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Entomological notes on all described species of the mayfly-family Prosopistomatidae (Insecta: Ephemeroptera)

von

Martin SCHLETTERER & Leopold FÜREDER *)

Synopsis: In order to provide a database we summarized available entomological information on all described species of the family Prosopistomatidae. Given the paucity of knowledge it is emphasised that further research activities on the overall distribution of the family Prosopistomatidae should be initiated.

1. Introduction:

When *"Prosopistoma"* was discovered in 1762 by GEOFFROY, he initially described it as a crustacean, due to the structure of the mesothorax. He defined it as *Binoculus haemisphericus* GEOFFROY 1762, and afterwards the name was changed to *Binoculus foliaceus* GEOFFROY in FOURCROY 1785. Later, LATREILLE (1833) described the genus *Prosopistoma* and separated it from arguloid Crustacea, but still considered it to be a branchiopod. It is not clear which species was used by the latter author to describe the genus, because he was working on specimens of *P. variegatum* LATREILLE 1833, but referred also to GEOFFROY's species as *"prototype de mon crustacé"*. Finally *P. variegatum* was designated as the type specimen by EATON (1884). In 1868, more than 100 years after the discovery, Emile JOLY realized that the *"binocle à queue en plumet"* was a mayfly larva (JOLY 1871, JOLY & JOLY 1872). HUBBARD (1979) provided a revision of the complicated nomenclature. The genus *Myanmarella* SINITSHENKOVA, 2000, known only from fossil records, was originally described as another genus of the Prosopistomatidae, but is more likely associated with the genus *Palaeocloeon* (KLUGE 2004). Nowadays the family Prosopistomatidae is considered monogeneric, with 20 described species. Accounting the worldwide situation of Prosopistomatidae, data is scattered and there is a lack of a synoptic work on all species. Thus this publication shall provide an entomological database about this rare mayfly taxon.

*) Addresses of the authors: University of Innsbruck, Institute of Ecology, River Ecology and Invertebrate Biology, Technikerstraße 25, 6020 Innsbruck, Austria, schletterer@gmx.at

2. Methods:

In order to review existing knowledge, a bibliographic synthesis was performed. As a result an overview on the worldwide situation of the family Prosopistomatidae is provided.

3. Results:

The Prosopistomatidae occur throughout the Palaearctic, Oriental, Australian and Afrotropical Realms, but they are entirely lacking in the Nearctic and Neotropics. Only from three species adults are known: *P. africanum*, *P. pearsonorum* and *P. pennigerum* (GILLIES 1954, CAMPBELL & HUBBARD 1998, VAYSSIÉRE 1881, FONTAINE 1955, 1982).

Beside the (formerly) widespread European species *P. pennigerum* (MÜLLER, 1785), in the Western-Palaearctic another two species are known: *P. phoenicium* ALOUF, 1977 (syn. *P. oronti*, see THOMAS et al. 1988), that is restricted to Israel, Lebanon and Syria, and recently *P. orhanelicum* DALKIRAN, 2009 was described from northwestern Turkey. Another three species are known from the Eastern Palaearctic (*P. sinense, P. trispinum, P. unicolor*), and from the oriental realm eight species (*P. annamense, P. boreus, P. funanense, P. indicum, P. lieftincki, P. olympus, P. palawana, P. wouterae*) are known. From the Australian region two species are known, *P. sedlaceki* PETERS 1967 and *P. pearsonorum* CAMPBELL & HUBBARD 1998. In Australia the family Prosopistomatidae was collected in coastal rivers of north Queensland (PEARSON & PENRIDGE 1979) and misidentified: it was not *P. sedlaceki*, which is known from New Guinea (Peters 1967), but the new species *P. pearsonorum* (CAMPBELL & HUBBARD 1998). In the Afrotropics four species were recorded (*P. africanum, P. crassi, P. deguernei, P. variegatum*), however a couple of species are awaiting description (Barber-James, pers.-comm.).

A database including comments on species, etymology, type localities and deposits of material on all described species of the genus *Prosopistoma* (LATREILLE 1833) is summarised below.

Prosopistoma africanum GILLIES 1954

Etymology: Africa, continent where this species occurs
Locality: Sigi River, Amani (5°5`S, 38°40`E), altidude: 213-853 m, Tanganyika, Africa, leg. M.T. Gillies (IV.1951 – VI.1953) (now Tanzania)
Type material: British Museum, Natural History (holotype [larva] + additional adults and larvae)
Remarks: closest to *Prosopistoma* sp. from Belgish-Congo (PAULIAN 1947), but *P. africanum* differs by the 2nd antennal segment, character of fore tibial armature, proportion of labial palps and unserrated hairs in the maxille
Additional Records: widespread in Africa (BARBER-JAMES 2003), e.g. Sabie River - Krüger National Park (BARBER-JAMES 2003), Usutu River - Swaziland (ARCHIBALD & DE MOOR 1981)

