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SEVEN NEW SPECIES OF *MAXILLARIA* FROM PANAMA AND COSTA RICA

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Six of the following new species are described from Panama and one, *M. cacaoensis,* from Cerro Cacao, Costa Rica. Any of the five species described from western Panama could also occur in adjacent Costa Rica.

Maxillaria cacaoensis J.T. Atwood, sp. nov. FIGURE 1.

TYPE: COSTA RICA. Prov. Guanacaste: Cantón of Liberia, Cordillera de Guanacaste, Cerro Cacao, Estación Cacao, 1,100 m, 10 Feb 1995, *A. Mora 60* (Holotype: INB; Isotype: SEL).

Planta a *Maxillariae mombachoensis* J.T. Atwood similis sed foliis brevioribus crassioribusque et ovario breviore differt.

Plant cespitose, apparently densely so, to about 10 cm tall; roots to ca. 2 mm in diameter. Pseudobulbs coarsely rugose in dried specimens, semiorbicular, compressed, 2–3.5 × 2.5 cm, subtended by sheaths that are apparently bladeless; apex 1-foliate. Leaves coriaceous, strongly keeled beneath especially apically; blades 6–9 × 2–3 cm in the type, obtuse. Inflorescences short; scapes ca. 3 cm concealed by inflated bracts; ovary about 1.5 cm long, concealed by the subtending floral bract. Flowers campanulate to somewhat spreading, yellowish orange with white at the base of the sepals and petals; lip reddish. Sepals ovate-lanceolate, 3.5 × 1.5 cm, acute. Petals elliptic-oblanceolate, acute, 2.8 × 1 cm. Lip hinged to the column foot, sharply 3-lobate at about ⅖ from the base; lateral lobes rounded in front, somewhat clasping the column; midlobe fleshy, ovate, recurved to somewhat reflexed, ca. 1.8 × 1.4 cm in natural position, bluntly acute to obtuse; calli 2, of 2 keels at the base and a central ligulate callus rounded in front ending just below the base of the midlobe. Column stout, nearly straight, ca. 1.4 cm long including anther; foot 5–6 mm long; anther ca. 4 mm.

ETYMOLOGY: named for the type locality, Cerro Cacao.

Maxillaria cacaoensis is known only by the type collection from a cloud forest in Northern Costa Rica at 1,100 m elev. It is most similar to Nicaraguan *M. mombachoensis* in flower color and in the large floral bracts, but has a much shorter ovary and noticeably shorter and thicker leaves. There may be yet another taxon on one of the islands in Lake Nicaragua with smaller flowers. Apparently isolation on these mountaintops enables the separate populations to develop identifiably different morphological characteristics. Pollinators in this group are unknown, but the large, inflated floral bracts and fleshy orange to yellow flowers suggests pollination by hummingbirds. The collection date of the type indicates at least a January and February flowering season.

Maxillaria cacaoensis is a member of the difficult *M. cucullata* Lindl. complex represented in Costa Rica by four species and in Panama by two. The following key should distinguish them in this area.

1. Ovary trigonous, e.g., triangular in cross section; flowers greenish stained with maroon . . . . . *M. cf. obscura* Lind. and Rchb.f.
1. Ovary not trigonous, not triangular in cross section, flowers not colored as above 2
   2. Flowers orange or green, peppered with maroon; lip usually dark maroon . . . . . *M. puncto-striata* Rchb.f.
   2. Flowers not peppered with maroon, lip never dark maroon 3
      3. Sepals and petals cream white, lip not red; scapes longer than 7 cm. . . . . *M. cedralensis* J.T. Atwood and D.E. Mora
      3. Sepals and petals yellow to orange, white at the base, lip red; scapes less than 5 cm . . . . . *M. cacaoensis* J.T. Atwood

Maxillaria darienensis J.T. Atwood, sp. nov. FIGURE 2.

TYPE: PANAMA. Prov. Darien: Cerro Pirre, valley between Pirre and next most southerly peak, 10–20 Jul 1977, *Folsom 4412* (Holotype: MO; Isotype: SEL).

A *Maxillariae ampliflorae* C.Schweinf. affinis sed floribus minoribus, labelli lobis brevioribus distinguitur.

Plant an upright or decumbent cane forming epiphyte of unknown height but probably large; base of plant unknown. Stems to about 1 cm in diameter, roots to about 1 mm in diameter. Pseudobulbs compressed, ovoid, ca. 5 × 2.5 cm (*N* = 1), mostly concealed by subtending, smooth, foliaceous sheaths, somewhat furrowed when dry, apically 1-foliate. Leaves increasing in size

