Acta Soc. Zool. Bohem. **77**: 159–163, 2013
ISSN 1211-376X

Suitability of nail polish for marking the common rough woodlouse, *Porcellio scaber* (Oniscidea)

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Received 13 January 2013; *accepted 16 June 2013*
Published 5 August 2013

Abstract. The durability and toxicity of nail polish marks used in field studies on the woodlouse, *Porcellio scaber*, were evaluated in the laboratory. Six groups of 40 individuals were each kept on different substrates (two groups each on loamy soil, sand and gravel), with three groups of marked and three groups of unmarked woodlice as a control. Individuals were marked with a small dot of nail polish on the dorsal part of their body. The numbers of marked and unmarked animals dead and alive after 7, 14 and 28 days were counted. The relatively low durability of the marks was due to moulting and abrasion (65–75% of the marked animals were recorded after one week and less than 25% after one month). Nail polish was toxic for woodlice as there was a higher mortality of marked individuals on two of the substrates (loamy soil and sand $p<0.05$). We conclude that nail polish is not suitable for long term marking of common rough woodlice.

Key words. Marking stability, toxicity, methodology, Isopoda.

INTRODUCTION

We need to distinguish between individuals of species from time to time in ecological investigations (e.g. studies on migration and population size) and ethological studies (e.g. social hierarchy, home range, shelter fidelity). It is harder to recognise individuals of short-lived invertebrates than long-lived vertebrates. There are some specific methods for marking invertebrates. There are ways colour marking of individuals internally by feeding them with coloured food or using a sub-cuticular injection of a coloured medium. These methods are suitable for transparent animals or animals the bodies of which have transparent parts (e.g. integument between terga). Radioactive or stable isotopes can also be used for marking animals (ingested in food), but it is only possible to mark subpopulations using this method (Southwood & Henderson 2000, Paris 1965). External marking is more commonly used, especially of the final developmental stage of insects (imago). We can mark them by mutilation (e.g. by marking beetle elytra with a rasp or laser), tagging (coded labels on locusts, molluscs etc.) or painting. Painting terrestrial isopods has been used in life history (Lawlor 1976, Madhavan & Shribbs 1981) and distributional studies (Brereton 1957, den Boer 1961, Paris & Pitelka 1962).

Painting might affect the survival of animals as they are more visible to predators, or by intoxication or directly due to the restraining effect of the dried paint. Another important point is the durability of the mark – it can be lost by defaecation (inner marks) or moulting or abrasion. Potential effects of marking on the survival of marked invertebrates have been often evaluated

Presented at the 11th Central European Workshop on Soil Zoology, České Budějovice, Czech Republic, 11–14 April 2011.

but the durability of the marks is less frequently studied. We evaluated the durability and toxicity of nail polish marks used in field studies on the woodlouse *Porcellio scaber* Latreille, 1804.

MATERIAL AND METHODS

Altogether 240 live individuals of the common rough woodlouse, *Porcellio scaber,* were collected in Olomouc and divided into six groups of 40 individuals. In each group animals of both sexes of approximately similar size (adults) were kept in 20×20×12 cm plastic boxes. Substrates in the bottom of the boxes differed: two boxes contained gravel, two sand and two loamy soil. Four stones (covering 15–20 cm^2) were placed in each box as shelters. One box of each pair was the control and the other the experimental box. Woodlice in experimental boxes were marked with a small dot of nail polish (60 seconds RIMMEL London TM) on dorsal part of their body, which covered parts of the 3^{rd}–4^{th} pereionits. Woodlice in the control boxes were not marked and only manipulated. The boxes were kept in the dark at a constant temperature of 15 °C in an incubator and pieces of potato were provided as food for the woodlice. Humidity in the boxes was kept high (wet substrate and 100% humidity). Woodlice were checked and numbers of dead and alive, marked and unmarked individuals were recorded after 7, 14 and 28 days, respectively. This experiment was carried out in April–May 2009.

