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## A preliminary treatment of the Central American species of *Octoblepharum* (Musci: Calymperaceae)

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**ABSTRACT.** The species of *Octoblepharum* occurring in Central America have been critically examined. Six are recognized as valid species: *O. albidum*, *O. cocuiense*, *O. cylindricum*, *O. erectifolium*, *O. pulvinatum* and *O. stramineum*. Synonyms are given for these species: *O. longifolium* = *O. albidum*; *O. mittenii*, *O. fragillimum*, *O. pellucidum* and = *O. pulvinatum* var. *angustifolium* are synonyms of *O. cocuiense*; *O. juruense* and *O. densum* = *O. pulvinatum* and *O. purpureo-brunneum* = *O. stramineum*. All species are widely distributed in the area except for *O. cylindricum* and *O. stramineum* that are known only from Belize and Panama respectively.

**RESUMEN.** Las especies de *Octoblepharum* que se presentan en America Central han sido criticamente estudiadas. Se reconocen seis especies: *O. albidum*, *O. cocuiense*, *O. cylindricum*, *O. erectifolium*, *O. pulvinatum* y *O. stramineum*. Se dan los sinonimos para estas especies: *O. longifolium* = *O. albidum*; *O. fragillimum*, *O. mittenii*, *O. pellucidum*, *O. perforatum* y = *O. pulvinatum* var. *angustifolium* son sinonimos de *O. cocuiense*; *O. juruense* y *O. densum* = *O. pulvinatum* y, *O. purpureo-brunneum* = *O. stramineum*. Todas las especies son de amplia distribucion en el area excepto *O. cylindricum* y *O. stramineum* que se conocen solo para Belize y Panama respectivamente.

*Octoblepharum* was described as a new genus by Hedwig as early as 1801. The description was based on the characters of the sporophyte: "*Peristomium simplec octodentatum. Sporangium sine apophysi*", and the sexual condition of the plants, "*Flos masculus femineo iunctus*". The genus is distributed throughout the tropical and subtropical regions of the world. In the Americas, it extends from Southern United States through Central America, the Caribbean and into South America as far south as Bolivia and Southern Brazil. It is an important component of the lowland rain forests frequently growing intermixed with species of *Calymperes*, *Syrhophodon*, leafy (Jungermanniales) and thalloid hepatics (e.g. Metzgeriales). It also occurs at higher elevations and

some species like *O. cylindricum* and *O. tatei* appear to be elements of the tropical forests above 1000 meters. Twenty one species and two varieties have been validly published for the Neotropics, two for Africa and five species and one variety for Asia and Oceania (Wijk et al. 1964, 1969). Thus, the center of species diversity appears to be the Neotropics. Based on leaf structure, *Octoblepharum* has been traditionally placed in the family or tribe Leucobryaceae together with *Leucophanes*, *Exodictyon* (sensu lato), *Arthrocormus* and *Leucobryum* (Mitten 1869, Brotherus 1924-1925, Herzog 1925, Dixon 1932, Reimers 1954). Cardot (1899) in a detailed study of the anatomic characters of the leaves segregated the family into four Tribes: Leucobryeae including

*Leucobryum*, *Schistomitrium*, *Ochrobryum* and *Cladopodanthus*; Octoblephareae including *Octoblepharum*; Arthrocoreae with *Arthrocoreum* and *Exodictyon* (including *Exostratum* Ellis) and, Leucophaneae which included the single genus *Leucophanes*. The characters that distinguished *Octoblepharum* from the rest of the taxa were: the triangular chlorocysts in a single central layer as seen in the transverse section of the leaf. Fleischer (1904) stressing peristomial characters placed *Octoblepharum*, *Leucophanes*, *Exodictyon* and *Arthrocoreum* in the “Reihe Monocranoideae (Hyophyloideae)”, family Leucophanaceae, close to the Syrrhodontaceae and Calymperaceae; *Leucobryum* and related genera were placed in the “Reihe Dicranoideae” Phil. close to *Fissidens*, *Dicranum*, *Holomitrium* and *Campylopus*. In the Monocranoideae, Fleischer like Cardot (1899), distinguished three “Gruppen”: Octoblephareae Card. (*Octoblepharum*), Leucophaneae Card. (*Leucophanes*) and Arthrocoreae (*Arthrocoreum*, *Exodictyon*). The two characters that defined Octoblephareae were based on the structure of the leaf as seen in transverse section. These were: triangular chlorocysts in a single layer and absence of a midstereid band. Later, Fleischer (1918) changed his mind and included *Octoblepharum*, *Leucophanes*, *Exodictyon* and *Arthrocoreum* in the “Unterreihe Leucobryineae” of the “Reihe Dicranoideae” together with *Leucobryum* and related genera.

Andrews (1947) included *Octoblepharum*, *Leucophanes*, *Arthrocoreum* and *Exodictyon* in the Calymperaceae and *Leucobryum* and related genera in the Dicranaceae. Robinson (1971), Crosby and Magill (1977) and Magill (1981) followed Andrews’ proposal. Edwards (1979) working on cell patterns in haplolepideous moss peristomes confirmed Andrews’ (1947) moving of *Leucophanes*, *Octoblepharum*, *Exodictyon* and *Arthrocoreum* from the Dicranales to the Syrrhodontales. He also postulated a peristome formula for *Octoblepharum albidum* Hedw. that is  $2(3)'' : 2''z$  for one tooth. This species has eight triangular-shaped teeth. Edwards (1979) noted that by peristome alone the relationships of *Octoblepharum* were less clear but certain features of the gametophyte, i.e. production of leaf tip

gemmae, suggested closer affinities with members of the Calymperaceae. Ellis (1985) has proposed to include *Octoblepharum*, *Leucophanes*, *Arthrocoreum*, *Exodictyon* and *Exostratum* in the subfamily Leucophanoideae of the Calymperaceae. Robinson (1985, 1990) redefined the family Leucobryaceae based on the structure and proposed function of the leaf. *Octoblepharum* was retained in the Leucobryaceae while *Leucophanes* and *Exodictyon* were excluded from it. Our preliminary studies on peristome structure and ornamentation of *O. albidum* and some characters of the gametophyte like the preferential production of marginal rather than apical gemmae, appear to support Robinson’s proposal of including *Octoblepharum* in the Leucobryaceae. Nevertheless, peristome structure of other species like *O. pulvinatum* and *O. stramineum* indicate closer affinities with the Syrrhodontales, particularly *AArthrocoreum*, *Leucophanes*, *Exodictyon* and *Exostratum*.

