natural and experimental plants exhibiting a wide variation for follicle length, seed number and pollen sterility.

Follicles (fruits) for this study were drawn from a total of 27 plants/sectors consisting of: nine plants selected from natural population based on the differences in flower colour (pink, light pink, white, white with pink orifice) and pubescence; six F_1 hybrids; seven M_1 plants raised from seeds treated with γ-ray (20 and 30 Kr) or ethyl methane sulphonate (0·6 and 1·0%), and five sectors varying in pollen fertility from a plant raised from single node following 2 Kr, γ-ray treatment.

Observations on follicle length and seed number were taken in matured follicles collected before dehiscence and dried in storage. Shrivelled seeds when found were not taken into account. In the total of 1513 follicles sampled, a wide variation (Fig. 1) was observed for follicle length (6 mm to 53 mm) and seed number (one to 44). Intra-plant variation was present for both characters in all the 27 plants/sectors. The mean values for follicle length and seed number of individual plants/sectors which were found to be significantly different ranged from $9{\cdot}8 \pm 1{\cdot}75$ mm to $38{\cdot}6 \pm 10{\cdot}79$ mm and $2{\cdot}9 \pm 1{\cdot}47$ to $28{\cdot}0 \pm 8{\cdot}36$, respectively.

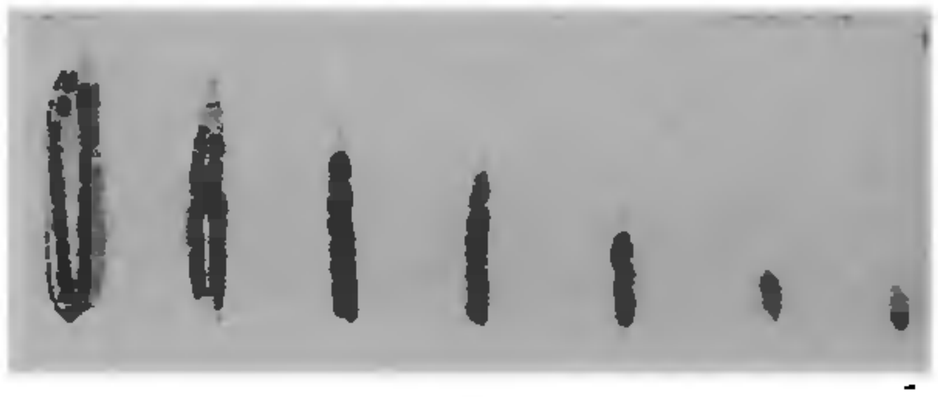

FIG. 1

The association of follicle length and seed number was tested for linear relationship using data from individual follicles of plants. The coefficient of determination of 88·2% obtained for the pooled data was indicative of an intimate linear relationship. A highly significant positive linear relationship between these characters was evident in each of the plants/sectors studied. The regression of follicle length (y) on seed number (x) was worked out using pooled data and was determined as $b_{yx} = 0{\cdot}8693$. Thus the data provide indirect but compelling evidences for a linear relationship as verified over a wide range of expression of both characters within and across genotypes.

Pollen sterility in the 27 plants/sectors ranged from 1·28% to 92·33%. The correlation of pollen sterility with follicle length and seed number were computed using respective plant means. A highly significant but negative correlation was detected in respect of mean follicle length and pollen sterility ($r = -0{\cdot}8408$) on the one hand and mean seed number and pollen sterility ($r = -0{\cdot}9040$) on the other.

The high negative correlation between seed number and pollen sterility may be considered to reflect a close correspondence in the fertility of the male and female gametes in the materials studied. This relationship may be profitably employed in screening plants for fertility in mutation experiments. But, in view of the wide intra-plant variation for both follicle length and seed number, the conclusions need to be based on adequate samples.

The authors are thankful to Dr. G. S. Randhawa, Director, for his encouragement and Mr. P. R. Ramachander and Mr. V. R. Srinivasan for suggestions on the analyses of the data.

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T. VASANTHA KUMAR.

1. Nitsch, J. P., *The Biochemistry of Fruits and Their Products*, Academic Press, London 1970, **1**, 427.
2. Coombe, B. G., *Ann. Rev. Plant Physiol.*, 1976, **27**, 207.
3. Nitsch, J. P., *Encyclopedia Plant Physiol.*, 1965, **15** (1), 1537.
4. Hui Lin Li and Willaman, J. J., *Econ. Bot.*, 1972, **26**, 61.

