

## NOTES ON KENYA *ACETABULARIA* LAMOUROUX, (CHLOROPHYTA)

By

SHAKUNTALA A. MOORJANI  
*University College, Nairobi*

*Acetabularia* is a pan-tropical genus with extra-tropical extensions. It comprises about twenty species which are all marine. The mature thallus is calcified (in varying degrees according to the species) and has an erect, unbranched siphonous stipe terminating in one or more whorls of gametangial rays. The rays may be free or fused along their lateral margins and contain numerous spherical cysts at maturity. On the upper surface and near the base, each ray bears a coronal knob, which knobs jointly comprise the corona superior. Some species also have a corona inferior below the gametangial rays. The corona superior bears delicate, deciduous hairs, which in certain species are rudimentary.

On the east coast of Africa, *Acetabularia* has been recorded in South Africa (Levring, 1938; Papenfuss & Egerod, 1957) and in Mozambique at Inhaca Island and Peninsula (Isaac & Chamberlain, 1958). As far as the author has been able to ascertain from the records available to her, the genus *Acetabularia* has not been previously recorded for the Kenya coast.

In this paper three species of *Acetabularia* are reported for the Kenya coast. The first of these *Acetabularia* was recorded in April, 1968. A piece of old coral on which *Udotea orientalis* A. & E. S. Gepp, were growing was collected on the coral reef at Diani Beach and brought to Nairobi to make further observations on this species. On this piece of old coral there appeared an *Acetabularia* which was identified as *A. moebii* Solms-Laubach by Prof. Wm. E. Isaac.

Again, earlier this year, some *Acetabularia* were observed on old coral in culture of *U. orientalis*. The laboratory culture consisted of three pieces of old coral which had been collected on the reef at Diani Beach on 4 April, 1969 and transported to Nairobi in a Polythene jar filled with sea water, from which they were removed a week later and transferred to a glass aquarium (12 in  $\times$  7½ in  $\times$  7½ in) which was filled with filtered sea water brought from the coast. Two petri dishes, full of clean sand from the coast, in which individual *Udotea* had been planted, were placed in the aquarium. The level of water in the aquarium was marked. The aquarium was placed on a bench near a window.

Daily from 8.30 a.m. to 4.30 p.m. the aquarium was exposed to illumination provided by a 100 watt Bench lamp which was placed on one corner of the aquarium. The heat from the lamp also helped to raise the temperature of the water from 18° to 24°C and maintain it for some time.

Aeration was provided by means of an aerator with polythene tubing ending in an air stone-diffuser.

Care of the culture involved only the adding of distilled water from time to time to replace the water lost by evaporation and thus maintain a constant volume and salinity. Algae growing on the walls of the aquarium were removed.

The first *Acetabularia* were seen growing a week after the culture had been set up in the laboratory. In the following weeks unbranched axes with terminal whorls of sterile hairs were noticed which later developed the characteristic disks of gametangial rays. The developmental sequence was followed and was found to be similar to the one described by Egerod (1952). Later three species were identified from the culture material. There may be a fourth species but at present this is uncertain.

The Kenya *Acetabularia* found are all small species. When mature, the thalli are between 3.0-10.0 mm. tall and the disks are between 1.5-4.0 mm. in diameter.

Following is a key to the Kenya species found.

KEY TO THE KENYAN SPECIES

1. Gametangial rays entirely free . . . . . *A. clavata*.  
    Gametangial rays not entirely free . . . . . 2.
2. Gametangial rays in contact throughout; broadly rounded or emarginate apices  
    . . . . . *A. moebii*.  
    Gametangial rays partly adhering, mammillate apices. . . . . *A. exigua*.  
*Acetabularia clavata* Yamada, 1934, p. 57, figs. 24 and 25. (fig. 1)

