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Poecilostomatoid copepods of the families Clausidiidae, Lichomolgidae, Pseudanthessiidae, and Corycaeidae from Indonesian coastal waters

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Abstract—Taxonomy and distribution were studied on the species of the families Clausidiidae, Lichomolgidae, Pseudanthessiidae, and Corycaeidae recently collected from 8 sites in the Indonesian waters. Twenty species were recorded, including *Kelleria pectinata* (A. Scott 1909), *Pseudomacrochiron parvum* (A. Scott 1909), *Corycaeus andrewsi* Farran, 1911, *C. asiaticus* Dahl, 1894, *C. catus* Dahl, 1894, *C. crassiusculus* Dana, 1849, *C. longistylis* Dana, 1849, *C. Lubbocki* Giesbrecht, 1892, *C. robustus* Giesbrecht, 1891, *C. pacificus* Dahl, 1894, *C. speciosus* Dana, 1849, *Farranula concinna* (Dana 1849), *F. gibbula* (Giesbrecht 1892). Four undescribed species, *Hemicyclops* sp.1., *Hemicyclops* sp.2., *Paramacrochiron* sp., *Pseudanthessius* sp., and *Kelleria australiensis* Bayly, 1971, *K. regalis* Gurney, 1927, and *C. erythraeus* Cleve, 1901 and the male of *P. parvum*, which has been unknown so far, were new records for the area.

The distribution of these species in Indonesian waters and other regions in the world is compiled and discussed, while the undescribed or newly recorded species will be described in detail in forthcoming papers.

Key words: Clausidiidae, Lichomolgidae, Pseudanthessiidae, Corycaeidae, Poecilostomatoida

Introduction

Only a few studies on the taxonomy and biogeography of Indonesian poecilostomatoid copepods, chiefly the families Clausidiidae, Lichomolgidae, Pseudanthessiidae, and Corycaeidae have been carried out previously. Dana's (1849) papers are the first report dealing with copepods collected from Bangka Strait. The Challenger Expedition (1872–1876) collected copepods from a few stations in Buru Sea, Banda Sea and Celebes Sea. Collections of copepods have also been reported from other expeditions such as Valdivia (1898) from the Indian Ocean side of western Sumatra, and Snellius (1929) from Buru-Ambon Island. A. Scott (1909) dealt with copepods including some species of Poecilostomatoida in Indonesian waters using the samples collected during the Siboga Expedition (1899–1900). Additional species of copepods from Indonesian waters were reported by Cleve (1901) from Bali and Bangka Straits, Carl (1907) from Ambon Bay, Früchtl (1923, 1924) from Aru Island, Delsman (1939, 1949) from Jakarta Bay and Sunda Strait, Fleminger et al. (1982) from Sorong Sea, and Ohtsuka et al. (1987) using samples collected from Celebes Sea. However, there has been no comprehensive study on the Indonesian poecilostomatoid copepods so far.

This paper summarises a research on the poecilostomatoid fauna in the Indonesian waters and present a list of species with a discussion on their geographical patterns. The morphological description of the undescribed- and/or newly recorded species will be given forthcoming papers (Mulyadi 2005).

Materials and Methods

The present samples were obtained from 8 sites (Fig. 1) during 1999–2004. For convenience of description, these sites are grouped into three areas with reference to their geographical and hydrological conditions. There are the coastal waters of Indian Ocean side of southern Java (Area A including Sites 1 and 2), the Java Sea (Area B including Sites 3, 4 and 5), and the eastern region (Area C including Sites 6, 7 and 8).

Samples were collected by surface or vertical hauls (from 5 m, 10 m and 25 m depth to the surface) of conical plankton nets (0.10 mm and 0.33 mm mesh size, 0.35 m and 0.45 m mouth diameter, respectively). The samples were fixed and preserved in 5% buffered formaldehyde/sea water solution. As far as possible, the specimens were identified to the species level by dissection and examination with a cam-

