A REVISION OF THE ASTERS OF THE HIMALAYAN AREA

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INTRODUCTION

UP to the present time, apart from isolated references, information on the genus *Aster* in Asia has been derived from the Flora U.R.S.S. (1959), so far as the central and northern parts of Asia and Siberia are concerned and, less recently, from Handel-Mazzetti's papers (1936, 1937 and 1938) on the species of Western China. Onno's revision (1932) is now largely out-of-date and was applied on a world-wide basis to *A. alpinus* and the species related to it. Thus, for the rich Himalayan area (here roughly defined as the area bounded between the Himalayan range and the northern frontier of Tibet to the south and north, and the Mekong-Salween divide and the W. Pakistan-Afghanistan frontier to the east and west) there has not been a general account of *Aster* since Hooker's Flora of British India (1881).

The western part of the Himalayan range was adequately collected by the end of last century but the botanical exploration of Nepal, Bhutan and south-eastern Tibet has, for the most part, only been possible since that time. The volume of material from these countries has greatly increased during the last thirty years enabling a fuller account of these species to be written than was possible in Hooker's time. In the past, the classification of Himalayan and Western Chinese plants has gone on to some extent in separate watertight compartments, but the distribution of many of them overlap these boundaries and an examination of almost any group of species from these areas must disclose several superfluous names.

The present paper is a preliminary to another equally pressing revision of the species of *Erigeron* from the same area which the author has in hand. *Aster* and *Erigeron* are so closely allied that a certain amount of confusion has existed between them and a revision of one must necessitate a definition of their mutual boundary, at least so far as it affects their representatives in this region. Such a definition is discussed in the following pages but it must be pointed out that *Erigeron* as understood here includes only Sect. *Trimorphaea* and Sect. *Erigeron*. The views of Cronquist (1943, 1947) and Solbrig (1962) are followed in respect of *E. canadensis* and other members of Sect. *Coenotus* and they are regarded as species of *Conyza*. This treatment gains support from the embryological evidence produced and expounded by Harling (1951). Sect. *Conyzastrum* Boiss. and Sect. *Pseudoconyzastrum* Rech. f. are also excluded on the grounds that, because of their homochromous flowers, their sterile disc achenes and their usually distinctive habit, they together make up a separate and natural genus, *Psychrogeton* Boiss., which has been largely overlooked.

As well as the species of *Aster s. str.*, this paper also takes account of some species that are related to and have from time to time been described as Asters but are now placed in different genera. Thus *A. altaicus* Willd. and its allies are treated here under *Heteropappus* Less., and *A. indicus* Linn.,

which has been variously placed in *Calimeris* and *Asteromoea*, is included here under *Boltonia*. The latter is a return to Bentham's treatment of *Boltonia* on the grounds that the structure of the Asiatic species can be derived from the American representatives of this genus and there is no reason why it should not be common to both continents. It is doubtful whether *B. indica* is truly indigenous to the Himalayan area, but there can be no doubt that *Callistephus sinensis* occurs only as a cultivated species and consequently it finds no place in this paper, nor do the American species of *Aster* that have escaped from cultivation as has been observed in the case of *A. pilosus* Willd. (originally as *A. ericoides*) e.g. *Raizada* 7438(K) from Chakrata, Jaunsar, N.W. India.

MORPHOLOGY OF THE HIMALAYAN ASTERS AND THE DELIMITATION OF ERIGERON AND OTHER GENERA

The precise limits of *Aster* have long been questioned, especially vis-à-vis *Erigeron*, and while this section does not set out to circumscribe all the minor genera that are closely related to *Aster*, it does attempt to define the boundary between these two principal genera.

HABIT: Of the 33 species of *Aster* described in this paper 28 are herbaceous perennials and the remainder in varying degrees suffrutescent; annual and biennial aster-like plants belong to *Heteropappus* (which also includes some perennial taxa) or to *Callistephus* Cass. In stature, 18 species of *Aster* are regularly more than 30 cm tall, 4 of them approaching or attaining 1 metre, and 2 of them, *A. trinervius* and *fulgidulus*, over 2 metres. Of the remainder, 6 often attain 30 cm and the rest do not exceed 20 cm. The Asiatic species of *Erigeron* are probably all perennials as well, but seldom do they exceed 30 cm in height, and never, it seems, are they shrubs.

The species of *Aster* almost exclusively have short horizontal rhizomes forming loose or dense clumps of flowering stems. Well-developed stolons occur in several species, e.g. *A. tricephalus* and *neo-elegans*, and may become an obvious feature of some species, as in *A. stracheyi* where they measure as much as 30 cm long. Among the Himalayan species tap-roots are seldom encountered, e.g. in *A. bipinnatisectus*, and such roots are more often a feature of *Heteropappus* and *Boltonia* species. Among the Asiatic Asters, tuberous roots, like those of *Ranunculus ficaria*, are characteristic only of *A. asteroides;* elsewhere in the *Aster* group at large, similar roots are found in the South African *Diplopappus asper* Less. Long fleshy roots are present in *A. diplostephioides*, which is related to *A. asteroides*, and probably its roots should be regarded as an extended form of the short tuberous condition.

The species of Subsect. *Homochaeta* are divided on the origin of their peduncles. In some they are borne terminally on the rhizome amid a rosette of basal leaves, in others the peduncles are extra-rosulate and spring directly from the rhizome below the rosette of leaves. In *A. hypoleucus* (Sect. *Orthomeris*), which is a dwarf shrub, the peduncles are unique in becoming hardened at maturity and persisting after the capitula have fallen.

INDUMENTUM: *Aster* species are, generally speaking, pubescent and the hair type is simple never stellate. The trichomes may be few- or many-celled, the latter varying from the fine tomentose condition, such as in *A. albescens* and *hypoleucus* (see Fig. 1, C), to the thicker villous hair which is very common

especially at the base of the capitula, e.g. *A. flaccidus* (see Fig. 1, A). The few-celled hairs on the leaves of some specimens of *A. trinervius* are unusual in being scabrous and having swollen basal epidermal cells (see Fig. 1, B).

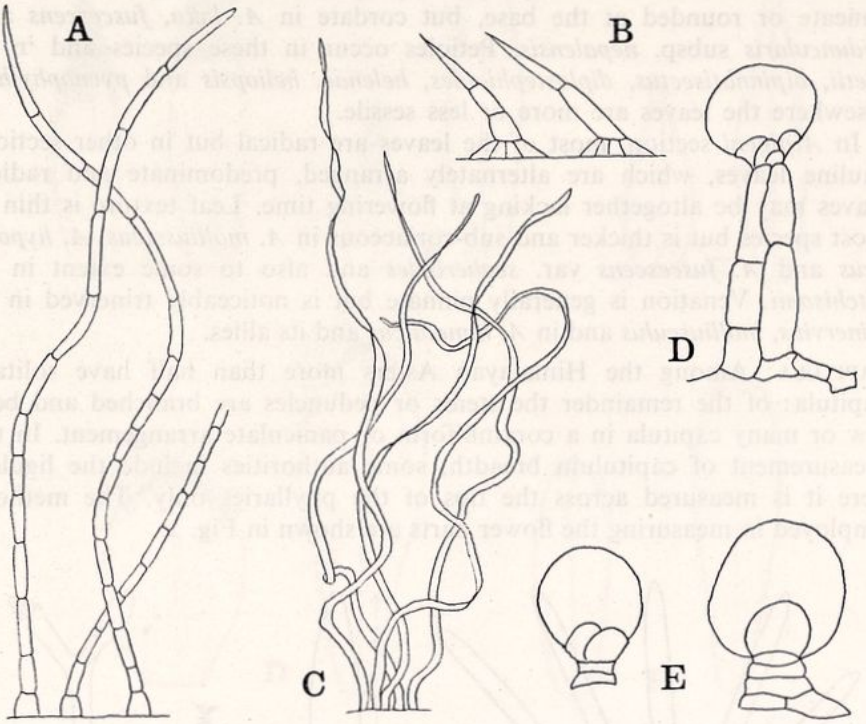

FIG. 1. Hairs and glands.
A, villous hairs from *Aster flaccidus* involucre (×5); B, asperate hairs from surface of *A. trinervius* leaf (×10); C, fine tomentose hairs from under surface of *A. albescens* leaf (×15); D, stipitate gland from *Heteropappus crenatifolius* peduncle (×50); E, subsessile glands from *A. albescens* leaf (×50).

The distribution of hair shows little specialisation; almost every species is pubescent at least on the peduncles, on the undersides of the leaves, especially on the veins, and on the phyllaries at least at the margin, with the possible exception of *A. stracheyi* in which the phyllaries are sometimes glabrous. The flowers are sometimes pubescent at the junction of the cylindrical basal tube and the ligule, in the case of the ray flowers, and at the junction of the campanulate part of the corolla in the disc flowers. These hairs are especially prominent in *A. tricephalus* and *flaccidus* but are also seen in *A. stracheyi* and other species. Floral pubescence is of value in separating the subspecies of *A. asteroides:* in subsp. *asteroides* the lobes of the disc corollas are covered with minute black hairs whereas those of subsp. *costei* are covered with glistening glands or white hairs.

Glands, usually of the glistening golden type, are common on the stems and foliage of most species of *Aster* and *Heteropappus;* both stipitate and subsessile forms occur (see Fig. 1, D and E).

LEAVES: The leaves in the majority of species are simple, entire-margined or shallowly or coarsely dentate and the teeth are often mucronate-tipped.

A. bipinnatisectus, as its name implies, is the sole exception in having dissected leaves which are similar to those of the species belonging to *Machaeranthera*, an American section of *Aster*. Leaf shapes include those of oblong, ovate, lanceolate, oblanceolate or spathulate proportions and may be attenuate, cuneate or rounded at the base, but cordate in *A. laka*, *fuscescens* and *peduncularis* subsp. *nepalensis*. Petioles occur in these species and in *A. bietii*, *bipinnatisectus*, *diplostephioides*, *helenae*, *heliopsis* and *pycnophyllus;* elsewhere the leaves are more or less sessile.

In *Alpigeni* section, most of the leaves are radical but in other sections cauline leaves, which are alternately arranged, predominate and radical leaves may be altogether lacking at flowering time. Leaf texture is thin in most species but is thicker and sub-coriaceous in *A. molliusculus*, *A. hypoleucus* and *A. fuscescens* var. *scaberoides* and also to some extent in *A. aitchisonii*. Venation is generally pinnate but is noticeably trinerved in *A. trinervius*, *molliusculus* and in *A. himalaicus* and its allies.

CAPITULA: Among the Himalayan Asters more than half have solitary capitula: of the remainder the stems or peduncles are branched and bear few or many capitula in a corymbiform or paniculate arrangement. In the measurement of capitulum breadth, some authorities include the ligules: here it is measured across the tips of the phyllaries only. The methods employed in measuring the flower parts are shown in Fig. 2.

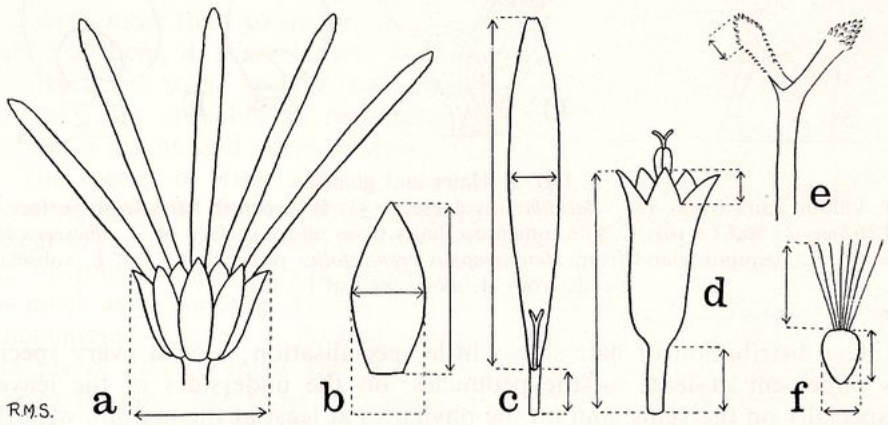

FIG. 2. Diagramatic sketch showing dimensions measured in a, the capitulum; b, phyllaries; c, ray flowers (basal tube and ligule); d, disc flowers (total length, basal tube and lobe length); e, style appendage length; f, pappus and achene.

INVOLUCRE: The involucre consists of several series of phyllaries which may all be of approximately the same size, as in *A. flaccidus* and in most species of the *Alpigeni* section, or the outer phyllaries may be much shorter than the inner ones, forming an imbricate involucre, as in *A. albescens*. The phyllaries are generally broad (0·75–) 1–3 (–13) mm, herbaceous or membranous in texture, usually uniform in thickness or gradually becoming thicker and indurated at the centre and base, rarely hard and coriaceous as in *A. aitchisonii* and *molliusculus*. The inner series are usually more membranous at the apex but in *Heteropappus* species most of the phyllaries, or certainly the inner ones, have broad scarious margins (see Fig. 3, G). Where

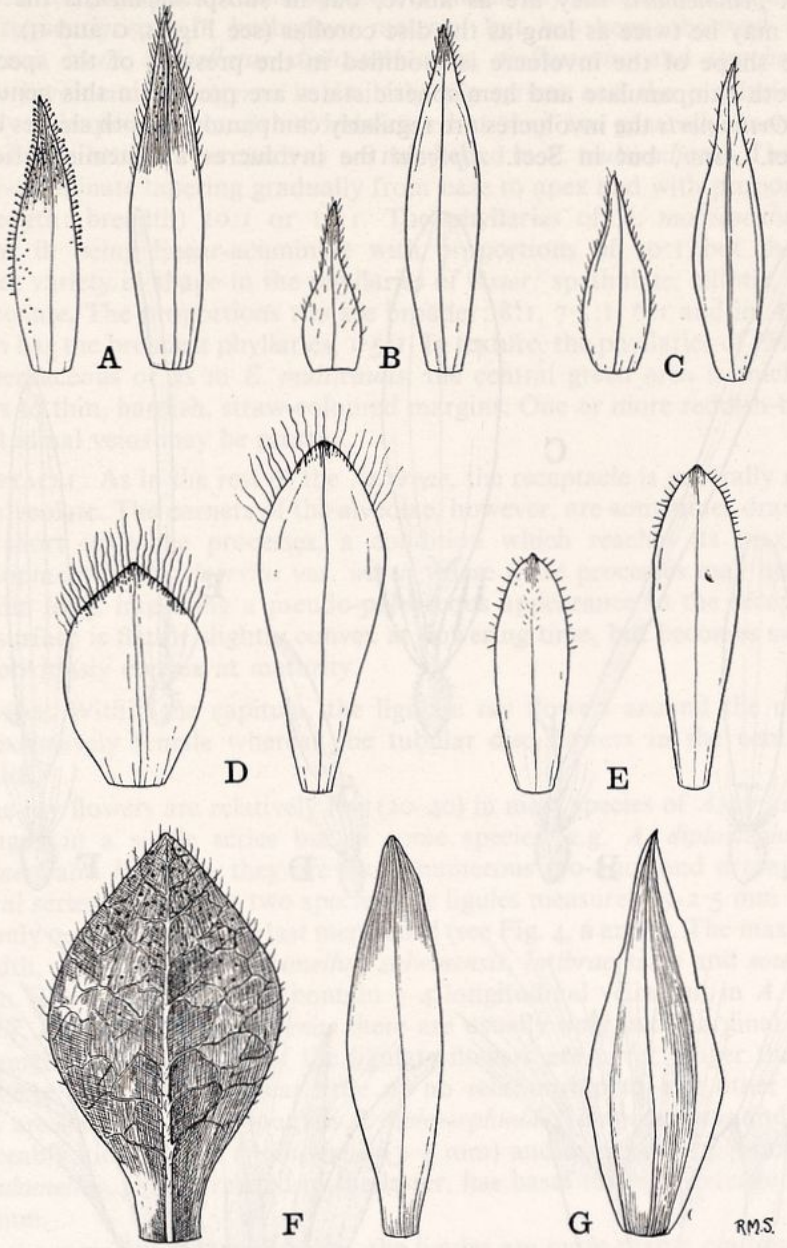

FIG. 3. Variations in phyllaries.
Outer and inner phyllaries respectively of A, *Aster vestitus;* B, *A. poliothamnus;* C, *A. albescens;* D, *A. aitchisonii;* E, *A. trinervius;* F, *A. indamellus* and G, inner phyllary of *Heteropappus altaicus* (all ×9).

the phyllaries are membranous or herbaceous in texture, the outer and sometimes the intermediate series are green or purplish but are generally straw-coloured when coriaceous. The inner series is as long as the disc corollas (at least in bud), but this may vary within the same species, e.g. in *A. peduncularis*

subsp. *peduncularis* they are as above, but in subsp. *nepalensis* the inner series may be twice as long as the disc corollas (see Fig. 4, G and H).

The shape of the involucre is modified in the pressing of the specimen but both campanulate and hemispheric states are present in this genus. In Sect. *Orthomeris* the involucres are regularly campanulate, both shapes occur in Sect. *Aster*, but in Sect. *Alpigeni* the involucres are hemispheric. At

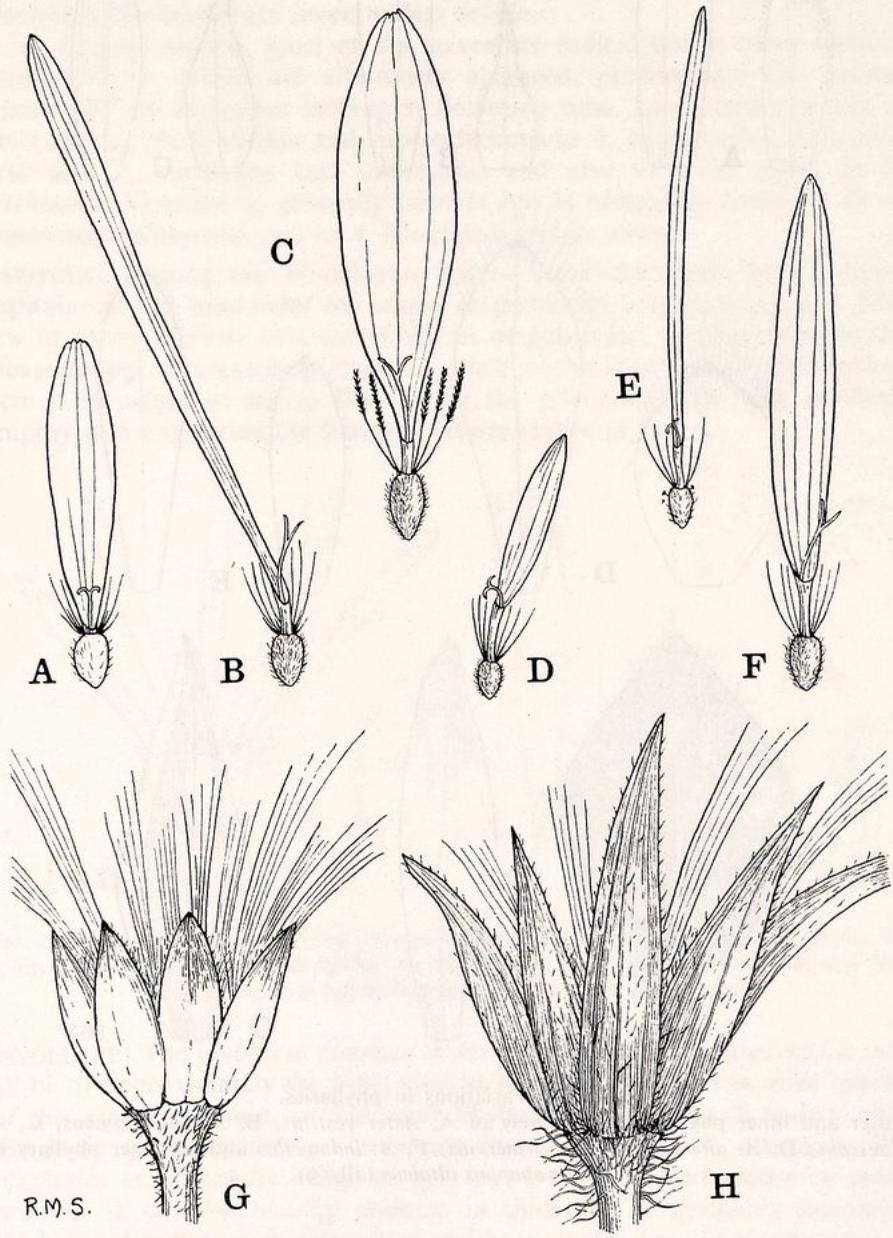

FIG. 4. Variations in ray flowers and involucres.
A-F, ray flowers of A, *Aster latibracteatus;* B, *A. diplostephioides;* C, *A. barbellatus;* D, *A. albescens;* E, *A. heliopsis;* F, *A. peduncularis* (all × 3). G-H involucres of *A. peduncularis*, G, subsp. *peduncularis;* H, subsp. *nepalensis* (both × 2).

maturity the phyllaries become spread out and finally reflexed. This condition is infrequently seen in harbarium material but has been observed in *A. albescens*, *bietii*, *barbellatus*, *diplostephioides*, *molliusculus* and *stracheyi*.

The involucre in *Erigeron* is similarly 2–3 seriate and the phyllaries are usually subequal or somewhat imbricate but they are generally narrower, 0·6–0·8 mm broad or as much as 1·6 mm broad in *E. multiradiatus*. They are linear-acuminate tapering gradually from base to apex and with proportions of (length: breadth) 10:1 or 12:1. The phyllaries of *A. molliusculus* are similar in being linear-acuminate with proportions of 10:1 but there is greater variety in shape in the phyllaries of *Aster:* spathulate, elliptic, ovate or obovate. The proportions too are broader: 8:1, 7·5:1, 6:1 and in *A. laka* which has the broadest phyllaries, 1·5:1. In texture, the phyllaries of *Erigeron* are herbaceous or as in *E. multicaulis*, the central green area is thick and tapers to thin, hardish, straw-coloured margins. One or more reddish-brown longitudinal veins may be present.

RECEPTACLE: As in the rest of the *Astereae*, the receptacle is generally naked and alveolate. The corners of the alveolae, however, are sometimes drawn up into short scale-like processes, a condition which reaches its maximum development in *A. trinervius* var. *wattii* where these processes may measure 0·8 mm long, imparting a pseudo-paleaceous appearance to the receptacle. The surface is flat or slightly convex at flowering time, but becomes swollen and obviously convex at maturity.

FLOWERS: Within the capitula, the ligulate ray flowers around the margin are exclusively female whereas the tubular disc flowers in the centre are bisexual.

The ray flowers are relatively few (20–40) in most species of *Aster* and are arranged in a single series but in some species, e.g. *A. diplostephioides*, *falconeri* and *heliopsis*, they are more numerous (70–120) and arranged in several series. In the first two species, the ligules measure 1·5–2·5 mm broad but only 0·5–1·5 mm in the last mentioned (see Fig. 4, B and E). The maximum breadth, recorded in *A. indamellus*, *salwinensis*, *latibracteatus* and *souliei*, is 3 mm. The ligules generally contain 3–4 longitudinal veins but in *A. sikkimensis*, *pycnophyllus* and *helenae* there are usually only two marginal veins. Although the basal tubes of the ligulate flowers are never longer than the involucre, they seem to bear little or no relationship to any other parts. They are short (ca. 1 mm long) in *A. diplostephioides*, *latibracteatus* and *bietii*, noticeably longer in *A. molliusculus* (3–4 mm) and *aitchisonii* (4–5 mm), yet *A. indamellus*, closely related to the latter, has basal tubes of average length 2–3 mm.

In the majority of *Aster* species, the ligules are more than 1 cm long and, in species where they fall below this figure, they are more than 1 mm broad with the only exceptions of *A. sikkimensis* (0·65–0·7 cm long, 0·7–0·8 mm broad) and *A. albescens* (0·3–0·45 cm long, 0·6–1·0 mm broad). In *Heteropappus holohermaphroditus* alone in this Himalayan group are the ray flowers completely absent.

Among the species of *Erigeron* that are commonly confused with Asters, the ray flowers are generally more numerous, i.e. more than 100 in each head as in *E. roylei* or *multiradiatus* but they may be as few as 40–70 in *E. bellidioides*. In dimensions, few species exceed 1 cm long, 1 mm broad (e.g.

E. multiradiatus 0·8–1·8 cm long, 0·85–1·2 mm broad); the rest are smaller and generally less than 0·5 mm broad.

Usually the ligules are flat but they are often inrolled lengthwise in *A. diplostephioides*. This condition probably arises in the fresh state especially in bud, but is also seen in fully-opened flowers and may become more obvious on drying. It is also very noticeable in the ligules of *Erigeron uniflorus* L. Circinate coiling of the ligules which has been observed in some *Erigeron* species, e.g. *E. dolichostylus* Botsch., is also to be seen here in *A. flaccidus* but is probably a very general withering phenomenon among ligules.

The disc flowers, as indeed is the case in most of the Compositae, also have a basal tube 1·5–2 mm long, which at maturity is usually clearly differentiated from the upper campanulate section, which, in turn, is divided apically into the 5-lobed limb. (In bud, the corollas widen gradually from base to apex). The disc corollas of *A. latibracteatus* are distinctive in that the basal tubes are almost absent and widen suddenly becoming funnel-shaped in outline (see Fig. 6, C).

In *Aster* the limb is generally divided into five equal triangular lobes but among *Heteropappus* species one lobe is always longer than the others hence the corollas are somewhat zygomorphic or bilabiate (4-lobed corollas have been observed in *H. gouldii*) (see Fig. 5). Minor discrepancies in lobe length

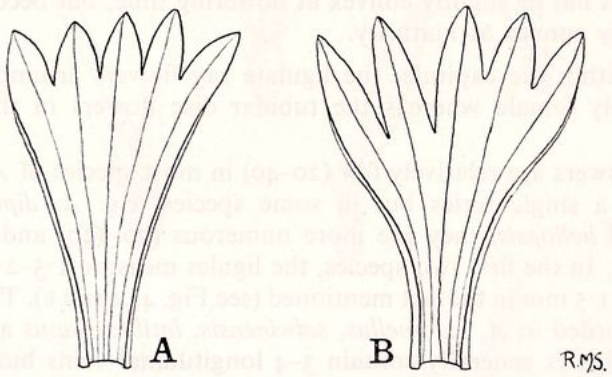

FIG. 5. Lobation of disc flower corollas.
A, disc flower (dissected) of *A. peduncularis* showing regular lobation; B, disc flower of *Heteropappus holohermaphroditus* showing unequal lobation (both ×4).

are, of course, observable in many species if one looks for them, but they are a definite and obvious feature of *Heteropappus* disc corollas where the disparity may be as much as 1 mm (i.e. about 20 per cent of the total length of the corolla). Classically, bilabiate corollas were only reported in *Rhinactina* Less. species (*Aster* Sect. *Xylorhiza*), although Bentham could not observe them (Benth. & Hook. Gen. Pl. 2: 273, 1873). Probably this inequality of lobation occurs in several unconnected groups of species within the *Astereae* but, at least among the close allies of *Aster* in the Himalayan area, it has only been observed with any degree of constancy in *Heteropappus*.

The breadth of the disc corollas measured at the base of the lobes, provides another means of distinguishing most species of *Aster* from those of *Erigeron*. In the former they measure (0·8–) 1–1·75 mm broad whereas in *Erigeron* 0·45–0·7 mm is usual and only *E. multiradiatus* attains 0·8–1 mm (these

measurements were made on fully opened, mature corollas softened by boiling and not in the dry state).

The series of eligulate, female, tubular flowers which occur between the ray and hermaphrodite flowers in species of *Erigeron* belonging to *Trimorphaea* Section (*Trimorpha* Vierh.) are never found in *Aster*. Elsewhere, a similar arrangement may be seen in *Stereosanthus* Franch., which was originally placed with some doubt between *Inuloideae* and *Senecioideae*, but should probably be ascribed to the *Astereae*.

Flower colour is, of course, typical of the heterochromous *Asterinae*—bluish purple rays and yellow disc. This deviates towards pink rays in *A. thomsonii* and towards white in *A. trinervius* and *peduncularis*, but sporadic albino forms appear to be rare judging by their fewness on herbarium sheets. Edaphic factors may influence the flower colour and it has been suggested that the degree of blueness or redness of the rays is conditioned by the alkalinity of the substrate upon which the plant is growing (see Onno 1932 p. 67). In some species, e.g. *A. diplostephioides* and *A. asteroides* subsp. *costei*, although the disc flowers when fully open are yellowish they are dark purple in the bud. Much of the latter coloration disappears as the disc corollas expand but it probably accounts for the difference in colour which may be observed in some immature specimens when compared with the notes made by the collector who no doubt examined mature capitula. Flower colour change in the opposite direction, i.e. greenish white in the bud but coloured when fully open, may be observed in several species in the dried and in the living state as is confirmed by field notes, e.g. *A. himalaicus* (*Ward* 9871).

STAMENS: In most species of *Aster* the stamens hardly emerge from the disc corollas but in *A. trinervius* they are sometimes almost wholly exserted. Generally, they are devoid of detail of any practicable taxonomic value and are not used in the classification of *Aster* species. The *Astereae* as a whole is characterised by stamens that have rounded or pointed, but not tailed, anther lobes. In this connection, *Wardaster* Small, a monotypic genus indigenous to S.W. Szechuan, is supposed to differ from *Aster* in having "mucronate" anther lobes. These, however, seem to be only slightly longer and more pointed than those of *A. flaccidus* subsp. *tsarungensis* or *A. fuscescens* which have anthers of comparable size.

STYLES: The arms of the bifid styles are divided into a lower proximal part, 0·23–1·3 mm long, which bears lines of receptive stigmatic papillae, and an apical sterile portion, the appendage, bearing relatively long hairs which probably sweep the pollen from the staminal tube.

Cronquist (1947) observed among the American representatives that the style appendages of *Aster* are usually relatively long and acute or acuminate, whereas those of *Erigeron* are shorter, broader and more obtuse. In Asia this is largely true as well, although no hard and fast line may be drawn with regard to shape, but in length the appendages of *Erigeron* styles measure between 0·15 and 0·25 mm long and those of *Aster* 0·3 and 1·1 mm, the majority of species being above 0·5 mm long. There is a certain amount of variation in appendage length within the species; among Himalayan populations *A. flaccidus* has been found to vary between 0·46 and 0·78 mm.

PAPPUS: Of the three forms of pappus found in *Aster*, the simple condition is perhaps the commonest and is in fact the type often encountered in numerous

other genera of the Compositae (see Fig. 6, A). In this the setae are all approximately uniform in thickness and length, i.e. almost as long as the disc corollas (in *Aster*, there is only a negligible increase in length of the setae between those on immature and those on fully mature achenes). The colour is sometimes significant, usually it is whitish, but in *A. himalaicus* it is pure white and in others, e.g. *A. fuscescens* and *barbellatus*, brownish. The latter species is also noteworthy in that the bristles become distinctly barbellate at the apex.

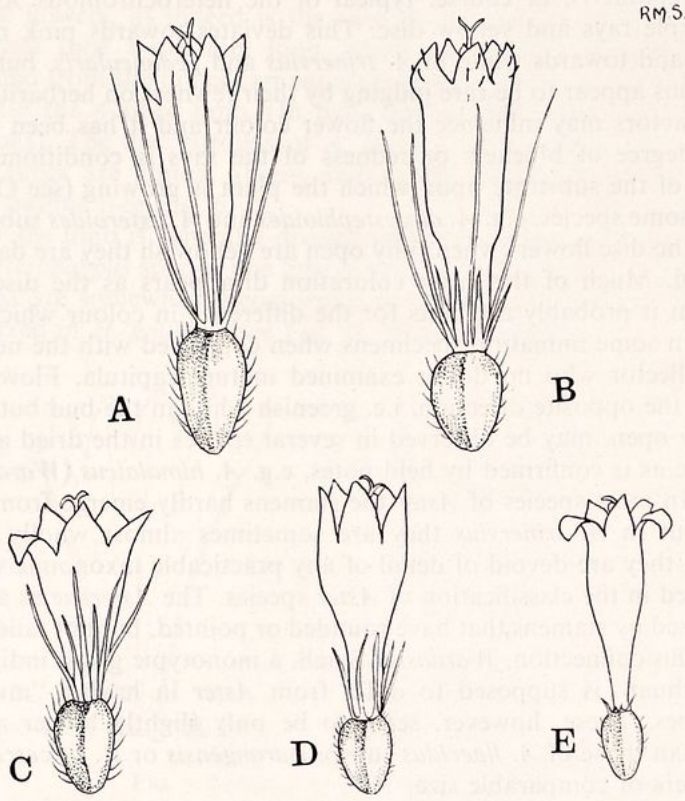

FIG. 6. Forms of pappus and proportions relative to disc corollas.
A, *Aster indamellus* showing a simple pappus; B, *A. asteroides* showing double pappus; C, *A. latibracteatus* showing double pappus with coarse inner setae; D, *A. souliei* showing short simple pappus; E, *Boltonia indica* showing rudimentary pappus. (all ×6. Number of setae reduced in all except E).

The double or heteromorphic pappus has setae similar to the above but in addition has an outer series of shorter setae which are a fifth or a quarter as long as the disc corollas (see Fig. 6, B). Cronquist (1947) suggested, in relation to *Erigeron*, that these originated in two ways, either by diminution of some members of the inner series or by enlargement of the uppermost achenial hairs. Judging by their nature, the former means seems to have been more important in *Aster*. In conjunction with the reduction in size, adjacent setae have become fused, as in *A. peduncularis*, and the members of the outer series are often broader than the inner and become sub-paleaceous. The simple condition passes gradually into the double and it has certainly arisen

more than once as can be observed in *A. peduncularis*, *molliusculus* and *salwinensis*.

The double pappus is almost a constant feature of *Erigeron* but in that genus the outer series is generally composed of setae that are only slightly broader than those of the inner.

In the third form the setae are all only one third or half as long as the disc corollas and generally brownish in colour (see Fig. 6, D). To this group belong *A. thomsonii* and *souliei* which are not obviously related; reduction in length of the whole pappus too may have taken place more than once in the development of this genus.

Other variations in pappus structure have been used in the classification of the small genera that surround *Aster*. Thus in the Asiatic species of *Boltonia* the pappus is rudimentary or reduced to a ring of setae an eighth or less as long as the disc corollas (see Fig. 6, E). In the American species of this genus, the pappus is more strongly developed and a pair of setae at the lateral margins of the achenes are stouter and twice as long as the remainder. In the Asiatic species too, the marginal setae are sometimes more strongly developed than the others.

In *Heteropappus*, the pappus of the marginal achenes are absent or reduced in some species (e.g. *H. crenatifolius*) to about a third of the length of the disc corollas, the pappus of the disc flowers being of normal length. The setae in *Aster*, *Heteropappus* and *Boltonia* are usually persistent but in *Callistephus* Cass. they are attached to a ridge on the top of the achene and are deciduous at maturity. Generally in the *Asterinae* the setae are individually attached to the achene but in the genus *Chamaegeron* Bunge, they are joined to a basal ring and are deciduous with it.

Both Bentham and Cronquist have remarked on the fragility of the *Erigeron* pappus as compared with that of *Aster*. Facile though such a distinction may seem, it is nevertheless largely true that it is difficult to handle an *Erigeron* pappus without breaking the setae.

ACHENES: Apart from size, the achenes show little variation throughout the genus. They are all of the bilaterally compressed type with two marginal ribs or with an additional rib on one or both sides as in *A. trinervius*, and sometimes with six ribs in *A. albescens*. The shape varies from oblong to obovate and they are sparsely or densely covered with fine straight ascending hairs. Glands are also present in several species, e.g. *A. heliopsis*, *tricephalus* and sometimes in *A. flaccidus*.

VEINING: To the practised eye, another distinction between *Aster* and *Erigeron* lies in the veining of the phyllaries, achenes and flowers, especially the disc flowers. The veins of *Erigeron* have a resinous, reddish-brown coloration which is easily recognised whereas the corresponding veins of *Aster* are slightly darker than the surrounding tissue and usually a non-descript brown. There may well be a detectable biochemical difference between the two genera.

SUMMARY: From the above survey it will be seen that there is no single character which, considered alone, will separate all the species of *Aster* from those of *Erigeron* and *vice versa*. If taken in conjunction, however, the differences reviewed here should be sufficient for this purpose. Cronquist (1947) summarised the differences between the American representatives of

these genera in tabular fashion: on the same lines, the following table contrasts the salient differences between them in the area under discussion.

Erigeron	*Aster*
Habit: Small or medium-sized, perennial, rhizomatous herbs up to 30 cm tall, sometimes woody at base.	*Habit:* Small, medium or large, perennial, rhizomatous herbs, often more than 30 cm sometimes 1–2 m tall, sometimes shrubs.
Phyllaries: Generally thin or thickly herbaceous in the centre with dry straw-coloured margins. Subequal or imbricate, usually narrow 0·45–0·8 (–1·6) mm broad, outer and inner series approximately similar in breadth.	*Phyllaries:* Thin and herbaceous or thicker and coriaceous, becoming thin and fimbriate at the margins, usually broad (0·75–) 1–6 (–13) mm, subequal or imbricate, inner series often narrower than intermediate and outer series.
Ligules: Generally small and narrow (i.e. less than 1 cm long, 1 mm broad or half this size) and usually numerous i.e. more than 100, rarely 40–70.	*Ligules:* Commonly longer and broader (above 1 cm long, 1 mm broad), most with less than 70, sometimes narrower and more numerous (up to 120).
Disc flowers: Narrow usually less than 1 mm broad. Eligulate female flowers sometimes present.	*Disc flowers:* Above 1 mm broad. Eligulate female flowers never present.
Style appendages: 0·15–0·25 mm long, broadly triangular and acutish.	*Style appendages:* 0·3–1·1 mm long, lanceolate or acuminate.
Pappus: Often double, outer and inner series similar in thickness; bristles usually fragile.	*Pappus:* Simple or double, outer series of the latter often becoming subpaleaceous; bristles robust.
Achenes: regularly 2-ribbed.	*Achenes:* 2-ribbed in most, sometimes 3–4, rarely 6.
Veining: Veins of involucre, flowers and achenes often reddish-brown and resinous-coloured.	*Veining:* Veins of involucre, flowers and achenes brownish never resinous-coloured.

THE DISTRIBUTION OF THE HIMALAYAN ASTERS

It is not known nor hypothesised whereabouts the genus originated but it is highly probable that the basal species, e.g. *A. trinervius*, *flaccidus*, *amellus*, and *alpinus* or their ancestors, must have been widespread in Asia in preglacial times, in areas further north than their present stations. From these areas they may have migrated to Japan, in the case of *A. trinervius*, while Japan was still a peninsular appendage of the eastern coast of Asia; to North America in the case of *A. alpinus* while the Behring Strait was still bridged by land. They also migrated south into the mountains of Western China and into the Western Himalayan area and, along with numerous other species, spread from these stations colonising the Himalayan range.

From the field-notes accompanying the herbarium specimens, none of the species appear to be particularly demanding in respect of habitat either as regards substrate or ecological associates. They occur in forest clearings or on open hillsides with no very marked preference for alkaline or acidic conditions and this seems to be confirmed from their behaviour in cultivation,

although their tolerance tends more in the direction of acid conditions. Some species, e.g. *A. flaccidus*, have been collected from screes; others, e.g. *A. asteroides*, have a preference for marshy ground. The only unusual habitat has been recorded for *A. flaccidus* subsp. *glandulosus* which has twice been collected beside warm sulphurous springs in Tibet.

As regards altitudinal range, the majority of species grow between 2000 and 5000 m; indeed, only four species, *A. flaccidus* and *himalaicus*, *Heteropappus gouldii* and *boweri*, are commonly found above this elevation. *H. boweri*, a native of the Tibetan plateau, is the only species of this group that grows consistently above 5000 m. The major taxonomic divisions of *Aster* occupy distinct altitudinal ranges. Thus, the species of Sect. *Aster* and *Orthomeris* generally grow between 2000 and 4000 m among woodland and scrub; the species of Sect. *Alpigeni* occur in alpine meadows above the tree line (3000–3500 m) between 3000 and 5000 m. Below 2000 m a significant proportion of the specimens of *A. helenae*, *peduncularis*, *trinervius* and *vestitus* has been collected. *Boltonia indica* occurs only at or below 1000 m.

In the interests of fostering a uniform geographical approach to the distribution of Himalayan genera, the species of *Aster* have been considered in the light of the distributional patterns or "types" elucidated by Stearn (1960). These types combine to show regions of endemism and pathways of migration which a variety of Himalayan species display. In the following, the order and the wording of these types are those used originally by Stearn.

(1) "Species of Western, Central and Northern Asia".
(*a*) "extending into Kashmir": *Heteropappus altaicus*. (According to some authorities, the distribution of this species should extend to Eastern China but the specimens from that region seem to be annual or biennial plants that are closer to *H. crenatifolius* and probably distinct from the Central Asiatic—Western Himalayan taxon).
(*b*) "extending along the Western Himalaya": *Aster flaccidus* and *Heteropappus semiprostratus* (*Aster flaccidus* may also be regarded as having a distributional pattern corresponding to type 7. There are also several records for this species in Western Tibet).

(2) "Species confined to Western Himalaya (including Western Nepal) and possibly adjacent Afghanistan": *A. aitchisonii*, *falconeri*, *indamellus*, *laka*, *molliusculus*, *peduncularis*, *thomsonii* and *Heteropappus holohermaphroditus*. Both *A. falconeri* and *peduncularis* have Nepalese subspecies that extend no further east than about the eighty-third meridian. Somewhere between longitude 80° and 84° E according to Stearn, runs the "boundary between the Western and the Eastern Himalaya as botanical provinces".

(3) "Species confined to Nepal on the southern slopes of the main Himalayan mountain range". As in *Allium* (Stearn, 1960), there are no species of *Aster* with this type of distribution.

(4) "Species of Western China extending along the whole Himalaya to or into Kashmir": *A. albescens*, *asteroides*, *diplostephioides*. To these species *A. stracheyi* should probably be added. The majority of its specimens have been collected in Western Himalaya and it has also been gathered in Nepal, Sikkim and Bhutan, but extends no further east than Bhutan. Possibly therefore, it originated in Western China along

with its close relatives *A. salwinensis* and *himalaicus* and has since lost all connection with that region.

(5) "Species of Western China extending from Yunnan along the Eastern Himalaya over much of Nepal and in some instances beyond it into the Kumaun Himalaya": *A. himalaicus*, *sikkimensis* (and *nigromontanus*), *trinervius* and *vestitus*. Of these the distribution of *A. himalaicus* reaches Nepal but *A. sikkimensis* and *vestitus* extend only as far as Sikkim. *A. nigromontanus* is considered to be no more than a subspecies of *A. sikkimensis*—see the discussion of the latter species. *A. trinervius* is placed in this category with some hesitation as it cannot very well be regarded as a species of "Western China". Its distribution extends from Japan over most of China entering the Himalayan region from Western China and ranges as far west as longitude 81° E in Nepal and as far south as Assam. It thus appears to be much wider than any of the categories allow.

