

Two new species of the genus *Prosopistoma* (Ephemeroptera, Prosopistomatidae) from Vietnam

TOMÁŠ SOLDÁN¹ and DIETRICH BRAASCH²

Institute of Entomology, Czechoslovak Academy of Sciences, České Budějovice¹,
and Entomological Society of German Democratic Republik, Berlin²

Taxonomy, habitats, abundance, Oriental, key, nymphs

Abstract. Two new species, *Prosopistoma annamense* sp. n. (mature male and female nymph) and *P. funanense* sp. n. (mature male and female nymph), are described and illustrated. Their critical taxonomic characters are keyed and compared with other Oriental *Prosopistoma* species. Direct observation of living nymphs at the type locality provides basic data on their bionomy.

Of the 13 known species of the genus *Prosopistoma* LATREILLE, 1833, 3 are from Europe and the Middle East, 4 from the Afrotropical region and 6 from the Oriental region (GILLIES, 1954; PETERS, 1967; DEMOULIN, 1970; ALOUF, 1977). All but one species were described as nymphs (cf. GILLIES, 1954), but our knowledge of nymphal and adult biology is very scanty, with the exception of the only European species, *P. pennigerum* (cf. LAFON, 1952; DEGRANGE, 1955 and others). Two additional species are now described below from the Oriental region, nymphs are compared with those of the other known species from this area and Papua New Guinea. Observations on the behaviour and abundance of nymphs at the type locality were made, and aspects of nymphal habits are discussed.

Prosopistoma funanense sp. n.

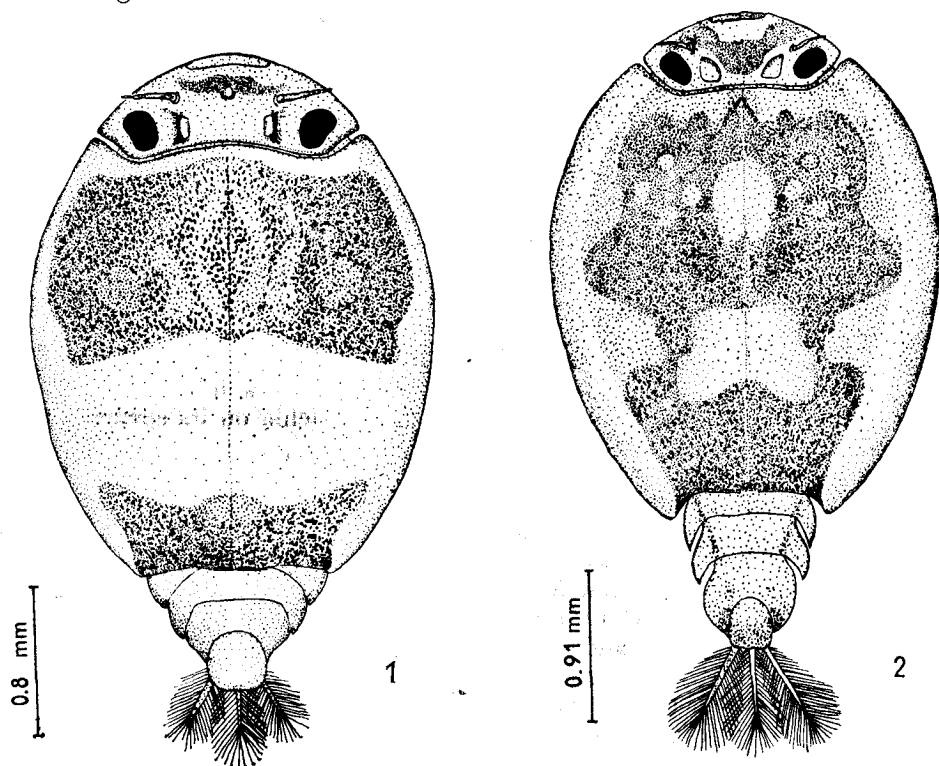
(Figs. 1, 3, 5, 7, 9, 11, 12)

