

Biology of Cyclophyllidean Tapeworms in Indian Natural and Experimental Hosts at Garhwal Himalayas and Gangetic Plains

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Introduction

Vampirolepis somariensis was described by Malhotra and Capoor in 1980 from the avian host *Turdoides striatus* in Garhwal Himalayas. The cysticeroid larva of this cestode has been reported from natural infections of high altitude grass beetle at 750 mASL in this investigation. Experimental albino mice, *Mus musculus* have been reported to be their definitive hosts. The dung beetles, *Tenebrio molitor*, at Allahabad in the Gangetic plains, have been found to serve as intermediate hosts of the dilepidid cestode, *Echinorhynchotaenia* sp. as well as that of the taeniid tapeworms, *Fossor* spp. for the first time in this study. A revised key to genus *Fossor* Honess, 1937 has been proposed to include two new forms of larvae from Indian beetles.

Materials and Methods

Three of 40 dung beetles, *Tenebrio molitor* examined at Bamrauli, Allahabad in the Gangetic plains yielded 4 interesting dilepidid larvae of *Echinorhynchotaenia* sp.. Ten of these beetles also harboured 15 taeniid larvae of *Fossor bamrauliensis* n.sp. in the haemocoel. Simultaneously, 20 out of a sample of 210 *T. molitor* from a different locality viz. Atrampur, Allahabad yielded 9 cysticeroids of *F. allahabadense* n.sp.. Another lot of 225 grass beetles, *Gonocephalus dorsogronusum* were

examined at Satpuli (750 mASL) in Garhwal Himalayas. Twentyeight of these grass beetles had single worm infestations by somewhat elongate cysticeroids in the haemocoel. These larvae obtained from natural infections at high altitude were fed orally by stomach tube to 3 months old 5 experimental male albino mice, *Mus musculus*. Mature worms of *Vampirolepis somariensis* Malhotra and Capoor, 1980 were removed after 60 days post-infection from these experimental mice.

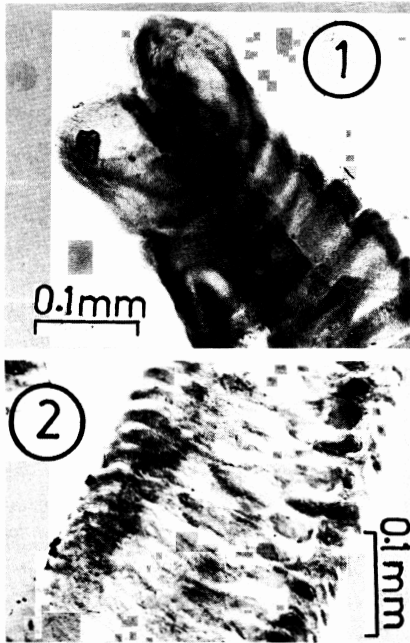
Stained slides of the larvae as well as mature worms were prepared by the usual method (Malhotra, 1985). Camera lucida drawings were prepared and microphotographs were taken by NIKON trinocular computerised microphotography unit. All measurements are given in millimeters and given as range followed by mean in parentheses.

Results

1. *Echinorhynchotaenia* sp. larva (Figs. 1—5)

Body of the larva 6.40—8.398 (7.39) long \times 0.15—0.36 (0.29) wide. Neck absent. Strobilate portion immediately behind scolex broader than long (Figs. 1, 2, 3) measuring 0.02—0.05 (0.03) \times 0.26—0.36 (0.32). Scolex typical (Figs. 1, 3) with four suckers and a rostellum. Scolex, 0.19—0.2 (0.19) long \times 0.16—0.19 (0.18) wide. Suckers small, 0.05—0.06 (0.05) \times 0.06—0.10 (0.07). Rostellum (Fig. 4) armed with several rows

