

## THE GENUS *HEDYSARUM* (LEGUMINOSAE) IN THE HIMALAYAS

by

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The Himalayan species of the genus *Hedysarum* were studied for the first time by Baker (1876). He recognized eight species from the region and all these species were considered as endemic to the Himalayas, mostly to West Himalaya. Since then several investigations have been made in connection with the Himalayan species. Prain (1897) suggested that *Hedysarum laxiflorum* Benth. ex Baker was identical with *H. sibiricum* Poir. In a monograph of the genus by B. Fedtschenko (1902) *H. Falconeri* Baker was treated as a variety of the widespread species *H. obscurum*, which is now considered as a synonym of *H. hedysaroides*. *H. strobiliferum* Baker was identified by Fedtschenko as *Astragalus chlorostachys* Lindley. Also, he reported the occurrence of *H. sikkimense* eastwards in Yunnan. Ali (1972) reported the extension of distribution of *H. minjanense* Rech. f., an Afghan species, to Chitral and Kashmir. Ohashi (1974 & 1975) described two new species and one new variety from Central Nepal, and treated *H. strobiliferum* as a distinct species of *Astragalus* with a discussion on the distinction between *Hedysarum* and *Astragalus*. However, *A. manaslensis* Kitamura (1957) was proved to be identical to *H. nepalense* Ohashi.

In the present paper one new species and one new variety are described, and one new combination is proposed. However, there remain several hitherto unrecognized forms in the Himalayas especially in the Tibetan regions. Moreover, as we could not examine the Himalayan specimens of *H. minjanense*, this species is excluded from the present paper. Judging from the original description of the species, *H. minjanense* is apparently near to *H. kumaonense*. Under these circumstances, at present we recognize nine species, one subspecies, and two varieties from the Himalayas as follows:

1. *Hedysarum alpinum* L.  
    subsp. *laxiflorum* (Benth. ex Baker) Ohashi et Tateishi
2. *H.*     *astragaloides* Benth. ex Baker
3. *H.*     *cachemirianum* Benth. ex Baker
4. *H.*     *campylocarpon* Ohashi
5. *H.*     *Falconeri* Baker
6. *H.*     *kumaonense* Benth. ex Baker
7. *H.*     *manaslense* (Kitamura) Ohashi
- 7'. var. *nepalense* (Ohashi) Ohashi
8. *H.*     *microcalyx* Baker

9. *Hedysarum pseudomicrocalyx* Ohashi et Tateishi  
 10. *H. sikkimense* Benth. ex Baker  
 10'. var. *megalanthum* Ohashi et Tateishi

These plants listed above have been classified into two sections, i.e., Sect. Sub-*acaulia* B. Fedtschenko and Sect. *Gamotion* Basiner. Only *Hedysarum kumaonense* belongs to the former section, and all others belong to the latter. However, floral characteristics in the Himalayan species treated in the present paper seem to show different taxonomic features from what have been recognized by classifying these sections. Especially the differences in the wings and the calyces are remarkable among these species (Fig. 53). *H. campylocarpon* and *H. manaslense* are characterized in having the wings usually longer than the standard and keel-petals, and the 4-lobed calyx. In *H. cachemirianum* the wings are almost as long as the other petals and have an elongate claw and a short auricle, and the calyx is tubular. The wings of *H. astragaloides* and *H. microcalyx* have a long auricle with a slightly expanded apex, but the shape of the calyx differs from each other as shown in Fig. 53. In *H. kumaonense*, *H. Falconeri* and *H. cachemirianum* the auricles of the wings are apparently shorter than the claw, but these three species are different conspicuously in the calyces and keel-petals. The calyx of *H. kumaonense* is characterized by its elongate upper lobes. On the basis of the differences in floral morphology, therefore, the Himalayan species of *Hedysarum* may be regarded as an assemblage of considerably heterogeneous species. Although the present work is preliminary, the following five species-groups can be recognized: (1) *H. campylocarpon* and *H. manaslense*; (2) *H. sikkimense*, *H. pseudomicrocalyx*, *H. alpinum* subsp. *laxiflorum*, *H. microcalyx* and *H. astragaloides*; (3) *H. kumaonense*; (4) *H. Falconeri*; and (5) *H. cachemirianum*.

The present study is based mainly on the specimens of the Herbarium, Department of Botany, Faculty of Science, University of Tokyo (TI); British Museum (Nat. Hist.) (BM); and Royal Botanic Gardens, Kew (K). We wish to express our thanks to the authorities at the British Museum (Nat. Hist.) and the Royal Botanic Gardens, Kew, for enabling us to study the specimens in their charge. We also indebted to Dr. Hiroshi Hara, Professor Emeritus of the University of Tokyo, for his valuable suggestions and criticisms.

Key to the species, subspecies and varieties.

1. Almost acaulescent. Calyx 5-lobed, all the lobes equal or the upper lobes a little longer than the others. Standard and keel-petals equal and longer than the wings, wings 10.5–13.5 mm long, keel-petals 14.5–15.5 mm long; auricle of wings shorter than the claw, 1–1.5 mm long. Pods 1–2-jointed, without wings along the margin, the articles 8–9 mm long . . . . *H. kumaonense*
1. Caulescent, erect herbs . . . . . 2
2. Leaves whorled. Calyx 5-lobed, lateral and lower lobes nearly equal and longer than the upper lobes. Keel-petals longer than the standard, wings shorter than the standard, wings 12–15 mm long, keel-petals 14.5–18 mm long; auricle of wings slightly expanded at the apex, longer than or

	Calyx	Relative Length of Petals	Wing
H. MANASLENSE		$W \approx K > S$	
H. CAMPYLOCARPON		$W \approx K > S$	
H. PSEUDOMICROCALYX		$K > W > S$	
H. SIKKIMENSE		$K > W \approx S$	
H. ALPINUM SSP. LAXIFLORUM		$K > W \approx S$	
H. ASTRAGALOIDES		$K > S = W$	
H. MICROCALYX		$K \approx S = W$	
H. KUMAONENSE		$K \approx S = W$	
H. FALCONERI		$K \approx S = W$	
H. CACHEMIRIANUM		$K \approx S \approx W$	

Fig. 53. The calyces and wing-petals of the Himalayan species of *Hedysarum*, showing differences in shape and size among the species, and, at the same time, relative length of petals in each species respectively; S: standard, W: wing, and K: keel-petal. For example, in *H. manaslense* the calyx is 4-lobed and the wing-petal is longer than the keel-petal or rarely as long as it, and both wing and keel-petal are longer than the standard. In *H. Falconeri* the calyx is 5-lobed, and the keel-petal and the standard are nearly equal and longer than the wing-petal.

- as long as the claw, 2.5–3.5 mm long. Bracteoles distinctly shorter than the calyx-tube. Pods (1–)2–3-jointed, with wings along the margin, the articles 8–18 mm long ..... *H. microcalyx*
2. Leaves opposite. Calyx 5-lobed, lateral and lower lobes nearly equal and distinctly longer than the upper lobes. Keel-petals longer than the wings, wings longer than the standard, wings 20–21 mm long, keel-petals 24.5–26 mm long; auricle of wings not expanded at the apex, almost as long as the claw, 3.5–4 mm long. Bracteoles nearly equalling the calyx-tube ..... *H. pseudomicrocalyx*
2. Leaves alternate ..... 3
3. Calyx 4-lobed. Wings usually longer than the standard and keel-petals; auricle of wings as long as the claw, 3.5–4.5 mm long. Pods 2.5–4 cm long, 2–3(–4)-jointed ..... 4
4. Calyx 4–6 mm long, the tube apparently longer than the lobes, lateral and lower lobes 1.2–2.5 mm long. Pods pendulous, irregularly crenulate to toothed along the margin ..... *H. campylocarpon*
4. Calyx 7–8 mm long, the tube more or less longer than the lobes, lateral and lower lobes 3–4 mm long. Pods ascending, entire along the margin ..... 5. *H. manaslense*
5. Standard puberulent ..... var. *manaslense*
5. Standard glabrous ..... var. *nepalense*
3. Calyx 5-lobed. Wings not longer than the keel-petals ..... 6
6. Standard nearly equalling the keel-petals; auricle of wings shorter than the claw, 1–1.5 mm long. Lateral calyx-lobes about 4 mm long ..... 7
7. Calyx-tube tubular, 5–6 mm long, calyx-lobes acuminate at the apex. Claw of wings elongated, about 7 mm long; wings almost as long as or a little shorter than the keel-petals. Pods (1–)2–3-jointed, the articles 1.3–2 cm long, with irregularly erose-dentate wings along the margin ..... *H. cachemirianum*
7. Calyx-tube campanulate, 2.5–3.5 mm long, calyx-lobes long-cuspidate at the apex. Claw of wings short, 3–3.5 mm long; wings distinctly shorter than the keel-petals. Pods 1–3-jointed, the articles 1–1.3 cm long, with almost entire wings along the margin ..... *H. Falconeri*
6. Standard shorter than the keel-petals; auricle of wings elongated, almost as long as the claw, more than 2.5 mm long ..... 8
8. Lower and lateral calyx-lobes nearly equal, 4–6 mm long. Corolla yellowish. Wings shorter than the standard. Pods 1–2-jointed, with distinct wings ..... *H. astragaloides*
8. Lower calyx-lobes longer than the lateral lobes. Wings longer or a little shorter than the standard ..... 9
9. Calyx glabrous or nearly so on the tube. Wings equalling or longer than the standard. Ovary glabrous. Bracts 2–3 mm long, shorter than the pedicel. Pods (3–)4-jointed, without wings, the articles

- shorter than 6 mm ..... *H. alpinum* subsp. *laxiflorum*
9. Calyx densely pubescent to rarely subglabrous. Corolla mauve to reddish purple. Ovary densely pubescent. Bracts 3.5–10 mm long, longer than the pedicel. Pods with narrow wings, the articles longer than 8 mm ..... 10. *H. sikkimense*
10. Flowers 23–28 mm long. Ovary 5-ovuled. Leaflets with uniformly appressed white hairs below ..... var. *megalanthum*
10. Flowers 13–18(–19) mm long. Ovary 2(–3)-ovuled. Pods 1–2(–3)-jointed. Leaflets hairy along the midrib below ... var. *sikkimense*

1) **Hedysarum alpinum** L., Sp. Pl. ed. 1, 750 (1753)

subsp. **laxiflorum** (Benth. ex Baker) Ohashi et Tateishi, comb. nov.

[Pl. 13g. Figs. 54, 70d, 71c]

*H. laxiflorum* Benth. ex Baker in Hook. f., Fl. Brit. Ind. **2**: 146 (1876).

*H. sibiricum* Poir. sensu Prain in Journ. Asiat. Soc. Beng. **66** (2): 378 (1897).

*H. alpinum* L. sensu B. Fedtsch. in Act. Hort. Petrop. **19**: 253 (1902).

A perennial, 30–120 cm high; stems erect, slender, glabrous or very sparsely pubescent. Stipules leaf-opposite, membranaceous, connate, about 7 mm long, glabrous. Leaves alternate, usually 10–15 cm long, glabrescent or appressed-pubescent along the rachis; leaflets 8–16 pairs, narrowly ovate (37)<sup>1)</sup> or narrowly elliptic (2), retuse to obtuse or acute at the apex, (10–)15–25(–30) mm long, (4–)5–10 mm broad, entire along the margin, glabrous above, appressed-pubescent on the costa below, lateral veins (8–)12–18 pairs, rather prominent below. Racemes 10–30-flowered, 8–17 cm long including the peduncle, glabrescent or pubescent on the rachis. Bracts early deciduous, narrowly ovate (37), acuminate or often acute at the apex, 2–3 mm long. Pedicels 3–6 mm long, nearly glabrous or rather densely pubescent with appressed silky hairs. Bracteoles narrowly ovate (36), 2–3 mm long and less than 0.4 mm wide. Calyx 4–6 mm long, nearly glabrous on the tube and minutely pubescent on the lobes, 5-lobed; tube 3–3.5 mm long, the lower lobe longer than the other lobes, narrowly triangular (73) to narrowly ovate (36), 2–2.5 mm long, the upper and lateral lobes deltate, about 1 mm long. Corolla (colour unknown): Keel-petals longer than the other petals, standard shorter than or almost as long as the wings. Standard narrowly obovate (46–47), emarginate at the apex, 14–15 mm long and about 6 mm wide, glabrous; wings 14–16 mm long including the claw (claw 3–4 mm long), 1.7–2.3 mm wide, the lamina nearly narrowly elliptic (1), long-auriculate (auricles linear, 3–3.5 mm long), obtuse at the apex; keel-petals 16.5–18 mm long including the claw (claw 5–6 mm long), 4.5–5.5 mm wide, shortly auriculate at the base. Androecia diadelphous, vexillar stamen 14–16 mm long, 3–5 mm shorter than the longest one of the other stamens. Gynoecia sessile or minutely stiped, 20–22 mm long, the ovary 4-ovuled, 6–7 mm long, glabrous, the style 14–15 mm long, glabrous. Pods (Fig. 70d) (3–)

1) The number in parentheses after the shapes of leaflets, bracts, bracteoles, calyx-lobes, petals and articles of pods is correspond with that in the Chart of simple symmetrical plane shapes by the Systematics Association Committee for descriptive Biological Terminology (cf. Taxon **11**, 1962).

