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Jouannetia (*Pholadopsis*) *spinosa*: A New Species of Spinous Rock-boring Pholadid (Bivalvia: Myoida) from the West Pacific

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Abstract: *Jouannetia* (*Pholadopsis*) *spinosa* n. sp. is described as the second species in the West Pacific and the sixth species of the subgenus *Pholadopsis*. It lives in weakly consolidated mud and sand blocks obtained from relatively deep waters in Japan and the Philippines. *J.* (*P.*) *spinosa* n. sp. is characterized by a small spherical shell with dense spiny sculpture, remarkably concave posterior portion of the anterior slope, a siphonoplax with claw-like spines on the posterior margin, and red pigmentation on the translucent mantle collar at the base of the siphon. It has been collected from depths ranging from 50 to 180 m, and shows a marked difference in depth range compared to the intertidal congener *Jouannetia* (*Pholadopsis*) *globulosa* in the West Pacific. The structure of the mesoplax in the subfamily Jouannetiinae is also discussed in detail.

Keywords: Jouannetiinae, *Pholadopsis*, new species, molecular phylogeny, mesoplax

Introduction

The genus *Jouannetia* is a small group in the family Pholadidae characterized by a large siphonoplax in the right valve, a well developed spherical callum in the left valve, and absence of apophysis (Turner, 1955, 1969, 1998). The subgenus *Pholadopsis* is further characterized by the presence of a pectinated siphonoplax and the absence of the laminae ('buttress' of Morton, 1986) that in the subgenus *Jouannetia* projects inwardly at the position of the posterior adductor muscle in the posterior portion of the valves (Turner, 1955). According to Turner (1955), Morton (1986) and Cosel (1995), only five species were described so far and were all extremely rare in occurrence. These are *J.* (*P.*) *globulosa* (Quoy & Gaimard, 1835) (*non J.* (*P.*) *globosa* Sowerby, 1849) [Japanese name: Toge-suzu-gai] in the Indo-Pacific; *J.* (*P.*) *pectinata* Conrad, 1849, in the East Pacific; *J.* (*P.*) *quillingi* Turner, 1955, in the West Atlantic; and *J.* (*P.*) *vignoni* Fischer, 1862, and *J.* (*P.*) *uncinata* Cosel, 1995, in the East Atlantic.

Extensive field sampling of pholadoidean boring bivalves by T. H. and others recovered a tiny species assignable to the subgenus *Pholadopsis* from relatively deep waters in Japan and the Philippines. It is the sixth species of this little known subgenus and is described herein.

Materials and Methods

Morphological observations

The specimens of *Jouannetia* (*Pholadopsis*) *spinosa* n. sp. were collected from weakly consolidated mud and sand blocks in Tateyama Bay, Chiba Prefecture (type locality; Fig. 1) and from several other localities in the West Pacific (Fig. 1). Live individuals were carefully extracted from their burrows, and the detailed morphology of siphons *in vitro* was observed under

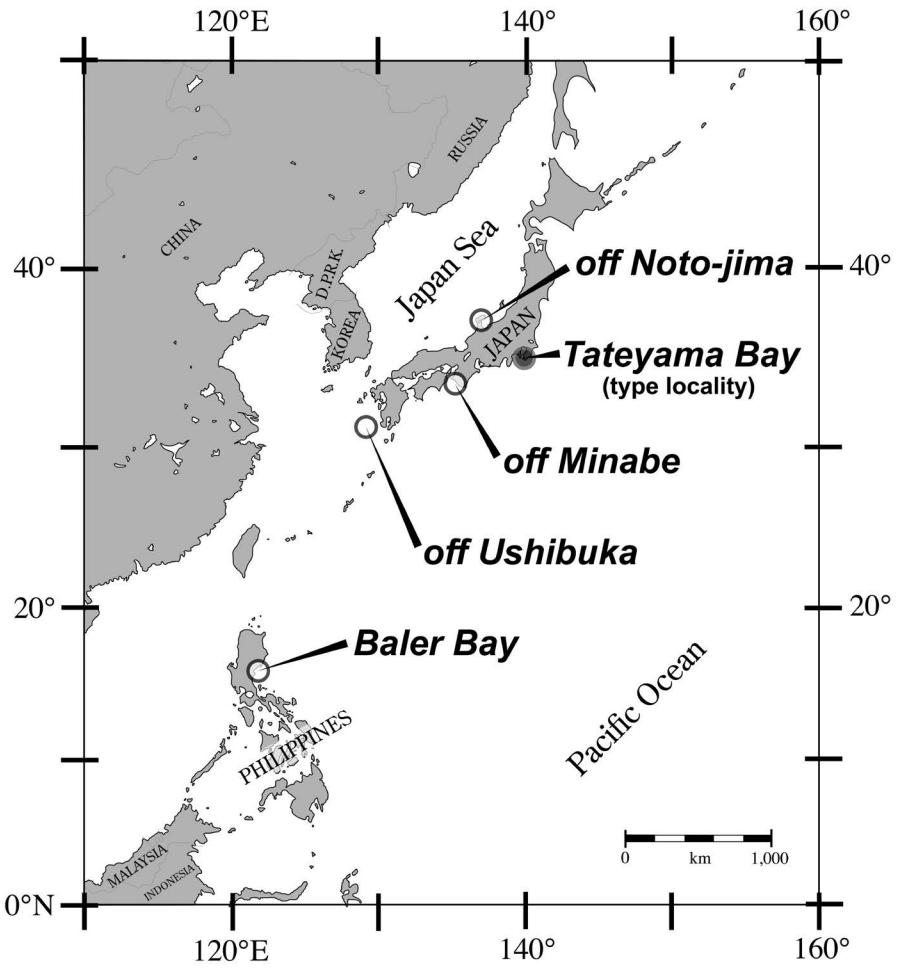

Fig. 1. Locality map of *Jouannetia* (*Pholadopsis*) *spinosa* n. sp.

a binocular microscope. The morphology of 48 live and liquid-preserved specimens of *J*. (*P*.) *globulosa* collected from various localities in West Pacific was likewise examined. Shell length and height of intact right valves were measured for 44 specimens of *J*. (*P*.) *spinosa* n. sp. and 48 of *J*. (*P*.) *globulosa*, following new criteria for dimensioning (Fig. 2) for the sake of elimination of the size variation in appendix plates. Terminology of conchological characters follows Turner (1954, 1969, 1998).

