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Observations on *Arthrothamnus bifidus* J. Ag.

By

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Arthrothamnus bifidus J. Ag. was described for the first time by Gmelin under *Fucus bifidus* basing on a specimen from Kamtchatka, and then Ruprecht reported the same plant under a different name, *A. radicans*. In 1930 Yendo touched upon this species when he described a new species of *Hedophyllum* and discussed its systematic relation to *Thalassiophyllum* and *Arthrothamnus*. He described very precisely the development of young plants produced from gametophytes, but commented rather reservedly on the development of tertiary fronds from auricles. But so far as the writer is aware, besides this there is no report on the development of the auricles nor on the sorus of this alga.

The present apecies is distributed in the northern parts of the Pacific, from the Aleutian Islands westward to the Island of Hokkaidō, Japan. The southern limit of its distribution lies most probably around Kusiro, on the south eastern coast of Hokkaidō. Near the Akkesi Biological Station of our University which is located near Kusiro this very interesting alga is found in abundance.

Being favoured by this favorable condition the writer has been paying special attention to this alga since 1931, for elucidating specially how and when sori are produced, and also how young blades are produced from auricles which are very peculiar to the present species as well as to its systematic ally, *A. kurilensis* Rupr. These questions have been answered, fortunately, by collecting specimens nearly every month throughout the whole year.

The sori of the unilocular sporangia are produced always in winter time, at first on the under surface of blades in two parallel rows, leaving the central part about 1–2 cm wide and both margins sterile. Later, however, these two parallel rows join into one in several places, the central sterile portion also becoming fertile. Still later sori begin to appear also on the upper surface forming one irregular longitudinal line, which occupies the central portion of the blades. The unilocular sporangia are clavate in shape, approximately 110 μ long and 13 μ in the broadest diameter.

Fig. 1. A full-grown sterile specimen collected by S. KAWABATA in the Island of Sikotan, Kuriles, in July 1934.

Paraphyses are approximately 160 μ long becoming gradually thicker upwards, and at their top they bear a mucilage-cap which measures about 40 μ in hight.

The development of new blades from the auricles is quite interesting.

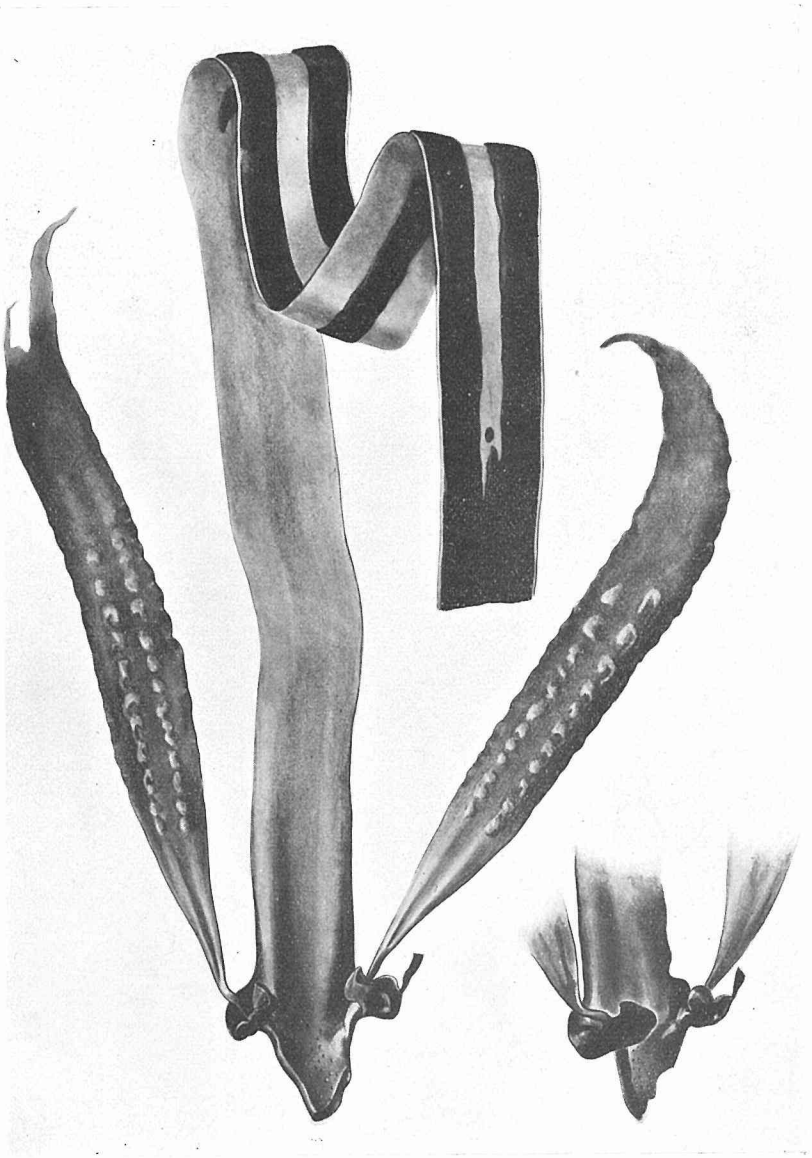

Fig. 2. A soriferous specimen bearing two new young blades, which was collected near Akkesi, Kusiro Prov., Hokkaidō in March 1934.

