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Gaultheria marronina sp. nov. (Ericaceae) from Sichuan, China

Peter W. Fritsch, Lu Lu, Bo Xu, Hong Wang and De-Zhu Li

Gaultheria marronina, a new species from the Hengduan Mountain chain of western Sichuan Province, China, is described and illustrated. This species is similar to G. bryoides P. W. Fritsch & L. H. Zhou from the Gaoligong Mountains in its white fleshy calyx with a maroon capsule but differs in its stem setae 0.34–0.50 mm long, petioles 0.4–0.6 mm long, leaf blades 5.1–6.2 × 2.1–3.1 mm, overwintering flower bud pedicels 0.6–0.8 mm long, calyx lobes 2.2–3.0 mm long, and usually slightly open fruiting calyx, among other characters. The species is known only from two widely separated unprotected populations and is categorized as endangered.

Gaultheria Kalm ex L. (Ericaceae: Vaccinioideae: Gaultherieae) comprises about 135 species distributed primarily in eastern Asia, Malesia, and the Americas (Fritsch et al. 2008). The genus is generally defined by the combination of an evergreen habit, the presence of methyl salicylate, and a fleshy fruiting calyx, although the latter two features have been lost in various species. Gaultheria is likely paraphyletic in that the genera Diplycosia Blume and Tepuia Camp are phylogenetically nested within it (Bush et al. 2009, Fritsch et al. 2011).

Gaultheria series Trichophyllae was erected by Airy Shaw (1941) to accommodate species endemic to the Himalaya–Hengduan Mountains of eastern Asia with the combination of small leaves (i.e. generally <1 cm long), solitary axillary flowers, paired apical bracteoles, and five calyx and corolla lobes. The series was recognized in the most recent global revised classification of Gaultheria (Middleton 1991) and is strongly supported as monophyletic in molecular phylogenetic studies (Bush et al. 2009, Lu et al. 2010, Fritsch et al. 2011). Recent field expeditions to the mountains flanking the Salween (Nu) River in far western Yunnan Province by the first two authors and others have uncovered a number of new species in this series (Fritsch et al. 2008, 2015a, 2015b). An expedition to western Sichuan Province was undertaken in September 2011 in an attempt to locate populations of possible new Gaultheria species based on the collections of S. Y. Hu made in the 1940’s. This expedition resulted in the discovery of a population with fruit morphology unknown in any other species of Gaultheria. The following spring the third author encountered a separate population with the same fruit morphology, and in June 2015 the second author returned to the 2011 locality and collected the plants in full flower. These populations are here described and illustrated as a new species. This discovery raises the number of species recognized in the section to 18 (Fritsch et al. 2015a, 2015b).

Gaultheria marronina P. W. Fritsch & Lu Lu sp. nov. (Fig. 1–2)

Haec species Gaultheriae bryoidi P. W. Fritsch & L. H. Zhou simillima, sed ab eo setis ramorum 0.34–0.50 mm longis, petiolis 0.4–0.6 mm longis, laminis 5.1–6.2 × 2.1–3.1 mm, dentibus marginalibus laminae 3 to 6 in quoque latere, pedicellis gemmarum florifer is 0.6–0.8 mm longis, gemmis floralibus 0.9–1.3 × 0.6–1.0 mm, calycibus fructuum subglobo se-cupuliformibus truncatis 5–8 × 6–8 mm plerumque leviter aperitis differt.

Type: China. Sichuan Province: Tianquan County, Yazikou Pass, old state road from Tibet to Sichuan, above tunnel on Highway G318, summit ridge of Erlang Shan, 29.86113N, 102.29115E, 2908 m a.s.l., 16 Sep 2011, L. Lu and P. W. Fritsch LL-2011-37 (holotype: KUN, isotypes: CAS, E, GH, K, MO).

