THE HEPATIC, *CALYCULARIA CRISPULA* (METZGERIALES) REPORTED FROM MALAWI AND ZAMBIA

Calycularia crispula *Mitt.*, in Journal of the Proceedings of the Linnean Society of Botany 5: 122 (1861); Pandé & Udar: 331 (1956); Jones: 497 (1985). Type: Himalayas, Sikkim, *J.D. Hooker 1679* (G, iso.).

Calycularia golae Gerola: 471–485 (1947). Type: Abyssinia, Vondo, *Vatova s.n.*

Thallus procumbent, dark bottle-green, to olive-green, nearly translucent, delicate and easily torn when wet; almost colourless in dead basal parts, with brownish margins when dry; in overlying mats, on tree bark or on soil covering tree boles; firmly adherent to substrate along midrib throughout its length; 7.5–23.0 mm long, simple or with a single terminal bifurcation (Figures 13A; 14A), branches 5.0–7.5 × 7.5–9.0 mm, occasionally short lateral branches arising ventrally near base, basal part semilobate; wings thin and wide, margins slightly scalloped and strongly undulate, otherwise entire; apex notched (Figure 13E) with the 2 terminal lobes overlapping somewhat; ventral scales situated between lobes and visible from above, arched over edge, small and inconspicuous, mostly confined to apices of ventral face, colourless, up to 500 μm long, 3 or 4 cell rows wide at base, central cell row longer and tapering to uniseriate tip, lateral rows shorter, all ending in and laterally with one to several slime papillae, ± 50 μm, with spherical top (Figure 13C); rhizoids very long and dense, smooth, faintly brown, ± 20 μm in diameter, restricted to midrib ventrally; midrib ± 1/5 of branch width, ± 280 μm (or more) thick and generally consisting of 12–15 rows of thin-walled homogeneous cells (Figure 13D), in cross section 4–6-sided, ± 42.5 × 27.5–32.5 μm, in longitudinal section ± rectangular, up to 137 μm long, without a central strand of conducting cells, gradually becoming thinner laterally and wings eventually unistratose (Figure 13D); epidermal cells of midrib slightly thicker-walled, rectangular to pentagonal, generally 55 × 25 μm, in cross section 32.5 × 25.0–32.5 μm, containing numerous chloroplasts, ± 5.0 μm

