

## Occurrence of some Lejeuneaceae (Jungermanniophyta) in Bahia, Brazil

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**Abstract.** Five species of Lejeuneaceae, tribe Lejeuneae from state of Bahia, Brazil are described and illustrated. Data on geographic distributions, distribution in Brazil and habitat in Bahia are also given.

### INTRODUCTION

The Lejeuneaceae in Brazil are represented by ca. 63 genera and 465 species (Yano 1996) and in Bahia by ca. 97 species into ca. 35 genera (data in part not published). In Bahia the members of Lejeuneaceae grow in a great diversity of habitats, such as “campos rupestres”, “caatinga”, “cerrado”, ombrophilous forest, seasonal forest, mangroves and urban zones. Most species are generalists, growing on various substrates.

In Brazil the Lejeuneaceae are poorly studied taxonomically in spite of a great number of records. The most important study for neotropics, including Brazil, was by Gradstein (1994), but only for Ptychanthoideae and part of

Lejeuneoideae (tribe Brachiolejeuneae). In Bahia we have begun a study of the Lejeuneaceae and results have been very interesting. The members of Lejeuneaceae found in Bahia belong to four subfamilies according to the concept accepted here: Bryopteridoideae, Ptychanthoideae, Lejeuneoideae and Cololejeuneoideae. In our opinion, these four evolutionary trends are well defined in Lejeuneaceae. The Lejeuneoideae are the best represented in numbers of species. In this paper five species belonging to the Lejeuneoideae, tribe Lejeuneae, are described and illustrated: *Cyrtolejeunea holostipa* (Spruce) Evans, *Harpalejeunea uncinata* Steph., *Leptolejeunea exocellata* (Spruce) Evans, *Leucolejeunea conchifolia* (Evans) Evans and *Leucolejeunea xanthocarpa* (Lehm. & Lindenb.) Evans.

## MATERIALS AND METHODS

Species deposited in Alexandre Leal Costa Herbarium (ALCB) collected in “Estação Veracruz”, a private ecological reserve belonging to “Veracel Celulose S.A.”, in the state of Bahia, Brazil, were studied. The “Estação Veracruz” is primary Atlantic forest fragment situated in southern Bahia and occupies ca. 6,000 ha between Porto Seguro and Santa Cruz de Cabrália counties. The systematic arrangement follows Schuster (1980) (in part).

## RESULTS

*Cyrtolejeunea holostipa* (Spruce) Evans, Bull. Torrey Bot. Club 30: 553. 1903.

Basionym: *Lejeunea holostipa* Spruce, Trans. Proc. Bot. Soc. Edinburgh 15: 171. 1884.

Type-locality: Venezuela.

(Figure 1).

Gametophyte small, prostrate, branches *Lejeunea*-type. Stem in cross section with 7-8 cortical cells and 3 medullary cells. leaves erect-spreading, contiguous to imbricate; lobe ovate, 238.5-265µm long x 132.5-153.7µm wide, margin entire, apex rounded; cells oblong to rounded, 14.5-23.7µm x 11.9-17.2µm, thick-walled, with large trigones and inconspicuous intermediate thickenings; oil-bodies not seen; ocelli absent; lobule ovate, 106µm long x 74.2µm wide, strongly inflated, free margin plane, keel strongly arched, gibbous, apical tooth long, hyaline papilla not seen. Underleaves small, 85.8µm wide, unlobed, distant, orbicular. Ventral merophytes two cells wide. Androecia on long lateral branches, bracts in 3 pairs, bracteoles like underleaves, present throughout. Gynoecia on short lateral branches, bracts with lobes obovate, margin entire, bracteole large, obovate, apex emarginate; perianth not found.

Specimens examined: Brazil, Bahia: “Estação Veracru” Ecological Reserve, between Eunápolis and Porto Seguro, ombrophilous forest, domain of Tropical Atlantic Rainforest, in “mussununga” vegetation, 10/6/1999, S.B. Vilas Bôas-Bastos & C. Bastos 681 (ALCB 41881).

Geographic distribution: Tropical America.

Distribution in Brazil: Espírito Santo (Schäfer-

Verwimp 1991), Pernambuco (Pôrto 1990), Rio de Janeiro (Spruce 1888), São Paulo (Visnadi 1998).

Substrate: tree trunk.

*Leucolejeunea conchifolia* (Evans) Evans, Torrey Bot. Club 7: 229. 1907.

Basionym: *Archilejeunea conchifolia* Evans, Mem. Torrey Bot. Club 8(2): 128. 1902.