The first attempt to classify the Neotropical species of *Octoblepharum* was done by Florschütz (1955). He proposed a classification of the American species of *Octoblepharum* based on transverse sections of the leaves (“costa”) at middle and apex. Two major subdivisions were distinguished based on the shape of cross sections at midleaf: whether it be +/- equilaterally triangular with rounded edges or flattened and biconvex. In the first subdivision he included two species: *Octoblepharum ampullaceum* Mitt. and *O. erectifolium* Mitt.; the rest of the Neotropical species were placed in the second subdivision. In the second group characterized by a flattened, biconvex costa, he distinguished two sections based on the number of layers of hyalocysts as seen in cross section at apex. One section included species having two layers of hyalocysts and, the other, species had four layers. Florschütz based his studies mostly on the critical examination of type specimens. Thus, as he clearly stated (Florschütz 1955), the variability of the species were not known to him. He recognized ten species for the Americas: *Octoblepharum albidum* Hedw., *O. ampullaceum* Mitt., *O. cocuiense* Mitt., *O. cylindricum* Schimp. ex Mont., = *O. erectifolium* Mitt. ex Williams, *O. fragillimum* Aongstr., *O.*

*pellucidum* C. Müll., *O. pulvinatum* (Doz. & Molk.) Mitt., *O. rhabdostegium* C. Müll. ex Broth. and *O. stramineum* Mitt. He suggested that *O. rhabdostegium* could be a hybrid of *O. albidum* and *O. cylindricum*. The species has the vegetative parts and the seta like *O. albidum*, the capsule however is cylindrical and the peristome teeth are lanceolate with protruding articulations. The hypothetical parental species often grow intermixed in the same turfs, at least in the Suriname area where he made his observations.

Yano (1975) in her studies of the Leucobryaceae of Sao Paulo, Brazil, reported 4 species occurring in that state. In a later report on *Octoblepharum* (Yano 1985) she reported eight species and two varieties for Alto Rio Negro in the northern Brazilian Amazons. These were: *O. albidum*, *O. albidum* var. *albidum*, *O. albidum* var. *violacens* C. Müll., *O. ampullaceum*, *O. cylindricum*, *O. cocuiense*, *O. erectifolium*, *O. pellucidum*, *O. pulvinatum* and *O. stramineum*. She gave information on habitat and association of species and indicated that the most common species for the area were: *O. albidum* var. *albidum*, *O. pulvinatum* and *O. stramineum*.

*Octoblepharum*, the oldest genus of the Leucobryaceae, is, as pointed out by Andrews (1947), a "very natural group". Its leaf structure is quite different from *Leucophanes*, *Exodictyon* and *Arthrocormus*. The leaves are thick, ligulate or strap-shaped and in transverse section composed of a single centrally located layer of mostly triangular chlorocysts surrounded by two or more layers of porose hyalocysts. Each chlorocyst is surrounded by 3-4 hyalocysts. Like *Exodictyon* and *Exostratum*, but unlike *Leucophanes*, the leaf does not have a midstereid band. It shares with *Leucophanes* the single central layer of chlorocysts surrounded by layers of porose hyalocysts.

#### KEY TO THE CENTRAL AMERICAN SPECIES OF OCTOBLEPHARUM

(1) Leaves triangular-terete (semi-circular), cross-section at midleaf equilaterally triangular with

rounded angles, entire leaves more than 20 mm long ..... *Octoblepharum erectifolium*

(1) Leaves flattened, cross-section at midleaf biconvex, entire leaves less than 10 mm long (except *O. cocuiense*) ..... 2

(2) Leaves with a metallic luster when dry, stramineous above changing to a deep red, to orange-red at base, margins strongly undulated due to presence of marginal inflated hyalocysts ..... *Octoblepharum stramineum*

(2) Leaves dull, light green, yellow green sometimes with a rose to purple coloration at base or throughout the leaf (*O. cocuiense*), margins straight to slightly undulated (*O. albidum*) ..... 3

(3) Upper hyaline lamina cells strongly pitted, elongated hexagonal near border, rectangular to oblong quadrate at middle and narrowly elongated near costa, leaf with a dark pseudocostal area of elongated chlorocysts, peristome of 16 teeth deflexed away from the mouth when wet (hygrochastique) ..... *Octoblepharum cocuiense*

(3) Upper hyaline lamina cells inconspicuously pitted, long hexagonal to rectangular or quadrate, leaf without a pseudocostal area of elongated chlorocysts, peristome of 8-16 teeth inflexed when wet (xerochastique) ..... 4

(4) Leaves fragile, upper lamina cells irregularly quadrate to short hexagonal (20-45(-50)  $\mu$ m long), apex obtuse, abruptly apiculate, peristome of 16 mostly paired teeth ..... *Octoblepharum pulvinatum*

(4) Leaves sturdy, upper lamina cells long hexagonal to rectangular or quadrate-hexagonal from midlamina to base, apex more or less obtuse, apiculate to acuminate, peristome teeth 8 ..... 5

(5) Central lamina cells long hexagonal to rectangular with narrow pits, limbidium indistinct, apex dentate, capsules oval, seta more than 10 mm long, peristome of 8 teeth with delicate trabeculae

and vertical striations .....  
 .....*Octoblepharum albidum*

(5) Central lamina cells quadrate, with oval pits, limbidium distinct, apex more or less smooth, capsule cylindrical, seta less than 10 mm long, peristome of 8 teeth with strong, thick, trabeculae and delicate vertical striations .....  
 .....*Octoblepharum cylindricum*

### *Octoblepharum* Hedwig

Plants glaucous-green to yellow-reddish purple in color dull to shiny, one species with a metallic luster; stems erect, sparingly branched, branches single or in 2-3's. Leaves erect-patent to curve outward above midleaf, strap-shaped, ligulate, obtuse-apiculate to + shortly acuminate, flattened to +/- terete-triangular; margins smooth to dentate or undulate at apex, with or without a distinct row of elongated cells; with a basal laminal area of +/- highly porate hyalocysts in 1(-2) layers; cross-section of the leaf at middle with 3-4(-5) layers of hyaline cells surrounding a central layer of mostly triangular to tear-drop shaped chlorocysts. Autoicous or dioicous, seta straw to dark orange-red, sinistrorse, short (<10 mm long) or long (>10 mm). Capsule oblong or cylindrical, orange to dark-red, (0.5-)1 - 2.6 mm long, phanerophore stomata at base peristome arthrodontous of 8-16 teeth, smooth to vertically striated-reticulated or with semi-circular or bar-like thickenings, with a prostome, with thick or faint trabeculae, outer and inner peristomal plate with 2-3 rows of cells. Operculum rostrate, 0.5-1.8 mm long; calyptra cucullate, smooth, red at apex, stramineous below, 1.5-2.1 mm long. Spores yellow-green to brownish-green, (15-)17.5-34.5(-50) µm in diameter, proximal face concave, distal face convex.

1. *Octoblepharum albidum* Hedw. Spec. Musc. 50. 1801. Type: "E Providentiae insula acceperat Dillenius, Swartz in Jamaica; procul dubio terrestre". Lectotype: Swartz, Jamaica (G).

*Octoblepharum longifolium* Lindb. Oefv. K. Vet.

Foerh. 21: 608. 1865. Type: "Habitat in insula O'Tahiti, ubi Sept. 1852 parce legit Rev. S.B. Ponten (Exp. Eugenie)" (H-SOL.)

