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GRASSES OF RAWALPINDI DISTRICT

(A Catalogue of the Collection in the Garden College Herbarium)

BY

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ROYAL BOTANIC GARDEN Ack. 1K

GRASSES OF RAWALPINDI DISTRICT, PUNJAB (PAKISTAN)

In spite of the great economic importance of grasses for food, fibre and fodder and for soil binding very few botanists have paid much attention to this group of flowering plants. As the Punjab lies largely in the arid belt stretching west to Arabia and North Africa it lacks trees, but grasses are abundant. In Rawalpindi district alone there are at least 170 species of *Gramineae*, and if the whole area were carefully explored more would be added to the list. Many of them have considerable economic value, and were our marginal and submarginal lands properly managed these could grow high-yielding crops of valuable grasses.

Rawalpindi district occupies the northernmost corner of the Punjab. It lies between 33° and 34° North Latitude and 72° and 74° East Longitude, and is bounded on the north by Hazara district of the N.-W. Frontier Province, on the east by Poonch Province of Kashmir State, on the south by Jhelum district and on the west by Attock district. There is little level land in the district at the present time, but it is evident from the geological formations that in the past much of it was a loess plain, which has gradually become more and more dissected into ravines probably because the Himalayan uplift has made it possible for the streams in the monsoon to erode the unconsolidated soil with great ease. A second reason for the present bad conditions is over-grazing together with poor management.

In the plains portion of the district there are some bare rocky ridges, outliers of the Himalayan foot-hills, and some fertile portions between the bad lands, but it is too rough and there is too little water in it to allow anything but a little well irrigation in favoured spots. Its prosperity depends on the monsoon rains.

The north-eastern corner of the district, consisting of the Murree tehsil is mountainous, running up to 7,500′ elevation and this portion has a flora very different from that of the plains, though in the summer many of the weeds, which grow in the plains during the monsoon months, find it possible to grow at heights upto 7,000′. The district, however, is so far north and so far from the ocean that the rainfall here is much less than in the hill stations of the East Punjab and the United Provinces of the Indian Union. The average rainfall in Rawalpindi between June 1 and September 30 is 22·5″ and in Murree 36·2″. As a result of this moderate rainfall Murree lacks the luxuriant epiphytic vegetation of Mussorie and the mountains further east. The total number of species and the tropical element in the flora are much reduced in consequence.

Because of a difference of 6,000′ in altitude between the plains portion of the district and the tops of the Murree hills there is a good deal of difference

between the grass flora of the plains, the foothills and the forested mountains. The western side of the district is the driest with a large proportion of xerophytic grasses, many of them North African. In the Murree Hills there are a good many temperate species. During the monsoon many tropical and sub-tropical grasses flourish in the foot-hills and plains. Many of our grasses are widely distributed in other parts of the world.

Overgrazing is universal in the plains as well as in the hills as a result of which erosion is progressing ruthlessly, impoverishing the region. The Punjab Forest Department has shown how erosion can be checked and surplus water conserved by scientifically levelling and, terracing the ground and check-damming the ravines, but outside it few realise the urgency of the problem. In many places the soil has almost all been washed away exposing the parent rock, so that even with complete closure to grazing it would take many years for new soil to form.

As in the rest of the Punjab there are two favourable seasons when plants grow without irrigation. The first is the spring when there is an ephemeral covering of vegetation in March, which dries up in April with the onset of hot weather. Only hardy perennials and a few annuals can survive till the monsoon breaks early in July. Then the hillsides become green and more tropical types rapidly appear, which flourish in August and begin to dry in September on the close of the monsoon.

The chief cereal crops are wheat, barley, maize, *jowar* (*Sorghum vulgare*), *bajra* (*Pennisetum glaucum*), rice and sugarcane, all included in the natural order *Gramineae*.

As far as is known there are no grasses endemic to the area. Most of them belong to the widely distributed dry Mediterranean flora, or are widespread tropical species. Many are cosmopolitan weeds of cultivation. A few are temperate grasses. There is only one indigenous bamboo (*Dendrocalamus strictus*) but it is not common.

There has been little collecting of grasses in is tract. The only important collection is at the Gordon College, Rawalpindi. The few numbered specimens in the Dehra Dun Herbarium were collected by J. E. T. Aitchison (1870) and by Gen. Wingate, and references to some grasses are found in J. L. Stewart's publication Punjab Plants (1869). About 1851 Dr. Fleming collected specimens of grasses in the Salt Range and Murree Hills, but no reference to this collection has been traced. A number of Murree grasses collected by E. W. Trotter more than 60 years ago are in the Gordon College Herbarium as are the writer's own specimens and those collected by Professor Mohinder Nath Nayyar and Professor Eugene Nasir. Very recently Mr. A. G. Bhatti was deputed by the Forest Department to work on hill grasses and he studied those found near Tret at about 3,000′ elevation. Mr. R. N. Parker, I.F.S., a Chief Conservator

of Forests of the pre-partition Punjab, was interested in grasses, and some Rawalpindi specimens collected by him are probably at Dehra Dun. The writer's is the first attempt to bring together a complete list of the grasses of the region. It includes a few species collected in adajcent districts which, from the absence of any important barriers, may probably be found in Rawalpindi district with further exploration.

