

**COPULATION IN *PORRORCHIS INDICUS* (SCHMIDT & KUNTZ 1967)
(SYN. *PSEUDOPORRORCHIS INDICUS* DAS 1957)**

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ABSTRACT

A study is made on pairs of worms found *in coitu* in the intestine of a heavily infected crow-pheasant dissected during the daytime. Sphincter muscles associated with the genital structures in the two sexes assist in holding the copulating worms together. The copulating worms have their proboscis firmly attached to the wall of the intestine. The bursa of the male everts and engulfs the posterior end of the female and remains in this condition during copulation which lasts for more than four hours.

VERY little information is available concerning the mechanism of copulation in Acanthocephala. Podder¹ described the process of copulation in *Acanthosentis duttai*. According to him the everted bursa of the male is attached to the posterior end of the female and the vagina is sucked out and lodged in the cavity of the bursa. Later the bursa with the vagina is retracted. Van Cleave² gave a figure of a pair of specimens of *Gorgorhynchus clavatus in copula* but gave no description.

Golvan³ stated that the bursa is usually invaginated in the posterior part of the male but during copulation it is everted and surrounds the posterior part of the female. Yamaguti⁴ differed from this view and mentioned, "but such copulation has never been observed in life". He further stated "So far as I am aware, the evagination of the bursa is postmortem phenomenon".

Crompton⁵ suggested that the paucity of information about copulation in acanthocephalan worms may be due to the facts that this process may take place rapidly and at night.

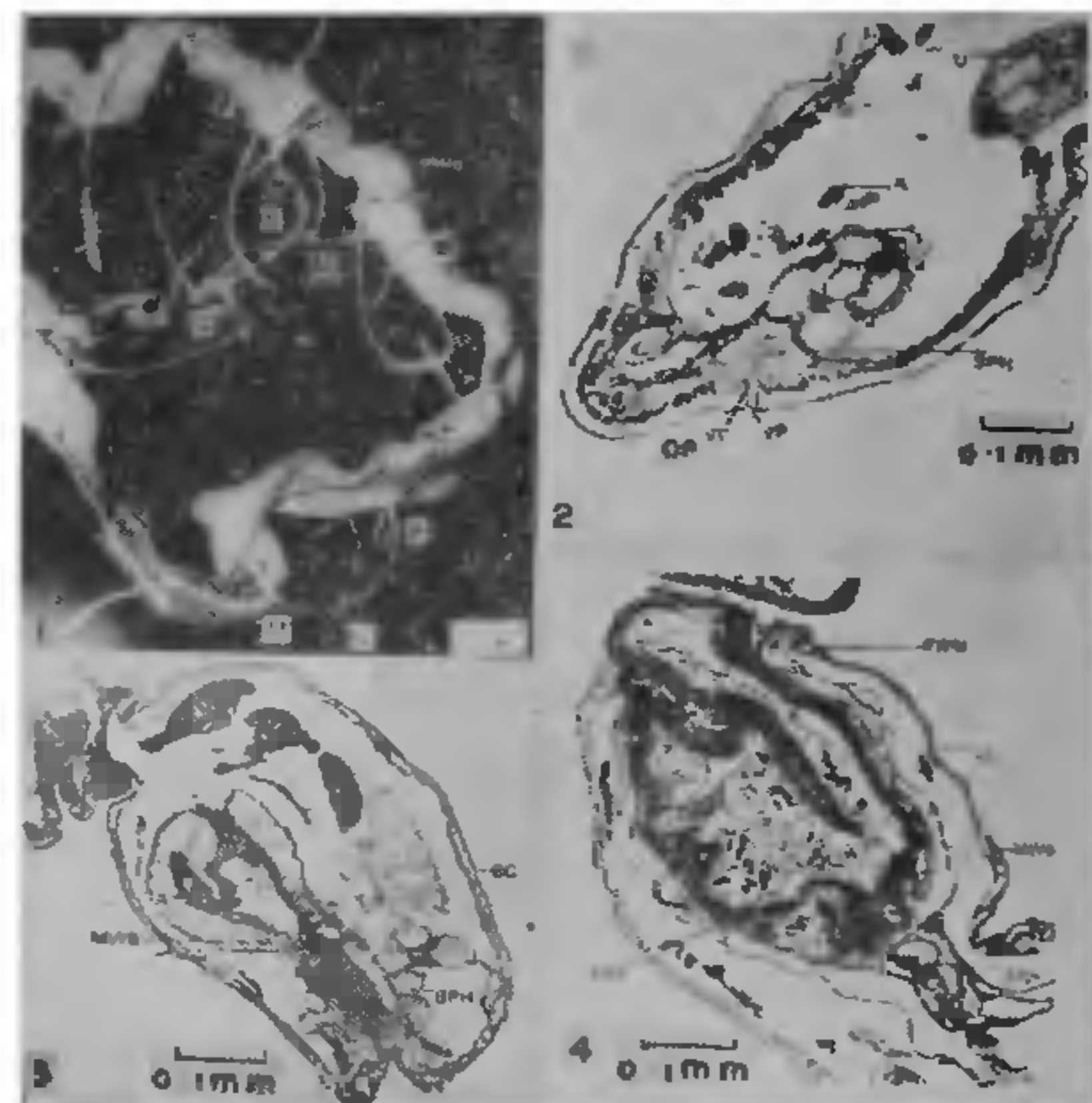
MATERIAL AND METHODS

Two crowpheasants dissected on 28th February, 1975 were heavily infected with the acanthocephalan worms, *Porrorchis indicus*. Three pairs of these worms were found *in coitu* (Fig. 1) in the intestine of one of the infected birds.

