

A contribution to the floristics and vegetation of Zanskar (Kashmir)

By

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Abstract

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Some observations on the vegetation and plant-ecology were made on a journey through Zanskar (part of the Jammu and Kashmir state). Trees are growing near water-courses on to about 3800 m also in the dry southern part of Zanskar; the timberline on both sides of the highest ridge of the Himalayas seems to be situated at about 3800—3900 m. Crop plants are grown in southern Zanskar on to about 4000 m; they need irrigation. The overgrazing led to a vast extension of *Artemisia*- and *Astragalus-Acantholimon* vegetation units. The 13 places of plant collection, reaching from 3600 to 4700 m, are characterized, and a plant list of collected plants with precise locality data is given. For *Cremanthodium plantagineum* Max. a new combination has to be proposed: *Cremanthodium ellisii* (Hook. f.) Seybold et Kull comb. nov.

Introduction

The floristics and ecology of the area of Zanskar, part of the state of Jammu and Kashmir, are only known insufficiently. On a journey through this area from the Northwest to the South the second author made some observations on the vegetation and the plant-ecology and collected some plants, most of which are enumerated in this paper. The identifications were carried out by the first author.

Zanskar in most cases is described in floras and floristic papers as one unit and very often it is mentioned only when places in Ladak proper could not be denominated (in this way proceed KACHROO et al. 1977, BALAPURE 1982). Only STEWART (1917, 1972) in some cases indicates more detailed localities, but in general he only states "Zanskar". Furthermore, few data concerning Zanskar

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can be found in HARTMANN (1966). Some relatively minute locality descriptions of the Suru valley (= Karcha valley) in the NW part of Zanskar originate from MEEBOLD (1909) and WHITE (1983). From an area nearby southwest of Zanskar a new account of exploration was published recently (BHATTACHARYYA & UNIYAL 1982).

As an administration area, Zanskar belongs to the province of Ladak of the Jammu and Kashmir state. But the internal part of Zanskar is totally separated from Ladak proper and only reached beyond passes of an altitude of more than 4000 m. Only the Suru valley in NW-Zanskar is more easily accessible. Zanskar extends more than 100 km from NW to SE and has a very distinct orography. So it cannot be taken as an undivided unit and a more detailed floristic description would be very desirable. Naturally only species flowering during August in the different heights could be collected, but the plant-list may be a small contribution to a more accurate description of the area. Therefore, information on the vegetation and its ecology is added as well. Regarding the vegetation, a general review was published by SCHWEINFURTH (1957), a more detailed description of Ladak by STEWART (1916) and many data concerning NW-Zanskar can be taken from MEEBOLD (1909). In the new flora of the Kashmir Himalaya (DHAR & KACHROO 1983) from north-eastern Zanskar some detailed localities are named. The main part of our observations and collections originate from the southern moiety of Zanskar.

Climature and vegetation

Zanskar has a dry and cold climate, which is usually found in the internal parts of the NW-Himalaya. This "Tibetan climate" was already mentioned by THOMSON (1852). A "Klimadiagramm" from Leh in the upper Indus valley is shown by WALTER et al. (1975). According to these climatic conditions, the vegetation-period is very short (May/June to about September, cp. KACHROO et al. 1977). The altitudes of the area range from 3300 to more than 5000 m. Therefore most of Zanskar belongs to subalpine and alpine orbiomes: a subalpine/alpine scrub zone, alpine meadows and an alpine "steppe". Near the settlements there is always cultivated land.

The most north-western part of Zanskar, the Suru (= Karcha) valley is relatively green compared to the valleys of inward and southern Zanskar. Especially the upper valley of the Zanskar river (Tsarap Lingti) shows in great parts a desert-like vegetation. Also the valleys from the highest ridge at the Kashmirian/Indian border down to the Bhaga valley are very dry.

The Bhaga valley itself, which belongs to the Upper Lahaul, again is relatively green, and further down, near Kyalong, relatively dense forests are found especially on the N-exposed slopes.