(6) "Species confined to the Eastern Himalaya": *A. barbellatus*, *heliopsis*, *neo-elegans* and *tricephalus*.

(7) "Species extending from north-western China (Kansu) over Tibet to the Himalaya": *A. flaccidus* (see also under Type 1), *poliothamnus*, *souliei*, *yunnanensis* and *Heteropappus crenatifolius*.

(8) "Species of the dry plateau zone of Tibet, some reaching the dry zone of Sikkim or Nepal or both": *Heteropappus boweri* and *gouldii*.

(9) "Species confined to the moist gorge country of south-eastern Tibet: *A. bipinnatisectus*, *fulgidulus*, *hypoleucus*, *poliothamnus* and *retusus*. Stearn appears to limit this category to the Tsangpo Valley but Ward (1935) considered the "river gorge country" as the region lying between the Tsangpo gorge (longitude 92° E) and the Valley of the Yangtze (longitude 98° E) between the twenty-eighth and thirty-second parallels. This would greatly extend the present category and would include what Handel-Mazzetti (1931) regarded as the "oberbirmanisch—west-yunnanesische Monsungebiet". If this category is considered to have this enlarged scope it would then include six species that are confined to the Yunnan-Tibet-Burma borderland and would otherwise be excluded from Stearn's scheme. These species are: *A. bietii*, *fuscescens*, *helenae*, *latibracteatus*, *pycnophyllus* and *salwinensis*.

(10) "Species occurring in the Himalaya and Ceylon or Southern India or both". There are no species of *Aster* that can be placed here.

Boltonia indica is unplaced in this scheme and, as stated in the discussion, must probably be regarded as an adventive species.

The species that are endemic to the Himalayan region must be included in the non-migrational categories of this scheme, i.e. types 2, 3, 6 and 9. In all the species endemic to the Western Himalaya (type 2) with the exception of *A. falconeri*, the pappus is simple or only incipiently double. The species of Subsect. *Heterochaeta* would appear to have originated in Western China, possibly in the older mountains of S.W. Yunnan and later migrated along the younger Himalayan range. *A. falconeri* is closely related to *A. diplostephioides* and probably evolved from its stock only after it had spread to the Western Himalaya.

The distribution of *A. flaccidus* is wider than is shown above. To the west it extends from Central Asia into Iran and Afghanistan; to the east as far as Manchuria and Eastern China. Its distribution can be held to correspond to two of Stearn's categories and, it may have entered the Himalayan region from two directions. The species of subsect. *Heterochaeta* all bear some relationship to *A. faccidus* and were possibly evolved from the ancestral stock of that species. Thus, the eastern stream from China, apart from giving rise to various forms that have been recognised as distinct by various authorities, e.g. *A. glarearum*, may also have given rise to the species of subsect. *Heterochaeta*. The western stream from the Altai Mountains appears to have been less plastic or had fewer opportunities for diversification and gave rise only to subsp. *glandulosus*.

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ABBREVIATIONS

In addition to the customary abbreviations employed in taxonomic works the following have been used in citing specimens gathered by teams of

collectors. Their surnames are given in full when they first occur in each instance then subsequent records are abbreviated as follows.

L. & S.	Ludlow & Sherriff.
L.S. & T.	Ludlow, Sherriff & Taylor.
L.S. & E.	Ludlow, Sherriff & Elliot.
L.S. & H.	Ludlow, Sherriff & Hicks.
P.S. & W.	Polunin, Sykes & Williams.
S.S. & W.	Stainton, Sykes & Williams.

ASTER Linn Gen. Pl. Ed. 5, n. 954 (1754)

Perennial herbs or shrubs, rootstock generally rhizomatous, herbaceous or somewhat woody, rarely tuberous. *Stems* small, medium or tall (up to 2 m) generally leafy, unbranched or branching above, ± pubescent or villous, glandular or eglandular. *Leaves* alternate, herbaceous or subcoriaceous, cordate, ovate, elliptic, lanceolate, linear or spathulate, sessile or petiolate, basal leaves often absent at flowering time. *Capitula* solitary, several or numerous in corymbose panicles; involucre several-seriate, phyllaries subequal or imbricate, herbaceous or coriaceous, usually more than 1 mm broad, often becoming membranous at the margins. *Ray flowers* female, 1–2 seriate, generally few sometimes numerous (ca 120) white, pink, purplish or blue, ligules relatively long and broad. *Disc flowers* hermaphrodite generally about 1 mm broad, yellow or purplish, ± equally 5-lobed. Style branches of disc flowers ± flattened, appendages 0·3–1·5 mm long, lanceolate or triangular, rarely elongate. *Pappus* setose, persistent, white or brownish, simple with all setae of similar length or only $\frac{1}{4}$–$\frac{1}{3}$ as long as disc corollas or double with an outer series of shorter and often subpaleaceous setae. *Achenes* compressed, oblong or obovate with two marginal ribs or with one or sometimes two additional ribs on each face. *Receptacle* flat or convex, foveolate or fimbrillate, sometimes pseudo-paleaceous.

TYPE SPECIES: *Aster amellus* Linn. (according to Hitchcock & Green, Prop. Intern. Bot. Congr. 1930 p. 181, 1929).

GENERIC AND INFRAGENERIC DIVISIONS

Aster Linn. Perennial herbs or shrubs. Pappus setae as long as disc corollas or sometimes uniformly only $\frac{1}{4}$–$\frac{1}{3}$ as long.

The divisions used here follow those of Nees (Gen. et Sp. Ast. 1832), Bentham & Hooker f. (Gen. Pl. 2: 271–274, 1873), A. Gray (Fl. N. Amer. 172–207: 1886) and Onno (1932).

The numbered sequence of species given below is the one followed in this paper.

Sect. **Aster.** Medium sized herbs or shrubs. Capitula several or numerous in corymbs, rarely solitary. Involucre several seriate, phyllaries imbricate or subequal, ± subcoriaceous at the base, foliaceous at the apex. Pappus simple (sometimes double in *A. peduncularis* and *A. laka*).

Pappus as long as disc corollas:

1. *indamellus*, 2. *aitchisonii*, 3. *vestitus*, 4. *poliothamnus*, 5. *fuscescens*, 6. *peduncularis*, 7. *laka*.

Pappus half as long as disc corollas:

8. *thomsonii*.

Sect. **Orthomeris.** A. Gray. Medium or tall (rarely dwarf) herbs or shrubs. Capitula several or numerous in corymbs, rarely solitary. Involucre 3–4 seriate, imbricate; phyllaries dry, subcoriaceous scarcely herbaceous, margins membranous. Achenes 2–4 ribbed.

Pappus usually simple, sometimes double:

9. *trinervius*, 10. *albescens*, 11. *fulgidulus*, 12. *sikkimensis*, 13. *pycnophyllus*, 14. *helenae*, 15. *molliusculus*, 16. *hypoleucus*.

Sect. **Alpigeni** Nees. Small or medium sized herbs. Capitula solitary or 2–3. Involucre several-seriate; phyllaries subequal, herbaceous. Pappus simple or double.

Subsect. **Homochaeta** Onno. Pappus simple, as long as disc corollas. Peduncles intrarosulate:

17. *tricephalus*, 18. *neo-elegans*, 19. *barbellatus*, 20. *bietii*, 21. *retusus*.

Peduncles extrarosulate:

22. *himalaicus*, 23. *heliopsis*, 24. *stracheyi*, 25. *salwinensis*.

Subsect. **Heterochaeta** (DC.) Benth. & Hook. f. Pappus double, outer setae short usually subpaleaceous. Leaves entire.

26. *flaccidus*, 27. *asteroides*, 28. *diplostephioides*, 29. *falconeri*, 30. *yunnanensis*, 31. *latibracteatus*.

Subsect. **Bipinnatisecti,** subsect. nov. foliis bipinnatisectis, pappis duplicibus.

32. *bipinnatisectus*.

Subsect. **Brachychaeti** (Onno pro series) Pappus $\frac{1}{4}$–$\frac{1}{3}$ as long as disc corollas.

33. *souliei*.

Heteropappus Less. Annual, biennial or perennial herbs. Ray flowers sometimes absent. Disc corollas unequally lobed. Pappus setae as long as disc corollas on all achenes or $\frac{1}{3}$ as long or absent on ray achenes.

Ray flowers present:

34. *altaicus*, 35. *semiprostratus*, 36. *crenatifolius*, 37. *gouldii*, 38. *boweri*.

Ray flowers absent:

39. *holohermaphroditus*.

Boltonia L'Herit. Perennial herbs. Pappus rudimentary or $\frac{1}{8}$–$\frac{1}{10}$ as long as disc corollas.

40. *indica*.

KEY TO GENERA, AND TO SPECIES OF ASTER

1. Pappus of all achenes rudimentary or short, only ca. $\frac{1}{10}$ as long as disc corollas . . . . . *Boltonia* (see p. 157)

\+ Pappus of disc achenes at least $\frac{1}{3}$–$\frac{1}{2}$ as long as their corollas . . 2

2. Annual, biennial or perennial herbs. Leaves linear, lanceolate or spathulate (usually less than 1 cm broad), entire or rarely toothed. Phyllaries at least the inner ones with obvious white scarious margins. Disc corolla lobes unequal in length (ca. 1 mm difference between longest and shortest lobes). Pappus of ray achenes short, absent or ± as long as disc corollas . . . . . *Heteropappus* (see p. 147)

\+ Perennial herbs or shrubs. Leaves linear, lanceolate, spathulate, ovate, or obovate, usually dentate or denticulate, sometimes entire (usually more than 1 cm broad). Phyllaries becoming membranous at margins but not obviously white scarious. Disc corolla lobes ± equal in length. Pappus setae, at least the inner series, of equal length on all achenes, ± as long as disc corollas or only ⅓–½ as long . . . (*Aster*) 3

3. Pappus ca. ⅓–½ as long as disc corollas 4

\+ Pappus, at least the inner setae, ± as long as disc corollas . . . 5

4. Plants small or medium-sized (3–30 cm tall). Stems ± straight. Leaves oblanceolate or spathulate, margins entire, seldom toothed. Capitula solitary . . . . . 33. *A. souliei*

\+ Plants medium-sized (20–60 cm tall). Stems ± flexuose. Leaves elliptic or ovate, margins 4–6 toothed. Capitula 1 or several . 8. *A. thomsonii*

5. Pappus simple, setae all ± similar in length and thickness . . 6

\+ Pappus double, outer setae shorter and sometimes broader than those of inner series 30

6. Capitula several (ca. 5) to many, corymbose, 0·5–1·2(–1·5) cm broad 7

\+ Capitula solitary or few (2–3), more than (1·3–)1·5 cm broad . 19

7. Leaves ovate, cordate at the base, or reniform 8

\+ Leaves elliptic, lanceolate or spathulate 9

8. Stems straight. Leaves ovate to reniform. Phyllaries 2–3 seriate. Pappus setae brownish . . . . . 5. *A. fuscescens*

\+ Stems flexuose. Leaves ovate or lanceolate, attenuate at base. Phyllaries 1–2 seriate. Pappus white . 6. *A. peduncularis* (subsp. *peduncularis*)

9. Leaves trinerved (trinervation basal or suprabasal) . . . 10

\+ Leaves pinnately veined 11

10. Herbs rarely more than 25 cm tall. Leaves (1·5–)2–3(–5) cm long, brown, scale-leaves present at base of stems. Phyllaries linear-lanceolate acuminate (N.W. India, W. Pakistan and Kashmir) 15. *A. molliusculus*

\+ Herbs or subshrubs, usually more than 30 cm tall. Leaves generally more than 3 cm long, scale-leaves absent at base of stems. Phyllaries spathulate, obtuse rarely acute. (Nepal and further east) 9. *A. trinervius*

11. Shrubs often (0·3–)1–2 m tall. Leaves lanceolate or elliptic, whitish tomentose or pilose beneath . . . . . 10. *A. albescens*

\+ Herbs sometimes woody at base, usually less than 1 m tall . . 12

12. Ligules ± distinctly 2-veined. Stems flexuose 13

\+ Ligules 3–4 veined. Stems ± straight 15

13. Leaves lanceolate, sessile, semiamplexicaul and often subauriculate at the base. Ligules 40–60 . . . . . 12. *A. sikkimensis*

\+ Leaves petiolate, ovate or narrowly lanceolate. Ligules 10–30 . 14

14. Internodes 3–10 cm long. All leaves ovate. Indumentum partly glandular 13. *A. pycnophyllus*

\+ Internodes 1 cm or less, long. Basal leaves ovate, cauline leaves narrowly lanceolate. Indumentum eglandular. (N.E. Burma) . 14. *A. helenae*

15. Pappus brownish. Leaves, at least the lower ones, petiolate, oblong 5c. *A fuscescens* var. *oblongifolius*

\+ Pappus white, leaves sessile 16

16. At least outer phyllaries with soft green tips. Leaves herbaceous green 17

\+ Phyllaries coriaceous without soft green tips, straw-coloured, ciliate. Leaves thinly subcoriaceous, greyish-green (W. Pakistan) 2. *A. aitchisonii*

17. Outer phyllaries elliptic or oblanceolate, 1·5–2·5 mm broad, with broad, veiny, foliaceous tips. Indumentum somewhat glandular or eglandular 1. *A. indamellus*

\+ Outer phyllaries ca. 1 mm broad, foliaceous tips acuminate, not veiny. Indumentum highly glandular (Sikkim and further east) . . 18

18. Suffrutescent herbs. Leaves elliptic, 1–1·5(–3) cm long, 2–5(–8) mm broad . . . . . 4. *A. poliothamnus*

\+ Perennial herbs, not woody at base. Leaves lanceolate, 2·5–6·5 cm long, 0·45–1·5 cm broad. . . . . 3. *A. vestitus*

19. Low growing shrubs 20

\+ Herbs 21

20. Shrubs ca. 15 cm tall. Leaves 0·5–1·5 cm long, 2–3·5 mm broad, revolute, white-tomentose beneath. Capitula solitary; peduncles becoming hardened and persisting at maturity . . 16. *A. hypoleucus*

\+ Subshrubs 30(–80) cm tall. Leaves up to 1–1·5(–3) cm long, 2–6 mm broad, pubescent and glandular beneath. Peduncles bearing 1–3 capitula (rarely in corymbs), not becoming hardened nor persisting at maturity 4. *A. poliothamnus*

21. Phyllaries imbricate. Subcoriaceous, lanceolate 1 mm, or less, broad; margins narrowly scarious . . . . 15. *A. molliusculus*

\+ Phyllaries subequal, herbaceous, ovate, oblanceolate or spathulate, more than 1 mm broad 22

22. Leaves petiolate, ovate, cordate at base 23

\+ Leaves sessile or tapering at base, oblanceolate or spathulate . 24

23. Stems 15–90 cm tall. Capitula 1–2·5 cm broad. Involucre 2-seriate; phyllaries up to 0·5 cm broad, margins narrowly membranous 6b. *A. peduncularis* subsp. *nepalensis*

\+ Stems 10–30 cm tall. Capitula 2–2·5 cm broad. Involucre 3-seriate; phyllaries up to 1·3 cm broad. Completely foliaceous . . 7. *A. laka*

24. Peduncles borne terminally on rhizomes and emerging from centre of rosettes of leaves 25

\+ Peduncles extrarosulate borne laterally on the rhizomes and emerging below base of leaf rosette 28

25. Ligules 3–3·5 cm long. Leaves spathulate or lanceolate usually 1·5–2 cm broad. Upper cauline leaves sheathing the capitulum at first. Phyllaries fringed with dark hairs in the bud . . . . 20. *A. bietii*

\+ Ligules 1–2 cm long. Leaves spathulate or linear-oblanceolate usually less than 1·5 cm broad. Upper leaves not sheathing capitula. Phyllaries without dark fringing hairs 26

26. Radical and basal leaves generally present at flowering time. Cauline leaves distinct or slightly overlapping, decreasing in size gradually above. Stems seldom less than 40 cm tall 27
\+ Radical and basal leaves often absent at flowering time. Cauline leaves ± similar in size, usually overlapping. Stems usually ca. 30 cm tall 17. *A. tricephalus*

27. Leaves finely hirsute. Capitula solitary, rarely few, 1·5–2·5 cm broad. Pappus tawny, setae barbellate at the apex. . 19. *A. barbellatus*
\+ Leaves pubescent. Capitula few, sometimes solitary, 1·3–1·5 cm broad. Pappus whitish, setose; setae not barbellate at apex 18. *A. neo-elegans*

28. Radical leaves (when present) ovate, cordate at the base. Cauline leaves sessile ovate or broadly elliptic, semiamplexicaul. Ligules numerous (100–120) and narrow . . . . . 23. *A. heliopsis*
\+ Radical leaves oblanceolate or elliptic. Cauline leaves linear or oblong Ligules 15–70 29

29. Plants bearing fine stolons up to 30 cm long. Phyllaries ± glabrous, villous only at base, often purplish tinged. Pappus white or pinkish 24. *A. stracheyi*
\+ Stolons if present generally shorter and stouter 30

30. Plants glandular pubescent throughout. Phyllaries 2·5–3·5 mm broad. Ligules 50–70. Pappus white . . . 22. *A. himalaicus*
\+ Plants almost eglandular. Phyllaries up to 2·5 mm broad. Ligules 15–30. Pappus brown . . . . 25. *A. salwinensis*

31. (5+) Leaves bipinnatisect . . . 32. *A. bipinnatisectus*
\+ Leaves entire or toothed at the margins but not divided . . 32

32. Shrubs 1–2 m tall. Leaves ovate with glistening areas of epidermis beneath. Capitula numerous in terminal corymbs 11. *A. fulgidulus*
\+ Herbs. Capitula solitary or several, not numerous . . . 33

33. Cauline leaves ovate or elliptic, cordate or cuneate at the base, petiolate 34
\+ Cauline leaves lanceolate, oblanceolate or spathulate attenuate at the base but not petiolate 35

34. Stems 15–90 cm tall. Capitula 1–2 cm broad. Involucre 2-seriate; phyllaries up to 0·5 cm broad, margins narrowly membranous 6. *A. peduncularis*
\+ Stems 10–30 cm tall. Capitula 2–2·5 cm broad. Involucre 3-seriate, outer phyllaries up to 1·3 cm broad without membranous margins 7. *A. laka*

35. Leaves spathulate, usually retuse at the apex . . 21. *A. retusus*
\+ Leaves spathulate, lanceolate or ovate but not retuse at the apex . 36

36. Ligules 2–3 cm long. Stems ± surrounded at the base by a collar of leaf remains 37
\+ Ligules 1–2 cm long, seldom longer. Leaf remains, if present, scanty, not forming a distinct collar at the base of stems 39

37. Phyllaries 3·5–5·5 mm broad. Capitula usually 2–3, less often solitary. Upper cauline leaves few and large, 4–5 cm long, 1–2 cm broad, ovate, cordate at the base . . 30. *A. yunnanensis* var. *angustior*

\+ Phyllaries 1–3 mm broad. Capitula always solitary. Cauline leaves linear or lanceolate, narrow 38

38. Upper parts of peduncle ± naked. Radical leaves thinly petiolate, margins entire. Phyllaries uniseriate slightly villous. Disc flowers purple, at least in bud . . . . . 28. *A. diplostephioides*

\+ Upper parts of peduncle leafy, leaves ± continuous with 2–3 seriate involucre. Phyllaries ± densely villous at margins. Radical leaves tapering to broad stout petioles, margins denticulate. Disc flowers yellow . . . . . 29. *A. falconeri*

39. Roots short, tuberous. Disc corolla lobes either yellow and bearing minute black hairs or purplish with or without pale glandular or eglandular hairs . . . . . 27. *A. asteroides*

\+ Roots not tuberous. Disc corolla lobes yellow (or purplish) but without black hairs 40

40. Stems bearing a few, brown scale-like leaves at the base. Cauline leaves linear or elliptic up to 5 cm long, 1 cm broad. Capitula solitary or as many as 5. Phyllaries ca. 1 mm broad, lanceolate, subcoriaceous 15. *A. molliusculus*

\+ Stem bases without scale leaves. Capitula strictly solitary. Phyllaries generally more than 1 mm broad, herbaceous 41

41. Pappus white. Leaves pubescent or glabrous and ciliate. Involucre densely villous or glandular at the base . . . . . 26. *A. flaccidus*

\+ Pappus buff or brown. Leaves glabrescent or villous. Involucre not densely villous nor glandular at the base 42

42. Peduncles closely leafy to the apex. Outer phyllaries ovate. Basal tubes of ray and disc corollas short up to 1·25 mm long. Pappus coarsely bristly 3–3·5 mm long . . . . . 31. *A. latibracteatus*

\+ Peduncles sparsely leafy above. Outer phyllaries linear-lanceolate. Basal tubes of ray and disc corollas 2–2·5 mm long. Pappus setose, 4–6 mm long . . . . . 25. *A. salwinensis*

1. **Aster indamellus** Grierson, **nom. nov.**

Syn.: *A. pseudamellus* Hook. f. Fl. Brit. Ind., 3: 249 (1881); in Gard. Chron. 2: 659 (1886) non Wender. (1831).
A. amellus auct. non Linn.: C. B. Cl. Comp. Ind. 41 (1876).

Perennial rhizomatous herbs, rootstock somewhat woody. *Stems* 30–50 cm tall, striate, covered with fine crisp ascending pubescence, sometimes glandular. *Leaves* distinctly veined and covered with fine appressed hairs on both surfaces intermixed with sessile glistening glands especially beneath; basal leaves absent at flowering time, cauline leaves ± evenly distributed on stem, 1·8–6 cm long, 0·6–2 cm broad, elliptic or oblanceolate, sessile, cuneate at base, acute or obtuse and mucronulate at apex, margin entire or with 3–4 small teeth on each side. *Capitula* 1·2–1·6 cm wide, rarely solitary often 4–10(–20) in corymbs, sometimes numerous in corymbose panicles; involucre 5–7 mm high, 2–3 seriate finely appressed pubescent and glandular; phyllaries ± equal in length, occasionally somewhat imbricate, outer ones 1·5–2·5 mm broad, lanceolate or obovate, foliaceous, distinctly veined, intermediate phyllaries 1–1·5 mm broad, indurated at the base with soft, green or purplish

tips, inner ones somewhat membranous, purplish at the apex. *Ray flowers* 20–30, basal tubes, 2–3·5 mm long, ligules blue, mauve or pink 1·3–1·8 cm long 1·75–3 mm broad. *Disc flowers* yellow 4·5–5·5 mm long, tube 1·5–2 mm long, lobes 1 mm long. Style appendages 0·75 mm long, lanceolate. *Pappus* white, simple, 5 mm long. *Achenes* 3 mm long, 1·5 mm broad, pale brown with two marginal ribs, finely and sparsely white pubescent often glandular near the apex.

HABITAT: In fields or on grassy slopes among shrubs and trees, sometimes in rock crevices and on screes.

N.W. INDIA: Without locality, *Jacquemont* (syntype K); *Jaeschke* (syntype K); Kumaun, 2440–2745 m, *T. Thomson* (syntype K); Kunawar, Pangi, 18 viii 1847, *T. Thomson* (K); same locality, near Gujral Nullah, 3960 m, viii 1878, *Watt* 2715 (E); same locality, 3050 m, viii 1897, *Lace* 2125 (E); Garhwal, Badrinath, 3050–3235 m, viii 1855, *Schlagintweit* 10036 (BM); Kumaun, Nipchang Valley, Darma, 3655–3960 m, 31 viii 1884, *Duthie* 3022 (K); Byans, Kali Valley, 16 ix 1894, *Duthie* 3023 (K); Byans, Naihil, 3500 m, 30 vii 1886, *Reid* (E); near Rama, 3560 m, 4 viii 1886, *Reid* (E); Hainta Valley, 18 vii 1888, *Drummond* 22510 (E); Simla, *Drummond* 26121 (K); Kashang Forest, 2745–3655 m, viii-ix 1890–1891, *Lace* 489 (E); 1013 (E); Lahul, Rotang Pass, 3350 m, 6 viii 1916, *Cooper* 5258 (E); Koksir, 3050 m, 7 viii 1916, *Cooper* 5210 (E); Seri Nal, 3050 m, 19 ix 1916, *Cooper* 5652 (E); Sissu, 8 vii 1941, *Bor* 10298 (E, K); Kyelang, 3140 m, 4 vii 1941, *Bor* 14982 (E, K); Billing Lumpa, 3655 m, 18 vii 1941, *Bor* 15462 (E, K); Kyelang, 3350 m, 19 vii 1930, *Koelz* 499 (MICH).

KASHMIR: Upper Chenab Valley, 2745 m, 28 viii 1879, *Ellis* 407 (K); Kishenganga Valley, Kel, 1980 m, 2 x 1940, *Ludlow & Sherriff* 8284 (E, BM).

NEPAL: Muktinath, 4110 m, 10 vii 1931, *Sharma* E16 (BM); Harifores 2135 m, 15 x 1931, *Sharma* E153 (BM); Marsianda Valley, 4570 m, 13 vii 1950, *Lowndes* 1187 (BM); near Balangra Pass, 3960 m, 23 vii 1952, *Polunin, Sykes & Williams* 2556 (E, BM); Gurchi Lagna, 3350 m, 28 viii 1952, *P.S. & W.* 3073 (E, BM); Lulo Khola, 4570 m, 18 ix 1952, *P.S. & W.* 3489 (E, BM); Dojam Khola, 4110 m, 23 ix 1952, *P.S. & W.* 3580 (E, BM); Jumla, 2315 m, 6 viii 1952, *P.S. & W.* 5012 (E, BM); Rara Daha, 2985 m, 13 viii 1952, *P.S. & W.* 5159 (E, BM); Samargaon, N of Tukucha, 3960 m, 15 viii 1954, *Stainton, Sykes & Williams* 7246 (E, BM); Kagbeni, 3050 m, 17 viii 1954, *S.S. & W.* 7302 (E, BM); Chimgaon, 2895 m, 14 ix 1954, *S.S. & W.* 7833 (E, BM); Taglung, 3050 m, 22 ix 1954, *S.S. & W.* 7982 (E, BM).

TIBET: Yang Si, 10 viii 1939, *F. M. Bailey* (E).

This is one of a group of related species the common ancestor of which must once have been widespread in the continent of Asia. It appears to have given rise to *A. amellus* in Europe, *A. indamellus* and *aitchisonii* in the Western Himalaya, *A. maackii* in Eastern Siberia, and although less closely allied, probably also to *A. vestitus* and *poliothamnus* in the East Himalayan region. Of these *A. indamellus* is most closely related to *A. amellus*. *A. maackii*, apart from being remote geographically, is eglandular and its phyllaries are of a thicker texture with hyaline margins. *A. aitchisonii* (which see) has harder greyish-green leaves and its phyllaries lack the soft foliaceous tips that are characteristic of this species. Leaves and phyllaries are narrower in *A. vestitus* as well as being more strongly glandular. The suffrutescent *A.*

poliothamnus has small elliptic or lanceolate leaves and its peduncles bear fewer capitula.

A. amellus is more difficult to separate from *A. indamellus*, its counterpart in India (Kashmir and Nepal)—hence the etymology. The tendency to enlarged outer phyllaries is sometimes encountered in *A. amellus* but they are not distinctly veined as they are here (see Fig. 3, F). The two species generally resemble one another in habit, but *A. amellus* is less leafy and usually eglandular. Furthermore, its phyllaries are mostly obtuse, imbricate and distinctly ciliate.

A. indamellus is not in general cultivation in this country and is probably too similar to *A. amellus* ever to become more popular and widely grown.

2. **Aster aitchisonii** Boiss. Fl. Or. Suppl. 287 (1888).

Syn.: *A. amellus* auct. non Linn.: Aitch. in Jour. Linn. Soc. 18: 68 (1880).
A. pseudamellus auct. non Hook. f.: Aitch. in Jour. Linn. Soc. 19: 168 (1882).

Erect or decumbent perennial herbs; rootstock somewhat woody. *Stems* several, 25–30 cm tall covered with short, white, eglandular pubescence. *Leaves* thinly subcoriaceous, greyish-green, margins slightly inrolled, glabrous above, sparsely and somewhat stiffly pubescent on midrib and margins beneath; basal leaves absent at flowering time; cauline leaves numerous, ± evenly distributed on stems, 2–4·5 cm long, 0·4–1·3 cm broad, ovate-lanceolate tapering to a very short petiole (ca. 2–3 mm long) at base, acute at apex, margin with 2–3 sharp, distant teeth per side up to 5 mm long. *Capitula* 6–7 mm broad, ca. 5 in terminal corymbs; involucre 7–8 mm high, 4-seriate, imbricate; phyllaries coriaceous straw-coloured with narrow purplish rims at the apex, margins finely white ciliate, outer phyllaries ovate, 2 mm long, 1 mm broad, inner ones lanceolate 5·5–7 mm long, 1·5–2 mm broad. *Ray flowers* 8–10, tube 4–5 mm long, ligules white, 7–8 mm long, 2·5–3 mm broad. *Disc flowers* yellow, 5–5·6 mm long, tube 3 mm long, lobes 1·5 mm long. Style appendages lanceolate, 0·5 mm long. *Pappus* white, simple, 5 mm long. *Achenes* (immature) 3 mm long, 2-ribbed, pale brown, covered with long, whitish, silky hairs, eglandular.

W. PAKISTAN: Kurram Valley, Katskalle, 2135–2440 m, 1879, *Aitchison* 812 (holo. G., iso. BM, K); Capnitri (?Chapri) 2135 m, 14 vii 1880, *Aitchison* 323 (K, BM).

The relationship between this species and both *A. amellus* and *indamellus* is a close one; Boissier at first tentatively labelled it as "*A. amellus var.* (minimi!)". It is distinguishable, as Boissier's naming suggests, by the smaller size of its capitula and also by its tougher xerophytic habit. The stems tend to be densely leafy and on the peduncles the uppermost leaves overlap and to some extent become confused with the lowermost phyllaries. In *A. aitchisonii*, however, the leaves are always pale greyish-green and bear a few sharp pointed teeth on the margins. The phyllaries are coriaceous, completely lacking the foliaceous tips of *A. indamellus*, and their margins are fringed with fine white cilia (see Fig. 3, D).

3. **Aster vestitus** Franch. in Jour. de Bot. 10: 378 (1896).

Syn.: *A. sherriffianus* Hand.-Mazz. in Jour. Bot. 76: 285 (1938).

Erect perennial rhizomatous herbs. *Stems* 60–130 cm tall, ± densely

glandular pubescent sometimes intermixed with appressed or spreading pilose hairs. *Leaves* glandular pubescent on both surfaces, intermixed with pilose hairs above and with almost villous hairs beneath; basal and lower cauline leaves absent at flowering time, middle and upper cauline leaves numerous and overlapping, lanceolate, 2·5–6·5 cm long, 0·45–1·5 cm broad, sessile, rounded at base, rarely somewhat cuneate, apex acute, apiculate, margin with 2–3 small teeth per side or subentire. *Capitula* numerous in terminal corymbs, disc 1 cm wide; phyllaries 4·5–5·5 mm long, 0·6–1·2 mm broad, lanceolate, acute or acuminate, hard, straw-coloured at base, often herbaceous and purplish towards apex, glandular pubescent. *Ray flowers* 20–30, basal tube 1·5 mm long, ligule white, mauve or blue-violet, 1 cm long, 2 mm broad. *Disc flowers* yellow 4·5 mm long, basal tube 1·5 mm long, lobes 1 mm long. Style appendages triangular, 0·5–0·75 mm long. *Pappus* whitish, simple, as long as disc corollas. *Achenes* 2·5 mm long, 1·5 mm broad, obovate, laterally compressed, 2-ribbed, brownish and covered with white silky hairs, sometimes intermixed with subsessile glands.

TYPE: Yunnan, Mt. Che-tcho-tze, audessus de Ta-pin-tze, 3 x 1882, *Delavay* 588 (P).

HABITAT: In dry sandy soil on open banks and amongst shrubs.

SIKKIM: Lingmuthang, 3050 m, 12 ix 1912, *Rohmoo Lepcha* 55 (E, K); Sum bo tun, 609 m, 18 vii 1878, *Dungboo* (BM).

TIBET: Chumbi, 26 viii 1913, *Cooper* 740 (E); Champitang to Yatung, 3655–3960 m, 2 viii 1936, *Chapman* 314 (K); Yatung, 3050 m, 20 viii 1938, *Gould* 1537 (K).

BHUTAN: Jaisah, Bumthang, 2745 m, 12 ix 1914, *Cooper* 2079 (E); Kiki La, Bumthang, 3200 m, 3 x 1914, *Cooper* 2268 (BM); Chendebi, 2450 m, 5 viii 1937, *Ludlow & Sherriff* 3522 (BM holo. *A. sherriffianus*); near Bumthang, 2895 m, 31 vii 1949, *Ludlow, Sherriff & Hicks* 16982 (E, BM); Ha Dzong, 2745 m, 26 x 1949, *L.S. & H.* 17533 (BM); Yuto La, 2745–3050 m, 31 viii 1949, *L.S. & H.* 19668 (E, BM); Ha, 2745 m, 21 ix 1950, *L.S. & H.* 21498 (BM).

BURMA: Shan States, Taunggyi, 1450–1600 m, 22 xii 1957, *McKee* 5874 (K).

In distribution this species extends to Western Yunnan and South Western Szechuan and has also been found in Northern Siam.

A. vestitus resembles *A. indamellus* in its densely leafy stems, in its terminal corymbs of capitula and in the foliaceous tips of the phyllaries. It differs from *A. indamellus*, however, in having lanceolate leaves which are less obviously toothed and in lacking the broad, leafy, outermost phyllaries of that species. The indumentum of both species is similar but *A. vestitus* is more plentifully glandular. The features that Handel-Mazzetti (l.c.) used to distinguish *A. sherriffianus* appear to be unreliable: forms with purely glandular stems and those with glandular and villous hairs on the stems occur both in Western China and in the Eastern Himalaya, nor can it be said that the phyllaries in the latter area are more herbaceous.

4. **Aster poliothamnus** Diels in Fedde. Repert. Beih. 12: 503 (1922).

Syn.: *A. ramsbottomii* Hand.-Mazz. in Jour. Bot. 76: 284 (1938).

Perennial suffrutescent caespitose herbs forming clumps ca. 1 m wide;

rootstocks woody. *Stems* 15–20 cm tall (sometimes over 1 m tall, according to collectors), virgate, finely pubescent and glandular. *Leaves* densely and finely pubescent intermixed with subsessile glistening glands, basal leaves absent, cauline leaves numerous and ± evenly distributed on the branches becoming fewer and smaller on the peduncles, elliptic, 1–1·5(–3) cm long 2–5(–8) mm broad, sessile attenuate at base, acute and mucronate at the apex, rarely obtuse, margins entire. *Capitula* 1–1·2 cm broad in corymbs or solitary and terminal on the numerous upper branches. Involucre 6–7 mm tall, 4–5 seriate, imbricate; phyllaries 2·5–7 mm long, 0·8–1 mm broad, lanceolate, subcoriaceous, straw-coloured, finely pubescent and glandular, outer and intermediate ones with green herbaceous tips, margins ciliate. *Ray flowers* 10–20, basal tube 2 mm long, ligules mauve or white, 0·5–1 cm long, 1·2–2 mm broad. *Disc flowers* yellow, 5–6 mm long, basal tube 1·6–2 mm long, lobes 0·75–1 mm long. Style appendages 0·5–0·75 mm long, lanceolate. *Pappus* 5 mm long, simple, buff-coloured. *Achenes* (immature) oblong, 2·5 mm long, 0·75 mm broad, 2-ribbed, brownish, covered with pale silky hairs.

TYPE: Western Szechuan, between Dege and Bejü near Hobo, 3450 m, 9 viii 1914, *Limpricht* 2169 (BRSL).

HABITAT: Abundant on dry gravel or earth slopes, on cliffs and in open scrub-covered country.

S.E. TIBET: Chamdo district, Salween Gorge 2745–3050 m, 3 viii 1933 *Ward* 10675 (BM holo. of *A. ramsbottomii*, iso. E); Pasho district, Kham, Valley of Du Chu, 3655 m, 6 vii 1936, *Hanbury-Tracy* 48 (BM); Pasho district, Sangonang, 3655 m, 24 vi 1936, *Hanbury-Tracy* 81 (BM).

The characters which Handel-Mazzetti used to distinguish *A. ramsbottomii* from *A. poliothamnus* seem to be completely insufficient. The stems of his type specimen are woody but no more so than they are in the type of *A. poliothamnus*, nor less green. Peduncle length is variable in this group: they may be few (ca. 6) and short in a corymbose arrangement but more usually the peduncles are longer and bear one or few capitula as in Handel-Mazzetti's type specimen. Between the two are intermediate conditions such as one finds in the type of *A. poliothamnus*. The green strap-like appendages at the tips of the phyllaries, which Handel-Mazzetti points to, are also variable even in Ward's specimen, they may taper continuously into the basal part of the phyllary or they may be obviously narrower (see Fig. 3, B). In common, apart from their suffrutescent habit, these specimens all have small elliptic leaves and a finely pubescent and glandular indumentum. The involucres are distinctly imbricate and the phyllaries have green herbaceous appendages. Their floral details, of course, agree.

This species is related to *A. vestitus* in its densely leaved stems and in its glandular indumentum. The involucres of both species are similar in organisation and in having green herbaceous apical appendages to the phyllaries. It differs from it, however, in being obviously suffrutescent and in having smaller and differently shaped leaves.

5. **Aster fuscescens** Bur. & Franch. in Jour. de Bot. 5: 49 (1891); Hutch. in Bot. Mag. t. 8728 (1917).

Erect perennial rhizomatous herbs. *Stems* 15–60 cm tall, densely leafy or with the majority of leaves aggregated at the base, glandular and pubescent

at least above. *Leaves* usually glandular and sparsely or densely villous, soft or subcoriaceous in texture, veins sometimes prominent on both surfaces, margins repand dentate, teeth mucronate. Basal and lower cauline leaves broadly ovate and cordate at the base, or oblong and rounded at the base, 3–7(–12) cm long, 2·5–6(–10) cm broad, borne on petioles up to 15 cm long, upper cauline lanceolate or ovate-cordate, petiolate or sessile. *Capitula* as many as 30 in terminal corymbs, 1–1·5 cm broad. Phyllaries 2–3 seriate, subequal, 6–10 mm long 1·5–2 mm broad, linear-lanceolate, thickly herbaceous with membranous margins, glabrous or covered with short-stalked glands. *Ray flowers* 20–25, basal tubes 1·5–2 mm long, ligules bluish or purple, 0·8–1·9 cm long, 1·3–2·5 mm broad. *Disc flowers* yellow or orange 5·5–7·5 mm long, basal tubes 1·75–2 mm long, lobes 1·3–1·6 mm long. Style appendages 0·75–1 mm long, lanceolate. *Pappus* simple, buff or brownish, setae irregular in length 4·5–7·5 mm long. *Achenes* obovate 2·75–3·5 mm long, 1–1·5 mm broad, brownish, glabrous or sparsely sericeous and sometimes glandular above.

TYPE: Szechuan, environs de Tatsien-lu, 1890, *Prince Henri d'Orleans & Bonvalot* (P).

HABITAT: Alpine meadows and grassy slopes amongst scrub.

This species is clearly divided into three varieties as follows:

1. Basal and lower cauline leaves broadly ovate, cordate at the base, sparsely or moderately villous and glandular 2
\+ Basal and lower cauline leaves oblong or lanceolate, ± densely villous and glandular . . . . . var. *oblongifolius*
2. Leaves thin and soft, veins hardly prominent. Capitula 15–30 per corymb . . . . . var. *fuscescens*
\+ Leaves tough, veins prominent on both surfaces. Capitula less than 10 per corymb . . . . . var. *scaberoides*

5a. **Aster fuscescens** Bur. & Franch. var. **fuscescens**

Stems robust 4–6 mm thick at the middle, up to 60 cm tall, pubescent. *Leaves* sparsely villous on both surfaces but denser on the veins beneath; radical leaves absent at flowering time but on sterile shoots up to 7(–12) cm long, 6·5(–10) cm broad, broadly ovate, cordate at the base, borne on petioles up to 12 cm long, middle and upper cauline leaves 5–8 cm long, 3–7 cm broad, similar in shape, borne on petioles up to 3 cm long, uppermost leaves among branches of inflorescence narrower, ovate lanceolate. *Capitula* 15–30 per corymb, 1·2–1·5 cm broad. Phyllaries 0·8–1 cm long, 1–1·5 mm broad covered with short-stalked brownish glands.

N.E. UPPER BURMA: Chimili Pass, 3800 m, 19 viii 1919, *Farrer* 1223 (E); Moku-ji Pass, 3595–3655 m, 4 viii 1920, *Farrer* 1806 (E); W. Flank of N'Maikla—Salween Divide, 26°25′ N, 98°48′ E, 3655–3960 m, ix-x 1925, *Forrest* 27238 (E), 27522 (E).

S.E. TIBET: Tsarung, Mt. Kenichunpo, 3800 m, v-vii 1932, *Rock* 21981 (E).

This is the most robust of the three varieties. The leaves are soft in texture and intermediate so far as density of indumentum is concerned, between the other two varieties. The cauline leaves overlap one another often obscuring the stem and surrounding the corymb.

