

TRANSACTIONS
OF THE
BOTANICAL SOCIETY.

VOLUME X.



EDINBURGH:
PRINTED FOR THE BOTANICAL SOCIETY.

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ERRATA.

- Page 28, line 27, for June 10 read March 11, p. 106.
,, 115, line 32, for xxv. read xxii.
,, 127, line 4, for Giardina read Giardini.
,, 127, line 7, for 180,000 read 60,000.
,, 130, line 34, for Custard apples read pomegranates.
,, 193, *Note*—Omit the words, “Dr Hooker, however, originally described it as a member of the *Cycadaceæ*.”
- ,, 335, to List of Plants *add*—
Bryum purpurascens ?
Dicranum scoparium, var.
Hypnum Kneiffii, condensed form.
sarmentosum, var., with shorter leaves than usual.

5. *Presentations.*—William Jameson, Esq., surgeon-major, Saharunpore, presented a collection of dried specimens of Indian forest trees and ferns. Dr Vartan presented dried plants from Nazareth. William Craig, M.B. and C.M., presented growing plants of *Botrychium Lunaria*, which he had collected in a field in Ayrshire, which had been five years under cultivation. J. Couper Johnston, M.B., Melksham, presented specimens of monstrous roses, in which the axis was prolonged beyond the flower, and ended in a cluster of leaves. Mrs Walker-Arnott presented a portrait of the late Dr Burchell.

Mr M'Nab placed on the table a collection of alpine and other plants in flower, including *Meconopsis aculeata* and *Chirita bifolia*.

Thursday, 8th July 1869.—Dr CLEGHORN, President,
in the Chair.

The following Gentlemen were elected Fellows:—

1. *Resident Fellow.*

WILLIAM P. DRUMMOND.

2. *Non-Resident Fellow.*

J. LINDSAY STEWART, M.D.

The following Communications were read:—

I. *Notes of a Botanical Tour in Ladak or Western Tibet.* By
J. L. STEWART, M.D., Conservator of Forests, Punjab.

At the request of my friend Dr Cleghorn, I have put together the following notes of a tour made through considerable parts of Ladak, in August and October 1868, and have now the honour to lay it before the Society. I have to express my regret at the meagreness and incompleteness of these notes in several respects, which depend chiefly on a large portion of my material being at present beyond reach at Kew.

For years I had entertained a hope that I might be able

to visit some part of Tibet, which is beyond the British boundary, and in 1868 I obtained permission to visit Ladak or Western Tibet, lying in the territory of H.H. the Maharajah of Kashmir, chiefly in order to get some personal knowledge of its flora, to supplement experience as to great portions of the Himalaya to the south.

Among the most notable of those who had at any time botanised within the Tibetan area were Jacquemont, Vigne, and Dr Thomson, the collections of the last having been very extensive. I kept for the most part free of Dr Thomson's tract (except in Nubra), and a considerable part of the northernmost portion of my route had only been traversed by European officers on sporting or surveying expeditions. Some of the extreme parts had only been visited within two years by Mr Johnson and Dr Cayley, who had both crossed the great range on the hither side of Turkistan. I may note that my own plants were supplemented by a collection of about 175 species made by Dr Cayley in 1867; and I have to premise that, as my specimens have not yet been rigidly identified, many of the botanical names given are dubious or provisional.

The heights of the camps and passes, &c., were taken by the boiling point of water, and may be considered fairly approximate; and the distances are from routes of authority, corrected or supplemented by noting a pedometer, which I constantly carried.

To begin with the tour, then,—from Koolloo, in the Bias basin, where I had for some time been inspecting forests, I, on 21st July 1868, crossed by the Harshar Pass (14,052 feet) into Lahoul, in the Chenab basin, and after traversing considerable tracts on the Chandra and Bhaga, which unite to form the Chenab, and spending at the Moravian mission station of Kyelang two very pleasant and instructive days with the Rev. H. Jaeschke, a most industrious and intelligent botanist, I, on 5th August, entered Ladak by crossing the Baralacha Pass, which here separates British territory, in the basin of the Chenab, from that of Kashmir, in the Indus basin.

The elevation of the pass above the sea is about 16,000 feet, and as the top is rounded or flattish, with some soil, about a dozen flowering herbaceous plants were found on

or close to the crest. Hence a road goes eastward to Spiti, another British district, with flora, &c. of a Tibetan type. But our route lay in a north-easterly direction, down one of the longest tributaries of the Zanskar river, which takes its rise from near the pass; and ere I reached my first camp in Ladak, a good many of the ordinary plants of the Lahoul side had disappeared, while a proportion of them still occurred, some to cease entirely within a few days; and Tibetan forms had become more or less common, two of the most characteristic being *Oxytropis macrophylla*, with viscous leaves, and a large, very tough root, afterwards found abundant in many places in Ladak, at from 12,500 to 17,000 feet, and *Biebersteinia odora*, a Rutaceous plant, with viscous leaves, yellow flowers, and a strong scent, frequently got in some numbers in Ladak, but only locally, at from 14,500 to 17,000 feet.

The following are some others of the chief plants got on this march, with some notes of the heights at which they were subsequently found:—A tall *Corydalis* (one of several Ladak species), rarely got afterwards, at from 14,800 to 16,000 feet; a *Viola*, at 15,000 feet, not found again; *Geranium Wallichianum*, occasional, at from 14,800 to 16,300 feet; *Potentilla Inglisii*, not uncommon locally, at from 15,000 to 17,000 feet; *Taraxacum officinale*, abundant in many places, from 14,000 to 18,000 feet; *Nepeta discolor*, common in many parts, from 11,500 to 17,000 feet; *N. longibracteata*, often found at 15,000 to 17,800 feet; *Oxyria reniformis*, rare, from 10,500 and at times up to 17,000 feet; *Suæda* species, common at and above parts from 10,000 to 16,000 feet; several species of *Polygonum*, the chief being *P. tortuosum*, often found at from 14,000 to 17,000 feet; *Rheum Moorcroftianum*, rare, at 11,500 to 15,500 feet; *Triglochin palustre*, in many places at 10,500 to 16,200 feet; and *Lloydia serotina*, found at 14,000 to 16,300 feet, but not seen after the 8th August. The camp was at Kelung, on a flat green spot by the stream, $7\frac{1}{2}$ miles from the crest of the pass, at an elevation of 14,493 feet.

On the 6th of August, a march of 18 miles in a northerly direction brought me to Rachuk (13,854 feet), on the same stream. *En route* (and several times subsequently) marmots' holes were common, and the animals themselves

might be seen for a minute, until they spied the intruders, and dived into their burrows. Two shrubby plants, both used for fuel, occurred—*Lonicera angustifolia*, frequently observed at from 13,000 to 15,300 feet, and the better known *tama*, "Tibetan furze" of travellers, *Caragana pygmaea*, which frequently occurred in quantity in parts of Ladak (except to the north of the Pangong Lake), at from 13,500 to nearly 18,000 feet. The stems of the latter grow to six inches in girth, and afford the best fuel of all these Tibetan desert plants. The following also occurred:—A small *Ranunculus*, with tricuspid leaves, afterwards seen abundantly in many places, at from 11,000 to 16,000 feet; *Dianthus* sp., only got here at 13,800 feet; *Astragalus multiceps*, common in many places from 11,000 to 16,500 feet; a small *Potentilla*, with procumbent leaves, abundant in Ladak from 11,400 to 16,600 feet, and occasionally to 17,800 feet; *Thymus Serpyllum*, only here at 14,000 feet, and on the following day; *Eurotia ceratoides*, abundant in many parts from 12,000 to occasionally 18,000 feet, its thick roots being much used for fuel; *Urtica hyperborea*, which occurs frequently from 14,000 to 17,500 feet, and the young leaves of which are used as a vegetable; and *Allium* sp., with narrow leaves, also used as a vegetable.