There is no up-to-date book which can be recommended to a student who may wish to master Punjab grasses. The seventh volume of the Flora of British India gives useful information, but it is out of date and many of its species have been given other names in more up-to-date floras due to the splitting of large unmanageable *genera* like ***Panicum*** and *Andropogon* into more manageable units.

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NOTE—1. The alphabetical list appended to Dr. Stewart's Catalogue of Grasses has been prepared in the office of the Silvicultural Research Division, Punjab.

2. The star-marked grasses are described in Ind. For. Records (Botany), Vol. II, No. 1 (1941).

LAHORE
June 1950

'Silva', Punjab
Pakistan

CATALOGUE OF GRASSES COLLECTED IN RAWALPINDI DISTRICT

(The star-marked grasses are described in Ind. For. Records (Botany), Vol. II, No. 1

BAMBUSEAE

Dendrocalamus , Nees

1. *Dendrocalamus strictus*, (Roxb.) Nees. Wild in the Margalla Reserve (Parker). The district is too dry for wild bamboos to flourish but a few have been planted in Rawalpindi.

FESTUCEAE

Bromus, L.

2. *Bromus asper*, Murray. Trotter collected it at Murree

3. *Bromus japonicus*, Thunb. A common weed about roadsides and cultivation in both plains and hills.

4. *Bromus japonicus*, Thunb, var. *falconeri*. (Stapf) R. R. S. This is a variety with more pubescent spikelets and longer divergent awns. Rawalpindi and Peshawar.

5. *Bromus mullis*, L. Common by roadsides in Murree.

6. *Bromus tectorum*, L. Only reported from Rawalpindi by Gen. Wingate.

Brachypodium, Beauv.

7. *Brachypodium distachyon*, (L) Beauv., N. W. Frontier Province and Jhalar, Attock district.

8. *Brachypodium sylvaticum* (Huds). Beauv. Murree hills on banks in the forest, resembling *Agropyron* but the young spikelets are round in cross section and the spikelets are not quite sessile.

Sclerochloa, Beauv.

9. *Sclerochloa dura*, (L) Beauv. Abbottabad, 4,200'; Uri, Kashmir 4,000'. A dwarf ruderal.

Poa, L.

10. *Poa annua*, L. Throughout the area, common. Makes lawns in Rawalpindi in March which soon wither in the heat.

11. *Poa ludens*, R. R. S. (*Poa pseudopratensis*, Hk. f., not of Beyer (1819) or Scribner and Rydberg (1896). Murree.

12. *Poa nemoralis*, L. Sparing, Murree hills.

13. *Poa pratens*, L. Common, Murree hills.

Aeluropus, Trin.

14. *Aeluropus repens*, (Desf.), Parl. Common in Jhelum district.—J. L. Stewarts' Punjab Plants?

Eragrostis, Beauv.

15. *Eragrostis amabilis*, (L) Wight, (*E. tenella*, var. *plumosa* Stapf. Occasionally found as a ruderal in Rawalpindi.

16. *Eragrostis cilianensis,** (All.) Link ex Lutati, Dhamial near Rawalpindi

17. *Eragrostis papposa*, (R and S.) Steud. A xerophytic plains perennial with quite pale very narrow spikelets on long filiform pedicels. Common Trans Indus.

18. *Eragrostis pilosa*, L. An annual species, common about cultivation in the monsoon. The spikelets are very numerous in flexuous panicles.

19. *Eragrostis poaeoides,** Beauv. (*E. minor*, Host). This cosmopolitan annual is common throughout the district chiefly about cultivation.

Desmostachya, Stapf

20. *Desmostachya bipinnata*, (L.) Stapf, (*Eragrostis cynosuroides*, Beauv.) *'dab'* or *'drab'* is a tough perennial pioneer often growing where nothing else can exist even on alkaline soils. Animals usually leave it alone but buffaloes are said to eat it when young.

Dactylis, L.

21. *Dactylis glomerata*, L. Orchard Grass, is common on banks in the Murree Hills. It is usually found above 6,000'.

Lamarckia, Moench.

22. *Lamarckia aurea*, (L) Moench. This Mediterranean species is a dwarf annual with a handsome golden coloured inflorescence. It grows at Attock and in the N. W. F. P.

Arundo, L.

23. *Arundo donax,** L. *'Nara'*, *'bans'*, *'sukna'* is occasionally planted in the plains and foothills as a hedge. One of our largest grasses.

Phragmites, Trin.

24. *Phragmites karka,** (Retz.) Trin. *'Nal'*, *'Naria'*, *'dila'* is another very large grass resembling Arundo, but it grows near water. In *Arundo* the glumes are silky hairy while in *Phragmites* the rachilla is hairy and the lemmas are naked. Plains and low hills.

Neyraudia, Hk. f.

25. *Neyraudia arundinacea,** (L) Henr. (*N. madagascariensis*, Hk. f.) This is a large grass, up to 8' tall with tiny spikelets which look undeveloped. Occasional up to 5,000'.

Pappophorum, Schreb.

26. *Pappophorum, persicum** (Boies). Steud. (P. *Aucheri*, Jaub and Spach) Fairly common in the plains in desert places.

