

Cololejeunea cardiocarpa, an epiphyllous liverwort in southern Africa (Lejeuneaceae)

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ABSTRACT

Cololejeunea cardiocarpa was misidentified by Arnell (1963) and described by him as a new variety, *Leptocolea cristata* var. *lanciloba*. Gradstein *et al.* (1983) drew attention to this error. Fresh material has now been collected and the species is described here and illustrated with photographs.

UITTREKSEL

Arnell (1963) het *Cololejeunea cardiocarpa* verkeerd geïdentifiseer en as 'n nuwe variëteit, *Leptocolea cristata* var. *lanciloba* beskryf. Gradstein *et al.* (1983) het die aandag op hierdie fout gevestig. Vars materiaal is nou versamel en die spesie word hier beskryf en met foto's geïllustreer.

INTRODUCTION

Arnell (1963) cited *Alice Pegler PRE-CH 916*, as the type of the name of his new variety, *Leptocolea cristata* var. *lanciloba* S. Arnell, a leafy liverwort epiphyllous on *Encephalartos villosus* Lem., from Kentani Dist., eastern Cape Province. Recently, however, Gradstein *et al.* (1983) recognized that Arnell's description and illustrations clearly referred to *Cololejeunea cardiocarpa* (Montagne) Schuster.

This report is given for the following reasons: 1, the above information may easily be overlooked; 2, the distribution of this species in southern Africa, as reported by Gradstein *et al.* (1983) in Plate 1/3, is indicated by a dot in the southwestern Cape, instead of in the eastern Cape (Transkei) as it should be, and 3, fresh material has recently come to hand.

In the highly specialized family, Lejeuneaceae Cavers, to which *Cololejeunea cardiocarpa* belongs, the subfamily Cololejeuneoideae Herz. ex Grolle, is said to represent a pinnacle in the evolution of the leafy hepatics (Schuster 1980). Two tribes are recognized: Displasiolejeuneae Schuster and Cololejeuneae, the latter with two genera, *Cololejeunea* (Spruce) Schiffn. and *Aphanolejeunea* Evans, but the characters separating them are not at all clear-cut. They are generally distinguished by the following: the absence of underleaves, the small size of the plants, the cells being more or less uniform, the stems with one row of ventral cortical cells, the leaves with a narrowly ovate or lanceolate shape, and the rhizoids in a small group, one group per lateral leaf. The species of *Cololejeunea* have vegetative lateral branching of, what is termed, the *Lejeunea*-type, i.e. a branch does not originate from a cortical cell and is thecal or 'collared'; there are numerous discoid gemmae with smooth outlines, mostly originating from intramarginal leaf cells and with

their plane parallel to the lobe face; the leaves have inflated lobules with a hyaline papilla usually more or less proximal to the apical tooth and the perianth is distinctly beaked with five carinae.

Schuster (1980) states that currently as many as about 200 species have been described under *Cololejeunea sensu lato*. Of the three subgenera in the genus *Cololejeunea* treated by him (Schuster 1980), namely *Protocolea* Schuster, *Platycolea* Schuster and *Cololejeunea*, those assigned to *Protocolea* and *Platycolea* never have tubercles or conoidal processes on the cells of the leaf lobes, lobules, bracts and perianths, as are present in *Cololejeunea*. Species in subgenus *Platycolea*, with its subgeneric type, *Cololejeunea cardiocarpa* (selected by Schuster), are characterized by laterally connate, finger-like hyaline cells at the lobe apices and compressed perianths with low antical and postical keels. *Platycolea* includes at least 31 species which, however, display a wide diversity of characters. Accordingly, E.W. Jones (pers. comm.) argues that there is much to be said for keeping those species with 'hyaline border cells to the leaves' united in the genus *Pedinolejeunea* Chen & Wu (or in the subgenus *Pedinolejeunea* Benedix ex Mizut.), rather than splitting them up by the shape of the lobules into *Platycolea* and *Pedinolejeunea*, as was done by Schuster. Clearly, there still is much that is controversial about the matter.

Tixier (1985) places *C. cardiocarpa* in section *Platycolea* Schuster s. em., subsection *Fimbriatae* Tixier; lately, he (Tixier unpublished) has attempted to divide it into several species because of its extreme variability (E.W. Jones pers. comm.).