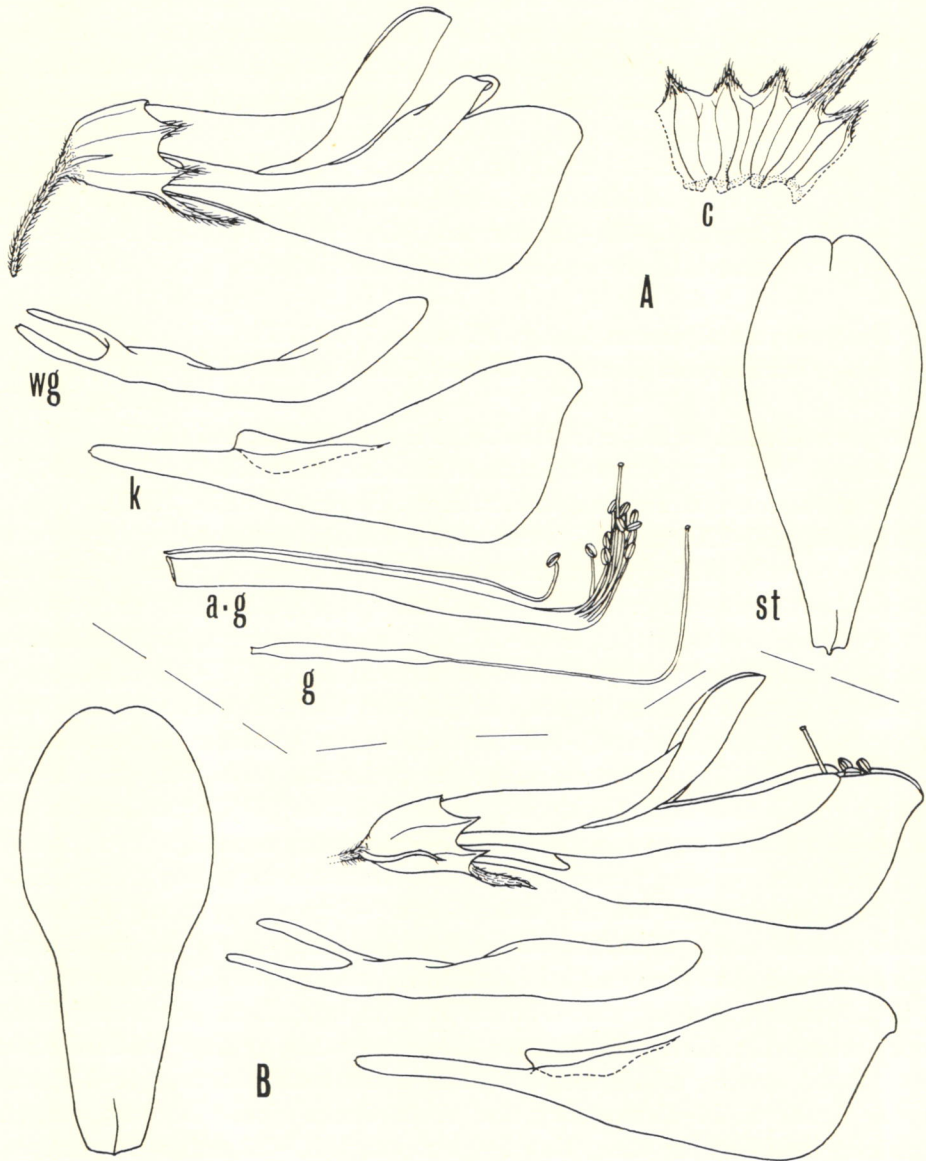


Fig. 54. Flowers of *Hedysarum alpinum* subsp. *laxiflorum*. c. Calyx from inside, st. Standard, wg. Wing, k. Keel-petal, a.g. Androecium and gynoecium, g. Gynoecium. All  $\times 4$ . A from J. E. Winterbottom, 25 June 1847 (Syntype of *H. laxiflorum*), B from B. O. Corentry 1539.

4-jointed, stiped (the stipes about 3 mm long), glabrous, reticulate-nerved on both surfaces, both sutures without wings; articles broadly elliptic (5), 5–6 mm long and 4–5 mm wide. Seeds (Fig. 71c) about  $3 \times 2.2 \times 1$  mm in size.

Distr. West Himalaya and West Tibet (Fig. 55).

Specimens examined: WEST TIBET. (Falconer 440  $\kappa$ —Lectotype of *H. laxiflorum*).

KASHMIR. Valley of Kishengunga (J. E. Winterbottom, 25 June 1847,  $\kappa$ -Syntype of *H. laxiflorum*); No precise locality (B. O. Corentry 1539  $\kappa$ ).

In general habits and the shape of flower petals *Hedysarum alpinum* and *H. laxiflorum* are very close to each other. So it seems to be natural to regard them as conspecific, but *H. laxiflorum* differs apparently from *H. alpinum* in having lax-flowered racemes, distinct lower calyx-lobe which is longer than the other lobes, deciduous bracts, and ascending wingless pods. The number of leaflets on a leaf is 17–33 in *H. laxiflorum* against 11–28 in *H. alpinum*.

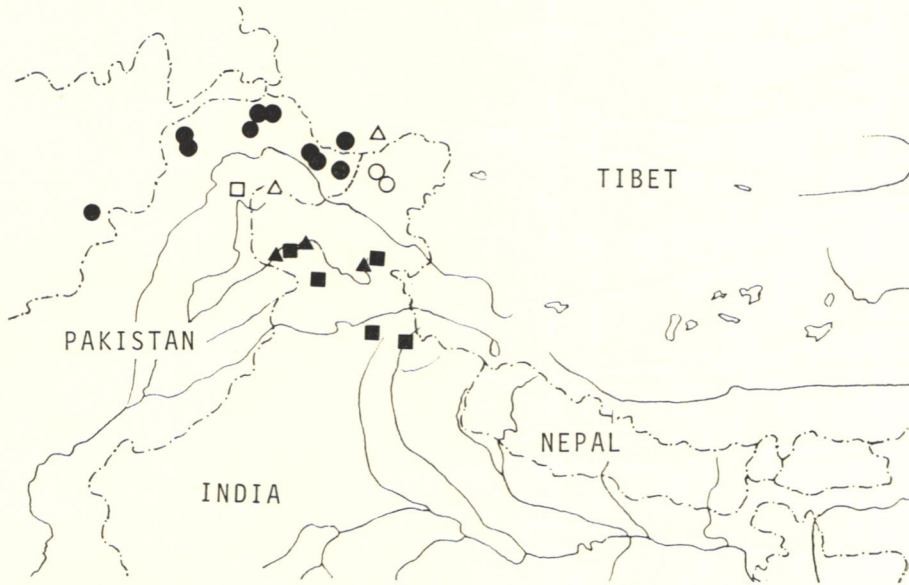


Fig. 55. Approximate distribution of the N.W. Himalayan species of *Hedysarum*.  
 ●: *H. Falconeri*, □: *H. pseudomicocalyx*, △: *H. alpinum* subsp. *laxiflorum*, ○: *H. cachemirianum*, ■: *H. micocalyx*, ▲: *H. astragaloides*.

2) ***Hedysarum astragaloides*** Benth. ex Baker in Hook. f., Fl. Brit. Ind. **2**: 146 (1876)–Aitch. in Journ. Linn. Soc. **18**: 49 (1880)–B. Fedtsch. in Act. Hort. Petrop. **19**: 252 (1902)–Kitamura, Fl. Afghanistan 231 (1960). [Pl. 12a. Fig. 56]

A perennial, 20–60 cm high; stems erect, slender to sometimes robust, with dense appressed silky hairs (0.5–1 mm long) at first. Stipules leaf-opposite, scariose, connate, usually 1–1.2 cm long, with rather densely white silky hairs outside. Leaves alternate, usually 10–20 cm long; leaflets 17–31 i.e. 8–15 pairs, narrowly ovate (37) to narrowly elliptic (2) or sometimes elliptic (4), rounded to obtuse or acute, often with a minute mucro at the apex, 15–48 mm long, (5–)7–15 mm wide, entire along the margin, upper surfaces glabrous and with uniformly very minute gland-like dots, lower surface with densely or rarely rather sparsely appressed white hairs (about 1 mm long), lateral veins obscure on both surfaces. Racemes densely 10–30-flowered or more, more than 10–25 cm long including the peduncle of 7–15 cm long, with dense appressed white hairs. Pedicels 3–5 mm

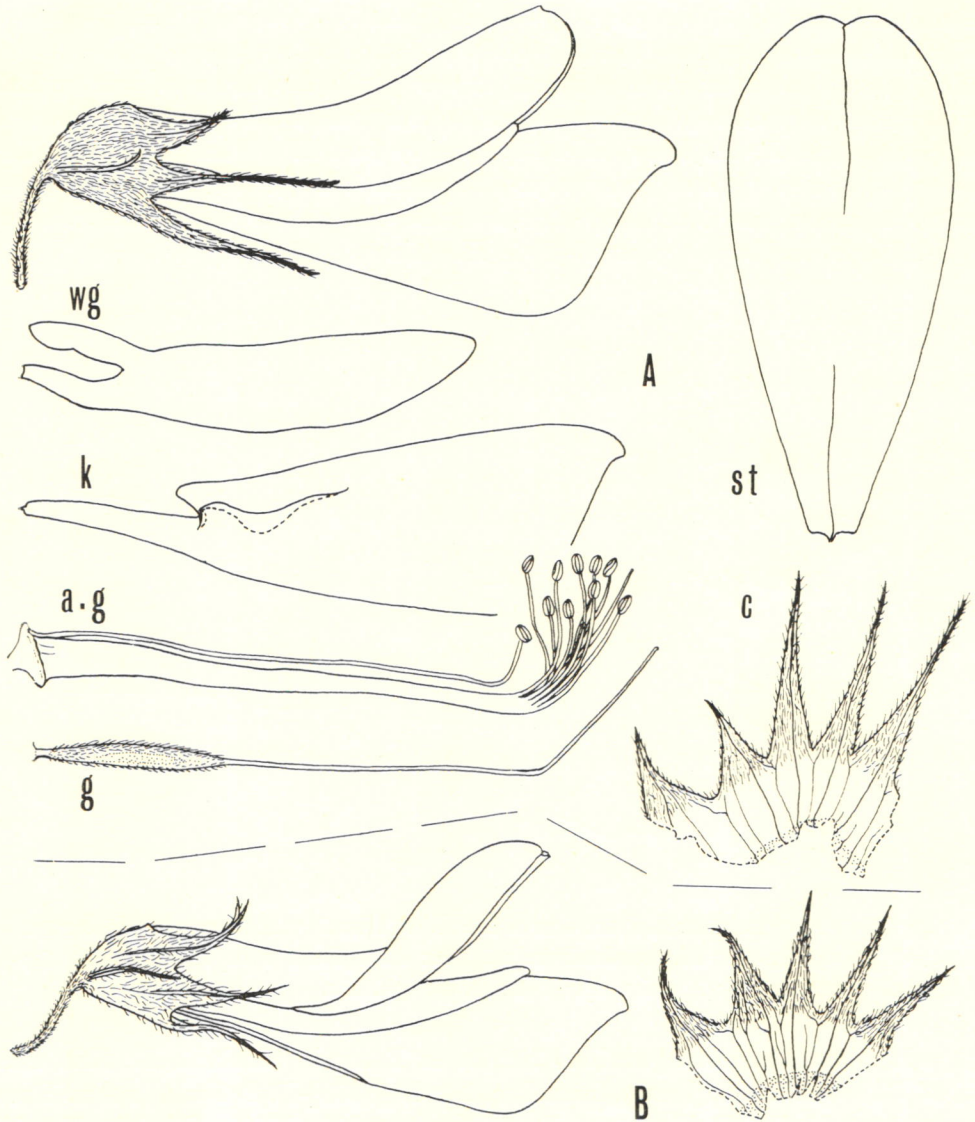


Fig. 56. Flowers of *Hedysarum astragaloides*. c. Calyx, st. Standard, wg. Wing, k. Keel-petal, a.g. Androecium and gynoecium, g. Gynoecium. All  $\times 4$ . A from the lectotype, B from N. L. Bor 15388.

long, densely to very densely hairy. Bracts distinctly longer than the pedicel, subulate (72), 8–10 mm long, 0.5–0.8 mm wide, pubescent outside and along the margin, glabrous inside. Bracteoles narrowly triangular (73), 2.5–3.5 mm long, about 0.5 mm wide, hairy like the bract. Flowers (15–)18–22(–23) mm long. Calyx 6–9.5 mm long, sparsely to densely pubescent, 5-toothed, teeth more or less unequal, upper two teeth triangular (76), 3–4 mm long, about 2 mm wide at the base, lateral and lower teeth narrowly triangular (74), 4–6 mm long, 1.5–2 mm



wide at the base. Corolla yellowish; standard shorter than the keel-petal, narrowly obovate (46) to obovate (47), emarginate at the apex, 15.5–18 mm long, 6–7.5 mm wide; wings clawed, 14–15.5 mm long, the lamina narrowly elliptic (2), 11–12 mm long, 2–3.5 mm wide, obtuse at the apex, auriculate at the base, the auricle 2.5–3.5 mm long, the claw about 3.5 mm long; keel-petals clawed, 17.5–20 mm long, the lamina narrowly obovate (46) to obovate (47), 12–15 mm long, 5.5–6 mm wide, usually slightly mucronate at the apex, auriculate near the base, the auricle about 1 mm long, the claw about 6 mm long. Androecia diadelphous, the vexillar stamen shorter than the others, 15–17.5 mm long, the others 17.5–22 mm long, anthers about 0.5 mm long. Pistils 19–23 mm long, shortly stiped, the ovary 5–6 mm long, (1–)2(–3)-ovuled, the style 13.5–16 mm long. Pods 1–2-jointed, stipitate, both sutures with apparent wings; articles elliptic to broadly elliptic (3–5).

Distr. Kashmir and Punjab (Fig. 55).

Specimens examined: KASHMIR. Kishtwar, 11–12000 ft. (T. Thomson, 20 June 1848 κ–Lectotype, BM–Isotype); Kishtwar, Barnaj Nullals near Sappline Miues, 10000 ft., grassy slopes, fls. cream white (Ludlow & Sherriff 9134 BM). PUNJAB. Lahul (H. Jaeschke 236 κ–Syntype); Billing Lumpa, 14000 ft. (N. L. Bor 15458 κ); 12500 ft. (N. L. Bor 15388 κ); Tugiling–Gondla (J. R. Drummond 23487 κ); Upper Chenab (R. Sillis 575 κ); Chenab Valley, 11000 ft. (R. Sillis 1493 κ); Chenab Valley, 11000 ft. (Thomson s.n. κ).

We could observe only young pods. Baker (1876) described that the pod has a distinct rather crisped wing on the lower side and an obscure one on the upper. This feature is very distinct in the Himalayan *Hedysarum*.

3) ***Hedysarum cachemirianum*** Benth. ex Baker in Fl. Brit. Ind. 2: 146 (1876)–B. Fedtsch. in Act. Hort. Petrop. 19: 244 (1902).

