



## Two new species of *Plagiostachys* (Zingiberaceae) from Zamboanga Peninsula, Philippines

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**ABSTRACT:** Two new species of *Plagiostachys* from Zamboanga Peninsula, Philippines, are described and illustrated. *Plagiostachys subsessiliflora* Mazo and *Plagiostachys longipetiolata* Mazo, both have non-mucilaginous inflorescences. A distribution map, proposed conservation assessment, and an updated key to Philippine *Plagiostachys* species are provided.

**KEY WORDS:** Alpinieae, IUCN, *Plagiostachys escriptorii*, *P. lourdesiae*, *P. strobilifera*, taxonomy, Zamboanga.

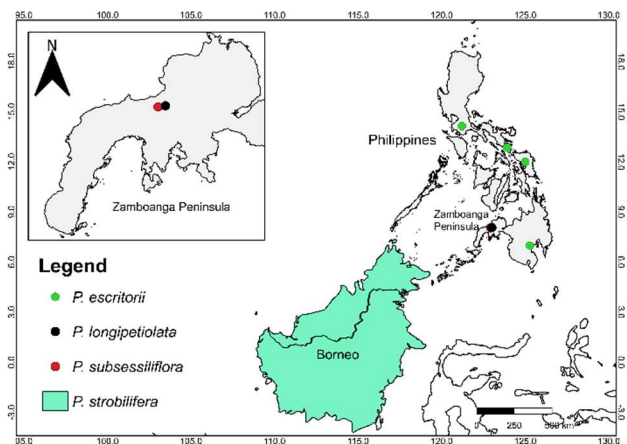
### INTRODUCTION

*Plagiostachys* Ridl. (Zingiberaceae) is a genus of terrestrial perennial herbs with about 30 species (POWO, 2021; Salasiah and Meekiong, 2020). It is distributed mainly in the Malesian region, with the center of diversity in Borneo (POWO, 2021; ZRC, 2021; Julius *et al.*, 2008). The genus is recognized by having inflorescences that emerge laterally from leaf sheaths, either just above the ground, in the middle, or very close to the terminal of the leaf shoots (Smith, 1985; Ridley, 1899, 1909). *Plagiostachys* nested within the *Alpinia zerumbet* clade in the subfamily *Alpinioideae* Link (Julius *et al.*, 2008; Kress *et al.*, 2005). Smith (1985) divided Bornean species into two groups based on the presence and absence of mucilaginous substance in the inflorescence, ligule, bracteole, calyx and style character, flower color, and fruit shape. However, species described after Smith's classification (Julius *et al.*, 2007; Gobilik *et al.*, 2005; Sakai and Nagamasu, 2003; Cowley, 1999), authors have encountered problems in fitting new taxa into this classification. Recent phylogenetic analysis found out that *Plagiostachys* is divided into three subclades and morphological characters used by Smith were scattered within the subclades (Julius *et al.*, 2008).

In the Philippines, there are nine recognized *Plagiostachys* species, all are endemic except *P. albiflora* Ridl., and seven of which are recorded in Mindanao island (Acma *et al.* 2019, Pelsler *et al.* 2011 onwards). *Plagiostachys lourdesiae* Docot, from the type locality in the Zamboanga Peninsula is the most recent addition for the Philippines (Docot, 2020). The region of Zamboanga Peninsula in western Mindanao has a unique biogeographical history and is one of the less explored regions in the country. Until recently, explorations in the region had resulted in the discoveries of new species of both flora and fauna.

During floristic inventory in the municipality of Leon B. Postigo, Zamboanga del Norte (Fig. 1) from January

to September 2021, two interesting *Plagiostachys* species were collected. The taxa could be separately distinguished based on the differences in the shape of leaves and ligules, distance of inflorescences from the ground, and arrangement and color of flowers. After a thorough examination of their morphology, literature review, and consultation of taxonomic keys (Docot, 2020; Salasiah and Meekiong, 2020), no match was made for both species, thus described and illustrated here as new to science.



**Fig. 1.** Map showing the distribution of *Plagiostachys escriptorii*, *P. strobilifera*, *P. subsessiliflora*, and *P. longipetiolata*.

### MATERIALS AND METHODS

Morphological observation and measurements of the species were based on fresh and preserved material, dried specimens, and photographic images of the plant. Images of type specimens of *Plagiostachys* species in the Philippines and neighboring countries were examined from JSTOR Global Plants (<http://plants.jstor.org>), and Zingiberaceae Resource Center (<http://padme.rbge.org.uk/ZRC>). The evaluations of the conservation status of the new taxa

