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# Pollen morphology of the Amacayacu Forest dynamics plot, Western Amazon, Colombia

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**ABSTRACT**
Amacayacu Forest Dynamics Plot (AFDP) is a 25-ha (500 m × 500 m) site located at Amacayacu National Natural Park (ANNP), Colombian Amazonia. The flora of AFDP is represented by *terra firme* Forest, the phytophysiognomic unit of the Amazon region with the greatest richness of plant species. However, high-resolution pollen images and morphological descriptions from the Amazon North-west are still rare. This study presents detailed information about pollen grains that will benefit future palynological analyses, particularly of Quaternary material. Herein we describe 255 tree species, comprising 72 families and 192 genera. Those species were grouped into 236 morphotypes. Six species revealed morphological variations among the pollen types within the same species and 36 species were impossible to differentiate from each other. Overall morphology shows apertures with a dominance of tricolporate (61%), inaperturate (5.8%), monocolpate (5.5%), and triporate (4.7%), and variation of sexine sculptures, with dominance of reticulate (66%), scabrate (11.3%), echinate (7.05%) and rugulate (4.3%). With respect to size, the equatorial diameter has a median of 29 µm (SD = 15.5), while the polar diameter has median of 32 µm (SD = 14.7).

**KEYWORDS**
Amacayacu Park; Western Amazon; pollen; morphology; *terra firme* Forest

## 1. Introduction

Amazonian rainforests play an important role in the regional climate of South America, and in the global carbon and hydrological cycles (Tian et al. 1998; Saatchi et al. 2007, 2011; Bustamante et al. 2016; Zuleta et al. 2017). The flora of Amazonia is the richest in the world and includes a large variety of environments such as *terra firme* forests, rainforests, floodplain forests, seasonal forests and even savannas. However, its floristic composition is not yet fully understood (Pitman et al. 2001; Steege et al. 2013; Pimm et al. 2014; Slik et al. 2015; Cardoso et al. 2017). *terra firme* forests in the north-western Amazon are among the most species-rich forests in the world (Valencia et al. 1994; Steege et al. 2003; Lleras et al. 2005; Duque et al. 2017), including not only trees but also lianas (Duivenvoorden 1996; Burn et al. 2010). Western Amazonia has more nutrient-rich soils, a shorter dry season, and a different taxonomic and functional composition of tree species than central and eastern Amazonia (Phillips et al. 1994; Steege et al. 2006).

Amazonian trees show a large disparity in species abundance, with only 227 species accounting for ~50% of the number of trees while 11,000 species represent less than 0.12% of the total number of trees (Steege et al. 2013, 2016). Already other taxonomic studies in the lowland Amazon rainforest, including periodically flooded *terra firme* forests and white-sand forests, have shown 6727 tree species among a total of 14,003 plant species (Cardoso et al. 2017).

Of the 227 most abundant species (Steege et al. 2013), almost half (102) occur in the Amacayacu National Natural Park (ANNP) (south-east of Colombia). Most plant families from ANNP originated in Gondwana, with a centre of endemism influenced by the northern Andes (Prance 1978; Gentry 1982; Rudas and Prieto 1998).

While the floristic composition of Amazonia remains poorly understood, the pollen flora is even less studied. There are relatively few palynological works based upon western Amazonian floras; most have focused on Colombian Amazonia or on the floras near Manaus, Brazil (Carvalho 1971; Carreira and Barth 1986, 2003; Carreira et al. 1996, 2005; Herrera and Urrego 1996; Jimenez 1996; Jimenez and Rangel 1997; Colinvaux et al. 1999; Jimenez et al. 1999, 2008; Rangel et al. 2001; Gurgel et al. 2004; Moura et al. 2004; Bush and Weng 2007; Ferreira et al. 2012; Absy and Rodrigues 2013; Rodrigues et al. 2016).

Here, we describe and illustrate pollen from 255 tree species from a forest plot in the western Amazonia of Colombia (Amacayacu), and describe general trends of pollen morphology within these species.

## 2. Materials and methods

### 2.1. Study area

The Forest Global Earth Observatory (ForestGEO) is a global network of scientists and forest research sites dedicated to advancing the long-term study of the world's forests

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(Anderson-Teixeira et al. 2015). The network has more than 60 forest plots that were established and are monitored following the same protocols (Condit 1998). One of these is the Amacayacu Forest Dynamics Plot (AFDP), located within ANNP, Colombian Amazonia (lat. −3.80917°, long. −70.2679°; elev. 100 m above sea level; Figure 1). This 25-ha plot (500 m × 500 m) was established on *terra firme* forest that grows on Neogene sedimentary bedrock (the Pebas Formation), and it is characterised by a hilly and moderately dissected topography. Amacayacu soils are generally lower in nutrients and have high acidity and low base saturation due to the dominance of kaolinite and quartz (Chamorro 1989).

The mean annual temperature is 25.8 °C, mean annual precipitation is 3.2 m and the relative humidity is ∼86% (Prieto 1994; Rudas 1996; Rudas and Prieto 2005; Barreto-Silva et al. 2014; Duque et al. 2017; Zuleta et al. 2017). According to Köppen (1936), the climate is classified as tropical wet (Af). The entire Amacayacu Park occupies 2930 km$^2$ at the southern end of the Amazon Basin ('Amazon trapezium'). The study area is situated between the Amazon River (between Matamatá Creek and the Amacayacu River) in the south and the Cotuhé River (between Pamaté Creek and Lorena Channel) in the north, and from Cabimas creek in the west to the Purité River in the eastern (Lleras et al. 2005).

All plants with diameter at breast height (dbh) > 1 cm were identified, mapped, tagged, and measured following standard protocols (Condit 1998; Anderson-Teixeira et al. 2015). The census of AFDP, comprising 123,714 individuals, identified 1230 species, with an average diversity of 597.5 species per hectare (Duque et al. 2017), one of the largest in the world.

### 2.2. Description and illustration of modern pollen grains

We aspire to describe the pollen morphology of all 1230 species identified in the AFDP, a major task that will take years of work. In this first work, we describe 255 species. We used the extensive palynological collection housed at the Smithsonian Tropical Institute (STRI; Moreno et al. 2014), which holds the palynological slides for 28,000 mostly Neotropical species. The STRI collection includes the Alan Graham pollen collection, Barro Colorado Island pollen collection and Amazonia collection, among others (Moreno et al. 2014). We searched in our palynological collections for each of the 255 species listed in AFDP and found 133 of them. For the remaining 122 species, we used another species within the same genus as a surrogate for the species in the plot. We chose species that were geographically as close as possible to species from AFDP (Table 1). We analysed all slides available for a given species including the same species from different geographical areas. Descriptions of pollen grains were made using a Nikon Eclipse 80i microscope, following the standard terminology (Punt et al. 2007). Photographs with magnification 40× and 100× were captured using DIC M/N2 system (Difference Interference Contrast Illumination), with a Nikon Digital Camera DXM 1200 F and Nikon ACT-1 version 2.63 image-capturing software. Measurements of the morphological structures of each species were made using ImageJ 1.51n software. There are 1999 pictures, each displaying individual bars representing 10 µm, arranged into 17 plates. The collection information on all botanical species, as well as the England Finder (EF) location coordinates of photographed grains, is included as Supplementary material.

The complete description and illustration of all 255 species were also added to the STRI palynological database (Jaramillo and Rueda 2018), where most pollen morphological characteristics are tabulated, making polytomous searches possible. This database is public and can be accessed over the Internet.

## 3. Results

**Anacardiaceae** R. Brown

*Anacardium excelsum* (Bertero & Balb. ex Kunth) Skeels (Plate 1, figures 1–3, 8–9)

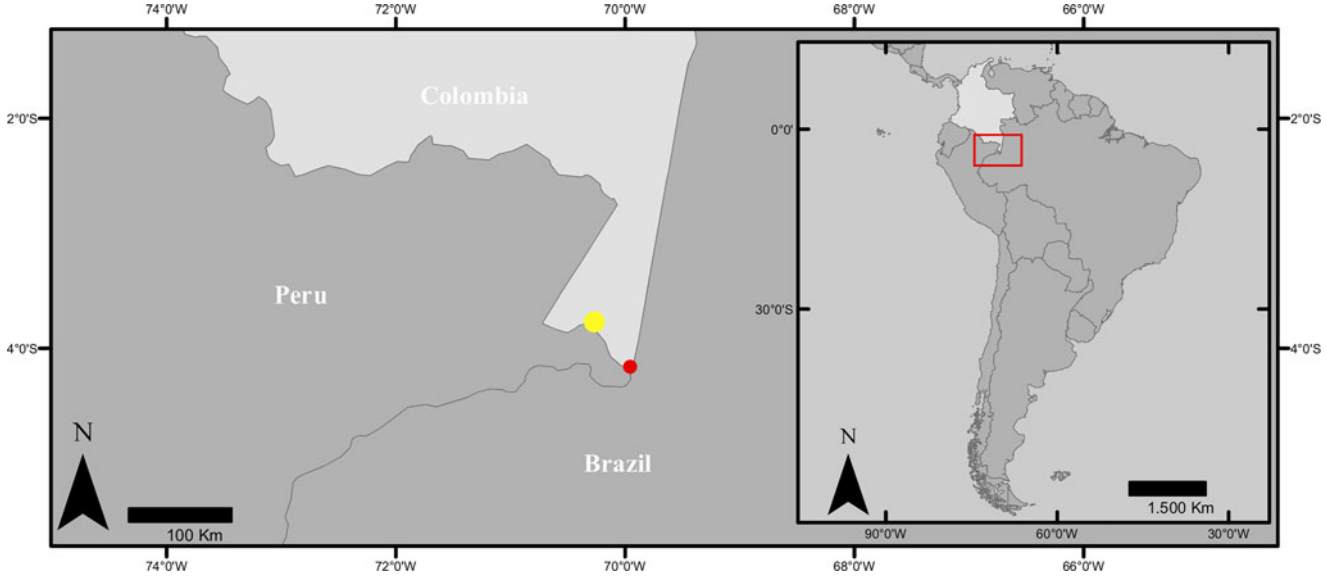



Figure 1. Study area in the Amacayacu National Natural Park (ANNP), Western Amazonia. The yellow circle shows the location of the Amacayacu Forest Dynamics Plot (AFDP) in the ANNP, Colombian Amazonia. The red circle represents the city of Leticia. Source: Authors.

**Table 1.** List of species whose pollen grains are impossible to differentiate from each other under light microscopy.

| Species | Family | Morphotypes | Plates |
|---|---|---|---|
| *Piptocoma discolor* | Asteraceae | Asteraceae | II |
| *Vernonanthura puberula* | Asteraceae | Asteraceae | II |
| *Dussia tessmannii* | Fabaceae | Leguminosae Type A | IV V |
| *Hymenolobium nitidum* | Fabaceae | Leguminosae Type A | V |
| *Vatairea erythrocarpa* | Fabaceae | Leguminosae Type B | VI |
| *Vataireopsis speciosa* | Fabaceae | Leguminosae Type B | VI |
| *Abarema auriculata* | Fabaceae_Mimosoideae | Mimosaceae Type A | VII VII |
| *Inga umbelifera* | Fabaceae_Mimosoideae | Mimosaceae Type A | VIII IX |
| *Abarema barbouriana* | Fabaceae_Mimosoideae | Mimosaceae Type B | VIII |
| *Inga nobilis* | Fabaceae_Mimosoideae | Mimosaceae Type B | VIII |
| *Endopleura uchi* | Humiriaceae | Humiriaceae | IX |
| *Sacoglottis trichogyna* | Humiriaceae | Humiriaceae | IX |
| *Aegiphila integrifolia* | Lamiaceae | Aegiphila | IX |
| *Aegiphila panamensis* | Lamiaceae | Aegiphila | X |
| *Aniba puchury-minor* | Lauraceae | Lauraceae | X |
| *Endlicheria paniculata* | Lauraceae | Lauraceae | X |
| *Theobroma glaucum* | Malvaceae | Theobroma | XI |
| *Theobroma obovatum* | Malvaceae | Theobroma | XI |
| *Adelobotrys adscendens* | Melastomataceae | Adelobotrys Type **B** | **XI** |
| *Adelobotrys tessmannii* | Melastomataceae | Adelobotrys Type B | XI |
| *Clidemia quinquenervia* | Melastomataceae | Melastomataceae | XI |
| *Tococa caquetana* | Melastomataceae | Melastomataceae | XI |
| *Compsoneura capitellata* | Myristicaceae | Compsoneura | XII |
| *Compsoneura sprucei* | Myristicaceae | Myristicaceae | XII |
| *Piper arboreum* | Piperaceae | Piper | XIII |
| *Piper obliquum* | Piperaceae | Piper | XIII |
| *Triplaris americana* | Polygonaceae | Triplaris Type A | XIII |
| *Triplaris cumingiana* | Polygonaceae | Triplaris Type C | XIII |
| *Paullinia cupana* | Sapindaceae | Paullinia Type B | XV |
| *Paullinia rugosa* | Sapindaceae | Paullinia Type B | XV |
| *Chrysophyllum africanum* | Sapotaceae | Chrysophyllum Type A | XV |
| *Chrysophyllum cainito* Type 1 | Sapotaceae | Chrysophyllum Type A | XV |
| *Chrysophyllum argenteum* Type 1 | Sapotaceae | Chrysophyllum Type C | XV |
| *Chrysophyllum argenteum* Type 2 | Sapotaceae | Chrysophyllum Type D | XV |
| *Cestrum nocturnum* | Solanaceae | Cestrum | XVI |
| *Cestrum schlechtendahlii* | Solanaceae | Cestrum | XVI |
| *Cecropia peltata* | Urticaceae | Urticaceae | XVI |
| *Pourouma bicolor* | Urticaceae | Urticaceae | XVI |
| *Cecropia obtusifolia* | Urticaceae | Cecropia Type B | XVI |
| *Cecropia pachystachya* | Urticaceae | Cecropia Type B | XVI |

Monad; prolate spheroidal, subprolate; amb circular; isopolar; symmetry radial; tricolporate; pores lalongate; colpi thin; exine tectate; striatoreticulate; columellae smaller than 1 µm; equatorial view length 34.5 µm (29–41, n = 10); equatorial view width 29 µm (26–32, n = 10); polar view length 27.8 µm (27–29, n = 4); colpi length 28.2 µm (18.9–34.2, n = 5); pore length 9.4 µm (8.9–10.5, n = 5); pore width 6.9 µm (4.8–8.6, n = 5).

*Tapirira guianensis* Aubl. (Plate 1, figures 4–7,14–15)

Monad; subprolate, prolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; apex acute; exine tectate; columellae indistinct; striate. There are inconspicuous reticula; equatorial view length 27.1 µm (24–33, n = 11); equatorial view width 19.9 µm (18–23, n = 11); polar view length 22.1 µm (18–28, n = 9); colpi length 22.4 µm (20–29, n = 7); pore length 7.8 µm (5.8–10.3, n = 6); pore width 4.4 µm (2.8–5, n = 6).

**Annonaceae** Juss.

*Annona cacans* Warm. (Plate 1, figures 11–13)

Tetrad tetragonal; isolated grains asymmetric; inaperturate; exine intectate; clavate; clavae conspicuous and smaller than 1 µm; equatorial view length 80.9 µm (66–90, n = 10); equatorial view width 60.7 µm (54–77, n = 10).

*Cremastosperma novogranatense* R.E. Fr. (Plate 1, figures 10, 20)

Tetrad tetragonal; isolated grains asymmetric; inaperturate; exine tectate; columellae indistinct, smaller than 1 µm; simplicolumellate; reticulate; homobrochate; lumina smaller than 1 µm; equatorial view length 72.7 µm (63–83, n = 9); equatorial view width 87 µm (78–104, n = 9).

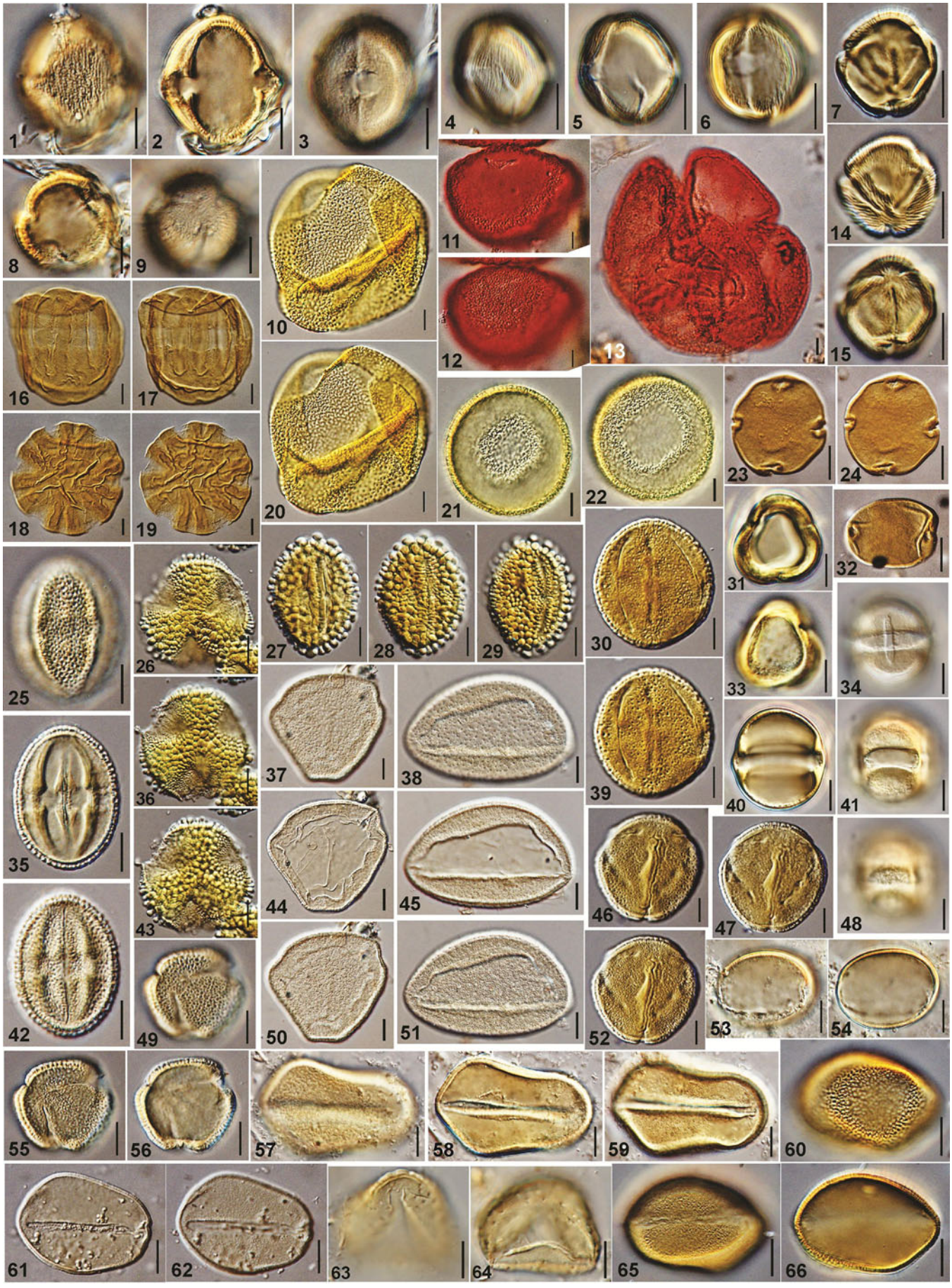
*Rollinia salicifolia* Schltdl. (Plate 1, figures 21–22)

Monad; spherical; amb circular; symmetry radial; inaperturate; exine semitectate; columellae conspicuous and greater than 1 µm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 µm; equatorial view length 44.5 µm (36–56, n = 10); equatorial view width 47.2 µm (42–57, n = 10).

Apocynaceae Juss.

*Aspidosperma megalocarpon* Müll. Arg. (Plate 1, figures 16–19)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; stephanocolporate; pore lalongate; 12-colpori; with margin and apex obtuse; exine tectate; columellae indistinct; scabrate; equatorial view length 64.3 µm (58–69, n = 9); equatorial view width 55.3 µm (51–59, n = 9); polar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view length 66 μm (61–70, n = 9); colpi length 39.2 μm (34.4–46.6, n = 5); pore length 8.7 μm (8.7–8.7, n = 1); pore width 7.6 μm (7.6–7.6, n = 1).

*Lacmellea gracilis* (Müll. Arg.) Markgr. (Plate 1, figures 23–24, 32)

Monad; suboblate; amb circular; isopolar; symmetry bilateral; dicolporate and tetracolporate, brevicolpate; exine tectate; columellae indistinct; scabrate; equatorial view length 21 μm (20–22, n = 2); equatorial view width 26.5 μm (26–27, n = 2); polar view length 26.2 μm (21–29, n = 9).

*Tabernaemontana longipes* Donn. Sm. (Plate 1, figures 31, 33–34, 40–41, 48)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pores lalongate; brevicolpate, with costa endocolpi and apex obtuse; exine tectate; columellae indistinct. Nexine thicker in equatorial region; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 32.7 μm (31–34, n = 10); equatorial view width 29.1 μm (27–30, n = 10); polar view length 29.3 μm (29–30, n = 3); colpi length 15.5 μm (15.5–15.5, n = 1); pore length 20.2 μm (20.2–20.2, n = 1); pore width 6.2 μm (6.2–6.2, n = 1).

**Aquifoliaceae** Bercht. & J. Presl

*Ilex integerrima* reissek (Plate 1, figures 26–29, 36, 43)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pores lalongate; colpus with constriction; exine intectate; clavate, clavae with different sizes; equatorial view length 42.8 μm (40–46, n = 10); equatorial view width 32.5 μm (30–35, n = 10); polar view length 42.2 μm (39–48, n = 8); colpi length 28.4 μm (24.7–33.1, n = 8).

**Araliaceae** Juss.

*Dendropanax monogynum* (Vell.) Seem. (Plate 1, figures 30, 39, 46–47, 52)

Monad; subprolate and prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pores lalongate; apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 46.6 μm (42–49, n = 8); equatorial view width 41.6 μm (37–46, n = 8); polar view length 45.6 μm (44–47, n = 5); colpi length 32.4 μm (28.4–34.3, n = 7); pore length 7.4 μm (7.4–7.4, n = 2); pore width 4.9 μm (4.8–5, n = 2).

*Schefflera bangii* Harms (Plate 1, figures 25, 35, 42, 49, 55–56)

Monad; prolate, subprolate; amb circular; isopolar; symmetry radial; tricolporate; pores lalongate; colpi with margin, costa endocolpi, apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; colpi length 24.3 μm (22.1–28, n = 9); colpi width 1 μm (1–1, n = 2); pore length 7.3 μm (6.2–8.5, n = 6); pore width 3.8 μm (3.4–4.2, n = 6).

**Arecaceae** Bercht. & J. Presl

*Astrocaryum acaule* Mart. (Plate 1, figures 37–38, 44–45, 50–51)

Monad; anisopolar; two types, symmetry bilateral, radial; monosulcate (monocolpate), and symmetry radial when trichotomosulcate; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 43 μm (41–45, n = 2); equatorial view width 61.5 μm (59–64, n = 2); polar view length 50.7 μm (43–56, n = 7).

*Attalea anisitsiana* (Barb. Rodr.) Zona (Plate 1, figures 57–59)

Monad; anisopolar; symmetry bilateral; monosulcate (monocolpate); with margin (1.347–1.629 μm), apex obtuse; exine intectate; baculate, baculae smaller than 1 μm; equatorial view length 26.5 μm (20–31, n = 10); equatorial view width 52.5 μm (45–63, n = 10); colpi length 44.8 μm (37.6–50.9, n = 8); colpi width 3 μm (2.4–3.9, n = 5).

*Bactris concinna* Mart. (Plate 1, figures 63–64; Plate 2, figures 1–3)

Monad; anisopolar; two types, symmetry bilateral, monosulcate (monocolpate), and symmetry radial when trichotomosulcate; apex obtuse; exine tectate; columellae indistinct; micropitted; equatorial view length 20.3 μm (14–25, n = 9); equatorial view width 38.8 μm (35–42, n = 9); colpi length 25.4 μm (12.3–33.2, n = 6).

*Chamaedorea tepejilote* Liebm. (Plate 1, figures 53–54)

Monad; anisopolar; symmetry bilateral; monosulcate (monocolpate); colpus irregular and as long as grain; exine tectate; columellae indistinct; psilate; equatorial view length 24.3 μm (22–27, n = 10); equatorial view width 28.4 μm (26–33, n = 10).

*Desmoncus polyacanthos* Mart. (Plate 1, figures 60, 65–66)

Monad; anisopolar; symmetry bilateral; monosulcate (monocolpate), colpus as long as grain; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 26.3 μm (23–30, n = 10); equatorial view width 38.8 μm (35–42, n = 10); colpi length 34.3 μm (33.2–35.4, n = 2); colpi width 1.3 μm (1.3–1.3, n = 1).

**Plate 1.** The scale bars represent 10 μm. Photographs were taken at 100× magnification, with the exception of figure 3 (40× magnification). Ev = equatorial view; Pv = polar view; Gv = general view. **Anacardiaceae:** *Anacardium excelsum* (Ev: 1–3; Pv: 8–9); *Tapirira guianensis* (Ev: 4–6; Pv: 7, 14–15). **Anonnaceae:** *Annona cacans* (Isolated Grain 11–12, Tetrad: 13); *Crematosperma novogranatense* (Gv: 10, 20); *Rollinia salicifolia* (Gv: 21–22). **Apocynaceae:** *Aspidosperma megalocarpon* (Ev: 16–17; Pv: 18–19); *Lacmellea gracilis* (4-colporate PV: 23–24; 2-colporate EV: 32); *Tabernaemontana longipes* (Ev: 34, 40–41, 48; Pv: 31, 33); **Aquifoliaceae:** *Ilex integerrima* (Ev: 27–29; Pv: 26, 36, 43). **Araliaceae:** *Dendropanax monogynus* (Ev: 30, 39; Pv: 46–47, 52); *Schefflera bangii* (Ev: 25, 35, 42; Pv: 49, 55–56); **Arecaceae:** *Astrocaryum acaule* Type 1 (Ev: 37, 44, 50), *Astrocaryum acaule* Type 2 (Ev: 38, 45, 51); *Attalea anisitsiana* (Ev: 57–59); *Bactris concinna* Type 1 (Ev: 63–64); *Chamaedorea tepejilote* (Ev: 53–54); *Desmoncus polyacanthos* (Ev: 60, 65–66); *Geonoma elegans* (Ev: 61–62).

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*Geonoma elegans* Mart. (Plate 1, figures 61–62)

Monad; anisopolar; symmetry bilateral; monosulcate (monocolpate), colpus as long as grain, apex obtuse; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 27.8 μm (23–30, n = 9); equatorial view width 37.7 μm (36–41, n = 9); colpi length 32.1 μm (31.8–32.4, n = 2).

*Hyospathe elegans* Mart. (Plate 2, figures 4–6, 14) 2 types

Monad; anisopolar; two types, symmetry bilateral, monosulcate (monocolpate), and symmetry radial when trichotomosulcate; apex obtuse; exine tectate; columellae indistinct, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 23.6 μm (19–29, n = 11); equatorial view width 35 μm (30–38, n = 11); colpi length 34 μm (31.2–36.5, n = 6).

