

AYTONIACEAE (HEPATOPHYTA)

ASTERELLA ABYSSINICA NEWLY REPORTED FROM SOUTH AFRICA AND MALAWI

A specimen of *A. abyssinica*, Duckett & Matcham 6049, from Monk's Cowl, Drakensberg, Kwazulu-Natal, collected in April 1997, has recently come to hand by the generosity of Prof. J.G. Duckett, of the University of London. Besides this, I also collected this species in 1991 in Nyika National Park, Malawi (*S.M. Perold* 2664, 2672), from where it has not yet been recorded. The species is described and illustrated here. It is referred to the subgenus *Brachyblepharis* (Gottsche *et al.*) Grolle, because the short tips of the segments of the pseudoperianth separate at maturity. This is also the first report of the subgenus *Brachyblepharis* in both South Africa and Malawi.

Asterella abyssinica (Gottsche) Grolle in Vanden Berghen: 170 (1972).

Fimbriaria abyssinica Gottsche in Gottsche *et al.*: 569 (1846); *Hyperantron abyssinicum* (Gottsche) Trevis.: 441 (1877); Steph.: 122 (1899). Type: Abyssinia cum *Targionia elongata*, in caespite Un. itin. n. 500 a *Kotschy* lecto pauca specimina inventa (not seen).

Thalli smallish to medium-sized, rather delicate and occasionally somewhat spongy, dorsally flat, green to light olive-green, crystalline when fresh, margins hyaline or tinged with mauve to deep purple, outlines of subdorsal air chambers faintly visible from above, medianly elongate and apically directed, laterally in radiating, \pm parallel rows, air pores not visible, encircling cells very slightly raised when wet; thallus margins flat or raised to partly inflexed when dry; in crowded, overlying mats, simple or once pseudodichotomously furcate (Figure 13A), with apical (often immediately distal to foot of stalk) or latero-ventral innovations from a tapering stipitate base. Branches ligulate to obcordate, widening gradually from a narrow base, sometimes irregularly shaped and abruptly constricted, when simple, up to 15 mm long, when branched, total length \pm 18 mm long, with terminal branches \pm 5 mm long and moderately divergent, 2.3–5.0 mm wide, 400–450(–630) μ m thick over midrib, laterally thinning out into attenuate wings, apex slightly notched, with appendages of few ventral scales recurved over

edge; margins acute, thin, weakly scalloped, slightly undulate; ventrally the flanks of only the distal part purple, remainder green, but occasionally entirely purple, medianly keeled, midrib often green throughout, with row of purple scales on either side usually only distally present (Figure 13B), but sometimes along whole length.

Dorsal epidermis unistratose, containing chloroplasts, cells 5- or 6-sided when seen from above, thin-walled, (40.0–)45.0–65.0(–72.5) \times 22.5–37.5 μ m, their orientation changing from apically directed medianly to outwardly sloping laterally, in transverse section 25.0–32.5 μ m thick (Figure 13E, F), toward margin occasionally containing an oil body; marginal cells (Figure 13H) mostly in 1(2) row(s), long- or short-rectangular, sometimes rather irregularly shaped, 22.5–30.0 \times 12.5–22.5 μ m; air pores hardly raised, simple, small, \pm 12.5 \times 10.0 μ m, 80.0–137.5 μ m distant from each other, bounded by innermost circle of remains of collapsed cells (not shown), and outwardly surrounded by 2 intact, partly overlapping concentric rings of 6 or 7 \pm wedge-shaped cells in each (Figure 13G), inner ones smaller, 10.0–15.0 \times 15.0–22.5 μ m, outer ones 15.0–20.0 \times 20.0–37.5 μ m; assimilation tissue 215–260 μ m thick, with small, empty air chambers (Figure 13E), 30.0–100.0 μ m wide, in 2 or 3 storeys, toward margins elongating and sloping obliquely, chlorophyllose cells in bounding walls rounded or elongated, 32.5–42.5 \times 27.5–30.0 μ m; storage tissue confined to keel, \pm 220 μ m thick, cells angular, isodiametric, 17.5–27.5 μ m wide, closely packed together, occasional cells with an oil body; rhizoids arising from ventral epidermis of keel, smooth, 15.0–20.0 μ m wide, or pegged, 12.5–15.0 μ m wide. Scales in 2 forwardly directed ventral rows, one on either side of midrib (Figure 13B), in different shades of mauve to purple, obliquely triangular, with a single appendage (Figure 13I), body of scale up to 800 μ m long, 650–750 μ m wide at base, sometimes crescentic, cells 4–6 sided, 57.5–65.0 \times 27.5–40.0 μ m, with up to 11 smaller, colourless cells containing remains of oil body; appendage oblong to elliptical, 420–430 \times 300–310 μ m, sometimes constricted at base, \pm 200 μ m wide, tapering above to a