P. annamense SOLDÁN & BRAASCH 1984

Etymology: related to the location where it was found (Annam Highland in Central Vietnam)
Localities: rocky streams and rivers near sea level
(1) Nha-Ho, Song Kinh-dinh, 15 km W of Phanrang [108°52`19``E, 11°37`58``N], Thuan hai Prov. (Vietnam), leg. T. Soldàn (16.IV. – 5.V.1982)
(2) Dap-Nha-Trinh, Song Kinh-dinh (Vietnam), leg. T. Soldàn (20.IV.1982), leg.
(3) Chau-Song Pha, 50 km E of Dalat (Vietnam), leg. T. Soldàn (20.IV.1982), leg.
Type material: Institute of Entomology ČSAV, České Budějovice
Additional Records: China, Hunan Province, Xiangjiang River, He-Jiang-Tao, VII.1980; 1 larva, China, Hunan Province, Xiangjiang River, Lao-Bu-Tou, VII.1980. leg. Liu, Wang & Hu (in Insects Collection, College of Life Sciences, Nanjing Normal University, Nanjing 210097, China). see LIU et al. (1984)

P. boreus PETERS 1967

Etymology: "Boreus", Gr. meaning of nordwind
Localities: small rocky (gravel) streams
(1) Burungkot, Upi nerar Cotabato – Mindanao (Philippine Islands), Altitude: 460 m (1500 ft), leg. F. Werner - 1.-6.I.1947 (214 larvae)
(2) A stream on the eastern slope of Mt. McKinley, near Davo – Mindanao (Philippine Islands), Altitude: 915 m (3000 ft), leg. F. Werner - 24.VIII.1946 (28 larvae)
Type material: Holotype at Field Museum of Natural History, paratopotypes at collections of Florida A.&M. University, University of Utah and the Bernice P. Bishop Museum

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P. crassi GILLIES 1954

Etymology: "crassi", because it was discovered by Mr. R.S. Crass
Localities:
(1) Umgeni River (29°30`S, 30°30`E), Natal, Africa, leg. R.S. Crass (XII.1953), Altitude: 400 m (1200 ft)
(2) Tutela ferry (28°75`S, 30°30`E), Natal, Africa, leg. W.D. Oliff (12.XI.1953)
Type material: British Museum, Natural History (holotype + 2 paratypes)
Additional Records: Thukela River, KwaZulu-Natal (OLIFF 1960), lower Vaal River (CHUTTER 1968)

P. deguernei (VAYSSIÈRE) 1893

Etymology: "deguernei", in honour of Mr. M. Jules de Guerne
Locality: River Senegal, about 435 km (270 miles) upstream Saint-Luis, Senegal
Type material: ?

P. funanense SOLDÁN & BRAASCH 1984

Etymology: "funanense", species name derived from the name of an ancient state in SE Asia
Locality: Nha-Ho, Song Kinh-dinh, 15 km W of Phanrang [108°52`19``E, 11°37`58``N], Thuan hai Prov. (Vietnam), leg. T. Soldàn (16.IV – 5.V.1982)
Type material: Institute of Entomology ČSAV, České Budějovice

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P. indicum PETERS 1967

Etymology: "indicum", from the location "India"
Locality: Koratty River, Erumeli, 55 km (35 mi) E of Kottayam (Kerala State, India), Altitude: 110 m (350 ft), leg. W.L. & J.G. Peters (5.-6.II)
Type material: Holotype at Florida A.&M. University, paratopotype at University of Utah

P. lieftincki PETERS 1967

Etymology: "lieftincki", in honour of Dr. M.A. Lieftinick, who encouraged the work of Peters
Localities: small stream
(1) Rangala, 19 km (12 mi) ENE of Kandy, Knuckles Mountains (Central. Prov., Ceylon = Sri Lanka) [Swedish Ceylon Expedition, location 130], Altitude: 1100 m (3600 ft)
(2) Rangala, 22 km (14 mi) ENE of Kandy, Knuckles Mountains (Central. Prov., Ceylon = Sri Lanka) [Swedish Ceylon Expedition, location 131], Altitude: 1500 m (5000 ft), leg. P. Brinck, H. Anderson, L. Cederholm (11.III.1962)
Type material: Holotype at Zoological Institute Lund, paratopotypes at collections of Florida A.&M. University, University of Utah, Bernice P. Bishop Museum
Additional Records: *Prosopistoma* sp. from Sri Lanka (HENRY 1929)

