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REVISION OF *ANEMONE* SECT. *HIMALAYICAE* (*RANUNCULACEAE*) WITH THREE NEW SERIES

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The members of *Anemone* L. sect. *Himalayicae* (Ulbr.) Juz. (*Ranunculaceae*) are mainly distributed in the Himalaya of North India, Nepal and Bhutan and the neighbouring mountains of SW China at elevations between 1850 and 4800 m. Their taxonomy is re-evaluated on the basis of a critical morphological analysis of extensive herbarium material. The section is placed in *Anemone* subgen. *Omalocarpus* and differentiated into three new series: ser. *Obtusilobae*, ser. *Trullifoliae* and ser. *Rupestres*. A conspectus, keys to species, subspecies and varieties, descriptions of taxa, illustrations and distribution maps are presented. Eleven species with several infraspecific taxa are recognized and their synonymy, variability and relationships are discussed. In addition to the generally accepted species *Anemone obtusiloba*, *A. trullifolia* and *A. rupestris*, we recognize the following: *A. polycarpa*, *A. rockii*, *A. geum* and *A. coelestina* and four Chinese endemics, *A. yulongshanica*, *A. patula*, *A. subpinnata* and *A. subindivisa*. *Anemone imbricata* and *A. fuscopurpurea* are described but excluded from the section. The origins, morphological differentiations and eco-geographical radiations of *Anemone* sect. *Himalayicae* are discussed.

Keywords. *Anemone* subgen. *Omalocarpus* sect. *Himalayicae*, *A. obtusiloba* complex, new series, phytogeography, *Ranunculaceae*, Sino-Himalayan region, taxonomy.

Introduction

Anemone L. sect. *Himalayicae* (Ulbr.) Juz., also called the *Anemone obtusiloba* D.Don complex, is one of the most difficult taxonomic groups in the genus *Anemone* (*Ranunculaceae* Juss.), due to the uncertain number of taxa and their problematic relationships. There have been three serious attempts to revise this complex: by Brühl (1896), Lauener (1960) and Wang *et al.* (2001). However, Brühl used data from only about 10 collections and although Lauener examined more collections, he

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dealt only with a limited number of morphological characters. More recently, Wang *et al.* in the Flora of China provided a treatment of the genus *Anemone* which, for the *A. obtusiloba* complex, included 11 species, seven subspecies and 13 varieties. In this paper we amplify this treatment by Wang *et al.* on the basis of a critical morphological analysis of extensive herbarium material, a thorough literature survey and a discussion of the differentiation and relationships of the taxa involved. We recognize three new series, 11 species, five subspecies and 14 varieties.

Materials and Methods

Our study is based mainly on c.2000 herbarium specimens received on loan from the following herbaria: BBG, BC, BCC, BM, BRA, E, GH, K, KATH, KRA, KRAM, KW, LE, P, PRG, US, VAB, W and WU (Holmgren *et al.*, 1990), including 240 specimens collected in the high-mountain areas of India, Nepal and China by the early collectors Delavay, Forrest, Handel-Mazzetti, J. D. Hooker, Kingdon-Ward, Ludlow & Sheriff, Polunin, Potanin, Rock, Stainton *et al.*, Thomson and T. T. Yu, together with 60 specimens used by Lauener (1960). In addition, we have examined the types of most species, subspecies and varieties in the section. From these specimens about 300 flowering and fruiting samples were studied in detail, using light and scanning electron microscopy, in order to obtain comparative data on basal and involucral leaves, flowers and achenes.

Historical Survey

Anemone obtusiloba D.Don was described (Don, 1825) from the Nepal Himalaya, and shortly thereafter other authors published *A. trullifolia* Hook.f. & Thoms., *A. rupestris* Wall. ex Hook.f. & Thoms. and *A. falconeri* Thoms. (Hooker & Thomson, 1855). Later *Anemone coelestina* Franch. (Franchet, 1885), *A. imbricata* Maxim. (Maximowicz, 1889) and *A. gelida* Maxim. (Maximowicz, 1890) were described from the Himalaya and adjacent territories of China as taxa allied or closely related to *A. obtusiloba*. Within the Himalayan members of the group Brühl recognized only two species, *Anemone obtusiloba* and *A. rupestris*. He reduced the other taxa to subspecies and regarded the recognition of *Anemone falconeri* as uncertain. Shortly thereafter Finet & Gagnepain (1904) recognized four species within this complex (*Anemone obtusiloba*, *A. trullifolia*, *A. glauciifolia* and *A. reflexa*). In his extensive revision of *Anemone* Ulbrich (1906) recognized five species within the *A. obtusiloba* group (*A. obtusiloba*, *A. rupestris*, *A. trullifolia*, *A. coelestina* and *A. imbricata*). After Ulbrich's revision a number of new species allied to *Anemone obtusiloba* were described: *A. bonatiana* H.Lév. (1909), *A. geum* H.Lév. (1915), *A. polycarpa* W.E.Evans (1921), *A. rockii* Ulbr. (1929), and *A. ovalifolia* (Brühl) Hand.-Mazz. (1931).

Overlapping and variable characters have complicated the taxonomy of the *Anemone obtusiloba* complex. Pritzel (1841), who produced the first monograph on

Anemone, classified *A. obtusiloba* in section *Anemonospermos* DC. (1824). Maximowicz (1890) placed *Anemone imbricata* into section *Anemonanthea* DC. and *A. gelida* into section *Omalocarpus* DC. After an examination of the achene morphology in *Anemone*, Janczewski (1892) classified *A. obtusiloba* in section *Pulsatilloides* DC., together with *A. glauciifolia* Franch. from China, and *A. capensis* L. and *A. alchemillifolia* E.Mey. from South Africa. Brühl (1896) regarded such a taxonomic association as unjustified and suggested a relationship between the groups of *Anemone obtusiloba* and *A. narcissiflora*. Moreover, Finet & Gagnepain (1904) included *Anemone gelida* and *A. imbricata* in the same section as *A. narcissiflora*.

Like Janczewski (1892), Ulbrich (1906) included the species of the *Anemone obtusiloba* complex in section *Pulsatilloides*, but separated them as series *Himalayicae* Ulbr. After examining c.160 specimens, including 30 types, from 120 localities, Lauener (1960) noted almost continuous variation in many characters, especially of 'sepals' (often termed tepals in the literature, but referred to as 'petaloids' in this paper), pistil and involucral leaf characters, as well as indumentum. Lauener believed that four species within the *Anemone obtusiloba* complex (*A. obtusiloba*, *A. rupestris*, *A. trullifolia* and *A. imbricata*) could be distinguished on the basis of the shape, dissection and teeth characters of the basal leaves.

Tamura (1967) took Brühl's opinion into consideration and consequently removed *Anemone obtusiloba* and allied species from section *Pulsatilloides*, and re-classified them in section *Omalocarpus* as subsection *Himalayicae* (Ulbr.) Tamura. Tamura (1991, 1995) also followed Juzepchuk (1937) in raising the rank of section *Omalocarpus* to subgenus *Omalocarpus* (DC.) Juz. and of subsection *Himalayicae* to section *Himalayicae* (Ulbr.) Juz. In these publications, Tamura erroneously called the section '*Himalayica*', despite the original spelling '*Himalayicae*' by Ulbrich (1906), Juzepchuk (1937), and even by Tamura himself in his earlier publication (Tamura, 1967).

According to Wang (1974, 1980), a total of 10 species of section *Himalayicae* occur in China: the previously mentioned *Anemone obtusiloba*, *A. rupestris*, *A. trullifolia* and *A. rockii*, and six Chinese endemics: *A. patula* C.C.Chang & W.T.Wang, *A. yulongshanica* W.T.Wang, *A. subpinnata* W.T.Wang, *A. liangshanica* W.T.Wang, *A. lutienensis* W.T.Wang and *A. subindivisa* W.T.Wang. However, Wang placed *Anemone imbricata* in section *Omalocarpus*.

In North India and Nepal four species of section *Himalayicae* were recognized: *Anemone obtusiloba*, *A. rupestris*, *A. trullifolia* and *A. geum*, with *A. falconeri* transferred to *Hepatica* (Hara & Williams, 1979; Chaudhary, 1988; Sharma *et al.*, 1993). In addition, Hara (1973) described *Anemone fuscopurpurea* as a taxon allied to *A. obtusiloba* which was later placed into the monotypic section *Fuscopurpurea* Tarasevich & Chaudhary (1987).

According to Qureshi & Chaudhri (1978), only *Anemone obtusiloba* and two closely related species, *A. multisepala* Qureshi & Chaudhri and *A. neelamiana* Qureshi & Chaudhri, occur in Pakistan. They place these species into section *Anemonanthea*. In

contrast, Rechinger & Riedl (1992) maintain that *Anemone obtusiloba* belongs to section *Omalocarpus* and that it occurs in both Pakistan and Afghanistan.

In revising the subtribe *Anemoninae* Spach, Starodubtsev (1989, 1991) suggested raising section *Pulsatilloides* sensu Ulbrich to the status of genus, *Pulsatilloides* (DC.) Starod., with several East Asian and African species. He included in this genus the section *Himalayicae* (Ulbr.) Starod. with the following three species: *Pulsatilloides obtusiloba* (D.Don) Starod., *P. trullifolia* (Hook.f. & Thoms.) Starod., and *P. gelida* (Maxim.) Starod. However, he transferred *Anemone imbricata* to section *Imbricatae* Starod. in the genus *Anemonastrum* Holub.

On the basis of morphological and molecular analyses Hoot *et al.* (1994) verified the correct placement of the *Anemone obtusiloba* complex in section *Omalocarpus* ('*Homalocarpus*') with five species: *A. obtusiloba*, *A. rupestris*, *A. trullifolia*, *A. coelestina* and *A. geum*.

The treatment of the *Anemone obtusiloba* complex in the Flora of China by Wang *et al.* (2001) differed from Wang (1974, 1980) in that *A. liangshanica* and *A. lutienensis* were reduced to varieties of *A. trullifolia*, whereas *A. coelestina*, *A. geum* and *A. polycarpa* were recognized as species.

Placement and Definition of *Anemone* sect. *Himalayicae*

In our treatment we mainly follow Hoot *et al.* (1994) and Tamura (1995) in accepting the placement of the *Anemone obtusiloba* complex as section *Himalayicae* (not '*Himalayica*') within the subgenus *Omalocarpus. Anemone* subgen. *Omalocarpus* has two sections: *Omalocarpus* and *Himalayicae.* Members of both sections share numerous and mostly synapomorphic morphological characters: short, erect or ascendent monopodial rhizomes with several axillary flowering stems (scapes), rosulate basal leaves with vaginate petioles, sessile involucral leaves, umbellate cymose inflorescences, a perianth of 5–8 petaloids, sessile achenes in globose or ovoid heads and the synplesiomorphic feature of tricolpate pollen grains. Furthermore, both sections evidently have the same and apomorphic chromosome base number of $x = 7$ (see Discussion).

In agreement with Tamura (1967, 1995) we regard the taxa in section *Himalayicae* as characterized by having reduced inflorescences with only 1(2–3) flowers. In our opinion, other diagnostic characters of this section include the three reduced sessile involucral leaves (bracts) which are always distinctly smaller than the basal leaves, and petaloids with 3–5(–7) basal veins, usually lacking anastomoses.

Differential Characters within the Section

For the taxonomic differentiation of the section, we first examined c.80 morphological characters and then narrowed down the list to 16 quantitative and 19 qualitative features. Several quantitative characters, such as the range of basal leaf number

(mostly 5–12) or the average number of basal leaves (7–8), were too similar across the taxa to be useful. They depend largely on the plant's age and ecological conditions. The same applies to the number of scapes and petaloids, the length and width of petaloids, and the length of involucral bracts, scapes, pistils and stamens.

We consider the most important quantitative characters to be the length and width of petioles and blades of basal leaves. These vary from blades orbicular-ovate (wider than long) with long narrow petioles to blades oblong (longer than wide) with short, broad, or almost absent petioles. There are great differences in the degree of leaf division from twice 3-sect or 3-lobed with leaflets on petiolules or fused to completely undivided leaves. Great variability is also observed with respect to the indumentum of the basal leaves, involucral bracts, scapes and pedicels, from villous and densely pubescent to practically glabrous. Flowers differ in many qualitative and quantitative characters, for example in the shape of petaloids which may be obovate, elliptic or oblong-elliptic. In addition, petaloid colour varies considerably within most taxa and several colour variants frequently occur in the same population. For example, flowers of whitish-blue, orange-brown, deep blue-violet, dark red, and white with violet tinges are found in single populations of *Anemone obtusiloba* in the Himalaya. Further differences between taxa exist with respect to petaloids in one or two whorls (and then often dimorphic), in their veins and vein anastomoses, in the presence of staminodes and in the stamens and their filaments. The quantitative characters of achene and style length are also important. Styles may be conical, apically straight or slightly curved and rarely even uncinate.

To summarize, the most important characters for taxonomic differentiation within *Anemone* sect. *Himalayicae* are:

- base of leaf blades (cordate or rounded to truncate, attenuate or cuneate)
- division of leaf blades (from twice 3-sect to undivided)
- leaflets (with petiolules or sessile)
- inflorescences (several- or solitary-flowered)
- shape of inflorescence bracts (lobed, with teeth or undivided)
- petaloids (monomorphic or dimorphic)
- anastomosing petaloid veins (present or absent)
- shape of filaments (linear or dilated, i.e. lanceolate)
- staminodes (present or absent)
- achenes (ovoid or sometimes ± compressed, without or with distinct lateral ribs)
- indumentum of leaves, stems, pedicels, petaloids, pistils and achenes.

CONSPECTUS, KEY AND REVISION OF *ANEMONE* SECT. *HIMALAYICAE*

The following conspectus differs from Starodubtsev (1991) and Tamura (1995) in the circumscription of many taxa and some nomenclatural details. We recognize 11 species (with five subspecies and 14 varieties) in section *Himalayicae*, which occur mainly in the Himalaya of Nepal and North India and in adjacent areas of China.

They are classified into three new series: *Obtusilobae*, *Trullifoliae* and *Rupestres*. For the three narrow endemics *A. patula*, *A. subpinnata* and *A. subindivisa* from China (Sichuan) no ripe achenes are yet available. Their placement into the series is still provisional. Two other species (*Anemone imbricata* and *A. fuscopurpurea*) are briefly described and discussed, but are excluded from section *Himalayicae* and the Key.

Anemone L., Sp. Pl. 538 (1753); Gen. Pl. 241 (1754). – Type: *Anemone coronaria* L.

Subgenus **Omalocarpus** (DC.) Juz., Fl. URSS 7: 256 (1937). – Type: *Anemone narcissiflora* L.

Section **Himalayicae** (Ulbr.) Juz., Fl. URSS 7: 256 (1937). – *Anemone* subsect. *Brevistylae* Ulbr. ser. *Himalayicae* Ulbr., Bot. Jahrb. Syst. 37: 201 (1906). – *Anemone* subsect. *Himalayicae* (Ulbr.) Tamura, Sci. Rep. (Osaka Univ.) 16: 27 (1967). – *Pulsatilloides* (DC.) Starod. sect. *Himalayicae* (Ulbr.) Starod., Vetrenitsy 124 (1991). – Type: *Anemone obtusiloba* D.Don.

Series **Obtusilobae** Ziman, Ehrendorfer & Bulakh, **ser. nov.**
Achenia ovoidea, non compressa, sine costis lateralibus, plus minusve dense pilosa, styli paulo flexi, 1–2.5 mm longi. Foliorum radicalium petiola 1–2(3) mm lata, laminae in parte basali cordatae sive rotundatae, plerumque distincte trisectae foliolis apicalibus petiolulatis, tripartitis, trilobatis sive integerrimis. – Type: *Anemone obtusiloba* D.Don.

Achenes ovoid, not compressed, without lateral ribs, more or less densely pubescent, styles slightly bent, 1–2.5 mm long. Basal leaves with petioles 1–2(3) mm wide, blades cordate or rounded at base, mostly 3-sect with apical leaflets petiolulate, 3-parted to 3-lobed or undivided.

1. *Anemone obtusiloba* D.Don
   - A. subsp. *obtusiloba*
     - a. var. *obtusiloba*
     - b. var. *potentilloides* Lauener
     - c. var. *leiophylla* (W.T.Wang) Ziman, Ehrendorfer & Bulakh
   - B. subsp. *megaphylla* W.T.Wang
   - C. subsp. *nepalensis* Chaudhary
2. *Anemone patula* C.C.Chang & W.T.Wang
3. *Anemone polycarpa* W.E.Evans
4. *Anemone subpinnata* W.T.Wang
5. *Anemone rockii* Ulbr.
   - a. var. *rockii*
   - b. var. *pilocarpa* W.T.Wang
   - c. var. *multicaulis* W.T.Wang
6. *Anemone geum* H.Lév.

Series **Trullifoliae** Ziman, Ehrendorfer & Bulakh, **ser. nov.**

Achenia ovoidea, non compressa, sine costis lateralibus, plus minusve dense pilosa, styli erecti, 2–2.5 mm longi. Foliorum radicalium petiola (2–3)4–10 mm lata, laminae in parte basali attenuatae, cuneatae sive truncatae, plus minusve tripartitae foliolis sessilibus nec petiolulatis vel indivisae. – Type: *Anemone trullifolia* Hook.f. & Thoms.

Achenes ovoid, not compressed, without lateral ribs, more or less densely pubescent, with straight styles 2–2.5 mm long. Basal leaves with petioles (2–3)4–10 mm wide, blades attenuate, cuneate or truncate, more or less 3-divided or undivided, leaflets never petiolulate.

7. *Anemone trullifolia* Hook.f. & Thoms.
    a. var. *trullifolia*
    b. var. *liangshanica* (W.T.Wang) Ziman & B.E.Dutton
    c. var. *lutienensis* (W.T.Wang) Ziman & B.E.Dutton
8. *Anemone coelestina* Franch.
    a. var. *coelestina*
    b. var. *linearis* (Brühl ex Hand.-Mazz.) Ziman & B.E.Dutton
    c. var. *holophylla* (Diels) Ziman & B.E.Dutton
9. *Anemone subindivisa* W.T.Wang
10. *Anemone yulongshanica* W.T.Wang
    a. var. *yulongshanica*
    b. var. *truncata* (H.F.Comber) W.T.Wang

Series **Rupestres** Ziman, Ehrendorfer & Bulakh, **ser. nov.**

Achenia ellipsoidea, distincte compressa, costis lateralibus distinctis, plerumque glabra, styli curvati, 1.2–1.8 mm longi. Foliorum radicalium petiola 1–2 mm lata, laminae in parte basali subcordatae, bis trisectae, foliolis petiolulatis, foliolum apicale trisectum. – Type: *Anemone rupestris* Wall. ex Hook.f. & Thoms.

Achenes ellipsoid, distinctly compressed, with lateral ribs, mostly glabrous, styles curved, 1.2–1.8 mm long. Basal leaves with petioles 1–2 mm wide, blades basally subcordate, twice 3-sect, leaflets petiolulate, apical leaflet 3-sect.