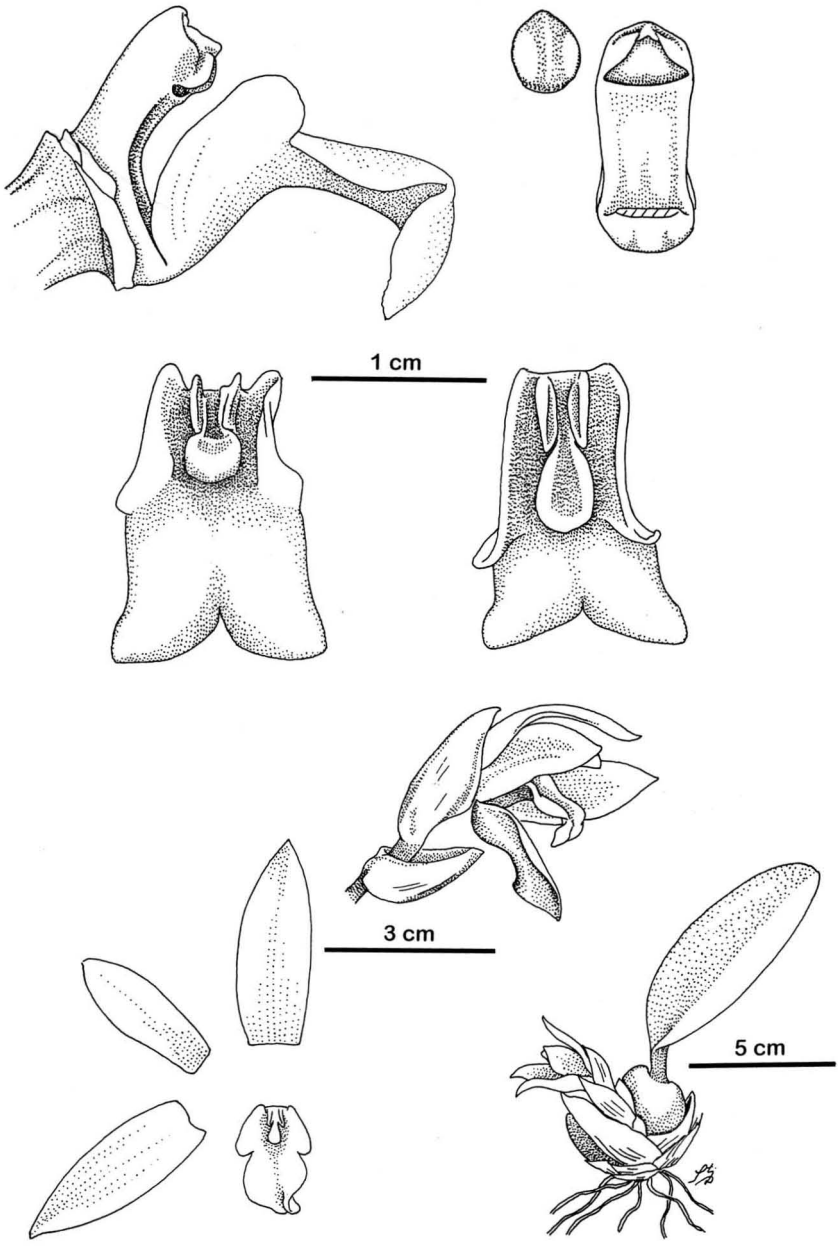

FIGURE 1. *Maxillaria cacaoensis* J.T. Atwood. Drawn by S. Dalström based on *Mora 60* (SEL).

towards the apex of each shoot, soon deciduous below; petiole short or long, not abruptly narrowed above the somewhat oblique articulation; blade thin, elliptic, 2–23 × 1–3.5 cm, obtuse to rounded. Inflorescences appearing in the flush of new growth, each subtended by a half lyre shaped rhizome bract; scape 4–6 cm loosely concealed by conduplicate scape bracts; ovary 9–11 mm long, exceeded by the conduplicate, acute floral bract 1.5–1.75 cm long. Flowers campanulate, according to collectors white, or sepals and petals white with pink band centrally, lip white and yellow with reddish outline; probably turning yellow with age (*de Nevers et al. 5524*). Sepals similar, elliptic-lanceolate, 2–2.4 × 0.6–0.8 cm, acuminate; laterals forming a

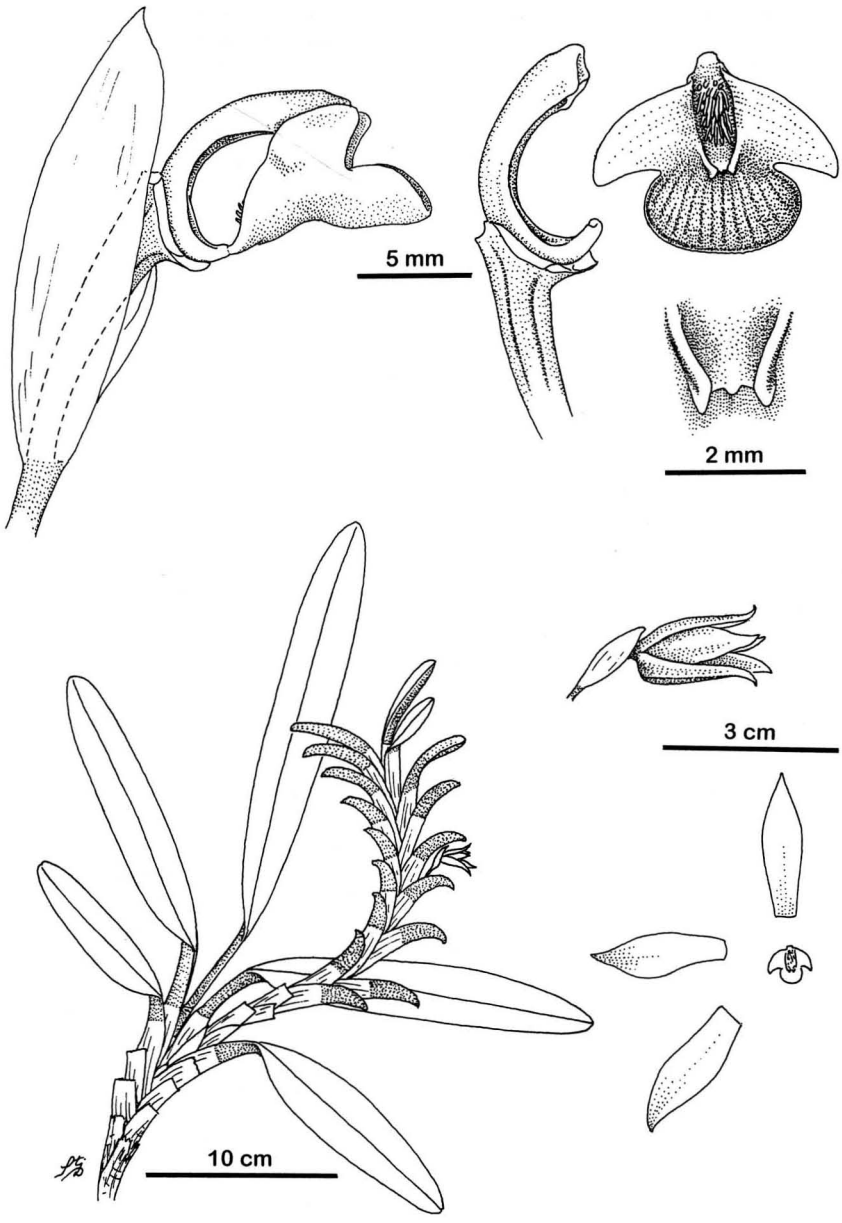

FIGURE 2. *Maxillaria darienensis* J.T. Atwood. Drawn by S. Dalström: plant habit based on *Folsom 6335* (MO); floral diagnosis based on *Folsom 4412* (SEL).