HORDEAE

Agropyron, J. Gaertn.

27. *Agropyron semicostatum*, Nees ex Steud. Apparently very rare in Murree but fairly common in the temperate parts of Kashmir; also reported from Kaghan.

Triticum, L.

28. *Triticum aestivum* L. *Gehun, kanak.* Wheat is cultivated throughout the district without irrigation.

Hordeum, L.

29. *Hordeum murinum*, L. Rare about Rawalpindi but fairly common in Murree. An annual weed of roadsides and cultivated land.

30. *Hordeum vulgare*, L. Barley, '*jao*' is commonly cultivated.

Lolium, L.

31. *Lolium perenne*, L. Common on grassy hillsides in Murree.

32. *Lolium multiflorum*, Lam. Italian Rye Grass is stated by Hooker to be cultivated form of the last. It has been collected in Murree and Nathia Gali but it is not cultivated. In *perenne* the *lemmas* are awnless while in this at least the upper *lemma* is awned. Both are perennial.

33. *Lolium rigidum*, var. *duthiei* Hack. An uncommon field annual. Has been collected in Jhelum and the type was collected by Duthie in Srinagar, Kashmir.

34. *Lolium temulentum*, L. '*Darnel*' is an occasional coarse annual weed in Rawalpindi and Murree. It is often considered to be poisonous but Duthie states that it is edible unless the seeds have been ergotized or diseased.

Pholiurus, Trin.

35. *Pholiurus incurvus*, (L) Schinz and Thell. Rare, only found in Topi Park, Rawalpindi, near a pond.

AVENEAE

Schismus, Beauv.

36. *Schismus barbatus*, (L.) Thell. (S. *marginatus*, Beauv). An inconspicuous annual. Campbellpur, N. W. F. P., and on the Upper Indus in Kashmir.

Koeleria, Pers.

37. *Koeleria cristata* (L) Pers. A perennial, temperate grass; fairly common in Murree, the Galis and Kashmir.

38. *Koeleria phleoides* (Vill.) Pers. An unimportant annual weed commonly found in the plains in the spring, also found up to 6,000′ in the hills, Edible.

Avena, L.

39. *Avena fatua*, L. False oats is common in grain fields throughout the district. It can be distinguished from true oats by its smaller grain and by numerous rusty hairs on the lemmas.

40. *Avena sativa*, L. Oats, '*jai*,' is occasionally cultivated about Rawalpindi.

Helictotrichon, Bess

41. *Helictotrichon asperum*, (Munro) Bor, var. *royle* , (Hk. f.) R. R. S. (*Avena aspera*, var. in Fl. Brit. Ind). Occasional in Murree and Khanpur. The genus is near *Avena* but the awns are twisted, not straight.

AGROSTIDEAE

Calamagrostis, Adans.

42. *Calamagrostis munroana*, (Aithc. and Hems.) Boiss. An unimportant summer grass, Murree hills, usually above 5,000'.

43. *Calamagrostis pilosula*, (Trin.) Hk. f. Another unimportant temperate summer annual. Changla Gali. This species and the last are placed in *Agrostis* by some botanists but in that genus the flowering glumes are glabrous.

Agrostis, L.

44. *Agrostis semiverticillata*, (Forsk.) C. Christ. (A. *Verticillata*, Vill). Kuldanna, Murree hills.

45. *Agrostis stolonifera*, L. (*A. alba, var. stolonifera*, in Fl. Brit. Ind) Murree, collected by Trotter. Rare.

46. *Agrostis subaristata*, Aitch and Hems. A plant of wet places, near the last but this has a short but definite awn.

Alopecurus, L.

47. *Alopecurus myosuroides*, Huds. (*A. agrestis*, L.). An annual weed of cultivated ground. Peshawar, Poonch City.

48. *Alopecurus nepalensis*, Trin. ex Steud. Another unimportant spring annual, Rawalpindi, Lahore.

Polypogon, Desf.

49. *Polypogon interruptus*, H. B. K. (*P. Littoralis*, or *P. fugax*). Fairly common in damp soil in both plains and hills.

50. *Polypogon monspeliensis*, (L.) Desf. A common annual weed in plains and hills with a very fulvous inflorescence. Called *malhar* in the Salt Range.

Phleum, L.

51. *Phleum arenarium*, L. A spring annual weed. Abbottabad, Kashmir.

52. *Phleum paniculatum*, Huds. Another spring weed. Abbottabad, Ghora Gali. The empty glumes are not fringed in this while they are in the last species.

Muehlenbergia, Schreb.

53. *Muehlenbergia duthieana*, Hack (M. *sylvatica*, of Fl. Brit. Ind.). A summer grass in the hills, usually from 4,000'—9,000'.

54. *Muehlenbergia himalayensis*, Hack. ex Hk. f. Hazara and the Murree Hills, usually from 3,000'—7,000.'

55. *Muehlenbergia huegelii*, Trin. (*M. viridissima*, Nees), Murree and Dunga Gali, 6,000—9,000'.

Sporobolus, R. Brown

56. *Sporobolus arabicus*, Boiss. '*Lunakh*', Rawalpindi and Dhamyal. Common on alkaline soils after heavy rain and often unmixed with other grasses. (Parker) "*usar ki ghas*" (Duthie).