Plants in dense to loose turfs and cushions, glaucous-green or with a pink to purple tone at base, 0.5-1.5(-3) cm tall. Stems sparingly branched, branches single or in 2-3's, cross-section of stem without a central strand. Leaves erect-patent to curve spreading, flattened, strap-shaped, apiculate, (3-)4-6(-8) mm long. Margins inconspicuous, 1-2 cells wide, sometimes undulate due to presence of marginal inflated hyalocysts that occur single or in rows of 3-5 (or more): Basal hyaline lamina with elongated hexagonal to rectangular hyalocysts, in 1(-2) layers, pits narrow and inconspicuous; cross-section of leaf at middle flattened with a central layer of triangular to tear-drop shaped chlorocysts surrounded by 3-4 layers of hyalocysts on each surface. Seta smooth, exerted, (2-)4-8 mm long, straw to orange-red. Capsules erect to subinclined, (0.5-)1 - 1.5(-2) mm long, oblong to short cylindrical, orange-red, darker and contracted at rim. Peristome of 8 triangular teeth, smooth to vertically striated or reticulated. Operculum rostrate 0.5-1.2 mm long. Calyptra smooth, red at apex, stramineous below to 1.5 mm long. Spores convex on the distal side, concave on the proximal face, 20-25 µm in diameter.

Illustrations. Dillenius (1741, Tab. XLVI, Fig. 21), Hedwig (1801, Fig. 6), Cardot (1900, Pl. XIII, Fig. 61; Pl. XIV, Fig. 61), Fleischer (1904, Fig. 22, a-d), Bartram (1949, Fig. 32, A-D), Whittier (1976, Fig. 26, A-C), Breen (1963, Pl. 24, Figs. 2, 3, 5-8), Florschütz (1964, Fig. 39, a-h), Magill (1981, Fig. 44 (1-9)), Robinson (1985, Fig. 10-14), da Costa (1988, Fig. 5, a-f).

Habitat. Bark of trees, particularly palms, basis of trees and shrubs, decomposing logs, soil and rocks. It is characteristically a lowland species although it can be found in forests above 1000 m.

Distribution in Central America. *Octoblepharum albidum* is the most cosmopolitan of the species. It is known from Belize (Corozal, El Cayo, Toledo), Guatemala (Izabal), El Salvador (Ahuachapán, Santa Ana), Honduras (Comajagua,

La Ceiba), Costa Rica (Alajuela, Puntarenas, San José), Panama (Bocas del Toro, Colon, Panama, San Blas).

Selected specimens examined.

BELIZE. Corozal: Tigersavana, ca. 88° 11' W, 18° 11' N, Davidse & Brant 32516A (M0); El Cayo: Lundell Chanek 44 (NY); Toledo: Maya Mountains 88° 46-30' W, 16° 33-35' N, Davidse & Brant 32090 (M0), Punta Gorda, White s.n. (NY).

GUATEMALA. Izabal: Sof Puerto Barrios, Croat 41798 (M0).

EL SALVADOR. Ahuachapán: Cerro Grande de Apaneca, Winkler 26 (M0); Santa Ana: Hacienda Montecristo, Metapán, Winkler 33 (M0); Calderón JF001041 (M0).

HONDURAS. Atlántida: La Ceiba, Yuncker 7990 (NY); Comajagua: El Achote, hills above plains of Siguatep, Yuncker et al. 6554 (NY).

COSTA RICA. Alajuela: Rancho Trébol, Crosby 3825 (110). Puntarenas: Isla del Cano, Gomez 20035 (M0), Las Cruces, Gomez 25344 (M0); San José: Parque Morazán, Nee 14029 (M0).

PANAMA. Bocas del Toro: Changguinola, Antonio 3170 (M0, PMA); Colón: Santa Rita, Dressler & Lewis 3740A (M0); Panamá: Barro Colorado Island, Barbour trail 715, Croat 7801 (M0, PMA), Pearson Trail, Shattuck 877 (M0, PMA), Pipeline Road, Croat 16618 (M0), road to Fort Sherman, Barsallo et al. 11, 12 (M0, PMA), Cerro Campana, Hammel 5553 (M0, PMA), ELLlano-Cartí Road, Croat 33691 (M0), Goofy Lake, 9° 10' N, 79° 25' W, Crosby 4328 (M0, PMA), Miraflores Locks, Nee & Mori 3695 (M0, PMA), Summit Garden, Nee & Mori 3698 (M0, PMA), summit Hills, Croat 16650 (M0, PMA), Curundu, Mori & Kallunki, 2985 (M0, PMA); San Blas Intendency: ELLlano-Cartí road, 09° 15' N 79° 00' W, McPherson 11061A (M0).

*Octoblepharum albidum* includes a very diverse group of plants from the typical forms with short oblong capsules and smooth triangular peristome teeth to forms with more elongated capsules, triangular teeth with faint, delicate vertical striations and hyaline lamina cells not as elongated as in most populations of *O. albidum*. There is also a form with leaves having a dark purple coloration at base and a peristome with strong vertical striations (*Salazar 6588*, Barro Colorado Island,

PMA). Taxonomic evaluation of these forms will be dealt with in the treatment for Flora Neotropica.

2. *Octoblepharum cocuiense* Mitt. J. Linn. Soc. Bot. 12: 109. 1869. Type: "Fl. Negro, in monte Cocui, in palmarum truncis. Spruce", (NY).

*Octoblepharum mittenii* Jaeg. Ber. Tätigk. St. Gallischen. Naturwiss. Ges. 1871-1872: 321. 1873 (Adumbr. 1: 169). Type: "Patria: America austral, ad flumen Uaupés, Panuré in rupibus umbrosis (Spruce)" (isotype, FH-Bartr.).

*Octoblepharum fragillimum* Aongstr. Oefv. Kongl. Vetensk. Akad. Fohr. 33(4): 60. 1876. Lectotype: "Octobl. fragillimum J. An. Angstrom scripsit" (S).

*Octoblepharum perforatum* C. Müll. Hedwigia 34: 119. 1895. Type: "Goyaz: Serra dos Pyreneos. Ule 1546. Decembri (H-BR).

*Octoblepharum pellucidum* C. Müll. Gen. Musc. Fr. 89. 1901. Lectotype: "Brasilia, Rio de Janeiro, Corcovado, pr. "Caixa de agua" ad terram humidam 17/Vii/1873. Leg. Hj. Mosén 196" (H-BR) (lectotype selected by Florschütz 1955); isotype (S-Reg).

*Octoblepharum pulvinatum* (Doz. & Molk.) Mitt. var. *angustifolium* Broth. Hedwigia 45: 263. 1906. Type: "Estado de Amazonas; Rio Madeira, Marmellos, an Baumstämmen (n. 2339)" (H-BR).

Nomenclatural note. The specimen of *O. fragillimum* at Stockholm does not have a locality or collector's name; nevertheless, it appears to be the original collection cited. Since there appears to be no potential isotypes I have selected this collection at Stockholm as the lectotype for *O. fragillimum*.

In the protologue of *O. perforatum* the collector's number for the type specimen is given as: "Ule n. 1545". Of the specimens studied, there is only one at H-BR that correspond to the type locality and substrate but the sample number is 1546 instead of 1545. There appears to be a typo mistake either in the protologue or in the labelling of the

specimen. Specimen 1546 has been selected as the lectotype. I have not been able to examine any type specimens of *O. pellucidum* to the present. I agree with Florschütz (1955) selection of Mosén's 196 collection from Brazil as the lectotype. The characters observed in this collection correspond closely to those given by Müller in his original description of the species.