Etymology
The epithet marronina refers to the maroon capsule of the species. Among the species of Gaultheria series Trichophyllae, a capsule consistently with this color is known only in this species and in G. bryoides.
Figure 1. Images of *Gaultheria marronina* sp. nov. and its habitat. (A) habit, flowering plants, (B) habitat in the Erlang Shan, western Sichuan Province, China, on the steep bank of a road cut and rock outcrop near the summit; plants of the species can be seen in the lower center of the image, (C) flower in lateral view with subtending bracteoles and part of the pedicel, (D) flower in apical view showing stamens and stigma, (E) habit, fruiting plants, (F) fruit, oblique view. Photographs: (A), (C)–(D) from L. Lu; (B), (E) from P. W. Fritsch; (F) from B. Xu. Scale bars: (A) ca 4 cm, (C)–(D) 3 mm, (E) 3 cm, (F) 5 mm.
Prostrate shrublet with stems to 4 cm long from horizontal stolons, hermaphroditic. Current-year branchlets brown proximally, pale green and strongly flushed red above distally, to 2.5 cm long, not puberulent, with appressed-uncinate or ascending straight or slightly undulate setae, longer setae 0.34–0.50 mm long. Internodes among largest leaves averaging 0.65–1.10 mm long. Petioles 0.4–0.6 mm long, abaxially glabrous, adaxially glabrous or with sparse white puberulence in a line, their margins entire. Longer leaf blades elliptic, slightly rhombic, or slightly obovate, planar to cupped, 5.1–6.2 × 2.1–3.1 mm, 1.8–2.4 times as long as wide, thick-chartaceous to subcoriaceous, abaxially dull pale green except glossy green near margin, glabrous, adaxially glossy green, glabrous except for often sparse white puberulence proximally on midvein; midvein abaxially planar or raised, not thickened immediately below apical gland, adaxially impressed; secondary veins obscure on both sides; base cuneate; margin proximally one-fifth to one-half entire, otherwise serrulate, slightly thickened, slightly revolute; marginal teeth (setae) 3 to 6 per side, often incurved and lying atop or adjacent to upper leaf surface, the longer 0.14–0.20 mm long; apex acute to obtuse, tip with planar or upward-pointing apical gland and midvein not thickened immediately below apical gland. Overwintering flower bud pedicels 0.6–0.8 mm long, glabrous, overwintering flower buds 0.9–1.3 × 0.6–1.0 mm, slightly compressed laterally, 1.3–1.5 times as long as wide, glabrous, bracteoles slightly keeled, their margins not ciliolate. Flowers 3.0–3.5 mm long. Calyx green, 3.0–3.4 mm long; lobes narrowly deltoid, 2.2–3.0 × 1.3–1.7 mm, glabrous, with ciliolate margin and sharply acute apex. Corolla greenish white or white, campanulate, 2.8–3.2 × 3.0–4.2 mm; lobes 1.0–1.2 × 1.0–1.7 mm. Stamens 10; filaments gradually narrowed from base

Figure 2. *Gaultheria marronina* sp. nov. (A) habit, fruiting plant, (B) leaf, abaxial view, (C) end of branchlet with leaf bases and flower bud, (D) flower with subtending bracteoles and part of pedicel, (E) stamen, ventral view, (F) stamen, lateral view, (G) nectar glands and gynoecium, (H) fruit, lateral view, (I) fruit, apical view. (A)–(B) from L. Lu and P. W. Fritsch LL-2011-37 (CAS); (C)–(G) from L. Lu and M. Y. Zhang LL-2015-01 (CAS); (H)–(I) from L. Lu and P. W. Fritsch LL-2011-37 (CAS) and images of the living plant.
to apex, 0.5–0.6 mm long; anthers yellow, with cells 0.5–0.6 mm long and with 1 awn per theca 0.12–0.30 mm long. Style 1.0–1.5 mm long; stigma pink. Fruiting pedicel 1.5–2.0 mm long. Fruiting calyx subglobose-cupuliform, truncate at base in outline, slightly open or rarely closed, 5–8 × 6–8 mm, its outer and inner wall pure white; lobes 2.5–4.5 mm, deltoid, erect or usually incurved, with smooth eciliolate apex. Capsule maroon, exceeded by calyx lobes.

**Distribution, habitat and phenology**

*Gaultheria marronina* is known from five collections, only three of which can be mapped with precision. It was twice collected in the Erlang Mountains of the Hengduan Mountain chain in western Sichuan Province, China, growing on a slope in moss under *Rhododendron* mixed secondary forest with ferns, *Abies* and *Rubus* in clay loam soil with black humus on mixed metamorphic and sedimentary bedrock at 2908–2918 m a.s.l., and once near Dujiangyan City. These two localities are separated by ca 200 km. The other two collections, both by S. Y. Hu, are only documented to the level of Sikang Province, a former administrative unit of China that is now part of western Sichuan Province. We observed individuals of the species flowering in June, and fruiting individuals in September, with some fruits from the previous season observed still remaining on the plants in June.