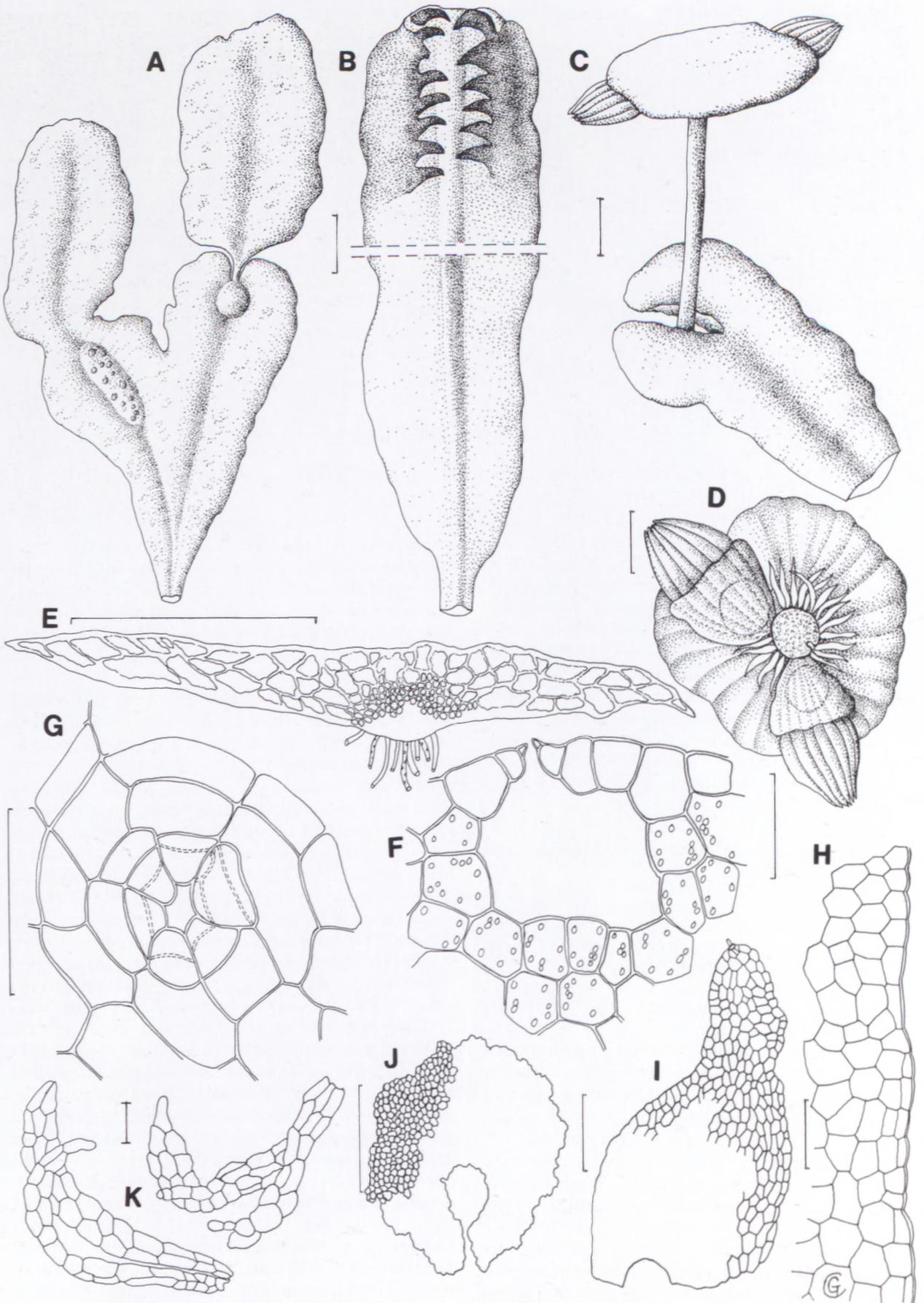


FIGURE 13.—*Asterella abyssinica*. A, dorsal view of branched thallus with gametocidia on separate branches of same plant; B, ventral view of thallus; C, carpocephalum raised on stalk; D, ventral view of carpocephalum; E, t/s of thallus; F, t/s of air pore and air chamber; G, air pore and surrounding cells from above; H, marginal cells of thallus; I, ventral scale; J, t/s of stalk; K, paleae. A–J, Duckett & Matcham 6049; K, S.M. Perold 2672. Scale bars: A–E, 1 mm; F–H, 50 μ m; I, J, 250 μ m; K, 100 μ m. Artist: G. Condy.