Plants erect in compact turfs or cushions, purple-red to lightgreen with a pinkish hue, 2-4.5 cm tall. Stem sparingly to highly branched, densely foliose, moderately red-tomentose. Leaves erect-patent to slightly spreading, ligulate, flattened with a dark central area of elongated chlorocysts, obtuse and apiculate to acuminate (4.1-)7-12(-15) mm long; margins smooth to undulate or dentate at apex, 1-2 cells wide; cross-section of the leaf at middle flattened, biconvex with 3(-4) layers of hyalocysts on each side of the central chlorophyllous layer, at apex with one layer of hyalocysts on each side of the chlorocysts layer; basal hyaline lamina conspicuously pitted, elongated hexagonal at border, quadrate and slightly inflated towards center and elongated rectangular near the costa, with thick walls and large perforations on the abaxial and adaxial walls at base. Seta exerted, 11 mm long, dark-red. Capsules cylindric 1.7-2.6 mm, dark-red, darker at rim: peristome of 16 narrowly elongated, orange-red to yellow-orange teeth, deflexed when wet (hygrochastique), erect when dry, with semi-circular to circular thickenings on the dorsal plate. Operculum rostrate to 1.8 mm long. Calyptra smooth to 2 mm long (one measurement), red at apex, stramineous below. Spores brown-green, 30-45(-50)  $\mu\text{m}$  in diameter (from open capsule).

Illustrations. Cardot (1900, Pl. XIV, Fig. 64. as *O. fragillimum*), Bartram (1949, Fig. 32, J-K as *O. mittenii*), Florschütz (1964, Fig. 37, a-b), Griffin III (1979, Fig. 40-43).

Habitat. Epiphyte on bark of trees particularly palms, on rocks, and in soil, from 400-1000 m.

Distribution in Central America. This species is distributed in Belize (Cayo), Costa Rica (Cartago, Limón, Pejivalle), Panama (Coclé, Colón, Panamá, Veraguas).

Selected specimens examined.

BELIZE. El Cayo: Mountain pine ridge (FH).

COSTA RICA. Cartago: Hills SE of Tuis. Crosby 3819 (MO); Pejivalle. Valerio 46 (FH); Limón: W of bridge over Río Toro Amarillo and Guapiles, Crosby 3667 (MO).

PANAMA. Coclé: From Cano Sucio to Cerro Tife, Antonio 3708 (MO, PMA); Colón: Near Peluca, Kennedy 2799A (MO, PMA); Panamá: Cerro Jefe, 9° 10' N, 79° 25' W, Allen 4936 (MO, PMA), Crosby 4518 (W, NY, PMA), Nee & Mori 14220 (MO, PMA), Cerro Campana, Welch 19951 (MO, NY, PMA), 19977 (NY), 8° 40' N, 79° 55' W, Crosby 10,071 (MO, PMA), El Valle de Antón, 80° 10' W, 8° 35' N, Crosby 4393 (MO, PMA); Veraguas: Alto de Piedra, 8° 30' N, 81° 05' W, Crosby 10,122, 10,218 (MO, PMA).

3. *Octobleparum cylindricum* Schimp. ex Mont. Ann. Soc. Nat. Bot. ser. 2, 14: 349. 1840. Type: "Hab. ad truncos deustos secus ripas fluminis quod. Oyapok dicunt, Maio 1835, lectum. Lepr. Coll. n. 282. Lectotype: "Guyane, Leprieur 282" (PC).

Plants in dense tufts glaucous-green, with a pink color towards center, 0.5-1.5(-2) cm tall. Stems sparingly branched. Leaves erect to curve outwards above middle, flattened dorsiventrally, strap-shaped, apiculate to shortly acuminate, not fragile, 4-6(-8) mm long. Margins conspicuous at apex, 1-2 cells thick, entire to undulate towards apex, rarely toothed; basal hyaline lamina gradually tapering to the costal area (at least one side) with quadrate hyalocysts at center and next to costa, short hexagonal near border, quadrate to rectangular at base. Cross-section of the leaf at middle flattened, with a central layer of triangular to tear-drop shaped chlorocysts surrounded by 2-3 layers of hyalocysts on each surface. Seta smooth, exerted (8-)10-18(-20) mm long, straw to light orange-red, lighter below insertion. Capsules long cylindric, erect to arcuate or subinclined, straw, tan-orange to light reddish-brown, dark red at rim and neck, urn slightly contracted below mouth, 1.5-2 mm long. Peristome of 8 lanceolate teeth, with thickened midline and trabeculae on the inner face and diagonal to vertical striations.

Operculum long rostrate, curve, to 1.1 mm long. Calyptra red at apex, gradually changing to stramineous below to 2 mm long. Spores 8-21  $\mu$ m in diameter, strongly granular.

Illustrations. Cardot (1900, Pl. XIV, Fig. 63); Florschütz (1964, Fig. 40, a-h); Griffin III (1979, Fig. 56-62).

Habitat. This species grows in dense turfs on trunks of trees, occasionally on the ground (sand) or on stones (Florschütz, 1964).

Distribution in Central America. Belize (El Cayo).

Specimens examined.

BELIZE: El Cayo, Pine Ridge, Bartlett 12972 (MO, NY).

4. *Octoblepharum erectifolium* Mitt. ex Williams. N. Am. Fl. 15: 162. 1913. Type: "Trinidad-Cruzer" (NY).

Plants in dense to loose turfs, whitish-green to yellow-green, to 4 1/2 mm tall. Stem unbranched or sparingly branched. Leaves erect to curve, to more than 20 mm long, terete-triangular at middle, apiculate to shortly acuminate, fragile and broken in the upper half to upper third. Margins +/- conspicuous at apex, 2-4 cells thick, +/- crenate to dentate; basal hyaline lamina gradually tapering to the costal area, hyalocysts elongated rhomboid shorter on apical margins, finely pitted. Cross-section of the leaf at apex with two layers of hyalocysts on each side of the chlorophyllous layer, cross-section at middle, terete-triangular with the central layer of chlorocysts surrounded by 4-6 layers of hyalocysts on each surface. Seta long to 16 mm (one specimen), orange, darker at rim. Capsules to 2 mm long, erect to subinclined, orange to orange-brown. Peristome of 8 elongated teeth with pronounced trabeculae and reticulated ornamentation, reddish in color. Operculum to 1.2 mm long (one specimen), long rostrate. Calyptra and spores not seen.

Illustrations. Bartram (1949, Fig. 32, H-I), Florschütz (1964, Fig. 35, a-e).

Habitat. This species grows on granite rocks (Florschütz, 1964), soil, decomposing logs, at basis of trees and as a corticolous epiphyte. It does appear to be an element of mossy forests above 700 m.

Distribution in Central America. Guatemala (Alto Verapaz, Baja Verapaz, Civijá); Costa Rica (Alajuela, Cartago, Heredia, San José); Panama (Panamá).

Selected specimens examined.

GUATEMALA. Verapaz: Chirriacté, Standley 91692 (FH); Baja Verapaz: Civijá, Sharp 5199 (FH).