Type-locality: Orange Band.

(Figure 2).

Gametophyte robust, 1.4mm wide, green, prostrate, branches *Lejeunea*-type. Stem in cross section with 14 cortical cells and 21 medullary cells. Leaves imbricate, spreading; lobe ovate, 0.8-0.9mm long x 0.6mm wide, margin entire, apex obtuse to rounded, falcate; cells oblong, 25-35.6µm long x 21,1-22.4µm wide, thin-walled, trigones small to inconspicuous, intermediate thickenings absent; oil-bodies not seen; ocelli absent; lobule very large, 392.2-450.5µm long x 206.7-185.5µm wide, oblong-ovate, inflated, free margin arched, keel weakly convex or straight, apical tooth long, falcate, hyaline papilla not seen. Underleaves unlobed, 0.5-0.6mm wide, contiguous to imbricate, rotundate. ventral merophytes two cells wide. Androecia not found. Gynoecia on short lateral branches, bracts oblong-ovate, margin entire, bracteole unlobed, oblong; perianth obovate, 5-keeled.

Specimens examined: Brazil, Bahia: “Estação Veracru” Ecological Reserve, between Eunápolis and Porto Seguro, ombrophilous forest, domain of Tropical Atlantic Rainforest, in “mussununga” vegetation, 10/6/1999, S.B. Vilas Bôas-Bastos & C. Bastos 627, 629, 630, 636, 637, 658, 676, 689, 717 (ALCB 41826, 42828, 41829, 41835, 41836, 41858, 41876, 41889, 41917).

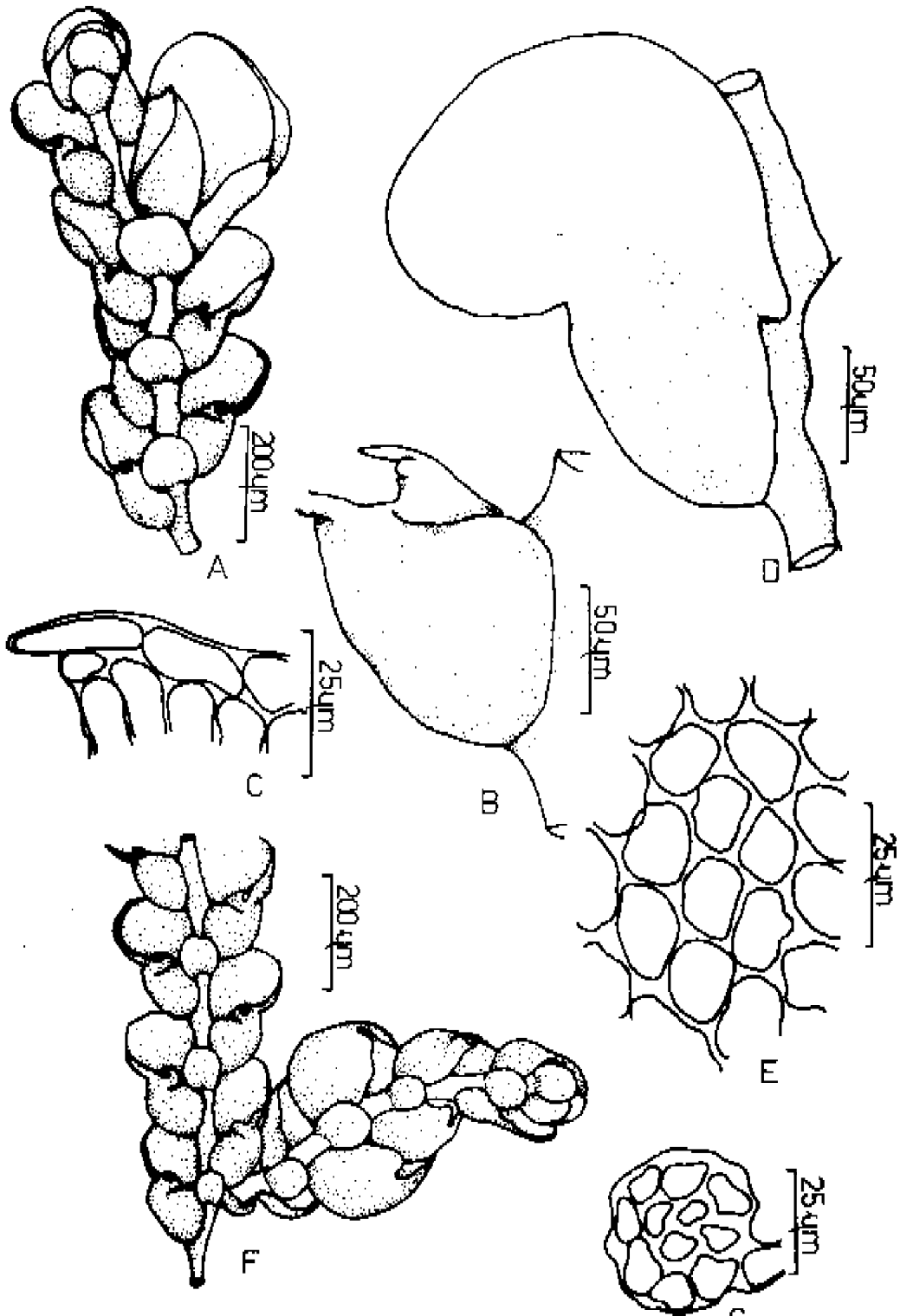
Geographic distribution: United States of America and Brazil.