57. *Sporobolus coromandelianus*, (Retz) Kunth. A small annual which is not rare in Rawalpindi in the hot weather.

58. *Sporobolus diandrus*,* (Retz.) Beauv. *'Nonak'*, *'harnak'*, Rawalpindi.

59. *Sprobolus indicus*,* (L.) R. Br. Rare in Rawalpindi. Valued as a fodder grass in Gujranwala.

60. *Sporobolus ioclados*, Hk. f. Non. Nees. In a Rawalpindi pond. The species as originally described was based on African specimens and this material may need a new name (Mrs. Chase).

Milium, L.

61. *Milium effusum*, L. A temperate forest grass found above 6,000'.

Oryzopsis, Michx

62. *Oryzopsis molinoides*, (Boiss) Hack. ex Paulsen. (*O. Lateralis*, Stapf) usually above 5,000' on steep grassy banks. Murree, Changla Gali, Dunga Gali, Abbottabad.

63. *Oryzopsis molinoides*, var. *effusa*, (Hk. f.) R. R. S. Murree Hills. The inflorescence is less strict than in the typical form, being somewhat branched, the spikelets are usually tinged with purple and larger in size.

64. *Oryzopsis munroi*, Stapf, Murree hills, usually above 4,500'. The florets are larger than in the last two and the whole plant tends to be larger.

Stipa, L.

65. *Stipa jacquemontii*, Jaub and Spach. Changla Gali. A slender rock crevice plant usually found above 8,000'

66. *Stipa tortilis*, Desf. Campbellpur, Peshawar. A xerophytic form with awns 3"-4" long. The column of the awn is hairy.

Aristida, L.

67. *Aristida adscensionis**, L. (*A depressa*, Retz) *'Lumb'*. A common widespread desert type on poor soils. Ascends to 8,000' on the Upper Indus.

68. *Aristida cyanantha**, (Nees) Steud. The largest of the *genus* in our area, forming large tufts on hot rocky or gravelly banks in the foothill zone to about 4,500'. Common along the Jhelum, Darya Gali.

69. *Aristida funiculata*, Trin and Rupr. This is a common monsoon annual about Rawalpindi in the hot weather, sometimes on roofs.

70. *Aristida mutabilis*, Trin. and Rupr. Another plains annual, common in sandy soils in the Punjab but apparently rare in our area.

71. *Aristida hystrix**, L. Reported by Aitchison from Rawalpindi but I have not seen any specimens. His No. 118.

72. *Aristida pogonoptila*, Boiss. Reported from Hasan Abdal by Falconer. This and the last should be checked. I do not have any specimens from this area. It grows at Sargodha and Sangla hill.

ZOYSIEAE

Tragus, Haller

73. *Tragus biflorus*, (Roxb) R and S. (*T. racemosus*, Hk. f.) A common dwarf, annual of the plains and foothills up to 4,000'.

CHLORIDAE

Leptochloa, Beauv.

74. *Leptochloa chinensis*, (L.) Nees. This species and the next are summer weeds about cultivation. Not common.

75. *Leptochloa filiformis*, (Lam.) Beauv. Like the last but there are 2-3 instead of 4-7 florets per spikelet.

Tripogon, Roth.

76. *Tripogon filiformis*, Nees ex steud. A slender summer annual with a narrow flexuous panicle, Barian, Murree hills, 6,500'.

77. *Tripogon purpurascens*, Duthie (*T. abyssinicus*, of Hk. f.). This is a dwarf perennial forming a close turf on rocky banks, walls or hillsides. Saidpur, Hasan Abdal, Abbottabad, Pipe Line.

Eleusine, Gaertn.

78. *Eleusine flagellifera*, Nees. A useful plant of the hot plains, analagous to *Cynodon* but much tougher and more xerophytic with hard and bulbous stem bases. '*Chhimbar*', '*ghantil*'.

79. *Eleusine indica* (L.) Gaertn. An edible annual grass found about cultivation in the plains and lower hills.

80. *Eleusine verticillata*, Roxb. Another ruderal found in the plains in the hot weather. Much like the last but this is awned and the spikes are more scattered. A good fodder.

Dactyloctenium, Willd.

81. *Dactyloctenium aegyptium*,* (L.) Aschera. and Schweinf. (*Eleusine* in Hk. f.) Another common, weedy, summer ruderal of the plains, said to be a good forage and fodder grass.

Cynodon, Pers.

82. *Cynodon dactylon*,* (L.) Pers. '*Dab*' or '*doob*' Bermuda Grass is the best grass for lawns and fodder in the district. It is commonest in the plains but ascends to 8,000'.

Chloris, Swartz.

83. *Chloris digitata*, (Roxb) Steud. (*C. incompleta*, Roth) A tall, weedy monsoon grass of the plains, often growing in the protection of bushes. Sometimes grows in the low hills.

84. *Chloris villosa*, (Desf). Pers. (*Tetrapogon villosus*, Desf). A very common perennial on sterile land in the plains, said to be good forage, is abundant on '*usar*' soil. (Duthie).