***Cololejeunea cardiocarpa* (Montagne) Stephani** in Hedwigia 29: 91 (1890).

Cololejeunea (*Platycolea*) *cardiocarpa* (Montagne) Schuster: 54 (1959); Schuster: 173 (1963); Schuster: 1278 (1980); Vanden Berghen: 226 (1977); Vanden Berghen: 448 (1978).

Lejeunia cardiocarpa Montagne: 446, 447 (1838–1842). Type: Cuba.

Leptocolea cardiocarpa (Montagne) Evans: 268 (1911); Schuster: 144 (1955); Jones: 200 (1957).

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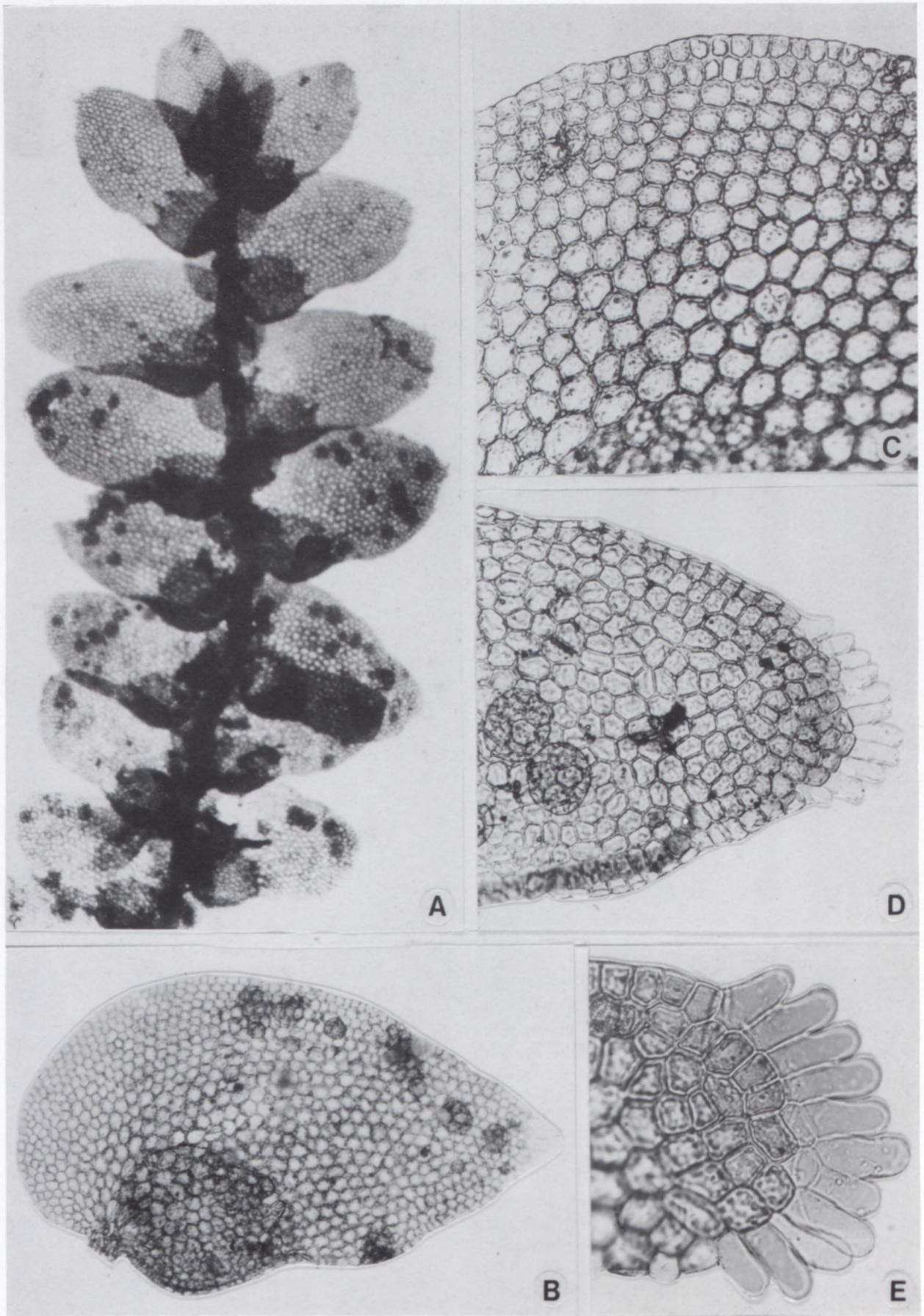