TWO NEW SPECIES OF *MYXOBOLUS* (MYXOSPORIDEA: PROTOZOA) PARASITIC ON *CIRRHINA MRIGALA* (HAMILTON) AND *PUNTIUS CURMUCA* (HAMILTON)

THE importance of myxosporidian parasitism of fish stocks had come to light in recent years and the reports on the pathological symptoms, the mortalities caused by them as well as their biology had been reviewed by Mitchell[1] and Seenappa[2]. In India, more than forty species have been described by several workers from both marine and freshwater fishes[3–8]. In the present report two new species of *Myxobolus* are described.

During the course of investigation under a fish disease scheme, fishes were collected from the irrigation canal at Tungabhadra Dam and the river Netravathi at Bantwal. One (17 cm) of the four mrigal (*Cirrhina mrigala*) yearlings caught in the T.B. Dam canal had two white cysts at the inner base of the hemibranchs. In the Netravathi sample a *Puntius curmuca* (19·0 cm) had several white cysts below the scales. The cysts were either circular, subspherical or irregular in shape. They were punctured and the spore smears were prepared. The smears were stained with methylene blue (1·0%) and Lugol's iodine. The spore characters were recorded and camera lucida sketches were drawn.

Since, formalin preserved samples were used polar filament extrusion was not attempted.

From the spore characters noticed, both the parasite species were found to belong to the genus *Myxobolus*.

Myxobolus sp. from *C. mrigala* : The spores oval in front view and lenticular in side view; the shell valves thick, sutural ridge without thickenings or articulations; the intercapsular ridge, present between the openings of the polar capsules, more or less diamond shaped; polar capsules unequal, one larger and pyriform, and another smaller (about half of the larger) and almost oval, with bluntly tapering anterior ends; the triangular polar capsule nucleus at the posterior end of the capsule; the sporoplasm, containing a nucleus and an almost oval iodinophilous vacuole, fills most part of the extracapsular space (Fig. 1).

Myxobolus sp. from *P. curnuca* : Spores oval in front view and lenticular in side view with the posterior end broader than the anterior; the shell valves thick; sutural ridge without thickenings; the intercapsular ridge triangular and very prominent pointing down in between the openings of the polar capsules; the polar capsules pyriform, either equal or slightly unequal and with pointed anterior ends; the nucleus of polar capsule situated at the posterior end of capsule; the sporoplasm shield shaped with a centrally situated nucleus; the iodinophilous vacuole circular

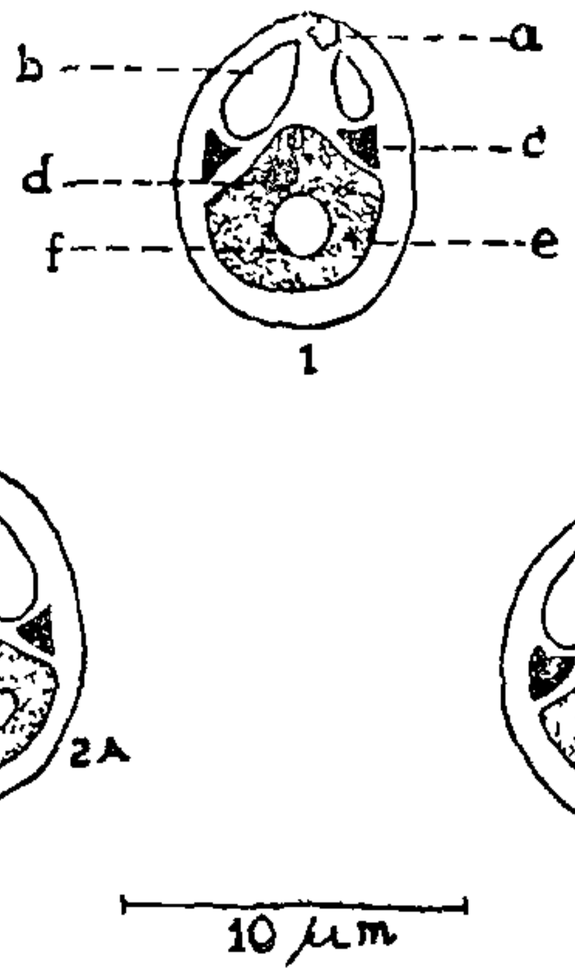

FIG. 1. *Myxobolus carnaticus* (*a*) Intercapsular ridge, (*b*) Polar capsule, (*c*) Polar capsule nucleus, (*d*) Sporoplasm nucleus, (*e*) Sporoplasm, (*f*) Iodinophilous vacuole. FIG. 2. *Myxobolus curnucae*. A. Spore with unequal polar capsule B. Spore with equal polar capsule.

to nearly cylindrical, the size and position being variable (Fig. 2).

