

***Myxosoma gnathopogonae* sp. nov. (Myxosporea, Bivalvulida)**  
**Found in the Cutis of the Roach *Gnathopogon***  
***elongatus caerulescens***

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**Key words:** *Myxosoma*, Myxosporca, new species, roach, *Gnathopogon*, SEM

**Introduction**

Seventy three species of *Myxosoma* have been described and all of these specific characteristics were described in the following papers: Kudo (1920, 1933, 1934), Fujita (1924, 1927, 1929), Fantham *et al.* (1939, 1940), Ozaki and Ishizaki (1941), Hoshina (1949, 1952), Laird (1953), Iversen (1954), Ishizaki (1957), Bychowsky (1962), Baker (1963), Guilford (1963, 1965, 1967), Hoffman *et al.* (1965), Lalitha-kumali (1969), Parker *et al.* (1971), Spall (1974), Chung and Kou (1977), Narashimuhamurti *et al.* (1980).

In Japan, following thirteen species of *Myxosoma* are known by Kudo (1920, 1933, 1934), Hoshina (1952), Ishizaki (1957): *M. acuta* (Fujita, 1912), *M. acheilognathi* (Fujita, 1927), *M. anguillae* (Fujita, 1929), *M. concentricata* (Ozaki and Ishizaki, 1941), *M. dujardini* Thelohan 1892, *M. dermatobia* (Ishii, 1916), *M. elliptica* (Fujita, 1924), *M. gigi* (Fujita, 1927), *M. kawabatae* (Fujita, 1927), *M. leucogobiana* (Fujita, 1927), *M. luciogobii* Ishizaki, 1957, *M. pseudorasborae* Hoshina, 1952, and *M.*

*sphaerica* (Fujita, 1924).

The present paper describes a myxozoan parasite found in *Gnathopogon elongatus caerulescens* collected in the Lake Okutama from summer to autumn in 1980. About 14 percent of the fish were infected by several milky white cysts in the head region of the host fish. The present species differs from all known *Myxosoma* species in various respects. Therefore, the species is thought to be new and *M. gnathopogonae* sp. nov. is proposed for its specific name.

**Materials and Methods**

Myxozoan parasites were obtained from 54 specimens out of 372 roaches (*Gnathopogon elongatus caerulescens*) captured in the Lake Okutama (map reference: 35°46'N, 139°02'E) Tokyo from August to November, 1980. Observations of the parasite was made both on fresh and fixed specimens. Preparations for light microscopy were prepared as follows: pieces of the infected tissues were fixed in Bouin's solution, embedded in parafin, sectioned at 5  $\mu$ m and stained with hematoxylin and eosin (HE) and Mowry's alcian blue (Sano, 1974). Smear preparations of spores were fixed in methyl alcohol or Carnoy's solution and stained with any of Giemza's stain, HE, PAS and Best's carmin. For scanning

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electron microscopy, spores were fixed in 2.5% glutaraldehyde (in 0.1 M phosphate buffer, pH 7.4) at 0 C for 2 hours, and then treated with 1% osmic acid at 0 C for 1 hour.

### Description of the Species

*Myxosoma gnathopogonae* sp. nov.

Host: *Gnathopogon elongatus caeruleus* (Sauvage), Cyprinidae

Location: cutis of the head region

Locality: Lake Okutama, Tokyo

Date and infection rate:

As a whole, 14.5% (54/372 fish)

Aug. 28, 1980, 14.3% (3/21 fish)

Sept. 4, 1980, 22.0% (13/59 fish)

Oct. 4, 1980, 12.9% (36/280 fish)

Nov. 14, 1980, 16.7% (2/12 fish)

Material: NSMT-Pr 159, National Science Museum, Tokyo, MPM Coll. No. 19374, Meguro Parasitological Museum, Tokyo.

#### Specific description

##### Trophozoite (Vegetative forms)

Fully grown trophozoites have macroscopical size and lie in the cutis of the head region, especially on the snout, but the other parts of body posterior to operculum are free from the infection (Fig. 5).

