

Species of *Plocamium* on the South African Coast

by

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Species of the Red Algal genus *Plocamium* are a common and an attractive feature of the South African intertidal marine flora. This paper collates information on this genus from literature and the collections of Tyson, Becker, Isaac, Simons, the University of Cape Town Ecological Survey, Pocock and the Botanic Station, Durban. Specimens of the latter two collections, although seen, are not cited here. The Ecological Survey referred to above was carried out by Professor Stephenson assisted by various members of the University staff between 1931 and 1940 and their collections are cited below with the designation "*Ecol. Surv.*", after the manner of Silva (1959).

The coast south of Swakopmund in South West Africa in the west and of Xai-Xai, near the mouth of the Limpopo River in the east, is included in the geographical region referred to here as South Africa.

MORPHOLOGY

Plocamiums develop sympodially and the last-formed laterals of individual sympodia together constitute the more or less zig-zag axes of the erect fronds. The terminal portion of each sympodium is usually displaced to one side and appears as a lateral. The latter is referred to as the "lowest of the pinnae (in a second group of laterals)", and is most often simple. All the true laterals of a sympodium are compound, unilateral and in one plane; their number is limited and characteristic of the species. Because the laterals arise adaxially only they occur as second groups of pinnae on alternate sides of the zig-zag axes.

Alternating second groups of laterals consisting of more than two, at least in the upper parts:

Laterals in pairs below, in threes above..... 4. *P. rigidum*
 Laterals seldom in pairs:

Lowest of laterals in each second group usually branched, fertile branches (sporophores) appear different from sterile ones..... 1. *P. glomeratum*

Lowest of laterals in each second group simple, sporophores scarcely different from sterile:

Simple pinnae much longer than wide, much less than 0.5 mm wide at base.... 3. *P. beckeri*

Simple pinnae about twice as long as broad, about 1 mm or more at base, plant broadly flattened..... 2. *P. membranaceum*

Alternating second groups of laterals mostly of two:

Plant foliose, apically somewhat membranous:

Lower of paired pinnae very narrowly triangular, less than 0.5 mm wide at base 8. *P. telfairiae*

Lower of paired pinnae broadly triangular, often more than 1 mm wide at base:

Plant about 2 mm wide, pinnae not obviously toothed, sporophylls modified pinnules 6. *P. suhrii*

Plant 5 mm or wider, leathery below, somewhat membranous above, pinnae frequently obviously toothed on outer margins, teeth often compound, sporophylls frequently intermixed with sterile bracts in axils of pinnae..... 7. *P. corallorhiza*

Plant not foliose, pinnae narrowly awl-shaped, fleshy..... 5. *P. cornutum*

1. *P. glomeratum* J. Ag. in Sp. Alg. 2: 397 (1852); Epicr.: 340 (1876). Fig. 1.
P. subfastigiatum Kütz. in Tab. Phyc. XVI: 18, t. 51, fig. e and f (1866).

Holdfast: Loosely intertwined, terete, slender, prostrate axes with short, unbranched, rigid haptera and erect fronds. *Erect system*: Fronds up to 10 cm high,



FIG. 1 and 2. Fig. 1.—*Plocamium glomeratum* J. Ag.: (a) Portion of a well-developed plant, $\times 2$; (b) portion of a fertile plant showing sporophores, $\times 4$; (c) portion of plant in detail, $\times 15$.

FIG. 2.—*Plocamium membranaceum* Suhr: (a) portion of a well-developed tetrasporic plant, $\times 2$; (b) portion of plant in detail showing axillary sporophylls, $\times 50$.

subdichotomously branched; axes slender, more or less terete below, complanate and somewhat membranous above but remaining narrow; up to six pinnae in each second group, the lowest frequently branched; sporophores aggregated, ultimately ball-like, sporophylls bipinnately branched, modified pinnules; colour dark red; male and female plants not seen.

SOUTH WEST AFRICA.—Swakopmund, *Isaac* I. 1717; *Simons* 354; 497.

