DIFFERENCES OF MAXILLULA AND HINGEMENT AMONG THREE PHYLOGENETIC GROUPS IN THE SPECIES OF GENUS *LOXOCONCHA* SARS, 1866 (CRUSTACEA, OSTRACODA, PODOCOPIDA)

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ABSTRACT

A total of 27 species of the genus *Loxoconcha*, in which 21 species living in the coast of Japan, two species in the European and Mediterranean coasts and four species from Vietnam were presented in the present study. The data set of 6 species was referred from the previous literatures and of 21 species was shown here for the first time. Sampling was carried out in a variety of locations from Japan and Vietnam in period of 2012 to 2015. Species of genus *Loxoconcha* was divided into three phylogenetic groups based on the distributional pattern of the pore system below eye tubercle. The difference of the chaetotaxy on three endites of maxillula and the difference of length of posterior tooth of left valve's hingement were consistent with three phylogenetic groups. The total number of setae of three endites on the maxillula was lowest in the Group A, highest in the Group C, but the length of posterior tooth in hingement of the left valve was largest in the Group A and smallest in the Group C. On the other hand, the numbers of setae of exopodite and outer 1st podomere of the endopodite as well as the length of other hinge elements (posterior socket, anterior tooth) on the left valve did not show any remarkable relationships.

Keywords: Loxoconcha, chaetotaxy, maxillula, taxonomy, phylogeny.

1. INTRODUCTION

The maxillula (referred as the maxilla or first maxilla of some authors) is the fourth head appendage of ostracods. It lies immediately behind the mandibles and has two functions, feeding and, in some groups, respiration [1]. In podocopan ostracods, the maxillula consists of a protopodite, bearing antero-medially an endopodite (commonly referred to as a palp; often segmented, lying parallel to the three endites) and three endites (sometimes referred to as masticatory lobes), all of which terminate in several short setae [1]. The endites and palp assist the mandibles in moving food towards the mouth and removing waste particles from the mouth region. The maxillula also consists of an extremely well developed epipodite branchial plate with radiating long, setulous, or feathery setae posteriorly and several reflexed setae point forwards [1]. The branchial plate beats continously, circulating water within the body cavity and presumably assisting with respiration. The primary function of the current produced by the branchial plate is to maintain a flow of oxygenated water through the domicilium [2, 3].

The hingement of cytheracean ostracods has been regarded as a very significant character for taxonomy, especially at the generic or familial level [4]. Hingement of the

species of the genus *Loxoconcha* overall belongs to gongylodont which is characterized by bilobate terminal elements: an anterior tooth locates between two sockets and a posterior socket between two teeth in the right valve [1, 5, 6].

Loxoconcha is one of the most diverse recent ostracod genera. Species of this genus are distributed in low-to-middle-latitude areas of marine and brackish waters and up to more than 150 living and 350 fossil species have been identified in the world [7]. There are some different opinions on the history of this genus. However, at present this genus is considered to originate in the late Palaeogene and started its adaptive radiation in the Neogene [8]. The oldest record of *Loxoconcha* species in Japan is lower Miocene (approximately 18 Ma) [9]. Relating to the maxillular structure of *Loxoconcha* genus, the setae of branchial plate ranges from 15 to 17 setae, in which the number of reflexed setae is zero or one [10, 11]. The large palp consists of two podomeres, proximal one with four setae antero-distally, one seta postero-distally and distal one with one strong claw and two stout setae. Each endite has six stout setae [5].

Up to now, published illustrations of *Loxoconcha* maxillula and hingement in the literature are fewer than those of other appendages, probably because the maxillula has normally little perceived taxonomic meaning. For the case of the maxillula, it is only well considered in the majority of species, has similar morphology and has the same function in all groups, and is not sexually dimorphic or involved in reproduction. However, since sexual selection and functional differences have played little or probably no role in shaping the morphology of the maxillula, it has a potential to reflect evolutionary trends at higher taxonomic levels [11]. Therefore, the aim of this paper was to document the number of setae on the different parts of maxillula and length of hingement of *Loxoconcha* species, and to seek to identify phylogenetically significant trends.

