adansonia

2024 • 46 • 1

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art. 46 (1) — Published on 8 January 2024
www.adansonia.com

PUBLICATIONS SCIENTIFIQUES

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Adansonia est une revue en flux continu publiée par les Publications scientifiques du Muséum, Paris
Adansonia *is a fast track journal published by the Museum Science Press, Paris*

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Diffusion – Publications scientifiques Muséum national d'Histoire naturelle
CP 41 – 57 rue Cuvier F-75231 Paris cedex 05 (France)
Tél.: 33 (0)1 40 79 48 05 / Fax: 33 (0)1 40 79 38 40
diff.pub@mnhn.fr / http://sciencepress.mnhn.fr

ISSN (imprimé / *print*): 1280-8571/ ISSN (électronique / *electronic*): 1639-4798

Peliosanthes maheswariana D.Borah, N.Tanaka & Taram, sp. nov. (Asparagaceae), from Arunachal Pradesh, NE India, and *P. sinica* new to India

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Submitted on 24 February 2023 | accepted on 27 April 2023 | published on 8 January 2024

Borah D., Taram M. & Tanaka N. 2024. — *Peliosanthes maheswariana* D.Borah, N.Tanaka & Taram, sp. nov. (Asparagaceae), from Arunachal Pradesh, NE India, and *P. sinica* new to India. *Adansonia*, sér. 3, 46 (1): 1-8. https://doi.org/10.5252/adansonia2024v46a1. http://adansonia.com/46/1

ABSTRACT
Peliosanthes maheswariana D. Borah, N. Tanaka & Taram, sp. nov. is described and illustrated from West Kameng District of Arunachal Pradesh, NE India. It is similar to *P. sinica* F.T.Wang & Tang in sharing such characters as a long proximally creeping stem and tufts of leaves at some intervals, but can be clearly distinguished mainly by the larger leaves with more numerous longitudinal veins, longer peduncle, larger slightly drooping flowers and almost superior ovary. On the other hand, we also found *P. sinica* occurring in the same district of Arunachal Pradesh, which is a new record for the flora of India. We provided taxonomic data on these two species with notes concerning their relationships to congeners.

KEY WORDS
Asparagaceae,
Arunachal Pradesh,
eastern Himalayas,
flora,
plant geography,
new species.

RÉSUMÉ
Peliosanthes maheswariana *D.Borah, N.Tanaka & Taram, sp. nov. (Asparagaceae), de l'Arunachal Pradesh, Inde du Nord-Est, et* P. sinica*, nouvelle pour l'Inde.*
Peliosanthes maheswariana D. Borah, N. Tanaka & Taram, sp. nov. est décrite et illustrée, elle a été récoltée dans le district de West Kameng dans l'état d'Arunachal Pradesh au NE de l'Inde. Elle ressemble à *P. sinica* F.T.Wang & Tang par ses longues tiges proximales rampantes et ses feuilles regroupées par intervalles, mais s'en distingue visiblement par ses feuilles plus larges à nervures longitudinales plus nombreuses, un pédoncule inflorescentiel plus long, des fleurs plus grandes et légèrement penchées, ainsi qu'un ovaire pratiquement supère Par ailleurs, *P. sinica* est aussi reconnu dans ce même district, et constitue un nouvel enregistrement pour la flore de l'Inde. Des notes taxonomiques sont fournies sur ces deux espèces, ainsi que sur leurs rapports avec les espèces affines.

MOTS CLÉS
Asparagaceae,
Arunachal Pradesh,
Himalaya oriental,
flore,
phytogéographie,
espèce nouvelle.

