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The identity of *Euploea tulliolus goodenoughi* Carpenter, 1942, a crow butterfly (Lepidoptera: Nymphalidae, Danainae) from Papua New Guinea


The nominal taxon *Euploea tulliolus goodenoughi* Carpenter, 1942, based on a unique crow butterfly collected on Goodenough Island in 1913, is shown to represent a small, aberrant female of the locally common *Euploea leucostictos eustachius* (Kirby, 1889). This new synonymy invalidates the only previous record of the Purple Crow, *Euploea tulliolus* (Fabricius, 1793), from the islands of Milne Bay Province, Papua New Guinea. However, two female *Euploea tulliolus* collected from islands in the Louisiade Archipelago during 2010 are reported here, constituting the first valid records of the Purple Crow from the Milne Bay islands.

(R.I. Vane-Wright)

Keywords: *tulliolus* species complex, new synonymy, new records, Milne Bay islands, *Euploea leucostictos*
Mediyansyah

A new tree frog of the genus *Kurixalus* Ye, Fei & Dubois, 1999 (Amphibia: Rhacophoridae) from West Kalimantan, Indonesia


*Kurixalus absconditus* sp. nov., a new species of tree frog of the genus *Kurixalus*, described from West Kalimantan on the basis of molecular phylogenetic and morphological evidence. The new species can be distinguished from its congeners by a combination of following morphological characters: having smaller body size, more prominent of mandibular symphysis, skin smooth on throat, vomerine odontophores two oblique series touching anterior corner of choanae and widely separated, vomerine teeth thick, buccal cavity narrow and deep, choanae with teardrop shaped, single vocal slit, weakly crenulated dermal fringe on fore- and hindlimbs.

(Mediyansyah, Amir Hamidy, Misbahul Munir and Masafumi Matsui)

**Keywords:** *Kurixalus absconditus* sp. nov., new species, West Kalimantan

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Raden Pramesa Narakusumo

Four new species of *Epholcis* Waterhouse (Coleoptera: Scarabaeidae: Melolonthinae: Maechidiini) from the Moluccas, Indonesia


Here, we provide the first record of the chafer beetle genus *Epholcis* Waterhouse, 1875 from the Moluccas, Indonesia. We describe four new species: *E. acutus* sp. nov., *E. arcuatus* sp. nov., *E. cakalele* sp. nov., and *E. obiensis* sp. nov. A lectotype is designated for *Maechidius moluccanus* Moser, 1920, which is redescribed and transferred to the genus *Epholcis* as *E. moluccanus* (Moser) comb. nov.

(Raden Pramesa Narakusumo and Michael Balke)

**Keywords:** Coleoptera, *Epholcis*, Maechidiini, Melolonthinae, Moluccas
Mulyadi

New records and redescription of *Labidocera rotunda* Mori, 1929 (Copepoda, Calanoida, Pontellidae) from Sebatik Island, North Kalimantan, Indonesia, with notes on its species-group

TREUBIA, December 2019, Vol. 46, pp. 73–84.

During a plankton trip around Sebatik Island, North Kalimantan, a copepod *Labidocera rotunda* Mori, 1929 (Calanoida, Pontellidae) was collected for the first time in Indonesian waters. Both sexes are redescribed and compared to previous descriptions. The geographical distribution of the species confirms that it is of Indo-Pacific origin. There has been a mix-up between *L. rotunda* described by Mori (1929) from Pusan, Korea and *L. bipinnata* from Sagami Bay, described by Tanaka (1936). Fleminger et al. (1982) have argued that the minor difference is based on the presence or absence of cephalic hooks and had synonymized *L. bipinnata* with *L. rotunda*.

(Mulyadi)

Keywords: copepods, Indonesia, *Labidocera rotunda*, new record, Pontellidae

Djunijanti Peggie

Biological aspects of *Papilio peranthus* (Lepidoptera: Papilionidae) as observed at Butterfly Research Facility - LIPI, Cibinong, Indonesia


*Papilio peranthus* is endemic to Indonesia, where it occurs on several islands and island groups. This beautiful butterfly is extensively traded, thus efforts to breed this species are very desirable. Captive breeding research was conducted on *P. peranthus* during September 2016 to December 2018. In total, 221 individuals were available for observation. Data on the life cycle of the species, together with observations on females being approached for mating, and female oviposition after mating, are presented. The result demonstrate that *P. peranthus* is not monogamous. Observations on other biological aspects are also reported.

