

# PLANTS RELATED TO *MECONOPSIS PSILONOMMA* (PAPAVERACEAE) IN NORTHERN SICHUAN AND SOUTHEASTERN QINGHAI, CHINA

TOSHIO YOSHIDA<sup>1,2</sup> AND HANG SUN<sup>3</sup>

**Abstract.** Four new species of *Meconopsis*—*M. huanglongensis*, *M. inaperta*, *M. hispida*, and *M. trichogyna*—are described and illustrated, *M. barbisetata* is redescribed, and a new series of *Meconopsis*, series *Barbisetatae*, is proposed.

**Keywords:** *Meconopsis*, series *Barbisetatae*, Huanglong, Jiuzhi, Nianbao Yuze, Yanggong Shan

Following the rediscovery and revision of *Meconopsis psilonomma* Farrer (Yoshida and Sun, 2017), the taxonomy of species related to it in northern Sichuan and adjacent southeastern Qinghai are subject to review. Through collaborative studies of related plants in the field and in herbaria, four species are distinguished as new: *Meconopsis huanglongensis* T. Yoshida & H. Sun, *M. inaperta* T. Yoshida & H. Sun, *M. hispida* T. Yoshida & H. Sun, and *M. trichogyna* T. Yoshida & H. Sun. *Meconopsis barbisetata* C. Y. Wu & H. Chuang ex L. H. Zhou, which was treated as a synonym of *M. psilonomma* in Grey-Wilson's (2014) monograph of the genus, is reestablished on the basis of new specimens and photographs and is recognized as a distinct species.

*Meconopsis huanglongensis* grows around the pass called

Xueshanliang (雪山梁), located 8 km west of the famous sightseeing spot, Huanglong (黄龙) in Songpan Xian (松潘县), northern Sichuan. *Meconopsis inaperta* grows in Baiyu Xian (白玉县), Litang Xian (理塘县), and Yajiang Xian (雅江县) in northwestern Sichuan. *Meconopsis barbisetata* grows in Jiuzhi Xian (久治县) and Banma Xian (班玛县) in southeastern Qinghai. *Meconopsis hispida* grows on Yanggong Shan (羊拱山), a mountain range running along the boundary between Hongyuan Xian (红原县) and Heishui Xian (黑水县), northern Sichuan. *Meconopsis trichogyna* is in Dege Xian (德格县), northwestern Sichuan. The ovaries of *Meconopsis barbisetata*, *M. hispida*, and *M. trichogyna* have hairs with minute branches near their bases. These species are included in series *Barbisetatae*, which is proposed here.

## TAXONOMY

*Meconopsis huanglongensis* T. Yoshida & H. Sun, *sp. nov.*  
TYPE: CHINA. Sichuan: Xueshanliang, near Huanglong, Songpan Xian, 32°44'23"N, 103°44'02"E, 4000 m, 11 July 2016, T. Yoshida K107 (Holotype, KUN; Isotype, TI). Fig. 1–5, 28–29.

*Meconopsis huanglongensis* differs from the related *M. psilonomma* Farrer in the posture of the flowers, opening flat or dish-shaped in fine weather (usually cup-shaped in the latter), and stigma less than 5 mm long (to 8 mm long in the latter).

**Herbs**, monocarpic, 18–45 cm tall. **Taproot** napiform or broadly napiform, occasionally dauciform, 1–2.5 cm long, 0.6–1.6 cm across, contracted at junction with stem, distally with slender roots. Most parts of plant covered with bristles; bristles to 4 mm long. **Stem** (below uppermost leaf) simple, 0.3–5 cm long. **Leaves** crowded near base of stem, petiolate; **petiole** membranous, broadly linear, 1–6 cm long, 1.2–4 mm wide; **lamina** somewhat thick, oblong, oblanceolate or elliptic, or lowest small leaves ovate, 1.5–8 cm long, 0.5–1.9 cm wide, base attenuate, or occasionally cuneate,

margin entire or occasionally wavy, apex obtuse or acute, both surfaces sparsely or moderately bristly or occasionally glabrous. **Inflorescence** scapose; scape 3–9 mm across when fresh, 2–7 mm across when dried, with dense retrorse or patent bristles. **Flowers** 1 per scape, laterally facing, opening flat or dish-shaped in fine weather, 5.5–11 cm across. **Calyx** 1.5–2.3 cm long, sparsely or moderately hairy with short bristles. **Petals** 6–10, deep purple or magenta purple, obovate, broadly obovate, rounded, rhombic or elliptic, 3–5.7 cm long, 1.5–5 cm wide, 3.2–3.7 times longer than stamens, base cuneate, margin entire or occasionally denticulate near apex, apex rounded or obtuse. **Stamens** numerous; **filaments** similar to or more deeply colored than petals, 7–13 mm long, lower 1/2 to 3/4 dilated, to 1.5 mm wide, boat-shaped, upper portion filiform, outermost filaments often scarcely dilated; dilated part of filaments overlapping and tightly surrounding ovary, filiform part of filaments more or less erect; **anthers** oblong, 1.2–1.8 mm long, **thecae** yellow or dull orange. **Ovary** ellipsoid, 4–7 mm long, densely or sparsely hairy with ascending bristles;

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<sup>1</sup>Hoshiya 330-6, Oamishirasato-shi, Chiba 299-3222, Japan

<sup>2</sup>Corresponding author: kharka@wa2.so-net.ne.jp

<sup>3</sup>Key Laboratory for Plant Diversity and Biogeography of East Asia, Kunming Institute of Botany, Chinese Academy of Sciences, Kunming 650201, Yunnan, China; sunhang@mail.kib.ac.cn



FIGURE 1. Distribution map of *Meconopsis psilonomma* Farrer and related plants, based on Google Earth. 1: *M. psilonomma* Farrer var. *psilonomma*; 2: *M. psilonomma* var. *zhaganaensis* T. Yoshida & H. Sun, *M. psilonomma* var. *callicola* T. Yoshida & H. Sun; 3: *M. psilonomma* var. *sinomaculata* (Grey-Wilson) H. Ohba; 4: *M. huanglongensis* T. Yoshida & H. Sun; 5: *M. hispida* T. Yoshida & H. Sun; 6: *M. barbisetata* C. Y. Wu & H. Chuang ex L. H. Zhou; 7: *M. trichogyna* T. Yoshida & H. Sun; 8: *M. inaperta* T. Yoshida & H. Sun.

style 2–4 mm long in flower, to 7 mm long in fruit; stigma clavate, 2–5 mm long, 4- to 6-lobed; lobes linear-oblong. Fruit a capsule, ellipsoid or broadly ellipsoid, 10–16 mm long, 6–12 mm across, bristly or glabrous.

**Distribution:** CHINA. N Sichuan: Xueshanliang, near Huanglong, Songpan Xian, 3900–4100 m elevation.

**Habitat and ecology:** southwest-facing alpine slopes, sometimes among dwarf shrubs of *Potentilla* (*Dasiphora*) and others, occasionally with inflorescence protruding through canopy of shrubs; rooting in gravelly humus soil.

**Additional specimens examined:** CHINA. Sichuan: Xueshanliang, near Huanglong, Songpan Xian, 32°44'23"N, 103°44'02"E, 4000 m, 28 July 2014, T. Yoshida K98 (KUN, TI).

*Meconopsis huanglongensis* is rather uniform in comparison with *M. psilonomma*. *Meconopsis huanglongensis* is stouter and somewhat fleshier, with more widely opening showy flowers. The flowers have deeper and more brightly colored petals and have relatively shorter stamens gathered compactly around the pistil. *Meconopsis*

*huanglongensis* grows in drier and sunnier habitats without a covering of mosses and in more exposed and bare soils than does *M. psilonomma*. Flies frequent the mass of stamens on fine days.

The anthers of *Meconopsis psilonomma* do not form a compact mass around the stigma because the outer filaments of *M. psilonomma* are gradually shorter and the upper filiform part of the filaments usually radiate outward. The longer stigma of *M. psilonomma* clearly protrudes from the loose mass of anthers at anthesis.

*Meconopsis huanglongensis* is also similar to *M. henrici* Bureau & Franch., but differs in having a solitary scape (2–12 scapes in the latter), in the often scarcely dilated outermost filaments (outer- and innermost filaments similarly dilated in the latter), in the ellipsoid or broadly ellipsoid capsules (obovoid or narrowly obovoid in the latter), and in the taproot usually napiform (elongate in the latter).

*Meconopsis huanglongensis* and *M. psilonomma* belong to series *Henricanae* C. Y. Wu & H. Chuang ex Grey-Wilson (2014).



FIGURE 2. *Meconopsis huanglongensis* T. Yoshida & H. Sun at type locality. Photograph by T. Yoshida, 11 July 2016.