11. *Anemone rupestris* Wall. ex Hook.f. & Thoms.
    A. subsp. *rupestris*
    B. subsp. *gelida* (Maxim.) Lauener

Species of *Anemone* subgen. *Omalocarpus* excluded from section *Himalayicae*:

12. *Anemone imbricata* Maxim.
13. *Anemone fuscopurpurea* H.Hara

Key to species

1a. Achenes ellipsoid, distinctly compressed, with lateral ribs, mostly (sub)glabrous; basal leaves with blades twice and deeply 3-sect with 3-sect apical leaflets ___ **11. A. rupestris**

1b. Achenes ovoid, not (or sometimes slightly) compressed, without lateral ribs, more or less densely pubescent; basal leaves with blades less deeply and often only once 3-sect to 3-cleft with 3-parted to 3-lobed or undivided apical leaflets, but leaves sometimes also completely undivided ___ 2

2a. Basal leaves mostly deeply divided and at least the terminal leaflets with distinct petiolules, blades basally cordate or rounded, often wider than long or as wide as long; indumentum variable to reduced; leaf petioles only 1–2(–3) mm wide ___ 3

2b. Basal leaves more shallowly divided and the lobes without distinct petiolules, or completely undivided, blades basally mostly attenuate, cuneate or truncate, often longer than wide; indumentum villous to densely pubescent; leaf petioles mostly broader and (2–)4–10 mm wide ___ 8

3a. Involucral bracts mostly 3-parted to 3-dentate; scapes 1- or 2(–3)-flowered _ 4

3b. Involucral bracts undivided or partly 3-lobed; flowers solitary ___ 6

4a. Bases of basal leaves rounded, apical leaflets with petiolules 10–15 mm long; staminodes present; achene styles uncinate ___ **3. A. polycarpa**

4b. Bases of basal leaves cordate (rarely subtruncate), apical leaflets with shorter petiolules; staminodes absent; achene styles straight or slightly curved ___ 5

5a. Apical leaflets on petiolules 1–2 mm long, lateral leaflets subsessile; scapes 1–3-flowered; filaments linear ___ **1. A. obtusiloba**

5b. Apical leaflets with petiolule only 0.5–1 mm long; flowers solitary; filaments lanceolate ___ **2. A. patula**

6a. Basal leaves longer than wide, apparently pinnatifid, apical leaflets 3-sect, on 3–5 mm long petiolules, lateral leaflets subsessile, unequally 3-parted; petioles of basal leaves 2–5 cm long ___ **4. A. subpinnata**

6b. Basal leaves about as long as wide, mostly 3-sect to 3-cleft, apical leaflets 3-lobed or undivided; petioles of basal leaves 5–20 cm long ___ 7

7a. Apical leaflets with petiolules 1–2 mm long; petaloids dimorphic, 10–20 × 6–12 mm; filaments sublinear (0.3–0.5 mm wide) ___ **5. A. rockii**

7b. Apical leaflets with petiolules 5–10 mm long; petaloids all similar, 5–12 × 4–9 mm; filaments lanceolate (0.5–1 mm wide) ___ **6. A. geum**

8a. Blades of basal leaves with attenuate base; scapes 1–3-flowered; petaloids sometimes with anastomosing veins ___ 9

8b. Blades of basal leaves with truncate base; flowers solitary; petaloids without anastomosing veins ___ 10

9a. Blades of basal leaves 3-parted to 3-lobed, rhombic-ovate to obovate; involucral bracts 3-lobed or 3-dentate; scapes 1–3-flowered; involucral bracts mostly 3-lobed or 3-dentate; filaments ovate-lanceolate _____ **7. A. trullifolia**

9b. Blades of basal leaves weakly 3-lobed to undivided, oblong-linear to oblanceolate; involucral bracts undivided; flowers solitary; filaments linear _____ **8. A. coelestina**

10a. Blades of basal leaves undivided or obscurely 3-lobed; involucral bracts entire or 3-dentate; petaloids 5–10 × 5–8 mm, with 3–5 veins ___ **9. A. subindivisa**

10b. Blades of basal leaves mostly 3-parted or 3-lobed; involucral bracts 3-lobed; petaloids 8–16 × 8–10 mm, with 3 veins _____ **10. A. yulongshanica**

1. Anemone obtusiloba D.Don, Prodr. Fl. Nepal 194 (1825). – *Anemone obtusiloba* D.Don subsp. *obtusiloba* (*typica*) Brühl, Ann. Roy. Bot. Gard. Calcutta 5: 78 (1896). – *Anemone obtusiloba* D.Don subsp. *genuina* Ulbr., Bot. Jahrb. Syst. 37: 242 (1906). – Type: Hab. In Gosaingsthan Nepaliae, *Wallich* s.n. (lecto BM, designated here by Ziman and Mosyakin). **Figs 1, 18.**

Anemone govaniana Wall., Numer. List 166: 4688 (1831), nom. nud., non Lindl. (1844). – The specimen of *A. obtusiloba* annotated as *A. govaniana* India, 10–11000 ft, Herb. *Falconer* 29 is deposited at K in a type folder.

Anemone mollis Wall., Numer. List 166: 4689 (1831), nom. nud.

Anemone discolor Royle, Ill. Bot. Him. Mount. 11: 52 (1839). – Type: NW India, Himalayae Alpibus. Choor-Urukta et Kendarkanta supra 10000 pedes elevatis, *Royle* (lecto LIV).

Anemone micrantha Klotzsch, Bot. Ergebn. Reise Waldemar 133 (1862). – *Anemone obtusiloba* D.Don subsp. *micrantha* (Klotzsch) Ulbr., Bot. Jahrb. Syst. 37: 242

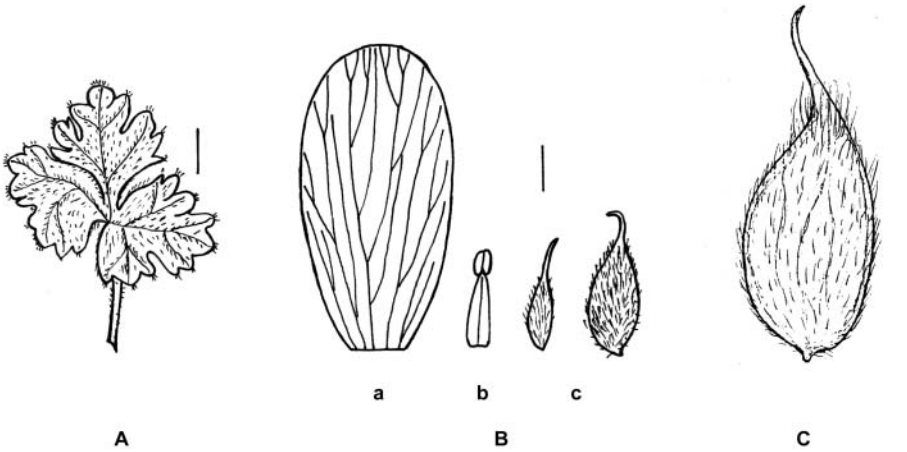

FIG. 1. *Anemone obtusiloba* D.Don subsp. *obtusiloba*. A, basal leaf; B, flower parts (a, petaloid; b, stamen; c, carpels); C, achene (A–B, *Potanin* 1872, LE; C, *Grey-Wilson & Philips* 471, K). Scale bars (applies to Figs 1–17): A = 1 cm; B–C = 1 mm.

(1906). – Type: Not designated. We have examined the likely syntypes *Duthie* s.n. from Kashmir (K), *Potanin* s.n. from Kansu (LE) and *Delavay* s.n. from Yunnan (LE).

Anemone obtusiloba D.Don var. *coerulea* Ulbr., Bot. Jahrb. Syst. 37: 242 (1906). – Type: Kashmir, *Falconer* 29 (lecto K!, designated here).

Anemone obtusiloba D.Don var. *chrysantha* Ulbr., Bot. Jahrb. Syst. 37: 242 (1906). – Type: Tibet, Kardang, *Hans* (lecto K!, designated here).

Anemone rupestris Hook.f. var. *villosa* Marquand & Shaw, J. Linn. Soc. 48: 154 (1929). – Type: Tibet, Nyima La, 3960–4270 m, in open pastures in the *Rhododendron* shrub belt, 22 vi 1924, *Kingdon-Ward* 5821 (holo K!).

Anemone obtusiloba D.Don var. *polysepala* W.T.Wang, Acta Phytotax. Sin. 12: 169 (1974). – Type: China, Yunnan, Weisi, 3780 m, 29 v 1940, *Feng* 4270 (holo PE!).

Anemone multisepala Qureshi & Chaudhri, Pakistan Syst. 2: 15 (1978). – Type: NW Pakistan, Chitral Distr., Gujargol near Lowari Pass, Bioban, Lowari Top, 17 vii 1977, *Shah & Khan* 2439 (holo ISL).

Anemone neelamiana Qureshi & Chaudhri, Pakistan Syst. 2: 15 (1978). – Type: Azad Kashmir, Muzaffarabad Distr., Upper Neelam Valley, Dudgai, 3800 m, 28 vi 1978, *Iqbal & Abbasi* 1827 (holo ISL).

Anemone obtusiloba D.Don var. *leiocarpa* Tamura, Acta Phytotax. Geobot. 37: 153 (1986). – Type: Nepal, Bhojpur Distr., Salpa-Bhanjyang-Charapani, 3320 m, 26 vi 1976, *Tabata* 10924 (holo KYO!).

Basal leaves 5–10 (rarely to 20); petioles 3–15(–20) cm × 1–2 mm, villous or pubescent; blades 3-sect (sometimes 3-parted or 3-lobed), reniform-pentagonal to broadly ovate, 2–6 × 2–10 cm, densely spreading villous to sparsely pubescent or sometimes abaxially subglabrous; bases cordate (rarely subtruncate); leaflets (or lobes) overlapping or remote; apical leaflets of 3-sect leaves on petiolules 1–2 mm long, 3-parted, 3-cleft, or 2- to 3-lobed, rarely undivided, rhombic-ovate to broadly rhombic, subequal or larger than lateral leaflets; with margins obtusely or acutely dentate; lateral leaflets subsessile, unequally 2- or 3-parted or 2- or 3-lobed, oblique-flabellate to ovate (Fig. 1A). *Scapes* 2–5, 5–25(–35) cm long, spreading-villous or pubescent, 1- or 2(–3)-flowered. *Involucral bracts* 3-parted, 3-cleft, 3-lobed or 3-dentate (rarely undivided), broadly rhombic, rhombic-obovate, oblong-ovate, lanceolate, or cuneate, 1–3 cm long, appressed pilose. *Pedicels* 1–3(–5) cm long, appressed pilose. *Petaloids* 5–7, obovate or elliptic, white, bluish or yellowish, 5–15 × 3–8 mm, abaxially pilose; basal veins 3–5, anastomosing veins absent (rarely solitary) (Fig. 1Ba). *Staminodes* absent. *Stamens* 2.2–3 mm long; filaments linear, slightly narrowed apically, 0.5–0.8 mm long; anthers ellipsoid, connectives narrow (Fig. 1Bb). *Carpels* ovoid, 1.2–2 mm long, usually villous or sometimes subglabrous, hairs 0.5–1 mm long; styles straight or curved, 0.5–1.5 mm long (Fig. 1Bc). *Achenes* broadly ovoid, rarely slightly compressed, but without ribs, 3–6 × 2–3.5 mm, densely strigose, softly pubescent or subglabrous (hairs 0.6–1.6 mm long); styles apically hooked or substraight, 1–2.5 × 1–1.5 mm (Fig. 1C).

Distribution and habitat. Afghanistan, Pakistan, Kirgizstan, Mongolia, W and SW China (NW Yunnan, SW Sichuan, E and S Xizang, Gansu, Shanxi, Sikang), North India (Kumaon, Simla, Punjab, Kashmir), Nepal, Bhutan, Burma (Fig. 18). In forests, at forest margins, meadows and alpine grassland; 1850–4800 m.

Nomenclatural notes. In the protologue of *Anemone obtusiloba* Don (1825) cites the locality and collection/collector information as 'Hab. In Gosaingsthan Nepaliae. Wallich.'. We studied several specimens collected by Wallich, of which only the BM specimen has a label closely corresponding to the protologue data: 'Gosaingsthan Nepalensium, Wallich s.n.' (BM!). The plant itself is undoubtedly *Anemone obtusiloba*, but the specimen bears no notes made by Don, and thus its identity as the holotype is questionable. In the Kew herbarium (K) the folder with 'type specimens' contains several herbarium sheets. We select here the BM specimen as the lectotype of *Anemone obtusiloba*.

Taxonomic remarks. Don (1825) characterized *Anemone obtusiloba* as having 3-sect villous basal leaves with cuneate bases, incised-crenate margins and obtuse terminal lobes, 3-lobed involucral leaves, solitary flowers, 5 obovate petaloids, and pubescent achenes. Hooker (1872) noted the variability of *Anemone obtusiloba*, especially with respect to the size, colour and villosity of flowers and shape of basal leaves. Consequently, he suggested that there might be several infraspecific taxa. Brühl (1896) confirmed the evident variability within *Anemone obtusiloba* and was the first author to devise an infraspecific classification that included six subspecies and five varieties. In addition to *Anemone obtusiloba* subsp. *obtusiloba* (= '*typica*'), Brühl recognized six others: subsp. *trullifolia* (with three varieties: var. *linearis*, var. *spatulata* and var. *rotundifolia*), subsp. *coelestina*, subsp. *ovalifolia* (with two varieties: var. *geochares* and var. *orthocaula*), subsp. *saxicola*, subsp. *omalocarpella* and subsp. *imbricata*. The first three subspecies (subsp. *trullifolia*, subsp. *coelestina* and subsp. *ovalifolia*) later were accepted as separate species (see below), whereas subsp. *saxicola* was discussed by Lauener (1960: 198) under *A. rupestris*, and subsp. *omalocarpella* (Wang *et al.*, 2001: 323) under *A. polycarpa*. According to Ulbrich (1906), *Anemone obtusiloba* consists of two subspecies and two varieties: subsp. *obtusiloba* (= '*genuina*') and subsp. *micrantha* (differing mainly in size), and vars. *coerulea* and *chrysantha* (differing mainly in petaloid colour). Lauener (1960), however, recognized three subspecies: subsp. *obtusiloba* (with two varieties: var. *obtusiloba* and var. *potentilloides*), subsp. *ovalifolia*, and subsp. *rockii* which differ mainly in their leaf shapes. Wang (1974, 1980) differentiated five infraspecific taxa of *Anemone obtusiloba* in China: subsp. *obtusiloba* and subsp. *ovalifolia* (as above), and in addition subsp. *megaphylla*, subsp. *leiophylla* and var. *polysepala*. According to Wang, subsp. *megaphylla* and subsp. *leiophylla* differ from subsp. *obtusiloba* in their basal leaves; and var. *polysepala* by its more numerous petaloids.

Hara & Williams (1979) noted that in Nepal *Anemone obtusiloba* was represented by subsp. *obtusiloba* and subsp. *omalocarpella*. Tamura (1986) described *Anemone obtusiloba* var. *leiocarpa* from Nepal (endemic to the Bhojpur District), which

differed from subsp. *obtusiloba* in its more or less compressed, slightly marginate, glabrous or sparsely hispid carpels. However, Chaudhary (1988) considered that in Nepal there were four subspecies of *Anemone obtusiloba*: the forementioned subsp. *obtusiloba*, subsp. *omalocarpella* and subsp. *potentilloides*, but also the new subsp. *nepalensis*, which he differentiated by leaf and flower characters. *Anemone obtusiloba* was considered by Qureshi & Chaudhri (1978, 1988) to include two varieties (var. *obtusiloba* and var. *potentilloides*). In addition they described two endemics from Pakistan, *Anemone multisepala* and *A. neelamiana*, closely related to *A. obtusiloba*. *Anemone multisepala* was stated to differ from *A. obtusiloba* in having narrowly obovate-cuneate leaflets and smaller but more numerous yellow petaloids, and from *A. neelamiana* in having white flowers with 8 petaloids. More recently Thothathri & Uniyal (1982) and Riedl & Nasir (1991) reduced these recently described Pakistani species to synonymy under *Anemone obtusiloba* due to the considerable overlapping variability.

Our analysis leads us to agree with Lauener (1960) in recognizing *Anemone trullifolia* as a distinct species and not as a subspecies of *A. obtusiloba*. However, we treat *Anemone rockii* and *A. geum* (= *A. ovalifolia*) not as subspecies but as species. We also agree with Lauener in regarding *Anemone discolor* and *A. micrantha* as synonyms of *A. obtusiloba* as there are no distinct characters to separate them. With respect to *Anemone multisepala* and *A. neelamiana*, we follow Thothathri & Uniyal (1982) and Riedl & Nasir (1991) in regarding these as synonyms of *A. obtusiloba*. In our opinion, *Anemone obtusiloba* subsp. *saxicola* and *Anemone obtusiloba* subsp. *omalocarpella* should be included in *A. rupestris* due to the similarity of their basal leaves and especially their achenes. *Anemone obtusiloba* subsp. *leiophylla* and *Anemone obtusiloba* subsp. *potentilloides* should rather be treated as varieties because of their weak distinguishing characters. Thus, we recognize three subspecies in *Anemone obtusiloba*: subsp. *obtusiloba* (with two varieties, var. *leiophylla* and var. *potentilloides*), subsp. *megaphylla* and subsp. *nepalensis*, whose differences are given in the following key.

Key to subspecies and varieties

1a. Petioles of basal leaf blades 15–20 cm long; leaf blades 3–6 × 4–10 cm, sparsely pubescent; scapes 25–35 cm long; petaloids 5, 10–15 × 5–10 mm _____ **1B.** subsp. **megaphylla**

1b. Petioles of basal leaf blades 3–15 cm long; leaf blades 1–6 × 1–8 cm, pubescent or villous; scapes mostly less than 20 cm long; petaloids 5–7, 7–12 × 4–8 mm 2

2a. Scapes only up to 10 cm long; basal leaves with blades 1.5–2.5 × 2.5–3.5 cm, pubescent, with acute teeth _____ **1C.** subsp. **nepalensis**

2b. Scapes usually longer than 10 cm; basal leaves with blades up to 4 × 6 cm, often villous and with obtuse teeth. **1A.** subsp. **obtusiloba** _____ 3

3a. Basal leaves densely spreading-villous, mostly with obtuse teeth _____ **1Aa.** var. **obtusiloba**

3b. Basal leaves pubescent, often with acute teeth _____ 4

4a. Petaloids blue; basal leaves with obtuse to acute teeth, apical leaflets 3-lobed _____ **1Ab.** var. **potentilloides**

4b. Petaloids white; basal leaves with acute teeth, apical leaflets 3-sect _____ _____ **1Ac.** var. **leiophylla**

1A. subsp. **obtusiloba**

Petioles of basal leaves 5–15 cm long; blades mainly 3-sect, sometimes 3-parted to 3-lobed, broadly ovate or reniform-pentagonal, usually obtusely dentate, 1–4 × 1–6 cm, densely spreading-villous to sometimes sparsely pubescent; apical leaflets 3-lobed to 3-cleft, rhombic-ovate. Scapes 5–20 cm long. Involucral bracts 3-parted to 3-lobed or sometimes 3-dentate, rarely undivided, rhombic to cuneate, 1–2 cm long. Petaloids 5–7, white, blue or yellowish, 8–12 × 3–8 mm.

Distribution and habitat. As the species.

1Aa. var. **obtusiloba**

Petioles of basal leaves 5–12 cm long; blades 3-sect, broadly reniform-pentagonal, obtusely dentate, 2–4 × 2–6 cm, densely spreading-villous; apical leaflets 3-lobed, rhombic-ovate. Scapes 5–20 cm long. Involucral bracts 3-parted to 3-lobed, rhombic or cuneate. Petaloids 5–7, white, blue or yellowish, 8–12 × 5–8 mm.

Distribution and habitat. As the species.

Selection of herbarium specimens. AFGHANISTAN. Nuristan: Kamdesh, 2800 m, 22 vi 1959, *Gilli* 766 (W).

PAKISTAN. NW Frontier: Hazara Distr., Murree Hills, 15 vi 1955, *Webster & Sack* 5719 (K); Mukshpuri, 2500 m, 3 v 1970, *Ecker* 19737 (W); Hazara, Pipe Line, 31 v 1975, *Chaudhri & Qureshi* 306 (W); Chitral Distr., Gujargol near Lowari Pass, Bioban, Lowari Top, 17 vii 1977, *Shah & Khan* 2439 (ISL).

MONGOLIA. 1895, *Przewalski* s.n. (without geographic details and number) (LE); Archengsi, Cecerle Ich-Tamir, 1850 m, 26 vi 1978, *Knapp* 233179 (LE).