In the Suru valley along the river a more or less dense shrub of *Populus*, *Salix*, *Myricaria* and *Hippophae* is growing. On the slopes we find a grassland

of steppe-like character and further on a chamaephyte-bushland with *Artemisia*, *Astragalus* and *Acantholimon* as leading genera, as described by MEEBOLD (1909; cp. also MANI 1978). This type of vegetation is due to grazing (SCHWEINFURTH 1983). In the central parts of Zaskar there are several afforestations with poplars and willows on gravelly slopes and alluvial terraces along water courses, e.g. near Padam and between Padam and Burdun Gompa. Old trees were only seen near settlements. The shrub along the shores of the river shows poor growth in the upper Zaskar valley south of Padam. The statement made by THOMSON (1852, still referred to by SCHWEINFURTH 1957) that no trees are present in the internal part of Zaskar is not, or at least no longer, true.

Near Pune at 3800 m along water courses and in the neighbourhood of a house we still found relatively big trees. Further up in the valley leading to Tetha and Kurgiakh there are hardly any trees to be seen. In this latter area the lower slopes of the valley are prevalently covered with the *Artemisia*- and *Astragalus-Acantholimon* associations. On the other side of the highest ridge, the valley leading down from Shingo La to the upper Bhaga valley is extremely waste; on the naked slopes nearly no vegetation is developed and only little areas with *Artemisia*-steppe and some alpine meadows near the water-courses could be observed. On this side, the trees reaching the highest altitude are some poplars at about 3900 m on a great alluvial fan, where melting water is continuously running down. Further to the South, above Darcha isolated bushes of *Juniperus excelsa* MB. are growing in the alpine grassland and the *Artemisia*-associations. The growth of the *Juniperus* trees is severely restricted by grazing and collection of wood as fuel (SCHWEINFURTH 1983). The timberline on both sides of the highest ridge seems to be at about 3800–3900 m. This is almost the same height as found in the Karakorum (HARTMANN 1966) and a higher altitude than that was reported by KAUL & SARIN (1971) for the Jammu Hills and by MANI (1978) for the NW-Himalaya in general. The snowline at the Shingo La (height of the pass: 5085 m) is situated at 4800 to 5000 m depending on the direction.

Around the villages and settlements we find crop plants which need temporary irrigation: barley, wheat, peas, potatoes and some buckwheat. There are no apricots and nuts in the area around and S of Padam, which are found to be growing at altitudes of about 3600 m in Ladak proper (in the upper Indus valley). Potatoes are grown in the upper Zaskar valley and further to the South on to above Tetha (3850 m); whereas peas are still being grown near Kurgiakh (about 4000 m). KACHROO et al. (1977) indicate the cultivated area to reach up to 3344 m. This seems to be only true approximately for the Suru valley.

Near the water-courses, especially above 3800 m, we find alpine meadows. Their relatively great extension in the uppermost valley S of Kurgiakh is caused by the proximity of the highest ridge. Further to the East, in Ladak proper, they are getting more and more infrequent due to the lower precipitation and generally dry climate, as already mentioned by STEWART (1916).

A natural vegetation without an obvious human impact seems to be present nowhere, except perhaps near the Shingo La pass.

Places of collection

All places are designated according to the map: India and Pakistan 1:250 000 (Jammu and Kashmir-India), published by the US Army Map Service, Corps of Engineers; Washington D.C. The following sheets were used: Series U 502, sheet N I 43-7, N I 43-11, N I 43-12, N I 43-16. Also mentioned are names noted on the World Map 1:1 000 000, Series 1301, N I 43 (Srinagar) diverging from those on the more detailed maps. The places are listed from N to S, according to the course of the journey, which took place in August 1982.