P. olympus SARTORI & GATTOLLIAT 2003

Etymology: "olympus"; in the Acknowledgements the authors thank E.R. Perucco and M. Fornerod from "Olympus Optical, Switzerland", thus it can be assumed, that the name was selected due to this connection
Locality: Temalat (Sungai Guang) stream[116°33`29``E, 2°59`29``N] (a tributary of Seturan River), Malinau watershed, East Kalimantan (Indonesia), leg. P. Derleth & J.-L-Gattolliat (21.VI.2000)
Type material: Museum of Zoology, Lausanne (Switzerland)
Remarks: ULMER (1940) collected *Prosopistoma* sp. in Sumatra (Indonesia)

P. orhanelicum DALKIRAN 2009

Etymology: "orhanelicum" is derived from the name of Orhaneli stream and Orhaneli district
Localitiies: Southwestern Turkey, Bursa province, Orhaneli district, Orhaneli stream, leg. N. Dalkıran (IV. - XI. 2001)
(1) Deliballılar site (39°55´56´´ N, 28°58´21´´ E), altitude 345 m (Holotype: 01.XI.2001)
(2) Cinarcik site (40°01´23´´ N, 28°47´53´´ E) altitude 220 m
(3) Kestelek I site (39°57´28´´ N, 28°35´24´´ E) altitude 75 m
(4) Kestelek II site (39°56´49´´ N, 28°32´14´´ E) altitude 50 m
Type material: Uludag University, Art and Science Faculty, Biology Department, Hydrobiology Section, Aquatic Insect Collection (Turkey)

P. palawana PETERS 1967

Etymology: "Palawan", an island of the Philippines Bacunppan
Locality: Bacungan, near Puerto Princesa – Palawan (Philippine Islands), rocky stream near sea level, leg. F. Werner 22.-30.III.1947 (37 larvae)
Type material: Holotype at Field Museum of Natural History, paratopotypes at collections of Florida A.&M. University, University of Utah and the Bernice P. Bishop Museum

P. pearsonorum CAMPBELL & HUBBARD 1998

Etymology: "pearsonorum", in honour of Barbara and Richard Pearson
Locality: Mitchell River (16°31`S, 144°55`E, Australia), larvae collected on 27.I.1988, subimagines on 11.V.1988
Type material: Museum of Victoria, Melbourne

P. pennigerum (MÜLLER) 1785

Etymology: "pennigerum" – related to the feather-like caudal filaments
Synonyms: *P. foliaceus* (FOURCROY 1785), *P. pisciforme* (DUMERIL 1816), *P. punctifrons* LATREILLE 1833
Locality: Seine near Paris (GEOFFROY 1762)
Type material: ?
Reference Material: (1) Private collection of M. Schletterer and (2) "Reference collection of benthic invertebrates of the Upper Volga Basin" at Tver State Technical University (SCHLETTERER & KUZOVLEV 2007)
Additional Records: France, Luxembourg, Netherlands, Germany, Austria, Portugal, Spain, Italy, Macedonia, Greece, Turkey, Algeria, Sweden, Czech Republic, Hungary, Romania, Georgia, Latvia, Russia (see review about the historical distribution of the species: SCHLETTERER & FÜREDER, in prep.)

P. phoenicium ALOUF 1977

Synonyms: *P. oronti* ALOUF 1977 (see THOMAS et al. 1988)
Localities:
(1) Nahr-d-Damour, location Gisr-l-Cadi (Lebanon), Altitude: 260 m, collected: VI.1973
(2) Nahr-l-`Assi (Oronte), location Hermel (Lebanon), Altitude: 600 m, collected: 20.VII.1974, October 1974 & 1975, 23.XI.1975
Type material: Private collection of N.J. Alouf at the Faculty of Science - L'Université Libanaise
Additional Records: Syria and Israel (KOCH 1988)

P. sedlaceki PETERS 1967

Etymology: "sedlaceki", in honour of Mr. Josef Sedlacek (Director of Bernice P. Bishop Museum Field Station, Wau, Territory of Papua and New Guinea)
Localities:
(1) Bulolo River, E of Wau, New Guinea Altitude: 900 m (2950 ft), leg. W.L. & J.G. Peters (15.-27.X.1964)
(2) 1 km (0,8 ft) downstream junction of Bulolo River and Karinga Creek, NW of Wau, New Guinea Altitude: 850 m (2800 ft), leg. W.L. & J.G. Peters (12.X.1964)
(3) Lower Mist Camp, S of Idenburg River, New Guinea, Altitude: 1400-1600 m (4600-5280 ft), leg. L.J. Toxopeus (31.I.1939)
(4) Brook of Bonegi stream, W of Honiara, Guadalcanal, Solomon Islands, leg. T. Wolff (29.VII.1962)
Type material: Holotype at Florida A.&M. University, paratopotypes at University of Utah; paratypes from New Guinea and Solomon Islands material are in collections of the Rijksmusen van Natuurlijke Historie and Universitetes Zoologiske Museum (Copenhagen)