FIGURE 3. *Meconopsis huanglongensis* T. Yoshida & H. Sun in foggy weather at type locality. Photograph by T. Yoshida, 11 July 2016.



FIGURE 4–5. **4**, *Meconopsis huanglongensis* T. Yoshida & H. Sun. Flower without petals (left), flower without petals and outer stamens (right); collected at type locality on 11 July 2016. Photograph by T. Yoshida. **5**, *Meconopsis huanglongensis* T. Yoshida & H. Sun. Dried fruit collected at type locality on 28 July 2014. Photograph by T. Yoshida.

TABLE 1. Major features separating *Meconopsis huanglongensis* from *M. psilonomma*.

	<i>M. huanglongensis</i>	<i>M. psilonomma</i>
Shape of taproot	Napiform, broadly napiform, occasionally dauciform	Dauciform or narrowly napiform
Size of taproot	1–2.5 cm long, 0.6–1.6 cm across	1–4 cm long, 0.6–1.3 cm across
Length of bristles	To 4 mm long	To 3(–4) mm long
Thickness of fresh peduncle	3–9 mm across	2–7 mm across
Flower posture	Laterally facing	Half-nodding or laterally facing, occasionally upright in small plants
Flower shape in fine weather	Opening flat or dish-shaped	Usually cup-shaped, occasionally dish-shaped in small plants
Petal number	6–10	5–7(or 8)
Petal color	Deep purple or magenta purple	Pale purple, lavender purple, purple or deep purple; deeper colored toward base; with or without prominent dark purple blotch at base
Proportion of petals to stamens	Petals ca. 3.5 times longer than stamens	Petals ca. 3 times longer than stamens
Length of filaments	7–13 mm long; outer filaments nearly similar or slightly shorter than others	5–15 mm long; outer filaments gradually shorter
Dilated part of filaments	Lower 1/2 to 3/4 of filaments dilated to 1.5 mm wide, boat-shaped; outermost filaments often scarcely dilated	Inner filaments dilated to 1.5 mm wide toward base, outer filaments often scarcely dilated, or all filaments scarcely dilated
Filiform part of filaments	More or less erect	Erect or ascending, often radiating
Length of stigma	2–5 mm long	3–8 mm long
Habitat	Dry, without moss cover	Moist, partly moss covered

*Meconopsis inaperta* T. Yoshida & H. Sun, *sp. nov.*  
 TYPE: CHINA. NW Sichuan: Baiyu Xian, western side of Ganbailu Yakou (甘白路丫口) near Acha (阿察), 31°06'25"N, 99°26'17"E, 4000 m, 16 July 2017, T. Yoshida K120 (Holotype, KUN; Isotype, TI). Fig. 1, 6–9.

*Meconopsis inaperta* resembles *M. psilonomma* Farrer but differs from the latter in the racemose inflorescence (solitary scape and solitary flower in the latter), taproot elongate (dauciform or napiform in the latter), capsule narrowly ellipsoid (ellipsoid in the latter), and flowers usually with 4 petals (with 5 or more petals in the latter). *Meconopsis inaperta* also resembles *M. lancifolia* (Franch.) Franch. ex Prain but differs from the latter in the cup-shaped flowers with half closed mouth (dish- or bowl-shaped in the latter) and petals 4 or occasionally 5 or 6 (4–9, often 5–6 in the latter).

*Herbs*, monocarpic, (20–)30–50 cm tall. *Taproot* elongate, to 15 cm long or more, 0.7–1.5 cm across, distally gradually narrowed and with slender roots. Most parts of plant densely or moderately bristly; bristles to 2–4(–5) mm

long. *Stem* (below uppermost leaf) 0.7–2.7 cm long. *Leaves* crowded near base of plant, petiolate; *petiole* membranous, linear, 1.5–5 cm long, 1–2 mm wide; *lamina* linear-oblong or oblanceolate, 2.5–12 cm long, 0.5–1.5 cm wide, base attenuate, margin entire, apex acuminate or sometimes acute or obtuse, both surfaces bristly. *Inflorescence* racemose, with 2–8 flowers mostly on upper half of rachis, without bracts, some flowers occasionally in axils of basal leaves (bracts); basal pedicels sometimes elongating to 10 cm or more, rarely bracteolate, rarely with additional lateral flower; *peduncle* (rachis) to 9 mm across when fresh, 3.5–6 mm across when dried, usually hollow, covered with retrorse bristles; *pedicels* 0.5–5 cm long, to 10 cm long in fruit (in terminal flowers). *Flowers* cup-shaped, often half-closed at mouth, 3–5 cm across. *Calyx* 1.7–2.5 cm long, densely bristly. *Petals* purple, gradually more deeply colored near base, 4 or occasionally 5 (or 6), rounded, broadly obovate or obovate, (3–)3.5–5.5 cm long, 2–4.5 cm wide, base cuneate or sub-rounded, margin entire, occasionally irregularly denticulate near apex, occasionally cleft toward base, apex rounded or



FIGURE 6. *Meconopsis inaperta* T. Yoshida & H. Sun at type locality. Photograph by T. Yoshida, 16 July 2017.

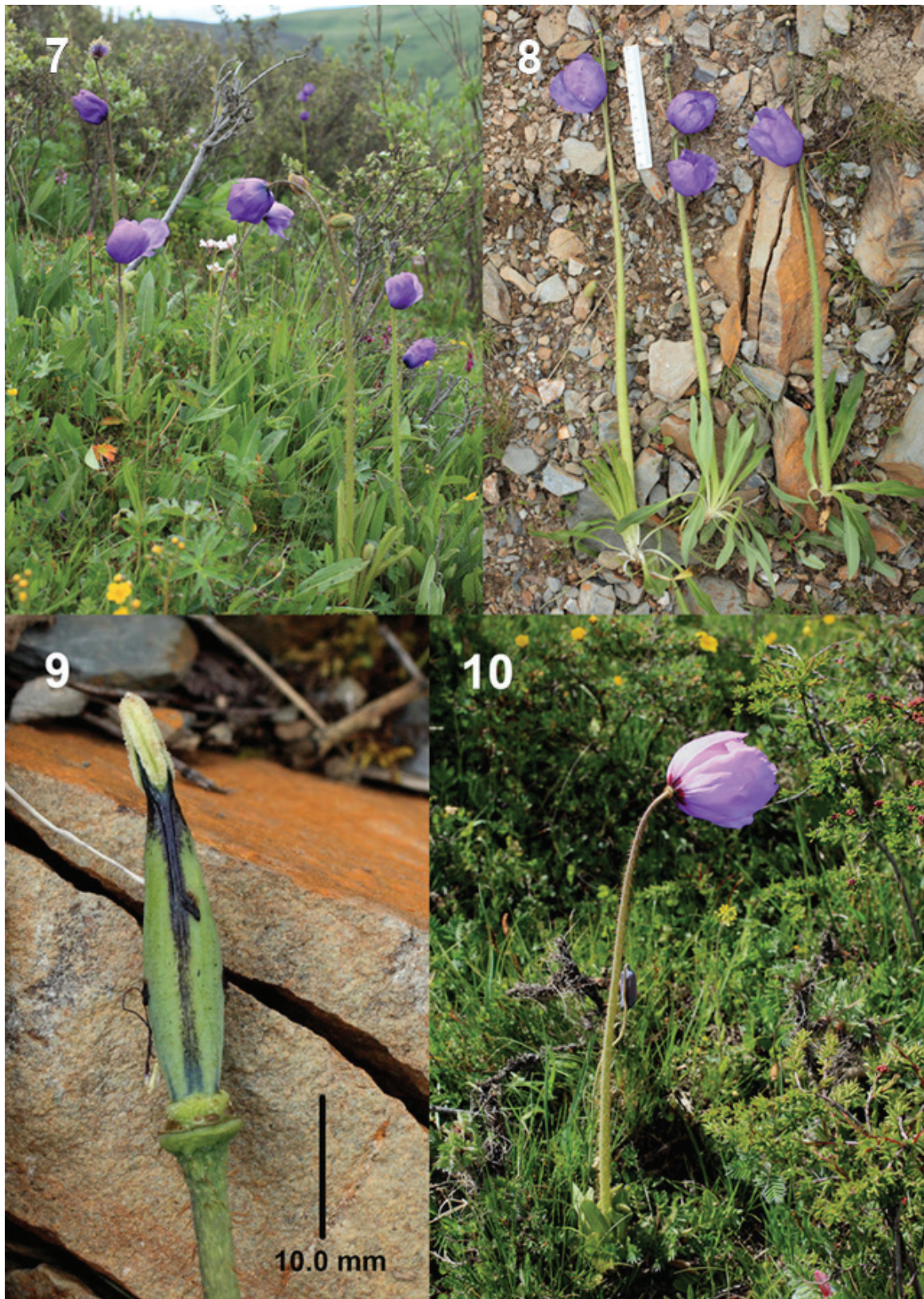


FIGURE 7–10. **7**, *Meconopsis inaperta* T. Yoshida & H. Sun at type locality. Photograph by T. Yoshida, 16 July 2017. **8**, *Meconopsis inaperta* T. Yoshida & H. Sun at type locality on 16 July 2017. Photograph by T. Yoshida. **9**, *Meconopsis inaperta* T. Yoshida & H. Sun. Young fruit at type locality on 16 July 2017. Photograph by T. Yoshida. **10**, *Meconopsis barbiseta* C. Y. Wu & H. Chuang ex L. H. Zhou at Sangchi Shan. Photograph by T. Yoshida, 21 June 2016.