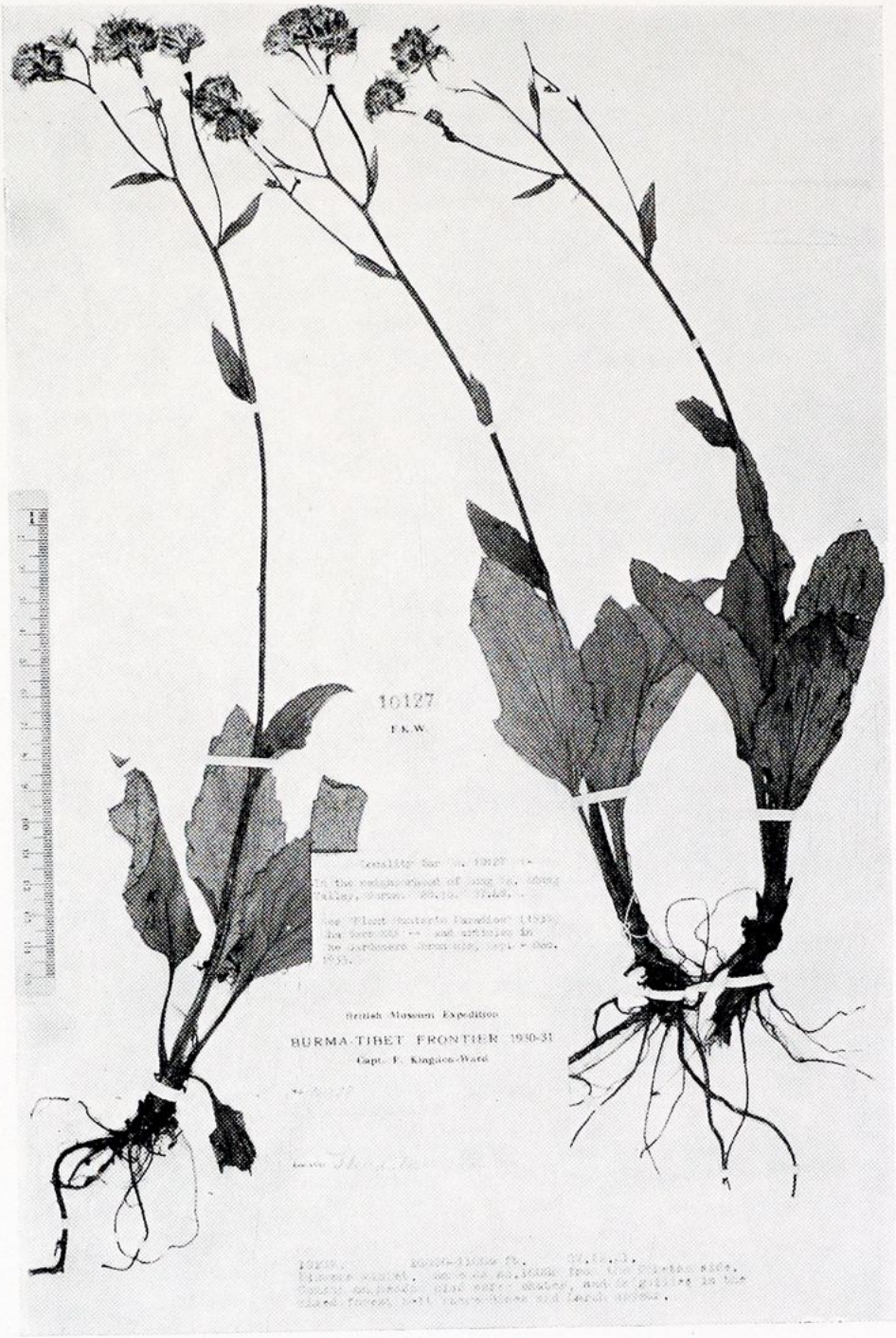


PLATE 8. Type specimen of *Aster fuscescens* Bur. et Franch. var. *oblongifolius* Grierson.

5b. **Aster fuscescens** Bur. & Franch. var. **scaberoides** Chang in Bull. Fan Mem. Inst. 6: 47 (1935).

Stems slender 15–45 cm tall 1·5–3 mm thick at the middle, glabrescent below, brownish pubescent above sometimes intermixed with shortly stalked glands. *Leaves* sparsely covered with villous hairs and glistening glands, subcoriaceous, prominently veined on both surfaces. Basal and lower cauline leaves broadly ovate, cordate at the base 3–6·5 cm long 3–6 cm broad, borne on petioles up to 15 cm long, margins dentate or repand-dentate, teeth mucronate; upper cauline leaves narrower, ovate or lanceolate, becoming sessile. *Capitula* as many as 10 per corymb, 1–1·5 cm broad. Phyllaries 6–8 mm long, 1·5–2 mm broad, glabrous.

S.E. TIBET: Tsarung, Salween-Kui Chiang Divide, 28°40′ N, 98°15′ E, vii-viii 1919, *Forrest* 18890 (syntype E), 19313 (syntype E, K); Mt. Kenichunpo, N of Sikitung, 3655 m, v-vi 1932, *Rock* 22189 (E).

N.E. UPPER BURMA: Moku-ji Pass, 3050 m, 28 viii 1920, *Farrer* 1836 (E); Nam Tamai Valley, 28° N, 97°45′ E, 2745–3350 m, 7 ix 1937, *Ward* 13199 (E, BM); Tama Bum, 98°15′ E, 26°50′ N, 3200 m, 14 x 1953, *Ward* 21473 (E, BM); Taron Valley, 28°10′ N, 98°10′ E, 2305 m, 19 x 1938, *Kaulback* 129 (BM), 130 (BM).

This variety is more slender than the other two but like var. *oblongifolius*, the stems bear fewer leaves which, however, are thicker and harder in texture. The phyllaries are completely glabrous.

5c. **Aster fuscescens** Bur. & Franch. var. **oblongifolius** Grierson, **var. nov.** (Plate 8). Foliis oblongis vel lanceolatis, chartaceis, plus minusve densius villosis et glandulosis distincta.

Stems 25–35 cm tall, 2·5–3 mm thick at the middle, villous and glandular pubescent. *Leaves* ± densely villous along the veins intermixed with subsessile glistening glands, veins hardly prominent. Basal and lower cauline leaves oblong or lanceolate 5–8·5 cm long, 2·5–3·5 cm broad, margins repand dentate, teeth mucronate; upper cauline leaves few, lanceolate, sessile 3–7 cm long, 1·5–3 cm broad. *Capitula* 6–10 per corymb, 1·3–1·5 cm broad. Phyllaries 1 cm long, 1·6–2 mm broad, villous and glandular puberulent.

BURMA: Upper Adung Valley, N of Tahawndam, 3050–3350 m, 27 ix 1931, *Ward* 10127 (holo. BM, iso. E).

TIBET: Tibetan Side of Namni La Pass, 28° 35. N, 98° E, 3350 m, 3 ix 1931, *Ward* 10025 (BM).

The leaf-shape and more abundant indumentum make this variety distinctive. It is intermediate in robustness and the leaves, like those of the typical variety, are not prominently veined. The phyllaries are villous and glandular puberulent.

A. fuscescens is to be recognised by its corymbose inflorescence, its subequal phyllaries and its brownish pappus. It seems to have no very close relatives in the Sino-Himalayan region, although it has been compared with *A. scaber* Thumb. which it resembles in leaf shape but is otherwise very different in having shorter imbricate involucres. In detail of the latter, *A. fuscescens* may be more closely related to *A. senecioides* Franch. but the lanceolate or oblanceolate leaves of this species approach only those of var. *oblongifolius*.

A. fuscescens is distributed between 26° and 40°N, mostly on the hills around the Irrawaddy, Salween, Mekong and Yangtze Rivers. The typical variety extends further east into Yunnan but in the west only succeeds in entering N.E. Upper Burma and S.E. Tibet at a few places. Var. *scaberoides* on the other hand is its western counterpart and enters Yunnan only in the area between the Irrawaddy and the Salween Rivers. Var. *oblongifolius* appears to have a more local distribution and has been found only at two stations on either side of the Burma-Tibet frontier.

In the garden, var. *fuscescens* is hardy and has been reported to seed itself with comparative freedom. It was introduced by Ward in 1914 but, in spite of the somewhat flattering Botanical Magazine illustration, it is not sufficiently attractive to have a wide appeal. Its habit is by no means graceful and the rays are not showy enough to offset the brownish quality of the pappus and disc flowers.

6. **Aster peduncularis** Wall. ex Nees, Gen. et Sp. Ast. 24 (1832); C.B. Cl. Comp. Ind. 48 (1876). Wall. Cat. 2967 (1831) nom. nud.

Syn.: *Amphirhapis peduncularis* DC. Prod. 5: 344 (1836).
Diplopappus asperulus DC. Prod. 5: 277 (1836).
Aster asperulus (DC.) Hook. f. Fl. Brit. Ind. 3: 252 (1881). Wall. Cat. 2968 (1831) nom. nud.: Nees, Gen. et Sp. Ast. 281 (1832) nom. nud.

Perennial rhizomatous herbs. *Stems* erect usually flexuose, 15–90 cm tall, glabrous or thinly villous below, glandular or villous above. *Leaves* often distinctly 3-nerved, ± evenly distributed on stem at least as far as peduncles, 4–17 cm long, 1·5–7 cm broad, including petiole 0·5–4·5 cm long, scattered villous on both surfaces, usually denser towards the margin, elliptic or ovate, cuneate, rounded or cordate at base tapering to a broad sheathing petiole, apex acute or acuminate mucronate, margin coarsely dentate. *Capitula* solitary or several, corymbose, 1·1–2(–2·5) cm broad; involucre 2-seriate; phyllaries 0·7–1·4(–2·5) cm high, 1·5–3·5(–5) mm broad, finely glandular or villous at base, ovate to linear lanceolate, all ± equal in size or some almost twice as long as others, green or purplish tinged, membranous especially at the margins, 1·5–3·5(–5) mm broad. *Ray flowers* 18–36, basal tube 1·5–3·5 mm long, ligules bluish-mauve or white, 1·2–2·5 cm long. *Disc flowers* yellow, 4·5–7 mm long, basal tube 1·5–3 mm long, lobes 0·5–1·5 mm long. Style appendages lanceolate, ca. 0·5 mm long. *Pappus* simple, semi-double or double, outer pappus of narrow or broad setae, inner pappus as long as disc flowers often barbellate, whitish or buff. *Achenes* obovate, 4–4·5 mm long, 3–3·75 mm broad, covered with fine buff hairs.

This species is divided into two subspecies as follows:

Plants more than 30 cm tall. Leaves cuneate or rounded at base (not obviously cordate). Capitula several . . subsp. *peduncularis*

Plants sometimes only 10–15 cm tall (but not uncommonly reaching 40 cm). Leaves cordate at base. Capitula 1 or 2 (rarely more). subsp. *nepalensis*

6a. **Aster peduncularis** Wall. ex Ness subsp. **peduncularis**

HABITAT: In rock crevices and forest clearings.

N.W. INDIA: Without locality, *Jacquemont* 2207 (K); Kumaon, *Wallich* 2967

holo. K, iso. E, BM); 2968 (K, holo. of *A. asperulus*, iso. BM), Garhwal, Rampur, 14 x 1938, *Kirit Ram* 8845 (E); Tehri, Thati Katur, 1525 m, 26 ix 1948, *Rup Chand* 1213 (MICH); Simla, without precise locality, 2135–2745 m, *T. Thomson* (E, K); Simla, 10 ix 1831, *Lady Dalhousie* (C.B.D.) (E); Simla, ix 1855, *Anderson* (E); prope Theog, 2135 m, 1884, *Drummond* 1645 (E), 1646 (K); Mussoorie, ix-x 1916, *Anderson* (E); Bashahr, above Kandar, 2440 m, 20 x 1890, *Lace* 646 (E); Kangra, Dharmsala, 2440 m, 7 x 1874, *Clarke* 24016 C (BM); Jaunsar, Kanasar-Bodyar Road, 2135 m, 17 ix 1936, *Raizada* 7204 (E); Deoban, 22 ix 1936, *Raizada* (E); Kulu, Manali, 1830 m, 26 ix 1916, *Cooper* 5688 (E); Sarchi Nal, 3050 m, 27 ix 1916, *Cooper* 5711 (E); Naggir, Hall Estate, 1830 m, 3 x 1930, *Koelz* 1414 (MICH).

This subspecies appears to be confined to the Western Himalaya between the southern frontier of Kashmir and Nepal (see map, Fig. 9) being replaced by *A. thomsonii* in the former and seemingly completely absent from the latter. It is readily distinguished from subsp. *nepalensis* by the leaf character but there are several other interesting differences. Pubescence, although similar in both subspecies, varies in its distribution; here the stems are usually completely glabrous but the peduncles and the bases of the capitula are more or less glandular. The capitula may measure as much as 2 cm in breadth but are generally smaller than in subsp. *nepalensis* and average 1–1·5 cm. The involucre which is less variable than in the latter and normally only as long as the disc flowers, nevertheless does occasionally produce, as in the isotype at Edinburgh, phyllaries which are longer, or, as in *Raizada* 7204, the first heads to develop have larger phyllaries than in those that follow. This indicates, perhaps, that their size is not wholly determined genetically but is influenced by other factors as well. Within the pappus there is a range of conditions between truly simple and double but in this subspecies the outer setae are always narrow and the broader subpaleaceous type, that is found in subsp. *nepalensis*, is absent. In several specimens fusion has taken place between two or three adjacent setae of the inner series but this coherence never extends for more than half the length of these setae.

Of the two, this subspecies is the more easily confused with *A. thomsonii* and in herbaria is frequently mixed with material of it. There are, however, several features which readily distinguish them: the leaves of *A. thomsonii* are generally less sharply toothed and are sessile, its disc corollas are only about 3·5 mm long and its pappus pale brown and only half as long as the disc corollas.

6b. **Aster peduncularis** Wall. ex Nees subsp. **nepalensis** Grierson, **subsp. nov.**

Planta 15–60 cm alta, ± villosa, foliis cordatis, capitulis solitariis vel rarius pluris, phyllaribus longitudine floribus disci aequalis vel subduplo longioribus.

HABITAT: In pine or oak forests.

NEPAL: More Langno, 22 ix 1936, *F. M. Bailey* (E); between Jumla & Garjigoth, 3050 m, 8 viii 1952, *Polunin, Sykes & Williams* 5016 (holo. E, iso. BM); Rimi, SE of Jumla, 3050 m, 27 ix 1952, *P.S. & W.* 5436 (E, BM); Gad Rangchi, 1675 m, 16 x 1952, *P.S. & W.* 5751 (E, BM); above Gurjakhani, 2895 m, 15 ix 1954, *Stainton, Sykes & Williams* 4425 (E, BM); Maikot, 2590

m, 7 x 1954, *S.S. & W.* 4721 (E, BM); Lete, S of Tukucha, Kali Gandaki, 2440 m, 16 ix 1954, *S.S. & W.* 7861 (E, BM); Bhuji Khola, 2305 m, 16 x 1954, *S.S. & W.* 9065 (E, BM).

Although only known from eight gatherings, this shows itself to be a variable subspecies. Two of these collections (*P.S. & W.* 5016 and *S.S. & W.* 4721) are of small scapiform plants averaging 15 cm tall while the remainder are taller—up to at least 60 cm—with leafy stems. They bear solitary (or, less often, two) capitula which, on the average, are larger (1·5 cm) than in the last subspecies. *P.S. & W.* 5436, however, has obviously been a larger plant with its stem branching above to bear about 8 heads. Leaves are again the easiest means of distinguishing this from the other subspecies; they are always larger and usually more coarsely toothed and, unlike subsp. *peduncularis*, the sheathing petioles are strongly developed and may become almost auriculate at their bases. In indumentum, this subspecies appears to be almost completely eglandular and the villous type of hair is more abundant on the stems, peduncles and leaves. Phyllaries are particularly variable (see Fig 4, G and H); they average 1–1·4 cm long, 2·75–3 mm wide, but in several specimens, and sometimes on the same plant as those of average size, they may attain 2·5 cm long, 5 mm broad. The pappus again varies between the simple and double conditions and fusions have taken place between adjacent setae of the inner series but the outer setae are usually broader and more paleaceous than in subsp. *pedunculare*.

7. **Aster laka** C. B. Cl. Comp. Ind. 49 (1876); Hook. f. Fl. Brit. Ind. 3: 253 (1881).

Rhizomatous perennial herbs. *Stems* erect, scarcely flexuose, 10–15(30) cm tall, glabrous below, white villous pubescent near capitula. *Leaves* pilose on both surfaces, basal leaves often absent on flowering stems but on sterile shoots ovate or oblong, 4–5·5 cm long, 3–4 cm broad, cordate at base, obtuse or mucronate at apex, margin dentate, borne on petioles ca. 6 cm long, cauline leaves ± evenly distributed on stems, upper ones often sheathing capitula at first, 4–9 cm long, 3–7·5 cm broad; broadly ovate, cordate at base, obtuse or acute and mucronate at apex, margin repand dentate or denticulate, petioles 4·5–8 cm long, alate, semi-amplexicaul. *Capitula* solitary or as many as 3, 2–2·5 cm wide; phyllaries 3-seriate, ± equal in length, sparsely to moderately white villous, outer ones ovate, 1·2–2·5 cm long, 0·5–1·3 cm broad, herbaceous, green or purplish, inner ones narrower and membranous. *Ray flowers* as many as 45, basal tubes 3 mm long, ligules mauve, 1·6–2 cm long. *Disc flowers* mauve, 7·5 mm long, basal tubes 2–2·5 mm long, lobes 1–1·5 mm long. Style appendages ovate, 0·5 mm long. *Pappus* simple or double, white, inner setae as long as disc corollas, outer setae, when present, ca. 1 mm long, similar to inner setae or somewhat stouter. *Achenes* (submature) obovate, 3 mm long, 1·5 mm broad, brownish, 2-ribbed covered with white silky hairs.

HABITAT: On cliffs and rock faces.

KASHMIR: Sinthan Pass, head of Bringhi valley, 3500 m, 9 ix 1940, *Ludlow & Sherriff* 8198 (E, BM); same locality, 3500 m, 24 x 1940, *L. & S.* 8286 (BM); Kishtawara, Bangar, 4570 m, 31 vii 1943, *L. & S.* 9263 (BM); Rajpargan Sanctuary, Bringhi Valley, 3200 m, 24 viii 1943, *L. & S.* 9367 (BM).

INDIA: Kangra, Laka near Dhurmsala, 3350 m, 17 x 1874, *Clarke* 23840 and 23869 (K-syntypes); Laka, 3050 m, *Edgeworth* 5045 (K); Chamba, above Bara, 3050 m, 17 ix 1896, *Lace* 1503 (E).

A. laka is closely allied to *A. peduncularis*, in particular to subsp. *nepalensis*, and its reduction to a third subspecies of this taxon might be justified. Both are similar in height and have ovate-cordate leaves with sheathing petioles; both have similar capitula although those of *A. laka* tend to be larger. Its specific status is maintained, however, principally on the structure of the involucre. This is triseriate in *A. laka* and its broad outermost phyllaries are entirely foliaceous whereas the involucre of *A. peduncularis* is biseriate and its narrower outer phyllaries have thin membranous margins.

8. **Aster thomsonii** C. B. Cl. Comp. Ind. 48 (1876); Hook. f. Fl. Brit. Ind. 3: 252 (1881).

Syn.: *Calimeris flexuosus* Royle ex DC. Prod. 5: 258 (1836); Ill. Bot. Himal. 251, t. 58 (1839).
A. flexuosus (DC.) Ktze. Rev. Gen. 316 (1891) *non* Fisch. (1812) *nec* Nutt. (1818).

Perennial rhizomatous herbs. *Stems* 20–60 cm tall, erect, usually ± flexuose, villous and glandular especially above, becoming glabrous towards the base. *Leaves* finely pubescent or villous, sometimes sparsely so, and usually glandular on the lower surface; basal leaves lacking at flowering time, cauline leaves ± evenly distributed, elliptic-ovate 4–10 cm long, 2·3–5·5 cm broad, cuneate, sessile at the base, rarely petiolate, acute or acuminate at the apex, margin shallowly or coarsely 4–6 toothed per side. *Capitula* solitary or as many as 10 on terminally branched stems, 1–1·5 cm broad; phyllaries 0·8–1·0 cm long, 1·2–1·5 mm broad, pubescent but becoming thickly villose at the base, 2-seriate, subequal, ovate, acuminate, herbaceous, green or straw-coloured at the base. *Ray flowers* 25–35, basal tube 1·5–2 mm long, ligules pink or purplish, 1–2 cm long. *Disc flowers* 3–4 mm long, basal tube 1–1·25 mm long, lobes ca. 1 mm long. Style appendages lanceolate, ca. 0·5 mm long. *Pappus* simple, 1–2 mm long, buff or pale brown. *Achenes* 2·5–4·5 mm long, 1·25–2 mm broad, obovate, finely pilose, 2–4 ribbed.

HABITAT: In open pastures in alpine zone, on cliff faces and in conifer forests.

PAKISTAN: Hazara, Kagan Valley, 2745 m, 18 viii 1896, *Duthie* 19717b (K); Kagan Valley between Balakot, 34°35′ N, 73°20′ E, and Babusar Pass 35°10′ N, 74°2′ E, vii-ix 1954, *Abel* 102 (BM).

KASHMIR: Pir Panjal, 2745 m, 2 viii 1875, *Clarke* 27129 (BM), Sind Valley, 3200 m, 3 ix 1876, *Clarke* 31014 (BM); Gulmarg, 2440–2745 m, 10 vii 1892, *Duthie* (E, BM); Pahlgam, 30 vii 1920, *R. R. Stewart* 5504 (K); Desu, 2305 m, 26 vi 1939, *Ludlow* 138 (BM); Tilpatra Forest near Rampur, Thelum Valley, 2925 m, 6 vii 1940, *Ludlow & Sherriff* 7734 (E, BM); Sinthan Pass, Bringhi Valley, 3350 m, 7 ix 1940, *L. & S.* 8190 (E, BM); near Atholi, Kishtawar Dist., 2440 m, 22 vii 1943, *L. & S.* 9207 (E, BM); Gulmarg, 2970 m, 9 viii 1956, *Polunin* 56/120 (E).

INDIA: Dalhousie, 2440 m, 17 ix 1874, *Clarke* 22624 (BM); Chamba, Kalalop Forest, 2305 m, 25 vii 1895, *Lace* 766 (E); Garhwal, above Dhunpoor, 2895 m, *Madden* 490 (E); Kedarnath, 19 1938, *Kirit Ram* 8932 (E); Jaunsar, Konain, 2440 m, 19 ix 1936, *Raizada* 7261 (E); Simla, 2440–3050 m, viii

1849, *Thomson* (K, BM); Simla, *Madden* 492 (E); Simla, 29 vi and 11 viii 1831, *Lady Dalhousie* (E); Mussourie, *Royle* 113 (holo. GE, not seen); s.n. (K—probably also type material).

As already stated, this species is easily confused with *A. peduncularis* and the differences between them are set out in the discussion of the latter. Also, because of the similarity in the shape of their leaves and capitula, forms of *Inula nervosa* have been confused with both species but are easily separable on floral details.

The short pappus is common to both *A. thomsonii* and *A. souliei* but the constituent setae are not coarse bristles nor are they so darkly coloured as they are in the latter and the species are not otherwise related. Assuming, however, that *A. peduncularis* and *A. thomsonii* are directly descended from the same ancestral stock, and that their close similarity is not due to convergence, the pappus of the latter may be homologous with the outer series of setae of *A. peduncularis*, the inner series having entirely disappeared.

A. thomsonii has been in cultivation in this country since before the end of last century but it is uncertain precisely when or by whom it was introduced. *A. thomsonii nanus* of gardens seems to be no more than a low growing form (20–30 cm tall) of this species. With *A. amellus*, *A. thomsonii* was one of the parents of the well-known garden hybrid *A. x frikartii* which was raised by M. Frikart, a Swiss grower, probably in the early 1920's. It received an Award of Merit from the Royal Horticultural Society in 1925.

9. **Aster trinervius** D. Don, Prod. Fl. Nepal, 177 (1825); Roxb. Hort. Beng. 61 (1814) *nom. nud.;* Spreng. Syst. Veg. 3: 528 (1826); Roxb. Fl. Ind. 3: 433 (1832); non Gilib. (1781).

Perennial suffrutescent rhizomatous herbs. *Stems* 0·6–2 m tall, erect, rarely flexuose, terete, smooth or striate, glabrescent below, ± finely pubescent above or ± coarsely and densely pilose throughout. *Leaves* smooth or bullate, venation pinnate but ± distinctly 3-nerved, sparsely or densely scabrous especially on the upper surface, occasionally glabrescent or finely pilose; often interspersed with subsessile glistening glands; basal leaves absent at flowering time, cauline leaves ± evenly distributed, lower ones 4·5–10·5 cm long, 1·5–2 (–4·25) cm broad, elliptic, lanceolate or ovate, rarely broadly ovate, attenuate at base to a short usually broad petiole (up to ca. 7 mm long), acuminate at apex, margin with 4–7 shallow teeth on each side, upper cauline leaves 3·5–5·5 cm long, 0·7–1·5 cm broad, narrowly ovate or lanceolate, sessile at base, acuminate at apex, margins entire or serrulate. *Capitula* 0·6–1·2(–1·5) cm broad, few (ca. 6)—numerous in tight or lax corymbs or in lax corymbose panicles; phyllaries ca. 25, 4–5·5(–7·5) mm long imbricate, 3-seriate, spathulate, acute or obtuse, herbaceous or subcoriaceous, green or purplish, glabrous or finely pubescent, margins somewhat membranous, ciliate or rarely glabrous. *Ray flowers* 10–20, basal tube 2–3 mm long, ligules 7–10 mm long, 1·75–3 mm broad, usually white, sometimes pale pink rarely purplish or bluish. *Disc flowers* yellow 5–6·5 mm long, basal tube 1·5–2 mm long, lobes 1·25–2 mm long, often glandular. Stamens and styles often much exserted, style appendages 0·75–1 mm long, lanceolate. *Pappus* simple, dirty white or reddish, 4·5–6 mm long. *Achenes* 2·5–4 mm long, 0·75–1·5 mm broad, obovate, greyish-brown, 2–3 ribbed, covered with

sparsely silky hairs, sometimes glandular. Receptacle fimbrillate or subpaleaceous, fimbrillae as much as 0·8 mm long.

HABITAT: Clearings in *Abies*, *Quercus* or *Tsuga* forests, on steep grassy banks amongst shrubs and bracken, fields and river beds.

A. trinervius is one of the most widely distributed Asiatic species extending from Nepal over Northern China to Japan and is certainly the most protean. The facies of the plants vary considerably between populations and the characters show little correlation among themselves. The species has been divided into several varieties by Handel-Mazzetti (1938) and by Kitamura (Comp. Jap.: 345, 1937) but these seem to have only limited application here and its treatment in this paper is one that follows from an examination of the type specimens involved. Obviously, however, this is a species that deserves a wider treatment and not one that is limited as to region.

During the past twenty-five years *A. trinervius* has been treated as a synonym of *A. ageratoides* on account of its being a later homonym of *A. trinervius* Gilibert. The validity of the names published by the latter author have been investigated by McVaugh (1949) who found that Gilibert did not consistently follow, either in practice or belief, the Linnaean system of binary nomenclature. It was accordingly recommended that the names published by Gilibert should be abandoned as being contrary to Article 23(3) of the International Rules of Nomenclature. This advice has been followed by some authors in respect to other genera; here Gilibert's name is regarded

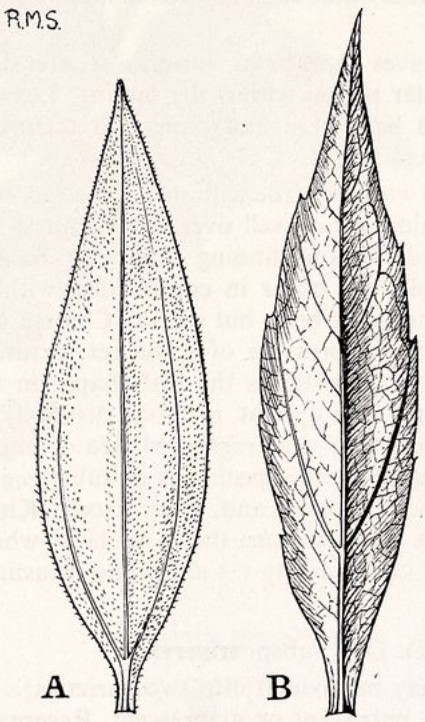


FIG. 7. Leaves of *Aster trinervius*.
A, subsp. *trinervius* showing basal trinervation; B, subsp. *ageratoides* showing suprabasal trinervation (both × 1½).

as invalid and thus the objection to the use of *A. trinervius* Don is removed.

It must also be pointed out that Roxburgh has often been incorrectly cited as the author of *A. trinervius*. It is true that he was the first to publish this name but, like others that appeared in his Hortus Bengalensis (1814), it must be treated as a *nomen nudum*. Don took up the name and published a description of the plant in his Prodromus, seven years before Roxburgh's fuller treatment of it in his Flora Indica (1832). The type specimens which these authors used are different although they have the same origins. Roxburgh's was founded on a cultivated plant which was grown from seed collected by Buchanan-Hamilton in Nepal. Don makes no mention of this cultivated specimen in his description but quotes "*ad Narainhetty Nepalensium, Hamilton . . . Floret Octobri*" which appears on the specimen from his herbarium, now at the British Museum.

In the leaves, although described as being pinnately-veined, the lowermost pair of lateral veins are more strongly developed than the others and give the leaf the appearance of being trinerved. These veins spring from the midrib either in the short petiole as in subsp. *trinervius* or some distance above this point within the lamina as in subsp. *ageratoides* (see Fig. 7).

Key to the subspecies of Aster trinervius

Trinervation of leaves basal, lowermost lateral veins joining midrib in the petiolar region of the leaves. Leaves ovate-lanceolate, rounded at the base, thick or subcoriaceous in texture, sometimes thin. Capitula 0·8–1·5 cm broad . . . . . subsp. *trinervius*

Trinervation of leaves suprabasal, lowermost lateral veins joining midrib above the petiolar region within the lamina. Leaves elliptic-lanceolate, attenuate at the base, thin and papery in texture, sometimes bullate. Capitula 0·6–1 cm broad . . . . . subsp. *ageratoides*

This basic division was not made without taking representatives from China and Japan into consideration: well over one hundred specimens from these regions were studied without finding any with basally trinerved leaves. Thick leaf-textures do not occur in conjunction with suprabasal venation in the specimens considered here, but among Chinese specimens bullate leaf surfaces often give the impression of a thicker texture. Details of the leaf base are often as characteristic as the leaf shape: in subsp. *trinervius* it is rounded and narrows rapidly but is more distinctly attenuate in subsp. *ageratoides*. The distinction with regard to size of capitula can only apply to the Himalayan region; some specimens of subsp. *ageratoides* from China are more than 1 cm in breadth and, from Japan, Kitamura has described *A. ageratoides* subsp. *megacephalus* the capitula of which, including ligules, measure 3 cm broad i.e. probably 1·5 cm broad measuring across the tips of the phyllaries.

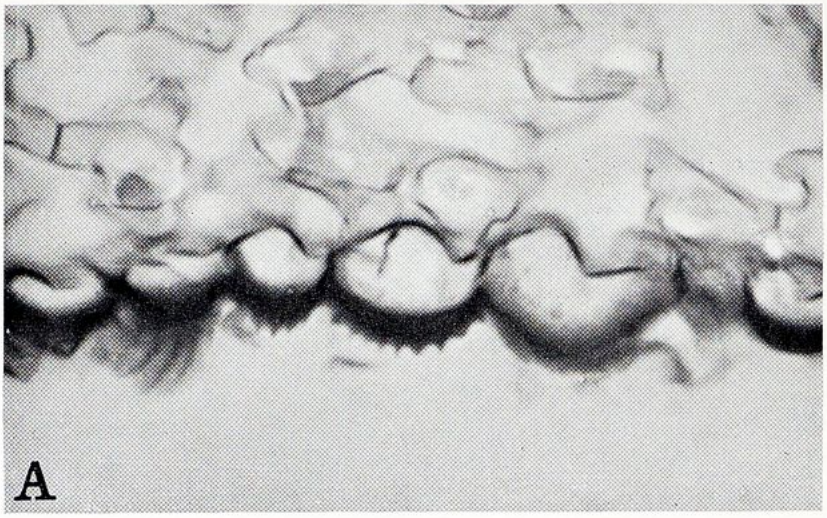
9a. **Aster trinervius** D. Don subsp. **trinervius**

This subspecies may be divided into two varieties:

Leaves and stems pubescent or glabrescent. Receptaclar fimbrillae up to 0·5 mm long . . . . . var. *trinervius*

Leaves and stems hoarily strigose. Receptacular fimbrillae 0·8–1 mm long. Plants of Assam . . . . . var. *wattii*

PLATE 9. Type specimen of *Aster fulgidulus* Grierson.



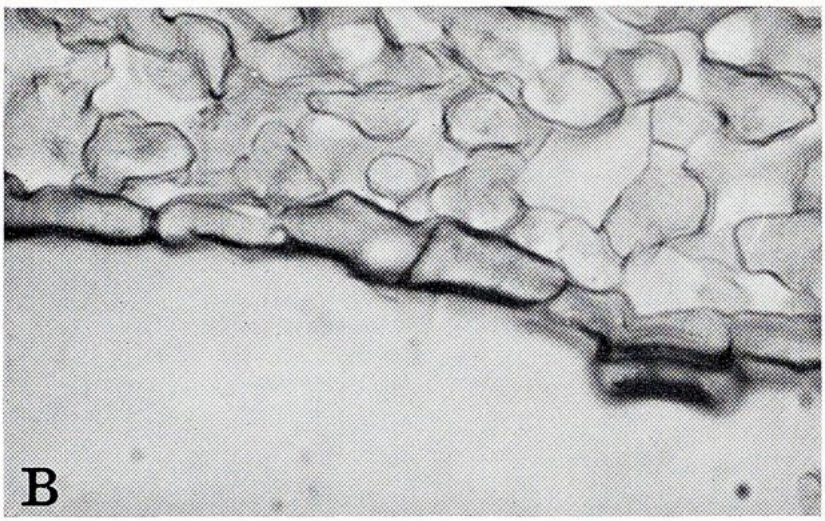


PLATE 10. Vertical sections of *Aster* leaves (prepared from dried material; both × 500). A, *Aster fulgidulus* showing corrugated outer walls of lower epidermis (one cell wall cut obliquely). B, *A. albescens* showing smooth outer walls of lower epidermis.

9aI. **Aster trinervius** subsp. **trinervius** var. **trinervius**

Syn.: *A. trinervius* Don Prod. Fl. Nepal. 177 (1825).
A. asperrimus Wall. Cat. 2970 (1828) non Less. (1830).
Galatella asperrima Nees Gen. et Sp. Aster 173 (1832).
Diplopappus asperrimus DC. Prod. 5: 277 (1836).
Aster scabridus C. B. Cl. Comp. Ind. 47 (1876) non E. Mey. ex DC. (1836).

NEPAL: Narainhetty, 23 x 1802, (*Buchanan*) *Hamilton* (BM holo., *A. trinervius*); without locality, *Wallich* 2970 (holo. of *A. asperrimus* and *A. scabridus* K, iso. BM, E); Bhargoo, 1927, *Dhwoj* 212 (E); Khading, 2440 m, 1928, *Dhwoj* 225 (E); Dharot, 1525–1830 m, 1928, *Dhwoj* 247 (E); Thosey, 1830–2440 m, 1930, *Dhwoj* 352 (E); Lete, 2440 m, ix 1954, *Stainton, Sykes & Williams* 7726 (E, BM); Mardi Khola, 1675 m, 16 ix 1954, *S.S. & W.* 8452 (E, BM); Ila, Bheri River, 1830 m, 8 ix 1952, *Polunin, Sykes & Williams* 3272 (E, BM); Maina, 1980 m, 12 xi 1952, *P.S. & W.* 5566 (E, BM); Chaunrikarka and Surkva, 2440 m, 24 x 1954, *Zimmerman* 1880A (E, BM, G).

ASSAM: Khasia, *Griffith* 262 (K); Mishmee, *Griffith* 3112 (K); Jaintea, Jongre, 915 m, 13 xii 1885, *C. B. Clarke* 42507E (K).

BURMA: Lohit Valley, 28°10′ N, 97°0′ E, 1220 m, 25 xi 1926, *Ward* 7665 (K, BM).

In a species as variable as *A. trinervius* is, intermediates between two major subspecies are almost inevitable. Some of those specimens cited above from Assam are somewhat variable in the position of the trinervation; the following plants have basally trinerved leaves and so must belong to subsp. *trinervius*, but differ from it and approach subsp. *ageratoides* in respect of their smaller capitula (i.e. about 0·8 mm broad) and their thinner chartaceous leaves.

NEPAL: Near Gurjakhani, 2440 m, 11 ix 1954, *Stainton, Sykes & Williams* 4351 (E, BM); Lete, 2440 m, 16 ix 1954, *S.S. & W.* 7863 (E, BM); Muri, 1980 m, 27 xi 1954, *S.S. & W.* 9160 (E, BM); Manebhanjyang, 1500 m, 5 xi 1954, *Zimmermann* 2059 (E, BM, G).

Of these, *S.S. & W.* 9160 is a striking plant with entirely purple phyllaries and may represent a distinct form of this species.

9aII. **Aster trinervius** subsp. **trinervius** var. **wattii** (C. B. Cl.) Grierson, **comb. nov.**

Syn.: *Aster wattii* C. B. Cl. in Jour. Linn. Soc. 25: 36 (1889).

Stems 0·3–2 m tall stiffly or softly strigose. *Leaves* basally trinerved, thick and sometimes stiffly subcoriaceous. Inflorescence paniculately corymbose. *Capitula* 1–1·5 cm broad. Phyllaries often thickly coriaceous. Ligules white.

ASSAM: Naga Hills, Kegwina Edge, 1675–1980 m, 10 x 1885, *C. B. Clarke* 61855 (syntype K), 41918 (syntype K, BM); Manipur Valley, 795 m, 4 xii 1881, *Watt* (E, K); Manipur, Mungba, 915 m, i 1882, *Watt* 6646 (E); Naga, Purr, *Bor* 6716 (K); Laruri, *Bor* 6723 (K); Manipur, Karong, 1065 m, x-xi 1950, *Koelz* 26280 (MICH), 26994 (MICH); same locality, 20 xi 1950, *Rup Chand* 4032 (MICH).

This variety is in several respects more uniform than the typical variety.

The specimens are all robust; the pubescence is always dense, sometimes soft, sometimes coarse; the capitula are large and less variable in size; the receptacle is strongly pseudopaleaceous.

Clarke often did not cite his type specimens by number and, as in the present instance, one is left to deduce the specimens that he examined from clues in the description or in the locality quoted. Here he wrote "Kohima, altitude 4000–6500 ft." after the original description but, although the name of the species is commemorative, this locality does not appear on any of Watt's specimens that have been examined. It does, however, appear on one of Clarke's labels, No. 41136. This bears the inscriptions "*Aster trinervius* Roxb." which is scored out, and "*Aster wattii* sp. nova" both in Clarke's hand but it also reads "Rays white, disc pinkish". The sheet to which this label is affixed is a mixed one bearing three small specimens of *Inula nervosa* and one of *A. trinervius* var. *wattii*. A second label, 61855, on this sheet, also in Clarke's handwriting, bears the words "*Aster trinervius* Roxb., Kegwina Edge, 6500 ft. Duplicate of white ray". ("Duplicate" probably refers to his 41918 which was collected in the same area and also inscribed *A. wattii*). As is well-known, *Inula nervosa* often does have red or pinkish disc flowers but *Aster trinervius* never does. Thus, on this mixed sheet, the label 41136 refers to the former and it seems probable that Clarke appended the name of his new species to the wrong label and added the locality from it to the description he was preparing. It also seems clear that Clarke's 41928 and 61855 should be regarded as syntype material and that the *locus classicus* should be "Kegwina Edge" not "Kohima". The complication with *Inula nervosa* is perhaps ironical since, in his Compositae Indicae (p. 47), he remarked that he believed *A. trinervius* to be synonymous with that species.

9b. **Aster trinervius** D. Don subsp. **ageratoides** (Turcz.) Grierson, **comb. nov.**

Syn.: *A. ageratoides* Turcz. in Bull. Soc. Nat. Mosc. 7: 154 (1837); Kitamura in Jour. Jap. Bot. 12: 642 (1936) and 19: 338 (1943); Kitamura, Comp. Jap. 1: 345 (1937); Hand.-Mazz. in Acta Hort. Gotoburg. 12: 210 (1938).

A. trinervius auct. non Don: Hand.-Mazz. Symb. Sin. 4: 1090 (1936).

No division into lower infraspecific categories has been attempted in this subspecies. Variation in size and character of parts of the numerous specimens is considerable and seems to be accompanied by little correlation. Handel-Mazzetti (l.c.) divided the Chinese representatives of this taxon into nine varieties some of which are sound but others lead to the assemblage of heterogeneous specimens brought together by the key characters employed. Few of these varieties seem to have any application here and, after the citation of specimens, some of the prevalent variation is discussed and where possible related to previously recognised taxa.

Apart from the leaf character, the Himalayan specimens of this subspecies are generally only sparsely scabrid pubescent and have smaller capitula with narrower phyllaries (usually less than 1 mm broad) than those of subsp. *trinervius*.

TYPE: Peking, 1843, *Kirilow* (LE).

NEPAL: Ghurchi Lagna, 3200 m, 28 viii 1952, *Polunin, Sykes & Williams* 3058

(E, BM); NW of Gurjakhani, 3275 m, 19 ix 1954, *Stainton, Sykes & Williams* 4481 (E, BM); Ghustung Khola 2895 m, 11 xi 1954, *S.S. & W.* 4789 (E, BM); Tukucha, 3350 m, 12 ix 1954, *S.S. & W.* 7801 (E, BM); Arun Valley, Chyamtang, 2440 m, 20 ix 1956, *Stainton* 1753 (E, BM).

BHUTAN: Simtoka Timpu, 2440 m, 13 x 1914, *Cooper* 2376 (E); Chapcha Timpu, 2135 m, 18 xi 1914, *Cooper* 3606 (BM); near Kohina, Mo Chu, 3655 m, 4 x 1949, *Ludlow, Sherriff & Hicks* 17414 (E, BM).

ASSAM: Khasia, Munglerie, 915–1830 m, 13 x 1850, *Hooker & Thomson* (K); Kohima, 1220–1830 m, 8 vii 1935, *Ward* 12583 (BM).

SIKKIM: Lachen, 2135 m, 4 viii 1849, *Hooker* (K); Chateng, 2440 m, 6 xi 1917, *Cave* (E).

SE TIBET: Nyam Jang Chu, between Le and Pangchen, 27°41′ N, 91°48′ E, 2305 m, 2 xi 1938, *Ludlow. Sherriff & Taylor* 6477 (E, BM).

NE BURMA: Hpimaw Hill, 2440 m, 3 x 1919, *Farrer* 1356 (E); Hpimaw, Ngaw Cheng Valley, 1830 m, 23 ix 1919, *Ward* 3675 (E).

Leaf shape in general follows that of the type species (*Kirilow* 1843), that is to say, with elliptical leaves tapering at the base into a broad or slender petiole. The leaves are narrower, 1·5 cm broad, in *S.S. & W.* 7801, and similar to those on the specimens that Handel-Mazzetti cited as var. *heterophyllus* Maxim. Bullate leaf surfaces, which Handel-Mazzetti used to characterise his var. *firmus* seem to be relatively uncommon in Himalayan populations and do not occur in subsp. *trinervius* but are encountered in subsp. *ageratoides* in *Cooper* 2376 and *Cave* s.n. Both specimens were collected late in the season and this character may indicate a moribund condition of the leaves which may occur widely in thin-leaved plants once they have reached maturity. Certainly, Handel-Mazzetti's usage of it has brought some very dissimilar specimens together.

