An updated list of type material of Ephemeroptera Hyatt & Arms, 1890, deposited at the Zoological Museum of Hamburg (ZMH)

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Abstract
The type specimens of Ephemeroptera (Insecta) housed at the Zoological Museum of Hamburg (ZMH) are compiled in this document. The current nomenclature of all species is given. In total, Ephemeroptera type material of ZMH encompasses 161 species. Fifty-one holotypes and five lectotypes are present. Forty-one species are represented by syntypes, 85 by paratypes and five by paralectotypes. Material of two species (Cinygma asiaticum Ulmer, 1924 and Pseudocloeon klapaleki Müller-Liebenau, 1982) is missing. The present catalogue is an updated version of Weidner (1964a).

Keywords
Ephemeroptera, Hamburg, type specimens, Ulmer, ZMH
Introduction

The Ephemeroptera collection of the Zoological Museum of Hamburg (ZMH) contains 433 species and approximately 4,500 specimens. In total, 161 species are represented by type material. In this sense, this is one of the largest collections with the highest number of type specimens of this insect order in Germany. Furthermore, the mayfly collection together with the caddisfly collection comprise some of the oldest voucher material of the entomological collection at the ZMH which was mainly collected at the end of the 19th century and in the first decades of the 20th century by the Hamburgian entomologist Dr. h.c. Georg Ulmer (1877–1963) (e.g., Weidner 1964b).

Georg Ulmer was born in Hamburg on 5 March 1877. He was the oldest son of seven siblings. After his father died in 1889, he decided to become a school teacher. During his qualification time in the early 1890s, he began collecting insects in the vicinity of Hamburg (Ulmer 1964). Initially, he started to compile a beetle collection but since he observed a mass emergence of mayflies at the river Fulda near Kassel in 1898, he started to focus his collecting efforts and taxonomic studies on primarily aquatic insect groups like mayflies or caddisflies (Ulmer 1964). In 1899, he finished his teacher training and started his career as a board school teacher in Hamburg for 32 years until 1934. Beside his profession, he studied voluntarily the faunistics, biology, systematics and taxonomy of Ephemeroptera (e.g., Ulmer 1904a, 1926, 1939) and Trichoptera (e.g., Ulmer 1905, 1951), and other freshwater invertebrates (e.g., Ulmer 1901, 1902a).

His first publication (Ulmer 1900) was followed by 175 scientific publications until his death on 15 January 1963 (Illies 1964). In the first years of his scientific career, he mainly studied the faunistics and taxonomy of caddisflies in the vicinity of Hamburg (e.g., Ulmer 1902b), or other localities in Germany (e.g. Ulmer 1904b, 1915). From the year 1905 on, he intensively started to study the material from foreign countries (including tropical regions), which has been lent to him by colleagues or other institutions (e.g., Ulmer 1905).

Besides the Trichoptera, Ulmer worked on mayflies (e.g., Ulmer 1908, 1909, 1912). Between 1904 and 1943, he published thirty research papers on the systematics and taxonomy of Ephemeroptera (Kimmins 1963; Illies 1964) with the description of 111 species (Weidner 1964a). His studies on mayflies resulted in the fundamental revision of the Southeast Asian mayfly fauna with the description of numerous species (Ulmer 1939).

During World War II (in 1943), the Zoological Museum Hamburg (that time located near the central railway station) was bombed and nearly all dry preserved material housed in the collections was destroyed and burned in the fire. Only material deposited in ethanol was transferred into the underground networks and survived the war (Weidner 1967). The valuable Ephemeroptera and Trichoptera collection of Georg Ulmer was kept in his private house outside of Hamburg. In 1964, the insect collection of Georg Ulmer was donated to the ZMH (Weidner 1964b) providing the majority of the recent voucher material of the ZMH in these two insect orders.
Table 1. List of type material of Ephemeroptera Hyatt & Arms, 1890, deposited at the Zoological Museum of Hamburg, with the state and metamorphic stage of materials, current nomenclature, family assignment, related literature and complementary information. Abbreviations in this list are as follows: Type: HT = Holotype; LT = Lectotype; PT= Paratype(s); PLT= Paralectotype(s); ST = Syntypes. (state): (1) Specimen conserved in alcohol; (2) Pinned dry specimen; (3) Specimen or part of it mounted on microscopic slide. Stage: F= Female imago; M= Male imago; N= Nymph; SF= Female subimago; SM= Male subimago. Complementary information: a. Holotype wrongly designated by Weidner (1962, 1964a); b. Holotype designated by Ulmer on the label, not in the publication; c. Holotype apparently not in Stockholm (see http://www.nrm.se/download/18.1cb760b014a762ca801342e9/1421068753427/EPHEMEROPTERA_list.pdf); d. Specimen not labelled, but comes from the type series; e. Not type material! The types are the nymphs and the adults were only described in 1925; f. Only fore- and hindlegs in ZMH; g. Only fore wing in ZMH and remains in Naturkunde Museum, Berlin; h. Only foreleg; i. Only hind wing in ZMH and remains in Naturkunde Museum, Berlin; j. Only one forewing in ZMH and remains apparently not in Stockholm (http://www.nrm.se/download/18.1cb760b014a762ca801342e9/1421068753427/EPHEMEROPTERA_list.pdf); k. Wrongly considered by Ulmer, as a syn. of E. bellieri (Hagen).

