



***Adelobotrys tessmannii* (Merianieae, Melastomataceae) and allies: a refined circumscription and description of two new Amazonian species with notes on their ecology**

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Abstract

Adelobotrys tessmannii is re-circumscribed and a lectotype is designated. Two new species, *A. latifolius* and *A. microcarpus*, are described, and all three species are illustrated. They have a Western Amazonian, broadly sympatric distribution, which is depicted. Field surveys and chemical soil analyses presented show that *A. latifolius* prefers more fertile soils than *A. microcarpus*, while *A. tessmannii* does not differ from the other species in this respect.

Key words: Bolivia, Brazil, Colombia, Ecuador, neotropics, Peru, soil preferences

Introduction

Adelobotrys de Candolle (1828: 127) is an exclusively neotropical and predominantly Amazonian genus. Of the described species that belong to *Adelobotrys sensu stricto*, as defined by Schulman & Hyvönen (2003), one species occurs from Mexico and Jamaica to South America, one is endemic to Panama, and the remaining species dwell in South America, mostly in lowland to submontane rainforest. Its distribution and ecology help to explain why the genus is still so poorly known, despite a relatively high number of total collections made, since the Amazonian rainforest biome remains inadequately and highly unevenly explored botanically (Schulman *et al.* 2007a, b). Most previously described species of *Adelobotrys* require a re-circumscription and several taxa are still undescribed (Schulman & Hyvönen 2003).

Adelobotrys tessmannii Markgraf (1927: 1140) was described almost nine decades ago as the 14th species in a genus that now is thought to contain some 45 species, although it hasn't been revised since Cogniaux (1891); for a more detailed account on the taxonomic history of the genus see Schulman & Hyvönen (2003). Since the discovery of *A. tessmannii*, at least a couple of thousand collections of *Adelobotrys* have been made. Hence, it is not surprising that the original description no longer provides a clear circumscription of *A. tessmannii*, and that it is easily confused with related species. As a result, herbarium specimens of *A. tessmannii* have often been misidentified as *A. adscendens* (Sw.) Triana (1867: 210), and at least four different species of *Adelobotrys* have repeatedly been misidentified as *A. tessmannii*.

Here we clarify the circumscription of *A. tessmannii* and segregate two new species on the basis of their morphology. We also provide general distribution maps for all three species, and present an account on their edaphic preferences on the basis of ecological field surveys and soil chemical analyses.

Material & Methods

Taxonomy, distribution, and conservation:—Collections of the following 34 herbaria were studied between 1998 and 2014 for specimens of *Adelobotrys*: AAU, AMAZ, B, BM, BR, C, CAS, COL, DS, F, G, H, HBG, HUA, K, L, LL, LPB, M, MG, MICH, MO, NY, P, QCA, S, SP, TEX, TUR, U, UC, US, and W (acronyms after Thiers, queried June 12 2014), and the Harvard University Herbaria. All collections of the species treated here are listed below under

'Taxonomy', and a complete list of the ca. 2,100 specimens of *Adelobotrys* representing ca. 1,200 different collections is available from the first author upon request.

A number of specimens exhibited intermediate morphology between *A. tessmannii* and *A. latifolius* or *A. adscendens*. These were interpreted as putative hybrids and are listed separately under 'Taxonomy'.

To complement distribution maps, we georeferenced verbal locality descriptions using relevant maps and the GEOnet Names Server GNS (available at <http://geonames.nga.mil/gns/html/>; queried in 2000–2002) in cases when specimen labels did not include coordinates of the collecting site. However, only those collections that could be georeferenced with reasonable accuracy and confidence were used for the production of maps.

Conservation status was evaluated using the categories and criteria, and guidelines, of IUCN (2012).

Soil preferences:—We used quantitative species inventories and soil sampling carried out by K. Ruokolainen, H. Tuomisto, and N. Llerena in a total of 396 sites of old growth lowland rainforests of Amazonian Brazil, Ecuador, and Peru (Fig. 1) for estimating edaphic preferences of the species treated here. The field study areas can be delineated into four separate regions that we here call Madre de Dios (in southern Peru), Loreto (northern Peru), Yasuní (Ecuador) and Juruá (central Brazil). Additionally, Melastomataceae sampling was carried out along the central Río Caquetá in the Department of Amazonas in Colombia and in the region of Manaus in Brazil, but the species treated here were not encountered in those two areas, and therefore they are not included in the subsequent analyses.

In each study site, occurrences of all Melastomataceae species were recorded in straight inventory lines of 5 × 500 m (328 sites) or 2 × 500 m (68 sites). The species were identified on the basis of voucher specimens deposited at AMAZ, INPA, QCA, QCNE, SP, or USM, with duplicates at TUR, where they were available to us also for the taxonomic treatment. When several inventory lines were established close to each other, usually only one reference voucher referred to individuals observed in all these lines, since this was not found to cause problems for a reliable identification of the species treated here. More detailed accounts of the inventories and sampling methods can be found in Ruokolainen & Tuomisto (1998), Tuomisto & Ruokolainen (2001), Ruokolainen *et al.* (2002), Tuomisto *et al.* (2003a, 2003b), Higgins *et al.* (2011), and Suominen *et al.* (2013).

For each inventory line, we had two or three surface soil samples (mostly at 0–5 cm depth in mineral soil) from elevationally high and low points. The majority of the soil samples were analysed in the laboratory of MTT Agrifood Finland, some in the laboratory of Geological Survey, Finland, or in the laboratory of World Soil Information (ISRIC), The Netherlands. In all the laboratories the analyses followed the standard methods described by van Reeuwijk (1993). In the present analyses, we used only the sum of base cations (Ca, K, Mg, Na) extractable by ammonium acetate. This is a correlate of general soil fertility and has been found to be one of the soil variables that is most closely related to the variation in Melastomataceae species composition in Amazonian forests (Ruokolainen & Tuomisto 1998, Tuomisto *et al.* 2003a, 2003b, Suominen *et al.* 2013).

Our null hypothesis was that the three species of *Adelobotrys* have no difference in their preferences of soil cation concentration. We tested this by investigating, for each pair of species, whether the average of the natural logarithm of soil cation concentration of the inventory lines occupied by one species differed from the corresponding average calculated for another species. The rationale for the log-transformation was that a given absolute change in nutrient concentration changes the rate of chemical reactions more when the nutrient concentration is low than when it is high. To estimate if the observed difference between the averages of two species differs more than a random expectation we ran a permutation test. The test was performed separately for Juruá and Loreto, the only regions that had two or three co-occurring species. In the first step of the permutation test, we randomly assigned to each species the same number of inventory lines as the species had observed occurrences within the region. The random selection of the inventory lines was restricted so that it repeated the observed number of co-occurrences of the species among the inventory lines. This restriction was done to mimic the spatial structure of the original data as closely as possible. After the random assignment of the lines to the species, we calculated the average of the logarithms of the cation concentration per species, and the difference between the species pairs. The random assignment and the following calculation of the difference between the species was repeated 999 times. In this way we obtained, for every species pair, an estimate of the random distribution of the difference in the average of the logarithm of soil cation concentrations of inventory lines. Finally, we estimated the risk of rejecting the null hypothesis by comparing the observed difference between a species pair to the random distribution of the difference.

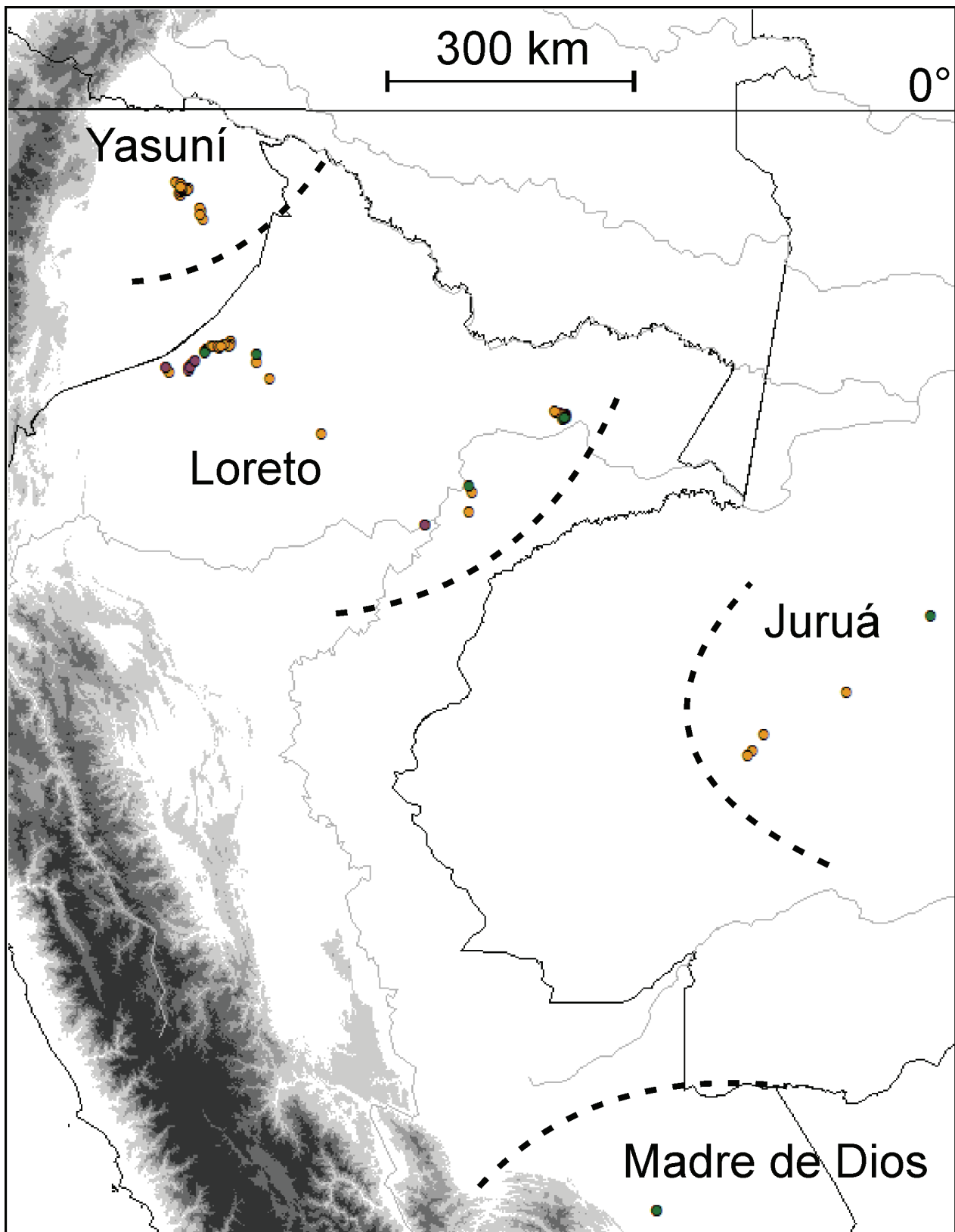


FIGURE 1. Localities (n=390) of quantitative species inventories (n=396) and soil sampling for estimating soil preferences of the species treated here. Individuals of the species were found in the localities as follows: orange dot = *Adelobotrys latifolius*, green dot = *A. microcarpus*, violet dot = *A. tessmannii*; in one locality two species were found. The four separate regions in which field studies were carried out and where at least one of the three species was encountered are marked (Madre de Dios in southern Peru, Loreto in northern Peru, Yasuní in Ecuador and Juruá in central Brazil). Elevation is depicted as follows: 0–1000 m as white; 1001–2000 m, 2001–3000 m, 3001–4000 m, and >4000 m as progressively darker shades of grey. For approximate location of map section in South America, see Fig. 3D.

Results

Taxonomy

Adelobotrys tessmannii Markgraf (1927: 1140) (Fig. 2)

Type:—PERU. Ostperu: Unterer Itaya (l. Nebenfl. d. ob. Amazonas), im lichten Überschwemmungswald bei San Antonio, 110 m ü. d. M. (blühend und fruchtend 16. Juni 1924), *Tessmann 3572* (holotype at B destroyed, photographs of it at F!, HUH!, NY!; lectotype here designated at G! no. 8469, isolectotypes at F!, NY!).



