

Asparagopsis in Europe

THE spread of *Asparagopsis* in Europe has rightly attracted considerable attention, but the excitement with which each new record has been greeted has tended to obscure certain unanswered questions regarding two species at present accepted, *A. armata* Harv. and *A. taxiformis* (Delile) Trev.

Montagne¹ based the original treatment of the genus on *Fucus taxiformis* Delile², although changing the epithet to the illegitimate *delilei*; the combination *Asparagopsis taxiformis*, usually credited to Collins and Hervey³, was, in fact, used by Trevisan⁴ and afterwards overlooked. *A. taxiformis* has been reported widely from the tropical waters of the Pacific, Indian and Atlantic Oceans, the most northerly records in the latter being from Bermuda, the Canary Islands, and possibly the Azores⁵, although the latter report has been questioned⁶. *A. taxiformis* has also been reported from the Mediterranean, where it is said to be restricted to the eastern region. Apart from some observations by Schiffner⁷, which have been disputed, there appears to be only one record, from Algeria, of the occurrence of *A. taxiformis* as such in the western Mediterranean, and that is based on a drift specimen thought to have originated in the eastern region⁸. However, it should be noted that the type locality for *Falkenbergia hillebrandii*, the alternate phase in the life-history of *Asparagopsis taxiformis*, is the Island of Elba, and there are other early reports⁹ of the occurrence of this entity in the western Mediterranean. *Asparagopsis armata* was first described from Australia during the last century and specimens referred to this species were first identified in Europe some forty years ago. Further reports of its occurrence in various localities in north-west Europe and North Africa have been made over the years, but there is still a marked disjunction in tropical waters between the European and Australian areas of distribution.

The first question to be answered concerns the relationship between *A. armata* and *A. taxiformis*. From the literature^{6,10} it would appear that the only difference between the two algae is the occurrence of branches bearing spines in the former. The type material of *A. armata* is now preserved in the herbarium of Trinity College, Dublin, and, although the present location of Delile's type specimens is unknown¹¹, part at least of Delile's original collection of *A. taxiformis* has been found in the Lamouroux Herbarium during a visit to the Institut Botanique, Caen. Examination of these type materials and of other collections confirms that the presence or absence of spine-bearing branches is the only criterion by which the two entities can be distinguished. *A. taxiformis* and *A. armata* have been accepted as distinct species by all authors except Schiffner⁷, who considered them merely as growth forms of a single species.

Schiffner's observations have been ignored or dismissed as the erroneous interpretation of badly prepared specimens¹⁰, but some recent personal observations indicate that further investigation of the production of spine-bearing branches in this genus is necessary. During the past few years, several specimens of *Asparagopsis* in which the spine-bearing branches characteristic of *A. armata* were very reduced in size and number have been collected at various localities on the south and west coasts of Britain and Ireland, while in a single collection from the Isles of Scilly no trace of the spine-bearing branches could be found so that the fronds were otherwise indistinguishable from those referred to *A. taxiformis*. In connexion with this problem, it should be noted also that there are no apparent morphological differences between *Falkenbergia rufolanosa* and *F. hillebrandii*, the alternate phases in the life-histories of *A. armata* and *A. taxiformis* respectively.

The second question relates to the origin of the European material referred to *A. armata*. It has been accepted universally that the European material was initially of

Australian origin but, in view of the doubts as to the relationship between *A. taxiformis* and *A. armata*, a re-consideration of the origin of the European material is warranted. Whether this can now be undertaken depends very largely on the extent to which the taxonomic problem can be elucidated.

The third question concerns the life-history of the entity in the British Isles. Tetrasporangia have never been detected in the *Falkenbergia* phase in Britain or Ireland, while plants of the *Asparagopsis* phase with carpospores appear to be diminishing in frequency¹². The barbed branches of the *Asparagopsis* phase facilitate vegetative propagation and the floating 'balls' of the *Falkenbergia* phase, which occur so abundantly on occasions in British waters, have been observed to re-attach with ease¹³. The new attachment is relatively weak and the 'ball' is readily detached so that it may well be moved on many times during its life. These observations suggest that independent propagation of both the *Asparagopsis* and *Falkenbergia* phases is occurring and that the actual life-history of the entity in British waters may not be the functional sequence of sexual, carposporic and tetrasporic phases demonstrated in other areas¹⁴. It is probable that this independent vegetative propagation is a likely explanation for the small differences in geographical distribution of the two phases which have become increasingly marked during recent years and which have been attributed by various authors^{15,16} to differences in ecological requirements.

These three questions demonstrate the deficiencies in our knowledge of *Asparagopsis*, which is by no means as complete as is often assumed. By directing attention to the crucial problem of the relationship between *A. taxiformis* and *A. armata* it is hoped that further investigations will provide the answers to this, and the related problems. In this connexion, reports of the occurrence of spineless specimens of *Asparagopsis* in Britain will be particularly valuable.

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Mechanism for Nitrogen-increased Shoot/Root Ratios

ABERG's review¹ cites Söding (*Die Wuchstofflehre*, Georg Thieme Verlag, Stuttgart, Germany, 1952) as suggesting that the generally recognized increased shoot/root ratios resulting from nitrogen fertilization are caused by nitrogen-increased growth hormone content which, in turn, inhibits root growth and promotes shoot growth in the intact plant. This suggestion appears reasonable and was supported by Boscmark², who compared the growth of roots in high nitrogen solution with that of roots growing in solutions containing growth hormones.

Strong experimental support for this hypothesis was obtained from two experiments conducted in this Labora-