CHINA. **Yunnan**: Ca-long-pin, 18 vii 1889, *Delavay* s.n. (LE); Lidjiang [Likiang], Mt. Yulung-Schan, vi 1914, *Handel-Mazzetti* 4078 (WU); Djinscha-djiang [Yangtze], Landsang-djiang [Mekong], Lenago, 4050 m, 7 vi 1916, *Handel-Mazzetti* 8856 (WU); Likiang, eastern slopes of Likiang Snow Range, 25 vi 1922, *Rock* 4767 (W); Chung-tien, Mts. West Hsiao Chung-tien, v 1932, *Rock* 24666 (K). **Sichuan**: Da-Dsian lu (Tatsien-lou, Tarsando), 18 v 1893, *Potanin* s.n. (LE); Mts. of Kulu, Muli Territory, 1932, *Rock* 23953 (K). **Kansu**: T'ao River basin, alpine meadows, vi 1925, *Rock* 12254 (K); Terra Tangutorum, 14 vii 1872, *Potanin* s.n. (LE); Reg. Tangutica, 1873, *Plantae a Przewalski collectae* (E); ibid., 1880 (E, LE); Valle Runwyz, 1885, *Potanin* s.n. (LE); Berg Shao Wu Taishan, Waldgreuse, vii 1879, *Moellendorf* 612 (WU). **Xizang**: Montes Tala-gui, 4 vi 1884, *Przewalski* 92 (LE); Rija simitra, 11 vi 1884, *Przewalski* 123 (LE); Kam, Djagyn-gol, 1900, *Ladygyn* 25 (LE); Dohpa, 13–14000 ft, 15 vii 1900, *Ladygyn* 264 (LE); 17 vii 1900, *Ladygyn* 645 (LE); Entok-gomba, 11500 ft, 26 iv 1901, *Ladygyn* 25 (LE).

NEPAL. Yarpang, 16000 ft, 10 viii 1932, *Sharma* 3415 (BM); Jumla, 7500 ft, 4 v 1952, *Polunin et al.* 906 (K); Gandak Kosi Watershed, 12000 ft, 5 v 1953, *Proud* 150 (BM); Chhairo gaun, North of Tukucha, 10000 ft, 2 vi 1954, *Stainton et al.* 877 (BM); Ankhu Khola, Barand, 10200 ft, 5 vi 1962, *Bowes-Lyon* 103 (BM); Bagmati Zone, Gossain Kurda, 3000 m, 8 v 1967, *Nicolson* 3299 (BM); Dolpo Valley, 5 mi East of Ting Kyu, 4800 m, 2 viii 1973, *Grey-Wilson & Philips* 471 (K); Purangaun, above Garunga, North of Parbat, 2700 m, 4 v 1976, *Wormald* 116 (BM).

BHUTAN. Phaksana, 10500 ft, 6 vi 1971, *Ramesh Bedi* 68 (E).

INDIA. Kashmir: Keslitoar, 10000 ft, *Thomson* 4688 (K); Simla La, 13–14000 ft, 22 i 1924, *Kingdon-Ward* 5821 (BM); Apharwat, 12000 ft, 12 viii 1956, *Polunin* 56/220 (BM); Gulmarg, above Khelanmarg, 30 v 1971, *Robson* 1911 (BM); Upper Chenab: Pangi Valley, 23 v 1881, *Ellis* 1141 (WU); Dehra Dun, Kulu Valley, 8 vi 1949, *Basa* s.n. (W); Kulu Valley, Pulga, 17 vi 1950, *Jain & Bharadwaja* s.n. (W); Simla Hill State: Punjab, Kamru, Baspa Valley, 13000 ft, 26 vi 1939, *Sheriff* 7345 (BM); Simla, Huttoo, 10000 ft, 20 v 1956, *Chiddall* 38 (BM).

KIRGIZSTAN. Tien-Shan: Upper part of the basin of Sary-Dzhas, close river Kaska-Ter, 3 vii 1902, *Sapozhnikov* s.n. (LE); Semirechenski Distr., close Przewalski, river Tjuz, 3 vii 1912, *Sapozhnikov* s.n. (LE); Basin of Sary-Dzhas, close river Gjuz, 15 vii 1959, *Zviagina* s.n. (LE).

1Ab. var. **potentilloides** Lauener, Notes Roy. Bot. Gard. Edinburgh 23: 187 (1960). – Type: supra Shupien, in herbosis excelsissimus, *Jacquemont* 665 (holo K!; iso BM!). – *Anemone potentilloides* Cambess. ex Besant, Gard. Chron. 177: 371 (1927), nom. subnud. – *Anemone obtusiloba* subsp. *potentilloides* (Lauener) Chaudhary, Bot. Zhurn. 73: 1188 (1988).

Petioles of basal leaves 5–8 cm long; blades mainly 3-sect, reniform-pentagonal, obtusely to acutely dentate, 1–3 × 1–2 cm, pubescent; apical leaflets 3-lobed, broadly rhombic. Scapes 10–20 cm long. Involucral bracts mostly 3-lobed, oblong-rhombic, 1–2 cm long. Petaloids 5–6, blue, 8–12 × 4–8 mm.

Distribution and habitat. India (Himachal Pradesh, Lahul, Kashmir), Pakistan (Chitral, Hazara) (Fig. 18); 2700–4000 m.

Selection of herbarium specimens. INDIA. Kashmir: Apharwat, 12000 ft, 12 viii 1956, *Polunin* 56/220 (BM); Gulmarg, above Khelanmarg, 30 v 1971, *Robson* 1911 (BM).

PAKISTAN. NW Frontier: Hazara Distr., Murree Hills, 15 vi 1955, *Webster & Sack* 5719 (K); Mukshpuri, 2500 m, 3 v 1970, *Ecker* 19737 (W); Hazara: Pipe Line, 31 v 1975, *Chaudhri & Qureshi* 306 (W).

1Ac. var. **leiophylla** (W.T.Wang) Ziman, Ehrendorfer & Bulakh, **stat. nov.** – *Anemone obtusiloba* D.Don subsp. *leiophylla* W.T.Wang, Fl. Reipubl. Popul. Sin. 28: 350 (1980). – Type: China, NW Yunnan, Gongshan Drung-Nu Zu Zi Zhixian, 1938, *T.T. Yu* 22076 (holo PE!).

Petioles of basal leaves 5–12 cm long; blades 3-sect, reniform-pentagonal, acutely dentate, 1–4 × 2–6 cm, sparsely pubescent; leaflets remote, apical 3-cleft, broadly rhombic. Scapes 8–25(–35) cm long. Involucral bracts 3-dentate or undivided, oblong-rhombic, 1–2 cm long. Petaloids 5–7, white, 7–12 × 3–7 mm.

Distribution and habitat. China (Yunnan) (Fig. 18). At forest margins and on grassy slopes; 2900–3000 m. Endemic of NW Yunnan (Gonshan Drung-Nu-Zi Zhixian).

Known only from the type collection.

1B. subsp. **megaphylla** W.T.Wang, Fl. Reipubl. Popul. Sin. 28: 350 (1980). – Type: China, SW Yunnan, Chengkang, Snow Range, grassy slopes, 3400 m, 24 vii 1938, *T.T. Yu* 16956 (holo PE!).

Petioles of basal leaves 15–20 cm long; blades 3-parted, reniform-pentagonal, acutely dentate, 3–6 × 4–10 cm, sparsely pubescent; lobes overlapping, apical leaflet 3-cleft, broadly rhombic. Scapes 25–35 cm long. Involucral bracts 3-lobed, rhombic or rhombic-obovate, 2–3 cm long. Petaloids 5, blue, 10–15 × 5–10 mm.

Distribution and habitat. China (SW Yunnan: Zhenkang Xian) (Fig. 18), on grassy slopes; c.3400 m.

Known only from the type collection.

1C. subsp. **nepalensis** Chaudhary, Bot. Zhurn. 73: 1188 (1988). – Type: Nepal, Jaljale, 3500 m, 23 vi 1979, *Sajiu & Tuladhar* s.n. (holo KATH!).

Petioles of basal leaves 3–5 cm long; blades 3-sect, rhombic-ovate, 1.5–2.5 × 2.5–3.5 cm, pubescent, margins acutely dentate, apical leaflets 3-parted. Scapes 5–10 cm long. Involucral bracts 3-sect, ovoid, 1–1.2 cm long. Petaloids 5, white, basally bluish, c.10 × 8 mm.

Distribution and habitat. Central Nepal (Okhaldhunga, Dhading, Baglung) (Fig. 18); 3500 m.

Selection of herbarium specimens. NEPAL. Okhaldhungagaon, South of Dhorpatan, 10000 ft, 1 v 1954, *Stainton et al.* 350 (BM), 374 (BM), 376 (BM); Jaljale, 3500 m, 23 vi 1979, *Sajiu & Tuladhar* s.n. (KATH!).

2. Anemone patula C.C.Chang ex W.T.Wang, Acta Phytotax. Sin. 12: 169 (1974). – Type: China, Central Sichuan, Li Xian, 3500 m, 14 vi 1936, *K.L. Chu* 2796 (holo E!). **Figs 2, 19.**

Basal leaves 5–9; petioles 3–10 cm × c.1 mm, subglabrous; blades 3-sect, orbicular-ovate, 0.5–3.5 × 1–4 cm, sparsely pubescent or glabrescent, bases deeply cordate; leaflets subsessile; apical leaflets 3-lobed, flabellate-rhombic, lobes flabellate-obovate, margins lobulate, lobules narrowly ovate, sometimes denticulate; lateral leaflets 3-lobed, obliquely flabellate (Fig. 2A). *Scapes* 3–6, 5–25 cm long, subglabrous; flowers solitary. *Involucral bracts* 3-lobed to 3-dentate, rarely undivided, obovate, 1–2 cm long, puberulent or subglabrous. *Pedicels* 2–5 cm long, puberulent or subglabrous. *Petaloids* 5(–6), white or blue-purple, ovate or broadly

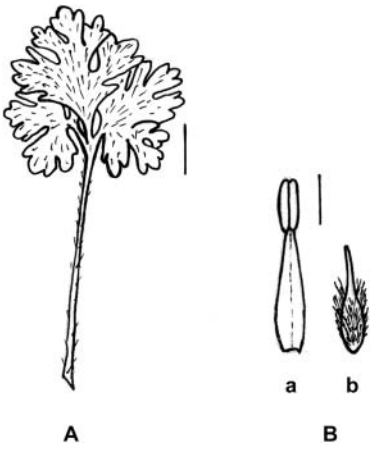

FIG. 2. *Anemone patula* C.C.Chang ex W.T.Wang var. *patula*. A, basal leaf; B, flower parts (a, stamen; b, carpel) (A–B, Flora of China, 2001).

obovate, 4–12 × 2–9 mm, puberulent, basal veins 3–7, anastomosing veins absent. *Stamens* 3–5 mm long; filaments lanceolate (Fig. 2Ba). *Carpels* 2–4 mm long, villous (Fig. 2Bb). *Achenes* unknown.

Distribution and habitat. China (Sichuan) (Fig. 19). In *Abies* forests and in thickets; 3500–3530 m.

Taxonomic remarks. Wang (1974) described *Anemone patula* as a species allied to *A. rupestris* but differing in the shape of the basal leaflets (subsessile and 3-lobed), larger petaloids and strongly villous carpels. Based on these characters, but also on its solitary flowers and lanceolate filaments, *Anemone patula* is closer to *A. obtusiloba* and keys out in series *Obtusilobae*. Additional study is needed in this species due to the limited herbarium material and lack of data on achenes. Wang (1980) recognized two varieties of *Anemone patula*, var. *patula* and var. *minor*, which differ in scape and leaf size, and the size, colour and villosity of the flowers. These varieties were later accepted by Wang *et al.* (2001).

Key to varieties

1a. Petaloids white or blue-purple, 8–12 × 5–9 mm; scapes 10–25 cm long; leaf blades 1–3.5 × 1.5–4 cm _____ **2a.** var. **patula**
1b. Petaloids white, 4–6 × 2–3 mm; scapes 5–10 cm long; leaf blades 0.5–1 × 1–2 cm _____ **2b.** var. **minor**

2a. var. **patula**

Leaf blades 1–3.5 × 1.5–4 cm. Scapes 10–25 cm long. Petaloids white or blue-purple, 8–12 × 5–9 mm.

Distribution and habitat. Central Sichuan (Li Xian). In *Abies* forests; 3500 m.

Known only from the type collection.

2b. var. **minor** W.T.Wang, Fl. Reipubl. Popul. Sin. 28: 350 (1980). – Type: China, Sichuan, Baoxing Xian, 3530 m, 1936, *K.L. Chu* 923 (holo PE!).

Leaf blades 0.5–1 × 1–2 cm. Scapes 5–10 cm long. Petaloids white, 4–6 × 2–3 mm.

Distribution and habitat. Central and western Sichuan (Baoxing Xian, Jinchuan Xian). In thickets; 3530 m.

Known only from the type collection and a few specimens collected in the same area and cited in the protologue.

3. Anemone polycarpa W.E.Evans, Notes Roy. Bot. Gard. Edinburgh 13: 154 (1921). – *Anemone rupestris* subsp. *polycarpa* (W.E.Evans) W.T.Wang, Fl. Reipubl. Popul. Sin. 28: 43 (1980). – Type: China, Yunnan, 'Mekong-Salween divide. Alt. 12000 ft, ix 1914, *Forrest* 13320' (holo E!). **Figs 3, 19.**

Anemone rupestris Wall. ex Hook.f. & Thoms., Fl. Ind. (1855), pro parte (excl. type).

Leaves 5–12, petioles 5–12 cm × c.1 mm, sparsely puberulent; blades twice 3-sect, ovate, 3–5 × 2–4 cm, sparsely puberulent, bases rounded; apical leaflets on petiolules 10–15 mm long, 3-parted, broadly ovate; lateral leaflets on petiolules 3–5 mm long, 3-lobed, ovate (Fig. 3A). *Scapes* 2–5, 5–20 cm long, 1–3-flowered, sparsely puberulent. *Involucral bracts* 3-parted, obovate-rhombic, 1–3 cm long, puberulent. *Petaloids* 5–6(–7), monomorphic, reddish-white, ovate-elliptic, 7–14 × 4–9 mm,

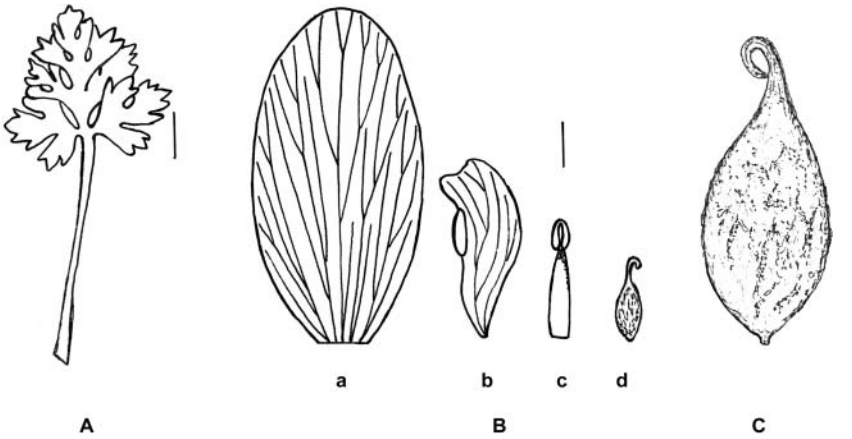

FIG. 3. *Anemone polycarpa* W.E.Evans. A, basal leaf; B, flower parts (a, petaloid; b, staminode; c, stamen; d, carpel); C, achene (A, Flora of China, 2001; B, *Forrest* 20738, E; C, *Stainton et al.* 5403, WU).

sparsely puberulent, basal veins 3–5, anastomosing veins absent (Fig. 3Ba). *Staminodes* present (Fig. 3Bb). *Stamens* 3–4 mm long; filaments linear (Fig. 3Bc). *Carpels* up to 80, long ellipsoid, 3–3.5 mm long, villous, styles hooked (Fig. 3Bd). *Achenes* fusiform, compressed, 3–4 × 2–2.5 mm, sparsely puberulent along medial line, hairs dimorphic (c.1 mm and 0.3 mm long); ribs absent; styles apically thickened and uncinate, 1–4 × 1.5 mm (Fig. 3C).

Distribution and habitat. China (NW Yunnan, Sichuan, SE Xizang), Nepal, North India (Assam), Bhutan (Fig. 19). On grassy and rocky slopes; 3500–4800 m.

Taxonomic remarks. Anemone polycarpa was described as a species close to *A. obtusiloba* (Evans, 1921), but differing mainly in the pinnatisect basal leaf lobes, numerous hairy carpels, and achenes with uncinate styles. Lauener (1960), however, proposed to reduce it to a synonym of *Anemone rupestris*, and both Wang (1980) and Chaudhary (1988) treated it as *A. rupestris* subsp. *polycarpa* (W.E.Evans) W.T.Wang. Sharma *et al.* (1993) regarded *Anemone polycarpa* as a distinct species and Wang *et al.* (2001) accepted this status but they included in it *A. saxicola* (Brühl) Tamura & Kitamura based on *A. obtusiloba* D.Don subsp. *saxicola* Brühl. Our examination of the holotype (*Forrest* 13320) from Yunnan, and also *Stainton et al.* 5403 from Nepal, suggests that *Anemone polycarpa* differs from *A. rupestris* in the 3-parted involucral bracts, larger monomorphic puberulent petaloids, narrower filaments, presence of staminodes, less compressed but more elongate achenes without ribs and with few dimorphic hairs, and apically thickened uncinate styles. Consequently, we regard this taxon as a species which is closer to *Anemone obtusiloba* than to *A. rupestris*.

Selection of herbarium specimens. CHINA. **NW Yunnan**: Mekong-Salween Divide, vi 1921, *Forrest* 19578 (K); Doker-la, Mekong, Salween Divide, ix 1921, *Forrest* 20738 (E); Mekong, Salween Divide, Sila, 4000 m, 16 viii 1938, *T.T. Yu* 22374 (E); Upper Kjukiang Valley (Clulung), South of Lungtsahmura, 3800 m, 10 viii 1938, *T.T. Yu* 1958 (E). **Sichuan**: Dongregro, 4500 m, 21 vii 1922, *Smith* 3262 (BM); Sung pan hsien, 8 viii 1928, *Fang* 4063 (E). **Qinghai**: Maqin Xian, Dawu Xiang, 3500 m, 31 vii 1993, *T.N. Ho & Bartolomew* 618 (BM).

NEPAL. Central Nepal: Bhurungdi, Khola, 22 v 1954, *Stainton et al.* 5403 (WU); Lamjung Himal, 4500 m, 13 ix 1954, *Stainton et al.* 6326 (BM, E); South of Bhubnjeng Kharka, 3400 m, 9 viii 1974, *de Haas* 2137 (BM); Sagarmatha Zone, Solukhumbu Distr., Pike Peak, 3560 m, *Miyamoto et al.* 84048 (BM).

INDIA. Assam: Tha Chu Valley, 11000 ft, 9 vii 1950, *Kingdon-Ward* 19594 (BM).

BHUTAN. Shing Be Me La, 10500 ft, 16 v 1949, *Ludlow & Sheriff* 20639 (BM).