CAPE PROVINCE.—Namaqualand: Port Nolloth, *Isaac* I. 1716. Cape Town: Sea Point, *Tyson* s.n. (BOL 27222); False Bay, *Ecol. Surv.* F. 87. Caledon: Cape Hangklip, *Simons* 676. Bredasdorp: Arniston, *Ecol. Surv.* A.R.3.F. Riversdale: Still Bay, *Ecol. Surv.* S.S. 36, in part.

Agardh (1852) comments on three characteristics of this species which, in South Africa at least, seem unique: first, the branching of the pinna lowest in each second group; secondly, the number of pinnae in each of such groups—three to six; thirdly, the much-branched sporophylls aggregated on sporophores different from sterile fronds—“as in some ferns”. The Ecological Survey records and specimens of this species are based on a wrong identification by Kylin (1938) and have been transferred to *P. beckeri* Simons.

2. *P. membranaceum* Suhr in Alg. Beitr., Flora 23: 261 (1840); J. Ag. in Sp. Alg. 2: 399 (1852); Epicr.: 341 (1876); de Toni in Syl. Alg. 4: 593 (1900). Fig. 2. *P. latiusculum* Kütz. in Tab. Phyc. XVI: 17, t. 47 (1866).

Holdfast: Relatively stout branched haptera. *Erect system*: Broadly flattened throughout, leathery below, somewhat membranous above where mid-rib sometimes clearly visible; pinnae patent, deltoid or triangular, obtuse at tips, broad, about 2 mm at base, lowest of each second group simple, pinnules sometimes lobed; sporophylls modified pinnules and axillary, widely distributed, shortly, compactly and dichotomously branched. Male and female plants not seen.

CAPE PROVINCE.—Cape Town: Table Bay, *Tyson* s.n. (BOL 27216); Camps Bay, *Simons* 656.

The name given to this plant belies its true nature as it is quite as leathery as a well-developed specimen of *P. corallorhiza*. As with the latter species, however, on being pressed it loses its true texture and appears thinly membranous. The width of this plant is stated to be as much as 8 mm although Kützing's (l.c.) figure does not indicate anything like this. The plants cited here are up to 6 mm wide and the detailed structure is as indicated in Kützing's Figure “e”, t. 47 (l.c.). The appearance of this plant is distinctive mainly because of its breadth and the clearly defined laterals in second groups of three or four. *P. membranaceum* appears to be a deep water form as it has only been found washed up. The plants are up to 20 cm high.

3. *P. beckeri* Simons, sp. nov. Fig. 3.

P. glomeratum auct. non J. Ag.; Kylin in Lunds Univ. Arsskr. N.F. Avd. 2, 34 (8): 12, t. 3, Fig. 7 (1938).

Thallus usque ad 15 cm altus, delicatulus, ramosissimus; axibus primariis compressis, seriebus secundis alterne pinnatis; pinnis imis in qua serie fere subulatis, simplicibus, secundis paulum ramosis, tertiis plus ramosis, quartis (rarissime) multo ramosis, pinnulis gracillimis, submembranaceis, subcostatis; sporophyllis pinnularum transformatione formati, clavatis simplicibus vel dichotomo-decompositis; cystocarpiis non visis; colore coccineus.

Type: Natal, Port Edward, *Simons* 623 (PRE).



FIG. 3 and 4. Fig. 3.—*Plocamium beckeri* Simons: (a) portion of a well-developed plant, $\times 1$; (b) portion of plant in detail, $\times 15$; (c) sporophylls as modified pinnules, $\times 30$

FIG. 4.—*Plocamium rigidum* Bory: (a) Portion of a well-developed plant, $\times 1$; (b) portion of a plant in detail, $\times 15$; (c) sporophylls as modified pinnules, $\times 30$.

Holdfast: Short, intertwined, slender, rhizomatous axes with short, branched haptera and erect fronds. *Erect system*: Fronds up to 15 cm high, delicately and much-branched, compressed, slender; almost always three laterals in each second group, occasionally four, the lowest simple, almost awl-shaped, the second little-branched, the third more-branched and, when present, the fourth most-branched; ramuli very slender, somewhat membranous and faintly ribbed; sporophylls transformed pinnules, clavate, simple or dichotomo-compound, very often cruciform; bright pink in colour.