INTRODUCTION

Peliosanthes Andrews (Andrews 1810: t. 605) is classified in Convallariaceae (Dahlgren *et al.* 1985) or in the tribe Convallarioideae (Tanaka & Nguyen 2023) of Asparagaceae (Chase *et al.* 2009; APG IV 2016). It comprises approximately 70 species (Tanaka & Kalyuzhny 2020) distributed in south and southeast Asia, covering India, Nepal, Bhutan, Bangladesh, Myanmar, Thailand, Malaysia, Indonesia, Laos, Cambodia, Vietnam, China and Taiwan (Jessop 1976). Recently, many new taxa of this genus have been described especially from eastern Indochina (e.g. Tanaka & Kalyuzhny 2020; Averyanov *et al.* 2021; Nguyen *et al.* 2021; Vislobokov *et al.* 2022) and northeastern India. From the latter region, nine species and one variety have been reported as new since 2017 (Roy *et al.* 2017, 2020; Tanaka 2018, 2019; Borah *et al.* 2020; Odyuo *et al.* 2020; Taram *et al.* 2020). Of these taxa, three species, *P. arunachalensis* D.K.Roy, A.A.Mao & Aver. (Roy *et al.* 2017: 15), *P. nagalandensis* Odyuo, D.K.Roy, N.Tanaka & A.A.Mao (Odyuo *et al.* 2020: 286) and *P. tobuensis* Odyuo, D.K.Roy, Lytan, N.Tanaka & A.A.Mao (Odyuo *et al.* 2020: 290), are known to share a long proximally creeping stem.

In December 2022, while conducting a field survey in West Kameng District, Arunachal Pradesh, NE India, the first two authors encountered two unfamiliar species of *Peliosanthes* with an elongate, proximally creeping stem; one was in flower, bearing many small dark purple flowers and comparatively small leaves, while the other was still in early bud and had larger leaves with more numerous longitudinal veins. These two plants apparently represented different species. To investigate the flowers of the latter plant, the first author again made a trip to the habitat in January 2023. Besides observations in the field, some specimens of the plant bearing flowers were collected and brought back to the laboratory for further study. On closer examination of both plants, we came to the conclusion that the plant collected earlier (in 2022) is *P. sinica* F.T.Wang & Tang (Wang & Tang 1978: 253) which was originally described from Yunnan, SW China. This species has been recorded also from Laos (Averyanov *et al.* 2015) and Thailand (Chayamarit *et al.* 2014), but not from India. The other plant we had collected later (in 2023) proved to be quite a new, very distinct species. We named it *P. maheswariana* D.Borah, N.Tanaka & Taram, sp. nov. Here we provide data on the morphological and ecological aspects of the two species with photographic illustrations and notes concerning their relationships to some similar species.

MATERIAL AND METHODS

Flowering specimens of both the species were collected from West Kameng district of Arunachal Pradesh, North East India, on 02 December 2022 and 10 January 2023 respectively. All parts of the plants were photographed using a digital camera (Nikon D3300, Nikon Inc.). The collected specimens were processed using standard herbarium methods (Jain & Rao 1977) and deposited in the Indian herbaria ASSAM and ARUN. Besides observations mainly of the ecological aspects in the habitat, the morphological characters of the plants of *Peliosanthes* were examined closely at the laboratory. Measurements of various portions of the plants were made chiefly on living samples. Examination of digitized images of relevant herbarium specimens (including types) was performed on the websites hosted by Chinese Virtual Herbarium (http://www.cvh.org.cn/), Herbarium LE (https://en.herbariumle.ru), and by the Muséum national d'Histoire naturelle (https://science.mnhn.fr/).

SYSTEMATICS

Family Asparagaceae Juss.
Genus *Peliosanthes* Andrews

Peliosanthes maheswariana
D.Borah, N.Tanaka & Taram, sp. nov.
(Figs 1, 2; Table 1).

Peliosanthes maheswariana sp. nov. is similar to *P. sinica* F.T.Wang & Tang in having an elongate proximally creeping stem, short anthers and a pistil distally abruptly tapering into a conical style, but differs mainly by the larger leaves with more numerous longitudinal veins, longer peduncle, larger drooping (vs ascending) flowers, internally whitish yellow (vs purple or greenish purple) perianth, larger corona with a relatively narrow distal opening, and almost superior (vs half-inferior) ovary.

Type material. — **India** • Arunachal Pradesh, West Kameng district, West Kameng; alt. 800-900 m; 10.I.2023; *D. Borah 4045* (holo-, ASSAM!; iso-, ARUN!).

Etymology. — The species is named in honor of Shri. Maheswar Borah, a dedicated plant grower of Biswanath, Assam, who has funded the trips of the first author to remote localities of the region in search of plants.

Distribution. — NE India (Arunachal Pradesh).

Phenology. — Flowering in December-February.

