



POLYMORPHISM AND TAXONOMIC PROBLEMS IN THE *PERLODES MICROCEPHALUS* GROUP (PLECOPTERA: PERLODIDAE); *PERLODES MORTONI* REMOVED FROM SYNONYMY

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ABSTRACT

Perlodes spp. of the *microcephalus*-group can presently be identified only by microscopic sclerites on the edge of the egg anchor. However, males from populations identified by egg structure have characteristic frequency distributions of relative wing lengths (RWL) which are helpful in species distinctions. Across its range, *Perlodes dispar* is uniform both with regard to male RWL and egg anchor sclerites. Apart from a single small German population, *P. microcephalus* is uniform with regard to egg anchor sclerites, but polymorphic concerning male RWL. *P. dispar* and *P. microcephalus* are frequently sympatric biospecies. The allopatric *Perlodes mortoni* (Klapálek, 1906) from the British Isles is removed from synonymy with *P. microcephalus* (Pictet, 1833) and regarded as a distinct species. It resembles *P. dispar* by invariably micropterous males. The egg anchor sclerites differ from both other species but individual variation is so remarkable that no characteristic species standard can be described. The biospecies status of *P. mortoni* needs confirmation with other methods.

Keywords: *Perlodes* spp., *Perlodes mortoni* spec. propr., polymorphism, brachypterism, egg anchor, sympatry, allopatry, biospecies.

INTRODUCTION

The taxonomy of *Perlodes* species was confused until Claude Berthélemy (1964) conducted a comparative study of the eggs. In the present paper only taxa with short pyramidal, approximately tetrahedric eggs with a very wide collar-less anchor pole, i.e., the *Perlodes microcephalus* group, are addressed.

Berthélemy (1964) showed that characters on which species distinctions had previously relied are unsuitable. For example, the type species of the genus, *P. microcephalus* (Pictet, 1833) had been given its name because of its allegedly narrow head. In fact, relative head width does not differ appreciably between species (Berthélemy 1964). Extreme shortness of male wings in the population in the river

Saale at Halle had struck Burmeister (1839). Pictet (1841) was uncertain if this was a malformation, or a species different from his *P. microcephalus*. Rambur (1842) referred to Burmeister and Pictet, and compared his new species *Perla dispar* to an "abortive specimen" of other macropterous taxa found together with it on the banks of the river Seine at Paris. Already Brinck (1954) had called *P. microcephalus* variable, and Berthélemy (1964) quantitatively described wing polymorphism and marked shortwingedness in males of *Perlodes microcephalus*. Comparison of specimens identified by their characteristic eggs revealed that colouration and proportions of the female subgenital plate were equally unreliable (Berthélemy 1964).

Distinctive traits of *Perlodes* eggs described by

Berthélemy (1964) have proven valid and are also suggested for species distinctions in some recent taxonomic synopses (Tierno de Figueroa et al. 2003, Fochetti & Tierno de Figueroa 2008). How males can be reliably identified except "*ex societate feminarum*" remains unclear because wing length varies in at least one of the species, and genital characters are not known.

Years ago I studied a female syntype of *P. mortoni* from Scotland. Its eggs agreed neither with *P. microcephalus* of which it is supposedly a synonym (Illies 1955) nor with *P. dispar*. Interest in the matter was revived when I accidentally discovered a North German *Perlodes* population which seemed to be *P. mortoni*. The present study shows that *P. mortoni* from the British Isles is much more similar to *P. dispar* than to *P. microcephalus*. Probably, the British populations represent a separate species.

MATERIALS AND METHODS

Fore wing length from base to tip (WL) and head width across the eyes (HCW) of alcohol preserved specimens were measured with an eyepiece micrometer on a WILD M5 dissecting microscope at 6-50x. To eliminate effects of absolute specimen size the degree of brachypterism was expressed as relative wing length, $RWL = WL/HCW$.

