



Vaccinium carmesinum (Ericaceae), a new species of blueberry from Mt. Tago Range, Mindanao Island, Philippines

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Abstract

Vaccinium carmesinum is described as a new species of Ericaceae from Mt. Tago Range, Mindanao Island, Philippines. It is similar to *V. platyphyllum* Merrill and *V. luzoniense* S. Vidal but is distinct from the former by longer and wider leaves, longer racemes, longer bracts, glabrous corollas, and glabrescent fruits, and from the latter by longer petioles, leaf glands distributed along the blade margin, glabrous rachis, and lanate filaments. *Vaccinium carmesinum* bears the widest leaves among Philippine *Vaccinium*. Its discovery increases the number of *Vaccinium* species recognized in the Philippines to 37.

Key words: Mindanao, Pantaron Mountain Range, Vaccinieae, volcanic-igneous

Introduction

Vaccinium Linnaeus (1753: 349) (Vaccinieae: Vaccinioideae) is one of the most species-rich genera in the family Ericaceae, estimated to comprise ca. 450–500 species distributed around the world except in Antarctica and Australia (Sleumer 1966–1967; Argent 2014). The floristic region of Malesia is considered to be the center of diversity of the genus (Sleumer 1966–1967) with species generally inhabiting montane forests (Argent 2018), particularly mossy forest, on exposed mountain ridges or summits. Although the genus is diverse, its taxonomic limits are still uncertain (Argent 2008; Fritsch *et al.* 2020). Evidence of its monophyly has not been resolved (Vander Kloet & Dickinson 2009) with the current phylogenetic data based on DNA sequences strongly suggesting nonmonophyly (Kron *et al.* 2002).

The island of Mindanao is the largest southern island in the Philippines and is known to harbor great biodiversity and species endemism (Amoroso *et al.* 2019). Within this island lies Mt. Tago Range—a component of the central cordillera of Mindanao Island separating the provinces of Bukidnon in the west and Agusan del Sur in the east (Gronemeyer *et al.*

2014). This mountain range is part of the ancestral land of the Higaonon tribe and is considered a terrestrial Philippine Key Biodiversity Area (KBA) that supports the Tagoloan River watershed spanning the provinces of Bukidnon and Misamis Oriental (BWPDC 2012). Mt. Tago Range harbors one of the remaining intact forests in Northern Mindanao. However, it is currently not legally protected (Coritico *et al.* 2020a) and is relatively unexplored because of political instability (Lagunday *et al.* 2017; Lagunday & Amoroso 2019). Nonetheless, documenting and collecting the flora of this range has been successful (Coritico *et al.* 2020a, b). Preliminary data from this work demonstrate that the range boasts a high degree of biodiversity and endemism. For example, many of the new Philippine *Nepenthes* Linnaeus (1753: 955) species discovered and described during the past decade were discovered in this range (Gronemeyer *et al.* 2011a, b, 2014; Lagunday *et al.* 2017; Lagunday & Amoroso 2019).

Previous fieldwork aimed at collecting specimens in botanically unexplored areas of the Philippines has led to the discovery of several new *Vaccinium* species (e.g. Salares *et al.* 2018; Fritsch *et al.* 2020; Tamayo *et al.* 2021). These discoveries have demonstrated that Philippine *Vaccinium* contains a higher species diversity than previously understood. Presently, 36 species of *Vaccinium* are recognized for the Philippines (Pelser *et al.* 2011 onwards; Tamayo *et al.* 2021). However, many of these need further taxonomic study, as half of the Philippine *Vaccinium* species are rare and often known only from the type locality (Vander Kloet 1996).

During fieldwork in Mt. Tago Range (2014–2019) as part of botanical survey projects, a species of *Vaccinium* with a scrambling habit, notably wide leaves, and lustrous white flowers was vouchered. The specimen was compared with other similar species and based on detailed study of its vegetative and floral characters it is concluded that the specimen represents an undescribed taxon. Here we describe this new species under a morphological species concept (Cronquist 1978) and provide an illustration and photographic images of the living plants. This discovery raises the number of species of *Vaccinium* documented in the Philippines to 37.