Habitat and ecology. — The new species was growing abundantly on rocks or forest floor in the slopes of the type locality above 800 m a.s.l. The area was very close to a perennial stream, but the area remains dry from November to March. It was growing in association with *Begonia hatacoa* Buch.-Ham. ex D.Don, *Dendrocnide sinuata* (Blume) Chew, *Begonia* sp., *Pothos* sp., *Syzygium* sp., *Psychotria* sp., *Dalhousiea bracteata* (Roxb.) Graham ex Benth., *Pseuderanthemum leptanthum* (C.B.Clarke) Lindau, etc.

Description

Terrestrial or lithophytic, glabrous evergreen perennial herbs. **Stem** distally erect to ascending, proximally creeping and rhizome-like, part above ground up to 1 m tall (including leaves on top of stem), proximal creeping part up to 1 m long, terete, up to 0.8 cm in diam., green, annual nodes spaced at intervals of 8-14.5 cm, up to *c.* 1.8 cm in diam.; **scaly leaves** (scales) deltoid-ovate, lanceolate, or narrowly deltoid, 1-20 cm long, 0.8-2 cm wide at base (when expanded), acute or acuminate, brownish, hyaline along margins,

Fig. 1. — *Peliosanthes maheswariana* D.Borah, N.Tanaka & Taram, sp. nov.: **A**, **B**, plants in habitat; **C**, entire plant; **D**, distal part of flowering and fruiting stem; **E**, distal part of flowering stem; **F**, adaxial surface of leaf; **G**, abaxial surface of leaf. Photos by D. Borah; layout by D. Borah & N. Tanaka. Scale bars: C-E, 10 cm.

ephemeral, those sheathing apical portion of stem several, basally imbricate; scars (nodes) of scales between annual nodes 11-15, often with fibrous remnants, spaced at intervals up to 1.7 cm long. **Roots** 1 to a few (*c.* 3) from annual nodes aged at least 1 year, wiry, some stilt-like, proximally rigid, up to 3 mm in diam. **Leaves** 1-2 from annual node, persistent usually for up to 3 years, petiolate; *petiole* rigid, subterete, 10-30 cm long, 3-5 mm wide, suberect; *blade*

TABLE 1. — Comparison of selected key characters and distribution between five long-caulescent species of *Peliosanthes*. Data excerpted from Odyuo *et al.* (2020) for *P. nagalandensis* and *P. tobuensis*, Roy *et al.* (2017) for *P. arunachalensis*, and the present paper for *P. maheswariana* sp. nov. and *P. sinica* (from NE India). Abbreviations: **Arun. Prad.**, Arunachal Pradesh; **Nagal.**, Nagaland.

Character/ distribution	***P. maheswariana* D. Borah, N. Tanaka & Taram, sp. nov.**	***P. nagalandensis* Odyuo, D.K.Roy, N.Tanaka & A.A.Mao**	***P. tobuensis* Odyuo, D.K.Roy, Lytan, N.Tanaka & A.A.Mao**	***P. arunachalensis* D.K.Roy, A.A.Mao & Aver.**	***P. sinica* F.T.Wang & Tang**
Longitudinal veins per blade	64-68, of which 16-17 thicker	10-15	9-17	Many	9-13
Flower diameter (mm)	13-16	12-15	8-12	12-15	7-8.5
Raceme length (cm)	(6)9-15	5-7	2-4	2-3	5-12
Corona color, base outline, diameter (mm)	Cream yellow, orbicular, 6-7.5	Dark purple, hexagonal, 4.5-6	Dark purple, hexagonal, 3.5-4	(color not reported), hexagonal, 4-4.5	Dark purple, orbicular to hexagonal, 3.5-4
Anther length (mm)	1.2-1.3	2-2.5	0.3-0.4	3-3.5	0.5
Ovary	Almost superior	Inferior	Superior	Superior	Half-inferior
Distribution	NE India (Arun. Prad.), SW China	NE India (Nagal.)	NE India (Nagal.)	NE India (Arun. Prad.)	NE India, NE Thailand, N Laos, SW China

