

Marine Fungi of Iceland: Calcareophilous Forms

By

A. R. CAVALIERE and A. H. MARKHART III

Department of Biology, Gettysburg College
Gettysburg, Pennsylvania

ABSTRACT

Examinations of shell fragments from the coast of Iceland reveal perforations that resemble the remains of fungal organisms. These fungal-like forms are described, illustrated and discussed.

In a recent report (Cavaliere and Alberte, 1970) several aspects of "shell fungi" were treated, among which was an historical resume, the occurrence, morphology and nature of these organisms.

The discovery of possible penetration of calcareous shells by fungi dates back to the last century. Since then, well over a dozen investigators have reported and described the presence of fungal-like organisms in the shells of an assortment of calcareous organisms.

METHODS AND RESULTS

As a result of the total biological investigations of fungi in Iceland and Surtsey, several samples of shell fragments were collected along the mainland coast (Reykjavík, Hafnarfjörður, Keflavík, Grindavík, and Akureyri) as well as along the shores of Surtsey. All the collections made were sifted through graded mesh to separate the minute shell fragments from the predominantly lava and pumice fraction. The most common shell fragments capable of being identified belong to the Mytilidae. The fragments were prepared for observation by mounting them in clear cellulose acetate. This process rendered the specimens stationary without reducing their translucent properties.

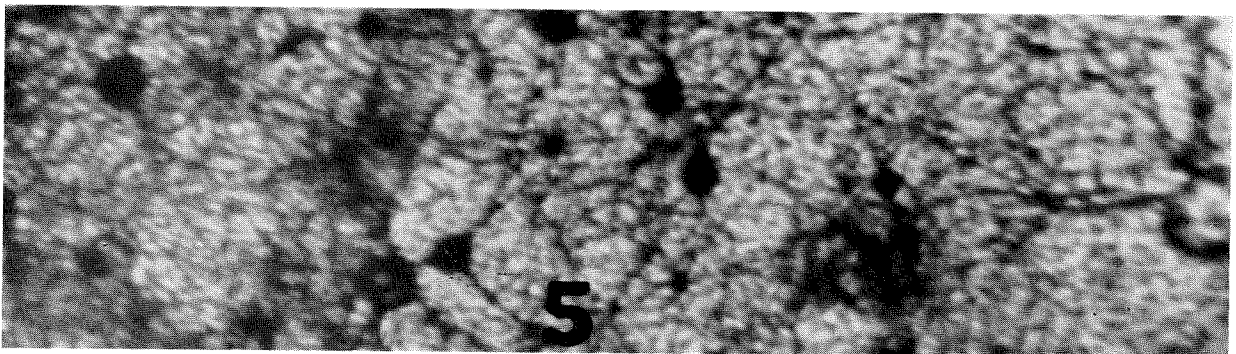
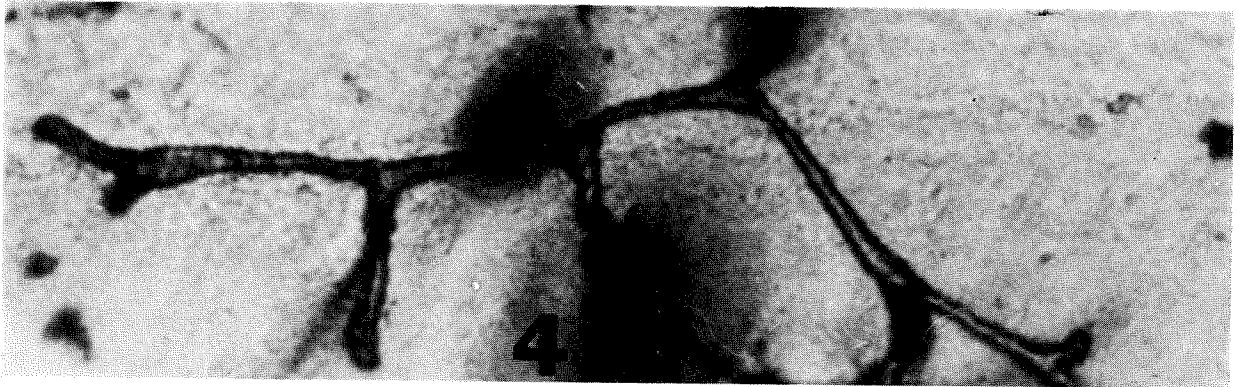
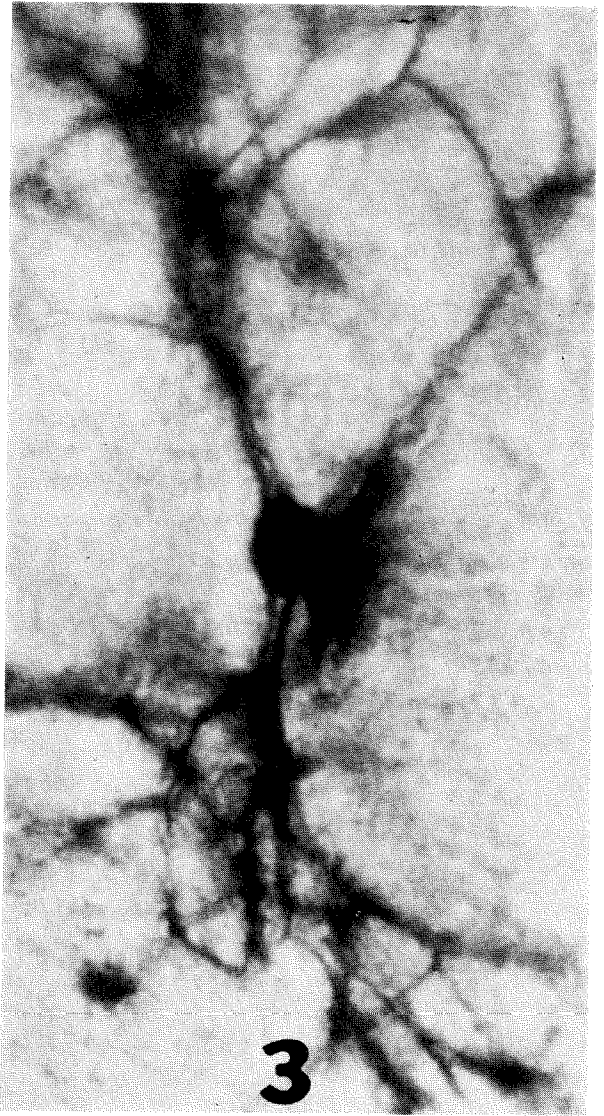
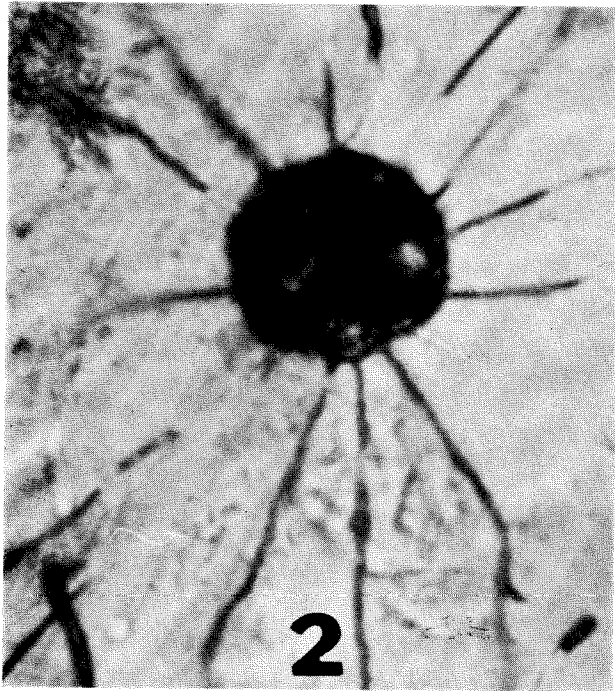
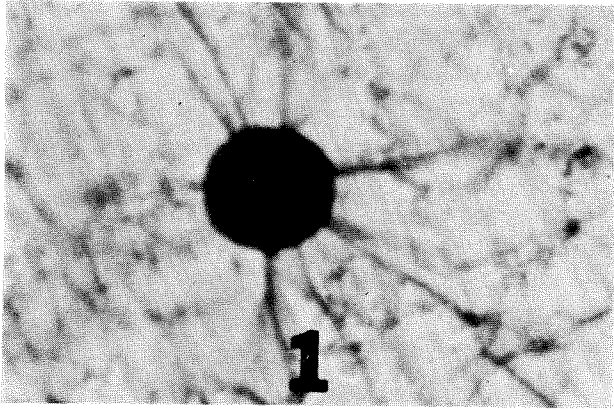
Examinations of shell fragments revealed the common occurrence of four fungal-like forms. Each of the forms are apparently capable of penetrating all three layers of the shell, the perio-