Trophozoites are located in the cutis (Fig. 6). They are elliptical and somewhat protruded from the surface of the skin. But trophozoites are irregular-shaped when located closely each other. The size of trophozoites is 0.6 to 2.4 mm. A few small

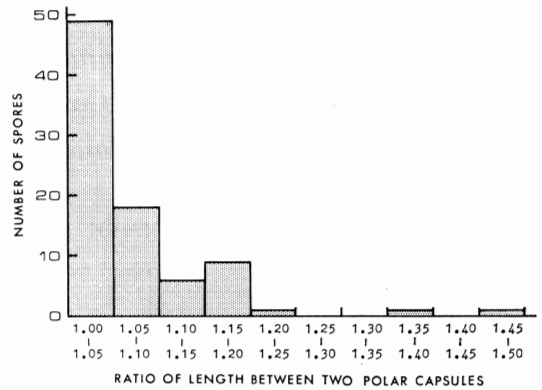


Fig. 1 The ratio of length between two polar capsules of *Myxosoma gnathopogonae* sp. nov.

trophozoites less than 0.015 mm are also found in the tissue by histological observations. Trophozoites are coarse and filled with spores in the central part, whereas homogeneous and filled with nuclei and sporonts in the peripheral zone. The central portion is stained with alcian blue, but the peripheral zone is not stainable. The sporulation is shown in Figs. 10–15. The sporont are monosporoblastic.

##### Spore

The dimension of spore is compiled in Table 1. Spores are elliptical or oval in front view, lenticular with somewhat attenuated anterior end in side view, lenticular in end view and covered with mucous substance (Figs. 9, 16–18). They considerably vary in form and size (Figs. 19–21). The spore-valve is smooth without any appendage. The sutural line is straight.

Table 1 Dimension of spore and polar capsule of *Myxosoma gnathopogonae* sp. nov.

Item	Mean ( $\mu\text{m}$ )	Range ( $\mu\text{m}$ )	SD ( $\mu\text{m}$ )	N
Spore				
length	11.7	9.3–13.4	0.813	100
width	8.9	7.2–10.3	0.720	100
thickness	7.0	5.7–8.2	0.548	100
length: width	1.3	1.1–1.6	0.108	100
Polar capsule				
length	5.4	4.1–6.7	0.488	100
width	2.8	2.1–3.1	0.370	100

Remarks: Measurements are made by fresh specimens.

A pair of elongated-ovoid polar capsules are situated closely to each other, hardly leaving any space between them. These capsules in a spore vary in size. Figure 1 shows the ratio of length between two polar capsules. Half of the samples examined are almost equal in size ( $<1.05$ ), whereas the other half have higher ratio than 1.05 up to 1.47. There is no intercapsular appendix between them. The polar filament coils 12–14 times in the capsule but very undiscernible. Fresh spores easily extrude the polar filaments by being dried. The filament is about 60–100  $\mu\text{m}$  long (Fig. 22). Two extruded polar filaments run parallel to each other (Fig. 7). Two apertures of the polar capsules are found at a short distance of about 1  $\mu\text{m}$  between them (Fig. 8). The large sporoplasm contains two nuclei and is homogeneous. Iodinophilous vacuoles are absent. Irregular-shaped iodostainable granules are observed in the sporoplasm and on the surface including the mucous substance surrounding the spore.

Following six species of fishes were collected in the lake from August to November 1980 (number of fish captured in parentheses): *Biwia zezera* (16), *Zacco platypus* (12), *Hypomesus transpacificus nipponensis* (3), *Tribolodon hakonensis* (2), *Salmo gairdneri* (2) and *Pseudorasbora parva* (1). All these fishes were found free from the myxozoan parasite.

