A Taxonomic Revision of Anemone L. Subgenus Anemonanthea (DC.) Juz. sensu lato (Ranunculaceae) III

Svetlana ZIMAN, Carl S. KEENER, Yuichi KADOTA, Elena BULAKHA, Olga TSARENKO and Bryan E. DUTTON

aM. G. Kholodny Institute of Botany of the National Academy of Sciences, Tereshchenkivska str. 2, Kiev, 01601 UKRAINE;
b208 Mueller Laboratory, Pennsylvania State University, University Park, Pennsylvania, 16802 U. S. A.;
cDepartment of Botany, National Science Museum, Amakubo 4–1–1, Tsukuba, Ibaraki, 305-0005 JAPAN;
dDepartment of Biology, Western Oregon State University, Monmouth, Oregon, 97361 U. S. A.

(Received on July 11, 2003)

This is the last part of a taxonomic revision of Anemone subgenus Anemonanthea sensu lato. In Part III species nos. 23–32 are revised. Involucral leaves, flowers and achenes of the species accepted are illustrated here.


Key words: Anemone, morphology, subgenus Anemonanthea, taxonomy.


TYPE: “Chine Prov. Kansu, terr. Tangut.”, 1873, Przewalski (LE !).

Anemone takasagomontana Masam. in Not. Syst. 6: 37 (1937).


Rhizomes long-horizontal, stolon-like, 1–2 mm in diameter, and short oblique, 8–10 mm in diameter. Basal leaves 2–5; petioles basally vaginate, 5–10(–20) cm long, surrounded by fibrous remnants, puberulent; blades ternate, cordate-pentagonal, 2–3 × 2.5–4 cm, sparsely puberulent; petiolules 1–3 mm long; central leaflets 3-lobed, wide-rhombic; base cuneate; margin inciso-serrate; apex obtuse; lateral leaflets unequally 2-lobed, smaller. Scapes 5–15 (–25) cm long, sparsely puberulent above; cymes 1-flowered. Involucral leaves 3; petioles basally vaginate and connate, 1–1.5 cm × 3–5 mm; blades 3-parted to 3-lobed, smaller than in basal leaves, triangular-ovate to ovate, puberulent; petiolules 1–2 mm long. Pedicels 1–3 cm long, puberulent. Tepals 5(–6), elliptic-obovate, with narrow base and wide apex, white, pinkish or yellow, 4–8 × 3–5 mm, subglabrous or sparsely puberulent; basal veins 3–5, anastomosing veins absent. Stamens 3–4 mm long; filaments filiform; anthers ellipsoid, connectives narrow. Ovaries ovoid, with lateral ribs, 1.2–1.8 mm long, sparsely covered with hairs ca. 0.1 mm long or glabrous; styles apically uncinate, 0.5–0.7 mm long, stigmas linear (Fig. 2S). Achenes ovoid to ellipsoid, slightly compressed, with narrow ribs, 2.5–3 × 1.5 mm, sparsely puberulent (hairs ca. 0.1 mm long); styles uncinate, 0.5–0.7 mm long, glabrous; stigmas linear (Fig. 3O).
Chromosome number: unknown.

Distribution: China (S Gansu, E Qinghai, S Shanxi, W Sichuan, NW Yunnan); occurring in shady places, alt. 2000–3500 m.

Specimens examined: CHINA; Yunnan, Dshoni Valley, Tao-che, 31.5.1885, Potanin (LE); Lan Kien-ho, 31.3.1889, Delavay 43/2 (K); Lilijiang, Yulong-Shan, He Shui, Lou Shan, 3350 m, 31.5.1985, Kunming 004 (E); Kansu, Monasterium Runwyz-ge, Tao-Che, 1885, Potanin (LE, MHA); Sichuan, Heupin, pres Tchen-keou-tin, 3.6.1895, Farges 1341 (K, LE).

In describing A. exigua, Maximowicz (1876) noted in its 3-partite involucral leaves, small solitary flowers and sparsely puberulent small achenes. He thus regarded this taxon as close to A. stolonifera. As a result of our examination of the characteristics of the three foregoing species of sect. Rosulantes (including their types), we regard A. exigua as a high-mountain endemic species close to the A. stolonifera—A. davidii subgroup but which differs from them by its habit (all parts of plants are smaller); by the involucral leaf petioles 0.5–1 cm long; slightly reduced involucral leaf blades; solitary flowers having subglabrous tepals without vein anastomoses, and absence of staminodes.

The recently described A. exigua var. shanxiensis (B. L. Li and X. Y. Ya 1989) differs from A. exigua var. exigua by its yellow sepals and greater number of carpels. In our opinion, these distinctions however are within the limits of the variability of the species, and thus we are not recognizing var. shanxiensis in this treatment.

Masamune (1937) described A. takasagomontana from the flora of Taiwan, as a species close to A. exigua, but differing by its crenate leaf margins, shorter scapes (ca. 6 cm long), 1–3-flowered cymes, longer pedicels (4–6 mm long) and smaller sepals (ca. 5 mm long). These plants need more detailed study, and consequently at the present time their taxonomic state is debatable.


Rhizomes long horizontal stolon-like, 1–2 mm in diameter, and short ascending, 4–7 mm in diameter. Basal leaves 3–6; petioles 5–8(–15) cm long, basally vaginate, surrounded by fibrous remnants, subglabrous; blades ternate, rhombic, 2–4 × 3–4 cm, sparsely appressed-puberulent; petiolules 2–5(–7) mm long; central leaflets 3-lobed, rhombic or rhombic-ovate; base broadly cuneate; margin subacutely serrate or incised; apex acute; lateral leaflets unequally 2-parted or 2-lobed, oblique-flabellate. Scapes solitary, 5–15(–20) cm long, sparsely puberulent above; cymes 1–2-flowered. Involucral leaves 3; petioles 5–10(–25) × 1–2 mm; blades ternate, similar to those in basal leaves, but larger, 2–5 × 3–6 cm, sparsely puberulent; petiolules 1–3 mm long; central leaflets 3-lobed, lateral leaflets 2-lobed and smaller. Pedicels 2–5(–7) cm long, densely puberulent. Tepals 5(–6), obovate-elliptic, with wide base and apex, white, pinkish or mauve, 6–8(–10) × 4–6 mm, subglabrous or sparsely puberulent; basal veins 3–5, anastomosing veins absent (rarely solitary). Stamens 3–6 mm long; filaments filiform; anthers ellipsoid, connectives nar-
row. Ovaries ovoid, 1–2 mm long, compressed, with ribs 0.1–0.2 mm wide, subglabrous; styles 0.2–0.5 mm long; stigmas subglobose (Fig. 2T). Achene bodies ovoid, compressed, with ribs 0.1–0.2 mm wide, 3–4 × 2–3 mm, glabrous; styles slightly curved, ca. 0.5 mm long, glabrous; stigmas slightly dilated.

Chromosome number: unknown.

Distribution: China (Sichuan–Guan Xian, Nanchuan, S Xizang), India, Bhutan, Nepal, Sikkim; occurring in forests, by streams, alt. 1600–3000 m.

Specimens examined: INDIA; Assam: Delu Valley, 9000 ft., Tsuga forests, 29.6.1928, Kingdon-Ward 8389 (K). BHUTAN; Rudo La, Pimi, 9000 ft., 16.4.1949, Ludlow et al. 2012 (K); Batte Dzong, Ha Chu, 8500 ft., 19.4.1949, Ludlow et al. 16065 (K); Ha Chu, 10 mi below Ha Dzong, 9000 ft., 1.5.1949, Ludlow et al. 16127 (GH, K, E); E side of Dochu La, E of Thimphu, 2750 m, forests, Grierson & Long 1052 (K).

This species was described by Hooker f. and Thomson (1855) as a taxon close to *A. nemorosa* and *A. ranunculoides* on the basis of small plants with horizontal woody rootstocks, 3-partite leaves, 1–2-flowered scapes, and a white or pinkish perianth. Although Ulbrich (1905) regarded this taxon as only a variety of *A. caerulea*, in their treatment of a modern flora of India, Sharma et al. (1993) accepted it as a species and noted its horizontal rhizomes, 3-foliolate basal and involucral leaves, 4–5 subglabrous tepals, compressed glabrous ovaries and achenes.

*Anemone griffithii* is allied to *A. exigua* but differs from it by its narrower free involucral leaf petioles, glabrous ovaries and achenes. However, its most significant distinctions include the ternate (not 3-parted to 3-lobed ones as in *A. exigua*) involucral leaf blades and nearly sessile subglobose stigmas. With this type of stigmas, *A. griffithii* together with *A. davidii* form a link between sectt. Anemonanthea and Stolonifera.

Wang, in 1974, described *A. nanchuanensis* as a Chinese endemic (Sichuan, Nanchuan) very close to *A. griffithii* (differing by the short rhizomes, 3-sected involucral leaf blades and glabrous ovaries). These features are characteristic of *A. griffithii*, and later Wang (1980) did not include this species in the flora of China. In this treatment we also do not accept this taxon as a species but we believe it is only an aberrant form of *A. griffithii*.

