

ON A STILIFERID GASTROPOD PARASITIC IN THE CLOACAL CHAMBER OF *HOLOTHURIA ATRA* JAEGER

S. JONES AND D. B. JAMES

Central Marine Fisheries Research Institute, Mandapam Camp, India

ABSTRACT

Over 1,300 specimens of *Holothuria atra* ranging in size from 78 to 351 mm were examined for internal commensals and parasites, and of these, eight were found to harbour gastropods belonging to the genus *Stilifer* in their cloacal chamber. Thirteen parasites were collected in all of which three had egg capsules between the shell and the pseudopallium.

The parasite which appears to be a new one is described and figured and its early development is given. Unsuccessful attempts to infect fresh holothurians with free swimming veligers are briefly discussed.

INTRODUCTION

INSTANCES of parasitic gastropods in holothurians are rather rare. Gould (1849) reported a parasitic gastropod, *Stilifer acicula*, without giving any description, merely stating "Hab. Fejee Islands, in *Holothuria*". He has not given the specific identity of the holothurian or the part from which the parasite was collected. Recently, Johnson (1964) in his "Recent Mollusca of Augustus A. Gould" has simply listed *Stilifer acicula* without adding any details. Von Martens (1866) described a single species of *Stilifer* from the cloaca of *Holothuria glaberrima*. Thiele (1931) and Caullery (1952) have given a general account of the parasitic gastropods belonging to the family Stiliferidae.

While regularly examining the holothurians for parasites and commensals associated with them, the authors came across a parasitic gastropod belonging to the genus *Stilifer* inside the cloacal chamber of *Holothuria atra*. These holothurians were collected from localities in the neighbourhood of Mandapam and examined for parasites by cutting open the body. Over 1,300 specimens of *Holothuria atra* were examined in this study. The table below gives the details of the holothurians examined and parasites obtained.

Date	Place	No. of Holothurians examined	Size range of host* (mm)	No. of parasitized holothurians	No. of parasites
18-11-1965	Vedalai	17	191-351
7- 1-1966	Shingle Is.	37	141-261	2	3
3- 3-1966	Mandapam	22	110-190	2	(1, 2)† 4
10- 3-1966	Vedalai	128	121-282	1	(1, 3)† 2
22- 3-1966	Vedalai	96	110-253	1	2
28- 3-1966	Vedalai	220	111-279
5- 4-1966	Vedalai	91	110-300	1	1
27- 4-1966	Vedalai	193	90-256
26- 5-1966	Vedalai	236	73-273
2- 7-1966	Vedalai	299	78-270	1	1
TOTAL ..		1,359		8	13

* The size of the holothurians was measured after allowing the holothurian to settle for sometime on the measuring board.

† The figures in parentheses indicate the number of parasites in each holothurian.