| Taxon            | Original name            | Author(s), year | Type (state) | Stage | Current nomenclature                  | Family          | Literature & Complementary information |
|------------------|--------------------------|-----------------|--------------|-------|---------------------------------------|-----------------|-----------------------------------------|
| alegrettae       | Massartella alegrettae   | Ulmer, 1943     | HT (2)       | M     | Massartella alegrettae Ulmer, 1943    | Leptophlebiidae | (i.)                                    |
| ambiguum         | Pseudocloeon ambiguum    | Müller-Liebenau, 1982 | PT (1)    | N     | Liebebiella ambigua (Müller-Liebenau, 1982) | Baetidae        | Wältz and McCafferty 1987               |
| ammophila        | Oligoneuria ammophila    | Spieth, 1938    | PT (1)       | N     | Homooneuria ammophila (Spieth, 1938)  | Oligoneuriidae  | Edmunds and Allen 1957                 |
| anatolica        | Rhithrogena anatolica    | Kazanci, 1985   | PT (1)       | M     | Rhithrogena anatolica Kazanci, 1985   | Heptageniidae   | (d.)                                    |
| annandaei        | Polymitarcy annandaei    | Chopra, 1927    | ST (1)       | F     | Ephoron annandaei (Chopra, 1927)      | Polymitarcyidae | Hubbard and Srivastava 1985            |
| apicatum         | Cloeon apicatum          | Navás, 1933     | ST (2)       | M     | Cloeon navasi van Bruggen, 1957       | Baetidae        | van Bruggen 1957; (d.)                 |
| bicusculus       | Metrotopus bicusculus    | Ulmer, 1920     | HT (3)       | M     | Metrotus bicusculus Ulmer, 1920       | Ameletidae      | Putzh 1977a; (f.)                      |
| belgica          | Torleya belgica          | Lestage, 1917    | (PT) (2)     | M, F  | Torleya major (Klapalek, 1905a)       | Ephemereellidae | (c.)                                    |
| bengalensis      | Ecdyonurus bengalensis   | Ulmer, 1920     | HT, PT (2, 3) | M, E  | Ecdyonurus bengalensis Ulmer, 1920    | Heptageniidae   | (b.)                                    |
| berneri          | Rheohectis berneri       | Müller-Liebenau, 1974 | HT (1)  | N     | Heterocloeon berneri (Müller-Liebenau, 1974) | Baetidae        | McCafferty and Provonska 1975         |
| bicorne          | Centroptilum bicorne     | Ulmer, 1909     | PT (1)       | F     | Afrotipilum bicorne (Ulmer, 1909)     | Baetidae        | Gillies, 1990                          |
| biobionicum      | Deleatidium biobionicum  | Ulmer, 1938     | PT (2)       | F     | Meridialis biobionica (Ulmer, 1938)   | Leptophlebiidae | Peters and Edmunds 1972; (g.)          |
| Taxon | Original name | Author(s), year | Current nomenclature | Family | Native range | Stage | Literature & Complementary information |
|-------|---------------|-----------------|-----------------------|--------|--------------|-------|----------------------------------------|
| bishopi | Platybaetis bishopi | Müller-Liebenau, 1980 | | Baetidae | Müller-Liebenau, 1980 | HT (1) | |
| boettgeri | Pseudocloeon boettgeri | Ulmer, 1924 | | Baetidae | P. boettgeri | ST (1, 2, 3) | M, F |
| borneonia | Epeorella borneonia | Ulmer, 1939 | | Heptageniidae | E. borneonia | LT , PLT (1, 2) | M, F , SF |
| braueri | Hagenulodes braueri | Ulmer, 1920 | | Leptophlebiidae | H. braueri | PT (1) | M |
| brenneriana | Rhithrogena brenneriana | Klapalek, 1905a | | Heptageniidae | R. brenneriana | PT (1) | M |
| brunneum | Cloeon brunneum | Esben-Petersen, 1909 | | Baetidae | A. peterseni | ST (1, 2) | M, F |
| caenoides | Neoephemeropsis caenoides | Ulmer, 1939 | | Neoephemeridae | N. caenoides | LT , PLT (1, 3) | M, F , N |
| camerunense | Pseudocloeon camerunense | Ulmer, 1920 | | Baetidae | O. camerunense | ST (1, 3) | M |
| canariensis | Baetis canariensis | Müller-Liebenau, 1971 | | Baetidae | B. canariensis | HT , PT (1) | M, N |
| cavum | Cinygma cavum | Ulmer, 1927 | | Heptageniidae | C. cavum | HT (1, 3) | M |
