

NOTES ON THE ANTARCTIC MOSSES *POHLIA CRUDA* AND *P. INFLEXA*

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ABSTRACT. Cell laxity in specimens of *Pohlia cruda* (Hedw.) Lindb. var. *imbricata* (Card.) Bartr. from the Antarctic botanical zone is discussed, a character which has led to confusion with *Pohlia wahlenbergii* (Web. et Mohr) Andrews. Statistical studies on populations of *P. cruda* var. *imbricata* from South Georgia and the South Orkney Islands reveal significant differences in cell shape and leaf length between these areas. *Pohlia inflexa* (C. Muell.) Wijk et Marg., a bulbiferous species, is reported for the first time from the South Orkney Islands and the Antarctic Peninsula.

The taxonomy of the moss genus *Pohlia* has been revised for the Antarctic continent and its offshore islands by Greene and others (1970) and for South Georgia by Clarke (1973). Consequently identifications of *Pohlia* specimens from this region should be straightforward but some confusion has existed with a small number of specimens from the South Orkney and South Shetland islands. In an attempt to clarify the situation, all *Pohlia* specimens in the British Antarctic Survey Herbarium (AAS) from the South Orkney, South Shetland and South Sandwich islands together with those from the Antarctic continent and its offshore islands have been re-examined. (The AAS bryophyte herbarium is currently located at the Institute of Terrestrial Ecology, Bush Estate, Penicuik, Midlothian.) The taxa involved were *P. cruda* var. *cruda*, *P. cruda* var. *imbricata* (Card.) Bartr., *P. inflexa* (C. Muell.) Wijk et Marg. and *P. nutans* (Hedw.) Lindb.

CELL LAXITY IN *POHLIA CRUDA*

Cell laxity, a bulging and displacement of cell walls perpendicular to the plane of the leaf, (Figs. 1a and 1b) has been used as a key taxonomic character in the distinction of *P. wahlenbergii* var. *glacialis* (Schliech. ex. Brid.) E. F. Warburg. from other South Georgian species by Clarke (1973) and for British species by Smith (1978). Its use in this way assumes a clear-cut difference between lax and non-lax cells. A degree of cell laxity towards the base of the leaf was, however, found to be common in all Antarctic taxa but variable between leaves on the same stem. After the examination of leaf spectra of many specimens it was not possible to infer any relationship between the occurrence of lax celled leaves and seasonal growth patterns. These leaves appeared to be randomly distributed on each stem. *P. cruda* specimens showed a greater tendency to laxity than *P. nutans* or *P. inflexa*; some *P. cruda* var. *imbricata* specimens from all areas except South Georgia also showed laxity in upper leaf cells. In these cases the cells were shorter than typical *P. cruda* leaf cells (Fig. 1a) and could be confused with the areolation of *P. wahlenbergii* var. *glacialis* from South Georgia (Fig. 1b). Specimens showing varying degrees of laxity can, however, be distinguished from *P. wahlenbergii* as at least some leaves have the long rhomboidal cells with a sigmoid curve (Fig. 2a) typical of *P. cruda*. The leaf shape is also different in that the widest point of the leaf occurs at about one-third and one-fifth of the leaf length from the leaf base in *P. cruda* and *P. wahlenbergii* respectively. *P. wahlenbergii* is a streamside and flush species forming swards or deep tall loose turves. *P. cruda* is a short turf forming species of rock ledges and crevices. Herbarium material can often be distinguished