**Table 1.** Comparative morphology between *Plagiostachys subsessiliflora*, *P. escriptorii*, and *P. lourdesiae*.

| Characters                          | <i>P. subsessiliflora</i>   | <i>P. escriptorii</i>       | <i>P. lourdesiae</i>  |
|-------------------------------------|-----------------------------|-----------------------------|-----------------------|
| <b>Ligule</b>                       |                             |                             |                       |
| Height (mm)                         | 11–13                       | 5–8                         | 10–16                 |
| Apex                                | Unequally 2(–3)-lobed       | Rounded or irregular        | Rounded or obtuse     |
| <b>Petiole</b>                      |                             |                             |                       |
| Length (cm)                         | Petiolate, 2.7–5.5          | Subsessile                  | Petiolate, 1.5–3.0    |
| <b>Lamina</b>                       |                             |                             |                       |
| Shape                               | Lanceolate                  | Oblong or oblanceolate      | Narrowly oblong       |
| Size (cm)                           | 72–96 × 12–16               | 60* × 9–13                  | 53–62 × 6–10          |
| Texture adaxial                     | Glabrous                    | Glabrous                    | Glabrous              |
| Texture abaxial                     | Pubescent                   | Pubescent                   | Glabrous              |
| <b>Inflorescence</b>                |                             |                             |                       |
| Distance from the ground (cm)       | 13–16                       | 5–10                        | 30–50                 |
| Flower arrangement along the rachis | Congested                   | Congested                   | Lax                   |
| <b>Bracteoles</b>                   |                             |                             |                       |
| Shape                               | Boat-like, open to the base | Boat-like, open to the base | Tubular               |
| Size (mm)                           | 11–13                       | 13.3                        | 10–15                 |
| Texture                             | Pubescent                   | Pubescent                   | Pubescent             |
| <b>Pedicel</b>                      |                             |                             |                       |
| Length (mm)                         | Short, 0.7–1.0              | 5–8                         | 6–8                   |
| <b>Anther crest</b>                 |                             |                             |                       |
| Apex                                | Trilobed                    | Truncate                    | Rounded               |
| <b>Fruits</b>                       |                             |                             |                       |
| Shape                               | Globose to subglobose       | Oblong                      | Globose to subglobose |
| Dimension (mm)                      | 16–25 × 18–22               | 20 × 12.5                   | 20–26 × 13–18         |

\*=Average

were based on the International Union for Conservation of Nature (IUCN) criteria (IUCN Standards and Petitions Subcommittee, 2019).

## TAXONOMIC TREATMENT

*Plagiostachys subsessiliflora* Mazo, *sp. nov.*

**Figs. 2–3**

**Type:** Philippines. Mindanao: Zamboanga del Norte Province, Municipality of Leon B. Postigo, barangay Tinuyop, Molina River, 8°3'40.50"N, 122°56'40.28"E, 300–350 m elev, 24 May 2021, *K.R.F. Mazo 44* (Holotype: PNH; Isotype: CMUH).

**Diagnosis:** *Plagiostachys subsessiliflora* is allied to *P. escriptorii* Elmer and *P. lourdesiae* in having a gullet-type labellum. However, it significantly differs in having unequally 2(–3)-lobed ligules, lanceolate leaves, short pedicels, and trilobed anther crest. Detailed morphological comparison is presented in Table 1.

**Description:** A perennial terrestrial herb growing in loose clumps, with subterranean short creeping rhizome. *Leafy shoot* 3.0–4.5 m tall with 7–9 leaves, base swollen at 3.0–4.2 cm; sheath brownish-green, striate, sericeous; ligule unequally 2(–3)-lobed, lobes 1.5–5.5 mm, apex rounded, sericeous; petiole 2.7–5.5 cm long, channelled, densely pubescent, mid-green, swollen at the base; *lamina* lanceolate, 72–96 × 12–16 cm, base oblique, asymmetrical, the lower ones wider, margin ciliate, undulate, apex acuminate, acumen to 1.5 cm long, adaxial surface glabrous except the sparsely puberulent midrib, green; abaxially surface pubescent, paler green. *Inflorescence* borne 13–16 cm above the base of the leafy

shoot, 13–20 cm long; peduncle 2.2–3.0 cm, pubescent, yellowish, 2–6 branched at the base or unbranched, non-mucilaginous; bracts 4–6 sericeous, red, apex acuminate to caudate, outermost bract 13–16 × 8–11 cm, broadly ovate, innermost bract 4–5 × 2–3 cm, ovate; bracteoles 11–13 mm long, boat-like, open to the base, red, brown-pubescent, partially decaying; pedicel short, 0.7–1.0 mm long, pubescent, red; flowers 30–35 mm long, red, pubescent; calyx tube red, densely pubescent, 16–18 mm long, apex 3-dentate; corolla tube 17–22 mm long, lageniform, outside glabrous at the base becoming pubescent towards the upper part, inside puberulent on the lower half becoming pubescent on the upper half, white on the lower tube becoming red on the upper part; dorsal corolla lobes narrowly oblong, 10–12 × 2.5–3.0 mm, red, pubescent on outer surface, apex cucullate; lateral corolla lobes narrowly oblong, 8–10 × 2.5–3.0 mm, red, pubescent on outer surface, apex cucullate; labellum broadly ovate when flattened, 11–13 × 9–10 mm, red, apex bilobed, middle part rigid, margin entire, pubescent near base; lateral staminodes linear, 2–3 mm long, red, puberulent; filament 4–5 mm, pubescent; anther 5–6 × 2.0–2.5 mm, pubescent, red tinged white; thecae 4–5 mm, densely pubescent; anther crest 1.5–2.0 mm long, red, puberulent, apex trilobed; style 24–28 mm long, free from the corolla wall, lower half puberulent, upper half pubescent, white; stigma ca. 1 mm wide, glabrous, red; ostiole pubescent; epigynous gland subglobose 2.5–3.0 mm long, yellow; ovary globose to subglobose, 3–4 × 2–3 mm, densely pubescent, red, locules 3, placentation axile. Fruits globose to subglobose, 16–25 × 18–22 mm, immature red to maroon, turn green at maturity, pubescent,

