

Short Communication: Characteristic of *Anodendron paniculatum* (Apocynaceae) in Mount Nglanggeran, Yogyakarta, Indonesia

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Abstract. Widodo, Luthfi MJ. 2017. Short Communication: Characteristic of *Anodendron paniculatum* (Apocynaceae) in Mount Nglanggeran, Yogyakarta, Indonesia. *Biodiversitas* 18: 645-651. *Anodendron paniculatum* was found in climbing route of Mount Nglanggeran, Yogyakarta at coordinates location of 7°50'29.6" S and 110°32'19.5" E, at an altitude of 480 masl. The identification of *A. paniculatum* was conducted based on Museum Nasional d'Histoire Naturelle (MNHN), Paris, France with collection number of herbarium of P00256390. Information about *A. paniculatum* in Indonesia was very rare, even almost non-existent. This study aimed to describe the morphological characteristics of *A. paniculatum* included the morphology of flower, flower bud, leaf and stem. The study was conducted through periodically visiting at the research location. The observation was conducted to flowering period, the structure of flower and fruit and other supporting data. The specimen of samples were collected for herbarium collection and observation in the laboratory. The observation in the laboratory was conducted on morphological characteristics of habitus, stem, leaf and flower. The data were compared with literature and existing herbarium collections. The results of the study showed that the specimen of *A. paniculatum* is a liana, inflorescence in leaf axil and the end of branching, the size of panicle is about 15 cm, consisted of small yellowish tubular flowers with each flower has a length of 1.3 cm.

Keywords: *Anodendron paniculatum*, Apocynaceae, characteristic, Mount Nglanggeran

INTRODUCTION

In exploration and observation of wild plants in Mount Nglanggeran on October 16, 2009, we found woody lianas in a climbing route at coordinates location of 7° 50'29,6 "S and 110° 32'19,5 " E, at an altitude of 480 m asl. The plants were difficult to identify due to the lack of flower and fruit. On subsequent observation, we found flowering buds in December 2013. The identification is done and it is known that the plant species is *Anodendron paniculatum* A. DC.

Anodendron belongs to the subfamily Apocynoideae, family Apocynaceae (Takhtajan 2009). *Anodendron* genus consists of 17 species (Middleton 2007). It is naturally distributed from India, Japan, South China, to Vanuatu. Backer and Bakhuizen v.d. Brink (1965) state that there are three types of *Anodendron* in Java, namely *Anodendron coriaceum* (Bl.) Miq., *A. paniculatum* DC, and *A. tenuiflorum* Miq. According to Flora of China Editorial Committee (1995), *Anodendron* consists of 16 species covering a large area of India, Malaysia, Sri Lanka, and Vietnam. In China, there are five species of *Anodendron* namely *Anodendron benthamianum*, *A. howii*, *A. punctatum*, *A. affine*, and *A. formicinum*.

A. paniculatum in Mount Nglanggeran is a woody liana. The plant population was very limited. We found this plant in only one location. This species does not have a local name, so there is no local knowledge regarding its potential

(Widodo 2015). In Andhra Pradesh, India, *A. paniculatum* included in the list of medicinal plants with the International Union for Conservation of Nature (IUCN) status as endangered or threatened species (Ved et al. 2002).

The aim of the research was to describe morphological characters of *A. paniculatum* found on Mount Nglanggeran, Gunungkidul, Yogyakarta. The existence of the species *A. paniculatum* in Mount Nglanggeran needs to be disseminated to present the richness of flora on the island of Java. Currently, the knowledge about the diversity of flora on Java island, especially wild plants is less known.

MATERIALS AND METHODS

Study area

The research was conducted on the main climbing route of Mount Nglanggeran which is an ecotourism area in Gunungkidul, Yogyakarta, Indonesia (Figure 1) from August 2009 to March 2016. The plant identification method is performed according to Singh (2010). The plant was observed in situ periodically to accomplish the inflorescence, flowers, fruit, stem, root, and other supporting data. Photographic documentation was done as the first step of the identification process. Samples for herbaria were taken as minimal as possible and were done

carefully to maintain the population sustainability. Identification were carried on based on literature and voucher herbaria available.