COSTARICA. Alajuela: Reservabiologica, Crosby 10859 (NY, MO); Cartago: I.C.E. Tapantí Project Area, 9° 11' N, 83° 46' W, Crosby 6318 (FH, H-BR); El Muneco: On the Rio Navarro, Standley & Torres 51210 (FH); Heredia: Yerba Buena, northeast of San Isidro, Standley & Valerio 49947 (FH), 49653 (FH, H-BR); San José: La Palma, Standley 38161 (FH, NY), SE slopes of Cerros de Zurquí, N of village of San Louis Norte, Crosby 6396 (MO).

PANAMA. Panamá: Cerro Jefe, Gentry & Dwyer 5595 (MO, PMA).

5. *Octoblepharum pulvinatum* (Doz. & Molk.) Mitt. J. Linn. Soc. 12: 109. 1869. *Arthrocormus pulvinatus* Doz. & Molk. Type: "ad truncos arborum Surinamensium frequens, Splitgerber in hb. Acad. Ludg.-Bat. no. 1214". Holotype (L); isotype (NY).

*Octoblepharum juruense* Broth., Hedwigia 45: 263. 1906. Type: "An Palmenstamm, Juruá Miry. Río Juruá. September 1901". Holotype (H-BR); isotypes (FH, S).

*Octoblepharum densum* Broth. Denkschr. Ak. Wiss. Wien Math. Nat. Kl. 83: 278. 192. Type: "Sao Paulo. Bertioga prope Santos; ad ostium fluminis da Facenda (59)" Holotype (H-BR).

Plants in loose to dense turfs, glaucous-green,

some populations with a tinge of pink, 0.8-2 cm tall. Stem with erect, +/- parallel innovations. Leaves erect-spreading to flexuose secund, shiny and fragile with a broad hyaline lamina abruptly narrowing to the strap-shaped upper costal portion, mucronate to nearly truncate, 5-8(-9) mm long. Margins smooth, sharply to inconspicuously and obtusely dentate at apex, smooth below, slightly undulate; upper hyaline lamina cells irregular in shape, short hexagonal to quadrate and +/- pentagonal to 45-50(-60)  $\mu\text{m}$  longest diameter, pits narrow and inconspicuous: cross-section of leaf at middle convex on the adaxial surface, concave on the abaxial one, with a central layer of triangular chlorocysts surrounded by (2-3) layers of porose hyaline cells on each surface. Seta exerted, 5.4-7.5 mm long, cylindrical, light yellow at apex, orange-red below. Capsules erect to subinclined, 2-2.5 mm long, cylindrical, orange-red, slightly contracted under mouth, bulging papillose at base. Peristome of 16 elongated, +/- paired teeth, articulated, light orange to yellowish to +/- pellucid, trabeculate with papillae, bar-like thickenings and central circular depressions. Operculum long rostrate to 1 mm long. Calyptra smooth to 2.1 mm long, red at apex, stramineous below. Spores rounded 15-18  $\mu\text{m}$  in diameter.

Illustrations. Dozy & Molkenboer (1854, Tab. II, Figs. 1-18); Cardot (1900, Pl. XIV, Fig. 62, a-c); Bartram (1949, Fig. 32, e-g); Florschütz (1964, Fig. 38, a-i); Yano (1975, Fig. 6, a-i); Delgadillo & Sharp (1976, Fig. 1-3); Griffin III (1979, Fig. 63-67).

Habitat. Plants of *Octoblepharum pulvinatum* grow epiphytic on trees, particularly palms, shrubs, rotten wood, humus, occasionally on rocks, from lowland to 1000 meters, sometimes growing with *O. albidum* Hedw.

Distribution in Central America. Belize (Belize, El Cayo and Toledo; Yucatán Peninsula); Guatemala (Alta Verapaz, Petén; Los Amates); Honduras (Atlántida); Nicaragua (Zelaya); Costa Rica (Limón, Puntarenas; San José), Panama (Bocas del Toro, Coclé, Colón, Panamá, Veraguas).

Selected specimens examined.

BELIZE. Belize: Manatee Pine Ridge, Gentle 112 (US); El Cayo: Cocquericot, Bartlett 12030 (MO, US), Caves Branch River, Whitefoord 1213 (MO); Toledo: Maya Mts., Boutin & Schlosser 5019, 5020a, 5157 (MO); Yucatán Peninsula: Sibun river, Lundell 1197 (MO, US); Baker's road, Lundell 1226 (US).

GUATEMALA. Alta Verapaz: Finca Mocca, Johnson 98 (US); Jalapa: Los Amates, Kellerman 7393, 7394 (US); Petén: Bartlett 12610 (US), Sta. Teresa, Subin River, Lundell 2769 (US).

HONDURAS. Atlántida: Lancetilla valley, Standley 52734, 54179 (US).

NICARAGUA. Zelaya: Comarca del Cabo, Seymour 5883 (MO); Serranías de Yolandia, ca. 11° 36'-37' N, 81° 22' W, Stevens & Krukoff 4887A (MO).

COSTA RICA. Cocos Island: Between Chatham & Wafer Bays, Gómez 18005 (MO), Crum 1595 (G, H, L, US), Klawe s.n. (US); Limón: Along 2° road 233 between Turrialba and Siquirres, Crosby 3684 (MO), Finca Montecristo, on río Reventazón, Standley & Valerio 18130, 48526 (US), Hamburg Finca, on the río Reventazón, Standley & Valerio 48727 (US); Puntarenas: Isla del Cano, Gómez 20005 (MO); Quarter settlement of Monte Verde, Crosby 2335 (MO); Villa Neilly, Crosby 2698 (MO); San José: Slopes adjacent to Airport, Lisner 1863 (MO);

PANAMA. Bocas del Toro: Isla Colón, Crosby 1084 (MO, PMA); Coclé: El Valle de Antón, 80° 10' W; 8° 35' N, Crosby 4137 (MO, PMA); Colón: Santa Rita 9° 15' N, 79° 40' W, Crosby 10,461 (MO, PMA); Panamá: Barro Colorado Island, Wheeler Trail, Montalvo & D'Arcy 377 (MO, PMA), along El Llano Carti road 9° 15' N, 79° 00' W, Crosby 10410 (MO, PMA), Croat 33785B (MO, PMA), on road from El Llano to Carti-Tupile Rd., Kennedy 2720b (MO), Cerro Campana 79° 55' W, 9° 40' N, Crosby 4508 (MO, PMA); Veraguas: Isla de Coiba, Antonio 2353 (MO, PMA), Boca de Concepción, 08° 50' N, 81° 00' W, McPherson 11378 (MO, PMA), forests of Concepción, 08° 50' N, 81° 00' W, McPherson 11378 (MO, PMA), forests on slopes and along Río Caloveborita, Nee & Mori 13982-a (MO, PMA), Santa Fé, Alto de Piedra, 8° 30' N, 81° 05' W, Crosby 10,223, 10,111 (MO, PMA).