[Pl. 12d, d'. Figs. 57, 70a, 71a]

A perennial herb. Stems 35–60 cm high, erect, pubescent but soon glabrescent. Stipules leaf-opposite, scariose, connate, up to 1.5 cm long, glabrous. Leaves alternate, usually 7–13 cm long including the petiole, leaf-rachis yellowish hairy when young but soon glabrescent; petioles usually 0.5–2 cm long. Leaflets generally opposite, 21–27 i.e. 10–13 pairs, narrowly ovate (37) or narrowly elliptic (2), obtuse but occasionally apiculate at the apex and obtuse to rarely more or less cordate at the base, 1.5–2.5(–3.3) cm long and 5–10 mm wide, entire along the margin, glabrescent but when young long-pubescent, densely appressed pubescent along the midrib; stipels absent. Racemes axillary from the axil of the middle leaf, usually about 20 cm long including the peduncle, densely 30–40-flowered, glabrescent on peduncles but densely yellowish pubescent on inflorescence-rachis in flower and glabrescent in fruit. Bracts narrowly triangular (72–73), 6–8 mm long and up to 1 mm wide at the base, pubescent outside. Pedicels 2–3 mm long in flower and 3–4 mm long in fruit, pubescent but later less hairy. Flowers patent or a little pendulous. Bracteoles subulate (72), 4–5 mm long and up to about 0.5 mm wide at the base, sparsely pubescent. Calyx about 10 mm long, densely pubescent outside in flower, 5-lobed above the middle; lobes narrowly triangular (73), lateral ones 4.5–6 mm long, longer than the other lobes or as long as the lower

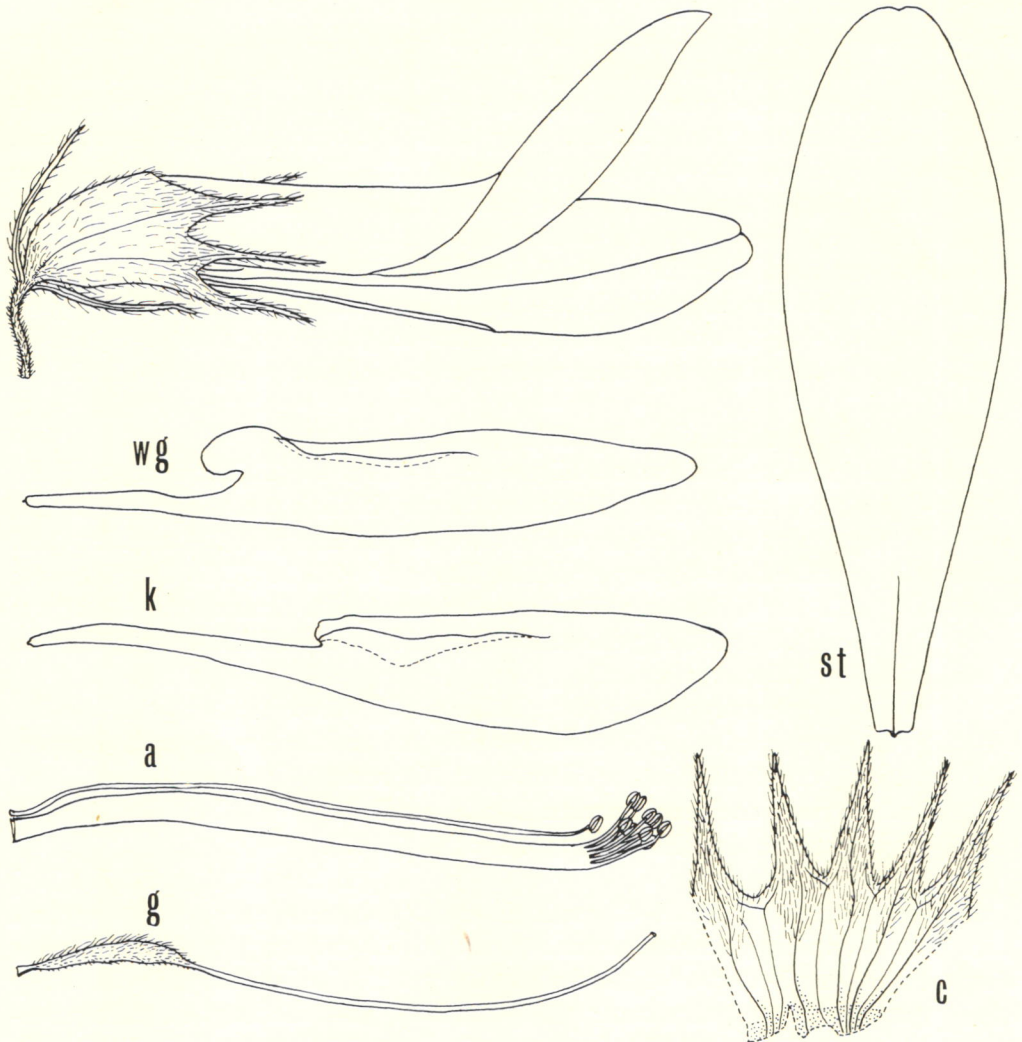


Fig. 57. Flower of *Hedysarum cachemirianum*. c. Calyx, st. Standard, wg. Wing, k. Keel-petal, a. Androecium, g. Gynoecium. All  $\times 4$ . From T. A. Rao 9552.

lobe, upper lobes about 4.5 mm long, shorter than the others. Corolla purple-red; standard nearly equalling or a little longer than the other petals, keel-petals longer than the wings. Standard narrowly obovate (46), slightly retuse or obtuse at the apex, 24–26 mm long and 7–8.5 mm wide, glabrous; wings 22–24 mm long including the claw, 3.5–4 mm wide, the lamina narrowly ovate (37), 16–17 mm long, shortly auriculate at the base, obtuse at the apex, the claw about 7 mm long; keel-petals 23–25 mm long including the claw, 4–5 mm wide, the lamina nearly elliptic (2), obtuse at the apex, 13–15 mm long, the claw about 10 mm long. Androecia diadelphous, vexillar stamen 19–20 mm long, usually about

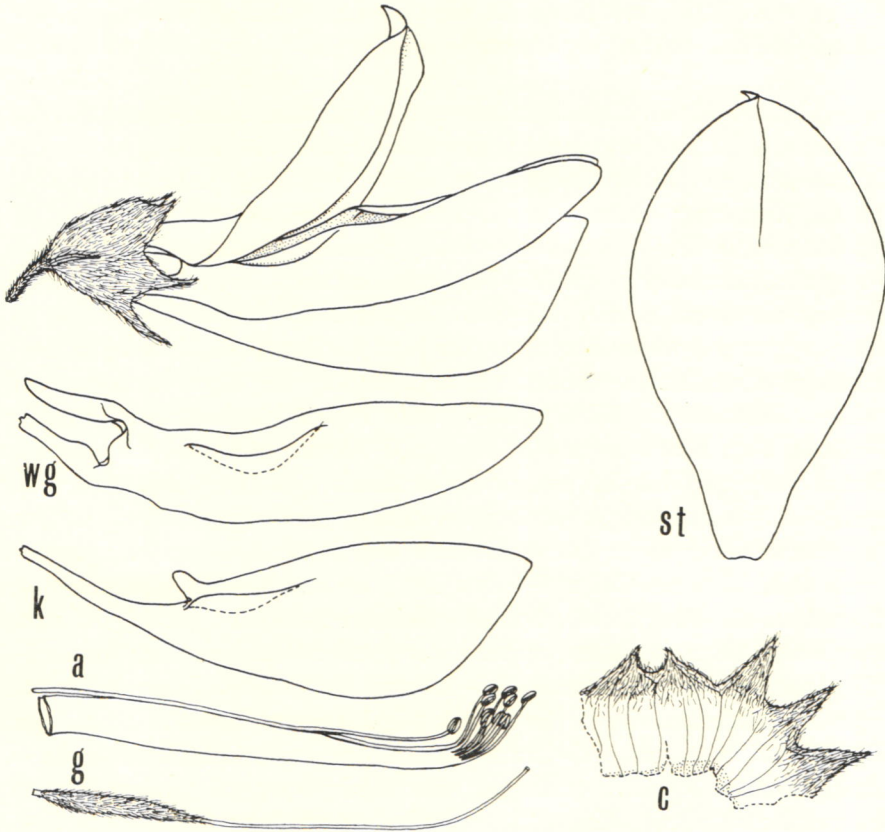


Fig. 58. Flower of *Hedysarum campylocarpon*. c. Calyx, st. Standard, wg. Wing, k. Keel-petal, a. Androecium, g. Gynoecium. All  $\times 4$ . From Kanai & Shakya 676163.

3 mm shorter than the longest one of the other stamens. Gynoecia stiped (the stipes about 1 mm long), 22–23 mm long, the ovary 2–3-ovuled, 4.5–5 mm long, densely minute pubescent, the style 16–17 mm long, glabrous. Pods (Fig. 70a) patent or pendulous, (1–)2–3-jointed, up to 5.5 cm long, distinctly stipitate (the stipes 7–11 mm long), with sparsely appressed minute hairs, with clear reticulation on both surfaces, both sutures with distinct wings, wings up to 1 mm broad and almost entire; articles broadly elliptic (5), obovate (47) or ovate (38), 1.3–2 cm long and about 1 cm wide. Seeds (Fig. 71a) about  $6 \times 4.5 \times 1.5$  mm in size.

Distr. Kashmir (Fig. 55).

Specimens examined: KASHMIR. Kolohoi Valley, 12000 ft., earthy north facing slopes (O. Polunin 56/566 BM); Thajwas, 3800 m (T. A. Rao 9552 T1).

*Hedysarum cachemirianum* and *H. Falconeri* are similar to each other in having long calyx-lobes, keel-petals nearly equalling the standard and not elongated auricles of wings. However, the former differs clearly from the latter by the longer wings nearly equalling the keel-petals, tubular calyx and almost entire margin of the loment-wings against wings distinctly shorter than the keel-petals, campanulate

clayx and erose-dentate margin of the loment-wings in *H. Falconeri*.

4) ***Hedysarum campylocarpon*** Ohashi in Journ. Jap. Bot. **49**: 164 (1974).

[Pl. 12b. Figs. 58, 70f, 71d]

A perennial, 30–90 cm high. Stem erect, robust, about 5 mm thick near the base, white-tomentose at first but nearly glabrescent. Stipules leaf-opposite, connate, membranaceous, simple at the apex, usually 1–2 cm long, glabrous inside, pubescent outside but later glabrescent. Leaves alternate, usually 15–20 cm long including the petiole, leaf-rachis white-woolly; leaflets alternate or opposite, 17–21 i.e. 8–10 pairs, narrowly ovate (37–38) or sometimes narrowly elliptic (3), acute or obtuse at the apex, usually 1.5–4 cm long and 0.7–1.8 cm wide, with sparsely to densely appressed white silky hairs on both surfaces, entire along the margin; stipels not present. Inflorescences axillary, usually 12–20 cm long, usually 20–30-flowered, inflorescence-rachis white-woolly at first but later less hairy; peduncles 4–10 cm long. Bracts narrowly ovate (37–38) or ovate (39) or cymbiformis, 3–10.5 mm long and 1.5–2.5 mm wide, acuminate at the apex, pubescent outside; pedicels 3–5 mm long, densely pubescent, ascending or patent in flower but curved downwards in fruit; bracteoles narrowly ovate, 3–4 mm long, about 1 mm wide, pubescent outside. Calyx 4–6 mm long, uniformly with dense minute hairs outside and on the lobes inside, 4-lobed above the middle; tube 3–3.5 mm long, distinctly longer than the lobes; upper lobes shorter than the other lobes, 1–2 mm long, 2-toothed at the apex (teeth 0.5–1.3 mm long), lateral and lower lobes almost equal in shape and size or the former a little shorter than the latter, triangular (75–76), 1.2–2.5 mm long, 1.5–2 mm wide at the base. Corolla magenta or purplish, wings almost equal to or longer than the keel-petals, standard shorter than the keel-petals; standard elliptic (3), rounded or acute at the apex, 15.5–17 mm long, 7.5–9 mm wide, glabrous; wings clawed more or less incurved, 17.5–19 mm long, the lamina narrowly oblong (14), 3–5 mm wide, obtuse at the apex, auriculate at the base, the auricles 3.5–4.3 mm long, coherent at the apex, the claw 3.5–4.3 mm long; keel-petals long-clawed, incurved, 17–18 mm long, the lamina nearly obovate, acute at the apex, auriculate at the base, 4.5–5.5 mm wide, the claw 5.6–6.5 mm long. Androecia diadelphous, vexillar stamen free from or sometimes partly adherent to the others near the middle, 13.5–16 mm long, the longest one among connate stamens 17–20 mm long, usually 3–4 mm longer than the vexillar one. Gynoecia 17–21 mm long, shortly stiped, the stipe 0.5–1 mm long, the ovary narrowly elliptic, 6–8 mm long, 2–3(–4)-ovuled, with densely appressed minute hairs, the style 10–14 mm long, glabrous. Pods (Fig. 70f) pendulous, 2–3(–4)-jointed, 2.5–4 cm long, distinctly stiped, with appressed minute hairs but afterwards glabrescent, both sutures apparently margined, the margin irregularly crenulate to toothed; articles narrowly obovate (47), oblong (16) or elliptic (4), 8–12 mm long, 6–7 mm wide, reticulate-veined. Seeds (Fig. 71d) usually 4.3–4.7 × 3.3–3.5 mm in size.

Distr. Central Nepal (Fig. 59).

Specimens examined: NEPAL. Chilime Kharka, 13500 ft., stream side, fls. purple (Polunin 1226, Jul. 1949, BM–Holotype, TI–Isotype); Kyangchin Gompa, Lat. 28°13'N, Long. 85°44'E, 4100 m (Dobremez 1073 GR); Serwotche, Langtang

valley, 4000 m, sur moraines, avec *Salix daltoniana* (A. Maire 584 GR); Likhoo Shailoong, 14–15000 ft. (Dhwoj 0408 BM); Kyangin Kharka, 11–12000 ft. (S. B. Malla 9195 BM); Langtang, 12000 ft. (Polunin 562 BM, T1); Shiar Khola, 9500 ft. (Gardner in 1953 BM); Langtang–Kyangjing, 3400–3800 m (Kanai & Shakya 676163 T1).

