

Redescription and Identification of a Gymnophallid Trematode in a Brackish water clam, *Tapes* (*Ruditapes*) *philippinarum*

TAKURO ENDO

Department of parasitology, Jikei University School of Medicine,
Tokyo 105, Japan

TOSHIKAZU HOSHINA*

Department of Pathology, Tokyo University of Fisheries

(Received for publication Mar. 8, 1974)

Fujita (1906, 1907) reported the presence of cercariae and metacercariae of some digenetic trematodes in the brackish water clam, *Tapes (Ruditapes) philippinarum* from the Bay of Tokyo. Later, Ogata (1944) raised the metacercariae to adult stage and identified the parasite with *Gymnophallus brusicola* Odhner, 1900.

During investigation into the occurrence of larval trematodes in the clam, the present authors found some errata concerning the Ogata's description and his identification of the worm. This paper deals with redescription of the trematode.

Materials and Methods

Clams, *Tapes (Ruditapes) philippinarum*, were collected during 1967 to 1969 at Tokyo Bay near the estuary of the river Edo.

The metacercariae were found in the interior part of the umbo of the clam. The metacercariae were observed at living state or after being fixed with Schaudinn's solution and stained with Heidenhain's iron haematoxylin. Some of the materials were fed to mice, and the animals were killed 3 to 7 days after feeding. Fully developed worms recovered from the intestines of the animals were investigated by the same methods as described above.

Results

METACERCARIA (Fig. 1):

Pyriiform body broadly round anteriorly, more pointed posteriorly; entire body with spines in quincunxial arrangement. Body length 197-337 μ , maximum width 104-213 μ . Oral sucker with lateral ear-like projection, 62-105 μ by 93-116 μ , near anterior end of the body. Eighteen to 20 gland cells behind oral sucker, and opening of the cell at the anterior end of the body. Ventral sucker 31-40 μ by 34-45 μ at about anterior two-thirds of the body. Prepharynx absent; pharynx 24-36 μ by 22-26 μ ; esophagus similar to pharynx in size; large ceca terminated posterior to ventral sucker. Testes opposite, slightly posterior to ventral sucker, 39-51 μ by 17-25 μ ; seminal vesicle hardly seen. Genital pore of pit-like shape at some distance anterior to ventral sucker. Ovary 31-41 μ by 21-31 μ , closely situated to anterior end of right testis; oviduct with attenuated proximal and more enlarged and ciliated distal portions, arises from posterior of ovary. Laurer's canal originates in distal portion of oviduct. Vitellaria in a single mass, on opposite side of ovary, postero-dorsal to ventral sucker. Uterus opens to genital atrium through behind ventral sucker. Excretory bladder filled with excretory granules, V-shaped, spreading to level of oral sucker. Flame cell formula $2[(2+2)+2]=12$.

* Present address: Egota Park Mansions 811,
6-41-2, Asahigaoka, Nerima-ku, Tokyo, Japan

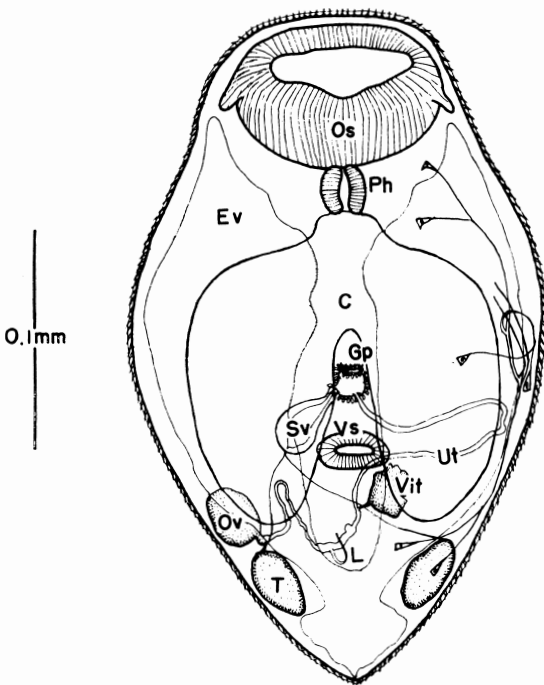


Fig. 1 Metacercaria

C: Ceca, Ev: Excretory vesicle, Gp: Genital pore, L: Laurer's canal, Os: Oral sucker, Ov: Ovary, Ph: Pharynx, Sv: Seminal vesicle, T: Testis, Ut: Uterus, Vit: Vitellaria, Vs: Ventral sucker.

