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A Preliminary Taxonomic Revision of *Heteropsis* (Araceae)

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Abstract—A preliminary taxonomic revision is presented of the Neotropical genus *Heteropsis*, widely known as the source of a regionally important non-timber forest product; a tough resistant root fiber used in craftware and furniture making. Eighteen species and one variety are recognized, including two new species, ***Heteropsis reticulata*** and ***Heteropsis vasquezii***; *Heteropsis melinonii* is considered to be of doubtful status. Descriptions, illustrations, geographical distribution and taxonomic commentary for each species, and an identification key are provided. Lectotypes are designated for *Heteropsis oblongifolia, Heteropsis rigidifolia* and *Heteropsis salicifolia*. Short reviews are provided of taxonomic history, phylogeny, vegetative and reproductive morphology, growth cycle, uses, and conservation status.

Keywords—Amazonia, hemi-epiphytes, Neotropics, non-timber forest products, root fibers.

Heteropsis Kunth (1841) is one of the most poorly known genera of the Araceae (Croat 1998). Although widely distributed in the neotropics and of regional economic importance as the source of a valued root fibre, there has been no attempt at a taxonomic revision since Engler's (1905) treatment for Das Pflanzenreich.

The reasons for this state of affairs are not hard to find. At first sight, most species do not even look like aroids because of their unusually short petioles which lack the well-developed sheath typical of most Araceae. Their hemi-epiphytic life form makes it difficult to understand the plants as a whole, even morphologically. Many climb high into the canopy of primary forests where their flowering and fruiting take place and, as a result, the colors and forms of their living reproductive organs have often only recently been recorded during detailed forest surveys (Ribeiro et al. 1999). The complexity of the extended body of the plants, from seedling to mature flowering branches, is still only understood in the few species that have been most intensively studied (Soares Morais 2008). Most species remain known to the taxonomist principally through the study of herbarium specimens, which are usually incomplete. The typical herbarium specimen consists of a fertile branch with a post-floral/pre-fruiting inflorescence, but many others are sterile and taken from attached shoots, the leaves of which are normally distinct from those of fertile branches, at least in size if not also in shape and texture. Even the mature leaves of many species are not easy to distinguish. Many published descriptions are incomplete, especially in details of the inflorescence and infructescence; some species are still known only from the type material. Above all, *Heteropsis* is a genus centred in Amazonia, where the Araceae are still only partially known, particularly the geographical distribution of already recognized species. It is to be expected that range extensions and the discovery of new species will result from future field studies there.

However, the recent growth of interest in *Heteropsis* as a plant of economic importance in Amazonia has highlighted the need for a new taxonomic treatment, to summarize existing knowledge, revise species delimitations, and provide an identification key. Cipó-titica, as *Heteropsis* is known in Brazil, is part of the extractivist economy of Amazonia as a source of a highly resistant fiber used in making craft products and is a native plant of significant economic importance in the region. A number of ecological and ethnobotanical studies, mostly of recent decades, have focussed on *Heteropsis* roots (Galvão 1959; Milliken et al. 1992; Potiguara and Nascimento 1994; Hoffman 1997; Fadiman 2003; Knab-Vispo et al. 2003; Plowden et al. 2003; Durigan and Castilho 2004; Rondón 2005). Species delimitation and identification are an important support for the development of sustainable management practices of the wild populations which continue to be the sole source of the root fiber.

The revision presented here brings the taxonomy of the genus up to date in so far as existing collections permit, but is underpinned by recent detailed work in the Reserva Florestal Adolpho Ducke near Manaus (Ribeiro et al. 1999; Soares and Mayo 1999; Soares Morais 2008; Soares et al. 2009, 2011). Based on populations of seven species in one area, these studies have brought to light many new or previously poorly known morphological details, including life cycle, shoot architecture, leaf morphology, root anatomy, ecology, and reproductive morphology. This work demonstrates the need for intensive field studies, even to describe adequately the morphology.

For the reasons outlined above, the present revision should be considered preliminary to a more definitive future treatment. Nevertheless, it will provide a useful basis for ecological and conservation work and we hope it will also stimulate further taxonomic studies of the genus.

Materials and Methods

This revision is based in the first place on a field survey of populations of the seven species so far recorded in the Reserva Florestal Adolpho Ducke (RFAD) near Manaus, central Amazonia. For other species, collecting expeditions were made by the first author (M. L. Soares) in the Brazilian states of Amapá, Amazonia, Bahia, Espírito Santo, and Rio de Janeiro. Collections of the following herbaria were examined either during personal visits of the first author (M. L. Soares) or through loans kindly made by the curators (acronyms follow Holmgren and Holmgren 2004): CEPEC, HAMAB, IAN, INPA, K, MBML, MG, MO, P, R, RB, SP, U, UEFS, and UFB.

Data for the maps showing the geographical distribution of the species were taken from herbarium specimen label information. The maps were made using the world map data base ESRI in the program ArcView, with the projection system Geográfica and Datum WGS84.

IUCN conservation status assessments were made for all species using the Geocat (2012) online tool (http://www.kew.org/science-research-data/kew-in-depth/gis/species-conservation/geocat/index.htm), which estimates the status of components B1 and B2 (EOO: extent of occurrence; AOO: area of occupancy) of Criterion B (Geographic range) using the geographical coordinates of plant specimen records (Rivers et al. 2011). Since most information available on natural populations was obtained from herbarium specimen labels, these assessments are incomplete and have only preliminary and partial status. We obtained latitude and longitude coordinates either from GPS data or estimated them from maps and Google Earth; the resulting data matrix is thus only provisional. Species known from less than five localities are assessed as data deficient (DD).

Collection methodology and preparation of herbarium specimens followed Croat (1985). For material collected in the Ducke Reserve, individuals located beyond easy reach in the forest were collected by an experienced technician proficient in the use of a long arm pruner and tree climbing equipment. Specimens were pressed and dried at the Coordenação de Botânica of the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus and later incorporated into the INPA herbarium. Inflorescences and infructescences were preserved in FAA or 70% ethanol, permitting further study of their morphology and for illustration. All collections were photographed whenever possible.

The morphological study of the material included both observations made in the natural habitat and laboratory and herbarium study. In the field, particular attention was paid to characters not visible in herbarium specimens such as habitat, stem color, axillary bud shape, undulation of petiole margins, leaf blade color and texture, visibility of leaf venation and colors of spadix, spathe, infructescence, and berries. Laboratory procedures included dissection of reproductive organs and measurement of the internodes, axillary buds, petiole, sheath, leaf blade, peduncle, spathe, spadix, flowers, and fruits. Measurements of width or diameter were taken at the widest point of the structure and the morphological nomenclature adopted generally followed that of Radford et al. (1974) and Mayo et al. (1997). Measurements of vegetative and reproductive organs, especially those at small scale, were made using a Mitutoyo digital caliper. Measurements of leaves and internodes were made on plagiotropic shoots, except in the case of immature specimens of *H. reticulata* Croat & M. L. Soares, where climbing shoots were measured.

Morphology of germinating seeds and seedlings was studied using seeds of *H. tenuispadix* G. S. Bunting collected in the Reserva Ducke. These were cultivated at 30°C, without pre-germination treatment in vermiculite, using the FANEM germination chambers of the Coordenação de Silvicultura Tropica (CSPT)–INPA. Observations were made on alternate days.

The descriptions of the growth cycle of *Heteropsis* presented here are based primarily on field observations of living plants in the Reserva Ducke, supplemented by examination of herbarium specimens of other species.

The main previous sources used in this taxonomic revision used were those of Schott (1860), Engler (1905), Jonker-Verhoef and Jonker (1953, 1968), Bunting (1988, 1995), Croat (1997), and Soares and Mayo (1999). For characterizing the vegetation types the main sources were Velloso et al. (1991) and Ribeiro et al. (1999).

In the citations of exsiccatae following each species description, specimens are arranged in alphabetical order by nation, state or province and municipality. In cases where there is no collector's number the herbarium accession number, if available, is given instead. The phenology abbreviations (fl = in flower or recently post-floral; fr = in submature or mature fruit; ster = sterile, without reproductive organs) are given immediately after the herbarium acronym. Where the phenology abbreviation follows more than one herbarium acronym, it applies to them all unless otherwise indicated. The species are arranged in alphabetical order.

Results and Discussion

Taxonomic History—*Heteropsis* was described by Kunth (1841), based on *H. salicifolia* Kunth and *H. oblongifolia* Kunth, both collected in the Atlantic Forest region of eastern Brazil by Friedrich Sellow (also known as Sello; see Urban 1893). However, two species had already been recognized formally prior to the recognition of the genus as a distinct taxon. *Dracontium integerrimum* Vell. (= *H. oblongifolia*) was published and illustrated by Vellozo (1831) but collected by him and described much earlier, probably between 1783–1790 (Instituto Camões 2003). *Heteropsis flexuosa* (H. B. K.) G. S. Bunting was collected in 1800 by Humboldt and Bonpland and published as *Pothos flexuosus* H. B. K. (1825). Schott (1856, in Schott 1853–1858) added *H. spruceana* Schott and later published a more general treatment which included four species (Schott 1860). Engler's first treatment was in Flora brasiliensis (Engler 1878: 47–50), followed by the Monographiae Phanerogamarum monograph (Engler 1879: 98–100), both recognizing only three species. The next revision was also by Engler (1905) in his Pflanzenreich monograph, with six species, adding *H. rigidifolia* Engl., *H. longispathacea* Engl., and *H. jenmanii* Oliv. Although already described as species of other genera, neither *H. flexuosa* (as *Anthurium flexuosum* (H. B. K.) Kunth) nor *H. melinonii* (Engl.) A. M. E. Jonker & Jonker (as *Rhodospatha blanda* Schott subsp. *melinonii* Engl.) were recognized as species of *Heteropsis* at this time.

Following Engler's Pflanzenreich revision no further attempt at a complete revision was made, leaving the genus as one of the most poorly understood in the whole family (Croat 1998). Instead, individual species were described as new discoveries following field expeditions or as the result of work on floristic treatments, e.g. *H. ecuadorensis* Sodiro (1908), *H. boliviana* Rusby (1910), *Heteropsis peruviana* K. Krause (1925), *Heteropsis rimbachii* K. Krause (1925) (= *H. ecuadorensis*), *Heteropsis linearis* A. C. Sm. (1939), and *Heteropsis macrophylla* A. C. Sm. (1939). The most important contribution of recent decades was certainly the work of George S. Bunting in Venezuela. Bunting (1979) recognized the economically most important species, *Pothos flexuosa*, as *Heteropsis flexuosa*, thus finally providing it with its correct name 154 yr after Kunth's original description in 1825. He also described the two varieties *Heteropsis spruceana* var. *robusta* G. S. Bunting (1986; now *H. robusta* (G. S. Bunting) M. L. Soares) and *H. flexuosa* var. *maguirei* G. S. Bunting (1988) and the two new species *H. tenuispadix* (1986) and *Heteropsis steyermarkii* G. S. Bunting (1986).

The treatment of Araceae for the Flora of Surinam published by Jonker-Verhoef and Jonker (1953, 1968) dealt with three species of *Heteropsis*, *H. melinonii*, *H. jenmanii* (= *H. flexuosa*), and *H. longispathacea*. Bunting (1979, 1995) published two floristic treatments for Venezuela. Bunting (1988: 466) recognized *H. flexuosa* var. *maguirei* and in the Flora of the Venezuelan Guayana, Bunting (1995) recognized five species and four varieties: *Heteropsis flexuosa* var. *flexuosa*, *H. flexuosa* var. *maguirei*, *H. melinonii*, *H. spruceana* Schott var. *spruceana*, *H. spruceana* var. *robusta*, *H. steyermarkii*, and *H. tenuispadix*. Croat (1997), in a treatment for central French Guiana, recorded three of these: *Heteropsis flexuosa*, *H. spruceana*, and *H. steyermarkii*. In the Flórula de las Reservas Biológicas de Iquitos, Peru, Vásquez (1997) recorded three species and one variety: *Heteropsis linearis*, *H. oblongifolia*, *Heteropsis sp.*, and *H. spruceana* var. *robusta*. In a recent floristic treatment of the Reserva Florestal Adolpho Ducke near Manaus in central Amazonia by Ribeiro et al. (1999), Soares and Mayo (1999) recorded seven species: *H. duckeana* M. L. Soares, *H. flexuosa*, *H. macrophylla*, *H. tenuispadix* (as *H. riedeliana* Schott), *H. spruceana*, *H. steyermarkii*, and *H. tenuispadix*. Grayum (2003) recorded one species, *H. oblongifolia* from Costa Rica. Soares et al. (2009) described two new species, *H. croatii* M. L. Soares and *H. duckeana* and raised *H. spruceana* var. *robusta* to species rank as *H. robusta*. Soares and Mayo (2010) recorded 14 species for Brazil: *H. croatii*, *H. duckeana*, *H. flexuosa*, *H. linearis*, *H. longispathacea*,

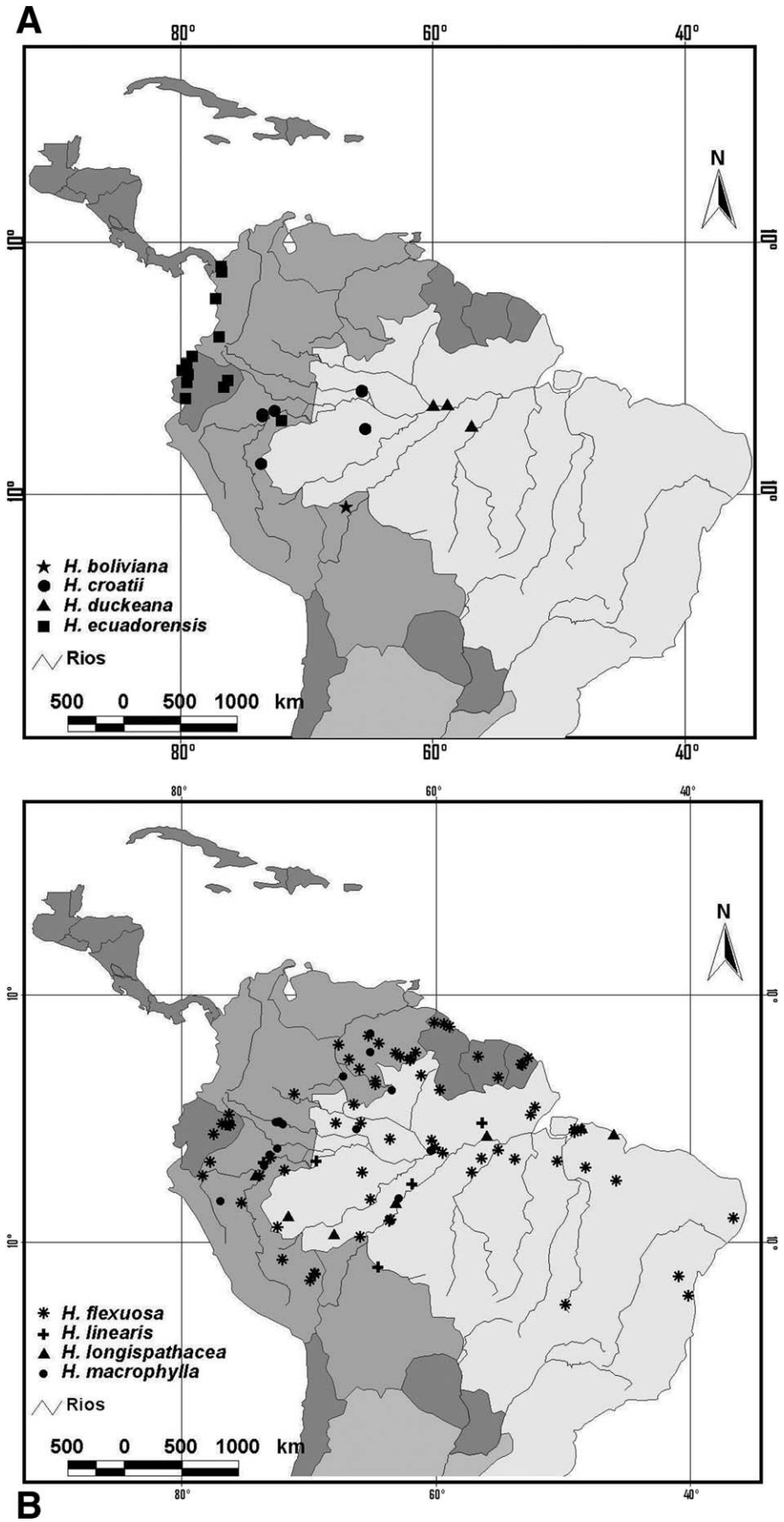

FIG. 1. Geographical distribution of species of *Heteropsis*. A. *H. boliviana*, *H. croatii*, *H. duckeana*, and *H. ecuadorensis*. B. *H. flexuosa*, *H. linearis*, *H. longispathacea*, and *H. macrophylla*. Drawn by Francisca D. A. Matos.

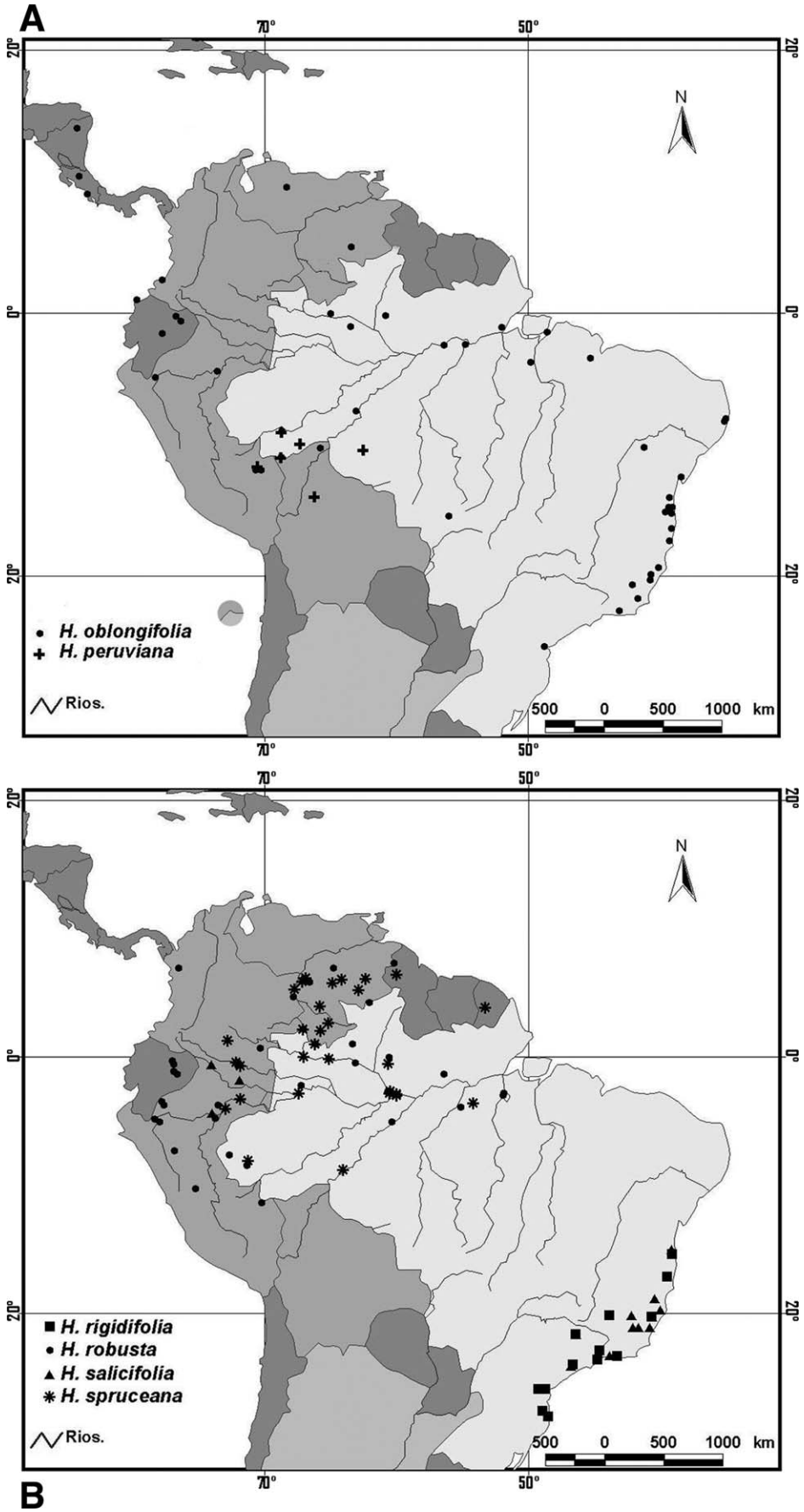

FIG. 2. Geographical distribution of species of *Heteropsis*. A. *H. oblongifolia* and *H. peruviana*. B. *H. rigidifolia*, *H. robusta*, *H. salicifolia*, and *H. spruceana*. Drawn by Francisca D. A. Matos.

H. macrophylla, *H. oblongifolia*, *H. peruviana*, *H. rigidifolia*, *H. robusta*, *H. salicifolia*, *H. spruceana*, *H. steyermarkii*, and *H. tenuispadix*.

Geographical Distribution—*Heteropsis* is essentially an Amazonian genus (Figs. 1–3). Sixteen of the total 18 species recognized in this treatment occur in Amazonia: *H. boliviana*, *H. croatii*, *H. duckeana*, *H. ecuadorensis*, *H. flexuosa*, *H. linearis*, *H. macrophylla*, *H. longispathacea*, *H. oblongifolia*, *H. peruviana*, *H. reticulata*, *H. robusta*, *H. spruceana*, *H. steyermarkii*, *H. tenuispadix*, and *H. vasquezii* Croat & M. L. Soares. Of these, *H. oblongifolia* also occurs in Costa Rica, Pacific northwestern South America and in the eastern Atlantic Forest of Brazil, while *H. ecuadorensis* and *H. robusta* also occur in Pacific northwestern South America. *Heteropsis flexuosa*, *H. robusta*, *H. spruceana*, *H. steyermarkii*, and *H. tenuispadix* also occur in the Guianas. Nine species, or half the total, are recorded here as endemic to the Amazon drainage, most occurring in the western half: *H. boliviana*, *H. croatii*, *H. duckeana*, *H. linearis*, *H. longispathacea*, *H. macrophylla*, *H. peruviana*, *H. reticulata*, and *H. vasquezii*.

Given the single species in Central America, the occurrence of four species in the Brazilian Atlantic Forest (*H. flexuosa*, *H. oblongifolia*, *H. rigidifolia*, and *H. salicifolia*), the latter two endemic, is surely significant from a historical biogeographical standpoint (Fig. 2).

Ecology, Life Form and Shoot Architecture—Species of *Heteropsis* inhabit different strata and niches within humid tropical forests. Ecological studies of habitat preferences among the species in the Reserva Ducke have shown that two preferred low-lying terrain (*H. spruceana* and *H. steyermarkii*) and three low forest strata (*H. spruceana*, *H. steyermarkii*, and *H. tenuispadix*). *Heteropsis flexuosa*, on the other hand, preferred higher ground and higher forest strata (Soares Morais 2008).

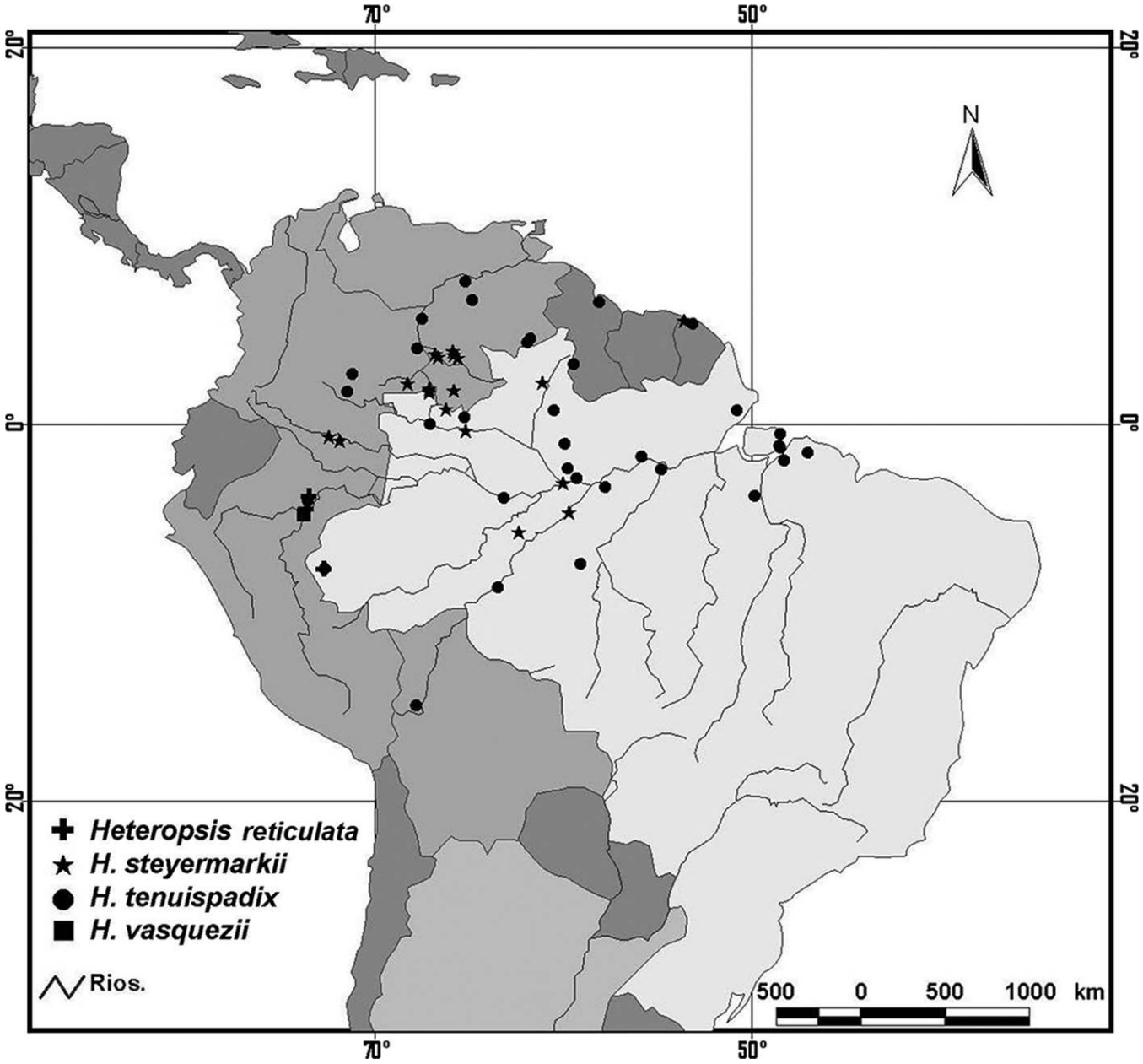

Fig. 3. Geographical distribution of *Heteropsis steyermarkii*, *H.tenuispadix*, *H. vasquezii*, and *H. reticulata*. Drawn by Francisca D. A. Matos.

Heteropsis species can be classified as secondary hemi-epiphytes (Croat 1990), but in fact it seems from our observations in the Reserva Florestal Adolpho Ducke (Figs. 4A , D, E) that the plants may never lose contact with the soil, since by the time the lower portion of the stem rots away, feeder roots emitted higher up the stem already connect the plant to the ground. The hemi-epiphytic life form provides great plasticity in growth response to local conditions such as favourable light luminosity and availability of hosts, enabling the plant to move about within its habitat to find the most suitable conditions for its development (Madison 1977; Lee and Richards 1991; Poulsen and Balslev 1991).

In general the species germinate in or on the soil (Figs. 4A, D, E) in humid terra firme forest at altitudes between 50–2,000 m (includes information from specimen labels) and the seedlings then search for a host tree on which they establish themselves (Fig. 5A) by anchor roots (Figs. 5A–D). When seedlings or juvenile and before the lower part of the stem rots and loses connection with the soil, the plants emit feeder roots that are either free or adhere to the host tree trunk (Figs. 4D, E, 5B). At this stage the plant can produce plagiotropic shoots that develop more-or-less horizontally and lack adventitious roots (Fig. 5C), while continuing to grow upwards by attached stems to the adult flowering phase. Frequently, however, plants also produce flagelliform shoots, a form of vegetative reproduction adapted to search for a new host tree. Flagelliform shoots have much longer internodes and reduced leaves and may directly encounter a new trunk where they can become established, or grow down to the ground and seek a host by prostrate growth along the forest floor (Fig. 5D). When the plant reaches a suitable height, perhaps determined by light intensity, it attains adult flowering status by producing a mass of branching plagiotropic shoots that can have internodes up to 1 cm in diameter (Fig. 5E). By this time the plant will have developed feeder roots, which may hang down freely to the forest floor or cling to the host trunk.

As the plant passes from seedling to attached stems and finally to mature plagiotropic branches, the leaves pass through a range of forms and sizes, i.e. a heteroblastic sequence (Blanc 1980; Ray 1983, 1987a, b, c). Correspondingly, the plant passes through various life forms adapted to different micro-habitats, from a terrestrial without developed leaves (euphylls), then transforming into a root-climber, and finally emitting free-aerial plagiotropic branches and flagelliform shoots, the latter transforming again into terrestrial stoloniferous axes which seek out new host tree trunks (Ray 1983).

The appearance of the plant in its root-climbing phase differs according to how it arrived at the host trunk. If the plant has grown directly from germination on the soil, the stem is straight with shorter internodes and the leaves are patent and smaller than mature ones on plagiotropic branches (Figs. 4A–C). If, however, the root climber has developed from a flagelliform shoot, its stem is more twisted with longer internodes and with larger and less strongly patent leaves.

Plagiotropic Shoots—The growth pattern of plagiotropic shoots in adult *Heteropsis* plants can be both sympodial and monopodial (Ray 1988: 61). Plagiotropic shoots branch to form axes terminating in inflorescences and these individual flowering shoots tend to be characteristic of the species in the shape of their overall outline, the presence of axillary buds or not, the pattern of occurrence of cataphylls and euphylls, and the number and size of the internodes, in addition to the morphology of the inflorescence and infructescences. The outline shape of the flowering shoots (i.e. the envelope or convex hull formed by the leaves of the shoot) is ovate in *H. flexuosa*, with the leaves tending to diminish in size towards the shoot apex, elliptic-obovate in *H. macrophylla* and *H. tenuispadix,* and oblanceolate in *H. spruceanum*. *Heteropsis steyermarkii* has a rather distinct structure in its flowering shoots, producing a characteristic sympodial pattern of reiteration from a bud at a node close to the preceding spathe and further study may show that this morphology is connected in some way to the fully developed, sheathed petiole in this species.

The leaf morphology of the plagiotropic shoots was chosen as the basis for the taxonomic descriptions of this revision and therefore when comparing plants and descriptions it should be borne in mind that leaves from other phases of the life cycle, e.g. those of attached root-climbing stems, flagelliform shoots or seedlings, are often different in shape from those of the plagiotropic shoots.

Flagelliform Shoots—The function of flagelliform shoots, or flagellae, can be viewed as to multiply meristems within the habitat space of the plant in a search for the conditions that will best lead to flowering, i.e. a strategy for reproduction in limiting ecological conditions (Blanc 1980). The meristem can change its ontogenetic pathway, allowing rapid structural changes in the search for new microhabitats (Ray 1987b, 1987c, 1988).

Flagelliform shoots in *Heteropsis* may be produced both from the apex of the shoot and from lateral buds. Five species in the Reserva Ducke were observed to produce flagelliform shoots in their juvenile stages: *H. flexuosa*, *H. macrophylla*, *H. spruceana*, *H. steyermarkii,* and *H. tenuispadix*. A well-established individual of *Heteropsis flexuosa* was observed emitting a flagelliform shoot that extended for 10 m in length to reach a neighbouring host tree (Fig. 6A, B). A similar observation was reported by Hoffman (1997) in his study of this species in the Guianas and by Fadiman (2003) in *H. ecuadorensis* in Ecuador. In another case in the Reserva Ducke, an individual that had fallen to the forest floor together with its host tree was observed producing flagelliform branches from the apex of a plagiotropic shoot as well as from the main shoot, each seeking a new host (Figs. 4F, G, arrows). The patterns of growth of flagelliform shoots are thus highly plastic.

Roots—The roots of *Heteropsis* are dimorphic, classified either as anchor roots or feeder roots, and the two types have distinct anatomy, morphology, and behaviour. Anchor roots arise on the side of the stem and are adapted to fix the plant to the surface of the host (usually a tree trunk); they are of smaller diameter and lack geotropism. When the support tree has a DBH (diameter at breast height) of less than 10 cm, the anchor roots often grow to entirely surround the trunk. Feeder roots are geotropically positive, much longer and with greater diameter (up to 1 cm in *H. flexuosa*). Their function is to root into the soil and provide water and nutrients to the growing stem. The feeder roots are extremely strong and flexible and for this reason are much used in Amazonia as a source of excellent fiber, mainly for craft products and in furniture making.

Feeder roots may hang freely or adhere to the host; the epidermis is easily removed and is smooth, pale brown to grey-green when young and pale to dark grey when mature. Typically, the roots reiterate, forming branch points in their development towards the ground. This results from damage

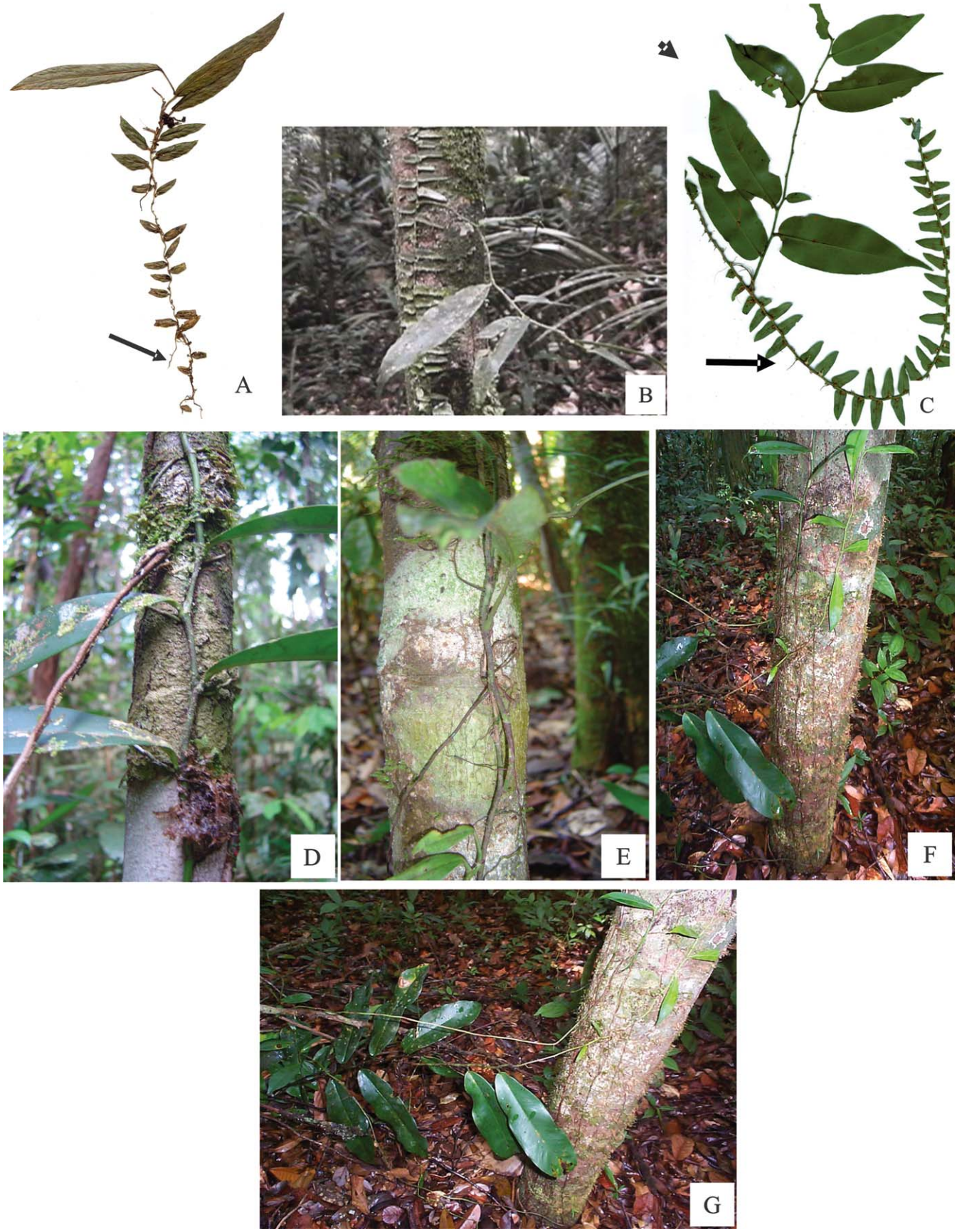

FIG. 4. Establishment of seedlings and flagelliform shoots of *Heteropsis* on host tree. A. *H. steyermarkii*, arrow shows anchor root. B. Seedling of *H. spruceana* on host tree. C. *H. spruceana*, lower arrow showing anchor root and upper arrow a plagiotropic lateral branch. D. Young *H. macrophylla* emitting a feeder root. E. Young *H. steyermarkii* emitting a feeder root (arrow). F–G. Plagiotropic shoot of an individual of *H. flexuosa* on a fallen tree, producing flagelliform shoot from a plagiotropic branch. A–E: images from Reserva Ducke by M. L. Soares, F–G: images from Amapá by L. Pereira.