4. Anemone subpinnata W.T.Wang, Acta Phytotax. Sin. 12: 170 (1974). – Type: China, Szechuan: Mu-li, Wachin, Ching-chang, 3750 m, 21 vi 1937, *T.T. Yu* 6512 (holo PE!). **Figs 4, 19.**

Leaves 4–7, petioles 2–5 cm × 1–2 mm, villous; blades apparently pinnatifid, but in principle 3-sect, elliptic, c.2.5 × 1.8 cm, densely pubescent, bases subcordate or broadly cuneate; apical leaflets with petiolules 3–5 mm long, 3-sect,

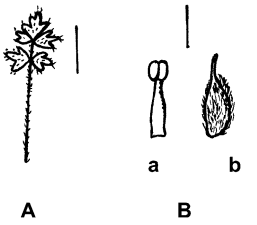

FIG. 4. *Anemone subpinnata* W.T.Wang. A, basal leaf; B, flower parts (a, stamen; b, carpel) (A–B, Flora of China, 2001).

rhombic-obovate, margins incised-dentate with secondary leaflets 3-parted; lateral leaflets subsessile, unequally 3-lobed, obliquely cuneate (Fig. 4A). *Scapes* 2–5, 3–10 cm long, villous, 1-flowered. *Involucral bracts* subequally 3-lobed, elliptic-ovate to oblong-ovate, c.1 cm long; lobes entire or apical lobes 3-dentate, puberulent, apically obtuse. *Pedicels* 1–4 cm long, puberulent. *Petaloids* 5, white, tinged blue, purplish or violet, elliptic-obovate, 5–8 × 4–6 mm, villous, basal veins 3–5, anastomosing veins absent. *Stamens* 2–4 mm long; filaments linear (Fig. 4Ba). *Carpels* cylindric, 2.7–3.2 mm long, villous; styles curved (Fig. 4Bb). *Achenes* unknown.

Distribution and habitat. China, endemic of SW Sichuan, Muli, Wachin (Fig. 19). In alpine meadows; 3700 m.

Taxonomic remarks. Wang (1974) described this species as a narrow endemic from Sichuan, taxonomically close to *Anemone obtusiloba* but differing in its subpinnate basal leaf blades, solitary flowers and strongly villous carpels. According to our data, *Anemone subpinnata* differs from *A. obtusiloba* also in its wider basal leaf petioles, entire (sometimes 3-lobed) involucral bracts, and linear filaments. Additional studies are needed due to the lack of data on achenes and the limited herbarium material available.

Known only from the type collection and a few specimens collected in the same area and cited in the protologue.

5. Anemone rockii Ulbr., Notizbl. Bot. Gart. Berlin-Dahlem 10: 876 (1929). – *Anemone obtusiloba* D.Don subsp. *rockii* (Ulbr.) Lauener, Notes Roy. Bot. Gard. Edinburgh 23: 188 (1960). – Type: China, SW Kansu, southern slopes of Minshan, South of Shimen, in crevices of limestone cliffs, along streams, 10600 ft, vi 1925, *Rock* 12520 (lecto K!, designated here by Ziman and Mosyakin; iso E!). **Figs 5, 20.**

Leaves 5–15; petioles 5–20 cm × 3 mm, sparsely puberulent or glabrescent; blades 3-sect, broadly ovate, 2.5–5 × 2.5–5 cm, glabrous or abaxially sparsely puberulent, bases cordate; apical leaflets on petiolules 1–2 mm long, 3-lobed, broadly ovate or rhombic, lobes incised lobulate; lateral leaflets subsessile, unequally 2- or 3-lobed,

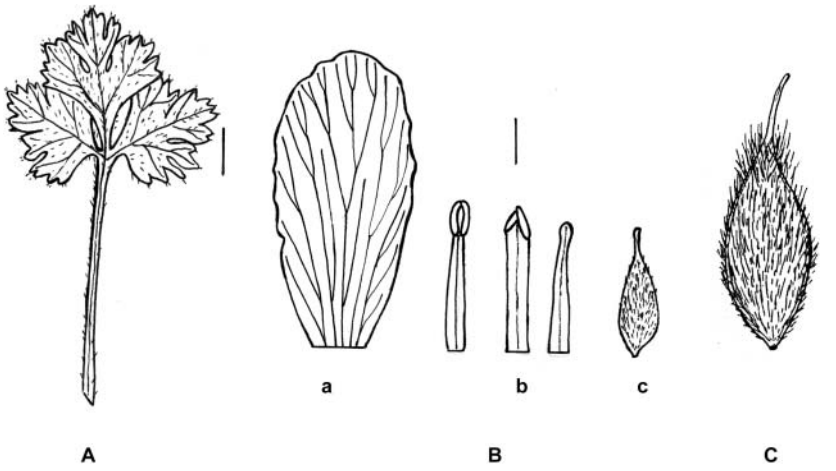

FIG. 5. *Anemone rockii* Ulbr. var. *rockii*. A, basal leaf; B, flower parts (a, petaloid; b, stamens; c, carpel); C, achene (A, Flora of China, 2001; B, *Forrest* 30471, BM; C, *Polunin* 906, E).

obliquely flabellate; lobes and lobules contiguous, overlapping or remote (Fig. 5A). *Scapes* 2–10, 10–30 cm long, glabrous or sparsely puberulent; flowers solitary. *Involucral bracts* undivided or 3-lobed, obovate, 1–3 cm long, margins dentate or entire. *Pedicels* 2–6(–10) cm long, puberulent. *Petaloids* 5(–6–9), dimorphic, white, blue (rarely purplish), oblong-obovate, 10–20 × 6–12 mm, sparsely puberulent or glabrous, basal veins 3–5, anastomosing veins solitary or absent (Fig. 5Ba). *Staminodes* sometimes present. *Stamens* 4–5 mm long; filaments sublinear, 0.3–0.5 mm wide (Fig. 5Bb). *Carpels* 2.8–3.5 mm long, cylindric, densely or sparsely puberulent; styles straight (Fig. 5Bc). *Achenes* ovoid, slightly compressed, 3–4 × 1–1.5 mm, glabrous or sparsely to densely pubescent (hairs c.1 mm long); styles slightly bent, 1.3–1.4 mm long (Fig. 5C).

Distribution and habitat. China (Yunnan, Sichuan, Gansu, Xizang), Nepal (Fig. 20). On grassy slopes; 2100–4000 m.

Taxonomic remarks. Anemone rockii was separated from *A. obtusiloba* by Ulbrich (1929) on the basis of several collections made by Rock in SW Kansu, western China, which had more robust stems, more divided basal leaves with a deeper sinus and larger flowers. Having examined syntypes from K and BM, we note that *Anemone rockii* differs from *A. obtusiloba* also by its wider basal leaf petioles, subglabrous leaf blades, solitary flowers, undivided or 3-lobed involucral bracts, subglabrous usually dimorphic petaloids, linear staminodes, and densely pubescent achenes with slightly bent styles. We believe these distinctions merit recognizing *Anemone rockii* as a distinct species. According to Wang (1980) and Wang *et al.* (2001), *Anemone rockii* consists of three varieties. Although the majority of plants throughout the distribution of this species belong to *Anemone rockii* var. *rockii*,

several plants from SW China with remote basal leaf blade lobes and distinctly pubescent achenes have been recognized as distinct varieties, var. *pilocarpa* W.T.Wang and var. *multicaulis* W.T.Wang, differing in the number and colour of their petaloids.

Key to varieties

1a. Leaf blade lobes and lobules contiguous or overlapping; achenes glabrous or subglabrous _____ **5a.** var. **rockii**
1b. Leaf blade lobes and lobules remote; achenes densely pubescent _____ 2

2a. Petaloids 8–9, white _____ **5b.** var. **pilocarpa**
2b. Petaloids 5–6, white or blue _____ **5c.** var. **multicaulis**

5a. var. **rockii**

Basal leaf blade lobes and lobules contiguous or overlapping. Petaloids 7–8, white or purplish. Achenes glabrous or subglabrous.

Distribution and habitat. China (Yunnan, Sichuan, Gansu, Xizang), Nepal (Fig. 20). On grassy slopes; 2100–4000 m.

Selection of herbarium specimens. CHINA. **Yunnan**: Distr. of Chung-tien, 13000 ft, v 1932, *Rock* 24666 (BM). **Sichuan**: Distr. of Tchen-keou-tin, *Farges* s.n. (P); top of Mt. Wa, vii 1903, *Wilson* 3052 (K). **Kansu**: Upper Tebbu County, southern slopes of Minshan, South of Shimen in crevices of limestone clifts along streams, 10600 ft, vi 1925, *Rock* 12408 (BM), 12487 (BM), 12520 (K); gravelly slopes at foot of Shimen, 12000 ft, vii–viii 1925, *Rock* 13061 (BM, E, K); Minshan near Djirakana Shimen limestone crevices, x 1925, *Rock* 13626 (BM, E, K). **Xizang**: Mt. Kenichumpo, Salween and Irawady Divide, 14000 ft, vi 1932, *Rock* 21952 (BM), 21953 (BM).

NEPAL. **West Nepal**: Chankheli Lagna, 30 iv 1952, *Polunin et al.* 4345 (E); Saldanggaon, v 1952, *Polunin et al.* 16 (E); Jumla, v 1952, *Polunin et al.* 906 (E); Pansala, vi 1952, *Polunin et al.* 880 (E); Myagdi, Dara, 20 vi 1952, *Polunin et al.* 4344 (E); Lete Kali Gandaki, 20 iv 1954, *Stainton et al.* 581 (E). **East Nepal**: Uttar Ganga, iv 1954, *Stainton et al.* 969 (E); Baglurg, South of Dhorpatan, v 1954, *Stainton et al.* 356 (E); Prangburg, vi 1954, *Stainton et al.* 877 (E).

5b. var. **pilocarpa** W.T.Wang, Fl. Reipubl. Popul. Sin. 28: 350 (1980). – Type: China, Yunnan, Chengkou Xian, 2100 m, 27 viii 1935, *C.C. Chang* 2064 (holo PE!).

Basal leaf blade lobes and lobules remote. Petaloids 8–9, white. Achenes densely pubescent.

Distribution and habitat. China (Yunnan: Chengkou Xian). On grassy slopes; 2100 m.

Nomenclatural notes. Plants of this taxon were collected by C. C. Chang in 1935. He initially annotated them as '*A. pseudo-rockii* sp. nova', but this name was never published. In 1980 Wang published it as *Anemone rockii* var. *pilocarpa*.

Known only from the type collection.

5c. var. **multicaulis** W.T.Wang, Fl. Reipubl. Popul. Sin. 28: 350 (1980). – Type: China, Sichuan, Xichang Shi, 3000 m, 1977, *W.T. Wang* 40171 (holo PE!).

Basal leaf blade lobes and lobules remote. Petaloids 6, white or blue. Achenes densely pubescent.

Distribution and habitat. China (SW Sichuan: Xichang Shi). On grassy slopes; 3000 m.

Known only from the type collection.

6. Anemone geum H.Lév., Bull. Acad. Int. Geogr. Bot. (Le Mans) 25: 25 (1915). – *Anemone bonatiana* var. *geum* (H.Lév.) H.Lév., Cat. Pl. Yun-Nan 219 (1917). – Type: China, Yunnan, lagune du haut plateau de Ta-Hai-Tse, 3200 m, v 1912, *Maire* s.n. (holo E!). **Figs 6, 19.**

Anemone obtusiloba Franch., Plantae Delav. 8 (1889), non D.Don (1825).

Anemone obtusiloba D.Don subsp. *ovalifolia* Brühl, Ann. Bot. Gard. Calcutta 5: 78 (1896). – *Anemone ovalifolia* (Brühl) Hand.-Mazz., Symb. Sin. 7: 315 (1931). – *Anemone geum* H.Lév. subsp. *ovalifolia* (Brühl) Chaudhary, Bot. Zhurn. 73: 1188 (1988). – Type: NW China, Yunnan, Yungning, *Handel-Mazzetti* 3157 (holo WU!)

Anemone obtusiloba D.Don var. *geochares* Brühl, Ann. Bot. Gard. Calcutta 5: 78 (1896). – Type: China, Regio Tangutorum (N Tibet), 1880, *Przewalski* s.n. (lecto LE!, designated here by Ziman; iso E).

Anemone obtusiloba D.Don var. *orthocaula* Brühl, Ann. Bot. Gard. Calcutta 5: 78 (1896). – Type: India, Kumaon near the Lebung pass, 14–15000 ft, 1 viii 1886, *Duthie* 5272 (holo BM!; iso LE!).

Anemone wardii Marquand & Shaw, J. Linn. Soc. 48: 154 (1929). – Type: Tibet, Doshong La, Pemako, 25 x 1924, *Kingdon-Ward* 6262 (holo K!).

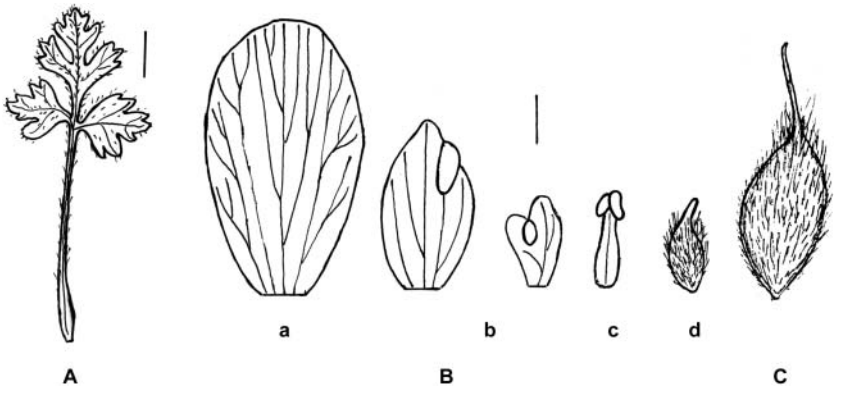

FIG. 6. *Anemone geum* H.Lév. A, basal leaf; B, flower parts (a, petaloid; b, staminodes; c, stamen; d, carpel); C, achene (A–B, *Handel-Mazzetti* 6671, WU; C, *Smith* 10642, BM).

Anemone rupestris Hook.f. var. *pilosa* Marquand & Shaw, J. Linn. Soc. 48: 154 (1929). – Type: Temo La, 4270 m, in pastures among dwarf *Rhododendron* on the open moorland, 6 vi 1924, *Kingdon-Ward* 5747 (holo K!).

Anemone obtusiloba D.Don subsp. *ovalifolia* Brühl var. *polysepala* W.T.Wang, Fl. Reipubl. Popul. Sin. 28: 43 (1980). – Type: China, NW Yunnan, 3780 m, 29 vii 1970, *Feng* 4070 (holo PE!).

Anemone obtusiloba D.Don subsp. *ovalifolia* Brühl var. *angustilimba* W.T.Wang, Fl. Reipubl. Popul. Sin. 28: 43 (1980). – Type: China, SW Sichuan, 25 viii 1936, *W.T. Wang* 660929 (holo PE!).

Basal leaves 5–15, petioles villous, 3–15 cm × 2–3 mm; blades ovate, 3-sect or sometimes 3-parted, 2–5 × 2–5 cm, densely long hairy or sparsely short hairy; bases subcordate or subtruncate; apical leaflets of 3-sect leaves on petiolules 5–10 mm long, 3-lobed or undivided, broadly rhombic, longer (sometimes much) longer than lateral leaflets which have petiolules 1–3 mm long and are 2- or 3-lobed (Fig. 6A). *Scapes* 2–5, 5–25 cm long, villous or pubescent; flowers solitary. *Involucral bracts* undivided or 3-lobed, 1–2 cm long, puberulent. *Pedicels* 1–2(–6) cm long, puberulent. *Petaloids* 5(–8), broadly ovate, white, yellowish, mauve or blue, 5–12 × 4–9 mm, abaxially pubescent; basal veins 3(–5), anastomosing veins absent (Fig. 6Ba). *Staminodes* sometimes present, c.2 mm long (Fig. 6Bb). *Stamens* 2–3 mm long; filaments lanceolate, 0.5–1 mm wide (Fig. 6Bc). *Carpels* narrowly ovoid, 2–3 mm long, pubescent or subglabrous, hairs 0.5–0.7 mm long; styles straight, 0.5–1.5 mm long (Fig. 6Bd). *Achenes* ovoid, sometimes slightly compressed, 3–4.8 × 1.6–2.3 mm, villous or subglabrous, hairs 0.8–1.3 mm long; styles straight, 1.8–2.6 mm long (Fig. 6C).

Distribution and habitat. Pakistan, China (Quinghai, NW Yunnan, W Sichuan, Xizang, S Xinjiang), Nepal, North India (Assam, Himachal Pradesh, Uttaranchal, Sikkim) (Fig. 19). In scrub and alpine meadows; 1900–4800 m.

Chaudhary (1988) reported the occurrence of this taxon in Bhutan (without localities) and in Burma (Shan, Mt. Victoria) but we were unable to find any herbarium collections from these localities.

Taxonomic remarks. Brühl (1896) described typical *Anemone obtusiloba* subsp. *ovalifolia* as having ovate 3-sect basal leaf blades and slightly compressed hirsute or glabrous pistils and achenes. He recognized two varieties, var. *geochares* and var. *orthocaula*, which differ in having prostrate-procumbent or erect-ascendent scapes, respectively. Several years later Léveille (1915) described plants from China (Yunnan) having characters similar to '*ovalifolia*' of Brühl as *Anemone geum* H.Lév. Shortly afterwards he (Léveille, 1917) reduced it to *Anemone bonatiana* var. *geum*. Handel-Mazzetti (1931) then described plants with ovate 3-sect basal leaf blades from Yunnan as *Anemone ovalifolia* (Brühl) Hand.-Mazz. by raising Bruhl's variety to specific status. Under this name he included *Anemone rupestris* var. *lobata* and *A. obtusiloba* subsp. *micrantha* Ulbr. pro parte based on the similar shape of the

basal leaves. Later Lauener (1960) reinstated this taxon as *Anemone obtusiloba* subsp. *ovalifolia* and treated *A. geum* as its synonym. Wang (1974, 1980) also considered *Anemone geum* as a synonym of *A. obtusiloba* subsp. *ovalifolia*, but recently Wang *et al.* (2001) accepted *A. geum* as a distinct species with two subspecies, subsp. *geum* and subsp. *ovalifolia*. After examination of specimens from Nepal and India, Hara & Williams (1979) and Sharma *et al.* (1993) recognized *Anemone geum* and included *A. ovalifolia* as a synonym. Chaudhary (1988) considered *Anemone geum* to include two subspecies, subsp. *geum* and subsp. *ovalifolia*, which, although occurring in the same area, differed mainly in rhizome shape and the pubescence of the basal leaves. According to the results of our examination of the type specimens of *Anemone geum* (*Maire* from Yunnan) and *A. ovalifolia* (*Handel-Mazzetti* from Yunnan), plus examination of other herbarium specimens (mainly from K, BM and E), we confirm the morphological similarity of these plants and believe all of them belong to *A. geum*. The species name by Léveille (1915) has priority over the combination *A. ovalifolia* (Brühl) Handel-Mazzetti (1931). Despite our recent recognition of *Anemone geum* subsp. *geum* and *A. geum* subsp. *ovalifolia* (Wang *et al.*, 2001), here we reject these taxa. Wang (1980) recognized three varieties within *Anemone geum* (albeit using the name *A. obtusiloba* subsp. *ovalifolia*): var. *ovalifolia*, var. *polysepala* and var. *angustilimba*. Variety *polysepala* was described as differing from the other varieties by its greater number of petaloids and was distinguished further from var. *angustilimba* by the shape of its basal leaf blades. Following our examination of the type specimens of Wang's var. *polysepala* (*Feng* 4070) and var. *angustilimba* (*W.T. Wang* 660929), we regard all these 'differential' characters as too variable to be of taxonomic significance. Therefore we conclude that it would be better to recognize *A. geum* as a species without distinct subspecies and varieties.

Selection of herbarium specimens. PAKISTAN. Prov. Frontiere, Gittidas au Katawai, 4100 m, 15 vii 1953, *Schmidt* 445 (BM).