6. *Octoblepharum stramineum* Mitt. J. Linn. Soc. Bot. 12:110. 1869. Type: "Fl. Negro, San Carlos, Spruce". Holotype (NY); isotype (S). *Octoblepharum purpureo-brunneum* C. Müll. Malpighia 10: 512. 1896. Lectotype: "Guiana, Georgetown leg. Quelch "Hbr. C. Müll." (H-



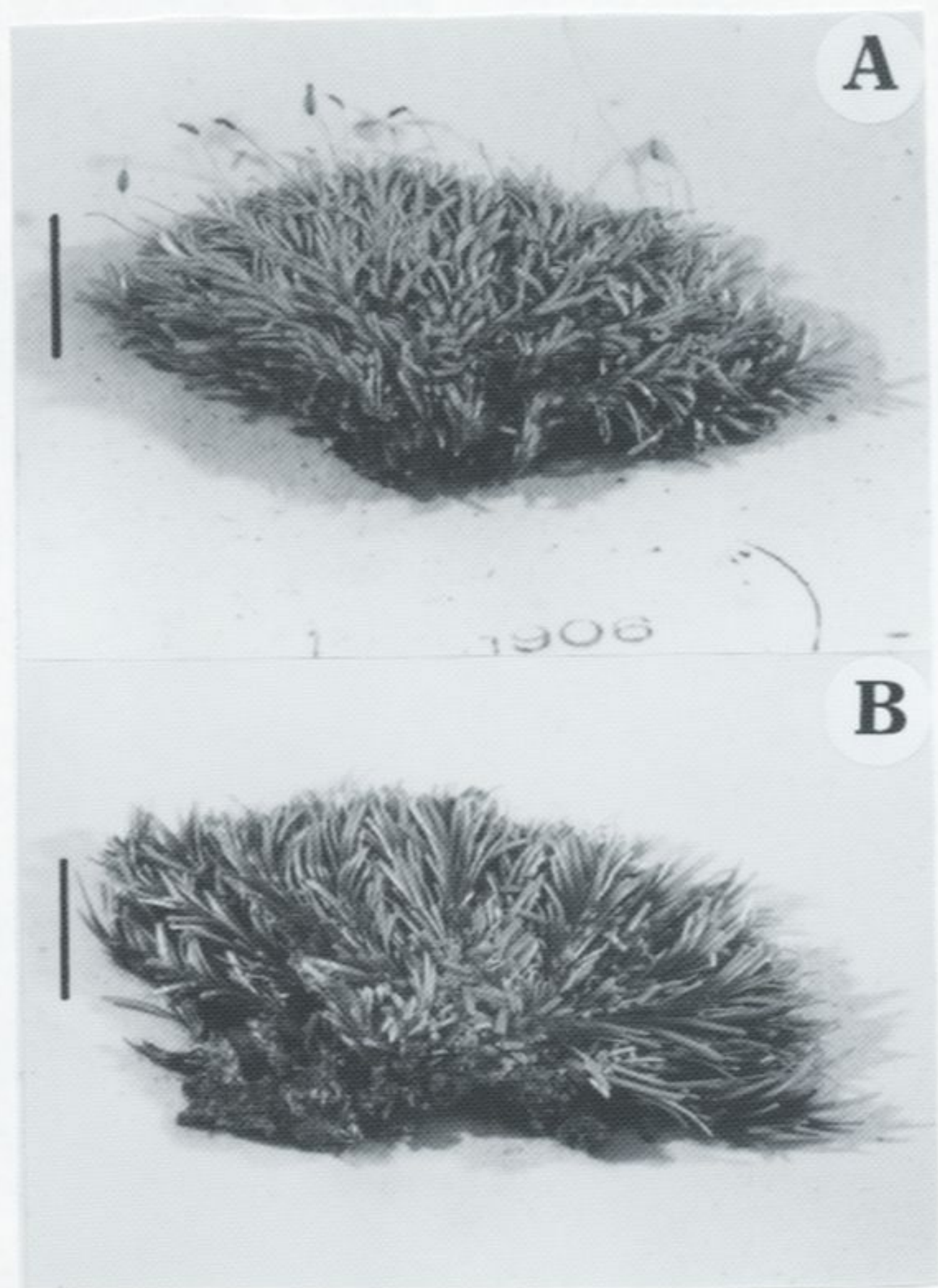


Fig. 1. *Octoblepharum stramineum*. A-B. Habit. A from Spruce s.n. (NY, holotype); B from Quelch s.n. (BM, isotype of *Octoblepharum purpureo-brunneum*). Scale = 1 cm.

Broth); isotypes (BM, FH, H-Broth. (in part), JE (2 specimens), M, NY-ex Card.).

Plants in dense lustrous, reddish purple turfs to 2 cm tall. Stem erect, dark red, sparingly branched, tomentose. Leaves erect, closely adpressed with a metallic luster, red-purple at base, gradually changing to yellow-green above, (3.8-)5.3-7.5(-10.7) mm long, with a broad hyaline lamina gradually narrowing to the strap-shaped, +/- terete, humid, upper costal area, apex obtuse acuminate to cuspidate. Margins smooth, undulate-crenulate by the enlarged bulging marginal hyalocysts; basal hyaline lamina with rectangular to hexagonal, strongly pitted hyalocysts, pits large and conspicuous, border cells narrowly elongated in 3-5 rows, hyalocysts in the lower half of the lamina with large perforations forming a large conspicuous area close to the costa resembling a cancellina. Cross section of the leaf at apex with two layers of hyalocysts on each surface of the central chlorophyllous layer; at middle with 3-4 layers of hyalocysts on each surface of the central chlorophyllous layer. Seta long exerted, light brown to dark red at base, lighter above, straw color, 6-9 mm long. Capsules rounded to cylindrical, erect to subinclined, orange in color, darker at insertion, slightly constricted under mouth, exothecial cells bulging outward at base, 1-1.8 mm long. Peristome of 16 paired, elongated teeth, pale yellowish, deflexed when wet (hygrochastique), erect when dry, with trabeculae and central depressions (foveolae). Operculum long-rostrate to 1 mm long. Calyptra smooth, cucullate, red at apex, stramineous below, 1.7-2 mm long. Spores brown, oval-triangular, 15-22.5  $\mu\text{m}$  in diameter.

**Illustrations.** No illustrations in the literature are known to us for this species. Thus I have included photographs of the habit (Fig. 1) and some relevant morphological features (Fig. 2-3) that will facilitate identification of this species until the final treatment for Flora Neotropica is completed.

**Habitat.** Epiphyte on trees, on dead logs, sand, moist rock crevices from low elevations to above 1000 m. Apparently not a very common species.

**Distribution in Central America.** This species is reported only for Panama (Darién, Veraguas).

**Specimens examined.**

PANAMA. Darién: South of El Real, Alturas de Nique, near Cana Mine, 07° 45' N, 77° 40' W, McPhearson 116230 (MO, PMA); Veraguas: Along road above Escuela Agricola "Alto de Piedra", Cerro Tute, 8°30' N, 81°05' W, Crosby 10,257 (MO, PMA).