CAPE PROVINCE.—Bredasdorp: Arniston, *Isaac* I. 868, I. 1538. Mossel Bay: Tergniet, *Isaac* I. 297, I. 1568, I. 1569, I. 1715. Knysna: Robberg, *Isaac* I. 1428, I. 1429. Port Elizabeth, *Ecol. Surv.* E. 60, E. 62, E. 78, E. 79. Bathurst: Kowie, *Becker* s.n. (BOL 27219, 27220, 27221).

NATAL.—Port Shepstone: Port Edward, *Simons* 623 (PRE, type); Ramsgate, *Simons* 624. Durban: Reunion Rocks, *Isaac* I. 1023; Durban, *Ecol. Surv.* D. 64. Inanda: Umhloti, *Simons* 630. Umfolosi: Umpangazi, *Ecol. Surv.* G. 1. G.

MOZAMBIQUE.—Maputo: Ponto Abril, *Isaac* I. 379, I. 700. Inhaca Island: Lighthouse, *Isaac* I. 200, B. 255. Gaza: Xai-Xai, *Isaac* I. 710.

The name *P. beckeri* Schm. appears in manuscript on Becker mountings of this species. Attempts to find a published reference to the name have failed, so it is assumed to have no standing. In describing this as a new species it seems fitting to retain the epithet "*beckeri*" to honour Dr. H. Becker who contributed so materially to South African phycology in the late 19th century.

This species has in the past been confused with *P. coccineum* (Huds.) Lyngb. from the northern hemisphere. *P. beckeri* differs in that its pinnae almost always alternate in threes and it lacks marginal sporophylls. Another closely related species is *P. delicatulum* Baardseth (1940), but the latter produces simple or once-forked sporophylls compared with the frequent cruciform or sometimes much branched sporophylls of *P. beckeri*.

4. *P. rigidum* Bory in Belanger, *Voy. Bot. Crypt.*, 164 (?); Kütz., *Sp. Alg.*, 885 (1849); *J. Ag.*, *Sp. Alg.* II, pt. 2: 397 (1852); *J. Ag.*, *Epicr. Syst.*, 340 (1876); *J. B. de Toni*, *Syl. Alg.* IV, sect. 2: 592 (1900); *H. Kylin*, *Rhodoph. von Südafrika*, 12, t. 3, fig. 8 (1938). Fig. 4.

Holdfast: Creeping, compressed rhizomatous axes, branched at intervals, up to 1 mm thick; strongly recurved hook-like pinnae interlock with the same from adjacent rhizomes. *Erect system*: Fronds arise from upturned apices and other parts of rhizomes, much branched, somewhat leathery, rigid; pinnae alternately paired below, in threes above; sporophylls more or less palmately branched, branches of variable length; cystocarps sessile, marginal.

SOUTH WEST AFRICA.—Swakopmund, *Simons* 352, 355, 374, 496; *Isaac* I. 1351, I. 1352, I. 153, I. 1539, I. 1540, I. 1541. Lüderitz, *Simons* 406, *Isaac* I. 1356, I. 1357, I. 1358.

CAPE PROVINCE.—Namaqualand: Port Nolloth, *Simons* 357; *Isaac* I. 1168, I. 1260, I. 1537, I. 1543, I. 1544, I. 1545, I. 1546; *Ecol. Surv.* N. 6. A.; Hondeklip Bay, *Ecol. Surv.* I.B.4.G. Malmesbury: Paternoster, *Ecol. Surv.* P.11.E; *Simons* 481. Cape Town: Oudekraal, *Ecol. Surv.* A.87. Caledon: Cape Hangklip, *Ecol. Surv.* C.H.3.F. Bredasdorp: Dyer Island *Tyson* s.n. (BOL 27213); Cape Agulhas, *Ecol. Surv.* A.G.4.F; *Tyson* s.n. (BOL 27210, 27211, 27215). Locality unstated: *Tyson* s.n. (BOL 27212, 27214).

