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OBSERVATIONS ON *SPHENIA BINGHAMI* TURTON

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(Text-figs. 1, 2)

The family Myidae is represented in British seas by the two large and well-known species, *Mya arenaria* L. and *M. truncata* L., which burrow deeply into muddy sand and into stiff mud or clay respectively, and by the much smaller *Sphenia binghami* Turton. Interest in members of this family of Eulamellibranchia was aroused during 1949 when studying two species which are common along the coast of California, namely *Platyodon cancellatus* (Conrad) and *Cryptomya californica* (Conrad). These differ most interestingly in habitat. The former bores into soft rocks between tide marks, and the latter, although practically devoid of siphons, burrows deep in the mud of tidal estuaries, always in association with burrows made by various large invertebrates. The species most usually involved is *Callianassa californiensis*, a large anomuran prawn (McGinitie, 1935). The almost sessile siphons open into the sides of the burrows. Accounts of both species have been prepared for publication in California.

The desire to survey more widely the range of form and habit in this family led to this inquiry into *Sphenia binghami*. This has been described and also figured, although indifferently, by Forbes & Hanley (1853) and Jeffreys (1865). They record a wide distribution in depths of between 5 and 25 fathoms in the Mediterranean, along the Atlantic coasts of Spain and France, and around the British Isles as far north as Scarborough on the east and Skye on the west. But there is a surprising paucity of recent records, and certainly during the present century this species has been almost completely overlooked. By the kindness of Dr W. J. Rees, shells collected off Weymouth by Canon A. M. Norman and now in the possession of the British Museum (Natural History) were examined. But no complete specimens were available. *S. binghami* is not listed in the Plymouth Marine Fauna (Marine Biological Association, 1931), although it very probably occurs in that area. There are a number of early records from the Clyde sea area but no specimens have as yet been found in the course of the faunal survey at present being conducted from Millport. Dr H. O. Bull states that it is not recorded from the Cullercoats area. It is, however, listed in the Marine Fauna of the Isle of Man as occurring in various localities around the island at depths of between 12 and 26 fathoms.

Specimens were finally obtained from the marine station at Port Erin through the kindness of Dr N. Sumner Jones who identified them during the course of his work on the bottom fauna and sent them living, by air, to Glasgow. This work would have been impossible without his help and care.

Habitat

Some ten specimens were eventually received, the majority alive, the largest being only about 1 cm. long. Dr N. S. Jones writes saying that 'all the specimens I have found came from an area about one to two miles south of the Calf of Man, in about 20 fathoms. The bottom consists of gravel and fairly large stones, many of which are limestone. I picked out all the stones brought up in the dredge that showed holes bored by *Hiatella*. The *Sphenia* inhabit these holes, presumably after the death of the original occupant. I obtained them by breaking up the stones with a hammer and picking them out of the cavities. For each *Sphenia* there must have been about 50 living *Hiatella*.' The accounts given by Forbes & Hanley and by Jeffreys are very similar, the latter writing of the occurrence of *Sphenia* within cavities of limestone rocks and oyster shells perforated by *Saxicava rugosa* (*Hiatella rugosa*) and *Cliona celata* and also within the holdfasts of *Laminaria*.

There is no doubt that *Sphenia* has been overlooked for so long owing to confusion with the much commoner *Hiatella* with which it normally lives and which it superficially resembles. When the siphons are extended distinction between the species is easy, those of *Hiatella* being red and also relatively longer with the two openings the more widely separated. But when contracted only careful examination of the ligament, external in *Hiatella* and internal in *Sphenia*, provides certain indication. Both *Sphenia* and the two species of *Hiatella*, no matter whether the latter are boring or byssal-attached individuals (Hunter, 1949) are frequently very iregular in shape. Jeffreys refers to the frequent distortion of the shell in *Sphenia* and this was also noted in all the specimens personally examined, three of which are shown in Fig. 1. This irregular shape is certainly associated with the mode of life, namely attachment by byssus (see Fig. 1 B) within crevices, often those initially formed or else increased in size by *Hiatella*, in stones or shells. The lack of mobility and the nature of the habitat was further indicated by the presence of encrusting growths of hydroids, polyzoa, etc., both on the shell and on the periostracum at the base of the siphons.

