

The Flowering Plant Genus *Gaultheria* (Ericaceae) in the Gaoligong Shan, along the Border Region of China and Myanmar

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A taxonomic revision of the flowering plant genus *Gaultheria* (Ericaceae) in the Gaoligong Shan region of western Yunnan Province and extreme southeastern Xizang Province (Tibet) in China, and eastern Kachin State in northern Myanmar (Burma), is presented. Twenty-four species, three of which (*G. bryoides*, *G. notabilis*, and *G. pseudonotabilis*) are endemic, and two varieties (of *G. leucocarpa*) are recognized from the region. One new species (*G. bryoides*) is described from northern Myanmar, one new combination (*G. eciliata*) is made, and lectotypes are designated for *G. dumicola*, *G. forrestii*, *G. hookeri*, *G. repens*, *G. suborbicularis*, *G. tetramera*, and *G. veitchiana*. The treatment includes a key to species, descriptions, specimen citations, and images or illustrations of some species. Also included are species distribution maps based on estimates of geographic coordinates of old collections and GPS-derived coordinates of more recent collections.

KEYWORDS: Burma, China, Ericaceae, Gaoligong Shan, *Gaultheria*, Kachin, Myanmar, Taxonomy, Tibet, Xizang, Yunnan.

高黎贡山白珠属

本文对位于中国云南西部和西藏东南部至缅甸北方克钦邦东部的高黎贡山地区有花植物类群白珠属进行了系统修订。研究确认该地区有二十四种及两变种本属植物，其中含三个高黎贡山特有种 (*G. bryoides*, *G. notabilis*, 和 *G. pseudonotabilis*)，一个新组合 (*G. eciliata*)， 并一个采自缅甸北部的新种 (*G. bryoides*)。并对全部二十四种中的七个种 (*G. dumicola*, *G. forrestii*, *G. hookeri*, *G. repens*, *G. suborbicularis*, *G. tetramera*, 和 *G. veitchiana*) 进行了模式选定。这一修订包括了分种检索表、文献引证、种的特征描述，以及根据目前可得到的全部新老标本资料估算得出的地理信息所绘制的种分布图。

关键词：高黎贡山、中国、云南、西藏、 缅甸、克钦邦、杜鹃花科、白珠属、分类订正。

As part of a long-term, large-scale multidisciplinary biotic survey and inventory of the Gaoligong Shan (GLGS), we have begun to examine the taxonomy of several groups of vascular plants in this region for which we have expertise. The GLGS is a 600 km-long high-elevation mountain range that over much of its length straddles the border between China and Myanmar. The GLGS is situated at the heart of a vast biodiversity hotspot, i.e., a region of high levels of biodiversity under severe threat of destruction through human activity (Li et al. 2000; Stotz et al. 2003;

Liu and Kress 2005; Chaplin 2006). Our first treatment of GLGS vascular plants, that of the Symplocaceae (Zhou et al. 2006), served as a model for forthcoming treatments of other vascular plant groups of interest to us. Here, we follow up the treatment of Symplocaceae of the GLGS with one for the flowering plant genus *Gaultheria* Kalm ex Linnaeus.

Gaultheria contains about 135 species within the Ericaceae (heath family) distributed throughout eastern Asia and much of the Americas, with several species also in southern Australia, Tasmania, and New Zealand. The group includes species that are the original sources of wintergreen oil (methyl salicylate), commonly used in the confection industry and medicine. Several species of *Gaultheria* in the GLGS possess significant quantities of the oil (e.g., *G. fragrantissima*, *G. griffithiana*), and in these a strong wintergreen odor emanates from the leaves when they are crushed. The genus is distinctive among members of the Ericaceae by its fruit, a dry capsule or berry surrounded by a typically expanded and brightly colored fleshy calyx, which is presumably eaten by birds that disperse it.

Based on molecular data alone and in combination with morphology, Kron et al. (2002) have demonstrated that *Gaultheria* forms a clade with *Chamaedaphne* (Linnaeus) Moench, *Diplycosia* Blume, *Leucothoe* D. Don, and *Tepuia* Camp. This clade is thought to be diagnosable by 4-appendaged anthers and a base chromosome number of 11, although appendages have been modified or lost in some species, and *Diplycosia* has a base chromosome number of 9 or 18. The delimitation and relationships of both *Diplycosia* (ca. 100 species, Southeast Asia and Malesia) and *Tepuia* (seven species, northern South America) relative to *Gaultheria* are poorly understood, although there is evidence that at least several species of *Diplycosia* nest phylogenetically within *Gaultheria* (Powell and Kron 2001).

Airy Shaw (1941), based in part on the work of Copeland (1931), provided a classification of the Asian and temperate North American species of *Gaultheria*, dividing them into five sections and six series. Middleton (1991) incorporated most of Airy Shaw's scheme in his global classification of the genus, while altering some ranks and circumscriptions as needed. The GLGS species fall into four sections and six series of Middleton. Section *Chiogenopsis* D.J. Middleton, based on leaves usually less than 1 cm wide, two bracteoles inserted immediately beneath the calyx, solitary flowers, and glabrous corolla, includes series *Hispidulae* Airy Shaw (flowers tetramerous: *G. suborbicularis*) and series *Trichophyllae* Airy Shaw (flowers pentamerous: *G. cardiosepala*, *G. dolichopoda*, *G. hypochlora*, *G. nivea*, *G. sinensis*, *G. thymifolia*, and *G. trichophylla*; also *G. bryoides* and *G. eciliata*, not included in Middleton's account, can be included here). Section *Monoanthemona* D.J. Middleton, based on leaves more than 10 mm long, pluribracteolate pedicels, and solitary flowers, includes series *Nummularioideae* Airy Shaw (*G. nummularioides*). Section *Brossaeopsis* Airy Shaw, based on flowers in racemes and leaf venation melastomataceous, includes series *Dumicola* Airy Shaw (raceme very short and flowers ca. 5 mm long: *G. dumicola* and *G. notabilis*) and series *Codonanthae* D.J. Middleton (raceme longer and corolla more than 10 mm long: *G. pseudonotabilis* can be placed here). Section *Brossaea* (Linnaeus) D.J. Middleton, based on flowers in racemes and leaf venation pinnate, includes the remainder of the GLGS species, all in two series of subsection *Botryphoros* D.J. Middleton: series *Gymnobotrys* (Airy Shaw) D.J. Middleton (raceme eperulate, slender, and usually geniculate: *G. leucocarpa*) and series *Leucothoides* (Airy Shaw) D.J. Middleton (raceme usually perulate, usually not slender or geniculate: *G. cuneata*, *G. discolor*, *G. fragrantissima*, *G. griffithiana*, *G. hookeri*, *G. praticola*, *G. pyrolifolia*, *G. semi-infera*, and *G. wardii*).

Prior taxonomic treatments of *Gaultheria* that include the GLGS region differ in various ways. Xu (1986a) recognized 19 species from Yunnan Province, and Xu (1986b) recognized 14 from Xizang Autonomous Region (Tibet). Xu (1991a, b) recognized 26 Chinese species for the *Flora*

Reipublicae Popularis Sinicae. Eight *Gaultheria* species with a distribution in China were subsequently described as new by Fang (1999), and these plus one other missed by Xu (1991a; *G. codonantha* Airy Shaw) were included in the treatment of the genus for the *Flora of China* (Fang and Stevens 2005). Eighteen species of *Gaultheria* were listed in Kress et al. (2003) for Myanmar (Burma), one of which (*G. stapfiana* Airy Shaw) was later reduced to synonymy by Fang and Stevens (2005; also listed is *Diplycosia discolor* Nuttall ex J.D. Hooker (\equiv *G. discolor*) and *G. pyroloides* Miquel (a Japanese and Alaskan species)). The *Flora of Gaoligong Mountain* (Li et al. 2000), comprising a list of all vascular plant species in the GLGS known up to the time of its publication, included 20 species of *Gaultheria*, one of which (*G. forrestii* Diels) was later reduced to synonymy by Fang and Stevens (2005).

Our treatment modifies the above numbers of species of *Gaultheria* for particular areas in the following ways: 25 species known from Yunnan Province, 23 from Xizang Autonomous Region,

TABLE 1. Species richness and endemism of *Gaultheria*, by region. *, endemic. Those species bearing author names are not treated in this paper.

Region	No. species/ No endemics	Species
Yunnan	25/3	<i>G. cardiosepala</i> , <i>G. cuneata</i> , <i>G. discolor</i> , <i>G. dolichopoda</i> , <i>G. dumicola</i> , <i>G. eciliata</i> , <i>G. fragrantissima</i> , <i>G. griffithiana</i> , <i>G. hookeri</i> , <i>G. hypochlora</i> , <i>G. jingdongensis</i> R.C. Fang*, <i>G. leucocarpa</i> , <i>G. nivea</i> , <i>G. notabilis</i> *, <i>G. nummularioides</i> , <i>G. praticola</i> , <i>G. prostrata</i> , <i>G. pseudonotabilis</i> *, <i>G. pyrolifolia</i> , <i>G. semi-infera</i> , <i>G. sinensis</i> , <i>G. suborbicularis</i> , <i>G. thymifolia</i> , <i>G. trichophylla</i> , <i>G. wardii</i>
Xizang (Tibet)	23/4	<i>G. brevistipes</i> (C.Y. Wu & T.Z. Hsu) R.C. Fang*, <i>G. codonantha</i> , <i>G. cuneata</i> , <i>G. dolichopoda</i> , <i>G. eciliata</i> , <i>G. fragrantissima</i> , <i>G. griffithiana</i> , <i>G. heteromera</i> R.C. Fang*, <i>G. hookeri</i> , <i>G. hypochlora</i> , <i>G. nivea</i> , <i>G. nummularioides</i> , <i>G. praticola</i> , <i>G. purpurea</i> R.C. Fang*, <i>G. pyrolifolia</i> , <i>G. semi-infera</i> , <i>G. sinensis</i> , <i>G. straminea</i> R.C. Fang ¹ , <i>G. suborbicularis</i> , <i>G. thymifolia</i> , <i>G. trichophylla</i> , <i>G. trigonoclada</i> R.C. Fang*, <i>G. wardii</i>
China	34/14	<i>G. borneensis</i> , <i>G. brevistipes</i> *, <i>G. cardiosepala</i> , <i>G. codonantha</i> , <i>G. cuneata</i> *, <i>G. discolor</i> , <i>G. dolichopoda</i> , <i>G. dumicola</i> , <i>G. eciliata</i> , <i>G. fragrantissima</i> , <i>G. griffithiana</i> , <i>G. heteromera</i> *, <i>G. hookeri</i> , <i>G. hypochlora</i> , <i>G. jingdongensis</i> *, <i>G. leucocarpa</i> , <i>G. longiracemosa</i> Y.C. Yang*, <i>G. nivea</i> *, <i>G. notabilis</i> *, <i>G. nummularioides</i> , <i>G. praticola</i> *, <i>G. prostrata</i> *, <i>G. pseudonotabilis</i> *, <i>G. purpurea</i> *, <i>G. pyrolifolia</i> , <i>G. semi-infera</i> , <i>G. sinensis</i> , <i>G. straminea</i> l, <i>G. suborbicularis</i> *, <i>G. taiwaniana</i> S.S. Ying*, <i>G. thymifolia</i> , <i>G. trichophylla</i> , <i>G. trigonoclada</i> *, <i>G. wardii</i>
Myanmar (Burma)	19/1	<i>G. bryoides</i> *, <i>G. cardiosepala</i> , <i>G. discolor</i> , <i>G. dolichopoda</i> , <i>G. dumicola</i> , <i>G. fragrantissima</i> , <i>G. griffithiana</i> , <i>G. hookeri</i> , <i>G. hypochlora</i> , <i>G. laxiflora</i> Diels, <i>G. leucocarpa</i> , <i>G. nummularioides</i> , <i>G. punctata</i> Blume, <i>G. pyrolifolia</i> , <i>G. semi-infera</i> , <i>G. sinensis</i> , <i>G. thymifolia</i> , <i>G. trichophylla</i> , <i>G. wardii</i>
Gaoligong Shan	24/3	<i>G. bryoides</i> *, <i>G. cardiosepala</i> , <i>G. cuneata</i> , <i>G. discolor</i> , <i>G. dolichopoda</i> , <i>G. dumicola</i> , <i>G. eciliata</i> , <i>G. fragrantissima</i> , <i>G. griffithiana</i> , <i>G. hookeri</i> , <i>G. hypochlora</i> , <i>G. leucocarpa</i> , <i>G. nivea</i> , <i>G. notabilis</i> *, <i>G. nummularioides</i> , <i>G. praticola</i> , <i>G. pseudonotabilis</i> *, <i>G. pyrolifolia</i> , <i>G. semi-infera</i> , <i>G. sinensis</i> , <i>G. suborbicularis</i> , <i>G. thymifolia</i> , <i>G. trichophylla</i> , <i>G. wardii</i>

¹Fang and Stevens (2005) considered *Gaultheria straminea* to be endemic to China, but the label information of the specimen *F. Kingdon Ward 8134* (K) states that this collection was from the Delei Valley in Assam, India.

34 species total from China, 19 species from Myanmar, and 24 from GLGS (Table 1). The GLGS harbors 23/34 (68%) of all *Gaultheria* species known from China, 18/19 (95%) of all *Gaultheria* species known from Myanmar, and 24/37 (65%) of all *Gaultheria* species known from the two countries combined. Adjacent regions have substantially fewer species of *Gaultheria*. For example, Sichuan Province has nine species, Guizhou Province three species, and Guangxi Province one species (Fang and Stevens 2005), Bhutan ten (Rae 1991), Nepal seven (Hara 1982) and all of Malasia 24 (Sleumer 1966). Furthermore, all of the species from Guizhou, Guangxi, Bhutan, and Nepal also occur in the GLGS. Based on these data and data from other floras, it is clear that the GLGS lies at the heart of the major center of diversity for *Gaultheria* species in eastern Asia, possessing more species of this genus than any area of comparable size in either Asia or Malasia.

MATERIALS AND METHODS

The materials and methods generally follow those in “The Symplocaceae of Gaoligong Shan” (Zhou et al. 2006), with the following modifications. Approximately 1176 collections were studied, 835 of which were ultimately determined to originate from the GLGS. The material examined comprises the GLGS collections from KUN, the herbarium with the richest collection in SW China, and also those from A, BM, CAS, E, GH, K, and P. Some images of specimens from other herbaria (e.g., type specimens at L and NY) were examined via the World Wide Web, where noted.

Many of the collections have resulted from a biotic survey and inventory project primarily involving staff from KUN, CAS, and E, at which the first, second, and third sets from most of these expeditions, respectively, have been deposited. There have been 14 collecting expeditions undertaken in the context of this inventory (all planned expeditions with a vascular plant component for the project have now been carried out), and all specimens from these expeditions have been processed and accessioned at CAS and KUN for study. All of these expeditions use the same series of collecting numbers and are referred to herein as “GLGS” collections. The various teams collecting under this number series that appear on specimen labels are listed in Appendix 1, as are abbreviations for other major collectors or collecting teams (with ten or more *Gaultheria* collections) that have conducted expeditions to the Gaoligong Shan.

The number of synonyms is few in this work relative to that in Zhou et al. (2006) for *Symplocos*, and we have designated several lectotypes and made substantially more taxonomic changes than in Zhou et al. (2006). Thus, in contrast to Zhou et al. (2006), we include full citation of types for all synonyms.

Where a single measurement is used, it indicates length. Leaf blade measurements are from the larger leaves on each specimen. Leaf blade color and fruiting calyx lobe shape were assessed in the dry state. Anthers were measured from the base to the terminal pores (i.e., excluding awns).

The Chinese names of taxa are from Xu (1981, 1986a), Fang (1999), and Fang and Stevens (2005). New Chinese names are published here for *Gaultheria bryoides* (拟苔藓白珠), *G. discolor* (苍白叶白珠), *G. eciliata* (须毛白珠), and *G. thymifolia* (细叶白珠) because there are no current Chinese names available for these taxa.

For a map of Chinese counties (Xian) and Myanmar Districts included in the GLGS region cited in this work, see Zhou et al. (2006: Figure 3). For the present paper, we employ the spellings for Myanmar townships from Global Administrative Areas (GADM version 0.6 <http://biogeo.berkeley.edu/gadm/>) in the file Mmr4.shp. A list of species recognized, and an index to exsiccatae that we have examined for this study, are provided in Appendices 2 and 3. It is unclear from some label data whether collections made before the year 1949 with a locality of Gongshan Xian or Tsarong Xiang in Zayü Xian were made on the west (i.e., within the GLGS) or east (i.e.,

outside of the GLGS) side of the Nujiang. We chose to include such specimens in our treatment. The data on the labels of a few GLGS team collections conflict for county and township versus geographic coordinates due to uncertainty in the field as to the location of the county border (particularly at the southern end of Fugong Xian). In these cases, we cite the specimens in their correct county and township but indicate the mistake on the labels in brackets. It is unclear from label information whether many of the collections from Fugong Xian (including the former Bijiang Xian, which is now part of Fugong Xian) were from the east or west side of the Nujiang, although most were probably from the east side. We have included these collections in the citations but have not plotted them on the maps. A number of collections have a locality with the name “Hpimaw” in Myanmar (i.e., *R.J. Farrer 895, 990, 1068; Sukoe 10080; F. Kingdon Ward 1691*), which we interpret as the same name as “Pianma” in Lushui Xian of Yunnan, China. Similarly, we interpret localities with the name “Hpimaw Pass” in Myanmar as the same name as “Pianma Pass” at the crest of the GLGS in China.

TAXONOMIC TREATMENT OF *GAULTHERIA*

***GAULTHERIA* Kalm ex Linnaeus, Sp. Pl. 1:395. 1753.**

TYPE: *Gaultheria procumbens* Linnaeus.

Brossaea Linnaeus, Sp. Pl. 2:1190. 1753.

Chiogenes Salisbury, Trans. Hort. Soc. London 2:94. 1817. \equiv *Glyciphylla* Rafinesque, Am. Month. Mag. 4:192. 1819.

\equiv *Phalerocharpus* G. Don, Gen. Syst. 3:841. 1834.

\equiv *Lasierpa* Torrey, Geol. Rep. New York, 152. 1839.

Shrubs, erect to prostrate, terrestrial or rarely epiphytic, evergreen, hermaphroditic, dioecious, or gynodioecious; indumentum of simple, unicellular or multicellular eglandular or gland-tipped trichomes; terminal buds abortive, axillary buds with numerous (GLGS) imbricate scales. Stipules absent. Leaves spirally arranged (GLGS), simple, petiolate, sometimes with strong wintergreen odor when crushed; leaf blade venation of major secondary veins usually pinnate or occasionally 2 originating at or near base on either side of midvein, margin usually serrate or crenate with teeth glandular- or trichome-tipped, apex glandular-tipped or -mucronate (GLGS). Inflorescences axillary racemes or solitary flowers (GLGS), sometimes bud stage appearing in autumn. Flowers actinomorphic. Pedicel articulated with calyx and when inflorescences racemose subtended by a \pm cucullate bract; bracteoles 2 and opposite or rarely several and \pm alternate (GLGS), \pm cucullate. Calyx synsepalous, lobes (4)5. Corolla green, white, pink, or red, sympetalous, urceolate to campanulate (GLGS), lobes (4)5. Stamens (2–6, 8)10, free from the corolla, distinct, straight, included, replaced by filamentous staminodes in female flowers with or without anther-like structures; filaments flattened, papillose (GLGS), dilated medially or submedially, nearly equal; anthers inverting during development, 2-locular, each locule opening by a pore that can include a short ventral slit (GLGS), with white disintegration tissue present dorsally along connective, 1 or 2 awns present per locule (GLGS) (if 1 then sometimes bifurcate). Nectary disk with ca. 10 deltoid or subulate lobes. Gynoecium (2–4)5(6)-carpellate; ovary superior or rarely slightly inferior, ovules 5–10 or numerous per locule; style 1, simple, columnar, hollow; stigma truncate. Fruit a globose capsule (GLGS) dehiscent loculicidally (GLGS) or irregularly, or a berry; receptacle and calyx dark purple, blue, pink, red, or white, accrescent, usually fleshy or rarely thin. Seeds numerous per fruit, ca. 1–1.5 mm in diam., angled; testa of \pm isodiametric to slightly elongated cells. $2n = 22, 24,$ or $26,$ or polyploid based on $n = 11$ or 12 .

A genus of ca. 135 species widely distributed in E and S Asia, SE Australia (including Tasmania), North and South America, and New Zealand; 34 species in China, 14 endemic; ca. 19 species in Myanmar, 1 endemic; 24 species in the GLGS, 3 endemic (numbers from Fang and Stevens (2005) and Kress et al. (2003), as modified on the basis of the present treatment).

Key to Species of *Gaultheria* in the Gaoligong Shan

* indicates species with two entries in key

- 1a. Inflorescences always 1-flowered; larger leaf blades $0.15\text{--}1.5 \times 0.08\text{--}0.85$ cm ($0.6\text{--}2.1 \times 0.5\text{--}1.9$ cm in *G. nummularioides*).
 - 2a. Bracteoles more than 2, not apical; corolla inside pubescent; filaments pubescent; anthers $1.3\text{--}1.5$ mm15. *G. nummularioides*
 - 2b. Bracteoles 2, apical; corolla and filaments glabrous; anthers $0.3\text{--}1.1$ mm.
 - 3a. Branchlets long-trailing; calyx lobes and corolla lobes 4; corolla $2\text{--}3$ mm; anthers $0.3\text{--}0.5$ mm; style $0.6\text{--}0.8$ mm; calyx at fruiting red 21. *G. suborbicularis*
 - 3b. Branchlets not long-trailing; calyx lobes and corolla lobes 5 (rarely 4 in *G. hypochlora* and *G. sinensis*); corolla $3\text{--}5.5$ mm; anthers $0.5\text{--}1.1$ mm; style $0.9\text{--}3$ mm; calyx at fruiting blue, white, or rarely pinkish white or pink.
 - 4a. Leaf blade margin teeth villous-setose-tipped23. *G. trichophylla*
 - 4b. Leaf blade margin teeth setulose-tipped.
 - 5a. Some or all leaf blades abaxially pubescent at least along midvein.
 - 6a. Calyx lobes deltoid to narrowly ovate-deltoid; stamen filaments $1\text{--}1.3$ mm, gradually dilated medially from apex; larger leaf blades oblanceolate, suborbicular, or rarely elliptic, abaxially often whitish green11. *G. hypochlora*
 - 6b. Calyx lobes broadly ovate-deltoid; stamen filaments $0.6\text{--}1.2$ mm, \pm dilated medially, sides convex-curved; larger leaf blades elliptic to oblanceolate, light green to light brown20. *G. sinensis*
 - 5b. Leaf blades always abaxially glabrous.
 - 7a. Leaf blade $1.5\text{--}2.2 \times 0.8\text{--}1$ mm, margin entire or with $1\text{--}3$ teeth per side and usually involute; calyx at fruiting not fleshy1. *G. bryoides*
 - 7b. Leaf blade $3.5\text{--}15 \times 1\text{--}4$ mm, margin serrate with $3\text{--}15$ teeth per side and planar to slightly revolute; calyx at fruiting fleshy.
 - 8a. Pedicel $9\text{--}13$ mm; bracteoles $0.5\text{--}1(-1.2) \times 0.5\text{--}0.7(-1.4)$ mm5. *G. dolichopoda*
 - 8b. Pedicel $1\text{--}5$ mm; bracteoles $1\text{--}4 \times 1\text{--}3$ mm.
 - 9a. Calyx lobes $1.3\text{--}1.8$ mm, overlapping at base, apex bluntly acute; style $0.9\text{--}1.1$ mm; calyx at fruiting blue ...7. *G. eciliata*
 - 9b. Calyx lobes $2\text{--}3$ mm, not overlapping at base, apex acuminate; style $1.5\text{--}3$ mm; calyx at fruiting white, pinkish white, or pink.
 - 10a. Shrublets prostrate; leaf blade elliptic; calyx $2.5\text{--}3$ mm13. *G. nivea*
 - 10b. Shrublets decumbent; leaf blade oblanceolate, linear-oblanceolate, or oblong-oblanceolate; calyx $3\text{--}3.5$ mm.
 - 11a. Shrublets $10\text{--}30$ cm tall; larger leaf blades $8.5\text{--}13$ mm; corolla urceolate, lobes $0.6\text{--}0.8$ mm; anther awns $0.5\text{--}0.6$ mm; style $2.5\text{--}3$ mm2. *G. cardiosepala*

- 11b. Shrublets 2.5–10 cm tall; larger leaf blades 5–8.5 mm; corolla campanulate, lobes 1–2.5 mm; anther awns 0.2–0.3 mm; style ca. 1.5 mm22. *G. thymifolia*
- 1b. Some or all inflorescences 2- or more-flowered; larger leaf blades 1.4–17 × 0.7–9.7 cm.
- 12a. At least one secondary vein on each side of leaf blade arising at or near base of blade and extending to apex or nearly so.
- 13a. Leaf blade secondary veins 2–4 on each side of midvein, margin with 10–25 teeth per side; rachis and pedicels hirsute or lanate; bracteoles apical; corolla urceolate, villos inside4. *G. discolor*
- 13b. Leaf blade secondary veins 1 or 2 on each side of midvein, margin with 25–many teeth per side; rachis and pedicels glabrous or puberulent; bracteoles basal; corolla campanulate, glabrous.
- 14a. Plants to 0.4 m tall; leaf blade to 3.4 cm14. *G. notabilis*
- 14b. Plants 0.6 m tall or more; leaf blade 5–16 cm.
- 15a. Branchlets glabrous or at most puberulent; bracts 1.3–2.3 mm; calyx 2.2–2.6 mm; corolla 3–4 mm; capsule 3–6 mm in diam., strigillose-hirtellous6. *G. dumicola*
- 15b. Branchlets setose-hirsute (as well as puberulent); bracts 2.5–8 mm; calyx 4–6 mm; corolla 6–15 mm; capsule 7–11 mm in diam., glabrous17. *G. pseudonotabilis*
- 12b. Secondary veins all arising along midvein with proximal veins becoming faint or anastomosing before reaching apex.
- 16a. Base of leaf blade cordate to auriculate-cordate12. *G. leucocarpa*
- 16b. Base of leaf blade cuneate to rounded, occasionally subtruncate or subcordate.
- 17a. Leaf blade abaxially appressed-stipitate-glandular.
- 18a. Leaf blade adaxially puberulent on midvein and usually stipitate-glandular; bracts 1.2–2.5 mm wide; style 2.5–4 mm; calyx at fruiting white to red, lobes incurved; capsule sericeous3. *G. cuneata*
- 18b. Leaf blade adaxially glabrous; bracts 2–3.5 mm wide; style 2–2.5 mm; calyx at fruiting dark purple, lobes ± erect; capsule glabrous or sparsely puberulent18. *G. pyrolifolia*
- 17b. Leaf blade abaxially gland-dotted or variously pubescent but not stipitate-glandular.
- 19a. Branchlets glabrous or occasionally sparsely setulose (or puberulent or both).
- 20a. Leaf blade margin with 40–75 teeth per side, apex narrowly acuminate to caudate; corolla glabrous; anther awns 0.7–1.1 mm; fruiting calyx thin9. *G. griffithiana*
- 20b. Leaf blade margin with 20–40 teeth per side, apex obtuse to acuminate; corolla pubescent inside; anther awns 0.4–0.8 mm; fruiting calyx fleshy.
- 21a. Inflorescences generally from both upper and lower leaf axils, also often borne below the leaves; bracts narrowly deltoid, keeled; bracteoles subapical or usually apical; filaments sparsely pilose; anthers 1.3–1.5 mm8. *G. fragrantissima*
- 21b. Inflorescences generally from the upper leaf axils; bracts elliptic to suborbicular, not keeled; bracteoles ± medial; filaments glabrous; anthers 0.7–1.3 mm10. *G. hookeri**

- 19b. Branchlets evenly scattered to densely setose, setose-hirsute, villous-hirsute, or pilose-villous (and often puberulent).
- 22a. Bracts ovate, elliptic, or suborbicular, apex rounded, acute, or rarely (in some *G. hookeri*) shortly acuminate.
- 23a. Plants 30–300 cm tall, erect to occasionally \pm prostrate, stems branched, branchlets not notably elongate; leaf blade $1.7\text{--}3.8 \times$ as long as wide; inflorescences 7–24-flowered; corolla 1.8–4 mm wide; calyx at fruiting blue or blue flushed with white, lobes \pm erect with margin pale-edged10. *G. hookeri**
- 23b. Plants 15–30 cm tall, prostrate to decumbent, stems unbranched or branchlets elongate; leaf blade $1.1\text{--}2.2 \times$ as long as wide; inflorescences 1–6-flowered; corolla 4.5–6 mm wide; calyx at fruiting black, lobes incurved with margin not pale-edged16. *G. praticola*
- 22b. Bracts deltoid, deltoid-ovate, rhombic-lanceolate, or linear-lanceolate, apex sharply acute to aristate.
- 24a. Branchlets not notably elongate; bracts 1.2–3.7 mm; bracteoles apical or subapical; stamens 2–819. *G. semi-infera*
- 24b. Branchlets elongate; bracts 4–6 mm at least proximally along inflorescence; bracteoles \pm medial; stamens 1024. *G. wardii*

1. *Gaultheria bryoides* P.W. Fritsch & L.H. Zhou, sp. nov. Type.—MYANMAR. Kachin: [Putao District. Nogmung Township], Nam Tamai Valley [Gaoligong Shan], 1937–1939, *F. Kingdon Ward 13216a* (holotype: BM!).

Hace species *Gaultheria dolichopoda* similis, sed petiolo 0.7–1.5 mm longo, lamira elliptica $1.5\text{--}2.2 \times 0.8\text{--}1$ mm, margine integero vel 1–3-dens in quoque latere et plerumque involuto differt.

Shrublets, prostrate. Branchlets elongate, densely reddish brown-uncinate-setulose and white-puberulent. Petiole 0.2–0.3 mm, glabrous; leaf blade elliptic, $1.5\text{--}2.2 \times 0.8\text{--}1$ mm, gradually smaller along stems toward both ends of each year's growth, $1.9\text{--}2.6 \times$ as long as wide, subcoriaceous, \pm glossy, abaxially greenish brown, adaxially dark greenish brown, both surfaces glabrous or midvein occasionally adaxially sparsely puberulent toward base, midvein abaxially raised and adaxially planar or obscure, secondary and tertiary veins obscure, base cuneate to subrounded, margin entire or serrate, with 1–3 shortly setulose-tipped teeth per side, slightly thickened, often involute to occasionally planar, apex acute. Inflorescences axillary, 1-flowered; bracts absent. Flowers unknown. Pedicel ca. 0.8 mm, glabrous; bracteoles 2, apical, oblong-ovate, not keeled, $0.5\text{--}1 \times 0.5\text{--}0.8$ mm, persistent, glabrous, margin entire, apex broadly obtuse to rounded. Calyx at fruiting probably white, not fleshy; lobes erect or incurved, not pale-edged, apex long-acute to acuminate. Capsule ca. 3.5 mm in diam., glabrous; fruiting style ca. 1.5 mm, glabrous.

This new species, clearly a member of *Gaultheria* ser. *Trichophyllae* Airy Shaw, is easily distinguished from all other species of Asian *Gaultheria* by its minute leaf blades ($1.5\text{--}2.2 \times 0.8\text{--}1$ mm). It appears to be unique among the species of the series also in its non-fleshy fruit. It is thus far known to us only from the type. The species is named for its moss-like appearance.

The specimen label of the holotype indicates that it was separated from the collection *F. Kingdon Ward 13216*. The label indicates that the collection from which it was separated was *Meconopsis speciosa* Prain, but further investigation has revealed that the original determination list at BM of the collections of F. Kingdon Ward has designated *13216* as a specimen of *Saxifraga calcicola*

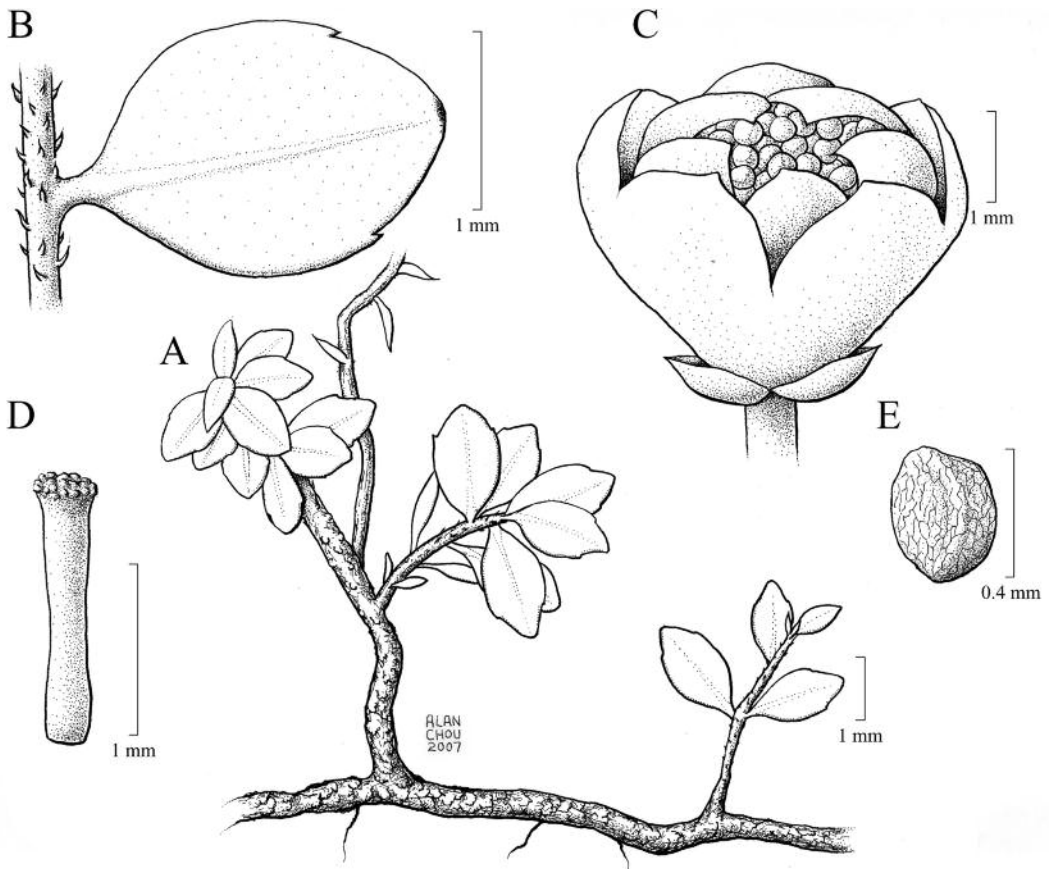


FIGURE 1. *Gaultheria bryoides*. A. Whole plant. B. Branchlet and leaf (abaxial view). C. Fruit. D. Style. E. Seed. Based on *Kingdon Ward 13216a* (BM).

J. Anthony, with the following collection information: Nam Tamai Valley, 28°N, 97°45'E, 9000–11,000 ft., 10 September, 1937 (J. Gregson, pers. comm.). Thus, this collection information, although not on the label, can probably be considered applicable to the holotype of *G. bryoides*.

ILLUSTRATION.— Figure 1.

PHENOLOGY.— Fr. Sep.

DISTRIBUTION AND HABITAT.— 2700–3300 m. In GLGS: MYANMAR. Kachin: Putao District (Nogmung Township); Figure 2. Endemic to GLGS.

CHINESE NAME.— 拟苔藓白珠 (新拟) ni tai xian bai zhu

2. *Gaultheria cardiosepala* Handel-Mazzetti, Anz. Akad. Wiss. Wien, Math.-Naturwiss. Kl. 60:185. 1923. SYNTYPES.— CHINA. Yunnan: Montis Dji-schan ad bor.-occ. urbis Dali (Talifu), 3350 m, 21 May 1915, *H.F. v. Handel-Mazzetti 6416* (?W, E!, K!); — CHINA. Xizang: Prope fines Tibeto-Birmanicas inter fluvios Lu-djiang (Salween) et Djiou-djiang (Irrawadi orient. super.), in glarea granitica ad rivum supra vicum Schutsche ad flumen Irrawadi [Gaaligong Shan], 24°58'N, 3000–3350 m, 9 July 1918, *H.F. v. Handel-Mazzetti 9441* (?W, A!) [specimen at A = *G. thymifolia*, see below].

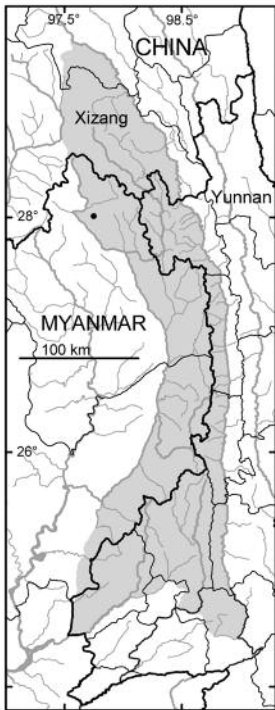


FIGURE 2. Distribution map of *Gaultheria bryoides* in the GLGS region.

Shrublets 10–30 cm tall, decumbent, gynodioecious. Branchlets elongated, terete, densely red-, ferrugineous-, brown-, or black-uncinate-setulose and often white-puberulent. Petiole 0.4–1.2 mm, glabrous or occasionally adaxially puberulent; leaf blade oblanceolate, oblong-oblanceolate, or linear-oblanceolate, 8.5–13 × 2–3.5 mm, gradually smaller along stems toward both ends of each year's growth, 3–6 × as long as wide, coriaceous, abaxially dull light green to light brown with glossy edge, adaxially ± glossy green to brown, both surfaces glabrous or midvein occasionally puberulent adaxially toward base, midvein abaxially prominent and adaxially sulcate, secondary and tertiary veins obscure, base cuneate, margin serrate, with (4–)6–15 setulose-tipped teeth per side, planar to slightly revolute, apex acute to obtuse. Inflorescences axillary, 6–8.5 mm, 1-flowered; bracts absent. Pedicel 2–4 mm, glabrous; bracteoles 2, apical, broadly ovate, not keeled, 1.2–2.5 × 1.2–1.5 mm, persistent, glabrous, margin entire, apex broadly obtuse. Calyx 3–3.5 mm; lobes 5, ovate-deltoid, 2.5–3 × 1.2–1.8 mm, not overlapping at base, glabrous, margin entire, apex acuminate. Corolla white, greenish white, pinkish white, white flushed with pink, or pink, urceolate, 3.5–4.5 × 2–3.5 mm, glabrous on both sides; lobes 5, oblong, 0.6–0.8 mm. Staminodes (in female flowers) 10, ca. 0.4 mm. Stamens 10; filaments ca. 1.2 mm, gradually dilated submedially from apex, glabrous; anthers 0.9–1.1 mm, 4-awned; awns 0.5–0.6 mm. Ovary glabrous; style 2.5–3 mm, glabrous. Calyx at fruiting white or pinkish white (in GLGS), fleshy; lobes incurved to erect, narrowly pale-edged. Capsule 4–7 mm in diam., glabrous.

We have not seen the material at W (H.F. v. Handel-Mazzetti's herbarium) for this treatment and thus we have not been able to lectotypify *Gaultheria cardiosepala*. Because the syntype at A of H.F. v. Handel-Mazzetti 9441 (and presumably all material of the 9441 collection) is *G. thymifolia*, a future lectotypification should be selected only among the material of H.F. v. Handel-Mazzetti 6416.