Distribution in Brazil: Espírito Santo (Schäfer-Verwimp 1991), São Paulo (Visnadi 1998).

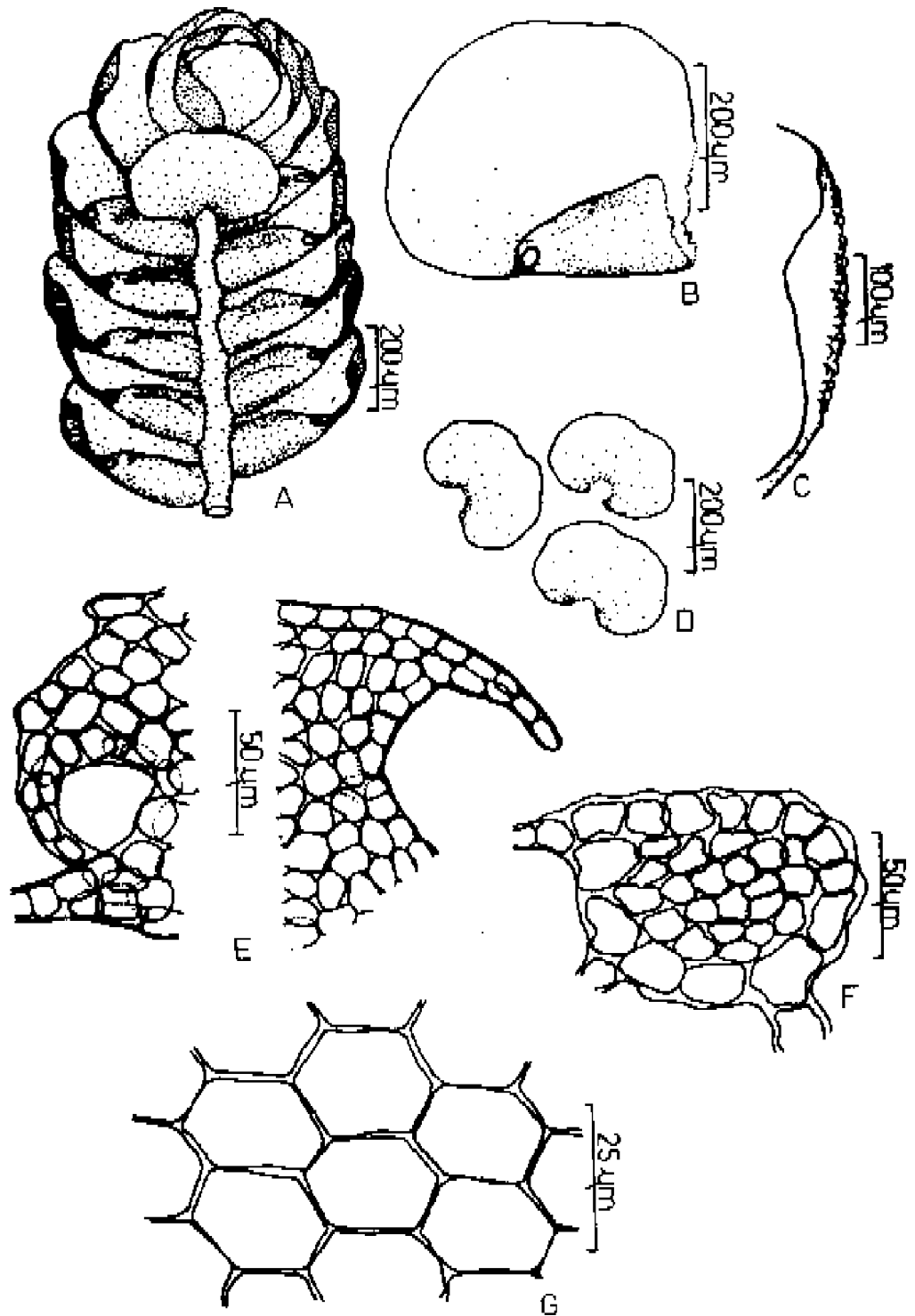
Substrate: tree trunk.