(narrowly) elliptic, 20-40 cm long, 5-10 cm wide, arcuate, base attenuate, margins entire, apex acute to acuminate, subplicate, glabrous, glossy on both surfaces, longitudinal veins 64-68 (16-17 thicker and 3 thinner veins within the thicker ones), cross-veinlets fine, inconspicuous, perpendicular to oblique to longitudinal veins, straight to variously curved. **Flowering stem** (including peduncle and inflorescence rachis) 25-32 cm long, usually slightly declined, flattened and narrowly two-edged; *peduncle* often slightly curved near base, rigid, up to 17 cm long, 3 mm wide, green; *inflorescence* a raceme, rachis (6)9-15 cm long, green, bearing 18-30 flowers. **Bracts** (including those on peduncle) antrorse, narrowly triangular to subulate, 4-23 mm long, 1.5-5 mm wide (at base), green or light green, hyaline along margins; sterile bracts on peduncle 2-5 (excluding basal ones); fertile (floral) bracts 2 (1 outer bract and 1 inner bracteole) for each flower, outer bracts exceeding floral buds, inner bracteoles 1-2 mm long, *c.* 1 mm wide, lanceolate, acuminate. **Flowers** turned toward the same side, slightly drooping, solitary in bracts, 1.3-1.6 cm across, pedicellate; *pedicels* terete, 2-3 mm long, straight and ascending when flowers are in bud, becoming curved in flower and in fruit, green, purplish or blackish green. **Perianth** bowl-shaped, fleshy, externally green to dark purple, glossy, internally whitish yellow, distally 6-cleft; *proximal syntepalous part* flatly saucer-shaped, 3.5-3.8 mm long, basally abruptly narrowed into a very small stalk much shorter than pedicel; *segments* obliquely spreading, broadly or deltoid-ovate, 4-6 mm long, 4.5-5 mm wide, apex obtuse to rounded, entire. **Stamens** 6, monadelphous; *corona* epitepalous, hemispheric or conoid with wall incurved distally, thickened toward base, wall at base 1.5-1.8 mm thick, basal outline orbicular, 6-7.5 mm in diam. at base, 3 mm high, surface whitish yellow, fleshy, apical opening relatively narrow, rounded, scarcely lobed, 2 mm in diam.; *anthers* 6, sessile, nearly vertically attached to orifice of corona, ovate, 1.2-1.3 mm long, introrse, creamy; *pollen* creamy. **Pistil** 1, 3 mm high, pale green; *ovary* almost superior (or very slightly half-inferior), hemispheric, 1.5 mm high and 3.5 mm wide at base, trilocular; *ovules* 4 per locule, borne on basal central placenta; *style* subconic, truncate at apex, 1.5 mm long, 1-1.5 mm wide at base, *stigma* trisected, 0.8 mm wide. **Immature seeds** ovoid-ellipsoid, up to 1.5 cm long, 1 cm wide, green.

TAXONOMIC RELATIONSHIPS

Peliosanthes maheswariana sp. nov. shares a long, proximally creeping stem with six other species so far known. Three of these six species were originally described from SW China; *P. sinica*, *P. pachystachya* W.H.Chen & Y.M.Shui (Chen & Shui 2003: 489) and *P. minutiflora* N.Tanaka, J.Murata & S.K.Wu (Tanaka *et al.* 2013: 135). The new species is distinguishable from them chiefly by the larger leaf blades with more numerous longitudinal veins, longer peduncle, larger drooping (vs ascending) flowers, internally whitish yellow (vs purple or greenish purple) perianth, larger corona with a relatively narrow distal opening, and almost superior (vs distinctly half-inferior) ovary. The other three of the six species were described from NE India; *P. arunachalensis* (Roy *et al.* 2017), *P. nagalandensis* and *P. tobuensis* (Odyuo *et al.* 2020). *P. maheswariana* sp. nov. differs from *P. arunachalensis* mainly by the longer leaf blades (20-40 vs 16.5-21.5 cm), longer racemes (6-15 vs 2-3 cm), more numerous flowers (18-30 vs 7-10), and shorter anthers (1.2-1.3 vs 3-3.5 mm); from *P. tobuensis* by the longer racemes (6-15 vs 2-4 cm), orbicular (vs hexagonal) corona and longer anthers (1.2-1.3 vs 0.3-0.4 mm); from *P. nagalandensis* by its shorter anthers (1.2-1.3 vs 2-2.5 mm) and almost superior (vs inferior) ovaries. Several selected key distinguishing characters of *P. maheswariana* sp. nov. and four other related species are compared in Table 1. For the details of differences between the six previously known long-caulescent species and an identification key to them, see Odyuo *et al.* (2020).