The march of 7th August, after a very steep ascent at the beginning, led up to the (southern) Lachalung La (*La* is pass in Tibetan), at the crest of which, among earth, behind and near projecting ridges of rock, about a dozen species of plants were found. Among these the chief were a prickly specimen of *Alsine*, growing in rounded, hassocky clumps (and often mentioned by Dr Thomson); it frequently occurs near the crests of passes from 14,000 up to 18,600 feet; and a small broad-leaved *Arenaria*, common in similar situations to the former, at from 15,000 to 18,600 feet. At this crest also were got an *Isopyrum*, only found once subsequently (on the 8th), at 15,000 feet; a very small *Thalictrum*, got occasionally down to 12,000 feet at Le; a viscous *Lychnis*, found occasionally at from 15,000 to 17,000 feet; *Tanacetum tomentosum*, abundant at many places from 15,500 to 18,000 feet; *Ephedra Gerardiana*, which is common in many places from 11,500 to 16,600

feet; and *Cystopteris fragilis* (the only fern I got in Ladak), and which occurs frequently from 12,000 to 17,500 feet, generally under overhanging rocks, &c.

At some rocks on the ascent, about 15,000 feet, were found an *Aquilegia*, only got once subsequently at 13,000 feet; *Campanula aristata*, only this once; *Dracocephalum heterophyllum*, a very strong-smelling plant, abundant at many places afterwards from 14,000 to 17,500, and occasionally to 18,000 feet; and *Nepeta graveolens*, got here only. A short descent from (southern) Lachalung to camp at Lachalung Sumdo, thirteen miles from Rachuk, lying at 15,788 feet, in a hollow between the former and the higher Lachalung La to the north. At camp I first found a small *Polygonum*, with sagittate leaves, afterwards abundant at many places from 15,000 to 17,500 feet, and the leaves of which are used as a vegetable.

From Lachalung Sumdo a long march of twenty-four miles to Kiangchu ("spring of the wild ass"), by first a steepish ascent of a couple of miles to Lachalung La, at the crest of which, 16,500 feet, some half dozen plants grew, including the *Alsine*.

Most of the rest of the way lay down the valley of a stream, where, about 15,000 feet, were got *Valeriana tenella*, not found again, and *Scrophularia Kotschyi*, afterwards common in many places at from 10,500 to 16,500 feet. For the last five or six miles the road ran along the plain of Kiangchu, about two or three miles wide and eight or ten miles long, at 15,500 feet, and in many places covered with *Caragana*. Water was got by digging holes in a channel which traversed the plain. Near my camp were a number of merchants carrying south borax from Puga, some marches north of this, where much of it is got.

After halting on the 9th August, the march of the 10th was along a valley and across a low water-shed, near which *kiang* (wild asses) were seen, to Rukcham (15,551 feet), lying not far from some tributaries of the Zanskar river, a distance of twenty miles in all. From Kiangchu *Euphorbia Tibetana* occurred, and was found occasionally afterwards from 11,500 to 16,800 feet.

At Rukcham the porters were changed, the twenty-five

men who had brought the traps from Kyelang in Lahoul, nine marches, being paid up, and seven or eight *yaks* being engaged to go on to Gia. The march of the 11th August, of sixteen miles, still northerly, in a main valley, with but little water at intervals, brought us to Dimring, 16,182 feet. Here was the summer head-quarters of the tribe of grazing people who furnished our *yaks*, whose villages are far to the south-east; and part of the breadth of the valley was dotted with their small black tents, made of *yaks'* hair.

Near the camp was a good deal of herbaceous vegetation, and here I found for the first time *Artemisia sacrorum*, which was afterwards abundant in many places from 10,500 to 16,500 feet, with a thick root, which is occasionally used for fuel; and *Marrubium lanatum*, at 15,500 feet, afterwards frequently got, at times to 18,300 feet. On the way to Dimring I had, for the first time in Ladak, got *Scopolia præalta*, at 16,000 feet, and it was afterwards frequent locally down to 13,300 feet. It is said to be poisonous to cattle when fresh, and is injurious to man when by mistake used as a vegetable.

From Dimring, on the 12th August, the road ran steep up to the crest of the Taghlang La, which is 17,349 feet. On and near the rocky crest were found some six or seven plants (mostly Cruciferous, as often in such situations), including *Lecanora miniata*, an orange-coloured lichen, found on many passes in Ladak from 15,700 to 18,600 feet. On the descent from the pass a white-flowered variety of *Taraxacum* was common at 17,000 feet, and *Polygonum tortuosum* occurred at 16,000 feet, the highest at which it was found. From 15,500 feet were found *Christolea crassifolia*, abundant in many places in Ladak from 11,800 to 17,000 feet; *Stachys* sp., abundant in many parts down to 11,300 feet in the Indus valley; *Carum*, common in many places down to 11,800 feet; *Pedicularis tubiflora*, almost stemless, with long yellow flowers, and not uncommon in Ladak, down to 11,500 feet.

Near Gia, 14,000 feet, twenty miles in all, barley was cultivated to about 14,500 feet, about the highest at which I saw it, and *Pisum sativum*, at about the same height, where, however, it does not ripen well; but it is commonly

cultivated down to 10,500 feet. At Gia were two or three trees of *Populus balsamifera*, nearly the highest at which it was seen; it is not uncommon planted down to 11,000 feet, though not so frequent as *P. pyramidalis* (Lombardy poplar). In some cases the former reaches 8 feet in girth and 70 feet high. Here also were some trees of the common cultivated willow (near *Salix alba*) of Ladak, in many parts of which it is abundant.

Gia was the first permanently inhabited place I had seen since crossing the Bara Lacha. Here there are several considerable villages, with the first of the Tibetan *gompas* or monasteries, curiously built high on steep rocks over the brawling stream.

On 13th August, by a march of twenty miles still northerly, along the stream which comes from near the Taghlang Pass, I reached Upshi, which lies at 11,841 feet, close to the confluence of that stream with the Indus. In the course of this day's journey a considerable change took place in the flora, the chief members of which may be noted as follows:—*Clematis* occurred in places, climbing over the *Myricaria* bushes in the stream-bed, and was abundant in many places afterwards, from 10,200 to 15,200 feet; a Rose, like *R. Webbiana*, was in flower, and was common afterwards in places from 11,500 to 13,500 feet; *Myricaria elegans*, the one of the two Ladak sp. which has large leaves and smaller flowers, became common here, and occurred often afterwards in great abundance in the beds of streams, to from 11,800 to 15,500 feet, and occasionally to 16,400 feet, becoming minute and herb-like at the last height,—its wood is often used for fuel; *Galium Aparine*, which occurred afterwards occasionally, from 12,000 to 13,500 feet; *Cirsium arvense*, and *Mulgedium Tartaricum*, both frequent at places from 14,000 down to 11,000 feet; *Convolvulus arvensis*, common in fields, from 11,300 to 13,000 feet; *Lancea Tibetica*, a small plant with pretty blue flowers, was abundant in the turf by the stream, and often found afterwards from 10,500 to as high as 16,000 feet; *Veronica Anagallis*, occasionally from 11,000 to 13,500 feet; *Mentha Royleana*, frequent in wet places, from 11,000 to 12,000 feet; *Nepeta floccosa*, which occurs locally from 11,000 to 13,300 feet; *Perowskia*

abrotanoides grew in thickets, and occurred afterwards from 10,500 to occasionally 13,000 feet; and *Hippophae rhamnoides* began here in quantity, and in Ladak was often abundant as a shrub of some size, from 10,500 to 15,500 feet, with its thorns excellent as a fence, and its fruit—terribly sour—occasionally eaten. Near Upshi there was a good deal of *Arundo Phragmites*, common in many parts, from 10,500 to 14,000 feet, which is eaten by cattle, and apparently occasionally made into baskets.

Fagopyrum was cultivated from 13,200 feet downwards, and is common in Ladak down to 10,200 feet; and a Sinapis, of which the leaves and oil are used, is frequently cultivated from 13,000 feet downwards. At Upshi were some trees of *Prunus Armeniaca*, with fair fruit; it is cultivated from 12,000 feet downwards. Trees of *Populus pyramidalis* occurred, from 12,500 feet, and lower than this it is very commonly planted in Ladak.

From Upshi to Le the route is somewhat north-westerly, and the march of 14th August brought me to Stagna, at first along uncultivated slopes, then with much cultivation at places, especially near the end. *Lepidium latifolium* was common here, and at many places afterwards, from 10,500 to 14,000 feet. *Tribulus* occurred at the end of the march, and is not unfrequent in this part of Ladak from 10,300 to 12,000 feet; *Pandertia pilosa* commenced here, and was frequently seen subsequently from 10,500 to more than 14,000 feet; *Salsola collina*, which occurs from 10,500 to 13,300 feet. Towards Stagna, in low ground, *Iris Kumaonensis* was abundant, and afterwards frequently occurred at 10,200 to 12,000 feet; *Avena fatua*, often abundant in fields, &c., from 10,500 to 11,500 feet; and in canal-cuts, &c., *Potamogeton crispus* was common, and subsequently occurred often at 11,400 to 11,500 feet. Of cultivated plants, *Faba vulgaris* and *Medicago sativa*, both common from 10,500 to 12,000 feet; and *Lathyrus sativa*, from 10,000 to 11,500 feet in Ladak. Along this tract, and in the valley of the Indus generally near this, where irrigation is possible, there are multitudes of *Populus pyramidalis* and *Salix*, both grown for timber.