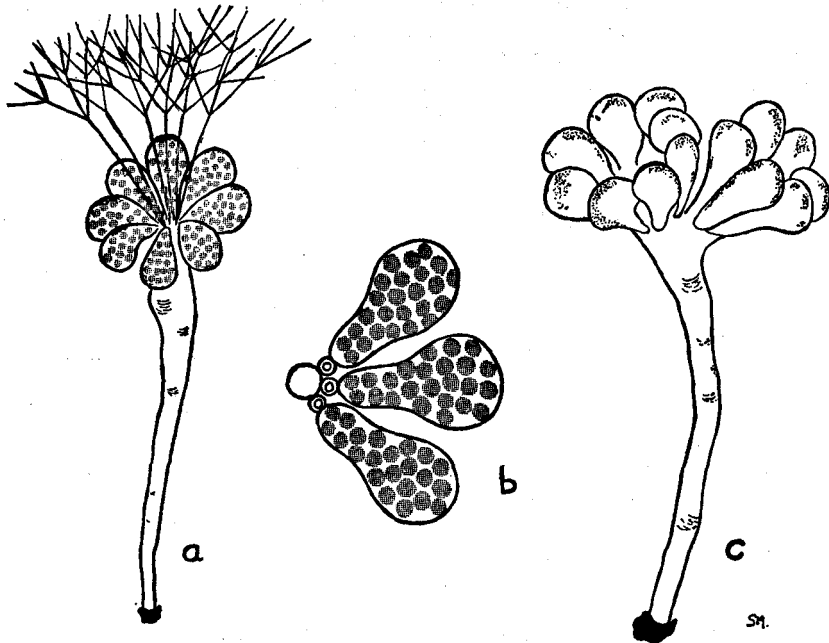


FIGURE LEGEND

- Fig. 1 *Acetabularia clavata* Yamada.  
 a. A mature reproductive thallus ( $\times 10$ ).  
 b. Part of a gametangial disk, as seen from above ( $\times 20$ ).  
 c. A plant with two gametangial disks ( $\times 10$ ).

Egerod: *Univ. Calif. Publ. Bot.*, vol. 25, No. 5, p. 413.

Thallus slightly calcified, 4.0-6.5 mm. high, stipe slightly rugose, bearing a single apical gametangial disk, 1.5-2.0 mm. in diameter, composed of 6-9 gametangial rays; the rays free and widely spaced, each ray clavate in shape with smooth rounded distal margin and containing numerous spherical cysts, 50-60 $\mu$  in diameter; each coronal knob of corona superior bearing two or three sterile hairs; corona inferior lacking.

The Kenya plants are in general agreement with the description of *A. clavata* given by Egerod (1952) but are, however, larger in size. They grow up to 6.5 mm. in height.

Egerod mentions that *A. clavata* frequently occurs intermingled with *A. moebii*, to which it bears some resemblance and that although both species are of approximately the same size, they can be distinguished by the arrangement of the gametangial rays. Whilst it is true that the Kenya *A. clavata* also occurs intermingled with *A. moebii*, the two are not of the same size in culture. *A. clavata* is much smaller than *A. moebii* and it can be easily distinguished from it by the arrangement of the gametangial rays. The rays of *A. moebii* form a solid disk while those of *A. clavata* are free from each other (fig. 1b). Another distinctive character of *A. clavata* observed in culture is its

dark green disk. Egerod also mentions that the rays of Hawaiian *A. clavata* are equal in width throughout their length, but this is not the case in the Kenya plants in which the rays are clavate in shape.

Another observation made on the Kenya specimens is that there is a variation in the number (two or three) of hair scars on the coronal knobs of the same gametangial disk.

Egerod has reported that a number of Hawaiian plants of *A. clavata* had two gametangial disks at the apex. In the culture all the plants, except one, had a single apical disk. In the plant with two gametangial disks, the two disks were clearly alongside one another (fig. 1c) and not in two series as illustrated by Egerod.

*Type locality:* Ryukyu Islands.