The collection T.T. Yü 20324, with white fruit, is atypical for *Gaultheria cardiosepala* in its setulose pubescence on the midvein abaxially, and may represent a hybrid with, e.g., *G. hypochlora*. The collections GLGS 22409 and 23018, both sterile, also have this pubescence, but without reproductive features present it is difficult to confidently provide a species name for these specimens.

SELECTED ILLUSTRATION.— T.Z. Xu, Fl. Yunnan. 4:600 t. 171(4–8). 1986.

PHOTOGRAPHIC IMAGE.— Figure 3.

PHENOLOGY.— Fl. Mar–Jun, fr. Aug–Sep.

DISTRIBUTION AND HABITAT.— Subtropical evergreen broadleaf forests, coniferous forests, thickets, rocky places; 2100–4000 m. In GLGS: CHINA. Yunnan: Fugong Xian, Gongshan Xian (Cikai Zheng, Dulongjiang Xiang), Lushui Xian (Luyobenzhou Xiang, Pianma Xiang), Tengchong Xian (Houqiao Zheng), MYANMAR. Kachin: Myitkyina District (Chipwi Township); Figure 4. Outside of GLGS: Yunnan.

CHINESE NAME.— 苍山白珠 cang shan bai zhu

ADDITIONAL GAOLIGONG SHAN SPECIMENS EXAMINED: CHINA. YUNNAN: F 30879 (E).



FIGURE 3. Fruiting plants of *Gaultheria cardiosepala*. Photo by L. Lu.

FUGONG XIAN. Che-tse-lo, 4000 m, 26 Aug 1934, *Tsai 58197* (A, E). **GONGSHAN XIAN.** **Cikai Zheng.** E side of Gaoligong Shan at Km 48 on rd from Gongshan to Kongdang, 3330 m, 11 Nov 2004, *GLGS 22409* (CAS); same data, *GLGS 23108* (CAS). **Dulongjiang Xiang.** Salween-Kiu Chiang divide, Lunguailaka, 3200 m, 16 Sep 1938, *Yü 20324* (A, E, KUN). **LUSHUI XIAN.** **Luyobenzhou Xiang.** E'ga Cun, Km 25 on forest rd, E side of Gaoligong Shan, 2130 m, 8 Aug 2005, *GLGS 25749* (CAS). **Pianma Xiang.** W slope of Pianma Yakou, Fengxue Yakou, 3000 m, 27 Jul 1978, *BE 1351* (KUN); Hpimaw Hill, 10800 ft., 10 May 1919, *R.J. Farrer 895* (E); vicinity of Km 58 on rd from Lushui to Pianma, W side of Gaoligong Shan, 2810 m, 14 May 2005, *GLGS 22922* (CAS); Pianma Yakou, 3300 m, 8 Jun 2006, *Lu 22* (CAS); 3150 m, 4 Aug 1978, *NE 1853* (KUN); Hpimaw, 10000–11000 ft., 20 Jun 1914, *KW 1691* (E); Hpimaw Pass, 11000 ft., 8 Jun 1929, *Sukoe 10080* (K); Pianma Yakou, Jia Gao Di, 3600 m, 15 Aug 1964, *Wu 8416* (KUN). **TENGCHONG XIAN.** Shweli-Salween divide, 8000 ft., Mar 1906, *F 5003* (A, E); W flank of Shweli-Salwin divide, 10000 ft., Aug 1912, *F 8931* (A, E, K); Shweli-Salwin divide, 10000 ft., Sep 1913, *F 12021* (E). **Houqiao Zheng (Guyong Zheng).** Ji Zhao Shan, 2640–3500 m, 25 May 1964, *Wu 6886* (KUN); Dan Za to Liang Ya Shan, 3700 m, 18 Apr 1980, *L.S. Xie 886* (KUN). **MYANMAR. KACHIN: MYITKYINA DISTRICT. Chipwi Township.** N'Maikha-Salwin divide, Jun 1931, *F 29668* (E).

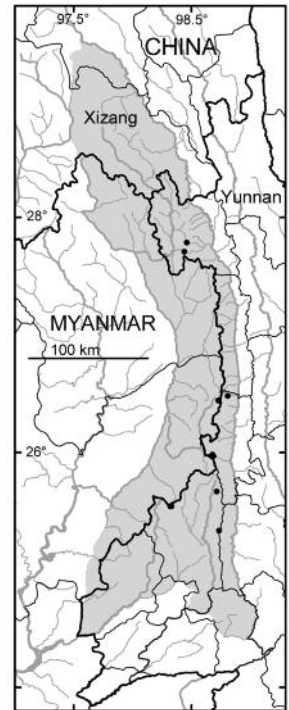


FIGURE 4. Distribution map of *Gaultheria cardiosepala* in the GLGS region.

3. *Gaultheria cuneata* (Rehder & E.H. Wilson) Bean, Bot. Mag. 145: t. 8829. 1919. Basionym: *Gaultheria pyroloides* J.D. Hooker & Thomson ex Miquel var. *cuneata* Rehder & E.H. Wilson in Sargent, Pl. Wilson. 1:554. 1913. TYPE.— CHINA. Sichuan: west and near Wen-chuan Xian, 2000–2600 m, July and September 1908, *E.H. Wilson 920* (holotype: A!; isotypes: E!, GH!, K [2!]).

Shrublets 8–20 cm tall, prostrate to decumbent. Branchlets not notably elongate, terete, white-puberulent and usually sparsely orange- to brown-appressed-stipitate-glandular. Petiole 0.5–2 mm, puberulent and often also stipitate-glandular; leaf blade elliptic to slightly oblanceolate, 1.9–3.5 × 0.7–1.2 cm, 1.4–3.0 × as long as wide, chartaceous to subcoriaceous, abaxially greenish brown, abaxially and usually adaxially orange- to brown-appressed-stipitate-glandular, adaxially white-puberulent proximally on midvein, midvein abaxially raised and adaxially impressed, secondary veins 2–4 on each side of midvein, arising along midvein with proximal veins becoming faint or anastomosing before reaching apex, abaxially raised, adaxially planar to impressed, tertiary veins abaxially raised or obscure and adaxially impressed or obscure, base cuneate, margin shallowly serrate, with 8–20 teeth per side, planar to slightly revolute, apex acute to obtuse. Inflorescences terminal or subterminal (or both) open racemes, 0.8–4.5 cm, 2–10-flowered; rachis slender, white-puberulent, often also shortly stipitate-glandular; bracts ovate, not keeled, 2–3 × 1.2–2.5 mm, persistent, glabrous, margin entire or ciliolate, apex acute to obtuse. Pedicel 3–5 mm, shorter distally on inflorescences, orange-stipitate-glandular, glands more abundant and stipes longer distally on inflorescences; bracteoles medial to subapical, ovate to ovate-lanceolate, 2–3 × 1–2 mm, apex acute, otherwise similar to bracts. Calyx 1.5–2.5 mm; lobes 5, ovate, 1.5–2 × 1.2–1.7 mm, glabrous, margin entire or ciliolate, apex acute to acuminate. Corolla white to pink, urceolate, 4–5 × 2.5–5 mm, glabrous; lobes 5, deltoid, 0.7–1 mm. Stamens 10; filaments ca. 2 mm, gradually dilated submedially from apex, glabrous; anthers ca. 1 mm, awns ca. 1 mm. Ovary sericeous; style 2.5–4 mm, glabrous. Calyx at fruiting white to red, fleshy; lobes incurved, indistinctly pale-edged. Capsule 4–6 mm in diam., sericeous.

Gaultheria prostrata W.W. Smith [Notes Roy. Bot. Gard. Edinburgh 11:210. 1920. TYPE.—CHINA. Yunnan: Gongshan Xian, Mekong-Salween divide, 28°12'N, 14000 ft., July 1917, *G. Forrest 14371* (holotype: E!; isotypes: K!, P!); = *Gaultheria pyroloides* Miquel var. *reducta* Diels, Acta Horti Gothob. 1:182. 1924. TYPE.—CHINA. Sichuan; mountains SE of Matang, 4800 m, 13 September 1922, *H. Smith 4374* (holotype: ?B, destroyed; isotype: E!)], very similar to *G. cuneata*, may be expected to occur in the GLGS. It can be distinguished from *G. cuneata* by the generally smaller and rounder leaves (10–15 × 6–8 mm, 1.1–2 × as long as wide), bracts that are 2–3 mm wide, campanulate flowers with lobes ca. 1.5–2 mm, 2–4-awned anthers, and a style that is 1.5–2 mm. It also occurs at higher elevation (4250–4800 m) than *G. cuneata*.

SELECTED ILLUSTRATIONS.—Bean, Bot. Mag. 145: t. 8829. 1919; R.C. Fang, Fl. Reipubl. Popularis Sin. 57(3):48 t. 15(6–9). 1991; G.H. Zhu & L.B. Zhang, eds. Fl. China Ill. 14: t. 655(6–9). 2006.

PHENOLOGY.—Fl. Jul, fr. Aug–Oct.

DISTRIBUTION AND HABITAT.—*Rhododendron* forests, margins of *Abies* forests, thickets, on rocks; 3000–3800 m. In GLGS: CHINA. Xizang: Zayü Xian (Tsarong Xiang). Yunnan: Gongshan Xian (Bingzhongluo Xiang); Figure 5. Outside of GLGS: Guizhou, Sichuan, Yunnan.

CHINESE NAME.—四川白珠 *si chuan bai zhu*

GAOLIGONG SHAN SPECIMENS EXAMINED: CHINA. XIZANG: ZAYÜ XIAN. Tsarong Xiang.

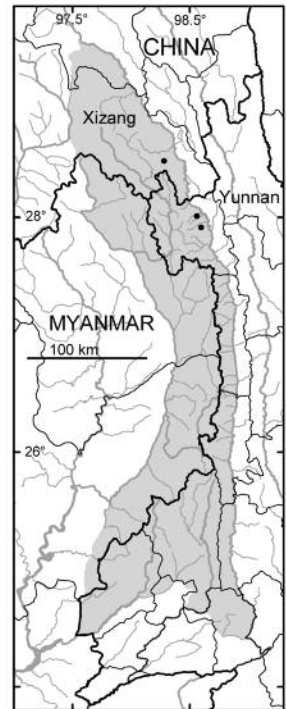


FIGURE 5. Distribution map of *Gaultheria cuneata* in the GLGS region.

Solo-la, 14500 ft., Aug 1932, *Rock 22653* (A, K). YUNNAN: Atuntze, Hungpoh, Bengah, 3700 m, 19 Nov 1937, *Yü 7998* (E); 1937, *Yü 8917* (A); *Yü 10192* (A). GONGSHAN XIAN. **Bingzhongluo Xiang**, Song Ta, 3800 m, 25 Jun 1982, *QX 7547* (KUN); Cham-pu-tung, 3000 m, Sep 1935, *Wang 66695* (A, KUN).

4. *Gaultheria discolor* Nuttall ex J.D. Hooker, Bot. Mag. 84: t. 5034. 1858. *Diplycosia discolor* (Nuttall ex J.D. Hooker) C.B. Clarke, Fl. Brit. India 3:459. 1882. TYPE.— Bot. Mag. 84: t. 5034. 1858; specimens, if such exist, not seen.

Gaultheria longibracteolata R.C. Fang, Novon 9:166.1999. TYPE.— CHINA. Yunnan: Luchun Xian, 1700 m, 19 September 1973, *D.D. Tao 68* (holotype: KUN!; isotype: KUN!).

Shrubs 0.7–2.4 m tall, erect. Branchlets not notably elongate, angulate, densely ferruginous-to brown-appressed- to ascending-setose and white-puberulent. Petiole 2–7 mm, setose and puberulent; leaf blade elliptic, 2.9–8.2 × 1.6–3.5 mm, apically along stems often smaller and narrower, 1.5–2.9 × as long as wide, subcoriaceous, abaxially light to dark brown (whitish green when fresh), with darker major veins, orange- to ferruginous-gland-dotted or appressed-setulose with trichomes of various lengths, adaxially glabrous or proximally white-puberulent on midvein, midvein abaxially prominent and adaxially narrowly sulcate, secondary veins 2–4 on each side of midvein, arising at or near base and along midvein and extending to apex or nearly so, abaxially raised, adaxially slightly impressed to rarely planar, tertiary veins abaxially raised and adaxially impressed or obscure, base cuneate to subrounded, margin revolute at least proximally, basal half entire, apical half serrulate to denticulate with 10–25 teeth per side, apex acute, obtuse, or rarely shortly acuminate. Inflorescences axillary and terminal, dense racemes or occasionally panicles branched at or near base, 1.2–4 cm, 4–12-flowered; rachis slender, white- to yellow-hirsute or -lanate; bracts suborbicular to orbicular, keeled, 3.5–5.5 × 3–6 mm, caducous, glabrous or adaxially strigose medially, margin ciliate and often glandular-ciliate, apex shortly aristate. Pedicel 2.5–3.5 mm, white- to yellow-hirsute or -lanate; bracteoles apical, ovate-lanceolate, oblong-ovate, or oblong-elliptic, 3–6 × 1.5–3.2 mm, otherwise similar to bracts. Calyx 2.5–4 mm; lobes 5, ovate to ovate-deltoid, 2–3 × 1.5–2 mm, outside glabrous, inside strigose or hirtellous medially, apically keeled, margin ciliate or glandular-ciliate, apex acuminate-aristate. Corolla white, often with purple or pink lobes, urceolate, 4–5 × 3–5 mm, outside glabrous, inside white-villous; lobes 5, oblong, 0.7–1 mm. Stamens 10; filaments 1–1.5 mm, gradually dilated medially from apex, sparsely pilose; anthers 1–1.3 mm, awns 0.2–0.4 mm. Ovary hirtellous; style 2–3 mm, strigose at least proximally or rarely glabrous. Calyx at fruiting purple to black, fleshy, glaucous; lobes erect, not pale-edged. Capsule 3–7 mm in diam., sericeous-hirtellous.

In the original publication of *Gaultheria longibracteolata*, Fang (1999) distinguished this species from *G. discolor* by its densely hispid and puberulent branchlets, abaxially sparsely appressed-setulose leaf blades, pilose styles, and anthers with aristae ca. 0.8 mm. The description of *G. discolor* in the Flora of Bhutan (Rae 1991), however, stated that the branchlets there are sparsely setose (= hispid). Furthermore, our examination of specimens from outside the GLGS [i.e., *A. Henry 9460B* (A), *9460C* (K), *9761* (A), *9761A* (K); 1898, *F. Kingdon Ward 7376* (K), *9091* (A); *S. Mokim s.n.* (E); May 1868, *C.S.P. Parish s.n.* (K); *Z.H. Tsi 91-214* (A); *H.T. Tsai 51543* (A); *C.W. Wang 81223A* (A); and *T.T. Yü 17726* (A)] reveals that the other characters used to delimit the two species do not exhibit correlated gaps in morphological variation. Thus the delimitation of two species is not warranted.

SELECTED ILLUSTRATIONS.— J.D. Hooker, Bot. Mag. 84: t. 5034. 1858; R.C. Fang, Novon 9:168 t. 4. 1999 (as *G. longibracteolata*); G.H. Zhu & L.B. Zhang, eds. Fl. China III. 14: t. 659(1–7). 2006 (as *G. longibracteolata*).



FIGURE 6. Flowering branchlet of *Gaultheria discolor*. Photo by P. Fritsch.

PHOTOGRAPHIC IMAGE.— Figure 6.

PHENOLOGY.— Fl. May–Sep fr. Sep–Jan.

DISTRIBUTION AND HABITAT.— Subtropical evergreen broadleaf forests, thickets, open slopes; 900–2000 m. In GLGS: CHINA. Yunnan: Gongshan Xian (Dulongjiang Xiang); Figure 7. Outside of GLGS: Yunnan [Myanmar, Thailand].

CHINESE NAME.— 苍白叶白珠 (新拟) an bai ye bai zhu

GAOLIGONG SHAN SPECIMENS: CHINA. YUNNAN: GONGSHAN XIAN. Dulongjiang Xiang. Along trail toward Qinglan Dang, W side of the Dulongjiang Valley, ca. 0.3 direct km SW of Maku and ca. 4.2 direct km NE of Myanmar border, 2010 m, 19 Aug 2006, *GLGS 32542* (KUN).

5. *Gaultheria dolichopoda* Airy Shaw, Bull. Misc. Inform. Kew 1940:321. 1941. TYPE.— CHINA. Xizang: Tsangpo Gorge, near Sechen La, 3000–3300 m, 1 December 1924, *F. Kingdon Ward 6331* (holotype: K!).

Shrublets 5–23 cm tall, decumbent. Branchlets elongate, terete, densely ferruginous-uncinate-setulose. Petiole 0.7–1.5 mm, glabrous or adaxially occasionally white-puberulent; leaf blade linear-oblongate, 6–9.5(–15) × 1.5–1.8(–4) mm, usually gradually smaller along stems toward both ends of each year's growth, 3.3–4.8 × as long as wide, coriaceous, abaxially dull light green to light brown with glossy edge, adaxially glossy green to brown, both surfaces glabrous or adaxially occasionally puberulent toward base on midvein, midvein abaxially prominent and adaxially sulcate, secondary and tertiary veins obscure, base cuneate, margin serrate, with 5–7 setulose-tipped teeth per side, planar to slightly revolute, apex acute to obtuse. Inflorescences axillary, 1.5–2 cm, 1-flowered; bracts absent. Pedicel slender, drooping, 0.9–1.3 cm,

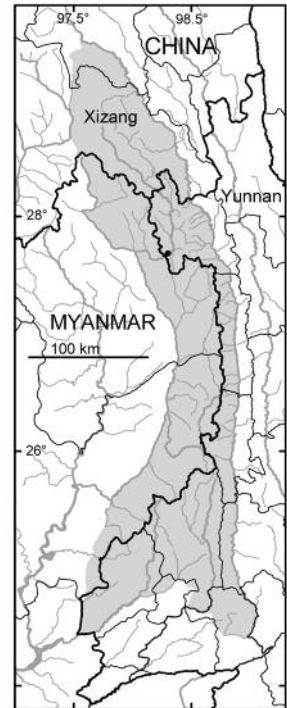


FIGURE 7. Distribution map of *Gaultheria discolor* in the GLGS region.

glabrous; bracteoles 2, apical, ovate-deltoid, not keeled, $0.5\text{--}1(-1.2) \times 0.5\text{--}0.7(-1.4)$ mm, persistent, glabrous, margin entire, apex acute to shortly acuminate. Calyx 3–4 mm; lobes 5, ovate-deltoid, $2\text{--}3 \times 1.5\text{--}1.7$ mm, not overlapping at base, glabrous, margin entire, apex acuminate. Corolla white to pink, broadly urceolate, ca. 5×4 mm, both sides glabrous; lobes 5, oblong, ca. 0.5 mm. Stamens ca. 2 mm, dilated near base from apex; anthers 4-awned. Ovary glabrous; style ca. 3 mm, glabrous. Calyx at fruiting blue, fleshy; lobes incurved, not pale-edged. Capsule ca. 5 mm in diam., glabrous.



FIGURE 8. Fruiting branchlet of *Gaultheria dolichopoda*. Photo by L. Lu.

The type of *Gaultheria dolichopoda* has notably larger leaves than our specimens of the species.

SELECTED ILLUSTRATION.— Airy Shaw, Kew Bull. 1948:161 t. 4. 1948. The illustration of this species in T.Z. Xu, Fl. Xizang, 3:694 t. 277(1) has a pedicel that is too short for *Gaultheria dolichopoda* and is likely based on a specimen of a different species of *Gaultheria*, e.g., *G. hypochlora*.

PHOTOGRAPHIC IMAGE.— Figure 8.

PHENOLOGY.— Fl. Aug, fr. Oct.

DISTRIBUTION AND HABITAT.— Alpine thicket-meadows, *Abies* forests, rocky places, thickets; 2700–3000 m. In GLGS: CHINA. Yunnan: Gongshan Xian (Dulongjiang Xiang), MYANMAR. Kachin: Putao District (Nogmung Township); Figure 9. Outside of GLGS: Xizang.

CHINESE NAME.— 长梗白珠 chang geng bai zhu

GAOLIGONG SHAN SPECIMENS EXAMINED: CHINA. YUNNAN: GONGSHAN XIAN. Dulongjiang Xiang. Vicinity of Xixiaofang on trail from Bapo to Gongshan via Qiqi, W side of Gaoligong Shan, 2970 m, 30 Oct 2004, GLGS 22005 (CAS); Xi Shao Fang, W side of GLGS, 2700–2900 m, 4 Jun 2006, Lu 58A (CAS). **MYANMAR. KACHIN: PUTAO DISTRICT. Nogmung Township.** Mungku Hkyet, 9000–10000 ft., 19 Aug 1937, KW 13005 (BM).

6. *Gaultheria dumicola* W.W. Smith, Notes Roy. Bot. Gard. Edinburgh 9:106. 1916. TYPE.— CHINA. Yunnan: [Tengchong Xian], hills west of Tengyueh [Gaoligong Shan], 25°N, 6000 ft., July 1912, *G. Forrest* 8573 (lectotype, here designated: E! isolectotypes: A!, K!).

Three collections of *G. Forrest* (7730, 8573, and 9568) were cited in the protologue, none of which were specifically designated as the type of *Gaultheria dumicola*. We have selected *G. Forrest* 8573 from E as lectotype because it is the home institution of W.W. Smith and the word “Type” is handwritten on the E sheet along with a label on which is printed “Type Specimen.” We do not know if the handwriting is Smith’s.

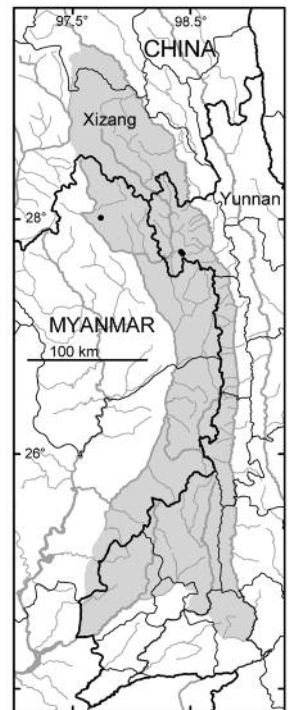


FIGURE 9. Distribution map of *Gaultheria dolichopoda* in the GLGS region.

- Gaultheria dumicola* W.W. Smith var. *petanoneuron* Airy Shaw, Hooker's Icon. Pl. 33: t. 3206. 1933. TYPE.— CHINA. Yunnan: [Tengchong Xian], N'maikha-Salwin divide [Gaoligong Shan], 26°N, 8000–9000 ft., November 1919, *G. Forrest 18832* (holotype: K!; isotype: E!).
- Gaultheria dumicola* W.W. Smith var. *aspera* Airy Shaw, Bull. Misc. Inform. Kew 1940:312. 1941. TYPE.— MYANMAR. Kachin: [Putao District. Nogmung Township], Adung Valley [Gaoligong Shan], 1800 m, 17 February 1931, *F. Kingdon Ward 9245* [as "9425" in protologue] (holotype: BM; isotype: A!).
- Diplycosia pauciseta* Merrill, Brittonia 4:153. 1941. TYPE.— MYANMAR: Kachin: [Putao District, Nogmung Township], Adung Valley [Gaoligong Shan], 1800 m, 17 February 1931, *F. Kingdon Ward 9245* [as "9425" in protologue] (holotype: A!).
- Diplycosia alboglauca* Merrill, Brittonia 4:153. 1941. TYPE.— MYANMAR. [Kachin: Myitkyina District. Chipwi Township], Kang-fang [Gaoligong Shan], 1600 m, 6 December 1938, *Vernay-Cutting Expedition (F. Kingdon Ward) 84* (holotype: NY [on-line image!]).
- Gaultheria dumicola* W.W. Smith var. *pubipes* Airy Shaw, Kew Bull. 1948:110. 1948. TYPE.— CHINA. Yunnan: [Fugong Xian. Shangpa Zheng], Shang-pa Hsien [sic][Gaoligong Shan], 2400 m, 13 October 1933, *H.T. Tsai 54404* (holotype: A!).

Shrubs 0.6–4 m tall, erect, gynodioecious. Branchlets elongate, terete to slightly flattened, (in GLGS) glabrous or often sporadically white-puberulent. Petiole 2–7 mm, glabrous, puberulent, gland-dotted, or setose; leaf blade ovate to ovate-lanceolate, 5–16 × 2.5–9.7 cm, apical blades along stems generally smaller and narrower than basal ones, 1.3–4.1 × as long as wide, subcoriaceous, abaxially greenish brown to brown and glabrous or dark red-gland-dotted, -setose, or -villos, adaxially glabrous, veins abaxially prominent, midvein adaxially sulcate, secondary vein 1(2) on each side of midvein, arising at or near base and extending to apex, inner tertiary veins 7–13 on each side of midvein and adaxially slightly impressed, base subrounded, rounded, or cordate (basally on branchlets blade base often rounder or more strongly cordate than those apically on branchlets), margin irregularly denticulate, with many often setose-tipped teeth, planar to slightly revolute, apex acuminate to caudate. Inflorescences axillary and terminal, dense racemes or glomerules, 0.9–2.3 cm, 2–23-flowered; rachis stout, glabrous or white-puberulent; bracts narrowly deltoid, keeled, 1.3–2.3 × 0.6–1 mm, persistent, glabrous, margin ciliolate or glandular-ciliolate, apex acute. Pedicel 3–10 mm, glabrous or white-puberulent; bracteoles basal, similar to bracts. Calyx 2.2–2.6 mm; lobes 5, ovate to lanceolate-deltoid, 1.7–2.5 × 0.7–1.3 mm, glabrous, margin entire, apex acuminate. Corolla green, greenish yellow, greenish white, or green distally flushed with red and dark red, campanulate, 3–4 × 2.5–4.5 mm, glabrous; lobes 5, broadly deltoid, ca. 1 mm. Stamnodes (in female flowers) ca. 0.7 mm. Stamens 10; filaments 0.7–1 mm, gradually dilated medially from apex, glabrous or sparsely hirtellous; anthers ca. 1 mm, awns ca. 0.4 mm. Ovary sparsely strigillose-hirtellous; style 1–2 mm, glabrous. Calyx at fruiting dark purple to black, thin, often glaucous; lobes incurved, not pale-edged. Capsule 3–6 mm in diam., sparsely strigillose-hirtellous.

Five varieties of *Gaultheria dumicola* have been recognized in the treatment of *Gaultheria* for Flora of China (Fang and Stevens 2005), four of which (i.e., all except var. *hirticaulis* R.C. Fang) have morphological features that are represented in the GLGS. Varieties *dumicola* and *petanoneuron* have glabrous twigs, leaves, and inflorescences, and are distinguished from each other by broadly ovate leaf blades that are usually cordate or rounded-truncate at the base in var. *petanoneuron*, versus ovate leaf blades that are cuneate to rounded at the base in var. *dumicola*. Variety *pubipes* has puberulent young twigs, pedicels, bracts, and bracteoles and glabrous leaf blades, whereas var. *aspera* has glabrous young twigs, pedicels, bracts, and bracteoles and shortly brown-hispid leaf blades abaxially.

From thorough examination of these characters as they occur in the GLGS and surrounding

areas, we conclude that the pattern of morphological variation present in the specimens representing these four varieties does not justify the recognition of infraspecific taxa. White puberulence on the vegetative parts and pedicels, like most species of *Gaultheria* in the GLGS, is sporadic and can occur independently of the other features used to diagnose varieties—when observed under high magnification, it can be seen that even the type of *G. dumicola* has such stem pubescence. Most of the variation in leaf blade shape occurs within, rather than among, plants: leaf blades are typically larger and more cordate proximally along the stem, and gradually become smaller and more rounded at the base distally. Usually when a specimen has been annotated as var. *petanoneuron*, the stem segments of such specimens have been taken from the proximal part of a branchlet. There does appear to be a weak south-to-north trend within the GLGS populations of *G. dumicola* of narrower leaf blades that are less cordate at the base, but these characters vary continuously. Finally, on much of the Chinese side of the border, there does appear to be a strong break in variation between around 26 and 27 degrees latitude (Fugong County) in plants with glabrous leaf blades to the south versus those with setose-villous leaf blades abaxially to the north. Nonetheless, this distinction breaks down in various regions: in the Pianma area, there are plants with glandular dots but no trichomes; in the north part of the GLGS (Dulongjiang Xiang), several collections have no glands or trichomes; and all the collections from Myanmar, whether in the northern or southern part of the range of the species, have both glands and trichomes, or sometimes the glands are tipped with short trichomes.

SELECTED ILLUSTRATIONS.—Airy Shaw, Hooker's Icon. Pl. 33: t. 3206. 1933 (as *G. dumicola* var. *petanoneuron*); T.Z. Xu, Fl. Xizang. 3:696 t. 278(8–10). 1986.

PHOTOGRAPHIC IMAGES.—Figures 10–11.

PHENOLOGY.—Fl. Jan–Dec, fr. May–Dec.

DISTRIBUTION AND HABITAT.—Subtropical evergreen broadleaf forests, mixed evergreen and deciduous broadleaf forests, coniferous forests, thickets, open slopes; 1400–3100 m. In GLGS: CHINA. Yunnan: Fugong Xian (Lishadi Xiang, Shangpa Zheng), Gongshan Xian (Dulongjiang Xiang), Lianghe Xian, Longling Xian (Longjiang Xiang, Zhen'an Zheng), Longyang Qu (Bawan Xiang, Lujiang Xiang, Mankuan Xiang), Lushui Xian (Luobenzhou Xiang, Pianma Xiang), Tengchong Xian (Houqiao Zheng, Jietou Xiang, Qushi Xiang, Ruidian Xiang, Shangyun Xiang, Yunhua Xiang, Zhonghe Xiang), MYANMAR. Kachin: Myitkyina District (Chipwi Township,



FIGURE 10. Hermaphroditic inflorescence of *Gaultheria dumicola*. Photo by P. Fritsch.



FIGURE 11. Female inflorescence of *Gaultheria dumicola*. Note staminodes against sides of ovary in flower on right. Photo by P. Fritsch.

Hsawlaw Township), Putao District (Nogmung Township); Figure 12. Outside of GLGS: Yunnan [Myanmar].

CHINESE NAME.— 丛林白珠 *cong lin bai zhu*

ADDITIONAL GAOLIGONG SHAN SPECIMENS EXAMINED: CHINA.

YUNNAN: Jul 1912, *F 15785* (A, E [2], K [2]); Mid W Yunnan, Dec 1924, *F 26075* (E, K). **FUGONG XIAN.** Bi Jiang Agriculture Middle School, 2500 m, 27 May 1978, *BE 86* (KUN); Che-tse-lo, 3200 m, 12 Sep 1934, *Tsai 58538* (A, KUN); Kong Dong La Bu Jin, 2500 m, 7 Jul 1978, *NE 908* (KUN); **Lishadi Xiang.** Vicinity of N fork of the Yamu River, ca. 0.7 km E of Shibali Logging Station, on rd from the Nujiang to Yaping Pass, E side of Gaoligong Shan, 2467 m, 2 May 2004, *GLGS 20245* (CAS); Yaduo Cun, vicinity of Shibali, N side of N fork of the Yamu He, E side of Gaoligong Shan, 2590 m, 4 Aug 2005, *GLGS 26349* (CAS); Niwaluo Cun, vicinity of Shiwaneluo Village above the Nujiang, E side of Gaoligong Shan, 1500 m, 12 Aug 2005, *GLGS 27387* (CAS). **Shangpa Zheng.** Zhuminglin Cun, ca. 2 km E of the Nujiang above Zhuminglin Village, E side of Gaoligong Shan, 1940 m, 22 Aug 2005, *GLGS 28845* (CAS); 1600 m, 2 Oct 1933, *Tsai 54726* (A, E, KUN); 1600 m, 5 Oct 1933, *Tsai 54770* (A, E, KUN); 1800 m, 8 Oct 1934, *Tsai 54817* (A, E, KUN); 2000 m, 20 Sep 1933, *Tsai 56533* (A, KUN); 2100 m, 27 Sep 1933, *Tsai 56641* (A, E); 2800 m, 10 Oct 1934, *Tsai 58671* (A, KUN); 2000 m, 29 Oct 1934, *Tsai 59061* (A, E); 2000 m, 31 Oct 1934, *Tsai 59162* (A). **GONGSHAN XIAN. Dulongjiang Xiang.** Ma Gu, 2000 m, 17 Nov 1959, *Feng 24318* (KUN [2]); vicinity of Maku, S region of the Dulongjiang Valley, W side of the Dulongjiang, 2080 m, 16 Dec 1990, *GLGS 1101* (CAS, KUN); vicinity of Moqiewang, middle region of the Dulongjiang, ca. 4 km NNE of Kongdang, E side of the Dulongjiang, 2200 m, 14 Jan 1991, *GLGS 1881* (CAS, KUN); Dan Dang He, 2000 m, 18 Jan 1991, *GLGS 3267* (KUN); along the Dandangwang He, NW of Bapo, W side of the Dulongjiang, 1800 m, 18 Jan 1991, *GLGS 3268* (CAS, KUN); Dan Dang He, 1400 m, 19 Jan 1991, *GLGS 3300* (KUN); Li Qi, 1850 m, 28 Jan 1991, *GLGS 3710* (KUN); Maku, 2100 m, 13 Mar 1991, *GLGS 4550* (KUN); same data, *GLGS 4562* (KUN); Xue Ba La Ka, 2000 m, 20 Apr 1991, *GLGS 6175* (KUN); N of the second team, 2300 m, 16 May 1991, *GLGS 6846* (KUN); S of the second team, 1400 m, 19 Jan 1991, *GLGS 6907* (KUN); above Panjiasheng between Shigong Qiao and Xixiaofang on trail from Bapo to Gongshan via Qiqi, W side of Gaoligong Shan, 2350 m, 31 Oct 2004, *GLGS 22027* (CAS [2]); W side of the Dulongjiang Valley, ca. 1 direct km NW of Maku and ca. 4.5 direct km NE of Myanmar border, 2140 m, 18 Aug 2006, *GLGS 32478* (CAS); San Dui, 2000 m, 5 Jun 2006, *Lu 66* (CAS); Maku, 2200 m, 6 Aug 1982, *QX 8939* (KUN); Long Yuan, 2400 m, 26 Aug 1982, *QX 9664* (KUN); Long Yuan, 2500 m, 30 Aug 1982, *QX 9751* (KUN); Taron-Taru divide, bucahwang, 1700 m, 29 Oct 1938, *Yü 20873* (A, E, KUN); Tangtewang, 2300 m, 7 Nov 1938, *Yü 20999* (E, KUN). **LIANGHE XIAN.** From Mangdong to Mongyang, 1450 m, 17 Oct 1974, *G.D. Tao 12813* (KUN). **LONGLING XIAN. Longjiang Xiang.** Da Mo Shan, 1830–2340 m, 4 Dec 1958, *J. Chen 720* (KUN); ridge S of pass at top of Gaoligong Shan on old rd from Baoshan to Tengchong via Dahaoping, E side of Gaoligong Shan, 2410 m, 5 Sep 2003, *GLGS 18831* (CAS); 2500 m, 18 Aug 1941, *Wang 90126* (KUN). **Zhen'an Zheng.** Vicinity of Nankang Village, E side of Gaoligong Shan, ca. 3 km E of pass on new rd from Baoshan to Tengchong via Nankang Yakou, 1908 m, 25 Aug 2003, *GLGS 17831* [mistakenly as Longyang Qu, Lujiang Xiang on the label but all other data are correct] (CAS). **LONGYANG QU. Bawan Xiang.** Vicinity of Nankang Yakou, E side of Gaoligong Shan near crest, 2170 m, 26 May 2005, *GLGS 23757* (CAS). **Lujiang Xiang.** Nankang Botanic Garden (Lihuipo), summit of Gaoligong Shan, 2130 m, 18 Nov 2000, *GLGS 13197* (CAS, KUN); Lihuipo area near Nankang Village, E side of Gaoligong Shan near crest, just N of new rd from Baoshan to Tengchong via Nankang Yakou, 2210 m, 24 Aug 2003, *GLGS 17711* (CAS). **Mangkuan Xiang.** Bai Hua Ling, 2400 m, 27 Jan 1995, *GLGS 61* (KUN [2]); Baihualing, Daluchang National Forest, E side of Gaoligong Shan, 2100 m, 25 Nov 2000, *GLGS 13428* (CAS, KUN); Baihualing Cun, Jiujiezi area, E side of Gaoligong Shan, 1985 m, 8 Sep 2003, *GLGS 18883* (CAS). **LUSHUI**

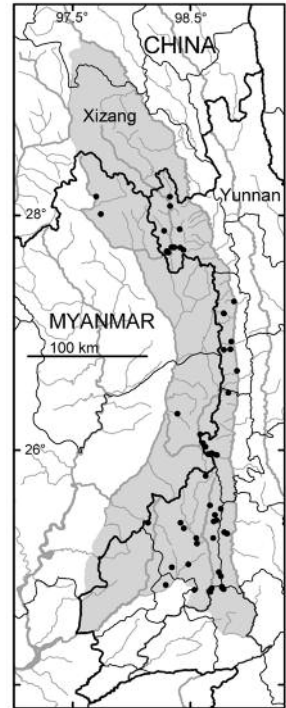


FIGURE 12. Distribution map of *Gautheria dumicola* in the GLGS region.

XIAN. Yao Jia Ping, along rd to Lu Zhang, 2440 m, 25 Oct 1996, *GLGS 8013* (E, KUN); Yaojiaping, 2440 m, 25 Oct 1996, *GLGS 8063* (KUN); same location, 2270 m, 28 Oct 1996, *GLGS 8215* (E, KUN); Shangjiang District, 17 Apr 1960, *NW Yunnan Expedition 8232* (KUN); from Liushui to Yaojiaping, 2050 m, 2 Jul 1960, *NW Yunnan Expedition 10343* (KUN [2]); Close to Da He, Zhuan Wang He, 2400 m, 30 Jun 1964, *Wu 7316* (KUN). **Luobenzhuo Xiang.** Vicinity of Bifu Bridge, ca. 32.7 direct km S of Fugong City and ca. 7.7 direct km W of the Nujiang, E side of Gaoligong Shan, 2640 m, 1 May 2004, *GLGS 20833A* [mistakenly recorded as Fugong Xian, Pihe Xiang on the label but all other data are correct] (CAS). **Pianma Xiang.** Gugang Community, from Pianma to Wu Zhong, 2200 m, 29 Jul 1978, *BE 1486* (KUN); 17 km N of Pianma toward Gangfang, W side of Gaoligong Shan, 2253 m, 17 May 2005, *GLGS 24382* (CAS); Pianma Yakou, 2100 m, 31 May 2006, *Lu 101* (CAS); same location, 2200 m, 31 May 2006, *Lu 102* (CAS); Pianma to Pianma Yakou, 2500 m, 14 Aug 1964, *Wu 8356* (KUN). **TENGCHONG XIAN.** Mid W of Yunnan, 7000 ft., Dec 1924, *F 7730* (E, K); Ma-chang-Kai Valley, N of Tengyueh, 6000–7000 ft., Feb 1913, *F 9568* (A, E, K); Shweli-Salwin divide, 9000–10000 ft., Jul 1918, *F 17774* (E, K); between Tengyueh and Burmese border, en route to Sadon, 8000 ft., Nov 1922, *Rock 7293* (A); same data, *Rock 7293a* (A); prope Tengyueh, 1800 m, Oct 1914, *C.K. Schneider 2561* (A, GH, K). **Houqiao Zheng (Guyong Zheng).** Vicinity of Gaoshidong in Guyong Linchang (forest farm), ca. 9.8 direct km ENE of Houqiao (Guyong), 2570 m, 27 May 2006, *GLGS 30676* (CAS). **Jietou Xiang.** Between Jietou and Datang, 1670 m, 27 Oct 1998, *GLGS 11078* (CAS, KUN); Shaba Cun, Tientai Shan, W side of Gaoligong Shan, 2240 m, 28 Oct 1998, *GLGS 11123* (CAS, KUN); Shaba Cun, community forest of Lidazhai, W side of Gaoligong Shan, 1880 m, 23 Dec 2000, *GLGS 13601* (CAS, KUN); Xinzhuang Cun, vicinity of Lijiapo, ca. 5.9 direct km ENE of Jietou on W side of Gaoligong Shan, 1940 m, 23 May 2006, *GLGS 29462* (CAS). **Qushi Xiang.** Jiang Zuo, 2030–2300 m, 14 Sep 1960, *Yin 60-1044* (KUN). **Ruidian Xiang.** Yunfeng Cun, Yunfeng Shan, along trail from Yunfeng Si to base of mtn. on N side of the moist valley directly E of Yunfeng Si, ca. 8.6 direct km SSW of Ruidian, 2010 m, 3 Jun 2006, *GLGS 31006* (CAS). **Shangyun Xiang.** W side of Gaoligong Shan on old trail (southern silk road) just N and above old rd from Baoshan to Tengchong via Dahaoping, 2300 m, 4 Sep 2003, *GLGS 18687* (CAS). **Yunhua Xiang.** 2000 m, 13 Oct 1963, *J.Z. Zhao 7* (KUN). **Zhonghe Xiang.** Huan Xi Po, 2100 m, 8 Aug 1980, *S.H. Li 80-599* (KUN). **MYANMAR. KACHIN: MYITKYINA DISTRICT. Hsawlaw Township.** Chawngwaw, 7000 ft., *KW 3486* (E). **PUTAO DISTRICT. Nongmung Township.** Nam Tamai Valley, Mungku Hkyet, 7000–8000 ft., 1937, *KW 13489* (BM).

