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OBSERVATIONS ON DONAX FOSSOR SAY AT ROCKAWAY BEACH, NEW YORK

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During the past summer I noticed some peculiar actions on the part of the clam *Donax fossor* which I have not seen mentioned or described in the literature. It might be of some interest and value to make a record of this.

All during the summer in the years when *D. fossor* appears in the sandy beaches of Rockaway, it can be seen and collected when it is uncovered in smaller or larger numbers by the rushing surf. As soon as the clams are uncovered they begin to burrow into the wet sand and in a few moments all of them have vanished. This repeated process caught my attention and I began to devote some time to observing it more closely.

The behavior of *D. fossor* in the rush of water is highly interesting. As soon as it is flushed from its hiding place, the clam extends its foot and its siphons. The foot is extended from the front half of the shell, reaching from about the middle point of the dorsal edge clear around to a similar point on the ventral. The foot is large, thin, the color of clouded mucous except for the tip, which is thicker and has a light buff tinge. The entire foot can be extended to a length equal to that of the shell, and the tip itself is capable of its own farther extension. This tip is very active and moves about excitedly, seeking with the aid of the incurved edge of the foot, to anchor itself against the rush of the water. Simultaneously with the foot, the siphons are exserted, the dorsal siphon (efferent or anal) pointing upward toward the dorsal line, the ventral siphon (afferent or branchial) pointing straight out, in a line almost parallel to the general direction of the ventral edge. If, however, the animal is caught in the backwash of the wave before it has succeeded in anchoring itself, it is turned so that its long axis

is parallel to the rush of the water, the wide posterior section facing in the direction of the current. As this is taking place, both siphons turn sharply toward the umbo, the dorsal siphon lying in direct contact with the posterior edge of the shell and the ventral siphon lying close alongside the latter. The siphons turn either to the left or the right, depending upon which valve the shell happened to fall. This position of the siphons is maintained until the foot finds a secure purchase in the sand. Once this has happened, the siphons surrender the curved position, assume momentarily the "relaxed" position (dorsal upward, ventral straight out) and are then immediately withdrawn. After a few preliminary wriggles while the foot is being further inserted in the sand, the shell upends and in six to ten convulsive jerks (rarely as much as thirteen), lasting from two to four seconds, it disappears. At times I have observed *D. fossor* acting in a like manner in the upsurge of a wave, but in this case the shell, instead of having the posterior section facing the ocean, has it facing the beach and the animal burrows in in this position. Occasionally the shell, in the down-rush of the water, is left in a small tide pool formed at the base of the jetty poles. In this case the siphons assume the "relaxed" position and the clam remains in this posture for some time before withdrawing the siphons and burrowing in.

Now and then, when the receding wave is weak, the clam does not assume the position perpendicular to the wave line, but remains more or less parallel to it. When this happens the siphons remain in the "relaxed" position until the moment the burrowing begins, when as usual they are withdrawn. When the current is at its roughest and the clam is hurled about, the siphons are exserted but do not curve umbo-ward. This curving takes place only when the receding water has somewhat slowed down and the clam has a chance of securing an anchorage.

When one has watched the behavior of the clam for some time, it becomes difficult to avoid the opinion that the siphons are being used either as a steering organ, to help turn the shell perpendicular to the wave line, in which case it is being aided by the elongated wedge shape of the valves, or as a braking organ to help halt the shell in its rush and to enable the foot to obtain a purchase in the sand, or as both simultaneously. Even though

I believe the second of the two conjectures to be the sounder one, we still have here a most unique function for these tubes. It can be argued that the siphons are turned umboward in an attempt to keep them from being damaged on broken bits of shells and pebbles as the shell is being swept along. But if such is the case, it is much more likely that the siphons would be entirely withdrawn into the shell. Besides, if this turning is indeed for protection, it is not clear why the dorsal siphon, which curves up near the posterior edge of the shell, needs to be better protected than the ventral siphon which lies posteriorly alongside it, since both are equally vulnerable.

If we try to seek a reason for the actions just described, we might find an answer in a report by Mori (1938) on the behavior of *Donax semigranosus* Dkr. (in his paper printed *D. semignosus*) on the coast of Okinosu in Tokusima-si, Japan. He found that *semigranosus* lived in largest concentration in the area limited seaward by the line which represents the limit of beach that is continually under water (this line moves with the tide), and landward by the line reached by the outmost lapping of the waves. (See his table I.) It is clear that to maintain this position, the mollusk has to migrate with the rising and falling of the tide, which, according to Mori it does for a distance of 3 to 6 meters at neap tide and as much as 30 meters at the spring tide. In the case of *D. fossor*, which also apparently engages in such a migration, at least during the summer months, the distance averages roughly 20 feet.