ADULT (Fig. 2):

Shape and size of the fully grown worm are almost similar to those of metacercaria. However, with the growth of the parasite, ceca diminish markedly and excretory granules disappear. Reproductive organs develop, the winding uterus occupying most part of hind body.

Body length 249–404 μ , maximum width 140–228 μ . Oral sucker with lateral ear-like projection, 62–110 μ by 93–119 μ , near anterior end of body. Ventral sucker 33–42 μ by 34–46 μ at about anterior three-fifths of body. Prepharynx absent; pharynx 28–36 μ by 22–26 μ ; esophagus short; diminished ceca terminated anterior to ventral sucker. Testes opposite, slightly posterior to ventral sucker, 46–67 μ by 29–43 μ ; seminal vesicle undivided and large with about 52 μ in length, prostatic glands well developed;

genital pore certain distance anterior to ventral sucker. Ovary 41–55 μ by 36–46 μ , close to right testis; oviduct arising from posterior portion of ovary; seminal receptacle absent. End of oviduct enlarged, appearing to serve as substitute for seminal receptacle. Laurer's canal opens dorsally on median line between ventral sucker and posterior end of body. Vitellaria in a single mass, on opposite side of ovary, postero-dorsal to ventral sucker. Well developed uterus occupying most part of hind body and extending anterior to testes on both sides. Eggs thin-shelled; embryonated eggs 19–29 μ by 11–16 μ . Excretory bladder V-shaped, spreading to level of oral sucker. Flame cell formula same as in metacercaria, $2[(2+2)+2]=12$.

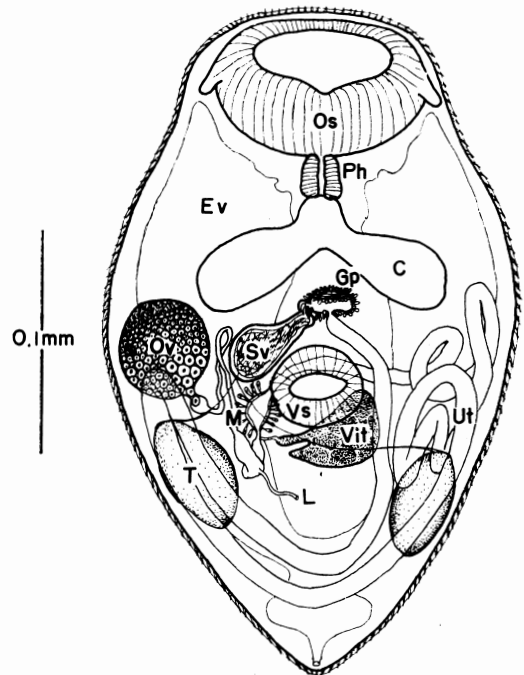


Fig. 2 Adult

C: Ceca, Ev: Excretory vesicle, Gp: Genital pore, L: Laurer's canal, M: Mehlis' gland, Os: Oral sucker, Ov: Ovary, Ph: Pharynx, Sv: Seminal vesicle, T: Testis, Ut: Uterus, Vit: Vitellaria, Vs: Ventral sucker.

Table 1 Comparison of the diagnostic characteristics of related species.

Species	<i>G. brusicola</i>	<i>P. timondavidi</i>	<i>Ad hoc</i> parasite	
			by Ogata	by the present authors
Size	900-500 μ by 500-880 μ	330-670 μ by 230-320 μ	420-480 μ by 210-230 μ	250-410 μ by 140-230 μ
Sucker ratio	1 : 1.2-1.4	1 : 2.2-2.6	1 : 2.5	1 : 2.5-2.8
Excretory vesicle	Y-shape	V-shape	V-shape	V-shape
Flame cell formula	2[(2+2+2) + (2+2+2)]	2[(2+2) + 2]	2[(2+2) + 2]	2[(2+2) + 2]
Egg size	21-28 μ by 15-19 μ	18-22 μ by 9-14 μ	22-25 μ by 12-14 μ	19-29 μ by 11-16 μ

IDENTIFICATION :

From the characteristics mentioned above, the parasite could be identified with *Parvatrema timondavidi* Bartoli, 1963. Some of the principal characteristics of the worm and its related species are shown in Table 1.