| chinensis | Baetis chinensis | Ulmer, 1936 | | Baetidae | B. chinensis | ST (1) | M, F |
| chinensis | Heptagenia chinensis | Ulmer, 1920 | | Heptageniidae | H. chinensis | ST (2) | M |
| chinensis | Siphluriscus chinensis | Ulmer, 1920 | | Siphlonuridae | S. chinensis | PT (3) | M |
| corsicus | Ecdyonurus corsicus | Esben-Petersen, 1912a | | Heptageniidae | E. corsicus | PT (2) | M |
| costaricanus | Leptohyphes costaricanus | Ulmer, 1920 | | Leptohyphidae | L. costaricanus | HT (2, 3) | M |
| crassinervis | Polyplocia crassinervis | Ulmer, 1939 | | Euthyplociidae | P. crassinervis | PT (2) | M |
| croaticus | Siphlonurus croaticus | Ulmer, 1920 | | Siphlonuridae | S. croaticus | PT (1, 3) | M |
| curvata | Paraleptophlebia curvata | Ulmer, 1927 | | Leptophlebiidae | P. curvata | PT (1, 3) | M |
| deigma | Liebebiella deigma | Waltz & McCafferty, 1987 | | Baetidae | L. deigma | HT (1, 3) | N |
| difficilum | Pseudocloeon difficilum | Müller-Liebenau, 1982 | | Baetidae | L. difficilum | PT (1, 3) | M, SM, SF |
| diptera | Hagenulopsis diptera | Ulmer, 1920 | | Baetidae | H. diptera | ST (1) | |
| diptera | Hagenulopsis diptera | Ulmer, 1920 | | Baetidae | H. diptera | ST (1) | |
| diptera | Hagenulopsis diptera | Ulmer, 1920 | | Baetidae | H. diptera | ST (1) | |
| diptera | Hagenulopsis diptera | Ulmer, 1920 | | Baetidae | H. diptera | ST (1) | |
| diptera | Hagenulopsis diptera | Ulmer, 1920 | | Baetidae | H. diptera | ST (1) | |
| diptera | Hagenulopsis diptera | Ulmer, 1920 | | Baetidae | H. diptera | ST (1) | |
| diptera | Hagenulopsis diptera | Ulmer, 1920 | | Baetidae | H. diptera | ST (1) | |
| diptera | Hagenulopsis diptera | Ulmer, 1920 | | Baetidae | H. diptera | ST (1) | |
| diptera | Hagenulopsis diptera | Ulmer, 1920 | | Baetidae | H. diptera | ST (1) | |
| diptera | Hagenulopsis diptera | Ulmer, 1920 | | Baetidae | H. diptera | ST (1) | |
| diptera | Hagenulopsis diptera | Ulmer, 1920 | | Baetidae | H. diptera | ST (1) | |
| Taxon | Original name | Author(s), year | Type (state) | Stage | Current nomenclature | Literature & Complementary information |
|-------|---------------|-----------------|-------------|-------|----------------------|----------------------------------------|
| duporti | Ephemera duporti | Lestage, 1921 | PT (2) | M | Ephemera duporti | Lestage, 1921 |
| eatoni | Rhithrogena eatoni | Ulmer, 1920 | ST (1, 2, 3) | M, SF | Rhithrogena eatoni | Ulmer, 1920 |
| edmundsi | Platybaetis edmundsi | Müller-Liebenau, 1980 | HT (1) | N | Platybaetis edmundsi | Müller-Liebenau, 1980 |
| ehrhardti | Thraulus ehrhardti | Ulmer, 1920 | ST (1, 2, 3) | M, F | Needhamella ehrhardti | Ulmer, 1920 |
| eloisae | Derlethina eloisae | Sartori, 2008 | PT (1) | N | Derlethina eloisae | Sartori, 2008 |
| feuernborni | Pseudoligoneuria feuernborni | Ulmer, 1939 | ST (1, 3) | N | Chromarcys magnifica | Navás, 1932 (syn.) |
| flexus | Siphlurus flexus | Clemens, 1913 | PT (1) | M | Siphloplecton basale | Walker, 1853 (syn.) |
| fluviatile | Cloeon fluviatile | Ulmer, 1920 | PT (1, 3) | M, F | Cloeon fluviatile | Ulmer, 1920 |
| formosana | Chloroperla formosana | Ulmer, 1942 | ST (1, 2, 3) | M, SF | Leptophlebiidae | Ulmer, 1942 |
| formosanus | Chirotonetes formosanus | Ulmer, 1920 | PT (2) | M | Chirotonetes formosanus | Ulmer, 1920 |
| fruhstorfferi | Massartella fruhstorfferi | Ulmer, 1943 | FT (1, 3) | N | Massartella fruhstorfferi | Ulmer, 1943 |
| gornostajevi | Epeorus gornostajevi | Tshernova, 1981 | PT (1) | M | Epeorus gornostajevi | Tshernova, 1981 |
| grandis | Isonychia grandis | Ulmer, 1913 | ST (1, 3) | M | Isonychia grandis | Ulmer, 1913 |
| guranica | Heptagenia guranica | Belov, 1981 | PT (1) | M | Heptagenia guranica | Belov, 1981 |
| haenschi | Euthyplocia haenschi | Ulmer, 1942 | PT (2) | M | Euthyplocia haenschi | Ulmer, 1942 |
| horai | Potamanthellus horai | Lestage, 1930 | HT (2) | N | Potamanthellus horai | Lestage, 1930 |
| hutanis | Dudgeodes hutanis | Sartori, 2008 | PT (1) | N | Dudgeodes hutanis | Sartori, 2008 |