FIGURE 2. *Adelobotrys tessmannii* Markgr. **A** habit showing abaxial (two leaves to the left) and adaxial sides of laminae, and inflorescence; **B** malpighian hairs from lamina abaxial side (lower three from lamina proper, upper three from vein) with point of attachment marked on two hairs; **C** larger (epipetalous) stamen; **D** smaller (episepalous) stamen; **E** bud showing cylindrical hypanthium, shallowly 5-lobed calyx, and somewhat exerted calyx teeth; **F** fruiting hypanthium with persistent calyx, and clear constriction at torus, also shown are the only somewhat elongated branches of the partial inflorescence with scars of fallen-off flowers; **G** old fruit after disintegration of hypanthium showing the remaining costae that are not apically connected by a circular vascular strand. Drawn by R. Ilmanen from *J. Schunke 5118* (**A**, **C**, **D**, **E**), *Dorr & Barnett 5829* (**B**), *P. C. D. Cazalet & T. D. Pennington 7544* (**F**), and *Y. Mexia 7101a* (**G**). Scalebars: for **A** 5 cm, **B** 0.5 mm, **C–D**, **E–F**, and **G** 5 mm.

Full description:—The following represents a refined circumscription based on 60 herbarium specimens representing 37 separate collections (listed below) and including a description of all above-ground parts presented in the same format as those of recently described species of *Adelobotrys* (Schulman 2003a, 2008).

Liana adhering to support by adventitious roots produced in comb-like rows on internodes, reported height of fertile plants (1–)4–9 m (occasional herbarium label descriptions as ‘scandent herb’ or ‘shrub’ interpreted as confusions). *Stem* slender, diameter in fertile branches to 0.6 cm, terete to somewhat flattened or slightly fluted, when very young densely pubescent with rusty-brown, appressed, ca. 0.5–1.5(–2) mm long malpighian hairs, soon largely glabrescent and only very sparsely pubescent when mature; stem surface between hairs smooth, light brown to olive-green; internodes in vegetative parts of fertile stems (2.5–)4.5–10(–14) cm long; nodes not or only slightly swollen, hardly more pubescent than the internodes (apart from densely pubescent axillary buds). *Leaves* opposite, isomorphic. Petiole (1.1–)1.5–3(–4) cm long (ratio of lamina length to petiole length 2.9–6.9 or even 8.9), 1–2 mm in diameter; terete to flattened, grooved above; sparsely to fairly densely covered with brown malpighian hairs at first, glabrescent with age especially below. *Lamina* elliptic or (narrow) ovate to wide elliptic, (8.5–)9.6–11.6(–14.1) × (4.2–)5.3–6.6(–8.5) cm (ratio of length to width 1.4–2.6), base (cuneate to) rounded or cordulate, apex mostly short-acuminate, margin serrulate, often revolute (in herbarium specimens); chartaceous to subcoriaceous; in living plant glossy, green to olive-green, in herbarium specimens greyish to brownish olive-green with dark brown veins below. Both surfaces of lamina pubescent with rusty-brown malpighian hairs at first but soon largely glabrescent, mature leaves with a few hairs along main veins above, below usually with sparse pubescence along main veins and scattered hairs between them, the hairs being appressed, 0.3–1 mm long, laterally flattened but not dilated (apparently 1 cell layer thick, 2 layers wide), symmetrical to somewhat asymmetrical, (sub)sessile and (sub)straight to slightly sigmoid especially on main vein; on lamina proper especially on abaxial side malpighian hairs interspersed with minute, elongate-club-shaped glands (ca. 0.1 mm long); epidermis of adaxial surface usually with dense greyish hemispherical protuberances ca. 0.07 mm across. *Margin of lamina* with sparse malpighian ciliation and with persistent obliquely spreading pale, multiseriate, terete, unbranched, 0.5–1.5 mm long setulae tipping marginal teeth 1–1.5 mm apart. *Venation* basally acrodromous with midrib plus four distal main veins, stronger pair of acrodromal veins only somewhat closer to lamina margin than to midrib (distances 1:1.2–1:1.8), pinnate secondary veins clearly visible below, 4–8 mm apart; reticulate tertiary veins vaguely visible near main veins below; veins prominent below, flat to somewhat impressed above. Axils of main veins on abaxial side usually with a few to many multiseriate, terete, unbranched setulae ca. 0.6–1.2 mm long, tipped by a multicellular gland. *Inflorescence* a terminal, broadly conical, lax double thyrsoid (*sensu* Weberling 1989) with up to hundreds of flowers; at anthesis 15–22 × 9–13(–19) cm including 4–8 cm long peduncle; rachis with (3 or) 4 or 5 elongated internodes, nodes with two main branches consisting of (2 or) 3 elongated internodes and with two or sometimes four shorter branches (of 1–2 internodes) produced from accessory buds subtending the main branches, internodes of rachis, and branches, progressively shorter towards apex; partial inflorescence a compressed double cincinnus with branches bearing up to 6 flowers each and only somewhat elongated in fruit. Peduncle subtended by leaves similar to ordinary vegetative leaves; lowermost node of rachis with bracts similar to but smaller than vegetative leaves, upper nodes with progressively smaller and narrower bracts, bracts at lowermost node persistent but those at upper nodes mostly absent already at anthesis; cincinni subtended by caducous sessile elliptic bracteoles ca. 3–5 × 3–4 mm. Pedicel at anthesis 4–6 mm, slender. *Flower* perigynous, hypanthium coriaceous, cylindrical to ellipsoid, smooth, rather abruptly widening from pedicel, (3.2–)3.5–4.5 mm long and 1.5–1.8 mm wide at torus; calyx spreading-cup-like, shallowly 5-lobed, 1–1.6 mm long; outer calyx teeth slender, (1.0–)1.5–2.5 mm long including caducous apical setula, exerted beyond inner lobes by (0.5–)1.1–2.1 mm; pedicel with rather dense, hypanthium and calyx with sparse cover of brown malpighian hairs, hypanthium glabrescent in fruit, calyx sparsely pubescent also on inner side but with rim mostly aciliolate; calyx reportedly green to yellowish-green or whitish in living plant. *Petals* 5, colour in living plant reportedly white to pink, pale lavender, violet, or purple, when dry dull yellowish-brown, glabrous; obovate, 6.5–8(–9) mm long; venation actinodromous and flabellate (*sensu* Hickey 1973). *Stamens* 10, anisomorphic, bent and crowded to one side of flower, glabrous, reportedly purple to violet or deep lavender; filaments 4.5–5.5 mm, laterally dilated, strap-like, ca. 0.4–0.5 mm wide; geniculate at junction between filament and anther, anther bent introrsely (i.e., with ventral side down). *Anthers* subulate, dorsal-arcuate, base rounded; single apical pore ca. 0.2–0.3 mm across; connective hardly prolonged between filament and thecae, basally extended into an erect spur, dorsally into a gradually ascending, apically deeply cleft appendage. *Larger (epipetalous) stamens*: thecae clearly arcuate, 6.5–7.5 mm long and ca. 0.5 mm thick at base, apical pore dorsally inclined; basal connective appendage ca. 0.6–0.9 mm long, triangular-subulate and variously slightly lobulate, dorsal appendage 2.6–3.2 mm long and apically cleft by ca. 0.7–1.0 mm. *Smaller (episepalous) stamens*: thecae only slightly arcuate, 4.3–4.5 mm long and ca. 0.5 mm thick at base, apical pore subterminal; basal connective appendage ca. 0.8–1 mm long, irregularly lobulate, dorsal appendage 2.5–3.0 mm long

and apically cleft by ca. 0.6–0.9 mm. *Ovary* 5-locular, roughly cylindrical, somewhat fluted, truncate at apex, 2.5–3.5 × 0.7–1.0 mm, glabrous; style 6.0–7.0 mm long, somewhat sigmoid, glabrous, reportedly purplish; stigma punctate. *Pedicelel in fruit* (5–)7–10(–12) mm. Fruiting hypanthium ellipsoid to ovoid, clearly constricted at torus, 5–6.5 × 4.5–5 mm, reportedly pale or yellowish green in living plant; thin, sparsely pubescent, 10-costate, disintegrating at maturity revealing costae that are not apically connected by a circular vascular strand. Calyx persistent in fruit, horizontally spreading to broadly cup-shaped, as wide as hypanthium, 1.3–1.9 mm long. *Fruit* a 5-locular loculicidal capsule completely enveloped by the hypanthium but free from it; globose, somewhat 5-angled, rounded-truncate at apex. Placenta central, sessile and hardly extended from the central column. *Seeds* numerous, narrowly wedge-shaped, ca. 1.4–1.6 × 0.3–0.4 mm; surface smooth to slightly rugose; embryo occupying central third, testa elongated at both ends possibly forming air-filled sacs; testa light brown, embryo dark brown (in herbarium specimen).

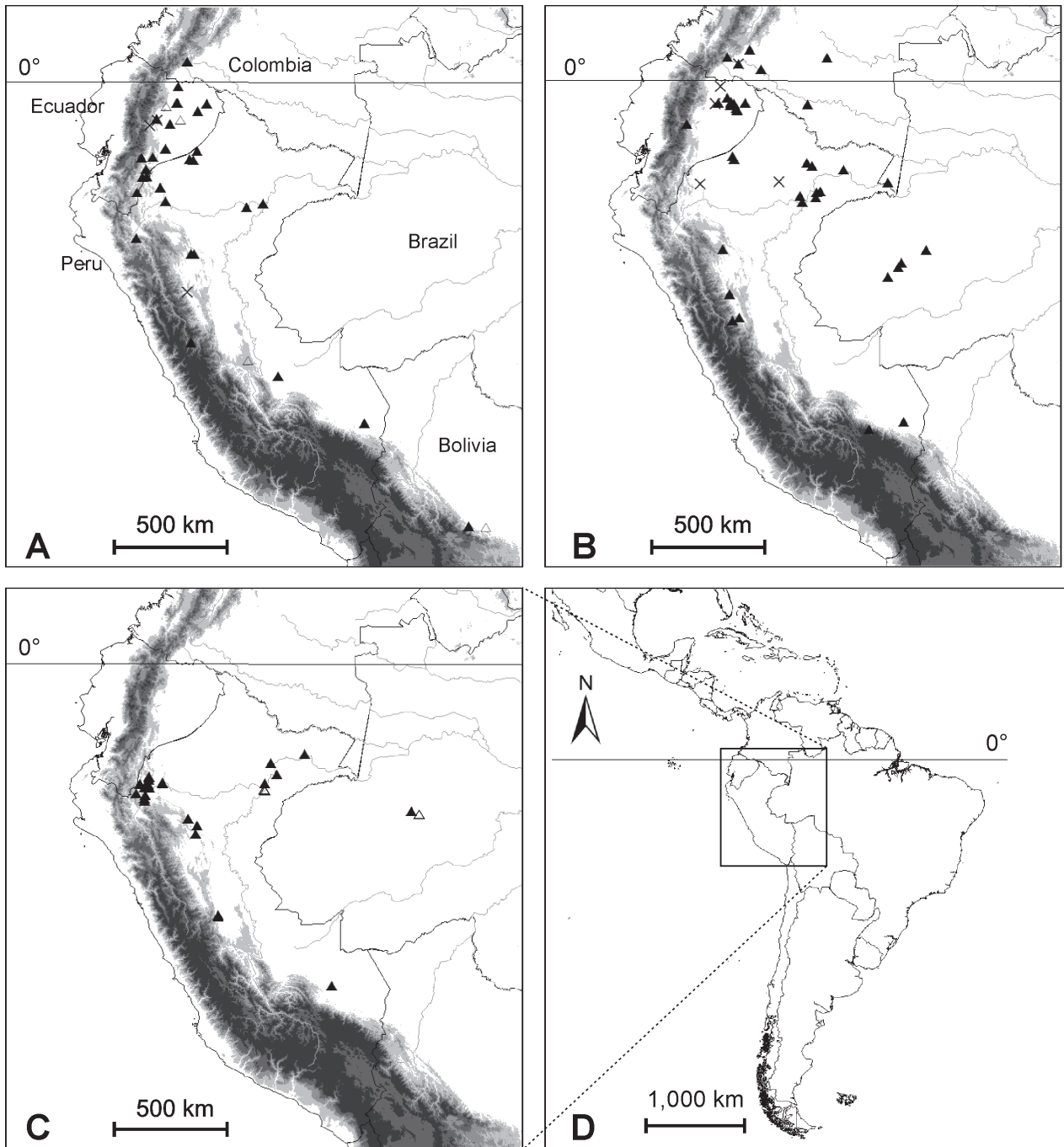


FIGURE 3. Collecting localities of specimens of the species treated here. A. *Adelobotrys tessmannii* (solid triangles), *A. cf. tessmannii* (open triangles), and possible hybrids between *A. tessmannii* and *A. adscendens* (crosses). B. *A. latifolius* (solid triangles) and possible hybrids between *A. latifolius* and *A. tessmannii* (crosses). C. *A. microcarpus* (solid triangles) and *A. cf. microcarpus* (open triangles). D. The location in South America of the map section shown in A–C. Elevation is depicted in A–C as follows: 0–1000 m as white; 1001–2000 m, 2001–3000 m, 3001–4000 m, and >4000 m as progressively darker shades of grey.

