slightly bearded. *Spikelets* 1.6 cm. long. *Lower glume* 16 mm. long, glabrous and rough, 5-nerved. *Upper glume* 13-14 mm. long, 3-nerved, glabrous and rough; sometimes both the glumes much shorter. *Lemma* 5-6 mm. long, strongly keeled, 3-nerved, suddenly contracted into a callus, oblique, sharp pointed, laterally bearded, 1-1.5 mm. long. *Awns* densely plumose with long spreading hairs, 10-15 mm. long, tips obtuse or acute with a naked exerted scabrous point; column very short.

Ziarat; Kharan; Loralai; Bolan Pass.

#### 9. *Aristida plumosa* Linn.

*Aristida plumosa* Linn., Sp. Pl. ed. 2: 1666 (1762); Hook.f., Fl. Brit. Ind. 7: 228 (1896).

Perennial. *Culms* erect or geniculate-ascending, simple or sometimes branched, up to 30 cm. high, 2-noded, glabrous; lower internodes lanate the upper shortly hairy or glabrous, *Leaf-blades* convolute, up to 10 cm. long, 0.9 mm. broad, glabrous; *sheaths* (lower) densely tomentose, the upper glabrous; *ligule* a rim of short hairs. Panicle erect, loose, generally enclosed by the uppermost sheath at the base; axis more or less scabrid; branches geminate, many-flowered, naked at the base; branches and pedicels scabrid. *Spikelets* up to 1.8 cm. long. *Lower glume* lanceolate, 1- to 3-nerved, 15 mm. long, more or less obtuse. *Upper glume* narrower, 1-nerved, up to 18 mm. long. *Lemma* 6-7 mm. long; callus 2 mm. long, densely hairy, the hairs not reaching the middle of the lemma. *Awn* with unequal branches; middle branch up to 5 cm. long, naked at the base, plumose upwards with the tip naked; lateral branches 0.8-2 cm. long, naked, column not tortuose, glabrous. *Anthers* 2 mm. long.

Mianwali; Khanewal; Multan; Bahawalpur; Quetta; Qila Saifullah; Nushki; Fort Sandeman; Hyderabad; Quetta.

10. ***Aristida paradisea*** Edgew.

*Aristida paradisea* Edgew. in Jour. As. Soc. Beng. 16 : 1219 (1847).

A perennial grass with a short rhizome. *Culms* up to 45 cm. high, erect or geniculate-ascending, simple or branched. *Leaf-blades* rather stiff, articulate on the sheaths, lower up to 20 cm. long; *sheaths* terete, tight, glabrous and smooth, bearded at the mouth; *ligules* absent. Panicle loose, up to 15 cm. long; axis scabrid; branchlets scabrid, bearing the spikelets in racemes; pedicels scabrid. *Spikelets* up to 9 mm. long. *Lower glume* 6-7 mm. long, subnavicular, fimbriate at the apex, 3-nerved, glabrous or with scattered hairs. *Upper glume* 7-9 mm. long, 3-nerved, inserted slightly higher up, narrower than the lower, emarginate at the apex. *Lemma* 3 mm. long; callus densely setulose. *Awn* with very unequal branches; median branch up to 3.5 cm. long, long-plumose, the lateral branches 6-12 mm. long, more or less divergent; column as long as the lemma, papillose-scabrid, conspicuously laxly hairy, bearded-hirsute near the apex.

Kala Bagh ; Hyderabad ; Bhakkar.

11. ***Aristida hirtigluma*** Steud.

*Aristida hirtigluma* Steud., Nom. ed. 2, pt. 1 : 131 (1840); Hook. f., Fl. Brit. Ind. 7 : 227 (1896), excl. *A. pogonoptila*.

Annual or perennial. *Culms* tufted, erect, up to 40 cm. high, slightly scabrid; nodes glabrous. *Leaf-blades* 5-10 cm. long, 0.9 mm. wide, slightly scabrid below, very shortly hairy above with long hairs towards the base, convolute filiform with capillary tips; *sheaths* quite glabrous except for a few long hairs at the mouth, margins hyaline; *ligule* a ciliate rim. Panicle narrow, up to 20 cm. long, erect, few-spiculate; axis glabrous, slightly scabrid. *Spikelets* up to 20 cm. long. *Lower glume* 6-8 mm. long, lanceolate or oval-lanceolate, acute, 3-nerved, 2-lobed or erose at the tip, velutinate-ciliate on the back and the margins. *Upper glume* up to 10 mm. long, mucronate or short-awned, emarginate or short-awned, emarginate or 2-fid at the apex, hairy on the back and the margins. *Lemma* 3 mm. long, cylindrical, glabrous, slightly muricate; callus 0.7-1 mm. long, bearing 2 rings of white hairs, the lower with shorter hairs while the upper (at the base of the lemma) with long hairs reaching the middle of the lemma. *Awn* articulated on the lemma,

the median branch up to 7 cm. long, naked at the base and at the tip, otherwise plumose ; column 7-10 mm. long, tortuose, tuberculate-scabrid and more or less plumose with long hairs. Anthers 3-4 mm. long.

Thana Bullo Khan ; Peshawar ; Karachi ; Rawalpindi ; Dera Ismail Khan ; Khewra ; Bolan Pass.

#### 4. *Stipa* Linn.

Perennial rarely annual grasses with convolute rarely flat leaves. Panicle effuse or contracted or almost spike-like. Spikelets narrow, 1-flowered ; rachilla jointed above the glumes, not produced. Glumes persistent, 1- to 3-nerved. Lemma convolute, cylindric or oblong-cylindric, 5- to 7-nerved, rather rigid, tip gradually tapering or minutely 2-lobed ; callus more or less bearded, usually pungent ; awn simple, continuous with or jointed on the lemma, bent or geniculate, twisted below, plumose or naked above the knee. Palea 2-keeled or 2-nerved, almost as long as the lemma or shorter. Ovary glabrous ; styles distinct ; stigmas plumose. Grain cylindric, tightly embraced by the hardened lemma and palea.

#### KEY TO THE SPECIES

- |                                                                                                                  |                           |
|------------------------------------------------------------------------------------------------------------------|---------------------------|
| 1. Awn plumose or hairy throughout its length .....                                                              | 1. <i>S. szovitsiana</i>  |
| Awn plumose above the column only.....                                                                           | 2. <i>S. himalaica</i>    |
| Awn glabrous or hairy on the column only .....                                                                   | 2                         |
| 2. Tip of the lemma entire.....                                                                                  | 3                         |
| Tip of lemma 2-fid or 2-toothed.....                                                                             | 5                         |
| 3. Perennial ; culms 30-90 cm. high.....                                                                         | 4                         |
| Annual ; culms 5-10 cm. high : panicle partially enclosed in the sheath ; awn 5-10 cm. long ; column hairy... .. | 3. <i>S. tortilis</i>     |
| 4. Awn 3.6 cm. long ; lemma hairy.....                                                                           | 4. <i>S. sibirica</i>     |
| Awn 15-20 cm. long, glabrous throughout .....                                                                    | 5. <i>S. capillata</i>    |
| 5. Column of the awn twisted.....                                                                                | 6                         |
| Column of the awn not twisted .....                                                                              | 6. <i>S. splendens</i>    |
| 6. Panicle lax : lemma 1/2 as long as the upper glume ; palea much shorter than the lemma .....                  | 7. <i>S. jacquemontii</i> |

Panicle dense, compact ; palea nearly as long as the lemma.....