mentum ca. 3 mm long. Petals elliptic-oblanceolate, ca. 2.1 × 0.55 cm, acuminate. Lip about as broad as long, 7–9 × 7–9 mm when spread, 3-lobate on the upper ⅓; lateral lobes somewhat embracing the column, falcate, bluntly acute in front; midlobe semiorbicular ca. 3.5 mm across, somewhat fleshy with moderately inrolled margin; callus fleshy terminating at the base of the midlobe, tuberculate towards the base. Column arching, slightly broadened above, 8 mm long excluding foot (ca. 2.5 mm) and anther. Capsule unknown.

PARATYPES: Comarca de San Blas: Cerro Brewster, 850 m, Premontane rain forest, *de Neve, et al. 5524* (MO). Prov. Darien: Ridge top

area north of Cerro Pirre, between Cerro Pirre top and Rancho Plastico, 1,200–1,400 m, *Folsom, Contrerra, and Brijilio 6335* (MO).

ETYMOLOGY: Named for the province, Darien, in which the type collection was made.

Maxillaria darienensis is known only in eastern Panama, although reports of *M. bradeorum* (Schltr.) L.O. Williams and *M. ampliflora* C. Schweinf. from Colombia and Ecuador may be based on this species. It is most similar to *M. ampliflora* but is somewhat intermediate in size with *M. bradeorum,* a species with usually more purple-saturated flowers and with proportionately longer and sharply acute lateral lobes. Both *M. ampliflora* and *M. bradeorum* are sympatric in western Panama and Costa Rica where no hybrids have been recorded. Little is known of *M. darienensis.* It belongs to a group of species long ago classified in the genus *Camaridium* characterized by large plants with canes sometimes more than 2 m high and usually ephemeral flowers. According to herbarium records *M. darienensis* is a mid elevation species (850–1,400 m) of premontane and lower montane rain forests.

Maxillaria lutheri J.T. Atwood, sp. nov.
FIGURE 3.

TYPE: PANAMA. Prov. Bocas del Toro: Cerro Colorado, above the Copper Mine, elev. ca. 1,600 m, Jun 1986, *Luther et al. 1068* (Holotype: SEL).

A *Maxillariae sigmoideae* affinis sed labello longiore et labelli lobis lateralis non falcatis recedit.

Plant an erect to decumbent cane forming epiphyte to about 1 m high. Stems erect when young becoming decumbent with age, the new shoots developing at the base of the pseudobulb; rhizome much elongate, to about 40 cm; roots to about 1.5 mm in diameter. Pseudobulbs small and hidden by 4–5 foliaceous bracts, to ca. 4 × 1 cm, apically 1-foliate. Leaves very obliquely articulate to the conspicuous sheath; petiole conspicuous, to ca. 7 cm, longer and narrower in the apical leaf, conspicuously narrowed above the articulation; blade somewhat chartaceous, keeled beneath, elliptic, to 25 × 3.5 cm, acuminate, rather dark in dried specimens. Inflorescences appearing along rhizomes of developing shoots; scapes to ca. 4 cm subtended by conduplicate, acute rhizome bracts; ovary 7–8 mm long subtended by a floral bract 1.5–1.8 cm. Flowers campanulate, pink to lavender with white lip. Sepals similar, the laterals forming a rounded mentum, ovate-lanceolate, 15–20 × 6–8 mm, somewhat keeled beneath apically, apex acuminate. Petals oblanceolate to obovate, with about 5 veins, 14–17 × 5 mm, acute. Lip fixed and continuous with the column foot, ca. 10 × 4 mm in natural position, 3-lobate on the upper ⅓, deeply saccate at the base; lateral lobes not projecting in front, embracing the column; midlobe fleshy, ovate, 3–4 × 3 mm. Column somewhat arcuate, ca. 1 cm long including the anther; callus rounded and projecting just beyond the sinuses between lobes; column foot ca. 2 mm long; anther ca. 1.5 mm long. Capsule ca. 2 cm long, oblanceolate.

PARATYPES: PANAMA. Prov. Chiriquí: Cerro Hornito, NNE of Gualaca, elev. 1,750–2,000 m, 27 Dec 1977, *Dressler 5761* (SEL). Trocha 3 de noviembre, near Paso de la Zorra shelter, elev. ca. 1,300 m; 5 Apr 1978, *Dressler 5807* (SEL). Cerro Colorado, alt. 1,750 m, *Luer et al. 10559* (MO). South slopes of Cerro Pate Macho along Río Palo Alto; 1,300–1,800 m, 11 Nov 1981, *Knapp, Herre and Coley 2084* (MO). Cerro Colorado, mining road 20 mi above bridge over Río San Félix, 2,000 m, 21 Nov 1979, *Antonio 2611* (MO).

ETYMOLOGY: named for the senior collector, Harry Luther, Director of the Bromeliad Identification Center, Selby Gardens.