CHINA. **Yunnan**: Close to Yungning, 3140 m, 23 vi 1914, *Handel-Mazzetti* 2730 (WU); Likiang, Mt. Julung Shan, 6 ix 1914, *Handel-Mazzetti* 661 (WU), 4080 (WU); Yulung Shan, Mt. Nguluho, 3400 m, 7 vi 1915, *Handel-Mazzetti* 6671 (WU); Haba and Dugwantsum, SE of Chung tien, 4350 m, 23 vi 1915, *Handel-Mazzetti* 6908 (WU); eastern slopes of Mt. Dyinaloko, North Peak of the Likiang Snow Range, 13000 ft, vi 1923, *Rock* 9016 (W); Likiang Snow Range, 3780 m, 29 vii 1970, *Feng* 4070 (PE). **Sichuan**: Mts. Daliang Shan (territory Lolo), East of Ningyuen, South Dsilimba, 3275 m, 26 iv 1914, *Handel-Mazzetti* 1757 (WU); Fumadia and Wolo-ho, close to Yenyuen and Yungning, 3300 m, 15 vi 1915, *Handel-Mazzetti* 3065 (WU); South of Tschescha and North of Yungning, close to monasterium Muli, 3800 m, 24 vi 1915, *Handel-Mazzetti* 7179 (WU); close to Doko, and South of Yungning, monasterium Muli, 4350 m, 4 viii 1915, *Handel-Mazzetti* 7405 (WU); Sung-pan, 3000 m, 6 vii 1922, *Fang* 2624 (E); 9 vii 1922, *Smith* 2448 (BM); Sungpan-hsien, 8 viii 1928, *Fang* 4068 (E); Hsioeh-shan, 4300 m, 19 vii 1932, *Smith* 3885 (BM); Hsioeh-Shan, 25 viii 1936, *W.T. Wang* 660929 (PE). **Shansi**: Yang ling kie (Ou t'ai chan), 30 vi 1922, *Licent* 6556 (BM). **Chindu**: Xian, Qingshuine Xiang, between Madou and Yushu, 4300 m, 11 viii 1996, *T.N. Ho et al.* 1613 (BM). **Qinghai**: Tongde Xian, Longmuer Xiume, between Jungong (Gyumgo) and Hebei, North side of Hung He, 3650 m, 22 vii 1993, *T.N. Ho et al.* 156 (BM); Maqin (Magen) Xian, Dawu Xiang, along Gegu He, 3500 m, 31 vii 1993, *T.N.*

Ho et al. 618 (BM). **Xizang**: Doshong La, Pemako, 3050 m, 25 x 1924, *Kingdon-Ward* 6262 (K); Radja and Yellow River Gorges, 13000 ft, vi 1926, *Rock* 14105 (E), vi 1926, *Rock* 14196 (BM, E); Tsarung, Solo-la, alpine belt, 14500 ft, vi 1932, *Rock* 22245 (BM, E). **Xinjiang**: Kangting (Tachienlu), 3100 m, 15 vii 1934, *Smith* 10462 (WU); Yulingkong, Gomba La, 3700 m, 22 vii 1934, *Smith* 10701 (BM).

NEPAL. East Nepal: Largeng Khola, 14500 ft, 21 vi 1950, *Lowndes* 1038 (BM); Sangda: North of Tukucha, 19 viii 1954, *Stainton et al.* 7316 (BM); Basia: Banjang, 4700 m, 6 viii 1973, *Einarsson et al.* 2728 (BM); Close to Dhorpatan, North side of Uttar Ganga, 3800 m, 3 iv 1974, *Vickery* 554 (BM); Cha Lundgpa, 15300 ft, 29 vii 1977, *Miehe* 391 (E), 393 (E).

INDIA. **Uttaranchal**: Kutti Yangti Valley, 15000 ft, 1 viii 1886, *Duthie* 5272 (WU). **Assam**: Tulung La, 1935, *Kingdon-Ward* 11681 (BM); Luguthang, 12000 ft, *Kingdon-Ward* 11622 (BM).

7. Anemone trullifolia Hook.f. & Thoms., Fl. Ind. 1: 22 (1855). – *Anemone obtusiloba* D.Don subsp. *trullifolia* (Hook.f. & Thoms.) Brühl, Ann. Bot. Gard. Calcutta 5: 78 (1896). – *Anemone trullifolia* Hook.f. & Thoms. var. *typica* Finet & Gagnep., Bull. Soc. Bot. France 11: 61 (1904). – Type: East Himalaya, Hab. Sikkim. Regio alpina, 11–15000 ft, 14 vii 1849, *Hooker* s.n. (lecto K!, second step designation here by Ziman and Mosyakin; iso E!). **Figs 7, 20.**

Anemone obtusiloba D.Don subsp. *trullifolia* (Hook.f. & Thoms.) Brühl var. *spatulata* Brühl, Ann. Bot. Gard. Calcutta 5: 78 (1896). – Types: Brühl reported several type localities and specimens: 'Sikkim (H. f. and others), near Thaling, Tsumtong (King's collectors!); Chumbi: on Pit-ze-la, Pan-ka-la, Oey-gung-la; Phari (King's collectors!); Bhutan; N. W. Himalaya?', without numbers and data on herbarium (probably CAL). As we have not seen these plants, we are unable to designate a lectotype.

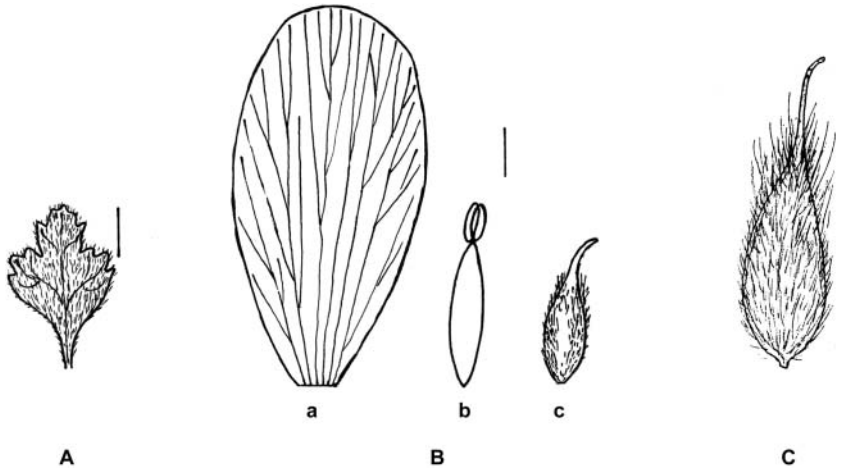

FIG. 7. *Anemone trullifolia* Hook.f. & Thoms. var. *trullifolia*. A, basal leaf; B, flower parts (a, petaloid; b, stamen; c, carpel); C, achene (A–B, *Handel-Mazzetti* 7179, WU; C, *Smith & Cave* 1711, E).

Anemone obtusiloba D.Don subsp. *trullifolia* (Hook.f. & Thoms.) Brühl var. *rotundifolia* Brühl, Ann. Bot. Gard. Calcutta 5: 78 (1896). – Type: Sikkim, near Thaling, 13000 ft, and in other localities (*Cunningham, G. Gammie, King's collectors!*). Like var. *spatulata*, we have not seen any of these plants.

Anemone chumulangmaensis W.T.Wang, Acta Phytotax. Sin. 12: 171 (1974). – Type: China, Tibet, Mons Chumulangma, Kama, 4380 m, 15 vi 1959, *Exped. ad Montem Chumulongma* 269 (holo PE!).

Leaves 4–10; petioles flat, 1–3(–5) cm × 3–5 mm, villous or densely pubescent, rarely puberulent; blades 3-parted to 3-lobed, spathulate, rhombic-obovate to obovate, 2–7 × 1–5 cm, villous or densely pubescent, bases attenuate (sometimes cuneate), margins distally dentate, apices rounded (Fig. 7A). *Scapes* 2–7, 3–15(–20) cm long, villous or densely pubescent, 1–3-flowered. *Involucral bracts* 3-lobed or 3-dentate, sometimes entire, narrowly obovate or lanceolate, 1–2.5 cm long, hirsute. Bracteoles sometimes present, small, paired. *Pedicels* 1–5(–8) cm long, pubescent or puberulent. *Petaloids* 5–6(–15), monomorphic or sometimes dimorphic (if more than 6), white, yellow, pinkish, purplish or blue, elliptic-obovate, 5–12(–15) × 4–8(–10) mm, densely or sparsely pubescent, hirsute or villous, anastomosing veins 1–2(–3) or sometimes absent (Fig. 7Ba). *Stamens* 1.8–3.4 mm long; filaments ovate-lanceolate, 0.5–0.7 mm wide (Fig. 7Bb). *Carpels* cylindric-ovoid, 2–4 mm long, villous or pubescent (Fig. 7Bc). *Achenes* ellipsoid-ovoid or fusiform, slightly compressed, 3.2–4.4 × 1.6–2.2 mm, without ribs, villous, hairs c.1 mm long; styles straight, 2–2.6 mm long (Fig. 7C).

Distribution and habitat. SW China (NW Yunnan, S Sichuan, SW Gansu, S Quinghai, S Xizang), East Nepal, India (Sikkim), Bhutan (Fig. 20). In forests and alpine meadows; 2500–4800 m.

Nomenclatural notes. Hooker and Thomson cited two collections (syntypes) in the protologue: 'Sikkim, alt. 11–15,000 ft, *Hooker f.*; and Bhotan, *Griffith*'. Specimens of the respective collections are deposited at K and E. Lauener (1960) cited the E specimens ('Sikkim: 3350–4570 m, J.D.Hooker' and 'Bhutan: Griffith 1718') as syntypes, while Chaudhary (1988) cited as a type the first specimen mentioned by Lauener (Hooker's specimen 'Sikkim, 3350–4570 m, J.D.Hooker', but from K), which can be regarded as an effective lectotypification. However, in that citation Chaudhary changed feet to metres and failed to indicate the collection date explicitly identifying the lectotype. Since there are several of Hooker's specimens representing at least two collections ('Hab. Sikkim. Regio alpina. Alt. 11–15000 ped., 14 vii 1849 and 5 ix 1849. Coll. J.D.Hooker. Herbarium Hookerianum 1867'), we have made the second step lectotypification of one of these.

Taxonomic remarks. Anemone trullifolia was described from the eastern Himalaya as a taxon very close to *A. obtusiloba* (Hooker & Thomson, 1855). Brühl (1896) recognized *Anemone trullifolia* as a subspecies of *A. obtusiloba* and also made *A. coelestina*, a species which had recently been described by Franchet (1885), another

subspecies of *A. obtusiloba*. However, he did not note any differences between these two taxa except for the yellow or blue petaloid colour and the distribution (*Anemone trullifolia* in the Himalaya and *A. coelestina* in SW China, Yunnan). Brühl noted the differences in basal leaf shape within subspecies *trullifolia* and on this basis he described three varieties: var. *linearis* (with mainly linear entire leaves), var. *spatulata* (with short-spathulate 3-lobed leaves) and var. *rotundifolia* (with suborbicular 3-lobed leaves). *Anemone trullifolia* and *A. coelestina* were maintained by Ulbrich (1906) under the former name as one 'species collectiva'. In contrast, Finet & Gagnepain (1904) proposed two varieties for *Anemone trullifolia*, var. *coelestina* and var. *souliei*, and Diels (1912) recognized var. *campestris* and var. *holophylla* within this taxon. Lauener (1960), however, again separated *Anemone trullifolia* and *A. coelestina* as distinct species and distinguished them by the shape of the basal leaves and the hairiness of the pistils. Furthermore, within *Anemone trullifolia*, he recognized var. *trullifolia*, var. *linearis* and var. *holophylla*, differentiated on the basis of leaf shape. Wang (1974) described three narrow endemics close to *Anemone trullifolia*: *A. chumulangmaensis* W.T.Wang, *A. liangshanica* W.T.Wang and *A. lutienensis* W.T.Wang. *Anemone chumulangmaensis* was lumped with *A. trullifolia* var. *trullifolia* by Wang himself and we agree with this. Furthermore, after examining the type materials of *Anemone liangshanica* and *A. lutienensis* we have reduced both to varieties of *A. trullifolia* (Figs 7, 8 and 9).

Key to varieties

1a. Leaf blades 3-lobed, ovate or broadly lanceolate; scapes 1–3-flowered; petaloid anastomosing veins 1–3 _____ **7a.** var. **trullifolia**

1b. Leaf blades 3-parted or 3-cleft, spathulate or rhombic; flowers solitary; petaloid anastomosing veins absent _____ 2

2a. Leaf blades 3-parted, spathulate; petaloids 7–9 × 5–6 mm, villous _____ **7b.** var. **liangshanica**

2b. Leaf blades 3-cleft, rhombic; petaloids 9–13 × 6–8 mm, sparsely pubescent _____ **7c.** var. **lutienensis**

7a. var. **trullifolia**

Leaf blades 3-lobed, ovate or broadly lanceolate. Scapes 1–3-flowered. Petaloids 5–7, anastomosing veins 1–3.

Distribution and habitat. China (NW Yunnan, SW Sichuan, S Xizang), Nepal, India (Sikkim, Himachal Pradesh), Bhutan (Fig. 20). Along streams in forests and in alpine meadows; 2500–4500 m.

Selection of herbarium specimens. CHINA. **Yunnan**: Long-Ki, 1894, *Delavay* s.n. (WU); v 1906, *Bailey* (LE); Likiang Range, 1933, *McLawrens* 307 (BM); Xiao huadinba, above Farm, v 1981, *SBEC* 747 (E). **Sichuan**: Mts. [near] Muli, vii 1930, *Forrest* 28434 (BM); Mountains round

Muli, vii 1930, *Forrest* 28484 (BM); ibid., 1931, *Forrest* 30041 (BM), 30471 (BM), 30817 (BM). **Xizang**: Mons Chumulangma, Kama, 4380 m, 15 vi 1959, *Exped. Mt. Chumulangma* 269 (PE).

NEPAL. Jansala, 3000 m, 17 v 1973, *Einarsson et al.* 53 (BM).

INDIA. **Sikkim**: Regio alpina, 11–15000 ft, 14 vii 1849, *Hooker* s.n. (E, K); Llonok, 15000 ft, 22 ix 1909, *Smith & Cave* 1711 (E); Zemu and Lhonakh Valleys, Yeumtang, 12000 ft, 13 ix 1947, *Cave* 167 (E); Himalaya: Jolinka, 14500 ft, vii 1931, *Bentham* s.n. (BM). **Himachal Pradesh**: Chamba, below Sathraundi, Bera Nullah, 10000 ft, 8 vi 1981, *Sayers* 3689 (BM).

BHUTAN. 1867, *Griffith* 1718 (E, K); Mem La, Paro Valley, 13000 ft, 15 v 1949, *Ludlow & Sheriff* 16247 (BM, E); Mangde Chu, 14000 ft, 12 vi 1966, *Bowes-Lyon* 3440 (BM); Waitang, Isampa, 15000 ft, 2 vi 1949, *Ludlow et al.* 19202 (BM); Cho La, 12500 ft, 4 vii 1949, *Ludlow et al.* 20800 (BM).

7b. var. **liangshanica** (W.T.Wang) Ziman & B.E.Dutton, Fl. China 6: 324 (2001). – *Anemone liangshanica* W.T.Wang, Acta Phytotax. Sin. 12: 170 (1974). – Type: China, Sichuan, Lepo, Liangshan, Hwangmaokeng, 2800 m, 19 vi 1959, *C.C. Hu et al.* 761 (holo PE!). **Fig. 8.**

Leaf blades 3-parted, spathulate. Flowers solitary. Petaloids white or purplish, 7–9 × 5–6 mm, villous; anastomosing veins absent.

Distribution and habitat. China. Endemic to western Sichuan, Lepo (= Leibo Xian) (Fig. 20). In alpine meadows; 3000–3600 m.

Known only from the type collection and a few specimens collected in the same area and cited in the protologue.

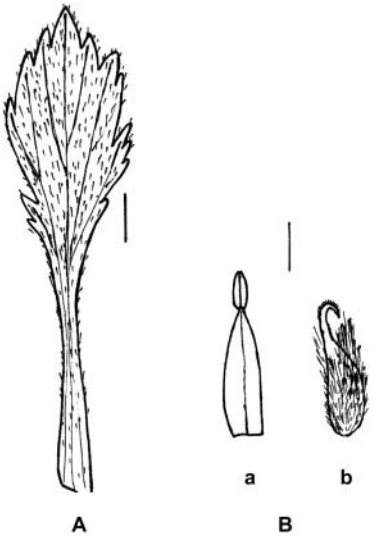

FIG. 8. *Anemone trullifolia* var. *liangshanica* (W.T.Wang) Ziman & B.E.Dutton. A, leaf; B, flower parts (a, stamen; b, carpel) (A–B, Flora of China, 2001).

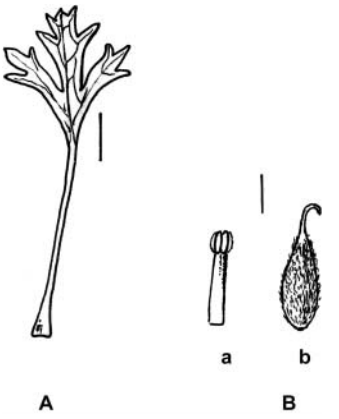

FIG. 9. *Anemone trullifolia* var. *lutienensis* (W.T.Wang) Ziman & B.E.Dutton. A, basal leaf; B, flower parts (a, stamen; b, carpel) (A–B, Flora of China, 2001).

7c. var. **lutienensis** (W.T.Wang) Ziman & B.E.Dutton, Fl. China 6: 324 (2001). – *Anemone lutienensis* W.T.Wang, Acta Phytotax. Sin. 12: 170 (1974). – Type: China, Yunnan, Lichiang, Lutien, 28 v 1939, *R.C. Ching* 20548 (holo PE!). **Fig. 9.**

Leaf blades 3-cleft, rhombic. Petaloids white or blue, 9–13 × 6–8 mm, sparsely pubescent; anastomosing veins absent.

Distribution and habitat. China. Endemic to NW Yunnan (Lichiang, Lutien) (Fig. 20). In alpine meadows; 4000 m.

Known only from the type collection and a few specimens collected in the same area and cited in the protologue.

8. Anemone coelestina Franch., Bull. Soc. Bot. France 32: 4 (1885). – *Anemone obtusiloba* D.Don subsp. *coelestina* (Franch.) Brühl, Ann. Roy. Bot. Gard. Calcutta 5: 78 (1896). – *Anemone trullifolia* Hook.f. & Thoms. var. *coelestina* (Franch.) Finet & Gagnep., Bull. Soc. Bot. France 51: 61 (1904). – Type: China, Prov. Yunnan, sommet du mont Hee-chan-men, supra Lan-Kong, 2 vi 1884, *Delavay* 3 (lecto P!, designated here by Ziman and Mosyakin). **Figs 10, 20.**

Anemone bonatiana H.Lév., Feddes Repert. Spec. Nov. 7: 98 (1909). – Type: China, Yunnan: Lao Kouy-Chan, pres My Le, 1906, Herb. Bonati, *Ngueou* 607 (holo E!).

Leaves 5–10; petioles 1–4 cm × 8–10 mm, villous or densely pubescent; blades subtrilobed to undivided, oblong-linear to oblanceolate, 2–8 × 1–3 cm, villous, bases cuneate-attenuate; margins obtusely or acutely dentate (Fig. 10A). *Scapes* 2–8, 3–10 cm long, densely pubescent; flowers solitary. *Involucral bracts* undivided, linear-lanceolate, 1–3 cm long, villous. *Pedicels* 1–3 cm long, villous. *Petaloids* 5–6, monomorphic, reddish blue or bluish white, yellow, reddish orange, reddish violet or

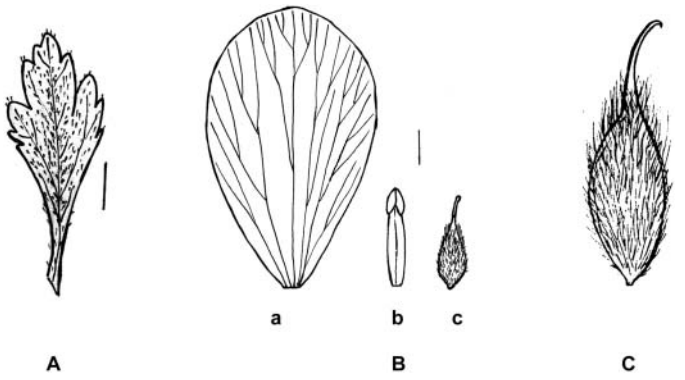

FIG. 10. *Anemone coelestina* Franch. var. *coelestina*. A, basal leaf; B, flower parts (a, petaloid; b, stamen; c, carpel); C, achene (A, *Delavay* 1887, WU; B, *Handel-Mazzetti* 2437, WU; C, *Forrest* 1922, LE).

bluish violet, broadly elliptic, 8–14 × 7–12 mm, densely pubescent, basal veins 3–5, anastomosing veins absent (sometimes solitary) (Fig. 10Ba). *Stamens* 2.5–3 mm long; filaments linear (Fig. 10Bb). *Staminodes* absent or occasionally present. *Carpels* ovoid, 3–4 mm long, villous; styles straight (Fig. 10Bc). *Achenes* ovoid, 3–4.5 × 2 mm, without ribs, villous, hairs c.1 mm long; styles substraight, c.2.5 mm long (Fig. 10C).