### Discussion

Walliker (1968) proposed the generic name *Myxosoma*, in place of *Myxobolus*, considering that there is no solid foundation for the distinction between the both genera based on the existence of iodophilous vacuoles in the sporoplasm. Lom (1969) also recognized *Myxosoma* as non-valid genus. On the other hand, Parker *et al.* (1971), Spall (1974) and Narasimhamurti *et al.* (1980) dealt with the genus

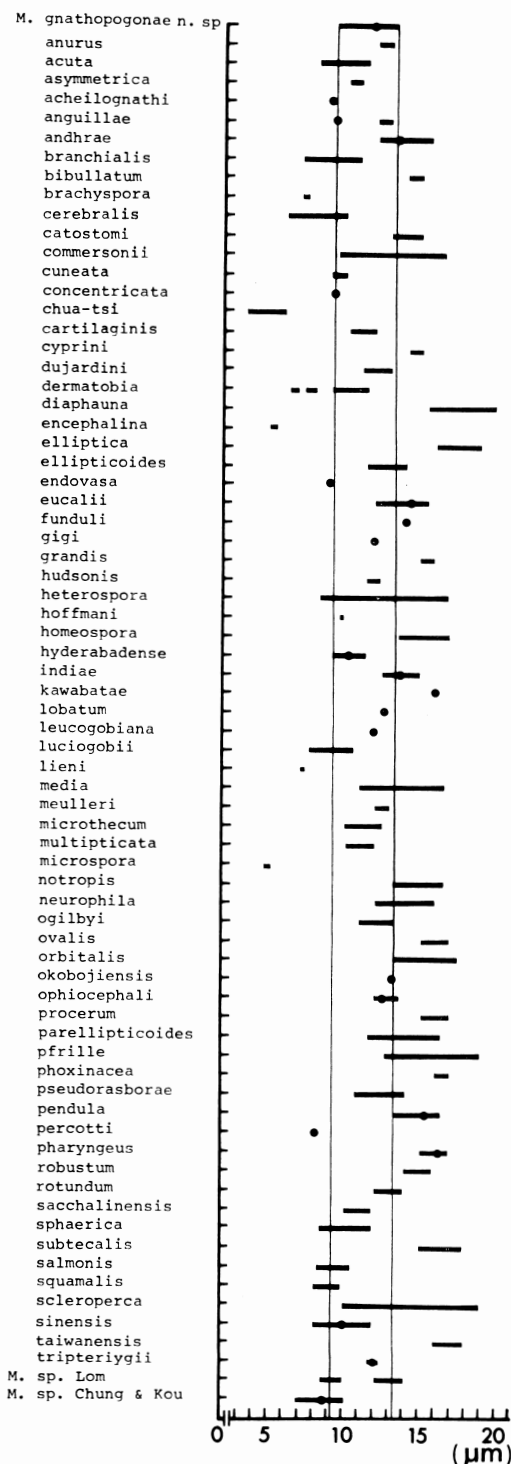


Fig. 2 Spore length of *Myxosoma gnathopogonae* sp. nov. and other described species of *Myxosoma*.

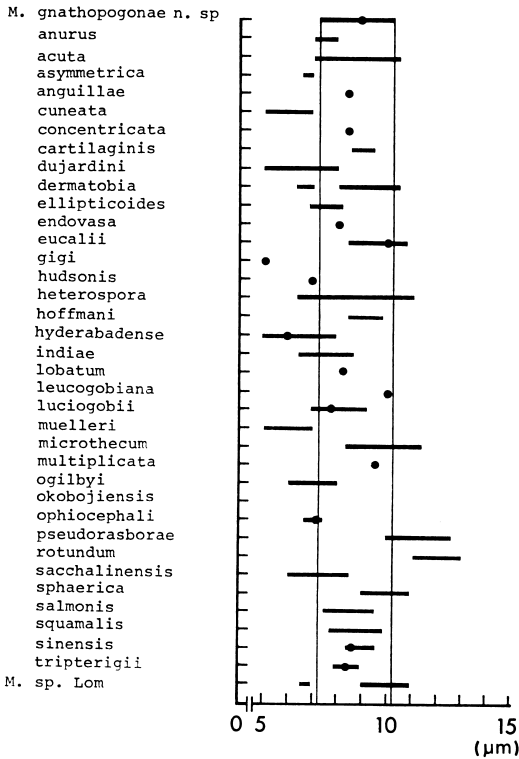


Fig. 3 Spore width of *Myxosoma gnathopogonae* sp. nov. and other described species of *Myxosoma*. (Species with different size in spore length from *M. gnathopogonae* are excluded.)

as valid. Recently the genus *Myxosoma* is considered to valid and the present authors also retain the genus.

