THE BORNEAN GENUS HYPOBATHRUM (RUBIACEAE)
AN INVESTIGATION OF ITS CHARACTERS AND TAXONOMIC STATUS

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ABSTRACT
MULYANINGSIH, TRI. & RIDSDALE, C. E. 2002. The Bornean genus Hypobathrum (Rubiaceae). An investigation of its characters and taxonomic status. Reinwardtia 12(1): 95–116. — The investigation on the characters and taxonomic status of the Bornean genus Hypobathrum was based on morphological observations of 140 specimens in Herbarium Borgoriense. The present study shows that there are 24 species that can be recognised. There are six species already placed in the genus (H. frutescens, H. longifolium, H. microcarpum, H. racemosum, H. salicinum and H. venulosum), three species require new combinations (H. coniocarpum, H. gracile, and H. rufidulum), one species requires a new combination and a new status (H. hirtum), a new name in Hypobathrum is required for one species (H. lancifolium). In the present study twelve new species are proposed (H. bangueyense, H. caudifolium, H. collinum, H. ellipticifolium, H. glaberrimum, H. glabrum, H. lithophilum, H. palustre, H. rheophyticum, H. riparium, H. sampitense, and H. subulatum). In addition, one incompletely known species is mentioned.

Keywords: Hypobathrum, Rubiaceae, Borneo, taxonomy

INTRODUCTION

Hypobathrum is one of the small genera belonging to the tribe Octotropideae (Rubiaceae), with about 26 described species from the Old World in Tropical Africa & Madagascar and Comoro islands and Mainland S. E. Asia and Malesia to the Philippines and Celebes (Robbrecht, 1980; Baillon, 1879; Index Kewensis, 1997). Some species of this genus are recorded as being used as vegetables and medicines by local people (Burkill, 1935; Siemonsma & Piluer, 1994).

The typical characters of plants of this genus are small understory treelets with horizontal branchlets and bilocular, baccate fruits and superficially resemble coffee, which is also reflected in the local names of the plants – Kopen (Java) or Kikopi (Sunda).

The name Hypobathrum was created by Blume in 1826, for a plant which Junghuhn collected from Burangrang mountain, West Java. From 1826 to 1875, it remained a monotypic genus that was characterised by the axillary inflorescences, flowers are arranged in dense cymes. From 1814, a related species of the genus was described by Roxburgh from a plant collected by Buchanan in 1796 from Lukshmeepoora, Chitagong, India. At the time he named the taxon as Randia racemosa. In 1829, the same taxon was described by Richard as Spicillaria leschenaultii, but a year latter in 1830, De Candolle changed
this name to Petunga roxburghii, then it became the type of the genus Petunga. Lastly, in 1877 Kurz transferred the taxon to the genus Hypobathrum as H. racemosum.

In 1851, Korthals considered the genus Petunga, and he found four species in Sumatra, Java and Borneo, three of them were found in Borneo, one of which is Petunga lanceolata Korth. Baillon (1879) treated Hypobathrum in Tropical Africa, Madagascar and Comoro islands, and he recognised 14 species, six of which were knew species and a further eight new combinations, one of which was H. lanceolatum (Sond.) Baill., which was based on Krausia lanceolata Sond. This plant has typical characters such as the flowers in a cyme, turbinate, pentamemorous, corolla throat sparsely villous, stamens exerted, anthers basifixed and ovule 1 per locule and is not related to the Bornean species which requires a new name.

Hooker (1882) was the first author who considered that Petunga should be placed into Hypobathrum, but without clearly stating his reasons. Later, Backer (1956) accepted this treatment, because the differences between the two genera were only in the absolute length of the spike axis.

On 1902, Koorders and Valeton stated that genus Hypobathrum was different from Petunga, and they recorded three species of Hypobathrum: H. brevipes K. & V., H. frutescens Blume and H. parviflorum Miquel and four species of Petunga: P. brevispica K. & V., P. glomerata (Blume) DC, P. longifolia DC and P. microcarpa (Blume) DC in Java. Six decades later, Backer and Bakhuizen van den Brink f. (1965) revised them; P. glomerata (Blume) DC was placed in the synonym of H. frutescens Blume; H. brevipes K. & V. and P. brevispica K. & V. were placed in the synonym of H. parviflorum Miquel, and P. longifolia DC was placed in the synonym of H. microcarpa (Blume) Bakh. f. The authors thus accepted four species of Hypobathrum in Java. Later Wong (1989), considered that P. longifolia DC to be a different from H. microcarpa (Blume) Bakh. f., and made the combination H. longifolium (DC) Wong. In Malaya, Wong (1989), treated Hypobathrum and described four species and ten incompletely known species.

It was considered essential to do an in-depth study of the Bornean genus Hypobathrum, especially to solve the taxonomic problems, such as misidentifications of H. longifolium (DC) Wong var. hirta (Ridley) Wong in Malaya by Wong (1989).

The present study has attempted to ascertain the correct names of the taxa, improve the classification, and to determine relationships between the species. An identification key and data on the distribution of the taxa are also given.

The study is based on an investigation of the herbarium materials from BO and fresh material from Bogor Botanical Garden. From the collections studied by the authors, details and whereabouts are given only for those specimens used for an in-depth morphological study. Measurements and descriptions are from dried materials, except for floral and fruit sizes, which are based on rehydrated (boiled in water) materials. The observations were made using a binocular microscope.

MORPHOLOGICAL CHARACTERS

Habit

The Hypobathrum species are usually shrubs or small trees or treelets, seldom trees, but specimens of H. frutescens can reach up to 16 m tall.

Branchlet

Shape. Most species have quadrangular branchlets when young and becoming subterete with age, or always subterete (H. lithophilum and H. subulatum), or always quadrangular (H. coniocarpum and Hypobathrum sp.).

Surface. The young branchlets usually have a puberulous indumentum with simple hairs only, in most species the hairs disappear with age. However some species have glabrous branchlets. There are two species with persistent hairs. H. rufidulum has a tomentose indumentum and H. hirtum has a hirsute indumentum.

Leaves

General. The attachment of the leaves is decussate in all species. Most leaves are petiolated with a subterete petiole, but H. salicinum and H. subulatum have sub sessile leaves with flattened petioles. The texture of the leaves is coriaceous.

Shape. The species have various leaf shapes, for example: elliptic leaf (H. bangueyense, H. collinum, H. ellipticifolium, H. glabrum and H. rufidulum); lanceolate (H. frutescens, H. glaberrimum, H. lanceifolium, H. microcarpa, H. racemosum and H. riparium); varying between elliptic and lanceolate (H. hirtum and H. longifolium); ovate (H. palustre and H. sampitense); linear (H. lithophilum, H. rheophyticum, H. Salicinum and H. subulatum).

Base. The base of the leaves mainly vary between acute and cuneate or between cuneate...
and attenuate. Often the base of the leaves are obtuse (H. collinum and H. gracile).

**Apex.** Normally vary between acuminate and cuspidate, often acute (H. longifolium), or cuspidate e.g. H. hirtum, or caudate (H. caudifolium, H. collinum, H. glaberrimum, H. lithophilum, H. rheophyticum, H. subulatum and H. venulosum). In the latter case the transition to the leaf apex can be gradual.

**Upper and lower surface.** The upper surface is always smooth. Often the upper surface is also shining such as on H. palustre. The lower surfaces are normally more rough and are different in colour (lighter than above). All the Borneo species have glabrous leaves on upper surface but on lower surface the veins are normally glabrous, often with a caducous indumentum (H. caudifolium and H. frutescens), or some times species have persistent hairs, such as H. hirtum which has hirsute veins, H. banguyense, H. gracile, H. longifolium, H. palustre and H. rheophyticum have puberulous veins and H. rufidulum has a tomentose indumentum all over.

**Venation.** The venation is usually depressed on the upper surface, rarely the primary veins are prominent on the upper surface (H. racemosum and H. salicinum). Venation is raised on lower surface. Primary veins vary between massive and stout or between stout to moderate, or between moderate and weak. Normally the angle of divergence of the secondary vein varies between acute and moderate. The number of secondary veins varies between 5–11 pairs. Most tertiary veins are inconspicuously reticulate, such as H. lithophilum, H. rheophyticum, H. salicinum and H. subulatum. The marginal veins are arcuate or looped.

**Margin.** The leaf margins are always entire and they are usually glabrous, but some species have a caducous puberulous indumentum such as H. frutescens, H. longifolium, H. palustre and Hypobathrum sp. However H. rufidulum has a persistent indumentum on its leaf margins.

**Stipule**

**Shape.** Normally the stipules vary from ovate keeled to triangular and keeled, or lanceolate, keeled. The position of stipules is interpetiolar.

**Stipule base.** The stipule base is usually free, or often connate. For example H. hirtum has ovate stipules with a connate base, while triangular stipules with connate bases are found on H. rufidulum and H. collinum has lanceolate stipules connate at the base.

