Sapienza Università Editrice

E-ISSN 2284-4880
ISSN 0429-288X

Fragmenta entomologica, 54 (1): 65–68 (2022)

Short scientific note
Submitted: March 18th, 2021 – *Accepted:* October 18th, 2021 – *Published:* May 15th, 2022
DOI: 10.13133/2284-4880/490

Trapping methods and apparent commonness and rarity of small carrion beetles (Coleoptera: Leiodidae, Cholevinae)

Menno SCHILTHUIZEN

Naturalis Biodiversity Center, Darwinweg 2, 2333CR Leiden, the Netherlands – menno.schilthuizen@naturalis.nl

Abstract
Generalised trapping methods are often used for unbiased sampling of specific taxa or guilds. Two previously unpublished data sets on small carrion beetles from the Netherlands show strikingly different species abundance distributions, which probably are largely the result of methods capturing different aspects of beetle activity.

Key words: Cholevinae, pitfall traps, beetle sampling, species abundance distributions.

Standardised, large-scale trapping methods are commonly used to sample insect groups in an automated fashion. Such studies are important for monitoring contemporary changes in insect biomass and biodiversity (e.g., Gray et al. 2014; Hallmann et al. 2019; Topp et al. 2008). However, as trapping methods become more standardized and consolidated in tradition, the awareness that method-specific characteristics may not always reveal true species abundances can be lost.

The soil-dwelling small carrion beetles of the leiodid subfamily Cholevinae are hard to capture manually in sufficient quantities, which is why baited pitfall traps have always been a favoured method for collecting them (e.g., Sokolowski 1942, 1956; Tizado & Salgado 2000; Kočárek 2002). And although it has been known that certain genera and species have special habitat requirements (e.g., *Nemadus colonoides* in bird nests, *Choleva* species in small mammal burrows; Koch 1989), the general opinion about commoness and rarity in European Cholevinae has largely been based on carrion trapping results. For example, most *Choleva* and *Nargus* species are considered to be relatively uncommon compared with most *Catops*, *Sciodrepoides*, and *Ptomaphagus* species, and it is insufficiently realised that this impression may be biased by the propensity of species to be attracted by carrion-baited traps.

While curating the leiodid holdings of Naturalis Biodiversity Center, I recently had the opportunity to view the impact of trapping method on apparent commonness and rarity in Cholevinae from the Netherlands. This concerns two sizeable, previously unpublished data sets, here termed Lichtenbeek and Wijster (Table 1).

The Wijster material amounted to 5378 dry-mounted Cholevinae collected at the 3500 ha nature reserve Dwingelderveld (52.8°N 06.4°E) between 10.iii.1959 and 23.ii.1966 as bycatch of the ground beetle pitfall trapping operations of Biologisch Station Wijster (Den Boer & Van Dijk 1995). This program used unbaited square 25 x 25 cm pitfall traps dug into the soil; as preservative in the traps, 3% formalin was used (den Boer & van Dijk 1994). The Lichtenbeek data concerned 636 Cholevinae collected in the 89 ha Lichtenbeek Estate (52.00°N 05.84°E) near Arnhem. The material was collected by myself 29.v. - 5.vi.1982 using pitfall traps baited with horse meat (16 traps), mushrooms (2 traps), and Dutch old cheese (3 traps). The traps used were round 10 cm traps dug into the soil; as preservative in the traps, 70% ethanol was used. The Wijster and Lichtenbeek localities are ecologically comparable (mixed forest and heathland on sandy soil, ca. 50 m above sea level) and are separated by 95 km. All material was identified by me to species level, where necessary using genital dissection, and is deposited in the collection of Naturalis Biodiversity Center (RMNH); small numbers of duplicates are retained in my private collection.

The Lichtenbeek material is similar to other European cholevine trapping results (Latella et al. 2019; Madra et al. 2010; Růžička 1994): high abundances of several species of the genera *Catops* (e.g., *C. coracinus* 92 ex., *C. tristis* 69 ex.) and *Sciodrepoides* (e.g., *S. watsoni* 309 ex.),

Table 1 – Numbers of individuals of Cholevinae (Leiodidae) at Lichtenbeek and Wijster, arranged by order of abundance at Lichtenbeek. Full data are available from https://www.researchgate.net/profile/Menno-Schilthuizen.

