Eur. J. Entomol. **111**(1): 69–74, 2014
doi: 10.14411/eje.2014.008
ISSN 1210-5759 (print), 1802-8829 (online)

The efficiency of pitfall traps as a method of sampling epigeal arthropods in litter rich forest habitats

Johanna SIEWERS[1], Jens SCHIRMEL[2] and Sascha BUCHHOLZ[3]*

[1]Biological Station Wesel, Freybergweg 9, 46483 Wesel, Germany; e-mail: Johanna.Siewers@gmx.de

[2]Ecosystem Analysis, Institute of Environmental Science, University of Koblenz-Landau, Fortstraße 7, 76829 Landau, Germany; e-mail: schirmel@uni-landau.de

[3]Department of Ecology, TU Berlin, Rothenburgstr. 12, 12165 Berlin, Germany; e-mail: sascha.buchholz@tu-berlin.de

Key words. Araneae, Carabidae, ground-dwelling arthropods, capture efficiency, deciduous forest, methodology

Abstract. Pitfall trapping is an approved self-sampling method for capturing epigeal arthropods for ecological and faunistic studies. Capture efficiency of pitfall traps may be affected by external factors and the design of the trap. Pitfall traps set in forests are usually protected with covers or wire grids, but the effect of these constructions on sampling efficiency as well as their practicability and necessity have so far received little attention. During the present study pitfall traps of four different designs (covers, wire grids, litter exclosure, open) were tested in terms of their efficiency in capturing ground-dwelling arthropods (Acari, Araneae, Carabidae, Formicidae, Isopoda, Myriapoda, Opiliones) in order to gain a better understanding of the applicability and reliability of pitfall traps in forests. The study was carried out in an oak-beech forest in Northwest Germany using a total of 40 pitfall traps (ten replicates per trap design). Generalised linear models indicated no significant differences in arthropods counts among catches of pitfall traps of the four different designs, except for woodlice. Ordination analyses (NMDS) and MANOVA revealed no significant differences in spider and carabid beetle species compositions of the catches. In contrast, for both these taxa there were significant differences in the body sizes of the individuals caught. We conclude that the catches of pitfall traps are little affected by their design. Furthermore, the litter layer and litter input have no effect on the capture efficiency and thus there seems to be no need to protect pitfall traps with covers or wire grids in litter rich forest habitats.

INTRODUCTION

Pitfall trapping is an approved self-sampling method for collecting ground-dwelling arthropods in ecological and faunistic studies. Pitfall traps were introduced by Barber (1931) and in general they consist of cups filled with a killing and conserving fluid that are set with the rim of the cup level with the surface of the ground (Balogh, 1958). So set, these traps can be used to catch and determine the activity densities of surface active arthropods, such as spiders and ground beetles (Tretzel, 1955; Greenslade, 1964; Luff, 1975; Uetz & Unzicker, 1976; Adis, 1979; Curtis, 1980). Despite several criticisms (e.g. Bombosch, 1962; Topping & Sunderland, 1992), pitfall traps are widely used as they are easy to handle and inexpensive. In addition, usually high numbers of individuals and species can be caught, making statistical analyses possible (Spence & Niemelä, 1994).

The capture efficiency of pitfall traps may be influenced by several different factors. For example, Antvogel & Bonn (2001) and Bergeron et al. (2013) analyzed effects of habitat structure (e.g., ground cover, litter, surrounding vegetation) and Saska et al. (2013) the effect of weather conditions. Other studies report the effects of the experimental setup, such as material, size, number and position of traps (Luff, 1975; Adis, 1979; Waage, 1985; Brennan et al., 1999; Work et al., 2002), trap type and colour (Spence & Niemelä, 1994; Lemieux & Lindgren, 1999; Buchholz et al., 2010; Knapp & Růžicka, 2012) and different killing and conserving fluids on the catches (Pékar, 2002; Schmidt et al., 2006; Jud & Schmidt-Entling, 2008; Knapp & Růžicka, 2012).