This species is very variable and its limits are difficult to establish. Generally, the thallus is fairly rigid. In its more typical form it resembles *P. cornutum*, but,



FIG. 5 and 6. Fig. 5.—*Plocamium cornutum* (Turn.) Harv.: (a) Portion of a well-developed plant, $\times 1$; (b) portion of plant in detail, $\times 2$; (c) sporophylls as modified pinnules, $\times 40$.
 FIG. 6.—*Plocamium suhrii* Kütz.: (a) Portion of a well-developed plant, $\times 1$; (b) portion of plant in detail, $\times 10$; (c) axillary sporophylls $\times 50$; (d) marginal, sessile cystocarp, $\times 10$.

whereas in the latter species all the pinnae alternate in pairs and are more or less awl-shaped, in *P. rigidum* the pinnae are somewhat more triangular and in the upper parts occur in threes. There are some rather more delicate forms which seem otherwise to be indistinguishable from the type. It is possible such forms were referred by Grunow (1867) to *P. rigidum* var. *tenuior*. There is too a rather more membranous form with somewhat more triangular pinnae but attempts to find any distinguishing character from *P. rigidum* have not succeeded.

5. *P. cornutum* (Turn.) Harv. in Ner. Austr.: 123 (1847); J. Ag. in Sp. Alg. 2: 404 (1852); Epicr.: 346 (1876); de Toni, Syl. Alg. 4: 598 (1900). Fig. 5.
Fucus cornutus Turner in Hist. Fuc.: t. 258 (1811).
Thamnocarpus cornutus Kütz. in Phyc. Gen.: t. 59, fig. 3 (1843); Tab. Phyc. XVI: 19, t. 55, fig. a-c (1866).

Holdfast: Relatively stout, shortly branched, decurrent axes with knob-like attaching suckers at their extremities; colour a dilute pink, the whole occupying little space. *Erect system*: Ascending main axes comparatively little-branched; pinnae in alternating pairs, the lower simple, awl-shaped, the upper somewhat branched, all crowded, overlapping, appearing to arise from all sides; sporophylls pedicellate, apparently axillary, shortly and furcately branched; cystocarps not seen.

CAPE PROVINCE.—Namaqualand: Port Nolloth, *Isaac* I. 1205; *Simons* 311. Malmesbury: Paternoster, *Simons* 480; *Ecol. Surv.* P.4.F.; Saldanha Bay, *Simons* 566. Cape Town: Table Bay, *Tyson* s.n. (BOL 27164, 27165, 27172); Three Anchor Bay, *Tyson* s.n. (BOL 27173); Oudekraal, *Ecol. Surv.* A. 54; Buffel's Bay, *Isaac* I. 1224; Sunny Cove, *Isaac* I. 378; Kalk Bay, *Tyson* s.n. (BOL 27166); False Bay, *Ecol. Surv.* F. 85. Caledon: Hermanus, *Simons* 487, 552; *Isaac* I. 377. Knysna: *Ecol. Surv.* K.KN.1.A. Bathurst: Kowie, *Becker* s.n. (BOL 27167, 27168, 27169, 27170, 27171); Kleinemonde, *Ecol. Surv.* X.1.V. East London: Kidd's Beach, *Isaac* I. 1307; East London, *Ecol. Surv.* L. 90. Kentani: Qolora, *Ecol. Surv.* Q.Q.1.R; Locality unstated: *Becker* s.n. (BOL 27174, 27175, 27176).

P. cornutum is comparatively easy to recognize because of its crowded pinnae which appear to arise on all sides of the somewhat terete axis which is sparingly branched. Occasionally forms approach the habit of *P. rigidum* but generally the latter can be distinguished by their terminal arrangement of pinnae in second groups of three.

6. *P. suhrii* Kütz. in Sp. Alg.: 886 (1849); Tab. Phyc. XVI: 19, t. 54 (1866) Fig. 6.