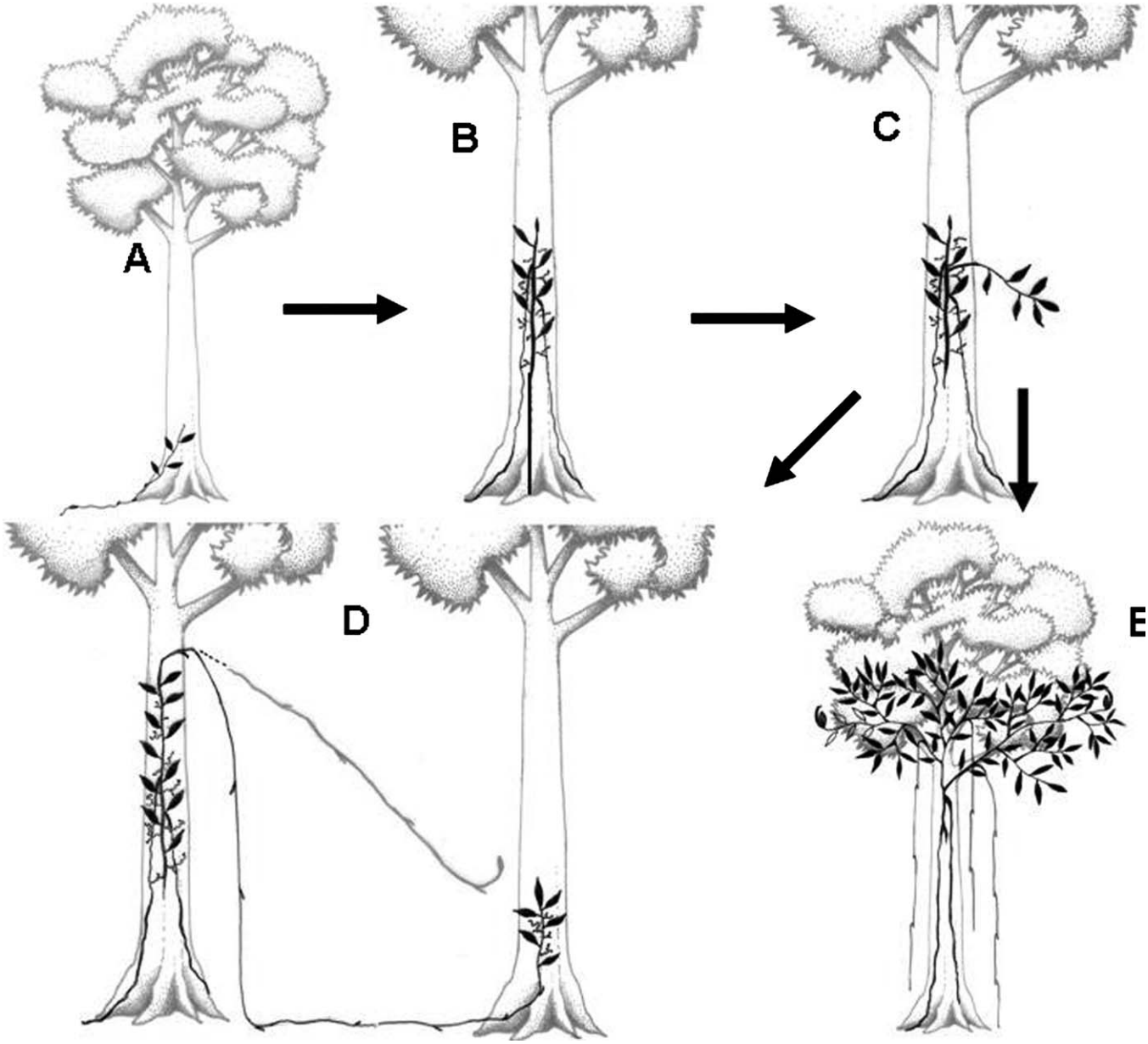

FIG. 5. Schematic illustration of establishment stage and development in *Heteropsis*. A. Seedling establishment. B. Young plant with feeder and anchor roots. C. Loss of contact with the soil and production of plagiotropic branches. D. Emission of flagelliform shoots. E. Adult plant.

caused to the apical meristem, probably by herbivorous insects, and a lateral region of the root's meristem then produces a new root axis from near the damaged tip. On reaching the ground the root produces dark brown branches of smaller diameter, forming a network of roots within the soil. *Heteropsis duckeana* differs from other species studied in having lenticels throughout the length of the feeder roots and by the anatomy of the root central cylinder.

Biophysical studies of the roots in species from the Reserva Ducke (Soares Morais 2008) showed that *Heteropsis* roots have a density and resistance similar to those of the wood of ten timber species used in furniture making in Amazonia and that these characteristics are independent of root diameter. Of those studied, the species with the largest root diameter were *H. duckeana*, *H. flexuosa*, and *H. macrophylla* and those of least diameter were *H. spruceana*, *H. steyermarkii,* and *H. tenuispadix.*

***Leaves and Axillary Buds*—**The leaves of *Heteropsis* are distinct from those of other Araceae. Almost the entire petiole is congenitally fused to its subtended internode, leaving free only a short portion corresponding to the apical geniculum seen in related genera (subfamily Monsteroideae, Mayo et al. 1997). Only *Heteropis melinonii* and *H. steyermarkii* have the normal petiole morphology with a long sheath.

Although in general the foliage of *Heteropsis* species is rather similar, we have found the following characters (in addition to leaf shape and size) to be helpful in distinguishing the species: the shape of the axillary buds, the length of the petiole, the shape and color of the leaf blade, and the distance of the infra-marginal collective veins and external marginal veins from the leaf margin.

The shape of the axillary buds is useful for distinguishing some species as in *H. flexuosa*, in which the bud is strongly extrorse with an acute apex both in juvenile and adult plants.

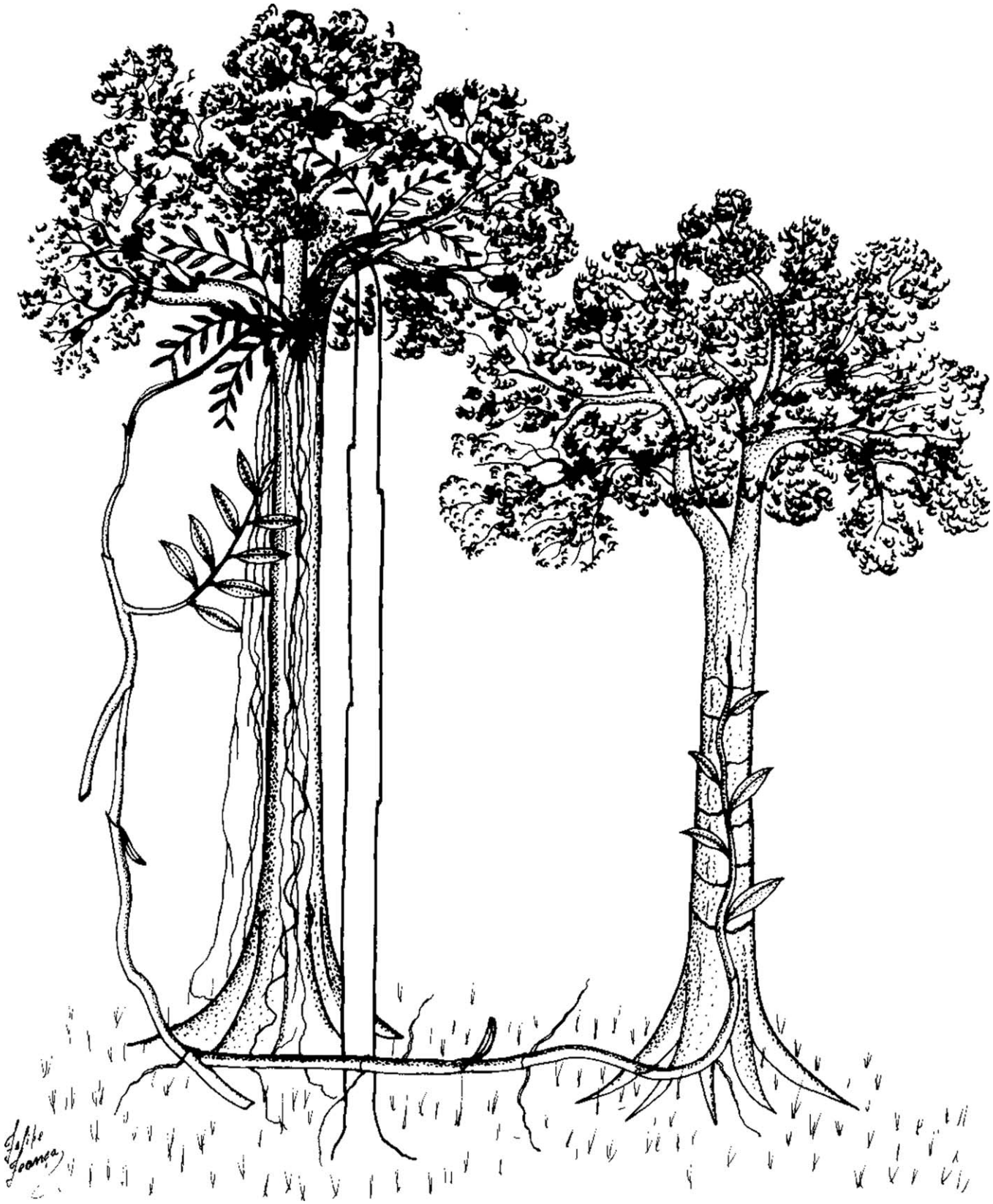

FIG. 6. Schematic illustration showing an individual of *H. flexuosa* well established on a host tree, producing a flagelliform shoot. Left host tree: lateral branch of flagelliform shoot. Right host tree: establishment of a flagelliform shoot on a host, showing twisting of the stem and elongated internodes.

In other species, the buds are distinctly rounded or truncate, as in *H. duckeana*, *H. linearis*, *H. macrophylla*, *H. reticulata, H. rigidifolia*, *H. steyermarkii,* and *H. vasquezii*. In the other species, the buds are usually straight or introrse with acute or acute-acuminate apices.

Petiole length is diagnostic not only in *H. melinonii* and *H. steyermarkii*, as mentioned above, but also in *H. spruceana* in which the leaves are subsessile. Marginal sinuosity of the petiole is characteristic of most species except in *H. duckeana*, *H. flexuosa*, *H. reticulata* (immature leaves), *H. steyermarkii,* and *H. vasquezii*, in which the margin is smooth and in some cases revolute.

Leaf blade shape may be linear (*H. linearis*), linear-lanceolate (*H. rigidifolia*), narrowly oblong (*H. macrophylla*), elliptic (*H. reticulata, H. vasquezii*), and in the other species, elliptic to oblong or lanceolate or oblanceolate. The leaf blade is usually of a similar tone of green on both sides, but in some it may be more yellowish abaxially (*H. flexuosa*, *H. oblongifolia*) or even dark brown (*H. reticulata*); *H. steyermarkii* is notable for its adaxially bronze to vinaceous young leaf blades and the distinctly glaucous abaxial face of the leaves from seedling to adult phases. The blade may be coriaceous to subcoriaceous with the apex acute, acuminate or attenuate, frequently with a distinct acumen. At the base the blade may be acute, cuneate to obtuse or rounded. The leaf margin is somewhat sinuate in *H. duckeana, H. longispathacea, H. spruceana, H. tenuispadix,* and *H. vasquezii*, and revolute in *H. flexuosa, H. oblongifolia, H. duckeana,* and *H. vasquezii*.

The midrib of the leaf blade is usually sulcate to insculpted with the primary lateral and interprimary veins obscure when fresh and somewhat impressed abaxially when dried, except in *H. duckeana, H. reticulata,* and *H. rigidifolia*, in which they are prominent on both surfaces when dried. The inframarginal collective vein, which joins the primary and interprimary veins, is conspicuous and usually accompanied by one or two external marginal veins, except in *H. macrophylla*, *H. reticulata*, *H. steyermarkii,* and *H. vasquezii*, which lack any visible external marginal vein.

A morphometric study of the leaf outline shape of five species in the Reserva Ducke using Elliptic Fourier Analysis (Soares et al. 2011) showed that some species can be distinguished at least partially by this character alone.

Inflorescence—Flowering shoots usually have short internodes and buds on the first few internodes of the apical region. Some species (*H. flexuosa*, *H. macrophylla,* and *H. vasquezii*) have either no buds or only one is present on an apical internode near the spathe. For some species in which the internodes are longer (*H. robusta*, *H. spruceana*, and *H. tenuispadix*) or more robust (*H. flexuosa*, *H. macrophylla*, and *H. vasquezii*), the structure of the flowering shoots is diagnostic.

The inflorescences are terminal or axillary on lateral branches of the plagiotropic shoots and the peduncle is short except in *H. steyermarkii*, in which it is longer than in any other species (Figs. 7I , J).

The spathe is convolute to semi-convolute and usually inflated, opening at anthesis and afterwards deciduous. The spathes vary in shape, size and color (Figs. 7A–M). Cuspidate to slightly cuspidate shapes are found only in *H. croatii, H. longispathacea* and *H. salicifolia* (Figs. 7F, G). In most species the spathe is ovoid to ellipsoid (Figs. 7A–E, H–M), but in *H. tenuispadix* the spathe opens widely and is patent to pendent at anthesis as can be seen in Figs. 7L, M.

The spadix is stipitate with a well-developed stipe in *H. steyermarkii* (Figs. 7L, M; 8E–G) and *H. tenuispadix* (Fig. 8G). The spadix is cylindric to subcylindric, ellipsoid to subclavate, usually shorter than the spathe and usually white or yellowish-cream in *H. duckeana*, *H. flexuosa, H. oblongifolia, H. spruceana,* and *H. tenuispadix* (Figs. 8A–D, G) and other species, but in *H. steyermarkii* it is rose-vinaceous (Figs. 8E–F).

The flowers are hermaphrodite with four free stamens per flower or fewer through abortion; the filament is flattened with a slender connective and the anthers are ovate to ellipsoid, dehiscing by apical slits and inserted at the apex of the connective. The pollen grains are fully zonate or rarely di-aperturate, the exine sculpturing is foveolate to psilate (Grayum 1992). The gynoecium is obpyramidal to prismatic with four to six sides and is usually truncate at the apex. The ovary is incompletely bilocular with anatropous ovules. Placentation is basal to sub-basal except in *H. steyermarkii,* which has axile placentation. The ovary locules are filled with a transparent mucilaginous substance (*H. spruceana, H. tenuispadix*), which in *H. duckeana* was observed to dry within seconds when exposed to the air. The stylar region is dense and broader than the ovary and the stigma is small and varies from discoid to subdiscoid, ellipsoid to oblong.

Infructescence—The fruits are berries with two to four seeds. The berries are colored when mature and, in the species studied more completely, show a variety of colors from cream to yellow in *H. duckeana* (Fig. 9A) and *H. flexuosa*, yellow to orange in *H. macrophylla*, *H. robusta, H. spruceana* (Figs. 9B–C), *H. Steyermarkii,* and *H. tenuispadix* (Fig. 9F), to red with a dark brown apex in *H. oblongifolia* (Fig. 9D) although orange-yellow in the Costa Rican populations of the latter species. The berries are obovoid, truncate to somewhat prismatic, and the persistent stylar region is broad with a distinct stigma scar.

The seeds are ovoid in *H. ecuadorensis* and obovoid to subobovoid, oblong-elliptic to truncate in the other species. The testa is smooth or rugose except in *H. steyermarkii* in which it is foveolate. The embryo is large, without endosperm. The seeds are surrounded by a usually sweet pulp that is yellowish in *H. duckeana* and *H. flexuosa* and orange in *H. tenuispadix* and *H. spruceana*.

The seeds of *H. tenuispadix* are obovoid to subcylindric with a rugose testa and are surrounded by an orange mucilaginous pulp (Fig. 10A). Germination begins with the rupture of the testa after nine days, with the simultaneous emergence of the radicle and the plumule (Fig. 10B). The pattern of germination is crypto-cotyledonous-hypogeal (Duke 1965). At 20 d the seedling has a stem with slender internodes bearing various cataphylls and anchor roots at the nodes and the main root has trichomes only in the proximal region (Fig. 10C).

Not a great deal is known concerning the dispersal of the seeds of Araceae (Mayo et al. 1997) and there is no published study of pollination or dispersal in the genus *Heteropsis*. In our study we observed small primates (monkeys) visiting the mature fruits of *H. tenuispadix*. The colored sweet pulp also suggests dispersal by birds and/or primates. Roosmalen (1985) has reported that the fruits of *Heteropsis* form part of the diet of spider monkeys (*Ateles paniscus*) in Surinam.

Phylogeny and Classification within Araceae—*Heteropsis* is a genus of hemi-epiphytes with distichous, entire leaves, a boat-shaped spathe which is deciduous after anthesis and bisexual flowers lacking a perigone. The classification of Mayo et al. (1997), updated by Bogner and Petersen (2007), treated *Heteropsis* as a monogeneric tribe Heteropsideae in subfamily Monsteroideae. In recent molecular phylogenetic

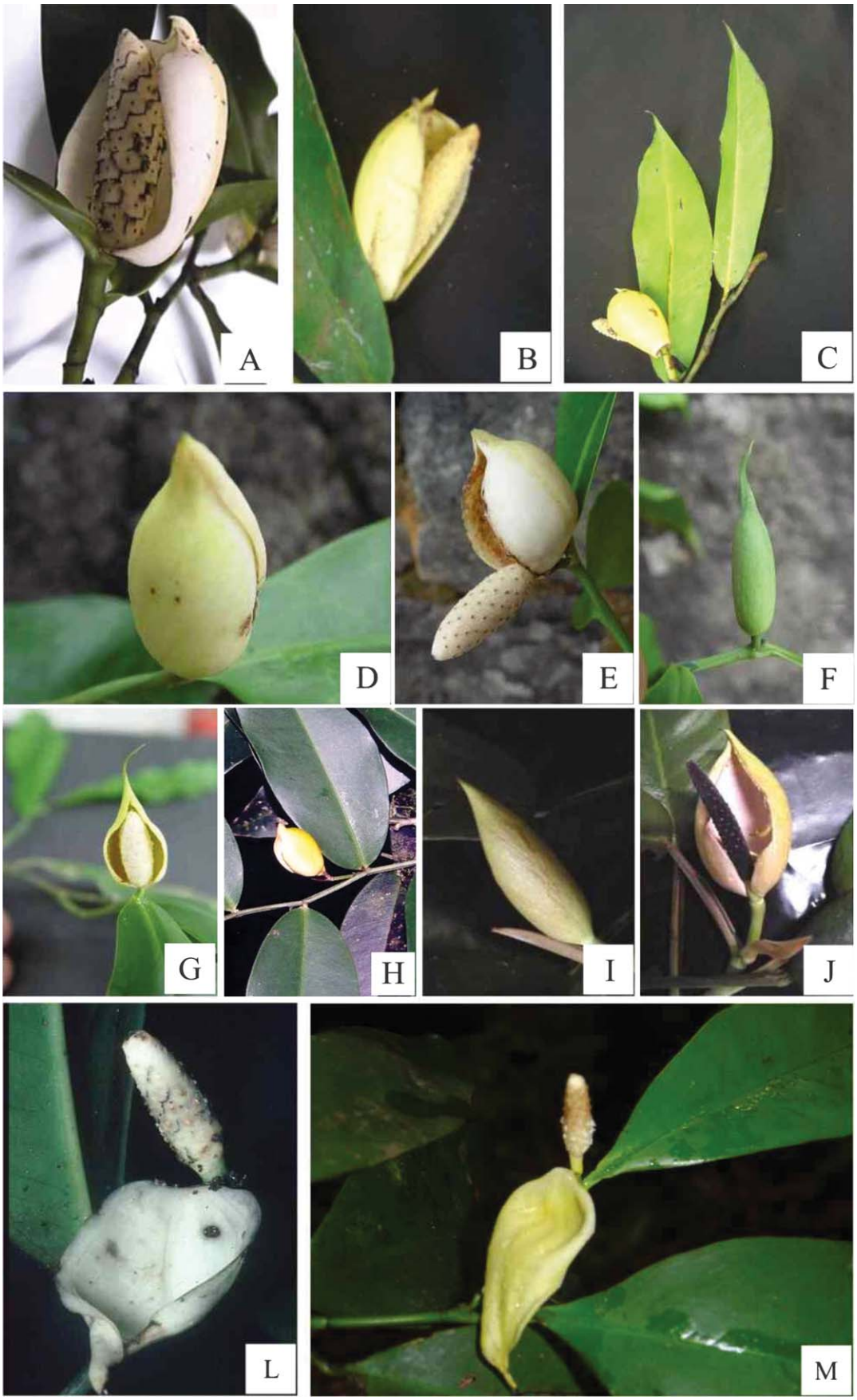

Fig. 7. A–M. Inflorescences in bud and at anthesis. A. *Heteropsis duckeana*. B–C. *H. flexuosa*. D–E. *H. oblongifolia*. F–G. Bud and open inflorescence of *H. salicifolia*, respectively. H. *H. spruceana*. I–J. Bud and open inflorescence of *H. steyermarkii*, respectively. L–M. *H. tenuispadix*. (photos A–C, H–J and M by M. L. Soares; D–G by Hélio; L by Projeto Flora Reserva Florestal Adolfo Ducke).

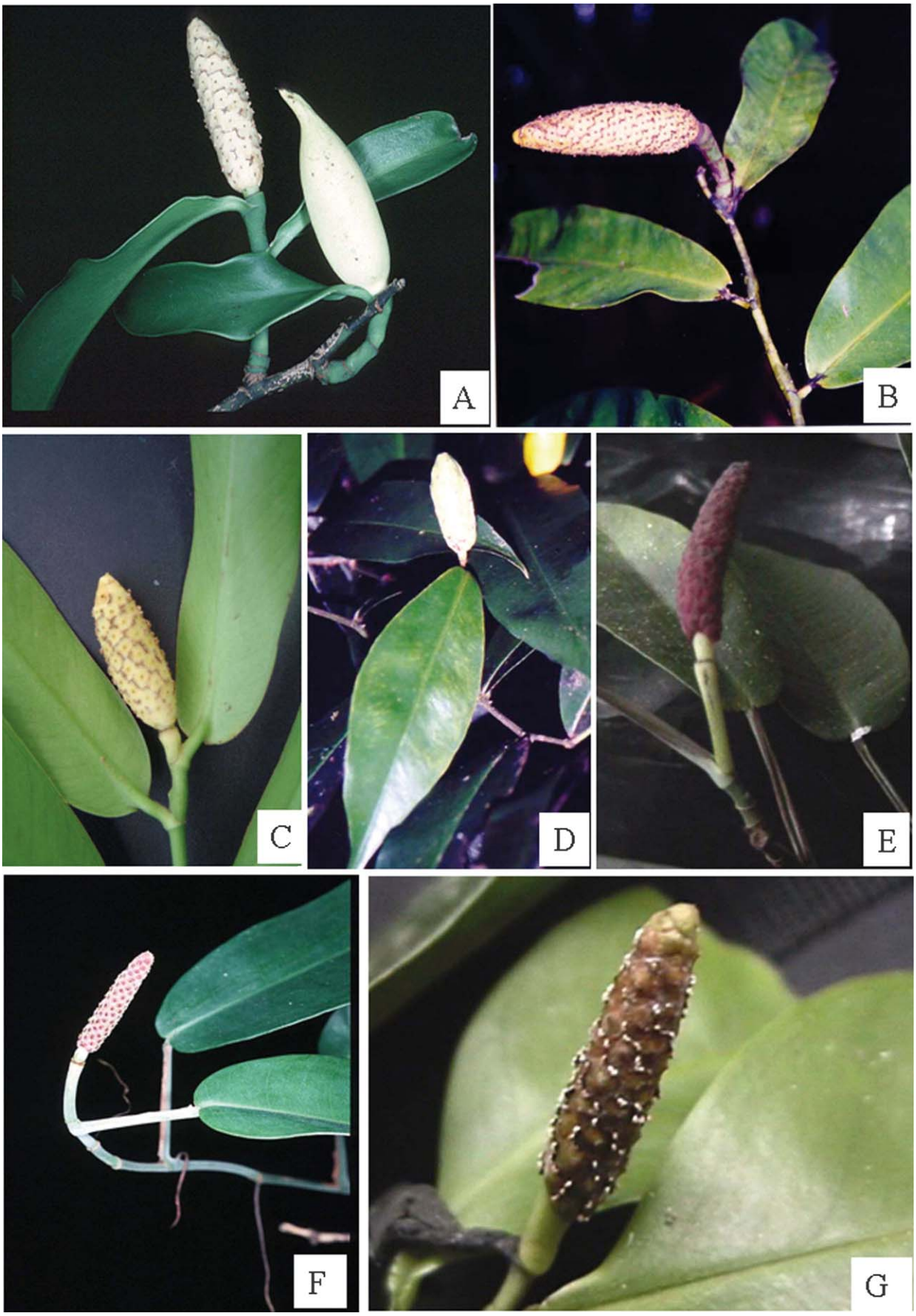

FIG. 8. A–G. Inflorescences after anthesis. A. *H. duckeana*. B. *H. flexuosa*. C. *H. salicifolia*. D. *H. spruceana*. E–F. *H. steyermarkii*. G. *H. tenuispadix*. (photos: A, B, D-F by M. L. Soares; C by M. Nadruz; G by Projeto Flora Reserva Florestal Adolfo Ducke).

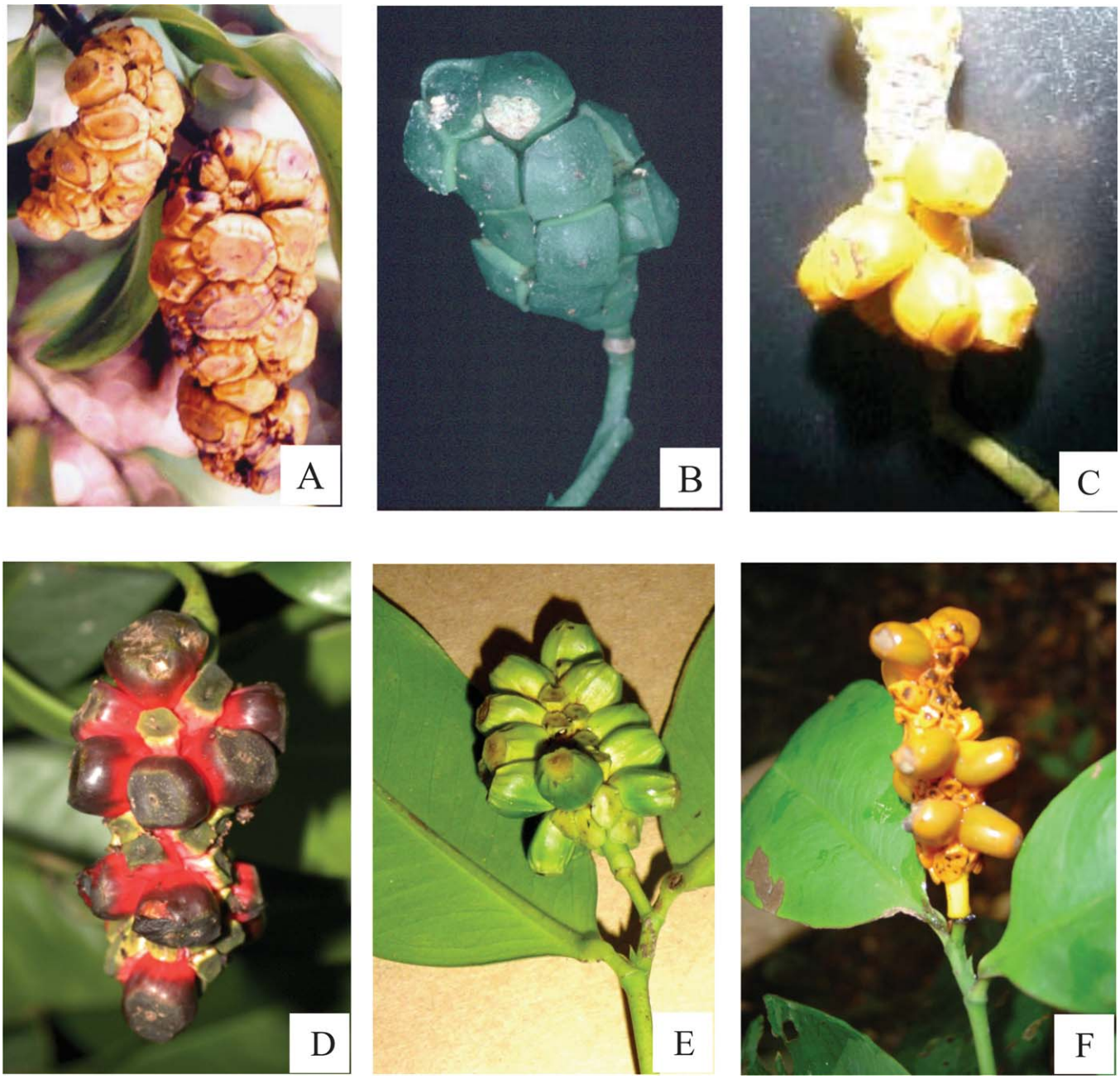

FIG. 9. A–F. Mature and immature infructescences of *Heteropsis*. A. *H. duckeana*. B–C. Immature and mature infructescences of *H. spruceana*, respectively. D. *H. oblongifolia*. E–F. Immature and mature infructescences of *H. tenuispadix*, respectively. (photos: A, C, E, F by M. L. Soares, B by Projeto Flora Reserva Florestal Adolfo Ducke, D by André Amorim).

studies (Tam et al. 2004; Cabrera et al. 2008; Cusimano et al. 2011), the assignment to Monsteroideae is confirmed, with *Heteropsis* forming a clade with the genera *Alloschemone*, *Rhodospatha* and *Stenospermation*, all genera endemic to the Neotropics. This arrangement implies that the congenital fusion of the petiole sheath and internode, the monopodial structure of the flowering shoots in some species, and the lack of trichosclereids are all apomorphies that arose within the lineage leading to *Heteropsis* or within the radiation of the genus itself.

Economic Uses and Conservation—The genus *Heteropsis* is economically important in the Neotropics, particularly in Amazonia and the Guianas, as a source of a resistant fiber called cipó-titica in Amazonas and Pará, timborana in Bahia, cipó-liaça in Paraná, and outside Brazil ue yai or popo, bejuco de montaña, piquigua (Ecuador), mamure (Venezuela), nibbi or mibi (Guiana), tamshi (Peru), and tedbai (Colombia). The fiber is extracted from the feeder roots and is used for making baskets, ropes, brooms, furniture (Fig. 11), and in the construction of boats and houses (Galvão 1959; Milliken et al. 1992; Potiguara and Nascimento 1994).

Recent studies like that of Hoffman (1997) report the use of the roots of *Heteropsis flexuosa* by the Wai-Wai people of southeast Guyana for different types of cordage, baskets, bags, brooms, furniture, and other craft products as well as a head decoration in ceremonies to invoke the sun. Plowden et al. (2003) reported the use of this cipó (*H. flexuosa*) for various purposes including binding in house-building in two

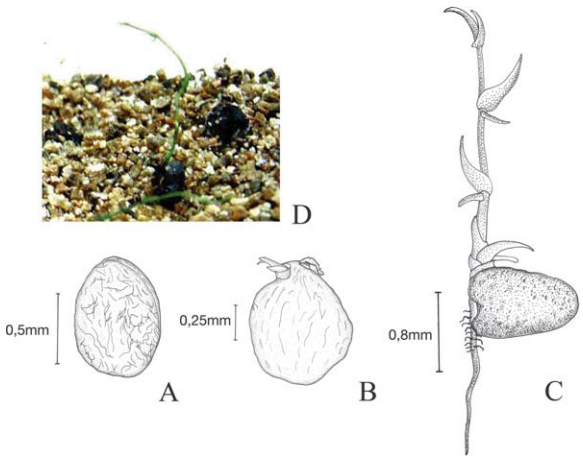

FIG. 10. A–D. Germination of the seed of *H. tenuispadix*. A. Seed. B. Germinating seed. C. Seedling. D. Germination on vermiculite (A, B, C drawn by Felipe França, D photo by M. L. Soares).

indigenous reserves on the upper Rio Guamá in Pará state. Fadiman (2003) reported the use in Ecuador of piquigua (*H. ecuadorensis*) by the Afro-Ecuadorian mestizos for the decoration of bottles and for baskets used to store potatoes and onions in their houses. Durigan and Castilho (2004) record the extractivism of cipó-titica in the Jaú National Park in Brazil for local use in shops at localities along the Rio Negro and in the town of Novo Airão and the city of Manaus. Rondón (2005) reports the use of roots of *H. spruceana* in basket-making by the Piaroa people in Venezuela.

Despite many species of *Heteropsis* having been recorded in conservation areas (biological reserves) which help to preserve the species by restricting access, they may still be vulnerable because of the constant human pressures in these same areas. The species are targets of unsustainable forms of extractivism and disorganized exploitation and are vulnerable to the uncontrolled destruction of natural forests. These pressures threaten the sustainability of the commercialization of *Heteropsis* root fiber.

FIG. 11. Bundles of roots and craft products of *Heteropsis*. A. Roots prepared for the market (piraiba). B. Production of brooms in Rondônia. C. Chair and tray. D. Baskets of various types (photos: A and D by C. C. Durigan, B by Kinnup, C by M. L. Soares).

Taxonomic Treatment

Heteropsis Kunth, Enum. Pl. 3: 59. (1841).—TYPE species: *H. salicifolia* Kunth (1841).

Secondary hemi-epiphytes, stem quadrangular to cylindric, usually longitudinally striate, axillary buds introrse to extrorse with an acute, rounded or truncate apex; roots dimorphic (anchor roots and feeder roots). Leaves distichous, numerous, petiole usually short, free, canaliculate and geniculate apex, sheath usually congenitally fused to the subtending internode, rarely with a fully developed free-sheathed petiole (*H. melinonii, H. steyermarkii*); leaf blade linear, obovate, elliptic, oblong to oblanceolate, coriaceous to subcoriaceous, apex acute, acuminate to attenuate, base attenuate, cuneate to rounded, green to yellowish-green, rarely glaucous abaxially (*H. melinonii, H. steyermarkii*), midrib insculpted to sulcate, primary lateral and interprimary veins parallel-pinnate, forming an infra-marginal collective vein near the margin, with 1(–2) marginal veins often present externally, finer venation reticulate. Inflorescence solitary, terminal and axillary, flowering shoot stem slender to thick, usually bearing several cataphylls which are caducous after anthesis, peduncle short to short, cylindric; spathe ovate to elliptic to ovate or oblong, convolute to semi-convolute, white to yellow, apex acuminate to cuspidate, opening at anthesis and deciduous afterwards; spadix erect, free, cylindric to ellipsoid, shorter than spathe, white to yellow, exceptionally rose to vinaceous (*H. steyermarkii*), usually stipitate, stipe usually short, rarely absent. Flowers hermaphrodite, perigone absent. Stamens 4 per flower or less by abortion, free, filament flattened, connective slender, anthers ovate to ellipsoid, dehiscing by apical slits, inserted at the apex of the connective. Gynoecium obpyramidal to prismatic, with four to six sides, usually truncate apically; ovary incompletely 2-locular, locules usually filled with a translucid mucilage; ovules anatropous, collateral; placentation basal to sub-basal, exceptionally axile, stylar region dense, broader than the ovary; stigma discoid to sub-discoid, elliptic to oblong. Fruit a berry, obovoid to obpyramidal to somewhat prismatic, 1–4-seeded, yellow to orange or red, stylar region broad with a stigmatic scar. Seed ovoid to obovoid or ellipsoid, usually surrounded by a sweet mucilaginous, transparent, yellowish to orange pulp, testa smooth to rugose or foveolate, embryo large, endosperm absent.