*Leucolejeunea xanthocarpa* (Lehm. & Lindenb.) Evans, Torrey Bot. Club 7: 229. 1907.

Basionym: *Jungermannia xanthocarpa* Lehm. & Lindenb. in Lehmann, Nov. Min. Cogn. Stirp.



**Figure 1.** *Cyrtolejeunea holostipa* (Spruce) Evans. A) gametophyte with gynoecia, ventral view; B) lobule; C) apical tooth; D) leaf, dorsal view; E) laminal cells; F) gametophyte with androecia; G) transverse section of the stem.



**Figure 2.** *Leucolejeunea conchifolia* (Evans) Evans. A) gametophyte, ventral view; B) leaf; C) leaf apex; D) underleaves; E) apical teeth; F) transverse section of the stem; G) laminal cells.

Pug. 5: 8. 1833.

Type-locality: Brazil.

(Figure 3).

Gametophyte robust, 1.34mm wide, prostrate, branches *Lejeunea*-type. Stem in cross sections with 14 cortical cells and 21 medullary cells. Leaves imbricate, spreading; lobe oblong-ovate, 0.5mm long x 0.3mm wide, margin revolute, apex rounded; cells oblong, 18.9-22µm long x 16.8-17.6 wide, thick-walled, trigones large, sometimes with intermediate thickenings; oil-bodies not seen; ocelli absent; lobule ovate-rectangular, 243.6-285.6µm long x 117.6-138.6µm wide, free margin involute for its entire length, keel straight, apical tooth short, hyaline papilla not seen. Underleaves unlobed, large, 0.5mm wide, imbricate, reniform. Ventral merophytes two cells wide. Androecia on long lateral branch, bracts in 7-8 pairs, bracteole on base. Gynoecia on short lateral branch, bracts oblongs, margin revolute, entire, bracteole oblong, strongly revolute; perianth obovate, rostrum long.

Specimens examined: Brazil, Bahia: "Estação Veracruz" Ecological Reserve, between Eunápolis and Porto Seguro, ombrophilous forest, domain of Tropical Atlantic Rainforest, in "mussununga" vegetation, 10/6/1999, S.B. Vilas Bôas-Bastos & C. Bastos 628, 643, 648, 686, 707, 701, 709, 719, 720 (ALCB 41827, 41842, 41847, 41886, 41907, 41901, 41909, 41919, 41920).

Geographic distribution: Pantropical.

Distribution in Brazil: Espírito Santo (Schäfer-Verwimp 1991), Pernambuco (Pôrto 1990), Rio de Janeiro (Gottsche et al. 1844, Costa 1992, 1999), Santa Catarina (Thiers 1982), São Paulo (Herzog 1927, Schiffner & Arnell 1964, Giancotti & Vital 1989, Visnadi et al. 1994, Vital & Visnadi 1994, Visnadi 1998).

Substrate: tree trunk.

*Harpalejeunea uncinata* Steph. Hedwigia 35: 97. 1896.

Type-locality: Luqillo Montains, Puerto Rico.

(Figure 4).

Gametophyte small, 0.6mm wide, green, prostrate, branches *Lejeunea*-type. Stem in cross section with 7 cortical cells and 4 medullary cells.

Leaves contiguous to moderately imbricate; lobe ovate, 307.4-371µm long x 180.2-206.7mm wide, falcate, margin entire, apex apiculate to cuspidate, formed by 4-6 cells; cells hexagonal to oblong, 15.8-27.7µm long x 18.4µm wide, thin-walled, trigones small, intermediate thickenings inconspicuous; oil-bodies not seen; ocelli 1-2, basal, large; lobule ovate, 132.5µm long x 100.7µm wide, strongly inflated, free margin involute, keel strongly arched, apical tooth long, hyaline papilla on base of apical tooth. Underleaves small, 106µm wide, cordate, distant, sinus acute to lunate, lobes 4 cells wide. Ventral merophytes two cells wide. Androecia and gynoecia not found.