Mature nymph (holotype): Body length 2.7 (2.2-3.1) mm, length of cerci 0.4 (0.3-0.6) mm. Head relatively wide, dark yellowish with diffuse transversal spot on clypeus. Width of head three times length. Antennae 5-segmented, segment two $\frac{2}{3}$ length of segments 3-5, apical segment long and narrow. Labrum oval, ratio length : width 3.7 : 10.6, laterally rounded or bluntly pointed, anterior margin convex in middle, slightly concave anterolaterally, smooth, without any hair. Outer incisors of mandibles with three apical teeth, inner tooth twice longer, inner margin serrated near apex with 3-4 small teeth; inner incisor narrow, as wide as $\frac{1}{3}$ width of outer one, with two apical teeth, inner tooth distinctly longer, inner margin serrated with three small spines; three long, unserrated bristles arising from base of inner incisor. Maxilla with three stout spines and two bristles, segment 2 of maxillary palps longer by $\frac{1}{4}$ than segment 2, segment 3 long, as long as a half of segment 2, slightly pointed at apex. Glossae rounded, produced anterolaterally, segment two of labial palpi $\frac{2}{3}$ length of segment 1, segment three

3/4 length of segment 2; surface of labium evenly covered with conspicuous S-like impressions.

Mesonotum and abdomen light brownish yellow, with colour pattern as in Fig. 1 — two large, transversal, not connected bands near anterior and posterior margins, inconspicuous paler smudges in fore band. Maximum width of mesonotum a little longer than length measured along medial suture or equal in length. Apex of inner margin of tibiae of fore legs with 8 spines, progressively larger apically; first three spines very slightly serrated on their outer margin, remaining spines simple. Six abdominal gills. Posterolateral projections of abdominal segments VII—IX bluntly pointed at apex, broad, their axes parallel with or directed inside to body axis. Cerci whitish, unicolorous.

Subimago and adult unknown.



Figs. 1—2: Whole nymph of *Prosopistoma*. 1 — *P. funanense* sp. n. 2 — *P. annamense* sp. n.

Material examined: Mature ♀ nymph (holotype), 10 ♂♀ nymphs (paratypes): Vietnam, Thuan hai Prov., Song Kinh-dinh, Nha-Ho, 15 km W of Phan-rang, 108°52'19" E., 11°37'58" N., April 16—May 5, 1982 leg. T. Soldán. Holotype in alcohol, parts of paratypes on slides; deposited in the Institute of Entomology, ČSAV, České Budějovice, some paratypes in the collection of junior author.

Species name derived from that of an ancient state in S. E. Asia. Distribution unknown except from the type locality, Oriental. Habitats of nymphs are generally the same as those of the following species but nymphs were

collected at only two sites of the type locality with moderate current speed (10–30 cm.s⁻¹). Contary to those of *P. annamense* sp. n., the nymphs were extremely rare at the type locality during the dry season. Life cycles are probably identical but the emergence period of this species seems to be a little postponed since mostly not fully mature nymphs were found. Nymphs inhabit exclusively stony bottom and their quantitative representation is negligible — less than 0.05% of total mayfly standing crop. Taxonomically, this species seems to be related to *P. wouterae* LIEFTINCK and *P. palawana* PETERS from the Sunda Islands and Philippines respectively. It can be distinguished mainly by the colour pattern of the mesonotum, the relatively short second antennal segment, and the apical segment of maxillary palps being distinctly longer than 1/2 of segment 2. Further characters distinguishing this species from other Oriental species of *Prosopistoma* are apparent from the key below.

Prosopistoma annamense sp. n.

(Figs. 2, 4, 6, 8, 10, 13, 14)

Mature nymph (holotype): Body length 3.1 (2.9–4.4) mm, length of cerci 0.5 (0.3–0.7) mm. Head relatively narrow, less than 3 times as broad as long, eyes black, ocelli greyish. Head yellowish, marked with conspicuous dark brown V-shaped band of frons and vertex. Antennae usually 5-segmented, but sometimes only 4-segmented (last segment lacking) were observed; segment 2 of antennae longer than 3/4 of length of segments 3–5 (ratio 6 : 7). Apical segment very short, 1/3 length of segment 4, rounded at apex and relatively wide. Labrum narrow, nearly 3.5 times as broad as long, laterally produced into distinct bluntly pointed narrow lobes (Fig. 6) with anterolateral emargination and numerous microtrichia on its surface. Outer incisors of mandibles with three bluntly pointed teeth, inner margin serrated with small teeth; inner incisors with two apical teeth, serrated in the similar way, as wide as 1/3 of width of outer one. Three long unserrated bristles arising from base of inner incisor. Maxillae relatively narrow, with three large apical stout spines and three bristles; segment 2 of maxillary palps longer by 1/4 than segment 1, apical segment short, as long as 1/3 of segment 2 (Fig. 10). Paraglossa only moderately produced laterally; labium smooth, without impressions. Segments 2 and 3 of labial palps as long as or slightly shorter than segment 1, segment 3 as long as 1/2 of segment 2.