Key to the Species of *Heteropsis*

1. Petiole 4–9 cm long including sheath ..... 16. *H. steyermarkii*
1. Petiole equal to or less than 3.0 cm long, lacking sheath 2
2. Leaf blade equal to or greater than 30.0 cm long 3
3. Leaf blade equal to or less than 3.0 cm wide ..... 6. *H. linearis*
3. Leaf blade equal to or greater than 4.0 cm wide 4
4. Leaf blade linear to oblong, leaf 5–9 cm wide, collective vein 0.25–0.5 mm distant from leaf margin ..... 8. *H. macrophylla*
4. Leaf blade elliptic, leaf width 9–24 cm, collective vein 0.95–2.05 mm distant from leaf margin 5
5. Leaf blade less than or equal to 32.0 cm long ..... 11. *H. reticulata*
5. Leaf blade greater than or equal to 35.0 cm long ..... 18. *H. vasquezii*
2. Leaf blade less than 30.0 cm long 6
6. Infra-marginal vein distance from margin equal to or greater than 1.3 mm 7
7. Plant occurring in Atlantic Forest of Eastern and Northeastern Brazil 8
8. Flowering spadix 3.5 cm long or more, 1.0–1.4 cm diam, petiole margin smooth, no sinuations ..... 5. *H. flexuosa*
8. Flowering spadix up to 3.5 cm long, up to 0.8 cm diam, petiole margin sinuate at least towards apex 9
9. Leaf blade 3.5–7 cm wide, oblong, oblong-ovate to oblong-obovate ..... 9. *H. oblongifolia*
9. Leaf blade 1.8–4.0 cm wide, lanceolate to oblanceolate ..... 14. *H. salicifolia*
7. Plant occurring elsewhere 10
10. Axillary buds acute at apex, internodes subquadrangular to quadrangular in section, leaf shortly attentuate to obtuse at base 11
11. Infra-marginal vein up to 1.6 mm distant from margin, internodes of flowering shoot 0.18 cm or more diam, peduncle 0.5–0.6 cm long, spathe 3.49–3.51 cm long ..... 2. *H. croatii*
11. Infra-marginal vein 2.0 mm or more distant from margin, internodes of flowering shoot up to 0.17 cm diam, peduncle 0.09–0.1 long, spathe 2–2.5 cm long ..... 13. *H. robusta*
10. Axillary buds rounded at apex, internodes subcylindric to cylindric in section, leaf cuneate at base 12
12. Spathe 2.5–5.0 cm long, petiole 0.5–0.8 cm long, leaf blade 0.22–0.28 mm thick, internodes of flowering shoot 0.3 cm diam, peduncle 1.0–1.5 cm long, spadix 1.0–1.5 cm diam, spadix stipe 0.15–0.2 cm long ..... 3. *H. duckeana*
12. Spathe 7.0–8.0 cm long, petiole 0.2–0.4 cm long, leaf blade 0.12–0.16 mm thick, internodes of flowering shoot 0.18 cm diam, peduncle 0.3–0.7 cm long, spadix 0.7 cm diam, spadix stipe 0.03–0.06 cm long ..... 7. *H. longispathacea*
6. Infra-marginal vein less than 1.3 mm distant from margin 13
13. Leaf 9 cm wide or more 14
14. Leaf blade linear to oblong, infra-marginal vein 0.25–0.5 mm from margin ..... 8. *H. macrophylla*
14. Leaf blade elliptic or ovate, infra-marginal vein 0.95–1.25 mm from margin 15
15. Leaf blade 22.5 cm long or more, 9.0 cm wide or more, petiole margin smooth, no sinuations ..... 11. *H. reticulata*
15. Leaf blade up to 21.0 cm long, up to 9.0 cm wide, petiole margin sinuate at least towards apex ..... 17. *H. tenuispadix*
13. Leaf less than 9 cm wide 16
16. Plant from Atlantic forest of Eastern and Northeastern Brazil ..... 12. *H. rigidifolia*
16. Plant from elsewhere, not Atlantic forest of Brazil 17
17. Spadix 0.8–1.0 cm diam 18
18. Leaf blade linear, axillary buds rounded to truncate at apex 19
19. Leaf blade 1.5–3.0 cm wide, axillary buds 2.0–3.0 mm long, petiole 0.3–1.0 cm long, infra-marginal vein 0.7–0.8 mm from margin ..... 6. *H. linearis*
19. Leaf blade 5.0–9.0 cm wide, axillary buds 5.0–8.0 mm long, petiole 1.0–3.0 cm long, infra-marginal vein 0.25–0.5 mm from margin ..... 8. *H. macrophylla*
18. Leaf blade lanceolate, ovate, elliptic, oblong or oblanceolate, axillary buds acute at apex 20
20. Leaf blade oblong to oblanceolate, internodes cylindric to subcylindric in section, petiole 0.4–0.6 cm long, peduncle 0.6–1.0 cm long, spathe white-cream, 4.0–4.5 cm long ..... 4. *H. ecuadorensis*

20. Leaf blade lanceolate, ovate or elliptic, internodes quadrangular to subquadrangular in section, petiole 0.1–0.3 cm long, peduncle 0.2–0.5 cm long, spathe yellow, 1.5–2.8 cm long ..... 15. *H. spruceana*

17. Spadix 0.3–0.7 cm diam 21

21. Internodes quadrangular to subquadrangular, petiole 0.1–0.3 cm long, spathe 1.5–2.8 cm long ..... 15. *H. spruceana*

21. Internodes cylindric to subcylindric, petiole 0.3–1.0 cm long, spathe 2.0–4.5 cm long (unknown in *H. reticulata*.) 22

22. Leaf blade oblong to oblanceolate, petiole 0.30–0.31 cm long ..... 1. *H. boliviana*

22. Leaf blade lanceolate, ovate or elliptic, petiole 0.3–1.0 cm long 23

23. Peduncle 0.3–0.5 cm long, leaf blade 4.0–9.0 cm wide, petiole 0.6–1.0 cm long, infra-marginal vein 1.0–1.25 mm distant from margin, spadix ellipsoid, spadix stipe 0.4–0.7 cm long ..... 17. *H. tenuispadix*

23. Peduncle 0.07–0.21 cm long, leaf blade 2.5–4.5 cm wide, petiole 0.3–0.7 cm long, infra-marginal vein 0.5–1.0 mm distant from margin, spadix cylindric, spadix stipe 0.2–0.25 cm long 24

24. Axillary buds acute at apex, leaf blade lanceolate, 0.13–0.21 mm thick, visible external marginal vein 1, peduncle 0.07–0.12 cm long, spadix 2–2.5 cm long ..... 10. *H. peruviana*

24. Axillary buds rounded at apex, leaf blade ovate to elliptic, 0.24–0.62 mm thick, visible external marginal vein absent, peduncle 0.2 cm long, spadix 1.8 cm long ..... 11. *H. reticulata*

1. Heteropsis boliviana Rusby, Bull. New York Bot. Gard. 6: 493. 1910.—TYPE: BOLIVIA. Isapuri, 5 Oct. 1901, *R. S. Williams 721* (holotype: NY; isotype: K! fl).

Plant hemi-epiphytic, internodes cylindric. Petiole ca. 3 mm long, cuneate; leaf blade 7–15 cm long, 2.5–4 cm wide, oblong to oblanceolate, subcoriaceous, dark green, rigid when dried, apex acute, base cuneate, midrib prominent, primary lateral veins numerous and slender on the abaxial surface, infra-marginal collective vein ca. 1 mm distant from the margin. Inflorescence terminal and axillary, axillary bud acutely pointed, straight, internodes of flowering shoot slender; peduncle slender, recurved in fruit; spathe ca. 3.5 cm long, oblanceolate, rigid, apex strongly acuminate and ca. 6 mm long; spadix 1.8–2 cm long, 6 mm diam, oblong, stipitate. Berry (young in material seen), dark when dried, truncate, quadrilateral. Figure 1A.

Habitat and Distribution—*Heteropsis boliviana* is known only from a single location in Bolivia.

Phenology—The type collection was made in October and the Kew isotype is at a recently post-floral stage with the spathe already shed.

Conservation Status—Based on guidance from the Geocat (2012) online tool, the preliminary conservation assessment of *H. boliviana* is data deficient (DD), since this species is currently known only from a single locality.

Etymology—The specific epithet refers to the country where the type specimen was collected.

Notes—*Heteropsis boliviana* is morphologically similar to *H. ecuadorensis*, but differs in the cylindric stem, straight, acutely pointed axillary buds, slender internodes of the floral shoot and smaller spadix, only 1.8–2.0 cm long. In *H. ecuadorensis* the stem is subcylindric, the buds are acutely pointed and extrorse, the floral internodes are less slender and the spadix is 4–5 cm long.

The above description is based on examination of the Kew isotype and the original description of the type material.

2. Heteropsis croatii M. L. Soares, Kew Bull. 64: 264. 2009.—TYPE: BRAZIL. Acre, Cruzeiro do Sul, Rio Moa, 7°38′S, 73°36′W, 21 Aug. 1986, *T. B. Croat & A. Jr. Rosas 62424* (holotype: INPA! fl; isotypes: K!, MO! fl).

Plant hemi-epiphytic, scandent; internodes 3–5 cm × 2.8–5 mm, longitudinally striate when dried, quadrangular, usually sulcate, grey-greenish brown; lateral bud ca. 1–2 mm long, straight to introrsely curved, with pointed apex. Petiole 5–8 × 1.6–2.8 mm; sheath often sinuate at the margin, especially those of the flowering shoot; geniculum ca. 4 mm long; leaf blade 15–26 × 5–8.4 cm, oblanceolate, subcoriaceous, greenish-brown on both surfaces when dried, 0.11–0.27 mm thick, apex 1.5–2.5 cm long, acuminate-attenuate, base shortly attenuate, midrib weakly sulcate, primary and secondary lateral veins impressed on the upper surface, prominent on lower surface, submarginal collective vein prominent, c. 1.5 mm from margin, with a single outer submarginal vein. Inflorescence terminal and axillary, flowering shoot 3.5–10.5 cm long, internodes 1.5–3 cm × 1.8–3 mm, matte brown, weakly quadrangular; peduncle 0.5–0.6 × 0.2 cm, usually extrorsely twisted at apex; spathe ca. 3.5 × 1.5 cm, convolute, longer than spadix, cuspidate, yellowish, apex acuminate; spadix 1.5–2 cm × 6–7 mm, cylindric, apex rounded, cream, stipitate; stipe 3–6 mm × 1.4–1.7 mm, subcylindric to weakly quadrangular. Stamens ca. 1.5 × 0.75 mm; gynoecium ca. 2.5 × 2.5 mm, prismatic, apex 2.5–3.5 mm wide, locules 2 per ovary, ovules 2 per locule, 1–1.5 mm long, anatropous, subsessile, usually one smaller than the other, placentation sub-basal, stigma discoid. Infructescence ca. 5.5 cm × 3.3 cm; berry 6–10 × 5–8 mm, bright orange, pulp orange; seed 6–10 × 6–7.5 mm, obovoid, testa subrugose. Figures 1A, 12.

Habitat and Distribution—*Heteropsis croatii* occurs in Plateau Forest (terra firme) in western Amazonia in Brazil (Acre, Amazonas) and Peru (Loreto) at altitudes of 120–230 m.

Phenology—This species has been collected in flower in April, May, August to October, and in fruit from January to May.

Conservation Status—Using guidance from the Geocat (2012) online tool, the preliminary conservation assessment of *H. croatii* is least concern (LC), based on 9 localities and a 50 km cell width (auto value cell size option for area of occupancy).

Etymology—The specific epithet honors the outstanding work of Dr. Thomas B. Croat of the Missouri Botanical Garden, the leading specialist of our era in Neotropical Araceae systematics, whose numerous important contributions include his unrivalled collections and extensive and numerous publications on the family.

Notes—*Heteropsis croatii* is morphologically similar to *H. robusta* in the quadrangular internodes, oblanceolate leaf blade and inflorescence size, but differs by the midrib which is not yellowish on the lower surface in dried material, the adaxially impressed primary lateral veins, the thicker floral

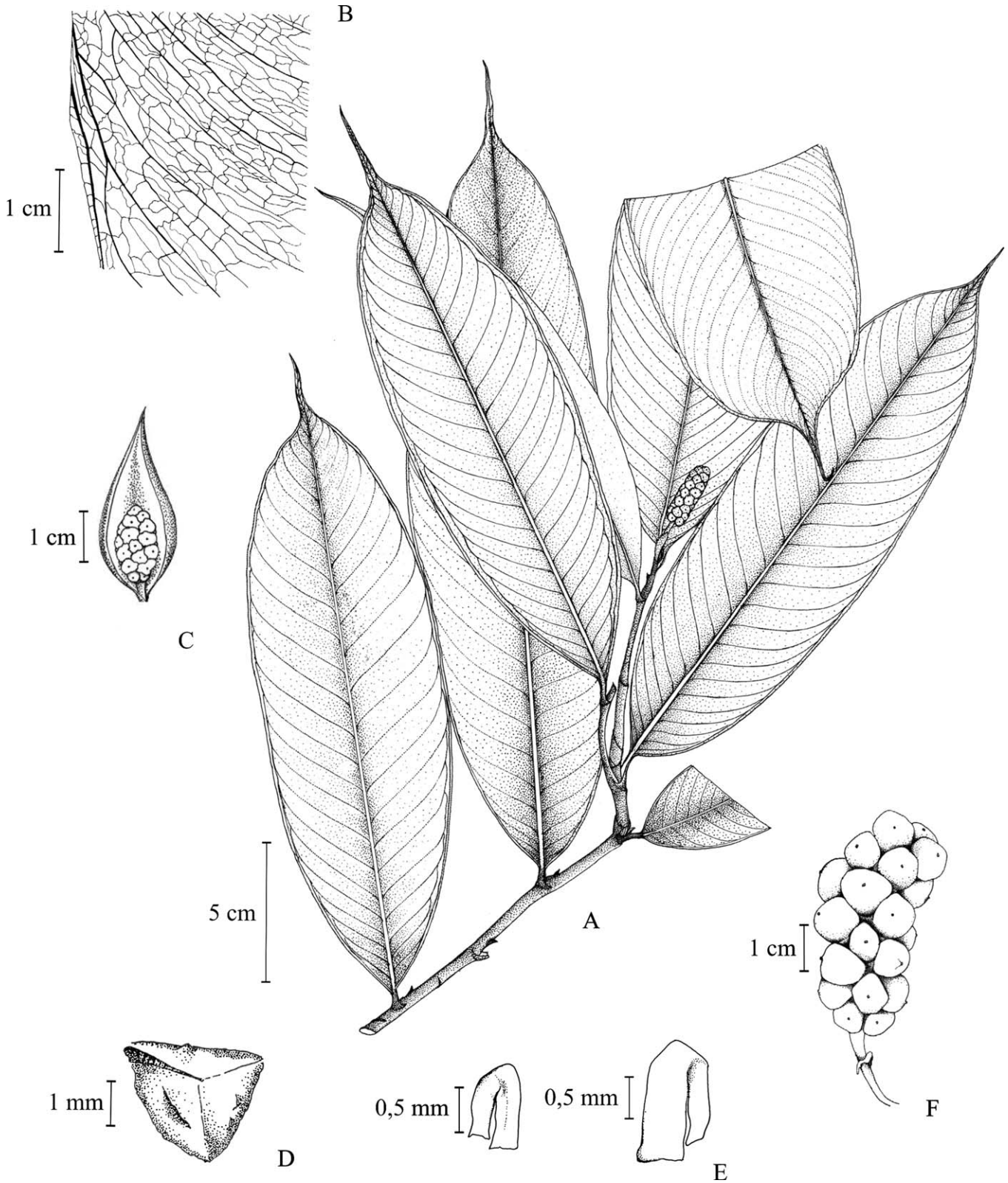

Fig. 12. *Heteropsis croatii*. A. Habit. B. Venation on left abaxial surface of leaf blade. C. Inflorescence. D. Frontal view of flower. E. Lateral view of ovules. F. Infructescence. (A, B, D, E prepared from *Croat & A. Jr. Rosas 62424* (INPA); C from *Cid & Lima 3443* (INPA); F prepared from *Gentry & Revilla 15878* (MO)). Drawn by Felipe França.

shoot axis, and especially by the short, usually extrorsely twisted peduncle and cuspidate spathe much longer than the spadix. In *H. robusta* the midrib is yellowish on the abaxial surface of the leaf blade, the floral shoot axis is slender, the peduncle is not extrorsely twisted and the spathe is not cuspidate and only slightly longer than the spadix.

Additional Specimens Examined—BRAZIL. Amazonas: Município de Coari, Rio Urucu, base da PETROBRÁS, 28 May 1991, *Freitas & Mota 394*

(INPA fr); Município de Maraã, Rio Japurá, Lago Maraã 1°51′S 65°36′W, 4–5 Dec 1982, *Plowman et al. 12189* (INPA, MO fl, fr); Colonia dos Índios Canamarís, Rio Japurá, 1°50′S 65°35′W, 31 Oct 1982, *Cid & Lima 3443* (INPA fl).

PERU. Loreto: Provincia de Maynas, 3°50′S 73°30′W, 23 Feb 1981, *Gentry et al. 31560* (MO fr); 16 Aug 1988, *McDaniel 30195* (MO ster); Distrito Las Amazonas, Comunidad Piloto "Roca Eterna" 3°25′S 72°33′W, 27 Mar 1991, *Grández et al. 2304* (MO fr); Puerto Almendraz, Rio Nanay, 13 Jan 1976, *Gentry & Revilla 15878* (MO fr); 20 km WSW of Iquitos, 3°46′S 73°20′W, 30 Mar 1989, *Chota 14* (MO ster); 3°48′S 73°35′W, 9 Jan 1986, *Vásquez & Jaramillo 7080* (MO fr); Santa Maria de Nanay and Iquitos, 23 Feb 1981, *Gentry et al. 31560* (MO fr); 3°55′S 73°35′W, 30 Sep 1990, *Pipoly et al. 12616* (MO fl); Rio Nanay 3°40′S 73°30′W, 6 Jul 1984, *Vásquez & Jaramillo 5214* (MO fl); 3°55′S 73°35′W, 25 Sep 1986, *Vásquez & Jaramillo 7980* (MO fr); Rio Yavari, 14 Apr 1964, *Schunke 6391* (MO fr).

3. HETEROPSIS DUCKEANA M. L. Soares, Kew Bull. 64: 264. 2009.—TYPE: BRAZIL. Amazonas, Manaus, Reserva Florestal Adolfo Ducke, km 0.35 caminho alojamento-torre, 8 Nov. 2002, *M. L. Soares 503* (holotype: INPA! fl; isotypes: K!, MG!, MO!, RB! fl).

Plant scandent climbing to 35 m high, shoot leafy, aerial roots ca. 7–8 mm diam, subcylindric, reddish brown when young, grey when mature; internodes 2–3 cm × 4–9 mm, brown, longitudinally striated when dry, somewhat flattened on one side, rounded on the other; lateral bud 1–2 mm long, apex rounded. Petiole 5–8 × 2–3 mm, usually twisted, margin paler; geniculum ca. 3 mm long, darker than petiole; leaf blade 9–17 × 2.5–4 cm, elliptic-lanceolate, subpatent, olive-green when fresh, becoming brown when dry, glossy, subcoriaceous, 0.22–0.28 mm thick, apex acute, base cuneate, margin revolute, slightly sinuate, lateral veins numerous, obscure on both sides when fresh, visible when dry, submarginal collective vein 2–3 mm distant from margin, external marginal veins 1–2. Inflorescence terminal and axillary, flowering shoot 2.5–7 cm long, internodes 0.5–1.5 cm × 3 mm, with 1–2 small, persistent euphylls at the most apical nodes; peduncle short, 1–1.5 cm long, 3–4 mm diam; spathe 2.5–5 × 4–5.8 cm when expanded, yellow on both sides, inflated, convolute, apex shortly acuminate, margin cream, spathe of floral buds 2–3 cm × ca. 8 mm, dark green; spadix 3.8–5.3 × 1–1.5 cm, cylindric, apex weakly acuminate, pale yellow, stipitate, stipe 1.5–2 × ca. 3 mm. Stamens 3–4 × 1.25–1.7 mm, anthers 1 × 1.5 mm; gynoecium 3–3.5 × ca. 3.5 mm, obpyramidal, ovary 2.5 × 1.8 mm, locules 2 per ovary, ovules 2 per locule, 0.6–1 × 0.7 mm, anatropous, subsessile, placenta basal to sub-basal, stigma 1–1.5 mm long, oblong-elliptic. Infructescence: 6–6.5 × 2.3–3.2 cm; berry 10–17 × 9–18 mm, apex 6–8 mm diam, subobovoid, yellow, pulp yellow; seeds 1–2 per berry, 10–15 × 9–13 mm, obovoid, testa rugose. Figures 1A, 7A, 8A, 9A, 13.

Habitat and Distribution—*Heteropsis duckeana* occurs in terra firme plateau forest (floresta de platô) at altitudes of approximately 150 m. It is so far known only from Central Amazonia, Brazil.

Phenology—Flowering specimens have been collected between October and December, and fruiting material in January.

Conservation Status—Using guidance from the Geocat (2012) online tool, the preliminary conservation assessment of *H. duckeana* is data deficient (DD), since this species is currently known from only three localities.

Etymology—The specific epithet refers to the collecting locality where this species was first recognized: the Reserva Florestal Adolfo Ducke which belongs to the Instituto Nacional de Pesquisas da Amazônia (INPA), in the municipality of Manaus, Brazil.

Notes—*Heteropsis duckeana* is morphologically similar to *H. rigidifolia* from the Atlantic Forest but differs in the less coriaceous, non-rigid, and less spreading leaf blade, longer internodes and petioles, and especially in the larger size of the spadix and seeds. In *H. rigidifolia* the internodes are 1.5–2 cm long, the petiole 3–5 mm long, the leaf blade is coriaceous, rigid and spreading, the spathe is 2–3 cm long, the spadix 1.5–3 cm long, 0.6–0.8 cm diam, and the seed 8 mm long, 4–5 mm diam. The aerial roots of *H. duckeana* have lenticels throughout and the anchor roots adhering to the host tree are flattened and velvety reddish-brown. The ovary locules contain a transparent mucilaginous substance which dries rapidly on exposure to air.

A study of the root anatomy of *Heteropsis* species in the Reserva Adolfo Ducke (Soares Morais 2008) showed that *H. duckeana* differs from other species in the presence of brachysclereids in the central cylinder.

Additional Specimens Examined—BRAZIL. Amazonas: Itacoatiara, Mil Madeireira, 12 Dec 1999, *Soares et al. 486* (INPA fl); Manaus, Reserva Florestal Adolfo Ducke, 6 Jan 2005, *Soares & Pereira 759* (INPA fr); 13 Oct 1994, *Vicentini 747* (INPA fl). Pará: Itaituba, Parque Nacional do Tapajós, km 60 da estrada Itaituba-Jacarecanga 20 Nov 1978, *Silva & Rosário 3852* (K, MG, U, fl).

4. HETEROPSIS ECUADORENSIS Sodiro, Anales Univ. Centr. Ecuador 22 (162): 278. 1908.—TYPE: ECUADOR. "Crescit in silv. subtropi. secus fl. Pilaton prov. Quitensis et in tropicalibus prov. Guayas propre El Naranjito", província de Quito, Rio Pilaton, *L. Sodiro s.n.* (syntype probably at QPLS); província de Guayas, El Naranjito, *L. Sodiro s.n.* (syntype probably at QPLS).

Heteropsis rimbachii K. Krause, Notizbl. Bot. Gart. Berlin-Dahlem 9: 269–270. 1925.—TYPE: ECUADOR. "im Walde der Küstenebene am Rio Quimbo sehr häufig" (very frequent in the coastal forest along the Rio Quimbo), *Rimbach 77* (holotype: B! fl).

Scandent hemi-epiphyte; aerial roots ca. 5 mm diam, subcylindric, pale brown when dry, with dark brown annular markings; leafy shoot with internodes 2–9.5 cm long, 0.3–0.75 cm diam, slightly striate longitudinally when dry, rounded with one side somewhat sulcate to flattened, pale green when dry; lateral bud 1.5–3 mm long, apex pointed, introrse to straight. Petiole 4–6 mm long, ca. 1.5 mm wide, canaliculate, margin undulate at the apex; genuiculum ca. 4 mm long; leaf blade 9.5–16 cm long, 2.5–5.5 cm wide, oblong to oblanceolate, subcoriaceous, pale brown on both surfaces when dry, 0.13–0.38 mm thick, apex acuminate, base cuneate to obtuse, midrib somewhat sulcate adaxially, prominent abaxially, same color as blade, primary lateral veins and interprimary veins obscured adaxially, impressed abaxially, tertiary veins forming distinct reticulations near the margin, infra-marginal collective vein prominent, 0.75–1 mm distant from the margin, external marginal vein 1, near the collective vein. Inflorescence terminal and axillary, flowering shoot (2.2-) 3.5–13 cm long, internodes 2.5–3 cm long, 1.5–3 mm diam, pale brown, sulcate, buds present at the first to third internodes; peduncle 6–10 mm long, cylindric, generally twisted extrorsely at the apex; spathe ca. 4.0–4.5 cm long, 2–3 cm wide, closed, oblong, apex acuminate, white-cream; spadix (2-) 4–5 cm long, 0.8–1 cm diam, subcylindric, apex acuminate, stipitate, white to cream, stipe 2–6 × 1.4–3 mm. Gynoecium

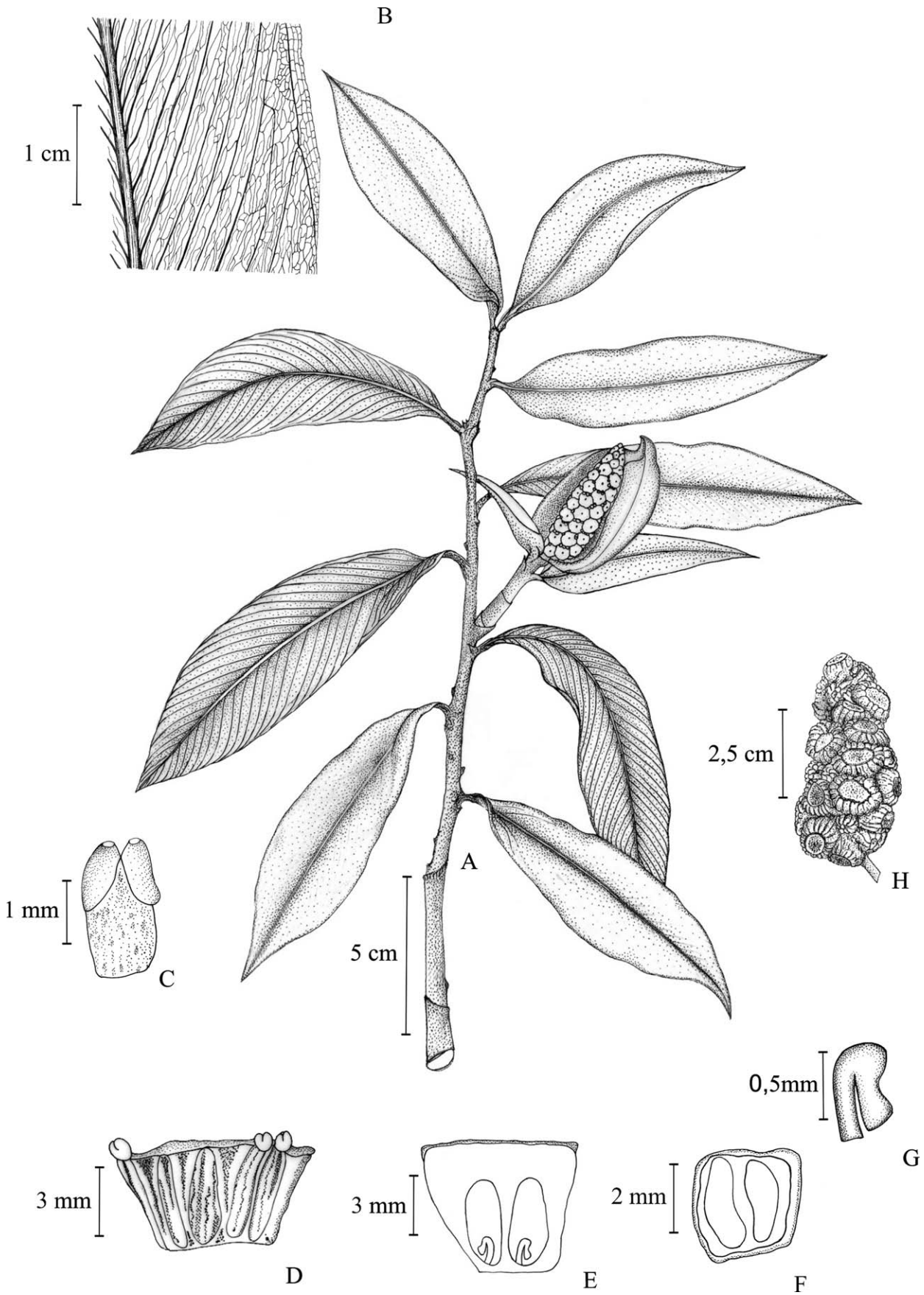

FIG. 13. *Heteropsis duckeana*. A. Habit. B. Venation on right abaxial surface of leaf blade. C. Frontal view of stamen. D. Lateral view of flower. E. Longitudinal section of gynoecium. F. Transverse section of ovary. G. Lateral view of ovule. H. Infructescence. (A–H prepared from *Soares et al. 503* (INPA) and *Soares & Pereira 759* (INPA)). Drawn by Felipe França.

2–3 mm long, 2.5–3 mm diam, prismatic, apex 2.8–3.5 mm diam, stigma oblong to discoid. Infructescence 6–8 cm long, 3 cm diam; berry 10–18 × 8–12 mm, ovoid to globose, orange; seed 8–13 × 7–12 mm, ovoid, testa rugose. Figures 1A, 14.

Common Names—The following common names have been recorded for this species: bejuco de montaña (Peru), piquigua (Ecuador).

Habitat and Distribution—*Heteropsis ecuadorensis* is known from Colombia, Ecuador and Peru, occuring between 50–2,000 m alt.

Phenology—Flowering specimens have been collected in February, March, June and September, and fruiting material in January, and from April to June.

Conservation Status—Using guidance from the Geocat (2012) online tool, the preliminary conservation assessment of *H. ecuadorensis* is least concern (LC), based on 9 localities and a 50 km cell width (auto value cell size option fora of occupancy).

Etymology—The specific epithet refers to Ecuador where this species was first discovered.

Notes—In Sodiro's original description of *H. ecuadorensis*, the author did not designate a holotype, citing two syntypes instead. Unfortunately, it has not been possible to examine these nor to ascertain whether they are still in existence. As it is possible that these specimens do still exist, probably at QPLS, we have not designated a neotype here.

Krause described *H. rimbachii* based on the collection *Rimbach 77* from Ecuador. The author states in the original description that this species is frequent in lowland coastal forests of the Rio Quimbo and is notable by its usually oblanceolate leaves and the numerous and long aerial roots emerging from the stem. In these characters, *H. ecuadorensis* resembles *H. flexuosa* (Kunth) G. S. Bunting but *H. ecuadorensis* differs from this species in the slender, pointed, introrse axillary buds and especially by the much more slender stem and spadix.

Heteropsis ecuadorensis is distinguished when sterile by the oblanceolate leaf, the pointed introrse buds, and when fertile by the length of the spathe and spadix (4–5 cm). Although in spadix size it can be confused with *H. longispathacea* Engl., it differs from this species by the acuminate apex of the spathe; in *H. longispathacea* the spathe is cuspidate and 7–8 cm long.

Additional Specimens Examined—COLOMBIA. Departamento Chocó: Município de Nuquí, 5°32′N 77°15′W, Feb–Mar 1994, *Galeano et al. 5281* (MO ster); Município de Riosucio, 11 Sep 1987, *Cardenas 421* (MO ster); Município de Turbo, 25 Dec 1983, *Brand & Escobar 743* (MO fl); San Juan de Urabá-Chigorodó, 28 Mar 1986, *Renteria et al. 4881* (MO fl).

ECUADOR. s.d., *Rimbach 834* (photo MO ster); 14 May 1997, *Vargas et al. 1373* (MO fr); s. d., *Delinks & Robles 68* (MO ster). Esmeraldas: 4 May 2000, *Neill & QCNE 12785* (MO ster); 00°59′N 79°01′W, 24 Aug 1991, *Pedersen & Bergmann 97662* (K, MO ster); 12 Apr 1943, *Elbert & Little Jr. 6243* (K fr); 0°37′N 79°54′W, 16 Mar 1992, *Croat 73074* (MO fl, fr). Guayas: Reserva Ecológica Manglares, 2°24′S 79°35′W, 28 Feb 1992, *Ceron 18363* (MO ster); 24 May 1980, *Harling & Andersson 19388* (MO fl). Los Rios: 1 Sep 1976, *Croat 38682* (MO ster); Pichilingue, 15 Jun 1945, *McClure 21350* (MO fr). Pichincha: Rio Palenque, 21 Feb 1974, *Gentry 10099* (K fl); Centro Científico 00°30′S, 79°22′W, 2 Jun 1990, *Rubio & Alverson 390* (MO fr); entre Rio Mocachi e Palenque, 24 Jan 1981, *Gentry 30720* (K fr); 24 Jan. 1981, *Gentry 24728A* (MO fr); 25 Mar. 1980, *Gentry & Dodson 28471* (MO ster); 15 Aug 1978, *Dodson et al. 7076* (MO fl). Manabi: Rio Mongolla, 00°09′S 79°51′W, 12 Apr 1997, *Clark et al.* (MO fr). Province Napo, 28 May 1988, *Coelho 298* (MO fl); 00°57′S 76°13′W, 9–13 Jan 1988, *Palacios 2407* (MO fl). Pastaza: Rio Curaray, 1°30′S 76°32′W, 3 Sep 1985, *Palacios & Neill 787* (MO fr); Papagayos 00°20′N 79°28′W, 6–8 Sep 1996, *Clark 2745* (MO fr).

PERU. Departamento Loreto: Rio Javari, 14 Apr 1964, *Vigo 6391* (K fr).

5. Heteropsis flexuosa (H. B. K.) G. S. Bunting, Revista Fac. Agric. Univ. Centr. Venezuela 10: 201. 1979. *Pothos? flexuosus* H. B. K., Nov. Gen. Sp. 7: 151. (1825). *Anthurium? flexuosum* (H. B. K.) Kunth, Enumeratio Plantarum, vol. III, p. 82. (1841).—TYPE: VENEZUELA. Montana de Javita, *Humboldt & Bonpland 978* (holotype: P! ster).

Heteropsis jenmanii Oliv., Hooker's Icon. Pl. 20: t. 1949 (1890).—TYPE: GUYANA. Mazaruni River, Kalacoon, May 1889, *G. S. Jenman 5000* (holotype: K! fl).

Plant hemi-epiphytic, scandent; shoot densely leaved, internodes 2–5.5 cm long, 0.3–1 cm diam, subcylindric, one side flattened to slightly sulcate, pale green, dark brown, vertically striate when dry; lateral bud 3–6 mm long, generally extrorse, apex acute. Petiole 0.5–1 cm long, 2–2.6 mm diam, strongly canaliculate, usually twisted, margin smooth; geniculum 3–5 mm long; leaf blade 13–27 cm long, 3.5–9.5 cm wide, lanceolate to obovate, subcoriaceous, subglossy, dark green adaxially, yellowish-green abaxially when living, pale to dark brown and opaque when dried, margin revolute, 0.24–0.60 mm thick, apex acuminate to attenuate, 1–2.4 cm long, base acute to cuneate, rarely obtuse, midrib flattened to etched or impressed adaxially, prominent abaxially, yellowish, primary lateral veins and interprimaries obscured on both surfaces, infra-marginal collective vein prominent, 1–2.5 mm distant from the margin, external marginal vein 1. Inflorescence terminal or axillary, flowering shoot 2–14 (–18) cm long, internodes 0.5–4 cm long, 2–6 mm diam, dark brown when dried, slightly sulcate, axillary buds lacking or only present on the first internode; peduncle 2–5 mm long, 3–4 mm diam, dark green; spathe 3.5–6 cm long, 1–1.5 cm diam, closed, ellipsoid, convolute when open, yellow, as long as the spadix, apex acute; spadix 3.5–6 cm long, 1–1.4 cm diam, ellipsoid, subclavate, apex obtuse, pale yellow, stipitate, stipe 3–5 × 3–5 mm, green, subcylindric. Stamens 1.5–2.5 mm long, 1–2.5 mm wide, anthers ovate; gynoecium ca. 3.5 mm long, 2.5 mm diam, slightly prismatic, apex 2–5 mm diam, ovary 1.5–2.5 mm long, 0.7–1 mm wide, oblong, locules 2 per ovary, ovules 1–2 per locule, 0.7–2 mm long, anatropous, subsessile, placentation sub-basal, stigma discoid-oblong. Infructescence when immature 4.6–6 cm long, when mature 8–13 cm long, 3–4 cm diam; berry 10–15 × 7–15 mm, green when immature, yellow when mature, with dark green apex, truncate; seed 8–14 × 0.5–1 mm 2 per berry, brown, glossy, oblong. Figures 1B, 4F, 4G, 6, 7B, 7C, 8B, 15.

Common Names—The following common names have been recorded for this species: cipó-titica (Brazil), nibbi ou mibi (Guiana), tamshi (Peru).