1. Karcha valley = Suru valley; Karcha Nar, about 7 km W Gulmatunga (Gulmatungo, Gulmathongos); N of Nun Kun mountains; about 3600 m above sea level
Ground: gravel-soil of valley-bottom; with *Salix-Myrica* shrub
2. Ringdom Gompa area (= Rungdum, Rangdum); E of locality Zulidok (= Zuildo) mentioned on the World Map; 3900—4000 m
Ground: metamorphic sediments on hill side, gravel and loam in the valley bottom
3. Pensi La, southern slopes, S of the pass-lakes, looking to the Durung-Drung-glacier; 4280-4350 m
Ground: gneisses
4. Padam, near the settlement (Ukti Fort on the World Map); about 3600 m
Ground: slopes of debris, gravel and loamy soils of valley-bottom
5. Burdun Gompa area (= Bardun Gompa) about 3700 m, mostly bare rocky areas
Ground: slopes of debris, metamorphic sediments
6. Mune Gompa-Reru-Itchor (= Ichar); upper valley of the Zaskar river, called Tsarap Lingti Chu; 3700—3850 m
Ground: Gravel, moraines, alluvial terraces, rocks and rock-debris, bare rocky areas frequent
7. Pune Gompa near Char (= Purne Gompa); surroundings and way to Phuktal Gompa; 3800 m
Ground: alluvial terraces of gravel, rocks, moraines
8. Tetha (= Thesur)-Kuru-Tanze; about 3850—3950 m
Ground: young valley sediments (gravel, loam)
9. Kurgiakh; (on the World Map the place Ruttar, 5 km N of Kurgiakh, is mentioned); 4000—4050 m
Ground: slopes of debris, gravel
10. Way from Kurgiakh to the South, along the Kurgiakh Chu (about 11 km); 4050—4400 m
Ground: slopes of debris, gravel, loamy valley-bottom

11. Tingdur region, about 11—13 km S of Kurgiakh; 4400—4550 m
Ground: rocks, slopes of debris, glacial moraines
12. Lakong region (from Kurgiakh Chu valley to Shingo La); 4400—4700 m
Ground: rocks, slopes of debris
13. Ramjak ground region, 5—8 km SSE Shingo La (on the World Map: immediately E of the figur 8 of "6318"); 3900—4100 m. Politically, this place is already a part of Punjab province; the border of Zaskar as a part of the Jammu and Kashmir state crosses the Shingo La. From Ramjak the way leads down to Darcha in the valley of the river Bhaga; on the World Map Darcha is called Rangyo.

Remarks on the ecology

At the collection sites the following types of vegetation were observed:
fields of debris with isolated plants:

- on gravel and alluvial fans: 4, 5, 6, 7, 10
- on moraine-terraces: 6
- mobile fine coarsed debris: 2, 7, 13

bushland: at water margins with *Salix*, *Myricaria*, *Hippophae*: 1

at water margins with *Rosa*, *Lonicera*, *Ribes*: 6

Artemisia- "steppe": 8, 9

Astragalus-*Acantholimon* associations: 8

alpine grassland: grassland with *Leontopodium*: 2, 11

typical alpine high-meadows, above 4000 m, with many alpine species in crevices and near water-courses of the melting water: 3, 10, 11, 12

cultivated areas and ruderal vegetation (with introduced species):

- 4, 5, 8, 9

According to the climate, the plant cover is restricted to a short period of activity, but nevertheless it is relatively well developed up to high altitudes if water is available. Above 3800 m low spreading perennials predominate on the slopes: *Artemisia*, *Astragalus* and *Acantholimon* species. In the steep slopes of the Suru valley starting from about 3000 m and in the surroundings of Padam at about 3600 m, the same "steppe" vegetation is found, *Acantholimon* seems to be infrequent in the lower part of this chamaephyte-zone. In protected localities *Ephedra gerardiana* is growing as a relatively high shrub (> 50 cm). But a zone of dense shrubs, found in the Jammu hills by KAUL & SARIN (1971) could be observed nowhere in our transect through Zaskar. This is probably due to the small amount of snow in this area: a higher shrubby growth-form is therefore not well developed.

In areas with a high water supply during the vegetation period as in alpine meadows, especially along water-courses, we find a high number of species, mostly herbs. The vast extension of the *Artemisia*- and *Astragalus*-*Acantholimon* vegetation units in the valley south of Pune (collection places 8 and 9) is

quite likely due to overgrazing (cp. SCHWEINFURTH 1983). South of Kurgiakh, as already stated, alpine meadows show greater extension and also some areas with knee-deep shrubs of *Lonicera* and *Ephedra* are conspicuous. In dry pebbly areas along and in the streams *Epilobium latifolium* is frequent. Dry grassy places in this area are characterized by *Leontopodium leontopodium* and *Potentilla argyrophylla*. Along water-courses, as well as dry, and in crevices the following species are frequently observed: *Chrysanthemum pyrethroides*, *Geranium himalayense*, *Polygonum tortuosum*, *Saxifraga flagellaris*, *Sedum* sp. and two different *Astragalus* species. Near running water we found more or less regularly: *Anaphalis nepalensis*, *Corydalis crithmifolia*, *Cremanthodium ellisii* (= *plantagineum*), *Delphinium cashmerianum*, *Pleurospermum stellatum* and *Polygonum rumicifolium*. On the way to the Shingo La, a more or less dense vegetation between the rocks reaches up to 4700—4800 m; further up between the boulder only isolated phanerogams were observed.