Tools and materials

Equipment used for observation and data collection consists of digital cameras Sony NEX F3, Sony Cyber-Shot DSCW180, Canon DSLR, rulers, micrometers, calipers, roll-meters, transparent plastic bags, scissors, cutter, paper label, Global Positioning system (GPS), dried herbarium equipment, small bottles, stereo microscope Nikon SMZ 1500 equipped with camera, and Nikon light microscope equipped with a Nikon Eclipse 50 DSF1. Herbarium processing was done as determined by Simpson (2006) and Singh (2010). Herbarium specimens are stored at the State Islamic University Sunan Kalijaga, Yogyakarta (Herbarium Baturagung, BAW451112A2, and BAW401113A).

Methods

The steps of the research consisted of observation and photographing all part of *A. paniculatum* in-situ, making dried herbarium collection, photographing dried herbarium, and describe the structure of plant morphology in detail. The morphological data subsequently matched and identified using guidance by Backer and Bakhuizen v.d. Brink (1965), Trimen (1895), Flora of China (1995), Middleton (2007), PROSEA (2016), and India Biodiversity Portal (2016). Data from the dried herbarium were matched with the herbarium of the Museum National d'Histoire Naturelle, Paris, France (MNHN 2016), Virtual herbaria Austria (2016), and the Royal Botanic Gardens Kew (RBGK) (2016).

RESULTS AND DISCUSSION

The existence of *A. paniculatum* were known during exploration of wild plants in Mount Nglanggeran, Gunungkidul, Yogyakarta from August 2009 to March 2016. The most prominent character of the plant is its woody lianas habitus. Other characteristics are grayish bark surface, clear lenticels, single elliptical/oblong leaf, 10-20 cm long, 3-6 cm wide, tapered tip, base rounded, dark green, smooth upper surface, lower surface pale green, pinnate leaf veins and opposite leaf arrangement. At the beginning of the exploration, we had not found the flowers and fruit. Flower was found during December 27, 2011 until December 22, 2012 visitation. On February 11, 2012, we found a flower in dry condition, making it difficult to described. On January 13, 2013, flower found in full bloom and then we collect for further identification. Identification is done by using the book Flora of Java, Volume 2 (Backer and Bakhuizen v.d. Brink 1965) and it can be concluded that this plant species is *Anodendron*. Figure 2 shows a specimen of *Anodendron* from Mount Nglanggeran, GunungKidul. Description of *Anodendron* characters by Backer and Bakhuizen v.d. Brink (1965), Trimen (1895) and Flora of China (1995) are presented in Table 1.

Based on detailed observations on characteristics of the leaves and flowers, it is known that the *Anodendron* specimen collected was *Anodendron paniculatum*. Table 2 shows a comparison of the *A. paniculatum* description according to Backer and Bakhuizen v.d. Brink (1965) with specimen from Mount Nglanggeran. The table also shows the description of the characteristics *A. paniculatum* from other sources.