25. *Anemone scabriuscula* W. T. Wang


Rhizomes vertical or slightly oblique, short, branched, 2–4 cm × 6–10 mm. Basal leaves 2–5; petioles 6–10 cm long, basally vinate, surrounded by fibrous remnants, sparsely puberulent or subglabrous; blades 3-sected, pentagonal or pentagonal-ovate, 3–7 × 3–8 cm, strigose, foveolate and roughish; bases cordate; petiolules 1–2 mm long; central segments 3-lobed, rhombic; base cordate; margin inciso-serrate; apex long-acuminate; lateral segments unequally 2-parted, oblique-flabellate. Scapes 4–6 cm long, puberulent above; cymes 1-flowered. Involutural leaf petioles 0.5–1 cm × 1–2 mm; blades 3-sected, similar to those in basal leaves, but smaller, 1.5–3.5 × 2–4 cm, sparsely puberulent; petiolules 1–2 mm long; central segments 3-parted to 3-lobed; lateral segments 2-parted. Pedicels ca. 2 cm long, densely substrigose. Tepals 5, obovate, with narrow base and rounded apex, white, 5–7 × 3–4 mm, densely puberulent; basal veins 3–5, vein anastomoses absent. Stamens 2–3 mm long; filaments filiform; anthers ellipsoid; apices minutely mucronate. Ovaries ovoid, ca. 2.5 mm long, glabrous; styles curved, ca. 1 mm long; stigmas linear. Achenes not observed.

Chromosome number: unknown.

Distribution: China (W Yunnan: Judian of Lijiang County); occurring in forests and
semi-shadow slopes, alt. 3000 m.

Wang (1974) described this taxon as very close to *A. davidii* but differing mainly by its smaller leaves, scapes and flowers. According to our data, *A. scabriuscula* differs from *A. davidii* by its lack of long rhizomes, its 1-flowered scapes, and much smaller tepals (5–7 mm long only) without vein anastomoses. Like *A. griffithii*, *A. scabriuscula* has narrow involucral leaf petals, glabrous ovaries and achenes (rare in sect. Anemonanthea), but it differs from the latter by smaller 3-sected involucral leaf blades. In our opinion, this taxon should receive additional study, including a careful comparison of its achenes.

Sect. III. **Tuberosa** (Ulbr.) Juz., Fl. URSS 7: 241 (1937).


*Anemone caerulea* Lam., Encycl. 318 (1779).

*Anemone pyrenaica* Pall. ex Pritz. in Linnaea 15: 640 (1841).


Rhizomes tuberous, cylindroid, branched, 15–20 × 7–12 mm. Basal leaves 1–2, developing before flowering; petioles 10–20 cm long, scarcely pubescent, with underground scale-like wide basal parts (“ears”) 5–8 × 8–10 mm; blades ternate, pentagonal, 3–4 × 3.5–4 cm, scarcely pubescent; petiolules 3–5 mm long; central leaflets 3-parted; base cuneate; margin shallowly inciso-dentate; apex acute; lateral leaflets similar to central ones, but 2-parted. Scapes 10–20(−30) cm long, 1-flowered, glabrous. Involutreral leaf petioles 15–30 × 1–2 mm; blades ternate to 3-sected, similar to those in basal leaves, 1.5–3.0 × 3–5 cm, densely pubescent; petiolules 2–5(−10) mm long (Fig. 1T). Pedicels 5–10 cm long, scarcely pubescent. Tepals 12–14(−18), oblong-elliptic, blue-violet, whitish or yellowish, dimorphic, in two circles: outer tepals with dark spots at base, 15–20 × 5–6 mm, scarcely pubescent along the central vein or basally; basal veins 5–7, vein anastomoses 1–3; inner tepals 12–14 × 3–4 mm, glabrous; basal veins 3–5, anastomosing veins absent. Stamens 4–6 mm long, filaments linear, basally slightly dilated, anthers oblong, connectives wide. Ovaries subovoid, puberulent, ca. 1 mm long; styles curved, ca. 1 mm long; stigmas linear (Fig. 2U). Achenes bodies elongate-ellipsoid, basally narrowed, 3–3.5 × 1.6–1.8 mm, sparsely puberulent (hairs ca. 0.1 mm long); slightly compressed, with narrow ribs; styles curved, pressed to achene bodies, 0.5–0.7 mm long, glabrous; stigmas linear (Fig. 3P).

Chromosome number: n = 8, 16 (Baumberger 1970).

Distribution; Europe: Italy, Bulgaria, Albania, Yugoslavia, Greece, Corsica and Sicily; occurring mainly in semi-shade, alt. 500–1500 m.

Specimens examined: **ITALY**: Neapoli, 10.3.1841, Heldreich (W); Castellamare, 1844, Leresche (KW); Florentia, 25.3.1861, Cesari (KW); Lucania, 15.4.1922, Orphanides (KRA); Roma Prov., Lazic, 6.4.1993, Iberite (LE). **GREECE**: Attica, Pentelico, 13.3.1850, Orphanides (KW). **JUGOSLAVIA**: Montenegro, 10.5.1934, Pievovich (KRA). **MACEDONIA**: Orlovo Brdo, prope Krilovak, 31.3.1965, Majer (KRAM). **CHERNOGORIA**: Pasmo Lovzanee, Cetini do Ivanovej Kority, 24.5.1973, Jasiewicz (KRAM).

*Anemone apennina* was described by Linnaeus (1753) as having tuberous rhizomes and a 10–12-leaved perianth. According to Pritzel (1841), *A. apennina* was characterized by its scarcely puberulent, ternate basal leaves, glabrous scapes and involucral leaves, and solitary flowers having 12–18 elongate tepals with obtuse apices. Grenieer and Gordon (1848) noted the
Fig. 2. Continued.  
N. *A. nikoinensis*—Japan, Kochi Pref., Takaoka-gun, Niyodo-mura, Mt. Torigata, 22.5.1889, Makino 33961 (LE). 
O. *A. reflexa*—Mongolia, Noin-Ula, 1925, Glagolev (LE). 
Scale indicates 1 mm.
petiolate involucral leaves resembling the basal ones and the basally pubescent blue tepals.

Candolle (1824) regarded this taxon as consisting of two varieties: var. *ranunculus nemorosus* (with shortly petiolulate leaf segments and white flowers) and var. *parvula* (with sessile leaf segments, smaller flowers).

According to our data, the most essential characters of *A. apennina* are cylindroid

horizontal rhizomes, 3-sected basal and involucral leaves, a dimorphic perianth, basally dilated filaments, ovaries and achenes without lateral ribs, and we have no reason to accept its infrageneric taxa.


**TYPE:** TURKEY: “In monte Tauro. Aestate 1836”, Kotschy (isotype designated by Demiriz in 1967–K !).


Rhizomes tuberous, cylindroid, branched, 15–30 x 5–10 mm. Basal leaves 1–2, developing before flowering; petioles 8–15 cm long, scarcely pubescent or glabrous, with underground scale-like wide basal parts ("ears") 5–8 x 8–10 mm; blades 3-sected, pentagonal, 3–4 x 3.5–4 cm, scarcely pubescent; petiolules absent or 1–2 mm long; central leaflets 3-parted; base cuneate; margin shallowly inciso-dentate; apex obtuse; lateral leaflets similar to central ones, but 2-parted. Scapes 10–25 cm long, 1-flowered, glabrous. Involutral leaf petioles 15–25 x 1–2 mm; blades 3-sected, similar to those in basal leaves, 1.5–3.0 x 3–5 cm, densely pubescent; petiolules 1–3 mm long Pedicels 5–10 cm long, scarcely pubescent. Tepals 9–15, linear-oblong, blue, whitish or pink, glabrous, dimorphic, in two circles: outer tepals 10–25 x 2–5 mm; basal veins 3–5, anastomosing veins 5–9; inner tepals 8–15 x 2–3 mm; basal veins 3–4, vein anastomoses 1–4. Stamens 2.5–5.5 mm long, filaments filiform, anthers ellipsoid, connectives wide. Ovaries ovoid, slightly compressed, puberulent at the base, ca. 1 mm long; styles oblique, 0.1–0.2 mm long; stigmas dilated (Fig. 2V). Achenes bodies ellipsoid, 2–2.2 x 1.2–1.3 mm, compressed, with narrow lateral ribs, sparsely puberulent at the base (hairs ca. 0.1 mm long); styles slightly curved, 0.1–0.2 mm long, glabrous; stigmas slightly dilated (Fig. 3R).

Chromosome number: n = 8, 16 (Baumberger 1970).

Distribution: Caucasus (Russia, Georgia), Balkans (Greece, Jugoslavia, Albania, Bulgaria), Asia Minor (Turkey, Syria); occurring in semi-shaded-localities in forests, shrubs, and in open mountain slopes, alt. 900–1500 m.


GREECE; Attica, Pentelico, 3.4.1891, Halacya (WU); Cephalonia, Ainos, 19.5.1951, Bolos & al. (BCC); Rodhos Isl., Mt. Profet Elias, 24.3.1965, Davis 40348 (K).

CYPRUS; Buffabento, 7.3.1938, Loch (K); Madhari, Sarendi, 1.3.1971, Gnichard (K); Adelphi, Yironos Range, 2.4.1974, Meible (K).

TURKEY; Prov. Balikesir, Bigadic, 21.3.1956, Davis & Polunin 25138 (K); Antalya, Avlan, S of Golu, 29.4.1959, Hennipman 789 (K); Prov. Pontus, Distr. Trabzon, Zigana Pass summit, Pontic Alps, 17.5.1960, Furse (K); Kayseri, Pinarbasi to Gurun, Ziyaret Tepesi, 23.5.1965, Code 1347 (K); Vil. Gumushane, 23.5.1975, Jasiewicz (KRAM); Fundort, 30.3.1985, Rechinger (WU).