obtuse, *Stamens* numerous; *filaments* pale purple, sometimes darker toward base, filiform, 7–14 mm long; *anthers* oblong, (1–)1.5–2.2 mm long, *thecae* pale yellow. *Ovary* pale green, often tinged with dark purple toward apex, usually with 3–5 dark purple streaks, narrowly ovoid or ellipsoid, 9–13 mm long, glabrous or hairy with ascending bristles; *style* tinged dark purple, 0.5–1.5 mm long, to 3 mm long in fruit; *stigma* pale yellow, ovoid or oblong, 3–5 mm long, with 3–5 lobes. *Capsules* narrowly ellipsoid, 1.5–2 cm long, 5–7 mm across, glabrous or sparsely bristly.

**Distribution:** CHINA. Sichuan: Baiyu Xian, Litang Xian and Yajiang Xian, 3950–4200 m elevation.

**Habitat and ecology:** often on northwest-facing alpine slopes densely covered with various herbs and grasses and scattered shrubs of scale-bearing *Rhododendron* and *Salix*; rooting in humus soil intermixed with gravel.

**Additional specimens examined:** CHINA. Sichuan: Yajiang Xian, Kazi La Shan (卡子拉山), 30°01'05"N, 100°48'42"E, 4,150 m, 19 June 2017, *T. Yoshida* K112 (KUN).

The specimen *T. Yoshida* K112 is similar to *T. Yoshida* K120, but the plants are 15–20 cm tall, the 4–6 petals are 3–4 cm long and often cleft, and the anthers are 0.8–1.3 mm long. The immature plants have the terminal cup-shaped flowers barely open and the lateral flowers just in bud. Although the plants are smaller and appear somewhat different, they share the key features of *Meconopsis inaperta*.

*Meconopsis inaperta* is unique in the half-closed, cup-shaped flowers usually with 4 petals. We consider it to be intermediate between *M. psilonomma* in series *Henricanae* (C. Y. Wu & H. Chuang) Grey-Wilson section *Impeditae*

Grey-Wilson and *M. lancifolia* of section *Forrestiana* (C. Y. Wu & H. Chuang) Grey-Wilson. More studies are needed to determine its higher-level classification.

***Meconopsis barbisetata*** C. Y. Wu & H. Chuang ex L. H. Zhou, *Acta Phytotax. Sin.* 17 (4): 113–114 (1979). TYPE: CHINA. Qinghai: Jiuzhi Xian, eastern bank of Xiemu Cuo (斜木措), north side of Nianbao Shan (年保山), 4400 m, 1971, *Guoluo Team* (果洛队) 438 (HNWP). Fig. 1, 10–14, 33–38.

*Herbs*, monocarpic, 20–50 cm tall. *Taproot* napiform or narrowly napiform, 1–3 cm long, 0.7–1.4 cm across, contracted at junction with stem, distally with slender roots. *Stem* (below uppermost leaf) simple, 0.3–1.5 cm long. *Leaves* all basal; *petiole* membranous, broadly linear, 1–5 cm long, 1–4 mm wide; *lamina* oblong, oblanceolate or strap-shaped (lowermost small leaves elliptic), 1.5–8 cm long, 0.4–1.2 cm wide, base attenuate, margin entire, apex obtuse or acute, upper surface densely bristly, lower surface moderately or sparsely bristly. *Inflorescence* a solitary scape; *scape* 2.5–7 mm across when dried, densely covered with patent or retrorse bristles; bristles to 2–4.5 mm long. *Flower* solitary, half nodding or laterally facing, cup-shaped, 3–5 cm across. *Calyx* unknown. *Petals* 5–8, often 6, purple with dark reddish purple blotch at base, obovate or occasionally elliptic, 3.7–6.5 cm long, 1.5–4 cm wide, base cuneate, margin entire, occasionally irregularly denticulate near apex, apex rounded. *Stamens* numerous, radiating; *filaments* purple or dark reddish purple, paler toward apex, filiform, 7–13 mm long, slightly or scarcely dilated toward base; *anthers* oblong, 1–2.5 mm long, *thecae* pale yellow or occasionally whitish. *Ovary*



FIGURE 11. *Meconopsis barbisetata* C. Y. Wu & H. Chuang ex L. H. Zhou at Sangchi Shan. Photograph by T. Yoshida, 10 July 2017.





FIGURE 12. *Meconopsis barbisetata* C. Y. Wu & H. Chuang ex L. H. Zhou at Luanshitou Yakou on 10 July 2017. Photograph by T. Yoshida.

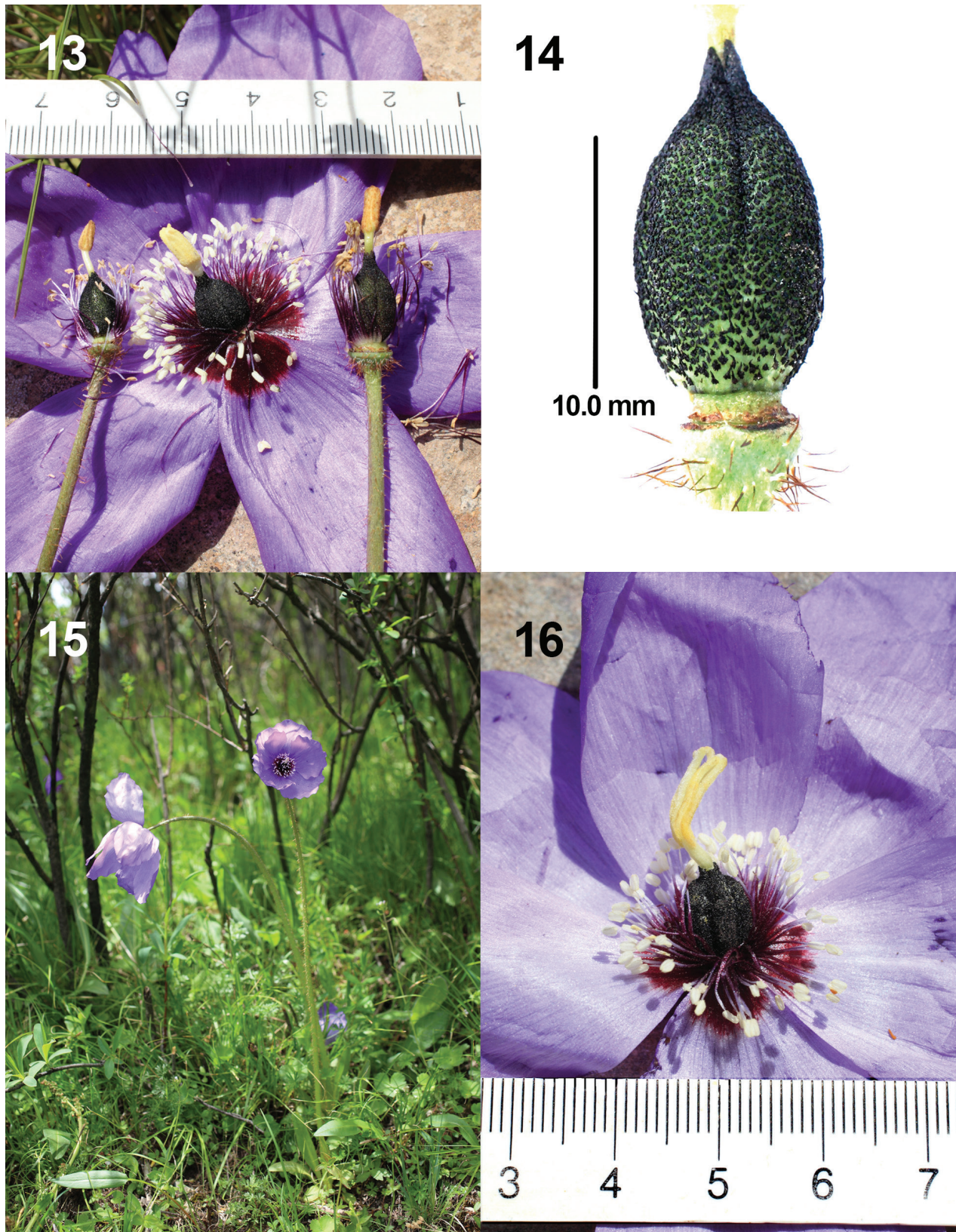


FIGURE 13–16. **13**, *Meconopsis barbisetata* C. Y. Wu & H. Chuang ex L. H. Zhou at Sangchi Shan on 10 July 2017. Photograph by T. Yoshida. **14**, *Meconopsis barbisetata* C. Y. Wu & H. Chuang ex L. H. Zhou. Ovary just after flowering at Sangchi Shan on 21 June 2016. Photograph by T. Yoshida. **15**, *Meconopsis hispida* T. Yoshida & H. Sun at type locality. Photograph by T. Yoshida, 20 June 2016. **16**, *Meconopsis hispida* T. Yoshida & H. Sun. Flower near type locality on 18 July 2017. Photograph by T. Yoshida.