The long, proximally creeping stem of these seven species (including *P. maheswariana* sp. nov.) is deemed as apomorphic (vs acaulescent or short stem). The species having this trait are hence regarded as members of a monophyletic group. It is highly desirable to conduct a further analysis of their evolutionary relationships.

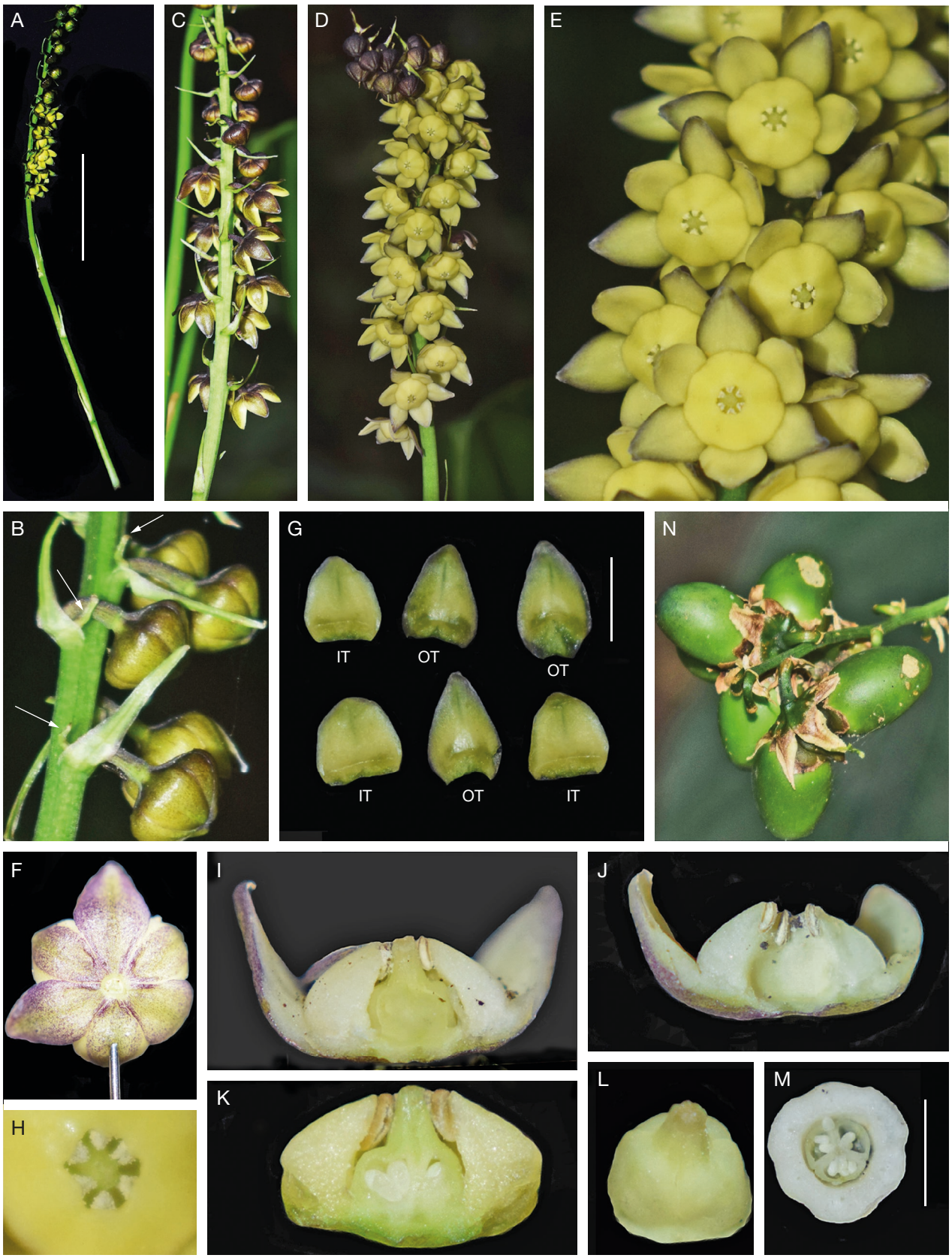

FIG. 2. — *Peliosanthes maheswariana* D.Borah, N.Tanaka & Taram, sp. nov.: **A**, flowering stem; **B**, portion of young raceme with bracteoles arrowed; **C**, **D**, inflorescence; **E**, portion of inflorescence; **F**, back view of flower; **G**, perianth segments (**IT**, inner tepal; **OT**, outer tepal); **H**, part of corona showing the apical orifice; **I**, **J**, longitudinal section of flower, with pistil (**I**) or pistil removed (**J**); **K**, longitudinal section of corona and pistil; **L**, pistil, view from above; **M**, transversal section of ovary showing locules and ovules; **N**, immature fruit-like seeds. Photos by D. Borah; layout by D. Borah & N. Tanaka. Scale bars: A, 5 cm; G, M, 5 mm.

Peliosanthes sinica F.T.Wang & Tang.
(Fig. 3)

Flora Reipublicae Popularis Sinicae 15: 253 (Wang & Tang 1978).

ORIGINAL DESCRIPTION. — *Species nova caulis 5.5-18.5 cm vel ultra longo plus minusive procumbenti notabilis*.

TYPE MATERIAL. — **China** • Yunnan, Simao; 1200 m; plant 30 cm high; flowers violet; 28.IV.1957; *China – Soviet Union joint expedition to Yunnan 8178* (holo-, PE [PE00036760], image seen).