Habitat and Distribution—*Heteropsis flexuosa* occurs in dense ombrophilous terra firme forest in all regions where it occurs, and in tall várzea forest in Amazonia, preferring in this case higher terrain. The species is widespread in South America being known from Bolivia, Brazil (Acre, Amapá, Amazonas, Bahia, Maranhão, Pará, Pernambuco, Rondônia, Roraima), Colombia, Ecuador, French Guiana, Guyana, Peru, Surinam, and Venezuela at altitudes between 50–1,000 m altitude.

Phenology—Flowering and fruiting specimens have been collected throughout the year.

Conservation Status—Using guidance from the Geocat (2012) online tool, the preliminary conservation assessment of *H. flexuosa* is least concern (LC), based on 39 localities and a 50 km cell width (auto value cell size option for area of occupancy).

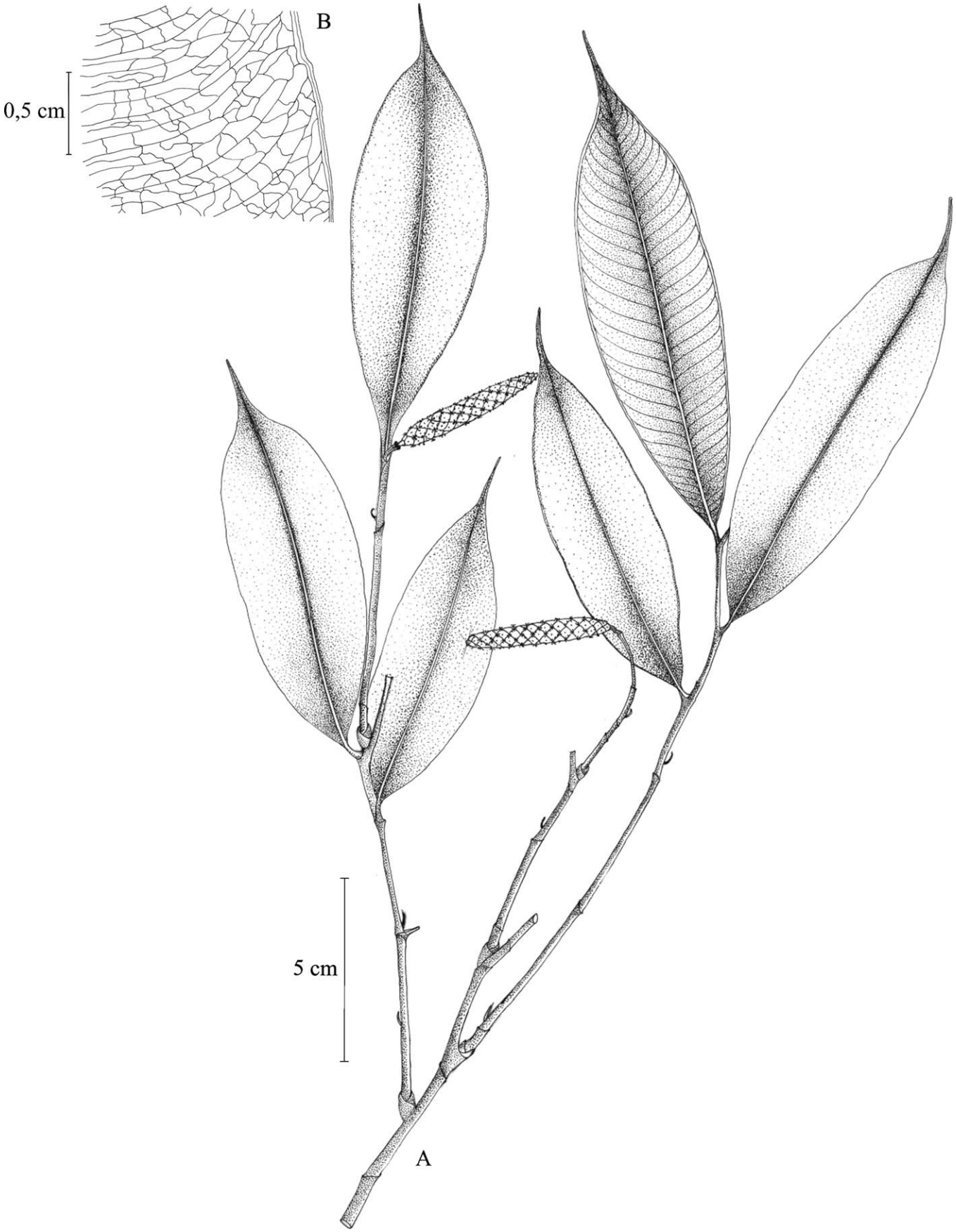

Fig. 14. *Heteropsis ecuadorensis*. A. Habit. B. Venation on right abaxial surface of leaf blade. (A and B prepared from *Coelho 298* (MO)). Drawn by Felipe França.

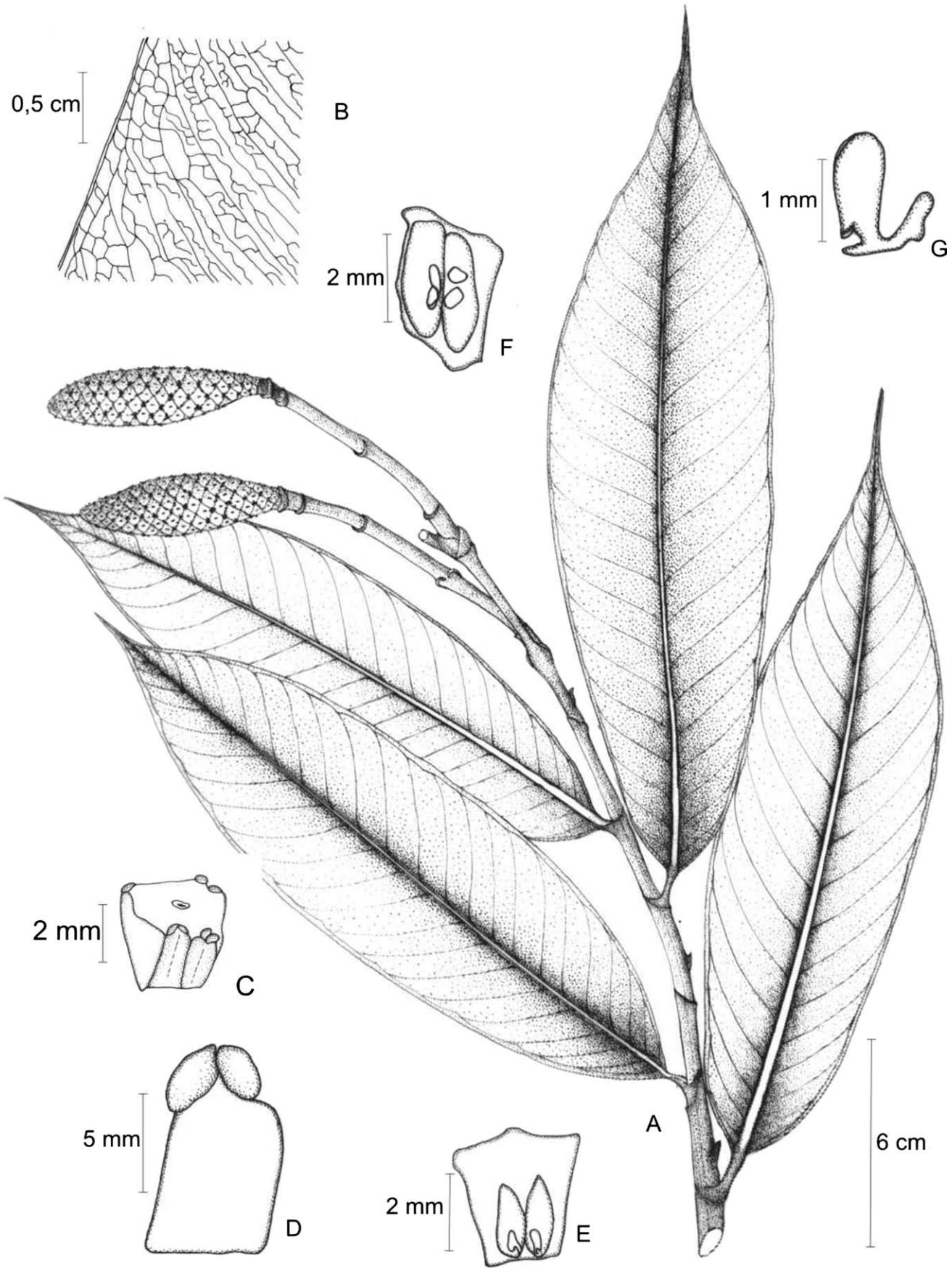

FIG. 15. *Heteropsis flexuosa*. A. Habit. B. Venation on left abaxial surface of leaf blade. C. Oblique surface view of flower. D. Frontal view of stamen. E. Longitudinal section of gynoecium. F. Transverse section of ovary. G. Lateral view of ovules. (A–G prepared from *Soares et al. 497* (INPA)). Drawn by Felipe França.

Etymology—The species epithet probably refers to the flexuose aerial roots which are widely used in Amazonia for fiber.

Notes—*Heteropsis flexuosa* has a broad distribution, exceeded only by *H. oblongifolia* to which it is somewhat similar morphologically (see commentary for the latter species). *H. flexuosa* has also often been confused in herbarium material with *H. macrophylla*, but the latter can be distinguished by the longer, non-twisted petioles (1–3 cm long), the narrowly oblong leaf blade, olive-green adaxially, paler green abaxially, with an obtuse to shortly cuspidate apex, numerous primary lateral veins which are prominent abaxially, inframarginal collective vein close to the margin (ca. 0.25–5 mm distant) and usually lacking an external marginal vein, shortly stipitate to sessile spadix and prominently discoid stigma. *H. flexuosa* has an oblong to elliptic leaf blade which is yellowish-green abaxially, subcoriaceous, acuminate to attenuate apically, with the veins obscured on both surfaces, inframarginal collective vein 1–2.5 mm distant from the margin with an external marginal vein, stipitate spadix and a discoid to oblong, but less prominent stigma.

In an ecological study of four species of *Heteropsis*, within an area of 2.4 ha. in the Reserva Florestal Adolpho Ducke (Soares Morais 2008), *H. flexuosa* was found to be the most abundant species, comprising 37% of the recorded *Heteropsis* plants, and occurred on all types of terrain in different strata and on host trees of different diameters. However, it was most common in quadrats at higher elevations within the area ($R^2 = 0.27$; $t = 3.92$; $p = 0.03$). These results, together with label data gathered from specimens collected in other localities show that *H. flexuosa* occurs between 50 and 1,000 m alt. and is plastic ecologically.

Field observations at the Reserva Florestal Adopho Ducke confirmed that *H. flexuosa* produces spreading or somewhat pendent plagiotropic branches. Within each lateral shoot, the leaves (8–14 in number) become progressively smaller toward the apex, thus forming an oval profile for the branch as a whole. This feature of the branch morphology is distinctive to *H. flexuosa* and differentiates it from the other species studied in the Reserva Ducke (*H. macrophylla*, *H. spruceana*, *H. steyermarkii*, *H. tenuispadix*).

Heteropsis flexuosa was originally described as *Pothos flexuosus* by Kunth based on material collected by Humboldt and Bonpland. The origin of the collection was given as "Crescit inter Atures et Maypures (Missiones del Orinoco); item ad ripam Fluminis Nigri et Tuamini, prope Javitam" ("Occurs between Atures and Maypures (Orinoco Missions); also along the banks of the Rio Negro and Rio Tuani near Javita"). The type specimen in the Paris herbarium (P) is sterile with broad usually obovate leaves. The label reads "Herbier Humboldt & Bonpland (P), Pothos? flexuosus–sub? N. 978 Montana de Javita" and this information, together with the match of specimen and published description confirm it as the holotype. Kunth (1841) later made the new combination *Anthurium flexuosum* Kunth. Oliver described *H. jenmanii* based on the collection *Jenman 5000* from Guyana, which was later reduced to synonymy with *H. flexuosa* by Bunting (1979).

Additional Specimens Examined—BOLIVIA. Pando: Abuna, 9°50′S 65°40′W, 8 Jul 1992, *Gentry & Alan Perry 77987* (MO fl).

BRAZIL. Acre: Marechal Thaumaturgo, 9°02′52.92″S–9°02′35.46″S 72°16′24.48″W–72°15′59″W, 30 Nov 2000, *Daly et al. 10286* (MO fl). Amapá: Mazagão, 25 Feb 1988, *Pires & Silva 2022* (MG fl). Porto Grande, 1 Mar 2001, *Pereira et al. 151* (HAMAB, INPA fl); 1 Mar 2001, *Pereira et al. 160* (HAMAB, INPA, MG fl); 1 Mar 2001 *Pereira et al. 162* (INPA ster). Amazonas: 19 Dec 1955, *Coelho s.n.* (INPA 3140 fr). Manaus, Reserva Florestal Adolpho Ducke, 24 Nov 1993, *Ribeiro et al. 1181* (INPA fr); 15 Dec 1994, *Ribeiro & Silva 1536* (INPA fl); 31 Jan 1996, *Ribeiro et al. 1799* (INPA fr); 21 Feb 1995, *Soares et al. 190* (INPA fr), *Soares et al. 497* (INPA fl); 8 Sep 1994, *Assunção s.n.* (INPA 176280 fr); 8 Sep 1994, *Assunção et al. 47* (INPA fl); Barcelos, 20 Apr 1955, *Froes 28374* (IAN fr); Humaitá, 16 Jun 1980, *Janssen 474* (INPA fl); 3°07′S 58°59′W, 17 Aug 1986 *Croat 62269* (INPA, MO ster); 16 Aug 1986, *Croat 62208* (MO ster); Manaus-Itacoatiara, 12 Oct 1976, *Adair s.n.* (INPA 72818 fl); 20 Nov 1968, *Coelho & Lima s.n* (INPA 25953 fl); 24 Nov 2000, *Souza et al. 418* (INPA fl); 3 Nov 1973, *Steward & Ramos P17656* (INPA, U fl); Rio Javari, 8 Aug 1973, *Lleras et al. P17214* (U fl); Santa Isabel do Rio Negro, 1 Sep 2003, *Soares et al. 523* (INPA fl, fr); Urucu, 18 Sep 2005, *Soares et al. 669* (INPA fr); 19 Sep 2005, *Soares et al. 671* (INPA fl, fr); 14 Dec 2005, *Soares et al. 758* (INPA fl); São Gabriel da Cachoeira, 10 Feb 2001, *Hoffman & Farias 139* (INPA fl). Bahia: Ilhéus, 29 Nov 2000, *Gonçalves et al. 407* (CEPEC ster); 6 Mar 2001, *Gonçalves et al. 791* (CEPEC ster); 11 Dec 1997, *Gonçalves & Jardim 134* (CEPEC ster). Una, 7 Nov 2005, *Soares et al. 753* (CEPEC ster); 16 Dec 1968, *Santos 317* (CEPEC fl, fr); Goianesia, 8 Apr 2003, *Bastos et al. 2956* (MG fl); Uruçuca, 6 May 1996, *Nadruz et al. 1180* (CEPEC ster). Maranhão: Rio Turiaçu, 20 May 1979, *Jangoux & Bahia 759* (MG fl). Pará: 25 Sep 1948, *Froes 23608* (RB ster); 11 Mar 1958, *Froes 34197* (IAN fl); 19 Nov 1977, *Prance et al. 25577* (MG fl); 30 Mar 1974, *Medeiros & Marinho s.n.* (IAN 143489 fr); Jul 1952, *Pires 7052* (IAN fl); 22 Nov 1996, *Carlos et al. 1229* (MG fr); 17 Aug 1969, *Silva & Souza 2290* (MG fr); 16 Nov 2001, *Bastos et al. 2275* (MG fl); 11 Sep 1908, *Pessoal do Museu 9636* (MG ster); 23 Mar 1986, *Balée 2014* (MO ster); Belém, 26 Apr 1960, *Oliveira 601* (IAN fr); 18 Sep 1963, *Oliveira 2581* (IAN fr). Castanhal, 3 Oct 1942, *Silva s.n.* (IAN fr); Itaituba, 20 May 1983, *Amaral et al. 1352* (INPA fr); Mocambo, 1°25′S 48°25′W, 13 Aug 1986, *Croat 62105* (MO ster); Tucuruí, 22 Oct 1983, *Lima & Silva 90* (INPA fl); 21 Oct 1966, *Pires & Silva 10279* (IAN fr); Paragominas, 4°17′S, 47°32′W, 1 Mar 1980, *Plowman et al. 9402* (INPA, MO ster); Santarém, Feb 1955, *Froes 31473* (IAN fl). Pernambuco: Recife, 14 Feb 1990, *Guedes 2267* (UFBA fl). Rondônia: 28 Jun 1983, *Silva 6506* (INPA fl); Porto Velho, 26 Oct 1979, *Vieira et al. 310* (INPA fl); 27 Jul 1997, *Lobato et al. 1830* (MG fl). Roraima: 18 Feb 1971, *Prance et al. 10598* (INPA fl); 28 Feb 1971, *Prance et al. 10761* (INPA fl); 16 Nov 1977, *Steward et al. 39* (INPA fl).

COLOMBIA. 17 Sep 1991, *Vester 569* (MO ster).

ECUADOR. 19 Jun 1991, *Palacios & Freire 7396* (MO fr). Napo: 12 Nov 1987, *Ceron 2881* (MO fl); 00°52′S 76°05′W, 9–13 Jan 1988, *Ceron & Coelho 3295* (MO fr); 00°57′S 76°13′W, 9 Jan 1988, *Neill et al. 8353* (MO fr); 00°57′S 76°13′W, 9 Jan 1988, *Neill et al. 8268* (MO fl) ; 00°52′S, 76°05′W, 11–17 Jan 1988, *Coelho 14* (MO fr); 00°52′S, 76°05′W, 11–17 Jan 1988, *Coelho 83* (MO fl fr) ; 0°59′S 76°12′W, 8 Jan 1995, *Aulestia & Omehuat 3213* (MO fl); 1 Apr 1999, *Leimbeck 123* (MO ster); 1 Jan–8 Oct 1938, *Gill 64* (K ster); Orellana Reserva Étnica Huaorani, 0°48′S 76°28′W, 6 Oct 1993, *Dik 630* (MO fl); 01°02′33″S 76°53′11″W, 30 Jan 2004, *Freire & Narajo 478* (MO ster); 00°45′S 76°45′W, 21 Nov 1991, *Neill & Rojas 10022* (MO ster); 0°38′S 76°9′W 14 Feb 2002, *Koster et al. 926* (MO fl). Pastaza: 01°34′S 77°25′W, 25 Nov 1990, *Gudiño 1132* (MO fl); 18 Dec 1991, *Gudiño & Gualinga 1619* (MO ster); 01°15′S 76°55′W, 1 Mar 1989, *Vlastimil Zak 4051* (MO ster); 01°15′S, 76°55′W, 1–6 Mar 1989, *Vlastimil Zak 4143* (MO ster). Sucumbios, 00°00′S, 76°11′W, 15 Nov 1991, *Palacios et al. 9258* (MO ster). San Martín: Provincia Mariscal Cáceres, 2 May 1981, *Schunke-V. 12827* (MO ster).

FRENCH GUIANA. Reserve des Nouragues, 4°3′N 52°42′W, 6 Mar 2004, *Poncy et al. 1807* (P, CAY, MO, U fl); Montagne de Kaw, 1 Apr 1984, *de Granville 6703* (P fr); Rivière Arataye 1 Feb 1969, *Oldeman 2899* (P fl); 27 Mar 1981, *Barrier 2830* (B, K, MO, NY, P, U, US fr); Marifasoula, 29 Aug 1961, *Schnell 11543* (P ster); Sipomama 18 Jun 1984, *Sauvain 139* (K, P ster); Wayãpi 4 Dec 1974, *Grenand 560* (K ster); 28 Mar 1910, *Anderson 432* (K ster); 29 Jun 1979, *Prevost 670* (K ster), 03°37′N 53°12′W, 27 Mar 1983, *Mori & Pipoly 15415* (MO, P fr); 15 May 1986, *Mori & Pennington 18014* (MO fr).

GUYANA. 5°30′N 58°22′W, 6 Jul 1982, *Croat 53843* (MO ster); 03°37′N 53°12′W, 11 Feb 1993, *Croat 74186* (MO fl); 11 Feb 1993, *Croat 74186A* (MO ster). Essequibo River, 15–24 Dec 1937, *Smith 2722* (P fl), 15 May 1997, *Clark 4557* (U fr). Pomeroon–Supenaam 07°17′N 58°54′W, 11 Jul 1997, *Hoffman & Ehringhaus 5104* (MO ster); Potaro–Siparuni 04°15′N 58°30′W, 17 Mar 1996, *Hoffman & Allicock 5060* (MO fr); 04°12′N 58°30′W, 19 Mar 1996, *Hoffman & Allicock 5052* (MO fr); 19 Mar 1996, *Hoffman & Allicock 5061* (MO fr); 03°37′N 53°12′W, 19 Mar 1996, *Hoffman & Allicock 5066* (MO ster); 04°12′N 58°30′W, 19 Mar 1996, *Hoffman & Allicock 5067* (MO ster); 19 Mar 1996, *Hoffman & Allicock 5070* (MO fr); 19 Mar 1996, *Hoffman & Allicock 5071* (MO ster); 19 Mar 1996, *Clark 1336* (U fl); 17 Dec 1997, *Clark 3617* (U fr); 23 May 1997, *Clark 4881* (U fl); Rupununi, 5 Feb 1991, *Jansen-Jacobs et al. 2381* (MO, U fr); 02°00′N 59°15′W, 23 Oct 1992, *Jansen-Jacobs et al. 3077* (K, MO, P, U fr).

PERU. 2 Jan 1973, *Berlin 800* (MO fr); 04°55′S 73°45′W, s.d., *Baluarte s.n.* (MO 5564058 ster). Reserva Tambopata, 15 Mar 1988, *Bell et al. 88–178* (K fr); 14 Mar 1980, *Huashikat 2262* (MO fr). Bagua: 04°55′S 78°19′W, 20 Oct 1995, *Vásquez et al. 20362* (MO fr); 04°55′S 78°19′W, 14 Oct 1995, *Vásquez & Jaramillo 20268* (MO fr); 04°55′S 78°19′W, 22 Oct 1995, *Vásquez et al. 20393* (MO fr); 17 Nov 1997, *Rojas et al. 583* (MO fr). Loreto: Maynas, 6 Sep 1990, *Ruiz et al. 1561* (MO ster); 18 Nov. 1990, *McCann 117* (MO ster); 18 Aug 1983, *Rimachi 6935* (MO ster); 15 Aug 1990, *Salaun & McCann 31* (MO ster); 22 Aug 1990, *Salaun & McCann 40* (MO ster); 3°28′S, 72°50′W, 25 Jan 1990, *Vásquez & Ayala 13411* (MO fl); 73°20′W, 94°10′S, 2 Jul 1988, *Vásquez & Jaramillo 10829* (MO fr); 12 Apr 1977, *Plowman et al. 6832* (MO ster); 3 May 1977, *Plowman et al. 7204* (MO ster); Rio Ucayali, 75°10′W, 07°05′S, 27 Nov 1985, *Vásquez et al. 6978* (MO fr). Madre de Dios: 12°50′S 69°17′W, 1 Mar 1981, *Gentry & Young 31848* (MO ster); 12°49′S 69°18′W, 18 Feb 1984, *Gentry et al. 45612* (MO fr); 12°49′S 69°43′W, 22 Jul 1985, *Gentry et al. 51220* (MO fr); 12°49′S 89°18′W, 20 Aug 1990, *Reynel et al. 5283* (MO fr); 71°52′W 11°40′S, 14 Oct 1986, *Foster 11825* (MO fr); 12°49′S 69°17′W, 26 Jun 1980, *Barbour 5804* (MO fr). Pasco: 29 May 1984, *Salick 7064* (MO ster); 6 Apr 1985, *Salick 7256* (MO ster); 10°09′S 15°12′W, 29 Aug 1986, *Salick 7706* (MO ster); 10°09′S 15°12′W, 29 Aug 1986, *Salick 77087* (MO ster); 29 Aug 1986, *Salick 7708* (MO ster); Rio Santiago, 77°40′W, 3°50′S, 22 Dec 1979, *Tunqui 416* (MO fr); 17 Sep 1979, *Huashikat 651* (MO fr). Puno: 13°21′S 69°40′W, 16 May 1992, *Gentry et al. 76649* (MO fr); 30 Mar 1996, *Aguilar & Castro 437* (MO fr); 12°50′S 69°17′W, 27 Sep 1994, *Vásquez et al. 19286* (MO fr).

SURINAME. Kamueatta, 2 Jul 1918, *Hohenkerk s.n.* (K fr). Kariako, Barama River 07°22′N 59°42′W, 4 Sep 1996, *van Andel et al. 1039* (U ster); 15 Mar 1949, *Jonker et al. 2715* (IAN fr); 4 Mar 1918, *Wallnofer 3803* (K fr); 12 Feb 1919, *B.W. 4255* (P fl); 30 Jun 1924, *B.W. 6555* (MO ster); 6 Feb 1942, *Stahel s.n.* (K, MO fl); 16 Mar 1942, *Stahel s.n.* (MO fr); 15 Mar 1949, *Lanjouw & Lindeman 2715* (K fr); 2°58′18″N 54°33′14″W, 11 Apr 1998, *Evans & Peckham 2857* (MO fr); Coppename River, 10 Mar 2004, *Clarke & Rhodes 11360* (U fr); Mapane, 25 Apr 1967, *Vreden 11650* (K ster).

VENEZUELA. 6 Feb 1990, *Stergios & Velazco 14706* (MO ster), 5°37′N 67°22′W, 29 Jan 1991, *Romero et al. 2270* (MO fl); 5°37′N 67°22′W, 6 Feb 1992, *Romero et al. 2317* (MO ster); 5°37′N 67°22′W, 9 Feb 1992, *Romero et al. 2343* (MO fl); 18 Apr 1990, *Perez 962* (MO ster); 6°21′N 64°59′W, 25 Jan 1994, *Salas s.n.* (MO 05033605 ster). Amazonas: 5°37′N 67°22′W, 1 Feb 1991, *Romero et al. 2287* (MO fl); 23 Mar 1983, *Clark 83–1* (MO ster). Atabapo: 02°24′N 64°24′W, Oct 1991, *Marin 1684* (MO fr); 14 Feb 1990, *Aymard & Delgado 7852* (MO ster); 3°39′N 65°42′W, 6 Mar 1985, *Liesner 18387* (MO fl, fr); 0°50′N 66°10′W, 25 Nov 1984, *Croat 59314* (MO ster). Atures: Nov 1989, *Sanoja et al. 3178* (MO fr); 9 May 1980, *Steyermark 122135A* (MO ster); 0°50′N 66°10′W, 10 May 1980, *Steyermark et al. 122221* (MO fl); 5°35′N 67°15′W, 2 Nov 1988, *Liesner 25679* (MO fr). Bolivar: 04°55′N 62°49′W, 1 Sep 1986, *Fernandez 3322* (INPA, MO fl); 04°23′N 61°38′W, 21 Oct 1985, *Holst & Liesner 2385* (MO ster); Nov 1994, *Knab-Vispo 224* (MO ster); Feb 1986, *Elio Sanoja 199* (MO ster); 5°43′N 64°07′W, 30 Oct–2 Nov 1988, *Aymard & Angel Fernandez 7248* (MO ster). Rio Negro: 22 Jan 1992, *Aymard et al. 9728* (MO ster); 30 Mar 1953, *Steyermark 74792* (MO ster); 14 May 1953, *Steyermark 73349* (MO fl); 22 May 1980, *Steyermark et al. 117194* (MO ster); 4°59′N 61°10′W, 9 May 1988, *Liesner 24394* (MO ster); 4°23′N 61°38′W, 22 Oct 1985, *Liesner 18962* (MO ster); 4°30′N 61°35′W, 7 Nov 1985, *Liesner 19635* (MO fr); 20 Apr 1986, *Liesner & Host 20076* (MO ster); Cassiquiare, Rio Javita, 7 Apr 1981, *Clark & Ribeiro s n.* (MO ster).

var. MAGUIREI G. S. Bunting, Phytologia 64: 466. 1988.—TYPE: VENEZUELA. Bolivar, alto rio Cuyuni, rio Uiri-Yuk, El Foco, 30 Aug. 1962, *Maguire, Steyermark & Maguire 53515* (holotype: NY!).

Heteropsis flexuosa var. *maguirei* differs from the typical variety in its longer petioles (1.5–2 cm long) usually with undulate margins towards the apex and broader leaf blades (10–13 cm wide). The longer petiole is distinctive and according to Bunting (1988) has been observed up to 4 cm long in specimens from the Território Federal do Amazonas in Venezuela. Further collections of this variety are needed.

6. HETEROPSIS LINEARIS A. C. Sm., J. Arnold Arbor. 20: 289. 1939.— TYPE: BRAZIL. Amazonas, Município de São Paulo de Olivença, bacia do Rio Solimões, Oct–Dec 1936, *Krukoff 8781* (holotype: NY!; isotypes: BR!, K!, P!, U! fl, fr).

Plant a scandent hemi-epiphyte; branches with internodes 3–4 cm long, 4–7 mm diam, longitudinally striate when dried, subcylindric, with one side somewhat sulcate, dark brown when dried; axillary buds 2–3 mm long, apex rounded to truncate. Petiole 0.3–1 cm long, 1.6–3 mm diam, strongly canaliculate, margin sinuate, membranaceous; geniculum 0.9 mm long; leaf blade 12–34 cm long, 1.5–3 cm wide, linear, strongly coriaceous, dark brown on both surfaces when dried, 0.34–0.70 mm thick, margin revolute, apex acute, base strongly attenuate, midrib flattened adaxially, somewhat prominent abaxially, same color as blade, primary lateral veins and interprimary veins numerous, obscured adaxially when dried, impressed abaxially, strongly ascending towards leaf apex, joining near the margin, tertiary veins forming scattered reticulations, infra-marginal collective vein prominent, 0.75 mm distant from the margin, external marginal veins 1–2, near the collective vein. Inflorescence terminal and axillary, flowering shoot 11–25 cm long, internodes 2.5–3.4 cm long, dark brown, sulcate, lateral buds present from the first to the fifth internode; peduncle 0.8–1.4 cm long, 1–2.4 mm diam, cylindric; spathe not seen; spadix 4–7 cm long, 0.8–1 cm diam, ellipsoid, apex acuminate to obtuse, yellowish-cream, stipitate, stipe 5–7 × 3.7–4 mm. Gynoecium 2.5–4 mm long, 7–8 mm diam, truncate, apex 5–6 mm wide, stigma oblong to elliptic. Infructescence ca. 6 cm long, 3 cm diam (immature). Figures 1B, 16.

Common Names—The following common name has been recorded for this species: tamishi tablacho (Peru).

Habitat and Distribution—*Heteropsis linearis* occurs in terra firme forests and forests on seasonally flooded ground. It is known from Brazil (Amazonas, Pará, Rondônia) and Peru, occurring between 120 and 130 m alt.

Phenology—Flowering specimens have been collected between October and January and fruiting material in August and December.

Conservation Status—Using guidance from the Geocat (2012) online tool, the preliminary conservation assessment of *H. linearis* is least concern (LC), based on 7 localities and a 50 km cell width (auto value cell size option for area of occupancy).

Etymology—The species epithet refers to the linear leaf shape.

Notes—*Heteropsis linearis* is easily distinguished from the other species of the genus, even in sterile material, by the leaf blade which is narrowly linear, rigid, coriaceous and attenuate at the base. Despite this, it has often been confused with *H. rigidifolia*, which differs from *H. linearis* by the shorter (not exceeding 22 cm long) and broader (not less than 2 cm wide) leaf blade. However, the main difference between the two species lies in the size of the spadix, which is much smaller in *H. rigidifolia* (1.5–3 cm long). In Smith's original description of *H. linearis* the flowering shoot is described as short, but our observations, based on a larger number of specimens from a wider range of locations and habitats show that it may reach 25 cm in length. Herbarium material from Peru revealed that the spathe is cream-colored and the feeder roots, known there as "tamishi tablacho", are less used than those of "tamishi normal", which is *H. flexuosa*.

Additional Specimens Examined—BRAZIL. Amazonas: Manicoré, 21 Aug 1976, *Mota s.n.* (INPA 61600 fr). Pará: Óbidos, 22 Dec 1907, *Ducke 9184* (MG fr). Rondônia: Costa Marques, 24 Mar 1987, *Cid et al. 8675* (INPA ster); 1842, *Claussen 17* (P ster).

PERU. Loreto: Maynas 11 Jan. 1980, *Aronson 1030* (K, MO fl); 03°48′S 73°25′W, 11 Apr 1988, *Vásquez & Jaramillo 10547* (MO ster); Nov 1990,

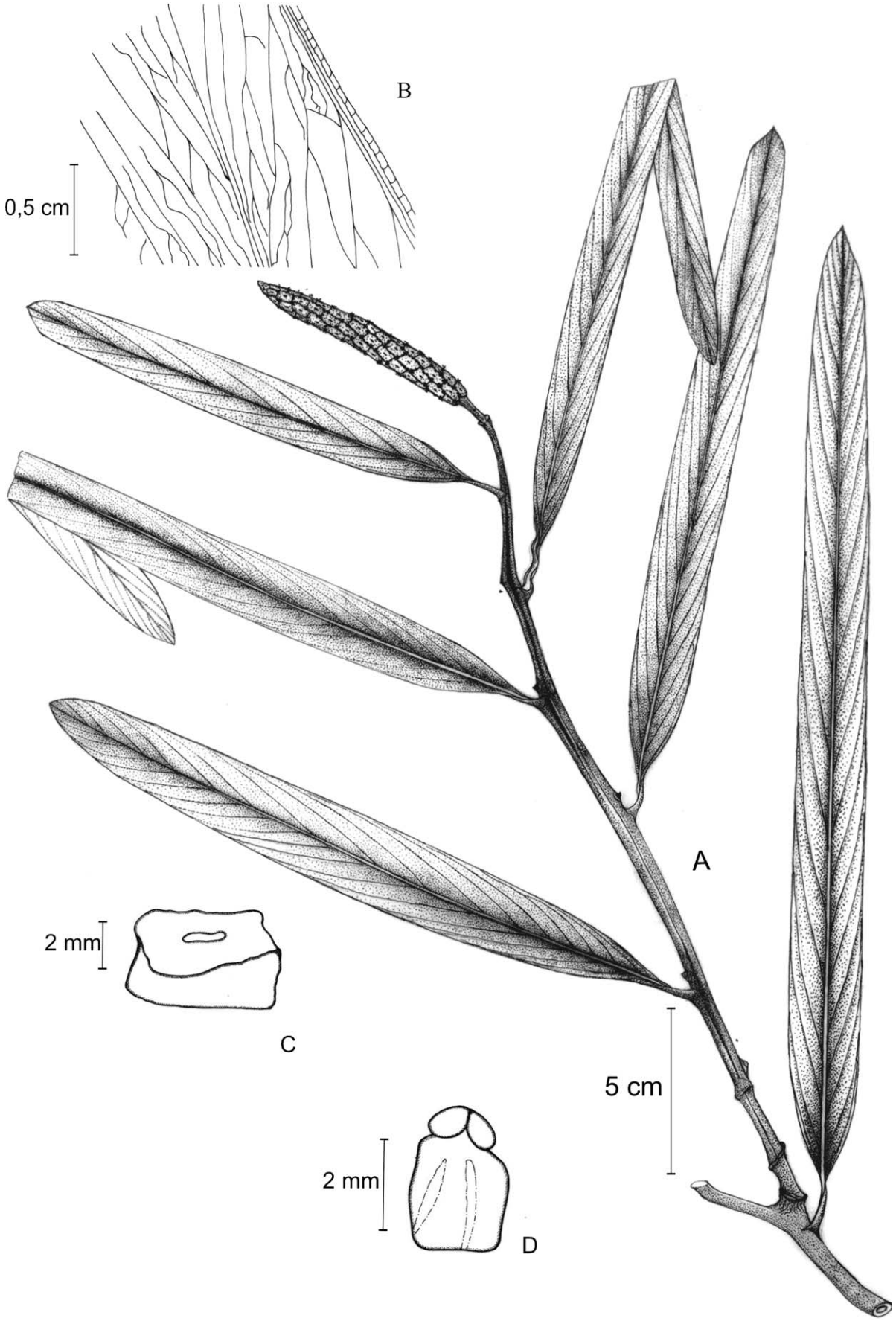

FIG. 16. *Heteropsis linearis*. A. Habit. B. Venation on abaxial surface of leaf blade. C. Oblique surface view of flower. D. Frontal view of stamen. (A–D prepared from *Vásquez & Jaramillo 15120* (MO)). Drawn by Felipe França.

Vásquez & Jaramillo 15120 (MO fl); estrada Zungarocha à Puerto Almendra, 3 Dec 1964, *Dodson & Torres 3013* (MO fl).