Specimens examined: Brazil, Bahia: "Estação Veracruz" Ecological Reserve, between Eunápolis and Porto Seguro, ombrophilous forest, domain of Tropical Atlantic Rainforest, S.B. Vilas Bôas-Bastos & C. Bastos 778 (ALCB 41978).

Geographic distribution: Caribbean

Distribution in Brazil: Rio de Janeiro (Oliveira e Silva & Yano 1998).

Substrate: tree trunk.

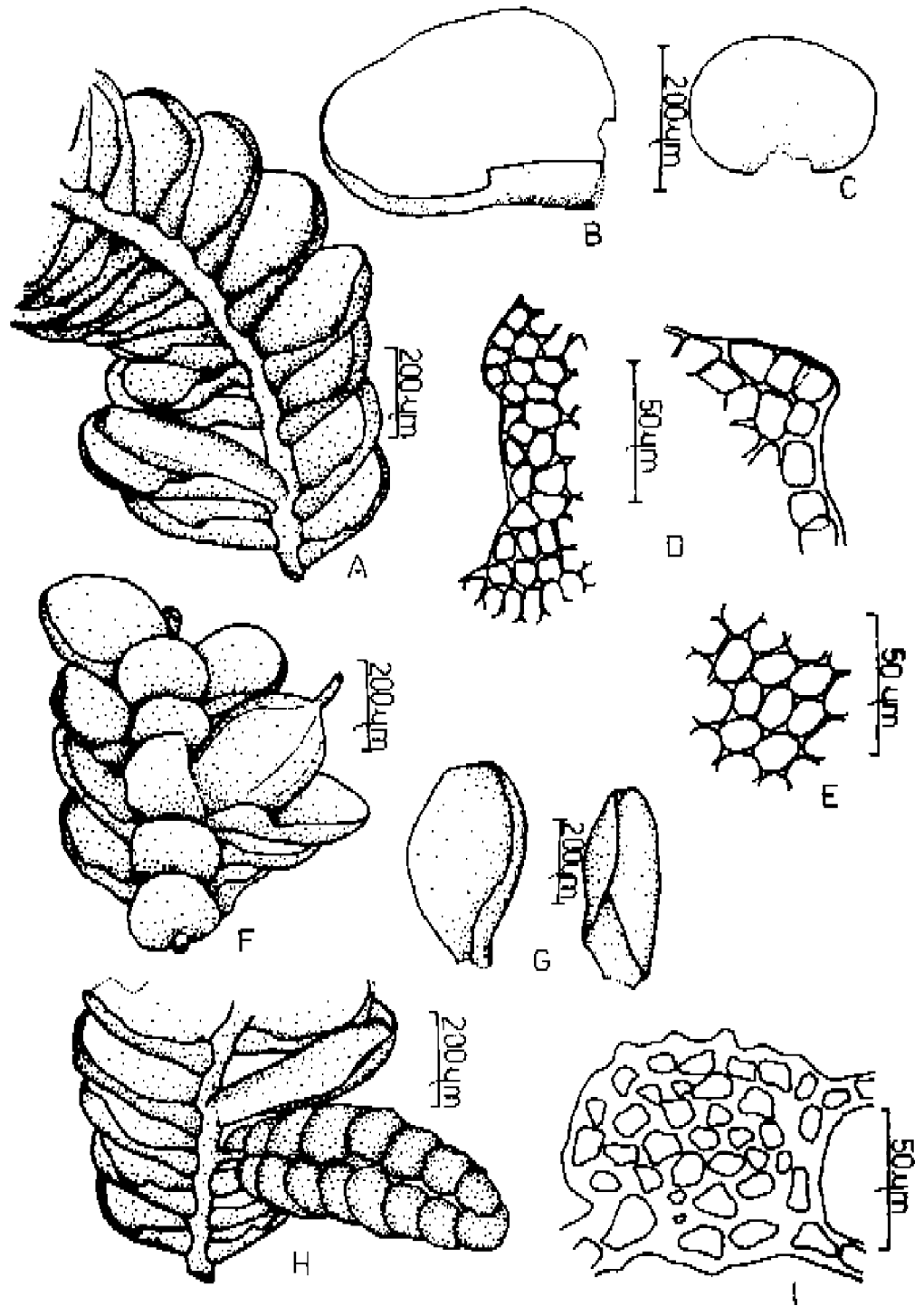
*Leptolejeunea exocellata* (Spruce) Evans, Bull. Torrey Bot. Club 29: 498. 1902.