Especially in forests and habitats with abundant litter, field workers often cover pitfall traps to protect them from precipitation, accumulation of leaves or dilution of the conserving solution (e.g., Spence & Niemelä, 1994; Mallis & Hurd, 2005; Schuldt et al., 2008). Moreover, wire grids are often used to keep small vertebrates out. To date, the effect of these constructions on sampling efficiency as well as their practicability and necessity have received little attention except for Buchholz & Hannig's (2009) study, which determined the effect of covers in open and dry grasslands where there is little litter. However, the effect of covering pitfall traps might be quite different in other habitats, such as forests, where falling leaves may affect uncovered pitfall traps more than covered traps. Furthermore, while preventing small vertebrates from falling into traps, wire grids may, depending on their mesh size, reduce the catch ability of, e.g., long-legged spiders and large-bodied carabid beetles. Finally, little is known about the potential effect of the structure of litter, for example, the amount of litter cover and its thickness, on trapping. In this context, it is arguable to what extent covers as well as wire grids operate as an effective protection against litter.

* Corresponding author.

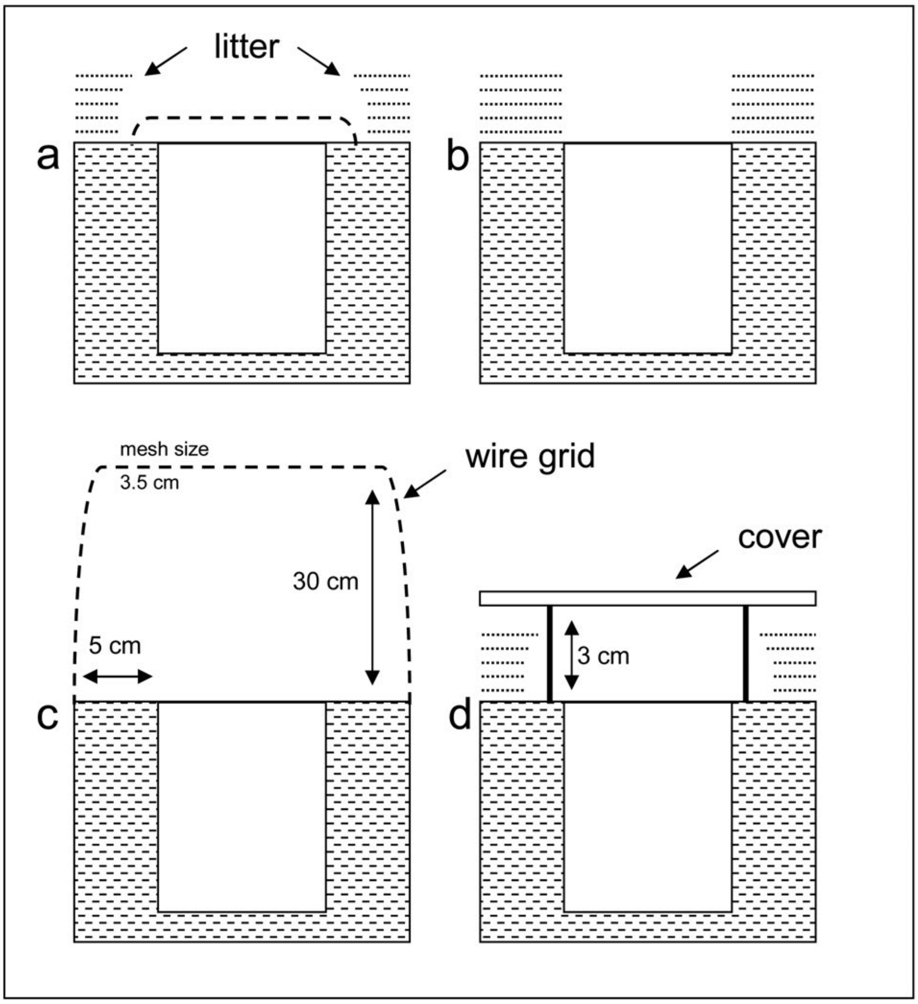

Fig. 1. The different types of pitfall traps used in this study: a – wire grid; b – open; c – litter exclosure; d – cover.

The present study aims to determine whether the design of pitfall traps affects the numbers of epigeal arthropods caught in habitats with abundant litter by addressing the following questions:

(i) Do we need to protect pitfall traps with covers and wire grids, respectively, in order to obtain the best possible catches in habitats with abundant litter?

(ii) Is the species composition and functional characteristics of the individuals caught by pitfall traps (in the case of carabid beetles and spiders) affected by the design of the traps?