Particle-size analysis of the substrates in the boxes (Fig. 1) was done using a shaker device (product of the Stavební stroje Brno Company, type No 710000). Differences in survival were analyzed using t-tests.

RESULTS AND DISCUSSION

This study on the durability of the marks and survival of marked and unmarked common rough woodlice on three substrates revealed that the number of animals with marks in the experimental groups decreased; 65–75% of the animals were still marked one week later and less than 25% one month later (Fig. 2). The marks were less durable in the boxes with a gravel substrate. Probably gravel, with the biggest particles, provided spaces for the woodlice to creep into. According Schmalfuss (1984), *P. scaber* belongs to the ecomophological type *clinger*, i.e. species that nestle into the substrate. Although *P. scaber* is not an active digger, they can loss their marks by abrasion during moving in the narrow spaces between pieces of gravel, whereas in the boxes with sand or loamy soil they remained on the surface. Similarly, Petit and her students (Petit et al. 2003, Penny et al. 2005, Petit & Gibbs 2005, Gordon et al. 2007) tested the durability of various external marks on the millipede *Ommatoiulus moreletii* (Lucas, 1860), an invasive species in Australia. *O. moreletii* can be categorized as ecomorphological type bulldozer, which digs actively into soil (Hopkin & Read 1992). All the different kinds of marks tested had low durability and were quickly lost due to the burrowing activity of the millipedes. Moreover, marks can be lost by moulting.

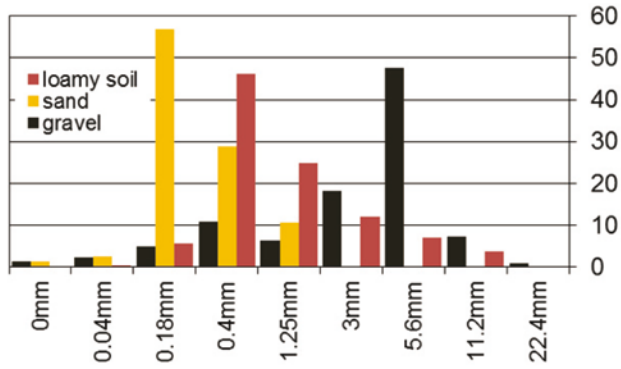

Fig. 1. Particle-size composition (% dry weight) recorded for the substrates used in the experiments on *Porcellio scaber*.

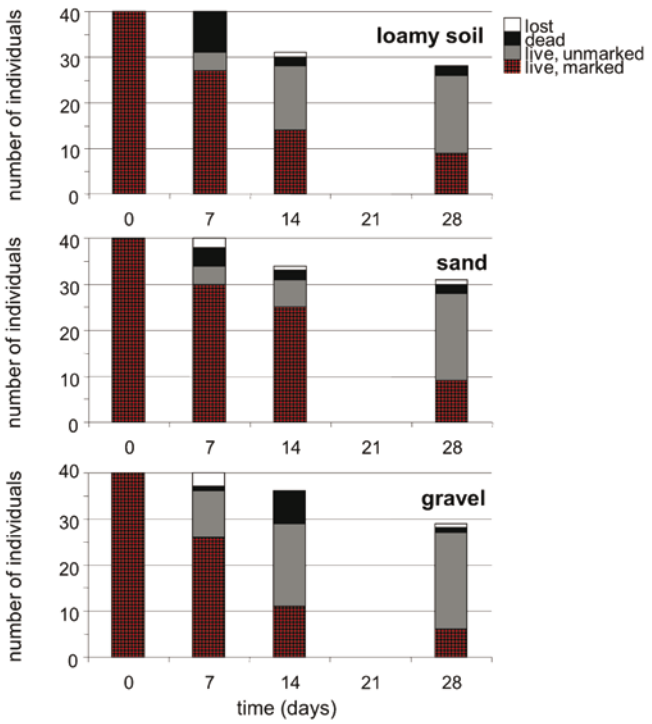

Fig. 2. Durability of the marks on the woodlouse, *Porcellio scaber*, kept on different substrates for 28 days.