85. *Chloris gayana*,* (Knnth) Rhodes Grass is said to be cultivated in Murree but I have seen no specimens.

Melanocenchris, Nees

86. *Melanocenchris plumosa*, Jaub. and Spach, Domeli and Jhelum (Sultan Ahmad). An unimportant desert grass.

PHALARIDEAE

Phalaris, L.

87. *Phalaris arundinacea*, L. Reed. Canary Grass, a perennial of wet ground, was collected in Murree by Trotter and the specimen is in the Gordon College Herbarium. Rare.

88. *Phalaris minor*, Retz. A common weed in cultivated ground in the plains and up to perhaps 3,000'.

ORYZEAE

Oryza, L.

89. *Oryzva sativa*, L. '*Dhan*', '*Chawal*', Rice is raised in a few places near streams but the district is too dry for much rice cultivation.

MELINIDEAE

Arundinella, Raddi

90. *Arundinella nepalensis*,* Trin. (*A brasiliensis*, Hk. f.). A common perennial with a large panicle superficially resembling *Panicum antidotale* but this has awns. Plains and lower hills. Called "*garali*", "*garham*" or "*gram*" at Tret according to A. G. Bhatti.

PANICEAE

Digitaria, Heist.

91. *Digitaria bifasciculata*,* (Trin.) Henr (*D. cruciata*, Nees ex Steud) Common in the plains and up to 8,000' often about cultivation. This and the following 'crab grasses' are believed to be excellent for fodder.

92. *Digitaria ciliaris*, (Retz) Koeler, (*Panicum sanguinale*, var. *ciliare*, Hk. f.) Much like the last and found up to 8,000'. The hairs of the mature spikelets are spread out like a fringe on both sides.

93. *Digitaria adscendens*, Henr. Much like D. *bifasciculata*, but the spikes are usually longer and the spikelets are more slender. A plant of the plains, low hills and Murree. Rachis flat, broad.

94. *Digitaria nodosa*, Parl. (*Panicum sanguinale*, var. *pabulare*, Hk. f.) A perennial desert species with woody bulbous roots and pale pubescent spikelets growing in Rawalpindi, Margalla, Saidpur, Hasan Abdal, Jhelum, etc.

95. *Digitaria royleana*, (Nees) Prain. (*Paspalum* in Fl. Brit, Ind.) The smallest of the *genus* in our area. The heads are very small and numerous, the seeds black and the hairs on the spikelets have calvata tips. Pubescence mealy. Rawalpindi in the hot weather.

Brachiaria, Griseb.

96. *Brachiaria distachya*, (L) Stapf, (*Panicum distachyon* L.) Rawalpindi in the hot weather.

97. *Brachiaria ramosa*, (L) Stap. (*Panicum ramosum*, L. or *P. petiverii*, Trin). This is a good fodder and is common in the plains and lower hills in the hot weather.

98. *Brachiaria reptans*, (L) Gardener and Hubbard. (*Panicum reptans*, L). Another hot weather grass of the plains often in cultivated fields. Good for fodder.

Urochloa, Beauv.

99. *Urochloa helpus*, (Trin) Stapf, (*Panicum javanicum* of Fl. Brit. Ind.) Another useful, tropical monsoon grass, common in the plains and up to 5,000'. It is sometimes hard to separate from *Brachiaria ramosa*. This is more hairy, the spikelets are larger and overlap more and the lower glume is 1/3 shorter than the spikelet.

Paspalum, L.

100. *Paspalum distichum*, L. This is another good fodder grass and is common about ponds and wet places. The spikes are almost always in pairs.

Paspalidium, Stapf.

101. *Paspalidium flavidum*, (Retz) A. Camus, (*Panicum flavidum*, Retz). Very common at the close of the monsoon in the plains and up to 4,000'. Useful as fodder and the seeds are rich in oil and have been used as grain in time of famine.

Panicum, L.

102. *Panicum antidotale*,* Retz. A perennial, common all over the plains in hedges and among bushes, up to 5' tall and with solid woody, terete, polished stems. Opinions differ as to its fodder value (Duthie). Inferior as fodder even when gouny (F. M. K.), said to be an antidate for hydrophobia (BOR).

103. *Panicum hydaspicum*, Edgew. A common hot weather annual in the plains.

104. *Panicum miliaceum*,* L. '*Cheena*', '*cheeni*', '*chinwa*'. This millet is occasionally found in the district but is not an important crop.

105. *Panicum proliferum*, Lam. A large, tropical, spreading, thick-stemmed water grass found about Rawalpindi and Khanna.

Isachne, R. Br.

106. *Isachne himalaica*, Hk., f. Material from Rawalpindi may represent a new species according to Mrs. Chase of the Smithsonian Insitution. Rare.

107. *Isachne australis*, R. Br. Reported from Rawalpindi by Aitchison.

Oplismenus, Beau.

108. *Oplismenus undulatifolius*,* (Ard) Beauv. An unimportant grass, not uncommon in the Murree Hills. The genus suggests *Panicum* but as Duthie points out both glumes are awned while in *Panicum* the outer glume is never awned. In this species, the spikelets are fascicled on a simple, terminal spike.

Echinochloa, Beauv.