P. procerum Suhr, Alg. Eckl.: 726 (1834), nom. illegit.

P. nobile J. Ag., Sp. Alg. 2: 397 (1852); Epicr.: 341 (1876).

P. fullerae Schm. ex Mazza in Sag. Alg. Ocean.: 221 (1908); de Toni, Syl. Alg. VI: 315 (1924).

P. membranaceum. Kylin in Rhodoph. von Südafrika, t. 3, fig. 9 (1938). Auct. non Suhr.

Holdfast: Slender rhizomes of limited length from which groups of short haptera arise at intervals. *Erect system*: Compressed fronds of about 2 mm width arise on short terete stalks from the holdfast, up to 15 cm high, not much branched; pinnae in alternating pairs, sometimes strictly alternate or, occasionally, in threes, the lower simple, triangular and somewhat falcate, margins entire, crenate or obsoletely toothed, the upper laterals more or less branched; mid-rib of single row of cells often clearly visible as a thin median line in young parts; sporophylls modified pinnules, branched, almost digitate, sometimes in the axils of pinnae; cystocarps marginal, sessile, on pinnae.

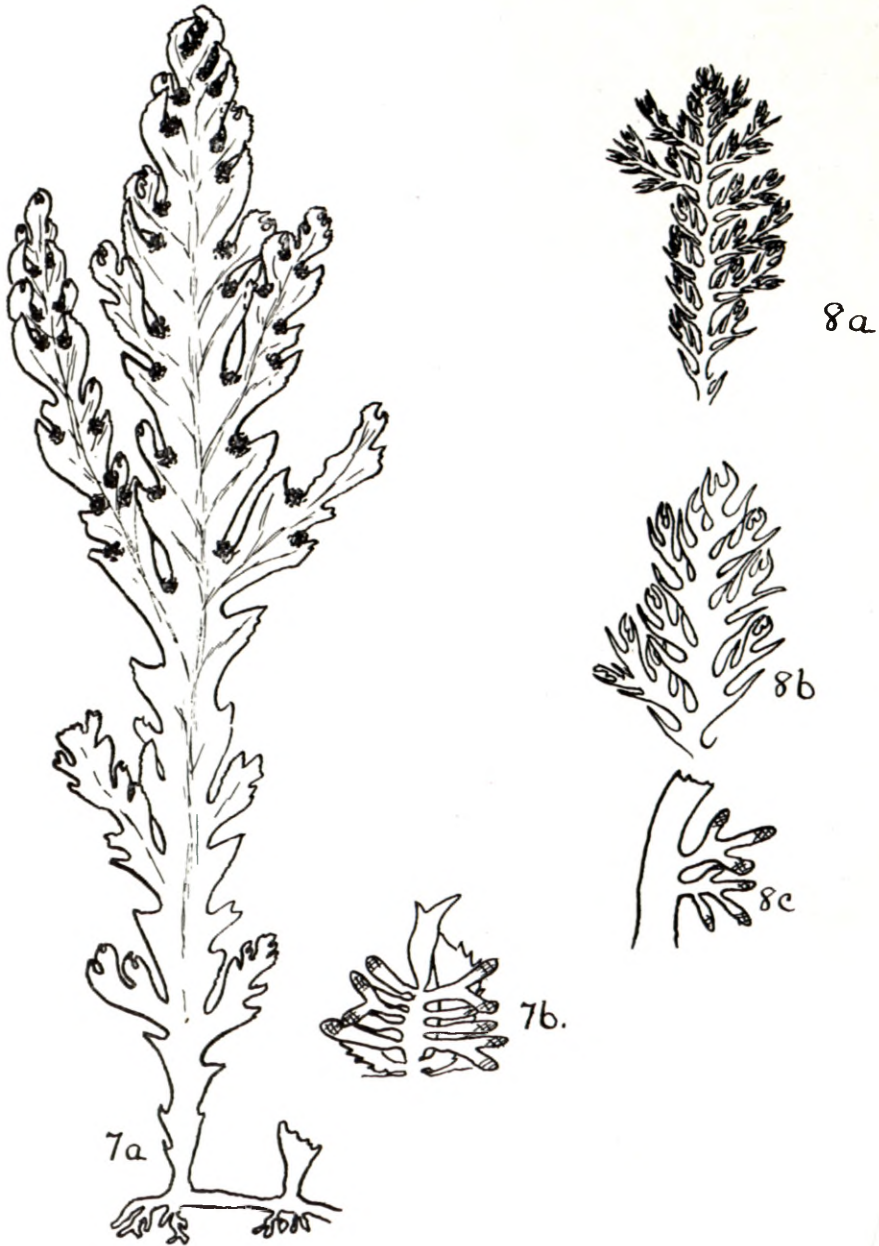


FIG. 7 and 8. Fig. 7.—*Plocamium corallorhiza* (Turn.) Harv.: (a) Portion of a well-developed plant showing axillary sporophylls, $\times 1$; (b) sporophylls with toothed bract, $\times 40$.