..... 8. *S. chitralensis*

1. ***Stipa szovitsiana*** Trin.

*Stipa szovitsiana* Trin. in Hoh. Bull. Soc. Nat. Mosc. 243 (1838).

Perennial. *Culms* 15-35 cm. high, densely tufted, clothed below with shining sheaths, slightly pubescent, esp. at the nodes, 10-25 cm. long. filiform, tips long capillary ; sheaths of uppermost leaf 10-15 cm. long, 4-6 mm. wide. scabrid ; ligule membranous, hyaline, 4 mm. long, obtuse. Panicle elongate, narrow, more or less enclosed in the dilated sheath of the uppermost leaf ; branches and pedicels short, erect. Spikelets 1.2 cm. long. *Glumes* hyaline, 7 cm. long, tips slender, twice as long as the glume ; lower glume 1-nerved or 3-nerved at the base ; upper 3-nerved. *Lemma* cylindric, silkily hairy ; callus 1/6 the lemma, bearded. *Awn* 10-15 cm. long, plumose throughout its length, column 1/4 of its length.

Dir ; Chitral ; Quetta ; Ziarat. Common.

2. ***Stipa himalaica*** Roshev.

*Stipa himalaica* Roshev. in Not. Syst. Hort. Petrop. 5 : 11 (1924).

*Stipa pennata* Hook. f., Fl. Brit. Ind. 7 : 230 (1896) non Linn.

Perennial. *Culms* 30-60 cm. high, densely tufted. *Leaf-blades* 30-45 cm. long, rigid, convolute, very scabrid ; *sheaths* smooth or rough ; ligule oblong, membranous, 8 mm. long. Panicle narrow, sheathed at the base. few-flowered ; branches short. Spikelets 2.5 cm. long. *Glumes* 4.5 mm. long, hyaline, subequal, cuspidately acuminate. *Lemma* 1 cm. long, hirsute, glabrous above ; callus 5 mm. long. *Awn* twisted and glabrous from the lower third, 13.5-24 cm. long, plumose above the column only.

Ziarat, Juniper Tract ; Upper Swat ; Gilgit ; Kagan, Babusar Pass.

3. ***Stipa sibirica*** Lamk.

*Stipa sibirica* Lamk., Illustr. 1 : 158 (1791); Hook. f., Fl. Brit. Ind. 7 : 231 (1896).

Perennial. *Culms* 30-60 cm. long, 3-8 mm. wide, smooth ; *ligule* membranous, oblong. Panicle elongate, very narrow, 15-30 cm. long, inclined ; branches 2-nate, 6 cm long, erect and appressed, rarely spreading, scaberulous ; pedicels usually shorter than the spikelets.

Spikelets terete, lanceolate, green, 6-8 mm. long. *Glumes* subhyaline, oblong-lanceolate, 8 mm. long, hyaline, 1-nerved. *Lemma* as long as the upper glume, terete or slightly dorsally flattened, hairy; callus short, conical. *Awn* about twice as long as spikelets, rather stout, hairy towards the base only; column tortuose. *Palea* as long as the lemma, linear, obtuse, dorsally hairy. *Anther* tips bearded.

Kagan Valley : Shogran ; Swat : Kalam.

#### 4. *Stipa tortilis* Hook. f.

*Stipa tortilis* Hook. f., Fl. Brit. Ind. 7 : 231 (1896) non Desf.

Annual. *Culms* very slender, tufted, 10-15 cm. long, 4 mm. wide, scabrid below hairy above; *sheaths* smooth, bearded at the mouth, the uppermost dilated; *ligule* reduced to a ciliate rim. Panicle dense flowered, almost spiciform 2.5-10 cm. long, partially sheathed at the base; sheath 6 mm. broad. Spikelets fascicled, 18-25 mm. long. *Glumes* subequal, 1.5-1.8 cm. long, hyaline, setaceous linear, 3-nerved. *Lemma* 4 mm. long, linear, hairy or scabrid; callus 2 mm. long, acute, bearded at the top only. *Awn* 5-10 cm. long, straight; column only hairy. *Anthers* with bearded tips.

Peshawar ; Quetta ; Fort Sandeman ; Campbellpur ; Khyber Pass Kohat-Hangu.

#### *Stipa capillata* Linn.

*Stipa capillata* Linn. Sp. Pl. ed. II. 116 (1762); Hook. f., Fl. Brit. Ind. 7 : 230 (1896)

Perennial. *Culms* 30-90 cm. high, rather stout, glabrous, smooth. *Leaf-blades* 30-60 cm. long, filiform, convolute, scaberulous; *ligule* lanceolate, membranous. Panicle very narrow, more or less enclosed in a sheath which is 15-25 cm. long with a filiform blade often as long as itself; branches and pedicels short. *Spikelets* 2.5 cm. long, white glistening hyaline. *Glumes* unequal; lower shorter than the upper, very narrow, with finely acuminate tip, 5-nerved below; upper glume similar but longer, 5-nerved. *Lemma* 1/2 as long as the upper glume (1.25 cm.), glabrous above, nerves pubescent below; callus 1/2 as long as the lemma, scabrid, bearded at the top. *Awn* 15-20 cm. long, flexuous, smooth, glabrous throughout. *Palea* glabrous. *Anthers* with naked tips.

Chitral,

6. ***Stipa jacquemontii*** Jaub. & Spach

*Stipa jacquemontii* Jaub. & Spach, Illustr. Pl. Orient. 4 : 60 (1850-53) ;  
Hook. f., Fl. Brit. Ind. 7 : 232 (1896).

Perennial. *Culms* erect, densely tufted, 25-45 cm. high. *Leaf blades* convolute, filiform, 16-25 cm. long, erect, subflexuous ; *ligule* a very short membrane. Panicle narrow, 10-15 cm. long, erect or slightly inclined ; lower branches 7.5 cm. long ; branchlets bearing one or two erect spikelets at the extremity. Spikelets erect, green or purple, 4-6 mm. long, linear-lanceolate. *Glumes* subequal, lanceolate, acuminate, 3 nerved, 6 mm. long, with broad hyaline margins, *Lemma* terete, villous, about 4.5 mm. long, tip minutely 2-toothed ; callus short, conical, oblique, bearded ; *awn* geniculate, twisted, 2.5-3.2 cm. long. *Palea* much shorter than the lemma.

Quetta ; Kagan Valley : Shogran.

7. ***Stipa chitralensis*** Bor

*Stipa chitralensis* Bor in Kew Bull. 1954 : 500 (1954).

A grass with a perennial rhizome. *Culms* erect, up to 40 cm. high, entirely covered by the sheaths, smooth, glabrous ; nodes glabrous. *Leaf-blades* erect, up to 22 cm. long, 6 mm. broad, smooth and glabrous on both surfaces ; *sheaths* loose and glabrous with ciliate auricles ; *ligule* membranous, truncate, 1.5 mm. long. Panicle congested compact, 9 cm. long, 2 cm. wide, axis smooth, glabrous ; branches short, smooth, glabrous. Spikelets shortly pedicelled, 9.5 mm. long, lanceolate. *Lower glume* 8 mm. long, 2.5 mm. broad, oblong acute, hyaline, glabrous, smooth, 3 nerved, the lateral nerves anastomosed with the median. *Upper glume* 8.5 mm. long, 2 mm. broad, oblong, acute, 5-nerved. *Lemma* 9.5 mm. long, 2.5 mm. broad, membranous, 5-nerved, apex 2-fid with the lobes 2.5 mm. long, hyaline, dorsally pilose with the hairs 2 mm. long ; callus obtuse, hairy, 0.5 mm. long, column 6 mm long, contorted, antrorsely scabrid. *Palea* 9 mm. long, pilose between the nerves. Anthers 6 mm. long.