Eggs dissected from females were dehydrated and mounted in Euparal, several with the anchor pole detached and upright in the slide mount. Sclerites of the anchor disc margin were drawn with a drawing tube on a Leica DMLS compound microscope at 600x. Eggs from individual females were all similar.

RESULTS AND TAXONOMY

Females of all species were macropterous and able to fly, RWL ranging from 3.6-5.5.

Perlodes microcephalus (Pictet 1833)

Material examined. Numerous specimens from Germany, Switzerland, Austria, North and South Italy, Greece and Anatolia were examined for egg structure. Biometry was additionally performed on the following: Germany: Hesse, upper course of river Fulda between Obernhausen and Ried, 11♂, 11♀; Hesse, Spessart, tributary to river Schmale Sinn, 7♀;

Lower Saxony, Harz Mts, Hohegeiss, 1♀; Northrhine Westphalia, Albaum, 2♂, 1♀ (det. J. Aubert); Baden-Württemberg, river Kocher at Gaildorf, 2♂, 1♀; Bavaria, Bavarian Forest, Rotbach at Böbrachmühle, 3♂. Austria, Pongau, Eben, 2♂. Switzerland, Hochrhein at Sargans, 3♂, 2♀. Turkey, Armenia, Pülümür Pass, 3♂, 1♀; North Anatolia, Pass between Terfenni and Korkuteli, 1500m, 8♂, 13♀.

Assigned to *P. microcephalus* with doubt: Germany, Lower Saxony, Medingen, 8♂, 5♀.

Brachypterism. Males range from strongly to barely brachypterous, several have a RWL similar to females. Wing length variation does not seem to be random but to occur stepwise. Should this be confirmed in larger samples the phenomenon might be related to number of larval instars through which specimens grew before metamorphosis.

Egg structure. Sclerites on the anchor disc margin are well delimited and large. They are 2-3 times longer in radial direction than they are wide in peripheral direction. Sclerite orientation is oblique, sclerite tips point in a clockwise direction.

Variation between specimens from central Germany, Italy (Sila Grande), or Anatolia is normally not greater than between individual platelets of the illustrated specimen (Fig. 5). However, a female from N. Italy and one from Greece, Olympus, had shorter platelets.

Aberrant population. A sample from N. Germany, Medingen near Uelzen, is assigned to *P. microcephalus* with some doubt. Variation of male wing length (Fig. 2) seems to resemble *P. microcephalus* but sclerites on the egg anchor are different between specimens and resemble some of the *P. mortoni* eggs shown in Fig. 5.

A single female of *P. dispar* was taken at the same site.

Notes. Types of *Perla microcephala* are no longer available (Zwick 1972). I regard Berthélemy (1964) as first revisor in the sense of the INTERNATIONAL CODE OF ZOOLOGICAL NOMENCLATURE and follow his interpretation of the name.

Perlodes dispar (Rambur 1842)

Material examined. Numerous specimens from Germany and the entire range between Toulouse, Sweden and Armenia were examined for egg structure. Biometry was performed on 12♂ and 7♀