SYRIA; Damascus, 4.6.1885, Kotschy (KW).

LEBANON; Jabal el Knaisse, 8.4.1959, Polunin 5225 (K); Col of Dahr el Baidar, E of Beirut, 9.3.1966, Archibald 1095 (K).

Ulbrich (1906) regarded A. apennina and A. bella as "species collectiva". According to Hayek (1927), A. bella is a subspecies of A. apennina but differing from subsp. apennina mainly by its glabrous leaves and perianth. Juzepchuk (1937) noted in A. bella the large variability of leaf and stem hairiness, and tepal number and size. According to Davis et al. (1965), A. bella is distributed mainly in Asia Minor (Turkey) and the Caucasus, but also in the Balkans, where this A. bella shows an overlapping of morphological characters with A. apennina which occurs predominantly in Europe.

Chater (1973) considered that the area of A. bella is limited in the central part of the Mediterranean, and he emphasized the strong similarity between A. apennina and A. bella, as well as the variability of their essential morphological characters. Therefore, Chater regarded their distinction at the species level as artificial.

According to our data, plants of A. bella differ from plants of A. apennina by their shorter basal leaf petiololes (1–2 mm) and blades, shape of involucral leaf blades (3-sected, with acute or obtuse ultimate lobules), tepal size and shape (smaller, linear-
oblong, with more vein anastomoses), and hairiness (glabrous in A. blanda), filament base shape (filiform), carpel shape and hairiness (with lateral ribs and pubescent only at the base), and smaller achenes. As a result of our study, we regard A. blanda as a distinct species.


**Anemone apennina** L. var. **parvula** DC., Prodr. 1: 19 (1824).

**Anemone blanda** Boiss. var. **parvula** (DC.) Boiss., Fl. Orient. 1: 13 (1867).


Rhizomes semiglobose, branched, 8–12 × 5–8 mm. Basal leaves 1–2, developing before flowering; petioles 5–8(–10) cm long, glabrous, with basal underground scale-like glabrous “ears” 5–8 × 4–5 mm; blades ternate, 1.5–2.0 × 2–3(–4) cm, glabrous; petiolules 1–2 mm long; central leaflets 3-parted; base cuneate; margin shallowly serrate-dentate; apex obtuse; lateral leaflets similar to basal ones, but bipartite. Scapes 1–3(–5), 10–15(–20) cm long, glabrous; cymes 1-flowered. Involucral leaf petioles 5–15 mm long; blades ternate, subglabrous, 1.5–2 × 2–2.5 cm, petiolules 1–2 mm long; central leaflets wide-lanceolate, with entire lobules or few teeth; lateral leaflets bipartite (Fig. 1V). Pedicels 2–3 (up to 5) cm long, densely pubescent. Tepals 8–10, linear-lanceolate, with wide base and apex, blue or whitish, dimorphic, glabrous: outer ones 8–12 × 3–4 mm, basal veins 5–7, vein anastomoses 1–3; inner ones 7–8 × 2 mm, basal veins 3, anastomosing veins absent. Stamens 2–4 mm long; filaments filiform; anthers ellipsoid, connectives wide. Ovaries ovoid, 0.5–0.8 mm long, basally covered with hairs 0.1 mm long; styles slightly curved, 0.2–0.3 mm long; stigmas subcapitate (Fig. 2V). Achenes bodies elongate-ellipsoid, slightly asymmetric and slightly compressed, with ribs ca. 0.5 mm wide, 2–2.2 × 1–1.2 mm, sparsely puberulent (hairs ca. 0.1 mm long); styles slightly curved, 0.2 mm long, glabrous; stigmas slightly dilated (Fig. 3S).

**Chromosome number**: unknown.

**Distribution**: Caucasus: Armenia, Georgia, Russia, Turkey, N Iran; occurring in shrubs and meadows, alt. 700–2300 m.


According to Juzepchuk (1937), A. caucasica differs from A. blanda in its smaller rhizomes, shorter petioles of the involucral leaves, smaller sepal number and size, and short-curved achene styles. Nevertheless, Juzepchuk regarded A. caucasica as the geographical variant of the W. European A. apennina. According to Davis et al. (1965), both A. blanda and A. caucasica occur in Turkey, with the latter differing from the former mainly in its glabrescent involucral leaves; 8–11 blue or white sepalas, these usually 7–13 mm long, and smaller and more delicate stems.

**Anemone caucasica** differs from both A. apennina and A. blanda mainly in the shape of the rhizomes (subspherical and cylindroid); shorter basal and involucral leaf petioles; shape of ultimate leaf lobules (obtuse and acute); smaller flower and achene size, but ribs in A. caucasica, achenes wider, and subcapitate stigmas.


**Sect. 4. Stolonifera** (Ulbr. ex Juz.) Juz., Fl. URSS 7: 241 (1937).


torr. Chara-Murin et Wydrenka, 1835", Turczaninov, Herb. Hooker (holotype-K !):
"Ad ripam inendivadesu Baicali, 1836", Turczaninov (paratype-LE !).

Rhizomes short ascending, branched, 4–6 mm in diameter, but sometimes long-
horizontal, stolon-like branches ca. 1 mm in diameter (often not found). Basal leaves 2–3
with distinct blades (scale-like leaves absent), developing before flowering; petioles
basally vaginate (their remnants sometimes seem to be scale-like leaves), 10–15(–20) cm
long, pubescent or subglabrous; blades 3-
sected, reniform-pentagonal, 3–5 × 4–7(–10)
cm, puberulent; bases cordate; margins
lobulate-dentate, apices obtuse; segments
subsessile; central segments 3-lobed or
toothed in upper part, broadly rhombic; lat-
eral segments 2-parted, oblique-flabellate.
Scapes solitary, (5–)10–25(–30) cm long,
puberulent or subglabrous; cymes 1(–2)-flow-
ered. Involucral leaves 3, sessile; blades 2–
3-parted or 3-lobed in upper part, rhombic or
lanceolate, unequal, 1–3 × 2–4 cm (Fig.
1W). Pedicels 3–8(–10) cm long, pubescent.
Tepals 5(6–7), obovate, with rounded bases
and apices, white, 10–15 × 6–7 mm, sparsely
pubescent or subglabrous; basal veins 3–5,
anastomosing vens 3–5. Stamens 4–7 mm
long; filaments filiform; anthers oblong-
ellipsoid; connectives narrow. Ovaries ovoid,
basally rounded, 1.5–2.5 mm long, sparsely
covered with hairs ca. 0.1 mm long; styles
0.2–0.5 mm long; stigmas subglobose (Fig.
2Y). Achene bodies basally narrowed, ob-
long-ovoid, slightly compressed, with nar-
row ribs, 4–5 × 2–2.5 mm, sparsely puberu-
 lent (hairs ca. 0.1 mm long); styles hooked,
ca. 0.5 mm long, basally puberulent; stigmas
slightly dilated (Fig. 3S).

Chromosome number: n = 8 (Baumberger
1970).

Distribution: RUSSIA (Siberia), China (S
Gansu, NW Sichuan, Yunnan, E Heilong-
jiang, Jilin, Liaoning, S Shanxi), N Korea,
Mongolia; occurring in forests and bushes or
grassy slopes, alt. 500–3100 m.

Specimens examined: RUSSIA; Primorje, Amur
river, near the village of Daiso, Maximowicz (LE);
Vladivostok Reg., 1910, Vojnovska-Kriger (MHA);
Khasan Distr., Furugelma Isl., 5.1975, Zdorovjeva
(MHA); Kavalerskii Distr., Povorot, 22.5.1980,
Starodubtsev (MHA); close Vladivostok, Sedanka,
7.6.1981, Starodubtsev (VLA); Amurski Reg.:
Arkharinski Distr., Mutnaja, 4.7.1981, Nedoluzhko
& Starodubtsev (MHA). CHINA: Kansu, Wutu, 2500 m,
19.6.1930, C. S. Hao 432 (PE); Sichuan: Tghen-keou-
Tin, Farges 386 (LE); Paohsing, 1954, T. P. Soong
38347 (K); Pu-hsi-Kou, 2300 m, 2.5.1959, AS 245
(K); Manchuria: Matsiokhe, 11.5.1905, Sizov (LE).
KOREA; Prov.Chamgim: Distr. Musany, 22.5.1897,
Komarov (LE).

The distinct features of the carpels and
achenes (minute styles but thickened
subsessile stigmas) are the basis for inclusion
of A. baicalensis and its allied taxa in sect.
Stolonifera or the genus Arsenjevia. In addi-
tion, its rhizomes are mainly short and stout,
and the long thin rhizomes are stolon-like,
but because of their short duration they are
not always observed (cf. sect. Stolonifera).
However, on the basis of the morphological
features of above-ground shoots and their
seasonal rhythms, A. baicalensis is closer to
plants of subsect. Rosulantes (not the A.
flaccida-subgroup), on the basis of its sev-
eral basally vaginate basal leaves which de-
velop before flowering and are surrounded
by fibrous remnants.

Anemone baicalensis differs from A.
flaccida in the absence of bracteoles and
fewer flowers and sepal veins anastomosing.
Anemone baicalensis is a variable taxon,
leading to the description of several nar-
rowly-defined species: Wang (1974) de-
scribed A. kansuensis as a Chinese endemic
(Kansu) which was distinguished from A.
ulbrichiana by its hairiness (appressed) and
stigma shape (elliptic-turbinate). Another
narrow Chinese endemic, A. saniculiformis
C. Y. Wu, was distinguished by its 3-lobed
basal leaf central segments and bilobate lat-
eral ones.