DISTRIBUTION. — NE India (Arunachal Pradesh – new record), NE Thailand (Chayamarit *et al.* 2014), NE and central Laos (Averyanov *et al.* 2015), SW China (Wang & Tang 1978).

PHENOLOGY. — Flowering in November-December (Arunachal Pradesh).

HABITAT AND ECOLOGY. — Plants of *P. sinica* were growing in abundance in dry floor of subtropical forests of Sessa (Arunachal Pradesh).

SPECIMENS EXAMINED. — **India** • Arunachal Pradesh, West Kameng district, Sessa; 700-800 m; 02.XII.2022; *D. Borah & M. Taram 4016* (ASSAM!).
China • Yunnan, Cheli Hsien [Jinghong]; 1400 m; X.1936; *C.W. Wang 79161* (para-, PE[PE00036761, PE00290266]).
Laos • Vientian Prov., Kasi Distr.; *c.* 900 m; 22.III.2013; *L. Averyanov et al. LA-VN 723* (LE[LE01049919]) • Houphan Prov., Hem Distr.; 700-900 m a.s.l.; 12.IV.2015; *N.T. Hiep et al. LA-VN 1378* (LE[LE01058044], P[P00991539]) • Xiangkhouang Prov., Kham Distr.; 1200-1400 m a.s.l.; 4.IV.2015; *T.H. Nguyen et al. LA-VN 1074* (LE[LE01049915], P[P00910379]).

REMARK
Peliosanthes sinica is characterized by the long, proximally creeping stem, tufts of leaves at intervals, peduncles shorter than the inflorescence, small anthers 0.4-0.6 mm long, and half-inferior ovaries abruptly tapering into a conical style. It is similar to both *P. pachystachya* W.H.Chen & Y.M.Shui and *P. minutiflora* N.Tanaka, J.Murata & S.K.Wu, but differs from the former mainly by the shorter pedicels (2-2.5 vs 9-10 mm long, Chen & Shui 2003), and from the latter by the larger flowers (6-8.5 vs 2.5-3 mm in diameter, Tanaka *et al.* 2013).