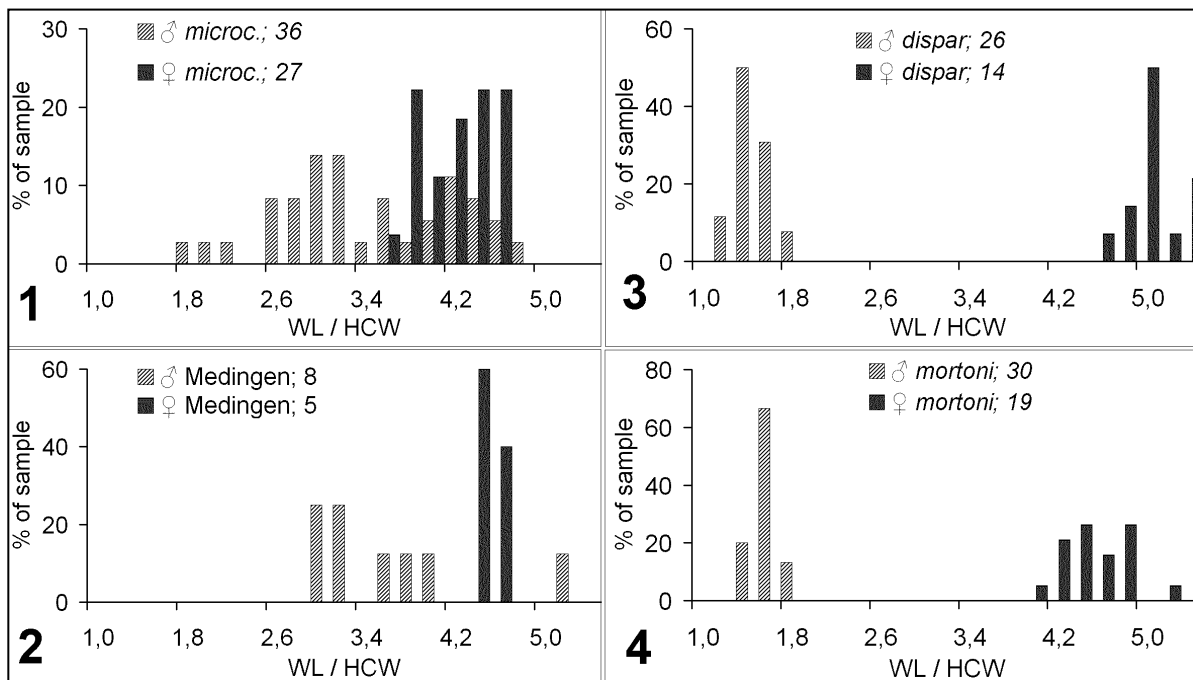
from Germany, Hesse, river Fulda at Schlitz-Richthof, 10♂, 7♀ from Hungary, river Raba at Magyarlak, and single males from Rio Lozoya, central Spain; France, Pont du Gard; Sweden, R. Njva; and Armenia, Village Kasach.

Brachypterism. Male wings are between 1.2 and 1.8 times as long as head width, the distribution peaks at a RLW of 1.4. In a RWL frequency distribution, males are widely separate from females.

Egg structure. The anchor disc margin is covered by numerous irregularly shaped polygons which are barely sclerotized and were difficult to draw (Fig. 5).

No individual or geographical variation was observed.

Notes. Albarda (1889) studied the types of Rambur's Perlidae in coll. Selys-Longchamps. He identified the single male from Paris as "*Dictyoptyx microcephala* Pictet, ♂, forma microptera" which supports the present interpretation of the name. All males in samples including *P. dispar* females were very dark, live specimens appearing almost black and the way in which they moved to hide reminded one of rove beetles (Coleoptera: Staphylinidae).



Figs. 1-4. *Perlodes* spp., frequency (% of sample) of particular relative wing-lengths (RWL = WL/HCW) in males and females. 1. *P. microcephalus*. 2. *P. microcephalus* (?) from Medingen, N. Germany. 3. *P. dispar*. 4. *P. mortoni*. Figures in legends are the numbers of specimens measured; compare text for origin of samples.

***Perlodes mortoni* Klapálek 1906, species propria**

Material examined. *Syntypes.* The complete original material sent by K. J. Morton seems to be in Klapálek's collection in the Natural History Museum at Praha Kunratice. Most specimens are from "Uddington, 13.iv.1902, K.J. Morton" or very similar collecting dates, plus several specimens from

Carluk, Scotland, K.J. Morton (several dates; one ♀ with "*Dictyoptyx microcephala* Pict." in Morton's hand). There are also 1♂, 1♀ from "3.v.80 Gotha Dr. Müller" mentioned in Klapálek (1906). Several Scottish specimens are labelled "Cotype", only 2♀ from "Uddington, 13.iv.1902, K. J. Morton" are labelled "Type". For lack of time, biometry was not performed and only one of the latter two females was