2. MATERIAL AND METHODS

2.1. Sampling and specimen preservation

A total of 27 species of the genus *Loxoconcha*, in which 21 species living in the coast of Japan, two species in the European and Mediterranean coasts and four species from Vietnam were represented in this study. The data set of hingement elements was completely new. The information of chaetotaxy of maxillula in the 6 species was referred from the literatures and in others was shown here for the first time (Appendix 1). Sampling was carried out in a variety of places from Japan and Vietnam in period of 2012 to 2015. The information of sampling locations and time is shown in more detailed in Appendix 1.

Sampling was conducted during low tide in the study areas. At the sampling points, where the water depth was less than 30 cm, the uppermost 5 mm of the active layer of sediment was scooped into a plastic bottle using a scoop (a flat scoop with dimensions of 12 × 15 cm or a rectangular scoop of 4 × 7 cm, depending on the degree of surface irregularity). Then, all of the collected specimens were fixed in 5 – 10% formaldehyde that had been neutralised with hexamethylenetetramine, before being washed through 16-mesh (# 1 mm) and 250-mesh (# 0.063 mm) sieves. Part of the washed material was fixed with 70 – 80% alcohol for later observations of the appendages, and the remaining material was dried.

2.2. Specimen treatment

The specimens were dissected under a binocular microscope in the laboratory. Their appendages and carapaces were then observed and sketched using a differential interference contrast microscope with a camera lucida (BX-50, OLYMPUS) to obtain illustration photos. Also for the dissected specimens, soft parts were mounted on a slide glass in the “Neo

Sigaral" agent and carapaces were on a cardboard slide with single hole. At the same time, the number of setae on maxillula (three endites, endopodite, outer 1st podomere of endopodite, exopodite) (Figure 2) was counted and the chaetotaxy of maxillula was also observed. The dimensions of the valves and hinge elements (e.g., tooth of anterior element, socket and tooth of posterior elements) were measured using some computer software such as ImageJ, Adobe Photoshop, and Paint….

Dried carapaces and individuals were coated with gold using a quick auto-coater (JFC-1500, Ion Sputtering Device) and were then observed with a scanning electron microscope (JSM-5600LV, JEOL). Scanning electron microscope photos were subsequently used for identification of carapace size, pore groups, muscle scars and hinge elements (Figure 1).

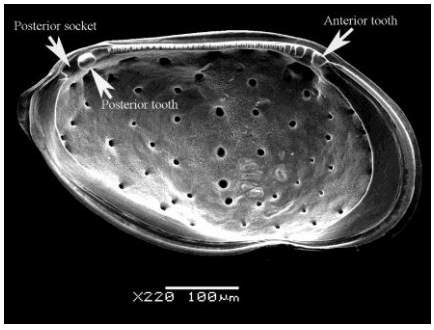

Figure 1. Internal view of male left valve in *Loxoconcha* sp. 12

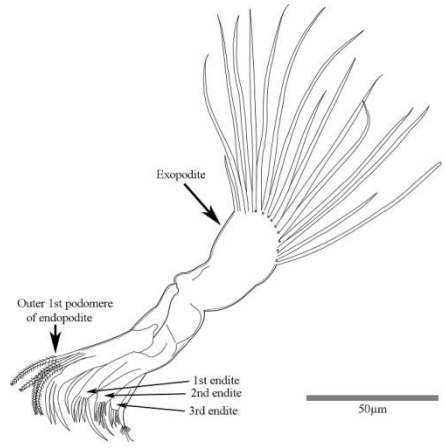

Figure 2. Sketching of maxillula of *Loxoconcha sesokoensis* Le & Tsukagoshi, 2014 [12]

2.3. Subgroup division

Species of genus *Loxoconcha* was divided into three phylogenetic groups based on the distributional pattern of the pore system below eye tubercle [8]. The Groups A and B were defined by Ishii *et al*., 2005 [8], whereas the Group C was defined by Le & Tsukagoshi, 2014 [12].

2.4. Statistical analysis

t-Test analysis (t-Test: Two-Sample Assuming Unequal Variances) at 5% level of probability was used to compare the differences in hinge elements and the number of maxillular setae between two phylogenetic groups.

