Notes on Aristothamnion purpuriferum (Kütz.) J. Ag.

By

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INTRODUCTION.

This South African seaweed is listed by Stephenson (8), and known by local phycologists, as *Pleonosporium purpuriferum* (Kütz.) de Toni. In Kylin's (6) recent publication on the genera of the Rhodophyceae it appears as *Aristothamnion purpuriferum*, by which name I shall discuss it. The purpose of the present paper is to record the occurrence of tetrasporangia and to discuss this plant's taxonomy.

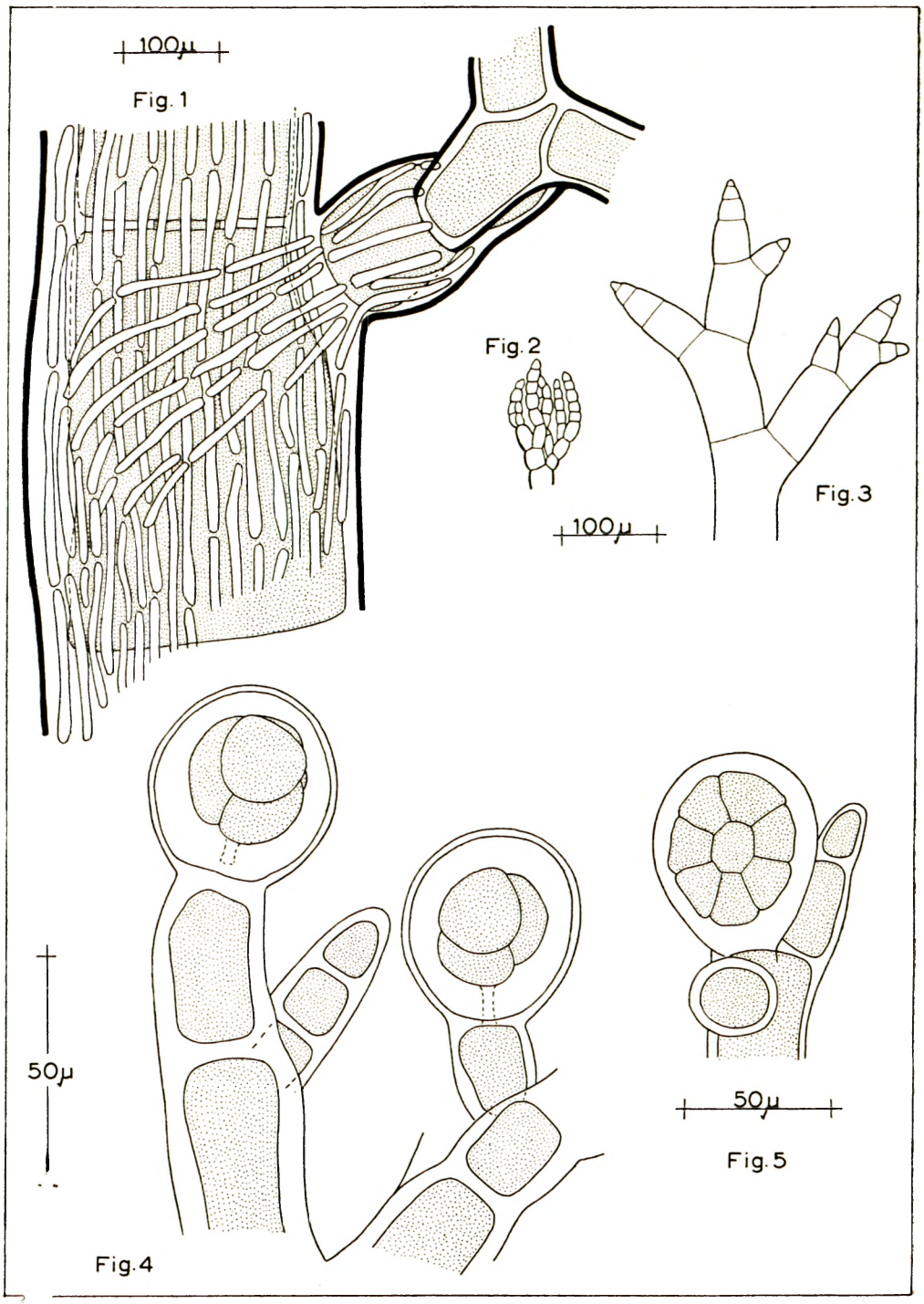
MORPHOLOGY.