**Family & Complementary information:**
- Ephemeroptera
- Hepageniidae
- Baetidae
- Leptophlebiidae
- Meteolepturidae
- Oligoneuriidae
- Teleogamidae
- Uncertain nomenclature

**Literature & Complementary information:**
- Lestage, 1921
- Ulmer, 1920
- Sartori, 2008
- Navás, 1932
- Walker, 1853
- Eaton, 1885
- Tshernova, 1981
- Belov, 1981
- Ulmer, 1912
- Ueno, 1931
- McDunnough, 1924
- Pescador and Peters, 1990
- Mercado and Elliott, 2004
- Campbell and Surer, 1998
- Bae and McCafferty, 1998
- Sarovar et al. 2008
- Dominguez and Flowers, 1989
- Kluge, 2004
| Taxon      | Original name         | Author(s), year | Type (state) | Stage | Current nomenclature                  | Family               | Literature & Complementary information |
|------------|-----------------------|-----------------|--------------|-------|---------------------------------------|----------------------|----------------------------------------|
| hyalinus   | Ecdyonurus hyalinus   | Ulmer, 1912     | ST (1, 2, 3) | M, E  | Afronurus hyalinus (Ulmer, 1912)      | Heptageniidae        | Kang and Yang 1994                     |
| insularis  | Rhithrogena insularis | Esben-Petersen, 1913 | PT (2) | M, F | Rhithrogena insularis Esben-Petersen, 1913 | Heptageniidae        | (d.)                                   |
| irina      | Cinygmula irina       | Tshernova & Belov, 1982 | PT (1) | M     | Cinygmula irina Tshernova & Belov, 1982 | Heptageniidae        |                                        |
| jacobsoni  | Tricorythus jacobsoni | Ulmer, 1913     | ST (1, 3) | M, F  | Sparsorythus jacobsoni (Ulmer, 1913)  | Tricorythidae        | Sroka and Soldán 2008; (a.)           |
| japonicus  | Chirotonetes japonicus| Ulmer, 1920     | ST (1, 2, 3) | M, F  | Isonychia japonica (Ulmer, 1920)      | Isonychiidae         | Ueno 1931; (a.)                        |
| javanicus  | Afronurus javanicus   | Ulmer, 1939     | HT (1) | M     | Afronurus javanicus Ulmer, 1939       | Heptageniidae        |                                        |
| javanicus  | Baeitis javanicus     | Ulmer, 1913     | ST (1, 2, 3) | F     | Baeitis javanicus Ulmer, 1913         | Baeitidae            |                                        |
| jorgenseni | Campsurnus jorgenseni | Esben-Petersen, 1912b | ST (1) | M, F  | Campsurnus jorgenseni Esben-Petersen, 1912 | Polymitarcyidae      |                                        |
| jorgenseni | Cloeon jorgensis      | Esben-Petersen, 1909 | ST (1, 3) | M, F  | Americaebaetis jorgensis (Esben-Petersen, 1909) | Baeitidae            | Lugo-Ortiz and McCafferty 1999         |
| karnyi     | Hagenulus karnyi      | Ulmer, 1939     | ST (1, 3) | SM, SF | Choroperes (Euthraulus) karnyi (Ulmer, 1939) | Leptophlebiidae      | Peters and Edmunds 1970                |
| krapelini  | Pseudocloeon krapelini| Klapalek, 1905b | LT, PLT (1, 3) | M, SM | Pseudocloeon krapelini Klapalek, 1905 | Baeitidae            | Waltz and McCafferty 1985             |
| krieghoffi | Chitonophora krieghoffi| Ulmer, 1920     | ST (2) | M, S  | Ephemerella mucronata (Bengtsson, 1909) (syn.) | Ephemerellidae       | Jacob 1974                            |
| lacuscoerulei | Tasmanophlebia lacuscoeruloi | Tillyard, 1933 | PT (1) | SF    | Tasmanophlebia lacuscoeruloiTillyard, 1933 | Oniscigastridae      | (d.)                                   |
| laminatum  | Deletidium laminatum  | Ulmer, 1920     | PT (3) | M     | Meridialaris laminata (Ulmer, 1920)    | Leptophlebiidae      | Peters and Edmunds 1972; (h.)          |
| lamuriensis| Thalerosphyrus lamuriensis | Sartori, 2014c  | HT, PT (1, 3) | N    | Thalerosphyrus lamuriensis Sartori, 2014 | Heptageniidae        |                                       |
| latifrons  | Cinygmula latifrons   | Tshernova & Belov, 1982 | PT (1) | M     | Cinygmula hirasaana (Imanishi, 1935) (syn.) | Heptageniidae        | Kluge 1995                             |
| latus      | Tricorythus latus     | Ulmer, 1916     | PT (1, 2, 3) | M     | Tricorythus latus Ulmer, 1916          | Tricorythidae        |                                        |
| lestagei   | Atalophlebiodes lestagei | Ulmer, 1938     | ST (1, 3) | N     | Meridialaris lestagei (Ulmer, 1938)    | Leptophlebiidae      | Dominguez et al. 2006                 |
| Taxon | Original name | Author(s), year | Type (state) | Stage | Current nomenclature | Literature & Complementary information |
|-------|---------------|-----------------|--------------|-------|----------------------|-------------------------------------|
| lieftincki | Heptagenia lieftincki | Ulmer, 1939 | HT, PT (1, 3) | M, F | Compsoneuria lieftincki | Ulmer, 1939; Sartori 2014a |
| lobatus | Ecdyonurus lobatus | Ulmer, 1924 | ST (1, 2, 3) | M, F, SF | Afronurus lobatus | Ulmer, 1924; Sartori 2014a |
| longilobata | Leptophlebia longilobata | Tshernova, 1928a | PT (1, 3) | M | Paraleptophlebia longilobata | Tshernova, 1928a; Tiunova and Kluge 2016 |
| longus | Tricorythus longus | Ulmer, 1916 | PT (1, 2, 3) | M, F | Tricorythus longus | Ulmer, 1916; Sartori 2014a |
| lucida | Atalophlebia lucida | Ulmer, 1920 | HT (1) | M | Thraulophlebia lucida | Ulmer, 1920; Demoulin 1955; (c.) |
| macedonicus | Rhoenanthus macedonicus | Ulmer, 1920 | HT (2) | M | Neoephemera maxima | Joly, 1871; Bae and McCafferty 1998 |
| maculipennis | Thraulus maculipennis | Ulmer, 1920 | HT (1) | M | Hermanella maculipennis | Ulmer, 1920; Dominguez and Flowers 1989 |
| magnificus | Rhoenanthus magnificus | Ulmer, 1920 | PT (1, 2, 3) | M, N | Rhoenanthus magnificus | Ulmer, 1920; Sartori 2014a; Wang and McCafferty 2006; (f.) |
| major | Choroterpides major | Ulmer, 1939 | HT, PT (1, 3) | M, N | Choroterpides (Euthraulus) major | Ulmer, 1939; Sartori 2014a |
| marginatus | Thraulus marginatus | Ulmer, 1913 | ST (1, 3) | M, F | Choroterpes (Euthraulus) marginatus | Ulmer, 1913; Peters and Edmunds 1970 |
