CHAPTER V

STUDIES ON DJOMBANGIA INDICA SP. NOV. (CESTODA: Caryophyllidea: Lytocestidae: Djombangiinae S. Fam. Nov.)

AND A NOTE ON 'DIVERTICULOSIS' OF THE FISH DUODENUM INFECTED WITH D. INDICA.
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STUDIES ON DIOUBANGIA INDICA SP. NOV. (cestode: Cestodariidae: Platyhelminthes: Dicrocoeliidae) AND A NOTE ON 'DIVERTICULOSIS' OF THE FISH DUODENUM INFECTED WITH D. INDICA.

INTRODUCTION

Bovien (1926) established Dioumbangia to include the only species, D. penetrans Bovien, 1926, recovered from Clarisae batrachus (Linn.). The chapter includes an account of another species, D. indica, recovered from the duodenum of Clarisae batrachus collected from the different tanks at Raipur during 1972 & 73.

Also discussed is the pathomorphology of 'diverticulosis' of the duodenum caused by this species of worms.

Seasonal infection: Fishes from six different tanks, namely, Maharajband, Budha tank, Kho-Kho tank, Telebandha tank, Rajatalao and Dumertala oak were systematically surveyed for parasitic infection. Ten specimens of each species of fishes were examined every fortnight during the year 1972 & 73.

In the subsequent years ten specimens from each tank of only species found infected were examined. Dioumbangia indica was recovered on three occasions, twice in March and once in April, 1973 from fishes of Budha tank. 1 to 10 worms were recovered from infected fishes.
MORPHOLOGY (Fig.68)

(Measurement in millimeters of ten worms, averages under bracket)

Body is fleshy, medium sized, measuring 7.296 to 13.776 (9.6) long and 1.768 to 4.272 (2.827) broad. Worms appear very much contracted when removed from host specimens.

Measurements of other parts are as follows:

Holdfast, 0.364 to 1.488 (1.142) long and 0.676 to 1.548 (1.076) broad; neck, 0.624 to 1.68 (1.114) long and 0.34 to 1.248 (0.6) broad; pretesticular body, 0.57 to 1.329 (0.839) long and 0.48 to 2.688 (1.686) broad; utero-testicular region, 3.466 to 8.64 (5.088) long and 1.056 to 3.184 (3.048) broad; post-testicular region, 0.528 to 1.392 (0.883) long, 1.632 to 2.976 (2.333) broad at the level of cirrus sac and 1.344 to 2.688 (2.049) broad at the level of ovary.

HISTOLOGY

Holdfast (Fig.69): Cuticle is thin. Sub-cuticle is thick, composed of outer circular, inner longitudinal muscles and epidermal neuromuscular cells. Parenchyma comprises diagonal & radial muscles and parenchymatous cells.

Holdfast bears at tip a feeble sucker. The sucker measures 0.329 by 0.517 and is lined with radial muscles.

Neck and pre-testicular region of body (Fig.70 & 71): Cuticle and sub-cuticle both are thick; the latter comprises of several layers of outer circular and inner
longitudinal muscles. The subcuticle comprises subcuticular cells and neuromuscular cells, which gradually diffuse in the parenchyma. The neuromuscular cells form lateral nerve trunks. The parenchyma includes parenchymatous cells and dense mass of longitudinal muscles.

**Uterotesticular region (Fig. 72 to 74)**: Histology is similar to neck & pre-testicular region. However, the epimedullary longitudinal muscles of the parenchyma are very prominently arranged here in a layer differentiating the parenchyma into an outer cortex and an inner medulla. The vitelline follicles lie in the cortex and the testes & uterus lie in the medulla.

**Post-testicular region (Fig. 75 to 77)**: Histology is similar to utero-testicular region except that the epimedullary longitudinal muscles of parenchyma are less prominent here. Ovarian follicles, isthmus, oocyte, vagina and uterus lie in the medulla, while the vitellaria are cortical.