FIGURE 1.—*Cololejeunea cardiocarpa*, vegetative phase. A, ventral view of plant (note gemmae on leaf surface); B, ventral view of leaf; C, antical margin of lobe; D, apex of lobe, with several hyaline cells; E, hyaline cells at apex of lobe, much enlarged and, toward centre, showing 2 subrectangular hyaline cells at their base. A–C, *Brusse 5869*; D, E, *Brusse 5721*. A, $\times 35$; B, $\times 70$; C, D, $\times 175$; E, $\times 350$.

Lejeunia (subg. *Colo-Lejeunea* sect. *Leptocolea*) *cardiocarpa* (Montagne) Spruce: 300 (1884–1885).

Lejeunia jooiriana Austin: 20 (1875). *Lejeunea* (*Colo-Lejeunea*) *jooiriana* Stephani: 171 (1892). *Cololejeunea jooiriana* (Stephani) Evans: 173 (1902). *Leptocolea jooiriana* (Stephani) Evans: 270 (1911); Stephani: 844 (1915). Type: Louisiana.

Physocolea savesiana Stephani: 904 (1912–1917).

Synonymy mostly after Schuster: 1278 (1980) and partly after Tixier: 46 (1985).

Epiphyllous or corticolous on mostly smooth bark, in small patches, closely appressed to substrate, flat, thin, freely branching, yellow-green to green, small to medium-sized. Stems up to ± 6 mm long, slender, 50–55 μm wide and together with the leaves up to 1500 μm wide at maturity (Figure 1A), lacking underleaves, but bearing small fascicles of rhizoids near each leaf; on cross section with 1 medullary and 5 rows of cortical cells (more if section taken close to origin of a branch). Leaves flat and appressed both wet and dry, ovate to ovate-triangular, obtusely rounded apically, widest below midline (Figure 1B), spreading at an angle of 55°–75°, rather imbricate, dorsal base usually extending across and slightly beyond stem. Lobes (600–)850–1000 \times 300–550 μm , narrowed at base, antical (Figure 1C) and postical margins smooth, nearly straight, apex fairly obtuse to rounded, generally bordered with a row of 4–16 hyaline cells, elongated and rather finger-like (Figure 1D), 40–65 \times 15–20 μm , sometimes at their base small, subrectangular cells, 12.5–25.0 \times 20 μm , also hyaline (Figure 1E); chlorophyllose cells at apex $\pm 17.5 \times 12.5 \mu\text{m}$, medially 25–30 \times 15.0–22.5 μm and at base $\pm 17.5 \times 12.5 \mu\text{m}$, all of one type, thin-walled, with small trigones, containing oil bodies, usually 3–7 per cell, fusiform in shape; antical margin rarely with a row of \pm quadrate, hyaline cells. Lobules inflated, ovate to broadly ellipsoidal, constricted at base (Figure 2F), extending $\frac{1}{3}$ – $\frac{2}{5}$ the distance from stem to apex of lobe, 300–325 \times 250 μm , cells $\pm 20.0 \times 12.5 \mu\text{m}$, keel convex, nearly continuous with postical margin of lobe, lobule apex with obtuse, slightly jutting out, 1-celled tooth, 20 \times 15 μm ; about midway between apical tooth and keel, a more prominent 3- or 4-celled proximal tooth, with an inconspicuous, concealed hyaline papilla at its base (Figure 2B). Stylus 2-celled, 45.0–52.5 \times 10 μm , basal cell often larger than apical cell (Figure 2C). Gemmae numerous, discoid, broadly oval with smooth outline, unspecialized and lacking adhesive cells, usually on lower lobe surface and mostly originating from intramarginal cells, ± 60 –70 μm in diameter, composed of ± 29 cells of which ± 17 around margin (Figure 3D).