(Djunijanti Peggie)

Keywords: egg-laying, mating, life cycle, *Papilio peranthus*, parent stocks
Flying foxes are important ecological keystone species on many archipelagoes, and Indonesia is home to over a third of all flying fox species globally. However, the amount of research on this clade belies their importance to natural systems, particularly as they are increasingly threatened by anthropogenic development and hunting. Here, we provide a review of the literature since the publication of the Old World Fruit Bat Action Plan and categorize research priorities as high, medium, or low based on the number of studies conducted. A majority of the research priorities for Indonesian endemics are categorized as medium or high priority. Low priority ratings were in multiple categories for widespread flying fox species found throughout Southeast Asia, though much of the data were from outside of the Indonesian extent of the species range. These research gaps tend to highlight broader patterns of research biases towards western Indonesia, whereas significant research effort is still needed in eastern Indonesia, particularly for vulnerable island taxa.

(Susan M. Tsang and Sigit Wiantoro)

Keywords: bats, conservation, Pteropodidae, Pteropus, threats
NEW RECORDS AND REDESCRIPTION OF LABIDOCERA ROTUNDA MORI, 1929 (COPEPODA, CALANOIDA, PONTELLIDAE) FROM SEBATIK ISLAND, NORTH KALIMANTAN, INDONESIA, WITH NOTES ON ITS SPECIES-GROUP

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ABSTRACT

During a plankton trip around Sebatik Island, North Kalimantan, a copepod Labidocera rotunda Mori, 1929 (Calanoida, Pontellidae) was collected for the first time in Indonesian waters. Both sexes are redescribed and compared to previous descriptions. The geographical distribution of the species confirms that it is of Indo-Pacific origin. There has been a mix-up between L. rotunda described by Mori (1929) from Pusan, Korea and L. bipinnata from Sagami Bay, described by Tanaka (1936). Fleminger et al. (1982) have argued that the minor difference is based on the presence or absence of cephalic hooks and had synonymized L. bipinnata with L. rotunda.

Keywords: copepods, Indonesia, Labidocera rotunda, new record, Pontellidae

INTRODUCTION

The genus Labidocera Lubbock, 1853, at present comprises up to 62 species, inhabits the surface waters (0-30 m surface layer) from the tropical to the warm temperate regions (Sherman, 1963, 1964; Walter & Boxshall, 2019). The genus is divided into five species-group, such as detruncata, kroyeri, minuta, pectinata, and an unassigned group, on the basis of the included species morphological characteristics (Fleminger et al., 1982; Mulyadi, 1997, 2003). Labidocera rotunda belongs to the L. pectinata species group, which is composed of seven species of the Indo-Pacific region, i.e., L. carpentariensis Fleminger, Othman & Greenwood, 1982, L. japonica Mori, 1935, L. javaensis Mulyadi, 1997, L. moretoni Greenwood, 1978, L.papuensis Fleminger et al. 1982, L. pectinata Thompson & Scott, 1903, and L. rotunda Mori, 1929 (= L. bipinnata Tanaka, 1936).
Labidocera rotunda is relatively widespread in the inshore surface waters of East Asia from Okhotsk to the Malay Archipelago (Fleminger et al., 1982; Fleminger, 1986; Othman & Toda, 2006). The species displays some extreme morphological variability as reported by Chen & Zhang (1965), Fleminger et al. (1982), Othman & Toda (2006), and Jeong et al, (2014).

Tanaka (1936) described a member of the L. pectinata group, L. bipinnata from Sagami Bay, Japan. Sewell (1948) suggested that L. rotunda and L. bipinnata are synonymous with L. pectinata. However, Fleminger (1967) retained L. rotunda and L. pectinata as separate species, while L. bipinnata was synonymized with L. rotunda because of their minor difference in the presence or absence of lateral cephalic hooks (Fleminger et al. 1982).

During a study on the plankton copepods from the Indonesian seas, one newly recorded species of the genus Labidocera, L. rotunda Mori, 1929, was found in a plankton sample from Sebatik Island, East Kalimantan, which Nova Mujiono (Research Center for Biology LIPI) collected and kindly sent me.

This paper thus deals with redescriptions and illustrations of the female and male of Labidocera rotunda. The text further aims at clarifying some synonymy, and discusses the distribution of L. pectinata species group, in Indonesian waters, in adjacent waters, as well as throughout the world’s oceans.

MATERIALS AND METHODS

Plankton samples were provided from the collection of the Research Center for Biology, Indonesian Institute of Sciences (LIPI), collected on 6 June 2011 at Sebatik Island, East Kalimantan (04°09’19.4” N, 117°54’06.2” E) by surface tows during the daytime, with a conical plankton net (mesh size 0.33 mm; mouth diameter 45 cm). Samples were fixed and preserved in 2% formaldehyde/seawater. Specimens of Labidocera were sorted from the original samples, stained with methylene blue, dissected with needles in 10% glycerol/distilled water, and the body and appendages were observed under a compound microscope equipped with a drawing tube. The morphological terminology follows Huys & Boxshall (1991).

