

## Additions to “Rubiaceae of Thailand. A pictorial guide to indigenous and cultivated genera”

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ABSTRACT. Descriptions, notes and colour plates of four monotypic (monospecific) genera (*Clarkella* Hook. f., *Gardeniopsis* Miq., *Hyptianthera* Wight & Arn. and *Morindopsis* Hook. f.) are presented which had not been included in “Rubiaceae of Thailand. A pictorial guide to indigenous and cultivated genera” (Puff et al., 2005). *Morindopsis laotica* is reduced to a synonym of *M. capillaris*.

KEYWORDS: *Clarkella*, *Gardeniopsis*, *Hyptianthera*, *Morindopsis*; Rubiaceae; Flora of Thailand.

### INTRODUCTION

Since the publication of “Rubiaceae of Thailand. A pictorial guide to indigenous and cultivated genera” (Puff et al., 2005), photographs of another four genera not covered in the book have become available. This brings the total of illustrated Thai Rubiaceae genera illustrated by us to 88 [out of c. 110], or c. 80 per cent .

All four genera are monotypic (monospecific); two are rheophytes, one obligate (*Morindopsis*), the other (*Hyptianthera*) facultative; one is a herbaceous limestone dweller (*Clarkella*), and the fourth (*Gardeniopsis*) an occupant of the lowland evergreen rain forests in the Peninsula. The names of two of the genera (*Gardeniopsis*, *Morindopsis*) are somewhat unfortunate and misleading, as they are not at all allied to their well known name sakes *Gardenia* and *Morinda*.

### THE GENERA

**Clarkella** Hook. f., Fl. Brit. India 3: 46. 1880.

Small, ascending to erect herbs with a short, tuber-like rhizome. Stems with a solitary, relatively large basal leaf (the second completely suppressed; rarely present, but then much smaller than the other) and typically 1(–2), rarely 3, pairs of smaller, isophyllous leaves. Leaves membranous, petiolate; stipules small, entire. Inflorescence a solitary, terminal, shortly pedunculate, up to 7-(rarely more)flowered cyme; in luxuriously developed individuals sometimes, in addition, also few-flowered inflorescences in the axils of the uppermost leaf pair. Flowers (4–)5-merous, hermaphrodite. Calyx with somewhat unequal lobes, sometimes 1 lobe divided into 2. Corolla infundibular, puberulous on the outside,

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glabrous inside, lobes valvate in bud, spreading in open flowers. Stamens included, inserted at the base of the tube, filaments short. Ovary 2-celled, each locule with a multiovulate placenta; common style very short, the 2 short stigma lobes filiform, hairy, included. Fruits indehiscent (?), crowned by persistent calyx lobes; each locule with numerous minute seeds.

A monotypic, disjunct genus of uncertain tribal position, known from the W. Himalayas (India: Uttar Pradesh), Upper Myanmar, Thailand and China (Yunnan, Guizhou). See further notes below.

**Clarkella nana** (Edgew.) Hook.f., Fl. Brit. India 3: 46. 1880; Lauener, Notes R.B.G. Edinb. 32: 104. 1972.— *Ophiorrhiza nana* Edgew., Trans. Linn. Soc. London 20: 60. 1846.— *Ophiorrhiza pellucida* H.Lév., Repert. Spec. Nov. Regni Veg. 13: 176. 1914.— *Clarkella siamensis* Craib, Bull. Misc. Inform. Kew 1931: 216. 1931; Craib in Fl. Siam. 2: 36. 1932.— *Clarkella nana* (Edgew.) Hook.f. var. *siamensis* (Craib) Fukuoka & Kurosaki, Tonan Ajia Kenkyu 8: 178 (1970), Fig. 1.

Distribution.— NORTHERN: Mae Hong Son, Chiang Mai, Nan, Lampang, Tak; SOUTHWESTERN: Kanchanaburi (Sangkhla Buri); PENINSULAR: Nakhon Si Thammarat [Tung Song, Kao Chem, *Rabil* 139: type of *C. siamensis*].

Notes.— Fukuoka (1978), studying the species' floral anatomy and morphology, uncritically associated *Clarkella* and *Argostemma* (actually tribe Argostemmateae!) with tribe Hedyotideae. In any case, floral features alone are inconclusive and believed to be insufficient to determine the plant's tribal position. Fruit and seed morphological and anatomical, palynological, as well as molecular data are needed to evaluate the tribal alliance.