*Geographical distribution:* PACIFIC OCEAN. Ryukyu Islands, Hawaiian Islands. INDIAN OCEAN. Kenya. Diani Beach, reef opposite Jadini.

*Acetabularia moebii* Solms-Laubach, 1895, p. 30, pl. 4, fig. 1. (fig. 2)

*A. minutissima* Okamura, 1912, p. 184 pl. 100.

*A. wettsteinii* Schussnig, 1930b, p. 338 (cf. Feldmann, J. & G., 1947, p. 81, fig. 1 & 2.)

Borgesesen: "Marine Algae from Mauritius", 1950, p. 6, fig. 1.

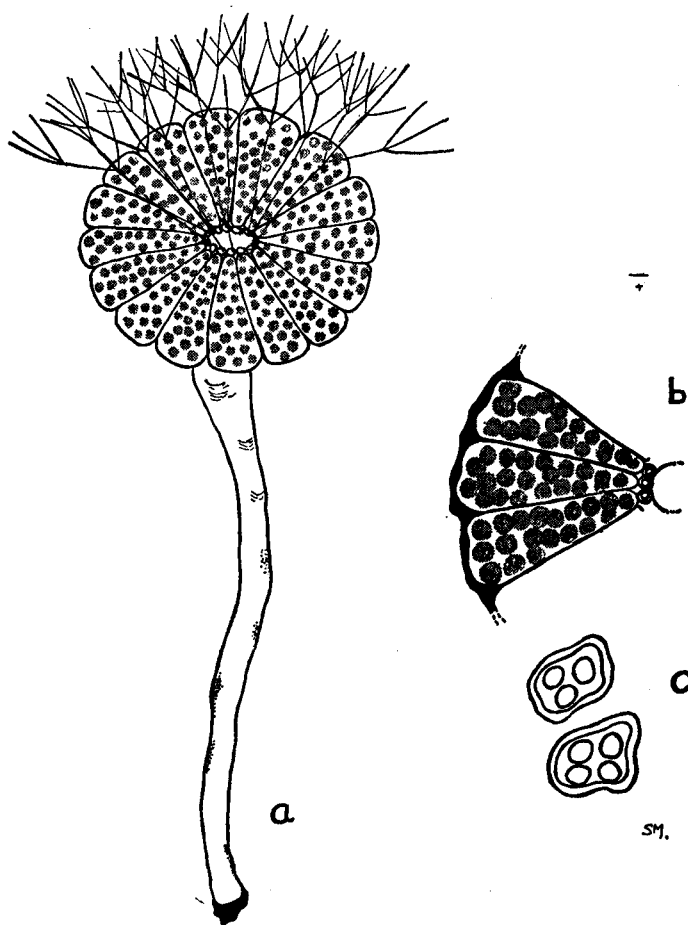


Fig. 2. *Acetabularia moebii* Solms-Laubach.

- a. A mature reproductive thallus ( $\times 10$ ).
- b. Part of a gametangial disk, as seen from above ( $\times 15$ ).
- c. Coronal knobs with thin walled hair scars ( $\times 200$ ).

Egerod: *Univ. Calif. Publ. Bot.*, vol. 25, No. 5, p. 411.

Thallus slightly calcified, 8-10 mm. high, stipe slightly rugose, bearing a single flat apical gametangial disk, 3-4 mm. in diameter, composed of 14-19 rays, the rays cemented together laterally through calcification, each ray cuneate with smooth broadly rounded or emarginate distal margin and containing numerous spherical cysts 79-158 $\mu$  in diameter; each coronal knob of corona superior bearing 3-5 sterile hairs; corona inferior lacking.