Auto- or paroicous. Androecia situated below perianth or on a short lateral branch, bracts mostly unmodified but distinguishable from vegetative leaves by the absence of apical hyaline cells, in several pairs; antheridia 1 or 2 per bract (Figure 2D), flask-shaped, 150 \times 90 μm , with hyaline neck $\pm 100 \mu\text{m}$ long. Perichaetial bracts with lobes somewhat smaller than those of vegetative leaves, 450 \times 200 μm , widely spreading, apex obtuse with a few hyaline cells, lobule 200 \times 180 μm . Perianth terminal or sometimes on a lateral branch, sessile, usually with a single innovation, rarely 2, 560 \times 440 μm , more or less compressed, outline obovate, with 2 sharp lateral keels and 2 smaller ventral ones (Figures 2E; 3C), apex with short beak (Figure 3B). Sporangium initially enclosed in

a delicate calyptra, containing numerous spores. Spores irregularly ovate, green, 25–45 \times 20 μm , consisting of several cells (Figure 2H). Elaters attached to inner wall of valves of sporangium (Figures 2F; 3A), distributed 4, 4, 3, 3 per valve, 175 \times 25 μm , free apices blunt (Figure 2G). This description was based on southern African collections.

Arnell (1963) could not have been familiar with the above species, hence he described the Pegler specimen as a new variety, *Leptocolea cristata* var. *lanciloba*. According to Jones (pers. comm.) *Cololejeunea cardiocarpa* appears to differ from *Leptocolea cristata* (Stephani) E.W. Jones by being a smaller plant with a more delicate texture; its leaves are ovate (not oval or obovate as in *L. cristata* and are broadest proximally, tapering to a narrow apex (but they are variable); the lobule is short with the free margin inflexed and not visible *in situ*, as it is in *L. cristata* and its cell walls are thin and lack trigones, the cells being transparent.

Cololejeunea cardiocarpa is a widespread pantropical and oceanic subcosmopolitan (Pócs 1978) species, known from North, Central and South America, Africa, Madagascar and New Caledonia. In Africa it has been recorded from Sierra Leone (Jones & Harrington 1983), Cameroon (Tixier 1975), Zaïre, Kenya, Uganda, Tanzania (Bizot & Pócs 1979; Bizot & Pócs 1982; Gradstein *et al.* 1983; Jones 1957; Pócs 1985) and from Zimbabwe (Vanden Berghen 1978). In the checklist by Magill & Schelpe (1979) *Cololejeunea cardiocarpa* is reported as occurring in southern Africa; there are few records from the subcontinent but new collections, such as the two from Swaziland cited under specimens examined, gradually increase the known distribution area in southern Africa. It is, apparently, able to tolerate considerable desiccation and, though usually epiphyllous, it becomes corticolous under dry conditions, but probably is more difficult to find on bark. Jones (1957) reports it as growing in mostly montane localities in the tropics, whereas Schuster (1980) regards it as confined to the Coastal Plain in the United States. Pócs (1978) reported it from lowland forest, submontane rain forest and montane rain forest, with the highest frequency per leaf in the submontane rain forest. Gradstein *et al.* (1983) found it occurring from lowland to lower montane forests under humid to subxeric conditions. Two of the southern African collections are from a coastal forest (Figure 4).

Schuster (1980) states that the finger-like, hyaline cells of the leaf apices are absolutely diagnostic. These are, however, not always well developed and may sometimes even be lacking, when it may be more difficult to place a specimen correctly. Schuster (1980) also remarks that the stylus in this species is merely a slime papilla, but I found it to be 2-celled in the specimens I examined. It probably is not of diagnostic significance.

SPECIMENS EXAMINED

SWAZILAND.—2631 (Mbabane): Malolotja Nature Reserve, evergreen riverine forest, on leaflets of a cycad, alt. 930 m, (–AA), *Prendergast s.n.*; small tree-lined gully in Highland Grassland, on small, thin dentate leaves of bush tree, alt. 1390 m, (–AA), *Prendergast s.n.* (both specimens fide Dr E.W. Jones (pers. comm.) and held at the herbarium of the Malolotja Nature Reserve, Mbabane, Swaziland).