*Oenocarpus circumtextus* Mart. (Plate 2, figures 7–9)

Monad; anisopolar; symmetry bilateral; monosulcate (monocolpate); apex obtuse, with margin (2.012–2.281 μm); exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 42.4 μm (38–53, n = 10); equatorial view width 56.3 μm (12–66, n = 10); colpi length 48.5 μm (38.3–56, n = 5); colpi width 13.5 μm (10–18.6, n = 5).

*Socratea exorrhiza* (Mart.) H. Wendl. (Plate 2, figures 10–12)

Monad; anisopolar; symmetry bilateral; monosulcate (monocolpate); as long as grain; exine intectate; echinate; echinae conical, with sharp and base broad (2.064 μm); equatorial view length 52.9 μm (45–64, n = 10); equatorial view width 58.3 μm (50–69, n = 10).

**Asteraceae** Bercht. & J. Presl

*Piptocoma discolor* (Kunth) Pruski (Plate 2, figures 15–19)

Monad; oblate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; colpus as long as grain; exine tectate; columellae indistinct; echinate; echinae conical and sharp (10.326–13.253 μm); equatorial view length 60 μm (54–68, n = 4); equatorial view width 51.5 μm (45–63, n = 4); polar view length 54 μm (51–61, n = 6); colpi length 34.1 μm (34.1–34.1, n = 1).

*Vernonanthura puberula* (Less.) H. Rob. (Plate 2, figures 20–21, 28–29)

Monad; spherical; amb circular; isopolar; symmetry radial; tricolporate; exine tectate; columellae conspicuous and digitate; echinate; echinae sharp and conical (8.112–10.377 μm); equatorial view length 54.3 μm (50–62, n = 3); equatorial view width 49 μm (46–53, n = 3); polar view length 50.1 μm (44–55, n = 10).

**Bignoniaceae** Juss.

*Jacaranda copaia* (Aubl.) D. Don (Plate 2, figures 13, 22, 30, 39, 48)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpus with constriction, margin (1.321 μm) and apex obtuse; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 45.9 μm (43–50, n = 9); equatorial view width 34.2 μm (31–37, n = 9); polar view length 45.9 μm (40–52, n = 10); colpi length 29.3 μm (2.6–40.3, n = 4); colpi width 2 μm (1.3–2.6, n = 3); pore length 5.6 μm (5.6–5.6, n = 1); pore width 2.8 μm (2.8–2.8, n = 1).

**Boraginaceae** Juss.

*Cordia nodosa* Lam. (Plate 2, figures 23–27, 37)

Monad; spherical; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 42 μm (41–43, n = 2); equatorial view width 40.5 μm (40–41, n = 2); polar view length 48 μm (42–53, n = 8); colpi length 23.5 μm (18.6–28.4, n = 2); pore length 6 μm (6–6, n = 1); pore width 3.7 μm (3.7–3.7, n = 1).

*Cordia spinescens* L. (Plate 2, figures 31–33)

Monad; spherical; isopolar; symmetry radial; triporate; pore circular; exine tectate; columellae conspicuous and greater than 1 μm, simplicolumellate; reticulate; homobrochate; muri width 0.747–2.012 μm and lumina width 2.017–5.867 μm; equatorial view length 50 μm (41–61, n = 10); equatorial view width 50.1 μm (40–62, n = 10).

**Burseraceae** Kunth

*Crepidospermum goudotianum* (Tul.) Triana & Planch. (Plate 2, figures 43–44, 51–52)

Monad; prolate; amb triangular-obtuse-convex; isopolar; symmetry radial; tricolporate; pore lalongate; colpi 2/3 as long as grain, apex acute; exine tectate; columellae indistinct; nexine thicker in equatorial region (1.088–3.120 μm); psilate; equatorial view length 39.3 μm (35–45, n = 9); equatorial view width 27.7 μm (23–31, n = 9); polar view length 26.5 μm (23–30, n = 6); colpi length 27.3 μm (23.6–29.4, n = 5); pore length 8.8 μm (6.2–11.6, n = 5); pore width 9.1 μm (2.8–29.4, n = 5).

Plate 2. The scale bars represent 10 μm. Photographs were taken at 100× magnification. Ev = equatorial view; Pv = polar view; Gv = general view. **Arecaceae:** *Bactris concinna* Type 2 (Ev: 1–3); *Hyospathe elegans* Type 1 (Ev: 4–5), *Hyospathe elegans* Type 2 (Ev: 6, 14); *Oenocarpus circumtextus* (Ev: 7–9); *Socratea exorrhiza* (Ev: 10–12). **Asteraceae:** *Piptocoma discolor* (Ev: 15–16; Pv: 17–19); *Vernonanthura puberula* (Ev: 20, 28; Pv: 21, 29). **Bignoniaceae:** *Jacaranda copaia* (Ev: 13, 22, 30; Pv: 39, 48). **Boraginaceae:** *Cordia nodosa* (Ev: 26–27, 37; Pv: 23–25); *Cordia spinescens* (Ev: 31–33). **Burseraceae:** *Crepidospermum goudotianum* (Ev: 43–44; Pv: 51–52); *Dacryodes acutipyrena* (Ev: 40–41; Pv: 42, 49–50); *Dacryodes excelsa* (Ev: 53–55; Pv: 59–60); *Dacryodes glabra* (Ev: 34–36; Pv: 45–46); *Protium apiculatum* (Ev: 38, 47, 68; Pv: 56, 69, 78); *Protium brasiliense* (Ev: 61–62; Pv: 57–58); *Tetragastris panamensis* (Ev: 76–77, 85; Pv: 66–67, 75); *Trattinnickia aspera* (Ev: 64–65; Pv: 63,72). **Calophyllaceae:** *Caraipa densiflora* (Ev: 74, 83–84; Pv: 73, 82); *Mahurea exstipulata* (Ev: 86–87, 96; Pv: 94–95); *Marila laxiflora* (Ev: 70–71, 79; Pv: 80–81). **Cannabaceae:** *Celtis iguanaea* (Pv: 88–90); *Celtis schippii* (Ev: 91–93).

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*Dacryodes acutipyrena* Cuatrec. (Plate 2, figures 40–42, 49–50)

Monad; spherical; amb circular; isopolar; symmetry radial; stephanocolporate; pore lalongate; 4-colporate; apex acute; exine tectate; columellae indistinct; scabrate; equatorial view length 27.6 μm (22–35, n = 9); equatorial view width 27.6 μm (21–32, n = 9); polar view length 27 μm (22–34, n = 10); colpi length 16.1 μm (13.5–18, n = 6); pore length 3.5 μm (2.7–4.4, n = 6); pore width 2.4 μm (1.9–3.2, n = 6).

*Dacryodes excelsa* Vahl (Plate 2, figures 53–55, 59–60)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpus apex acute; exine tectate; columellae indistinct; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 38.7 μm (33–45, n = 10); equatorial view width 33.3 μm (27–43, n = 10); polar view length 39.8 μm (35–44, n = 10); colpi length 22.3 μm (18.7–26.3, n = 5); pore length 7.3 μm (6–8.8, n = 5); pore width 4.9 μm (3.9–6, n = 5).

*Dacryodes glabra* (Steyerm.) Cuatrec. (Plate 2, figures 34–36, 45–46)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpus apex acute; exine tectate; columellae indistinct; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 40.9 μm (35–44, n = 10); equatorial view width 33.3 μm (29–37, n = 10); polar view length 36.8 μm (31–44, n = 8); colpi length 22.2 μm (19.4–23.8, n = 5); pore length 7.2 μm (6.3–7.9, n = 5); pore width 5.3 μm (4.3–6.2, n = 5).

*Protium apiculatum* Swart (Plate 2, figures 38, 47, 56, 68–69, 78)

Monad; subprolate, prolate; amb triangular-obtuse-convex; isopolar; symmetry radial; tricolporate; pore lalongate; exine tectate; columellae indistinct; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 32.7 μm (25–38, n = 10); equatorial view width 22.9 μm (17–26, n = 10); polar view length 23 μm (18–29, n = 10); colpi length 24.1 μm (20.5–27.1, n = 7); pore length 6.1 μm (4.9–7.5, n = 7); pore width 4 μm (2.8–5, n = 7).

*Protium brasiliense* (Spreng.) Engl. (Plate 2, figures 57–58, 61–62)

Monad; suboblate, prolate spheroidal; amb triangular-obtuse-convex; isopolar; symmetry radial; tricolpate; pore lalongate; apex acute; exine tectate; columellae indistinct, nexine thicker than sexine; psilate; equatorial view length 28.5 μm (25–32, n = 10); equatorial view width 24.6 μm (19–27, n = 10); polar view length 25.8 μm (22–30, n = 9); colpi length 18.5 μm (14.7–23.3, n = 8); pore length 6.6 μm (5.1–8.6, n = 8); pore width 3.1 μm (2.2–4.1, n = 8).

*Tetragastris panamensis* (Engl.) Kuntze (Plate 2, figures 66–67, 75–77, 85)

Monad; subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; apex acute; exine tectate; columellae indistinct; reticulate; lumina smaller than 1 μm; equatorial view length 34.9 μm (28–40, n = 9); equatorial view width 26.7 μm (22–29, n = 9); polar view length 24.9 μm (20–32, n = 9); colpi length 22.2 μm (16.8–25.6, n = 9); pore length 6.9 μm (5.9–8.1, n = 8); pore width 3.3 μm (2–4.7, n = 8).

*Trattinnickia aspera* (Standl.) Swart (Plate 2, figures 63–65, 72)

Monad; subprolate; amb triangular-obtuse-convex; isopolar; symmetry radial; tricolporate; pore lalongate; apex acute; exine tectate; columellae indistinct; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 50.7 μm (43–57, n = 10); equatorial view width 44.2 μm (38–48, n = 10); polar view length 40.3 μm (34–45, n = 10); colpi length 29.1 μm (23.1–38.6, n = 10); pore length 10 μm (8.4–15, n = 10); pore width 4.3 μm (2.2–7.1, n = 10).

**Calophyllaceae** J. Agardh

*Caraipa densifolia* Mart. (Plate 2, figures 73–74, 82–84)

Monad; subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction and margin (1.088–1.495 μm), apex acute; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 27.2 μm (24–30, n = 8); equatorial view width 22.1 μm (17–26, n = 8); polar view length 23.2 μm (18–26, n = 9); colpi length 21.5 μm (17.3–23.7, n = 4); pore length 7.3 μm (7.3–7.4, n = 2); pore width 4.4 μm (4.1–4.8, n = 2).

*Mahurea exstipulata* Benth. (Plate 2, figures 86–87, 94–96)

Monad; prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction and margin (1.030–1.152 μm), apex acute; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 36.5 μm (28–41, n = 10); equatorial view width 24.6 μm (22–29, n = 10); polar view length 26 μm (26–26, n = 1); colpi length 29.1 μm (26.6–34.6, n = 5); colpi width 2.9 μm (2.9–2.9, n = 1).

*Marila laxiflora* Rusby (Plate 2, figures 70–71, 79–81)

Monad; prolate spheroidal, spherical; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; exine tectate;

**Plate 3.** The scale bars represent 10 μm. Photographs were taken at 100× magnification, with the exception of figure 97 (40× magnification). Ev = equatorial view; Pv = polar view; Gv = general view. **Cannabaceae:** *Celtis schippii* (Pv: 1–3); *Trema micrantha* (Pv: 4–5). **Cardiopteridaceae:** *Citronella incarum* (Ev: 11–12; Pv: 13–14); *Dendrobangia multinervia* (Ev: 8, 16–17; Pv: 6–7, 15). **Celastraceae:** *Maytenus cassineformis* (Ev: 9–10, 18–19; Pv: 20–25); *Salacia pyriformis* (Ev: 26, 36; Pv: 45, 54, 63). **Clusiaceae:** *Calophyllum longifolium* (Ev: 27–30; Pv: 31–33); *Chrysochlamys dependens* (Pv: 34–35, 43–44, 52–53); *Clusia alata* (Ev: 61–62, 71; Pv: 72, 81, 84); *Garcinia binucao* (4-porate Pv: 37–39; 3-porate Pv: 46–47); *Garcinia multiflora* (Ev: 40–42; Pv: 49–51); *Tovomita stylosa* (Ev: 58–60, 70; Pv: 67–68). **Connaraceae:** *Connarus panamensis* (Ev: 48, 57, 66; Pv: 55–56); *Rourea glabra* (Ev: 73–75; Pv: 64–65). **Dichapetalaceae:** *Dichapetalum axilare* (Pv: 90–91). **Ebenaceae:** *Diospyros virginiana* (Ev: 76–78; Pv: 69, 79–80). **Erythroxylaceae:** *Erythroxylum panamense* (Ev: 85–86, 95–96; Pv: 87–89). **Euphorbiaceae:** *Conceveiba guianensis* (Ev: 82–83, 92–93; Pv: 100–102); *Croton ortholobus* (Ev: 97–99); *Hevea brasiliensis* (Ev: 94, 103).

columellae indistinct; verrucate; colpi length 26.3 μm (22.4–28.8, n = 6).

**Cannabaceae** Martinov

*Celtis iguanaea* (Jacq.) Sarg. (Plate 2, figures 88–90)

Monad; oblate spheroidal; amb circular; isopolar; symmetry radial; triporate; exine tectate; columellae conspicuous, type pilum, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 28.4 μm (21–32, n = 5); equatorial view width 29.4 μm (21–33, n = 5); polar view length 28 μm (25–33, n = 3); pore length 3 μm (2.2–3.5, n = 5); pore width 2.7 μm (1.7–3.7, n = 5).

*Celtis schippii* Standl. (Plate 2, figures 91–93; Plate 3, figures 1–3)

Monad; oblate; circular; isopolar; symmetry radial; stephanoporate (4-porate); pores lolongate; exine tectate; columellae indistinct; scabrate; equatorial view length 18.4 μm (17–20, n = 5); equatorial view width 21.2 μm (20–22, n = 5); polar view length 22 μm (21–23, n = 5); pore length 2.1 μm (1.9–2.4, n = 2); pore width 3.8 μm (3.3–4.3, n = 2).

*Trema micrantha* (L.) Blume (Plate 3, figures 4–5)

Monad; elliptic; isopolar; symmetry bilateral; diporate; exine tectate; columellae indistinct; scabrate, there are some granula; equatorial view length 27.1 μm (25–32, n = 10); equatorial view width 28.9 μm (25–35, n = 10).

**Cardiopteridaceae** Blume

*Citronella incarum* (J.F. Macbr.) R.A. Howard (Plate 3, figures 11–14)

Monad; subprolate and prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with apex acute; exine tectate; columellae conspicuous, type pilum, simplicolumellate; reticulate; homobrochate; equatorial view length 31.6 μm (20–37, n = 10); equatorial view width 23.6 μm (22–28, n = 10); polar view length 24.9 μm (21–35, n = 10); colpi length 21.8 μm (20–23.7, n = 5).

*Dendrobangia multinervia* Ducke (Plate 3, figures 6–8, 15–17)

Monad; subprolate and prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpus with constriction and margin; apex acute; exine tectate; columellae conspicuous smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 30.5 μm (29–32, n = 10); equatorial view width 26.3 μm (24–30, n = 10); polar view length 29.8 μm (26–33, n = 10); colpi length 21.9 μm (18.7–24.7, n = 3).

**Celastraceae** R. Br.

*Maytenus cassineformis* Reissek (Plate 3, figures 9–10, 18–19, 25)

Monad; subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore circular; exine tectate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 38.7 μm (35–44, n = 10); equatorial view width 31 μm (28–35, n = 10); polar view length 35 μm (33–37, n = 3); colpi length 24.4 μm (21–29, n = 6); pore length 6.5 μm (3.9–8.6, n = 5); pore width 5.6 μm (1.1–10.3, n = 5).

*Salacia pyriformis* (Sabine) Steud. (Plate 3, figures 26, 36, 45, 54, 63)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpus with margin and apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate and duplicolumellate; reticulate; heterobrochate; lumina width 1.040–2.055 μm; equatorial view length 34.7 μm (31–40, n = 9); equatorial view width 29.4 μm (27–34, n = 9); polar view length 32.9 μm (28–37, n = 8); colpi length 26.9 μm (24.7–32.2, n = 7); pore length 5.2 μm (4.9–5.4, n = 2); pore width 4.2 μm (3.9–4.5, n = 2).

**Clusiaceae** Lindl.

*Calophyllum longifolium* Willd. (Plate 3, figures 27–33)

Monad; subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with margin, apex acute; exine tectate; columellae conspicuous and smaller than 1 μm; simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 38.7 μm (34–42, n = 10); equatorial view width 35.3 μm (32–38, n = 10); polar view length 36.1 μm (33–41, n = 9); colpi length 22.7 μm (8.8–29.3, n = 10); colpi width 2.7 μm (1.5–3.4, n = 9); pore length 9.6 μm (8.8–10, n = 3); pore width 5.8 μm (3.2–7.9, n = 3).

*Chrysochlamys dependens* Planch. & Triana (Plate 3, figures 34–35, 43–44, 52–53)

Monad; spherical; circular; isopolar; symmetry radial; tricolporate; pore circular; brevicolpate; exine intectate; echinate; echinae smaller than 1 μm; equatorial view length 20 μm (20–20, n = 1); equatorial view width 21 μm (21–21, n = 1); polar view length 19.2 μm (16–22, n = 9).

*Clusia alata* Planch. & Triana (Plate 3, figures 61–62, 71–72, 81, 84)

Monad; spherical, subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpus with constriction and margin (1.143–1.868 μm); exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 53 μm (43–57, n = 8); equatorial view width 47.2 μm (42–51, n = 8); polar view length 51.8 μm (45–58, n = 10); colpi length 40.9 μm (36.8–44, n = 5).

*Garcinia binucao* (Blanco) Choisy (Plate 3, figures 37–39, 46–47)

Monad; amb circular; isopolar; symmetry radial; tricolporate, stephanocolporate; pore circular; 3–4 colpori; exine intectate; columellae conspicuous and smaller than 1 μm; clavate; polar view length 28.3 μm (26–30, n = 9).

*Garcinia multiflora* Champ. ex Benth. (Plate 3, figures 40–42, 49–51)

Monad; subprolate and prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpus with margin

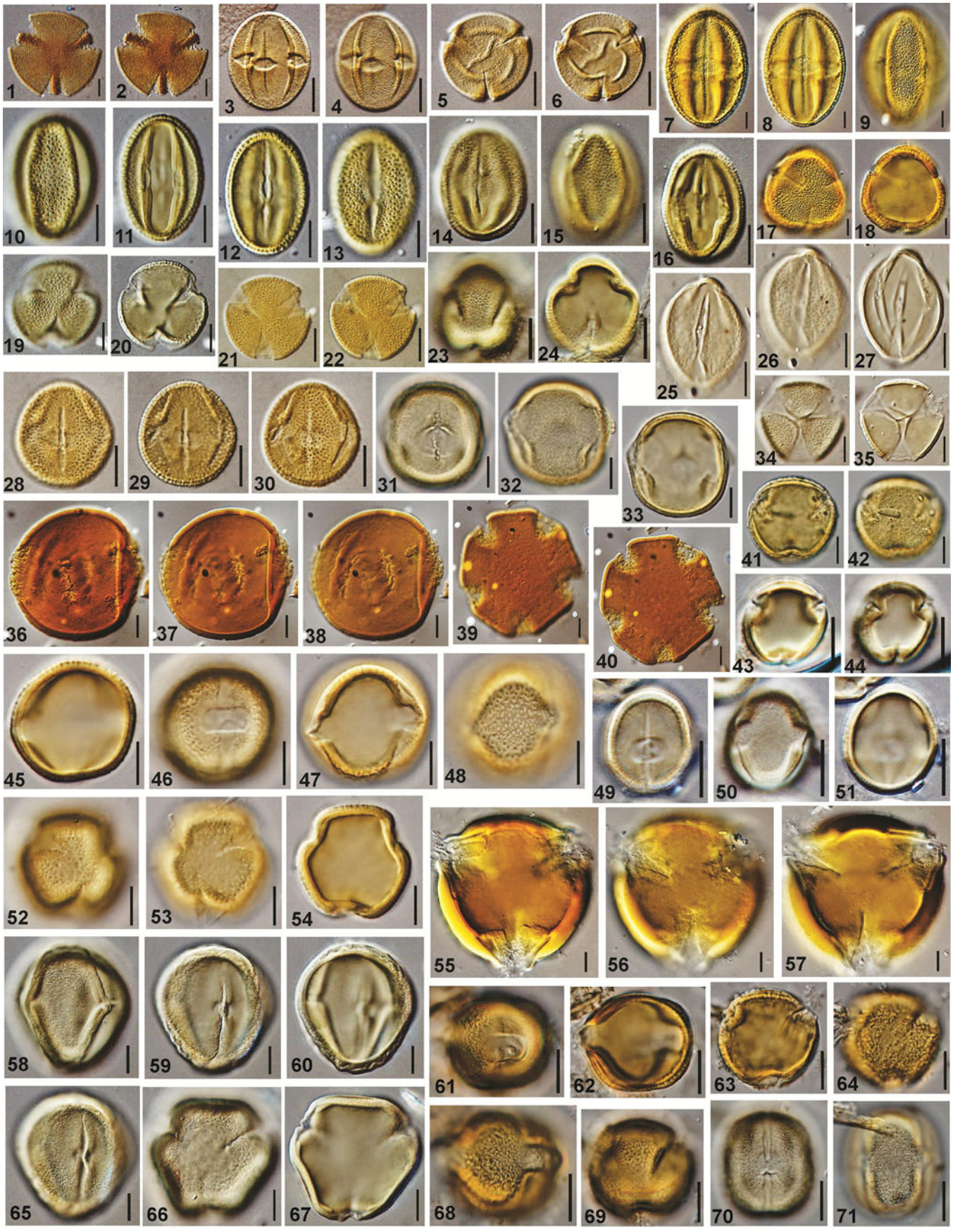

**Plate 4.** The scale bars represent 10 μm. Photographs were taken at 100× magnification. Ev = equatorial view; Pv = polar view; Gv = general view. **Euphorbiaceae:** *Hevea brasiliensis* (Pv: 1–2); *Pera pulchrifolia* (Ev: 3–4; Pv: 5–6); *Sapium glandulosum* (Ev: 7–9; Pv: 17–18). **Fabaceae–Faboideae:** *Acosmium bijugum* (Ev: 10–13; Pv: 19–20); *Acosmium dasycarpum* (Ev: 14–16; Pv: 23–24); *Andira inermis* (Ev: 28–30; Pv: 21–22); *Bobgunnia madagascariensis* (Ev: 25–27; Pv: 34–35); *Clathrotropis brachypetala* (Ev: 31–33; Pv: 41–42); *Clitoria javitensis* var. *portobellensis* (Ev: 36–38; Pv: 39–40); *Dalbergia hupeana* (Ev: 49–51; Pv: 43–44); *Deguelia scandens* (Ev: 45–48; Pv: 52–54); *Dioclea violaceae* (Pv: 55–57); *Diplotropis martiusii* (Ev: 61–62, 68; Pv: 63–64, 69); *Dipteryx oleifera* (Ev: 58–60, 65; Pv: 66–67); *Dussia tessmannii* (Ev: 70–71).

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(1.152–2.429 μm), apex acute; exine tectate; columella inconspicuous; scabrate; equatorial view length 40.4 μm (37–48, n = 10); equatorial view width 29.7 μm (25–35, n = 10); polar view length 31.8 μm (29–37, n = 4); colpi length 30.6 μm (28.8–34.3, n = 6); pore length 6.3 μm (6.3–6.3, n = 2); pore width 3.5 μm (3.2–3.8, n = 2).

*Tovomita stylosa* Hemsl. (Plate 3, figures 58–60, 67–68, 70)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain; exine semitectate; columellae conspicuous and smaller 1 μm, pluricolumellate; reticulate; homobrochate; equatorial view length 28.1 μm (25–33, n = 10); equatorial view width 25.7 μm (23–30, n = 10); polar view length 29.6 μm (26–32, n = 9); colpi length 20.6 μm (18.4–23.8, n = 8); pore length 9.1 μm (8–10.9, n = 8); pore width 3.5 μm (2.2–5.1, n = 8).

**Connaraceae** R. Br.

*Connarus panamensis* Griseb. (Plate 3, figures 48, 55–57, 66)

Monad; oblate spheroidal, spherical; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 17.8 μm (16–20, n = 10); equatorial view width 19 μm (17–20, n = 10); polar view length 19.8 μm (18–21, n = 6); colpi length 10.6 μm (9.3–13.1, n = 5); pore length 7.5 μm (6.6–9, n = 3); pore width 5 μm (3.3–6.5, n = 3).

*Rourea glabra* Kunth (Plate 3, figures 64–65, 73–75)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolpate; colpi 2/3 as long as grain, with margin and apex acute; exine semitectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; equatorial view length 28.1 μm (26–30, n = 10); equatorial view width 22.9 μm (21–25, n = 10); polar view length 24.7 μm (21–29, n = 7); colpi length 18.4 μm (15.4–22.3, n = 8).

**Dichapetalaceae** Baill.

*Dichapetalum axillare* Woodson (Plate 3, figures 90–91)

Monad; amb triangular-obtuse-convex; isopolar; symmetry radial; tricolporate; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; polar view length 20.6 μm (19–22, n = 8).

**Ebenaceae** Gürke

*Diospyros virginiana* Linneaus (Plate 3, figures 69, 76–80)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain, marginate (1.7–2.1 μm); exine tectate; columellae indistinct; scabrate; equatorial view length 64.4 μm (58–72, n = 10); equatorial view width 46.5 μm (41–53, n = 10); polar view length 55.2 μm (50–63, n = 10); colpi length 57.9 μm (52.8–62.3, n = 3); colpi width 2 μm (2–2, n = 1); pore length 9.2 μm (5.6–16.3, n = 3); pore width 5 μm (4.3–6.5, n = 3).

**Erythroxylaceae** Kunth

*Erythroxylum panamense* Turcz. (Plate 3, figures 85–89, 95–96)

Monad; equatorial shape subprolate; polar shape circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain, with margin that varies 1.596 and 2.363 μm (with exitus digitatus), apex acute; syncolporate; exine semitectate; columellae conspicuous and smaller than 1 μm; sexine thinner at the poles; simplicolumellate; reticulate; homobrochate; lumina vary between 0.714 and 1.878 μm; equatorial view length 55.8 μm (51.6–59.9, n = 20); equatorial view width 46.7 μm (40–53.5, n = 20); polar view length 52.6 μm (51–55.8, n = 18); colpi length 39.7 μm (32.7–45.4, n = 12).

**Euphorbiaceae** Juss.

*Conceveiba guianensis* Aubl. (Plate 3, figures 82–83, 92–93, 100–102)

Monad; prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with margin, costa endocolpi, apex obtuse; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 25.2 μm (23–27, n = 10); equatorial view width 24.1 μm (22–26, n = 10); polar view length 25.1 μm (21–28, n = 9); colpi length 16.3 μm (15.6–16.8, n = 3); colpi width 1.4 μm (1.4–1.5, n = 2); pore length 7.4 μm (6.6–8.4, n = 3); pore width 2.1 μm (1.9–2.3, n = 3).