Basionym: *Lejeunea exocellata* Spruce, Trans. Proc. Bot. Soc. Edinburgh 15: 195. 1884.

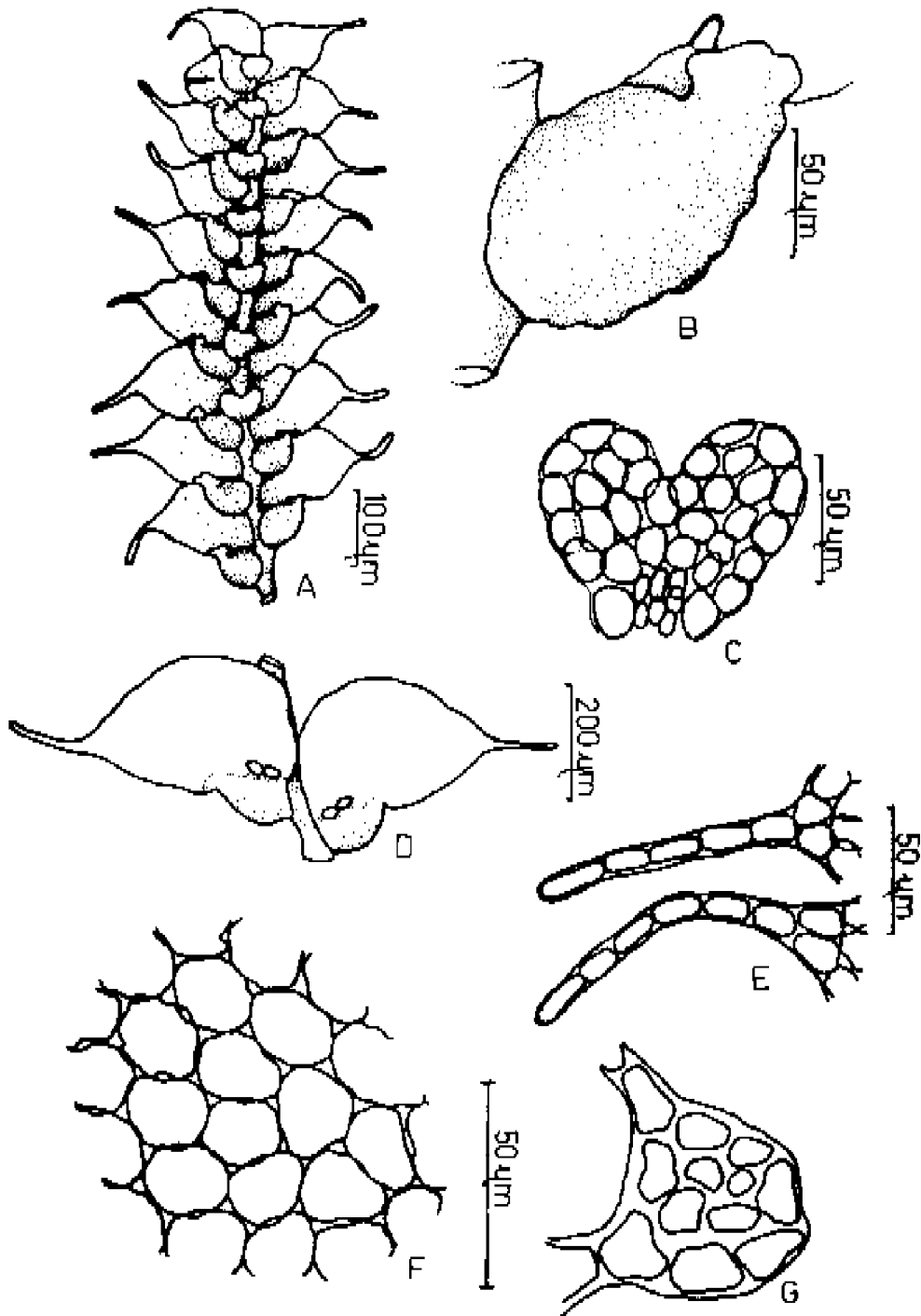
Type-locality: Peru

(Figure 5).