**Margin.** The stipule margins are ciliated.

**Inner and outer surface.** Most species have stipules which are glabrous on the inner surface, often the base of the stipules are pilose such as on H. racemosum. The outer surface of the stipules vary: glabrous (H. collinum, H. glaberrimum, H. lanceifolium, H. longifolium, H. racemosum, H. riparium and H. venulosum), or tomentose on the tip (H. banguyense and H. salicinum) or tomentose on the base or along the midrib (H. caudifolium, H. ellipticifolium, H. glabrum, H. gracile, H. microcarpum, H. palustre, H. rufidulum and H. sampitense), or hirsute over the whole parts (H. hirtum and H. subulatum).

**Duration.** Mostly the stipules are caducous to sub-caducous, but some are persistent (H. caudifolium, H. coniocarpum, H. glaberrimum, H. gracile, H. lithophilum, H. rufidulum and H. venulosum).

**Inflorescence**

**Inflorescence.** The inflorescences are normally axillary, but they can be axillary to pseudoterminal (end bud still present), e.g. H. racemosum. Most inflorescences originate from the nodes but others are supra-axillary (H. caudifolium, H. collinum, H. glaberrimum, H. gracile, H. lithophilum, H. rufidulum and H. venulosum).

**Bracts and Bracteoles**

**Bracts.** Bracts on the axis and on the dichasium are present. The bracts usually vary between ovate and triangular or between triangular to lanceolate, except on H. subulatum, where the shape of the bracts is spear like.

**Inner and outer surface.** In most species the bracts are glabrous on the inner surface. There are some exceptions where the base of the bracts are pilose on the inner surface (H. ellipticifolium, H. microcarpum, H. racemosum, H. salicinum and H. sampitense), or sericeous overall (H. rufidulum), or sericeous on the tip e.g. H. coniocarpum and H. hirtum.

**Position.** The bracts are usually compiled decussate on the elongate axis and opposite on dichasium, or often opposite and alternate on the elongate axis and opposite on the dichasium (H. glabrum, H. lithophilum, H. rheophyticum, and H. subulatum).

**Bracteoles.** Bracteoles are usually ovate, keeled or triangular, keeled, but sometimes narrowly triangular, keeled (H. rheophyticum).

**Bracteoles base.** Some species have bracteoles with the base free and some others have bracteoles with the base connate on one side. For example H. banguyense, H. collinum, H.
coniocarpum, H. hirtum, H. lithophilum and H. rheophyticum have a triangular bracteoles with the base free. H. caudifolium, H. frutescens, H. glabrum, H. gracile and H. longifolium and Hypobathrum sp. have ovate bracteoles with the base free. H. elliptifolium, H. lanceolatum, H. riparium and H. salicinum have triangular bracteoles with the base connate on one side. H. glaberrimum, H. microcarpum, H. palustre, H. racemosum, H. sampitense and H. venulosum have ovate bracteoles with the base connate on one side and lanceolate bracteoles with the base connate on one side are found on H. rufidulum.

Inner and outer surface. The inner surfaces of the bracteoles are usually glabrous, but can be pilose on the base (H. racemosum); or sparsely sericeous on the top (H. coniocarpum and H. hirtum), or sparsely sericeous over the whole surface (H. rufidulum).

Position. Most bracteoles are inserted opposite to the base of the pedicel, or at the middle to the top of the pedicel (H. glaberrimum and H. venulosum); or one bracteole inserted on the base of the pedicel (H. longifolium); or only one bracteole inserted on the middle to the top of the pedicel (H. subulatum).

Margin. The bracteole margins are ciliated.

Flowers

General. Most flowers are small, at most up to about 2.5–5 mm long by 2–4 mm in diameter. The flowers are campanulate (corolla lobes united to compose a cup-shaped) or infundibular (funnel-shaped). The flowers are usually tetramerous. The exceptions are H. hirtum, H. rufidulum and H. subulatum which are the only species in the genus to have penta-merous flowers.

The arrangement of the flowers varies: a densely compound dichasia (fig. 1a.–Group of the false dichotomy with the flowers to open situated between two lateral flower or cluster e. g. H. frutescens); a compound verticillate dichasia (fig. 1b. H. racemosum); a simple verticillate dichasia (fig. 1c. Dichasium are compiled decussate on elongate axis, such as on H. caudifolium, H. elliptifolium, H. lancifolium, H. microcarpum, H. racemosum, H. riparium, H. salicinum, H. sampitense and fig. 1d. Dichasium are compiled opposite and alternate on elongate axis, e. g. H. glabrum); a panicle (fig. 1e. The branches of the primary axis are racemose and the flowers pedicellate e. g. Hypobathrum sp.); sub raceme (fig. 1f.–Pedicelate flowers are compiled decussate on elongate axis, pedicel ≤ 1 (–2) mm long, e. g. H. bangueyense, H. coniocarpum, H. glaberrimum, H. gracile, H. hirtum, H. lithophylum, H. longifolium, H. rheophyticum, H. subulatum and H. venulosum; fig. 1g. Compiled opposite and alternate on elongate axis e. g. H. lithophilum, H. rheophyticum and H. subulatum); spike (fig. 1h.–Sessile flowers are compiled decussate on elongate axis e. g. H. palustre and H. rufidulum).

Peduncle. The peduncle lengths vary from extremely short (≤ 2 mm) to ≥ 20 mm, to long, H. caudifolium which has peduncle up to 45 mm long. Peduncle type varies between subterete and ensiform or ensiform and quadrangular. The peduncle surface is usually puberulous, sometimes hirsute (H. coniocarpum and H. hirtum), or glabrous (H. bangueyense and H. racemosum).

Pedicel. Most flowers are sub-sessile with an extremely short pedicel ≤ 1 (–2) mm long.

Calyx. The lobes are united to form cup- or funnel-shaped calyx which usually has four or five tiny ovate or triangular lobes. The calyx is usually extremely short (up to 1.5 mm long) and is always persistent on the fruit.

Surface. The calyx is usually glabrous on the inside, except in H. coniocarpum where it is sericeous on the apex of the lobes. On outside, the calyx is sometimes sericeous on the lobes or over the whole of the outer surface, but it also can be glabrous e. g. H. venulosum. The calyx lobes are ciliated on the margins.

Corolla. The corolla is usually campanulate or infundibular, usually four lobed, seldom 5 lobed. The corolla texture is usually thin, but it can be thick (H. bangueyense, H. coniocarpum and H. elliptifolium). The shape of the corolla lobes is usually rotundate or ovate.

Fig. 1. The arrangement of flowers in inflorescence: a. densely compound dichasia; b. compound verticillate dichasia; c. and d. simple verticillate dichasia; e. panicle; f. and g. sub raceme; h. spike.

Surface. The corolla is usually glabrous on the outer surface, less frequently it is hairy, e. g. H. hirtum, H. lithophilum, H. longifolium, H. rheophyticum, H. rufidulum and H. subulatum.
The inner surface of the throat is usually sparsely to densely villous, but it can be glabrous e.g. in *H. coniocarpum*, *H. glaberrimum* and *H. lancifolium*. The margins of the lobes are ciliated.

**Stamen.** The stamen is usually sub-sessile (with filament up to 1 mm long) seldom sessile e.g. *H. collinum*, *H. glaberrimum*, *H. lithophilum*, *H. microcarpum*, *H. riparium* and *H. subulatum*. The stamens are usually inserted in the throat, sometimes around the middle of the tube (*H. ellipticifolium*, *H. sampitense* and *H. subulatum*).

**Anther.** The anthers are always slightly protruding (the tips of the anthers are exerted in open mature flowers), their shape varies from ovate, lanceolate, to linear. The apex is always acute and its base is always bilobed. The anther is usually dorsifixed around the middle, sometimes sub-basifixed, but rarely dorsifixed (*H. coniocarpum* and *H. microcarpum*).

**Disc.** Most species have an annular disc and few have annular swollen. In nature, the ring-like, green disc surrounding the base of the style is coated with nectar. Although actual observations are lacking, it is suggested that the flowers are visited by flies while in search of nectar they carry out pollination (Robbrecht & Puff, 1986).

**Pistil.** The ovary is always inferior and consists of two locules, with 1–9 ovules per locule. Placental position is apical and pendulous.

**Style.** The style is usually terete and smooth. The exception is *H. subulatum* where it is terete with vertical grooves. Most species have a style which is villous over the whole surface, if the surface is vertically grooved then the hairs are found on the grooves. According Robbrecht & Puff (1986), hairs and vertical grooves have function in pollen presentation. In some species the style is glabrous (*H. coniocarpum*, *H. glaberrimum* and *H. lancifolium*).

**Stigma.** The stigma is always bifid, with the lobes linear or oblong. The lobes open horizontal in the mature flowers to facilitate pollen reception but they are closed in the bud stage when pollen presentation may occur.

**Fruit**

*Fruit* (fig. 2). Most species have subglobose fruits, but other shapes occur: elliptic (*H. coniocarpum* and *H. salicinum*), or obovate (*H. ellipticifolium*, *H. rheophyticum* and *H. sampitense*), or pyriform (*H. gracile*, *H. lithophilum*, and *H. subulatum*), or turbinate (*H. venulosum*). The fruits are smooth, except in *H. gracile* and *H. venulosum* which are vertically grooved. The surface of the fruits are usually glabrous, but may also tomentose (*H. rufidulum*), hirsute (*H. hirtum* and *H. longifolium*), and puberulous (*H. subulatum*). The fruits are baccate (mesocarp fleshy and juicy).