Maxillaria lutheri is a rather attractive species of cloud forests apparently endemic to western Panama at 1,300–2,000 m. It should also occur in Costa Rica. It belongs to a group of species that includes *M. minor* (Schltr.) L.O. Williams, *M. paleata* (Rchb.f.) Ames and C. Schweinf. (syn: *M. wrightii* (Schltr.) Ames & C. Schweinf.), *M. schlechteriana* J.T. Atwood, *M. sigmoidea* (C. Schweinf.) Ames and Correll, and *M. vaginalis* Rchb.f. It is most closely related to *M. sigmoidea* but the lateral lobes of the shorter lip do not project forward.

Maxillaria scalariformis J.T. Atwood, sp. nov.
FIGURE 4.

TYPE: PANAMA. Prov. Chiriquí: near "Vivero," 2–3 km. So. of Fortuna dam site, Valle de Hornito, 10 May 1982, *R.L. Dressler 6050* (Holotype: SEL).

Planta caulibus elongatis, a *Maxillariae tricarinatae* J.T. Atwood affinis, floribus grandioribus et callo non carinato differt.

Plant an erect, cane forming, often branched epiphyte to at least 50 cm. Stems erect to decumbent, 0.8–1.0 cm in diameter, concealed by nearly smooth leaf sheaths; larger roots to 2 mm in diameter. Pseudobulbs absent (juveniles?). Leaves borne along the canes, soon deciduous below; blades suddenly narrowed above the articulation, thin to subcoriaceous, lanceolate, 3.5–13 × 1.0–2.2 cm, unequally 2-lobate, apiculate,

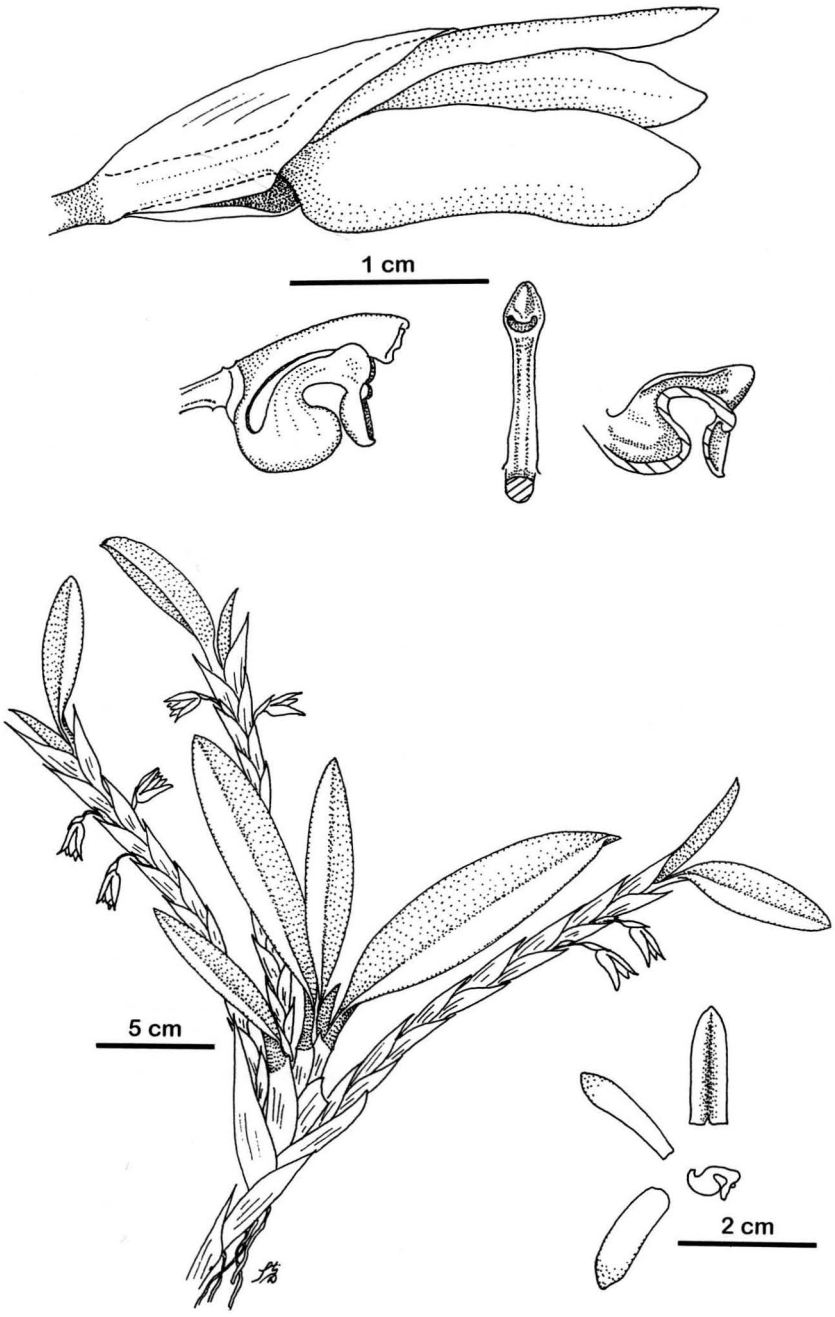

FIGURE 3. *Maxillaria lutheri* J.T. Atwood. Drawn by S. Dalström based on *Luther et al. 1068* (SEL).

each lobe rounded. Inflorescences 2 or more per leaf axil, and much shorter than the subtending leaf, scapes ca. 5 cm, not completely concealed by conduplicate, acute, scape bracts; ovary 0.8–1.3 cm, exceeded by the subtending floral bract 1.5–1.6 cm. Flowers large and attractive, about 4 cm across, pink to lavender with spreading recurved segments. Sepals similar, each with 5 or more nerves, elliptic-lanceolate, 1.7–2.6 × 0.5–0.9 cm, acute to shortly acuminate. Petals