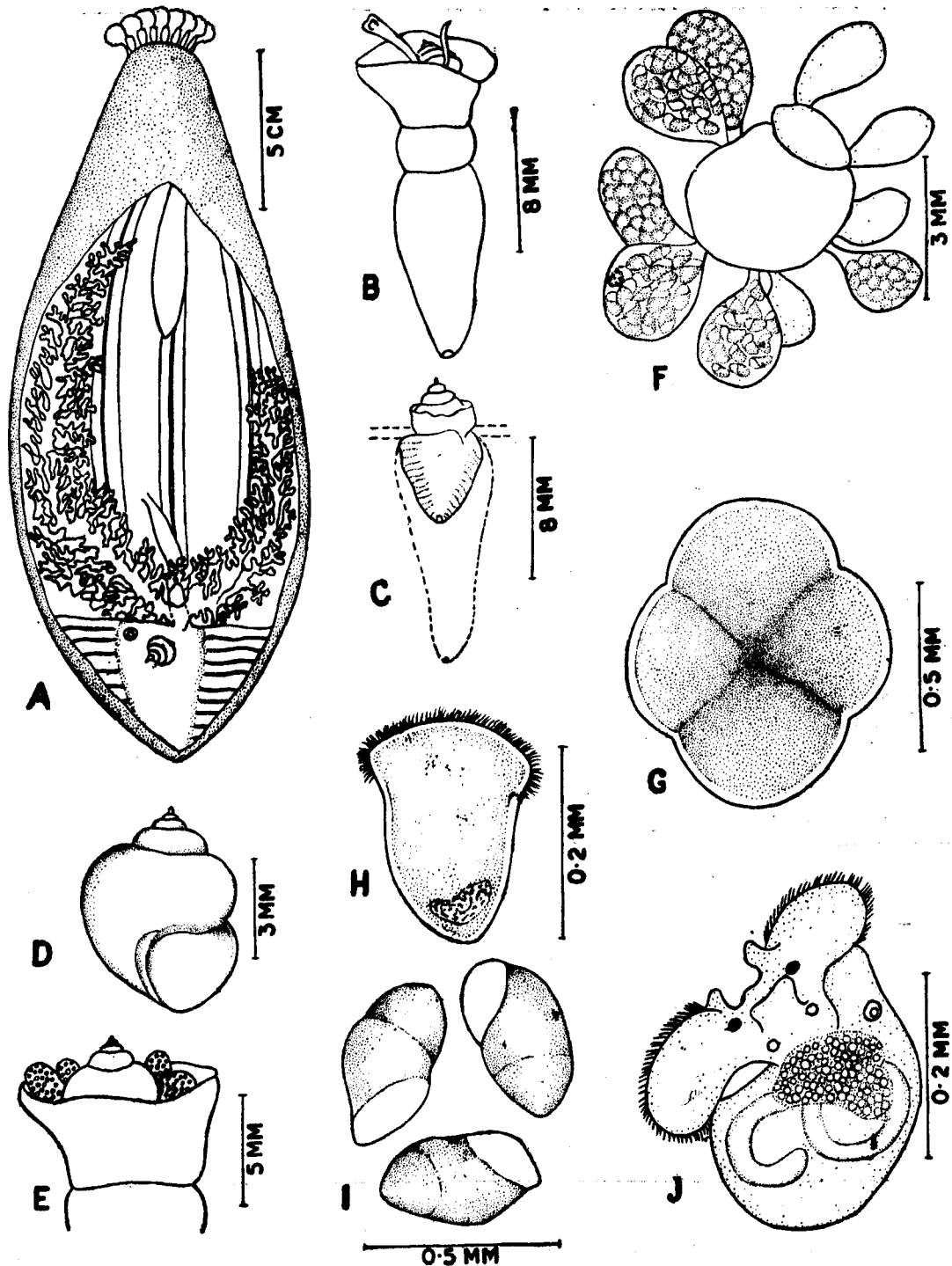


FIG. 1. A. *Holothuria atra* cut open to show the position of the parasites. B. *Stilifer* sp. in the fully extended condition. C. *Stilifer* sp. in the contracted condition. D. Shell of the parasite. E. Anterior part of the parasite to show the position of the egg capsules. F. Egg capsules. G. Four-celled stage. H. Early veliger. I. Shells of the veligers. J. Late veliger.

ADULT PARASITES

All the parasites were collected from the cloacal chamber at the base of the respiratory trees. They occupy a more or less central position inside the cloacal chamber (Fig. 1 A).

The parasites firmly attach to the cloacal chamber by piercing its wall. When the cloacal chamber is cut open the upper portion of the shell with the pseudopallium is seen. The parasite pierces the thick wall of the cloacal chamber and opens into the coelom. At the place where the parasite is attached to the host there is a constriction. It is often difficult to separate the parasite without tearing off the tissues of the host.

The maximum number of parasites that were collected from a single holothurian was three. Out of the eight holothurians which were found with parasites four had a single parasite each, three had two, and one had three.

The length of the largest specimen in the expanded state was 16 mm. and the breadth of the shell for the same specimen was 5 mm. The body of the parasite (Fig. 1 B) is clearly demarcated into three regions. The anterior region shows an expanded rather girdle-like membrane known as pseudopallium in which the shell, foot, and the tentacles are lodged. The shells are covered to a great extent by the thick pseudopallium which is generally placed in a diagonal manner, as a result of which only a small portion of the shell is seen on one side. In some cases the pseudopallium almost covers the whole of the shell leaving only the apex to be seen outside. In mature female specimens the pseudopallium (Fig. 1 E) acts as a brood pouch in which the egg capsules are placed. The foot is long and slender with the distal end appearing slightly bilobed. It is highly retractile and could be seen in constant movement over the shell. At the base of the foot there is a small triangular expansion of unknown function which is concealed by the pseudopallium. The middle portion is short and somewhat constricted. The parasite is attached to the wall of the cloacal chamber at this portion. The posterior region which is nearly two-thirds of the length of the body is the proboscis which is provided with an opening at the tip. The walls of the proboscis are highly muscular and it acts as a sucking organ. When preserved the parasite contracts to a very great extent (Fig. 1 C).