**TAXONOMY**

**HYPOBATHRUM** Blume


**Habit** shrub, tree or treelet. **Trunk** straight with pairs of horizontal to divaricating branches. **Branchlets** quadrangular to subterete, bark smooth or vertically fissured, glabrous, or caducous or persistent hairs.

**Leaves** ovate, elliptic, lanceolate or linear, coriaceous, decussate, symmetrical, above gla-
brous, drying colour pale green, grayish dark brown or dark brown, below glabrous or persistent hairs or hairs disappear by ages, on the primary or primary and secondary veins or over the whole parts, drying colour light brown, brown or dark brown; margins entire, glabrous, caducous or persistent hairs; veins above depressed or prominent, below prominent; primary veins weak to massive; secondary veins curved; 5–14 pairs, with acute to wide angle divergence, tertiary veins inconspicuous or conspicuous, marginal veins arcuate. Petiole subterete or flatten.

Stipules ovate, triangular or lanceolate, keeled, caducous, sub-caducous or persistent, base free or connate, inner and outer surface glabrous or hairy, margins ciliate.

Bracts deciduous or opposite and alternate, ovate, triangular or lanceolate, keeled, inner and outer surface glabrous, sericeous or pilose, margins ciliate. Bracteoles ovate, triangular or lanceolate, keeled, one or pair inserted on the base or on the middle of the top of pedicel, inner and outer surface glabrous or hairy, margins ciliated, the base free or connate on one side.

Inflorescences axillary or axillary-pseudoterminal, deflected, horizontal or erect, originating from the nodes or supra-axillary in origin. Peduncle extremely short or distinct, glabrous or with caducous or persistent hairs.

Flowers hermaphrodite, arranged in a densely compound dichasia, a simple or compound verticillate dichasia, sub raceme, a panicle, or a spike, sessile or sub sessile, tetramerous or pentamerous. Hypanthium cup or funnel-shaped, glabrous or hairy. Pedicel extremely short or distinct, glabrous or with hairy. Calyx cup or funnel-shaped, inside and outside glabrous or with hairy, divided into 4–5 tiny ovate or triangular lobes, margins ciliate. Corolla cup- or funnel-shaped, thin or thick, tubes short, the throat glabrous or villous, divided into 4–5 rotundate or ovate lobes, contorted in the bud, margins ciliate. Perianth epigynous. Ovary inferior, bilocules, one to many ovules per locule. Stamens 4–5, sessile or sub sessile, inserted in the throat or around the middle of the tube. Anthers ovate, lanceolate or linear, with two lobes at the base, dorsifixed, or dorsifixed around the middle or sub-basifixed, erect, slightly protruding in the blossom flower. Stigma bifid, 2 oblong or linearly lobed, glabrous or villous, lobes open horizontal and exerted in the blossom flower. Style terete, smooth or vertical grooves, glabrous or villous. Disc annular or annular swollen. Perianth epigynous. Ovary inferior, 2 loculed with 1 to many ovules per locule.

Fruits baccate, subglobose, obovate, elliptic, pyriform or turbinate, smooth or vertical grooves, glabrous or hairy, with a persistent calyx; exocarp leathery, mesocarp fleshy, endocarp membranaceous. Stalk extremely short or distinct, glabrous or hairy. Seeds 1 to many, concave or compressed, arranged pendulous imbricate, exostesta was composed of elongate strongest fibrous cells, sulcate, embryo foliate, spatulate, basal lateral, cotyledon incumbent.


Hypobathrum is found throughout Borneo, both Malaysian and Indonesian political areas.

**KEY TO THE BORNEAN SPECIES OF HYPOBATHRUM**

1. a. Branchlets with a persistent indumentum ..... 2
   b. Branchlets glabrous or with a caducous indumentum ........................................ 4

   b. Bracts not sericeous over the whole surface. Bracteoles inside sericeous on the top. Flowers in sub raceme, sub sessile. Anthers dorsifixed around the middle ...................... 3


4. a. Leaves linear, tertiary veins inconspicuous...... 5
   b. Leaves not linear, tertiary veins conspicuous .. 8

   b. Leaves puberulous on the veins of the lower surface. Bracts opposite and alternate. Bracteoles base free. Anthers dorsifixed around the middle ..... 6

   b. Bracts not spear like and the first bracts do not elongate. A pair of the bracteoles inserted
oppositely to the pedicel. Inflorescences arising from the nodes. Flowers tetramerous. Style smooth .................................................. 7
8. a. Bracts inside hairy ........................................... 9
b. Bracts inside glabrous ....................................... 15
9. a. Stipules outside glabrous .................................. 10
b. Stipule outside hairy ........................................ 13
b. Stipules persistent. Pedicel hairy .................... 11
11. a. Bracteoles inserted oppositely to the base of the pedicel. Inflorescences originating from the nodes ............................................. 4. H. coniocarpum
b. Bracteoles inserted oppositely to the middle to the top of the pedicel. Inflorescences supra-axillary in origin ............................................. 12
b. Disc annular. Fruits obovate ..................................... 14
15. a. Flowers in a spike, sessile .................................... 16
b. Flowers not in a spike, sub sessile ..................... 17
b. Lower surface of veins and petiole scattered puberulous. Stipules base free. Bracteoles base connate on one side, inserted oppositely to the base of the pedicel. Corolla funnel-shaped. Anthers dorsifixed around the middle .................................................. 15. H. palustre
17. a. Bracteoles base connate on one side .................. 18
b. Bracteoles base free ........................................... 19
18. a. Corolla inside villous in the throat. Anthers sub-basifixed. Style villous on the middle to the top ............................................. 18. H. riparium
b. Corolla inside glabrous. Anthers dorsifixed around the middle. Style glabrous .................................. 11. H. lancifolium
19. a. Veins with a persistent indumentum on lower surface. Flowers in sub raceme ................... 23
b. Veins glabrous or with a caducous indumentum on lower surface. Flowers not in sub raceme, 20
b. Bracts triangular, decussate. Pedicule hairy, ... 21
b. Flowers not in a panicle ........................................ 22
b. Stipule triangular, caducous. Bracteoles inserted oppositely to the base of the pedicel. Inflorescences arising from the nodes. Peduncle and axis glabrous. Anthers sub-basifixed .................................................. H. bangueyense

1. Hypobathrum bangueyense Mulyaningsih & Ridsdale, sp. nov. —Fig. 3

Folia elliptica subitus venis puberulis, petioli hirti, stipulae triangulares caducae, bracteae triangulares decussatae glabrae, bracteoleae triangulares basi liberae pedicelli basi opposite insertae, corolla crassa, lobii ovati, fusi villosa, stylus stigma villosus, antherae subbasifixa. – Typus: P. Castro & F. Melegrito 1445 (BO–holotype), North East Borneo, Banggi (Banguay) island, VIII 1923. Fl.

Habit unknown. Branchlets divaricating, when young quadrangular and becoming sub-terete with age, bark smooth, glabrous; internodes 37–45 mm long, 2.5 mm wide, 2 mm thick, pilose on the young nodes after stipules have fallen.

Leaves elliptic, 75–108 mm long, 26–46 mm wide, above glabrous, drying colour pale green, below puberulous on primary and secondary veins, brown; apex cuspidate; the base cuneate; margins with caducous hairs; veins above depressed below prominent, primary veins stout, secondary veins ascending, curved, 7 pairs, moderate angle of divergence, tertiary veins
conspicuous. Petiole terete 6–7 mm long, hirsute on upper surface.

Fig. 3. Hypobathrum bangueyense; A. flowering shoot from P. Castro & F. Melegrito 1445; B. flower bud; C. mature flower; D. pistil; E. the longitudinal section of the hypanthium; F. corolla; G1. Bracteole inside; G2. bracteole outside; H1. Bract inside; H2. Bract outside.

Stipules caducous, triangular, 7 mm by 5 mm, keeled, outer surface tomentose on the tip, inner surface glabrous, the base free, apex acute.

Bracts triangular, 2 mm by 0.5 mm, strongly keeled, decussate, the apex acuminate, glabrous on outer and inner surfaces. Bracteoles triangular 1 mm by 0.3 mm, keeled, opposite at the base of the pedicel, inside glabrous, outside sparsely sericeous, the base free.

Inflorescences deflected, arising from the nodes. Peduncle up to 2 mm long, glabrous. Axis glabrous, 15–50 mm long, 10–35 nodes, compressed below nodes, 4 mm space between nodes.

