NOTES FROM THE
ROYAL BOTANIC GARDEN
EDINBURGH

VOLUME XXVII · No. 2 · 1967

THE GENUS PSYCHROGETON (COMPOSITAE)

A. J. C. GRIERSON

HISTORY AND REAPRAISAL OF THE GENUS

THE present paper has arisen as a result of research during the past few years into the *Astereae* of the Himalayan and adjacent areas. This work has necessitated an examination of the limits not only of *Aster* and *Erigeron* but also the several small genera that surround them. In proposing the rehabilitation of *Psychrogeton*, a natural and clearly defined genus is brought once more into perspective and should do much to reduce the confusion that surrounds the Asiatic members of *Erigeron* at the present time.

Psychrogeton was created by Boissier (1875) as a monotypic genus to accommodate *P. cabulicus* and by inference the asteroid plants with homochromous capitula in contrast to the generally heterochromous state of *Aster* and *Erigeron*. Such plants were also characterised by double pappuses and trilobed ligules. In the following year Bentham (1876) reduced *Psychrogeton* to a position of synonymy under the *Alpigeni* section of *Aster* and related it to *A. molliusculus*, adding "A Boissiero distinguitur capitulo homochromo luteo sed hic forte error latet e verbis Griffithii Itin. Not. 306 'capitulo aureo' deductus, quod forte de disco praedictum fuit."

Boissier also proposed *Erigeron* Sect. *Conyzastrum* with the following circumscription "Flores feminei omnes tenuissime filiformes truncato 2-3 dentati pluriseriales rarius uniseriales" and also his Sect. *Heterochaeta* ("flores feminei omnes ligulati") which he based on De Candolle's genus of that name. This has been taken up by K. H. Rechinger (1950 and 1955) who added Subsect. *Pseudoconyzastrum* characterised by prominent ligules. It is largely from these groups that the species now placed in *Psychrogeton* are derived.

The genus remained in obscurity until O. Hoffmann (1903) made the combination *P. turkestanicus* on the basis of Regel & Schmalhausen's *Diplopappus* and Franchet's *Aster* of the same name,* enumerating the homochromous nature of the capitulum, the numerous ligules and the sterile disc flowers as the definitive characters for separating it from *Aster*. Krascheninnikov (1936)

* Hoffmann at first (1894) followed Bentham's lead and placed *Psychrogeton* under *Aster* Sect. *Alpigeni*.

and Novopokrovsky (1938) made further recombinations derived from *Erigeron and Diplopappus* basionyms. Since that time these species have become submerged in *Erigeron* wherein they are completely unnatural and only contribute to the inconsistencies of that genus.

In none of the above publications were the characters of this group properly reviewed either as *Psychrogeton* or as *Erigeron* sect. *Conyzastrum*. The following is an emended and amplified description.

PSYCHROGETON Boiss. Fl. Or. 3: 156 (1875).

Syn: *Erigeron* Sect. *Conyzastrum* Boiss. Fl. Or. 3: 166 (1875); Rech. f. in Phyton 2 : 124 (1950) et Biol. Skr. 8 (Symb. Afghan. II): 11 (1955). *Erigeron* Subsect. *Pseudoconyzastrum* Rech: f. in Biol. Skr. 8 (Symb. Afghan. II): 17 (1055).

Perennial or more rarely biennial herbs. Rootstock usually thickly woody surrounded with a mass of leaf remains and cataphylls from current and previous years growth, sometimes thin, non caespitose and ± unlignified. Stems up to 60 cm tall but usually smaller, scapose or subscapose. Basal leaves green or greyish-white tomentose, often glandular, lanceolate, oblanceolate, obovate or rotund, entire, dentate or subpinnatifid, petiolate or subpetiolate, cauline leaves entire or dentate. Capitula seldom above 1–1.5 cm broad (measured across the tips of the phyllaries), solitary or few, rarely racemose or corymbose. Phyllaries 2–3 seriate, imbricate or ± equal in size, outer ones herbaceous, inner ones scarious margined. Ray flowers tubular or ligulate, several-many, basal tubes usually 3–4 mm long and normally more than 0·2 mm broad, ligules white, yellow or reddish, prominent or short and scarcely exceeding the pappus rarely much shorter than their styles, entire or 2–3 lobed. Disc flowers hermaphrodite (but usually functionally male), few (8–10) or numerous, similar in colour to the ray, as long as pappus and 0·5–1 mm broad (measured at the base of the lobes). Styles of female flowers linear, those of disc flowers lanceolate, unappendaged. Achenes 2–5 mm long, those of ray obovate or oblanceolate, those of disc linear, empty, rarely similar to those of female flowers. Pappus simple or, especially on sterile achenes, with a few outer bristles, sometimes obviously double.

Type: *Psychrogeton cabulicus* Boiss.

Some of the points included in this description demand clarification and others that are obviously at variance with *Erigeron* must be discussed.

The homochromous yellow or white capitula remain constant throughout the group but the reddish coloration which is also characteristic comes with ageing and desiccation. *Davis* 763K (*P. persicus* Boiss.) records "flowers yellow" yet on the specimens they are distinctly red. Other specimens of different species may be observed in which the majority of heads have yellow flowers but that a few, obviously the oldest capitula, have red flowers. The same ageing effect is no doubt responsible for the confusion manifest in the case of *Baillie & Dunsheath* 57. Flower colour is recorded as "yellow" then in another hand the note has been added "but N.B. that one plant had purplish ligules when received at Kew!" Hoffmann (l.c.) has already alluded to this change of colour and other instances have been observed elsewhere, e.g. in Orchidaceae, but not in *Erigeron* s. str.

Breadth of flowers is a valuable general guide to affinity in the *Astereae*. Here the tubes of the pistillate flowers are commonly 0·2 mm broad whereas 0·1 is general in *Erigeron*. The ligule itself when present may measure up to 2·5 mm broad: *Erigeron* seldom attains even 1 mm. The disc flowers are often more than 0·5 mm broad whereas those of *Erigeron* are seldom more than half this breadth. In respect of size, therefore, *Psychrogeton* resembles *Aster* much more than it does *Erigeron*.

The greatest weight of evidence for separating *Psychrogeton* from *Erigeron* and *Aster* rests, as Hoffmann (l.c.) found, with the sterility of the disc achenes. Leaving aside chance unfertilised achenes, there is no case known in the latter genera in which all the disc achenes are sterile (narrow, linear and without embryos) as they are in *Psychrogeton*. Among its twenty species, however, there are three exceptions (*P. brachyspermus, chionophilus and obovatus*) in which the achenes of the bisexual flowers are comparable in shape and size with those of the female flowers and appear to be as fertile. They are closely related to other "normal" species so far as habit, flowers form and coloration are concerned and cannot be regarded as other than members of this genus. *P. chionophilus* is in any case unstable so far as this character is concerned: in the majority of specimens examined the disc achenes are apparently fertile but in one gathering they are obviously sterile.

The styles of the bisexual flowers in the majority of species bear only elongated club-shaped collecting hair cells but in the three exceptional species listed above the styles of the bisexual flowers resemble those of other asteroid genera in that there are lines of small pointed receptive hairs near the point of bifurcation of the style branches in addition to the collecting hairs (see Pl. 3).

Geographically, *Psychrogeton* is a relatively compact genus having as its centre the Pamir-Hindu Kush region and extending from there into Persia, Afghanistan, Turkestan and N. W. Himalaya with two species only (*P. amorphoglossus* and *nigromontanus*) occuring in Kurdistan. Its distribution thus resembles those of *Eremurus* and *Eremostachys*. Several species of *Psychrogeton*, however, are discontinuous or apparently so. For example, *P. amorphoglossus* occurs separately in Kurdistan, in several scattered regions in Iran, in E. Afghanistan and Turkestan. *P. obovatus* in scattered stations in Iran and has one record in Afghanistan. In some places these discontinuities represent lack of collecting, in others the lack of suitable habitats.

THE DELIMITATION OF PSYCHROGETON FROM CONYZA AND OTHER GENERA

In the *Astereae* the genera, unless one is well acquainted with them, are often difficult to recognise and additionally, in Central Asia, several splinter genera have been created from the larger members sometimes on flimsy and insufficient evidence. It is dangerous to advocate the abandonment of such genera without thorough revision but, from the present series of studies; it would seem that *Krylovia* Schischk. (based on disc flower dentation and the ratio of achene to pappus lengths) and *Asterothamnus* Novopokr. (based on woody habit and various leaf characteristics) are suspect and require more critical comparison with *Aster* and *Erigeron*. The present discussion, however, limits itself to classical and long established genera, but the necessity for

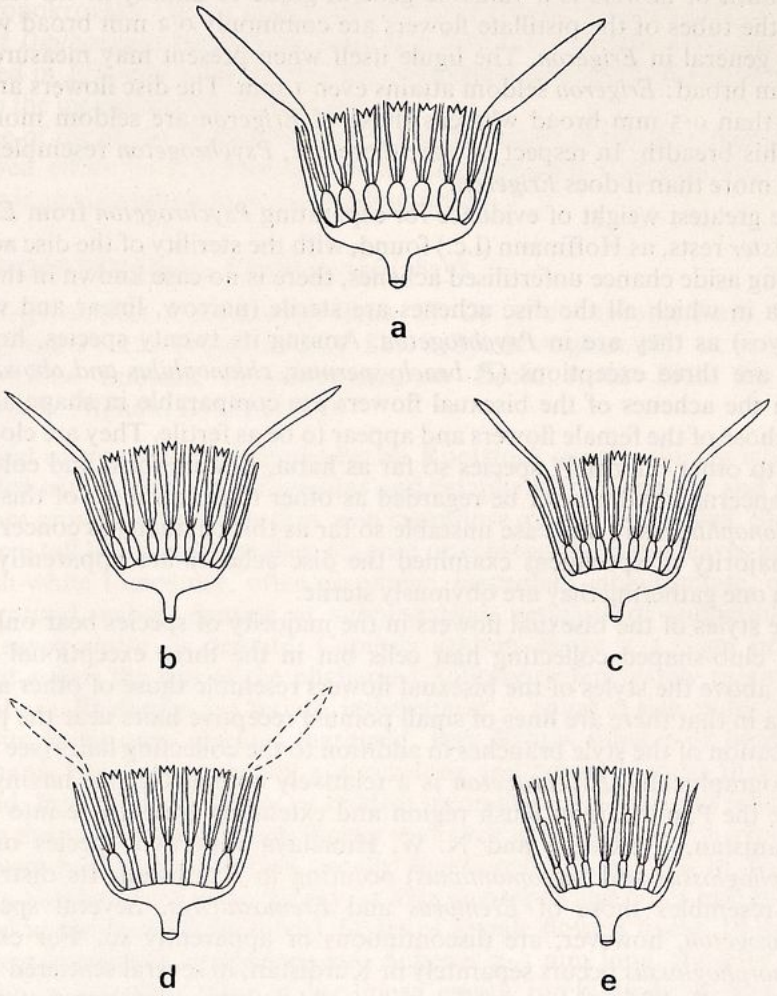
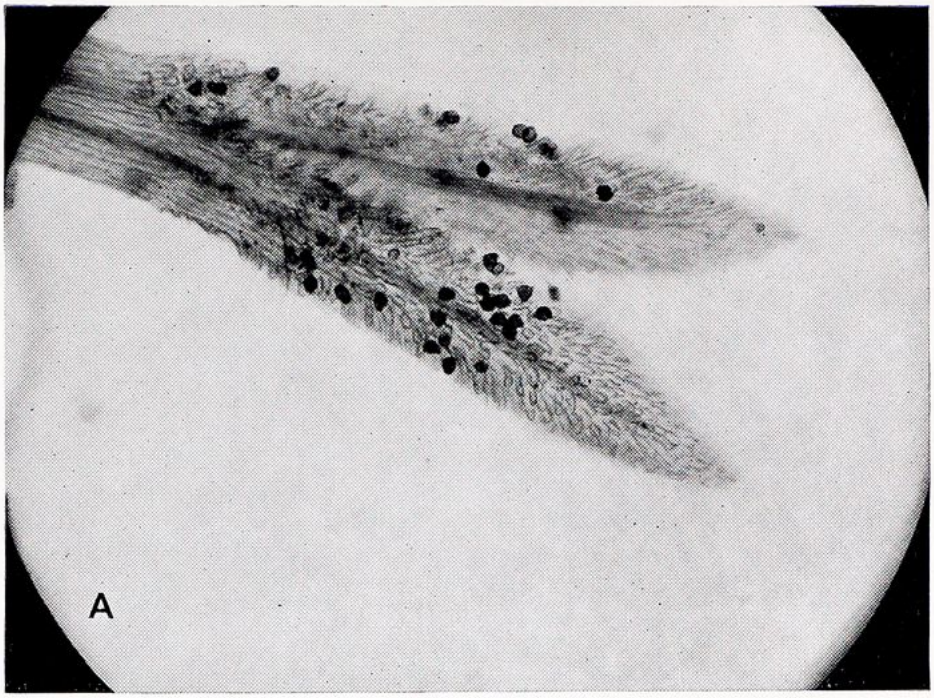


FIG. 1. Diagrammatic representations of capitula summarising the differences that exist between *Psychrogeton* and the three principal Asiatic genera allied to it: *Aster*, *Erigeron and Conyza*. These show (A) *Aster* relatively larger flowers, those of the disc generally with obvious basal tubes and larger obovate achenes; (B) *Erigeron* s. str. flowers and achenes narrower, (rays generally more numerous), disc flower corollas without obvious basal tubes; (C) *Erigeron Trimorphaea* with similar floral proportions but with an intermediate series of eligulate female flowers. (D) *Psychrogeton* the marginal female flower achenes only fertile, those of the disc linear and sterile: ligules dotted to indicate that female flowers may be tubular or ligulate to some degree. (E) *Conyza* with numerous female flowers the corollas of which are mostly shorter than the pappus and the relatively few hermaphrodite flowers; the achenes here are more oblong than in the other genera.

clear delimitation from neighbouring taxa and for exploring in advance all possible sources of confusion is obvious when proposing the re-establishment or creation of such genera (See fig. 1).

Possible confusion may arise in *Psychrogeton* in the case of the broad liguled species (*P. cabulicus*, *andryaloides* and *rotundifolius*) because of their superficial resemblance to *Aster* and, similarly, the narrow liguled species (*P.*



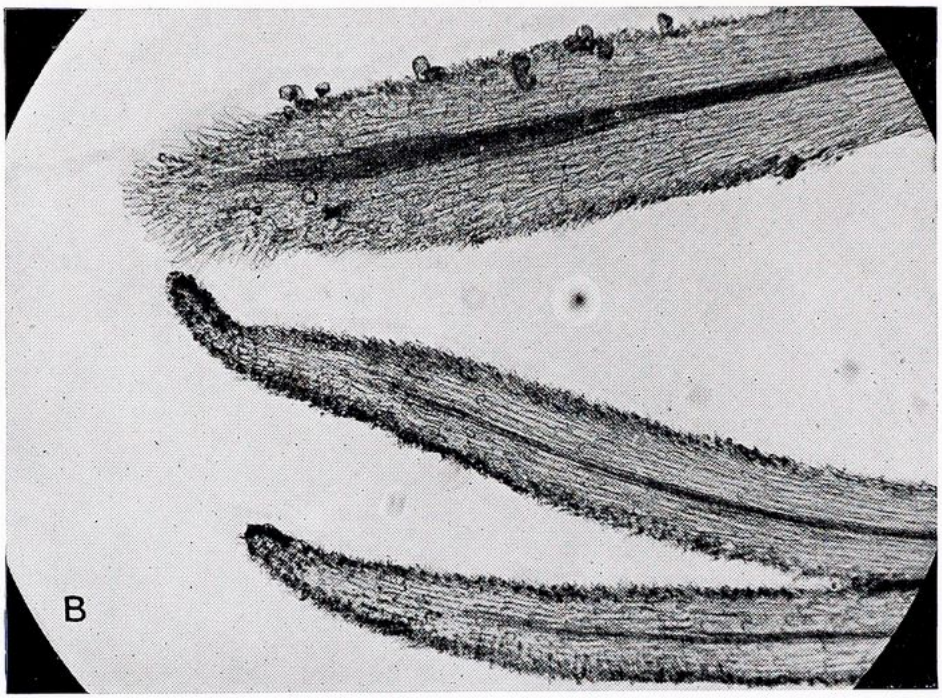


PLATE 3. Styles of *Psychrogeton* species.
A, Style branches of a bisexual flower of *P. amorphoglossus* showing large collecting hairs only. B, style branches from a female flower of *P. obovatus*, above, with small receptive hairs only, and, below, the inner surface of a single style branch from a bisexual flower of the same species showing receptive hairs along much of its length and collecting hairs only at the apex.

biramosus, *primuloides* and *pseuderigeron*) may be mistaken for Erigerons. These species, however, are clearly distinct from both genera by reason of the basic generic characteristics of *Psychrogeton* (the homochromous flowers that turn reddish on drying, the sterile disc achenes, etc.). There is, in truth, little chance of error following on precise examination.

It is in the fourth group of species (see Arrangement of Species, p. 108) that difficulty may be expected. *P. aucheri* and *P. nigromontanus* are both tall erect herbs and, being biennials or short-lived perennials, are less woody than the majority of Psychrogetons. The inflorescences are racemose or corymbose and, as the female flowers are shorter than the pappus, the possibility of confusion with *Conyza* is likely. The basic generic differences do not provide an immediate solution since the achenial characters of both are to some extent similar: several species of *Conyza* have been found to have sterile achenes, though without the slender proportions of those of *Psychrogeton*, and evidence of reddening following floral desiccation has been observed in one species of *Conyza*. The differentiation between these genera must therefore be elaborated, for, although there can be no doubt here concerning the exclusion of the prominently liguled species from *Conyza*, it must be remembered that over half the species of *Psychrogeton* are without such ligules and could conceivably be classed as Conyzas. For this reason, the following table of generic differences based on a survey of *Conyza* specimens at Edinburgh and Kew is offered.

Psychrogeton	*Conyza*
Perennial or sometimes biennial herbs (e.g. *P. aucheri* and *rotundifolius*).	Annual and biennial herbs, sometimes perennials rarely shrubs (e.g. *C. spinosa* Sch. Bip. & *C. incana* (Vahl) Willd.
Rootstock usually thick branched and woody caespitose; simple in biennial species.	Rootstock usually simple tapering hardly lignified rarely branched and woody never caespitose.
Acaulescent or short stemmed species with numerous basal leaves; sometimes tall stemmed (up to 1m. e.g. *P. aucheri*) then cauline leaves strongly developed.	Well developed stems (up to 2m. tall) always present. Cauline leaves always present sometimes with basal leaves e.g. *C. japonica*.
Generally monocephalous or with few capitula e.g. *P. obovatus*. Capitula sometimes numerous corymbose or paniculate e.g. *P. aucheri*, etc.	Capitula 10–∞ corymbose or paniculate seldom in racemes e.g. *C. gnaphalioides* H. B. K., very rarely monocephalous (unnamed specimens from Reunion Isl. at Edinburgh).

Psychrogeton	*Conyza*
Flowers homochromous yellow or whitish becoming red or purplish on fading.	Flowers homochromous or sometimes non-descript in colour not reddening on fading except in *C. japonica* and *C. viscidula*).
Female flower corollas ligulate or tubular longer or as long as pappus rarely (*P. nigromontanus*) ½–⅔ as long as style.	Female flower corollas ligulate or tubular, as long as pappus but often only ½–⅔ as long as style.
Female flower as many as or 3–4 times more numerous than bisexual flowers.	Female flowers 6–10 times more numerous than bisexual flowers rarely, e.g. *C. canadensis*, only 2–3 times more numerous.
Achenes of female flowers fertile 2–4 mm long compressed oblanceolate or obovate. Achenes of bisexual flowers flat, narrowly linear, sterile; rarely apparently fertile and similar in shape to female flower achenes.	Achenes of female flowers fertile mostly ca 1 mm long, seldom 2 mm, ovate rarely oblanceolate. Achenes of bisexual flowers generally sterile, cylindrical or similar in shape to fertile achenes.
Pappus setae on fertile achenes more numerous than on sterile ones.	Pappus setae of female flower achenes fewer than on bisexual flower achenes.
Veins of flowers and achenes not resinous coloured.	Veins of flowers and achenes resinous coloured.

Two aspects of this survey require amplification: the proportional distribution of sexes in the capitula and the degree of sterility in the bisexual flower achenes.

In counts made of constituent flowers within each capitulum the following results and proportions were obtained. As this study was made on herbarium specimens these results are based on one or a few capitula of each species for obvious reasons.

Psychrogeton	*Conyza*
andryaloides; 62♀, 54☿ (1½ : 1)	*chiliensis;* (type of genus) 290♀, 53☿ (6 : 1)
aucheri; 64♀, 29☿ (2 : 1)	*gouanii;* 212♀, 14☿ (15 : 1)
alexeenkoi; 28♀, 7☿ (4 : 1)	*ivifolia;* 170♀, 8☿ (21 : 1)
amorphoglossus; 49♀, 16☿ (3 : 1)	*stricta;* 56♀, 4☿ (16 : 1)
cabulicus; 26♀, 54☿ (2 : 1)	*japonica;* 208♀, 21☿ (10 : 1)
rotundifolius; 25♀, 20☿ (5 : 4)	*viscidula* 152♀, 3☿ (50 : 1)
	canadensis; (results variable) 46♀, 2☿, (23 : 1) 51♀ 17☿ (3 : 1)

Sterility of the bisexual flower achenes was tested only by the presence or absence of embroyos. In this respect the species of *Psychrogeton* were found to be consistently sterile except in *P. chionophilus* and *brachyspermus* which have bisexual flower achenes that are apparently identical with those of the female flowers. In *Conyza*, bisexual flower achenes of *C. japonica*, *plebeja*, *stricta* and *viscidula* were found to be consistently empty but *C. canadensis* and *C. bonariensis* (both members of Sect. *Coenotus*) had only 1 out of 5 and 2 out of 11 sterile achenes respectively. In shape, the bisexual flower achenes of *Conyza* are oblong resembling the immature female achenes and are unlike the elongate linear flattened sterile achenes of *Psychrogeton*. It should also be noted that these characters, i.e. sterility and shape of the central achenes, are those that most readily distinguish this genus from *Aster* and *Erigeron*.