We accept A. baicalensis including four
varieties, viz., varis. baicalensis, glabrata, kansuensis and saniculiformis, but we regard most of the previousely described allied taxa (viz., A. litoralis, A. ulbrichiana) as synonyms of A. baicalensis because their defining the characteristics are within the limits of the variability of A. baicalensis.

Key to the varieties of Anemone baicalensis
1a. Basal leaf petioles and scapes pubescent or puberulent .................................. 2
1b. Basal leaf petioles and scapes glabrous; ovaries glabrous ................. 29b. var. glabrata
2a. Basal leaf petioles and scapes spreading-puberulent ........... 29a. var. baicalensis
2b. Basal leaf petioles and scapes appressed-puberulent ......................
3a. Tepals 7–8 mm long; stigmas elliptic-turbinate .................. 29c. var. kansuensis
3b. Tepals 10–20 mm long; stigmas globose .................................. 29d. var. saniculiformis

29a. var. baicalensis


Anemone glabrata (Maxim.) Juz., Fl. URSS 7: 197 (1937).


Anemone baicalensis var. litoralis Litw. in sched., ad Herb. Fl. Ross. 6: 117 (1908).

Anemone littoralis (Litw.) Juz., l. c. (1937). TYPE: Vicinity of Vladivostok (lectotype–LE !).


Anemone nemorosa Finet in J. Bot. 21 (1908).


Rhizomes oblique, short, 5–7 mm in diameter, with long slender terrestrial stolons, ca. 1 mm in diameter. Basal leaves 2–3; peti-
oles 5–15 cm long, glabrous; blades 3-sected, cordate-pentagonal, 3–3.5 x 5–5.5 cm, adaxially sparsely puberulent, abaxially subglabrous; base cordate; segments subsessile; central segment 3-lobed, rhombic, base cuneate; secondary lobes subpinnately divided, ultimate lobules broadly lanceolate, narrowly ovate or ovate; lateral segments 2-parted, oblique-flabellate. Scapes 10–30 cm long, sparsely puberulent above; cymes 1(–2)-flowered. Involucral leaves 3, sessile, blades 3-lobed, unequally rhombic, puberulent. Pedicels 3.5–8 cm long, puberulent. Tepals 5, elliptic-ovoblate, with rounded bases and apices, white, 8–10 x 4–7 mm, sparsely puberulent, veins 3–5, anastomosing vein absent. Stamens 4–5 mm long, filaments filiform; anthers ellipsoid, connectives narrow. Ovaries ovoid, 2–3 mm long, densely covered with hairs ca. 1 mm long; styles straight, less than 1 mm long; stigmas subglobose. Achene lacking.

Distribution: China (W Sichuan, N Yunnan (Cikai, Qiaojia), in shady places under forests in valleys, alt. 1700–2400 m.

This species is rather close to A. baicalensis and differs from it mainly by having terrestrial (not underground) stolons, and solitary flowers with smaller sepals lacking anastomosing vein.


TYPE: Russia. “Due and the village of Mgachi in Sakhalin, Augustinowicz” (holotype-LE !, isotype-K !).

Rhizomes oblique, short, 5–10(–15) mm in diameter, branched, sometimes also with long-horizontal stolon-like branches, 1–1.5 mm in diameter. Basal leaves 3–4, scale-like (5–8 x 5–8 mm), and several leaves, with distinct blades, developing after flowering; solitary leaves develop on rhizomes apart from the reproductive shoots (having basally vaginate petioles) and 2–3 leaves at the bases of the reproductive shoots (with basally slightly dilated petioles), 10–25(–30) cm long, scarcely puberulent or subglabrous; blades 3-sected, reniform-pentagonal, 3.5–8 x 6–10(–14) cm, adaxially sparsely puberulent; bases cordate; margins denticulate; apices obtuse or acute; segments shortly petiolulate (1–2 mm long) or sessile; central segments 3-lobed, rhombic, ultimate lobules triangular or broadly lanceolate; lateral segments 2-parted, oblique-flabellate. Scapes 1–3, 15–25(–40) cm long, sparsely puberulent or subglabrous; cymes 2–3(–5)-flowered. Involucral leaves 3(–5), subsessile; blades deeply to medi ally 3-lobed, unequal, 3–6 x 5–8 cm, sparsely puberulent; lobes mainly rhombic, shallowly incised, cuneate, obtuse (Fig. 1X). Bracteoles 1–2, 6–15 x 3–7 mm, lanceolate, entire or 3-lobed. Pedicels 4–7 cm long, sparsely puberulent. Tepals 5(–6), obovate-elliptic, with rounded bases and apices, white, pink or yellowish, persistent, 6–10(–20) x 3–5(–10) mm, glabrescent or sparsely appressed-puberulent; basal veins 5–9, anastomosing veins 7–9. Stamens 3–5 mm long; filaments filiform; anthers ellipsoid or oblong, connectives narrow. Ovaries ovoid, basally narrowed, ca. 2 mm long, densely covered with hairs 0.2–0.3 mm long; styles hardly recognizable (0.1–0.2 mm long); stigmas capitate (Fig. 2Y). Achene bodies ovoid, 3–4 x 1.5–2.5 mm, sparsely puberulent (hairs ca. 0.1 mm long) or glabrate; styles straight, ca. 0.5 mm long, glabrous; stigmas subcapitate (Fig. 3T).

Chromosome number: n = 7 (Kurita 1956, Nishikawa 1985).

Distribution: Russia (Far East–Primorje, Sakhalin), Japan (Hokkaido, Honshu, Shikoku, Kyushu), China (S Anhui, Guizhou, Hubei, Hunan, S Jiangsu, Jiangxi, Sichuan, NW Yunnan, NW Zhejiang); occurring in forests and shady grassy places, alt. 400–3000 m.
Specimens examined: RUSSIA; Primorje Reg., close Vladivostok, Sedanka, 18.5.1980, Starodubtsev (VLA); Sakhalin, Novoaleksandrovsk, 20.5.1977, Chernjajeva (MHA); Pilovaja, 20.6.1980, Starodubtsev 6516 (VLA); Juzhno-Sakhalinsk, 11.6.1980, Starodubtsev 6501 (VLA); Kuriles Chemjaeva (MHA); Pilov c1 9.6.1963, Egorova 1028 (MHA). CHINA; Yunnan, Les bois a Tang Yong Tchang (Lang Kong), 5.1887, Delavay (LE); Chien-chuan-Mekong dubytev 6501 (VLA); Kuriles. 15.8.1958, Li Hung-Jun 6122 (K); Anhui, Jinzhai, Bai Ma Zhai, Xi Da Wa, 1300 m, 14.5.1984, K.Yao 8915 (K). JAPAN; Hokkaido, Kanayama, Minemi-furano-cho, Sorachi-gun, 27.5.1987, Tsugaru & Ivinoru 7768 (MHA); Honshu, Miyagi Pref., Tomiya-machi, Numata, 1985, Akinari (NY); Natori-shi, Osawa, 13.5.1984, Tateishi & al. 10139 (K); Tsugaru 3385 (K); Tateishi 8005 (MHA); Ishikawa Pref. 5.5.1959, Tanaka (K); Nagano Pref., Mt. Yakuishi, Kitaazami-gun, 31.5.1977, Tsugaru 3385 (MHA); Shiga Pref., Mt. Ibuki, 1000 m, 19.5.1963, Murata & Koyama (LE); Ishikawa Pref., near Maruyama-hatsudensho, Komatsu-shi, 28.4.1985, Tsugaru & Takeuchi 7851 (MHA); Kyoto Pref., Ashimidi, Keihoku-cho, Kita-Kyoto-gun, 25.4.1987, Tsugaru & Takahashi 8005 (MHA); Shikoku, Kochi Pref., Ootoyo-mura, Nagaoka-gun, 5.5.1893, Makino 33955 (LE);

Anemone flaccida shares carpel and rhizome features (subsessile thickened stigmas and short perennial and long stolon-like rhizomes) with A. baicalensis and other taxa of sect. Stolonifera. However, it shares morphological aspects of the above-ground shoots (basal leaves with distinct blades which develop after flowering, although the large scale-like leaves are persistent) with the taxa of sect. Anemonantha. This species is rather variable and it includes several varieties (most of them were described initially as new species).

Key to the varieties of Anemone flaccida
1a. Rhizomes both long and short; tepals white to pink; ovaries with narrow bases; stigma globose ........................................2
1b. Rhizomes short only; tepals white to red-dish-purple; ovaries with rounded bases; stigma turbinate or broadly ovoid.......3

2a. Basal leaf petioles and scapes glabrous to subglabrous; cymes 2–3-flowered; involucral leaf blades mainly 4–6 cm long; tepals 7–10 mm long.......................31a. var. flaccida
2b. Basal leaf petioles and scapes hirsute; cymes 4–5-flowered; involucral leaf blades ca. 3 cm long; tepals 5–6 mm long .......................31b. var. hirtella
3a. Tepals 5, white, 10–15 mm long; anthers mucronate at apex; stigma mainly turbinate...31c. var. anhuensis
3b. Tepals 4–8, reddish-purple, 6–10 mm long; anthers apiculate at apex; stigma broadly ovoid........31d. var. anhuensis

31a. var. flaccida


CHINA: Wubu, Anhui, Qingyang Xian, Jiuhuashan, Tiantai, 1000 m, 16.04.1987, W. G. Ge 87103 (holotype-PE).

