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# Morphometrical and anatomical characteristics of *Pisidium casertanum* (POLI) from the Lake Biwa (Japan) (Bivalvia: Eulamellibranchiata: Pisidiidae)

With 3 Figures and 1 Table

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Abstract. Shell indices, mantle muscules arrangement, outer demibranch position and nephridium configuration of *Pisidium casertanum* (POLI) specimens from the Lake Biwa (north of Kyoto, Japan) are compared to those of European samples. It is concluded that the Japanese form is quite peculiar both in conchological and anatomical aspects and probably deserves a subspecific or even a specific status. The final decision would be possible after investigation of new materials. Some suppositions concerning *P. kawamurai* MORI from the same lake are put forward.

Kurzfassung. **Morphometrische und anatomische Charakterisierung von *Pisidium casertanum* (POLI) aus dem Biwa-See (Japan) (Bivalvia: Eulamellibranchiata: Pisidiidae).** - Schalenindizes, Anordnung der Muskulatur des Mantels, Position des äußeren Kiemenblatts sowie Konfiguration der Niere von Exemplaren von *Pisidium casertanum* (POLI) aus dem Biwa-See (nördlich von Kyoto, Japan) werden mit Exemplaren europäischer Herkunft verglichen. Es wird festgestellt, daß die japanische Form sowohl in konchyologischer als auch anatomischer Hinsicht sehr eigentümlich ist und wahrscheinlich eines subspezifischen oder gar eigenen spezifischen Status bedarf. Eine endgültige Entscheidung würde erst nach Untersuchung neuen Materials möglich sein. Einige Vermutungen zum taxonomischen Status von *P. kawamurai* MORI aus dem gleichen See werden vorausgeschickt.

## Introduction

Profound systematic investigation of Japanese species of the genus *Pisidium* was initiated by S. MORI. Among others, two interesting forms from the Lake Biwa (*Pisidium kawamurai* MORI and *P. cinereum lacustre* WOODWARD) were mentioned in his review (Mori, 1938). Since that time, some new ideas concerning taxonomy of small clams were introduced (KUIPER, 1962) and the new approach for diagnostics based on the wide species concept was applied for the faunistic revision in many European countries (ZEISSLER, 1971; PIECHOCKI, 1989). Anatomical investigation (KORNIUSHIN, 1992) revealed some characters of high diagnostic and taxonomic value which were neglected earlier. In the light of the recent advances in systematics of Pisidium, the new study of Japanese species seems to be rather important. The ancient Lake Biwa characterized by the number of endemic species (MORI, 1984) is especially interesting in this aspect.

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## Materials and methods

We had at our disposal the series of 10 specimens from the Lake Biwa, North Basin, off Hayasaki, depth 30 m, undated, collected and kindly granted by Dr. TETSUYA NARITA (Center for Ecological Research, Kyoto University). Measured were the length (L) and height (H) of a valve, shell thickness (D) and the breadth of hinge plate under the umbo (BH). Characters of the mantle edge (including mantle musculature), ctenidia, brood sacs and nephridia were considered the most important anatomical features (KORNIUSHIN, 1992). Position of the outer demibranch (Table 1) was evaluated by the ordinal number of inner demibranch filament corresponding to the anterior edge of the outer one.

## Results and discussion

The studied specimens have large compressed shells with flat posteriorly located umbones and relatively narrow hinge plate (Fig. 1 A-B). The largest one has the following dimensions: L 4.4 mm, H 3.7 mm, D 2.1 mm. In the mentioned characters, as well as in the values of shell indices, our specimens are most similar to those designated by MORI (1938) as *P. cinereum lacustre* WOODWARD. At the same time, they differ by triangular outline of the valve, arched hinge plate and hooked cardinal teeth, resembling in this aspect to the European lacustrine form *Pisidium casertanum* f. *ponderosum* STELFOX, 1918. Two specimens of the studied sample are characterized by the oval outline and the broad hinge plate (Fig. 1 D-E). Despite the mentioned differences, we consider the studied population conspecific to that described by MORI (1938). Nowadays, no subspecies are recognized in *P. cinereum* ALDER, 1838 = *P. casertanum* (POLI, 1791). Therefore, we can determine here only the species name of the studied sample - *P. casertanum*. However, peculiarities of the form inhabiting the Lake Biwa are obviuos and worth special investigation.

We compared shell indices of our sample with some conspecific forms from other regions (Table 1). All the mentioned samples from Europe were taken from the collection of the author, material from the Lake Baikal was kindly granted by Z.V. SLUGINA, Limnological Institute, Irkutsk. Among the estimated indices, the thickness index (D/H) is the most demonstrative. Populations of *P. casertanum* f. *ponderosa* from European lakes and *P. casertanum* f. *minuta* KOZHOV, 1936 from Lake Baikal have much higher values of this parameter. The forms from the Lake Lagunnoye on Kunashir island described as distinct species by STAROBOGATOV & BUDNIKOVA (1985) should be also mentioned in this connection: thickness index varies in them from 0.67 to 0.75. Only some stream populations may have the values of thickness index similar to those from Lake Biwa (Table 1) but they differ by the elongated oval shell with rounded outline and have no distinct angles or strongly arched hinge plate. The hinge index in the latter population is higher than in typical *P. casertanum*, but less than in *ponderosum* form. All the differences are statistically significant.