In this connection, I have observed two factors that enable *fossor* to maintain its position in the changing tides. Since the shell has to be flushed from its subsurface position by the rushing water, it never takes its place at the very tip of the advancing surge like a bit of flotsam, but is usually a short distance behind the van, where, should it stop at this point, it would probably be reached by a succeding wave even in a falling tide. Similarly it usually succeeds in anchoring itself during or just after the interval between the onrush and the backwash of the wave, and hence occupies a place in front of the line that is continually covered by water. By these two devices it succeeds in keeping itself from being abandoned on land by the receding tide on the one hand, and driven to deeper water on the other. Eva Stoll (1937) describes certain motions of *Donax vittatus*

Da Costa that enable it to creep forward or to leap backward in order to escape from an unfavorable environment (rocks etc.) upon which a chance wave had thrown it. I have never observed this motion in *D. fossor* in Rockaway and believe that its entire migration is accomplished by wave action alone. Here it might also be noted that when the habitat of *D. fossor* is given as "near the ebb line" (Alexander 1941, p. 127) that is only part of the truth.

Mori reports that *semigranosus* leaps from the sand in advance of the wave and is then washed up or drawn back to a different location. He was able to trick the clams into coming forth by simulating the characteristics of a breaking wave: he sprinkled water about, scraped the sand with his foot and rapidly rotated a can in which sand and a *Donax* had been put. All these attempts to rouse *D. fossor* in Rockaway remained fruitless. I have at times observed it to "leap" up from below the surface so that in one jerk it had its shell half uncovered, but since this occurred mainly at the jetties where *Donax* and its chief associate, the sand crab (*Emerita talpoida* Say) were concentrated in unbelievable numbers, I concluded that *D. fossor* did this to avoid an obstructing crab or another clam. However, it is entirely possible that this leaping from the sand does occur as the wave passes over the buried clam. But since the water at this moment is completely roiled by loosened sand, observation is impossible. It would be of value to experiment further to settle this point.

It is interesting to note the position assumed by the Japanese *Donax* as drawn by Mori in his figure 13b. Here too the shell orients itself with its longer axis parallel to the rush of the water, the wide posterior end facing in the direction of the current. The siphons however, are only little exserted, the ventral one about half as much as the dorsal, and both pointing straight back, neither assuming the curved position of *fossor*. It would be of great interest to observe the behavior of other *Donax* species throughout the world.

The contrast between the behavior of young *Spisula solidissima* Dillw. and *D. fossor* is significant. The former is a true sand dweller and being flushed from its shelter represents a tragedy for it. It lies helplessly in the open or makes a few feeble attempts to dig in. Unless by chance it succeeds in

getting back to deep water, it dies. In the waves and rush of water, it withdraws both siphons (united to the tip), and the foot, and is aimlessly thrown about like a dead shell.

The *Donax*, however, seems to have chosen its restless environment, and its behavior in it lies well within its natural mode of life. This can be seen in the amazing success it has in keeping alive in this dangerous ecology. At its peak, *D. fossor* in numbers comes directly after the *Spisula* and perhaps *Mytilus edulis* L. in Rockaway. Yet dead *Donax* shells are surprisingly rare whereas the others clutter up the beaches the year round.

References

Alexander, Robert C. 1941. Some shells from South Cape May Beach. Nautilus, Vol. 54, pp. 126–128.

Mori, Syuiti. 1938. *Donax semignosus* Dkr. (sic) and the experimental analysis of its behavior at the flood tide. Zoological Magazine Tokyo, Vol. 50, pp. 1–12.

Stoll, Eva. 1937. Beobachtungen ueber die Fortbewegung bei einigen grabenden Muscheln. Revue Suisse Zool. (Genève), Vol. 44, pp. 383 ff.

THE OCCURRENCE OF POLYGYRA TEXASIANA (MORICAND) IN ALABAMA

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The purpose of this paper is to report the occurrence, in west-central Alabama, of *Polygyra texasiana* (Moricand), a species heretofore not recorded from that state.

Hinton (1951) recorded this species as *Polygyra triodontoides* (Bland), with the information that the shells were found in abundance in open prairie-land in Hale County, Alabama. Subsequently, the writer (1953), while studying Hinton's specimens, noted that the aperture of each shell presents an althogether different picture from that of *P. triodontoides:* the teeth are similar, close together, and almost completely basal, whereas those of *P. triodontoides* are dissimilar and widely separated. In addition, the spire is quite depressed, whereas that of *triodontoides* is distinctly elevated. The features thus noted were