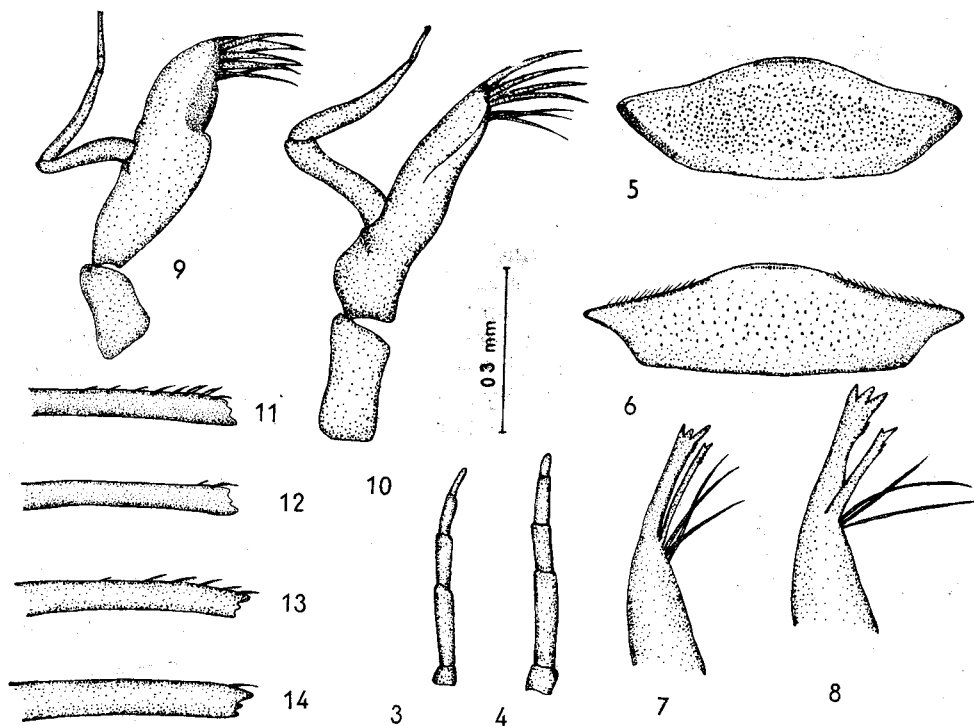
Mesonotum and abdomen whitish yellow, mesonotum with colour pattern as in Fig. 2 — irregular large dark spots with two large and several small and rounded spots inside. In some specimens, anterior and posterior parts of dark brown markings are fully separated by narrow W-shaped band. Apex of inner margin of fore tibiae with 4–5 very finely serrated spines and another 1–2 unserrated ones situated proximally; apex of middle and hind tibiae with a single unserrated spine. Six pairs of abdominal gills. Posterolateral spines of abdominal segments VII–IX asymmetrical, pointed axes (especially in segments VII and VIII) directed outwards from the axis of body. Cerci yellowish white, unicolorous.

Subimago and adult unknown.

Material examined: Mature ♀ nymph (holotype), 58 ♂ nymphs mostly mature (paratypes): Vietnam, Thuan hai Prov., Song Kinh-dinh, Nha-Ho, 15 km W of Phan-rang, 108°52'19''

E., 11°37'58" N., April 16 — May 5, 1982; paratype (1 nymph), Song Kinh-dinh, Dap-Nha-Trinh, April 20, 1982; paratypes (3 nymphs), stream, Cau-Song Pha, 50 km E of Dalat, April 20, 1982 leg. T. Soldán. Parts of paratypes on slides, holotype in alcohol; deposited in the Institute of Entomology, ČSAV, České Budějovice, some paratypes in the collection of junior author.