3. RESULTS

3.1. Dimensions of hinge elements

The length of anterior tooth of hingement of the left valve ranged from 11.3 to 25.8 µm, the length of posterior socket from 15.2 to 34.4 µm and of posterior tooth between 9.3 and 26.2 µm. A comparison among three groups showed that the length of posterior tooth of hingement was largest in the Group A, median in the Group B and smallest in the Group C, e.g., these numbers of the Group A from 17.9 to 26.2 µm, the Group B between 9.4 and 16.7 µm and the Group C between 9.3 and 13.7 µm (Table 1). Statistical analysis (t-Test) indicated the length of posterior tooth of the left valve of the Group A (average of 22.6 µm) was much larger than that of the Group B (average of 13.1 µm) and the Group C (average of 11.5 µm), but there was no significant difference in this character between the Groups B and C (Table 2). The reduction tendency from the Group A to the Group C also was presented in

the length of anterior tooth of hingement in the left carapace, but this tendency was not consistent. There was no clear difference in the length of posterior socket of hingement of the left valve among three pore groups (Table 2). A comparison of the length of hinge elements of the left valve of phytal species and bottom dwelling species revealed no obvious differences between these species (Table 1).

Table 1. Dimension of some hinge elements of left valves of 24 species of the genus *Loxoconcha*

Order	Species name	Group	Habitat	Carapace length (µm)	Anterior tooth (µm)	Posterior socket (µm)	Posterior tooth (µm)	Sex	N
1	*Loxoconcha japonica* Ishizaki, 1968	A	P, N	586	22.7	25.2	19.9	M	2
2	*L. shanhaiensis* Hu, 1981	A	P, N	547	19.4	23.4	18.3	M	2
3	*L. lilljeborgii* Brady, 1868	A	P, N	536	24.7	25.1	25.5	F	1
4	*L. tumulosa* Hu, 1979	A	P, N	533	23.2	-	25.9	F	1
5	*Loxoconcha* sp. 1	A	P, N	496	19.4	23.4	17.9	M	2
6	*Loxoconcha* sp. 7	A	P, N	482	20.8	22.3	20.8	ND	1
7	*L. mutsuensis* Ishizaki, 1971	A	P, N	694	24.4	26.9	26.2	M	3
8	*L. harimensis* Okubo, 1980	A	Bt, N	532	18.5	21.1	21.9	ND	2
9	*L. tosaensis* Ishizaki, 1968	A	Bt, N	646	21.8	34.4	22.7	M	2
10	*L. modesta* Ishizaki, 1968	A	Bt, N	624	25.2	28.5	25.7	M	2
11	*Loxoconcha* sp. 8	A	P, N	514	20.0	24.0	22.0	F	1
12	*Loxoconcha* sp. 12	A	P, N	553	18.1	23.1	24.5	M	2
	Average of group A			*561.9*	*21.5*	*25.2*	*22.6*		
13	*L. noharai* Le & Tsukagoshi, 2014	B	Bt, Br	535	19.5	24.6	11.0	M	4
14	*L. santosi* Le & Tsukagoshi, 2014	B	Bt, Br	487	15.3	22.5	9.4	M	4
15	*L. pulchra* Ishizaki, 1968	B	Bt, Br	576	23.4	24.0	11.7	M	3
16	*L. kosugii* Nakao & Tsukagoshi, 2002	B	Bt, Br+N	691	22.9	31.1	13.9	M	3
17	*L. uranouchiensis* Ishizaki, 1968	B	Bt, Br+N	534	20.8	26.7	13.4	M	2
18	*Loxoconcha* sp. 5	B	Bt, Br	461	25.8	15.2	16.7	F	1
19	*L. ocellata* Bold, 1973	B	Bt, Br+N	624	15.8	21.2	13.2	M	1

Order	Species name	Group	Habitat	Carapace length (µm)	Anterior tooth (µm)	Posterior socket (µm)	Posterior tooth (µm)	Sex	N
20	*Loxoconcha* sp. 4	B	Bt, b	532	14.3	29.4	15.7	F	2
	Average of group B			*555.0*	*19.7*	*24.3*	*13.1*		
21	*L. yoshidai* Le et al., 2016	C	Bt, N	465	17.8	26.7	11.2	M	5
22	*Loxoconcha* sp. 3	C	Bt, N	472	ND	23.3	11.7	M	2
23	*L. sesokoensis* Le & Tsukagoshi, 2014	C	Bt, N	486	11.3	20.8	9.3	M	4
24	*L. vietnamensis* Tanaka et al., 2009	C	Bt, N	502	18.1	23.6	13.7	M	3
	Average of group C			*481.3*	*15.7*	*23.6*	*11.5*		

Abbreviations: Bt (Bottom dwelling species); P (Phytal species); Br (Brackish water); N (Normal marine water); F (Female); M (Male); ND (No data).