Specimens of *P. casertanum* from the lake Biwa have rather dense porosity (Fig. 1 C); scars of the inner radial muscle bundles (KORNIUSHIN, 1990) are quite clear but most of them are merged with the mantle line, 2 to 3 anterior bundles have separated scars (Fig. 1 F).

In the principal anatomical characters (short presiphonal suture, clearly distinguished muscle bundles of the pedal slit, short outer demibranch, closed nephridia with rectangular dorsal lobe) (Fig. 2), the studied sample corresponds to the diagnosis of *P. casertanum* group (KORNIUSHIN, 1992). In outer demibranch characteristics (Table 1) it is most similar to some stream populations from Europe and Far East of Russia. At the same time, the mantle muscle bundles are somewhat weaker then in the mentioned form of *P. casertanum* and similar to those of the *ponderosum* form, known from European lakes (Fig. 3).

The data presented above as well as those published in literature (MORI, 1938) show that *P. casertanum* from the Lake Biwa is quite peculiar both in conchological and anatomical as-

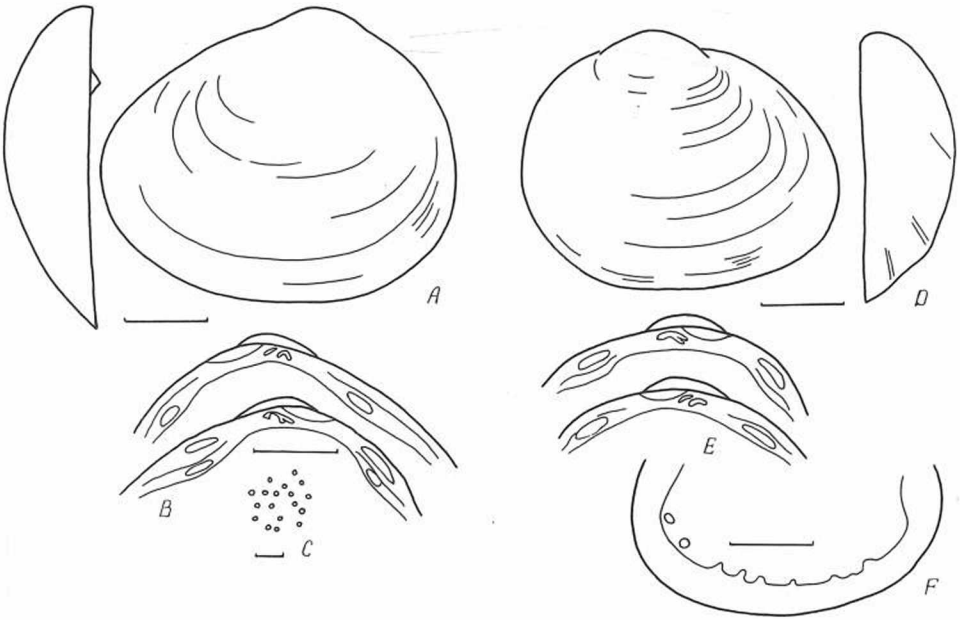


Fig. 1: Shells (A, D), hinges (B, E), pores (C) and muscle scars (F) of *Pisidium casertanum* specimens from the Lake Biwa: A-C -typical specimens, D-F - specimens with broad hinge plate. Scale bar: A-B and D-F = 1 mm, C = 0.1 mm.

| Form and locality, number of measurements | Height index (H/L) | Thickness index (D/H) | Hinge index (BH/H) | Position of the outer demibranch, n filaments |
|---|---|---|---|---|
| *P. casertanum*, Lake Biwa, n = 7 | 0.84 ± 0.018 | 0.55 ± 0.063 | 0.069 ± 0.015 | 13 - 15 |
| Stream population, Ukraine, n = 6 | 0.83 ± 0.022 | 0.60 ± 0.022 | 0.056 ± 0.004 | 13 - 17 |
| f. *ponderosa*, Estonia, n = 5 | 0.89 ± 0.030 | 0.69 ± 0.021 | 0.075 ± 0.004 | 9 - 10 |
| f. *ponderosa*, Ukraine, n = 6 | 0.89 ± 0.031 | 0.69 ± 0.047 | 0.079 ± 0.009 | 10 - 11 |
| f. *minuta*, Lake Baikal, n = 7 | 0.86 ± 0.024 | 0.69 ± 0.043 | 0.060 ± 0.011 | 10 - 11 |

Table 1: Morphometrical characters of *Pisidium casertanum* specimens from Lake Biwa in comparison with some other forms of the species.

pects. We consider that it is possibly a distinct subspecies or even a species. However, our material is not sufficient for the final determination of its status and collecting of new material is desirable.

