

**SOME NOTES ON THE DISTRIBUTION OF PLASMODIOPHORA
DIPLANTHERAE, A PARASITIC FUNGUS ON SPECIES OF
HALODULE**

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(With two Text-figures)

Plasmodiophora diplantherae (F. & W.) Iv. Cook is a specific parasite on species of the sea-grass genus *Halodule*. It had been recorded only from its type locality in the West Indies, but from a recent study of extensive herbarium material it has proved to be a widely distributed pantropic species.

Amongst unidentified sea-grasses of the genus *Halodule* from the herbarium of the University of Copenhagen I found a small collection of plants from the Key Islands (Moluccas). These plants seemed to be closely allied to *Halodule pinifolia* (Miki) Hartog, but differed from it in their almost entire leaf-tips and the strongly swollen internodes of the stem which gave the latter the appearance of a string of beads (Fig. 1). As the tips of young leaves of *H. pinifolia* often are almost entire no importance was attached to this character. The remarkable, very conspicuous, swollen internodes, however, distinguished these plants from all material of the genus *Halodule* that I had ever seen before. As a tendency to thicken at the internodes of the stem does not occur in either the genus *Halodule* or in the related genera *Cymodocea* and *Syringodium*, I hesitated long about the status of this material. Fortunately I found that the swellings of the internodes were caused by a parasitic fungus, belonging to the family of the Plasmodiophoraceae, viz. *Plasmodiophora diplantherae*.

PLASMODIOPHORA DIPLANTHERAE (F. & W.) Iv. Cook

Ostenfeldiella diplantherae Ferdinandsen & Winge in Ann. Bot. 28: 648, fs. 1, 4, pl. 45. 1914 — *Plasmodiophora diplantherae* (F. & W.) Iv. Cook in Hong Kong Nat. 1 (Suppl.): 34, pl. 13 f. 2. 1932; in Arch. Protistenk. 80: 194, f. 9, pl. 6 fs. 5, 6. 1933.

DESCRIPTIONS & ILLUSTRATIONS.—Johnson & Sparrow, Fungi in oceans and estuaries 60, 319. 1961; Karling, Plasmodiophorales 32, pl. 4 fs. 98-101. 1942.

Resting spores spherical, brown, 4-4.5 μ in diameter, with thin, hyaline, brownish, smooth membranes, producing plasmodia which grow to a large size, 125-200 μ in diameter and contain many nuclei. Plasmodia induce the host cells to increase in size from 35 μ to 200 μ in diameter.

The effect on the host had been already studied by Ferdinandsen & Winge (1914). They found that only the internodes of the stem were infected by the parasite, the cells in the tops of the internodes remaining uninfected. In the meristematic part of

the plant uninucleate myxamoebae are present. Lower down in the internode large plasmodia occur; they cause swelling of the host tissue and tangential stretching instead of radial stretching of the cell. In the lower part of the internodes many of the cells are filled with masses of spores. The parasite is restricted to the inner cortex and does not occur in the outer cortex or in the central cylinder of the host, so the infected plant is able to continue its growth.

The species had been recorded so far only from St Croix (Virgin Islands) in the West Indies (Ferdinandsen & Winge, 1914), where it was a parasite on *Halodule wrightii* Aschers.

Later I discovered on several occasions the fungus also on other members of the genus *Halodule*, and now it is known as a parasite on the following species: *H. uninervis* (Forsk.) Aschers., *H. tridentata* (Steinheil) F. v. M., *H. beaudettei* (Hartog) Hartog, *H. wrightii*, and *H. pinifolia*. I did not succeed in finding it on species of the allied genera *Cymodocea* and *Syringodium*, although I had considerably more material of these. Therefore, it seems that *Plasmodiophora diplantherae* is a specific parasite of the genus *Halodule*.

Heavily diseased plants can be recognized easily in the herbarium (e.g. *Simmonds 15033*, *Jensen 247*). In most cases, however, the symptoms seem to be limited to one or more shoots of the host, while the other parts look healthy and do not seem to be affected by the parasite. Early stages of the disease can, of course, not be detected in the herbarium material. The distribution of *Plasmodiophora diplantherae* is pantropic and covers almost the whole area of distribution of the genus *Halodule* (Fig. 2).

MATERIAL STUDIED:—

UNITED STATES OF AMERICA: Florida, Pinellas County, St Petersburg, Tampa Bay, 24/28 Dec. 1951, on *Halodule beaudettei* from muddy substrate at extreme low-water-mark, *R. F. Thorne 10304* (UC).

CUBA: Province of Oriente, Guantánamo Bay, 17/30 March 1909, on *H. wrightii* in shallow water at Conde beach, *N. L. Britton 2129* (US).

BAHAMA ISLANDS: South Caicos, East Bay, 22 June 1954, on *H. beaudettei* rooting in sand of shallow bay, *G. R. Proctor 8910* (GH).

VIRGIN ISLANDS: St Croix, Krauses Lagoon, 4 Febr. 1906, on *H. wrightii*, *F. Bergesen* (US).

GUADELOUPE: Marie Galante, 27 March 1936, on *H. beaudettei*, *L. Rodriguez 4359* (P).

TRINIDAD: Charachacare, 2 Jan. 1954, on *H. beaudettei* in shallow, sheltered sandy bay; very heavily infected! *N. U. Simmonds 15033* (K).



Fig. 1.—*Halodule pinifolia* (Miki) Hartog, heavily infected by *Plasmodiophora diplantherae* (F. & W.) Iv. Cook (*Jensen 247*, $\times 1$).

CURAÇAO: St Joris Baai along the north-eastern coast, 8 July 1958, on *H. beaudettei*, *M. Diaz-Piferrer* (MICH).