(iii) Does the structure of the litter layer affect the capture efficiency of pitfall traps?

MATERIAL AND METHODS

The study was carried out in an oak-beech forest (Fago-Quercetum – vegetation structure: mean vegetation coverage = 5%, height of herbaceous plant layer = 6 cm, litter coverage = 95%, depth of litter = 3 cm) near the city of Münster (51°54´37N, 7°44´44E) in North Rhine-Westphalia, Germany. The climate is Sub-Atlantic with a mean annual temperature of 7.9°C and an average annual precipitation of 758 mm (MURL NRW, 1989). The area ("Wolbecker Tiergarten") is one of the oldest forest stands in the region (stand age: ~800 years) and covers an area of nearly 300 ha (Lanuv, 2010). Characteristic elements are deciduous trees (~85%) and a high quantity of dead wood (mean percentage for the study area: 10%).

To record the activity densities of ground-dwelling arthropods, pitfall traps were set from 20 June to 7 July 2009 (16 sampling days). The traps (plastic cup, diameter: 8.5 cm, height: 12 cm) were filled up to one third with a formalin solution (3%) and a few drops of detergent to kill and conserve the animals. Traps were set randomly (but > 5 m apart from each other) and level with the surface of the soil. In order to investigate the effect of covers and wire grids, ten pitfalls were covered with white, square plastic covers (14 × 14 cm) 3 cm above the trap opening and ten traps were covered by a wire grid (mesh size: 3.5 cm) (Fig. 1). Furthermore, ten pitfall traps remained open and were thus entirely exposed to the entry of litter. Finally, to test for the possible effects of the litter layer we installed litter exclosures (mesh size: 3.5 cm, height: 30 cm, width: 5 cm around the trap) around ten pitfall traps. Hence, in total there were four treatments with ten replicates of each (altogether 40 traps).

The catches were sorted and preserved in ethanol (75%). For the analyses we counted the numbers of acarians (Acari), spiders (Araneae), ground beetles (Coleoptera: Carabidae), ants (Formicidae), woodlice (Isopoda), millipedes (Myriapoda) and harvestmen (Opiliones). The species of spiders and carabid beetles were determined using standard determination keys of Roberts (1987, 1998), Heimer & Nentwig (1991) and Nentwig et al. (2013) for spiders and Müller-Motzfeld (2006) for carabid bee-

TABLE 1. Total number of individuals of Acari, Araneae, Carabidae, Formicidae, Isopoda, Myriapoda and Opiliones caught by the pitfall traps in the four treatments: wire grid, plastic cover, litter exclosure and open. Data presented as mean ± SE.

	Treatment (n = 10)				*F*	*P*
	wire grid	cover	litter exclosure	open		
Acari	1.0 ± 0.5	0.9 ± 0.4	0.4 ± 0.2	1.6 ± 0.5	1.59	0.21
Araneae	33.4 ± 6.0	48.9 ± 9.5	38.8 ± 7.4	44.5 ± 5.1	0.91	0.45
Carabidae	15.3 ± 2.4	20.4 ± 2.2	20.0 ± 2.3	23.6 ± 2.4	2.16	0.11
Formicidae	1.2 ± 0.3	0.8 ± 0.3	1.7 ± 0.4	3.1 ± 2.0	1.53	0.22
Isopoda	13.1 ± 2.6	35.4 ± 6.7	15.1 ± 4.3	18.4 ± 6.0	3.74	0.02
Myriapoda	4.9 ± 1.9	8.5 ± 3.4	5.6 ± 2.9	5.5 ± 1.8	0.38	0.77
Opiliones	2.3 ± 1.0	2.7 ± 0.9	3.1 ± 1.5	3.8 ± 1.7	0.24	0.87

tles. Nomenclature followed Platnick (2013) (Araneae) and Müller-Motzfeld (2006) (Carabidae).

As a functional trait we chose average body size. Data was taken from Nentwig et al. (2013) for female spiders and from Trautner & Geigenmüller (1987) and Dücker et al. (1997) for carabid beetles.