Notes:—The outer calyx teeth of the type represent the lower end of the range given above (1 mm). This, however, seems aberrant, since no other specimens with as short outer calyx teeth have been observed. In the original description (Markgraf 1927) *A. tessmannii* is characterised as a “sub-scandent small tree”, but it is clear from available material that the true growth form is lianaceous. The laminae are mostly narrower and somewhat smaller than what the original description indicates, and the bracts in the inflorescence are leaf-like, not “minute”, while small caducous bracteoles are present. The pedicels are 2–3 times longer compared to measurements given in the original description, which also states that the style is 3 mm long (not 6–7 mm), so it seems the original description was based on immature floral structures.

Habitat:—Primary lowland to montane rainforest on mineral soil, sometimes along rivers or roads at forest edge; by some collectors habitat described as “swampy” and as “secondary forest”. Elevation from 150 to 1,600 m a.s.l.

Distribution:—Western Amazonia between 65°30' and 78°40' W, from 1°3' N in Putumayo, Colombia, through Ecuador and Peru to 17°3' S in Cochabamba, Bolivia (Fig. 3). Possible hybrids with *A. adscendens* have been collected in Ecuador and Peru, and with the below described new species *A. latifolius* Schulman in Colombia, Ecuador, and Peru. *Adelobotrys tessmannii* is here reported from Bolivia for the first time.

Phenology:—Collected with flowers in November–January, April, and June; with fruits in November–January, March–April, and August.

Conservation:—Least concern (LC), i.e., not threatened. The extent of occurrence clearly exceeds the threshold value of 20,000 km². The available data are too scanty to estimate the true area of occupancy and, especially, population size or trends in it, but there is no plausible reason to estimate that these would approach levels warranting placement in or near threatened categories.

Specimens of *A. tessmannii* examined:—BOLIVIA. Cochabamba: Itirapampa, old road from Villa Tunari to Cochabamba, 500 m, 17°3' S 65°30' W, 29 January 1999, *Maas, P.J.M., Maas, H., Vargas C.I., Specht C., Quispe, F. 8805* (LPB!). COLOMBIA. Putumayo: Mocoa, el Pepino: Finca el Placiv, 27 December 1967, *Herbar W. Schwabe s.n.* (B!). ECUADOR. Morona-Santiago: Taisha, Río Guambime, a small river situated 2–3 km E of the military camp, 400 m, 2°23' S 77°30' W, 17 June 1980, *Branbyge, J. & Asanza C., E. 32011* (AAU!, MO); Morona-Santiago: Taisha, Río Guambime, vegetation on the riverbanks and in the adjacent forest, 400 m, 2°23' S 77°30' W, 18 June 1980, *Branbyge, J. & Asanza C., E. 32031* (AAU!, CAS!, MO); Morona-Santiago: Vieja Cordillera de Cutucú. Patuca (ca. 2°40'S; 78°12'W)—Santiago road, E of the Río Namangoza, km 25.4, 600–1000 m, 23 October 1988, *Dorr & Barnett 5829* (NY!); Morona-Santiago: Gualaquiza, Vertiente occidental de la Cordillera del Condór, arriba del valle del río Quimi, 1600 m, 3°30'38" S 78°24'55" W, 12 December 2001, *Freire, E. 4342* (MO!); Morona-Santiago: Cordillera del Cóndor, Cuangos, 20 km east of Gualaquiza, near disputed Peru-Ecuador border. Transect # 5, 1470 m, 3°29' S 78°14' W, 19 July 1993, *Gentry, A. 80150* (MO!); Morona-Santiago: Cordillera del Cóndor. Centro Shuar Warints. 2 km al sureste del Centro, 925 m, 3°10'45" S 78°16'17" W, 6 October 2002, *Katan, T. et al. 22* (MO!); Napo: Comunidad de Chira Isla, Cap. rivademeira, on Río Napo, on the N side of the river, about 1 km W of Chiro Isla center, 200–275 m, 0°36'6" S 75°52'30" W, 18 April 1990, *Bensman 206* (QCA!); Napo: Parque Nacional Yasuni. Plot #24. Km 92.5, 0°53'22" S 76°13'31" W, 13 May 1997, *Macias, M. 360* (TUR!); Napo: 20 km al W de Coca, al sur de Río Napo, por vía de Los Zorros, 300 m, 0°35' S 77°3' W, 22–23 April 1985, *Neill, Palacios, Stein & Zaruma 6383* (TEX!); Napo: 20 km al W de Coca, al S del Río Napo, por Via de los Zorros, 350 m, 0°35' S 77°3' W, 22–23 April 1985, *Neill, Palacios, Stein & Zaruma 6393* (F!, QCA!, MO, NY); Napo: 15 km al W de Coca, costado Sur del Río Napo, por vía de Los Zorros, 250 m, 0°35' S 77°2' W, 18–20 April 1985, *Zaruma, Neill, Baker & Palacios 105* (NY!, MO); Napo-Pastaza: Río Aquarico, Santa Celilia, 23 January 1972, *Dobson, F. H. III & Wolfe, F. H. 946* (CAS!); Napo-Pastaza: Canton Napo (?), trail Zatzayacu to Las Palmas Elevation 500 m, 22–28 March 1935, *Mexia, Y. 7101a* (NY!, US!, MO); Pastaza: Pastaza Canton, Pozo Villano 2 de Arco. 2 km del pueblo de Villano, 400 m, 1°25' S 77°20' W, 3 December 1991, *Tipaz, Espinoza & Gualinga 573* (F!, TEX!, MO, QCNE); Santiago-Zamora: Taisha. Banks of Río Guaguayme, 450 m, 27 January 1962, *Cazalet, P.C.D. & Pennington, T.D. 7544* (NY!, US!, K); Santiago-Zamora (“Oriente”): Eastern slope of the cordillera, valley of the ríos Negro and Chupianza (on the trail from Sevilla de Oro to Mendez). El Partidero, 630–930 m, 14 December 1944, *Camp E-1513A* (NY!, US!); Santiago-Zamora (“Oriente”): Eastern slope of the cordillera, valley of the ríos Negro and Chupianza (on the trail from Sevilla de Oro to Mendez). El Partidero, 630–930 m, 14 December 1944, *Camp E-1513B* (NY!); Zamora-Chinchi: Nangaritzá Canton, Lower slopes of Cordillera del Cóndor, above Río Nangaritzá at Pachicutza, 950 m, 4°7' S 78°37' W, 4 December 1990, *Neill & Palacios 9501* (US!, QCNE, MO). PERU. Amazonas: Valle del Río Santiago, approx. 65 km N de Pinglo; Quebrada Caterpiza, 2–3 km atrás de la comunidad de Caterpiza, 200 m, 5 December 1979, *Huashikat, V. 1444* (MO!); 11 December 1979, *Huashikat, V. 1497* (MO!); 19 December 1979, *Huashikat, V. 1584* (MO!); 16 January 1980, *Huashikat, V. 1797* (MO!); Amazonas: 1 km atrás de La Poza, Río Santiago, 180 m, 13 November 1979, *Tungui, S. 51* (MO!); Huánuco:

Leoncio Prado, Rupa Rupa, Jacintillo (márgen izquierda del Río Monzón), 3 November 1971, *Schunke V., J. 5118* (F!, G!, NY!, US!); Loreto: Alto Amazonas, Pastaza (?), Andoas; Carretera Tambo; transect direction 140° (TR 8, Sub 4), 2°49'11" S 76°24'42" W, *Llerena, N. 525* (TUR!); Loreto: Alto Amazonas, Pastaza (?), Andoas; Margen derecha río Pastaza, 30 minutos río arriba en deslizador, direction of transect 250° (TR 10, Sub 14, Ind 2), 2°47'2" S 76°33'17" W, *Llerena, N. 573* (TUR!); Loreto: Loreto, San Antonio, Río Samiria, 23 August 1983, *Ayala & Arévalo 4226* (F!, NY!, AMAZ, MO); Loreto: Loreto, Close to the village of San Antonio, 150–200 m, 4°32' S 73°38' W, 15 January 1996, *Ruokolainen, K., Tuomisto, H., Koivunen, H., Lusa, E., Bardales, C., Fachín, L. & Torres, G. 7986* (TUR!); Loreto: Loreto, Río Corrientes at the Ecuador border, between Teniente Lopez and Puesto Avanzado Elevation 280–350 m, 4 April 1977, *Gentry, A., Revilla, J. & Daly, D. 19085* (MO!), Madre de Díos: Tambopata; a 1 hora con 30 minutos del albergue Tambopata Research Center, transect direction 0°, (TR 416, Sub 10), 13°7'24" S 69°37'15" W, *Llerena, N. 882* (AMAZ!); Madre de Díos: Tambopata, a 45 minutos del Albergue Tambopata Research Center, margen izquierdo del río Tambopata; transect direction 0°, (TR 419, Sub 7), 13°7'45" S 69°37'11" W, *Llerena, N. 930* (TUR!); San Martín: Lamas, Alonso de Alvarado, San Juan de Pacayzapa, al este del Puente (Carretera a Moyobamba), 900 m, 16 April 1973, *Schunke V., J. 5948* (AAU!, F!, NY!, U!); San Martín: Lamas, Alonso de Alvarado, al oeste de San Juan de Pacayzapa (Carretera a Moyobamba), 800–900 m, 22 April 1973, *Schunke V., J. 6004* (AAU!, F!, NY!, U!); *Herb. Barbey-Boissier, s.n.* (G!); Region Inca: Río Miaria, appr. 8 km from Miaria, 11°18' S 73°3' W, 12 March 1994, *Sarmiento & Kalliola 94-185* (TUR!).

Specimens interpreted as hybrids between *A. tessmannii* and *A. adscendens*:—ECUADOR. Pastaza: Ca 15 km N of Puyo alongside road to the E, 1000 m, 1°15' S 77°50' W, 28 December 1987, *Boom, B., Rombold, J. & Doenges, R. 7842* (F!, K!, NY!, QCA!, U!, US!); Napo-Pastaza: Mera, 1160 m, 26 December 1958, Harling 3703 (NY!). PERU. San Martín: Mariscal Cáceres, Tocache Nuevo, Camino a Santa Rosa (Márgen derecha del Río Mishollo), 350–370 m, 9 August 1973, *Schunke V., J. 6773* (HUH!).

Specimens interpreted as hybrids between *A. tessmannii* and the below described *A. latifolius*:—COLOMBIA. Putumayo: Umbría, 325 m, 0°54' N 76°10' W, October–November 1930, *Klug, G. 1779* (BM!, HUH!, MICH!, NY!, S!). ECUADOR. Napo: Río Aguatico, ca. 5 km S of Lago Agrío. 7 February 1973, *Lugo S., H. 3221* (AAU!, U!, US!); Napo: 21 km E of Loreto, by road, 300 m, 2 June 1988, *Renner 69322* (AAU!); Napo: 21 km E of Loreto, by road, 300 m, 2 June 1988, *Renner 69322* (US). PERU. Amazonas: Valle de Río Santiago, Quebrada Caterpiza, 2–3 km atrás de la comunidad Caterpiza, 200 m, 3°50' S 77°40' W, 10 December 1979, *Tungui, S. 267* (US); Loreto: Provincia Maynas, Distrito Sargento Lores, Isla de Aguajal (?), 95–110 m, 7 January 1983, *McDaniel, S. & Rimachi Y., M. 26632* (BR!, NY!, TEX!, US!).