Plant list

Prefatory note: The specimen-number is followed by the number of the place of collection which is given in parentheses. All specimens are preserved in the herbarium of the Staatl. Museum für Naturkunde, Stuttgart (STU).

Species of the genera *Artemisia* (2588, 2607, 2672, 2673), *Astragalus* (2591, 2592, 2602, 2655, 2671) and some other specimens, especially of Boraginaceae and Fabaceae, have been omitted because of lack of organs needed for correct identification or because of poor preservation. Finally a species of *Allium* shall be noted, which could not be identified: 2709 (11). STEWART mentions two species of *Allium* from Zanskar, but it is neither.

Ephedraceae:

1. *Ephedra Gerardiana* Wall. ex Stapf

on slopes of all exposures, on rubble and debris; 2665 (7; 3750 m, frequent); from this area also mentioned by STEWART. Also found at places 9, 10 (very frequent). Highest observed location: place 11, about 4400 m, on a moraine-slope.

Juncaceae:

2. *Juncus membranaceus* Royle ex D. Don

2583 (1). According to STEWART very common in Ladak, but not mentioned from Zanskar. KACHROO et al. refer to Suru (in the lower Suru valley).

Apiaceae:

3. *Chaerophyllum villosum* Wall. ex DC.
2649 (6), where it was observed repeatedly, also at (7).
4. *Heracleum pinnatum* Clarke
2595 (1).
5. *Pleurospermum candollei* (DC.) Clarke
2613 (3), 2692 (10; 4260 m). At wet places.
6. *Pleurospermum stellatum* Benth.
(= *P. govianum* (DC.) Benth.). 2722 (11; 4500 m). Observed always at water-margins in the area (11). STEWART mentions Kurgiakh; KACHROO et al. Khardung La.

Asteraceae:

7. *Anaphalis nepalensis* (Spreng.) Hand.-Mazz.
2614 (3; 4350 m). Also observed at (11; 4400 m) at water-margins. STEWART mentions the species as very common in alpine zones of Ladak. No references from Zanskar.
8. *Chrysanthemum (Pyrethrum) griffithii* Clarke
2584 (1).
9. *Chrysanthemum (Pyrethrum) pyrethroides* (K. et K.) B. Fedtsch.
(= *Ch. richteria* Benth.). 2705 (10; 4300 m), also observed (11; 4500 m); on rocky slopes. According to STEWART common in the dry inner mountains of Ladak and Zanskar.
10. *Cremanthodium ellisii* (Hook. f.) Seybold et Kull comb. nov.
Basionym: *Werneria ellisii* Hook. f., Flora Brit. India 3: 357, 1881.
Synonym: *Cremanthodium plantagineum* Maximovicz, Bull. Acad. Sci. St. Pétersbourg 27: 481, "1881".
GOOD (1929), when combining the two taxa *Werneria ellisii* and *Cremanthodium plantagineum*, preferred the epitheton *plantagineum*. But the epitheton *ellisii*, which according to Tax. lit. 2: 276, 1979 was already published in March 1881, is obviously older. The work of MAXIMOVICZ was reported in the Academy on May, 26th, 1881 and printed on January, 21st, 1882, as stated on p. 572. Also compare the data of publication in Index nominum genericorum of the genera *Potaninia*, *Nannoglottis*, *Pomatosace*, *Tretocarya* and *Przewalskia*, which were published by MAXIMOVICZ simultaneously. Therefore in the genus *Cremanthodium* the new combination mentioned above had been necessary.
2720 (11; 4500 m). Not mentioned from Zanskar by STEWART.
11. *Erigeron alpinus* L.
2581 (1); 2596 (1).
12. *Inula obtusifolia* Kerner
2651 (6).
13. *Leontopodium leontopodium* (D.C.) Hand.-Mazz.
(= *L. alpinum* auct.) 2577 (2); 2678 (10; 4260 m); observed repeatedly at

- (11). Always growing in alpine grassland, not in gravel or rocky places (as already mentioned by MEEBOLD for the Suru valley).
14. *Saussurea gnaphalodes* (Royle) Ostenf.
2714 (11; 4500 m).
15. *Senecio krasbennikovii* Schischkin
2731 (13; 3900 m). STEWART mentions the species only from Ladak, not from Zanskar. (Collection place 13 is also some km outside the political border of Zanskar).
16. *Taraxacum officinale* Web. s.l.
2736 (13; 4100 m). On a little alpine meadow between rocky slopes.