Flowers arranged in sub raceme, sub-sessile, tetra-merous, 2 mm by 1.1 mm. Pedicel 0.2 mm long, hirsute. Hypanthium funnel-shaped, 0.8 mm by 0.8 mm, glabrous. Calyx funnel-shaped, 0.5 mm by 1.2 mm, tubes glabrous, lobes 4, tiny ovate, 0.4 mm by 0.7 mm, inside glabrous, outside sparsely sericeous on the apex. Corolla thick, funnel-shaped, 1.8 mm by 1 mm (flower bud), glabrous on outer surface, tubes short, the throat sparsely villous; lobes 4, ovate, 0.8 mm by 1 mm. Stamens 4, sub sessile, inserted in the throat; filament 0.1 mm long; anthers sub-basifixed, 1 mm by 0.2 mm. Style smooth, terete, 0.6 mm long, sparsely villous on the middle to the top. Stigma bifid, lobes 0.6 mm long, sparsely villous on outer surface. Disc annular. Ovules 5 per locule.

Fruits not seen.

DISTRIBUTION AND ECOLOGY. The herbarium specimens were collected only from Banguey island, but no notes on habit and ecology were made.

2. Hypobathrum caudifolium Mulyaningsih & Ridsdale, sp. nov.—Fig. 4


Habit treelet, 3-4 m high, 3 cm diam. Branchlets divaricating, when young quadrangular and becoming subterete with age, bark smooth, glabrous but around the nodes scattered puberulous on young growth, internodes 50–73 mm long, 1.5–2 mm wide, 1.5–2 mm thick.

Leaves ovate to elliptic, 100–140 mm long, 28–60 mm wide, above glabrous, drying colour dark brown, below sparsely puberulous on the primary veins of the young growth, drying colour brown; apex acutate; the base acute; margins glabrous; veins above depressed, below prominent, primary veins moderate to weak, secondary veins curved, 7 pairs, ascending with acute to moderate angle of divergence, tertiary veins conspicuous. Petiole 7–10 mm long, above sparsely puberulous on the young growth.

Stipules persistent, ovate, 5–7 mm by 4.5–6 mm, keeled, apex acuminate to cuspidate, the base free, inside glabrous, outside scattered tomentose along the midrib.

Bracts triangular, 1.5 mm by 0.8 mm, keeled, decussate, inside glabrous, outside sericeous over the whole parts. Bracteoles ovate, 0.9–1 mm by 0.5–0.8 mm, faintly keeled, opposite at the base.
of the pedicel, inside glabrous, outside densely sericeous on the midrib to the whole parts, the base free.

Inflorescences deflected, horizontal or erect; supra-axillary in origin. Peduncle 15–45 mm long; axis 70–100 mm long with 23–26 nodes, 3–7 mm between nodes, subterete to ensiform, sparsely hirsute.

Fig. 4. Hypobathrum caudifolium; A. flowering shoot from H. Wiradiinata 1310; B. flower bud; C. mature flower; D. pistil; E. the longitudinal section of the hypanthium; F. corolla; G1. bracteole inside; G2. bracteole outside; H1. bract inside; H2. bract outside.

Flowers arranged in a simple verticillate dichasia, sub sessile, tetramerous, 4.5 mm by 2 mm. Pedicel 0.5 mm long, glabrous. Hypanthium cup-shaped, 0.5–1 mm by 0.7–1 mm, densely hirsute. Calyx funnel-shaped, 0.7–1 mm by 0.7–1 mm, outside densely sericeous, inside glabrous, lobes 4, ovate, 0.3–0.7 mm by 0.5 mm, faintly keeled. Corolla thin, funnel-shaped, 3.8 mm by 2 mm, outside glabrous, tubes up to 2 mm in long, inside sparsely villous in the throat, lobes 4, rotundate, inside sparsely villous on the base. Stamens 4, sub sessile, inserted in the throat, filaments 0.1 mm long, anthers linear, 1.7 mm by 0.2 mm, dorsifixed around the middle, the base with two lobes. Style terete, smooth, 1.25 mm long, densely villous on the middle to the top. Stigma bifid, lobes linear, densely villous on outside. Disc annular. Ovule 1 per locule.

Fruits not seen.

VERNACULAR NAMES. BORNEO: Semampat (Kutai), Dejang (Dayak).

NOTES. This species strongly resembles H. gracile but differs in the following characters: hairy on primary veins below, inflorescence type, calyx and corolla shape and hypanthium hairy.

3. Hypobathrum collinum Mulyaningsih & Ridsdale, sp. nov.—Fig. 5

Folia elliptica glabra, stipulae caducae ad subcaducae basi connatae, inflorescentiae crasse deflexae supra-axillariter orae, flores spiciformes.


Habit unknown. Branchlets subterete when young quadrangular and becoming subterete with age, bark smooth, glabrous; internodes 45–65 mm long, 2.5–3 mm wide, 2–2.5 mm thick.

Leaves elliptic, 105–150 mm long, 33–53 mm wide, above glabrous, drying colour dark brown, lower surface glabrous, drying colour brown; apex caudate; the base obtuse; margins glabrous; veins above depressed, below prominent, primary veins moderate, secondary veins curved, 7–9 pairs, ascending with angle of divergence moderate, tertiary veins conspicuous. Petiole 3 mm long, 1 mm diam., glabrous.

Stipules caducous to sub-caducous, lanceolate, 7 mm by 3 mm, keeled, the base connate, apex cuspidate, glabrous on inner and outer surfaces.

Bracts ovate, 1.2 mm by 0.8 mm, keeled, decussate, inside glabrous, outside sericeous on the top. Bracteoles triangular, 0.8 mm by 0.4 mm, keeled, one inserted on the middle to the top of pedicel, glabrous on inner and outer surfaces, the base free.

Inflorescences stout, horizontal to deflected, supra-axillary in origin. Peduncle ensiform, 3–4 mm long, 1 mm diam., puberulous. Axis ensiform, 15–25 mm long, 1 mm wide, 8–12 nodes, space between nodes 2–3 mm, glabrous.

Flowers arranged in a spike, sessile, tetramerous, 2 mm by 0.8 mm. Hypanthium funnel-shaped, 0.8 mm by 0.7 mm, glabrous. Calyx subcampanulate, 0.8 mm by 0.8 mm, glabrous on inner surface; lobes 4, narrowly triangular, 0.5 mm by 0.3 mm, outside sparsely sericeous on the top. Corolla thin, campanulate, 1.6 mm by 0.8 mm; outer surface glabrous, inner surface densely villous in the throat; lobes 4, rotundate, 0.6 mm by 0.4 mm, glabrous on inner surface. Stamens 4,
sessile, inserted in the throat; anthers lanceolate to linear, 0.7 mm by 0.2 mm, sub-basifixed, base with two lobes. Style smooth, terete, 0.2 mm by 0.05 mm, villous on the middle to the top. Stigma bifid, 0.1 mm long, villous on the outer surface. Disc annular. Ovules 5 per locule.

Fruit smooth, subglobose, 7–8 mm by 4–5 mm, glabrous, exocarp thick, mesocarp fleshy, endocarp membranaceous. Stalk 1.5 mm long, 2 mm diam., glabrous. Seeds 1–2 per locule, concave to compressed, 5 mm long, 3 mm wide, 0.8 mm thick.

DISTRIBUTION. Bukit Batu Milier (Central Borneo).

4. Hypobathrum coniocarpum (Korth.) Mulyaningsih & Ridsdale, comb. nov.


Habit unknown. Branchlets subterete but quadrangular on young growth, bark smooth, glabrous but sparsely puberulous on below the nodes of the young growth, internodes 38–60 mm long, 2.5 mm wide, 2.5 mm thick.

Leaves elliptic, 70–75 mm long, 32 mm wide, glabrous, above pale green, below drying colour brown; apex acute; the base attenuate; margins glabrous; secondary veins curve, 9 pairs, ascending with moderate angle divergence, tertiary veins conspicuous. Petiole subterete, 5 mm by 1 mm, scattered puberulous on the upper part.

Stipules caducous, triangular, 7 mm by 4 mm, keeled, inside glabrous, outside sparsely puberulous along the midrib, the base free, apex obtuse.

Bracts ovate, 1 mm by 1 mm, keeled, decussate, inside pilose on the base, outside hirsute. Bracteoles triangular, 0.7 mm by 0.8 mm, keeled, opposite at the base of pedicel, outside sericeous on the top, inside glabrous, the base connate on one side.

Inflorescences deflected, originating from the nodes. Peduncle ensiform, 3 mm by 1.5 mm, sparsely puberulous. Axis 9–12 mm long, 30 nodes, space between nodes 2 mm, sparsely puberulous.

Flowers arranged in a simple verticillate dichasia, sub sessile, tetramerous, 3 mm by 1 mm.
Pedicel 1 mm by 1.5 mm, sparsely puberulous. **Hypanthium** cup-shaped, 1.5 mm by 1 mm, glabrous. **Calyx** campanulate, 0.5 mm by 1 mm, inside glabrous, outside scattered sericeous; lobes 4, triangular, 0.3–0.7 mm by 0.5–0.7 mm. **Corolla** thick, sub-campanulate, 2.2 mm by 1 mm, inside villous in the throat, outside glabrous; lobes 4, ovate 1.2 mm by 0.6 mm. **Stamens** 4, sessile, inserted around the middle of the tube; anthers dorsifixed around the middle, linear, 0.9 mm by 0.1 mm. **Style** smooth, terete, 0.4–1.25 mm, villous on the middle of the top. **Stigma** bifid, linear, 0.6 mm by 0.1 mm, villous on outer surface. **Disc** annular. **Ovules** 7 per locule.