Plants of var. flaccida are distributed throughout the area of species; var. hirtella occurs in SW Hubei (Lichuan), in valleys by streams, alt. 1000 m; var. hofengensis occurs in SW Hubei, NW Hunan and E Sichuan in valleys by streams, alt. 1200–1800 m; and var. anhuensis occurs in S Anhui (Mt. Jiuhuashan), in Pinus forests, in mountain valleys, alt. 1000 m.


Rhizomes short, stout, branched, 4–7 mm in diameter, also with long horizontal stolon-like branches, ca. 1 mm in diameter. Basal leaves 2–3, scale-like (3–4 mm long), and solitary, with distinct blades, developing after flowering; petiole 3–10 cm long, puberulent above; blade 3-sected, pentagonal, 2–4 × 2–5 cm, sparsely puberulent; base cordate; margins dentate; apex acute or acuminate; petiolules 1–2 mm long; central segments rhombic-ovate or rhombic; lateral segment smaller, unequally 2-lobed. Scapes 5–10(–20) cm long, puberulent above; cymes 1(–2)-flowered. Involucral leaves 3; sessile; blades 3-parted or 3-lobed, rhombic-ovate or elliptic, 1–3 × 2–5 cm; base cuneate; margins denticulate or entire, apex obtuse; sparsely puberulent. Pedicels 2–6 cm long, puberulent. Tepals 5, elliptic-ovate, with narrow bases and rounded to acuminate apices, white and reddish tinged or blue, 7–15 × 5–7 mm, sparsely puberulent; basal veins 3–5, anastomosing veins absent (rarely solitary). Stamens 4–7 mm long; filaments filiform; anthers narrow-ellipsoid; connectives narrow. Ovaries ovoid, 1.5–2 mm long, densely covered with hairs 0.2–0.3 mm long; styles 0.2–0.4 mm long; stigmas turbinate (Fig. 2Z). Achene bodies ovoid, 3–4 × 2 mm, densely puberulent (hairs ca. 0.5 mm long), styles ca. 0.5 mm long; stigmas thickened.

Distribution: China (SW Sichuan, NW Yunnan); in forests and moist places near forest margins, alt. 2400–3000 m.

Specimens examined: CHINA: Yunnan: 2200 m, 18.5.1881, Delavay 1504 (LE); supra Tapinze, 2200 m, 17.5.1885, 1909, Delavay (LE); bois de Kou-toui, an nord de Yang-in-chan (Lan-Kong), 16.4.1887, Delavay (P); Che tcho Tu, 2000 m, 1.6.1887, Delavay (P); Che tcho Tu, 2000 m, 2.6.1887, Delavay (P); Mts. S of Churiho, near Honchin and Chiuho, S of Likiang, 28.5.1922, Rock 4084 (P); E slope Tsanj-Shanj Range, close Mt. Dali, 3000 m, 30.5.1955, An. Fedorov, Linchewski & Kirpichnikov 1478 (LE).

Anemone delavayi was recognized as a member of the Stolonifera-group (Ulbrich 1906, Wang 1974, Tamura 1995), and Wang (1974) regarded it as a taxon close to A. baicalensis.

After examining ample herbarium material, we came to the conclusion that this species is closer to A. flaccida because of the development of basal leaves with distinct blades after flowering and having several scale-like persistent leaves. It differs from A. flaccida in having solitary basal leaves with blades, solitary scapes and 1-flowered cymes, and larger tepals lacking anastomosing veins.

Pei (1933) regarded that A. oligocarpa differed from A. delavayi by its smaller flowers (tepals 5–6 × 3 mm), and sessile turbinate stigmas. These distinctions correspond at the varietal level only, and following Wang et al. (2001), we are accepting two varieties of A. delavayi, viz., var. delavayi and var. oligocarpa which differ in tepal size and stigma shape. The former variety occurs in NW Yunnan and the latter one in SW Sichuan.

32b. var. oligocarpa (C. J. Pei) Ziman &

TYPE: CHINA: Sichuan “SW of Tachienlu, S of Chiu-lung, 3000 m, in shaded ravines, fl. May 23.1939” W. C. Cheng 988 (holotype–P !).

Sect. 5.  

Ser. 10.  
Keiskea  

TYPE: unknown.  

Rhizomes long horizontal, branched, 5–10 × 3–5 mm, and stolons ca. 1 mm in diameter. Basal leaves 1–3; petioles basally vaginate, 10–30 cm × 2–3 mm, subglabrous; blades 3-sected, rhombic-pentagonal, 3–8 × 3–7 cm, sparsely puberulent; leaflets sub-sessile; central leaflets narrow-rhombic; bases broadly cuneate; margins dentate; apices acute to acuminated; lateral leaflets similar to central ones. Scapes 10–20 cm long, subglabrous; cymes 1-flowered. Involucral leaves sessile, basally slightly connate; blades 3-lobed to shallowly incised, ovate-oblong, 2–5 × 1–3 cm; bases broadly cuneate; margins incised-dentate to toothed; apices acuminate; subglabrous (Fig. 1Y). Pedicels 2–6 cm long, sparsely puberulent. Tepals 10–22, linear-lanceolate, white or reddish, 12–20 × 3–5 mm, basally sparsely puberulent; basal veins 3, vein anastomoses absent (sometimes solitary). Stamens 3–7 mm long; filaments basally slightly dilated and compressed; anthers ellipsoid, connectives wide. Ovaries on stalks ca. 1 mm long, ovoid, 2–3 mm long, slightly compressed, sparsely covered with hairs 0.1–0.3 mm long; styles conic, straight, ca. 1 mm long; stigmas subcapitate (Fig. 2Z). Achenes ovoid–ellipsoid, slightly compressed, with narrow ribs, ca. 4–5 × 2–3 mm, sparsely puberulent (hairs ca. 0.2 mm long); styles straight to curved, ca. 1 mm long, glabrous; stigmas triangular-subulate (Fig. 3U).

Chromosome number: n = 14 (Baumberger 1970).

Distribution: Japan (Honshu, Shikoku, Kyushu); in forests.

Initially A. keiskeana was regarded (Ulbrich 1906) as a member of sect. Anemonanthea, and afterwards Kurita (1957) proposed to include this species into genus Hepatica or separate it as a monotypic genus. Tamura (1967) separated A. keiskeana as a section of Anemone, and Starodubtsev (1991) considered this section to be a distinct genus and treated a North American A. deltoidea as another member of this genus. According to our data, A. keiskeana differs from A. deltoidea by its few 3-sected basal leaves with distinct petioles and blades, developing before anthesis, 3-lobed involucral leaves, 10–22 linear-lanceolate puberulent tepals, and compressed ovaries and achenes on longer stalks.

Specimens examined: JAPAN; Yamashiro Prov., inter Hozukyo et Kameoka, 15.9.1959, Murata 5972 (LE); Kochi Pref., 12.3.1935, Yoshinago (LE); Kochi Pref., Sakaka-cho, Takaoka-gun, 9.3.1940, Makino (LE); Hondo: Yagimachi, in Tunba, 19.3.1955, Togashi 1155 (LE).

Ser. 11.  

34.  Anemone deltoidea  Hook. f. ex Dougl. in Fl. Bor. Amer. 16 (1830).  
TYPE: U. S. A.: “In sylvis densis umbrosis ad oras Columbiae, Douglas” (holotype–BM !).


Rhizomes long horizontal, branched, ca. 2 mm in diameter. Basal leaves 2–3, scale-like, and solitary, with distinct blades; petioles 10–15 cm long, glabrous; blades ternate,
pentagonal, 3–5 × 3–7 cm, glabrous; leaflets subsessile; central leaflets ovate to rhombic, somewhat deltoid; bases broadly cuneate; margins crenate to serrate; apices acuminate; lateral leaflets similar to central leaflets. Scapes 10–30 cm long, glabrous; cymes 1-flowered. Involutural leaves 3; petioles 2–5 × 1–2 mm; blades undivided, ovate-rhombic, 4–8 × 2–3 cm, subglabrous; bases broadly cuneate; margins crenate to serrate; apices acuminate (Fig. 1Z). Pedicels 3–6 cm long, sparsely puberulent. Tepals 5, ovate to obovate, white, 12–20 × 12–15 mm, glabrous; basal veins 5–7, vein anastomoses absent (sometimes solitary). Stamens 3–5 mm long; filaments filiform; anthers ellipsoidal, connectives wide. Ovaries on stalks ca. 1 mm long, ovoid, slightly compressed, 1.5–2 mm long, basally covered with hairs ca. 4 mm; styles straight, 0.5–1 mm long; stigmas subcapitate (Fig. 2Z2). Achene bodies on stalks 1.5–2 mm long, subglobose, slightly compressed, with narrow ribs, 3–5 × 2.5–3 mm, puberulent (hairs 0.2–0.3 mm long); styles straight to subulate, 0.5–1 mm long, glabrous; stigmas linear (Fig. 3V).

Distribution: NW North America; U. S. A. Washington, Oregon, California; in forests and margins, alt. 200–2000 m.

During a lot of years this species was regarded as a member of sect. Anemonanthea, and recently Tamura (1995) again confirmed the affinity of A. deltoidea to the North American species of the foregoing section. However, Starodubtsev (1991) proposed to separate A. deltoidea (together with A. keiskeana) from Anemone as a genus Trapuria and Dutton (1996) noted the unsimilarity of the A. nemorosa-group and A. deltoidea and paid attention on its peculiar number of chromosomes (n = 7). Anemone deltoidea is close to A. keiskea indeed and has to be regarded as a member of sect. Keiskea, but as a monotypic series Deltoideae.