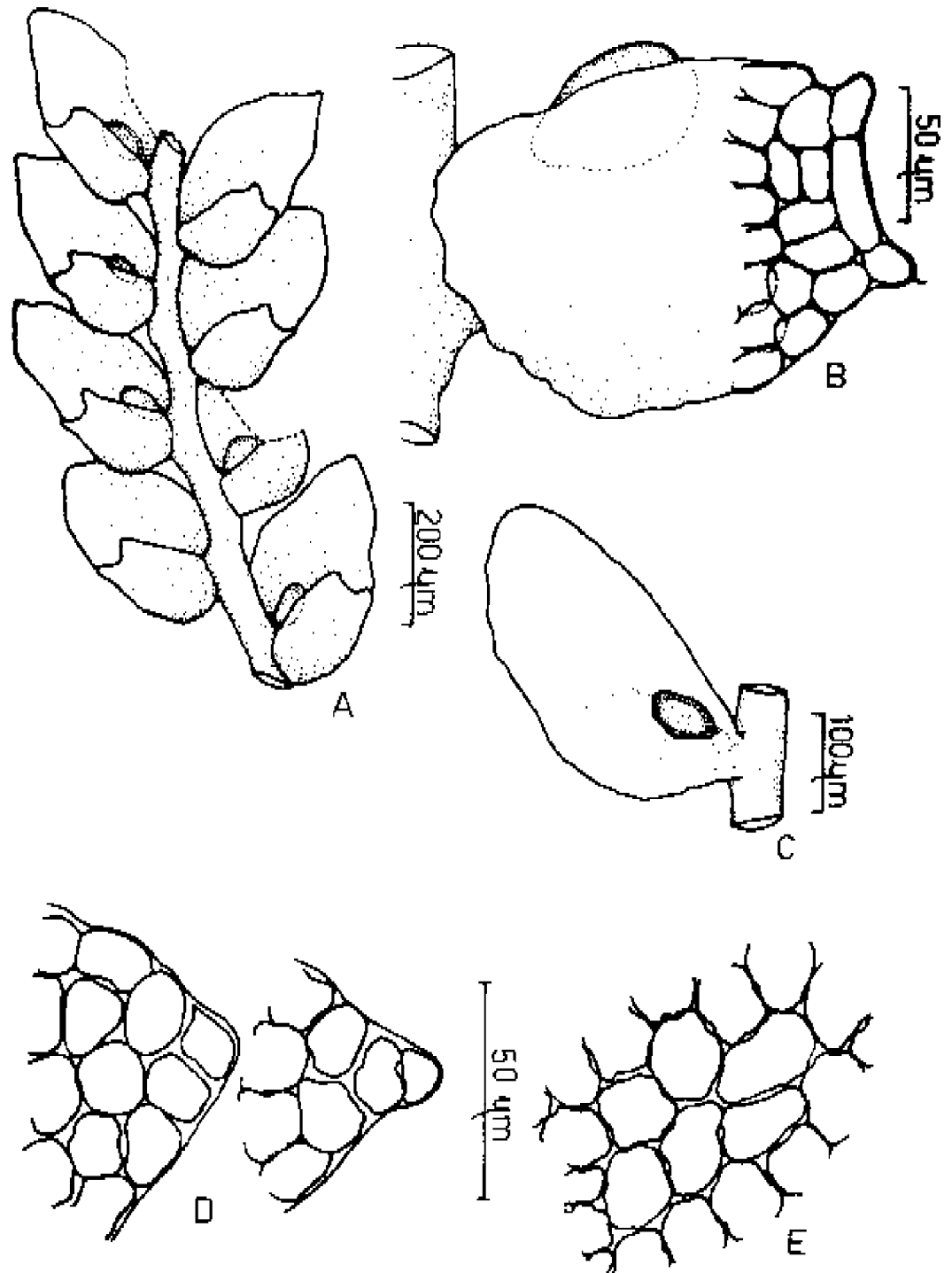
Gametophyte small, prostrate, branches *Lejeunea*-type. Leaves distant to contiguous, erect-spreading; lobe ovate, 344.5µm long x 185.5µm wide, margin crenate, apex rounded to obtuse, formed by 1-2 cells; cells hexagonal to oblong, 19.8-25µm long x 15.8-17.1µm wide, thick-walled, trigones small, intermediate thickenings nodulose; oil-bodies small; ocellus basal, large, partially hidden by lobule; lobule ovate to ovate-rectangular, inflated, 185.5µm long x 132.5µm wide, free margin plane, keel moderately arched, crenate, apical tooth short, hyaline papilla not seen. Underleaves small, 81.8µm wide, distant, lobes filiform, formed of a row of 2-3 cells. Ventral merophytes two cells wide. Androecia and gynoecia not seen.



