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Two new species of *Psychotria* L. (Psychotrieae-Rubiaceae) from Dinagat Island, Philippines

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Abstract. *Psychotria alejandroi* and *P. nitidifolia*, two new species from Dinagat Island, Philippines, are described and illustrated. Both species belong to the *Pilosella* species group sensu Sohmer and Davis (2007), characterized by inflorescences with defined axes bearing sessile flowers and fruits. *Psychotria alejandroi* is similar to *P. pilosella* but can be distinguished by having truncate, lobed stipules with its inner lobes extending into long aristae, lanceolate to narrowly ovate leaves that are coriaceous and scabrous, longer inflorescences (2–4 cm long), bracts with entire margins, 5- to 6-merous flowers, and weakly ribbed pyrenes with weakly ruminant endosperms. *Psychotria nitidifolia* resembles *P. castroi* but differs by its smaller habits (0.6–1.5 m), shorter petioles ((0.8)1.3–1.7 cm), smaller leaves ((4.0)9.2–11.2 cm × (1.5)3.2–3.9 cm), blades drying dark khaki brown, monochotomous to trichotomous inflorescences, prolate fruits with smaller, obscure calyx lobes (0.2–0.3 mm), and strongly ridged pyrenes with weakly ruminant endosperms. Field images, a distribution map, and an identification key to the *Psychotria* species (*Pilosella* group) occurring on Dinagat Island are also provided. Based on the IUCN categories, the two new species are evaluated as critically endangered (CR). The discovery of these species highlights the urgency for further biological explorations and to conserve the remaining forested habitats of Dinagat Island, as this area serves as the only sanctuary for a multitude of narrowly endemic species.

Keywords: Cagdianao, narrow endemic, Rubioideae, taxonomy, threatened taxa, ultramafic soils.

INTRODUCTION

Psychotria L. (Rubiaceae) is one of the largest plant genera, comprising ca. 1,645 species of primarily understory shrubs to small trees with a vast geographical spread (Sohmer 1978; Frodin 2004; Davis et al. 2009; POWO 2024). The genus contributes abundantly to tropical and subtropical rain-

forests, particularly in Africa, the Americas, Asia, and Oceania, and their fleshy fruits serve as an essential food source for many frugivorous animals and attract a wide variety of animal dispersers (Snow 1981; Herrera 1989; Gentry 1990). The genus is generally characterized by having caducous stipules, white to yellow small flowers in terminal inflorescences, colorful drupaceous fruits, and seeds with ethanol-soluble pigments in their seed coats (Nepokroeff et al. 1999; Andersson 2002). Its sheer diversity challenges taxonomists, evolutionary biologists, and conservationists to study it in its entirety, especially in biodiversity hotspots like the Philippines.

The Philippine archipelago boasts an astounding diversity of 113 known species of *Psychotria*, of which 106 are endemic (Sohmer and Davis 2007; Pelser et al. 2011 onwards; Bautista et al. 2024). However, more than half of these are either presumably extinct or threatened (vulnerable to critically endangered) and have never re-collected since their first collection (Sohmer and Davis 2007), dating back decades to over a century ago, particularly those found in the meridional Philippines. Continuous efforts to study *Psychotria* are slowly being made, with rediscoveries of species previously thought to have gone extinct (e.g., Ordas et al. 2019; Biag and Alejandro 2020; 2022; Batuyong et al. 2021), the revision of taxon names (Berger 2023), and the description of novel species (Bautista et al. 2024). With numerous species considered extinct in the wild, further studies are needed in this period of rapid biodiversity decline.

Dinagat Island is the third-largest island in the Mindanao biogeographic region, situated in the north-eastern tip of Mindanao (Fig. 1). A comprehensive plant survey of the island by Lillo et al. (2019) revealed that it is characterized by six forest habitat types having a unique floral assemblage, with over 400 native species, of which 10% are island endemics. Over recent years, several new micro-endemic species from the island were described (Robinson et al. 2019; Amoroso et al. 2023; Tamayo et al. 2023). However, many of the island's forested areas have not been explored and are currently threatened by anthropogenic activities, necessitating urgent research and exploration.

Fieldwork in the municipality of Cagdianao, Dinagat Island, led to the collection of two enigmatic *Psychotria* species thriving in forests on ultramafic soils. Examination of the specimens revealed that both species belong to the *Pilosella* group, characterized by monochotomous or trichotomous inflorescences with defined axes and branches, terminated by clusters of sessile flowers and fruits (Sohmer and Davis 2007). Hence, we hereby describe in detail two new species of *Psychotria* from Dinagat Island, Philippines.