*Croton ortholobus* Müll.Arg. (Plate 3, figures 97–99)

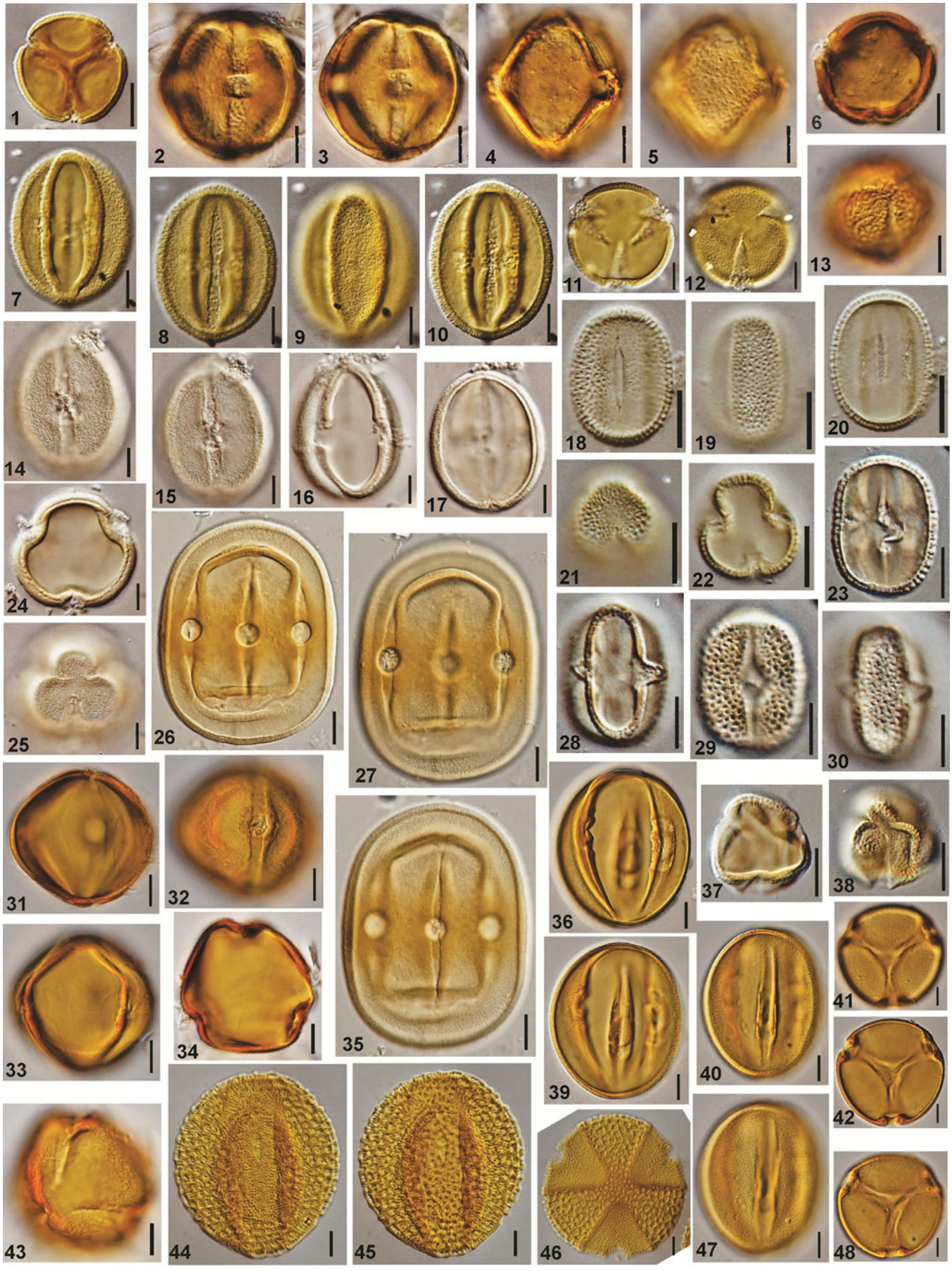
Monad; spherical; amb circular; symmetry radial; inaperturate; exine intectate; clavate; clavae displaying croton pattern; equatorial view length 81.1 μm (66–92, n = 9); equatorial view width 90.9 μm (77–107, n = 9).

*Hevea brasiliensis* (Willd. ex A. Juss.) Müll. Arg. (Plate 3, figures 94, 103; Plate 4, figures 1–2)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolpate; colpi 2/3 as long as grain, with operculum (11.066–14.405 μm); exine intectate; baculae conspicuous and smaller than 1 μm; equatorial view length 48.1 μm (45–50, n = 9); equatorial view width 40.9 μm (37–46, n = 9); polar view length 50.1 μm (46–53, n = 10); colpi length 36.5 μm (36.5–36.5, n = 1).

*Pera pulchrifolia* Ducke (Plate 4, figures 3–6)

Plate 5. The scale bars represent 10 μm. Photographs were taken at 100× magnification. Ev = equatorial view; Pv = polar view; Gv = general view. **Fabaceae-Faboideae:** *Dussia tessmannii* (Ev: 1–2; Pv: 3–4); *Hymenolobium heterocarpum* (Ev: 5–6; Pv: 7, 14); *Hymenolobium nitidum* (Ev: 8–11; Pv: 12–13); *Lecointea amazonica* (Ev: 15–17; Pv: 18); *Lonchocarpus araripensis* (Ev: 19–21); *Machaerium biovulatum* (Ev: 22–25; Pv: 26–28); *Machaerium floribundum* (Ev: 29–31; Pv: 32–34); *Monopteryx inpae* (Ev: 36–38); *Ormosia coccinea* (Ev: 35, 42; Pv: 50,58); *Ormosia macrocalyx* (Ev: 39–41; Pv: 48–49), *Platymiscium pinnatum* (Ev: 43–45; Pv: 51–53); *Pterocarpus rohrii* (Ev: 62–64; Pv: 65–67); *Swartzia arborescens* (Ev: 46–47, 55; Pv: 56–57); *Swartzia leptopetala* (Ev: 54, 68–69; Pv: 59, 70); *Swartzia panamensis* (Ev: 60–61, 72; Pv: 71).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Monad; subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi 2/3 as long as grains, with margin and apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 29.5 μm (29–31, n = 10); equatorial view width 24.6 μm (22–26, n = 10); polar view length 27.4 μm (26–31, n = 8); colpi length 19.6 μm (18.1–21.1, n = 9); pore length 5.2 μm (4.4–6, n = 9); pore width 2.7 μm (2.5–3.1, n = 9).

*Sapium glandulosum* (L.) morong (Plate 4, figures 7–9, 17–18)

Monad; prolate; amb triangular-obtuse-convex; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain, with margin and apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; micropitted; homobrochate; lumina smaller than 1 μm; equatorial view length 70.6 μm (64–76, n = 10); equatorial view width 48.1 μm (43–51, n = 10); polar view length 49.2 μm (44–56, n = 8); colpi length 54.4 μm (50.7–58.8, n = 7); pore length 18.7 μm (16–23.5, n = 7); pore width 9.3 μm (7.2–11.6, n = 7).

**Fabaceae-Faboideae** Lindl.

*Acosmium bijugum* (Vogel) Yakovlev (Plate 4, figures 10–13, 19–20)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lolongate; colpi with constriction and margin (0.808–1.597 μm), apex acute; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 31.8 μm (27–36, n = 10); equatorial view width 22.1 μm (19–25, n = 10); polar view length 24.1 μm (21–29, n = 9); colpi length 20.9 μm (17.3–25.2, n = 6); colpi width 1 μm (0.7–1.2, n = 4).

*Acosmium dasycarpum* (Vogel) Yakovlev (Plate 4, figures 14–16, 23–24)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore circular; colpi with constriction and margin (1.040–1.495 μm), apex acute; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 27.8 μm (25–31, n = 10); equatorial view width 19.8 μm (15–23, n = 10); polar view length 23.3 μm (20–27, n = 10); colpi length 18.5 μm (15.3–20.5, n = 3); colpi width 0.8 μm (0.6–1, n = 2).

*Andira inermis* (W. Wright) Kunth ex DC. (Plate 4, figures 21–22, 28–30)

Monad; oblate spheroidal, subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with apex acute; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 26.9 μm (25–28, n = 9); equatorial view width 22.6 μm (18–27, n = 9); polar view length 25.7 μm (22–29, n = 10); colpi length 16.3 μm (15.1–18.5, n = 5); pore length 4.4 μm (3.8–5, n = 2); pore width 2.9 μm (2.9–2.9, n = 1).

*Bobgunnia madagascariensis* (Desv.) J.H. Kirkbr. & Wiersema (Plate 4, figures 25–27, 34–35)

Monad; subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction, apex acute, syncolporate; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 33.3 μm (31–35, n = 10); equatorial view width 25.8 μm (24–28, n = 10); polar view length 31.6 μm (29–34, n = 9); colpi length 26.4 μm (24.6–27.4, n = 4); colpi width 1.9 μm (1.4–2.5, n = 3).

*Clathrotropis brachypetala* (Tul.) kleinhoonte (Plate 4, figures 31–33, 41–42)

Monad; prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore circular; colpi with apex acute; exine tectate; columellae indistinct and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 32.6 μm (30–37, n = 9); equatorial view width 28.3 μm (24–33, n = 9); polar view length 32.7 μm (28–37, n = 9); colpi length 19 μm (14–25.4, n = 9); colpi width 1.4 μm (1.2–1.7, n = 2); pore length 11.5 μm (7.7–15, n = 5); pore width 8.6 μm (7.7–9.5, n = 5).

*Clitoria javitensis* var. *portobellensis* (Beurl.) Fantz (Plate 4, figures 36–40)

Monad; prolate spheroidal; amb circular; isopolar; symmetry radial; stephanocolpate; 5 colpi, with irregular margins with free ectexinic elements; exine semitectate; columellae indistinct; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 66.4 μm (60–72, n = 5); equatorial view width 62.6 μm (58–67, n = 5); polar view length 73.2 μm (66–83, n = 10); colpi length 22.9 μm (20.4–29.4, n = 4).

*Dalbergia hupeana* Hance (Plate 4, figures 43–44, 49–51)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpus apex acute; exine tectate; columellae conspicuous; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 23.1 μm (21–26, n = 10); equatorial view width 19.7 μm (15–22, n = 10); polar view length 21.7 μm (19–23, n = 6); colpi length 16.1 μm (15–17.2, n = 6); pore length 6.2 μm (4.7–7, n = 6); pore width 5.2 μm (3.1–6.1, n = 6).

*Deguelia scandens* Aubl. (Plate 4, figures 45–48, 52–54)

**Plate 6.** The scale bars represent 10 μm. Photographs were taken at 100× magnification, with the exception of figures 44–46 (40× magnification). Ev = equatorial view; Pv = polar view; Gv = general view. **Fabaceae-Faboideae:** *Swartzia panamensis* (Pv: 1); *Swartzia pendula* (Ev: 2–5; Pv: 6, 13); *Swartzia simplex* var. *continentalis* (Ev: 7–10; Pv: 11–12); *Swartzia tomentosa* (Ev: 14–17; Pv: 24–25); *Vatairea erythrocarpa* (Ev: 18–20; Pv: 21–22); *Vataireopsis speciosa* (Ev: 23, 28–30; Pv: 37–38); **Fabaceae-Caesalpinioideae:** *Bauhinia guianensis* (Ev: 26–27, 35); *Campsiandra angustifolia* (Ev: 31–33; Pv: 34, 43); *Campsiandra comosa* (Ev: 36, 39–40, 47; Pv: 41–42, 48); *Cenostigma gardnerianum* (Ev: 44–45; Pv: 46).

**Plate 7.** The scale bars represent 10 μm. Photographs were taken at 100× magnification, with the exception of figure 36 (40× magnification). Ev = equatorial view; Pv = polar view; Gv = general view. **Fabaceae-Caesalpinioideae:** *Crudia amazonica* (Ev: 6, 11–12; Pv: 4–5); *Dicorynia paraensis* (Ev: 1–3; Pv: 7); *Hymenaea stigonocarpa* (Ev: 8–9; Pv: 14–15, 17); *Macrolobium angustifolium* (Ev: 10, 19–20, 28); *Senna macranthera* (Ev: 18, 24, 27; Pv: 13, 16, 22); *Tachigali paniculata* (Ev: 23, 25–26, 30–31; Pv: 32–35). **Fabaceae-Mimosoideae:** *Abarema auriculata* (Isolated Grain: 29; Polyad: 21, 36–38).

Monad; spherical, subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 26.8 μm (23–28, n = 9); equatorial view width 26.8 μm (23–30, n = 9); polar view length 28.1 μm (25–35, n = 10); colpi length 19.4 μm (16.1–22.5, n = 5); colpi width 2.5 μm (2.2–2.8, n = 2); pore length 8.9 μm (5.7–11.2, n = 5); pore width 4.1 μm (2.5–5.4, n = 5).

*Dioclea violacea* Benth. (Plate 4, figures 55–57)

Monad; oblate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; exine tectate; tectum thicker than sexine and nexine; columellae indistinct.; psilate; polar view length 85.4 μm (73–97, n = 9).

*Diplotropis martiusii* Benth. (Plate 4, figures 61–64, 68–69)

Monad; suboblate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 21.2 μm (19–22, n = 10); equatorial view width 24.8 μm (23–26, n = 10); polar view length 25.2 μm (23–29, n = 10); colpi length 16.1 μm (12.7–19.9, n = 9); pore length 10.1 μm (8.8–11.5, n = 9); pore width 5.8 μm (4.5–7.5, n = 9).

*Dipteryx oleifera* Benth. (Plate 4, figures 58–60, 65–67)

Monad; prolate spheroidal; amb triangular-obtuse-convex; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction, apex acute; exine tectate; columellae conspicuous, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 45.5 μm (44–47, n = 2); equatorial view width 41.5 μm (41–42, n = 2); polar view length 41.2 μm (39–45, n = 9); colpi length 34.6 μm (34.6–34.6, n = 1); colpi width 3.5 μm (3.5–3.5, n = 1); pore length 7.3 μm (7.3–7.3, n = 1); pore width 4.3 μm (4.3–4.3, n = 1).

*Dussia tessmannii* Harms (Plate 4, figures 70–71; Plate 5, figures 1–4)

Monad; subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain, with constriction, apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 26.4 μm (25–28, n = 10); equatorial view width 22.7 μm (20–25, n = 10); polar view length 22.6 μm (20–25, n = 11); colpi length 22.2 μm (19–25.4, n = 9); colpi width 2.3 μm (1.3–6.7, n = 9); pore length 7 μm (5.6–8.5, n = 7); pore width 6.3 μm (5.3–7.2, n = 7).

*Hymenolobium heterocarpum* Ducke (Plate 5, figures 5–7, 14)

Monad; suboblate; amb triangular-obtuse-convex; isopolar; symmetry radial; tricolporate; pore circular; colpi with apex acute; exine tectate; columellae indistinct; psilate; equatorial view length 24.5 μm (22–30, n = 10); equatorial view width 19.9 μm (18–23, n = 10); polar view length 22 μm (21–23, n = 3); colpi length 18.3 μm (16.2–19.7, n = 3); pore length 5.2 μm (5.2–5.2, n = 1); pore width 5.9 μm (5.9–5.9, n = 1).

*Hymenolobium nitidum* Benth. (Plate 5, figures 8–13)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore circular; colpi as long as grain, with constriction; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 28.9 μm (24–33, n = 9); equatorial view width 25 μm (22–28, n = 9); polar view length 25.2 μm (22–28, n = 10); colpi length 19.4 μm (18.6–20.4, n = 5); colpi width 2.8 μm (2.8–2.8, n = 1); pore length 4.1 μm (4.1–4.1, n = 1); pore width 4.3 μm (4.3–4.3, n = 1).

*Lecointea amazonica* Ducke (Plate 5, figures 15–18)

Monad; subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore circular; colpi with constriction and margin (0.639–1.010 μm); apex acute; exine tectate; columellae indistinct; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 28 μm (26–32, n = 10); equatorial view width 21.1 μm (18–24, n = 10); polar view length 22.7 μm (22–24, n = 3); colpi length 19.8 μm (17.7–21.9, n = 7); colpi width 0.5 μm (0.5–0.5, n = 1); pore length 6.9 μm (6.9–6.9, n = 1); pore width 4.7 μm (4.7–4.7, n = 1).

*Lonchocarpus araripensis* Benth. (Plate 5, figures 19–21)

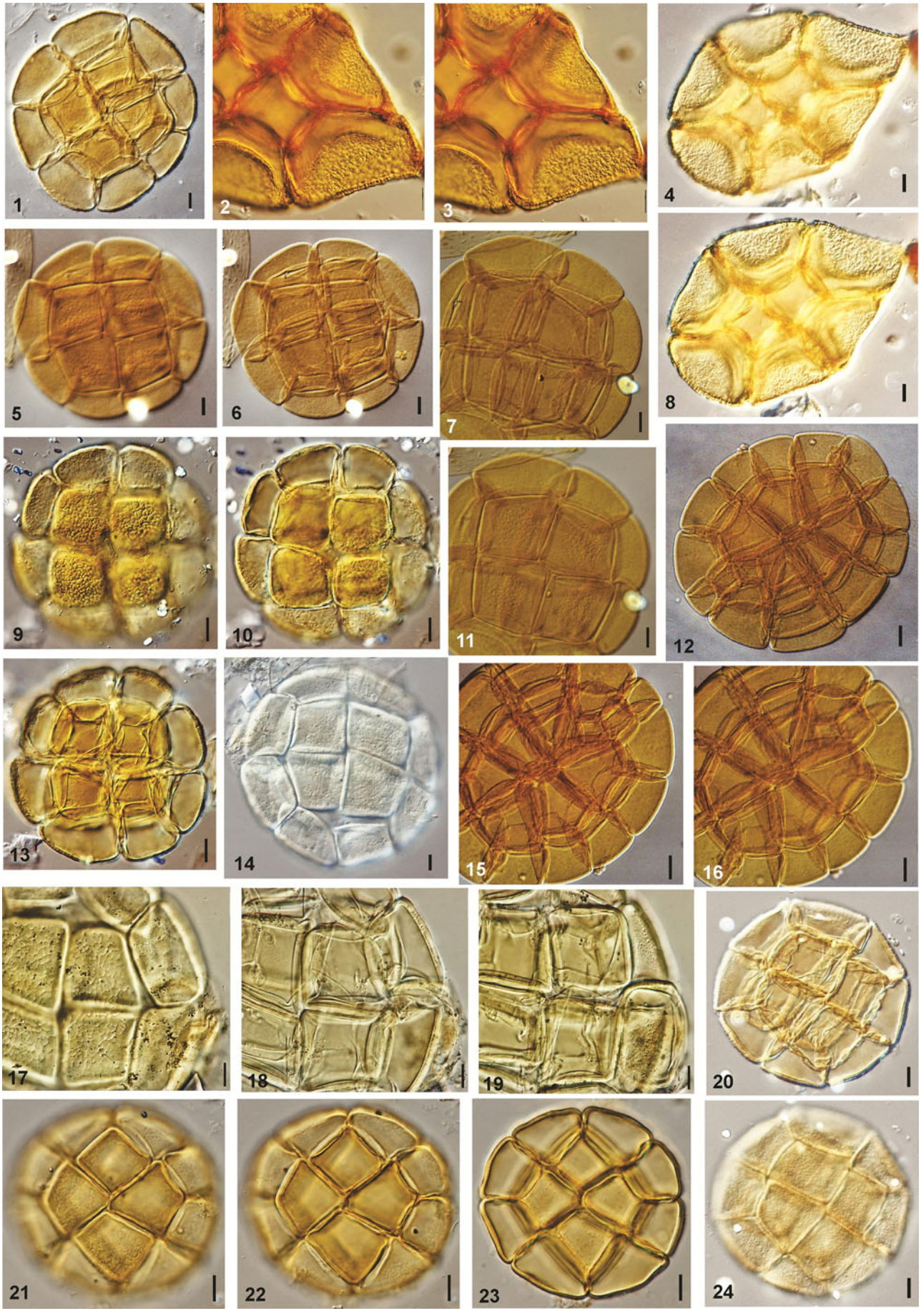
Monad; subprolate, prolate; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction, apex acute; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 53.3 μm (40.6–59, n = 10); equatorial view width 42.2 μm (38.7–46.6, n = 10); colpi length 34.4 μm (31.3–38.3, n = 4); pore length 12.9 μm (12.6–13.4, n = 3); pore width 8.9 μm (7.4–10.4, n = 3).

*Machaerium biovulatum* Micheli (Plate 5, figures 22–28)

Monad; subprolate, spherical; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction and apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 27.3 μm (23–32, n = 10); equatorial view width 22.8 μm (20–28, n = 10); polar view length 24.4 μm (21–28, n = 10); colpi length 19.9 μm (14.9–24.8, n = 7); colpi width 3 μm (2.1–3.8, n = 2); pore length 6 μm (3–7.8, n = 4); pore width 3.6 μm (2.8–5.2, n = 3).

*Machaerium floribundum* Benth. (Plate 5, figures 29–34)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction and apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 22.3 μm (20–25, n = 9); equatorial view width 20.8 μm (19–23, n = 9); polar view length 21.3 μm (20–23, n = 10); colpi length 16.8 μm (14.1–18.6, n = 5); pore length 7.4 μm (5.9–8.4, n = 5); pore width 5.2 μm (3.6–6.1, n = 5).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*Monopteryx inpae* W.A. Rodrigues (Plate 5, figures 36–38)

Monad; subprolate, prolate spheroidal; isopolar; symmetry radial; tricolporate; pore circular; colpus apex acute; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 47 μm (40–54, n = 2); equatorial view width 42 μm (38–46, n = 2).

*Ormosia coccinea* (Aubl.) Jacks. (Plate 5, figures 35, 42, 50, 58)

Monad; prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore circular; colpi with margin (2.020–3.162 μm) and apex acute; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 48 μm (45–51, n = 10); equatorial view width 42.6 μm (38–48, n = 10); polar view length 48.5 μm (48–49, n = 2); colpi length 26 μm (13.6–30.9, n = 7); pore length 8.8 μm (6.8–10.9, n = 2); pore width 8.7 μm (6.6–10.8, n = 2).

*Ormosia macrocalyx* Ducke (Plate 5, figures 39–41, 48–49)

Monad; prolate spheroidal; circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with apex acute; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 52.8 μm (37–60, n = 10); equatorial view width 45.1 μm (34–51, n = 10); polar view length 50.7 μm (42–59, n = 10); colpi length 31 μm (22.8–34.4, n = 4); pore length 6.5 μm (6.5–6.5, n = 1); pore width 4.9 μm (4.9–4.9, n = 1).

*Platymiscium pinnatum* (Jacq.) Dugand (Plate 5, figures 43–45, 51–53)

Monad; subprolate, prolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 14.3 μm (13–16, n = 10); equatorial view width 12.2 μm (9–14, n = 10); polar view length 12.7 μm (11–14, n = 7); colpi length 10.7 μm (9.5–11.8, n = 2); pore length 4 μm (3.9–4.1, n = 2); pore width 2.8 μm (2.4–3.3, n = 2).

*Pterocarpus rohrii* Vahl (Plate 5, figures 62–67)

Monad; prolate, subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore circular; colpi with constriction and margin, apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; colpi length 15.7 μm (14.3–17, n = 9); pore length 6.2 μm (5.2–7.6, n = 8); pore width 6.5 μm (4.2–7.5, n = 8).

*Swartzia arborescens* (Aubl.) pittier (Plate 5, figures 46–47, 55–57)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction and apex acute; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 31.9 μm (27–36, n = 10); equatorial view width 28.5 μm (23–33, n = 10); polar view length 28 μm (25–30, n = 10); colpi length 22.1 μm (18.1–24.9, n = 5); colpi width 2.6 μm (1.3–3.3, n = 5); pore length 5.7 μm (3.7–8, n = 5); pore width 3.5 μm (2.6–5.2, n = 5).

*Swartzia leptopetala* Benth. (Plate 5, figures 54, 59, 68–70)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction, apex acute; exine tectate; columellae indistinct; scabrate; equatorial view length 30.6 μm (27–37, n = 10); equatorial view width 27 μm (25–30, n = 10); polar view length 27.4 μm (25–32, n = 10); colpi length 23.1 μm (20.5–24.4, n = 4); colpi width 2 μm (1.9–2.2, n = 2); pore length 8 μm (7.3–8.9, n = 3); pore width 3.8 μm (2.9–5, n = 3).

*Swartzia panamensis* Benth. (Plate 5, figures 60–61, 71–72; Plate 6 figure 1)

Monad; spherical, subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction and margin (1.010–1.471 μm), apex acute. Parasyncolporate; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 25.2 μm (23–26, n = 9); equatorial view width 23 μm (21–25, n = 9); polar view length 25.4 μm (22–28, n = 8); colpi length 20.4 μm (18–22.1, n = 6); colpi width 1 μm (0.9–1.1, n = 4).

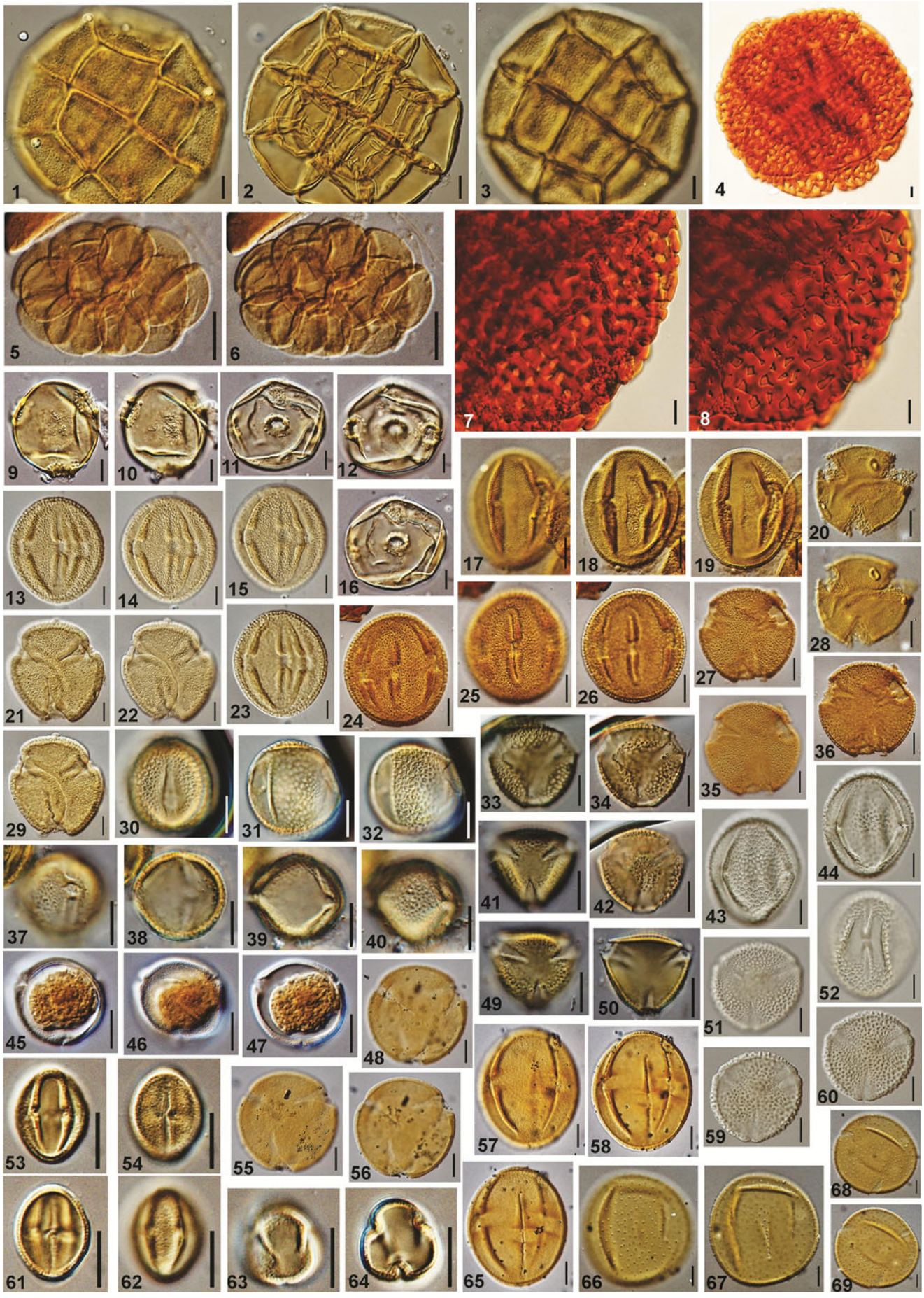
*Swartzia pendula* Spruce ex Benth. (Plate 6, figures 2–6, 13)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpus apex acute; exine tectate; columellae indistinct, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 36.8 μm (33–40, n = 6); equatorial view width 34.7 μm (28–38, n = 6); polar view length 34.1 μm (31–42, n = 8); colpi length 31.1 μm (27.9–33.5, n = 4); colpi width 3.3 μm (3–3.6, n = 4); pore length 6.3 μm (3.6–7.6, n = 4); pore width 3.5 μm (2.8–5.2, n = 4).