Differential diagnosis and discussion: This species is named after the Annam Highland in central Vietnam. It is related to *P. palawana* PETERS and especially to *P. wouterae* LIEFTINCK. It can be distinguished mainly by the colour pattern of the mesonotum (this seems to be closely related to that of *P. boreus* PETERS), relatively more narrow head, short apical segment of antennae and maxillary palps and small number of serrate spines on fore



Figs. 3—14: 3, 5, 7, 9, 11, 12 — *P. funanense* sp. n.: 4, 6, 8, fig. 13, 14 — *P. annamense* sp. n., nymphs: 3, 4 — antenna. 5, 6 — labrum, dorsal view. 7, 8 — apex of maxilla, 9, 10 — maxilla. 11, 13 — apex of inner margin of fore leg. 12, 14 — apex of inner margin of middle leg.

tibiae. Also the arrangement of posterolateral spines of abdominal segments VII—IX is different. As pointed out by PETERS (1967), the Oriental species of *Prosopistoma* appear to represent one closely related group indicating the phylogeny of the species, different from Palearctic and Afrotropical species (cf. GILLIES, 1954, 1956). Critical distinguishing characters of Oriental species are apparent from the following key which is based mainly on that by PETERS (1967). For a discussion of taxonomic value of individual nymphal characters see GILLIES (1954) and PETERS (1967).

Distribution and biology: So far known only from the east slopes of

the Annam Highland (the basin of the Kinh-dinh) but it is probably widely distributed in southern and central Vietnam. Nymphs were collected in rocky streams and rivers near sea level. For detailed description of the type locality (Kinh-dinh River) see SOLDÁN (1983). Nymphs prefer gravel bottom riffles or small stones (up to 10 cm in diameter). They were never found at sandy and clayey microhabitats and only exceptionally at plant debris or roots microhabitats. As with other mayfly species of stony bottom at this locality, the current speed seems to be the major factor responsible for distribution of nymphs of *P. annamense* within microhabitats. Nymphs are generally rare, their quantitative presentation in stony microhabitats with 10–30, 30–80 and 80–120 cm.s⁻¹ current speed was less than 0.05%, 2.6–3.5%, and 1.2–1.8% of the total mayfly standing crop respectively. Nymphs live under stones mainly at the streamline, occurring only exceptionally on the exposed upper surface of stones. They are firmly attached with various head orientation, upstream orientation not prevailing. They were found mostly together with *Baetis*, *Pseudocloeon*, *Isonychia*, *Cinygmmina*, *Choroterpides*, *Simothraulius*, *Tricorythus* and *Clypeocaenis* nymphs.

Nymphs isolated in a jar are very good and fast swimmers. They can swim very well also in the reversal position. Since cerci and paracercus assist probably negligibly in swimming and snake-like movements are excluded owing to the incredibly enlarged and stiff mesonotum ("carapax"), the swimming seems to be realised mainly by movements of gills. Oxygen demands of nymphs are not so pronounced, as one can judge indirectly considering their habitats. They can survive several days in jars without a change of water at temperatures over 30 °C. Nymphs of *Prosopistoma* were, however, never found at isolated pools, which occur on the river bed during the dry season, where the nymphs of some leptophlebiids and of *Potamanthodes* and *Roenanthus* can easily survive. Water temperature at the type locality fluctuated from 26.4 °C at night min. to max. 29.8 °C by day.

The nymphs of *P. annamense* do not seem to be predators like those of the European species *P. pennigerum*. The examination of gut content of 5 nymphs showed remains of diatoms and algae and also possible remnants of oligochaets. Head capsules of insect larvae were not found. In Madagascar both carnivorous and herbivorous (detritivorous) species of *Prosopistoma* were found (cf. FONTAINE, 1980).

Life cycle: unknown. At the type locality, nymphs of various developmental stages occurred simultaneously during the period studied. Emergence seems to be continual, at least during the dry season.