The conclusions derived from the above survey are in line with those which Cronquist (1943, 1947) drew up to separate *Conyza* from American Erigerons. The development of *Psychrogeton* is parallel to that of *Conyza* so far as the sterilisation of the central achenes is concerned but without the increased number of female flowers or the diminished number of bisexual flowers that are characteristic of that genus, *Psychrogeton* is therefore understood as having sprung from the *Conyza-Erigeron-Aster* stock, having affinities with all three but being generally more closely allied to the first two and, so far as the tall stemmed species are concerned, resembling Conyzas.

As they stand at present, the three other asteroid genera with which *Psychrogeton* might be confused, *Brachyactis*, *Lachnophyllum* and *Chamaegeron*, are readily separated on the grounds of their heterochromous flowers or because of their fertile disc achenes. They are an anomalous group of genera the relationships of which are difficult to understand although in the case of *Lachnophyllum* and *Chamaegeron* these may lie with *Erigeron*.

The asiatic species of *Brachyactis* are themselves discordant: *B. pubescens* (DC.) Aitch. & Clarke (*B. robusta* Benth.) should possibly be a *Conyza* (*C. pubescens* DC.) as Gray (1880) pointed out, and so probably should *B. roylei* (DC.) Wend. *B. menthodora* (*Conyza anomala* DC.), on the other hand, is clearly no *Conyza* on account of its prominent ray flowers and is possibly the only Asiatic member of the Astereae that has decurrent leaves. The affinities of this species are difficult to assess but seems to have little in common with *B. ciliata* Bunge, the type of this genus.

Brachyactis has long remained difficult to place and, as a genus, poorly characterised. Cronquist & Keck (1957) pointed out that *B. ciliata* has affinities with *Aster exilis* and *A. subulatus* and consideration should be given to the possibility of uniting these anomalous species as a separate genus. The question of including *Aster tripolium* in such a genus, which Cronquist & Keck also suggest, seems, however, less possible.

ARRANGEMENT OF SPECIES

The species of *Psychrogeton* fall roughly into four groups of relationship which are founded partly on vegatative and partly on floral characteristics. Although these groups are arranged in favour of the prevailing reduction in size of the female flowers, conspicuously liguled species are found to occur in three separate groups because of other obvious relationships. Arrangement according to vegetative and inflorescence characters alone (corymbose

inflorescences with several cauline leaves similar to the basal leaves leading to plants with solitary capitula and cauline leaves few and dissimilar to the basal leaves) such as Solbrig (1960) was able to employ in the case of South American Erigerons, here appears to run contrary to the course of floral evolution. The recognised groups are as follows:

I. *P. cabulicus*, *andryaloides*, *rotundifolius*

This group is characterised by prominent ligules 1–2 mm broad (the ligules of other prominently liguled species measure less than 1 mm broad). Two of the species, *P. andryaloides* and *P. cabulicus*, are closely related and agree in having woody rootstocks. The third species (*P. rotundifolius*) has thin roots suggestive of short lived perennials. In *P. andryaloides* the peduncles are monocephalous and bear few narrow leaves which are dissimilar to the basal leaves. *P. cabulicus* has branched peduncles but the branches bear solitary capitula. In *P. rotundifolius*, which bears little relationship to the other species of this group, the peduncles are branched each branch generally bearing two capitula, and the cauline leaves are similar to the basal ones.

II. *P. amorphoglossus*, *candidissimus*, *alexeenkoi*, *lumbricoides*, *primuloides*, *olgae*.

These are characterized by inconspicuously liguled female corollas which are shorter than the pappus. Their rootstocks are in general thickly woody but those of *P. olgae* and *P. primuloides* are slender. Flower stems are usually unbranched except in *P. candidissimus* and cauline and basal leaves are dissimilar. The relationship between these species is obvious and their connection with the first group is established by the close resemblance between *P. andryaloides* and *P. amorphoglossus*. *P. primuloides* has prominent ligules.

III. *P. obovatus*, *sphaeroxylus*, *drabiformis*, *persicus*, *aellenii*, *chionophilus*, *brachyspermus*.

The female flowers here are tubular and lobed at the mouth but hardly ligulate. The species are almost equally divided on the state of the rootstock: Those of *P. obovatus*, *sphaeroxylus* and *drabiformis* are thickly woody, the remainder are thin. In *P. sphaeroxylus* and *drabiformis* the cauline leaves are few and unlike their basal counterparts; in the other species they are several and similar throughout. Peduncles are generally monocephalous with the exceptions of *P. persicus* and *P. obovatus* where two or more capitula may be borne at the ends of the branches. Certain luxuriant specimens of *P. persicus* may be confused with those of *P. aucheri* providing a link between this group and the next.

IV. *P. biramosus*, *pseuderigeron*, *aucheri*, *nigromontanus*

The species in the previous groups seldom attain 15 cm in height, here they are generally taller, up to 90 cm, and usually bear more than six capitula in corymbs or racemes at the ends of the stems or branches. The stems furthermore are generally leafy and the leaves are similar throughout. *P. biramosus* and *pseuderigeron* have ligulate female corollas; those of *P. aucheri* and *nigromontanus* are tubular and shorter or as long as the pappus. In duration the plants of this group are biennials or short lived perennials and are not conspicuous in their development of woody rootstocks.

ACKNOWLEDGEMENTS

The author is indebted to the Directors and Curators of the following herbaria for the facilities they made available for loan of material and, in some cases, for study at their institutes: The British Museum (Natural History) (BM); The Forest Research Institute and College, Dehra Dun, India (DD); The Conservatoire et Jardin botanique, Geneva, Switzerland (G); The Botanical Institute of the Academy of Sciences of the U.S.S.R., Leningrad (LE); The Royal Botanic Gardens, Kew (K); The Botanische Staatssammlung, Munich (M); The Botanik Museum, Oslo (O); The Herbarium of the University of Michigan, U.S.A. (MICH); The Museum National D'Histoire Naturelle, Paris (P); Gordon College, Rawalpindi, Pakistan (RAW); The Naturhistorisches Museum, Vienna, Austria (W).

KEY TO THE SPECIES OF PSYCHROGETON

1. Female flowers ligulate, corollas at least more than 1.5 mm longer than the pappus 2
+ Female flower corollas (ligulate or tubular) shorter, or slightly longer than the pappus 7
2. Stems 15–20 cm tall bearing several—many capitula in loose racemes or corymbs. Cauline leaves relatively well developed and numerous 3
+ Stems or peduncles usually less than 15 cm tall (rarely 30 cm), generally monocephalous but sometimes with 2–3 capitula. Cauline leaves few 4
3. Leaves stiffly pilose, coarsely toothed. Capitula 1–1·5 cm broad 18. *P. pseuderigeron*
+ Leaves softly pubescent, entire margined. Capitula ca 1 cm broad 17. *P. biramosus*
4. Plants not caespitose, crowns simple. Roots thin, possibly biennial 5
+ Plants caespitose, crowns branched. Roots thick, woody obviously perennial 6
5. Stems lax, ca 20 cm tall. Leaves rotund or orbicular. Capitula 0·8 cm broad; phyllaries 1–2 seriate . . . . 3. *P. rotundifolius*
+ Stems decumbent or erect ca 10 cm tall. Leaves obovate. Capitula 1.5 cm broad; phyllaries 3–4 seriate . . . . . 9. *P. primuloides*
6. Leaves lanceolate, entire. Indumentum sparsely pilose becoming bristly at base of capitula. Ligules always yellow . . . 1. *P. cabulicus*
+ Leaves obovate or oblanceolate, margins ± coarsely dentate, rarely entire. Indumentum lanate—tomentose especially at base of capitulum, rarely almost glabrous. Ligules whitish or yellow. . 2. *P. andryaloides*
7. Stems 15–20 (–90) cm tall bearing several to many capitula in loose racemes or corymbs 8
+ Stems or peduncles generally less than 15 cm tall, monocephalous or sometimes 2–3-cephalous 9
8. Female flower corollas $\frac{1}{2}$–$\frac{2}{3}$ as long as styles. Bisexual flowers 6–12 per capitula . . . . . 20. *P. nigromontanus*
+ Female flower corollas as long as styles. Bisexual flowers 10–35 per capitula . . . . . 19. *P. aucheri*

9. Rootstock thickly woody, usually branched and densely caespitose 10
+ Rootstock slender, unbranched, non-caespitose . . . 16
10. Indumentum greyish or whitish tomentose, glandular or eglandular 11
+ Indumentum pilose and glandular but not tomentose . . 12
11. Indumentum appressed white tomentose, eglandular. Peduncles 1–3 cephalous; capitula up to 1 cm broad . . 6. *P. candidissimus*
+ Tomentum greyish interspersed with glistening subsessile glands. Peduncles monocephalous. Capitula 1–1·5 cm broad 4. *P. amorphoglossus*
12. Plants usually ca 10 cm tall. Indumentum almost purely glandular 13
+ Plants often only ca 5 cm but sometimes as much as 20 cm tall. Eglandular pilose hairs ubiquitous among subsessile glands or confined to leaf margins or undersides, but always obvious 14
13. Female flower corolla tubes deeply cut lengthwise, ligulate. Cauline leaves few, entire margined. Involucre imbricate but not strongly so 7. *P. alexeenkoi*
+ Female flower corollas ± tubular to apex. Cauline leaves numerous, coarsely toothed. Involucres distinctly imbricate. 8. *P. lumbricoides*
14. Stems often 2–3–cephalous. Phyllaries subequal, outer ones 1–5 mm broad. Cauline leaves numerous, oblanceolate or elliptic. 10. *P. obovatus*
+ Stems monocephalous. Phyllaries imbricate, outer ones 1 mm broad or less. Cauline leaves otherwise 15
15. Leaves obviously dentate. Cauline leaves absent or solitary, linear, bractlike. Phyllaries linear – acuminate, ca 0.5 mm broad. Bisexual flower corolla lobes setose. . . . 12 *P. drabiformis*
+ Leaves crenate or roundly toothed. Cauline leaves several. Phyllaries oblong, subacute, ca 1 mm broad. Bisexual flower corolla lobes glabrous 11. *P. sphaeroxylus*
16. Indumentum lanate tomentose . . . . . 5. *P. olgae*
+ Indumentum pilose and glandular but not tomentose . . 17
17. Lower leaves linear-oblanceolate, entire . . 14. *P. aellenii*
+ Lower leaves oblanceolate or obovate, margins crenate or denate 18
18. Flowering stems usually 2–3–cephalous 13. *P. persicus*
+ Flowering stems monocephalous 19
19. Leaves 3–5 cm long. Peduncles ca 10 cm tall. Female flower corollas ca 0.5 mm longer than pappus. . . . 16. *P. brachyspermus*
+ Leaves 1–2 cm long. Peduncles less than 5 cm tall. Female flower corollas shorter than pappus . . . . 15 *P. chionophilus*

1. Psychrogeton cabulicus Boiss. Fl. Or. 3: 156 (1875); Novopokr. in. Not. Syst. URSS 7: 135 (1937) et ex Nevski in Acta Inst. Bot. Acad. Sci. URSS Ser. 1, Fasc. 4: 278 (1937).

Syn.: *Diplopappus turkestanicus* Rgl. et Schmalh. in Acta Hort. Petrop. 5: 615, (1878); O. et B. Fedtsch. Consp. Fl. Turkest. 4: 162 (1911).
Aster turkestanicus (Rgl. & Schmalh.) Franch. in Ann. Sc. Nat. Ser. 6, 16: 303 (1883).
Erigeron turkestanicus (Rgl. & Schmalh.) O. Fedtsch. in Acta Hort. Petrop. 21: 341 (1903).
Psychrogeton turkestanicus (Rgl. & Schmalh.) Hoffm. in Vidensk. Meddel. Nat. Foren. Kbhvn. 145 (1903).
Erigeron psychrogeton M. Pop. in Acta Inst. Bot. Acad. Sci. URSS Ser. 1, Fasc. 7: 8 (1948), in clavi.

Erigeron dichrous M. Pop. in Trud. Uzbek. 14: (1941).
Erigeron edelbergii Rech. f. et Koeie in Biol. Skr. 8: 2 (Symbolae Afghanicae II) 18, fig. 9 et 15a (1955).
Erigeron koelzianus Rech. f. l.c. 18, figs. 10 et 15b.
Erigeron cabulicus (Boiss.) Botsch. in Fl. URSS 25: 277 (1959).
Erigeron dolichostylus Botsch. in Fl. URSS 25: 278 et 588 (1959).

Fig. 2,a.

Erect or decumbent perennial herbs. Rootstock thick, branching, woody, bearing unbranched or, more usually, once or twice branched peduncles 5–30 cm tall, indumentum softly or stiffly pilose with or without subsessile glands, hairs generally becoming more bristly and glands more abundant at the base of capitula. Cataphylls yellowish (in sicco) sometimes withered, linear-spathulate, 1–1·5 cm long, entire margined. Radical leaves lanceolate or linear-lanceolate, 3–10 cm long (including petiole 1–5 cm long) 0·5–1 cm broad gradually attenuate below into petiole, acute at the apex, margin entire, very rarely with one or two minute denticulations on each side, cauline leaves similar in shape becoming sessile. Capitula solitary at the apex of branches 1·2–1·75 cm broad; phyllaries 3 seriate, subequal, linear-lanceolate, acuminate usually 50–60, (4–) 6–6·5 mm long 0·8–1 mm broad, Female flowers ligulate, ca. 30(–100), yellow, basal tube (2·2–) 3–3·5 (–4) mm long, ligule 2–3 mm long 0·6–2 mm broad. Disc flowers bisexual, tubular, 5–lobed, 4–4·7 mm long, lobes 0·7–0·9 mm long. Fertile achenes 3·2–3·6 mm long 0·6–1·2 mm broad narrowly obovate, finely sericeous. Pappus double, outer setae few ca 0·8 mm long, inner setae 25–35, scabrous, 4–4·5 mm long.

AFGHANISTAN: Gorge to Sar-i-Chasme, *Griffith* 910 (K); Summit of Hajeekuk, 3470 m, *Griffith* 1052 (Holo. G, K?); Khash Distr. 3050 m, 9.viii. 1937, *Koelz* 12983 (W, Holo. *E. koelzianus*): Lorinj Pass, 3050 m, 27.viii. 1939, *Koelz* 13736 (W); Deh Kundi, Sar-i Nil, 3000 m, 7. vi. 1949, *Edelberg* 1941 (W, Holo *E. edelbergii*); Nuristan, Netshingel, 4000 m, 16. vii. 1949, *Edelberg* 2007 (W): Dadali, 22. vii. 1959, *Lindberg* 705 (W): Bamian, Band-i Amir ca. 34°23′ N, 67°17′ E, 2800–2900 m, 13–14. vii. 1962, *Rechinger* 18266 (W); Band-i Amir, ad lacum Band-i Panir, ca. 34°23′ N 67°17′ E, ca. 2800 m, 14. vii. 1962, *Rechinger* 18405 (W); Kabul, Unai, Kuh-i Qhalandaran, rocky limestone slopes, 3700 m. 24. vi. 1962, *Hedge & Wendelbo* 4495 (E)

TADZHIKISTAN: Artscha-bulak, 6. vii. 1878, *Kuschakewicz* sn (E,M); Szussamyr, 3050–3655 m, vii 1881, *Fetissow* sn (E); Servaschan Passrut, 2135–2440 m, vi-vii 1882, *Regel* sn. (E,M); same locality, 14 viii 1954, *Molyakov* 576 (LE); Alai Tagh Range, 20 vii 1930, *Jusepczuk* 737 (LE); Kafinahan River, 23 vii 1939, *Afanassjev* 132 (LE); Badakshan, Basin of Kaindy River, *Tsvelev* 1435 (LE); Hissar Range, Anzob, 6 viii 1960, *Egorova* 2303 (LE).

KIRGIZ: Tian-Shan, 2440-3655 m, *Kuschakewicz* sn. (LE, syntype of *Diplopappus turkestanicus*); in alpibus, 1871, *O. Fedtschenko* s.n. (LE—syntype of *Diplopappus turkestanicus*).

TURKMENIYA: Kopetdag mountains, ad cacumen m. Rizazasch (or Risarasch), in rupibus, 2700 m, 10. vii. 1898, *Litwinov* 1492 (LE, holo *E. dolichostylus*). Also from this republic, Novopokrovski (in Acta Inst. Bot. Acad. Sci. URSS

Ser I, Fasc. 4, 278: 1937) cites the collection of *P. cabulicus* by B. A. Fedtschenko on the Kuhitang Range.

P. cabulicus is a widespread and variable species as the description and citation show. There is, however, some pattern in this variation. Griffith's type specimen is a plant of more than 15 cm tall (the main shoots are broken); the peduncles are branched and bear at least three capitula. The rootstock and

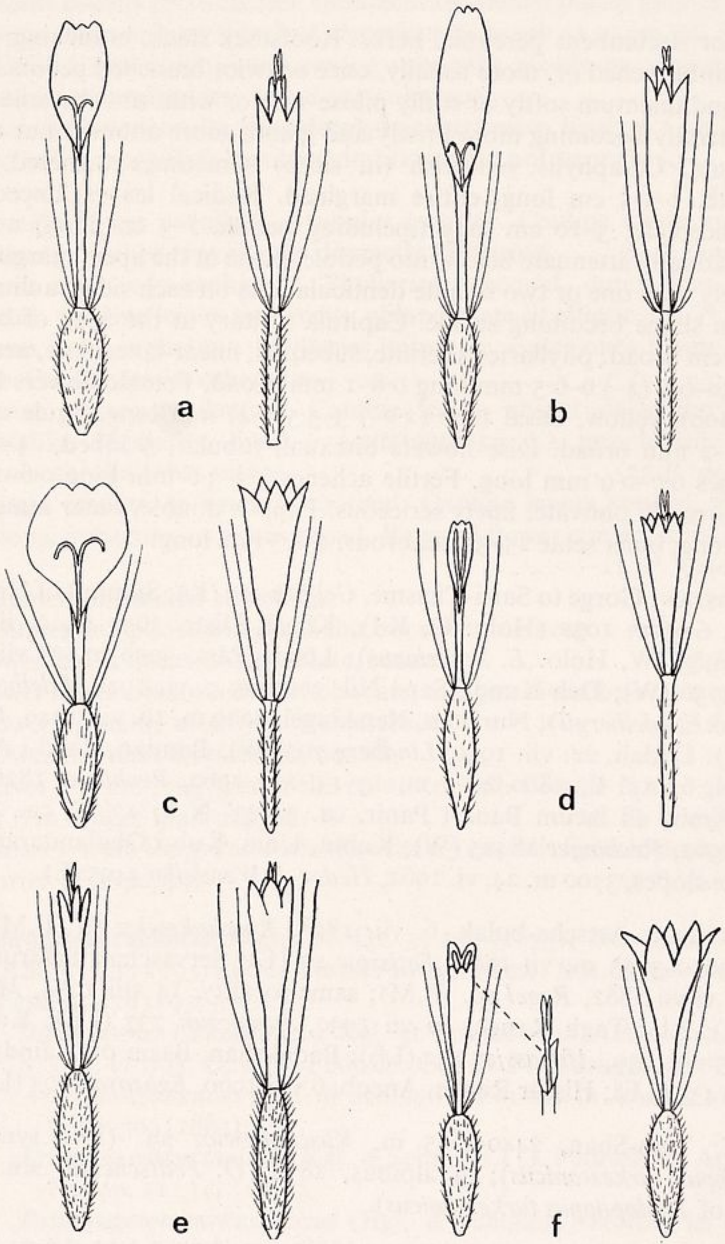


FIG. 2. Drawings of female and hermaphrodite flowers of A. *P. cabulicus*, B. *P. andryaloides;* C. *P. rotundifolius;* D. *P. amorphoglossus;* E. *P. obovatus;* F. *P. chionophilus.* (all × 6.The number of pappus setae reduced throughout.)

crown of the plant are thick and woody. This is the general form of the species in Afghanistan; Rechinger's *Erigeron edelbergii* and *koelzianus* are identical with it.

In the adjoining Soviet Republics of Tadzhikistan and Kirghiz the species is rarely as tall as 15 cm and average 8-10 cm. The leaves and capitula are also smaller than in the Afghanistan plants. Such specimens were originally designated *Diplopappus turkestanicus* and a case might be made for their recognition as a diminutive subspecies of *P. cabulicus*.

Litvinov's specimen is the only one to have been examined from Kopetdag. It is much closer to the Afghan form as regards stature and size of parts although somewhat less woody. The grounds for its segregation as *Erigeron dolichostylus* because of the longer styles of the female flowers and the inrolling of the ligules seem to be insufficient. Reflexing or inrolling of ligules might be regarded as a sound taxonomic character if it could be shown to be a regular feature of a particular taxon and one that may be observed in the living state. Here the observation is based on one collection of dried flowers and it seems to be a widespread phenomenon among ligules of the *Astereae* that they are held erect or horizontal in flower and only on fading do they collapse and inroll.