7. HETEROPSIS LONGISPATHACEA Engl., Pflanzenr. IV, 23B: 53. 1905. —TYPE: BRAZIL. Amazonas, Rio Juruá, Nov. 1901, *Ule 6016* (holotype: B! fl).

Plant a scandent hemi-epiphyte; aerial roots ca. 5 mm diam, subcylindric, pale brown when dried, fissured longitudinally; shoot slender, somewhat flexuose, internodes 2.7–4 cm long, 2.4–4.5 mm diam, somewhat striated longitudinally when dried, subcylindric with one side slightly flattened, pale brown when dried; axillary buds ca. 2–3 mm long, straight to introrse, apex rounded. Petiole 2–4 mm long, ca. 2 mm diam, canaliculate, margin paler and sinuate at apex; geniculum ca. 2 mm long; leaf blade 12–19 cm long, 4–5 cm wide, lanceolate to oblanceolate, subcoriaceous, pale brown on both surfaces when dried, 0.12–0.16 mm thick, apex acuminate, base cuneate, midrib somewhat sulcate adaxially, prominent abaxially, primary lateral veins and interprimary veins prominent only abaxially, infra-marginal collective vein prominent, 1.5–2 mm distant from the margin, external marginal vein 1, closely adjacent to the collective vein. Inflorescence terminal and axillary, flowering shoot 4.5–6 cm long, internodes 1.3–2 cm long, ca. 1.8 mm diam, pale brown, slightly sulcate; peduncle 0.3–0.7 mm long, 1.3–3.5 mm diam, subcylindric; spathe ca. 7 cm long, 2.5 cm wide when expanded, 8 cm long, 1.4 cm wide when closed, oblong, apex strongly cuspidate; spadix 3.5–4.2 cm long, ca. 7 mm diam, subcylindric, apex acuminate, stipitate, stipe 0.3–0.6 × ca. 1.2 mm. Gynoecium with apex 2–2.5 mm diam, stigma elliptic. Infructescence not seen. Figures 1B, 17.

Habitat and Distribution—*Heteropsis longispathacea* is known from Brazil (Acre, Amazonas, Maranhão, Pará), Peru, and Surinam, occurring at 300–800 m alt.

Phenology—Flowering specimens have been collected in flower in December, February, April and July and fruiting material in December.

Conservation Status—Using guidance from the Geocat (2012) online tool, the preliminary conservation assessment of *H. longispathacea* is least concern (LC), based on 7 localities and a 50 km cell width (auto value cell size option for area of occupancy).

Etymology—The species epithet refers to the spathe which is relatively much longer than the spadix.

Notes—*Heteropsis longispathacea* is easily recognized when fertile because of the long, cuspidate spathe, much longer than the slender spadix. It is morphologically similar to *H. salicifolia*, but differs from the latter in the longer and wider, usually lanceolate, leaf blade and by the introrse axillary buds, longer cuspidate spathe and longer spadix. In contrast, *H. salicifolia* has an elliptic-oblong leaf blade, extrorse lateral buds, shorter spadix and the spathe has a much shorter apex. The type material of *H. longispathacea* is from the Rio Juruá in Amazonas State (Brazil) occurring in a clear water region near the Andes. However there are records from the state of Pará, possibly from *terra firme* forest, at Castanhal, near Belém. Given this distribution, it may be inferred that *Heteropsis longispathacea* probably occurs in central Amazonia and has so far gone unrecorded due to lack of collections. Specimen label information records that according to local people in Amazonia, the juice of the aerial roots of this species causes irritation and itching, perhaps because of the presence of calcium oxalate.

Additional Specimens Examined—BRAZIL. Acre: Porto Alegre, Alto Purus, 8 Apr 1904, *Huber s.n.* (MG 4391 fl); 10 Apr 1904, *Huber s.n.* (INPA, MG 4432 fl); Tarauacá, Dec 1956, *Bockermann 298* (SP fl). Maranhão: Alzilandia, Rio Turiaçu, 1 Jul 1978, *Jangoux & Bahia 124* (MG fl); 29 May 1979. Pará: Castanhal, 22 Feb 1966, *Silva et al.* 549 (MG fl). Óbidos, 29 May 1979, *Jangoux & Bahia 979* (MG fl); Porto Alegre, próximo à Tucuruí, 10 Apr 1904, *Huber et al. 4432* (MG fl).

PERU. 30 Jul. 1974, *Berlin 1871* (MO ster).

8. HETEROPSIS MACROPHYLLA A. C. Sm., J. Arnold Arbor. 20: 290. 1939.—TYPE: BRAZIL. Amazonas, Município de Humaitá, 11 Nov. 1934, *B. A. Krukoff 7151* (holotype: NY!; isotypes: K!, U! fl).

Plant a scandent hemi-epiphyte; stem thick, internodes 2.5–5.5 cm long, 2–8 mm diam, subcylindric, strongly striate longitudinally, subglossy to opaque, dark green, becoming black when dried; axillary buds 5–8 mm long, straight, apex rounded or obtuse. Petiole 1–3 cm long, 2–3 mm diam, strongly canaliculate, margin smooth; geniculum 1–1.5 cm long, dark green; leaf blade 16–38 cm long, 5–9 cm wide, narrowly oblong, narrowly elliptic or lanceolate, rigid, coriaceous, olive-green adaxially, pale green abaxially, margin slightly sinuate, 0.4–0.8 mm thick, apex obtuse to shortly acuminate, 1–1.3 cm long, base cuneate, acute, subacute, obtuse, midrib slightly sulcate, impressed adaxially, prominent and dark green abaxially, primary lateral veins and interprimary veins numerous, distinct abaxially when dried, infra-marginal collective vein prominent, 0.25–0.9 mm distant from the margin, outer marginal vein usually absent. Inflorescence terminal and axillary, flowering shoot 2.8–8 cm long, internodes 4–25 × 3–7 mm diam, dark when dried, subcylindric, without lateral buds on the internodes; peduncle 1–3 cm long, thick, dark green; spathe not seen; spadix 4–7.5 cm long, 1–1.8 cm diam, apex obtuse, pale yellow, shortly stipitate, stipe short or absent. Stamens 2.5–3.5 mm long, 1–1.75 mm wide, anthers ca. 1 mm long; gynoecium 4.5 mm long, ca. 5 mm diam, truncate, apex 2.4–5.1 mm diam, ovary 1.3–1.8 mm long, 0.5–0.8 mm wide, 2-locular, locules full of white, sticky mucilage, ovules 1–2 per locule, 0.75–1 mm long, anatropous, subsessile, placentation subbasal, stigma punctate-discoid. Infructescence berry cream when immature, orange when mature. Figures 1B, 4D, 18.

Habitat and Distribution—*Heteropsis macrophylla* occurs in dense ombrophilous terra firme forest in Brazil (Amazonas), Colombia, Ecuador, Peru and Venezuela, at 100–400 m alt.

Phenology—Flowering specimens have been collected from November to February and in July, and fruiting material in November.

Conservation Status—Using guidance from the Geocat (2012) online tool, the preliminary conservation assessment of *H. macrophylla* is least concern (LC), based on 18 localities and a 50 km cell width (auto value cell size option for area of occupancy).

Etymology—The species epithet refers to the leaf size, which at the time of the first description was larger than most other species then known.

Notes—*Heteropsis macrophylla* is similar to *H. flexuosa*, but differs from the latter in its longer (1–3 cm), untwisted petioles, narrowly oblong, strongly coriaceous leaf blades that are olive-green adaxially, paler green adaxially, obtuse to shortly cuspidate at the apex, obtuse at the base, with numerous, abaxially prominent lateral veins, the infra-marginal collective vein close (ca. 0.25–0.5 mm) to the margin, usually lacking an external marginal vein, spadix shortly stipitate

FIG. 17. *Heteropsis longispathacea.* A. Habit. B. Venation on abaxial surface of leaf blade. (A and B prepared from *Bockermann 298* (SP)). Drawn by Felipe França.

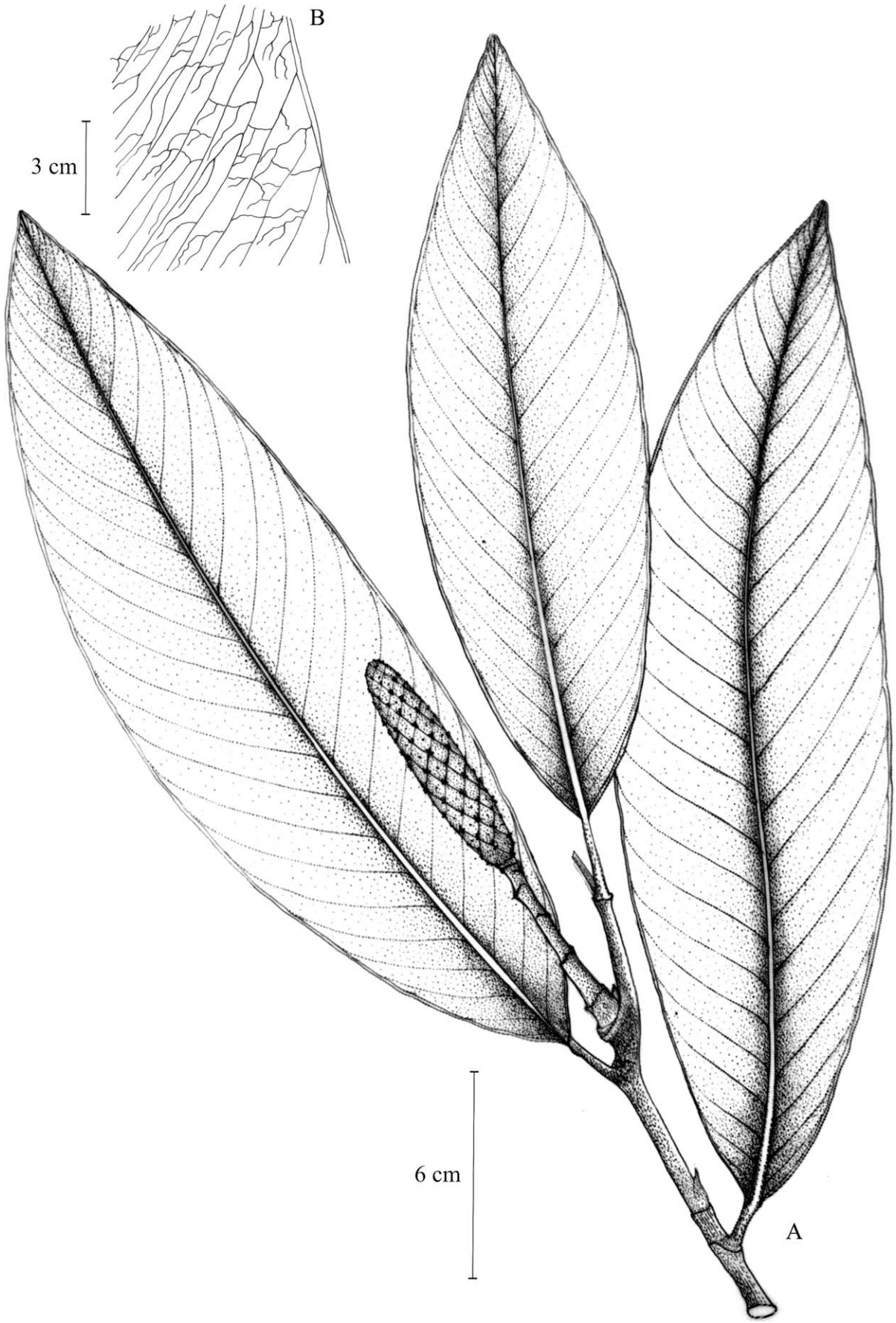

FIG. 18. *Heteropsis macrophylla*. A. Habit. B. Venation on right abaxial surface of leaf blade. (A and B prepared from *Soares et al. 674* (INPA)). Drawn by Felipe França.

or sessile, and prominent, punctate, discoid stigma. *Heteropsis flexuosa* has an oblong or lanceolate, subcoriaceous, abaxially yellowish-green leaf blade with a cuspidate-acuminate apex, the veins obscured on both surfaces, infra-marginal collective vein 1–2.5 mm distant from the margin, and a single external marginal vein, the spadix is stipitate, the stigma discoid-oblong and neither prominent nor punctate. Although we have not examined a fresh infructescence of *H. macrophylla*, specimen label data states that the berries are cream when immature and orange when mature; however, there is no infructescence on the specimen where this information is recorded. Label data also show that the aerial roots of this species are used for cordage in the construction of traditional houses by the indigenous people of Amazonia.

Our field observations show that the leaves of climbing shoots are horizontally patent on the host tree trunk with cuneate leaf blade bases, but the leaf base is obtuse in mature plagiotropic shoots. This is a rare species in the Reserva Florestal Adolfo Ducke (RFAD) and the few recorded individuals were found at a height of over 20 m. In statistical analyses carried out in ecological studies in the Reserve (Soares Morais 2008), this species showed preference for host trees of DBH (diameter at breast height) of at least 30 cm. However, this result should be treated with caution because only a few individuals were studied there. In addition, older trees are more likely to be colonized by *Heteropsis* than younger trees, simply because they have been present in the forest for longer.

Additional Specimens Examined—BRAZIL. Amazonas: Santa Isabel do Rio Negro, 20 Oct 1999, *Soares et al. 460* (INPA ster); Reserva Florestal Adolpho Ducke, 14 Feb 2002, *Soares et al. 674* (INPA fl).

COLOMBIA. Caquetá: Amazonas, Araracuara, 0°34′S 72°08′W, 4 Nov 1989, *Londoño et al. 1146* (MO fr); 0°34′S 72°08′W, 24 Nov 1989, *Londoño et al. 1489* (MO ster); 0°36′S 72°10′W, 31 May 1990, *Alvarez et al. 686* (MO ster); 0°39′S 72°8′W, 18 Oct 199, *Alvarez et al.1098*, (MO ster); 0°37′S 72°24′W, 9 Nov 1991, *Duivenvoorden et al. 940* (MO ster); 0°50′S 71°50′W, 25 Nov 1991, *Duivenvoorden et al. 1629* (MO ster); 0°50′S 71°50′W, 28 Nov 1991, *Duivenvoorden et al. 1811* (MO ster); 0°50′S 71°50′W, 28 Nov 1991, *Duivenvoorden et al. 1847* (MO ster); Município de São José del Guaviare, 02°46′31.1″N 72°17′33.6″W, 31 Oct 1995, *Lopes et al. 576* (MO ster).

ECUADOR. Napo: Parque Nacional Yasuní, 00°55S 76°11′W, 26 May–8 Jun 1988, *Ceron & Hurtado 3898* (MO ster); 13 Dec 1988, *Ceron & Hurtado 11412* (MO fl); 00°57′S 76°13′W, 19–13 Jan 1988, *Palácios 2430* (K, MO fl).

PERU. Loreto: Maynas, 2 Nov 1988, *Wallnofer 188* (K ster); 30 Mar 1979, *Clark 7119* (MO ster); 03°15′S 72°54′W 29 Jul 1991, *Vásquez & Grandez 17539* (MO fl); 04°10′S 73°20′W, 13 Dec 1988, *Vásquez & Jaramillo 11412* (MO fl); 04°10′S 73°20′W, 15 Dec 1988, *Vásquez & Jaramillo 11465* (MO fl). Madre de Dios: 30 Nov 1984, *Young & Stratton 321* (MO fr); 2 Jul 1978, *Plowman & Schunke 7514* (K, MO, U ster).

VENEZUELA. Amazonas: 3°02′10″N 67°00′00″W, 18 Apr 1990, *Perez 963* (MO ster); 14 Jul 1986, *Stanford Zent 786–28* (MO ster); San Carlos de Rio Negro, 1°56′N 67°03′W, 30 Mar 1979, *Clark 7119* (MO ster). Bolivar: Sucre, 04°59′N 64°49′W, 1 Feb 1989, *Fernandez & Sanoja 4981* (MO fl); 6°30′N 64°50′W, 16 Jun1995, *Knab-Vispo 398* (MO ster).

9. HETEROPSIS OBLONGIFOLIA Kunth, Enum. Pl. 3: 60. 1841.—TYPE: BRAZIL. *F. Sellow* (as "*Sello*") *207* (lectotype, here designated: K! fl).

Dracontium integerrimum Vell., [Fl. Flumin. 9: t. 119 (1831), *nom. nud*.] Arquivos do Museu Nacional 5: 389 (1881). *Heteropsis integerrima* (Vell.) Stellfeld, Arq. Mus. Paranaense 8: 179 (1950).—TYPE: BRAZIL. Published plate t.119, original citation: "Dicitur etiam Timbô-peba . . . Habitat silvis maritimis." No specimen is known to exist.

Plant a scandent hemi-epiphyte; shoot densely leaved, internodes 1.9–5 cm long, 1.0–6 mm diam, dark green, subquadrangular, one side flattened to slightly sulcate, pale brown when dried, longitudinally striate; axillary bud 2.7–5 mm long, extrorse to straight, apex pointed. Petiole 4–9 × 1.5–2.4 mm, strongly canaliculate, margin pale, sinuate towards the apex; geniculum 3–4 mm long; leaf blade 10–23 cm long, 3.2–7 cm wide, ovate, lanceolate, oblong to oblanceolate, coriaceous, subglossy, dark green adaxially, paler green abaxially when living, opaque pale brown when dried, 0.14–0.58 mm thick, margin revolute, apex abruptly cuspidate to acuminate, base cuneate, acute, subacute to obtuse, midrib sulcate adaxially, prominent, yellowish abaxially, primary lateral veins and interprimary veins prominent abaxially when dried, infra-marginal collective vein prominent, 0.6–3 mm distant from margin, external marginal veins 1–2. Inflorescence terminal, axillary, flowering shoot 1–14 cm long, internodes 0.2–3 × 0.12–0.46 cm diam, pale brown when dried, sulcate, normally with lateral bud on the apical internode; peduncle 0.5–3 mm long, 2–4 mm diam, dark green; spathe as long as the spadix, 3.5–5 cm long, 0.9–1.3 mm diam when closed, ca. 5 cm wide when expanded, oblong to ovate, inflated, convolute, yellow, with a white stripe ca. 1.5 cm wide at the margin, apex acuminate to abruptly cuspidate, sometimes somewhat twisted; spadix 1.5–3.5 × 0.5–0.8 cm diam, ellipsoid, apex rounded-acuminate, pale yellow, stipitate, stipe 2.3–4 × 2–4 mm, green, subcylindric. Stamens 3–3.5 mm long, 1–1.25 mm wide, anthers ovate to elliptic; gynoecium 1.5–3.5 × 1.5–3 mm diam, prismatic, with tannin cells in the stylar region, apex 2–3.5 mm diam, ovary 2-locular, 1–1.5 mm long, obpyramidal, locules with sticky, translucid mucilaginous contents, ovules 2 per locule, ca. 0.5 mm long, anatropous, sessile, placentation sub-basal, stigma punctate-discoid to oblong. Infructescence 6–10 cm long, 2–3.3 cm diam; berry 10–17 × 8–17 mm, green when immature, brown when pre-mature, red with dark brown apex (or orange-yellow to red in Costa Rica) when mature, truncate to prismatic; seed 7–10 × 4–8 mm, 2–4 per berry, brown (black in Costa Rica), oblong to elliptic. Figures 2A, 7D, 7E, 9D, 19.

Common Names—The following common names have been recorded for this species: cipó-titica (Brazil), bejuco de hombre (Peru).

Habitat and Distribution—*Heteropsis oblongifolia* occurs in dense, ombrophilous forest, seasonal montane forest, secondary forest or in disturbed areas with rock outcrops in Bolivia, Brazil (Acre, Amapá, Amazonas, Bahia, Espírito Santo, Maranhão, Mato Grosso, Minas Gerais, Pará, Paraná, Pernambuco, Rio de Janeiro, Roraima), Colombia, Costa Rica, Ecuador, Nicaragua, Peru, and Venezuela, at between 50 and 2,000 m alt.

Phenology—Flowering and fruiting specimens have been collected almost throughout the year, but specimens have not been seen in flower in June and September or in fruit in August.

Conservation Status—Using guidance from the Geocat (2012) online tool, the preliminary conservation assessment of *H. oblongifolia* is least concern (LC), based on 34 localities and a 50 km cell width (auto value cell size option for area of occupancy).

Etymology—The species epithet refers to the more oblong leaf shape, in contrast to the lanceolate leaf shape of *H. salicifolia*, the latter being the only other species described by Kunth (1841).

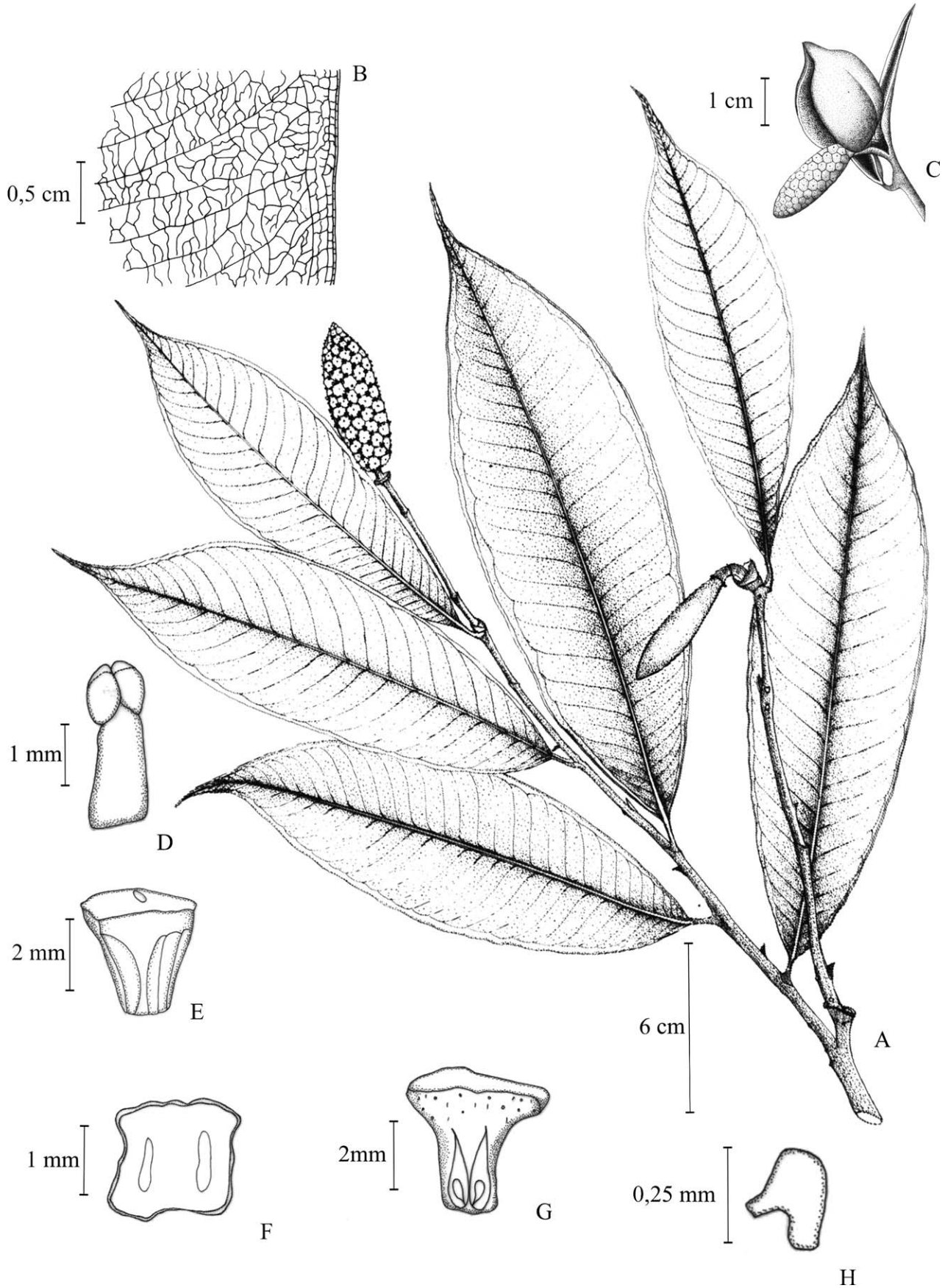

FIG. 19. *Heteropsis oblongifolia*. A. Habit. B. Venation of right abaxial surface of leaf blade. C. Inflorescence. D. Frontal view of stamen. E. Lateral view of gynoecium. F. Transverse section of ovary. G. Longitudinal section of gynoecium. H. Lateral view of ovule. (A–H prepared from *Soares et al. 600* (INPA)). Drawn by Felipe França.

Notes—*Heteropsis oblongifolia* is the most widely distributed species, occurring from Central America (Nicaragua and Costa Rica) to tropical South America although it has not been recorded from the Guianas and Suriname. This wide distribution is accompanied by great morphological and ecological variation, with habitats ranging from sea level to 2,000 m. Grayum (2003: 118) notes that in view of the wide disjunction between Costa Rica and eastern Brazil, there is doubt that the Central American taxon is really conspecific with the Atlantic Forest taxon. A more detailed comparison of living plants (beyond the scope of the present study) from the two regions is needed to resolve this question.

The species has some similarities to *H. flexuosa*, especially in the morphology of the leaf blade and this has led to many dubious identifications in sterile herbarium specimens. However, *H. oblongifolia* differs from *H. flexuosa* by its straight lateral buds, the apical sinuations of the petiole margin, less coriaceous leaf blade, infra-marginal collective vein up to 3 mm distant from the margin, and presence of 1–2 external marginal veins. When fertile, the main characters that differentiate the two species are to be found in the spathe, which in *H. oblongifolia* has a white stripe along the margin, an acuminate to abruptly cuspidate apex and red mature berries, dark brown at the apex and yellowish towards the base in Costa Rican material. In *H. flexuosa* the petiole has a smooth margin and is usually twisted, the leaf blade is coriaceous, the flowering shoot has at most a lateral bud on the internode below the spathe or none at all, the spathe is yellow, and the berries are yellow when mature.

In the original description of *Heteropsis oblongifolia* Kunth cited only "Brasilia meridionalis (Sellow legit.)", i.e. a collection by Friedrich Sellow (also known as Sello) from southern Brazil. Kunth's herbarium was deposited at Berlin (B) and this type specimen must have been included in it. However, this specimen did not survive the damage to B during the Second World War. The microfiche of Schott's collection of drawings at Vienna (Nicolson and Riedl 1984; Schott 1984) includes a drawing (Icon no. 3577) which is the only one determined by Schott as *Heteropsis oblongifolia* and which bears the annotation "Her. G. Berol. 207". Since Schott attempted whenever possible to have drawings made of type specimens, it is probable that this specimen represents the collection *Sellow 207*. This is confirmed by the presence of a duplicate specimen at K, in the herbarium of W. J. Hooker with more detailed label information: "207. Ex Herb. Reg. Berolinense 1859, *Heteropsis oblongifolia* Kunth. Doubletten Brasilia. Sello." We have therefore selected this specimen, doubtless originally an isotype, as the lectotype of *H. oblongifolia* Kunth.

Vellozo's name *Dracontium integerrimum* (Flora Fluminensis, t. 119) was invalid when first published (Vellozo 1831) because there was no description or any analysis in the figure (i.e. a separate figure or element showing details). It remained a *nomen nudum* until the first publication of Vellozo's complete text of the Flora Fluminensis (Vellozo 1881), by which time Kunth's epithet had priority in the genus *Heteropsis*; the combination *Heteropsis integerrimum* was later made by Stellfeld (1950) in his study of Vellozo's work on Araceae. A comparison of the habit, leaves and post-floral inflorescences leaves little doubt that *H. oblongifolia* and *H. integerrima* denote the same species.

Additional Specimens Examined—BOLIVIA. 30 Jul 1982, *Sperling & King 6409* (K, MO fl, fr).

BRAZIL. Acre: Brasiléia, 1 Nov 1980, *Lowrie 670* (INPA, MO fl). Amapá: Laranjal do Jarí, 13 Nov 2004, *Pereira & Cardoso 748* (HAMAB, INPA fr). Amazonas: Humaitá, 11 Oct 1934, *Krukoff 6493* (U fl). Rio Negro, 2 Ma 1973, *Loureiro et al. s.n.* (INPA 37938 fr); Santa Isabel do Rio Negro, 11 Jun 1976, *Marinho 516* (IAN ster). Bahia: Ilhéus, 19 Mar 1998, *Queiroz & Leoni 4984* (CEPEC, K fl); Mata da Esperança, 8 Nov 2005, *Soares et al. 751* (CEPEC, INPA fl); 8 Nov 2005, *Soares et al. 752* (CEPEC, INPA fl); 16 Apr 1991, *Mayo & Santos 751* (K, MO ster); 18 Apr 1991, *Mayo et al. 755* (CEPEC, K, MO ster); 6 Oct 1970, *Santos 1276* (CEPEC fr, K fl); 14 Dec 1988, *Santos 4454* (CEPEC fr); Serra Bonita, 9 Nov 2005, *Soares et al. 755* (CEPEC, INPA fl); Itacaré, km 15, Estrada Taboquinhas 24 Apr 1991, *Mayo et al. 770* (K, MO ster); 24 Apr 1991, *Mayo et al. 792 (*CEPEC ster, K); 26 Apr 1991, *Mayo et al. 801* (CEPEC, K, MO ster). Juçari, 11 May 1991, *Mayo et al. 813* (CEPEC, K, MO ster). Maraú, 25 Feb 1980, *Carvalho et al. 159* (CEPEC fl); Porto Seguro, 11 Jan 1977, *Harley et al. 17851* (CEPEC, K ster); Prado, 22 Oct 1993, *Thomas et al. 10156* (CEPEC fr); Una, 28 Jul 1994, *Jardim et al. 519* (CEPEC ster); 7 Nov 2005, *Soares et al. 754* (CEPEC, INPA ster); 11 Jan 1977, *Harley et al. 18232* (CEPEC, K ster); 14 May 1991, *Mayo et al. 821* (K, MO fr); Wenceslau Guimarães, 31 May 1991, *Mayo & de Carvalho 866* (CEPEC, K, MO ster). Espírito Santo: Domingos Martins, 30 Jul 1986, *Croat 61816* (MO ster); Linhares, 15 Oct 1992, *Folli 1664* (MO ster); 2 Oct 1971, *Santos 2046* (CEPEC, K fl); Santa Teresa, Aparecidinha, 9 Nov 1998, *Kollmann et al. 914* (INPA, MBML, RB fl); 27 Oct 1998, *Kollmann et al. 802* (MBML fl); 24 Nov 2004, *Kollmann et al. 1082* (MBML fl); 27 Oct 1999, *Demuner et al. 189* (INPA, MBML fl); Estação Biológica de Santa Lúcia, 17 Nov 1994, *Soares 600* (INPA, MBML fl). Maranhão: Monção, 12 Apr 1985, *Balée & Gely 859* (MO ster). Mato Grosso: 4 Oct 1975, *Lisboa et al. 659* (INPA fl). Minas Gerais: Carangola, 30 Jan 2001, *Gonçalves et al. 706* (UFMG fr). Pará: 14 Dec 1979, *Maciel et al. 528* (MG fl); 6 May 1968, *Pires & Silva 11645* (IAN fl); 13 Mar 1968, *Silva 2731* (IAN fr); Porto Trombetas, s.d., *Evandro 390* (INPA fl); Santarém, 15 Nov 1977, *Prance et al.* 25429 (MG fl); 17 Aug 1969, *M. Silva 2291* (MG fl); Tucuruí, 5 Jun 1980, *M.G. Silva & Rosário 5380* (MG fr). Paraná: Antonina, Bairro Alto, 4 Feb 1983, *Hatschbach et al. 46085* (K, MBM, UFMG ster). Pernambuco: Cabo, 13 Jan 1993, *Nadruz & Mayo 887* (K ster); Curado, *Lins & Silva s.n.* (RB 321894 ster); Recife, 26 Jan 1996, *Lins & Cleidson 137* (RB ster). Rio de Janeiro: 18 Feb 1981, *Lima et al. 559* (MO fl); Aug 1965, *Strang 680* (GUA fl); Campos dos Goytacazes, 2 Feb 1984, *Kuhlmann 6507* (RB ster); 1 Oct 1987, *Ribeiro et al. 1146* (GUA ster); Magé Paraíso, *Farney et al. 521* (RB fl). Roraima: 21 Feb 1971, *Prance et al. 10660* (INPA, U ster).

COLOMBIA. 24 Apr 1990, *Londono et al. 1626* (MO ster); 24 Jul 1990, *Alvarez et al. 882* (MO ster). Caquetá: 8 Nov 1991, *Duivenvoorden et al. 848* (MO ster).

COSTA RICA. *Lankester 153* (K fr); 9 May 1960, *Lankester 1762* (K fr); 4 May 1983, *Gomez et al. 20424* (K ster). Aguabuena, 3 km W of Rincón 15 Apr 1993, *Thomsen 336* (K fl). Heredia, Parque Nacional de Bráulio, 5 Jul 1990, *Acevedo 96* (K fr).

ECUADOR: Esmeraldas, 3 Nov 1994, *Pennington 14959* (K ster). Morona Santiago, 26 Aug 1985, *Anananch 129* (MO ster). Napo: Apr 1988, *Paz & Mino 81010* (MO ster); 13 Mar 1968, *Pitman & Romero 287* (MO ster); 0°40.853′S 76°23.697′W, 20 Jun 1995, *Acevedo-Rodriguez & Cedeno 7423* (MO fl, fr); Sucumbios, Apr–Oct 1988, *Paz & Mino* 81010 (MO ster). Pastaza: 26–31 Jan 1989, *Neill & Hurtado 8822* (MO ster).

NICARAGUA. Rosita, 14°08′58″N 84°16′00″W, 21 May 1994, *Rueda, et al. 1459* (K ster).

PERU. Bagua: 04°55′S, 78°19′W, 3 Feb 1996, *Jaramillo et al. 1060* (MO fr); 12°50′ S, 69°20′W, 6 Oct 1985, *Smith et al. 589* (MO fl). Loreto: Maynas, 04°29′S, 73°35′W, 24 Nov 1990, *Grandez & Ruiz 2143* (MO fr); 18 Aug 1978, *Haxaire 5157* (P ster); 13 Jul 1982, *Rimachi 6203* (MO fr); 6 Apr 1989, *Vásquez et al. 11999* (MO fr); 9 Nov 1982, *Vásquez & Jaramillo 3424* (MO fr); 12 Apr 1977, *Plowman et al. 6832* (MO ster). Madre de Dios: 30 Nov 1991, *Timana & Jaramillo 3620* (K ster); 28 Feb 1981, *Gentry & Young 31789* (MO fr); 12°15′S, 69°17′W, 5 Nov 1984, *Young & Stratton* 186 (MO fl); 27 Mar 1981, *Young 205* (MO fr); 2 Jun 1980, *Barbour 5487* (MO fr); Apr 1988, *Foster et al. 81010* (MO ster); Monte Virgem, 6 Sep 1979, *Huashikat 410* (MO fr); Rio Santiago, 21 Feb 1980, *Huashikat 2168* (MO fr); Tambopata, 3 Mar 1981, *Gentry & Young 31969* (K, MO fr).

VENEZUELA. Amazonas: 5°37′N 67°22′W, 1 Feb 1991, *Romero et al. 2286* (MO ster). Bolivar: 04°58′N, 63°24′W, Apr 1988, *Fernandez 4506* (MO fr); Caño Mosquito, 30 Jan 1976, *Colchester 2126* (K ster); 21 Feb 1976, *Lister 259* (K ster); 23 Feb 1976, *Lister 267* (K ster).

10. HETEROPSIS PERUVIANA K. Krause, Notizbl. Bot. Gart. Berlin-Dahlem 9: 270. 1925.—TYPE: PERU. Província de Tarma, Departamento Junin, December 1902, *Weberbauer 1819* (holotype: B! fl, fr).

Plant a scandent hemi-epiphyte, shoot slender; internodes 2.7–4 cm long, 2.4–4.5 mm diam, slightly striate longitudinally when dried, subcylindric, one side flattened to sulcate, dark brown when dried; axillary buds ca. 2–2.5 mm long, straight to introrse, apex acute. Petiole 4–7 mm long, 1.5 mm diam, strongly canaliculate, margin sinuate towards the apex; geniculum ca. 0.5 mm long; leaf blade 11–17 cm long, 2.5–4.5 cm wide, lanceolate, subcoriaceous, dark brown on both surfaces when dried, 0.13–0.21 mm thick, apex long-acuminate, base cuneate, midrib slightly flattened adaxially, prominent and striate abaxially, primary lateral veins and interprimaries oblique, obscured adaxially, prominent abaxially, infra-marginal collective vein prominent, 0.5–1 mm distant from the margin, external marginal vein 1, close to the margin. Inflorescence terminal and axillary, flowering shoot 4.5–9 cm long, internodes 1.7–2.5 cm long, ca. 1.2 mm diam, pale brown, slender, slightly sulcate; peduncle 0.7–1.2 mm long, 0.9–1.4 mm diam, cylindric; spathe ca. 3.5–4.5 cm long, 2 cm wide when expanded, oblong-elliptic, apex acuminate, ca. 1 cm long; spadix 2–2.5 cm long, 0.4–0.7 cm diam, cylindric, stipitate, apex acuminate, stipe 2–2.5 mm × 1.2–1.7 mm. Gynoecium with apex 2.5–3 mm diam, stigma discoid. Infructescence ca. 7.5 cm long, 3 cm diam; berry 7–10 × 6–8 mm, orange; seed subovoid, 5–8 cm × 3–6 mm. Figures 2A, 20.