The Kenya plants examined agree well with the description given by Egerod (1952) and Borgesen (1951). However, the size of the Kenya plants examined exceeds those described from Hawaii and Mauritius. Papenfuss (1957) and Isaac & Chamberlain (1958) have also made similar observations for *A. moebii* found on the east coast of S. Africa and Inhaca Island and Peninsula respectively. The Kenya plants reach a height of up to 10 mm and the disk has a diameter of up to 4 mm. The gametangial rays are in close contact laterally through slight to moderate calcification (fig. 2b). No disks with free rays were observed as have been observed by Egerod for the Hawaiian plants and by Borgesen for the Mauritius plants.

Borgesen (1951) quotes Solms-Laubach as stating that there are only five hair scars per coronal knob. In the Kenya plants 3-5 scars were observed. This is in agreement with Egerod and Borgesen who have observed similar numbers. In addition, it was observed that in the Kenya plants there is a variation in the number of hair scars on the coronal knobs of the same gametangial disk. This was also observed by Egerod for the Hawaiian plants. The hair scars of the Kenya plants (fig. 2c) are thin walled in agreement with Solms-Laubach and not thick walled as reported for the Mauritius plants.

*Type locality:* Mauritius.

*Geographical distribution:* ATLANTIC OCEAN. Mediterranean Sea. INDIAN OCEAN. Red Sea, Mauritius, east coast of Southern Africa, Kenya, PACIFIC OCEAN. China Sea, Japan, Hawaiian Islands, Southern Marshall Islands.  
Kenya: Diani Beach, reef opposite Jadini.

*Acetabularia exigua* Solms-Laubach, 1895; p. 28, pl. 2. fig. 1, 4. (fig. 3)  
E. Y. Dawson: *Pacific Sci.*, vol. X, No. 1956, p. 42.

Thallus slightly calcified, 3-6 mm. high, stipe slightly rugose, bearing a single apical disk, 1.5-3.0 mm. in diameter; disk flat or cup-shaped, composed of (6)-8-12 gametangial rays, rays slightly cemented together laterally for part of the length; each ray ovoid with mammillate apex and containing numerous spherical cysts, 79-95  $\mu$  in diameter; each knob of corona superior bearing two or three sterile hairs; corona inferior lacking.

This is a small plant like *A. clavata* but can be easily distinguished from the latter by its mamillate ray tips and also by its often cup-shaped disk (fig. 3a) in contrast to the flat disk of *A. clavata*. The rays in *A. exigua* are cemented together laterally for part of the length (fig. 3b) while they are entirely free in *A. clavata*. In many plants of *A. exigua* it was observed that the apices had broken off (fig. 3c).

There is a variation in the number of hair scars on the coronal knobs of the same gametangial disk.

In the laboratory culture, a plant was observed which had two gametangial disks in series but the lower disk was incomplete and had the gametangial rays in twos as shown in fig. 3d.