Another form from the Lake Biwa, namely *P. kawamurai* MORI, 1938 should be mentioned in this connection. This species is not available for us now, but as far as we can conclude from the description, it is similar or even synonymous to *P. subtilestriatum* LINDHOLM, 1909, distributed in arctic and subarctic Eurasia, being also quite common in the Lake Baikal. The

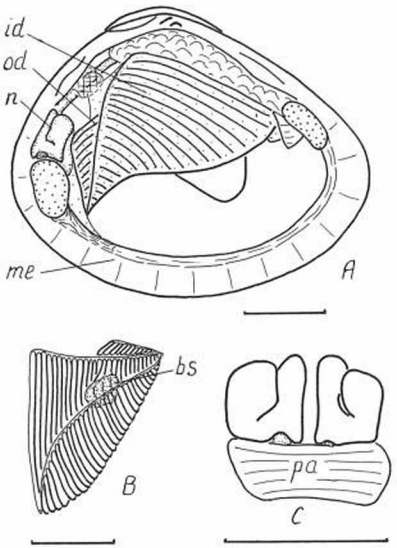


Fig. 2: Anatomy of *Pisidium casertanum* specimens from the Lake Biwa: A - general view of soft body, B - internal view of gill with the juvenile brood sac, C - dorsal view of nephridia; bs - brood sac, id - inner demibranch, me - mantle edge, od - outer demibranch, n - nephridium (dorsal lobe), pa - posterior adductor. Scale bar: 1 mm.

mentioned species is so peculiar in anatomical aspect (the outer demibranch has a clear rudiment of descending lamella), that we proposed to include it in another genus *Lacustrina* STERKI (KORNIUSHIN, 1992). It seems very important to study anatomy of *P. kawamurai* and check its affinity to *P. subtilestriatum*. Such investigation may contribute greatly to our understanding of historic development of the fauna in the Lake Biwa.

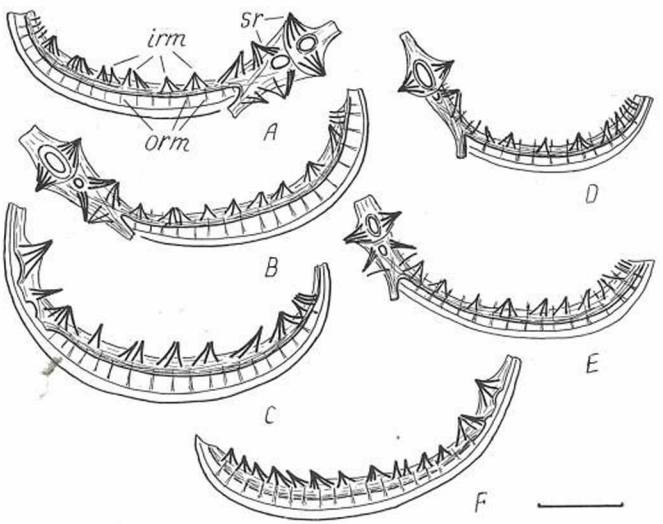


Fig. 3: Mantle musculature of *Pisidium casertanum* specimens from the Lake Biwa (A, B), the typical form from Ukraine (C) and Amur river, Russian Far East (F) and the form *ponderosum* from Ukraine (D, E); sr - siphonal retractors, irm - inner radial muscules, orm - outer radial muscules. Scale bar: 1 mm.

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## References

KORNIUSHIN, A.V. (1992): Anatomical aspects of the taxonomy and phylogeny of Pisidioidea (Bivalvia). - Proc. Tenth Internat. Malacol. Congr. (Tübingen, 1989). Tübingen: 601-605.

KUIPER, J.G.J. (1962): Note sur la systematique des pisidies. - J. Conchyl. **102** (2): 53-57.

MORI, S. (1938): Classification of Japanese *Pisidium*. - Mem. Coll. sci. Kyoto Imp. Univ., ser. B **14** (2): 255-278.

MORI, S. (1984): Molluscs. In: Lake Biwa. Dordrecht e.a.: 331-337.

PIECHOCKI, A. (1989): The Sphaeriidae of Poland (Bivalvia, Eulamellibranchia). - Annal. Zool. **42** (12): 249-320.

STAROBOGATOV, YU.I. & BUDNIKOVA, L.L. (1985): Molluscs of the family Pisidiidae (= Sphaeriidae) from the lake Lagunnoje, Kunashir Island, Kurile Islands. - Trudy Zool. Inst. Akad. Nauk SSSR **135**: 95-114 (Russ., with English summary).

ZEISSLER, H. (1971): Die Muschel *Pisidium*. Bestimmungstabelle für die mitteleuropäischen Sphaeriacea. - Limnologica **8** (2): 453-503.

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