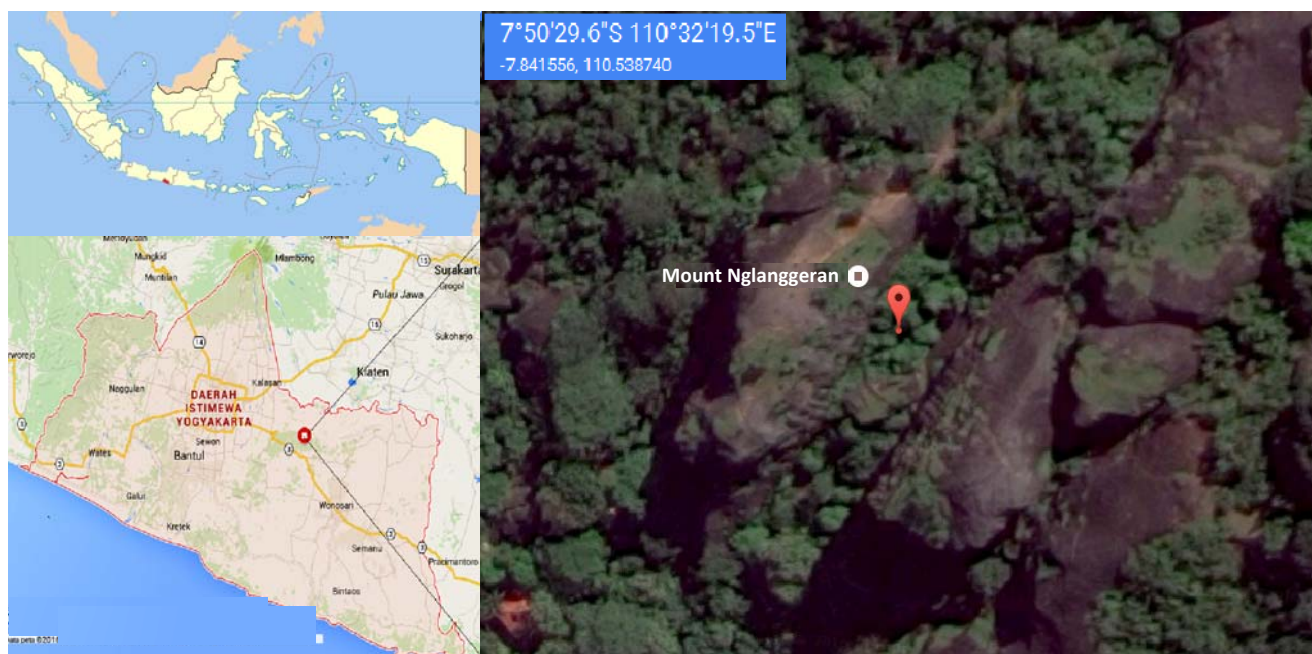


Figure 1. Location of *Anodendron paniculatum*. (A) of Yogyakarta Province of Indonesia, (B) the western side of Mount Nglanggeran, Gunungkidul.

The main character of *A. paniculatum* of Mount Nglanggeran are as follow: Large woody climbers, glabrous liana, latex watery. Leaves: petiole 1-1,5 cm long, oblong or obovate, 10-20 by 3-6 cm, apex acuminate, base cunetae to rounded, 8-20 pairs of secondary veins, usually slight prominent beneath, glabrous above and beneath. Inflorescence terminal, forming panicle, glabrous, 10-15 cm long, pedicels thins \pm 8 mm long. Sepals ovate, 0,8-1 $\frac{1}{2}$ mm long, apex rounded to acute, glabrous. Corolla greenish yellow; tube 3-5 mm long, lobes trap-shaped,

falcate, 6-9 mm long, glabrous outside, pubescens inside of lobes and tube. Flowering December-January.

Based on these data and descriptions in Table 1 it can be seen that the characteristics of the leaves of the *Anodendron* are more in line with the description of Middleton (2007), but the characters of the flower stalk are more similar to Backer and Bakhuizen v.d. Brink (1965). Matching of *Anodendron* herbarium of Mount Nglanggeran with type herbarium of the Museum National d'Histoire Naturelle, Paris collection number P00256390 (MNHN 2016) is shown in Figure 2.



Figure 2. *Anodendron paniculatum* collected from Mount Nglanggeran, Yogyakarta. (A) *A. paniculatum* habitus, (B) rods, (CD) twigs and leaves, (EF) inflorescence branches, (G) inflorescence paniculate cyme form, (H) flower buds, (I) flowers in bloom, and (J) longitudinal section of the flower.