Specimens of uncertain status determined as *A. cf. tessmannii*:—BOLIVIA. Cochabamba: José Carrasco Torrico, Valle del Sajta, 220 m, 17°8' S 64°50' W, 4 October 1996, *Kessler, M., Acebey, A., Gonzáles, J. & Sonnentag, M. 8819* (GOET!)—sterile specimen. COLOMBIA. Putumayo: Mocoa, el Pepino: Finca el Placiv, 800 m, 10 December 1967, *Herbar W. Schwabe 67416* (B!). ECUADOR. Carretera de Petro-Canada en construcción. Vía Auca, 115 km al sur de Coca, 6 km al sur del Río Tigüino, 320 m, 1°15' S 76°55' W, 31 March 1989, *Zak, V. & Rubio, D. 4199* (NY!, TEX!, US!); Napo: Carretera Coca-Loreto. Entre la Comuna 10 de Agosto y el Río Pinguillo, 1000 m, 0°43' S 77°28' W, 20 October 1988, *Cerón, C.E. & Iguago, C. 5308* (MO!)—the three preceding specimens differ from typical *A. tessmannii* by their dense and dark malpighian indument and greyish lamina colour. PERU. Ucayali: Obenteni forest (or Obentini), Gran Pajonal, 1000–1200 m, June 1976, *Scott 880* (US!)—sterile specimen lacking diagnostic features. UNKNOWN COUNTRY. 1778–1788, *Ruiz & Pavón 15/63* (F!)—fragment.

Adelobotrys latifolius Schulman, *sp. nov.* (Figs. 4 and 5)

Type:—COLOMBIA. Comisaría del Putumayo: Umbría, forest, 0° 54' N—76° 10' W, 325 m, January–February 1931 (fl., fr.), *G. Klug 1953* (holotype S!; isotypes BM!, F!, HUH!, K!, NY!, US!).

Diagnosis:—*Adelobotrys tessmannii* Markgr. *affinis sed foliis fere glabris laminis ovatis latioribus in sicco viridibus venis luteolis (nec griseis venis fuscis), partibus ultimis inflorescentiae cincinnis duplicatis ramis perelongatis, dentibus exterioribus calycis brevibus, et hypanthiis in fructu globosis differt.*

Allied to *Adelobotrys tessmannii* Markgr. but differs by having almost glabrous leaves, broader ovate laminae that dry green with yellowish veins (not grey with dark brown veins), ultimate branching of the inflorescence in the form of double cincinni with strongly elongated branches, short outer calyx teeth, and globose fruiting hypanthia.

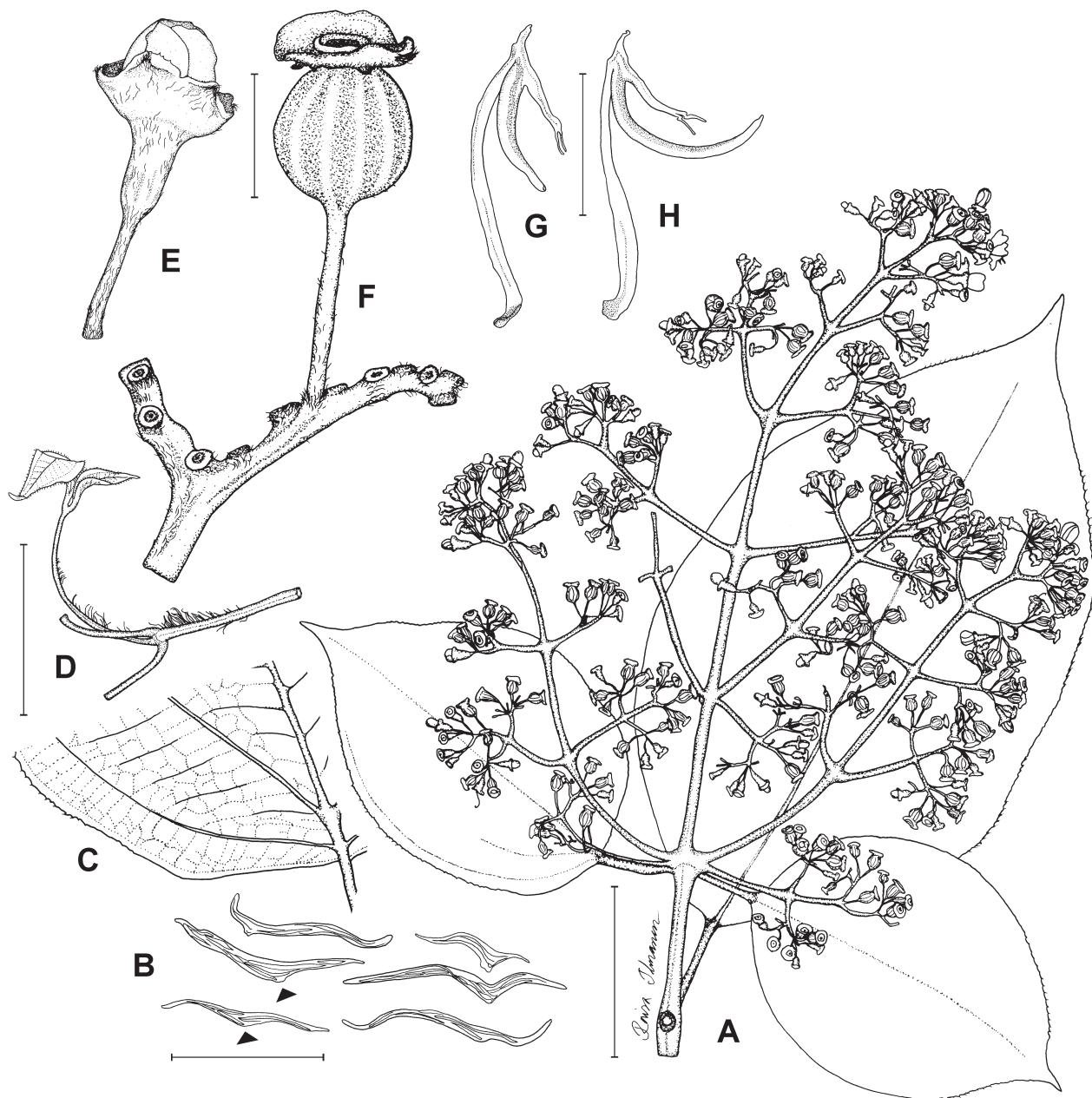


FIGURE 4. *Adelobotrys latifolius* Schulman, *sp. nov.* **A** habit with inflorescence; **B** malpighian hairs from lamina abaxial side (lower two from lamina proper, upper four from vein) with point of attachment marked on two hairs; **C** section of lamina abaxial side showing visibility of veins and partly serrulate margins; **D** tip of shoot showing adventitious climbing roots; **E** bud showing cylindrical hypanthium, shallowly 5-lobed calyx, and vestigial calyx teeth; **F** fruiting hypanthium with persistent calyx and clear constriction at torus, also shown is the strongly elongated branch of the partial inflorescence with scars of fallen-off flowers; **G** smaller (episepalous) stamen; **H** larger (epipetalous) stamen. Drawn by R. Ilmanen from *Woytkowski 7850* and *K. Ruokolainen et al. 10332* (**A, C, D**), *G. Klug 1953* (**B**), *Cuatrecasas 11274* (**E, G, H**), and *J. Schunke 3906* (**F**). Scalebars: for **A** and **C–D** 5 cm, **B** 0.5 mm, **E–F** and **G–H** 5 mm.

Full description:—*Liana* adhering to support by adventitious roots produced in comb-like rows on internodes, reported height of fertile plants (2–)8–12(–15) m (occasional herbarium label descriptions as ‘tree’ or ‘shrub’ interpreted as confusions). *Stem* slender, diameter in fertile branches to 0.7 cm (maximum reported diameter 3.3 cm), terete to somewhat flattened or slightly fluted, when very young densely pubescent with rusty-brown, appressed, short (ca. 0.5–0.8 mm long) malpighian hairs, soon largely glabrescent and only very sparsely pubescent when mature; stem surface between hairs smooth, greenish to dull straw-coloured or greyish-brown; internodes in vegetative parts of fertile stems 4.5–11 cm long; nodes not or only slightly swollen, hardly more pubescent than the internodes (apart from densely pubescent axillary buds). *Leaves* opposite, isomorphic. Petiole (3.3–)3.5–5.5(–6.3) cm long (ratio of lamina length to petiole length 2.8–5.2), 1–2 mm in diameter; terete to flattened, grooved above; sparsely to fairly densely

covered with brown malpighian hairs at first, glabrescent with age especially below. *Lamina* ovate to wide elliptic (or suborbiculate), (9.9–)13.5–19.5(–28) × (6.3–)9–14(–20.4) cm (ratio of length to width 1.3–1.9), base cuneate to rounded or cordulate, apex short-acuminate to acute, margin serrulate (to subentire), sometimes revolute (in herbarium specimens); chartaceous to subcoriaceous; in living plant glossy and typically vivid pure green, in herbarium specimens green to olive-green or brownish with straw-coloured to brown veins below. Both surfaces of lamina pubescent with rusty-brown malpighian hairs at first but very soon glabrescent, mature leaves glabrous above (or with a few hairs along main veins), below scattered hairs remain along main veins, hardly any between them, the hairs being appressed, 0.4–0.7 mm long, laterally flattened but not dilated (apparently 1 cell layer thick, 2 layers wide), symmetrical to somewhat asymmetrical, (sub)sessile and (sub)straight to slightly sigmoid especially on main vein; lamina proper on abaxial side with scattered but fairly abundant minute, elongate-club-shaped glands (ca. 0.1 mm long); epidermis of adaxial surface usually with rather dense greyish hemispherical protuberances ca. 0.07 mm across. *Margin of lamina* mostly without malpighian ciliolation but with persistent, obliquely spreading, pale, multiseriolate, terete, unbranched, 1–2 mm long setulae tipping marginal teeth 1.2–2 mm apart. *Venation* basally acrodromous with midrib plus six distal main veins the outermost of which are weak but mostly well discernible, central pair of acrodromal veins only somewhat closer to lamina margin than to midrib (distances 1:1–1:1.5), pinnate secondary veins clearly visible below, 0.4–0.8 cm apart; reticulate tertiary veins typically partly visible below; veins prominent below, flat (to somewhat impressed) above. Axils of main veins on abaxial side usually with a few to many multiseriolate, terete, unbranched setulae 0.6–1.2 mm long, tipped by a multicellular gland. *Inflorescence* a terminal, broadly conical, lax double thyrsoid with up to hundreds of flowers; at anthesis (13–)22–28 × (9–)16–22 cm including (3.5–)5–8 cm long peduncle; rachis with 4 or 5 elongated internodes, nodes with two main branches consisting of 3 elongated internodes and with two or sometimes four shorter branches (of 1–2 internodes) produced from accessory buds subtending the main branches, internodes of rachis, and branches, progressively shorter towards apex; partial inflorescence a double cincinnus with branches bearing up to 10 flowers each, characteristically elongated in fruit and reminiscent of arms of an octopus when only scars of fallen fruits remain. Peduncle subtended by leaves similar to ordinary vegetative leaves; lowermost node of rachis with bracts similar to but smaller than vegetative leaves, upper nodes with progressively smaller and narrower bracts, bracts at lowermost node persistent but those at upper nodes mostly absent already at anthesis; cincinni subtended by caducous sessile elliptic bracteoles 3–5 × 3–4 mm. Pedicel at anthesis 4–6 mm, slender. *Flower* reportedly slightly fragrant, perigynous, hypanthium coriaceous, cylindrical to ellipsoid, smooth, rather abruptly widening from pedicel, (3.3–)3.6–4.2 mm long and (1.3–)1.6–2.2 mm wide at torus; calyx spreading-cup-like, shallowly 5-lobed, 1.3–1.6 mm long; outer calyx teeth vestigial to ca. 0.6 mm long including caducous apical setula, not exerted beyond inner lobes; pedicel with rather dense, hypanthium and calyx with sparse cover of brown malpighian hairs, hypanthium glabrescent in fruit, calyx sparsely pubescent also on inner side and with rim often ciliolate; hypanthium and calyx reportedly green to pale or yellowish green in living plant. *Petals* 5, colour in living plant reportedly (white to) white with lilac base or pink to deep-purplish pink or even blue-violet, when dry dull brownish-yellow, glabrous; obovate, 8–10 mm long; venation actinodromous and flabellate. *Stamens* 10, anisomorphic, bent and crowded to one side of flower, glabrous; filaments 6–9 mm, laterally dilated, strap-like, ca. 0.5 mm wide; geniculate at junction between filament and anther, anther bent introrsely (i.e., with ventral side down). *Anthers* subulate, dorsal-arcuate, base rounded; single apical pore ca. 0.3 mm across; connective hardly prolonged between filament and thecae, basally extended into an erect triangular spur, dorsally into a gradually ascending, apically deeply cleft appendage. *Larger (epipetalous) stamens*: thecae clearly arcuate, 6.2–7 mm long and 0.4–0.5 mm thick at base, apical pore dorsally inclined; basal connective appendage ca. 0.8–1 mm long, subulate and variously slightly lobulate, dorsal appendage 3.6–4 mm long, cleft by ca. 1.5–1.7 mm. *Smaller (episepalous) stamens*: thecae only slightly arcuate, 3.9–4.9 mm long and 0.4–0.5 mm thick at base, apical pore subterminal; basal connective appendage ca. 0.7 mm long, irregularly lobulate, dorsal appendage 3.2–3.9 mm long, cleft by ca. 1.3–1.6 mm. Ovary 5-locular, roughly cylindrical, somewhat fluted, truncate at apex, 3–4 × 1.4–1.6 mm, glabrous; style 7.2–9 mm long, somewhat sigmoid, glabrous; stigma punctate. *Pedicel in fruit* 5–8 mm. Fruiting hypanthium globose to ovoid, clearly constricted at torus, 5–6 × 4.5–5 mm; thin, sparsely pubescent, 10-costate, disintegrating at maturity revealing costae that are not apically connected by a circular vascular strand. Calyx persistent in fruit, horizontally spreading to broadly cup-shaped, as wide as hypanthium, ca. 2 mm long. *Fruit* a 5-locular loculicidal capsule completely enveloped by the hypanthium but free from it; globose, somewhat 5-angled, rounded-truncate at apex. Placenta central, sessile and hardly extended from the central column. *Seeds* numerous, narrowly wedge-shaped, ca. 1.5–1.7 × 0.4 mm; surface smooth to slightly rugose; embryo occupying central third, testa elongated at both ends possibly forming air-filled sacs; testa light brown, embryo somewhat to clearly darker brown (in herbarium specimen).