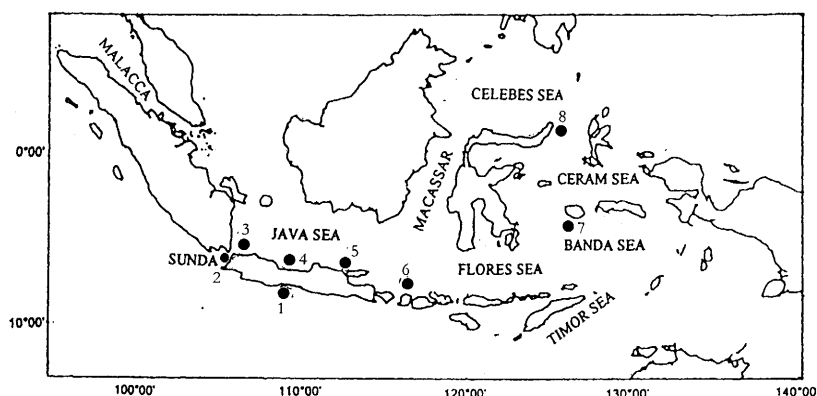


Fig. 1. Map of Indonesian waters showing study sites 1–8. 1=Cilacap Bay; 2=Off Labuan, Sunda Strait; 3= Jakarta Bay; 4=Off Tegal; 5=Off Surabaya; 6=Lombok Sea; 7=Ambon Bay; 8=Lembah Strait, Bitung.

era lucida.

Result and Discussion

A total 20 species were identified, including 2 species of Clausidiidae (*Hemicyclops* sp.1 and *Hemicyclops* sp.2), 5 species of Lichomolgidae (*Kelleria australiensis*, *K. pectinata*, *Paramacrochiron* sp., and *Pseudomacrochiron parvum*), 1 species of Pseudanthessidae (*Pseudanthessius* sp.), and 12 species of Corycaeidae (*Corycaeus andrewsi*, *C. asiaticus*, *C. catus*, *C. crassiusculus*, *C. erythraeus*, *C. longistylis*, *C. lubbocki*, *C. robustus*, *C. pacificus*, *C. speciosus*, *Farranula concinna* and *F. gibbula*). Among these species, *K. australiensis*, *K. regalis* and *C. erythraeus* are new records, and 4 species denoted here without specific name are hitherto undescribed species. The other 13 species have been recorded from Indonesian waters by previous expedition reports.

The occurrence, geographic ranges, and habitats of all the recorded species are listed in Table 1. Of these species 15% (3 species: *P. parvum*, *C. crassiusculus* and *C. speciosus*) are cosmopolitan, while Indo-Pacific species comprised 45% (9 species). The species recorded only from the Indian or Pacific Oceans accounted for 10% (2 species: *K. pectinata* and *K. regalis*) and 5% (1 species: *C. longistylis*), respectively, and 5% (1 species: *K. australiensis*) was considered to be endemic to the Australian waters before this study, and 20% (4 species) are undescribed species.

Based on their horizontal distribution and habitats, copepods are divided into 5 species groups: oceanic, neritic-oceanic, neritic, estuarine-neritic, and estuarine (Park 1970, Kim 1986, Madhupratap & Haridas 1986). According to these groups, more than half, 65% (13 species) of the present species are classified as oceanic species, and 7 species (35%) are neritic species.

Comparison of poecilostomatoid between three study areas

The number of observed species was highest at eastern region (Area C) with 14 recorded species. The poecilostomatoid population decreased towards the western part, 14 species at area C, 9 species each at areas B and A (Table 1). Among the poecilostomatoid species occurred in this study, 3 species (*C. asiaticus*, *C. lubbocki*, and *F. gibbula*) have been found from all study areas, 1 species (*P. parvum*) for areas A–B, 5 species (*K. australiensis*, *C. andrewsi*, *C. catus*, *C. erythraeus*, and *C. pacificus*) for areas A–C, 1 species (*P. parvum*) only for area A, 5 species (*K. pectinata*, *K. regalis*, *Hemicyclops* sp.1, *Hemicyclops* sp.2, and *Pseudanthessius* sp.) only for area B, and 5 species (*Paramacrochiron* sp., *C. crassiusculus*, *C. longistylis*, and *C. speciosus*) only for area C, respectively.