A full description of the morphology of *A. purpuriferum* has been given by Westbrook (9) who regarded it as a species of *Callithamnion*. For purposes of clarity its salient features are given here.

It is one of the species of Ceramiaceae with a well developed cortex made up of decurrent filaments arising at the lower ends of branches (Fig. 1). The ultimate branches are always uncorticated and two types can be distinguished—those of limited growth and those of unlimited growth. The apices of branches of unlimited growth have corymbosely clustered and inflexed branchlets (Fig. 2), but branches of limited growth have branchlets which spread and rapidly taper to acute apices (Fig. 3). The plants are typically dioecious with a separate sporophytic phase. Female organs are produced laterally on intercalary cells near the apices of branches of unlimited growth, whereas male organs occur laterally on intercalary cells of branches of limited growth. Both poly- and tetrasporangia have been recorded as lateral structures on intercalary cells of branches of limited growth.

OBSERVATIONS.

In the many male and female plants I have examined the reproductive organs occurred in the positions noted above. On certain plants I have found polysporangia also occupying the position described for them. Such plants have borne no other type of reproductive structure. The only tetrasporangia observed have occupied an unexpected position. These arise on occasional plants bearing numerous female structures in all stages of development up to maturity and appearing therefore to be female plants. In these specimens the apical cell of a branch of unlimited growth is occasionally replaced by a subglobose swelling containing four tetrahedrally arranged spores (Fig. 4). The wall of such a sporangium is very thick and a distinct pit-connection is visible between the subtending vegetative cell and the spore group. These sporangia are nearly twice as wide as their subtending cells, but narrower than a mature polysporangium (Fig. 5). Tetrasporangia have a diameter of 25–35 μ; an average sized polysporangium is 50 μ in diameter.


100μ
Fig. 1
Fig. 2
100μ
Fig. 3
50μ
Fig. 4
50μ
Fig. 5

Further sporangium-like bodies with undivided contents are encountered in exactly similar positions to the tetrasporangia described above, but whether they are mature monosporangia or immature tetrasporangia I have not been able to ascertain. They appear to be more numerous than tetrasporangia but nevertheless occur only occasionally. Cystocarps have been observed arising lower down on branches terminating in either of these sporangial structures.

RECORDS OF " ABNORMAL " TETRASPORANGIA AND THEIR SIGNIFICANCE IN THE CERAMIACEAE.

The occurrence of the tetrasporangia is " abnormal " in that they are produced on apparently female plants. Records of such occurrence are not uncommon in the Ceramiaceae, particularly in species of *Callithamnion*. Westbrook (10) records a single tetrasporangium arising terminally on a branch of a female plant of *C. tetricum*, an " abnormality " apparently similar to that now recorded for *A. purpuriferum*. The normal position of tetrasporangia of *C. tetricum* is on separate sporophytic plants where they are borne laterally on branches of limited growth, as are the polysporangia of *A. purpuriferum*. Westbrook did not investigate the cytology of the " abnormal " sporangia on *C. tetricum* but seemed to think that no reduction division accompanied the formation of their spores. She referred, however, to an account of *C. brachiatum* by Mathias (7) of similar " abnormal " sporangia in which there was meiosis. Drew (Fritsch 5) found reduction division taking place in the formation of tetraspores produced on plants of *Spermothamnion turneri*—a related species—bearing functional female organs. It is possible that conclusions similar to Drew's may result from cytological study of the " abnormal " sporangia of *C. tetricum* and *A. purpuriferum*.

The significance of the occurrence of reduction division in the production of such " abnormal " spores is that the plants bearing them are diploid and the carpospores resulting from the fertilisation of procarps arising on the same plants should be triploid. Drew found evidence of triploid carpospores developing on plants of *S. turneri* which also bore tetrasporangia. It is obvious that until the cytology of the " abnormal " sporangia in *A. purpuriferum* is investigated no conclusions may be drawn as to whether the plants producing them are haploid or diploid.

