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PREDATION AND FEEDING IN THE NATICID GASTROPOD *NATICARIUS INTRICATOIDES* (HIDALGO)

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Abstract

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Muricid gastropods are known to drill by a combination of mechanical (scraping with the radula) and chemical (dissolution of calcium carbonate by the action of an enzyme or an acid) means. The latter activity is controlled by a gland termed the accessory boring organ (ABO). Whether or not naticids have a functional ABO has long remained a moot point. Observations are here presented for a recent species of naticids that support the hypothesis of an ABO in that group. Laboratory studies show that *Naticarius* attacks its prey on the surface of the sediment; the normally observed behaviour for naticids is that they drill while submerged in the sediment. The palaeoecological significance of these observations is discussed.

Introduction

Naticids are well known to be important predators of marine infaunal molluscs and, together with muricids, leave unequivocal traces of their activities in the fossil record. Normally naticids attack and consume their prey within the sediment (Ziegelmeier, 1954; Reyment, 1966, 1967; Taylor, 1970; Adegoke and Tevesz, 1972; Berg and Nishenko, 1975; Dudley and Vermeij, 1978; Martinell and Porta, 1980; Carriker, 1981; Kitchell et al., 1981). There are, however, occasional reports of active hunting on the surface of the sediment (cf. Bromley, 1981).

In the present note, we record the results of laboratory investigations on the behaviour of the naticid species *Naticarius intricatoides* (Hidalgo) on the infaunal bivalve *Chamalea gallina* (L.). The predator did not perform in accordance with the generally demonstrated behavioural mode of naticids in that the initial attack, manipulation of the prey, drilling and feeding took place on the surface of the sediment. Our observations indicate the likelihood of *Naticarius*, as well as a second naticid species of the genus *Tectonatica*, having used an accessory boring organ (ABO) in the drilling process.

Methods

The observations were made in the Department of Geology, University of Málaga, in June, 1987. The experiments were made in an aquarium with a volume of 50 l, containing normal seawater. The predator, *Naticarius intricatoides*, was collected from a depth of 5–10 m, on a sandy bottom, in the fishing harbour of Fuengirola, Province of Málaga, Spain, using standard dredging equipment. The bivalve, *Chamalea gallina*, was taken at the same time from the same locality.

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The water temperature during the period of laboratory observation was between 23 and 28°C. The period required for the episode of predation was between 24 and 32 hr. The sediment used in the aquarium was the same as that encountered by the animals in their natural habitat.

Results and discussion

The act of predation was initiated by the naticid mounting the bivalve, which was situated on the surface of the sediment. Despite the fact that the prey moved around slowly during the period of attack, the naticid retained its initial position, firmly emplaced on the upper valve. After terminating its drilling and feeding activities (24–32 hr), the naticid abandoned the defunct bivalve and burrowed into the sediment. Examination of the dead *Chamalea* disclosed that a small, neat round hole had been drilled. Only part of the viscera of the mollusc had been consumed.

Figure 1 shows the naticid in position during the process of drilling. Figure 2 illustrates

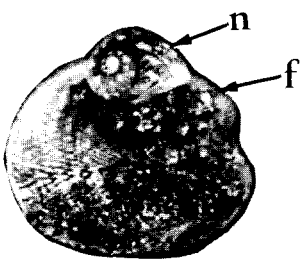

Fig.1. Photograph of *Naticarius* in the position adopted for drilling *Chamalea*. The gastropod is indicated by *n* and the extended foot by *f*. Natural size.

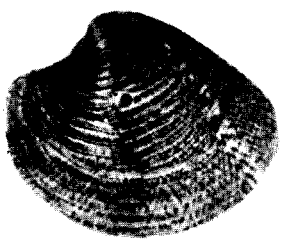

Fig.2. Location of the hole drilled by *Naticarius* in *Chamalea*. Natural size.