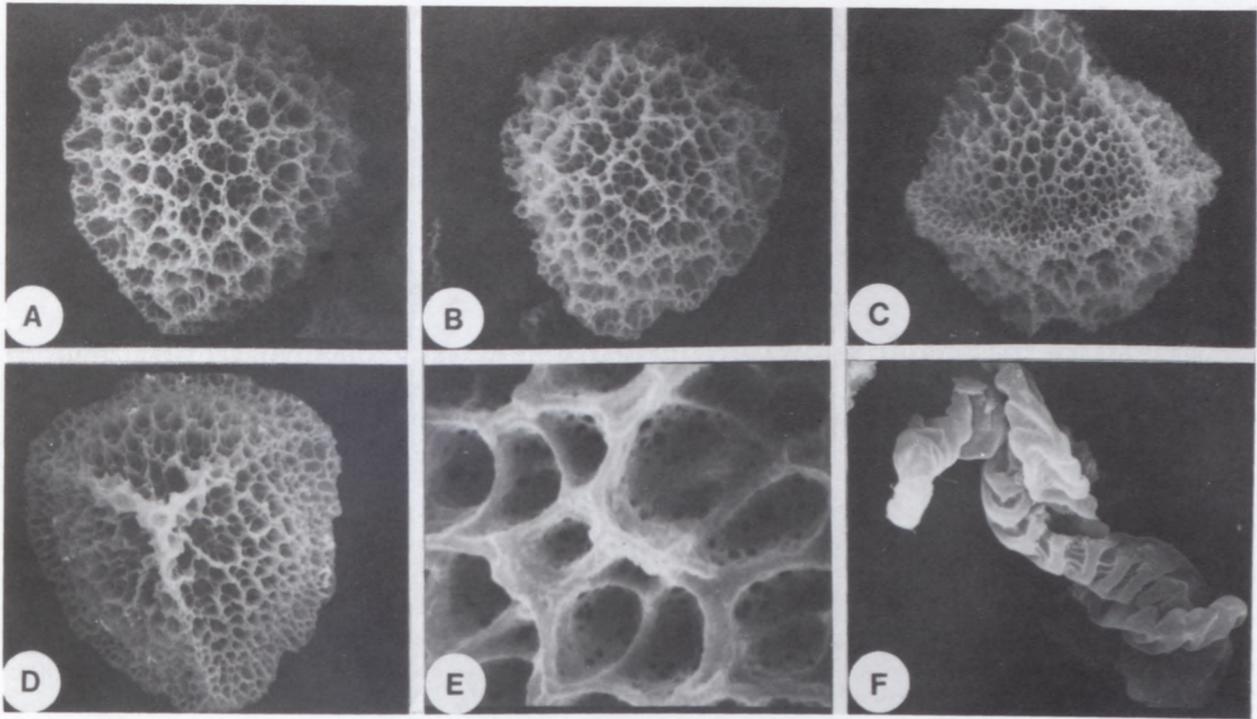


FIGURE 14.—SEM micrographs of *Asterella abyssinica*, Duckett & Matcham 6049. A–E, spore: A, B, distal face; C, side view; D, proximal face; E, much enlarged areolae on proximal face, basally highly porate. F, elater. A, $\times 543$; B, $\times 586$; C, $\times 590$; D, $\times 594$; E, $\times 4104$; F, $\times 679$.

conical apical cell, marginal cells subquadrate, $\pm 32.5 \times 35.0 \mu\text{m}$, or rectangular, $\pm 57.5 \times 27.5 \mu\text{m}$, inner cells angular, $32.5\text{--}50.0 \times 22.5\text{--}42.5 \mu\text{m}$, only one cell containing an oil body, $\pm 27.5 \times 25.0 \mu\text{m}$,