Abbreviations used in the text to describe morphological features are: A1, antennule; A2, antenna; Pdg1–Pdg5, pedigerous somites 1–5; P1-P5, swimming legs 1–5; Ur1–Ur5, urosomal somites 1–5; CR, caudal ramus/i; CO, coxa; BA, basis; Re1–Re3, exopodal segments 1–3; Ri1–Ri3, endopodal segments 1–3; Se, outer spine; Si, inner spine; St, terminal spine. Articulating segments of the antennule are designated by Arabic numerals, ancestral segments by Roman numerals. One seta and one aesthetasc on a segment of the A1 are designated as 1s + 1ae. The prosome length was measured from the anterior apex to the mid-posterior end of the prosome, and the urosome length from the mid-anterior end of the
urosome to the posterior end of the caudal rami, and all these were measured with a calibrated ocular micrometer.

All voucher specimens are formalin-preserved and deposited at the Museum Zoologicum Bogoriense (MZB), Research Center for Biology, Indonesian Institute of Sciences (LIPI), Cibinong, Indonesia.

RESULTS

There are many copepod species found from a short expedition to Sebatik Island, North Kalimantan (previously East Kalimantan) Province, Indonesia in June 2011. Among the copepod species, Labidocera rotunda Mori, 1929 was found. It is a first record for Sebatik Island and Indonesian waters as well.

The morphology of both sexes of the newly record L. rotunda shows some variations compare to those from Korea, Japan, China and Singapore waters mainly on the posterior corners of the last prosomal somite, the fifth legs and the ornaments on the urosome.

DESCRIPTIONS

Family Pontellidae Dana, 1853

Genus Labidocera Lubbock, 1853

Labidocera rotunda Mori, 1929 (Figs. 1-2)


Material examined.–Ten adult females (1.96–2.30 mm) and 10 adult males (1.58–2.14 mm) collected at Sebatik Island, East Kalimantan (04°09’19.4’’N, 117°54’06.2’’E) on 6 June 2011.

Female.–Body (Fig. 1a) elongated, with prosome approximately 3.6 times as long as urosome. Cephalosome rounded anteriorly, distinctly separated from Pdg1; Pdg4 and Pdg5 completely fused, posterior corners of prosome produced into asymmetrical spiniform processes, left side slightly wider than right and reaching to 1/4 length of the genital compound somite (Fig. 1a–e). Cephalosome with lateral hooks and pair of dorsal lenses, lenses spherical, small and situated apart; rostrum bifid, gap between rostral rami narrow.

Urosome (Fig. 1a–e) with 3 free somites; genital compound somite with wide spur on right antero-laterally, 1 antero-lateral spiniform process and 2 unequal spiniform processes ventro-laterally; genital operculum concaved on central part of tip (Fig. 1e). Right antero-
Figure 1. *Labidocera rotunda* Mori, 1929. Female. a, whole animal, dorsal view; b, Pdg5 and urosome, dorsal view; c-d, Pdg5 and urosome, dorsal view; e, Pdg5 and urosome, ventral view; f, rostrum, frontal view; g, antennule; h, left P5; i, right P5.

**RESULTS**

The rearing room observations gave data on the early stages of *Papilio peranthus*, whereas observations in the butterfly enclosure provided information on adult behavior. The observations of this butterfly species were conducted within the period of September 2016 through December 2018, encompassing 221 observed adults in total.

(I). The parental stock of the first batch of *P. peranthus transiens* from Bali all successfully eclosed between 25 September 2016 and 1 October 2016, to give 18 males and 11 females. Male number 238, which emerged on 26 September, was found at 10:00 mating with newly emerged female 239 on 27 September. Male 240, which emerged on 27 September, was found mating with newly emerged female 251 on 28 September. From this first batch, data on duration of adult life were obtained for five individuals, which ranged from 10 to 19 days.

Ovipositing females were not observed for this first batch, but eggs were obtained from leaves of the host plant, *Micromelum minutum*. It was not possible to locate all eggs, determine which eggs were had been laid by particular females, or ascertain exactly when the eggs were laid. Most eggs were found on the underside of young leaves or young shoots (Fig. 3), glued with secretion from the colleterial glands (Chew & Robbins, 1984). Eggs were checked and taken every afternoon but some eggs might have been missed. The eggs were brought to the rearing room to rear the early stages. Thirty-seven eggs were obtained on 27 September, 104 eggs on 28 September, and some further eggs up to 9 October. At the same time, *Papilio polytes* individuals were in the enclosure, using the same host plants, so it was not easy to determine the eggs. The hatchlings were then moved to individual plastic jars and were given individual numbers. There were 81 individual F1 *P. peranthus*, 38 of which failed.
lateral of Ur2 with expanded spiniform process pointing posteriorly, disto-lateral of Ur2 without any processes. Anal somite and caudal rami partly fused and exceedingly short, only 0.1 length of Ur1; caudal rami asymmetrical, approximately 1.5 times as long as wide, left ramus slightly wider than right, and without any processes, each ramus carrying five plumose setae along distal margin and reduced seta (seta VII) located on dorsal surface near medial distal angle (Fig. 1a, b).