P. sinense TONG & DUDGEON 2000

Etymology: "Sina", meaning China

Localities/Deposits of material: third- or fourth-order streams with moderate current

(1) near the Lower Waterfall, Lam Tsuen River, Ng Tung Chai (22°26´ N, 114°08´ E), Hong Kong, China, leg. Tong Xiaoli (6.IV.1998) 1 holotype + 5 larvae (SCAU); Additional material: 5 larvae (3 in SCAU, 2 in FAMU), leg. Tong Xiaoli (25.II.1997), 4 larvae (HKU), leg. Tony K. T. Chan (28.IV.1993)

(2) small stream, Shing Mun Country Park (22°24´ N, 114°09´ E), leg. Tony K. T. Chan (29.04.1993) (2 larvae, HKU)

(3) Tai Po Kau Nature Riserve (22°25´ N, 114°11´ E), leg. Tong Xiaoli (25.V.1997) (1 larva, AFDHK)

(4) Chung Lung (22°24´ N, 114°06´ E), leg. Tong Xiaoli (11.II.1998) (1 larva, SCAU)

(5) Long Men Xian, Nankunshan Nature Reserve, Guangdong Province, China, leg. Tong Xiaoli (20.III.1997) (1 larva, SCAU)

(6) Wu Hua Xian, Qimuzhang Nature Reserve (23°51´ N, 115°22´ E), leg. Maggie Verrall (5.IV.1997) (1 larva, SCAU)

(7) Xin Yi Xian, Dawuling Nature Reserve (22°14´~22°17´ N, 111°8´~111°15´ E), leg. Maria L. Salas (26-28.IV.1997) (6 larvae, SCAU).

Type material: Insect collection of the South China Agricultural University, Guangzhou, P. R. China (SCAU); holotype from Lam Tsuen River, Ng Tung Chai (6.IV.1998)

Additional material: at each locality abbreviations are used, to indicate, where the material is stored

HKU = Department of Ecology & Biodiversity, The University of Hong Kong

AFDHK = the insect collection of the Agriculture and Fisheries Department of Hong Kong Government (AFDHK)

FAMU = Collection of Florida A & M University, Tallahassee, Florida

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P. trispinum ZHOU & ZHENG 2004

Etymology: "trispinum" from lat. tri- (three) and spina (spine); refers to the three spines on inner margin of fore tibia

Locality: Fengshan, Jinggu County (23°30´N, 100°41´ E), Yunnan Province, China, leg. Chang-Fa Zhou (8.IV.2001)

Type material: Insects Collection, College of Life Sciences, Nanjing Normal University, Nanjing 210097, China (holotype + 30 Paratypes)

P. unicolor ZHOU & ZHENG 2004

Etymology: "unicolor", lat. 'of a single colour', referring to uniform reddish brown mesonotum of this new species

Locality: Jingdong County (24°26´N, 100°50´ E), Yunnan Province, China, leg. Chang-Fa Zhou (15.IV.2001)

Type material: Insects Collection, College of Life Sciences, Nanjing Normal University, Nanjing 210097, China. (holotype + paratype)

P. variegatum LATREILLE 1833

Etymology: "variegatum" – miscellaneous from the known species *P. pennigerum*

Locality: Madagascar, leg. M. Goudot

Type material: ?

P. wouterae LIEFTINCK 1932

Etymology: "wouterae", in honour of Miss Woutera van Benthem Jutting (Zoological Museum at Amsterdam), who discovered this species
Locality: Tjisaroea Estate (a rocky stream), northern slope of Mt. (Goenoeng) Panggerango, West Java, Altitude: 1050 m
Type material: Museum Buitenzorg
Additional Records: Thailand, Songkhla Province, Amphur Rataphum, (2nd order stream below Boripat Waterfall, 6° 59´ N, 100° 9´ E), 60 km SW of Amphur Hat Yai, 200 m a.s.l., 15 larvae leg. Bauthong, Parnrong & Sites (28.IV.2000, 25.X. 2000, 10.VI. 2001). Specimens are deposited in the museum of the Department of Pest Management, Faculty of Natural Resources, PSU, Hat Yai, Thailand and in the reference insect collections of the University of Missouri-Columbia and Florida A&M University (PARNRONG et al. 2002).

4. Discussion:

The records are scattered and some species were only found once and not rediscovered after their description. Obviously Prosopistomatidae are a very rare and sensitive family, which underlines the need of a special protection of all species i.e. the inclusion to the IUCN list (SCHLETTERER & FÜREDER, in prep.). For example, the species *Prosopistoma pennigerum* became rare throughout Europe due to an increase of anthropogenic activities, i.e. habitat alternation and/or eutrophication, within the 20th century. Given the paucity of knowledge further research activities on the overall distribution of the family Prosopistomatidae should be initiated.

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