Distribution and habitat. China (Yunnan, Sichuan, E and S Xizang), Nepal, Bhutan, North India (Sikkim, Assam) (Fig. 20). In *Rhododendron* forests and scrub, on grassy slopes, streamsides, alpine meadows; 2500–5000 m.

Taxonomic remarks. Anemone coelestina was described by Franchet (1885) from Yunnan as a species close to *A. trullifolia* but differing from it by the long-ovate subtrilobed basal leaves, and 5 blue or white petaloids. Although Ulbrich (1906) and Handel-Mazzetti (1931, 1939) recognized *Anemone coelestina* as a species, other authors (e.g. Brühl, 1896; Finet & Gagnepain, 1904; Lauener, 1960; Wang, 1974, 1980; Chaudhary, 1988) regarded this taxon as a subspecies or variety of *A. trullifolia*, or included it in *A. trullifolia* as a synonym. After a comparative examination of many specimens we note that *Anemone trullifolia* and *A. coelestina* share important characters but that *A. coelestina* differs from *A. trullifolia* in having mostly undivided, oblong-linear to oblanceolate basal leaf blades with wider petioles (3–5 and 8–10 mm), undivided bracts, solitary flowers, fewer monomorphic petaloids (5–6 only as compared with 5–15 in *A. trullifolia*) without anastomosing veins, and linear filaments. Consequently, we recognize *Anemone coelestina* as a distinct species. Brühl (1896) described *Anemone obtusiloba* subsp. *trullifolia* var. *linearis* on the basis of its linear entire basal leaf blades. Handel-Mazzetti (1939) also recognized this variety and published it as *Anemone trullifolia* var. *linearis* (Brühl) Hand.-Mazz. This variety was also recognized by Lauener (1960) who assumed its proximity to *Anemone coelestina*. As a result of our examination of the type specimens of var.

linearis (*Pratt* 493 in K and BM) and var. *souliei* (*Soulie* 7 in K) we note their similarity in the basal leaves with short wide petioles and undivided oblong-linear blades, undivided bracts, solitary flowers, and petaloids without anastomosing veins. Accordingly, we recognize only one variety (var. *linearis*). However, we believe this variety to be closer to *Anemone coelestina* than to *A. trullifolia* and include it under *A. coelestina*. Variety *holophylla* Diels was also described under *Anemone trullifolia* but was transferred to *A. coelestina* (Handel-Mazzetti, 1939). Nevertheless, Lauener (1960) and Wang (1974, 1980) included var. *holophylla* in *Anemone trullifolia*. However, as a result of our examination of the type material of var. *holophylla* (*Forrest* 2166 in BM, E, K) with its lanceolate, almost entire apically toothed basal leaf blades, and blue-violet petaloids without anastomosing veins, we regard these plants as closer to *Anemone coelestina* than to *A. trullifolia*, and thus transfer var. *holophylla* from *A. trullifolia* to *A. coelestina*.

Key to varieties

1a. Leaf blades subtrilobed, ovate-oblong; petaloids bluish-white, anastomosing veins solitary; staminodes absent _____ **8a.** var. **coelestina**

1b. Leaf blades undivided or rarely obscurely 3-lobed, linear to oblanceolate; petaloids bluish-violet, anastomosing veins absent; staminodes absent or sometimes present _____ 2

2a. Leaf blades linear, margins acutely dentate; staminodes absent **8b.** var. **linearis**

2b. Leaf blades oblanceolate, margins obtusely dentate; staminodes sometimes present _____ **8c.** var. **holophylla**

8a. var. **coelestina**

Leaf blades subtrilobed, ovate-oblong. Petaloids bluish-white, anastomosing veins solitary; staminodes absent.

Distribution and habitat. China (Yunnan, Sichuan) (Fig. 20). In alpine meadows and bushes; 3500–4800 m.

Selection of herbarium specimens. CHINA. **Yunnan**: sommet du mont Hee-chan-men, environs de Ta-li, 11 vii 1883, *Delavay* 3 (P, WU); Mts. Koua-la-po, prei Ho-Kin, env. De Bali, 26 v 1884, *Delavay* 1853 (P); Mt. Hee Chang men, above Lang-Kong, 2 vi 1884, *Delavay* 48 (WU); 30 x 1884, *Delavay* 1034 (WU); Lang-Kong, 16 iv 1887, *Delavay* s.n. (LE, PE, WU); Lao Kouy-Chan, pres My Le, 1906, *Ngueou* 607 (E); Yangtze Watershed, slopes of Likiang Snow Range, v 1910, *Forrest* 5640 (BM, K); Lichiang Range, 10–11000 ft, vi 1913, *Forrest* 10135 (BM); Xiao Huadinba, above farm, 18 v 1981, *SBEC* 747 (E). **SW Sichuan**: Mts. Liukuliandse, between Yenyuen and Castle Kwapi, 18 v 1914, *Handel-Mazzetti* 2437 (WU); Yungning, 16 vi 1914, *Handel-Mazzetti* 3085 (WU); Mts. Kopati, Djago and Muli, vi 1928, *Rock* 16162 (LE); Mts. Mitsuga, West of Muli Gomba, 4875 m, vi 1928, *Rock* 16206 (E, K).

8b. var. **linearis** (Brühl) Ziman & B.E.Dutton, Fl. China 6: 325 (2001). – *Anemone obtusiloba* subsp. *trullifolia* (Hook.f. & Thoms.) Brühl var. *linearis* Brühl, Ann.

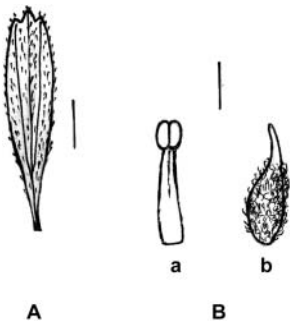

FIG. 11. *Anemone coelestina* var. *linearis* (Brühl) Ziman & B.E.Dutton. A, basal leaf; B, flower parts (a, stamen; b, carpel) (A–B, Flora of China, 2001).

Roy. Bot. Gard. Calcutta 5: 77 (1896). – *Anemone trullifolia* var. *linearis* (Brühl) Hand.-Mazz., Acta Horti Gothob. 13: 178 (1939). – Type: West Szechuan and Tibetan Frontier, chiefly near Ta chien Lu, 9–13000 ft, xii 1890, *Pratt* 493 (holo BM!). **Fig. 11.**

Anemone souliei Franch., Bull. Soc. Bot. France 32: 4 (1885). – *Anemone trullifolia* Hook.f. & Thoms. var. *souliei* (Franch.) Finet & Gagnep., Bull. Soc. Bot. France 51: 62 (1904). – Type: Chine. Prov. Se-tchuen, Tongolo, pres Ta-tsien-lou, vii–viii 1891, *Soulie* 7 (holo P!).

Leaf blades mostly undivided (rarely obscurely 3-lobed), linear, acutely dentate, 8–15 × 2–3 cm. Petaloid anastomosing veins absent. Staminodes absent.

Distribution and habitat. China (NW Yunnan, W and S Sichuan, Xizang), Bhutan (Fig. 20). In *Rhododendron* forests and bushes, and in alpine meadows; 2800–4900 m.

Selection of herbarium specimens. CHINA. **Yunnan**: 1930, *Forrest* 28855 (E); vii 1935, *W.T. Wang* (PE). **Sichuan**: Tibetan Frontier, chiefly near Ta chien Lu, 9–13000 ft, xii 1890, *Pratt* 493 (BM); Tongolo, pres Ta-tsien-lou, vii–viii 1891, *Soulie* 7 (P!); Hongyuan Co., Rangkouxing, 1 viii 1982, *Zhao Qing Sheng* 212 (E); Chazhenliangzi, 3700 m, 31 vii 1989, *Zhao Qing Sheng* 14 (E). **Xizang**: Pasho Distr., Kham, Valley of Du Chu, 14000 ft, 13 vii 1936, *Hanbury-Tracy* 30 (BM). BHUTAN. Chojo Dzong, 13500 ft, 30 vi 1949, *Ludlow et al.* 16687 (K).

8c. var. **holophylla** (Diels ex H.F.Comber) Ziman & B.E.Dutton, Fl. China 6: 324 (2001). – *Anemone trullifolia* Hook.f. & Thoms. var. *holophylla* Diels, Notes Roy. Bot. Gard. Edinburgh 5: 263 (1912). – Type: China: Yunnan, Eastern flank of the Lichiang Range, 3050–3350 m, v 1906, *Forrest* 2166 (lecto E!; iso BM, K!). **Fig. 12.**

Anemone coelestina Franch. var. *polygyna* H.F.Comber and f. *holophylla* (Diels) H.F.Comber, Notes Roy. Bot. Gard. Edinburgh 27: 226 (1934).

Leaf blades oblanceolate, margins obtusely dentate. Petaloid anastomosing veins absent. Staminodes sometimes present.

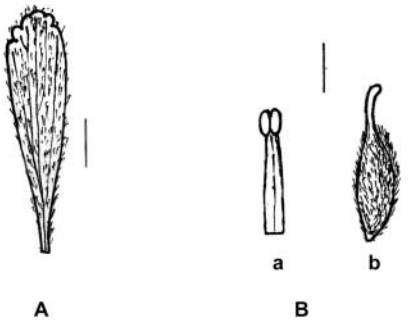

FIG. 12. *Anemone coelestina* var. *holophylla* (Diels ex H.F.Comber) Ziman & B.E.Dutton. A, basal leaf; B, flower parts (a, stamen; b, carpel) (A–B, Flora of China, 2001).

Distribution and habitat. China (NW Yunnan, Sichuan, Xizang), Nepal, North India (Assam) (Fig. 20). In *Rhododendron* forests and on grassy slopes; 2500–4900 m.

Selection of herbarium specimens. CHINA. **Yunnan**: Likiang Range, v 1906, *Forrest* 2166 (BM, E); ibid., vi 1906, *Forrest* 2226 (BM); ibid., vii 1906, *Forrest* 2634 (E); Distr. Chung-tien, 13000 ft, Mts. West of Hsiao Chung-tien, v 1932, *Rock* 24664 (BM, K); Pei Ma Shan, Mekong-Jangtze Divide, SW of Atuntze, vi 1932, *Rock* 22764 (BM, K); Haba Shan, North of Yangtze loop, third Peak of Likiang Snow Range, 1932, *Rock* 24793 (BM, K). **Sichuan**: Hongyuan Co., Rangkouxiang, 3740 m, 31 vii 1989, *Zhao Qing-Sheng* 212 (BM); Hongyuan Co., Chazhen liangzi, 3700 m, 31 vii 1989, *Zhao Qing-Sheng* 14 (BM). **Xizang**: 1906, *Forrest* 362 (K); Tafsiculi-Daevo, 25 vi 1914, *Shimprift* 1797 (WU); Hills of Lhasa, 14000 ft, 26 vii 1943, *Ludlow & Sheriff* 9701 (BM).

NEPAL. East Nepal: Tamur Valley: Mewa Khola, Topke Gola, 13500 ft, 14 v 1956, *Stainton* 262 (BM, E).

INDIA. Assam: Mago, 11700 ft, 1935, *Kingdon-Ward* (BM); Chumbi and Phari, 1878, *Dunboo* s.n. (BM).

9. Anemone subindivisa W.T.Wang, Acta Phytotax. Sin. 12: 173 (1974). – Type: China, Szechuan, Muli, Mons Misuga, 3700–4000 m, 26 v 1937, *T.T. Yu* 5756 (holo PE!). **Figs 13, 21.**

Leaves 3–7; petioles 2.5–4 cm × 5–10 mm, villous; blades undivided or obscurely 3-lobed, broadly ovate or orbicular-ovate, 3–4 × 2–3 cm, villous; bases rounded-truncate; margins obtusely dentate, apices rounded (Fig. 13A). *Scapes* 2–5, 3–10 cm long, villous; flowers solitary. *Involucral bracts* entire or subequally 3-dentate, lanceolate, 1–2 cm long, with obtuse apices, villous. *Pedicels* 0.5–1 cm long, villous. *Petaloids* 5–6, white, broadly elliptic, 8–12 × 5–8 mm, sparsely puberulent, basal veins 3–5, without anastomoses. *Stamens* 3–5 mm long; filaments lanceolate (Fig. 13Ba). *Carpels* 3–3.5 mm long, densely pubescent (Fig. 13Bb).

Distribution and habitat. China. Endemic to SW Sichuan: Muli (Fig. 21). In *Abies* and *Pinus* forests and on grassy slopes; 2500–4000 m.

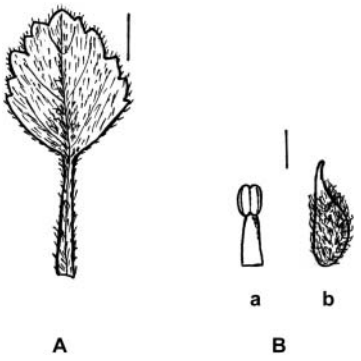

FIG. 13. *Anemone subindivisa* W.T.Wang. A, basal leaf; B, flower parts (a, stamen; b, carpel) (A–B, Flora of China, 2001).

Taxonomic remarks. Wang (1974) described this species from China (Sichuan) as very close to *Anemone trullifolia* but differing from it by the rounded-truncate basal leaf bases and mainly undivided blades. Our data confirm that *Anemone subindivisa* is a member of series *Trullifoliae* but we suggest it is closer to *A. yulongshanica*, differing from it by its undivided basal leaf blades, wider petioles, entire (sometimes 3-dentate) lanceolate involucral bracts, and smaller petaloids. We accept this taxon as a species but we note the necessity for further detailed study, especially of its mature achenes.

Known only from the type collection and a few specimens collected in the same area and cited in the protologue.

10. Anemone yulongshanica W.T.Wang, Bull. Bot. Res. NE Forest Univ. 16: 159 (1996). – Type: China, Yunnan, Likiang Snow Range, 1937, *T.T. Yu* 15595 (holo PE!). **Figs 14, 21.**

Leaves 5–9; petioles 4–13 cm × 2–3 mm, pubescent or densely villous; blades 3-parted or 3-lobed, pentagonal or broadly ovate, 1–5.5 × 1–6 cm, herbaceous or

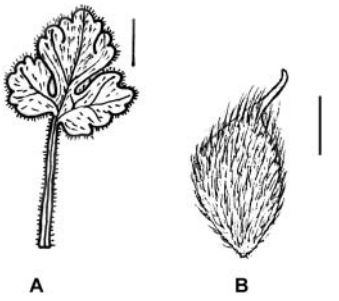

FIG. 14. *Anemone yulongshanica* W.T.Wang var. *yulongshanica*. A, basal leaf; B, achene (A, Flora of China, 2001; B, *T.T. Yu* 1559, PE).

papery, pubescent or villous, bases truncate; apical lobes 3-lobed or undivided, rhombic-ovate or broadly rhombic, sparsely obtusely dentate; lateral lobes unequally 2-lobed, obliquely broadly cuneate or flabellate (Fig. 14A). *Scapes* 2–9, 3–15(–30) cm, villous or pubescent; flowers solitary. *Involucral bracts* unequally 3-parted or 3-lobed, narrowly rhombic or oblong-lanceolate, 0.7–3 cm long, pubescent. *Pedicels* 1–7 cm long, puberulent. *Petaloids* 5–6, white, yellowish or bluish, narrowly obovate or elliptic, 8–16 × 8–10 mm, sparsely appressed pubescent, basal veins 3, without anastomosing veins. *Stamens* 2–3 mm long; filaments lanceolate. *Carpels* 2.5–3.5 mm long, linear-lanceolate or narrowly ovoid, sericeous or pubescent. *Achenes* ovoid, 2.8–3.7 × 1.8–2.2 mm, without ribs, villous, hairs c.1 mm long; styles 1.4–1.6 mm long, straight or slightly curved (Fig. 14B).

Distribution and habitat. China (NW Yunnan, SW Sichuan) (Fig. 21). In *Abies* forests, on rocks and grassy slopes; 2600–3900 m.

Taxonomic remarks. Diels (1912) noted that certain plants referable to *Anemone trullifolia* had basal leaves with truncate bases. However, Comber (1934) later regarded these variants as belonging to *Anemone coelestina*, not *A. trullifolia.* Moreover, Comber described them as *A. coelestina* var. *truncata* and var. *polygyna* (the latter with more carpels), and he considered that both varieties were close to *A. coelestina* var. *holophylla*. Eventually Wang (1996) described *Anemone yulongshanica* on the basis of a specimen of *A. obtusiloba* from Yunnan collected by T. T. Yu. It differs from *Anemone obtusiloba* s.str. mainly by the apical lobes of the basal leaves (3-lobed or undivided). According to our data *Anemone yulongshanica* has certain affinities to series *Obtusilobae* but should be regarded as a member of series *Trullifoliae*. It differs from *Anemone trullifolia* by the basally truncate or subcordate (not attenuate) basal leaf blades, narrower filaments, and smaller ovoid achenes with shorter styles. Wang (1974) divided this species into two varieties, with var. *yulongshanica* differing from var. *truncata* mostly by its larger basal leaves and bracts. Wang *et al.* (2001) maintained these varieties and both are recognized in this treatment.

Key to varieties

1a. Basal leaf petioles 6–13 cm long, pubescent; leaf blades 3–5.5 × 4–6 cm, basally subcordate, apical lobes 3-cleft; involucral bracts 1.5–3 cm long; carpels linear-lanceolate, sericeous _____ **10a.** var. **yulongshanica**

1b. Basal leaf petioles 4–5 cm long, densely villous; leaf blades 1–3.5 × 1–4 cm, basally truncate, apical lobes undivided; involucral bracts 0.7–2 cm long; carpels narrowly ovoid, pubescent _____ **10b.** var. **truncata**

10a. var. **yulongshanica**

Basal leaf petioles 6–13 cm long, pubescent; leaf blades 3–5.5 × 4–6 cm, basally subcordate, apical lobes 3-cleft (Fig. 14A). Involucral bracts 1.5–3 cm long. Carpels linear-lanceolate, sericeous (Fig. 14B).

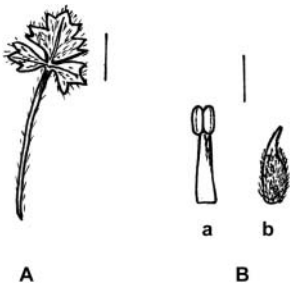

FIG. 15. *Anemone yulongshanica* var. *truncata* (H.F.Comber) W.T.Wang. A, basal leaf; B, flower parts (a, stamen; b, carpel) (A–B, Flora of China, 2001).

Distribution and habitat. China (Yunnan). Endemic to the Lichiang Snow Range.

Known only from the type collection.

