Zootaxa 3955 (1): 045–064
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

http://dx.doi.org/10.11646/zootaxa.3955.1.2
http://zoobank.org/urn:lsid:zoobank.org:pub:04C3DC7D-07DE-458A-8F0D-DB494AB1A8CB

Comments on the biology of *Sciodrepoides watsoni watsoni* (Spence, 1813) with descriptions of larvae and pupa (Coleoptera: Leiodidae: Cholevinae)

ALEKSANDRA KILIAN[1,4] & ANNA MĄDRA[2, 3]

[1]*Department of Biology, Evolution and Conservation of Invertebrates, University of Wrocław, Przybyszewskiego 63/77, 51-148 Wrocław, Poland. E-mail: aleksandra.kilian@uni.wroc.pl*

[2]*Natural History Collections, Faculty of Biology, Adam Mickiewicz University, Umultowska 89, 61-614 Poznań, Poland*

[3]*Laboratory of Criminalistics, Faculty of Law and Administration, Adam Mickiewicz University, Św. Marcin 90, 61-809 Poznań, Poland. E-mail:madan@amu.edu.pl*

[4]*Corresponding author*

Abstract

The late-instar larva of *Sciodrepoides watsoni watsoni* is redescribed and the egg, first and second instar and pupa are described for the first time. Immature stages habitus, chaetotaxy, detailed illustrations and details of life cycle are provided. Previous descriptions of larva of *S. watsoni* are discussed. The structures of larvae of *S. watsoni* are compared with those of other known larvae of Cholevinae.

Key words: Coleoptera, Staphylinoidea, Leiodidae, Cholevinae, egg, larva, pupa, chaetotaxy, Palaearctic

Introduction

Sciodrepoides watsoni (Spence, 1813) is the most widespread member of Cholevinae, present in 35 European and six Asian countries (Perreau 2004), inhabiting western and northern Asia to Japan and temperate zone of Northern America (Szymczakowski 1961). Although it is one of the most common and abundant necrophagous species (Mroczkowski 1978; Ulrich *et al.* 2007), data on its biology and distribution are still scarce as for most of Leiodidae. This is probably due to their small size, identification difficulties and hidden way of life. *Sciodrepoides watsoni* is defined as a warm-season species and spring breeder (Topp 1994). It can reproduce successfully at relatively high temperatures (>16°C) and under long day conditions (16L: 8D) (Topp 2003). It is active for the most of vegetation season: from April to October (Růžička 1994; Mądra *et al.* 2010). The peak of its activity falls in the middle of summer (Růžička 1994; Mądra *et al.* 2010) or in late spring (Kočárek 2002). Late summer generation usually dies in late autumn and early winter. At the same time begins the development of the spring generation, which appears in March (Szymczakowski 1961). It is an omnipresent species, but shows preference for open habitats (Růžička 1994; Kočárek 2002, 2003). It feeds on decaying plant and animal matter (Szymczakowski 1961).

Sciodrepoides watsoni was also listed in few studies concerning carcass entomofauna (Růžička 1994; Kočárek 2003; Ulrich *et al.* 2007; Schlechter 2008) and forensic entomology (Matuszewski *et al.* 2008; Schilthuizen *et al.* 2011), however its significance in the latter is rather irrelevant.

Among 13 species of *Sciodrepoides* Hatch, 1933 (http://cholevidae.myspecies.info/), immature stages are known only for *S. watsoni.* The mature final instar larva was described by Eichelbaum (1901) as *Catops watsoni.* This and the single illustration were cited by Paulian (1941), who added some extra detail.

Accepted by W. Hall: 6 Mar. 2015; published: 1 May 2015

frontal and clypeal part of head. Pronotum seems to have the same number and arrangement of setae, mesonotum and metanotum have the same, 2 pairs of setae, while abdominal segments look more setose than in *S. watsoni*. Personal observation of one of authors lead to conclusion, that pupae of Cholevinae must differ very little because pupa of *S. watsoni* is very similar to pupa of the only North American member of the primarily Palaearctic Leptodirini, *Platycholeus hamatus* n. sp. (in prep.) in: arrangement and number of setae, number of terminal prolongations (pseudocerci) and microsculpture.