Antennule (Fig. 1g) 24-segmented, posterior margin of 2nd to 12th segments (ancestral segments II–XVI) fringed with fine setules; ancestral segment II–IV, XXVII–XXVIII completely fused, while VIII–IX incompletely fused. Fusion pattern and setal formula as follows: I, 3s + 1ae (aesthetasc); II–IV, 4s + 1ae; V, 2s + 1ae; VI, 2s; VII, 2s + 1ae; VIII–IX, 4s + 1ae; X, 2s; XI, 2s + 1ae; XII, 2s + 1ae; XIII, 2s + 1ae; XIV, 2s + 1ae; XV, 2s + 1ae; XVI, 2s + 1ae; XVII, 2s + 1ae; XVIII, 2s + 1ae; XIX, 2s + 1ae; XX, 2s + 1ae; XXI, 2s + 1ae; XXII, 1s; XXIII, 1s; XXIV, 1s + 1s; XXV, 1s + 1s + 1ae; XXVI, 1s + 1s; XXVII–XXVIII, 4s + 1ae.

P1–P4 with 3-segmented exopods and 2-segmented endopods, coxa bearing inner plumose setae; basis of P4 with plumose seta on posterior side. P5 (Fig. 1h–i) asymmetrical, left leg longer than right; coxa and intercoxal sclerite completely fused; basis with outer seta on posterior face near proximal end; right Re with small intercalary denticle between unequal apical processes; inner margin with 2 medial unequal processes and 2 minute prominences on outer margin; Ri with 7 denticles (Fig. 1h). Left leg (Fig. 1i) exopod similar to that in L. pectinata, segment with 2 unequal processes distally and 2 minute prominences on outer margin; Ri pectinate with 5 denticles (Fig. 1h, i).

Male.– Prosome more compact than in female (Fig. 2a), dorsal eye lenses larger than those of female and in contact with each other. Length ratio of prosome to urosome 3.13 : 1. Posterior corners of Pdg5 produced into asymmetrical acuminate processes in dorsal view. Left side terminates into simple sharp apex, but right side bifurcate with acuminate denticles between processes in dorsal view, in lateral view right side trifurcate with minute denticles between outer and middle processes, outer process reaching beyond posterior end of Ur1, inner one reaching middle of Ur1 (Fig. 2b–d). Urosome composed of 5 free somites; proportional lengths of urosomites and caudal ramus 47.2 : 21.7 : 12.3 : 9.4 : 9.4 (=100) (Fig. 2a), genital somite (Fig. 2a–e) wider than long, with long acicular process ventrally, reaching middle of Ur2; anal somite and caudal rami completely fused.

Right antennule geniculate, indistinctly 13-segmented; segments XII–XIV with arthrodial membranes incompletely formed, segments II–IV, XV and XVI, XXI–XXIII completely fused. Fusion pattern and setal formula as follows: I, 3s + 1ae; II–IV, 4s + 1ae; V–XI, 14s + 4ae; XII–XIV, 6s + 2ae; XV–XVI, 4s + 2ae; XVII, 2s + 1ae; XVIII, 2s + 1ae; XIX, 1s + p (hooked process) + 1ae; XX, 1s + p + 1ae; XXI–XXIII, 2s + p + 1ae; XXIV, 1s + 1s + p; XXV, 1s + 1s + 1ae; XXVI–XXVIII, 6s + 1ae. Segment XIX with anterior setiform process, segment XX and compound segment XXI–XXIII with toothed ridge provided with
Figure 2. *Labidocera rotunda* Mori, 1929. Male. a, whole animal, dorsal view; b, Pdg5 and urosome, dorsal view; c, Pdg5 and urosome, lateral view; d, posterior corner of right Pdg5; e, Ur1-Ur3, dorsal view; f, Ur1 and Ur2 ventral view; g, right A1; h, geniculate region of right A1.
serrated denticles, respectively, and segment XXIV with spur-like process distally, expanding to middle of next segment (Fig. 2h).