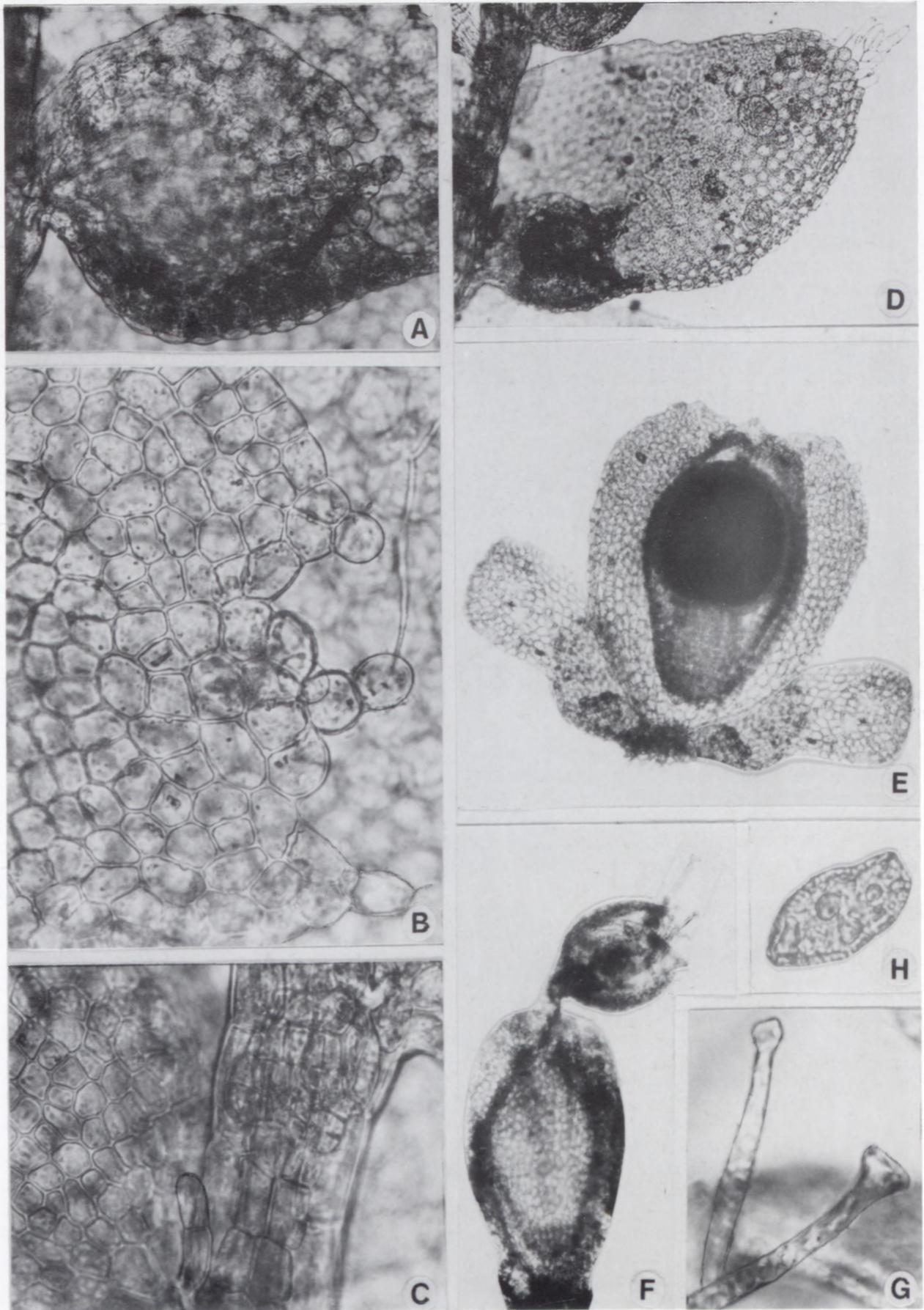


FIGURE 2.—*Cololejeunea cardiocarpa*. A–C, vegetative phase: A, lobule *in situ*; B, lobule with apical and proximal teeth much enlarged; C, stylus. D–H, sexual phase: D, 2 antheridia in lobule; E, perianth with perichaetial leaves at base; F, open perianth with sporangium; G, 2 elaters partially shown; H, spore. A–F, H, *Brusse 5869*; G, *Brusse 5721*. A, $\times 175$; B, C, G, $\times 350$; D, $\times 87$; E, $\times 70$; F, H, $\times 700$.