Flowers of *Clarkella* superficially resemble those of certain *Ophiorrhiza* species, so that it does not come as a total surprise that Chinese material of *Clarkella* was originally described as *Ophiorrhiza pelludica* (see Lauener & Ferguson, 1972; apparently overlooked by Fukuoka, 1978). Vegetatively, *Clarkella* resembles certain *Argostemma* species (tuber-like rhizome; suppression of one leaf of a pair, i.e., extreme anisophylly). And, together with certain *Argostemma* species, it is among the few true rubiaceae geophytes whose aerial parts disappear in the dry season; in the following rainy season new flowering shoots originate from the underground parts (i.e., tuber-like rhizomes).

*Clarkella* fruits, too, look very similar to those of *Argostemma* (Fig. 1D–E). A direct comparison is not possible at this stage as their detailed morphology and anatomy is unknown because of lack of preserved, fully mature material. It is assumed that its fruits (described as "indehiscent" from not fully mature material) will, very much as in *Argostemma*, eventually develop into lid capsules from which seeds are ejected by drops of rain water (ombrophily; see Puff et al., 2005: 189). This does not necessarily imply a relationship between the two genera but is more likely to be a comparable ecological adaptation (also found in genera of other families, notably Gesneriaceae or Melastomataceae).

The species occurs at altitudes ranging from 450 to 1100 m and grow in cracks of rocks of moist to wet limestone outcrops or cliffs, usually in shade or semi-shade, and are often associated with other characteristic limestone rock plants such as various Gesneriaceae. As is typical for plants of such habitats, they exhibit rather extreme



Figure 1. *Clarkella nana* (Edgew.) Hook.f.: A. habit and habitat, note fruiting plants (upper half) and several young plantlets with the (seemingly) solitary basal leaves; B. flowering plant; C. flowers; D. developing fruits; E. immature fruits. A, D–E from Kanchanaburi (Sangkhla Buri), B–C from Tak (Doi Hua Mot); all photographs Thamarat Phutthai.

environment/habitat-dependent variability in most of their characters (plant size; number of leaf pairs; leaf shape and size; petiole length; extent of inflorescences; absence or presence additional axillary inflorescences; flower size), often even within one and the same population. "*Clarkella siamensis*," previously thought to be a Thai endemic, merely refers to luxuriously developed individuals ("our species is much larger in all its parts than *C. nana* which it resembles very much in habit;" Craib, 1932: 36); we agree with Lauener & Ferguson (1972) that it does not even need recognition as a variety.

*Clarkella nana* was previously thought to occur in the Himalayas and Thailand only (Smitinand et al., 1970), but it has since also been recorded from Upper Myanmar and China (Lauener & Ferguson, 1972: 104 & map, fig. 1).

Distribution within Thailand, too, is disjunct (to date, several localities are known from 5 northern provinces, and one locality each from the Southwest and from the Peninsula; as far as Thailand is concerned, the map in Lauener & Ferguson, 1972, is outdated). We are, nevertheless, confident that a thorough survey of Thai limestone vegetation will eventually yield further records which will close the gaps in the presently known, scattered distribution range of this species. Field investigations must, however, be carried out during the rainy season (flowers and fruits are recorded from July to September) because the aerial parts disintegrate and eventually completely disappear in the dry season.

**Gardeniopsis** Miq., Ann. Mus. Bot. Lugduno-Batavi 4: 250. 1869.

Shrubs or treelets. Leaves opposite, petiolate; stipules interpetiolar, lanceolate. Flowers 5-merous, hermaphrodite, sessile, 1 or 2 in leaf axils or at a series of leafless nodes immediately below the leaves. Calyx with small lobes. Corolla hypocrateriform, lobes contorted to the right in bud, longer than the short tube, curved upwards and inward, never fully spreading. Stamens inserted at the base of the corolla tube, included; anthers linear, basifixed, in a cone-like arrangement. Ovary 2-celled, each locule with a solitary ovule attached to septum; style short, bearing a fusiform stigma. Fruits indehiscent, slightly fleshy, longitudinally ridged or not, 2-seeded, crowned by the persistent, slightly enlarged calyx lobes.