*Swartzia simplex* var. *continentalis* Urb. (Plate 6, figures 7–12)

Monad; suboblate, subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction, margin (1.857–2.055 μm) and some granula. Colpi with apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 38.6 μm (32–43, n = 8); equatorial view width 30.8 μm (26–35, n = 8); polar view length 35.3 μm (31–40, n = 10); colpi length

**Plate 8.** The scale bars represent 10 μm. Photographs were taken at 40× magnification, with the exception of figures 2–3, 7, 11, 15–19 (100× magnification). Ev = equatorial view; Pv = polar view; Gv = general view. **Fabaceae-Mimosoideae:** *Abarema auriculata* (Polyad: 1); *Abarema barbouriana* (Polyad: 5–7, 11); *Calliandra trinervia* (Polyad: 2–4, 8); *Cedrelinga cateniformis* (Polyad: 9–10, 13); *Enterolobium cyclocarpum* (Polyad: 12; 15–16); *Inga nobilis* (Polyad: 14; 17–19); *Inga pezizifera* (Polyad: 21–23); *Inga umbelifera* (Polyad: 20, 24).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31.9 μm (29.3–34.9, n = 5); colpi width 2.7 μm (1.9–3.2, n = 5); pore length 2.6 μm (2.6–2.6, n = 1); pore width 4.7 μm (4.7–4.7, n = 1).

*Swartzia tomentosa* DC. (Plate 6, figures 14–17, 24–25)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction, apex acute; exine tectate; columellae conspicuous and greater than 1 μm; lumina smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 49.1 μm (43–58, n = 11); equatorial view width 41.1 μm (37–44, n = 11); polar view length 44.1 μm (39–49, n = 9); colpi length 42.3 μm (38.7–47.1, n = 5); colpi width 3.5 μm (3.1–4.3, n = 5); pore length 9.8 μm (9.7–9.8, n = 2); pore width 6 μm (5–7.1, n = 2).

*Vatairea erythrocarpa* (Ducke) Ducke (Plate 6, figures 18–22)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolpate; colpi with apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 24.6 μm (23–26, n = 10); equatorial view width 17.8 μm (15–19, n = 10); polar view length 17.4 μm (14–21, n = 9); colpi length 13.8 μm (12.3–14.8, n = 4).

*Vataireopsis speciosa* Ducke (Plate 6, figures 23, 28–30, 37–38)

Monad; prolate spheroidal, prolate, subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; apex acute; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; colpi length 20.2 μm (17.5–23.6, n = 6); pore length 5.7 μm (5.7–5.7, n = 1); pore width 5.1 μm (5.1–5.1, n = 1).

**Fabaceae-Caesalpinioideae** Lindl.

*Bauhinia guianensis* Pulle (Plate 6, figures 26–27, 35)

Monad; subprolate; isopolar; symmetry radial; tricolporate; amb circular; colpi with constriction, apex acute; exine tectate; columellae indistinct; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 71.4 μm (60–79, n = 10); equatorial view width 58 μm (50–62, n = 10); colpi length 41.6 μm (33.4–47.9, n = 8); colpi width 2.8 μm (2.1–3.3, n = 8); pore length 7.3 μm (5.2–8.9, n = 8); pore width 7 μm (5.9–8.3, n = 8).

*Campsiandra angustifolia* Benth. (Plate 6, figures 31, 34, 43)

Monad; oblate spheroidal; amb triangular-obtuse-convex; isopolar; symmetry radial; tricolporate; pore circular; colpi with margin (1.196–1.857 μm), apex acute; exine tectate; columellae indistinct; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 44.1 μm (42–48, n = 10). Equatorial view width 44.2 μm (37–48, n = 10); polar view length 45 μm (42–49, n = 11); colpi length 35.8 μm (33.1–38, n = 6); colpi width 3.4 μm (2.4–4.6, n = 6); pore length 5.1 μm (3.8–6.4, n = 6); pore width 6.4 μm (5.2–8.2, n = 6).

*Campsiandra comosa* Benth. (Plate 6, figures 36, 39–42, 47–48)

Monad; subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore lolongate; colpi with margin (1.545–2.281 μm) and apex acute; costa endocolpi becomes thinner when it approaches the annulus and porus (this characteristic gives the impression of 3 pores). Parasyncolporate in polar view; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 60.9 μm (58–65, n = 10); equatorial view width 50 μm (46–56, n = 10); polar view length 58.2 μm (55–62, n = 8); colpi length 45 μm (39.1–51.2, n = 5); colpi width 2.3 μm (1.7–3.2, n = 5); pore length 3 μm (1.5–4.9, n = 3); pore width 9.4 μm (8.3–10.1, n = 3).

*Cenostigma gardnerianum* Tul. (Plate 6, figures 44–46)

Monad; subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore lolongate; colpi with margin and costa endocolpi. Colpus is covered by fine layer of sexina (tectum) and with sculpture microreticulate; apex obtuse. There is a dark mark contouring the colpus in polar view; exine semitectate; columellae conspicuous, duplicolumellate; lumina width 1.196–5.031 μm and muri width 1.196–1.868 μm; reticulate; homobrochate; equatorial view length 79.5 μm (76–85, n = 10); equatorial view width 72.8 μm (67–78, n = 10); polar view length 81.8 μm (78–87, n = 10); colpi length 62.2 μm (47.7–72.9, n = 5); colpi width 26.6 μm (17.9–37.1, n = 4); pore length 3 μm (2.7–3.4, n = 2); pore width 11.1 μm (10.7–11.6, n = 2).

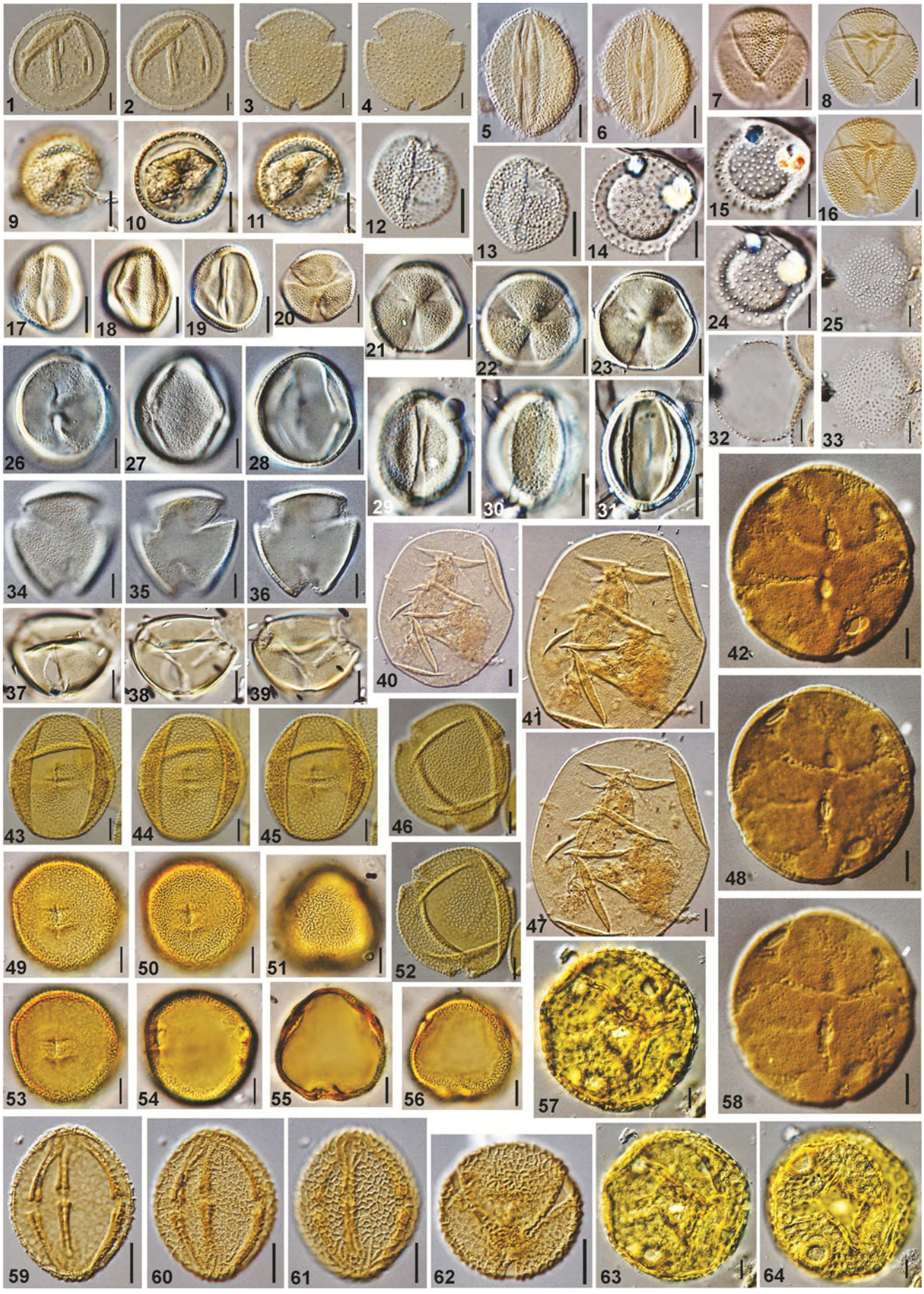
*Crudia amazonica* Benth. (Plate 7, figures 4–6, 11–12)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction; exine tectate; columellae conspicuous; striatoreticulate; homobrochate; equatorial view length 58 μm (53–61, n = 10); equatorial view width 40.8 μm (36–49, n = 10); polar view length 52.5 μm (45–55, n = 6); colpi length 49.8 μm (45–54.2, n = 5); colpi width 3.5 μm (2.4–4.7, n = 2).

*Dicorynia paraensis* Benth. (Plate 7, figures 1–3, 7)

Monad; subprolate; amb triangular-obtuse-convex; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction and margin (0.857–1.720 μm), apex acute; parasyncolporate in polar view; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate;

**Plate 9.** The scale bars represent 10 μm. Photographs were taken at 100× magnification, with the exception of figure 4 (40× magnification). Ev = equatorial view; Pv = polar view; Gv = general view. **Fabaceae-Mimosoideae:** *Inga umbelifera* (Gv100x: 1–3); *Parkia multijuga* (Polyad: 4, 7–8); *Stryphnodendron microstachyum* (Polyad: 5–6). **Gentianaceae:** *Potalia amara* (Ev: 11–12, 16; Pv: 9–10). **Gesneriaceae:** *Drymonia serrulata* (Ev: 17–19; Pv: 20, 28). **Humiriaceae:** *Endopleura uchi* (Ev: 24–26; Pv: 27, 35–36); *Sacoglottis trichogyna* (Ev: 13–15, 23; Pv: 21–22, 29). **Hypericaceae:** *Vismia baccifera* (Ev: 30–32; Pv: 33–34, 42); *Vismia latifolia* (Ev: 37–40; Pv: 41, 49–50); *Vismia macrophylla* (Ev: 43–44, 52; Pv: 51, 59–60). **Icacinaceae:** *Calatola costaricensis* (Pv: 45–47); *Poraqueiba sericea* (Ev: 57–58, 65; Pv: 48, 55–56). **Lacistemataceae:** *Lacistema aggregatum* (Ev: 53–54, 61–62; Pv: 63–64). **Lamiaceae:** *Aegiphila integrifolia* (Ev: 66–67; Pv: 68–69).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homobrochate; lumina smaller than 1 μm; equatorial view length 30.8 μm (29–34, n = 9); equatorial view width 24.3 μm (22–26, n = 9); polar view length 27.4 μm (22–34, n = 9); colpi length 23.6 μm (20.8–26.6, n = 9); colpi width 1.5 μm (1–1.7, n = 4).

*Hymenaea stigonocarpa* Mart. ex Hayne (Plate 7, figures 8–9, 14–15, 17)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore circular; exine tectate; columellae indistinct; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 54.8 μm (51–58, n = 10); equatorial view width 41.1 μm (38–44, n = 10); polar view length 48.4 μm (46–56, n = 11); colpi length 43.6 μm (39.6–48.6, n = 6); colpi width 3.9 μm (2–4.9, n = 4); pore length 7.4 μm (4.5–10.8, n = 3); pore width 7.1 μm (5.5–9.2, n = 3).

*Macrolobium angustifolium* (Benth.) Cowan (Plate 7, figures 10, 19–20, 28)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lolongate; exine tectate; columellae conspicuous and smaller than 1 μm. Thick tectum; striatoreticulate; homobrochate. There are multiple lumina in each stria. Equatorial view length 56.1 μm (49–62, n = 9); equatorial view width 37.1 μm (30–42, n = 9); colpi length 48.5 μm (39.4–54.2, n = 5); colpi width 4.3 μm (3.6–5.2, n = 3); pore length 4.8 μm (4.3–5.4, n = 2); pore width 8.4 μm (7.2–9.7, n = 2).

*Senna macranthera* (DC. ex Collad.) H.S. Irwin & Barneby (Plate 7, figures 13, 18, 16, 22, 24, 27)

Monad; prolate, subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with margin (2.089–2.490 μm) and with constriction, apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; colpi length 53.8 μm (47.3–58.5, n = 7); colpi width 3.1 μm (1.9–4.2, n = 6).

*Tachigali paniculata* Aubl. (Plate 7, figures 23, 25–26, 30, 35)

Monad; suboblate; amb triangular-obtuse-convex; isopolar; symmetry radial; tricolporate; pore circular; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 28.2 μm (26–32, n = 10); equatorial view width 32.8 μm (31–39, n = 10); polar view length 32.8 μm (27–36, n = 10); colpi length 16.1 μm (13.2–18.7, n = 4); colpi width 5.2 μm (3.1–7.3, n = 3); pore length 7.4 μm (7.2–7.6, n = 4); pore width 7.4 μm (6.6–8.1, n = 4).

**Fabaceae-Mimosoideae** Lindl.

*Abarema auriculata* (Benth.) Barneby & J.W. Grimes (Plate 7, figures 21, 29, 36–38; Plate 8, figure 1)

Polyad; isolated grains anisopolar; symmetry asymmetric; pantoporate; exine semitectate; rugulate. The swollen apical part of columellae connects with each other, forming a semicontinuous tectum and appearance of rugulae. Equatorial view length 33.8 μm (28–39, n = 5); equatorial view width 43.2 μm (39–47, n = 5).

*Abarema barbouriana* (Standl.) Barneby & J.W. Grimes (Plate 8, figures 5–7, 11)

Polyad; isolated grains anisopolar; symmetry asymmetric; stephanoporate; exine semitectate; columellae indistinct. Exine is thicker in the distal region; regulate. The swollen apical part of columellae connects with each other, forming a semicontinuous tectum and appearance of rugulae. Equatorial view length 31.5 μm (29–34, n = 2); equatorial view width 41 μm (38–44, n = 2).

*Calliandra trinervia* Benth. (Plate 8, figures 2–4, 8)

Polyad; rectangular; isolated grains anisopolar; symmetry asymmetric; pantoporate; pore circular; exine semitectate; columellae conspicuous and smaller than 1 μm; rugulate. The swollen apical part connects with each other columellae, forming a semicontinuous tectum and appearance of rugulae. Equatorial view length 37.8 μm (34–40, n = 4); equatorial view width 60.5 μm (52–65, n = 4).

*Cedrelinga cateniformis* (Ducke) Ducke (Plate 8, figures 9–10, 13)

Polyad; isolated grains anisopolar; symmetry asymmetric; pantoporate; exine semitectate thicker in the distal region and rugulate. The swollen apical parts of the columellae connect with each other, forming a semicontinuous tectum and appearance of rugulae. Equatorial view length 24 μm (22–25, n = 3); equatorial view width 29 μm (24–35, n = 3).

*Enterolobium cyclocarpum* (Jacq.) Griseb (Plate 8, figures 12, 15–16)

Polyad; isolated grains anisopolar; symmetry asymmetric; pantoporate; exine tectate; columellae indistinct; psilate; equatorial view length 20 μm (17–25, n = 9); equatorial view width 29.7 μm (27–34, n = 9).

*Inga nobilis* Willd (Plate 8, figures 14, 17–19)

Polyad; isolated grains anisopolar; symmetry asymmetric; exine semitectate; columellae indistinct. Exine is thicker in the distal region; rugulate. The swollen apical part of columellae connects with each other, forming a semicontinuous tectum and appearance of rugulae Equatorial view length 33 μm (31–35, n = 2); equatorial view width 39.5 μm (39–40, n = 2).

**Plate 10.** The scale bars represent 10 μm. Photographs were taken at 100× magnification, with the exception of figure 40 (40× magnification). Ev = equatorial view; Pv = polar view; Gv = general view. **Lamiaceae:** *Aegiphila panamensis* (Ev: 1–2; Pv: 3–4); *Vitex masoniana* (Ev: 5–6; Pv: 7–8, 16). **Lauraceae:** *Aniba puchuryminor* (Ev: 9–11); *Endlicheria paniculata* (Ev: 12–13); *Ocotea oblonga* (Ev: 14–15, 24); *Pleurothyrium maximum* (Ev: 25, 32–33). **Lecythidaceae:** *Eschweilera albiflora* (Ev: 17–19; Pv: 20); *Lecythis zabucajo* (Ev: 29–31; Pv: 21–23). **Loganiaceae:** *Strychnos brachistantha* (Ev: 26–28; Pv: 34–36); *Strychnos toxifera* (Pv: 37–39). **Magnoliaceae:** *Magnolia sororum* (Gv: 40–41, 47). **Malpighiaceae:** *Hiraea faginea* (Gv: 42, 48, 58). **Malvaceae:** *Abroma augusta* (Ev: 59–61; Pv: 62); *Apeiba membranacea* (Ev: 43–45; Pv: 46, 52); *Apeiba tibourbou* (Ev: 49–50, 53–54; Pv: 51, 55–56); *Quararibea spatulata* (4-aperturate Pv: 57, 63–64).

**Plate 11.** The scale bars represent 10 μm. Photographs were taken at 100× magnification. Ev = equatorial view; Pv = polar view; Gv = general view. **Malvaceae:** *Quararibea spatulata* (3-aperturate Pv: 1–3); *Sterculia apetala* (Ev: 4–6, 12; Pv: 9–11); *Theobroma glaucum* (Ev: 16–18; Pv: 24–26); *Theobroma obovatum* (Ev: 7–8, 13; Pv: 14–15). **Marcgraviaceae:** *Marcgravia polyantha* (Ev: 29–31; Pv: 39–40). **Melastomataceae:** *Adelobotrys adscendens* (Ev: 19–21; Pv: 22–23); *Adelobotrys tessmannii* (Ev: 36, 46; Pv: 34–35); *Bellucia pentamera* (Ev: 32–33, 42; Pv: 41, 52); *Clidemia hirta* (Ev: 78–80; Pv: 70, 81); *Clidemia quinquenervia* (Ev: 64–66); *Henriettea tuberculosa* (Ev: 27–28, 37–38; Pv: 47–48); *Miconia lamprophylla* (Ev: 49–51; Pv: 62–63); *Miconia serrulata* (Ev: 59–61; Pv: 71–72); *Mouriri acutiflora* (Ev: 74–77; Pv: 73); *Mouriri mytilloides* subsp. *parvifolia* (Ev: 43–45; Pv: 53–55); *Tococa caquetana* (Ev: 56–58; Pv: 67–69).

*Inga pezizifera* Benth. (Plate 8, figures 21–23)

Polyad; isolated grains anisopolar; symmetry asymmetric; pantoporate; semiexine tectate; columellae indistinct, type pilum. Exine is thicker in the distal region; rugulate; the swollen apical part of columellae connects with each other, forming a semicontinuous tectum and appearance of rugulae

Equatorial view length 19.2 μm (16–22, n = 10); equatorial view width 24.3 μm (20–30, n = 10).

*Inga umbellifera* Steud. ex DC. (Plate 8, figures 20, 24; Plate 9, figures 1–3)

Polyad; isolated grains anisopolar; symmetry asymmetric; pantoporate; semiexine tectate; columellae indistinct and type pilum. Exine is thicker in the distal region; rugulate. The swollen apical part of columellae connects with each other, forming a semicontinuous tectum and appearance of rugulae Equatorial view length 28 μm (27–29, n = 2); equatorial view width 32.5 μm (29–36, n = 2).

*Parkia multijuga* Benth. (Plate 9, figures 4, 7–8)

Polyad; isolated grains anisopolar; symmetry asymmetric; triporate; exine tectate; columellae conspicuous and greater than 1 μm, simplicolumellate; reticulate; heterobrochate; equatorial view length 37 μm (33–41, n = 2); equatorial view width 56 μm (49–63, n = 2).

*Stryphnodendron microstachyum* Poepp. (Plate 9, figures 5–6)

Polyad; circular; isolated grains anisopolar; symmetry asymmetric; pantoporate; exine tectate; columellae indistinct; scabrate; 4 pores; equatorial view length 10.9 μm (10–12, n = 7); equatorial view width 13.1 μm (12–14, n = 7).

**Gentianaceae** Juss.

*Potalia amara* Aubl. (Plate 9, figures 9–12, 16)

Monad; spherical; amb circular; isopolar; symmetry radial; triporate; pore circular; exine tectate; columellae indistinct; psilate; with granules; equatorial view length 43.7 μm (38–49, n = 10); equatorial view width 50 μm (35–59, n = 10); pore length 6.1 μm (4.8–8.3, n = 8); pore width 5.9 μm (4.4–8.5, n = 8).

**Gesneriaceae** Rich. & Juss.

*Drymonia serrulata* (Jacq.) Mart. (Plate 9, figures 17–20, 28)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi 2/3 as long as grain. Colpi with granules and with costa-endocolpi. Apex obtuse; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 38.6 μm (36–42, n = 9); equatorial view width 31.6 μm (28–36, n = 9); polar view length 38.2 μm (35–45, n = 11); colpi length 25.3 μm (22.1–31.1, n = 6).

**Humiriaceae** A. Juss.

*Endopleura uchi* (Huber) Cuatrec. (Plate 9, figures 24–27, 35–36)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore circular; colpi 2/3 as long as grain, with margin (1.221–1.818 μm) and apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 42.7 μm (38–50, n = 10); equatorial view width 39.2 μm (34–44, n = 10); polar view length 42.3 μm (39–45, n = 10); colpi length 23.9 μm (21–27.8, n = 7); colpi width 1.4 μm (0.8–1.8, n = 3); pore length 7.2 μm (5.3–9.1, n = 2); pore width 4.8 μm (4.5–5.1, n = 2).

*Sacoglottis trichogyna* Cuatrec. (Plate 9, figures 13–15, 21–23, 29)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi 2/3 as long as grain, with constriction and margin (2.343–3.899 μm), apex obtuse; exine tectate; columellae conspicuous, smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 56.6 μm (48–61, n = 10); equatorial view width 50.5 μm (45–53, n = 10); polar view length 53.8 μm (50–60, n = 9); colpi length 38.8 μm (35.3–45.9, n = 5); colpi width 1.8 μm (1.5–2.2, n = 4).

**Hypericaceae** Juss.

*Vismia baccifera* (L.) Triana & Planch. (Plate 9, figures 30–34, 42)

Monad; prolate spheroidal; amb triangular-obtuse-convex; isopolar; symmetry radial; tricolporate; pore circular; colpi with margin (3.172–4.546 μm), apex acute; exine semitectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; equatorial view length 23 μm (16–26, n = 7); equatorial view width 21.3 μm (14–26, n = 7); polar view length 26.4 μm (25–29, n = 9); colpi length 16.5 μm (12.6–18.8, n = 5); colpi width 2.5 μm (2.1–2.9, n = 2); pore length 5.4 μm (4.7–6.1, n = 2); pore width 3.8 μm (3.2–4.5, n = 2).

*Vismia latifolia* (Aubl.) Choisy (Plate 9, figures 37–41, 49–50)

Monad; oblate spheroidal; amb triangular-obtuse-convex; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 19.7 μm (18–21, n = 9); equatorial view width 19.8 μm (18–21, n = 9); polar view length 21.4 μm (18–24, n = 7); colpi length 15.4 μm (14.1–16.5, n = 4); colpi width 1.7 μm (1.7–1.7, n = 1); pore length 3.8 μm (3.7–4, n = 3); pore width 2.6 μm (2.4–2.7, n = 3).