Description

Shell. This is white in colour and typically almost twice as long as broad, seldom much exceeding 1 cm. in length. It has been well described by Forbes & Hanley and by Jeffreys, and only points of special interest demand mention. The hinge is situated about one-third of the distance from the anterior end and possesses the chondrophore characteristic of the Myidae with the associated condensed internal ligament (Fig. 2, *l*). The asymmetry of the hinge mechanism is responsible, as in all Myidae, for the shell being inequivalve, the right valve being the larger as shown in Fig. 1, A–C. This asymmetry is still more marked in *Aloidis* (*Corbula*), a genus included with the Myidae in the Myacea (see Thiele, 1935). There is a slight posterior gape but the shell valves in this region as indicated in Fig. 1 A–C, are very weakly calcified, another point of resemblance with *Aloidis*, although calcified plates occur in this region in *A. gibba* (Yonge, 1946).

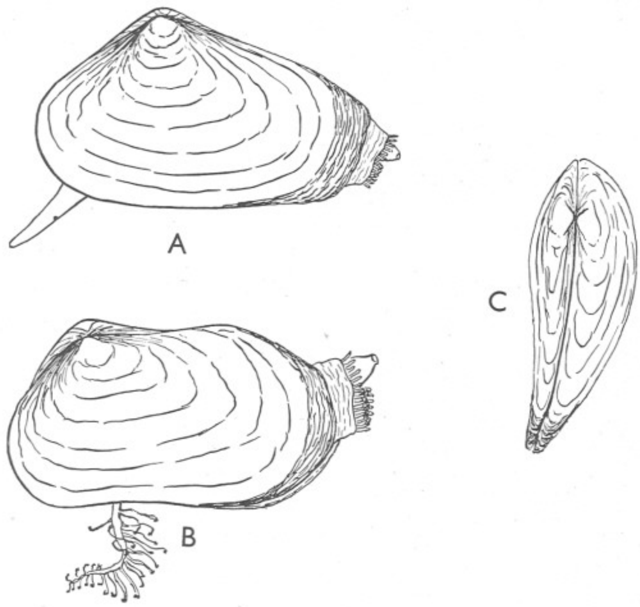

Fig. 1. *Sphenia binghami*, sketches of living specimens showing variation in form. A, specimen viewed from left side with foot and siphons projecting, ×10; B, specimen showing byssus, also siphons projecting, ×8; C, specimen viewed from dorsal aspect showing asymmetry of valves, right being the larger, and also twisting of the shell valves posteriorly due to environmental influences, ×4. In all the posterior area of uncalcified shell is indicated.

Intact animal. The only previous description of the living animal appears to be that furnished by Forbes & Hanley, and based on an account by a Mr Clark who observed the animal at Exmouth. It is substantially correct. As shown in Fig. 1 A, the small foot is thin and wedge-shaped, its prime function being to plant the stout byssus thread shown in Fig. 1 B. The short siphons are united and, as in Myidae generally, surrounded with periostracum. The siphons are thus composed of the inner and middle lobes of the mantle edge, together with the periostracal groove (Yonge, 1948). There is a common outer row of simple tentacles, numbering about 36 in a specimen of shell length 8·0 mm. The inhalant siphon is fringed with an inner row of tentacles, about 12 in number in the specimen mentioned above. These arch inwards, acting as strainers. The exhalant siphon has a tubular membrane which is very mobile. Although slightly longer, the siphons of *Sphenia* closely resemble those of *Aloidis gibba* (Yonge, 1946). But they are less sensitive, probably because there is much less danger of any sudden intake of sediment than in the mud-living *A. gibba*.