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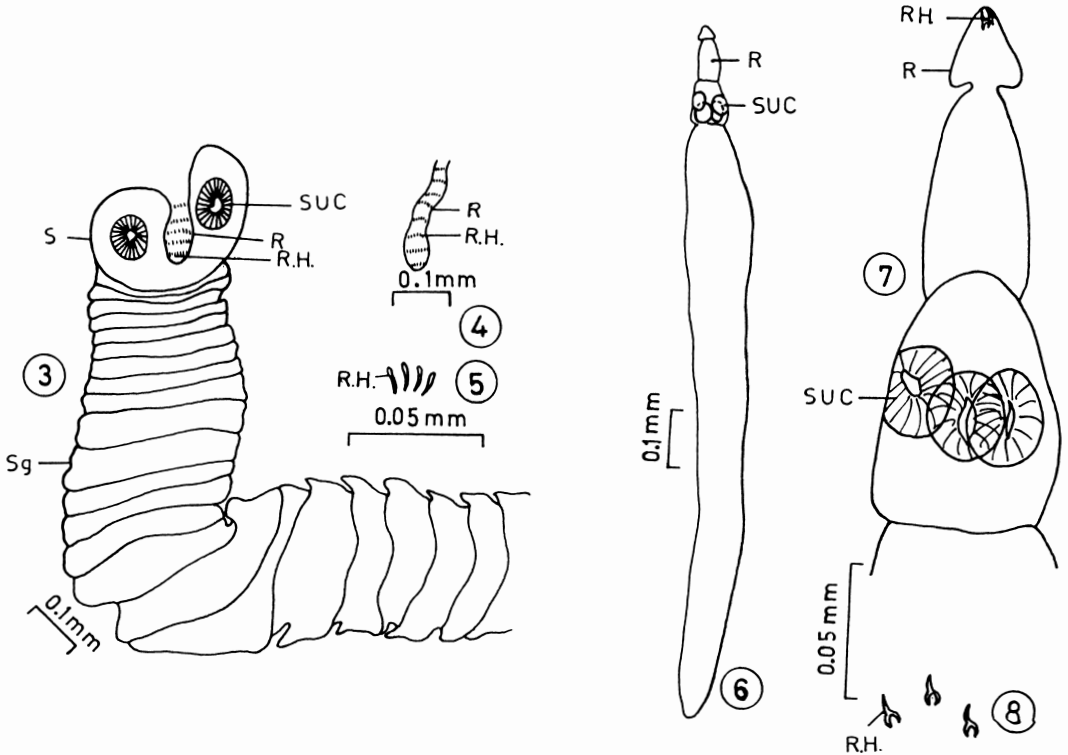


of minute spine-shaped rostellar hooks. Each row has 8—9 rostellar hooks measuring 0.005—0.01 (0.01) in length (Fig. 5). Rostellum, 0.15—0.19 (0.18) long \times 0.02—0.05 (0.05) wide.

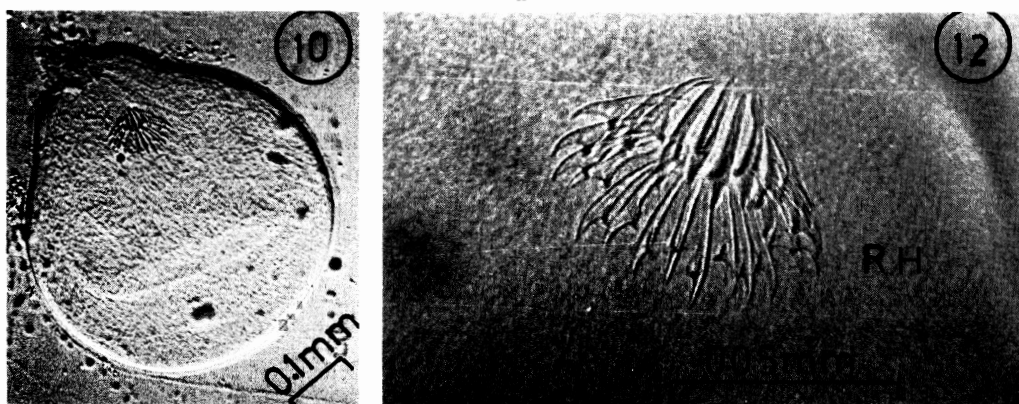
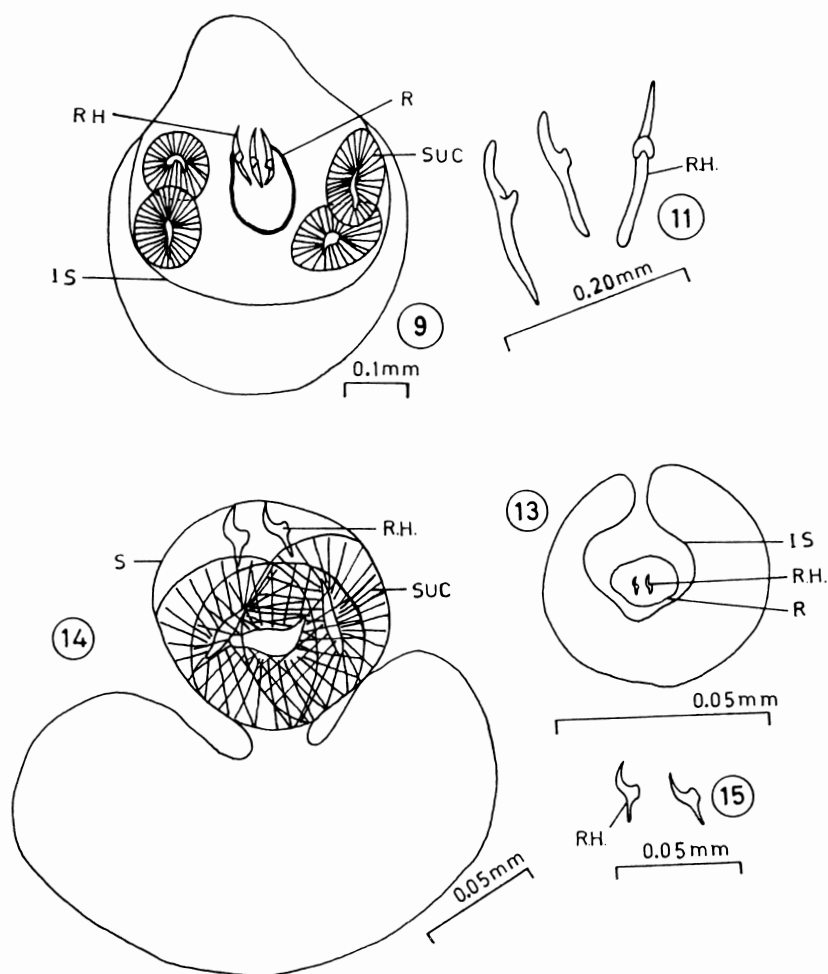
2. *Vampirolepis somariensis* cysticeroid (Figs. 6—8)