Autoicous, but androecia and archegoniophores sometimes on separate plants. *Androecia* extending backwards medianly, occasionally furcate, at apex of branch or more proximally at constriction (Figure 13A), antheridia immersed in sessile, elongated or oval cushions, $\pm 1375 \times 750 \mu\text{m}$, lacking scales and opening above via stout, raised, conical papillae, $\pm 200 \mu\text{m}$ long. *Archegoniophores* proximal to apical notch of main branch (Figure 13C) or just proximal to stipitate innovation of apical branch (Figure 13A), single or occasionally paired at apices of 2 forking branches, almost sessile and hemispherical when young, paleae hidden (Figure 13A). *Carpocephala* at maturity raised on stalk, arising $\pm 1.7 \text{ mm}$ proximal to apex of branch in apical notch, length 4–5 mm, whitish green or streaked with purple, widening slightly toward base, in transverse section at midlength (Figure 13J), $\pm 520 \times 450 \mu\text{m}$, weakly ribbed, with a single rhizoid furrow containing pegged rhizoids, cortical cells not well differentiated, except for their outer walls being slightly thickened and rounded, variable in size, $12.5\text{--}22.5 \times 12.5\text{--}15.0 \mu\text{m}$, medullary cells angular, $15.0\text{--}35.0 \times 15.0\text{--}27.5 \mu\text{m}$; scattered along length of stalk a few hyaline or purple paleae, $400\text{--}500 \times 160\text{--}180 \mu\text{m}$, at its summit numerous paleae (Figure 13K), hyaline or purple, up to $820 \mu\text{m}$ long, basally 2 or 3 cells wide, above 3–5 cells wide, $65.0\text{--}85.0 \times 35.0\text{--}47.5 \mu\text{m}$, apical cell $42.5\text{--}62.5 \times 17.5\text{--}22.5 \mu\text{m}$; disc green, rather flat to weakly convex, suborbicular (Figure 13C), $3.5\text{--}4.0 \text{ mm}$ diam., $\pm 1.1 \text{ mm}$ thick, margin undulate, air chambers covered above by slightly bulging walls and opening via small, compound air pores, below (Figure 13D) with membranous, bistratose involucre

partly covering capsules like a flap, margin entire and unistratose, capsules mostly 2, rarely 1 or 3(4), obovate, $1200 \times 950 \mu\text{m}$, wall green, unistratose, cells elongated, 4- or 5-sided, $45.0\text{--}75.0 \times 25.0\text{--}37.5 \mu\text{m}$, thin-walled, toward apex of capsule rounded, $35.0\text{--}47.5 \times 37.5\text{--}42.5 \mu\text{m}$, walls with trigones at corners; pseudoperianths exerting horizontally from beneath rim of carpocephalum (Figure 13C) for $\pm 1000 \mu\text{m}$, colourless, split into 8–10 segments, these up to $1375 \mu\text{m}$ long and $340 \mu\text{m}$ wide at base, tapering to slender tips, which are initially attached, becoming free before capsule dehiscence. Spores $62.5\text{--}72.5 \mu\text{m}$ diam., triangular-globular, pale yellow to yellow, translucent, wing undulate, up to $10 \mu\text{m}$ wide, margin crenulate, distal face (Figure 14A, B) convex, reticulate, with network of ± 6 larger, primary areolae across, $\pm 10\text{--}15 \mu\text{m}$ wide and extending over wing, their delimiting ridges only slightly raised and not clearly defined among the numerous criss-crossing walls of small, subsidiary areolae, areolar floor highly porate; proximal face with prominent triradiate ridge (Figure 14C, D), its arms continuous from pole to wing, but not clearly extending across, each of 3 facets with numerous areolae, larger at pole and smaller toward wing, but not clearly arranged in primary and subsidiary areolae, floor also highly porate (Figure 14E). Elaters yellow, $135\text{--}150 \mu\text{m}$ long, $10 \mu\text{m}$ wide in centre, slightly tapering to rounded ends, $\pm 7.5 \mu\text{m}$ wide, with coiled, bispiral thickenings throughout (Figure 14F).

DISCUSSION

Asterella abyssinica is widespread in tropical Africa and has been reported by various authors from Burundi, Cameroun, Ethiopia, Rwanda, Sierra Leone, Tanzania, Zaïre and Zimbabwe (Wigginton *et al.* 1996). These are the first records, however, for South Africa (Figure 15) and Malawi. The species is generally found along stream-

Amended key to the southern African species of *Asterella* (see Perold 1994)