Molecular phylogenetic analysis

To confirm the phylogenetic status of *J*. (*P*.) *spinosa* n. sp., molecular phylogenetic analyses were implemented using 328 base pairs (bp) of nucleic Histone 3 (H3) gene sequences for all jouannetiine species previously reported from the West Pacific region (Table 1). This genetic marker is useful for species identification in pholadoidean bivalves as well as the mitochondrial 16S ribosomal RNA gene (Haga, 2007). Sample preparation, DNA extraction, polymerase chain reaction (PCR) amplification and sequencing procedures follow Haga (2007). Live animals were fixed by pure ethanol after boiling following Ueshima (2002) and Fukuda *et al*. (2008), then

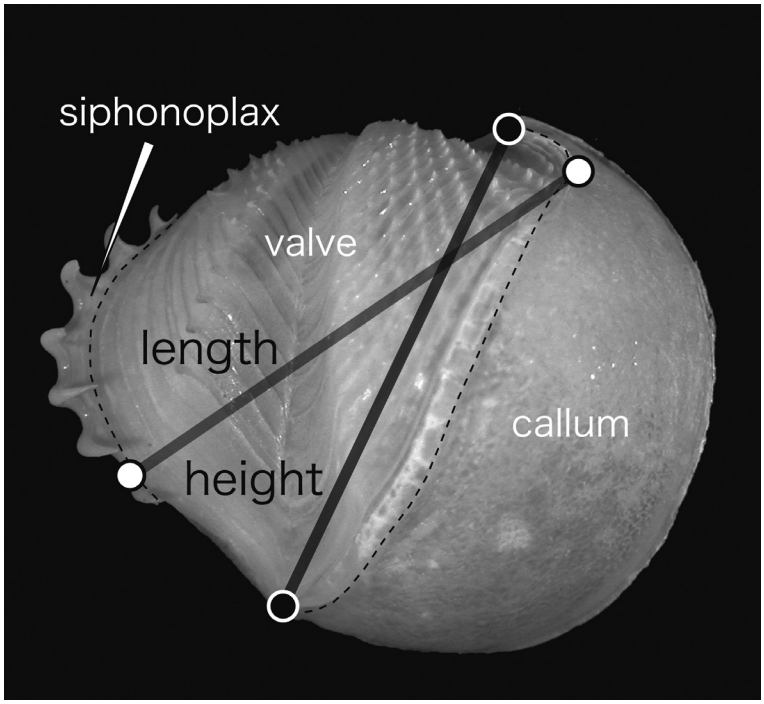

Fig. 2. Measurement method of shell length and height used in this study.

Table 1. Species of Jouannetiinae from the West Pacific analyzed in this study, locality of specimens, and GenBank accession number.

Subfamily	Species	Locality; Habitat	NCBI no.	Reference
Jouannetiinae (ingoup taxa)	*Jouannetia* (*Pholadopsis*) *globulosa*	Kitanashiro, Itoman, Okinawa, Japan; dyke of mudrock, intertidal	AB439262	Haga, 2007
	Jouannetia (*Pholadopsis*) *globulosa*	Okinoshima, Tateyama, Chiba, Japan; dyke of mudrock, intertidal	AB439263	this study
	Jouannetia (*Pholadopsis*) *spinosa*	-80 m, off N of Okinoshima, Tateyama, Chiba, Japan; block of mudrock, subtidal (Holotype)	AB439264	Haga, 2007
	Jouannetia (*Pholadopsis*) *spinosa*	-40–80 m, off NW of Okinoshima, Tateyama, Chiba, Japan; block of mudrock, subtidal	AB439265	this study
	Jouannetia (*Jouannetia*) *cumingii*	Yonashiro, Nakagusuku, Okinawa, Japan; dead coral, intertidal	AB439266	Haga, 2007
	Nettastomella japonica	-50–80 m, off N of Okinoshima, Tateyama, Chiba, Japan; block of mudrock, subtidal	AB439267	Haga, 2007
Martesiinae (outgroup taxa)	*Parapholas quadrizonata*	Chôjagasaki, Hayama, Kanagawa, Japan; dyke of mudrock, intertidal	AB439268	Haga, 2007

genomic DNA was extracted by Chelex 100 resin (Biorad, USA; Walsh *et al*., 1991); a small volume of adductor muscle was incubated in 100 µl 10% Chelex solution at 99.9ºC for 30 min. on a thermal cycler. After centrifuge, the aliquot was used as template. H3 sequences were amplified by standard PCR method using primers H3aF (5'-ATG GCT CGT ACC AAG CAG

ACV GC-3') and H3aR (5'-ATA TCC TTR GGC ATR ATR GTG AC-3') (Colgan *et al*., 2000). PCR amplifications were performed using 30 cycles under the following conditions: denaturing at 94 ºC for 40 sec., annealing at 54 ºC for 40 sec. and extension at 72 ºC for 1 min. The purified PCR products were then sequenced using an automated cycle-sequencer (ABI PRISM 3100) with Big Dye sequencing kit v3.1 (ABI) following the manufacturer's protocol. A total of 328 bp sequences were sequenced in both strands.

Sequences were assembled using GENETIX Version 6 (GENETIX Co.), then aligned by eye. Appropriate substitution models and parameter settings by using Akaike Information Criterion (AIC) were estimated on MrModeltest2 version 2.2 (Nylander, 2002; program distributed by the author). Maximum likelihood (ML) and unweighted maximum parsimony (MP) analyses were performed using PAUP* 4.0b10 (Swofford, 2001). Bayesian analysis was implemented running Metropolis coupled, Monte Carlo Markov Chains (MCMCMC) with four differentially 'heated' simultaneous chains and two replicates (runs) on MrBayes v3.1.2 (Huelsenbeck & Ronquist, 2001; Ronquist & Huelsenbeck, 2003). MP analysis was conducted with heuristic searches with 100 random addition analysis and TBR branch swapping. The ML analysis using estimated substitution parameters was conducted by heuristic searches with 100 random addition analysis and TBR branch swapping. In the Bayesian analysis, GTR+G was selected as an appropriate substitution model for the dataset, which was partitioned into three categories for each codon positions. The analysis was run for one million generations with sampling trees from every 100 generations, and then first 3,000 trees were discarded as 'burn-in'. Statistical values supporting the nodes were of estimation undertaking 1,000 bootstrap replicates for MP and ML analysis, and of posterior probabilities for Bayesian analysis. All the newly determined sequences were submitted to GenBank with the accession numbers listed in Table 1.

Institutional Abbreviations: MNHN – Muséum national d'Histoire naturelle, Paris; NCBI – National Center for Biotechnology Information, Bethesda, USA; NCSM – Nanao Childrens' Science Museum, Nanao, Ishikawa, Japan; NSMT – Department of Zoology, National Museum of Nature and Science, Tokyo (formerly National Science Museum, Tokyo).

Taxonomy

Superfamily Pholadoidea Lamarck, 1809
Family Pholadidae Lamarck, 1809
Subfamily Jouannetiinae Tryon, 1862
Genus *Jouannetia* Des Moulins, 1828: 244.
Type species: *Jouannetia semicaudata* Des Moulins, 1828, by original designation.

Subgenus *Pholadopsis* Conrad, 1849: 156
Type species: *Pholadopsis pectinata* Conrad, 1828, by original designation.

