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least chiefly) to take place in the heart: on this point fresh observations on living animals, which I have not at the present moment at my disposal, are much to be desired.—*Zoologischer Anzeiger*, xiv. Jahrg., no. 357, Feb. 23, 1891, pp. 78–80.

The Function of the Gemmiform Pedicellariæ of Sea-Urchins.

By M. HENRI PROUHO.

Since the pedicellariæ of Sea-Urchins were described by O. F. Müller the nature and functions of these singular organs have been explained in very different ways. In a paper on certain Echinoids from our own coasts * I asked myself what the rôle of the pedicellariæ was; and not being able at the moment to make a statement based upon definite observation, I had to content myself with the only probable hypothesis, and consider the pedicellariæ to be organs of defence. To-day I have the honour of submitting to the Academy an observation made in the aquarium of the Arago laboratory, which may easily be repeated.

The pedicellariæ of the Echinidæ were long ago divided into three classes, viz. the ophicephalic, the tridactyle, and the *gemmiform*. In the present notice we have to concern ourselves with the last of the three only, that is to say with those which exhibit jaws, each provided with a muscular and glandular pouch, the secretion of which issues at the tip, which is terminated by a sort of poison-claw. The head of the gemmiform pedicellariæ of *Strongylocentrotus lividus* is directly attached to a calcareous stalk articulated to the test; it is capable of movement on the extremity of this stalk, but it cannot bend down to its base, so that an animal of small size which could glide to the foot of the pedicellaria would be sheltered from its attacks. The gemmiform pedicellaria cannot stoop to seize its enemy, and is therefore at a disadvantage in protecting the test. Moreover these pedicellariæ, which in *Strongylocentrotus lividus* have a length of 1 centimetre, are scattered through a forest of spines, a very large number of which are as much as 3 to 4 centim. long. If, therefore, a large animal approach the Sea-Urchin to attack it, it would seem that this animal would be protected by the spines themselves against the bites of the pedicellariæ. In short the active zone of these organs, which lies above the test and below the tips of the spines, appears to us, *à priori*, badly placed, and the *ensemble* of the facts is well calculated to make us pause ere we consider the gemmiform pedicellariæ to be weapons of much effect, notwithstanding their glands and poison-claws. But the difficulty completely disappears when we observe the way in which the Sea-Urchin defends itself by the aid of its gemmiform pedicellariæ.

If in a tub containing one or several specimens of *Asterias glacialis*, previously kept without food for a considerable period, we place a *Strongylocentrotus lividus* †, we shall not have long to wait

* 'Archives de Zoologie expérimentale,' 1887.

† The experiment here described I have repeated with *Sphærechinus granularis*, with identically the same results.

before we see it attacked by the Starfishes. As soon as the Urchin feels the contact of the ambulacral tentacles of the Starfish attempting to seize it, it quickly lowers the spines of the region menaced. These spines take up a slanting radial position round the centre of the attack, and they are so completely inclined that the majority of them become almost tangents to the test. By thus lowering its spines the Urchin unmasks its gemmiform pedicellariæ, which we now observe extended towards the arm of the Starfish, and presenting to it their widely open jaws. The *Asterias* continues the attack; but as soon as one of its sucker-feet touches the head of a pedicellaria, it is immediately bitten, and we can but conclude that the pain occasioned by the bite is very keen, for the arm of the starfish is precipitately withdrawn. In retracting, the sucker-foot which has been bitten *always* carries away the pedicellaria fixed in the wound.

Sometimes the first bites suffice to repulse the *Asterias*; but on other occasions the latter continues the attack, and then it becomes a really interesting sight to watch the Urchin unmasking its pedicellariæ at all the points of attack, and, if I may be permitted to use the expression, thus following the movements of its enemy by showing its teeth. In a first encounter the advantage always rests with the Urchin, and the *Asterias* retires riddled with wounds; but since each pedicellaria only serves a single time in the defence of the Sea-Urchin, since it leaves its jaws in the wound, the Urchin by degrees exhausts its means of defence. If therefore we leave a Sea-Urchin in a tub with several Starfishes, and the latter continue the assault, the Urchin succumbs to its fate; but the issue of the combat is for us a matter of secondary moment. The manner in which the Urchin unmasks its weapons, which are ordinarily concealed and protected by the spines, appears to me, on the other hand, particularly worthy of attention.

As soon as the Urchin is apprised, by means of its peripheral nervous system, of the danger which menaces it, it communicates to its spines a movement which has nothing in common with the customary movements of these organs, and the sole object of which is to bring the jaws of its gemmiform pedicellariæ to bear on the enemy. It is interesting to note that this movement of the spines is precisely the opposite of that which takes place if we wound the surface of the test with the point of a needle for instance. In this case spines and pedicellariæ incline towards the wounded spot. On the contrary, when the Urchin assumes a defensive position it withdraws the spines from the point menaced, at the same time directing towards its enemy its pedicellariæ, which are thus unmasked and the jaws of which are ready to bite. In this case it is not a local pain, but a more complex sensation which we cannot analyze, which provokes a combination of movements undeniably interesting in a creature so low in the scale.—*Archives de Zoologie expérimentale et générale*, sér. 2, t. viii., Année 1890, no. 4, pp. xlii-xliv (*Comptes Rendus*, cxi. (1890), pp. 62-64).