Chitral : Guger, *Harris*.

8. ***Stipa splendens* Trin.**

*Stipa splendens* Trin. in Spreng., Neue Entdeck. 2: 54; Hook. f., Fl Brit. Ind. 7: 232 (1896).

Perennial. Culms robust, 1.2-2 m. high, as thick as a goose-quill below, yellow, shining. Leaf blades convolute, 15-30 cm. long, scabrid; sheaths loose, smooth or scaberulous; ligule elongate. Panicle very large, 30-50 cm. long, loose or contracted, pyramidal when open; axis slender, smooth; branches semiverticillate, capillary, 10-25 cm. long, simple below branched above. Spikelets dull or purplish, 5-6 mm. long, sessile or shortly pedicelled. Glumes as long as the spikelet, unequal, oblong-lanceolate, subacute, lower shorter, 1-nerved, upper longer, 3-nerved. Lemma as long as the glumes, silky villous, 2-fid at the apex; callus short, conical. Awn 10-15 mm. long, weakly geniculate, not twisted; palea villous. Anthers bearded at the tips.

Gilgit, M. S. Zahur, Shaukat Ali.

5. ***Oryzopsis* Michx.**

Perennial tufted grasses with flat leaves. Panicle effuse or contracted, often lax and nodding. Spikelets ovoid or lanceolate, usually awned; rachilla jointed above the glumes, not produced. Floret one, hermaphrodite. Glumes equal or subequal, persistent, usually acute or subacuminate, thin, 3- to 5-nerved, the side nerves often short. Lemma shorter or as long as the glumes, convolute, more or less dorsally flattened, ovate or obovate or lanceolate, 5- (very rarely 3) nerved, rigidly membranous to coriaceous, tip obscurely 2-lobed; callus very broad and short, obtuse; awn (when present) arising from the minute sinus in the tip, jointed on the lemma and deciduous, bristle-like, scabrid. Palea almost as long as the lemma or rather shorter. Grain tightly enclosed by the hardened lemma and palea.

## KEY TO THE SPECIES

- |                                                                |                          |
|----------------------------------------------------------------|--------------------------|
| 1. Lemma smooth, 3.5 mm. long.....                             | 1. <i>O. microcarpa</i>  |
| Lemma hairy, more than 4 mm. long .....                        | 2                        |
| 2. Spikelets 7-7.5 mm. long; lemma as long as the glumes ..... | 2. <i>O. aequiglumis</i> |
| .....                                                          |                          |
| Spikelets 4-6 mm. long; lemma shorter than the glumes .....    | 3                        |

3. Panicle very narrow, strict ; branches short, erect... 3. *O. lateralis*  
 Panicle open ; branches long and spreading... 4
4. Panicle 15-30 cm. long ; branches in distant pairs, many-spiculate ..  
 ..... 4. *O. munroi*  
 Panicle up to 9 cm. long, 6 cm. wide ; branches few-spiculate .....  
 ..... 5. *O. wendelboi*

### 1. *Oryzopsis microcarpa* Pilger

*Oryzopsis microcarpa* Pilger in Notizbl. Bot. Gart. Berlin 14 : 346 (1939).

Perennial. Culms up to 70 cm. high, terete, stout, glabrous. Leaf-blades up to 25 cm. long, 2.5 mm. broad, linear, acuminate, scabrid ; sheaths tight, striate, glabrous ; ligules hyaline, 5 mm. long. Panicle up to 30 cm. long ; branches open, in distant pairs, lower up to 12.5 cm. long, naked for 8 cm. then branching shortly and bearing 2-5 spikelets ; axis, branchlets and pedicels scabrid. spikelets ovate-elliptic, acuminate, 7 mm. long, straw coloured above but greenish at the base. Lower glume as long as the spikelet, 3-nerved, the lateral nerves short and close to the median, smooth, glabrous, dorsally rounded. Upper glume similar but narrower than the lower, as long as or shorter than the upper. Lemma elliptic-acute, dark brown, shining, smooth, 3.5 mm. long, 1.5 mm. broad. Palea as long as the lemma, 2-nerved, smooth.

Quetta, Hanna Valley, 12. 5. 54, Asghar Ali.

### 2 *Oryzopsis aequiglumis* Duthie

*Oryzopsis aequiglumis* Duthie, Grasses. N, W, Ind. 27 (1888).

*Oryzopsis duthiei* Hack. ex Hook. f., Fl. Brit. Ind. 7 : 234 (1896).

Perennial. Culms up to 123 cm. high, smooth and glabrous. Leaf-blades up to 30 cm. long, 5 mm. broad, rough on the upper surface, very rough below ; sheaths as long as or longer than the internodes, tight, striate, scaberulous ; ligule membranous, lacerate, 5 mm. long. Panicle nodding, up to 30 cm long ; lower branches 2- to 3- nate, up to 18 cm. long ; naked at the base for 8 cm. and then branching and with many spikelets ; nodes 9 cm. apart in the lower portion of the panicle: pedicels 3-10 mm. long. Spikelets 7-7.5 mm. long, oblong-acuminate, green or with a pale purple tinge. Lower glume as long as the spikelet, elliptic



acute when flattened, 5- nerved, the 2 lateral nerves very short. Upper glume as long as the lower, 3- nerved. Lemma slightly shorter or as long as the glumes, narrowly elliptic-acuminate, 3- nerved, 2 sparsely covered with a mat of brownish appressed hairs, awned ; awn up to 13 mm long. Palea as long as the lemma, 2-nerved.

Kagan Valley ; Juniper Tract, Ziarat.

### 3. *Oryzopsis lateralis* Stapf

*Oryzopsis lateralis* Stapf in Hook. f., Fl. Brit. Ind. 7 : 234 (1896).

Perennial. Culms densely tufted, forming a stout branching base, smooth. Leaf-blades 2-10 cm. long, convolute, filiform, smooth or nearly so, acuminate, stiff or flexuous : ligule hyaline, Panicle very narrow strict, 10-25 cm. long; axis smooth ; branches short, erect, scaberulous ; pedicels short, scaberulous. *Spikelets* 4-5 mm. long, ovoid or ovate-lanceolate, subrostrately acuminate, green or tipped with purple. *Glumes* subrostrately acuminate, faintly 5-nerved, the pair next the midrib arching and anastomosing with the median, outer pair similarly arching ; lower longer than the upper; upper more obscurely 3-to 5-nerved. *Lemma* 4 mm. long, shorter than the upper glume, lanceolate, finely subsilky, purpurescent, tip minutely 2-toothed ; awn 2.5-5 mm. long, not twisted.

Hazara ; Baltistan ; Karakoram ; Dir ; Thandiani ; Kagan ; Gujar ; Chitral.

### 4. *Oryzopsis munroi* Stapf

*Oryzopsis munroi* Stapf in Hook. f., Fl. Brit. Ind. 7 : 234 (1896).