Discussion

Odhner created the genus *Gymnophallus* in 1900, and then erected the subfamily Gymnophallinae in 1906. Fujita (1925) proposed to create a new genus *Gymnophalloides* in the subfamily. Later, Cable (1953) added a new genus *Parvatrema* to it. Since the genus *Parvatrema* was quite different from the other two genera, Yamaguti (1958) insisted to erect the subfamily Parvatrematinae. Ching (1965) created new genera : genus *Lacunovermis* in the subfamily Parvatrematinae and genus *Meiogymnophallus* in the subfamily Gymnophallinae. Thus, the classification of this group has been variable and so confused until recently (Stunkard and Uzman, 1958 ; James, 1962 ; Loos-Frank, 1971). According to Yamaguti (1971), the latest taxonomy of the Gymnophallid group is as follows :

Family	Gymnophallidae
Subfamily	Gymnophallinae
Genus	<i>Gymnophallus</i> <i>Gymnophalloides</i> (= <i>Lacunovermis</i>) <i>Meiogymnophallus</i>
Subfamily	Parvatrematinae
Genus	<i>Parvatrema</i>

Fujita (1906) reported that the frequency of occurrence of the metacercariae in the

clam, *Tapes (Ruditapes) philippinarum*, collected at Tokyo Bay was very high. Ogata (1944) also found that almost 100% of the clams were infected with the parasite. The present authors found that all the clams of more than 28 mm long collected at Tokyo Bay were parasitized with the metacercariae.

Nothing is given in the Ogata's paper concerning the ear-like projection of the oral sucker of both larva and adult, and the flame cell formula of the adult. Detailed information on the reproductive organs are also obscure in his paper.

After careful observation by the authors of both metacercaria and adult of this parasite, the trematode described by Ogata as those of *Gymnophallus brusicola*, was proved to belong not to the genus *Gymnophallus* but to the genus *Parvatrema*. The most principal key to the determination of that genus is to be the presence of the vitellaria forming a single mass and the flame cell formula as well. With the consideration of other characteristics, it was finally determined to be identical with *P. timondavidi* Bartoli, 1963, of which metacercariae and adults were already found by Bartoli (1963, 1965) in a clam, *Mytilus galloprovinciaris*, at Marseilles Bay and in an experimentally infected herring gull, *Larus argentatus michaellis*, respectively. Although the metacercaria of *P. timondavidi* has not yet been demonstrated in Japan from the genus *Mytilus*, it has broadly been found in several clam species : *T. philippinarum*, *Laternula kamakurana*, *Glauconome angulata* and *Telina* sp. (Ogata, 1944).

Summary

Ogata (1944) reported the presence of a metacercaria of the gymnophallid trematode in the brackish water clam, *Tapes (Ruditapes) philippinarum*. The metacercaria was raised to adult stage in the experimental animal, and the parasite was identified with *Gymnophallus brusicola* Odhner, 1900.

With this trematode, however, the present authors found that the parasite is not identical with *G. brusicola* but with a species belonging to the genus *Parvatrema*. Comparing this trematode with known species of the genus, it was finally identified with *P. timondavidi* Bartoli, 1963.

Acknowledgements

The authors would like to express their gratitude to Professor Jiro Ito, Hygiene Laboratory, Shizuoka University, for his valuable criticism and to Professor Akio Kobayashi, Department of Parasitology, Jikei University School of Medicine, for critical reading of the manuscript and encouragement through our studies.