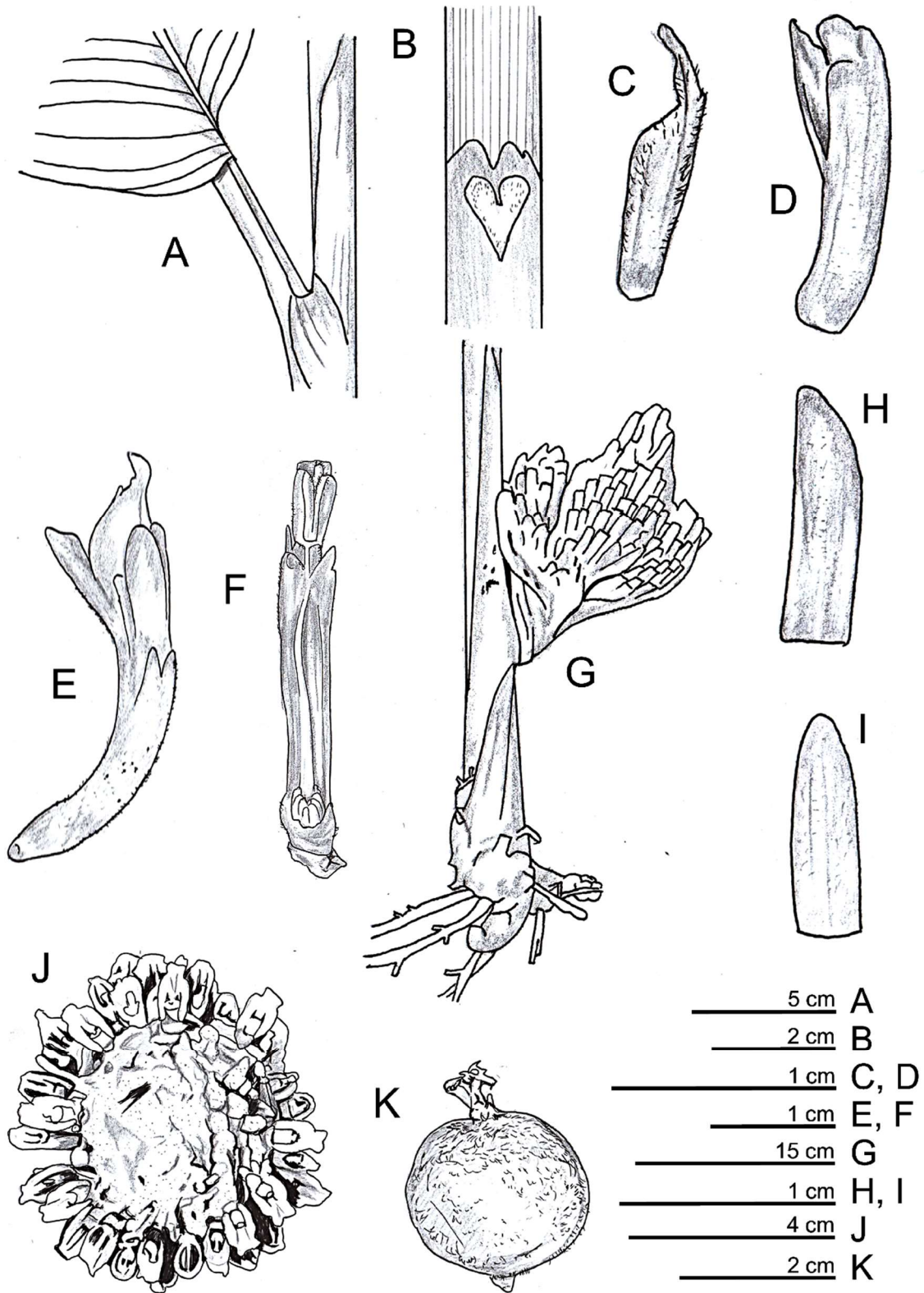
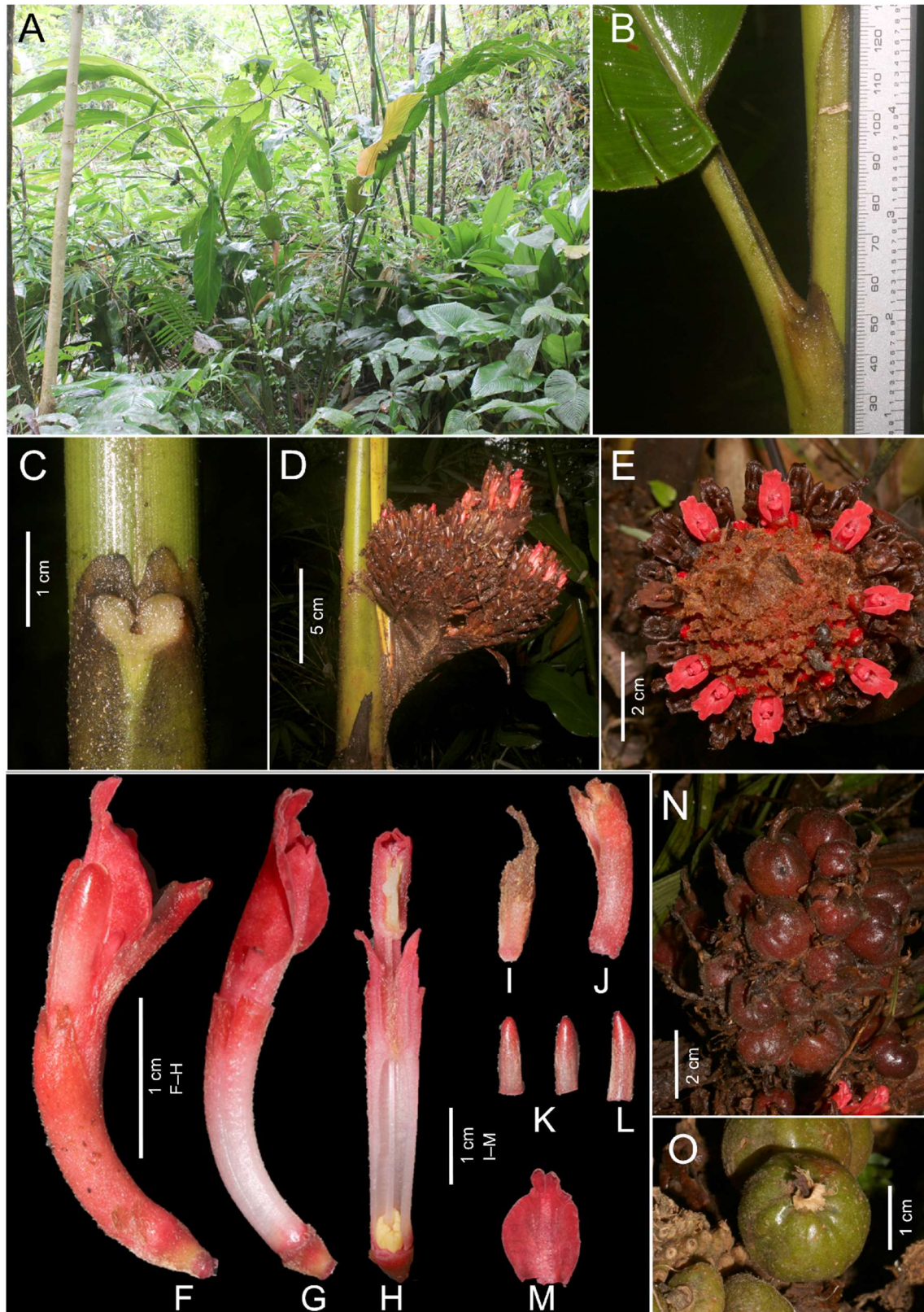