The shell (Fig. 1 D) is globular and thin with five whorls in large specimens. Its breadth varies from 2-5 mm and the apex ends abruptly in a more or less pointed tip. The colour is pearly white. The surface of the shell is not smooth and has a number of pits and curved grooves. On one shell there were some encrustations which were restricted to the apex of the shell.

The sexes are separate in this species. On three occasions when two parasites were found in the same holothurian only one of them (the large one) carried the egg capsules. The shells of the two parasites which were found in one holothurian were removed without injuring the body of the parasite. In the larger specimen the last whorl was orange with black dots and in the smaller specimen the last whorl was orange in colour.

As a result of the parasitic mode of life in the present species the foot is highly reduced, the digestive tract is poorly developed, and the radula is absent. The development of the proboscis and the pseudopallium are also associated with the parasitic mode of life. Hirase (1932) has discussed the adaptive modifications of the parasitic gastropod *Stilifer celebensis* which occurs on the starfish *Ceratonardoa semiregularis*.

There appears to be a size relation between the parasite and the host. It is most likely that the holothurians are parasitized when they are small because in all the large holothurians (110-351 mm. in length) dissected only large parasites (3-5 mm. in shell width) were collected. The smallest parasite which was 2 mm in shell width was collected from a holothurian of 78 mm

in length. Small-sized specimens of *Holothuria atra* are found away from the shore and in comparatively deeper waters. The holothurians examined in this study were mostly from waters less than 2 metres deep and the specimens were large. The veligers of these parasites presumably enter into small holothurians through the respiratory current of water and attach themselves to the wall of the cloacal chamber of the host by the velar lobes. Since the force of the respiratory current will be comparatively weaker in smaller holothurians than in larger specimens, chances for the veligers to settle inside the cloacal chambers of small holothurians are better.

The parasite when removed from the host and put in a finger bowl with fresh sea-water moves by jerks with the shell directed forwards. It is also seen to excrete a dull reddish substance. The parasite evidently draws nourishment from the body of the host through the proboscis.

All eight holothurians which had the parasites were carefully examined to see whether they suffered from any ill effects because of them. All of them were found to be normal and it was not possible to distinguish the parasitized specimens from unparasitized ones.

EARLY DEVELOPMENT

In three of the specimens which were collected on 7-1-1966, 10-3-1966, and 28-3-1966, there were two parasites in each of them in close proximity to each other inside the cloacal chamber. In all three cases one of them was large and the other one small. The large specimens had a bunch of capsules between the shell and the pseudopallium. In one case there were 14 and in the other 8 capsules, but the number of them was not noted in the specimen collected on 7-1-1966. They were arranged around a jelly-like mass (Fig. 1 F) and were of different sizes with the eggs in different stages of development. The smaller capsules were at the centre and the larger ones at the margin. They were oval in shape and attached to the jelly-like mass by a short and narrow stalk. Their length varied from 1.406 to 2.695 mm and the breadth from 1.172 to 2.051 mm. In one instance the following stages of development were seen in the eight capsules. The first one was large and transparent with some space inside it where all the veligers were freely swimming. The second and third ones were also transparent but there was not much space inside for the veligers to swim. The veligers in these had eyes. The fourth one was almost opaque but showed the outlines of three or four veligers moving inside. The rest of the four were small and opaque.

Eggs

The earliest stage that could be obtained was the four-celled stage (Fig. 1 G). One of the capsules which was broken open had 133 eggs in the four-celled stage. The size of the four-celled eggs varied from 0.204 to 0.235 mm.

Early Veliger

The early veliger (Fig. 1 H) has no shell. It is more or less triangular in shape with the anterior end bulged. Eyes are absent. At the posterior end of the body the shell gland is present. The length and breadth are 0.235 and 0.172 mm respectively.