Variation in inflorescence (using the term to mean the disposition of capitula) is largely continuous but several forms can be recognised. In the type specimen it consists of short leafy branches which arise in the upper quarter of the stem and bear 3–6 capitula in terminal corymbs (see Fig. 8, A). These corymbs are loosely and irregularly grouped and do not come to lie on one plane. This form of inflorescence is also found in the type specimens of var. *trinervius* and var. *wattii* and among Chinese populations of subsp. *ageratoides*, but is more uncommon in Himalayan specimens e.g. *L.S. & T.* 6477 and *Hooker* s.n. (Sikkim). In the following specimens, the branches are more elongated and the corymbs come to lie on the one plane to form a compound corymb (see Fig. 8, B): *Hooker & Thomson* s.n. (Khasia), *Ward* 3675, *Farrer* 1356 and probably *Stainton* 1753 which is immature. These are similar to Handel-Mazzetti's var. *laticorymbus*. Reduction to a single compact terminal corymb (see Fig. 8, C) has taken place in *S.S. & W.* 4481 and 7801. This reduction is carried further and the inflorescence consists of 3–6 capitula in *S.S. & W.* 4789 and similar examples may be seen in var. *trinervius* in *S.S. & W.* 7863, 9160 and in *Zimmermann* 2059 (see Fig. 8, F).

In the more diffuse forms of inflorescence, some are symmetrically branched (see Fig. 8, D) but in others the daughter axes break away from the parent axis at wide and varying angles (see Fig. 8, E). The first form is represented in subsp. *ageratoides* in China but, in the Himalayan region, is more common in var. *trinervius* e.g. *Griffith* 3112, *S.S. & W.* 8452 and *Dhwoj* 225. The

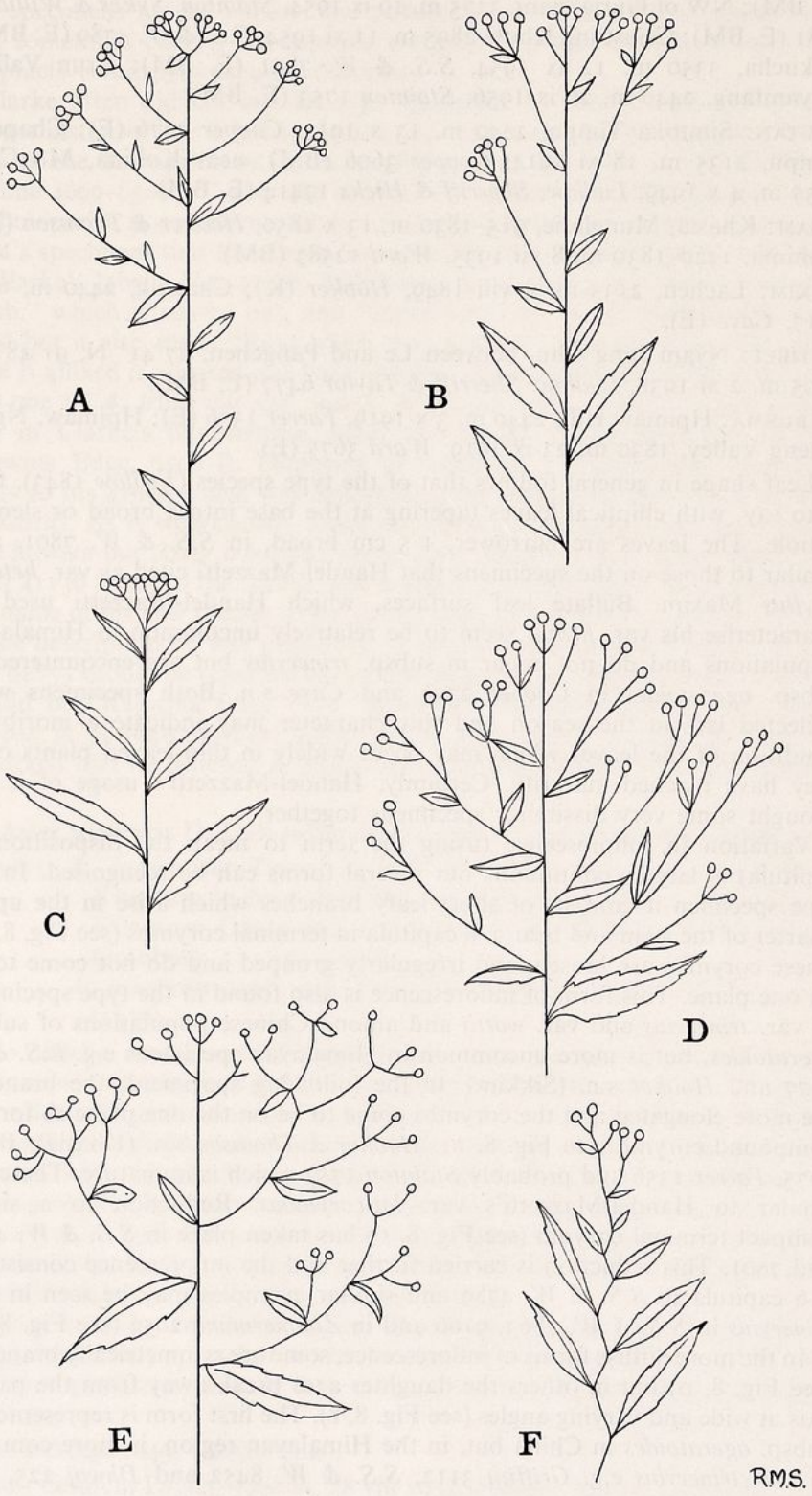


FIG. 8. Diagrams illustrating variation of inflorescence of *A. trinervius*. Explanations in text.

irregularly branched form is seen in *L.S. & H.* 17414 and from Yunnan in *T.T. Yü* 23134; in subsp. *trinervius*, *S.S. & W.* 7726 is yet another example. Between the compact and the diffusely branched forms there are numerous intermediates of which *Cooper* 2376 and *Cave* s.n. are instances.

In general, *A. trinervius* is a medium sized to tall herb with a straight or sometimes flexuose stem and ± distinctly trinerved leaves. Indumentum and glandulosity are both variable and in some specimens the short asperate hairs have prominent bases (see Fig. 1, B). The phyllaries vary in size but they are generally spathulate and rounded on the back, not lanceolate and carinate as they are in *A. albescens* (see Fig. 3, C and E). The ligules, of which there are 10–20, are usually white or white tinged with purple and are longer and broader than those of *A. albescens*. The disc flowers are rarely without a few glands at the apex of the lobes and are remarkable at maturity for their much exserted styles and stamens. The receptacle at times is pseudo-paleaceous but is often quite strongly fimbrillate.

10. **Aster albescens** (DC.) Hand.-Mazz. in Acta. Hort. Gotob. 12: 205 (1938); Jour. Bot. 76: 284 (1938); Wall. Cat. 2974 (1831) *nom. nud.*

Syn.: *Amphirhapis albescens* DC. Prod. 5: 343 (1836).
Aster ignoratus Kunth & Bouché in Ind Sem. Hort. Berol: 11 (1845); Linnaea 3: 388 (1847).
Aster ferrugineus Edgew. in Trans. Linn. Soc. 20: 64 (1846); Walp. Rep. 6: 716 (1847), non Wendl. (1819).
Aster cabulicus Lindl. in Bot. Reg. 1843, Misc. 62; Boiss. Fl. Or. 3: 158 (1875).
Microglossa albescens (DC.) C. B. Cl. Comp. Ind. 59 (1876); Hook. f. Fl. Brit. Ind. 3: 257 (1881); Bot. Mag. t. 6672 (1883).
Microglossa cabulica (Lindl.) C. B. Cl. Comp. Ind. 57 (1876).
Conyza conspicua Wall. Cat. 3066 (1831) *nom. nud.*
Solidago salicifolia Wall. Cat. 2974 (1831) *nom. nud.*

Erect shrubs. *Stems* 30–180 cm tall, covered with brownish pubescence intermixed with stipitate glands, rarely white tomentose, becoming glabrous with age. *Leaves* glandular or eglandular above with fine brownish pubescence especially along the veins; variously glabrous, pilose or greyish or white tomentose beneath but almost always intermixed with golden subsessile glands. Basal leaves absent at flowering time; cauline leaves alternate, ± evenly distributed on stem, 3–10(–17) cm long, 0·8–2·75 cm broad, elliptic, lanceolate or ovate, cuneate, sessile or very shortly petiolate at base, acute or shortly acuminate at apex, margin entire, denticulate or crenately toothed. *Capitula* in terminal corymbs, numerous when borne on main shoots or as few as 6 on lateral shoots, 5–7(–9) mm broad. Phyllaries lanceolate, sparsely pubescent or whitish tomentose especially towards base, imbricate, 3–4 seriate, ± carinate, 3·4–4·8 mm long, 0·6–0·8(–1) mm broad, central part green, often purplish at the tip, subcoriaceous, margins membranous lacerate fimbriate especially towards apex. *Ray flowers* ca. 15–30, basal tube 2·5 mm long, ligule blue, pink, mauve or white 4–4·5 mm long, 0·6–1·2 mm broad. *Disc flowers* yellow 4·5 mm long, basal tube 1·5 mm long, lobes often glandular, at least in bud, ca. 0·5 mm long. Style appendages broadly triangular ca. 0·5 mm long. *Pappus* buff or brownish, sometimes reddish, simple, 3·5–4 mm long. *Achenes* 1·75–2·5 mm long, 0·5 mm broad, greyish-

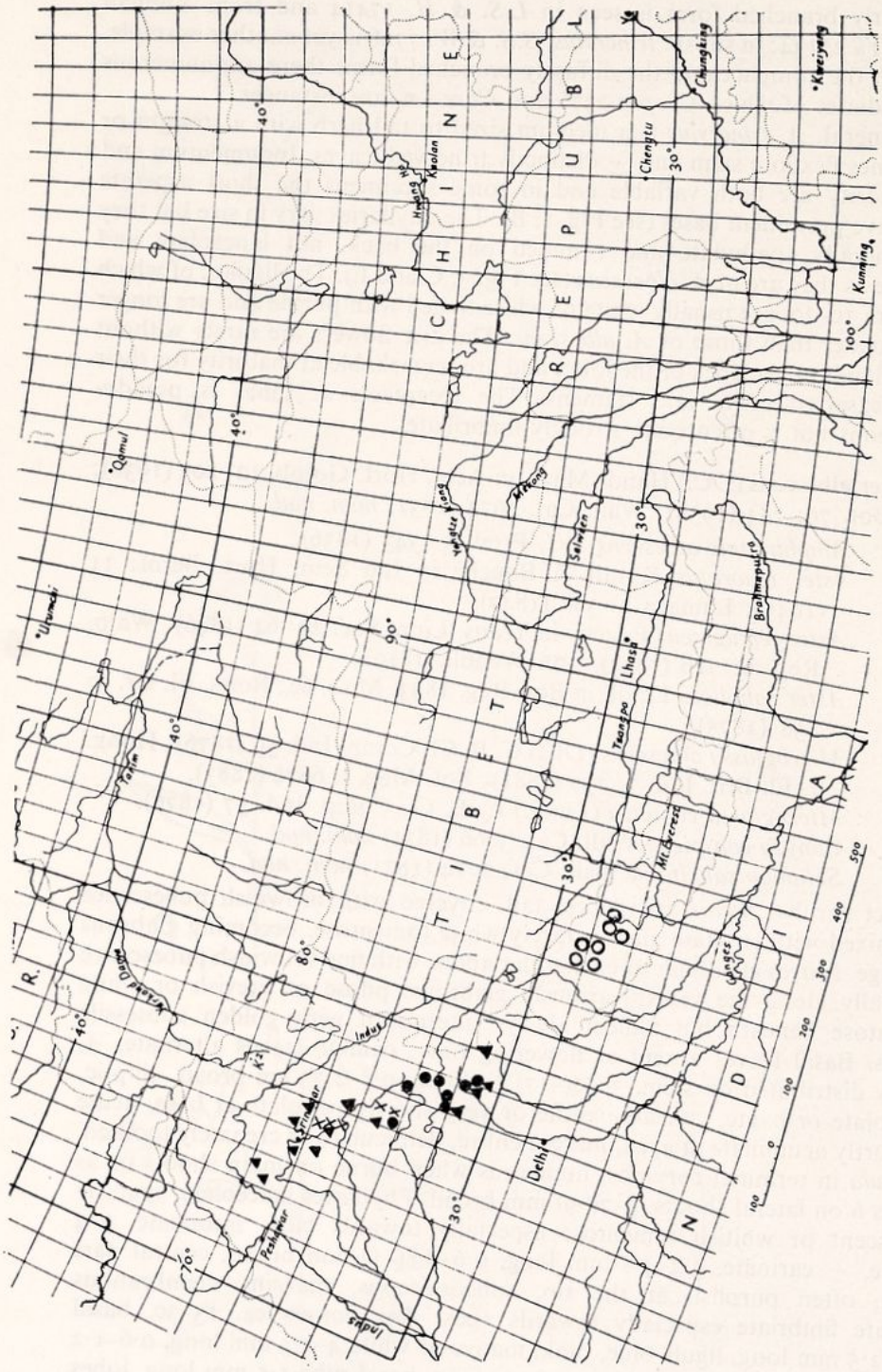


FIG. 9. Map to show distribution of *Aster laka*, *A. thomsonii* and the subspecies of *A. peduncularis*.

△ *A. thomsonii*; ● *A. peduncularis* subsp. *peduncularis*; ○ *A. peduncularis* subsp. *nepalensis*; × *A. laka*.

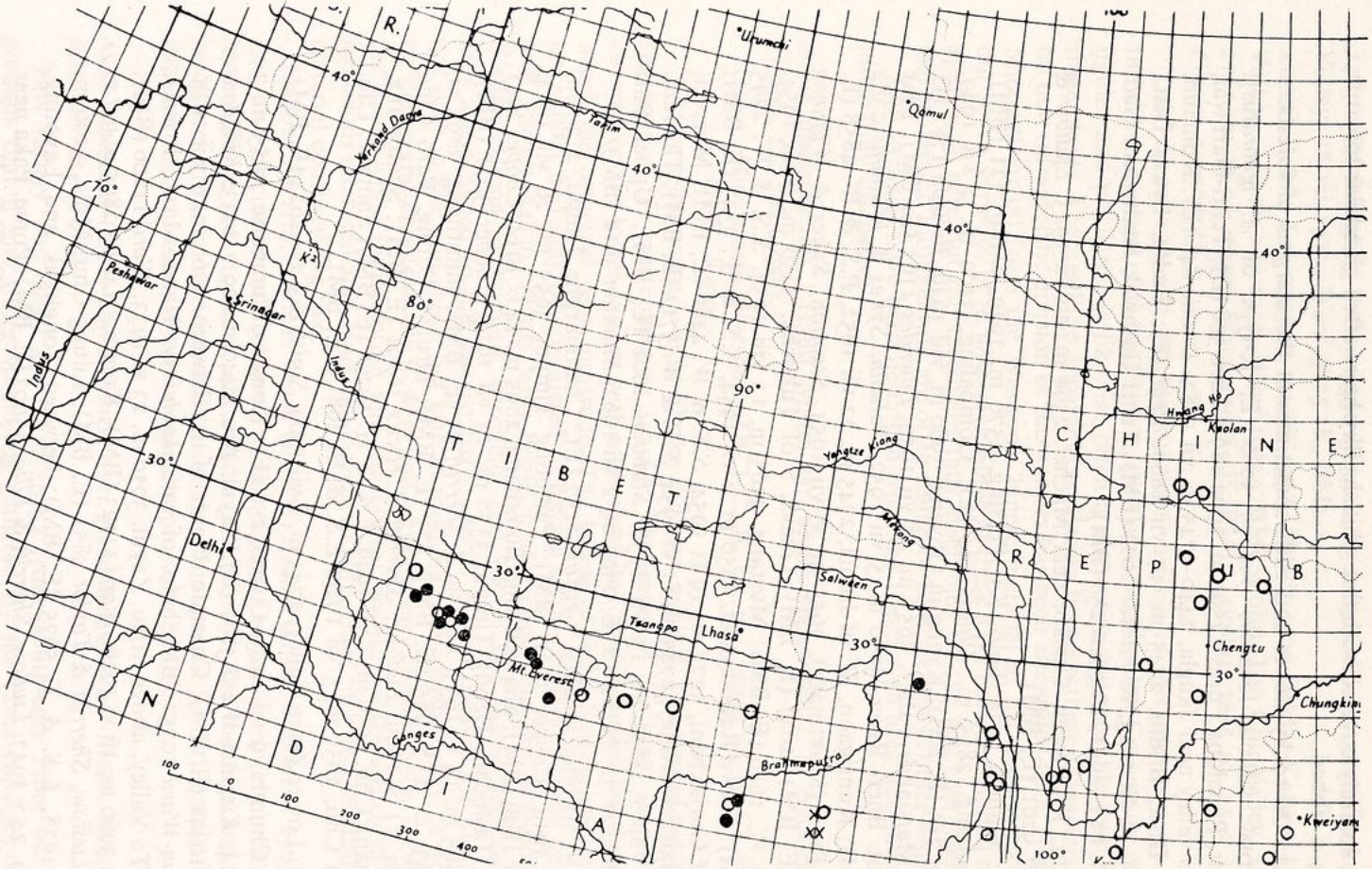


FIG. 10. Map to show distribution of the infraspecific taxa of *Aster trinervius* in the Himalayan area and in Western China.

● *A. trinervius* subsp. *trinervius*; ○ *A. trinervius* subsp. *ageratoides*; × *A. trinervius* subsp. *ageratoides* var. *wattii*.

brown, sparsely covered with fine whitish silky hairs often glandular towards apex, 4–6 ribbed.

HABITAT: On rocky slopes and cliffs sometimes at the margins of forests.

NW INDIA: without locality, *Wallich* 3066 (E, K-type of *A. ignoratus*); Bashahr, Punalong Forest, 2590 m, 29 vi 1890, *Lace* 308 (E); Tehri-Garhwal, Ganges valley near Jangla, 2440–2745 m, vii 1883, *Duthie* 848 (E); Kumaun, Byans Dist., Bridhi, 2745 m, 17 vii 1886, *Reid* (E); Budhi, Byans Dist., 2700 m, 12 vii 1923, *R. Parker* 2072 (BM); Tehri Garhwal, Rudugaira Gad, 3885 m, 23 ix 1952, *Huggins* 258 (BM).

KASHMIR: Kishtawar, Chiskot near Machel, 2590 m, 20 vii 1943, *Ludlow & Sherriff* 9201 (E, BM).

NEPAL: Wallich 2974 (holo. K); Porsing, 4570 m, 1929, *Dhwoj* 121 (BM); Loom-chang, 2825 m, *Dhwoj* 144 (E); Gompaling, 3200 m, 2 vii 1949, *Polunin* 753 (E, BM); Kyangjin Ghyang, 3960 m, viii 1949, *Polunin* 1781 (E, BM); Marsiandi Valley, 3655 m, 15 vii 1950, *Lowndes* 1195 (E, BM); near Tarakot, Bheri River, 3050 m, 5 vii 1952, *Polunin, Sykes & Williams* 2382 (E, BM); Kunrigaon, SE of Jumla, 2745 m, 22 vii 1952, *P.S. & W.* 4858 (E, BM); Pura (Muktinath), 3655 m, vi-vii 1954, *Stainton, Sykes & Williams* 1470 (E, BM); 2027 (E, BM); Ghasa, S of Tukucha, 3350 m, 6 vii 1954, *S.S. & W.* 1610 (E, BM); Mustang, 4265 m, 12 viii 1954, *S.S. & W.* 2395 (E, BM); above Ranmagaon, 3350 m, 2 vii 1954, *S.S. & W.* 3347 (E, BM); NW of Gurjakhani, 3275 m, 19 ix 1954, *S.S. & W.* 4486 (E, BM); Marpha, Kali Gandaki Valley, 2745 m, 11 vi 1954, *S.S. & W.* 5711 (E, BM); Thudam, Arun Valley, 3655 m, 15 vii 1956, *Stainton* 1002 (E, BM); Upper Buri Gandaki, 28°32′ N, 84°50′ E, 2305 m, 2 vii 1962, *Stainton* 3912 (BM).

BHUTAN: without locality, *Griffith* 2157 (E); Chalimarphe Timpu, 2135 m, 19 vii 1914, *Cooper* 1431 (BM); Parshong Timpu, 3655 m, 26 vii 1914, *Cooper* 1899 (BM); Shabjethang, Bumthang, 2895 m, 24 ix 1914, *Cooper* 2241 (BM); Tashicho, Dzong Timpu, 3350 m, 13 vii 1914, *Cooper* 3071 (BM); Ha, 2895 m, 15 vi 1933, *Ludlow & Sherriff* 95 (E, BM); Bumthang, 2895 m, vii 1933, *L. & S.* 265 (E, BM), 273 (E, BM); Drugye Dzong, Paro Chu, 2440 m, 11 v 1949, *Ludlow, Sherriff & Hicks* 16191 (E, BM); Shabjetang, Bumthang Chu, 3050 m, 1 vii 1949, *L.S. & H.* 19296 (E, BM); Shingbe, Lao, Me La Chu, 3050 m, 5 vii 1949, *L.S. & H.* 20813 (E, BM).

SIKKIM: Lower Zemu Valley, 2745 m, 8 vii 1909, *Smith & Cave* 2624 (E, BM).

TIBET: Chumbi, 9 vii 1913, *Cooper* 250 (E); Kongbo, Tumbatse, 3655 m, 3 vii 1924, *Kingdon-Ward* 5897 (E); Zayul, Ata, 2440 m, 29 v 1933, *Kingdon-Ward* 10441 (E, BM); Charndo, Gorge of the Salween, 3960 m, 6 viii 1935, *Kingdon-Ward* 10752 (BM, holo. of var. *glandulosus* Hand.-Mazz., E iso.); Rong To Valley, above Migu, Zayul, 3050 m, 23 xi 1933, *Ward* 11006 (BM); Karta, 3960 m, 16 vi 1936, *Ward* 11723 (BM); Kongbo, Lusha 2895 m, 17 vi 1938, *Ludlow, Sherriff & Taylor* 4851 (E, BM); Lilung Chu, Molo, 3200 m, 26 vi 1938, *L.S. & T.* 5675 (E, BM); between Tongkyuk and Layoting, 2440 m, 24 v 1947, *Ludlow, Sherriff & Elliot* 13003 (E, BM); Pome, Paka near Tongyuk Dzong, 3050 m, 1 vi 1947, *L.S. & E.* 13810 (E, BM); Kongbo, Doshung La, 3200 m, 24 vi 1947, *L.S. & E.* 15314 (E, BM).

BURMA: Hpawte, 2440 m, 21 viii 1919, *Farrer* 1249 (E); Mt. Victoria, Kanpelat, 26 v 1924, *Cooper* 5940A (E); Hpimaw Pass, 2745 m, viii 1924, *Forrest*

24836 (E); Seinghku Valley, 3350–3655 m, 15 x 1926, *Ward* 7594 (E); Adung Valley, 18 vii 1931, *Ward* 9825 (E, BM).

ASSAM: Bomte La, 2745 m, 14 vii 1938, *Ward* 13929 (BM); Kahao, Lohit Valley, 1360 m, 2 vi 1950, *Ward* 19521 (BM); Lohit, Tha Chu Valley, 2440–2745 m, 16 vii 1950, *Ward* 19648 (E, BM); Jakpho, 3015 m, 25 x 1885, *Clarke* 41356A (K).

Leaf shape, size and indumentum are variable in this species as is also the size and shape of the capitulum, phyllaries and ligules. Coloration of the ligules and phyllaries is likewise often a distinctive but variable feature of these plants. There is little apparent correlation between these characters and no new infraspecific division of this species has been attempted here. Handel-Mazzetti (1938) from the Western Chinese material at his disposal, keyed out seven varieties of *A. albescens*. Some of these have been considered to be applicable here but the specimens thus assembled on the key characters of leaf shape and indumentum are often found to be divergent in other respects.

Two varieties have been described from the Himalayan area and must be more fully discussed.

Aster albescens (DC.) Hand.-Mazz. var. **niveus** Hand.-Mazz. in Acta Hort. Gotob. 12: 208 (1938).

Syn.: *Microglossa albescens* (DC.) C. B. Cl. var. *nivea* C. B. Cl. ined. Herb. Kew.

This varietal name, which Clarke did not publish, was appended to a specimen of his own collection 41356A. The leaves of this plant are thickly covered on the lower surface with a dense white felted indumentum through which the principal veins protrude. The leaves of the following specimens are similar and may be considered to belong to this variety: *Cooper* 5940A and *Forrest* 24836. Plants with dense white indumenta are common in Western China in Yunnan, Szechuan and Kansu and in the Himalayan area are confined to the eastern parts and to Assam. Leaves are variable not only in size and shape but also in toothing: the corymbs may be dense or sparse and details of the flowers and capitula vary considerably. Between the dense white indumentum and the typical greyish tomentum there are numerous intermediates. Handel-Mazzetti to judge from cited and determined material confused the two.

Ludlow, Sherriff & Hicks 17408 (E, BM) from Tsanka, Bhutan at 2305 m may also be considered to belong to this category as it has white tomentose leaves. There are, however, about 60 ray flowers in the capitula and the involucres are less imbricate than is usual in this species. Unfortunately, this specimen is immature; it may eventually prove to be distinct.

Aster albescens (DC.) Hand.-Mazz. var. **glandulosus** Hand.-Mazz. in Jour. Bot. 76: 284 (1938).

This variety was based on *Ward* 10752 from South-east Tibet on the grounds that it and other specimens gathered by the same collector had glabrous leaves which were densely glandular. The leaves of *A. albescens*, however, are generally glandular. Here too there are numerous intermediates between the typical greyish tomentose and the glabrous conditions, and glabrous or subglabrous specimens occur in the western as well as the

Eastern Himalaya. The position is further complicated by other specimens from SE Tibet (e.g. *L.S. & E.* 15314) the leaves of which are densely glandular but in which the typical fine tomentose hair has been replaced by coarser pilose hairs (these specimens are in no way similar to Handel-Mazzetti's var. *pilosus*). These glabrous leaved specimens differ among themselves in the size of the leaves, involucres and flowers and in the colouring of the phyllaries.

In cultivation *A. albescens* was introduced as long ago as 1842 as seed by Griffith supposedly from Kabul (thus *A. cabulicus* Lindl.) but Hooker (Bot. Mag. t. 6672) gives Royle the credit for introducing it. The several forms in cultivation today are of varying merit of which that known as "*Aster harrowianus*" is probably the best and is hardy even in Central Perthshire. It forms a plant up to two metres tall with long (ca. 12 cm) elliptic, repand dentate leaves with large terminal corymbs of capitula (6–7 mm broad) with phyllaries (ca. 1 mm broad) usually strongly tipped with purple. The blue ligules are well developed here (7–8 mm long, 1·5–2 mm broad), unlike some other forms where they are pale and narrower. *A. harrowianus* Diels (in Notes Roy. Bot. Gard. Edin. 5: 184, 1912) based on *Forrest* 4004 with narrow capitula and pale flowers does not match the above description but var. *glabratus* (*Forrest* 2508), which Diels described at the same time, does. Handel-Mazzetti (1938), however, reduced var. *glabratus* to synonymy under his var. *salignus* (Franch.).

From the other tall growing shrubby Asters, *A. albescens* may be distinguished by the pinnate venation of the leaves in which the lateral veins are all similar in prominence, unlike those of *A. trinervius*. The leaves in this species also lack the glistening areas of epidermis which characterise the leaves of *A. fulgidulus* and the outer walls of the epidermal cells are smooth (see Plate 10, B). The phyllaries are always lanceolate and acute, not obtuse as they are in *A. trinervius*, and usually somewhat carinate. Superficially *A. albescens* bears a close resemblance to *Inula cuspidata* and specimens of this may be confused in herbarium collections. The latter species, however, differs in having silky pilose (not lacerate fimbriate) margins to the phyllaries and the anther cells bear obvious tails.

11. **Aster fulgidulus** Grierson, **sp. nov.** (Plate 9 and 10, A).

Frutex. *Radix* ignota. *Caules* 1·2–2 m alti, brunnei, minute fusco-pubescentes pilis glandulosis conspersis. *Folia* basalia ignota; caulina ovata (4–)6–9 cm longa (2–)2·5–4·5 cm lata, penninervia, ad bases rotundata, ad apices acuta, marginibus integris, petiolis 5 mm longis, supra glabra vel in nervis medianis parce pubescentia, subtus in venis minoribus fulgidula. *Capitula* numerosa 0·7–0·8 cm lata, in corymbis terminalibus laxe dispositis; involucris 3–4 seriatis imbricatis; phyllares 1·6–3·2 mm longae, 0·7–0·8 mm latae, coriaceae, carinatae, viscido-glandulosae, marginibus scariosis fimbriatis, ad apices ciliatae, purpureae. *Flores radii* ca 16, tubis basalibus 2·4 mm longis, ligulis luteis (fide collectorum sed, in sicco, non nunquam purpurascentibus) 5 mm longis 1·6–1·8 mm latis. *Flores disci* lutei (non nunquam extra purpurascentes) 4·8–5·2 mm longi, tubis basalibus 1·6–1·8 mm longis, lobis 0·8–1 mm longis. Appendices stylorum triangulares, 0·3 mm longae. *Pappus* sordidus, duplex, setis interioribus 4–4·4 mm longis, exterioribus 1 mm longis, interioribus aequilatis. *Achaenia* immatura, 1·4 mm longa, oblonga, sericea.

Shrub. *Roots* unknown. *Stems* 1·2–2 m tall, brown, minutely brownish pubescent interspersed with glandular hairs. *Basal leaves* absent; cauline leaves ovate (4–)6–9 cm long (2–)2·5–4·5 cm broad, pinnately veined, rounded at the base, acute at the apex, margins entire, petioles 5 mm long, glabrous or sparsely pubescent on the mid-rib above, somewhat glossy on the minor veins beneath. *Capitula* numerous in loose terminal corymbs. 0·7–0·8 cm broad; involucres 3–4 seriate, imbricate; phyllaries 1·6–3·2 mm long, 0·7–0·8 mm broad, coriaceous, carinate, viscid glandular, margins scarious, fimbiate, purplish. *Ray flowers* ca. 16, basal tubes 2·4 mm long, ligules yellow (according to collectors but somewhat purplish in the dried state), 5 mm long, 1·6–1·8 mm broad. *Disc flowers* yellow (slightly purplish when dry) 4·8–5·2 mm long, basal tubes 1·6–1·8 mm long, lobes 0·8–1 mm long. Style appendages triangular, 0·3 mm long. *Pappus* dirty white, double, inner setae 4–4·4 mm long, outer setae 1 mm long, as broad as the inner series. *Achenes* immature, 1·4 mm long, oblong, sericious.

TIBET: Tangme, Po Tsangpo-Yirong Confluence, 2135 m, 3 vi 1947, flowers yellow; shrub 4–6 ft, *Ludlow, Sherriff & Elliot* 13074 (holo. E, iso. BM).

This species is obviously closely related to *A. albescens* from which it differs in its larger ovate leaves with their glistening areas of epidermis over and between the minor veins on the lower surface. These areas, which are readily discernible with a hand lens, are composed of epidermal cells the outer walls of which are thickened and raised into parallel ridges or corrugations (see Plate 10, A). The physiological purpose, if any, of these thickened walls is unknown.

The flower colour is rather uncertain: it was recorded as "flowers yellow" without specifying ray or disc flowers but both show small amounts of purplish coloration in the dried state. According to Ludlow (in conversation), this specimen was gathered by a native collector working with Ludlow, Sheriff & Elliot and may have been incorrectly noted. Ludlow himself could not remember the colour. Possibly the ray flowers were whitish with a purple flush.

The pappus in *A. albescens* can only be regarded as simple; although there may be several short outer setae present, they are too few to be classed as a series. In *A. fulgidulus* the outer setae are more numerous forming a definite series and the pappus must be looked upon as double although there is little distinction in width of setae. This, with *A. salwinensis*, *molliusculus* and *peduncularis*, is another instance of the mutability of the pappus structure in this genus.

12. **Aster sikkimensis** Hook. in Bot. Mag. t. 4557 (1851); Fl. des Serres, Ser. I, 6: t. 624 (1851); Walp. Ann. 5: 173 (1858); C. B. Cl., Comp. Ind. 42 (1876); Hook. f. Fl. Brit. Ind. 3: 252 (1881); Hand.-Mazz. in Notizbl. Bot. Gart. Berl. 13: 611 (1937).

Erect perennial herbs. *Stems* 50–80 cm tall, purplish, flexuose, pubescent, sometimes densely so above, glabrescent and somewhat woody at the base. *Leaves* sometimes glabrescent, usually sparsely pubescent on both surfaces with scattered glistening glands below; radical leaves lanceolate, ca. 22 cm long (fide Hook.), tapering below into a broad indistinct petiole, acuminate at the apex; lower cauline leaves absent at flowering time, upper ones

lanceolate 5–12 cm long, 1·5–5 cm broad, sessile or attenuate, subpetiolate and auriculate or semi-amplexicaul at the base, acuminate at the apex, margin distantly denticulate. *Capitula* numerous in terminal corymbs, 1–1·2 cm broad. Involucre 4 mm high; phyllaries 3–4 mm long, 0·5–0·6 mm broad, lanceolate-acuminate, 2–3 seriate, finely pubescent, margin somewhat membranous, lacerate and often purplish. *Ray flowers* 40–60, basal tube 1·5 mm long, ligules white, rose, blue or purple, 6·5–7 mm long, 0·7–1 mm broad. *Disc flowers* apparently pale at first then purplish on opening, corollas 3·5–4 mm long, basal tube 1·5 mm long, lobes 0·75–1 mm long. Style appendages lanceolate, 0·75–1 mm long. *Pappus* buff to brownish, simple, 3–3·5 mm long. *Achenes* brownish, obovate, 2 mm long, 0·75–1 mm broad, sparsely silky pilose, 4-5 ribbed.

SIKKIM: Lachen, Lachoong and Singalilah, viii-xii 1849, 2440–3655 m, *J. D. Hooker* (syntypes K, BM, E); Tumbok, 3050 m, 9 x 1870, *Clarke* 12771B (BM); without locality, 3350 m, 11 x 1874, *Treutler* 877 (K); Kuthart, 3050 m, *Clarke* 25545B & C (K); Chowbhanjan, 3655 m, 1913, *Ribu & Rohmoo* 6711 (E).

NEPAL: without locality, 1830 m, *Hooker* (K); Terra Bimbe, 2745–3050 m, *Dhwoj* 430 (E, BM); entre Chaunrikharka et Surkva, 2440 m, 27 x 1954, *Zimmermann* 1880 (E, BM); Tamur Valley, 3050 m, xi 1955—i 1956, *Brough* 26 (BM).

CULTIVATED: Hort. Kew, 1851 (syntype K, E).

A. sikkimensis is related to the group of species that includes *A. pycnophyllus*, *helenae* and a species from W. China, *A. nigromontanus* Dunn (in Jour. Linn. Soc. 35: 501, 1903), and is perhaps most closely related to the last named. In common, they all have flexuose stems, distinctly veined leaves and ligules that have two well-marked lateral veins. *A. nigromontanus*, however, belongs to S. Yunnan and is most readily distinguished by its leaves which are shortly petiolate and ovate-acuminate and with margins that are more coarsely toothed than those of *A. sikkimensis*. The phyllaries of *A. sikkimensis* are always pubescent whereas those of *A. nigromontanus* are nearly glabrous. The latter may eventually prove to be a subspecies of *A. sikkimensis* but should not be regarded as completely synonymous with it as Handel-Mazzetti (l.c.) proposed.

The original description and collectors' notes describe the flower colour of this species as white to rose-purple or blue but specify no distinction between ray and disc. In the dried state it does appear as if the expanded disc flowers were of a more intense purplish colour than the rays, but the unopened flower buds are paler. The Botanical Magazine illustration (of which the plate in Flore des Serres is a copy) represents the disc as yellow shading to brown, but the corollas are drawn as if unopened.

Seed of *A. sikkimensis* was introduced by J. D. Hooker in 1849 from Sikkim and the species may possibly still be in cultivation. It is reputed to be hardy although the stems are cut back by winter frosts.

13. **Aster pycnophyllus** W. W. Sm. in Notes Roy. Bot. Gard. Edin. 8: 332 (1915).

Erect perennial rhizomatous herbs. *Stems* 30–60 cm tall, flexuose, reddish, glabrescent below, villose above, usually branched only in inflorescence.

Leaves sparsely covered with fine pilose and glandular hairs on each side or glabrescent beneath; lower leaves absent at flowering time, middle and upper cauline leaves petiolate, petioles 1–2 cm long, rarely subsessile, laminae 7–10(–15) cm long, 3–4 cm broad, ovate or ovate-lanceolate, acuminate at apex, rounded or somewhat cordate at base, margins repand dentate with up to 7 mucronate teeth, venation pinnate, minor veins distinct on lower surfaces. *Capitula* 6–8 mm broad, numerous in paniculate corymbs. Phyllaries 3–4 seriate, imbricate, 2·8–4 mm long, 0·6–0·8 mm broad, linear-lanceolate, acuminate, pilose and glandular on the back, margins membranous, lacerate. *Ray flowers* 10–30, basal tubes 1·8–2 mm long, ligules purplish blue 4–7·5 mm long, 0·7–1·2 mm broad. *Disc flowers* yellow (or sometimes purplish tinged in the dried state), 3·6–3·8 mm long, basal tubes 1·2–1·4 mm long, lobes 0·8–1·1 mm long. Style appendages narrowly lanceolate 0·4 mm long. *Pappus* 3·8 mm long whitish or buff, simple. *Achenes* 1·7–1·8 mm long, 0·7 mm broad, obovate, sparsely pubescent.

HABITAT: Thickets, banks and rocks in sheltered positions.

TYPE: Yunnan, Tali Range, *Forrest* 4001 (E).

ASSAM: Japvo, Naga Hills, 3015 m, 28 ix 1935, *Bor* 6439 (K); Chingkhu 2680 m, 5 ix 1935, *Bor* 6787 (K).

NE UPPER BURMA: Hpimaw Pass, 3050 m, 1 x 1919, *Farrer* 1346 (E); Chawng maw hka, 2440–2745 m, 28 ix 1919, *Ward* 3702 (E); Valley of Seinghku, 2745 m, 24 x 1926, *Ward* 7609 (E, K, BM); Taron Valley, 28°10′ N, 98°10′ E, 2305 m, 19 x 1938, *Kaulback* 132 (BM).

TIBET: Adung Valley, 28°25′ N, 97°55′ E, 1830 m, 4 xi 1931, *Ward* 10145 (E, BM).

A. pycnophyllus was first used as a manuscript name by Franchet in the Paris herbarium and was later taken up by Diels (in Notes Roy. Bot. Gard. Edin. 7: 199 and 340, 1913) in a published list of Forrest's exsiccatae. Diels associated the name with *F.*4001, the type of the species, but it remained without formal description until 1915.

This species is related to *A. sikkimensis* and *A. helenae* but is separated from the former by its leaves which are differently shaped and usually have distinct, slender petioles. From the latter, it is again readily distinguished by leaf shape but also by its more elongated internodes (3–10 cm long) and by its partly glandular indumentum.

Possible confusion may arise between *A. pycnophyllus* and specimens of *A. trinervius*, but in the latter the lowermost pair of lateral veins in the leaves are more prominent than the others, their phyllaries are obtuse and the ligules are 3–4 veined.

14. **Aster helenae** Merr. in Brittonia 4: 185 (1941).

Erect rhizomatous, perennial herbs. *Stems* 20–40 cm tall, lower parts leafless, glabrous and flexuose with prominent leaf-scars, upper parts densely leafy (internodes, less than 1 cm long), minutely greyish pubescent. *Leaves* distinctly veined, minutely pubescent on both surfaces becoming glabrous adaxially; radical leaves on sterile shoots, elliptic-ovate, 4–6·2 cm long, 1–2·2 cm broad, margin coarsely dentate, teeth mucronate, apex acute, base cuneate tapering into densely pubescent petiole 2·5–5 cm long; upper cauline

leaves linear-lanceolate, 5–8 cm long, 0·5–1·2 cm broad, margin coarsely 4–6 dentate on each side, apex acuminate, tapering at base into petiole 0·5–1 cm long. *Capitula* 6–7 mm broad, few (5–15) or numerous in terminal corymbs. Phyllaries 2–4 mm long, 0·25–0·5 mm broad linear-lanceolate, minutely pubescent, central part green, margins sub-membranous, purplish tinged above. *Ray flowers* 20–25, basal tube 2 mm long, ligules purplish mauve 4·5–5 mm long, 1 mm broad, with two distinct lateral veins. *Disc flowers* yellow, basal tube 1·5–2 mm long, lobes 1–1·2 mm long. Style appendages lanceolate, 0·8 mm long. *Pappus* 2·75–3 mm long, off-white, simple. *Achene* obovate, 1·75–2 mm long, 0·6 mm broad, brownish, minutely pubescent above.

HABITAT: Among mossy stones on fringe of forest near river bank.
BURMA: Kang Fang, 1675 m, 5 xii 1938, (Vernay-Cutting Expedition) *Ward* 81 (holo. NY); Myitkyina district, 15 xi 1938, *Naw Mu Pa* 17469 (K).

Merrill compared this species with *A. trinervius* which, size apart, it resembles particularly in its capitulum and flowers. It remains clearly distinct, however, on account of its habit: the naked lower part (15–25 cm) of the stem, the short internodes and the narrow coarsely toothed leaves which are crowded at the ends of the stems. Unlike *A. trinervius* the two lowermost lateral veins are not more strongly developed than the others and the leaves are thus pinnately veined.

It is also related to *A. sikkimensis* and *pycnophyllus*, which see for comparisons.

A. helenae (named in honour of Mrs. C. Suydam Cutting) is said to be a common species around Myitkyina in forest clearings and along river banks.

15. **Aster molliusculus** (DC.) C. B. Cl. Comp. Ind. 45 (1876); Hook. f. Fl. Brit. Ind. 3: 251 (1881). Wall. Cat. 2972 (1831) *nom. nud.;* Nees Gen. et Sp. Ast. 281 (1832) *nom. nud.*

Syn.: *Diplopappus molliusculus* Lindl. ex DC. Prod. 5: 277 (1836).
Diplopappus roylei Lindl. ex DC. l.c. 276.
Hersilia simplex Klotzsch, Pl. Wald. Reis. Bot. 75, t. 73 (1862).
A. scaposus Klatt in Sitzb. Akad. Muench. 84 (1878).