All statistical analyses were performed using the free software environment R 3.0.1 (R Development Core Team, 2013) including the packages VEGAN and MASS for multivariate statistics. In order to detect possible differences in total catches of ground-dwelling arthropods (Acari, Araneae, Carabidae, Formicidae, Isopoda, Myriapoda, Opiliones) as well as in numbers of species of carabid beetles and spiders caught by the four types of traps (explanatory variables: wire grid, cover, litter exclosure, open), generalised linear models (GLM) were used. To compensate for over-dispersion, the standard errors were corrected using a quasi-Poisson model (Crawley, 2008; Zuur et al., 2009). Furthermore, the significance of differences in the body sizes of spiders and carabid beetles was tested using generalised linear models (GLM) using a Gamma distribution.

A non-metric multidimensional scaling (NMDS) (isoMDS engine) was used to display the species composition for spiders and carabid beetles caught by the four traps. For ordination, species activity densities were square root transformed. The NMDS was based on the Bray-Curtis dissimilarity matrix. In search of a stable solution and the lowest stress value, a maximum number of 100 random starts was used. In addition, a multivariate analysis of variance (MANOVA, 9,999 permutations; ADONIS function in VEGAN) was performed to assess the effect of the treatments on species composition. For all multivariate statistics, sporadic species with less than three individuals in the total catch were excluded. This resulted in 14 species of spiders (1,621 individuals) and 12 species of carabid beetles (781 individuals) being included in the ordination analysis.

RESULTS

A total of 1,656 Araneae belonging to 37 species, 820 Isopoda, 793 Carabidae belonging to 19 species, 245 Myriapoda, 119 Opiliones, 68 Formicidae and 39 Acari were recorded. We found no significant differences in capture efficiencies of the four traps except for the order Isopoda (Table 1). For this taxon the highest catches were recorded in the covered traps. More species of spiders and ground beetles were caught by the traps within "litter exclosures" (Appendix 1), but the differences were not significant (Table 2). In contrast, for both these taxa significant differences in body size were detected in the catches by the four types of trap (Araneae: $F = 4.59$, $P = 0.008$; Carabidae: $F = 3.79$, $P = 0.02$), with the largest spiders and carabid beetles more frequently recorded in covered traps.

Ordination analyses did not show any significant effect of the different traps on the species composition (Fig. 2): neither the distribution of spiders ($F = 1.30$, $R^2 = 0.10$, $P = 0.21$) nor the distribution of carabid beetles ($F = 1.19$, $R^2 = 0.10$, $P = 0.28$) showed significant differences among treatments (MANOVA).

DISCUSSION

Apart from Isopoda, our results indicate that the four types of traps did not differ significantly in the numbers of arthropods caught. In general, woodlice occur mostly in moist and dark habitats such as holes in dead wood, loose litter and under stones (Abbott, 1918). For this reason, Isopoda might be attracted by dark holes beneath covers.

Differences in terms of the numbers of individuals with particular functional traits were found with large species

TABLE 2. Total number of species (no. spec.) and body size [mm] of Araneae and Carabidae caught by the pitfall traps in the four treatments: wire grid, plastic cover, litter exclosure and open. Data presented as mean ± SE.

	Treatment (n = 10)				*F*	*P*
	wire grid	cover	litter exclosure	open		
Araneae						
no. spec.	5.6 ± 0.3	5.8 ± 0.6	7.3 ± 6.7	6.7 ± 0.6	1.83	0.16
body size	3.96 ± 0.09	5.02 ± 0.32	4.31 ± 0.23	4.61 ± 0.18	4.59	0.008
Carabidae						
no. spec.	4.5 ± 0.8	5.2 ± 0.7	6.1 ± 0.6	5.9 ± 0.4	1.16	0.34
body size	13.96 ± 1.78	18.55 ± 0.90	17.01 ± 0.63	15.47 ± 0.43	3.79	0.02