ovoid, 6–12 mm long, with dense dark purple branched hairs in close contact with each other; hairs 0.3–0.8 (–1) mm long, usually erect along surface of ovary and incurved above branches, occasionally straight and ascending especially those near base of ovary, with several rounded ridges running longitudinally on surface and with hollow pits inside hairs, apex rather obtuse; branches to 0.25 mm long on lower half of hairs, retrorse, imbricate, surrounding axis of hairs, apex obtuse; *style* pale green or occasionally whitish, 1.5–4 mm long, ridged toward base, covered at least near base with hairs like those on ovary; *stigma* pale yellow, 3–5 mm long, 4–7-lobed, lobes linear-oblong, often free after flowering. *Capsules* ellipsoid, 1.5–2.3 cm long, 0.8–1.4 cm across, with dense branched hairs.

**Distribution:** CHINA. SE Qinghai: Jiuzhi and Banma Xian, 3650–4100 m elevation.

**Habitat and ecology:** on southwest-facing alpine slopes with dwarf shrubs of *Spiraea*, *Sibiraea*, *Caragana*, *Potentilla* (*Dasiphora*) and *Salix*; often rooting close to dwarf shrubs with scapes protruding through canopy of shrubs; rooting in gravelly humus.

**Additional specimens examined:** CHINA. Qinghai: Jiuzhi Xian, July 1974, *Guoluo Grassland Team* (果洛草原站) 289 (HNWP); Qinghai: Jiuzhi Xian, Sangchi Shan (桑赤山), 33°22'03"N, 101°19'18"E, 3,950 m, 21 June 2016, *T. Yoshida* K100 (KUN, TI); Qinghai: Jiuzhi Xian, Luanshitou Yakou (乱石头丫口), 33°25'23"N, 101°13'30"E, 4,000 m, 23 June 2016, *T. Yoshida* K101 (KUN, TI); Qinghai: Banma Xian, Makehe (玛可河) Forest Reserve, southern side of Nianbao Yuze, 32°47'53"N, 101°04'42"E, 3650 m, 25 June 2016, *T. Yoshida* K103 (KUN, TI).

The type specimen of *Meconopsis barbisetata*, *Guoluo Team* 438, was collected on the eastern bank of Xiemu Cuo (斜木措); also known as Ximeng Cuo (希門措) or Xian-nu Hu (仙女湖), north of Nianbao Shan (年保山); also known as Nianbao Yuze (年保玉则) or Guoluo Shan (果洛山), 4400 m, on 1 August 1971. The type locality is difficult to approach because of a wide debouchure of the lake that floods during the rainy season.

The specimens *T. Yoshida* K100 and K101 were collected on ridges north of Nianbao Yuze in an area similar to the type locality of *Meconopsis barbisetata*, but ca. 10 km east. These collections are similar to the type specimen in having branched hairs on the ovary. Observation of the branched hairs on the ovary is difficult because the entangled hairs are less than 1 mm long and the tips of each are usually incurved and inserted behind adjacent hairs. Drawings of the branched hairs accompanying the description of *M. barbisetata* by L. H. Zhou (1979) are inaccurate in shape and length.

The intricate hollow branched hairs of the ovary are considered to be advantageous in preventing freezing of the ovary by keeping an insulating layer of air on the surface and in offering a foothold for pollinators visiting the laterally facing or half-nodding flowers.

***Meconopsis hispida*** T. Yoshida & H. Sun, *sp. nov.* TYPE: CHINA. N Sichuan: Hongyuan Xian, western side of Yanggong Shan (羊拱山), 32°13'22"N, 102°35'04"E, 3850 m, 20 June 2016, *T. Yoshida* K99 (Holotype, KUN; Isotype: TI). Fig. 1, 15–19, 30–32.

*Meconopsis hispida* resembles *M. barbisetata* C. Y. Wu

& H. Chuang ex L. H. Zhou in many features, especially in sharing the feature of hairs on the ovary with branches near their base. It differs from the latter in the branched hairs on the ovary to 2 mm long (to 0.8 mm long in the latter), usually with straightly elongate and sharply pointed tip (often incurved above the branches and rather obtuse at apex in the latter), with many minute ridges running longitudinally on the surface (with several rounded ridges running longitudinally on the surface in the latter); in the branches borne close to the base of hairs (borne in the lower half of hairs in the latter), often gradually upturned toward the apex (retrorse and not upturned in the latter); in the larger capsules, to 2.8 cm long (to 2.3 cm long in the latter); and in the longer stigma, to 9 mm long (to 5 mm long in the latter).

**Herbs**, monocarpic, 30–45 cm tall in flower, to 55 cm tall in fruit. *Taproot* napiform, 1–3 cm long, 8–13 mm across, contracted at transition to stem, distally with slender roots. *Stem* (below uppermost leaf) simple, 0.5–2.5 cm long. *Leaves* all basal; *petiole* membranous, broadly linear, 2–4 cm long, 1.5–3.5 mm wide; *lamina* oblanceolate or linear-oblong, 2–10 cm long, 5–12 mm wide, base attenuate, margin entire, apex obtuse or acute, both surfaces densely or moderately, rarely sparsely, bristly. *Inflorescence* scapose, with solitary scapes and solitary flowers; *scapes* 2–5 mm across in flower, to 8 mm across in fruit, densely bristly; bristles to 3(–4) mm long. *Flowers* laterally facing or half nodding, cup- or bowl-shaped, 4–7 cm across. *Calyx* unknown. *Petals* often 6, rarely 5 or 7, purple with dark reddish purple blotch at base, obovate or elliptic, 3.7–5 cm long, 1.7–3 cm wide, base cuneate, margin entire or irregularly denticulate and wavy near apex, apex rounded. *Stamens* numerous, radiating; *filaments* dark reddish purple, gradually whitish near apex, filiform, 6–12 mm long, slightly dilated toward base; *anthers* ellipsoid or oblong, 1–2 mm long, *thecae* pale yellow or whitish. *Ovary* ovoid or broadly ellipsoid, 6–10 mm long at anthesis, densely covered with hairs in close contact with each other; hairs dark purple, 0.3–2 mm long, branched at base, with many ridges running longitudinally on surface, with narrow and hollow pits inside hairs; main branches of hairs usually erect or ascending, straight, elongate, much longer than basal branches, rarely nearly equaling basal branches in length; basal branches to 0.3 mm long, radiating in various directions, often gradually upturned toward apex; main branches and basal branches with sharply pointed tips; *style* pale yellow, 1.5–4 mm long, often covered with dark purple branched hairs at base; *stigma* pale yellow, 4–9 mm long, 4- to 6-lobed; lobes linear-oblong. *Capsules* obovoid or ellipsoid, 1.7–2.8 cm long, 9–15 mm across, densely covered with branched hairs.

**Distribution:** CHINA. N Sichuan: Yanggong Shan, along boundary between Hongyuan and Heishui Xian, 3750–4000 m. Most plants in the population of *Meconopsis hispida* on Yanggong Shan are on the western side of the mountain range, but some are on the eastern side.

**Habitat and ecology:** among shrubs of *Spiraea*, *Salix*, and *Berberis* on mostly southwest-facing but occasionally southeast-facing slopes; rooting in moist, humus-rich gravelly soil.

**Additional specimen examined:** CHINA. N Sichuan: Hongyuan Xian, western side of Yanggong Shan (羊拱山), 32°13'39"N, 102°35'08"E, 3900 m, 18 July 2017, *T. Yoshida* K121 (KUN, TI).