Erect perennial herbs with thick somewhat woody rootstocks. *Stems* (6–)12–25(–40) cm tall, sparsely pubescent or covered with soft white hispidulous hairs, eglandular. *Leaves* pubescent especially beneath or ± glabrous; radical leaves absent, basal cauline leaves scale-like usually withered, upper cauline leaves (0·8–)1·5–5 cm long (0·1–)0·3–0·9 cm broad, elliptic, lanceolate or oblanceolate, 3-nerved, sessile, cuneate at base, acute at the apex, margin somewhat inrolled, entire or with 2–3 shallow teeth on each side. *Capitula* solitary or as many as 5, borne on ± naked peduncles from the axils of the upper leaves, 1–2 cm broad; involucre 2–3 seriate, imbricate; phyllaries lanceolate, acuminate, 4·5–9 mm long, 0·8–1 mm broad, coriaceous, glabrous or pubescent, straw-coloured below, brownish or purplish above, margins narrowly membranous. *Ray flowers* 15–25, basal tubes 2–3 mm long, ligules 0·6–1·2 cm long, 1·5–2·5 mm broad, pink or white turning pink with age. *Disc flowers* yellow, 4–6 mm long, basal tubes 1–2 mm long, lobes 0·8–1 mm long. Style appendage 0·2–0·5 mm long, triangular. *Pappus* whitish, 3·5–5·5 mm long, double or simple with a few

outer bristles, setae of inner series sometimes unequal in thickness. *Achenes* 2·75–4 mm long, linear, 4-ribbed, pale brownish, densely or sometimes sparsely covered with silky hairs.

HABITAT: Damp rocky slopes and open cliff faces.

This species is here divided into two varieties as follows:

Stems 12–25(–40) cm tall. Leaves (at least on the main stems) 1·5–5 cm long, 3–9 mm broad. Capitula 1·2–2 cm broad . . var. *molliusculus*

Stems 6–9 cm tall. Leaves 1 cm long, 1–2 mm broad. Capitula ca. 1 cm broad . . . . . var. *minor*

15a. **Aster molliusculus** var. **molliusculus**

W PAKISTAN: Swat, Batain, 2743 m, 27 vii 1953, *R. R. Stewart & Rahman* 25285 (BM); Hazara, Kaghan Valley, 3050 m, 24 v 1896 (Coll. Inayat) *Duthie* 19719/a (K); same locality, 2375 m, 26 vi 1958, *Burtt & Arshad Ali* B961 (E); same locality, 1960, *McVean* (E).

KASHMIR: Poosiana, 2135 m, 5 vii 1876, *C. B. Clarke* 28429A (BM); Sind Valley near Baltal, 2745–3050 m, 27 vi 1892, *Duthie* 11563 (BM); Pir Panjal, 3050–3500 m, vi 1902, *Drummond* 13907 (E, K), 13917 (K); Zaiwan, Sind Valley, 3200 m, 17 vi 1940, *Ludlow & Sherriff* 7647 (E, BM); Baltal, Sind Valley, 2895 m, 28 v 1941, *L. & S.* 8307 (E, BM).

INDIA: without locality, *Royle* (K, isotype of *Diplopappus roylei*); Chamba, 2135–2440 m, *T. Thomson* (E, K, BM); Kilar to Darwas, 2440 m, 10 ix 1895, *Lace* 1301 (E); Langera to Padri Pass, 2440 m, 12 v 1896, *Lace* 1356 (E); Lahul, Theog Forests, 2285 m, vii 1890, *Watt* 8387b (E); Theog Mattiana, 16 v 1888, *Drummond* 22607 (E, K); Mussoorie, 3350 m, 3 vi 1904, *Drummond* 22737 (K); Chur, 1885, *Drummond* 26122 (E, K); Simla, 29 iv 1831, *Dalhousie* (E); Kumaun, ix 1885, *Reid* (E); Kumaun, *Strachey & Winterbottom* 1 (K); Sirmore, *Wallich* 2972 (holo. K).

From the above it will be seen that the distribution of *A. molliusculus* stretches south-eastwards from Kashmir to Kumaun but does not extend as far as W. Nepal. Certainly no specimens have been observed from Sikkim and presumably Hooker's inclusion of other materials from that country must account for his extraordinary remark (Fl. Brit. Ind. 3: 251) "It is difficult (if possible) to distinguish this from *Erigeron multiradiatus*".

In the suite of material cited, there is a noticeable variation in indumentum. The specimens from the north, Kashmir, Hazara and Chamba, tend to be glabrescent with stems sparsely pubescent and leaves glabrous except for ciliate margins. In the south, however, around Simla and in Kumaun, the plants are regularly pubescent except in var. *minor* which is also glabrescent.

As to the condition of the pappus, this is usually double in the south but simple in the north with the exception of those specimens from Kashmir. *Burtt & Ali's* specimen is anomalous in that the setae are of irregular thickness as if fusions had taken place between them but *McVean's* specimen from the same locality is quite normal in this respect.

15b. **Aster molliusculus** (DC.) C. B. Cl. var. **minor** Grierson, **var. nov.** A var. *molliusculo* differt planta humiliore, glabrescens, caulibus 6–9 cm altis, foliis linearibus, integris vel paucidenticulatis, 1 cm longis, 0·1–0·2 cm latis, capitulis 1 cm latis.

INDIA: Himalaya boreale occidentale, 8 v 1848, *T. Thomson* (K), Simla, *Madden* 495 (E); Simla Hills, *Strachey & Winterbottom* 4 (K); Shalai, 2745 m, 21 iv 1889, *Watt* 9761 (holo. E).

A. molliusculus has frequently been confused with *Heteropappus altaicus* but it may be readily distinguished by its stems which regularly bear ovate brown scale-like leaves at the base. Its phyllaries are always narrower and stiffer than those of *H. altaicus* and the hyaline margin is always much less developed. The achenes which are linear or oblanceolate and ± densely pubescent contrast with those of *H. altaicus* which are obovate and scantily pilose. It also differs, of course, in having the disc corolla lobes of regular size and not unequal as they are in *Heteropappus*.

16. **Aster hypoleucus** Hand.-Mazz. in Jour. Bot., Lond. 76: 285 (1938).

Dwarf caespitose shrubs ca. 15 cm tall; annual shoots divaricately branched, white tomentose; terminal branches or peduncles numerous, hardening and persisting for a time after the capitula fall. *Leaves* coriaceous, elliptic or oblanceolate, 0·5–1·5 cm long, 2–3·5 mm broad, acute or somewhat obtuse, mucronate at apex, narrowed and subpetiolate at base, margins revolute, entire or with one small mucronate tooth on each side, glabrous or somewhat araneose above, white tomentose beneath. Peduncles 2–3 cm long, glabrescent below the solitary terminal capitula and bearing a few subulate leaves. *Capitula* 4–5 mm broad; phyllaries coriaceous, 4-seriate, imbricate, lanceolate, inner ones 4 mm long, 0·6 mm broad, glabrous, purplish brown, margin straw-coloured, scarious, ciliate. *Ray flowers* ca. 13, basal tube 1·5 mm, ligule whitish 4·5 mm long, 1 mm broad. *Disc flowers* 4 mm long, basal tube 1 mm long, lobes 1·25 mm long. *Pappus* white, simple, ca. 4·5–5 mm long. *Achenes* immature, oblong, 2 mm long, 0·75 mm broad, sericeous.

HABITAT: Hot cliffs, dry sandy banks and on gravel.

TIBET: Kyrindong Dzong, 3350–3650 m, 14 vii 1935, *Ward* 11993 (holo. BM); Kongbo, Tsangpo Valley, Shu Bridge, 29°01′ N, 93°25′ E, 3050 m, 8 x 1938, *Ludlow, Sherriff & Taylor* 7187 (E, BM).

Handel-Mazzetti originally compared this species with his *Aster lavandulifolius* from S.W. Szechuan which is 1 m tall with small corymbs of flowers and generally resembles an *Olearia*. A closer comparison might be made with *Asterothamnus fruticosus* (Winkl.) Novopokr. (Syn. *Calimeris fruticosus* C. Winkl.) from Turkestan which agrees in being a small shrub (up to 30 cm tall) with divaricately branched stems and peduncles which persist in the same manner after bearing their solitary terminal capitula. *A. hypoleucus*, however, is distinct in its dwarfer stature, its elliptical leaves which are green above and white tomentose beneath and its smaller capitula.

Asterothamnus was proposed by Novopokrovski (in Not. Syst. U.R.S.S. 13: 334, 1950) to accommodate the dwarf shrubby species of Aster that are indigenous to Central Asia. It is characterised by tomentose indumentum and revolute leaves bearing cartilaginous mucros but is not distinguished by characters involving the involucre, flowers, achenes or pappus. Although by no means all the genera of Compositae are delimited by floral or capitular characters, it is nevertheless preferable that large polymorphic genera such as *Aster* should not be divided without relying on definite characters of this

PLATE 11. Type specimen of *Aster neo-elegans* Grierson.

PLATE 12. Type specimen of *Aster barbellatus* Grierson.

sort. Thus, while comparing *A. hypoleucus* with *Asterothamnus fruticosus*, it is felt advisable to maintain the former as a species of *Aster*.

The author is indebted to the Curator of the Herbarium of the Botanical Institute of the Academy of Sciences of the U.S.S.R., Leningrad, for lending the type specimens of *Asterothamnus fruticosus* and of the other species of this central Asiatic genus, for comparison.

17. **Aster tricephalus** C. B. Cl. Comp. Ind. 43 (1876); Hook. f. Fl. Brit. Ind. 3: 250 (1881) p.p.; Onno in Bibl. Bot. 106: 53 (1932) pp.

Rhizomatous perennial herbs often with robust stolons and sterile rosettes. *Stems* 30–40 cm high, unbranched below, sparsely pilose. *Leaves* pilose and glandular, radical and basal leaves of flowering stems absent or shrivelled, but on sterile rosettes spathulate up to 6·5 cm long and 2 cm broad; cauline leaves ± evenly distributed on stem usually overlapping, upper ones often surrounding the capitula 3·5–6·5 cm long, 0·6–2·1 cm broad, oblanceolate, elliptic or lanceolate, sessile, semi amplexicaul at base, obtuse or acute at apex, margins entire or with 2–3 shallow teeth per side. *Capitula* 1–3 (rarely more), 2–2·8 cm broad; phyllaries 1–2 seriate, herbaceous, 1·2–1·4 cm long, 0·2–0·3 cm broad, oblanceolate, acute or obtuse mid-veins brownish, ciliate otherwise ± glabrous. *Ray flowers* 50–60, basal tubes 0·2 cm long, ligules white or blue, 1·8 cm long. *Disc flowers* yellow 4·5–5·5 mm long, pubescent, basal tube 1·5–2 mm long, lobes 1·5 mm long. Style appendage 0·5 mm long, lanceolate. *Pappus* whitish or buff, simple, 5–5·5 mm long. *Achenes* brown, obovate, 3·4–4 mm long, 2-ribbed, finely pubescent, glandular at apex.

SIKKIM: Phullalong, 3350 m, 6 x 1870, *Clarke* 13392 (lectotype BM); Singaleet (Singalela?), 3655 m, 25 x 1875, *C. B. Clarke* 25638 (K); Phullalong, 3655 m, 26 x 1875, *C. B. Clarke* 25656 (K), 25657 (K); without locality, 3655 m, 13 x 1874, *Treutler* 891 (K); Tari, 3960 m, 12 viii 1913, *Rohmoo Lepcha* 1138 (E), 1144 (E); Bokta, 3960 m, 1913, *Ribu & Rohmoo* 6508 (E); Rathong Chu, 3960 m, 1913, *Ribu & Rohmoo* 6543 (E).

NEPAL: Chianie (?), 3960 m, viii 1888, *King's collector* (K).

As in the majority of his original descriptions, Clarke does not cite specimens by numbers and possibly those he used in describing this species lie in the Calcutta herbarium. It is fairly certain, however, that his specimens at Kew and the British Museum also represent type material. They agree closely with his description in that the lower leaves are shrivelled or lacking ("*folia inferiora . . . saepe mox decidua*") and the stems are leafy to the apex and often bear three capitula ("*ad apicem foliati ibique corymbosim 1–3 cephali*"). This treatment is a return to Clarke's original concept of *A. tricephalus* and it differs from both Onno's and Hooker's interpretations which include specimens of *A. neo-elegans* and *barbellatus*. *Clarke* 13392 has been chosen as lectotype because it bears a drawing of a disc flower and floral parts together with notes on the pappus in Clarke's handwriting.

A. tricephalus is similar in height to *A. barbellatus* but is generally more robust than either it or *A. neo-elegans*. The flowering stems are often without basal leaves, although they are usually present on the well-developed stolons, and they often bear the number of capitula indicated by its name. Ray flowers are more numerous here than in either of its relatives.

18. **Aster neo-elegans** Grierson, **sp. nov.** (Plate 11).

Syn.: *A. elegans* Hook. f. & Thom. ex C. B. Cl. Comp. Ind. 44 (1876) p.p. non Willd. (1803) nec Nees (1832).

A. tricephalus auct non C. B. Cl.: Hook. f. Fl. Brit. Ind. 3: 250 (1881) p.p.; Onno in Bibl. Bot. 106: 53 (1932) p.p.

Diplopappus elegans Hook. f. et Thoms. ined.

Herba elegans perennis rhizomatosa et stolonifera. *Caulis* 40–75(–100) cm altus, simplex, molliter adpresse pubescens. *Folia* pubescentia, basalia persistentia 5–7 cm longa, 0·8–1 cm lata, oblanceolata vel spathulata, altiora gradatim decrescentia distantia, linearia, acuta, sessilia vel basi attenuata, ad apices acuta vel obtusa marginibus integris. *Capitula* singula vel bina, rarius plura, 1·3–1·5(–1·7) cm latum; phyllares herbaceae, 1–2 seriatae, molliter pubescentes 6–8 mm longae, 1–1·5 mm latae, lineares acutae, ciliatae. *Flores radii* 35–40, tubis basalibus 2 mm longis, ligulis albis vel coeruleo-purpurascentibus 0·7–1·2 cm longis. *Flores disci* lutei 5 mm longi, tubis basalibus 2 mm longis, lobis 0·75 mm longis. Appendices stylorum lanceolatae 0·5 mm longae. *Pappus* albidus, uniseriatus, 4–5 mm longus. *Achaenia* brunnescentia, obovata 2·5–3 mm longa, sericea, supra pauci-glandulosa.

Slender perennial rhizomatous and stoloniferous herbs. *Stems* 40–75(–100) cm tall, unbranched, finely appressed pubescent. *Leaves* finely pubescent; basal leaves persistent 5–7 cm long, 0·8–1 cm broad, oblanceolate or spathulate decreasing gradually in size becoming distant and linear acute in upper part of stems, acute or obtuse at apex, sessile or attenuate at base, margins entire. *Capitula* 1–2(–10), 1·3–1·5(–1·7) cm broad, phyllaries herbaceous, 1–2 seriate, finely pubescent and ciliate, 0·6–0·8 cm long, 0·1–0·15 cm broad linear acute. *Ray flowers* 35–40, basal tube 2 mm long, ligules white, mauve or blue-violet, 0·7–1·2 cm long. *Disc flowers* yellow 5 mm long, basal tube 2 mm long, lobes 0·75 mm long. Style appendages 0·5 mm long, lanceolate. *Pappus* whitish, simple, 4·5 mm long. *Achenes* light brown, obovate, 2·5–3·0 mm long, sparsely silky with a few glands above.

HABITAT: In forest clearings often on marshy ground.

SIKKIM: Lachen, 3050–3655 m, 31 vii 1849, *Hooker* (K); Yeumtang, 3655 m, 7 ix 1849, *Hooker* (K); without locality, 3050–4570 m, *Hooker* (E).

BHUTAN: Rukubji Tongsa, 2895 m, 9 ix 1914, *Cooper* 2038 (E); Hingai La tol Naha, 3440–1980 m, 28 v 1938, *Gould* 264 (K); Yuto La, 3200 m, 4 ix 1947, *Ludlow, Sherriff & Hicks* 16999 (holo. E, iso. BM); between Thrashiling and Chendebi, 2440 m, 6 viii 1949, *L.S. & H.* 17064 (E, BM); Dhur near Bumthang, 3050 m, 23 vii 1949, *L.S. & H.* 19509 (E, BM); Yuto La, Trongsa Dzong, 3200 m, 2 viii 1949, *L.S. & H.* 19546 (E, BM).

TIBET: Yatung, 27°51′ N, 88°35′ E, 1897, *Hobson* (K); East of Yatung, 3050 m, 3 viii 1936, *Chapman* 1056 (K).

When published, *A. elegans* Hook. f. et Thoms. ex C. B. Cl. was a "later homonym" twice over, as the above synonymy shows, and must be rejected for this reason. It was based on an unpublished name, *Diplopappus elegans*, which Hooker and Thomson used in the herbarium for this taxon and material of it was mixed with specimens of *A. himalaicus* at Kew but has now been separated. Hooker (l.c.) mentions *Diplopappus elegans* in synonymy

under *A. tricephalus*, but refers to *Aster elegans* only in a note (on the same page, under *A. heterochaeta*) pointing out the confusion of names that had been applied to the single-headed species of *Aster* collected by Thomson and himself. Clarke, also at Kew, mistakenly determined material of an *Erigeron* species collected by Royle as *A. elegans* (this specimen he later decided was "almost beyond doubt the true *Heterochaeta asteroides* DC."). This confusion is reflected in the description which he published and, from it, Hooker was unable to recognise the species.

A. neo-elegans is distinguished by being taller (75 cm) than its closest relatives, *A. tricephalus* and *barbellatus*. It is finely pubescent and has narrow leaves that are distant especially in the upper part of the stems or just overlapping nearer their bases, and show a marked decrease in size upwards. Radical leaves are normally present at flowering time. Their rootstocks are finely developed and slender stolons are usually present. The plants generally bear one or two capitula which are smaller than those of *A. tricephalus* or *barbellatus*.

19. **Aster barbellatus** Grierson, **sp. nov.** (Plate 12).

Syn.: *A. tricephalus* auct. non C. B. Cl.: Onno in Bibl. Bot. 106: 53 (1932), p.p.

Herba erecta stolonifera vel rhizomatosa. *Caulis* 30–40 cm altus, simplex, mono vel rarius bi-cephalus parce vel moderate pilosus. *Folia* molliter hirsuta et glandulosa; basalia spathulata 3–6·5 cm longa, 0·9–1·2 cm lata, basi attenuata, ad apicem obtusa vel acuta, marginibus integris vel 3–4 sinuato-dentatis, caulina spathulata vel oblonga 3–11 cm longa, 0·8–1·5 cm lata, ad basem caulis leviter conferta, supra distantia, caule ad apicem subnudo. *Capitulum* 1·5–2·5 cm latum; phyllares oblongae vel spathulatae 25–30, 1–2 seriatae, 0·9–1 cm longae, 0·15–0·25 cm latae, acutae vel obtusae, herbaceae, parce pilosae et ciliatae. *Flores radii* 30–40, tubis basalibus 2 mm longis, ligulis purpureis vel coeruleis, 1·5–2 cm longis, 0·2–0·25 cm latis. *Flores disci* lutei 6·5 mm longi, tubis basalibus 1·5–2 mm longis, lobis 1·5 mm longis. Appendices stylorum 0·5–0·75 mm longae, lanceolatae. *Pappus* uniseriatus, rufescens, setis supra barbellatis, 4–5·5 mm longis. *Achaenia* brunnea 3 mm longa, sparsim sericea, supra glandulosis conspersis.

Erect rhizomatous or stoloniferous herbs. *Stem* 30–60 cm high unbranched one or rarely two-headed, sparsely or moderately pilose. *Leaves* finely hirsute and glandular; basal leaves usually persistent, spathulate, 3–6·5 cm long, 0·9–1·2 cm broad, attenuate at base into a broad petiole, obtuse or acute at apex, margin entire or with 3–4 shallow teeth per side, cauline leaves spathulate or oblong, 3–11 cm long, 0·8–1·5 cm broad, overlapping in lower part of stem, becoming distant above and upper part of stem ± naked. *Capitulum* 1·5–2·5 cm broad; phyllaries oblong or spathulate 25–30, 1–2 seriate, 0·9–1 cm long, 0·15–0·25 cm broad, acute or obtuse, herbaceous, finely and sparsely pilose and ciliate. *Ray flowers* 30–40, basal tube 2 mm long, ligule mauve or blue 1·5–2 cm long, 0·2–0·25 cm broad. *Disc flowers* yellow 6·5 mm long, basal tube 1·5–2 mm long, lobes 1·5 mm long. Style appendages 0·5–0·75 mm long, lanceolate. *Pappus* simple, reddish or buff, setae thick barbellate above, 4–5·5 mm long. *Achenes* brown, 3 mm long, obovate, covered with fine silky hairs, sparsely glandular at apex.

HABITAT: On open grassy slopes and at the edges of fields, sometimes amongst dwarf shrubs.

NEPAL: 5 miles E of Timure, 4110 m, 3 vii 1949, *Polunin* 776 (BM); Taglung, Kali Gandaki, 3050 m, 11 vii 1954, *Stainton, Sykes & Williams* 1696 (BM); Pura, 3655 m, 29 vii 1954, *S.S. & W.* 2081 (E, BM); Lete, 2440 m, 12 vi 1954, *S.S. & W.* 5728 (E, BM); Tukucha, 3200 m, 22 viii 1954, *S.S. & W.* 7388 (E, BM); Thinigaon, Kali Gandaki, 4265 m, 29 viii 1954, *S.S. & W.* 8038 p.p. (BM).

SIKKIM: Lingmuthang, 3050 m, 12 ix 1912, *Rohmoo Lepcha* 76 (E); Cho-lih la, near Chumbi, 3 vii 1878, *Dungboo* (BM).

TIBET: Chumbi, 20 viii 1913, *Cooper* 665 (E, BM); Yatung, 1897, *Hobson* (K), E of Yatung, 3050 m, *Chapman* 383 p.p. (K).

BHUTAN: Leji, 3655–3800 m, 25 vi 1949, *Ludlow, Sherriff & Hicks* 16656 (E, BM); Chojo Dzong, 3960 m, 23 ix 1949, *L.S. & H.* 17275 (E, BM); Dur Chutsen, 3655 m, 19 vii 1949, *L.S. & H.* 19455 (holo. E, iso. BM).

This species is somewhat intermediate between *A. tricephalus* and *A. neoelegans* but is at once distinguished by its finely hirsute leaves. Radical leaves are again present as well as fine stolons. Cauline leaves are generally overlapping in the lower part of the stem but tend to become distant above and the apex of the stem is naked or nearly so. The capitula are generally solitary and in only two examples are more present. They are similar in size to those of *A. tricephalus* but have fewer ray flowers (up to 40) and differ in having pubescent phyllaries. Pappus setae are often distinctly reddish and thicker than in the allied species and tend to become plumose at the tips (see Fig. 4, C).

The circumpolar *A. alpinus* spreads as far as southern Turkestan in Central Asia and further East, has been recorded from Shansi and Chihli, but does not enter the Himalayan area. Here its nearest relatives are the species allied to *A. tricephalus* and in particular *A. barbellatus*. Generally the latter is a taller species (*A. alpinus* is often less than 20 cm tall, rarely as much as 30 cm) but so closely similar are some specimens that a note of the critical distinguishing characters is included.

Glands: These are completely absent in *A. alpinus* but occur in *A. tricephalus* and its allies in varying degrees and usually at least the achenes bear a few glands at the apex. Hobson's specimen cited above is almost without glands.

Floral pubescence: A. tricephalus and its allies are distinctly pubescent at the apex of the lobes of the disc corollas and at the top of the basal tubes. The flowers of *A. alpinus* are generally glabrous; subsp. *subvillosus* (confined to the European Alps and Carpathians) alone is consistently pubescent.

Pappus: Whitish or buff in *A. alpinus*, never reddish as in *A. barbellatis:* although simple in both species, the setae are thicker and barbellate at the apex in *A. barbellatus*.

20. **Aster bietii** Franch. in Jour. de Bot. 10: 373 (1896); Onno in Bibl. Bot. 106: 55 (1932); Hand.-Mazz. in Notizbl. Bot. Gart. Berl. 13: 621 (1937).

Syn.: *A. mekongensis* Onno in Bibl. Bot. 106: 54 (1932) p.p.

Erect or ascending rhizomatous perennial herbs. *Stems* 25–35 cm tall, ± densely glandular pubescent intermixed with a few eglandular villous hairs.

Leaves more sparsely glandular and villous, basal leaves small, often withered at flowering time, but on sterile shoots 6–9 cm long, 0·9–1·8 cm broad, obovate or spathulate, attenuate at base into a winged petiole up to 4 cm long, apex obtuse, mucronate, margin ciliate, entire or 1–2 denticulate near apex, cauline leaves ± evenly distributed on stems and upper ones sheathing capitulum, at least in the young state, lower cauline leaves similar to basal ones, upper cauline leaves oblong or ovate 2·8–6·5 cm long, 1–2·1 cm broad, sessile, semiamplexicaul, rounded or attenuate at base, acute, mucronate at apex, margin ciliate, entire or denticulate. *Capitulum* solitary 2–3·2 cm broad; pyllaries 2-seriate, 1·4–1·6(–2·2) cm long, 0·4–0·5 cm broad, foliaceous, lanceolate-acuminate, green often brownish towards apex with darkly coloured villous and glandular hairs. *Ray flowers* ca. 70, tubes 1 mm long pubescent, ligules purplish-blue up to 3·5 cm long, 2 mm broad. *Disc flowers* 6·5–7 mm long, tubes 2–2·5 mm long, lobes 1·5 mm long, purplish in the dried state. Style appendages 0·75–1 mm long, linear-lanceolate. *Pappus* simple, olive-brownish, 7 mm long. *Achenes* obovate, 4·5–4·75 mm long, 1·5–2 mm broad, light brown, covered with shortly stalked glands especially at base and apex.

HABITAT: On ledges of cliffs, alpine meadows and screes.

TYPE: Yunnan 1890, *Prince Henri d'Orleans* (P).

SE TIBET: Tsarung, Ka-gwr-pu, Mekong-Salween divide, 28°25′ N, 3960–4570 m, vii 1917-18, *Forrest* 14241 (E), 14417 (E), 17230 (E), 17240 (E); Doker-la, Mekong-Salween divide, 28°20′ N, 3655 m, viii 1917, *Forrest* 14744 (E); Salween-Kui Chiang divide, 28°40′ N, vii 1919, *Forrest* 18892 (E); Mt. Wuli-la, E of Salween River, 4110 m, vi-vii 1932, *Rock* 23262 (E); 22409 (E); Mountains of Nakela, Mekong-Salween divide, 4265 m, vi-vii 1932, *Rock* 23094 (E); Yundshi Mts., 3800 m, x-xi 1932, (seed) *Rock* 23449 (E).

In distribution this species extends from the Mekong-Salween divide eastwards as far as the Lichiang Range in Yunnan.

From the appearance of the capitulum with its very long ligules, this species might at first sight be mistaken for *A. diplostephioides* but remains distinct from it by its pappus both in coloration and form. Within subsection *Homochaeta*, it was related to *A. himalaicus* by Onno but differs from this species in that the flower stems are borne terminally on each branch of the rhizome and are not extrarosulate in origin. Onno included some specimens of this species within his circumscription of *A. mekongensis* (as well as others belonging to *A. himalaicus*). It often does resemble the latter especially in the immature state (see *Forrest* 14241, 17230, 18892, *Rock* 23094) but is readily distinguished by the presence of dark hairs at the tips of the phyllaries, which show as a dark fringe around the young capitulum, and also by the colour of the pappus.

21. **Aster retusus** Ludlow in Bull. Brit. Mus. (Nat. Hist.) 2: 69, Fig. 3 (1956).

Low growing perennial herbs. Rootstock stoloniferous, stolons up to 20 mm long, 1·5 mm thick. *Stems* 4–8 cm tall, sparsely pilose at base, more densely so above, hairs reddish-purple, multicellular. *Leaves* glabrous; basal leaves rosulate, spathulate, rounded and retuse at apex, gradually attenuate at base into a short petiole, margin entire sometimes slightly ciliate, 1–3 cm long, 4–8 mm broad; cauline leaves 3–4, sessile, oblanceolate, 1–2 cm long,

2–4 mm broad, margin sometimes ciliate. *Capitulum* solitary, 1–1·5 cm broad; phyllaries 2–3 seriate, outer series lanceolate, inner ones linear, acute or acuminate 6·5–9 mm long, 1·5–2·5 mm broad, margins and apex purplish recurved, ciliate otherwise glabrous. *Ray flowers* ca. 25, tube 3 mm long, ligule 16–18 long, 1·5 mm broad, purplish mauve. *Disc flowers* 5·5–6 mm long, lobes ca. 0·75 mm long. *Pappus* double, outer setae ca. 1 mm long, inner setae as long as disc flowers or slightly longer, yellowish, barbellate. *Achenes* immature, oblong, slightly hirsute, ca. 1·5 mm long, 0·5 mm broad.

HABITAT: On rocks.

SE TIBET: Kongbo, Nambu La, 4265 m, 18 vii 1947, *Ludlow, Sherriff & Elliot* 15467 (holo. BM).

This little alpine species has been said to be related to *A. salwinensis* but it differs from that species in its retuse glabrous leaves which are always entire and not denticulate; in its phyllaries which are glabrous except for the ciliate margins and in its peduncles which are not extra-rosulate.

A. retusus may also be compared with *A. staticifolius* Franch. from Yunnan and Szechuan in Western China. The latter generally bears retuse spathulate leaves but differ in that they are consistently ciliate (the margins of the leaves in *A. retusus* bear only a few hairs) and are sparsely to moderately appressed pubescent. The venation of the leaves is similar in both species i.e. with strong trinervation from the base and often with another opposing pair of lateral veins arising above (the figure accompanying the original description is incorrect on this point). The rootstock of *A. staticifolius*, however, is quite different; it is woody and strongly branched whereas in *A. retusus* it is shortly stoloniferous and shows no sign of woodiness. Also, the peduncles of *A. staticifolius* are only finely pubescent, the capitula are somewhat broader than those of *A. retusus* and the phyllaries are never strongly ciliate.

22. **Aster himalaicus** C. B. Cl. Comp. Ind. 43 (1876); Hook. f. Fl. Brit. Ind. 3: 250 (1881); Onno in Bibl. Bot. 106: 54 (1932).

Syn.: *A. mekongensis* Onno l.c. p. 54, p.p.

Erect perennial rhizomatous herbs, sparingly stoloniferous, villous and glandular pubescent throughout. *Stems* (3–)8–25 cm tall, arising laterally from the base of leaf rosettes. *Radical leaves* withered or lacking on flowering stems but on sterile shoots obovate, oblanceolate or broadly elliptic, lamina 2–3·5 cm long, 0·8–2·5 cm broad, margins entire or with 2–3 denticulate teeth, apex obtuse or acute, mucronate, attenuate at base into petiole 1–4·5 cm long; cauline leaves ± evenly distributed, lower ones often withered or absent, upper ones close to the capitulum, oblong, obovate or lanceolate, 1·3–5·2 cm long, 0·5–2 mm broad, acute or obtuse mucronate at apex, rounded or somewhat attenuate at base, sessile, semiamplaxicaul, margin entire or with 2–3 denticulate teeth. *Capitulum* solitary or very rarely 2–3 on branches arising near middle of stem, 1·5–2 cm broad; phyllaries 20–25, ovate-lanceolate, 2-seriate, 0·9–1·2 cm long, 2·5–3·5 mm broad, herbaceous, green or purplish-tinged, outer ones villous and glandular, inner ones glabrescent. *Ray flowers* 50–70, basal tubes 1·5–2 mm long, ligules purplish blue 1·3–1·7 cm long, 1·25–2 mm broad, often involute. *Disc flowers* 6·75–7·5 mm long, somewhat pubescent towards the base, basal tubes 2 mm long,

lobes 1·5 mm long, yellow or purplish (according to collectors' notes). Style appendages broadly triangular, 0·5 mm long. *Pappus* white or off-white, simple or with an outer series of a few narrow or rarely paleaceous setae, inner setae ca. 5·5 mm long. *Achenes* 2·5–3 mm long 1–1·25 mm broad, obovate, 2-ribbed, brownish, sparsely silky pilose and glandular towards apex.

HABITAT: On open or scrub clad hill slopes among turf or gravel.

NEPAL: Shebal Joong, 4875 m, 5 ix 1927 (comm. Wigram) *Dhwoj* 113 (E, K); without locality, 1927 (comm. Wigram) *Dhwoj* 178 (E); Pangsing, 5180 m, 1929, *Dhwoj* 92 (E, BM); Maney Dara, 3960–4265 m, 1930, *Dhwoj* 546 (E, BM); Baraha Pokhri, 4265 m, 19 ix 1950, *Lowndes* 1523 (E, BM); entre Simigaon et Chimikolchi, 3750 m, ix 1954, *Zimmermann* 1346 (BM); Beding, 4050 m, ix 1954, *Zimmermann* 1381 (E, BM), 1445 (BM); Ripimu Glacier, 27°50′ N, 86°30′ E, 5180 m, 16 x 1950, *L. W. Swann* R17 (BM).

SIKKIM: Yumthang, 4570 m, 6 ix 1849, *Hooker* (K); Yakla, 4875 m, 18 x 1869, *Clarke* 9896A (BM); Jongri, 3960 m, 15 x 1875, *Clarke* 25746 (BM), 25771 (K), 26195B & D (K), 26197 (syntypes-K); Nathu La, 4265 m, 24 viii 1913, *Cooper* 608 (E); Megu, 4265 m, 1913, *Ribu & Rohmoo* 6439 (E).

BHUTAN: Phajudin Timpu, 3960 m, 14 xi 1914, *Cooper* 3536 (BM); Phage La, Mangde Chu, 4265 m, viii-ix 1949, *Ludlow, Sherriff & Hicks* 17205 (E, BM), 17214 (E, BM); Passu Sepo, Mangde Chu, 4720 m, 10 ix 1949, "Rays pink, disc dark red", *L.S. & H.* 17235 (BM).

ASSAM: Ze La, 4265 m, 22 viii 1938, *Ward* 14135 (BM).

BURMA: Seinghku Valley, 28°10′ N, 97°20′ E, 3655–3960 m, 13 x 1926, *Ward* 7583 (E, K, BM), 7525 (K); Adung Valley, 28°20′ N, 97°40′ E, 28 vii 1931, "Ray flowers very blue . . . disc flowers purple when open greenish-white young", *Ward* 9871 (BM).

TIBET: Chumbi, Yatung, 1897, *Hobson* p.p. (K).

In China, the distribution of this species extends as far east as the Lichiang Range in Yunnan.

The group of species centred around *A. himalaicus–A. salwinensis, heliopsis, stracheyi* have in the past been split asunder by some authorities mostly on the grounds of the pappus. The double pappus here is in an incipient condition—a conclusion which Onno (l.c. p. 56) hinted at, for in his remarks on *A. stracheyi*, which he related to *A. salwinensis*, he wrote: "Es ist sehr gut möglich, dass sich *Heterochaeta*-Arten mehrfach aus *Homochaeta*-Arten herausgebildet haben". This evolution in the pappus may be seen to take place within a single species as in *A. peduncularis*. In *A. himalaicus, stracheyi* and *heliopsis* the pappus is usually simple but in the first named species it may occasionally be double. In *A. salwinensis*, on the other hand, it is usually double but in some specimens almost simple with only a few outer setae. In this group the outer setae resemble shortened members of the inner series and the broad sub-paleaceous type of outer setae seen in *A. asteroides* and *diplostephioides* are not found here.

The species of this group also have a distinctive habit due to the extra-rosulate origin of the flower stem, springing as it does from the rhizome below the rosette of leaves. The latter are obovate or spathulate with denticulate or more strongly toothed margins except in *A. heliopsis* where they are ovate.

Within this group of related species, *A. stracheyi* can usually be recognised at a glance by its long (up to 30 cm) fine stolons and by its phyllaries which are glabrescent or with a little villous hair at their base at the junction of the peduncle and this separates it from *A. salwinensis* which it may closely resemble. Both *A. salwinensis* and *heliopsis* have brownish pappus setae but the ray flowers in the former are few (15–30) and broad (2·5–3 mm) but in the latter are numerous (ca. 100) narrow and involute (ca. 0·5 mm broad, see Fig. 4, E). In *A. salwinensis* and *himalaicus* also, the disc flowers are deeply purplish tinged (at least, in the dry state) a condition that is not obvious elsewhere in the group. Both *A. stracheyi* and *himalaicus* have a white pappus but the latter is at once differentiated by its glandular foliage and involucre as well as its coarser, more robust habit and numerous ray flowers (50–70).

In common with its close relative, *A. heliopsis*, *A. himalaicus* has a mixed indumentum but both elements of it, glandular and villous hairs, are more strongly developed here. It is further separated from *A. heliopsis* by the latter's larger size, cordate basal leaves, narrower and more numerous ligules and by its brownish pappus. *A. heliopsis* and *himalaicus* are coarser and more robust in habit than the other species. Slender specimens of *A. himalaicus* may be mistaken for forms of *A. salwinensis*, e.g. *L.S. & H.* 17205 and 17214 which are cited here, but they are distinct from the latter species on account of the pappus colour and the broader phyllaries. *A. latibracteatus*, under which several gatherings of *A. salwinensis* were distributed, is widely separated from this group in habit and in that the flowers are almost without basal tubes, the disc flowers are very small and the pappus is truly double with broad paleaceous outer setae.

From the specimens which he cited with the original description, but without designating a type, it is clear that Onno described his *A. mekongensis* on a mixture of specimens. Some of these are *A. bietii*, but the majority are no more than a Yunnanese form of *A. himalaicus* that usually has more copious white villous hair which render the leaves a paler green. Onno did in fact relate *A. mekongensis* to *A. bietii* but the latter does not have the same extra-rosulate type of peduncle, its pappus is brownish and its ligules are longer (up to 3·5 cm).

23. **Aster heliopsis** Grierson, **sp. nov.** (Plate 13).

Herba perennis rhizomatosa; rosulae steriles plerumque adsunt. *Caulis* erectus 15–35 cm altus, pilosus, glandulis breviter stipitatis conspersis. *Folia* glandulosa et pilosa, praesertim ad costam; radicalia oblonga vel cordata, petiolis 2·5–5 cm longis, laminis 2–4 cm longis, 1–3 cm latis, apicibus obtusis vel mucronulatis, marginibus integris vel denticulatis; caulina inferiora tempore florendi nulla; superiora 2–4 cm longa, 1·2–2 cm lata, elliptica, sessilia, semiamplexicaulia. *Capitulum* solitarium, 1·8–2·2 cm latum; phyllares 15–20, 2-seriate, ovatae, 1·5 cm longae, 0·3–0·6 cm latae, glandulosae et pilosae, apicibus acutis. *Flores radii* numerosi ca. 100–120, tubis 2 mm longis, ligulis coeruleo-purpurascentibus, 1·5 cm longis, 0·5 mm latis. *Flores disci* lutei 4–4·5 mm longi, tubis 1 mm longis, lobis c. 0·5 mm longis, glabri. Appendices stylorum late triangulares, acutae, 0·5 mm longae. *Pappus* simplex, 5 mm longus, brunneus. *Achaenia* obovata, 0·9–1 cm longa, 1·5 mm lata, brunnescentia, 2-costata, parce pilosa et glandulifera.

Perennial rhizomatous herbs with sterile rosettes. *Stems* erect 15–35 cm

tall, indumentum pilose intermixed with short stalked glandular hairs. *Leaves* glandular and pilose especially on the veins; radical leaves withered or absent from flowering stems but on sterile shoots oblong or cordate, 2–4 cm long, 1–3 cm broad, borne on petioles 2·5–5 cm long, apex obtuse or mucronulate, margins entire or denticulate; lower cauline leaves lacking at flowering time, upper ones 2–4 cm long, 1·2–2 cm broad, elliptic, semiamplexicaul at the base. *Capitulum* solitary, 1·8–2·2 cm broad; phyllaries 15–20, ovate, 2-seriate, 1·5 cm long, 0·3–0·6 cm broad, glandular and pilose, acute at the apex. *Ray flowers* 100–120, basal tube 2 mm long, ligule blue-lilac 1·5 cm long, 0·5 mm broad. *Disc flowers* yellow, 4–4·5 mm long, basal tube 1 mm long, lobes c. 0·5 mm long, glabrous. Style appendages broadly triangular, acute, 0·5 mm long. *Pappus* simple, 5 mm long, brownish. *Achenes* obovate, 0·9–1 cm long, 1·5 mm broad, pale brown, 2-ribbed, glandular and sparsely pilose.

HABITAT: Cliff faces.

NEPAL: Bikhoo (? Lihkoo) Shailoong, 4265–4570 m, *Dhwoj* 403 (holo. E, iso. BM).

SIKKIM: Alukthang, 4265 m, 1913, *Ribu & Rohmoo* 6617 (E).

BHUTAN: Rinchen Chu, Takse La, 4570 m, 18 viii 1949, *Ludlow, Sherriff & Hicks* 17159 (E, BM).

This species has been named from the resemblance of the capitulum, seen in front view, to the medieval cartographer's representation of the sun: the disc representing its orb, the phyllaries (which are longer than the disc) its solar flares, the rays its sun beams.

A. heliopsis is distinguished from *A. himalaicus* by its cordate or oblong radical leaves, larger size narrower and more numerous ligules and brownish pappus. See also the remarks following the description of the latter species.

24. **Aster stracheyi** Hook. f. Fl. Brit. Ind. 3: 250 (1881), Bot. Mag. t. 6912 (1886); Onno in Bibl. Bot. 106: 56 (1932).

Small, erect or ascending perennial rhizomatous herbs bearing several long fine stolons up to 30 cm long. *Stem* springing from base of rosette of radical leaves, 3–18 cm tall, often reddish, villous. *Leaves* glabrous or sparsely to moderately pilose on both surfaces, ciliate, 3-nerved from base, veins reddish; radical leaves elliptic or spathulate 0·8–3·5 cm long, 0·6–1·3 cm broad, margin entire or 3–4 serrate, apex obtuse or acute, attenuate at base into petiole 1–6·5 cm long; cauline leaves linear, oblong or obovate, 0·9–2 cm long, 0·15–0·8 cm broad, margin entire or 1–2 denticulate or serrate, apex acute or obtuse, sessile or attenuate at base into a short petiole. *Capitulum* solitary 1·3–1·8 cm broad; phyllaries glabrous or ciliate only at base 0·8–1·2 cm long, 2·5–3·75 mm broad, lanceolate, 2-seriate, herbaceous, purplish tinged, often deeply so. *Ray flowers* 30–40, tubes 1·5 mm long, ligules blue mauve, 0·9–1·3 cm long, 1·75–2 mm broad. *Disc flowers* yellow, 5·5 mm long, tubes 2 mm long, lobes 1 mm long. Style appendages lanceolate 0·5 mm long. *Pappus* simple, white or pinkish, setae 4·5–5 mm long. *Achenes* 2·25–3·0 mm long, 0·75–1 mm broad, obovate, densely whitish pubescent.

HABITAT: Grassy rocks and among boulders in alpine turf sometimes near the sides of streams.