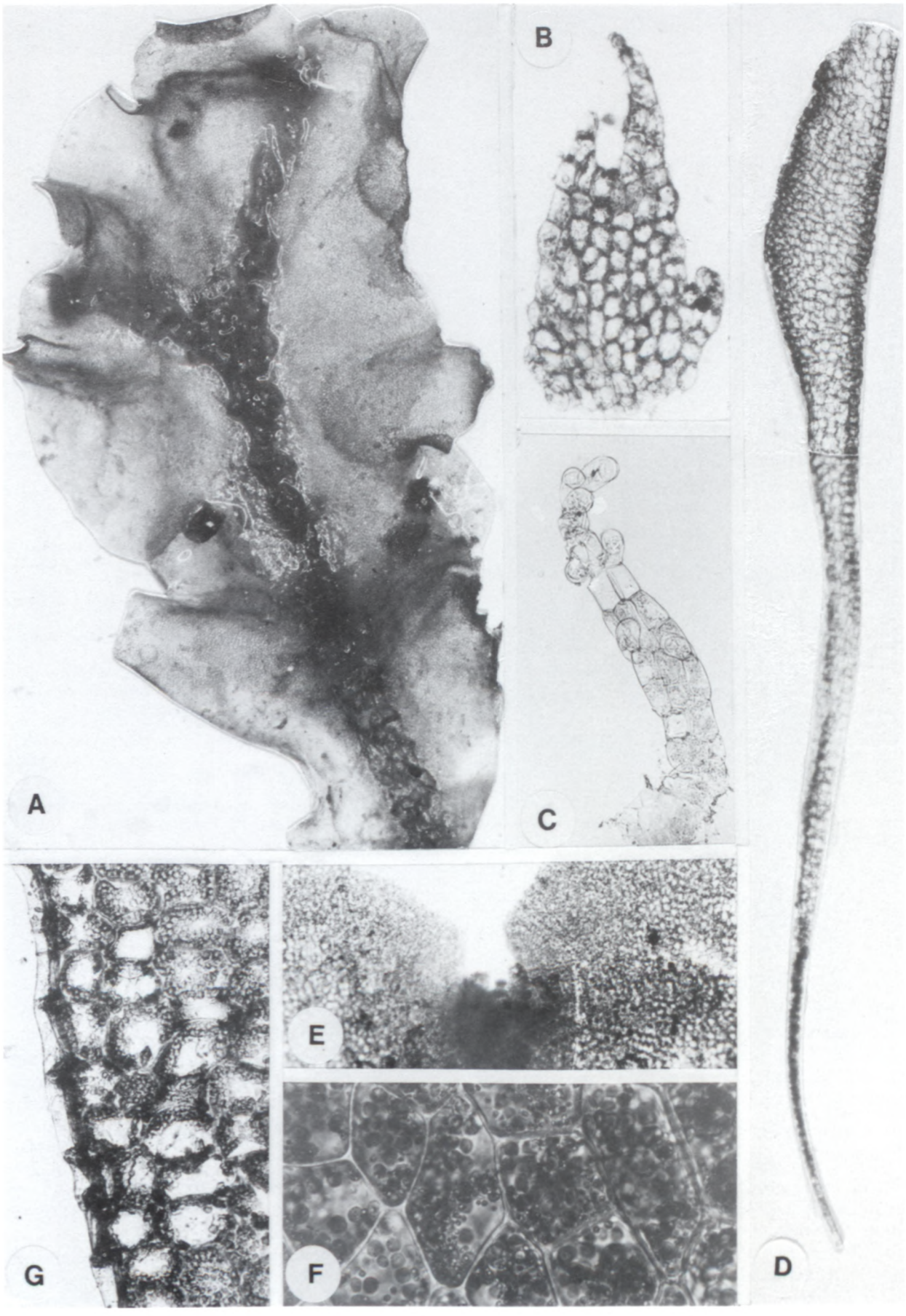

FIGURE 13.—*Calycularia crispula*. A, male thallus with androecia; B, scale-like involucre which individually covers antheridium; C, ventral scale with slime papillae; D, part of transverse section of thallus, showing one unistratose wing and costa without central conducting strand; E, ventral face of apex of thallus, showing apical notch and slime papillae; F, chloroplasts and small oil bodies inside thallus cells, seen from above; G, cells along margin of thallus seen from above. A–C, F–G, *S.M. Perold 2677*; D, *S.M. Perold 2668*. A, × 9.5; B, × 90; C, × 125; D, E, × 45; F, × 400; G, × 150.