Perennial. Culms 60- 110 cm. high, terete, stout or slender, glabrous, smooth ; nodes glabrous. *Leaf-blades* 10-25 cm. long, 2.5-6 mm. broad, linear, acuminate, tapering to a fine point, scaberulous ; sheaths tight, glabrous, scaberulous between the nerves ; *ligule* hyaline, oblong, 3.5 mm. long. Panicle 15-30 cm. long ; branches open, 2-nate, distant, lower up to 9 cm. long. naked for 2.5 cm. then branching shortly and bearing 9-10 shortly pedicelled spikelets towards the ends ; axis, branches, branchlets and pedicels glabrous but scabrid. *Spikelets* ovate to lanceolate, rostrately acuminate, 4-6 mm. long, green with purple tips. *Lower glume* as long as the spikelet, 3- to 5-nerved, the lateral nerves very short, smooth, glabrous, dorsally rounded, keeled towards the tip with the keel

scabrid. *Upper glume* similar, 5-nerved, as long as the lower or shorter. *Lemma* elliptic-acute, dark brown, 4 mm. long, lanceolate, 1.5 mm. broad, 5-nerved, dorsally covered with numerous yellowish hairs; awn 4-8 mm long, straight or slightly curved, antrorsely scabrid, caducous. *Palea* as long as the lemma, 2-nerved, covered with yellowish hairs.

Kagan Valley; Murree Hills; Swat State; Chitral; Gujar

### 5. *Oryzopsis wendleboi* Bor

*Oryzopsis wendelboi* Bor ex Wendelbo in Nytt Mag. f. Bot. 1: 16 (1952).

A glaucous, caespitose perenaial grass. *Culms* up to 30 cm. high, terete, slender, glaucous, leafy throughout; nodes glabrous. *Leaf-blades* involute or convolute, setaceous, glaucous, up to 8 cm. long, flat, 2 mm. broad, linear, acuminate, tapering to a fine point, rugose on the upper surface, margins scabrid; *basal sheaths* loose, scarious, smooth, glabrous, striate, tardily loosened, those of the culms tight, glaucous, striate, margins hyaline, glabrous, minutely scabrid between the nerves; *ligule* white, membranous, 4-5 mm. long. *Panicle* up to 9 cm. long, 6 cm. wide; branches open, few-spiculate; axis, branches, branchlets and pedicels smooth, glabrous. *Spikelets* elliptic, acuminate, 5-6 mm. long, purple or purple at the base and whitish above. *Lower glume* as long as the spikelet, 3-nerved, smooth, glabrous, acuminate, dorsally rounded, keeled towards the tip with keel scabrid. *Upper glume* similar, 5-nerved, as long as the lower or slightly shorter. *Lemma* elliptic, acute, dark brown, 4 mm. long, lanceolate, 1.5 mm. broad, 5-nerved, dorsally covered on the sides with short yellowish hairs. *Palea* as long as the lemma but narrower, 2-nerved, covered with short, yellowish hairs near the top. Stamens 3; anthers 2.5 mm. long, purple. *Caryopsis* 3 mm. long; hilum linear, 2 mm. long. *Awn* 25 mm. long, straight, purple, antrorsely scabrid, caducous.

Chitral: Barum Gol. Shokor Shal, *Per Wendelbo.*

### 12. Tribe: Zoysieae.

Spikelets hermaphrodite or some hermaphrodite and others male, 1-flowered, falling entire, either singly or in clusters of 2-5, in slender spiciform panicles or racemes; rachilla usually not produced beyond the floret. Glumes equal or the lower much smaller and suppressed, awnless or with a straight awn from the tip, the upper or both often indurated.

Lemma shorter than the upper glume, hyaline or delicately membranous, 1-to 3-nerved, usually awnless.

## KEY TO THE GENERA

- |                                                                               |     |     |     |                   |
|-------------------------------------------------------------------------------|-----|-----|-----|-------------------|
| 1. Spikelets falling in clusters or 2-5; glume with hooked spines on the back | ..  | ... | ... | 1. <i>Tragus</i>  |
| Spikelets falling singly                                                      | ... | ... | ... | 2                 |
| 2. Glumes long awned; lemmas not pectinate                                    |     |     |     | 2. <i>Perotis</i> |
| Glumes awnless; lemmas pectinate                                              |     |     | ... | 3. <i>Latipes</i> |

1. *Tragus* Haller.

Annual or perennial grasses with ascending or decumbent culms; blades rather rigid, with cartilaginous, spinulosely-ciliate margins. Panicle cylindric, slender; all the spikelets of a cluster fertile, 3.5-4 mm. long. Spikelets sessile, in deciduous clusters of 2; rachilla tough, not continuous beyond the floret. Floret 1, hermaphrodite. Glumes very dissimilar, the lower minute, or quite suppressed, hyaline, upper longer, 5-nerved, membranous between the hispid or spine-hooked ribs and nerves. Lemma lanceolate to lanceolate-oblong, membranous, 3-nerved; pales as long as the lemma, 2-nerved. Embryo  $\frac{1}{3}$  length of the caryopsis; hilum punctiform, basal.

1. *Tragus biflorus* (Roxb.) Schult.

*Tragus biflorus* (Roxb.) Schult., Mant. 2: 205 (1757).

*Tragus racemosus* Hook. f., Flor. Brit. Ind. 7: 97 (1896) non Scop.

*Lappago biflora* Roxb. Fl. Ind. 1: 281 (1832).

An annual or perennial grass. Culms short, rigid, decumbent, spreading or erect, leafy almost to the top, 5-20 cm. high. Leaf-blades flat, lanceolate, narrow, base subcordate, glabrous, margins distantly spinulose, up to 6 cm. long, 3-4 mm. broad; sheaths long, the uppermost like a spathe, loose, margins scarious and minutely ciliate; ligule a dense ridge of stiff hairs. Raceme-spike-like, 1.5-7 cm. long; axis scabrid. Spikelets 3.5-4 mm. long, 1-flowered, borne in groups on a short peduncle. Lower glume usually suppressed, if present, very minute and hyaline. Upper glume narrowly lanceolate, 3.5 mm. long, acuminate, embracing the lemma, 5-nerved, these being present as ribs on the dorsal surface and bear hooked spines. Lemma ovate-lanceolate, just over 2

mm. long, puberulous, embracing a narrowly oblong palea and a bisexual flower.

Sukkur, Hyderabad ; Karachi ; Peshawar ; Quetta ; Multan; Rawalpindi ; Lahore. Very common.

## 2. *Perotis* Ait.

Annual or perennial grasses with leafy culms and usually broad leaves. Inflorescence a pseudo-spike like raceme, villous from the long capillary awns. Spikelets 1-flrd. very small, narrow, sessile or subsessile, solitary, jointed below the glumes ; rachilla not produced. Glumes equal, rigidly membranous, 1-nerved, passing into long capillary awns. Lemma much shorter, thin membranous, lanceolate, acute, hyaline, 1-nerved ; palea very minute, hyaline, nerveless.

### 1. *Perotis hordeiformis* Nees

*Perotis hordeiformis* Nees ex Steud., Nom. ed. 2 : 306 (1840).

*Perotis indica* (Linn.) O. Ktze , Rev. Gen. Pl. 787 (1891).

*Perotis latifolia* Ait., Hort. Kew. 1 : 85 (1789) ; Hook. f., Flor. Brit Ind. 7: 98 (1896).

