Capture of four stored-grain Coleoptera with WB Probe II Traps in different cereals

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Abstract

The commercially available trap WB Probe II Traps have been used in laboratory to monitor insects activity in stored grains (oat grain, *Avena sativa*, wheat grain, Triticum aestivum, and maize grain, *Zea mays*) at a temperature of 24 ± 1 and relative humidity of 70 ± 5%. The major beetle pests of cereals in Italy belonging to the order Coleoptera: *Oryzaephilus surinamensis* (L.), *Rhyzopertha dominica* (F.), *Sitophilus oryzae* (L.) and *Tribolium castaneum* (Herbst) were added to the grains at 0.9 insect per kg There were significant differences in the numbers of insects collected by the traps. The numbers of the different species captured were significantly different when compared across trap and cereal types. In all cereals considered the traps trapped *O. surinamenis*, *S. oryzae* and *T castaneum*, whereas *R. dominica* was trapped only in oat grain.

Introduction

Traps are effective and sensitive tools for detection of adult beetles and are superior to standard grain sampling procedures for detection (Loschiavo, 1974 and 1975; Barak and Harein, 1982; Lippert and Hargstrum, 1987; Cogan and Wakefield, 1987 and 1994; Cogan et al., 1990; Stejskal, 1997; Trematerra, 1997; Dowdy and Mullen, 1998). Large variation in trap catch was observed; much of this phenomenon is attributable to variation in trap efficiency (Hagstrum et al., 1990). This variation often is due to environmental factors affecting insect behaviour rather than actual changes in population density. These rations can vary with insect species, grain temperature, and trapping duration (Fargo et al., 1989 and 1994; Trematerra and Mancini, 1997; Vela-Coiffier et al , 1997) The specific objectives of our study were to evaluate the difference in trap catch as a function of insect species and cereal type.

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Materials and Methods

Laboratory cultures of the major grain pests in Italy belonging to the order Coleoptera saw-toothed grain beetle, *Oryzaephilus surinamensis* (L.), lesser grain borer, *Rhyzopertha dominica* (F.), rice weevil, *Sitophilus oryzae* (L.), and the red flour beetle, *Tribolium castaneum* (Herbst), were reared in glass jars containing clean, untreated, spring wheat *Triticum aestivum*. Grain moisture content was about 14% and temperature was maintained at 26 ± 1℃ The experiment was carried out using the commercially available Trap, WB Probe II Trap (Burkholder, 1984). The tests have been performed in laboratory at a temperature of 24 ± 1℃ and relative humidity of 70 ± 5% Testing was conducted in containers made from plastic pipe, 25 cm in diameter and 35 cm in height. Each container was filled to within 15 cm of the top with 9 kg of oats grain, *Avena sativa*, wheat grain, *Triticum aestivum*, or maize grain, *Zea mays*. The insects were introduced to the top of the grain mass and allowed to acclimatise for 24 h before traps were inserted. Ten insects of each of the three species were put into individual containers (i e a single species per container); this results in approximately 0.9 insects per kg.

Traps were placed in the infested grain, positioned in the centre of each container, for 72 h. The traps were then removed from the grain mass and the number of insects captured was noted Each treatment was completed, for each species, in 5 replications, with a total of 60 tests.

Results

According to our study, there were significant differences in the numbers of insects collected by the traps among the tests. Also, the numbers of the different species captured were significantly different when compared across trap and cereal types (Table 1).

In all cereals, considered traps trapped *O. surinamensis*, *S. oryzae* and *T. castaneum*, whereas *R. dominica* were trapped only in A. sativa. The WB Probe II Trap trapped more *T. castaneum* than *S. oryzae* and *O. surinamensis* the species less trapped has been *R. dominica*. Better results were observed in wheat grain,

T. aestivum, with 32% of *S. oryzae* trapped.

Comparing the effectiveness of the traps (Figures 1 – 2) with regard to their ability to detect the adults of the Coleoptera: in *O. surinamensis* the effectiveness of the traps has been 16% in wheat grain, *T. aestivum*, 10% of adults were trapped in oat grain, *A. sativa*, and 6% in maize grain, *Z. mays*. Regarding S. oryzae: 12% of released adults were trapped in oat grain, 32% were trapped in wheat grain and 2% in maize grain. For *T. castaneum* the effectiveness of the traps has been: 16% of released adults in oat grain, 18% were trapped in wheat grain and 6% in maize grain.