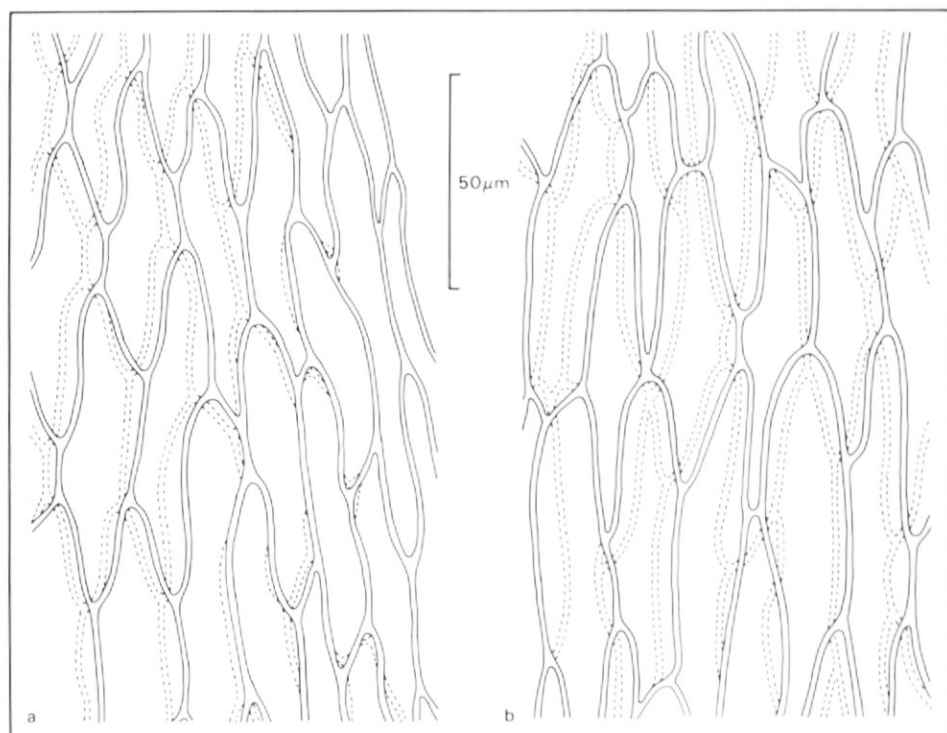


Fig. 1. a. Upper lamina cells of Antarctic *Pohlia cruda* var. *imbricata* showing a degree of laxity.
 b. Upper lamina cells of South Georgian *P. wahlenbergii*, showing characteristic lax areolation (from Clarke, 1973).

on sight by the light green, slightly glossy leaves with red nerves characteristic of *P. cruda*. Specimens of *P. wahlenbergii* are dull, however, with leaves varying between pink and green in colour.

P. wahlenbergii is not known from the Antarctic botanical zone, and its preference for habitats between 0 and 100 m on South Georgia suggests that it is unlikely to be found there.

P. CRUDA VAR. *IMBRICATA* POPULATIONS

Differences between *P. cruda* var. *imbricata* populations on South Georgia and in the Antarctic were noted by the author during examination of herbarium material. This variation is reflected in the different ranges of leaf and cell sizes provided for South Georgia by Clarke (1973) and the Antarctic by Greene and others (1970). An investigation of the size and nature of these differences was undertaken by a statistical analysis of leaf and cell measurements.

Sixteen specimens were examined, eight chosen at random from South Georgia and eight at random from the South Orkney Islands. Two stems were taken from each specimen and two leaves were taken from each stem. Leaves to be measured were selected from below the comal tuft to avoid differences arising from the measurement of bracts on fertile stems. Leaf length, leaf width and the point at which the widest part of the leaf occurs were recorded for each leaf. Cell length,

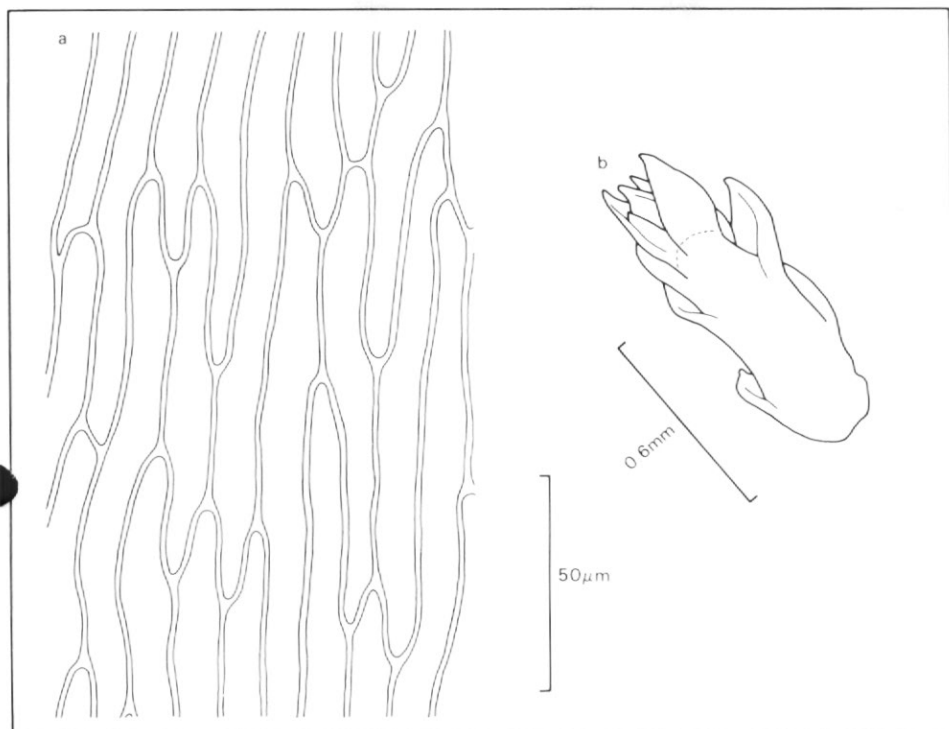


Fig. 2. a. Upper lamina cells of Antarctic *P. cruda* var. *imbricata* showing non lax, sinuose areolation. b. Bulbil from a South Orkney *P. inflexa* specimen (R. I. L. Smith 424).

cell width and the cell length/width ratio were also measured on two cells per leaf. These cells were taken from approximately one third of the leaf length from the apex, midway between the nerve and margin. The width of lax cells was measured on the upper or lower surface of the leaf to avoid obtaining a high value by measuring the maximum visible (diagonal) width of the cell. In total, 128 cells and 64 leaves were measured from the 16 specimens. A *t*-test conducted on these data produced the results given in Table I.