Specimens examined: U. S. A.; Oregon. Sauvil’s Island, 5.1886, Howell (LE); Lime Co., near Hisk Lake, 23.8.1897, Corville (WU); Elk Meadows, 18.7.1925, Thompson 293 (K); Washington: Caskade Mts., Upper Valley of the Nesqually, 8.6.1893, Allen (LE); 7.1895, Allen (K); 8.8.1895, Allen (LE); Mt. Rainier National Park, 5.8.1916, Hunnewall (NY); Pierce Co., Indian Reservation, 16.5.1937, Everdam (LE).

Discussion

Our comparative study of the taxa within Anemonanthea s. l. showed that scape, basal leaf petiole and pedicel length are high variable, but that there is little difference in the size of the basal and involucral leaf blades. The length of involucral leaf petioles in most species is 1–3 cm (sometimes 2–5 cm) as in A. udensis, A. debilis, and A. grayi), or ca. 1 cm only, as in A. raddeana, A. ranunculoides, A. caerulea, and A. uralensis. The length of the basal leaf petiolules frequently exceeds 2 mm, except for A. umbrosa and A. quinquefolia in which it is generally 1–2 mm. The majority of species is characterized by solitary flowers. Most species have 5–6 tepals, although several species have 6–8 tepals (A. nemorosa, A. amurensis, A. ranunculoides, A. trifolia, A. oregana) or even 8–15 tepals (A. altaica, A. pseudoaltaica, A. raddeana, A. keiskeana). The tepals of most species are 10–20 × 4–8 mm, but several species have larger tepals (10–25 × 6–12 mm, as in A. altaica, A. pseudoaltaica, A. nikoensis), and one species (A. reflexa) is characterized by having the smallest (tepals 5–7 × 2–3 mm). The number of basal tepal veins varies from 3–5 to 5–7, and in most species the tepal vein anastomoses are absent. The stamens in most species are 3–5 mm long, although in several species (A. nemorosa, A. amurensis, A. trifolia, A. umbrosa, A. grayi) they are 4–8 mm long. The essential morphometric achene characters of most species of subgen. Anemonanthea s. l. taxa are quite similar. Although the achene body size is 2–4 × 2 mm in most
species, in several species (*A. amurensis*, *A. soyensis*, *A. altaica*, *A. pseudoaltaica*, *A. davidii*, *A. baicalensis*) the achenes are larger (4–5 mm long) or even smaller (mainly 1.5–2.5 mm long) in a few species (*A. caerulea*, *A. uralensis* and *A. caucasica*). The achene styles are mainly 1–1.5 mm long, although in several species (*A. stolonifera*, *A. caucasica*, *A. flaccida*) the achene styles are shorter than 0.5 mm. Within the qualitative characters, we regard the types of rhizomes as essential. In particular, the rhizomes may be dimorphic (long horizontal, thin, fleshy and intensively branched, or short, ascending, rather thick). These are not always found because the development of long rhizomes occurs during a rather short period. On the other hand, several taxa always have monomorphic, mainly long rhizomes. Many taxa characteristically have an intensive vegetative propagation and depressed sexual reproduction. Both the basal and involucral leaf blades are ternate (bitemate) or 3-sected. Usually the involucral leaf blades are similar to those of basal leaves. The leaflets (or segments) are mainly rhombic (sometimes pentagonal or oblong), of the variability of leaf blade shape (its diagnostic character), with cuneate-like bases, dentate-incised margins and acute or obtuse apices. The basal leaf petioles are long and narrow and either perish completely or gradually desintegrate basally and thus are surrounded by fibrous remnants, or are sharply dilated (scale-like). The involucral leaf petioles are distinct (narrow or wide) or absent. Basal and involucral leaf petiolules are almost always present, but they differ in size and shape considerably.

Most of taxa are characterized by a monomorphic perianth, although several species (mainly having more than 10 tepals) have a dimorphic perianth consisted of two circles of tepals differing in shape, size, vein anastomoses and hairiness (*A. nemorosa*, *A. ranunculoides*, *A. altaica*, *A. pseudoaltaica*, *A. apennina* and *A. caucasica*). However, in a few species (*A. umbrosa*, *A. stolonifera* and *A. davidii*) the staminodes are either dilated stamens without anthers or dilated carpels without ovaries.

Although the shape of tepals is similar within most taxa, oblong-elliptic or oblong-ovate, with rounded apices and wide bases, sometimes the tepals are linear-lanceolate (*A. caucasica* and *A. reflexa*) or their bases narrowed (*A. amurensis*, *A. debilis*, *A. nikoensis* and others). The tepals of all species are straight or spreading, and only in *A. reflexa* they are bent or reflexed. Within subgen. Anemonanthea s. l. the tepals predominately have a white colour, although in some cases the tepals are greenish, red, blue to purple or yellow, and in several species it varies.

In all species the stamens are numerous, with filiform monomorphic filaments which are sometimes apically dilated (*A. uralensis*, *A. trifolia* and *A. reflexa*) or basally dilated (*A. nemorosa*, *A. caerulea*, *A. pseudoaltaica* and *A. quinquefolia*). In most species the anthers are oblong-elliptic with rather wide connectives, although narrow anther connectives were noted in ten species (*A. umbrosa*, *A. soyensis*, *A. raddeana*, *A. davidii* and others). However, in several specimens of *A. ranunculoides* we noted funnel-shaped apices of filaments, and in *A. reflexa* the filaments were dilated-compressed.

According to our data, in most taxa the achene bodies are ovoid or ovoid-ellipsoid, but subglobose in *A. uralensis* and *A. deltoidea*, and ellipsoid in *A. apennina* and *A. caucasica*. The styles generally are conic, apically curved or straight, but uncinate styles were noted in *A. caerulea* and *A. exigua* only. The achene bodies are usually rounded basally, but sometimes they are slightly narrowed (*A. udensis*, *A. altaica* and *A. baicalensis*), but distinctly narrowed achene body bases only occur in *A. grayi*, *A. oregana* and *A. baicalensis*. Sessile achenes predominate; distinct achene stalks
are noted only in *A. keiskeana* (0.5–0.7 mm long) and *A. deltoidea* (1.5–2 mm long). Slightly compressed achenes having narrow lateral ribs occur in 17 species of subgenus Anemonanthea s. l. In *A. trifolia*, *A. altaica*, *A. quinquefolia* and others the achene ribs are 0.1–0.2 mm wide (ca. 0.5 mm wide in *A. caucasicus*). In most species the stigmas are subcapitate or subglobose and in mature achenes they are slightly dilated or even sublinear, although only in *A. flaccida* are the achene stigmas distinctly subcapitate.

A high level of variability is characteristic for the pubescence of the basal and involucral leaves, scapes and pedicels. In roughly half of the species (*A. caerulea*, *A. ranunculoides*, *A. baicalensis*, *A. deltoidea* and others) the tepals are more or less puberulent abaxially, and glabrous in the other hal. Almost all taxa are characterized by a dense villosity of the carpels and achene bodies, with hairs mainly 0.1–0.2 long; in only several species (*A. nikoensis*, *A. piperi* and *A. delavayi*) the hairs are longer (0.5–2 mm long), although in several species (*A. soyensis*, *A. reflexa*, *A. grayi*, *A. oregana*, *A. stolonifera*, *A. davidii* and others) the carpels and achenes are subglabrous or scarcely puberulent, and in *A. griffithii* and *A. scabriuscula* they are glabrous. In most species the carpel and achene styles are glabrous, but in several species (*A. nemorosa*, *A. altaica*, *A. quinquefolia*, *A. lancifolia* and *A. baicalensis*) they are puberulent.

As a result of our comparative analysis, the initially circumscribed subgenus Anemonanthea has to be divided into two subgenera, viz., Anemonanthea and Stolonifera.

Only few invariable and important characters are in common to all taxa of both subgenera: distinct horizontal or ascending rhizomes, few basal leaves with long petioles and 3-sected (sometimes ternate) blades, ovaries and achenes densely covered by hairs 0.1–0.3 (rarely 1–2) mm long (puberulent). However, the distinctions between the taxa of these subgenera are considerable: in subgen. Anemonanthea, n = 8; the involucral leaves are petiolate, and the carpels and achenes have mainly linear stigmas; whereas in subgen. Stolonifera n = 7, the involucral leaves are sessile, and the carpels and achenes have mainly dilated or subcapitate stigmas. As circumscribed in this treatment, each subgenus is rather heteromorphic because both include include plants with long and short rhizomes, basal leaves with distinct blades or scale-like ones which develop before or after anthesis, hypogeal or epigeal germination, and 3-colpate, pantocolpate or polycolpate pollen grains. Herein we are treating subgen. Anemonanthea s. str. to consist of three sections, viz., Anemonanthea, Rosulantes and Tuberosa, and 28 species.

All taxa of sect. Anemonanthea are geophytic ephemerals which are characterized by a short duration of the aerial vegetation. These plants are non-rosetteous because they have solitary reproductive shoots with several small underground persistent scale-like basal leaves. Following flowering, solitary green leaves with distinct blades and long narrow petioles develop on rhizomes apart from the reproductive shoots (not always found and sometimes regarded as absent). Germination is hypogeal (very small scale-like cotyledons develop as underground ones). The pollen grains are 3-colpate.