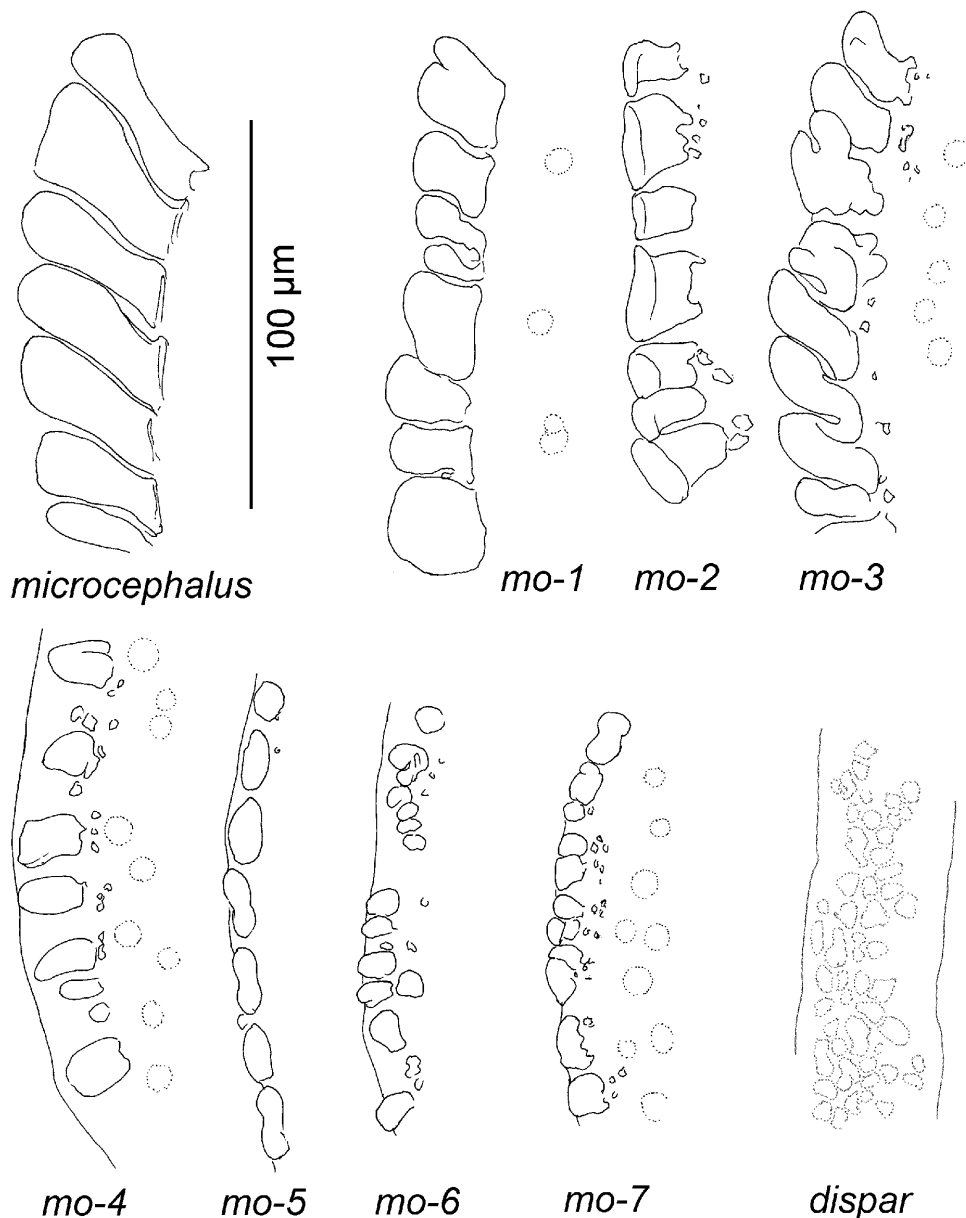


Fig 5. *Perlodes* spp., sclerite platelets on periphery of anchor disc of German *P. microcephalus* (River Fulda at Ried), *P. dispar* (River Fulda nr Schlitz), and Scottish *P. mortoni*. *mo-1* to *mo-7* show individual ♀♀, most from River Tweed, *mo-2* from River Dee. There are 5 ♀♀ similar to *mo-3* (including one from River Tay), 4 ♀♀ are similar to *mo-6*, 5 ♀♀ (rivers Tweed and Dee) are similar to *mo-7*. Orientation (centre of anchor disc is towards right hand side) and scale same for all.

studied for eggs. Its abdomen is detached and on a card pinned with the fore body, several eggs are in Euparal on a plastic slide pinned with the specimen, plus a few eggs on a glass slide presently in my collection.

Additional material. Scotland: R. Tweed at Innerleithen, 1.v.2010, D. Pryce, under stones, 25♂, 15♀; Perthshire, Dunkeld, R. Tay, late April 1990, Andreas Zwick, 1♂, 1♀; Wales: R. Dee at Pen-y-Lan,

Clwyd/Shropshire border, iii.2004, Malaise trap, D. Pryce, 4♂, 3♀;

Brachypterism. Very similar to *P. dispar*, male wings between 1.4 and 1.8 times as long as head width, peaking at a RWL of 1.6 (Fig. 4).

Egg structure (Fig. 5). Sclerites on the anchor disc margin differ extremely between specimens taken together, ranging from relatively large plates longer than wide and in one case also with a clockwise twist (*mo-3*) to irregularly shaped sclerites placed at distances from each other along the disc periphery, to a single row of short, transverse sclerites (*mo-5*), and ultimately, numerous small sclerites which on their medial edge may not be clearly separate from very small sclerotized patches (*mo-6*, *mo-7*).

The spectrum of observed character expressions was similar between British rivers, there were more specimens with relatively small than with large sclerites. There are no clear differences from the presumed aberrant population of *P. microcephalus* from Medingen, N. Germany.

Unlike in *P. dispar*, brown pigmentation and sclerotization of structures along the anchor disc margin were always expressed.

Notes. Illies (1955) formally synonymized *P. mortoni* with *P. microcephalus*. Evidence for this decision was not mentioned. Historical specimen labels reveal that K. J. Morton had felt the same. Other students also agreed that the single British - Irish *Perlodes* is indeed *P. microcephalus* (for example, Hynes 1967, 1977, Costello 1988a, Elliott 1992, Ashe, O'Connor & Murray 1998). Short-wingedness of the Irish Plecoptera received special attention but no male *P. mortoni* was available (Costello 1988b).

I abstain from the originally intended lectotype designation because: 1, not all of the evident syntypes could be adequately studied; 2, fresh material shows that egg anchor sclerites vary too much for any single specimen to represent a reference specimen characteristic of the species.