**Figure 3.** *Leucolejeunea xanthocarpa* (Lehm. & Lindenb.) Evans. A) gametophyte, ventral view; B) leaf; C) underleaves; D) lobule apices; E) laminar cells; F) gynoecia; G) gynoecial bracts; H) androecia; I) transverse section of the stem.



**Figure 4.** *Harpalejeunea uncinata* Steph. A) gametophyte, ventral view; B) lobule; C) underleaf; D) leaves with ocelli, dorsal view; E) lobe apices; F) laminal cells; G) transverse section of the stem.



**Figure 5.** *Leptolejeunea exocellata* (Spruce) Evans. A) gametophyte, ventral view; B) lobule; C) leaf with ocellus, dorsal view; D) lobe apices; E) laminal cells.



Specimens examined: Brazil, Bahia: "Estação Veracruz" Ecological Reserve, between Eunápolis and Porto Seguro, ombrophilous forest, domain of Tropical Atlantic Rainforest, 28/10/1999, S.B. Vilas Bôas-Bastos & C. Bastos 2035, 2036 (ALCB 44602, 44603).

Geographic distribution: Neotropical.

Distribution in Brazil: Acre, Amazonas, Paraná, Rio de Janeiro, Santa Catarina (Bischler 1969), São Paulo (Schiffner & Arnell 1964).

Substrate: tree trunk.

The material examined was insufficient for the preparation of a transverse section of the stem, and the underleaves were inadequate for drawing. According to Reiner-Drehwald (1995), *L. exocellata* has 7 cortical cells and 3 medullary cells in the stem. The underleaves are distant, with filiform lobes (3-4 cells long and two cells wide).

## DISCUSSION

The species studied were collected in southern Bahia in ombrophilous forest, domain of Atlantic Forest, a vegetation type occurring on the Brazilian coast with characteristics of the tropical rain forest. The Atlantic Forest of southern Bahia has certain floristic similarities with Amazonian forests. It is true for both bryophytes and vascular plants, and suggests ancient links between Amazonian and Atlantic forests, as was advocated by Andrade-Lima (1966), who found 388 Amazonian species ranging southern Bahia to northern Espírito Santo (*vide* Rizzini 1979).

Most of the species studied in this paper are restricted to southeastern and northeastern Brazil, and only *Leptolejeunea exocellata* represents an Amazonian element. *Leucolejeunea conchifolia* and *Harpalejeunea uncinata* have a more restricted distribution in Brazil, and the former has not been reported for other South American countries, being reported only from the coastal plain of southeastern USA by Schuster (1980). According to Delgadillo (1995) this disjunctive pattern also occurs in several neotropical mosses, whose distribution includes North America and Brazil, and is not easily explained by a range dissection hypothesis. The

lack of adequate collecting may be the source of these patterns. *Leucolejeunea xanthocarpa* is a Pantropical species, occurring in Asia (Indomalaya to China and Japan) and central and southern Africa, and widespread in the New World (*vide* Schuster 1980), with larger distribution in South America. *Cyrtolejeunea holostipa*, *Leucolejeunea conchifolia* and *leucolejeunea xanthocarpa* in the collecting site were found in "mussununga" vegetation, which is a similar vegetation to "restinga" (coastal shrub with halophyte and xeromorphic vegetation) into ombrophilous forest. In other areas out side of Bahia these species were found mainly in Atlantic forest areas.

The bryophyte flora of the southern Bahia is somewhat similar that of the southeastern Brazil, but with some Amazonian elements. It is likely due to floristic reasons, since the Atlantic forest ranges from northeastern (Pernambuco state) to southeastern (Santa Catarina state) Brazil, although extensive areas have already been destroyed, and according to Costa (1999) of the original areas (ca. 1.6 million km<sup>2</sup>) only 1-6% persists as isolated fragments, and their bryophyte flora has been less studied than the vascular plant flora. Nevertheless, climatic causes and distribution patterns must be undervalued.

There are several approaches to explain different disjunctive patterns among bryophytes, including step-by-step migrations, geological events, climatic changes and long range dispersal, as discussed by various authors (see Gradstein 1983 and Delgadillo 1995). However, the apparent disjunct distribution may be represent lack of complete floristic catalogues for the neotropical area, mainly for Lejeuneoideae. The Brazilian bryophyte flora is in need of more extensive fieldwork as well as monographic treatments of many genera or families (as pointed out by Schäfer-Verwimp 1996) in order to explain the real geographic distribution patterns.

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