Annual or sub-perennial. *Culms* tufted, up to 45 cm. high, erect from a geniculate base, smooth and glabrous. *Leaf blades* flat, ovate or lanceolate, base cordate, tapering to an acute tip, surfaces smooth and glabrous, margins spinulose, 1.2-1.5 cm. long, 4 mm. to 1 cm. broad ; *sheaths* short, loose, smooth and glabrous, margin scarios ; *ligule* a very minute, membranous ridge : upper margin erose or ciliate. Raceme spike-like, terminal, consisting of numerous small spikelets seated upon very short pedicels on a central, simple, scabrid rachis which is 2.5-20 cm. long. Spikelets 2.5-4 mm. long ; callus conical. *Glumes* subequal, 2.5-4 mm. long, linear, narrow, scabrid or hispid, tapering into a scabrid, purple awn up to 1.5 cm. long. *Lemma* 1 mm. long, hyaline, narrowly lanceolate ; palea narrow, about as long as the lemma, hyaline. Embryo  $\frac{1}{3}$  the grain, hilum small, basal.

Lahore, M. S. Zahur.

### 3. *Latipes* Kunth.

Perennial grasses with subulate or convolute leaves. Inflorescence a simple spike-like raceme. Spikelets 1-flowered, borne in pairs, persistent on the flattened, truncate, spreading, jointed pedicels ; one perfect, the other barren. Glumes thickly coriaceous ; lower usually the longest,

narrow, recurved, 3 nerved, with pectinate margins, dorsally smooth ; upper lanceolate, spinuously tuberculate, embracing the lemma. Lemma shorter than the upper glume, oblong, acute, hyaline ; palea minute, linear-oblong.

1. **Latipes senegalensis** Kunth.

*Latipes senegalensis* Kunth, Rev. Gram. 1 : 201 (1829) ; Hook. f., Fl. Brit. Ind. 7 : 97 (1896).

Perennial. Culms 7-30 cm. high, wiry, creeping, with many erect or spreading branches, leafy. *Leaf-blades* 2.5-7.5 cm. long, subulate, convolute ; *sheaths* glabrous ; shorter than the internodes, mouth hairy ; *ligule* absent. Raceme 5-15 cm. long ; rachis glabrous ; pedicels distant, 2.5 mm. long, cuneate, flattened, with winged and ciliate margins, bearing at the broad apex 2 purplish brown spike-

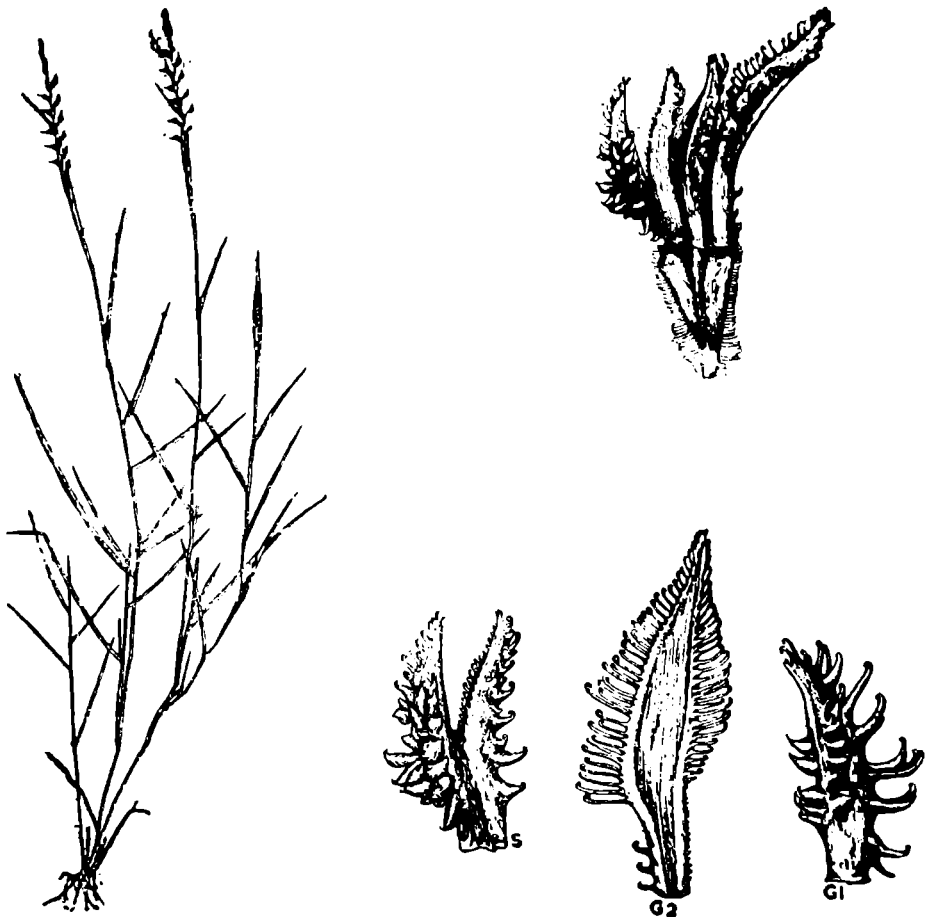


Fig. 187. *Latipes senegalensis*

lets, one perfect, the other not. *Lower glume* about 3 mm. long, lanceolate, narrow, recurved, 3-nerved, with pectinate margins, purplish brown. *Upper glume* rather more than 2.5 mm. long, ovate-

lanceolate, purplish-brown, tuberculate on the back. *Lemma* 15. mm. long, ovate-oblong, acute, hyaline.

Hyderabad ; Karachi ; Quetta.

### Tribe 13. **Phalarideae**

Spikelets alike, hermaphrodite, strongly laterally compressed, 3-flowered with the lower 2 flowers male or barren and terminal floret bisexual, arranged in open or contracted sometimes spike-like panicles ; rachilla disarticulating above the glumes and between the florets, not rarely produced beyond the upper floret. Glumes persistent, equal and as long as the spikelet, or the lower or both shorter, membranous to chartaceous Lower two lemmas longer than the third or smaller, in some cases reduced to minute scales. awnless or awned from the back or tip ; terminal lemma awnless.

#### KEY TO THE GENERA

1. Spikelets subterete .. .. . (*Anthoxanthum*)  
Spikelets more or less flattened .. .. . 2
2. Lower lemmas reduced to minute scales .. .. . 1. *Phalaris*  
Lower lemmas well developed... .. . 2. *Hierochloe*

#### 1. **Phalaris** Linn.

Annual or perennial grasses with flat leaves. Panicle contracted, more or less spiciform. Spikelets laterally compressed ; rachilla disarticulating above the glumes, not or obscurely produced beyond the terminal floret. Florets 3 ; the lower two minute, rudimentary, the uppermost hermaphrodite. Glumes subequal, keeled ; keel often winged. Empty lemmas very small, subulate to lanceolate, usually reduced to a minute scale ; fertile lemma thin, ultimately rigid, 5-nerved, awnless, ovate, acute. Palea as long as the lemma, 2-nerved. Styles long, distinct ; stigmas plumose, exerted from the top of the spikelet.

#### KEY TO THE SPECIES

1. Annuals ; glumes winged.....2  
Perennial, rhizomatous ; glumes not winged ... *Ph. arundinacea*
2. Wings crenate or serrulate .. .. . *Ph. minor*  
Wings entire... .. . *Ph. canariensis*

1. **Phalaris minor** Retz.