The accompanying figures show this matter clearly (Fig. 3, A–C). The auricles generally do not grow beyond about 4–5 cm. The full-grown auricles roll inward, often showing some bullations on them. The inner-

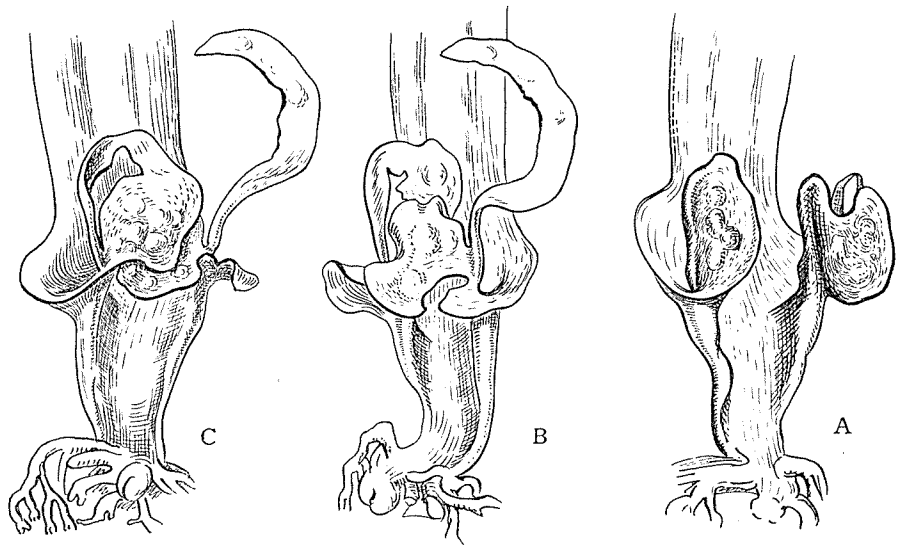

Fig. 3. A. Basal portion of the frond showing full-grown auricles, The innermost part of one auricle is clearly thickened longitudinally. B. and C. More advanced stages.

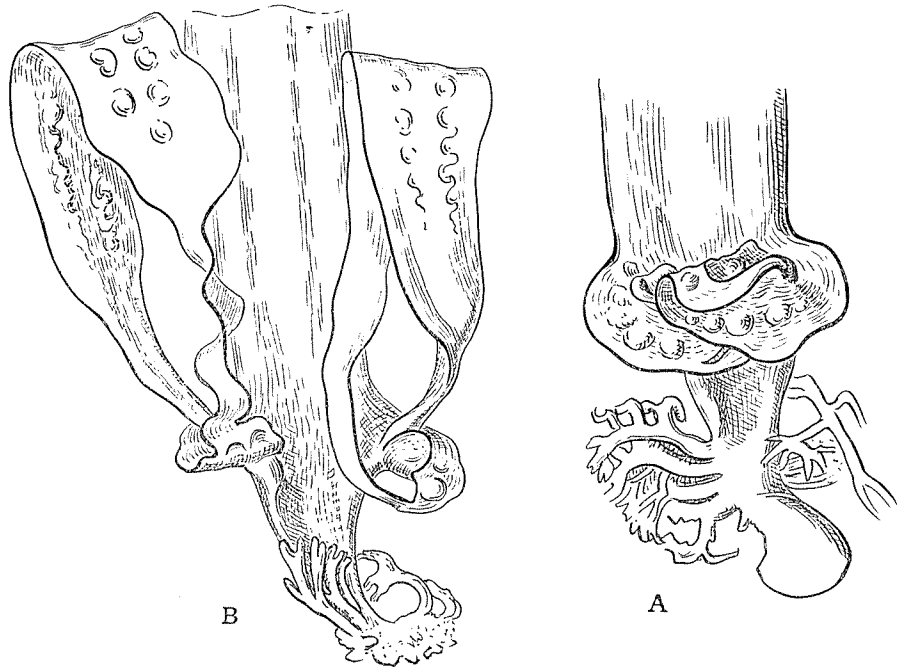

Fig. 4. A. A specimen with bending auricles. B. A more advanced stage. The tops of the young blades are still connected with the auricles.