The proportions of the female corollas show some variation as the above description shows and their styles are likewise variable: the measurements range from 4·2–5.2 mm. Litvinov's specimen is remarkable in that the styles attain 6 mm, but this is insufficient reason for specific distinction even with the geographical separation that appears to exist.

The leaf margin appears to be critical in the differentiation of this species from *P. andryaloides* (see also the notes following the description of the latter species). It has been described as entire in *P. cabulicus* and, in almost all specimens examined, this is completely true but, as Botschantzev (l.c.) points out in his description, some specimens, e.g. *Rechinger* 18405, have a few leaves with one or two widely spaced denticulations on either side. For this reason *Erigeron koelzianus* was differentiated although so poor is the condition of the type specimen that denticulations are hardly apparent on its leaves. Such minute teeth must be interpreted as demonstrating a minor, and possibly ontogenetic, instability in the leaf form of this species and not as a contradiction of the specific criteria.

In general, *P. cabulicus* is to be recognised by its woody rootstock, entire (or almost always entire) margined lanceolate leaves, simple or often branched peduncles, pilose or stiffy pubescent indumentum which usually becomes bristly at the base of the capitula and by its regularly yellow ligules. It differs most conspicuously from *P. andryaloides* (q.v.) which it most closely resembles in habit, leaf shape and indumentum.

2. Psychrogeton andryaloides (DC.) Novopokr. ex Krasch. in Acta Inst. Bot. Acad. Sci. URSS. Ser. 1, Fasc. 3: 343 (1937) in obs.

Syn.: *Conyza andryaloides* DC. Prod. 5: 377 (1836).

Fig. 2,b.

Dwarf caespitose perennial herbs. Rootstock often thickly woody. Cataphylls generally present, oblong, 0·5–1 cm long, dentate or crenate at the apex

Basal leaves lanceolate, oblanceolate or obovate, rarely elliptic, ± distinctly petiolate, sparsely or densely lanate-tomentose interspersed with subsessile glistening glands, rarely almost glabrous. Lamina 1·5–4 cm long 0·5–1·5 cm broad, acute or obtuse at the apex, attenuate at the base, margins ± coarsely dentate sometimes entire, veins often prominent especially beneath; petioles 1–3 cm tall, erect, sparsely or moderately tomentose but generally densely so at the base of the involucre, and bearing 1–3 linear or oblanceolate leaves 0·5–1 cm long. Capitula 1–1·5 cm broad; phyllaries ca. 30, imbricate, 2–3 seriate, 5–8 mm long ca. 1 mm broad, lanceolate-acuminate, green in the centre, pale at the margins, outer phyllaries sparsely or ± densely tomentose. Female flowers 40-70 (–100), white or yellow, 0·8–2 mm or more longer than the pappus, becoming rose or pinkish on fading, basal tube ca. (1·6–) 2–3(–3.8) mm long, ligule 0·6–5·4 mm long. 0·7–1·2 mm broad. Disc flowers 3·8–4·2 mm long, lobes 0·6–1 mm long. Fertile achenes oblanceolate, 2·8–3 mm long 0·8 mm broad, finely sericeous; sterile achenes linear, empty. Pappus of fertile achenes simple, setae ca. 20–50, 2.6–4 mm long, white, scabrous. Pappus of sterile achenes double.

This species is widely distributed in the mountainous regions north and west of the Western Himalayas and must be the most variable of the genus. This variability is reflected in the "species" that have been divided from it, deriving from reduction in stature, thus *E. minjanensis* was separated; from variation in density of indumentum, thus *E. sanglichensis;* from leaf shape and toothing: *E. stenodon* with deeply toothed almost pinnatifid leaves and *E. paghmanicus* with toothed leaves but smaller than the latter; from variation in flower colour, *E. poncinsii* with yellow (not white) ligules. Recognition of this variability at specific level has led to confusion and, in the present paper, only three varieties are distinguished and seem sufficient to include the major and most clear cut of these variations which will be further reviewed under separate heading. The following key shows how this varietal division is achieved:

1.	Plants mostly greyish or whitish tomentose	2
+	Plants mostly glabrous and glandular . . .	var. c. *denudatus*
2.	Rays yellow	var. b. *poncinsii*
+	Rays white	var. a. *andryaloides*

2a. Psychrogeton andryaloides var. **andryaloides**

Syn.: *Conyza andryaloides* DC. Prod. 5: 377 (1836).

Erigeron andryaloides (DC.) Benth. ex Clarke, Comp. Ind. 52 (1876); Hook. f. Fl. Brit. Ind. 3: 255 (1881); Boiss. Fl. Or. Suppl. 288 (1888); Botsch. in Fl. URSS. 25: 274 (1959).

Erigeron stenodon Rech. f. et Edelb. in Biol. ‚Skr. 8 (Symb. Afgh. II) 23 (1955).

N. W. India: Ind. prov. boreali occidentali, *Royle* (G holotype, not seen, K); without precise locality, *J. L. Stewart* 384, 1743, 1755 (E); Lahoul to Ladak, on the way to Jarma, 3350 m, 7 vi 1879, *Watt* 2424 (E); Lahoul, Chandra—Bhaga confluence, 19 vi 1888, *Drummond* 22605 (E); Lahoul, Gondla, 2590 m, 8 viii 1916, *Cooper* 5343 (E); Kenlung Lake 4570m, 21 viii 1916, *Cooper* 5409

(E); Sissu, 3960 m, 5 vii 1938, *Bor* 12349 (E); Billing Lumpa, 3960 m, 12 vi 1941, *Bor* 12677 (E); Gondla, 3655 m, 5 vi 1941, *Bor* 14663 (E); Kenlung, 4570 m, 21 vi 1941, *Bor* 15423 (E).

W. PAKISTAN: Chitral, 3350 m, 3 vi 1895, *Harriss* 16249 (E); Barum Gol, Shokar shal, 3500 m, 17 vi 1950, *Wendelbo* sn. (O); Birir, 35° 38′ N, 71° 44′ E, 2590 m, 22 v 1958, *Bowes Lyon* 686 (BM, W): Ojhor, 36° 4′ N, 71° 48′ E, 3655 m, 10 vi 1958, *Bowes Lyon* 861 (BM, W); Chitral-Mastuj track, Reshun, 1829m, 15 v 1958, *Stainton* 2441 (BM); Turikho River, Istat, 3045 m, 21 v 1958, *Stainton* 2490 (BM); Agram, Arkari Gol, W. of Tirich Mir, 3350 m, 10 vi 1958, *Stainton* 2636 (BM, W); Chitral Gol, 3045 m, 14 vi 1958, *Stainton* 2676 (BM); Barum Gol, SE. of Tirich Mir, 3655 m, 28 vi 1958, *Stainton* 2676 (BM); Barum Gol, SE. of Tirich Mir, 3655 m, 28 vi 1958, *Stainton* 2776 (BM, W); Baltistan, Hushi Valley, 3655 m, 5 vii 1955, *Nasir & Webster* 5970 (RAW).

KASHMIR: Baltistan, Skardo 2040–2285 m, viii–ix 1856, *Schlagintweit* 709 (E); Gilit, 4265 m, 23 ix 1885, *Giles* sn. (E); Dorah Pass, 3350 m, 21 vi 1886, *Giles* 265 (E); Astor, near Tashing in Rupal Valley, 2440-2745 m, 22 viii 1892, *Duthie* 12504 (E); Ladakh, Khardong Pass, 4875 m, vii 1937, *C. C. Burt* 43 (E), 161 (E); Ladak, Mashoo Nullah, Leh, 3960 m, 24 vi 1941, *Ludlow & Sherriff* 8434 (E, BM); Karakoram, Gharesa Glacier, 3655 m, 21 vii 1960, *Polunin* 6093 (E).

AFGHANISTAN: Cent. Nuristan, oberes Kantiwo-Tal zwischen Biubruts und Mangeb Pass, 2500-3000 m, 20 vi 1935, *Kerstan* 964 (W); Paghman, 2743 m, 27 vii 1937 *Koelz* 11117 (W); Nuristan, Chitras, 3000 m, 30. v. 1948, *Edelberg* 852 (type of *E. stenodon*, W); Nuristan ober Kamdesch, 2600 m, 22 vi 1950 *Gilli* 3926 (W); Kabul, Paghman 3300 m, 21 vi 1962, *Hedge & Wendelbo* 4409 (E); Parvan, Panjshir Valley, W. side of Anjuman Pass, 4100 m, 23 vii 1962 *Hedge & Wendelbo* 5446 (E).

2b. Psychrogeton andryaloides var **poncinsii** (Franch.) Grierson **comb. nov.**

Syn.: *Aster poncinsii* Franch. in Bull. Mus. Hist. Nat. Ser. II, 7: 345 (1896).
Diploppapus andryaloides O. & B. Fedtsch. Rastit. Turkest. 4: 163 (1911).
Erigeron poncinsii (Franch.) Botsch. in Bot. Journ. URSS. 42: 776 (1957); Fl. URSS. 25: 275 (1959); Ikonnikov, Pamir Pl. in Inst. Acad. Tadzhik. 20: 231 (1963).
Erigeron minjanensis Rech. f. in Biol. Skr. 8: (Symb. Afghan. 2): 20 (1955).
Erigeron paghmanicus Rech. f. l. c. p. 22.
Erigeron sanglichensis Rech. f. et Edelb. l. c. p. 20.

AFGHANISTAN. Wakhan, vallee du haut Oxus, Bozai Gumbez (Buzai Gumbad), 1893, *Poncins* sn. (P, type of *Aster* poncinsii); Minjan Pass, 3655 m, 26 vii 1937, *Koelz* 12693 (type of *E. minjanensis* W, E); Weran, 3000 m, vi 1948, *Edelberg* 1469 (W); Sanglich, 3000–3600 m, 16 vii 1948, *Edelberg* 1491 (W. type of *E. sanglichensis*); Bagrami, Nedjerau Tal, 2800 m, 27 vi 1951, *Neubauer* 330 (W); Urura-Passhohe, 3900 m, 9 viii 1951, *Neubauer* 593 (W); Paghman gebirge, 400 m, 16 vii 1950, *Neubauer* 883 (W, type of *E. pagmanicus*); same locality, *Neubauer* 884 (W); Paghman, 3000 m, 3 vi 1950, *Volk* 337 (W); Hindukush, 4415 m, 19 ix 1960, *Baillie & Dunsheath* 57 (K); Kabul, Bisut, 3000 m, 4 vii 1962, *Hedge & Wendelbo* 5027 (E); Paghman, 4050 m, 10 vii

1962, *Hedge & Wendelbo* 5213 (E); Parvan, Panjshir Valley, W. side of Anjuman Pass, 4100 m, 23 vii 1962, *Hedge & Wendelbo* 5450 (E).

TADZHIKISTAN. Darwas, inter Tokrai et Chyrgowat, 1525–1830 m, iii–iv 1883, *A. Regel* sn. (E, W, K); Murghab River, (i.e. ca. 38° 5′ N, 72° 30′–74° E), 1892, *Nazarov* sn. (LE); Pamir and Shugnan, 1 vii 1906, *Khorev* 42 (LE); Shakdarya River, in the basin of the Goont (i.e. ca. 72° 50′ E, 37° 30′ N), 3600 m, 18 vii 1956, *Trinornev* (?) 173 (W).

Flower colour has in some cases not been noted by the collector involved and although in the absence of such notes it it often possible to distinguish the colour of the rays, the pigmentation of the following gatherings appears to be intermediate in intensity between accredited white and yellow specimens which makes their certain indentification impossible. These specimens, then, may be regarded as doubtful or intermediate between var. *andryaloides* and var. *poncinsii*.

N. W. INDIA. Ravine above Sungnam, Kunawar, 22 viii 1847, *T. Thomson* sn. (K); Dankar, Piti, 3 ix 1847, *T. Thomson* sn. (K); "Tibet Occ.," *T. Thomson* sn. (E, W); Kinlung, Lahul, Kangra, 4110 m, 24–25 viii 1933, *Koelz* 6717 (MICH); Kunzam La, Spiti Valley, 4265 m, 7 viii 1932, *Bhagwan Singh* 211 (MICH).

KASHMIR. Dras, 3960 m, 31 viii 1922, *R. R. Stewart*, 7429 (RAW); Gilgit, Naltar Lakes, 3655 m, 21 vii 1954, *R. R. Stewart* 26236 (RAW); Deosai Plain, 3960 m, 29 vii 1940, *R. R. Stewart* 20020 (RAW); Kargia, Zaskar, 4110 m, 12–15 vii 1933, *Koelz* 5409 (MICH).

AFGHANISTAN. Cabul, *Honigberger* (W); Paghman, 3000 m, 3 vi 1950, *Volk* 337 (W); Nidjarao, 3300 m, 14 ix 1951, *Volk* 2354 (W); Saleh-lang, 7 vii 1960, *Lindberg* 1011 (W); Wanasgul Valley, 3655–4570 m, vii 1956, *Thesiger* 1567 (BM); 1582 A (BM); Kabul, Unai, Kuh-i Qualandaran, 3700 m, 24 vi 1962, *Hedge & Wendelbo* 4499 (E).

De Candolle did not mention flower colour in his descriptions of *Conyza andryaloides* and probably Royle did not record it. The latter's unnumbered specimens at Kew give the impression of having had white rays and no specimens from his main collecting area in N. W. India (shown as Tehri Garhwal, between 30–31° N and 77–79° E, in Wallich's Plantae Asiaticae Rariores 3, Pl. 396) have been recorded as having yellow rays.

In the south of the species range, therefore, the probability is that the rays are always white, although a few herbarium specimens are of doubtful colour. In Afghanistan both white and yellow rays are recorded and further north, in Tadzhikistan, from various accounts and from the few specimens examined the rays are consistently yellow. They are clearly a pale yellow in the type of *Aster poncinsii*, as Franchet stated, and the belief that white rays do not occur in the north is borne out by the fact that Botschantzev (l.c.) and Ikonnikov (l.c.) key out both *E. andryaloides* and *poncinsii* as having yellow rays, albeit of different intensities of colour, and seek to distinguish them on the grounds of leaf shape and indumentum density. The variability to which these Russian authors draw attention and the specimens which are here left uncertainly placed may point to an understanding of the colour variation in this species.

Although recorded as white the specimens (or some of them) from N. W. India, Kashmir and Afghanistan may indeed by pale cream, that is, white with a trace of yellow. The genetical factors responsible for producing this yellow pigment may be cumulative becoming more abundant in some races than in others.

These arguments might be taken to indicate that, because of the preponderance of yellow rayed specimens in the north, subspecific status should have been given to var. *poncinsii* but, as this taxon may be recognised only by colour and having regard to the doubtfully placed specimens from Kashmir and N. W. India, varietal rank would seem to be more suitable at the present time.

2c. Psychrogeton andryaloides var. **denudatus** (Botsch.) Grierson **comb. nov.**

Syn.: *Erigeron poncinsii* (Franch.) Botsch. var. *denudatus* Botsch. in Fl. URSS. 25 : 276 (1959): Ikonnikov, Pamir Fl. in Inst. Acad. Tadzhik. 20 : 231 (1963).

TADZHIKISTAN. Lake Yashil Kul (ie. 37° 40′ N, 72° 50′–73° 10′ E), vi 1913, *Bukinisch* 200 (LE).

N. W. INDIA. Lahul, Bara Lacha La, 4875 m, 16 vii 1938, *Bor* 9452 (RAW); Lahul, Kinlung, 3960 m, 11 vi 1933, *Koelz* 5319a (MICH).

KASHMIR. "Tibet occidentali" (possibly Ladakh), 4 vii 1848, *T. Thomson* sn. (K); Zanskar, Pader, Sinku La Pass, 20–21 vi 1856, *Schlagintweit* 6261 (E); Top of Pentse La Pass (between Zanskar and Dras), 29 vi 1856, *Schlagintweit* 7485 (BM); Zanskar, Bok, 4110 m, 13 ix 1931, *Koelz* 2926a (RAW); Zanskar, Chumikmarpo, 4115 m, 12–15 vii 1933, *Koelz* 5362 (MICH).

The development of the white tomentose indumentum is very variable both on leaves and involucres. This may be observed within the same gathering, e.g. *Hedge & Wendelbo* 5213, one specimen has almost glabrous but glandular involucres whereas the other is densely tomentose. Franchet drew up his description of *Aster poncinsii* from a gathering of three plants of which one has thick whitish tomentose but the other two have thinner greyish coverings. There are further gradations between the typical indumentum and the glabrescent. Botschantzev in naming Erigerons from the Pamirs came upon some glabrous and glandular plants to which he gave the name *Erigeron poncinsii* var *denudatus*. The above specimens of this well marked variety have been examined in this present study.

With respect to *P. cabulicus*, the inclusion of this variety means that the critical differentiating character between it and *P. andryaloides* is the toothed leaf margin of the latter. Most other characters that have previously been used e.g. flower colour, peduncle branching, indumentum, cauline leaves, etc., are not individually absolute and are to some extent shared by *P. andryaloides*. It is not suggested that specimens with entire margined but tomentose leaves should be regarded as anything other than *P. andryaloides*. In any case it is rare to find a plant of this species in which all the leaves are entire and even when this is so, as in *R. R. Stewart* 20020, other specimens belonging to the same gathering have dentate leaves.

The above variety might have been mistaken for a form of *P. cabulicus* in which the leaves have become dentate but the following points should be borne in mind. Firstly, the indumentum of *P. andryaloides* is acknowledged to be very variable and, secondly, no specimens with the peduncles branched as

they are in *P. cabulicus* is known to have toothed leaves. The other differences between the two species tabulated below should also be noted. Additionally, the majority of the specimens of var. *denudatus* cited above were collected in Kashmir where *P. cabulicus* is unknown. This concept is not only in line with Botschantzev's ideas but also with C. B. Clarke's—in a pencilled note he recognised T. Thomson's specimens from Kashmir as a glabrous variety of *P. andryaloides* although he never published it.

The following summary of differences will conclude this account.

P. cabulicus	*P. andryaloides*
Cataphylls spathulate, entire.	Cataphylls oblong, crenate.
Leaves entire margined never tomentose.	Leaves dentate rarely entire, tomentose but sometimes glabrous and glandular.
Cauline leaves several lanceolate.	Cauline leaves few, linear.
Peduncles usually branched.	Peduncles unbranched or branching only at base.
Capitula bristly pilose at base.	Capitula usually tomentose at base.
Phyllaries ca. 40 per capitulum.	Phyllaries ca. 30 per capitulum.

3. Psychrogeton rotundifolius Grierson **sp. nov.** (Plate 4 and Fig 2, C).

Herba biennis (?) laxiuscula. Radices angustae vix lignescentes. Indumentum ubique sparsim pilosum, pilis usque ad 1 mm longis et praesertim pedunculosis minute papillo-glandulosum. Caules decumbentes 15-25 cm longi, foliati, alte 2–3 ramosi, ramis 1–2 cephalis. Folia basalia rotundata vel orbiculata, petiolata; laminae chartaceae, 3–3·5 cm longae et latae, ad bases truncatae vel breviter attenuatae, marginibus irregulariter vel late crenato-dentatis; petioli (3–) 5–7 cm longi. Folia caulina rotundata vel obovata 2–3·5 cm longa 1·5–2·5 cm lata, supra decrescentia, apice mucronulatis, ad bases sessilia vel attenuata et subpetiolata, marginibus integerrimis. Capitula 0·5–0·75 cm lata; phyllares 2– seriatae subaequales oblanceolatae 3–4 mm longae 1–1·2 mm latae, ad apices purpurascentes, partibus medianis viridibus, ad margines albescentes membranaceae. Flores feminei 12–25, ligulati, tubis basalibus 1·8–2 mm longis, ligulis albis, 1·5–3 mm longis 1·2–2 mm latis obovatis, apicibus minute trilobatis. Flores disci bisexualis tubulosi, albi, 4 mm longi quinquedentati, dentibus ca 1 mm longis 0·5 mm latis. Pappi simplices albidi vel purpurascentes (in sicco) 2.8–3 mm longi, setis ca 15 scabris. Achaenia florum radii immatura, oblanceolata, ca 2 mm longa 0.4 mm lata, parce sericea; achaenia florum disci linearia, vacua.

AFGHANISTAN. Darrah-Zang, 23 v 1959, *Lindberg* 431 (W); Prov. Maymana, Darreh-Zang near Belčeragh, in wet places at the mouth of cave. Flowers white, 1400 m, 29 v 1962, *Hedge & Wendelbo* 3742 (E—holotype).