P5 (Fig. 2i) uniramous and asymmetrical; coxa of left Re coalescent with intercoxal sclerite; right Re 2-segmented, Re1 (chela) broadened with convex inner margin, slightly longer than its maximum width (except thumb), thumb at proximal end terminating into inwardly curved, pointed hook, outer surface of chela between thumb and distal end of Re1 with 1 stout process near base and 1 small median anvil-shaped lamella, single seta present on posterior surface near base of Re2. Re2 (finger) slightly longer than Re1, curved inwards, and terminating into 2 subequal round-tipped spines and 1 median seta on concave surface. Left leg with coxa very short, basis 2.5 times as long as coxa, bearing 1 small seta on posterior surface; Re1 broadly rectangular, with 2 small triangular spines arising on and near outer distal corner; Re2 about half length of Re1, bulb-shaped, inner margin divided into 2 parts by strong projection extending beyond distal margin of segment, proximal part hirsute, distal part narrowing abruptly just behind projection and unarmed; distal end with 2 stout, round-tipped spines and 2 aesthetasc-like setae, these spines and setae longer than their own segment.

Remarks.—The general morphological characteristics of the Labidocera species collected from Sebatik Island were close to those of L. rotunda described from Pusan, Korea by Mori (1929). In Indonesian waters, some female specimens of L. rotunda exhibited morphological differences with the Korean specimens such as: 1) posterior corners of prosome with triangular processes are extending to 1/4 of the genital compound somite (Fig. 1a–e) (vs. reaching 1/3 of Ur1), 2) the genital compound somite with wide spur on right antero-laterally and three spiniform processes ventro-laterally (Fig. 1e) (vs. Ur1 with four spiniform processes ventro-laterally), 3) the Ur2 is having a long spine-like process on the right antero-lateral surface (Fig. 1a, b) (vs. the Ur2 with a small knob on the right antero-lateral surface), 4) the CR is asymmetrical (Fig. 1b, e) (vs. the CR symmetrical), and 5) inner margin of the right Re with two unequal spines (vs. inner margin of the right Re with four unequal spines).

Labidocera rotunda displays some extreme morphological variability as reported by Chen & Zhang (1965), Fleminger et al. (1982), Othman & Toda (2006) and Jeong et al. (2014). Fleminger et al. (1982) and Othman & Toda (2006) found some discrepancies in individuals of female L. rotunda. Labidocera rotunda is readily distinguishable from the other species by the following characteristics: 1) cephalosome with lateral hooks, 2) distal segment of male left P5 with long tuberculate papillae, 1 claw-like process, and 2 unequal spines, and 3) right posterior corner of Pdg5 bearing 2 unequal processes with a narrow gap between these processes. Mori (1929) described this species from Pusan, Korea, but the male fifth leg depicted showed minor morphological differences with Indonesian specimens. In
Mori’s (1929) figure, the genital compound somite has a long finger-like process, and the posterior corner of the right Pdg5 is trifurcate in the male.

Distribution.—*Labidocera rotunda* clearly belongs to the *L. pectinata* species-group, which is recognized as a unique monophyletic lineage within the primarily tropical Indo-West Pacific radiation of coastal water species encompassed by the *Labidocera kröyeri* (Brady, 1883) species complex. *Labidocera rotunda* is widely distributed in inshore surface waters in the East Asia from Okhotsk to the Malay Archipelago (Singapore Strait) (Fleminger et al., 1982; Fleminger, 1986; Othman & Toda, 2006). In the Inland Sea of Japan, the copepod commonly occurs in the warmer season in the temperature range of 19°–29°C and at salinities range of 29–34 ppm; it disappears from the plankton community during the colder months (Hirota, 1964, 1968; Onbé et al., 1988).

The published records of *L. rotunda* as listed above delineate a relatively widespread geographical distribution in inshore surface waters off East Asia. The northern limits are in the Sea of Japan and off eastern Japan overlaps with that of *L. japonica*, and indeed the two species have been collected together in a tow taken off the southeast coast of Hokkaido (latitude 41°49’ N, longitude 141°46’ E). Records of this species from the Andaman Sea, and the waters off southern Burma and Singapore, suggest that *L. rotunda* extends to the west, following the Strait of Malacca (Fleminger unpubl.; Othman & Toda, 2006). The presence of *L. rotunda* at Sebatik Island, East Kalimantan is the first record for Indonesian waters.

**DISCUSSION**

At least, 26 species of *Labidocera* are recorded from the Indo-Pacific region, including eight species from Australian waters, i.e., *L. carpentariensis* Fleminger, Othman & Greenwood, 1982; *L. caudata* Nicholls, 1944; *L. cervi* Krämer, 1895; *L. dakini* Greenwood, 1978; *L. farrani* Greenwood & Othman, 1979; *L. moretoni* Greenwood, 1978; *Labidocera* sp. female (Greenwood, 1978); and *L. tasmanica* Taw, 1974, that have all until now been reported from Australian waters only (Dakin & Colefax, 1940; Nicholls, 1944; Taw, 1974; Greenwood, 1978).