**Conservation status**

The geographic distribution of *Gaultheria marronina* is known with certainty from only three collections; the locality information on the labels of two other known collections is too vague to map with more precision than from the area of western Sichuan Province (i.e. the area of the former Sikang Province referred to on the labels). Neither of the known localities lies within protected areas, and mining, grazing, and dam-building activities in the Erlang Shan region suggest a projected decline. As calculated with the aid of GeoCAT (Bachman et al. 2011), the area of occupancy (AOO) is 8 km². The Erlang population extends only ca 30 m along a road bank. In accordance with the criteria specified in IUCN (2014), we categorize this species as ‘Endangered’ (EN): B2ab(iii).

**Similar species**

*Gaultheria marronina* is easily distinguished from all others in *Gaultheria* series *Trichophyllae* by several distinctive characters. Its consistently maroon capsule alone distinguishes it from all species of the series except for *G. bryoides*, a species from the Adung Valley of northern Myanmar (Fritsch et al. 2008) and the Dulong Valley in the Gaoligong Mountains in Yunnan Province, China (PWF and LL pers. obs.). In all other species of the series the capsule is typically green, or only rarely maroon in *G. eciliata* (S. J. Rae & D. G. Long) P. W. Fritsch & L. H. Zhou and *G. sinensis* J. Anthony.

In addition to the capsule color, *Gaultheria marronina* and *G. bryoides* share elliptic, slightly tomentose, or slightly obovate leaf blades with sparse white puberulence proximally on the midvein, narrowly deltoid and eciliolate calyx lobes, anthers with 1 awn per theca, and fruits with a white mature calyx. However, *G. marronina* is distinguished from...
G. bryoides by many other characters, i.e. stem setae 0.34–0.50 mm long (vs 0.20–0.24 mm), petioles 0.4–0.6 mm long (vs 0.2–0.4 mm), leaf blades 5.1–6.2 × 2.1–3.1 mm (vs 2–3 × 1.2–1.6 mm), leaf blade marginal teeth (setae) 3 to 6 per side (versus 0 to 3 per side), overwintering flower bud pedicels 0.6–0.8 mm long (vs 0.1–0.2 mm), overwintering flowering buds 0.9–1.3 × 0.6–1.0 mm (vs 0.7–0.9 × 0.5–0.6 mm), calyx lobes 2.2–3.0 mm long (vs 1.5–2.0 mm), and a fleshy calyx that is subglobose-cupuliform and usually slightly open, 5–8 × 6–8 mm, with a truncate base in outline (versus globose and closed, 4–6 × 4–6 mm, and a rounded base).

The new species is also distinguished from most species of Gaultheria series Trichophyllae by its pure white fruiting calyx. Other than this species and G. bryoides, the only species of the series with consistently pure white fruiting calyces are G. cardiosepala Hand.-Mazz., G. nivea (J. Anthony) Airy Shaw, and G. thymifolia Stapf ex Airy Shaw. The new species is distinguished from these not only by the maroon (versus green) capsule, but also by a prostrate or prostrate-ascending habit (versus ascending-erect), the distal leaf blade marginal teeth of at least some leaves lying atop or adjacent to the upper leaf surface (versus oriented off the surface), and an open fruiting calyx (versus closed; Table 1). The only other species with a white fruiting calyx, i.e. G. ciliisepala Airy Shaw ex P. W. Fritsch & Lu Lu, G. hypochlora Airy Shaw, and G. stenophylla P. W. Fritsch & Lu Lu, have a blue and white fruiting calyx color polymorphism (Fritsch et al. 2011b). Gaultheria marronina is easily distinguished from all these species by its glabrous calyx margins (versus ciliolate; Table 1).

Additional specimens examined (paratypes)
China. Sichuan Province: Sikang, precise location not specified, S. Y. Hu 2454 (KUN); Sikang, precise location not specified, year 1931, S. Y. Hu 2517 (KUN); Tianquan County, Yazikou Pass, old state road from Tibet to Sichuan, above tunnel on Highway G318, summit ridge of Erlang Shan, 29.52797°N, 102.29208°E, 2918 m a.s.l., 10 Jun 2015, L. Lu and M. Y. Zhang LL-2015-01 (CAS, KUN); Dujiangyan City, Kuailongzigu, Hongkou Village, 31°19′16″N, 103°35′50″E, 28 May 2012, B. Xu and Y.-D. Gao s.n. (CDBI).

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