A monotypic genus of somewhat uncertain tribal position, distributed from peninsular Thailand southwards to Peninsular Malaysia, Sumatra and Borneo.— See notes further below.

**Gardeniopsis longifolia** Miq., Ann. Mus. Bot. Lugduno-Batavi 4: 250. 1869; King & Gamble [Mat. Fl. Malay Penins. 15], J. Asiat. Soc. Bengal 73: 64. 1904; Ridl., Fl. Malay Penins. 2: 112. 1923; Craib in Fl. Siam. 2: 174. 1934; Wong in Ng, Tree Fl. Malaya 4: 350. 1989. Fig. 2.

Distribution.— PENINSULAR: Surat Thani (Khao Sok National Park), Phangnga, Pattani, Yala.

Notes.— The species is (very) rare in Thailand and only known from a few collections, most of them old. It grows at low altitudes (200–500 m) in evergreen rain forest and appears to favour habitats along streams.

The generic name *Gardeniopsis* (meaning "resembling *Gardenia*") is rather



Figure 2. *Gardeniopsis longifolia* Miq.: A. treelet with pinkish young foliage; B. shoot apex with stipules; C. flowers (corolla lobes never open!); D. corolla from above, note right-contorted aestivation; E. sectioned corolla to show anthers in cone-like arrangement; F. immature fruit. All from Surat Thani (Khao Sok National Park); all photographs C. Puff.

misleading as the two genera have little in common. The most striking differences in the fertile parts concern both flower and fruit structure: While all *Gardenia* are characterized by flowers exhibiting secondary pollen presentation (SPP; see Puff et al. 2005: 32 & plate 2.4.1A for details), free anthers and at least partially exerted stigmas, *Gardeniopsis* lacks SPP and has stamens (with anthers forming a cone-like structure) and stigmas included in the corolla tube (Fig. 2E). Another very peculiar floral character is that its contorted corolla lobes never open and expand but rather form a kind of hollow sphere (Fig. 2C–D). The pollination mode of these flowers is unknown but it is presumed that small insects might enter the closed flowers via the lateral gaps formed by the contorted and twisted but not tightly adhering corolla lobes (see Fig. 2C). Yet another fundamental difference is the presence of a 2-celled ovary with a solitary ovule in each locule [ovary 1-celled, with numerous ovules on 2–9 parietal placentas in *Gardenias*]. Consequently, also the fruits (only 2-seeded in *Gardeniopsis*, vs. many-seeded in *Gardenia*) are strikingly different. Inflorescences of *Gardeniopsis* are axillary, those of *Gardenia* terminal. Vegetatively, *Gardenias* are usually easily distinguishable by having resin-coated buds, shoot tips and young parts (because of copious exudate production of colleters on the inside of stipules); this also is absent in *Gardeniopsis*.

To date, *Gardeniopsis*' tribal affinities have not yet been satisfactorily resolved.

**Hyptianthera** Wight & Arn., Prodr. Fl. Ind. Orient.: 399. 1834.

Shrubs or small trees, evergreen, glabrous. Leaves opposite, shortly petiolate; stipules interpetiolar, deltoid-lanceolate. Inflorescences axillary, paired, sessile, much congested cymes; individual flowers subtended by a pair of bracteoles. *Flowers* sessile, 4–5-merous, hermaphrodite. Calyx with a short basal tubular part and lanceolate lobes. Corolla hypocrateriform, tube about as long as the lobes, the latter contorted to the left in bud; glabrous on the outside, the inside with short hairs on the lobes and below the anthers. Stamens subsessile, inserted at or just below the throat; anthers basally hairy, almost completely included. Ovary 2-celled, each locule with several ovules pendulous from the apical part of the septum, crowned by a ring-like disk; style with 2 stigma lobes, the latter and the upper part of the style hairy. Fruit a drupe with a thin endocarp, 2-celled, each cell with usually up to 4–5 seeds.

A monotypic genus belonging to tribe Octotropideae (syn. Hypobathreae) and occurring from Nepal and E. India to China (Yunnan) and Indochina.—See notes below.