MATERIAL AND METHODS

The descriptions of the new species were based on living and preserved specimens collected in August 2023 from the ultramafic forests of Cagdianao, Dinagat Island, Philippines (Fig. 1). Initial identification of the material was carried out by utilizing the taxonomic keys and descriptions by Sohmer and Davis (2007) and through protologues, with the comparison of *Psychotria* specimens from USTH and digitized types from international herbaria (e.g., A, HUH, K, NY, and US). The herbaria acronyms follow Thiers (2025). Morphological examinations of specimens were performed using an Olympus SZ51 dissecting microscope and metric vernier caliper, and character-state terminologies were based on Beentje (2016). The materials were deposited in USTH and FEUH. Georeferenced data based on these collections, personal observations, and the records of Pelser et al. (2011 onwards) were used to generate distribution maps and compute the area of occupancy (AOO) using the Geospatial Conservation Assessment Tool (GeoCAT; Bachman et al. 2011).

TAXONOMIC TREATMENT

***Psychotria alejandroi* Ordas, Chen, & Odulio sp. nov.** (Figures 2, 4A–C)

Type: Philippines, Dinagat Island Province, Municipality of Cagdianao: Barangay Legazpi, 10°09'12" N 125°39'12" E, 60 m, on ultramafic soils of open canopy forests, 30 Aug 2023, *Odulio, Zamudio, et al.* DIN23-026 (holotype USTH, isotypes USTH, incl. spirit, FEUH).

Diagnosis

Psychotria alejandroi is similar to *Psychotria pilosella* Elmer but is distinct in having truncate, lobed stipules with its inner lobes extending into long aristae (vs. unlobed, ovate stipules with acute cleft apices), lanceolate to narrowly ovate leaves (vs. obovate to narrowly oblanceolate leaves) that are coriaceous and scabrous (vs. chartaceous to subcoriaceous), 2–4 cm long inflorescences (vs. 0.7–2.7 cm long), bracts with entire margins (vs. serrate to lacinate), 5- to 6-merous flowers (vs. 4- to 5-merous), weakly ribbed pyrenes with weakly ruminant endosperms (vs. ribbed to ribbed-ridged pyrenes with distinct ruminant endosperms).

Description

Tree ca. 3.0–3.5 m tall. Young stems hispid; internodes 0.4–1.0 cm long, defoliated at lower branches.