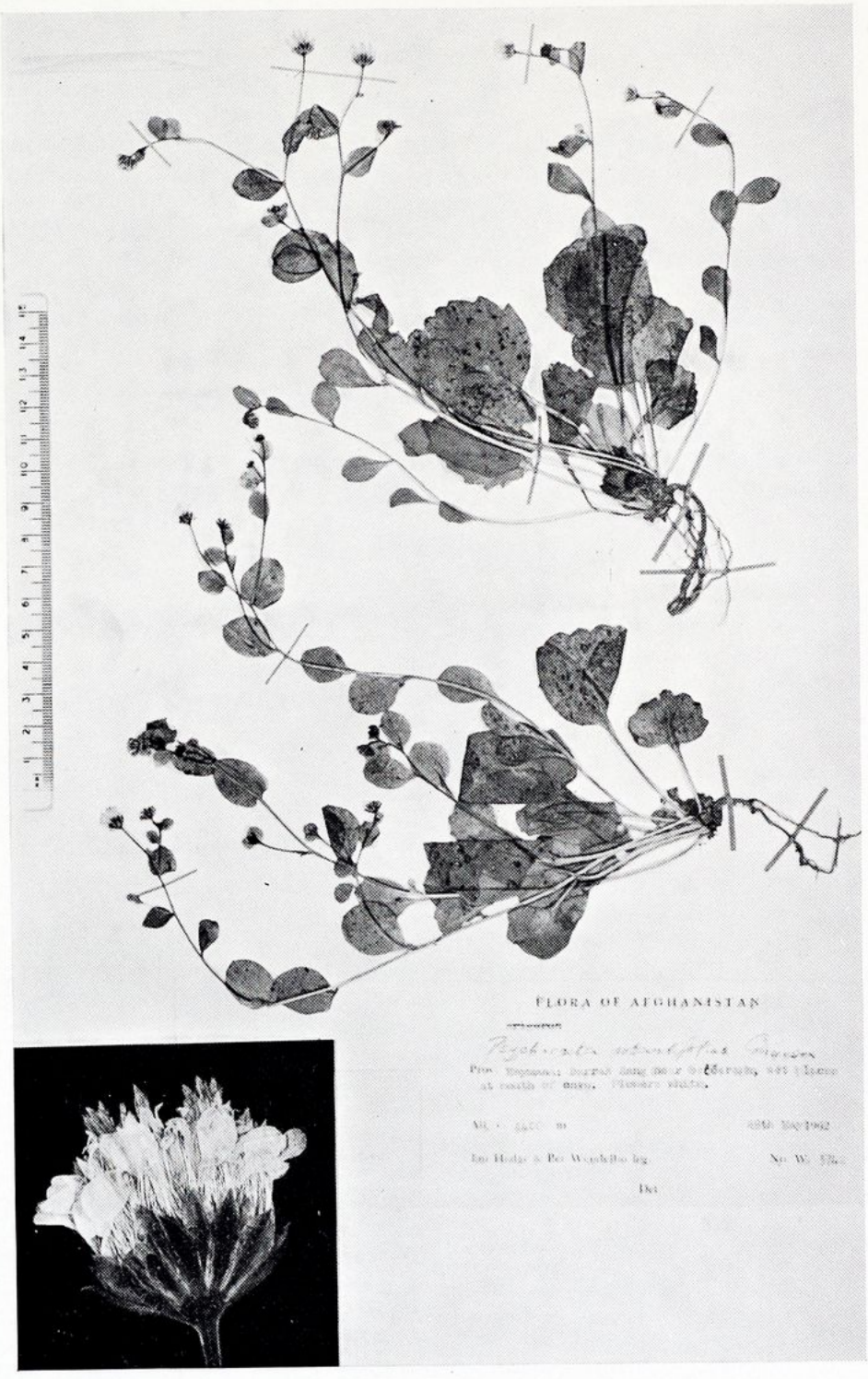


PLATE 4. Type specimen of *Psychrogeton rotundifolius* Grierson.

This species occupies an isolated position among the radiate species of *Psychrogeton*. From the appearance of the thin simple roots it is either a biennial or a short lived perennial in contrast to the woody and densely caespitose nature of *P. andryaloides* and *cabulicus*. The leaf pattern and distribution is completely foreign to these species but finds a parallel in *P. obovatus*, a non-radiate and caespitose taxon. Ecologically it has exploited a unique niche: whereas other species occupy exposed situations in open stony ground or in rock crevices, *P. rotundifolius* grows in moist shady situations at the mouths of caves and under overhanging rocks. This habitat preference is reflected in the lax nature of the plants and in the soft texture of their leaves.

4. Psychrogeton amorphoglossus (Boiss.) Novopokr. in Not. Syst. URSS 7: 136 (1938).

Syn.: *Erigeron amorphoglossus* Boiss. Diagn. Ser. 1, 6: 80 (1845); Rech. f. in Phyton 2: 126 (1950); Rech. f. in Biol. Skr. 8 (Symb. Afghan. 2): 13 (1955).
Heterochaeta leucophylla Bunge in Mem. Acad. Imp. Petersb. 7: 325 (1854).
Erigeron leucophyllus (Bge.) Boiss. Fl. Or. 3: 171 (1875); Botsch. in Fl. URSS. 25: 272 (1959).
Erigeron bizgensis Rech. f. in Phyton 2: 129 (1950).
Erigeron mollissimus Rech. F. et Koeie in Biol. Skr. 8 (Symb. Afghan. 2): 13 (1955).
Erigeron shahvaricus Rech. f. in Phyton 2: 128 (1950).
Erigeron stapfianus Rech. f. in Phyton 2: 127 (1950).

Fig. 2,d.

Dwarf perennial herbs. Rootstock usually thick, woody, branching and caespitose, sometimes slender, upper parts generally covered with foliar remains from previous years. Cataphylls sometimes present, brownish (in *sicco*), oblong, ca. 0·75 cm long, shallowly crenate at the apex, covered with subsessile glistening glands. Basal leaves ovate, lanceolate or oblanceolate, petiolate, ± densely tomentose on both surfaces, interspersed with subsessile glistening glands, somewhat detersile; lamina 1·5–2·5 cm long 0·75–1·5 cm broad, margin entire or shallowly, rarely sharply, 2–3 dentate on each side, apex obtuse or acute, attenuate at the base into petiole 1–3 cm long. Peduncles erect or ascending, 3–10 (–20) cm long, sparsely tomentose and glandular, and bearing 3-4 linear-lanceolate leaves 0·5–1 cm long, generally monocephalous but sometimes branched at the base. Capitula 1–1·5 cm broad. Phyllaries 2–3 seriate, ± subequal or imbricate, linear-lanceolate or oblanceolate, 7–10 mm long 0·6–0·8 (12) mm broad, usually tinged with purple at the tips. Female flowers 30–40, 4–5·5 mm long (± as long as pappus), ligulate above for almost half its length, ligule ovate, lobes variable in size, generally 2–3. Bisexual flowers tubular, 4–5 mm long. Fertile achenes narrowly oblanceolate, 3–5·5 mm long, 0·6–1 mm broad, sparsely sericeous and glandular; achenes of bisexual flowers linear, empty. Pappus simple or double, setae 30–40, coarse, barbellate, 4–5 mm long.

IRAN. In rupestribus Besmitschal, montis Demavent, 21 vi 1843, *Kotschy* 348 (W,BM syntype); ad fontem Dscheschme-Pias et in cacumine m. Kuh-Daena, 29 vii 1842, *Kotschy* 759 (W, K, BM, E—syntypes); Zerdakou, *Aucher* 3108 (G, K-syntype); Ispahan, *Aucher* 4747 (G, K, BM—syntype); in fissuris rupestribus Kuh Nar, 3655–3960 m., vii 1868, *Haussknecht* sn. (W, syntype); Gipfel des Kuh-i-Buhl, 6 ix 1885, *Stapf* 1291 (WU, K, Holotype *E. stapfianus*); Kerman, in rupibus alpinis montis Kuh-i-Dschupar, 3000–3600 m., 9 vi 1891, *Bornmüller* 5058 (W, K, BM, E); Kerman, in rupibus alpinis summis montis Lalesar, 3700–4200 m., 15 vii 1892, *Bornmüller* 5060 W, K, BM, E); m. Elburs, Asadbar, in jugo Gerdene-Berg, 2700-2900 m., 2 vii 1902, *Bornmüller* 7488 (W, K, BM); Kuh Domine, iii 1908, *Bornmüller* sn. (W); In m. Elwend, Choremabad, 27 vi 1910, *Bornmüller* sn. (W); Khorasan, in monte Kuh-e-Bizg, in rupium fissuris, ca 2300 m., 4–6 vii 1937, *Rechinger* 1471 (W, K, BM—holotype *E. bizgensis*); Shahrud Bustam, in declivibus australibus montium Shavar, in saxosis calc. 3500–3900 m., 20–26 vii 1948, *Rechinger* 6010 b (W, holotype *E. shavaricus* BM, K-iso); Bakhtiari, Gahar, 2745 m., limestone cliffs, flowers yellow to red-brown, 30 v 1941, *Koelz* 17925 (W); Kazvin, montes Elburs centr., in valle fluvii Keredj, prope Germnab, 3200 m, *Gauba* 1296 (W).

IRAQ. Kurdistan, Erbil, montes Quandil, ad confines Persiae, ca 36° 30′ N 45° E, 28 vii—1 viii 1957, *Rechinger* 11165 (W); Erbil, Mons Helgund, ad confines Persiae, ca 36° 40′ N 44° 50′ E, in declivibus occidentalibus summi montis, ca 3000–3800 m., substr. schist metamorph. et serpentin., 10–14 viii 1947, *Rechinger* 11448 (W); Helgund, 3620 m., 15 viii 1956, *B.R. Haley* 164 (BM).

AFGHANISTAN. Nozi, 3050 m., 22 vi 1937, limestone rock, *Koelz* 11999 (W); Loring Pass, 3655 m., 27 viii 1939, *Koelz* 13796 (W); Farakulum, 2700–3000 m, 19 vii 1948, *Koeie* 2528 (W, E); Ghazni, in faucibus Say Khoshkak (Nawar Kotal), inter Okak et Bihzud (Diwal Kol), ca 33° 53′ N 65° 50′ E, ca 3150, 6 vii 1962, *Rechinger* 17845 (W); Bamian, Band-i-Amir, ca 34° 23′ N 67° 17′E, in declivibus saxosis aridis, ca 2800-2900 m, 13-14 vii 1962, *Rechinger* 18276 (W); Kabul, in latere orientali jugi Unai, ca 34° 25′ N 68° 25′ E, ca 3100 m., 22 vii 1962, *Rechinger* 18570 (W); Bamian, on hill west of Shibar pass, crevices of rocks, ca 3000 m, 14 vi 1962, *Hedge & Wendelbo* 4217 (E); Bamian, Band-i-Amir, rich limestone steppe vegatation, flowers yellow, ca 2900 m, vi 1962, *Hedge & Wendelbo* 4776 (E); Kabul, in the vicinity of Panjao, limestone rock crevices, flowers yellow, 2700 m., 1 vii 1962, *Hedge & Wendelbo* 4916 (E).

TURKEY. Hakkiari, Kara Dag, 3440 m, 16 vii 1954, *Davis* 24494 (E,BM); Cilo dag, 10 km W of Cilo Tepe, 3655 m, 9 viii 1954, *Davis* 24192 (K).

TADZHIKISTAN: Shakhrisyabz (ie., 39° 0′ N 66° 50′ E), 1770 m, 16 vi 1896, *Lipsky* 4725 (LE); Ala tay, 3000 m, 18 vii 1952, *Tsvelev* sn. (LE).

TURKMENISTAN: Kuhitang Range, Markumi, (ie., 38° 0′ N 66° 15′ E), 5 vii 1931, *Nevski* 596 (LE).

UZBEKISTAN: 25 vi 1959, *Botschantzev* 532 (LE).

KAZAKHSTAN: In regione alpine montis Karatau, 12 ix 1841, *Lehmann* sn. (P. type of *E. leucophyllus*): Karatau, 14 vi 1934, *Tegutlya* 231 (LE).

P. amorphoglossus is a relatively variable species but one in which the variation is more or less continuous. Several species have been created within its orbit but none of them, it seems to me, are sufficiently different to warrant

this recognition. It is perhaps of interest to discuss these taxa and the variability which their examination brings to light.

E. stapfianus intergrades completely with *P. amorphoglossus* in its original sense. Its leaves are described as being broader 2:1 as against 3:1 but the leaves of Stapf's specimens are no broader than some of Bornmüller's nor are they broader than on some of the recently collected material from Afghanistan e.g. *Hedge & Wendelbo* 4916. It is supposed to have a few linear-lanceolate cauline leaves as against none or very few in *P. amorphoglossus* but one finds cauline leaves to be as numerous on the syntypes of the latter. The achenes of *E. stapfianus* are described as being 5–5·5 mm long but they are as long in Haussknecht's syntype. *P. amorphoglossus* has, according to Rechinger, only 25 pappus setae in contrast to more than 30 in *E. stapfianus*, but *Kotschy* 348 has about 40 setae and they may be more numerous in other specimens (see below).

E. shahvaricus is described as having an involucre of more than 10 mm long but this figure is approached (but not exceeded) by only three heads on the type specimen: the others measure only 8 mm. The latter figure may be regarded as an average one for *P. amorphoglossus*, but involucres of 10 mm are not uncommon e.g. *Bornmüller* 5058. Rechinger also makes the distinction that in this species and in *E. mollissimus* the phyllaries are broader above the middle whereas those of *P. amorphoglossus* are broader below the middle. After examining the syntypes of the latter, one can only point out that the outer phyllaries are linear-lanceolate but that the inner ones tend to be oblanceolate. They are broader (1–1.2 mm) than usual in *E. shahvaricus* and *mollissimus*, but no more so than in *Bornmüller* 5060 which Rechinger cites as *E. amorphoglossus* (in Phyton 2, 126: 1950). The phyllaries are rendered more conspicuous in the type of *E. shahvaricus* because they are more strongly purplish than is usual. The capitula in this specimen (the only one quoted by Rechinger) are by no means mature which probably accounts for the small size of the achenes (3·5 mm long).

E. mollissimus is a larger plant but, here again, only one gathering is known. Two of the specimens measure 15 cm tall, generally *P. amorphoglossus* measures 5–10 cm. *E. mollissimus* is described as having branched peduncles but among the syntypes of *P. amorphoglossus*, *Aucher* 4747 and *Kotschy* 759 contain similarly branched specimens. In breadth of capitulum two specimens measure 20 mm as against the general 1·5 mm or rare 1·8 mm for *P. amorphoglossus*. On the basis of a single gathering *E. mollissimus* can only be judged as being no more than a vigorous race of *P. amorphoglossus*.

E. bizgensis was also described from a single collection and is obviously closely allied to *P. amorphoglossus*. The rootstock is more slender and loosely branched than is usual in the latter. While noticeably glandular, the indumentum is only sparsely tomentose. The peduncles are the tallest on record, 12–20 cm. Although similar in the proportion of tube to ligule, the female corollas differ in that the ligule is deeply divided into 2–3 lobes. The pappus of the fertile achenes is more luxuriant and contains 65–70 setae. This may prove to be somewhat distinct from *P. amorphoglossus*, but not at specific level.

E. leucophyllus was described from dwarf specimens collected on the Kara Tau Range in Northern Turkestan by Lehmann. Having examined an isotype specimen (from Paris) and other less dwarf specimens from the Kara Tau and elsewhere in Turkestan loaned by Leningrad and labelled as *E.*

leucophyllus, I am forced to the conclusion that it is nothing more than a northern race of *P. amorphoglossum*. The above specimens differ from more typical *P. amorphoglossum* in having more numerous outer pappus bristles.

Bunge originally compared his *Heterochaeta leucophylla* with *H. erigeroides*, which is a small form of *Erigeron multiradiatus* (DC.) Benth. Boissier (l.c.) on the other hand likened it to *P. amorphoglossus* but, because he had used the character of the outer pappus to divide *Erigeron* into sections (placing *E. amorphoglossum* in Sect. *Conyzastrum* and *E. leucophyllus* in Sect. *Heterochaeta*), did not press the comparison further than by remarking "ab *Heterochaeta* specibus Candolleanis ligulis pappo brevioribus diversum".

Superficially, *P. amorphoglossus* is very similar to *P. andryaloides* and it may indeed be difficult to separate them in the case of vegetative or incomplete specimens. Difficulty also arises, especially in Afghanistan, because several of the characters which are most conveniently applied in separating these species are variable. Thus, while it is in most cases possible to distinguish one from the other, there are specimens which in the proportion or character of their parts tend to assume those of the other species. For this reason the following table of differences is given:

amorphoglossus	*andryaloides*
Indumentum generally strongly glandular.	Indumentum eglandular or sparsely glandular, but glands becoming more numerous in Afghan Specimens.
Leaves mostly entire or slightly denticulate, rarely obviously toothed.	Leaves generally toothed rarely entire.
3–5 longitudinal veins present in leaves but lateral veins not prominent.	Lateral veins of leaves often prominent especially in N. W. India and Kashmir but veins sometimes inconspicuous.
Leaves lanceolate or oblanceolate, less often ovate.	Leaves ovate or obovate, less often lanceolate or elliptic.
Peduncles not unusually branched.	Peduncles very rarely branching near the base.
Flowering capitula broadly conical *in sicco*, ± turbinate at base.	Flowering capitula campanulate or hemispheric *in sicco*, truncate at base.
Phyllaries linear lanceolate or oblanceolate, usually less than 1 mm broad, acuminate at the apex, generally tinged with purple, mostly glandular.	Phyllaries lanceolate or oblanceolate, usually ca. 1 mm broad, acute at apex. Generally green and buff, seldom noticeably glandular.
Ligules generally shorter than pappus but sometimes 0·5 mm longer than it; apex generally deeply lobed, less often entire or notched, 0·4–0·6 mm broad.	Ligules longer than pappus but sometimes only by 1·5 mm, entire or notched at the apex rarely lobed, 0·6–1.2 mm broad.
Fertile achenes 3·8-5·5 mm long, obviously glandular.	Fertile achenes 3–3·5 mm long, generally eglandular.

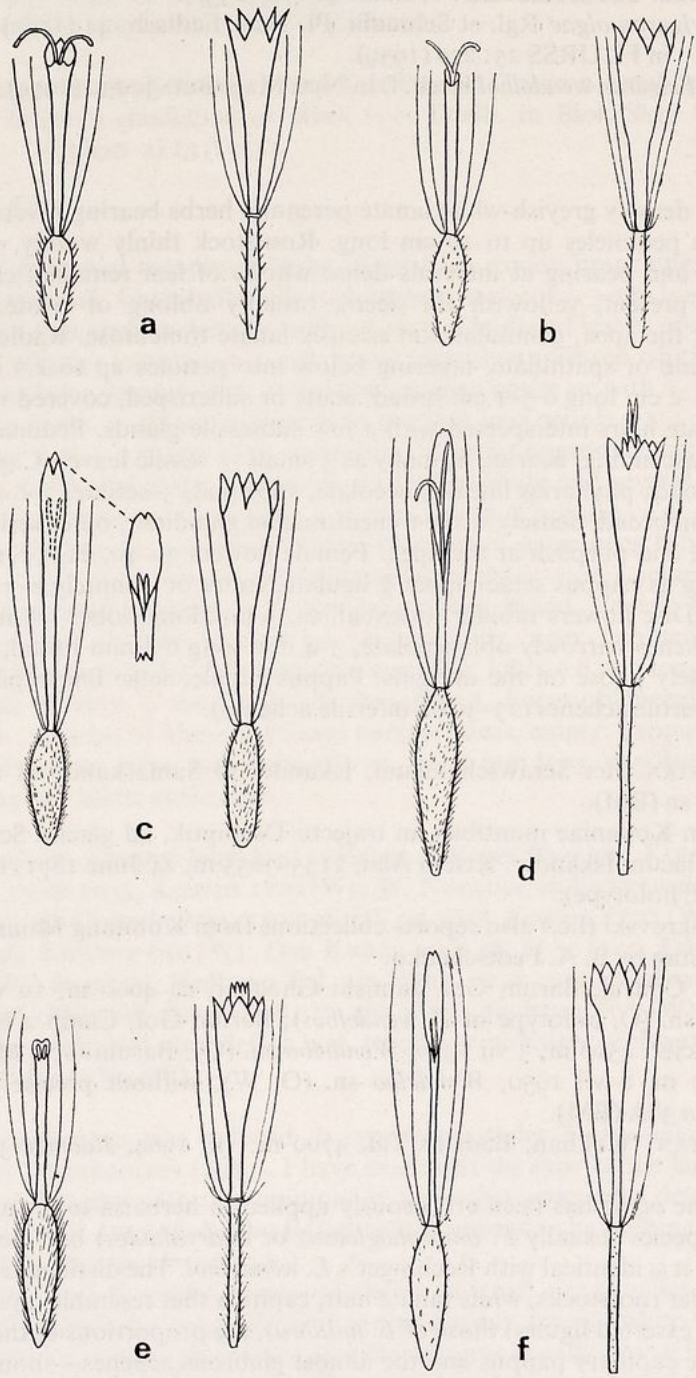


FIG. 3. Drawings of female and hermaphrodite flowers of A. *P. aellenii;* B. *P. persicus;* C. *P. brachyspermus;* D. *P. alexeenkoi*, E. *P. lumbricoides;* F. *P. olgae;* (all × 6. The number of pappus setae reduced throughout.)

5. Psychrogeton olgae (Rgl. et Schmalh.) Novopokr. ex Nevski in Acta Inst. Bot. Acad. Sci. URSS. Ser. 1, Fasc. 4: 278 (1937).

Syn. *Erigeron olgae* Rgl. et Schmalh. Pl. Nov. Fedtsch. 44 (1882); Botsch. in Fl. URSS 25: 270 (1959).

Erigeron wendelboi Rech. f. in Nytt Mag. Bot. 3: 230 (1954).

Fig. 3,f.

