

# How to trap a slug: Commercial versus homemade slug traps

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## Abstract

The Iberian Slug, *Arion lusitanicus* Mabille (Stylomatophora: Arionidae), has developed into a destructive pest in Swedish gardens and orchards over the past 10–20 years. Many attempts to eradicate this pest have been made using a variety of different methods.

The aim of this study was to investigate the effectiveness of two different types of homemade traps made from simple, inexpensive materials (plastic PET bottle or an ice-cream box) compared to one type of commercially sold trap (Slugtrap<sup>®</sup> IT-PAC AB, Sweden) used with bait and beer as attractants. Experiments were carried out on a private property outside Lund, Sweden, over a period of 7 days. The results showed that a homemade trap, i.e. a box trap, can be as efficient as a commercial trap, particularly due to their similar design. In contrast, the homemade bottle trap was not very successful. Additionally, it was discovered that the bait used in the commercial traps did not increase the number of slugs trapped. It was concluded that the beer was the main slug attractant. Ultimately this study suggests a low-cost alternative for small scale to the rather expensive commercially sold traps.

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## 1. Introduction

The Iberian Slug, *Arion lusitanicus* infamous for its sometimes cannibalistic behaviour, originates from the Iberian Peninsula (Spain and Portugal) and has spread across Europe during the 1970s (Hagnell et al., 2004). Members of this species are 8–13 cm long. Their coloration varies from dark red/brown to almost black. The discrimination between other species, for example *Arion ater* (Large Black Slug), can be very difficult. Dissection with studies of the genital apparatus is often necessary for correct identification.

Hybrids between these two species have recently been discovered and research is currently conducted with regard to this new form (Hagnell et al., 2003, 2004).

In Swedish gardens and orchards *Arion lusitanicus* has developed into a destructive pest over the past 10–20 years. This has been due to their rapid reproduction and ravenous appetites, stripping foliage and fruit from any available source (von Proschwitz, 1997). Many attempts to eradicate this pest have been made using a variety of different methods.

## 2. Materials and Methods

The aim of this study was to investigate the effectiveness of two types of homemade traps made out of simple, inexpensive materials compared to a commercially sold trap. It was assumed that homemade traps in the style of the commercial trap used filled with beer are as equally efficient as commercial traps.

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The field experiment was conducted in a garden area just outside the city of Lund, Sweden, 2004-18-10–2004-25-10.

The study was carried out using two different types of homemade traps as well as one type of a commercial trap, Slugtrap<sup>®</sup> (IT-PAC AB, Sweden). The latter consists of a plastic, cubic box which is designed to be used with bait, provided by the manufacturer, mixed with warm water. The bait was placed according to the manufacturer’s instructions (see Fig. 1) along with approximately 50 cl of light beer (2.1% alcohol by volume). The trap was dug down in the ground so that the top was in level with the surface of the ground. In order to evaluate the efficiency of the bait, the trap was also used with dry bait and no bait at all.

According to instructions published on the internet ([www.ourgardenpests.com/Traps](http://www.ourgardenpests.com/Traps); 04-10-08), homemade bottle traps were constructed as follows (see Fig. 1). A top third of a 1.5l soft drink bottle was cut, inverted and pushed into the body of the bottle. The trap was secured by stapling around the rim of the top portion. The trap was then filled with approximately 25 cl beer and dug into the ground at a 20–30° angle so that the opening faced upwards. This angle was chosen for easier access by slugs, to prevent the bottle from being filled with rainwater and to prevent the beer from pouring out.

During the experimental period, it was observed that the bottle trap did not give the expected results. Subsequently, also a new type of homemade trap was invented. According to the construction principle of the commercial traps, it was made out of a rectangular ice-cream box. The edges of the box were cut off by approximately 2 cm, but the corner edges were left intact in order to be able to attach the lid. The box was dug down until the openings were at ground level and was filled with 33 cl of beer (see Fig. 1). This type of trap was not used until the third day of the experimental period.

Four locations were chosen according to the Slugtrap<sup>®</sup> instructions, using shaded and damp areas favoured by slugs. In these locations, four commercial traps, four homemade bottle traps and two homemade box traps were placed. The commercial traps were treated with wet

bait, dry bait and no bait, respectively. In each location, traps were spaced within a distance of 1 m.

During the experimental period, the two homemade box traps were rotated between the four locations to minimise the local effect on the number of trapped slugs in the different locations. Thus, at all times two locations had three traps (commercial, homemade bottle and box) and the remaining two locations had two traps (commercial and homemade bottle). In the locations with the homemade box trap, a commercial trap with bait (wet or dry) was used. In the same manner, the commercial traps with dry, wet and no bait were rotated between locations.