Life cycle. Deleurance-Glaçon studied the life cycles of 23 species of Leptodirini (1958a,b, 1963, 1964) and provided a lot of interesting data about changes in biology of cavernicolous species (for example fewer and larger eggs, fewer immature stages) but life cycles of representatives of other subfamilies are far less studied, which makes it impossible to provide fully comparative data of process of adaptation to cavernicolous life, still, since in 1986 Peck postulated.

Data about life cycle was provided also for different species of cavernicolous *Ptomaphagus* Illiger, 1798 (Peck 1973; Sbordoni & Cobolli-Sbordoni 1973; Peck 1975, 1983, 1984, 1986) or other Ptomaphagini (Gnaspini 1993a), some information about life cycle of *Ch. holsatica* provided Heun (1955) and Casale (1975) for *Ch. agilis*.

The length of the life-cycle of *S. watsoni* (ca. 20 days) is relatively short as compared to other Cholevinae (e.g. *Choleva holsatica*: 103 days, *Ptomaphagus hirtus*, 92 days, *Catops nigricans*: 50 days) (Heun 1955; Peck 1975). However, *S. watsoni* is a warm-season species and was bred at ca. 20°C, contrary to mentioned representatives of Cholevinae, which are cold-season or cave-inhabiting species and were bred at as follows: 8, 12.5 and 15°C (Heun 1955; Peck 1975; Topp 1990, 2003). Interestingly, the length of life cycle of recently studied representative of Camiarinae *Zearagytodes maculifer* (Broun, 1880), was about 25 days at 21°C (Kadowaki *et al.* 2011). However, to compare these life cycles, temperature-dependent growth models would be necessary.

Our observations concerning the appearance of eggs and behaviour of the larvae are in line with those of *Ch. holsatica* and *P. hirtus* (Heun 1955; Peck 1975). Heun (1955) and Peck (1975) also noticed oval and whitish coloured eggs, covered with soil and debris, laid at random locations. Similarly to us, Heun (1955) observed that at the end of egg development, the chitinized parts of larva are visible through the egg membrane. The size of *S. watsoni* egg is significantly smaller as compared to *Ch. holsatica,* especially in width (Heun 1955).

The most detailed description of larval behaviour of Cholevinae larvae is presented in Heun's work on *Ch. holsatica*. Some elements of behaviour described by Heun (1955) were also observed in *S. watsoni*: quickly moving larvae, using pygopod for locomotion, attachment to the food source, building larval cocoon etc. We did not observe any behaviour specific to *S. watsoni*.

In our experiment individuals of *S. watsoni* fed with dead animal material, as all members of Cholevini, which are reported as scavengers, both as larvae and adults (Peck & Cook 2002). However, they were captured preferably on carrion of small rodents (Kočárek 2003; Schlechter 2008) or small pieces of rotten meat in baited traps (Růžička 1994; Kočárek 2002; Ulrich *et al.* 2007) where they occurred in large numbers.

Acknowledgments

We are grateful to Prof. Andrzej Warchałowski (University of Wrocław) for help with translating descriptions of Eichelbaum and Paulian. We also grateful to PhD Jonathan Cooter for reading the manuscript. Thanks are also extended to M.Sc. Dawid Bielewicz (Adam Mickiewicz University in Poznań) for molecular analyses and to PhD Eng. Radosław Stelmaszczyk for his help with preparing some of digital imaging. This study was funded by 1076/S/IBŚ/2014 and GIWB-04/2011.

References

Adamczyk, B., Kilian, A. & Salgado, J.M. (2011) Description of the larva of *Quaestus* (*Quaesticulus*) *pachecoi* (Bolivar,1915) (Coleoptera: Leiodidae: Cholevinae). *Annales Zoologici*, 61, 691–708. http://dx.doi.org/10.3161/000345411X622534

Ashe, J.S. & Watrous, L.E. (1984) Larval chaetotaxy of Aleocharinae (Staphylinidae) based on a description of *Atheta coriaria* Kraatz. *The Coleopterists Bulletin*, 38, 165–179.

Blas, M. & Vives, E. (1978) A proposito de la biologia y desarrollo de *Cholevinus pallidus* (Ménétries, 1832) (Col. Catopidae). *Miscelánia Zoológica (Barcelona),* 4, 147–159.