Materials and Methods

Dried herbarium specimens and *in situ* photographs of the plant were used as the basis for the description. Microscopic details were described with the use of an AmScope stereomicroscope of up to 64× magnification. Herbarium specimens from A, BRIT, CAS, and K were also studied for comparison. The taxonomic works of Copeland (1930), Sleumer (1966–1967), Argent (2008), and recent Philippine *Vaccinium* literature (Co *et al.* 2002; Salares *et al.* 2018; Fritsch *et al.* 2020; Tamayo *et al.* 2021) were consulted to ensure the uniqueness of the species and to compare it with the other known species of *Vaccinium* in the region.

Taxonomic Treatment

Vaccinium carmesinum M.N.Tamayo & P.W.Fritsch, *sp. nov.* (Figs. 1–2)

Type:—PHILIPPINES. Mindanao Island, Bukidnon Province, Municipality [City] of Malaybalay, Barangay Kibalabag, Mt. Limbawon, [Mt. Tago Range,] accessory trail to peak, 8.26217°N, 125.18055°E, 1546 m elevation, 10 June 2019, *Plants and Lichens of the Southern Philippines Survey 611* (holotype PNH!, isotypes A!, BRIT BRIT572077!, CAS!, CMUH!, NY!).

Paratypes:—PHILIPPINES. Mindanao Island: Province of Bukidnon, Municipality [City] of Malaybalay, Barangay Kibalabag, Mt. Limbawon, [Mt. Tago Range,] open area with *Pandanus*, 8.27577°N, 125.18333°E, 1832 m elevation, 30 June 2015, *Peter W. Fritsch 2081* (BRIT BRIT554025!, CAS 490415!); Mt. Kiamo summit, [Mt. Tago Range,] on ridge of heathland scrub, 8.2563°N, 125.14799°E, 1760 m elevation, 7 May 2014, *Darin S. Penneys 2377* (BRIT BRIT554030!, CAS 490401!).

Diagnosis:—*Vaccinium carmesinum* resembles *V. platyphyllum* Merrill (1917: 294) and *V. luzoniense* S.Vidal (1886: 168), but differs from the former by longer and wider leaves, longer racemes, longer bracts, glabrous corollas, and glabrescent fruits, and from the latter by longer petioles, leaf glands distributed along the length of the blade margin, a glabrous inflorescence rachis, and lanate filaments.