*Vismia macrophylla* Kunth (Plate 9, figures 43–44, 51–52, 59–60)

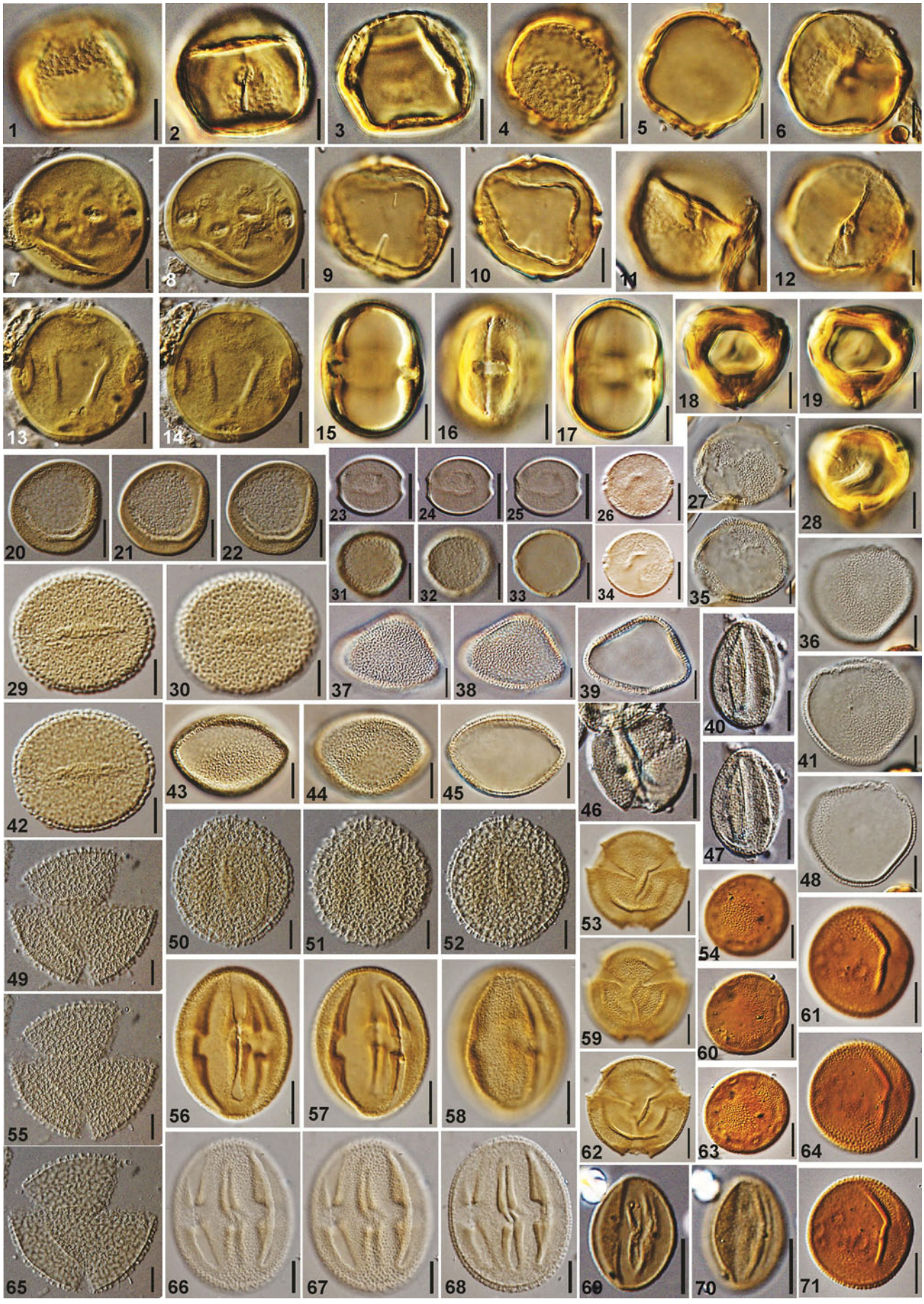
Monad; subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate, colpi with constriction, apex acute; exine semitectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina width 1.317–2.378 μm and muri width 0.319–0.904 μm; equatorial view length 42.5 μm (38–46, n = 6); equatorial view width 39 μm (36–42, n = 6); polar view length 40.7 μm (36–48, n = 10); colpi length 31.9 μm (27.4–37.4, n = 5).

**Icacinaceae** Miers

*Calatola costaricensis* Standl. (Plate 9, figures 45–47)

Monad; amb circular; symmetry radial; tricolporate; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; polar view length 25.8 μm (24–29, n = 10).

*Poraqueiba sericea* Tul. (Plate 9, figures 48, 55–58, 65)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Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction and margin (2.020 μm); exine intectate; columellae conspicuous and smaller than 1 μm; clavate; equatorial view length 53 μm (48–59, n = 10); equatorial view width 43.8 μm (41–47, n = 10); polar view length 44.7 μm (39–51, n = 9); colpi length 34.1 μm (31.6–36.2, n = 4); pore length 15 μm (11.6–17.5, n = 5); pore width 5 μm (2.6–6.4, n = 4).

**Lacistemataceae** Mart.

*Lacistema aggregatum* (P.J. Bergius) Rusby (Plate 9, figures 53–54, 61–64)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction and margin (0.589 μm), apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 16.6 μm (16–17, n = 10); equatorial view width 11.3 μm (10–13, n = 10); colpi length 11.9 μm (10.5–13.4, n = 6); pore length 3.4 μm (2.9–4.2, n = 3); pore width 1.6 μm (0.9–2.1, n = 3).

**Lamiaceae** Martinov

*Aegiphila integrifolia* (Jacq.) B.D. Jacks. (Plate 9, figures 66–69)

Monad; spherical, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolpate; colpi with apex acute; exine tectate; columellae indistinct; echinate; echinae sharp, conical and smaller than 1 μm; equatorial view length 58.4 μm (56–61, n = 10); equatorial view width 57.4 μm (53–64, n = 10); polar view length 60.1 μm (55–65, n = 10); colpi length 18.1 μm (13.4–26.6, n = 6).

*Aegiphila panamensis* Moldenke (Plate 10, figures 1–4)

Monad; spherical; amb circular; isopolar; symmetry radial; tricolpate; colpi with margin; exine tectate; columellae indistinct; echinate; echinae sharp, conical and smaller than 1 μm; equatorial view length 64 μm (56–71, n = 8); equatorial view width 57.6 μm (45–64, n = 8); polar view length 64 μm (52–76, n = 10); colpi length 31.4 μm (14.5–42.4, n = 3).

*Vitex masoniana* Pittier (Plate 10, figures 5–8, 16)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolpate; colpi as long as grains, with constriction, margin and apex acute. The margin edges are more prominent and reticulate (with small lumina); exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; heterobrochate; equatorial view length 35.1 μm (33–38, n = 10); equatorial view width 31.7 μm (30–36, n = 10); polar view length 35.1 μm (32–38, n = 10); colpi length 30.4 μm (28.8–32.7, n = 6); colpi width 3.6 μm (3.6–3.6, n = 1).

**Lauraceae** Juss.

*Aniba puchury-minor* (Mart.) Mez (Plate 10, figures 9–11)

Monad; spherical; symmetry radial; inaperturate; exine tectate; exine is very thin. Columellae conspicuous and smaller than 1 μm; echinate; echinae smaller than 1 μm, faintly discernible and scattered; equatorial view length 26 μm (23–27, n = 10); equatorial view width 26.9 μm (25–28, n = 10).

*Endlicheria paniculata* (Spreng.) J.F. Macbr. (Plate 10, figures 12–13)

Monad; spherical; amb circular; symmetry radial; inaperturate; exine intectate and echinate. Echinae smaller than 1 μm; equatorial view length 17.9 μm (15–19, n = 10); equatorial view width 20.7 μm (18–25, n = 10).

*Ocotea oblonga* (Meisn.) Mez (Plate 10, figures 14–15, 24)

Monad; spherical; symmetry radial; inaperturate; exine intectate; echinate. Echinae sharp, conical and smaller than 1 μm; equatorial view length 27 μm (23–28, n = 10); equatorial view width 28.8 μm (23–33, n = 10).

*Pleurothyrium maximum* O.C. Schmidt (Plate 10, figures 25, 32–33)

Monad; spherical; symmetry radial; inaperturate; exine intectate; echinate. Echinae sharp, conical and smaller than 1 μm; equatorial view length 44.1 μm (39–53, n = 10); equatorial view width 46.3 μm (39–54, n = 10).

**Lecythidaceae** A. Rich.

*Eschweilera albiflora* (DC.) Miers (Plate 10, figures 17–20)

Monad; subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction and margin (1.143–1.407 μm) and apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; micropitted; homobrochate; Lumina smaller than 1 μm; equatorial view length 25.1 μm (24–28, n = 9); equatorial view width 19.8 μm (18–21, n = 9); polar view length 24.8 μm (23–27, n = 9); colpi length 16.8 μm (15.5–18.2, n = 5); colpi width 1.1 μm (0.8–1.5, n = 3).

*Lecythis zabucajo* Aubl. (Plate 10, figures 21–23, 29–31)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolpate; colpi as long as grain and with constriction; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 29.8 μm (28–32, n = 9); equatorial view width 21.7 μm (19–23, n = 9); polar view length 29 μm (27–31, n = 10); colpi length 20.3 μm (16.4–23, n = 6).

Plate 12. The scale bars represent 10 μm. Photographs were taken at 100× magnification. Ev = equatorial view; Pv = polar view; Gv = general view. **Meliaceae:** *Carapa guianensis* (3-colporate Ev: 1–3; Pv: 4–5; 4-colporate Ev: 6, 11–12; Pv: 9–10); *Guarea megantha* (Ev: 7–8; Pv: 13–14); *Trichilia cipo* (Ev: 15–17; Pv: 18–19, 28). **Monimiaceae:** *Mollinedia elliptica* (Gv: 20–22). **Moraceae:** *Ficus insipida* (Gv: 23–25); *Naucleopsis oblongifolia* (Pv: 31–33), *Sorocea affinis* (Gv: 26, 34). **Myristicaceae:** *Compsoneura capitellata* (Ev: 29–30, 42); *Compsoneura sprucei* (Gv: 36, 41, 48); *Iryanthera coriacea* (Gv: 27, 35); *Osteophloeum platyspermum* (Gv: 37–39); *Otoba latialata* (Ev: 40, 47; Pv: 46); *Virola peruviana* (Ev: 43–45). **Nyctaginaceae:** *Neea amplifolia* (Ev: 50–52; Pv: 49, 55, 65). **Ochnaceae:** *Lacunaria crenata* (Ev: 56–58; Pv: 53, 59, 62); *Lacunaria jenmanii* (Ev: 66–68); *Quiina cajambrensis* (Ev: 61, 64, 71; Pv: 54, 60, 63). **Opiliaceae:** *Agonandra obtusifolia* (Ev: 69–70).

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**Loganiaceae** R. Br. ex Mart.

*Strychnos brachistantha* Standl. (Plate 10, figures 26–28, 34–36)

Monad; spherical, subprolate, prolate spheroidal; amb triangular-obtuse-convex; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 37.5 μm (34–40, n = 10); equatorial view width 34.2 μm (30–38, n = 10); polar view length 39.3 μm (34–48, n = 10); colpi length 23.6 μm (22.8–24.5, n = 2); pore length 7.5 μm (7–7.9, n = 2); pore width 3.5 μm (3.5–3.6, n = 2).

*Strychnos toxifera* R.H. Schomb. ex Lindl. (Plate 10, figures 37–39)

Monad; circular; symmetry radial; tricolporate; exine tectate; columellae indistinct, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; polar view length 34 μm (34–34, n = 1).

**Magnoliaceae** Juss.

*Magnolia sororum* Seibert (Plate 10, figures 40–41, 47)

Monad; spherical; inaperturate; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 97.6 μm (83–115, n = 11).

**Malpighiaceae** Juss.

*Hiraea faginea* (Sw.) Nied. (Plate 10, figures 42, 48, 58)

Monad; spherical; amb circular; pantoporate; pore circular; exine semitectate; columellae conspicuous; micropitted; equatorial view length 59.8 μm (49–71, n = 8); equatorial view width 61.9 μm (51–72, n = 8); pore length 6.4 μm (5.4–7.2, n = 5); pore width 5.8 μm (4.3–8, n = 5).

**Malvaceae** Juss.

*Apeiba membranacea* Spruce ex Benth. (Plate 10, figures 43, 46, 52)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; brevicolpate and apex acute; exine semitectate; columellae conspicuous and smaller than 1 μm, simplicolumellate, lumina width 0.904–1.863 μm and muri width 0.286–0.591 μm; reticulate; homobrochate; equatorial view length 61.7 μm (57–70, n = 3); equatorial view width 51.3 μm (48–53, n = 3); polar view length 57 μm (48–61, n = 6); colpi length 16.1 μm (16.1–16.1, n = 1); pore length 9 μm (9–9, n = 1); pore width 2.1 μm (2.1–2.1, n = 1).

*Apeiba tibourbou* Aubl. (Plate 10, figures 49–51, 53–56)

Monad; oblate spheroidal, spherical; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; brevicolpate, colpus with exitus digitatus (Kremp, 1965); exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate, lumina width 0.639–1.116 μm and muri width 0.202–0.429 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 42.6 μm (38–47, n = 10); equatorial view width 42.6 μm (36–48, n = 10); polar view length 45.1 μm (42–52, n = 10); colpi length 14.5 μm (11.8–17.4, n = 6); pore length 8.7 μm (6.8–10.7, n = 5); pore width 6.1 μm (5.2–6.7, n = 5).

*Abroma augusta* (L.) L.f. (Plate 10, figures 59–62)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with margin (1.212 μm), apex obtuse; exine semitectate; columellae conspicuous, simplicolumellate, lumina width 0.904–2.045 μm and muri width 0.286–0.452 μm; reticulate; Homobrochate; equatorial view length 38.8 μm (36–42, n = 10); equatorial view width 30 μm (28–34, n = 10); polar view length 33.7 μm (31–38, n = 10); colpi length 25.4 μm (22.1–30, n = 5).

*Quararibea spatulata* Ducke (Plate 10, figures 57, 63–64; Plate 11, figures 1–3)

Monad; spherical; amb circular; isopolar; symmetry radial; tricolporate, stephanocolporate; pore circular; 3–4 colpori, brevicolpate and apex obtuse; exine semitectate; columellae conspicuous and greater than 1 μm, pluricolumellate; reticulate; homobrochate; equatorial view length 87.8 μm (75–101, n = 9); equatorial view width 93.1 μm (80–103, n = 9); polar view length 92 μm (81–103, n = 2); pore length 9.2 μm (7–11.3, n = 7); pore width 10.2 μm (7.1–12.9, n = 7).

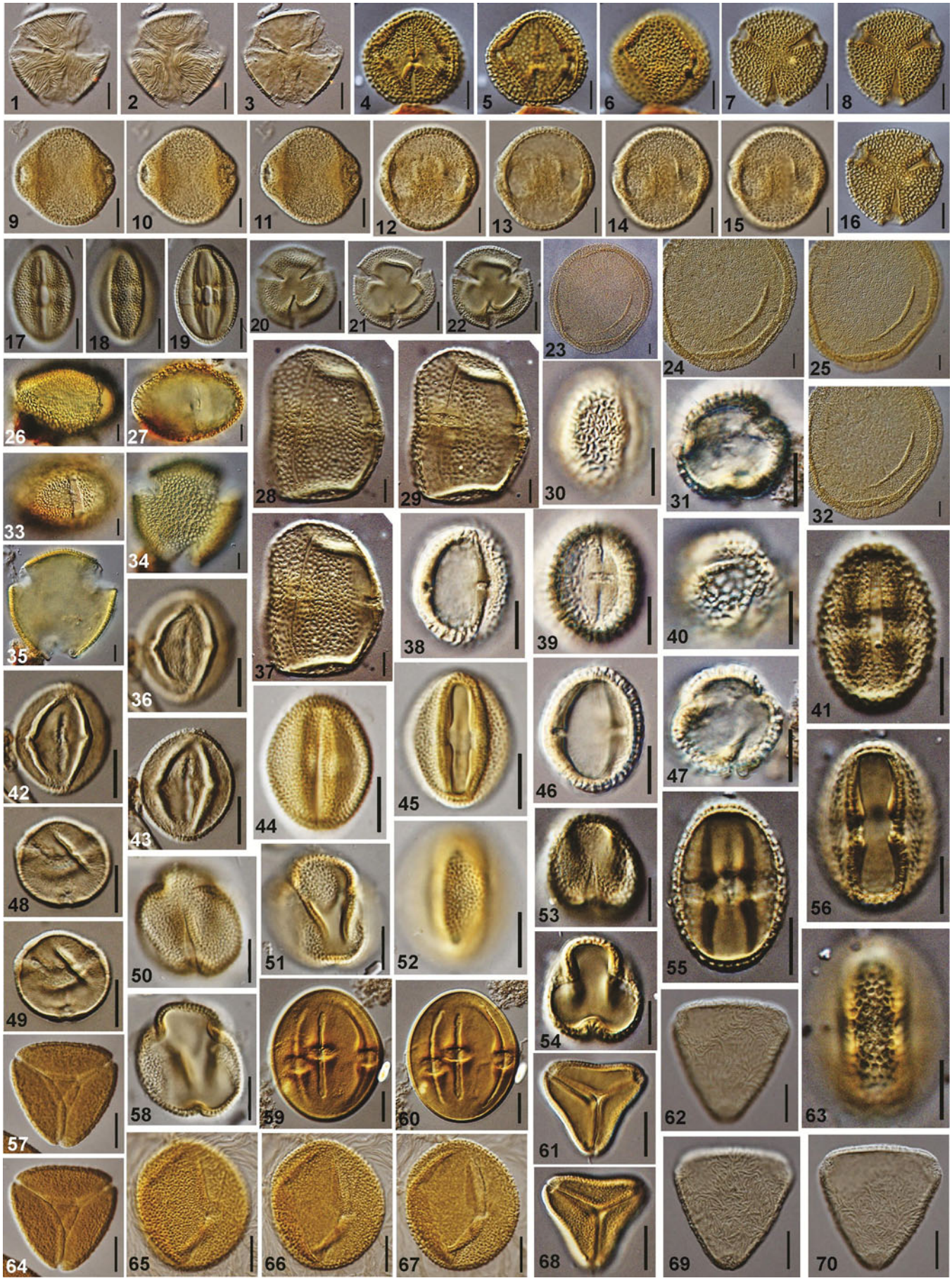
*Sterculia apetala* (Jacq.) H. Karst. (Plate 11, figures 4–6, 9–12)

Monad; subprolate, prolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; exine semitectate; columellae conspicuous and greater than 1 μm, simplicolumellate; reticulate; homobrochate; equatorial view length 35.9 μm (32–41, n = 10); equatorial view width 29.9 μm (24–36, n = 10); polar view length 34.1 μm (30–37, n = 9); colpi length 25.9 μm (19–29.4, n = 7); colpi width 1.6 μm (1.5–1.7, n = 3); pore length 7 μm (6.3–8, n = 6); pore width 2.2 μm (1.7–2.4, n = 6).

*Theobroma glaucum* H. Karst. (Plate 11, figures 16–18, 24–26)

Monad; oblate spheroidal, spherical; circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi 2/3 as long as grain; exine semitectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate;

**Plate 13.** The scale bars represent 10 μm. Photographs were taken at 100× magnification. Ev = equatorial view; Pv = polar view; Gv = general view. **Opiliaceae:** *Agonandra obtusifolia* (Ev: 1; Pv: 2–4). **Picramniaceae:** *Picramnia latifolia* (Ev: 5–7; Pv: 8–9, 19). **Piperaceae:** *Piper arboreum* (Gv: 10–11); *Piper obliquum* (Gv: 12–13). **Proteaceae:** *Roupala montana* Type 1 (Ev: 20–21; Pv: 22–24), *Roupala montana* Type 2 (Ev: 25, 35, 44; Pv: 26–28). **Polygalaceae:** *Moutabea excoriata* (Ev: 14, 29; Pv Type 1: 15–17; Pv Type 2: 18, 33–34). **Polygonaceae:** *Coccoloba belizensis* (Ev: 30–32; Pv: 39–41); *Triplaris americana* (Ev: 36–37, 45–46; Pv: 38, 47, 53); *Triplaris caracasana* (Ev: 48–50; Pv: 54–56); *Triplaris cumingiana* (Ev: 42–43, 51–52; Pv: 57–58, 66–67). **Primulaceae:** *Ardisia guianensis* (Ev: 63–65; Pv: 72–74); *Cybianthus amplus* (Ev: 59–62; Pv: 68–70); *Stylogyne lateriflora* (Ev: 75–77, 87; Pv: 71, 78). **Putranjivaceae:** *Drypetes diversifolia* (Ev: 83, 88–90; Pv: 95–97). **Rhamnaceae:** *Ziziphus itacaiunensis* (Ev: 79–80, 84; Pv: 91–92, 98). **Rhizophoraceae:** *Cassipourea peruviana* (Ev: 82, 86, 94, 101; Pv: 81, 85). **Rosaceae:** *Prunus reflexa* (Ev: 93, 99–100).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lumina width 0.714–1.720 μm and muri width 0.143–0.515 μm; equatorial view length 34.5 μm (32–38, n = 8); equatorial view width 34.2 μm (32–37, n = 8); polar view length 36.8 μm (34–40, n = 10); colpi length 17.5 μm (16.6–18, n = 3); pore length 4.5 μm (3.8–4.9, n = 3); pore width 1.8 μm (1.7–1.9, n = 3).

*Theobroma obovatum* Klotzsch ex Bernoulli (Plate 11, figures 7–8, 13–15)

Monad; oblate spheroidal, spherical; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina width 0.869–1.578 μm and muri width 0.202–0.606 μm; equatorial view length 26.9 μm (25–29, n = 9); equatorial view width 26.7 μm (23–28, n = 9); polar view length 28.3 μm (26–31, n = 9); colpi length 12.8 μm (11–16.2, n = 7); pore length 3.8 μm (3–4.4, n = 3); pore width 2.2 μm (1.9–2.7, n = 3).

**Marcgraviaceae** Bercht. & J. Presl

*Marcgravia polyantha* Delpino (Plate 11, figures 29–31, 39–40)

Monad; prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpus apex obtuse; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; colpi length 16 μm (13.2–17.2, n = 5); pore length 4.8 μm (4.8–4.8, n = 1); pore width 1.2 μm (1.2–1.2, n = 1).

**Melastomataceae** Juss.

*Adelobotrys adscendens* (Sw.) Triana (Plate 11, figures 19–23)

Monad; subprolate, prolate; amb triangular-obtuse-concave; isopolar; symmetry radial; heterocolpate; pores lalongate; 3 colpori alternating with 3 pseudocolpi; apex acute, syncolporate; exine tectate; columellae indistinct; scabrate; equatorial view length 13.5 μm (13–15, n = 10); equatorial view width 9.8 μm (8–11, n = 10); polar view length 10.8 μm (9–13, n = 10); colpi length 9.3 μm (7.9–11.1, n = 4); pore length 1.7 μm (1.7–1.7, n = 1); pore width 1.1 μm (1.1–1.1, n = 1).

*Adelobotrys tessmannii* Markgr. (Plate 11, figures 34–36, 46)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore circular; colpi with constriction and apex acute; syncolporate in polar view; exine tectate; columellae indistinct; scabrate; equatorial view length 17 μm (15–19, n = 6); equatorial view width 13 μm (12–15, n = 6); polar view length 14.6 μm (11–18, n = 9); colpi length 13.4 μm (13.1–13.8, n = 2).

*Bellucia pentamera* Naudin (Plate 11, figures 32–33, 41–42, 52)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; heterocolpate; pores lalongate; 3 colpori alternating with 3 pseudocolpi; with margin (1.010–1.152 μm), apex acute; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 27.7 μm (26–30, n = 9); equatorial view width 20.9 μm (19–23, n = 9); polar view length 24.9 μm (22–33, n = 10); colpi length 17.6 μm (16.5–19.5, n = 8); colpi width 0.7 μm (0.7–0.7, n = 1); pore length 5.5 μm (4.3–7.3, n = 4); pore width 3.2 μm (2.8–3.4, n = 4).

*Clidemia hirta* (L.) D. Don (Plate 11, figures 70, 78–81)

Monad; subprolate; amb circular; isopolar; symmetry radial; heterocolpate; pore lalongate; 3 colpori alternating with 3 pseudocolpi; apex acute; exine tectate; columellae indistinct; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 27.6 μm (22–30, n = 10); equatorial view width 21.3 μm (17–24, n = 10); polar view length 23.5 μm (19–29, n = 10); colpi length 19.2 μm (15.9–21.8, n = 4); pore length 3.7 μm (3.7–3.7, n = 1); pore width 2.1 μm (2.1–2.1, n = 1).

*Clidemia quinquenervia* (Mill.) Almeda (Plate 11, figures 64–66)

Monad; subprolate, prolate; isopolar; symmetry radial; heterocolpate; pore lalongate; 3 colpori alternating with 3 pseudocolpi; apex acute; exine tectate; columellae indistinct; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 18.3 μm (17–20, n = 9); equatorial view width 13.9 μm (13–16, n = 9); colpi length 11.4 μm (10.4–13.4, n = 7); pore length 3.5 μm (3.5–3.5, n = 1); pore width 1.8 μm (1.8–1.8, n = 1).

*Henriettea tuberculosa* (Donn. Sm.) L.O. Williams (Plate 11, figures 27–28, 37–38, 47–48)

Monad; prolate; amb circular; isopolar; symmetry radial; heterocolpate; pore circular; 3 colpori alternating with 3 pseudocolpi; apex acute; exine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 19.3 μm (17–21, n = 10); equatorial view width 13.1 μm (12–14, n = 10); polar view length 15 μm (13–17, n = 6); colpi length 12.4 μm (11.5–12.9, n = 5); pore length 3.2 μm (3.2–3.2, n = 1); pore width 2.1 μm (2.1–2.1, n = 1).

*Miconia lamprophylla* Triana (Plate 11, figures 49–51, 62–63)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; exine tectate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 16.1 μm (15–18, n = 10); equatorial view width 14.2 μm (13–17, n = 10); polar view length 15.6 μm (15–16, n = 10); colpi length 9.9 μm (8.4–11.4, n = 5); pore length 3.8 μm (3.7–3.9, n = 2); pore width 2.4 μm (2–2.7, n = 2).

**Plate 14.** The scale bars represent 10 μm. Photographs were taken at 100× magnification, with the exception of figure 23 (40× magnification). Ev = equatorial view; Pv = polar view; Gv = general view. **Rosaceae:** *Prunus reflexa* (Pv: 1–3). **Rubiaceae:** *Alibertia longiflora* (Ev: 4–6; Pv: 7–8, 16); *Faramea anisocalyx* (2-porate Pv: 9–11; 3-porate Ev: 12–15); *Ixora coccinea* (Ev: 17–19; Pv: 20–22); *Palicourea angustifolia* (Gv: 23–25, 32); *Psychotria calophylla* (Ev: 26–27, 33; Pv: 34–35). **Rutaceae:** *Amyris brenesii* (Ev: 36, 42–43; Pv: 48–49); *Conchocarpus nicaraguensis* (Ev: 28–29, 37); *Zanthoxylum juniperinum* (Ev: 30, 38–39, 46; Pv: 31, 40, 47). **Sabiaceae:** *Ophiocaryon heterophyllum* (Ev: 44–45, 52; Pv: 50–51, 58); *Meliosma glabrata* (Ev: 41, 55–56, 63; Pv: 53–54). **Salicaceae:** *Casearia arborea* (Ev: 59–60). **Sapindaceae:** *Allophylus floribundus* (Pv: 62, 69–70); *Cupania latifolia* (Ev: 65–67; Pv: 57, 64); *Cupania scrobiculata* (Pv: 61, 68).

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*Miconia serrulata* (DC.) Naudin (Plate 11, figures 59–61, 71–72)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; heterocolpate; 3 colpori alternating with 3 pseudocolpi; exine tectate; columellae indistinct; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 28.1 μm (26–30, n = 9); equatorial view width 19.9 μm (16–22, n = 9); polar view length 30.6 μm (29–32, n = 9); colpi length 21.1 μm (19.6–23.9, n = 4).