7. *Gaultheria eciliata* (S.J. Rae & D.G. Long) P.W. Fritsch & L.H. Zhou, **comb. & stat. nov.** Basionym: *Gaultheria trichophylla* Royle var. *eciliata* S.J. Rae & D.G. Long, Notes Roy. Bot. Gard. Edinburgh 45:334. 1988. TYPE.—BHUTAN. Mongar: Pung La, 3660 m, 9 July 1949, *F. Ludlow, G. Sherriff, & J.H. Hicks 20904* (holotype: BM, photo of holotype, E!).

Chiogenes suborbicularis W.W. Smith var. *albiflorus* T.Z. Xu, Acta Bot. Yunnan. 6:41. 1984. TYPE.—CHINA. Yunnan: Gongshan Xian, Mekong-Salwin divide, Sila, 4000 m, 16 August 1938, *T.T. Yü 22351* (holotype: KUN No. 04829161; isotype: KUN No. 04829171).

Shrublets, prostrate. Branchlets elongate, light brown flushed with red, terete, black-uncinate-setulose. Petiole 0.4–1 mm, glabrous; leaf blade elliptic, often asymmetric, 3.5–6.5 × 1–2.5 mm, gradually smaller along stems toward both ends of each year's growth, 1.5–4 × as long as wide, subcoriaceous, green, glabrous, both surfaces ± glossy, midvein abaxially planar and adaxially planar to slightly sulcate, secondary and tertiary veins obscure, base cuneate to rounded, margin serrate, with 3–8 setulose-tipped teeth per side, planar, apex slightly acuminate. Inflorescences 5–10 mm, 1-flowered; bracts absent. Pedicel 1–2 mm, glabrous; bracteoles 2, apical, orbicular, not keeled, 1.3–1.6 × 1.3–1.8 mm, persistent, glabrous, margin entire, apex broadly obtuse to rounded. Calyx 1.7–2.6 mm; lobes 5, ovate-deltoid, 1.3–1.8 × 1.4–2 mm, overlapping at base, outside glabrous, inside glabrous or pubescent, margin entire, slightly erose, or ciliate, apex bluntly acute. Corolla white, campanulate, 3–4 × 2.7–4 mm, glabrous on both sides; lobes 5, deltoid-oblong, 0.7–1.1 mm. Stamens 10; filaments 1.1–1.4 mm, gradually or abruptly dilated subbasally

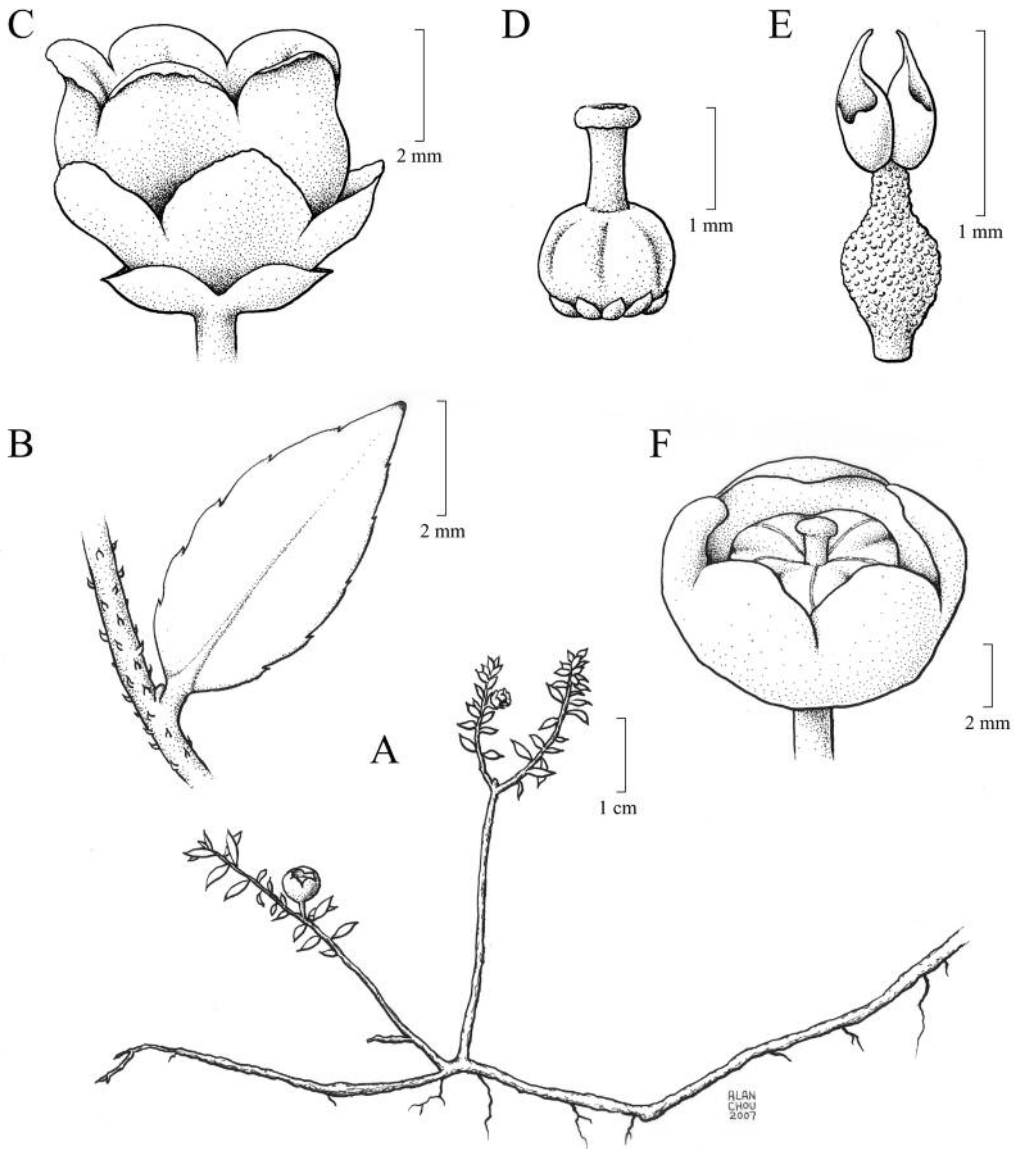


FIGURE 13. *Gaultheria eciliata*. - A. Whole plant, in fruit. - B. Branchlet and leaf (abaxial view). - C. Flower. - D. Gynoecium with subtending nectary disk. - E. Stamen. - F. Fruit. C-E based on *Yü 19877* (E); A, B, F based on *GLGS 16874* (CAS).

from apex, glabrous; anthers 0.5–0.7 mm, 2-awned; awns 0.1–0.3 mm. Ovary glabrous; style 0.9–1.1 mm, glabrous. Calyx at fruiting blue, fleshy; lobes incurved or erect, not pale-edged. Capsule 4–6 mm in diam., glabrous.

Rae and Long (in Long 1988) described this taxon as a variety of *Gaultheria trichophylla*, distinguishing it from the nominal variety by its smaller, ovate leaf blades with serrulate, eciliate margins and acute apex. We observed the following differences in var. *trichophylla* versus var. *eciliata*: leaf blade width 2–6 mm (versus 1–2.5 mm) with midvein abaxially raised to prominent (ver-

versus planar), marginal teeth setose-tipped (versus setulose-tipped), and apex acute to subrounded (versus slightly acuminate); calyx 2.8–3.6 mm (versus 1.7–2.6 mm) with lobes mostly not overlapping at base (versus overlapping at base); corolla lobes 1.8–2.8 mm (versus 0.7–1.1 mm); anthers 0.7–1 mm (versus 0.5–0.7 mm) with awns 0.3–0.9 mm (versus 0.1–0.3 mm); and style 2–2.5 mm (versus 0.9–1.1 mm). With the apparent absence of any intermediacy in these characters between the two taxa, we consider the differences between them substantial enough to warrant recognition of variety *eciliata* at the species level.

ILLUSTRATION.— Figure 13.

PHOTOGRAPHIC IMAGE.— Figure 14.

PHENOLOGY.— Fl. Jul–Aug, fr. Aug–Oct.

DISTRIBUTION AND HABITAT.— Montane grasslands, thickets, meadows; 3200–4100 m.

In GLGS: CHINA. Xizang: Zayü Xian. Yunnan: Gongshan Xian (Bingzhongluo Xiang, Cikai Zheng, Dulongjiang Xiang); Figure 15. Outside of GLGS: Yunnan [Bhutan].

CHINESE NAME.— 须毛白珠 (新拟) xu mao bai zhu.

GAOLIGONG SHAN SPECIMENS EXAMINED: CHINA. XIZANG: ZAYÜ XIAN. Ri Dong Qu, 4100 m, 9 Sep 1982, *QX 10228* (KUN). **YUNNAN: GONGSHAN XIAN. Bingzhongluo Xiang.** Chang Pu Tong, 3500–3700 m, 10 Jul 1940, *Feng 7675* p.p. (KUN); vicinity of Niwaidanbu, ca. 2.4 direct km SW of Gawagapu Mtn., ca. 1.3 direct km E of Chukuai Lake and ca. 16.5 direct km WSW of Bingzhongluo, W side of Gaoligong Shan, 3900 m, 30 Aug 2006, *GLGS 31667* (CAS). **Cikai Zheng.** N of rd from Gongshan to Kongdang, E side of Gaoligong Shan, u-shaped valley draining into upper reaches of the Pula He, 3429 m, 3 Oct 2002, *GLGS 16952* (KUN); Yipsaka Lake, 2.4 direct km SE of Heipu Pass tunnel on new rd from Gongshan to Dulongjiang Valley, E side of Gaoligong Shan, 3500 m, 12 Aug 2006, *GLGS 32019* (CAS); Heipu Pass along rd from Gongshan to Dulongjiang valley, E side of Gaoligong Shan, 3490 m, 12 Aug 2006, *GLGS 32041* (CAS); Yipsaka Lake, 2.4 direct km by SE of Heipu Pass tunnel on new rd from Gongshan to Dulongjiang Valley, E side of Gaoligong Shan, 3560 m, 12 Aug 2006, *GLGS 32078* (CAS); ca. 1.2 direct km SSE of Heipu Pass tunnel on new rd from Gongshan to Dulongjiang Valley, E side of Gaoligong Shan, 3350 m, 13 Aug 2006, *GLGS 32102* (CAS). **Dulongjiang Xiang.** N side of pass above tunnel on rd between Gongshan and Kongdang, W side of Gaoligong Shan, 3530 m, 2 Oct 2002, *GLGS 16874* (CAS); Upper Kiukiang Valley, S of Lungtsahmura, 3900 m, 10 Aug 1938, *Yü 19877* (A, E, KUN); Salween-Kiu Chiang divide, Lunguailaka, 3200 m, 16 Sep 1938, *Yü 20336* (A, E).



FIGURE 14. Fruiting branch of *Gaultheria eciliata*. Photo by D. Lin.

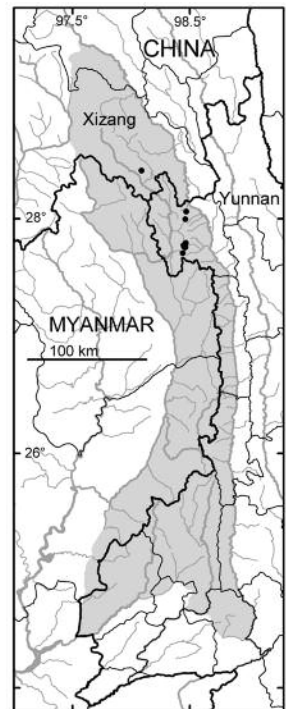


FIGURE 15. Distribution map of *Gaultheria eciliata* in the GLGS region.

8. *Gaultheria fragrantissima* Wallich, *Asiat. Res.* 13:397. 1820. TYPE.— Nepal. *N. Wallich 765* (probable holotype: K; isotypes: A [image!], L [on-line image!], NY [2; on-line images!]).

Gaultheria forrestii Diels, Notes Roy. Bot. Gard Edinburgh 5:210. 1912. TYPE.— CHINA. Yunnan: east flank of the Tali Range, 25°40'N, 10000–12000 ft., July 1906, *G. Forrest 4183* (lectotype, here designated: E!; isolectotype: A!).

Although N. Wallich's type material is mainly at K, we have not seen material of *N. Wallich 765* from K and do not know if such exists. The disposition of the holotype, therefore, remains in question.

Diels cited two collections in the protologue of *Gaultheria forrestii* (*G. Forrest 4175* and *4183*), neither of which was specifically indicated as the type. We have designated the E specimen of *G. Forrest 4183* as lectotype because it is the only sheet we have seen among the duplicates of the two collections with the word "Type" hand-written on it. The handwriting may be that of Diels, as based on the handwriting sample in Steenis (1950), although types of other species not named by Diels also sometimes have "Type" in the same handwriting.

Shrubs or rarely small trees, 0.25–4 m tall, erect, arching, or pendent, with strong wintergreen odor, gynodioecious. Branchlets elongate, slightly angulate, glabrous or occasionally patchily white-puberulent and/or sparsely red- to brown-appressed to -ascending-setulose. Petiole 0.5–1.5 cm, glabrous or occasionally puberulent or setulose or both; leaf blade elliptic, oblong-elliptic, or ovate-elliptic, 6.9–17 × 2.4–7.4 cm, those near inflorescences generally smaller, 1.7–4.1 × as long as wide, chartaceous to subcoriaceous, abaxially greenish brown to brown and dark red- to brown-gland-dotted or -setulose, adaxially white-puberulent proximally along midvein, midvein abaxially prominent and adaxially sulcate, secondary veins 3–6 on each side of midvein, arising along midvein with proximal veins becoming faint or anastomosing before reaching apex, abaxially raised, adaxially slightly raised to slightly impressed, tertiary veins abaxially raised and adaxially slightly raised to slightly impressed, base cuneate, margin regularly serrulate, with 20–40 teeth per side, planar to slightly revolute, apex acute to acuminate. Inflorescences axillary and terminal, moderately dense racemes, generally from both upper and lower leaf axils and also often borne below leaves, 2–9 cm, 1–29-flowered, bud stage elongate and conspicuous in autumn; rachis slender, densely white-pubescent to -villous, rarely also ascending-setose; bracts narrowly deltoid, keeled, 2.5–4 × 2.5–3 mm, persistent, abaxially glabrous, adaxially white-strigillose or -ascending-pubescent, margin ciliate, apex sharply acute. Pedicel 2–7 mm, white-pubescent and rarely also setose; bracteoles subapical or usually apical, deltoid, 1.8–2.5 × 1.3–1.8 mm, otherwise similar to bracts. Calyx 2–3.2 mm; lobes 5, deltoid, 1.5–2.8 × 1.2–1.9 mm, outside glabrous, inside white-sericeous, margin ciliate, apex sharply acute. Corolla white or occasionally pinkish white, light green, or light yellow, urceolate to subglobose, 3.5–5 × 2.5–4.5 mm, outside glabrous, inside densely white-pilose; lobes 5, oblong, 0.6–1 mm. Staminodes (in female flowers) ca. 2 mm. Stamens 10; filaments 1.5–2 mm, gradually dilated medially from apex, sparsely pilose; anthers 1.3–1.5 mm, awns 0.4–0.8 mm. Ovary white-lanate or -hirtellous; style 2–5 mm, glabrous. Calyx at fruiting dark purple to black, fleshy; lobes erect, pale-edged. Capsule 2–6 mm in diam., sericeous.

SELECTED ILLUSTRATIONS.— R.C. Fang, Fl. Reipubl. Popularis Sin. 57(3):54 t. 16(3–7). 1991; *ibid.*, 56 t. 17(1–4, as *G. forrestii*); G.H. Zhu & L.B. Zhang, eds. Fl. China III. 14: t. 656(3–7). 2006; *ibid.*, 661(1–5).

PHOTOGRAPHIC IMAGE.— Figure 16.

PHENOLOGY.— Fl. Oct–Jun, fr. Apr–Oct.

DISTRIBUTION AND HABITAT.— Subtropical evergreen broadleaf forests, coniferous forests, mixed forests, thickets; 1250–2650(–3000) m. In GLGS: CHINA. Xizang: Zayü Xian. Yunnan: Fugong Xian (Lishadi Xiang, Lumadeng Xiang, Maji Xiang, Shangpa Zheng), Gongshan Xian



FIGURE 16. Inflorescences of *Gaultheria fragrantissima*. Photo by P. Fritsch.

(Bingzhongluo Xiang, Cikai Zheng, Dulongjiang Xiang), Longling Xian (Longjiang Xiang), Longyang Qu (Lujiang Xiang), Tengchong Xian (Jietou Xiang, Mazhan Xiang, Qingshui Xiang, Shangyun Xiang, Tengyue Zheng, Wuhe Xiang, Xinhua Xiang), MYANMAR. Kachin: Myitkyina District (Hsawlaw District), Putao District (Nogmung Township); Figure 17. Outside of GLGS: Xizang, Yunnan [Bhutan, India, Malaysia, Myanmar, Nepal, Sri Lanka, N Vietnam].

CHINESE NAME.—芳香白珠 fang xiang bai zhu

GAOLIGONG SHAN SPECIMENS EXAMINED: CHINA. XIZANG: ZAYŪ XIAN. A mtn. close to the city, 2650 m, 18 Jun 1973, *QX 73-191* (KUN). **YUNNAN:** E slope of Gaoligong Shan, 2120 m, 25 May 1964, *NT 9075* (KUN). **FUGONG XIAN.** **Lishadi Xiang.** Niwaluo Cun, vicinity of Luweide village, above the Nujiang, E side of Gaoligong Shan, 1810 m, 17 Aug 2005, *GLGS 27742* (CAS). **Lumadeng Xiang.** Ca. 12 km from the Nujiang on the rd to Yaping Pass, E side of Gaoligong Shan, ca. 27 direct km N of Fugong City, 1969 m, 26 Apr 2004, *GLGS 19536* (CAS); Cao He, ca. 6 km from the Nujiang on rd to Yaping Pass, E side of Gaoligong Shan, ca. 25 direct km N of Fugong City, 1675 m, 26 Apr 2004, *GLGS 19546* (CAS); along S fork of Yamu River on rd from the Nujiang to Yaping Pass, E side of Gaoligong Shan, ca. 25.2 direct km N of Fugong City, 1608 m, 25 Apr 2004, *GLGS 19824* (CAS). **Maji Xiang.** Mujiajia Cun, vicinity of Mujiajia Village close to the Nujiang, E side of Gaoligong Shan, 1380 m, 15 Aug 2005, *GLGS 27585* (CAS). **Shangpa Zheng.** 2300 m, 27 Oct 1933, *Tsai 54947* (A); 2000 m, 22 Sep 1934, *Tsai 56578* (A). **GONGSHAN XIAN.** Along the Pu La He from Gongshan to Dulongjiang, 1750 m, 7 May 1979, *NE 79-36* (KUN); Qi Qu (the seventh district) to Bai Zi Di, 1900 m, 8 May 1979, *NE 79-46* (KUN); E slope of Gaoligong Shan, 2200 m, 28 Jul 1982, *QX 8827* (KUN).

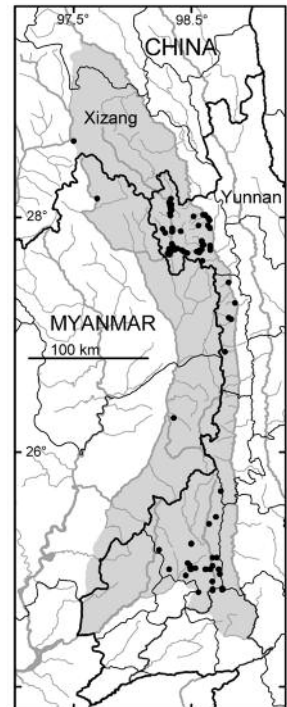


FIGURE 17. Distribution map of *Gaultheria fragrantissima* in the GLGS region.

Bingzhongluo Xiang. From Bingzhongluo to Shi Meng Guan, 1650 m, 10 Sep 1997, *GLGS 8816* (E); same location, 1650 m, 14 Sep 1997, *GLGS 9142* (E); same location, 1720–1760 m, 6 Jul 2000, *GLGS 12048* (CAS, KUN); *GLGS 12061* (CAS, KUN); Shuangla, E side of Gaoligong Shan, rd from Gongshan to Bingzhongluo, 1650 m, 17 Apr 2002, *GLGS 14487* (CAS, KUN); Puhuasigou, E side of Gaoligong Shan, rd from Bingzhongluo to Stone Gate, 1710 m, 21 Apr 2002, *GLGS 14590* (CAS, KUN); Dalaqing, E side of Gaoligong Shan, rd from Gongshan to Bingzhongluo, 1650 m, 25 Apr 2002, *GLGS 14704* (CAS, KUN); vicinity of Fucui, N side of Nianwaluo He, ca. 10.8 direct km WSW of Bingzhongluo, E side of Gaoligong Shan, 2780 m, 1 Sep 2006, *GLGS 31751* (CAS); vicinity of Xiaochala, ca. 1 km NW of mouth of the Shuangla He and ca. 25.5 direct km N of Gongshan, rd from Gongshan to Bingzhongluo, W side of the Nujiang, 1700 m, 20 Aug 2006, *GLGS 33742* (CAS); same data, *GLGS 33750* (CAS); Bing Zhong Luo River, E slope of Gaoligongshan, 1750–2500 m, 1 Aug 1979, *NE 79-1242* (KUN); same data, *NE 79-1249* (KUN); from Bingzhongluo to Bing Da, 1600–1700 m, 4 Jul 1982, *QX 7944* (KUN); Salwin Valley, SW of Champotong, 1800 m, 24 Jun 1934, *Yü 19140* (A, E). **Cikai Zheng.** 1700–1900 m, 3 Oct 1940, *Feng 8169* (KUN); Dangan Park, just W of Gongshan, W side of the Nujiang, 1600 m, 6 Nov 1990, *GLGS 201* (CAS, KUN); Qiqi to Dong Shao Fang, 2000 m, 15 Oct 1996, *GLGS 7569* (KUN); E side of Gaoligong Shan, Dangan Park above Gongshan, 1600–1900 m, 29 Jun 2000, *GLGS 11768* (CAS, KUN); same data, *GLGS 11770* (CAS, KUN); E side of Gaoligong Shan, W of Gongshan and E of Qiqi along the Pula He, vicinity of Qiqi Bridge, 1850 m, 10 Jul 2000, *GLGS 12213* (CAS, KUN); E side of Gaoligong Shan, W of Gongshan and W of Qiqi, along the Pula He, trail to Dongshao Fang and Dulongjiang Valley, 2200 m, 10 Jul 2000, *GLGS 12246* (CAS, KUN); E side of Gaoligong Shan, W of Gongshan, S side of the Pula He directly opposite Qiqi, 2000–2150 m, 11 Jul 2000, *GLGS 12270* (CAS, KUN); Heiwadi, E side of Gaoligong Shan, along the Pula He on new rd to Dulongjiang Valley, 2400 m, 12 Apr 2002, *GLGS 14144* (CAS, KUN); Yimaluo, E side of the Salween River, along trail to Wild Ox Valley, 2020 m, 16 Apr 2002, *GLGS 14361* (CAS, KUN); Heiwadi, E side of Gaoligong Shan, along the Pula He on new rd to Dulongjiang Valley, 2020 m, 20 Apr 2002, *GLGS 14518* (CAS, KUN); E side of Gaoligong Shan, W of Gongshan, along the Pula He on trail from Gongshan to Qiqi and Dulongjiang Valley, 2020 m, 29 Apr 2002, *GLGS 14751* (CAS, KUN); Black Mtn., Dangan Park directly W and above Gongshan, E side of Gaoligong Shan, 1780 m, 30 Sep 2002, *GLGS 15630* (CAS, KUN); Dangan Park directly W and above Gongshan, E side of Gaoligong Shan, 1700 m, 24 Sep 2002, *GLGS 16548* (CAS, KUN); vicinity of Mangzhou Wadi, S side of the Danzhu He, ca. 13.6 direct km WSW of Danzhu Cun and ca. 14.8 direct km SW of Gongshan, E side of Gaoligong Shan, 3000 m, 12 Aug 2006, *GLGS 33104* (CAS); vicinity of Heiwadi Qiao on rd from Gongshan to Kongdang, ca. 9.5 direct km NW of Gongshan, E side of Gaoligong Shan, 1790 m, 18 Aug 2006, *GLGS 33545* (CAS); vicinity of Dimupo, ca. 7 direct km WNW of Gongshan on rd from Gongshan to Kongdang, E side of Gaoligong Shan, 2530 m, 17 Aug 2006, *GLGS 33693* (CAS); the hill behind the city, 1650 m, 27 Apr 1979, *NE 79-3* (KUN); from Gongshan to Dulongjiang, E slope of Gaoligongshan, 1600–1700 m, 17 Jul 1982, *QX 7994* (KUN); same locality, 1700 m, 17 Jul 1982, *QX 8028* (KUN). **Dulongjiang Xiang.** W bank of Dulongjiang, the fourth village, 1300 m, 2 Nov 1959, *Feng 24715* (KUN); Dulongjiang Valley, 22 Nov 1990, *GLGS 780* (CAS, KUN); vicinity of Meiliwang, along trail from Bapo to Gongshan, E side of the Dulongjiang, 1500 m, 23 Nov 1990, *GLGS 835* (CAS, KUN); vicinity of Jimudang, ca. 5 m NW of Bapo, W side of the Dulongjiang, 1400 m, 6 Dec 1990, *GLGS 885* (CAS, KUN); W bank of the Dulongjiang, 1400 m, 11 Dec 1990, *GLGS 996* (KUN); vicinity of Maku, southern region of Dulongjiang Valley, W side of the Dulongjiang, 1780 m, 15 Dec 1990, *GLGS 1071* (CAS, KUN); same locality, 2080 m, 16 Dec 1990, *GLGS 1108* (CAS, KUN); Ma Bi Luo, 1310 m, 30 Dec 1990, *GLGS 1394* (KUN); Mei Li Wang, 1800 m, 7 Jan 1991, *GLGS 1653* (KUN); Muo Qie Wong, 1608 m, 9 Jan 1991, *GLGS 1748* (KUN); same location, 1560 m, 10 Jan 1991, *GLGS 1830* (KUN); Mei Li Wong, 1800 m, 10 Jan 1991, *GLGS 1930* (KUN); Song Dang Luo, 1600 m, 14 Jan 1991, *GLGS 1996* (KUN); Kong Dang, 1445 m, 20 Nov 1990, *GLGS 2050* (KUN); vicinity of Longyuan, ca. 6 km S of Dizhengdang, W side of the Dulongjiang, 1690 m, 23 Nov 1990, *GLGS 2175* (CAS, KUN); between Dizhengdang and Xiongdang, along Kelaoluo River which is the northwestern tributary of the Dulongjiang, 1980 m, 29 Nov 1990, *GLGS 2234* (CAS, KUN); Dan Dang Wang He, 1400 m, 16 Jan 1991, *GLGS 3144* (KUN); Dan Dang He, 1900 m, 18 Jan 1991, *GLGS 3275* (KUN); Ma Bi Dang, 1300 m, 21 Feb 1991, *GLGS 4076* (KUN); Kong Dang, 1480 m, 1 Mar 1991, *GLGS 4114* (KUN); Mong Dang, 1310 m, 4 Mar 1991, *GLGS 4176* (KUN); Ma Ku, 1800 m, 6 Mar 1991, *GLGS 4202* (KUN); same location, 1830 m, 6 Mar 1991, *GLGS 4203* (KUN); same location, 1850 m, 7 Mar 1991, *GLGS*

4232 (KUN); Si La Luo, 1450 m, 13 Mar 1991, *GLGS 4713* (KUN); Qia Wu Dang, 2100 m, 22 Mar 1991, *GLGS 4810* (KUN); Wang Mei Dong, 2100 m, 26 Mar 1991, *GLGS 5158* (KUN); Lang Ben Dang, 2100 m, 27 Mar 1991, *GLGS 5256* (KUN); Xi Shao Fang, 2500 m, 30 Mar 1991, *GLGS 5338* (KUN); Long Yuan, 1700 m, 30 Mar 1991, *GLGS 5366* (KUN); same location, 1650 m, 11 Apr 1991, *GLGS 5435* (KUN); same data, *GLGS 5471* (KUN); same location, 1630 m, 11 Apr 1991, *GLGS 5522* (KUN); Di Zheng Dang, 1850 m, 13 Apr 1991, *GLGS 5677* (KUN); same location, 1780 m, 14 Apr 1991, *GLGS 5773* (KUN); same location, 1800 m, 16 Apr 1991, *GLGS 5984* (KUN); Wang Mu La Ka, 2400 m, 18 Apr 1991, *GLGS 6058* (KUN); Si Fang La Ka, 2000 m, 21 Apr 1991, *GLGS 6273* (KUN); N of the second team, 2300 m, 16 May 1991, *GLGS 6841* (KUN); Mei Li Wang, 1800 m, 21 May 1991, *GLGS 7008* (KUN); Xianjiudang, W side of Gaoligong Shan, along Dulongjiang Valley on trail from Kongdang to Dizhengdang, 1560 m, 23 Jul 2002, *GLGS 15232* (CAS, KUN); vicinity of Nengpula, E side of the Dulongjiang just E of Hongxin Qiao (Red Star bridge) ca. 0.5 km SW of Bapo, 1330 m, 29 Oct 2004, *GLGS 20752* (CAS); ca. 0.6 km NW of Meiliwang on trail between Bapo and Xixiaofang on trail from Bapo to Gongshan via Qiqi, W side of Gaoligong Shan, 1660 m, 31 Oct 2004, *GLGS 21311* (CAS); N side of Shilawa River, W side of the Dulongjiang ca. 0.5 direct km SW of Dizhengdang (Lengdang) and ca. 22 direct km N of Kongdang, 1910 m, 29 Oct 2004, *GLGS 21446* (CAS); W side of the Dulongjiang, ca. 2 direct km SSW of Dizhengdang (Lengdang) and ca. 20.5 direct km N of Kongdang, 1930 m, 30 Oct 2004, *GLGS 21560* (CAS); Bailai Zhai, Longyuan Cun, W side of the Dulongjiang, ca. 7 direct km S of Dizhengdang (Lengdang) and ca. 15.5 direct km N of Kongdang, 1720 m, 28 Oct 2004, *GLGS 21618* (CAS); Mabiluo on E side of the Dulongjiang just N of Mabidang, ca. 4 km N of Bapo, S side of river along input channel to hydroelectric station, 1380 m, *GLGS 21930* (CAS); W side of the Dulongjiang Valley, ca. 1 direct km NW of Maku and ca. 4.5 direct km NE of Myanmar border, 2140 m, 18 Aug 2006, *GLGS 32505* (CAS); from Dulongjiang to San Dui (the third team), 10 Jul 1979, *NE 79-1169* (KUN); 1500 m, 22 Aug 1982, *QX 9399* (KUN); Kiukiang Valley, Mt. Ching Ting La Ka, 1800 m, 26 Jul 1938, *Yü 19492* (A, E, KUN). **LONGLING XIAN. Longjiang Xiang.** Yun Long Shang, Fu Long Si, 1500 m, 28 Nov 1958, *J. Chen 657* (KUN); vicinity of Xiaoheshan, along trail on S side of Hwy. S317 (new hwy. from Baoshan to Tengchong via Nankang Yakou) at Km 23.5, W side of Gaoligong Shan, 2037 m, 23 May 2005, *GLGS 24613* (CAS); vicinity of Xiaoshuihe, Xiaoheishan Provincial Nature Reserve area, W side of Gaoligong Shan, 1990 m, 27 May 2005, *GLGS 25065* (CAS); 1800 m, 11 Apr 1934, *Tsai 55732* (A, E); 1700 m, 16 Mar 1934, *Tsai 56477* (A, E, KUN). **LONGYANG QU. Lujiang Xiang.** Nankang Botanic Garden (Lihuipo), summit of Gaoligong Shan, 2170 m, 20 Nov 2000, *GLGS 13302* (CAS). **TENGCHONG XIAN.** Hills SW of Tengyueh, 5700 ft., May 1912, *F 7466* (A, E, K); hills E of Tengyueh, 5000 ft., May 1912, *F 7659* (A, E, K); same location, 7000 ft., Nov 1912, *F 9335* (A, E, K); hills around Tengyueh, Nov 1912, *F 9389* (E); hills E of Tengyueh, 6–7000 ft., Feb 1913, *F 9591* (A, E, K); hills NW of Tengyueh, 7000 ft., Feb 1913, *F 9694* (A, E, K); hills S of Tengyueh, 6000 m, Mar 1913, *F 9792* (A, E, K); Shweli-Salwin divide, 8–9000 ft., Apr 1914, *F 12344* (E, K); hills around Tengyueh, 5000–7000 ft., Jul 1919, *F 18098* (A, E, K); bank of the Shweli, 8000 ft., Mar 1931, *F 29457* (E [2]); Shweli-Salwin divide, E of Tengyueh, 8000 ft., Jun 1931, *F 29803* (E); Shweli River drainage basin to summit of Shweli-Salween watershed, E of Tengyueh, 15 Jan 1923, *Rock 7887* (A); Shweli River drainage basin and environs of Tengyeh, 1800 m, Feb 1923, *Rock 7902* (A). **Jietou Xiang.** Dayuanzi Cun, W of Gaoligong Shan ridge, ca. 2 direct km SW of Dayuanzi, 1590 m, 15 May 2006, *GLGS 28202* (CAS); Xin Zhuang Cun, vicinity of Lijiapo, ca. 5.9 direct km ENE of Jietou, W side of Gaoligong Shan, 1940 m, 23 May 2006, *GLGS 29464* (CAS); same data, *GLGS 29465* (CAS). **Mazhan Xiang.** Bao Jia Xiang, 1850 m, 15 Apr 1985, *Fragrances Resource Expedition 85-229* (KUN); Dakong Shan Volcano, 2040 m, 2 Jun 2006, *GLGS 29886* (CAS); same data, *GLGS 29889* (CAS); same location, 1940 m, 2 Jun 2006, *GLGS 29895* (CAS). **Qingshui Xiang.** Liangying Cun, vicinity of Huangguaqing, 1470 m, 1 Jun 2006, *GLGS 30853* (CAS); data location, *GLGS 30855* (CAS). **Shangyun Xiang.** Pingdi Cun, near Guanggui Village, W side of Gaoligong Shan, N of old rd from Baoshan to Tengchong via Dahaoping on dirt track N of bridge across the Longchangjiang, 1335 m, 30 Aug 2003, *GLGS 18071* (CAS); Taipingpu area, W side of Gaoligong Shan on old trail (southern silk road) just N and above old rd from Baoshan to Tengchong via Dahaoping, 2300 m, 4 Sep 2003, *GLGS 18688* (CAS). **Tengyue Zheng.** Bao Feng Si, 1850–2000 m, 27 Dec 1958, *J. Chen 1029* (KUN); vicinity of Baofeng Si, NW outskirts of Tengchong City, 1790 m, 31 May 2006, *GLGS 29757* (CAS). **Wuhe Xiang.** Vicinity of Tuting Village, E side of the Longchuanjiang, W side of Gaoligong Shan, 1250 m, 23 May 2005, *GLGS 24565* (CAS). **Xinhua Xiang.** Longjin Cun,

NE corner of Xinhua Xiang near border with Puchuan Xiang, W of the Longchangjiang and W of S end of Gaoligong Shan, 1940 m, 5 Jun 2006, *GLGS 31118* (CAS). **MYANMAR. KACHIN: MYITKYINA DISTRICT. Hsawlaw Township.** Ngawchang Valley and tributaries, near Htawgaw, 7000 ft., 7 Mar 1939, *KW 381* (A). **PUTAO DISTRICT. Nongmung Township.** Adung Valley, 6000 ft., 16 Feb 1931, *KW 9243* (A); same locality, 7000–8000 ft., 16 Mar 1931, *KW 9305* (A).

9. *Gaultheria griffithiana* Wight, *Calcutta J. Nat. Hist.* 8:176. 1847. TYPE.—BHUTAN. *W. Griffith 3483* (syntypes: K!, K; isotype: GH [image!]).

Gaultheria caudata Stapf, *Bot. Mag.* 154: t. 9228. 1931. TYPE. — *Bot. Mag.* 154: t. 9228. 1931; specimens, if such exist, not seen.

Gaultheria lasiocarpa T.Z. Xu, *Acta Phytotax. Sin.* 30:175. 1992. TYPE.—CHINA. Sichuan: Miyi, 3200–3300 m, 7 July 1983, *Qinghai-Xizang Expedition 11831* (holotype: PE).

Gaultheria miyiensis T.Z. Xu, *Acta Phytotax. Sin.* 30:178. 1992. TYPE.—CHINA. Sichuan: Miyi, 2700 m, 6 June 1990, *T.Z. Xu Mi-003* (holotype: KUN!).