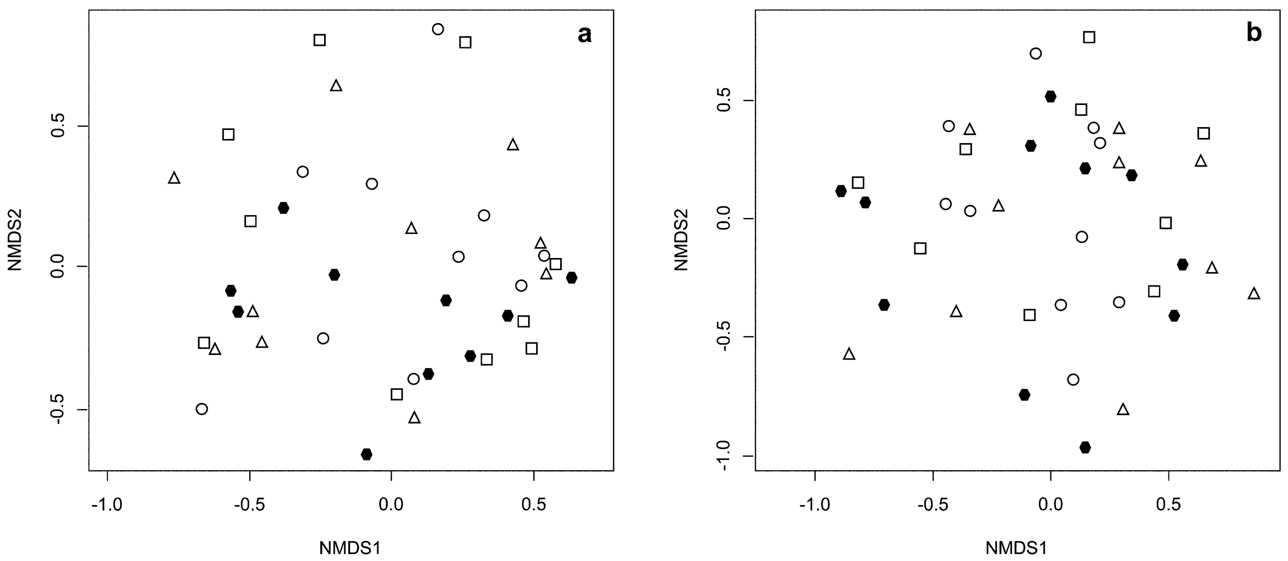

Fig. 2. Results of the NMDS ordination for spiders (a – stress = 15.06) and carabid beetles (b – stress = 10.63) caught by the pitfall traps in the four treatments: [wire grid (square), cover (triangle), litter exclosure (hexagon) and open (circle)]. Species composition did not differ among treatments (spiders: $F = 1.30$, $R^2 = 0.10$, $P = 0.21$; carabid beetles: $F = 1.19$, $R^2 = 0.10$, $P = 0.28$; MANOVA, 9,999 permutations).

more frequently recorded in the catches of covered traps. One reason might be that most large species of spiders and carabid beetles are night active and thus seek shelter during the day (Turin, 2000; Nentwig et al., 2013). As large species need large cavities in which to shelter (such as under stones, stems or pieces of deadwood) the covers over the pitfall trap were possibly attractive refuges for them and as a consequence these traps caught higher numbers of large than small species, which tend to stay in the litter layer (Wagner et al., 2003).

There is a vertical stratification in the distribution of ground-dwelling spiders in litter, which is attributed to microhabitat conditions, mainly abiotic factors (Wagner et al., 2003). Due to lower spatial resistance there, large spiders (such as free hunting Agelenidae and Lycosidae) preferentially occur in the spacious, upper litter layer or on the litter surface, while small-bodied species more frequently occur in the compacted, middle and lower litter layers. The same is reported for carabid beetles by Sergeeva (1994). Consequently, the probability of trapping large-bodied species may be higher since pitfall traps mostly catch surface-active species while litter-dwelling species are mostly unrepresented.

Finally, Topping (1993) points out that small-bodied spiders, e.g. those belonging to the family Linyphiidae, can escape from pitfall traps more easily and thus relatively few are caught. The same applies to carabid beetles, which can avoid traps, as shown by Van der Drift (1951) and Greenslade (1964).

In terms of the questions we set out to answer, it seems to be unnecessary to protect pitfall traps with covers or wire grids in forests with abundant litter, as the presence of covers or grids did not significantly affect their efficiency in capturing epigeal arthropods. This is partially in accordance with Buchholz & Hannig (2009), who found no significant effect of pitfall covers in dry grassland habitats. Nevertheless, we recommend the use of wire grids above the trap opening to prevent small vertebrates and debris from entering the traps as this often makes it easier and faster to sort and count the catch.