Taxonomy and distribution remarks

All species of *Hemicyclops* appear to be intertidal forms or inhabitants of shallow waters, and some live in association with other animals. In their revisionary work, Vervoort and Ramirez (1966) recognized 22 species. Since then 6 more species have been described, viz., *H. perinsignis* Humes, 1973, *H. columnaris* Humes, 1984, *H. mortoni* Boxshall & Humes, 1987, *H. ctenidis* Ho & Kim, 1990, *H. gomsoensis* Ho & Kim, 1991, and *H. japonicus* Itoh & Nishida, 1993. The two undescribed species to be the 2nd and 3rd species of *Hemicyclops* from Indonesian waters, the other one being *H. leggei* (Thompson & Scott 1903) collected from dredge washings (13 m depth) at the Aru Islands (A. Scott 1909). *Hemicyclops* sp.1 and *Hemicyclops* sp.2 can be distinguished from its congener by a combination of features in the segmentation and armature of the antennule and the antenna, the forms of the 1st, 3rd and 5th legs.

The genus *Paramacrochiron* Sewell, 1949 consists of six known species, *P. maximum* (Thompson & Scott 1903), *P. ennoreense* Reddiah, 1968, *P. sewelli* Reddiah, 1968, *P. rhizostomae* Reddiah, 1968 from Indian Ocean, *P. pacificum*

Table 1. List of the species of the families Clausidiidae, Lichomolgidae, Pseudanthessiidae and Corycaeidae recorded in the present study, their sampling sites and their previous records in Indonesian waters, neighbouring areas and the major oceans. ○=present records, ●=previous records, Ud=Undescribed species; Nr=New records; previous records from A=Indonesian waters; B=Australian waters; C=China Seas; D=Japanese waters; I, P, At=Indian, Pacific, and Atlantic Oceans; O=Oceanic; N =Neritic; c=common species; r=rare species.

No.	Species	Sites								Neighbour. areas				Remarks
		1	2	3	4	5	6	7	8	A	B	C	D	
1.	<i>Kelleria australiensis</i>	○							○	Nr	●			N
2.	<i>K. pectinata</i>				○					●				I N
3.	<i>K. regalis</i>				○					Nr				I N
4.	<i>Pseudomacrochiron parvum</i>		○		○					●				IPAt N
5.	<i>Hemicyclops</i> sp.1				○					Ud				N
6.	<i>Hemicyclops</i> sp.2				○					Ud				N
7.	<i>Paramacrochiron</i> sp.								○	Ud				O
8.	<i>Pseudanthessius</i> sp.				○					Ud				N
9.	<i>Corycaeus andrewsi</i>	○						○	○	○	●	●		IP O
10.	<i>C. asiaticus</i> (c)	○		○	○	○	○	○	○	○	●	●		IP O
11.	<i>C. catus</i>	○									●	●	●	IP O
12.	<i>C. crassiusculus</i>							○	○	○	●	●		IPAt O
13.	<i>C. erythraeus</i>	○						○	○	○	Nr	●		IP O
14.	<i>C. longistylis</i>							○	○	○	●	●	●	P O
15.	<i>C. lubbocki</i> (c)	○			○			○	○	○	●	●		IP O
16.	<i>C. robustus</i> (r)								○	○	●	●		IP O
17.	<i>C. pacificus</i> (r)	○								○	●	●	●	IP O
18.	<i>C. speciosus</i>								○	○	●	●	●	IPAt O
19.	<i>Farranula concinna</i>								○	○	●	●	●	IP O
20.	<i>Farranula gibbula</i> (c)	○		○					○	○	○	●	●	IP O

*1=Cilacap Bay, central Java (07°40'S 109°00'E); 2=Off Labuan, Sunda Strait (06°10'S 106°00'E); 3=Jakarta Bay (06°00'S 106°45'E); 4=Off Tegal, central Java (06°00'S 109°10'E); 5=Off Surabaya, east Java (07°10'S 109°10'E); 6=Lombok Sea (08°40'S 116°00'E); 7=Ambon Bay (03°40'S 128°10'E); 8=Lembah Strait, Bitung, North Celebes (01°30'N 124°00'E).

(Wilson 1950) and *P. japonicum* Humes, 1970 from the West Pacific and Japan Sea, respectively. Humes (1970) stated that information on many details of the external anatomy is lacking in existing descriptions and figures of the five known species of *Paramacrochiron*. The differentiation of *Paramacrochiron* sp. from the known species is based primarily on certain features of the females. The present species is distinguishable from other congener by characteristic of the 5th legs, the segmentation and armature of the antennule and the antenna, and the small size of its body.