5) **Hedysarum Falconeri** Baker in Fl. Brit. Ind. 2: 146 (1876).

[Pl. 13c. Figs. 60, 70h]

*H. obscurum* L. var. *Falconeri* (Baker) B. Fedtsch. in Act. Hort. Petrop. 19: 243 (1902)—Kitamura in Results Kyoto Univ. Sci. Exp. Karakoram Hindukush 3: 92 (1964).

*H. obscurum* L. var. *affghanicum* B. Fedtsch., l.c. 243 (1902).

A perennial, 45–60 cm high; stems erect, more or less pubescent with appressed white hairs (about 0.5 mm long). Stipules leaf-opposite, membranaceous, connate, usually early deciduous, 1–1.5 cm long, nearly glabrous. Leaves alternate, usually (10–)15–20(–23) cm long, hairy like the stem along the rachis; leaflets opposite or occasionally alternate near the base, (5–)7–10(–13) pairs, elliptic (3–4) or ovate (38–39) or occasionally narrowly elliptic (2), obtuse to acute and mucronulate at the apex, 15–30 mm long, 6–15 mm broad, entire along the margin, glabrous or sparsely pubescent with appressed white hairs above, sparsely to rather densely pubescent below, lateral veins rather prominent on both surfaces. Racemes usually 20–30(–45)-flowered, 10–40 cm long including the peduncle, with sparse to rather dense hairs like the stem; pedicels (2–)3–5 mm long, densely pubescent with appressed or ascending white hairs (less than 0.5 mm long). Bracts subulate (72) to narrowly triangular (73), 3–10 mm long, 0.5 mm wide, almost glabrous to rather densely pubescent outside. Bracteoles subulate (72) to narrowly triangular (73), 2–5 mm long, about 0.3 mm wide, ciliate, nearly glabrous to pubescent outside. Calyx 7–9 mm long, white-pubescent or rarely almost glabrous outside, rather densely appressed minute puberulent on the lobes inside, 5-lobed; tube 2.5–3.5 mm long, apparently shorter than the lobes; calyx-lobes with conspicuous long-cuspidate apex, upper lobes 4–5 mm long, lateral and lower lobes nearly subulate (72) to narrowly triangular (73), 5–6 mm long. Corolla purple to violet;

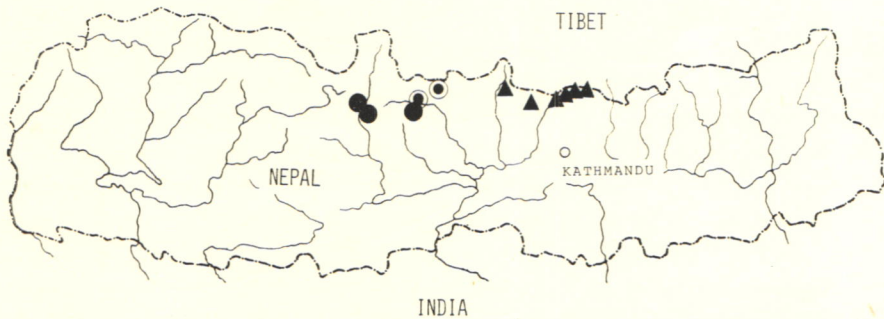


Fig. 59. Distribution of *Hedysarum manaslense* (◉: var. *manaslense*, ●: var. *nepalense*) and *H. campylocarpon* (▲).

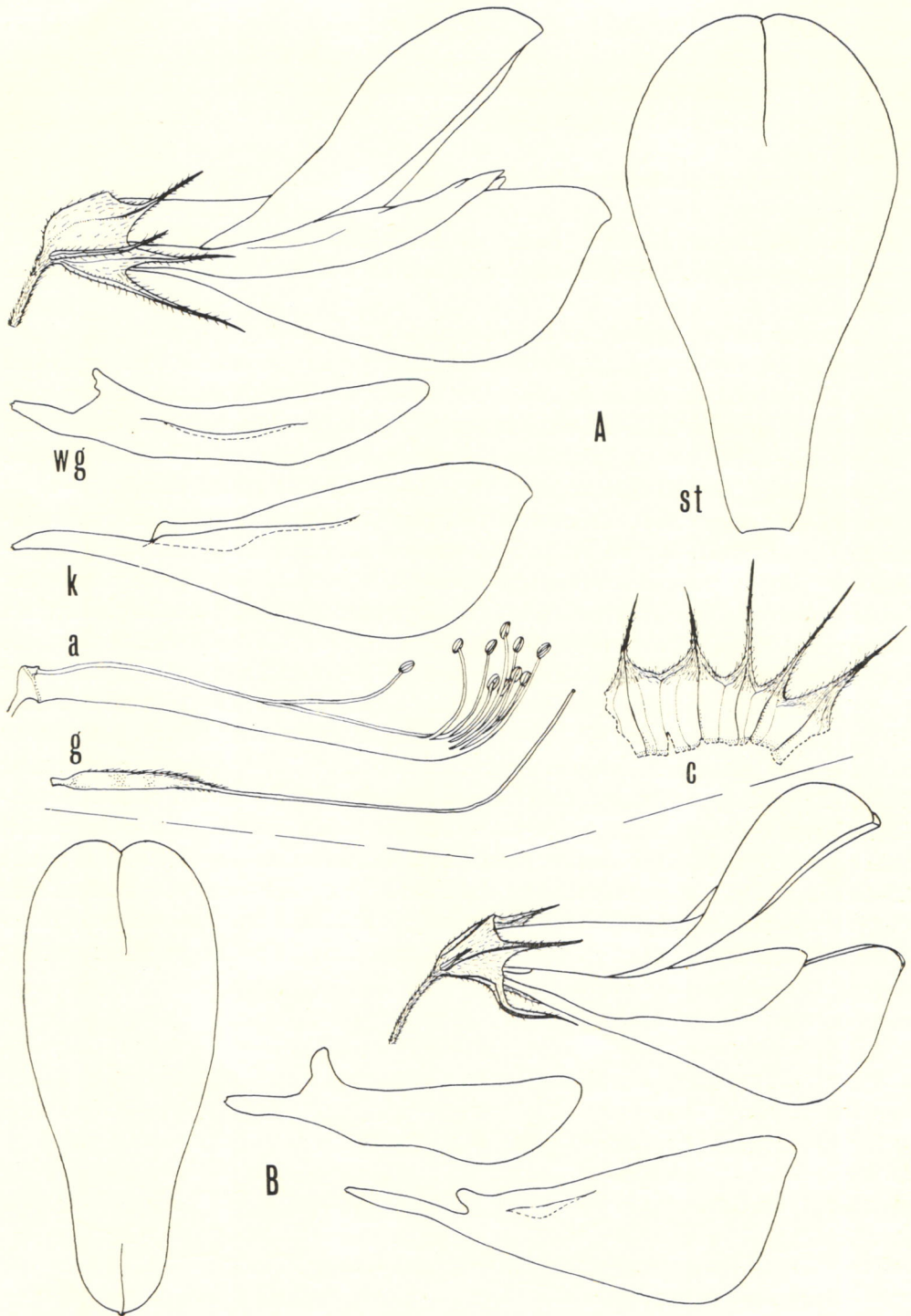


Fig. 60. Flowers of *Hedysarum Falconeri*. c. Calyx from inside, st. Standard, wg. Wing, k. Keel-petal, a. Androecium, g. Gynoecium. All  $\times 4$ . A from Inayat 25563, B from the lectotype.

keel-petals as long as the standard or occasionally a little shorter than the standard, wings distinctly shorter than the other petals. Standard narrowly obovate (46) to obovate (47), emarginate at the apex, 17–20 mm long and 7–10 mm wide, glabrous; wings 13–16 mm long including the claw (claw 3–3.5 mm long), the lamina narrowly elliptic (1), 3–3.5 mm wide, shortly auriculate, obtuse at the apex; keel-petals 17–20 mm long including the claw (claw 4.5–5.5 mm long), the lamina 5–6 mm wide, obtuse or acute at the apex, auriculate at the base. Androecia diadelphous, vexillar stamen 12–14 mm long, usually 6–7 mm shorter than the longest one of the other stamens. Gynoecia 19–22 mm long, minutely stiped (the stipe about 0.5 mm long), the ovary usually 2(–3)-ovuled, 4.5–5 mm long, minutely appressed pubescent, the style 13.5–16 mm long, glabrous. Pods (Fig. 70h) 1–3-jointed, stiped (the stipe 3–4 mm long), rather densely appressed pubescent, reticulate-nerved on both surfaces, both sutures with distinct wings, wings about 1 mm broad and irregularly erose-dentate along the margin; articles broadly elliptic (5) to nearly orbicular (6), 10–13 mm long and 8–10 mm wide.

Distr. N. Afghanistan, Karakoram, Himalaya, and W. Tibet (Fig. 55).

Specimens examined: AFGHANISTAN. Kurrum Valley, Shendtoi, 10000 ft. (Aitchison 786 κ—Syntype of *H. obscurum* var. *affghanicum*). KARAKORAM. Charesa Glacier, 12000 ft., terminal moraine, sheltered area, locally dominant, fls. rose purple, 1.5 ft. high (O. Polunin 6096 BM); Hispar Glacier, left bank, Chokutens, 11000 ft. (R. Scott Russell 1205 BM); Barpu Glacier, left bank, 12500 ft., broken rock, valley side (R. Scott Russell 1109 BM, TI); Solu Glacier, R. bank, 12500 ft. (R. Scott Russell 1737 BM); South facing slope about 4 miles north west of Hispar Village, Nagar State, 11000 ft., dry stony and scree places, fls. rosy purple, 3 ft. (O. Polunin 6337 BM). KASHMIR. Chitral (A. Barrett s.n. κ); Chitral, Madaglast, 10500–11500 ft. (S. M. Toppin 494 κ); Chitral State, E. side of Barum South Glacier, 10500 ft. (B. K. Porter A6 κ); Rana Valley, S. W. of Astor Gilgit Agency, 35°20'N, 75°50'E, stony glacial moraine among scattered pines, 11500 ft. (Lanckester & Pearson TEL1278 BM); Upper Satpura, Baltistan (Sidigi, Nasir & Ali 4129 κ); Kashmir, Godai (Inayat 25563 κ); Kashmir, 10–12000 ft. (Giles 613 κ); loc. cit., 8300 ft. (Giles 149 κ); Gilgit (Tanner 146 κ). WEST TIBET. Common up to near foot of Baltora Glacier (Conway 5 κ); Exact locality unknown (Falconer 441 κ—Lectotype).

*Hedysarum Falconeri* is similar to *H. cachemirianum* and *H. astragaloides*. The flowers of *H. Falconeri* are very similar to those of *H. astragaloides*, but the former differs from the latter in 1) the colour of corolla, i.e., purple to violet in *H. Falconeri* against yellowish in *H. astragaloides*, 2) relative length between the keel-petals and the standard, i.e., standard is as long as the keel-petals in *H. Falconeri* against standard is shorter than the keel-petals in *H. astragaloides*, and 3) relative length of the auricle and the claw of wings, i.e., the auricle is shorter than the claw in *H. Falconeri* against both are nearly equal in *H. astragaloides*.

6) ***Hedysarum kumaonense*** Benth. ex Baker in Fl. Brit. Ind. 2: 145 (1876)—B. Fedtsch. in Act. Hort. Petrop. 19: 311 (1902). [Pl. 13f. Figs. 61, 70e, 71e]

A perennial herb, decumbent to subdecumbent, almost acaulescent, stem less than 5 cm long, internodes usually concealed by the stipule. Stipules leaf-

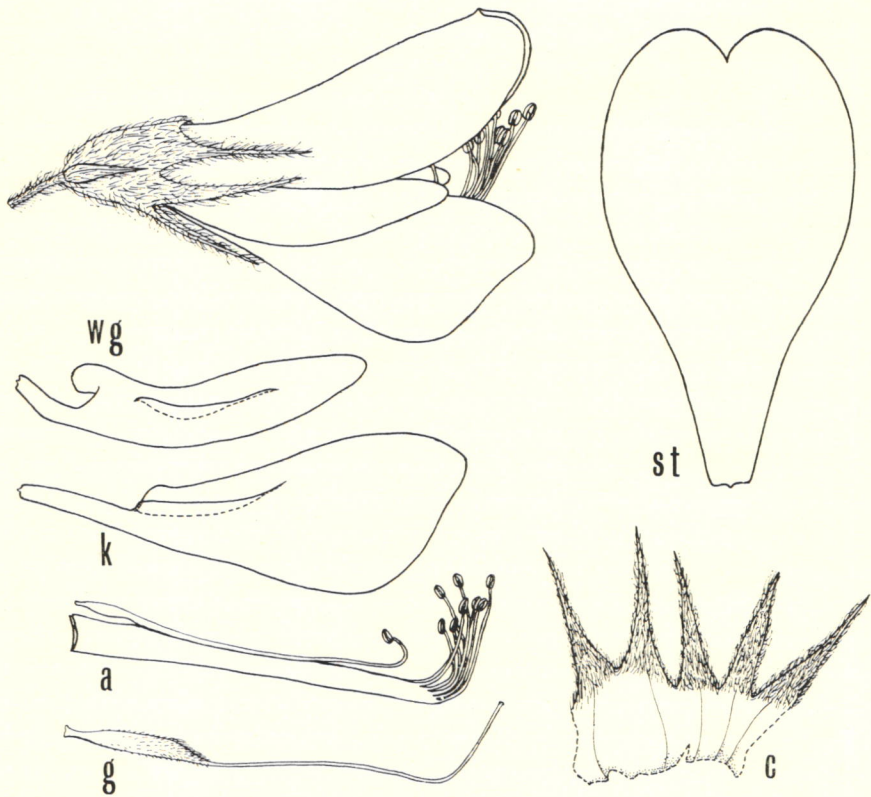


Fig. 61. Flower of *Hedysarum kumaonense*. c. Calyx, wg. Wing, k. Keel-petal, a. Androecium, g. Gynoecium. All  $\times 4$ . From Stainton, Sykes & Williams 856.