Key to nymphs of Oriental *Prosopistoma*

- 1 (2) Posterolateral projections of abdominal segments VII–IX broad, truncated; short and stout bristle among those arising near base of inner incisor of mandible (Papua New Guinea, Solomon Islands) *P. sedlaceki* PETERS
- 2 (1) Posterolateral projections of abdominal segments VII–IX broad, apex bluntly or acutely pointed; all bristles arising near base of inner incisor equal in width.
- 3 (4) Apex of inner margin of fore tibiae with two apical, serrated spines, remainder of margin with minute, unserrated spines; 12 or more bristles near inner mandibular incisor of mandibles (Sri Lanka) *P. lieftincki* PETERS
- 4 (3) Apex of inner margin of fore tibiae with more than two long, serrated or unserrated spines approximately equal in length; at most 6–9 serrated bristles near base of inner incisor of mandibles.

- 5 (6) Apex of inner margin of fore tibiae with 3—4 equal-sized apical unserrated spines; remaining spines coarsely serrated; 6—9 bristles arising from base of inner mandibular incisor (Mindanao I., Philippines) *P. boreus* PETERS
- 6 (5) Apex of inner margin of fore tibiae with more than 4 equal-sized finely serrated or unserrated spines; 3 long unserrated bristles arising from base of inner mandibular incisor.
- 7 (8) Two long bristles arising from base of apical spines of galea-lacinia of maxillae; 6 unserrated spines on apex of inner margin of fore tibiae (India) *P. indicum* PETERS
- 8 (7) Three or more bristles arising from base of apical spines of galea-lacinia of maxillae; 6—8 serrated spines on apex of inner margin of fore tibiae.
- 9 (10) Apical segment of maxillary palps longer than 1/2 length of segment 2; mesonotum with posterior and anterior dark brown bands separated, with light band as wide as anterior dark one (Fig. 1) (Vietnam) *P. funanense* sp. n.
- 10 (9) Apical segment of maxillary palps distinctly shorter than 1/2 length of segment 2; mesonotum with connected bands with numerous pale spots or bands separated by narrow W-shaped lighter band (cf. Fig. 2).
- 11 (12) Segment 2 of antennae equal in length to segments 3—5; segment 2 of labial palps 3/4 length of segment 1; no light spots in anterior dark band on mesonotum (Palawan I., Philippines) *P. palawana* PETERS
- 12 (11) Segment 2 of antennae distinctly shorter than segments 3—5; segment 2 of labial palps 2/3 length of segment 1; numerous pale spots in anterior dark band on mesonotum.
- 13 (14) Apex of inner margin of fore tibiae with 6 serrated spines; segment 3 of maxillary palps a little shorter than 1/3 length of segment 2; posterolateral spines of segments VII and VIII of abdomen parallel or bent outwards to body axis (Vietnam) *P. annamense* sp. n.
- 14 (13) Apex of inner margin of fore tibiae with 8 serrated spines; segment 3 of maxillary palps a little longer than 1/3 length of segment 2; posterolateral spines of segments VII and VIII of abdomen parallel or bent inwards to body axis (Sunda Is.) *P. woutersae* LIEFTINCK

REFERENCES

- ALOUF N. J. 1977: Sur la presence du genre *Prosopistoma* au Liban. Description de *P. oronti* n. sp. et *P. phoenicium* n. sp. (Ephemeroptera). *Annls Limnol.*, 13 : 133—139.
- DEMOULIN G. 1970: Ephemeroptera des faunes éthiopienne et malgache. *S. Afr. Anim. Life*, 14 : 24—170.
- DEGRANGE CH. 1955: Sur la morphologie de *Prosopistoma foliaceum* Fourcr. *C. R. Acad. Sci., Paris*, 240 : 1668—1669.
- FONTAINE J. 1955: Les formes ailées de *Prosopistoma foliaceum* Fourcroy (Ephemeroptera). *Bull. Soc. Linn. Lyon*, 24 : 60—65.
- FONTAINE J. 1980: Regime alimentaire des larves de deux genres d'Ephéméroptères: *Rapto-baetopus* Müller; Liebenau, 1978 et *Prosopistoma* Latreille, 1833. In: FLANNAGAN J. F. & MARSHALL K. E. (eds.): *Advances in Ephemeroptera Biology*. P. 201—210, Plenum, New York, London.
- LAFON J. 1952: Note sur *Prosopistoma foliaceum* Fourcr. (Ephéméroptères). *Bull. Soc. zool. Fr.*, 77 : 425—436.
- GILLIES M. T. 1954: The adult stages of *Prosopistoma* Latreille (Ephemeroptera) with description of two new species from Africa. *Trans. R. ent. Soc. Lond.*, 105 : 355—372.
- GILLIES M. T. 1956: A supplementary note on *Prosopistoma* Latreille (Ephemeroptera). *Proc. R. ent. Soc. Lond.*, 31 : 165—166.
- PETERS W. L. 1967: New species of *Prosopistoma* from the Oriental Region (*Prosopistomatoidae*: Ephemeroptera). *Tidjs. Ent.*, 110 : 207—222.
- SOLDÁN T. 1983: Two new species of *Clypeocaenis* (Ephemeroptera, Caenidae) with a description of adult stage and biology of the genus. *Acta ent. bohemoslov.*, 80 : 196—205.