MOZAMBIQUE: Bazaruto Island, 28 Oct. 1958, on *H. wrightii* in very shallow water, *A. O. D. Mogg* 28670 (PRE); Inhaca Island, intertidal mud-flats opposite the Marine Laboratory, 8 Oct. 1957, on *H. wrightii*, *A. O. D. Mogg* 27730 (PRE); idem, 31 Oct. 1962, on *H. uninervis*, *Mauve* and *Verdoorn* 65 (PRE); idem, on *H. wrightii*, 1 Nov. 1962, *Mauve* and *Verdoorn* 105 (L).

YEMEN: Hodeidah, 23 Dec. 1888, on *H. uninervis*, *Schweinfurth* 148 (GH).

PERSIA: Bushire, on *H. wrightii*, *K. H. Reehinger* 1731 (C).

INDIA: Tuticorin, 25 Febr. 1928, on *H. tridentata*, *F. Bergesen* 281 (C); idem, Hare Island, 28 Febr. 1928, on *H. tridentata*, *F. Bergesen* 302 (US).

VIETNAM: Nha Trang, Ile Tré, 6 Nov. 1957, dredged from 5-6 m depth on *H. tridentata*, *J. Feldmann* 9753 (Herb. Lab. Biol. vég. marine, Paris).

JAPAN: Ryukyu Islands, Okinawa, Awashi (Awase or Ashi) reef, 7 Oct. 1945, on *H. pinifolia* (US, MICH); Okinawa, on the east side of the island opposite Kadena, 9/11 April 1953, on *H. tridentata* from low-tide level of an exposed shore, *E. Y. Dawson* 11618 (UC).

MALAYA: Johore, Pulau Tinggi, 19 June 1915, on *H. tridentata* from a sandy coral beach near low tidal level, *Burkill* 899 (SING); Singapore, Pulau Senang, 1 April 1956, on *H. tridentata* from sandy littoral pools of a coral reef, *Burkill* 547 (SING, BO, L).

PHILIPPINES: Mindoro, Puerto Galero, Balateros Maliit, 20 May 1924, on *H. pinifolia* from tidal flat behind coral reef, *J. Pascasio* 371 (15476) (UC); idem, on *H. uninervis*, *J. Pascasio* 376 (15481) (UC); Puerto Galero, 2/4 Dec. 1953, on *H. tridentata*, *M. Doty* 10912 (L, Hawaii University); Cavalli Island in the

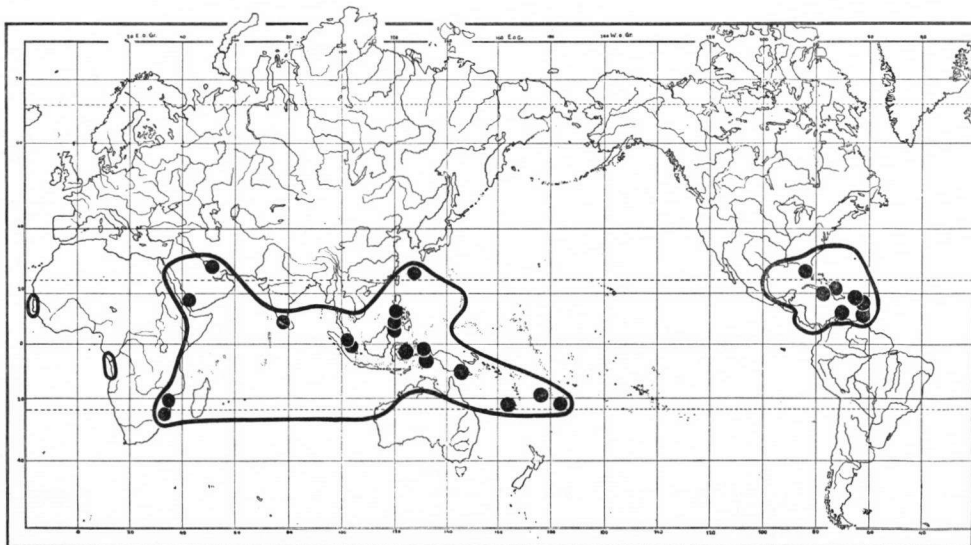


Fig. 2.—Distribution of *Plasmodiophora diplantherae* (F. & W.) Iv. Cook. The area of the genus *Halodule* is surrounded by a thick line.

Sulu Sea, Sept. 1910, on *H. pinifolia*, E. D. Merrill 7179 (US); Sulu Group, Pearl Bank, June 1923, on *H. pinifolia*, R. Kienholz (UC).

INDONESIA: Moluccas, Sula Islands, Samana, 1 Sept. 1954, on *H. pinifolia* from sandy spot, A. H. G. Alston 17036 (BM); Key Islands, Jamtil, 9 May 1922, on *H. pinifolia* from 1 m depth in the surf, Jensen 247 (C, BO, US, A, GH); New Guinea, Sorong, 1872, on *H. pinifolia*, Beccari 11821 (P.P. 132) (FI, L).

AUSTRALIAN NEW GUINEA: Port Moresby, Ela Beach, 17 June 1960, on *H. pinifolia* in shallow water, R. F. Thorne 12564 (LAE).

FIJI ISLANDS: Suva, Viti Levu, 22/28 May 1926, on *H. pinifolia*, W. A. Setchell & H. E. Parks 17739 (UC).

NEW CALEDONIA: Balade, 8 Jan. 1961, on *H. tridentata* from muddy bottom, H. S. McKee 8009 (US).

TONGA ISLANDS: Tongatapu, Nuku'alofa, 15 April 1953, on *H. pinifolia* exposed at low tide, T. G. Yunker 15288 (US, GH).

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