**Fruits** smooth, obovate, 6–7 mm by 2.5–3 mm, glabrous, exocarp thick, mesocarp fleshy, endocarp membranaceous. **Stalk** 6 mm by 0.7 mm, sparsely puberulous. **Seeds** 7 per locule, compressed, 4 mm long, 1 mm wide, 0.1 mm thick.

**DISTRIBUTION AND ECOLOGY.** This species was found growing on the clayey ground near the riparian forest at Martapura (South Borneo) and Kombang mountain, West Kutai (East Borneo). It is found at an altitudinal range 30–2100 m above sea level. Flowering: September, fruiting: November (middle Java); flowering and fruiting: January–April, or June–August (West & East Java).

**VERNACULAR NAMES.** Apit, Hapit, Kopian, Kopen (Java); Resberesan (Madura); Kikopi (Sunda).

7. **Hypobathrum glaberrimum** Mulyaningsih & Ridsdale, sp. nov. –Fig. 7

Folia lanceolata glabra, stipulæ persistentes, bracteolæ pedicelli e medio ad apicem insertæ, inflorescentiae supra-axillariter ortae, flores in sub-campanulæ, corolla utrinque glabra, stylus teretius stigma bifidum glaber. – **TYPUS:** **Amadjah** 346 (BO!–holotype, L–isotype) Central Borneo, Untung river, 27 XII 1898. Fl. bud & fr.

**Habit** unknown. **Branchlets** divaricating, subterete but quadrangular on young growth, bark smooth with rounded scars made by insects, glabrous, internodes 40–75 mm long, 2–3 mm wide, 1–2 mm thick. **Leaves** lanceolate, 90–198 mm long, 23–66 mm wide, glabrous, upper surface (grayish) dark brown and lower surface drying colour brown; apex cuspidate to caudate; the base attenuate to cuneate; margins glabrous; veins above depressed, below prominent, primary veins stout to moderate, secondary veins curved, (6–) 8–11 pairs, ascending with moderate angle divergence, tertiary veins conspicuous reticulate. **Petiole** subterete, 2–7 mm by 1–2 mm, glabrous.

**Stipules** persistent, triangular to lanceolate, 5–11 mm by 4–7 mm, faintly keeled, glabrous on inside and outside, the base connate, apex acute to narrowly acuminate. **Bracts** narrowly triangular, 1.5–3 mm by 0.5–1.5 mm, keeled, decussate, inside pilose on the base, outside sericeous along the midrib. **Bracteoles** ovate, faintly keeled, 1–1.5 mm by 0.8–1 mm, apex acuminate, opposite at the middle to the top of the pedicel, inside glabrous, outside
sericeous on the top, the base connate on one side.

DISTRIBUTION AND ECOLOGY. This species has been found near river banks, at Untung river, Lelebulan (Central Borneo), Magne river (East Borneo) and in North Borneo.

8. Hypobathrum glabrum Mulyaningsih & Ridsdale, sp. nov. – Fig. 8

Folia elliptica glabra, stipulae triangulares caducae extra in costa tomentosae, bracteae ovatae oppositae vel alternatae, bracteolae basi liberae extus omnin sericeae, inflorescentiae e nodis ortae, flores in simplices dichasiis verticillatis, pedunculus, axis pedicelli glabri. – Typus: E. G. Sauver 1031 (BO!–holotype), Central Borneo, Tanah Laut, Tunggel mountain. 2 VIII 1965. Fl. bud.

Habit treelet to tree, 7 m high. Branchlets when young quadrangular and becoming subterete with age, bark smooth, glabrous; internodes 51–60 mm long, 2 mm wide, 2.5 mm thick, pilose on the young nodes after stipules have been fallen.

Leaves elliptic, 92–102 mm long, 32–37.5 mm wide, glabrous, above drying colour dark brown, below drying colour brown; apex cuspidate; the base cuneate, margins entire; veins above depressed, below prominent, primary veins moderate, secondary veins curved, 7–8 pairs, ascending with acute to moderate angle of divergence, tertiary veins conspicuous. Petiole subterete, 3 mm long, 1 mm diam., glabrous.

Stipules caducous or sub-caducous, triangular, 7 mm by 1.5 mm, apex obtuse, inside glabrous, outside tomentose along the midrib.

Bracts ovate, keeled, 1.9 mm by 0.8 mm, opposite and alternate, inside glabrous outside sericeous.

Bracteoles ovate, keeled, 1 mm by 0.7 mm, opposite at the base of pedicel, inside glabrous, outside sericeous, the base free.

Inflorescences erect, originating from the nodes. Peduncle subterete, 5 mm long, 1 mm diam., glabrous. Axis subterete, 18–24 mm long, 0.8 mm wide, 7–10 nodes, space between nodes irregular glabrous.

Flowers arranged in simple verticillate dichasia, sub sessile, tetramerous, 3 mm by 1.7 mm. Pedicel 0.3 mm long, 0.3 mm diam., glabrous. Hypanthium funnel-shaped, 0.5 mm by 0.7 mm, glabrous. Calyx funel-shaped, 0.5 mm by 0.7 mm, glabrous. Stigma bifid, ovate, 0.1–0.3 mm by 0.05 mm, glabrous. Disc annular. Ovules 2–3 per locule.

Fruits smooth, subglobose, 5–8 mm by 4–7 mm, glabrous, exocarp thick, mesocarp fleshy, endocarp membranaceous. stalk 1.5–3 mm by 4–7 mm, glabrous. Seeds compressed to con-cave, 1–3 per locule, 3–6 mm long, 2–2.5 mm wide, 0.5–2.5 mm thick, endosperm homogeneous.
lobes 4, rotundate, 1 mm by 0.9 mm, glabrous on inner surface. *Stamens* 4, sub sessile, inserted in the throat; filaments 0.3 mm by 0.1 mm; anthers lanceolate to linear, 0.2–1.3 mm by 0.05–0.1 mm, dorsifixed around the middle, the base with two lobes. *Style* smooth, terete, 0.8 mm by 0.1 mm, densely villous on the middle to the top. *Stigma* bifid, 0.1 mm long, villous on outer surface. *Disc* annular. *Ovules* 4–per locule.

**DISTRIBUTION AND ECOLOGY.** This species was found growing on periodically inundate land near Kelai river at the base of Nyapa mountain on 20 m above sea level, and in the disturbed forest and in the marshy calcareous forest at Kelinjau river, and in the secondary forest at Sak river (East Borneo) and Prarawin mountain, Banjarmasin (South Borneo).

**VERNACULAR NAMES.** BORNEO: Semampat (Kutai), Dejang (Wai-Dayak).


**NOTES.** *H. hirtum* (Ridley) Mulyaningsih & Ridsdale is based on *Petunga hirta* Ridley. Wong (1989) described this taxon as *H. longifolium* (DC) Wong var. *hirta* (Ridley) Wong. During the present study on *Muhamad Nur* 7405, it was noted that the taxon has the following typical characters: stipules persistent, ovate, outside hirsute over the whole parts; flowers pentameros; calyx infundibular, lobes outside sericeous over the whole parts and seed one per locule. These characters differ significantly from *H. longifolium* (DC) Wong var. *hirta* (Ridley) Wong is distinct species, it should be excluded from *H. longifolium* (DC) Wong and hence the taxon is once again recognised as a distinct species.


**DISTRIBUTION AND ECOLOGY.** This species has been found on the middle slopes of limestone ridge at Teng Bukap, Kuching, and in the plain of primary forest (30 m above sea level) at Kombeng mountain, West Kutai (East Borneo).

**VERNACULAR NAMES.** BORNEO: Kopi hutan (Melayu), Kupi tarun.


DISTRIBUTION AND ECOLOGY. Mempawah, Pontianak (West Borneo), Tewe river, Martapura (South Borneo), but no notes on habit and ecology were made.

NOTES. The specific epithet lanceolatum is already occupied in Hypobathrum with the combination H. lanceolatum (Sond.) Baill. based on Krausia lanceolata Sond. which is a different species. Hence a new specific epithet is required for the present taxon. H. lanceolatum (Sond.) Baill. has the following different characters: flowers turbinate, in a cyme, pentameric, corolla throat sparsely villous, stamens exerted, anthers basifixed and ovule 1 per locule.

12. Hypobathrum lithophilum Mulyaningsih & Ridsdale, sp. nov. – Fig. 9


Habit shrub, 1 m high. Branchlets divaricating, subterete, bark smooth, on below the nodes with caducous hairs, internodes 32–47 mm long, 1.5 mm wide, 2 mm thick.

Leaves linear, 95–133 mm long, 15–20 mm wide, above glabrous, drying colour grayish dark brown to dark brown, below sparsely puberulous on primary veins, drying colour brown; apex caudate; the base attenuate; margins glabrous; veins above depressed to prominent and below prominent, primary veins stout, secondary veins curved, 5–6 pairs, ascending with acute angle of divergence, tertiary veins inconspicuous. Petiole subterete, 5–9 mm long, 1 mm diam, sparsely puberulous. Stipules persistent, triangular keeled, 4–6 mm by 3–4 mm, inside glabrous, outside scattered sericeous along midrib, the base free, apex acute to acuminate.