Два новых вида рода *Prosopistoma* (Ephemeroptera, Prosopistomatidae) из Вьетнама

Таксономия, биотопы, абунданция, Ориентальная область, определитель, нимфы

Резюме. Описание и изображение двух новых видов: *Prosopistoma annamense* sp. n. (взрослый самец и нимфа самки) и *P. funanense* sp. n. (взрослый самец и нимфа самки). Их различительные признаки приведены в виде определителя и сравниваются с тако-

выми у ориентальных видов рода *Prosopistoma*. Прямые наблюдения за личинками в типичном местонахождении позволило дать обзор основных данных о местах их обитания, абундации и поведении.

Received February 6, 1984; accepted February 21, 1984

Authors' address: Dr. T. Soldán, Entomologický ústav ČSAV, Na sádkách 702, 370 05 České Budějovice, Czechoslovakia; D. Braasch, dipl. biol., Maybachstrasse 1a, 15 Potsdam, DDR.

REVIEW

Balás G. & Sáringer G.: KERTÉSZETI KÁRTEVŐK (Animal pests in horticulture). 1069 pp., 462 figs., 21 tables, 68 pp. references, Akadémiai kiadó, Budapest, 1982.

The authors of this remarkable and extensive work about animal pests in gardens and orchards are well known Hungarian specialists. They have ably synthesized the rich information of world literature with their own research experience.

The relatively extensive General part, in which T. Jermy and G. Szelényi took part, occupies a good quarter of the book. The authors thus stress the great importance of theoretic principles for the practice of plant protection.

The Introduction is devoted to the history of the Hungarian phytopathological research. The principles of the ecology of pests and their populations (autecology of species and synecology of agricultural communities), of forecasting, and of the organization of warming service are covered. The structure of the traditionally high standard Hungarian plant protection and warming service network is described. The principle of integrated control is the leading motive of this section. In this framework biological, physical and mechanical methods are discussed, including prophylaxy, together with the aimed chemical control. A separate chapter is devoted to selected research methods in plant protection and pest control and to the machines used in pest control practice in gardens and orchards.

In the Special part, more than 500 animal species of economic importance are reviewed. Sometimes the species with common life his-

tories and damage manifestation are grouped and described collectively. The animals are arranged according to the zoological system. It should be appreciated that not only insects but other invertebrate (Vermes, Mollusca, Acari etc.) and also vertebrate taxa are included. Each family is briefly characterized and its peculiarities from different points of view (morphology, anatomy, immature stages, importance in horticulture etc.) are emphasized. Separate species or their groups follow in a lucid arrangement, in each case described according to a unified scheme: host plant, type of injury, description of adult and immature stages, life cycle, economic importance and possibilities of control. Numerous photographic illustrations of pest species and symptoms of damage have been chosen with great care.

The last section provides a list of pests, arranged according to the Hungarian and scientific names of plants and their damaged parts. More than 2000 references, mostly from Hungarian sources, are added.

Although the main attention is concentrated on horticultural plants (vegetables, flowers, fruit trees and shrubs), the data on polyphagous species often apply also to agricultural plants. One may only regret that so comprehensive book, the extent of which is hardly approached by analogous horticultural manuals, can be fully understood only by a limited number of specialists. The text is written in Hungarian with only brief German content. Translation into one or more widely used languages, e.g. English, would surely be appreciated.

I. Novák