FIG. 8.—*Plocamium telfairiae* Harv. ex Kütz.: (a) Portion of a well-developed plant, $\times 1$; (b) portion of a plant in detail, $\times 7$; (c) sporophylls as modified pinnules, $\times 30$.

CAPE PROVINCE.—Knysna: Robberg, *Ecol. Surv.* R.R.2.C; Plettenberg Bay, *Isaac* I. 1548. Humansdorp: Storms River, *Ecol. Surv.* T.2.G, T.T.4.D. Bathurst: Kowie, *Becker* s.n. (BOL 27141, 27142, 27143, 27144, 27145, 27146). Locality unstated: *Tyson* s.n. (BOL 27217, 27218).

NATAL.—Inanda: Umhloti, *Simons* 631.

Agardh (1876) by retaining his name of *P. nobile* for this taxon rejected the prior claim of *P. suhrrii* published by Kützing in 1849. The justification for this was apparently Agardh's refusal to acknowledge that Kützing's two publications of *P. suhrrii* are synonymous and both referred to *P. procerum* Suhr. However, there seems to be no good reason for allowing this suggestion of Agardh's and the Kützing name must, therefore, be accepted as correct, since *P. procerum* Suhr, on which this taxon is based, is a homonym.

The main feature of this species is the grouping of laterals in pairs as is found in *P. corallorhiza*. It differs from the latter in its smaller size, both in length and width, the absence of teeth on the margins of the pinnae, and the occurrence of sporophylls as modified pinnules. Agardh's statement that the laterals occur most often in secund groups of three is misleading, unless he had the wrong plant in hand, as both Suhr and Kützing stated quite clearly that the laterals are paired or even strictly alternate. Suhr also pointed out that his plant was akin to *P. corallorhiza* rather than to *P. coccineum*. This being the case, Agardh's statement must be viewed with caution. Plants, which might be of this species, with laterals occasionally in threes have been seen.

7. *P. corallorhiza* (Turn.) Harv. in Hook. et Harv. *Alg. New Zeal.*: 542 (1845); Harv. in *Ner. Austr.*: 121 (1847); J. Ag. in *Sp. Alg.* 2: 402 (1852); *Epicr.*: 348 (1876); de Toni in *Syl. Alg.* 4: 602 (1900). Fig. 7.
Fucus corallorhiza Turn. in *Hist. Fuc.* t. 96 (1811).
P. robertiae Schmitz ex Mazza in *Sag. Alg. Ocean. Nuova Not.* 19: 18 (1908).
Fucus cirrhosis Turn. in *Hist. Fuc.* t. 63 (1811).
Thamnophora corallorhiza C. Ag. in *Sp. Alg.*: 225 (1821); *Syst. Alg.* 240 (1824); Suhr in *Alg. Eckl.*: 7, t. 1, fig. 10 (1834); Kütz. in *Sp. Alg.*: 887 (1849); *Tab. Phyc.* XVI: 20, t. 56, fig. f-k (1866).

Holdfast: Relatively thick, somewhat flattened, branched rhizomes with short strongly recurved simple pinnae and short haptera attaching plant to rock or other plants. *Erect system*: Fronds from holdfast narrowly complanate at base rapidly expanding to 10 mm or more in width, compressed, leathery below, slightly membranous ultimately, up to 30 cm high; pinnae alternate or more commonly alternating in pairs, the lower simple, the upper more or less branched, broadly triangular, outer margins frequently arcuate and toothed, teeth often compound; sporophylls axillary or superficial, often intermixed with minute, toothed bracts; cystocarps marginal on axillary bracts, frequently closely clustered.