Shrubs or rarely small trees, 1–6 m tall, erect to arching, with strong wintergreen odor, gynodioecious. Branchlets elongate, terete to slightly angulate, glabrous or rarely sparsely setulose. Petiole 4–12 mm, glabrous or occasionally white-puberulent; leaf blade elliptic, oblong-elliptic, lanceolate-elliptic, or oblanceolate-elliptic, 6.7–15.8 × 2.5–5.1 cm, 2.4–5.4 × as long as wide, coriaceous, abaxially greenish brown to brown and dark red- to brown-gland-dotted or occasionally -papillose-setulose, adaxially white-puberulent proximally along midvein, midvein abaxially prominent and adaxially sulcate, secondary veins 3–6 on each side of midvein, arising along midvein with proximal veins becoming faint or anastomosing before reaching apex, abaxially raised, adaxially planar to impressed, tertiary veins abaxially raised and adaxially planar to impressed, base cuneate to rounded, margin regularly serrulate, with 40–75 teeth per side, planar to slightly revolute, apex narrowly acuminate to caudate. Inflorescences axillary and terminal, rather open racemes, generally from both the upper and lower leaf axils, 1.2–8 cm, 4–25-flowered, bud stage elongate and conspicuous in autumn; rachis slender, white-pubescent to -villous; bracts ovate to ± hemispherical, not keeled, 1.7–4.2 × 2.2–3 mm, persistent, abaxially glabrous, adaxially white-sericeous or -strigillose, margin ciliolate, apex broadly obtuse to rounded. Pedicel 3–9 mm, white-pubescent; bracteoles medial or submedial, deltoid-ovate, keeled, 1.5–2 × 1–1.4 mm, apex acuminate, otherwise similar to bracts. Calyx 2.5–3.5 mm; lobes 5, ovate-deltoid, 1.5–2.8 × 1.3–1.8 mm, outside glabrous, inside white-tomentose at least apically, margin ciliolate, apex obtuse to acute. Corolla white to green, occasionally pink- or purple-tinged, campanulate to subglobose, 4–6 × 3–7 mm, glabrous; lobes 5, broadly deltoid, 0.8–2.5 mm. Staminodes (in female flowers) ca. 1 mm. Stamens 10; filaments ca. 2 mm, gradually dilated medially from apex, glabrous; anthers 1.2–1.4 mm, awns 0.7–1.1 mm. Ovary white-sericeous; style 2–3.5 mm, proximally hirtellous. Calyx at fruiting dark purple to black, thin; lobes incurved, pale-edged. Capsule 3–8 mm in diam., sericeous.

SELECTED ILLUSTRATIONS.—O.S. Stapf, *Bot. Mag.* 154: t. 9228. 1931 (as *G. caudata*). R.C. Fang, *Fl. Reipubl. Popularis Sin.* 57(3):57 t. 17(5–8). 1991; G.H. Zhu & L.B. Zhang, eds. *Fl. China Ill.* 14: t. 661(6–10). 2006.

PHOTOGRAPHIC IMAGE.—Figure 18.

PHENOLOGY.—Fl. Apr–Sept, fr. May–Dec.

DISTRIBUTION AND HABITAT.—Subtropical evergreen broadleaf forests, mixed evergreen and deciduous broadleaf forests, deciduous broadleaf forests, thickets; 2160–3300 m. In *GLGS: CHINA*. Yunnan: Fugong Xian (Lishade Xiang, Lumadeng Xiang, Shangpa Zheng), Gongshan Xian (Bingzhongluo Xiang, Cikai Zheng, Dulongjiang Xiang), Longyang Qu (Bawan Xiang,



FIGURE 18. Inflorescences of *Gaultheria griffithiana*. Photo by L. Zhou.

Lujiang Xiang, Mangkuan Xiang), Lushui Xian (Luobenzhou Xiang, Luzhang Zheng, Pianma Xiang), Tengchong Xian (Houqiao Zheng, Jietou Xiang, Mingguang Xiang, Ruidian Xiang, Shangying Xiang, Shangyun Xiang, Wuhe Xiang), MYANMAR. Kachin: Myitkyina District (Chipwi Township, Hsawlaw Township), Putao District (Nogmung Township); Figure 19. Outside of GLGS: SW Sichuan, Xizang, Yunnan [Bhutan, NE India, Myanmar, Nepal, Vietnam].

CHINESE NAME.— 尾叶白珠 wei ye bai zhu

GAOLIGONG SHAN SPECIMENS EXAMINED: CHINA. YUNNAN:

FUGONG XIAN. Ya Qiang Ke, E of Gaoligongshan, 2000 m, 12 Sep 1979, *Z.G He & B.Y. Zhang 622* (KUN); Gu Qiao Da Dui, Qiao Mi Gu Lu, 2600 m, 10 Jun 1982, *QX 7247* (KUN). **Lishadi Xiang.** Above forest logging camp ca. 20 km W of Salween River crossing, 2600 m, 21 Oct 1996, *GLGS 7885* (E, KUN); Ya Ping, 2500 m, 31 Oct 1996, *GLGS 7905* (KUN); vicinity of Shibali Logging Station on rd from the Nujiang to Yaping Pass, E side of Gaoligong Shan, 2485 m, 28 Apr 2004, *GLGS 20029* (CAS); Yaping, Shibali Logging Station on rd from the Nujiang to Yaping Pass, 3007 m, 2 May 2004, *GLGS 20137* (CAS); vicinity of N fork of the Yamu River, ca. 0.7 km E of Shibali Logging Station, on rd from the Nujiang to Yaping Pass, E side of Gaoligong Shan, 2467 m, 2 May 2004, *GLGS 20247* (CAS); between the Nujiang and Shibali Logging Station, ca. 6.5 km W of Shibali, on rd from the Nujiang to Yaping Pass, E side of Gaoligong Shan, 2868 m, 8 May 2004, *GLGS 20401* (CAS); Yaduo Cun, above Shibali to Myanmar border at Yaping Yakou, N side of N fork of the Yamu He, E side of Gaoligong Shan, 2750

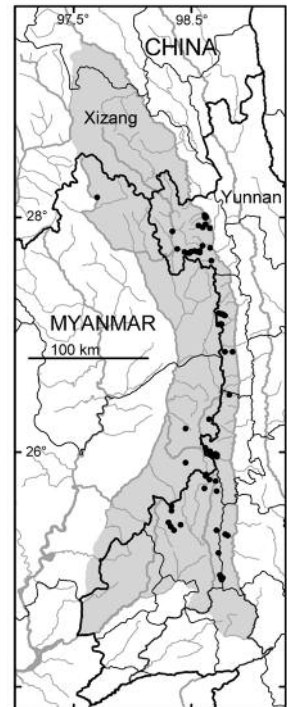


FIGURE 19. Distribution map of *Gaultheria griffithiana* in the GLGS region.

m, 10 Aug 2005, *GLGS 26900* (CAS); same locality, 2770 m, 15 Aug 2005, *GLGS 28326* (CAS); Yaduo Cun, vicinity of Shibali, N side of N fork of the Yamu He, E side of Gaoligong Shan, 2510 m, 16 Aug 2005, *GLGS 28462* (CAS). **Lumadeng Xiang.** Rd along S fork of the Yamu River, rd to Armero Pass, ca. 23 km SW of the confluence of N and S forks of the Yamu, E side of Gaoligong Shan, 3022 m, 2 May 2004, *GLGS 20283* (CAS); Yaping Cun, above southern Shibali, along S fork of Yamu He, rd to Amero Pass, E side of Gaoligong Shan, 2800 m, 14 Aug 2005, *GLGS 27273* (CAS); Yaping Cun, rd above old Shibali on N side of S fork of the Yamu He, E side of Gaoligong Shan, 2540 m, 22 Aug 2005, *GLGS 28857* (CAS). **Shangpa Zheng.** 2700 m, 17 Oct 1933, *Tsai 54448* (A, KUN); 2500 m, 19 Oct 1933, *Tsai 54473* (A). **GONGSHAN XIAN.** Si Qu (the fourth district), 3150 m, 24 May 1960, *NT 8528* (KUN); E slope of Gaoligongshan, 2600 m, 29 May 1960, *NT 9095* (KUN); Chih-tse-lo, 3000 m, 3 Sep 1933, *Tsai 54104* (A, E); same locality, 3200 m, 30 Aug 1932, *Tsai 58322* (A). **Bingzhongluo Xiang.** Yi Qi (the first district), 13 Apr 1959, *Feng 24557* (KUN [2]); Gongdan Holy Hills, E side of Gaoligong Shan, trail from Bingzhongluo to top of Holy Hills, 2500 m, 17 Apr 2002, *GLGS 14454* (CAS, KUN); Gong Dang (God's Mtn.) beyond end of rd to a marble quarry just SW of Bingzhongluo, E side of Gaoligong Shan, 2620 m, 9 Oct 2002, *GLGS 17105* (CAS, KUN); W side of the Nujiang near first turn of the river between Gongshan and Bingzhongluo, 2250 m, 13 Nov 2004, *GLGS 23109* (CAS); Gongdang Sacred Mtn., ca. 2.8 direct km S of Bingzhongluo, E side of Gaoligong Shan, 2480 m, 13 Nov 2004, *GLGS 23145* (CAS); Qiao Na Tong to Bai Mang Xue Shan, 2400 m, 29 May 1960, *NT 8807* (KUN); Zheng Ta, 2300 m, 29 May 1979, *NE 79-255* (KUN); Qi Na, 2400–2600 m, 20 Jun 1982, *QX 7407* (KUN); Song Ta, 3000–3400 m, 25 Jun 1982, *QX 7557* (KUN). **Cikai Zheng.** Hei Pu Shan, 22 Oct 1940, *Feng 8643* (KUN); Qiqi to Dongshaofang, 2730 m, 14 Dec 1996, *GLGS 7733* (KUN); E side of Gaoligong Shan, in Dangdan Park above Gongshan, 1600–1900 m, 29 Jun 2000, *GLGS 11752* (CAS, KUN); E side of Gaoligong Shan, W of Gongshan, along a branch of the Pula He, W of Rizhidi Bridge, trail from Qiqi to Dongshao Fang and Dulongjiang Valley, 2100–2200 m, 11 Jul 2000, *GLGS 12293* (CAS, KUN); E side of Gaoligong Shan, W of Gongshan, along the Pula He, trail from Qiqi to Dongshao Fang and Dulongjiang Valley, 2770–3050 m, 15 Jul 2000, *GLGS 12582* (CAS, KUN); Dan Zhu, Alamen, E side of Gaoligongshan, 2200 ft., 25 May 2000, *GLGS 13735* (CAS, KUN); E side of Gaoligongshan, W of Gongshan, along the Pula He, trail from No. 12 Bridge to Dongshaofang and Dulongjiang Valley, 2900 m, 1 May 2002, *GLGS 14793* (CAS, KUN); vicinity of Dimupo, ca. 7 direct km WNW of Gongshan, rd from Gongshan to Kongdang, E side of Gaoligong Shan, 2530 m, 17 Aug 2006, *GLGS 33681* (CAS); same data, *GLGS 33699* (CAS); Qiqi trail to 12th bridge, 2400–2500 m, 3 Jun 2006, *Lu 6-39* (CAS). **Dulongjiang Xiang.** Xui Ba La Ka, 2200 m, 15 May 1991, *GLGS 5912* (KUN); Wang Nu La Ka, 2700 m, 18 Apr 1991, *GLGS 6056* (KUN); Shang Hong, 2800 m, 20 Apr 1991, *GLGS 6437* (KUN); from Dulongjiang to Gongshan, 1979, *Q. Lin 790673* (KUN); Kong Mu Da Dui, 1560–3500 m, 16 Jul 1973, *Q. Lin 790963* (KUN). **LONGYANG QU.** **Bawan Xiang.** Vicinity of Dahaping Yakou on rd from Baoshan to Tengchong, E side of Gaoligong Shan, 2410 m, 30 May 2005, *GLGS 26076* (CAS); same data, *GLGS 26086* (CAS). **Lujiang Xiang.** Bawan Cun, Dasheyao, E side of Gaoligong Shan, old rd from Baoshan to Tengchong via Dahaoping, 2240 m, 2 Sep 2003, *GLGS 18574* (CAS). **Mangkuan Xiang.** Baihualing, Daluchang National Forest, E side of the Gaoligongshan, 25 Nov 2000, *GLGS 13445* (CAS, KUN); Baihualing, 2200 m, 12 May 1923, *X.C. Shi 408* (KUN [2]). **LUSHUI XIAN.** **Luobenzhuo Xiang.** Vicinity of Bifu bridge, ca. 32.7 direct km S of Fugong City and ca. 7.7 direct km W of the Nujiang, E side of Gaoligong Shan, 2640 m, 1 May 2004, *GLGS 20831* [mistakenly recorded as Fugong Xian, Pihe Xiang on the label but all other data are correct] (CAS). **Luzhang Zheng.** Rd between the Salween and Pianma, W side of Gaoligong Shan, 2700 m, 15 Oct 1998, *GLGS 10427* (CAS, KUN); Yao Jia Ping, 2440 m, 25 Oct 1996, *GLGS 8018* (KUN); rd between Lushui and Pianma Yakou at Km 53 from turn off on Liuku-Fugong rd., E side of Gaoligong Shan, 2850 m, 15 Oct 2002, *GLGS 15971* (CAS, KUN); vicinity of Yaojiaping between Lushui and Pianma Pass, E side of Gaoligong Shan, 2450 m, 11 May 2005, *GLGS 22682* (CAS); area above Yaojiaping Forest Station, Sanjiang River, E side of Gaoligong Shan, 2737 m, 18 May 2005, *GLGS 24437* (CAS); vicinity of Km 58, rd from Liuku to Pianma, E side of Gaoligong Shan, 2649 m, 19 May 2005, *GLGS 24499* (CAS); *GLGS 24505* (CAS); Yao Jia Ping, 2600 m, 23 Jul 1960, *NT 10398* (KUN). **Pianma Xiang.** 3000 m, 14 Sep 1996, *GLGS 7261* (KUN [2]); same data, *GLGS 7285* (KUN [2]); along Changyan He, E of Pianma, rd between Pianma and Lushui, W side of Gaoligong Shan, 2370 m, 15 May 2005, *GLGS 22945* (CAS); along river just E of Pianma, W side of Gaoligong Shan, 1990 m, 16 May 2005, *GLGS 22994* (CAS); Gangfang Yakou, rd from Pianma to Gangfang, W side of Gaoligong Shan, 2260 m, 15 May 2005,

GLGS 24198 (CAS); upper slopes of the Pianma River, ca. 10 km E of Pianma, W side of Gaoligong Shan, 2510 m, 16 May 2005, *GLGS 24242* (CAS). **TENGCHONG XIAN.** W flank of Shweli-Salween divide, 8000–9000 ft., Aug 1912, *F 8949* (E, K); ascent of Sansi Gorge from the Chinese side, 7000–8000 ft., Sep 1912, *F 9120* (E); Shweli-Salwin divide, Jul 1919, *F 18134* (A, E, K); same locality, Oct 1919, *F 18972* (E, K); Xian Ping He, 2200 m, 11 Oct 1983, *Q. Lin 770596* (KUN). **Houqiao Zheng (Guyong Zheng).** Vicinity of Gaoshidong in Guyong Linchang (forest farm), ca. 9.8 direct km ENE of Houqiao (Guyong), 2570 m, 27 May 2006, *GLGS 30658* (CAS); vicinity of Gaoshidong in Guyong Linchang (forest farm), ca. 11.4 direct km E of Houqiao (Guyong), 2060 m, 27 May 2006, *GLGS 30685* (CAS); 2600 m, 18 May 1964, *Wu 6647* (KUN); Dan Zha to Chang Ping Ba Tou, 2400 m, 14 Apr 1980, *L.S. Xie 853* (KUN). **Jietou Xiang.** Datang Cun, vicinity of Dahe Linggan, NNE of Datang, W side of Gaoligong Shan, 2240 m, 15 May 2006, *GLGS 30053* (CAS). **Mingguang Xiang.** Zizhi Cun, ca. 9.5 direct km NE of Zizhi, rd to Baduolin Yakou (the pass into Myanmar at border marker 8), Jiangaoshan, W side of Gaoligong Shan, 2750–2850 m, 19 May 2006, *GLGS 29210* (CAS); Zizhi Cun, rd from Zizhi to Baduolin Yakou (the pass into Myanmar at border marker 8), Jiangaoshan, W side of Gaoligong Shan, 2650 m, 20 May 2006, *GLGS 29291* (CAS); Zizhi Cun, Jiangaoshan, rd from Zizhi to Baduolin Yakou (the pass at marker 8 between China and Myanmar), W side of Gaoligong Shan, 2770 m, 23 May 2006, *GLGS 30511* (CAS); Zizhi Cun, Jiangaoshan, trail E of Baduolin Yakou (pass at marker 8 between China and Myanmar), W side of Gaoligong Shan, 3020 m, 3 May 2006, *GLGS 30558* (CAS); same data, *GLGS 30568* (CAS); Zizhi Cun, vicinity of Dazhuba on N side of a large agricultural valley in NE corner of Zizhi Cun, ca. 9.4 direct km ENE of Zizhi, W side of Gaoligong Shan, 2070 m, 23 May 2006, *GLGS 30596* (CAS). **Ruidian Xiang.** Yunfeng Cun, Yunfeng Shan, along top of ridge NE of Yunfeng Si, ca. 9.2 direct km SSW of Ruidian, 2290 m, 3 Jun 2006, *GLGS 29974* (CAS); same data, *GLGS 31011* (CAS). **Shangying Xiang.** Da Tian Po, W side of Gaoligongshan between Dahaoping and the pass dividing the Irrawadi and Salween watersheds, old rd between Baoshan and Tengchong, 2700 m, 5 Nov 1998, *GLGS 11550* (CAS, KUN); top of ridge at border between Baoshan Shi and Tengchong Xian, N and S of old rd from Baoshan to Tengchong via Dahaoping, 2400 m, 4 Sep 2002, *GLGS 18788* (CAS); Dahaowo of Dajianpo Village, SE of Dahaoping, W side of Gaoligong Shan, 2160 m, 1 Jun 2005, *GLGS 25318* (CAS). **Shangyun Xiang.** Top of ridge at border between Baoshan Shi and Tengchong Xian, N and S of old rd from Baoshan to Tengchong via Dahaoping, 2400 m, 4 Sep 2003, *GLGS 18737* (CAS); same data, *GLGS 18788* (CAS). **Wuhe Xiang.** Ridge S of the pass at top of Gaoligong Shan on old rd from Baoshan to Tengchong via Dahaoping, W side of Gaoligong Shan, 2525 m, 5 Sep 2003, *GLGS 18842* (CAS); above Dahaoping along ridge S of Dahaoping Yakou (pass at the border between Tengchong Xian and Longyang Qu), W side of Gaoligong Shan, 2405 m, 30 May 2005, *GLGS 25120* (CAS); ridge at the pass of Daohaoping by following trail to N of the pass, W side of Gaoligong Shan, 2432 m, 30 May 2005, *GLGS 25199* (CAS). **MYANMAR. KACHIN: MYITKYINA DISTRICT. Chipwi Township.** N'Maikha-Salwin divide, 11000 ft., Jun 1931, *F 29649* (BM, E); Htagaw, valley of Naung Chaung Laohi, 9000 ft., 14 May 1914, *KW 1590* (E). **Hsawlaw Township.** Ridge above Laktang, 9000 ft., 8 Jun 1919, *KW 3201* (E). **PUTAO DISTRICT. Nongmung Township.** Adung Valley, 8000 ft., 14 Apr 1931, *KW 9408* (A); same locality, 31 May 1931, *KW 9488* (A); same locality, 1 Jun 1931, *KW 9573* p.p. (A).

10. *Gaultheria hookeri* C.B. Clarke, Fl. Brit. India 3:458. 1882. TYPE.—INDIA. Sikkim: Lachen, 10–11000 ft., 2 August, 1849, *J.D. Hooker s.n.* (lectotype, here designated: K!).

The protologue of *Gaultheria hookeri* mentions both (Mt.) Lachen and Choongtam collections by J.D. Hooker. The four sheets of the type material that we have seen all have C.B. Clarke's handwriting, but otherwise no indication of type. We have chosen the 2 August 1849 Lachen collection from K (one sheet) as lectotype because it has both flowering and fruiting material and is on its own sheet. Other sheets have only flowering material or contain two labels with different dates of collection.

Gaultheria hookeri C.B. Clarke var. *angustifolia* C.B. Clarke, Fl. Brit. India 3:458. 1882. TYPE.—INDIA. Sikkim: Yakla, 9–10000 ft., 10 May 1876, *C.B. Clarke 27837A* (holotype: K!).

Gaultheria stapfiana Airy Shaw, Kew Bull. 1952:171. 1952. TYPE.—CHINA. Yunnan: [Tengchong Xian],

western flank of the Shweli-Salwin divide, 25°40'N, 2700 m [Gaoligong Shan], June 1919, *G. Forrest 18021* (holotype: E!; isotypes: A!, K!).

Gaultheria veitchiana Craib, Gard. Chron. ser. 3, 52:188. 1912. TYPE.—CHINA. Western China, 1800–3000 m, May 1904, *E.H. Wilson 3916* (lectotype, here designated: K!; isolectotypes: A [3; images!]).

Both *E.H. Wilson 1627* and *3916* were cited in the protologue of *Gaultheria veitchiana*, without specific indication of type. Rehder and Wilson (1913) cited *3916* as “type,” but did not indicate a particular duplicate of this number. We have chosen the *E.H. Wilson 3916* specimen at K as lectotype because it is a wild-collected plant, *E.H. Wilson 1627* being an ex situ collection (if it is still extant) from a plant in cultivation, and because Craib’s herbarium is K.

Shrubs 0.3–3 m tall, erect to occasionally ± prostrate, gynodioecious. Branchlets not notably elongate, terete to slightly angulate, sparsely or usually densely tawny-, ferruginous-, or black-appressed- to ascending-setose or -villous-hirsute and often white-puberulent, occasionally nearly glabrous. Petiole 2–10 mm, at least some on each individual sparsely to densely setose or villous-hirsute; leaf blade oblanceolate to occasionally oblong-elliptic, elliptic, or obovate, 3–12.7 × (0.8–)1.3–4 cm, 1.7–3.3(–3.8) × as long as wide, subcoriaceous to coriaceous, abaxially green to brown and red- to black-gland-dotted to -appressed-setulose or -setose, adaxially glabrous or white-puberulent proximally along midvein, midvein abaxially prominent and adaxially sulcate, secondary veins 3–7 on each side of midvein, arising along midvein with proximal veins becoming faint or anastomosing before reaching apex, abaxially raised to prominent, adaxially impressed, tertiary veins abaxially raised to prominent and adaxially impressed, base cuneate to occasionally subrounded, margin regularly serrulate, with 20–40 teeth per side, planar to slightly revolute, apex acute to occasionally obtuse or shortly acuminate. Inflorescences axillary and terminal, rather open racemes, generally from the upper leaf axils, 1.5–6.5 cm, 7–24-flowered, bud stage conspicuous in autumn; rachis slender, white-pubescent or -villous; bracts broadly elliptic, ovate-elliptic, or suborbicular, not keeled, 2.5–6 × 2–4.5 mm, persistent, abaxially glabrous or white-pubescent, adaxially white-pubescent to -strigillose or rarely glabrous, margin ciliolate and often stipitate-glandular, apex acute to shortly acuminate. Pedicel 1–9 mm, glabrous or white-pubescent; bracteoles ± medial, deltoid-ovate, 1.7–3 × 1.2–2.1 mm, otherwise similar to bracts. Calyx 1.8–3 mm; lobes 5, deltoid to deltoid-ovate, 1.4–2.2 × 1–2 mm, outside glabrous, inside glabrous or white-puberulent, margin ciliolate, apex acute. Corolla pink, pink-magenta, or occasionally white or white with pink distally, urceolate, 3.5–5.5 × 1.8–4 mm, outside glabrous, inside white-hirsute; lobes 5, oblong, 0.5–0.7 mm. Stamines (in female flowers) ca. 1 mm. Stamens 10; filaments 1–1.8 mm, gradually dilated submedially from apex, glabrous; anthers 0.7–1.3 mm, awns 0.4–0.8 mm. Ovary tawny- to white-hirtellous; style 1.5–3 mm, glabrous or proximally pubescent. Calyx at fruiting blue or blue flushed with white, fleshy; lobes ± erect, pale-edged. Capsule 4–6 mm in diam., sericeous.

Gaultheria hookeri var. *angustifolia* is recognized in the Flora of China (Fang and Stevens 2005) on the basis of its lanceolate or linear-lanceolate (versus elliptic) leaf blades 2–4 cm wide (versus 1–1.5 cm). Leaf blade shape and width vary continuously across the geographic distribution of the species, and we have thus placed this variety in synonymy under *G. hookeri*.

See also discussion under *Gaultheria pyrolifolia*.

SELECTED ILLUSTRATION.—T.Z. Xu, Fl. Yunnan. 4:592 t. 169(1–6). 1986.

PHOTOGRAPHIC IMAGE.—Figure 20.

PHENOLOGY.—Fl. May–Oct, fr. Jun–Nov.

DISTRIBUTION AND HABITAT.—Deciduous broadleaf forests, coniferous forests, open slopes, mountain summits, meadows, thickets; (1900–2100)2400–4400 m. In GLGS: CHINA. Xizang: Zayü Xian (Tsarong Xiang). Yunnan: Fugong Xian (Lishade Xiang, Lumadeng Xiang), Gongshan



FIGURE 20. Flowering branchlets of *Gaultheria hookeri*. Photo by L. Zhou.

Xian (Bingzhongluo Xiang, Cikai Zheng, Dulongjiang Xiang), Lushui Xian (Luzhang Zheng, Mangkuan Xiang, Pianma Xiang), Tengchong Xian (Houqiao Zheng, Jietou Xiang, Mingguang Xiang), MYANMAR. Kachin: Myitkyina District (Chipwi Township, Hsawlaw Township), Putao District (Nogmung Township); Figure 21. Outside of GLGS: Guizhou, Sichuan, SE Xizang, Yunnan [Bhutan, India, Myanmar].

CHINESE NAME.—红粉白珠 hong fen bai zhu

ADDITIONAL GAOLIGONG SHAN SPECIMENS EXAMINED: CHINA.

XIZANG: ZAYŪ XIAN. 2500–2700 m, 30 Aug 1983, *S.Z. Chen* 7102 (KUN); Migyitun, 8500 ft., 28 May 1936, *F. Ludlow & G. Sherriff* 1721 (E). **Tsarong Xiang.** 3200 m, 29 Jun 1982, *QX 7769* (KUN [2]); mtns. of Tjonatong, upper Salwin River, 14500 ft., Jun 1932, *Rock* 22335 (A, E, K); same locality, 14500 ft., Jun 1932, *Rock* 22338 (A, E, K); Wuli-la Mts., E of the Salwin River and N of Alulaka, 14000 ft., Jun 1932, *Rock* 22435 (A, E, K); same locality, 14500 ft., Jun 1932, *Rock* 22436 p.p. (A, E, K). **YUNNAN:** 9000 ft., Sep 1904, *F 5066* (E, K); 1917, *F 14997* (E); Jun 1917, *F 15742* (A, E, K); 1917, *F 15809* (A, E, K). **FUGONG XIAN.** Che-tse-lo, 4000 m, 24 Aug 1934, *Tsai* 58139 (A). Fa Mu Chang, 3200 m, 14 Jun 1979, *NE 79-557* (KUN); Gu Qiao Da Dui, 1900–2600 m, 10 Jun 1982, *QX 7248* (KUN [2]). **Lishadi Xiang.** Between Shibali Logging Station and Yaping Pass, ca. 4 km W of Shibali, rd from the Nujiang to Yaping Pass, E side of Gaoligong Shan, 2785 m, 2 May 2004, *GLGS 20086* (CAS); between the Nujiang and Shibali Logging Station, ca. 6.5 km W of Shibali, rd from the Nujiang to Yaping Pass, E side of Gaoligong Shan, 2868 m, 8 May 2004, *GLGS 20393* (CAS); same data, *GLGS 20395* (CAS); same data, *GLGS 20396* (CAS);

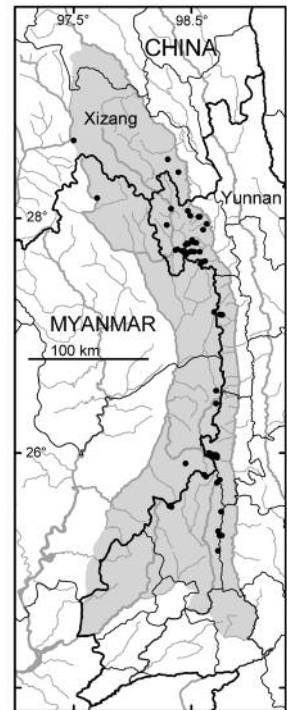


FIGURE 21. Distribution map of *Gaultheria hookeri* in the GLGS region.

Yaduo Cun, above Shibali along N side of S fork of the Yamu He, E side of Gaoligong Shan, 2900 m, 15 Aug 2005, *GLGS 28289* (CAS). **Lumadeng Xiang.** Yaping Cun, S of Yaping Yakou in the second cirque with two small lakes in the bottom, just below border with Myanmar, E side of Gaoligong Shan, 3650 m, 17 Aug 2005, *GLGS 28682* (CAS). **GONGSHAN XIAN.** Bai Han Luo, Yi Qi (the first district), 22 Nov 1959, *Feng 24684* (KUN [2]); the fourth district, 3100 m, 24 May 1960, *NT 8523* (KUN); Tong Ze to Xiong Ku, 3000 m, 6 Jun 1960, *NT 9255* (KUN). **Bingzhongluo Xiang.** Chang Pu Tong, 3000–3200 m, 8 Sep 1940, *Feng 7666* (KUN); in regionis temperatae ad fluvium Lu-djiang (Salween) prope Tschamutong pteridietis graminosis supra vieum Bahan, 3200–3700 m, 18 Feb 1916, *H.F. v. Handel-Mazzetti 8953* (E); Qiu Na Tong, 3450 m, 31 May 1979, *NE 79-295* (KUN); upper Bingzhongluo River, 2500–3450 m, 3 Aug 1979, *NE 79-1383* (KUN); See-roo-la, 3500 m, Oct 1935, *Wang 66779* (A); See-roo-la, Cham-pu-tung, 3000 m, Oct 1935, *Wang 66785* (A, KUN). **Cikai Zheng.** Hei Pu Shan, 13 Oct 1940, *Feng 8419* (KUN); track from Qi Qi toward Dulongjiang, 3000–3750 m, 15 Oct 1996, *GLGS 7752* (E, KUN); track from Dong Shao Fang to Qiqi, 3160 m, 16 Oct 1996, *GLGS 7811* (E, KUN); E side of divide above Dong Shao Fang Forest Station on Nan Mo Wang Shan, 2900 m, 22 Sep 1997, *GLGS 9576* (E); E side of Gaoligong Shan, along the Danzhu He, rd from the Nuijiang at Danzhu to Myanmar border, 3300 m, 2 Jul 2000, *GLGS 11889* (CAS, KUN); E side of Gaoligong Shan, W of Gongshan and W of Qiqi between Dongshao Fang and the pass to the Dulongjiang Valley, 3400 m, 16 Jul 2000, *GLGS 12700* (CAS, KUN); E side of Gaoligong Shan, W of Gongshan, trail from Qiqi to Dongshao Fang and the pass to the Dulongjiang Valley, 3400 m, 17 Jul 2000, *GLGS 12770* (CAS, KUN); E side of Gaoligong Shan, W of Gongshan, along the Pula He, trail around No. 12 Bridge, 2770 m, 2 May 2002, *GLGS 14829* (CAS); rd from Gongshan to Kongdang, E side of Gaoligong Shan, 2830 m, 23 Sep 2002, *GLGS 16503* (CAS, KUN); Labadi, along a branch of the Pula He, rd from Gongshan to Kongdang. E side of Gaoligong Shan, 3000 m, 29 Sep 2002, *GLGS 16711* (CAS, KUN); same locality, 3020 m, 29 Sep 2002, *GLGS 16725* (CAS, KUN); same locality, 2970 m, 30 Sep 2002, *GLGS 16786* (CAS, KUN); same locality, 2970 m, 30 Sep 2002, *GLGS 16809* (CAS, KUN); N of rd from Gongshan to Kongdang, E side of Gaoligong Shan, u-shaped valley draining into the upper reaches of the Pula He, 3350 m, 3 Oct 2002, *GLGS 16935* (CAS, KUN); E side of Gaoligong Shan, rd from Danzhu to Myanmar border, 2700 m, 10 Nov 2004, *GLGS 22373* (CAS); E side of Gaoligong Shan, rd from Gongshan to Kongdang, 3020 m, 11 Nov 2004, *GLGS 22389* (CAS); same locality, 3330 m, 11 Nov 2004, *GLGS 23014* (CAS); E side of Gaoligong Shan at Km 46, rd from Gongshan to Kongdang, 3270 m, 11 Nov 2004, *GLGS 23029* (CAS); vicinity of Cikeluo Qiao near Km 41, rd from Gongshan to Kongdang and ca. 16.8 direct km WNW of Gongshan, E side of Gaoligong Shan, 3030 m, 21 Aug 2006, *GLGS 33822* (CAS); vicinity of Danghatu near Km 49, rd from Gongshan to Kongdang and ca. 20.4 direct km WNW of Gongshan, E side of Gaoligong Shan, 3360 m, 21 Aug 2006, *GLGS 33932* (CAS); Danzhu Cun, vicinity of Elong Shankou at Myanmar border, ca. 15.7 direct km WSW of Danzhu, E side of Gaoligong Shan, 3250 m, 24 Aug 2006, *GLGS 34040* (CAS); same data, *GLGS 34046* (CAS); same data, *GLGS 34048* (CAS). **Dulongjiang Xiang.** Wang Nu La Ka, 2700 m, 18 Apr 1991, *GLGS 6059* (KUN); S of the third team, 20 May 1991, *GLGS 6926* (KUN); camping site of Zhi Zhi Zu, 2700 m, 9 May 1979, *NE 79-76* (KUN); Dulongjiang to Gongshan, 1979, *NE 79-618* (KUN); same data, *NE 79-665* (KUN); Kong Mu Da Dui, 3500–3800 m, 11 Jul 1979, *NE 79-1076* (KUN); same locality, 3500–3800 m, 17 Jul 1979, *NE 79-1077* (KUN); same locality, *NE 79-1099* (KUN); Salwin-Kiukiang divide, Newahlung, 3400 m, 11 Jul 1938, *Yü 19321* (A, E, KUN); Salween-Kiukiang divide, Gemahlaka, 3700 m, 14 Oct 1938, *Yü 20672* (KUN); Salwin-Kiukiang divide, Swangchiang, 2800 m, 5 Nov 1938, *Yü 22964* (A, E, KUN). **LUSHUI XIAN.** From Cha Kuo to 3793 location, 3000–3300 m, 3 Aug 1978, *BE 1742* (KUN); Yao Jia Ping, 3000 m, 13 Jul 1960, *NT 10414* (KUN); same data, *NT Team 10416* (KUN). **Luzhang Zheng.** Pianma Yakou, pass between Lushui and Pianma, crest of Gaoligong Shan, 3250 m, 15 Oct 2002, *GLGS 15954* (CAS, KUN); area above Yaojiaping Forest Station, Sanjiang River, E side of Gaoligong Shan, 2737 m, 18 May 2005, *GLGS 24458* (CAS); vicinity of Yaojiaping Forest Station between Lushui and Pianma, E side of Gaoligong Shan, 2720 m, 19 May 2005, *GLGS 24485* (CAS); just below Fengxue Yakou (the pass between Lushui and Pianma), between Km 54 and 58, E side of Gaoligong Shan, 3125 m, 19 May 2005, *GLGS 24520* (CAS); same data, *GLGS 24539* (CAS); same data, *GLGS 24542* (CAS). **Mangkuan Xiang.** Bai Hua Ling, 8 May 1997, *Dao et al. 9435* (KUN [2]); Baihualing, Zhan Gong Fang, 3100 m, 1 Sep 1995, *X.C. Shi 682* (KUN [2]). **Pianma Xiang.** Hpimaw Hill, 9000–10000 ft., 30 May 1919, *R.J. Farrer 990* (E); E slope of Pianma You Kou, 2900 m, 27 Oct 1996, *GLGS 8132* (KUN); same data, *GLGS 8133* (KUN); W slope of Irrawaddy-Salween Watershed, rd to Pian Ma, ca.

10–20 km E of Pian Ma, 2800 m, 25 Oct 1996, *GLGS* 8285 (E, KUN); Pian Ma Ya Kou, summit of rd from Liuku to Pian Ma, 3140 m, 4 Oct 1997, *GLGS* 9960 (E, KUN); vicinity of Pianma Pass, rd from Lushui to Pianma, W side of Gaoligong Shan, 3080 m, 11 May 2005, *GLGS* 22690 (CAS); same locality, 14 May 2005, *GLGS* 22883 (CAS); vicinity of Km 58, rd from Lushui to Pianma, W side of Gaoligong Shan, 2810 m, 14 May 2005, *GLGS* 22908 (CAS); vicinity of Km 62, rd from Lushui to Pianma, W side of Gaoligong Shan, 2790 m, 17 May 2005, *GLGS* 23306 (CAS); same locality, 2760 m, 17 May 2005, *GLGS* 23318 (CAS); vicinity of Feng Xue Yakou (Windy and Snowy Pass), rd from Lushui to Pianma, W side of Gaoligong Shan, 3127 m, 11 May 2005, *GLGS* 23946 (CAS); upper slopes of the Pianma River, ca. 10 km E of Pianma, W side of Gaoligong Shan, 2510 m, 16 May 2005, *GLGS* 24247 (CAS). **TENGCHONG XIAN.** Shweli-Salwin divide, 10000 ft., Aug 1912, *F* 9003 (A, E, K); Shweli-Salwin divide, 9000–10000 ft., Aug 1913, *F* 11778 (A, E, K); Shweli-Salwin divide, 13000 ft., Sep 1917, *F* 14966 (E); Jang-tzaw Shan, Shweli-Salwin divide, 9000 ft., Jul 1919, *F* 18360 (E, K); top of Salwin-Shweli divide, 1922, *J.W. & C.J. Gregory B. G.-3* (BM). **Houqiao Zheng (Guyong Zheng).** Ji Zhao Shan (Chicken Feet Mtn.), 3500–3640 m, 25 May 1964, *Wu* 6888 (KUN); Dan Zha, Jian Gao Shan, Xia Si He, 2400 m, 1 Jun 1964, *Wu* 6955 (KUN). **Jietou Xiang.** Datang Cun, vicinity of Daogou Yilinggan, NNE of Datang, W side of Gaoligong Shan, 2900 m, 16 May 2006, *GLGS* 30125 (CAS). **Mingguang Xiang.** Zizhi Cun, near ridgetop along trail parallel with Myanmar border to W of border crossing at Baduolin Yakou (the pass into Myanmar at border marker 8), Jianga Shan, ca. 10 direct km NE of Zizhi, W side of Gaoligong Shan, 3000–3050 m, 19 May 2006, *GLGS* 29152 (CAS); Zizhi Cun, ca. 9.5 direct km NE of Zizhi, rd to Baduolin Yakou (the pass into Myanmar at border marker 8), Jianga Shan, W side of Gaoligong Shan, 2750–2850 m, 19 May 2006, *GLGS* 29222 (CAS); same data, *GLGS* 29243 (CAS). **MYANMAR. KACHIN: MYITKYINA DISTRICT. Chipwi Township.** N^omaikha-Salwin divide, 9000–10000 ft., Jun 1931, *F* 29704 (E); Htagaw, valley of Maung-chuang, Jalu country, 9000–10000 ft., 1914, *KW* 1617 (E); Hsaugaw, valley of Naung-chaung, Laohi County, 6 Mar 1914, *KW* 1627 (E). **Hsawlaw Township.** Chewchi Pass, 11800 ft., 3 May 1920, *R.J. Farrer* 1679 (E). **PUTAO DISTRICT. Nongmung Township.** Adung Valley, 8000 ft., 27 May 1931, *KW* 9556 (A); same locality, 11000 ft., 31 May 1931, *KW* 9570 (A); same locality, 8000 ft., 1 Jun 1931, *KW* 9573 p.p. (A).

11. *Gaultheria hypochlora* Airy Shaw, Bull. Misc. Inform. Kew 1940:324. 1941. TYPE.—INDIA. Assam: Delei Valley, 3000 m, 31 May 1928, *F. Kingdon Ward* 8266 (holotype: K!).