| media | Ephemera media | Ulmer, 1936 | ST (2) | M, F, SM,SF | Teloganopsis media | Ulmer, 1939; Sartori 2014a; Wang and McCafferty 2006; (f.) |
| meli | Thalerosphyrus meli | Ulmer, 1926 | PT (2, 3) | M, F | Epeorus meli | Ulmer, 1926; Demoulin 1955; (c.) |
| mexicana | Heptagenia mexicana | Ulmer, 1920 | PT (1, 3) | M | Macrogenia mexicana | Ulmer, 1920; Sartori 2014a; Wang and McCafferty 2006; (f.) |
| mjoebergi | Euphyurus mjoebergi | Ulmer, 1917 | FT (1) | M | Ulmerophlebia mjoebergi | Ulmer, 1917; Sartori 2014a; Wang and McCafferty 2006; (f.) |
| montium | Thraulus montium | Ulmer, 1943 | HT (2) | M | Traverella montium | Ulmer, 1943; Sartori 2014a |
| multus | Baetis multus | Müller-Liebenau, 1984 | PT (3) | N | Labiobaetis multus | Müller-Liebenau, 1984; Sartori 2014a |
| nasuta | Heptagenia nasuta | Ulmer, 1939 | PT (1, 2) | M, F | Chlorogenia nasuta | Ulmer, 1939; Sartori 2014a; Wang and McCafferty 2006; (f.) |
| natans | Chankagenesia natans | Buldowsky, 1987 | PT (1) | M | Chlorogenia natans | Buldowsky, 1987; Sartori 2014a |
| necatii | Ecdyonurus necatii | Kazanci, 1987 | PT (1) | M | Chlorogenia necatii | Kazanci, 1987; Sartori 2014a; Wang and McCafferty 2006; (f.) |
| Taxon         | Original name      | Author(s), year | Type (state) | Stage | Current nomenclature                          | Family     | Literature & Complementary information |
|--------------|--------------------|-----------------|--------------|-------|-----------------------------------------------|------------|------------------------------------------|
| necopinatus  | Baetis necopinatus | Müller-Liebenau, 1981 | HT (1, 3)    | M     | Labiobaetis necopinatus (Müller-Liebenau, 1981) | Baetidae   | McCafferty and Wältz 1995               |
| nigrescens   | Baetis nigrescens  | Navás, 1932     | ST (2)       | M     | Baetis nigrescens Navás, 1932                 | Baetidae   | Müller-Liebenau 1971                   |
| nigrescens   | Tasmanophlebia nigrescens | Tillyard, 1933 | PT (1) | E, N  | Tasmanophlebia nigrescens Tillyard, 1933     | Oniscigastridae (d.) |                      |
| nigropunctata| Caenis nigropunctata | Klapalek, 1905b | ST (2, 3)    | F     | Caenis nigropunctata Klapalek, 1905          | Caenidae   | Malzacher 2015                          |
| nigropunctatula | Caenis nigropunctatula | Malzacher, 2015 | HT, PT (1, 3) | M, F  | Caenis nigropunctatula Malzacher, 2015       | Caenidae   |                                          |
| nitidum      | Centroptilum nitidum | Ulmer, 1916    | ST (2)       | F     | Bugilliesia nitida (Ulmer, 1916)            | Baetidae   | Lugo-Ortiz and McCafferty 1996         |
| novatus      | Baetis novatus     | Müller-Liebenau, 1981 | HT (3)     | N     | Baetis novatus Müller-Liebenau, 1981        | Baetidae   | Müller-Liebenau 1981                   |
| obscurum     | Pseudocloeon obscurum | Ulmer, 1913    | ST (3)       | M     | Pseudocloeon obscurum Ulmer, 1913           | Baetidae   |                                        |
| olivascens   | Baetis olivascens  | Ulmer, 1939     | HT, PT (1, 3) | M, S, SF | Baetis olivascens Ulmer, 1939               | Baetidae   |                                        |
| operosus     | Baetis operosus    | Müller-Liebenau, 1984 | PT (3) | N     | Labiobaetis operus (Müller-Liebenau, 1984)   | Baetidae   | McCafferty and Wältz 1995             |
| orientale    | Pseudocloeon orientale | Müller-Liebenau, 1982 | HT (3) | N     | Liebebiella orientale (Müller-Liebenau, 1982) | Baetidae   | Wältz and McCafferty 1987              |
| orientalis   | Palingenia orientalis | Chopra, 1927   | PT (2)       | M     | Palingenia orientalis Chopra, 1927           | Palingeniidae |                                            |
| orientalis   | Raptobaetopus orientalis | Müller-Liebenau, 1978 | HT (3) | N     | Raptobaetopus orientalis (Müller-Liebenau, 1978) | Baetidae   | Jacob 1991                              |
| ornata       | Rhithrogeniella ornata | Ulmer, 1939    | HT, PT (1, 3) | M, F  | Rhithrogeniella ornata Ulmer, 1939           | Heptageniidae | Sartori 2014d                           |
| ornatum      | Procloeon ornatum  | Tshernova, 1928b | LT (1, 3)    | M     | Procloeon ornatum Tshernova, 1928            | Baetidae   | Sowa 1975                               |
| paradoxa     | Anagenesia paradoxa | Buldowsky, 1935 | PT (1)       | M, F  | Anagenesia paradoxa Buldowsky, 1935          | Palingeniidae |                                            |
| parvus       | Ecdyonurus parvus   | Ulmer, 1912     | ST (1, 2, 3) | M, F  | Rhithrogena parv (Ulmer, 1912)               | Heptageniidae | Sartori 2014b                           |
| patagonica   | Atalophlebia patagonia | Lestage, 1931 | HT (1, 3) | F     | Meridialaris patagonica (Lestage, 1931)      | Leptophlebiidae | Peters and Edmunds 1972                |
| pekinensis   | Caenis pekinensis  | Malzacher, 2016 | HT, PT (1, 3) | N     | Caenis pekinensis Malzacher, 2016            | Caenidae   |                                          |
| Taxon                       | Original name                  | Author(s), year | Type (state) | Stage | Current nomenclature | Family                                       | Literature & Complementary information |
|-----------------------------|--------------------------------|-----------------|--------------|-------|----------------------|----------------------------------------------|------------------------------------------|
| pekingensis                 | Baetis pekingensis             | Ulmer, 1936     | HT, PT (1)   | M, F, SM, SF | Baetida              | Leptophlebiidae                              | Waltz et al. 1994                        |