Habitat and Distribution—*Heteropsis peruviana* is known from Bolivia, Brazil (Acre, Rondônia), and Peru; little is known of its ecology but it is probably a hemi-epiphyte of terra firme Amazonian forest.

Phenology—Flowering specimens have been collected in September and fruiting material from January to March, in July, and from October to November.

Conservation Status—Using guidance from the Geocat (2012) online tool, the preliminary conservation assessment of *H. peruviana* is least concern (LC), based on six localities and a 50 km cell width (auto value cell size option for area of occupancy).

Etymology—The species epithet refers to Peru, where it was first discovered.

Notes—According to the original citation, *Heteropsis peruviana* was the first species of the genus known from Peru. It was compared to *H. longispathacea* Engl. from Brazil, collected on the lower Juruá, but it differs from the latter in the longer petioles, shortly acuminate leaf apex and smaller and broader spathe and spadix. *Heteropsis peruviana* is also similar to *H. tenuispadix*, which when sterile can easily be confused with *H. peruviana* because of the great variation in leaf shape. The best characters to distinguish these two species are as follows: in *H. tenuispadix* the primary lateral veins and interprimaries are arched towards the apex and the spathe is oblong with a shortly acuminate apex, while in *H. peruviana* the veins are straight or patent and the spathe apex is ca. 1 cm long, according to the original description.

Additional Specimens Examined—BOLIVIA: La Paz, Madidi, Hondo, Negro, 14°38′51″S 67°47′40″W, 21 Mar 2002, *Fuentes 3922* (MO fr).

BRAZIL. Acre: 2 Nov 1980, *Cid & Moreira 3108* (INPA fr); Sena Madureira, 4 Oct 1968, *Prance et al. 7821* (INPA, K, MG, P, fr). Rondônia: Jaru, 2 Jul 1984, *Cid et al. 4986* (INPA, MO fr); Brasiléia, 6 Fev. 1983, *Teixeira et al. 1387* (INPA fr).

PERU. Madre de Dios: 14 Sep 1985, *Nunez 1859* (MO fl); 5 Sep 1986, *Foster et al. 11285* (MO fl); 21 Jan 1989, *Smith et al. 1458* (MO fr); Purus, 24 Feb 2000, *Graham & Vigo 1103* (MO fr).

11. **Heteropsis reticulata** Croat & M. L. Soares sp. nov.—TYPE: BRAZIL. Acre: Cruzeiro do Sul, próximo ao aeroporto, 13 Feb 1976, *Monteiro & Damião 349* (holotype: INPA! fr).

Planta hemiepiphytica; internodia longitudinaliter striata, subcylindrica, gemmae axillares apice rotundatae; folia ramulorum plagiotropium petiolo 3–5 mm longo, lamina 13–17 cm longa, 3–4.5 cm lata, 0.24–0.62 mm crassa, ovata vel elliptica, coriacea, rigida, castanea in pagina abaxiali, venam marginalem destituta, venam infra-marginalem margine 0.5–1 mm distanti instructa; pedunculus ca. 2 mm longus, spadix ca. 1.8 cm longus, 0.4 cm diam, cylindricus, stipite ca. 2.5 mm longo suffultus.

Plant a scandent hemi-epiphyte; aerial roots ca. 4.3 mm diam, subcylindric, rugose, chestnut-brown when young; internodes 2–2.5 cm long, 1.5–3 mm diam, subcylindric, strongly striate longitudinally, greenish-brown when dried; axillary buds ca. 2 mm long, with rounded apex. Petiole 3–5 mm long, 1.4–1.8 mm diam, canaliculate, margin sinuate at the apex, slightly twisted; geniculum ca. 3 mm long, darkened; leaf blade 13–17 cm long, 3–4.5 cm wide, ovate to elliptic, coriaceous, rigid, when dried adaxially greenish-brown, abaxially dark brown, opaque on both sides when dried, margin strongly revolute, slightly sinuate, 0.24–0.62 mm thick, apex acuminate, base obtuse to acute, midrib strongly sulcate adaxially, prominent, rounded abaxially, primary lateral veins and interprimaries prominent, infra-marginal collective vein prominent, 0.5–1 mm distant from the margin, external marginal vein lacking. Inflorescence terminal and axillary, flowering shoot 5 cm long, internodes 1–1.5 cm long, 1.4–1.8 mm diam, greenish-brown when dried, subcylindric, sulcate, axillary buds usually present on the first and second internodes; peduncle ca. 2 mm long, 1.7 mm diam; spathe not seen; spadix ca. 1.8 cm long, 4 mm diam, cylindric, apex acute, stipitate, stipe ca. 2.5 × 1.2 mm, cylindric, blackened when dried. Gynoecium with apex 4–5 mm diam, stigma oblong. Infructescence 4.5–7.5 cm long, 2–3 cm diam when mature; berry 14–17 mm diam, at apex; seeds 3–4 per berry. Figures 3, 21 (mature), Fig. 22 (immature).

Habitat and Distribution—*Heteropsis reticulata* occurs in dense ombrophilous terra firme forest and in flooded forest in Brazil (Acre) and Peru, at 100–150 m alt.

Phenology—Flowering specimens have been collected in November and fruiting material in January and February.

Conservation Status—Using guidance from the Geocat (2012) online tool, the preliminary conservation assessment of *H. reticulata* is data deficient (DD), since this species is currently known only from four localities.

Etymology—The specific epithet refers to the prominently reticulated finer venation of the abaxial leaf surface, particularly evident in immature attached leaves.

Notes—The fertile material described here (Fig. 21) as *Heteropsis reticulata* shares with *H. rigidifolia* and *H. robusta* its rigid leaf blade and spadix size, but differs from these species in the ovate to elliptic leaf blade with obtuse base and strongly revolute margin.

The sterile collection cited below (*Croat 62631*), collected in dense ombrophilous terra firme forest at 150 m alt., is part of an immature attached stem (Fig. 22), rather than a mature plagiotropic branch. It differs from the type and paratype material in the longer, smooth-margined petioles, larger size of the leaf blade with more strongly prominent fine reticulate abaxial venation, the less revolute leaf margins, the dried adaxial leaf surface greyish-brown and abaxial surface yellowish-brown.

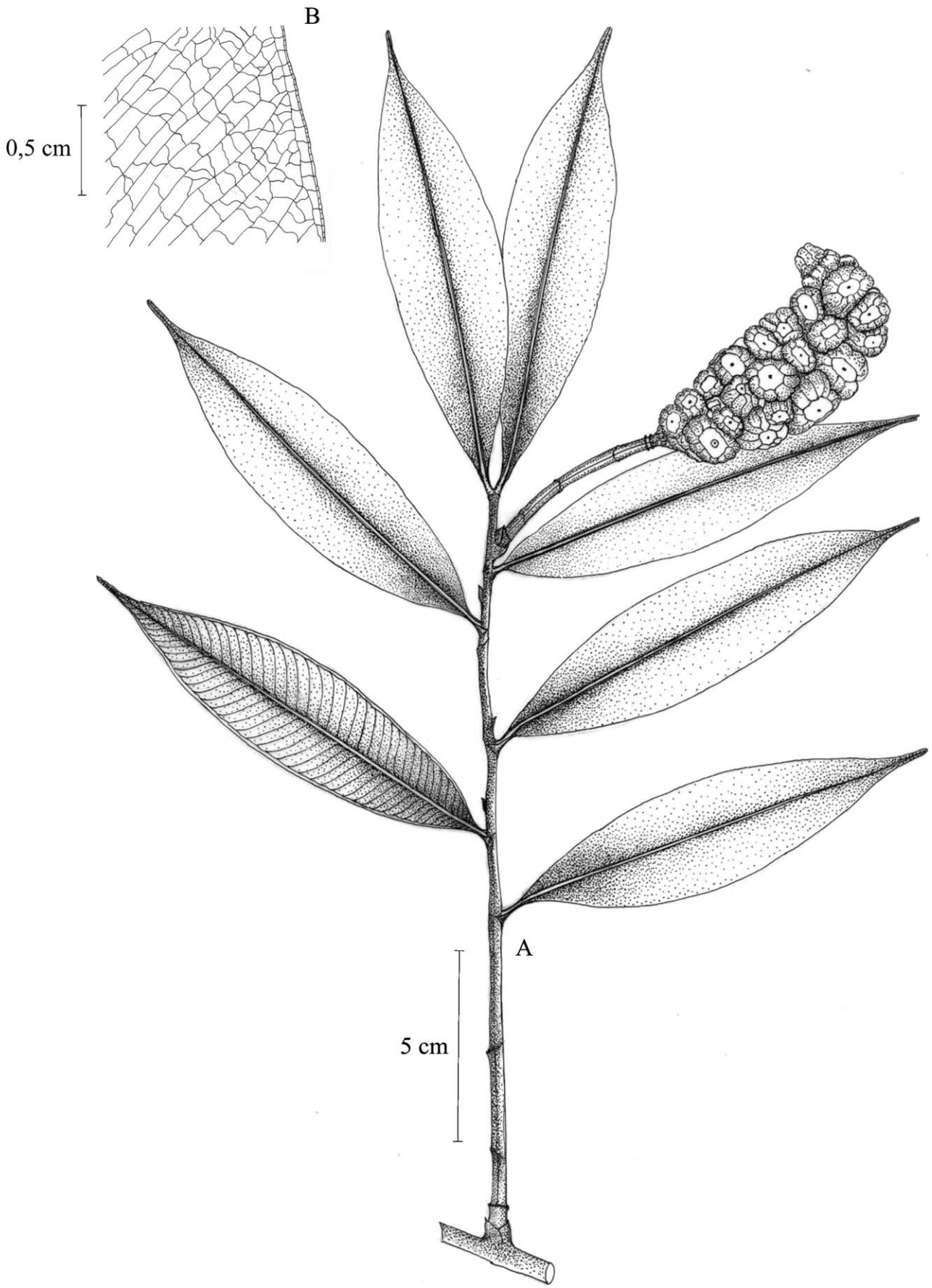

Fig. 20. *Heteropsis peruviana*. A. Habit. B. Venation of right abaxial surface of leaf blade. (A and B prepared from *Teixeira et al. 1387* (INPA)). Drawn by Felipe França.

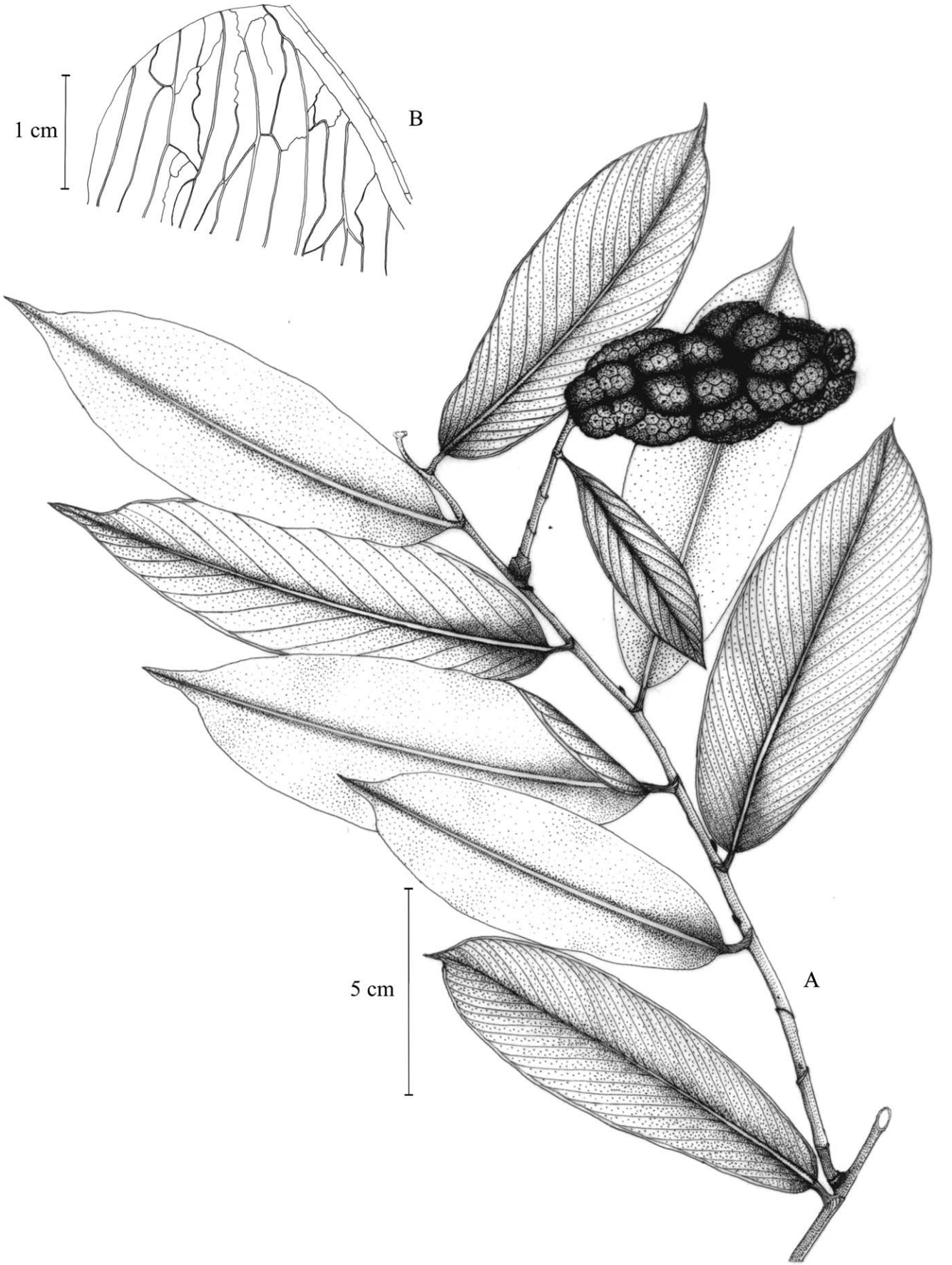

FIG. 21. *Heteropsis reticulata*. Mature plagiotropic shoot. A. Habit. B. Venation of right abaxial surface of leaf blade. (A and B prepared from *Grández et al. 5183* (MO)). Drawn by Felipe França.

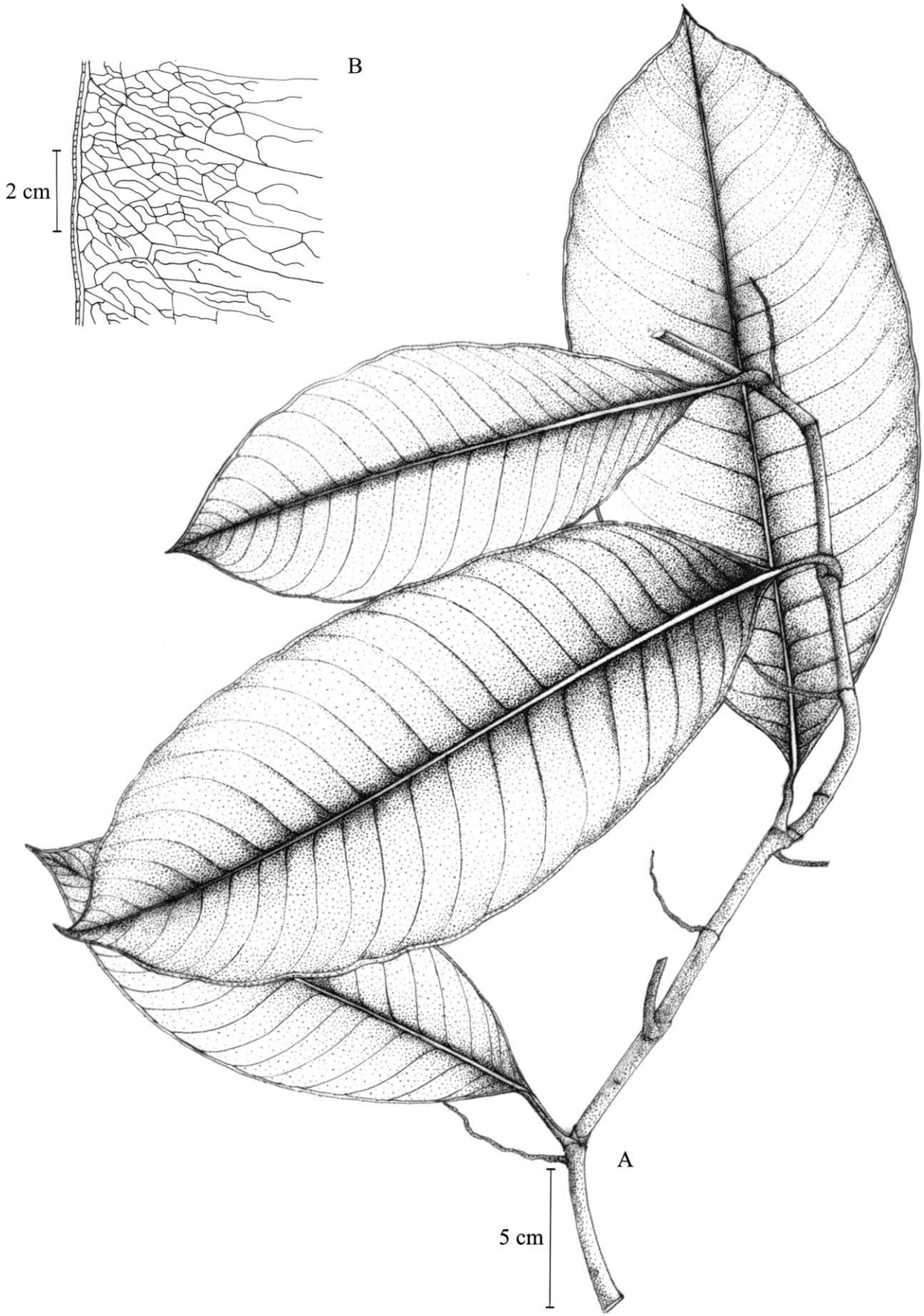

Fig. 22. *Heteropsis reticulata*. Attached climbing shoot with large leaves. A. Habit. B. Venation of left abaxial surface of leaf blade. (A and B prepared from *Croat 62631* (MO)). Drawn by Felipe França.

This specimen, however, agrees with the type and paratype collections in the striate and cylindric to subcylindric internodes, the infra-marginal collective vein close to the margin, and the absence of visible marginal veins.

Immature attached leaves of larger size and different appearance to the mature leaves of plagiotropic branches are characteristic of certain other species, notably *H. rigidifolia*, and we propose that *Croat 62631* and the cited type and paratype specimens of *H. reticulata* belong to the same species. Since this taxon remains poorly known we provide here further descriptive details of the specimen *Croat 62631*, which may be useful in testing our proposal when new information becomes available:

Plant a scandent hemi-epiphyte. Internodes 3–8 cm long, ca. 3 mm diam, longitudinally striate when dried, cylindric, glossy, dark brown when dried, buds not seen. Petiole 1–2 cm long, ca. 2 mm diam, strongly canaliculate, dark brown, margin smooth (not undulate); blade 22.5–32.0 cm long, 9–13 cm wide, 0.26–0.36 cm thick, elliptic, subcoriaceous, glossy, adaxial surface dark green, dark greyish-brown when dried, abaxial surface yellowish-brown and opaque, apex abruptly acuminate, base acute to attenuate, midrib flattened at the base and sulcate towards the apex on adaxial side, prominent and convex on abaxial side, primary lateral veins 12–18 on each side, somewhat obscured on adaxial surface, prominent on abaxial surface, finer veins reticulate and prominent when dried, infra-marginal collective vein ca. 1 mm distant from margin.

Additional Specimens Examined—PERU. Departamento Loreto: Provincia Maynas, Carretera Nauta-Iquitos, 04°29′S 73°35′W, 23 Nov 1990, *Grández & Ruíz 2118* (MO fl); 03°48′S 73°25′W, 17 Feb 1993, *Grández et al. 5183* (MO, NY fr).

BRAZIL. Acre: Cruzeiro do Sul, between Cruzeiro do Sul and Rio Branco, 7°38′S, 72°35′W, *Croat 62631* (INPA, MO ster).

12. Heteropsis rigidifolia Engl., Pflanzenr. IV. 23B: 51. 1905.—TYPE: BRAZIL. Santa Catarina, Blumenau, 1886, *Schenk 815* (lectotype: B! fl, here designated).

Plant a scandent hemi-epiphyte; internodes 1.5–2 cm long, 3–4.7 mm diam, slightly striate longitudinally when dried, subquadrangular, flattened on one side, pale grey when dried; axillary buds ca. 2 mm long, rounded to truncate at the apex. Petiole 3–5 mm long, 2–6 mm diam, canaliculate, margin sinuate towards the apex; geniculum ca. 6 mm long; blade 14–22 cm long, 2–4 cm wide, linear to lanceolate, patent, strongly coriaceous, rigid, when dried greenish-brown on both surfaces, 0.21–0.48 mm thick, apex acute to acuminate, base cuneate to obtuse, midrib somewhat flattened on the adaxial side, with dispersed transverse striae, somewhat prominent on abaxial side, primary lateral veins and interprimary veins impressed on the adaxial side, prominent on the abaxial side, tertiary veins forming indistinct reticulations, submarginal collective vein 0.75–1 mm distant from the margin, external marginal vein 1, close to the submarginal collective vein. Inflorescence terminal and axillary, flowering shoot 7.5–20 cm long, with internodes 2–5 cm long, 2.8–3.5 mm diam, when dried greenish-brown, shallowly sulcate; peduncle ca. 2.5 mm long; spathe 2–3 cm long, ca. 2.5 cm wide, oblong, apex acuminate; spadix 1.5–3 cm long, 0.6–0.8 cm diam, subcylindric, apex acuminate, stipitate, stipe 0.75–2 mm × 1.4–2 mm. Gynoecium with apex 1.5–2 mm diam, stigma elliptic. Infructescence 7–9 cm long, 6 cm diam; berry to 10 × 8 mm, orange; seed subovoid, ca. 6–8 × 4–5 mm. Figures 2B, 23.

Habitat and Distribution—*Heteropsis rigidifolia* is known only from the Atlantic Forest of Brazil (Bahia, Espírito Santo, Minas Gerais, Paraná, Rio de Janeiro, Santa Catarina, and São Paulo), where it occurs at 220–950 m alt.

Phenology—Flowering specimens have been collected between October and December, and fruiting material between January and February.

Conservation Status—Using guidance from the Geocat (2012) online tool, the preliminary conservation assessment of *H. rigidifolia* is least concern (LC), based on 13 localities and a 50 km cell width (auto value cell size option for area of occupancy).

Etymology—The specific epithet refers to the rather rigidly coriaceous leaves.

Notes—*Heteropsis rigidifolia* was described by Engler based on three syntypes: *Loefgren & Edwall 1652* (B) from Peruibe, São Paulo, *Mosén s.n.* (S) from Santos, São Paulo and *Schenk 815*, (B) from Blumenau, Santa Catarina. Only one of these, *Schenk 815*, was found in this study, at the Berlin Herbarium (B), which we propose here as the lectotype. *Heteropsis rigidifolia* is easily recognized by its strongly coriaceous and rigid leaf blade with the veins prominent on both surfaces when dried. It is easily confused with *H. salicifolia* by the leaf shape with its cuspidate apex but differs from the latter by the truncate lateral buds, rigidity of the leaf blade, prominence of the veins and white spathe, which in *H. salicifolia* is greenish-yellow to cream. Furthermore, the leaf blade of *H. rigidifolia* is usually oblanceolate in the juvenile and climbing phases.

Additional Specimens Examined—BRAZIL. Bahia: Una, Reserva Biológica do Mico-Leão, 15°09′S 39°05′W, 14 Nov 1992, *Thomas et al. 9447* (K ster, MO, NY fl); Parque Nacional de Monte Pascoal, 16°53′S 39°25′W, 11 Jan 1977, *Harley et al. 17848* (K ster); 13 Jan 1977, *Harley et al. 17921* (K ster); Wenceslau Guimarães, 31 Feb 1991, *Mayo & F. A. Carvalho 862* (CEPEC, K, MO ster). Espírito Santo: Santa Teresa, Rio Bonito, 31 Jan. 202, *Kollmann & Bausen 5454* (MBML fr); 15 Feb 2000, *Demuner & Bausen 717* (MBML fr). Minas Gerais: Marliéria, 13 Dec 2000, *Temponi et al. 205* (VIC ster). Paraná: Antonina, 19 Jan 1966, *Hatschbach et al.* 13555 (U ster); Curitiba, 1 Oct 1982, *Hatschbach 33642* (MO fl); 24 Mar 1911, *Dusen 11392* (K ster). Rio de Janeiro: 25 Jan 1998, *Oliveira, 1424* (GUA fr). Itatiaia, Parque Nacional do Itatiaia, 22°28′S 44°45′W, 7 Dec 1995, *Braga et al. 3084* (RB fl); 21 Nov 1995, *Nadruz et al. 1100* (RB fl); Parati, 20 Oct 1993, *Marquete 1293* (RB fl). Santa Catarina: 2 Nov 1953, *Reitz & Klein 1098* (MO ster). Brusque, 10 Nov 1949, *Reitz 3194* (U ster). São Paulo: Reserva Ecológica da Juréia, 19 Feb 1996, *Costa et al. 127* (SP fr); 10 Mar 1982, *Hatschbach & Kummrow 45527* (CEPEC, K ster); 28 Nov 1991, *Rossi 950* (SP fl); 18 Dec 1990, *Mamede et al. 382* (SP fl).

13. Heteropsis robusta (G. S. Bunting) M. L. Soares, Kew Bulletin 64: 269. 2009. *Heteropsis spruceana* var. *robusta* G. S. Bunting, Phytologia 60: 303. 1986.—TYPE: VENEZUELA. Território Federal Amazonas, 90–110 m, 4 Aug 1980, *Francisco Guanchez 61* (holotype: MYF).

Plant scandent, branches slender, aerial roots 3–6 mm diam, greyish; internodes 2–5 cm × 2.6–4 mm, longitudinally striate when dried, quadrangular, yellowish; axillary buds 1–1.5 mm long, straight, apex sharply pointed. Petiole 3–7 × 1.2–2 mm, margin slightly sinuate; geniculum 2–4 mm long; leaf blade 10–24 × 4–8 cm, ovate-lanceolate, dark green when fresh on both surfaces, dark green to pale brown when dried, matte, membranaceous, 0.13–0.26 mm thick, apex 1–3 cm long, caudate, base obtuse to shortly attenuate, margin slightly sinuate, midrib sulcate on upper surface, prominent, yellowish on lower surface, primary and secondary lateral veins arched in the direction of the apex, more easily seen on lower surface, submarginal collective

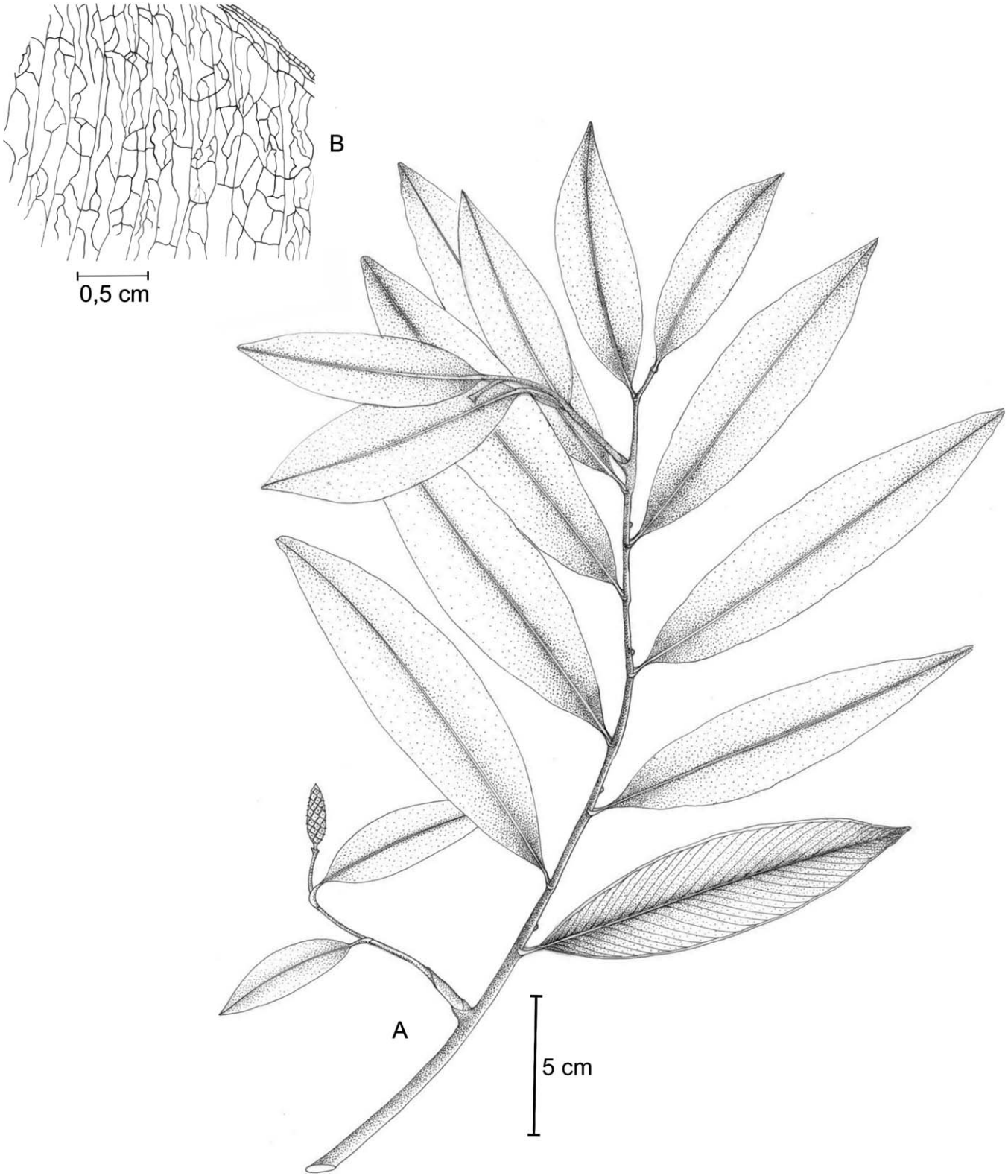

Fig. 23. *Heteropsis rigidifolia*. A. Habit. B. Venation of right abaxial surface of leaf blade. (A and B prepared from *Braga et al. 3084* (RB)). Drawn by Felipe França.

vein 2–3 mm from the margin, with 1 marginal vein. Inflorescence terminal and axillary, flowering shoot 3–6.5 cm long, slender, internodes 1–2.5 cm × 1.3–1.7 mm, yellowish when dry, slightly quadrangular; peduncle ca. 0.1 cm long; spathe 2–2.5 × ca. 2 cm, (closed spathe 2 × 0.7–0.9 cm) yellow on both surfaces, inflated, convolute, apex acuminate; spadix 1.5–2.5 × 0.6–1 cm, cylindric, yellowish-white, apex rounded to acuminate, stipitate, stipe 2–3 × 1.1–1.6 mm. Stamens ca. 0.8 mm long, 0.7 mm wide; gynoecium ca. 1.25 × 0.8 mm, prismatic, locules 1–2 per ovary, ovules 1–2 per

locule, anatropous, placentation sub-basal, stigma discoid to subdiscoid. Infructescence: 3–5.5 cm × 2–3.5 mm; berry obovoid, orange, 8–13 × 5–9 mm, apex 2–4 mm diam; seed 6–9 × 4–6 mm, subobovoid. Figures 2B, 24.

Common Names—The following common names have been recorded for this species: titiquinha (Manaus, Amazonas, Brazil); memidi, minñato, mamure (Venezuela); ninguno (Colombia).

Habitat and Distribution—*Heteropsis robusta* occurs in moist evergreen tropical forest; fertile material has been collected at between 1.5 and 20 m above ground level. The species is known from Brazil (Acre, Amazonas, Pará, Roraima), Colombia, Ecuador, Peru and Venezuela, at 110–1,000 m alt.

Phenology—Flowering specimens have been collected between February and August, and fruiting material from April to December.

Conservation Status—Using guidance from the Geocat (2012) online tool, the preliminary conservation assessment of *H. robusta* is least concern (LC), based on 27 localities and a 50 km cell width (auto value cell size option for area of occupancy).

Etymology—The specific epithet refers to the larger size of the leaves of this taxon when compared with those of *H. spruceana*.

Notes—G. S. Bunting distinguished *Heteropsis spruceana* var. *robusta* from *H. spruceana* var. *spruceana* only by its larger and relatively broader leaf blades. However we regard it as a distinct species on the following character differences (character states for *H. spruceanum* in brackets): petiole 0.3–0.7 cm long, not twisted (subsessile, twisted); petiole margin slightly sinuate (smooth); leaf blade 10–24 × 4–8 cm (9–14.7 × 3–4.7 cm); leaf blade ovate-lanceolate, apex caudate, base obtuse to shortly attenuate (ovate-elliptic, apex strongly attenuate, base cuneate to rounded), leaf blade surface matte (glossy and usually covered with bryophytes); spadix 1.5–2.5 × 0.6–1 cm (2–2.8 × ca. 0.5 cm); mature berry orange (yellowish-orange).

Additional Specimens Examined—BRAZIL. Acre: Cruzeiro do Sul, Aeroporto, 29 Feb 1976, *Ramos & Mota 195* (INPA fr); 22 Apr 1971, *Prance et al. 12220* (INPA, U fr); 7 Feb 1976, *Monteiro & Damião 159* (INPA, MO fr); Sena Madureira: Bacia do Rio Purus, 8°27′S, 71°21′W, 20 Sep 1994, *Daly et al. 8279* (MO fl). Amazonas: Novo Aripuanã, 21 Apr 1985, *Cid et al. 5684* (INPA fr); Serra do Aracá, 0°48′N, 63°18′W, 27 Feb 1984, *Pipoly et al. 6711* (INPA fr); Rio Negro, 6 May 1971, *Silva et al. 1278* (INPA fr); Santa Isabel do Rio Negro, 2 Sep 2003, *Soares & Amaral 530* (INPA fr). Pará: Altamira, 18 Aug 1978, *Bahia 78* (MG fl, fr); Carajás, 7 Jun 1982, *Sperling et al. 5965* (MG fl); Porto Trombetas, 15 Oct 1987, *Knowles s.n.* (INPA 154829 fl); Presidente Medici, 4°00′S, 55°04′W, 7 Feb 1976, s.c. (MO 3474604, fl). Roraima: *Prance et al. 10660* (K ster).

COLOMBIA. Caquetá: Araracuara, 22 April 1989, *Londono et al. 270* (MO ster); 0°37′S, 72°24′W, 10 Dec 1991, *Duivenvoorden et al. 2683* (MO ster). Chocó: 17 Jan 1979, *Gentry & Renteria 24281* (MO ster). Vaupés: 29 Aug 1976, *Zarucchi 1923* (INPA, K fr).

ECUADOR. Gonzalo Pizarro, 19 May 2002, *Morales et al. 801* (MO fr). Napo: 0°27′S, 77°01′W, 6 Apr 1986, *Backer et al. 6889* (MO fr); Guiana Takutu, 1 May 1992, *Pennington & Johnson 437* (K fr). Pastaza: 40 km ao Oriente de Montalvo, 00°44′S, 76°52′W, 26–30 Apr 1990, *Gudiño 252* (MO fr); Carretera de PETRO-CANADA, Via Auca, 115 km al sur de Coca, 01°15′S, 76°55′W, 22–28 Feb 1989, *Vlastimil Zak 4035* (MO fl); Rio Curaray, 29 Aug 1985, *Palacios & Neill 737* (MO fr).

PERU. 23 Nov 1964, *Dodson & Torres 2973* (MO ster). Amazonas: 11 Mar 1973, *Kayap 560* (MO fl); Vale do Rio Santiago, 3°50′S, 77°40′W, 6 Mar 1980, *Tunqui et al. 1008* (MO fr). Imaza: 04°55′S, 78°19′W, 15 Jun 1996, *Rodriguez & Atamain 1056* (MO fr). Loreto: Maynas, Rio Nanay, 28 Jun 1982, *Gentry & Revilla 15878* (K fr); 3°50′S, 73°30′W, 25 Feb 1981, *Gentry et al. 31743* (MO fr); 3°50′S, 73°30′W, 19 Apr 1982, *Gentry et al. 36483* (MO fr); 26 Mar 1979, *Ayala 1704* (MO fr); 4°29′S, 73°35′W, 23 Nov 1990, *Grandez & Ruiz 2119* (MO ster). Iquitos: 12 May 1976, *Rimachi 2241* (MO fr); Requena, Sapuena, Jenaro Herrera, 4°50′S, 73°45′W, 14 Sep 1987, *Vásquez & Jaramillo 9584* (MO fr). Madre de Dios: 41 km do Porto Maldonado, 24 Apr 1977, *Gentry et al. 19736* (MO fr). Pasco: Oxapampa, 10°11′S, 75°13′W, 1 Dec 1982, *Smith 2864* (MO fr); 10°20′S, 75°15′W, 12 May 2003, *Lingan et al. 495* (MO ster); Pichinaki: 28 Jun 1982, *Gentry et al. 37245* (MO fr); San Martins Mariscal Caceres: 26 May 1982, *Schunke-V. 13653* (MO fr).