opposite, scariose, more or less brown, connate, bifide at the apex, 0.5–2 cm long, densely to sparsely white-pubescent outside. Leaves alternate, 5–32 cm long including the petiole, leaf-rachis sparsely to densely white-pubescent; petioles 0.5–7 cm long; leaflets usually opposite, (13–)17–31(–33) i.e. (6–)8–15(–16) pairs, obovate (47–48) to broadly obovate (49) or sometimes elliptic (3–4) to broadly elliptic (5), retuse to emarginate at the apex, obtuse at the base, (2–)5–15(–18) mm long and (1–)4–11(–14) mm wide, glabrous or sparsely to densely white-pubescent and densely with minute dark dots above, densely white-pubescent and with minute light-coloured dots below, entire along the margin, with minute hair-like appendages at the base of petiolule, stipels absent. Racemes axillary, 4–35 cm long including the peduncle, densely to sparsely white-pubescent along inflorescence-rachis; peduncles (3–)5–30 cm long, sparsely to densely white-pubescent; flowers dense but rarely rather lax, 8–35-flowered per raceme, patent. Bracts narrowly ovate (36–37) to ovate (38), 4–8(–10) mm long and 1–3.5 mm wide, white-pubescent outside, ciliate. Pedicels 1.5–3.5 mm long in flower, densely pubescent. Bracteo-les narrowly ovate (36–37), 2.5–3.5 mm long and 0.5–1 mm wide, pubescent outside, ciliate. Calyx 6.5–8(–10) mm long, densely pubescent, 5-lobed; lobes narrowly triangular (73–74), upper 2-lobes 4–5.5(–7) mm long, longer than or as



long as the lateral lobes, lower lobes 4–5(–6) mm long, shortest or nearly equal to the other lobes. Corolla red, purplish red or pink; standard and keel-petals nearly equal, wings shortest. Standard obovate (47–48), emarginate at the apex, 13.5–16 mm long and (7–)8–8.5 mm wide, glabrous; wings 10.5–13.5 mm long including the claw (claws 2.5–3.5 mm long) and 2–3 mm wide, the lamina narrowly ovate (37), shortly auriculate at the base (auricles ovate or elliptic, 1–1.5 mm long), obtuse at the apex; keel-petals 14.5–15.5 mm long including the claw (claws 3.5–4.5 mm long), 4.5–5.5 mm wide, the lamina obtuse at the apex, shortly auriculate at the base. Androecia diadelphous but vexillar stamen occasionally adherent partly to the other stamens near the middle, vexillar stamen 12–13 mm long, (2–)3–4 mm shorter than the longest one of the other stamens. Gynoecia sessile or short-stiped (the stipes less than 0.5 mm long), 14.5–18 mm long, the ovary 2–3-ovuled, 3.5–5 mm long, densely short-appressed-pubescent, the style 10.5–13 mm long, glabrous. Pods (Fig. 70e) 1–2-jointed, shortly stipitate (the stipes about 1 mm long), with sparsely appressed minute hairs, reticulate-nerved on both surfaces, without wings; articles elliptic (4), 8–9 mm long and 6–7 mm wide. Seeds (Fig. 71e) about  $4.5 \times 3.5 \times 1.5$  mm in size.

Distr. Himalaya from Kumaon to Tibet and Central Nepal (Fig. 62).

Specimens examined: NEPAL. Phoksumdotal, 29°05'N, 82°57'E, 12500 ft., on dry stony slopes (Stainton 4298 BM, TI); Suligad, 9000 ft., open grassy slope (T. B. Shrestha 5273 KATHM, TI); Rohagaon, Suligad, 10000 ft., grass slopes, fls. rose, and undersides of leaves rather silvery (Polunin, Sykes & Williams 2182 BM, TI); loc. cit., 11000 ft., open stony slopes, petals red (Polunin, Sykes & Williams 3381 BM, TI); Barbung Khola, Kakkotgaon, 12000 ft., on dry stony slopes, fls. bright dark pink (Polunin, Sykes & Williams 1097 BM, TI); Kharpu–Durpa, Humla Karnali, 8000 ft., dry grass slopes, corolla dirty cream with red markings (Polunin, Sykes & Williams 4305 BM, TI); Lulo Khola, 15000 ft., on open sunny slopes (Polunin, Sykes & Williams 3480 BM); Purana Mugu–Tankia, Mugu Khola, 13000 ft., open stony slopes (Polunin, Sykes & Williams 5323 BM, TI); Chairogaon, N. of Tukucha, 11000 ft., on open grass slopes (Stainton, Sykes & Williams 774 BM, TI); loc. cit., on open slopes (Stainton, Sykes & Williams 856 BM, TI); Tukucha, 9500 ft., beneath conifers on hillside (Stainton, Sykes & Williams 803 BM, TI); Tukucha, Kali Gandaki, 11000 ft., open grass slopes (Stainton, Sykes & Williams 1927 BM,

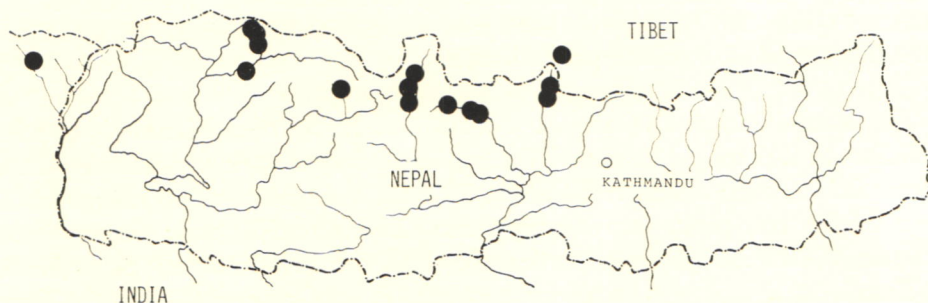


Fig. 62. Distribution of *Hedysarum kumaonense* in Nepal.

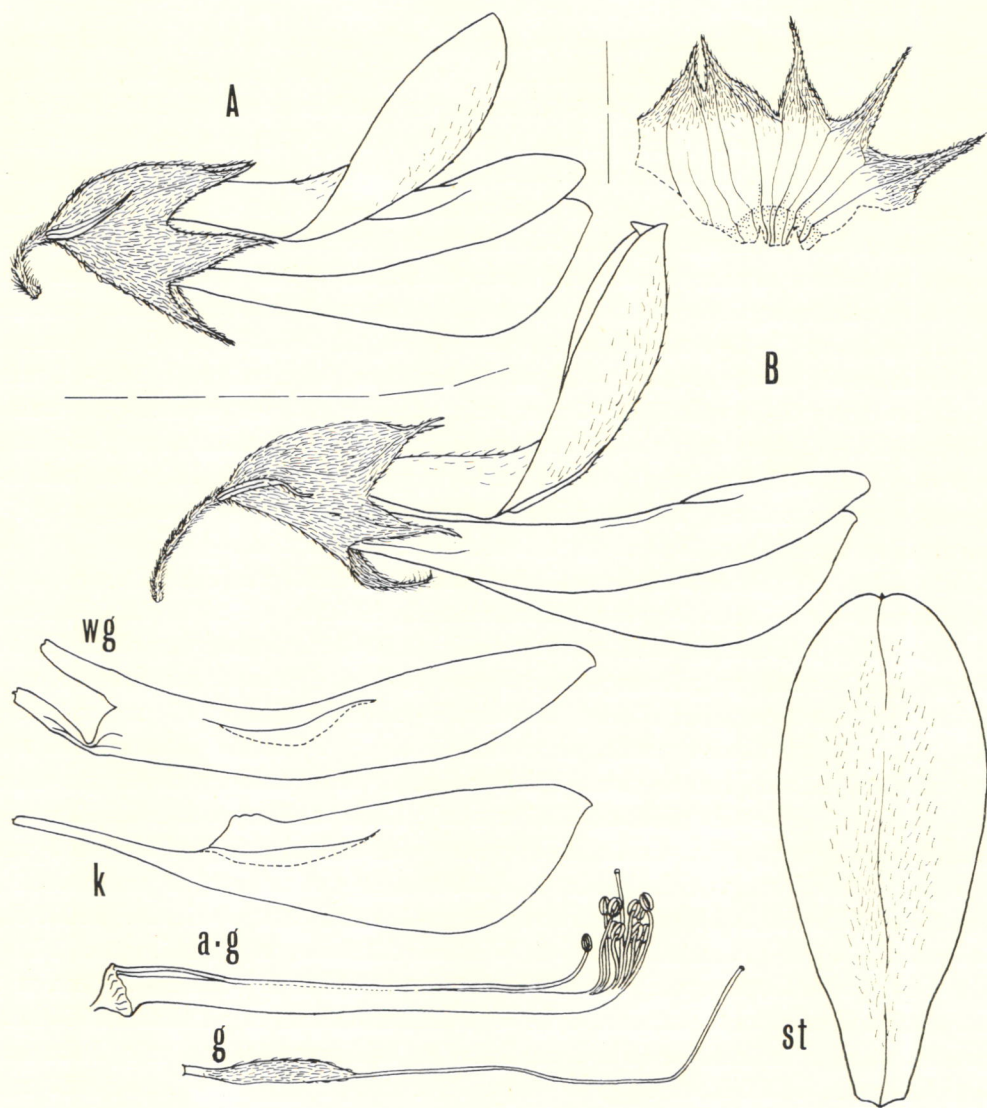


Fig. 63. Flowers of *Hedysarum manaslense*. st. Standard, wg. Wing, k. Keel-petal, a.g. Androecium and gynoecium, g. Gynoecium. All  $\times 4$ . A from S. Nakao, 7 June 1953 (Isotype of *Astragalus manaslensis*), B from D. G. Lowndes 1474 (Isotype of *H. nepalense* var. *subhirtellum*).

TI); Tat Pani-Pisang, 2900 m (S. Nakao s.n. KYO, TI); Manany, 15000 ft. (K. N. Shirma E43 BM); Marsiandi Valley, 11500 ft., on open dry hillsides (D. G. Lowndes L.1000 BM); Marsiandi Valley, 8600 ft., a single plant on shingle slides, flowers bright rose-pink, leaves grey-green (Lowndes 910 BM); Shiar Khola, Thaple La, 8000 ft?, high alpine scree slope (P.C. Gardner 1605 BM); Shiar Khola, near Tumjl, 8500 ft., open bouldery ground (P. C. Gardner 834A BM). TIBET. Track to Thaple La, 13000 ft., grassland on soil bank, flowers red purple (P. C.

Gardner 703 BM).

7) **Hedysarum manaslense** (Kitamura) Ohashi in Journ. Jap. Bot. **50**: 23 (1975). [Pl. 13h. Figs. 63, 70c, 71f]

*Astragalus manaslensis* Kitamura in Kihara, Peoples Nepal Himal. 422 (1957).

*H. nepalense* Ohashi var. *subhirtellum* Ohashi in Journ. Jap. Bot. **49**: 164 (1974).

A perennial, 30–150 cm high. Stems robust, (3–)5–7 mm thick near the base, densely white-tomentose at first but afterwards become less hairy. Stipules leaf-opposite, membranaceous, connate, simple at the apex, up to 2 cm long, glabrous inside, pubescent outside but later glabrescent. Leaves alternate, usually 15–20 cm long including the petiole, leaf-rachis white-tomentose at first; petioles usually 1.5–2.5 cm long; leaflets generally opposite, (15–)17–21(–23) i.e. (7–)8–10(–11) pairs, narrowly ovate (37–38) or narrowly elliptic (2–3), acute to obtuse at the apex, usually 3–6 cm long and 1–2 cm wide, sparsely pubescent above, tomentose beneath, entire along the margin; stipels not present. Inflorescences axillary, up to 20 cm long including the peduncle, usually 20–30-flowered, peduncles and inflorescence-rachis tomentose but later glabrescent. Bracts membranaceous, cymbiformis or narrowly ovate (36–37), acuminate at the apex, 6–11 mm long, 1.5–2 mm wide, sparsely pubescent outside, glabrous inside. Pedicels 3–5 mm long, with densely ascending hairs in flower. Bracteoles narrowly ovate (36), acuminate at the apex, 2.5–5.5 mm long, 0.3–0.8 mm wide, hairy like the bract. Calyx 7–8 mm long, densely minute-pubescent, 4-lobed above the middle; tube more or less longer than the lobes, 3.5–4.5 mm long; upper lobes shorter than the other lobes, transversely broadly triangular, 2–3.5 mm long, 4–6 mm wide at the base, 2-toothed at the apex (the teeth 1.5–2.5 mm long), lateral and lower lobes narrowly triangular (73), 3–4 mm long, 1.5–2 mm wide at the base. Corolla pink to bright purplish pink; wings longer than the other petals, keel-petals longer than the standard, or occasionally all the petals nearly equal. Standard obovate (47), rounded or apiculate, 15.5–19 mm long, 6–9 mm wide, with minute white hairs on both surfaces; wings narrowly elliptic (2), 16.5–23.5 mm long including the claw, 2.5–4.5 mm wide, the lamina obtuse at the apex, distinctly auriculate near the base, the auricles 3–4 mm long, the claw 3–5 mm long; keel-petals 16.5–20 mm long including the claw, 4–6 mm wide, the lamina acute, obtuse or apiculate at the apex, auriculate at the base, the claw 6–7 mm long. Androecia diadelphous, vexillar stamen occasionally adherent partly to the other stamens, 14–18.5 mm long, other 9 stamens connate, 16–21 mm long, the longest one usually about 3 mm longer than the vexillar one. Gynoecia stiped, 17–22 mm long, the ovary 2–3(–4)-ovuled, 4.5–7 mm long, densely minute-pubescent, the style 11–15 mm long. Pods (Fig. 70c) ascending, 2–3(–4)-jointed, 2.5–3.5(–4) cm long, distinctly stipitate, appressed minute hairy or glabrescent, both sutures a little margined, the margin entire; articles narrowly obovate (47), 7–10(–13) mm long, 4–6 mm wide, more or less reticulate-veined. Seeds (Fig. 71f) about 4.5 × 3.5 mm in size.

7-i) Var. **manaslense**.

Distr. Central Nepal (Fig. 59).