The grass beetle, *G. dorsogronusum* were found harbouring small somewhat elongate larva (Fig. 6) at Allahabad. Generally infestation of 1 worm per beetle was recorded from the haemocoel of beetles. The larvae, 0.7—1.35 (0.95) long \times 0.02—0.22 (0.19) wide. Neck absent. Scolex distinct from the strobila, 0.07—0.095 (0.09) \times 0.05—0.07 (0.07). The four suckers, oval to

Figs. 1—2 *Echinorhynchotaenia* sp. larva 1. Microphotographs of scolex (\times 140) and 2. segments (\times 140).



Figs. 3—5 *Echinorhynchotaenia* sp. larva 3. W.M. of larva (\times 140); 4. rostellum (\times 140); 5. rostellar hooks (\times 640). Figs. 6—8 *Vampirolepis somariensis* cysticeroid 6. W.M. of larva (\times 140); 7. scolex and rostellum (protruded) (\times 640); 8. rostellar hooks (\times 640).



Figs. 9—12 *Fossor (Cysticercus) bamrauliensis* n.sp. larva 9. W.M. of larva ($\times 170$); 10. Microphotograph of W.M. of larva ($\times 90$); 11. rostellar hooks magnified ($\times 255$); 12. Microphotograph of rostellar hooks ($\times 620$). Figs. 13—15 *Fossor (Cysticercus) allahabadense* n.sp. larva 13. W.M. of larva showing invaginated scolex ($\times 140$); 14. W.M. of larva magnified with evaginated scolex ($\times 640$); 15. rostellar hooks ($\times 640$).

Abbreviations

R, rostellum; RH, rostellar hooks; IS, invaginated scolex; S, scolex; SUC, sucker; Sg, segment

spherical, 0.02—0.03 (0.02) × 0.02—0.03 (0.03). Rostellum (Fig. 7) retractile, eversible, 0.02—0.023 (0.022) × 0.02—0.03 (0.03). Rostellar hooks (Fig. 8), 0.01—0.013 (0.011) in length. Rostellar sac, 0.06—0.08 (0.07) long × 0.03—0.05 (0.04) wide.