Moulting frequency of *Porcellio scaber* is approximately 33±7 days (Zidar et al. 1998). This may be the reason, why only 25% of the animals were still marked 28 days after marking.

We recorded the mortality in both groups of woodlice, experimental and control (Fig. 3). The mortality in the experimental group was significantly higher than in the control group on loam and sand, respectively (loam: t_3=2.93, p=0.03; sand: t_3=2.75, p=0.04). This mortality may be due to a poisoning effect. We suppose some chemicals in the nail polish might pass through cuticle into the haemolymph. Common pill woodlice, *Armadillidium vulgare* Latreille, 1804, marked with nail polish are less active than unmarked individuals (Drahokoupilová & Tuf 2012). Although these authors did not record a higher mortality in *A. vulgare* the experiment only lasted for 9 days and it is likely that mortality would be delayed due to low consumption.

There was no difference in the mortality of marked animals and unmarked animals kept on a gravel substrate (t_3=0.88, p=0.22).The reason for the higher mortality recorded in the boxes with a gravel substrate may be the tendency of the woodlice to hide in the pores in the substrate (Fig. 1), which could have resulted in their being damaged during inspections (we tried to find and count all the animals, live or dead). Raking the substrate to expose the woodlice could be too harsh a treatment for their delicate bodies and the cause of the higher mortality in both groups. Additionally, there is a category *lost* individuals (Fig. 2). Some individuals were not found and as they could not have escaped from the closed boxes we assume these losses were due to cannibalism of moulting individuals, which is thought to be due to a need for calcium (Brereton

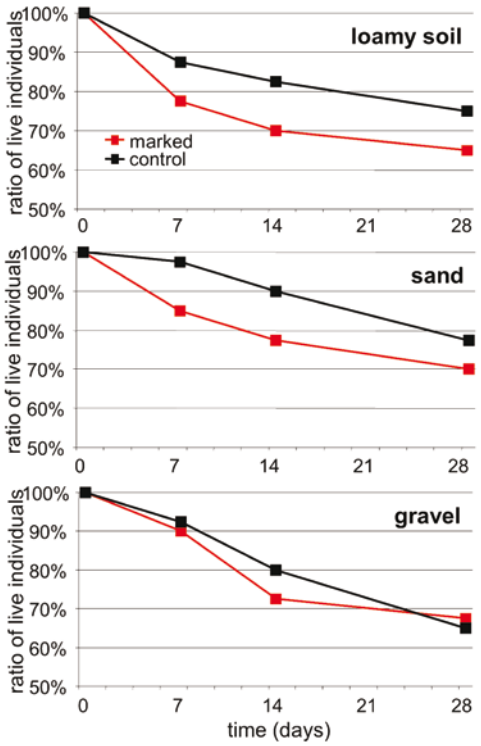

Fig. 3. Comparison of the mortality of marked and unmarked woodlice, *Porcellio scaber*, kept on different substrates for 28 days.

1957). The higher level of cannibalism in boxes with gravel may be due to the damaging effect of the periodic counts on the numbers of individuals in these boxes, as woodlice are more likely to attack injured individuals (Dangerfield & Telford 1993).

Summarising nail polish is not a suitable for marking common rough woodlouse as marked individuals suffer a higher mortality and the marks are not very durable. It is, however, possible to use nail polish to mark individuals in short term experiments.

Acknowledgements

This study was done by students of a *Soil Biology Practicum* class at Palacký University, Olomouc, Czech Republic. This article was partially funded by an internal grant of Palacký University No. PrF_2013_016. The language of the manuscript was kindly checked by Professor Anthony F. G. Dixon (Norwich, UK).

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