109. *Echinochloa colonum*, (L) Link, *'sanwak'*, *'sawank'* is a coarse, common grass of the plains and lowr hills. It is excellent fodder and according to Duthie there is sale for the seeds in Rawalpindi. Common in cultivated fields in the monsoon.

110. *Echinochloa crusgalli*, (L) Beauv. *'Bara sanwak'*, barnyard grass is usually coarser than the last and usually with much longer awns. It favours wet places and in Kashmir is common at the edges of rice fields. A good fodder, green or dry.

111. *Echinochloa frumentacea*, (Roxb) Link. *'Sanwak'*, *'sanwan'* is often cultivated for its seed in the Punjab and Kashmir hills and is to be expected in this area.

Tricholaena, Schrad.

112. *Tricholaena teneriffae*,* (L. f) Parl. I have specimens of this Mediterranean xerophytic grass from Hasan Abdal on lime-stone, from Attock and the N. W. F. P.

Setaria, Beauv.

113. *Setaria italica*, (L) Beauv. *'Kangni'*, *'churri'*, (Jhelum basin. *Duthie*) Italian millet is commonly cultivated in the Himalayas especially in the inner valleys.

114. *Setaria lutescens*, (Weigel) Hubbard. (*S. glauca*, Beauv.) *'Bandra'*. *'bandri'*, *'ban kangni'*, Foxtail is one of the commonest weeds about cultivation in both plains and hills. The awns are rust coloured and the fruitlets are transversely wrinkled. An edible grass.

115. *Setaria tomentosa*, (Roxb.') Kunth, (*Setaria intermedia*, (Roth) R. and S.). A sub-tropical foxtail with the false spike thin and ragged and the young fruits finely transversely wrinkled . Common about Rawalpindi.

116. *Setaria verticillata*, (L.) Beauv. Another subtropical weed preferring shady places. The barbs on the bristles point backwards and the inflorescences become tangled and stick together. It is a coarse grass but is eaten when young. It seems to be spreading in Rawalpindi.

117. *Setaria viridis*, (L.) Beauv. Another cosmopolitan, subtropical and temperate weed resembling lutescens but the false spikes are green and the young fruits are not transversely wrinkled. It will grow on the bare soil of landslides. Abbottabad and the Murree hills.

Pennisetum, Pers

118. *Pennisetum flaccidum*, Girseb. A temperate roadside grass with a slender, flexuous fox tail like inflorescence. Usually above 6,000'.

119. *Pennisetum orientale*,* Rich, *'Manniara'* in Tret. A common perennial with the inner bristles copiously ciliate. From 2,000—7,000'.

120. *Pennisetum glaucum*, (L.) R. Br., (*P. typhoideum* or *typhoides*) *-Bajra*' bullrush or spiked millet is a very common hot weather crop on unirrigated land in the plains.

Cenchrus, L.

121. *Cenchrus barbatus*, Schum. '*Bhurt*', '*bhurat*'. The rigid involucel spines make it a pest when ripe but it is considered to be a good fodder when young.

122. *Cenchrus ciliaris*,* L. (*Pennisetum cenchroides*, Rich), '*Sitti*', '*anjan*', '*dhaman*'. Very common and much valued in the plains and lower hills.

123. *Cenchurs setigerus*, Vahl. (*C. biflous* Roxb.) A valuable desert fodder grass with the same names as the last (Gorrie). Fairly common in the plains.

ANDROPOGONEAE

Imperata, Cyrillo.

124. *Imperata cylindrica*,* (L) Beauv. Cotton grass is easily recognized by its pure white cylindrical spike-like panicles of silky spikelets. It is found on wet or waterlogged soil in all warm countries and furnishes good pasture when young. Called "*kaii*" in Tret according to Bhatti.

Saccharum, L.

125. *Saccharum officinarum*, L. Very little sugar-cane '*ganna*), is raised in Rawalpindi but a good deal is raised about Hasan Abdal.

126. *Saccharum spontaneum*, L. This is a large, gregarious grass, very common near water in the monsoon. It is a poineer in land ruined by torrents and is invaluable in reclamation work though it may be a nuisance in cultivated ground. The inflorescence is white and the ripe fruits are deciduous, leaving naked stalks. "*Kan*", "*kons*", *knhi*". A plant of the plains and lower hills.

127. *Saccharum bengalense*, Retz. (*S. munja* or *S. sara* or *S. arundinaceum*) '*Kana*' or '*sarkanda*'. One of our largest grasses, abundant on the flood plains of the great rivers of the Punjab and along water courses. It grows in great clumps which may attain 15' height. The different parts of the plant have separate names and many uses for matting, ropes, screens, sieves, etc. Only the young leaves are tender enough for fodder. Like the last it is useful as a soil binder.

Erianthus, Michx.

128. *Erianthus filifolius*. Nees ex Hack. Murree and the Gallies, usually above 5,000'; a strong perennial grass with very long and slender leaf tips and a reddish inflorescence.

129. *Erianthus griffithii*, (Munro) Hk. f. A xerophtic analogue of *Saccharum bengalense*. It grows in great clumps on dry banks and hills with a handsome white fluffy inflorescence ripening after the close of the rains.

Eulalia, Kunth.