***Jouannetia* (*Pholadopsis*) *spinosa* n. sp.**

(Figs. 1, 3–6)

Description

Shell: Shell spherical, whitish-translucent, very thin and fragile, inequivalve, left valve larger than right, covered totally with thin, pale-yellow periostracum. Largest specimen 14.1 mm long and 10.75 mm high (including callum and siphonoplax). Umbonal reflection opisthogyrate. Anterior slope large, occupying half of total valve length, and composed of smooth anterior and decussate posterior parts separated by prominent radial keel in right valve (Figs. 3B, E; 4A, C;

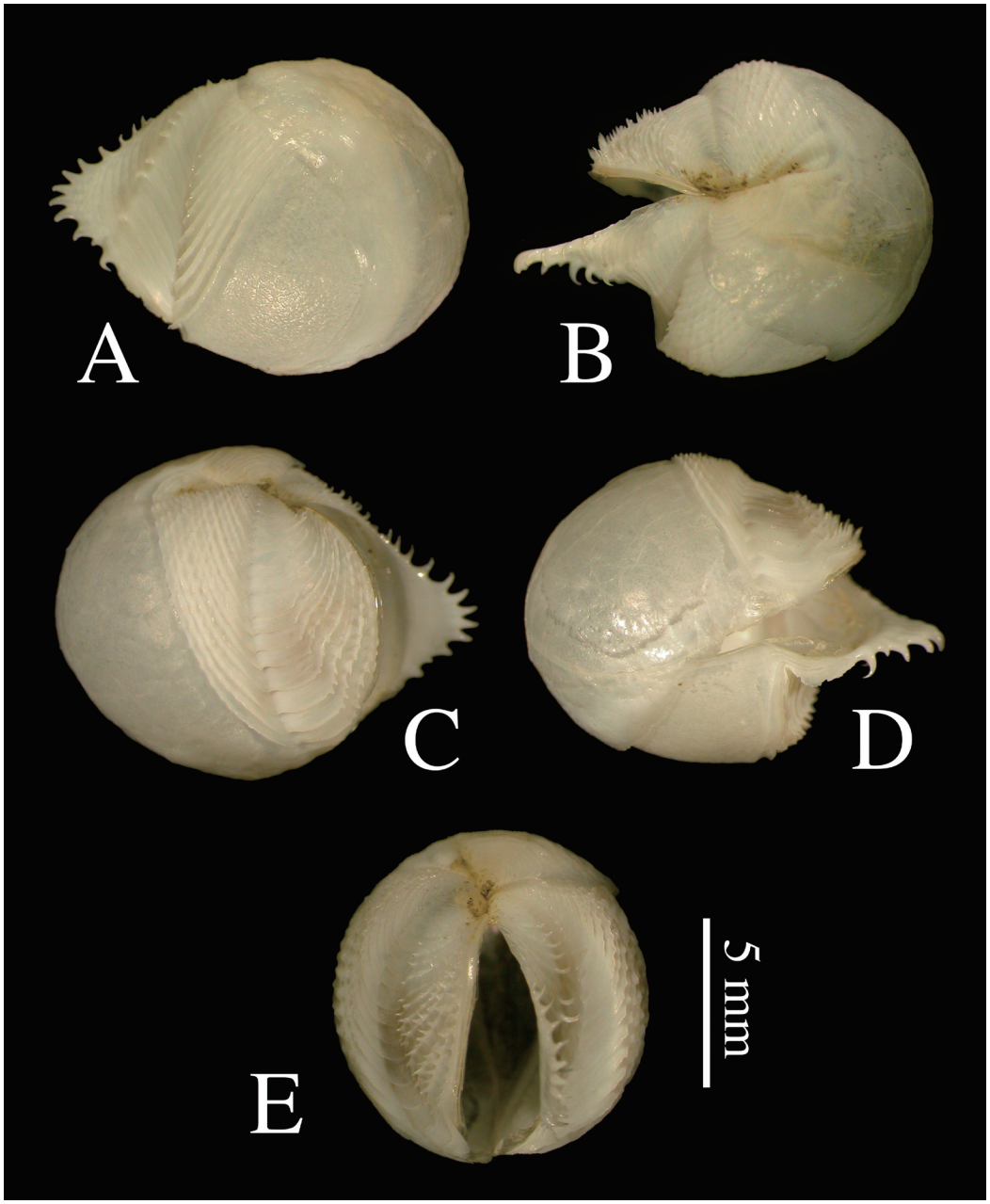

Fig. 3. Holotype of *Jouannetia* (*Pholadopsis*) *spinosa* n. sp. NSMT-Mo 76764. **A**. Right view. **B**. Dorsal view. **C**. Left view. **D**. Ventral view. **E**. Posterior view.

5H) and by weak crenation in left valve (Figs. 3B–D; 4D). Imbrication rather obscure, deeper in right valve than in left (Figs. 3, 4), terminating at ventral condyle in right valve and at pit-like concavity in left valve (Fig. 4). Disc narrow, with low blade-like sculptures on growth lines (Figs. 3–5). Posterior slope narrower in right valve than in left (Figs. 3–4) and separated from disc by weak undulation bearing row of regularly spaced, strong spines in most individuals (Figs. 3A, E;