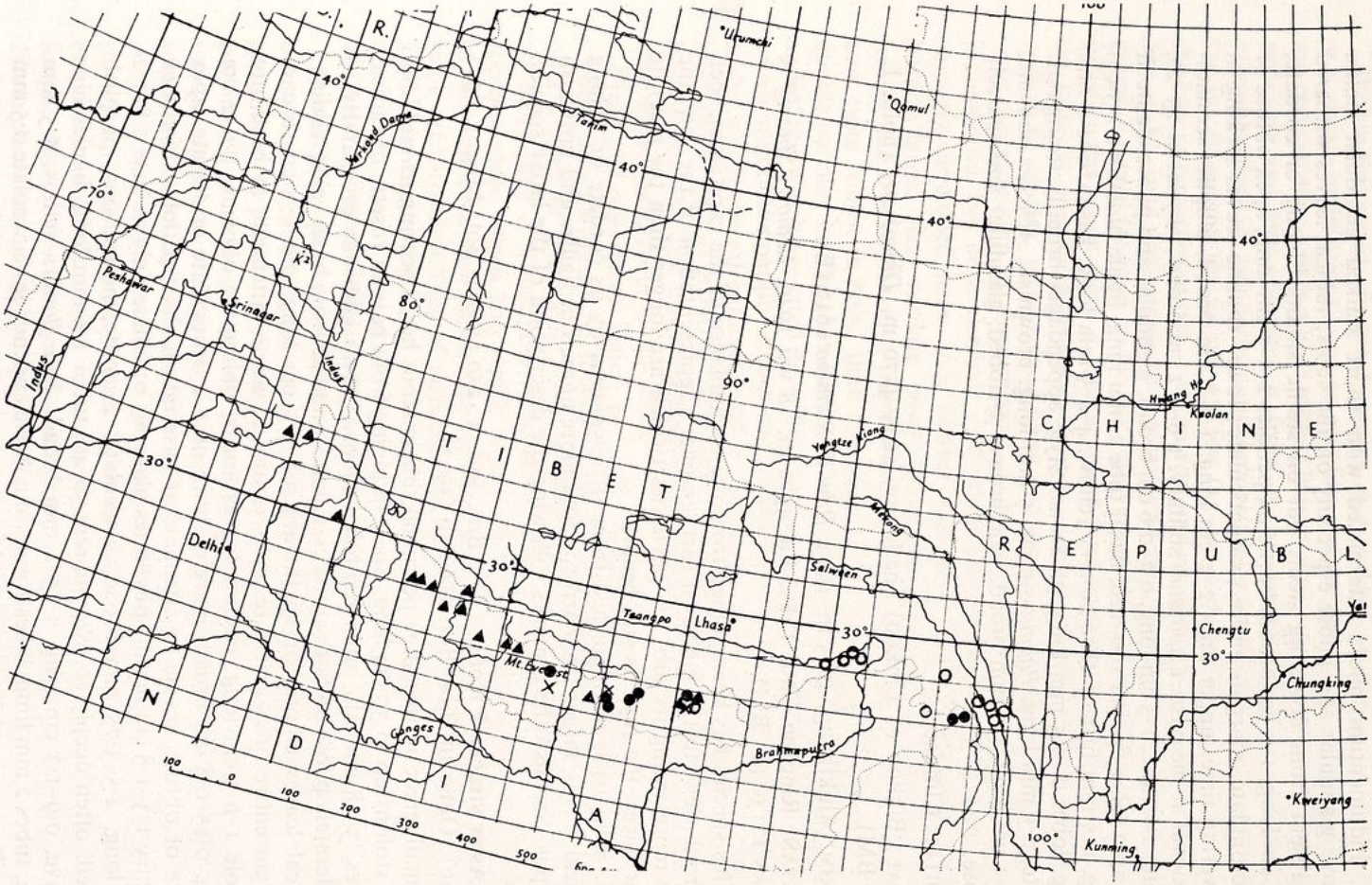


FIG. 11. Map to show distribution of *Aster heliopsis*, *A. himalaicus*, *A. salwinensis* and *A. stracheyi*.

× *A. heliopsis*; ● *A. himalaicus*; ○ *A. salwinensis*; ▲ *A. stracheyi*.

INDIA: Kunawar, Sungnam, 18 ix 1886, *Drummond* 22188 (E); Kulu, Seri Nal, 3960 m, 19 ix 1916, *Cooper* 5642 (E); Shatool Pass to Pindree, 3655–3960 m, *Madden* 494 (E); Tehri Garhwal, Bamsor Pass, 4570–4875 m, 26 viii 1883, *Duthie* 851a (E, BM); Kumaun, Pindari, 3655 m, *Strachey & Winterbottom* 2 (syntype-K, BM); without locality, 1832, *Wallich* (syntype-K); Nipchang Valley, Darma, 3655–3960 m, 31 viii 1884, *Duthie* 3020 (E); Byans, Pabang Gadh, *Duthie* 5672 (K); Byans, Palang-garth, 3048 m, 19 vii 1886, *Reid* (E).

NEPAL: Pongsing, 4570 m, 1929, *Dhwoj* 140 (E, BM), 162 (E); Tangba (? Tamba), 4265–4570 m, 1930, *Dhwoj* 219 (E, BM); Nurget, 3050 m, 22 viii 1935, *F. M. Bailey* (BM); Khola Kharka, 4570 m, vii 1949, *Polunin* 1119 (BM); Chilime Khola, 3960–4570 m, vii 1949, *Polunin* 1137 (BM); Langissa Kharka, 3960 m, ix 1949, *Polunin* 1913 (BM); Lulo Khola, 4570 m, 18 ix 1952, *Polunin, Sykes & Williams* 3469 (E, BM); Ringmigaon, Phoksumdo Tal, 4720 m, 21 ix 1952, *P.S. & W.* 3543 (E, BM); Thakurji Lekh, south of Jumla, 3655 m, 16 vii 1952, *P.S. & W.* 4726 (E, BM); Mustang, 12 viii 1954, *Stainton, Sykes & Williams* 2394 (BM); Lamjung Himal, 4110 m, 11 vii 1954, *S.S. & W.* 6288 (E, BM); Samargaon and Sangdah, north of Tukucha, 4110–4570 m, viii 1954, *S.S. & W.* 7286 (BM), 7507 (E, BM); Saipal, 4570 m, 18 viii 1954, *Arnold* 30 (BM); Tamur Valley, Mewa Khola, Topke Gola, 3960 m, 12 vii 1956, *Stainton* 946 (E, BM); Ganesh Himal, Ankho Khola, 28°12′ N, 85°5′ E, 3350 m, 18 vii 1962, *Stainton* 4004 (BM); Langtung Himal, 28°14′ N, 85°35′ E, 4450 m, 28 vii 1963, *Stainton* 4065 (BM).

SIKKIM: Without locality, 1888, *King's collector* (E); Alookthang, 4570 m, 12 viii 1913, *Rohmoo Lepcha* 978 (E); Kangling, 4265 m, 1913, *Ribu & Rohmoo* 6524 (E).

BHUTAN: Parsheng Timpu, 3800 m, 26 vii 1914, *Cooper* 1905 (E, BM); Saga La, Upper Mangde Chu, 4720 m, 15 vii 1949, *Ludlow, Sherriff & Hicks* 16847 (E, BM); Rinchen Chu, Takse La, 4720 m, 19 viii 1947, *L.S. & H.* 17173 (E, BM).

This species is easily recognisable by its small size, fine stolons glabrescent phyllaries and white pappus. See also the notes on its relationships following the description of *A. himalaicus* and *A. salwinensis*.

A. stracheyi, according to Hooker (Bot. Mag. t. 6912: 1886), was reputed to have been introduced into cultivation in 1885 although Wallich was the first to have procured specimens of it over fifty years earlier probably from Dr. Govan, the first botanical explorer to have visited Kumaun. It was grown and flowered at Edinburgh ten years ago but has since been lost. It is not offered in the recent catalogues published by the leading horticultural institutes and societies.

25. **Aster salwinensis** Onno in Bibl. Bot. 106: 74 (1932); Hand.-Mazz. in Notizbl. Bot. Gart. Berl. 13: 626 (1937).

Erect or ascending rhizomatous perennial herbs with sterile rosettes of leaves. *Stems* 5–20 cm tall, villous, eglandular. *Leaves* glabrescent or sparsely villous on veins, ciliate; basal leaves obovate or elliptic, petiolate, laminae 1·5–4·0 cm long, 0·8–1·5 cm broad, margins usually denticulate, obtuse or acute at apex, attenuate at base; petioles 1·5–3·5 cm long; cauline leaves elliptic, oblong or obovate, 1–4 cm long, 0·6–1·1 cm broad, acute or obtuse

at apex, sessile or attenuate and subpetiolate at base, margin entire or 1–2 denticulate. *Capitulum* solitary 1–1·8 cm broad: phyllaries 1–2 seriate, lanceolate acuminate 0·7–1 cm long, 1·75–2·25 mm broad, herbaceous, margins membranous, green or purplish at tips. *Ray flowers* 15–30, tubes 2–2·5 mm long; ligules blue-purple or crimson, rarely white, 1–1·5 cm long, 2·5–3 mm broad. *Disc flowers* dull orange (fide *Forrest*), reddish-brown (fide *Ludlow & Sherriff*) or yellow but lobes often purplish in dry state, 4·5–5·5 mm long, tubes 2–2·5 mm long, lobes 1–1·5 mm long. Style appendages lanceolate, 0·75 mm long (stamens and styles sometimes exserted). *Pappus* double or occasionally simple with a few short outer setae, buff or brownish, inner setae 4–6 mm long, outer setae narrowly paleaceous 1–1·5 mm long. *Achenes* obovate, 4 mm long, 1·5 mm broad, brownish, 2–4-ribbed, sparsely fine white pilose.

HABITAT: On open stony alpine meadows and rock shelves, sometimes amongst dwarf rhododendrons.

TYPE: Onno in his original description did not indicate any choice of type from among the specimens which he cited. The *Forrest* and *Farrer* gatherings listed here were among these and must be regarded as syntypes.

SE TIBET: Tsarung, Ka-gwr-pu, Mekong-Salween divide, 28°35′ N, 3655–4570 m, viii-ix 1917-18, *Forrest* 14554 (E), 16881 (E), 17219 (E); Doker La, Mekong-Salween divide, 28°20′ N, 98°42′ E, 4265 m, viii-ix 1918-21, *Forrest* 17253 (E), 19949 (E); Salween-Kui-Chiang divide, 28°40′ N, 98°15′ E, 3960 m, viii-ix 1919-21, *Forrest* 19088 (E), 20252 (E); NW of Si-chi-to, 28°48′ N, 98°15′ E, x 1922, *Forrest* 22928 (E); Mt. Wuli-La, N of Alulaka, 3655 m, vi-vii 1932, *Rock* 22365 (E); Mt. Kenichumpo, W of Champutong, 3655–4570 m, v-x 1932, *Rock* 21970 (E), 22519 (E).

SE TIBET: Kongbo, Tamnyen La 29°20′ N, 94°43′ E, 3500 m, 22 vi 1938, *Ludlow, Sherriff & Taylor* 4945 (BM); Tsangpo Valley, Doshong La, 29°29′ N, 94°59′ E, 3960–4265 m, vii 1938, *Ludlow, Sherriff & Taylor* 5232 (E, BM), 5279 (E, BM); 2 miles W of Tsanang La, Tsanang Chu near Paka, 29°13′ N, 94°24′ E, 4110 m, 17 vii 1938, *L.S. & T.* 5857 (E, BM); Kulu Phu Chu, near Paka, 3500 m, 23 vii 1938, *L.S. & T.* 5912 (E, BM); Tsangpo Valley, Lush La, 29°27′ N, 94°35′ E, 4110 m, 19 ix 1938, *L.S. & T.* 7113 (E, BM); Lilung Chu, 3290 m, 3 x 1938, *L.S. & T.* 7169 (BM); Deyang La, 4110 m, 10 vii 1947, *Ludlow, Sherriff & Elliot* 14298 (E, BM), 14304 (E, BM).

NE UPPER BURMA: Chawchi Pass, 3655–3900 m, vii-viii 1920, *Farrer* 1716 (E), 1884 (E); Moku-ji Pass, 3800 m, 4 viii 1920, *Farrer* 1790 (E); Seinghku Valley, 28°8′ N, 97°25′ E, 2745–3050 m, ix-x 1926, *Ward* 7011 (K), 7478 (K); Delei Valley, 28°15′ N, 96°40′ E, 3655–3960 m, xi 1928, *Ward* 8682 (K).

The distribution of this species extends into North-Western Yunnan but no further east than the Mekong-Yangtze divide.

This species is most closely related to *A. stracheyi* and small specimens may easily be mistaken for it. It certainly appears to have nothing in common with *A. senecioides* Franch. with which Onno compared it. *A. salwinensis*, however, never has the elongated stolons that are a common feature of *A. stracheyi*, its phyllaries always have distinct longitudinal veins whereas those of the latter are smooth and often purple in colour. The pappus of *A. salwinensis* is brown but that of *A. stracheyi* is white. It has nothing to do

with *A. latibracteatus* under which name some specimens have been distributed.

For further remarks on the relationship of this species, see the notes following the description of *A. himalaicus*.

26. **Aster flaccidus** Bunge in Mem. Acad. Sci. St. Petersb. 2: 599 (1835) et Enum. Fl. Alt. 77 (1835); Ledeb. Fl. Ross. 2: 473 (1846); Turcz. Fl. Baic. Dah. 2: 8 (1856); Onno in Bibl. Bot. 106: 62 (1932); Hand.-Mazz. in Notizbl. Bot. Gart. Berl. 13: 625 (1937).

Syn.: *Aster heterochaeta* C. B. Cl. Comp. Ind. 44 (1876); Hook. f. Fl. Brit. Ind. 3: 250 (1881) p.p. excl. typ. (=*A. asteroides* (DC.) O. K t ze., q.v.).
A. tibeticus Hook. f. Fl. Brit. Ind. 3: 251 (1881) p.p.
Erigeron flaccidus (Bunge) Botsch. in Not. Syst. Herb. Inst. Bot. U.R.S.S. 16: 388 (1954); Fl. U.R.S.S. 25: 217 (1959).
Erigeron heterochaeta (C. B. Cl.) Botsch. l.c.

Erect perennial herb, rootstock thinly rhizomatous. *Stems* usually 5–15 cm tall, but sometimes up to 30 cm, somewhat thickened at the base with leaf remains but not densely nor fibrously so, covered with white villous hairs especially in the upper parts usually intermixed with stipitate glands, sometimes almost exclusively glandular with subsessile glands. *Leaves* villous on both surfaces or glabrescent, margins crisped or flat, ciliate, basal leaves spathulate or obovate, 1·7–6·5 cm long, 0·8–1·5 cm broad, acute or obtuse, mucronate at the apex, attenuate and somewhat petiolate at base, sometimes 3-nerved and veiny; cauline leaves 2–3 on lower part of stem or more or ± evenly distributed on stem. *Capitulum* solitary (1·2–)1·5–2(–3) cm broad; involucre 0·8–1 cm long, densely or sparsely lanate-villous with white or coloured hairs, intermixed with stipitate or subsessile capitate glands, or almost exclusively glandular; phyllaries linear-lanceolate, 2-seriate, herbaceous, shorter than or as long as the disc flowers, green or blackish with fragile villous hairs. *Ray flowers* 30–65, basal tube 1–2 mm long, ligules blue or mauve, rarely pink, 1·3–1·9(–3) cm long, 1·25–2·3 mm broad, usually with a few eglandular hairs at the apex of the tube, styles prominent often blackish. *Disc flowers* yellow 5·5–6·5 mm long, basal tube 1·5–2·5 mm long, lobes 1 mm long, usually with a few pale (rarely dark) eglandular hairs at the top of the basal tube and on the outer surface of the lobes. Style appendages lanceolate or narrowly lanceolate, 0·4–1·2 mm long. *Pappus* whitish, inner setae 6–7 mm long, outer 1·5 mm long, narrowly subpaleaceous. *Achenes* 2·5 mm long, narrowly obovate, 2-ribbed, brownish, covered with fine silky buff hairs, sometimes intermixed with short stalked glands near the apex or sometimes almost completely glabrous.

HABITAT: Screes and alpine pastures.

TYPE: Altai, 1832, *Bunge* (LE).

This is one of the most widespread of Asiatic asters, its distribution stretching from Iran, through the Himalaya and Central Asia, to N. China and Siberia. It shows quite considerable variation and several infraspecific categories have been recognised throughout its range. The following are applicable here.

Key to the subspecies of Aster flaccidus

Stems up to 15 cm tall. Leaves usually ± villous pubescent on both surfaces. Peduncles villous pubescent but not markedly glandular, becoming densely villous at the base of the involucre. Capitula 1·5–2 cm broad subsp. *flaccidus*

Stems 5–15 cm tall. Leaves usually glabrous or ciliate. Peduncles distinctly glandular but not densely villous at the base of the involucre. Capitula 1·2–1·8 cm broad . . . . . subsp. *glandulosus*

Stems 25–45 cm tall. Leaves usually villous pubescent on both surfaces. Peduncles villous and glandular, densely so, at base of involucres. Capitula 2–3 cm broad . . . . . subsp. *tsarongensis*

26a. **Aster flaccidus** Bunge subsp. **flaccidus.**

Syn.: *Aster heterochaeta* C. B. Cl. Comp. Ind. 44 (1876); Hook. f. Fl. Brit. Ind. 3: 250 (1881) p.p. excl. typ.
A. flaccidus Bunge var. *fructu-glandulosus* Ostenf. in Hedin S. Tibet 36 (1922) p.p.
A. flaccidus Bunge subsp. *fructu-glandulosus* (Ostenf.) Onno in Bibl. Bot. 106: 65 (1932) p.p.

W PAKISTAN: Kurram Valley, Mt. Sikaram, 3960–4265 m, 7 viii 1879, *Aitchison* 951 (K); Chitral, Karumbar Pass, E of Baroghil Pass, 4265 m, 26 vii 1958, *Stainton* 3013 (E, BM).

KASHMIR: Without locality, *Falconer* 3580 (K) (ad subsp. *glandulosus* vergens); Zanskar, Sinku La Pass, 20 vi 1856, *Schlagintweit* 6260 (E); Nubra, Laotse Pass, 18 viii 1856, *Schlagintweit* 2348 (E); Burzil, 4415 m, 1 viii 1876, *C. B. Clarke* 29855 (K, BM); Karakorum, 4415 m, 8 viii 1876, *Clarke* 30223A (K); Sassir Pass (Karakorum Trade Route), 4720 m, 25 vii 1928, *Ludlow* 423 (BM); Zanskar, Kargia, Chumikmarpo, 4110 m, vii 1933, *Koelz* 5360 (MICH); Zanskar, Lagong, 4110 m, 10 vii 1933, *Koelz* 5412 (MICH); Baltistan, Dras Valley, 3350–3655 m, 29 vi 1892, *Duthie* 11643 (E, BM); Tilail, Kargeh Pass, 3960–4265 m, 30 viii 1893, *Duthie* 13919 (E, BM); Ladak, Hanupatta, 4415 m, 20 vi 1928, *Osmaston* 54 (K) (*ad subsp. glandulosum vergens*); above Suru, 3655 m, 8 vii 1928, *Osmaston* 162 p.p. (K); Ladak, above Chortren Chen, 5180 m, 19 viii 1931, *Koelz* 2671 (E); Ladak, Khardong Pass, 4570–5180 m, vii 1937, *C. C. Burt* 163 (E), 167 (E); Sinthan Pass, 4265 m, 5 vii 1939, *Ludlow* 186 (E, BM); Kishenganga, Shonthar Gali, 3655 m, 7 viii 1939, *Ludlow & Sherriff* 1503 (E, BM); near Srinagar, 3960 m, 14 viii 1940, *L. & S.* 7933 (E, BM); Khardong La, 4875 m, 18 vi 1941, *L. & S.* 8417 (BM); Barnaj Nullah, 3050 m, 9 vii 1943, *L. & S.* 9166 (BM); Karakoram, Gilgit, 4505 m, 13 vii 1960, *Polunin* 6018 (E); Gharesa glacier, 13 miles E of Nagar, 4720 m, 27 vii 1960, *Polunin* 6108 (E).

INDIA: Kumaon, Lebung Pass, 5180 m, 6 ix 1884, *Duthie* 3024 (E); Jolinkla, 4265 m, 1 viii 1886, *Reid* (E); Lebung, 4570 m, 2 viii 1886, *Reid* (E); Lahaul, Keylang 3960 m, viii 1878, *Watt* 2486 (E); above Pasparag, 6 vi 1888, *Drummond* 22599 (E); above Dubar, 7 vii 1888, *Drummond* 22601 (E); Chandratal, 1 ix 1933, *Koelz* 6934 (MICH); Dilburig, Bhaga Valley, 3050–4265 m, 3 viii 1933, *Rup Chand* 13a (MICH); Bara Lacha La, 3050 m, 16 vii 1938, *Bor* 8683 (E, K); Rangcha Galli, 4415 m, 8 vii 1941, *Bor* 14026 (E, K);

above Kargang, 3960 m, 21 vi 1941, *Bor* 14889 (E, K); Suchu, 30 vi 1941, *Bor* 15106 (E, K).

TIBET: Without precise locality, 4265–5485 m, *T. Thomson* (E, K); Camp 94, N Tibet, 5025 m, 26 vii 1898, *Deasy* 91 (BM); Tinki Dzong, 4570 m, 13 vii 1924, *Hingston* 337 (K-*ad. subsp. glandulosum vergens*); Sowgon, near Gyantze, 4110 m, 10 vii 1924, *Ludlow* 33 p.p. (BM); Mandarlik, 3437 m, vii 1900, *Hedin* (S); Kar-jakkak-sai, Chimen-tagh, 3984 m, 21 vii 1900, *Hedin* (S-*ad subsp. glandulosum vergens*); Lager XVII, 4024m, 31 vii 1900, *Hedin* (S-*ad subsp. glandulosum vergens*).

NEPAL: Langissa Kharka, 4720 m, 15 vi 1949, *Polunin* 376 (BM); Soldanggaon, 5635 m, 26 vi 1952, *Polunin, Sykes & Williams* 9 (BM); Sisne Himal, 5025 m, 27 vii 1952, *P. S. & W.* 249 (BM); Changyan Khola, 4570 m, 14 vi 1953, *Gardner* 726 (BM); Chimgoan, N of Tuckucha, 4415 m, 17 vii 1954, *Stainton, Sykes & Williams* 1858 (BM); Langtang Himal, 28°14′ N, 85°35′ E, 4570 m, 28 vii 1962, *Stainton* 4067 (BM); Dolpo, Tarap, 29°2′ N, 83°11′ E, 4875 m, 3 vii 1963, *Stainton* 4396 (BM); Mukut, 28°51′ N, 83°26′ E, 4720 m, 18 vii 1963, *Stainton* 4437 (BM).

In this subspecies the leaves may be almost glabrous or villous, glandular or eglandular and the indumentum varies without obviously being correlated to other characters. The type specimen has glabrous and ciliate leaves but the involucre is not densely glandular as it is in subsp. *glandulosus*. In some specimens from Lahaul, Nepal and Sikkim the leaves are villous and quite strongly glandular (e.g. *Bor* 15106, *P. S. & W.* 9, *S. S. & W.* 1283, 1858 *Rohmoo Lepcha* 249, 274) but they are not sufficiently different from the eglandular specimens to warrant formal recognition. Leaves with crisped margins are common among plants from Punjab and Nepal, but this also is too variable in occurrence and lacks co-ordination with other characters to form a basis for distinction.

The villous hairs of the involucre are frequently bicoloured, the walls of the lower cells being blackish whereas the others, forming the longer part of the hairs, are white. These hairs are fragile and often break at or near the junction between the two colours (there may be a line of weakness here). Thus some phyllaries are blackish due to their covering of broken hairs while others, even on the same head, which have been protected from rubbing are whitish due to the tangled lanate upper parts of the hairs. In f. *griseo-barbatus* most of the hair cells have dark coloured walls and the whole hair seems to be tougher than those that are bicoloured thus the phyllaries are darker and more shaggy.

26aI. f. **griseo-barbatus** Grierson, **f. nova.**

Syn.: f. *atropurpureus* Onno in Bibl. Bot. 106: 65 (1932) p.p.

Differt a typo indumentum involucri griseo-coloratum.

SIKKIM: Chumolari, 4875 m, 12 ix 1912, *Rohmoo Lepcha* 478 (E).

BHUTAN: Gaffoo La, 5025 m, 15 ix 1949, *Ludlow, Sherriff & Hicks* 17245 (E, BM); Marlung Tsampa, 4720 m, 11 vii 1949, *L.S. & H.* 19408 (BM).

ASSAM: Mishmee Hills, Tha Chu Valley, Lohit, 3050–3655 m, 9 vii 1950, *Ward* 19595 (E, BM).

Onno's f. *atropurpureus* was designed to include plants whose stems and involucres are darkly coloured but made no reference to the indumentum

upon them. In addition to *Rohmoo Lepcha* 478, he cited *Forrest* 14448 which is not thickly lanate but has purplish stems and veins in the leaves. This specimen, however, is regarded as being a somewhat anomalous specimen of subsp. *tsarungensis*. Tamamschian (Fl. U.R.S.S. 25: 109, 1959) cited typical f. *atropurpureus* Onno as a synonym of *A. fallax* Tamamsch. Although the Siberian and Mongolian specimens to which Onno referred have not been examined, there is no justification for regarding the two as being identical although some individuals might have been wrongly referred. The type specimen of *A. fallax* shows, as Tamamschian stated, that this species is related to *A. alpinus;* the pappus is simple and the phyllaries are largely glabrous with ciliate margins, not lanate villous.

The following specimen is similar to the slender form of subsp. *glandulosus* because of its aggregation of narrowly spathulate basal leaves (2·3–3·5 cm long, 0·4–0·5 cm broad) and its ± naked peduncles. The capitula are similar in size to those of subsp. *glandulosus* but are villous at the base intermixed with a few long stalked glands. The ligules are fewer (ca. 30) and longer than in this subspecies. It probably amounts to no more than a local form and, for the present, is maintained in subsp. *flaccidus*.

NE UPPER BURMA: Valley of Di Chu, 3655 m, 27 vii 1926, *Ward* 7199 (K).

26b. **Aster flaccidus** Bunge subsp. **glandulosus** (Keissl.) Onno in Bibl. Bot. 106: 66 (1932).

Syn.: *A. flaccidus* var. *glandulosus* Keissler in Ann. Nat. Hist. Hofmus. Wien 22: 26 (1907).

A. flaccidus var. *fructu-glandulosus* Ostenf. in Hedin, S. Tibet 36 (1922) p.p.

A. glandulosus (Keissl.) Hand.-Mazz. in Ost. Bot. Zeit. 79: 35 (1930) non Labill. (1806).

A. flaccidus subsp. *fructu-glandulosus* (Ostenf.) Onno in Bibl. Bot. 106: 65 (1932) p.p.

This subspecies is characterised by ± glabrous, ciliate leaves and involucres which are covered with dark shortly stalked glands and only a few villous hairs. The majority of its leaves are basal and the upper half of the peduncles are generally naked. It is generally quite distinct from subsp. *flaccidus* but intermediate specimens that resemble the latter in having more pubescent leaves or involucres do occur.

INDIA: Piti (Spiti), Dankar, 2 ix 1847, *T. Thomson* (K).

KASHMIR: Without locality, *Jacquemont* 1030 (K); Hanle Plain, 14 ix 1847, *T. Thomson* (K); Pangong, 4875 m, 16 viii 1848, *Strachey* 24 (K); Laptel, 4570 m, *Strachey & Winterbottom* 2a (K); Hanle, 4200 m, 13 vii 1931, *Koelz* 2305 (K); Ladak, Rongdu Nala, Shyok Valley, 4720 m, 8 viii 1947, *Schomburg* 33 (BM).

TIBET: Without locality, 5425 m, ix 1891, *Thorold* 28 (K); Gooring Valley, 30°12′ N, 90°25′ E, 5025 m, vii-viii 1895, *Littledale* (K); Südufer des Mangzaka, 5370 m, 1906, *Zugmayer* (W—holo. of subsp. *glandulosus*); Lager XLIV, 5125 m, 18 viii 1901, *Hedin* (S); Lager CCXI, E of Lake Manasarovar, 4654 m, 24 vii 1907, *Hedin* (S); Tingri, vii 1922, *Wollaston* 109 (K); Khorta Chu, 3655 m, 11 vi 1922, *Morton* 74 (K).

PLATE 13. Type specimen of *Aster heliopsis* Grierson.

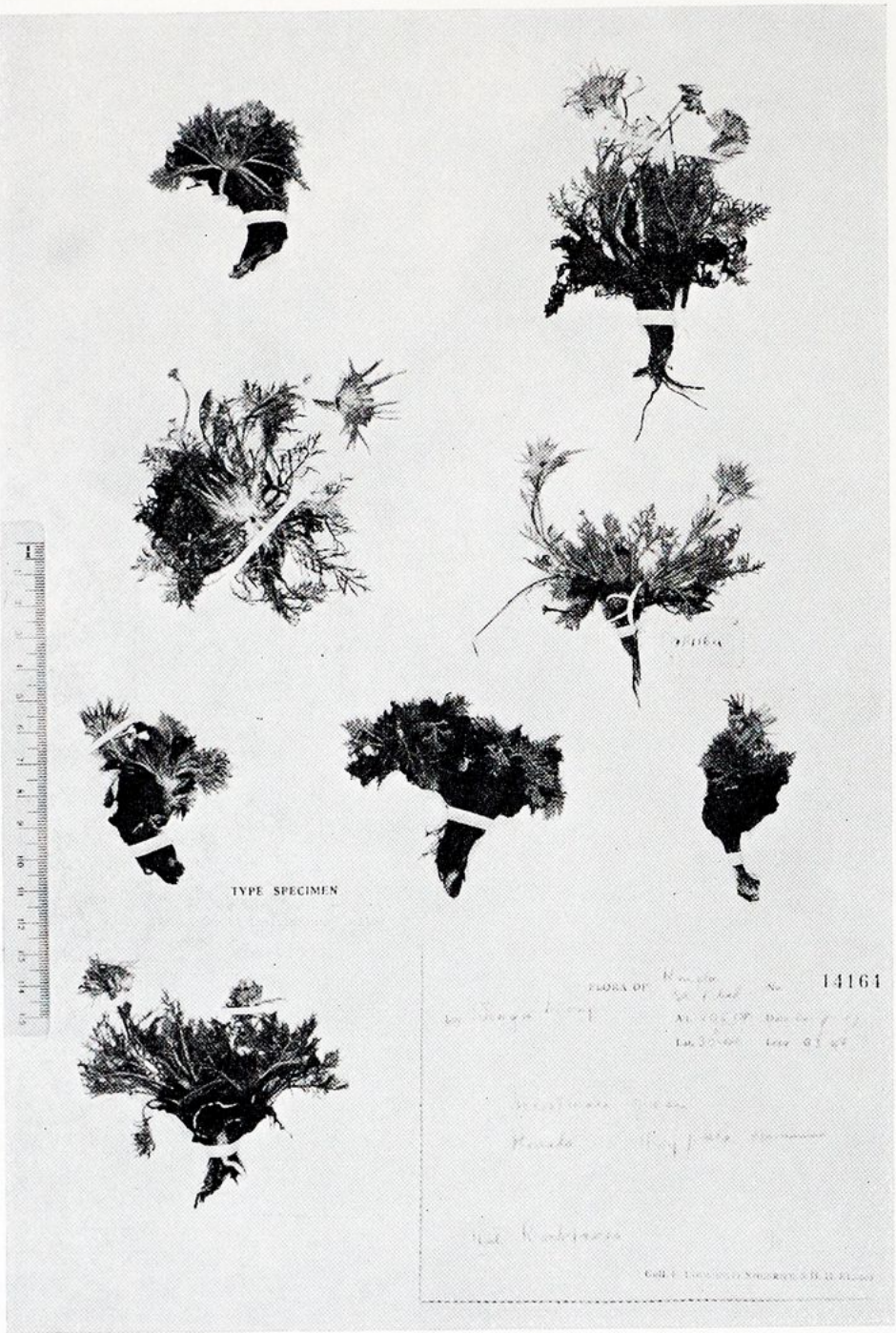


PLATE 14. Type specimen of *Aster bipinnatisectus* Ludlow.

This subspecies is confined to W Tibet, Kashmir and NE Punjab. Some of the specimens from the two last named localities are frequently more slender and have smaller capitula (less than 1·5 cm broad). Clarke must, at one time, have regarded them as distinct since he pencilled a manuscript name on some of Thomson's sheets at Kew. He did not publish this name, however, perhaps because this was one of the taxa (an *Erigeron* close to *E. multiradiatus* was the other) involved in the ill-starred *A. tibeticus* Hook. f. which Hedin (l.c. 38) exposed as being based on a mixture. In any case, there seems to be no very clear demarcation between this form and typical subsp. *glandulosus*.

Into this subspecies most of Hedin's material which Ostenfeld described as var. *fructu-glandulosus* finds its way. Glandular achenes occur sporadically in this species but often seem to reflect the general state of the glandulosity of the plants themselves, though by no means all glandular specimens have glandular achenes, and are uncorrelated with other diagnostic characters.

26c. **Aster flaccidus** Bunge subspecies **tsarungensis** Grierson, **subsp. nov.**

Plantae altiores et robustiores, folia supra glabra subtus sparse villosa, capitulum usque ad 3 cm diametrum.

Syn.: *A. flaccidus* subsp. *flaccidus* Onno in Bibl. Bot. 106: 63 (1932) p.p.
A. diplostephioides auct. non C. B. Cl.: Hand.-Mazz. in Notizbl. Bot. Gart. Berl. 13: 624 (1937).

Stems 25–45 cm tall, somewhat shaggily villous above with intermixed capitate glandular hairs. *Leaves* ± evenly distributed on stem, sometimes becoming aggregated in the lower stem, 4–10 cm long, 0·5–1·5(–3) cm broad. *Capitulum* 2–3 cm broad, phyllaries 1·3–1·5 cm long, 2–3·5 mm broad, pale or blackish green becoming greyish at base with hair. *Ray flowers* ca. 60–75, basal tube 1–2 mm long, ligules purplish blue 2 cm long, 2 mm broad. *Disc flowers* 7·5–9 mm long, basal tube 2 mm long, lobes 1·25–1·4 mm long.

SE TIBET: Tsarung, Mekong-Salween divide, Ka-gwr-pu, 28°30′ N, 3655–3960 m, vii-ix 1917-18, *Forrest* 14765 (E), 16674 (E); Doker La, 28°20′ N, 3960 m, viii 1918, *Forrest* 16873 (holo. E); Salween-Kui Chiang divide, 28°20′ N, 98°27′ E, 3655 m, viii 1921, *Forrest* 19964 (E); Goo du Shan, 28°12′ N, 100°12′ E, 3960 m, vii 1921, *Forrest* 20532 (E); without locality, *Forrest* 30778 (E); Western range of Mekong, Kaakerpo, Doker La & Tsarung, 3800 m, v-vi 1932, *Rock* 23069 (E); Mountains of Nakela, E of Turagan, Mekong-Salween divide, 4265 m, vi-vii 1932, *Rock* 23102 (E); Doker La, 4265–4570 m, ix 1913, *Ward* 1123 (E); Mekong-Salween divide, Sewalongba, 3900 m, 30 viii 1930, *T. T. Yü* 22574 (E); Kongbo, Deyang La, 4265 m, 11 viii 1947, *Ludlow, Sherriff & Elliot* 14323 (E, BM).

Subsp. *tsarungensis* is generally taller and more robust than the other subspecies. Most of the above specimens were identified as *A. diplostephioides* by Handel-Mazzetti (l.c.) but there are several obvious points of difference between the two species (see below).

Within the group of species related to it in subsect. *Heterochaeta*, *A. flaccidus* may be differentiated from *A. asteroides* by its rhizomatous habit and fibrous roots. From *A. diplostephioides* it is distinct because the lower parts of the stems of these plants are not surrounded by dense collars of leaf remains from previous years and the leaves themselves are broadly and indistinctly petiolate. The involucres of *flaccidus* and *asteroides* are similar

but the latter are generally more densely glandular and less villous-lanate. The lobes of the disc flowers never bear the minute black hairs that are a constant feature of *A. asteroides* subsp. *asteroides*. The setae of the outer pappus are never broadly paleaceous and are merely about twice as broad as the setae of the inner series whereas in *A. asteroides* and in *A. diplostephioides* they are about 4 times as broad. As regards the development of the pappus within this group, *A. flaccidus* is looked upon as the modern representative of the basal group from which the other numbers of the subsect. *Heterochaeta* have arisen.

Both *A. flaccidus* and *A. heterochaeta* C. B. Cl. are recognised and differentiated in Fl. URSS 25 (under *Erigeron*) but are so distinguished that, of the material examined, probably only the type specimen would qualify to be placed in *A. flaccidus*. In it the ligules are over 3 cm long and have drooped on fading (surely as far as the herbarium is concerned, this must largely depend on how the plant was laid out to dry, although it was probably this that Bunge had in mind when he applied the epithet "*flaccidus*"). The style branches are long (1·5–1·6 but not over 2 mm); the glands on the stem are stalked but not as shortly stalked as those of e.g. *A. flaccidus* subsp. *glandulosus*. Among the collections examined, the ligules on most are 1–2 cm long and sometimes give the appearance of having drooped (but not associated with the characters given by Fl. URSS). The longest style branches observed (2 mm long) were in *Farrer* 131 (type of *A. glarearum* W. W. Sm. & Farrer from Kansu, which Handel-Mazzetti reduced to synonymy under *A. flaccidus*); elsewhere the majority measure 1–1·5 mm such variation is to be expected in a species as widespread as this one, it appears to be quite continuous and to divide it mathematically is surely artificial.

27. **Aster asteroides** (DC.) O. Ktze. Rev. Gen. 315 (1891) (sphalm. *A. asterodes*), non Macmillan (1892) nec Rusby (1893).

Syn.: *Heterochaeta asteroides* DC. Prod. 5: 282 (1836).
Aster likiangensis Franch. in Jour. de Bot. 10: 370 (1896); Onno in Bibl. Bot. 106: 71 (1932).

Erect perennial herbs. Rootstock tuberous. *Stems* (3–)5–15(–35) cm tall, green or purplish, villous and glandular pubescent. *Leaves* glabrous and ciliate or villous; basal leaves (1–)2–4 cm long, (0·4–)0·8–1·7 cm broad, ovate or elliptic borne on petioles 1–3 cm long, acute or obtuse at apex, margin entire or more rarely 1–2 denticulate; cauline leaves few, lower ones similar to basal leaves, upper ones linear or lanceolate, almost sessile. *Capitulum* solitary, 1–1·7 cm broad; phyllaries 2–3 seriate, lanceolate, acuminate 0·55–1 cm long, 1–3 mm broad, herbaceous, darkly glandular pubescent and villous especially at the base, hairs often purplish. *Ray flowers* 30–70, tube 1·5 mm long, ligules dark blue-purple or mauve (1·0–) 1·3–2·5 cm long, 1·5–2·5 mm broad. *Disc flowers* orange-yellow or purplish 4–5·5 mm long, tube ca. 1 mm long, lobes 1·25–1·5 mm long, glabrous, glandular or pubescent on the exterior. Style appendages lanceolate, 0·5–0·75 mm long. *Pappus* white or yellowish, double, outer setae paleaceous 1·25–1·5 mm long, 0·2 mm broad inner setae 4–5 mm long, generally reaching only as far as base of disc corolla lobes. *Achenes* immature, 2–3 mm long, 0·75 mm broad, brownish, sparsely covered with fine silky buff hairs.

The genus *Heterochaeta* was created by De Candolle to accommodate species of *Asterinae* in which the capitula are solitary and the pappus double, and he based *H. asteroides* on a numbered type specimen, *Royle* 114/2. The genus was reduced to synonymy under *Aster* by Bentham (Benth. & Hook. f. Gen. Pl. 2: 272, 1873) who pointed out that some of the species it contained were Erigerons. Royle's material associated with the name *H. asteroides* at Kew consists of a mixture of specimens of this species, *A. flaccidus* and a species of *Erigeron*. Clarke (Comp. Ind. 44, 1876) used the name *A. heterochaeta* for specimens of *A. flaccidus*, basing it, however, on *Heterochaeta asteroides* DC. and incorrectly cited Bentham as the authority for this combination. Hooker (Fl. Brit. Ind. 3: 250, 1881) and Boissier (Fl. Or. Suppl. 287, 1888) followed Clarke in this treatment. In 1896, Franchet (l.c.) described *A. likiangensis* and compared it with *A. heterochaeta*, or rather, *A. flaccidus*. Onno (l.c.) pointed out the confusion that existed between *A. asteroides* (or *A. likiangensis*, as he called it) and *A. flaccidus*, but basing his opinion on the mixed (but now separated) material at Kew, proposed that *Heterochaeta asteroides* should be regarded as a *nomen ambiguum*. The latter species, however, was not described at Kew and there is only one specimen in De Candolle's herbarium as *Royle* 114/2. This has been identified with *A. likiangensis* Franch. and any connection with *A. flaccidus* finally discounted. (The author is grateful to the Director, Conservatoire et Jardin botanique, Geneva, for sending a photograph of this type specimen and to Mme. Vautier for examining it critically). Onno mistakenly pointed out that the combination *Aster asteroides* could not be used for this species as it would be a later homonym; it is clearly the earliest usage of this epithet as is shown above.

Onno divided this species into two subspecies and this treatment is followed here and for the most part the same criteria are used for distinguishing them. There is, however, one additional character which he overlooked. In the typical subspecies, the disc corollas are yellow or orange and their lobes are sparsely covered with minute blackish hairs. The lobes of the purplish disc flowers of subsp. *likiangensis*, on the other hand, are glabrous or glandular or bear a few long white hairs, but never black hairs. This provides a useful means of verification in the case of weakly coloured flowers, especially in the dried condition, and also because the purplish coloration which is most noticeable in the bud fades when the flowers open. In this respect this species is similar to *A. diplostephioides* and to *Erigeron multiradiatus*.

Using this criterion and re-examining the type specimen of Léveillé's *Aster costei*, *Maire* 122/1914 (field note: "centre brun sombre"), the disc flowers are seen to be only faintly purplish and their lobes are without black hairs; it is therefore a pale form of Franchet's *A. likiangensis*. Onno used his subsp. *costei* to cover the plants that are now regarded as belonging to the typical subspecies but as the epithet "*likinagensis*" has not previously been employed at subspecific level, subsp. *costei* must now be used for the eastern subspecies.