Dwarf, densely greyish-white lanate perennial herbs bearing several monocephalous peduncles up to 10 cm long. Rootstock thinly woody, single or branched and bearing at intervals dense whorls of leaf remains; cataphylls generally present, yellowish (in sicco), broadly oblong or ovate, obtuse, crenate at the apex, glandular and scantily lanate tomentose. Radical leaves oblanceolate or spathulate, tapering below into petioles up to 2.5 cm long, laminae 1–2 cm long 0·5–1 cm broad, acute or subcrisped, covered with long white lanate hairs interspersed with a few subsessile glands. Peduncles often purplish, ascending, bearing as many as 5 small ± sessile leaves. Capitula ca. 1·5 cm broad; phyllaries linear-lanceolate, subequal, 3–seriate, 7–8 mm long 0·5–1·5 mm broad, densely white tomentose and glandular, outer series green, acuminate and purplish at the apex. Female flowers 30–40, ca. 5·6 mm long (± as long as pappus setae) upper ⅓ ligulate, entire or minutely 2–3 lobed at the apex. Disc flowers tubular, bisexual, ca. 5 mm long, lobes 0·8 mm long. Fertile achenes narrowly oblanceolate, 3–4 mm long 0·8 mm broad, sparsely and minutely pilose on the margins. Pappus simple, setae fine capillaceous, 50–70 on fertile achenes (25–30 on infertile achenes).

TADZHIKISTAN. Iter Serawschanicum, Iskander to Samarkand, 28 vii 1915, *Balabajew* sn (BM).

KIRGIZ. In Kokaniae montibus, in trajectu Dschiptik, ad glacies Schtschurowski, ad lacum Iskander, Ktschi Alai, 2135–3655 m, 24 June 1871, *O. Fedtschenko* (LE holotype).

Novopokrovski (l.c.) also reports collections from Kuhitang Mountains of Turkmenistan by B. A. Fedtschenko.

PAKISTAN. Chitral, Barum Gol, Jamishi Ghochar, ca 4000 m, 10 vii 1950, *Wendelbo* sn. (O, holotype of *E. wendelboi*); Barum Gol, Camp 2 by South Barum glacier, 4500 m, 3 vii 1950, *Wendelbo* sn. (O); Barum Gol, Marmano Shal, 3700 m, 8 vii 1950, *Wendelbo* sn. (O, W); without precise locality, *Bowes Lyon* 38A (BM).

AFGHANISTAN: Wakhan, Badjens Tal, 4700 m, viii 1964, *Roemer* 384 (M).

The name *olgae* has been erroneously applied in herbaria to a number of different species (usually *P. amorphoglossus* or *andryaloides*) but there is no doubt that it is identical with Rechinger's *E. wendelboi*. The distinctive characters—slender rootstocks, white lanate hair, capitula that resemble (apart from the lack of exserted ligules) those of *E. uniflorus*, the proportions of the female flowers, the capillary pappus and the almost glabrous achenes—should combine to render this a well-nigh unmistakable species.

This species is closely related to *P. amorphoglossus* and is very similar to it in leaf shape and general facies. *P. olgae*, however, is more slender with thinner less lignified rootstocks which are usually surmounted by broad yellowish cataphylls. The tomentum also is usually more prominent than in *P. amorpho-*

glossus. Within the capitulum the ligules of *P. olgae* are narrower (0·4 mm broad) than those of *P. amorpholgossus* (0·7 mm). The pappus of *P. olgae* is finer and the achenes are almost glabrous

6. Psychrogeton candidissimus (Rech f. et Edelb.) Grierson, **comb. nov.**

Syn.: *Erigeron candidissimus* Rech f. et Edelb. in Biol. Skr. 8: (Symb. Afghan. 2) 13 (1955).

Fig. 4,d.

Dwarf perennial caespitose herbs. Rootstock woody branching, branches 0·5 or more thick. Cataphylls yellowish brown (in sicco) 2–3 mm long, oblong, acute with two crenate-dentate teeth on each side. Basal leaves oblanceolate, ovate or elliptic; lamina 0·5–1 mm broad, densely appressed whitish tomentose, eglandular, lateral veins prominent, margin entire or with 2–3 teeth per side, apex acute or obtuse, attenuate at the base into petiole 0·5–1·5 cm long. Peduncles 2–6 (–12) cm long ascending, densely appressed canescent tomentose, monocephalous or bearing up to 3 capitula and several oblanceolate cauline leaves 5–7 mm long 1–2 mm broad. Capitula ca 1 cm broad, phyllaries imbricate 3–4 seriate, linear-lanceolate, outer ones broadly acute ca 2mm long 0·6 mm broad, greyish tomentose, inner ones ± acuminate, buff coloured, sparsely tomentose, 5 mm long 1 mm broad. Female flowers ca. 50, tubular or scarcely ligulate ca 3·6 mm long, apex minutely 3 lobed. Bisexual flowers tubular, 5–lobed, ca 4 mm long, lobes 0·8 mm long. Achenes of female flowers 3 mm long 0.6 mm broad, linear-oblanceolate, finely sericeous; achenes of bisexual flowers narrow linear, empty. Pappus simple or with a few outer setae, inner setae ca 25, 3·6–4 mm long, capillaceous often becoming barbellate at the apex.

AFGHANISTAN. Central Nuristan, zwischen Kotagel Pass und Kotagel, 1600–2400 m, 15 vii 1935, *Kerstan* 1220 (W); W. Nuristan, in Eichenwald zwischen Kulatan und Gultscheilam, 1500 m., 18 vii 1935 *Kerstan* 1270 (W); Pashki, 18 v 1948, *Edelberg* 640 (W): Deh Kundi, 2900 m, 11 vi 1949, *Edelberg* 1295 (Holo. W); Bagrami, Nedjerau Tal, am Hang, 27 vi 1951, *Neubauer* 310 (W) Kurdertal, Seitental des Petsch, 16 viii 1951, *Neubauer* 808 (W); Gusalak, Kurdertal, Seitental des Petsch auf trockener sonniger Felswand, 16 viii 1951, *Neubauer* 824 (W).

P. candidissimus was reduced to synonymy under *E. leucophyllus* (Bge.) Boiss, by Botschantzev (1959). I have examined the type of the latter species and must disagree with this opinion. It and other specimens determined as belonging to *E. leucophyllus* by Botschantzev appear to be nothing more than forms of *P. amorphoglossus* (q.v.).

The leaves of *P. candidissimus* are always of small size (smaller than those of *P. amorphoglossus* generally are) and uniformly greyish white tomentose. Leaf venation is fairly prominent and the margins usually bear a few shallow teeth. Flowering stems are sometimes simple but they are more often branched and bear two or three capitula. The latter are always smaller than those of *P. andryaloides* or of the more closely related *P. amorphoglossus*. Phyllaries are less sharply acute than in these species and more strongly imbricate. The female flowers are more or less tubular and scarcely broadened at the apex.

7. Psychrogeton alexeenkoi Krasch. in Acta Inst. Bot. Acad. Sc. URSS. Ser. 1, Fasc. 3: 343 (1937).

Syn.: *Erigeron nigrimontanus* M. Pop. in Not. Syst. URSS 8: 55 (1940), Acta Inst. Bot. Acad. Sci. URSS Ser. 1, 7: 9 (1948), non Boiss. et Buhse 1860.

Erigeron karatavicus Pavl. in Vestn. A. N. Kaz. SSR. 52: 49 (1949); Fl. URSS 25: 272 (1959).

Erigeron kermanensis Rech. f. in Phyton 2: 133 (1950).

Erigeron polyadenus Rech. f. et Koeie in (Symb Afghan II) Biol. Skr. 8: 15 (1955).

Erigeron alexeenkoi (Krasch.) Botsch. in Fl. URSS 25: 271 (1959).

Fig. 3,d.

Erect caespitose perennial herbs. Roots woody branched and thickened above with foliar remains. Indumentum densely glandular consisting of subsessile glands interspersed with a few eglandular pilose hairs especially on the prominent veins on the undersides of leaves. Basal leaves obovate, spathulate or elliptic, petiolate: lamina 1·5–3 cm long 0·5–1·5 cm broad, obtuse or acute at the apex, margin entire or with a few broad crenate-dentate teeth, cuneate and attenuate into a petiole (up to 2·5 cm long) at base. Peduncles monocephalous, unbranched or rarely branched at the base, bearing 3–4 linear cauline leaves ca 1 cm long, sometimes with 1 or 2 oblanceolate cauline leaves near the base up to 3 cm long 0·75 cm broad. Capitula broadly conical, 1–1·5 cm broad. Phyllaries 3–4 seriate, imbricate, straw coloured with green centres, margins narrowly hyaline, sometimes tinged with pinkish purple, 5–8 mm long, 0·4–1 mm broad. Female flowers ca. 30–40, 4–5·25 mm long (± as long as pappus), the lower 2–3 mm tubular, ligulate above, ligule 0·2–0·3 mm broad, rounded or acute, notched or 2–3 lobed at the apex. Bisexual flowers tubular, 5– lobed, 4–5.2 mm long, lobes 0·6–0·8 mm long. Fertile achenes oblanceolate, 3·8–4·2 mm long 0·8–1 mm long 0·8–1 mm broad, sparsely sericeous and glandular; achenes of bisexual flowers linear, empty. Pappus simple, 30–40 setae, 3·8–5·2 mm long, finely scabrous.

IRAN. Prov. Kerman, in monte Kuh-i-Hasar, 4000–4400 m, 8 viii 1892, *Bornmüller* 5055 (W, BM, K—holotype *E. kermanensis*); Fars, Kuh Dena, Gardaneh Sicani, 1 viii 1949, *Behboudi* 1239 E (W); Kerman: Kuh Hezar, vi 1952, *Famouri* 2583 E (W).

AFGHANISTAN. Koh-i-baba, 4265–4570 m, *Griffith* 911 (K); same locality, 3400 m, 24 vii 1948 *Koeie* 2643 (W); Parvan, Panjshir Valley, Darrah Rastagal, 3200 m., 18 vii 1962, *Hedge & Wendelbo* 5230 a (E); Bamian, Band-i Amir ad lacum Band-i Panir, 34° 23′ N 67° 17′ E., ca 2800 m. 14 vii 1962, *Rechinger* 18403 (W).

TADZHIKISTAN. Wakhan, in valle fl. Pamir, pr. castellum Langar-gischt, 3150 m. 27 vii 1901, *Alexeenko* 3287 (LE, holotype).

UZBEKISTAN. Tschimkent (Chimkent) district, 1908, *Knorring* 745 (LE, isotype *E. karatavicus* and of *E. nigrimontanus* N. Pop.—holotype TAK, not seen).

PAKISTAN. Chitral, Laspur (Harchin), 36° 2′ N 72° 27′ E, scree, pale yellow, 3960 m. 16 vii 1958, *Bowes Lyon* 38 (BM); same locality, dry crevices or scree golden yellow, 23 vii 1958, *Bowes Lyon* 95 (BM).

P. alexeenkoi is related to *P. amorphoglossus* and resembles that species in habit, leaf-shape and in the general outlines of the capitulum. It differs from *P. amorphoglossus* most conspicuously in its indumentum and by its more imbricate involucre. The female flowers of both species agree in having well developed but non-exserted ligules but those of *P. alexeenkoi* are generally longer.

The type of *E. kermanensis* from W. Iran, although remote from the centre of distribution in Afghanistan can only be regarded as a smaller specimen. Of the Persian specimens, Behoudi's resembles the type in its proportions but Famouri's is very similar to those gathered elsewhere.

E. karatavicus according to the Flora URSS is regarded as a very local species and is differentiated from *P. alexeenkoi* in the key as having the ligules differently shaped—rounded at the apex with 3 small blunt teeth instead of acute, entire or with 2–3 large unequal teeth. The apex of the ligule, however, is variable in this species: rounded or acute ligules, notched or cut at the apex occur side by side at least in Persia and Afghanistan.

P. alexeenkoi is even more closely related to *P. lumbricoides* and differs from it in its female corollas, but in an unequivocal fashion. There are also other minor points which support the specific identity of *P. lumbricoides* and these are reviewed in the discussion under that species.

8. Psychrogeton lumbricoides (Gilli) Grierson **comb. nov.**

Syn.: *Erigeron lumbricoides* Gilli in Fedde Repert. 68: 89 (1963)

Fig. 3,e.

Dwarf erect or ascending caespitose herbs. Roots woody, branched and often annularly marked above. Indumentum densely glandular consisting of subsessile glandular hairs, eglandular hairs absent. Basal leaves obovate, oblanceolate or spathulate, petiolate: lamina 1–2 cm long, 0·6–1·3 cm broad, veins prominent beneath, apex acute or obtuse, margin coarsely dentate, cuneate at base and attenuate into petioles 1–2 cm long. Peduncles up to 10 cm long, unbranched or rarely branching near base, branches monocephalous and bearing 6 or more linear or oblanceolate cauline leaves, the lower ones up to 2 cm long, coarsely 1–2 toothed on each margin. Capitula 0·75–1·4 cm broad. Phyllaries 3–4 seriate, imbricate 3·5–6 mm long 0.6–1 mm broad, outer ones green, inner ones pale straw-coloured often with green midribs and broad membranous, cilate or fimbriate margins. Female flowers ca. 50, corollas tubular 3–3·5 mm long, 3–4 lobed at the apex, eligulate, Bisexual flowers tubular, 4·6–4·8 mm long, 5–lobed, lobes ca 0·6 mm long. Fertile achenes oblanceolate, 2·6–2·8 mm long, 0·6 mm broad, densely sericeous; achenes of bisexual flowers linear, empty. Pappus simple, ca 20 setae, 4 mm long, barbellate.

AFGHANISTAN. Paghman, 17 miles W. of Kabul, 2440–2745 m., 23 vi 1939, *Chaworth-Musters* s.n. (BM): Bei Kabul, in Spalten einer steilen Felswand im Paghmantal, 2480 m., 1 vii 1949, *Gilli* 3923 (W—holotype); Gulbahar, 27 v 1950, *Neubauer* 917 (W): Panjshir—Gulbahar, 26 vii 1950, *Volk* 1006 (W); Bagrami, Nedjerau-Tal, am Bach, 27 vi 1951, *Neubauer* 308 (W); in valle Paghman, ca 34° 36′ N 68° 56′ E, substr. gneiss, 2300–2800 m, 21 vi 1962, *Rechinger* 17161 (W); Paghman, valley above village, crevices of rocks. Ray

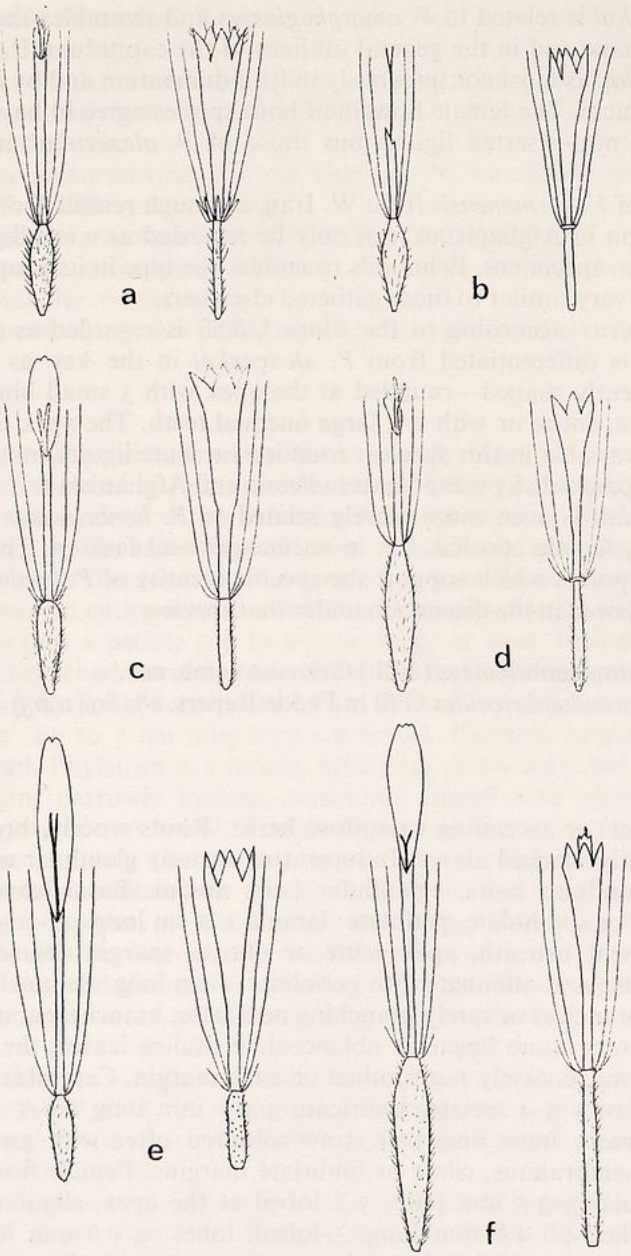


FIG. 4. Drawings of female and hermaphrodite flowers of A. *P. aucheri;* B. *P. nigromontanus;* C. *P. biramosus;* D. *P. candidissimus;* E. *P. pseuderigeron;* F. *P. primuloides* (all × 6 The number of pappus setae reduced throughout.)

flowers white. 2500 m, 21 vi 1962, *Hedge & Wendelbo* 4353 (E); Parvan, Panjshir valley, Darrah Rastagal, dry slopes, 3200 m, 18 vii 1962, *Hedge & Wendelbo* 5230b (E).

P. lumbricoides is undoubtedly very closely related to *P. alexeenkoi* and has generally been mistaken for it. Outwardly it may readily be differentiated from *P. alexeenkoi* by the greater development of cauline leaves and by the

coarser toothing of these and the basal leaves. To the naked eye, their involucres can be distinguished because they appear to be more strongly imbricate than those of *P. alexeenkoi*. Basically, however, both species generally agree in the number of phyllaries and the degree of imbrication and the difference between them appears to stem from the stronger colour contrast between the outer and inner series. The principal distinguishing character is to be found in the female corollas: in *P. lumbricoides* they are tubular without any ligulate extension and noticeably shorter than the corollas of the bisexual flowers. The achenes of *P. lumbricoides* are smaller and more densely sericeous (so much so that around the top of the achene the achenial hairs appear to form an outer pappus) and they are apparently eglandular.

There is a temptation here to regard *P. lumbricoides* as a subspecies of *P. alexeenkoi* localised in the Panjshir–Paghman mountain range to the north of Kabul. But the break between those with liguliform and those with tubular corollas is a sharp one and the subsidiary characters are likewise sound. Both species occur together—*Hedge & Wendelbo* 5320 was a mixed gathering —but even so the characters remain distinct.

9. Psychrogeton primuloides (M. Pop) Grierson **comb. nov.**

Syn.: *Erigeron primuloides* M. Pop. in Not. Syst. URSS 8: 49 (1940); Botsch. in Fl. URSS 25 : 268 (1959.

Fig. 4,f.

Dwarf decumbent perennial herbs. Root simple, thin, somewhat lignified and surrounded above by a dense collar of leaf remains. Indumentum subcanescent pilose, intermixed, especially on the leaves, with glistening subsessile glands. Basal leaves obovate-spathulate, 2–2·5 cm long 1 cm broad, obtuse at the apex, margin 3–5 crenate-dentate on each side above, cuneate and subpetiolate at the base. Peduncles several, up to 8 cm long, monocephalous and bearing several (ca 4) sessile lanceolate cauline leaves, 0·75–1 cm long 2–4 mm broad, acute at the apex, margins entire. Capitula ca 1·5 cm broad; phyllaries 3–4 seriate, imbricate, 4–7·5 mm long 1 mm broad, outer ones green linear-lanceolate acute, inner ones pale green with membranous margins, acuminate. Female flowers 50–60 ligulate (2–3 mm longer than pappus), basal tubes 4 mm long, ligules ca 3·5 mm long 0·8 mm broad minutely 2–3 notched at the apex. Disc flowers bisexual tubular 5-lobed, corollas 4·8 mm long, lobes 0·8 mm long. Pappus simple, 30–35 setae, 4·6 mm long, scabrous. Fertile achenes narrowly oblanceolate 4–4·4 mm long 0·8 mm broad, sericeous.

TADZHIKISTAN. W. Pamir Alai, montes Tschulbair, in rupibus calcareis supra pagum Sina 30 v 1930. *Popov & Vvedensky* 350 (LE—isotype, TAK—holotype, not seen).

Popov originally compared *P. primuloides* with *P. pseuderigeron* which, although having small exserted ligules, is nevertheless a tall-stemmed species. In facies, habit and indumentum, however, *P. primuloides* resembles *P. alexeenkoi* and *lumbricoides*. In both of these the female flowers corollas are shorter than the pappus but they are dwarf species in which the peduncles spring directly from the crowns of the plants. The basal leaves are similar in shape, the cauline leaves are small and not strongly developed.

10. Psychrogeton obovatus (Benth.) Grierson **comb. nov.**

Syn.: *Brachyactis obovata* Benth. in Hook. Ic. 12 : 7 (1872, not 1876) *in nota*.

Erigeron obovatus (Benth.) Boiss. Fl. Or. 3: 167 (1875); Rech. f. in Phyton 2: 130 (1950).

Erigeron latisquamus Boiss. Fl. Or. 3: 167 (1875): Rech. f. in Phyton 2 : 131 (1950).

Erigeron bornmuelleri Hausskn. in Sched. ap. Bornm. It. Pers.—turc., 1892–3, No. 5061.

Erigeron latisquamus var *bornmuelleri* (Hausskn.) Bornm. in Beih. Bot. Centralbl. 28 : Pt. 2 : 245 (1912).

Psychrogeton bornmuelleri Novopokr. in Not. Syst. URSS. 7 : 136 (1938).

Psychrogeton amorphoglossus var *latisquamus* Novopokr. in Not. Syst. URSS 7 : 136 (1938).

? *Krylovia popovii* (Botsch.) Tamamsch. in Fl. URSS 25 : 131 t. 10, fig. 3.

? *Aster popovii* Botsch. in Not. Syst. URSS 16 : 381 (1954).