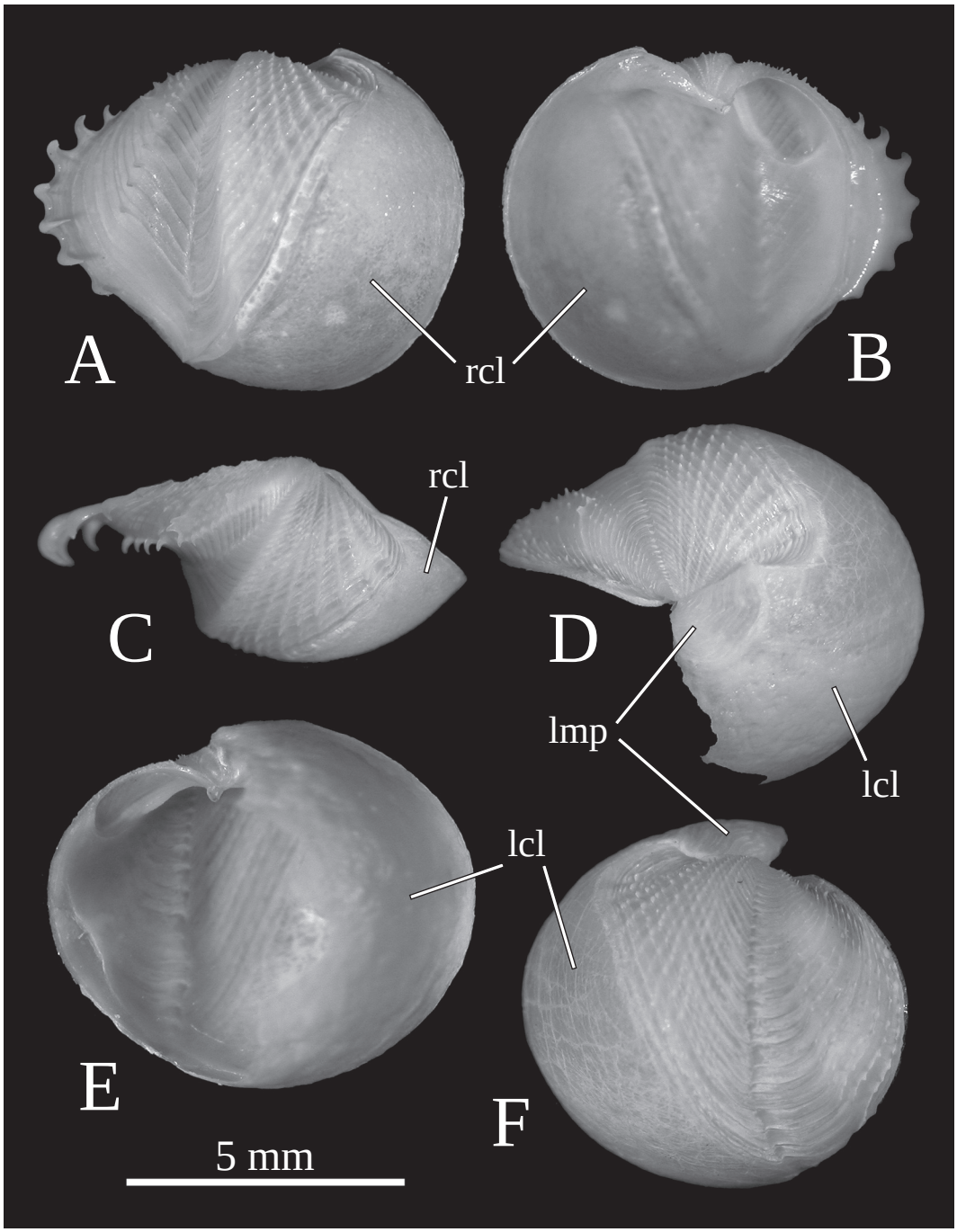

Fig. 4. Fully-grown adult specimen of *Jouannetia* (*Pholadopsis*) *spinosa* n. sp. showing internal shell morphology. Paratype, NSMT-Mo 76765. **A**–**C**. Right valve in external, internal and dorsal views, respectively. **D**–**F**. Left valve in dorsal, internal and external views, respectively. Abbreviations: lcl, left callum; lmp, left mesoplax; rcl, right callum.

4A, C; 5I). Posterior slope of left valve rather large, ornamented with dense needle-like spines arranged co-marginally with growth lines (Figs. 3B, D, E; 4D, F). Posterior margin of left valve rounded and slightly overlapped by right valve (Fig. 3E).

Internal surface vitreous and glistening. Apophysis absent in all stages of post-larval shell. Adductors anisomyarian. Right anterior adductor scar larger than left scar, depressed dorso-ventrally (Fig. 4B); left anterior adductor scar usually obscure due to weak muscle impression (Fig. 4E). Right posterior adductor scar oval, larger than left scar, occupying approximately 1/3 of shell height (Fig. 4B), left posterior adductor scar also oval but strongly depressed dorso-ventrally (Fig. 4E). Lamina (= buttress) absent at position of posterior adductor scar (Fig. 4B, E). Pallial line mostly obscure and sinupalliate. Pallial sinus shallow and circular. Siphonal retractor scar narrow, elongate dorso-ventrally, composed of two elements. Ventral adductor scar obscure, located above ventral tip of umbonal-ventral ridge. Umbo of right valve totally concealed by spirogyrate umbonal reflection in fully-grown adult specimens (Fig. 4B). Ligament tiny, rod-shaped, extending from posterior tip of umbonal reflection in right valve (Fig. 4B). Chondrophore semicircular, hanging down from umbo in left valve (Fig. 4E). Umbonal-ventral ridge narrow in right valve (Figs. 4B; 5B) but wide and much more prominent in left valve (Figs. 4E; 5C).

Juvenile shell in active boring stage lunate, strongly depressed antero-posteriorly lacking siphonoplax and callum, largely open in anterior end, from which mobile, discoid foot projects (Fig. 5E, F). Antero-dorsal portion of umbonal reflection also widely open (Fig. 5E, F) and partially covered by left mesoplax (Fig. 5A–D). Ventral condyle largely developed in right valve (Fig. 5B, D).

Siphonoplax: Siphonoplax semicircular, comprising of single thick plate, protruding from posterior tip of right valve, and occupying 1/3 of shell height (Figs. 3–5). Claw-like and regularly arranged prosogyrate strong spines along posterior margin of siphonoplax, from 5 to12 in number but 7–9 in most individuals (Figs. 3A, C, D; 4A–C; 5G–I; Table 2). Siphonoplax appears slightly earlier than callum during ontogeny (Fig. 5B, D).

Mesoplax: Mesoplax asymmetric, composed of pair of calcareous flat plates on umbonal reflection. Left mesoplax (lmp) significantly larger than right mesoplax, subtriangular, marked with rough growth lines, and connected on left side to umbonal reflection of left valve at ca. 30° angle relative to longitudinal axis (Figs. 3B, C, E; 4D, F; 5A, C). Right mesoplax (rmp) thin, small, quadrate, marked with indistinct growth lines, located beneath left mesoplax, and covering umbonal reflection of right valve (Fig. 5B, D, G, H). Right mesoplax invisible from outside in full-grown conjoined valves due to covering by left mesoplax and dorsal portion of left callum (*e.g*. Figs. 3; 5I). In juvenile individuals, left mesoplax contacting almost horizontally with left umbonal reflection (Fig. 5A, C). In later growth stages left mesoplax subsequently fused with posterior portion of left callum (Figs. 3; 4D, E).

Callum: Callum originating from anterior margins of both valves in final growth stage (Figs. 3–4). Right callum (rcl) semicircular, occupying 1/3 of shell length (Figs. 4A–C; 5G, H). Left callum (lcl) large, subglobular, occupying half of shell length, and laterally expanding to enclose anterior portion of right callum (Figs. 3A, B, D; 4D, E; 5I). Both callums smooth but with tiny depressions over their surface, and lined internally with thin, translucent periostracum (Figs. 3A–D; 4; 5G–I).

Siphon: Siphons fused over their entire length, covered with thick, yellow periostracum, extending twice shell length and to the level of the opening of the burrow (Fig. 6A, B, E), but capable of being contracted completely within the shell (Fig. 6E). Mantle collar (mc) usually pigmented with red and surrounded with short tentacles (Fig. 6C: tmc). Tentacles around aperture of inhalant siphon about 10 in number (Fig. 6C: tis). Exhalant siphon bearing a thin, transparent, highly mobile siphonal process (sp in Fig. 6D), from which two needle-like long tentacles (tentacles on the siphonal process; tsp in Fig. 6D) extend dorso-ventrally.