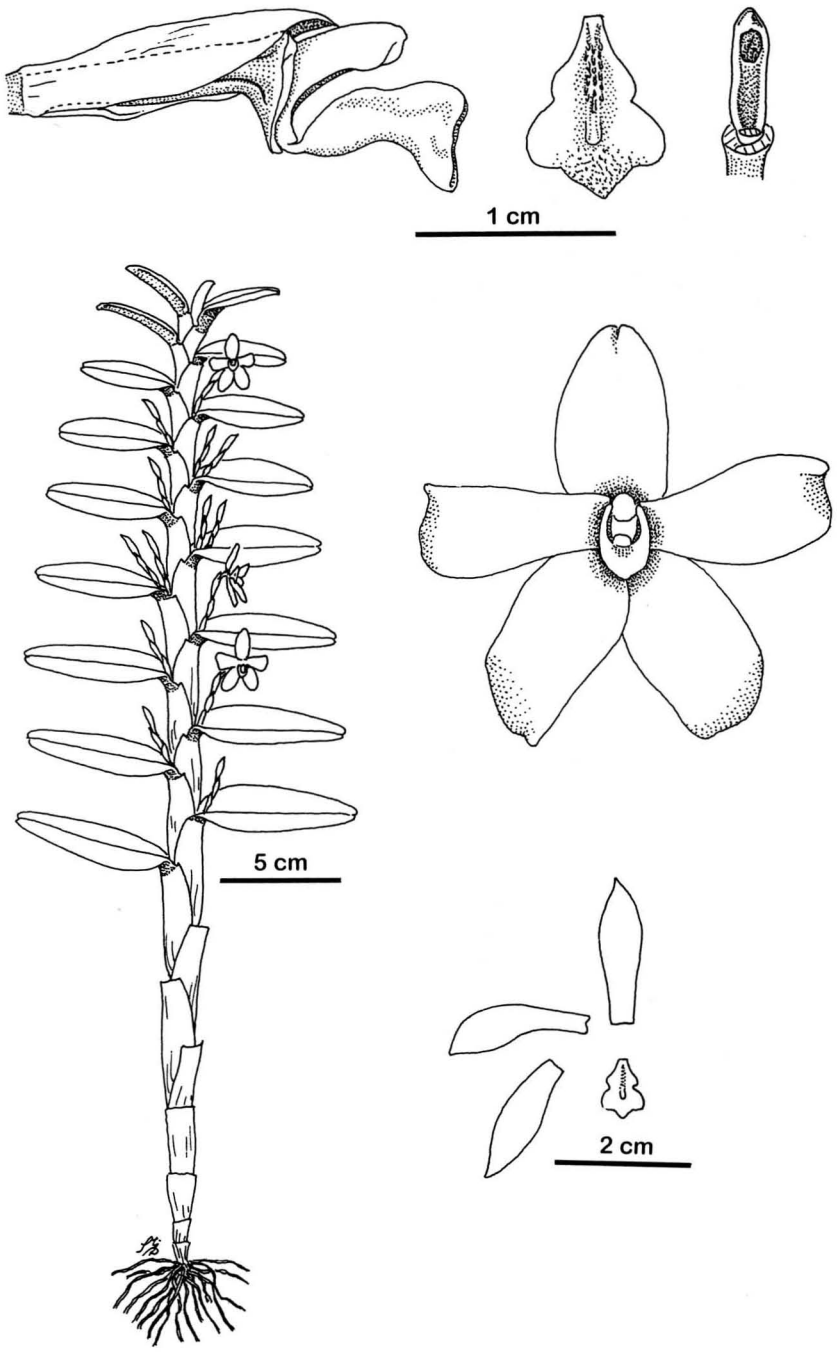

FIGURE 4. *Maxillaria scalariformis* J.T. Atwood. Drawn by S. Dalström: plant habit based on *McPherson 7820* (SEL); floral diagnosis based on *Dressler 6050* (SEL).

with 5–7 nerves, oblanceolate-falcate, 1.7–2.4 × 0.45–0.7 cm, acute to shortly acuminate. Lip loosely hinged to column foot, somewhat canaliculate in natural position, obovate to subpandurate when spread, 7–8.5 × 6–8 mm, 3-lobate on the apical ⅓; lateral lobes somewhat embracing the column, broad, rounded; midlobe fleshy, verrucose, subtriangular to rounded, broader

than long; callus swollen and bulb-like with parallel sides, apically rounded, terminating below the midlobe, with numerous papillae at the base. Column stout, somewhat curved, cylindrical, 5–6 mm excluding foot (2.5–3 mm) and granular anther cap (1.5–2 mm). Capsule ellipsoid, ca. 3 cm, lacking a pedicel, appearing in axils below the axils containing flowers.

PARATYPES: PANAMA. Prov. Chiriquí: Gualaca-Chiriquí Grande Road over Fortuna Lake, 1,170 m elev., 23 Jun 1987, *Croat 66678* (SEL). Near Fortuna Dam along Quebrada de Arena, ca. 1,100 m, 6 Dec 1985, *McPherson 7820* (MO). Prov. Veraguas: "Cerro Tute" ridge up from former Escuela Agricola, Sante Fe, 1,000–1,300 m, 20 Feb 1983, *Hamilton and Dressler 3063* (MO).

ETYMOLOGY: Named in allusion to the ladder-like appearance of the canes.

Maxillaria scalariformis is one of the most attractive flowers of the cane forming maxillarias. It is apparently endemic to rain forests of western Panama at 1,000–1,300 m, although it is expected to be found in adjacent Costa Rica. It most closely resembles *M. tricarinata* J.T. Atwood (see below) but has much larger flowers and proportionately smaller lip with much less well defined midlobe. Apparently flowering throughout the year.

Maxillaria synsepala J.T. Atwood, sp. nov.
FIGURE 5.

TYPE: PANAMA. Prov. Chiriquí: Distrito Bugaba, Cerro Punta, 2,200 m, 26 Jan 1985, *van der Werff and Herrera 6435* (Holotype: SEL; Isotype: MO).

A *Maxillariae biolleyi* (Schltr.) L.O. Williams affinis, sepalis a medio connatis et labello majore differt.