Bracts narrowly triangular, 1–1.5 mm long, 0.5–0.8 mm wide, faintly keeled, opposite and alternate, inner surface glabrous, outer surface sericeous over the whole parts or on the top. Bracteoles triangular, 0.5–0.8 mm long, 0.5 mm wide, keeled, opposite on the middle to the top of pedicel, inside glabrous, outside sericeous on the top, the base free.

Inflorescences erect, originating from the nodes. Peduncle quadrangular or ensiform, 1.5–4 mm long, 0.5–1 mm wide, sparsely pu-berulous, compressed below the nodes. Axis 7–35 mm by 0.5–1 mm, tomentose, 6–15 nodes, space between nodes up to 3–8 mm.

Flowers arranged in sub raceme, sub sessile, tetra-merous, 4 mm long, 2 mm diam. Pedicel 1–2 mm long 0.5 mm diam., glabrous. Hypanthium funnel-shaped, 1.5 mm long, 1 mm wide, puberulous. Calyx subcampanulate, 0.5–1 mm by 1 mm, inside glabrous, lobes 4, ovate faintly keeled, 0.3 mm by 0.5 mm, outside sericeous. Corolla thin, funnel-shaped 2.6 mm long, 2.1 mm diam., outer surface sparsely puberulous; tubes ex-tremely short (up to 2 mm), inner surface densely villous in the throat, lobes 4, ovate, 1.1 mm long, 1 mm wide, margins ciliated. Stamens 4, sessile, inserted in the throat; anthers lanceolate, 1.2 mm by 0.2 mm, dorsifixed around the middle. Style smooth, terete, 1.5 mm long, included, villous. Stigma bifid, 0.8 mm by 0.2 mm, lobes lanceolate, villous. Disc annular. Ovules 5 per locule.

Fruits pyriform with vertical grooves, 8.5–10 mm by 3 mm, glabrous, exocarp thick, mesocarp fleshy, endocarp membranaceous. Stalk extremely short, 1–2 mm long, 0.5 mm diam., glabrous.
Seeds 3–5 per locule, compressed, 4 mm long, 1–1.5 mm wide, 0.8–1 mm thick.

DISTRIBUTION AND ECOLOGY. This species has been found dwelling stones in the primary forest on the banks of the Mahakam river bank, Batu Penolong, Toho river (East Borneo). It is found at an altitudinal range 100–150 m above sea level.

VERNACULAR NAME. BORNEO: Urvur (Dayak – Bahau).

13. HYPOBATHRUM LONGIFOLIUM (DC) Wong

DISTRIBUTION AND ECOLOGY. This species has been found in Thailand (by streams in evergreen forest at Surat, in lowland in the evergreen forest at Püket and on a hill near a stream at Pattānī); Malay Paninsula (in the forest at Pahang, Kwala Tmbeling, Selangor, Labu river, Perak, Goping; near a waterfall at Tapah, Penang and on a hill at Kelantan, Chaniaj); Sumatra, Java (in lowland to hill forest at Banten, Preanger, Semarang, Jepara, Madiun and Banyuwangi), Borneo (on the over flood-plain at Dahun, West Kutai, East Borneo). It grows at an altitudinal range 10–1200 m above sea level.

VERNACULAR NAMES. BORNEO: Pangihu (Kutai), Beran nipa (Benuwa-Dayak); Kihapiet, Kiapiet, Kikopi-lalaki (Sunda); Babalan, Hapit, Klagu, urang-urangan (Java).

14. HYPOBATHRUM MICROCARPUM (Blume) Bakh. f.

DISTRIBUTION AND ECOLOGY. This species has been found in the mixed dipterocarp forest or primary forest, on the dry land to wet land on the slopes of mountain or plain throughout Sumatra, Java and Lesser Sunda islands, or on the margin of rivulet at Mukun river. (East Borneo) and Kabili-Sepilok, and on limestone hill at Balembangan insland (North Borneo). It grows at an altitudinal range 30 - 100 m above sea level, at Landak river, Kapuas river, Kuala Penjauh (West Borneo); Wanariset, Mukun river at Samarinda (East Borneo).

VERNACULAR NAMES. Kayu-bras, Bras, Bebras, Membras, Muntimagas (Dusun), Kiapit (Sunda), Klayu (Java).

USES. In Indonesia, the young leaves and shoot tips are eaten raw as a vegetable and used medicinally for making astringent.

15. Hypobathrum palustre Mulyaningsih & Ridsdale, sp. nov. – Fig. 10


Habit sprawling shrub to treelet, up to 3 m high. Branchlets helicoid, subterete but quadrangular on young growth, bark smooth with a densely caducous hirsute; internodes 32–45 mm long, 1.5–2 mm wide, 1–1.5 mm thick.

Leaves ovate, 80–90 mm long, 28–35.5 mm wide; upper surface shinning; lower surface puberulous on primary and secondary veins, colour brown; apex cuspidate to caudate; the base attenuate; margins with caducous hairs; veins upper depressed, below prominent, primary veins stout to moderate, secondary veins 6–7 pairs, tertiary veins conspicuous. Petiole subterete, 4–6 (–9) mm long, scattered puberulous. Stipules caducous, triangular, 7–9 mm by 2.5–4 mm, inside glabrous, outside tomentose along the midrib or the base, apex acute, the base free.

Bracts ovate, 1 mm by 0.8 mm, faintly keeled, outside densely sericeous, inside glabrous, decussate. Bracteoles ovate, 0.4–1.3 mm by 1 mm, faintly keeled, opposite at the base of pedicel, outside densely sericeous over the whole parts, inside glabrous, the base connate on one side.

Inflorescences erect, originating from the nodes. Peduncle ensiform, 1–1.3 mm long, 0.75 mm wide, hirsute. Axis subterete to ensiform, (8–) 15–30 mm long, 8–15 nodes, 1.5 mm between nodes, hirsute.

Flowers arranged in a spike, sessile, tetramerous, 2–4 mm by 1–2 mm. Hypanthium subcampanulate, 0.5–1 mm by 0.7–1.2 mm, hirsute. Calyx funnel-shaped, 0.5–0.8 mm by 1–1.5 mm, inside glabrous, lobes 4, ovate, 0.4–0.4 mm by 0.5 mm, faintly keeled, outside sericeous over the whole surface. Corolla thin, funnel-shaped, 1–3 mm by 0.7–2.1 mm, inside sparsely villous in the throat, outside glabrous; lobes 4, rotundate,
0.6–1.3 mm by 0.6–1 mm, all parts sericeous on outside. *Stamens* 4, sub sessile, inserted in the throat, filaments up to 0.2 mm; anthers linear, 0.8–1.3 mm long, dorsifixed around the middle. *Style* smooth, terete, 0.4–1.5 mm, villous on the middle to the top. *Stigma* bifid, stigma lobes linear 0.4–1.5 mm long, villous. *Disc* annular. *Ovules* 2–3 per locule.

Fig. 10. *Hypobathrum palustre*; A. flowering shoot from v. Balgooy & v. Setten 5466; B. flower bud; C. mature flower; D. pistil; E. the longitudinal section of the hypanthium; F. corolla; G. bracteole; H1. bract inside; H2 bract outside.

Fruits not seen.

**DISTRIBUTION AND ECOLOGY.** Recorded as growing on alluvium in the peat swampy forest and in the dipterocarp forest on the base of Palung mountain (30 m above sea level) at Pontianak (West Borneo).

**NOTES.** This species resembles *H. gracile* on the flowering plant, but it differs on the following typical characters: e. g. bark of branchlets covered with caducous hairs, leaves below puberulous on primary and secondary veins, stipules triangular keeled, inflorescences originating from the nodes, bracteoles base connate on one side and hypanthium hisrute.

16. **HYPOBATHRUM RACEMOSUM** (Roxb.) Kurz.

**DISTRIBUTION AND ECOLOGY.** This species has been found at an altitudinal range 50–100 m above sea level in India (in the swamp forest at Lukehsmee-poora, Chittagong, not unfrequent in the coral-reef-forest of Katchall, especially near marshes at Nicobar islands); Myamar (not unfrequent in the swamp forests and in somewhat swampy places at Arracan, Pegu Mt.); Cambodia, Thailand (in the evergreen forest at Tā Ngaw, Bāng Son, Tākō (Surāi); common on landward edge of mangrove at Kārāi Lantā, Trang, Āo Tong or in the scrub by stream at Ranaawng and Lam Lieng (Pūket); in the light evergreen forest at Kao Chum Tawng and Tungsong (Nakawn Sīrtamarāti); Malay Peninsula (on the low marshy ground at Jōhōr, Tebing Tinggi, Malaca, Mērmāu Selangor, Batu tīga, Penang; on the waterfall at Perlis, Bersih Hangat and Kanga); Indonesia (in the forest throughout Sumatra, Java, Borneo/Celebes (West Borneo: Sambas river, Sanggau and Batu Lessung, South Borneo: in the secondary vegetation at Martapura, or on the base of limestone hill at Muara Uya, East Borneo: on the small river bank in the disturbed primary forest at Long Bangun and Magne river); Philippines (in the forest at Palawan and Balabac).