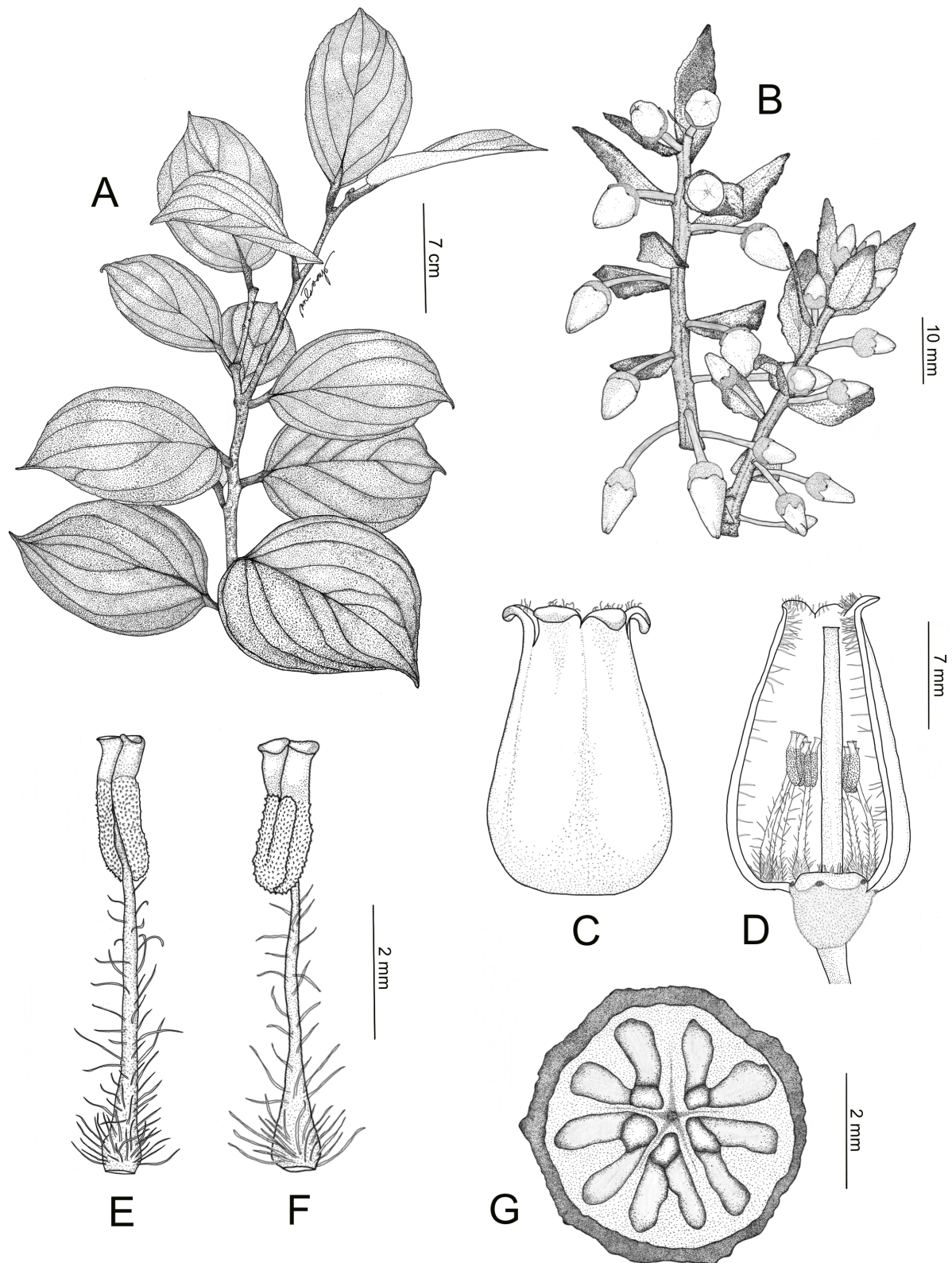


FIGURE 1. *Vaccinium carmesinum*. **A.** Leafy branchlet. **B.** Inflorescences showing flower buds and foliaceous bracts. **C.** Corolla. **D.** Dissected flower showing stamens, style, ovary, hypanthium, and calyx. **E.** Dorsal view of stamen. **F.** Ventral view of stamen. **G.** Fruit cross section. Illustration by MNT.