3. *Fossor* (*Cysticercus*) *bamrauliensis* n.sp.
(Figs. 9—12)

The sac of larva, 0.45—0.62 (0.48) × 0.49—0.53 (0.51) (Figs. 9, 10). Scolex, 0.39—0.46 (0.39) long × 0.30—0.43 (0.33) wide. Rostellum, 0.14—0.20 (0.19) long × 0.09—0.11 (0.11) wide. Rostellum armed with 24 rostellar hooks, 0.03—0.05 (0.04) long, while guard, blade and handle, 0.01—0.02 (0.01) × 0.001—0.01 (0.003); 0.01—0.02 (0.01) × 0.003—0.01 (0.002), and 0.02—0.03 (0.02) × 0.001—0.004 (0.003), respectively (Figs. 11, 12). Suckers small, oval, 0.05—0.12 (0.08) × 0.10—0.18 (0.15).

4. *Fossor* (*Cysticercus*) *allahabadense* n.sp.
(Figs. 13—15)

The size of larva (Figs. 13, 14), 0.12—0.23 (0.21) × 0.20—0.25 (0.23) possessing a sac just behind the scolex. Scolex, 0.09—0.14 (0.11) × 0.10—0.17 (0.14). Rostellum, 0.04—0.06 (0.05) × 0.05—0.07 (0.06). Rostellar hooks (Fig. 15), 34—35 (34) in single row, 0.013—0.019 (0.016) with the handle shorter than blade. The guard, blade and handle, 0.003—0.004 (0.004); 0.005—0.01 (0.01) and 0.006—0.007 (0.007) in length, respectively. Suckers, 0.04—0.05 (0.05) × 0.05—0.07 (0.06).

Discussion

1. *Echinorhynchotaenia* sp. larva

There is likelihood of the beetle, *T. molitor* acting as an intermediate host in the life cycle of the dilepidid cestode, *Echinorhynchotaenia* sp. that possibly has some bird as its definitive host. This is the first report of dilepidid larvae from an Indian dung beetle.

2. *V. somariensis* cysticeroid

The present larval forms from the grass beetle had morphometric resemblance with mature worms of *V. somariensis* in the size of rostellum possessing 10—11 minute wrench-shaped rostellar hooks that are of similar size in larva as well as in adult, and both these larval as well as mature tapeworms have been recorded from the same geographic habitat. The experimental recovery of mature worms of *V. somariensis* by feeding the larvae to *M. musculus* further confirmed the conclusions based on morphometric observations. Hence the authors feel justified to consider the present cysticeroids as those of *V. somariensis* with the grass beetle, *G. dorsogronusum* serving as an intermediate host in its life cycle.

3. *F.* (*Cysticercus*) *bamrauliensis* n.sp.

Abduladze (1970) gave an illustrated account of the three species of the genus *Fossor* viz. *Fossor* sp. (Hiregaudar and Rao, 1955) Abduladze, 1970; *F. monostephanos* (Linstow, 1905) Abduladze, 1970 and *F. taxidiensis* (Skinker, 1935) Honess, 1937. The key to species given in this work was based on characteristics of rostellum and rostellar hooks, the characters which have been elaborately studied in the present larval form. The larva, under consideration in this report, is a cysticeroid bearing single row of typical taeniid rostellar hooks. It shows distinctly separate characteristics in shape, size and number of rostellar books from the other three known species of the genus *Fossor*. It differs from *F. monostephanos* in possessing typical taeniid shape of rostellar hooks instead of rose-thorn shaped hooks, lesser number of larger rostellar hooks in which blade is shorter than the handle. The new form differs from *F. taxidiensis* in smaller size of rostellar hooks whose blade is slightly curved and handle is larger than the guard. Besides the shape of the rostellar hooks of the two forms are very different in that the guard is neither as prominent nor projected in the new form towards outside as it occurs in *F. taxidiensis*. The new form also differs from *F. sp.* in having greater number of larger rostellar hooks. Lastly, the larval forms under study are being reported from a beetle host, *T. molitor*

which appears to be an unusual intermediate host of taeniid cestode from the order Coleoptera of the family Tenebrionidae.

Host — *Tenebrio molitor*

Habitat — Haemocoelae

Locality — Bamrauli, Allahabad, India

Holotype — Holotype slide no. PCLS 117/88 deposited with the Parasitological Collections, Department of Zoology, University of Allahabad, Allahabad, U.P., India.

4. *F. (Cysticercus) allahabadense* n.sp.