Late Veliger

The late veliger (Fig. 1 J) has a shell, a pair of well-developed velar lobes, and a pair of eyes. The length varies from 0.408 to 0.439 mm and the breadth is 0.235 mm. The velar lobes are well ciliated and have two stumps which develop into tentacles later. The two lobes of the liver mass are large and the coiled intestine can be seen through the translucent shell. Below the

eyes there is a pair of clear structures known as statocysts. At the anterior part of the alimentary canal there is a pulsating vesicle which is probably the beginning of the heart. The shell of the veliger (Fig. 1, I) has a single whorl, a blunt and rounded apex, and a wide mouth.

In one of the capsules there were 187 veligers. The veligers while remain inside usually in a compact manner leaving very little interspace and in the course of their movements stike against the wall of the capsule. A few of the veligers move in the central space of the capsule and periodically try to come to the surface of the inner wall of the capsule and press against it and rest. The mode of liberation of the veligers from the capsules is as follows. All the veligers come out one by one from a weak point in the capsular wall. After the exit of each veliger the opening appears to be closed. When almost all the veligers are out, the wall of the capsule collapses. In a particular case the veligers started coming out at 11 A.M. and all of them were out by 12-30 P.M. When an actively swimming veliger was observed under a stereoscopic microscope, small particles of dirt found in the water were seen to be driven towards the velar lobes due to the currents created by the cilia in them.

Lebour (1932) described the eggs and early larvae of *Stilifer stylifer* a commensal on the echinoid *Psammechinus miliaris* from Plymouth. It may be pointed out here that the egg capsule described by Lebour (*op. cit.*) is more or less three-cornered and cushion-shaped, each one having 60 to 80 eggs and the shell of the veliger is more or less globular. In the present case the egg capsules are oval with 130 to 190 eggs and the shell of the veliger is slightly elongated.

PARASITISATION EXPERIMENTS

A few attempts were made to parasitise holothurians by introducing live veligers into them. In order to test whether the free swimming veligers have any affinity towards the holothurian a few veligers were left on the cloacal chamber of a dissected holothurian. The veligers were found to attach to the cloacal wall after sometime.

For the purposes of introducing the veligers, only small holothurians were selected. Live veligers were taken into a pipette and introduced with force into the cloaca of small holothurians so that they could reach the farther end of the body. After introducing the veligers the holothurians were left in a trough and were covered with a moist cloth dipped in sea-water. This cloth was periodically wetted to keep the holothurians alive. After about six hours of keeping them in the trough they were transferred to aquarium tanks. This method was followed in order to allow the veligers to settle down within the cloaca of the holothurians without being washed out by the respiratory current of water. The injected specimens were removed at intervals of one week and cut open to see whether the veligers have settled inside the cloacal chambers. The respiratory trees and viscera were also examined under a stereoscopic microscope for the presence of the parasites. The attempts did not meet with any success. This was presumably due to the limited number of live veligers available and also due to the laboratory conditions under which the experiments were conducted.

The adult parasite, after its removal from the host, was not able to enter into any fresh host again. Even when introduced into the cloacal chamber it could not remain there, but were ejected along with the outgoing respiratory current of water.

LITERATURE CITED

- CAULLERY, M. 1952. *Parasites and Symbiosis*. Sedgwick and Jackson Limited, London, 340 pp.
GOULD, A. A. 1849. New species of shells. *Proc. Boston Soc. Natur. Hist.*, 3: 84.

- HIRASE, S. 1932. The adaptive modifications of the gastropod *Stilifer celebensis* Kukenthal parasitic on the starfish *Ceratonardoa semiregularis* (Müller and Troschel). *Proc. malac. Soc. Lond.*, 20: 73-76, pls. vii and viii.
- JOHNSON, R. I. 1964. The recent Mollusca of Augustus A. Gould. *Bull. U.S. natn. Mus.*, 239: 36.
- LEBOUR, M. V. 1932. The eggs and early larvae of two commensal gastropods, *Stilifer stylifer* and *Odostomia eulimoides*. *J. mar. biol. Ass., U.K.*, 18: 117-122.
- MARTENS, H. VON. 1866. Über die von Dr. Jagor gesammelte *Stylifer* Arten auf Luzon. *Sber. Ges. Naturf. Freunde Berl.*, 1865, p. 14.
- THIELE, J. 1931. *Handbuch der Systematischen Weichtierkunde*. Jena, Verlag von Gustav Fischer, 778 pp.