According to our research, there are 20 species within sect. Anemonanthea which can be classified in five rather discrete groups of taxa which herein are recognized at the series level.

Ser. Anemonanthea includes ten species within which three species (*A. nemorosa*, *A. trifolia* and *A. ranunculoides*) are distributed mainly in Europe (*A. ranunculoides* occurs
also in Asia Minor), *A. uralensis* occurs only in the Urals, and the next six species (*A. amurensis*, *A. caerulea*, *A. udensis*, *A. umbrosa*, *A. debilis* and *A. soyensis*) are distributed in Eastern Asia, mainly in the Far East.

We regard *A. nemorosa*, the type species of sect. Anemonanthea, as a variable taxon, and in following Dutton (1996), the continuous nature of the character variation through the range of this taxon makes recognition of infraspecific entities unwarranted. We believe the specific characteristics of *A. nemorosa* such as its monomorphic rhizomes, ternate glabrous basal and involucral leaf blades with petiolules 3–5 mm long, dilated involucral leaf petioles 1–3 cm long, solitary flowers with 5–7 glabrous sepals having 3–5 vein anastomoses, are the basis for distinguishing this species from other species.

Within ser. Anemonanthea, there are two subgroups differing by the involucral leaf petiole width, carpel style length and stigmas shape. The first subgroup includes two pairs of the allied, so called “sister species”. The first pair of species, *A. nemorosa-A. amurensis*, is characterized by involucral leaf petioles 1–3 cm long, involucral leaf blades similar to those in the basal leaves, 1-flowered cymes, a perianth of 5–8 glabrous tepals and achene bodies 3–5 mm long. The second pair of species, *A. caerulea-A. uralensis*, is characterized by involucral leaf petioles 3–5 mm long, involucral leaf blades larger than those in the basal leaves, few-flowered cymes, a perianth of 5 pubescent tepals and achene bodies 1–2 mm long. *Anemone amurensis* differs from *A. nemorosa* by its basal leaflet shape and tepal characters (fewer, monomorphic, narrower, lacking vein anastomoses) and achene body stigmas shape. *Anemone uralensis* differs from *A. caerulea* by its tepal shape, colour and hairiness, and filament shape only, as well as by its the narrow area (endemic to the Urals), and chromosome number (tetraploid).

The second subgroup of ser. Anemonanthea is divided into two sets of species, based mainly on tepal characters (pubescent or glabrous, and presence or absence of vein anastomoses). The first set consists of *A. ranunculoides*, which stands apart because of its involucral leaf petiole length (3–5 cm long), dimorphic tepals with 5–9 vein anastomoses and achene styles 0.8–1.5 mm long. Despite the varied opinions about the affinities of *A. nemorosa* and *A. ranunculoides*, these species differ considerably. Their main distinctions include the involucral leaf petiole shape, characters of the inflorescence, tepal venation, colour and hairiness. On the basis of its tepals and achenes, *A. ranunculoides* is closer to the *A. udensis-A. trifolia* complex. With Dutton (1986), we do not recognize the infraspecific taxa of *A. ranunculoides*. *Anemone trifolia* differs from *A. udensis* by its few-flowered cymes, 5–8 glabrous tepals, and solitary vein anastomoses. Within *A. trifolia* we accept three subspecies, viz., subspp. *trifolia, albida* and *brevidentata*.

In the second set of species, *A. umbrosa* differs from the second set of species, *A. umbrosa* differs from *A. soyensis* and *A. debilis* by its basal leaf blade shape, number of tepals and achene hair length. Because of the variability of leaf blade shape (its diagnostic character), we have not found any diagnostic basis for recognizing *A. extremiorientalis*; hence, we regard it as the synonym of *A. umbrosa*. *Anemone soyensis* was initially described as a variety of either *A. umbrosa* or *A. debilis*, and after its separation as a species two morphologically similar taxa were described also, viz., *A. yezoensis* and *A. sciaphila*. However, we regard both of them as synonyms of *A. soyensis*. Moreover, *A. debilis* was separated from *A. ranunculoides* or from *A. caerulea* as a taxon close to either species. According to our data, *A. debilis* has several essential characters lacking in *A.
Anemone gracilis and A. caerulea, but present in A. soyensis (e. g., involucral leaves dissimilar to basal ones, and white glabrous tepals without vein anastomoses). Furthermore, these taxa have similar basal and involucral leaflet shapes, as well as similarities in their perianth and achenes. Therefore, we are following Dutton (1996) in accepting ties in their perianth and achenes. Therefore, a close relationship of A. debilis and A. soyensis. Anemone debilis (diploid) and A. soyensis (tetraploid) are distinguished on the basis of involucral leaf petioles 1-3 cm long, and achene shape, size and hairiness.

Anemone gracilis and A. linearis are treated as synonyms of A. debilis.

Series Altaicae includes three species, viz., A. altaica, A. pseudoaltaica and A. raddeana, which are distributed in Asia and differ from the other series of subgen. Anemonanthea series by the larger number and especially the solitary flowers and cymes. Anemone altaica was initially separated from A. nemorosa on the basis of the distinctions in its rhizome and leaf shape, and tepal number and shape, which lead Ulbrich (1906) to regard these two species, together with A. umbrosa, as a “species collectiva”. In our opinion, A. altaica is indeed close to A. nemorosa on the basis of several essential characters of the leaves and especially the solitary flowers and tepals (dimorphic glabrous; with 3-5 vein anastomoses), as well as the types of rhizomes, tepals and achenes. We regard A. altaica as a sister species to A. pseudoaltaica due to many common essential characters (e. g., rhizomes of two types, and solitary flowers with 8-12 glabrous sepal). These two taxa, however, have certain distinctions sufficient to regard them as discrete species (shape of basal leaf blades, tepals, carpels and achenes). Anemone raddeana is allied to both of the foregoing taxa on the basis of several essential characters of rhizomes, tepals and achenes, but it differs from these species mainly by its leaf, tepal, and stamen shape. Moreover, A. altaica is diploid, and A. pseudoaltaica and A. raddeana are polyploid taxa. We regard A. hakodatensis as a synonym of A. pseudoaltaica which has three varieties, viz., var. pseudoaltaica, gracilis and katonis. In this treatment, A. raddeana consists of two varieties (raddeana and lacerata), but we are not recognizing subspecies villosa and glabra, and variety integra. Anemone maximowiczii and A. juzepczukii herein are treated as synonyms of A. pseudoaltaica.

According to Ohwi (1984), A. nikoensis is close to the A. altaica complex, but it has several essential distinctions, mainly the involucral leaf petioles, tepal shape and achenes, and to consider that these distinctions are sufficient to recognize A. nikoensis at the series level (ser. Nikoenses).

Both the monotypic ser. Reflexae and the North American ser. Quinquefoliae differ from the foregoing taxa mainly by the same characters, but A. reflexa differs from the species of ser. Quinquefolia by its few-flowered cymes, small bracteoles, small bent tepals, and very short hairs on the achenes. Five species (A. quinquefolia, A. lancifolia, A. piperi, A. grayi and A. oregana) occurring in Canada and the United States are characterized by many essential characters of the rhizomes, leaves and flowers. Consequently, because of these characters in common and their distinctive traits, we regard that this group corresponds to a series level (ser. Quinquefoliae). There are two geographically isolated subgroups, the A. quinquefolia-A. lancifolia complex occurs in Eastern North America, and the A. piperi-A. grayi-A. oregana complex occurs in Western North America. The former subgroup is closer to the European A. trifolia (involucral leaf petioles 0.5–2 cm long, tepals 5, solitary vein anastomoses present, achene styles sparsely puberulent), and the latter to the Eastern Asian A. soyensis (involucral leaf petioles 1–3 cm long, tepals 5–7, vein...
anastomoses absent, achene styles glabrous). *Anemone lancifolia* differs from *A. quinquefolia* by its lateral leaflet and filament shape, and by the hairiness of the leaves, scapes, ovaries and achenes. We are treating *A. quinquefolia* as consisting of subsp. *quinquefolia* and *minima* (with *A. pedata* as a synonym), and *A. grayi* as consisting of subsp. *grayi* and *lyallii*.

Within the second subgroup, *A. piperi* differs from other two species by its generally vertical rhizomes, several puberulent scapes, and ovaries and achene bodies densely covered with hairs 1–2 mm long. *Anemone grayi* has smaller mainly white or blue tepals, basally narrowed and slightly compressed achene bodies with narrow lateral ribs, whereas *A. oregana* has larger red to blue tepals, basally rounded and not compressed achene bodies without ribs; *A. adamsiana* and *A. felix* are synonyms of *A. oregana*.

We are separating five species from sect. Anemonanthea on the basis of their distinctive features including several basal leaves with distinct blades developing before anthesis (rosetteous shoots), any scale-like leaves (but basal remnants of old leaf petioles), epigean germination, pantocolpate pollen grains, basally gradually dilated leaf petioles, 1-few-flowered cymes, 5 tepals, and subglabrous or glabrous achene bodies. Herein these five species (*A. stolonifera* occurs in Japan, China and Korea, *A. griffithii* in China, India, Bhutan, Nepal, Sikkim, and *A. davidii*, *A. exigua* and *A. scabriuscula* are endemics of China) are treated as a section (sect. Rosulanthes).