Table 1. Adults of *Oryzaephilus surinamensis*, *Rhyzopertha dominica*, *Sitophilus oryzae* and *Tribolium castaneum* trapped in stored grains of *Avena sativa*, *Triticum aestivum* and *Zea mays*.

Cereals	N. of adults	*Oryzaephilus surinamensis*	*Rhyzopertha dominica*	*Sitophilus oryzae*	*Tribolium castaneum*
	10	2	–	–	3
	10	1	–	1	2
Avena sativa	10	–	1	5	1
	10	1	–	–	1
	10	1		–	1
	10	2	–	2	1
	10	3	–	3	1
Triticum aestivum	10	1	–	6	2
	10	1	–	1	–
	10	1	–	4	3
	10	–	–	1	1
	10	1	–	–	–
Zea mays	10	–	–	–	
	10	1	–	–	
	10	1	–	–	2

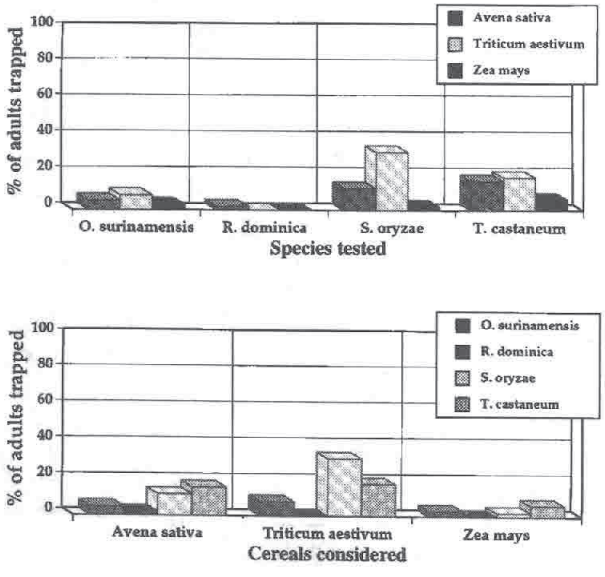

Fig 1 – 2. Adults of *Oryzaephilus surinamensis*, *Rhyzopertha dominica*, *Sitophilus oryzae* and *Tribolium castaneum* Trapped in stored grains of *Avena sativa*, *Triticum aestivum* and *Zea mays*.

Discussion

Our experiment illustrates the importance of insect species and cereal type in interpreting trap catch of the WB Probe II Traps. Grain type has been shown to have an impact on trap catch for known densities of insects. The amount of cracked grain and fine material also influences insect movement. The condition of the grain may also have an impact on the random movement of the insects and thus affect the number of insects trapped.

All insect traps depend on insect movement, then any factor that influences beetle movement 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). According to our data *T. castaneum*, *O. surinamensis* and *S. oryzae* are very active insects, whereas *R. dominica* does not move as much as other species and therefore is not as likely to be trapped.

Fargo et al. (1989) showed that the number of insects of a given species trapped increased significantly with trapping duration. The response to trapping duration varies with species, and thus should be considered when interpreting

trap catch. On the other hand, choice of trapping duration can be complicated by the fact that trapping efficiency changes due to insects already trapped emitting aggregation or a repellent signal, as an alarm pheromone, that can influence trap attractiveness (Trematerra et al , 1996).

When samples are taken without monitoring these factors, there will be no way to remove the variability in trap catch, and estimates are likely to be inaccurate (Subramanyam and Harein, 1989) The relationship between trap catches and insect densities obtained from grain samples needs to be determined so that trap information can be valuable in determining an appropriate pest management strategy.

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