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## LITERATURE CITED

- Andrews, A.L. 1917.** Taxonomic notes VI. The Leucobryaceae. *The Bryologist* 50: 319-326.
- Bartram, E.B. 1949.** Mosses of Guatemala. *Fieldiana: Botany* 25: 1-442.
- Breen, R.S. 1963.** Mosses of Florida. University of Florida Press. Gainesville.
- Brotherus, V.F. 1924-1925.** Musci. Pp. 220-228. In A. Engler & R. Prantl, *Die Natürlichen Pflanzenfamilien* (2nd. ed.) Vol. 10. Wilhelm Engelmann, Leipzig.
- Cardot, J. 1899.** Nouvelle classification des Leucobryacées basée principalement sur les caractères anatomiques de la feuille. *Revue Bryologique* 1: 1-18.
- Cardot, J. 1900.** Recherches anatomiques sur les Leucobryacées. *Memoire de la société nationale des sciences naturelles et mathématiques de Cherbourg* 32: 1-84.
- Crosby, M.R. & Magill, R.E. 1977.** A dictionary of Mosses. Missouri Botanical Garden, St. Louis.
- De Costa, D. 1988.** Leucobryaceae do Parque Nacional da Tujica, no Estado do Rio de Janeiro (Brasil). *Rodriguesia* 64/66 (41/40): 41-48.
- Delgadillo, C. & Sharp, A. J. 1976.** Vegetative reproduc-

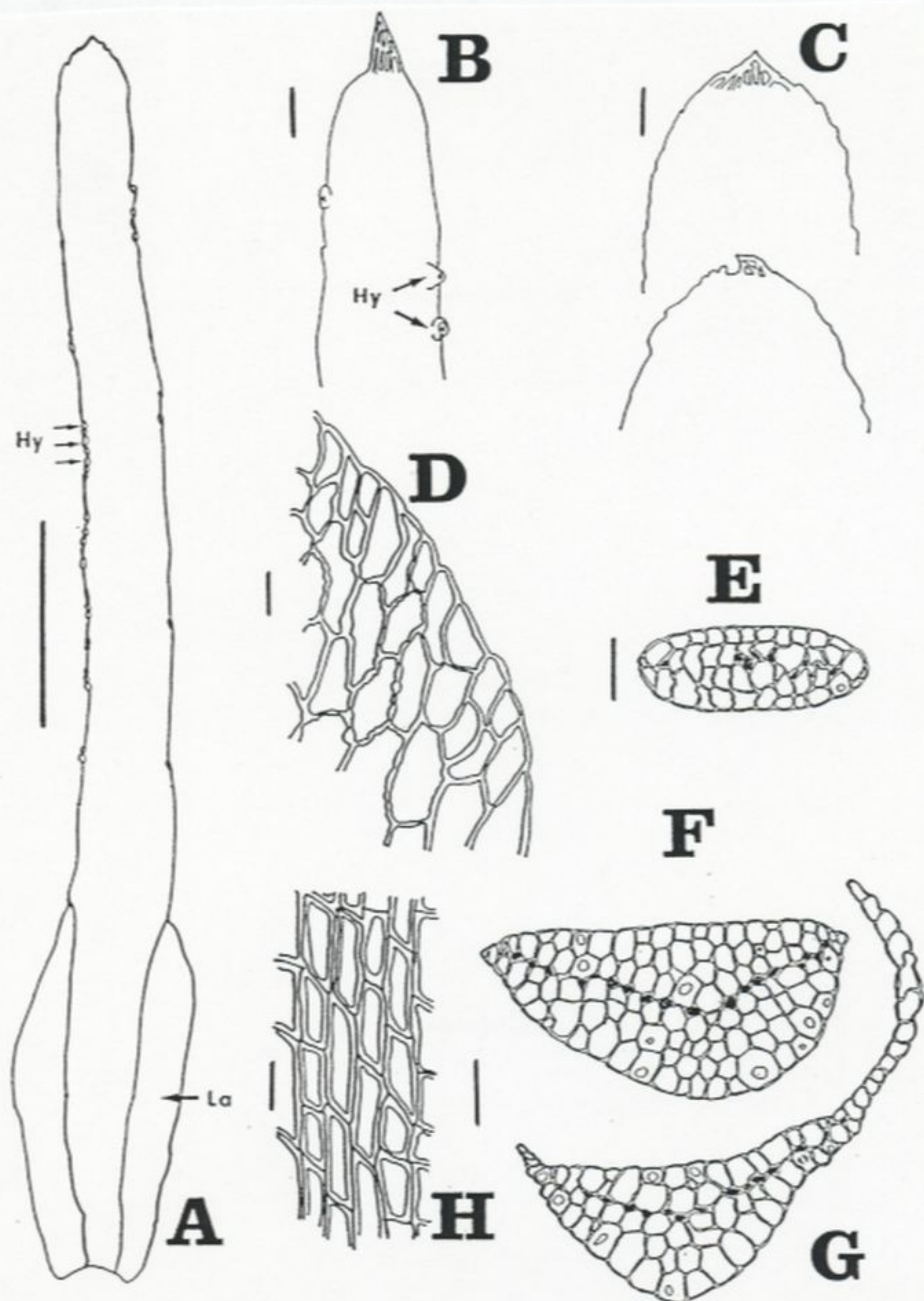


Fig. 2. *Octoblepharum stramineum*. A. Vegetative leaf, Hy = inflated hyalocysts, La = hyaline lamina, scale = 1 mm. B. Upper portion of leaf with inflated marginal hyalocysts (Hy), scale = 120  $\mu$ m. C. Apices of vegetative leaves, scale = 120  $\mu$ m. D. Upper lamina cells, scale = 30  $\mu$ m. E-G. Transverse sections of leaf, E. At apex, F. At end of hyaline lamina, G. At base, scale = 92  $\mu$ m. H. Leaf, basal lamina cells, scale = 46  $\mu$ m. A from Schultes & Cabrera 16581 (NY). B, D from Quelch s.n. (M, isotype of *Octoblepharum purpureo-brunneum*); C, H from Spruce s.n. (NY, holotype); E from Appun. (NY mixed with syntype collection of *Octoblepharum ampullaceum*); F-G from Crosby 10,257 (MO, NY).