- 1a Pseudoperianth with segments apically free at maturity subgenus *Brachyblepharis* 1. *A. abyssinica*
- 1b Pseudoperianth with segments remaining apically attached at maturity Subgenus *Phragmoblepharis*:
- 2a Thalli spongy, with tall air chambers mostly in one storey, and then not subdivided by supplementary partitions, each opening dorsally by a stellate pore; ventral scales occasionally fimbriate at single lanceolate appendage; carpocephalum round or umbonate and lacking paleae at summit of stalk; pseudoperianth extending $\pm 300 \mu\text{m}$ beyond involucre and subdivided into 12 or 13 segments; spores $75\text{--}95 \mu\text{m}$ diam., dark brown, ornamentation with irregular zig-zagging ridges 2. *A. muscicola*
- 2b Thalli compact, firm, with small, low air chambers in several storeys, only some top ones opening above by a dorsal, non-stellate pore; ventral scales with 1 (or 2) lanceolate or ovate appendages, margin \pm entire; carpocephalum round or umbonate, papillose or \pm smooth, with paleae at summit of stalk; pseudoperianth extending more than $1000 \mu\text{m}$ beyond involucre and subdivided into 14–16 segments; spores more than $100 \mu\text{m}$ diam., yellow or brown, ornamentation with larger areolae generally containing subsidiary areolae:
- 3a Thalli smallish to large; carpocephalum covered with distinct papillae, projecting $\pm 200 \mu\text{m}$; paleae at summit of stalk shaggy, dense, pale mauve or colourless, up to $3000 \mu\text{m}$ long and 4 or 5 cells wide at base; ventral scales with lanceolate appendage; spores elaborately ornamented with 6–8 areolae across distal face, $20\text{--}30 \mu\text{m}$ wide and ridges extending across wing, containing numerous subsidiary areolae (common, mostly summer rainfall species) 3. *A. bachmannii*
- 3b Thalli medium-sized to very large; carpocephalum \pm smooth or with low papillae; paleae at summit of stalk colourless or purple, length variable; ventral scales with lanceolate or ovate appendages, spores less elaborately ornamented:
- 4a Thalli medium-sized; carpocephalum with umbonate head; paleae at summit of stalk mostly colourless, some very long, more than $8000 \mu\text{m}$ in length, ± 4 cells wide at base; ventral scales with 1 or 2 lanceolate appendages; spores on distal face with (4–)6–9 areolae across, $\pm 32 \mu\text{m}$ wide, very high ridges seldom extending across wing, usually containing small subsidiary areolae (winter rainfall species) 4. *A. marginata*
- 4b Thalli large to very large; carpocephalum with rounded head, distinctly lobed below; paleae at summit of stalk almost colourless to purple, $2000\text{--}3000 \mu\text{m}$ long, some up to 7 cells wide at base; ventral scales with single, large-celled, ovate appendage, constricted at base; spores on distal face with 5–8 areolae across, $25\text{--}30 \mu\text{m}$ wide and extending to wing margin, almost empty of subsidiary areolae and hollow (summer rainfall, mostly Afrotropical species) 5. *A. wilmsii*

banks or on damp rocks. The thalli are rather thin and delicate and seemingly not adapted to drought conditions. The species can be recognised by the flattened discs of the carpocephala and by the horizontally protruding pseudoperianths, their rather short segments becoming free at the tips before the capsules dehisce.

Perold 2664 (PRE); at bridge over Chelinda River, on rock and stone wall. (–DA), 16 April 1991, S.M. Perold 2672 (dupl. E. PRE).

SPECIMENS EXAMINED

South Africa

KWAZULU-NATAL.—2929 (Underberg): Drakensberg Park, Monks Cowl, near streambank on path to Crystal Falls, (–AB), 1 800 m. 21 April 1997, Duckett & Matcham 6049 (dupl. E. PRE), with *A. bachmannii* and *Targionia hypophylla*.

Malawi

NYIKA NATIONAL PARK.—1033: on path across river, leading to Juniper Forest, on soil of vertical bank. (–DB), 15 April 1991, S.M.

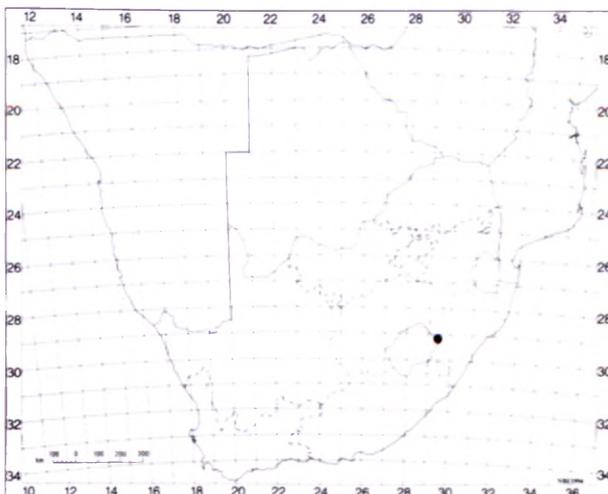


FIGURE 15 —Distribution of *Asterella abyssinica* in South Africa.

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