*Mouriri acutiflora* Naudin (Plate 11, figures 73–77)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; heterocolpate; pore lalongate; 3 colpori alternating with 3 pseudocolpi; exine tectate; columellae indistinct; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 20.9 μm (19–22, n = 10); equatorial view width 19.5 μm (18–22, n = 10); polar view length 19.4 μm (16–21, n = 9); colpi length 15.2 μm (14.1–16, n = 3); pore length 6.3 μm (5.8–6.8, n = 4); pore width 3.7 μm (3.3–4.4, n = 4).

*Mouriri myrtilloides* var. *parvifolia* (Benth.) Morley (Plate 11, figures 43–45, 53–55)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; heterocolpate; pore lalongate; 3 colpori alternating with 3 pseudocolpi. Colpus with constriction and apex obtuse. Exine tectate; columellae conspicuous and smaller than 1 μm; regulate. Equatorial view length 40.3 μm (36–45, n = 10); equatorial view width 32.5 μm (28–45, n = 10); polar view length 37.7 μm (36–43, n = 10); colpi length 26.5 μm (23.6–30.2, n = 6); pore length 7.1 μm (6.2–7.9, n = 2); pore width 4.4 μm (3.6–5.2, n = 2).

*Tococa caquetana* Sprague (Plate 11, figures 56–58, 67–69)

Monad; subprolate, prolate spheroidal; amb triangular-obtuse-convex; isopolar; symmetry radial; heterocolpate; pore lalongate; exine tectate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 18 μm (16–21, n = 10); equatorial view width 15 μm (14–17, n = 10); polar view length 17.1 μm (16–19, n = 8); colpi length 12.8 μm (10.2–15.4, n = 6); pore length 4.5 μm (3.7–5.3, n = 6); pore width 1.8 μm (1.3–2.7, n = 6).

**Meliaceae** Juss.

*Carapa guianensis* Aubl. (Plate 12, figures 1–6, 9–12)

Monad; spherical, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate and tetracolporate; pore circular; colpi with constriction and margin, apex obtuse; exine tectate; columellae indistinct; reticulate; lumina smaller than 1 μm; equatorial view length 35.9 μm (30–43, n = 10); equatorial view width 36 μm (33–40, n = 10); polar view length 39.6 μm (35–55, n = 7); colpi length 15.1 μm (11.8–20.3, n = 8); pore length 4.5 μm (3.9–5.3, n = 7); pore width 3.9 μm (3.1–4.9, n = 7).

*Guarea megantha* A. Juss. (Plate 12, figures 7–8, 13–14)

Monad; spherical; amb circular; isopolar; symmetry radial; stephanocolporate; pore circular; 4 colpori, loxocolporate; brevicolpate; exine tectate; columellae indistinct; scabrate; equatorial view length 44 μm (39–47, n = 6); equatorial view width 45.5 μm (43–48, n = 6); polar view length 47.4 μm (43–52, n = 9); colpi length 19.9 μm (19.9–19.9, n = 1); pore length 4.1 μm (4.1–4.1, n = 1); pore width 6.4 μm (6.4–6.4, n = 1).

*Trichilia cipo* (A.Juss.) C.DC. (Plate 12, figures15–19, 28)

Monad; prolate; amb triangular-acute-convex; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain, with costa endocolpi (2.060–2.973 μm) and apex acute; exine tectate; columellae indistinct; reticulate; lumina smaller than 1 μm; equatorial view length 44.3 μm (38–53, n = 10); equatorial view width 29.5 μm (25–32, n = 10); polar view length 27.3 μm (25–29, n = 6); colpi length 29.1 μm (24.7–35, n = 7); pore length 8.3 μm (4.7–10.5, n = 7); pore width 3.9 μm (1.6–4.9, n = 7).

**Monimiaceae** Juss.

*Mollinedia elliptica* (Gardner) A. DC. (Plate 12, figures 20–22)

Monad; spherical; symmetry radial; inaperturate; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 24.1 μm (21–28, n = 8); equatorial view width 23.9 μm (18–28, n = 8).

**Moraceae** Gaudich.

*Ficus insipida* Willd. (Plate 12, figures 23–25)

Monad; suboblate; elliptic; isopolar; symmetry bilateral; diporate; pore circular; exine tectate; columellae indistinct; scabrate; equatorial view length 12.2 μm (11–13, n = 10); equatorial view width 15.4 μm (14–17, n = 10).

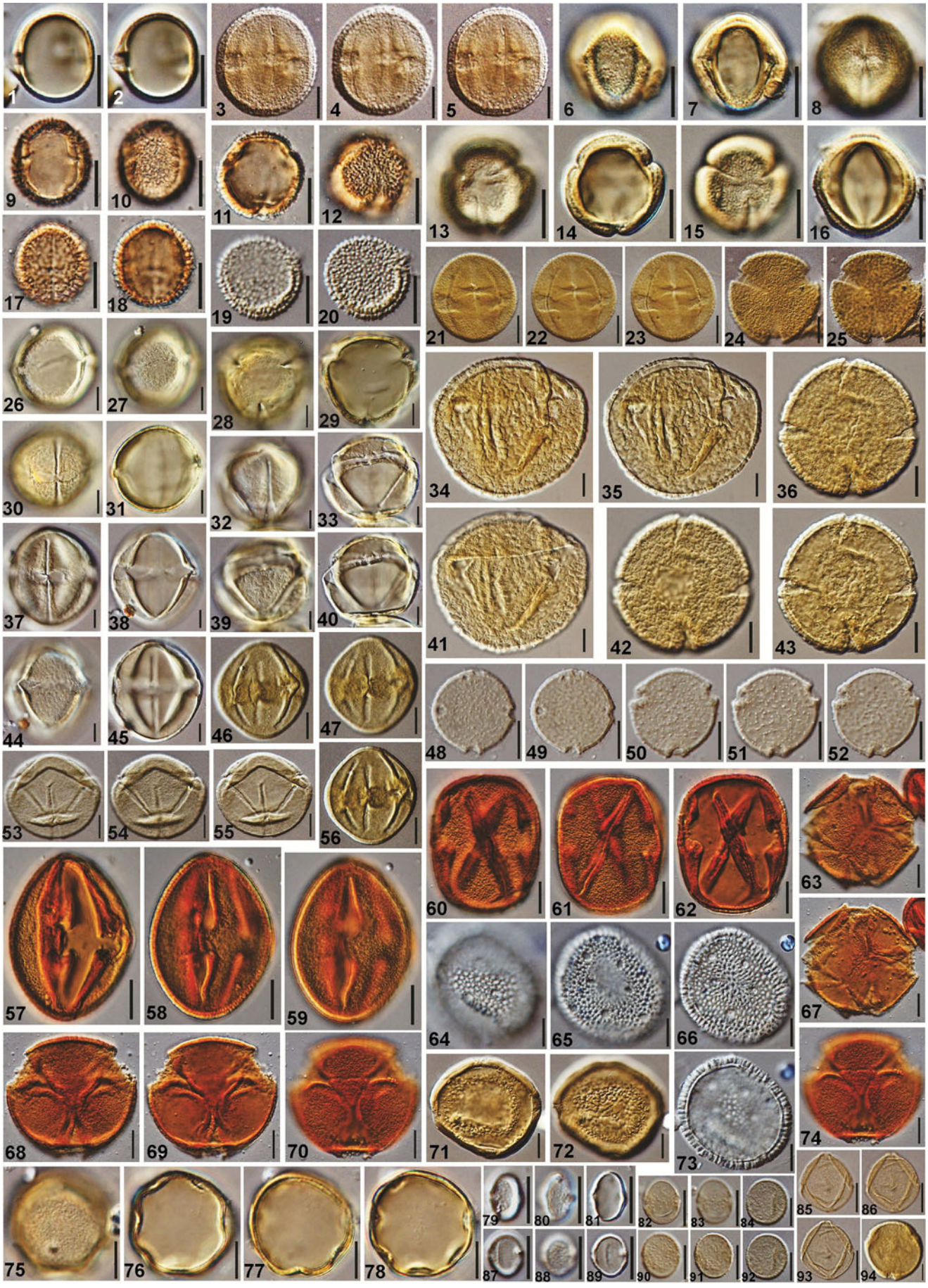
*Naucleopsis oblongifolia* (Kuhlm.) Carauta (Plate 12, figures 31–33)

Monad; circular; isopolar; symmetry radial; triporate; exine tectate; columellae indistinct; echinate; echinae smaller than 1 μm; polar view length 18.1 μm (16–20, n = 10).

*Sorocea affinis* Hemsl. (Plate 12, figures 26, 34)

Monad; suboblate, oblate spheroidal; isopolar; symmetry bilateral; diporate; circular; exine tectate; columellae indistinct; echinate. Echinae smaller than 1 μm; equatorial view

**Plate 15.** The scale bars represent 10 μm. Photographs were taken at 100× magnification. Ev = equatorial view; Pv = polar view; Gv = general view. **Sapindaceae:** *Matayba opaca* (Ev: 1–3; Pv: 4–6); *Paullinia bracteosa* (Pv: 7, 14); *Paullinia cupana* (Pv: 8–10); *Paullinia rugosa* (Pv: 11–12); *Talisia acutifolia* (Ev: 13, 20–21; Pv: 17–19); *Vouarana guianensis* (Pv: 15–16, 22). **Sapotaceae:** *Chrysophyllum africanum* (Ev: 28–30; Pv: 26–27); *Chrysophyllum amazonicum* (Ev: 24–25, 33; Pv: 23, 32); *Chrysophyllum argenteum* Type 1 (Ev: 34–36; Pv: 44–45), *Chrysophyllum argenteum* Type 2 (Ev: 37–39, 46); *Chrysophyllum argenteum* subsp. *panamense* (Ev: 31, 40–41, 50); *Chrysophyllum cainito* Type 1 (Ev: 47–48, 59), *Chrysophyllum cainito* Type 2 (Ev: 57–58, 66); *Chrysophyllum marginatum* (Ev: 42–43, 51–52; Pv: 53–55); *Chrysophyllum mexicanum* (Ev: 49, 60, 78; Pv: 61, 69, 79); *Chrysophyllum oliviforme* (Ev: 56, 64–65); *Chrysophyllum splendens* (Ev: 62–63); *Manilkara bidentata* (Ev: 70, 72–73); *Micropholis guyanensis* (Ev: 67–68, 76–77); *Micropholis venulosa* (Ev: 74–75); *Pouteria cladantha* (Ev: 84–86; Pv: 82–83); *Sarcaulus brasiliensis* (Ev: 81; Pv: 71, 80).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length 16.3 μm (14–18, n = 10); equatorial view width 17.8 μm (16–19, n = 10).

**Myristicaceae** R. Br.

*Compsoneura capitellata* (A. DC.) Warb. (Plate 12, figures 29–30, 42)

Monad; symmetry bilateral; monosulcate (monocolpate); exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 29.5 μm (25–35, n = 10); equatorial view width 36.9 μm (32–40, n = 10); colpi length 24.4 μm (21.7–28.2, n = 4).

*Compsoneura sprucei* (A. DC.) Warb. (Plate 12, figures 36, 41, 48)

Monad; spherical; symmetry radial; inaperturate; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 29.1 μm (24–34, n = 9); equatorial view width 35.1 μm (34–38, n = 9).

*Iryanthera coriacea* Ducke (Plate 12, figures 27, 35)

Monad; spherical; symmetry asymmetric; inaperturate; exine tectate; columellae conspicuous, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 34.3 μm (28–44, n = 10); equatorial view width 39.1 μm (33–47, n = 10).

*Osteophloeum platyspermum* (Spruce ex A. DC.) Warb. (Plate 12, figures 37–39)

Monad; inaperturate; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 24.7 μm (22–28, n = 10); equatorial view width 33.4 μm (29–38, n = 10).

*Otoba latialata* (Pittier) A.H. Gentry (Plate 12, figures 40, 46–47)

Monad; subprolate, prolate; circular; isopolar; symmetry radial; tricolpate; exine tectate; columellae indistinct and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 24.1 μm (22–27, n = 9); equatorial view width 17.8 μm (17–19, n = 9); polar view length 24.2 μm (21–30, n = 10); colpi length 18.5 μm (17.6–19.4, n = 2).

*Virola peruviana* (A. DC.) Warb. (Plate 12, figures 43–45)

Monad; anisopolar; symmetry bilateral; monosulcate (monocolpate); exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 24.3 μm (21–29, n = 6); equatorial view width 33.2 μm (31–35, n = 6); colpi length 24.8 μm (24.8–24.8, n = 1); colpi width 2.5 μm (2.5–2.5, n = 1).

**Nyctaginaceae** Juss.

*Neea amplifolia* Donn. Sm. (Plate 12, figures 49–52, 55, 65)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolpate; colpi with margin and apex acute; exine semitectate; columellae conspicuous and greater than 1 μm, simplicolumellate; reticulate; homobrochate; equatorial view length 48.7 μm (45–51, n = 6); equatorial view width 42.3 μm (38–45, n = 6); polar view length 54.3 μm (42–60, n = 10); colpi length 35.3 μm (33.6–38.3, n = 3).

**Ochnaceae** DC.

*Lacunaria crenata* (Tul.) A.C. Sm. (Plate 12, figures 53, 56–59, 62)

Monad; subprolate, prolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction and margin (1.714–2.290 μm), apex obtuse; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 36.1 μm (32–39, n = 10); equatorial view width 28.3 μm (27–31, n = 10); polar view length 31.4 μm (27–37, n = 10); colpi length 25.9 μm (21.2–29, n = 7); colpi width 1.6 μm (1.1–1.9, n = 3); pore length 7 μm (5.6–7.9, n = 5); pore width 3.7 μm (3–4.6, n = 5).

*Lacunaria jenmanii* (Oliv.) Ducke (Plate 12, figures 66–68)

Monad; subprolate, prolate, prolate spheroidal; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction and margin (1.286–3.014 μm), apex obtuse; exine tectate; columellae conspicuous, simplicolumellate; reticulate; homobrochate. Equatorial view length 47.4 μm (42–52, n = 8); equatorial view width 37.6 μm (34–41, n = 8); colpi length 32 μm (31–33.6, n = 5); colpi width 2.8 μm (2.2–3.3, n = 2).

*Quiina cajambrensis* Cuatrec. (Plate 12, figures 54, 60–61, 63–64, 71)

Monad; spherical; amb circular; symmetry radial; pantoporate; pore circular; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 25.3 μm (20–28, n = 7); equatorial view width 26.6 μm (24–29, n = 7); polar view length 25.7 μm (22–31, n = 10); pore length 3.1 μm (2.1–3.8, n = 4); pore width 2.5 μm (2.2–2.7, n = 4).

**Plate 16.** The scale bars represent 10 μm. Photographs were taken at 100× magnification. Ev = equatorial view; Pv = polar view; Gv = general view. **Sapotaceae:** *Sarcaulus brasiliensis* (Ev: 1–2). **Simaroubaceae:** *Picrolemma spruce* (Ev: 3–5); *Simaba glabra* (Ev: 6–8, 16; Pv: 13–15); *Simarouba amara* (Ev: 9–10, 17–18; Pv: 11–12). **Siparunaceae:** *Siparuna guianensis* (Ev: 21–23; Pv: 24–25); *Siparuna parciflora* (Ev: 19–20). **Solanaceae:** *Brunfelsia grandiflora* (Ev: 34–35, 41; Pv: 36, 42–43), *Cestrum nocturnum* (Ev: 37–38, 44–45; Pv: 32–33, 39–40); *Cestrum schlechtendahlii* (Ev: 26–27, 30–31; Pv: 28–29); *Solanum diversifolium* (Ev: 46–47, 56; Pv: 53–55). **Stemonuraceae:** *Discophora guianensis* (4-porate Pv: 48–49; 3-porate Pv: 50–52). **Styracaceae:** *Styrax grandifolius* (4-colporate Ev: 60–62; Pv: 63, 67; 3-colporate Ev: 57–59; Pv: 68–70, 74). **Thymelaeaceae:** *Schoenobiblus daphnoides* (Ev: 64–66, 73). **Trigoniaceae:** *Trigonia laevis* (Pv: 71–72). **Ulmaceae:** *Ampelocera cubensis* (Pv: 75–78). **Urticaceae:** *Cecropia longipes* (Ev: 79–81); *Cecropia obtusifolia* (Ev: 87–89); *Cecropia pachystachya* (Ev: 82–83); *Cecropia peltata* (Ev: 90–91); *Pourouma bicolor* (Ev: 84, 92); *Urera bacifera* (Pv: 85–86, 93). **Verbenaceae:** *Citharexylum macrophyllum* (Pv: 94).

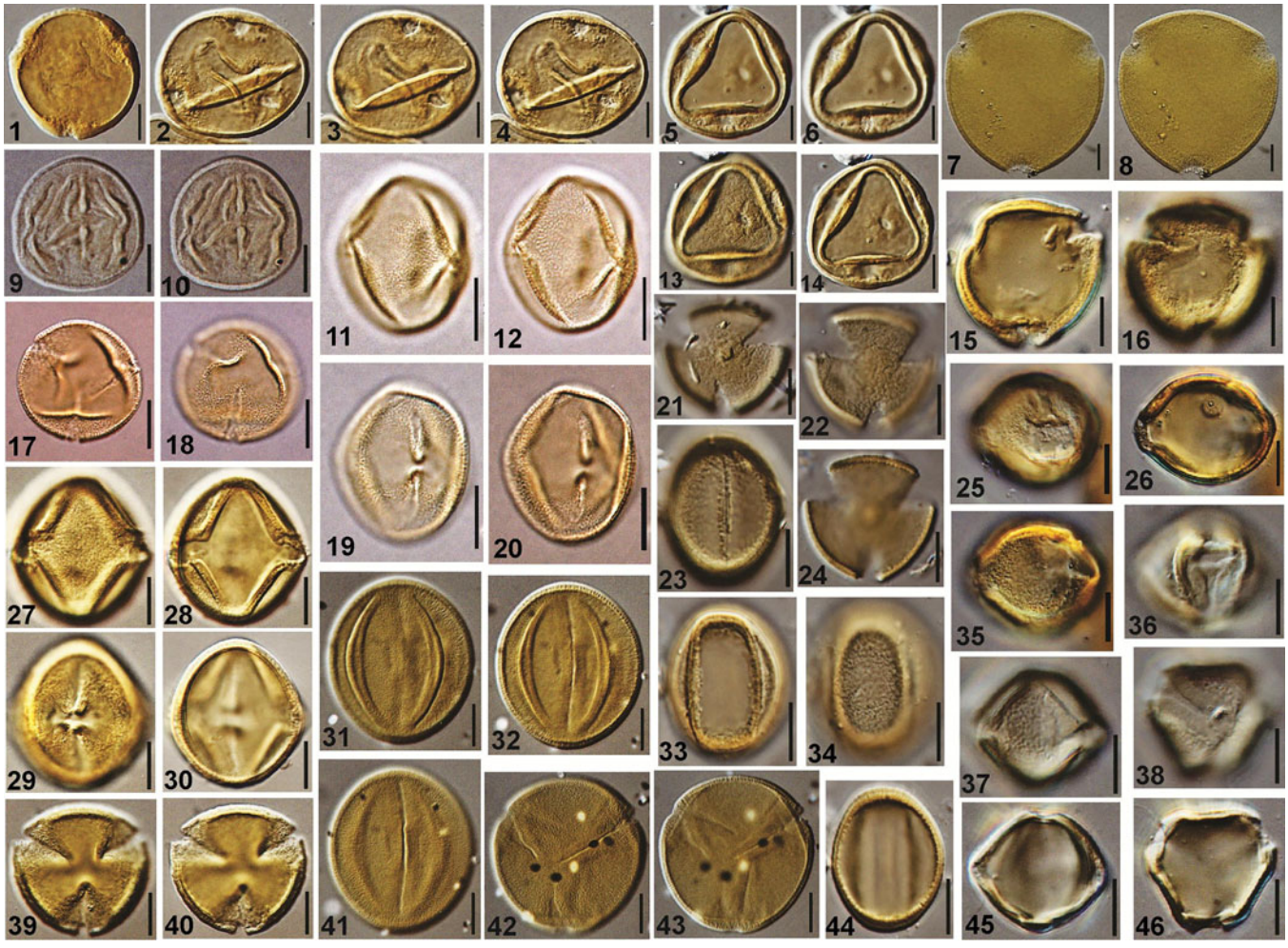

**Plate 17.** The scale bars represent 10 μm. Photographs were taken at 100× magnification. Ev = equatorial view; Pv = polar view; Gv = general view. **Verbenaceae:** *Citharexylum macrophyllum* (Ev: 2–4; Pv: 1, 5–6, 13–14); *Petrea volubilis* (Pv: 7–8). **Violaceae:** *Gloeospermum sphaerocarpum* (Ev: 9–10); *Leonia cymosa* (Ev: 11–12, 19–20; Pv: 17–18); *Rinorea guianensis* (Ev: 25–26, 35; Pv: 15–16); *Rinorea squamata* (Ev: 23, 33–34, 44; Pv: 21–22, 24). **Vochysiaceae:** *Erisma calcaratum* (Ev: 27–30; Pv: 39–40); *Ruizterania cassiquiarensis* (Ev: 31–32, 41; Pv: 42–43); *Vochysia ferruginea* (Ev: 36–37, 45; Pv: 38, 46).

**Opiliaceae** Valeton

*Agonandra obtusifolia* Standl. (Plate 12, figures 69–70; Plate 13, figures 1–4)

Monad; prolate spheroidal, subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi 2/3 as long as grain, apex acute, colpi with constriction; exine tectate; columellae indistinct; echinate; echinae smaller than 1 μm. Equatorial view length 21.5 μm (21–22, n = 10); equatorial view width 17.4 μm (16–20, n = 10); polar view length 21.9 μm (20–23, n = 10); colpi length 13.8 μm (13–15, n = 4); colpi width 2 μm (1.7–2.2, n = 2).

**Picramniaceae** Fernando & Quinn

*Picramnia latifolia* Tul. (Plate 13, figures 5–9, 19)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain, with constriction; exine tectate; columellae conspicuous and smaller than 1 μm; striate. Equatorial view length 23.1 μm (18–26, n = 10); equatorial view width 16 μm (15–17, n = 10); polar view length 18 μm (16–21, n = 10); colpi length 19.9 μm (17–22, n = 8); colpi width 1.4 μm (0.7–2.2, n = 5).

**Piperaceae** Giseke

*Piper arboreum* Aubl. (Plate 13, figures10–11)

Monad; symmetry bilateral; monosulcate (monocolpate); exine tectate; columellae indistinct; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 9.2 μm (8–10, n = 8); equatorial view width 10.8 μm (9–12, n = 8).

*Piper obliquum* Ruiz & Pav. (Plate 13, figures 12–13)

Monad; symmetry bilateral; monosulcate (monocolpate); exine tectate; columellae indistinct, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 11.7 μm (9–14, n = 10); equatorial view width 14.9 μm (14–16, n = 10).

**Polygalaceae** Hoffmanns. & Link

*Moutabea excoriata* Mart. ex Miq. (Plate 13, figures 14–18, 29, 33–34)

Monad; subprolate, prolate, prolate spheroidal; amb circular; isopolar; symmetry radial; stephanocolporate; pore circular; 13–14 colpori, colpi with apex acute; exine tectate; columellae indistinct; scabrate. Equatorial view length 46 μm (36–55,

n = 10); equatorial view width 37.5 μm (26–43, n = 10); polar view length 53.1 μm (48–59, n = 7); colpi length 29.9 μm (23.9–36.7, n = 10); colpi width 3 μm (2.3–4.1, n = 7); pore length 5 μm (3.4–6.3, n = 9); pore width 4.5 μm (2.6–6.8, n = 8).

**Polygonaceae** Juss.

*Coccoloba belizensis* Standl. (Plate 13, figures 30–32, 39–41)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with margin (1.006–1.597 μm), apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 58 μm (52–62, n = 10); equatorial view width 45.7 μm (43–51, n = 10); polar view length 50.9 μm (46–54, n = 7); colpi length 42.6 μm (36.4–46.8, n = 6).

*Triplaris americana* L. (Plate 13, figures 36–38, 45–47, 53)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lolongate; colpi with apex acute; exine semitectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; equatorial view length 53.3 μm (47–63, n = 10); equatorial view width 44.8 μm (38–50, n = 10); polar view length 48.5 μm (41–55, n = 10); colpi length 45.3 μm (38.6–55.5, n = 7); pore length 4.5 μm (3.9–5.5, n = 3); pore width 5.9 μm (5.1–6.4, n = 3).

*Triplaris caracasana* Cham. (Plate 13, figures 48–50, 54–56)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lolongate; colpi with apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 28.9 μm (25–36, n = 10); equatorial view width 22.4 μm (18–28, n = 10); polar view length 24.7 μm (18–30, n = 6); colpi length 22.1 μm (15.6–27.7, n = 3); colpi width 2.4 μm (2.4–2.4, n = 1); pore length 2.3 μm (2.3–2.3, n = 1); pore width 3.7 μm (3.7–3.7, n = 1).

*Triplaris cumingiana* Fisch. & C.A. Mey. (Plate 13, figures 42–43, 51–52, 57–58, 66–67)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with margin (1.720–2.607 μm), apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate. Equatorial view length 54.9 μm (51–59, n = 9); equatorial view width 41.6 μm (38–45, n = 9); polar view length 50.3 μm (44–55, n = 10); colpi length 35 μm (33.6–36.9, n = 5); colpi width 1.3 μm (1.3–1.3, n = 1); pore length 6.2 μm (5.9–6.4, n = 2); pore width 8.2 μm (7.7–8.6, n = 2).

**Primulaceae** Batsch ex Borkh.

*Ardisia guianensis* (Aubl.) Mez (Plate 13, figures 63–65, 72–74)

Monad; subprolate, prolate spheroidal; circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi 2/3 as long as grain, apex acute; exine semitectate; columellae indistinct; reticulate; homobrochate; circular lumina and thin muri. Equatorial view length 21.8 μm (18–25, n = 10); equatorial view width 17.7 μm (15–20, n = 10); polar view length 17.1 μm (15–19, n = 7); colpi length 12.6 μm (8.6–16.8, n = 4); pore length 12.5 μm (6.8–16.3, n = 3); pore width 3.3 μm (3.3–3.3, n = 1).

*Cybianthus amplus* (Mez) G. Agostini (Plate 13, figures 59–62, 68–70)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain, with margin and apex acute; exine tectate; columellae indistinct; psilate; equatorial view length 21.7 μm (20–24, n = 9); equatorial view width 14.8 μm (13–16, n = 9); polar view length 17 μm (17–17, n = 1); colpi length 16.6 μm (12.9–18.9, n = 6); pore length 4.3 μm (3.7–4.8, n = 5); pore width 2.3 μm (1.6–3, n = 5).

*Stylogyne lateriflora* (Sw.) Mez (Plate 13, figures 71, 75–78, 87)

Monad; subprolate, prolate; circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi 2/3 as long as grain, with constriction and margin (1.46 μm), apex acute; exine semitectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate. Equatorial view length 28.2 μm (27–29, n = 10); equatorial view width 21 μm (19–23, n = 10); polar view length 23.3 μm (21–25, n = 7); colpi length 20.7 μm (18.1–22.8, n = 6); pore length 5.1 μm (4–7.9, n = 5); pore width 2.8 μm (1.5–4.7, n = 5).