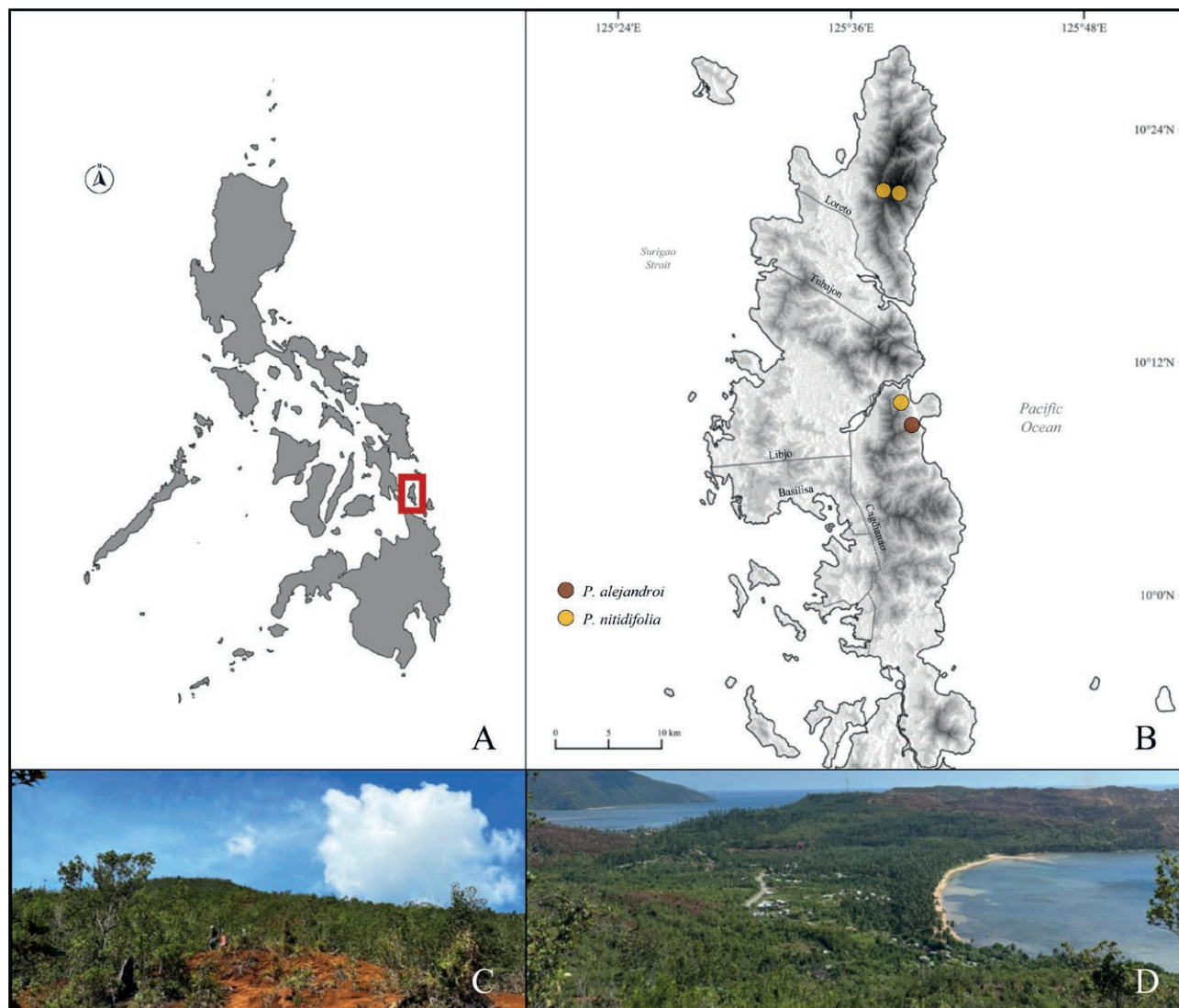


Figure 1. Map of Dinagat Island, Philippines, with known occurrence records of *Psychotria alejandroi* Ordas, Chen, & Odulio and *P. nitidifolia* Ordas, Chen, & Alfeche: A. Map of the Philippines showing the location of Dinagat Island (red box). B. Distribution of *Psychotria alejandroi* (brown) and *P. nitidifolia* (gold) on Dinagat Island. C. Open canopy forests with ultramafic soils in Cagdianao. D. Locality of Barangay Legazpi, Cagdianao.

Stipules caducous, valvate, truncate, divided into 6 to 8 linear lobes, 10 mm × 4 mm, hispid outside, apex of the inner lobes having two tips drawn out into long aristae. Leaves opposite-decussate, petioles 0.8–2.4 cm long, hispid; leaf blades lanceolate to narrowly ovate, (4.3)8.5–14.5 cm × (1.3)3.4–5.3 cm, coriaceous and scabrous, adaxially sparsely hirsute but indumentum denser on midrib, abaxially hispid but indumentum denser on midrib and lateral veins, bright green but drying reddish brown; lateral veins 9–18 on each side of the midrib, visible on adaxial surface, very prominent on abaxial surface; tertiary venation manifest on abaxial surface; base

attenuate to cuneate; apex attenuate to acuminate. Inflorescences/infructescence monochotomous to trichotomous, erect, 2–4 cm long, tomentose, with each branch terminated by 3–10 sessile flowers and fruits; principal axis of trichotomous inflorescences 0.7–2.0 cm long, with the middle axis frequently having a primary node, supporting three branches, 1.2–1.8 cm long; principal axis (peduncle) of monochotomous inflorescences 0.5–0.8 cm long, sometimes with one primary node supporting three branches, 1.0–1.1 cm long; bracts and bracteoles persistent, ovate, 1.0–1.5 mm long, densely hispid outside, margins entire, apex widely acute. Flowers ses-