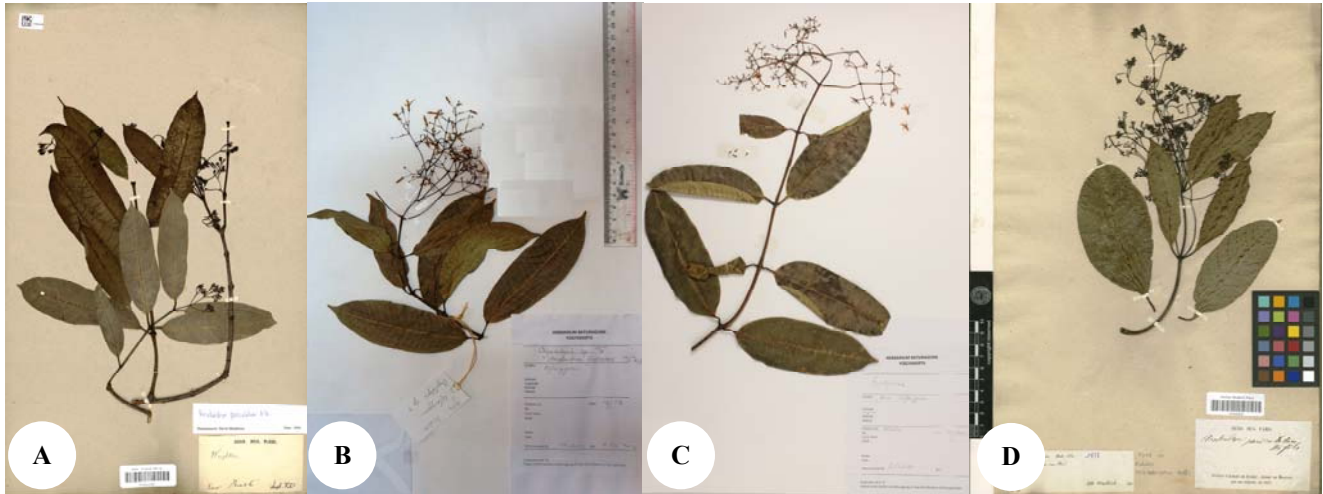


Figure 3. Comparison between *Anodendron* herbarium of Mount Nglanggeran with herbarium type *A. paniculatum*. (A-B) *A. paniculatum* Herbarium of Mount Nglanggeran (BAW451112A2, BAW401113A1); (C-D) *Anodendron paniculatum* A. DC. MNHN type (P00256390, P00492328).

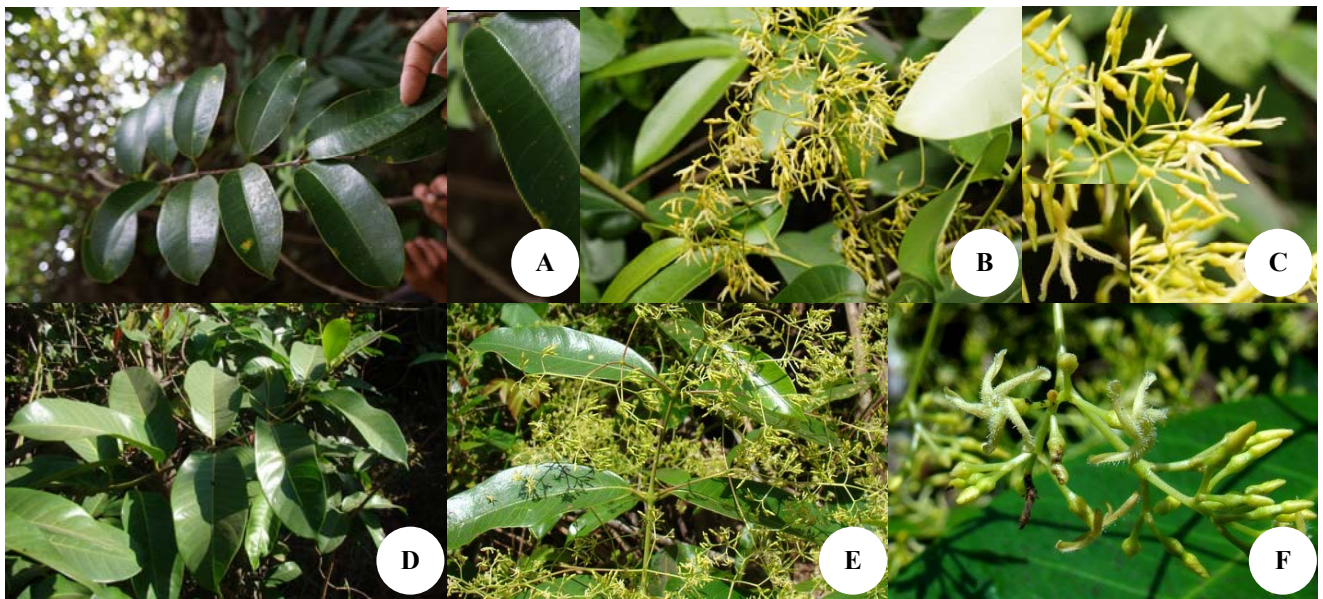


Figure 4. (A-C) Description *A. paniculatum* Collected from Mount Nglanggeran, Yogyakarta, (D-F) description *A. paniculatum* according to Efloraofindia (2007), A = the leafy twigs, B = inflorescence, C = flower, D = leafy twigs, E = inflorescence, F = flower

From the identification using herbarium type, it is known that the flower part of herbarium is still in the phase of buds, so it is difficult to know the size of the flower parts. Identification based on images (visual data) of these resources (websites) is done for comparison (re-check). Sources of these include coldb.mnhn.fr, www.kew.org and herbarium.univie.ac.at. Figure 3 shows a comparison of *A. paniculatum* according to Efloraofindia (2007) with *A. paniculatum* from Mount Nglanggeran.