The morphometric data of both the species of *Myxobolus* is given in Table I.

TABLE I

Measurements (in µ) of two species of Myxobolus. *The values given are the means of* 35 *observations and those given in parentheses are the ranges*

Spore characters	*Myxobolus* sp. from *C. mrigala*	*Myxobolus* sp. from *P. curnucae*
Size of the spore	8·6 × 6·8 (8–9) (6–7)	9·8 × 7·6 (8–11) (7–8)
	Unequal	*Unequal*
Size of the polar capsule		
Larger :	3·8 × 2·0 (3·5–4·0)	4·9 × 2·5 (4·5–5·0) (2–3)
Smaller :	2·1 × 1·5 (2–3) (1–2)	3·9 × 2·4 (3–4) (2–3)
		Equal
		4·1 × 2·3 (4–5) (2–3)
Size of the sporoplasm	3·0 × 5·0 (4·5 6·0)	3·0 × 5·2 (2 4) (5 6)
Thickness of the spore	5·3 (5–6)	5·2 (5·0 5·5)

Of the two *Myxobolus* sp. described in this report, the one parasitizing the gills of *C. mrigala* was found to resemble *Myxobolus dispar* Thelohan, 1895, in having unequal polar capsules and an intercapsular ridge, but differs from it in the size of the spore and the polar capsule as well as in not having thickenings or articulations on the shell valves. Further, this species also resembles *M. vanivilasae*[2] in the shape of unequal polar capsule and in having intercapsular ridge, but differs from it in the site of infection, size and shape of the spore and the size of the smaller polar capsule. The other one collected from *P. curmuca* had similarity with *Myxobolus batae* described from *Labeo bata*[3] in the shape of the spore and the polar capsule, presence of an intercapsular ridge and in the size of the spore. But it differs in the site of infection, absence of thickenings on the sutural ridge and in the thickness of spore. Further, this species also had similarity with *M. vanivilasae* in possessing both equal and unequal polar capsules, presence of intercapsular ridge and the site of infection, but differs from it in the spore shape and size of the polar capsule. Since, the present two species of *Myxobolus* collected from *C. mrigala* and *P. curmuca* do not compare well with other species of *Myxobolus* described so far,[4–8] they are considered new and are named as *Myxobolus carnaticus* sp. nov. and *Myxobolus curmucae* sp. nov. respectively. It may be added that this is the first record of *Myxobolus* sp. infection on *P. curmuca.*

The authors thank Prof. H. P. C. Shetty, Director of Instruction, College of Fisheries, Mangalore, for the encouragement and facilities. This research was supported in part by a grant from the Indian Council of Agricultural Research, New Delhi.

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1. Mitchell, L. G., *Parasitic Protozoa*, Academic Press, New York, 1977, 2, 115.
2. Seenappa, D., *M.F.Sc. Thesis*, College of Fisheries, University of Agricultural Sciences, Mangalore, 1978.
3. Karamchandani, S. J., *J. Inland Fish. Soc. India*, 1970, 2, 170.
4. Tripathi, Y. R., *Rec. Ind. Mus.*, 1953, 50, 63.
5. Southwell, T. and Prashad, B., *Ibid.*, 1918, 15, 344.
6. Chakravarty, M. M., *Arch. protistenk*, 1939, 92, 169.
7. —, *Proc. Ind. Acad. Sci.*, 1943, 18B, 21.
8. Chaudhury, S. R. and Chakravarty, M. M., *Acta Protozol.*, 1970, 8, 167.

HISTOPATHOLOGY OF THE CESTODE *AMOEBOTAENIA INDIANA* (COHN. 1900) FROM *GALLUS DOMESTICUS* AT AURANGABAD, INDIA

THE cestode *Amoebotaenia indiana* has been found in large numbers in the intestine of *Gallus domesticus* at Aurangabad, India. The worm is short with a penetrative type of scolex, the rostellum is provided with hooks. It penetrates the mucosa and the submucosa and adheres there very firmly and does not reach the muscle layers. Plug formation is seen at the ruptured epithelial portion, which may have been formed from lymphocytes and eosionophilic cells.

Pieces of the infected and uninfected intestine were fixed in Bouin's; they were dehydrated by graded alcohols, cleared and embedded in paraffin wax. The transverse and longitudinal sections were taken at 7 μ. The slides were stained with (Weigert's) iron haematoxylene and eosine.

These cestodes get attached to the host by the hooks on the rostellum. Here the worm tries to approach the intestine through the crypts of Lieberkuhn (Fig. 1) and succeeds in destroying the crypts and reaching upto the submucosa (Fig. 2) ; later the hooks of the rostellum pierce through the submucosal epithelial tissue (Fig. 3).