*Phalaris minor* Retz., Obs. Bot. 3: 8 (1783); Hook. f., Flor. Brit. Ind. 7: 221 (1836).

*Phalaris canariensis* Wall., Cat. n. 3782 (non Linn.)

Annual. Culms erect or geniculately ascending, 30-90 cm. high. Leaf-blades linear, acuminate, 15-25 cm. long, 10-17 mm. broad, surface and margins scaberulous; sheaths tight, glabrous; ligule oblong, membranous, scarious. Panicle cylindric, up to 6 cm. long, 1.5 cm. in diameter. Spikelets much laterally compressed, 3-5 mm. broad. Glumes acuminate keel winged, margin crenate or serrulate. Lemma ovate, acute silky, 1.8 mm. long, shining, coriaceous. Palea narrow lanceolate, acute.

Very common throughout the area.

2. *Phalaris arundinacea* Linn., Sp. Pl. 55 (1753).

Probably introduced.

3. *Phalaris canariensis* Linn. has been reported by Lace from Baluchistan but is probably a misdetermination for *Ph minor*, from which it is easily distinguished in having quite entire wings of the glumes.

*Phalaris paradoxa* Linn. f. was recorded from Lahore by J. L. Stewart but has not been collected since. It is characterized by the spikelets occurring in groups of seven, one fertile surrounded by six sterile and the whole group falling entire.

2. **Hierochloe** Gmelin ex R. Br.

Perennial, sweet scented grasses. Panicle small, bronze or purple coloured, open or contracted. Spikelets laterally compressed, with one perfect terminal floret and below it two male or neuter florets, all falling together; rachilla jointed above the glumes, not produced above the uppermost floret. Glumes equal or subequal, 3-nerved. Staminate or neuter lemma about as long as the glumes, boat-shaped. Lemmas 3, hispidulous, hairy along the margins. Fertile lemma somewhat indurate, about as long as the others, smooth or nearly so, awnless; palea 3-nerved, rounded on the back. Caryopsis free within the lemma and the palea.

1. *Hierochloe laxa* R. Br.

*Hierochloe laxa* R. Br. in Wall., Cat. n. 3796; Hook. f., Flor. Brit. Ind. 7 : 222 (1896).

Perennial. Culms up to 70 cm. high, ascending from a stout creeping rootstock, the lower 3 nodes short with dilated sheaths. Leaf-blades ensiform, or lanceolate acute, 10-15 cm. long, up to 12 mm. broad, smooth; ligule large, oblong, Panicle 7.5-12.5 cm. long loose, oblong inclined, branches solitary or 2-nate, pedicel capillary. Spikelets much compressed, brown. 6.5 mm. long, 3-flowered, the lower 2 male or neuter, the terminal bisexual. Glumes equal or sub equal; lower 5.5 mm. long, 1-nerved, membranous hyaline; upper 6 mm. long, faintly 3-nerved. Sterile lemmas as long as the spikelet, truncate, shortly awned, hirsute, and ciliate, paleate. Palea 2-keeled, 2-fid. more or less hispid. Fertile lemma 3.5 mm. long, hirsute above the middle, along the margins and the keel, awned; awn 2 mm. long. Palea 1-nerved, more or less hispid.

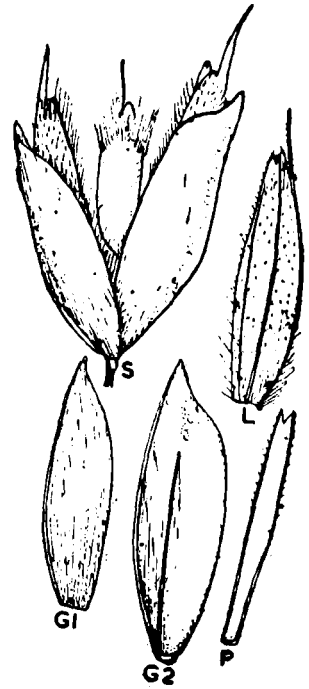


Fig. 188. *Hierochloe laxa*

Kagan Valley: Gitidas, I. I. Chaudhri; Saiful Maluk, Shaukat Ali; Gilgit: Burzil Pass, A. H. Khan, I. A. Siddique

Tribe: 14. **Oryzaceae**

Spikelets all alike and hermaphrodite, or more or less dissimilar and unisexual, apparently falling entire, 1 (rarely 3-) flowered, with the terminal floret hermaphrodite or unisexual and the latter if present reduced to scale like lemmas, pedicelled, in open or contracted panicles; the unisexual spikelets with the sexes borne in different panicles on the same plant or in the same panicle, the female on the upper branches or at the ends of the branches, the male below them; rachilla disarticulating below the floret or florets. Glumes very minute or confluent into an annular rim or suppressed; sterile lemmas mostly shorter than the fertile floret or more often suppressed; fertile or male



lemmas membranous to coriaceous, awnless or with a straight awn from the tip, 3- to 9- nerved ; palea 3- to 9-nerved.

## KEY TO THE GENERA

1. Leaf-blades ovate-lanceolate to linear-oblong. ....(*Hygrorhiza*)  
     Leaf-blades linear.....2
2. Florets 3 ; the two lower sterile and reduced to the lemmas ;  
     fertile lemma coriaceous ..... 1. *Oryza*  
     Floret 1 ; fertile lemma papyraceous .. .....(*Leersia*)

1. **Oryza** Linn.

Tall annual or perennial grasses with long narrow leaves. Spikelets 3-flowered, only one fertile, arranged on the branches of an elongated panicle, the upper lemma articulated above the two lower sterile lemmas. The glumes are represented by obscure lips or scales at the apex of the peduncle. The lower lemmas subulate, empty. Fertile lemma strongly laterally compressed, as long as the spikelet, coriaceous or papyraceous, hard, dimidiate-oblong, folded and keeled, obtuse, acute or aristate, strongly 3- to 5-nerved ; the lateral nerves forming a thickened margin ; palea of the same texture as the lemma and as long, linear, 3-nerved, keeled, with membranous margins. Lodicules 2, entire or 2-lobed. Stamens 6, with slender filaments. Caryopsis enclosed in the hardened lemma and palea and sometimes adnate to it.

## KEY TO THE SPECIES

- Panicle loose ; lower glume up to 4 cm. long. ....1. *O. sativa*  
 Panicle spike-like ; ligule narrow, fringed with short hairs. 2. *O. coarctata*

1. **Oryza sativa** Linn.

*Oryza sativa* Linn., Sp. Pl. 333 (1753).

Annual. Culms up to 1.5 m. or more tall ; nodes glabrous. Leaf-blades linear-acuminate, 30-60 cm. long, 6-8 mm. broad ; sheaths smooth, with ciliate auricles, the lower without a limb ; ligule long, scarious, lanceolate, finally splitting. Panicle loose, erect, finally nodding, 15-30 cm. long ; rachis rather robust, angled and channelled, scaberulous ; pedicels angular, short, swollen at the tip. Spikelets ovoid-oblong or ovoid, erect, 8-12 mm. long, awned or not. Lower Lemmas oblong-

lanceolate, acute or subulate, entire or toothed at the top, about 2 mm. long, empty. *Fertile lemma* as long as the spikelet, finely granulate.

Cultivated throughout the Province

var. **fatua** Prain in Beng. Pl. 1184 (1903).