Stagna is situated on a wide flat near the left bank of

the river, with much cultivation of cereals, &c., and has a monastery on a lofty rock.

On the 15th August, a march of seventeen miles, two-thirds of the way along the low ground, and then crossing to the right bank by a bridge, the remainder up a sloping dry tract, brought me to Le, situated at about 12,000 feet above the sea, some miles from the Indus.

On the way, and especially as I traversed the dry slope, *Échinops nivea* and *Caroxylon Griffithii* were common, both of which I only saw in this valley at 11,000 to 12,000 feet. *Potamogeton gramineum* was common in water at 10,500, and occurred afterwards not unfrequently up to 14,400 feet.

Le, the capital of Ladak, is a city of some size, with groves of poplars and willows about it, and is surrounded by a good deal of cultivation. The picturesque appearance of the city, with the temple and palace on the high rock above, have been rendered familiar by the illustrations in various books of travel. A little below the city is a poor fort, garrisoned by a small detachment of the Maharajah's soldiers. The climate is for a part of the year in summer nearly perfect; and the temperature ranged from 52° to 85° in middle of August, and from 44° to 70° at beginning of September. It is but rarely that more than a few drops of rain fall; one fair shower occurred while I was there, and in 1867 a moderate fall brought down some dozen of houses in the city.

I remained four days at Le, and took the opportunity of examining the flora, noting now (and at a subsequent stay of four days in Le) the following species, remarked for the first time here:—*Mathiola odoratissima*, found locally in some quantity, at from 10,200 to 13,300 feet, in the valley of the Indus and in Nubra only; *Sisymbrium Sophia*, only at Le; *Capparis spinosa*, common here at 12,000 to 12,500 feet, and found only in Indus valley and Nubra—in the latter, down to 10,300 feet, and the leaves used as a vegetable, and the fruit said to be eaten; *Stellaria media*, at Le only; *Malva parviflora* and *Lamium amplexicaule*, here, and at 10,800 feet in Nubra; *Nepeta salviaefolia*, here only at 12,400 feet; and a tall *Rumex*, found at damp places, from 10,500 to 13,000 feet, in Indus valley and Nubra;

Cuscuta planiflora occurs, at 10,500 to 11,500 feet in the Indus valley and Nubra, on *Mentha*, *Perowskia*, and *Stachys*. Here a moss was not uncommon, which appears to reach 15,500 feet or more in various parts of Ladak; only once found in fruit at 13,000 feet.

The only two flowers cultivated at Le were a *Chrysanthemum* and a *Tagetes*, neither of them very common there, or seen elsewhere in Ladak.

It may be noted that a great part of the fuel used by the well-to-do in Le is drift-wood of *Juniperus excelsa*, brought from the mouth of the Zanskar River, a few miles off.

During the time I was in the capital, a good many Yarkandis came in to trade—very hardy and independent-looking fellows, more so even than the Pathians of our north-west frontier. Their numbers this year were much increased, owing to its being the second season of Dr Cayley, as British agent in Ladak, for watching over the Turkistan trade. It had originally been arranged that I should be up in Le early enough to accompany Dr Cayley across the Karakash Pass, where only Mr Johnson of the Survey had preceded him; but circumstances had delayed me beyond the season at which he had to cross, and now I could only afford a week or two *towards* the Pass, and on the Changchenmo and north of the Pangong.

So I settled to have first a few days in the Nubra district, across the hills to the north of Le, including part of the basin of the Shayokk and that of the Yarma River, one of the most fertile and prettiest parts of Ladak; and this I fixed on, although Dr Thomson had spent some time in Nubra.

On the 19th August I commenced with a short march of seven miles in a northerly direction from Le, up a large valley to Karamlats, at 15,465 feet, prettily situated on a knoll by a small stream some miles above population and cultivation. On the way, the following additional plants occurred:—*Cicer Soongaricum*, not uncommon in Ladak from 10,600 to 16,000 feet, and of which the grain is eaten; *Lonicera glauca*, a small shrub, occurring occasionally at 13,000 to 15,000 feet; *Solenanthus* sp., not uncommon at from 13,300 to 16,000 feet; *Allardia tomentosa*, to

16,500 feet—next day, and once after, at 16,000 feet; *Ligularia arnicoides*, and to 17,000 feet next day, and not common afterwards; and *Waldheimia tridactylites*. The last was got at 16,500 feet on the 20th; it frequently occurred afterwards at great heights, and grew to 18,500 feet, at the extreme north point I reached, being the highest of any flowering plant I know in the Himalaya.

On the 20th August, from Karamlats there was a steady rise, latterly heaped with blocks covered with snow to Laoche La Pass, some three miles from camp. At the blocky and snowy crest, 17,500 feet, no plants were seen. The beautiful, scented *Delphinium Brunonianum*, the blue flowers of which are strung into necklaces, &c., was common on both sides here, as at other passes, about 16,000 feet, and one reached 18,300; *Gentiana nubigena*, with the longest, largest flowers of all I got, was common at places about 17,000 feet, and occurred at a similar height on two passes after this.

A steep descent of 500 feet, over a snow-field covering the mass of blocks, brought me to the Tso ("a lake"), a circular, apparently deep lake, whence the slope lessened, the valley widened, and the path lay along the bank of a stream from the lake. After sixteen miles in all, I reached Khardong, at 13,263 feet, some miles below the first villages and cultivation. The *Stachys* of the 12th was abundant from 16,000 feet downwards; and from 13,000 a *Berberis* was common, which afterwards was found down to 11,000 feet, but in this part of Nubra only.

The march of 21st August took me several miles down this stream, to near where it joins the Shayokk, and round and down some steep hills on the left banks of the latter hill, running north-westward to Kartshar, 11½ miles in all, a village picturesquely situated in the lateral glen of a small tributary. Here the lower elevation and increased moisture account for the presence of a good many plants not found in most other parts of Ladak. Amongst these, Dr Thomson got three sp. of *Orchidaceæ*, of which I found two. Of other plants, *Silene conica*, I got here only; *Vaccaria* here and in the Indus valley, at 11,500 feet; an *Arnebia*, like *A. hispidissima*, which is found in many places in Nubra and to the east, at from 10,500 to 16,000 feet;

Euphrasia officinalis, common in many places in Ladak, from 10,300, and occasionally to 16,300 feet; two species of *Pedicularis*, one of which occurred afterwards to 16,000 feet; *Polygonum Nepalensis*, got in Nubra only, at 10,500 to 11,500 feet. Near Kurtshar there was much *Myricaria* of both species in the bed of the small stream; and there was first seen *Lycium Ruthenicum*, which was common in young fruit, and found in Nubra only, from 10,200 to occasionally 13,500 feet. Its mawkish, sweet fruit is eaten.

Here, and in some other villages, are some trees of *Pyrus Malus*; but the fruit, which is small and pleasant, only ripens below this. In this village also were some trees of *Juglans regia*—one as much as 10 feet in girth, but short and stunted compared with those in the Himalaya farther south. I only saw it once afterwards in Nubra.

On the 22d August I made fifteen miles down the Shayokk to Diskit, a considerable village, with a monastery on the sloping hill over it, lying, at 10,689 feet, near the left bank of the river, opposite the junction with the latter of the Yarma (sometimes called the Nubra) from the north.

The only novelties of note on the march were *Potentilla Salesovii*, found at Ladak, here only at 10,800 feet, and *Tamarix Gallica*. The latter kind, frequently in fine red flower (darker than that of the plains), grows in some quantity, in parts of the Nubra valley, at 10,200 to 12,000 feet— at one place (26th) to 13,500 feet. It reaches 10 to 15 feet high, and generally is mixed with *Myricaria*, of which both species were abundant in many parts of the bed of the river, here as much as a mile and a half wide. *Hippophae* also was common in masses, attaining 15 to 16 feet in height.