Boehme, P., Amendt, J. & Zehner, R. (2012) The use of COI barcodes for molecular identification of forensically important fly species in Germany. *Parasitology Research*, 110, 2325–2332.
http://dx.doi.org/10.1007/s00436-011-2767-8

Casale, A. (1975) Ciclo biologico e morfologia preimmaginale di Coleoptera Staphylinoidea delle famiglie Leptinidae e Catopidae. *Redia*, 56, 199–230.

Cholevidae of the World (2014) Available from: http://cholevidae.myspecies.info/ (accessed 30 October 2014)

Decou, V.G. (1973) Recherches sur les Colepteres hypoges de Cuba. III. Catopidae-Catopinae: *Proptomaphaginus apodemus* Szymczakowski. *In: Resultats des expeditions biospeologiques cubano-roumaines a Cuba*. Editura Academiei Republicii Socialiste Romania, Bucharest, pp. 367–372.

Deleurance-Glaçon, S. (1961) Morphologie des larves de *Royerella tarissani* Bedel et Leptodirus hohenwarti Schm. *Annales de Speleologie*, 16, 193–198.

Deleurance-Glaçon, S. (1963) Recherches sur les Coleopteres troglobies de la sous-famille des Bathysciinae. *Annales des Sciences Naturelles, Zoologie*, 5, 1–172.

Deleurance, S. (1957) Description de la morphologie externe larvaire de *Diaprysius serullazi* Peyer. (Col. Bathysciitae). *Notes Biospeologiques*, 12, 17–22.

Deleurance, S. (1958a) Biologie et morphologie larvaire d'*Isereus serullazi* F., *Isereus colasi* Bon. et *Cytodromus dapsodes* Ab. *Comptes Rendus Hebdomadaires de l'Academie des Sciences*, 246, 3286–3287.

Deleurance, S. (1958b) Morphologie de la larve de *Bathysciella jeanneli* Ab. *Comptes Rendus Hebdomadaires de l'Academie des Sciences*, 246, 1926–1927.

Eichelbaum, F. (1901) Die Larven von *Catops watsoni* Spence and *Catops picipes* (?) Fbr. *Berliner Entomologische Zeitschrift*, XLVI, 9–14.

Folmer, O., Black, M., Hoeh, W., Lutz, R. & Vrijenhoek, R. (1994) DNA primers for amplification of mitochondrial cytochrome c oxidase subunit I from diverse metazoan invertebrates. *Molecular Marine Biology and Biotechnology,* 3, 294–249.

Franciscolo, M.E. (1956) Studio comparativo sulle larve mature delle specie liguri cavernicole del genere *Parabathyscia* Jeann. *Premier Congres International de Speleologie. Communications*, *1953*, 3, 95–112.

Gnaspini, P. (1993a) Brazilian Cholevidae (Coleoptera), with emphasis on cavernicolous species. III. *Dissochaetus* larvae, with description of a new feature. *Revista Brasileira de Entomologia*, 37, 545–553.

Gnaspini, P. (1993b) Brazilian Cholevidae (Coleoptera), with emphasis on cavernicolous species. IV. *Adelopsis* (*Iutururuca*) - biology and description of larvae. *Memoires de Biospeologie*, 20, 91–99.

Heun, C. (1955) Biologie und Okologie von *Choleva holsatica* Ben. & Ihss. *Entomologische Mitteilungen aus dem Zoologischen Staatsinstitut und Zoologischen Museum Hamburg*, 1, 195–228.

Kadowaki, K., Leschen, R.A.B. & Beggs, J.R. (2011) Spore consumption and life history of *Zearagytodes maculifer* (Broun) (Coleoptera: Leiodidae) on *Ganoderma*, its fungal host. *New Zealand Journal of Ecology*, 35, 61–68.

Kilian, A. (1998) Morphology and phylogeny of the larval stages of the tribe Agathidiini (Coleoptera: Leiodidae: Leiodinae). *Annales Zoologici*, 48, 125–220.

Kilian, A. (2007) Comparative morphology of larval Camiarinae (Coleoptera: Leiodidae). Genus *Paragyrtodes* Szymczakowski, 1966. *Zootaxa*, 1640, 1–39.