FIGURE 5. *Adelobotrys latifolius* Schulman, *sp. nov.* **A** inflorescence; **B** semi-opened flower, bud, and young fruiting hypanthia; **C** abaxial side of lamina showing acrodromous venation and ciliate margin. Photos by K. Ruokolainen of K. Ruokolainen *et al.* 16491 (**A**, **B**) and 16256 (**C**).

Notes:—This species was marked as *Adelobotrys tessmannii* morphotype 1 in the phylogenetic analysis by Schulman & Hyvönen (2003).

Habitat:—Primary to secondary lowland to montane rainforest, mostly in undulating terrain on lateritic clayey mineral soil often close to creeks or small streams, occasionally at edges of *Mauritia flexuosa* swamps and in periodically inundated terrain or on roadsides. Elevation from 100 to 1,800 m a.s.l.

Distribution:—Western Amazonia between 69°37' and 78°14' W, from 0°54' N in Putumayo, Colombia, through Ecuador and Western Brazil to 13°25' S in Cuzco, Peru (Fig. 3). Possible hybrids with *A. tessmannii* have been collected in Colombia, Ecuador, and Peru.

Etymology:—The epithet stems from the large leaves of the species, which generally are the broadest in the genus.

Phenology:—Collected with flowers in September–October, December–April, and June; with fruits in September, December–April, and June.

Conservation:—Least concern (LC), i.e., not threatened. The extent of occurrence clearly exceeds the threshold value of 20,000 km². The available data are too scanty to accurately estimate the true area of occupancy and, especially, population size or trends in it, but there is no plausible reason to estimate that these would approach levels warranting placement in or near threatened categories.

Paratypes:—BRAZIL. Amazonas: ca. 1.5 km west from the village of Barro Vermelho, Rio Juruá, 6°27' S 68°45' W, 120–140 m, April 16 2012, Ruokolainen, K. with H. Tuomisto, T. Emilio, F. Figueiredo & G. Moulatlet 16256

(TUR!); Amazonas: ca. 3.5 km east from the village of Inácio, Río Tarauacá, 6°57' S 69°43' W, 130 m, May 14 2012, *Ruokolainen, K. with H. Tuomisto, D. Castro & G. Moulatlet 16478* (TUR!); Amazonas: ca. 2 km north-west from the village of Diamantina, Río Tarauacá, 7°7' S 69°51' W, 140–170 m, May 16 2012, *Ruokolainen, K. with H. Tuomisto, D. Castro & G. Moulatlet 16491* (TUR!); Amazonas: Basin of Rio Jurua, Near mouth of Rio Embira (tributary of Rio Tarauaca), 7°30' S 70°15' W, 30 June 1933, *Krukoff, B.A. 5145* (BM!, F!, G!, HUH!, K!, M!, MICH!, MO!, NY!, S!, U!, UC!, US!). COLOMBIA. Amazonas: Parque Nacional Natural Amacayacu. Centro Administrativo INDERENA, a la orilla del Río Amacayacu, 100 m, 3°47' S 70°15' W, 14 April 1991, *Pipoly, J. 15400* (MO!); Comisaría del Caquetá: Morelia, 150 m, 14 September 1941, *von Sneidern s.n.* (S!); Comisaría del Putumayo: entre Achipayaco y Mocoa, 450–500 m, 25 December 1940, *Cuatrecasas 11274* (COL!, F!, US!); Putumayo: Mocoa y los alrededores al norte, 750–850 m, 3–7 December 1942, *Schultes & Smith 2041* (HUH!, US!); Hantanita ad fl. Orteguaza, terr. de Caqueta. 2 August 1926, *Woronow & Juzepczuk 6375* (NY!). ECUADOR. Napo: La Joya de los Sanchas, Parque Nacional Yasuní, carretera y oleoducto de Maxus, en construcción, km 10–13, 250 m, 0°25' S 76°37' W, 19 February 1993, *Gudiño, Grefa & Andi 2212* (US!, QCNE, MO); Napo: Parque Nacional Yasuní, plot #10. Km 32.4, 0°36'18" S 76°27'29" W, 18 March 1998, *Macias, M. 2922* (TUR!); Napo: Parque Nacional Yasuní, plot #24. Km. 92.5, 0°53'22" S 76°13'31" W, 12 May 1997, *Macias, M. 330* (TUR!); Napo: Parque Nacional Yasuní, plot #9. Km 32.4, 0°41'0" S 73°25'54" W, 4 May 1998, *Macias, M. 3678* (TUR!); Napo: Vía de los Aucas, 18 km al sur de Coca, 22 September 1985, *Palacios, W., Neill, Gómez, Cerón & Marles 822* (AAU!, NY!, QCA!, QAME); Napo: km 97.9 along the road traversing Yasuní National Park, 200–300 m, 0°55' S 76°13' W, 27 February 1998, *Ruokolainen, K. & Tuomisto, H. 11552* (TUR!); Napo: km 87 of the road traversing Yasuní National Park, 200–300 m, 0°51' S 76°16' W, 9 April 1997, *Ruokolainen, K. 10420* (TUR!); Napo: Yasuní National Park, 0–2 km NNE from the oil road at km 38, 200–300 m, 0°38' S 76°27' W, 25 March 1998, *Ruokolainen, K., Markkanen, S. & Tuomisto, H. 11834* (TUR!); Napo: km 49 along the road traversing Yasuní national park. Flood plain of quebrada Bogi, 200–300 m, 0°43' S 76°29' W, 14 April 1996, *Ruokolainen, K., Tuomisto, H., Poulsen, A., Moran, R., Quintana, C., Cañas, G. & Celi, J. 10332* (TUR!); Napo: Yasuní national park, close to the end of a side road branching at km 43, 200–300 m, 0°39' S 76°21' W, 19 April 1996, *Ruokolainen, K., Tuomisto, H., Poulsen, A., Moran, R., Quintana, C., Cañas, G. & Celi, J. 10370* (TUR!); Orellana: Vía de acceso Chiruisal-Río Tiputini, colecciones en los alrededores del km 4+230—Puente de dosel Chichico, 200–220 m, 0°37'49" S 75°54'8" W, 12 September 2005, *Pérez, A.J., Yandún, S., Endara, M.J., Cuadros, F. & Santillán, W. 5240* (W!, QCA); Tungurahua: colecciones a lo largo de la vía Río Negro—La Estancia (4.8 km), y sendero al Río Encanto (500 m), 1,600–1,800 m, 1°27'4" S 78°13'37" W, 25 February 2012, *Pérez, A.J. & Vallejo, M. 5240* (W!, QCA). PERU. Cuzco: Quispicanchis, Punkiri, 470 m, 2 March 1965, *Vargas 16089* (US!); Huánuco: vicinity of Tingo María, Pucayacu, Río Monzón, 882 m, 29 February 1964, *Mathias & Taylor 6367* (CAS!, F!, US!); Huánuco: Cachicoto, 800 m, 8 April 1963, *Woytkowski 7850* (F!, HUH!, K!, US!, MO); Loreto: Alto Amazonas, Pastaza (?), Andoas; Carretera Andoas-Huayurí km 22; transect direction 170° (TR 2, Sub 16). 2°44'28" S 76°23'49" W, *Llerena, N. 438* (TUR!); Loreto: Alto Amazonas, Capahuari Sur (Campamento Petrolero), 200 m, 2°51' S 76°20' W, 25 March 1982, *Vásquez, Smith & Jaramillo 3043* (NY!, US!, MO); Loreto: Loreto, close to the village of San Antonio, 150–200 m, 4°32' S 73°38' W, 16 January 1996, *Ruokolainen, K., Tuomisto, H., Koivunen, H., Lusa, E., Bardales, C., Fachín, L. & Torres, G. 8215* (TUR!); Loreto: Mariscal Ramon Castilla, ca. 3,5 km NNW from the village of Puerto Izango, río Yaguasyacu, 100–150 m, 3°16' S 72°0' W, 16 May 1997, *Ruokolainen, K., Tuomisto, H., Vargas, V. & Vormisto, J. 10778* (TUR!); Loreto: Maynas, Sargento Lores, Constancia Norte, 116 m, 4°7'4" S 72°55'17" W, 17 April 1997, *Vásquez, R., Phillips, O., Rojas, R. & Peña, A. 23381* (MO!); Loreto: Maynas, Negro Urco, Río Napo, 160 m, 3°0' S 73°28' W, 21 January 1983, *Gentry, A. & Emmons, L. 39646* (MO!); Loreto: Maynas, SW from the village of Carbajal, terrace of Macambo creek, tributary of río Itaya, 150–200 m, 4°19' S 73°44' W, 11 March 1996, *Ruokolainen, K., Criollo, G., Sarmiento, A., Tuomisto, H. & Vormisto, J. 10241* (TUR!); Loreto: Maynas, Asociación de Productores Libertad Agraria km 8, 100–150 m, 4°9' S 73°5' W, 11 February 1996, *Ruokolainen, K., Criollo, G., Sarmiento, A., Tuomisto, H. & Vormisto, J. 9257* (TUR!); Loreto: Maynas, Quebrada Blanco. ca. 2 km NW from the village of 7 de Julio, 100–150 m, 4°23' S 73°7' W, 9 May 1997, *Ruokolainen, K., Tuomisto, H., Vargas, V. & Vormisto, J. 10739* (TUR!); Loreto: Altura Tuta Pishco on Río Napo, 16 September 1972, *Croat, T. B. 20288* (MO!); Madre de Dios: Tambopata; a 1 hora con 30 minutos del albergue Tambopata Research Center; transect direction 0° (TR 416, Sub 9), 13°7'24" S 69°37'15" W, *Llerena, N. 879* (TUR!); San Martín: San Roque, 1350–1500 m, 8 January 1930, *Williams 7108* (F!, NY!); San Martín: Mariscal Cáceres, Tocache Nuevo, Quebrada Yshichimi, cerca al fundo del Sr. Luis Ludeña, 400 m, 17 October 1980, *Schunke V., J. 12376* (F!, NY!, US!); San Martín: Mariscal Cáceres, Tocache Nuevo, Carretera al Río Tocache, 14 April 1970, *Schunke V., J. 3906* (F!, G!, HUH!, K!, NY!); San Martín: Mariscal Cáceres, Tocache Nuevo, Fundo San Pablo, propiedad del Sr. Paterno Horna (Quebrada de Mote), 450 m, 4 June 1980, *Schunke V., J. 11775* (CAS!).