**VERNACULAR NAMES.** Bras, Bebras (Dayak); Muntimagas (Dusun Kuyu, Malay Peninsula), Kayu Ekor Gajah, Tulang Betina (Melayu); Kānlēn (Siamese, Peninsula).

**USES.** The Cambodians use this root as a part of decoction taken to treat yaws.

17. **Hypobathrum rheophyticum** Mulyaningsih & Ridsdale, *sp. nov.* – Fig. 11

Folia linearia subitus venis puberulis, petiolus subteretus puberulous, bracteae anguste triangulares oppositae vel alternatae, bracteoleae binatae ad pedicellum basin insertae, inflorescentiae erectae ad nodos ortae, pedunculus plus quam 30 mm longus, flores in sub-racemosae, tetrameri, hypanthium cupuliforme glabrum, corolla tenuis, faux sparse villosa, lobi ovati, stylus teretis stigma bifidum laevis glaber, fructus obovoidei laeves, pedicellos hisrutos. – Typus: *J. A. Mc Donald & Ismail* 3473 (BO!–holo, A–iso) East Borneo, Punjunan, Kayan-Mentaran, Gong river. Fl. & fr.

**Habit** shrub, 1–1.5 m high. *Branchlets* divaricating, when young quadrangular and becoming subterete with age, bark smooth, glabrous, internodes 12–25 mm long, 1 mm wide, 1 mm thick.

**Leaves** linear, 95–135 mm long 9–12 mm wide, above glabrous, drying colour grayish dark brown; below puberulous on all veins; drying...
colour brown; apex caudate; the base attenuate; margins glabrous; veins above depressed and below prominent, primary veins stout, secondary veins curved, 10 pairs, ascending with acute angle of divergence, tertiary veins inconspicuous. 

*Petiole* subterete, 5–8 mm long, 1–1.5 m diam, glabrous.

**Stipules** sub-caducous, triangular, keeled, 10 mm by 3 mm, glabrous, apex acuminate, the base free.

**Bracts** narrowly triangular, 4 mm long, 1 mm wide, faintly keeled, opposite and alternate, glabrous over the whole surfaces. **Bracteoles** narrowly triangular, keeled, 1.2 mm long, 0.5 mm wide, opposite at the base of pedicel, inner surface glabrous, outside sericeous, the base free.

**Inflorescences** erect, originating from the nodes. **Peduncle** subterete, 30–75 mm long, 0.1 mm wide, sparsely puberulous, axis compressed below the nodes, 7–13 mm by 0.5 mm, puberulous.

**Flowers** arranged in sub raceme, sub sessile, tetramerous, 4 mm long, 1 mm diam. **Pedicel** 1 mm by 0.5 mm, tomentose. **Hypanthium** cup-shaped, 2 mm long, 1 mm wide, glabrous. **Calyx** subcampanulate, 0.8–1 mm by 1 mm, inside glabrous, lobes 4, ovate, 0.5 mm by 0.5 mm, faintly keeled, outside sericeous. **Corolla** thin, subcampanulate, 2.2 mm long, 1 mm diam., outer surface hirsute, inner surface villous scattered in the throat, lobes 4, ovate, 0.8 mm long, 0.8 mm wide, margins ciliated. **Stamens** 4, sessile, inserted in throat, anthers lanceolate, 1.2 mm by 0.2 mm, dorsofixed around the middle. **Style** smooth, terete, 0.8 mm long, glabrous. **Stigma** bifid, 0.8 mm by 0.2 mm, lobes lanceolate. **Disc** annular. **Ovules** 7 per locule.

**Fruits** smooth, obovate, 12.5 mm by 5 mm, glabrous, exocarp thick, mesocarp fleshy, endocarp membranaceous. **Stalk** extremely short, 1 mm long, 1 mm diam., puberulous. **Seeds** compressed, 5 mm long, 1.5 mm wide, 1 mm thick, seeds 7 per locule.

**DISTRIBUTION AND ECOLOGY.** This species has been found in the primary forest, on the floodplain at least 10 m from Gong river, Kayan-Mentarang, Punjungan (East Borneo). Species rich, associates include Hopea, Shorea, Pometia, Eugenia, Dipterocarpus, etc., on 425–450 m above level sea.

18. **Hypobathrum riparium** Mulyaningsih & Ridsdale, sp. nov. – Fig. 12


**Habit** unknown. **Branchlets** when young quadrangular and subterete with age, bark smooth and rounded scars made by insects, glabrous to sparsely puberulous on below nodes on young growth, internodes 42–80 mm long.

**Leaves** lanceolate, 75–85 mm long, 20–40 mm wide, glabrous, above drying colour pale green, below drying colour brown; apex cuspidate; the base attenuate; margins glabrous; veins above depressed, below prominent, primary veins stout, secondary veins curved, 6–7 pairs, ascending, moderate angle of divergence, tertiary veins conspicuous. **Petiole** subterete, 3–5 mm long, 1 mm diam, glabrous.

**Stipules** caducous, triangular, 6–7 mm, keeled, glabrous on inner and outer surface, the base free, apex acute.
Bracts triangular 1.8 mm by 0.9–1 mm, keeled, glabrous on outside and inside, decussate with rare distant. Bracteoles triangular 1–1.5 mm by 0.1–0.8 mm, keeled, inside glabrous, outside sericeous on the top, opposite at the base of pedicel, the base connate on one side.

Inflorescences erect, originating from the nodes. Peduncle ensiform, 2–5 mm long, 1.5–2 mm wide, puberulous. Axis 20–35 mm long, glabrous, 2–20 nodes.

Flowers arranged in a simple verticillate dichasia, sub sessile, tetramerous, 4 mm long, 2 mm diam. Pedicel extremely short, 0.2–0.8 mm long, puberulous. Hypanthium funnel-shaped, 0.3–0.7 mm long, 0.5–0.9 mm wide, glabrous. Calyx funnel-shaped, 0.7–0.9 mm long, tubes glabrous, lobes 4, ovate, 0.5–0.9 mm by 0.3–0.5 mm, faintly keeled, outside puberulous on the tip, inside glabrous. Corolla thin, funnel-shaped, 3 mm long, 2–3 mm diam, outside glabrous, tubes inside villous in the throat, lobes 4, rotundate, 1.4–1.5 mm long, 0.9–1.1 mm wide, glabrous, margins ciliate. Stamens 4, sessile, inserted in the throat; anthers lanceolate to linear, 0.9–1 mm long, sub-basifixed. Style smooth, terete, 0.9–1 mm long, lobes linear, villous on outer surface. Disc annular.

Ovules 2–5 per locule.

Fruits smooth, subglobose, 2.1 mm by 1.8 mm, glabrous; exocarp thick, mesocarp fleshy, endocarp membranaceous. Stalk 1.2 mm long, glabrous. Seeds 2–5 per locule compressed, 0.5 mm long, 0.2 mm wide, 0.05 mm thick.

DISTRIBUTION AND ECOLOGY. This species has been found at North Borneo and Tanggi river (West Borneo) but no notes on habit and ecology were made.


DISTRIBUTION AND ECOLOGY. This species has been found at Sibolangit (Sumatra) and Semedum mountain, (West Borneo), but no notes on habit and ecology were made.

20. HYPOBATHRUM SALICINUM (Miquel) Bakh.

DISTRIBUTION AND ECOLOGY. This species has been found in the forest at river bank on low hills at Mentoko river, Martapura (South Borneo) and at Sompacti (North Borneo).

21. Hypobathrum sampitense Mulyaningsih & Ridsdale, sp. nov. – Fig. 13

Folia ovata petioli glabri, stipulae triangulares extus sparse tomentosae caducae, bracteae ovatae intus basi pilosae extus costa sericea, bracteae basi uno latere connatae, inflorescentiae erectae ad nodos ortae, pedunculus axis glaber, flores in simplices dichasii verticillati, hypanthium infundibuliforme, corolla tenuis infundibuliformes lobis ovatis, fructus obovoides.


Habit unknown. Branchlets when young quadrangular and becoming subterete, bark smooth, a caducous puberulous above nodes, internodes 30–60 mm long, 2.5 mm wide, 3.5 mm thick.

Leaves ovate, 65–85 mm long, 27–39 mm wide, glabrous, above drying colour pale green, below brown; apex acuminate; the base attenuate;
margins glabrous; veins above depressed, below prominent, primary veins stout, secondary veins curved, 7 pairs, ascending and matching with moderate angle of divergence, tertiary veins conspicuous. *Petiole* subterete, 5–7 mm by 1 mm, glabrous.

*Stipules* caducous, triangular, 6 mm by 3 mm, faintly keeled, inside glabrous, outside sparsely tomentose along the midrib, apex acute.

**Fig. 13.** *Hypobathrum sampitense*; A. flowering shoot from P. Buwalda 7886; B. flower bud; C. mature flower; D. pistil; E. the longitudinal section of the hypanthium; F. corolla; G bracteole; H1. bract inside; H2. Bract outside; I. fruit; J. the longitudinal section of the fruit; K. seed; L. embryo.