Balsaminaceae:

17. *Impatiens gigantea* Edgew.
(= *I. sulcata* Wall. p.p.) 2639 (6; 3750 m); frequent at water-margins on stony places in the area between Mune and Itchor. From this place it was already mentioned by STEWART.

Boraginaceae:

18. *Lappula barbata* (M. Bieb.) Gürke
2609 (2).

Brassicaceae:

- Capsella bursa-pastoris* (L.) Med.
observed: (4) (8); not collected
19. *Descurainia sophia* (L.) W. et B.
2605 (2). According to STEWART common as a ruderal plant up to 9000 ft. Our place of collection is much higher.
20. *Draba oreades* Schrenk
2729 (12); observed at three locations, about 4600 m.
21. *Lepidium latifolium* L.
2650 (6); observed also at (7), (8).
22. *Malcolmia africana* (L.) R. Br.
2667 (9)
23. *Matthiola flavida* Boiss.
2636 (4)
24. *Sisymbrium brassiciforme* C.A. Mey.
2606 (2).

Caprifoliaceae:

25. *Lonicera asperifolia* (Dcne.) Hook. f. et Thoms.
2643 (6); also observed at (7), (9), (10; 4260 m); always at water-courses or in gravel-slopes near running water.

Caryophyllaceae:

26. *Cerastium holosteoides* Fries em. Hyl.
(= *C. vulgatum* L.; *C. fontanum* Baumg.), 2631 (3). According to STEWART common in Ladak, Zanskar is not mentioned by him.
27. *Dianthus* cf. *angulatus* Royle
2594 (1). From a place nearby mentioned by WHITE. Also mentioned by STEWART from Zanskar.
28. *Silene moorcroftiana* Wall. ex. Benth.
2626 (3; 4300 m).
29. *Stellaria graminea* L.
2669 (8); also observed at (7). STEWART explicitly names the same two places from Zanskar.

Chenopodiaceae:

30. *Chenopodium botrys* L.
2599 (1); 2637 (4); also observed at (5), (6).

Crassulaceae:

31. *Sedum ewersii* Ledeb.
2647 (6); 2735 (13; 4100 m). In rock crevices. WHITE mentions one accurately described locality in Zanskar, in the Suru valley.
32. *Sedum roseum* (L.) Scop.
2610 (3; 4350 m); 2677 (10; 4260 m); 2726 (12; 4600 m). STEWART names one place in Zanskar precisely: Kargia (is it the same as Kurgiakh?).
33. *Sempervivella acuminata* (Dcne.) Berger
2619 (3); 2680 (10); 2734 (13; 4000 m). STEWART describes the species as common in Ladak, but does not mention Zanskar. WHITE describes it from near our place (2).

Cuscutaceae:

34. *Cuscuta capitata* Roxb.
2664 (6; 3750 m).

Elaeagnaceae:

35. *Hippophae rhamnoides* L.
2685 (10; 4200 m): as a tiny shrub between rocks. Observed also at (1): tall shrubs on sandy shores of the river Karcha=Suru; at (2): little shrubs. STEWART names our place (2) from Zanskar.

Fabaceae:

36. *Astragalus* cf. *frigidus* (L.) A. Gray
2676 (10; 4260). STEWART only writes: Zanskar.

37. *Medicago falcata* L.
2648 (6); probably cultivated and then run to seed.
38. *Oxytropis* cf. *lapponica* (Wahl.) Gay
2684 (10; 4300 m). STEWART mentions the species only from Ladak.