Fig. 2. *Plagiostachys subsessiliflora* Mazo. A. Leaf attachment; B. Ligule; C. Bracteole; D. Calyx; E. Flower, calyx and bracteole removed; F. Longitudinal view of corolla tube showing epigynous glands, style, lateral staminodes and anther; G. Inflorescence, front view; H. Dorsal corolla lobe; I. Lateral corolla lobe; J. Inflorescence; K. Fruit. Drawn by J.P. Dalguntas.



**Fig. 3.** *Plagiostachys subsessiliflora* Mazo. **A.** Habit; **B.** Petiolate lamina showing inequilateral base; **C.** Ligule; **D.** Inflorescence, side view; **E.** Inflorescence, front view; **F.** Flower; **G.** Flower, calyx and bracteole removed; **H.** Longitudinal view of corolla tube showing epigynous glands, style, lateral staminodes and anther; **I.** Bracteole; **J.** Calyx; **K.** Corolla lobes; **L.** Dorsal corolla lobes; **M.** Labellum; **N.** Inflorescence showing reddish to maroon immature fruits; **O.** Mature fruits. Photographs by K.R.F. Mazo



corrugated, with persistent calyx remnants; seeds 4–8 × 2–4 mm, irregular in shape, black with white aril.

**Distribution and Habitat:** *Plagiostachys subsessiliflora* occurs in semi-shaded of the municipality of Leon B. Postigo, Zamboanga del Norte, at 300–350 m elevation. It was observed growing on humus cover with fertile and moist soils near stream.

**Phenology:** This new species was observed flowering and fruiting from May to September.

**Etymology:** The epithet *subsessiliflora* refers to the very short stalk of the flowers.

**Provisional conservation status:** *Plagiostachys subsessiliflora* is so far known only from its type locality in barangay Tinuyop, Leon B. Postigo, Zamboanga del Norte. There were only 4 populations with 5–10 individuals were observed. Survey in the surrounding areas (e.g. sitio Napolan, Lilik, Binwangan, and Kasong) were done but no additional individuals or populations were found. The habitat of this new species is threatened by illegal logging, mining activities, and land conversion. In fact, during collection, freshly illegally-cut trees were found about 10–30 meters away from the plants. Based on IUCN guidelines, *P. subsessiliflora* is categorized as Critically Endangered [CR:B2b(i,ii)] (IUCN, 2019).