At Diskit itself, where I halted on the 23d August, grew a tall *Allium*, with long narrow leaves and fine umbels of whitish flowers, the root, leaves, and flowers of which are eaten; and *Juncus bufonius*, which also occurs in the Indus valley, from 10,500 to 11,000 feet.

Populus pyramidalis and *Salix* were not uncommon here, as elsewhere in Nubra, among the cultivated plants of which are *Allium Cepa*, grown under 11,000 feet, and *Cucurbita maxima*, at 10,200 to 10,500 feet only, with *Panicum*

miliaceum at about the same heights, and turnip up to 11,500 feet. Here also, as in the Indus valley, *Ervum Lens* is grown at 11,400 to 11,500 feet.

On the 24th August I proceeded to Hundirri, twenty miles, lying at 10,604 feet, on the right bank of the Shayokk, still flowing north-westerly. About half-way the river was crossed on a small light raft of spars, supported by inflated goats' skins. *En route*, *Tamarix gallica* was common in and near the bed of the river, with *Myricaria*; and on the right bank, above Hundirri, a grove of wild *Populus Euphratica* extended nearly a mile in length, at about 10,500 feet. The tree here attains $1\frac{1}{2}$ to 2 feet in girth (one was seen of 5 feet) and 20 in height, and its wood is carried to some distance to be used as fuel. On the way, *Solanum nigrum* was found, the only time in Ladak. Close to Hundirri were a good deal of a *Vincetoxicum*, climbing in bushes, found once afterwards only; and *Colutea arborescens*, in flower and fruit, was common in places here only.

At Hundirri are a good many poplars and willows, with many apricot and other fruit trees, among which are one or two *Elaëagnus*, cultivated for its fruit, and reaching 5 or 6 feet in girth, and 25 feet in height. It is quite different in size, aspect, and leaf, &c., from the species which is commonly wild in the Himalaya to the south. It was planted at Unmaru also, a village eleven miles to the north-west, lying on the right bank of the river, at about 10,200 feet, whither I went on 25th August, while my camp halted at Hundirri. At the former, fruit trees were more numerous (and probably become more so further down the river), and included several Juglans.

On the way to Unmaru one specimen of *Orobanche cærulea* was found, the only time in Ladak, though it is frequent in Lahoul. On one of the cairns of stones, with sticks supporting prayers printed on cloth, coloured rags, &c., which are common in Ladak, were placed some pieces of branches of *Juniperus excelsa*, said to be brought from High some distance to the west. I was afterwards told that it grows high on the Yarma also.

From Hundirri, on the 26th August, after proceeding backwards some miles up the right bank of the Shayokk, I crossed, by the Chali Lungpa Pass, to the valley of the

Yarma River. The elevation of the crest was only 15,000 feet above the sea; but a great part of the ascent to it is up a terribly difficult ravine, so much obstructed by rocks and large shrubs, &c., that I cannot conceive how the traps (now carried by men) were got up it, unless their guides were better than mine, and so found a side-path. As it was, they only reached our destination after dark.

In the ravine, or rather rift, to over 13,000 feet, first occurred abundance of *Myricaria*, reaching 15 to 18 inches in girth; *Tamarix Gallica*, *Salix*, and *Hippophae*, with *Populus Euphratica*, more rare. *Arundo Phragmites* and *Perowskia* also are frequent to 13,000 feet. *Ribes leptostachyum*, of which the fruit is eaten, occurred at 12,000, and was found once afterwards in Nubra at 10,800 feet; and *Dracocephalum stamineum* was got here, and once or twice at similar heights in Nubra only.

At the foot of the very steep descent from the pass is the village of Chirasa, with its picturesque monastery on a high rock close by. Some three miles up the right bank of the Yarma, here running south, in the bed of which *Myricaria* was abundant, and *Tamarix* common, while near the banks were fine cultivated willows, one or two reaching 9 feet girth and 60 feet in height, brought me to Kuri, 10,231 feet, nineteen miles in all.

On the 27th August, the traps, &c., going straight to where camp was to be, I first went some miles up the river, and crossed it, with some difficulty, on men's shoulders, at a place where there is a great thicket of large *Hippophae*. Here I examined the warm springs of Churan, where there is a considerable discharge of warm water (temperature, 164° and 170°, that of the air being 71° Fahr.), with some chalybeate and much saline deposit. Then down the left bank of the river to Liakjang, a village at 10,356 feet, lying close to where the Yarma joins the Shayokk, and nearly opposite Diskit. By my route, this is twenty-eight miles from Kuri, a pretty stiff day's work, as the sun was hot.

Close to Liakjang, *Lonicera angustifolia* occurred to 4 feet high in hedges; and not far from it were one or two large trees and several shrubs, apparently wild, of a small-leaved *Ulmus* (*U. pumila* ?) mentioned by Dr Thomson, agreeing

with a species occurring in the Himalaya to the south, and not again seen by me in Ladak. I conceive that this was originally introduced.

Here, for the only time in Ladak, I saw tobacco growing. It was what I believe to be *Nicotiana rustica* (and quite different from the ordinary *N. Tabacum*), which I have now found cultivated in many parts of the Punjab hills and plains. Much of the tobacco consumed in Ladak is brought from Yarkand, and its leaf is said to be the same shape as that of Nubra. Here also I got some fairly good melons (*Cucumis Melo*), which are sparingly grown in Nubra, under 10,500 feet.

Hence I had intended to cross the Shayokk some miles higher (to the south-eastward); but getting word now that the river was still impassable at that place, I was obliged, on the 28th August, to cross here to a point a little above Diskit, and again march to and encamp at Kartshar, where I had been on the 21st. From it, on the 29th August, I made eighteen miles, three-fourths of the distance south-easterly up the left bank of the Shayokk, where was much *Myricaria* of both species, in the bud; and at one point, in a little hollow, at 12,000 feet, a clump of some dozens of fair-sized *Populus Euphratica*. The remainder of the way was up a considerable slope, and round a hill southward to Digar, eighteen miles in all.

This village lies near a small tributary of the Shayokk, at about 13,000 feet, and is perhaps the highest cultivated ground in this direction, wheat being the only cereal, and its highest point noted by me. Here were a few young planted *Salix*. On the way to or at Digar no special novelty occurred, except a solitary specimen (fresh) of *Lycopodon*, got near the village, and the only one I found in Ladak.

I halted on the 30th August, and on the 31st the way lay up the stream, still to the southward, the valley gradually becoming steeper. *Gentiana nubigena*, and several species of *Saussurea*, were common to 16,500 feet, at which height there was plenty of moisture, with a good many flowering shrubs, and much grass and sedge. But soon the steepness, aridity, and bareness increased, till at last, after a very steep ascent over large blocks (as on the Laoche La of the same range on

the 20th), with largish snow-beds near, I reached the Lasghun La Pass, 17,478 feet. As the crest was a narrow rocky ridge, with a good deal of snow, only three or four plants were found, among them being *Waldheimia*, and a green Lichen only got once afterwards.

By a very steep descent over blocks (as on the 20th), and then south-westerly, in steepish valleys, I, after some miles, reached the open Indus valley, with the *Echinops*, &c., which had not been found in Nubra; and turning westward, over and among bare low ridges, by-and-by arrived at Le, about twenty miles from Digar.

After a halt of five days at Le, I, on the 5th September, set out, the first part of the journey being south-easterly along the Indus valley on the right bank, passing the villages of She, Thikse, and Stagna, each with picturesque high rocks crowned with monasteries. Along part of this tract there is much population and cultivation, most of the wheat and barley being then reaped. *Hippophae* was not uncommon low, and *Zannichellia* occurred in water, with species of *Potamogeton*, &c. Here I had my first taste of the high winds of Ladak, of which soon after I got ample experience.

Camp was a few miles within the green valley of a small tributary of the Indus, at Kharru, twenty-six miles from Le, at 11,579 feet. Here I halted on the 9th, enjoying the rest and the pleasant temperature (from 45° at sunrise to 73° at highest), and the fine view southward across the Indus valley to the verdant glen, in which stands the monastery of Hemis, one of the largest in Ladak.

On the 7th September, I went twelve miles up the valley, passing early Chimre, with a monastery perched, as usual, on a high rock, the last to be seen for twenty-five days; and, a few miles farther on, leaving behind, at about 13,000 feet, the highest few stunted planted willows. On the way were seen large quantities of turf, cut and piled for fuel, which I have never seen in the Himalayas to the south. *Artemisia parviflora*, a glabrous species, occurred, and is frequently abundant at from 13,200 to occasionally 17,500 feet. *Artemisia sacrorum* was also common, and *Solenanthus* was abundant in leaf for miles, up to 16,000 feet.