Gentianaceae:

39. *Gentiana aquatica* L.
2687 (10; 4260 m) in a little water-course. STEWART mentions the species only from Ladak.
40. *Gentiana moorcroftiana* Wall. ex. G. Don
2694 (10; 4250—4400 m, at several localities). Observed also at (3).
41. *Gentiana prostrata* Haenke
2658 (7). STEWART mentions the species only from Ladak; in KACHROO et al. it is not included.
42. *Gentiana tianschanica* Rupr. ex Kusn.
2693 (10; 4300—4400 m).
43. *Gentiana* cf. *falcata* Turcz.
2662 (7).
Some other species of *Gentiana* could not be definitely identified: 2587 (1); 2623 (3); 2661 (7).
44. *Lomatogonium thomsonii* (Clarke) Fern.
2633 (4); 2663 (7); 2681 (10). STEWART mentions the species only from Ladak. KACHROO et al. describe *L. carinthiacum* (Wulf.) R. Br. from Zanskar, also WHITE from near our place (2).

Geraniaceae:

45. *Geranium himalayense* Klotzsch
2593 (1); also observed at places (8), (11), (12). Near Tetha as a ruderal plant on verges and borders of fields. On the way to Shingo La (12) the highest flowering individuals were found at about 4600 m. STEWART does not mention the species from Zanskar.

Lamiaceae:

46. *Elsoltzia eriostachya* Benth.
2725 (11; 4550 m).
47. *Nepeta discolor* Royle ex Benth.
2601 (1); 2624 (3; 4350 m); 2733 (13; 4100 m); also observed at (6) and (8). Common.
48. *Nepeta floccosa* Benth.
2640 (6; 3750 m). Also observed at (7), (8), (9). Common on rock and gravel debris.
49. *Nepeta glutinosa* Benth.
2634 (5); 2644 (6); 2654 (7).

50. *Stachys tibetica* Vatke
Observed at place (1). — Collected in Ladak (No. 2549 near Mulbekh).
Also described by WHITE for the Suru valley.

51. *Thymus serpyllum* agg.
2622 (3); 2679 (10; 4200—4260 m). Common on fine soil between rocks.

Onagraceae:

52. *Epilobium angustifolium* L.
2578 (1).

53. *Epilobium latifolium* L.
2668 (8); also observed at (11; 4400 m), where it is frequent. MANI states
as upper limit 4400 m, STEWART 4850 m. The latter seems to be true.

Orobanchaceae:

54. *Orobanche cernua* Loefl.
2645 (6; 3750 m), probably on an *Artemisia*. STEWART does not mention
the species from Zanskar.

Papaveraceae:

55. *Corydalis* cf. *crithmifolia* Royle
2708 (11; 4500 m), along water-courses.

56. *Corydalis gortschakovii* Schrenk
2612 (3; 4350 m).

57. *Meconopsis aculeata* Royle
2603 (3; 4300 m); 2691 (10; 4260 m). From Zanskar STEWART describes it
from Char (near our place 7), KACHROO et al. from Baralacha-La. The
spectacular plant is found at high altitudes, in Zanskar perhaps always
above 3800—4000 m. It is growing in open places between rocks and grav-
el near courses of melting water.

Plumbaginaceae:

58. *Acantholimon lycopodioides* (Girard) Boiss.
2683 (10; 4200 m). Observed also at (8), (9). Common in *Astragalus* domi-
nated associations, especially on dry slopes from 3700 m upwards. By the
Zanskari collected as wood for burning.

Polygonaceae:

59. *Oxyria digyna* (L.) Hill
2715 (11; 4500 m); 2728a (12; 4600 m). At very wet places.

60. *Polygonum affine* D. Don
2618 (2; 4350 m); 2675 (10; 4200 m). In most places between rocks.

61. *Polygonum aviculare* L.
2712 (11; 4500 m); also observed at (9). Ruderal plant, at place (11) on
localities where animals are driven to pasture.

62. *Polygonum runcifolium* Royle ex Bab.
2710 (11; 4500 m); also observed at (10).
63. *Polygonum tortuosum*. D. Don
2589 (1); 2703 (10; 4250—4400 m). The species seems to be variable; some observations at (7) and (8) may belong to it.
Rheum cf. *tibeticum* Maxim. ex Hook. f.
observed below Pensi La (near coll.-place 3), at about 4000 m. Not collected.