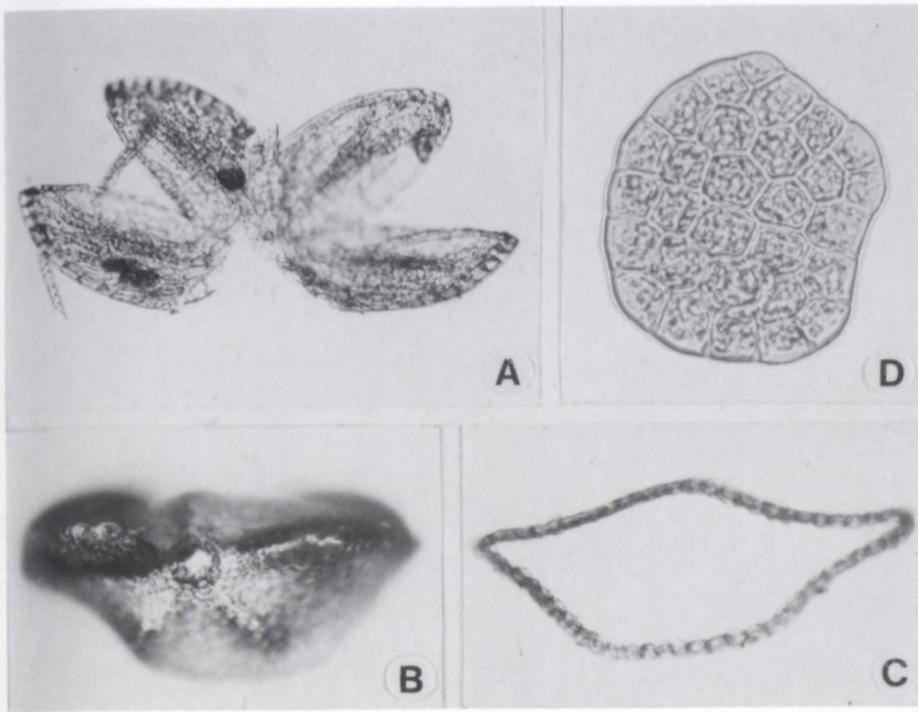


FIGURE 3.—*Cololejeunea cardiocarpa*. A–C, sexual phase: A, opened sporangium, showing attached elaters; B, tip of perianth from above; C, cross section taken \pm midway through perianth. D, gemma. A, Brusse 5721; B–D, Brusse 5869. A–C, $\times 87$; D, $\times 350$.

TRANSKEI.—3228 (Butterworth): Kentani Dist., growing on *Encephalartos villosus* Lem. leaves, (–AD), Pegler PRE-CH 916 (PRE); Dwesa Nat. Res., 4 km from campsite on road to mBashe, 10–50 m beyond nGoma River Bridge, near road, growing on *Buxus natalensis* (Oliv.) Hutch. leaves, in understorey vegetation of coastal forest, (–BD), Brusse 5721 (PRE); Dwesa Nat. Res., about 5 km from campsite on road to mPume gate, growing on *Encephalartos villosus* Lem. leaves, in understorey vegetation of coastal forest, (–BD), Brusse 5869 (PRE).

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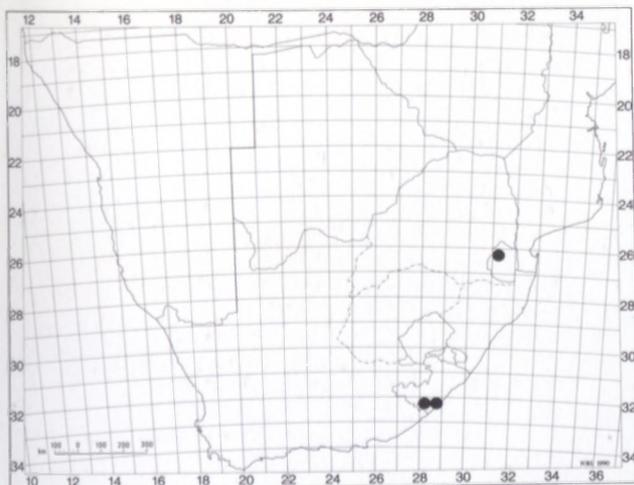


FIGURE 4.—Distribution of *Cololejeunea cardiocarpa* in southern Africa.

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