CAPE PROVINCE.—Malmesbury: Yzerfontein, *Ecol. Surv.* Y.I.F. Cape Town: Table Bay, *Tyson* s.n. (BOL 27179, 27181, 27182, 27183, 27184, 27186, 27187, 27190); Kommetje, *Isaac* I. 826; Oliphantsbos, *Isaac* I. 270; Buffel's Bay, *Isaac* I. 1221; Muizenburg, *Isaac* I. 266, I. 267, I. 267A; False Bay, *Ecol. Surv.* F. 4; *Tyson* s.n. (BOL 27185, 27188, 27189, 27191, 27192, 27197). Caledon: Hermanus, *Isaac* I. 268. Bredasdorp: Arniston, *Isaac* I. 864, I. 927. Riversdale: Still Bay, *Ecol. Surv.* S. 81. Mossel Bay: Tergniet, *Isaac* I. 296, I. 1562. Knysna: Plettenberg Bay, *Isaac* I. 1407. Humansdorp: Storms River, *Ecol. Surv.* T.T.4.C. Port Elizabeth: *Ecol. Surv.* E. 22.

Bathurst: Kowie, *Becker* s.n. (BOL 27140, 27147, 27148 and consecutive numbers up to 27161, 27194, 27195, 27196); *Shand* s.n. (BOL 27180); Kleinemonde, *Ecol. Surv.* X.5.A. East London: Kidd's Beach, *Isaac* I. 265, I. 265A; East London, *Ecol. Surv.* L. 38; Eastern Beach, *Isaac* I. 269. Komgha: Cape Morgan, *Flanagan* s.n. (BOL 27177). Willowvale: Udweza Point (Dwessa), *Isaac* I. 271, I. 1272. Elliotdale: The Haven, *Ecol. Surv.* H.1.C. Port St. Johns: *Isaac* I. 1448, *Simons* 657 and consecutive numbers up to 675. Locality unstated: *Becker* s.n. (BOL 27193).

NATAL.—Pinetown: Isipingo, *Isaac* I. 274. Durban: Reunion Rocks, *Isaac* I. 467; Durban, *Ecol. Surv.* D. 30. Lower Tugela: Umhlali, *Ecol. Surv.* U.8.A, U.22.A, U.U.4.A; Salt Rock Beach, *Isaac* I. 273.

MOZAMBIQUE.—Gaza: Xai-Xai, *Isaac* I. 713.

Locality unstated: *Becker* s.n. (BOL 27198 and consecutive numbers up to 27205).

There is a fair degree of variation in the form of the simple pinnae of this species especially regarding their shape and the presence or absence of marginal teeth. The outer margins of these pinnae are anything from strongly incurved to slightly recurved and with or without obvious teeth. Considering the range of variation in these characters, there seems to be no justification for the recognition of a separate species, *P. robertiae*, with entire margins.

Structures resembling axillary clusters of sporangia, but which consist instead of what seem like miniature juvenile forms of the plants bearing them, are of fairly frequent occurrence. The outer margins of these tiny pinnae are usually markedly toothed.

These bracts are sometimes found intermixed with sporophylls, or they contain spermatangia.

8. *P. telfairiae* Harv. ex Kütz. in *Sp. Alg.*: 885 (1849); *J. Ag.* in *Sp. Alg.* 2: 400 (1852); *Epicr.*: 342 (1876). Fig. 8.

P. abnorme Okam. in *Icon. Jap. Alg.* 3: 1 and 4, t. 101 (1913), non Hook. et Harv.

Holdfast: Slender, creeping, compressed axes with scattered, short, recurved pinnae and haptera at intervals. *Erect system*: Fronds slender, compressed, somewhat membranous, expanding slightly towards apices; pinnae in alternating pairs, the lower simple, entire, elongated, narrowly triangular, the upper branched, pinnae patent below, crowded and delicate above; sporophylls axillary, or modified pinnules, branches variable in length and form; cystocarps not seen.

MOZAMBIQUE.—Inhaca Island: Lighthouse, *Isaac* I. 913, B. 427.

This is a new record for southern Africa. Yendo (1915) suggested that this species is synonymous with *P. nobile* J. Ag.

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