The new larval form, under discussion, differs from *F. sp.* in having greater number of smaller rostellar hooks; from *F. bamrauliensis* n.sp. and *F. taxidiensis* in possessing much smaller size and greater number of rostellar hooks, and a longer handle than blade in these. The new form also shows difference from *F. monostephanos* in much smaller typical taeniid rostellar hooks than rose-thorn shaped hooks occurring in the latter species. The cysticercoid has also been collected from the haemocoelae of *T. molitor* which is a new host of *Fossor* spp. in India acting most likely as an intermediate host for the taeniid cestode. These were the first reports of cysticercoids of genus *Fossor* from India. Hence, based on above marked differences the authors are inclined to propose accommodation of the present lot of worms as a new species, *F. allahabadense* n.sp. named after the locality.

Host — *Tenebrio molitor*

Habitat — Haemocoelae

Locality — Atrampur, Allahabad, U.P., India

Holotype — Holotype slide no. PCLS 118/88 deposited with the Parasitological Collections, Department of Zoology, University of Allahabad, Allahabad, U.P., India.

Abduladze (1970) gave a table for differentiating the larvocysts of eight of the 13 genera included in suborder Taeniata Skrjabin and Schultz (1937). With the addition of present larval forms, the authors venture to elaborate this table as follows:—

Larva of the cysticercus type:

a) Chitinized hooks present on the rostellum — b)
b) Hooks present in single row — *Fossor* Honess (1937)

Hooks present in double row — *Taenia* Linnaeus (1758)

c) Hooks absent on the rostellum — *Taeniarhynchus* Weinland (1858)*

Based on the available information a revised key to species of genus *Fossor* is proposed as under:—

Revised key to species of genus *Fossor* (Honess, 1937)

1. Rostellum with 13 hooks ... *Fossor* sp. (Hiregaudar and Rao, 1955) Abduladze, 1970
Rostellum with more than 20 hooks ... 2

2. Handle of rostellar hooks shorter than blade ... 3

Handle of rostellar hooks longer than blade ... 4

3. Rostellar hooks, 0.190—0.210mm long ... *F. monostephanos* (Linstow, 1905) Abduladze, 1970

Rostellar hooks, 0.013—0.019mm long ... *F. allahabadense* n.sp.

4. Rostellar hooks, 0.034—0.048mm long ... *F. bamrauliensis* n.sp.

Rostellar hooks, 0.083—0.099mm long ... *F. taxidiensis* (Skinken 1935) Honess, 1937

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References

- 1) Abduladze, K. I. (1970): Essentials of Cestodology. 4. Taeniata of animals and man and diseases caused by them. (Ed. Skrjabin, K. I.) Israel Prog. Sci. Transl., Jerusalem, 240—243.
- 2) Hiregaudar, L. S. and Rao, S. R. (1955): An unusual record of *Taenia* with a single circle of hooks from a dog. *Curr. Sci.*, 24, 78.
- 3) Honess, R. F. (1937): Un nouveau cestode: *Fossor angertrudae* n.g., n.sp. du blaireau d'Amerique; *Taxidea Taxus taxus* (Schreber, 1778). *Ann. Parasitol.*, 15, 363—366.

- 4) Linnaeus, C. (1758): Systema Naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis synonymis, locis. (Editio decima, reformata) 1, 823pp. Holmiae.
- 5) Linstow, O. F. B. von (1905): Neue Helminthen. Arch. Naturg., jg., 71, Bd. 1, H. 3, 267—276.
- 6) Malhotra, Sandeep K. (1985): Systems models in ichthyoparasitology of the Garhwal Himalayan riverine ecosystems. Bull. Bot. Soc. Sagar, 32, 159—163.
- 7) Malhotra, Sandeep K. and Capoor, V. N. (1980) Introduction of taxonomic approach to differentiate *Vampirolepis somariensis* n.sp. Geobios, 7, 302—308.
- 8) Skinker, M. S. (1935): Two new species of tapeworms from carnivores and a redescription of *Taenia laticollis* Rud., 1819. Proc. U.S. Nat. Mus., 83, 211—220.
- 9) Skrjabin, K. I. and Schultz, R. S. (1937): Gel'mintology Krupnogo rogatogo skota i ogo molodnyaka (Helminthiasis of cattle and their young). Moskva, sel'khozgiz., 418pp.
- 10) Weinland, F. (1859) Observations on a new genus of Taenioids. Proc. Boston Soc. Nat. Hist., 6, 59—63.