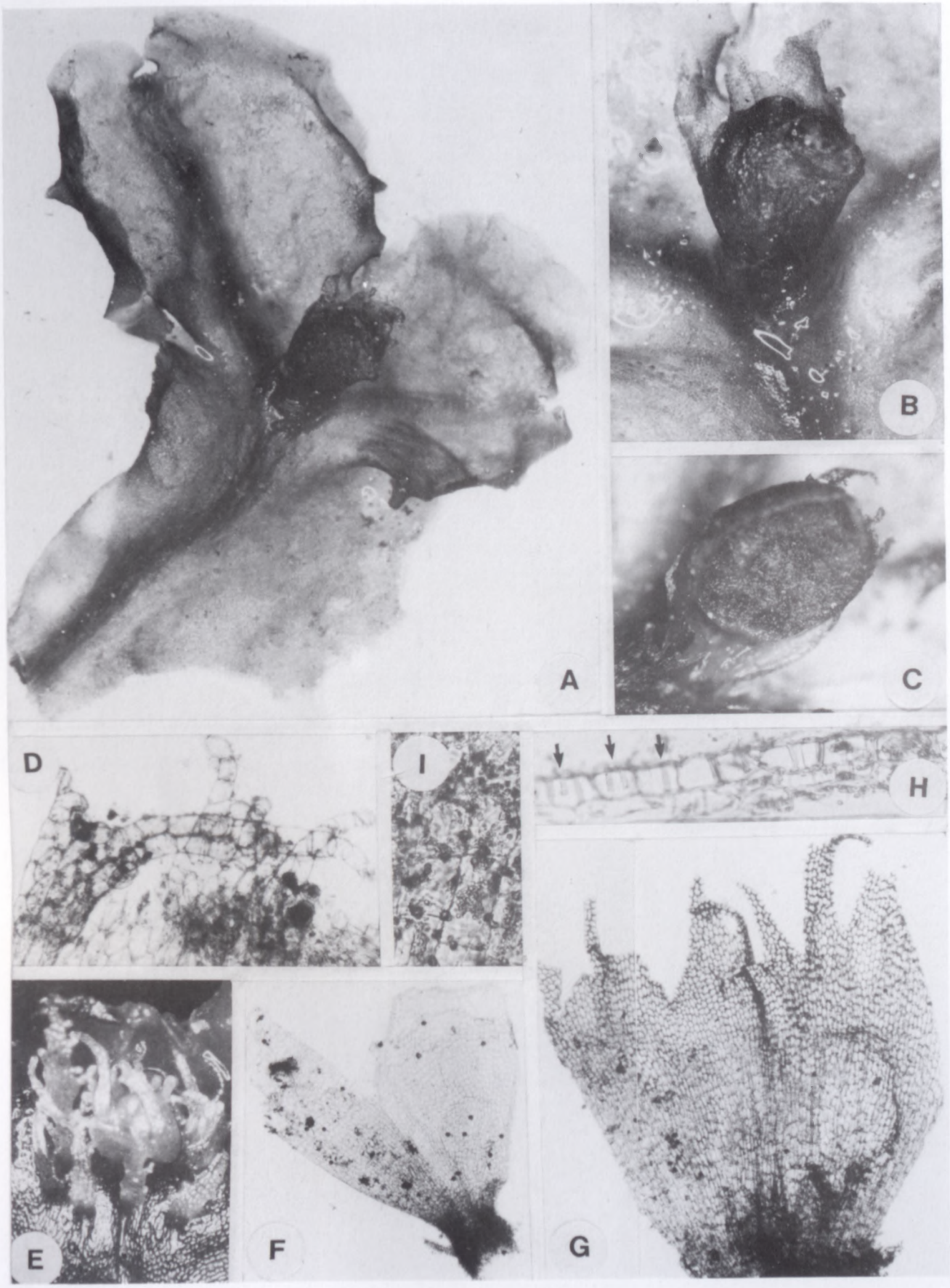

FIGURE 14.—*Calycularia crispula*. A, female thallus with young sporophyte enclosed in perianth; B, close-up of sporophyte; C, longitudinal section through capsule; D, involucral scales; E, cluster of archegonia protected by involucral scales, near apex of thallus; F, calyptra showing unfertilized archegonium at base; G, perianth with laciniate mouth; H, transverse section of capsule wall, rod-like thickenings indicated by arrows; I, cells in fragment of capsule wall, thickenings from above seen as dots. A–I, *S.M. Perold 2668*. A, × 6.5; B, C, × 12; D, × 90; E, × 20; F, G, × 18; H, I, × 300.

in diameter, as well as small oil bodies (Figure 13F); cells in wings, from above, pentagonal or hexagonal, 45–50 × 30–50 μm; cells at margin rectangular, 32.5–57.5 × 17.5–22.5 μm or pentagonal, 25 × 30 μm (Figure 13G).