Organs in the mantle cavity. The appearance after removal of the left shell valve and mantle lobe is shown in Fig. 2. Owing to the greater portion of the shell being posterior to the hinge and umbo—associated presumably with byssal attachment—the anterior adductor (*ad*) is much smaller than the posterior adductor (*pd*) and is also displaced ventrally. The same is true of the

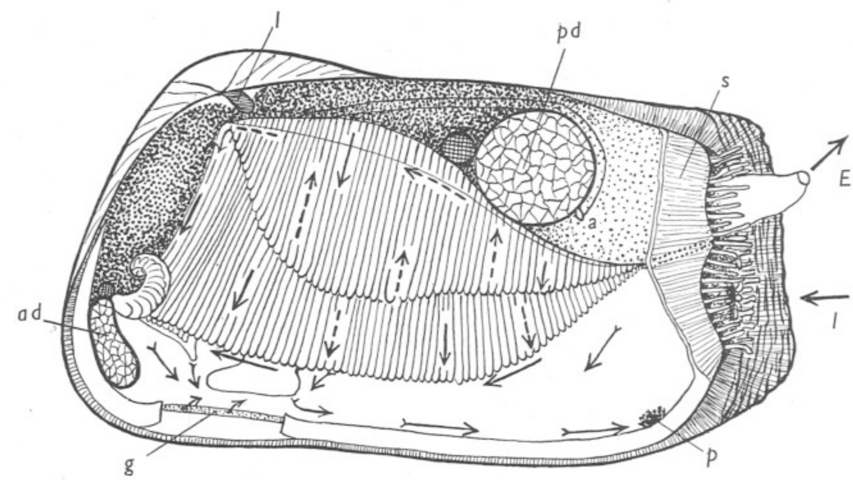

Fig. 2. *S. binghami*, animal viewed from left side after removal of left shell valve and mantle lobe, × 10. *a*, anus; *ad*, anterior adductor; *E*, *I*, exhalant and inhalant currents; *g*, glandular area; *l*, internal ligament; *p*, pseudofaeces; *pd* posterior adductor; *s*, base of siphons covered with periostracum. Complete arrows show currents on exposed surfaces on gills, broken arrows currents on under surfaces, feathered arrowas rejection currents.

anterior pedal retractor. The pedal gape is small, in correspondence with the small size of the foot, and the inner opening is bounded laterally by glandular areas (*g*), just as described in *Mya* (Vlès, 1909) and *Aloidis* (Yonge, 1946), and also present in *Cryptomya* and *Platyodon*. This appears to be a characteristic feature of the Myacea. Apart from the pedal gape the mantle edges are united ventrally, the inner and middle lobes being fused and also the periostracal grooves so that, as in the siphons, the mantle tissues exposed ventrally when the valves separate are everywhere covered with periostracum. But the mantle edges are not thickened as they are in the deep-burrowing *Mya arenaria* or *M. truncata* where, as previously suggested (Yonge, 1949), they probably assist in separating the shell valves. The gills, which are not plicated, are large, the inner demibranch being the larger but the outer one having a short supra-axial extension. There is a food groove along the edge of the inner demibranch only. The palps are small but typical in form; they have few but relatively large ridges.

The only point of interest in the internal anatomy is the style which lies in a sac separated from the mid-gut as in all other Myidae (though not in *Aloidis*). It is stout and straight and can be seen through the translucent walls of the visceral mass in the intact animal after removal of the shell. It was observed to rotate at a speed of about 60 revolutions a minute.

Ciliary currents. The nature of these is indicated by the arrows on Fig. 2. Frontal cilia carry particles ventralward on the outer surface of the outer demibranch but dorsalward, to the axis, on the inner surface. Along the axis there is a weak forward current. Although there is no food groove along the ventral margin of the outer demibranch, and most particles are carried around it to the inner surface, there is some slight forward movement due probably to large cilia such as those described in *Aloidis* where the course of the ciliary currents is identical in other respects (Yonge, 1946). On the inner demibranch frontal cilia beat ventralward on both faces and particles are carried oralward in a marginal food groove. Particles on the mantle surface are conveyed ventrally and eventually accumulate at the posterior end as masses of pseudofaeces (*p*). The cilia on the glandular patches lateral to the pedal gape are especially dense and long, and beat away from the pedal gape; there are small vortices on either side of the posterior end of the pedal gape, although not as well developed as those in *Mya* (Kellogg, 1915; Yonge, 1923). This again indicates that the problem of removing excess material from the mantle cavity is much less in byssally attached bivalves living in clean water than in those that burrow in soft substrata.