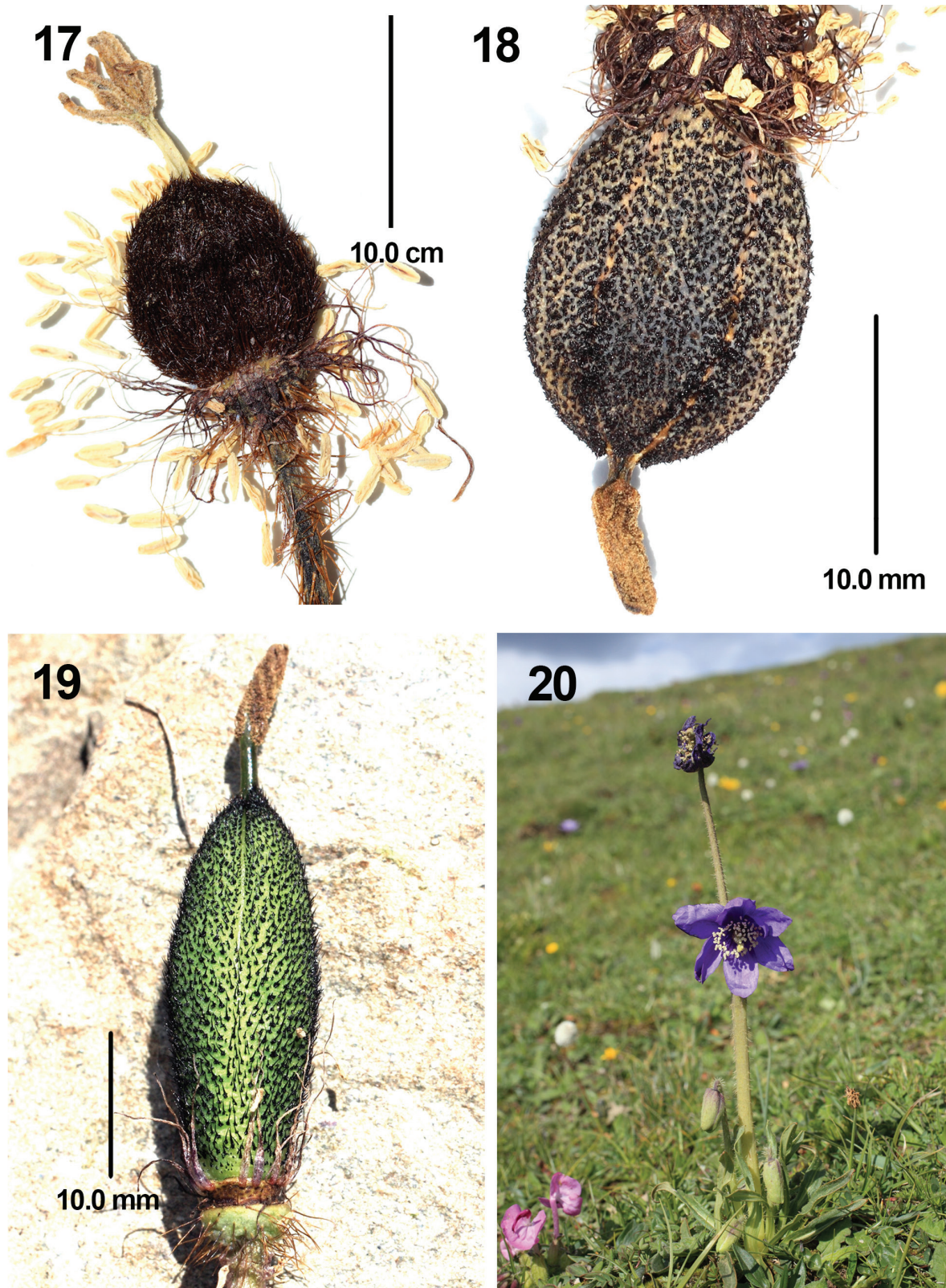


FIGURE 17–20. **17**, *Meconopsis hispida* T. Yoshida & H. Sun. Dried flower with petals removed, collected at type locality on 20 June 2016; ovary covered with dense bristles to 1.5 mm long. Photograph by T. Yoshida. **18**, *Meconopsis hispida* T. Yoshida & H. Sun. Dried flower just after flowering with petals removed, collected near type locality on 18 July 2017; developed ovary with dense bristles 0.3–0.7 mm long. Photograph by T. Yoshida. **19**, *Meconopsis hispida* T. Yoshida & H. Sun. Young fruit near type locality on 18 July 2017. Photograph by T. Yoshida. **20**, *Meconopsis trichogyna* T. Yoshida & H. Sun at type locality. Photograph by T. Yoshida, 14 July 2017.

*Meconopsis barbisetata* grows among dwarf shrubs on windy alpine slopes near the ridge. The flowering scapes often protrude slightly through the canopy of the shrubs. *Meconopsis hispida* grows among taller shrubs, occasionally in partial shade, on gentle slopes on the flank of mountains where the microclimate is milder.

We consider *Meconopsis hispida* to be intermediate between *M. barbisetata* and *M. psilonomma* Farrer var. *sinomaculata* (Grey-Wilson) H. Ohba in morphology and in distribution. The hairs on the ovary in *M. hispida* have ascending, straight, elongate tips similar to those of *M. psilonomma* var. *sinomaculata*, but have minute branches near their base similar to those of *M. barbisetata*. Yanggong Shan, where *M. hispida* occurs, is between Gonggaling, where *M. psilonomma* var. *sinomaculata* occurs, and Nianbao Yuze where *M. barbisetata* grows.

The specific epithet, *hispida*, derives from the branched hairs with sharply pointed tips on the ovary.

***Meconopsis trichogyna*** T. Yoshida & H. Sun, *sp. nov.* TYPE: CHINA. NW Sichuan: Dege Xian, Haizi Shan (海子山), 32°03'13"N, 99°00'43"E, 4450 m, 14 July 2017, T. Yoshida K119 (Holotype, KUN; Isotype, TI). Fig. 1, 20–24, 39–42.

*Meconopsis trichogyna* resembles *M. barbisetata* C. Y. Wu & H. Chuang ex L. H. Zhou in the hairs on the ovary with retrorse branches near the base, but differs from the latter in the color of the hairs: whitish in *M. trichogyna*, dark purple in *M. barbisetata*. The hairs of *M. trichogyna* are in two layers; an under layer of short hairs in close contact with each other and bending sharply in various directions, and an upper layer of longer hairs erect along the surface of the ovary (the hairs on the ovary of *M. barbisetata* are in a single layer). The inflorescence of *M. trichogyna* is racemose with a few basal flowers, while *M. barbisetata* has a solitary scape with a solitary flower. The flowers of *M. trichogyna* are dish- or bowl-shaped (*M. barbisetata* has a cup-shaped flower). *Meconopsis trichogyna* also resembles *M. lancifolia* (Franch.) Franch. ex Prain in the inflorescence and flower shape, but differs in having branched hairs on the ovary; the hairs on the ovary of *M. lancifolia* are unbranched.

*Herbs*, monocarpic, 12–28 cm tall in flower. *Taproot* elongate or dauciform, to 6 cm long or more, 6–9 mm across, distally gradually narrowed and with slender roots. Most parts of plant bristly; bristles pale green except on ovary. *Stem* (below lowermost flower) contracted, less than 6 mm long. *Leaves* crowded, petiolate; *petiole* membranous, broadly linear, 1.5–2.5 cm long, 1.5–2.5 mm wide; *lamina* oblong or linear-oblong, 2–8 cm long, 3–10 mm wide, base attenuate, margin entire, apex obtuse, acute or acuminate, both surfaces densely or moderately bristly. *Inflorescence* racemose and with few basal flowers, 3–5 flowers total; *peduncle* to 4 mm across when dried; *pedicels* 3–25 cm

long in flower; peduncle and pedicels with dense retrorse bristles; bristles to 2 mm long on small plants, to 4.5 mm long on large plants, those near flowers often tinged purple at apex. *Flowers* laterally facing, half-nodding or ascending, dish- or bowl-shaped, 4–7 cm across. *Calyx* 1–1.5 cm long, moderately or sparsely bristly. *Petals* 4–8, purple, obovate or elliptic, 2–3.8 cm long, 0.8–2 cm wide, base cuneate, margin entire or sometimes crenate and wavy near apex, apex obtuse or rounded, occasionally cleft toward base. *Receptacle* to 1.5 mm tall. *Stamens* numerous, radiating; *filaments* similar to petals in color, filiform, 6–9 mm long, gradually thickened toward base; *anthers* ellipsoid, ca. 1 mm long, *thecae* pale yellow. *Ovary* pale yellowish green, ovoid, 5–7 mm long, with dense whitish hairs; hairs with rounded ridges running longitudinally on surface, with hollow pits inside, with retrorse branches at base; hairs in two layers; hairs of under layer 0.2–0.5 mm long, densely covering whole surface of ovary, in close contact with each other, often bending sharply in various directions above basal branches; hairs of upper layer 1–2.5 mm long, rather soft, gradually thickened or dilated toward base, erect along surface of ovary and covering lower layer of hairs except near apex of ovary. *Style* pale yellowish green, 1–2.5 mm long. *Stigma* 1.5–3 mm long, 1.5–2.5 mm across, with 3–6 lobes. *Fruit* unknown.