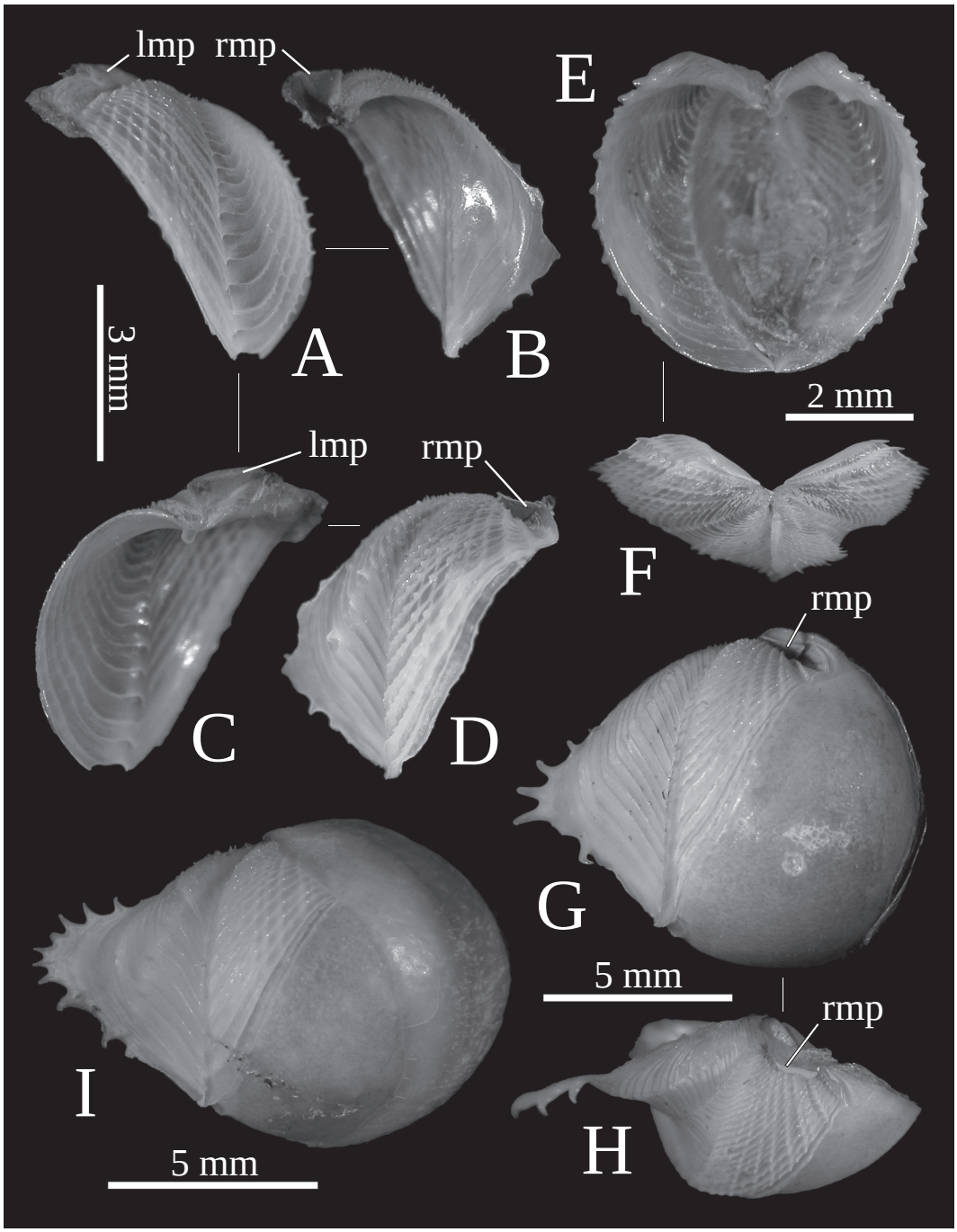

Fig. 5. *Jouannetia* (*Pholadopsis*) *spinosa* n. sp., paratypes, NSMT-Mo 76766. **A**–**D**. Juvenile specimen. **A**. External view of left valve. **B**. Internal view of right valve. **C**. Internal view of left valve. **D**. External view of right valve. **E**–**F**. Conjoined juvenile specimen. Anterior and dorsal views, respectively. **G**–**H**. Right valve showing right mesoplax (rmp). Exterior and dorsal views, respectively. **I**. Right view of slender shell for comparison to typical forms. Abbreviations: lmp, left mesoplax; rmp, right mesoplax.

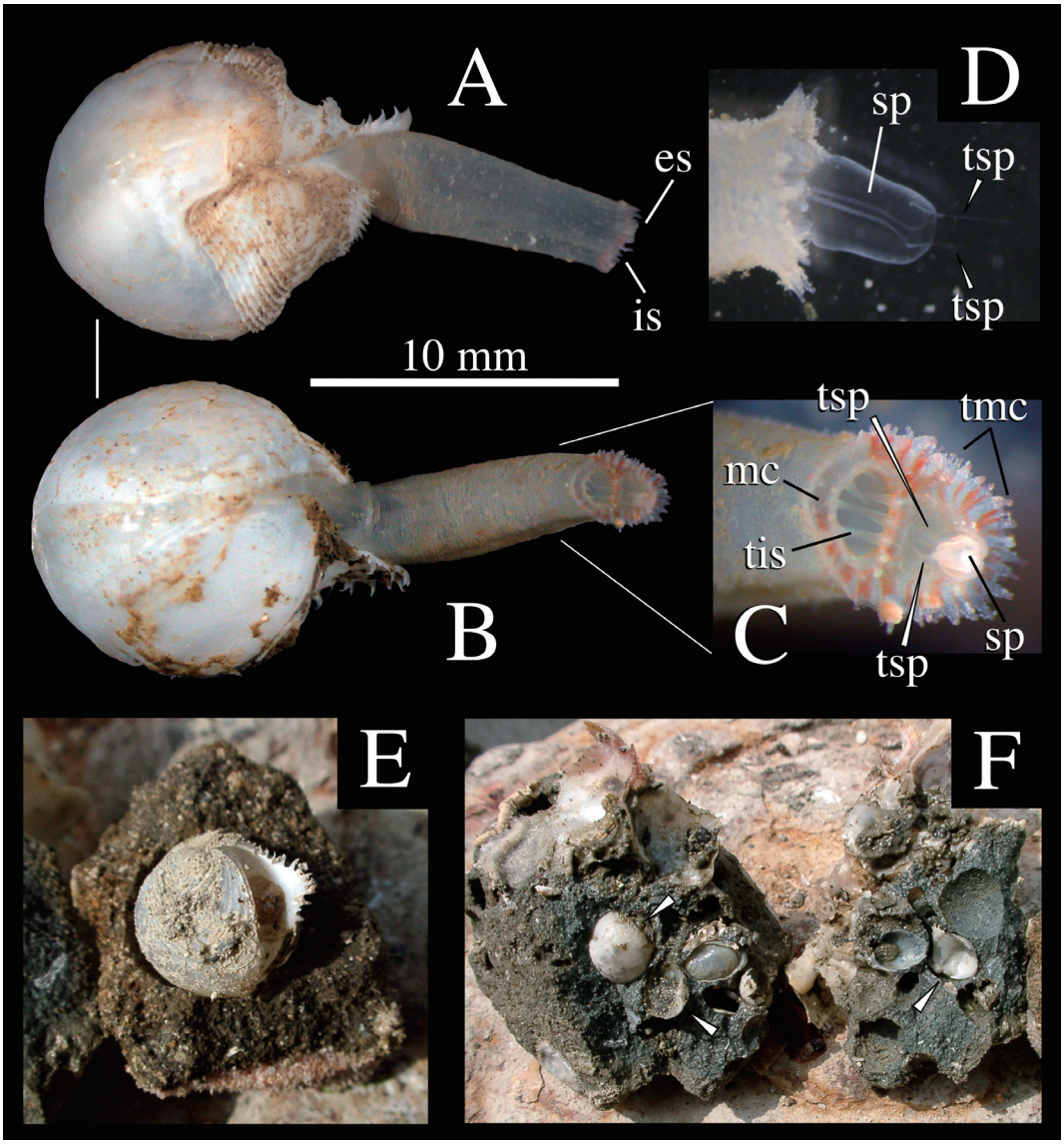

Fig. 6. Live animal of *Jouannetia* (*Pholadopsis*) *spinosa* n. sp. **A**–**B**. Animals with fully extended siphon. Dorsal and ventral views, respectively. **C**. Enlargement of siphonal tips in B. **D**. Enlargement of siphonal tips with siphonal process fully extended. **E**. Animal with siphons fully contracted. **F**. Boreholes in the substratum. Individuals are indicated by arrowheads. A–C and E are holotype. Abbreviations: es, exhalant siphon; is, inhalant siphon; mc, mantle collar; sp, siphonal process; tis, tentacles on the aperture of inhalant siphon; tmc, tentacles on the mantle collar; tsp, tentacles on the siphonal process.