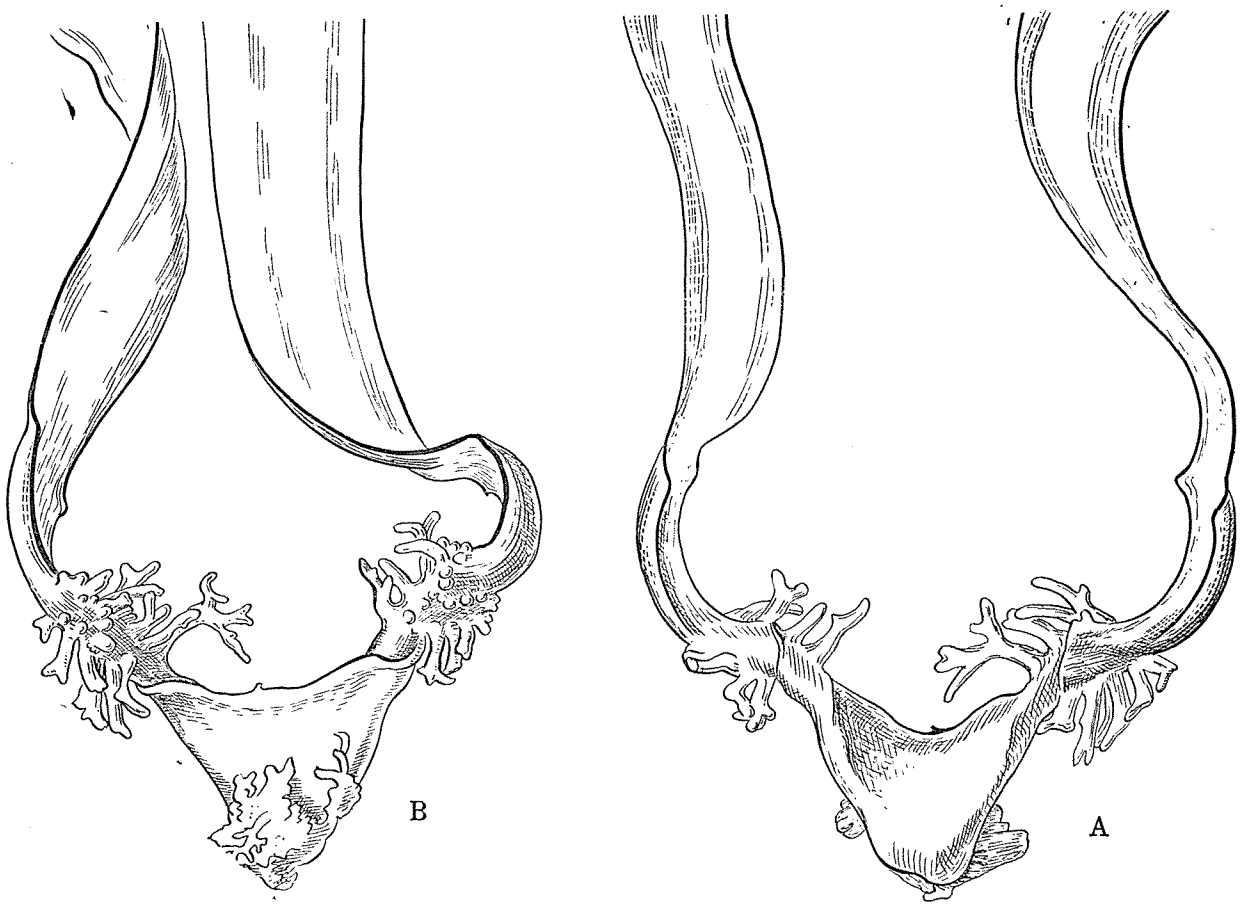

Fig. 5. A. A specimen the old blade of which was cut off. The beginning of auricles has already appeared on the young blades. The new roots are also issued. B. The same specimen seen from below.

most margin becomes evidently thicker than the other portion, forming the beginning of a new stem (Fig. 3, A). Then this thick portion is cut from the other thin portion and begins to grow, in most cases tearing off the upper marginal portion of the auricles as a sickle-shaped leaflet (Fig. 3, B–C). This occurs probably because the growth takes place only at this thick portion, now the continuation of the margin of an old frond, while in other portion of the auricles no growth takes place. In some cases, however, it is observed that both auricles lay down forward one upon another (Fig. 4, A), and also that new blades remain for some time connected with the margin of the auricles at their extremities (Fig. 4, B). That the outer margin of small sickle-shaped leaflet thus formed is always smooth while the other margin is not, is very easily explainable. The outer smooth margin represents the margin of the auricles, while the inner margin corresponds to the place where the new leaflets are torn away from the auricles. This special tendency of new leaflets to be sickle-shaped in the upper part can be recognised until they reach the length of about 30 cm. On the new baldes of about this size there are already two rows of bullations as in Fig. 2, while according to YENDO there is no bullation on the blades which are produced from gametophytes directly. Two stems which are newly produced are contorted inward and this fact is emphasised by the scars left behind by the fallen auricles. While two young blades are growing, the old soriferous one begins to be worn away. Decaying proceeds from the top of old blades downwards, but in most cases this does not continue gradually to its very base, but before the decay reaches there, a special region appears at the very base of the old blades, where the tissue begins to decay and the colour changes into black. Thus the remaining part of the old blades is cut down suddenly at this place. That is why the cut end is always rather smooth (Fig. 5, A–B).

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