OCCURRENCE OF TETRASPORES IN *A. PURPURIFERUM* IN RELATION TO ITS TAXONOMY.

There are apparently only two other references to the occurrence of tetrasporangia in *A. purpuriferum* both of which seem attributable to de Toni (3). Baardseth (2) questions the validity of de Toni's claim that tetrasporangia are produced by this plant;

FIG. 1.—Origin of cortical filaments.

FIG. 2.—Ultimate branchlets of branch of unlimited growth.

FIG. 3.—Ultimate branchlets of branch of limited growth.

FIG. 4.—Tetrasporangia terminating ultimate branchlets.

FIG. 5.—Mature polysporangium above and developing polysporangium below on a cell of a branch of limited growth.

he could not find tetrasporangia in material he examined, and noted that this had also been the experience of Papenfuss, with whom he had communicated privately on this matter. Westbrook (9) also mentions the occurrence of tetrasporangia in this species but she did not find any in the plants she examined. Since she did not name her authority for this statement it seems likely that she accepted de Toni's record. Thus the evidence of most investigators of this plant is that normal tetrasporangia are not produced.

The absence of normal tetrasporangia in this species is taxonomically important because this was the character used originally by Agardh to separate the genus *Aristothamnion* from *Callithamnion*. Sporophytic plants of species of *Callithamnion* characteristically produce tetrasporangia in the asexual phase, whereas in *Aristothamnion* it is only polysporangia that are produced by plants of this phase. In all other respects the two genera are indistinguishable. Apparently de Toni regarded the production of polysporangia in members of the Ceramiaceae as taxonomically fundamental and placed all species with this feature in his genus *Pleonosporium*. Westbrook (9), however, did not share this view but placed more emphasis on the characters of male and female structures. Because the position and structure of the male and female organs are identical in *A. purpuriferum* and *Callithamnion* spp., but quite unlike those of *Pleonosporium* spp., Westbrook placed *A. purpuriferum* in the genus *Callithamnion*.

Feldman-Mazoyer (4) in her treatise on the Ceramiaceae of the Mediterranean, concluded that the structure and development of the female organs were the only reliable characters indicating relationships and leading to a natural classification within the family. This is partly in agreement with Westbrook's view and seems the most logical. Her conclusion as to the relationship of *A. purpuriferum* with *Callithamnion* was therefore justified. But she was under the impression that normal tetrasporangia were produced by this plant and there seemed no reason for separating it from the genus *Callithamnion* as was proposed by Agardh (1).

CONCLUSIONS.

My record of tetrasporangia in *A. purpuriferum* is the first that has been made since de Toni's (3). The cytology of these structures has not been adequately investigated but they are " abnormal " in that they occur on plants bearing functional female organs. It would seem from the evidence of most investigators that sporophytic plants produce only polysporangia, and this character remains a point of difference between the genera *Aristothamnion* and *Callithamnion*. Although polysporangia are recorded for various species of *Callithamnion* they are accompanied by tetrasporangia (Fritsch 5, p. 729). Even if the tetrasporangia that I have described above should prove to arise on diploid plants forming a sporophytic phase of this species, their situation is not typical of species of *Callithamnion*. In this connection it should be noted that the tetrasporangia recorded by Mathias (7) as arising on sexual plants of *C. brachiatum* occurred in the lateral position normal for this genus. Also, Westbrook (10) found lateral tetrasporangia on the same female plant of *C. tetricum* which bore a single terminal tetrasporangium. It therefore seems appropriate at this stage to retain the name *Aristothamnion purpuriferum* (Kütz.) J. Ag. for the present species.

SUMMARY.

A new record of tetrasporangia in *Aristothamnion purpuriferum* is given. These tetrasporangia are abnormal in that they occur on individuals bearing mature female organs. Their morphological and taxonomic significance is discussed and it is concluded that in the present state of our knowledge this plant should be known as *A. purpuriferum* (Kütz.) J. Ag.

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