Specimens examined: NEPAL. Bimtakothi, 13500 ft. (Lowndes 1474 BM–Holotype of *H. nepalense* var. *subhirtellum* and TI–Isotype); Manaslu (S. Nakao, 7 Jun.

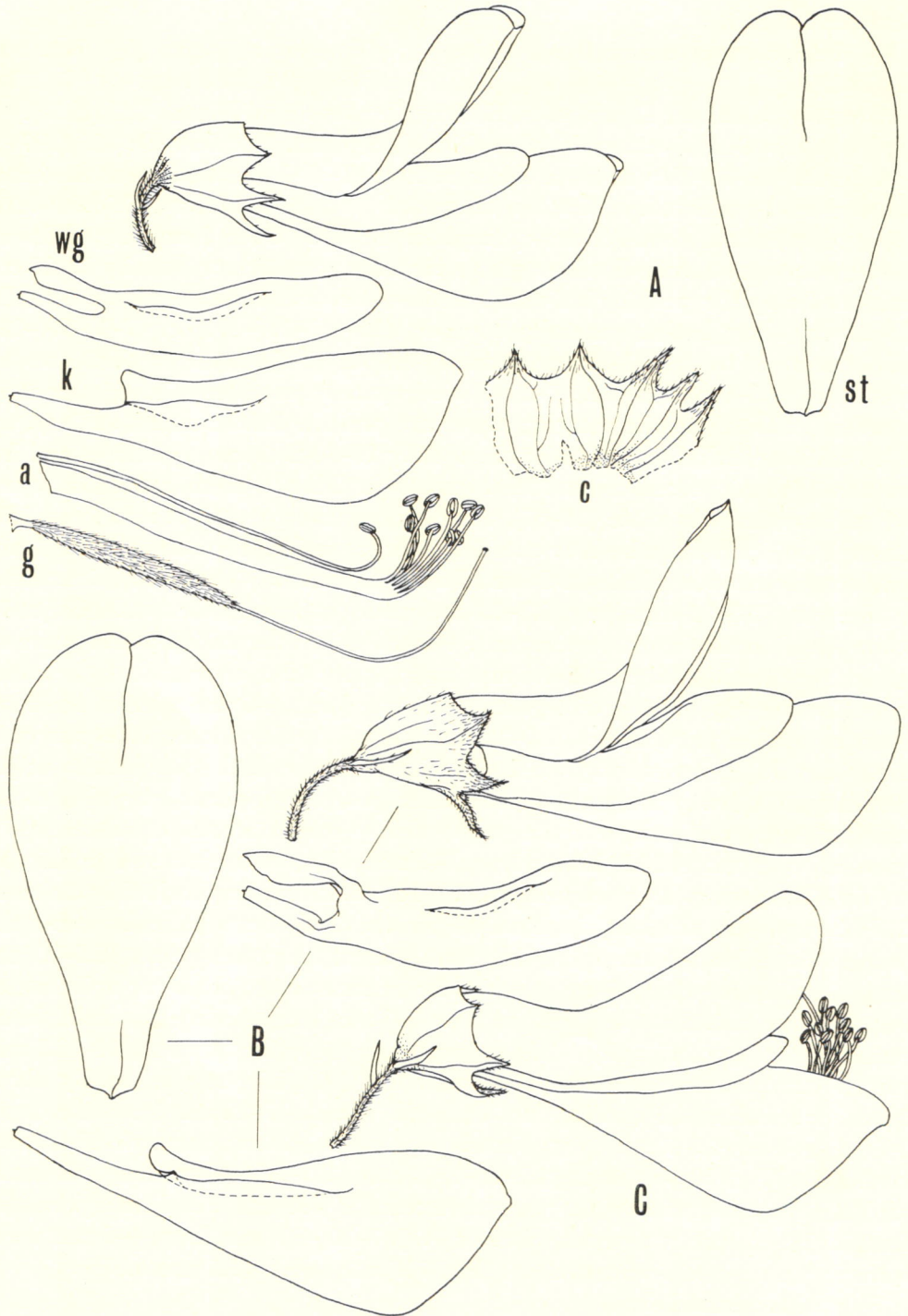


Fig. 64. Flowers of *Hedysarum microcalyx*. c. Calyx, st. Standard, wg. Wing, k. Keel-petal, a. Androecium, g. Gynoecium. All  $\times 4$ . A from G. Sherriff 7453, B from J. R. Drummond 23750, C from Lance s.n. (Syntype of *H. microcalyx*).

1953  $\pi$ -Isotype of *Astragalus manaslensis*).

7-ii) Var. **nepalense** (Ohashi) Ohashi in Journ. Jap. Bot. **50**: 23 (1975).

*Hedysarum nepalense* Ohashi in Journ. Jap. Bot. **49**: 162 (1974).

Distr. Central Nepal (Fig. 59).

Specimens examined: NEPAL. Tukucha, Kali Gandaki, 10000 ft. (Stainton, Sykes & Williams 1080 BM-Holotype of *H. nepalense* and  $\pi$ -Isotype; Stainton, Sykes & Williams 7394 BM,  $\pi$ ; Stainton, Sykes & Williams 7853 BM,  $\pi$ ; Stainton, Sykes & Williams 7995 BM,  $\pi$ ); Taglung, S. of Tukucha, 10000 ft. (Stainton, Sykes & Williams 1698 BM,  $\pi$ ); Marsiandi Valley, 11500 ft. (Lowndes 1065 BM,  $\pi$ ).

8) **Hedysarum microcalyx** Baker in Fl. Brit. Ind. **2**: 147 (1876)-B. Fedtsch. in Act. Hort. Petrop. **19**: 245 (1902)-Ohashi in Journ. Jap. Bot. **49**: 161 (1974).

[Pl. 12c. Figs. 64, 70b]

A robust perennial herb, branched at the top of woody rhizome. Stems erect, up to about 100 cm high, glabrous. Stipules membranaceous, connate along the whole margin, sheathing entirely young leaves and inflorescences, 3-5 cm long, glabrous on both sides. Leaves 3-4(-5)-whorled, 10-25 cm long, glabrous; petioles usually 2-3 cm long; leaflets more or less opposite, (13-)15-17(-19) i.e. (6-)7-8(-9) pairs, narrowly ovate to ovate (37-38) or elliptic (3), acute to obtuse at the apex, obtuse at the base, (20-)25-35(-50) mm long and (7-)10-15(-20) mm wide, glabrescent on both surfaces; stipels absent. Racemes axillary, (5-)10-20 cm long including the peduncle, glabrous or pubescent when young and later glabrescent; (5-)10-30(-35)-flowered per raceme. Bracts narrowly ovate (36-37), (3-)4-6(-8) mm long, glabrous. Pedicels 4-6 mm long, densely pubescent. Bracteoles narrowly ovate (36) to subulate (72), 1-2.5 mm long, attached at the upper part of pedicel. Calyx 3.5-5.5 mm long, almost glabrous, sparsely ciliate along the margin of lobes, 5-lobed, tube 3-4 mm long; lobes apparently shorter than the tube, upper two lobes shallowly triangular, acute at the apex, 0.7-1.5 mm long, lateral and lower lobes longer than the upper ones, triangular (75-76), 1.3-2 mm long. Corolla purple, purplish red or crimson purple; keel-petals longer than the other petals or rarely almost as long as the standard, standard longer than the wings. Standard obovate (47), emarginate at the apex, 14-17 mm long and 6-8 mm wide, glabrous; wings (12-)13-15 mm long and 2.3-3.5 mm wide, auriculate at the base of lamina, claws 2.5-3.5 mm long, auricles usually equal to the claw in length; keel-petals (14.5-)16.5-18 mm long including the claw, the lamina subacute or obtuse at the apex, auriculate at the base, 4.5-6 mm wide, claw 4-5.5 mm long. Androecia diadelphous, vexillar stamen 12-15 mm long, the other 9 connate stamens 15-19 mm long, the longest one about 3 mm longer than the vexillar one. Gynoecia more or less stiped, 19-21 mm long, the ovary 7-8 mm long, glabrous or minutely pubescent, (1-)2-3(-4)-ovuled, the style 10-11.5 mm long, glabrous. Pods (Fig. 70b) (1-)2-3-jointed, long-stipitate (the stipes 4-5 mm long), nearly glabrous or sparsely with minute appressed hairs, reticulate-nerved on both surfaces, both sutures with wings, the wing about 1 mm broad and entire along the margin; articles elliptic (3-4), 8-18 mm long and 5-9 mm wide.

Distr. West Himalaya from Kashmir to Upper Punjab (Fig. 55).

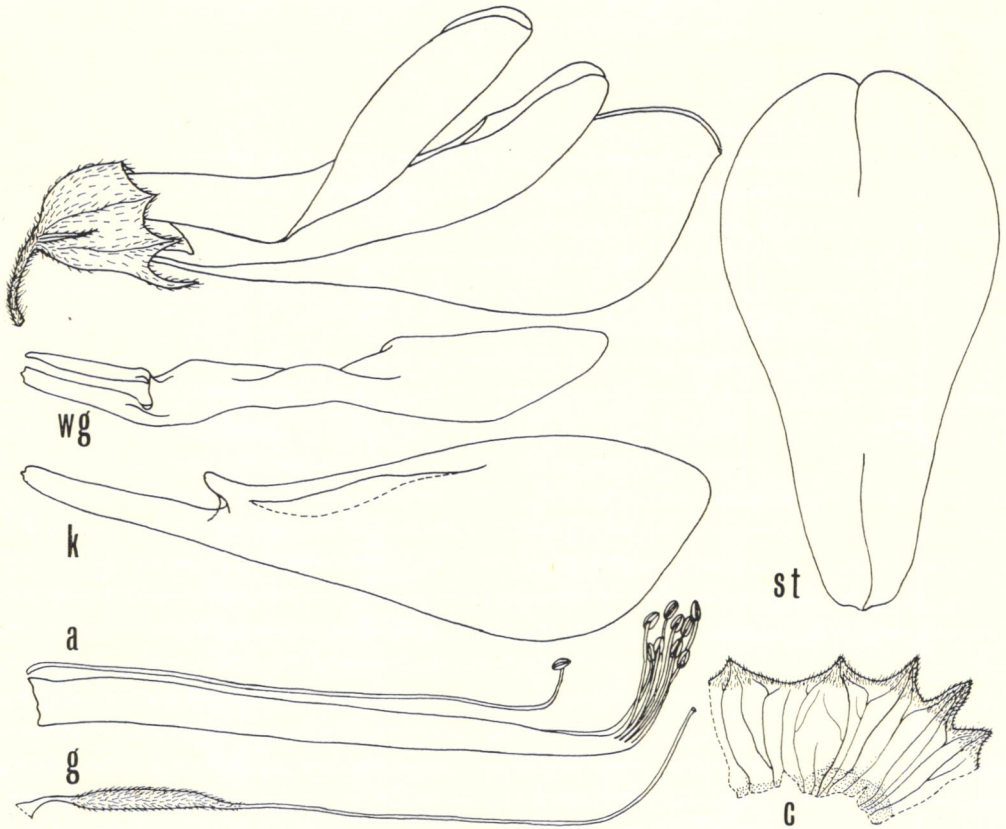


Fig. 65. Flower of the voucher specimen of *Hedysarum microcalyx* illustrated in Botanical Magazine t. 6931 (1887). c. Calyx, st. Standard, wg. Wing, k. Keel-petal, a. Androecium, g. Gynoecium. All  $\times 4$ .

Specimens examined; KASHMIR. Garhwal (Falconer 439  $\kappa$ -Lectotype of *H. microcalyx*); Chenab Valley (Thomson in 1852  $\kappa$ ); Ascent to Sauch Pass, 12000 ft., Chenab Valley (R. Sillis 1547  $\kappa$ ); Tihri, Garhwal (Duthie 1009 & 1010  $\kappa$ ); Kashmir (Lance s.n.  $\kappa$ -Syntype of *H. microcalyx*); Bharmoor, Chamba State, on rocks above Rajaor, 10500 ft., fls. purple (Unknown collector s.n.  $\kappa$ ); Pangi, Chamba State, below Biudratan, 8500 ft. (Duthie s.n.  $\kappa$ ). PUNJAB. Lahul (H. Jaeschke 235  $\kappa$ -Syntype of *H. microcalyx*); Lahul, Kandang, 10300 ft., a shrub with purple flowers (N. L. Bor 14994  $\kappa$ ); Lahul, Sissu, 10000 ft., purple fls. (N. L. Bor 12384 & 10295  $\kappa$ ); Lahul, Kyelang-Jespa, 10500 ft., a shrub on steep rocky wet places, flowers purplish red (N. L. Bor 16411  $\kappa$ ); Lahul, Gambur, 10200 ft., a herbaceous shrub in shade (N. L. Bor 13199  $\kappa$ ); no precise locality (J. R. Drummond 23485, 23750  $\kappa$ ); Simla Hill States, Baspa Valley, Lat.  $31^{\circ}23'N$ , Long.  $78^{\circ}30'E$ , 14500 ft., on banks of streams, flowers grape purple (G. Sherriff 7453 BM).