Furthermore, the type of trap did not significantly affect the species composition of spiders and carabid beetles. One should keep in mind that functional characteristics such as body size (and maybe leg length in spiders) do seem to be affected by pitfall trap design. Finally, the litter layer seems to have only minor direct effects on pitfall traps in forests since they did not catch significantly more arthropods in litter exclosures.

ACKNOWLEDGEMENTS. We would like to thank the city of Münster for providing access to the study sites. We are grateful to J. Linke and two anonymous reviewers for constructive comments on an earlier version of this manuscript. Many thanks also to R. Baumgartner for improving the English.

REFERENCES

Abbott C.H. 1918: Reaction of land Isopods to light. — *J. Exp. Zool.* **27**: 193–246.

Adis J. 1979: Problems of interpreting arthropod sampling with pitfall traps. — *Zool. Anz.* **202**: 177–184.

Antvogel H. & Bonn A. 2001: Environmental parameters and microspatial distribution of insects: a case study of carabids in an alluvial forest. — *Ecography* **24**: 470–482.

Balogh J. 1958: *Lebensgemeinschaften der Landtiere. Ihre Erforschung unter besonderer Berücksichtigung der zoozönologischen Arbeitsmethoden*. Akademie Verlag, Berlin, 560 pp.

Barber H.S. 1931: Traps for cave-inhabiting insects. — *J. Elisha Mitchell Sci. Soc.* **46**: 259–266.

Bergeron J.A.C., Spence J.R., Volney W.J.A., Pinzon J. & Hartley D.J. 2013: Effect of habitat type and pitfall trap installation on captures of epigaeic arthropod assemblages in the boreal forest. — *Can. Entomol.* **145**: 547–565.

Bombosch S. 1962: Untersuchungen über die Auswertbarkeit von Fallenfängen. — *Z. Angew. Zool.* **49**: 149–160.

Brennan K.E.C., Majer J.D. & Reygaert N. 1999: Determination of an optimal pitfall trap size for sampling spiders in a Western Australian Jarrah forest. — *J. Insect Conserv.* **3**: 297–307.

Buchholz S. & Hannig K. 2009: Do covers influence the capture efficiency of pitfall traps? — *Eur. J. Entomol.* **106**: 667–671.

Buchholz S., Jess A.-M., Hertenstein F. & Schirmel J. 2010: Effect of the colour of pitfall traps on their capture efficiency of carabid beetle (Coleoptera: Carabidae), spiders (Araneae) and other arthropods. — *Eur. J. Entomol.* **107**: 277–280.

Crawley M.J. 2008: *The R Book*. Wiley, Chichester, 942 pp.

Curtis D. 1980: Pitfalls in spider community studies (Arachnida, Araneae). — *J. Arachnol.* **8**: 271–280.

Dücker A., Müller-Reich C., Schmüser H., Pahnke K., Heubel K., Gienapp P., Borcherding R., Nötzold R., Heubel V. & Nötzold V. 1997: *Laufkäfer*. DJN Deutscher Jugendbund für Naturbeobachtung, Göttingen, 158 pp.

Greenslade P.J.M. 1964: Pitfall trapping as a method for studying populations of Carabidae (Coleoptera). — *J. Anim. Ecol.* **33**: 301–310.

Grell H. 1997: Die Flaschenfalle. — *Natursch. Landschaftsplan.* **29**: 126–127.

Heimer S. & Nentwig W. 1991: *Spinnen Mitteleuropas: ein Bestimmungsbuch*. Paul Parey, Berlin, Hamburg, 543 pp.

Jud P. & Schmidt-Entling M. 2008: Fluid type, dilution, and bitter agent influence spider preservation in pitfall traps. — *Entomol. Exp. Appl.* **129**: 356–359.

Knapp M. & Růžicka J. 2012: The effect of pitfall trap construction and preservative on catch size, species richness and species composition of ground beetles (Coleoptera: Carabidae). — *Eur. J. Entomol.* **109**: 419–426.

LANUV NRW 2010: *Natura 2000-Gebiet in Nordrhein-Westfalen.* URL http://www.naturschutzinformationen-nrw.de/natura2000-meldedok/de/fachinfo (accessed 01 July 2013).

Lemieux J.P. & Lindgren B.S. 1999: A pitfall trap for large-scale trapping of Carabidae: Comparison against conventional design, using two different preservatives. — *Pedobiologia* **43**: 245–253.