DESCRIPTION (BASED ON SPECIMENS FROM INDIA)
Terrestrial glabrous evergreen perennial herbs. **Stem** up to 50 cm long, up to 0.5 cm in diam. including proximal creeping portion, part above ground usually erect, 15-20 cm high, unbranched, apical portions covered with several basally imbricate transitory sheathing scales up to 7.5 cm long, annual nodes spaced at intervals of 10-16 cm, scars of scales between annual nodes 5-8 (excluding those on annual nodes), spaced up to 4 cm. **Roots** few, wiry, some stilt-like, proximally rigid, up to 3 mm in diam. **Leaves** 1-3 from annual node, suberect, petiolate; *petiole* sub-terete, 8-15 cm long, 2 mm wide; *blade* narrowly elliptic, 16-20 cm long, 3.5-5(7) cm wide, base attenuate, margin entire, often wavy, apex acute to acuminate, sub-plicate, main longitudinal veins 9-13, transverse veinlets fine, sub-perpendicular to longitudinal veins. **Flowering stem** (including peduncle and inflorescence rachis) 13-18 cm long, flattened, longitudinally ribbed, purplish green; *peduncle* erect, sometimes curved, rigid, 2-4 cm long, 2 mm wide, greenish; *inflorescence* a raceme, rachis 11-14 cm long, green, bearing 21-30 flowers. **Bracts** on peduncle 2, floral bract 1 for each flower (bracteole lacking), narrowly triangular, 6-10 mm long, 1-5 mm wide (when flattened), green or light green, hyaline along margins. **Flowers** solitary in bracts, usually slightly ascending to rachis, 6-8.5 mm across, pedicellate; *pedicels* straight, sub-terete, 2-2.5 mm long, slightly ascending, green to purple. **Perianth** fleshy, dark purple, distally 6-cleft; *proximal syntepalous part (tubular part)* obconic, 2 mm high, 3 mm long, basally abruptly narrowed into short stalk which is 1.2 mm long and shorter than pedicel; *segments* outspread, often recurved, ovate or triangular-ovate, 2.5-3.3 mm long, 2-2.5 mm wide (outer 3 slightly wider at base than inner 3), usually slightly revolute laterally, apex obtuse. **Stamens** 6, monadelphous; *corona* epitepalous, annular, wall thickened toward base, incurved, orbicular to hexagonal at base, 0.5 mm high, 3.5-4 mm in diam. at base, dark purple, distally scarcely lobed, apical opening rounded, 2-2.5 mm in diam.; *anthers* 6, elliptic or orbicular, *c.* 0.5 mm long, introrse, sessile, nearly vertically attached to orifice of corona, creamy; *pollen* creamy. **Pistil** 1; *ovary* half-inferior, distal exposed portion hemispheric, 0.7 mm high, 2 mm wide at base, trilobed, slightly purplish, trilocular; *ovules* 4 in one locule, borne on basal central placenta; *style* conoid-columnar, 1 mm long, purple, trilobed, apically truncate; *stigma* trisected, *c.* 0.4 mm across.

TAXONOMIC RELATIONSHIPS
As said above, *Peliosanthes sinica* is considered to be very close to both *P. pachystachya* and *P. minutiflora.* These three species are so similar in many characters that their taxonomic identities are to be reexamined more closely by analyzing their variation on a wider range of specimens. Comparison of character states between *P. sinica* and four related species is made in Table 1.

The habitat discovered in West Kameng District, Arunachal Pradesh, India, which lies on a southern flank of the southeast Tibetan Plateau, is now the westernmost locality in distribution of *P. sinica*.

Since a total of 13 species of *Peliosanthes* have been reported from NE India (Odyuo *et al.* 2020; Roy *et al.* 2020), the present discoveries of the two species, *P. maheswariana* sp. nov. and *P. sinica*, bring the total number to 15 in this region.

Acknowledgements
The authors are thankful to Jumter Nyorak, Ojar Taku, Dhiraj Gupta, Ranjit Kakati, Poonam Thapa and Niku Das for their help during collecting the specimens and two anonymous reviewers to improve the quality of this article.

Fig. 3. — *Peliosanthes sinica* F.T.Wang & Tang.: **A**, entire plant; **B**, distal part of flowering plant in late anthesis; **C**, abaxial surface of leaf; **D**, young inflorescence; **E**, **F**, portion of inflorescence in late anthesis; **G**, flower; **H**, longitudinal section of flower. Photos by D. Borah; layout by D. Borah & N. Tanaka. Scale bars: A, B, 10 cm.

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Submitted on 24 February 2023;
accepted on 27 April 2023;
published on 8 January 2024.