**Distribution:** CHINA. NW Sichuan: Dege Xian, 4400–4550 m in elevation.

**Habitat and ecology:** northwest-, west-, and southwest-facing gentle slopes in grasslands, occasionally among dwarf shrubs of *Caragana* and *Rhododendron*.

*Meconopsis trichogyna* is endemic to the limited region around the type locality. Because of its small population, we consider it to be one of the most endangered species of *Meconopsis*.

Like the hairs on the ovary of *Meconopsis barbisetata*, those of *M. trichogyna* are also considered to prevent the ovary from freezing or chilling by retaining air on the surface of the ovary and provide a foothold for visiting pollinators.

The intricate branched hairs covering the ovary of *Meconopsis barbisetata*, *M. hispida*, and *M. trichogyna* are unique in *Meconopsis* and the basis for establishing the new series *Barbisetatae* for these species.

***Meconopsis* series *Barbisetatae*** T. Yoshida & H. Sun, *series nov.* Type species: *Meconopsis barbisetata* C. Y. Wu & H. Chuang ex L. H. Zhou.

Series *Barbisetatae* differs from other series of *Meconopsis* in the intricately entangled, hollow, branched hairs covering the ovary. The series is related to series *Henricanae* C. Y. Wu & H. Chuang and to *M. lancifolia* (Franch.) Franch. ex Prain in section *Forrestinae* C. Y. Wu & H. Chuang. More studies are needed to resolve the higher classification of the series.

#### KEY TO SPECIES OF SERIES *BARBISETATAE*

- 1a. Inflorescence racemose and with few basal flowers; flowers opening widely; hairs on ovary with root-like branches at base and several rounded ridges on surface . . . . . *M. trichogyna*  
 1b. Inflorescence a solitary scape and a solitary flower; flower cup-shaped. . . . . 2  
 2a. Hairs on ovary with branches at base, with many longitudinal ridges on surface and with straight, ascending, sharply pointed tips; branches of hairs often gradually upturned toward apex . . . . . *M. hispida*  
 2b. Hairs on ovary with branches in lower half, with several rounded longitudinal ridges on surface, usually incurved above branches, apex rather obtuse; branches of hairs retrorse and imbricate, not upturned toward apex . . . . . *M. barbisetata*

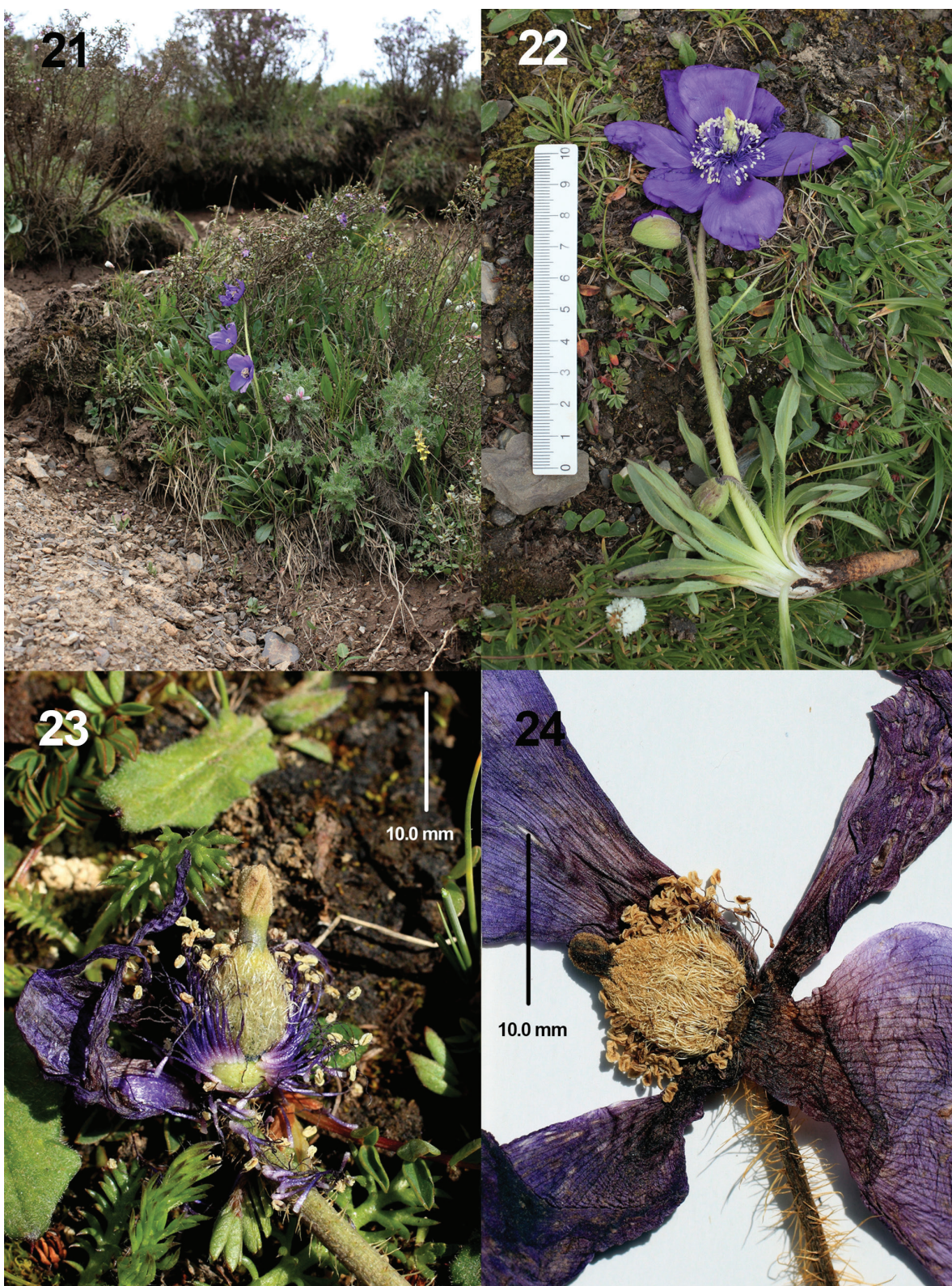


FIGURE 21–24. **21**, *Meconopsis trichogyna* T. Yoshida & H. Sun at type locality. Photograph by T. Yoshida, 14 July 2017. **22**, *Meconopsis trichogyna* T. Yoshida & H. Sun at type locality on 14 July 2017. Photograph by T. Yoshida. **23**, *Meconopsis trichogyna* T. Yoshida & H. Sun. Upper part of plant at end of flowering at type locality on 14 July 2017. Foreground stamens removed to show whitish hairs densely covering ovary, raised receptacle, and thickened base of filaments. Photograph by T. Yoshida. **24**, *Meconopsis trichogyna* T. Yoshida & H. Sun. Upper part of dried specimen collected at type locality on 14 July 2017. Foreground stamens removed to show ovary covered with two layers of hairs: hairs of lower layer to 0.5 mm long and densely covering whole ovary in close contact with each other; erect hairs of outer layer to 2.5 mm long, covering 2/3 of ovary from base. Photograph by T. Yoshida.