Plant incompletely known, apparently erect and monopodial; the holotype about 35 cm tall, but potentially much taller. Stem about 1 cm in diameter, concealed by the somewhat rugose leaf sheaths; roots unknown. Pseudobulbs absent as adults. Leaves distichous, obliquely articulate to the sheath; petioles short, narrowed very slightly above the articulation; blade thin, carinate beneath, elliptic, to ca. 9 × 2 cm. Inflorescences several per bract axil; scapes to about 7 cm, provided with long, linear, sharply acute bracts; ovary ca. 1 cm exceeded by an acute floral bract ca. 1.4 cm. Flowers medium sized, campanulate, white according to the collectors, delicate and probably short lived. Sepals dissimilar, the dorsal lanceolate, ca. 2.5 × 0.5 cm, acuminate; lateral sepals more than ½ connate, ca. 2.5 × 0.8 cm; the apices acuminate. Petals elliptic lanceolate, ca. 2.3 × 0.4 cm. Lip continuous with the short column foot, ca. 1 cm long, sharply 3-lobate on the upper ⅓; lateral lobes nearly truncate in front; midlobe fleshy, triangular 3–4 × 2–3 mm; calli two, one at the base tuberculate, one laminate callus ending below the base of the midlobe. Column ca. 5 mm long excluding the anther; foot 1–2 mm long.

ETYMOLOGY: named for the lateral sepals that are more than ½ joined.

Maxillaria synsepala is known only by the type collection from a cloud forest in western Panama at 2,200 m elev. It is unique among the cane-forming maxillarias for its lateral sepals that are about one half united. It is apparently unrelated to the *M. neglecta* (Schltr.) L.O. Williams group (*Pseudomaxillaria* and *Sepalosaccus*). Despite their connate lateral sepals, this latter group contains species which have very different sympodial plant habits, distinct pseudobulbs, and much smaller flowers. Plant habit of *M. synsepala* as well as lip morphology suggests a relationship with *M. amabilis* J.T. Atwood and *M. monteverdensis* J.T. Atwood. Also potentially related is *M. biolleyi* (Schltr.) L.O. Williams which is monopodial lacking pseudobulbs as adults but sympodial with pseudobulbs as juveniles. *Maxillaria synsepala* is known only by the type collection with date suggesting at least a January to February flowering period.

Maxillaria tricarinata J.T. Atwood, sp. nov.
FIGURE 6.

TYPE: PANAMA. Prov. Bocas del Toro: Trocha 3 de noviembre, near pass over continental divide (Paso de la Zorra), elev. ca. 1,500 m, 5 Apr 1978, *R.L. Dressler 5810* (Holotype: SEL).

A *Maxillariae tutae* J.T. Atwood affinis sed labello tricarinato a base differt.

Plant cane-forming, probably epiphytic or facultatively terrestrial on embankments, 37 cm tall. Stems monopodial, rather strict, unbranched in the present specimen, approximate; roots slender, to 1 mm in diameter. Pseudobulbs lacking in mature shoots; juvenile shoots unknown. Leaves articulate to somewhat rugose sheaths that conceal the stem, the lower ones soon deciduous; blades slightly narrowed beyond the articulation, carinate beneath, coriaceous, elliptic, 5–11 × 1.4–2.2 cm. Inflorescences 2 or more per leaf axil; scape 3–5 cm long, concealed by thin, conduplicate, acute bracts to ca. 1.5 cm; ovary with pedicel about 1 cm, subtended by a thin, conduplicate, acute, floral bract ca. 1.4 cm long. Flowers apparently somewhat campanulate, attractive with bright rose-purple sepals and petals and orange lip. Sepals similar, ovate-lanceolate, acute, 1.6–