*Bracts* ovate, 1.2 mm by 1 mm, keeled, decussate, outside sericeous on the midrib, inside pilose on the base. *Bracteoles* ovate, 0.8–1 mm by 0.6 mm, faintly keeled, opposite at the base of pedicel, outside sericeous on the base of the midrib, inside glabrous, the base connate on one side.

*Inflorescences* erect, originating from the nodes. *Peduncle* ensiform, 3–6 mm by 1.5 mm, glabrous. *Axis* ensiform, 5–10 mm long, 10–15 nodes, space between nodes up to 1.5 mm, glabrous.

*Flowers* arranged in a simple verticillate dichasia, sub sessile, tetramerous, 3 mm by 3.5 mm. *Pedicel* up to 0.2 mm by 0.3 mm, scattered puberulous. *Hypanthium* funnel-shaped, 0.5 mm by 1 mm, glabrous. *Calyx* funnel-shaped, 0.7 mm by 1.1 mm, inside glabrous; lobes 4, ovate, 0.5 mm by 0.7 mm, faintly keeled, outside sericeous over the whole parts. *Corolla* thin, funnel-shaped, 2.5 mm by 3.5 mm, inside densely villous in the throat, outer surface glabrous; lobes 4, ovate, 1.3 mm by 0.8 mm. *Stamens* 4, sessile, inserted in the middle of tube; anthers sub-basifixed, lanceolate, 1 mm by 0.2 mm. *Style* smooth, terete, 0.7 mm by 0.2 mm, villous on the middle to the top. *Stigma* lanceolate, 0.6 mm by 0.2 mm, villous on outer surface. *Disc* annular. *Ovules* 2 per locule.

*Fruits* smooth, obovate, with calyx tube elongate, 10 mm by 4 mm, glabrous, exocarp thick, mesocarp fleshy, endocarp membranaceous. *Stalk* 5 mm by 0.9 mm, sparsely puberulous. *Seeds* 1–2 per locule, compressed, 5 per locule, 5 mm long, 1–2 mm wide, 1 mm thick.

**DISTRIBUTION AND ECOLOGY.** This species has been found on the village plain at Sampit (Central Borneo).

**VERNACULAR NAME.** BORNEO: Sapit-sapit (Sampit).

**22. Hypobathrum subulatum** Mulyaningsih & Ridsdale, sp. nov. – Fig. 14


*Habit* shrub, 1–1.5 m high. *Branchlets* divaricating, subterete, bark smooth, glabrous. *Internodes* (10–) 25–40 mm long, 2–2.5 mm wide, 2–2.5 mm thick.

*Leaves* linear, 155–198 mm long. 15.5–20 mm wide, above glabrous drying colour grayish brown, below sparsely puberulous at the veins, drying colour brown; apex caudate; the base attenuate; margins glabrous; veins above depressed and below prominent, primary veins stout, secondary veins curved, 10–11 pairs, ascending with acute angle of divergence, tertiary veins inconspicuous. *Petiole* flatten, (0.5–) 5–8 mm long, 1–2 m diam., glabrous.

*Stipules* sub-caducous, triangular 7–14 mm by 3–5 mm, keeled, inside glabrous, outside sparsely sericeous over the whole surface, apex acuminate, the base free.

*Bracts* spear-like, 3.5–4 mm long, 0.9–1 mm wide, the first bracts elongate to linear, opposite
and alternate with irregular space, inside and outside glabrous. Bracteoles ovate 0.9–1.2 mm long, 0.5 mm wide, keeled, one inserted on the base of pedicel, inside pilose on the base, outside puberulous on the top, the base free.

Inflorescences erect, supra-axillary in origin. Peduncle quadrangular or ensiform, 1.5–4 mm long, 0.5–1 mm wide, sparsely puberulous. Axis 16–95 mm by 0.5–1 mm, tomentose, 6–20 nodes, space between nodes up to 3–6 mm.

Inflorescences erect, supra-axillary in origin. Peduncle quadrangular or ensiform, 1.5–4 mm long, 0.5–1 mm wide, sparsely puberulous. Axis 16–95 mm by 0.5–1 mm, tomentose, 6–20 nodes, space between nodes up to 3–6 mm.

Flowers arranged in sub raceme, sub sessile, pentamerous, 4.7–6.4 mm long, 2–4 mm diam. Pedicel extremely short, 0.5–1 mm long, hirsute scattered. Hypanthium cup-shaped, 1–2 mm long, 0.7–1 mm wide, glabrous. Calyx subcampanulate, 0.7–1 mm by 0.7–1 mm, inside glabrous, lobes 5, ovate faintly keeled, outside glabrous. Corolla thin, funnel-shaped 2.2–3 mm long, 1–4 mm diam., inside villous in the throat, outside sparsely puberulous; lobes 5, rotundate, 0.8–1.2 mm long, 0.8–1 mm wide, margins ciliated. Stamens 5, sessile, inserted in the tube, anthers lanceolate, 1–1.5 mm by 0.2 mm, dorsiﬁxed around the middle. Style smooth, terete, 0.8–1.3 mm long with 10 vertical grooves with villous on the middle to the top. Stigma bifid, 0.8–1.5 mm by 0.2–0.8 mm, lobes lanceolate, grooved with villous on the outer surface. Disc annular swollen. Ovules 3–7 per locule.

Fruits smooth, pyriform, 8–12.5 mm by 2.5–5 mm, sparsely puberulous, exocarp thick, mesocarp fleshy, endocarp membranaceous. Stalk extremely short, 1 mm long, 1 mm diam., glabrous. Seeds 3–7 per locule compressed, 2.8–3 mm long, 0.8–1 mm wide, 0.3–1 mm thick.

Distribution and Ecology. This species was found growing on the flood-plain at confluence of rivers on Sedalir mountain, Genderan village (North Borneo).

Notes. The species resembles *H. lithophilum* on the flowering plant, but the present species has the following different characters: petiole ﬂatten, glabrous; bracts spear-shaped but the first bract elongate to linear, opposite and alternate; bracteole one inserted on the base of pedicel; flower pentamerous; style vertical grooves; fruits pyriform and stalk glabrous.

23. HYPOBATHRUM VENULOSUM (Hook. f.) Wong

Distribution and Ecology. This species has been recorded as growing in the mixed dipterocarp forest on basalt ridge (800 m above level sea) at Bukit Batu Mersing, Sarawak. This species has also been at Penang, Singapore (Malay Peninsula); Palembang (Sumatra) and in the research forest at Kenepai mountain (West Borneo).


Uses. In Malaya, the pounded root is used to make a poultice used in small-pox, and the boiled roots for treating rheumatism.

24. HYPOBATHRUM SP.

Habit treelet, 2 to 4 m high, 10 cm diam. Branchlets divaricating, quadrangular, bark smooth, scattered puberulous below nodes disappear with age, internodes 24–43 mm long, 1–1.5 mm wide, 1.5–2 mm thick.

Leaves lanceolate, 70–85 mm long, 12–15 mm wide, glabrous, above drying colour pale
green; below drying colour brown; apex acumen-
tate; the base attenuate; margins a caducous
indumentum; veins above and below prominent,
primary veins moderate, secondary veins curved,
7 pairs, ascending and matching with acute angle
of divergence, tertiary veins conspicuous. Petiole
subterete, 6–8 mm long, hirsute on upper surface.

Stipules caducous, ovate, 5 mm by 5 mm,
faintly keeled, glabrous on inside and outside,
the base free, apex acuminate.

Bracts narrowly triangular, 1.5 mm by 0.8
mm, keeled, decussate, inside glabrous, outside
sparsely to densely hirsute. Bracteoles ovate, 1 mm
by 1 mm, keeled, inside glabrous, outside sericous,
opposite on the base of pedicel, the base free.

Inflorescences erect, supra-axillary in origin.
Peduncle quadrangular, sub-terete or ensiform, 1–
2 mm long, sparsely puberulous. Axis ensiform,
13–23 mm long, 20–30 nodes, 1.5–2.5 mm
between nodes, puberulous.

Flowers arranged in a panicle, sub sessile,
tetra-merous, incomplete. Pedicel up to 0.6 mm
long, sparsely hirsute. Hypanthium cup- to funnel-
shaped, 0.9 mm by 0.8–1 mm, scattered puberulous.
Calyx funnel-shaped, 1 mm by 1.2 mm,
glomerous on inner surface, hirsute on outer
surface; lobes 4 ovate, 0.3–0.4 mm by 0.4–0.5
mm, faintly keeled. Disc annular. Ovules 2–4 per
locule.

Fruits not seen.

DISTRIBUTION AND ECOLOGY. Found
growing on the bank of a small rocky river, at 200
m above level sea at PT. ITCI area (East
Borneo).

NOTES. Harry Wiradiinata 246 (from PT. ITCI
area East Borneo) is provisionally mentioned here.
It differs markedly Inflorescences erect, supra-axillary in origin and flowers arranged in a
panicle. It possibly represents a separate taxon.
However the flowers are incomplete, it does not
permit an adequate description.

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