	Lichtenbeek	**Wijster**
Sciodrepoides watsoni	309	32
Catops coracinus	92	42
Catops tristis	69	39
Sciodrepoides fumatus	52	6
Catops picipes	35	119
Catops subfuscus	28	8
Nargus velox	24	4470
Fissocatops westi	17	36
Catops fuliginosus	6	26
Catops chrysomeloides	1	6
Catops kirbii	1	3
Catops nigricans	1	209
Ptomaphagus sericatus	1	0
Catops morio	0	9
Nargus wilkini	0	325
Choleva spadicea	0	20
Choleva oblonga	0	12
Choleva jeanneli	0	10
Choleva glauca	0	3
Nargus anisotomoides	0	1
Choleva elongata	0	1
Choleva angustata	0	1

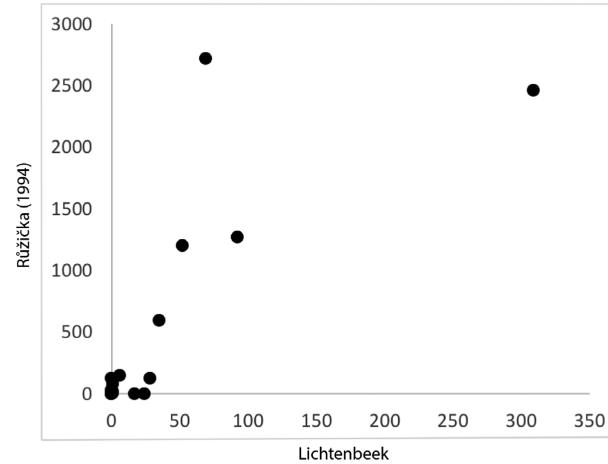

Fig. 1. Lichtenbeek data plotted against the baited-pitfall data from Růžička (1994).

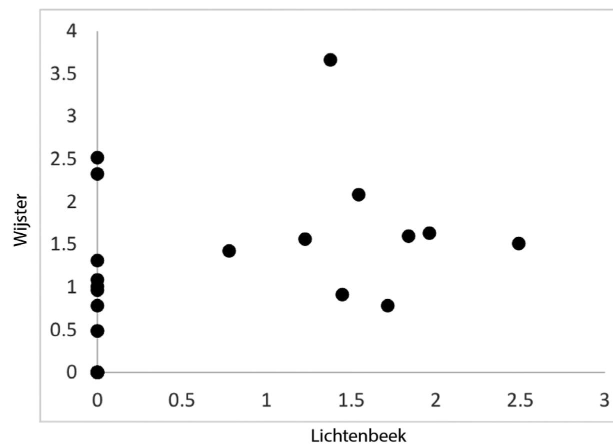

Fig. 2. Lichtenbeek data plotted against those from Wijster (log scale).

and low abundance or absence of members of *Nargus* and *Choleva*. For example, Fig. 1 shows a comparison between the Lichtenbeek data and those in the baited pitfall trapping study of Růžička in the Czech Republic (1994).

In contrast, the Wijster data show a very different picture of cholevine commonness and rarity: the unbaited pitfall traps gathered very large numbers of two *Nargus* species, *N. velox* (4470 ex.) and *N. wilkini* (325 ex.), as well as large numbers of two large-bodied *Catops* species, *C. picipes* (119 ex.) and *C. nigricans* (209 ex.). Other *Catops* and *Sciodrepoides* species were collected only in small numbers. Also of note are the relatively large numbers of *Choleva* (6 species, 47 ex.), normally rarely encountered in baited pitfall studies. Fig. 2 illustrates the absence of a correlation between the species abundance data for Wijster and Lichtenbeek.

Of course, the two trapping projects differ in important other aspects besides the type of traps used: the Wijster project took place over several years (Lichtenbeek just one week), across a wider range of environments (more than 200 traps placed across an area of at least 800 ha), and some twenty years earlier. Also, both studies used different preservatives in the traps: formalin in the Wijster project, ethanol in the Lichtenbeek project. Although no data are available specifically for their effect on attracting or repelling Leiodidae, comparative methodological studies (Brown & Matthews 2016; Gobbi et al. 2018; Knapp & Růžička 2012; Skvarla et al. 2014) have shown that the preservative used can affect the species composition yielded by pitfall traps. Nonetheless, the capture at large quantities of species normally, in my experience, rarely encountered in baited pitfalls, suggests that the main difference is caused by the different traps (i.e., baited vs. unbaited) used.