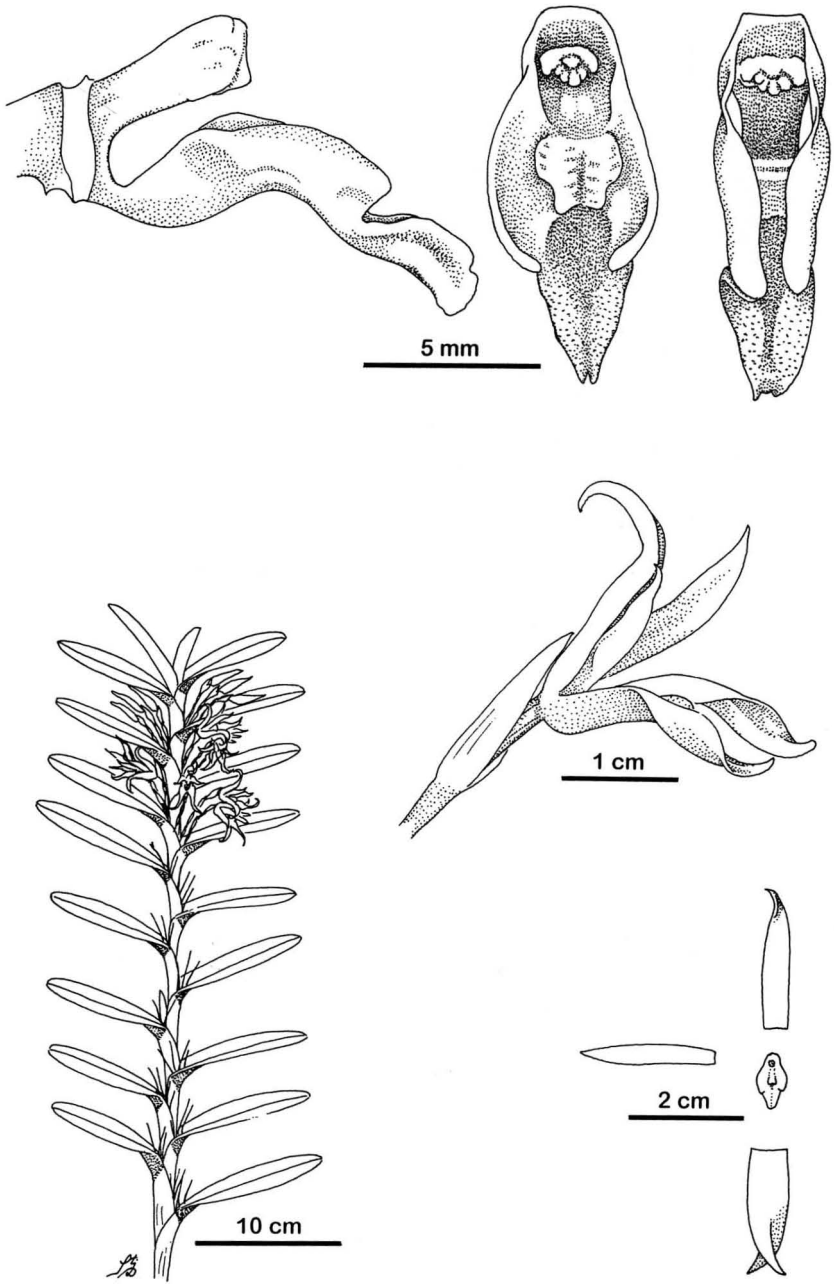

FIGURE 5. *Maxillaria synsepala* J.T. Atwood. Drawn by S. Dalström based on *van der Werff and Herrera 6435* (SEL).

1.8 × 0.6–0.7 cm; the lateral sepals forming a short mentum ca. 2 mm long. Petals rhombic-elliptic, acute, 1.4 × 0.6 cm. Lip fixed to and continuous with the column foot, rather complexly 3-lobate on the apical ⅓, sigmoid in lateral view, broadening from the base, ca. 8 mm × 4.5 mm in natural position; lateral lobes somewhat embracing the column, broadening and rounded above; midlobe somewhat fleshy, reflexed and recurved, acute, ca. 3 mm long; callus somewhat complex, of two lateral short and one central longer keel on the lower ½, at least the lateral 2 keels

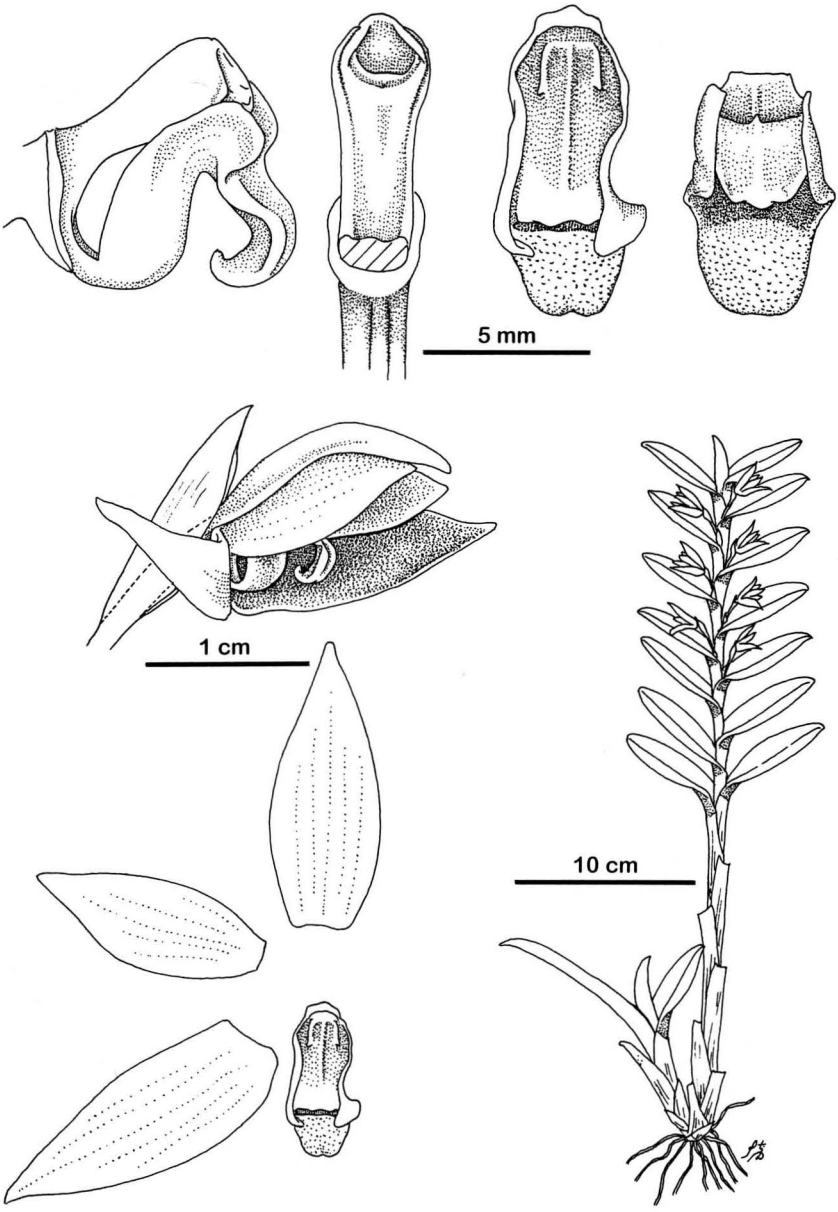

FIGURE 6. *Maxillaria tricarinata* J.T. Atwood. Drawn by S. Dalström based on based on *Dressler 5810* (SEL).

separating from the lip in front as porrect sharp apices, these superposed on a fleshy, plate-like, apically 3-dentate callus extending to the base of the midlobe. Column stout, 6 mm long excluding the anther; foot ca. 2 mm.

ETYMOLOGY: named in allusion to the three keels at the base of the lip.