**Hyptianthera stricta** (Roxb. ex Schult.) Wight & Arn., Prodr. Fl. Ind. Orient.: 399. 1834; Hook. f., Fl. Br. India 3: 121. 1880 (*pro parte*); Pit. in H.Lecomte, Fl. Indo-Chine 3: 266. 1923; Craib in Fl. Siam. 2: 127. 1932.—*Macrocnemum strictum* Roxb. ex Schult. in J.J.Roemer & J.A.Schultes, Syst. Veg. 5: 6. 1819.—*Rondeletia stricta* (Roxb. ex Schult.) Roth, Nov. Pl. Sp.: 140. 1821.—*Solena stricta* (Roxb. ex Schult.) D.Dietr., Syn. Pl. 1: 800. 1839.—*Hypobathrum strictum* (Roxb. ex Schult.) Kurz, Forest Fl. Burma 2: 50. 1877.—*Randia stricta* (Roxb. ex Schult.) Roxb., Fl. Ind. 2: 145. 1924.—*Hyptianthera bracteata* Craib, Bull. Misc. Inform. Kew 1911: 393. 1911; Pit. in H.Lecomte, Fl. Indo-Chine 3: 266. 1923; Craib in Fl. Siam. 2: 127. 1932. Fig. 3.



Figure 3. *Hyptianthera stricta* (Roxb. ex Schult.) Wight & Arn.: A. flowering branches; B. detail; C. flowers (below) and developing fruits (corollas fallen; above). All from Prachin Buri (Khao Yai National Park, Sai Yai Substation); all photographs C. Puff.

Distribution.—NORTHERN: Chiang Mai [Doi Suthep, types *H. bracteata*: Kerr 1145, 1792], Chiang Rai, Nan, Lampang, Phrae, Uttaradit, Sukhothai, Kamphaeng Phet; NORTHEASTERN: Phetchabun, Loei, Nong Khai; EASTERN: Chaiyaphum; SOUTHWESTERN: Kanchanaburi, Phetchaburi; SOUTHEASTERN: Prachin Buri.

Notes.—*Hyptianthera stricta* is variable in both vegetative features and characters in the fertile region. *Hyptianthera bracteata*, once described as a Thai endemic (Craib, 1911, 1932), cannot be upheld as a separate species on the basis of longer stipules and bracteoles.

The genus/species is part of a well-circumscribed but relatively ill-known group of closely allied genera which also includes *Hypobathrum* (syn. *Petunga*) and the Indochinese *Xantonnea*. Deb's (1989) proposal to merge *Hyptianthera* with *Hypobathrum* is not generally accepted and not followed here because more detailed work on this complex group needs to be carried out.

Field studies corroborate that the taxon is a facultative rheophyte, confirming van Steenis' (1981: 355) doubts whether the plant a "strict" (obligate) rheophyte. It typically grows in sandy banks along streams or in rocky areas around or in streams, not uncommonly together with other rheophytes such as *Kailarsenia lineata* (Rubiaceae) or the more common *Homonoia riparia* (Euphorbiaceae). Its riverine habitats are normally found in areas of dry evergreen and seasonal rain forest, but occasionally also in dry dipterocarp forest and pine forest (then often restricted to shaded gullies). The plants, however, also survive away from streams and rivers. Detailed information on herbarium labels is often too poor and imprecise to get an idea of the actual habitat situation.

**Morindopsis** Hook.f. in Benth. & Hook., Gen. Pl. 2: 93. 1873.

Shrubs or treelets, dioecious. *Leaves* opposite (decussate), shortly petiolate; stipules triangular. Inflorescences often paired and mostly distinctly supra-axillary, (long) pedunculate, consisting of much congested, several- to few-flowered cymes; each cyme subtended by a pair of bracts (sometimes uniflorous in females). Flowers 4–5-merous, subsessile, in the axils of minute bracteoles. Calyx with small lobes. Corolla hypocrateriform, tube pilose at the throat, lobes contorted in bud, spreading in open flowers. Stamens inserted just below the throat; anthers subsessile, their tips somewhat exerted from the throat (in males; sterile anthers much reduced and included in females). Ovary crowned by a ring-like disk, 2-celled, each locule with a multiovulate peltate placenta attached to septum; the common style with 2 at least basally hairy, filiform stigma branches slightly exerted from the throat (in females; ovary much reduced and empty in males, the rudimentary stigmas short and included). Fruits indehiscent, with a leathery skin (not conspicuously fleshy), elongated, crowned by the persistent and slightly enlarged calyx lobes; each of the two locules with numerous, imbricately arranged seeds.