Burrow: Burrow simple, rod-shaped in longitudinal section for juveniles, and becoming spoon- or scoop-shaped for fully-grown adults (Fig. 6F; arrowheads). Left callum tightly and perfectly fit to wall of burrow in fully-grown adults.

Type Material: Holotype (12.5 × 9.8 mm including callum and siphonoplax), conjoined, dry, (NSMT-Mo 76764; Figs. 3; 6A–C, E; 9), -80 m north off Okinoshima, Tateyama, Chiba, Japan,

Apr. 25, 2006, leg. T. H. Paratypes — 1 paratype, dry, -80–100 m, from the type locality, Apr. 6, 2003, leg. T. H. (NSMT-Mo 76765; Fig. 4); 10 paratypes, dry, -80–100 m, from the type locality, Mar. 26, 2007, leg. T. H. (NSMT-Mo 76766, MNHN; Fig. 5); 4 paratypes, dry, off Sakai, Minabe, Wakayama, Japan, Feb. 12, 2006, leg. S. Ikebe (NSMT-Mo 76767, MNHN); 6 paratypes, dry, -180 m off Ushibuka, Amakusa, Kumamoto, Japan, Oct. 2002, leg. M. Chino (NSMT-Mo 76768, MNHN); 1 paratype, dry, the AURORA 2007 cruise, CP2747, 15˚55´5˝N, 121˚42´1˝E, -118–124 m, Baler Bay, Aurora, Luzon, Philippines, June 2, 2007, M/V DA-BFAR (MNHN).

Type locality: North off Okinoshima, Tateyama, Chiba Prefecture, Japan; 35˚00´N, 139º49´E (Fig. 1).

Distribution: Japan – Along the Pacific side of Honshu, from Chiba to Wakayama Prefectures; Japan Sea of off Noto-jima Island in Toyama Bay, Ishikawa Prefecture (Kawabata, 2004; originally identified as *J*. (*P*.) *globulosa*, a voucher conjoined specimen is housed in NCSM, collected by late E. Yoshimura in Sep. 17, 1952); East China Sea of off Ushibuka, Kumamoto Prefecture. Philippines – Baler Bay in Aurora province, the Pacific side of Luzon Island, 50 to 180 m deep (Fig. 1).

Habitat: Lives in weakly consolidated mud and sand blocks.

Etymology: *Spinosus* (= spiny), Latin, named after the dense spines on the valves.

Discussion

Variations

Major morphological variation can be observed in the shell length and the number of spines on the siphonoplax. *J*. (*P*.) *spinosa* n. sp. is usually spherical in shell form, but some specimens have longitudinally more elongate shells (*e.g.* Fig. 5I). This morphological variation has resulted from different rates of longitudinal expansion in the siphonoplax and callum (see Fig. 8); in some specimens, the siphonoplax and callum are more slender than in the typical form.

Comparison

Among the five previously described species, only *J*. (*P*.) *globulosa* and *J*. (*P*.) *uncinata* are comparable to *J*. (*P*.) *spinosa* n. sp. The remaining three species, *J*. (*P*.) *pectinata*, *J*. (*P*.) *quillingi* and *J*. (*P*.) *vignoni* differ greatly from *J*. (*P*.) *spinosa* n. sp. in having more elongate and shells that are over twice as large, and in having an only slightly pectinate siphonoplax.

J. (*P*.) *spinosa* n. sp. most closely resembles *J*. (*P*.) *uncinata* from the tropical East Atlantic in having a nearly spherical shell with claw-like spines on the posterior margin of the siphonoplax (Fig. 7). *J*. (*P.) uncinata* is nevertheless distinguished from *J*. (*P*.) *spinosa* n. sp. by the following shell characters: 1) the small siphonoplax bearing longer and stronger but less numerous claw-like spines (Fig. 7A, B; Table 2), 2) the very fine, longitudinally striated wrinkles on the callum in the right valve (Fig. 7A), and 3) the fine spines regularly arranged in a line on the left mesoplax (Fig. 7C).

Both *J*. (*P*.) *spinosa* n. sp. and *J*. (*P*.) *globulosa* from the Indo-Pacific exhibit a similar shell profile, but *J*. (*P*.) *spinosa* n. sp. is distinguished from the latter primarily by its much smaller shell size (less than 1/3) and spherical profile (see Fig. 8), and the coarser surface sculpture. The posterior portion of the anterior slope is weakly concave (angle of less than 45˚) in *J*. (*P*.) *globulosa*, whereas in *J*. (*P*.) *spinosa* n. sp. it is remarkably concave (angle more than 50˚) with a prominent radial keel that separates the anterior portion into two parts. The number of spines on the margin of the siphonoplax is 14–23 in *J*. (*P*.) *globulosa*, while it is only 5–12 in *J*. (*P*.) *spinosa* n. sp. (Table 2). Furthermore, morphology of the mantle collar at the base of siphon is also different; *J*. (*P*.) *spinosa* n. sp. has a translucent mantle collar with localized red