Fig. 2,e.

Dwarf, erect or ascending perennial herbs. Rootstock thick, woody, branching, caespitose. Indumentum moderately or densely villous, interspersed with subsessile glands. Basal leaves spathulate, obovate or subrotund, broadly petiolate; lamina 1·5–3·5 cm long 1–2·5 cm broad, margin crenate—dentate, sometimes entire, obtuse or acute at the apex, attenuate at the base; petiole 1·5–3 cm long, winged. Peduncles several, 10–20 cm tall, bearing 1–3 capitula and about 6 elliptic or oblanceolate cauline leaves, 1–2 cm long. Capitula broadly obconical, 1–1·5 cm broad. Phyllaries 1–2 (–3) seriate,, subequal; outer phyllaries green, 0·8–1 (–1·4) cm long, 1·2–2 (–4·5) mm broad lanceolate or oblanceolate; inner ones straw-coloured with green midrib, 0·8–1 cm long, 0·6–0·8 mm broad, linear lanceolate. Female flowers 10–20 tubular, 3·6–4·8 mm long, 4–5 lobed or shortly ligulate above (2–3 lobes generally longer than the others). Bisexual flowers tubular, 4·5–5·5 mm long, lobes 1–1·2 mm long. Achenes (of female and bisexual flowers alike) elliptic, 3·2–4·4 mm long, ca. 0·8 mm broad, sericeous and glandular. Pappus double, outer setae ca. 0·6 mm long, inner setae ca. 25, 4·5–5·5 mm long, thick, scabrous.

IRAN. Kurdistania assyriaca, 1841, *Kotschy* 546 a (W, K—holotype *B. obovata*); in rupestribus faucis Schir Dere in M. Elburs pr. Derbend, 30 vi 1843, *Kotschy* 407 (G, W. BM—isotypes of *E. latisquamus*); In monte Kuh-Daena, 1842, *Kotschy* 960 (W); Kerman, in faucibus alpinis montis Kuh-i-Dschupar, 2800–3800 m, 10 vi 1892, *Bornmüller* 5061 (W, K, BM); In m. Raswend, 30 viii 1911, *Strauss* sn. (W); Bakhtiari, Galichir, 2135 m., 5 vi 1941, *Koelz* 18075 (W); Chiraz to Tolékhosrow, Kakan Kuhe, Kalivar, 23 ix 1949, *Esfandiari* 1220 E (W); W. Luristan, Ilam, 33° 42′ N, 46° 26′ E, 1700–1900 m., open forest dominated by *Quercus persica*, on slopes of rocky limestone, flowers light-yellow, 9 vi 1963, *Jacobs* 6832 a (W).

AFGHANISTAN. bei Kabul, Paghmantal, 2530 m, 1 vii 1949, *Gilli* 3908 (W).

In Iran the distribution of *P. obovatus* is confined to the mountains of the west and south and to the Elburz mountains in the north, the latter being the locality from which the type of *E. latisquamus* was collected. This geographical separation has no doubt been the major reason for the maintenance of *P. obovatus* and *P. latisquamus* as separate species. Rechinger (l.c.), however, was only able to draw a very narrow morphological distinction between them. The size of the phyllaries (one of his differentiae) is variable among the isotypes of *E. latisquamus*; the one at Vienna has large phyllaries 10 × 3 mm (and some that appear to be abnormal, 14 × 4·5 mm), on the isotype from Geneva they measure 7–8 × 2 mm, that is, no bigger than on the type of *P. obovatus*. A count of the pappus setae of the type specimens of both species gave about 25 for each which is the mean of the figures Rechinger used for distinction. Variation in leaf-shape, "orbiculata usque obovata" and "elliptico usque oblongo-obovata", seems no greater than that encountered in other species. There thus appear to be no grounds for regarding the two populations as distinct taxa.

The only specimen from Afghanistan* to be examined differs from the Persian material in that the cauline leaves are more numerous and the capitula and phyllaries are somewhat smaller. It was originally identified by the collector as a *Krylovia* and it matches the illustration in Fl. URSS of *K. popovii* which is also recorded from the Tian Shan and Pamir Alai ranges. I have not studies authenticated material of this species.

P. obovatus, although roughly agreeing in its thick rootstock, has little in common with *P. amorphoglossus;* its phyllaries, indumentum, cauline leaves and more numerous female flowers are quite different. It compares with *P. chionophilus* in that the achenes of the bisexual flowers of both species are of the same size and shape as those of the female flowers and appear to be as fertile. In other respects, however, these species are dissimilar. The development of the outer phyllaries and cauline leaves finds a parallel in *P. persicus*, but here bisexual flower achenes are normal in being unlike those of the female flowers. *P. obovatus* may be regarded as one of the most distinctive and isolated species of *Psychrogeton*.

Boissier (l.c.) cited Bentham's *Brachyactis obovata* but the dates given on the title pages of the publications might lead one to suppose that the latter's work appeared after Boissier's. Hooker's Icones was published in four parts to each volume, each part containing 25 plates. The last part of Vol. 12 was published in 1876 with the title page for the volume. The first part, containing Bentham's species, was noticed in the Gardeners' Chronicle of October 12, 1872. Notice of the third volume of Boissier's Flora appeared in the same publication on November 20, 1875.

11. Psychrogeton sphaeroxylus (Gilli) Grierson **comb. nov.**

Syn.: *Erigeron sphaeroxylus* Gilli in Fedde Repert. 68 : 88 (1963).

Fig. 5,a.

Dwarf erect or ascending perennial herbs. Roots thickly woody, branched above and bearing numerous rosettes of leaves. Indumentum ± densely pilose or sometimes villous intermixed with subsessile glandular hairs. Basal

* Since writing this two further Afghan Specimens have come to hand, both collected from Gardez Province, Mt. Safed Kuh: *Rechinger* 31910 (W), 32023 (W).

leaves rosulate, 0·3–1 (–2·5) cm long, 2–5 (–7·5) mm broad, obovate or spathulate, ± obtuse and entire at the apex, sometimes 3–5 crenately toothed, cuneate and attenuate below or sometimes with ± distinct petioles 1–1·5 cm long. Peduncles 2–3 (–8) cm tall, monocephalous, bearing several (up to 6) oblong or oblanceolate cauline leaves up to 1·5 cm long, ± obtuse at the apex, attenuate or subpetiolate at the base. Capitula ca 1 cm broad, broadly obconical. Phyllaries ca. 2–seriate, imbricate, 4–7 mm long, 0·8–1 mm broad, linear-oblong, obtuse or subacute at the apex, margin narrowly scarious. Female flowers ca 20–30, corollas tubular 3·2–3·6 mm long, limb 4–lobed lobes 0·6–0·8 mm long. Bisexual flowers tubular 4–4·2 mm long, limb 5–lobed, lobes 0·8–1 mm long, glabrous. Fertile achenes elliptic or oblanceolate, 2·8 mm long, 0·6 mm broad, sparsely sericeous and glandular: achenes of bisexual flowers linear, empty. Pappus double, outer setae few, thin, ca. 0·4 mm long, inner setae 15–20, 3–4 mm long, finely scabrous below, becoming thickened and barbellate at the apex.

AFGHANISTAN. Kalkberg NO von Bamian, an Felsen, 3040 m, 18 vii 1949, *Gilli* 3919 (Soz. Aufn. No. XXII)(W—syntype); same locality and ecological sample, *Gilli* 3920 (W); E. Afghanistan, bei Tschakewardak, unter dem Gipfel eines Kalkberges NW von Stausee, 2300 m, 6 viii 1949, *Gilli* 3921 (Soz. Aufn. No. XXXII) (W—syntype); Bamian, Montes Kuh-i-Baba, in faucibus inter Bamian et jugum Hadjigak, in fissuris rupium calc., ca. 34° 45′ N 68° 00′ E, ca. 3000 m, 17 vii 1962, *Rechinger* 18493 (W); Maymana, Darrah Belčeraghstony slopes, flowers whitish, 1200 m, 30 v 1962, *Hedge & Wendelbo* 3768 (E): Bamian, Paimuri Gorge, crevices of rocks, 2700 m, 27 vi 1962, *Hedge & Wendelbo* 4683 (E).

Both of Gilli's collections from Ecological Sample XXII are of very small plants with leaves no more than 1 cm and peduncles no more than 2 cm long. His gathering from Ecological Sample XXXII from a lower altitude is of larger plants (leaves 1·5 cm, peduncles 3 cm long). These specimens are the syntypes of this species; the others that I have cited here although generally larger in their vegetative parts (their maximum measurements are given in brackets in the description) are connected by intermediates and agree morphologically with those of Gilli. *Hedge & Wendelbo* 3768, however, deserves some comment. This specimen from N. W. Afghanistan has decumbent rather than more or less erect peduncles, leaves that are thinner in texture, more elongate or oblanceolate in outline, and indumentum that is less strongly glandular. In other respects, although immature, it agrees with material gathered in central and eastern parts of the country.

This species was originally compared with *P. chionophilus* and this is superficially a true comparison so far as the type specimens are concerned. Apart from the differences between these species which Gilli enumerated, *P. chionophilus* is a more slender plant with thin, scarcely woody roots and probably never adopts the caespitose habit of *P. sphaeroxylus*. The corollas of the female flowers of *P. chionophilus* are obliquely cut, entire and shortly ligulate at the apex and not divided into four lobes. *P. chionophilus*, however, is related to *P. persicus* and, through it, to *P. obovatus* and, in the opinion of the present author, *P. sphaeroxylus* is more closely related to the last named. *P. obovatus* is a larger plant but it agrees in habit, indumentum and to some extent in foliage characteristics. Its phyllaries, although not imbricated, tend

to be obtuse and the corollas of the female flowers are generally four-lobed. The close relationship that also exists with *P. drabiformis* has been discussed under that species.

P. sphaeroxylus may not be distinguished on any one character alone; its identity depends rather on a combination of several. These include the spathulate or obovate leaves which are rounded or toothed at the apex, the indumentum, the imbricate involucre of obtuse or subacute phyllaries, the hermaphrodite flower corollas and the barbellate tips of the pappus setae.

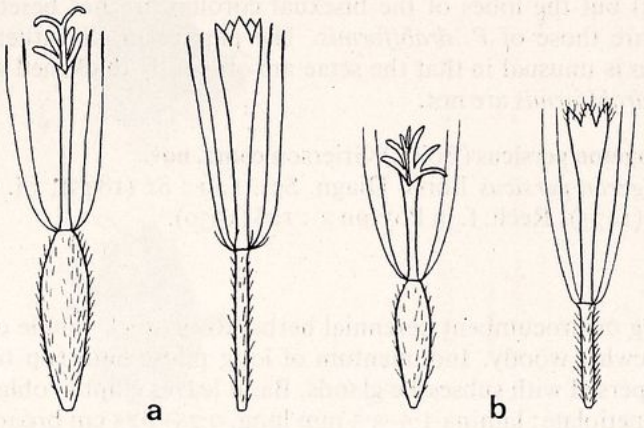


FIG. 5. Drawings to show female and hermaphrodite flowers of A. *P. sphaeroxylus*, B. *P. drabiformis;* (× 8. The number of pappus satae reduced in both.)

12. Psychrogeton drabiformis Grierson **sp. nov.** (Plate 5 and Fig. 5, b).

Herba perennis, nana, dense caespitosa. Radices crasse lignosae, caudicibus abbreviatis numerosis lignescentibus, reliquiis foliorum annorum praecedentium dense obtectis. Indumentum pedunculorum, involucrorum et foliorum paginae inferae ± dense pilosum, glandulis subsessilis intermixtis, foliorum paginae supra omnino glandulifera. Folia basalia rosulata, spathulata vel bellidiformia, 0·6–1·2 cm longa, 4–7 mm lata, apicibus 3–5 crenatodentatis, ad basin cuneata, attenuata vel subpetiolata. Pedunculi monocephali, usque ad 2·5 cm alti, ebracteati vel unibracteati, bractea 3–4 mm longa lineari. Capitula 7·5 mm lata. Phyllares 30–35 imbricatae 2–3 seriatae, anguste lineari-lanceolatae, acuminatae, 5–6 mm longae 0·4–0·6 mm latae, virides, marginibus albescentibus. Flores marginales feminei, lutei, ca 60 (pappi aequilongis vel paulo brevioribus) 2–2·5 mm longi, partibus inferioribus tubulosis 1·4–1·6 mm longis, limbis 4–5 lobatis. Flores disci bisexuales 3 mm longi, 5–lobati, apicibus loborum extra paucisetosis. Achaenia florum femineorum fertilia, anguste oblanceolata, 2 mm longa 0·4 mm lata, parce sericea; achaenia florum disci linearia vacua. Pappi achaeniorum fertilium simplices, 12–15 setae 2·4 mm longi, pappi achaeniorum disci ca 20 setae.

AFGHANISTAN. Bamian, hill on west side of Shibar Pass, ca 3000 m, crevices of rocks, flowers yellow, 14 vi 1962. *Hedge & Wendelbo* 4208 (E, holotype); Bamian, inter Bulola et jugam Shibar, ca 34° 53′ N 68° 10′ E, ca 2600–2800 m. 14 vi 1962, *Rechinger* 16803 (W).

This species is most closely related to *P. sphaeroxylus* which it resembles

in habit, leaf and to some extent in indumentum. But whereas the leaves of this species are rounded or only shallowly dentate, those of *P. drabiformis* are always distinctly toothed. The eglandular hair is coarser in the latter, but unlike *P. sphaeroxylus*, it is confined on the leaves to the undersides and margins. It is, however, in the capitulum that the main distinctions between these two species lie. The phyllaries of *P. sphaeroxylus* are fewer (ca. 20–25), approximately twice the width of those of *P. drabiformis* (0·8 mm broad) and broadly acute or rounded at the apex. The corollas of both female and bisexual flowers of *P. sphaeroxylus* are slightly longer (3 mm and 4 mm long respectively) but the lobes of the bisexual corollas are not beset with short bristles as are those of *P. drabiformis*. The pappus in all gatherings of *P. sphaeroxylus* is unusual in that the setae are obviously thickened at the ends: those of *P. drabiformis* are not.

13. Psychrogeton persicus (Boiss.) Grierson **comb. nov.**

Syn.: *Erigeron persicus* Boiss. Diagn. Ser. 1, 6 : 81 (1845); Fl. Or. 3 : 167 (1875); Rech. f. in Phyton 2 : 128 (1950).

Fig. 3,b.

Ascending or procumbent perennial herbs. Root stock simple or branched above, somewhat woody. Indumentum of long pilose hairs (up to 0·6–1 mm long) interspersed with subsessile glands. Basal leaves elliptic, oblanceolate or spathulate, petiolate; lamina 1·5–3·5 mm long, 0·75–1·25 cm broad, attenuate at base, acute at apex, margin with a few small teeth or entire; petiole up to 2·5 cm long, densely pilose at the base. Peduncles several, 7–22 cm long, each bearing up to 4 capitula and numerous cauline leaves 0·75–3 cm long, oblanceolate, sessile or attenuate and indistinctly petiolate at base, acute or subacuminate at the apex. Capitula 1–1·3 cm broad; phyllaries 2–3 seriate, subequal, 5–7 mm long linear, acuminate, outer ones ± uniformly green, purplish at the tips, inner ones straw-coloured, indumentum pilose and glandular becoming longer and more dense at the base. Female flowers ca. 50–60, corollas tubular, glabrous 3·2–3·4 mm long (as long as the style), 3–4 lobed at the apex. Bisexual flowers tubular, 4·2–4·8 mm long, 5–lobed at the apex, lobes 0·6–1 mm long. Pappus simple, 3·4–4·2 mm long, setae 30–40, capillaceous or finely scabrous. Fertile achenes elliptic or oblanceolate 2·4–2·8 mm long, 0·8 mm broad, finely sericeous and glandular; achenes of bisexual flowers linear, empty.

IRAN. In reg. superioribus alpis Kuh-Delu, 12 vii 1842, *Kotschy* 498 (W, E, BM, K, isotypes); Pir Omar Gudrun, as nives Mr. Schahu, 3655 m, ix 1867, *Haussknecht* 522 b (K); in montibus calcareis Avroman et Schahu, ad nives, 3655 m., vi–vii 1867, *Haussknecht* sn (W, BM, K); ad nives Killal (?) ix 1868, *Haussknecht* sn. (W, BM, K); Nehavend, in M. Kuh-i-Gerru, 2 viii 1908, *Strauss* sn (W); Kala-Kuh, 3200 m., 20 vii 1890, *Sawyer* (Watt Coll. 13093) (E); above Ardakan, 2590 m., 9 viii 1939, *Davis* 763 K (W, E); Luristan, Dorud, 2440 m., 27 vi 1941, *Koelz* 18364 (W); Kerman, Kuh-i Lalesar, 3800 m, 19 viii 1949, *Starmuehler* 148 (W).

Specimens of *P. persicus* may be recognised by their slender roots which are only occasionally swollen and much branched in their upper parts. The indumentum is distinctive and the leafy peduncles, although they find a parallel

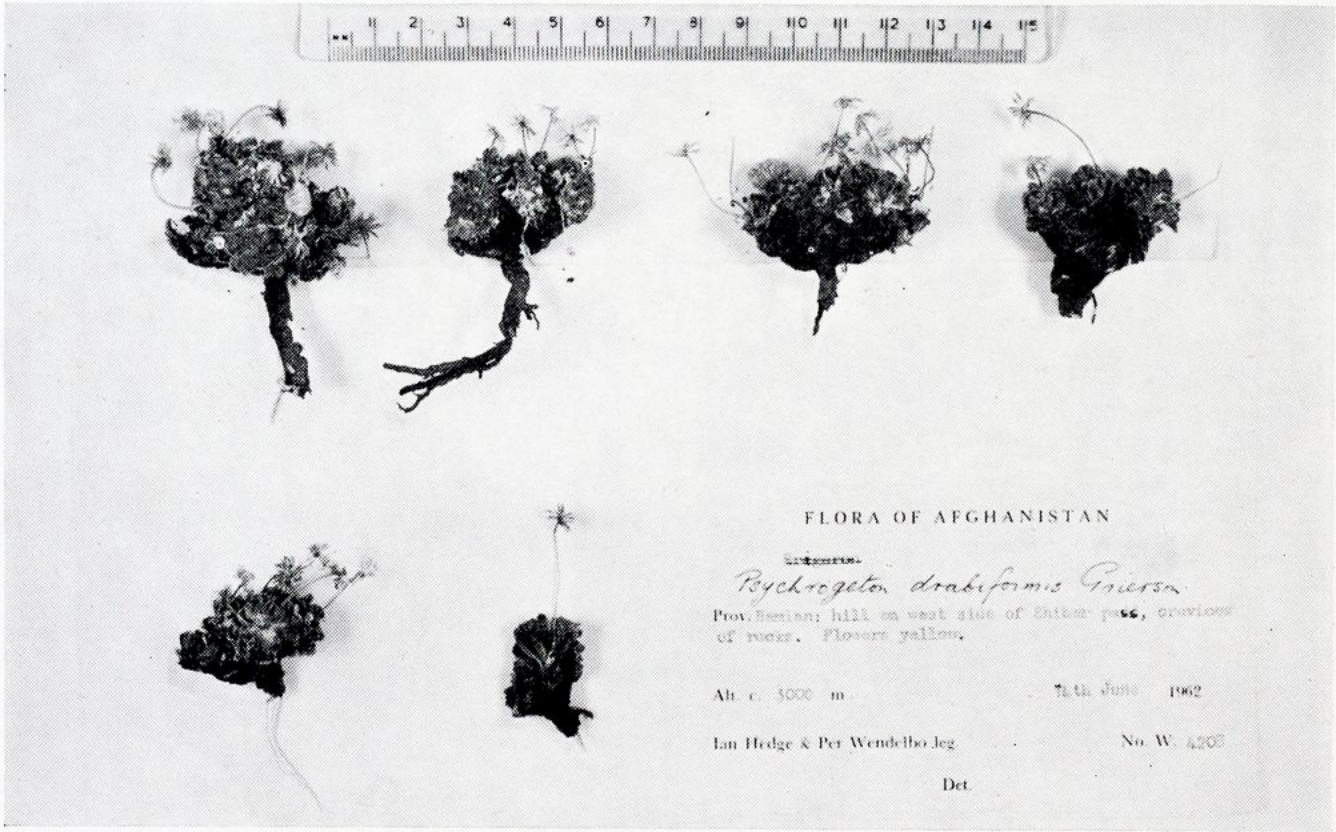


PLATE 5. Type specimen of *Psychrogeton drabiformis* Grierson.

in those of *P. obovatus*, are readily distinguished by their oblanceolate leaves. Taller specimens of *P. persicus* could be confused with depauperate plants of *P. aucheri*. The latter is usually coarser in habit with more richly branched peduncles, the indumentum is shorter, sparser and more glandular. The female flowers of *P. aucheri* are slightly longer than in *P. persicus* and they are minutely papillose: those of *P. persicus* are glabrous. The pappus of *P. aucheri* has an obvious outer series of smaller setae; the pappus of *P. persicus* is simple.

Stunted or grazed specimens of *Brachyactis roylei* (DC.) Wend. (*B. umbrosa* Benth.) may also be confused with this species but may be distinguished by the broader, leafier and more outer phyllaries, by the lack of coloration in the older flowers and because the achenes of the disc flowers are fertile and similar in shape to those of the marginal flowers.

14. Psychrogeton aellenii (Rech. f.) Grierson, **comb. nov.**

Syn. *Erigeron aellenii* Rech. f. in Phyton 2 : 132 (1950).

Fig. 3,a.