Table 2. Results of T-test on dimension of some hinge elements of the left valves of 24 species of the genus *Loxoconcha*

Hinge element	Compared pair	Mean of length (µm)	t Stat	t Critical two-tail	Conclusion
Anterior tooth	Groups A and B	21.5 and 19.7	1.08	2.23	No difference
	Groups A and C	21.5 and 15.7	2.48	4.30	No difference
	Groups B and C	19.7 and 15.7	1.49	2.78	No difference
Posterior socket	Groups A and B	25.2 and 24.3	0.42	2.18	No difference
	Groups A and C	25.2 and 23.6	0.99	2.31	No difference
	Groups B and C	24.3 and 23.6	0.35	2.23	No difference
Posterior tooth	Groups A and B	22.6 and 13.1	7.84	2.11	*Difference*
	Groups A and C	22.6 and 11.5	8.93	2.26	*Difference*
	Groups B and C	13.1 and 11.5	1.33	2.31	No difference
	L. japonica and *L. uranouchiensis* groups	22.3 and 11.3	6.47	2.45	*Difference*

t Stat < -t Critical two-tail or t Stat > t Critical two-tail: Difference.

-t Critical two-tail < t Stat < t Critical two-tail: No difference.

3.2. Chaetotaxy of maxillula

The *Loxoconcha* species showed the variation in the number of setae of some parts on the maxillula and mandible within this genus. In maxillula, the total number of setae of three endites ranged from 10 to 18, of the outer first podomere of the endopodite from 3 to 5 and of exopodite between 15 and 17 (Table 3).

The present study indicated the variation in number of setae of each endite among the *Loxoconcha* species. The number of setae of the first endite was from 3 to 7, while the

number was between 4 and 7 in the second, and between 3 and 6 in the third endite. The numbers of setae of the outer first podomere of the endopodite and of the exopodite on the maxillula were equivelent to 4 and 16, respectively.

The total number of setae of three endites on the maxillula was low in the Group A (ranges from 10 to 14 with average of 12.6 setae), median in the Group B (from 16 to 17 with average of 16.5 setae) and high in the Group C (between 16 and 18 with average of 16.8 setae) (Table 4). Statistical analysis (T-test) showed the significant difference in the number of setae of three endites between the Groups A and B, and between the Groups A and C, but no significant difference between the Groups B and C. This analysis also indicated the similar numbers of setae of the outer first podomere of the endopodite and of exopodite on the maxillula among three groups (Tables 3, 4).

With exception of the two bottom species (*Loxoconcha elliptica* and *L. harimensis*), the total number of setae of three endites on the maxillula of bottom-dwelling species (average of 16.5 setae) was significant higher than that of phytal species (average of 12.4 setae) (Tables 3, 4). The number of setae of the outer first podomere of the maxillulan endopodite, maxillulan exopodite and the third podomere of the endopodite on the mandible was independent with three phylogenetic groups and with life modes.

Table 3. Number of setae of three endites, the outer 1st podomere of the endopodite and exopodite on the maxillula of 17 species of the genus *Loxoconcha*