The intestines of the crowpheasants were opened in 0.8% saline. The posterior copulating regions of two of the copulating pairs of the worms were cut and fixed *in situ* at 4°C in 10% neutral formalin with 2% calcium acetate. After 24 hours of fixation, the copulating parts of the worms were repeatedly washed in cold distilled water and processed for sectioning. An attempt was made to fix one pair of entire worms *in copula* by pouring hot 70% alcohol but the copulating worms separated immediately after hot alcohol was poured on them. The posterior ends of the separated worms were cut out, dehydrated and embedded separately in paraffin with a view to studying the genitalia of these worms.

THE MALE GENITALIA

The everted bursa after copulation (Fig. 3) is 1.54 mm long and 0.98 mm thick. It tapers towards its attachment to the body where it is 0.42 mm thick. The wall of the bursa has the characteristic cuticle, sclerite and dilated lacunar canals, nuclei being absent. The muscular cap (Figs. 3 and 4), which is 0.63 mm in length and 0.51 mm in breadth, lies deep in the bursa. The penis papilla is situated a little to the right of the mid-line of the muscular cap and projects from its base. It is 0.21 mm long and 0.07 mm thick. The bursa can be retracted by means of retractor muscles.



FIGS. 1-4. Fig. 1. The alimentary tract of crowpheasant infected with *Porrorchis indicus*. Fig. 2. Section of the posterior end of female *Porrorchis indicus* soon after copulation. Fig. 3. Section of the everted bursa of male *Porrorchis indicus*, soon after copulation. Fig. 4. Section of the worms in copulation. (BC, Bursa cap; BWF, Body wall of female; BWM, Body wall of male; C, Copulation; F, Female; OP, Ovate projection; M, Male; MWB, Muscular wall of bursa; P, Penis papilla; SPH, Sphincter; U, Uterus; VC, Vaginal canal; VP, Vaginal pore.)

THE FEMALE GENITALIA

The posterior end of the female (Fig. 2) is dilated to form a bulb-like structure placed at an angle to the rest of the body. This bears at its distal end a highly muscular ovate projection which is 0.42 mm long and 0.168 mm broad. The vaginal pore is sub-terminal and is situated at a distance of 0.15 mm from the tip of the ovate projection. The vaginal canal measures 0.24 mm in length and is provided with a pair of sphincter muscles which lie one behind the other. The distal sphincter muscle is 0.196 mm and the proximal one is 0.112 mm in thickness. Extending from the proximal sphincter muscle is a narrow uterus which is 0.042 mm in breadth and 1.45 mm in length. The anteriormost part of the uterus is expanded into an uterine bell (0.112 mm in diameter) provided with two pouches in which mature eggs are stored. The mature eggs are double walled and measure 0.056 mm in length and 0.021 mm in thickness. The fertilised eggs acquire an additional membrane.

COPULATION

The copulating worms (Fig. 1) have their proboscis firmly embedded in the muscular walls of the host tissue and the two worms together form a 'U'-shaped curve. The copulatory bursa of the male is fully everted engulfing the posterior end of the female. Slight disturbances did not affect them and, when the copulatory region was cut off from the worm, they remained intact in spite of repeated washing and dehydrating. However, when hot alcohol was poured over a pair of living worms *in coitu*, they separated at once but the bursa remained everted.

The sagittal section of the bursa enveloping the posterior end of the female during copulation (Fig. 4) shows that the bursa has greater dimensions due to stretching—the length being 2.82 mm and breadth at the widest part being 1.28 mm. The muscular cap of the bursa is also expanded being 2.8 mm long and 0.98 mm at its maximum breadth. The posterior end of the female is lodged inside the bursa, and the muscular wall of the bursa is closely adherent to the body wall of the posterior end of the female. Secretions of the cement gland are formed where the two walls are not in close juxtaposition. The rim of the muscular cap of the bursa is provided with sphincter muscles which help in securing a firm hold on the female. The bursal opening remains closed before and after copulation, but it opens to an extent of 0.49 mm during copulation to accommodate the posterior end of the female. The penis papilla is so situated and oriented in relation to the vaginal pore that the penis passes freely into the vaginal pore the diameter of which is 0.042 mm. The vaginal canal is 0.056 mm in diameter. The length of the vaginal canal is 0.336 mm. The

sphincter muscles of the vaginal canal help in grasping the penis papilla. The large amount of secretion between the surface of the copulating regions probably acts as a lubricant to help in copulation and also in plugging the vaginal pore after copulation and ejaculation.

DISCUSSION

The contention of Crompton⁵ that copulation in acanthocephalan worms takes place either rapidly or at night, and hence it has escaped observation by most workers is untenable because in *Porrorchis indicus* copulation normally lasts for a long time as is evident from the fact that the copulating pairs remained *in copula* for over four hours when dissected intestines of heavily infected worms were kept in saline solution of suitable concentrations, and this was noticed in birds which were observed during the daytime. Further, it appears too farfetched to associate the diurnal rhythm of the bird with physiological processes of these parasitic worms which are in total darkness inside the alimentary canal of the host. The vagina of *Porrorchis indicus* was at no time "sucked out" as described by Podder¹ in *Acanthosentis dattai*, the only other Indian acanthocephalan where copulation has been described. Further, unlike in *Acanthosentis dattai* (Podder)¹, in which it was described that the bursa is retracted along with the vagina after the latter was "sucked in", in *Porrorchis indicus* the bursa everts out and engulfs the posterior end of the female and remains in this condition without being retracted. The eversion of the bursa is undoubtedly a normal process during copulation and not a postmortem phenomenon as mentioned by Yamaguti⁴. It could at best be a temporary post-coital situation.

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