**Notes:** *Plagiostachys subsessiliflora* closely resembles *P. escriptorii* and *P. lourdesiae* in having gullet type labellum, and other floral characters such as, calyx, corolla tube, and lateral staminodes. It differs readily to *P. escriptorii* by its globose to subglobose fruits (vs. ovoid), petiolate leaf blades (vs. sessile), unequally 2(–3)-lobed ligules (vs. rounded or irregular), subsessile flowers (0.7–1.0 mm vs. 5–8 mm), and trilobed anther crests (vs. truncate). The new species also stands out from *P. lourdesiae* in having unequally 2(–3)-lobed ligules (vs. rounded or obtuse), longer petioles (2.7–5.5 cm vs. 1.5–3.0 cm), pubescent abaxial leaf surfaces, boat-like bracteoles (vs. tubular), subsessile flowers (short, 0.7–1.0 mm vs. 6–8 mm), and trilobed anther crests (vs. rounded).

In the Philippines, *Plagiostachys corrugata* and *P. elegans* are not documented after their discoveries (Docot, 2020). The former was described by Elmer (1915) from a fruiting specimen and characterized by having ovoidly elongated with prominent corrugated fruits, and 2–4 cm long slender petioles (vs. globose to subglobose, 2.7–5.5 cm, not slender; *P. subsessiliflora*), while the latter is the smallest *Plagiostachys* species so far reaching up to 40 cm, with glabrous sheaths, and sessile leaf blades (vs. 3.0–4.5 m, tomentose, petiolate).

***Plagiostachys longipetiolata* Mazo, sp. nov.**

**Figs. 4–5**

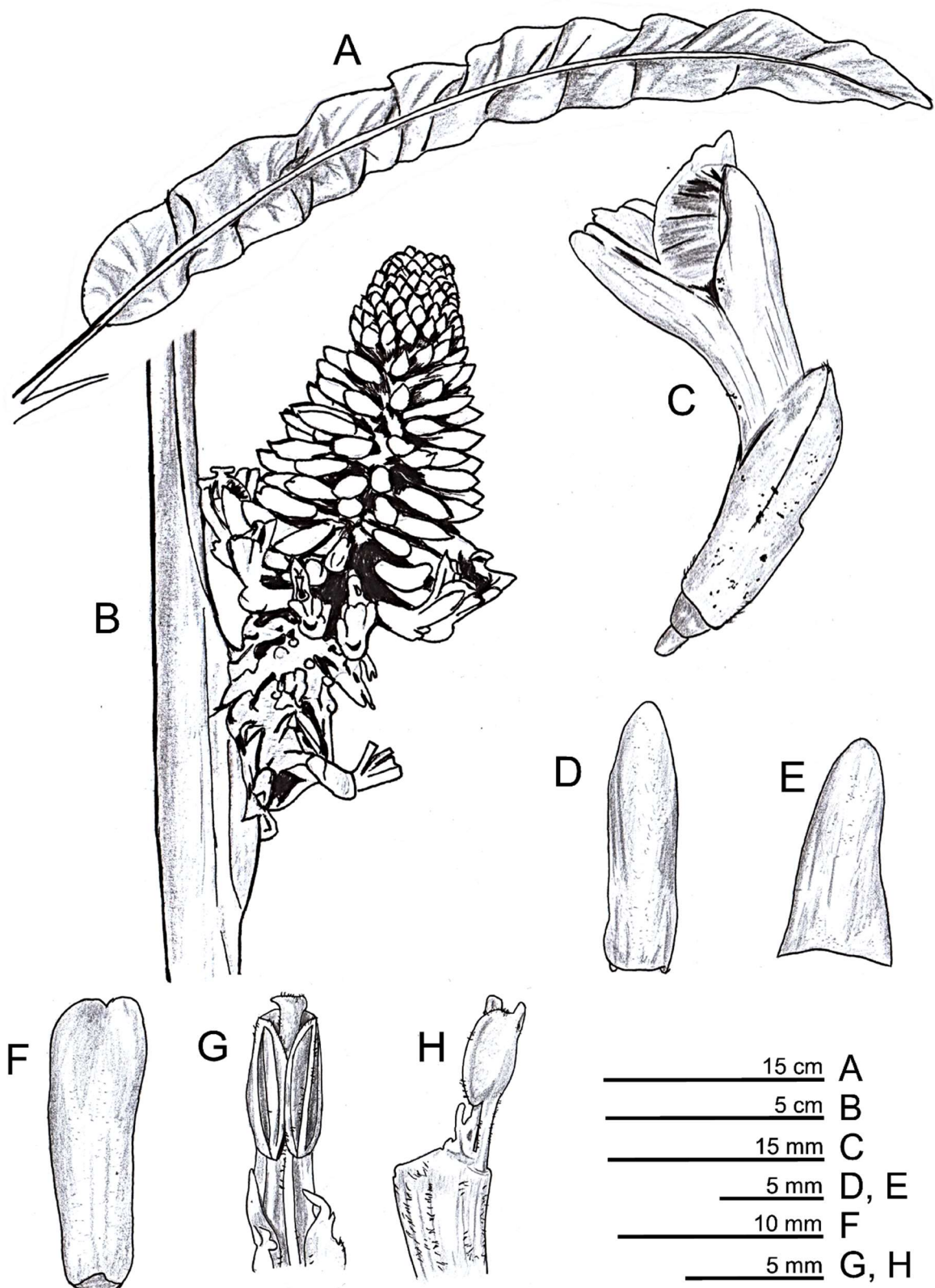
**Type:** Philippines. Mindanao: Zamboanga del Norte Province, municipality of Leon B. Postigo, barangay Tinuyop, Sapalola River, 8°3'50.47"N, 122°56'58.75"E, 410 m elev, 13 June 2021, *K.R.F. Mazo 45* (Holotype: PNH; Isotype: CMUH).