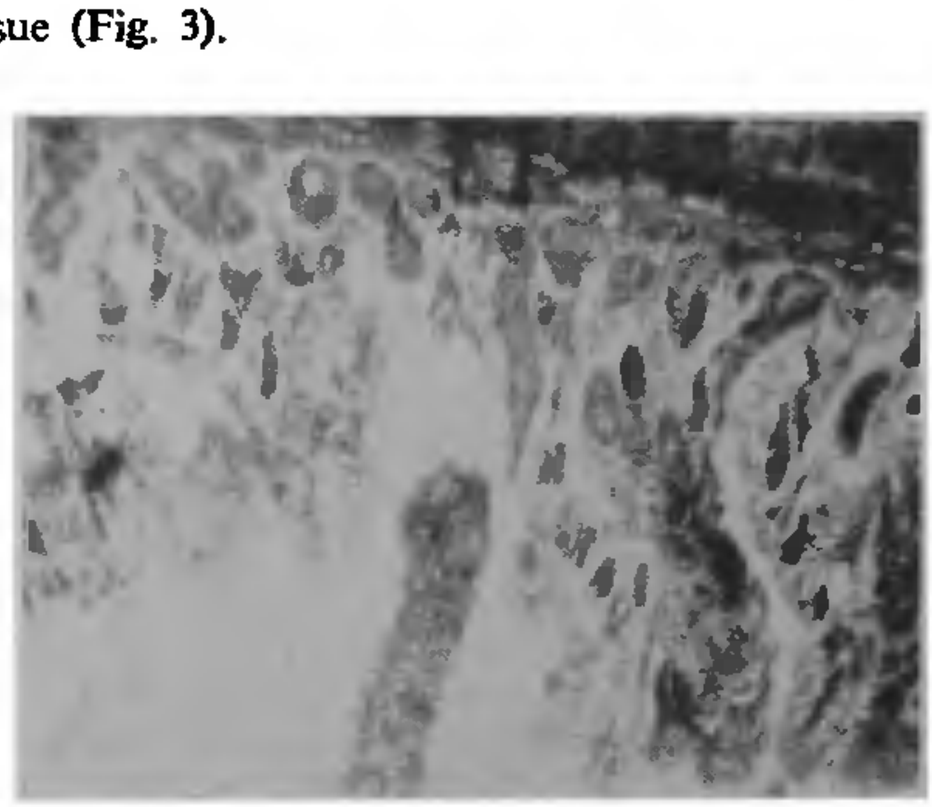

FIG. 1. *Amoebotaenia indiana* is approaching the crypts of Lieberkuhn of *Gallus domesticus.*

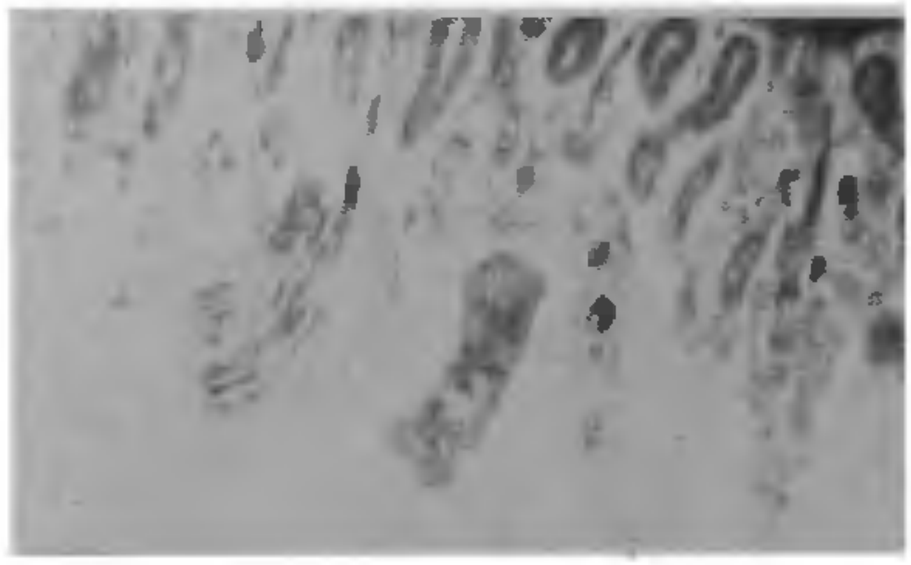

FIG. 2. *Amoebotaenia indiana* through the crypts upto the submucosal layer of *Gallus domesticus.*