Specimens interpreted as hybrids between *A. latifolius* and *A. tessmannii*:—see under the latter.

Specimen of uncertain status determined as *A. cf. latifolius*:—COLOMBIA. Comisaría del Putumayo: Río Putumayo en las márgenes del afluente izquierda La Concepción, 225 m, 27 November 1940, *Cuatrecasas 10821* (F!)—lamina margins not prominently ciliate, somewhat protruding K teeth.

Adelobotrys microcarpus Schulman, *sp. nov.* (Fig. 6)

Type:—PERU. Loreto: Alto Amazonas, High rainforest along Río Marañón near Teniente Pinglo, just above Pongo de Manseriche, 250–300 m, 4–7 October 1962 (fl., fr.), *J.J. Wurdack 2070* (holotype NY!; isotypes F!, G!, K!, S!, US!).

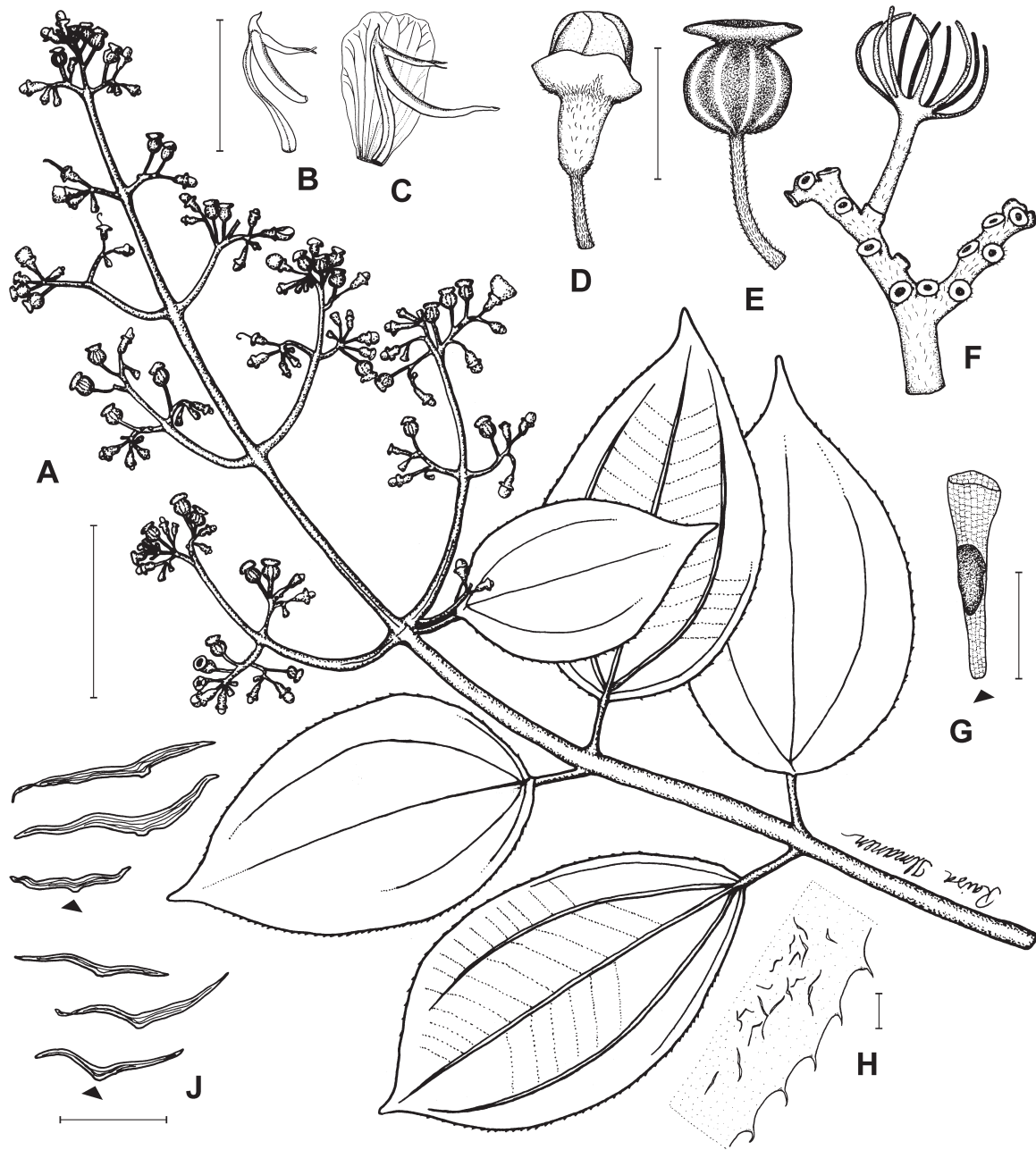


FIGURE 6. *Adelobotrys microcarpus* Schulman, *sp. nov.* A habit showing abaxial (lower- and uppermost leaves) and adaxial sides of laminae, and inflorescence; B smaller (episepalous) stamen; C larger (epipetalous) stamen and petal; D bud showing cylindrical hypanthium, shallowly 5-lobed calyx, and absence of calyx teeth; E fruiting hypanthium with persistent calyx and clear constriction at torus; F remains of old, disintegrated hypanthium (fruit removed) exhibiting costae that are not apically connected by a circular vascular strand, also shown are the strongly elongated branches of the partial inflorescence with scars of fallen-off fruit; G seed with point of attachment to placenta marked; H close-up view of serrulate-setulose lamina margin from abaxial side; J malpighian hairs from lamina abaxial side (lower three from lamina proper, upper three from vein) with point of attachment marked on two hairs. Drawn by R. Ilmanen from *J. J. Wurdack 2070*. Scalebars: for A 5 cm, B–C and D–F 5 mm, G and J 0.5 mm, H 2 mm.

Diagnosis:—*Adelobotrys tessmannii* Markgr. *affinis sed laminis fere glabris marginibus irregulariter serrulato-ciliolatis, partibus ultimis inflorescentiae cincinnis duplicatis ramis perelongatis, floribus minoribus, dentibus exterioribus calycis obsoletis, et hypanthiis in fructu parvis globosis differt.*

Allied to *Adelobotrys tessmannii* Markgr. but differs by having almost glabrous laminae, lamina margins irregularly serrulate-ciliolate, ultimate branching of the inflorescence in the form of double cincinni with strongly elongated branches, smaller flowers, obsolete outer calyx teeth, and small globose fruiting hypanthia.

Full description:—*Liana* adhering to support by adventitious roots to ca. 5 cm long produced in comb-like rows on internodes, reported height of fertile plants (1–)3–10(–15) m. *Stem* slender, diameter in fertile branches to 0.5 cm, terete to somewhat fluted, when very young densely pubescent with dull- to dark-brown, appressed, short (ca. 0.4–1 mm long) malpighian hairs, soon largely glabrescent; stem surface between hairs smooth, dull straw-coloured to brown or greyish; internodes in vegetative parts of fertile stems 4–10 cm long; nodes hardly swollen, not more pubescent than the internodes (apart from densely pubescent axillary buds). *Leaves* opposite, isomorphic. Petiole (1.2–)2.2–4.8(–6.2) cm long (ratio of lamina length to petiole length ranges from 2.3 to 7.5 but is typically around 4.5), ca. 1 mm in diameter; terete but flattened to somewhat grooved above; sparsely to fairly densely covered with brown malpighian hairs at first, glabrescent with age especially below. *Lamina* narrowly ovate to elliptic, (7.5–)8.5–14.5(–16) × (4–)5–7(–8) cm (ratio of length to width 1.7–2.3), base rounded to slightly cordulate, apex acuminate (to almost acute), margin mostly serrulate, often somewhat revolute (in herbarium specimens); chartaceous; in herbarium specimens typically greyish-olive-green with darkish brown veins below, somewhat shiny medium green in living plant. Both surfaces of lamina pubescent with medium- to dark-brown malpighian hairs at first but very soon glabrescent, mature leaves glabrous above (or with a few hairs along main veins), below sparse to medium pubescence remains along main and transverse veins and scattered hairs between them, the hairs being appressed, 0.5–1 mm long, laterally flattened but not dilated (apparently 1 cell layer thick, 2 layers wide), symmetrical to somewhat asymmetrical, sessile to very short-stalked and substraight to slightly sigmoid especially on main vein (and then broadly V- rather than T-shaped); on lamina proper on abaxial side malpighian hairs interspersed with minute, elongate-club-shaped glands (ca. 0.05–0.1 mm long); epidermis of adaxial surface usually with rather dense greyish hemispherical protuberances ca. 0.07 mm across. *Margin of lamina* with sparse ciliolation of tangential malpighian hairs and with persistent, obliquely spreading, pale, multiseriate, terete, unbranched, 0.5–0.7 mm long setulae tipping marginal teeth 1–2 mm apart. *Venation* basally acrodromous with midrib plus four distal main veins, stronger pair of acrodromal veins only somewhat closer to lamina margin than to midrib (distances 1:1–1:1.8), pinnate secondary veins visible below, 0.5–0.8 cm apart; tertiary veins not visible; veins prominent below, flat to somewhat impressed above. Axils of main veins on abaxial side with a few multiseriate, terete, unbranched setulae 0.5–1 mm long, tipped by a multicellular gland, a few such setulae sometimes also present on midrib a couple of cm above the base. *Inflorescence* a terminal, broadly conical, lax double thyrsoid with up to hundreds of flowers; at anthesis (16–)22–25 × 12–18 cm including (4–)6–7.5 cm long peduncle; rachis with 4 elongated internodes, nodes with two main branches consisting of usually 2 or 3 elongated internodes and with two shorter branches (of 1–2 internodes) produced from accessory buds, internodes of rachis, and branches, progressively shorter towards apex; partial inflorescence a double cincinnus with branches bearing up to 12 flowers each, characteristically elongated in fruit and reminiscent of arms of an octopus when only scars of fallen fruits remain. Peduncle subtended by leaves similar to ordinary vegetative leaves; lowermost node of rachis with bracts similar to but smaller than vegetative leaves, upper nodes with progressively smaller and narrower (sub)sessile bracts, bracts at lower nodes persistent but those at upper nodes mostly absent already at anthesis; cincinni subtended by caducous sessile elliptic bracteoles 3–5 × 2–3 mm. Pedicel at anthesis 3–5 mm, slender. *Flower* reportedly with slight sweet fragrance, perigynous, hypanthium coriaceous, cylindrical to ellipsoid, smooth, rather abruptly widening from pedicel, 2.5–3 mm long and 1.5–2 mm wide at torus; calyx spreading-cup-like, shallowly 5-lobed, ca. 1.6 mm long; outer calyx teeth absent to visible as vestigial knobs (to ca. 0.4 mm long), aetose; pedicel with dense, hypanthium and calyx with sparse cover of brown malpighian hairs, hypanthium glabrescent in fruit, calyx sparsely pubescent also on inner side but with rim mostly aciliate; hypanthium reportedly green in living plant but calyx light orange-brown to even purple or blue. *Petals* 5, colour in living plant reportedly (whitish to) pink or purple to lilac or even blue, when dry dull yellow, glabrous; obovate, 5.9–7.1 mm long; venation actinodromous and flabellate. *Stamens* 10, anisomorphic, bent and crowded to one side of flower, glabrous; filaments ca. 4 mm, laterally dilated, strap-like, ca. 0.3 mm wide; geniculate at junction between filament and anther, anther bent introrsely (i.e., with ventral side down). *Anthers* reportedly yellow, subulate, dorsal-arcuate, base rounded; single apical pore ca. 0.2 mm across; connective hardly prolonged between filament and thecae, basally extended into an erect triangular spur, dorsally into a gradually ascending, apically deeply cleft appendage, which is reportedly rosy pink. *Larger (epipetalous) stamens:* thecae clearly arcuate (sometimes even J-shaped), 4.9–5.5 mm long and 0.4 mm thick at base, apical pore dorsally inclined; basal connective appendage

ca. 0.6–0.7 mm long, subulate and variously slightly lobulate, dorsal appendage 2.2–3.2 mm long, cleft by ca. 0.5–0.8 mm. *Smaller (episepalous) stamens*: thecae only slightly arcuate, 3.1–3.9 mm long and 0.4 mm thick at base, apical pore subterminal; basal connective appendage ca. 0.5 mm long, irregularly lobulate, dorsal appendage 2.2–2.6 mm long, cleft by ca. 0.5–0.7 mm. *Ovary* 5-locular, roughly cylindrical, somewhat fluted, truncate at apex, 2.6–3 × 1.2–1.5 mm, glabrous; style 4.9–5.9 mm long, somewhat sigmoid, glabrous; stigma punctate. *Pedicel in fruit* to 5–7 mm. Fruiting hypanthium globose, clearly constricted at torus, 2.5–4.5 × 3–4.5 mm; thin, sparsely pubescent, 10-costate, disintegrating at maturity revealing costae that are not apically connected by a circular vascular strand. Calyx persistent in fruit, horizontally spreading, as wide as hypanthium, 1.4–1.6 mm long. *Fruit* a 5-locular loculicidal capsule completely enveloped by the hypanthium but free from it; globose, somewhat 5-angled, rounded-truncate at apex. Placenta central, sessile and hardly extended from the central column. *Seeds* numerous, narrowly wedge-shaped, ca. 0.9–1 × 0.25 mm; surface smooth to slightly rugose; embryo occupying central third, testa elongated at both ends possibly forming air-filled sacs; testa light brown, embryo darkish brown (in herbarium specimen).