| peruvianus                  | Baetis peruvianus              | Ulmer, 1920     | ST (2)       | M, SM | Baetida              | Leptophlebiidae                              | Jauge-Oritz and McCafferty 1959          |
| pococidar                   | Julohyphes pococidar           | Müller-Liebenau, 1980 | N             |       | Julohyphidae         | Baetida                                      | McCafferty and Provonsha 1975            |
| peterei                     | Lepthohyphes peterei           | Ulmer, 1920     | ST (1, 3)    | M, N  | Baetida              | Leptophlebiidae                              | Rugge 1985                               |
| philipinensis               | Ephemera philipinensis         | Ulmer, 1924     | ST (2)       | M, N  | Ephemeraeida         | Ephemerida                                   | McCafferty 1996                         |
| pinnellii                   | Lachania pinnellii             | Edmunds, 1951   | PT (1)       | M, F, N | Lachanidae           | Caenida                                      | Alar-Frieder and Malzacher 1986          |
| prominens                   | Hemphyllebias prominens       | Müller-Liebenau, 1971 | HT (1, 3)    | M     | Hemphyllebidae       | Ephemerida                                   | Demoulin 1956                           |
| puigae                      | Teloganopsis puigae            | Ubero-Pascal & Sartori, 2009 | PT (1)       | N     | Teloganopsida       | Ephemerida                                   | Grant and Proven 1993                    |
| pulcher                     | Afronurus pulcher              | Ulmer, 1930     | PT (1)       | M     | Afronurus            | Heptagenida                                  | Harker 1954; (j.)                        |
| purpurata                   | Ephemerus purpurata            | Ulmer, 1920     | PT (2)       | M     | Ephemerida           | Caenida                                      | Alar-Archer and Proven 1975              |
| purpuratus                  | Carinias purnarius             | Malcolm, 1976   | PT (1)       | M     | Carinias             | Caenida                                      | Alar-Archer and Proven 1975              |
| rhenensis                   | Heterocloeon rhenensis        | Müller-Liebenau, 1974 | HT, PT (1)   | M     | Heterocloeon        | Ephemerida                                   | Schwemer 1974                           |
| rosaces                     | Enepheles rosaces              | Turville, 1928b  | PT (1)       | M     | Enepheles            | Ephemerida                                   | Schwemer 1974                           |
| saturei                     | Ephemera saturei               | Ulmer, 1912     | PT (2)       | M     | Ephemera             | Caenida                                      | Schwemer 1974                           |
| scotti                      | Saphytides scotti              | Ulmer, 1916     | HT (1)       | M     | Saphytides           | Ephemerida                                   | Schwemer 1974                           |
| schaffneri                  | Simothraulus schaffneri        | Ulmer, 1916     | HT (1)       | M     | Simothraulus         | Leptophlebiidae                              | Schwemer 1974                           |
| Taxon     | Original name                  | Literature & Complementary information                                                                 | Current nomenclature                      | Family                       |
|-----------|--------------------------------|----------------------------------------------------------------------------------------------------------|-------------------------------------------|------------------------------|
| sikorai   | Euthyplocia sikorai            | Vayssière, 1895                                                                                          | Proboscidoplocia sikorai (Vayssière, 1895) | Euthyplociidae              |
| sinensis  | Iron sinensis                  | Ulmer, 1926                                                                                              | Epeorus sinensis (Ulmer, 1926)            | Heptageniidae               |
| soror     | Baetis soror                   | Ulmer, 1908, Pathz, 1972                                                                                   | Offalanius soror Ulmer (1908)             | Baetidae                    |
| sudanense | Centroptilum sudanense         | Ulmer, 1916                                                                                              | Bugilliesia sudanense Ulmer (1916)       | Baetidae                    |
| sumatrana | Baetis sumatrana               | Ulmer, 1939                                                                                              | Heterocloeon curiosum (McDunnough, 1923) | Baetidae                    |
| ulmeri    | Asionurus ulmeri               | Braasch & Soldán, 1986                                                                                     | Behningia ulmeri Lestage, 1930            | Behningiidae                |
| ulmeri    | Baetis ulmeri                  | Müller-Liebenau, 1981                                                                                      | Baetis ulmeri Münch, 1930                 | Baetidae                    |
| ulmeri    | Asionurus ulmeri               | Brush & Webb, 2006                                                                                        | Dipgonotus ulmeri Sartori et al., 2008    | Heptageniidae                |
| ulmeri    | Trichogenia ulmeri             | Braasch & Webb, 2006                                                                                       | Trichogenia ulmeri Sartori et al., 2008   | Heptageniidae                |
An updated list of type material of Ephemeroptera Hyatt & Arms, 1890...