Based on the comparison of morphological descriptions of the specimen collected with a description of the

literature, herbarium type, and photos from various references, it can be concluded that the specimen collection was *Anodendron paniculatum*. *Anodendron paniculatum* from Mount Nglanggeran, Yogyakarta has characters of longer flower stalk (pedicel), tubular corolla and corolla lobes are longer than that of literature (Table 1) as well as with reference herbarium. Habitus *A. paniculatum* of Mount Nglanggeran showed a more rigid leaf and glossy as well as more sub-veins of leaves. It is suggested that the difference of these characters are referred to subspecies.

Table 1. Description of *Anodendron* on the literacy

Sources	Description
Backer and Bakhuizen v.d. Brink (1965)	Flowers terminal or axillary in paniced cymes, small, 5 merous; calyx on the inside with or without basal glands, deeply divided; segments ovate-oblong; corolla salver-shaped; tube cylindric, slightly widened at the insertion of the stamens; throat constricted, hairy; faucal scales none; segments contorted in bud, overlapping to the right; stamens inserted below the middle of tube; filaments short; anther in the middle adhering to the stigma, sagittate; cells with as empty tail; disc annular-cupular, truncate or lobed; ovaries 2, free, in the lower halves or entirely enclosed by the disc, glabrous, ∞ ovuled; style short, glabrous; stigma thick, shortly collared; follicle spreading, tapering from the base, hard; seeds compressed, ovoid-oblong, beaked, with a long coma on the top of the beak, glabrous. Leaves opposite, penninerved. Liana.
Trimen (1895)	Woody twiners, 1. opp., subcoriaceous, fl. very small, in copious axillary and terminal paniculate cymes; cal.-segm. 5, very small; cor.-tube short, cylindrical, lobes 5, very narrow, strongly overlapping to right ; stam. 5, inserted near base of cor.-tube, anth. connivent, adherent to stigma; disk cupular, lobed; carp, distinct, ovules few, style very short, stigma thick, pointed; follicles stout, tapering, woody; seeds few, oval, compressed, strongly beaked, coma long.
Flora of China (1995)	Lianas with white latex. Leaves opposite, lateral veins usually wrinkled above. Cymes paniculate, terminal or axillary. Flowers small. Calyx deeply divided, with basal glands inside. Corolla salverform; tube cylindric, slightly dilated at staminal insertion, throat constricted, faucal scales absent; lobes overlapping and twisted to right. Stamens included, inserted just below middle of corolla tube; filaments short; anthers sagittate, connivent, adherent to pistil head, cells spurred at base; disc ringlike or cup-shaped, apex truncate or shortly 5-lobed. Ovaries 2, distinct, slightly higher than disc; ovules numerous in each ovary. Style short; pistil head thick, base with a ringlike membrane. Follicles divaricate, thick, narrowly ovoid, apex acuminate. Seeds compressed, ovate or oblong; beak with a long apical coma.
Middleton (2007)	Climbers or scramblers; producing white latex. Branches lenticellate or not; branchlets glabrous or, rarely, pubescens. Leaves opposite, those of a pair equal; petiolate, coriaceous to papery, entire. Inflorescence of axillary and/or terminal cymes, often forming panicles; flowers 5-merous, actinomorphic. Sepal lobes free; colleters at sepal margins of the base inside. Corolla lobes dextrorse; consisting of a narrow cylindrical tube which widens slightly at the point of stamen insertion into the upper tube and then with spreading lobes; lobes usually narrowly oblong or narrowly elliptic, rarely ovate, falcate. Stamen included in the corolla tube, attached to a ring to the style head; anthers sub sessile (except in the non-Malesian <i>A. benthamianum</i>), fertile in the upper half only, the lower half sterile, laterally with lignified guide rails and sagittate appendages at the base. Disk annular, 5 dentate or 5-crenate. Gynoecium 2-carpellate, apocarpous but apically united into a common style, superior, ovoid, glabrous; ovules numerous; style glabrous, short; style head ovoid with basal ring and no collar and short sharp projection on top. Fruit of paired follicles; divergent or sub divergent; wide at base, narrowing to end; longitudinally dehiscent. Seed beaked, grain narrow ovate or elliptic, flattened; glabrous; coma pointing towards the end of fruit.