The dimension and shape of the spores and polar capsule of the present species separate from other speices as shown in Figs. 2-4 and Table 2. The present species shows close resemblances to *M. ellipticoides* and *M. sacchalinsensis*, but distinctly differs from the above-mentioned two species as shown in Table 3. *M. ellipticoides* has flask-like polar capsules which have a relatively long duct and the conspicuous valvular nuclei. Two polar capsules are almost equal in size and less than half of the spore length. *M. sacchalinsensis* has perfectly fusiform spore in side view (Fuji-

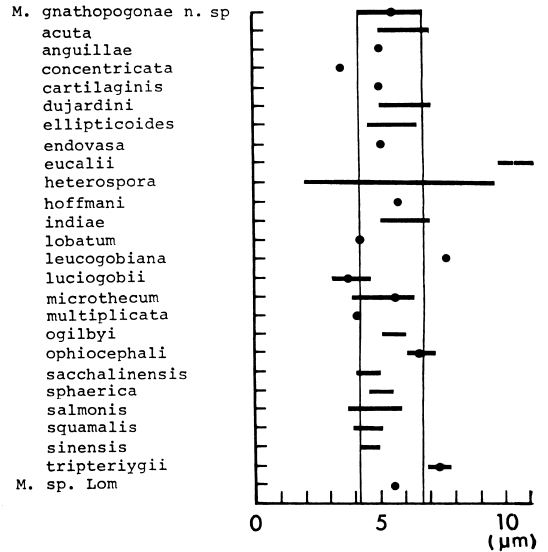


Fig. 4 Polar capsule length of *Myxosoma gnathopogonae* sp. nov. and other described species of *Myxosoma*. (Species with different size in spore length and width from *M. gnathopogonae* are excluded.)

ta, 1924), whereas the present species has lenticular form with somewhat attenuated anterior end in side view. Furthermore, *M. sacchalinsensis* is more or less extended oval form and often truncated anteriorly in front view. The polar capsules are almost equal in size and less than half of the spore length. The polar filaments are about 15  $\mu$ m long and shorter than the present species.

Consequently, the present species is distinguishable from all of above-mentioned species and is considered to be a new species and *Myxosoma gnathopogonae* is proposed. The specific name *gnathopogonae* refers to the generic name of the host fish.

Summary

The present paper describes a new myxozoa, *Myxosoma gnathopogonae* sp. nov. found in the cutis of the head of roach,

Table 2 Comparison of spore characteristics with related species of *Myxosoma*

Species	Inter capsular appendix	Valvular thickening	Fold	Number of coils of polar filament	Appendage of shell valve
<i>M. gnathopogonae</i>	—	—	—	12-14	—
<i>M. acuta</i>	+	—	—	ND	ND
<i>M. anguillae</i>	ND	—	+	ND	+
<i>M. cartilaginis</i>	ND	+	—	5- 7	ND
<i>M. ellipticoides</i>	ND	—	—	ND	ND
<i>M. hoffmani*</i>	ND	+	ND	ND	+
<i>M. indiae</i>	ND	ND	+	8-10	ND
<i>M. lobatum*</i>	ND	ND	+	ND	+
<i>M. microthecum</i>	+	—	—	ND	ND
<i>M. multiplicata</i>	ND	ND	+	ND	ND
<i>M. ogilbyi*</i>	ND	ND	+	ND	ND
<i>M. ophiocephali</i>	+	ND	+	7	ND
<i>M. sacchalinesis</i>	ND	—	—	ND	ND
<i>M. sphaerica</i>	ND	—	—	ND	+
<i>M. salmonis</i>	+	—	—	5- 6	—
<i>M. squamalis</i>	ND	—	—	4	+
<i>M. sinensis</i>	+	ND	+	6	ND
<i>M. sp. Lom*</i>	+	ND	ND	ND	+

+: present. —: absent. ND: not described.