We examined the voucher specimen of *Hedysarum microcalyx* illustrated in Botanical Magazine t. 6931 (1887). The plant was cultivated at Kew Garden and collected on 16 June 1886. However, the specimen differs from *H. microcalyx* as follows:

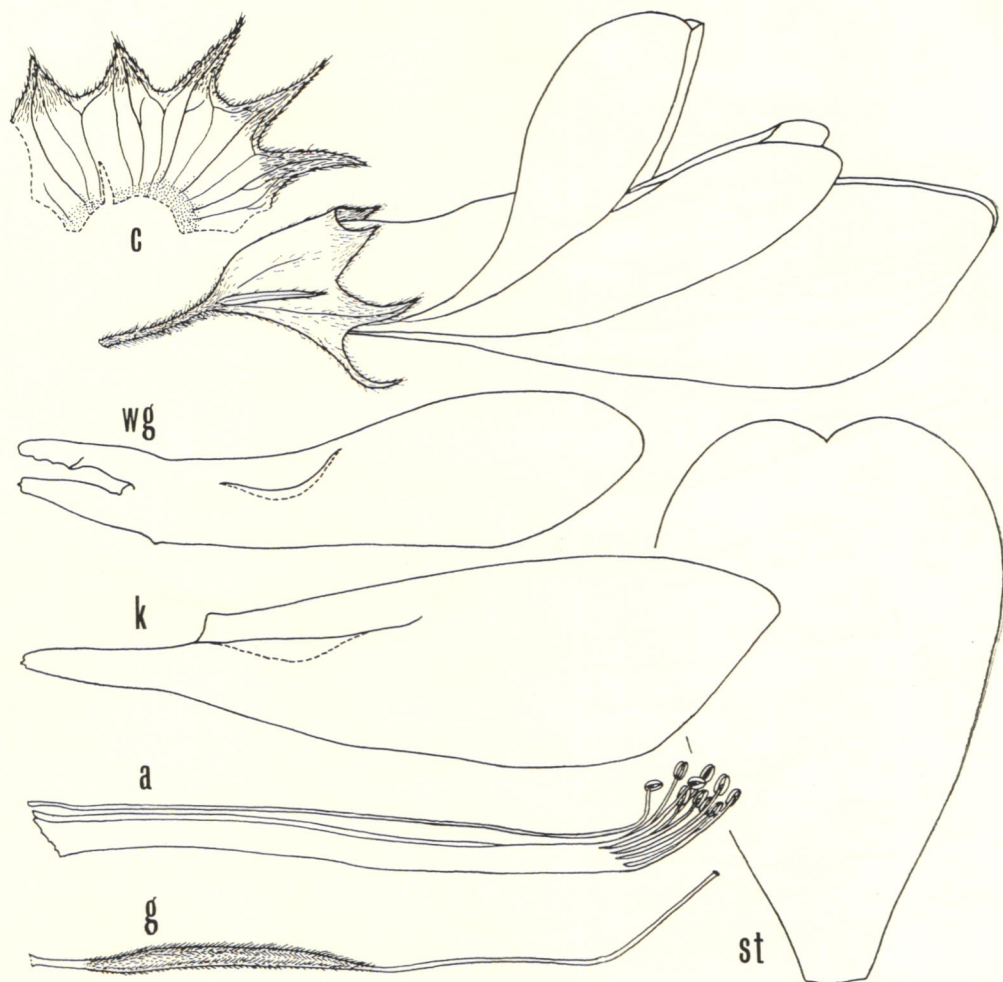


Fig. 66. Flower of *Hedysarum pseudomicrocalyx*. c. Calyx, st. Standard, wg. Wing, k. Keel-petal, a. Androecium, g. Gynoecium. All  $\times 4$ . From the holotype.

	Specimen of Bot. Mag. t. 6931	<i>H. microcalyx</i>
Leaves	alternate	whorled
Stipules	connate along the leaf-opposite margin	connate along the whole margin, hence, envelop the bud
Flowers	longer than 20 mm	15-18 mm long
Standards	shorter than the wings	longer than the wings
Ovary	4-5-ovuled	(1-)2-3(-4)-ovuled

The voucher specimen is very similar to *H. alpinum* L. but differs from the species in having bracts which are longer than the pedicel.

9) ***Hedysarum pseudomicrocalyx*** Ohashi et Tateishi, sp. nov.

[Pl. 14i. Fig. 66]

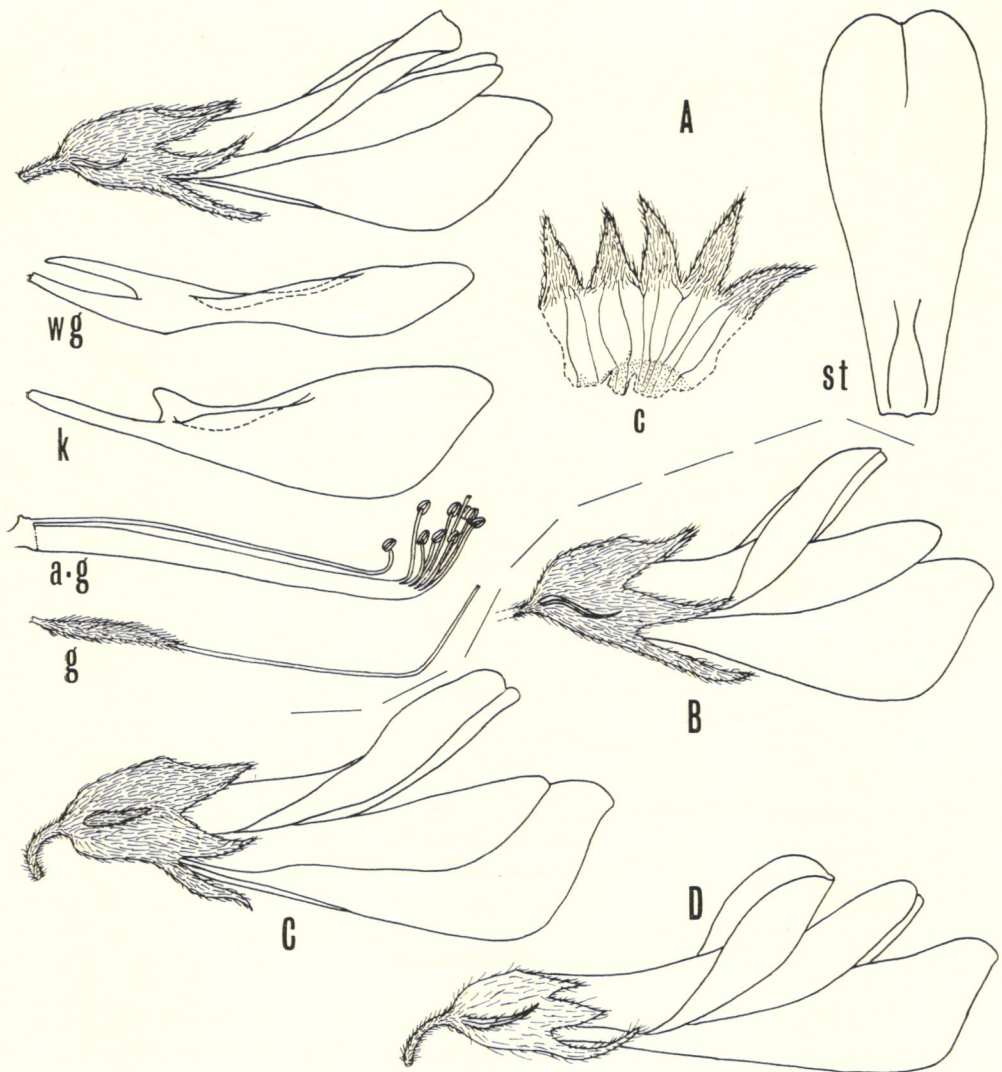


Fig. 67. Flowers of *Hedysarum sikkimense*. c. Calyx, St. Standard, wg. Wing, k. Keel-petal, a.g. Androecium and gynoecium, g. Gynoecium. All  $\times 4$ . A from J. D. A. Stainton 985 (Nepal), B from J. D. A. Stainton 630 (Nepal), C from Kanai et al. 720706 (Nepal), D from Forrest 30747 (China).

Planta perennis, 40 cm vel ultra alta. Caules erecti, robusti, glabrescentes. Stipulae foliis oppositae connatae, brunneae, membranaceae, juventute gemmam totam vaginantes, ca. 2 cm longae, glabrae. Folia opposita, vulgo (petiolo 1–1.5 cm longs incluso) 8–14 cm longa, rhachi sparsim adpresse pubescentia. Foliola 6–7-juga, generaliter opposita, elliptica (3) vel ovata (38), vulgo 25–35 mm longa 12–18 mm lata, apice obtusa vel acuta, utrinque sparsim vel paulo dense adpresse pubescentia, margine integra; sine stipellis. Inflorescentiae axillares ramosae, plerumque floribus 13–21 ornatae, vulgo 10–15 cm longae; pedunculo 5–7 cm



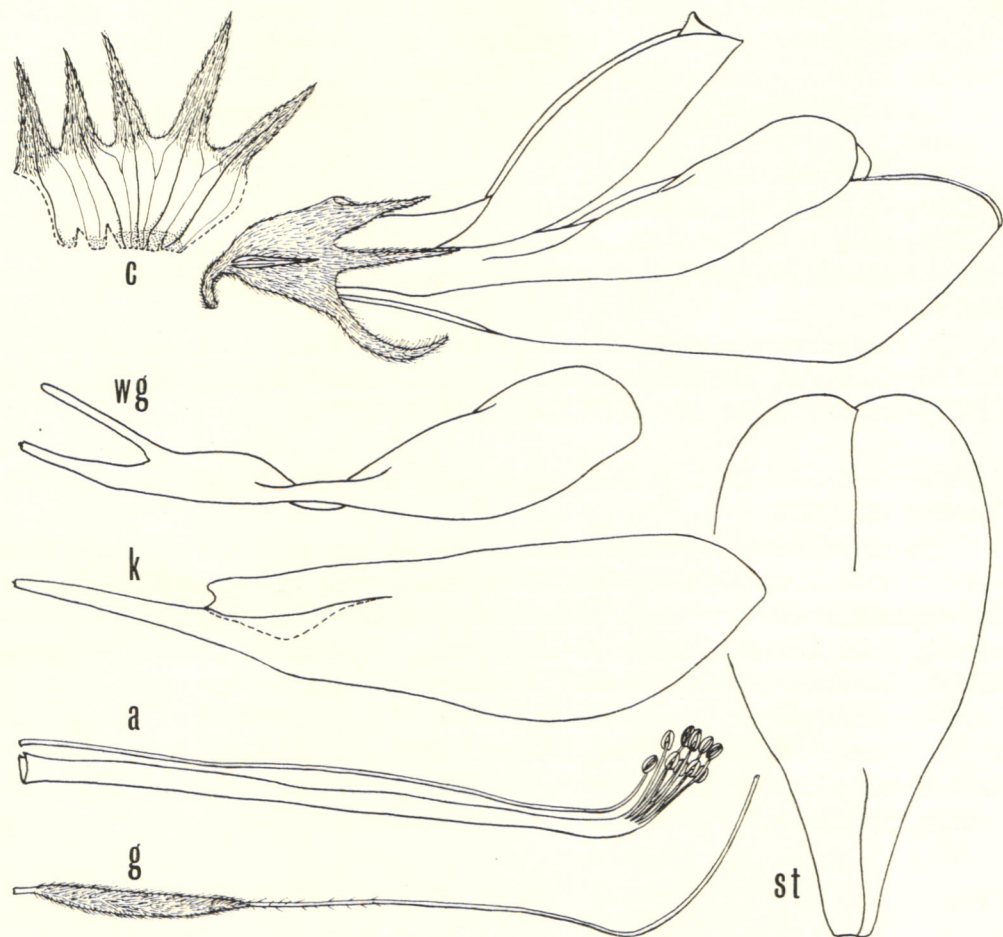


Fig. 68. Flower of *Hedysarum sikkimense* var. *megalanthum*. c. Calyx, st. Standard, wg. Wing, k. Keel-petal, a. Androecium, g. Gynoecium. All  $\times 4$ . From the isotype.

longo, glabrescenti, sed rhachi, tomentosis. Bracteae membranaceae, caducae, anguste ovatae (37), apice acuminatae, vulgo 12–13 mm longae et ca. 3 mm latae, utrinque glabrae, ciliatae. Pedicelli 3–5 mm longi per anthesin, dense adscenderter pubescentes. Bracteolae subulatae (72), ca. 4 mm longae et 0.3 mm latae, sparsim ciliatae. Calyx 6–7.5 mm longus, supra medium 5-fidus; tubo laciniis longiore, ca. 4 mm longo, fere glabro; lacinia postica ceteris brevior, latissime triangulari (79), ca. 2 cm longa, laciniis lateralibus et antica anguste triangularibus (74), 3–3.5 mm longis basi ca. 1.5 mm latis. Vexillum obovatum (48), apice emarginatum, alis et carinis brevius, 18–20 mm longum et 10.5–12 mm latum, utrinque glabrum; alae unguiculatae, (ungue 3.5–3.8 mm longo incluso) 20–21 mm longae et 4–5 mm latae, apice laminarum obtusae prope basin distincte auriculatae (auricula 3.5–4 mm longa); carina petalis ceteris longior, unguiculata, (ungue 5–6 mm longo

incluso) 24.5–26 mm longa et 6–7.5 mm lata, apice laminae obtusa. Stamina diadelpha, vexillari ca. 22 mm longa, ceteris 22–24 mm longa. Pistillum 25–26 mm longum, stipitatum (stipite ca. 2 mm longo); ovario 4–5-ovulato, ca. 9 mm longo, dense et breviter adpresse piloso; stylo 14–15 mm longo, glabro. Legumen ignotum.

Typus. HAZARA. Kagan (J. F. Duthie 21252, 12 July 1897 κ).

Distr. W. Himalaya: Hazara (Fig. 55).

This species is similar to *Hedysarum microcalyx*, but differs clearly in having opposite leaves and larger flowers with standard which is shorter than keel-petals and wings.

10) ***Hedysarum sikkimense*** Benth. ex Baker in Fl. Brit. Ind. **2**: 145 (1876)–B. Fedtsch. in Act. Hort. Petrop. **19**: 245 (1902)–Hand.-Mzt., Symb. Sin. **7**: 565 (1933)–Lauener in Not. Bot. Gard. Edinb. **30**: 246 (1970).

[Pls. 4b, 15. Figs. 67, 68, 70g, 71b]

*Astragalus Mairei* Lévl. in Bull. Acad. Géog. Bot. **25**: 49 (1915) & Cat. Pl. Yunnan 152 (1916).