Camp was at Zangrul, 15,964 feet, a level spot, with some

dry stone walls for shelter, where already many of the plants were drying up from the advance of the season; and here, as generally for some weeks after this, the fuel was chiefly the large thick roots of *Eurotia*, which is luckily one of the most abundant and wide-spread plants of this part of desert Ladak. *Caragana pygmæa*, already noted, is less widely distributed, and burns away more rapidly. Several odorous species of *Artemisia* are also used for fuel, as is the hassocky *Alsine*; but these want body, and none of them are equal to the two first named. From Zangrul, on the 8th September, I started (temperature 30°) for the higher of two passes open to me, and ascending eastward, the latter part being steep, at about five miles from camp, the Ze La was reached. Here, at 17,984 feet, the low temperature (34° at nine A.M.), caused chiefly by the proximity of large snow-fields and biting wind, prevented me from sitting long to enjoy the magnificent view of snowy peaks to the southward. Of the dozen or two of species which reached a considerable height, the most notable were *Delphinium Brunonianum* and *Gentiana nubigena*, to 17,000 feet; *Cystopteris fragilis*, to 17,500 feet; and *Waldheimia*, to 18,000 feet. At the crest I found only *Lecanora* and another Lichen, and a Moss.

A very steep and rough descent over and among blocks, mostly granitic, brought me to Ke Tso, a pretty, green, clear lake of about half a mile long. After this the road ran down a narrowish valley, gradually getting wider and the scenery tamer, till I reached Tankse, twenty-five miles from Zangrul. This is a small village, but the chief one in this tract, lying at 12,958 feet, with a good deal of flat and cultivation. At 13,500 feet there were one or two poor *Populus balsamifera*, the last for a long time.

On the 9th September, the road from Tankse lay up a widish valley along the stream on the banks of which Tankse is situated; the scenery at first rather picturesque, but gradually tamer, and with great marshy flats, up to Mughlib, nine miles, at 13,300 feet. At this poor, small hamlet, arrangements were made as to provisions for the more distant part of the trip. *Lonicera angustifolia* was occasional from 13,000 feet to the end; and at 13,000 feet an *Allium* occurred, with very narrow leaves and lilac

flowers, which is occasional in Ladak at 10,500 to 14,000 feet, and of which the leaves are eaten.

The march of 10th September was rather an interesting one, the first part of the way lying south-easterly up the valley to the head of the stream, where there were two small, shallow, clear lakes, surrounded by picturesque scenery. *Ranunculus aquatilis* occurred early, as did *Lonicera angustifolia*; and *L. glauca* grew in considerable clumps to the uppermost part near the Sartokh Pass, where Clematis was abundant. From this, 14,800 feet, the slope was easy, and, while descending, light snow fell for about half an hour. Ere long I got my first glimpse of the Pangong Tso, with its great blue bosom everywhere indented by spurs of the lofty mountains round it. With its north-west end full in sight, but without going within a mile or two of the margin, I turned northward, and soon reached Lukung, at 14,127 feet, a very poor, little settlement of Changpas (nomadic shepherds), who come here for grazing in summer, and spend the winter in villages a good way to the south. Toward Lukung, *Glaux maritima* was abundant in saline places, and at it were a dozen or so of small planted Salix, the last for many days.

On the 11th September, leaving at Lukung most of the servants and traps to await orders, I set out towards the north, and passing a few straggling shrubs of *Myricaria elegans*, with abundant Clematis, and leaving behind the last scraggy wild willows, I reached the last village in this direction, Phabrang, at 14,800 feet, where barley was the only crop, the highest at which I have noted it. Here, through the aid of a subordinate government official, met by accident, I was able to make fitter arrangements for provisions to be sent after us than those effected at Mughlib; and here also I picked up a guide, a Bot (as these people call themselves), named Lamba, one of the best and most willing natives with whom I ever had to do, and who accompanied me up to 1st October.

Three or four miles farther north (marmots being seen *en route*), and about eight and a half miles from our start, camp was at Gyanmor, 15,770 feet. This, like other similar places of encampment, was near a supply of water and grazing, the only permanent institution being a few

low, dry-stone walls to serve as shelter for passing travellers, and as a nucleus round which clustered the black tents of the Changpas, who bring their flocks hither in summer.

Hence I had intended to go the Changchenmo, a large eastern affluent of the Shayokk River, by a pass with the almost unpronounceable name, Kyapting Kyipting La; but here—and only after the tents were up, &c., so that there would have been much delay in again moving—I was assured that it would be impossible from beyond the pass to get up the river to the place I wished to reach.

Accordingly, on the 12th September, we retraced our detour of the preceding day, and, passing up the sloping side of a wide valley, in a north-easterly direction, with but little vegetation, only a dozen or so of plants in several miles, I at last reached the Marsemik La. This pass crosses the range which divides the Pangong from the Changchenmo watersheds, and though the ascent is long, it is not rough or steep; and even near the crest, 18,641 feet, the slopes being easy with earth among the stones, there was a greater variety and amount of vegetation than at any pass of nearly equal elevation I have ever crossed. Among other plants, *Urtica hyperborea* attained 17,500 feet, *Eurotia* and *Taraxacum* 18,000 feet, the highest at which I found either, and *Waldheimia* reached quite to the top. A good deal of snow lay near, and the temperature was only 46° at two P.M. In such circumstances, with, as often occurred, no large blocks for shelter from the piercing wind, and with, as generally, the poor fuel brought from the last camp, taking the boiling point was not a pleasant task; nor was the view from this pass or ridge a very striking one, so as to tempt me to linger. Near the crest hovered a kind of eagle (one of which I afterwards saw at the very crest of the Parang La, 19,000 feet), and several ravens were flying round. Some of the latter are generally seen about encampments at lower elevations.

From the crest, which was covered with granite blocks, the first part of the descent, with a steep slope among boulders, is not very comfortable; but these difficulties lessened long before I reached the place for camp, Panglung, at 16,040 feet, six or seven miles from the Marsemik

La, and nineteen miles from our starting-point. Here, on the border of a purling little tributary, which joins the larger stream which came from towards the pass, pursuing its course in a grassy valley, I halted on 13th September, temperature ranging from 27° to 52°. At this place there grew about forty species of plants, including ten Graminaceæ and Cyperaceæ, the most notable being a very minute *Gentiana*. *Ephedra* here, as often elsewhere at considerable elevations, was reduced to 1 or 2 inches in height.

On 14th September, the first nine miles of the way from Panglung was down the valley of the stream, still in a northerly direction, to Pamzal, at about 14,500 feet, at its confluence with the Changchenmo, by this time of year become quite a small stream, though flowing in a valley the bottom of which was a mile or two wide. The rest of the way the path ran up the shingly bed of the river, in which at places was a good deal of *Myricaria* scrub. At last I crossed from left to right bank to camp, which was at Silung Yokma, with some fuel growing about, at nineteen miles from Panglung, and lying at 15,000 feet.

The journey of 15th September, of ten miles in a northerly direction up the valley of a tributary of the Changchenmo, was rather a doubtful one, as none of the men with me had ever been much further up than our starting-place. At four miles up I passed Gokra, where there is a good deal of flattish ground with *Myricaria* scrub, at the junction of a large stream coming from a wide north-westerly valley, said to abound in wild yak, wild sheep, and antelope. Near this I saw five of the last. Hares were common; and I noticed the first kiang for many days. *Hippophae* was here, from the altitude, about 15,500 feet, reduced to quite a tiny shrub.

Hence the road was not pleasant up the bed of the stream, often running in a mere cleft between high rocks. At three miles above Gokra was Chonglung, 16,200 feet, on a flat, with much saline efflorescence, with a series of warm springs (122° to 130°) issuing mostly from calcareous excrescences, some of which reached 18 or 20 feet high, with the warm water gushing from some parts of their surfaces, and great icicles hanging from others. *Triglochin* was abundant in pools at the springs.

Some miles further up, after passing some large snow

fields in the now wider bed of the stream, camp was at last pitched for the night at Phu, 16,400 feet. Here grass and sedges grew in small patches, only in sufficient quantity for one meal for the yaks, and fuel, of *Eurotia*, was very scarce. Here, again, *Ephedra* was reduced to 2 inches high.