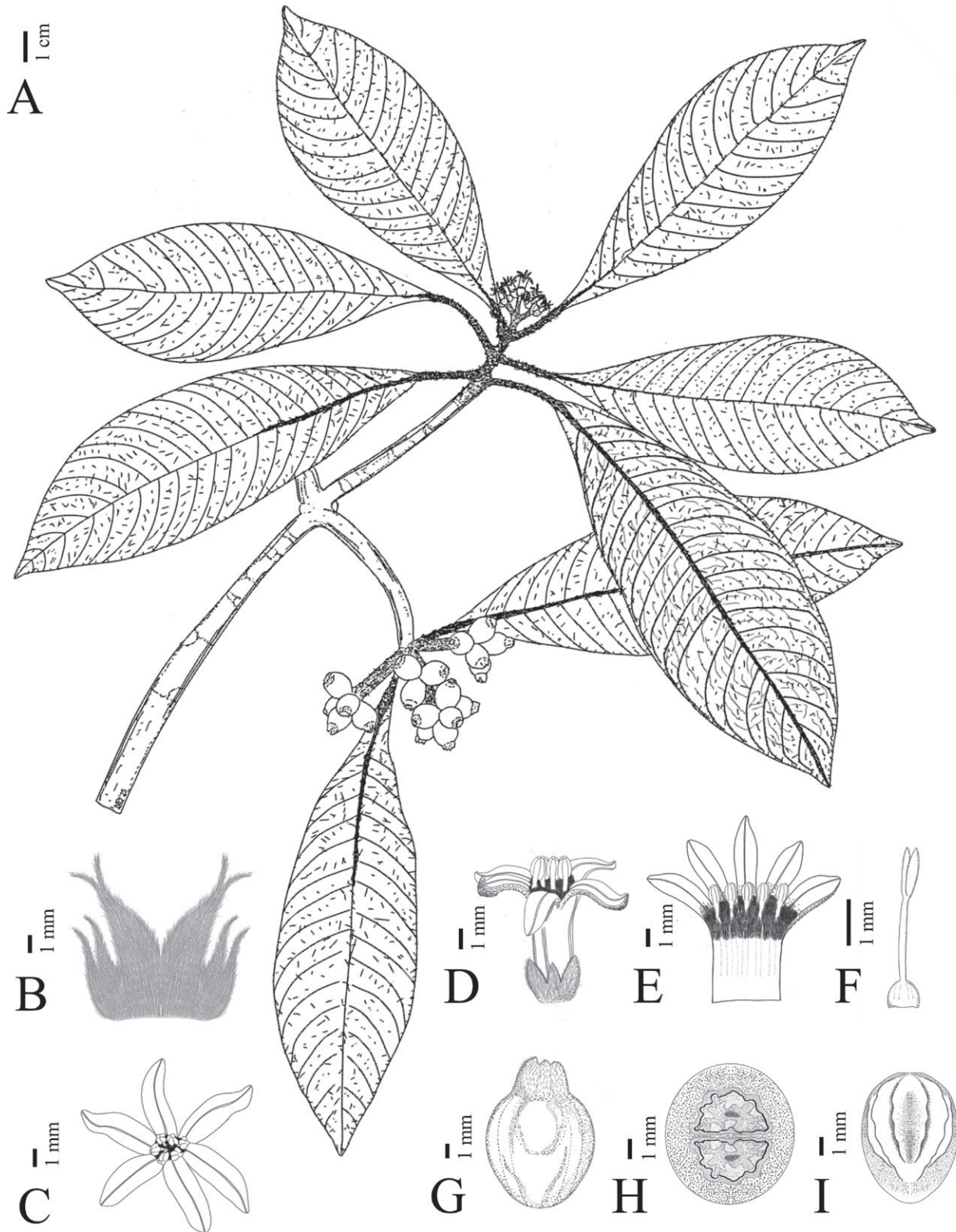


Figure 2. *Psychotria alejandroi* Ordas, Chen, & Odulio: A. Flowering and fruiting branch. B. Stipule. C. 6-merous flower (top view). D. 5-merous flower. E. 5-merous flower dissected. F. Gynoecium. G. Fruit. H. Fruit cross-section. I. Pyrene. Illustrated by G.N.G. Cortez.

sile, 5- to 6-merous; calyx (incl. hypanthium) cupuliform, 3.0–3.5 mm long, green, hispid outside; calyx lobes deltoid, 1.0–1.25 mm long, hispid outside, apex acute to obtuse; corolla white, salver-shaped; corolla tube 5 mm long, glabrous outside, densely hispid at throat within; corolla lobes oblong, slightly involute at the apex, 5 mm long, glabrous adaxially, echinate abaxially, apex acute; stamens 3.0–3.2 mm long, exerted from the corolla ca. 1 mm; filaments 2 mm long; anthers 1.0–1.2 mm long; carpels 4 mm long; ovary 0.7–1.0 mm long; style 2 mm long; stigma bifid, 1 mm long. Fruits sessile, subglobose to prolate, 8–10 mm x 5–7 mm in both fresh and dry state, smooth, slightly ribbed when dry, light russet (reddish brown), very sparsely hispid on top; calyx persistent, prominent, 2.0–3.5 mm long, green, truncate, limb 2.0–2.5 mm, lobes 0.5–1.0 mm, acute to obtuse; pyrenes oval, weakly ribbed, 6–7 mm x 5 mm; endosperm weakly ruminate.

Etymology

The species is named in honor of Dr. Grecebio Jonathan D. Alejandro, who has contributed significantly to the systematics of the Rubiaceae family in the Philippines.

Distribution, habitat, and phenology

Psychotria alejandroi is only known from its type locality (Fig. 1), occurring on ultramafic soils in open scrubby vegetation. The open dry forests of the type locality are prone to forest fires. Notable species in the area include *Alpinia brevibras* C.Presl. (Zingiberaceae), *Ampelocissus madulidii* Latiff (Vitaceae), *Bikkia montoyae* Mejillano, Santor & Alejandro (Rubiaceae), *Chewlunia auriculata* (Merr.) P.K.Hoo & Junhao Chen (Rubiaceae), *Osmoxylon yatesii* (Merr.) Philipson (Araliaceae), *Psychotria pilosella*, *Sararanga philippinensis* Merr. (Pandaceae), *Scaevola micrantha* C.Presl (Goodeniaceae), *Timonius finlaysonianus* (Wall. ex G.Don) Hook.f. (Rubiaceae), *Xanthostemon verdugonianus* Náves ex Fern.-Vill. (Myrtaceae), and several *Nepenthes* L. (Nepenthaceae) species. This new species was collected in flower and fruit in November. Hence, its flowering season is expected to be around May to November and fruiting from November to January.