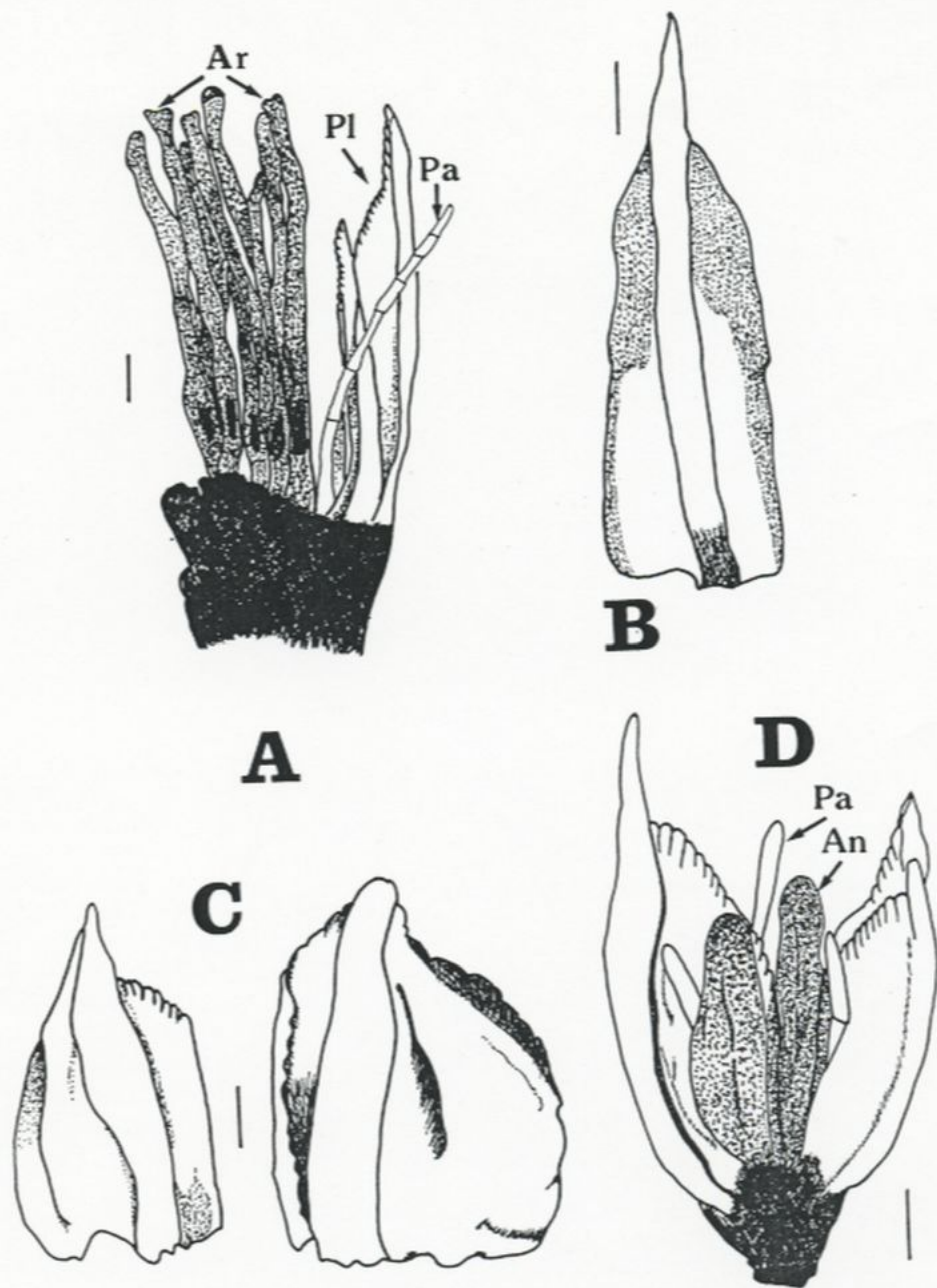


Fig. 3. *Octoblepharum stramineum*. A. Archegonia (Ar), paraphyses (Pa) and perichaetial leaves (Pl), scale = 46  $\mu$ m. B. Perichaetial leaf, scale = 300  $\mu$ m. C. Perigonial leaves, scale = 46  $\mu$ m. D. Perigonium with antheridia (An), innermost perigonial leaves and paraphyses (Pa), scale = 120  $\mu$ m. A, B from *Buck et al.* 1763 (NY); C-D from *Maas & Westra* 4204 (S).

tion in *Octoblepharum pulvinatum*. *Revue bryologique et lichénologique* 42(3):829-832.

**Dillenius, J.J. 1741.** *Historia Muscorum in qua circiter sexcentae species veteres et novae ad sua genera relatae describuntur, et iconibus genuinis illustrantur: cum appendice et indice synonymorum.* Oxford.

**Dixon, H.N. 1932.** Classification of Mosses. Pp. 397-412. In F. Verdoorn (ed.), *Manual of Bryology*. Martius Nijhoff, The Hague.

**Dozy F. & Molkenboer, J.H. 1854.** *Podromus Florae Bryologicae Surinamensis.* Erven Loosjes, Netherlands.

**Ellis, L.T. 1985.** A taxonomic revision of *Exodictyon* Card. (Musci: Calymperaceae). *Lindbergia* 11(1):9-37.

**Edwards, S.R. 1979.** Taxonomic implications of cell patterns in haplolepidous moss peristomes. Pp. 317-346. In G.C.S. Clarke and J.G. Duckett (eds.), *Modern approaches to bryophyte systematics.* Academic Press, London.

**Fleischer, M. 1904.** *Die Musci der Flora von Buitenzorg.* Part V. Vol. I (71). E.J. Brill, Leiden.

**Fleischer, M. 1918.** *Die Musci der Flora von Buitenzorg.* Part V. Vol. IV (83). E.J. Brill, Leiden.

**Florschütz, P.A. 1955.** A short survey of the American species of the genus *Octoblepharum*. *Mitteilungen der Thüringischen Botanischen Gesellschaft* 1(2-3):51-58.

**Florschütz, P.A. 1964.** *Flora of Suriname. Musci.* Vol. VI(1): 1-271. E.J. Brill, Leiden.

**Griffin III, D. 1979.** Guia preliminar para as Briófitas frequentes em Manaus e adjacências. *Acta Amazonica* (3): Suplemento 1-67.

**Hedwig, J. 1801.** *Species Muscorum Frondosorum descriptae et tabulis aeneis LXXVII coloratis illustratae.* (Opus posthumum editum a F. Schwaegrichen). Joannis Ambrosii Barthii, Lipsiae.

**Herzog, T. 1925.** Contribuições ao conhecimento da Flora Bryologica do Brasil. *Archivos de Botanica do Estado de São Paulo.* Vol. 1. Fasc. 2: 27-157.

**Magill, R.E. 1981.** *Flora of Southern Africa. Bryophyta I. Mosses. Sphagnaceae - Grimmiaceae.* Botanical Research Institute. Department of Agriculture and Fisheries. South Africa.

**Mitten, W. 1869.** Musci austro-americi. *Journal of the Linnean Society, Botany* 12:1-659.

**Reimers, H. 1954.** Bryophyta. Moose. Pp. 218-268. In A. Engler, *Syllabus der Pflanzenfamilien*, H. Melchior & E. Wedermann (eds.), 12th ed. Gebrüder Borntraeger, Berlin.

**Robinson, H. 1971.** A revised classification for the orders and families of mosses. *Phytologia* 21: 289-293.

**Robinson, H. 1985.** The structure and significance of the Leucobryaceous leaf. *Monographs of Systematic Botany, Missouri Botanical Garden* 11: 111-120.

**Robinson, H. 1990.** A functional evolution of the Leucobryaceae. *Tropical Bryology* 2: 223-237.

**Whittier, H.O. 1976.** *Mosses of the Society Islands.* Florida Technological University. Gainesville.

**Wijk, R. van der, Margadant, W.D. & Florschütz, P.A. 1964.** *Index Muscorum. Regnum Vegetabile Vol. III* (H-0). Utrecht. The Netherlands.

**Wijk, R. van der, Margadant, W.D. & Florschütz, P.A. 1969.** *Index Muscorum. Regnum Vegetabile Vol. V* (Addenda). Utrecht. The Netherlands.

**Yano, O. 1975.** *Leucobryaceae (Musci) do Estado de São Paulo.* Masters Dissertation. Escola Paulista de Medicina São Paulo, Brasil.

**Yano, O. 1985.** *Octoblepharum (Leucobryaceae) do Alto Rio Negro, Amazonas (Brasil).* *Acta Amazonica, Suplemento* 15(1-2):55-62.