Key to the subspecies of A. asteroides

Capitula (1–)1·5–2 cm broad. Ligules 1·5–2·3 cm long. Disc flowers purplish, lobes glabrous, glandular or pilose . . subsp. *costei*

Capitula 1–1·3(–1·6) cm broad. Ligules 1–1·3(–1·5) cm long. Disc flowers orange-yellow, lobes sparsely covered with short black hairs
subsp. *asteroides*

27a. **Aster asteroides** (DC.) O. Ktze. subsp. **asteroides**

Syn.: *A. hedinii* Ostenf. in Hedin, S. Tibet 6, pt. 3: 37 (1922).
A. likiangensis subsp. *costei* (Lévl.) Onno in Bibl. Bot. 106: 72 (1932), quoad specimina occidentali.

HABITAT: In open damp grassy places sometimes among rhododendrons.

KASHMIR: Without locality, 1833, *Royle* 114/2 (G holo. of *Heterochaeta asteroides* DC., photo. E); without locality, *Falconer* 3657 (K).

INDIA: Without locality (probably also from Kashmir), *Royle* (K); Mussoorie, Kidar Kantha, 4265 m, 29 v 1904, *Drummond* 22738 (E, K); Rupin Pass, Baspa Valley, 4265 m, 6 vii 1939, *Sherriff* 7396 (E, BM); Tehri Garhwal, Ganges Valley above Jhala, 3655–3960 m, 29 vi 1883, *Duthie* 790 (BM).

NEPAL: Kuti, 6 vi 1937, *F. M. Bailey* (E); Jargeng Khola, 4875 m, 6 vii 1950, *Lowndes* 1135 (E, BM); Jangla Banjyang, 3960 m, 29 vi 1952, *Polunin, Sykes & Williams* 2336 (E, BM); Thimigaon, Muktinath Himal, 4265 m, 21 vi 1954, *Stainton, Sykes & Williams* 1257 (BM); Tukucha, Kali Gandaki, 3655 m, 21 vii 1954, *S. S. & W.* 1922 (E, BM); Chalike Pahar, 4265 m, 17 vi 1954, *S. S. & W.* 3164 (E, BM); Dolpo, Tarap, 29°2′ N, 83°11′ E, 4875 m, 3 vii 1963, *Stainton* 4395 (BM); Mukut, 28°51′ N, 83°26′ E, 4730 m, 18 vii 1963, *Stainton* 4438 (BM).

SIKKIM: Without locality, 4265–4875 m, 1849(?), *J. D. Hooker* (K); Phari, 4265 m, 12 ix 1912, *Rohmoo Lepcha* 226 (E, K); Tang La, 4570 m, 12 ix 1912, *Rohmoo Lepcha* 307 (E, K); Lhonakh, 4570 m, 25 viii 1947, *Cave* 16/47 (E).

BHUTAN: Lingshi Timpu, 4570 m, 21 vii 1914, *Cooper* 1621 (E, BM); Dungshinggang, 4570 m, 18 vi 1937, *Ludlow & Sherriff* 3282 (E, BM); Lingshi Dzong, 4265 m, 28 v 1949, *Ludlow, Sherriff & Hicks* 16323 (BM); Sharma to Tremo La, 2743–3655 m, 12 vii 1938, *Gould* 1076 (K).

TIBET: Central Tibet, without locality, 23 vi 1892, *Rockhill* (K); Chumbi, below Ghorala 3960 m, vi 1891, *Waddell* 25 (K); Sokpo La, Sanga Choling, 4875 m, 12 viii 1936, *Ludlow & Sherriff* 2032 (BM); Hills around Lhasa, 3800–3960 m, vi 1943, *L. & S.* 8672 (BM), 9586 (BM), 9655 (E, BM); Rama to Dumpa Gompa, 4875 m, 30 vi 1939, *Gould* 2269 (K).

In Nepal according to Stainton (in conversation), this subspecies often occurs in close proximity to *A. flaccidus: A. asteroides* growing in moister swampy situations and *A. flaccidus* on the adjoining drier slopes.

27b. **Aster asteroides** (DC.) O. Ktze. subsp. **costei** (Lévl.) Grierson, **comb. nov.**

Syn.: *A. likiangensis* Franch. in Jour. de Bot. 10: 370 (1896); Hand.-Mazz. in Notizbl. Bot. Gart. Berl. 13: 626 (1937).
A. likiangensis subsp. *typicus* Onno in Bibl. Bot. 106: 71 (1932).
A. costei Lévl. in Bull. Géogr. Bot. 24: 14 (1915).

TYPE: Yunnan, Pâtures du Io-chan, *Maire* 122/1914 (E).

HABITAT: Alpine meadows at the base of rocks and in marshy areas.

SE TIBET: Nagong, Ata Kang La, *Ward* 10587 (BM); Kongbo, Pasum Chu, Ba La, 4265 m, 21 vi 1947, *Ludlow, Sherriff & Elliot* 13957 p.p. (E, BM); Budi Tsepo La, 4110 m, 1947, *L. S. & E.* 15264 (BM); Nambu La, 3800 m, 10 vii 1947, *L. S. & E.* 15372 (E, BM); Nambu La, 4510 m, 12 vii 1947, *L. S. & E.* 15404 (BM).

BHUTAN: Kangla Karchu La, 4570 m, 20 vi 1949, *Ludlow, Sherriff & Hicks* 16585A (BM).

In China this subspecies is common in W Yunnan, on the Mekong-Salween-Yangtze divides, on the Lichiang Range and in SW Szechuan.

In general, *A. asteroides* has been compared with *A. flaccidus* which it often resembles and a summary of the differences between them has been drawn up in the discussion of the latter. Among the other species belonging to subsect. *Heterochaeta*, it is related to *A. diplostephioides* because of its broad outer pappus setae, but is readily distinguished from that species on account of its smaller size, its tuberous roots and by its fewer and broader ligules.

28. **Aster diplostephioides** (DC.) C. B. Cl. Comp. Ind. 45 (1876); Hooker, Fl. Brit. Ind. **3**: 251 (1881); Bot. Mag. t. 6718 (1883).

Syn.: *Heterochaeta diplostephioides* DC. Prod. 5: 282 (1836).
A. diplostephioides subsp. *typicus* and subsp. *yunnanensis* var. *delavayi* Onno in Bibl. Bot. 106: 69 (1932).
A. delavayi Franch. in Jour. de Bot. 10: 374 (1896); Hand.-Mazz. in Notizb. Bot. Gard. Berl. 13: 623 (1937).
A. vilmorinii Franch. l.c. 373 p.p.
Erigeron diplostephioides (DC.) Botsch. in Acta Inst. Bot. Acad. Sci., U.R.S.S. 21: 341 (1961).

Erect, viscid, perennial herbs. Rhizomes branched bearing long thick roots below and surrounded by thick collars of fibrous leaf remains above. *Stems* (10–)15–40(–50) cm tall erect, unbranched bearing a solitary capitulum, generally glandular puberulent with scattered villose hairs. *Leaves* glandular and sparsely villous on veins and margins; basal leaves oblanceolate, petiolate (3–)6–13 cm long (0·9–)1·3–2·0 cm broad, including petiole (1–)4–7 cm long, apex acute or mucronate, margin entire or sometimes distantly denticulate; cauline leaves linear or lanceolate, decreasing in size from dimensions of basal leaves to 3·5 cm long, 0·4 cm broad or less, upper part of stem usually ± naked. *Capitulum* solitary (1·6–)2–2·5(–2·8) cm broad (across disc), phyllaries ± uniseriate, 1·2–1·5 cm long, 1–3 mm broad, linear lanceolate, acuminate, longer than disc, minutely blackish glandular with white villose hairs especially towards base. *Ray flowers* variable in number, sometimes 2-seriate, ligules 2–3 cm long, 1·25–2 mm broad, mauve, or blue-violet, basal tube 1·5 mm long. *Disc flowers* blackish or brownish purple externally at apex, yellow or orange within, 5–6 mm long, lobes 1 mm long, basal tube 1·5 mm. Style appendages lanceolate, 1·25 mm long. *Pappus* white or off-white, double, inner series 15–20 setae, 4·5–5 mm long, outer series 1–1·5 mm long. *Achenes* 3–3·5 mm long, 1–1·5 mm broad, obovate, 4-ribbed, pale brown, covered with short white stiffish hairs intermixed with glands.

HABITAT: Open grassy hillsides sometimes on screes, amongst scrub and in *Picea* forest clearings.

KASHMIR: Rimochagma Valley, 3960–4265 m, 20 vii 1892, *Duthie* (BM); Damdar Valley, 3960–4265 m, 3 vii 1893, *Duthie* 788 (BM); above Kainmul, Liddar Valley, 3350–3655 m, 21 vii 1893, *Duthie* 14159 (BM); Me La, 4110 m, 7 viii 1933, *Ludlow & Sherriff* 431 (BM); Sinthan Pass, 3500 m, 8 ix 1940, *L. & S.* 8204 (BM).

INDIA: Without locality, *Royle* 147 (holo. GE not seen) Kumaun, Rogi, 3655 m, viii 1886, *Drummond* 4731 (E); 4732 (E, K); Runang, 3350–4265 m, ix 1886, *Drummond* 4734 (E, K), 4735 (K), 4736 (K); Bashahr, Kiari Pass, 4050 m, 3 ix 1891, *Lace* 3B (E); Kulu, Chika, 3350 m, 27 vii 1916, *Cooper* 5164 (E); Tehri Garhwal, Rudugaira Gad, 78°55′ E, 30°57′ N, 4720 m, 13 ix 1952, *Huggins* 157 (BM).

NEPAL: Pharsey, 4265–4875 m, *Dhwoj* 196 (E, BM); Jargeng Khola, 4875 m, 4 vii 1950, *Lowndes* 1121 (E, BM); Kyangjino Gorge 3960 m, viii 1949, *Polunin* 1668 (BM); Dagpache, 4875 m, 13 viii 1949, *Polunin* 1749 (BM); Khaptang, Mugu Khola, 4870 m, 22 viii 1952, *Polunin, Sykes & Williams* 5383 (E, BM); between Garjiankot and Munigaon, SE of Jumla, 3200 m, 21 vii 1952, *P. S. & W.* 4821 (E, BM); Tinka Khola, 3960 m, 3 vii 1953, *Tyson* 73 (E, BM); Taglung, Kali Gandaki, 3655 m, 11 vii 1954, *Stainton, Sykes & Williams* 1744 (E, BM); Tegar and Namdo, N of Mustang, 4570 m, viii 1954, *S. S. & W.* 2235 (BM), 2300 (BM, E); Thinigaon, Kali Gandaki, 4265 m, 29 viii 1954, *S. S. & W.* 8038 p.p. (BM); Arun Valley, Thudam, 4265 m, 16 vii 1956, *Stainton* 1016 (E, BM); Langtang Khola, 28°10′ N, 85°25′ E, 2960 m, 27 vii 1962, *Stainton* 4061 (BM).

SIKKIM: Lingmuthang, 3050 m, 12 ix 1912, *Rohmoo Lepcha* 72 (E, K); Kengra Lama, 4265 m, 24 vii 1849, *Hooker* (K).

BHUTAN: Phajudin Timpu, 3350 m, 6 viii 1914 *Cooper* 2911 (BM); Narim Thang, 4265 m, 2 viii 1915, *Cooper* 4289 (BM); Tare La, above Ha, 3350–4265 m, 17 viii 1938, *Gould* 1187 (K); Kangla, Karchu La, 4570 m, 20 vi 1949, *Ludlow, Sherriff & Hicks* 16585 (E, BM); Gaffoo La, 4265 m, 9 vii 1949, *L. S. & H.* 16782 (BM); Singa La, Upper Ulo Chu, 4110 m, 4 x 1949, *L. S. & H.* 17364 (BM); Moula, Karchung Pass, Tsampa, 4570 m, 20 vi 1949, *L. S. & H.* 19208 (BM); Tsampa, Waitang, 4110 m, 27 vi 1949, *L. S. & H.* 19257 (E, BM); Singhi Dzong, 3200 m, vii-ix 1949, *L. S. & H.* 21280 (BM), 21320 (E, BM).

TIBET: Shinden Gompa, Nagong River, 3655–3960 m, *Ward* 10787 (BM); Dongkar, Cha La, 4415 m, 18 viii 1934, *Ludlow & Sherriff* 846 (E, BM); E of Yatung, 3050 m, 3 viii 1936, *Chapman* 382 p.p. (K); Kongbo, Tsangpo Valley, Pero La, 29°30′ N, 95°00′ E, 3500 m, 8 vii 1938, *Ludlow, Sherriff & Taylor* 5174 (E, BM); Drukla Chu, Panglar, 30°17′ N, 93°31′ E, 3500 m, 20 viii 1938, *L. S. & T.* 6864 (E, BM); Reting, 60 miles N of Lhasa, 4265 m, 21 vii 1942, *L. & S.* 8842 (E, BM); Khambu 4265 m, 10 vii 1939, *Gould* 2365 (K).

CHINA: NW Yunnan and SW Szechuan; the specimens cited by Handel-Mazzetti (1937) as *A. delavayi* may be included here along with the syntypes of this species *Delavay* 999 (P) and 1675 (P). The specimens that Handel-Mazzetti cited as *A. diplostephioides*, however, should be excluded as they belong to *A. flaccidus* subsp. *tsarungensis*.

The question of disc flower coloration in *A. diplostephioides* must be approached with caution because it changes as the flowers open. As Hooker (Bot. Mag. t. 6718) observed, they have "purple heads before expanding" then are yellowish within; the colour on the exterior subsequently fading from blackish to pale purple. The field-notes that collectors have composed naturally reflect the state of the disc flowers at the time the specimens were gathered and, because of their conflicting statements, Onno (l.c.) described the colour as yellow or purple.

In the specimens bearing such notes as "disc flowers yellow or orange" (e.g. *L. S. & H.* 16782 and *Stainton* 1016), these flowers are fully expanded, but others, wherein there are still some flowers in bud (e.g. *Lowndes* 1121), record: "disc at first black, then orange". A similar situation obtains in the syntypes of *A. delavayi*, which was described as having a dark violet disc: *Delavay* 1675 stated "Fleurs . . . du centre noirâtre", but in *D.*999 where the flowers are open, "disque jaune" was noted. In all such specimens, however, a purplish coloration is clearly observable on the outside of the lobes in the dried state, at least in well preserved material.

Handel-Mazzetti (1937 p. 623) was struck by these inconsistencies especially in respect to Forrest's field-notes; "Die Scheiben blüten als purpurbraun oder schwarzviolett angegeben; so sehen sie im Herbar aus. Forrest schreibt dull-orange und orange-green". Forrest, indeed, described the disc flowers as anything but purple yet, in every case, the same flowers are seen to have been purple at one time. One must assume then that he was at pains to record the colour of the fully opened flowers and disregarded that of the buds.

This colour-change is not peculiar to *Aster* but also happens in some *Erigeron* species, e.g. *E. multiradiatus*, in which it has been observed in living plants in the garden.

No importance can be attached to the characters which Onno used to differentiate *A. delavayi* as a variety. Flower colour has already been alluded to and relative length of the pappus, his other differentiating character, is variable even within the syntype specimens: the inner setae of *Delavay* 999 are actually longer than the disc flowers, elsewhere, e.g. *Forrest* 14588, they measure only 3·5 mm.

The specimens collected by Drummond which Hutchinson mentioned in his discussion of *A. falconeri* (in Gard. Chron. 18 June 1910) have broader and obviously denticulated leaves but do not seem to warrant specific description as he suggests; other specimens e.g. from Yunnan, *Forrest* 677, 3062 and 30789 have similar leaves.

Some dwarf specimens from Bhutan appear to be different at first glance but are seen to be connected to more typical specimens by a series of intermediates. *L. S. & H.* 19409 (Narlung Tsampa, 4720 m, 11 vii 1949—E, BM) may be an exception: its stems measure 8–10 cm tall, with thickly villose dark cross-walled hairs especially in the upper part of the stem intermixed with small dark glandular hairs. The leaves are spathulate 3·5–4·5 × 1–1·3 cm, villous but apparently eglandular, phyllaries 1 cm long and ligules (perhaps immature) only 1·4 cm long. This may indeed prove to be a distinct infraspecific taxon.

From the ancestral stock from which *A. diplostephioides* arose, *A. yunnanensis*, *falconeri* and *A. farreri* were probably also derived. They all have tall stems with leaf remains at the base, large capitula with long ligules and the

biseriate pappus is well developed. Because of its long ligules *A. bietii* might be placed in this group but cannot be closely related on account of its brownish simple pappus. *A. diplostephioides* differs from its allies by having the majority of its lanceolate leaves concentrated in the lower part of the stem while the upper part remains naked. The capitulum is always solitary and the phyllaries dark-coloured, narrow and only slightly longer than the disc. The disc flowers are blackish purple in the bud and fade on opening to orange or yellow. The relationship between *A. diplostephioides* and *A. asteroides* is also close. The latter is smaller in all its parts but the thickened, although tuberous, roots and the purple coloration of the disc flowers of subsp. *likiangensis* find parallels here.

A. diplostephioides is reputed to have been first introduced into cultivation by H. Elwes from Sikkim in 1882. Several other importations are on record of which probably the most recent is by Lowndes in 1950 from Nepal.

29. **Aster falconeri** (C. B. Cl.) Hutchinson in Gard. Chron. Ser. III, 47: 389 (1910): Bot. Mag. t. 8355 (1911).

Syn.: *A. diplostephioides* var. *falconeri* C. B. Cl. Comp. Ind. 45 (1876).
A. diplostephioides subsp. *falconeri* (C. B. Cl.) Onno in Bibl. Bot. 106: 69 (1932).
Erigeron falconeri (C. B. Cl.) Botsch. in Acta Inst. Bot. Acad. Sci., U.R.S.S. 21: 341 (1961).

Hoary or viscid perennial herbs. Rootstock a branched caudex usually surrounded above by leaf remains. *Stem* 15–50 cm tall glandular pubescent and sparsely villous or almost exclusively villous, bearing a solitary capitulum. *Leaves* villous and glandular puberulent, basal leaves spathulate or oblanceolate tapering to a broad and indistinctly petiolate base, 4·5–10(–18·5) cm long, 0·9–2·3 cm broad, obtuse or acute, mucronate at apex, margin distantly denticulate, cauline leaves 1·7–7·7 cm long 0·5–2·2 cm broad, evenly distributed on stem, upper ones overlapping and surrounding the capitulum, spathulate or lanceolate, rounded and semi-amplexicaul at base, acute at apex, margins entire or, especially the lower ones, denticulate. *Capitulum* solitary 2–2·7 cm broad; phyllaries 2–3 seriate, imbricate, 1·4–1·7 cm long, 0·2–0·3 cm broad, longer than disc, lanceolate-acuminate glandular and villous especially towards base, reddish or purplish near apex. *Ray flowers* 70–80, bluish-mauve, white at base (fide Hutch.) ligules 2·7–3·5 cm long, 1·5–1·75 mm wide, basal tubes 2–3 mm long. *Disc flowers* yellow or orange, 5·5–6 mm long, lobes 1·75–2 mm long, basal tubes 2·25–2·5 mm long. Style appendages broadly triangular ca. 0·5 mm long. *Pappus* buff or pale brown, double, inner setae 5–6 mm long, outer setae 1–2·5 mm long. *Achenes* 4-ribbed, glandular 4 mm long, 1–1·25 mm broad.

With the advent of recent material, it has become obvious that this species is readily divisible into two subspecies as follows:

Stems and foliage villous, eglandular. Involucre closely surrounded by four leafy bracts or upper leaves. Kashmir plants . subsp. *falconeri*
Stems and foliage glandular pubescent, villous hairs scanty usually only on mid veins of leaves. Upper leaves overlapping involucre but not usually closely surrounding it. Plants of Nepal and Kumaun subsp. *nepalensis*

29a. **Aster falconeri** (C. B. Cl.) Hutch. subsp. **falconeri**

HABITAT: Grassy alpine slopes and amongst rocks or boulders.

KASHMIR: Southern range, *Falconer* 561 (holo. K, iso. S); Tragbol, 3110 m, *Clarke* 29241 (K); Gulmarg, *Aitchison* 55 (K); Astan Marg, Liddar Valley, *Drummond* 14302 (K); Burzil Pass. *R. R. Stewart* 22094 (K); Below Deosai *Osmaston* 81 (K); above Gulmarg, 3350–3655 m, 31 v 1892, *Duthie* 11289 (E); Barai Pass, Kishenganga, 3500 m, 22 vii 1935, *Ludlow & Sherriff* 1455 (E, BM); Sinthan Pass, 3655 m, 28 vi 1939, *Ludlow* 150 (BM); Pir Panjal 3050–3655 m, 7 vii 1940, *L. & S.* 7748 (E, BM); Haramukh, 3960 m, 29 vii 1940, *L. & S.* 7855 (BM); Kishtawar, Banjar, 3350 m, 30 vii 1943, *L. & S.* 9243 (E, BM).

CULTIVATED: W. Marshall, Bexley (K); Rock Garden, Kew (K).

Specimens of this typical subspecies may be recognised at a glance. The leaves and stems are obviously covered with long silvery villous hairs which are almost lacking in subsp. *nepalensis*, the indumentum of which is predominantly glandular. The peduncle is generally leafy immediately beneath the capitulum and the uppermost few leaves closely surround it. In subsp. *nepalensis*, at least in mature specimens, the upper part of the peduncle is less densely leafy.

29b. **Aster falconeri** (C. B. Cl.) Hutch. subsp. **nepalensis** Grierson, **subsp. nov.**

A subsp. *falconeri* differt caulibus et foliis glanduloso-pubescentibus, pilis villosis paucioribus et plerumque tantum in venas centrales; foliis supremis involucro excedentibus sed non arcte cingentibus.

HABITAT: In grassy rock slopes and gullies sometimes among dwarf rhododendrons or in birch forests.

INDIA: Kumaun, Byans, Chalek, 3655–3960 m, 23 vii 1886, *Duthie* 5670 (MICH); between Jimba and Sumdum Pass, 3960 m, 4 vii 1948, *Rup Chand* 857 (E, MICH).

NEPAL: Chokar, 5 vii 1936, *F. M. Bailey* (E); Barbaria Lekh, 3655 m, 9 vii 1952, *Polunin, Sykes & Williams* 86 (E, BM); Jangla Banjyang, 3960 m, 29 vi 1952, *P. S. & W.* 2327 (E, BM); near Balangra Pass, 3960 m, 21 vii 1952, *P. S. & W.* 2525 (E, BM); Burchula Lekh, near Jumla, 3800 m, 11 vii 1952, *P. S. & W.* 4554 (E, BM); Tankia, Muga Khola, 4110 m, 20 viii 1952, *P. S. & W.* 5315 (E, BM); NE of Chalike Pahar, 4265 m, vi-ix 1954, *Stainton, Sykes & Williams* 3131 (E, BM), 4578 (BM).

Clarke and Onno both treated this species as a variety of *A. diplostephioides* but the differences between these taxa seem sufficiently strong to warrant the specific recognition which Hutchinson accorded *A. falconeri*. The foliar remains that surround the base of the stem here are not reduced to fibres as they are in *A. diplostephioides* but remain as withered membranous fragments, nor do they form such a dense collar. The lower leaves are less distinctly petiolate and more denticulate than are those of the latter. The stem is leafier and the cauline leaves are broader than in *A. diplostephioides*. Within the capitulum there is an increase in the number of phyllaries, the colour of the disc flowers is yellow or orange and not purplish in the bud as in *A. diplostephioides*. The style appendages are shorter and the pappus setae are brownish in *A. falconeri*.

30. **Aster yunnanensis** Franch. in Jour. de Bot. 10: 375 (1896) var. **angustior** Hand.-Mazz. in Notizbl. Bot. Gart. Berl. 13: 622 (1937).

Syn.: *A. diplostephioides* C. B. Cl. subsp. *yunnanensis* var. *yunnanensis* Onno in Bibl. Bot. 106: 70 (1932) p.p.
A. vilmorinii Franch. in Jour. de Bot. 10: 373 (1896) p.p.
A. labrangensis Hand.-Mazz. l.c. 621.
A. kawaguchii Kitamura in Acta Phytotax. Geobot. Kyoto 15: 41 (1953).
Erigeron vilmorinii (Franch.) Botsch. in Acta Inst. Bot. Acad. Sci., U.R.S.S. 21: 341 (1961).

Erect perennial herbs. Rootstock rhizomatous, rhizomes sometimes extending to 20 cm long. *Stems* 25–60 cm tall, surrounded by fibrous leaf remains at the base, variously pubescent, villous or glabrescent in the lower parts, pale or more usually dark glandular and villous above. *Leaves* pilose and glandular, ciliate margined; basal leaves 7–9 cm long, 1·5–2 cm broad, spathulate or oblanceolate, margins ± entire, acute at the apex broadly and indistinctly petiolate at the base; cauline leaves 6–8(–13) cm long, 1·5–2(–2·5) cm broad, oblong or narrowly lanceolate, sessile, rounded or cordate and semiamplexicaul at the base, acute or acuminate at the apex, margins entire or sometimes denticulate. *Capitula* 2–6, rarely solitary, 2–3 cm broad, borne on ± naked peduncles up to 12 cm long. Phyllaries 1–1·5 cm long, 1·4–1·6 mm broad, lanceolate, acuminate, white villous at least at base, minutely and usually darkly glandular above. *Ray flowers* numerous (ca. 120) basal tubes 1·6–2 mm long, ligules 2–3·5 cm long, 0·8–1·2 mm broad, bluish-mauve. *Disc flowers* yellowish 6–7·5 mm long, basal tube 1·8–2 mm, lobes 0·8–1·2 mm long. *Pappus* whitish, double, outer setae 0·8–1 mm long, inner setae 6–7 mm long. *Achenes* immature 3·5 mm long, 1 mm broad, 4-ribbed covered with short straight whitish hairs, somewhat glandular at the apex.

TYPE: W China, Yunnan, Tong Shan, 27°20′ N, 3050–3350 m, ix 1913, *Forrest* 11267 (E).

HABITAT: Rocky open hillsides above tree line.

TIBET: Hills above Lhasa, viii 1904, *Walton* (K); Ralung, 4415 m, 17 viii 1936, *Chapman* 223 (K); Charndo Dist., Salween Gorge, 3655–3960 m, 5 viii 1933, *Ward* 10689 (BM); Gorpo La, near Dongkar, 4720 m, 15 viii 1934, *Ludlow & Sherriff* 800 (E, BM); Reting, 60 miles N of Lhasa, 4265 m, 4 viii 1944, *L. & S.* 1104 (E, BM).

Aster yunnanensis in the strict sense, which does not appear to enter the Himalayan area at all, has more strongly developed leaves (basal leaves up to 16 cm long, 4 cm broad, cauline leaves up to 13 cm long and 4·5 cm broad —the upper leaves often broader than the basal). Its phyllaries may be as much as 5 mm and are commonly more than 2 mm broad. The ligules (up to 2·5 mm broad) are typically broader than in this variety and are often no more than 2 cm long but the ray flowers in this species vary considerably in their proportions. Clearly, the characters that delimit this variety are insufficient for specific differentiation.

A. vilmorinii, a name that has been applied to several of the above specimens, has been found, on examination of the syntypes, to have been based on a mixture of taxa: *Soulie* 305 (P) and *Pratt* 631 (E, BM) are specimens of *A. diplostephioides* and *Soulie* 418 (P) belongs to this variety.

Onno regarded *A. diplostephioides* as the basic species within the group that includes *A. falconeri*, *farreri*, *yunnanensis* and *delavayi* and divided them from it as subspecies and varieties using indumentum and the character and distribution of the leaves as his principal distinguishing characters. This gave rise to a very different arrangement and interpretation from Handel-Mazzetti's (l.c.) or from the present. Thus Onno cited *A. vilmorinii* under *A. diplostephioides* subsp. *yunnanensis* var. *delavayi* but as the specimen which Handel-Mazzetti later used as the type of var. *angustior* is included by Onno under his var. *yunnanensis*, this is quoted in the above synonymy.

A. labrangensis Hand.-Mazz. from W Kansu must also be included here for it represents a form of this variety in which the indumentum is paler and more glandular and the phyllaries are more thickly white villous (*A. yunnanensis* as a whole is variable in respect of indumentum). The isotype (Rock 14447) at Edinburgh shows that this was wrongly described as having a uniseriate pappus and in general facies it is very similar to *Ludlow & Sherriff* 800.

Because of the fibrous leaf remains surrounding the base of the stem, the numerous ray flowers and the double pappus *A. yunnanensis* is obviously related to *A. diplostephioides* and *falconeri* but differs from both in its generally pleiocephalous condition and from the latter in that it lacks all trace of bluish-purple coloration in its disc corolla lobes.

31. **Aster latibracteatus** Franch. in Jour. de Bot. 10: 371 (1896).

Erect perennial herbs sparsely or moderately buff villous in all parts. Rootstocks finely rhizomatous. *Stems* surrounded at the base by withered leaf remains, 10–18 cm tall, leafy. *Leaves* villous on both surfaces; radical leaves of flowering shoots absent or withered but on sterile rosettes up to 5 cm long, 1·7 cm broad, oblanceolate or spathulate, trinerved, 2–3 denticulate on each side, obtuse and mucronulate at the apex, attenuate or petiolate at base; cauline leaves ovate, oblong or oblanceolate 1·5–4 cm long, 0·7–1·3 cm broad, sessile at the base, acute and mucronulate at the apex, margins entire or 1–2 denticulate. *Capitulum* solitary, 1·2–1·6 cm broad; phyllaries 2–3 seriate, ovate or lanceolate, 0·8–1·0 cm long, 0·2–0·6 cm broad, foliaceous, sparsely buff tomentose and ciliate. *Ray flowers* 25–30, basal tubes 0–0·8 mm long, ligules blue or purplish, 1·3–1·7 cm long, 2·0–3·0 mm broad. *Disc flowers* yellow, 4 mm long, basal tubes 1·25 mm long, lobes 1·5 mm long. Style appendages lanceolate, 0·75 mm long. *Pappus* double, outer pappus pale 1·5–2 mm long, paleaceous, lacerate above, inner brown 3·0–3·5 mm long, setae thick. *Achenes* immature 3 mm long, 1·5 mm broad, pale brown, sparsely appressed pilose.

HABITAT: Stony alpine pasture.

TYPE: W China, Yunnan, ad cacumina montis Tsang-chan, 4000 m, *Delavay* 1207 (P), 2650 (P).

NE UPPER BURMA: Western flank of the Chimili—N' Maikla-Salween divide, 26°23′ N, 98°48′ E, 3350–3655 m, ix 1914, *Forrest* 24958 (E); Chimili Ridge, 3800 m, 1 viii 1919, *Farrer* 1162 (E).

The Burmese specimens cited above were previously determined by Onno as *A. brachytrichus* Franch. which, indeed, this species resembles but differs from it sharply in several important respects. The rhizomes are more finely

and extensively developed than in *A. brachytrichus*. The lower part of the stem is often naked in the latter but here it is covered with leaves or leaf remains. Although in both species the basal tubes of the corollas are short, they are sometimes completely absent in the ray flowers of *A. latibracteatus* but usually about 1 mm long in *A. brachytrichus* and its ligule is longer and narrower (2·5–3 cm long, 1–1·3 mm broad). In the dried state at least the disc flowers of *A. brachytrichus* have a purplish coloration which is completely absent in those of *A. latibracteatus*.

The structure of the pappus and achene is also significant in separating these two species. In *A. brachytrichus* the pappus is simple, less than half as long as the disc corollas and the setae are somewhat fused at the base as Onno pointed out. In the present species it is double, the outer series paleaceous, the inner thickly setose and reaching at least to the base of the disc corolla lobes; the elements of both series being free to the base. Unlike the achenes of *A. latibracteatus*, those of *A. brachytrichus* have distinct lateral margins or narrow wings and tend to be more glabrous.

This appears to be a species of very local distribution: Farrer remarks in his field-note "Only two occurrences of it seen, in colonies".

32. **Aster bipinnatisectus** Ludlow MS., **sp. nov.** (Plate 14).

Herba nana perennis. Caudex crasse lignosus, saepe supra floccos gossipinos ferens. *Caules* nonnulli, 2–8 cm alti, pilosi, ad bases reliquiis foliorum cincti. *Folia* albo-villosa, ad bases densiora, pilis 1–4 mm longis; radicalia rosulata, petiolata; petioli 1–2 cm longi, ad bases vaginati; laminae 1–2 cm longae, bipinnatisectae; segmenta primi ordinis utrinque 3–5, 5–7 mm longa, secundi ordinis utrinque 3–8, 1–3 mm longa; folia caulina radicalibus similia sed minora et pinnatisecta. *Capitulum* solitarium, 2·5–3·5 cm latum; phyllares 2-3 seriatae, imbricatae, lineares, acuminatae, villosae herbaceae, marginibus scariosis, apicibus purpurascentibus, exteriores 6–7 mm longae et 0·75 mm latae, interiores 9–10 mm longae et 0·8–1 mm latae. *Flores radii* circiter 20–25, tubis 2·5–3 mm longis, ligulis 1·3–1·5 cm longis et 2 mm latis, dilute purpureis. *Flores disci* lutei, 5·5–6 mm longi, tubis 1·6 mm longis, lobis ca. 1 mm longis. Appendices stylorum graciles, ca. 0·5 mm longae. *Pappus* duplex, albus, setis exterioribus subpaleaceis ca. 1 mm longis, interioribus tenuibus, scabridis, flores radii aequilongis. *Achaenia* 1·5 mm longa, 0·5 mm lata, dense sericea.

Dwarf perennial herbs with thick woody rootstocks. *Stems* 2–3, 2–8 cm tall, pilose, surrounded at the base by dense collars of foliar remains. *Leaves* white-villous, very densely so at base; radical leaves petiolate, petioles 1–2 cm long, vaginate at base, lamina 1–2 cm long, bipinnatisect, primary segments 3–5 pairs, 5–7 mm long, each with 3–8 pairs of secondary segments 1–3 mm long; cauline leaves 3–4, similar but smaller and pinnatisect only. *Capitulum* solitary 2·5–3·5 cm broad; involucre 2–3 seriate, imbricate, 9–10 mm high, villous; phyllaries linear, acuminate, herbaceous with scarious margins, purplish at tips, outer 6–7 mm long, 0·75 mm broad, inner 9–10 mm long, 0·8–1 mm broad. *Ray flowers* 20–25, basal tube 2·5–3 mm long, ligules 1·3–1·5 cm long, 2 mm wide, very pale mauve. *Disc flowers* yellow, 5·5–6 mm long, basal tube 1·6 mm long, lobes ca. 1 mm long. Style appendages narrowly triangular, ca. 0·5 mm long. *Pappus* double, white, outer setae subpaleaceous

ca. 1 mm long, inner setae slender, scabrid, as long disc corollas. *Achenes* 1·5 mm long, 0·5 mm broad, densely covered with silky hairs.

HABITAT: On rock faces.

SE TIBET: Shoga Dzong, 30°00′ N, 93°48′ E, 3200 m, 20 vii 1941, *Ludlow, Sherriff & Elliot* 14164 (holo. BM).

This species is distinguishable at a glance from all other Asiatic members of the genus by its bipinnatisect leaves which bear a superficial resemblance to those of certain species of *Anthemis*. Bipinnatisect leaves are also to be found in the New World Section *Machaeranthera* of North America and Mexico.

Other notable characteristics of this species are the strong woody rootstock, the long (1–4 mm) multicellular hairs on the leaves which often form dense cottony balls at top of the rootstock, the stout outer subpaleaceous pappus setae, recalling those of *A. asteroides*, and the very densely silky achenes.

33. **Aster souliei** Franch. in Jour. de Bot. 10: 372 (1896); Onno in Bibl. Bot. 106: 59 (1932); Hand.-Mazz. in Notizbl. Bot. Gart. Berl. 13: 620 (1937).

Syn.: *A. limitaneus* W. W. Sm. & Farrer in Notes Roy. Bot. Gard. Edin. 9: 80 (1916).
A. souliei Franch. var. *limitaneus* (W. W. Sm. & Farrer) Hand.-Mazz. in Notizbl. Bot. Gart. Berl. 13: 620 (1937).
A. forrestii Stapf in Bot. Mag. t. 9123 (1927).
A. ganlun Kitamura in Acta Phytotax. et Geobot. Kyoto, 15: 40 (1953).

Erect perennial herbs with thick non-stoloniferous rhizomes. *Stems* 5–15(–30) cm tall, ± glabrous or pubescent, scapose with few small leaves or leafy. *Leaves* pubescent on both surfaces or glabrous above and pilose on the veins beneath, usually distinctly ciliate; radical leaves 2–6·5(–11) cm long, 0·7–1·5 cm broad, oblanceolate, spathulate or more rarely obovate, obtuse or acute at apex, attenuate to a broad, indistinctly petiolate base, margins entire or more rarely obscurely crenate-toothed; cauline leaves lanceolate or oblanceolate, sessile, acute, similar in size to radical leaves, or linear or linear-lanceolate 3–1 cm long, 0·4–0·25 mm broad. *Capitulum* solitary, 1·2–2·2 cm broad; phyllaries 0·7–1·1 cm long, 1·5–2·5 mm broad, 3-seriate subequal, herbaceous, green or pale below, linear, acute or obtuse, pubescent, glabrous or glabrescent, ciliate. *Ray flowers* 40–65, basal tube 1·5–2 mm long, ligule blue or mauve 1·2–2·3 cm long, 2–3 mm broad. *Disc flowers* yellow, 3·5–5 mm long, basal tube 1·25–2 mm long, lobes 1·5 mm long. Style appendages lanceolate 1 mm long. *Pappus* reddish or brownish, 0·8–2 mm long, simple, setae thickish, broadened at the base. *Achenes* brownish, obovate, 2·5 mm long, 1·5 mm broad, 2-ribbed, buff sericeous, or more sparsely pubescent.

HABITAT: Open grassy slopes sometimes among dwarf rhododendrons.

TYPE: Cited as "circa Tongolo . . . in uliginosis (R. P. Soulié)" probably this is "Lieux marécageux à Tongolo, juillet-août 1891", *Soulié* 141 (P).

SE TIBET: Above Lhasa, viii 1904, *Walton* (K); Tsarung, Ka-gwr-pu, Mekong-Salween divide, 28°40′ N, 4415 m, viii 1918, *Forrest* 16777 (E—the type of *A. forrestii* was cultivated at Kew from seed of this number); Londre Pass,

Mekong-Salween divide, 28°14′ N, 98°40′ E, 4415 m, vii 1921, *Forrest* 19621 (E); Kongbo, Tumbatse, 3655 m, 3 vii 1924, *Ward* 5898 (E, K); Mago, Thang, 10 miles E of Tsona, 4265 m, 11 viii 1934, *Ludlow & Sherriff* 792 (E, BM); Langong Chu Valley, 28°50′ N, 93°48′ E, 3500 m, 26 v 1938, *Ludlow, Sherriff & Taylor* 3864 (E, BM); above Lhasa, 3960 m, vii 1939, *Richardson* 200 (BM); Reting, 4265 m, 21 vii 1942, *L. & S.* 8849 (BM); Reting, 4265 m, 17 vii 1943, *L. & S.* 9995 (BM); Hills south of Lhasa, 4415 m, 19 viii 1943, *L. & S.* 9882 (E, BM); Pome, Lokmo, near Tongyuk, 3500 m, 2 vi 1947, *Ludlow, Sherriff & Elliot* 13812 (E, BM); Kongbo, Tsogo, Pasum Tso, 3590 m, 18 vi 1947, *L. S. & E.* 13925 (E, BM).

BHUTAN: Saga La, Upper Mangde Chu, 4720 m, 14 vii 1949, *Ludlow, Sherriff & Hicks* 16818 (E, BM); Pangotang, Bumthang Chu, 3800 m, 26 v 1949, *L. S. & H.* 18977 (BM); Tolegang Tsampa, 3960–4415 m, 31 v 1949, *L. S. & H.* 19019 (E, BM); Me La, Cho La Valley, 3800 m, vi-ix 1949, *L. S & H.*. 20426 (BM), 21127 (BM).

NE UPPER BURMA: Seinghku Wang, 28°8′ N, 97°24′ E, 3960–4265 m, 9 vii 1926, *Ward* 7085 (E, K); Adung Valley, 28°20′ N, 97°40′ E, 3655 m, 13 viii 1931, *Ward* 9934 (BM).

This species is unquestionably closely related to *A. tongolensis* and so similar are they in floral details that there may be some justification for merging them, but the argument in favour of keeping them separate is a stronger one. Previous authorities have caused some of the confusion by differentiating them primarily on characters of indumentum and foliage. Thus *A. souliei*, was said to have glabrescent and ciliate leaves and phyllaries and almost leafless peduncles. *A. tongolensis* on the other hand was differentiated by having pubescent leaves and phyllaries and leafy peduncles. These distinctions must be treated as generalisations as both are variable: *A. souliei* can be pubescent and may have peduncles that are quite densely leaved, *A. tongolensis* may be almost glabrous and have only a few leaves on the peduncles.

Probably the most cogent differentiating characters are contained in the opening words of the original descriptions: *A. souliei*—"Rhizoma crassiusculum"; *A. tongolensis*—"Stolonifera, stolonibus gracilibus decumbentibus". In *A. souliei* the rhizomes are thick and shortly branched bearing a mass of fine roots below and a rosette of radical leaves above but are without stolons. Rhizomes of *A. tongolensis* are thinner and almost horizontal with longer branches and stolons are generally present on the specimens. The latter on this definition does not enter the Himalayan area but is confined to SW Szechuan and NW Yunnan. *A. souliei* also grows in these localities indeed it too was originally collected from Tongolo, but its distribution extends into Kansu as well as Tibet and Bhutan. *A. subcoeruleus* S. Moore, a synonym of *A. tongolensis*, was reputed to have been introduced into cultivation from "Hazara, NW India". This obviously does not refer to its natural distrubition.

Several species from Western China apart from *A. tongolensis* seem to be related to *A. souliei*, *A. brachytrichus* Franch. and *A. jeffreyanus* Onno, both have short pappus setae but differ in having ovate semiamplexicaul cauline leaves. The base of the stem is naked in *A. brachytrichus* but basal and radical leaves are present in *A. jeffreyanus*. In both species the disc flowers become purplish as they open and their distributions are centred on the Lichiang

Range, Yunnan. *A. handelii* Onno from near Chungtien resembles *A. tongolensis* very closely in habit. Its pappus is brownish but the setae are as long as the disc corollas and finer in texture.

A. souliei was introduced into cultivation by Forrest in 1918 from NW Yunnan. It has not recently been offered in the seed catalogues of any of the leading horticultural institutions or societies and is probably no longer in cultivation.

EXCLUDED SPECIES

Aster aureus D. Don, Prod. Fl. Nep. 178 (1825) = *Solidago aurea* Spr.