**Diagnosis:** *Plagiostachys longipetiolata* is most similar to *P. strobilifera* var. *strobilifera* (Baker) Ridl. from Borneo, but differs significantly in having conspicuously petiolate lamina (6.8–8.0 cm long vs. sessile or subsessile), larger and emarginate ligules (4.5–6.0 mm vs. 3 mm, truncate), longer bracteoles (12–16 mm vs. 10 mm), and calyx tubes (13–15 mm vs. 10 mm), orbicular labellum (vs. ovate), and trilobed anther crest (vs. truncate).

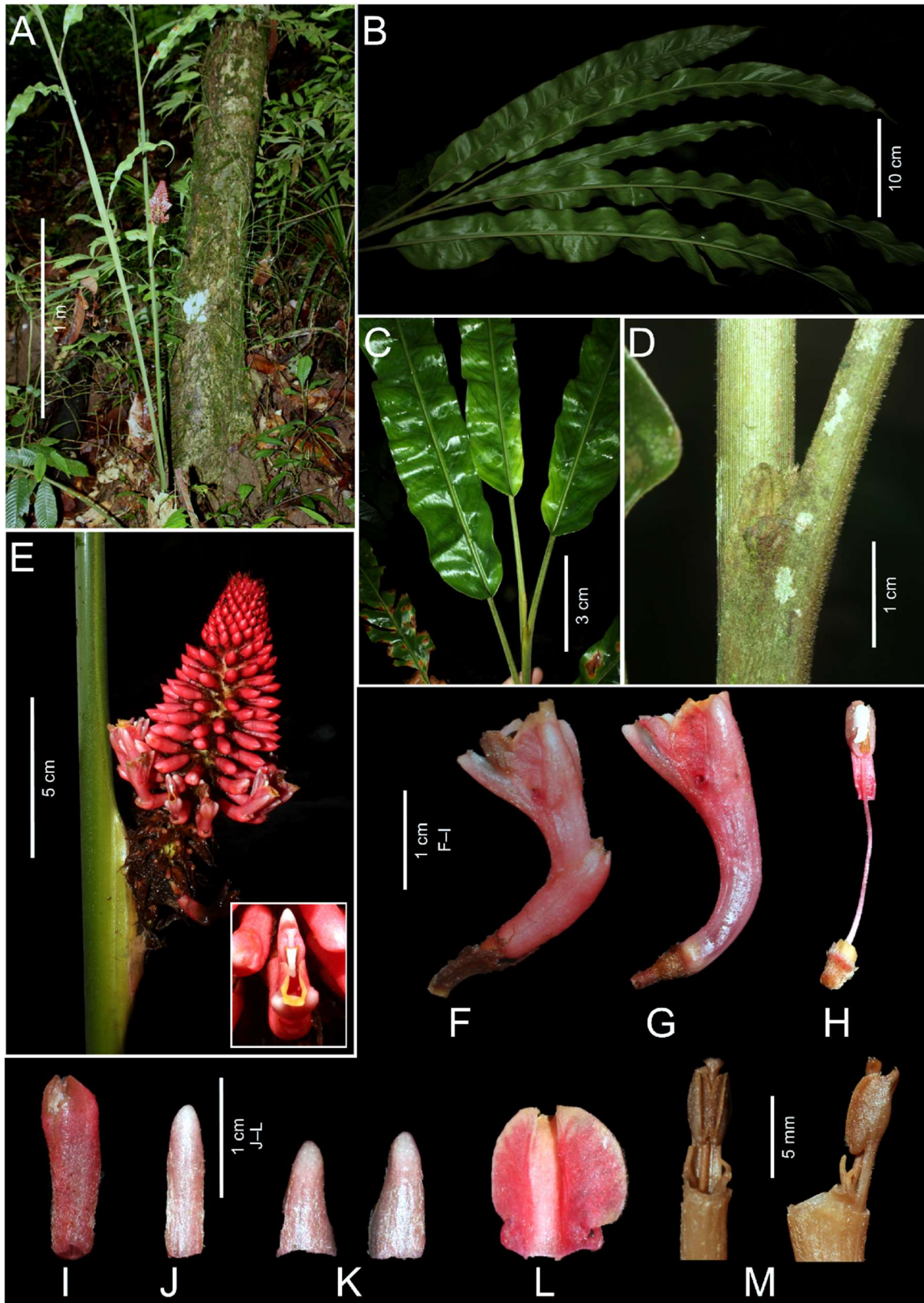
**Description:** A perennial terrestrial herb growing in loose clumps, with subterranean creeping rhizome. *Leafy shoot* 1.5–2.5 m tall with 6–8 leaves, base swollen at 2.5–3.0 cm; sheath striate, green, tomentose; ligule 4.5–6 mm long, emarginate, sericeous; petiole slender, 6.5–8.0 cm long, sericeous, green, slightly thickened at the base; *lamina* lanceolate, 47–60 × 4.5–7.0 cm, base rounded, lower blades sometimes asymmetrical, margin ciliate, strongly undulate, apex sharply acuminate, acumen up to 4 cm long, adaxial surface shiny, puberulent, green with light green striations; abaxial surface pubescent, paler green, midrib puberulent on the upper surface, pubescent on the lower surface. *Inflorescence* borne 1.2–1.5 m above the base of the leafy shoot, 14–16 cm long, cone-shape, unbranched; non-mucilaginous; bract not observed, decaying; bracteoles tubular, 12–16 mm long, brown-pubescent, partially decaying; pedicel 6.0–7.5 mm long, densely pubescent, pinkish to red; *flowers* 28–32 mm long, pinkish, pubescent; calyx tube 13–15 mm long, densely pubescent, pinkish, 3-dentate; corolla tube 12–17 mm long, lageniform, outside pubescent, inside lower half glabrous, upper half pubescent, pinkish; dorsal corolla lobes narrowly oblong, 11–14 × 3–5 mm, apex cucullate, pinkish, pubescent on outer surface; lateral corolla lobes narrowly oblong, 8–9 × 3–4 mm, apex cucullate, pinkish, pubescent on outer surface; labellum orbicular when flattened, 9–11 × 10–12 mm, pinkish, upper half of the margin orange to the truncate apex, middle part rigid, margin slightly undulate, glabrous; lateral staminodes linear to subulate, 2–3 mm long, pinkish, glabrous; filament 2–4 mm long, pubescent; anther 5–6 × 2–3 mm, pubescent, pinkish tinged white; thecae 4.7–5.0 mm, pubescent, yellow; anther crest 0.8–1.0 mm long, red, glabrous, apex trilobed; style 24–26 mm long, free from the corolla wall, lower half glabrous, upper half puberulent to pubescent, white; stigma ca. 1.5 mm wide, glabrous, pinkish; ostiole pubescent; epigynous gland subglobose, 2.0–2.5 mm long, yellow; ovary globose, 2.0–2.5 × 1.8–2.5 mm, densely pubescent, red, locules 3, placentation axile. Infructescence not observed.