stracum, prismatic and nacreous layers. A very common boring (Figs. 1,2), similar to ones described earlier by Cavaliere and Alberte (1970), is composed of a single, globose sporangium (35 μ in diameter) surrounded by 8–15 radiating, sparsely branched hyphae. The hyphae appear to extend some 30–65 μ from the sporangium and are about 2 μ in width. In several specimens (Fig. 1) a single, central pore, approximately 9 μ in diameter, was observed.

Two additional forms display a much more complex hyphal system. In one (Fig. 3) the single, oval or subspherical fruiting structure measures about 10–16 μ in diameter. Two or three stout (3–6 μ wide), vegetative hyphae radiate from the sporangium and become profusely branched. The extensive hyphal system may extend over 100 μ extramatrically. Another form (Fig. 4) exhibits stout, dichotomously branched hyphae (5–6 μ in diameter). Structures which appear to be small sporangia are borne laterally along the hyphal strands.

A final form (Fig. 5) appears quite common in Icelandic shells and has been described several times before (Porter and Zebrowski, 1937; Johnson and Anderson, 1962; Cavaliere and Alberte, 1970). The organism is composed of a massive hyphal and sporangial system. The sporangia are approximately 15 μ in diameter, each with a pore opening at the shell surface. The hyphae form a reticulated network which completely ramifies the substrate.

Figures 1–5. Calcareophilous forms. 1,2. Spherical sporangia-like forms with radiating hyphae. 3,4. Fungal-like forms having profusely branched hyphae. 5. Massive sporangial and hyphal system. Figure 5, 100X; all others, 200X.



DISCUSSION

The symmetry of form which tends to reoccur on several types of shells supports the possibility that what is being observed is more than mere tunnelings, cracks or artifacts of the shell. In addition, there are remarkable similarities between these "fungi" which appear in shells and other well known phycomycetous forms. Several factors, however, cast doubts on the actual existence of these fungi. All attempts made to culture them from fresh as well as dried bivalves have thus far failed. Porter and Zebrowski (1937) reported that they were able to isolate spores and hyphae by dissolving the shell fragments, however, our attempts along the same lines have failed. Finally, under the present methods of investigation we have not been able to determine whether we are dealing with fossilized remains of organisms, or indeed if they are fungi, whether they are recent and contemporary forms.

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