

**Habitat of the tidal gastropod *Echininus nodulosus***

by

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*Echininus nodulosus* (Pfeiffer) has not been reported in the Netherlands Antilles previously although we have observed that this species is by no means uncommon in this area and has been found by us on all the islands visited.

In *A r u b a*, on the NE coast at Bushi Ribana, near the old gold workings, the species is quite abundant with up to 5 specimens per sq. meter. It can be found on all the coasts of *C u r a ç a o* especially on the exposed northern side. Here the most dense accumulation was found to be 5 to 10 snails per sq. meter.

On *K l e i n C u r a ç a o* *Echininus nodulosus* was found only on the north and northeast coast - accumulation very dense with up to 12 snails per sq. meter. In *B o n a i r e* whilst rare on the north coast near Lagun, near Malmok it was found with up to 1 or 2 specimens per sq. meter.

In *S t. M a r t i n* the species was especially abundant on the rocky ridge between Baie aux Cailles and Simpson Bay Lagoon, southwest of Pointe du Bluff on the French side of the island.

The specimens found vary in size from 10 to 28 mm. It seems strange that we failed to find smaller ones. This may be due to the fact that the young are very similar to the common *Nodilittorina tuberculata* (Menke). However, also in *Tectarius muricatus* (L.) only adult specimens are found and *Tectarius* under 5 mm are seldom seen on the Leeward Antilles (although they are common for instance on the northeast point of Key Biscayne in Florida).

*Echininus* inhabits a very narrow zone only where a fine spray of sea-water bathes the rock. Higher up, out of reach of the mist of spray, *Echininus* is never found. Here it is replaced by *Tectarius muricatus* and only rarely are the two species found together in the same location.

There is however another littorinoid species, *Nodilittorina tuberculata* which frequents the same habitat as *Echininus*. *Nodilittorina* is much more numerous and is not restricted to the upper zone of the spray. It goes down to the sea-water level and can also be found in

rockpools even if these are slightly brackish or hypersaline. *Echbininus* on the other hand is never found submerged. It inhabits somewhat rough cliffs sometimes hiding in crevices but more often exposed to sun and wind just like *Tectarius* in its zone.

In order to investigate the factors that keep the species within their own areas, we made some observations and conducted some additional experiments with the three species mentioned: *Tectarius muricatus*, *Echbininus nodulosus* and *Nodilittorina tuberculata*.

Comparing the different habitats, we find differences in water and salt content of the substratum with a difference sometimes in vegetation also.

Habitat of	Water content	Salt content	Vegetation
<i>Tectarius</i>	4-24%	14-83%	Fungi & green algae
<i>Echbininus</i>	7-21%	24-154%	Green algae, some blue and brown algae, diatoms & fungi
<i>Nodilittorina</i>	16-20%	62-120%	Green and brown algae, some blue algae and diatoms
Submerged rock	100%	100%	Brown, green and blue algae and diatoms

**WATER CONTENT OF THE SUBSTRATUM.** — When compared with the water content of submerged rock, the three habitats have only a small amount of water in the substratum and the amount of *Tectarius* and *Echbininus* rock is still smaller than that of *Nodilittorina* rock. We failed to prove whether this may be of importance in relation to the zonation.

**SALT CONTENT.** — If we call the amount of salt in a submerged rock 100%, the salt content of the other habitats can be expressed in percentages of this. From the figures it will be seen that the variation in salt content is rather large. This is due, of course, to the interaction of splash and evaporation. We were able to prove that there are differences even between two places quite near to each other.

It was clear that *Echbininus* will always avoid locations with a salinity higher than about 154%. *Nodilittorina* is not affected by a high salinity of the rock. *Tectarius* appears to be more particular in this respect as it is seldom found in locations where the salinity is higher than 80%.

VEGETATION. — In the *Tectarius* zone, fungi are often the only vegetation found. Sometimes small spots of green algae are seen and in that case *Tectarius* shows some green pigment in its "stomach". Mostly, however, the stomachs are full of a whitish substance especially when *Tectarius* is located on pieces of wood, often its favorite place where there is an abundance of fungi. One assumes, therefore, that they consume fungi, but algae, too, if available.

In the *Echininus* zone, green algae predominate but there are also some blue-green and brown algae plus some diatoms and fungi present. Some *Echininus* examined showed different algae pigments present in their tracts so they do not seem to be too particular in this respect.

In the lower part of the *Nodilittorina* zone, green and brown algae predominate. Under water each group of algae may predominate in turn. In the *Nodilittorina* tracts, one may find a whole series of algal pigments. Where a somewhat aberrant vegetation is present, the tracts of the three snail species show that they ingest whatever food is available.

RAIN. — None of the three snails will move from their locations as long as the substratum is dry and the air humidity is low. If it starts raining the snails begin to move around and browse. This can be observed also when artificial rain is supplied.

SEA-WATER SPRAY. — When sea-water is sprayed as a fine mist, both *Nodilittorina* and *Echininus* commence browsing. *Tectarius* however will try to climb to a higher point where it is still dry. When sea-water is splashed over the snails, not only *Tectarius* but also *Echininus* will commence to move in an upward direction.

Our conclusion is that the amount of splash or spray determines the upper as well as the lower limit of the habitat of the *Echininus* zone. On an exposed coast, *Echininus* will be found therefore at a level of at least 8 meters above sea level but in the lee, this species may live only half a meter above the water.

Other factors seem to play a minor role. Probably the same holds good for *Tectarius* and *Nodilittorina*.