

3. *Chirothrips hamatus*, Tryb. (?)

Tauria: Ssympheropol (25. April 1902, in Apfelbaumblüten),
Kamysch-Burun (17. April 1901, in Pfersichbaumblüten).

Subordo Tubulifera.

4. *Anthothrips aculeatus*, Fabr. (= *Drepanothrips viticola*, Mokr.)

Tauria: Koktebel (11. Mai 1906, auf dem Weizen), Pestschanoe
(8. Mai 1906, auch da), Kadykoi (13. Mai 1906, auch da), Burkut
(24. Mai 1901, auch da).

Kaukasus: Novorossiisk: Schirokaja balka (11. April 1901), auf
den Trauben.

5. *Anthothrips statices* Hal.

Tauria: Melitopolkreise (Mai 1894, auf dem Weizen), Tschirik
[Perekopskreise (Juli 1905)].

O d e s s a, 22. April 1907.

5. The gonad in certain species of chitons.

By Harold Heath,

Leland Stanford University, California, U. S. A.

eingeg. 10. Mai 1907.

In 1851 Middendorff¹ discovered what he considered to be evidences of a hermaphroditic condition in the chiton, *Amicula pallasi*; but more recently Plate (1899)² working on the same species failed to find any trace of such a condition, and considered (l. c. p. 463) that the first named author was led astray through interpreting sperm mother cells as immature ova. With this one remotely possible exception all known chitons are reported to be dioecious. While working on the development of *Trachydermon raymondi*, a fairly common chiton on the west coast of the United States, I have found this species to be normally hermaphroditic. In the early stages ova appear in typical fashion, but about the time the animal becomes half grown, that is when it is four or five millimeters long, some of the primitive sex cells on the wall of the gonad commence to divide rapidly and ultimately form small clusters (0,065 mm in diameter) of spermatozoa among the neighbouring ova. There is no definite seat of development as in the solenogastres (Neomeniidae); the sperms arise at any point on the inner surface of the gland from the anterior to the posterior end. The number of spermatozoa is always

¹ Middendorff, Th., Reise in den äußersten Norden und Osten Sibiriens. Zool. V. Teil 2. S. 163—174.

² Plate, L., Die Anatomie und Phylogenie der Chitonen. Zool. Jahrb. Suppl. Bd. V (Fauna Chilensis). Teil C. S. 330.

comparatively small, and they are seemingly shed almost continuously during the winter and spring since they are rarely lacking from the gonoducts during these seasons.

As noted in a previous paper (Heath 1905)³ these chitons inhabit small elevated tide pools in which the water is rarely changed save by the dash of the surf. And furthermore the young are brooded by the parent as in the case of *Chiton polii*, *Ischnochiton imitator* and two or three other species. In the case of the present species a small number of individuals are usually grouped closely together during the breeding season, and under such circumstances a large number of spermatozoa is not essential as with the majority of species.

In this species the gonad arises at a very early period though I am as yet somewhat in doubt as to its exact mode of origin. In specimens not yet 2 mm long it exists in the form of two small sacs in contact with and partly overlapped by the forward end of the pericardium, and the dorsal aorta passes between them as in the solenogastres. At this time there is no evidence of an connection between the pericardial and gonad cavities, and if the gonad arises, as I now believe, as two proliferations of cells of the anterior pericardial wall and a cavity subsequently appears in each then there is at no time any such communication. In this early stage clearly defined though very slender gonoducts lead to the exterior. They extend from the posterior lateral angle of each gonad sac and are in direct communication with it. In one specimen, slightly over 1 mm long, these tubes end blindly in the neighbourhood of the lateral nerve, and accordingly I am strongly of the opinion that each gonoduct is almost wholly an outgrowth of the wall of the gonad and not in large measure an ectodermal product, though an examination of a larger number of specimens must be made before a definite statement may be made. The paired character of the gonad persists into the late stages of development, but save for a slight indentation at its anterior end (and this is frequently lacking) and the arrangement of the branches of the aorta, as Plate (l. c. Teil A, p. 113) has noted, it disappears in the adult.

In not less than twelve species of chitons found on the California coast the gonad and its ducts arise very early, invariably before the animal is 3 mm in length. In *Katharina tunicata*, for example, which often reaches a length of 80 mm in an adult condition, this is the case, the two gonad sacs and their ducts holding essentially the same relations as those described for *Tr. raymondi*. As development progresses the gonoducts usually become somewhat convoluted and at the same time

³ Heath, The Breeding habits of Chitons of the California Coast. Zool. Anz. Bd. XXIX. No. 12. pp. 390—393.

shift their position so that in individuals 5 mm long their inner openings are located on the dorsal surface of each gonad sac near its posterior end and close to the mid line. Before the complete establishment of these relations the cells lining these canals develop a heavy ciliated coat, and in those species which possess glandular enlargements (mucous or albumen glands erroneously termed uteri) signs of glandular activity make their appearance. It thus follows that in specimens not over 7 mm long the reproductive system is definitely established with relations practically as in the adult, the chief difference being the definite paired nature of the gonad.

In *Nuttalochiton hyadesi* and in *Acanthopleura echinata* (l. c. p. 113) Plate has found that the gonad even in comparatively large animals has no connection with the gonoducts and since these last named tubes are usually sharply differentiated into an inner glandular and an outer non glandular, ciliated section he considers it probable that they have different origins, the distal portion arising as an ectodermic invagination while the glandular is a product of the gonad. As noted above not less than twelve species of chitons examined on this point give no evidence of this double origin for in its early development the gonoduct is a tube of like appearance throughout, being of even calibre and ciliated. Hence I believe that where it is separated from the gonad until a late period in life it is to be looked upon as a very highly modified condition.

6. Note on *Eremicaster*, a Genus of Starfishes.

By Walter K. Fisher, Stanford University, California.

eingeg. 11. Mai 1907.

In 1905 (Bull. Bureau Fisheries, XXIV, p. 293) I described *Eremicaster* as a subgenus of *Porcellanaster*, with *tenebrarius* as type. Recently (Zool. Anz. 1907 p. 317) Prof. Ludwig raised this to the rank of a genus and changed the type to *Porcellanaster crassus* Sladen. In the genus he includes the following species: *crassus* Sladen, *gracilis* Sladen, *tenebrarius* Fisher, and *waltharii* Ludwig. In *Porcellanaster* s. str. are placed: *caeruleus* Wyv. Thom., *caulifer* Sladen, *tuberosus* Sladen, *granulosus* Perrier, *inermis* Perrier, *pacificus* Ludwig, *vicinus* Ludwig.

Ludwig rightly contends that the three characters mentioned by me — the presence of 3 cribriform organs, segmental pits and papillae, and 1 or 2 adambulacral spinelets — occur independently in the wider genus *Porcellanaster*. The last two characters have not the importance I supposed in 1905, for a species has since been described — *P. pacificus* Ludwig — which has 3 cribriform organs but no segmental pa-

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