Shrublets 3–30 cm tall, prostrate to decumbent. Branchlets elongate, terete, brown- to ferruginous-ascending-villous or slightly -uncinate-setulose and occasionally white-puberulent. Petiole 0.5–1.5 mm, abaxially glabrous or sparsely setulose, adaxially glabrous or white-puberulent; larger leaf blades oblanceolate, suborbicular, or rarely elliptic, 8–15 × 2.8–8.5 mm, gradually smaller and often narrower along stems toward both ends of each year's growth, 1.2–3.6 × as long as wide, subcoriaceous to coriaceous, abaxially dull light to often whitish green, or light brown, with a narrow glossy edge and sparsely setulose at least along midvein on at least some leaves, adaxially ± glossy green to brown and glabrous or white-puberulent proximally along midvein, midvein abaxially raised to prominent and adaxially sulcate to planar, secondary veins distinct or rarely obscure, (when visible) 1–3 on each side of midvein, tertiary veins distinct or rarely obscure, base cuneate to subrounded, margin serrulate, with 8–15 setulose-tipped teeth per side, revolute, apex acute, rounded, or emarginate. Inflorescences axillary, 5.5–8 mm, 1-flowered; bracts absent. Pedicel 1.5–4 mm, glabrous or occasionally setulose; bracteoles 2, apical, ovate, suborbicular, or occasionally elliptic, not or occasionally keeled, 1.2–3 × 1.5–2.3 mm, persistent, glabrous or occasionally setulose, margin entire, apex acute to rounded. Calyx 3–4.5 mm; lobes (4)5, deltoid to narrowly ovate-deltoid, 1.8–2.4 × 1.5–2.1 mm, mostly overlapping at base, outside glabrous, inside glabrous or pubescent, margin usually ciliate apically or rarely entire throughout, apex acute to obtuse. Corolla white to pink, campanulate, 3.5–4 × 4–6 mm, glabrous on both sides; lobes (4)5, deltoid to deltoid-oblong, 1.5–2.5 mm. Stamens (6–)10; filaments 1–1.3 mm, gradually dilated medially from apex, glabrous; anthers 0.6–0.8 mm, 2–4-awned; awns 0.3–0.4 mm. Ovary glabrous; style 1.5–2

mm. Calyx at fruiting blue, fleshy; lobes incurved, not or narrowly pale-edged. Capsule 7–9 mm in diam., glabrous.

Included under this species are all specimens of *Gaultheria* series *Trichophyllae* in GLGS with blue fruit, setulose-tipped teeth on the leaf margin, and deltoid or narrowly ovate-deltoid calyx lobes. As noted by Fang and Stevens (2005), *G. hypochlora* is often difficult to distinguish from *G. sinensis*. In his key to the species of series *Trichophyllae* known at the time of publication, Airy Shaw (1941) delimited *G. hypochlora* from *G. sinensis* by: leaves more or less chartaceous-coriaceous, obovate, cuneate at base, apex rounded, pallid below, green above, to 15 mm × 8 mm, and nerves below slightly prominent (versus leaves rigid and thick-coriaceous, elliptic-oblong to obovate, much less conspicuously discolored, to 17 × 5 mm, acute at both ends, and nerves below obscure). Fang and Stevens (2005) distinguished *G. hypochlora* from other species of series *Trichophyllae* in their key solely by leaf blade shape and size (obovate or oblong, less than two times as long as wide, 6–8 mm wide, apex obtuse to rounded, versus usually elliptic, elliptic-oblong, or linear, more than 2 × as long as wide, 1–7 mm wide, apex acute, obtuse, or acuminate).

Although these characters work reasonably well to place many of our specimens in one or the other species, from our examination of material both within and outside the GLGS it is clear that there are many narrow-leaved specimens (i.e., blade more than 2 × as long as wide) with strongly bicolorous leaf surfaces and other features of the leaf blade that would seem to most closely match *G. hypochlora* rather than *G. sinensis* (e.g., GLGS 16918, 31158, 32235; T.T. Yü 20049). Of these specimens, those in flower have a calyx with narrowly deltoid lobes, like those of all other *G. hypochlora* and unlike those of *G. sinensis*, in which the calyx lobes are broadly ovate-deltoid. We have included all such specimens under *G. hypochlora*, basing the main difference between the two species on calyx shape. In doing so, we have necessarily broadened the definition of *G. hypochlora* to include more narrow-leaved specimens. To the west of the GLGS, the leaves of some plants of what appear to be *G. hypochlora* become even narrower (e.g., *D. Long et al.* 742, Sikkim, India (E); *F. Ludlow et al.* 3733, Pachakshiri District, Xizang Province, China (E)), and it might be questioned whether these plants are really conspecific with those having the typical obovate to suborbicular leaves common in the GLGS and elsewhere in China. More collections and study of especially flowering material of these two species from across their ranges would help to clarify the taxonomy of this challenging group.

See also comments under *Gaultheria sinensis*.

ILLUSTRATIONS.— The illustrations of *Gaultheria sinensis* by R.C. Fang, *Fl. Reipubl. Popularis Sin.* 57(3):64 t. 19(6–8). 1991 and by G.H. Zhu & L.B. Zhang, eds. *Fl. China* Ill. 14: t. 666(6–8) are both the same as that of *G. hypochlora* by R.C. Fang, *Gaultheria* in L.K. Fu & T. Hong, eds. *Higher Pl. China* 5:696 t. 1121. 2003 (the latter treats *G. sinensis* as a synonym of *G. hypochlora*). We cannot discern which of the two species is illustrated in these works, because diagnostic features used in our treatment to distinguish them are not clearly depicted. The illustration of the fruit in the figures appears not to be that of *Gaultheria*.

PHENOLOGY.— Fl. Apr–Jul, fr. Jul–Oct.

DISTRIBUTION AND HABITAT.— Coniferous forests, thickets, meadows, grassy slopes, rocky places; 2500–4100 m. In GLGS: CHINA. Xizang: Zayü Xian (Tsarong Xiang). Yunnan: Fugong Xian (Lishadi Xiang, Lumadeng Xiang), Gongshan Xian (Bingzhongluo Xiang, Cikai Zheng, Dulongjiang Xiang), MYANMAR. Kachin: Myitkyina District (Hsawlaw Township, Waingmaw Township); Figure 22. Outside of GLGS: Sichuan, Xizang, Yunnan [Bhutan, India, Myanmar].

CHINESE NAME.— 绿背白珠 lu bei bai zhu

GAOLIGONG SHAN SPECIMENS EXAMINED: CHINA. XIZANG: ZAYÜ XIAN. Prope fines Tibeto-

Birmanicas inter fluvios Ludiang (Salween) et Djiou-djiang (Irrawadi or sup.), in jugi Tschiangschel, 3500–3800 m, 5 Jul 1916, *H.F. v. Handel-Mazzetti 9382* (A). **Tsarong Xiang.** Mt. Wuli-La, E of the Salwin River and N of Alulaka, 13500 ft., Jun 1932, *Rock 22407* (A, E, P). **YUNNAN: FUGONG XIAN. Lishadi Xiang.** Vicinity of Yaping Pass near Myanmar border, E side of Gaoligong Shan, 3620 m, 5 May 2004, *GLGS 20970* (CAS); Yadoo Cun, vicinity of Rimagudi, N side of N fork of Yamu He above Shibali, rd to Myanmar border, E side of Gaoligong Shan, 3560 m, 12 Aug 2005, *GLGS 27029* (CAS); Yadoo Cun, vicinity of Luodigoulu, N side of N fork of Yamu He, E side of Gaoligong Shan, 2520 m, 16 Aug 2005, *GLGS 28441* (CAS); Yadoo Cun, NE of Yaping Yakou at Myanmar border, N side of N fork of Yamu He, E side of Gaoligong Shan, 3840 m, 17 Aug 2005, *GLGS 28628* (CAS); same data, *GLGS 28629* (CAS). **Lumadeng Xiang.** Yaping Cun, SE Amero Pass along the ridge that forms the border between China and Myanmar, E side of Gaoligong Shan, 3460 m, 13 Aug 2005, *GLGS 27221* (CAS). **GONGSHAN XIAN. Bingzhongluo Xiang.** Chang Pu Tong, 3800 m, 11 Sep 1940, *Feng 7804* (KUN); along N side of Nianwaluo He, trail from Fucai to Chukuai Lake, ca. 13.2 direct km WSW of Bingzhongluo, E side of Gaoligong Shan, 3470 m, 17 Aug 2006, *GLGS 31158* (CAS); ca. 3.4 direct km S of Gawagapu Mtn. and ca. 15.8 direct km WSW of Bingzhongluo in next basin E of Chukuai lake, E side of Gaoligong Shan, 3710 m, 30 Aug 2006, *GLGS 31683*; Dong Ta, 3600 m, 25 Jun 1982, *QX 7580* (KUN); Champutong, Sijitong, 3000 m, Oct 1935, *Wang 67196* (A). **Cikai Zheng.** Hei Pu Shan, 9 Oct 1940, *Feng 8313* (KUN); rd from Gongshan to Kongdang, E side of Gaoligong Shan, 3340 m, 1 Oct 2002, *GLGS 16817* (CAS, KUN); N of rd from Gongshan to Kongdang, E side of Gaoligong Shan, u-shaped valley draining into the upper reaches of the Pula He, 3350 m, 3 Oct 2002, *GLGS 16918* (CAS, KUN [2]); same locality, 3429 m, 3 Oct 2002, *GLGS 16950* (CAS, KUN); Heipu Pass, rd from Gongshan to Dulongjiang Valley, E side of Gaoligong Shan, 3490 m, 12 Aug 2006, *GLGS 32036* (CAS); same data, *GLGS 32053* (CAS [2]); same data, *GLGS 32060* (CAS); Yipsaka Lake, 2.4 direct km SE of Heipu Pass tunnel on new rd from Gongshan to Dulongjiang valley, E side of Gaoligong Shan, 3560 m, 12 Aug 2006, *GLGS 32074* (CAS); same data, *GLGS 32080* (CAS); ca. 1.2 direct km SSE of Heipu Pass tunnel on new rd from Gongshan to Dulongjiang Valley, E side of Gaoligong Shan, 3350 m, 13 Aug 2006, *GLGS 32127* (CAS); same data, *GLGS 32150A* (CAS); near Yipsaka Lake, 2.1 direct km SSE of Heipu Pass tunnel on new rd from Gongshan to Dulongjiang Valley, E side of Gaoligong Shan, 3450 m, 13 Aug 2006, *GLGS 32235* (CAS); vicinity of Danghatu near Km 49 on rd from Gongshan to Kongdang and ca. 20.4 direct km WNW of Gongshan, E side of Gaoligong Shan, 3360 m, 21 Aug 2006, *GLGS 33929* (CAS); Danzhu Cun, along the Damawadi He (N branch of W-most origin of the Danzhu He) ca. 0.5 km E of Myanmar border and ca. 15.5 direct km WSW of Danzhu, E side of Gaoligong Shan, 3220 m, 24 Aug 2006, *GLGS 34106* (CAS); Qiqi trail to 12th bridge, 2400–2600 m, 3 Jun 2006, *Lu 40* (CAS). **Dulongjiang Xiang.** Xishaofang, 3400 m, 15 Oct 1996, *GLGS 7758* (KUN); N side of pass above tunnel on rd between Gongshan and Kongdang, W side of Gaoligong Shan, 3530 m, 2 Oct 2002, *GLGS 16876* (CAS, KUN); E side of pass of rd from Gongshan to Kongdang, W side of Gaoligong Shan near crest of range, 3670 m, 5 Oct 2002, *GLGS 17007* p.p. (CAS, KUN); W side of pass on rd from Gongshan to Kongdang, E side of Gaoligong Shan near crest of range, 3750 m, 5 Oct 2002, *GLGS 17032* (CAS, KUN); Song Du to Dong Shao Fang, 2600 m, 22 Jul 1982, *QX 8345* (KUN); Taron-taru divide, Ahtehmai, 2500 m, 29 Aug 1938, *Yü 20049* (A, E, KUN); Tarulaka, 3000 m, 3 Sep 1938, *Yü 20058* (KUN); Salwin-Kiukiang divide, Lunguailaka, 3600 m, 14 Sep 1938, *Yü 20262* (A, E, KUN); Tsukuai, 3600 m, 16 Oct 1938, *Yü 20709* (A, E, KUN). **MYANMAR. KACHIN: MYITKYINA DISTRICT. Hsawlaw Township.** Chimili Woods, 10800 ft., 4 Aug 1919, *R.J. Farrer 1191* (E); Chewchi Pass, 11000 ft., 2 Jul 1920, *R.J. Farrer 1676* (E); same locality, 12500 ft., 18 Jul 1920, *R.J. Farrer 1737* (E); ridge above Laktang, 8000–11000 ft., 25 May 1962, *KW 3062* (E). **Waingmaw Township.** Base of Seinghku, 10000 ft., 6 Apr 1924, *KW 6845* (K [2]).

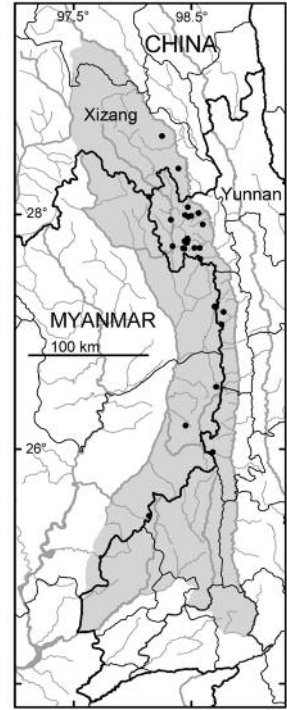


FIGURE 22. Distribution map of *Gaulteria hypochlora* in the GLGS region.

12. *Gaultheria leucocarpa* Blume, Bijdr. Fl. Ned. Ind., 856. 1826. *Brossaea leucocarpa* (Blume) O. Kuntze, Revis. Gen. Pl. 2:388. 1891. TYPE.—INDONESIA. Java. *C.L. Blume s.n.* (lectotype, designated by Sleumer (1957): L Herb. Lugd. Bat., No. 903.13-217 (Barcode No. 0007112) [on-line image!]; isolectotype: NY [on-line image!]; possible isolectotype: K!).

Shrubs 0.4–1.5 m tall, arching to scandent, with strong wintergreen odor. Branchlets elongate, terete to slightly flattened, glabrous or densely setose-glandular-hirsute and white-puberulent. Petiole 3–5 mm, glabrous or adaxially white-lanulate, rarely setose-hirsute; leaf blade lanceolate, 5.5–11 × 2.8–4.1 cm, usually smaller distally along stems, (1.7–)2.2–3.2 × as long as wide, thickly chartaceous to subcoriaceous, abaxially green to brown and glabrous and eglandular or glandular-setulose, adaxially glabrous or proximally white-villulose on midvein or rarely glandular-setulose, midvein abaxially prominent and adaxially slightly sulcate, secondary veins 3–5 on each side of midvein, arising along midvein with proximal veins becoming faint or anastomosing before reaching apex, abaxially raised, adaxially planar to impressed, tertiary veins abaxially raised and adaxially planar to impressed, base cordate, margin planar to slightly revolute, regularly serrulate, with 30–65 teeth per side, teeth rarely glandular-setose, apex long-acuminate. Inflorescences axillary and terminal, open racemes or occasionally panicles, 1.5–9 cm, 1–11-flowered; rachis slender, glabrous or rarely glandular-setulose-hirsute and white-puberulent; bracts deltoid to linear-deltoid, slightly keeled, 1.5–5 × 1–1.2 mm, persistent, glabrous, margin ciliolate, apex acute. Pedicel 4–8 mm, glabrous; bracteoles apical, 1.1–1.7 × 1.2–1.7 mm, base cordate, apex acute-acuminate, otherwise similar to bracts. Calyx 2.5–3.5 mm; lobes 5, broadly deltoid-ovate, 1.6–2 × 1.8–2 mm, glabrous, margin ciliolate, apex acute. Corolla white to green, campanulate, 3.5–5 × 3.5–5.5 mm, glabrous; lobes 5, deltoid, 1.3–2 mm. Stamens 10; filaments 1.2–1.5 mm, gradually dilated medially from apex, glabrous; anthers 0.9–1.4 mm, awns 0.3–0.4 mm. Ovary densely white-pilulose; style 2–3.5 mm, glabrous. Calyx at fruiting dark purple to black, fleshy; lobes ± incurved, not pale-edged. Capsule 4–7 mm in diam., sericeous.

The GLGS specimens of *Gaultheria leucocarpa* can be placed into two groups corresponding to glabrous versus pubescent branchlets and leaves. Both groups have a pubescent ovary and dark purple to black fruits, thus delimiting them from other varieties of the species. Such variants were recognized in the Flora of China treatment of *Gaultheria* (Fang and Stevens 2005) as vars. *yunnanensis* and *crenulata* respectively (the only other variety of *G. leucocarpa* recognized in the Flora of



FIGURE 23. Flowering branchlet of *Gaultheria leucocarpa*. Photo by L. Zhou.

China is var. *psilocarpa* (Copeland) R.C. Fang from Taiwan and the Philippines, with a glabrous ovary). Neither of these names, however, are correct. *Gaultheria l.* variety *hirsuta* [described originally as a variety of *G. yunnanensis*] appears to be taxonomically identical to var. *crenulata*, because the pubescence on the type specimen (1868, *D.J. Anderson s.n.*; K) matches that described for var. *hirsuta*. Although type material of the latter was not available to us, the taxonomic equivalence of these two varieties is confirmed by Fang and Stevens (2005), who placed *G. l.* var. *hirsuta* as a synonym of *G. l.* var. *crenulata*. Yet, the varietal epithet *hirsuta* was published four years earlier (1977) than the varietal epithet *crenulata* (1981).

As for the glabrous variant, Fang and Stevens (2005) placed *Gaultheria leucocarpa* var. *pingbienensis* in synonymy of *G. l.* var. *yunnanensis*, but the varietal epithet *pingbienensis* predates the varietal epithet *yunnanensis* by 18 years. Despite an intensive search of the KUN herbarium, we were unable to locate the type of *G. l.* var. *pingbienensis*, and we have not seen any other type material of this taxon. Thus we must rely on the treatment of Fang and Stevens (2005) as the basis for synonymy of these two taxa, with the caveat that *G. l.* var. *pingbienensis* was originally described as having affinity with *G. l.* var. *crenulata*, differing in only leaf shape characters — implying that, like *G. l.* var. *crenulata*, the branchlets are setose-glandular-hirsute.

Another name listed in synonymy of *Gaultheria leucocarpa* var. *yunnanensis* is *Vaccinium yunnanense* var. *franchetianum* H. Léveillé, but this is a nomen nudum.

SELECTED ILLUSTRATIONS.— R.C. Fang, *Fl. Reipubl. Popularis Sin.* 57(3):62 t. 18(1–8). 1991; G.H. Zhu & L.B. Zhang, eds. *Fl. China* III. 14: t. 662(1–8). 2006.

PHOTOGRAPHIC IMAGES.— Figures 23–24.

PHENOLOGY.— Fl. May–Aug, fr. Aug–May.

DISTRIBUTION AND HABITAT.— Subtropical evergreen broadleaf forests, secondary forests, coniferous forests, thickets on open slopes; 1500–2400(–3000) m. In GLGS: CHINA. Yunnan:



FIGURE 24. Fruiting branchlets of *Gaultheria leucocarpa* with immature fruit. Photo by L. Zhou.

Longling Xian, Tengchong Xian (Houqiao Zheng, Qushi Xiang, Shangyun Xiang, Yunhua Xiang), MYANMAR. Kachin: Myitkyina District (Chipwi Township); Figure 25. Outside of GLGS: Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan, Taiwan, Yunnan [Cambodia, Indonesia, Laos, Malaysia, Philippines, Thailand, Vietnam].

CHINESE NAME.— 白果白珠 *bai guo bai zhu*.

1. Branchlets and leaves glabrous 14a. var. *pingbienensis*
1. Branchlets and leaves setose-glandular-hirsute and white-puberulent 14b. var. *hirsuta*

12a. *Gaultheria leucocarpa* Blume var. *pingbienensis* C.Y. Wu ex T.Z. Xu, *Acta Bot. Yunnan.* 3:429. 1981. TYPE.— CHINA. Yunnan: Pingbian Xian, *K.M. Feng 4827* (holotype: KUN!).

Gaultheria laxiflora Diels, *Bot. Jahrb. Syst.* 29:515. 1900. TYPE.— CHINA. Sichuan: Nan ch'uan, Feng hsiang t'ang, *A. von Rosthorn 346* (syntype: B, destroyed); Nan ch'uan, Ch'ien ts'un kou, *A. von Rosthorn 624* (syntype: B, destroyed).

Pieris fortunatii H. Léveillé, *Bull. Soc. Bot. France* 54:369. 1907. TYPE.— CHINA. Guizhou: no locality or collector indicated, *666* (holotype: P).

Pieris vaccinium H. Léveillé, *Rep. Spec. Nov. Regni Veg.* 9:448. 1911. TYPE.— CHINA. Guizhou: Mont de Lou Tsong-Koan, 12 Jun 1897, *E.M. Bodinier 1659* (syntype: P); Gan-Pin, 28 Jul 1898, *L. Martin s.n.* (syntype: P).

Embelia vaniotii H. Léveillé, *Fl. Kouy-Tchéou*, 285. 1914–1915. TYPE.— Mount Tong Tscheou, June 1912, *J. Ziguizo 3051* (holotype: P).

Gaultheria leucocarpa Blume var. *yunnanensis* (Franchet) T.Z. Xu & R.C.

Fang, *Novon* 9:166. 1999. Basionym: *Vaccinium yunnanense* Franchet, *J. Bot. (Morot)* 9:368. 1895. *Gaultheria yunnanensis* (Franchet) Rehder, *J. Arnold Arbor.* 15:282. 1934. TYPE.— CHINA. Yunnan: Tchen-fong-chan [Cheng-feng-shan], *P.J.M. Delavay 3069* (holotype: P; isotype: L [on-line image!]).

Branchlets and leaves glabrous.

SELECTED ILLUSTRATIONS.— R.C. Fang, *Fl. Reipubl. Popularis Sin.* 57(3):62 t. 18(5–8). 1991; G.H. Zhu & L.B. Zhang, eds. *Fl. China Ill.* 14: t. 662(5–8). 2006.

PHENOLOGY.— Fl. May–Aug, fr. Aug–May.

DISTRIBUTION AND HABITAT.— Subtropical evergreen broadleaf forests, secondary forests, coniferous forests, thickets on open slopes; 1500–2400(–3000) m. In GLGS: CHINA. Yunnan: Longling Xian, Tengchong Xian (Houqiao Zheng, Qushi Xiang, Shangyun Xiang, Yunhua Xiang), MYANMAR. Kachin: Myitkyina District (Chipwi Township); Figure 25. Outside of GLGS: Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan, Taiwan, Yunnan [Cambodia, Laos, Thailand, Vietnam].

CHINESE NAME.— 无毛白果白珠 (新拟) *wu mao bai guo bai zhu*.

GAOLIGONG SHAN SPECIMENS EXAMINED: CHINA. YUNNAN: LONGLING XIAN. Yunlong Shan, Fulong Tan, 1510 m, 30 Nov 1958, *J. Chen 679* (KUN). **TENGCHONG XIAN.** Divide between the Shweli and Tengyueh valleys, 6000 ft., May 1912, *F 7965* (E, K); W flank of the Shweli-Salwin divide, 10000 ft., Aug 1912, *F 9061* (A, E, K); hills N of Tengyueh, 8000 ft., Nov 1912, *F 9298* (E, K). **HOUQIAO ZHENG (Guyong Zheng).** From Houqiao to Gaoligong Shan pass, 2400 m, 18 May 1964, *Wu 6608* (KUN). **QUSHI XIANG.** Gongping, N of Tengchong between Tengchong and Qushi, 1760 m, 26 Oct 1998, *GLGS 10983* (CAS,

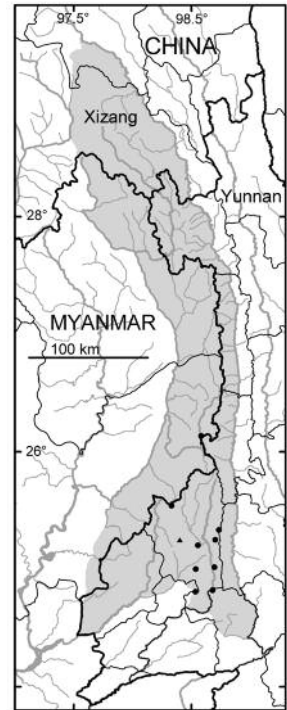


FIGURE 25. Distribution map of *Gaultheria leucocarpa* in the GLGS region. Dots = var. *pingbienensis*; triangle = var. *hirsuta*.

KUN). **Shangyun Xiang**. Chuanglong Cun, vicinity of Wangduo Village, W side of Gaoligong Shan, old rd from Baoshan to Tengchong via Dahaoping, 1540 m, 31 Aug 2003, *GLGS 18202* (CAS). **Yunhua Xiang**. Chao Yun Shan to Hong Mu Shu, 2000 m, 13 Oct 1965, *J.Z. Zhao 8* (KUN). **MYANMAR. KACHIN: MYITKYINA DISTRICT. Chipwi Township**. Kang-fang, N Burma, 6000 ft., 4 Jan 1939, *KW 188* (A, BM).

12b. *Gaultheria leucocarpa* var. *hirsuta* (D. Fang & N.K. Liang) T.Z. Xu, *Acta Bot. Yunnan.* 3:428. 1981. Basionym: *Gaultheria yunnanensis* (Franchet) Rehder var. *hirsuta* D. Fang & N.K. Liang, *Acta Phytotax. Sin.* 15(2):112. 1977. TYPE.— CHINA. Guangxi: Guiping Xian, Zijin, Yuanan, *N.K. Liang & D. Fang 10748* (holotype: Medical Institute of Guangxi; isotypes: PE, SZ).

Gaultheria leucocarpa Blume var. *crenulata* (Kurz) T.Z. Xu, *Acta Bot. Yunnan.* 3:429. 1981. Basionym: *Gaultheria crenulata* Kurz, *J. Bot.* 11:195. 1873. TYPE.— CHINA. Yunnan: [Tengchong Xian], Hotha [Tengchong], 15 August 1868, *D.J. Anderson* (holotype: CAL; isotype: K!).

Branchlets and leaves setose-glandular-hirsute and white-puberulent.

SELECTED ILLUSTRATIONS.— R.C. Fang, *Fl. Reipubl. Popularis Sin.* 57(3):62 t. 18(1–4). 1991; G.H. Zhu & L.B. Zhang, eds. *Fl. China Ill.* 14: t. 662(1–4). 2006.

PHENOLOGY.— Fl. Aug.

DISTRIBUTION AND HABITAT.— In GLGS: CHINA. Yunnan: Tengchong Xian; Figure 25. Outside of GLGS: Guangxi (Guiping Xian).

CHINESE NAME.— 硬毛白珠 ying mao bai zhu

13. *Gaultheria nivea* (J. Anthony) Airy Shaw, *Bull. Misc. Inform. Kew* 1940:326. 1941. Basionym: *Gaultheria sinensis* var. *nivea* J. Anthony, *Notes Roy. Bot. Gard. Edinburgh* 18:20. 1933. TYPE.— CHINA. Xizang: [Zayü Xian], Tsarong [Xiang], Salwin-Kiu Chiang divide [Gaoligong Shan], 28°40'N, 98°15'E, July 1919, *G. Forrest 19269* (holotype: E!; isotypes: A!, K!).

Shrublets 3–10 cm tall, prostrate. Branchlets elongate, terete, sparsely to densely light brown to ferruginous-uncinate-setulose and sparsely to densely white-puberulent. Petiole 0.4–1 mm, abaxially glabrous, adaxially white-puberulent; leaf blade elliptic, 5.5–8 × 1.8–3 mm, gradually smaller along stems toward both ends of each year's growth, 2.1–3.5 × as long as wide, coriaceous, abaxially dull light green to light brown with glossy edge, adaxially glossy green or brown, both surfaces glabrous except puberulent on midvein adaxially toward base, midvein abaxially prominent and adaxially sulcate, secondary and tertiary veins obscure, base cuneate to subcuneate, margin serrate, with 5–10 setulose-tipped teeth per side, planar to slightly revolute, apex acute to obtuse. Inflorescences axillary, 5–6.5 mm, 1-flowered; bracts absent. Pedicel 1.5–2 mm, glabrous; bracteoles 2, apical, broadly ovate, not keeled, 1.2–1.8 × 1.2–1.8 mm, persistent, glabrous, margin entire, apex broadly obtuse. Calyx 2.5–3 mm; lobes 5, ovate-deltoid, 2.5–2.7 × 1.5–1.8 mm, not overlapping at base, glabrous, margin entire, apex acuminate. Corolla white, campanulate, 3–3.5 × 4–5.5 mm, glabrous on both sides; lobes 5, deltoid-oblong, 1.2–1.5 mm. Stamens 10; filaments 0.8–0.9 mm, ± abruptly constricted medially from apex, glabrous; anthers 0.7–0.8 mm, 4-awned; awns 0.5–0.7 mm. Ovary glabrous; style ca. 1.5 mm, glabrous. Calyx at fruiting white, fleshy; lobes incurved to erect, narrowly pale-edged. Capsule 4–6 mm in diam., glabrous.

In the treatment of *Gaultheria* for the *Flora of China*, Fang and Stevens (2005) considered this taxon a variety of *G. sinensis*, whereas Airy Shaw (1941) treated it at the species level. We follow Airy Shaw's treatment, based on the narrower leaf blades (1.8–3 mm wide) with glabrous abaxial surfaces, calyx lobes 2.5–2.7 × 1.5–1.8 mm, and white fruit, all of which easily delimit it from

G. sinensis, which has leaf blades 3–7 mm wide with sparsely setulose abaxial surfaces along midvein on at least some leaves, calyx lobes 1.5–2.3 × 1.8–2.5 mm, and blue fruit. All these characters confer a closer resemblance of *G. nivea* to *G. cardiosepala*, *G. dolichopoda*, and *G. thymifolia* than to *G. sinensis*. During the summer 2006 GLGS expedition to the area of Chukuai Lake, both *G. nivea* and *G. thymifolia* were found growing in the same lake basin. Both of these collections were in fruit, and it would be desirable for flowering collections to be made of these and other populations in the area to better assess the distinctness of these two species.

ILLUSTRATIONS.— None known to us.

PHENOLOGY.— Fl. Jul, fr. Aug–Sep.

DISTRIBUTION AND HABITAT.— Alpine meadows, open ledges of cliffs, humus-covered boulders, stony slopes, among mosses; 3700–3800 m. In GLGS: CHINA. Xizang: Zayü Xian (Tsarong Xiang). Yunnan: Gongshan Xian (Bingzhongluo Xiang); Figure 26. Outside of GLGS: Yunnan.

CHINESE NAME.— 白果华白珠 bai guo hua bai zhu

ADDITIONAL GAOLIGONG SHAN SPECIMEN EXAMINED: CHINA.

YUNNAN: GONGSHAN XIAN. Bingzhongluo Xiang. Ca. 3 direct km SSW of Gawagapu Mtn. and ca. 16 direct km WSW of Bingzhongluo in the basin E of Chukuai Lake, E side of Gaoligong Shan, 3770 m, 29 Aug 2006, GLGS 31581 (CAS).

14. *Gaultheria notabilis* J. Anthony, Notes Roy. Bot. Gard. Edinburgh 18:18. 1933. TYPE.— CHINA. Yunnan: [Tengchong Xian], hills northwest of Tengyueh [Gaoligong Shan], 25°25'N, 98°30'E, 8000 ft., June 1925, *G. Forrest* 26722 (holotype: E!; isotype: K!).

Shrubs 0.3–0.4 m tall. Branchlets elongate, terete, densely ferrugineous-villous-setose and white-puberulent. Petiole 2–2.5 mm, villous-setose; leaf blade ovate, 1.9–3.4 × 1.2–1.7 cm, 1.6–2 × as long as wide, chartaceous to subcoriaceous, abaxially light brown- and ferrugineous-villous-setose, adaxially glabrous, midvein abaxially prominent and adaxially sulcate, secondary veins 2 on each side of midvein, arising along midvein near base and extending to apex, abaxially raised, adaxially impressed to planar, tertiary veins abaxially raised and adaxially impressed to planar, base rounded, subtruncate, or subcuneate, margin regularly serrulate, with 25–35 setose-tipped teeth per side, planar to slightly revolute, apex shortly acuminate. Inflorescences axillary and terminal, racemes, sometimes borne below leaves, ca. 1 cm, 3–8-flowered; rachis slender, glabrous; bracts deltoid-ovate, keeled, 1–2.1 × 0.8–1.2 mm, persistent, glabrous, margin ciliolate and stipitate-glandular, apex acuminate. Pedicel 1.5–5 mm, glabrous; bracteoles basal, otherwise similar to bracts but smaller. Calyx 3–3.8 mm; lobes 5, ovate-deltoid, 2–2.7 × 1–1.4 mm, glabrous, margin entire, apex acuminate. Corolla white, campanulate, 5–6 × 4.5–5.5 mm, glabrous; lobes 5, broadly deltoid, 2–3 mm. Filaments 1–1.5 mm, gradually dilated submedially from apex, sparsely villous; anthers 0.8–1 mm, 4-awned; awns 0.2–0.3 mm. Ovary glabrous; style 2.5–3 mm, glabrous. Calyx at fruiting dark purple. Capsule glabrous.

SELECTED ILLUSTRATION.— Airy Shaw, Kew Bull. 1948:160 t. 2(1–4). 1948.

PHOTOGRAPHIC IMAGE.— Figure 27.

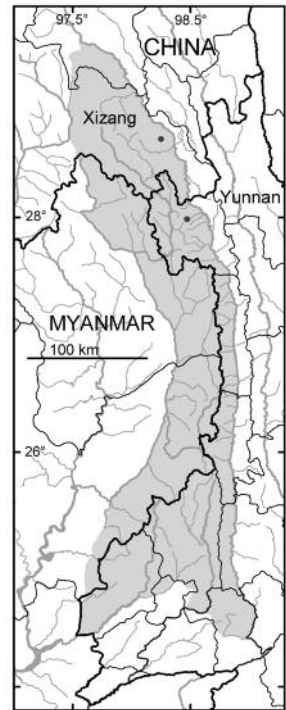


FIGURE 26. Distribution map of *Gaultheria nivea* in the GLGS region.



FIGURE 27. *Gaultheria notabilis*. Photo by L. Lu.

PHENOLOGY.— Fl. June.

DISTRIBUTION AND HABITAT.— Dry thickets, dry stony slopes, amongst scrub; ca. 2400 m. In GLGS: CHINA. Yunnan: Tengchong Xian; Figure 28. Endemic to GLGS.

CHINESE NAME.— 短穗白珠 *duan sui bai zhu*

15. *Gaultheria nummularioides* D. Don, Prodr. Fl. Nepal, 150. 1825. *Brossaea nummularioides* (D. Don) O. Kuntze, Revis. Gen. Pl. 2:388. 1891. TYPE.— NEPAL. *N. Wallich* s.n. (holotype: BM! [“10?8” on label, third digit illegible]; probable isotype: P! [No. 1524A]).

Gaultheria nummularioides D. Don var. *elliptica* Rehder & E.H. Wilson in Sargent, Pl. Wilson. 1:555. 1913. TYPE.— CHINA. Sichuan: Hung-ya Hsien, near Wa-wu-shan, 1000 m, 8 September 1908, *E.H. Wilson* 2708 (holotype: A [image!]; isotypes: GH [image!], K!).

Gaultheria nummularioides D. Don var. *microphylla* C.Y. Wu & T.Z. Xu, Fl. Xizang, 3:697. 1986. TYPE.— CHINA. Xizang: Mainling, *Qinghai-Xizang Exp. 75-1375* (holotype: KUN!).

Gaultheria repens Blume, Bijdr. Fl. Ned. Ind., 857. 1826. *Pernettya repens* (Blume) Zoll. & Moritz in Zoll., Verz. Syst., 3. 1846. TYPE.— INDONESIA. Java: Gede, *C.L. Blume* s.n. (lectotype, here designated: L Herb. Lugd. Bat. No. 903.13-240 (Barcode No. 0007127) [on-line image!]; isolectotypes: K!, L [4] [on-line images!], NY [on-line image!]).

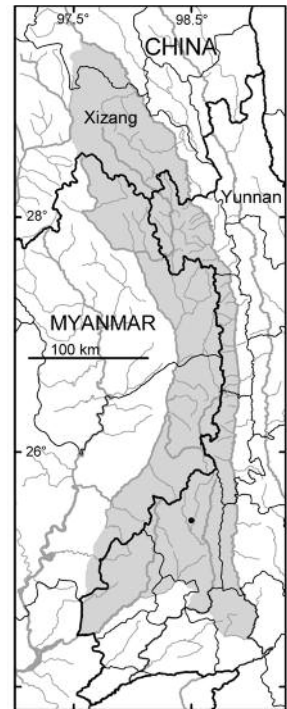


FIGURE 28. Distribution map of *Gaultheria notabilis* in the GLGS region.

No indication of type was indicated in the protologue of *Gaultheria repens*. Sleumer (1957) designated L as lectotype, but there are five sheets of the type material at L and Sleumer annotated all of these as "Type." We designated the L sheet Herb. Ludg. Bat. No. 903.13-240 (Barcode No. 0007127) as the lectotype because it has more material on the sheet than the other four sheets of the type material at L.

Shrublets, prostrate to pendent, occasionally epiphytic. Branchlets elongate and long-trailing, terete to irregularly ridged, wiry, white-puberulent and densely ferrugineous-villous-setose, setae flattened in cross-section. Petiole 0.5–3 mm, ferrugineous-villous-setose and often also white-puberulent; leaf blade ovate, subrhombic, or orbicular, 0.6–2.1 × 0.5–1.9 cm, usually gradually smaller along stems toward both ends of each year's growth, 0.9–1.4 × as long as wide, chartaceous to coriaceous, abaxially green to light brown, occasionally flushed with maroon, usually evenly ferrugineous-setose but occasionally sparsely so or some leaves glabrous, adaxially white-puberulent proximally along midvein, midvein abaxially raised and adaxially planar to impressed or obscure, secondary veins 1 or 2 on each side of midvein, abaxially raised to obscure, adaxially planar to impressed or obscure, tertiary veins abaxially raised to obscure and adaxially usually obscure, base truncate, subrounded, or cordate, margin serrulate, with 7–20 setose-tipped teeth per side, revolute, apex acute to rounded. Inflorescences axillary and occasionally terminal, 0.8–1.2 cm, 1-flowered; pedicel slender, 2–5 mm, glabrous or setulose; bracteoles several, not reaching the apex of pedicel, broadly ovate, not keeled, 2–5 × 1.5–4 mm, persistent, glabrous, margin ciliolate, apex obtuse to rounded. Calyx 3–4.5 mm; lobes 5, ovate, deltoid-ovate, or oblong-ovate, 2–4 × 1.6–2.2 mm, glabrous, margin ciliolate, apex acuminate. Corolla white to deep red, campanulate, 5–6 × 3–8 mm, outside glabrous, inside dull yellow- to ferrugineous-pubescent to -pilose; lobes 5, deltoid, 1.2–2 mm. Stamens 10; filaments 1.5–2 mm, gradually dilated subbasally from apex, densely yellow- to ferrugineous-pilose; anthers 1.3–1.5 mm, awns 0.4–0.5 mm. Ovary glabrous; style 2–3 mm, glabrous. Calyx at fruiting dark purple to black, fleshy; lobes erect, not pale-edged. Capsule 4–6 mm in diam., glabrous.