Ranunculaceae:

64. *Aconitum rotundifolium* Kar. et Kir.
2695 (10; 4260 m), along water-courses. By STEWART mentioned from Zanskar.
65. *Aconitum violaceum* Stapf
2615 (3; 4300 m). By STEWART described from the same locality and by WHITE from places in the Suru valley.
66. *Aquilegia* cf. *fragrans* Benth.
2664 (7).
Caliba palustris L.
observed at place (6). Not collected.
67. *Delphinium brunonianum* Royle
(= *D. jacquemontianum* Camb.) 2604 (3; 4300 m).
WHITE describes it from near our place (2).
68. *Delphinium cashmerianum* Royle
2608 (2); observed at (11; 4500 m).
69. *Ranunculus* cf. *brotherusii* Freyn
2627 (3; 4350 m).
70. *Ranunculus pulchellus* C.A. Mey.
2653 (7); 2666 (9; 4050 m). In wet places in valley grounds.
71. *Thalictrum vaginatum* Royle
2696 (10; 4300 m). From Zanskar STEWART mentions Tetha as locality.

Rosaceae:

72. *Potentilla argyrophylla* Wall.
(= *P. jacquemontiana* Camb.) 2621 (3; 4350 m); 2719 (11; 4500 m).
73. *Potentilla multifida* L.
2590 (1); 2670 (8).
74. *Potentilla pbyllocalyx* (Juz.) Schiman-Czeika
(= *P. fruticosa* L. var. *pumila* Hook. f.) 2723 (11; 4500 m). Mentioned from Zanskar, without locality, by STEWART.
Rosa webbiana Wall. ex Royle
observed at (5); (6); (7). Not collected. Always growing near the shores of the river on gravel or moraines. Common from Padam unto above Pune.

Rubiaceae:

75. *Rubia tibetica* Hook. f.
2656 (7). By STEWART described from Tetha (our place 8).

Salicaceae:

76. *Salix flabellaris* N.J. Anders.
2721 (11; 4500 m).

Saxifragaceae:

77. *Saxifraga cernua* L.
2701 (10; 4400 m); 2728 (12; 4600 m). STEWART does not mention this species from Zanskar.
78. *Saxifraga flagellaris* Willd.
2700 (10; 4350 m).
Saxifraga flagellaris Willd. ssp. *crassiflagellata* Hultén
2628 (3; 4350 m). From the same place mentioned by STEWART.
79. *Saxifraga birculus* L.
2713 (11; 4550 m). Mentioned by STEWART only for Ladak.
80. *Saxifraga jacquemontiana* Decne.
2730 (12; 4700 m). Also observed higher up on the way to Shingo La, in crevices between rocks up to about 5000 m. This species reached the highest altitude on our way.
Ribes orientale Desf.
observed at several points at (6) and (7); not collected.

Scrophulariaceae:

81. *Euphrasia officinalis* agg.
2632 (4); 2660 (7).
82. *Pedicularis bicornuta* Klotzsch
2611 (3; 4350 m). According to MANI the upper limit of the species is about 3900 m. Our collection place has a much higher altitude, which is in accordance with the data of STEWART.
83. *Pedicularis cheilanthifolia* Schrenk ex Fisch. et Mey.
2652 (7); 2688 (10; 4260 m).
84. *Pedicularis longiflora* Rudolph ssp. *tubiformis* (Kl.) Penn.
2659 (7); also observed at (8), (9), (10, up to 4250 m). Always near water-courses in wet meadows. STEWART only mentions it from Ladak.
85. *Pedicularis rhinanthoides* Schrenk ex Fisch. et Mey.
2582 (1); 2689 (10; 4260 m); also observed at (3; 4350 m). Also a white form was collected: 2690 (10). Place (3) is also mentioned by STEWART.
86. *Scrophularia dentata* Royle
2635 (4). By STEWART mentioned from Zanskar.

Solanaceae:

87. *Physochlaina praealta* (D. Don) Hook. f.
2641 (6), also observed at (4) and (5). In the area of Padam and upstream it seems to be a relatively frequent weed.

Tamaricaceae:

88. *Myricaria germanica* (L.) Desv.
2586 (1), STEWART makes no mention of any *Myricaria* for Zanskar, but MEEBOLD describes its occurrence in the same part of the Suru valley, where it is frequently growing as shrubs near the water.

Urticaceae:

89. *Urtica hyperborea* Jacquem. ex Wedd.
2707 (11; 4400 m and 4500 m). On localities, where pasturing animals are staying. Not mentioned for Zanskar by STEWART.

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