During the observation from 2010 to August 2016 in Mount Nglanggeran, we found only *A. paniculatum* on the location coordinates 7°50'29,6 "latitude and 110°32'19.5" BT. At the location of observation, spreading and growth of these species take place with the formation of adventitious roots on the stems that touch the ground. The spread of these species is very limited in the vicinity of the observation form branches that are still associated with the parent.

According to Foster (1993), *Anodendron paniculatum* is a synonym of *Anodendron oblongifolium*. Meanwhile, The Plant List (2013) explained that *Anodendron paniculatum* synonymous with *Anodendron lanceolatum* King & Gamble, *Anodendron manubriatum* Merr., *Anodendron moluccanum* Miq., *Anodendron rhinosporum* Thwaites, *Anodendron sutepense* Kerr, and *Anodendron tenuiflorum* (Miq.) Miq. *Anodendron paniculatum* synonymous with

Anodendron rhinosporum among others, indicated by herbarium isotype W-Rchb. 1889-0128335 (Virtual herbaria Austria, 2016) collection of Thwaites (1860) from Sri Lanka, further re-identified by Middleton.

Anodendron rhinosporum are critically endangered (World Conservation Monitoring Centre 2016). Meyer (2007) states that *A. paniculatum* is a new invasive plant in Tahiti. *Anodendron paniculatum* introduced from Sri Lanka to Tahiti in 1934. Contradictory information shows problems that may come from misidentification of species *Anodendron rhinosporum*, typifying *Anodendron paniculatum*, IUCN evaluation, or at least study *A. paniculatum*.

Based on the observations and comparison with descriptions in literature and herbarium reference, characters of *Anodendron paniculatum* of Mount Nglanggeran summarized as follows: Large woody