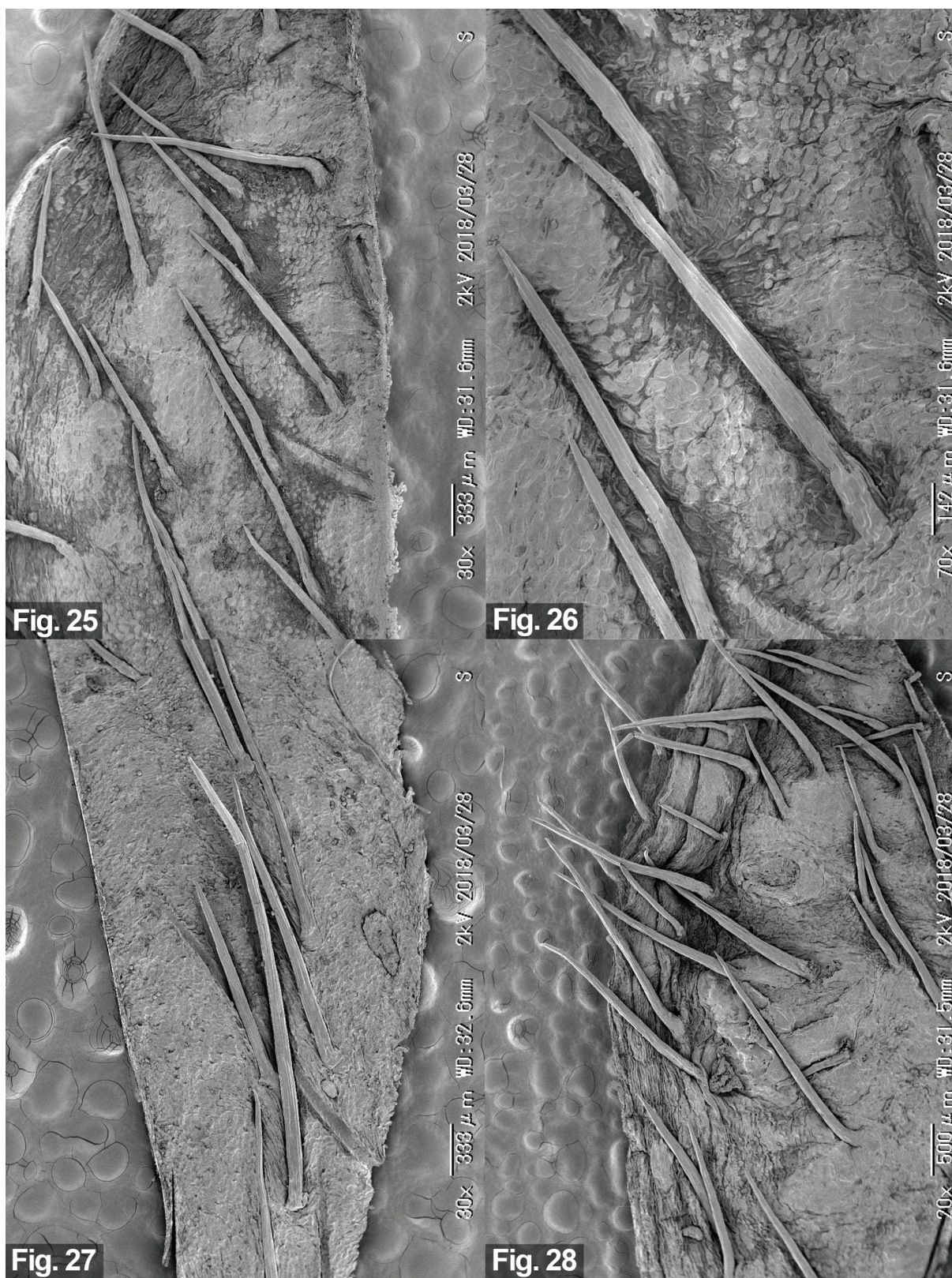


FIGURE 25–28. Scanning electron microscope images of the hairs on the dried ovary and capsules. **25–26**, *Meconopsis psilonomma* var. *psilonomma* (T. Yoshida K109). Ascending bristles on capsule; bristles with hard, sharply pointed apex and numerous fine longitudinal ridges on surface. **27**, *Meconopsis psilonomma* var. *sinomaculata* (T. Yoshida K116). Erect bristles on ovary at the end of flowering; bristles with sharply pointed hard apex and with numerous fine longitudinal ridges on surface. Lumpy surface of adhesive tape for attaching sample is visible around segment of ovary. **28**, *Meconopsis huanglongensis* (T. Yoshida K98). Ascending bristles on capsule; bristles with sharply pointed hard apex and numerous fine longitudinal ridges on surface.

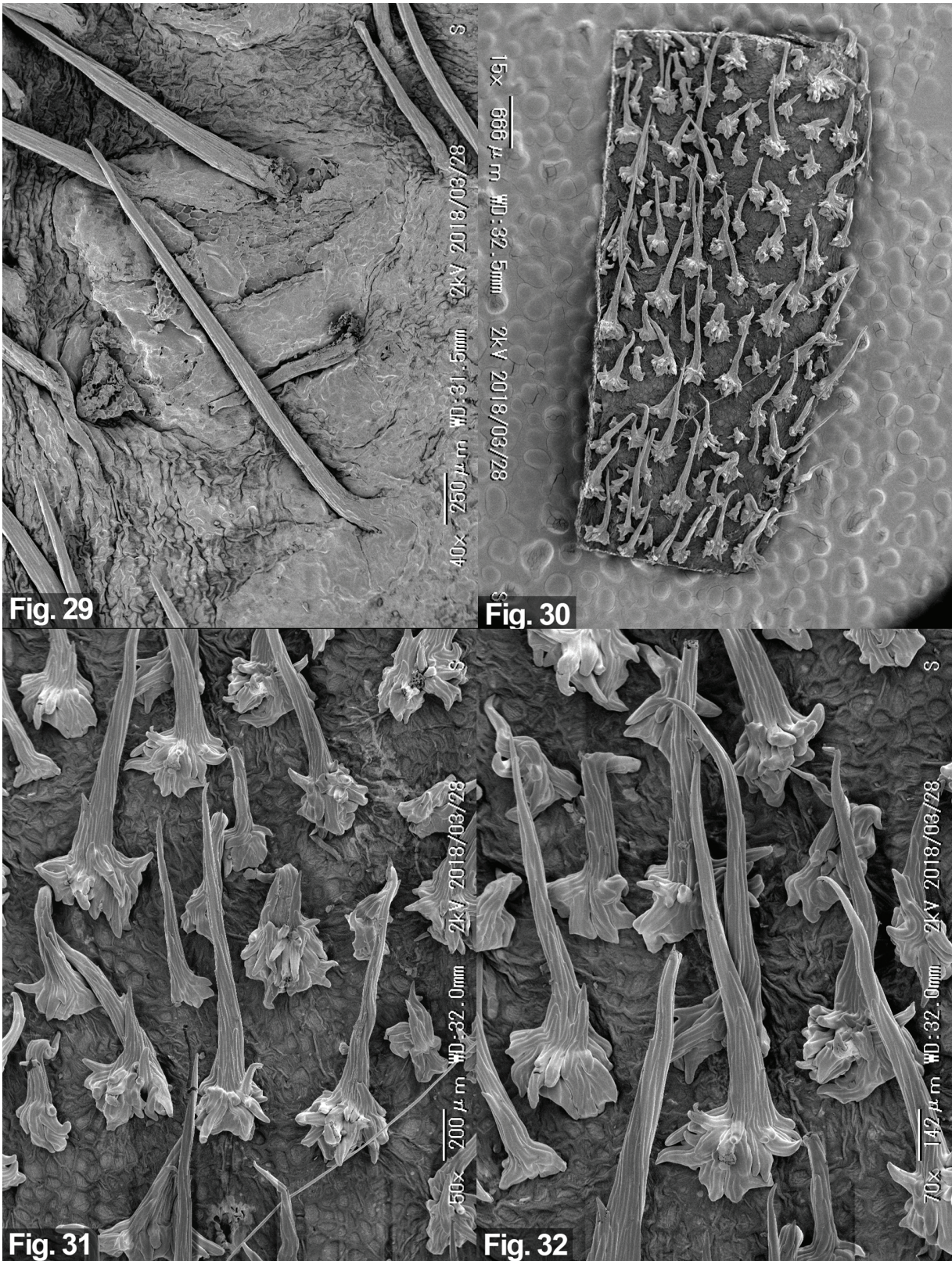


FIGURE 29–32. Scanning electron microscope images of the hairs on the dried capsule. **29**, *Meconopsis huanglongensis* (T. Yoshida K98). Ascending bristles on capsule; bristles with sharply pointed hard apex and numerous fine longitudinal ridges on surface. **30**, *Meconopsis hispida* (T. Yoshida K121). Ascending bristles on young capsule; segment of capsule on adhesive tape. **31–32**, *Meconopsis hispida* (T. Yoshida K121). Ascending bristles with sharply pointed apex and many rounded longitudinal ridges on surface and minute branches at base; branches often gradually upturned toward apex; hollow hairs are seen in cross section of branch of hair at upper right corner of Fig. 31.