**Proteaceae** Juss.

*Roupala montana* Aubl. Type 1 (Plate 13, figures 20–24)

Monad; oblate, suboblate; amb triangular-obtuse-convex; isopolar; symmetry radial; triporate; pore circular; exine tectate; columellae indistinct, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 17.6 μm (15–20, n = 7); equatorial view width 24.3 μm (21–27, n = 7); polar view length 22.8 μm (20–25, n = 10); pore length 2.3 μm (1.9–3, n = 3); pore width 2.6 μm (2.2–3.4, n = 3).

*Roupala montana* Aubl. Type 2 (Plate 13, figures 25–28, 35, 44)

Monad; suboblate, oblate spheroidal; amb triangular-obtuse-convex; isopolar; symmetry radial; triporate; pore circular; exine tectate; columellae indistinct; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 22.8 μm (21–27, n = 6); equatorial view width 26.5 μm (25–29, n = 6); polar view length 26.3 μm (23–28, n = 9); pore length 2.7 μm (2.7–2.7, n = 1); pore width 3.1 μm (3.1–3.1, n = 1).

**Putranjivaceae** Endl.

*Drypetes diversifolia* Krug & Urb. (Plate 13, figures 83, 88–90, 95–97)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain, with margin (with exitus digitatus) and apex acute; exine tectate; columellae conspicuous and smaller than 1 μm,

simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 29.7 μm (23–35, n = 10); equatorial view width 25.5 μm (22–29, n = 10); polar view length 29.1 μm (25–33, n = 9); colpi length 21.9 μm (17.1–27, n = 7); pore length 5.5 μm (4.4–8.2, n = 6); pore width 3 μm (2–4.5, n = 6).

**Rhamnaceae** Juss.

*Ziziphus itacaiunensis* Fróes (Plate 13, figures 79–80, 84, 91–92, 98)

Monad; suboblate; amb triangular-obtuse-concave; isopolar; symmetry radial; tricolporate; pore circular; colpi wider and with apex obtuse; exine tectate; columellae indistinct, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 23.4 μm (21–28, n = 8); equatorial view width 28.2 μm (26–31, n = 8); polar view length 27 μm (24–32, n = 7); colpi length 17.8 μm (16.8–19.1, n = 3); colpi width 8.6 μm (2.5–11.8, n = 3); pore length 5.2 μm (3.9–6.1, n = 3); pore width 5.8 μm (5.3–6.1, n = 3).

**Rhizophoraceae** Pers.

*Cassipourea peruviana* Alston (Plate 13, figures 81–82, 85–86, 94, 101)

Monad; prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with margin (0.869 μm) and costa endocolpi, colpi with apex acute; exine tectate; columellae conspicuous, simplicolumellate; reticulate; homobrochate. Equatorial view length 20.6 μm (17–23, n = 10); equatorial view width 13.4 μm (12–15, n = 10); polar view length 15.5 μm (14–17, n = 4); colpi length 14.8 μm (12.3–17.8, n = 9); pore length 5.2 μm (3.5–6.9, n = 7); pore width 2.6 μm (1.9–3.6, n = 7).

**Rosaceae** Juss.

*Prunus reflexa* (Gardner) Walp. (Plate 13, figures 93, 99–100; Plate 14, figures 1–3)

Monad; prolate, subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; Colpi thin, with margin, apex acute; exine tectate; columellae indistinct; striatoreticulate; with inconspicuous reticulum. Colpi length 25.7 μm (23.1–28.8, n = 4); pore length 7.2 μm (7.2–7.2, n = 2); pore width 5.5 μm (5.5–5.5, n = 2).

**Rubiaceae** Juss.

*Alibertia longiflora* K. Schum. (Plate 14, figures 4–8, 16)

Monad; prolate spheroidal, spherical; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain, with constriction; margin with exitus digitatus, with costa ectocolpi; exine semitectate; columellae conspicuous and greater than 1 μm, simplicolumellate; reticulate; homobrochate. Equatorial view length 35.3 μm (31–40, n = 10); equatorial view width 34.5 μm (30–38, n = 10); polar view length 37.1 μm (34–39, n = 8); colpi length 24.1 μm (20–26.2, n = 7); pore length 4.4 μm (4.4–4.4, n = 1); pore width 1.8 μm (1.8–1.8, n = 1).

*Faramea anisocalyx* Poepp. (Plate 14, figures 9–15)

Monad; outline circular; isopolar; symmetry bilateral; diporate; pore circular; exine tectate; columellae conspicuous and greater than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 49.3 μm (39–58, n = 10). Equatorial view width 46.6 μm (38–54, n = 10); polar view length 43.2 μm (34–50, n = 9); colpi length 28.7 μm (28.7–28.7, n = 1).

*Ixora coccinea* L. (Plate 14, figures 17–22)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain, with margin (with costa endocolpi), apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 30.8 μm (28–33, n = 10); equatorial view width 21.2 μm (19–26, n = 10); polar view length 27.5 μm (24–31, n = 8); colpi length 24.4 μm (22.4–26.5, n = 6); colpi width 0.9 μm (0.9–1, n = 3); pore length 6.6 μm (6.3–7.1, n = 3); pore width 4.4 μm (4.2–4.6, n = 3).

*Palicourea angustifolia* Kunth (Plate 14, figures 23–25, 32)

Monad; spherical; outline circular; symmetry radial; inaperturate; exine intectate; simplicolumellate, columellae conspicuous that branches into three parts (digitate); reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 36.9 μm (34–40, n = 10); equatorial view width 38.3 μm (36–43, n = 10).

*Psychotria calophylla* Standl. (Plate 14, figures 26–27, 33–35)

Monad; oblate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain; exine semitectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate. Equatorial view length 47 μm (47–47, n = 1); equatorial view width 67 μm (67–67, n = 1); polar view length 61.5 μm (50–70, n = 8); colpi length 28.6 μm (28.6–28.6, n = 1); colpi width 4.9 μm (4.9–4.9, n = 1); pore length 6.1 μm (6.1–6.1, n = 1); pore width 4.4 μm (4.4–4.4, n = 1).

**Rutaceae** Juss.

*Amyris brenesii* Standl. (Plate 14, figures 36, 42–43, 48–49)

Monad; prolate spheroidal, subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi 2/3 as long as grain, with constriction and apex acute; exine tectate; columellae indistinct; striatoreticulate; with inconspicuous reticulum. Equatorial view length 21.9 μm (21–23, n = 10); equatorial view width 17.4 μm (15–20, n = 10); polar view length 20.6 μm (19–22, n = 7); colpi length 13.9 μm (12.1–15.1, n = 6); pore length 3.5 μm (2.9–4.1, n = 3); pore width 2.5 μm (1.7–3, n = 3).

*Conchocarpus nicaraguensis* (Standl. & L.O.Williams) Kallunki & Pirani (Plate 14, figures 28–29, 37)

Monad; prolate; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain, apex acute; semiexine tectate; columellae conspicuous and smaller than 1 μm; reticulate; homobrochate; equatorial view length 75.2 μm (68.5–87.7, n = 5); equatorial view width 57.6 μm (50.5–64.3,

n = 5); colpi length 48.5 μm (43.8–50.8, n = 4); pore length 11.4 μm (9.4–16.4, n = 4); pore width 3.6 μm (3.4–3.9, n = 4).

*Zanthoxylum juniperinum* Poepp. (Plate 14, figures 30–31, 38–40, 46–47)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain; exine tectate; columellae conspicuous and greater than 1 μm, simplicolumellate; reticulate; homobrochate; equatorial view length 27.1 μm (25–29, n = 10); equatorial view width 20.5 μm (18–22, n = 10); polar view length 20.4 μm (18–23, n = 9); colpi length 19.6 μm (18–22.1, n = 8); pore length 4.6 μm (3.4–5.7, n = 8); pore width 2 μm (1–2.9, n = 8).

**Sabiaceae** Blume

*Ophiocaryon heterophyllum* (Benth.) Urb. (Plate 14, figures 44–45, 50–52, 58)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; apex acute; exine tectate; columellae conspicuous, smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 25.1 μm (22–28, n = 10); equatorial view width 18.4 μm (15–24, n = 10); polar view length 25 μm (20–27, n = 6); colpi length 21.8 μm (19–24.4, n = 8); colpi width 1.2 μm (1–1.5, n = 3); pore length 6.3 μm (5.5–7.6, n = 4); pore width 4 μm (3.3–4.6, n = 4).

*Meliosma glabrata* (Liebm.) Urb. (Plate 14, figures 41, 53–56, 63)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; apex acute; exine semitectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate. Equatorial view length 31.1 μm (29–33, n = 11); equatorial view width 22.5 μm (21–27, n = 11); polar view length 22.5 μm (22–23, n = 2); colpi length 22.2 μm (19.8–25, n = 6); pore length 8.3 μm (7.4–10.1, n = 3); pore width 4.9 μm (4.8–5, n = 2).

**Salicaceae** Mirb.

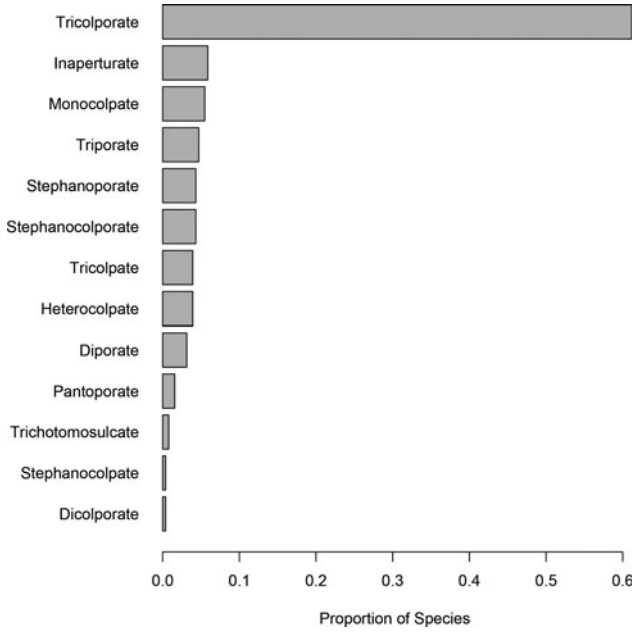


Figure 2. Types of apertures found in the 255 described species and the proportion of species that have these types of openings.

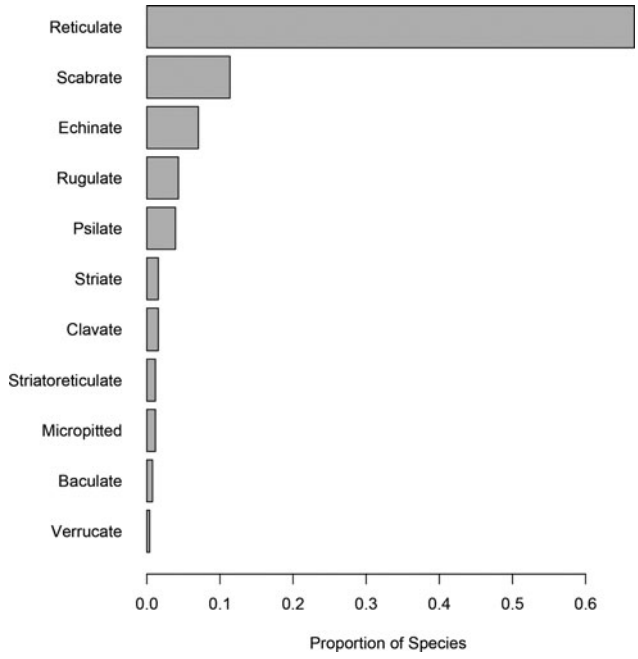


Figure 3. Types of sexine ornamentation found in the 255 described species and the proportion of species that have these types of sculpture.

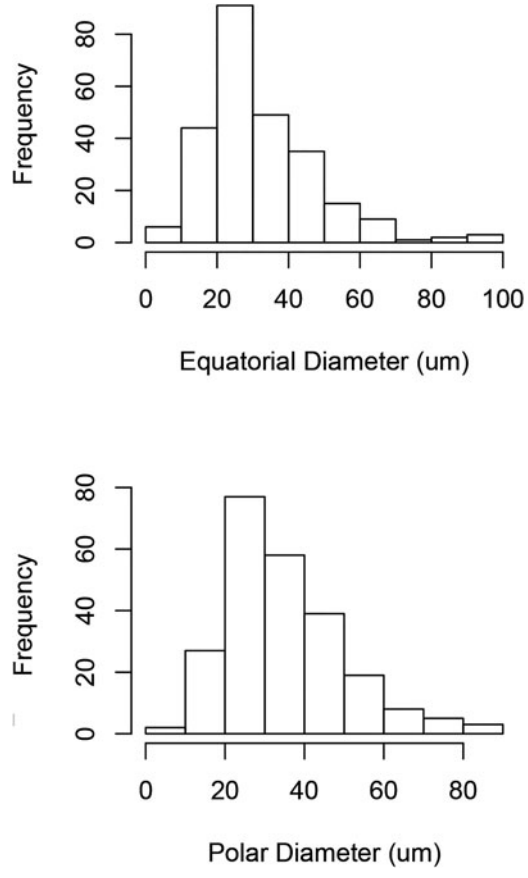


Figure 4. Distribution of pollen size (μm) in equatorial and polar diameters of the 255 described species.

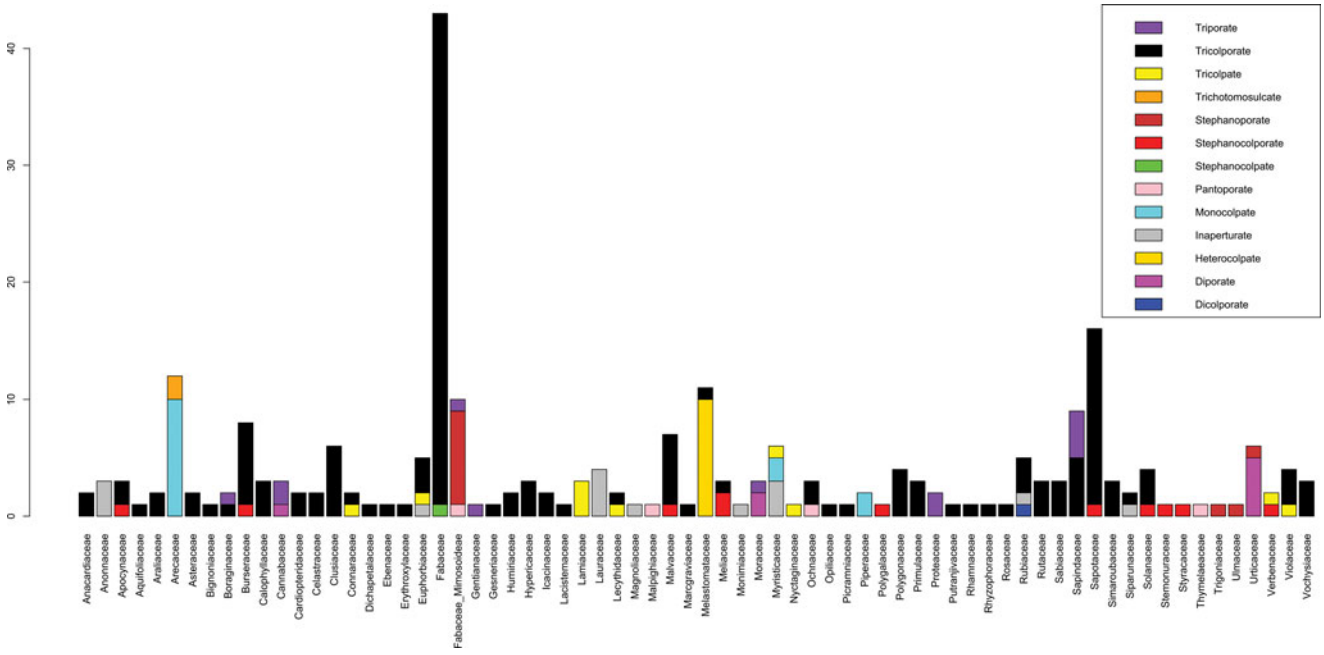


**Figure 5.** Distribution of aperture types among the 255 species described for the Amacayacu Forest Dynamics Plot (AFDP), by family.

*Casearia arborea* (Rich.) Urb. (Plate 14, figures 59–60)

Monad; subprolate, prolate spheroidal; isopolar; symmetry radial; tricolporate; pore lalongate; colpi 2/3 as long as grains, margin with exitus digitatus, apex obtuse; exine tectate; columellae inconspicuous and smaller than 1 µm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 µm. Equatorial view length 45 µm (37–49.1, n = 10); equatorial view width 38.6 µm (32.2–42.7, n = 10); colpi length 29.8 µm (26.4–34.1, n = 8); colpi width 1.7 µm (1.7–1.7, n = 1); pore length 8.8 µm (7.9–10.7, n = 10); pore width 3.6 µm (1.1–5.1, n = 10).

**Sapindaceae** Juss.

*Allophylus floribundus* (Poepp.) Radlk. (Plate 14, figures 62, 69–70)

Monad; amb triangular-obtuse-convex; isopolar; symmetry radial; triporate; exine tectate; columellae conspicuous, type pilum; rugulate; polar view length 32.7 µm (27–41, n = 6).

*Cupania latifolia* Kunth (Plate 14, figures 57, 64–67)

Monad; subprolate; amb triangular-obtuse-convex; isopolar; symmetry radial; tricolporate; pore lalongate; parasyncolporate; exine tectate; columellae conspicuous and smaller than 1 µm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 µm. Equatorial view length 38 µm (37–39, n = 2); equatorial view width 33 µm (32–34, n = 2); polar view length 29.8 µm (24–34, n = 10).

*Cupania scrobiculata* Rich. (Plate 14, figures 61, 68)

Monad; amb triangular-obtuse-concave; symmetry radial; tricolporate; syncolporate; exine tectate; columellae conspicuous and smaller than 1 µm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 µm; polar view length 20.9 µm (19–23, n = 10).

*Matayba opaca* Radlk. (Plate 15, figures 1–6)

Monad; subprolate, prolate spheroidal, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore circular; colpi with margin; exine tectate; columellae conspicuous and smaller than 1 µm; reticulate; homobrochate; lumina smaller than 1 µm; equatorial view length 26.9 µm (22–30, n = 9); equatorial view width 22.2 µm (17–24, n = 9); polar view length 27.8 µm (26–31, n = 10); colpi length 19.6 µm (15.6–21.8, n = 4); pore length 3.3 µm (3.3–3.3, n = 1); pore width 2.6 µm (2.6–2.6, n = 1).

*Paullinia bracteosa* Radlk. (Plate 15, figures7, 14)

Monad; amb triangular-obtuse-straight; symmetry radial; triporate; exine tectate; columellae indistinct; psilate; polar view length 36.6 µm (29.3–43.4, n = 10).

*Paullinia cupana* kunth (Plate 15, figures 8–10)

Monad; amb triangular-obtuse-straight; symmetry radial; triporate; exine tectate; columellae conspicuous and smaller than 1 µm; reticulate; homobrochate; lumina smaller than 1 µm; polar view length 62.8 µm (58–67, n = 10).

*Paullinia rugosa* Benth. ex Radlk. (Plate 15, figures 11–12)

Monad; amb triangular-obtuse-convex; symmetry radial; triporate; exine tectate; columellae conspicuous and smaller than 1 µm; reticulate; homobrochate; lumina smaller than 1 µm; polar view length 42.8 µm (38–48, n = 10).

*Talisia acutifolia* Radlk. (Plate 15, figures 13, 17–21)

Monad; oblate spheroidal, spherical; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with margin (1.355 µm), apex acute, parasyncolporate; exine tectate; columellae conspicuous and smaller than 1 µm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 µm. Equatorial view length 31.7 µm (31–32, n = 3); equatorial view width 30 µm (28–32, n = 3); polar view length 33.4 µm (31–36, n = 10); colpi length 20 µm (20–20, n = 1); colpi width

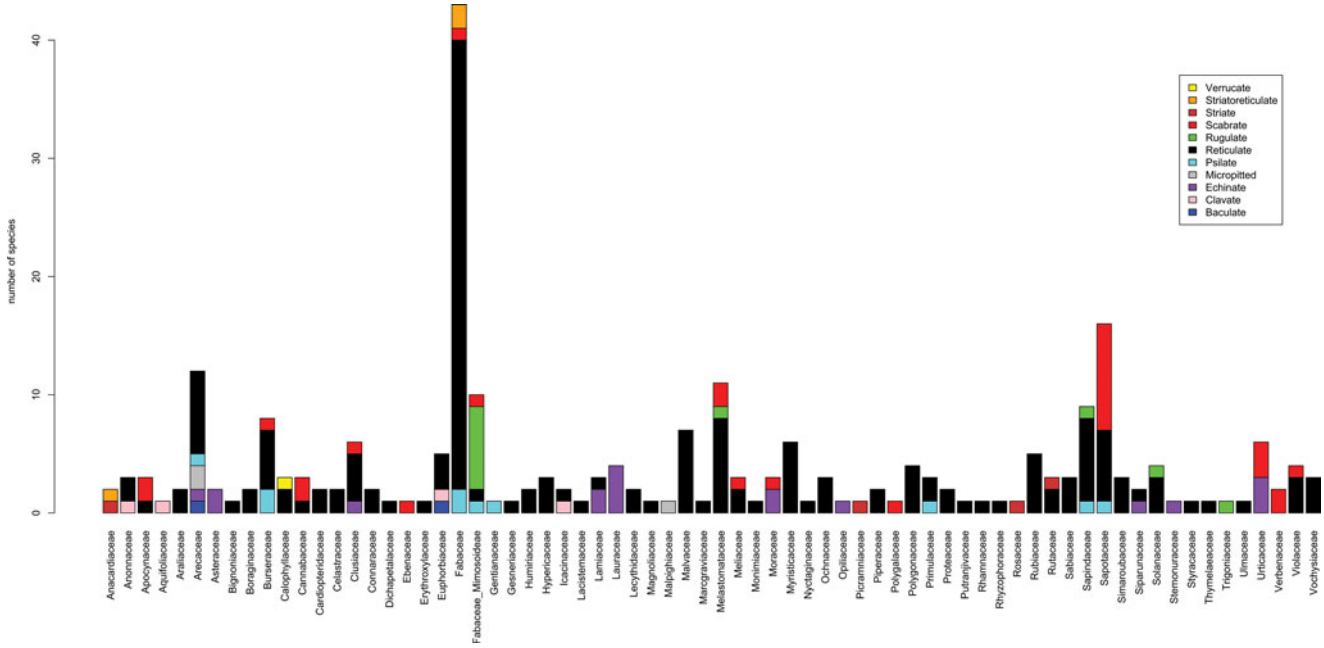


**Figure 6.** Distribution of ornamentation types among the 255 described species for the Amacayacu Forest Dynamics Plot (AFDP), by family.

1.3 µm (1.3–1.3, n = 1); pore length 11 µm (3.4–25.3, n = 3); pore width 8.4 µm (8–8.8, n = 2).

*Vouarana guianensis* Aubl. (Plate 15, figures 15–16, 22)

Monad; amb triangular-obtuse-convex; isopolar; symmetry radial; tricolporate; syncolporate in polar view; exine tectate; columellae indistinct and smaller than 1 µm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 µm; polar view length 24.1 µm (21–27, n = 10).

**Sapotaceae** Juss.

*Chrysophyllum africanum* A. DC. (Plate 15, figures 26–30)

Monad; prolate; amb triangular-acute-straight; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with costa endocolpi and apex acute; exine tectate; columellae indistinct; nexine is thicker in equatorial region (1.863–2.718 µm); scabrate. Equatorial view length 34 µm (32–35, n = 10); equatorial view width 21.4 µm (20–22, n = 10); colpi length 20.3 µm (17.8–22, n = 7); colpi width 1.7 µm (1.7–1.7, n = 1); pore length 6.4 µm (5.6–7, n = 7); pore width 1.9 µm (1.3–2.4, n = 7).

*Chrysophyllum amazonicum* T.D. Penn. (Plate 15, figures 23–25, 32–33)

Monad; prolate; amb triangular-obtuse-straight; isopolar; symmetry radial; tricolporate; pore lalongate; exine tectate; columellae indistinct; nexine is thicker (1.629–2.326 µm) in equatorial region; psilate; equatorial view length 29.8 µm (28–34, n = 10); equatorial view width 17.2 µm (15–19, n = 10); polar view length 19 µm (19–19, n = 4); colpi length 21.1 µm (18.3–24.1, n = 6); colpi width 1.3 µm (1.3–1.3, n = 1); pore length 4.1 µm (3.1–5.5, n = 6); pore width 2.2 µm (1.1–2.9, n = 6).

*Chrysophyllum argenteum* Jacq. Type 1 (Plate 15, figures 34–36, 44–45)

Monad; perprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with costa endocolpi, apex acute; exine tectate; columellae conspicuous, exine and nexine is thicker (1.545–2.124 µm) in equatorial region; reticulate; lumina smaller than 1 µm. Equatorial view length 40.3 µm (34–49, n = 10); equatorial view width 20.8 µm (18–23, n = 10); polar view length 20 µm (20–20, n = 1); colpi length 25.9 µm (21.8–30.4, n = 5); pore length 6.8 µm (6.3–7.3, n = 4); pore width 2.8 µm (2.1–3.8, n = 4).

*Chrysophyllum argenteum* Jacq. Type 2 (Plate 15, figures 37–39, 46)

Monad; prolate; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with costa endocolpi and apex acute; exine tectate; columellae indistinct, simplicolumellate; nexine thicker in equatorial region (1.212–2.231 µm); reticulate; homobrochate; muri are wider in equatorial region, lumina smaller than 1 µm. Equatorial view length 31.8 µm (28–36, n = 10); equatorial view width 19 µm (17–25, n = 10); colpi length 20.7 µm (19.1–23.3, n = 5); pore length 5.7 µm (3.6–7.6, n = 5); pore width 2 µm (1.1–2.5, n = 5).

*Chrysophyllum argenteum* subsp. panamense (Pittier) T.D. Penn. (Plate 15, figures 31, 40–41, 50)

Monad; prolate; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with costa endocolpi, apex acute; exine tectate; columellae indistinct; nexine thicker (1.116–1.879 µm) in equatorial region; scabrate; equatorial view length 30.1 µm (28–32, n = 10); equatorial view width 19 µm (17–21, n = 10); colpi length 21.2 µm (20.5–23.2, n = 6); colpi width 1 µm (0.9–1, n = 3); pore length 4.7 µm (4.4–5.4, n = 7); pore width 1.6 µm (1.3–2, n = 7).

*Chrysophyllum cainito* L. Type 1 (Plate 15, figures 47–48, 59)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi thin, with costa

endocolpi and apex acute; exine tectate; columellae indistinct; scabrate; equatorial view length 40.5 μm (36–43, n = 10); equatorial view width 30 μm (26–32, n = 10); colpi length 25.6 μm (22.6–28.8, n = 6); pore length 4.3 μm (3.5–5.4, n = 6); pore width 1.6 μm (1.3–2.1, n = 6).