Dwarf erect or ascending perennial herbs rootstock slender, branching, scarcely woody, swollen with foliar remains at the apex. Cataphylls 5 mm long, 3 mm wide, oblong, obtuse, yellowish brown (in sicco). Basal leaves oblanceolate or spathulate, acute or subacute at the apex, attenuate and petiolate at base, margins entire, 2–5 cm long including petiole 1–2 cm long, covered on both sides with long (ca 0·5 mm) fine pilose hairs and minute glandular papillae. Peduncles ± erect or ascending, monocephalous or branching and bearing up to 4 capitula, almost glabrous or covered with long pilose hair and shorter glandular hairs and bearing several linear, lanceolate or oblanceolate leaves 0·6–1·4 cm long. Capitula 1–1·4 cm broad; phyllaries subequal, 2–3 seriate, linear-lanceolate, acuminate, 5–6 mm long 0·8–1·2 mm broad purplish-green especially at apex. Female flowers ca 30–35, narrowly tubular, 3–lobed at the apex, ca 3.6 mm long. Bisexual flowers tubular, 5–lobed, 3·6–4 mm long lobes ca 0·6 mm long. Achenes of female flowers (immature) narrowly oblanceolate, ca 2–2·8 mm long, sericeous; achenes of bisexual flowers narrow, empty. Pappus ca 3·5–4 mm long, simple, setae ca 35, capillaceous or somewhat scabrous.

IRAN. Khorasan, Montes Hazar Masdjid, ca 2800 m, 8 vi 1948, *Rechinger & Aellen* 5133 (W—holo): Shahrud-Bustam, in declivibus australibus montium Shahvar, in saxosis calc., 3500–3900 m, 25 vii 1948, *Rechinger* 6010 a. (W, holo. var *hirsutifolius*).

P. aellenii is undoubtedly related to *P. chionophilus* and to *P. brachyspermus* which it resembles in habit and in the facies of the capitulum. The leaves, however, are strictly entire and covered (in varying degree) with long fine hair. The peduncles are sometimes branched which they never are in either of the above related species. The phyllaries are also more numerous. Female corollas are longer than those of *P. chionophilus* and shorter than those of *P. brachyspermus* but unlike both they seem to be consistently tubular. Also unlike them, the achenes of the female and bisexual flowers are quite different in appearance.

The characters which Rechinger (l.c.) used to define var *hirsutifolius* (slightly more obtuse leaves and more copious indumentum) are not on the present evidence sufficiently different from those of his typical variety and the species must be regarded as being somewhat variable in these respects. Nor have I observed any achenes on *Rechinger* 6010a as long as 4 mm: the longest seen was 2·8 mm.

P. chionophilus, *brachyspermus* and *aellenii* are far from being well understood and at present are only represented by altogether six gatherings. It is to be hoped that further collections will soon be made which would permit a more confident reappraisal of these species.

15. Psychrogeton chionophilus Krasch. in Acta Inst. Bot. Acad. Sci. URSS. Ser. I, Fasc. 3 : 343 (1937) in obs.

Syn.: *Erigeron chionophilus* Boiss. Fl. Or. 3 : 168 (1875): Rech. f. in Phyton 2 : 131 (1950) non Wedd. (1855).
Erigeron nivalis Boiss. Diagn. Ser. I, 6 : 82 (1845), non Nutt.
Conyza nivalis Boiss. in Sched. ap. Kotschy (1845).

Fig. 2,f.

Dwarf slender perennial herbs, ± erect or decumbent. Rootstock thin elongate, thickened above with leaf remains. Cataphylls 0·5-0·75 cm long, oblong, crenate-dentate at the apex, yellowish (in sicco) covered with glands and sparse stiff pubescence. Basal leaves oblanceolate-spathulate 1–2 cm long 3–7 mm broad, attenuate and indistinctly petiolate at the base, obtuse or subacute at the apex, margin 2–3 crenate-dentate on each side near the apex, sparsely villous pubescent and glandular. Peduncles decumbent (or prostrate?) 3–4·5 cm long, monocephalous, pubescent and glandular bearing 3–4 linear or lanceolate cauline leaves, 5–7 mm long, ca 1·5 mm broad. Capitulum 1–1·2 cm broad; phyllaries ca 20–25, 1–2 seriate, subequal, dark green with purplish tips, 7 mm long 1 mm broad, linear, acute at the apex, pubescent especially at the base and glandular. Female flowers ca 20 tubular, shortly ligulate at apex, 2·6–3 mm long; styles exserted. Bisexual flowers tubular, 5-lobed, 3–3·6 mm long; lobes ca 0·7 mm long. Achenes (immature) 2·5 mm long 0·6 mm broad, oblanceolate, finely sericeous (achenes of female and bisexual flowers often similar). Pappus simple, 2·4 mm long, ca 30 setae, scabrous.

IRAN. In cacumine montis Kuh-Daena, 1 viii 1842, *Kotschy* 800 a (G, W, K, BM-syntypes): ad fontem Dschesohme-Pias in M. Kuh-Daena, nivem liquescentem, 29 vii 1842, *Kotschy* 945 (G—syntype); Fars, Kuh Daena, 3600 m, ix 1955, *Remandien* 5254 E (W).

This species is allied to *P. persicus* and resembles it in its slender rootstock, in the shape of the basal and cauline leaves and in the female corollas. *P. chionophilus* differs sharply from the latter, however, in its smaller size, its less abundant tomentum, its regularly monocephalous peduncles and in having fewer phyllaries. It may possibly be regarded as a local and more alpine derivative of *P. persicus*. The present species is also closely related to *P. aellenii* and *brachyspermus*.

P. chionophilus in one case at least, *Remandien* 5254 E, is unstable with re-

gard to the development of the bisexual flower achenes: in this specimen they are normal i.e. linear and infertile. Probably as more material of the related *P. aellenii* and *brachyspermus* becomes available they too will prove to be unstable. *P. obovatus*, on the other hand, which has been more plentifully collected, has so far proved to be constant in this respect.

16. Psychrogeton brachyspermus (Botsch.) Grierson, **comb. nov.**

Syn.: *Erigeron brachyspermus* Botsch. in Not. Syst. URSS 18: 266 (1957) et ex Fl. URSS 25 : 269 (1959); Ikonnikov, Pamir Pl. (Trud. Bot. Inst. Ac. Tadzhik. 20) 233 (1963).

Fig. 3,c.

Slender dwarf perennial herbs. Rootstock slender, sometimes branched, bearing dense collars of leaf remains. Cataphylls ca 1 cm long 0·5 cm broad, oblong, trilobed, glandular. Basal leaves lanceolate or oblanceolate, 3-5 cm long 7–8 mm broad including petioles ca 1–2·5 cm long, attenuate into petiole at base, acute or subacute at the apex, margins entire or more usually distantly 3–4 dentate on each side indumentum sparsely villous pubescent and glandular with subsessile glands. Peduncles unbranched, ca. 10 cm tall, monocephalous, glandular, bearing 3–4 cauline leaves 1–2 cm long 2–3 mm broad, oblanceolate or spathulate, entire, sessile, ± acute at the apex. Capitulum ca 1·5 cm broad; phyllaries ca 25, subequal, 2–3 seriate purplish-green (in sicco), 5–8 mm long 1 mm broad, linear acuminate, villous pubescent and densely glandular. Female flowers ca 60, tubular or shortly ligulate, longer than the pappus; corollas ca 5·5 mm long, the upper 0·8 mm ligulate or tubular and 2–3 lobed at the apex; style not exserted. Bisexual flowers tubular 5 mm long, lobes 0·8 mm long. Achenes 2·5 mm long 0·6–0·7 mm broad, oblanceolate shortly and finely sericeous, achenes of female and bisexual flowers similar. Pappus 4·8 mm long simple ca 45–50 setae, setose.

KIRGIZ. Pamir orientalis, Mons Kara Kytej prope montem Aktash (i.e. ca 40° 4′ N, 72° 50′ E), in rupibus declivibus australis, 4300 m, 7 viii 1953, *Ikonnikov* sn (holo. LE).

This species is most closely related to *P. chionophilus* and may possibly be regarded as a larger and more elongated derivative of that species. The habit of both is similar although *P. brachyspermus* grows more erect. Leaves, peduncles and capitula are all larger but essentially similar in shape and degree of branching. Indumentum too is similar but *P. brachyspermus* has fewer eglandular hairs than *P. chionophilus* and they are less coarse. The main distinction between the species seems to lie in the proportions of the female corollas and the pappus. In both, these corollas are tubular or shortly ligulate (although in *P. brachyspermus* the upper margins of the ligules are sometimes inrolled) but in *P. brachyspermus* they are rather more than half a millimetre longer than the pappus whereas, in *P. chionophilus*, they are only as long as the pappus. Both species are alike in the proportions of the achenes: those of the bisexual flowers are as large as those of the female flowers and the development of embryos within them apparently commensurate.

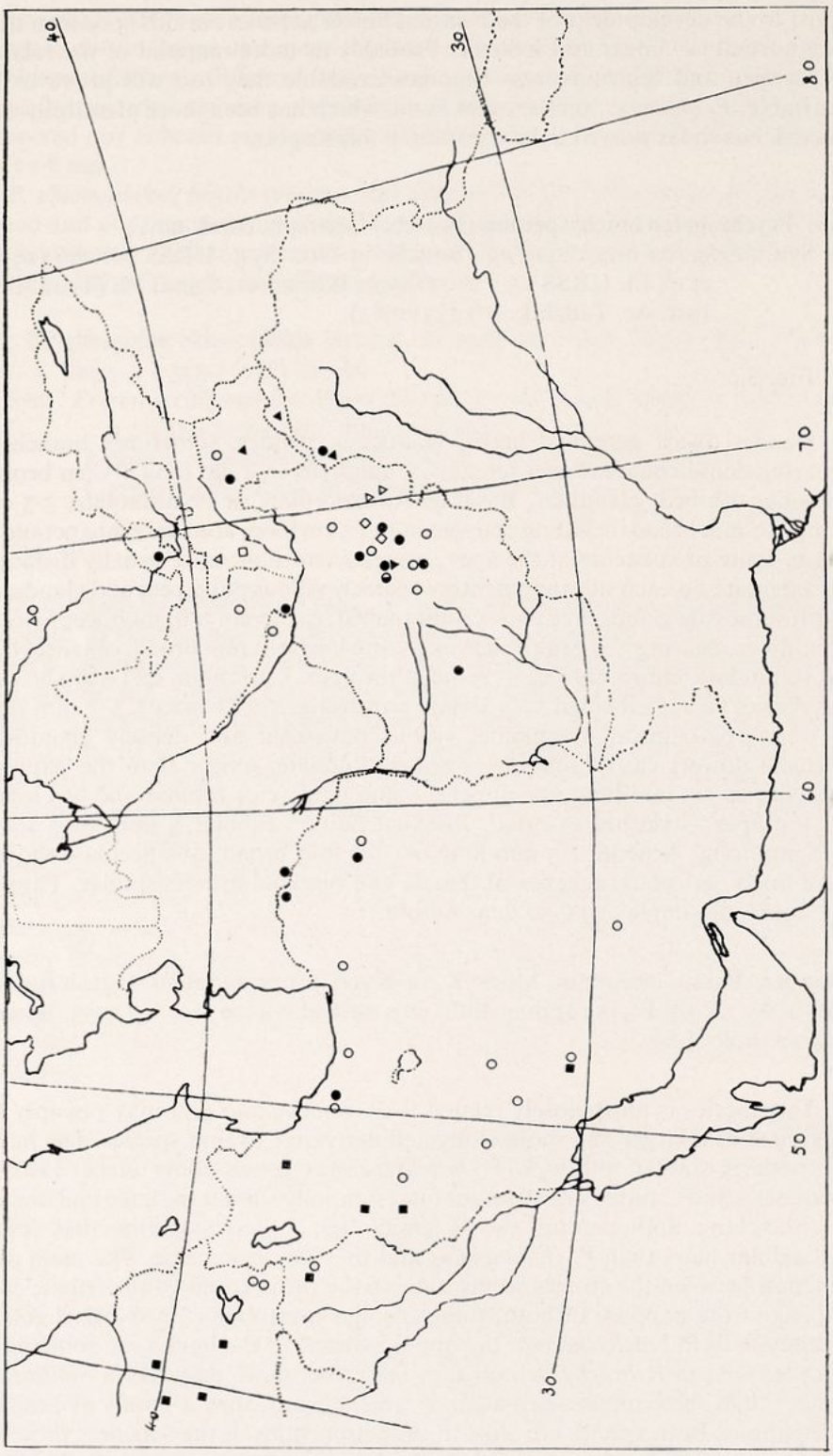


FIG. 6. Map of Central Asia to show distributions of: ○ *P. amorphoglossus*, ● *P. aucheri*, □ *P. biramosus*, ▽ *P. candidissimus*, ▼ *P. drabiformis*, ◇ *P. lumbricoides*, ◆ *P. nigromontanus*, ▲ *P. olgae*, △ *P. pseuderigeron*, ◐ *P. sphaeroxylus*.

17. Psychrogeton biramosus (Botsch.) Grierson **comb. nov.**

Syn.: *Erigeron biramosus* Botsch. in Fl. URSS 25 : 279 et in Addenda l.c. p. 588 (1959).

Fig. 4,c.

Erect perennial herb with woody rootstock bearing several erect or ascending stems 15 cm. tall (up to 35 cm according to Botschantzev) bearing 6 or more capitula in racemes or panicles; indumentum cinereous pilose with long multicellular hairs interspersed with glistening subsessile glands. Radical leaves withered at flowering time; lower cauline leaves 4–9 cm. long 0·6–1·2 cm broad, oblanceolate, tapering below into petioles 2–4 cm long, apex acute, margins entire; upper cauline leaves 1·5–3 cm long 2–5 mm broad, lanceolate or oblanceolate, tapering and subamplexicaul at base, acute at apex, margins entire. Capitula ca. 1·2 cm broad; phyllaries subequal, 3–seriate, 6–7 mm long 0·6–0·7 mm broad, linear-lanceolate, acuminate. Female flowers radiate, ca 60, ligules yellow, ca 2 mm long 0·8 mm broad, 2–3 toothed at the apex, basal tube ca 3 mm long: bisexual disc flowers numerous, tubular ca 4 mm long tubes ca 1 mm long 0·5 mm broad. Fertile achenes (immature) ca 2 mm long 0·5 mm broad, finely sericeous. Pappus double, outer setae sparse ca 0·6 mm long, inner setae 20–30, ca 4 mm long.

UZBEKISTAN. Montes Hissar, inter flum. Kanadara et Luczeb, 2900 m., 16 vii 1933, *Zaprjagaev* 599 (holo. LE)

Although only known from a single gathering, this is without doubt a very distinct species. It is most closely related to *P. aucheri* which it resembles in habit, leaf shape, inflorescence and in capitulum size and shape. *P. biramosus* differs from both *P. aucheri* and *P. nigromontanus* in being more obviously perennial and smaller in stature. Its leaves are always entire and without the dentation that is common to both these other species. *P. biramosus* is also nearly related to *P. pseuderigeron* and both these species differ from *P. aucheri* and *nigromontanus* in having well developed and exserted ligules.

Among these four related species *P. biramosus* and *pseuderigeron* seems to represent the basal point of a line of development in the female flower corollas: in *P. nigromontanus* the corollas are shorter than their styles and pappus; in *P. aucheri* as long as both styles and pappus; in *P. biramosus* and *pseuderigeron* the corollas are longer than both styles and pappus, and of the two *P. pseuderigeron* has the longer ligules. In this way, *P. biramosus* also forms an interesting link between the radiate and eradiate species of *Psychrogeton* and strengthens the argument for placing *P. aucheri* and *nigromontanus* in this genus rather than in *Conyza*.

18. Psychrogeton pseuderigeron (Bge.) Novopokr. ex Nevski in Acta. Inst. Bot. Acad. Sci. URSS Ser. 1, 4 : 278 (1937).

Syn.: *Heterochaeta psuederigeron* Bge. (Reliq. Lehmann.) in Mem. Acad. Imp. Petersb. 7 : 325 (1854).
Erigeron lehmanni Boiss. Fl. Or. 3 : 171 (1875), non Spreng.
Aster capusii Franch. in Ann. Sci. Nat. Ser. VI, 16 : 304 (1883).
Psychrogeton capusii Novopokr. ex Krasch. in Acta Inst. Bot. Acad. Sci. Ser 1, 3 : 343 (1937), in nota.

Erigeron capusii (Franch.) Novopokr. in Not. Syst. URSS 7 : 131 (1937).

E. pseuderigeron (Bge.) M. Pop in Not. Syst. URSS 7 : 131 (1937); l.c. 8, 49 (1940); Acta Inst. Bot. Acad. Sci. URSS. Ser 1, 7 : 9 (1948); Botsch. in Not. Syst. URSS 16 : 380 (1954), et Fl. URSS 25 : 267 (1959).

Fig. 4,e.

Erect or ascending perennial herbs. Rootstock elongate, somewhat woody, bearing several stems. Cataphylls mostly withered, ca 1 cm long 0·5 cm broad, oblanceolate, acute, margin 2–3 toothed on each side, pilose and glandular papillose. Stems ca 30 cm tall, striate, villous, bearing above several branches (as many as 6), each branch bearing several capitula. Basal leaves oblanceolate or obovate, acute or subacute at the apex, attenuate at the base into a petiole, lamina 4–5 cm long, 1·5–2 cm broad, petiole 4–5 cm long, margin coarsely 5–6 dentate on each side, indumentum pilose and glandular papillose. Cauline leaves oblong or oblanceolate, 2·5–7·5 cm long 0·75–2 cm broad, attenuate below into an indistinct petiole, otherwise similar to basal leaves. Capitula 1–1·5 cm broad; phyllaries 3–4 seriate, linear-lanceolate, acuminate, imbricate, outer phyllaries ca 4 mm long 0·5 mm broad, green, stiffly pilose dorsally, inner ones ca 6 mm long 0·8 mm broad, straw coloured, purplish at the tips, glandular papillose. Female flowers 60–70, ligulate, basal tube 3·2–4·0 mm long, ligule 3·6–4 mm long, entire or minutely 2–3 lobed at the apex. Bisexual flowers tubular, 5-lobed, ca 5·5–6 mm long; lobes 0·8 mm long. Achenes of female flowers fertile, ca 2·5 mm long 0·7–0·8 mm broad, oblanceolate, finely sericeous and glandular; achenes of bisexual flowers narrower empty. Pappus double, outer setae ca 0·6 mm long, narrowly paleaceous, inner setae ca 25, capillaceous or finely scabrous, ca 4·5 mm long.

KAZAKHSTAN. In regione alpine montis Karatau, 12 ix 1841, *Lehmann* 618 (holo. LE).

TADZHIKISTAN. Marzitasch (Zeravshan valley?), 6 vii 1881, *Capus* 597 (P—holo. of *Aster capusii*); Iter seravschanicum, Iskander to Samarkand, 30 vi 1915, *Balabajev* s.n. (BM). Also reported from the Kuhitang range, Tadzhikistan (*B. A. Fedtschenko* 567) by Novopokrovski (in Acta Inst. Bot. Acad. Sci. URSS Ser. 1, 4, 278 : 1937) and from the Ashkhabad-Kopet Dagh area by Nikitin (Illustr. Defin. Acc. Pl. Aschkhbad, 1965). Botschantzev (1959) recorded this species from Iran, but I have seen no specimens from that country.

P. pseuderigeron is distinguished from the other tall branched species of *Psychrogeton* (*P. aucheri*, *nigromontanus* and *biramosus*) by its oblong and more coarsely toothed cauline leaves and by its larger capitula which are borne on spreading branches from the upper half of the stem. As in *P. biramosus* the female flowers are ligulate but the ligules are longer than in the latter species.