VENEZUELA. Atabapo: 3°40′N, 67°13′W, 3 May 1979, *Davidse et al. 27115* (MO fl); 04°30′N, 65°48′W, Oct 1989, *Delgado 760* (MO fr). Atures: Santa Rosa de Ucata, 4°24′N, 67°48′W–4°24′N 67°46′W, 19 Apr 1989, *Romero et al. 1832* (MO fr); 4°20′25″N, 67°44′12″W, 20 Jun 1992, *Berry et al. 5157* (MO ster). Bolivar: Cedeño, Nov 1995, *Knab-Vispo 220* (MO fr); 06°35′N, 64°45′W, 20 Apr 1996, *Knab-Vispo & Rodriguez 537* (MO ster); 06°35′N, 64°45′W, 25 Jun 1996, *Knab-Vispo & Rodriguez 579* (MO fl); 4 Jul 1984, *Davidse & Miller 26976* (MO fl); 4°30′N, 61°40′W, 5 Nov 1985, *Liesner 19563* (K, MO fr); 05°19′N, 61°03′W, 27 Apr 1988, *Liesner 23908* (MO ster); 4°23′N, 61°38′W, 21 Oct 1985, *Liesner et al. 18888* (MO fr); Heres, 3°N, 62°W, 14 Feb 1981, *Steyermark et al. 124288* (MO fl). Rio Negro: 0°50′N, 66°10′W, 4–5 July 1984, *Davidse & Miller 26976* (MO fr). San Carlos de Rio Negro, 1°56′N, 67°03′W, 7 Apr 1981, *Clark & Ribeiro s.n.* (MO 2995016 fl); 1°56′N, 67°03′W, 12 May 1979, *Liesner 7361* (MO fl, fr); 01°54′N, 65°55′W, 13 Oct 1987, *Liesner & Delascio 21899* (MO fr); Caño Moriche 5°30′N, 66°35′W, 27 Apr 1986, *Zent 286* (MO ster).

14. HETEROPSIS SALICIFOLIA Kunth, Enum. Pl. 3: 60. 1841.—TYPE: BRAZIL. *F. Sellow s n.* (lectotype: K!, here designated).

Heteropsis riedeliana Schott, Oesterr. Bot. Zeitschr. 9: 99. 1859. *Heteropsis salicifolia* var. *riedeliana* (Schott) Engl. in C. F. P. Martius (ed.), Fl. Bras. III. 2. 29 (1878), and in A. and C. De Candolle, Monographiae Phanerogamarum 2: 100. 1879.—TYPE: BRAZIL. Rio de Janeiro, *Riedel s.n.* (holotype: LE).

Plant a scandent hemi-epiphyte; shoot with internodes 2–4.5 cm long, 3–3.5 mm diam, longitudinally striate when dried, subquadrangular, flattened on one side, grey-green when dried; axillary bud 2–3 mm long, extrorse, apex acute. Petiole 3–7 mm long, 1–3 mm diam, canaliculate, margin paler and membranaceous when dried, sinuate towards the apex; geniculum ca. 3 mm long, dark when dried; leaf blade 8–17 cm long, 1.8–3.0 (–4) cm wide, lanceolate to obovate, when fresh dark green on both surfaces to slightly paler below, chartaceous, semi-glossy, when dried subcoriaceous, greenish brown, 0.09–0.18 mm thick, apex cuspidate to acuminate, base cuneate, midrib slightly sulcate adaxially, prominent, green to yellowish abaxially, primary lateral veins and interprimaries prominent on abaxial surface, infra-marginal collective vein prominent, 1–2 (–2.5) mm distant from margin, external marginal veins 1–2. Inflorescence terminal and axillary, flowering shoot 2–11 cm long, internodes 2–3.5 cm long, 1–2.8 mm diam, greenish brown, slightly sulcate; peduncle 1–2 mm long, 1–1.5 mm diam, green; spathe 2–4 cm long, when closed 0.7–0.8 cm diam, when open ca. 1.5 cm wide, obovate, convolute, yellow, greenish to pale cream, as long as the spadix, apex cuspidate, usually twisted; spadix 1.3–3.5 cm long, 5–8 mm diam, cylindric, apex rounded to acuminate, white-cream, stipitate, stipe 1–2 mm × 1.4–2 mm diam, yellowish-green, cylindric. Stamens 1.5–2 mm long, 1 mm wide, anthers ovate to elliptic; gynoecium ca. 2 mm long, 2.5 mm diam, prismatic, apex 1.25–2.5 mm diam, ovary 2-locular, ca. 1.5 mm long, locules filled with a translucid, mucilaginous substance, ovules 2 per locule, 0.4–0.5 mm long, anatropous, subsessile, placentation sub-basal, stigma oblong, depressed. Infructescence 2.5–5.5 cm long, 1.3–2 cm diam; berry 6–10 × 6–8 mm, green when immature, not seen when mature; seed 6–8 × 6–7 mm, obovoid, testa glossy. Figures 2B, 7F, 7G, 8C, 25.

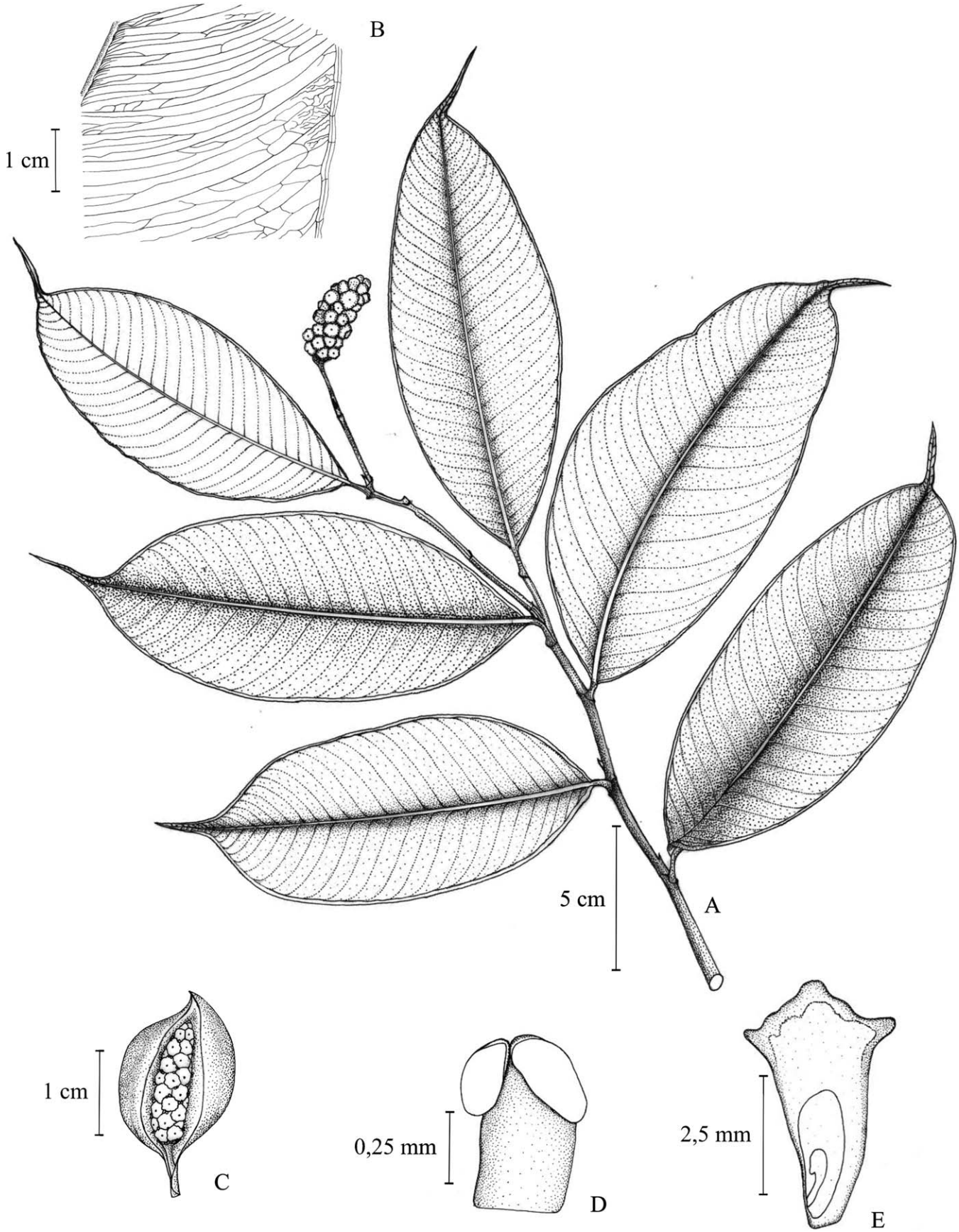

Fig. 24. *Heteropsis robusta*. A. Habit. B. Venation of right abaxial surface of leaf blade. C. Lateral view of inflorescence. D. Frontal view of stamen. E. Longitudinal section of gynoecium. (A and B prepared from *Romero et al. 1832* (MO), C prepared from *Liesner 7361* (MO), D and E from *Davidse et al. 27115* (MO)). Drawn by Felipe França.

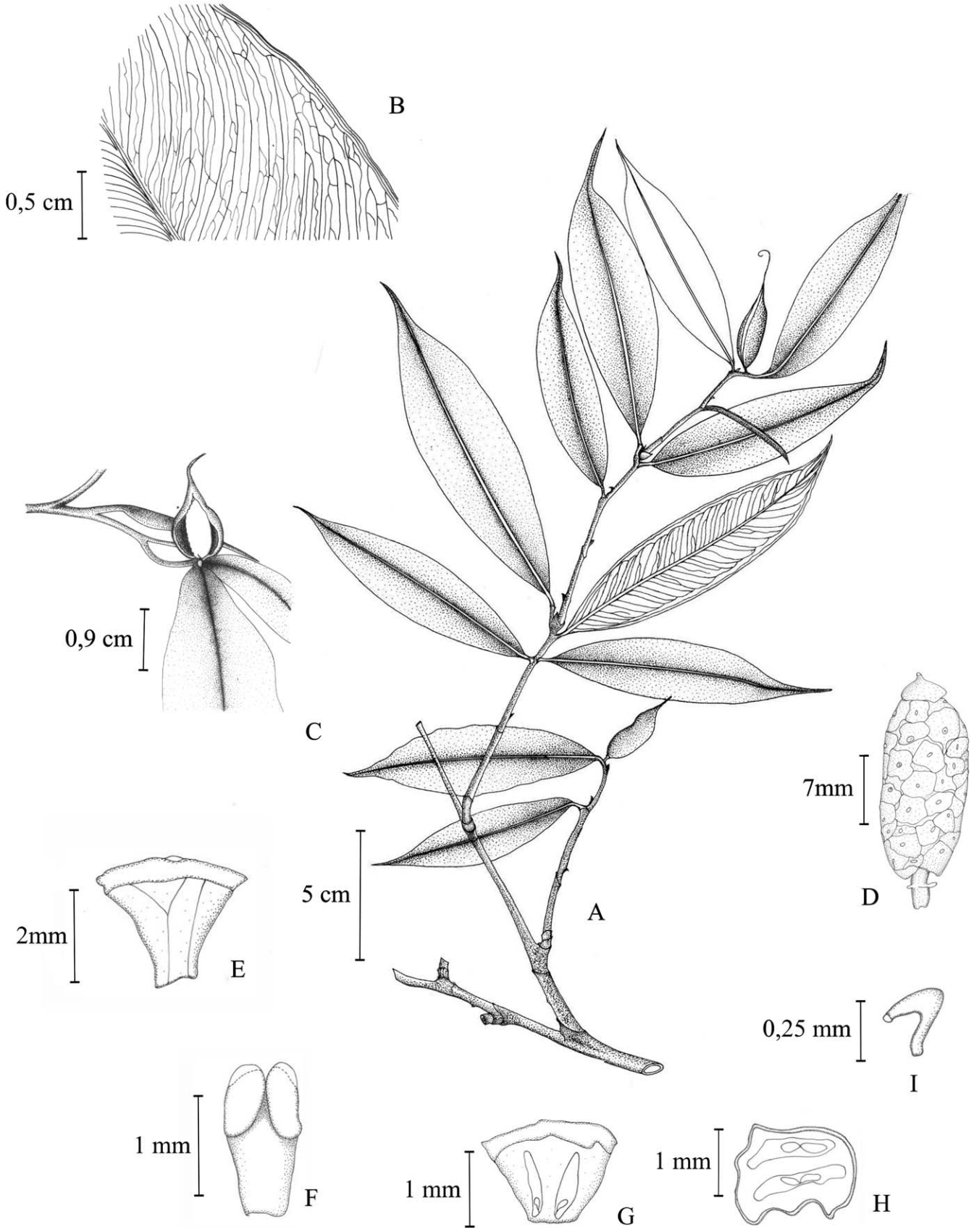

FIG. 25. *Heteropsis salicifolia*. A. Habit. B. Venation of right abaxial surface of leaf blade. C. Oblique lateral view of inflorescence. D. Spadix. E. Lateral view of flower. F. Frontal view of stamen. G. Longitudinal section of gynoecium. H. Transverse section of ovary. I. Lateral view of ovule. (A and B prepared from *Boone 939*; C–I from *Soares et al. 750* (INPA)). Drawn by Felipe França.

Habitat and Distribution—*Heteropsis salicifolia* occurs only in the Atlantic Forest of Brazil (Bahia, Espirito Santo, Minas Gerais, Rio de Janeiro, São Paulo), where it occurs up to 800 m alt.

Phenology—Flowering specimens have been collected in March, August and December, and fruiting mateiral in December and January.

Conservation Status—Using guidance from the Geocat (2012) online tool, the preliminary conservation assessment of *H. salicifolia* is least concern (LC), based on 19 localities and a 50 km cell width (auto value cell size option for area of occupancy).

Etymology—The specific epithet refers to the similarity of the leaf size and shape to those of the genus *Salix*.

Notes—*Heteropsis salicifolia* is known only from the Atlantic Forest of Brazil. It is highly branched and occurs at heights below 10 m in shaded forests. It is similar morphologically to *H. oblongifolia* but differs by its narrower leaf blades, non-revolute leaf margin, tertiary venation with the reticulations more distant from one another and especially by the spathe, which is ovate with a cuspidate and usually twisted apex. *H. oblongifolia* on the other hand, has a revolute leaf margin, strongly and more densely reticulated tertiary leaf venation and the spathe is oblong-ovate and inflated with a rounded to abruptly cuspidate apex which is only occasionally twisted.

Heteropsis salicifolia Kunth was originally based on an unnumbered collection made by Friedrich Sellow (also known as "Sello," see Urban 1893) in Brazil ("Brasilia meridionalis"). This specimen would have been deposited at the Berlin Herbarium (B), which included Kunth's own herbarium (Coelho and Mayo 2007: 215) but it no longer exists there. There are two drawings of herbarium specimens in Schott's Icones Aroideae (Icones Nos. 3581, 3582; Nicolson and Riedl 1984, Schott 1984) determined by Schott as *Heteropsis salicifolia* which have the data "Hrb. Berol. Bras. Sellow". Using the same arguments as previously given for *H. oblongifolia*, these most probably depict the holotype collection and just as in that case, there is a specimen at Kew (K). This has the label "Heteropsis salicifolia. Kth. Ex Herb. Reg. Berolinense. 1859 Brasilia. Sello." and can be accepted as originally an isotype. We therefore select this specimen as the lectotype.

Heteropsis riedeliana was described by Schott based on unnumbered material collected in Brazil by Ludwig Riedel and was later reduced by Engler (1878) as *H. salicifolia* var. *riedeliana* in his treatment for Flora brasiliensis. According to Engler the Riedel specimen was collected in Rio de Janeiro and later (Engler 1905) he states that the specimen is at Saint Petersburg Herbarium (LE). This is confirmed by the data on Schott's Icones Nos. 3579 and 3580 (Nicolson and Riedl 1984).

Additional Specimens Examined—BRAZIL. Bahia: Ilhéus, 8 Nov 2005, *Soares et al. 750* (CEPEC, INPA, fl). Espirito Santo: Reserva Florestal de Linhares, 27 Nov 1997, *Folli 3080* (RB fl); 23 Nov 1973, *Pinheiro & Santos 2226* (CEPEC fl), 20 Oct 1971; Santa Teresa, 30 Nov 2000, *Demuner & Bausen 1553* (INPA, MBML fl); Dois Irmãos, 20 Nov 1985, *Boone 909* (BHCB, INPA, MBML, MO fl); Santo Antônio, mata do Boza, 17 Nov 2004, *Soares et al. 601* (INPA, MBML fl); Fazenda Santa Lúcia, 19°57′24″S, 40°32′37″W, 25 Nov 1999, *Zappi et al. 442* (SP fl); Nova Lombardia, Goiapaboaçu, 2 Dec 1985, *Boone 939* (CEPEC, INPA, MBML, MO, RB fl); Reserva Biológica A. Ruschi, 6 Nov 2001, *Kollmann & Bausen 4944* (INPA, MBML fl); 16 Apr 2002, *Vervloet et al. 126* (INPA, MBML fr), 24 Oct 2002, *Vervloet et al. 1271* (INPA, MBML fl); São Lourenço-Caixa D'Agua, 30 Nov 1999, *Demuner & Pizziolo 273* (INPA, MBML fl). Minas Gerais: Caratinga-Matão, 19 Mar 1994, *Lombardi 527* (BHCB fl); 24 Oct 1984, *Lopes & Andrade 594* (BHCB fl); 9 Nov 1985, *Lopes & Andrade 789* (BHCB fl); 11 Jan 1991, *Stehmann s.n.* (BHCB, MO fr); Marliéria, Parque Estadual do Rio Doce, 28 Aug 1993, *Barbosa 28* (BHCB, MO fl); Parque Estadual do Rio Doce, 24 Mar 2000, *Temponi et al. 102* (VIC fl); 12 Dec 2002, *Temponi et al. 194* (VIC fr). Rio de Janeiro: 2 Oct 1874, *Glaziou 6999* (P fl); 25 Nov 1981, *Araújo 3695* (K fl); 14 Nov 1971, *Sucre 1967* (MO, RB fl); 16 Sep 1987, *Gomes et al. 235* (RB fl); Angra, 1 Dec 1992, *Araújo et al. 9697* (GUA fl); Corcovado, 6 Dec 1825, *Burchell 1125* (K ster); 16 Mar 1869, *Glaziou 3113* (P ster); 1 Jun 1915, *Hoehne 181* (SP fl); Itaguaí, 25 Nov 1981, *Araújo 3695* (K fl); Santa Maria Madalena, 18 Feb 1981, *Mayo et al. 559* (K, MO fr); Tijuca, Alto de Boa Vista, 20 Apr 1980, s.c. (MO ster). São Paulo: São Paulo, 24 Mar 1827, *Burchell 4649* (K ster); Cubatão, 9 Dec 1826, *Burchell 3492* (K fl); Interlagos, 10 Jan 1996, *Cordeiro 1633* (SP fl), 1875, *Mosen 3483* (P fl); Reserva Ecológica da Juréia, 6 Dec 1994, *Cordeiro et al. 1468* (SP fr); Reserva Biológica do Parque Estadual das Fontes do Ipiranga, 22 Nov 1996, *Jung & De Barros 366* (SP fl); 6 Dec 1978, *Wanderley 106* (SP fl); Vila Facchini, 31 Sep 1982, *Saran et al. 2* (SP fl); 20 Apr 1980, *Plowman 10099* (MO, RB ster).

15. HETEROPSIS SPRUCEANA Schott, Aroideae: 27. t. 60. 1856.—TYPE: BRAZIL. Amazonas, São Gabriel da Cachoeira, Jan–Aug. 1852, *R. Spruce 2174* (holotype: G!; isotypes: K!, P! fl).

Plant a scandent hemi-epiphyte; stem flexuose, slender, internodes 2–5 cm long, 3–9 mm diam, quadrangular, longitudinally striate, dark green, yellowish when dried; axillary buds small, ca. 2 mm long, straight, apiculate. Petiole 1–3 mm long, 0.9–1.5 mm wide, canaliculate, margin smooth to slightly sinuate towards the apex, membranaceous; geniculum ca. 2 mm long, apex acute; leaf blade 6–15 cm long, 2.5–4.7 (–5.5) cm wide, ovate to elliptic to lanceolate, dark green on both surfaces, often covered in mosses especially adaxially, subglossy on abaxial side, greenish-brown when dried, subcoriaceous when fresh, chartaceous to subcoriaceous when dried, margin sinuate, 0.10–0.17 mm thick, apex cuspidate to acuminate, 1–3 cm long, base obtuse to subacute, sometimes rounded, midrib sulcate and impressed on adaxial surface, prominent on abaxial surface, yellowish abaxially when dried, primary lateral veins and interprimaries subpatent, infra-marginal collective vein prominent, 0.5–0.75 mm distant from margin, external marginal vein 1. Inflorescence terminal and axillary, flowering shoot slender, 1.4–6 cm long, usually with a linear cataphyll ca. 0.8 cm long at the apical node, internodes 0.5–2 cm long, 0.7–1.7 mm diam, pale brown when dried, quadrangular, usually with an axillary bud on the second internode; peduncle 2–5 mm long, ca. 1.3 mm diam, subcylindric, blackened when dried; spathe 1.5–2.8 cm long, 6–8.5 mm diam, closed, oblong to obovate, convolute when open, shortly cuspidate, yellow, margin white; spadix 1.4–2.5 cm long, 0.5–1 cm diam, oblong-ellipsoid, greenish-cream, apex acute, stipitate, stipe 1.5–2.5 × 1.2–1.6 mm, dark when dried, quadrangular. Stamens 2–3.5 mm long, 1–2 mm wide, anthers oval; gynoecium ca. 2 mm long, 2.25 mm diam, slightly prismatic, apex 1.5–3 mm diam, ovary ca. 1.7 mm long, 2 mm wide, locules 2 per ovary, ovules 1–2 per locule, 0.7–1 mm long, anatropous, subsessile, placentation axile with ovules inserted below the centre of the ovary, stigma discoid. Infructescence 1.7–2.3 cm long when immature, 2.5–4 cm long, 1.3–2.5 cm diam when mature; berry 5–8 × 4–7 mm, green when immature, yellow when pre-mature, yellow-orange when mature, obovoid; seed 4–6 × 3–5 mm, 1–2 per berry, surrounded by orange, sweet mucilage. Figures 2B, 4B, 4C, 7H, 8D, 9B, 9C, 26.

Common Names—The following common names have been recorded for this species: cipó-titica, (Brazil), yare (Colombia), bejuco tripa de pollo, biñasta, munñate (Venezuela).

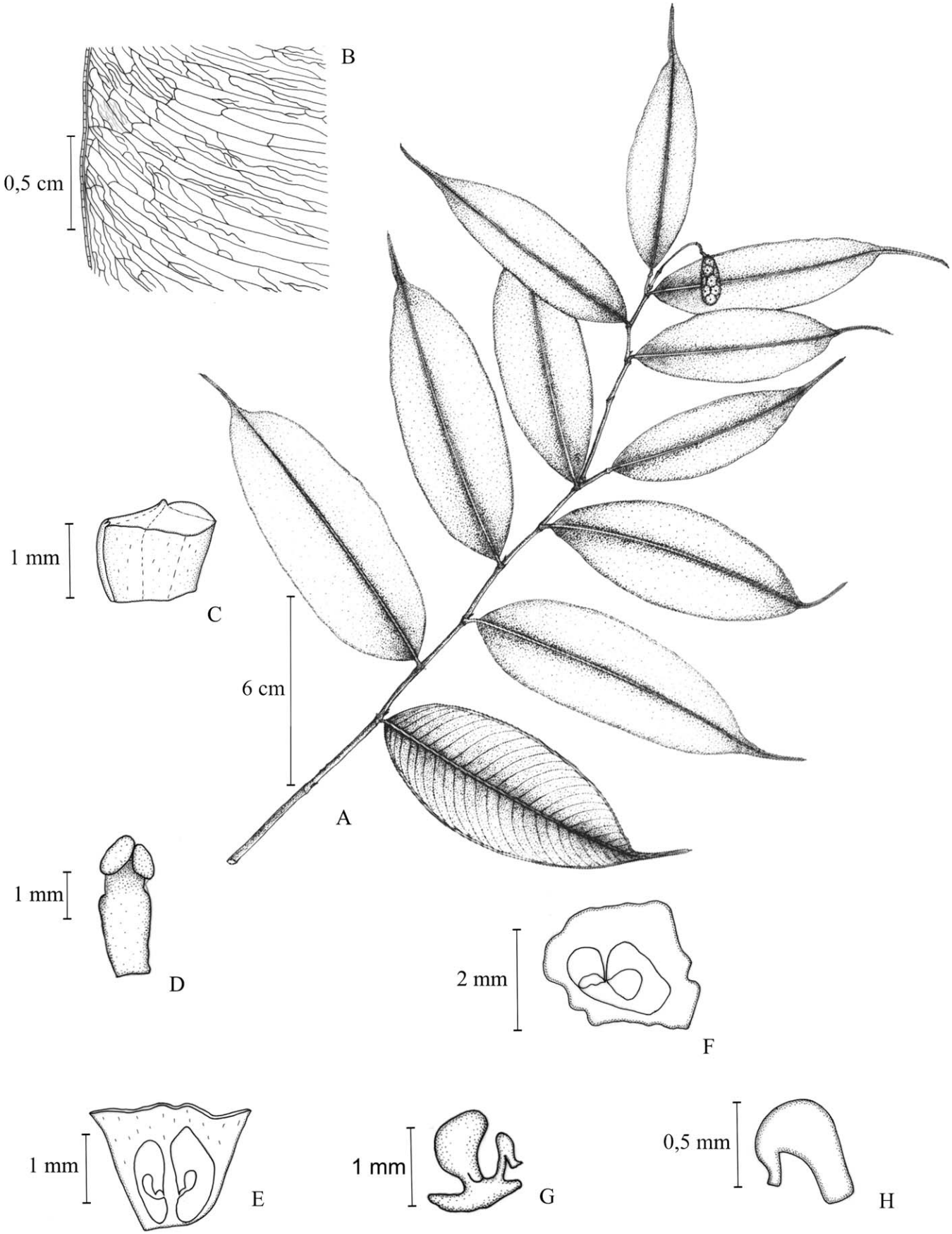

FIG. 26. *Heteropsis spruceana*. A. Habit. B. Venation of left abaxial surface of leaf blade. C. Lateral view of flower. D. Frontal view of stamen. E. Longitudinal section of gynoecium. F. Transverse section of ovary. G. Placenta with two ovules. H. Lateral view of ovule. (A-H prepared from *Soares et al. 405* (INPA)). Drawn by Felipe França.

Habitat and Distribution—*Heteropsis spruceana* occurs in dense terra firme ombrophilous forest in Brazil (Acre, Amazonas, Pará, Rondônia, Roraima), Colombia, Guiana, Peru and Venezuela, at 50–1,200 m alt.

Phenology—Flowering collections of this species have been recorded for all months except March, April, and July, and fruiting collections are known for all months except January and March.

Conservation Status—Using guidance from the Geocat (2012) online tool, the preliminary conservation assessment of *H. spruceana* is least concern (LC), based on 36 localities and a 50 km cell width (auto value cell size option for area of occupancy).

Etymology—The specific epithet honors the botanist Richard Spruce, who collected the type specimen during his epic botanical exploration of the plants of Amazonia during the 19th century.

Notes—*Heteropsis spruceana* is easily recognized by its slender, quadrangular stem, subsessile petiole, usually lanceolate, dark green leaf blade which frequently is covered adaxially with moss and is subglossy abaxially, and especially by the size of the inflorescence, the smallest in the genus. In a biophysical study of the roots of *H. spruceana* from the Reserva Florestal Adolpho Ducke-RFAD (Soares Morais 2008) this species was shown to have a basic density similar to that of ten of the common commercial timbers of Amazonia, and despite having roots of smaller diameter, their density was similar to that of the other species of *Heteropsis* studied. In an ecological study in the same area (Soares Morais 2008), *H. spruceana* showed a significant preference for lower-lying terrain, a useful result from the standpoint of developing future sustainable management of populations.

Additional Specimens Examined—BRAZIL. Acre: 7 Feb 1976, *Monteiro 159* (INPA, MG fr). Amazonas: Manaus, Reserva Florestal Adolpho Ducke, 16 Apr 1998, *Soares et al. 415* (INPA fr); 4 Feb 1998, *Soares et al. 405* (INPA fl); 18 Apr 2003, *Soares et al. 506* (INPA fr); 13 Feb 1996, *Lima et al. 1363* (INPA, K fl); 1 May 2001, *Kinupp & Bernardi 1798* (INPA fr); 1 May 2001, *Kinupp & Bernardi 1819* (INPA fr); Manaus, 20 Nov 1984, *Cabral s.n.* (INPA 148343 fr); 18 Apr 1947, *Froes 22164* (IAN fr); 5 Jun 1963, *Rodrigues & Chagas 5248* (INPA fr). Rio Cueiras, 4 Jun 1974, *Campbell et al. P211905* (INPA, MG, U fr); Rio Negro, 18 Apr 1947, *Froes 22164* (U fr); Santa Isabel do Rio Negro, 9 Oct 1987, *Cid et al. 9319* (INPA fr); São Gabriel da Cachoeira, 16 Feb 1971, *Prance et al. 10552* (INPA fl); 20 Oct 1978, *Madison et al. 497* (INPA fr); 11 Nov 1908, *Pessoal do Museu s.n.* (MG fr). Pará: Apr 1981, *da Silva et al. 1712* (MG ster); 20 Jun 1949, *Froes & Black 24561* (IAN fl); s.d., *Prance et al. 25577* (MG fr). Rondônia: 5 Feb 1983, *Bilby et al. 23* (INPA fr). Roraima: 16 Feb 1971, *Prance et al. 10552* (U fl) ; 2 Oct 1971, *Prance et al. 13590* (INPA, U fl).

COLOMBIA. Amazonas: 0°50′S 71°50′W, 29 Nov 1991, *Duivenvoorden et al. 1884* (MO fl). Caquetá: Araracuara 0°34′S 72°08′W, 16 Sep 1989, *Londoño & Moreno 804* (MO ster); Sierra del Chiribiquete, 1°4′07″N 72°46′32″W, 20 Nov 1992, *Franco et al. 4221* (MO ster); Guainía 3°38′N 67°52′W, 18 Mar 1998, *Franco et al. 5870* (MO ster).

GUYANA. 03°37′N 53°12′W, 14 Feb 1992, *Croat 74219* (MO fl). Mazaruni 14 Jun 2004, *Clarke et al. 12018* (U fr).

PERU. Loreto: 03°20′S 71°50′W, 12 Oct 1987, *Vásquez & Jaramillo 9737* (MO fr). Distrito Sargento Lopes, 04°07′22″S 72°55′31″W, 14 Apr 1997, *Vásquez et al. 23142* (MO fr).

VENEZUELA. 2°54′42″N 67°24′12″W, 19 May 1979, *Liesner 7546* (MO fl); 9 Mar 1996, *Berry et al. 6141* (MO ster). Amazonas: 2°26′N 65°7′W, 26 Jan 1991, *Stergios & Yanez 14868* (MO ster); 1°56′N 67°03′W, 17 Oct 1979, *Clark 7336* (MO fl). Atabapo: 7 Jul 1992, *Peres & Sosa 308* (MO fr); 3°3′ 0″N 65°48′40″W, 24 Oct 1992, *Perez & Sosa JPB-440* (MO fl); 3°43′40″N 65°48′40″W, 24 Oct 1992, *Peres & Sosa 441* (MO fr); 1°56′N 67°4′W, 15 Nov 1977, *Liesner 3532* (MO fr); 03°34′N 65°32′W, 26 Oct 1988, *Liesner 25421* (MO fl); 03°34′N 65°32′W, 28 Oct 1988, *Liesner 25562* (MO fl); 03°49′N 65°42′W, 1 Nov 1998, *Liesner 25582* (MO fr); 03°49′N 65°42′W, 4 Nov 1988, *Liesner 25792* (MO fr); Wankehe 6 Aug 1976, *Lister 655* (K ster). Atures: 4°59′N 67°41′W, 9 May 1980, *Steyermark et al. 122135* (MO ster); Sep 1989, *Velazco 470* (MO fr). Bolivar: 04°55′N 62°49′W, Sep 1986, *Fernandes 3301* (MO fl); 05°49′N 66°50′W, Oct 1989, *Fernandes et al. 6473* (MO fl); 05°33′N 67°08′W, Oct 1989, *Sanoja et al. 3302* (MO fr); 05°27′N 64°49′W, May 1989, *Marin 344* (MO fr); 5°43′N 64°07′W, 2 Nov 1988, *Aymard & Fernandez 7191* (MO fr); 6°13′N 61°27′W, 3 Aug 1985, *Aymard et al. 3927* (MO fl); 24 Aug 1961, *Steyermark 89467* (K fl); 4°30′N 61°30′W, 1 Nov 1985, *Liesner 19244* (MO fr); 04°30′N 61°40′W, 5 Nov 1985, *Liesner 19576* (MO fr); 4°30′N 61°36′W, 2 Nov 1985, *Liesner 19953* (MO fr); 05°00′N 61°10′W, 5 May 1988, *Liesner 24228* (MO ster); 5°46′N 62°17′W, 3 May 1986, *Liesner & Holst 20557* (MO fl); 5°56′N 62°16′W, 16 May 1986, *Liesner & Host 20901* (MO fl); 6°12′N 64°28′W, 11 May 1982, *Liesner & Morillo 14019* (MO fr); 06°50′00″N 64°50′00″W 7 May 1997, *Diaz et al. 3208* (MO fr); Casiquiare, 1°56′N 67°03′W, 25 Aug 1981, *Clark & Maquirino 8179* (MO ster); 1°56′N 67°03′W, 7 Apr 1979, *Liesner 6310* (MO fr). Rio Negro: 0°50′N 66°10′W, 21 Feb 1984, *Liesner 16151* (MO fl); 0°50′N 66°10′W, 8 Mar 1984, *Liesner 16482* (MO ster); 14–15 Oct 1987, 1°49′N 65°44′W, *Liesner & Delascio 21926* (MO fl); 1°49′N 65°44′W, 5 Nov 1987, *Liesner & Carnevali 22832* (MO fr); 00°50′N 66°10′W; 12 Apr 1984, *Plowman & Thomas 13553* (MO fr); Rio Mawarinuma, 20 Feb 1985, *Boom & Weitzman 5916* (INPA, K, MO, U fl); 0°50′N 66°10′W, 26 Nov 1984, *Croat 59323* (K, MO fr).

16. HETEROPSIS STEYERMARKII G. S. Bunting, Phytologia 60: 306. 1986.—TYPE: VENEZUELA. Depto. Río Negro, Territorio Federal do Amazonas, Río Yatua, Cerro Aruicua, 1°35′N, 66°10′W, ca. 125 m, 11–12 Apr 1970, *J. A. Steyermark & G. S. Bunting 102607* (holotype: VEN; isotypes: K!, MO! ster).