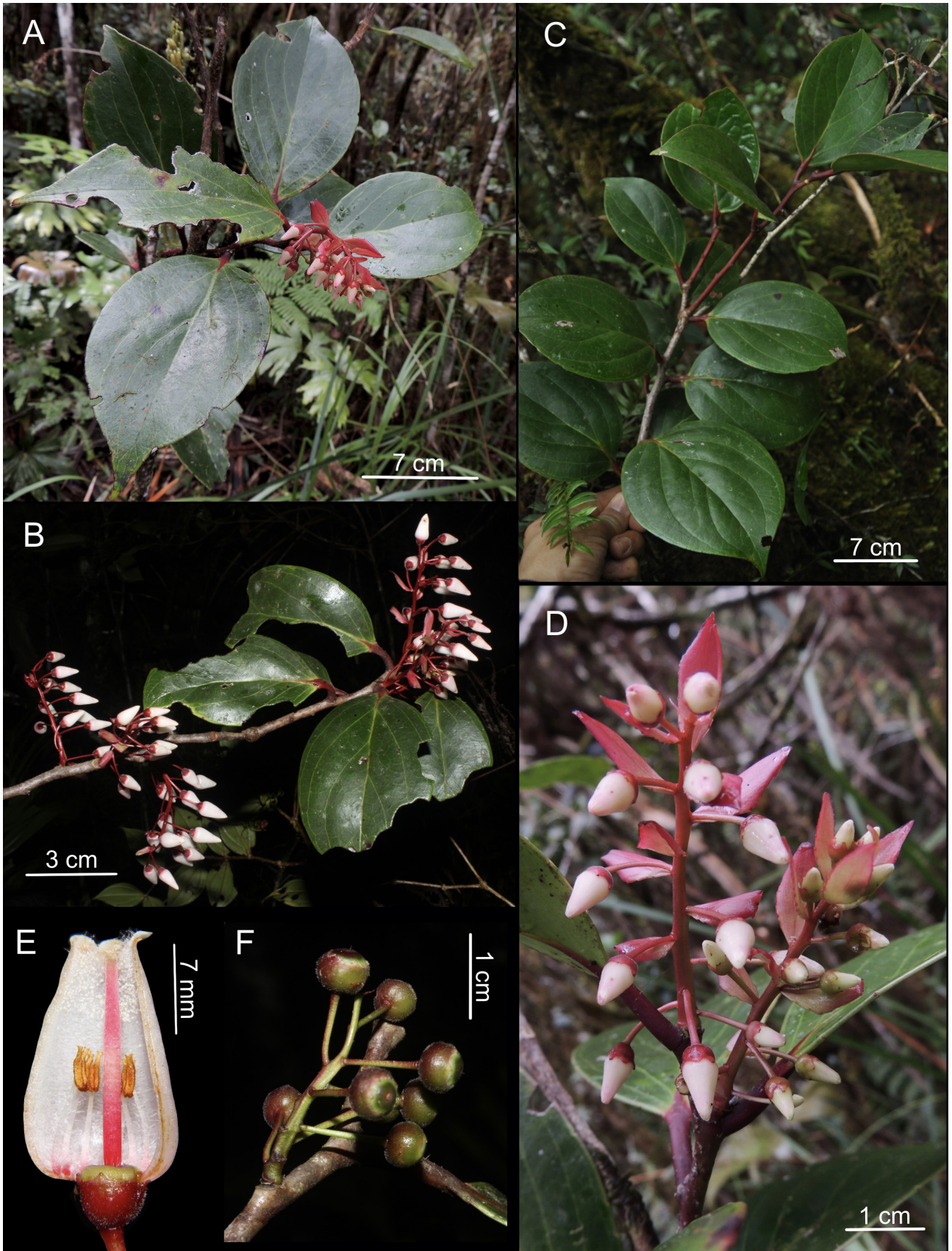


FIGURE 2. *Vaccinium carmesinum*. **A, B.** Flowering branchlet. **C.** Leafy branchlet. **D.** Inflorescences showing flower buds and foliaceous bracts. **E.** Longitudinal section of flower showing corolla, style and stamens. **F.** Immature fruits. Photographs: A, D by DSP; B, E, F by MAKP; C by DNT.