130. *Eulalia nuda*, (Trin.) Kuntze, (*Pollinia nuda*, Trin.), An inconspicuous grass in the Murree Hills from perhaps 4,000—7,000'.

Eulaliopsis, Honda.

131. *Eulaliopsis binata*,* (Retz.) Hubbard, (*Ischaemum angustifolium*, Hack.) '*Bhabbar*' is abundant enough in the district to be of economic importance. (F.M.K.) It is a plant of dry, rocky places in the outer hills and is useful for paper making. The white wool at the swollen bases of the secondary tufts is distinctive.

Arthraxon, Beauv.

132. *Arthraxon, hispidus*, (Thunb.) Makino, (*A. ciliaris* Beauv.) Kahuta, Abbottabad. An unimportant grass usually found below 5,000'.

133. *Arthraxon lanceolatus*, (Roxb.) Hochst. Another summer grass, 2,000'—8,000'.

134. *Arthraxon lancifolius*, (Trin.) Hochst. A dwarf, annual grass, usually from 4,000'—8,000" on banks and walls.

Pogonatherum, Beauv.

135. *Pogonatherum paniceum*, (Lam.) Hack. A slender grass bearing simple spikes often forming a turf in the outer hills on steep ground below springs or water courses from the plains to 6,000'.

Ischaemum, L.

136. *Ischaemum* sp. An undetermined species has been collected at Khanna near Rawalpindi.

Apluda, L.

137. *Apluda aristata*,* L. *Chhat or chhant* is one of the commonest grasses in the hills up to 7000'. It is often scandent. It is much used for hay.

Themeda, Forsk.

138. *Themeda anathera*,* (Nees) Hack '*Loonder*', '*lunji*' is exceedingly abundant in the low foothills and up to 7,500'. It is a good fodder grass.

Iseilema, Anders.

139. *Iseilema laxum*,* Hack. '*Chhat*' is a low weak grass on low lying land in good soil. Uncommon but a good fodder. Reported from Rawalpindi by Duthie. I have not seen any specimens.

Bothriochloa, Kuntze.

140. *Bothriochloa ischaemum*, (L.) Keng (*Andropogon ischaemum*, L.) '*Palwan*' is one of our commonest perennials and is found from the plains to 11,000'. It is a good fodder grass but a nuisance on a lawn.

141. *Bothriochloa pertusa*,* (L. A. Camus), *Andropogon pertusus*, Wild.) This is much like the last but the lower glumes of the sesaile spikelet have peculiar pits. Usually below 6,000.' This is a good fodder grass.

Dichanthium, Willamet.

142. *Dichanthium annulatum*, (Forsk.) Stapf, (*Andropogon annulatus*, Forsk.) '*Palwan*', (Tret,—*vide* Bhatti). This is another excellent fodder grass closely resembling the last two species and it can be recognised by the peculiar, regular over lapping of the scales like those of a snake and blunt glumes with hairs having enlarged bases. A plant of the plains and low hills

Eremopogon, Stapf.

143. *Eremopogon foveolatus*, (Del.) Stapf. (*Andropogun foveolatus*, Del.) This is abundant on sandy and rocky ground in the plains and is usually reckoned a good fodder grass. (Duthie). This resembles the last three grasses listed, but the spikes are solitary and the glumes are pitted.

Cymbopogon, Spreng.

144. *Cymbopogon distans*,* (Nees) Watson, (*Andropogon distans*, Nees). An odoriferous grass growing between 4,000′ and 8,000′. Ghora Gali Murree, Barian, etc. The panicles are deflexed and the leaves filiform and long tipped.

145. *Cymbopogon jwarancusa*,* (Jones) R. and S. (*Andropogon jwarancusa*, Jones) *Bur*, (khavi). This is a common scented grass in the plains and low hills. The raceme fascicles are densely congested and hairy. The leaf bases are flat, the older ones curled. The plant takes a brownish red colour when ripe.

146. *Cymbopogon martini*,* (Roxb) Watson, '*Rauns*' (Bhatti). Rusa Oil Grass. Much the largest of the genus, the leaf bases are broad and semi amplexicaul. Occasional from 2,000′—4,000′. Rawalpindi, Tret.

147. *Cymbopogon schoenanthus*,(L.) Spreng. (*Andropogon schoenanthus*, L.) "*Rusa ka tel*" (Duthie) Lemon scented and thought to be a poor fodder, often growing on low lying ground. It is sometimes hard to distinguish from *C. jwaraneusa* and there may be hybridization. The basal sheaths are in dense tufts, tightly clasping, thickened below, and the blades are more or less filiform and flexuous, except when very short. Common about Rawalpindi.

Veteveria, Thouras ex Virey.

148. *Veteveria zizanioides*,* (L.) Nash, (*Andropogon squarrosus* Hack.) '*Khas khas*' grass. This is the well known grass which furnishes an oil for perfumery and roots for '*khas khas*' *tatties*. It grows in low lying damp ground and is relished by buffaloes when young. The scabrid spikelets are distinctive. A plains plant.

Sorghum, Monech.