Differs in having deciduous spikelets which are always awned. The panicle is at first concealed within the spathe-like sheaths of the uppermost leaf ; joints of the panicle shortly bearded. The top of the pedicel is expanded into an annular ring or into 2 minute scales which represent the glumes. The sterile lemma has a conical callus and is glandular at the apex. Very common in rice growing districts.

## 2. *Oryza coarctata* Roxb.

*Oryza coarctata* Hort. Beng. 87 (1814) ; Fl. Ind. 2 : 206 (1822) ; Hook. f., Flor. Brit. Ind. 7 : 93 (1896)

Perennial. *Culms* up to 18 m. high, erect from a stout creeping rhizome, smooth, hard and polished. *Leaf-blades* 15-38 cm. long, 6-12 mm. broad, coriaceous, linear, caudate-acuminate, with spinulose margins ; *sheaths* glabrous, polished, reticulate like basket-work ; *ligule* very narrow, fringed with short hairs. Panicle 10-20 cm. long, spike like; rachis and branches trigonous, stiff, smooth. *Spikelets* up to 15 mm. long (incl. the awn). Glumes represented by 2 opposite, minute appressed rounded or truncate thick scales, one attached lower than the other. *Sterile lemmas* subulate, the lower 2.4 mm. long, the upper 4 mm. long. *Fertile lemma* 15 mm. long, lanceolate, boat-shaped, rounded and with a large projecting wing on the back, cuspidate with a stout hard glabrous white awn about 4 mm. long, 7- to 9-nerved, the lateral nerves forming thickened margin to the lemma. *Palea* 12 mm. long, linear lanceolate. cuspidately acuminate, strongly 5-nerved ; margins hyaline. *Loaicules* large, membranous, subquadrate or trapeziform.

Karachi ; Shikarpur ; banks of the Indus near Kotri.

## Tribe : 15. *Thysanolaeneae*

Spikelete very small, 2-flowered with the lower floret barren and reduced to the lemma and the upper floret bisexual, falling with part of the pedicel from the branches of large, much divided panicles ; rachilla tardily disarticulating above the glumes and between the

florets, produced beyond the upper floret and sometimes bearing a rudimentary floret.

### 1. *Thysanolaena* O. Ktze.

Perennial grasses with tall solid culms and broad leaves. Inflorescence a large much divided panicle. Spikelets very small, all alike, 2-flowered ; lower floret reduced to a lemma , the upper hermaphrodite, falling with part of the pedicel ; rachilla tardily disarticulating above the glumes and between the lemmas, produced beyond the upper floret and sometimes bearing a rudimentary floret. Glumes 1/2 as long as the spikelet, nerveless. Lower lemma as long as the spikelet, acuminate, 1- to 3-nerved. Upper lemma acuminate, becoming slightly hardened, 3- nerved, margin fringed with hairs ; palea shorter than the lemma ; 3-nerved, margin fringed with hairs ; palea shorter than the lemma ; grain free between the lemma and the palea.

### 1. *Thysanolaena maxima* O. Ktze.

*Thysanolaena maxima* O. Ktze. , Rev. Gen. Pl. 794 (1890).

*Thysanolaena agrestis* Nees in Edinb.New. Phil. Jour. 18 180 (1835) ; Hook., Flor Brit. Ind. 7 : 61 (1896).

*Thysanolaena procera* Mez in Janowsks, Bot. Archiv. 1 : 27 (1022).

Perennial. *Culms* up to 3.5 m. high, rounded, glabrous. Leaves numerous, broadly lanceolate, acuminate, flat, 30-60 cm. long, 5-10 cm. broad, glaucous ; *sheaths* tight, shining and very glabrous ; *ligule* cartilaginous, very short, truncate. Inflorescence a very large panicle 30-60 cm. long, glabrous. made up of many erect or suberect, filiform branches, which divide and subdivide into very numerous branchlets which are covered with innumerable minute spikelets. *Spikelets* 2-flowered, ovoid-lanceolate, acuminate, pedicellate, 1.2-1.6 mm. long ; rachilla shortly produced as a short stipe, 0.5 mm. long. *Glumes* sub-equal, about 0.75 mm. long, ovate, sub-acute, hyaline, obscurely 1-nerved. *Lower floret* barren ; lemma lanceolate, membranous, epaleate, 1-nerved. *Upper floret* bisexual ; lemma ovate, acute, ciliate with long erect white hairs ; palea short, truncate.

Cultivated in gardens.

Tribe : 16. **Arundinelleae.**

Spikelets all alike, 2-flowered with the lower floret male or barren and the upper bisexual ; rachilla disarticulating between the florets, not produced above the upper floret. Lower lemma similar to the upper glume, 3- to 9-nerved ; upper lemma more or less terete, smaller than the lower, 3- to 9-nerved ; frequently awned from the entire or two lobed tip, the awn usually geniculate and twisted below the knee, rarely awnless.

## KEY TO THE GENERA

Lemma of the upper floret scabrid or scaberulous, entire or minutely 2-lobed at the apex, lobes awned or awnless.... 1. *Arundinella*  
 Lemma of the upper floret bearded below the two lateral prominent lobes ... .. 2. *Danthoniopsis*

1. **Arundinella** Raddi

Perennial or annual grasses with simple or branched culms and flat leaves. Panicle usually stiff, open or contracted. Spikelets usually gaping, 2-flowered, the lower male or barren the upper hermaphrodite ; rachilla glabrous, readily disarticulating or continuous between the upper glumes and the lower floret, not produced. Glumes persistent, 3 to 5-nerved ; lower shorter, upper as long as the spikelet. Lower lemma subsistent, subequal to the lower glume, 3- to 7-nerved. Upper floret with a very short bearded or glabrous basal callus ; lemma membranous, finally thinly coriaceous, 1- to 7-nerved, entire or minutely 2-lobed at the apex, with the lobes muticous or each bearing a capillary bristle, awned from the tip or from the sinus of the 2 lobes or awnless ; awn straight or curved or geniculate and twisted below the bend.

## KEY TO THE SPECIES

Annual ; spikelets not more than 2 mm. long ... 1. *A. pumila*.  
 Perennial ; spikelets 3-4 mm. long ... .. 2. *A. nepalensis*

1. **Arundinella pumila** (Hochst.) Steud

*Arundinella pumila* (Hochst.) Steud., Syn. Pl. Gram. 114 (1854).  
*Arundinella tenella* Nees & Wight ex Steud. Nom. ed. 2 : 143 (1840) : Hook f., Fl. Brit. Ind. 7 : 71.

Annual. *Culms* solitary or tufted, erect, glabrous or with a few scattered hairs. *Leaf-blades* 2.5-7.5 cm. long, 6-12 mm. broad, ovate to linear-lanceolate, acuminate, membranous, beset with a few slender

soft hairs, base narrowed ; *sheaths* usually glabrous with ciliate margins ; *ligule* a minute ridge fringed with long hairs. *Panicle* 5-25 cm. long, effuse, copiously branched : rachis slender, strict, erect ; branches ternate or the lower subverticillately fascicled, each with widely spreading, capillary branches and branchlets. *Spikelets* 1.6-2 mm. long ; pedicels long slender. *Lower glume* 1.2-1.6 mm long, ovate-lanceolate, acute, thinly membranous, 3-nerved. *Upper glume* longer, 1.6-2 mm. long, ovate-lanceolate, cuspidately acuminate, 5-nerved. *Lower lemma* 5.6 mm. long, ovate, obtuse, paleate. *Upper lemma* 1 mm. long, lanceolate, scabrid above ; awn solitary, about 2.5 mm. long. the lower part brown, slightly twisted, the upper part pale.