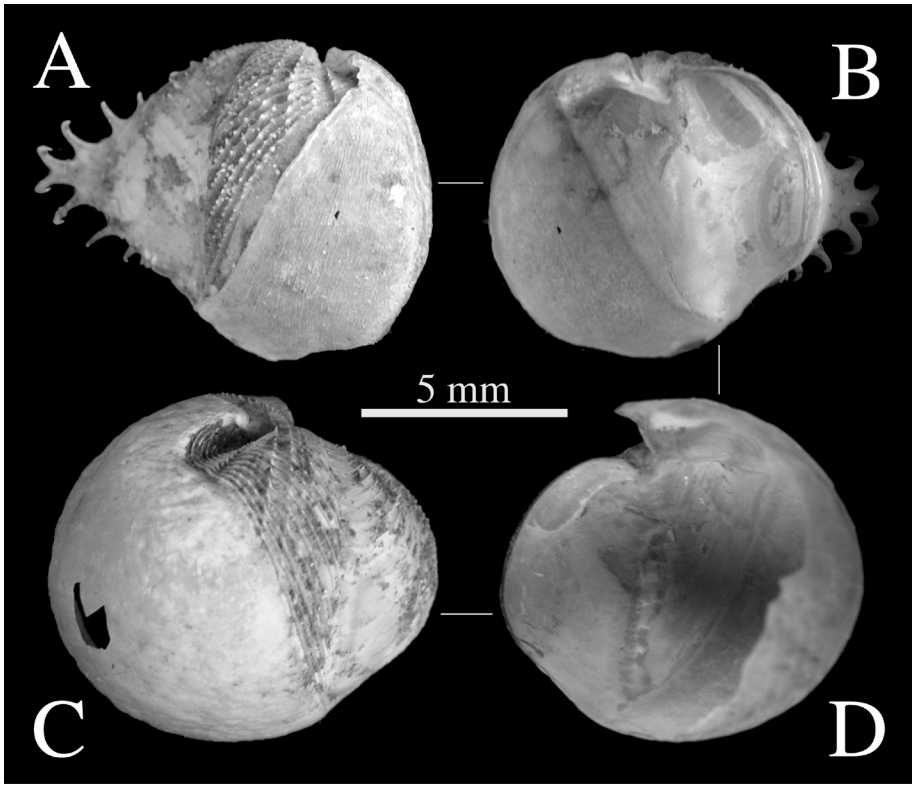

Fig. 7. Holotype of *Jouannetia* (*Pholadopsis*) *uncinata* Cosel, 1995, deposited in MNHN (8.0 mm, length of right valve without siphonoplax). A–B: Right valve in external and internal views, respectively. C–D: Left valve in external and internal views, respectively.

Table 2. The number of spines in the siphonoplax for *Jouannetia* (*pholadopsis*) *spinosa* and its congeners.

Species	Number of specimens examined	Number of spines
Jouannetia (*Pholadopsis*) *spinosa*	44	5–12
Jouannetia (*Pholadopsis*) *uncinata*	6	6–9
Jouannetia (*Pholadopsis*) *globulosa*	48	14–23

pigmentation (Fig. 6C), whereas that of *J*. (*P*.) *globulosa* has black pigmentation which widely spreads towards the siphonal tips.

The molecular phylogenetic analysis estimated using H3 also gave strong evidence that *J*. (*P*.) *spinosa* n. sp. is separate from *J*. (*P*.) *globulosa*. As shown in Fig. 9, *J*. (*P*.) *globulosa* and *J*. (*P*.) *spinosa* n. sp. are both monophyletic, and each species shares a specific single haplotype (data not shown herein). The same result was obtained in the analysis of nearly complete sequences of 18S ribosomal RNA (Haga, 2007). Although *J*. (*P*.) *spinosa* n. sp. and *J*. (*P*.) *globulosa* inhabit nearly the same geographical range, these facts clearly demonstrated that *J*. (*P*.) *spinosa* n. sp. is neither a geographical phenotype of *J*. (*P*.) *globulosa*, nor an ecological phenotype.

***Notes on the mesoplax in* Jouannetiinae**

This study documents the detailed structure of the mesoplax in the subfamily Jouannetiinae.

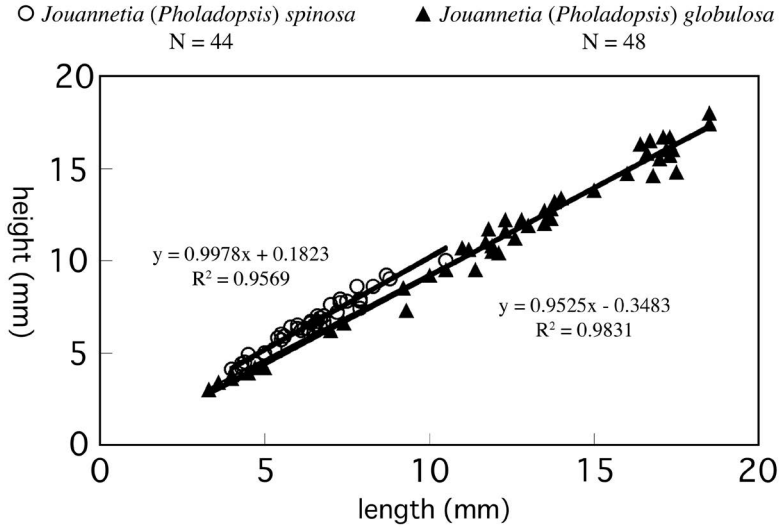

Fig. 8. Relationships of shell length and height in the right valve for *Jouannetia* (*Pholadopsis*) *spinosa* n. sp. and *J.* (*P.*) *globulosa*. The dimensional method was referable to Fig. 2.

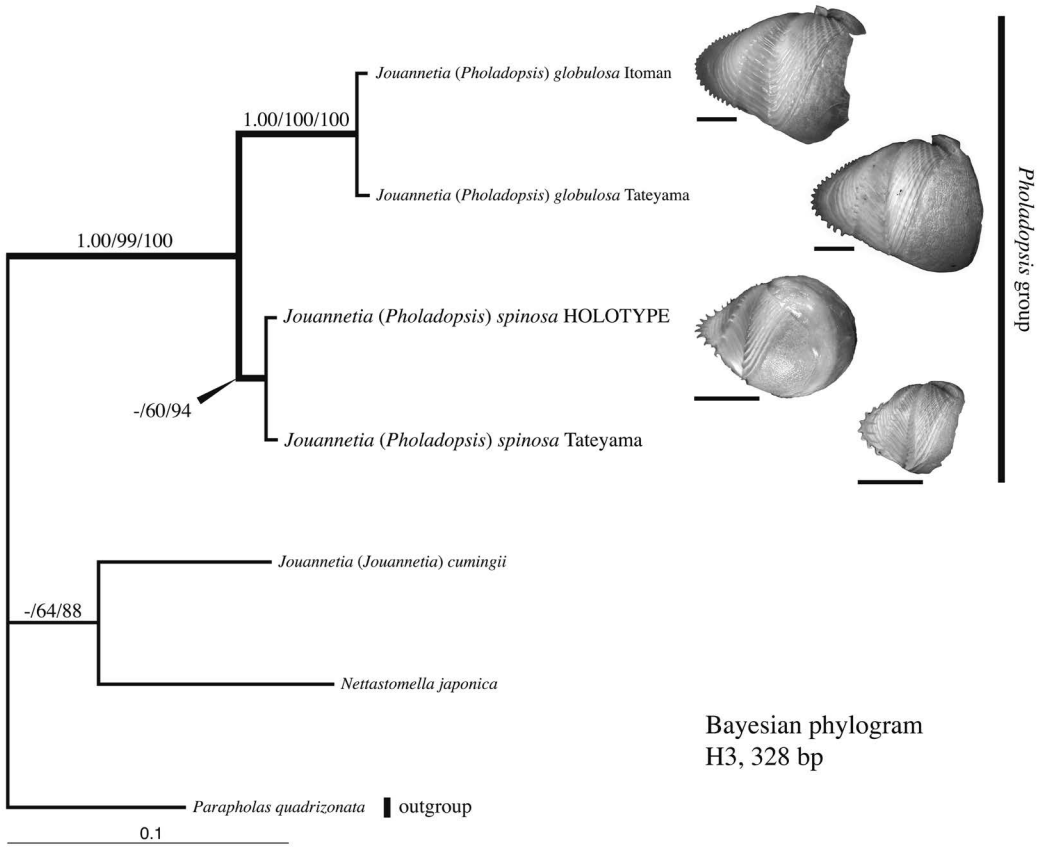

Fig. 9. Molecular phylogeny of West Pacific Jouannetiinae produced by Bayesian analysis of H3 nuclear gene. Nodal supports are of posterior probabilities (> 0.95), bootstrap values of ML (> 60) and of unweighted MP (> 90), respectively. Scale bars = 5 mm.