Notes

Psychotria alejandroi is morphologically similar to *P. pilosella*, an endemic species from the *Pilosella* group with a wide Philippine distribution, as both species occur as trees with dense pubescence on their vegetative structures, inflorescences that are both monochotomous and trichotomous, and similar flowering and fruiting

features. However, *P. alejandroi* is easily distinguished from *P. pilosella* by its stipules divided into 6 to 8 linear lobes, resembling fingerlike projections, with the inner lobes extending into long aristae. On the other hand, the stipules of *P. pilosella* are unlobed, ovate, and have acute cleft apices. The leaves of *P. alejandroi* are lanceolate to narrowly ovate, whereas it is obovate to narrowly oblanceolate in *P. pilosella*. In addition, the scabrous nature of the leaves in *P. alejandroi*, giving it a rough sandpaper-like texture, separates it from *P. pilosella*, as this feature is observed only in *Psychotria scaberula* Merr., a Dinagat Island endemic, and sometimes in *Psychotria surigaoensis* Sohmer & A.P.Davis. Differences in inflorescences, including length, bract margin shape, and flower merosity, separate the two species. Lastly, the pyrenes and the presence of ruminations in the endosperms are essential characters for delimiting *Psychotria* species (Sohmer & Davis 2007). The pyrenes of *P. alejandroi* are only weakly ribbed, possessing endosperms with weak ruminations in contrast to *P. pilosella* bearing ribbed to ribbed-ridged pyrenes with distinct ruminate endosperms.

Proposed conservation status

Few mature individuals of this species have been observed within the site, but further exploration in undisturbed forests within Cagdianao forests may reveal stable populations. With an estimated area of occupancy of AOO = 4 km² and its habitat susceptible to occasional forest fires and anthropogenic impacts such as mining and land conversion, *Psychotria alejandroi* is assessed as critically endangered (CR) under criterion B2ab. Fortunately, Cagdianao Mining, Inc. has taken steps toward conservation by designating a portion of the type locality's forests to be protected and under strict surveillance, similar to that in Mt. Redondo by Krominco, Inc.

***Psychotria nitidifolia* Ordas, Chen, & Alfeche sp. nov.** (Figures 3, 4D–F)

Type: Philippines, Dinagat Island Province, Municipality of Cagdianao: Barangay Legazpi, 10°10'11" N, 125°38'50" E, 105 m, on ultramafic soils in open canopy forest, 30 Aug 2023, Ordas, Alfeche, et al., DIN23-119 (holotype USTH; isotypes USTH incl. spirit, FEUH).

Diagnosis

The new species is comparable to *Psychotria castroi* Merr. & Quisumb. ex Sohmer & A.P.Davis but is distinguished in having a smaller habit (0.6–1.5 m vs. 2.0–7.0 m), shorter petioles ((0.8)1.3–1.7 cm vs. 1.7–3.0 cm), smaller leaves ((4.0)9.2–11.2 cm x (1.5)3.2–3.9 cm