Indonesia is the country with the richest fauna of the family Pontellidae in terms of species and species-groups. These comprise at least 16 species of *Labidocera* from 5 species-groups (the *detruncata*-*, kroyeri*-*, minuta*-*, pectinata*-group, and an unassigned group) (Fleminger, 1967, 1986; Mulyadi, 1997, 2002). Later Mulyadi (2014) divided the *L. detruncata* species-group into 5 species-subgroups, namely the *L. detruncata cervi*-*, L. d. detruncata*-*, L. d. farrani*-*, L. d. kaimanaensis*-*, and *L. d. sinilobata*-subgroups.

The present female specimens differ from the original female *L. rotunda* as described by Mori (1929) in having (1) the A1 24-segmented (vs. *L. rotunda* 21-segmented), (2) the left
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Locality</th>
<th>Female</th>
<th>Morphological feature</th>
<th>Male</th>
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</thead>
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<tr>
<td>Mori, 1937</td>
<td>Off Pusan, Korea</td>
<td>1. Posterior corners of Pdg5 produced into asymmetrical spiniform processes reaching beyond middle length of Ur1. 2. Antero-lateral margin of right Ur1 with spur-like process and 2 unequal postero-lateral spines. 3. Antero-lateral margin of right Ur2 with long spur-like process, and postero-lateral margin with knob-like process. 4. CR asymmetrical, right ramus longer than left; inner margin of right ramus with knob-like process. 5. P5 asymmetrical, right Re with small intercalary denticle between 2 unequal distal spines, 2 unequal Si and 2 small Se; Ri with 8 spines (apex bifurcate). Left Re with 2 unequal St and 2 small Se; Ri with 7 spines.</td>
<td>1. Posterior corner of right Pdg5 bifurcate with minute denticle between processes. 2. Acicular spine on right margin of Ur1 short reaching about ¼ length of Ur2. 3. P5, right Re1 with pronounced thumb, concave surface with 2 setae and 2 conical processes; Re2 elongated, curved inwards with 2 inner and 2 distal spines. Left Re1 with 2 unequal disto-lateral spines and inner seta; Re2 with spine-like process proximally, 2 spiniform processes and 2 setiform processes distally, inner margin hisurate.</td>
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<tr>
<td>Fleminger et al., 1982</td>
<td>Ariake Bay, Kyushu, Japan</td>
<td>1. Posterior corners of Pdg5 produced into symmetrical spiniform processes, reaching about 1/3 length of Ur1. 2. Antero-lateral face of right Ur1 with spur-like process, 1 anterior spine and 2 ventral spines. 3. Antero-lateral face of right Ur2 with spur-like process, and without postero-lateral knob-like process. 4. CR asymmetrical, right ramus longer than left; inner margin of right ramus without knob-like process. 5. P5, left Re with 2 unequal St and 2 small Se. Right Re with small intercalary denticle between 2 unequal distal spines, 2 unequal Si and 2 small Se. Left and right Ri with about 8 denticles.</td>
<td>1. Right corner of Pdg5 bifurcate with 2 or 3 minute denticles between processes. 2. Acicular process on right margin of Ur1 short, extending posteriad to about 1/4 length of Ur2. 3. P5, thumb of right Re1 with pronounced hook at distal end, concave surface with 2 setae and 1 conical process; Re2 elongated, curved inwards with 2 inner and 2 distal spines. Left Re1 with 1 small distal lateral spine; Re2 with medio-distal spur and rounded notch, spine-like processes and 2 setiform elements, inner margin hisurate.</td>
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<tr>
<td>Othman &amp; Toda, 2016</td>
<td>Singapore Strait</td>
<td>1. Posterior corners of Pdg5 produced into symmetrical spiniform processes reaching middle length of Ur1. 2. Antero-lateral face of right Ur1 with knob-like process, 1 anterior spine and 3 unequal ventral spines. 3. Antero-lateral face of right Ur2 with spine-like process, postero-lateral side with knob-like process. 4. CR asymmetrical, right ramus longer and wider than left; inner margin of right ramus without knob-like process. 5. P5 asymmetrical, left Re slightly longer than right, with 2 unequal distal spines and 2 small Se. Right Re with small intercalary denticle between 2 unequal distal spines and 2 small Se, medial margin with 2 unequal spines. Left Ri with 6 spines and right Ri with 9 spines.</td>
<td>1. Posterior corner of right Pdg5 bifurcate with minute denticle between processes. 2. Ur1 wider than long, with long ventral spine reaching slightly beyond middle of Ur2. 3. P5, right Re1 with pronounced thumb at distal end, concave surface with 1 long and 1 short spines and 1 conical process; Re2 elongated, curved inwards with 2 spines on concave surface and 2 spines at apex. Left Re1 with disto-lateral spine; Re2 with spine-like process proximally, 2 unequal spiniform process, 2 unequal setiform processes distally, inner margin hisurate.</td>
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<td>Jeong et al., 2014</td>
<td>Yellow Sea, China</td>
<td>1. Posterior corners of Pdg5 produced into symmetrical spiniform processes reaching 1/3 length of Ur1. 2. Antero-lateral face of right Ur1 with wide spur and 3 spines along lateral margin. 3. Antero-lateral face of right Ur2 with short spur, and without postero-lateral knob-like process. 4. CR asymmetrical, inner margin of left ramus without blunt process. 5. P5 asymmetrical, right Re with small intercalary denticle between unequal apical spines, 3 unequal Si and 2 small Se; left Re with 2 unequal distal spines and 2 Se. Both Ri’s with 9 denticles or, sometimes, reductions.</td>
<td>1. Posterior corner of right Pdg5 bifurcate with minute denticle between processes. 2. Ur1 wider than long, with short ventral spine, not reaching middle of Ur2. 3. P5, right Re1 with pronounced thumb at proximal end, concave surface with 2 spines and 1 conical process; Re2 elongated, curved inwards with 2 spines on concave surface and 2 spines at apex. Left Re1 with bluntly triangular process posterolaterally, Re2 with spine-like process proximally, 2 unequal spiniform process, 2 unequal setiform processes distally, inner margin hisurate.</td>
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posterior corner of Pdg5 shorter, (3) the right CR without dorsolateral semi-circular process, (4) the right margin of the genital double somite with an anterior spine, and (5) the right Ri of P5 without 2 inner spines (vs. L. rotunda with 2 spines). The male is distinguished from the typical L. rotunda in having (1) the right margin of Ur1 with a long spine-like process (vs. short spine) and (2) the right posterior corner of Pdg5 trifurcated.