Dioicous. *Androecia* consisting of 3 or 4(5) crowded, ± parallel rows of male scales overlying the midrib in the body of the thallus, reduced to 2 rows in the terminal branches (Figure 13A), antheridia short-stalked, globular, ± 250 × 240 μm when mature, each one covered by a forwardly directed laciniate scale (Figure 13B, C), laciniae up to 550 μm long × 250 μm wide at base, composed of cells 45–75 × 45 μm. *Gynoecia* acropetally arranged and singly placed dorsally, near the notched apex and when present, above the furcation of the branches (Figure 14A, B), slightly raised on a swelling, each with a group of ± 6–11 young archegonia (Figure 14E), ± 325 μm long, the necks composed of 6 cell rows and the tips brownish; just posterior to the archegonia and at their sides subtended by an involucre of narrow, laciniate scales (Figure 14D), erect to somewhat forwardly directed; when mature, the capsule spherical to ovate, leaning obliquely forward, 1750 × 1500 μm, containing a mass of spores and elaters and raised on the seta, here only ± 1000 μm long (Figure 14C) and not maximally elongated; capsule wall brown, bistratose (Figure 14H), cells square or rectangular, 37.5 × 37.5 to 75 × 20 μm, cell walls thin, but with some conspicuous orange-coloured semi-annular bands or stiffening rods, the latter projecting into the cell lumen (Figure 14I); perianth obconic and large when mature, enclosing capsule, green, with laciniate mouth (Figure 14G), 3100 μm long including ± 600 μm long laciniae, cells ± 75.0 × 37.5 μm; calyptra delicate and transparent (Figure 14F), bistratose, cells mostly pentagonal, ± 50.5 × 37.5 μm, with unfertilized archegonia attached to base. *Spores* with distal face rounded (Figure 15C, D), proximal face flat or indented (Figure 15A), light brown, translucent, diameter 35.0–42.5 μm, densely echinate, spines occasionally rather blunt, straight or bent (Figure 15B), 7.5 μm long and 5.0 μm wide at base, in between them small projections arising at corners of shallow areolae. *Elaters* bispiral (Figures 15F; 16), 10.0 μm thick, ± 310 μm long, tips solid, rounded. *Vegetative reproduction* by stipe arising from group of cells in colourless, seemingly dead marginal or basal parts of thallus, almost lunate, 175 × 375 μm, soon narrowly winged; also by ventral branches arising from midrib.

Grows on tree trunks and apparently also on soil, in sheltered, damp places in montane forest.

DISCUSSION

Calycularia crispula (family Allisoniaceae, order Metzgeriales) is well known in the Himalayas. An excellent description and line drawings of Indian material were given by Pandé & Udar (1956), who also studied the ontogeny of the gametangia and the embryogenesis. Jones (1985) remarked that his records of *C. crispula* were only the second report of this species from Africa [Tanzania and Malawi (which includes part of Chowo Forest)], the first was by Gerola (1947), when he described *C. golae* from Ethiopia (= Abyssinia). Jones believed that this species should be treated as a synonym of *C. crispula*. Arnell (1960) had misidentified a specimen of *C. golae*, collected by Dr John Eriksson in Ethiopia (= Abyssinia), as *Monocolea gottschei* Lindb. (Grolle 1985), which does not, however, grow in Africa. Besides the Himalayas (and Indomalaya) the genus *Calycularia* is also known from Taiwan, Japan, Siberia, Alaska (Schuster 1982), the Aleutian Islands and Pacific northwest of North America (Davidson & Smith 1992), as well as Mexico (Grolle 1980), and it is probably of Laurasian origin. Although