Luff M.L. 1975: Some features influencing the efficiency of pitfall traps. — *Oecologia* **19**: 345–357.

Mallis R.E. & Hurd L.E. 2005: Diversity among grounddwelling spider assemblages: habitat generalists and specialists. — *J. Arachnol.* **33**: 101–109.

Melber A. 1987: Eine verbesserte Bodenfalle. — *Abh. Naturw. Verein Bremen* **40**: 331–332.

Müller-Motzfeld G. 2006: Band 2, Adephaga 1: Carabidae (Laufkäfer). In Freude H., Harde K.W., Lohse G.A. & Kausnitzer B. (eds): *Die Käfer Mitteleuropas*. Spektrum, Heidelberg, pp. 1–521.

MURL NRW (Ministry for the Environment, Spatial Planning and Agriculture of NRW) (eds) 1989: *Klima-Atlas von Nordrhein-Westfalen.* MURL NRW, Düsseldorf.

Nentwig W., Blick T., Gloor D., Hänggi A. & Kropf C. 2013: *Central European Spiders – Determination Key Version 09.2013.* URL http://www.araneae.unibe.ch/index.html (accessed 01 May 2013).

Pekár S. 2002: Differential effects of formaldehyde concentration and detergent on the catching efficiency of surface active arthropods by pitfall traps. — *Pedobiologia* **46**: 539–547.

Platnick N.I. 2010: *The World Spider Catalog, Version 10.5*. American Museum of Natural History. URL http://research.amnh.org/entomology/spiders/catalog/index.html (15 May 2010).

R Development Core Team 2013: *R: A Language and Environment for Statistical Computing.* R Foundation for Statistical Computing, Vienna. URL http://www.R-project.org. (accessed 15 June 2013).

Roberts M.J. 1987: *The Spiders of Great Britain and Ireland. Vol. 2, Linyphiidae and Check List.* Harly Books, Essex, 204 pp.

Roberts M.J. 1998: *Spinnen Gids.* Tirion, Baarn, 397 pp.

Saska P., van der Werf W., Hemerik L., Luff M.L., Hatten T.D. & Honěk A. 2013: Temperature effects on pitfall catches of epigeal arthropods: a model and method for bias correction. — *J. Appl. Ecol.* **50**: 181–189.

Schmidt M.H., Clough Y., Schulz W., Westphalen A. & Tscharntke T. 2006: Capture efficiency and preservation attributes of different fluids in pitfall traps. — *J. Arachnol.* **34**: 159–162.

Schuldt A., Fahrenholz N., Brauns M., Migge-Kleian S., Platner C. & Schaefer M. 2008: Communities of ground-living spiders in deciduoud forests: Does tree species diversity matter? — *Biodivers. Conserv.* **17**: 1267–1284.

Sergeeva T.K. 1994: Seasonal dynamics of interspecific trophic relations in a carabid beetle assemblage. In Desender K., Dufrêne M., Loreau M., Luff M.L. & Maelfait J.-P. (eds): *Carabid Beetles: Ecology and Evolution.* Kluwer Academic Publishers, Dordrecht, pp. 367–370.

Spence J.R. & Niemelä J. 1994: Sampling carabid assemblages with pitfall traps: the madness and the method. — *Canad. Entomol.* **126**: 881–894.

Topping C.J. 1993: Behavioural responses of three linyphiid spiders to pitfall traps. — *Entomol. Exp. Appl.* **68**: 287–293.

Topping C.J. & Sunderland K.D. 1992: Limitations to the use of pitfall traps in ecological studies exemplified by a study of spiders in a field of winter wheat. — *J. Appl. Entomol.* **29**: 485–491.

Trautner J. & Geigenmüller K. 1987: *Tiger Beetles, Ground Beetles*. Josef Margraf, Aichtal, 488 pp.

Tretzel E. 1955: Technik und Bedeutung des Fallenfanges für ökologische Untersuchungen. — *Zool. Anz.* **155**: 276–287.

Turin H. 2000: *De Nederlandse Loopkevers. Verspreiding en oecologie (Coleoptera: Carabidae).* European Invertebrate Survey Nederland, KNVV, Leiden, 666 pp.

Uetz G.W. & Unzicker J.D. 1976: Pitfall trapping in ecological studies of wandering spiders. *J. Arachnol.* **3**: 101–111.