Novopokrovski (in Not. Syst. URSS 7, 133 : 1937) also described four varieties of this species: var. *serratifolius*, a more robust plant, up to 38 cm tall, collected from Fergana (Kirgiz); var. *erectus*, a slender variety as tall as the

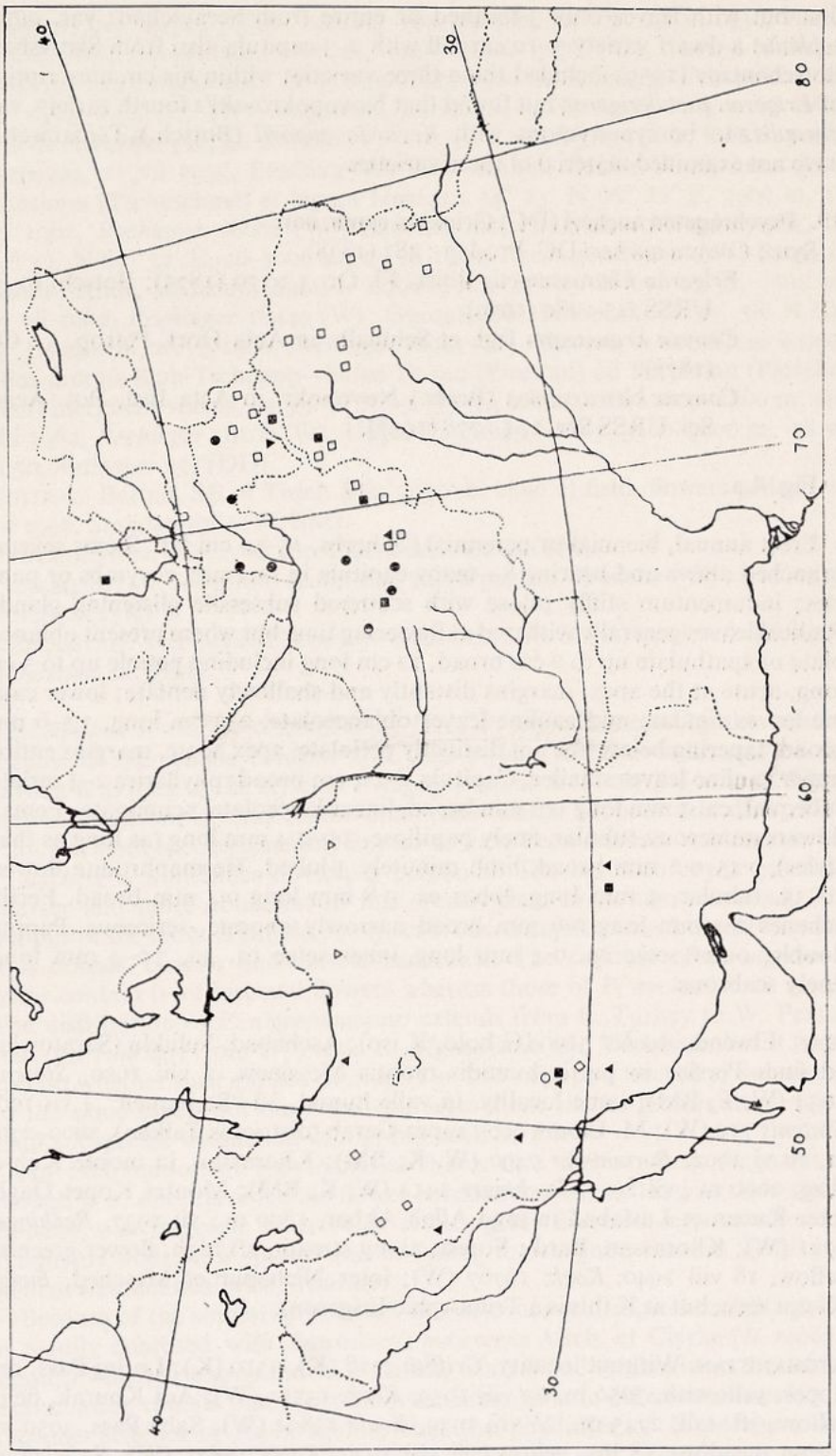


FIG. 7. Map of Central Asia to show distributions of: ▽ *P. aellenii*, ■ *P. alexeenkoi*, □ *P. andryaloides*, △ *P. brachyspermus*, ● *P. cabulicus*, ○ *P. chionophilus*, ▲ *P. obovatus*, ◇ *P. persicus*, ▼ *P. primuloides*, ◑ *P. rotundifolius*.

first but with leaves only 3-toothed or entire from Seravschan: var. *oligocephalus* a dwarf variety 5–10 cm tall with 2–3 capitula also from Seravshan. Botschantzev (1959) included these three varieties within his circumscription of *Erigeron pseuderigeron* but found that Novopokrovski's fourth variety, var. *filicaulis*, to be synonymous with *Krylovia popovii* (Botsch.) Tamamsch. I have not examined material of these varieties.

19. Psychrogeton aucheri (DC) Grierson **comb. nov.**

Syn.: *Conyza aucheri* DC. Prod. 7 : 281 (1838).

Erigeron khorassanicus Boiss. Fl. Or. 3 : 170 (1875); Botsch. in Fl. URSS. 25 : 280 (1959).

Conyza krausseana Rgl. et Schmalh. in Acta Hort. Petrop. 5 : 616 (1877).

Conyza khorassanica (Boiss.) Novopokr. in Acta Inst. Bot. Acad. Sci. URSS Ser. 1, 4 : 278 (1937).

Fig. 4,a.

Erect annual, biennial or perennial (?) herbs, 15–90 cm tall. Stems several, branched above and bearing 8—many capitula in racemes, corymbs or panicles; indumentum stiffly pilose with scattered subsessile glistening glands. Radical leaves generally withered at flowering time but where present oblanceolate or spathulate up to 2 cm broad, 12 cm long including petiole up to 5 cm long, acute at the apex, margins distantly and shallowly dentate; lower cauline leaves similar; mid cauline leaves oblanceolate, 2–3 cm long, 3·5–6 mm broad, tapering below but not distinctly petiolate, apex acute, margins entire; upper cauline leaves smaller. Capitula 1–1·4 cm broad; phyllaries 2–3 seriate, subequal, ca. 4 mm long 0·6 mm broad, linear lanceolate, acuminate. Female flowers numerous, tubular, finely papillose, 3·6–4·4 mm long (as long as their styles), 0·15–0·2 mm broad, limb minutely 3-lobed. Hermaphrodite flowers 10–35, tubular, 4 mm long, lobes ca. 0·8 mm long 0·4 mm broad. Fertile achenes 2·4 mm long 0·6 mm broad narrowly oborate, sericeous. Pappus double, outer setae ca. 0·4 mm long, inner setae ca. 30, 3·6–4 mm long, finely scabrous.

IRAN. Elwend, *Aucher* 3109 (G holo, K iso); Aschabad, Suluklu (Saratowka) ad fines Persiae in pratis humidis montis Messinew, 2 viii 1900, *Sintenis* 1034 (W, E, BM); same locality, in valle humid, ad "Steinquell" 4 vii 1900 *Sintenis* 710 (W); M. Elburs occ., supra Gerab (districtus Talkan), 2600–2700 m, 26 vi 1902, *Bornmüller* 7490 (W, K, BM); Khorassan, in monte Kuh-e-Bizg, 2000 m., vii 1937, *Rechinger* 1414 (W, K, BM); Montes Kopet Dagh, inter Kucan et Lutfabad in jugo Allah Akbar, 1800 m., vii 1937, *Rechinger* 1721 (W); Khorassan, Bardu Forest, along stream, 2ft high, flower greenish yellow, 18 viii 1940, *Koelz* 16767 (W); inter Nichapur et Mesched, *Bunge* (G not seen, but at K this is a Trimorphic Erigeron).

AFGHANISTAN. Without locality, *Griffith* 3118 (K), 3119 (K); Lorinj Pass, dry slopes, yellowish, 3050 m, 27 viii 1939, *Koelz* 13751 (W); Aoi Khurak, field, yellow, 3ft. tall, 2745 m., 28 viii 1939, *Koelz* 13802 (W); Sabz Pass, 3050 m, spring meadow, 18 ins. yellow, 28 viii 1939, *Koelz* 13821 (W); Safedzang, 3050 m, along stream, 1 ft., 24 ix 1939, *Koelz* 14007 (W); Burchao Pass,

3050 m, dry slope, yellow turning rose-purple, 10 ins. 13 x 1939, *Koelz* 14138 (W); Farakulum, 2700 m, 1948, *Koeie* 3276 (W); Hauz-i-Mahiha, 2600 m, 1948, *Koeie* 2410 (W); Paghman, 2900 m, Schattige Felsspalten, 17 vii 1950, *Volk* 947 (W); Paghman, Bachufer, 5 viii 1951, *Volk* 2168 (W); Col de Sabzzak, pré, au sommet, 17 vi 1959, *Lindberg* 653 (W); Doavi, pente herbeuse, 21 vii 1959, *Lindberg* 670 (W); Kabul, Qala-e Wazir inter Sar-i Chashma (Tscheschme) et jagum Unai, ca 34° 25′ N 68° 22′ E, 2900 m, 12 vii 1962, *Rechinger* 18086 (W); Bamian, inter Bamian et Band-i-Amir, ca 34° 52′ N 67° 32′ E, 28–3000 m, 13 vii 1962, *Rechinger* 18180 (W); Bamian, Bandi-i-Amir, ad lacum Band-i- Zolfikar, ca 34° 23′ N 67° 17′ E, 2900 m, 15 vii 1962, *Rechinger* 18440 (W); Ghorat, SW. Naourak, ca 33° 38′ N 64° 43′ E, 2480 m, 28 vii 1962, *Rechinger* 18927 (W); Ghorat, in declibivus borealibus montis Kuh-Tscheling—Safed Daraq (Pirestan) ad Parjaman (Partcheman) meridiem versus, ca 33° 7′ N 63° 55′ E, substr. calc. 2600–2800 m, vii-viii 1962, *Rechinger* 19109 (W); Upper Paghman Valley, 3500–4000 m, 16 vii 1950, *Neubauer* 231 (DD).

CHITRAL. Barum, SE of Tirich Mir, 3050 m, edge of field, flowers yellow, 29 vii 1958, *Stainton* 2784 (W, BM).

TADZHIKISTAN. Pamir, vii 1878, *Kuschakewicz* sn (BM).

TURKMENISTAN. Montium Kuhitang, supra pagum Chodsha-i-fil, 27 vi 1932, *Nevski* 414 (K).

UZBEKISTAN. Iter seravschanicum Iskander and Samarkand, 26 vii 1915, *Balabajew* sn. (BM).

This species is readily distinguished from *P. nigromontanus* by the relative lengths of the female corollas and their styles. Whereas in *P. aucheri* the corolla is as long as the style, in *P. nigromontanus* it is only $\frac{1}{2}$–$\frac{2}{3}$ as long. There are, in addition, several minor characters which support this disti ction. Plants of both species generally appear to have been annuals or biennials but *P. aucheri* is sometimes obviously perennial. The indumentum is generally coarser and more abundant in this species than in *P. nigromontanus*. The pappus of the latter is simple, finely scabrous or capillaceous but in *P. aucheri* it is double, coarser and almost barbellate. The capitula of *P. nigromontanus* contain 6–12 bisexual flowers whereas those of *P. aucheri* have 10–35. The distribution of *P. nigromontanus* extends from E. Turkey to W. Persia: that of *P. aucheri* from W. Persia to Afghanistan and Turkestan but it is uncertain whether their ranges overlap. The two might be treated as subspecies of the same taxon but the floral character alone merits greater importance than subspecific distinction in a group such as this.

An examination of type material shows that *Aucher* 3109, fragmentary though it is, does have female flower corollas that are as long as their styles. Boissier was therefore in error in reducing his *Erigeron nigromontanus* to synonymy under this species and in failing to recognise that his *E. khorassanicus* was identical with *P. aucheri*.

Because of the similarity in habit, inflorescence and capitulum this species is readily confused with *Brachyactis pubescens* Aitch. et Clarke (*B. robusta* Benth.) which also grows in N.W. India, Chitral and Afghanistan, but closer examination reveals that apart from the main generic differences (sterility of the disc achenes in *Psychrogeton*, etc.) the phyllaries of *B. pubescens* are broader (ca 1·5 mm) and that the female flowers are only about half as long as the styles.

29. Psychrogeton nigromontanus (Boiss. et Buhse) Grierson **comb. nov.**

Syn.: *Erigeron nigromontanus* Boiss. et Buhse, Aufz. (reprinted from Nouv. Mem. Soc. Nat. Mosc. 12 :) 114 (1860) non M. Pop.; Botsch. in Not. Syst. URSS 16 : 385 (1954); Botsch. in Fl. URSS. 25 : 282 (1959).

Erigeron aucheri Boiss. Fl. Or. 3 : 170 (1875) pp. quoad syn. *E. nigromontanus* Boiss. & Buhse.

Fig. 4,b.

Erect annual or biennial herbs. Stems 15–90 cm tall, foliaceous, paniculately branched above and bearing 7–many capitula; indumentum sparsely or densely and almost canescent pilose, hairs stout at base becoming finer and crisped above, glistening subsessile glands present especially on leaf undersides and on involucres. Radical leaves withered at flowering time, lower cauline leaves oblanceolate, up to 8 cm long 2·5 cm broad, tapering and subpetiolate at base, apex acute, margins distantly and shallowly dentate; middle cauline leaves 3 cm. long 0·75 cm. broad, oblanceolate, margins entire or with 1–2 teeth per side, upper cauline leaves on branches smaller. Capitula 0·75–1 cm broad; phyllaries subequal, 2–3 seriate, ca. 4 mm long 0·5 mm broad, green, pilose and glandular in the centre, margins pale straw coloured, apex acuminate. Female flowers numerous, corollas tubular, 1·75–2 mm long, ($\frac{1}{2}$–$\frac{2}{3}$ as long as style), puberulent, limb ± obliquely cut. Disc flowers 6–12, bisexual, ca 3·5 mm long. Fertile achenes oblanceolate ca 2 mm long 0·5 mm broad, sparsely pilose. Pappus simple, ca 20 bristles 3–4·5 mm long, finely scabrous.

IRAN. In alpe Kuh-Daena, 18 vii 1842, *Kotschy* 686 (G, W, K, E, BM—isotypes, distributed as *Conyza kotschyi* Boiss.); in humidis Giaurgael, prope Marauli, 21 vii 1865, *Haussknecht* sn (BM); inter Sihna et Kermanshah, ix 1867, *Haussknecht* sn (BM); Elwend, 1882, *Pichler* sn (K); Kuh Tschachah, 16 vii 1885, *Stapf* 2822 (K); Luristan, Dorud, 4 viii 1941, *Koelz* 18460 (MICH); 40 miles N. of Sanandaj, 1830 m, 25 vii 1962, *Furse* 3444 (K, W).

IRAQ. Kurdistan, Erbil Distr., Haji Omran, ca 1700 m, 8–9 viii 1957, *Rechinger* 11308 (W).

TURKEY. Kardagh, vii 1847, *Buhse* sn (LE—holo); Almuska, prope Baibourt, 10 vii 1862, *Bourgeau* 147 (W, K); Haertudagh, inter Malatiam et Charput, 1220 m, 30 ix 1859, *Haussknecht* sn (W); Sipikor in campis versus Jerbatan, 7 viii 1890, *Sintenis* 3267 (W, E, K); Bitlis, 20 miles E of Mus, 30 viii 1954, *Davis* 24775 (E).

The interpretation of both *P. aucheri* (*E. khorassanicus*) and *nigromontanus* in Fl. URSS. (l.c.) differs from the present one. In the key the species are differentiated not on the relative lengths of the female corollas, but on the grounds that the rims of these corolla tubes in *P. nigromontanus* are supposed to be ciliate and without teeth whereas those of *P. aucheri* have glabrous teeth. Examining the type specimens one finds that there are minute ligule-like teeth on the rim of *P. nigromontanus* corollas but shorter blunter teeth on *P. aucheri;* both are glabrous at the mouth of the tube but puberulent below.

Probably both species are variable in the matter of fine detail but I have seen no specimens of *P. nigromontanus* from Turkestan of which it is supposed to be a native.

In common with the three previous species (*P. aucheri*, *pseuderigeron* and *biramosus*) the habit of *P. nigromontanus* is similar to that of a *Conyza*. In this species, however, the paucity of hermaphrodite flowers and the fact that the corollas of the female flowers are distinctly shorter than their styles is additionally very characteristic of that genus. There can be no doubt that *P. nigromontanus* is correctly placed in *Psychrogeton:* the coloration of the flowers, the shape of the sterile achenes and the close relationship that exists between it and *P. aucheri* all indicate this. If *Psychrogeton* as genus is to be regarded as intermediate between *Erigeron and Conyza* then *P. nigromontanus* is indeed a borderline species.

INDEX TO EXISICCATAE

Aitchison 496 (2)
Alexeenko 3287 (7)
Aucher 3108 (4); 3109 (19); 4747 (4)
Baillie & Dunsheath 57 (2b)
Balabajew sn. (5, 18, 19)
Behboudi 1239 (7)
Bhagwan Sing 211 (2)
Bor 9452 (2c); 12349, 12677, 14663, 15423 (2a)
Bornmüller 5055 (7); 5058, 5060 (4); 5061 (10); 7488 (4); 7490 (19); sn. (4)
Bourgeau 147 (20)
Bowes Lyon 38 (7); 38a (5); 95 (7); 686, 861 (29)
Bunge sn (19)
Buhse sn (20)
Bukinisch 200 (2c)
Burt, C.C. 43, 161 (2a)
Capus 597 (18)
Chaworth-Musters sn. (8)
Cooper 5343, 5409 (2a)
Davis 763 (13); 24192b, 24494 (4); 24775 (20)
Drummond 22605 (2a)
Duthie 12504 (2a)
Edelberg 640 (6); 852 (2a); 1295 (6); 1469, 1491 (2b); 1941, 2007 (2)
Esfandiari 1220 (10)
Famouri 2583 (7)
Fedtschenko 567 (18); sn. (1, 5)
Furse 3444 (20)
Gauba 1296 (2)
Giles 265, sn. (2a)
Gilli 3919, 3920, 3921 (11); 3923 (8); 3926 (2a)
Griffith 910, 1052 (1); 3118, 3119 (19)
Haley, B. R. 164 (4)
Harriss 16249 (2a)
Haussknecht 522b, sn. (13); sn. (4, 20)
Hedge & Wendelbo 3742 (3); 3768 (11); 4208 (12); 4217 (4); 4353 (8); 4409 (2a); 4495 (1); 4499 (2); 4683 (11); 4776, 4916 (4); 5027 (2b); 5080 (2); 5213 (2b); 5230a (7); 5230b (8); 5446 (2a); 5450 (2b)

Honigberger sn. (2)
Ikonnikov sn. (16)
Jacobs 6832a (10)
Kerstan 964 (2a); 1220, 1270 (6)
Khorev 42 (2b)
Knorring 745 (7)
Koelz 2926a, 5319a, (2c); 5362 (2c); 5409 (2); 6717 (2c); 11117 (2a); 11999 (4); 12693 (2b); 12983, 13736 (1); 13751 (19); 13796 (4); 13802, 13821, 14007, 14138, 16767, (19); 17925 (4); 18075 (10); 18364 (13); 18460 (20)
Koeie 2410 (19); 2528 (4); 2643 (7); 3276 (19)
Kotschy 348 (4); 407 (10); 498 (13); 546 (10); 686 (20); 759 (4); 800a, 945 (15); 960 (10)
Kurschakewicz sn. (1, 19)
Lehmann 618 (18)
Lindberg 431 (3); 653, 670 (19); 705 (1); 1011 (2)
Litwinov 1492 (1)
Ludlow-Merritt 1510 (4)
Ludlow & Sherriff 8434 (2a)
Nasir & Webster 5970 (2a)
Neubauer: 231 (19); 310 (6); 330, 593 (2b); 808, 824 (6); 883 (2b); 884 (2b); 917 (8)
Nazarov sn. (2b)
Nevski 414 (19)
Pichler sn. (20)
Polunin 6093 (2a)
Poncins sn. (2b)
Popov & Vvedensky 350 (9)
Rechinger 1414 (19); 1471 (4); 1721 (19); 6010a (14); 6010b, 11165 (4); 11308 (20); 11448 (4); 16803 (12); 17161 (8); 17845 (4); 18086, 18180 (19); 18266 (1); 18276 (4); 18403 (7); 18405 (1); 18440 (19); 18493 (11); 18570 (4); 18927, 19109 (19)
Rechinger & Aellen 5133 (14)
Regel sn. (1, 2b)
Remandien 5254 (15)
Roemer 384 (5)
Royle sn. (29)
Sawyer (Watt. Coll.) 13093 (13)
Schlagintweit 709 (2a); 6261, 7485 (2c)
Sintenis 710, 1034 (19); 3267 (20)
Stainton 2441, 2490, 2636, 2676, 2776 (2a); 2784 (19)
Stapf 1291 (4); 2822 (20)
Starmuehler 148 (13)
Stewart, J.L. 384, 1743, 1755 (2a)
Stewart, R.R. 7429, 20020, 26236 (2)
Strauss sn (10, 13)
Thesiger 1567, 1582a (2)
Thomson sn. (2)
Volk 337 (2b); 947 (19); 1006 (8); 2168 (19); 2354 (2)
Watt 2424 (2a)
Wendelbo sn. (2a, 5)
Zaprjagaev 599 (17)

BIBLIOGRAPHY

BENTHAM, G. (1876). in Bentham & Hooker, Genera Plantarum 2 : 1233.

BOISSIER, E. (1875). Flora Orientalis 3 : 156–166.

BOTSCHANTZEV, V. P. (1959). in Flora U.R.S.S. 25 : 191–288.

CRONQUIST, A. (1943). The separation of Erigeron from Conyza. *Bull Torrey Club* 70 : 629–632.

(1947). Revision of the North American species of Erigeron. *Brittonia* 6 : 121–302.

CRONQUIST, & KECK, D. D. (1957). A reconstitution of the genus Machaeranthera. *Brittonia* 9 : 231–240.

GRAY, A. (1880). Notes on some Compositae. *Proc. Amer. Acad.* 16 : 78–108.

HOFFMANN, O. (1894). in Engler & Prantl, Die Naturlichen Pflanzen-familien 4, Abt. 5 : 163.

(1903). in Paulsen, O., Plants collected (by Olufsen) in Asia-Media and Persia. *Vedensk. Meddr. dansk naturh. Foren.* 145–160.

KRASCHENINNIKOV, I. M. (1936). New Asiatic Compositae. *Acta Inst. Acad. Sci. URSS.* Ser. 1, Fasc 3 : 343–345.

NOVOPOKROVSKY, I.V. (1938). De Astereis notae systematicae. *Not. Syst. Bot. URSS.* 7 : 131–137.

RECHINGER, K. H. (1950). Die ausdaurernden iranischen Arten von Erigeron Sectio Conyzastrum Boiss. *Phyton* 2 : 124–133.

(1955). *Biol. Scr.* 8, Symbolae Afghanicae II.: 9–25.

SOLBRIG, O. T. (1960). The South American sections of Erigeron and their relation to Celmisia. *Contr. Gray Herb.* 188 : 65–86.