**Distribution and Habitat:** *Plagiostachys longipetiolata* is only known from the type locality in the secondary lowland tropical rainforest of the municipality of Leon B. Postigo, Zamboanga del Norte, Mindanao. It was found along the river with shaded environment at 410 m elevation.

**Phenology:** This new species was observed flowering in June.



**Fig. 4.** *Plagiostachys longipetiolata* Mazo. **A.** Leaf attachment; **B.** Inflorescence; **C.** Flower; **D.** Dorsal corolla lobe; **E.** Lateral corolla lobe; **F.** Calyx; **G.** Stamen, front view; **H.** Epigynous gland, style and stamen; **I.** Calyx; **J.** Dorsal corolla lobes; **K.** Corolla lobes; **L.** Stamen, side view. Drawn by J.P. Dalguntas.



**Fig. 5.** *Plagiostachys longipetiolata* Mazo. **A.** Habit; **B.** Terminal portion of the leafy shoot showing undulate leaves; **C.** Leaf adaxial view showing slender petioles; **D.** Ligule **E.** Inflorescence, inset front view of the flower; **F.** Flower; **G.** Flower, calyx and bracteole removed; **H.** Epigynous gland, style and stamen; **I.** Calyx; **J.** Dorsal corolla lobes; **K.** Corolla lobes; **L.** Labellum; **M.** Stamen, front and side view (preserved in ethanol). Photographs by K.R.F. Mazo.



**Table 2.** Comparative morphology between *Plagiostachys longipetiolata*, *P. strobilifera* var. *strobilifera*, *P. strobilifera* var. *conica*, and *P. lasiophylla*.