Sind.

## 2. *Arundinella nepalensis* Trin.

*Arundinella nepalensis* Trin., Gram. Panic. 62 (1826).

*Arundinella brasiliensis* Hook. f., Flor. Brit. Ind. 7 : 73 (1896) non Raddi.

Perennial, rootstock hard, creeping and sending out stout, sheathed branches, or tufted and intricately branched. Culms 30-150 cm. high, stout or slender, simple or branched, hairy or almost glabrous ; nodes glabrous or pubescent. *Leaf-blades* 15-30 cm. long, 4-16 mm broad, usually ciliate at the narrow base, glabrous or hairy ; *sheaths* usually glabrous ; *ligule* a minute ridge fringed with long hairs. *Panicle* pyramidal ; thyrsiform or subcorymbose, 10-45 cm. long ; rachis angular, usually glabrous ; branches 2.5-25 cm. long ; few or many, fasciculate or subverticillate. *Spikelets* 4-5 cm. long, subsecund, pedicellate, ovoid lanceolate, usually glabrous. *Lower glume* 3 mm. long, ovoid-lanceolate, acuminate, subacuet, 3-nerved, glabrous. *Upper glume* 5 mm. long, ovate-lanceolate, acuminate, 5-nerved. *Lower lemma* 4 mm. long, elliptic-oblong, obtuse or shortly 2-fid, 3 to 5-nerved, paleate, barren or male ; *palea* 3 mm. long, lanceolate, hairy. *Upper lemma* less than 3 mm. long, bearded at the base, narrowly ovate-lanceolate, scaberulous ; awn 4 mm. long, straight or slightly twisted brown below, pale above.

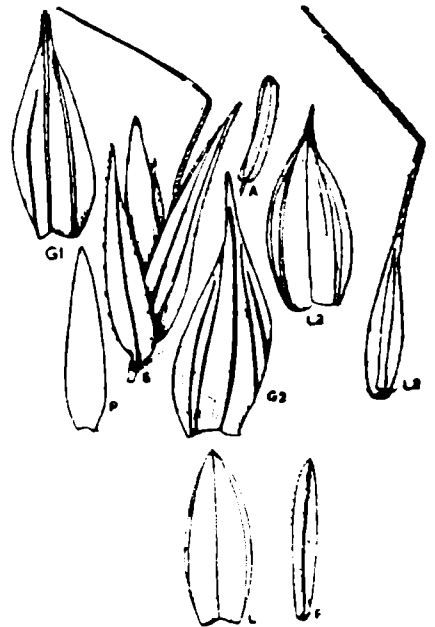


Fig. 189.—*Arundinella nepalensis*

Peshawar ; Sakesar ; Fort Munro ; Swat State ; Muzaffarabad ;  
Murree Hill.

## 2 *Danthoniopsis* Stapf

Perennials or annual grasses. Leaves linear or linear-lanceolate, flat ; ligule a fringe of hairs. Spikelets 2-flowered, paired or in threes, pedicelled, in open or contracted panicles ; rachilla glabrous, disarticulating between the florets, not produced. Glumes unequal, 3- to 5-nerved, the lower smaller, the upper as long as the spikelet. Lower floret male ; lemma similar to the upper glume, 5- to 9-nerved ; palea narrow, 2-keeled ; keels narrowly winged. Upper floret bisexual ; callus obtuse, 2-toothed or truncate, bearded ; lemma membranous to coriaceous, 7- to 9-nerved, deeply bifid, lobes acute and sometimes produced into bristles, bearded on the back below the lobes or with tufts of hairs, awned from the sinus ; palea narrow, 2-keeled, winged on the keels ; wings with an appendage at the apex. Lodicules 2, cuneate, fleshy. Stamens 3. Hilum linear. Embryo  $1/2$  the length of the grain.

### 1. *Danthoniopsis stocksii* (Boiss.) C. E. Hubb.

*Danthoniopsis stocksii* (Boiss.) C. E. Hubb. in A. W. Hill, Fl. Trop. Afr. 10 : 76 (1937).

*Tristachya stocksii* Boiss., Fl. Orient. 5 : 525 (1884).

*Tristachya barbata* Hook. f., Flor. Bri. Ind. 7 : 272 (1896) non Nees.

Perennial. Culms 15-45 cm. high, branched and woody at the base, geniculately ascending, the base clothed with tomentose leaf-sheaths ; nodes woolly. Leaf-blades 2.5-7.6 cm long, 2.4-4 mm. broad, linear-lanceolate from a rounded base, finely acuminate, pungent, rigid, glaucous, many-nerved, with a subserrulate thickened margin. Panicle 2.5-5 cm. long and nearly as broad, sparingly branched ; branches solitary and 2-nate, capillary. Spikelets nearly 18 mm. long (excl the awn) ; callus glabrous. Lower glume 6 mm. long, ovate-lanceolate, subacute, 3-nerved. Upper glume 8 mm. long, similar. Lower floret ; lemma nearly 13 mm. long, male, lanceolate, acuminate, interruptedly 7-nerved ; palea linear-lanceolate, 6 mm. long. Upper floret bisexual ; lemma 8 mm. long, densely hairy on the back above the middle with very slender hairs nearly 4 mm. long, 2-lobed, the lobes lanceolate, acute, aristate, each lobe 3-nerved, 4 mm. long with an awn 16 mm. long from a sinus.

Harnai, Lacc ; Hyderabad,

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# List of Publications of The Biological Society of Pakistan

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**Biologia**, the official organ of the Society, is a journal of biological sciences published twice a year during the months of June and December. It was established in 1955, and is edited by a board headed by Sultan Ahmad. It is available in exchange with other institutions for publications of a similar character. Previous issues of the journal are also available.

**Monograph I. Fungi of West Pakistan by Sultan Ahmad.**

This is a list of 1219 species of Fungi collected by the author from West Pakistan. About 1,000 of these are new records for this area. The Monograph is provided with a complete host-index and a large map of West Pakistan and adjoining areas. 126 pp., cloth bound, size 9½ in. x 7 in. Price Rs. 10/- only.

**Monograph II. The Codling Moth, *Cydia pomonella* (Linn.) in Baluchistan by Nazeer Ahmad Janjua, M. Maqsood Nasir and Ghulam Ullah Choudhry.**

The codling moth is a serious pest of apples, pears and quinces all over the world, and is firmly established in the former province of Baluchistan. The authors have subjected this pest to intensive investigation for 7 years (1941-1947) and have amassed a wealth of information regarding its distribution, host plants, nature and extent of damage, life and seasonal history, and the natural enemies. The Monograph contains 90 tables and 36 graphs. Indispensable for Economic Entomologists. Price Rs. 10/- only.

**Monograph III. Grasses of West Pakistan by Sultan Ahmad and R. R. Stewart.**

A complete illustrated account of 370 grasses comprising all the hitherto known species from West Pakistan with keys to the genera and species. Part I, pp. vi + 151, size. 9½" x 7", paper bound. Price Rs. 15/- only. Part II, pp., same size. Price Rs. 20/-

**Monograph IV. Polyporaceae of West Pakistan by Sultan Ahmad.**

An illustrated account of about 120 species of Polyporaceae collected by the author in West Pakistan. (Ready June 1960).