Discussion

Sphenia binghami is revealed as a member of the sublittoral fauna specialized for life at moderate depths under rather restricted conditions, but clearly less successfully than the two species of *Hiatella*, individuals of which are so very much the more common. The shell in *Sphenia* can certainly be modified to suit the constraint of the habitat while the foot, though doubtless capable of enabling the animal to move, is primarily concerned with planting the byssus. This mode of attachment is probably responsible, as in *Mytilus*, for the reduction of the anterior in relation to the posterior portion of the body. Unlike the other members of the Myidae, *Sphenia* is heteromyarian. The short siphons are adequate for the collection of suspended matter on which the animal feeds.

After publication of the accounts of *Cryptomya* and *Platyodon*, it is hoped to prepare a comparative account of the Myacea (i.e. the Myidae and also

Aloidis) showing how the basic form possessed by this group of Eulamellibranchia has been variously modified in connexion with specialization for life under a surprising variety of conditions.

Summary

Sphenia binghami Turton is a small member of the Myidae with the characteristic features of this family but adapted for life attached by a byssus within crevices in stones or shells at moderate depths. It is usually found with species of the much more numerous *Hiatella*. It has been confused with these, all having characteristically irregular shells. But examination of the ligament (internal in *Sphenia*, external in *Hiatella*) is enough to distinguish between them. Byssal attachment is probably responsible for the reduction of the anterior in relation to the posterior portion of the body and so for the heteromyarian condition not found in other genera of the Myidae.

REFERENCES

FORBES, E. & HANLEY, S., 1853. *A History of British Mollusca, and their Shells*, Vol. I. London.

HUNTER, W. R., 1949. The structure and behaviour of *Hiatella gallicana* (Lamarck) and *H. arctica* (L.), with special reference to the boring habit. *Proc. Roy. Soc. Edinb.*, B, Vol. 63, pp. 271–89.

JEFFREYS, J. G., 1865. *British Conchology*, Vol. III. London.

KELLOGG, J. L., 1915. Ciliary mechanisms of lamellibranchs with descriptions of anatomy. *Journ. Morph.*, Vol. 26, pp. 625–701.

MCGINITIE, G. E., 1935. Ecological aspects of a California marine estuary. *Amer. Midl. Nat.*, Vol. 16, pp. 629–765.

MARINE BIOLOGICAL ASSOCIATION, 1931. *Plymouth Marine Fauna*. 2nd ed.

THIELE, J., 1935. *Handbuch der systematischen Weichtierkunde*. Dritter Teil. Classis Bivalvia. Jena.

VLÈS, F., 1909. Monographie sommaire de la Mye (*Mya arenaria* Linné 1767). *Mém. Soc. Zool. France*, T. 22, pp. 90–141.

YONGE, C. M., 1923. The mechanism of feeding, digestion, and assimilation in the lamellibranch *Mya*. *Brit. J. Exp. Biol.*, Vol. 1, pp. 15–63.

—— 1946. On the habits and adaptations of *Aloidis* (*Corbula*) *gibba*. *Journ. Mar. Biol. Assoc.*, Vol. 26, pp. 258–76.

—— 1948. Formation of siphons in Lamellibranchia. *Nature*, Vol. 161, p. 198.

—— 1949. On the structure and adaptations of the Tellinacea, deposit-feeding Eulamellibranchia. *Phil. Trans. Roy. Soc. Lond.*, B, Vol. 234, pp. 29–76.