A. bellidioides Buch.-Ham. ex D. Don, Prod. Fl. Nep. 177 (1825) = *Erigeron bellidioides* C. B. Cl.

A. indicus Heyne in Wall. Cat. 2971 (1831) *nom. nud.* = *Pulicaria wightiana* C. B. Cl.

A. inuloides D. Don, Prod. Fl. Nep. 178 (1825) = *Erigeron multiradiatus* (DC.) Benth. & Hook. f.

A. lacunarum Aitch. & Hemsl. in Jour. Linn. Soc. 19: 168 (1882) = *Chamaegeron oligocephalus* Schrenk.

A. linifolius Wall. Cat. 3287 (1831) *nom. nud.* = *Senecio linifolius* (DC.) C. B. Cl.

A. multiradiatus Wall. Cat. 2969 *nom. nud.* = *Erigeron multiradiatus* (DC.) Benth. & Hook. f.

A. nitidulus DC. in Wight Contrib. 9 (1834) and Prod. 5: 247 (1836); C. B. Cl. Comp. Ind. 49 (1876) "remanet dubius"—Described from the Nilgiri Hills, Madras from which no species of *Aster* is known. Probably this is an *Erigeron* species.

A. odontophyllus Wall. Cat. 3285 (1831) *nom. nud.* = *Senecio linifolius* (DC.) C. B. Cl.

A. roylei Onno in Bibl. Bot. 106: 67 (1932) = *Erigeron multiradiatus* (DC.) Benth. & Hook. f.

Heteropappus Less. Syn. Comp. 189 (1832); DC. Prod. 5: 297 (1836); Benth. & Hook. f. Gen. Pl. 2: 269 (1873); O. Hoffm. in Nat. Pflanzenfam. 4, Abt. 5: 161 (1894); Tamamsch. in Fl. U.R.S.S. 25: 61 (1959).

Annual, biennial or perennial herbs up to 1 m tall, usually appressed strigose-pubescent and glandular. *Leaves* linear, oblanceolate or spathulate, indistinctly veined, sessile, attenuate at the base, obtuse or acute at the apex, margins entire or sometimes shallowly toothed. *Capitula* solitary or in loose terminal racemes or corymbs. Involucres 2–3 seriate, phyllaries linear-lanceolate, herbaceous, all ± similar in size or somewhat imbricate, margins at least of the inner ones usually scarious. *Ray flowers* ligulate, blue or mauve, rarely absent. *Disc flowers* yellow, tubular, 5 lobed, lobes of unequal lengths (4 short, 1 long). Style appendages deltoid, ca. 0·3 mm long. *Pappus* of equal length on all achenes or absent or short and coroniform on ray achenes, simple, straw-coloured or reddish. *Achenes* obovate, compressed, moderately sericeous, marginal ribs thickish. Receptacle slightly convex, foveolate.

Heteropappus was created by Lessing (l.c.) to separate from *Aster* those species in which the ray achenes have a pappus of short hairs (often somewhat fused together) whereas, in those of the disc, the pappus is of normal

length i.e. as long as the disc corollas. This was a realistic and easily followed division. Following a note by Franchet (Franch. & Sav. Enum. Pl. Japon. 2: 396, 1879) on the state of the pappus in varieties of *H. hispidus*, Novopokrovski (in Sched. ad Herb. Fl. Ross. 8: 193, 1922) added *A. altaicus* to the species already placed in *Heteropappus*. This species differs from the others in that the pappus of the ray and disc achenes are alike but its inclusion was based on similarities in habit, in phyllaries and in details of the receptacle and on the belief that, with the other species, it formed a naturally evolving series. These characters by themselves are somewhat unsatisfactory for taxonomic purposes in a group so variable as the *Asterinae*, but the view that it is correctly placed here is strengthened by the fact (hitherto unobserved, apparently) that these species differ from the majority of Asters in that the lobes of the disc corollas are of different lengths (see Fig. 5, B). While it is not suggested that this character is exclusive to this genus, it nevertheless adds weight to the acceptance of this as a natural genus when taken into account along with the distinctive habit of these plants.

This genus is most strongly represented in Eastern Asia but the distribution of *H. altaicus* extends from there to the Himalaya and Tibet and as far as Iran. The other species included here are endemic to the Himalayan-Tibetan area and W China.

Key to the Species of Heteropappus in the Himalayan area

1. Capitula discoid . . . . . 39. *holohermaphroditus*
+ Capitula radiate 2
2. Dwarf cushion-like plants with thickened cylindrical tap-roots 38. *boweri*
+ Plants neither cushion-like not having thickened cylindrical tap-roots 3
3. Plants obviously annual. Pappus of ray achenes absent, short or similar in length to those of disc achenes 5
+ Plants perennial. Pappus of uniform length in all achenes . . 4
4. Stems erect more than 20 cm long. Ray flowers about 15 34. *altaicus*
+ Stems decumbent or almost prostrate 7–20 cm long. Ray flowers 20–35 35. *semiprostratus*
5. Stems erect 15–30(–60) cm tall, branched above, leaves 0·8–1·3 cm broad . . . . . 36. *crenatifolius*
+ Stems 8–10(–30) cm tall, diffusely branched from the base. Leaves 0·2–0·65 cm broad . . . . . 37. *gouldii*

34. **Heteropappus altaicus** (Willd.) Novopokr. in Sched. ad Herb. Fl. Ross. 8: 193 (1922); Tamamsch. in Fl. U.R.S.S. 25: 66 (1959).

Syn.: *Aster altaicus* Willd. Enum. Hort. Berol. 881 (1809).

Erect, green or canescent, perennial herbs. *Stems* up to 1 m high but sometimes only 20–45 cm, often becoming somewhat woody at base, appressed and ascending, strigose-pubescent, sometimes spreading, interspersed with stipitate or sessile glands especially towards the apex near the capitula. *Leaves* appressed strigose-pubescent often intermixed with sessile glistening glands especially beneath; radical leaves absent at flowering time; cauline leaves linear-lanceolate, oblanceolate or spathulate, margins entire or rarely shallowly toothed, ± evenly distributed on stems, lower leaves 2–6·5(–10) cm long, 0·7–1·5 cm broad, upper leaves often reduced to 5 mm long, 1 mm

PLATE 15. Type specimen of *Heteropappus semiprostratus* Grierson.

PLATE 16. Type specimen of *Heteropappus holohermaphroditus* Grierson.

broad, acute or obtuse at apex, attenuate at base, margin entire. *Capitula* solitary at ends of branches or several forming loose terminal corymbs, 0·8–1·5 cm broad; phyllaries 2–3 seriate, 3·6–8 mm long, 0·6–1·8 mm broad, lanceolate, green, herbaceous, appressed strigose-pubescent usually with minute glandular hairs, at least the inner ones scarious margined. *Ray flowers* 15–18, basal tubes 1·4–2·8 mm long, minutely pubescent, ligules pale blue or mauve, 0·7–1·5 cm long, 1·4–2·4 mm broad. *Disc flowers* yellow 3·6–6 mm long, minutely pubescent, basal tubes 1·0–2·2 mm long lobes of unequal lengths: 4 short lobes 0·6–1·0 mm long, 1 long lobe 1·0–1·4 mm long. Style appendage triangular 0·2–0·4 mm long. *Pappus* off-white, stramineous or reddish brown, simple, 2·4–5·5 mm long. *Achenes* 2·0–2·8 mm long, 0·7–1·4 mm broad, obovate, greyish green or pale brown, sericeous, glandular above, margins thickish, paler.

This is a highly polymorphic species in which it is possible to make numerous more or less arbitrary groupings according to habit, leaf size and arrangement, capitula size and so on. Some of these segregates have been given specific rank but in the majority of cases this treatment seems hardly feasible in view of the numerous intermediates that exist between them and with typical *H. altaicus*. Here only two varieties have been recognised as follows:

Plants often greyish-green, fastigiately branched. Leaves, especially the upper ones, appressed to stems and peduncles . . var. *canescens*
Plants green, diffusely branched. Leaves scarcely appressed to stems var. *altaicus*

34a. **Heteropappus altaicus** (Willd.) Novopokr. var. **altaicus**

Syn.: *Aster altaicus* Willd. Enum. Hort. Berol. 881 (1809); C. B. Cl. Comp. Ind. 46 (1876); Hook. f. Fl. Brit. Ind. 3: 251 (1881).
Calimeris altaicus (Willd.) Nees, Gen. et Sp. Ast. 228 (1832); DC. Prod. 5: 258 (1836).
Aster angustifolius Lindl. ex Royle, Ill. Bot. Himal. 251, t. 58, 1839 (non Jacq.).

Stems 20–45 cm tall, diffusely branched, glabrescent or ± stiffly appressed pubescent. *Leaves* linear-lanceolate or spathulate, lower leaves up to 5(–10) cm long, 8–10 mm broad, somewhat trinerved at base, upper leaves spreading, 1–1·5(–2·5) cm long, 2–3 mm broad. Upper branches or peduncles usually branched and bearing several capitula. *Capitula* 0·8–1·2(–1·5) cm broad. *Ray flowers* ca. 15.

HABITAT: Pastures and dry stony ground.

TYPE: Willdenow Herb. No. 15877 (B, photograph E).

NW INDIA: Bashahr, Rarang Forest, 2745 m, 11 viii 1890, *Lace* 508 (E); Chamba, Kilar to Darwas, 2440 m, 10 ix 1895, *Lace* 1303 (E); near Jarma, 3050 m, 7 vi 1879, *Watt* 2426 (E); Kunawar, Leo, ix 1886, *Drummond* 22187 (E, K), 22190 (E, K).

Apart from Central Asia and NW Himalaya, this variety is also found in Afghanistan and Iran. As a whole the species is widely distributed in Central and East Asia and contains several varieties (see Hand.-Mazz. in Acta Hort. Gotob. 12: 220, 1938).

Being a cultivated plant, laxness of growth and leafiness (leaves measure

as much as 10 cm long) are more marked in Willdenow's type specimen than one finds among wild material. To a lesser degree, however, these are the characters that divide this variety from var. *canescens* although intermediates between them are not uncommon. Var. *altaicus* is portrayed tolerably well so far as habit and foliage are concerned by Royle's illustration of *Aster angustifolius* (l.c.), but 36 ray flowers instead of 15–20 have been drawn.

34b. **Heteropappus altaicus** (Willd.) Novopokr. var. **canescens** (Nees) Serg. in Krilov, Fl. W Siberia, 11: 226 (1949).

Syn.: *Calimeris canescens* Nees, Gen. et Sp. Aster, 229 (1832); DC. Prod. 5: 259 (1836).
Galatella juncea Lindl. ex Royle Ill. Bot. Himal. 251, t. 58 (1835); DC. Prod. 5: 257 (1836).
Aster pyrrhopappus Boiss. Fl. Or. 3: 158 (1875).
Aster spartioides C. B. Cl. Comp. Ind. 48 (1876).
Calimeris albertii Rgl. in Gartenflora 33: 130, t. 1152 (1884); Acta. Hort. Petrop. 8: 641 (1884).
Heteropappus canescens (Nees) Novopokr. in Sched. ad Herb. Fl. Ross. 8: 193 (1922); Nevski in Acta Inst. Bot. Acad. Sc. U.R.S.S. Ser. I, Fasc. 4: 278 (1937); Tamamsch. Fl. U.R.S.S. 25: 67 (1959).
Heteropappus albertii (Rgl.) Novopokr. & Tamamsch. Fl. U.R.S.S. 25: 67 (1959).

Plant greyish, ± stiffly appressed pubescent and glandular. *Stems* 30–60(–100) cm tall, fastigiately branched above. *Lower leaves* spathulate, 3(–5) cm long, 0·5–0·6 cm broad, upper leaves linear, ca. 1 cm long, 1–2 mm broad, appressed to branches and peduncles. Peduncles usually bearing solitary or few capitula. *Capitula* 0·9–1·1 cm broad. *Ray flowers* 15–20.

HABITAT: Roadsides and dry stony situations.

TYPE: Country of origin unknown, *Herb. Gunther* (n.v.).

PAKISTAN: Gilgit, *Giles* (E); Swat, Mingora, 915 m, 10 viii 1952, *R. R. Stewart* 24222 (BM); Chitral, Broz, 2135 m, 6 vi 1895, *Harriss* 16278 (E); Shishi, 2285 m, 28 vii 1958, *Bowes Lyon* 144 (BM); Brep, 2440 m, 7 viii 1958, *Stainton* 3078 (BM); Bashgalien Deh, 2135 m, 7 ix 1958, *Stainton* 3222 (BM); Nagar Village, 2440 m, vii-viii 1960, *Polunin* 6075 (BM), 6436 (BM); Nagar, Minapin Glacier, 3050 m, 1 viii 1961, *Lloyd & Megan* 22 (E, BM); Baluchistan, Ziarat, 2440 m, *Lace* 73 (E), 3994 (E); NW Frontier Prov., Cherat, 1310 m, 24 viii 1896, *H. H. Johnston* 4 (E).

NW INDIA: Without locality *Royle* (CAL, photo. E—type of *A. spartioides*).

KASHMIR: Hasora, ix 1856, *Schlagintweit* 6400 (E).

CULTIVATED: Saharunpur Bot. Gard. (as *Galatella juncea*), *Royle* (K).

The type specimen, according to Flora U.R.S.S., is probably located in Sweden but all enquiries to herbaria in that country have been without avail. Nor is it at the Wroclaw Herbarium where it was also suggested that it might be found. From the description, however, it is obvious that this is the taxon described by Nees and specimens lent by the Leningrad Herbarium show that this is the plant known in Central Asia as *Heteropappus canescens*. It is distinguished from var. *altaicus* by its more erect fastigiate branching

and by its more numerous, appressed and shorter leaves on the peduncles. In the dried condition, the plants are generally more greyish-green than those of the typical variety.

The pappus in *H. altaicus* is off-white, straw-coloured or pale rusty brown but occasionally darker colours arise. From Afghanistan, *Griffith* 3113 (K) upon which Boissier based his *Aster pyrrhopappus* ("pappus purpureo rufus"), is such a specimen but from other characters it must be placed in this variety. Similar specimens occur sporadically in var. *altaicus* (e.g. *Drummond* 22187, 22190).

Heteropappus albertii (Rgl.) Novopokr. based on a cultivated specimen raised from seed sent by A. Regel from Turkestan (Hort. Pomol. (?), 1883–LE) must also be regarded as synonymous with this variety. Here as in Willdenow's type of the species, there is greater laxness in growth than is found in wild material but the peduncles are little branched and bear numerous appressed leaves.

35. **Heteropappus semiprostratus** Grierson, **sp. nova.** (Plate 15).

Herba perennis plerumque a basi ramosa, valde decumbens, raro erecta. Radix lignescens. *Caules* adpresse et rigide pubescentes, 9–20 cm longi. *Folia* adpresse pubescentia glandulis sessilibus conspersis, linearia vel spathulata, patula, 1·4–3·2 cm longa, 2·5–5 mm lata, ad apices late acuta, bases attenuata, marginibus integerrimis. *Capitula* 1(–3) ad apices ramulorum 1·2–1·4 cm lata. Phyllares 3-seriatae, lanceolatae, acuminatae, 6–8 mm longae, 0·8–1·6 cm latae, saltem interiores scarioso-marginatae. *Flores radii* 20–35, tubis basalibus 1·6–2·2 mm longis, ligulis purpurascentibus, 1·2–1·5 cm longis, 2·1–2·2 mm latis. *Flores disci* lutei, 4–6 mm longi, tubis basalibus 1·4–2·2 mm longis, inaequaliter lobati, lobo singulo 1 mm longo, aliis 0·6 mm longis. *Pappus* rufescens, simplex 4–5 mm longus. *Achaenia* immatura, obovata, 1·5–1·8 mm longa, 0·7–0·8 mm lata, parce sericea.

HABITAT: Dry slopes in stony or sandy ground.

KASHMIR: Ladak, Gya, 4110 m, 15 vii 1941, *Ludlow & Sherriff* 8494 (holo. E, iso. BM).

NEPAL: Mustang, 3960–4265 m, viii 1954, *Stainton, Sykes & Williams* 2164 (E, BM), 2385 (E, BM).

TIBET: Tingri, Salt plain 45 miles NW of Mt. Everest, *Wollaston* 106 (K); Lal Pahar, 4570 m, vi 1925, *Champion* (K); Kala, 4265 m, viii 1936, *Chapman* 1049 (K).

This species is related to *H. distortus* (Turcz.) Tamamsch. (in Fl. U.R.S.S. 25: 66, t. 5, Fig. 2, 1959), another low growing species which was originally described from Udinsk, West of Lake Baikal in Southern Siberia. (The author is indebted to the Curator of the Herbarium of the Botanical Institute of the Academy of Sciences of the U.S.S.R., Leningrad, for lending the type specimen of this species—*Turczaninow* s.n., 1802—for comparison).

H. semiprostratus is altogether a more robust plant than *H. distortus*. The stems are stouter and bend almost at right angles at the base, looking as if they penetrated a layer of sand or scree to reach the underground perennating rootstock. The latter is generally thicker and more strongly woody than is the root of *H. distortus*. Also in *H. distortus*, the stems appear to be very densely leafy due to the presence of short axillary sterile shoots in the axils

of many of the cauline leaves. Such shoots are few in *H. semiprostratus* and the stems are less densely leafy. Both stems and leaves are covered with a stiff appressed pubescence in *H. semiprostratus* whereas, in *H. distortus*, the pubescence is finer and shorter. In the latter species the capitula are rarely more than 1 cm broad but in *H. semiprostratus* they are usually 1·5 cm broad. The phyllaries and flowers are also correspondingly larger. The ray flowers in *H. distortus* number 15–20 but in this species 25–30 are usual.

This species possibly has its origins in Central Asia along with *H. altaicus: Ludlow* 758 (Tien Shan, Kensu Junction, Tekkes, 15 viii 1930—E, BM) belongs to this taxon.

36. **Heteropappus crenatifolius** (Hand.-Mazz.) Grierson, **comb. nov.**

Syn.: *Aster crenatifolius* Hand.-Mazz. in Acta Hort. Gotob. 12: 217 (1938) pro max. parte, excl. syn. *A. praetermissus* Drumm. ined. et *A. bowerii* Rehd. & Kobuski (Hand.-Mazz. attributes this to Mattf.) in Journ. Arn. Arb. 14: 37 (1933) non Hemsl. et *A. bowerii* f. *annuus* Onno in Bibl. Bot. 106: 58 (1932).

Erect annual herbs. *Stems* 15–30(–60) cm tall, branching only above, ± spreading hispidulous-pubescent and glandular puberulent. *Leaves* covered with stiff appressed pubescence on both surfaces intermixed with glistening sessile glands; radical leaves absent at flowering time; lower cauline leaves 3·5–4·5 cm long 0·8–1·3 cm broad, oblanceolate or spathulate, margin usually crenately toothed above, attenuate at the base, obtuse or acute at the apex. *Capitula* solitary on short branches 1·3–1·8(–2) cm broad; phyllaries 2–3 seriate, 0·7–1·1 cm long, 0·6–2·0 mm broad, lanceolate, green, herbaceous, glandular puberulent, intermediate and inner series scarious margined. *Ray flowers* 30–40, basal tubes 1·2–1·8 mm long, ligules mauve or blue, 0·8–1·2 cm long, 1·6–2·4 mm broad. *Disc flowers* yellow, 4·2–5·0 mm long, basal tubes 1·4–1·6 mm long, lobes of unequal lengths: 2 short lobes 0·6–0·8 mm, 2 lobes of intermediate length 0·8–1·2 mm, 1 long lobe 1·2–1·4 mm long. Style appendages triangular, 0·3 mm long. *Pappus* simple, on disc achenes (2·8–)3·6–4·5 mm long, straw coloured or brownish; on ray achenes 0·2–0·4 mm long, sometimes absent or as long as on disc achenes. *Achenes* obovate 2·0–2·8 mm long, 1·0–1·2 mm broad, pale brownish streaked with black, sparsely sericeous with a few glands at the apex.

TYPE: China, Prov. Szechuan, Mao-ko Yen-ching prope Yenyuen, 2600 m, 15 v 1914, *Handel-Mazzetti* 445 (holo. W not seen, iso. E).

TIBET: Zayul, Rong Tö Valley, 1830 m, 13 v 1933, *Ward* 10405 (E, BM); Ata, 2440 m, 30 v 1933, *Ward* 10447 (E, BM); Tsangpo Valley, Tse, 2895 m, 10 xi 1947, *Ludlow, Sherriff & Elliot* 13305 (E, BM); Kongbo Je, Pasum Tso, 3655 m, 7 vii 1947, *L. S. & E.* 14089 (E, BM).

NEPAL: Barbung Khola, 28°52′ N, 83°15′ E, 3655 m, 15 vii 1963, *Stainton* 4427 (BM).

This species, and to some extent also *H. gouldii*, are unsatisfactory in that the accustomed practice in *Heteropappus* of delimiting taxa according to the state of the pappus has been abandoned. Handel-Mazzetti did this when he created *A. crenatifolius* and his treatment is perpetuated here. The correlation between pappus and habit, the most obvious characters by which these species may be classified, is not as complete as it appears to be in other parts

of the genus. Observation of living plants, at present impossible, may well disclose other important taxonomic characters and yield a more pertinent classification.

H. crenatifolius is generally broad-leaved with erect stems that are branched only above. In the type specimen the pappus of the ray and disc achenes are of equal length but there are other specimens, outwardly typical, in which the ray pappus is absent or short. Similarly in *H. gouldii*, which is narrow leaved and diffusely branched, the pappus of the type is uniform but it may be of unequal length in some specimens.

L. & S. 13305 (Tsangpo valley, Tse, 2895 m, 10 xi 1947) must be looked upon as a more luxuriant specimen of *H. crenatifolius*. It measures 60 cm tall and has leaves 3 cm long, 1 cm broad, but is richly branched and with capitula only about 1 cm broad. Its luxuriance is probably partly accounted for by its being collected late in the season and also because it was growing as a weed in "cultivated areas and on sandy hillsides", its cultural conditions were probably more favourable. This specimen is similar in habit to *Forrest* 6122 (from the Lichiang Valley, Yunnan) which Handel-Mazzetti cited with his description.

H. hispidus, the widespread E. Asiatic biennial species, is similar in appearance to *H. crenatifolius* but the ray pappus is always short, the achenes are usually black mottled and the leaves are narrower and often shallowly toothed. Duration, lack of glandulosity and the more numerous, almost non-scarious phyllaries keep it distinct from *H. crenatifolius*. Although in distribution *H. hispidus* extends only as far west as Hupeh, the possibility that *H. crenatifolius* is descended from a hybrid between it and some other species should not be overlooked.

37. **Heteropappus gouldii** (C. E. C. Fischer) Grierson, **nov. comb.**

Syn.: *Aster gouldii* C. E. C. Fisher in Kew Bull. 286 (1938).
Aster crenatifolius Hand.-Mazz. p.p. quoad syn. *A. praetermissus* Drumm. ined et *A. boweri* auct. non Hemsl.: Rehd. et Kobuski in Jour. Arn. Arb. 14: 37 (1933).

Decumbent spreading annual herbs. *Stems* 8–20(–30) cm tall, branched from base, covered with appressed strigose or spreading hispidulous hairs intermixed with subsessile glandular hairs especially above. *Leaves* covered with fine appressed strigose hairs with interspersed glistening glands. Radical leaves absent (or withered) at flowering time; cauline leaves linear, oblanceolate or spathulate, 0·8–3·0 cm long, 2–6·5 mm broad, sessile or attenuate and indistinctly petiolate at the base, obtuse or acute at the apex, margin entire. *Capitula* solitary or several at the ends of branches, 1–1·5 cm broad; involucre 2–3 seriate, phyllaries 5–7 mm long, 0·8–2·2 mm broad, green, herbaceous, glandular puberulent with whitish scarious margins. *Ray flowers* 20–40, basal tubes 2–2·2 mm long, ligules lilac or blue, 1·0–1·1 cm long, 1·6–1·9 mm broad. *Disc flowers* yellow, 3·4–4·2 mm long, basal tubes 1·2–1·4 mm long, lobes 5 (rarely 4) unequally divided, four short lobes 0·6–0·9 mm long, one long lobe 1·1–1·3 mm long (long lobe generally 0·3–0·4 mm longer than short lobes). *Pappus* 3–3·2 mm long, simple, off-white or reddish brown. *Achenes* 2·0–2·6 mm long, 1·1–1·4 mm broad, obovate, pale olive green with black mottling, moderately sericeous with a few glands at the apex.

HABITAT: Open grassy slopes sometimes on sandy soil and on river banks.
SIKKIM: Dotha, 3655 m, 12 ix 1912, *Rohmoo Lepcha* 170 (E).
TIBET: Gyangtse, vii-ix 1904, *Walton* 82 (BM), 125 (as *A. praetermissus*—E); Lhasa, 3655 m, viii-ix 1904, *Waddell* (K); Numa, 6 ix 1907, *H. M. Stewart* (K); Mountain behind Drepung, 5540 m, 27 viii 1936, *Chapman* 21 (holo. *A. gouldii* K); Ralung, 4420 m, 17 viii 1936, *Chapman* 1053 (K); Samoda, 4265 m, viii 1936, *Chapman* 1047 (K); 1054 (K); Singma Khangchung, 3500 m, 21 viii 1936, *Chapman* 1175 (K); 2 miles E of Lhasa, 3655–3960 m, 1 ix 1936, *Chapman* 1048 (K); Tsangpo valley, Tromda, 3350 m, 11 v 1938, *Ludlow, Sherriff & Taylor* 4196 (E, BM); Lhasa, 3595 m, vi-viii 1942, *Ludlow & Sherriff* 8734 (E, BM), 8821 (E, BM); Hills N of Lhasa, 3960 m, 21 vii 1943, *L. & S.* 9897 (E, BM); Ganden, 24 miles E of Lhasa, 3960 m, 26 vii 1944, *L. & S.* 11073 (E, BM); Pome, Trulung, 1980 m, 11 vi 1947, *Ludlow, Sherriff & Elliot* 12127 (E, BM).

There is a certain amount of variation among the specimens cited above. The type plant is slender, 10 cm tall with fine branches, leaves 1–2 cm long, 2–3 mm broad, and the capitula measure only 1 cm broad. The majority of the specimens, however, are more closely matched by *Walton* 125 (type of the unpublished *A. praetermissus*) which is probably a more robust form of the species. Among the specimens of this form, the dimensions of stem, leaves and capitulum achieve their maximum development.

A few somewhat anomalous specimens must be discussed. *L. S. & E.* 12127 has spreading hispidulous pubescence and is unusual in appearance since the lower 10–12 cm of the stem is naked and the specimens branch only above this point. This may be explained by their habitat for they were collected on a river bank presumably among lush vegetation or moving sand. In *L. & S.* 4196, the indumentum is similar and the plants resemble in habit and their mode of branching, impoverished specimens of *H. crenatifolius* (under which name it was distributed). The dimensions of their parts, however, are more in accord with this species. *L. & S.* 9953 is unusual only because the plants, collected from open grassy slopes, are almost completely prostrate.

Unlike *H. crenatifolius*, the pappus setae of the ray and disc achenes in above specimens are all of equal lengths. In only one specimen, *L. S. & T.* 7156 (Kongbo, Tsangpo Valley, Yusum, 2985 m, 30 ix 1938) the ray pappus is short (0·4 mm) yet from the point of view of size and habit, it must remain in the present species.

38. **Heteropappus boweri** Hemsl. in Jour. Linn. Soc. 30: 113 (1894) et 35: 180 (1902), et in Hook. Ic. Pl. 25: t. 2495 (1896); Onno in Bibl. Bot. 106: 56 (1932).

Dwarf biennial or perennial herbs with thick cylindrical tap-roots. *Stems* 3–6 on each plant, simple or branching near the base, 4–7 cm tall, hispidulous pubescent. *Leaves* covered on both sides with fine whitish ± appressed hairs or glabrescent above; basal leaves crowded, linear spathulate up to 3 cm long, 4 mm broad, apex acute or obtuse, margins entire, ciliate, smooth or crisped; cauline leaves as many as five, linear, 0·75–2·5 cm long, 1–2 mm broad. *Capitula* terminal, solitary, 1·5–2 cm broad. Involucre 2–3 seriate; phyllaries linear-lanceolate, subequal, ± 1 cm long, 1·2–2·5 mm broad,

herbaceous with narrow, lacerate margins scarious especially on the inner series. *Ray flowers* ca. 40; basal tubes 2 mm long; ligule lilac 1–1·3 cm long, 1·5–1·7 mm broad. *Disc flowers* yellow, 5 mm long, basal tubes 1·5 mm long; lobes finely pubescent on the outside, unequal, four lobes 0·5–0·6 mm long, one lobe 1·0–1·2 mm long. Style appendages lanceolate, 0·3–0·5 mm long. *Pappus* off-white or brownish, simple, 4 mm long. *Achenes* 2·8–3 mm long, 1 mm broad, narrowly obovate, ± compressed, pale brown with blackish streaks, sparsely covered with fine straight pale coloured hairs.

TIBET: Without locality, 5484 m, *Thorold* (holo. K); Gooring Valley, 30°12′ N, 90°25′ E, 5025 m, vii-viii 1895, *Littledale* (K); Horpa Tso, 5179 m, 3 vii 1896, (coll. A. Pike) *Deasy* 826 (K); Camp 100, 35°50′ N, 82°17′ E, 5085 m, 16 viii 1898, *Deasy* 97 (BM); without named locality, 35°14′ N, 88°20′ E, 5025 m, 26 vii 1896, *Welby & Malcolm* (K).

Bower traversed Tibet in 1892 from west to east from Le in Ladak (34° N, 77°45′ E, to China 30° N, 100° E). Thorold accompanied him as botanist and most of his specimens are reputed to have been collected north and west of Lhasa but the precise locality was not noted. The holotype (*Thorold* sn.) has been temporarily mislaid in the Kew Herbarium and so also is Littledale's specimen from which the drawing in Hooker's Icones Plantarum was prepared, hence these specimens have not been examined.

H. bowerii is distinct because of its compact cushion-like habit, its thick cylindrical roots and its leaves which are hispidulous pubescent on the upper surfaces and appear to be crisped at the margins. The roots show little sign of woodiness and there are relatively few dead leaves surrounding the collars of the plants which agrees with Onno's suggestion that they are biennials and not perennials as Hemsley originally stated. Onno, however, was incorrect in describing Ridley's specimen from Ku-Ku-Nor as *A. bowerii* f. *annuus*. This specimen is an *Erigeron*.

39. **Heteropappus holohermaphroditus** Grierson, **sp. nov.** (Plate 16).

Herba erecta perennis ad basim lignescens. *Caules* plures 15–45 cm alti, simplices, parce et minute adpresse pubescentes et glanduloso pilosi, in regione inflorescentiae pilis glandulosis praediti. *Folia* utrinque sparsim et minute adpresse pilosa et glandulosa, tandem eglandulosa; radicalia absunt florendi tempore; caulina oblanceolata vel spathulata, superiora late linearia, saepe ad caules ± adpressa, 1·3–3·5 cm longa (1·0–)2·5–8 mm lata sessilia, ad bases attenuata, ad apices obtusa mucronata, marginibus integris. *Capitula* 3–10, (0·9–)1·3–1·5 cm lata, ad apices pedunculorum usque ad 6 cm longorum. Phyllares 1–2 seriatae, lanceolatae, 6–7 mm longae, 1–1·7 mm latae, glanduloso pilosae, virides vel purpurascentes (in sicco), marginalibus scariosis. *Flores radii* nulli. *Flores disci* lutei 5·5–6 mm longi, tubis basalibus ca. 1·5 mm longis; limbus inaequaliter 5-lobatus, lobo singulo 2·2 mm longo et aliis 1·2 mm longis. Appendices stylorum 0·4–0·5 mm longae, lanceolatae. *Pappus* uniseriatus, fuscescens vel rufescens, setis circiter 30, 4–4·5 mm longis. *Achaenia* pallide brunnea, obovata 3·2 mm longa, 1·4 mm lata subcompressa, sericea, supra parce glandulosa, marginibus costatis.

Erect perennial herbs somewhat woody at the base. *Stems* several, 15–45 cm tall, simple, sparsely and minutely appressed pubescent and glandular, especially near the inflorescence. *Leaves* at first sparsely and minutely

appressed pilose and glandular on both surfaces, becoming eglandular, radical leaves absent at flowering time, cauline leaves oblanceolate or spathulate, the upper ones broadly linear, often somewhat appressed to the stems, 1·3–3·5 cm long (1–)2·5–8 mm broad, sessile, attenuate at the base, obtuse and mucronate at the apex, margins entire. *Capitula* 3–10, (0·9–)1·3–1·5 cm broad, borne on peduncles up to 6 cm long, in loose racemes or corymbs; phyllaries 1–2 seriate, lanceolate, 6–7 mm long, 1–1·7 mm broad, glandular pilose, green or purplish (in the dried state), margins scarious. *Ray flowers* absent. *Disc flowers* yellow, 5·5–6 mm long, basal tubes ca. 1·5 mm long, limb unequally 5-lobed, one lobe ca. 2·2 mm long, the others ca. 1·2 mm long. Style appendages 0·4–0·5 mm long, lanceolate. *Pappus* simple, fawn or reddish brown, setae ca. 30, 4–4·5 mm long. *Achenes* pale brown, obovate, 3·2 mm long, 1·4 mm broad, somewhat compressed, sericeous, sparsely glandular above, margins ribbed.

HABITAT: Dry hill slopes.

W PAKISTAN: Baluchistan, Ziarat, 2440 m, 13 vi 1962, *R. R. Stewart* 517 (RAW); Kasurmik, Baltistan, 2745 m, 16 viii 1940, *R. R. Stewart* 20807 (RAW); Bagicha to Olding, Indus Valley 2590 m, 23 viii 1940, *R. R. Stewart* 20988 (RAW); Saptura to Deosai, 3200 m, 5 viii 1955, *Nair & Webster* 6365 (RAW).

KASHMIR: Nubra, 3350 m, 6 ix 1848, *T. Thomson* (K); Skardo, 2745 m. *C. B. Clarke* 2998C (BM); Ashkoley, 3200 m, 10 viii 1876, *C. B. Clarke* 30325A (BM); Shaganthang Valley, 3050–3350 m, 18 vii 1892, *Duthie* (E, BM).

INDIA: Lahul, without locality, *Jaeschke* 68 (K); Simla, *Drummond* 26126 (K); Kyelang, 3350 m, vii 1938, *Bor* 8730 (E, K), 9217 (E, K); Kandey, 3655 m, 12 vii 1941, *Bor* 9926 (E); Gondla, 3050 m, 8 vii 1938, *Bor* 12444 (holo. E, iso. K); Ishushal, Chenab valley, 3050 m, 25 vii 1933, *Rup Chand* 455 (MICH); Dilburig 3655 m, 9 viii 1933, *Rup Chand* 9A (MICH).

Although he did not publish an account of it, this species was noticed by Clarke for his specimens 29987 and 30325 at the British Museum bear the note in his own hand "*A. altaicus*, but I can find no ray". The ray flowers are not merely reduced to inconspicuousness as sometimes happens in species of *Aster* and *Erigeron*; none has been found in any of the specimens examined.

This species is clearly related to *H. altaicus*, but is more distinctly woody, more finely pubescent and less obviously glandular. The lobes of the disc flowers are longer and the disparity between the longer and the shorter lobes is greater than in *H. altaicus*. As the break between the radiate and the eradiate condition is a sharp one without intermediates, these differences seem to warrant specific recognition.

Stewart's specimen from Baluchistan is to some extent similar in habit to *H. altaicus* var. *canescens;* the capitula are smaller (0·9–1 cm broad) and the upper leaves decrease gradually in size, the uppermost being about 1 mm broad.

Confusion has arisen on several occasions between this species and *Pulicaria angustifolia* DC., specimens of both have been mounted together on the same herbarium sheets. It superficially resembles the latter especially in the immature condition, but *P. angustifolia* is an annual species with short

yellow ray flowers, a coroniform outer pappus and hard non-scarious phyllaries.

Boltonia L'Hérit. Sert. Angl. 27 (1788); Nees, Gen. et Sp. Ast. 234 (1832); DC. Prod. 5: 301 (1836); Benth. Fl. Hongk. 173 (1861); Benth. & Hook. f. Gen. Pl. 2: 269 (1873).

Syn.: *Kalimeris* Cass. in Dict. Sci. Nat. 24: 324 (1822); Kitamura Comp. Jap. 304 (1937); Tamamsch. in Fl. U.R.S.S. 25: 123 (1959).
Calimeris Nees, Gen. et Sp. Aster 225 (1832) p.p.; DC. Prod. 5: 258 (1836), p.p.
Asteromoea Blume, Bijdr. 901 (1826); Nees, Gen. et Sp. Aster 232 (1832); Less. Syn. 191 (1832); DC. Prod. 5: 302 (1836).
Hisutua DC. Prod. 6: 44 (1837).
Martinia Vaniot in Bull. Acad. Géogr. Bot. 12: 31 (1903) et 13: 16 (1904).

Erect branched herbs, sparsely appressed pubescent and glandular. *Leaves* alternate, elliptic, oblanceolate or obovate, entire or dentate. *Capitula* ca. 1 cm broad, solitary or in lax panicles. Involucre 2–3 seriate, imbricate or subequal; phyllaries lanceolate or oblanceolate, margins sometimes scarious. *Ray flowers* female, ligulate. *Disc flowers* hermaphrodite, tubular, 5-lobed. Anthers and styles as in *Aster*. *Achenes* compressed, margins ribbed or winged, those of the ray sometimes 3-ribbed. *Pappus* setae short ($\frac{1}{10}$–$\frac{1}{8}$ as long as disc corollas), usually with two longer lateral bristles or sometimes absent.

Bentham and Hooker (l.c.) divided *Boltonia* into three sections: *Euboltonia*, *Dichaetophora* and *Asteromoea*, the last named being Asiatic, the other two American. According to some authorities. however, the Asiatic members differ generically from the American, and, since *Kalimeris* Cass. has precedence chronologically over *Asteromoea*, the Asiatic genus has been given this name.

Primarily the classification of this group depends upon the development of the pappus and ribs of the achene. In the American species *B. asteroides* L'Hérit., the type of the genus, the achenes are compressed and have two broad membranous wings or ribs. The pappus is composed of two stout lateral bristles 1·5–2 mm long (standing above the ribs of the achene) with a ring of shorter and finer setae between them. This form of pappus is found in other American species but the bristle length becomes reduced to 0·5 mm in *B. diffusa* and the shorter intermediate setae become subpaleaceous. In *B. campestris* Hemsl., belonging to Sect. *Dichaetophora*, the bristles 0·6–0·7 mm long are much weaker and the intermediate setae often merge with the cilia on the ribs of the achene and can only be distinguished by their lack of glandular tips. There is evidence of fusion at the base of the setae to form a corona in *B. diffusa*, otherwise the setae are separate, although according to some authorities *Boltonia* is characterised by such fusions.

Among the Asiatic members the pappus may be almost completely absent or may consist of a ring of setae 0·5 mm long as in *B. lautureana* Deb., with two lateral bristles ca. 1 mm long standing above the ribs of the achene. In *B. indica* (L.) Benth. where the pappus is greatly reduced, vestigial lateral bristles (0·2–0·3 mm long) are usually present although they appear to be deciduous. Fundamentally, all those species are alike in that lateral bristles

are present in most, although sometimes vestigial, and are usually more strongly developed than the rest of the pappus. The American species differ in being more strongly ribbed and winged.

Other characters also point to a close relationship between the American and Asiatic species. Pollen grains are identical. The receptacle is more nearly conical than in true Asters. Involucral and floral details are similar. Habit is the same throughout.

There are ample grounds for retaining these species within the same genus and, if considered necessary, for dividing it into sections as Bentham did.

40. **Boltonia indica** (L.) Benth. Fl. Hongk. 174 (1861); C. B. Comp. Ind. 40 (1876); Kurz in Jour. As. Soc. 2: 193 (1877); Hook. f. Fl. Brit. Ind. 3: 249 (1881).

Syn.: *Aster indicus* Linn. Sp. Pl. 876 (1753) et Syst. Veg. Ed. 14: 762 (1784). *Asteromoea indica* (L.) Blume, Bijdr. 901 (1826); Hand.-Mazz. Symb. Sin. 4: 1088 (1936); Acta. Hort. Gotob. 12: 225 (1938). *Kalimeris indica* (L). Sch. Bip. in Zoll. Syst. Verz. Ind. Archip. 125 (1854–55); Kitamura, Comp. Jap. 1: 306 (1937).

Erect rhizomatous perennial herbs. *Stems* 30–65 cm tall, glabrous or hispidulous, striate. *Leaves* alternate, glabrescent or sparsely appressed scabrous-pubescent on both surfaces but especially on margins and veins beneath; basal leaves absent, cauline leaves 3·5–6 cm long, 0·8–1·6 cm broad, oblanceolate, acute at the apex, margin sharply 2–6 toothed above the middle, teeth mucronate. *Capitula* several, 0·6–1 cm broad, borne on peduncles up to 12 cm long, bearing several bract-like, oblanceolate or elliptic leaves 1–2 cm long, 0·6–1·2 cm broad. Phyllaries imbricate, 2–3 seriate, 2–4 mm long, 1–1·7 mm broad, oblanceolate, acute or obtuse, central part green herbaceous, glabrous or sparsely pubescent, margin membranous ciliate. *Ray flowers* 15–20, basal tubes 1·5–1·7 mm long, ligules pale purple, 1·2–1·5 mm long, 1·5–2·4 mm broad. *Disc flowers* 3·5 mm long, basal tube 1·3 mm long, lobes somewhat unequal 0·8–1·3 mm long. *Pappus* 0·1–0·2 mm long, scanty, weak, deciduous, lateral setae usually present and slightly longer. *Achenes* (those of the ray sometimes 3-angular) 2 mm long, 1 mm broad, brown, margin often paler, finely pubescent and glandular above.

TYPE: China, without locality, *Herb. Linn.* 997/42.

ASSAM: Manipur, Karong, 1065 m, ix 1950, *Rup Chand.* 3713 (E, MICH).

BURMA: Lashio, 820 m, 3 vii 1912, *Lace* 5841 (E); Changyang, 25°50′ N, 97°48′ E, 455 m, 13 vii 1939, *Kaulback* 273 (BM).

The gatherings cited above agree with the specimen in the Linnaean Herbarium as to habit and details of pappus. *Rup Chand* 3713, however, may represent another variety of this species; the plant measures 28 cm tall and is more slender than *B. indica* usually is. Its leaves are thinner and more membranous and the capitula are only 6 mm broad. From localities further south in India, Bombay and Madras, there are specimens at Edinburgh Herbarium with longer (ca. 0·5 mm) and more numerous pappus setae, which probably belong to a different species, possibly *B. lautureana.* From their descriptions Clarke ("pappus brevis late paleaceus, paleis erosodentatis apice acuminatis") and Hooker ("pappus scales connate below, awned") were probably describing this species and not *B. indica.*

The possibility that *B. indica* is an adventive in India has been raised by Clarke and Hooker (l.c.). It is certainly much more common and is probably truly indigenous only in China where it occurs in situations that would appear to be spontaneous e.g. margins of thickets, open situations in forests, etc., but also as a roadside weed.

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