Labidocera rotunda was described by Mori (1929) from two male specimens collected off Pusan, Korea. Later Tanaka (1936) described the female and male of this species as L. bipinnata based on 91 specimens collected from Sagami Bay, Honshu. Tanaka (1936) indicated awareness of Mori’s description of L. rotunda but without explanation chose to stress the resemblance of L. bipinnata’s male to that of L. kroyer. Mori also dealt with both species (1937: 94–95, pl. 43, figs. 1–8) in his account of the pelagic copepods in Japanese waters, but without discussing their morphological similarities and differences. Tanaka (1964) subsequently did not indicate any change in his view of L. bipinnata vis-a-vis L. rotunda. Comparison of L. bipinnata males with Mori’s description of L. rotunda shows, that they have similar character states with respect to all complexes, sexually modified structures and that the only known morphological difference between them is the presence or absence of cephalic hooks. Cephalic hooks are plesomorphic in the Pontellidae and have been modified by secondary loss in a number of advanced pontellid genera. IntragenERICally they may be absent from some member species of a species-group (Greenwood, 1978), and they may be uniformly lost within a species during ontogenetic development (L. diandra Fleminger, 1967) as well as among isolated individuals as in L. kroyer (cf. Fleminger, 1967).

The absence of lateral cephalic hooks in the two known specimens of L. rotunda may be accounted for by several likely possibilities. Their absence may be due to a common mutation, a relatively rare allele, or aberrant development. On the other hand, being quite small, it is also reasonable to consider that Mori (1929) inadvertently overlooked the cephalic head-hooks in L. rotunda.

Following the rules of priority of the ICZN (1999), L. rotunda must be the valid name, and L. bipinnata is the junior synonym.

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for Biology, Indonesian Institute of Sciences for providing the copepod samples from Sebatik Island, East Kalimantan, Indonesia.