Species name	Group	Habitat	Carapace length (μm)	Maxillula						*N*
				First endite	Second endite	Third endite	Total three endites	Outer 1st podomere of endopodite	Exopodite	
Loxoconcha shanhaiensis Hu, 1981	A	P, N	547	5	4	5	14	4	16	-
L. mutsuensis Ishizaki, 1971	A	P, N	694	3	4	3	10	5	16	3
Loxoconcha japonica Ishizaki, 1968	A	P, N	586	4	5	4	13	3	17	-
L. rhomboidea Fischer, 1855	A	P, N	590	4	4	3	11	4	15	-
L. harimensis Okubo, 1980	A	Bt, N	532	5	4	4	13	3	16	-
L. elliptica Bonema, 1941	A	Bt, N+Br	660	5	4	4	13	4	17	-
Loxoconcha sp. 12	A	P, N	553	5	5	4	14	4	17	3
Average of group A				*4.4±0.30*	*4.3±0.18*	*3.9±0.26*	*12.6±0.57*	*3.9±0.22*	*16.3±0.26*	
L. pulchra Ishizaki, 1968	B	Bt, Br	576	6	7	4	17	4	16	-
L. kosugii Nakao & Tsukagoshi, 2002	B	Bt, Br+N	691	5	6	6	17	4	17	4
L. noharai Le & Tsukagoshi, 2014	B	Bt, Br	535	6	6	4	16	4	16	8
L. santosi Le & Tsukagoshi, 2014	B	Bt, Br	487	6	5	5	16	4	16	7
L. uranouchiensis Ishizaki, 1968	B	Bt, Br+N	534	5	6	5	16	4	16	2
Loxoconcha sp. 11	B	Bt, N	480	6	6	5	17	4	16	2
Average of group B				*5.7±0.21*	*6.0±0.26*	*4.8±0.31*	*16.5±0.22*	*4.0*	*16.2±0.25*	
L. yoshidai Le et al., 2016	C	Bt, N	465	6	6	5	17	4	16	7
Loxoconcha sp. 3	C	Bt, N	472	6	6	6	18	ND	16	1

Species name	Group	Habitat	Carapace length (μm)	Maxillula						*N*
				First endite	Second endite	Third endite	Total three endites	Outer 1st podomere of endopodite	Exopodite	
L. sesokoensis Le & Tsukagoshi, 2014	C	Bt, N	486	5	6	5	16	4	17	5
L. vietnamensis Tanaka *et al.*, 2009	C	Bt, N	502	5	6	5	16	4	16	3
Average of group C				*5.5±0.29*	*6.0*	*5.3±0.25*	*16.8±0.48*	*4.0*	*16.3±0.25*	

Abbreviations: ND (No data); - (data is taken from the literatures, i. e., *L. shanhaiensis* after [13]; *L. japonica* after [10]; *L. rhomboidea* and *L. elliptica* after [1]; *L. harimensis* after [5] and *L. pulchra* after [14]); Bt (Bottom dwelling species); P (Phytal species); Br (Brackish water); N (Normal marine water).

Table 4. Results of t-Test on number of the setae of three endites and of exopodite on the maxillula of 19 species of the genus *Loxoconcha*

Maxillular elements	Compared pair	Mean of number of setae	t Stat	t Critical two-tail	Conclusion
Three endites	Groups A and B	12.6 and 16.5	-6.40	2.31	*Difference*
	Groups A and C	12.6 and 16.8	-5.61	2.26	*Difference*
	Groups B and C	16.5 and 16.8	-0.47	2.78	No difference
	Phytal and Bottom species	12.4 and 16.5	-4.77	2.57	*Difference*
Exopodite	Groups A and B	16.3 and 16.2	0.36	2.26	No difference
	Groups A and C	16.3 and 16.3	0.09	2.26	No difference
	Groups B and C	16.2 and 16.3	-0.28	2.45	No difference

t Stat < -t Critical two-tail or t Stat > t Critical two-tail: Difference

-t Critical two-tail < t Stat < t Critical two-tail: No difference.

4. DISCUSSION

So far, the oldest *Loxoconcha* species have been found in Indo-West Pacific Region in the Oligocene (possibly the Late Eocene) [15-17]. This species has typical carapace shape of phytal species and belongs to the Group A. The oldest fossil record of the Group B in the world is species *L. pulchra* that was found from the Miocene in Japan [8, 9]. These facts suggest that in the world, the Group A has appeared before the Group B and the Group A is an original group of *Loxoconcha* s. s. Around Japan, the oldest fossil record of the Group A is species *L. nozokiensis* that was collected from the Early Miocene Akeyo Formation, Mizunami Group and Toyama Formation, Iwamura Group, Central Japan (ca. 18 Ma) [18]. Therefore, in Japan, the Group B seems as old as the Group A according to the fossil records**.**