10b. var. **truncata** (H.F.Comber) W.T.Wang, Bull. Bot. Res. NE Forest Univ. 16: 159 (1996). – *Anemone coelestina* Franch. var. *truncata* H.F.Comber, Notes Roy. Bot. Gard. Edinburgh 18: 226 (1934). – Type: China, Yunnan, East flank of Lichiang Range, 11000 ft, v 1910, *Forrest* 5640 (holo E!; iso K!, P!). **Fig. 15.**

Basal leaf petioles 4–5 cm long, densely villous; leaf blades 1–3.5 × 1–4 cm, basally truncate, apical lobes undivided (Fig. 15A). Involucral bracts 0.7–2 cm long. Carpels narrowly ovoid, pubescent (Fig. 15Bb).

Distribution. China (Yunnan). Endemic to the Lichiang Snow Range.

Known only from the type collection.

11. Anemone rupestris Wall. ex Hook.f. & Thoms., Fl. Ind. 1: 21 (1855). – Type: Sikkim, 4570 m, *Hooker* s.n. (lecto K!; iso E!). **Figs 16, 21.**

Anemone obtusiloba D.Don var. *lobata* Brühl, Ann. Bot. Gard. Calcutta 5: 78 (1896). – Type: Sikkim: on the Pa-Tang-La; Chumbi, at Ley-rong, *King's collector* (iso CAL).

Anemone rupestris Wall. ex Hook.f. & Thoms. var. *wallichii* Brühl, Ann. Bot. Gard. Calcutta 5: 78 (1896). – Type: Nepal, Gossain Than, *Wallich* 4696 (holo CAL; iso K).

Anemone obtusiloba D.Don subsp. *saxicola* Brühl, Ann. Bot. Gard. Calcutta 5: 78 (1896). – *Anemone saxicola* (Brühl) Tamura & Kitamura in Kihara, Fauna Fl. Nepal. Himal. 125 (1955). – Type: Kashmir, *Falconer* 28 (holo CAL).

Anemone obtusiloba D.Don subsp. *omalocarpella* Brühl, Ann. Bot. Gard. Calcutta 5: 78 (1896). – Type: Nipal, Scully (holo CAL).

Anemone bhutanica Tamura, Acta Phytotax. Geobot. 19: 75 (1962). – Type: Bhutan, Shukuna Mountain, 1 viii 1958, *Nakao* 101 (holo KYO).

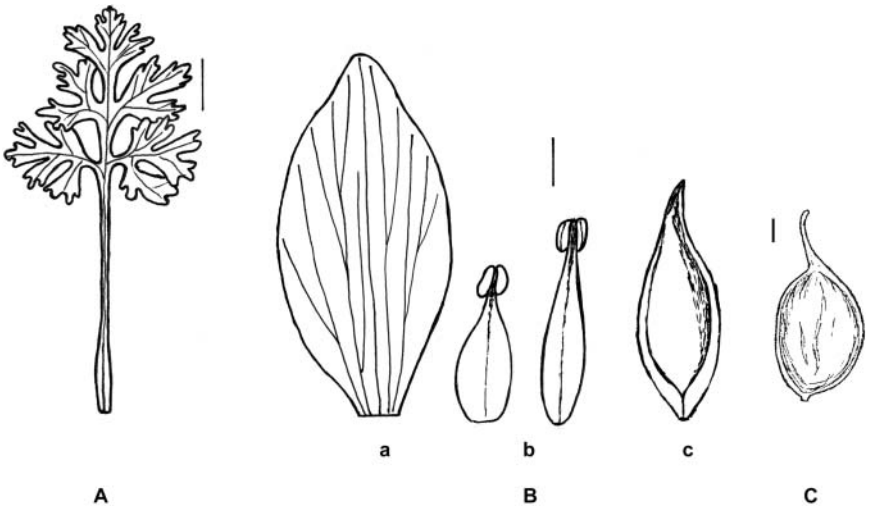

FIG. 16. *Anemone rupestris* Wall. ex Hook.f. & Thoms. subsp. *rupestris*. A, basal leaf; B, flower parts (a, petaloid; b, stamens; c, carpel); C, achene (A–B, *Ludlow & Sheriff* 20352, E; C, *Handel-Mazzetti* 1914, WU).

Basal leaves 4–7; petioles 3–10 × 1–2 mm, sparsely puberulent or subglabrous; blades twice 3-sect, ovate, 1–5 × 1–6 cm, sparsely puberulent or glabrous, bases subcordate; apical leaflets with petiolules 5–10 mm long, 3-sect or 3-parted, broadly rhombic, secondary leaflets with petiolules 1–2 mm long, ultimate lobules narrowly ovate or linear-lanceolate; lateral leaflets on petiolules 2–5 mm or subsessile, 3-parted or 3-lobed, subreniform (Fig. 16A). *Scapes* 2–6, 3–20 cm long, sparsely puberulent or subglabrous, 1–3-flowered. *Involucral bracts* undivided or 2- or 3-lobed, ovate-oblong, cuneate-obovate or rhombic, 1–3 cm long. *Pedicels* 1–6 cm long, puberulent or glabrous. *Petaloids* 5–6(–8), white, blue or purplish or reddish-white, oblong-elliptic or obovate, mainly dimorphic (outer and inner ones differ in size and colour), 5–10(–14) × 3–6(–8) mm, subglabrous, basal veins, anastomosing veins absent (Fig. 16Ba). *Stamens* 3.5–4.3 mm long; filaments lanceolate or oblong-elliptic (Fig. 16Bb). *Carpels* ovoid, compressed, 2.5–3.3 mm long, subglabrous; styles down-curved (Fig. 16Bc). *Achenes* broadly ellipsoid, compressed, 2.5–4 × 1.6–2 mm, subglabrous; ribs distinct; styles curved, sometimes basally bent, 1.2–1.8 mm long (Fig. 16C).

Distribution and habitat. China (Yunnan, Sichuan, S Xizang, Sikang), Nepal, Bhutan, India (Sikkim, Assam, Kashmir) (Fig. 21). In *Rhododendron* bushes, alpine meadows and on rocky outcrops; 2700–4800 m.

Taxonomic remarks. Anemone rupestris was described (Hooker & Thomson, 1855) as a taxon very close to *A. obtusiloba* but with smaller and more slender 1–3-flowered stems, with narrower segments to the more dissected leaves and is less hairy. Later, Hooker (1872) assumed this taxon to be a part of *Anemone obtusiloba* and not a

distinct species. Maximowicz (1890) described *Anemone gelida* on the basis of its twice 3-sect basal leaves, 3-lobed or entire bracts, 6–8 glabrous petaloid sepals and compressed pilose achenes with short straight styles. Shortly afterwards Brühl (1896) proposed to reduce *Anemone gelida* to a subspecies of *A. rupestris* due to the overall similarity except for the number and colour of petaloids and the pubescent receptacle. He recognized within *Anemone rupestris* three varieties: var. *lobata*, var. *wallichii* and var. *pusilla*. More recently, other authors (Ulbrich, 1906; Lauener, 1960) included *Anemone gelida* as a subspecies of *A. rupestris*. Thus, according to Lauener, *Anemone rupestris* includes two subspecies, subsp. *rupestris* and subsp. *gelida*, the latter with two varieties, var. *gelida* and var. *wallichii*. On the other hand, Wang (1974, 1980) and Chaudhary (1988) both regarded *Anemone rupestris* as consisting of three subspecies: subsp. *rupestris*, subsp. *gelida* and subsp. *polycarpa*. After a comparative study of *Anemone rupestris* and *A. gelida*, we confirm their similarity, but differentiate *A. gelida* by its smaller basal leaves, scapes, petaloids, and strictly solitary flowers. Consequently, following Wang *et al.* (2001), we accept *Anemone rupestris* and *A. gelida* as subspecies. In contrast, the characters listed by Brühl (1896) to separate three varieties appear to be too variable and not sufficiently distinct to warrant the recognition of the varieties. The same applies to the varieties of *Anemone rupestris* subsp. *gelida* (Lauener, 1960). Recently we included *Anemone obtusiloba* D.Don subsp. *omalocarpella* Brühl as a synonym of *A. polycarpa* (Wang *et al.*, 2001), but here we reject this opinion and accept it as a part of *A. rupestris* due to its 'nearly flat, margined, quite glabrous carpels' (Brühl, 1896: 78).

Key to subspecies

1a. Leaf blades 2–5 × 1–6 cm; scapes 10–20 cm long, 1–3-flowered; petaloids 5–6, 8–10(–14) × 4–6(–8) mm; flowers and achenes subglabrous _____ **11a.** subsp. **rupestris**

1b. Leaf blades 1–1.5 × 1–2 cm; scapes 3–12 cm long, 1-flowered; petaloids 5–8, 5–7 × 3–4 mm; flowers and achenes glabrous _____ **11b.** subsp. **gelida**

11a. subsp. **rupestris**

Leaf blades 2–5 × 1–6 cm. Scapes 10–20 cm long, 1–3-flowered. Petaloids 5–6, 8–10(–14) × 4–6(–8) mm. Flowers and achenes subglabrous (Fig. 16).

Distribution and habitat. China (Yunnan, Sichuan, Xizang), Nepal, Bhutan, North India (Fig. 21). On slopes and along streams; 2500–3000 m.

Selection of herbarium specimens. CHINA. **Yunnan**: Pei-ma shan, ix 1932, *Rock* 23390 (GH); Yangtze Watershed, western slopes of Likiang Snow Range, 6 vi 1922, *Rock* 4219 (BM). **Sichuan**: Yunghing, 24 vi 1914, *Handel-Mazzetti* s.n. (WU). **SE Xizang**: Tsarung, northern slopes of Mt. Kenichunpo, North of Sikitung, Upper Salween River, v 1932, *Rock* 22179 (E, K); Shinden-Gompa, Nagong, 25 vii 1933, *Kingdon-Ward* 10641 (BM); Kongbo Prov., Lusha

Chu, 12000 ft, 9 vi 1938, *Ludlow & Sheriff* 4723 (BM); 60 km North of Lhasa, Reting, 14000 ft, 27 vi 1944, *Ludlow & Sheriff* 11069 (BM).

NEPAL. Gosainsthan, Gopain Shar, *Wallich* 4696 (K); Arun Valley, Chhoyang Khola, West of Num, 13000 ft, 22 vi 1956, *Stainton* 739 (E).

BHUTAN. Me La, 9 vi 1949, *Ludlow & Sheriff* 20352 (E); Kangla Karcha La, Po Chu Drainage, 16000 ft, 20 vi 1949, *Ludlow & Sheriff* 16596 (E).

INDIA. Sikkim: Hills to North and West of Dzongri camp, 4200 m, 23 vi 1983, *Starling et al.* 82 (E); West Distr., between Dzongri and Black Kabru (Kabur), 4050 m, 17 vii 1992, *Long et al.* 450 (E); Kashmir, 15000 ft, alpine belt, 1864, *Falconer* s.n. (K); Sikkim, 4570 m, *Hooker* s.n. (E, K); Sikkim, Himalaya, 15000 ft, 1832, *Wallich* 4676 (K), 5479 (K); Kashmir ad Pir Panjal, *Jacquemont* s.n. (K).

11b. subsp. **gelida** (Maxim.) Lauener, Notes Roy. Bot. Gard. Edinburgh 23: 199 (1960). – *Anemone gelida* Maxim., Acta Hort. Petropol. 11: 21 (1890). – Type: China, S Sichuan, Valle Kserntso, 11 viii 1885, *Potanin* s.n. (holo LE!; iso K!). **Fig. 17.**

Anemone obtusiloba D.Don var. *pusilla* Brühl, Ann. Bot. Gard. Calcutta 5: 78 (1896). – Type: Sikkim, Sei-Cho-La, W of Jongri; Kapur below Kinchinjanga; Pandim-chu, 15000 ft, *King's collectors* s.n. (iso CAL!).

Leaf blades 1–1.5 × 1–2 cm. Scapes 3–12 cm long, 1-flowered. Petaloids 5–8, 5–7 × 3–4 mm. Flowers and achenes glabrous.

Distribution and habitat. China (Yunnan, Sichuan, Xizang), Bhutan, Nepal, India (Fig. 21). In alpine meadows; 4800–5000 m.

Selection of herbarium specimens. CHINA. **NW Yunnan**: Lu-djiang (Salween) and Djiou-djiang (Irrawadi), close to Tschiangschel, 4075 m, 4 vii 1916, *Handel-Mazzetti* 9262 (WU), 2730 (WU); Yangtze Watershed, western slopes of Likiang Snow Range, 6 vi 1922, *Rock* 4219 (E);

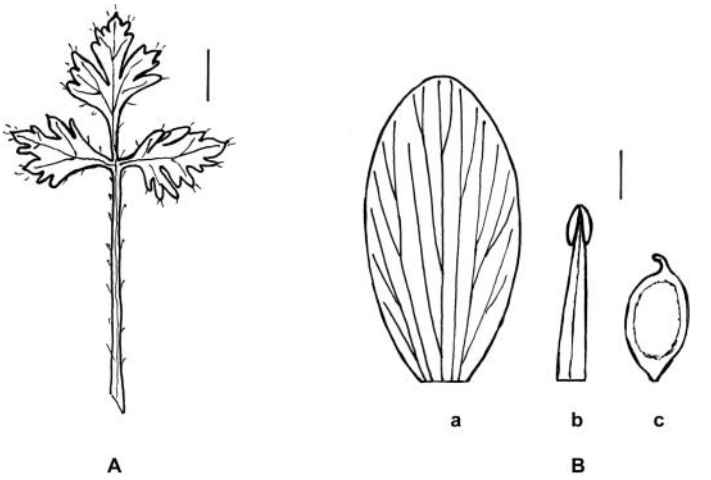

FIG. 17. *Anemone rupestris* subsp. *gelida* (Maxim.) Lauener. A, basal leaf; B, flower parts (a, petaloid; b, stamen; c, carpel) (A, *Handel-Mazzetti* 1658, WU; B, *Potanin* 1885, LE).

SW of Wei-Hsi, Mekong-Salween Divide, 4300 m, v 1928, *Rock* 16965 (K). **SW Sichuan**: Daliang-schan (territory Lolo), East of Nirgyuen, close Lauba, 2700 m, 25 iv 1914, *Handel-Mazzetti* 1658 (WU).

BHUTAN. Shimitang, Bumthang Co., 10500 ft, 23 v 1949, *Ludlow & Sheriff* 18940 (BM).

NEPAL. Dhimti Shir, 14000 ft, 1930, *Lall Dhwoj* 487 (BM); Lete: South of Tukucha, Kali Gandaki, 12500 ft, 7 vi 1954, *Stainton et al.* 1012 (BM); Bhurungdi Khola, 10000 ft, 15 vi 1954, *Stainton et al.* 5798 (BM); Rambrong, Lamjung Himal, 13500 ft, 5 vii 1954, *Stainton et al.* 6154 (BM); Inkhu Khola, 14000 ft, 17 vi 1964, *Bowes-Lyon* 2044 (BM); Dudh Kosi: Chaunrikharka, 13000 ft, 20 vi 1964, *Bowes-Lyon* 2087 (BM); Likhu Khola: East of Chaukharma, 12500 ft, *McCosh* 250 (BM).

INDIA. Sikkim: Hills to North and West Dzongri camp site, 4200 m, 23 vi 1983, *Starling et al.* 82 (E).

The remaining two species, *Anemone imbricata* Maxim. and *A. fuscopurpurea* H.Hara, described and discussed below, are rather isolated members of *Anemone* subgen. *Omalocarpus* but have sometimes been considered to belong to *Anemone* sect. *Himalayicae*. Until more information is available we prefer to exclude them from this section.

12. Anemone imbricata Maxim., Fl. Tangut. 8 (1889). – *Anemone obtusiloba* D.Don subsp. *imbricata* (Maxim.) Brühl, Ann. Bot. Gard. Calcutta 5: 78 (1896). – Type: China, S Tibet, Jangtze, 1884, *Przewalski* (E!, LE!).

Leaves 4–7; petioles basally vaginate, 3–5 × 0.1–0.2 cm, villous; blades appear pinnatifid but are in principle 3-sect, elliptic-ovate, 2–3 × 1.2–2 cm, villous; bases cordate; central segments on petiolules 5–10 mm long, 3-sect or 3-parted; lateral segments shortly petiolulate or subsessile, unequally 3-parted; segments and lobes imbricate. *Scapes* 3–5(–10), 5–12 cm long, villous; cymes 1–2-flowered. *Involucral bracts* with 3-parted or 3-lobed blades, 1–2 cm long, villous. *Pedicels* 1–3.5 cm long, villous. *Petaloids* 5–7(–9), obovate-oblong or obovate, with acute apices, purple or blackish-purple (rarely whitish), sometimes dimorphic, 8–13 × 4–8 cm, glabrous or sparsely puberulent only along central veins; basal veins 3, without anastomoses. *Stamens* 3–5 mm long; filaments linear, slightly dilated; anthers ellipsoid. *Carpels* broadly ovate, 2.5–3 mm long, glabrous. *Achenes* broadly elliptic, 4.5–6 × 3–4 mm, glabrous, compressed, with ribs 0.5–0.7 mm wide; styles basally bent, c.1 mm long.

Distribution and habitat. China (W Sichuan, SW Gansu, Qinghai, E Xinjang, Xizang). In bushes and on grassy slopes; 3200–5300 m.

Taxonomic remarks. Maximowicz (1889), who described *Anemone imbricata*, noted its pinnatifid basal leaf blades and long-vaginate dilated petioles, 3-lobed involucral bracts, solitary flowers with 5–9 violet 'sepals', dilated stamens, and compressed glabrous achenes with conic-cylindric styles. Among students of the *Anemone obtusiloba* complex only Brühl (1896) lumped *A. imbricata* with *A. obtusiloba*, whereas Ulbrich (1906), Lauener (1960) and Wang (1974, 1980, etc.) recognized *A.*

imbricata as a distinct species. Most authors regarded *Anemone imbricata* as a member of the *A. obtusiloba* complex but Starodubtsev (1991) made this species the type of a new section: *Anemonastrum* sect. *Imbricata*.

As a result of our comparative study of *Anemone imbricata* and examination of the *Przewalski* type material (in LE and E) we suggest that this taxon does not belong to sections *Himalayicae* (*Anemone obtusiloba* complex) or *Omalocarpus* but should be placed in a monotypic section *Imbricata* of *Anemone* subgen. *Omalocarpus*.

Selection of herbarium specimens. CHINA. **Yunnan**: Kunming, Dijing Pref., Degin Co., Bai Ma Shan, N of W Pass, 4530 m, vi 1993, *Alden et al.* 818 (E). **SW Sichuan**: Kulu Mts., Muli Territory, 15000 ft, *Rock* 23953 (BM), 23955 (BM); Djesi-La and Djesi-Longba, S of Tatsienlu, vi 1929, *Forrest* 12704 (K). **Qinghai**: Yushu Xian, between Yushu and Gyairong, 9 viii 1996, *T.N. Ho et al.* 2059 (GH). **Xinjang**: Kangting (Tanchienlu), Tapaoshan, 4700 m, 22 viii 1934, *Smith* 11512 (BM); Kuen-Lun, 24 vi 1894, *Robowski* 362 (LE). **Xizang**: Jangtze, 1884, *Przewalski* (E, LE); Russkoe Lake, 2 vi 1901, *Ladygin* 87 (LE); between Radja and Jupar, Wajo la, vi 1926, *Rock* 14146 (LE); Totuch Nira, 14300 ft, vii 1926, *Rock* 14371 (K); Alpine Region between Radja and Jupar Range, Wotila, 14500 ft, vi 1929, *Rock* 14231 (K); Nang La, 20 vi 1936, *Ludlow & Sheriff* 1840 (BM); N of Lhasa, 15000 ft, 24 vi 1942, *Ludlow & Sheriff* 8737 (BM); NW of Lhasa, Nyenchentang La, 10 vi 1943, *Ludlow & Sheriff* 9604 (BM).

13. Anemone fuscopurpurea H.Hara, J. Jap. Bot. 48: 353 (1973). – Type: E Nepal, Banduke pokhari Saju pokhari, 4200 m, 15 vi 1972, *Kanai et al.* 721252 (holo TI!; iso E!).

