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INFLUENCE OF PITFALL TRAPS AND WB PROBE II TRAPS ON THE CAPTURE OF FOUR STORED-GRAIN COLEOPTERA

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ABSTRACT

Two commercially available traps, the Pitfall Trap and the WB Probe II Trap, were used in the laboratory to monitor insects in wheat (*Triticum aestivum*) at 23–24°C and 65–70% r.h. The major coleopteran pests of cereals in Italy, *Oryzaephilus surinamensis* (L.), *Rhyzopertha dominica* (F.), *Sitophilus oryzae* (L.) and *Tribolium castaneum* (Herbst), were added to the grain at an infestation level of 0.9 insect/kg. There were significant differences in the total number of insects collected by the two trap types. In addition, there were significant differences in the number of individuals of each species captured, depending on the trap and the trap location.

The Pitfall Trap is located on the surface and within the grain bulk 15 cm below the surface. Analysis of captures in it indicated that *T. castaneum* migrated in numbers to the surface but *O. surinamensis* remained within the bulk. The WB Probe II Trap trapped more *T. castaneum* than *O. surinamensis* specimens. Fewer *R. dominica* and *S. oryzae* specimens were trapped.

INTRODUCTION

Insect traps are effective and sensitive tools for the detection of adult beetles (Loschiavo, 1974, 1975; Barak and Harein, 1982; Lippert and Hargstrum, 1987; Cogan and Wakefield, 1987, 1990; Cogan *et al.*, 1987, 1994; Cogan *et al.*, 1990; Fargo *et al.*, 1994) and are considered superior to the standard grain sampling procedures. Various researchers have observed wide differences in trap catch, and much of this variation has been attributed to variations in trap efficiency (Hagstrum *et al.*, 1990), which are often due to environmental factors affecting insect behaviour, rather than to actual changes in the population density, and vary according to insect species, grain temperature and trapping duration (Fargo *et al.*, 1989, 1994; Vela-Coiffier *et al.*, 1996).

The specific objective of this study was to evaluate the difference in trap catch as a function of insect species, trap type and trap location.

MATERIALS AND METHODS

Laboratory cultures of the major coleopteran grain pests in Italy, the saw-toothed grain beetle *Oryzaephilus surinamensis* (L.), the lesser grain borer *Rhyzopertha dominica* (F.), the rice weevil *Sitophilus oryzae* (L.) and the red flour beetle *Tribolium castaneum* (Herbst), were reared in glass jars containing clean, untreated wheat, *Triticum aestivum* L., at 26°C and about 14% moisture content (m.c.).

The experiment was carried out using two commercially available traps, a "Pitfall Trap" — on the surface and at a depth of 15 cm (Cogan *et al.*, 1990) — and a "WB Probe II Trap" (Burkholder, 1984).

The tests were carried out in the laboratory at 23–24°C and 65–70% r.h. They were done in plastic pipe containers, 25 cm in diameter and 25 cm in height. Each container was filled to within 8 cm of the top with 9 kg of *Triticum aestivum* wheat at 14% m.c.

The insects were introduced at the top of the grain mass and allowed to acclimate for 24 h before traps were inserted. Ten insects of each of the four species were put into separate containers (a single species per container). This resulted in a population density of about 0.9 insects per kg. The traps were placed for 72 h at the centre of each container in the infested grain. They were then removed from the grain mass and the number of insects captured was noted. Fifteen replicates were done for each species and each trap type.

RESULTS

In this study, there were significant differences in the number of insects collected by the two trap types. The number of the different species captured in each trap and treatment type was also significantly different (Fig. 1).

Pitfall Traps (average capture of 17.64%) were more efficient than WB Probe II Traps (average capture of 8%) in detecting beetles in stored wheat. Pitfall Traps at the grain surface yilded higher insect counts (18.33%) than those at a depth of 15 cm (16.94%).

Capture figures in the Pitfall Traps located at the surface and within the grain bulk indicated that *T. castaneum* migrated in numbers to the surface whereas *O. surinamensis* remained within the bulk.

The WB Probe II Trap trapped more *T. castaneum* than *O. surinamensis*; *S. oryzae* was captured in smaller numbers, and no captures of *R. dominica* were recorded.

The buried and surface Pitfall Traps (24.44% and 14.7% capture) both proved better than probe traps (10% capture) for *O. surinamensis*. Therefore, for this species the buried Pitfall Trap was the most effective.