On 16th September (temperature 18°, at 7.30 A.M.) the route lay still north-westerly, the narrowing valley getting more stony and arid, and vegetation more and more scarce. For some time there had been no trace of a path, and our only guides were little piles of two or three stones stuck on end, put up, as is the custom in these desolate parts, by a party which had preceded us by a few days. It consisted of a Yarkandi *vakil* (sub-ambassador), who had been directed with his attendants to take this route to his home *via* the Karakash, across the Kuenlun, to see if it would be a better route for traffic than the very difficult and trying pass at present used, the Karakoram, the road from which comes out on the Yarna in Nubra. This *vakil* had taken with him letters to Khush Begi, the ruler of Yarkand, from an enterprising European gentleman, who, as well as an agent of the Geographical Society, has since gone on to that place (and have now returned safe! November 1869).

Some seven miles from Phu I turned somewhat to the right, north-easterly, up a lateral glen, where the ascent at last became excessively steep; and here, from the elevation, I felt the shortness of breath more trying than on any other occasion, and was compelled to make pauses to try to recover breath every few yards. Neither here nor elsewhere have I ever had the pass-headache, but my guide and other Bots were frequently troubled with it, and used as a palliative to tie a tape tightly round the forehead. The small rill we had till then, had disappeared, and we left behind the last plants—*Tanacetum tomentosum* at 18,000, and *Waldheimia* at 18,500 feet.

At last I reached the crest of what I must call the Benami ("nameless") La, the crest of which, 19,600 feet, is flattish and rounded, very shingly like all the hills near this, and with a good deal of earth in places. None of the mountains within many miles appeared to be more than a few hundred feet above this point. The view to the north was limited by another range, but that to the south was

expanded, and included a splendid snow horizon; and as the wind was light, and the temperature 50° (at 1:30), the rest here was very enjoyable.

From the crest our road lay down an easterly valley with a small stream, we being now in the watershed of the Thang o Thang Plains, stretching to the range on the north, across which is the Karakash pass to Turkistan. There was not a blade of vegetation all this part, nor a trace of animal life, except one or two small gnat-like flies. At last, as it became certain that the tired yaks must be late, I halted for the night at a place, about 18,760 feet, some fifteen and a half miles from Phu; there was not a stalk of grass for the yaks, or a single root for fuel, of which only one day's supply had been brought from last camp.

With rather a dreary look-out I halted on the 19th September, and sent off an exploratory party eastward, I and Lamba going in a similar direction, to discover whether a road could be discovered by which to re-pass to the watershed on the south of the great range, for my time would not now allow of my risking the delays which might result from my diving further into these wilds. Scraps of *Waldheimia* occurred near camp, the highest flowering plant I ever got, and I think the last specimen of it I found, although from the lateness of the season it may have been unidentifiable after this. Besides it, small clumps of the hassocky *Alsine* were the only plants seen on my trip of exploration, which extended about three miles east from camp. Here I reached some 19,000 feet, and from the look of the range to the east, came to the conclusion that the passage to the south was feasible (in which opinion the scouts I had sent out luckily joined).

All the rock seen was of a modified slaty character, and the whole surface of the hills was, as before, covered with small stones. Below the place where I sat, at the extreme point of my trip, to the north-east, lay a widish plain, with the confluence of our stream and another (and so called Gnischu, "two waters"), bounded on the north by another range of hills, over which I had a most striking and extensive prospect of the Thang o Thang Plains, realising the plateau of Central Asia, if it exists anywhere. Humboldt long ago showed it does not exist *beyond* the Kuenlun.

On these plains to the north were many blue expanses with large white flats, being respectively some of the salt-lakes and ice lakes noted by Mr Johnson and Dr Cayley. I returned to camp much pleased with my two hours' work.

As the cold at this camp was about the greatest I had, down to 16° in early morning, and only rising to 47° at highest in the day, I need hardly say I had the greatest difficulty in retaining any caloric in my person, whatever amount of clothing I buried myself in, and the general effects of the cold for some weeks about this time were very severe. All water was, of course, frozen during the night; and I have repeatedly seen the ink remain frozen at midday in a small inkholder carried since morning in a courier's bag slung on my shoulder. The limbs were benumbed, and when the clothes happened to be worn a "raw" was established. The start and early part of the march, as you stumble along with cold and stiff limbs, and beard and moustache clotted with icicles, and the hands thrust well into the pockets, is not particularly lively. I, having a skin idiosyncratically sensitive to the effects of cold, suffered immensely more than nine men out of ten would do, and so may be inclined to exaggerate the discomfort from cold. But latterly my ears and nose, &c., were in a pitiable state; the backs of my hands could only be paralleled in a leper hospital (I have still the white scars of the sores), and the points of the fingers reached such a pitch with chaps that glycerine was powerless, writing difficult, and buttoning a problem and a torture.

On 18th September, as I set out on the route indicated by the explorations of the preceding day, I passed some marks of cooking fires, with tracks of men and baggage animals, indicating, at least, occasional travellers, near the mouth of the second of four considerable valleys which join at Gnischu. Up this we proceeded in a southerly direction for some miles with a moderate slope. Then up a short and very stiff ascent, along the edge of an old snow-field covered with new-fallen snow, which shone like a burnished silver shield, we came out on the flattish top of the same range as we had crossed on the 16th, probably at or close to the Lumkang La of Mr Johnson. The height was 19,632 feet, and there was a more extensive and splendid view over the plains seen to the north than on the previous day; and it was now appa-

rent that many of the mountains beyond them had large snow-fields, so that the snowless tract suggested by Dr Thomson does not exist *there*. Although there was almost no snow here, yet the southerly wind was so terribly bleak and bitter, that I was prevented from sitting long to enjoy the magnificent prospect.

So I proceeded along the top of the range for a mile or two, looking for a valley by which to descend to the southward, and urged to active exertion by the tearing wind from ahead. It is difficult for any one who has not felt such a wind on an open hill-top in desert Ladak to appreciate the violence and pertinacity with which it tries to drive you back, pulls at your clothes, blows off your hat, and seems as if it would wrench the beard from your face.

By-and-by we found and went down a glen descending very steeply to the south-west, where *Tanacetum tomentosum* began at about 17,500 feet; and by this glen, and a wider valley into which it ran, we eventually found a place with grass and fuel at about 17,200 feet. There we encamped, having done about fourteen miles in all—a very good day's work for our starved yaks, with no path any part of the way, and with the hills almost everywhere covered with stones troublesome in walking for man and beast.

On the morning of 19th September (temperature 17° at start, about 7.15 A.M.) after some eight miles down the lower-sloped valley in a south-westerly direction, we came out in the valley of the 15th above Chonglung, and keeping down it, encamped at Kiam on the Changchenmo, a little east from our camp, on the 14th. We had done some nineteen miles, and the elevation here was 15,500 feet. At about 16,000 feet occurred *Artemisia sacrorum*, and at 15,300 feet, *Scopolia*, the highest at which each was found. Some miles before reaching camp I saw a fine specimen of the horns, &c., of the *dūng* or wild yak (I had seen one previously), but forgot to annex it. Subsequently the promise of a reward set my guide searching, successfully, for a specimen. Also at various times I got specimens of the skulls of the wild goat, nowhere seen by me on the trip, and of the wild sheep (*nian*), possibly the *Ovis ammon*. Horns of tame and wild animals, but not generally very good specimens, are often placed in numbers on the cairns at crests of passes, and which have been already mentioned.

The first business on the 20th September was to examine the warm springs of Kiam, which had already been described, in a geological paper on part of this tract, by Captain Godwin Austen of the Survey. They are situated on an oozy, grassy, and saline flat, to the south of the river, under slaty hills. The temperature of the air being 42°, that of the springs was 88° and 90°. They are poor compared with those of Chonglung.

Then, the traps going straight, I made a detour by Kiamgo Traggar, a little way up the stream eastward, and afterwards by a wide valley south-easterly, with a magnificent snowy mountain in the distance ahead, I went up to Gnyingri, where the camp was, in a pleasant little green spot by a small stream, at 17,250 feet, eleven miles from Kiam. *En route* lime and granitic blocks were common, but the rock seen *in situ* was clay slate. Vegetation there was very little as yet, with no novelty of moment.