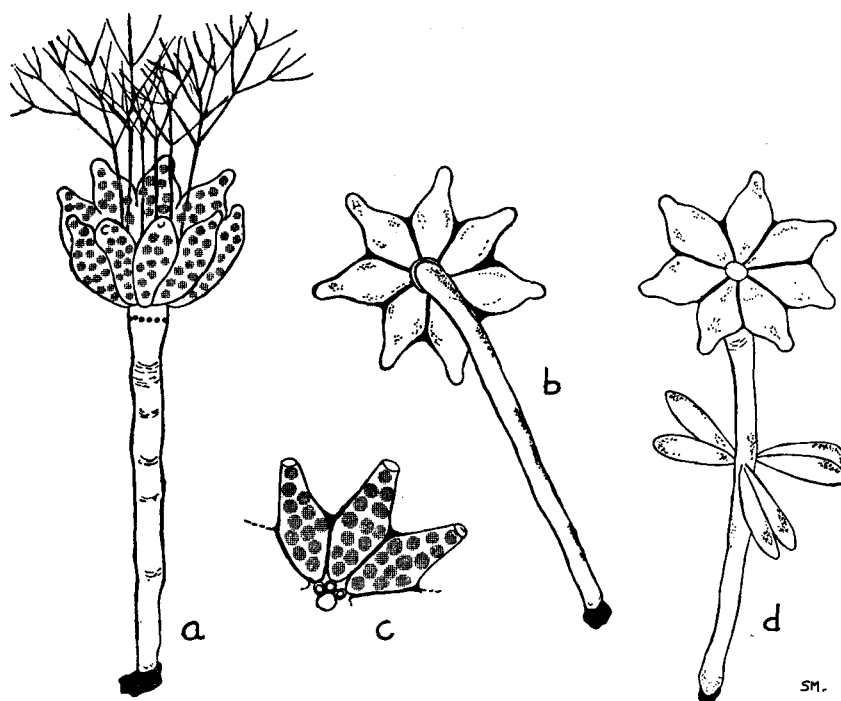


Fig. 3. *Acetabularia exigua* Solms-Laubach.

- a. A mature reproductive thallus ( $\times 10$ ).
- b. Ventral view of a gametangial disk showing lateral calcification of the rays ( $\times 10$ ).
- c. Part of a gametangial disk with broken ray apices ( $\times 15$ ).
- d. A plant with two gametangial disks ( $\times 10$ ).

**Geographical distribution:** "Tropical eastern Asia, Macassar, Celebes" (Solms-Laubach). INDIAN OCEAN. Kenya, PACIFIC OCEAN. Southern Marshall Islands.  
Kenya: Diani Beach, reef opposite Jadini.

The *Acetabularia* grew very well in culture. Over the three months' period of study numerous plants developed in the aquarium and reached maturity. It was difficult to identify the different species during the early stages of development, but once the gametangial disk was developing it was easy to recognise the species.

From the examination of juvenile stages, a developmental series was traced. It seems in the main to agree with the developmental series outlined by Egerod (1952). The phenomenon of diaphysis was however not observed in the Kenya plants examined. It was also observed that when a shoot was initiating a gametangial disk at its apex, it did not always shed its sterile branches. Egerod writes that none of the plants from Hawaii contained more than one whorl of sterile hairs at any one time, but in many Kenya plants two whorls of sterile hairs were seen concurrently.

#### ACKNOWLEDGEMENT

I wish to thank Prof. Wm. Edwyn Isaac for his encouragement and assistance in the preparation of this paper; Dr. H. B. S. Womersley of the Botany Dept., University of Adelaide, for identifying the species; and Mrs. F. Isaac for collecting the old coral pieces earlier this year.

LITERATURE CITED

- BORGESSEN, F., 1951. "Some Marine Algae from Mauritius, III", *Kgl. Danske Vidensk. Selskab, Biolog. Meddels.*, 18, Nr. 16 pp. 6-8.
- DAWSON, E. Y., 1956. "Some Marine Algae of the Southern Marshall Islands", *Pacific Sci.* vol. x, pp. 42-43.
- EGEROD, L. E., 1952. "An analysis of the Siphonous Chlorophycophyta", *Univ. Calif. Publ. Bot.*, vol. 25, pp. 408-414.
- ISAAC, Wm. E. and CHAMBERLAIN, Y. M., 1958. "Marine Algae of Inhaca Island and of the Inhaca Peninsula, II", *J. of S. Afr. Bot.*, vol. XXIV, pp. 139-140.
- OKAMURA, K., 1912. "Icones of the Japanese Algae", vol. 2, p. 184, pl. 100, figs. 7-11. *Tokyo.*
- PAPENFUSS, G. F. and EGEROD, L. S., 1957. "Notes on South African Marine Chlorophyceae" *Phytomorphology*, vol. 7, p. 91.
- \* SOLMS-LAUBACH, H. G., 1895. "Monograph of the Acetabulariaceae", *Trans. Linn. Soc. London, Bot. Ser. 2*, 5:1-39, pls. 1-4.
- \* Monograph not seen by the author.

(Received 18th August, 1969)