The results (Table 1) show that the differences between the leaf length and cell length means of the two areas are significant at the 5% level. The difference in cell width/length ratio means is also highly significant at the 0.1% level. Leaves of *P. cruda* var. *imbricata* from the South Orkney Islands are therefore shorter than the same taxon on South Georgia, and the cells are shorter and wider. These results confirm the different ranges of measurements reported for the two areas (Clarke, 1973; Greene and others, 1970). In addition the difference in leaf length, which is one of the defining characters of the var. *imbricata*, together with observations made from herbarium material, have suggested some discussion on variation within *P. cruda* as a whole.

Reports on the flora of South America (Cardot, 1908; Wijk and others, 1967; Seki, 1974) suggest the var. *imbricata* is absent from this area whereas Clarke (1973) reports both var. *cruda* and var. *imbricata* from South Georgia. In addition, he remarks that plants of var. *cruda* are more abundant and notes that a complete

Table I. Means of six variates measured on *P. cruda* var. *imbricata* specimens from South Georgia and the South Orkney Islands. Standard errors and significance levels for the differences between the area means are also given.

Variate	Mean for South Georgia	Mean for South Orkneys	Standard error	Significance level of difference
Leaf length/mm	1.879	1.601	0.840	$p < 0.05$
Leaf width/mm	0.746	0.778	0.0341	not significant
Ratio (distance from leaf base to widest point)/(leaf length)	0.252	0.262	0.0093	not significant
Cell width/ μm	14.758	16.042	0.4644	not significant
Cell length/ μm	127.489	104.533	6.1127	$p < 0.05$
Cell width/length ratio	0.120	0.158	0.0064	$p < 0.001$

intergradation of the two varieties occurs on the island. Greene and others (1970) refer all Antarctic specimens to the var. *imbricata* but mention that non-imbricate plants do occur. Intergradation between the latter and typical var. *imbricata* specimens has been observed during this study. The pattern of variation within the species thus appears to be clinal. There is no discontinuity between *P. cruda* var. *cruda* and var. *imbricata*, and plants with imbricate ovate leaves diagnostic of the latter variety become commoner with increasing latitude. The measurements provided here support this contention by showing that even among plants considered to belong to the var. *imbricata*, variation in diagnostic characters occurs with latitude.

P. INFLEXA

Several specimens of *P. inflexa* (C. Muell) Wijk et Marg. from the Antarctic have come to light and are listed in Table II. This species has not been formally reported from this area although Allison and Smith (1973) listed it in an account of the vegetation of Elephant Island, South Shetland Islands. This record was based on a single depauperate specimen (Allison 171 b, AAS det. G. C. S. Clarke and S. W. Greene) and hence the material reported here is useful confirmation of the

Table II. *Pohlia inflexa* (C. Muell.) Wijk et Marg. specimens from the Antarctic botanical zone.

Locality	Lat. and Long.	Collection/No.	Distribution to herbaria
*Signy Island, South Orkney Islands	60° 43' S 45° 38' W	R. I. L. Smith 424	AAS
Coronation Island, South Orkney Islands	60° 38' S 45° 35' W	R. I. L. Smith 3228A	BM, CHR, MEL, NY, PC, S
Recess Cove, Charlotte Bay, Danco Coast	64° 30' S 61° 31' W	R. I. L. Smith 3986	AAS, ALTA, BA, LE, PRE
Recess Cove, Charlotte Bay, Danco Coast	64° 30' S 61° 31' W	R. I. L. Smith 3987	BM, NY
Gamma Island, Melchior Islands, Danco Coast	64° 20' S 63° 00' W	R. I. L. Smith 4157A	AAS
Lahille Island, Graham Coast	65° 32' S 64° 22' W	R. I. L. Smith 4322	AAS, CHR, S

*Specimen previously determined as *P. cruda* var. *imbricata* by Greene and others (1970).

presence of the species in the Antarctic botanical zone (Greene, 1964). The specimens in Table II also extend the known geographical range of the species to the South Orkney Islands and the Antarctic Peninsula.

Antarctic plants of *P. inflexa* agree well with the descriptions and figures of South Georgian plants given by Clarke (1973). The bulbils, which characterize the species on South Georgia, have also been found in association with several Antarctic specimens (Fig. 2b). In the field, *P. inflexa* is perhaps more likely to be confused with *P. cruda* than *P. nutans*, the latter being distinguished by its slender, densely tufted habit and occasional fertility. *P. cruda* and *P. inflexa* are more similar in coloration and size, but specimens of *P. inflexa* lack the dense tufts and imbricate leaves of typical *P. cruda* from this area.

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