The data in the Table 1 indicates that the average length of posterior tooth of hingement of left valve in species of the Group A (22.6 μm) is larger than that of the Group B (13.1 μm) and the Group C (11.5 μm). The data in the Table 4 shows that the total number of setae of three endites on the maxilla of the Group A (average 12.6 setae) is smaller than that of the Group B (average 16.5 setae) and the Group C (16.8 setae). These characters indicate a possible trend that an evolutionary process may be a cause of change in the size of hinge

element and the number of maxillulan setae of *Loxoconcha* species [19], the younger evolutionary origin of the species is, the more setae of three endites of its maxillula and smaller dimension of posterior tooth of its valve get, on the other hand the older evolutionary origin of the species is, the fewer setae of three endites of its maxillula and bigger length of posterior tooth of its valve have. Although there is a lack of fossil records of the Group C, based on the possible relationships between evolutionary trend and the number of setae on the three endites on the maxillula, between evolutionary trend and the dimension of posterior tooth of hingement of left valve can suggest a possibility that the species of the Group C might have appeared after the species of the Group B and the Group A because its dimension of posterior tooth of hingement of left valve is smaller and its total number of three endites on the maxillula is higher than that of Groups A and B. It means that among three groups of the genus *Loxoconcha*, the Group C is youngest. Therefore, a further work on evolutionary origin of the Group C is needed to exploit its full potential.

Generally, among the species of *Loxoconcha*, the size of posterior tooth of hingement of left valve and the number of setae of three endites are changeable but the size of other hinge elements and the number of setae of outer first podomere of endopodite and of exopodite on the maxillula are nearly stable. Reasons to explain these facts probably include a genetic structure and a function of them. The genetic structure of posterior tooth of hingement of the left valve and three endites of the maxillula seem to change easier than their other parts. For the case of the maxillula, this opinion may be supported by the observation of maxillulan ontogeny of three species *L. noharai, L. sesokoensis* and *L. japonica* [20]. Within the three species, the difference in the number of setae of three endites appears in the earlier instar than that of other parts on the maxillula, i. e., the number of setae of three endites starts to differentiate in the instar A-4, of the outer first podomere of the endopodite in the instar A-2, of exopodite in the instar A-3 [20]. Also the main functions of three endites are collecting food and transporting them forwards the mouth. Thus, the number of setae of three endites should be quickly adjusted in order to adapt to the different micro environments.

5. CONCLUSION

Among the three phylogenetic groups, the total number of setae of three endites on the maxillula is lowest in the Group A, highest in the Group C, but conversely, the length of posterior tooth in hingement of the left valve is largest in the Group A and smallest in the Group C. The tendency of difference in the number of setae of exopodite and outer 1st podomere of the endopodite on the maxillula as well as the tendency of difference in the dimension of other elements on hingement (posterior socket, anterior tooth) of the left valve among the three phylogenetic groups does not found in this study.

Appendix

List of examined species in this study and their sampling location, sampling time