| Taxon          | Original name            | Author(s), year | Type (state) | Stage | Current nomenclature                                      | Family          | Literature & Complementary information |
|----------------|--------------------------|-----------------|--------------|-------|----------------------------------------------------------|-----------------|-----------------------------------------|
| ulmeriana     | Caenis ulmeriana         | Malzacher, 2015  | HT, PT (1, 3)| M, F  | Caenis ulmeriana Malzacher, 2015                        | Caenidae        |                                          |
| umbrata       | Teloganella umbrata      | Ulmer, 1939     | HT (1)       | SF    | Teloganella umbrata Ulmer, 1939                         | Telogandellidae |                                          |
| unguicularis  | Euphyurus unguicularis   | Ulmer, 1917     | PT (1)       | M     | Austrophlebiodes unguicularis (Ulmer, 1917)              | Leptoplebiidae  | Campbell and Suter 1988                 |
| unguiculatus  | Campsorus unguiculatus   | Ulmer, 1920     | ST (2)       | M     | Tortopsis unguiculatae (Ulmer, 1920)                    | Polymitarcyidae | Molineri 2010                           |
| usingi        | Rhithrogena usingi       | Esben-Petersen, | PT (2)       | M     | Rhithrogena germanica Eaton, 1885 (syn.)                | Heptageniidae   | Sowa 1971                               |
| verum         | Pseudocloeon verum       | Müller-Liebenau, | PT (1, 3)    | N     | Liebebiella vera (Müller-Liebenau, 1981)               | Bætidae         | Wältz and McCafferty 1987              |
| virens        | Cloeon virens            | Klapalek, 1905b | ST (2, 3)    | M, F  | Cloeon virens Klapalek, 1905                           | Bætidae         |                                          |
| vitellinum    | Centroptilum vitellinum  | Ulmer, 1939     | HT (2)       | M     | Centroptilum vitellinum Ulmer, 1939                    | Bætidae         |                                          |
| winckleri     | Isonychia winckleri      | Ulmer, 1939     | ST (2)       | M, E SF| Isonychia winckleri Ulmer, 1939                         | Isonychiidae    | (a.)                                    |
| wui           | Leptophlebia wui         | Ulmer, 1936     | ST (1)       | M, F  | Leptophlebia wui Ulmer, 1936                           | Leptoplebiidae  |                                          |
| wui           | Caenis wui               | Malzacher, 2016 | HT, PT (1,3) | N     | Caenis wui Malzacher, 2016                             | Caenidae        |                                          |