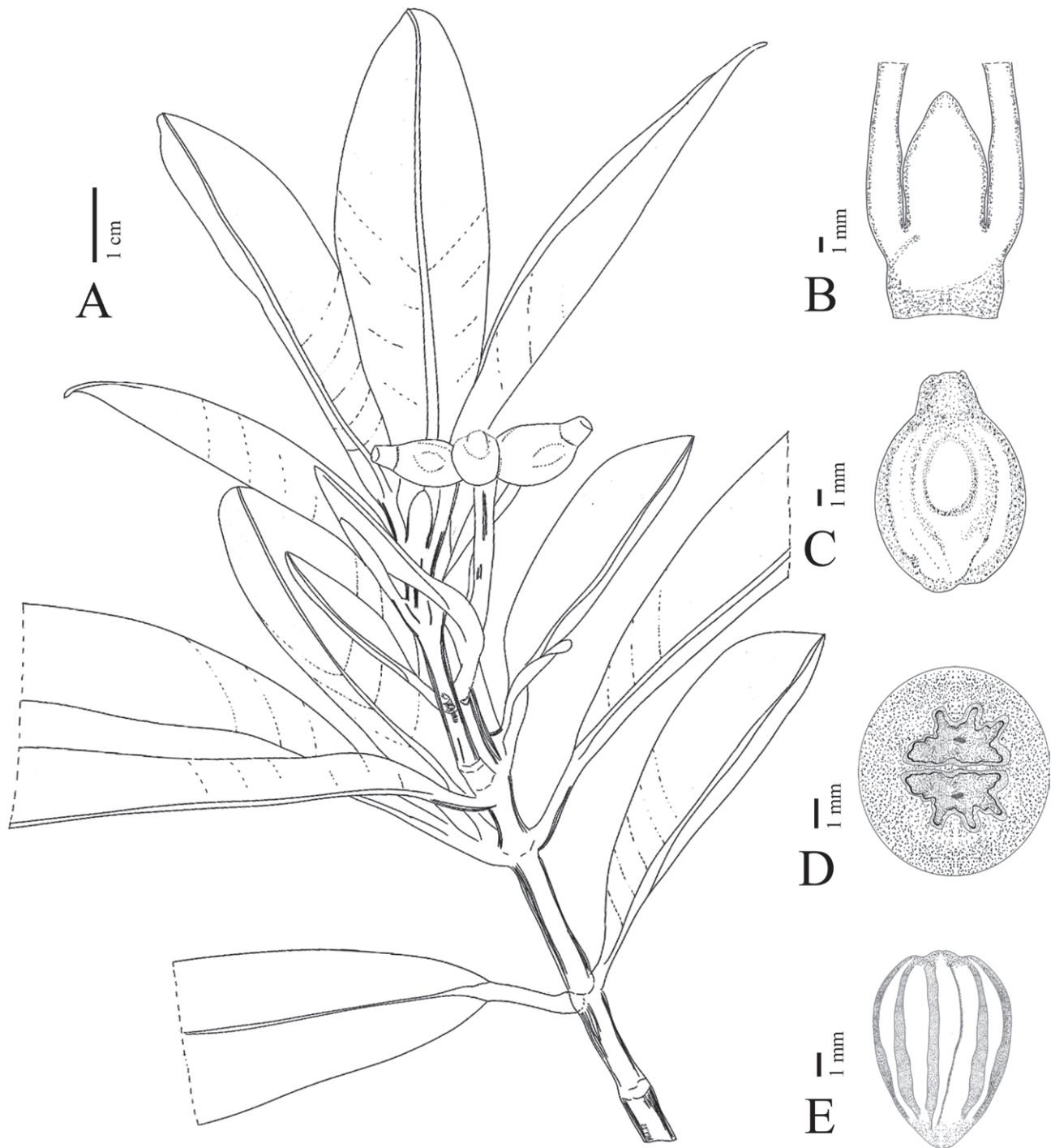


Figure 3. *Psychotria nitidifolia* Ordas, Chen, & Alfeche: A. Fruiting branch. B. Terminal bud enclosed in stipules. C. Fruit. D. Fruit cross-section. E. Pyrene. Illustrated by G.N.G. Cortez.

vs. 10–15 cm x 4.8–6.2 cm) drying dark khaki brown (vs. dark brown or reddish brown), monochotomous to trichotomous inflorescences (vs. monochotomous only), prolate fruits (vs. turbinate) with smaller, obscure calyx

lobes (0.2–0.3 mm vs. 0.5–0.7 mm), strongly ridged pyrenes with weakly ruminant endosperms (vs. weakly ribbed pyrenes with distinct ruminant endosperms).