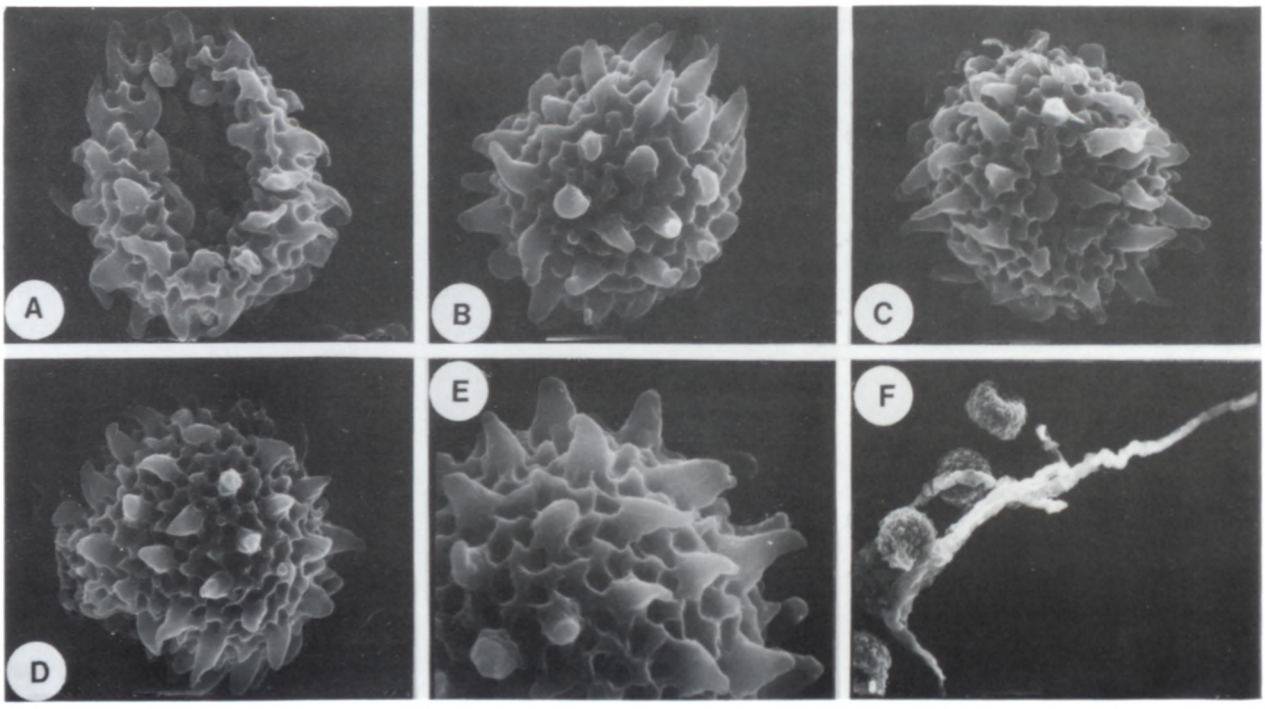

FIGURE 15.—*Calycularia crispula*. SEM micrographs of spores. A, ?proximal face of spore; B, spore seen from side; C, D, distal face of spore; E, part of spore much enlarged; F, young spores and elaters. A–E, *S.M. Perold 2668*; F, *S.M. Perold 2677*. A–D, × 995; E, × 1990; F, × 260. Micrographs by S.M. Perold.

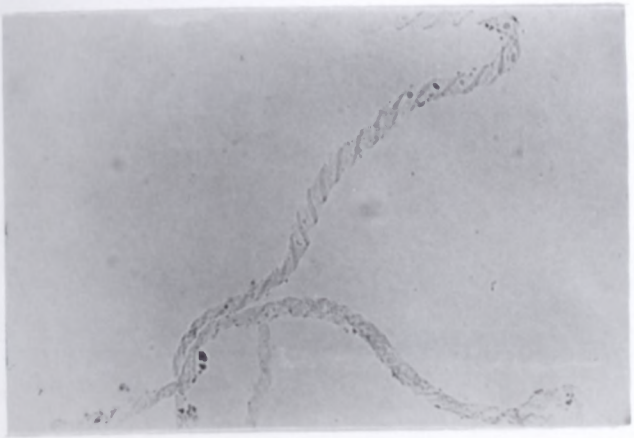

FIGURE 16.—*Calycularia crispula*, LM photograph of elater, *S.M. Perold 2677*, × 350.

Stephani (1900) had assigned six species to the genus, it now appears to have just two, with *C. crispula* and *C. laxa* Lindb. & Arnell [confined to the polar regions of Alaska and Siberia (Davidson & Smith 1992)], the only species belonging here, because Schuster (1982) transferred *C. radiculosa* to the new monotypic genus, *Sandeothallus* Schust.

The specimens collected by me are appreciably smaller than the thallus sizes reported by Jones (1985), i.e. 20–50 mm long. My collections must be young plants, as only one mature sporangium was found, which had not yet dehisced. Pandé & Udar (1956) reported it as dehiscing by 4–6 irregular valves. An elaterophore was not observed either; apparently it is not well developed in this species. The seta did not elongate much and the sporangium remained inside the perianth; with maturity the seta reportedly elongates and raises the sporangium above the perianth. The antheridia may not always be in continuous rows and may grow in groups. The small ventral scales are mostly confined to the region close to the apices of the plants examined; their presence distinguishes *Calycularia* from *Pallavicinia lyelli* and *Dumortiera hirsuta*, which lack them. The SEM spore micrographs taken in this study compare well with those of Inoue & Hibino (1984).

Specimens examined

ZAMBIA.—1033: Nyika Nat. Park, (–DA), Chowo Forest, on bark of tree next to path, 15-4-1991, *S.M. Perold 2668*.

MALAWI.—1033: Nyika Nat. Park, (–DA), 15 km W of Chilinda, in forest on *Parinari excelsa* tree, 16-4-1991, *S.M. Perold 2677*.

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