Within section Rosulanthes, there are two distinct subgroups which we regard as series, viz., Rosulanthes and Exiguae, which differ by key differentiae in their scapes, involucral leaf petiole length, presence or absence of bracteoles, tepal vein anastomoses and hairiness, presence or absence of staminodes and achene shape.

*Anemone davidii* was initially described as a variety of *A. stolonifera*. Although *A. davidii* is indeed close to *A. stolonifera*, it differs by its larger tepals having 5–15 vein anastomoses, staminodes between stamens and carpels and subcapitate carpel stigmas. *Anemone exigua* is a distinct species having involucral leaf petioles 3–5 mm wide and basally connate, and sparsely puberulent ovaries and achenes. The very close *A. griffithii* and *A. scabriuscula* differ one from another by their involucral leaf blade shape, achene style length and stigmas shape. In this treatment, *A. siuzevi* is a synonym of *A. stolonifera*, *A. petiolulata* is a synonym of *A. davidii*, *A. takasagomontana* is a synonym of *A. exigua*, and *A. nanchuanensis* is a synonym of *A. griffithii*.

Section Tuberosa includes two species characterized by tuberous rhizomes, few basal leaves developing before flowering, with long petioles sharply dilated at the base and scale-like, ternate blades, 3 petiolate involucral leaves similar to basal leaves, 1-flowered cymes, 8–12 tepals, 3-colpate pollen grains, and epigean germination. Its species, *A. apennina*, *A. blanda* and *A. caucasica*, have recognizable distinctions, including the shape of rhizomes, size of basal leaf and involucral leaf petioles, size of tepals and achenes, shape of achene bodies, styles and stigmas. Herein, we are treating *A. blanda* as a distinct species (*A. apennina*).

Finally, two sections (Stolonifera and Keiskea) are separated from the foregoing sections and are herein recognized as a distinct subgenus Stolonifera, which differs from subgen. Anemonanthea by its sessile involucral leaves, tendency to stalked carpels and achenes, and hardly recognizable styles and dilated stigmas, polycarpate pollen grains, and a chromosome base number of n = 7. Sections Stolonifera and Keiskea are distinguished from each other by number and shape of involucral leaves, number of flowers and their tepals, and essential characters of achenes (sessile or stalked achenes, styles
Sect. Stolonifera includes four species, *A. flaccida*, *A. delavayi*, *A. baicalensis* and *A. prattii*, which occur in Eastern Asia and which differ from other species in subgen. Anemonanthea s. l. mainly by their carpel stigma shape, smaller style size and villosity. On the basis of our research, these species are rather close to other species of subgen. Anemonanthea s. l. on the basis of comparable achene characters. Consequently, we see no reason to classify them in a separate genus *Arsenjevia*, as Starodubtsev (1989) and others proposed.

Following Juzepchuk (1937), we recognize two series within section Stolonifera, viz., Stoloniferae (not Baicalenses) and Flaccidae. According to our data, on the basis of the basal leaves and shoots, the taxa of ser. Stoloniferae are closer to those of sect. Rosulantes, whereas the taxa of ser. Flaccidae are closer to sect. Anemonanthea, because the taxa of ser. Stoloniferae have rosetteous shoots surrounded by remnants of basally vaginate bases of petioles, several basal leaves having distinct blades which develop before anthesis, whereas in ser. Flaccidae the basal leaves are scale-like only, and leaves with distinct blades develop only after anthesis some distance from the reproductive shoots.

The taxa of ser. Stoloniferae (*A. baicalensis* and *A. prattii*) are distinguished on the basis of their rhizomes (stolons aboveground or underground), tepal size and vein anastomoses, and achene shape. *Anemone baicalensis* is a variable taxon consisting of five varieties (*baicalensis*, *kansuensis*, *saniculiformis*, *litoralis*, and *glabrata*) which differ by tepal size, stigma shape and hairiness of ovaries, leaves and scapes. In this treatment we regard *A. ulbrichiana*, *A. rossii* and *A. brevistyla* as the synonyms of *A. baicalensis*.

The taxa of ser. Flaccidae (*A. flaccida* and *A. delavayi*) differ one from another by the number of basal leaves and scapes, bracteoles (present or absent), tepal size and vein anastomoses, and achene body hairiness. *Anemone flaccida* is a rather variable taxon which includes four varieties (*flaccida*, *hirrella*, *hofengensis*, and *anhuensis*) which differ mainly by tepal number, shape and size, and anther and stigma shape. We regard *A. laevigata* and *A. flaccida* var. *laevigata* as the synonyms of *A. flaccida*. After an examination of available herbarium material, we regard *A. delavayi* as closer to *A. flaccida* (not to *A. baicalensis* as in Wang 1974) mainly because of the distinctions of the basal leaves and seasonal development of shoots. Herein *A. delavayi* consists of two varieties (delavayi and oligocarpa which differs from the former variety by smaller flowers and sessile turbinate stigmas).

Section Keiskea includes two species, *A. keiskeana* (occurs in Japan) and *A. deltoidea* (W North America). We regard these species as representatives of two discrete monotypic series (Keiskea and Deltoidea) which differ in their rhizome thickness, number, shape, vein anastomoses and hairiness of tepals, length of achene stalks, shape and hairiness of achene bodies, and shape of the stigmas. In our opinion, although *A. keiskeana* merits recognition as a monotypic series, we have no reason to confirm its separation as genus *Tamuria* (Starodubtsev 1991).

The evolutionary trends within Anemonanthea s. l. appear to include a change of monomorphic perennial rhizomes to dimorphic (combination of short-nodulose nodes and long short-lived stolons), enlargement of involucral leaf blades, and a dilation of the petioles because of an increasing role as assimilating organs. With respect to the evolutionary trends of flowers, there is a reduction of several-flowered cymes to solitary flowers, development of a dimorphic perianth, reduction of tepal vein anastomoses and their pubescence, and a change of a var-
ied tepal number to either a 5-leaved or many-leaved perianth.

Results

As a result of our comparative analysis of the essential morphological characters of subgen. Anemonanthea, we are dividing this group of taxa into two subgenera (Anemonanthea and Stolonifera, comb. et stat. nov.). In this treatment subgen. Anemonanthea includes three sections (Anemonanthea, Rosulantes, sect. nov. and Tuberosa), and that subgen. Stolonifera includes two sections (Stolonifera and Keiskea).

As treated herein, sect. Anemonanthea consists of five series (Anemonanthea, Altaicae, comb. et stat. nov., Nikoenses, ser. nov., Reflexae, and Quinquefoliae, ser. nov.) with a total of 20 species. Within these series, we are not recognizing interspecific taxa of A. nemorosa and A. ranunculoides, but we are accepting A. trifolia subsp. trifolia, albida and brevidentata, A. pseudoaltaica vars. pseudoaltaica, gracilis and katonis, A. raddeana vars. raddeana and lacera, A. quinquefolia subsp. quinquefolia and minima, and A. grayi subsp. grayi and lyallii. In addition, we regard A. yezoensis and A. sciaphila as synonyms of A. soyensis, A. maximowiczii, A. juzepeczkii and A. amagisanensis as synonyms of A. raddeana, A. pedata as synonyms of A. quinquefolia, A. adamsiana and A. felix as synonyms of A. oregana.

Sect. Rosulantes includes two series (Rosulantes and Exiguae, ser. nov.) and five species. Within this section we regard A. siuzevi as a synonym of A. stolonifera, A. petiolulata as a synonym of A. davidi, A. takasagomontana as a synonym of A. exigua and A. nanchuanensis as a synonym of A. griffithii.

Sect. Tuberosa consists of two species, A. apennina and A. caucasica. We regard A. blandia as a subspecies of A. apennina with A. pyrenaica and A. caerulescens as synonyms.

Sect. Stolonifera consists of two series (Stoloniferae and Flaccidae) and four species. We accept A. baicalensis as consisting of five varieties (baicalensis, glabra, litoralis, kansuensis and saniculiformis), but we regard A. ulbrichiana, A. rossii and A. brevistyla as synonyms of A. baicalensis. We accept the variable A. flaccida as having four varieties (flaccida, hirtella, hofengensis and anhuensis), but we regard A. laevigata as a synonym of A. flaccida. According to our data, A. delavayi includes two varieties (delavayi and oligocarpa).

Finally, sect. Keiskea consists of two monotypic series (Keiskea and Deltoideae, ser. nov.).

In delimiting the taxa within subgen. Anemonanthea s. 1., we followed Tamura (1995), in addition to a number of other characters, viz., chromosome numbers, types of pollen grains and carpels, germination type and time of basal leaf development, types of rhizomes, shoot structure, shape and size of basal and involucral leaves, tepal number, shape, venation and villosity.

This treatment consists of a conspectus of subgen. Anemonanthea s. 1., together with brief description of the morphological characteristics of two subgenera, five sections and 11 series, as well as Latin diagnoses of seven new infrageneric taxa.

The presence of many significant characters (especially those of the shoots and achenes) in common to all taxa reflect the longstanding and well-defined habitats (shady forests or under bushes) and an ancient origin and differentiation of this group.

References


October 2004

Journal of Japanese Botany Vol. 79 No. 5


Starodubtsev V. N. 1989. New taxa of the subtribe...


また，本稿で認めた32種について，総苞藻（茎葉）及び花と種子を図示した。

(*)ウクライナ・M. G. コロドゥニィ植物学研究所，
(b)ペンシルバニア州立大学，
(c)国立科学博物館植物研究部，
(d)西オレゴン州立大学)