The above description is based on the only available specimen that serves at the type. The species is most similar to *M. tutae* J.T. Atwood described below, a species lacking keels on the lip and with shorter column. The collection date suggests flowering at least in March and April.

Maxillaria tutae J.T. Atwood, sp. nov.
FIGURE 7.

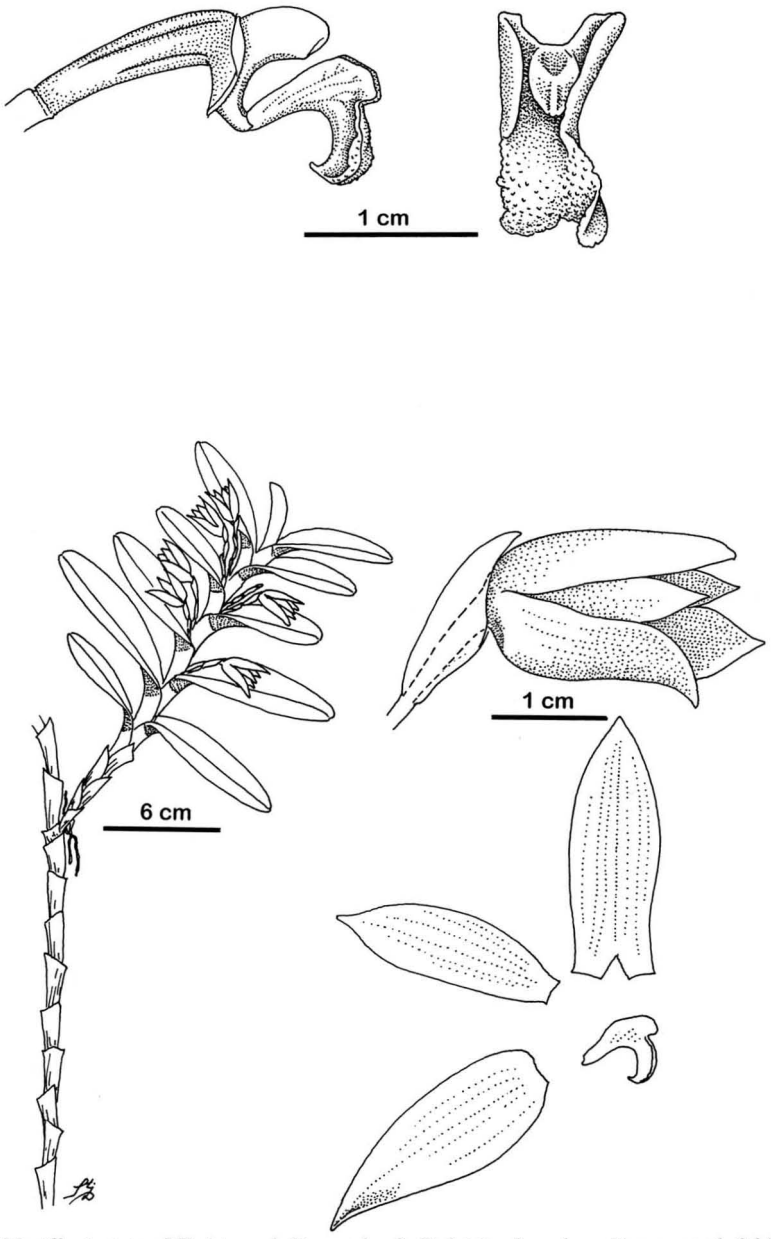

FIGURE 7. *Maxillaria tutae* J.T. Atwood. Drawn by S. Dalström based on *Knapp et al. 2641* (SEL).

A *Maxillariae tricarinatae* J.T.Atwood affinis labello non tricarinato recedit.

TYPE: PANAMA. Prov. Veraguas: Trail on ridge to summit of Cerro Tute [possibly Cerro Arizona misnamed (R.L. Dressler pers. comm.)], Cordillera de Tute, 1 km past Escuela Agricola Alto se de Piedras, W of Santa Fe. Upper montane and elfin forest, 1,250–1,410 m, *Knapp and Sytsma 2641* (Holotype: SEL; Isotype: MO).

Plant a shrub about 1 m high. Stems erect or decumbent, monopodial (at least as adults); roots to about 1.5 mm in diameter. Pseudobulbs lacking in adult shoots; juvenile shoots unknown. Leaves rather stiff with conspicuously rugose sheaths, the blades not narrowed above

the somewhat oblique articulation, not petiolate; blades elliptic, carinate beneath, to 10 × 2.5 cm, obtuse to somewhat unequally 2-lobate. Inflorescences 2 or more per leaf axil; scape ca. 5 cm, mostly concealed by the subtending leaf; ovary ca. 1 cm long. Flowers campanulate, according to collectors white with yellow column. Sepals elliptic-lanceolate, 2–2.4 × 0.7–0.75 cm, acute. Petals elliptic-falcate, 1.8–2 × 0.6–0.65 cm, acute. Lip hinged with the column foot, 3-lobate just above the middle, somewhat canaliculate below, ca. 1 cm long in natural position and difficult to spread; lateral lobes embracing the column, rounded, midlobe strongly recurved, ca. 4 × 4 mm; callus fleshy, ligulate. Column stout, ca. 4 mm long excluding anther, foot 3–4 mm long; anther unknown. Capsule unknown.

ETYMOLOGY: named for the mountain on which it was discovered.

Maxillaria tutae is known only by the type collection. It is most closely related to *M. tricarinata* with which it shares the plant habit and general flower size and general lip shape. However, that species has bright rose purple flowers with three keels on the base of the lip which is fixed to the column. It grows in montane rain and elfin forests.

ACKNOWLEDGMENTS

Gratitude is extended to Instituto de Biodiversidad (INB) and to Missouri Botanical Garden (MO), and to R.L. Dressler, for acquisition of specimens. Stig Dalström rendered the drawings.