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REFERENCES

- Albarda, H. 1889. Notes sur les perlides décrites par le Dr. Rambur. *Annales de la Société Entomologique de Belgique*, 33:37-49.
- Ashe, P., J.P. O'Connor, & D.A. Murray. 1998. A Checklist of Irish Aquatic Insects. Occasional Publications of the Irish biogeographical Society, 3, 80 pp.
- Aubert, J. 1952. Plécoptères décrits par le R. P. L. Navás S.J. 3. Les espèces de la péninsule ibérique. *Mitteilungen der schweizerischen entomologischen Gesellschaft*, 25:242-250.
- Berthélemy, C. 1964. Intérêt taxonomique des œufs chez les *Perlodes* européens. [Plécoptères]. *Bulletin de la Société d'Histoire Naturelle de Toulouse*, 99:529-537.
- Brinck, P. 1954. On the classification of the Plecopteran subfamily Perlodinae. *Opuscula Entomologica*, 19:190-201.
- Burmeister, H.C.C. 1839. Achte (14.) Zunft. Umschlagsfalter. Plecoptera. Pp. 863-881. *In: Handbuch der Entomologie* 2²: I-XII, 757-1050.
- Costello, M.J. 1988a. A review of the distribution of stoneflies (Insecta, Plecoptera) in Ireland. *Proceedings of the Royal Irish Academy*, 88 B (1):1-22.
- Costello, M.J. 1988b. Preliminary observations on wing-length polymorphism in stoneflies (Plecoptera: Insecta) in Ireland. *Irish Naturalists' Journal*, 22 (11):474-478.
- Elliott, J.M. 1992. The effect of temperature on egg hatching for three populations of *Perlodes microcephala* (PLECTET) and three populations of *Diura bicaudata* (LINNAEUS) (Plecoptera: Perlodidae). *Entomologists' Gazette*, 43:115-123.
- Fochetti, R. & J.M. Tierno de Figueroa. 2008. Plecoptera. *In: Fauna d'Italia*, vol. 43. Ed. Calderini de Il Sole 24 ore. Milan. 339 pp.
- Hynes, H.B.N. 1967. A key to the adults and nymphs of the British stoneflies (Plecoptera) with notes on their ecology and distribution. *Scientific Publications - Freshwater Biological Association*, 2nd extended ed., 17:1-91
- Hynes, H.B.N. 1977. A key to the adults and nymphs of the British stoneflies (Plecoptera) with notes on their ecology and distribution. *Scientific Publications - Freshwater Biological Association*, 3rd ed., 17:92 pp.

- Illies, J. 1955. Steinfliegen oder Plecoptera. *In*: Dahl, F. (ed.) 1955. Die Tierwelt Deutschlands und der angrenzenden Meeresteile 43:I-IV;1-150.
- Illies, J. 1966. Katalog der rezenten Plecoptera. Das Tierreich, Lieferung 82: I-IXX; 1-632.
- ICZN, International Commission on Zoological Nomenclature 2000. International Code of Zoological Nomenclature. Fourth Edition. <http://www.nhm.ac.uk/hosted-sites/iczn/code/>
- Kimmins, D.E. 1970. A list of the type-specimens of Plecoptera and Megaloptera in the British Museum (Natural History). *Bulletin of the British Museum of Natural History, Entomology*, 24(8):335-361.
- Klapálek, F. 1906. Revise a synopsis evropských Dictyopterygid. *Rozpravy České Akademie* [2], 15 (32):1-35.
- Newman, E. 1839. On the synonymy of the Perlites, together with brief characters of the old, and of a few new species. *Annals and Magazine of Natural History*, [2], 3 (25):32-37.
- Pictet, F.J. 1833. Mémoire sur les métamorphoses des Perles. *Annales des Sciences Naturelles* 28:44-65, pls V, VI.
- Pictet, F.J. 1841. Histoire naturelle générale et particulière des insectes Névroptères. Famille des Perlides. Kessmann. 1. Partie: I-XIII, 1-423, 53 plates, with legends on 23 pp.
- Rambur, J.P. 1842. Histoire naturelle des insectes. Névroptères. Paris, XVIII+534 pp., 12 pls.
- Tierno de Figueroa, J.M., A. Sánchez-Ortega (+); P. Membiela-Iglesia, & J.M. Luzón-Ortega. 2003. Plecoptera. *In*: Fauna Ibérica, vol. 22. Ramos, M.A. et al. (eds.). Museo Nacional de Ciencias Naturales. CSIC. Madrid. 2003. 404 pp.
- Zwick, P. 1972. Die Plecopteren Pictets und Burmeisters, mit Angaben über weitere Arten (Insecta). *Revue suisse de Zoologie*, 78 (1971):1123-1194.