The maximum temperature here was 48°, and on the 21st September, when we started (about 7.45 A.M.), it was at 27°, a great change from what I had been having. The route lay S.S.E. up a wide open valley, with a very moderate slope, the ground being in places riddled with the burrows of *Lagomys*, which are common in parts of Ladak at from 14,000 to 17,000 feet, this being about the highest at which I observed them; the trivial name, "tailless rat," is tolerably descriptive. Here also I saw five antelopes, and hares were abundant, this probably being about the highest point for the latter.

At four miles from camp was reached the crest of the Kiungang La, 18,070 feet, the temperature at 10 A.M. being 54°. This pass is rounded with a good deal of soil, some red sandstone and conglomerate cropping out; and at or near the top were some twenty species of plants, one or two, *e.g.* *Alsine*, going a few hundred feet higher. *Urtica hyperborea* and *Artemisia parviflora* were not seen above 17,500 feet, the highest point at which I saw the latter. As there was no great valley stretching directly away from the pass, the view was not a very extensive one. The raven was seen here; the chough and crow do not go quite so high (as a rule, but the former were seen after this at the crest of Parang La, 14,000 feet), and the pigeon with white-barred tail is not generally

seen much over 15,000 feet, and apparently not often so far as this from villages.

After a bit of steep descent from the pass, our route was S.S.E. down the moderate slope of the commencement of the Chang Parma, which stretches hence to the south-east end of the Pangong Tso, and is much the longest of its class (wide long valleys) I have seen. Here for some miles I was in Chinese territory, called by the Bots *Machin*, but I missed the stock sensation of a Tibetan journey, viz., being turned by the soldiers who are posted along the Chinese border to warn off intruders. In valleys to the west large snow-fields came down as low as 18,000 feet in places, and from them came a cold westerly wind, bringing a few drops of rain occasionally. In one of these valleys was a wild yak, quietly feeding, the only one I saw, so they would appear not to be *very* common in the country I traversed. About 17,000 feet a small broad flat-bodied lizard appeared. At a wide plain I turned south-westerly down the main valley, where, about 16,500 feet, *Myricaria*, reduced to under 3 inches in height, soon appeared, and was at first puzzling from its herb-like aspect. At 16,200 feet, eleven miles from our starting point, our camp was at Milpal, near which there was a good deal of *Eurotia* for fuel, and sedge and grass for the yaks, as well as water, the small stream having often disappeared in the gravelly bed, again to reappear.

On the 22d September (temperature 22°) I went seventeen miles further down the Chang Parma, here generally about three-quarters of a mile in width. The stream disappeared for a long way here, so that I had to make twelve miles ere water could be got for breakfast. *Glaux* was abundant for some way about 15,500 feet, below which a wild *Salix* grew in clumps to 15 or 16 feet high; *Potentilla Inglisii* was very common in bushes up to 6 or 8 feet in girth; and *Rheum* occurred, after weeks of absence, quite dried up. Towards the end of the march there was some *Myricaria*, reaching 6 or 7 feet in height, and *Lonicera glauca* occurred at the end, where in one corner was abundance of a prostrate *Astragalus*, with a prickly fruit, occasionally found after this in abundance locally down to 13,000 feet. *Christolea crassifolia* was one of the most common plants over all this part of the Chang Parma.

On this day kiang were seen in some numbers, and became common next day. And on this march also two kinds of spiders and one dipterous insect appeared. The common house fly, of different sizes, was seen at places up to 17,000 feet, and one appeared in the milk at the camp (18,500 feet) on the 16th September, but may have been *imported*. The only other animal not already mentioned as seen in the further and higher part of the tour was a small black spider. Butterflies had long disappeared, and no moths had been seen for three weeks, but possibly from the advance of the season only, as a smallish silvery-grey species had been rather common at over 16,000 feet south of Le, in the middle of August. During the whole of the northern part of the tour there were seen no sparrows, magpies, wagtails, or swifts, which are all common in the Indus valley, &c.; nor after the 11th September, near Phabrang, were any marmots observed for weeks.

Ferruginous ooziings were common near Shanrai, where our camp was, at 14,800 feet, near the junction of two fine bold precipitous glens, on the west side, with the main valley. It was less the picturesque, however, that induced me to halt here, than the state of the poor yaks, and they only arrived at dark, several of them with suppurating feet, from the stony ground we had been traversing.

The temperature was 26° at starting time on the 23d September, about this time never before 7.30 A.M., being somewhat regulated by the time at which the sun got over the high hills. Determining to finish the Chang Parma and reach the Pangong before night, I proceeded down the south-easterly gently sloping valley, nearly a mile wide in places. Scrubby vegetation was not uncommon, but there was no grass or sedge in quantity for miles. Blocks were numerous, the larger ones often granitic. A larger yellowish lizard and another dipterous insect appeared.

After fifteen miles I got a first sight of the Tso Niak, which is the eastern sweet water portion of the great lake, of which only the western saline part is called Pangong Tso, although the whole is generally named Pangong by Europeans; and I soon entered on the plain of twenty-five or thirty miles area, which lies on the north of the stream that joins the two portions of the lake, and of their two

extremities. It lies at about 14,000 feet and a little over, is for the most part sandy, and much burrowed by rats, which are common in many places in Ladak. Many parts of the plain are covered with *Arundo Phragmites*. *Myricaria* scrub was not uncommon. *Lepidium latifolium* was abundant in places, and *Mulgedium Tataricum* not uncommon.

At Ot, or rather that corner of the great plain so-called which is nearest the outlet of the connecting stream from the eastern part of the lake, our camp was pitched at 13,980 feet, twenty-one miles from Shanrai. The stream was brackish, and turned out to be easily fordable. About this river many wild geese and wild duck, a few dark herons, and a small wader, and ravens, crows, and wagtails were common. Scattered in the clay-beds running through the sand of the plain were multitudes of shells, almost all a *Lymnæa* and a *Planorbis*, with one or two of a small doubtful bivalve. Along the steep rocks, on the south side of the stream, "beach marks" of calcareous concretions were common to 50 or 60 feet above the level of the water. These, which continued—and often to greater heights—along the lake so far as I saw it, with other circumstances noted by Captain Austen, show that a gradual but rather rapid diminution of the water of the lake is going on; and, still further back, it would appear at one time to have overflowed at Sartokh Pass (of the 10th September), and run down the Tankse valley, eventually to join the Changchenmo.

The traps were very late in reaching this camp, owing to the fatigued and starved state of the yaks, one of which had died on the way, and two more had to be left behind when I started on the 24th September. Crossing the stream, I passed along its left bank for about three miles to where it falls into the Pangong Tso, and then westerly along the south-western edge to Khabatt, sixteen miles in all. The lake, from its great size and the gigantic mountains around, rising to 4000 or 5000 feet higher, surrounding it closely on all sides, is most impressive, and some of the details are interesting. But these are monotonous and repetitive, consisting of mile after mile of promontories of slaty rock, with granitic blocks alternating with sandy bays, with the same minor features of miles of rows of shells along the beach, varied with myriads of the bodies of a small shrimp-

like animal, or masses of a dead water-weed (*Potamogeton*?) floated down from the sweet-water portion; the only sign of life on the large scale being occasional small herds of kiang. Add to this, that the path was mostly rough and blocky, that herbs there were almost none, the chief vegetation being small patches of *Myricaria* in some of the bays, and that I was somewhat wearied of the desert I had already passed through, and it may be conceived that I had enough of the great lake ere I parted with it.

This parting occurred on the 25th September (temperature of air at starting (7.15 A.M.) 27°, of water of the lake 32°), when I made some nine miles, still westerly, along the shore, the lake at one place apparently diminishing to not more than two or three miles in width; but at Sharma, where we turned off from it, it could not be less than ten or twelve miles broad, and might be much more. In some parts along the lake *Myricaria* was seen up to as much as 7 or 8 feet in girth, by far the largest I saw.

From Sharma, after about six miles S.S.W. up a narrowish valley,—the latter part of the ascent rather stiff,—I reached the rounded flattish crest of the Sharma La. Here, 16,200 feet, the axis of the range appeared to be of granite, as were many of the blocks strewn over the ascent. From this there was an exceedingly stiff descent of a mile in sand with stones, down which, in the face of a strongish wind, it was easier to trot than walk. Here I saw two wild sheep, the only ones noticed on the tour, which, *with* the wind, ran up quite close to me and the guide.