A monotypic genus belonging to tribe Octotropideae (syn. Hypobathreae) and recorded from NE. India to Indochina.— See notes below.

**Morindopsis capillaris** (Kurz) Kurz, J. Asiatic Soc. Bengal, Pt. 2, Nat. Hist. 43(2): 189. 1874, Kurz, Forest Fl. Burma 2: 52. 1877; Hook. f., Fl. Brit. India 3: 121. 1880; Pit. in H.Lecomte, Fl.

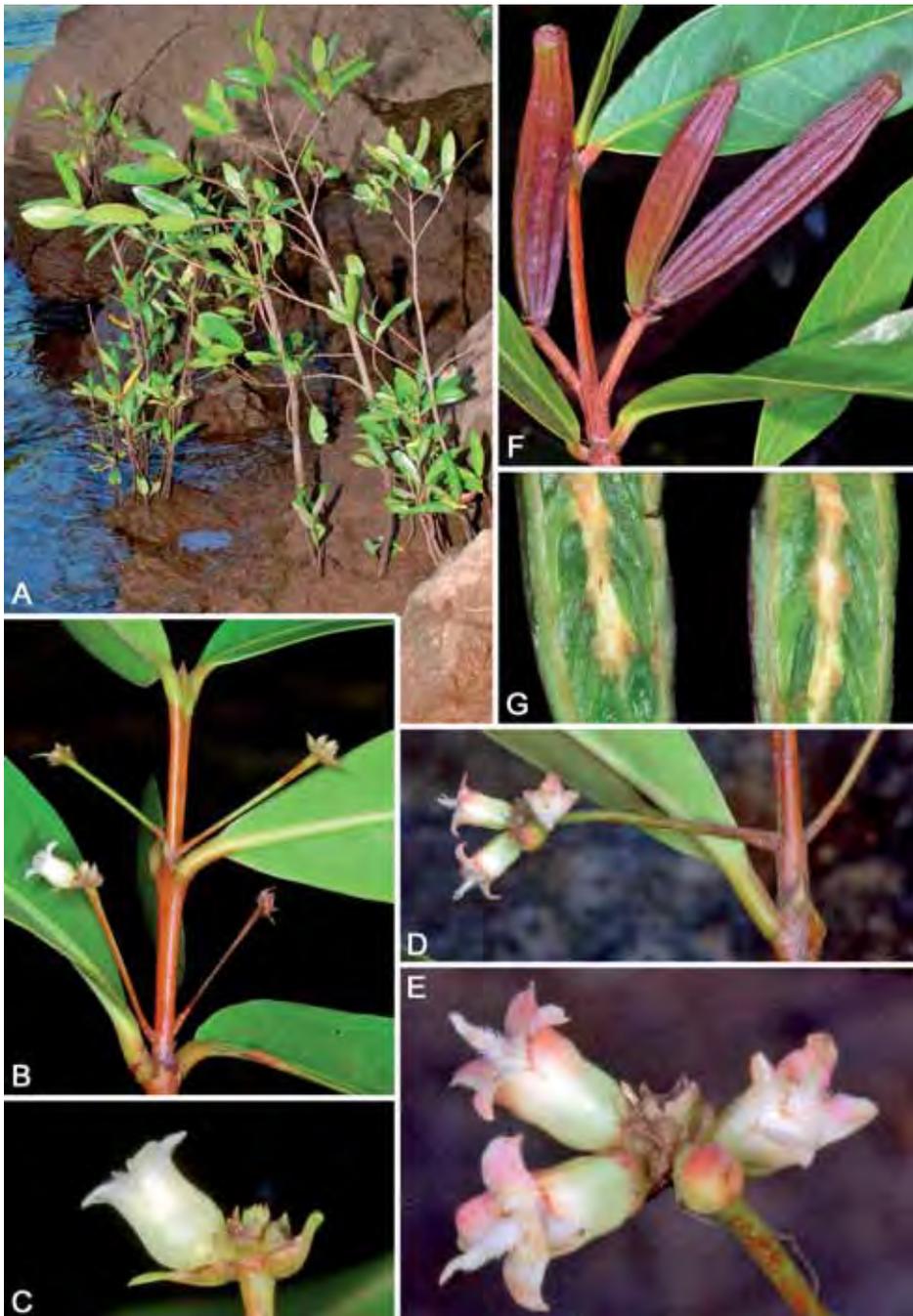


Figure 4. *Morindopsis capillaris* (Kurz) Kurz: A. habit; B–C. male plants; B. paired pedunculate inflorescences in supra-axillary position; C. detail of inflorescence, note boat-like subtending bracts; D–G. female plants; D–E. as B and C; F. fruits (almost mature); G. section of almost mature fruit, note imbricately arranged, elongated seeds. All from Kanchanaburi (Sai Yok National Park); all photographs C. Puff.

Indo-Chine 3: 263. 1923; Craib, Fl. Siam. 2: 126. 1932.— *Psilobium capillare* Kurz, J. Asiat. Soc. Bengal 41(2): 313. 1872.— *Morindopsis laotica* Pit., in H. Lecomte, Fl. Indo-Chine 3: 264. 1923, **synon. nov.** Fig. 4.

Distribution.— NORTHEASTERN: Phetchabun, Udon Thani, Nong Khai, Nakhon Phanom; EASTERN: Ubon Ratchathani; SOUTHWESTERN: Ratchaburi, Kanchanaburi; SOUTHEASTERN: Chanthaburi, Trat.

Notes.— Based on field observations, the species is an obligate (“strict”) rheophyte (not known to van Steenis, 1981, 1987, and therefore not included in his survey of the rheophytes of the world). It invariably grows in cracks of rocks (limestone, sandstone, granite) along or in rivers and streams, or in sandbanks. It is associated with various other rheophytes (often *Homonoia riparia*, Euphorbiaceae, and *Syzygium ripicola*, Myrtaceae), but never seems to be as common and conspicuous as these habitually similar plants and normally does not form large populations. This undoubtedly is one of the reasons for our assumption that *M. capillaris* is much more widespread than the documented, scattered distribution suggests. Another is that collectors, not being aware of the diversity of rheophytes, have frequently neglected these often difficult-to-access habitats and overlooked the species. In this context, collectors are also urged to produce accurate and precise habitat notes; were one to rely on the existing, not uncommonly very vague field notes, one would never guess that *M. capillaris* is a strict rheophyte.