Description:—Terrestrial leaning shrub or tree, evergreen, 2–5 m tall, sparsely branched. **Branchlets** glabrous, red when young, grayish brown at maturity, terete, 3–8 mm wide, lenticellate; perennating buds compressed-ovoid, 1.5–2.5 mm long; bud scales overlapping with minutely ciliate margins. **Leaves** persistent on older branchlets, spirally and evenly arranged, slightly overlapping, internodes 1–5 cm long; petiole crimson red, in cross section rounded abaxially and slightly raised adaxially, 10–18 × 1–5 mm, glabrous; lamina broadly elliptic, ovate, or rarely subrounded, with the larger leaves on each branchlet 7–15 × 0.4–9 cm, coriaceous, both surfaces reddish when young turning pale green abaxially and glossy adaxially, *in sicco* both surfaces light brown to ferruginous, without punctae, glabrous; midvein flattened or sunken adaxially, strongly raised abaxially, secondary veins 3 or 4 on each side of midvein with first pair arising from base and remainder along midvein, arc-ascending, abaxially raised, adaxially sunken, tertiary veins faintly evident or obscure, base cuneate to truncate, margin entire, weakly revolute, apex slightly acuminate, marginal glands sunken, 10–18 per side, scattered along length of margin but more concentrated towards the apex, 0.3–0.5 mm wide. **Inflorescence** pseudo-terminal or terminal, racemose, developing beyond confines of perennating bud, 1 per axil, 6–8 cm long at anthesis, densely 10- to 12-flowered; peduncle and rachis crimson red, slightly ridged, terete, glabrous; flower bracts caducous, crimson red, dark brown *in sicco*, foliaceous, ovate to elliptic, planar or occasionally cucullate, 6–15 × 2.5–3.5 mm, coriaceous, glabrous, margin entire, ciliate, with several yellowish or reddish globose glands, 0.15–0.20 mm diameter mainly on basal half and with cilia ca. 0.1 mm mainly on apical third, apex acute to obtuse with a terminal gland. **Pedicel** 3.5–15 × 0.5–0.9 mm at anthesis, terete, spreading, glabrous, occasionally with 1 or 2 globose glands near base or occasionally on apical half, ebracteolate. **Flowers** articulated at junction with pedicel, 3.5–12 mm long. **Hypanthium** crimson red, cupuliform, 1.5–2 × 2–2.5 mm, white-hirsutulous with trichomes 0.10–0.15 mm long; calyx limb 1.0–1.2 mm long, white-hirsutulous; calyx lobes broadly triangular, 0.8–1.2 mm long, white hirsutulous, margin entire, often ciliate, apex acute, with a prominent greenish (reddish *in sicco*) globose sessile terminal gland ca. 0.25 mm diameter. **Corolla** broadly acute, lustrous white, conical-urceolate, 7–12 × 2.5–6 mm, outside glabrous, inside white-lanate especially on upper and lower third, trichomes 0.5–1 mm long; corolla lobes 5 or 6, 1–2 × 1–1.5 mm, apex acute to obtuse. **Stamens** 8 to 10, monomorphic, distinct, 5.5–7.2 mm long; filaments white, straight, gradually dilated at base, 3.5–4.8 mm long, pink towards base, densely white-lanate with trichomes 0.5–1 mm long; anthers 2–2.4 mm long, cells 1.4–1.6 mm long, echinulate, tubules parallel, narrowly cylindrical, distinctly narrower than cells, opening by oblique ventrally oriented apical pores, 0.6–0.8 mm long, pore apex rounded, spurs absent. **Ovary** 5- or 6-locular but appearing pseudo-10- to 12-locular with false partitions extending ca. 1.5 mm from inner wall; ovules in two columns per locule. **Disk** disciform, ca. 2 mm in diameter, puberulent, margin shallowly ridged. **Style** reddish, not exerted from corolla, 10–12 mm long, glabrous. **Fruit** on pedicels 1.4–2.1 cm long, deep purple, dark brown or reddish *in sicco*, globose, slightly ridged, 4–6 × 4–6 mm, glabrescent except for minute cilia on calyx lobe margins; persistent calyx lobes erect; disk ca. 4.5 mm in diameter. **Seeds** numerous, minute, brown, ca. 0.8 mm long.

Distribution and Habitat:—*Vaccinium carmesinum* is endemic to two mountains (Mt. Kiamo and Mt. Limbawon) in Mt. Tago Range, Mindanao, growing in tropical lower montane rainforest to upper montane rainforest. Populations of *V. carmesinum* were mostly found near summits where they thrive on volcanic-igneous or clay substrate with abundant humus. They also occur in areas of open shaded mossy forests, or on ridges covered in heathland scrub. Paratypes of the new species were collected on ca. 10–30% west-facing slopes.

Etymology:—The epithet *carmesinum* is derived from the Greek word for crimson (blood red), as depicted by its crimson red petioles, floral bracts, peduncle, rachis, pedicels, hypanthium, and calyces. Moreover, a crimson red stain is extracted in notable quantity when the plants are soaked in a denatured alcohol solution.

Phenology:—Flowering in June. Fruiting from January to May.

Proposed Conservation Status:—Mt. Tago Range has not been extensively explored botanically, which results in uncertainty as to the conservation status of the species. This range is a non-protected area; thus, the extent of occurrence and area of occupancy for the species cannot be assessed. There are only two populations currently known. Hence, we recommend a conservation status of data deficient (DD) (IUCN Standards and Petitions Committee 2019).

Discussion:—In its combination of morphological characters, *Vaccinium carmesinum* matches no other species treated in relevant taxonomic treatments. In the artificial key to the species of Philippine *Vaccinium* (Copeland 1930), *V. carmesinum* keys to *V. platyphyllum*. The new species differs from *V. platyphyllum* by having longer and wider leaves (7–15 × 0.4–9 cm vs. 11–14 cm × 5–7 cm), longer racemes (6–8 cm vs. 4–6 cm), longer bracts (6–15 mm vs. ca. 8 mm), longer pedicels (3.5–15 mm vs. ca. 8 mm) that are glabrous (vs. slightly pubescent) and ebracteolate (vs. bracteolate), a glabrous (vs. sparsely pubescent) corolla outside, longer anthers (2.0–2.3 mm vs. ca. 1.5 mm), and longer (4.0–6.0 mm vs. ca. 3 mm) and glabrescent (vs. pubescent) fruits (Merrill 1917).