Order	Species name	Sampling location	Sampling time
1	*Loxoconcha japonica* Ishizaki, 1968	Sesoko Island, Okinawa Islands, southern Japan	5/2013
2	*L. shanhaiensis* Hu, 1981	Sesoko Island, Okinawa Islands, southern Japan	5/2013
3	*L. lilljeborgii* Brady, 1868	Sesoko Island, Okinawa Islands, southern Japan	5/2013
4	*L. tumulosa* Hu, 1979	Okinawa Islands, southern Japan	5/2013
5	*Loxoconcha* sp. 1	Sesoko Island, Okinawa Islands, southern Japan	5/2013
6	*Loxoconcha* sp. 7	Sesoko Island, Okinawa Islands, southern Japan	5/2013
7	*L. kosugii* Nakao & Tsukagoshi, 2002	Kisarazu city, Chiba Prefecture, central Japan	11/2012
8	*L. noharai* Le & Tsukagoshi, 2014	Ohura estuary, Okinawa Islands, southern Japan	5/2013
9	*L. santosi* Le & Tsukagoshi, 2014	Ada, Okinawa Islands, southern Japan	5/2013
10	*Loxoconcha* sp. 3	Sesoko Island, Okinawa Islands, southern Japan	5/2013
11	*L. yoshidai* Le *et al*., 2016	Bise beach, Motobu town, Okinawa Islands, southern Japan	5/2013
12	*L. sesokoensis* Le & Tsukagoshi, 2014	Sesoko Island, Okinawa Islands, southern Japan	5/2013
13	*Loxoconcha* sp. 8	Sesoko Island, Okinawa Islands, southern Japan	5/2013
14	*L. mutsuensis* Ishizaki, 1971	Miyazaki city, Miyazaki Prefecture, southern Japan	1/2015
15	*L. harimensis* Okubo, 1980	Miura city, Kanagawa Prefecture, central Japan	11/2014
16	*L. tosaensis* Ishizaki, 1968	Miura city, Kanagawa Prefecture, central Japan	11/2014
17	*L. modesta* Ishizaki, 1968	Miura city, Kanagawa Prefecture, central Japan	11/2014
18	*L. pulchra* Ishizaki, 1968	Kisarazu city, Chiba Prefecture, central Japan	11/2014
19	*L. uranouchiensis* Ishizaki, 1968	Miura city, Kanagawa Prefecture, central Japan	11/2014
20	*Loxoconcha* sp. 4	Miura city, Kanagawa Prefecture, central Japan	11/2014
21	*Loxoconcha* sp. 5	Obitsu river estuary, Chiba Prefecture, central Japan	11/2012
22	*Loxoconcha* sp. 11	Soi Sim island, Ha Long Bay, Ha Long city, Quang Ninh Province, northern Vietnam	12/2013
23	*L. ocellata* Bold, 1973	Thien Cung cave, Ha Long Bay, Ha Long city, Quang Ninh Province, northern Vietnam	12/2013
24	*L. vietnamensis* Tanaka et al., 2009	Van Don island, Quang Ninh Province, northern Vietnam	12/2013
25	*Loxoconcha* sp. 12	Dam Ngoai island, Phu Quoc Marine Protected Area, Kien Giang Province, southern Vietnam	11/2014
26	*L. elliptica* Bonema, 1941	England	
27	*L. rhomboidea* Fischer, 1855	England	

Data of *Loxoconcha elliptica* and *L.rhomboidea* is taken from Athersuch *et al*., 1989 [1].

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TÓM TẮT

SỰ KHÁC NHAU VỀ HÀM DƯỚI VÀ KHỚP NỐI VỎ GIỮA BA NHÓM CHỦNG LOẠI CÁC LOÀI THUỘC GIỐNG *LOXOCONCHA* SARS, 1866 (CRUSTACEA, OSTRACODA, PODOCOPIDA)

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Tổng số 27 loài thuộc giống *Loxoconcha* đã được sử dụng trong báo cáo này, trong đó 21 loài sống ở ven bờ Nhật Bản, 2 loài sống ở ven bờ biển Châu Âu và Địa Trung Hải và 4 loài ven bờ vùng biển nước ta. Kết quả nghiên cứu của 6 loài được tham khảo từ các báo cáo đã công bố, kết quả của 21 loài còn lại là hoàn toàn mới. Mẫu nghiên cứu được thu thập ở nhiều địa điểm khác nhau ven bờ biển Nhật Bản và Việt Nam từ năm 2012 đến 2015. Các loài thuộc giống *Loxoconcha* được chia thành ba nhóm chủng loại dựa trên mô hình phân bố các lỗ dưới mắt. Kết quả nghiên cứu cho thấy sự khác nhau có ý nghĩa thống kê về tổng số tua của ba thùy ở hàm dưới và sự khác nhau về chiều dài răng sau của khớp nối vỏ ở vỏ trái giữa ba nhóm chủng loại. Tổng số tua của ba thùy ở hàm dưới ít nhất ở nhóm A và nhiều nhất ở nhóm C, nhưng chiều dài răng sau ở khớp nối vỏ của nhóm A là dài nhất, nhóm C là ngắn nhất. Ngoài ra, số lượng tua của phiến mang và của phần đầu ở hàm dưới, chiều dài các bộ phận khác trên khớp nối vỏ (hốc răng sau, răng trước) của vỏ trái không có sự khác nhau rõ ràng giữa ba nhóm.

Keywords: Giống *Loxoconcha*, sắp xếp cấu trúc, hàm dưới, phân loại, phát sinh loài.