SELECTED ILLUSTRATIONS.— R.C. Fang, Fl. Reipubl. Popularis Sin. 57(3):64 t. 19(1–5). 1991; G.H. Zhu & L.B. Zhang, eds. Fl. China Ill. 14: t. 666(1–5). 2006.

PHOTOGRAPHIC IMAGES.— Figures 29–30.

PHENOLOGY.— Fl. Jul–Oct, fr. Aug–Jul.

DISTRIBUTION AND HABITAT.— Subtropical evergreen broadleaf forests, deciduous broadleaf forests, coniferous forests, meadows, thickets, often on rocks; 1300–4600 m. In GLGS: CHINA. Xizang: Zayü Xian (Tsarong Xiang). Yunnan: Fugong Xian (Lishadi Xiang, Lumadeng Xiang), Gongshan Xian (Bingzhongluo Xiang, Cikai Zheng, Dulongjiang Xiang), Tengchong Xian (Jietou Xiang, Mazhan Xiang, Qushi Xiang), MYANMAR. Kachin: Putao District (Nogmung Township); Figure 31. Outside of GLGS: Sichuan, Xizang, Yunnan [Bangladesh, Bhutan, India, Indonesia, Malaysia, Myanmar, Nepal].

CHINESE NAME.— 铜钱叶白珠 tong qian ye bai zhu

GAOLIGONG SHAN SPECIMENS EXAMINED: CHINA. XIZANG: ZAYÜ XIAN. Putsang River, Rong To Valley, 1933, *KW 10960* (BM); Tsari Chu, Podzo Stumdo, SE Xizang, 11500 ft., 15 Oct 1938, *F. Ludlow & G. Sherriff 6356* (A, E); Zhu Wa Geng, 2700 m, 2 Jul 1973, *QX 73-542* (KUN); Ri Dong Qu, 3000 m, 7 Sep 1982, *QX 10056* (KUN). Tsarong Xiang. Salwin-Kiu Chiang divide, 14000–14500 ft., 1920, *F 19867* (E, K, P [2]); Salwin-Kiu Chiang divide, 14500 ft., Oct 1921, *F 20871* (E, K, P). YUNNAN: FUGONG XIAN. Da You Team to Ma Shi Ding, 1 Aug 1979, *Q. Lin 791942* (KUN). Lishadi Xiang. Between Shibali Logging Station and Yaping Pass, ca. 7.2 km W of Shibali, rd from the Nujiang to Yaping Pass, E side of Gaoligong Shan, 2786 m, 2 May 2004, *GLGS 20182* (CAS); Yaduo Cun, above Shibali, S side of N fork of



FIGURE 29. Fruiting individuals of *Gaultheria nummularioides*. Photo by P. Fritsch.



FIGURE 30. Flowering individual of *Gaultheria nummularioides*. Photo by L. Zhou.

the Yamu He, rd to Myanmar border at Yaping Yakou, E side of Gaoligong Shan, 2830 m, 6 Aug 2005, *GLGS 26533* (CAS); Yaduo Cun, along rd from Shibali to Myanmar border at Yaping Yakou, E side of Gaoligong Shan, 2830 m, 8 Aug 2005, *GLGS 26706* (CAS). **Lumadeng Xiang.** Yaping Cun, vicinity of Shibali, S side of N fork of the Yamu He, E side of Gaoligong Shan, 2510 m, 16 Aug 2005, *GLGS 28473* (CAS). **GONGSHAN XIAN.** Salwin-Kiu Chiang divide, 15000 ft., 1 Oct 1921, *F 20868* (E, K); Salween Valley, Bahanlo, 23 Nov 1959, *Feng 24691* (KUN). **Bingzhongluo Xiang.** Alulaka, in regionis temperatae ad fluvium Lu-djiang (Salween), 2900–3200 m, 31 Jul 1916, *H.F. v. Handel-Mazzetti 9589* (A, P); in regionis temperatae ad fluvium Lu-djiang (Salween) prope Tschamutong, Tjiongatong, 3000 m, 8 Aug 1916, *H.F. v. Handel-Mazzetti 9763* (E); Di Ma Luo, 2500 m, 25 Nov 1979, *R.Q. Li 1* (KUN); same data, *R.Q. Li 3* (KUN); Si Ji Tong, Chang Pu Tong, 2800 m, Oct 1935, *W.C. Wang 67144* (A); same locality, 2500 m, Oct 1935, *W.C. Wang 67181* (A, KUN); same locality, 3000 m, Oct 1935, *W.C. Wang 67511* (A). **Cikai Zheng.** E side of Gaoligong Shan, W of Gongshan, vicinity of Qiqi above the Pula He, 2300–2570 m, 12 Jul 2000, *GLGS 12494* (CAS, KUN); E side of Gaoligong Shan, W of Gongshan, along the Pula He, trail from Qiqi to Dongshao Fang and the Dulongjiang Valley, 2770–3050 m, 15 Jul 2000, *GLGS 12550* (CAS, E, KUN); Danzhu, No. 1 Bridge, E side of Gaoligong Shan, 2080 m, 15 May 2001, *GLGS 13771* (CAS, KUN); Labadi, along a branch of the Pula He, rd from Gongshan to Kongdang, E side of Gaoligong Shan, 3000 m, 29 Sep 2002, *GLGS 16708* (CAS); along rd from Gongshan to Kongdang, E side of Gaoligong Shan, 3340 m, 1 Oct 2002, *GLGS 16818* (CAS, KUN); N of rd from Gongshan to Kongdang, E side of Gaoligong Shan, u-shaped valley draining into the upper reaches of the Pula He, 3429 m, 3 Oct 2002, *GLGS 16953* (CAS); along rd from Gongshan to Kongdang, E side of Gaoligong Shan, 2510 m, 10 Oct 2002, *GLGS 17128* (CAS, KUN); E side of Gaoligong Shan, rd from Danzhu to the Myanmar border, 2700 m, 10 Nov 2004, *GLGS 22344* (CAS); E side of Gaoligong Shan, rd from Gongshan to Kongdang, ca. 29 km from Gongshan, 2940 m, 12 Nov 2004, *GLGS 22520* (CAS); E side of Gaoligong Shan, rd from Gongshan to Kongdang, 2720 m, 12 Nov 2004, *GLGS 23073* (CAS); same locality, 2530 m, 12 Nov 2004, *GLGS 23099* (CAS); vicinity of Dimupo, ca. 7 direct km WNW of Gongshan, rd from Gongshan to Kongdang, E side of Gaoligong Shan, 2530 m, 17 Aug 2006, *GLGS 33689* (CAS); vicinity of Cikeluo Qiao near Km 41, rd from Gongshan to Kongdang and ca. 16.8 direct km WNW of Gongshan, E side of Gaoligong Shan, 3030 m, 21 Aug 2006, *GLGS 33810* (CAS); same data, *GLGS 33876* (CAS); Danzhu Cun, vicinity of Elong Shankou at Myanmar border, ca. 15.7 direct km WSW of Danzhu, E side of Gaoligong Shan, 3250 m, 24 Aug 2006, *GLGS 34057* (CAS); Heiwadi Cun, vicinity of Dimupo, rd from Gongshan to Kongdang, ca. 6.4 direct km WNW of Gongshan, E side of Gaoligong Shan, 2380 m, 27 Aug 2006, *GLGS 34188* (CAS); vicinity of Dimupo, near Km 28, rd from Gongshan to Kongdang, ca. 8.5 direct km W of Gongshan, E side of Gaoligong Shan, 2700 m, 30 Aug 2006, *GLGS 34352* (CAS); Qiqi trail to No. 12 Bridge, 1700–2600 m, 2 Jun 2006, *Lu 28* (CAS [2]); E slope of Gaoligong Shan, 2900–3200 m, 26 Jul 1982, *QX 8751* (KUN). **Dulongjiang Xiang.** Vicinity of Nengpula, directly opposite Bapo, W side of the Dulongjiang, 1400 m, 11 Dec 1990, *GLGS 977* (CAS, KUN); vicinity of Kongdang, E side of the Dulongjiang, 2600 m, 2 Jan 1991, *GLGS 1579* (CAS, KUN); Mo Qie Wang, 1704 m, 9 Jan 1991, *GLGS 1704* (KUN); Neng Pu La, 1300 m, 6 Feb 1991, *GLGS 3948* (KUN); Wang Nu La Ka, 2300 m, 18 Apr 1991, *GLGS 6049* (KUN); the third team, 2800 m, 20 May 1991, *GLGS 6954* (KUN); N of the third team, 2900 m, 22 May 1991, *GLGS 7040* (KUN); Dongshaofang, 2890 m, 16 Oct 1991, *GLGS 7677* (E); Qiqi to Dongshaofang, 2870 m, 14 Oct 1991, *GLGS 7735* (KUN); Dongshaofang, 2890 m, 14 Oct 1991, *GLGS 7794* (E, KUN); Qiqi to Dongshaofang, 3290 m, 21 Sep 1997, *GLGS 9517* (E, KUN); vicinity of Xixiaofang, trail from Bapo to Gongshan via Qiqi, W side of Gaoligong Shan, 2970 m, 30 Oct 2004, *GLGS 22006* (CAS); above Sandui campsite between Shigong Qiao and Xixiaofang, trail from Bapo to Gongshan via Qiqi, W side of Gaoligong Shan, 2760 m, 1 Nov 2004,

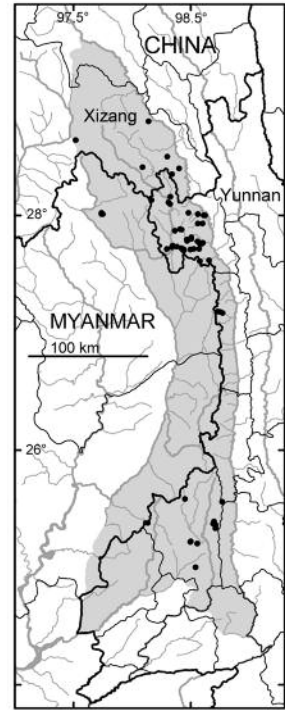


FIGURE 31. Distribution map of *Gaultheria nummularioides* in the GLGS region.

GLGS 22083 (CAS [2]); along rd between Kongdang the Heipu Pass tunnel on new rd from Gongshan to Dulongjiang Valley, ca. 8.4 direct km E of Kongdang, W side of Gaoligong Shan, 2460 m, 15 Aug 2006, *GLGS 32379* (CAS); above Maku, 2760 m, 20 Aug 2006, *GLGS 32754* (CAS); prope fines Tibeto-Burmanicas in convalle fluvii Djiou-djiang (Irrawadi or sup.), in pluviisilva mixta temperata supra vicum Schutsche, 2800–2900 m, 9 Jul 1916, *H.F. v. Handel-Mazzetti 9449* (A, E); Qiqi, Songdu, 2200, 21 Jul 1982, *QX 8254* (KUN); Long Yuan, 2300 m, 30 Aug 1982, *QX 9776* (KUN); Mt. Chingtinglaka, 2400 m, 28 Jul 1938, *Yü 19501* (A, E); Salween-Kiukiang divide, E of Wangtzang, 2600 m, 13 Sep 1938, *Yü 20232* (A, E); Salween-Kiukiang divide, Muchielung, 1800 m, 8 Oct 1938, *Yü 20574* (A, E, KUN); Salween-Kiukiang divide, Panbahlung, 2500–3000 m, 22 Oct 1938, *Yü 20822* (KUN); Salween-Kiukiang divide, Panbahlung, 3000 m, 22 Oct 1938, *Yü 20830* (A, E, KUN); Salween-Kiukiang divide, Swangochiang, 2800 m, 13 Jul 1938, *Yü 22085* (A, E, KUN); same locality, 2800 m, 5 Nov 1937, *Yü 22965* (KUN); Salween Valley, Bahanlo, 3000 m, 27 Sep 1938, *Yü 23115* (A, E, KUN). **TENGCHONG XIAN.** Hills E of Tengyueh, 6500 ft., Jul 1912, *F 8780* (E, K); same location, 6500–7000 ft., Dec 1912, *F 9364* (E); Shweli-Salwin divide, 7000–8000 ft., Jul 1918, *F 17579* (E, K); same locality, 7000–8000 ft., Sep 1924, *F 25172* (E, K, P); Salween-Irrawaddy divide, E flank, 11000–12000 ft., 21 Oct 1922, *KW 5429* (E); between Tengyueh and Burmese border, en route to Sadon, Nov 1922, *Rock 7384* (A, E). **Jietou Xiang.** Shaba Cun, community forest of Lidazhai, W side of Gaoligong Shan, 1800 m, 23 Dec 2000, *GLGS 13596* (CAS); Zhongping Cun, vicinity of Lijia Zhai, W side of Gaoligong Shan, 2420 m, 24 May 2006, *GLGS 29505* (CAS); same locality, 1820 m, 24 May 2006, *GLGS 29522* (CAS). **Mazhan Xiang.** Xiaokong Shan Volcano N of Tengchong, 1930 m, 25 Oct 1998, *GLGS 10941* (CAS, KUN [2]); Dakong Shan Volcano, 2040 m, 2 Jun 2006, *GLGS 29885* (CAS). **Qushi Xiang.** Bai Jia He, 1740 m, 4 Sep 1960, *Yin 60-1241* (KUN). **MYANMAR. KACHIN: PUTAO DISTRICT. Nongmung Township.** Nam Tamai Valley, Mungku Hkyet, 8000–9000 ft., 19 Aug 1937, *KW 12971* (BM); same locality, 9000–10000 ft., 8 Sep 1937, *KW 13172a* (BM); same data, *KW 13172* (BM); same locality, 8000–9000 ft., *KW 13478* (BM).

16. *Gaultheria praticola* C.Y. Wu & T.Z. Xu, *Acta Bot. Yunnan.* 3:425. 1981. TYPE.— CHINA. Yunnan: Deqin, 3600–4000 m, *K.M. Feng 6190* (holotype: KUN!).

The specimen *K.M. Feng 6190* (KUN) is stamped “ISOTYPUS;” one duplicate of *K.M. Feng 24033* (KUN) is stamped “TYPUS” and another “ISOTYPUS.” The protologue clearly indicates that *K.M. Feng 6190* at KUN is the holotype and that *K.M. Feng 24033* is not part of the type material.

Shrublets 15–30 cm tall, prostrate to decumbent. Stems unbranched or branchlets elongate, terete, densely tawny- to dull orange-pilose-villous and white-puberulent. Petiole 2–4 mm, pilose-villous; leaf blade broadly elliptic to ovate-elliptic, with sides often nearly parallel, 3.6–8.4 × 2.2–5 cm, 1.1–2.2 × as long as wide, subcoriaceous, abaxially green to brown- and tawny- to dull orange-pilose or rarely -setulose, adaxially glabrous, midvein abaxially prominent and adaxially narrowly sulcate, secondary veins (2)3–5 on each side of midvein, arising along midvein with proximal veins becoming faint or anastomosing before reaching apex, abaxially prominent, adaxially planar to impressed, tertiary veins abaxially raised and adaxially planar to impressed, base rounded, subrounded, subtruncate, or subcordate, margin regularly serrulate, with 25–65 setose-tipped teeth per side, planar to slightly revolute, apex acute to rounded and often cuspidate. Inflorescences axillary and terminal, open racemes, 1.3–3 cm, 1–6-flowered; rachis slender, white- to yellow-puberulent to -villulose; bracts broadly ovate, not keeled, 2–4 × 1.7–3.6 mm, persistent, glabrous or rarely adaxially white-hirtellous toward apex, margin ciliolate, apex rounded. Pedicel 2–6 mm, glabrous or puberulent; bracteoles medial, deltoid, 1–1.5 × 1–1.4 mm, glabrous, otherwise similar to bracts. Calyx 2.3–2.5 mm; lobes 5, deltoid-ovate, 1.3–2.2 × 1.3–2 mm, glabrous, margin ciliolate, apex acute. Corolla white to purplish green, campanulate to urceolate-globose, 4–5.5 × 4.5–6 mm, glabrous; lobes 5, deltoid, oblong, or ± hemispherical, 0.8–2.5 mm. Stamens 10; filaments 1.5–1.8 mm, gradually dilated medially from apex, glabrous; anthers 1.2–1.3 mm, awns ca. 0.8 mm. Ovary

thinly strigillose; style 2–4.5 mm, glabrous. Calyx at fruiting black, occasionally glaucous, fleshy; lobes incurved, not pale-edged. Capsule 5–6 mm in diam., thinly strigillose.

SELECTED ILLUSTRATION.— T.Z. Xu, *Acta Bot. Yunnan.* 3:425 t. 3(1–7). 1981.

PHENOLOGY.— Fl. Jun–Jul, fr. Sep–Oct.

DISTRIBUTION AND HABITAT.— Coniferous forests, grassy slopes, on rocks in thickets, meadows; 3000–3500 m. In GLGS: CHINA. Yunnan: Fugong Xian, Gongshan Xian (Cikai Zheng), Tengchong Xian; Figure 32. Outside of GLGS: SE Xizang, NW Yunnan.

CHINESE NAME.— 草地白珠 *cao di bai zhu*

GAOLIGONG SHAN SPECIMENS EXAMINED: CHINA. YUNNAN:
FUGONG XIAN. Jiang Sha Logging Station, 3500 m, 19 Jun 1978, *BE 611* (KUN). **GONGSHAN XIAN.** Hill behind Kongmu Community Team, 3500–3800 m, 17 Jul 1979, *NE 79-1102* (KUN). **Cikai Zheng.** N of rd from Gongshan to Kongdang, E side of Gaoligong Shan, u-shaped valley draining into the upper reaches of the Pula He, 3350 m, 3 Oct 2002, *GLGS 16928* (CAS, KUN); Heipu Pass along rd from Gongshan to Dulongjiang Valley, E side of Gaoligong Shan, 3490 m, 12 Aug 2006, *GLGS 32056* (CAS); Dong Shao Fang Pass, 3400–3500 m, 4 Jun 2006, *Lu 56* (CAS). **TENGCHONG XIAN.** Shweli-Salween divide, 10000 ft., Jul 1919, *F 18141* (A, E, K).

17. *Gaultheria pseudonotabilis* H. Li ex R.C. Fang, Novon 9:169. 1999. TYPE.— CHINA. Yunnan: Gongshan Xian, Dulongjiang Xiang, Qin Liang Dang [Gaoligong Shan], 1350 m, 9 March 1991, *Dulongjiang Investigation Team [GLGS] 4446* (holotype: KUN!; isotype: KUN!).

Shrubs 1–2 m tall, arching. Branchlets elongate, terete, densely dull orange- to brown-setose-hirsute and usually white-puberulent. Petiole 3–6 mm, setose-hirsute; leaf blade narrowly cordate, ovate, or lanceolate, 7.3–13.6 × 3.7–6.5 cm, 1.8–3.0 × as long as wide, coriaceous, abaxially greenish brown to brown and glabrous or white-puberulent along major veins, adaxially glabrous, midvein abaxially prominent and adaxially sulcate, secondary veins 1 on each side of midvein and extending to apex, usually an additional more irregular pair toward margins, abaxially prominent, adaxially sulcate, inner tertiary veins 6–12 on each side of midvein, abaxially prominent, abaxially impressed, base cordate, margin irregularly denticulate, with many setose-tipped teeth, planar to slightly revolute, apex long-acuminate. Inflorescences axillary and terminal, somewhat open umbelliform racemes, 2–3.8 cm, 3–11-flowered; rachis stout, glabrous; bracts suborbicular, keeled, 2.5–4.5 × 2–3.5 mm, persistent, glabrous, margin ciliolate and setulose, apex aristate. Pedicel 0.8–1.4 cm; bracteoles basal, ciliolate, otherwise similar to bracts. Calyx 4–5 mm; lobes 5, deltoid-ovate, ca. 3 × 2.5–3 mm, glabrous, margin entire, apex acuminate. Corolla green, pink, red, or white, broadly campanulate, 6–8 × 7–12 mm, glabrous; lobes 5, deltoid, 1.5–4 mm. Stamens 10; filaments 2.5–3 mm, rather abruptly dilated medially from apex, glabrous; anthers 2.5–3 mm, awns 0.2–0.3 mm. Ovary glabrous; style 4–6 mm, glabrous. Calyx at fruiting dark purple to black, rather fleshy; lobes incurved, not pale-edged. Capsule 7–11 mm in diam., glabrous.

SELECTED ILLUSTRATION.— R.C. Fang, *Novon* 9:170 t. 5. 1999.

PHENOLOGY.— Fl. Feb–Apr, fr. Jun–Sep.

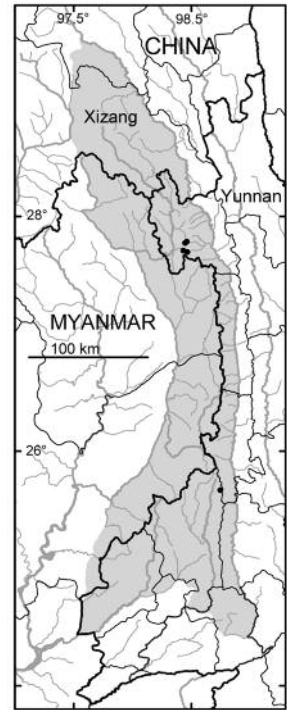


FIGURE 32. Distribution map of *Gaultheria praticola* in the GLGS region.

DISTRIBUTION AND HABITAT.— Subtropical evergreen broadleaf forests, deciduous broadleaf forests, *Taiwania* forests, thickets, on rocks; 1300–3000 m. In GLGS: CHINA. Yunnan: Gongshan Xian (Cikai Zheng, Dulongjiang Xiang); Figure 33. Endemic to GLGS.

CHINESE NAME.— 假短穗白珠 *jia duan sui bai zhu*

ADDITIONAL GAOLIGONG SHAN SPECIMENS EXAMINED: CHINA.

YUNNAN: GONGSHAN XIAN. 1300 m, 26 Nov 1959, *Feng 24731* (KUN); from Gongshan to Qiqi, 1600–1800 m, 2 Jun 2006, *Lu 108* (CAS [2]). **Cikai Zheng.** E side of Gaoligong Shan, W of Gongshan and E of Qiqi along the Pula He, vicinity of Qiqi Bridge, 1850 m, 10 Jul 2000, *GLGS 12221* (CAS, KUN); E side of Gaoligong Shan, W of Gongshan, along the Pula He, trail from Gazu to Qiqi and Dulongjiang Valley, 1800 m, 4 May 2002, *GLGS 14937* (CAS, KUN); trail from Gongshan to Qiqi, E side of Gaoligong Shan, 1550 m, 25 Sep 2002, *GLGS 16565* (CAS, KUN); vicinity of Mangzhou Wadi, S side of the Danzhu He, ca. 13.6 direct km WSW of Danzhu Cun and ca. 14.8 direct km SW of Gongshan, E side of Gaoligong Shan, 3000 m, 12 Aug 2006, *GLGS 33113* (CAS); Danzhu Cun, vicinity of Luomoduo, S slope of the Danzhu He ca. 6.2 direct km SW of Danzhu, E side of Gaoligong Shan, 1950 m, 16 Aug 2006, *GLGS 33398* (CAS). **Dulongjiang Xiang.** Vicinity of Nengpula, directly opposite Bapo, W side of the Dulongjiang, 1400 m, 8 Dec 1990, *GLGS 915* (CAS); along the Dandangwang He, NW of Bapo, W side of the Dulong Jiang, 1400 m, 16 Jan 1991, *GLGS 3149* (CAS); along the Gamolai He, trail from Bapo to Gongshan, E side of the Dulongjiang, 1350 m, 26 Jan 1991, *GLGS 3406* (CAS); vicinity of Kongdang, E side of the Dulong Jiang, 1450 m, 2 Mar 1991, *GLGS 4115* (CAS, KUN); Mo La Dang, 1400 m, 3 Mar 1991, *GLGS 4152* (KUN); Maku, 1850 m, 7 Apr 1991, *GLGS 4231* (KUN); vicinity of Mabidang, ca. 5 km N of Bapo, E side of the Dulongjiang, 1400 m, 8 Mar 1991, *GLGS 4634* (CAS); Dong Shan Ping, 1400 m, 9 Mar 1991, *GLGS 4669* (KUN); Bapo, 1350 m, 7 Apr 1991, *GLGS 5395* (KUN); Bapo, 1350 m, 15 May 1991, *GLGS 6738* (KUN); Mei Li Wang, 1800 m, 21 May 1991, *GLGS 7013* (KUN).

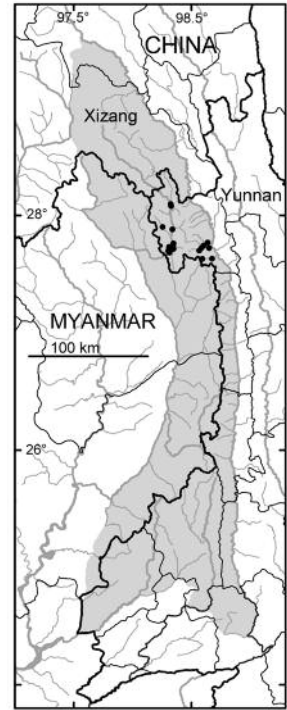


FIGURE 33. Distribution map of *Gaultheria pseudonotabilis* in the GLGS region.

18. *Gaultheria pyrolifolia* J.D. Hooker ex C.B. Clarke, Fl. Brit. India 3:457. 1882 [“*pyrolae-folia*”]. TYPE.— INDIA. Sikkim: Lachen, 13000 ft., 20 Jun 1849, *J.D. Hooker s.n.* (lectotype, designated by Fritsch and Trock (2007): K image catalogue number K00406!; probable isolectotypes: E!, GH!, NY [on-line image!], P!).

Shrublets 3–50 cm tall, decumbent, gynodioecious. Branchlets not notably elongate, terete, densely white-puberulent and occasionally with scattered uncinat-ascending stipitate glands or rarely setae. Petiole 1–4 mm, glabrous; leaf blade elliptic, suborbicular, obovate, or oblanceolate, 1.4–3.7 × 0.8–2.3 cm, 1.2–2.5 × as long as wide, coriaceous, abaxially olive-green to brown and orange- to dark red-appressed-stipitate-glandular, adaxially glabrous, veins abaxially raised or prominent and adaxially deeply impressed, secondary veins 2–4 on each side of midvein, arising along midvein with proximal veins becoming faint or anastomosing before reaching apex, base cuneate to rounded, margin serrulate, with 8–19 setulose-glandular teeth per side, revolute, apex acute to rounded. Inflorescences terminal and axillary, open racemes, usually subterminal or rarely borne below leaves, 1–2.2 cm, 1–5-flowered; rachis slender, sparsely to densely white-puberulent to -pubescent, rarely ferruginous-setose; bracts broadly ovate to suborbicular, not keeled, 2.3–5 × 2–3.5 mm, persistent, glabrous, margin entire or ciliolate, apex obtuse to rounded. Pedicel 3–8 mm, glabrous, white-puberulent, or rarely ferruginous-setulose; bracteoles ± medial, ovate, 1.6–3.5 × 0.7–1.5 mm, apex acute, otherwise similar to bracts. Calyx 1.8–3.5 mm; lobes 5, deltoid to deltoid-

ovate, 1.5–2.5 × 1.3–2 mm, glabrous, margin entire or ciliolate, apex acute. Corolla white, pink, or white flushed with pink, urceolate, 4–5 × 2.5–4 mm, outside glabrous or rarely white-puberulent, inside glabrous or rarely tawny-puberulent; lobes 5, oblong, ca. 0.5 mm. Staminodes (in female flowers) ca. 1.2 mm, with narrowly sagittate anther-like apex. Stamens 10; filaments 1.5–2 mm, gradually dilated medially from apex, glabrous; anthers 1–1.2 mm, awns 0.6–1 mm. Ovary glabrous or sparsely white-puberulent; style 2–2.5 mm, glabrous. Calyx at fruiting dark purple, glaucous, fleshy; lobes ± erect, pale-edged. Capsule 4.5–7 mm in diam., glabrous or sparsely puberulent.

Fritsch and Trock (2007), in recently lectotypifying both *Gaultheria pyrolifolia* and the Japanese and Alaskan species *G. pyroloides*, claimed that *G. miqueliana* Takeda, another name for the Japanese species, is nomenclaturally superfluous and thus illegitimate because the earlier name *G. pyroloides* was cited in its synonymy. Dr. K. Gandhi of Harvard University considers *G. miqueliana* to be legitimate because Takeda (1918) excluded part of the type material (Himalayan collections of J.D. Hooker & T. Thomson) from the type of *G. miqueliana*, and thus by implication retained the Japanese portion of the type material for this name (pers. comm.). There appears to be some debate as to whether this method of inclusion of type is contrary to the relevant section (Article 52) of the International Code of Botanical Nomenclature (McNeill et al. 2006). We make no attempt here to resolve this issue, but merely point out that if the above assertion is the correct interpretation of the code, then Fritsch and Trock's (2007) reason number three (3) under the lectotypification of *G. pyroloides* (p. 101) must be discounted as a basis for the choice of lectotype for this name. As affirmed by Gandhi, the other two reasons given as justification (there were two names clearly available for both the Himalayan and Japanese species when *G. miqueliana* was published, and the original description of *G. pyroloides* is essentially based on the Japanese part of the type material) are nonetheless sufficient for the choice of *G. pyroloides* over *G. miqueliana* for the Japanese species, even if *G. miqueliana* is legitimate.

Several GLGS specimens appear to be morphologically intermediate between *Gaultheria hookeri* and *G. pyrolifolia* (e.g., GLGS 16935 and 33822, *F. Ludlow et al.* 1397, *J. Rock* 22335 and 22435, *T.T. Yü* 20672). Such intermediates have suborbicular leaves, as in *G. pyrolifolia*, but relatively long, erect-ascending trichomes (rather than appressed) that are not tipped by a conspicuous gland, as in *G. hookeri*. They also can be intermediate in stature and leaf size. *Gaultheria pyrolifolia* shares features of several other Asian species of *Gaultheria* (decumbent habit, stipitate glands, relatively small leaves with a short petiole, and few-flowered racemes; *G. borneensis* Stapf, *G. cuneata*, and *G. pyroloides*), but these species all have white fruit, in contrast to the blue fruit of *G. pyrolifolia*. This blue color is the same as that in *G. hookeri*. Moreover, preliminary phylogenetic data based on DNA sequences (C. Bush et al., unpubl. data) place *G. pyrolifolia* strongly with *G. hookeri* rather than these other species. Thus, morphological features and results from phylogenetic analysis both suggest reticulate evolution between *G. hookeri* and *G. pyrolifolia*. The specific nature of the reticulation (introgression, hybrid speciation) will require extensive population sampling, field observations, and molecular marker data.

SELECTED ILLUSTRATION.— Anonymous, Ic. Cormophyt. Sin. 3:185, t. 4324. 1974.

PHENOLOGY.— Fl. Jun–Jul, fr. Aug–Sep.

DISTRIBUTION AND HABITAT.— Alpine rocky windswept areas, ledges of cliffs; 2900–4400 m. In GLGS: CHINA. Xizang: Zayü Xian (Tsarong Xiang). Yunnan: Gongshan Xian (Bingzhongluo Xiang, Dulongjiang Xiang), MYANMAR. Kachin: Putao District (Nogmung Township); Figure 34. Outside of GLGS: SE Xizang, [Bhutan, India, Myanmar, Nepal].

CHINESE NAME.— 鹿蹄草叶白珠 lu ti cao ye bai zhu

GAOLIGONG SHAN SPECIMENS EXAMINED: CHINA. XIZANG: ZAYÜ XIAN. Bimbi La, Tsari, SE Tibet, 9500–10500 ft., 6 Jun 1936, *F. Ludlow & G. Sherriff 1782* (E); Lang La, SE Xizang, 13000 ft., 17 Oct 1947, *F. Ludlow et al. 13323* (E); Ba La Pasum Chu, SE Tibet, 14500 ft., 22 Jun 1947, *F. Ludlow et al. 13972* (E [2]); Da Yang La, SE Xizang, 13500 ft., 4 Apr 1947, *F. Ludlow & G. Sherriff 15143* (A [2], E [2]). **Tsarong Xiang.** Salwin-Kiu Chiang divide, 13000–14000 ft., Jul 1921, *F 19865* (E, K, P [2]); mts. of Tjonatong, upper Salwin River, 14500 ft., Jun 1932, *Rock 22340* (A, E, K); mts. of Wuli-la, E of the Salwin River and N of Alulaka, 14500 ft., Jun 1932, *Rock 22436* p.p. (A, E, K). **YUNNAN: GONGSHAN XIAN.** **Bingzhongluo Xiang.** Chang Pu Tong, 3700–3700 m, 20 Sep 1940, *NE 7876* (KUN). **Dulongjiang Xiang.** Upper Kiukiang Valley (Clulung), S of Lungtasahmuru, 4000 m, 10 Aug 1938, *Yü 19879* (A, E, KUN). **MYANMAR. KACHIN: PUTAO DISTRICT. Nogmung Township.** Adung Valley, 12000–13000 ft., 17 Jun 1931, *KW 9648* (A).

19. *Gaultheria semi-infera* (C.B. Clarke) Airy Shaw, Bull. Misc. Inform. Kew 1940:306. 1941. Basionym: *Diplycosia semi-infera* C.B. Clarke, Fl. Brit. India 3:459. 1882. TYPE.—BHUTAN. 7000–9000 ft., *W. Griffith* (*Kew Distrib. no. 3482*) (holotype: K!; isotype: L [on-line image!]).

Gaultheria tetramera W.W. Smith, Notes Roy. Bot. Gard. Edinburgh 11:211. 1919. TYPE.—CHINA. Yunnan: [Tengchong Xian], hills east of Teng-yueh [Gaoligong Shan], 25°N, 6000 ft., May 1912, *G. Forrest 7702* (lectotype, here designated: E!; isolectotypes: A!, K!).

Gaultheria forrestii Diels var. *setigera* C.Y. Wu & T.Z. Xu, Acta Bot. Yunnan. 3:427. 1981. TYPE.—CHINA. Yunnan: Jingdong, *M.K. Li 2188* (holotype: KUN; isotype: KUN!).

There are six collections listed in the protologue of *Gaultheria tetramera* (*G. Forrest 7702*, 8757, 8786, 9331, 14882, and 15986), none of which is specifically denoted as the type. We have designated the E duplicate of *G. Forrest 7702* as the lectotype because E is the herbarium at which W.W. Smith worked and this is the only sheet of any of the E syntypes that we have seen (we have seen all except 14882) with the handwritten word “Type.” We have not been able to determine whether this is Smith’s handwriting.

Shrubs 0.2–4 m tall, erect or arching, gynodioecious. Branchlets not notably elongate, terete to slightly angulate, evenly scattered to densely tawny-, gray-, ferruginous-, brown-, or black-appressed to -ascending-setose and white-puberulent. Petiole 2–7 mm, glabrous or puberulent or setose or both; leaf blade elliptic, linear-elliptic, obovate, oblanceolate, or linear-oblanceolate, 2.6–10.8 × 1–4.2 cm, 1.7–7.3 × as long as wide, subcoriaceous, abaxially light green and ferruginous-, red-, brown-, or black-gland-dotted or -setose, adaxially glabrous or white-puberulent proximally along midvein, midvein abaxially prominent and adaxially narrowly sulcate, secondary veins 3–5 on each side of midvein, arising along midvein with proximal veins becoming faint or anastomosing before reaching apex, abaxially prominent to raised, adaxially impressed to occasionally planar, tertiary veins abaxially raised and adaxially impressed to occasionally planar, base narrowly cuneate to subrounded, margin regularly serrulate, with 10–30 teeth per side, planar to revolute, apex acute to obtuse. Inflorescences terminal and axillary, rather dense racemes with flowers ± secund, often borne below leaves, 0.8–4 cm, 1–22-flowered; rachis slender, white-pubescent to -puberulent; bracts deltoid to deltoid-ovate, keeled, 1.2–2.8(–3.7) × 0.8–1.8(–2.4) mm, per-

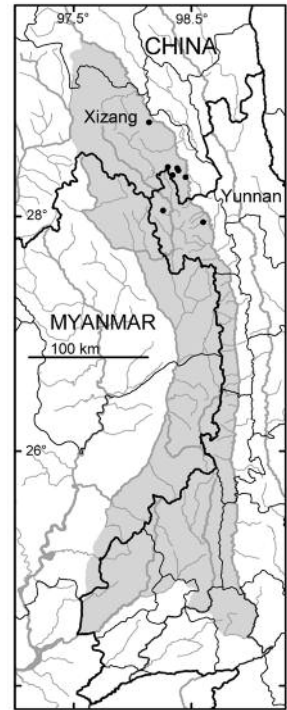


FIGURE 34. Distribution map of *Gaultheria pyrolifolia* in the GLGS region.

sistent, abaxially white-puberulent or occasionally glabrous, adaxially white-strigillose or glabrous, margin ciliolate or stipitate-glandular or both, apex acute to acuminate and often recurved. Pedicel 0.5–4 mm, white-puberulent; bracteoles apical or subapical, deltoid, 1.1–2.1 × 0.7–1.2 mm, otherwise similar to bracts. Calyx 2.2–2.7 mm; lobes (2 or 3)4 or 5, deltoid, 1.8–2.2 × 0.8–1.6 mm, glabrous, margin ciliolate or stipitate-glandular or both, apex acute to acuminate. Corolla white, pink, purplish pink, whitish yellow, or greenish white, urceolate, 2–3.5 × 2–3 mm, outside glabrous, inside sparsely to densely white-puberulent to -villulose or rarely glabrous; lobes 4 or 5, oblong, 0.3–0.6 mm. Staminodes (in female flowers) 5 or 6, with minute anther-like apex 0.5–0.9 mm. Stamens usually 5 (in flowers with 4 or 5 calyx and corolla lobes) or 8 (in flowers with 4 calyx and corolla lobes), occasionally 2–4 or 6; filaments 0.5–1.3 mm, gradually dilated subbasally from apex, glabrous; anthers 0.6–0.8 mm, awns 0.3–0.7 mm. Ovary ± semi-inferior, white-pilulose; style 1–2.3 mm, white-strigillose or -pilulose at least proximally or occasionally glabrous. Calyx at fruiting blue, bluish white, or purple, fleshy; lobes ± erect, pale-edged. Capsule 3–5 mm in diam., pilulose-sericeous.

Gaultheria tetramera has been considered distinct from other species of *Gaultheria* by several authors (Airy Shaw 1941; Xu 1991a; Fang and Stevens 2005), mainly through its 4-merous flowers (versus 5-merous in other racemose species). In addition, Smith (1919) noted the smaller leaves of *G. tetramera*, in contrast to those of *G. fragrantissima* and *G. veitchiana* (= *G. hookeri*), whereas Fang and Stevens (2005) used width as a key character in addition to the difference in merosity (ca. 2 × as long as wide versus 2.5–4 × as long as wide in *G. semi-infera* and *G. wardii*).