Fig.3. SEM photograph of the hole drilled by *Naticarius* (cf. Fig.2). The hole is not countersunk in the manner characteristic of naticids; it is surrounded by a frosted fringe. ×53.

the drilled shell and Fig.3 presents a magnified view of the borehole. It will be seen that the borehole does not display the morphology typically produced by naticids in that it is not countersunk. The area surrounding the hole (Fig.3) displays evidence of the initial application of the ABO (frosted appearance).

The SEM examination of the borehole provided evidence in support of the hypothesis put forward by Carriker (1981) to the effect that naticids, like muricids, probably use an accessory boring organ for softening the shell material prior to a phase of rasping with the radula. Bearing this in mind, it will be seen from Fig.4 that *Naticarius* began its attack at one location on the surface of the shell, as disclosed by remnant etching, and then moved to a new location a slight distance away. The SEM photograph indicates the presence of scratches on the shell-surface, presumably made by the radula. We submit that the frosting effect observed on the surface of the shell is the result of enzymatic activity from the ABO of the drill.

Further evidence in support of this opinion comes from the drilling activity of another naticid, *Tectonatica filosa* (Philippi), also from Málagan waters; again, the prey is *Chamalea*

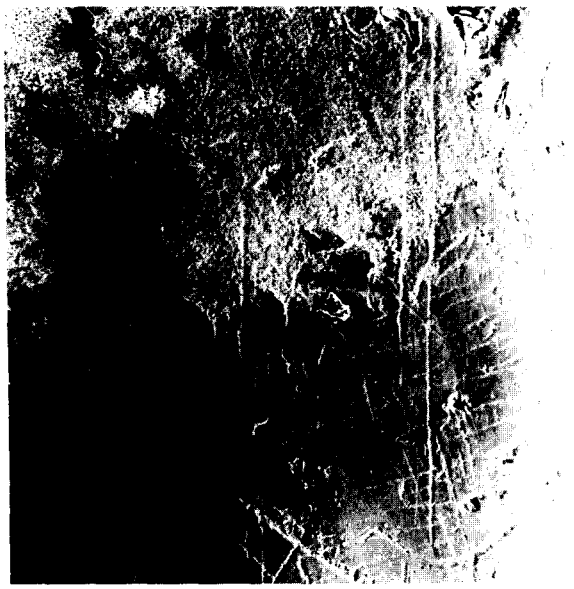

Fig.4. SEM photograph of the frosted (etched?) zone on the shell-surface of *Chamalea*. Observe the radula (?) scratches and frosted surface on the area occupied by the "false start" made by the naticid at the beginning of the drilling process. ×500.

Fig.5. Etched surface on *Chamalea* produced by *Tectonatica flambellata* at the initial phase of drilling. This corresponds to the area of application of the ABO of the gastropod. The chevroned scratches in the centre of the frosted zone probably derive from the activity of the radula. ×100.

gallina. Figure 5 shows the etched surface, bearing a few radula marks, made by the *Tectonatica* before being dislodged from the prey. It is suggested that the shape of the frosted area depicted in Fig.5 represents the area of contact of the ABO with the shell.

Conclusions

To summarize the information presented in this brief note, it seems that the case history reported here could well be the first eye-witness account of extra-sedimentary predation and feeding by a naticid gastropod. The fact that a species of naticids has been proven to behave in this manner has important consequences for the general ecology of gastropod predation and, additionally, the interpretation of the palaeoecology of drilled molluscan and cirrepede shells. It has been widely assumed that muricids and naticids hunt in virtually mutually exclusive niches (cf. Reyment, 1967). The observations presented here indicate that it may now be necessary to initiate a survey of the ethology of naticid predational strategies.

Although the evidence is somewhat circumstantial, it appears highly probable that naticids use an ABO in their drilling activity. It is therefore desirable that the question of the occurrence of an ABO in naticids, analogous to that in muricids, be made the object of a special investigation.

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