Kilian, A. (2012) Phylogenetic analysis of Camiarinae (Coleoptera: Leiodidae) based on larval morphology. *Annales Zoologici*, 62, 11–68.
http://dx.doi.org/10.3161/000345412X633667

Kočárek, P. (2002) Small carrion beetles (Coleoptera: Leiodidae: Cholevinae) in Central European lowland ecosystem: seasonality and habitat preference. *Acta Societatis Zoologicae Bohemicae*, 66, 37–45.

Kočárek, P. (2003) Decomposition and Coleoptera succession on exposed carrion of small mammal in Opava, the Czech Republic. *European Journal of Soil Biology,* 39, 31–45.
http://dx.doi.org/10.1016/S1164-5563(02)00007-9

Lawrence, J.F. (1991) Order Coleoptera. *In:* Stehr, F.W. (Ed.), *Immature Insects*. Michigan State University. Kendall/Hunt Pub. Co., Dubuque, Iowa, pp. 144–184.

Matuszewski, S., Bajerlein, D., Konwerski, S. & Szpila, K. (2008) An initial study of insect succession and carrion decomposition in various forest habitats of Central Europe. *Forensic Science International*, 180, 61–69.
http://dx.doi.org/10.1016/j.forsciint.2008.06.015

Mądra, A., Konwerski, S., Sienkiewicz, P. & Dąbrowicz, K. (2010) Cholevinae (Coleoptera: Leiodidae) wyżynnego jodłowego boru mieszanego - *Abietetum polonicum* obwodu ochronnego "Święty Krzyż" w Świętokrzyskim Parku Narodowym. *Wiadomości Entomologiczne*, 29, 167–179.

Menozzi, C. (1939) La fauna della grotta suja sul Monte Fascie (Genova) ed osservazioni biologiche sulla *Parabathyscia doderoi* Fairm. (Col. Catopidae), con descrizione della larva e della caratteristiche morfologiche del sus intestino e di quello dell' adulto. *Memorie della Societa Entomologica Italiana*, 18, 129–154.

Mroczkowski, M. (1978) Staphylinoidea nekrofagiczne Pienin (Coleoptera). *Fragmenta Faunistica*, 22, 235–246.

Paulian, R. (1941) Les premiers états des Staphylinoidea (Coleoptera). Étude de morphologie comparée. *Mémoires du Muséum National d'Histoire Naturelle*, New Series, 15, 11–361. 382–384, (fig. 180).

Peck, S.B. (1973) A systematic revision and the evolutionary biology of the *Ptomaphagus* (*Adelops*) beetles of North America

(Coleoptera: Leiodidae: Catopinae), with emphasis on cave-inhabiting species. *Bulletin of the Museum of Comparative Zoology*, 145, 29–162.

Peck, S.B. (1975) The life cycle of a Kentucky cave beetle, *Ptomaphagus hirtus* (Coleoptera; Leiodidae; Catopinae). *International Journal of Speleology*, 7, 7–17.
http://dx.doi.org/10.5038/1827-806X.7.1.2

Peck, S.B. (1983) Experimental hybridization between populations of cavernicolous *Ptomaphagus* beetles. *Canadian Entomologist*, 115, 445–452.
http://dx.doi.org/10.4039/Ent115445-5

Peck, S.B. (1984) The distribution and evolution of cavernicolous *Ptomaphagus* beetles in the southeastern United States. *Canadian Journal of Zoology*, 62, 730–740.
http://dx.doi.org/10.1139/z84-103

Peck, S.B. (1986) Evolution of adult morphology and life-history characters in cavernicolous *Ptomaphagus* beetles. *Evolution*, 40, 1021–1030.
http://dx.doi.org/10.2307/2408760

Peck, S.B. & Cook, J. (2002) Systematics, distributions, and bionomics of the small carrion beetles (Coleoptera: Leiodidae: Cholevinae: Cholevini) of North America. *The Canadian Entomologist*, 134, 723–787.
http://dx.doi.org/10.4039/Ent134723-6

Perreau, M. (2004) Leiodidae Fleming, 1821. *In:* Löbl, I. & Smetana, A. (Eds.), *Catalogue of Palaearctic Coleoptera. Hydrophiloidea - Histeroidea - Staphylinoidea*. Apollo Books, Stenstrup, pp. 133–203.