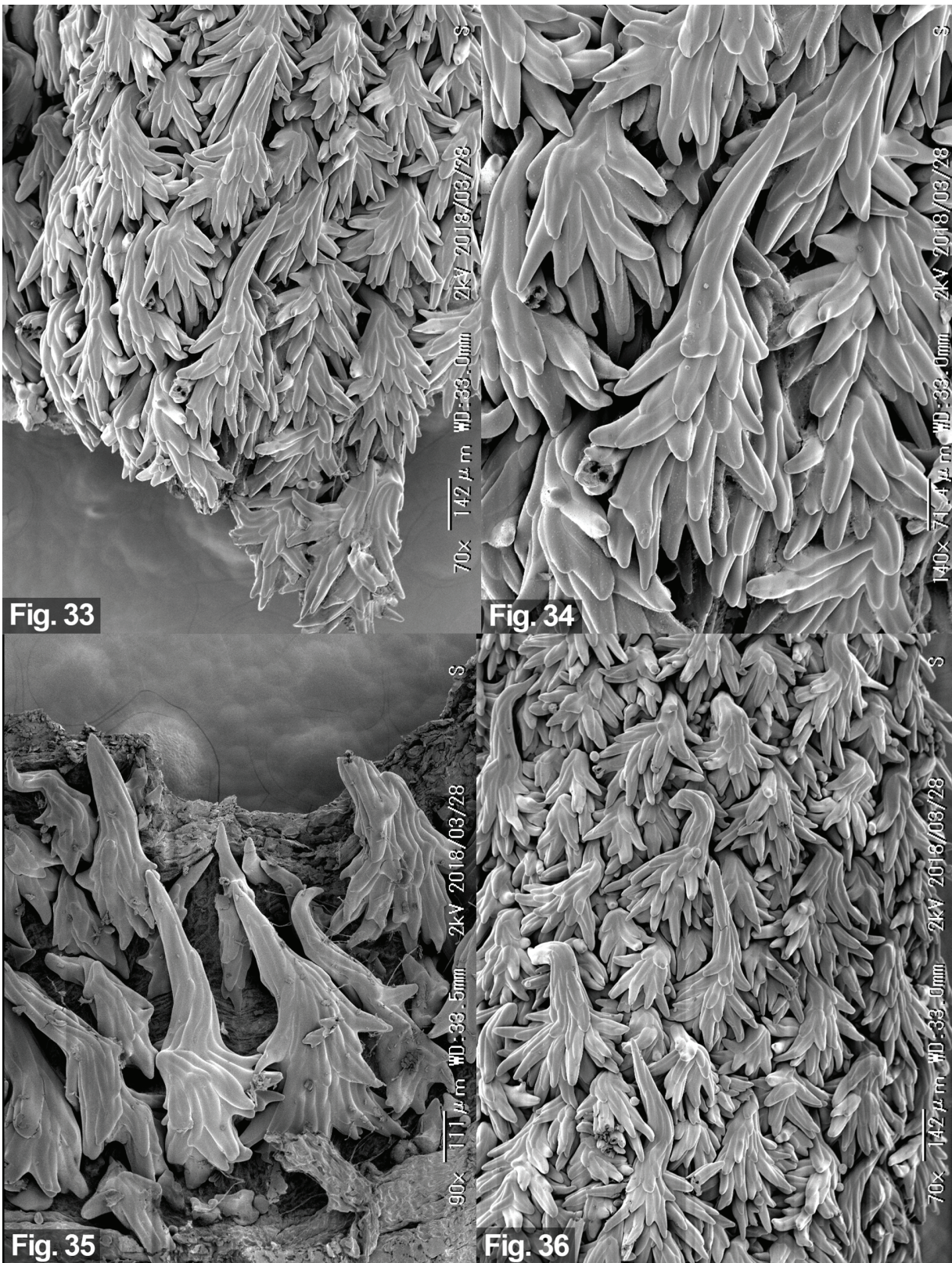


FIGURE 33–36. Scanning electron microscope images of the hairs on the dried ovary of *Meconopsis barbisetata* (T. Yoshida K100). Erect or ascending hairs on ovary; hairs often with obtuse apex, several rounded longitudinal ridges on surface and retrorse, imbricate branches on lower half of hairs; most erect hairs incurved above retrorse branches have tip inserted among bases of adjacent hairs. **33**, basal part of ovary with erect or ascending hairs; surfaces of broken branches of hairs in lower left of image show hairs gathered in clusters of several hollow hairs. **34**, ascending hairs near base of ovary; surfaces of broken branches of hairs are in lower left of image. **35**, ascending hairs near base of ovary. **36**, middle part of ovary.



FIGURE 37–40. Scanning electron microscope images of the hairs on the dried ovary. **37**, *Meconopsis barbisetata* (T. Yoshida K100). Upper part of ovary. **38**, *Meconopsis barbisetata* (T. Yoshida K100). Incurved hair near apex of ovary. **39**, *Meconopsis trichogyna* (T. Yoshida K119), basal part of ovary with erect long hairs and crowded short hairs; long hairs have many rounded longitudinal ridges on surface and sharply pointed tips; long hairs near the left margin of image are broken. **40**, *Meconopsis trichogyna* (T. Yoshida K119), basal part of long hairs with root-like retrorse branches, with rounded pollen adhering to hairs.

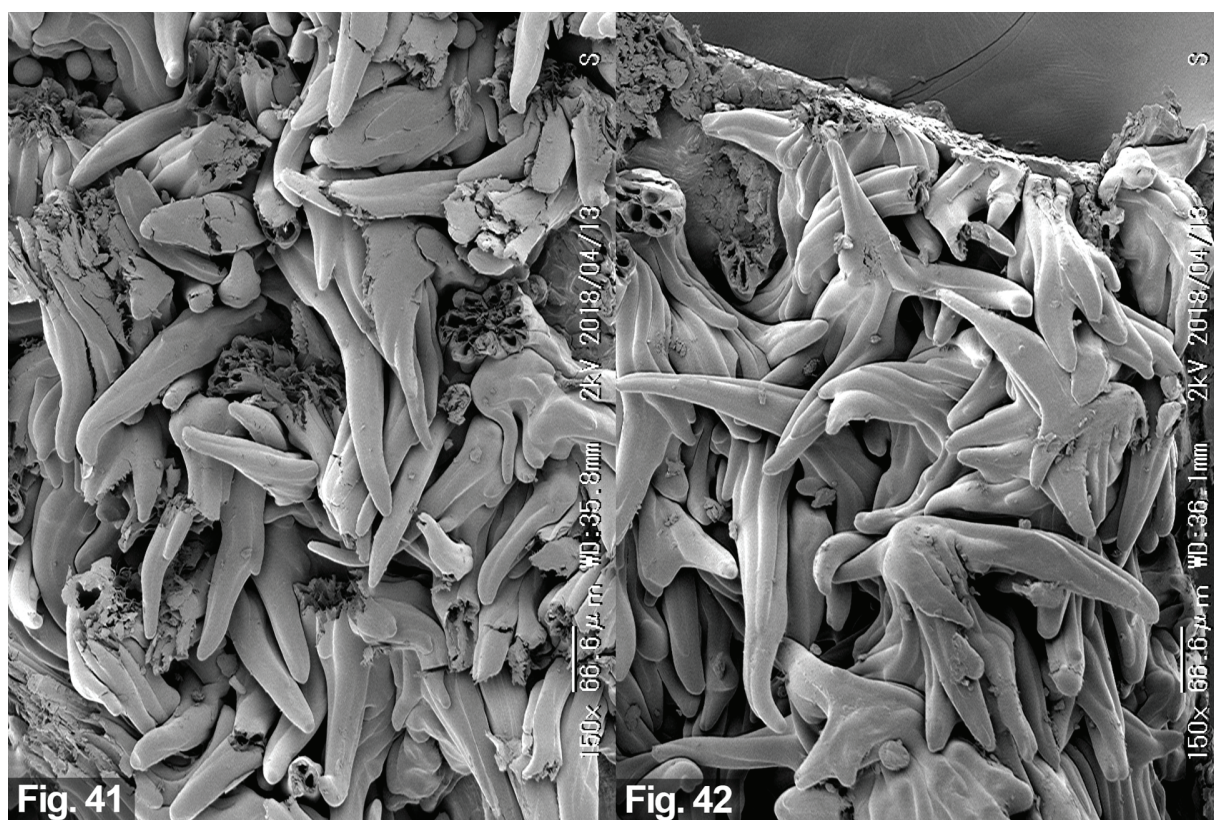


FIGURE 41–42. Scanning electron microscope images of the hairs on the dried ovary of *Meconopsis trichogyna* (T. Yoshida K119). **41**, basal part of ovary with long hairs broken off above base; surfaces of broken hairs imply that slender, long, hollow hairs are cohesive. **42**, upper part of ovary with crowded short hairs; short hairs often bend sharply in various directions above basal retrorse branches, few or several rounded ridges run longitudinally on surface of main and basal branches.

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