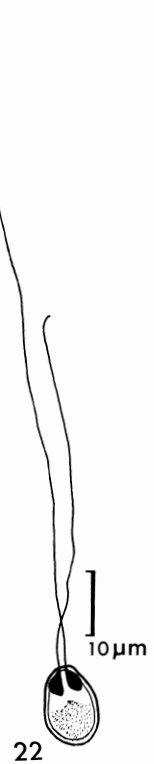
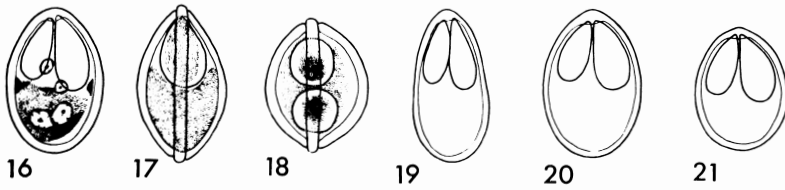
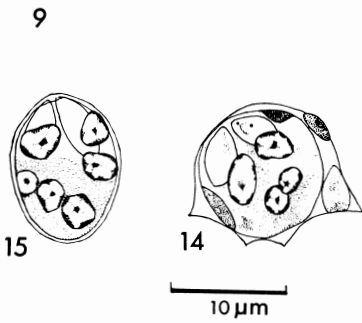
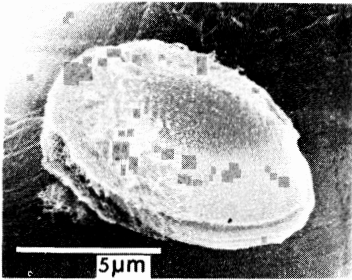
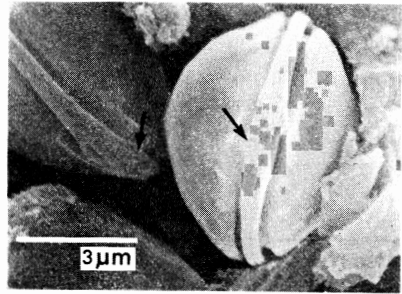
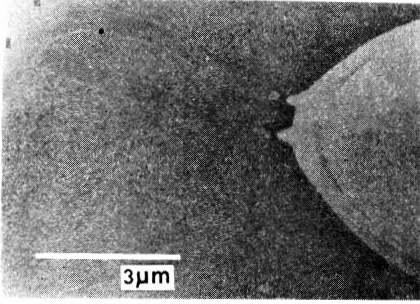
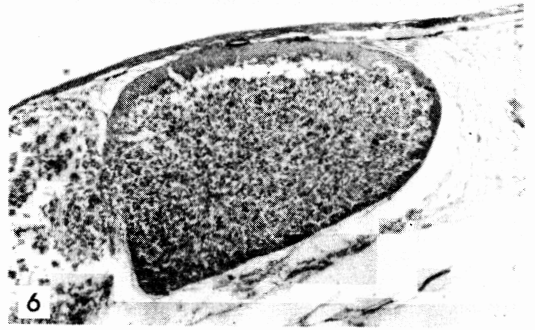
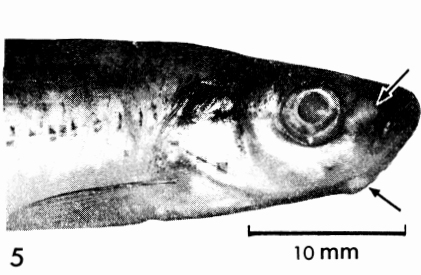
\* These species are referred to Kudo (1920), Bychowsky (1962) and Hoffman *et al.* (1965).

Table 3 Comparison of *Myxosoma gnathopogonae* sp. nov. with two related species, *M. ellipticoides* and *M. sacchalinesis*