Notes:—This species was marked as *Adelobotrys tessmannii* morphotype 2 in the phylogenetic analysis by Schulman & Hyvönen (2003).

Habitat:—Primary to somewhat disturbed or secondary lowland (to premontane) rainforest, mostly in undulating terrain on lateritic loamy soil. Elevation from 100 to 800 m a.s.l.

Distribution:—Western Amazonia between 67°47' and 78°40' W, from 3°18' S in Loreto to 12°21' S in Madre de Dios, Peru, and in western Brazil (Fig. 3).

Etymology:—The epithet was chosen because this species has notably small fruits, smaller than any other known species in the genus.

Phenology:—Collected with flowers in January–October; with fruits in January–March and May–October.

Conservation:—Least concern (LC), i.e., not threatened. The extent of occurrence clearly exceeds the threshold value of 20,000 km². The available data are too scanty to accurately estimate the true area of occupancy and, especially, population size or trends in it, but there is no plausible reason to estimate that these would approach levels warranting placement in or near threatened categories. However, of the three species treated here, *A. microcarpus* has the smallest extent of occurrence and is, according to currently available data, near-endemic to Peru.

Paratypes:—BRAZIL. Amazonas: ca. 2 km north from the village of Lago do Pupunha, Río Juruá, 100 m, 5°34' S 67°47' W, 1 April 2012, *Ruokolainen, K. with H. Tuomisto, T. Emilio, F. Figueiredo & G. Moulatlet 15966* (TUR!). PERU. Amazonas: Bagua, Imaza, Camino de Yamayakat hacia Kuzú, 270 m, 18 July 1994, *Díaz, C., Jujúa Katip, S. & Peña, A. 6923* (MO!); Amazonas: Bagua, Imaza, Región Nororiental del Marañón, Comunidad de Kampaenza, Ribera de la quebrada Shimutaz., Río Marañón, 320 m, 4°55' S 78°19' W, 7 October 1994, *Jaramillo, N. & Peas, C. 533* (MO!); Amazonas: Bagua, Imaza, Región del Marañón, Comunidad de Yamayakat, Río Marañón, 300 m, 4°55' S 78°19' W, 20 January 1995, *Rodríguez, E. 210* (MO!); Amazonas: Bagua, Imaza, Comunidad de Kampaenza, arriba río Shimutaz, 450 m, 4°55' S 78°19' W, 22 October 1995, *Rodríguez, E. 611* (MO!); Amazonas: Bagua, Imaza, Yamayakat, 350 m, 5°3'20" S 78°20'23" W, 1 June 1996, *Vásquez, R. & Vásquez, A. 21032* (MO!); Amazonas: Bagua, Imaza, Kampaenza, 320 m, 4°55' S 78°19' W, 23 October 1995, *Vásquez, R., Jaramillo, N. & Mayan, C. 20406* (TUR!); Amazonas: Bagua, Senepa, 2nd road from Nuevo Nazareth (Imacita), near mouth of Río Imaza, on Río Marañón, leading inland 2 km to Carretera, 250–300 m, 26 January 1967, *Tillett 671-24* (US!); Amazonas: Bagua, Yamayakat, trocha a Putuim, 400 m, 4°55' S 78°19' W, 16 October 1996, *Vásquez, R. & Jaramillo, N. 20287* (MO!); Amazonas: Condorcanqui, El Cenepa, Comunidad de Mamayaque, 400 m, 4°34'49" S 78°14'1" W, 9 August 1997, *Rojas, R., Peña, A. & Chávez, E. 0251* (MO!); Amazonas: Condorcanqui, El Cenepa, Comunidad de Mamayaque, Cabecera de la quebrada Saasá, 560 m, 4°37'3" S 78°19'57" W, 13 August 1997, *Vásquez, R. & Quiaco, E. 24548* (MO!); Amazonas: Condorcanqui, El Cenepa, Comunidad de Tutino, 340 m, 4°33'5" S 78°12'54" W, 28 July 1997, *Vásquez, R., Ampam, D., Quiaco, E., Ampam, A. & Dupis, C. 24450* (TUR!); Amazonas: Condorcanqui, El Cenepa, Comunidad de San Antonio, Río Cenepa, 300 m, 4°29'30" S 78°10'30" W, 20 June 1997, *Vásquez, R., Peña, A., Chávez, E. & Quiaco, E. 24078* (TUR!); Amazonas: Condorcanqui, El Cenepa, Comunidad de Mamayaque, Río Cenepa, Quebrada Sása, 400 m, 4°37'8" S 78°13'46" W, 6 February 1997, *Vásquez, R., Rojas, R. & Peña, A. 22385* (MO!); Amazonas: Condorcanqui, El Cenepa, Comunidad de Mamayaque, Río Cenepa, Quebrada Sása, 300 m, 4°31'40" S 78°11'40" W, 26 January 1997, *Vásquez, R., Rojas, R., Peña, A., Chávez, E. & Quiaco, E. 22337* (MO!); Amazonas: Río Cenepa, vicinity of Huampami, ca. 5 km E of Chávez Valdivia, el camino de Etseketa-Río Cenepa, 200–250 m, 4°30' S 78°30' W, 10 August 1978, *Ancuash, E. 1381* (MO!); Amazonas: Río Cenepa, vicinity of Huampami, ca. 5 km E of Chávez Valdivia, alrededor de la comunidad Huampami, 200–250 m, 4°30' S 78°30' W, 12 August 1978, *Ancuash, E. 1439* (MO!); Amazonas: Quebrada Kayamas lugar Cenepa, 390 m, 6 April 1973, *Ancuash, E. 186* (HUH!, MO!); Amazonas: Quebrada Huampami, 213 m, 5 May 1973, *Ancuash, E. 328* (F!, HUH!, MO!); Amazonas: Quebrada chigkan entsa,

Río Cenepa, 390 m, 4°30' S 78°30' W, 9 June 1973, *Ancuash, E. 590* (F!, HUH!, MO!); Amazonas: S of Huampami trail to house of Theodora, S of Río Cenepa, 240–255 m, 17 July 1974, *Berlin, B. 1669* (HUH!, MO!); Amazonas: Río Cenepa; 10 km So. of Huampami, 300 m, 16 September 1972, *Berlin, B. 53* (HUH!, MO!); Amazonas: Monte al lado de Huampami, 240–255 m, 29 July 1974, *Kayap, R. 1338* (HUH!, MO!); Amazonas: Río Cenepa, vicinity of Huampami, ca. 5 km E of Chávez Valdívía, al lado de casa de Vicente, Quebrada Apigkan entsa, 200–250 m, 4°30' S 78°30' W, 3 August 1979, *Kujikat, A. 128* (F!, MO!); Amazonas: Río Cenepa, vicinity of Huampami, ca. 5 km E of Chávez Valdívía, alrededor de casa Comunidad, cerca de Huampami, 200–250 m, 4°30' S 78°30' W, 12 August 1978, *Kujikat, A. 300* (F!, MO!); Amazonas: Río Cenepa, vicinity of Huampami, ca. 5 km E of Chávez Valdívía, al lado de Chigkan entsa, Quebrada Aintami, 200–250 m, 4°30' S 78°30' W, 17 August 1978, *Kujikat, A. 410* (MO!); Huánuco: Pachitea, Codo de Pozuzo, alluvial fan floodplain of Río Pozuzo after it emerges from mountains, trail to NW behind settlement, 450 m, 9°40' S 75°25' W, 18 October 1982, *Foster 9258* (AAU!, TEX!, MO); Huánuco: Pachitea; Codo de Pozuzo, alluvial fan floodplain of Río Pozuzo after it emerges from mountains, trail N of settlement to Río Mashoca, 500 m, 9°37' S 75°25' W, 19 October 1982, *Foster 9293* (NY!, TEX!, US!, MO); Loreto: Loreto, Nauta, from km 9.5 of Carretera Nauta-Iquitos ca. 1 km E-wards, 100–200 m, 4°26'44" S 73°35'5" W, 22 September 1998, *Schulman, L. 212* (AMAZ!, TUR!, USM!); Loreto: Mariscal Ramon Castilla, ca. 2 km SW from the village of Puerto Izango, río Yaguasyacu, terrace of río Amazon, 100–150 m, 3°18' S 72°1' W, 19 May 1997, *Ruokolainen, K., Tuomisto, H., Vargas, V. & Vormisto, J. 11122* (TUR!); Loreto: Maynas, ca. 3 km SE from the village of Sta Ana, 150–200 m, 4°6' S 73°7' W, 3 February 1996, *Ruokolainen, K., Criollo, G., Sarmiento, A., Tuomisto, H., Koivunen, H., Lusa, E. & Vormisto, J. 8927* (TUR!); Loreto: Maynas, River Momón, near to the tourist lodge of Amazon Selva Tours, 100–150 m, 3°40' S 73°20' W, 19 May 1986, *Ruokolainen, K., Tuomisto, H., García, M., Ríos, R. & Torres, A. 417* (TUR!); Loreto: Balsapuerto (lower Río Huallaga basin), 350–550 m, 29 August 1929, *Killip, E. P. & Smith, A. C. 28501* (NY!, US!); Loreto: Balsapuerto (lower Río Huallaga basin), 150–350 m, 28–30 August 1929, *Killip, E. P. & Smith, A. C. 28634* (HUH!, NY!, US!); Loreto: Balsapuerto, 220 m, March 1933, *Klug, G. 2948* (BM!, F!, G!, HUH!, K!, NY!, S!); Madre de Dios: Manu, Close to the village of Diamante, southern side of Río Alto Madre de Dios, 400 m, 12°21' S 70°57' W, 23 October 1998, *Ruokolainen, K., Tuomisto, H. & Zegarra, A. 13412* (TUR!); San Martín: San Martín, km 28 of Tarapoto-Yurimaguas road, 750–800 m, 6°27' S 76°19' W, 23 September 1986, *Knapp, S. & Mallet, J. 8386* (MO!); San Martín: Pongo de Cainarachi, Río Cainarachi, tributary of Río Huallaga, 230 m, Sep.–Oct. 1932, *Klug, G. 2603* (BM!, F!, G!, HUH!, K!, NY!, S!, US!); Eastern Peru, *Tessmann 3951* (F!, NY!); Stromgebiet des Maranon von Iquitos aufwärts bis zur Santiago-Mündung am Pongo de Manseriche, 4°28'0" S 77°37'0" W, 1924, *Tessmann 4076* (G!, S!).