A perennial herb, copiously branched at the top of woody rhizome. Stem slender, up to 35 cm high including the raceme, sparsely white-pubescent. Stipules leaf-opposite, scarioso, connate, bifide at the apex, 0.8–1.7 cm long, sparsely pubescent outside. Leaves alternate, 2–12 cm long including the petiole, leaf-rachis almost glabrescent; petioles usually less than 1 cm long; leaflets opposite, 19–29 i.e. 9–14 pairs, elliptic (3) or sometimes ovate (38), obtuse or slightly emarginate at the apex, obtuse at the base, 3–1.4 mm long and 1.5–7 mm wide, glabrous and densely with minute dots above, appressed pubescent on the midrib or uniformly appressed white-pubescent and with minute dots below, entire along the

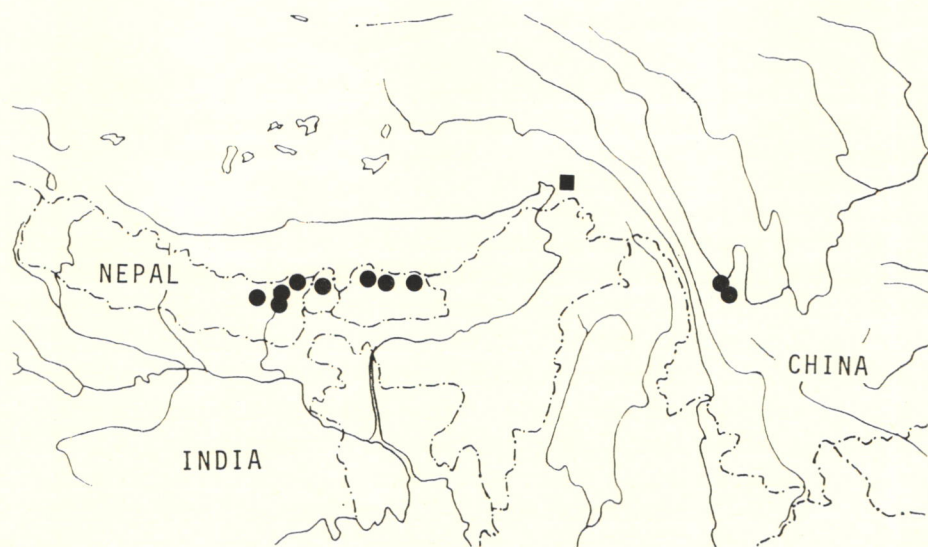


Fig. 69. Distribution of *Hedysarum sikkimense* var. *sikkimense* (●) and var. *megalanthum* (■) based on specimens examined.

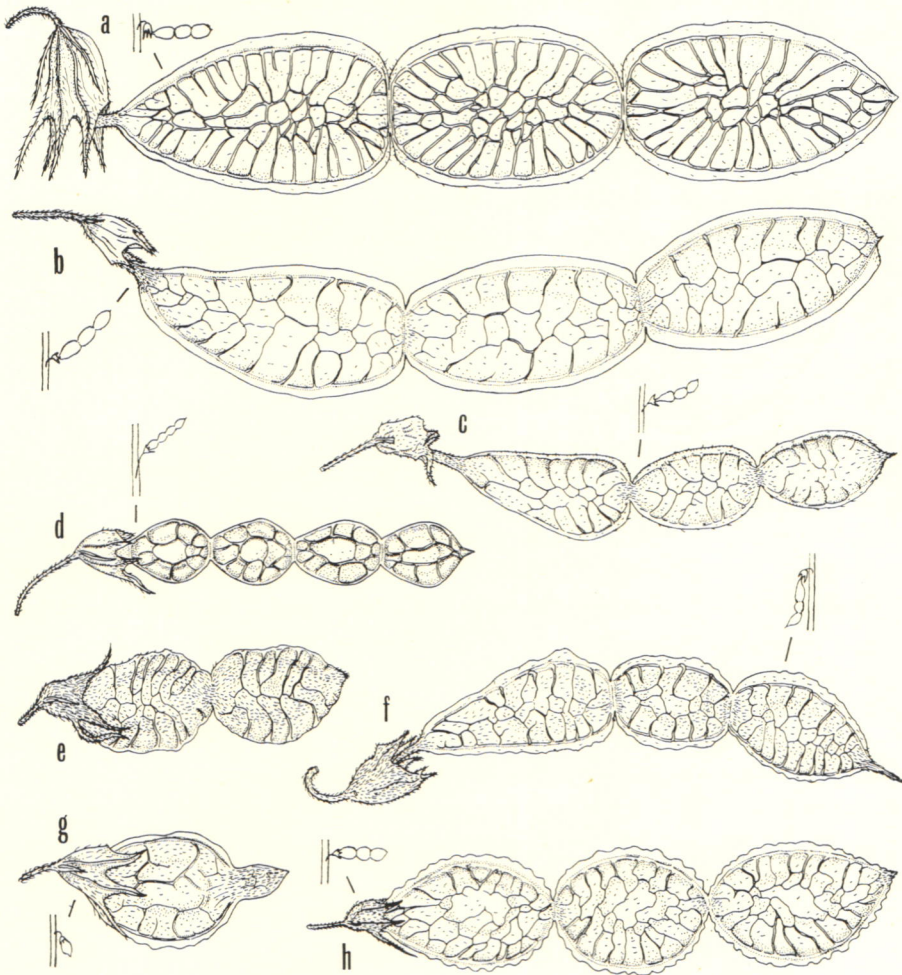


Fig. 70. Pods of the Himalayan species of *Hedysarum*. a. *H. cachemirianum* (O. Polunin 56/566), b. *H. microcalyx* (J. R. Drummond 23750), c. *H. manaslense* var. *nepalense* (Stainton, Sykes & Williams 7995), d. *H. alpinum* subsp. *laxiflorum* (lectotype), e. *H. kumaonense* (Polunin, Sykes & Williams 3480), f. *H. campylocarpon* (Dhwoj 0408), g. *H. sikkimense* (Kanai et al. 720706), h. *H. Falconeri* (lectotype). All  $\times 2$ .

margin; stipels absent. Racemes axillary from the axil of upper leaf, usually each one from one axil, 4–15 cm long including the peduncle, densely pubescent along inflorescence-rachis in flower but becoming nearly glabrous in fruit, flowers dense to rather lax, 8–25-flowered per raceme, patent or pendulous in flower. Bracts narrowly ovate (37) to ovate (38), 3.5–10 mm long and 0.7–3 mm wide, pubescent or occasionally glabrescent outside, ciliate. Pedicels 2–5 mm long in flower, densely pubescent. Bracteoles narrowly ovate (36), 1.3–4 mm long and 0.3–1 mm wide, pubescent outside, ciliate. Calyx 6–7.5(–9) mm long, densely pubescent to rarely

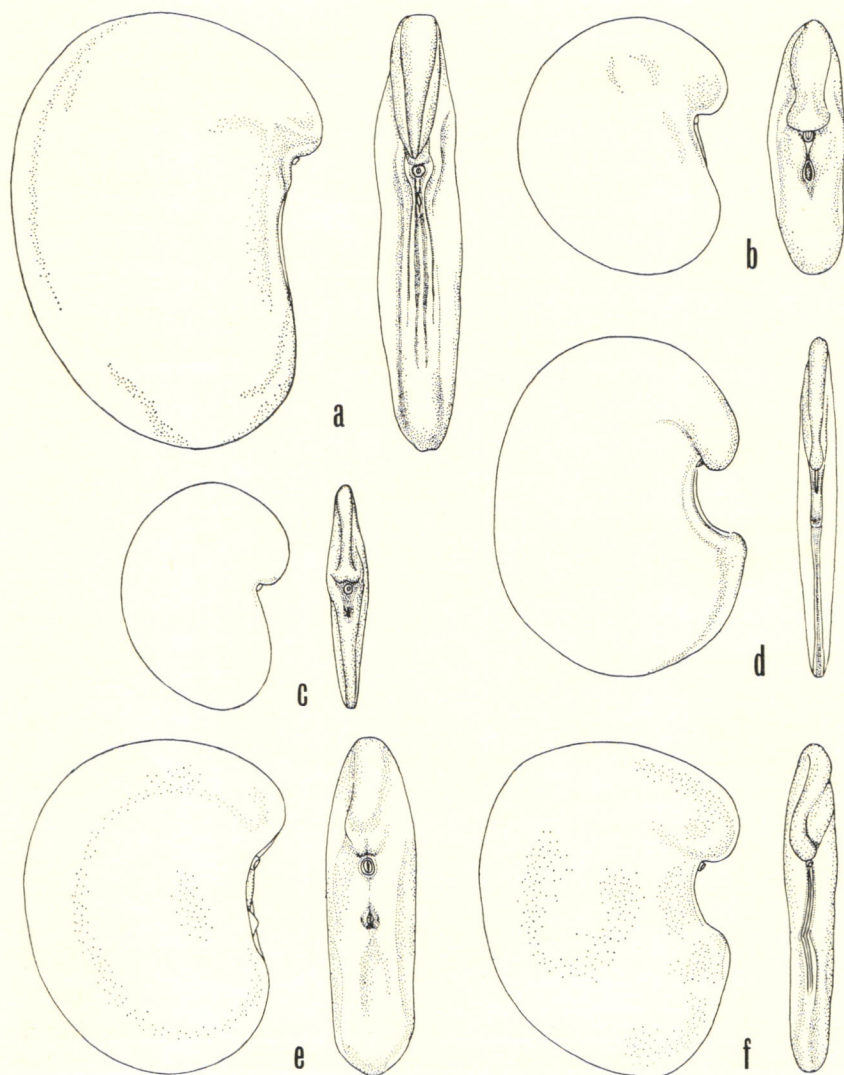


Fig. 71. Seeds of the Himalayan species of *Hedysarum*. a. *H. cachemirianum* (O. Polunin 56/566), b. *H. sikkimense* (Kanai et al. 720706), c. *H. alpinum* subsp. *laxiflorum* (lectotype), d. *H. campylocarpon* (Dhwoj 0408), e. *H. kumaonense* (Polunin, Sykes & Williams 3480), f. *H. manaslense* var. *nepalense* (Stainton, Sykes & Williams 7995). All  $\times 10$ .

nearly glabrous, 5-lobed above the middle; lobes narrowly triangular (74), lower lobes 3–4.5(–6) mm long, longer than the other lobes, upper lobes 1–3(–5) mm long, shorter than the others or as long as the lateral lobes. Corolla mauve, purple, reddish purple; keel-petals longer than the other petals, standard shorter than the wings or rarely equalling or a little longer than the wings. Standard narrowly obovate (46) to obovate (47), emarginate or occasionally almost obtuse at the apex, 12.5–15.5(–21) mm long and 5.5–6.5(–10.5) mm wide, glabrous; wings 13–16.5

(-24) mm long including the claw (claws 3.5-4.5 mm long), 2-2.5(-4.5) mm wide, the lamina nearly narrow-elliptic (1), long-auriculate (auricles linear, 3-4.5 mm long), obtuse at the apex; keel-petals 14.5-18(-27) mm long including the claw (claw 4-7 mm long), 4-5(-6.5) mm wide, the lamina subacute at the apex, auriculate at the base. Androecia diadelphous, vexillar stamen 12-16(-24) mm long, usually 2-4 mm shorter than the longest one of the other stamens. Gynoecia 17-19.5(-28.5) mm long, stiped (the stipe 0.5-1 mm long) or sometimes sessile, the ovary 2(-3)-ovuled or 5-ovuled, 3-5.5 or about 7 mm long, densely appressed-pubescent, the style 12-15 mm or 18-21 mm long, glabrous or sparsely minute-pubescent near the ovary. Pods (Fig. 70g) 1-2(-3)-jointed (or probably 5-jointed in var. *megalanthum*), shortly stipitate (the stipes 1-3 mm long), with sparsely appressed minute hairs, reticulate-nerved on both surfaces, both sutures with narrow wings, wings about 0.5 mm broad and minutely erose-dentate along the margin; articles almost orbicular (6) or broadly elliptic (5), 8-10 mm long and 6-8 mm wide. Seeds (Fig. 71b) 3-3.5 × 3 × 1 mm in size.

10-i) Var. **megalanthum** Ohashi et Tateishi, var. nov.

*H. tanguticum* Fedtsch. in Bot. Centralbl. **84**: 274 (1900).

*H. tongolense* Ulbr. in Bot. Jahrb. **50**, Beibl. 110: 19 (1913).

A typo floribus 23-28 (nec 13-19) mm longis, ovariis 5 (nec 2-3)-ovulatis et in anthesis infra paginis foliorum albo-pubescentibus (nec praeter costas pubescentes glabris) differt.

S. E. TIBET. Showa La, 9500 ft., fls. purplish pink, calyx brownish green, open hill slope (Ludlow, Sherriff & Elliot 13160 BM-Holotype, TI-Isotype).

Distr. Yunnan, Szechuan, S.W. Kansu, and Tibet (Fig. 69).

10-ii) Var. **sikkimense**.

Distr. Himalaya (Kashmir to Bhutan), Yunnan, and Szechuan (Fig. 69).

Specimens examined: NEPAL. Arun-Tamur Watershed, Thagla Bhanjyang, N. of Topke Gola, 14000 ft., on riverside ground, corolla purple, calyx reddish green (J. D. A. Stainton 985 BM, TI); Arun Valley, Barun Khola, N. of Num, 12500 ft., on rocky slope, corolla mauve (Stainton 630 BM, TI); Inukhu Khola, Naulekh Muni, 27°30'N, 86°45'E, 13500 ft., among dwarf shrubs, reddish purple flowers (D. McCosh 310 BM, TI); Thudam-Lama Chungbu, 3400-4200 m (Kanai et al. 727272 TI); Lama Chungbu, 4200 m, fl. durk purple, pendulous (Kanai et al. 720706 TI); Inukhu Khola, Dudh Kosi, 14000 ft., bright purple flowers, growing among dwarf shrubs (S. B. Lyon 2079 BM); Dadh-kund, 16-18000 ft. (Lall Dhwoj 0376 BM). BHUTAN. Me La, Cho La Valley, 12500 ft., fl. purple, flat open grassland (Ludlow, Sherriff & Hicks 20435 BM, TI); Ckebisa, 13000 ft. (R. E. Cooper 1754 BM). CHINA. Yunnan, Lichiang Range (McLaren's native collectors 39a BM); Yunnan (G. Forrest 5823 BM); loc. cit. (G. Forrest 30747 TI); No precise locality (R. E. Maire 121/1914 BM).

The flowers of the Chinese specimens of the species are less expanded than those of the Nepalese ones. The specimens from Nepal and those from Bhutan differ clearly from each other in flower. Further studies based on ample materials from Sikkim and Bhutan are apparently needed.

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