**REPRODUCTIVE SYSTEM**

**Male Genital System (Fig. 65)**: Testes are numerous, spherical or ovoid, medullary in position and measuring 0.048 to 0.168 long and 0.06 to 0.18 broad. They commence just behind the neck and extend, in two lateral rows, to the anterior level of ovary, thus occupying 3.45 to 8.64 of body length. Vas-efferentia form a loosely coiled vas deferens. Cirrus sac is massive, ovoid, lies medullary in the last seventh of body and measures
0.328 to 1.104 (0.808) long and 0.288 to 0.980 (0.648) broad. It encloses an ejaculatory duct and a cirrus proper. Cirrus opens in a genital atrium. The uterovaginal canal also opens in the genital atrium on the same surface. However, the cirrus and uterovaginal apertures are distinct from each other (Fig. 66).

**Female Genital System (Fig. 65):** Ovary lies in the last tenth of body. It is bilobed. The two lobes respectively measure 0.426 to 0.86 (0.527) by 0.17 to 0.493 (0.295) and 0.34 to 0.816 (0.638) by 0.017 to 0.51 (0.289). Each lobe of ovary comprises thirty five to forty follicles. The ovarian follicles measure 0.036 to 0.108. The two lobes of ovary are separated by a broad, horizontal isthmus, measuring 0.03 to 0.10 long and 0.48 to 0.84 broad. Oviduct arises from the right side of the isthmus and enters ootype. Ootype lies in the medulla. It is a large, oval chamber, surrounded by mehlis' gland. Mehlis gland occupies 0.108 to 0.23 (0.176) long and 0.18 to 0.24 (0.20) broad area at the posterior end of body. A duct from the transverse vitelline duct opens in the oviduct, close to ootype. The vaginal canal also opens in the oviduct, close to ootype. The vaginal canal measures 0.17 to 0.51 (0.328) long and 0.034 to 0.086 (0.06) broad. It is lined with a sheath of large cells with dark staining nuclei enveloped by outer circular and inner longitudinal muscles. The vaginal canal descends dorsal to ovary to open in the oviduct. Uterus commences at the ootype, and ascends dorsally to ovarian isthmus. It
forms several loops in the testicular region of body, bends upon itself at the level of anterior most testes and then descends. It forms several loops in the testicular region during descending course also. It is full of eggs in this region. The uterus finally joins the vaginal canal to form a common utero-vaginal canal before opening on the ventral surface through utero-vaginal aperture (Fig.66). The middle portion of the uterus is lined with glandular epithelial cells. The proximal and distal portions are non-glandular (Fig.74). Eggs are embryonated and operculate. The shell is thick and bears a spine.

Vitelline System: Vitelline follicles are exclusively cortical, extending from the level of anterior most testes to posterior end of body. Vitelline follicles are ovoid to spherical and measure 24 to 96 by 24 to 84 microns.

Nervous System: Nervous system includes a pair of lateral nerve trunks, extending the entire length of holdfast, neck & body and originate in the neuromuscular cells of parenchyma.

Excretory System: Excretory system includes three pairs of excretory tubes. These branch profusely in the holdfast and unite at the level of posterior end of body to form a median excretory bladder. The excretory bladder measures 0.03 to 0.06 (0.048) long and 0.07 to 0.17 (0.1) broad. The excretory bladder has rich innervation, hence stains deep blue with indoxyl acetate technique.
**Egg & Onchospheres (Fig. 67 & 68)**

The eggs are small, omerculate and embryonated. They measure 0.054 to 0.081 (av. 0.07) long and 0.0435 to 0.058 (0.052) broad. They are collected by teasing the uteri. Viable eggs are light brown in colour. Egg shell is covered with minute spines approximately 0.003 mm. length. The spinous projection at the apex of egg shell measures 0.0043 mm.

The onchosphere, with six hooks, is clearly visible along the length of egg. They measure 0.0348 to 0.0690 (0.0462) in length and 0.029 to 0.0348 (0.033) in breadth. They have a non ciliated membrane, six hooks arranged in three pairs, inner pair being slightly larger (0.0203 with median granular cells 0.0087 by 0.006) than either of the outer 2 pairs (0.016). The only other structure made out in the fresh preparation of onchosphere are several globular cells in the form of oil droplets. Movement of the onchosphere is slow (hooks are also capable of movement). They do not emerge from egg shell.