	<i>M. gnathopogonae</i>	<i>M. ellipticoides</i>	<i>M. sacchalinesis</i>
Cyst	0.6- 2.4 mm	5.0- 8.0 mm	
Spore			
length	9.3-13.4 $\mu\text{m}$	11.4-14.1 $\mu\text{m}$	10.5-11.0 $\mu\text{m}$
width	7.2-10.3 $\mu\text{m}$	6.8- 8.2 $\mu\text{m}$	8.0- 8.5 $\mu\text{m}$
Polar capsul form	elongated ovoid	flask-like (relatively long duct)	long pyriform
length	4.1- 6.7 $\mu\text{m}$	4.5- 5.9 $\mu\text{m}$	3.7- 4.0 $\mu\text{m}$
width	2.1- 3.1 $\mu\text{m}$	1.8- 3.2 $\mu\text{m}$	1.8- 2.0 $\mu\text{m}$
Host	<i>Gnathopogon elongatus caeruleus</i>	<i>Catostomus commersonii</i>	<i>Carassius vulgaris</i>
Habitat	skin of head	skin behind operculum	gall bladder
Reference		Fantham <i>et al.</i> (1939)	Fujita (1929)

*Gnathopogon elongatus caeruleus*, collected from the Lake Okutama, Tokyo. The specific characteristics are as follows; trophozoite (vegetative form) is elliptical, 0.6-2.4 mm long, polysporous, and is found in the cutis of the host. Spore is elliptical or oval in front view, lenticular, anteriorly attenuated in side view and measures 9.3-

13.4  $\mu\text{m}$  long, 7.2-10.3  $\mu\text{m}$  wide and 5.7  $\mu\text{m}$  thick. A pair of polar capsules are situated at the anterior end of the spore, 4.1-6.7  $\mu\text{m}$  long, 2.1-3.1  $\mu\text{m}$  wide. Polar filament is 60-100  $\mu\text{m}$  long. Two large nuclei are found in the sporoplasm. Iodionophilous vacuole is absent.



### Acknowledgement

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### Explanation of Figures

Figs. 5-22 *Myxosoma gnathopogonae* sp. nov. Fig. 5 *Gnathopogon elongatus caerulescens* infected by *M. gnathopogonae*. Arrows indicate trophozoites. Fig. 6 A cross section of a trophozoite. Figs. 7-9 Scanning electron micrographs of spores. Fig. 7 A spore with two extruded polar filaments. Fig. 8 Anterior end of spores showing opening of polar capsules on the sutural edge of spores (arrows). Fig. 9 A spore partially covered with mucous substance. Figs. 10-15 Successive stages in sporulation. Figs. 16-18 Spores. Fig. 16 Front view. Fig. 17 Side view. Fig. 18 End view. Fig. 19-21 Front view of spores. Fig. 22 A spore with two extruded polar filaments.

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ホンモロコ, *Gnathopogon elongatus caerulescens* に寄生する Myxozoa の一新種  
*Myxosoma gnathopogonae* sp. nov. について

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著者らは1980年8~11月, 東京都, 奥多摩湖にて採集したホンモロコの頭部に白色異物を認め, 調査の結果ミクソゾア類の *Myxosoma* の栄養型であることが証明された。本虫は次の形質を示した。

栄養型: 楕円形又は不定形,  $0.6 \sim 2.4 \times 0.5 \sim 1.7$  mm, polysporous, sporont は monosporoblastic, 胞子: 正面楕円形または卵円形, 側面凸レンズ形, 胞子殻平滑, 縫合線は直線, 極嚢は2個, 前端に位置し西洋梨形, 極糸のコイルは12~14回。胞子の長さ  $9.3 \sim 13.4 \mu\text{m}$ , 幅  $7.2 \sim 10.3 \mu\text{m}$ , 厚さ  $5.7 \sim 8.2 \mu\text{m}$ ; 極嚢の長さ  $4.1 \sim 6.7 \mu\text{m}$ , 同幅  $2.1 \sim 3.1 \mu\text{m}$ , 極糸の長さ約  $60 \sim 100 \mu\text{m}$ ; 胞子原形質に iodophilous vacuole を

欠く。

寄生部位: 頭部皮膚の真皮上層部。

寄生率: 上述の期間に 372 個体のホンモロコを採集し, このうち54個体に寄生を認めた。

同定: 魚類の皮膚寄生種で本種に類似するものは邦産種には認められないが, 外国種には *Myxosoma ellipticoidea*, *M. sacchaliniensis*, の2種がある。しかしこれらのいずれとも胞子, 栄養型, 寄生部位, 宿生等を異にし明らかに本種と区別される。したがって本種は新種と認められ *M. gnathopogonae* sp. nov. と命名した。