Over an experimental period of 7 days, each trap was emptied every morning and reset with appropriate bait and new beer. At the same time the traps were rotated between locations as described above.

### 3. Results

Following a positive identification of a sample of slugs, it was assumed that the majority of all slugs trapped were of the Iberian type.

A Kolmogorov–Smirnov test showed that the data from all traps, except the homemade bottle traps, were normally distributed ( $P$ -value > 0.05, see Table 1). Subsequently, a non-parametric test was required for the homemade bottle trap data set.

Table 1  
Kolmogorov–Smirnov tests of normality, testing normal distribution for the different treatments ( $P$ -value > 0.05 equals normal distribution)

Treatment	$P$
Commercial, dry bait	0.075
Commercial, wet bait	0.200
Commercial, no bait	0.137
Bottle	0.000
Box	0.200

Table 2  
Two-way ANOVA Tukey post-hoc test, comparing different treatments considering location  $P$ -value is shown

Location	Location	$P$
1	2	0.012
	3	0.998
	4	0.848
2	1	0.012
	3	0.007
	4	0.108
3	1	0.998
	2	0.007
	4	0.756
4	1	0.848
	2	0.108
	3	0.756



Fig. 1. Construction of the commercial trap, the homemade trap out of a 1.5l PET bottle and the new invented homemade box trap. (Altered from original <http://www.odla.nu/artiklar/slugtrap.shtml>; 04-10-08, [www.ourgardenpests.com/Traps](http://www.ourgardenpests.com/Traps); 04-10-08.)

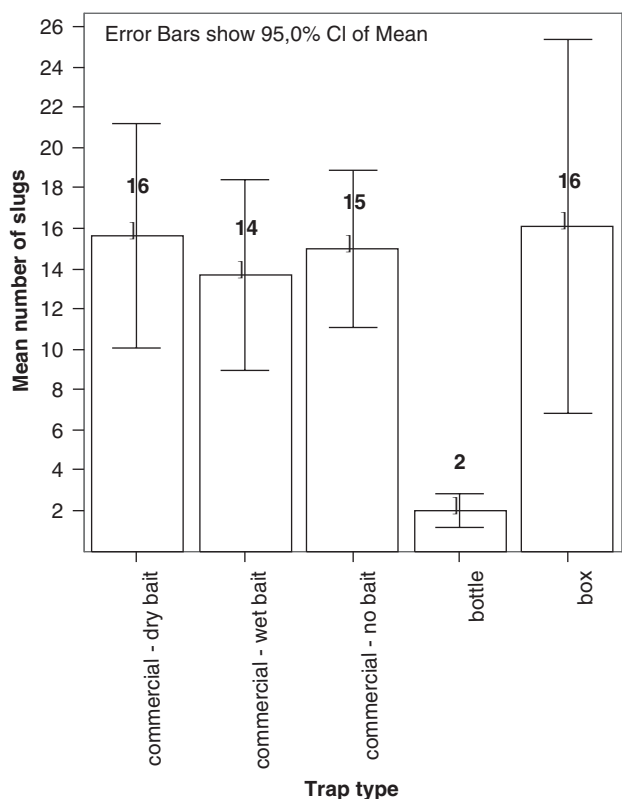


Fig. 2. Mean number of slugs trapped in each trap type over the experimental period of 7 days.

Initially, a two-way ANOVA test showed that a significant difference in the amount of slugs caught was found to exist between locations 2 and 1 and between locations 2 and 3 (see Table 2).

A one-way ANOVA test was used to compare the efficiency of the homemade traps and the commercial traps (see Fig. 2). A three-star significant difference was found within the group. Following a post-hoc test, a significant difference was found between the bottle trap and the other traps. There was no significant difference observed when comparing the use of dry, wet or no bait at all. When comparing the homemade box trap to the commercial trap with different bait treatments, no significant difference was observed (see Table 3).

The non-parametric tests, Kruskal–Wallis and the Mann–Whitney *U*-test, confirmed that there was a significant difference between the bottle trap and the other traps for all cases (see Table 3).

A parametric *T*-test was conducted between homemade box traps and commercial traps with bait, as the total number of replicas differed between groups and may have produced a slight fault in the results. Only data from locations and days in the presence of the homemade box trap were used in this test. If equal variance is assumed, the two-tailed *P* – value = 0.191 gives no significant difference between commercial and homemade traps ( $P_{crit} = 0.05$ ).