149. *Sorghum halepense*,* (L.) Pers., (*Andropogon halepense*, Brot.) '*Baru*', Johnson Grass, is a large troublesome grass in cultivated ground in the hot weather. It is very quick growing and considered by many to be a fine grass for fodder but under certain circumstances it seems to be harmful. Some state that it is poisonous when frosted and during drought. Common up to 5,000′.

150. *Sorghum nitidum*, (Vahl) Pers., (*Andropogon serratus*, Thunb.) var. *nitidus*, Hack. '*Barwani*' (Bhatti) '*chhota baru*'. This closely resembles the last but is smaller and the smaller fruits are very dark in colour. In this the primary branches of the panicle are up to 4" long and undivided while in the last they are branched and up to 8" long. A plant of the low hills.

151. *Sorghum vulgare*, Pers. (*Andr. sorghum*, Brot.) '*Jowar*' is one of the most important summer crops in the plains. When specially grown for fodder it is called '*chari*'.

Chrysopogon, Trin.

152. *Chrysopogon montanus*,* Trin. *Dhaulv*

153. *Chrysopogon fulvus*, (Spreng). Chioc. (*Andr. monticola*, R. and S.) Common in the plains and low hills and the size of the spikelets is very variable. The fodder is said to be good for horses.

154. *Chrysopogon fulvus*, var *robustus*, (Hk. f.) R. R. S. Jhelum.

155. *Chrysopogon fulvus*, var. *serrulatus* (Trin.) R. R. S. This variety usually has smaller florets but there seem to be intermediates which Trinlus separated as a distinct species. The intermediates may be hybrids. This group needs more study. Plains to 7,000'.

156. *Chrysopogon gryllus*,* (L.) Trin., (*Andr. gryllus*, L.) Very common in the hills from 5,000—9,000'. It is very variable and Hackel has divided it into sub species and varieties. According to Osmaston it is the best of thatching grasses. The panicles are erect, narrow and reddish and it is common on banks in open places.

Heteropogon, Pers.

157. *Heteropogon contortus*,* (L.) Beauv. (*Andr. contortus*, L.) '*Sariala*', '*surwala*'. Spear grass is probably the commonest monsoon grass in the low hills. It is a good fodder but it must be harvested before the barbs are ready or when they are ripe enough to be shaken out, (Gorrie). The awns adhere in masses when the plants are mature.

Rottboellia, L. f.

158. *Rottoellia exaltata*,* L. f. '*Phallia*' (Bhatti). A robust perennial monsoon grass with peculiar jointed terete spikes. A good fodder but not common. Tret.

Phacelurus, Griseb.

159. *Phacelurus speciosus*, (Stend.) C. E. Hubbard, (*Rottboellia speciosa*, Hack.) A temperate grass, common in Kashmir, apparently less common in the Murree hills.

Muesithea, Kunth.

160. *Muesithea laevus*, (Retx.) Kunth, (*Rottboellia perforata*, Roxb.) A subtropical grass found up to about 4,000'. It has a very slender spike with pairs of sessile spikelets, appressed when young and a ring at their base. The

glumes are without veins and have a polished appearance. Grows on low lying pasture land and is edible.

Hemarthria, R. Brown.

161. *Hemarthria compressa*, (L. f.) R. Br. (*Rottboellia compressa*, L. f.) *'phallia'* (Bhatti). Much like the last but the spikelets are not paired and the veins on the glumes seem to be partly rubbed off. Also a plant of wet soil at low elevations.

162. *Hemarthria compressa*, var. *fasciculata*, Hack. Aitonision No. 252 from Rawalpindi has been identified as the variety. Duthie considered the variety to be only a form with shorter leaves and shorter, more crowded spikes.

Lasiurus Boiss.

163. *Lasiurus hirsutus*, (Forsk.) Boiss. (*Elionurus hirsutus*, Munro). A handsome zerophytic grass with a white silky inflorescence and a hard coespitose rhizome. An excellent fodder grass except when old when it is good for thatching (Duthie). Common on sandy and stony ground, Peshawar, Rawalpindi, etc.

Hackelochloa, Kuntze.

164. *Hackelochloa granularis*, (L.) Kuntze, (*Manisuris granularis*.) L. f. A tropical annual growing in the monsoon in the plains and outer hills. The plant is hairy and has distinctive granular, bead like fruits which become dark when ripe.

MAYDEAE

Coix, L.

165. *Coix lacryma-jobi*, L. This is a large water grass only found at Wah near Hasan Abdal in Attock District. The white, hard, shell, or bead like involucres are known as 'Job's tears' and are said to be eaten in Burma and China.

Chionachne, R. Br.

166. *Chionachne koenigii*,* (Spreng) Thw., (*Polytoca barbata*, (Roxb.) Stapf. Another large grass found in the Tret hills near the *bands* of cultivated fields. The leaves and sheaths are armed with long stiff bristle like irritant hairs. The hard white polished stone-like fruit-cases resemble those of *Coix* but are smaller, roughly half the size.

Zea, L.

167. *Zea mays*, L. Maize, (*makki*), is an important monsoon crop everywhere in the Murree hills and is also commonly cultivated in the plains. More productive types would be tried.

(Added) *Catapodium*

168. *Catapodium tuberculosum*, Morr. Beside rail-road tracks between Campbellpur and Jhelum in April.

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