References

- 1) Bartoli, M. P. (1963): Note préliminaire sur l'anatomie et la biologie de *Parvatrema timondavidi* n. sp. (Trematoda, Digenea). C. R. Acad. Sci. (Paris), 273, 518-520.
- 2) Bartoli, M. P. (1965): Données nouvelles sur la morphologie et la biologie de *Parvatrema timondavidi* Bartoli, 1963 (Trematoda: Digenea). Ann. Parasit. (Paris), 40, 155-164.
- 3) Cable, R. M. (1953): The life cycle of *Parvaterma borinquenae* gen. et sp. nov. (Trematoda: Digenea) and the systematic position of the Gymnophallinae. J. Parasit., 39, 408-421.
- 4) Ching, H. L. (1965): Life cycle of *Lacunovermis conspicuus* n. gen., n. sp. and *Meiogymnophallus multigemmulus* n. gen., n. sp. (Gymnophallidae, Trematoda) from *Macoma inconspicua* and diving ducks from Vancouver, Canada. Proc. helminth. Soc. Wash., 32, 53-63.
- 5) Fujita, T. (1966): On two species of cercariae from *Paphia (Ruditapes) philippinarum*. Zool. Mag., 18, 197-203. (in Japanese)
- 6) Fujita, T. (1967): On the specific name of cercaria found in *Paphia (Ruditapes) philippinarum*. Zool. Mag., 19, 281-282. (in Japanese)
- 7) Fujita, T. (1925): Etudes sur les parasites de l'huître comestible du Japon *Ostrea gigas* Thunberg. Ann. Parasit. (Paris), 3, 37-59.
- 8) James, B. L. (1964): The life cycle of *Parvaterma homoeotecnium* sp. nov. (Trematoda: Digenea) and a review of the family Gymnophallidae Morozov, 1955. Parasitology, 54, 1-41.
- 9) Loos-Frank, B. (1971): Zur Kenntnis der gymnophalliden Trematoden des Nordseeraumes. Z. Parasitenk., 36, 206-232.
- 10) Odhner, T. (1900): *Gymnophallus*, eine neue Gattung von Vogeldistomen. Centralb. Bakt., Abt. 1, 28, 12-23.
- 11) Ogata, T. (1944): On the morphology, ecology and life history of an Agamodistome parasitic in bivalve, *Paphia (Ruditapes) philippinarum* (Adames et Reeve). Sci. Rep. T. B. D., 7 sec. B, 1-24.
- 12) Stunkard, H. W. and Uzmann, J. R. (1958): Studies on digenetic trematodes of the genera *Gymnophallus* and *Parvatrema*. Biol. Bull., 115, 276-302.
- 13) Yamaguti, S. (1958): Systema Helminthum. Vol. 1, pts. I and II, Inter-science Publ., London and New York, 1575 pp.
- 14) Yamaguti, S. (1971): Synopsis of digenetic trematodes of vertebrates. Vols. 1 and 2, Keigaku Publ., Tokyo, 1074 pp.

アサリ, *Tapes (Ruditapes) philippinarum*, に寄生する *Gymnophallid trematode* の再記載と, その分類について

遠藤卓郎

東京慈恵会医科大学寄生虫学教室

保科利一

東京水産大学増殖科病理学教室

藤田 (1906) は, アサリ, *Tapes (Ruditapes) philippinarum*, に一種類のメタセルカリアが寄生していることを報告したが, この吸虫に関してはその後 Ogata (1944) により詳しい研究がなされた. Ogata はそのメタセルカリアをマウスに与え, その腸管より成虫を得て, これを *Gymnophallus brusicola* Odhner, 1900 と同定した.

しかるに, 著者らは本吸虫の成虫の形態につき Odhner の *G. brusicola* に関する原記載と照合しつつ詳細に検討した結果, この吸虫が明らかに *G. brusiocla* と

は異種であることを証明した. (Table 1 参照)

本吸虫は特に, 口吸盤側部に耳状突起を有すること, 卵黄巣が1個の塊状よりなること, 排泄回が大きく, V-字型を呈すること, さらに焰細胞形式が $2[(2+2)+2]=12$ であること, などの形態学的諸特徴から, 分類学上 Family Gymnophallidae, Subfamily Parvatrematinae, Genus *Parvatrema* に属さすべきであり, さらに同属既知種約10種につき検討した結果から, *P. timondavidi* Bartoli, 1963 と同定さるべきであると結論された.