Table 2. Description of *Anodendron paniculatum* on the literacy

Sources	Description
Backer and Bakhuizen v.d. Brink (1965)	Leaves shortly and obtusely acuminate, from a rounded top, narrowly oblong-lanceolate-obovate, 10-25 cm by 3-9 cm; nerves on either side of midrib 12-14, rather approximate, inarching quite near the margin; petiole 1-1 ½ cm. Panicles not exceeding 10 cm; pedicels thin, ± 4 mm; calyx-segments 1 ½-1 ¾ mm; corolla tube finely scaly inside (also in the throat); segments linear-lanceolate, with an oblique top, obtuse, much longer than the tube, yellow, on the inner side finely scaly especially at the base, ± 3 mm long; follicles linear-conical, ± 5 ½ cm. 15 m high. Flowering June; West Java. Central Java; 50-500 m alt; forest.
Middleton (2007)	Branchlets glabrous. Leaves: petiole 0.7-2.6 cm long; blade elliptic, oblong or obovate, 13.9-28.5 by 1.3-10.4 cm, 1.7-4.6 times as long as wide, apex acuminate, more rarely apiculate, base cuneate to rounded, 8-18 pairs of secondary veins, usually slight prominent beneath, tertiary venation obscure, glabrous above and beneath. Inflorescence axillary and terminal, usually forming a panicle, glabrous, 5.5-15.2 cm long; pedicels 1.4-3.3 mm long, bracteoles at the base. Sepals ovate, 0.7-1.3 by 0.8-1.2 mm, 1-3 times as long as wide, apex rounded to acute, glabrous, ciliate or not. Corolla white to greenish yellow; tube 1.2-2.7 mm long, 0.4-1.4 times as long as lobes; lobes strap-shaped, falcate, 1.7-4.4 by 0.6-1 mm; glabrous outside, pubescens on inside of lobes and in tube. Stamens inserted at 0.3-1 mm by 0.2-0.4 mm. Disk annular, 5-dentate or 5 crenate, style head 0.6-0.8 mm long. Fruit 8-15.5 by 1-3 cm. Seeds grain 14-22 by 6-9 mm; long; coma 5.2-9 cm long.
Trimen (1895)	A very large woody twiner, stems reaching 3 or more in. diam., much dichotomously branched, bark greyish-brown, young parts glabrous; l. 4-6 in., oval-oblong, rounded at base, shortly and suddenly acuminate, obtuse, glabrous and shining on both sides, subcoriaceous, lat. veins numerous, prominent beneath, petiole ½ in., stout; fl. very small, on slender glabrous ped., numerous, cymes large, lax, trichotomous, bracts small, deciduous; cal.-segm. ovate, acute, slightly ciliate; cor. ½ in. diam., tube cylindrical, hairy in throat, lobes spreading, linear, obtuse, slightly falcate, with scattered white hairs on upper surface; stam. with very short broad fil; stigmas sessile, pointed; follicles 4-6 in., divaricate, ovate-oblong, cylindrical, blunt, glabrous, hard and woody, black; seeds few, 8-12, all attached to basal placenta, oval, much compressed, broad, flat, about 1 in. of which ¼ is beak, reddish-brown, coma over 3 in, copious. Moist low country up to 2000 ft., very common. Fl. March; pale dull orange. Also in E. Bengal, Burma, W. India, Java, Philippines. It is remarkable that this conspicuous plant seems to be unrecorded until Moon. The stems afford a very strong fibre.
Prosea (2016)	A glabrous liana. Leaves with petiole up to 2.5 cm long; blade elliptical to obovate, 14-28 cm × 1-10 cm (2-4.5 times as long as wide), base cuneate to rounded, apex acuminate, lateral veins 8-18 pairs. Inflorescence 5-15 cm long; pedicel 1.5-3 mm long; sepals about 1 mm long; petals whitish-yellow, glabrous outside, pubescens inside, tube 1-3 mm long, lobes 2-4 mm long; stamens inserted up to 1 mm from corolla base; disk 0.3 mm in diameter; pistil 1-1.5 mm long. Fruit 8-16 cm × 1-3 cm. Seed up to 22 mm × 9 mm, beak 6-17 mm long, coma 5-9 cm long.
India Biodiversity Portal (2016)	Large woody climbers, latex watery; bark brown. Leaves decussate, 8-22 x 4-8 cm, elliptic-oblong or elliptic-obovate, base rounded, apex obtusely acute, subcoriaceous; lateral nerves 10-13 pairs, parallel; petiole to 2 cm long. Flowers small, in axillary and terminal lax paniculate cymes; pedicel to 4 mm long. Calyx-lobes 5, c. 1 mm long, ovate, acute, alternating with 5 small glandular scales. Corolla yellowish-white, c. 8 mm across, slaver-form; tube c. 1.5 mm long, inflated over stamens; lobes 5, c. 4 mm long, slightly falcate, overlapping to right. Stamens 5, included; anthers sagittate, basally spurred, apex mucronate, connivent around stigma. Ovaries 2, free; ovules many, marginal; style c. 1 mm long; stigma obconic. Follicles divaricate, 9-14 x 2-3 cm, terete, tapering to the apex. Seeds 2-2.5 cm long, obovate, compressed, beaked, comose at apex.

climbers or liana, latex watery, young branchlets glabrous; bark brown. Leaves: petiole 0.7-2 cm long; blade elliptic, oblong or obovate, 8-22 x 4-8 cm, elliptic-oblong or elliptic-obovate, base rounded, apex obtusely acute, base cunetae to rounded, subcoriaceous; lateral nerves 10-13 pairs, parallel. Inflorescence, in axillary and terminal lax paniculate cymes; flowers small, pedicel to 4 mm long; Calyx-lobes 5, sepals about 1 mm long, ovate, acute, ovate,

acute, slightly ciliate. Corolla greenish yellow, cor. ½ in. diam., tube cylindrical, hairy in throat, lobes spreading, linear, obtuse, slightly falcate, with scattered white hairs on upper surface c. 8 mm across, slaver-form; glabrous outside, pubescens on inside of lobes and in tube, tube 1.2-2.7 mm long. Stamens included, inserted just below middle of corolla tube; filaments short; anthers sagittate, stigmas sessile, pointed. Flowering December-January.

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