Plant a scandent hemi-epiphyte; stem much-branched, internodes 0.7–5 cm long, 3–6 mm diam, subcylindric, longitudinally striate, greyish green, glossy, asperate when dried; axillary buds 1–3 mm long, apex rounded. Petiole 4–9 cm long including the sheath, free petiole 2–8 mm long, 1.6–3 mm diam, sheath with membranaceous margin, chestnut brown, paler than blade when dried; geniculum 0.5–1.7 cm long, dark brown; leaf blade 16–38 cm long, 3–11 cm wide, oblong to elliptic, subcoriaceous, fragile, adaxial surface dark brown when dried, subglossy, abaxial surface glaucous, lustrous, margin revolute, young leaf blade bronze to vinaceous on adaxial surface, silvery on abaxial, 0.12–0.35 mm thick, apex acute to acuminate, 0.75–1.5 cm long, base truncate to rounded, midrib sulcate on adaxial surface, prominent on abaxial surface, yellowish when dried, lateral veins numerous, arched, infra-marginal collective vein prominent, 0.25 mm from the margin, external marginal vein absent. Inflorescence terminal and axillary, flowering shoot 3–10 (–15) cm long, cataphylls, when present at the apical nodes, 1–2, linear, 3.5–9 cm long, caducous after anthesis, internodes 0.5–2 cm long, 1.6–3.6 mm diam, dark brown when dried, cylindric, buds usually present on the first and second internodes; peduncle 0.7–2.3 cm long, 1.4–5 mm diam, cylindric, green; spathe (young, still closed) 2–5 cm long, 1.4–2 cm diam, fusiform to inflated, apex acuminate, 1–2 cm long, expanded when mature, 6–7.5 cm long, ca. 6 cm wide, convolute, yellowish-green externally, cream to rose or violet internally; spadix 2–5 cm long, 0.3–1 cm diam, ellipsoid, apex obtuse to rounded, greyish to pale green, rose to violet, stipitate, stipe 5–10 × 1.2–3 mm, pale green, cylindric. Stamens 1.6 mm long, 0.8 mm wide, anthers ellipsoid; gynoecium 1.5–2 mm long, 1.5–1.75 mm diam, obpyramidal to truncate, apex 1.5–2.5 mm diam, ovary ca. 1.3 mm long, 1 mm wide, locules 2 per ovary, ovules 2 per locule, 0.5–0.6 mm long, anatropous, subsessile, placentation axile, stigma discoid to oblong. Infructescence: 4.5–7.5 cm long, 1.5–3 cm diam when mature; berry 4–8 × 3–7 mm, green when immature, orange when mature, subcylindric; seed 5–13 × 3–5 mm, 2 per berry, testa foveolate. Figures 3, 4A, 4E, 7I, 7J, 8E, 8F, 27.

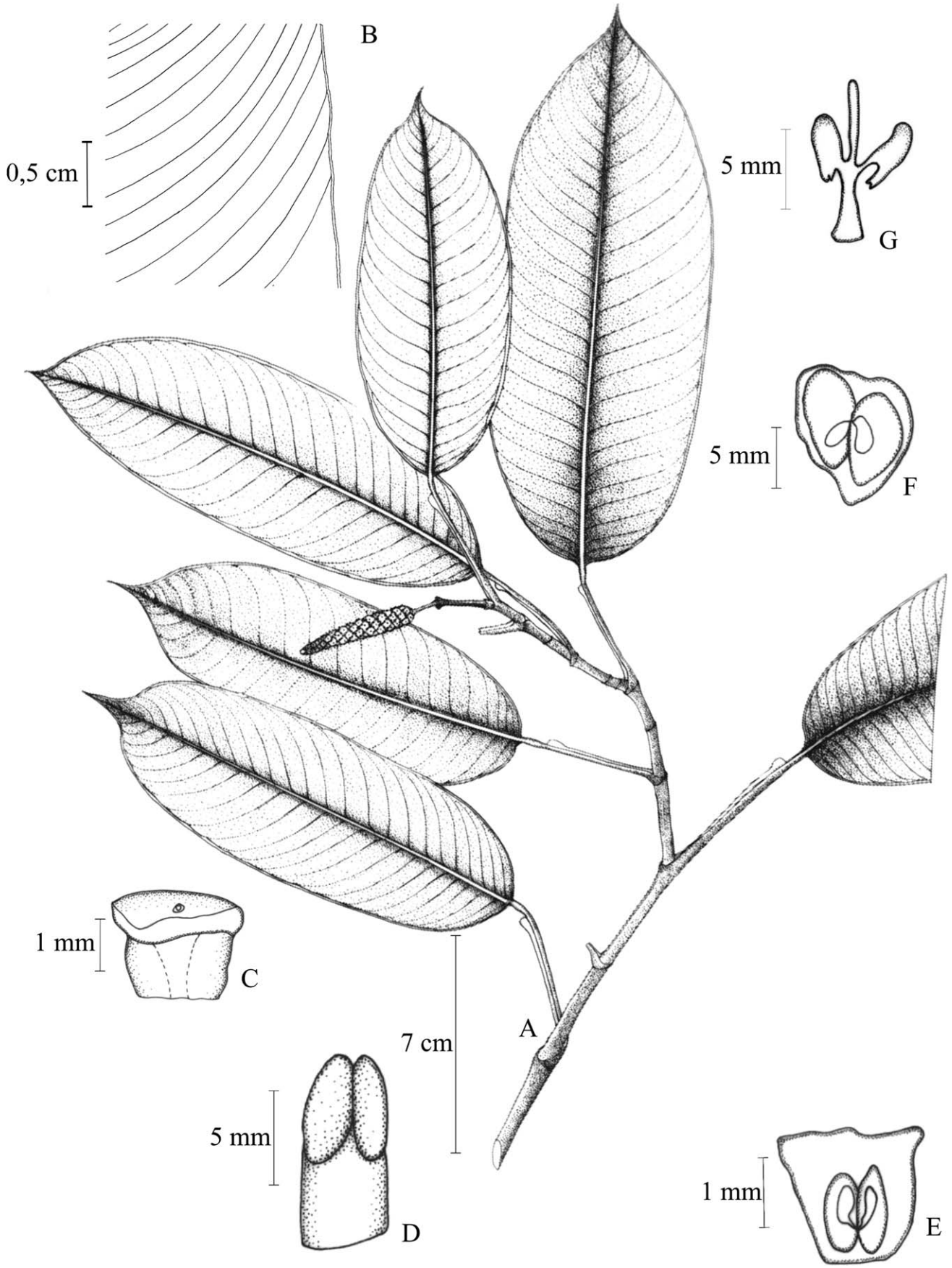

FIG. 27. *Heteropsis steyermarkii*. A. Habit. B. Venation of right abaxial surface of leaf blade. C. Oblique surface view of flower. D. Frontal view of stamen. E. Longitudinal section of gynoecium. F. Transverse section of ovary. G. Placenta with two ovules. (A–G prepared from *Soares et al. 505* (INPA)). Drawn by Felipe França.

Common Names—The following common names have been recorded for this species: bejuco (Guiana); guambe de cuamate, hoja de diablo (Venezuela).

Habitat and Distribution—*Heteropsis steyermarkii* is known from dense ombrophilous terra firme forest, usually in lower-lying terrain, in Brazil (Roraima and Amazonas), Colombia, Ecuador, French Guiana, Guyana, and Venezuela, occurring between 10–1,000 m alt.

Phenology—Flowering specimens have been collected in January, March, April, May, September, and November and fruiting material in May and September.

Conservation Status—Using guidance from the Geocat (2012) online tool, the preliminary conservation assessment of *H. steyermarkii* is least concern (LC), based on 19 localities and a 50 km cell width (auto value cell size option for area of occupancy).

Etymology—The specific epithet honors Julian Steyermark, renowned for his botanical explorations of the tepuis of Venezuela, among many other outstanding achievements.

Notes—*Heteropsis steyermarkii* is easily recognized without flowers by its long, sheathed petiole and the leaf blade with its glaucous (greyish) abaxial surface. Its vinaceous flowering spadix is also highly characteristic. This species differs markedly from the rest, except in the case of *H. melinonii*, which may be conspecific. Although *H. steyermarkii* and *H. spruceana* both have roots of smaller diameter than the others of the Ducke Reserve, both have a density similar to that of the wood of ten common Amazonian timbers, as do the roots of the other species of *Heteropsis* studied anatomically by Soares Morais (2008). *H. steyermarkii* is also similar to *H. spruceana* ecologically in its preference for low-lying terrain within forest.

Additional Specimens Examined—BRAZIL. Amazonas: Borba, BR 230, 8 May 1985, *Henderson et al. 366* (INPA fl); Manaus, Reserva Florestal Adolpho Ducke, 22 Feb 1996, *Sothers 794* (INPA ster); *Costa et al. 738* (INPA fl); 22 Nov 1995, *Soares et al. 240* (INPA ster); 26 Nov 2002, *Soares et al. 504* (INPA fl); 8 May 2003, *Soares et al. 505* (INPA fl); Manaus, estrada Manaus-Porto Velho, 14 Jul 1972, *Silva et al. 748* (INPA fl); Santa Isabel do Rio Negro, 29 Sep 1999, *Soares & Amaral 425* (INPA fl, fr); Feb 1959, *Rodrigues et al. 1013* (INPA ster). Roraima: s. d., *William 2409* (K ster).

COLOMBIA. 2°12′N 68°12′W, 8 Sep 1992, *Cortez et al. 318* (MO ster). Caquetá: 0°37′S 72°24′W, 9 Nov 1991, *Duivenvoorden et al. 941* (MO ster).

ECUADOR. Pastaza: 0°50′S 71°50′W, 25 Nov 1991, *Duivenvoorden 1625* (MO ster).

FRENCH GUIANA. Acarouany, 28 Mar 1905, *Benoist 658* (P fl); 20 Nov 1914, *Benoist 1113* (P fl); 5°31′N 53°33′W, 17 Jan 1997, *Cremers 14560* (MO fl); 20 Dec 1920, *Wachenheim s.n.* (P fl). Crique Cyathea, 17 Jan 1997, *Cremers 14560* (MO, U fl).

GUYANA. Siparuni, Essequibo River, 19 Mar 1996, *Hoffman & Allicock 5069* (U ster).

VENEZUELA. Amazonas: 3°45′N, 66°45′W, 125–400 m, 3 May 1970, *J. A. Steyermark & G. S. Bunting 103056* (MO fr, VEN not seen). 01°56′14″N 67°03′37″W, 26 Mar 2000, *Berry & Aymard 7214* (MO fl). Atabapo: 3°36′N 66°34′W, 8 May 1979, *Davidse et al. 17453* (K, MO fl). Cassiquiare, arredor Javita, 6–19 Jul 1969, *Bunting et al. 3907* (U ster); Rio Cunucunuma, 3°43′40″N 65°48′40″W, 29 Jan 1993, *Perez & Sosa 655* (MO fl). Rio Negro, 17 Apr 1970, *Steyermark & Bunting 102742* (MO fl); 1°56′N 67°03′W, 7 Apr 1979, *Liesner 6347* (MO fr); 1°56′N 67°03′W, 12 Apr 1979, *Liesner 6565* (MO fl); 01°56′N 67°03′W, May 1979, *Liesner 7516* (MO ster); 0°50′N 66°10′W, 21 Feb 1984, *Liesner 16156* (MO ster); Rio Siapa, 01°49′N 65°44′W, 4 Nov 1987, *Liesner & Carnevali 22799* (MO ster); 01°51′N 67°03′W, 11 Nov 1987, *Liesner & Carnevali 22986* (MO fl); 03°44′N 65°44′W, 10 Oct 1988, *Liesner 24641* (MO ster); 03°34′N 65°32′W, 27 Oct 1988, *Liesner 25500* (MO fl); Rio Mawarinuma, 0°50′N 66°10′W, 26 Nov 1984, *Croat 59335* (MO fl); 1°57′N 67°02′W, 6 Dec 1984, *Croat 59646* (MO ster); 0°50′N 66°10′W, 20 Mar 1984, *Liesner 16853* (MO fl).

17. HETEROPSIS TENUISPADIX G. S. Bunting, Phytologia 60: 306. 1986.—TYPE: VENEZUELA. Territorio Federal do Amazonas, ca. 130 m, 28 Mar 1976, *P. E. Berry 2189* (holotype: VEN; isotypes: MO!, MYF).

Plant a scandent hemi-epiphyte; shoot flexuose, usually tortuose, internodes 1–5 cm long, 3–5 mm diam, subcylindric, longitudinally striate, pale green, grey brown, and asperous when dried; axillary buds ca. 2 mm long, with acutely pointed apex. Petiole 0.6–1 cm long, 0.9–1.5 cm diam, canaliculate, margin sinuate, paler than the blade; geniculum 4–6 mm long, dark green; leaf blade 11–21 cm long, 4–9 cm wide, ovate to elliptic, subcoriaceous, adaxial surface dark green, abaxial surface pale green, subglossy on both surfaces, greenish-brown when dried, margin somewhat sinuate, 0.16–0.32 mm thick, apex acuminate to attenuate, 1–2.8 cm long, base cuneate to rounded, midrib sulcate and impressed on the adaxial surface, prominent on the abaxial surface, paler green than the blade, primary lateral veins and interprimaries patent to arching, infra-marginal collective vein prominent, 1–2.5 mm distant from the margin, external marginal vein 1. Inflorescence terminal and axillary, flowering shoot 2.3–8(–10) cm long, cataphyll at apical node linear (when present), ca. 4.2 cm long, leaf blade of leaves at apical nodes 12–15 cm long, 3–5.5 cm wide, internodes 0.5–2.6 cm long, 1.3–2.3 mm diam, dark brown when dried, subcylindric, buds usually present on the first, second, and third internodes; peduncle 3–5 mm long, 1.2–2 mm diam, cylindric; spathe 2–3.5 cm long, 4–6 mm diam, closed, elliptic to ovate, cream to white, pendent after anthesis, apex acuminate; spadix 2–3.4 cm long, 3.5–5 mm diam, ellipsoid, apex acute, greenish-cream, stipitate, stipe 4–7 × 0.5–1.4 mm, cylindric, yellowish-green, yellow when in fruit. Stamens 1–2 mm long, 0.75–1.25 mm wide, anthers obovate; gynoecium 2–2.5 mm long, 2.5–3 mm diam, truncate, apex 2–3 mm diam, ovary 1.5–1.7 mm long, 1–1.5 mm wide, locules 2 per ovary, ovules 2 per locule, 0.5–0.8 mm long, anatropous, subsessile, embedded in translucent mucilage, placentation sub-basal, stigma sub-discoid. Infructescence 3–4.5 cm long, 1.4–2.5 cm diam when mature; berry 5–15 × 5–10 mm, green when immature, yellowish to orange when mature, obovoid-subcylindric; seed 5–13 × 3–9 mm, obovoid, 2 per berry, with rugose testa, embedded in orange mucilage. Figures 3, 7L, 7M, 8I, 9E, 9F, 10, 28.

Common Names—The following common names have been recorded for this species: cipó-titica (Brazil), yare (Colombia).

Habitat and Distribution—*Heteropsis tenuispadix* occurs in dense terra firme ombrophilous forest, and also in secondary forest, in Brazil (Acre, Amapá, Amazonas, Pará, Rondônia, Roraima), Bolivia, Colombia, Guyana, Peru, Surinam, and Venezuela, occurring between 30 and 240 m alt.

Phenology—Flowering and fruiting specimens have been collected throughout the year except April (for flowering) and November (for fruiting).

Conservation Status—Using guidance from the Geocat (2012) online tool, the preliminary conservation assessment of *H. tenuispadix* is least concern (LC), based on 24 localities and a 50 km cell width (auto value cell size option for area of occupancy).

Etymology—The specific epithet refers to the slender spadix of this species.

Notes—*Heteropsis tenuispadix* shows morphological similarities with *H. robusta*, but differs in its cylindric stem, petiole length (0.6–1 cm long), patent or gently arched venation with sparser reticulations. The best distinguishing characters

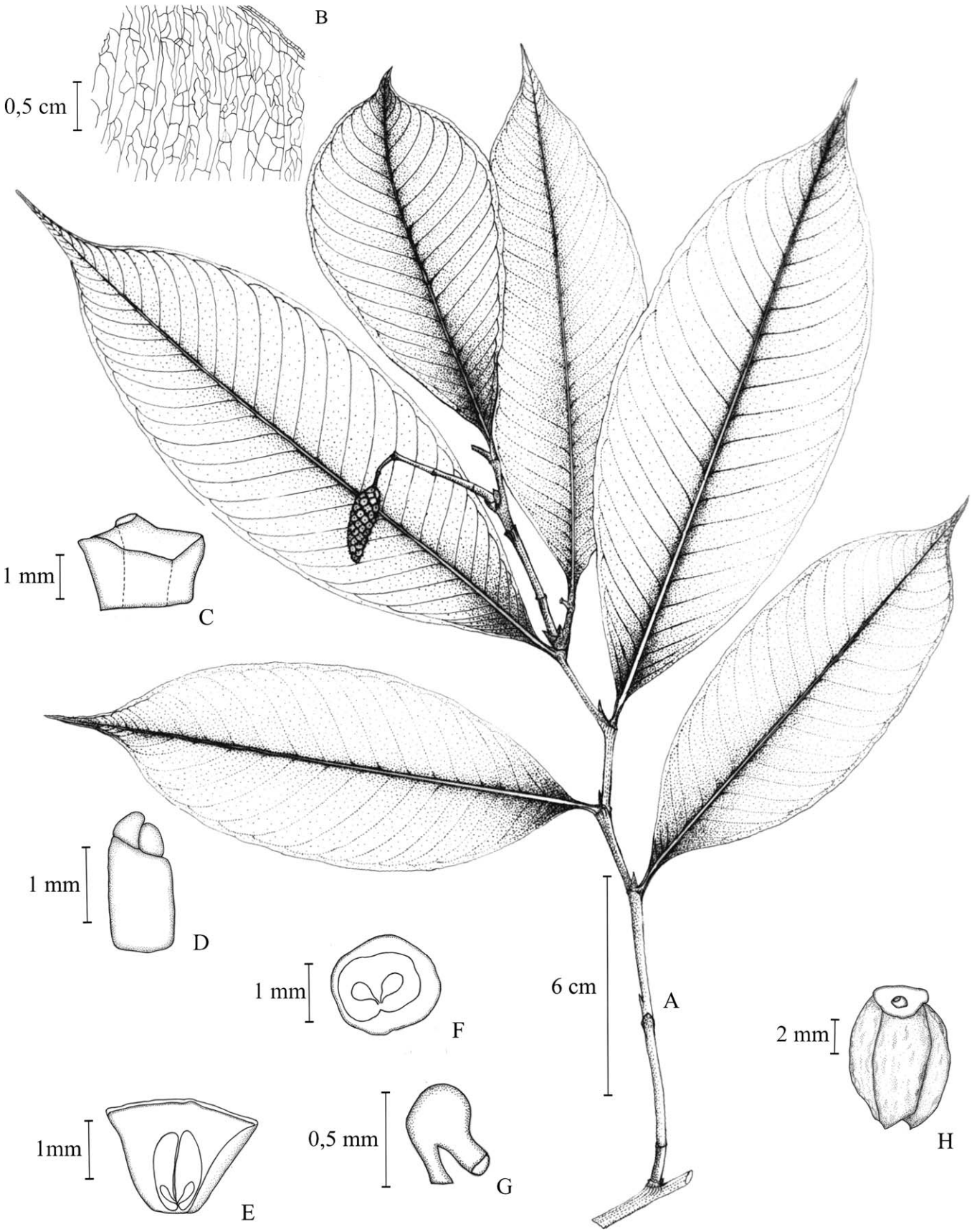

FIG. 28. *Heteropsis tenuispadix*. A. Habit. B. Venation of right abaxial surface of leaf blade. C. Lateral view of flower. D. Frontal view of stamen. E. Longitudinal section of gynoecium. F. Transverse section of ovary. G. Lateral view of ovule. H. Berry. (A–H prepared from *Soares et al. 495* (INPA)). Drawn by Felipe França.

are found in the inflorescence, the peduncle 3–5 mm long, a yellowish-green spadix stipe 4–7 mm long and the spathe pale cream to white and pendent prior to its shedding. *H. robusta* has a quadrangular stem, yellowish when dried, the petiole is 3–7 cm long and the venation is arched; the flowering shoot has quadrangular internodes, the spadix has a peduncle 1 mm long, the stipe 2–3 mm long, the spathe yellow, inflated and convolute. Morphometric studies (Soares et al. 2011) of the leaves from the plagiotropic shoots in species of *Heteropsis* from the Ducke Reserve found that leaf outline shape in *H. tenuispadix* is distinct from the other four species studied. Ecologically *H. tenuispadix* is also distinct occurring significantly more frequently in soils of higher clay content, whereas the reverse is the case in *H. spruceana*. Field observations established that plagiotropic shoots in *H. tenuispadix* usually have six to eight leaves, exceptionally ten, and the branches have an obovate overall outline, i.e. the leaves increase in size towards the shoot apex. This morphology differs from that of *H. flexuosa*, in which the leaves decrease in size towards the shoot apex. In *H. tenuispadix* the internodes of the plagiotropic shoots have a zig-zag orientation, especially notable in living specimens, which also differentiates the species from others.

Additional Specimens Examined—BOLIVIA. La Paz, Franz Tamayo 14°58′6″S 67°46′53″W, 29 Jan 2002, *Quintana et al. 203* (MO fr).

BRAZIL. Acre: Cruzeiro do Sul, 22 Apr 1971, *Prance et al. 12220* (K fr). Amapá: 10 Mar 2001, *Cesarino 22* (HAMAB, INPA, UB fr); 1 Mar 2005, *Pereira & Cardoso 1063* (HAMAB, INPA, RB fr); 6 Dec 2005, *Pereira & Nazaré 1363* (HAMAB, INPA, RB fl); Macapá, 1°30′N 53°30′W, 30 Dec 1984, *Mori & Cardoso 17552* (MO fl, fr). Amazonas: Manaus, Reserva Florestal Adolfo Ducke, 4 Mar 1994, *Vicentini 416* (INPA fr); 24 Jan 1995, *Vicentini et al. 806* (INPA fr); 26 Mar 1996, *Sothers & Silva 834* (INPA fr); 25 Apr 1996, *Sothers 855* (INPA fr); 5 Feb 1998, *Gomes 24* (INPA fl); 3 Jul 1993, *Ribeiro et al. 987* (INPA fr); 6 Sep 1966, *Prance et al. 2193* (INPA fr); 7 Mar 1995, *Nascimento 782* (INPA fr); 28 Dec 1995, *Souza et al. 195* (INPA fl); 12 Dec 1996, *Costa & Pereira 565* (INPA fr); 22 Nov 1995, *Costa & Assunção 431* (INPA fl); 13 Nov 1991, *Soares et al. 161* (INPA fl); 27 Nov 1995, *Soares et al. 276* (INPA ster); 20 Feb 2002, *Soares et al. 493* (INPA fl); 22 Mar 2002, *Soares et al. 495* (INPA fl, fr); 22 Mar 2002, *Soares et al. 500* (INPA fl); 22 Mar 2002, *Soares et al. 507* (INPA fl); 8 May 2002, *Soares et al. 508* (INPA fr); 30 Jan 2004, *Soares et al. 560* (INPA fl); 30 Jan 2004, *Soares et al. 561* (INPA fl); 30 Jan 2004, *Soares et al. 562* (INPA fl); 30 Jan 2004, *Soares et al. 563* (INPA fl); 30 Jan 2004, *Soares et al. 564* (INPA fl); 31 Jan 2004, *Soares et al. 565* (INPA fl); 12 Feb 1992, *Nee 42512* (MO fl); 1 May 2001, *Kinupp 1797* (INPA fl); 1 May 2001, *Kinupp 1808* (INPA fl); 29 Mar 2001, *Kinupp 2079* (INPA fr); 6 May 1966, *Rodrigues 7803* (INPA fr); 14 Aug 1957, *Rodrigues 536* (INPA fr); Coari, 22 Jan 1989, *Miralha et al. 150* (INPA fl); Manaus, Distrito Agropecuário, 2°24′26″S 59°43′40″W, Nov 1991, *Oliveira et al. 227* (INPA fl); 8 Aug 1979, *Cid et al. 10* (INPA fl); 4 Mar 1955, *Chagas s.n.* (INPA 849 fr); 18 Apr 1956, *Chagas s.n.* (INPA 3756 fr); 7 Aug 1956, *Ernani s.n.* (INPA 4050 fl); 28 Nov 1955, *Coelho, s.n.* (INPA 2984, RB fl); 2°19′S 60°05′W, 12 Feb 1992, *Nee 42512* (INPA fl); 10 Jun 1972, *Pires & Lima 83* (INPA fr); 30 Aug 1973, *Lisboa 18* (INPA fr); 16 Mar 1971, 19 Dec 1982, *Plowman et al. 12629* (INPA fl); 14 Nov 1955, *Rodrigues s.n.* (INPA 2900, RB fl); 23 Nov 1955, *Rodrigues s.n.* (INPA 2962, RB fr); 31 Oct 1962, *Rodrigues & Lima 4731* (INPA fr); 16 Mar 1971, *Rodrigues 9013* (INPA fr). Manaus, 27 Nov 2002, *Souza et al. 431* (INPA fl); 23 Nov 2000, *Souza et al. 406* (INPA fl). Maués, 26 Jul 1983, *Zarucchi et al. 3196* (INPA fl, fr); São Gabriel da Cachoeira, 26 Oct 1947, *Pires et al. 772* (IAN fl); 4 Mar 1975, *Cordeiro 457* (IAN fl); Santa Isabel do Rio Negro, 29 Sep 1999, *Soares et al. 440* (INPA, MO ster). Pará: Acará, Jacarequara, 23 Feb 1966, *Silva s.n.* (MG 31628 fl); Belém, 8 May 1991, *Bahia 135* (MG fr); 27 May 1960, *Oliveira 825* (IAN fr); Melgaço, 21 May 2002, *Oliveira et al. 409* (MG fr); 7 Mar 1970, *Silva 2942* (IAN fl); Mosqueiro, 13 Mar 1968, *Sastre 133* (P fr); Oriximiná, 29 Jun 1980, *Davidson & Martinelli 10575* (INPA fl); 31 Jun 1980, *Davidson & Martinelli 10659* (INPA fl); Santarém, Feb 1955, *Froes 31549* (IAN ster); s.d. *Silva 471* (IAN ster); Tucuruí, 24 Mar 1981, *Silva et al. 1422* (MG fr); 3°52′S 49°44′W, 15 Mar 1980, *Plowman et al. 9555* (IAN, INPA fr); Vila do Anani, 16 Dec 1993, *Oliveira et al. 125* (MG fr), 16 Dec 1993, *Oliveira et al. 129* (MG fr). Rondônia: 11 Feb 1983, *Silva et al. 107* (INPA fr). Roraima: 14 Mar 1971, *Prance et al. 10965* (INPA, MO fl).

COLOMBIA: Guaviare, 25 Feb 1995, *Cordobá et al. s.n.* (MO ster); 2°39′02″N 71°07′20″W, 15 Jan 1996, *Cárdenas et al. 7029* (MO ster).

GUYANA: 5°17′N 53°03′W, 16 Mar 1998, *Prévost 3490* (MO fr); Demerara, 24 Jul 1988, *Ter Steege & Jager 440* (K fr); Kabrora, Moruca River, 16 Oct 1997, *van Andel et al. 1996* (MO, U fl); Rupununi, 2 Feb 1991, *Jansen-Jacobs et al. 2302* (MO fl); 3°10′N 59°24′W, 6 Jul 1995, *Jansen-Jacobs et al. 4393* (K, MO, P, U fl).

PERU. Loreto: 9 Nov 1985, *Vasques & Jaramillo 4604* (MO fl).

SURINAM. Pomeroon-Supenaam, 7°28′N 59°02′W, 23 Jul 1997, *Hoffman & Ehringhaus 5132* (MO fr).

VENEZUELA. 11–12 Apr 1970, *Steyermark & Bunting 102601* (MO ster); 18 Sep 1975, *Berry 1417* (MO fl), 14 Aug 1982, *Croat 55049* (MO ster); Aripão, 10 Sep 1994, *Rosales et al. 1280* (MO ster). Atabapo: 10 Jan 1988, *Stergios et al. 11526* (MO fl). Atures: 5°33′N 67°27′W, 21 Jun 1984, *Miller et al. 1599* (MO fl). Bolivar: Cedeño, 6°35′00″N 64°45′00″W, 20 Apr 1996, *Knab-Vispo & Rodriguez 534* (MO ster); 6°35′00″N 64°45′00″W, 20 Apr 1996, *Knab-Vispo & Rodriguez 535* (MO ster); 4°30′N 61°40′W, 5 Nov 1985, *Liesner 19568* (MO fr).

18. **Heteropsis vasquezii** Croat & M. L. Soares sp. nov.—TYPE: PERU. Loreto: Requena, Sapuena, Jenaro Herrera, bosque primário, 04°50′S, 73°45′W, 170 m, 13 Sep 1987, *R. Vásquez & N. Jaramillo 9551* (holotype: MO!; isotype: INPA! fr).

Planta hemiepiphytica; internodia 1.7–8 cm longa, 5–9 mm diam; folia ramulorum plagiotropium petiolo 2–2.3 cm longo, 4–5 mm diam (in sicco), lamina elliptica, 35–55 cm longa, 14–24 cm lata, nervis primariis lateralibus utroque 14–25, venis tenuibus reticulatis obscuris instructa; spadix 9.5 cm longus, 1.2–1.8 cm diam.

Plant a scandent hemi-epiphyte; stem thick, internodes 1.7–8 cm long, 5–9 mm diam, subcylindric, widely sulcate on one side, slightly striate longitudinally, dark brown, semi-glossy when dried; axillary buds 8–10 mm long, straight with rounded apex. Petiole 2–2.3 cm long, 4–5 mm diam, strongly canaliculate, dark brown, margin smooth; geniculum ca. 1.5 cm long, black when dried; leaf blade 35–55 cm long, 14–24 cm wide, elliptic, conspicuously coriaceous, dark brown adaxially, matte brown abaxially, margin revolute, slightly sinuate, 0.87–0.95 mm thick, apex slightly acuminate, base acute to obtuse, midrib adaxially sulcate and the same color as the blade, abaxially prominent, rounded, darker brown than the blade, primary lateral veins 14–25 on each side, obscured adaxially, prominent abaxially, similar in color to blade, finer reticulated veins obscured, infra-marginal collective vein prominent, ca. 2 mm distant from margin, external marginal vein lacking. Inflorescence terminal and axillary, flowering shoot 2–9 cm long, internodes 0.5–2.5 cm long, 7–8 mm diam, dark brown when dried, subcylindric, widely sulcate on one side, axillary bud present on second internode; peduncle ca. 0.5 mm long, cylindric, thick; spathe not seen; spadix ca. 9.5 cm long, 1.2–1.8 cm diam, ellipsoid, apex obtuse, dark matte brown, shortly stipitate. Gynoecium 4–5 mm diam, irregularly angular to truncate. Infructescence ca. 12 cm long, 3.3 cm diam; berry 4–8 mm diam, green when immature, truncate, dark brown when dried with pale brown apex. Figures 3, 29.

Habitat and Distribution—*Heteropsis vasquezii* was collected in dense ombrophilous terra firme forest and is known only from the type locality in Loreto department in Peru, occurring at 150 m alt.

Phenology—The single known specimen is in young fruiting stage and was collected in September.

Conservation Status—Using guidance from the Geocat (2012) online tool, the preliminary conservation assessment

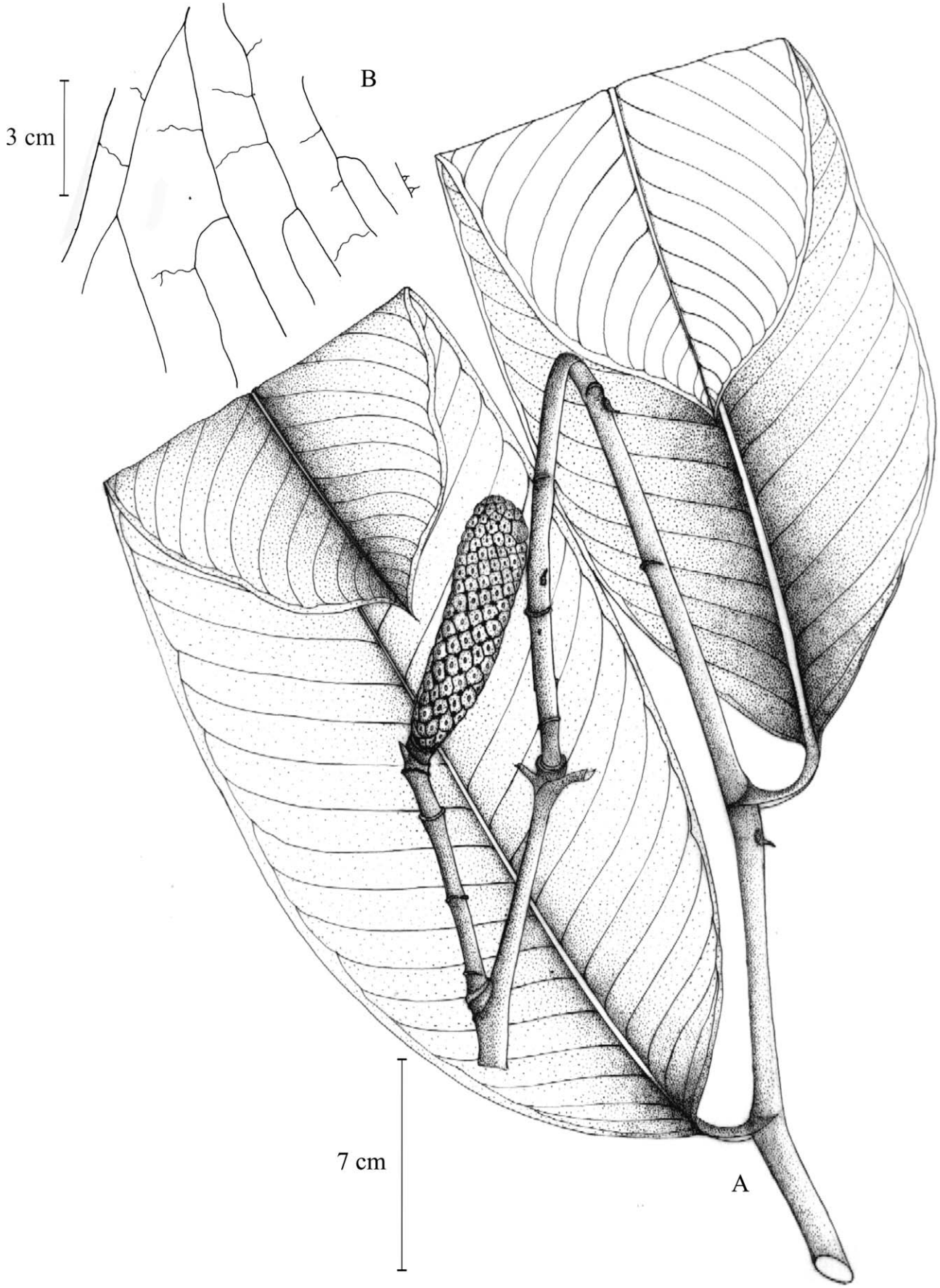

FIG. 29. *Heteropsis vasquezii*. A. Habit. B. Venation of left abaxial surface of leaf blade. (A and B prepared from *Vásquez & Jaramillo 9551* (INPA). Drawn by Felipe França.

of *H. vasquezii* is data deficient (DD), since this species is currently known only from a single locality.

Etymology—The specific epithet honors the collector of the type specimen, Rodolfo Vásquez, who has contributed greatly to the collections of Araceae from tropical South America and thus improved scientific knowledge of the family.

Notes—This species is recognized by its extremely wide, elliptic leaf blade which dries to a dark brown color adaxially and matte brown abaxially, with the primary lateral veins conspicuously more prominent than the interprimaries. *Heteropsis vasquezii* is easily distinguished from other species by the width of the leaf blade.

Doubtful Names—HETEROPSIS MELINONII (Engl.) A. M. E. Jonker and Jonker, Acta Bot. Neerl. 2: 356. 1953. *Rhodospatha blanda* subsp. *melinonii* Engl., Bot. Jahrb. Syst. 1: 483. 1881. *Rhodospatha melinonii* (Engl.) Engl. and K. Krause in Engler, Pflanzenr., IV, 23B: 96. 1908.—TYPE: FRENCH GUIANA. On the banks of the Rio Maroni, *Mélinon 91, Mélinon 817* (syntypes: P! ster).

Plant a hemi-epiphyte. Petiole ca. 6 cm long, sheath persistent, 6 mm broad on each side at the base, narrowing towards the apex, terminating in a geniculum 6–8 mm long; leaf blade 24 cm long, 10 cm wide, coriaceous, adaxially green, abaxially paler and glaucous-pruinose, oblong, apex shortly apiculate, base obtuse, lateral veins numerous and undifferentiated, arising from the midrib at an angle of ca. 90°, midrib well-differentiated, impressed adaxially, prominent abaxially. Peduncle and fertile parts unknown.

Habitat and Distribution—*Heteropsis melinonii* was described from lowland forest in French Guiana.

Etymology—The specific epithet refers to the botanist Eugène Mélinon, the collector of the syntypes.

Notes—*Heteropsis melinonii* was described by Engler as *Rhodospatha blanda* subsp. *melinonii*, based on two sterile specimens collected in French Guiana by Mélinon (*Mélinon 91, Mélinon 817*) and held at the Herbarium of the Paris Museum (P). Later, Engler and Krause promoted the subspecies to specific rank and redescribed the taxon based on the same specimens as *Rhodospatha melinonii* (Engl.) Engl. & Krause; our description is a translation of theirs. Jonker-Verhoef and Jonker (1953) transferred this species to *Heteropsis*. We have so far been unable to locate these specimens at the Museum National d'Histoire Naturelle (P) in Paris. The description of *H. melinonii* shows some striking resemblances to *H. steyermarkii*, particularly in the pruinose abaxial leaf surface, the oblong leaf blade and especially the free, long-sheathed petioles and the two taxa may well be conspecific.

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