The genus *Pseudomacrochiron* Reddiah, 1969 consists of five known species, *P. foliculus* (T. Scott 1912), *P. malayense* (Sewell 1949), *P. ornatum* (Krishnaswamy 1952), *P. stocki* Reddiah, 1969, and *P. parvum* (A. Scott 1909). *Pseudomacrochiron parvum* originally described as *Pseudanthessius parvus* by A. Scott (1909) based on female specimens found in Obi major coast, Indonesia. Sewell (1949) report this species from weed washing at the Nicobar Islands, while Ganapati and Shantakumari (1961) collected it in surface plankton from Lawson's Bay, India. The other record of this species is Morris (1973) from the *Sargassum natans* washing and neuston net from the Northwest Atlantic. In the present study I described the male of this species collected

from surface tow off Labuan, Sunda Strait.

The species of the genus *Kelleria* Gurney, 1927 are free-living, in intertidal burrows or associated with crinoids. Currently the literature indicates 11 known species, *K. andamanensis* Sewell, 1949, *K. australiensis* Bayly, 1971, *K. camortensis* Sewell, 1949, *K. fucicola* (T. Scott 1894), *K. gradata* Stock, 1967, *K. gurneyi* Sewell, 1949, *K. pectinata* A. Scott, 1909, *K. propinqua* (T. Scott 1894), *K. purpurocinta* Gurney, 1927, *K. regalis* Gurney, 1927, *K. rubimaculata* Krisnaswamy, 1952. In Indonesian waters, hitherto, only one species, *K. pectinata* was described by A. Scott (1909) from a single female collected in surface tow from the Bali Sea as *Pseudanthessius pectinatus*. The female of this species resembles *K. propinqua* (T. Scott 1894), but it is distinguished from the latter by the form of 2nd pair of maxilliped, proximal spine on 2nd segment of *K. propinqua* without fringe of long spinules, and the long apical claw on 3rd segment.

Thwin (1972) in his unpublished thesis description of *K. queenslandica* from the Brisbane River estuary, compared his material with Bayly's (1971) description of *K. australiensis* and listed 11 points difference. However, many of the differences concerned relatively minor details on less structures,

whereas the main features of the female mandible, maxilla, and maxilliped were the same. The present species resembles *K. australiensis* in general appearance, but it is distinguishable from the latter by the combination of mouthparts, the segmentation of antennule and antenna and the form of 5th legs. The present female 5th legs resembles with the abnormal form of 5th legs of *K. regalis* Gurney, 1927 figured by Humes and Ho (1969: 221–229, pl. 4, fig. 21). In having 2 lobes on inner margin of the 5th legs, but it is distinguished from the latter by the proportional lengths of prosome and urosome, and the combination characters of the mouthparts. It should be noted that Bayly's (1975) species of *Kelleria* was incorrectly referred to as *Kelleria* sp. nov. Examination of the material by Arnott and McKinnon (1981) showed that this species was, in fact, *K. regalis*, and the specimens were structurally more similar to Gurney's Suez Canal specimens than those from Madagascar (see, discussion in Humes and Ho, 1969: 225).

Twelve species of the family Corycaeidae were recorded, including 10 species of *Corycaeus* and 2 species of *Farranula*. Of the 10 species of *Corycaeus* described here, 2 belong to subgenus *Corycaeus* (*C. speciosus* and *C. crassiusculus*), 4 to subgenus *Ditrichocorycaeus* (*C. andrewsi*, *C. asiaticus*, *C. erythraeus*, and *C. lubbocki*), 2 to subgenus *Onychocorycaeus* (*C. catus* and *C. pacificus*), 1 to subgenus *Monocorycaeus* (*C. robustus*), and 1 to subgenus *Urocorycaeus* (*C. longistylis*). Most of these species occur in eastern Indonesian waters, and only 3 species, *C. asiaticus*, *C. lubbocki*, and *F. gibbula* were found from the Java Sea. *C. crassiusculus*, *C. longistylis*, *C. robustus*, and *C. speciosus* were found only from eastern Indonesian waters (Sites 6, 7 and 8). The less abundant species, *C. catus* and *C. speciosus* are common in the warm waters of all oceans. Both species were found only from Sites 7 and 7 and 8, respectively. The remaining rarely occurring species, *C. pacificus* and *C. robustus* were found at only a few sites (Sites 7 and 7 and 8).

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