Leaves 5–7; petioles 5–10 cm long, sparsely puberulent; blades 3-sect, rounded-ovate, 2–3 × 2–4 cm, glabrous, ciliate; segments subsessile; central segments 3-lobed, oblong-rhombic; bases cuneate; margins incised-dentate; lateral segments similar to central ones, but smaller. *Scapes* 2–4, mainly ascending, 5–15 cm long, basally villous; cymes 2–5-flowered. *Involucral bracts* 3-lobed, bases cuneate, margins dentate, 2–3 cm long, sparsely puberulent. *Pedicels* 4–5 cm long, villous. *Petaloids* 4–5, purple, oblong, basally narrowed, apically rounded, 6–10 × 2–5 mm, puberulent; basal veins 3–5, vein anastomoses 1–3. *Stamens* 2–2.5 mm long; filaments slightly dilated; anthers oblong. *Carpels* ovate, glabrous, styles curved, c.1 mm long. Data on achenes lacking.

Distribution and habitat. East Nepal (Pokhari, Topke Gola); 3600–4400 m.

Taxonomic remarks. Anemone fuscopurpurea was described (Hara, 1973) from the flora of the Himalaya (East Nepal) on the basis of several herbarium specimens without achenes. Hara regarded this taxon as close to both *Anemone obtusiloba* (sect. *Himalayicae*) and *A. demissa* (sect. *Omalocarpus*). Tarasevich & Chaudhary (1987) examined its pollen grains and placed *Anemone fuscopurpurea* in a monotypic section *Fuscopurpurea.* Based on a morphological study of the herbarium material available in E we suggest its affinities are to section *Omalocarpus*. Until more SEM data become available on the microsculpture of pollen grains from other members of subgenus *Omalocarpus* and until the fruits of *Anemone fuscopurpurea* can be studied,

we prefer to exclude this species from section *Himalayicae* and maintain it in section *Omalocarpus* rather than describe a separate section.

Specimens examined. NEPAL. Arun-Tamur, Topke Gola, 13500 ft, 11 v 1956, *Stainton* 253 (E); Topke Gola, 14000 ft, 4 vii 1971, *Beer* 8280 (E!).

DISCUSSION: ORIGIN AND ECO-GEOGRAPHICAL RADIATION OF *ANEMONE* SECT. *HIMALAYICAE*

The close affinities between *Anemone* sect. *Himalayicae* and sect. *Omalocarpus*, both accommodated within *Anemone* subgen. *Omalocarpus*, are supported not only by the numerous apomorphic morphological characters they share (see earlier), but also by their karyotype and chromosome base number $x = 7$. This number can be derived by several structural changes from the basic karyotype of $x = 8$, plesiomorphic for *Anemoninae* (Baumberger, 1970). That members of *Anemone* sect. *Himalayicae* are characterized by this apomorphic $x = 7$ has been obscured by earlier, clearly erroneous counts of $2n = 16$ (e.g. Sobti & Singh, 1961). These have now been superseded by several more careful recent studies which have clearly shown $n = 7$ or $2n = 14$ for *Anemone obtusiloba* (Bhattarai, 1989; further references in Starodubtsev, 1989), *A. geum* (= *A. obtusiloba* subsp. *ovalifolia*; Yang & Wu, 1993; Huang *et al.*, 1996) and *A. trullifolia* (Sarkar *et al.*, 1978). Members of *Anemone* sect. *Omalocarpus* and sect. *Himalayicae* are apparently diploid throughout and no polyploidy has yet been recorded for this clade.

Furthermore, Hoot *et al.* (1994) have presented very well-supported evidence from chloroplast DNA restriction analyses for the close relationships of *Anemone narcissiflora* and *A. demissa* (*Anemone* sect. *Omalocarpus*), and of *A. obtusiloba* and *A. trullifolia* (*Anemone* sect. *Himalayicae*). Available cladograms suggest a narrow sister relationship of the two species groups within a clearly separated major clade corresponding to the present *Anemone* subgen. *Omalocarpus*. This, in turn, is affiliated to a major clade of the genus *Anemone* s.l., characterized by the chromosome base number $x = 7$. Thus, the former placement of *Anemone* sect. *Himalayicae* under the genus or section *Pulsatilloides* (with $x = 8$; far from *Omalocarpus*), maintained until quite recently (e.g. Starodubtsev, 1991), is now definitively refuted.

The affinities between members of *Anemone* sect. *Omalocarpus* and sect. *Himalayicae* are so close that their taxonomic separation still suffers from uncertainties. Fruit characters of *Anemone rupestris* (sole species of *Anemone* sect. *Himalayicae* ser. *Rupestres*) tend towards *Anemone* sect. *Omalocarpus*. Furthermore, the placement of two critical and also rather isolated species, *Anemone fuscopurpurea* H.Hara and *A. imbricata* Maxim., is still under dispute. They are put either into *Anemone* sect. *Omalocarpus* or into monotypic sections of their own (see earlier). This makes further studies on the alliance of *Anemone* subgen. *Omalocarpus* necessary.

Members of *Anemone* sect. *Himalayicae* differ from those of *Anemone* sect. *Omalocarpus* predominantly with respect to derived, apomorphic characters which often can be interpreted as adaptations to high-montane or alpine habitats. This supports the hypothesis that *Anemone* sect. *Himalayicae* originated, possibly during the late Tertiary, Pleistocene and Postglacial eras, as a response to the lifting of the Himalayan, Tibetan and SW Chinese mountain systems (see Rowley *et al.*, 2001, etc.), from *Anemone* sect. *Omalocarpus*-like ancestors growing at lower elevations.

What can be said about the further morphological and eco-geographical differentiation within *Anemone* sect. *Himalayicae*? On comparison of taxa from *Anemone* ser. *Rupestres* with ser. *Obtusilobae* and finally with ser. *Trullifoliae* with respect to vegetative features, we can demonstrate a decrease in leaf size, a reduction in leaf division, an increasing fusion of leaflets combined with loss of petiolules, and an increase in the density of the indumentum. Noteworthy among reproductive features are reductions from several-flowered cymes to solitary flowers, a decrease in anastomosing veins in petaloids, development of staminodes, dilatation of initially linear filaments, and changes in the hairiness of petaloids, pistils and fruits. Trends

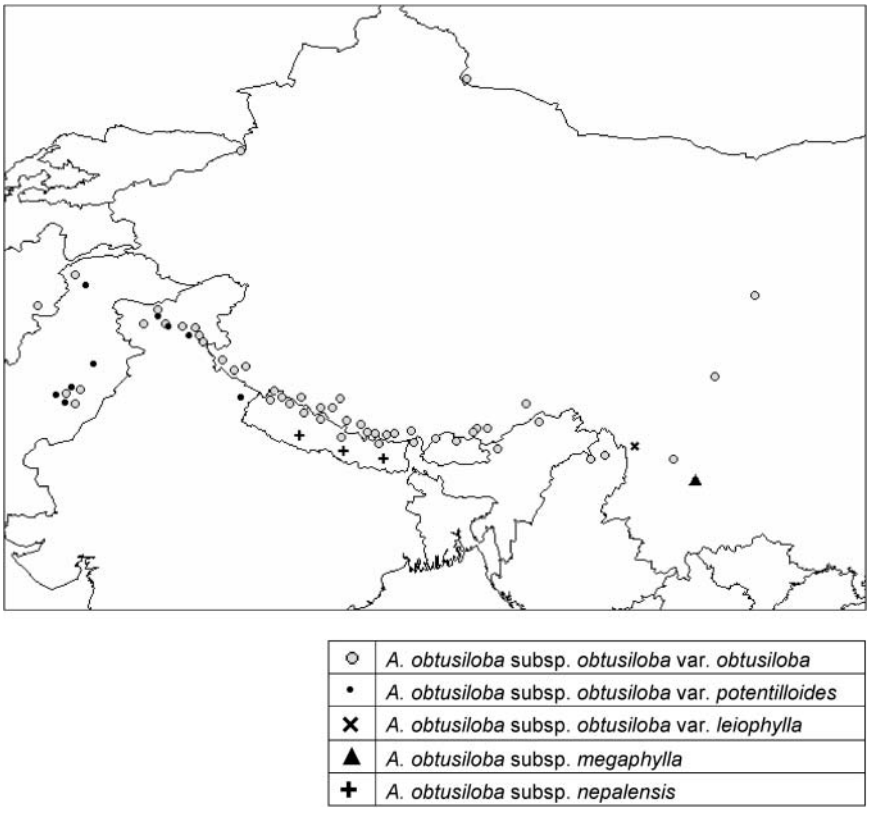

FIG. 18. Distribution of *Anemone obtusiloba*.

relevant for the achenes concern changes from ovoid to compressed, development of lateral ribs, and transformations of styles from straight to curved, bent or hooked. Within *Anemone* sect. *Himalayicae*, *Anemone obtusiloba* and *A. polycarpa* appear to have numerous plesiomorphic characters. Most other taxa, however, belong to an intermediate level, whereas *Anemone coelestina* and *A. subindivisa* apparently represent evolutionarily more advanced species.

The taxa of *Anemone* sect. *Himalayicae* are concentrated in the mountains of SW China and the Himalayan ranges of Burma, Bhutan, Nepal and North India. All of them are high-mountain plants occurring in the cool temperate montane to the subalpine and alpine belts at 1850–4800 m elevation (Figs 18–21). From *Anemone* ser. *Obtusilobae* the polymorphic *A. obtusiloba* has reached the widest distribution area within the section and now extends from SW China (with two endemic infraspecific taxa) to the Himalaya (with subsp. *nepalensis* in the central and var. *potentilloides* in the western part), Burma, Pakistan, Afghanistan, the mountains of North China, Kirgizstan and Mongolia (var. *obtusiloba* which also overlaps with other infraspecific taxa). It occurs from open forests at lower elevations to scrub at

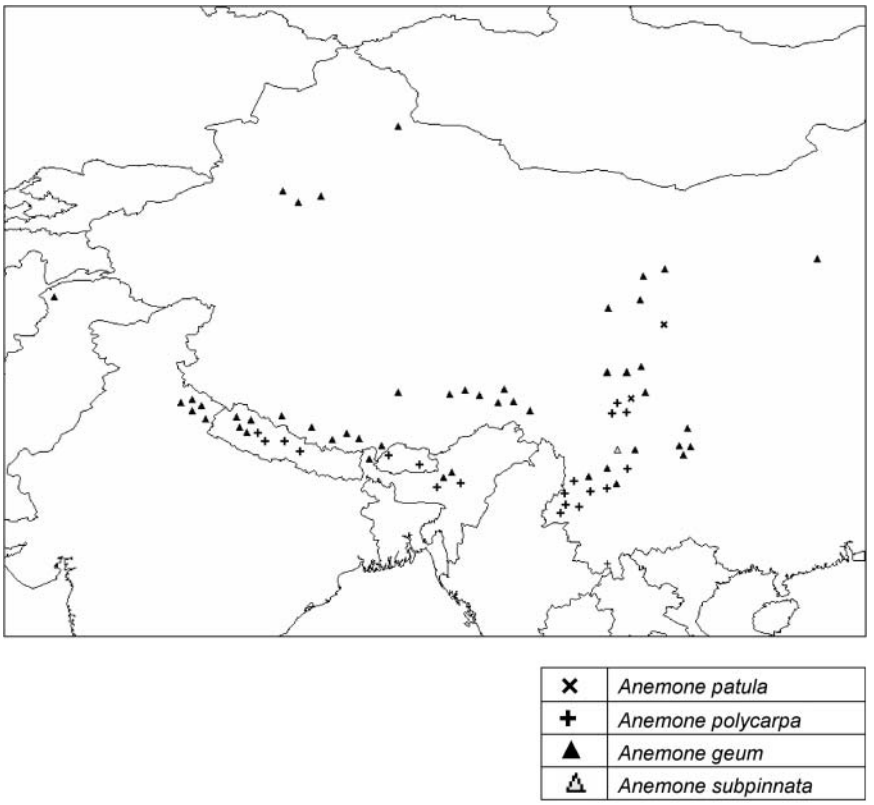

FIG. 19. Distribution of *Anemone patula*, *A. polycarpa*, *A. geum* and *A. subpinnata*.

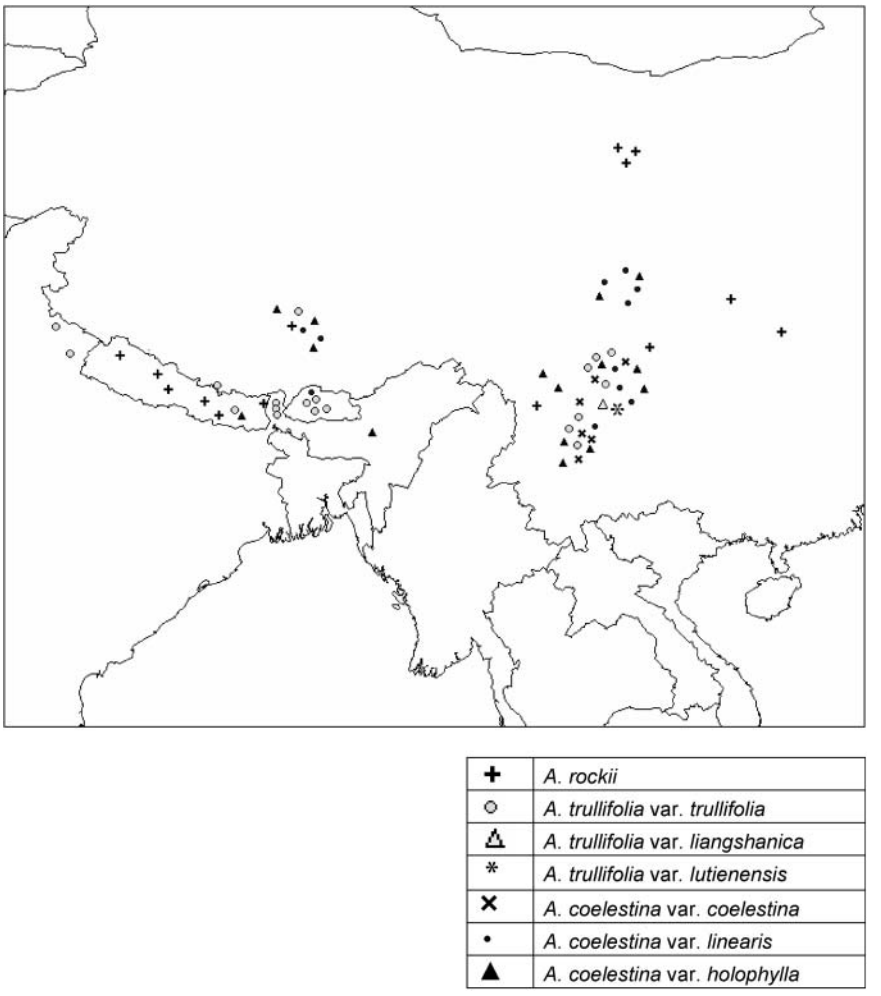

FIG. 20. Distribution of *Anemone rockii*, *A. trullifolia* and *A. coelestina*.

the timberline and to grassland, rocks and talus in alpine regions. Among the other members of *Anemone* ser. *Obtusilobae*, the species *A. geum* and *A. rockii* have also attained large areas of distribution and wide altitudinal ranges. The former reaches to the western Himalaya and from the mountains of SW China to the eastern Tienshan in Xinjang. *Anemone rockii* extends from Sichuan to the central Himalaya. In contrast, *Anemone polycarpa* is limited as an ultraoreophyte to altitudes above 3500 m and ranges through the Himalaya to SW China, whereas its close relatives *A. patula* and *A. subpinnata* occur as local endemics in the mountains of Sichuan.

The taxa of *Anemone* sect. *Himalayicae* ser. *Trullifoliae* and ser. *Rupestres* exhibit a similar eco-geographical pattern but are more restricted and disjunct in the central Himalaya and the mountains of SW China. Populations in both areas and with a wide altitudinal range characterize the *Anemone* ser. *Trullifoliae* taxa *A. trullifolia*

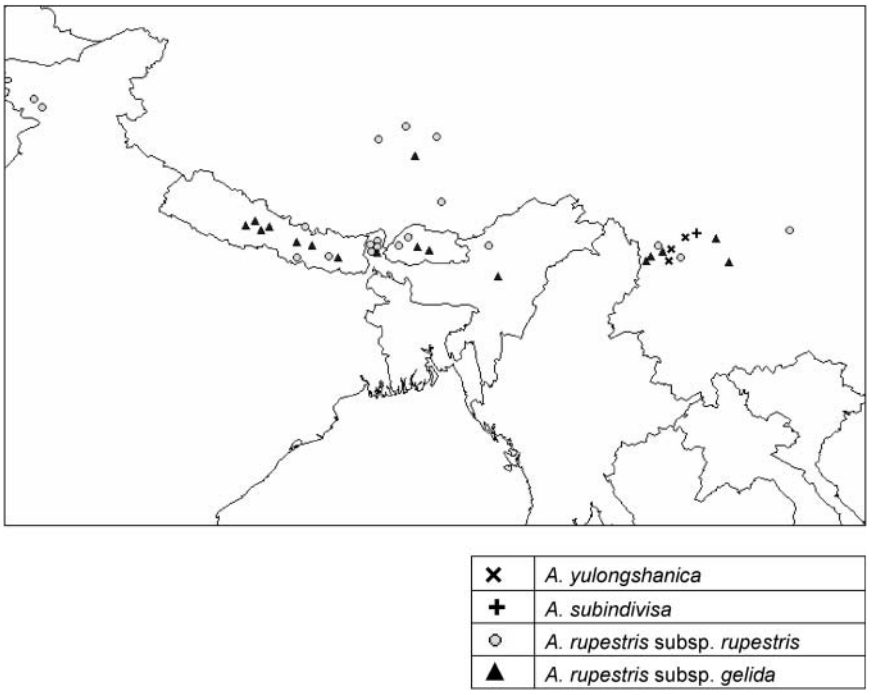

FIG. 21. Distribution of *Anemone yulongshanica*, *A. subindivisa* and *A. rupestris*.

var. *trullifolia* and *A. coelestina* var. *holophylla*, whereas *A. yulongshanica* and *A. subindivisa* are endemics in SW China. The other taxa of *Anemone* ser. *Trullifoliae* are restricted to high altitudes: *A. coelestina* var. *coelestina* and var. *linearis* occur in both areas, whereas *A. trullifolia* var. *liangshanica* and var. *lutienensis* have been found locally in SW China only. The infraspecific differentiation of *Anemone rupestris* in the monotypic series *Rupestres* is comparable: subsp. *rupestris* occurs at a relatively wide range of altitudes in the central and eastern Himalaya and adjacent Tibet, whereas subsp. *gelida* is an ultraoreophyte with populations in the Himalaya and the mountains of SW China.

In retrospect, one can conclude that the present eco-geographical distribution of taxa within *Anemone* sect. *Himalayicae* is due to an allopatric pattern of differentiation. This has apparently followed two parallel trends of expansion: (i) from the SW Chinese mountains and the eastern and central Himalaya to the western Himalaya, Afghanistan, the Tienshan and to mountain ranges in NW China and adjacent central Asia; (ii) from lower to higher and highest mountain regions. Comparable examples for an allopatric east/west differentiation along the Himalaya are afforded by the *Galium serpylloides* group (*Rubiaceae–Rubieae*: Schönbeck-Temesy & Ehrendorfer, 1987) and many other taxa. Within *Anemone* sect. *Himalayicae* the highest concentration of local endemic taxa (seven) is found in SW China, whereas only one other endemic is documented for the central Himalaya.

In most regions of the distribution area of the section more than one taxon has been found. Future field work should clarify if there is isolation between these taxa (due either to their occurrence in different habitats or to other mechanisms). If there is none, one has to consider varying degrees of hybridization. In view of the close affinities of most taxa, their great variability and often difficult separation, such a scenario appears quite likely.

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