'DIVERTICULAR' OF THE FISH DUODENUM

**Gross Structure**: The outer surface is studded with numerous 'diverticulae' (Fig. 78) measuring 1.104 to 1.392 (av. 0.267) by 1.672 to 2.16 (2.032) mm.

Cut-surface of the duodenum shows the worms to have penetrated very deep in the duodenal wall (Fig. 79).

**Microscopic Structure**: The worms penetrate the duodenal wall, close to pylorus, herniating through the
mucosa, sub-mucosa and the muscle layers. The successive stages of penetration are as follows:

The hold-fast of the worms attaches to the mucosa of the duodenum (Fig. 80), pushes the latter above it; this produces inflammatory responses, mainly mononuclear, in the sub-mucosa; the muscle layers give way and the serous coat bulges out in the form of a pouch or 'diverticulum' (Fig. 81). This pouch is small in the beginning, but grows larger subsequently. The leucocytes, from the sub-mucosa, infiltrate into this 'diverticulum'. While the outer wall of the diverticulum remains comparatively thin, the lateral walls become very thick and almost entirely occupied by leucocytes (Fig. 82 & 83). No trace of muscles is found in the 'diverticulum'. It is inferred that the 'diverticulum' is formed at the point where the muscle layers give way. The cavity of the 'diverticulum' is an extension of the duodenal lumen. The worm pushes its hold-fast into this cavity and lies thus.

These 'diverticulae' are closed on their outer surfaces. They do not open in the abdominal cavity. Bovien (1926), on the other hand, described them to open in the abdominal cavity of the fish host in the only other known species, *P. penetrans* Bovien, 1926.

Parasitic effects are prominently noticeable in the histology of the duodenum. Comparison of the histology of the duodenum of uninfected and heavily infected fishes reveals that, while the muscle layers are
very thin and the villi are very tall in the former (Fig. 85), they are very thick and the villi are much shorter in the latter (Fig. 84). The enormous thickening of muscles must affect peristalsis. The general metabolism must be affected. The fishes consequently become sluggish and moribund.

**TAXONOMIC DISCUSSION**

Yamaguti (1959) created a lot of confusion in assigning caryophyllaeidae (to include Caryophyllaeinae, Capingentinae & Lytocestinae) to cestodaria in total disregard of Wardle & McLeod (1962) who had raised a new order Caryophyllidea under Cestoda and included families, Caryophyllaeidae, Lyocestidae, Capingentidae and Wenyonidae under it. It is impossible to agree with Yamaguti's contention. Caryophyllidea are definitely like Pseudophyllidea. They are, however, peculiar in their monozoocy and absence of proglottisation. They seem to be neotenic proceroids.

The present author shares the opinion of Wardle & McLeod in that Caryophyllidea be retained under cestoda. It should include Lyocestidae, with cortical vitellaria, Capingentidae, with partly cortical and partly medullary vitellaria, Caryophyllaeidae, with entirely medullary vitellaria and Wenyonidae with the genital aperture in the anterior half of body.

Lyocestidae, however, should be divided into two sub-families, Lyocestinae and Djombangiinae n.s. fam. Djombangiinae, while it shares with Lyocestinae the
character of cortical vitelline follicles, is distinct from it in having a feeble sucker at the tip of holdfast, in the anterior extension of uterus and in the presence of embryonated eggs in the uterus.

Djombangiinae n.s.fam. would include Djombangia and the two species D.penetrans and D.indica sp.nov.

The present form D.indica sp.nov. is the second species under this genus. It differs from D.penetrans in having a short neck in the extension of vitellaria in the postovarian region and in the absence of recentaculum seminis. Besides these differences the diverticulae do not open in the duodenal surface (cf. D.penetrans where Bovien (1926) described them to open in the abdominal cavity).

Bovien (1926) referred the projections on the duodenal surface as 'Capsules'. The present author considers 'diverticulae' more apt.