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Mori, T. 1929. An annotated list of the pelagic copepods from the south-west part of the Japan Sea, with descriptions of two new species. Dobutsugaku Zasshi, 41: 198–212. [in Japanese with
English summary]
Mulyadi. 2014. Two new species of the family Pontellidae (Copepoda, Calanoida) from Arguni Bay, Kaimana, West Papua, Indonesia, with notes on their species-groups. Crustacea, 87(14): 1620–1639.
Biological aspects of *Papilio peranthus* (Lepidoptera: Papilionidae) within the enclosure could also be investigated, as Peixoto & Benson (2009) discussed for satyrine butterflies in a forest fragment in Brazil. The associations of adult butterflies with plants for nectar are generally far less specific (Courtney, 1986; Shreeve, 1992). This research showed that adult butterflies would go to most flowers available for nectar. An exception was *Antigonon leptopus*, in which the small flower opening perhaps limits the ability of this butterfly species to obtain nectar. However, *Papilio polytes* and several other butterfly species have been recorded to take nectar from this plant (Raju et al. 2001, table 1) as observed also with other butterfly species in the enclosure. Flower preference by *P. peranthus* was not investigated in detail as the adults in general would visit almost any flowers with corolla depth that could be reached by the proboscis (Corbet, 2000; Tiple et al., 2009). Based on daily observations inside the enclosure, newly emerged butterflies of this species do not visit flowers for nectar on the day of emergence. This corresponds to observations on *Tirumala limniace* by Li et al. (2015). At times when there were many butterflies of different species in the enclosure, additional 10% sugar solution was placed on *Hibiscus* flowers, and *P. peranthus* would also feed on that. Other behavior observed included "mud-puddling" (drinking) and urinating. Similar behavior was observed in *Papilio karna* at Cikaniki research station, Gunung Halimun - Salak National Park, April 2016. Many butterflies showed puddling behavior perhaps to obtain supplementary diet like sodium as suggested by Adler & Pearson (1982). The time of puddling observed here was between 12:00 – Patwardhan (2019) reported that puddling happened between 8:00 – with peak activity at 11:30. This behavior was recorded only on three male individuals, two of which were observed to have mated that morning. This behavior may warrant further study.

Understanding the biology of this butterfly species and how it thrives in captivity may lead to a better captive breeding operation for sustainable utilization of the butterflies. Further study regarding the fecundity of female *P. peranthus*, the success and survival rates of each life stages will be useful. Observations on the effect of parasitoids and predators will complement the understanding toward better management of a butterfly facility.

CONCLUSION

The mean duration of life cycle of *Papilio peranthus* demonstrated in this study was 31 days. The success rates of each life stage needs to be further assessed. Adults can live over 21 days. The male and female of this species are not monogamous. Males exhibit water-puddling behavior. The adults used most available flowers as nectar sources except *Antigonon leptopus*. Other behavior observed included "mud-puddling" (drinking) and urinating. Similar behavior was observed in *Papilio karna* at Cikaniki research station, Gunung Halimun - Salak National Park, April 2016. Many butterflies showed puddling behavior perhaps to obtain supplementary diet like sodium as suggested by Adler & Pearson (1982). The time of puddling observed here was between 12:00 – Patwardhan (2019) reported that puddling happened between 8:00 – with peak activity at 11:30. This behavior was recorded only on three male individuals, two of which were observed to have mated that morning. This behavior may warrant further study.

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enclosures could be undertaken. Daily activity patterns of the butterfly species co-existing in the quantitative assessments on the interactions among butterfly species co-existing in the, neither of which feed on Rutaceae, as they continued to thrive. More P. peranthus of will need to be conducted to check any assumption or potential of competition. The presence P. peranthus for inside the enclosure. At certain times the presence of receptivity by females (Darragh et al., 2017).

A specialized wing area with androconial scales was covered by a nail varnish, resulting in loss scales, as suggested by an experiment with Andersson et al., 2003; Wedell, 2005). Male pheromones can be dispersed from androconial males is influenced by various factors, including male pheromones (Boppré, 1984; Menzel, 1982). Male pheromones are important for female attraction, and the androconial scales play a role in the dissemination of these pheromones. In species like Troides helena and Heliconius melpomene in Panama, in which the androconial scales are highly developed, the scales are crucial for the attraction of females. This phenomenon, known as androconial scaling, is a specialized adaptation that enhances the attraction of females to males. It is observed that androconial scaling is more pronounced in species with a higher level of monogamy (Table 2). Monogamous species are more likely to have more developed androconial scales due to the importance of maintaining a single mating partner.

Troides helena and females was too widely separated. The observations demonstrate that both males and females of this species are not and females was too widely separated. Figure 11.

...
Materials and Methods. Provide a clear explanation of materials and methods used in the research. The place of specimen depository should be mentioned here.

Results. The results can be presented in the form of tables and figures when appropriate. The text should explain and elaborate the data presented. Captions of tables, figures, and plates should be inserted where you want them to be inserted. All line drawings, photographs and other figures should be submitted separately in JPEG format and the image size should be at least 1024 by 768 pixels.

Discussion. The discussion should interpret the results clearly and concisely, and should discuss the findings in relation with previous publications.

Acknowledgments. Acknowledgments of grants, assistance and other matters can be written in one paragraph.

References. List of references should be in alphabetical order by the first or sole author’s surname. Journal references should include author’s surname and initials, year of publication, title of the paper, full title of the journal (typed in italic), volume number and inclusive page numbers. Book references should include author’s surname and initials, year of publication, title of the book (typed in italic) or/and title of the chapter and editor (if part of a book), publisher, city of publication, and page numbers.

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