Specimens of uncertain status determined as *A. cf. microcarpus*:—BRAZIL. Amazonas: ca. 3 km north-west from the village of Roque, Río Juruá, 100 m, 5°5' S 67°14' W, March 28 2012, *Ruokolainen, K. with H. Tuomisto, T. Emilio, F. Figueiredo & G. Moulatlet 15942* (TUR!); Amazonas: Manaus-Caracarái road, km 72, area of WWF project “Minimal critical size of Ecosystems”, near streamlet of the camp of area “1302”, 30 April 1984, *Renner 914* (AAU!). PERU. Loreto: Requena, ca. 10 km E from Jenaro Herrera, 150–200 m, 4°55' S 73°35' W, 18 September 1998, *Ruokolainen, K., Tuomisto, H. & Cardenas, G. 12914* (TUR!); Loreto: Requena, ca. 2 km N from the biological station of Jenaro Herrera, 150–200 m, 4°52' S 73°39' W, 18 September 1998, *Ruokolainen, K., Tuomisto, H. & Cardenas, G. 12897* (TUR!).—all are sterile, young specimens with insufficient diagnostic characters for unequivocal identification.

Soil preferences:—Of the species treated here, *A. latifolius* was the most frequently observed, with 54 occurrences in a total of 396 inventory transects in the four geographical areas (Fig. 1). The frequency of *A. microcarpus* was less than one third of that (14 transects), and the least frequent was *A. tessmannii* (6 transects). Although all three species are broadly sympatric in the sense that their general distribution areas overlap, they tend not to share the same habitats on a local scale. *Adelobotrys microcarpus* was never observed to co-occur with the two other species, and *A. latifolius* and *A. tessmannii* co-occurred in only one transect.

Adelobotrys latifolius was typically found in forests on soils with relatively high cation concentration, whereas *A. microcarpus* tended to occupy forests on poorer soil (Fig. 7). This pattern was found both in regions where the two species co-occurred (Loreto and Juruá) and in the regions where only one of the two species was found (Madre de Dios and Yasuni). The probability to obtain in Loreto and Juruá by chance an equally or more strongly different average soil cation value for two species with the frequencies observed for *A. latifolius* and *A. microcarpus* were 0.022 and 0.314, respectively. The random probability that these minimum differences coincide and show the same direction (the same species is occupying poorer soils in both regions) is $(0.022 \times 0.314)/2 \approx 0.003$. Accordingly, we can refute the null hypothesis that the species would have no difference in their preference for soil cation concentration. This conclusion

is reinforced by the observed occurrence patterns from regions where the two species were found alone. No statistically significant difference in preferred soil cation concentration was found between *A. tessmannii* and *A. latifolius* ($p = 0.304$), or *A. tessmannii* and *A. microcarpus* ($p = 0.318$).

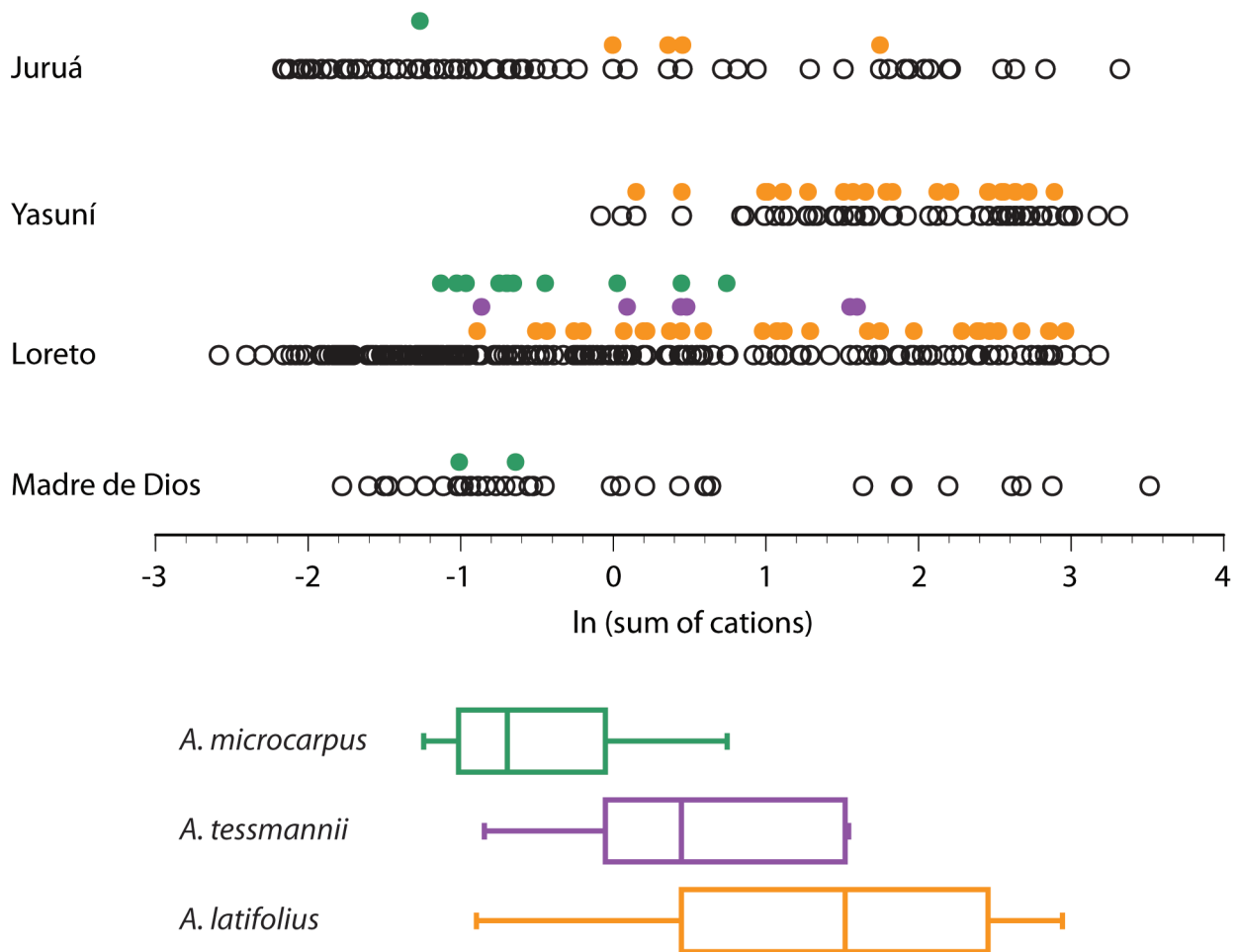


FIGURE 7. The occurrence of three species of *Adelobotrys* in soils of different soil cation concentration in four regions of Amazonian lowland rainforests (Juruá in central Brazil, Yasuní in Ecuador, Loreto in northern Peru, and Madre de Dios in southern Peru). Each open black circle indicates the natural logarithm of the sum of soil cation concentration (Ca+K+Mg+Na cmol(+)/kg) in one inventory transect (see Fig. 1 for locations of transects). The coloured circles indicate the soil cation concentration of an inventory transect where the species have been observed to occur. The box plot summarises, over all regions, the soil variation observed in those inventory transects where the species was encountered. The whiskers of the box embrace the minimum and maximum, the width of the box tells the limits of the first and third quartile, and the vertical line within the box shows the median of the natural logarithm of the sum of cation concentration. Orange colour stands for *A. latifolius*, green for *A. microcarpus*, and violet for *A. tessmannii*.

Most of the inventory transects were established in unflooded (*terra firme*) forests, but 35 of them (12 in Madre de Dios, 10 in Loreto and 13 in Yasuní) were established in floodplain forests that were either well-drained or swampy and dominated by the palm *Mauritia flexuosa*. *Adelobotrys microcarpus* and *A. tessmannii* were exclusively found in *terra firme*, while *A. latifolius* was found in seven floodplain transects in Yasuní, even though in Loreto also this species was encountered only in *terra firme* transects.

We have not tried to analyze possible preferences of the species in relation to topographic variation within the inventory transects. However, *A. latifolius* was clearly found more often along small creeks compared to the other two species.

Discussion

Taxonomy and identification:—Due to the lack of a comprehensive modern treatment of *Adelobotrys*, and rather

superficial original descriptions of most of the species, considerable confusion exists as to the identity of many species in the genus. This is particularly true for the *A. tessmannii*–*A. adscendens* complex *sensu* Schulman & Hyvönen (2003). The ca. 15 species in this group have deeply cleft dorsal connective appendages. This character is commonly used as diagnostic for species of *Adelobotrys*; the appendages of other species may be cleft, notched or entire. However, structures and shapes of the inflorescence, the calyx, the hypanthium in fruit, and, albeit to a more subtle extent, the indument and the shape of the laminae, do vary and provide good diagnostic characters for species in the *A. tessmannii*–*A. adscendens* complex.

The three species treated here, as well as *A. ciliatus* (Naud.) Triana (1871: 68), all possess unbranched setulae along lamina margins. These are never present in *A. adscendens*, in which any ciliation of the lamina is solely of malpighian hairs. Additionally, the relative size of the calyx and the hypanthium in fruit is a consistent diagnostic feature. In *A. adscendens* the calyx is small and clearly narrower than the mature fruiting hypanthium. In *A. ciliatus* the calyx is wider than the hypanthium, and in the three species described in this paper the calyx is as wide as the hypanthium. These three, again, differ from *A. ciliatus* by their much larger and laxer inflorescences.

The best distinguishing features between *A. tessmannii*, *A. latifolius*, and *A. microcarpus* are listed in Table 1.

TABLE 1. Comparison of characters that best distinguish *Adelobotrys tessmannii*, *A. latifolius*, and *A. microcarpus*.

Characters	<i>A. tessmannii</i>	<i>A. latifolius</i>	<i>A. microcarpus</i>
Average lamina shape and size on fertile branches	ovate to wide-elliptic, 10 × 6 cm	ovate to wide-elliptic, 17 × 12 cm	narrow-ovate to elliptic, 12 × 6 cm
Partial inflorescence	to 6+6 flowers, branches slightly elongated in fruit	to 10+10 flowers, branches clearly elongated in fruit	to 12+12 flowers, branches clearly elongated in fruit
Typical length of outer calyx teeth	1.5–2.5 mm	0–0.6 mm	0–0.4 mm
Length of petal	6.5–8 mm	8–10 mm	6–7 mm
Fruiting hypanthium shape and size	ellipsoid to ovoid, 5–6.5 × 4.5–5 mm	globose to ovoid, 5–6 × 4.5–5 mm	globose, 2.5–4.5 × 3–4.5 mm

Ecology and diversity:—In addition to different soil fertility preferences, another diverging ecological factor between *A. latifolius* and *A. microcarpus* appears to be the preference of the former to grow in moist microhabitats. We believe that the seemingly discrepant behaviour of *A. latifolius* of occurring in over half of the floodplain transects in Yasuní, but not in a single such transect in Loreto, can be explained by a difference in the flood cycle between the floodplain forests along the rivers Tiputini and Dícaro of Yasuní and the big Amazon river in Loreto. Tiputini and Dícaro are relatively small rivers that have their catchment area entirely within the almost aseasonal equatorial Amazonian lowlands. Therefore the floodplains of these rivers probably experience only occasional and short inundations, quite apart from the floods of the Amazon and its tributaries of Andean origin that are seasonally predictable and can last for several weeks. The longer-lasting, more severe floods may be too much even for *A. latifolius*, even though it thrives when the inundation pattern is more moderate. Unfortunately we do not have enough field data on *A. tessmannii* to be able to obtain a clear picture of its autecology, and notes on labels of herbarium specimens are not detailed enough to allow comparison with our field studies.

According to the phylogenetic analysis by Schulman & Hyvönen (2003), *Adelobotrys latifolius* (as *A. tessmannii* morphotype 1) and *A. microcarpus* (*A. tessmannii* mt2) are sister species, and *A. tessmannii* is sister to this species pair (hereafter the tessmannii clade). The sister species of the tessmannii clade is *A. fuscescens* Triana (1871: 68), which occurs in Colombia on the western side of the Andes. The three species of the tessmannii clade are morphologically quite similar, whereas *A. fuscescens* deviates from them in many aspects. This phylogenetic hypothesis together with the distribution patterns and habitat preferences presented here suggest a possible diversification history where (1) the dispersal barrier formed by the Andes could be associated with the split between *A. fuscescens* and the tessmannii clade, and (2) ecological specialisation could have driven further speciation on the eastern side of the Andes (cf. Schulman 2003b), or at least enabled the continued existence of closely related species in sympatry. However, more robust phylogenetic hypotheses and a better understanding on the geographical distributions and ecology would be necessary to test these hypotheses.

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