From field and herbarium observations, we consider *Gaultheria tetramera* to be conspecific with *G. semi-infera*. A substantial number of individuals on herbarium specimens that otherwise match the types of either *G. semi-infera* or *G. tetramera* exhibit both 4- and 5-merous flowers or fruit on the same branch. This observation was confirmed in the field, in which this polymorphism was clearly documented on a single individual growing along the road from Kongdang to Gongshan on the west side of the GLGS in the vicinity of GLGS 32380 (Fig. 36). Moreover, the individual showed several fruits with either three or six calyx lobes, and one even with two. Such variation was observed also on other plants in the vicinity. Within the GLGS, there is a definite preponderance for more elliptic and smaller leaves in Tengchong County, the area from which the type of *G. tetramera* was collected, and most of the individuals from there appear to be consistently 4-merous. Nonetheless, individuals with such leaves and/or the 4- and 5-merous condition can be found as far north as the Dulongjiang, and no distinct gaps in the variation of leaf morphology can be detected among the specimens identifiable to *G. semi-infera*/*G. tetramera* in association with either geography or other characters, including flower merosity. Populations from the Tengchong area can at most be considered a small-leaved phase within *G. semi-infera*, possibly associated with the volcanic soils that prevail in the region but not in the surrounding areas in which the species occurs.

SELECTED ILLUSTRATION.— T.Z. Xu, Fl. Xizang, 3:704 t. 282(4–7). 1986.

PHOTOGRAPHIC IMAGES.— Figures 35–36.

PHENOLOGY.— Fl. May–Jul, fr. Jul–Jan.

DISTRIBUTION AND HABITAT.— Subtropical evergreen broadleaf forests, deciduous broadleaf forests, coniferous forests, thickets, 1400–3400 m. In GLGS: CHINA. Xizang: Zayü Xian. Yunnan: Fugong Xian (Lishadi Xiang, Lumadeng Xiang, Shangpa Zheng), Gongshan Xian (Bingzhongluo Xiang, Cikai Zheng, Dulongjiang Xiang, Pengdang Xiang), Lianghe Xian, Longling Xian (Zhen'an Zheng), Lushui Xian (Luyobenzhou Xiang, Luzhang Zheng, Pianma Xiang), Tengchong Xian (Dongshan Xiang, Houqiao Zheng, Mingguang Xiang, Zhonghe Xiang), MYANMAR.



FIGURE 35. Flowering branchlet of *Gaultheria semi-infera*. Photo L. Zhou.



FIGURE 36. Fruit of *Gaultheria semi-infera*. Note fruit with four or five calyx lobes on same individual. Photo by P. Fritsch.

Kachin: Myitkyina District (Chipwi Township); Figure 37. Outside of GLGS: Xizang, Yunnan [Bhutan, India, Myanmar, Nepal].

CHINESE NAME.—五雄白珠 *wu xiong bai zhu*

ADDITIONAL GAOLIGONG SHAN SPECIMENS EXAMINED: CHINA.

XIZANG: ZAYÜ XIAN. Hui Dong Qu, Bu la Du, 2900 m, 7 Sep 1991, *QX 9998* (KUN); Ri Dong district, Shi la Du, 7 Sep 1991, *QX 10015* (KUN).
YUNNAN: 1919, *F 18805* (E, K); Mid W Yunnan, Nov 1925, *F 27777* (E, K); *F 29050* (E); *F 29984* (E); *F 30371* (E); between Tengyueh and Lungling, Oct 1922, *Rock 7210* (A); same data, *Rock 7238* (A); *Tsai 57788* (A);
FUGONG XIAN. From Bijiang City downtown to Tou Dao Shui, 2000 m, 26 May 1978, *BE 9* (KUN); La Bu Li, 2600, 7 Jul 1978, *BE 794* (KUN); Che-tse-lo, 3200 m, 30 Aug 1938, *Tsai 58323* (A, E); 9 Sep 1934, *Tsai 58420* (A, E). Kong Dong La Bo Jing La Bu Luo River, 2800 m, 11 Jul 1978, *BE 1006* (KUN); above forest logging camp ca. 15 km W of the Salween River cable car crossing, Yaping, 2600 m, 21 Oct 1996, *GLGS 7887* (E, KUN); Kong Tong La Bu Jin, Gaoligongshan, 2000 m, 8 Jul 1978, *NE 79-928* (KUN); Qian Mu Gu Lu, Aludeng, 2500–3000 m, 31 Jul 1979, *NE 79-1666* (KUN); Guqian Team, Qiao Mi Gu Lu, 1700–2000 m, 9 Jun 1982, *QX 7206* (KUN [2]); Pu Le Shang, 2700 m, 30 May 1979, *Y.M. Zhang 307* (KUN [2]).
Lishadi Xiang. Yaduo Cun, vicinity of Shibali, N side of N fork of the Yamu He, E side of Gaoligong Shan, 2590 m, 4 Aug 2005, *GLGS 26352* (CAS); Yaduo Cun, above Shibali, S side of N fork of the Yamu He, rd to Myanmar border at Yaping Yakou, E side of Gaoligong Shan, 2830 m, 6 Aug 2005, *GLGS 26546* (CAS); Yaduo Cun, above Shibali to Myanmar border at Yaping Yakou, N side of N fork of the Yamu He, E side of Gaoligong Shan, 2750 m, 10 Aug 2005, *GLGS 26907* (CAS); Yaduo Cun, above Shibali along N side of S fork of the Yamu He, E side of Gaoligong Shan, 2770 m, 15 Aug 2005, *GLGS 28320* (CAS); Yaduo Cun, vicinity of Luodigoulu, N side of N fork of the Yamu He, E side of Gaoligong Shan, 2520 m, 16 Aug 2005, *GLGS 28422* (CAS); same data, *GLGS 28428* (CAS).
Lumadeng Xiang. Yaping Cun, vicinity of Shibali, S side of N fork of the Yamu He, E side of Gaoligong Shan, 2510 m, 16 Aug 2005, *GLGS 28482* (CAS); Yaping Cun, below old Shibali, N side of S fork of the Yamu He, E side of Gaoligong Shan, 2150–2300 m, 1 Aug 2005, *GLGS 28741* (CAS); same data, *GLGS 28745* (CAS); Yaping Cun, below old Shibali, N side of S fork of the Yamu He, E side of Gaoligong Shan, 2040 m, 21 Aug 2005, *GLGS 28780* (CAS); Yaping Cun, above old Shibali, N side of S fork of the Yamu He, E side of Gaoligong Shan, 2700 m, 21 Aug 2005, *GLGS 28827* (CAS); same data, *GLGS 28828* (CAS); Yaping Cun, rd above old Shibali, N side of S fork of the Yamu He, E side of Gaoligong Shan, 2540 m, 22 Aug 2005, *GLGS 28854* (CAS); same data, *GLGS 28865* (CAS).
Shangpa Zheng. 2500 m, 16 Sep 1933, *Tsai 54254* (A, E); 2500 m, 19 Oct 1933, *Tsai 54472* (A, KUN); 2300 m, 25 Oct 1933, *Tsai 54938* (A, KUN); 2000 m, 20 Sep 1933, *Tsai 56532* (A, E); 2000 m, 28 Oct 1934, *Tsai 59026* (A).
GONGSHAN XIAN. E slope of Gaoligong Shan, 1800–3510 m, 15 Jul 1983, *Q. Lin 790977* (KUN); W slope of Gaoligong Shan, 2700 m, 15 Jul 1979, *Q. Lin 790982* (KUN [2]); Da You to Ma Shi Ding, 1930–2500 m, 31 Jul 1979, *NE 79-1891* (KUN).
Bingzhongluo Xiang. Chang Pu Tong, 2300–2500 m, 6 Sep 1940, *Feng 7543* (KUN); in regionis calide temperatae ad fluvium Lu-djiang (Salween) prope Tschamutong pteridietis graminosis ad vicum Bahan, 2600 m, 20 Apr 1916, *H. F. v. Handel-Mazzetti 9027* (A, E, K); from Ma Tong to Bai Mang Xue Shan, 2500 m, 29 May 1960, *NT 8825* (KUN); Mount Kenyichunpo and region of Champutong, Salween-Irrawadi Watershed, 11000 ft., 1923, *Rock 11230* (A); Si Chi Tong, 2800 m, Oct 1935, *Wang 67423-A* (A); same location, 2800 m, Oct 1935, *Wang 67423* (KUN); Si Chi Tong, Salwin-Kiu Kiang divide, 2000 m, Oct 1935, *Wang 67506* (A).
Cikai Zheng. Hei Pu Shan, 19 Oct 1940, *Feng 8600* (KUN [2]); track from Qiqi Forest Station SE toward Gongshan to main bridge over the Pa Le He, 1800–2000 m, 18 Sep 1991, *GLGS 7248* (E); Qiqi Nature Reserve Station to track heading toward Dulongjiang, 2400 m, 16 Oct 1996, *GLGS 7709* (E); Qiqi to Dongshaofang, 2730 m, 14 Oct 1996, *GLGS 7732* (E, KUN); E side of Gaoligong Shan, along the Danzhu He, rd from Nujiang at Danzhu to the Myanmar border, 2750 m, 1 Jul 2000, *GLGS*

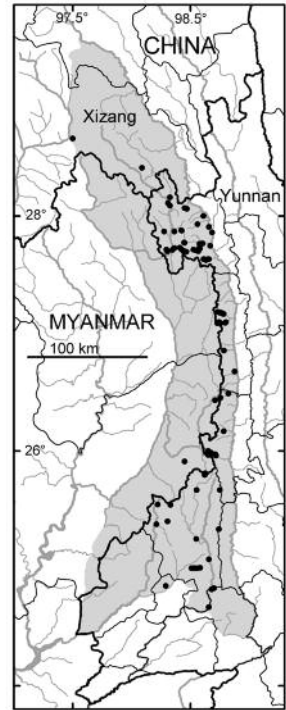


FIGURE 37. Distribution map of *Gaultheria semi-infera* in the GLGS region.

11839 (CAS, KUN); E side of Gaoligong Shan, vicinity of Daxue Cao waterfall, along the Danzhu He, rd from the Nuijiang at Danzhu to Myanmar border, 2600 m, 3 Jul 2000, *GLGS 11939* (CAS, KUN); E side of Gaoligong Shan, above Daxue Cao waterfall, along the Danzhu He, rd from the Nuijiang at Danzhu to the Myanmar border, 2500 m, 4 Jul 2000, *GLGS 11982* (CAS, KUN); E side of Gaoligong Shan, W of Gongshan and W of Qiqi, along the Pula He, trail to Dongshao Fang and Dulongjiang Valley, 2200 m, 10 Jul 2000, *GLGS 12245* (CAS, KUN); rd from Gongshan to Kongdang, E side of Gaoligong Shan, 2510 m, 10 Oct 2002, *GLGS 17129* (CAS, KUN); E side of Gaoligong Shan, rd from Danzhu to Myanmar border, 2700 m, 10 Nov 2004, *GLGS 22337* (CAS); same data, *GLGS 22343* (CAS); Danzhu Cun, S side of the Danzhu He ca. 8.5 direct km WSW of Danzhu, rd to Myanmar border, E side of Gaoligong Shan, 2550 m, 26 Aug 2006, *GLGS 34131* (CAS); Heiwadi Cun, vicinity of Dimupo, rd from Gongshan to Kongdang, ca. 6.4 direct km WNW of Gongshan, E side of Gaoligong Shan, 2380 m, 27 Aug 2006, *GLGS 34210* (CAS); vicinity of Dimupo, near Km 28, rd from Gongshan to Kongdang, ca. 8.5 direct km W of Gongshan, E side of Gaoligong Shan, 2700 m, 30 Aug 2006, *GLGS 34356* (CAS); trail from Qiqi to No. 12 Bridge, 2400–2600 m, 3 Jun 2006, *Lu 109* (CAS); hill behind Gongshan City, 2000 m, 11 Jun 1979, *NE 79-388* (KUN); Qiqi, 2000 m, 19 Jul 1982, *QX 8161* (KUN). **Dulongjiang Xiang.** Second team, E slope of Dulongjiang, 1800 m, 29 May 1964, *Feng 24723* (KUN [2]); vicinity of Kongdang, E side of the Dulongjiang, 2600 m, 2 Jan 1991, *GLGS 1598* (CAS, KUN); Dan Dan He, 1700 m, 18 Jan 1991, *GLGS 3281* (KUN); Xue Ba La Ka, 2000 m, 20 Apr 1991, *GLGS 6173* (KUN [2]); along the Gamolai He ca. 3 km S of Bapo, E side of the Dulongjiang, 1460 m, 30 Oct 2004, *GLGS 21123* (CAS); W side of the Dulongjiang, vicinity of Xiongdang Pass ca. 1 km N of Dizhengdang (Lengdang) and ca. 23.5 direct km N of Kongdang, 2000 m, 29 Oct 2004, *GLGS 21406* (CAS); vicinity of Sandui campsite between Shigong Qiao and Xixiaofang, trail from Bapo to Gongshan via Qiqi, W side of Gaoligong Shan, 2500 m, 29 Oct 2004, *GLGS 21970* (CAS); along rd between Kongdang and Heipu Pass tunnel, new rd from Gongshan to Dulongjiang Valley, ca. 8.4 direct km E of Kongdang, W side of Gaoligong Shan, 2460 m, 15 Aug 2006, *GLGS 32380* (CAS); vicinity of Waluoban, W side of Dulongjiang Valley, ca. 3.1 direct km N of Maku and ca. 5.5 direct km NE of Myanmar border, 2750 m, 18 Aug 2006, *GLGS 32433* (CAS); at Maku Village, W side of Dulongjiang Valley, ca. 4.4 direct km NE of Myanmar border, 2250 m, 19 Aug 2006, *GLGS 32576* (CAS); ca. 11.5 direct km N of tunnel at the pass into Dulongjiang Valley, rd from Gongshan to Kongdang and ca. 27.5 direct km NW of Gongshan, W side of Gaoligong Shan, 2370 m, 6 Jan 2009, *GLGS 34411* (CAS); San Dui to Mieliwang, 2200–2600 m, 5 Jun 2006, *Lu 70* (CAS [2]); Dulongjiang to Gongshan, 1979, *NE 79-636* (KUN); Longyuan, 1900 m, 29 Aug 1982, *QX 9738* (KUN); Chingtinglaka, 2400 m, 28 Jul 1938, *Yü 19503* (A, E); upper Kiukiang Valley, Singelila, 2500 m, 5 Aug 1938, *Yü 19641* (A, E); E mtn. of Dulongjiang Valley, 2500 m, 13 Sep 1938, *Yü 20206* (A, E); Panbahlung, Salwin-Kiukiang divide, 3000 m, 22 Oct 1938, *Yü 20831* (A [2], KUN). **Pengdang Xiang.** Jiwa, E side of Gaoligong Shan, rd from Gongshan to Bingzhongluo, 1458 m, 13 Apr 2002, *GLGS 14271* (CAS, KUN). **LIANGHE XIAN.** Mang Gu Shan, 1400 m, 2 Oct 1979, *Kunming Station of Chinese Acad. Sci. 12977* (KUN). **LONGLING XIAN.** 2400 m, 6 Jan 1934, *Tsai 54572* (A, E, KUN). **Zhen'an Zheng.** 1800 m, 4 Dec 1958, *J. Chen 723* (KUN). **LUSHUI XIAN.** N'maikha-Salween, 10000 ft., Jun 1919, *F 17984* (A, E, K); W hill of Yakou, 2950 m, 13 Sep 1996, *GLGS 7220* (KUN [4]); Yao Jia Ping, 2440 m, 25 Oct 1996, *GLGS 8040* (KUN); Yao Jia Ping, 2680 m, 26 Oct 1996, *GLGS 8120* (KUN); Yao Jia Ping, ca. 1 km along rd to Pianma, 2540 m, 28 Oct 1996, *GLGS 8210* (E); Yao Jia Ping, 2270 m, 28 Oct 1996, *GLGS 8252* (KUN); rd from Pianma to Liuku, W slope of Salween/Irrawaddy divide, 2400–2600 m, 5 Oct 1997, *GLGS 10048* (E, KUN); Km 62, rd between the Salween and Pianma, W side of Gaoligong Shan, 2690 m, 11 Oct 1998, *GLGS 10222* (CAS, E, KUN); rd between the Salween and Pianma, W side of Gaoligong Shan, 2630 m, 14 Oct 1998, *GLGS 10412* (CAS, KUN). **Luyobenzhou Xiang.** Vicinity of Bifu Bridge, ca. 32.7 direct km S of Fugong City and ca. 7.7 direct km W of the Nuijiang, E side of Gaoligong Shan, 2640 m, 1 May 2004, *GLGS 20834* [mistakenly recorded as Fugong Xian, Pihe Xiang on the label but all other data are correct] (CAS); E'ga Cun, forest rd at Km 35, E side of Gaoligong Shan, 3000 m, 6 Aug 2005, *GLGS 25674* (CAS). **Luzhang Zheng.** Rd between Lushui and Pianma Yakou at Km 53 from turn off on Liuku-Fugong rd, E side of Gaoligong Shan, 2850 m, 15 Oct 2002, *GLGS 15970* (CAS, KUN); Pianma Yakou, 2200 m, 31 May 2006, *Lu 103* (CAS [4]). **Pianma Xiang.** From Pianma to Wuzhong, 2100 m, 29 Jul 1978, *BE 1498* (KUN); Pianma Pass, 2100–2700 m, 11 Jul 1978, *BE 1607* (KUN); same locality, 2100–2700 m, 29 Jul 1978, *BE 1608* (KUN); Hpimaw, 7500 ft., 26 Jun 1919, *R.J. Farrer 1068* (E); 3000 m, 14 Sep 1996, *GLGS 7262* (KUN [3]); vicinity of Km 62, rd from Lushui to Pianma, W side of Gaoligong

Shan, 2790 m, 17 May 2005, *GLGS 23303* (CAS). **TENGCHONG XIAN.** Gan Lan Zai, 3 Dec 1934, *M. Chen 3556* (E); divide between the Shweli and Tengyueh Valley, 7000 ft., Aug 1912, *F 8757* (E, K); hills E of Tengyueh, 6500 ft., Jul 1912, *F 8786* (E); Shweli-Salween divide, 7000–8000 ft., Nov 1919, *F 9331* (E); same locality, 11000 ft., Oct 1919, *F 15986* (E, K); same locality, 7000 ft., Sep 1919, *F 18542* (E, K); hills around Tengyueh, 7000–9000 ft., Dec 1924, *F 26181* (E, K); Shweli-River drainage basin to summit of Shweli-Salween Watershed, E of Tengyueh, Nov 1922, *Rock 7692* (A); between the Salween and Irrawaddi, 1800–2000 m, Nov 1922, *Schneider 2606* (A, GH, K). **Dongshan Xiang.** Qingcaitang, old rd from Tengchong to Baoshan between Tengchong and the Longchuanjiang, 2070 m, 2 Nov 1998, *GLGS 11340* (CAS, E, KUN); *GLGS 11348* (CAS, E, KUN). **Houqiao Zheng (Guyong Zheng).** Vicinity of Gaoshidong in Guyong Linchang (forest farm), ca. 9.8 direct km ENE of Houqiao (Guyong), 2570 m, 27 May 2006, *GLGS 30663* (CAS); Danzha Cun, vicinity of Zhaobitan forest farm, ca. 26.5 direct km NNW of Houqiao (Guyong), 2630 m, 29 May 2006, *GLGS 30787* (CAS); Dan Zha, 2400 m, 17 Oct 1983, *Q. Lin 770689* (KUN); from Gu Yong to Dan Zhao, 29 May 1964, *Wu 6924* (KUN). **Mingguang Xiang.** Zizhi Cun, ca. 9.5 direct km NE of Zizhi, rd to Baduolin Yakou (the pass into Myanmar at border marker 8), Jianga Shan, W side of Gaoligong Shan, 2750–2850 m, 19 May 2006, *GLGS 29239* (CAS); Zizhi Cun, rd from Zizhi to Baduolin Yakou (the pass into Myanmar at border marker 8), Jianga Shan, W side of Gaoligong Shan, 2650 m, 20 May 2006, *GLGS 29289* (CAS); Zizhi Cun, Jianga Shan, rd from Zizhi to Baduolin Yakou (pass at marker number 8 between China and Myanmar), W side of Gaoligong Shan, 2770 m, 23 May 2006, *GLGS 30509* (CAS); Zizhi Cun, Jianga Shan, trail E of Baduolin Yakou (pass at marker 8 between China and Myanmar), W side of Gaoligong Shan, 3020 m, 23 May 2006, *GLGS 30532* (CAS). **Zhonghe Xiang.** Huan Xi Po, 2100 m, 8 Aug 1980, *S.H. Li 80-607* (KUN). **MYANMAR. KACHIN: MYITKYINA DISTRICT. Chipwi Township.** N'maikha-Salwin divide, 10000–11000 ft., Jun 1931, *F 29648* (E); Htawgaw, valley of Maung-chuang, Jalu country, 9000–10000 ft., 30 May 1914, *KW 1613* (E).

20. *Gaultheria sinensis* J. Anthony, Notes Roy. Bot. Gard. Edinburgh 18:19. 1933. TYPE.— CHINA. Xizang: Ka-gwr-pu, Mekong-Salwin divide, 28°25'N, 12000 ft., July 1917, *G. Forrest 14216* (holotype: E!; isotype: K!).

Gaultheria sinensis J. Anthony var. *major* Airy Shaw, Bull. Misc. Inform. Kew 1940:325. 1941 [“*maior*“]. TYPE.— CHINA. Yunnan: Kari Pass, Mekong-Yangtze divide, 27°40'N, 3300 m, August 1914, *G. Forrest 12938* (holotype: K!; isotypes: E!, BM!).

Gaultheria sinensis var. *crassifolia* Airy Shaw, Bull. Misc. Inform. Kew 1940:326. 1941. TYPE.— CHINA. Xizang: [Tsarong Xiang], Salwin-Kiu Chiang divide [Gaoligong Shan], 28°40'N, 98°15'E, October 1919, *G. Forrest 19286* (holotype: K!; isotype: E!).

Shrublets 3–15 cm tall, prostrate. Branchlets elongate, terete, ferruginous-, red-, light brown- or black-uncinate-setulose and often white-puberulent. Petiole 0.4–2 mm, abaxially glabrous or sparsely setulose, adaxially glabrous or white-puberulent; leaf blade elliptic to oblanceolate, 5.5–14 × 3–7 mm, gradually smaller along stems toward both ends of each year's growth, 1.4–2.6 × as long as wide, coriaceous to subcoriaceous, abaxially dull light green to light brown with narrow glossy edge and sparsely setulose at least along midvein on at least some leaves, adaxially ± glossy green to brown and glabrous or white-puberulent proximally along midvein, midvein abaxially raised to occasionally prominent and adaxially sulcate to occasionally planar, secondary veins (when visible) 2–5 on each side of midvein, secondary and tertiary veins obscure or occasionally distinct, base cuneate to subrounded, margin serrulate, with 4–14 setulose-tipped teeth per side, revolute to occasionally planar, apex acute to rounded. Inflorescences axillary, 6–9 mm, 1-flowered; bracts absent. Pedicel 1.5–5 mm, glabrous; bracteoles 2, apical, broadly ovate to orbicular, not keeled, 1.8–4 × 1.8–3 mm, persistent, glabrous, margin entire, apex broadly obtuse to rounded. Calyx 2.7–4 mm; lobes (4)5, broadly ovate-deltoid, 1.5–2.3 × 1.8–2.5 mm, mostly overlapping at base, outside glabrous, inside glabrous or pubescent, margin entire or distally slightly erose and

often distally ciliolate, apex acute to obtuse. Corolla white to pink, broadly urceolate to campanulate, 3–4.5 × 3–5 mm, glabrous on both sides; lobes (4)5, oblong to deltoid-oblong, 1–2 mm. Stamens 8–10; filaments 0.6–1.2 mm, dilated medially, sides convex-curved, glabrous; anthers 0.6–0.9 mm, 4-awned; awns 0.2–0.6 mm. Ovary glabrous; style ca. 1.5 mm. Calyx at fruiting blue, fleshy; lobes incurved, narrowly pale-edged. Capsule 6–8 mm in diam., glabrous.

Gaultheria sinensis vars. *major* and *crassifolia* were described by Airy Shaw (1941) on the basis of fruiting material only. These varieties were distinguished from the nominate variety on the basis of leaf size and thickness, respectively. Because both of these characters appear to vary continuously in *G. sinensis*, we are resigned to agree with Fang and Stevens (2005) in not recognizing these varieties, but stress the need for the collection of flowering specimens of *G. sinensis* with unusually large or thick leaves to provide further insight into the taxonomic status of these varieties.

See also comments under *Gaultheria hypochlora*.

SELECTED ILLUSTRATIONS.— See comments under *Gaultheria hypochlora*.

PHOTOGRAPHIC IMAGE.— Figure 38.

PHENOLOGY.— Fl. May–Jul, fr. Jun–Oct.

DISTRIBUTION AND HABITAT.— Subtropical evergreen broadleaf forests, deciduous forests, coniferous forests, grasslands, meadows; 2500–4200 m. In GLGS: CHINA. Xizang: Zayü Xian (Tsarong Xiang). Yunnan: Fugong Xian (Lishadi Xiang, Lumadeng Xiang, Yaping Xiang), Gongshan Xian (Bingzhongluo Xiang, Cikai Zheng, Dulongjiang Xiang), Lushui Xian (Pianma Xiang), MYANMAR. Kachin: Myitkyina District (Hsawlaw Township); Figure 39. Outside of GLGS: Sichuan, Xizang, Yunnan [Bhutan, India, Myanmar].

CHINESE NAME.— 华白珠 hua bai zhu

ADDITIONAL GAOLIGONG SHAN SPECIMENS EXAMINED: CHINA. XIZANG: ZAYÜ XIAN. Salwin-Kiu Chiang divide, 13000 ft., Aug 1921, *F 20040* (A, E, K, P); Deyang La, 13000 ft., 6 Jun 1947, *F Ludlow & G. Sherriff 15158* (A, E); Ri Dong Qu, 4200 m, 8 Sep 1982, *QX 10107* (KUN). **YUNNAN: FUGONG XIAN.** Che-tse-luo, 4000 m, 25 Aug 1934, *Tsai 58172* (A, KUN). Da you to Gua Didi, 3350 m, 1 Aug 1970, *Q. Lin 792037* (KUN). **Lishadi Xiang.** Between Shibali Logging Station and Yaping Pass, ca. 4.1 km W of



FIGURE 38. Fruiting plant of *Gaultheria sinensis*. Photo by L. Zhou.

Shibali, rd from the Nujiang to Yaping Pass, E side of Gaoligong Shan, 3007 m, 2 May 2004, *GLGS 20140* (CAS); Yaduo Cun, above Shibali to Myanmar border at Yaping Yakou, N side of N fork of the Yamu He, E side of Gaoligong Shan, 2750 m, 10 Aug 2005, *GLGS 26921* (CAS). **Lumadeng Xiang.** Yaping Cun, S side of N fork of the Yamu He above Shibali, E side of Gaoligong Shan, 3050 m, 8 Aug 2005, *GLGS 26754* (CAS); Yaping Cun, below Amero Pass along the rd back down to confluence of N and S fork of the Yamu He, E side of Gaoligong Shan, 3120 m, 13 Aug 2005, *GLGS 27161* (CAS); Yaping Cun, vicinity of Shibali, S side of N fork of the Yamu He, E side of Gaoligong Shan, 2510 m, 16 Aug 2005, *GLGS 28501* (CAS); Ou Lu Di, 3800 m, 28 May 1982, *QX 6998* (KUN). **Yaping Xiang.** Vicinity of Yaping Pass near the Myanmar border, E side of Gaoligong Shan, 3620 m, 5 May 2004, *GLGS 20969* (CAS); vicinity of Yaping Pass near the Myanmar border, E side of Gaoligong Shan, 3700 m, 5 May 2004, *GLGS 20975* (CAS). **GONGSHAN XIAN. Bingzhongluo Xiang.** Chang Pu Tong, 3500–3700 m, 10 Jul 1940, *Feng 7675* p.p. (KUN); ca. 3 direct km SSW of Gawagapu Mtn. and ca. 16 direct km WSW of Bingzhongluo in the next basin to the E of Chukuai Lake, E side of Gaoligong Shan, 3770 m, 29 Aug 2006, *GLGS 31589* (CAS); ca. 2.1 direct km S of Gawagapu Mtn. and ca. 15.2 direct km WSW of Bingzhongluo in the next basin to the E of Chukuai Lake, E side of Gaoligong Shan, 4000 m, 28 Aug 2006, *GLGS 32809* (CAS); Soo-roo la, Champutung, 3000 m, Sep 1935, *Wang 66678* p.p. (A, KUN); Chang Pu Tong, 3000 m, Oct 1935, *Wang 67099* (A, KUN). **Cikai Zheng.** E side of Gaoligong Shan, W of Gongshan, along the Pula He, trail from Qiqi to Dongshao Fang and Dulongjiang Valley, 2770–3050 m, 15 Jul 2000, *GLGS 12551* (CAS, KUN); E side of Gaoligong Shan, W of Gongshan, along the Pula He, trail from No. 12 Bridge to Dongshao Fang and Dulongjiang Valley, 2900 m, 1 May 2002, *GLGS 14794* (CAS); ca. 1.2 direct km SSE of Heipu Pass tunnel on new rd from Gongshan to the Dulongjiang Valley, E side of Gaoligong Shan, 3350 m, 13 Aug 2006, *GLGS 32150* (CAS); same data, *GLGS 32170* (CAS); E slope of Gaoligongshan, 3600 m, 26 Jul 1982, *QX 8726* (KUN). **Dulongjiang Xiang.** Sandui, W side of Gaoligong Shan, along Gamolai He on trail from Xishaofang to Bapo, 2570 m, 17 Jul 2002, *GLGS 15033* (CAS, KUN); E side of pass of rd from Gongshan to Kongdang, W side of Gaoligong Shan near crest of range, 3670 m, 5 Oct 2002, *GLGS 17007* p.p. (CAS, KUN); from Gongshan to Dulongjiang, 2700 m, 9 May 1978, *NE 79-86* (KUN); Gongshan Yakou to Dulongjiang, 1979, *NE 79-558* (KUN); Parolaka, 3500 m, 13 Oct 1938, *Yü 20683* (A, E). **LUSHUI XIAN.** Wang Zhuan He, close to Da He, 3100 m, 30 Jun 1969, *Wu 7333* (KUN). **Pianma Xiang.** W slope of Pianma Yakou, Fengxue Yakou, 3000 m, 27 Jul 1978, *BE 1351A* (KUN); Pianma Yakou, 3300 m, 8 Jun 2006, *Lu 21* (CAS). **MYANMAR. KACHIN: MYITKYINA DISTRICT. Hsawlaw Township.** Shing Hong Pass, 10500 ft., 16 Jun 1920, *R.J. Farrer 1622* (E).

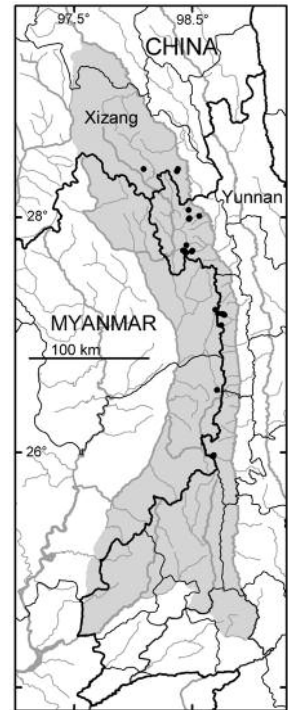


FIGURE 39. Distribution map of *Gaultheria sinensis* in the GLGS region.

21. *Gaultheria suborbicularis* W.W. Smith, Notes Roy. Bot. Gard. Edinburgh 8:186. 1914. *Chiogenes suborbicularis* (W.W. Smith) Ching ex T.Z. Xu, Acta Bot. Yunnan. 6:40. 1984. TYPE.—CHINA. Yunnan: western Yunnan [Gongshan Xian], between Yunnan and E Tibet [Gaoligong Shan], 15000 ft., *F. Kingdon Ward 850* (lectotype, here designated: E Barcode No. 231017!; isolectotype: E Barcode No. 231018!).

The type material of *Gaultheria suborbicularis* was indicated as E in the protologue, but there are two sheets of the type material at E, both with the written words “Type.” We have selected the E sheet barcoded as 231017 as lectotype because it has more material than the other sheet (231018) and has better flowering material. In addition, it bears a tag labeled “Type specimen” whereas this does not occur on 231018.

Shrublets, prostrate. Branchlets elongate and long-trailing, terete to irregularly ridged, wiry, densely tawny-, dull orange-, or ferruginous-ascending setose-villous and white-puberulent. Petiole 0.5–0.8 mm, glabrous or setulose; leaf blade broadly elliptic, suborbicular, or rarely elliptic, 4–8 × 3–5.5 mm, gradually smaller along stems toward both ends of each year's growth, 1.2–1.8 × as long as wide, coriaceous, abaxially greenish brown to brown and tawny- to ferruginous-appressed-setose, adaxially glabrous, midvein abaxially planar to raised and adaxially planar to impressed, secondary veins abaxially obscure and adaxially impressed or obscure, tertiary veins obscure on both surfaces, base rounded to subcordate, margin obscurely serrulate, with 10–13 setose-tipped teeth per side, revolute, apex obtuse to rounded. Inflorescences axillary, 4–5 mm, 1-flowered; bracts absent. Pedicel slender, 1–2 mm, glabrous; bracteoles apical, ovate to subrhombic, slightly keeled, 1.5–2 × 1.5–2.1 mm, persistent, glabrous, margin entire, apex acuminate. Calyx 1.7–2.7 mm; lobes 4, ovate-deltoid, 1.4–2 × 1–2 mm, glabrous, margin entire, apex shortly acuminate. Corolla rose, purplish, or sometimes white, campanulate, 2–3 × ca. 3 mm, glabrous; lobes 4, deltoid, 1–1.8 mm. Stamens 4–7; filaments ca. 0.6 mm, dilated medially, sides convex-curved, glabrous; anthers 0.3–0.5 mm, awns 0.1–0.2 mm. Ovary glabrous; style 0.6–0.8 mm, glabrous. Calyx at fruiting red, fleshy; lobes incurved, not pale-edged. Capsule 3–4 mm in diam., glabrous.

SELECTED ILLUSTRATIONS.— R.C. Fang, *Fl. Reipubl. Popularis Sin.* 57(3):70 t. 20(1–7). 1991; G.H. Zhu & L.B. Zhang, eds. *Fl. China* III. 14: t. 665(1–7). 2006.

PHOTOGRAPHIC IMAGE.— Figure 40.

PHENOLOGY.— Fl. May–Jul, fr. Aug–Oct.

DISTRIBUTION AND HABITAT.— Forest understories, thickets, grassy slopes, on rocks; 3000–4600 m. In GLGS: CHINA. Xizang: Zayü Xian (Tsarong Xiang). Yunnan: Gongshan Xian (Bingzhongluo Xiang, Cikai Zheng, Dulongjiang Xiang); Figure 41. Outside of GLGS: Yunnan.



FIGURE 40. Fruiting plants of *Gaultheria suborbicularis*. Photo by L. Lu.

CHINESE NAME.—伏地白珠 *fu di bai zhu*

ADDITIONAL GAOLIGONG SHAN SPECIMENS EXAMINED: CHINA.

XIZANG: ZAYÜ XIAN. Ri Dong Qu, 3800 m, 1 Sep 1935, *QX 10128* (KUN). **Tsarong Xiang.** Salween-Kiu Chiang divide, 15000 ft., Jul 1921, *F 19888* (E); same locality, 15000 ft., *F 20267* (E, P [2]); same locality, 15000 ft., 22 Apr 1955, *F 20872* (E); S Tsarong, Oct 1922, *F 22844* (E). **YUNNAN: GONGSHAN XIAN. Bingzhongluo Xiang.** Soo-roo la, Champutong, 3000 m, Sep 1935, *Wang 66678* p.p. (A, KUN). **Cikai Zheng.** Dong Shao Fang, 3300 m, 11 May 1979, *NE 79-134* (KUN). **Dulongjiang Xiang.** Kong Mu Da Dui, 3500–3800 m, 17 Jul 1979, *Q. Lin 791043* (KUN); upper Kiukiang Valley, Chuherton, 3100 m, 6 Aug 1936, *Yü 19684* (A, E, KUN); Salwin-Kiukiang divide, Netahtzu, 3600 m, 17 Oct 1938, *Yü 20737* (A, E, KUN).

22. *Gaultheria thymifolia* Stapf ex Airy Shaw, Bull. Misc. Inform. Kew 1940:322. 1941. TYPE.—MYANMAR. Kachin: [Myitkyina District. Chipwi Township], NE Upper Burma, western flank of the N'maikha-Salwin divide [Gaoligong Shan], 26°24'N, 98°48'E, 3300 m, June 1925, *G. Forrest 26867* (holotype: K!; isotypes: BM!, E!).

Shrublets 2.5–10 cm tall, mat-forming, decumbent. Branchlets elongate, terete, densely red-, ferruginous-, brown-, or black-uncinate-setulose and often white-puberulent. Petiole 0.2–0.8 mm, glabrous or occasionally adaxially white-puberulent; leaf blade linear-oblong to less often oblanceolate, 5–8.5 × 1.3–2.5 mm, gradually smaller along stems toward both ends of each year's growth, 2.4–6.2 × as long as wide, coriaceous, abaxially dull light green to light brown with glossy edge, adaxially glossy green to brown, both surfaces glabrous or occasionally adaxially puberulent along midvein toward base, midvein abaxially prominent and adaxially sulcate, secondary and tertiary veins obscure, base cuneate, margin serrate, with 3–8 setulose-tipped teeth per side, planar to slightly revolute, apex acute to obtuse. Inflorescences axillary, 5–7 mm, 1-flowered; bracts absent. Pedicel 1.5–3 mm, glabrous; bracteoles 2, apical, broadly ovate, not keeled, 1–1.8 × 1–2 mm, persistent, glabrous, margin entire, apex broadly obtuse. Calyx 3–3.5 mm; lobes 5, ovate-deltoid, 2–3 × 1.3–1.8 mm, not overlapping at base, glabrous, margin entire, apex acuminate. Corolla white to maroon, campanulate, 3–4 × 3–5 mm, glabrous on both sides; lobes 5, deltoid-oblong, 1–2(–2.5) mm. Stamens 10; filaments 0.7–1 mm, gradually or ± abruptly dilated from apex, glabrous; anthers 0.6–1 mm, 4-awned; awns 0.2–0.3 mm. Ovary glabrous; style ca. 1.5 mm, glabrous. Calyx at fruiting white to occasionally pink, fleshy; lobes incurved, narrowly pale-edged. Capsule 3–6 mm in diam., glabrous.

Gaultheria thymifolia has until now been considered a species solely of Myanmar. Most specimens of this species from China have been previously identified as *G. cardiosepala*, a species clearly distinguishable from *G. thymifolia* by leaves with longer internodes, an urceolate corolla (versus campanulate) with smaller lobes (0.6–0.8 mm versus 1–2.5 mm), and larger size of several features (stature, leaf blades, anther awns, and style), as specified in our key.

ILLUSTRATIONS.—None known to us.

PHOTOGRAPHIC IMAGE.—Figure 42.

PHENOLOGY.—Fl. Jun–Jul, Oct, fr. Aug–Oct.

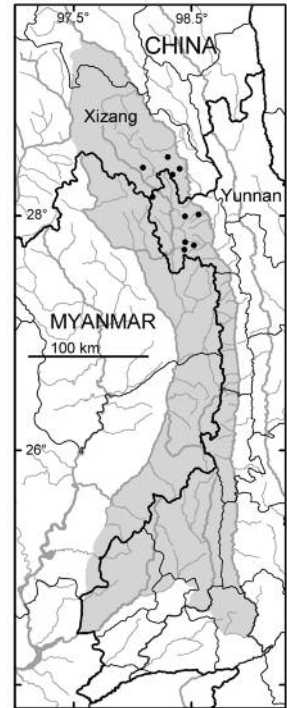


FIGURE 41. Distribution map of *Gaultheria suborbicularis* in the GLGS region.