Apart from being one of the relatively few rubiaceaceous rheophytes, the genus is remarkable for several reasons: the plant’s vegetative lateral branches and inflorescence axes (peduncles) are almost always in a clearly supra-axillary position, i.e., arise some distance above a leaf axil (Fig. 4B, D, F). This, together with the long, filiform peduncles bearing very small flowering heads, is a very good character combination to recognize the genus. It was presumably the shape of the inflorescence that tempted the author of the genus to call it *Morindopsis* (meaning “resembling *Morinda*”). This is somewhat unfortunate because the resemblance to *Morinda* is only a very superficial one and the two genera are not at all closely allied.

*Morindopsis* is dioecious; male and female inflorescences do not appear to differ much in their extent (in contrast to other dioecious Rubiaceae where female inflorescences are often less extensive and fewer-flowered than male ones; see Puff et al. 2005:32 for details). Both male and female flowers are variable in size and shape (even within populations) so that a trend to somewhat larger female and smaller male flowers recognizable in other dioecious Rubiaceae is not obvious. The genus’/species’ fruits are apparently adapted to water dispersal: trials have shown that they float although they do not contain any obvious air-filled tissue; their fruit wall is thick and leathery, most likely a good protection against quick dissolution and disintegration in water.

*Morindopsis* is best considered a monotypic genus, because the second species formally recognized up to now, *M. laotica*, is indistinguishable from the variable *M. capillaris*. In Flore Générale de l’Indo-Chine, where *M. laotica* was first described (Pitard, 1923: 263), the key separating this species and *M. capillaris* is highly misleading. It is based on characters of female plants, i.e. stigma characters and calyx lobe length in relation to ovary (“calyx tube”) length, although the original diagnosis of *M. laotica* was based on a male

specimen, apparently the only material known. It is quite obvious that small, reduced stigmas and rudimentary ovaries of male *M. laotica* were compared with the “normal” stigmas and ovaries of female *M. capillaris*.

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