These observations have implications for the perceived commonness and rarity of species of Cholevinae. *Nargus wilkini* as well as most *Choleva* species, for example, are normally considered rare, but the Wijster data suggest that they may be much commoner than assumed and are active on the soil even if they are not normally attracted to bait. Conversely, the very high numbers of several *Sciodrepoides* and *Catops* species in the Lichtenbeek data suggest that these species are numerous but do not normally come in unbaited traps, presumably because they move around mostly by flying.

In conclusion, the Wijster material reveals that simply relying on carrion-baited traps to study cholevine biodiversity is insufficient. Ground beetle pitfall traps should also be employed to sample the fauna in a more unbiased fashion. Even then, certain species with very specific habitat requirements (e.g., *Nemadus colonoides*) will be overlooked.

Acknowledgements – I thank the former collection manager at Naturalis, Mr. Hans Huijbregts, and former head of research, Dr. Jan van Tol, for providing access to the Wijster material. Permission for the original field work in Lichtenbeek was given by Het Geldersch Landschap and in Wijster bij Natuurmonumenten and Staatsbosbeheer. Mr. Jos van der Tang helped with processing the Wijster material. Comments on an earlier version of this manuscript by an anonymous reviewer greatly improved the paper.

References

Brown G.R., Matthews I.M. 2016. A review of extensive variation in the design of pitfall traps and a proposal for a standard pitfall trap design for monitoring ground-active arthropod biodiversity. Ecology and evolution, 6(12): 3953–3964.

Den Boer P.J., Van Dijk T.S. 1994. Carabid beetles in a changing environment. Wageningen Agricultural University Papers, 94(6): i–vii, 1–30.

Gobbi M., Barragán Á., Brambilla M., Moreno E., Pruna W., Moret P. 2018. Hand searching versus pitfall trapping: how to assess biodiversity of ground beetles (Coleoptera: Carabidae) in high altitude equatorial Andes? Journal of Insect Conservation, 22(3): 533–543.

Gray C.L., Slade E.M., Mann D.J., Lewis O.T. 2014. Do riparian reserves support dung beetle biodiversity and ecosystem services in oil palm-dominated tropical landscapes? Ecology and Evolution, 4(7): 1049–1060.

Hallmann C.A., Zeegers T., Van Klink R., Vermeulen R., Van Wielink P., Spijkers H., Van Deijk J., Van Steenis W., Jongejans E. 2020. Declining abundance of beetles, moths and caddisflies in the Netherlands. Insect Conservation and Diversity, 13(2): 127–139.

Knapp M. & Růžička J. 2012. The effect of pitfall trap construction and preservative on catch size, species richness and species composition of ground beetles (Coleoptera: Carabidae). European Journal of Entomology, 109(3): 419–426.

Kočárek P. 2002. Diel activity patterns of carrion-visiting Coleoptera studied by time-sorting pitfall traps. Biologia (Bratislava), 57(2): 199–212.

Koch K. 1989. Die Käfer Mitteleuropas. Ökologie, Bd. 1. Verlag Goecke & Evers, Krefeld.

Latella L., Pedrotti L., Gobbi M. 2019. Records of Cholevinae (Coleoptera: Leiodidae) sampled by pitfall traps in the Central Italian Alps. Journal of Insect Biodiversity, 13(2): 36–42.

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(3): 167–180.

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

Skvarla M.J., Larson J.L., Dowling A.P.G. 2014. Pitfalls and preservatives: a review. The Journal of the Entomological Society of Ontario, 145: 15–43.

Sokolowksi K. 1942. Die Catopiden der Nordmark (Col Catopidae). Entomologische Blätter für Biologie und Systematik der Käfer, 38: 173–211.

Sokolowski K. 1956. Über das Ködern von Catopiden (Col.). Entomologische Blätter für Biologie und Systematik der Käfer, 52: 157–160.

Tizado E.J., Salgado J.M. 2000. Local-scale distribution of cholevid beetles (Col., Leiodidae: Cholevinae) in the province of León (Spain). Acta Oecologica, 21(1): 29–35.

Topp W., Kappes H., Rogers F. 2008. Response of ground-dwelling beetle (Coleoptera) assemblages to giant knotweed (*Reynoutria* spp.) invasion. Biological Invasions, 10(4): 381–390.