DISTRIBUTION AND HABITAT.— Grasslands, meadows, open slopes, rocky places; 2800–3900 m. In GLGS: CHINA. Xizang (Zayü Xian) Yunnan: Gongshan Xian (Bingzhongluo Xiang, Cikai Zheng, Dulongjiang Xiang), Tengchong Xian, MYANMAR. Kachin: Myitkyina District (Chipwi Township, Hsawlaw Township, Waingmaw Township), Putao District (Nogmung Township); Figure 43. Outside of GLGS: Myanmar.

CHINESE NAME.— 细叶白珠 (新拟) xi ye bai zhu

ADDITIONAL GAOLIGONG SHAN SPECIMENS EXAMINED: CHINA. XIZANG: ZAYÜ XIAN. Prope fines Tibeto-Burmanicas inter fluvios Lu-djiang (Salween) et Djiou-Jiang (Irrawadi orient. Super.), 3000–3150 m, 9 Jul 1916, *H.F. v. Handel-Mazzetti 9441* (A). YUNNAN: GONGSHAN XIAN. Bingzhongluo Xiang. Ca. 2.6 direct km SSW of Gawagapu Mtn. and ca. 15.5 direct km WSW of Bingzhongluo in the next basin E of Chukuai Lake, E side of Gaoligong Shan, 3880 m, 25 Aug 2006, *GLGS 31446* (CAS); Mt. Kenyichunpo and region of Champutong, Salween-Irrawadi Watershed, 1923, *Rock 10252* (A). Cikai Zheng. Hei Pu Shan, 13 Oct 1940, *Feng 8417* (KUN). Dulongjiang Xiang. Gongshan Yakou to Dulongjiang, 1979, *NE 79-714* (KUN); W of Chang Pu Tong, 2800 m, Oct 1935, *Wang 67194* (A, KUN); Salween-Kiu Chiang divide, Parolaka, 3300 m, 10 Oct 1938, *Yü 20613* (A, KUN); Salween-Kiu Chiang divide, Panbahlung, 3800 m, 21 Oct 1938, *Yü 20821* (A, E, KUN). TENGCHONG XIAN. The seventh district, 1 Jul 1963, *J.S. Yang & X.N. Wang 63-1351* (KUN). MYANMAR. KACHIN: MYITKYINA DISTRICT. Hsawlaw Township. Chevochi Pass, 11800 ft., 24 Sep 1947, *R.J. Farrer 1677* (E). Waingmaw Township. advance base, Seinghku Wang, 10000–11000 ft., 5 Jun 1926, *KW 6849* (K); PUTAO DISTRICT. Nogmung Township. Adung Valley, 12000–13000 ft., 15 Jun 1931, *KW 9639* p.p. (A).

23. *Gaultheria trichophylla* Royle, Ill. Bot. Himal. Mts. 260. 1835. *Brossaea trichophylla* (Royle) O. Kuntze, Revis. Gen. Pl. 2: 387. 1891. TYPE.— INDIA. Jammu and Kashmir: Kishtwar, 10000 ft., *T. Thomson s.n.* (holotype: LIV; isotype: K!).

Gaultheria trichophylla Royle var. *obovata* Airy Shaw, Bull. Misc. Inform. Kew 1940:324. 1941. TYPE.— MYANMAR. Kachin: Upper Burma [Myitkyina District. Waingmaw Township], Seinghku Wang [Gaoligong Shan], 28°8'N, 97°24'E, 11000 ft., 17 June 1926, *F. Kingdon Ward 6944* (holotype: K!).

Gaultheria minuta Merrill, Brittonia 4:152. 1941. TYPE.— MYANMAR. Kachin: [Putao District. Nogmung Township], Adung Valley [Gaoligong Shan], 28°20'N, 97°45'E, 25 June 1931, 12500 ft., *F. Kingdon Ward 9701* (holotype: NY; isotype: A!, photograph of A in K!).

Gaultheria nana C.Y. Wu & T.Z. Xu, Acta Bot. Yunnan. 3:432. 1981. TYPE.— CHINA. Xizang: Dingjie Xian, *Qinghai-Xizang Expedition 5534* (holotype: KUN!).



FIGURE 42. Fruit of *Gaultheria thymifolia*. Photo by D. Lin.

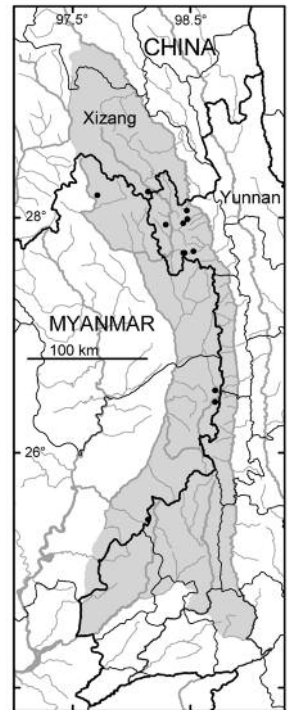


FIGURE 43. Distribution map of *Gaultheria thymifolia* in the GLGS region.

Shrublets 7.5–15 cm tall, prostrate to decumbent. Branchlets elongate, terete, ferruginous-, red-, light brown-, or black-villous-setose and white-puberulent. Petiole 0.4–1.5 mm, abaxially glabrous or occasionally villous-setose, adaxially glabrous or white-puberulent; leaf blade narrowly to broadly elliptic, oblong-elliptic, ovate, or slightly obovate, 3–14 × 2–6 mm, gradually smaller along stems toward both ends of each year's growth, 1.5–2(–3.7) × as long as wide, subcoriaceous to coriaceous, abaxially dull light green to light brown with narrow glossy edge and sparsely villous-setose at least along midvein on at least some leaves or occasionally all glabrous, adaxially glossy green to brown and glabrous or white-puberulent proximally along midvein, midvein abaxially raised to prominent and adaxially sulcate, secondary and tertiary veins distinct or occasionally obscure on both surfaces, secondary veins (when visible) 2–4 on each side of midvein, base cuneate to subrounded, margin serrulate with 4–14 villous-setose-tipped teeth per side, planar to slightly revolute, apex acute to subrounded. Inflorescences axillary, 6–8 mm, 1-flowered; bracts absent. Pedicel 1.5–3 mm, glabrous or white-puberulent; bracteoles 2, apical, broadly ovate to orbicular, not keeled, 1.2–2.5 × 1.3–2.4 mm, persistent, glabrous, margin entire, apex obtuse to rounded. Calyx 2.8–3.6 mm; lobes 5, ovate-deltoid to oblong-deltoid, 1.6–3 × 1.4–2.3 mm, mostly not overlapping at base, glabrous, margin entire, apex acute to subrounded. Corolla white to red, campanulate, 3.5–5.5 × 3.5–7 mm, glabrous on both sides; lobes 5, oblong to occasionally deltoid-oblong, 1.8–2.8 mm. Stamens 10; filaments 1–1.2 mm, gradually dilated medially or submedially from apex, glabrous; anthers 0.7–1 mm, 2- or 4-awned; awns 0.3–0.9 mm, occasionally bifid when 2-awned. Ovary glabrous; style 2–2.5 mm, glabrous. Calyx at fruiting blue, fleshy; lobes incurved to erect, narrowly pale-edged. Capsule 3–7 mm in diam., glabrous.

Gaultheria trichophylla is variable in leaf size and shape, habit, number of awns on the anthers, and other characters. We have chosen to recognize a single variable species without infraspecific taxa. Two other taxa with types collected outside the GLGS that might best be considered synonyms of *G. trichophylla* are *G. t.* var. *tetracme* Airy Shaw of Sichuan Province and *G. sinensis* J. Anthony var. *layaensis* S.J. Rae & D.G. Long of Bhutan. These taxa share with the other material comprising *G. trichophylla* villous-setose-tipped teeth on the leaf blade margin, a character not present in any other member of series *Trichophyllae*. *Gaultheria t.* var. *tetracme* and *G. s.* var. *layaensis* were separated from *G. trichophylla* partly through their four-awned anthers, but the number of awns per anther varies between two and four throughout the range of *G. trichophylla* and occasionally when the anthers are two-awned they are forked at the apex, suggesting reduction of two awns on each theca into a single awn via fusion. The other characters that reportedly distinguish these species, such as leaf size, shape, and thickness, all appear to be variable and continuous, with no correlated morphological gaps, but further study of this species throughout its range is warranted.

We have elevated *Gaultheria trichophylla* var. *eciliata* to species status in the present work (see discussion under *G. eciliata*).

SELECTED ILLUSTRATION.— T.Z. Xu, Fl. Xizang, 3:694 t. 277(2). 1986.

PHENOLOGY.— Fl. May–Jul, fr. Jul–Sep.

DISTRIBUTION AND HABITAT.— Montane grasslands, meadows,

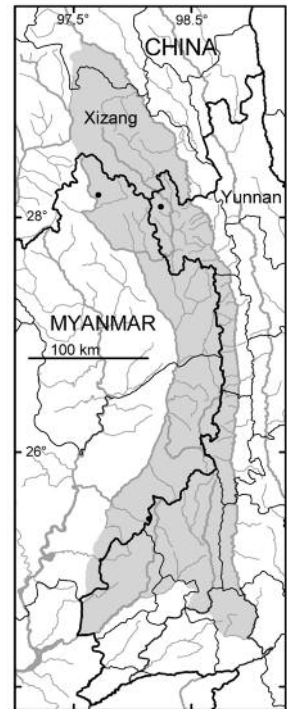


FIGURE 44. Distribution map of *Gaultheria trichophylla* in the GLGS region.

rocky places; 3300–4200 m. In GLGS: CHINA. Yunnan: Gongshan Xian (Dulongjiang Xiang), MYANMAR. Kachin: Myitkyina District (Waingmaw Township), Putao District (Nogmung Township); Figure 44. Outside of GLGS: Sichuan, Xizang, Yunnan [Bhutan, India, Nepal].

CHINESE NAME.— 刺毛白珠 *ci mao bai zhu*

ADDITIONAL GAOLIGONG SHAN SPECIMENS EXAMINED: CHINA. YUNNAN: GONGSHAN XIAN. **Dulongjiang Xiang.** Chialahmuto, 3600–4000 m, 7 Aug 1938, *Yü 19732* (A, E). MYANMAR. KACHIN: PUTAO DISTRICT. **Nogmung Township.** Adung Valley, 12000–13000 ft., 15 Jun 1931, *KW 9639* p.p. (A).

24. *Gaultheria wardii* C. Marquand & Airy Shaw, *J. Linn. Soc., Bot.* 48:198. 1929. TYPE.— CHINA. Xizang: Tong-kyuk, 9000 ft., 10 August 1924, *F. Kingdon Ward 6071* (holotype: K!).

Gaultheria trichoclada C.Y. Wu, *Acta Bot. Yunnan.* 3:424. 1981. TYPE.— CHINA. Xizang: Bomi, *P.C. Tsoong 6185* (holotype: PE).

Gaultheria wardii C. Marquand & Airy Shaw var. *elongata* R.C. Fang, *Novon* 9:174. 1999. TYPE.— CHINA. Yunnan: Gongshan Xian [Gaoligong Shan], 2000 m, 28 July 1982, *Qinghai-Xizang Expedition 8858* (holotype: KUN; isotypes: KUN!, PE).

Shrubs 0.5–2.5 m tall, erect to arching. Branchlets elongate, terete, densely gray-, tawny-, brown-, or ferruginous-ascending-setose-hirsute and usually white-puberulent. Petiole 1–3 mm, setose-hirsute; leaf blade lanceolate to oblong-lanceolate, 3–7.5 × 1.1–2.5 cm, 2.2–4.6 × as long as wide, subcoriaceous, abaxially green and ferruginous-villous-hirsute, adaxially pustulate and glabrous or villous-hirsute to hirtellous, midvein abaxially prominent and adaxially narrowly sulcate, secondary veins 3 or 4 on each side of midvein, arising along midvein with proximal veins becoming faint or anastomosing before reaching apex, abaxially prominent, adaxially planar to impressed, tertiary veins abaxially raised or obscure and adaxially planar to impressed, base subrounded, subtruncate, subcordate, or rarely cuneate, margin denticulate, with 11–21 teeth per side, revolute, apex acute to shortly acuminate. Inflorescences axillary and terminal, rather dense racemes, 1.7–2.5 cm, 4–18-flowered; rachis slender, white-villulose or ferruginous-villous-setose or both; bracts rhombic-lanceolate to linear-lanceolate, not keeled, 4–6 × 0.6–2 mm, smaller distally along inflorescence, persistent, outside glabrous, puberulent, or setulose, inside glabrous or white-puberulent, margin ciliate and occasionally also setulose, apex long recurved acuminate. Pedicel 3–7 mm, white-puberulent or setose or both; bracteoles ± medial, linear-lanceolate to linear, 2–3.5 × 0.3–1 mm, otherwise similar to bracts. Calyx 2.5–3 mm; lobes 5, lanceolate-deltoid, 2.2–2.6 × 0.9–1.2 mm, glabrous or sparsely white-villulose on both sides, margin ciliate or entire, apex acuminate. Corolla white, urceolate, 3.5–4 × 3.5–4.5 mm, glabrous; lobes 5, oblong, 0.4–0.5 mm. Stamens 10; filaments 1–1.5 mm, gradually dilated submedially from apex, glabrous; anthers 0.7–1 mm, awns 0.4–0.5 mm. Ovary densely white-pilose; style 1.5–2 mm, proximally strigose. Calyx at fruiting blue to black, thin to somewhat fleshy, frequently glaucous; lobes erect, not pale-edged. Capsule 4–6 mm in diam., pilulose.

In the treatment of *Gaultheria* for *Flora of China*, Fang and Stevens (2005) recognized *G. wardii* var. *elongata* based on a longer rachis (2.5–3.5 cm versus 1–3 cm), glabrous calyx (versus densely pubescent), and abaxially subglabrous bracts and bracteoles (versus densely pubescent). We have observed a specimen with elongate infructescences, glabrous calyx lobes, and abaxially moderately densely setulose and puberulent bracts and bracteoles (*GLGS 1087*), and another with compact inflorescences (< 2.5 cm), glabrous calyx lobes, and densely puberulent (and sparsely setulose) bracts and bracteoles (*H. Li et al. 7167*). The inflorescence length character used to delimit varieties is difficult to assess because the type of the species is in flower whereas that of

the variety is in fruit, and the inflorescences of *G. wardii* usually elongate during development. Nonetheless, the length of the inflorescence from our measurements varies narrowly but continuously from 1.7 to 2.5 cm. The geographic range of var. *wardii* stated in Fang and Stevens (2005; Gongshan Co., northern India, and Myanmar) completely overlaps that of var. *elongata* (Gongshan Co.). The overlap in the inflorescence length combined with our observations indicates to us that these entities are not sufficiently distinct to warrant recognition.

SELECTED ILLUSTRATIONS.— R.C. Fang, *Fl. Reipubl. Popularis Sin.* 57(3):48 t. 15(1–5). 1991; G.H. Zhu & L.B. Zhang, eds. *Fl. China Ill.* 14: t. 655(1–5). 2006.

PHOTOGRAPHIC IMAGE.— Figure 45.

PHENOLOGY.— Fl. July, fr. Oct–Feb.

DISTRIBUTION AND HABITAT.— Subtropical evergreen broadleaf forests, thickets; 1300–2600 m. In GLGS: CHINA. Xizang: Zayü Xian. Yunnan: Gongshan Xian (Cikai Zheng, Dulongjiang Xiang); Figure 46. Outside of GLGS: Xizang [India, Myanmar].

CHINESE NAME.— 西藏白珠 xi zang bai zhu

ADDITIONAL GAOLIGONG SHAN SPECIMENS EXAMINED: CHINA. XIZANG: ZAYÜ XIAN. Hills opposite the city, 2600 m, 18 Jun 1983, *QX 73-187* (KUN). YUNNAN: GONGSHAN XIAN. Cikai Zheng. E side of Gaoligong Shan, W of Gongshan, along a branch of the Pula He, W of the Rizhidi Bridge, trail from Qiqi to Dongshao Fang and the Dulongjiang Valley, 2100–2200 m, 11 Jul 2000, *GLGS 12295* (CAS, KUN). Dulongjiang Xiang. Vicinity of Meiliwang, trail from Bapo to Gongshan on E side of the Dulongjiang, 1600 m, 23 Nov 1990, *GLGS 826* (CAS); vicinity of Maku, S region of the Dulongjiang Valley, W side of the Dulongjiang, 1780 m, 15 Dec 1990, *GLGS 1087* (CAS); vicinity of the primary school, ca. 2 km N of Bapo,



FIGURE 45. Branchlets of *Gaultheria wardii* with immature fruit. Photo by P. Fritsch.

E side of the Dulongjiang, 1330 m, 29 Dec 1990, *GLGS 1368* (CAS); along the Gamolai He, trail from Bapo to Gongshan on E side of the Dulongjiang, 1400 m, 30 Dec 1990, *GLGS 1441* (CAS); Mei Li Wang, 1800 m, 5 Jan 1991, *GLGS 1608* (KUN); Mei Li Wang, 1800 m, 10 Jan 1991, *GLGS 1941* (KUN); Dan Dang He, 1400 m, 17 Jan 1991, *GLGS 3210* (KUN); Ma Ku, 1850 m, 7 Mar 1991, *GLGS 4255* (KUN); Mei Li Wang, 1800 m, 21 May 1991, *GLGS 6981* (KUN); ca. 0.6 km NW of Meiliwang, trail between Bapo and Xixiaofang on trail from Bapo to Gongshan via Qiqi, W side of Gaoligong Shan, 1660 m, 31 Oct 2004, *GLGS 21236* (CAS); same data, *GLGS 21290* (CAS); same data, *GLGS 21307* (CAS); above Panjiasheng between Shigong Qiao and Xixiaofang, trail from Bapo to Gongshan via Qiqi, W side of Gaoligong Shan, 2340 m, 2 Nov 2004, *GLGS 22106* (CAS); W side of the Dulongjiang Valley, ca. 1 direct km NW of Maku and ca. 3.6 direct km NE of Myanmar border, 2070 m, 17 Aug 2006, *GLGS 32375* (CAS); Meiliwang, 2000 m, 5 Jun 2006, *Lu 67A* (CAS); same data, *Lu 67B* (CAS); S of Tsunwangtu, 1600 m, 21 Nov 1938, *Yü 21060* (A, E).

ACKNOWLEDGMENTS

We thank the curators of the herbaria listed in the materials and methods section, who kindly made specimens available, and particularly J. Gregson of the British Museum for supplementary collection information concerning the type of *Gaultheria bryoides*; Jon Fong of the California Academy of Sciences for help with the collection database; D. Middleton and one anonymous reviewer for helpful comments on the manuscript; Dong Lin for some of the photographic images; and Alan Chou for the illustrations. This work was supported by U.S. National Science Foundation grants DEB-0103795 and DEB-0717711 to the first author.

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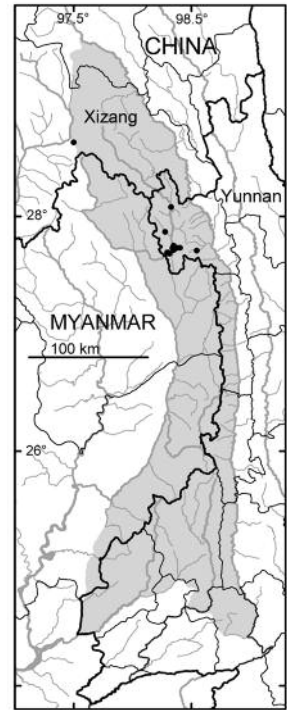


FIGURE 46. Distribution map of *Gaultheria wardii* in the GLGS region.

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Appendix 1

Abbreviations for Collectors and Expeditions that Record Ten or More *Gaultheria* Collections in the GLGS Area

| | |
|------|---|
| BE | Bijiang Expedition |
| F | Forrest, George |
| Feng | Feng, Kuo-mei |
| GLGS | (includes 17 collecting activities with the same number series) Dulong Jiang Investigation Team, 1990–1991; Gaoligong Shan Expedition, 1996–1997; Li Heng, Bruce Bartholomew, & Dao Zhiling, 1998; Li Heng, Bruce Bartholomew, Philip Thomas, Peter Fritsch, Dao Zhiling, Wang Zhonglan, & Li Rong, 2000; Li Heng, Dao Zhiling, & Yin Liwei, 2000; Li Heng, Dao Zhiling, Long Chunlin, Li Rong, & Liu Yitao, 2001; Li Heng, Dao Zhiling, Yin Liwei, & Li Rong, 2001; Li Heng, Ji Yunheng, & Li Rong, 2002; Li Heng, Li Rong, & Dao Zhiling, 2002; Gaoligong Shan Biodiversity Survey, 2001–2006 with the following participants: Li Heng, Dao Zhiling, Li Rong, Ji Yunheng, Liu Bengxi, Peter Fritsch, Bruce Bartholomew, Mark Watson, & David Knott, 2002; Li Heng, Dao Zhiling, Li Rong, Jiang Zhutan, Bruce Bartholomew, & Lihua Zhou, 2003; Li Heng, Dao Zhiling, Li Rong, Jiang Zhutan, Ji Yunheng, Peter Fritsch, Lihua Zhou, & Kate Armstrong, 2004; Li Heng, Dao Zhiling, Li Rong, Jiang Zhutan, Zhang Yuemei, Bruce Bartholomew, Lihua Zhou, David Long, Crinan Alexander, Martyn Dickson, & Katherine Bach, 2004; Li Heng, Dao Zhiling, Ji Yunheng, Gao Fu, Liu Benxi, Peter Fritsch, Lihua Zhou, & Martyn Dickson, 2005; Li Heng, Dao Zhiling, Ji Yunheng, Liu Benxi, Tang Anjun, Bruce Bartholomew, Lihua Zhou, Jin-Hyub Paik, & Simon Crutchley, 2005; Li Heng, Dao Zhiling, Ji Yunheng, Bruce Bartholomew, Lihua Zhou, Neil McCheyne, & Jin Xiaohua, 2006; Li Heng, Dao Zhiling, Ji Yunheng, Hu Guangwan, Peter Fritsch, Jin Xiaohua, Jin-Hyub Paik, Simon Crutchley, & Catherine Bush, 2006. |
| KW | Kingdon Ward, Frank |
| Lu | Lu, Lu & Lu Ren-fu |
| NE | Nujiang Expedition |
| NT | Nanshui Team |
| QX | Qinghai-Xizang Expedition |
| Rock | Rock, Joseph F. Charles |
| Tsai | Tsai, Hse-tao |
| Wang | Wang, Chi-wu |
| Wu | Wu, Su-kong |
| Yü | Yü, Te-tsun |

Appendix 2

List of Species

1. *Gaultheria bryoides* P.W. Fritsch & L.H. Zhou
2. *Gaultheria cardiosepala* Handel-Mazzetti
3. *Gaultheria cuneata* (Rehder & E.H. Wilson) Bean
4. *Gaultheria discolor* F. Muell.
5. *Gaultheria dolichopoda* Airy Shaw
6. *Gaultheria dumicola* W. W. Smith
7. *Gaultheria eciliata* (S.J. Rae & D.G. Long) P.W. Fritsch & L.H. Zhou
8. *Gaultheria fragrantissima* Wallich
9. *Gaultheria griffithiana* Wight
10. *Gaultheria hookeri* C.B. Clarke
11. *Gaultheria hypochlora* Airy Shaw
- 12a. *Gaultheria leucocarpa* var. *pingbienensis* C.Y. Wu & T.Z. Xu
- 12b. *Gaultheria leucocarpa* var. *hirsuta* (D. Fang & N.K. Liang) T.Z. Xu
13. *Gaultheria nivea* (J. Anthony) Airy Shaw
14. *Gaultheria notabilis* J. Anthony
15. *Gaultheria nummularioides* D. Don
16. *Gaultheria praticola* C.Y. Wu ex T.Z. Xu
17. *Gaultheria pseudonotabilis* H. Li ex R.C. Fang
18. *Gaultheria pyrolifolia* J.D. Hooker ex C.B. Clarke
19. *Gaultheria semi-infera* (C.B. Clarke) Airy Shaw
20. *Gaultheria sinensis* J. Anthony
21. *Gaultheria suborbicularis* W.W. Smith
22. *Gaultheria thymifolia* Stapf ex Airy Shaw
23. *Gaultheria trichophylla* Royle
24. *Gaultheria wardii* C. Marquand & Airy Shaw

Appendix 3

Index to Exsiccatae

All specimens examined by the authors are listed alphabetically by collector, followed by collection numbers. Numbers in parentheses correspond to those in the numerical list of species. Collections with more than one species listed are mixed collections.

J.D. Anderson (12a).

BE 9 (19); 86 (6); 611 (16); 794 (19); 1006 (19); 1351 (2); 1351A (20); 1486 (6); 1498 (19); 1607 (19); 1608 (19); 1742 (10).

J. Chen 657 (8); 679 (12b); 720 (6); 723 (19); 1029 (8).

M. Chen 3556 (19).

S.Z. Chen 7102 (10).

Dao et al. 9435 (10).

F 5003 (2); 5066 (10); 7466 (8); 7659 (8); 7702 (19); 7730 (6); 7965 (12b); 8573 (6); 8757 (19); 8780 (15); 8786 (19); 8931 (2); 8949 (9); 9003 (10); 9061 (12b); 9120 (9); 9298 (12b); 9331 (19); 9335 (8); 9364 (15); 9389 (8); 9568 (6); 9591 (8); 9694 (8); 9792 (8); 11778 (10); 12021 (2); 12344 (8); 14966 (10); 14997 (10); 15742 (10); 15785 (6); 15809 (10); 15986 (19); 17579 (15); 17774 (6); 17984 (19); 18021 (10); 18098 (8); 18134 (9); 18141 (16); 18360 (10); 18542 (19); 18805 (19); 18832 (6); 18972 (9); 19269 (13); 19286 (20); 19865 (18); 19867 (15); 19888 (21); 20040 (20); 20267 (21); 20868 (15); 20871 (15); 20872 (21); 22844 (21); 25172 (15); 26075 (6); 26181 (19); 26722 (14); 26867 (22); 27777 (19); 29050 (19); 29457 (8); 29648 (19); 29649 (9); 29668 (2); 29704 (10); 29803 (8); 29840 (9); 29984 (19); 30371 (19); 30879 (2).

R.J. Farrer 895 (2); 990 (10); 1068 (19); 1191 (11); 1622 (20); 1676 (11); 1677 (22); 1679 (10); 1737 (11).
Feng 7543 (19); 7666 (10); 7675 (9, 23); 7675 (20); 7804 (11); 8169 (8); 8313 (11); 8417 (22); 8419 (10);
8600 (19); 8643 (9); 24318 (6); 24557 (9); 24684 (10); 24691 (15); 24715 (8); 24723 (19); 24731 (17).
Fragrance Resources Expedition 85-229 (8).
GLGS 61 (6); 201 (8); 780 (8); 826 (24); 835 (8); 885 (8); 915 (17); 977 (15); 996 (8); 1071 (8); 1087 (24);
1101 (6); 1108 (8); 1368 (24); 1394 (8); 1441 (24); 1579 (15); 1598 (19); 1608 (24); 1653 (8); 1704 (15);
1748 (8); 1830 (8); 1881 (6); 1930 (8); 1941 (24); 1996 (8); 2050 (8); 2175 (8); 2234 (8); 3144 (8); 3149
(17); 3210 (24); 3267 (6); 3268 (6); 3275 (8); 3281 (19); 3300 (6); 3406 (17); 3710 (6); 3948 (15); 4076
(8); 4114 (8); 4115 (17); 4152 (17); 4176 (8); 4202 (8); 4203 (8); 4231 (17); 4232 (8); 4255 (24); 4446
(17); 4550 (6); 4562 (6); 4634 (17); 4669 (17); 4713 (8); 4810 (8); 5158 (8); 5256 (8); 5338 (8); 5366 (8);
5395 (17); 5435 (8); 5471 (8); 5522 (8); 5677 (8); 5773 (8); 5912 (9); 5984 (8); 6049 (15); 6056 (9); 6058
(8); 6059 (10); 6173 (19); 6175 (6); 6273 (8); 6437 (9); 6738 (17); 6841 (8); 6846 (6); 6907 (6); 6926 (10);
6954 (15); 6981 (24); 7008 (8); 7013 (17); 7040 (15); 7220 (19); 7248 (19); 7261 (9); 7262 (19); 7285 (9);
7569 (8); 7677 (15); 7709 (19); 7732 (19); 7733 (9); 7735 (15); 7752 (10); 7758 (11); 7794 (15); 7811
(10); 7885 (9); 7887 (19); 7905 (9); 8013 (6); 8018 (9); 8040 (19); 8063 (6); 8120 (19); 8132 (10); 8133
(10); 8210 (19); 8215 (6); 8252 (19); 8285 (10); 8816 (8); 9142 (8); 9517 (15); 9576 (10); 9960 (10);
10048 (19); 10222 (19); 10412 (19); 10427 (9); 10941 (15); 10983 (12b); 11078 (6); 11123 (6); 11340
(19); 11348 (19); 11550 (9); 11752 (9); 11768 (8); 11770 (8); 11839 (19); 11889 (10); 11939 (19); 11982
(19); 12048 (8); 12061 (8); 12213 (8); 12221 (17); 12245 (19); 12246 (8); 12270 (8); 12293 (9); 12295
(24); 12494 (15); 12550 (15); 12551 (20); 12582 (9); 12700 (10); 12770 (10); 13197 (6); 13302 (8); 13428
(6); 13445 (9); 13596 (15); 13601 (6); 13735 (9); 13771 (15); 14144 (8); 14271 (19); 14361 (8); 14454
(9); 14487 (8); 14518 (8); 14590 (8); 14704 (8); 14751 (8); 14793 (9); 14794 (20); 14829 (10); 14937 (17);
15033 (20); 15232 (8); 15630 (8); 15954 (10); 15970 (19); 15971 (9); 16503 (10); 16548 (8); 16565 (17);
16708 (15); 16711 (10); 16725 (10); 16786 (10); 16809 (10); 16817 (11); 16818 (15); 16874 (7); 16876
(11); 16918 (11); 16928 (16); 16935 (10); 16950 (11); 16952 (7); 16953 (15); 17007 (11, 20); 17032 (11);
17105 (9); 17128 (15); 17129 (19); 17711 (6); 17831 (6); 18071 (8); 18202 (12b); 18574 (9); 18687 (6);
18688 (8); 18737 (9); 18788 (9); 18831 (6); 18842 (9); 18883 (6); 19536 (8); 19546 (8); 19824 (8); 20029
(9); 20086 (10); 20137 (9); 20140 (20); 20182 (15); 20245 (6); 20247 (9); 20283 (9); 20393 (10); 20395
(10); 20396 (10); 20401 (9); 20752 (8); 20831 (9); 20833-A (6); 20834 (19); 20969 (20); 20970 (11);
20975 (20); 21123 (19); 21236 (24); 21290 (24); 21307 (24); 21311 (8); 21406 (19); 21446 (8); 21560 (8);
21618 (8); 21930 (8); 21970 (19); 22005 (5); 22006 (15); 22027 (6); 22083 (15); 22106 (24); 22337 (19);
22343 (19); 22373 (10); 22389 (10); 22409 (2); 22520 (15); 22682 (9); 22690 (10); 22883 (10); 22908
(10); 22922 (2); 22945 (9); 22994 (9); 23014 (10); 23018 (2); 23029 (10); 23073 (15); 23099 (15); 23109
(9); 23145 (9); 23303 (19); 23306 (10); 23318 (10); 23757 (6); 23946 (10); 24198 (9); 24242 (9); 24247
(10); 24382 (6); 24437 (9); 24458 (10); 24485 (10); 24499 (9); 24505 (9); 24520 (10); 24539 (10); 24542
(10); 24565 (8); 24613 (8); 25065 (8); 25120 (9); 25199 (9); 25318 (9); 25674 (19); 25749 (2); 26076 (9);
26086 (9); 26349 (6); 26352 (19); 26533 (15); 26546 (19); 26706 (15); 26754 (20); 26900 (9); 26907 (19);
26921 (20); 27029 (11); 27161 (20); 27221 (11); 27273 (9); 27387 (6); 27585 (8); 27742 (8); 28202 (8);
28289 (10); 28320 (19); 28326 (9); 28422 (19); 28428 (19); 28441 (11); 28462 (9); 28473 (15); 28482
(19); 28501 (20); 28628 (11); 28629 (11); 28682 (10); 28741 (19); 28745 (19); 28780 (19); 28827 (19);
28828 (19); 28845 (6); 28854 (19); 28857 (9); 28865 (19); 29152 (10); 29210 (9); 29222 (10); 29239 (19);
29243 (10); 29289 (19); 29291 (9); 29462 (6); 29464 (8); 29465 (8); 29505 (15); 29522 (15); 29757 (8);
29885 (15); 29886 (8); 29889 (8); 29895 (8); 29974 (9); 30053 (9); 30125 (10); 30509 (19); 30511 (9);
30532 (19); 30558 (9); 30568 (9); 30596 (9); 30658 (9); 30663 (19); 30676 (6); 30685 (9); 30787 (19);
30853 (8); 30855 (8); 31006 (6); 31011 (9); 31118 (8); 31158 (11); 31446 (22); 31581 (13); 31589 (20);
31667 (7); 31683 (11); 31751 (8); 32019 (7); 32036 (11); 32041 (7); 32053 (11); 32056 (16); 32060 (11);
32074 (11); 32078 (7); 32080 (11); 32102 (7); 32127 (11); 32150 (20); 32150A (11); 32170 (20); 32235
(11); 32375 (24); 32379 (15); 32380 (19); 32433 (19); 32478 (6); 32505 (8); 32542 (4); 32576 (19); 32754
(15); 32809 (20); 33104 (8); 33113 (17); 33398 (17); 33545 (8); 33681 (9); 33689 (15); 33693 (8); 33699
(9); 33742 (8); 33750 (8); 33810 (15); 33822 (10); 33876 (15); 33929 (11); 33932 (10); 34040 (10); 34046
(10); 34048 (10); 34057 (15); 34106 (11); 34131 (19); 34188 (15); 34210 (19); 34352 (15); 34356 (19);
34411 (19).

- J.W. & C.J. Gregory B. G-3 (10).
H.F. v. Handel-Mazzetti 8953 (10); 9027 (19); 9382 (11); 9441 (22); 9449 (15); 9589 (15); 9763 (15).
Z.G. He & B.Y. Zhang 622 (9).
KW 188 (12b); 381 (8); 850 (21); 1590 (9); 1613 (19); 1617 (10); 1627 (10); 1691 (2); 3062 (11); 3201 (9);
3486 (6); 5429 (15); 6845 (11); 6849 (22); 6944 (23); 9243 (8); 9305 (8); 9408 (9); 9488 (9); 9556 (10);
9570 (10); 9573 (9, 10); 9639 (21, 23); 9648 (18); 9701 (23); 10960 (15); 12971 (15); 13005 (5); 13172
(15); 13172a (15); 13216a (1); 13478 (15); 13489 (6).
Kunming Station of Chinese Acad. Sci. 12977 (19).
R.Q. Li 1 (15); 3 (15).
S.H. Li 80-599 (6); 80-607 (19).
Q. Lin 770596 (9); 770689 (19); 790673 (9); 790963 (9); 790977 (19); 790982 (19); 791043 (21); 792037
(20); 791942 (15).
Lu 21 (20); 22 (2); 28 (15); 40 (11); 56 (16); 58A (5); 6-39 (9); 66 (6); 67A (24); 67B (24); 70 (19); 101 (6);
102 (6); 103 (19); 108 (17); 109 (19).
F. Ludlow & G. Sherriff 1721 (10); 1782 (18); 6356 (15); 15143 (18); 15158 (20).
F. Ludlow et al. 13323 (18); 13972 (18).
NT 8523 (10); 8528 (9); 8807 (9); 8825 (19); 9075 (8); 9095 (9); 9255 (10); 10398 (9); 10414 (10); 10416
(10).
NE 908 (6); 1853 (2); 7876 (18); 79-3 (8); 79-36 (8); 79-46 (8); 79-76 (10); 79-86 (20); 79-134 (21); 79-255
(9); 79-295 (10); 79-388 (19); 79-557 (10); 79-558 (20); 79-618 (10); 79-636 (19); 79-665 (10); 79-714
(22); 79-928 (19); 79-1076 (10); 79-1077 (10); 79-1099 (10); 79-1102 (16); 79-1169 (8); 79-1242 (8); 79-
1249 (8); 79-1383 (10); 79-1666 (19); 79-1891 (19).
NW Yunnan expedition 8232 (6); 10343 (6).
QX 6998 (20); 7206 (19); 7247 (9); 7248 (10); 73-187 (24); 73-191 (8); 73-542 (15); 7407 (9); 7547 (3); 7557
(9); 7580 (11); 7769 (10); 7944 (8); 7994 (8); 8028 (8); 8161 (19); 8254 (15); 8345 (11); 8726 (20); 8751
(15); 8827 (8); 8858 (24); 8939 (6); 9399 (8); 9664 (6); 9738 (19); 9751 (6); 9776 (15); 9998 (19); 10015
(19); 10056 (15); 10107 (20); 10128 (21); 10228 (7).
Rock 7210 (19); 7238 (19); 7293 (6); 7293a (6); 7384 (15); 7692 (19); 7887 (8); 7902 (8); 10252 (22); 11230
(19); 22335 (10); 22338 (10); 22340 (18); 22407 (11); 22435 (10); 22436 (10, 18); 22653 (3).
C.K. Schneider 2561 (6); 2606 (19).
X.C. Shi 408 (9); 682 (10).
Sukoe 10080 (2).
G.D. Tao 12813 (6).
Tsai 54104 (9); 54254 (19); 54404 (6); 54448 (9); 54472 (19); 54473 (9); 54572 (19); 54726 (6); 54770 (6);
54817 (6); 54938 (19); 54947 (8); 55732 (8); 56477 (8); 56532 (19); 56533 (6); 56578 (8); 56641 (6);
57788 (19); 58139 (10); 58172 (20); 58197 (2); 58322 (9); 58323 (19); 58420 (19); 58538 (6); 58671 (6);
59026 (19); 59061 (6); 59162 (6).
Wang 66678 (20, 21); 66695 (3); 66779 (10); 66785 (10); 67099 (20); 67144 (15); 67181 (15); 67194 (22);
67196 (11); 67423 (19); 67423-A (19); 67506 (19); 67511 (15); 90126 (6).
Wu 6608 (12b); 6647 (9); 6886 (2); 6888 (10); 6924 (19); 6955 (10); 7316 (6); 7333 (20); 8356 (6); 8416 (2).
L.S. Xie 853 (9); 886 (2).
J.S. Yang & X.N. Wang 63-1351 (22).
Yin 60-1044 (6); 60-1241 (15).
Yü 7998 (3); 8917 (3); 10192 (3); 19140 (8); 19321 (10); 19492 (8); 19501 (15); 19503 (19); 19641 (19);
19684 (21); 19732 (23); 19877 (7); 19879 (18); 20049 (11); 20058 (11); 20206 (19); 20232 (15); 20262
(11); 20324 (2); 20336 (7); 20574 (15); 20613 (22); 20672 (10); 20683 (20); 20709 (11); 20737 (21);
20821 (22); 20822 (15); 20830 (15); 20831 (19); 20873 (6); 20999 (6); 21060 (24); 22085 (15); 22964
(10); 22965 (15); 23115 (15).
Y.M. Zhang 307 (19).
J.Z. Zhao 7 (6); 8 (12b).