Turner (1955, 1969, 1998) reported that the mesoplax in some species of *Jouannetia* is rudimentary, and fused to the left half of the callum. Therefore, it is very likely that in *Jouannetia* the mesoplax consists of a single plate located in the left side. Our detailed observation on individuals in different post-larval developmental stages however revealed that the mesoplax in *J.* (*P.*) *spinosa* n. sp. bears two appendix plates, of which the left one is significantly larger than the right (Figs. 4–5). Since the tiny right mesoplax is connected reversely to the right umbonal reflection and completely covered by the large left mesoplax, it is difficult to observe this structure from the outside. The same observation was already reported by Hirata (1953: p. 124, fig. 1C) in *J.* (*P.*) *globulosa*, but his work has been completely overlooked to date. We also confirmed the presence of a tiny right mesoplax both in *J.* (*P.*) *globulosa* and *J.* (*J.*) *cumingii*, and a pair of rudimentary triangular, symmetrical mesoplaxes was observed in young individuals of *Nettastomella japonica*, another genus of Jouannetiinae (unpublished data). Due to its tiny size, the mesoplax appears to have been overlooked in species of *Jouannetia* [*e.g. J.* (*P.*) *globulosa* in Okutani (2000: p. 1028, fig. 9); the tiny right mesoplax can be observed therein, although the specimen is erroneously illustrated as *J.* (*J.*) *cumingii*]. We suggest that the paired mesoplax be considered a general character of the subfamily Jouannetiinae, but this conclusion needs to be confirmed by detailed examination of other species of the subfamily.

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References

Colgan, D. J., Ponder, W. F. & Eggler, W. F. 2000. Gastropod evolutionary rates and phylogenetic relationships assessed using partial 28S rRNA and H3 sequences. *Zoologica Scripta* 29: 29–63.

Cosel, R. von 1995. Fifty-one new species of marine bivalves from tropical West Africa. *Iberus* 13: 1–115.

Fukuda, H., Haga, T. & Tatara, Y. 2008. *Niku-nuki*: a useful method for anatomical and DNA studies on shell-bearing molluscs. *Zoosymposia* 1: 15–38.

Haga, T. 2007. Phylogeny and morphological evolution of the boring bivalve Pholadina (Bivalvia: Mollusca). *Master's Thesis*. The University of Tokyo. iv+92+45 pp.

Hirata, K. 1953. Relation between callum formation and sexual maturation in *Jouannetia globulosa* (Quoy et Gaimard). *Science Reports of the Kagoshima University* 2: 123–131.

Huelsenbeck, J. P. & Ronquist, F. 2001. MRBAYES: Bayesian inference of phylogenetic trees. *Bioinformatics* 17: 754–755.

Kawabata, Y. 2004. Catalogue of the specimens preserved in Nanao Children Science Museum: Catalogue of the mollusks from Noto Peninsula, central Japan. *The Report of the Nanao Children Science Museum* 8: 43–82. (in Japanese with English title)

Morton, B. 1986. The biology and functional morphology of the coral-boring *Jouannetia cumingii* (Bivalvia: Pholadacea). *Journal of Zoology, Series A* 208: 339–366.

Okutani, T. 2000. Family Pholadidae. *In*: Okutani, T. (ed.), *Marine Mollusks in Japan*, pp. 1026–1029. Tokai University Press, Tokyo. (in Japanese)

Ronquist, F. & Huelsenbeck, J. P. 2003. MRBAYES 3: Bayesian phylogenetic inference under mixed

models. *Bioinformatics* 19: 1572–1574.
Swofford, D. L. 2001. *PAUP*: Phylogenetic analysis using parsimony (*and other methods), version 4.0b10*. Sinauer Associations, Sunderland, MA.
Turner, R. D. 1954. The Family Pholadidae in the Western Atlantic and the Eastern Pacific Part I — Pholadinae. *Johnsonia* 3(33): 1–64.
Turner, R. D. 1955. The Family Pholadidae in the Western Atlantic and the Eastern Pacific Part II — Martesiinae, Jouannetinae and Xylophagainae. *Johnsonia* 3(34): 65–160.
Turner, R. D. 1969. Superfamily Pholadacea Lamarck, 1809. *In*; Moore, R. C. (ed.), *Treatise on Invertebrate Paleontology. Part N. Mollusca 6. Bivalvia. Vol. 2 (of 3)*, pp. 702–741 Geological Society of America & University of Kansas Press, Boulder, Colorado & Lawrence, Kansas.
Turner, R. D. 1998. Superfamily Pholadoidea. *In*: Beesley, P. L., Ross, G. J. B. & Wells, A. (eds.), *Mollusca: The Southern Synthesis. Fauna of Australia. Vol. 5. Part A*, pp. 371–378. CSIRO Publishing: Melbourne.
Ueshima, R. 2002. Simple methods for DNA preservation in molluscan specimens. *Venus* 61: 91–94. (in Japanese with English abstract)
Walsh, P. S., Metzger, D. A. & Higuchi, R. 1991. Chelex 100 as a medium for simple extraction of DNA for PCR-based typing from forensic material. *Biotechniques* 10: 506–513.

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西太平洋から発見されたスズガイ亜科の 1 新種

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要　旨

日本及びフィリピンの水深 50 ～ 180 m から回収された軟らかい泥岩中より，スズガイ亜科の新種が発見された。本種は後閉殻筋の付着部位に突出した棚状構造（buttress）を欠くことから *Pholadopsis* トゲスズガイ亜属に分類され，1）小さい殻サイズ（附属板を含め殻幅 14 mm 以下）と，2）微小な棘が密生した球形の殻，3）後方に向かって急激かつ深く落ち込む右殻の殻体前区，4）5 ～ 12 本のかぎつめ状の棘を備えた水管板（siphonoplax），そして 5）局所的な赤色の色素をもつ水管基部の外套膜襟 によって特徴づけられる。本亜属には世界中から 5 種が知られ，本種はそのうち東大西洋の陸棚域から記載された *Jouannetia* (*Pholadopsis*) *uncinata* に最も類似するが，水管板後端の棘の形と数，そして休止板と中板の表面彫刻が異なる。従って，本種を *Jouannetia* (*Pholadopsis*) *spinosa* n. sp. フカミトゲスズガイ（新種・新称）として記載する。トゲスズガイ亜属は西太平洋において，*J.* (*P.*) *globulosa* トゲスズガイのみが知られているが，棲息水深が大きく異なり，本種のほうがより深い深度に分布するうえ，分子系統学的にも異なることがわかった。また，これまでスズガイ亜科の中板（mesoplax）は 1 枚から構成されると考えられてきたが，基本的には 1 対 2 葉からなる可能性が指摘された。