

Identification of Ommastrephid paralarvae from the northwestern Pacific

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Introduction

The family Ommastrephidae (Mollusca: Cephalopoda: Oegopsida) is one of the largest squid group and it contains many species of commercially importance. Estimates of the recruited stock of these species require information concerning the distribution and abundance of their paralarvae. Ommastrephid paralarvae are easily distinguished from those of other families by their fused tentacles. The taxonomic characters of ommastrephid paralarvae have been described for many species and most species can be identified by these characters. However, the taxonomic characters are frequently lost or damaged during net samplings. There are seven species of ommastrephid squid (*Todarodes pacificus*, *Nototodarus hawaiiensis*, *Ommastrephes bartramii*, *Sthenoteuthis oualaniensis*, *Euclidean luminosa*, *Hyaloteuthis pelagica*, *Ornithoteuthis volatilis*) around Japan and here we summarize the taxonomic characters of the paralarvae and provide a guide designed for rapid identification. We also investigated the utility of diagnostic DNA markers for the identification of damaged specimen.

Morphological identification

Five main and eight additional characters used to distinguish species of ommastrephid paralarvae were summarized from references (Wormuth *et al.*, 1992; Wakabayashi *et al.*, 2001; Harman & Young, 1985; Young & Hirota, 1991) and observed in specimens collected from northwestern Pacific using a binocular microscope and scanning electron microscope (SEM).

Table 1. Morphological comparison of ommastrephid paralarvae from northwestern Pacific

	Proboscis length as % of mantle length (ML)	Ratio of proboscis suckers (medial : lateral)	Type of chromatophore pattern on dorsal head (Saito <i>et al.</i> , 1990)	Ocular photophores	No. of intestinal photophores
<i>T. pacificus</i>	25-50	1 : 1	S	-	0
<i>N. hawaiiensis</i>	25-75	1 : 2	S	-	0
<i>O. bartramii</i>	75-100	1 : 2	S	-	0
<i>S. oualaniensis</i>	75-100	1 : 1	S	+	2
<i>E. luminosa</i>	50-75	1 : 1.5	N	+	1
<i>H. pelagica</i>	50-75	1 : 1.5	S	+	1
<i>O. volatilis</i>	25-75	1 : 2	S	+	2

Key to ommastrephid paralarvae from northwestern Pacific

1. Mantle length < 3.5 mm 2
 > 3.5 mm 7
2. Ratio of proboscis suckers; medial : lateral = 1 : 1 3
 1 : 1.5 4
 1 : 2 5
3. Proboscis length; very elongate (longer than twice the arm length) *S. oualaniensis*
 relatively short (shorter than twice the arm length) *T. pacificus*
4. Type of chromatophore pattern on dorsal head; type N *E. luminosa*

	type S	<i>H. pelagica</i>
(other character)		
Ocular and intestinal photophores; absent		<i>E. luminosa</i>
present		<i>H. pelagica</i>
5. Proboscis length; very elongate (longer than twice the arm length)		<i>O. bartramii</i>
; not relatively short (shorter than twice the arm length)	6	
6. Number of chromatophores on mantle < 20		<i>O. volatilis</i>
> 20		<i>N. hawaiiensis</i>
7. Proboscis length; very elongate (longer than twice the arm length)	8	
; relatively short (shorter than twice the arm length)	11	
8. Ocular and intestinal photophores; absent		<i>O. bartramii</i>
present	9	
9. Ratio of proboscis suckers; medial : lateral = 1 : 1		<i>S. oualaniensis</i>
1 : 1.5	10	
10. Degree of proboscis division < 20%		<i>E. luminosa</i>
> 20%		<i>H. pelagica</i>
11. Ratio of proboscis suckers; medial : lateral = 1 : 1		<i>T. pacificus</i>
1 : 2	12	
12. Ocular and intestinal photophores; absent		<i>N. hawaiiensis</i>
present		<i>O. volatilis</i>

Molecular identification

After extracting DNA from the samples, one primer pair (LCO1495N and COI6785R1, Wakabayashi *et al.*, 2007) was used to amplify a partial mtDNA COI gene. The PCR products were directly digested using the endonuclease *Alu* I. The seven species from northwestern Pacific had distinct restriction profiles (Fig. 1). The restriction profiles of the COI fragments of *O. bartramii*, *S. oualaniensis*, *E. luminosa* and *H. pelagica* were obtained from Wakabayashi *et al.* (2006).

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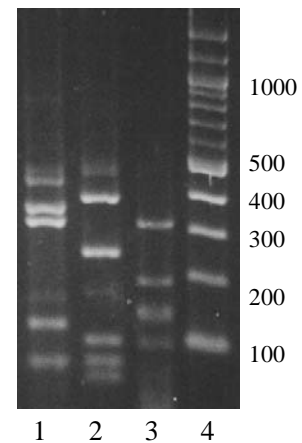


Fig. 1. Restriction profiles of the COI fragment digested by enzyme (*Alu* I). Lane1; *T. pacificus*, lane2; *N. hawaiiensis*, lane3; *O. volatilis*, lane 4; molecular marker