*Chrysophyllum cainito* L. Type 2 (Plate 15, figures 57–58, 66)

Monad; prolate; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with costa endocolpi; exine tectate; columellae indistinct; nexine is thicker in equatorial region (1.040–1.767 μm); scabrate. Equatorial view length 30 μm (28–32, n = 9); equatorial view width 19.4 μm (18–21, n = 9); colpi length 19.7 μm (17.2–22.5, n = 6); pore length 5.5 μm (4.7–7.4, n = 6); pore width 1.7 μm (1.3–2, n = 6).

*Chrysophyllum marginatum* (Hook. & Arn.) Radlk. (Plate 15, figures 42–43, 51–55)

Monad; prolate; rectangular; isopolar; symmetry radial; stephanocolporate; pore lalongate; 4 colpori; colpi thin, 2/3 as long as grain, with margin, apex acute; exine tectate; columellae conspicuous, digitate, larger than 1 μm, simplicolumellate; nexine thinner in equatorial region (0.515–1.212 μm); reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 32.6 μm (29–35, n = 10); equatorial view width 20.5 μm (18–22, n = 10); polar view length 18.4 μm (16–20, n = 5); colpi length 19.6 μm (18.4–20.4, n = 5); pore length 4.8 μm (3.9–5.6, n = 5); pore width 2.7 μm (2.5–3.2, n = 5).

*Chrysophyllum mexicanum* Brandegee ex Standl. (Plate 15, figures 49, 60–61, 69, 78–79)

Monad; prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi 2/3 as long as grain, with constriction and costa endocolpi; exine tectate; columellae indistinct, nexine thinner in equatorial region (1.457–1.629 μm); scabrate; equatorial view length 33 μm (30–36, n = 9); equatorial view width 21.4 μm (17–25, n = 9); polar view length 22 μm (18–27, n = 5); colpi length 21.4 μm (19.9–22.7, n = 5); pore length 5 μm (4.3–6.4, n = 5); pore width 1.8 μm (1.5–2.1, n = 5).

*Chrysophyllum oliviforme* L. (Plate 15, figures 56, 64–65)

Monad; subprolate, prolate; isopolar; symmetry radial; stephanocolporate; pore lalongate; 4 colpori; colpi with costa endocolpi, apex acute; exine tectate; columellae indistinct, simplicolumellate, nexine thinner in equatorial region (1.116–1.317 μm); reticulate; homobrochate; muri are wider in the equatorial region; lumina smaller than 1 μm. Equatorial view length 37.1 μm (32–40, n = 10); equatorial view width 28.2 μm (25–32, n = 10); colpi length 22.1 μm (18.6–25.4, n = 6); pore length 5.1 μm (3.5–7.6, n = 6); pore width 2.1 μm (1.2–2.8, n = 6).

*Chrysophyllum splendens* Spreng. (Plate 15, figures 62–63)

Monad; subprolate, prolate spheroidal; isopolar; symmetry radial; tricolporate; pore lalongate; colpi 2/3 as long as grain, with costa endocolpi and apex acute; exine tectate; columellae indistinct; nexine thicker in equatorial region; scabrate. Equatorial view length 39.8 μm (35–46, n = 11); equatorial view width 34.1 μm (30–38, n = 11); colpi length 20.1 μm (16.4–25.2, n = 6); pore length 6.2 μm (3.4–9.3, n = 6); pore width 2.4 μm (1.3–3.3, n = 6).

*Manilkara bidentata* R.O. Williams (Plate 15, figures 70, 72–73)

Monad; prolate spheroidal, prolate, subprolate; isopolar; symmetry radial; stephanocolporate; pore lalongate; 5 colpori, colpi 2/3 as long as grain, apex acute, margin with 1.010 μm; exine tectate; columellae indistinct; scabrate; colpi length 26.5 μm (19.7–29.1, n = 8); pore length 5 μm (4.1–6.4, n = 8); pore width 3 μm (2.2–3.4, n = 8).

*Micropholis guyanensis* (A. DC.) Pierre (Plate 15, figures 67–68, 76–77)

Monad; prolate; isopolar; symmetry radial; tricolporate; pore lalongate; colpi 2/3 as long as grain; exine tectate; columellae indistinct, sexina is differentiated in the equatorial region; nexine is thicker than sexine; scabrate; colpi length 21.7 μm (16.1–26.4, n = 7); pore length 4 μm (3.1–5.2, n = 6); pore width 1.7 μm (1.5–1.8, n = 6).

*Micropholis venulosa* (Mart. & Eichler) Pierre (Plate 15, figures 74–75)

Monad; subprolate; isopolar; symmetry radial; tricolporate; pore lalongate; exine tectate; columellae indistinct and with costa endocolpi; sexina is differentiated in the equatorial region; scabrate; colpi length 27.6 μm (26.9–28, n = 3); pore length 2.9 μm (2.9–2.9, n = 1); pore width 1 μm (1–1, n = 1).

*Pouteria cladantha* Sandwith (Plate 15, figures 82–86)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain; exine tectate; columellae indistinct, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 15.9 μm (14–17, n = 10); equatorial view width 12 μm (10–13, n = 10); polar view length 12.9 μm (12–14, n = 9); colpi length 11.9 μm (10.1–14.2, n = 5); pore length 2.3 μm (1.6–3.1, n = 5); pore width 1.4 μm (1–1.6, n = 5).

*Sarcaulus brasiliensis* (A. DC.) Eyma (Plate 15, figures 71, 80–81; Plate 16, figures 1–2)

Monad; prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore circular; exine tectate; columellae indistinct, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 17.1 μm (15–19, n = 10); equatorial view width 15.7 μm (14–17, n = 10); polar view length 16.2 μm (15–18, n = 9); colpi length 9.2 μm (7.6–10.9, n = 2); pore length 2.9 μm (2.3–3.3, n = 7); pore width 2.6 μm (2.1–3.5, n = 7).

**Simaroubaceae** DC.

*Picrolemma sprucei* Hook. F. (Plate 16, figures 3–5)

Monad; subprolate, prolate spheroidal; isopolar; symmetry radial; stephanocolporate; pore lalongate; 4 colpori; colpi 2/3 as long as grain; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length

34.6 μm (33–37, n = 10). Equatorial view width 30.9 μm (29–34, n = 10); colpi length 20.8 μm (19.2–24.2, n = 6); pore length 6.8 μm (6.1–7.7, n = 6); pore width 4.1 μm (3.6–4.3, n = 6).

*Simaba glabra* Engl. (Plate 16, figures 6–8, 13–16)

Monad; prolate spheroidal, subprolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain, with constriction; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 20.9 μm (17–24, n = 11); equatorial view width 18.7 μm (14–23, n = 11); polar view length 17.4 μm (15–20, n = 8); colpi length 16.8 μm (15.8–17.5, n = 5); pore length 5.8 μm (5–6.7, n = 2); pore width 2.5 μm (2.4–2.5, n = 2).

*Simarouba amara* Aubl. (Plate 16, figures 9–12, 17–18)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain; exine semitectate; columellae indistinct; echinate; sexine with small lumina. There are echinae (with less than 1 μm) in the muri. Equatorial view length 19 μm (15–22, n = 9); equatorial view width 17.1 μm (14–19, n = 9); polar view length 17.3 μm (15–19, n = 9); colpi length 14.5 μm (11.6–16.5, n = 5); pore length 4.6 μm (4.2–5, n = 4); pore width 1.5 μm (1.1–1.7, n = 4).

**Siparunaceae** Schodde

*Siparuna guianensis* Aubl. (Plate 16, figures 21–25)

Monad; prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 32.3 μm (28–38, n = 9); equatorial view width 29.7 μm (23–35, n = 9); polar view length 29.4 μm (24–34, n = 9); colpi length 21.5 μm (19.6–24.2, n = 5); colpi width 1.8 μm (1.8–1.8, n = 1); pore length 8.8 μm (7.9–9.7, n = 4); pore width 3.4 μm (1.5–4.5, n = 4).

*Siparuna parciflora* (Beurl.) A. DC. (Plate 16, figures 19–20)

Monad; spherical; outline circular; symmetry radial; inaperturate; exine intectate; echinate; echinae smaller than 1 μm; equatorial view length 16.7 μm (14–20, n = 9); equatorial view width 17.4 μm (14–20, n = 9).

**Solanaceae** Juss.

*Brunfelsia grandiflora* D. Don (Plate 16, figures 34–36, 41–43)

Monad; oblate spheroidal; amb circular; isopolar; symmetry radial; stephanocolporate; pores lalongate; 4-colpori; colpi with margin; exine semitectate; columellae conspicuous and smaller than 1 μm; regulate. Equatorial view length 61 μm (61–61, n = 1); equatorial view width 68 μm (68–68, n = 1); polar view length 48.3 μm (40–60, n = 6); colpi length 28.6 μm (28.6–28.6, n = 1).

*Cestrum nocturnum* L. (Plate 16, figures 32–33, 37–40, 44–45)

Monad; subprolate, prolate; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain, with constriction and margin (1.692 μm); apex obtuse; exine tectate; columellae indistinct; micropitted; like perforate. Equatorial view length 52.2 μm (41–66, n = 9); equatorial view width 46.9 μm (36–55, n = 9); polar view length 51.6 μm (43–58, n = 10); colpi length 44.3 μm (40–46.5, n = 4); colpi width 1.4 μm (1.1–1.7, n = 2); pore length 17 μm (14.3–22.1, n = 4); pore width 6.9 μm (5.6–8, n = 4).

*Cestrum schlechtendahlii* G. Don (Plate 16, figures 26–31)

Monad; oblate spheroidal, subprolate, prolate spheroidal; amb triangular-obtuse-convex; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain, with constriction; exine tectate; columellae inconspicuous, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 46.2 μm (37.5–52.6, n = 11); equatorial view width 43.7 μm (36.3–51.4, n = 11); polar view length 42.1 μm (38.7–51.5, n = 10); colpi length 35.7 μm (28–43.9, n = 4); pore length 18 μm (17.4–18.6, n = 2); pore width 4.7 μm (3.7–5.6, n = 2).

*Solanum diversifolium* Schltdl. (Plate 16, figures 46–47, 53–56)

Monad; prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi 2/3 as long as grain, with constriction, margin (1.495 μm), apex obtuse; exine tectate; reticulate; homobrochate; lumina smaller than 1 μm; equatorial view length 40.3 μm (36–45, n = 11); equatorial view width 38.6 μm (33–42, n = 11); polar view length 39.9 μm (38–43, n = 9); colpi length 29.9 μm (24.9–33.3, n = 10); colpi width 2.2 μm (1.4–3, n = 5); pore length 11.6 μm (7.9–15.5, n = 7); pore width 4.6 μm (3.4–6.5, n = 7).

**Stemonuraceae** Kårehed

*Discophora guianensis* miers (Plate 16, figures 48–52)

Monad; spherical; amb circular; isopolar; symmetry radial; two types: tricolporate and stephanocolporate; pore circular; 3–5 colpori; brevicolpate; exine tectate; columellae indistinct; echinate; echinae smaller than 1 μm. Equatorial view length 21.8 μm (20–23, n = 6); equatorial view width 22.2 μm (21–24, n = 6); polar view length 22.5 μm (21–24, n = 4); colpi length 2.7 μm (2.2–3.2, n = 2); pore length 3 μm (2.2–3.5, n = 6); pore width 1.6 μm (1–2.1, n = 6).

**Styracaceae** DC. & Spreng.

*Styrax grandifolius* Griff (Plate 16, figures 57–63, 67–70, 74)

Monad; subprolate, prolate, prolate spheroidal; amb circular; isopolar; symmetry radial; two types: stephanocolporate; pore lalongate; colpi 2/3 as long as grains, with margin (1.460–2.750 μm) and constriction, apex acute. 3–4 colpori; and parasyncolporate (with 3 apertures); exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 45.7 μm (39.6–50.7, n = 9); equatorial view width 37 μm (30.2–40.4, n = 9); polar view length 46.4 μm (41.6–50.7, n = 10); colpi length 35 μm (30.2–40.7,

n = 7); colpi width 3.2 μm (3.2–3.2, n = 1); pore length 6.2 μm (6.2–6.3, n = 2); pore width 3.3 μm (3.2–3.4, n = 2).

**Thymelaeaceae** Juss.

*Schoenobiblus daphnoides* Mart. (Plate 16, figures 64–66, 73)

Monad; spherical; amb circular; symmetry radial; pantoporate; pore circular; exine intectate; columellae conspicuous, type baculum and digitate; reticulate; reticulum has croton pattern; pore length 2.5 μm (1.9–2.8, n = 5); pore width 2.3 μm (2–2.8, n = 5).

**Trigoniaceae** A. Juss.

*Trigonia laevis* Aubl. (Plate 16, figures 71–72)

Monad; circular, rectangular; isopolar; symmetry radial; stephanoporate; exine tectate; columellae indistinct; regulate. The swollen apical part of columellae connects with each other, forming a continuous tectum and appearance of rugulae; polar view length 37.5 μm (33–45, n = 4).

**Ulmaceae** Mirb.

*Ampelocera cubensis* Griseb. (Plate 16, figures 75–78)

Monad; oblate; amb circular; isopolar; symmetry radial; stephanoporate; exine tectate; columellae inconspicuous, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; polar view length 29.4 μm (27.7–32.3, n = 10).

**Urticaceae** Juss.

*Cecropia longipes* Pittier (Plate 16, figures 79–81)

Monad; symmetry bilateral; diporate; pore circular; exine tectate; columellae indistinct; scabrate; with granula; equatorial view length 9.2 μm (8–11, n = 8); equatorial view width 6.8 μm (5–8, n = 8).

*Cecropia obtusifolia* Bertol. (Plate 16, figures 87–89)

Monad; symmetry bilateral; diporate; pore circular; exine tectate; columellae indistinct; scabrate; with granula; equatorial view length 8 μm (7–10, n = 5); equatorial view width 6.2 μm (5–8, n = 5).

*Cecropia pachystachya* Trécul (Plate 16, figures 82–83)

Monad; symmetry bilateral; diporate; pore circular; exine tectate; columellae indistinct; scabrate; with some granules; equatorial view length 12.4 μm (11–14, n = 10); equatorial view width 9.3 μm (8–10, n = 10).

*Cecropia peltata* L. (Plate 16, figures 90–91)

Monad; symmetry bilateral; diporate; pore circular; exine tectate; columellae indistinct; echinate; echinae smaller than 1 μm; equatorial view length 12.2 μm (10–15, n = 9); equatorial view width 9.9 μm (8–12, n = 9).

*Pourouma bicolor* Mart. (Plate 16, figure 84, 92)

Monad; symmetry bilateral; diporate; pore circular; echinae smaller than 1 μm; exine tectate; columellae indistinct; echinate; equatorial view length 15.7 μm (14–18, n = 10); equatorial view width 14.6 μm (13–16, n = 10).

*Urera baccifera* (L.) Gaudich. ex Wedd. (Plate 16, figures 85–86, 93)

Monad; spherical; amb circular; isopolar; symmetry radial; triporate, stephanoporate; exine tectate; columellae indistinct; echinate; echinae smaller than 1 μm; polar view length 18.6 μm (16–20, n = 10).

**Verbenaceae** J. St.-Hil.

*Citharexylum macrophyllum* Poir. (Plate 16, figure 94; Plate 17, figures 1–6, 13–14)

Monad; spherical; amb circular; isopolar; symmetry radial; tricolporate and stephanocolporate; pore lalongate; 3–4 colpori, with granula around the apertures; brevicolpate, but the colpi are not oriented symmetrically; exine tectate; columellae indistinct; scabrate. Equatorial view length 38.8 μm (35–46, n = 5); equatorial view width 37.6 μm (33–45, n = 5); polar view length 37.4 μm (33–42, n = 9); colpi length 15.8 μm (13.3–19.5, n = 4); pore length 4.7 μm (3.9–5.9, n = 5); pore width 3.5 μm (2.7–4.7, n = 5).

*Petrea volubilis* L. (Plate 17, figures 7–8)

Monad; amb triangular-obtuse-convex; isopolar; symmetry radial; tricolpate; brevicolpate; exine tectate; columellae conspicuous and smaller than 1 μm; scabrate; polar view length 60.1 μm (54–68, n = 9).

**Violaceae** Batsch

*Gloeospermum sphaerocarpum* Triana & Planch. (Plate 17, figures 9–10)

Monad; spherical; amb triangular-obtuse-concave; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction and margin (1.348 μm), apex acute; exine tectate; columellae indistinct; scabrate. Equatorial view length 28 μm (27–29, n = 3); equatorial view width 27.3 μm (27–28, n = 3); polar view length 30.7 μm (29–33, n = 6); colpi length 16.6 μm (15.4–17.9, n = 2).

*Leonia cymosa* Mart. (Plate 17, figures 11–12, 17–20)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi with constriction; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 26.6 μm (22–34, n = 5); equatorial view width 22.6 μm (19–26, n = 5); polar view length 22.9 μm (20–27, n = 9); colpi length 16.4 μm (16–16.8, n = 2).

*Rinorea guianensis* Aubl. (Plate 17, figures 15–16, 25–26, 35)

Monad; oblate spheroidal, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain, with margin; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 26.4 μm (25–28, n = 7); equatorial view width 27.4 μm (23–31, n = 7); polar view length 29.6 μm (26–33, n = 7); colpi length 19.5 μm (19.3–19.9, n = 4); pore length 9.2 μm (8–11, n = 4); pore width 5.8 μm (3.1–7.3, n = 4).

*Rinorea squamata* S.F. Blake (Plate 17, figures 21–24, 33–34, 44)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolpate; colpi as long as grain, with margin and apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 26.6 μm (21–33, n = 9); equatorial view width 23.2 μm (20–29, n = 9); polar view length 25.3 μm (22–31, n = 9); colpi length 17.2 μm (13.3–19.8, n = 3).

**Vochysiaceae** A. St.-Hil.

*Erisma calcaratum* (Link) Warm. (Plate 17, figures 27–30, 39–40)

Monad; subprolate, prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain, with constriction and margin, apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 28 μm (24–31, n = 7); equatorial view width 24.9 μm (21–28, n = 7); polar view length 27.2 μm (24–30, n = 10); colpi length 21.3 μm (19.8–23.1, n = 4); colpi width 1.1 μm (1.1–1.1, n = 1); pore length 8.1 μm (7.7–8.5, n = 3); pore width 1.8 μm (1.8–1.9, n = 3).

*Ruizterania cassiquiarensis* (Spruce ex Warm.) Marc.-Berti (Plate 17, figures 31–32, 41–43)

Monad; prolate spheroidal; amb circular; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain, with margin, apex acute; exine tectate; columellae conspicuous and smaller than 1 μm, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm. Equatorial view length 39.4 μm (37–43, n = 9); equatorial view width 37.1 μm (34–40, n = 9); polar view length 40 μm (38–43, n = 4); colpi length 29.2 μm (26.7–33.8, n = 7).

*Vochysia ferruginea* Mart. (Plate 17, figures 36–38, 45–46)

Monad; oblate spheroidal; amb triangular-obtuse-concave; isopolar; symmetry radial; tricolporate; pore lalongate; colpi as long as grain, apex acute; exine tectate; columellae indistinct, simplicolumellate; reticulate; homobrochate; lumina smaller than 1 μm; colpi length 13.3 μm (13.3–13.3, n = 2); pore length 6 μm (6–6, n = 1); pore width 2.4 μm (2.4–2.4, n = 1).

## 4. Discussion

The 255 species described from AFDP correspond to 197 genera and 72 families. Overall pollen morphology is composed of 13 types of apertures dominated by tricolporate (61%), inaperturate (5.8%), monocolpate (5.5%), and triporate (4.7%) (Figure 2). Sexine ornamentation constitutes 11 major types dominated by reticulate (66%), scabrate (11.3%), echinate (7.05%) and rugulate (4.3%) (Figure 3). Overall pollen size distribution is right-skewed for both equatorial and polar diameters (Figure 4). Equatorial diameter has a median of 29 μm (SD = 15.5), while polar diameter has a median of 32 μm (SD = 14.7). Most families have one or two aperture types, and only four (Myristicaceae, Euphorbiaceae, Mimosoideae, Rubiaceae) have three aperture types (Figure 5). Most families also have only one or two ornamentation types, although 10 families have three or more types (Arecaceae, Fabaceae, Mimosoideae, Annonaceae, Burseracae, Clusiaceae, Euphorbiaceae, Sapindaceae, Melastomataceae, and Sapotaceae) (Figure 6).

Several species had morphologically variable pollen types. *Astrocaryum acaule*, *Bactris concinna* and *Hyospathe elegans* each had two pollen types that varied in the shape of the grains and colpi (Plates 1 and 2). *Chrysophyllum argenteum* also had two pollen types, which showed variation in the grain shape as well as in thickness of the nexine in the equatorial region and in the shape of the apex of the colpi (Plate 15). The two pollen types of *Chrysophyllum cainito* revealed variation in grain shape and size of colpi, in the thickness of the nexine and muri in the equatorial region, and in presence/absence of margo bypassing the colpi (Plate 15). *Roupala montana*, also with two pollen types, showed different shapes of grains and pores and variation in the size of the lumina of the reticulum (Plate 13).

In addition, several species have very similar pollen morphologies even though they are not related (e.g. *Abarema auriculata* and *Inga umbelifera*). Therefore, for this group of species we also add the descriptive category *morphotype*, which indicates how a palynologist might name the grain if the pollen were found free in the sediment or soils, or in the body of animals (in the case of *Abarema auriculata* and *Inga umbelifera* we used the morphotype Mimosaceae Type A) (Table 1). This descriptive term, we think, could be useful as all individuals within the AFDP plot are identified. For example, if dispersed pollen were found in the soil of the plot and were assigned to the morphotype Mimosaceae Type A, the distance to individual trees of *Abarema auriculata* and *Vernonanthura puberula* could be calculated, and therefore the probability of the grain being produced by either *Abarema* or *Vernonanthura* could be calculated.

The 255 species have been grouped into 236 morphotypes (see Supplementary material), underscoring that at the plot level, the morphological diversity of the pollen grains captures the plant diversity of the plot. There are about 40 species which under light microscopy are impossible to differentiate from each other (Table 1). Higher-resolution techniques [e.g. scanning electron microscopy (SEM) and confocal microscopy] might reveal characters that would distinguish them from each other. That group of species includes *Piptocoma discolor* (Plate 2) and *Vernonanthura puberula* (Plate 2), both being spheroidal in shape, tricolporate, with inconspicuous endoaperture (pore) masked by sculpture, sexine tectate and with spines that are conical and sharp. *Dussia tessmannii* (Plates 4 and 5) and *Hymenolobium nitidum* (Plate 5) both are subprolate in shape, tricolporate with pores circular, tectate with conspicuous columellae, and reticulate (lumina smaller than 1 μm). *Vatairea erythrocarpa* (Plate 6) and *Vataireopsis speciosa* (Plate 6) both have prolate and subprolate shape, are tricolporate with circular pores, have colpi with acute apex, are tectate with conspicuous columellae, and are reticulate (with lumina smaller than 1 μm). *Abarema auriculata* (Plates 7 and 8) and *Inga umbelifera* (Plates 8 and 9) both are polyads with 16 pollen grains and circular shape, and periporate with five pores (*I. umbelifera* can have up to nine pores). *Abarema barbouriana* (Plate 8) and *Inga nobilis*

(Plate 8) have 16 pollen grains and circular shape, and are 4-porate. Those four polyad species are also semitectate and the columellae have a swollen apical part that connects columellae with each other, forming a semi-continuous tectum and giving the appearance of rugulae. *Endopleura uchi* (Plate 9) and *Sacoglottis trichogyna* (Plate 9) both have a subprolate shape and spheroidal prolate, are tricolporate with elliptic pores, with colpi 2/3 the length of the grain and with obtuse apex; both are tectate with conspicuous columellae, and are reticulate (lumina smaller than 1 μm). *Aegiphila integrifolia* (Plate 9) and *Aegiphila panamensis* (Plate 10) are spheroidal in shape (*A. integrifolia* can also be prolate spheroidal) with circular amb, tricolpate, tectate with indistinct columellae, and echinate (spines sharp, conical and smaller than 1 μm). *Aniba puchury-minor* (Plate 10) and *Endlicheria paniculata* (Plate 10) are spheroidal, inaperturate, intectate and both have an echinate sexine (spines smaller than 1 μm). Both *Theobroma glaucum* (Plate 11) and *Theobroma obovatum* (Plate 11) are either oblate spheroidal or spheroidal in shape with circular amb, tricolporate with elliptic pores, have thin colpi 2/3 the length of the grain, and are semitectate, reticulate, homobrochate and simplicolumellate. *Clidemia quinquenervia* (Plate 11) and *Tococa caquetana* (Plate 11) are similar in size, subprolate in shape, heterocolpate with elliptic pores, tectate and reticulate (with lumina smaller than 1 μm). Both *Adelobotrys adscendens* (Plate 11) and *Adelobotrys tessmannii* (Plate 11) are prolate or subprolate in shape, heterocolpate with lalongate pores, and the apex of colpi is acute; both are tectate and scabrate. *Piper arboretum* (Plate 12) and *Piper obliquum* (Plate 12) are both oblate in shape, monosulcate, tectate and reticulate (lumina less than 1 μm). Grains of *Chrysophyllum africanum* (Plate 15) and *Chrysophyllum cainito* (Plate 15) are prolate and tricolporate; pores are lalongate and colpi have costae-endocolpi; columellae are indistinct and surface is scabrate. *Paullinia cupana* (Plate 15) and *Paullinia rugosa* (Plate 15) both have a triangular-obtuse-subangular amb, are triporate, and have conspicuous columellae and a reticulate surface (with lumina smaller than 1 μm). *Cecropia pachystachya* (Plate 16) and *Cecropia obtusifolia* (Plate 16) both have subprolate and prolate grains and are diporate with circular pores, and their surface is tectate and scabrate. *Cestrum nocturnum* (Plate 16) and *Cestrum schlechtendahlii* (Plate 16) both have subprolate shapes (*C. nocturnum* can have prolate grains and *C. schlechtendahlii* can have oblate spheroidal grains), and both are tricolporate with elliptic pores; colpi run the length of the grain and have a constriction; both have indistinct columellae and both are reticulate (lumina less than 1 μm).

## 5. Conclusion

In this study we described pollen from 255 tree species belonging to 72 angiosperm families that occur in the 25-ha AFDP of Amacayacu National Natural Park in western Amazonia.

Most of the species are characterised by tricolporate (61%), inaperturate (5.8%), monocolpate (5.5%), or triporate (4.7%) apertures. Only four families (Myristicaceae, Euphorbiaceae, Mimosoideae, Rubiaceae) have three aperture types (monocolpate, inaperturate and tricolpate). There are four main patterns of grain ornamentation: reticulate (66%), scabrate (11.3%), echinate (7%) and rugulate (4.3%). In contrast to the majority of families, which have only one or two types of ornamentation, 10 families have three, four or five types (Arecaceae, Fabaceae, Mimosoideae, Annonaceae, Burseracae, Clusiaceae, Euphorbiaceae, Sapindaceae, Melastomataceae, and Sapotaceae). The pollen morphologies of the 255 species can be grouped into 236 morphotypes, indicating that pollen morphology captures a large amount of the plant diversity of the plot.

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