**Missing material**

| asiaticum     | Cinygma asiaticum        | Ulmer, 1924     | ST (2)       | M     | Incertae sedis                                          | Heptageniidae   | Tšernova and Below 1982                 |
| klapaleki     | Pseudocloeon klapaleki   | Müller-Liebenau,| PT (1)       | N     | Liebebiella klapaleki (Müller-Liebenau, 1982)           | Bætidae         | Wältz and McCafferty 1987              |
Georg Ulmer was an outstanding specialist and his comprehensive studies on the faunistics and taxonomy of various groups of freshwater invertebrates formed the foundation of the recent taxonomy and systematics of those groups, especially Ephemeroptera and Trichoptera.

In addition to Ulmer’s collection, the ZMH also stores primary type material described by other authors, such as Klapalek (1905a,b), Lestage (1930, 1935), Malzacher (1976, 2015, 2016), Müller-Liebenau (1971, 1974, 1980a, b, 1981), and Sartori (2008, 2014e). An interesting finding was the discovery of several paratypes of species described by Esben-Petersen (e.g. 1909, 1912a, b, 1913), which were not labelled as such but come from the type series, judging from the dates and places on labels. More information on these mayfly specialists can be found at http://www.ephemeroptera.de/inhaltsverz_deutsch/Galerie____/galerie____.html, a webpage maintained by Udo Jacob and Arne Haybach.

The only attempt, prior to this type catalogue, has been made by Weidner (1962, 1964a, 1977), who published a list of Ephemeroptera type material deposited in ZMH, without any taxonomic remarks. At that time, 121 species were mentioned. This catalogue is accessible online (https://www.cenak.uni-hamburg.de/sammlungen/zoologie/entomologie/typenkatalog.html).

Multiple subsequent taxonomic surveys utilizing a variety of different, high-resolution methods (morphological and molecular) led not only to the description of many new taxa, but also several supraspecific changes (e.g. Peters and Edmunds 1972; Puthz 1977; Braasch and Soldán 1986; Campbell and Suter 1988; Gillies 1990; Grant and Peters 1993; McCafferty and Waltz 1995; Lugo-Ortiz and McCafferty 1996, 1999; Sartori et al. 2008; Sartori 2014a, b, c.).

The catalogue that follows is arranged alphabetically by species name, followed by the original combination, author(s) name and year of publication. For each entry, an actual nomenclature (valid names or synonymy) is given. The kind of type and the metamorphic stage of specimens are abbreviated as indicated in the table header. The present study is a completely independent and new work; data reported by Weidner were not copied as a base for this catalogue. This study is entirely original work, based on the first author’s specimen-by-specimen examination of the ZMH collections from December 2013 to June 2014. Recent publications by Malzacher (2015, 2016) on Ulmer’s collection were also added.

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