| Characters                    | <i>P. longipetiolata</i> | <i>P. strobilifera</i> var. <i>strobilifera</i> | <i>P. strobilifera</i> var. <i>conica</i> | <i>P. lasiophylla</i>             |
|-------------------------------|--------------------------|---|---|-----------------------------------|
| <b>Ligule</b>                 |                          |   |   |                                   |
| Height (mm)                   | 4.5–6                    | 3   | 4–6                                       | 2–5                               |
| Apex                          | Emarginate               | Truncate  | Bilobed                                   | Rounded or truncate to emarginate |
| <b>Petiole</b>                |                          |   |   |                                   |
| Length (cm)                   | 6.5–8.0                  | Sessile or subsessile                           | Sessile or subsessile                     | Sessile or subsessile             |
| <b>Lamina</b>                 |                          |   |   |                                   |
| Shape                         | Lanceolate               | Narrowly lanceolate                             | Lanceolate to oblanceolate                | Narrowly lanceolate to linear     |
| Size (cm)                     | 47–60 × 4.5–7            | 54 × 3.5  | 24–59 × 12.2–13                           | 19.5–29 × 1.9–2.9                 |
| <b>Inflorescence</b>          |                          |   |   |                                   |
| Distance from the ground (cm) | 120–150                  | 15–60   | 2.5–71                                    | 2–3                               |
| Mucilage                      | Absent                   | Absent  | Absent                                    | Absent                            |
| <b>Bracteoles</b>             |                          |   |   |                                   |
| Length (mm)                   | 12–16                    | 5   | 20–24                                     | 10                                |
| <b>Calyx tube</b>             |                          |   |   |                                   |
| Length (mm)                   | 13–15                    | 10  | 25–27                                     | 16                                |
| <b>Labellum</b>               |                          |   |   |                                   |
| Shape                         | Orbicular                | Ovate   | Ovate                                     | Ovate                             |
| Color                         | Pink with orange tip     | Red with yellow tip                             | Scarlet with yellow tip                   | Dark red                          |
| <b>Lateral staminodes</b>     |                          |   |   |                                   |
| Shape                         | Linear to subulate       | Linear  | Oblong                                    | Oblong                            |
| <b>Anther crest</b>           |                          |   |   |                                   |
| Apex                          | Trilobed                 | Truncate  | Rounded                                   | 3-dentate or emarginate           |

**Etymology:** The epithet *longipetiolata* refers to the long petioles of the leaf blades.

**Provisional conservation status:** During the survey, only one flowering plant of *Plagiostachys longipetiolata* was encountered, and the range of distribution of this species is still unknown. Thus, this species is regarded as Data Deficient (DD) following IUCN guidelines (IUCN, 2019).

**Notes:** *Plagiostachys longipetiolata* also resembles *P. lasiophylla* J. Gobilik & A. Lamb from Sabah by having conspicuously undulating leaf blades and non-mucilaginous inflorescences. However, *P. longipetiolata* can be distinguished from *P. lasiophylla* in leaf morphology and plant height. It has petiole (6.5–8 cm vs. sessile or subsessile), larger lamina (47–60 × 4.5–7.0 cm vs. 19.5–29.0 × 1.9–2.9 cm), and taller habit (1.5–2.5 m vs. up to 0.5 m). Moreover, the inflorescence of *P. longipetiolata* emerges 1.2–1.5 m above the base of the leafy shoot (vs. 2–3 cm) with pinkish-yellow orbicular labellum (vs. dark red, ovate), longer bracteoles (12–16 mm vs. 10 mm), and linear to subulate lateral staminodes (vs. oblong).

Although fruits were not observed in *P. longipetiolata*, it significantly differs from *P. corrugata* in ligule length and apices (4.5–6 mm, emarginate vs. 8 mm, acute or obtusely rounded), petiole length (6.5–8.0 vs. 2–4 cm), and leaf sizes (47–60 × 4.5–7.0 cm vs. 20–30 × 5–6 cm). In addition, the infructescence of *P. corrugata* is borne from the basal portion of the stem while on the upper half or 1.2–1.5 m in *P. longipetiolata*. It also differs from *P. elegans* in terms of plant height (1.5–2.5 m vs. 40 cm), sheath texture (tomentose vs. glabrous), leaf attachment

(petiole vs. sessile), and shape of inflorescence (ovoid vs. obovoid). Detailed comparison between *P. longipetiolata* and allied species is presented in Table 2.

#### Key to Philippine *Plagiostachys*

1. Inflorescence borne > 1 m from the base of the leafy shoot; leaf margin strongly undulate ..... *P. longipetiolata*
1. Inflorescence borne ≤ 1 m from the base of the leafy shoot; leaf margin entire or undulate ..... 2
2. Lamina sessile or subsessile ..... 3
2. Lamina distinctly petiolate ..... 4
3. Leaves narrowly ovate; plant height up to 40 cm; sheath glabrous ..... *P. elegans*
3. Leaves narrowly oblong or oblanceolate; plant height more than 40 cm; sheath pubescent ..... *P. escriptorii*
4. Ligule glabrous ..... 5
4. Ligule hairy ..... 7
5. Calyx tube 2-lobed, short-hairy; ..... *P. philippinensis*
5. Calyx tube 3-lobed, glabrous; ..... 6
6. Anther crested; labellum oblong, subpanduriform; petiole 2 cm long ..... *P. parviflora*
6. Anther crestless; labellum obovate; petiole 4 cm long ..... *P. rolfei*
7. Fruit globose to subglobose; inflorescence non-mucilaginous ..... 8
7. Fruit ovoid or oblong; inflorescence mucilaginous or non-mucilaginous ..... 9
8. Inflorescence lax; bracteole tubular; pedicel 6–8 mm long ..... *P. lourdesiae*
8. Inflorescence congested; bracteole boat-like; pedicel ≤ 1 mm long ..... *P. subsessiliflora*
9. Ligule apex bilobed; fruit not corrugated ..... *P. albiflora*
9. Ligule apex obtuse to rounded; fruit corrugated ..... 10
10. Fruit red ..... *P. corrugata*
10. Fruit green ..... *P. lata*

**Other specimens examined:** *Plagiostachys escriptorii*: PHILIPPINES, Mindanao: District of Davao, Todaya (Mt. Apo), May 1909, *Elmer 10516* (MO [MO1787437-image!])





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