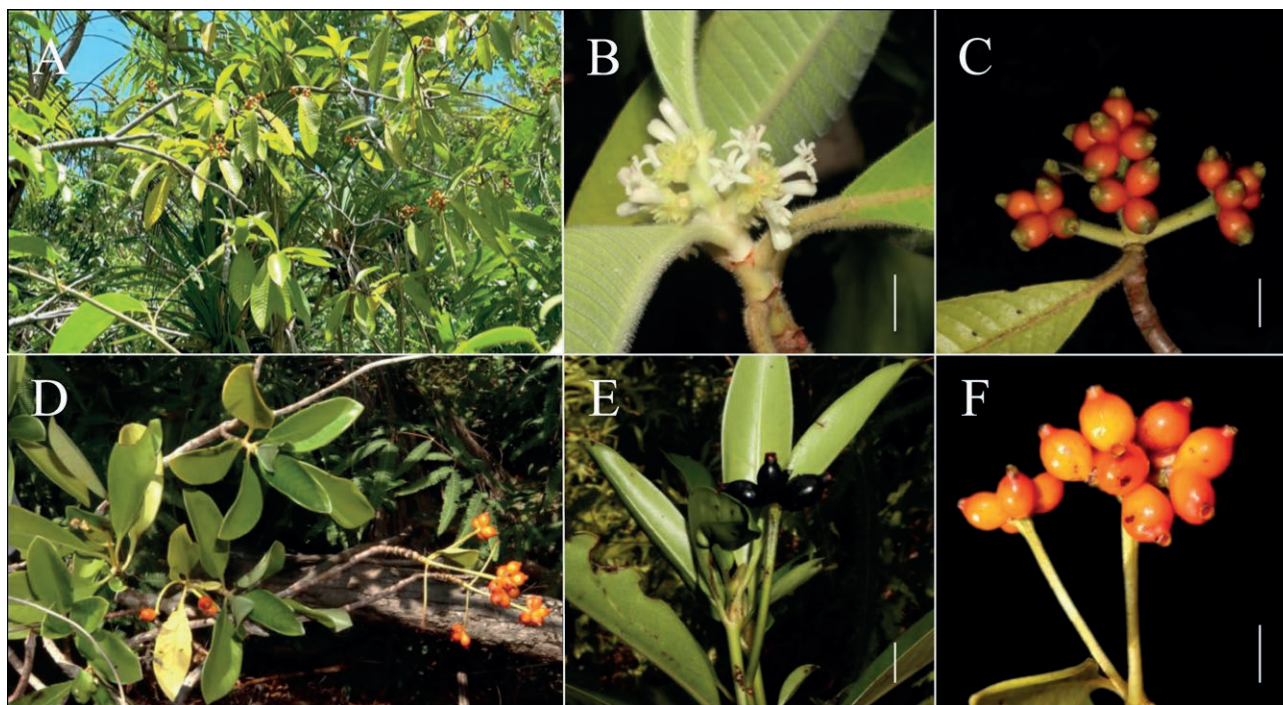


Figure 4. *Psychotria alejandroi* Ordas, Chen, & Odulio (A–C) and *Psychotria nitidifolia* Ordas, Chen, & Alfeche (D–F; D & F taken from specimen DIN23-119, E taken from specimen DIN23-133): A. Habit. B. Flowering branch. C. Fruiting branch. D. Habit. E–F. Fruiting branch. Scale = 1 cm.

Description

Shrub 0.6–1.5 m tall. Young stems glabrous; internodes 0.4–2.0 cm long, defoliated at lower branches. Stipules caducous, valvate, elliptic, 6–9 mm × 3–6 mm, glabrous outside, apex acute. Leaves opposite-decussate, petioles (0.8)1.3–1.7 cm long, glabrous; leaf blades oblanceolate, (4.0)9.2–11.2 cm × (1.5)3.2–3.9 cm, very coriaceous, glabrous on both surfaces, bright green but drying dark khaki brown; lateral veins 5–17 on each side of the midrib, somewhat visible on the adaxial surface, obscure on the abaxial side; tertiary venation inconspicuous; base cuneate to attenuate; apex acute to broadly acuminate. Inflorescences/infructescences monochotomous to trichotomous, erect, 4–6 cm long, glabrous, with each branch terminated by 1–10 sessile flowers and fruits; principal axis of trichotomous inflorescences 2.6–4.9 cm long, unbranched; principal axis (peduncle) of monochotomous inflorescences 1.3–3.2 cm long, with one primary node supporting three branches 1.5–3.0 cm long; bracts caducous, ovate, 3–6 mm long, glabrous outside, margins entire, apex acute to obtuse; bracteoles caducous, valvate, rounded to obtuse, 1–2 mm long, margins repand, apex acute to obtuse. Flowers unknown. Ovary and calyx in flowering stage unknown, in fruiting stage calyx 1.0–3.3 mm long, truncate, limb

1–3 mm long, lobes 0.2–0.3 mm long, deltate, obscure, apex rounded. Fruits sessile or very rarely pedicellate (then pedicels 3–6 mm long and very sparsely pilose), subglobose to prolate, 12–13 × 8–9 mm and smooth but 9–10 × 4–6 mm and longitudinally ribbed when dry, orange and dark purple, with distinct sheen on exocarp, glabrous; at least calyx persistent and prominent, orange, white, to purple, rarely green, glabrous outside; pyrenes obovate, strongly ridged on outer surface, 6.3–8.0 mm × 4.0–5.0 mm; endosperm weakly ruminate.

Etymology

The epithet of this new *Psychotria* species is based on its shiny, light green, very coriaceous leaves.

Distribution, habitat, and phenology

Psychotria nitidifolia is endemic to Dinagat Island, thriving on ultramafic soils in open, scrubby, and pygmy forests from ca. 105 to 850 m asl (Fig. 1). *In-situ* observations by the first author were recorded for this species in pygmy vegetation at the summit (ca. 850 m) of Mt. Redondo in the municipality of Loreto, which comprises a population of highly stunted variants of not more than 50 cm tall. This was also recorded by P. Pelser and J. Barcelona (Pelser et al. 2011 onwards) and Robinson et

al. (2019), under the name *Psychotria surigaoensis*. The new species was observed in fruit from June to November. The flowering season is expected to be from January to May.