Fewer captures of *R. dominica* were made in the buried Pitfall Trap (5.55% capture) and in the surface Pitfall Trap (3.33% capture), and none of these insects were found in the WB Probe II Trap.

The buried Pitfall Trap (11.11% capture) was better than the surface Pitfall Trap (9.33% capture) for *S. oryzae*, and only a few individuals of this species were found in the WB Probe II Trap (2.22% capture).

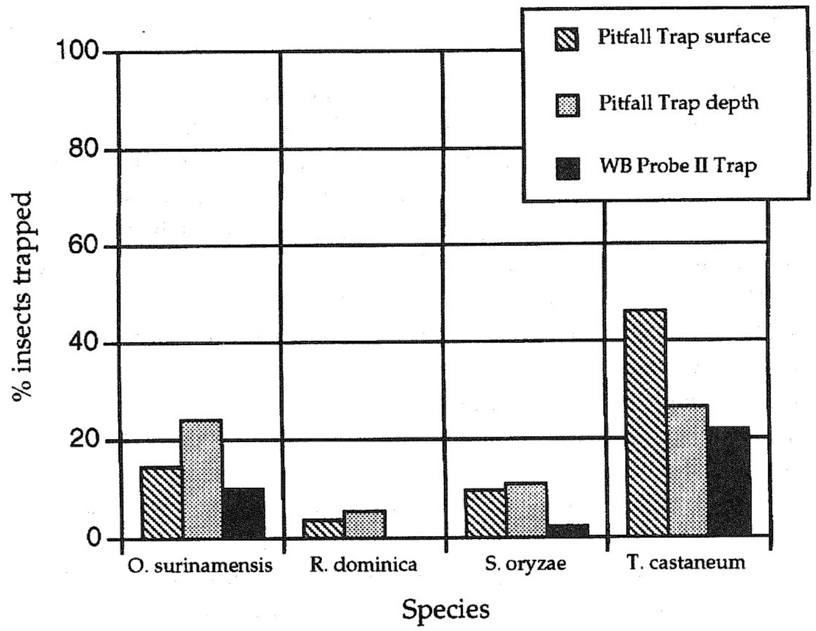

Fig. 1. Percentage of insects trapped during the experiment.

All of the traps were effective for *T. castaneum* adults, but the surface Pitfall Traps were better than the others: 46% of the adults were recorded in the surface Pitfall Traps, 26.66% in the buried Pitfall Traps and 22.22% in the WB Probe II Traps.

DISCUSSION

Since the effectiveness of all insect traps depends on insect movement, anything that influences this factor will also affect trap capture. The magnitude of this effect depends primarily on insect species, temperature, trapping duration, grain type and grain condition (Cuperus *et al.*, 1990).

Our experiment demonstrates the importance of insect species, trap type and trap placement in determining trap catch. *T. castaneum* is a very active insect; *R. dominica* does not move as much as do other species and therefore is less likely to be trapped. The same behaviour difference was observed by Subramanyam and Harein (1990).

Several researchers have found that trap catch was significantly greater at higher grain temperatures. Capture of *Cryptolestes* spp., for example, increased significantly at higher temperatures. However, between 10°C and 32°C, such species as *R. dominica*, *T. castaneum* and *S. oryzae* were not trapped in greater numbers at higher temperatures (Cuperus *et al.*, 1990).

Fargo *et al.* (1989) demonstrated that the number of insects (of any given species) captured increased significantly with trapping duration. Sampling probes are simply inserted into and immediately withdrawn from the grain; therefore, the possibility of collecting insects, especially in lightly infested grain, is low. Response to trapping duration, however, varies with the species, and this should be considered when interpreting a trap catch. The choice of trapping duration can be complicated because of efficiency changes. The insects already trapped emit a repellent signal (an alarm pheromone) that can decrease trap attractiveness and, consequently, efficiency (Trematerra *et al.,* 1996).

It has also been shown that grain type has an impact on trap catch of known densities of insects. The amount of broken grain and fine extraneous material also influences insect movement. The condition of the grain may also affect the random movement of the insects and, thus, the number trapped. When trap samples are counted without taking these factors into account, it is impossible to evaluate the variability in trap efficiency because estimates are likely to be inaccurate.

The primary objective of insect sampling in stored grain is early detection of infestations. Detection permits control measures to be implemented before extensive damage occurs. Insect traps detect populations sooner than do grain sampling devices and they facilitate more accurate monitoring of potential insect problems.

The relationship between trap catches obtained from grain samples and actual insect densities needs to be determined. Only thus can trap information be valuable in determining an appropriate pest management strategy.

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