Van der Drift J. 1951: Analysis of the animal community in a beech forest floor. — *Tijdschr. Entomol.* **94**: 1–168.

Waage B.E. 1985: Trapping efficiency of carabid beetles in glass and plastic pitfall trap containing different solutions. — *Fauna Nor. (B)* **32**: 33–36.

Wagner J.D., Toft S. & Wise D.H. 2003: Spatial stratification in litter depth by forest-floor spiders. — *J. Arachnol.* **31**: 28–39.

Work T.T., Buddle C.M., Korinus L.M. & Spence J.R. 2002: Pitfall trap size and capture of three taxa of litter-dwelling arthropods: Implications for biodiversity studies. *Environ. Entomol*. **31**: 438–448.

Zuur A.F, Ieno E.N., Walker N.J., Saveliev A.A. & Smith G.M. 2009: *Mixed Effects Models and Extensions in Ecology with R.* Springer, Berlin, 574 pp.

Received September 5, 2013; revised and accepted October 15, 2013

APPENDIX 1. List of species and the numbers caught in each of the different types of pitfall trap used in this study. Nomenclature follows Platnick (2013) for Araneae and Müller-Motzfeld (2006) for Carabidae.

Taxon	wire grid	cover	litter excl.	open	sum
Araneae					
Agroeca brunnea	0	2	0	3	5
Anyphaena accentuata	0	0	1	1	2
Centromerus dilutus	0	1	1	0	2
Centromerus sylvaticus	1	0	0	0	1
Clubiona comta	0	1	0	0	1
Clubiona pallidula	0	0	0	1	1
Clubiona terrestris	0	4	0	1	5
Diplocephalus picinus	1	0	1	0	2
Enoplognatha thoracica	1	0	0	0	1
Haplodrassus silvestris	1	5	3	6	15
Histopona torpida	133	273	160	235	801
Inermocoelotes inermis	0	0	1	0	1
Macrargus rufus	4	6	4	2	16
Metellina mengei	0	0	5	0	5
Microneta viaria	1	0	2	3	6
Neon reticulans	2	1	0	0	3
Nigma puella	0	0	1	0	1
Oedothorax agrestis	0	1	0	0	1
Ozyptila praticola	0	0	1	0	1
Palliduphantes pallidus	1	0	0	0	1
Pardosa lugubris	2	6	5	13	26
Philodromus rufus	0	1	0	0	1
Piratula hygrophila	138	159	153	136	586
Porrhomma montanum	0	0	1	0	1
Robertus lividus	13	15	10	11	49
Saaristoa abnormis	9	5	8	5	27
Tapinocyba insecta	1	0	0	2	3
Tenuiphantes flavipes	4	3	4	8	19
Tenuiphantes tenuis	1	0	0	0	1
Trochosa terricola	0	1	1	2	4
Walckenaeria alticeps	0	0	1	2	3
Walckenaeria antica	0	0	1	0	1
Walckenaeria atrobitialis	15	0	19	7	41
Walckenaeria corniculans	5	4	5	6	20
Walckenaeria cucullata	1	0	0	0	1
Walckenaeria monoceros	0	1	0	0	1
Walckenaeria nudipalpis	0	0	0	1	1
Sum	334	489	388	445	1656
Carabidae					
Abax parallelepipedus	63	80	46	70	259
Abax parallelus	11	10	16	24	61
Badister lacertosus	0	0	0	2	2
Carabus coriaceus	1	1	1	0	3
Carabus granulatus	0	0	0	1	1
Carabus violaceus ssp. purpurascens	18	43	66	54	181
Clivina fossor	2	0	1	0	3
Cychrus caraboides	2	11	7	7	27
Leistus rufomarginatus	6	3	7	16	32
Limodromus assimilis	0	0	1	0	1
Loricera pilicornis	3	0	1	0	4
Nebria brevicollis	14	15	16	7	52
Notiophilus biguttatus	1	0	0	3	4
Pterostichus anthracinus	0	1	0	0	1
Pterostichus melanarius	4	5	6	0	15
Pterostichus niger	0	3	2	6	11
Pterostichus nigrita	1	1	3	1	6
Pterostichus oblongopunctatus	26	31	27	45	129
Stomis pumicatus	1	0	0	0	1
Sum	153	204	200	236	793