Proposed conservation status

This species is only known to occur in two ultramafic areas in Dinagat Island: in Cagdianao forest and the Mt. Redondo Natural Bonsai Forest. With an estimated area of occupancy of AOO = 8 km², this species could be assessed as critically endangered (CR). Mining and land conversion have impacted portions of Dinagat Island's ultramafic forests, threatening this species' habitat. However, we recommend further explorations on other ultramafic forests of Dinagat Island to enhance understanding of the range and population dynamics of *Psychotria nitidifolia*.

Notes

Psychotria nitidifolia is a distinct species easily recognized from other species in the *Pilosella* group by its small glabrous habit, very coriaceous leaves, and fruits possessing a distinct sheen on their exocarps. Based on its features, it is closely allied to *P. castroi*, a Samar Island endemic last collected in 1969, as both have entirely glabrous habits and somewhat similar vegetative and fruit morphology. However, *P. nitidifolia* has smaller habit sizes ranging from short to highly stunted shrubs (vs. shrubs to small trees 2–7 m tall) and smaller leaf morphologies with sclerophyllous features. These characteristics are evident for plants that are well-adapted to serpentine soils in open canopy forests with high levels of sun exposure (Brady et al. 2005). In addition, the leaves of *P. nitidifolia*, when dried, are dark khaki brown in contrast to *P. castroi*, which is dark to reddish brown, an important character to separate the two species as the leaf color upon herbarium specimen preparation is significant to distinguish *Psychotria* species (Sohmer & Davis 2007). The inflorescences of *P. nitidifolia* occur as both monochotomous and trichotomous, whereas it is only monochotomous for *P. castroi* and are somewhat smaller (4.0–6.0 cm vs. 5.5–7.5 cm). The fruits of *P. nitidifolia* and *P. castroi* are subglobose, but the former has primarily prolate fruits, whereas the latter has turbinate fruits. In addition, the calyx lobes of *P. nitidifolia* in its fruiting stage are less distinct and obscure than *P. castroi*. Lastly, the strongly ridged pyrenes of *P. nitidifolia* possessing weak rumination in its endosperms distinguish it from *P. castroi*, which bears weakly ribbed pyrenes and a distinct ruminate endosperm.

Other specimens examined

Philippines, Dinagat Island Province, Municipality of Cagdianao: Barangay Legazpi, 10°10'11" N, 125°38'50" E, 120 m, on ultramafic soils of open canopy forest, 30 Aug 2023, Ordas, Alfeche, et al., DIN23-133, USTH; DIN23-134, USTH.

The two new species occur with other *Psychotria* species of the *Pilosella* group on Dinagat Island, namely *P. pilosella*, *P. scaberula*, and *P. surigaoensis*. Erroneous identification could happen if specimens are not examined carefully. Hence, a key to the known *Psychotria* species of the *Pilosella* group on Dinagat Island is provided to facilitate identification.

Key to the *Psychotria* species (*Pilosella* group) of Dinagat Island

1. Plant densely pubescent to hispid; stipules lobed or with cleft apices 2
1. Plant glabrous to sparsely pubescent; stipules with single acute apices 3
2. Stipules ovate to narrowly ovate, unlobed, apex acute but with a cleft; bracts 4–6 mm long, margins serrate to lacinate; flower 4- to 5-merous; fruits sparsely to densely pubescent or glabrous; pyrenes ribbed-ridged *P. pilosella*
2. Stipules truncate, divided into 6 to 8 lobes, apex of inner lobes having two tips drawn out into long aristae; bracts 1.0–1.5 mm long, margins entire; flower 5- to 6-merous; fruits chiefly glabrous but very sparsely hispid on top; pyrenes weakly ribbed *P. alejandroi*
3. Leaf blades strongly scabrous, especially below; fruits globose to obovoid *P. scaberula*
3. Leaf blades smooth; fruits turbinate to prolate 4
4. Leaf blades chartaceous to subcoriaceous; inflorescences 1.5–2.8 cm long, puberulous to pubescent; principal axis (peduncle) of monochotomous inflorescences 0.3–0.9 cm long; bracts ca. 1 mm long, puberulous outside; fruits turbinate *P. surigaoensis*
4. Leaf blades thickly coriaceous; inflorescences 2.6–4.9 cm long, glabrous; principal axis (peduncle) of monochotomous inflorescences 1.3–3.2 cm long; bracts 3–6 mm long, glabrous outside; fruits prolate *P. nitidifolia*

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