Table 3  
ANOVA Tukey post-hoc test, comparing different treatments *P*-values are shown

Treatment	Treatment	<i>P</i>
Commercial, dry bait	Commercial, wet bait	0.655
	Commercial, no bait	0.928
	Bottle	0.000
	Box	0.994
Commercial, wet bait	Commercial, dry bait	0.655
	Commercial, no bait	0.996
	Bottle	0.012
	Box	0.426
Commercial, no bait	Commercial, dry bait	0.928
	Commercial, wet bait	0.996
	Bottle	0.020
	Box	0.788
Bottle	Commercial, dry bait	0.000
	Commercial, wet bait	0.012
	Commercial, no bait	0.020
	Box	0.000
Box	Commercial, dry bait	0.994
	Commercial, wet bait	0.426
	Commercial, no bait	0.788
	Bottle	0.000

A *T*-test was also conducted with commercial traps, comparing no bait and wet bait, with only data from locations and days when no bait replica had been used. If equal variance is assumed the two-tailed *P* – value = 0.073, which is not significant ( $P_{crit} = 0.05$ ).

#### 4. Discussion

The Two-way ANOVA test demonstrated that the position of the traps had an effect on the number of slugs trapped in some of the locations. This could be due to the different vegetation types and abiotic factors such as light intensity, run-off and humidity between each location. To eliminate the variance in the data, a more homogenous site should be used in future experiments.

The one-way ANOVA as well as the non-parametric test confirmed the assumption that a homemade trap, i.e. in this case the box trap, can be as efficient as the commercial trap. Despite this, the first attempt using the bottle trap proved that this type of homemade trap is a less effective means of trapping slugs. The tests also showed that the bait was ineffective as there was no difference if it was wet, dry or absent. This demonstrates that it was the beer that had the only effect on the number of slugs trapped.

The significant difference between the homemade bottle traps and the homemade box/commercial traps could be due to several factors. One was that the diffusion rate is higher in the box/commercial traps due to a greater interaction area between the beer and

the air, resulting in a more intense beer odour. Secondly, the construction of the traps allows for a greater total entrance area to the box/commercial traps that is unidirectional when compared to the same in the bottle traps. Additional advantages of the box traps are the ease with which they can be constructed (without using staples) and emptied due to removable lids, compared to the bottle traps.

The parametric *T*-test showed that even if the skewness between the number of replicates in different treatments is taken into consideration, there is still no significant difference between homemade box traps and commercial traps, or between commercial traps with and without bait. New experiments are needed in order to determine if the lack of significance is due to the shorter experiment period alone.

A major problem that was experienced in this study was the difficulty to identify the Iberian slugs. The variance in coloration makes it very difficult, especially when identifying juveniles. Hybridisation of this species (Hagnell et al., 2004) with *Arion ater* (Large Black Slug) has further complicated the identification. The only appropriate way to identify them is to compare their genitalia following a dissection. Subsequently, all slug species were included in the data sets.

Because *A. lusitanicus* was the focus of the study, the results may therefore be conclusive for *A. ater* and the hybrids as well.

It was observed that the majority of trapped slugs remained alive despite being in liquid for some time. Therefore, it is strongly recommended to terminate the slugs by placing them in a freezer or exposing them to boiling water instead of placing them in compost as stated in the Slugtrap<sup>®</sup> instructions.

As the experiment was conducted late in the season at a time where slug populations are low, there were fewer slugs trapped than would have been expected if the experiment had been conducted in the summer. This may affect the results, but the ratio of the number of slugs caught in each type of trap should be independent

of the season and consequently the effect of the season would be minimal. On the other hand, slug populations in the summer may be too high so that traps become completely filled, resulting in the variance between each trap type being too low to produce significant results.

## 5. Conclusions

It can be concluded that the homemade box traps were as efficient as the commercial traps and therefore the box traps can be recommended as an inexpensive and effective method of trapping slugs. Despite this, an advantage of the commercial trap would be the additional outer box, which makes emptying and refilling easier. The commercial traps' military green colour blends into the garden surroundings better than the homemade box trap (which are often white or cream coloured), and are therefore more appealing from an aesthetical point of view.

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## References

- Hagnell, J., Schander, C., von Proschwitz, T., 2003. Hybridisation in Arionids: the rise of a super slug? British Council for Crop Protection Symposium, Proceedings 80, 221–226.
- Hagnell, J., Schander, C., von Proschwitz, T., 2004. Sniglarna som rör om i trädgårdar och släktträd. Fauna & Flora 99, 38–41.
- von Proschwitz, T., 1997. *Arion lusitanicus* Mabille and *A. rufus* (L.) in Sweden: a comparison of occurrence, spread and naturalization of two alien slug species. Heldia 4 Sonderheft 5, 137–138.