Růžička, J. (1994) Seasonal activity and habitat associations of Silphidae and Leiodidae: Cholevinae (Coleoptera) in central Bohemia. *Acta Societatis Zoologicae Bohemicae*, 58, 67–78.

Sbordoni, V. & Cobolli-Sbordoni, M. (1973) Aspetti ecologici ed evolutivi del popolamento do grotte temperate e tropicali osservazioni sul ciclo biologico di alcune specie di *Ptomaphagus* (Coleoptera Catopidae). *International Journal of Speleology*, 5, 337–347.
http://dx.doi.org/10.5038/1827-806X.5.3.11

Schilthuizen, M., Scholte, C., van Wijk, R.E., Dommershuijzen, J., van der Horst, D., Zu Schlochtern, M.M., Lievers, R & Groenenberg, D.S.J. (2011) Using DNA-barcoding to make the necrobiont beetle family Cholevidae accessible for forensic entomology. *Forensic Science International,* 210, 91–95.
http://dx.doi.org/10.1016/j.forsciint.2011.02.003

Schlechter, J. (2008) Beetle fauna found on carrion in three woodland sites in Luxembourg (Insecta, Coleoptera). *Bulletin de Societe des Naturalistes Luxembourgeois*, 109, 97–100.

Strambi, C. (1963) Étude de la morphologie larvaire d'un Colèpteré de la famille des Catopidae (sous-famille des Catopinae) *Choleva angustata* Fabricius. *Annales de Speleologie*, 18, 495–510.

Szymczakowski, W. (1961) *Chrząszcze-Coleoptera, Catopidae. Vol. XIX*. PWN, Warszawa, 70 pp.

Szymczakowski, W. & Plath, D. (1976) Catopidae aus dem Nepal-Himalaya (Ins., Col.). *Senckenbergiana Biologica*, 57, 35–48.

Tanaka, M. (1972) Descriptions of two larvae and a pupa of Catopidae from Japan (Coleoptera). *Bulletin of the Japan Entomological Academy*, 6, 41–46.

Topp, W. (1990) Selection for an optimal monovoltine life cycle in an unpredictable environment. Studies on the beetle *Catops nigricans* Spence (Col., Catopidae). *Oecologia*, 84, 134–141.
http://dx.doi.org/10.1007/BF00665607

Topp, W. (1994) Seasonal time partitioning and polymorphism in the developmental cycles of sympatric Staphylinoidea (Coleoptera) living in an unstable environment. *In:* Dank, H.V. (Ed.), *Insect Life Cycle Polymorphism: Theory, Evolution and Ecological Consequences for Seasonality and Diapause Control*. Kluver Academic Publishers, Netherlands, pp. 277–312.
http://dx.doi.org/10.1007/978-94-017-1888-2_14

Topp, W. (2003) Phenotypic plasticity and development of cold season insects (Coleoptera: Leiodidae) and their response to climatic change. *European Journal of Entomology*, 100, 233–243.
http://dx.doi.org/10.14411/eje.2003.038

Ulrich, W., Zalewski, M. & Komosiński, K. (2007) Diversity of carrion visiting beetles at rural and urban sites. *Community Ecology*, 8, 171–181.
http://dx.doi.org/10.1556/ComEc.8.2007.2.4

Wheeler, Q.D. (1990) Morphology and ontogeny of postembryonic larval *Agathidium* and *Anisotoma* (Coleoptera: Leiodidae). *American Museum Novitates*, 2986, 1–46.

Zwick, P. (1978) Bestimmungstabelle fur die Larven der Catopidae. *In:* Klausnitzer, B. (Ed.), *Bestimungsbucher zur Bodenfauna Europas, Lieferung 10, Ordnung Coleoptera (Larven)*. Akademie-Verlag, Berlin/W. Junk, The Hague, pp. 302–303.

Zwick, P. (1979) Contributions to the Knowledge of Australian Cholevidae (Catopidae auct.; Coleoptera). *Australian Journal of Zoology, Supplementary Series*, 70, 1–56.
http://dx.doi.org/10.1071/AJZS070