Vaccinium carmesinum can be distinguished from all other species of Philippine *Vaccinium* by its leaves, which are the widest of any *Vaccinium* in the Philippines. The pedicels are also notably ebracteolate and have 0 to 2 globose glands near the base or occasionally on the apical half. These glands might be homologous with bracteoles (typically two per pedicel in *Vaccinium*) with a reduction in size and/or number. Copeland (1930) mentioned pedicel glands in *V. luzoniense*. Unfortunately, this character was not thoroughly described for the other Philippine species in former publication where the absence of bracteoles in a specimen is noted as “unobserved” (i.e. Sleumer 1966–1967).

Vaccinium carmesinum is a member of *V.* section *Bracteata* Nakai in Nakai & Koidzumi (1927: 234) sensu Sleumer (Sleumer 1966–1967) as based on the combination of many-flowered racemose inflorescences, caducous foliaceous bracts, absence of a membranaceous wing at the sinuses of the corolla, and anthers that open by short introrse slits or terminal pores (Sleumer 1966–1967; Co *et al.* 2002; Salares *et al.* 2018). In Sleumer’s (1966–1967) key to the Malesian *V.* section *Bracteata*, *V. carmesinum* keys to *V. luzoniense*. *Vaccinium carmesinum* differs from *V. luzoniense*, however, by having longer petioles (10–18 mm vs. ca. 10 mm), longer and wider leaves (7–15 × 0.4–9 cm vs. 7–9 cm × 3–4.5 cm), with leaf glands distributed along the length of the leaf margin (vs. with merely a pair of glands near the base), glabrous rachis (vs. with capitate-glandular trichomes), white (vs. red) corollas, and densely lanate (vs. sparsely pubescent) filaments (Vidal 1886; Copeland 1930).

In the key to the Bornean species of *Vaccinium* (Argent 2018), *V. carmesinum* keys to *V. sarawakense* subsp. *montanum* Argent (2018: 108) but differs from it by having an inflorescence with fewer flowers (10- to 12-flowered vs. 7- to 20-flowered), glabrous rachis (vs. densely covered by short brown curved glandular trichomes), calyx lobes with a sessile terminal gland (vs. absent), white (vs. pale pink) corollas, and the absence of anther spurs (vs. presence).

In the sectional treatment of *Vaccinium* (Vander Kloet and Dickinson 2009), *V. carmesinum* can be treated as a member of *V.* section *Euepigynium* Schlechter (1919: 174) by its evergreen habit, monomorphic perennating buds, each with more than two scales, one perennating bud per leaf axil, plinerved leaf blade venation, entire leaf blade margin, peduncle longer than pedicels, calyx tube completely fused to the ovary, and pseudo-10-locular ovary. However, the boundaries of *V.* section *Euepigynium* and other sections of Malesian *Vaccinium* delimited by Vander Kloet and Dickinson (2009) were vaguely defined (i.e. the species included in each section are not provided). Hence, the sectional limits of *Vaccinium* in Malesia need further study.

During the process of diagnosing *Vaccinium carmesinum* as distinct from other Philippine species, we have become cognizant of problems in the taxonomy of the Philippine species. For example, *V. ilocanum* Merrill (1919: 441) and *V. rizalense* Merrill (1925: 43) were synonymized under *V. platyphyllum* by Copeland (1930) but characters seem divergent among these species and the justification relied mainly on macroscopic characters. A detailed study of this complex is currently in progress with emphasis on, e.g., ovary indumentum, corolla surfaces, and stamen characters.

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APPENDIX 1. Additional *Vaccinium* specimens examined for morphological comparison.

Vaccinium luzoniense S.Vidal. PHILIPPINES. Luzon Island: Province of Benguet (District of Lepanto), *S. Vidal 1535* (holotype K K000780748!).

Vaccinium platyphyllum Merrill. PHILIPPINES. Mindoro Island: Lagating (Mt. Halcon), Oriental Mindoro, 15 April 1991, *B.C. Stone et al. PPI 758* (BRIT BRIT26871!); Barangay Lantuyan (Mt. Halcon), Oriental Mindoro, ca. 1500 m elevation, 15 March 1997, *G. Argent et al. PPI 20095* (BRIT BRIT26880!).