A little further on was a sluggish stream, with abundance of *Potamogeton gramineus*, occasionally found to this height. And after nineteen miles in all, at 14,430 feet, our camp was pitched on the first grassy soft ground of any size we had had for weeks, not far from the considerable village of Chushal, and the first human habitations of any kind seen since Gyanmor on the 12th. Here, and southward for miles, extended a wide, grassy, and occasionally marshy plain, on which large flocks are grazed.

At Chushal I discharged the Bots and *yaks* that had served me so long and so well, and getting porters to replace them, on 20th September, proceeded southward up the shallow broad valley, a continuation of the wide plain. Passing, I

believe, not far from the Tso Rul, a small lake south of the Pangong, after fifteen miles, I reached Rihzung Koru, lying in the valley at 14,544 feet. *En route Caragana* reappeared, none having been seen on the northern part of the tour, at 14,400 feet; nor did it again disappear entirely for any length of time up to the time of crossing into Spiti (where also it is common). At the camp *Triglochin* was common in dampish places.

Halting on the 27th, I continued on the 28th September still southerly and up the same valley, and crossed the Tsakki La, 14,850 feet, at six miles, whence, in the same direction, down another wide valley, past a large grazing encampment; and after twenty-two miles in all, having been compelled to come some miles further than I intended, in order to get water, I encamped at Pera, 14,148 feet.

On 29th September, after a few miles south-westerly, over sandy flats, where the basket *Melica* of the Indus valley (apparently) was abundant in places at 13,200 feet, I struck the Indus. Hence, along the right bank, I went, in a westerly direction, to Cha, twenty-two miles in all, lying at 13,175 feet, on an island formed by two of the several channels of the river, here moving slowly along in a widish valley. None of these channels were at this place over knee-deep; but for some weeks before this a skin-raft had been necessary to cross some of them.

On 30th September the remaining channels and flats by the river were soon crossed, and after a very minor pass, I speedily struck the Hanle stream, not far south of where it joins the Indus, and proceeded up its left bank, its valley being for the most part widish, with a very low slope, to Chibra, at 13,603 feet, eighteen miles from our camp at Cha. *Myricaria* was abundant in many parts of the wide bed of the stream and the flats near it, up to and after this; and *Glaux* was profuse in many saline places on this and next day. In this tract very large herds of kiang were often seen, and I repeatedly counted more than one hundred in sight at once.

The journey of twenty-one miles on 1st October, still southerly up the same stream, brought me to Hanle itself, 13,426 feet, with its great monastery perched on the end of a high rocky ridge, and a small village at its base. Round this there are wide grassy plains, with meandering streams,

and a little cultivation, barley being the only cereal. Here I visited the monastery, and, without much edification, saw the *doited*-looking prior and brethren sitting among tinsel, coloured rags, and toys, mumbling at their devotions.

Having with difficulty got porters here to relieve those who had come with me from Chushal, and to accompany me to Spiti, I, on 2d October, proceeded westerly across the Hanle Plain, where *Christolea* was one of the chief plants, its split fruit lying in heaps in little hollows. The latter part of the way was up the rough and rocky valley of a small stream, where *Lonicera angustifolia* occurred at 14,400 feet, and vegetation of all kinds was very scarce all along. Camp was at (Eastern) Dongan, twenty miles, at 14,841 feet, very dreary and bare, with but little water or grass.

On 3d October, still up the valley, after turning southward, the ascent getting steeper, and all becoming more arid, and, if possible, barer, till at last, after a very steep bit of ascent, on which were patches of the minute *Myricaria* as high as 17,800 feet, I reached the crest of the Lanak La. On and near the broadish top—18,314 feet—there were a good many plants, but most of them at this season so dried up as to be unidentifiable, or perishable from brittleness. The most notable of them were *Delphinium Brunonianum*, *Marubium lanatum*, and *Urtica hyperborea*.

After a rapid steep descent, the route sloped more slowly for some miles to the highest water at (Western) Dongan, 14,271 feet, the whole country here and onwards being most sterile and bleak.

On 4th October (Sunday), as the cold was very severe, I left the windy, exposed site at Dongan, and made a short march of seven miles to Taga, at 14,060 feet, where I had a warmer, or at least a more sheltered camp. From both of these places, especially the former, there was a splendid view to the south and south-west, of the magnificent snowy peaks near the Parang La, towards which I was going.

The journey of 5th October, fifteen miles in a westerly direction, was across a pretty extensive plain, here running north and south, and up the narrow valley, in many places a mere ravine, of the Parang River to Nurba Sumdo, on a wider part of the channel, at 14,571 feet. *En route* there was but little vegetation, the most notable being a con-

siderable growth of *Myricaria* and *Hippophae*, about half-way, at 14,500 feet.

From Nurba Sumdo, on the 6th October, we soon turned south-westerly, up the right branch of the river, which comes from towards the Parang La. Up the left branch which joins the former near the north-east, goes the road from the pass to the Great Tsomoiri Lake (and towards the road by which I went northward between Kiangchu and Rukcham). A few *Lonicera angustifolia* occurred on the edge of the channel soon after the start, at 14,600 feet, the only shrub which was seen after this, except *Caragana*, which grew sparingly at our camp at Gnomnak, 15,046 feet, and fourteen miles from Nurba Sumdo.

On the 7th October I made a march of ten miles still up the bed of the stream, now mostly dry, the valley having become narrower, and with but little vegetation of any kind. Camp was at Netik, 15,681 feet, where there was still a good deal of very small *Caragana*.

From Netik, on 8th October, the road southerly was pretty steep and rough, at first along the side of, and the last two miles over, snow covering a great glacier, to the Parang La (pass). This was about six miles from our camp; the elevation is 18,961 feet, and the cold here was terrible. But as I now entered Spiti, which, although the vegetation, &c., is Tibetan in character, cannot be included here, I shall now bring my narrative to a close. And as this paper has already become far too much protracted, I shall omit the remarks I intended to have made on Ladak generally, and travelling in it, the character of the people, their dress, &c., with some notes on kiang, yaks, &c.

I must, however, enter a few general statistics, which I shall make as short as possible. And first, as to the ground gone over. From August 5th, when I crossed the Bara Lacha from Lahoul, to 8th October, when I crossed the Parang La into British territory again in Spiti, were fifty-one days on which there was no complete halt. In that time 837 miles were covered, and seventeen passes, of over 14,000 feet, were crossed (including both terminal ones).

With my Ladak specimens I amalgamated Dr Cayley's, about 175 species, producing a total of 400 species for Ladak. But excluding 13 cultivated plants, and 23 of Dr Cayley's,

neither collected nor noted by me, there is a total of 364 species of wild plants for two months' tour there. This will illustrate the comparative poverty of the flora of the country, since I have frequently in the Himalaya, in a tour of shorter duration, and not covering two-thirds of the ground, and with less experience in collecting than I had in Ladak, got more than double the number of species.

Seven of the species being cryptogamous, and three or four of doubtful identity, about 57 Natural Orders of flowering plants were represented in the collection, the following being about the number of specimens in each of the principal Natural Orders :—

Ranunculaceæ, . . .	17	Primulaceæ, . . .	9
Cruciferae, . . .	30	Gentianaceæ, . . .	8
Caryophylleæ, . . .	14	Boraginæ, . . .	5
Leguminosæ, . . .	21	Scrophulariaceæ, . . .	11
Rosaceæ, . . .	17	Labiatae, . . .	21
Crassulaceæ, . . .	10	Salsolaceæ, . . .	12
Saxifragaceæ, . . .	6	Polygonaceæ, . . .	13
Umbelliferæ, . . .	10	Graminæ, . . .	39
Compositæ, . . .	51	Cyperaceæ, . . .	9

In conclusion, I have again to beg that the Society may be lenient with this paper, as much of its incompleteness is owing to the absence of part of my material, and to the haste with which this has been written, in anticipation of the recess.

II. *Notes on the Famine Foods of Marwar.* By Assistant-Surgeon GEORGE KING, M.B., lately attached to the Marwar Political Agency. Communicated by Professor DICKIE, Aberdeen.

The substances resorted to by the very poor, as articles of food in times of famine, are probably pretty much alike in most parts of Northern India. With those used in our own provinces we are, unfortunately, but too familiar, yet as Marwar is a territory of which most Europeans know so little, I have ventured to throw together a few notes on the substitutes for the ordinary cereals which are being used there during the present severe famine. The accompanying specimens of the raw substances, and of the breads prepared