Morphological notes on the mouthparts of decapod crustacean larvae, with emphasis on palinurid phyllosomas

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Morphological notes on the mouthparts of decapod crustacean larvae, with emphasis on palinurid phyllosomas

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Abstract Some topics in the morphological study of mouthparts of decapod larvae, consisting of labrum, mandible, paragnath (= labium) and maxillule, are briefly reviewed. The morphological features of larval mouthparts are compared topographically in main decapod groups. Among them, two unique types are noted: palinurid and some thalassinid mouthparts. Palinurid phyllosoma larvae have dorsoventrally flattened mandibles sandwiched and covered between a large labrum and paired paragnaths. Furthermore, other posterior appendages, maxilla and maxillipeds, are placed far apart from the position of mouthparts. Phyllosoman mouthparts of *Panulirus japonicus* by VTR showed that active movements of labrum and paragnaths. Morphological characters of phyllosoman mouthparts suggest that microphagus feeding in their larval life based on Alexander's (1988) comments. In the symmetry of larval structures, two thalassinid families, Laomediidae and Thalassinidae, the zoeal larvae have remarkably asymmetrical mandibles and paragnaths. At present nothing is known on feeding mechanisms by those unique mouthparts. In addition, *lacinia mobilis* is found in left mandible of some caridean zoeal larvae and we have no information on the role of this structure which is lacking in adult phase of decapod mouthparts.

Key words: decapod crustaceans, mouthparts, mandible, morphology

In decapod larvae, the functional morphology of elementary mouthparts, consisting of labrum, mandible, paragnath (= labium) and maxillule, has been poorly understood in spite of many previous descriptive studies. One of the reasons for this condition may be due to technical difficulty in practical observation of mandibles-dissecting very small and fragile elements by hand, and no alternative, drastically improved methods have been developed to date. In addition, microscopical observations on the movement of each mouthpart for living small larvae have not been presented yet.

In this study, the larval mouthparts are compared topographically in main decapod groups. Among them, two unique forms are noted: palinurid and some thalassinid mouthparts, etc.

Palinurid mandibles

Palinurid phyllosoma larvae have dorso-ventrally flattened mandibles which are sandwiched between a large labrum and large paired paragnaths (Fig. 1A, 1B, arrow). In addition, other posterior appendages, maxillae and maxillipeds, are placed far apart from the position of mouthparts. Feeding motions of these parts have been fragmentally documented. Observation of mouthparts in the living 1st stage phyllosoma of *Panurlius japonicus* using VTR showed that active movements of labrum and paragnaths. Mastication mechanism in detail in digestive system of phyllosoman larvae is not confirmed yet, although Lemmens and Knott (1994) described the morphological change of mouthparts during metamorphosis in *Panulirus cygnus*. Alexander (1988) commented that the paragnaths

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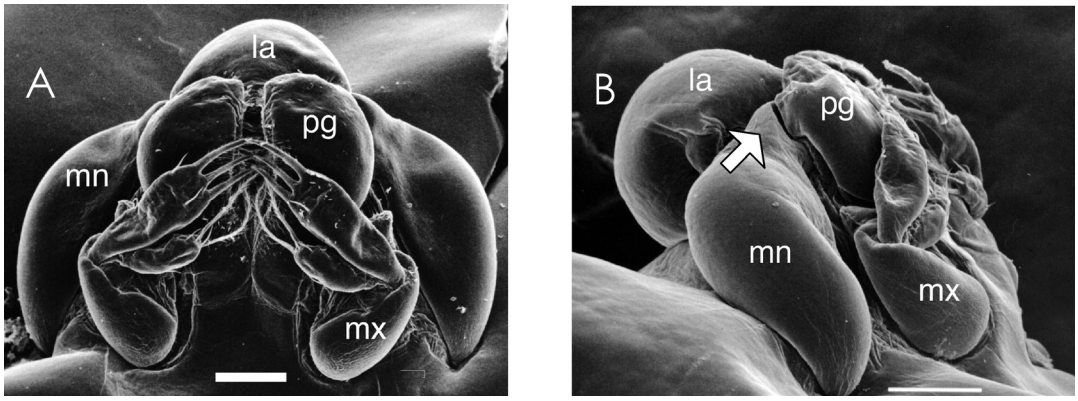

Fig. 1. Scanning electron micrographs of mouthparts of 8th phyllosoma in *Panurilus japonicus* in frontal (A) and lateral (B) view. White scale bars = 0.1 mm. la: labrum, mn: mandible, mx: maxillae, pg: paragnath.

are relatively small in macrophagus forms and show the greatest development in microphagus forms. Morphological characteristics of phyllosoma mouthparts suggest microphagus feeding mode in their larval life.

Heegaard (1969) described the mandibles of amphion larvae, having some similar body-plans to phyllosomas, and he stated that the two long lobes on the labium (= paragnath) are placed close together in phyllosoma, a reptant character, but in amphion they are short and placed far apart. Schram (1986) stated, "the mandibles are rather reduced and are typically formed as weak molar lobes, with no incisor lobe or palps. In females, the mandible have been termed vestigial, over which the labrum and paragnaths form opposed simple complex and concave flaps, respectively. The zoeal or amphion larvae and the males have well-developed mouthparts and guts. However, the reduced mouthparts and vestigial guts of the adult female indicate these do not feed but live off food reserved. Nothing is known about mode of feeding, or details of reproduction or locomotion". These morphological features suggest that the mandible of *A. reynaudii* is similar to those of the phyllosoma larvae of spiny lobsters except for topographic condition of labrum and paragnath.

Asymmetry in thalassinid mandibles

Another unique example is found in thalassinid mouthparts. Among zoeal larvae of the infraorder Thalassinidea, so far as known, those of the family Laomediidae and Thalassinidae have considerably asymmetrical mandibles and paragnaths - the left one is extremely elongated, while right one is very small (Gurney and Lebour, 1939; Sankolli, 1967; Yaldwyn and Wear, 1972; Goy and Provenzano, 1978; Fukuda, 1982; Rodrigues *et al.*, 1992). Many previous authors have been commented this uniqueness (Gurney, 1942; Factor, 1989), but no observations for movement of the mouthparts have been made to date. We have, therefore, no idea for actual function of the asymmetrical mandibles. Asymmetry in larval mouthparts has been known in some insect groups (cf. Heming, 1980), but there are no ideas for functional or adaptive significance for this just until recent years. Inoda *et al.* (2003) firstly revealed the function of asymmetrical mandibles of some larval insects-adaptation for catch and hold of the prey. In near future, we will make it clear about this interesting structure by advanced observation techniques of living larvae.

P.S. Lacinia mobilis in some decapod larvae

In addition to above two cases, special small and articulated seta-like structure on incisor process of mandibles, lacinia mobiles, should be noted. This minute spine-like structure has been known in adult form of peracarid decapods (cf. Dahl and Hessler, 1982; Richter and Kornicker, 2006). In some

caridean zoeal larvae (*e.g.*, Konishi and Kim, 2000), the left mandible possesses this structure while right mandible not. In adult peracarid shrimp, some possible roles in feeding prey have been stated, but no suggestions for decapod zoeas.

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