Flight Activity of *Prostephanus truncatus* (Horn) (Coleoptera: Bostrichidae) in Relation to Population Density, Resource Quality, Age, and Sex

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Higher flight activity has been observed in aged, high-density cultures of *Prostephanus truncatus* (Horn) (Coleoptera: Bostrichidae), but adults in new, low-density culture jars showed less flight activity. In order to understand this change in behavior, the effects of population density, age, resource quality, and sex on the flight of *P. truncatus* were studied in a wind tunnel. While an immediate density on the release platform had no significant effect on flight, beetles from high-density cultures were more inclined to fly than those from low-density cultures. Resource quality exerted a major influence on flight; insects in food suitable for boring and oviposition seldomly exhibited flight, however, when food was absent or of inferior quality for boring and oviposition, the dominant behavior was flight. Also, insects maintained for a week in food suitable for boring and oviposition were less ready to fly than those maintained in food unsuitable for boring and oviposition. The optimum age range for flight activity was before the peak of reproduction and insects rarely flew before 4 days or after 32 days of emergence. There were no significant differences between the flight activity of males and that of females. Based on these results, we conclude that age and resource quality are major influences on the flight activity of *P. truncatus* and a hypothesis is proposed in which reproductively active male and female beetles disperse from habitats of low resource quality to those that support their reproductive behavior. The practical implications of these results and the possible role of the male-produced aggregation pheromone are discussed.

**KEY WORDS:** *Prostephanus truncatus*; larger grain borer; Coleoptera; Bostrichidae; flight; stored product insect.

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INTRODUCTION

Many external and internal factors have been implicated in the dispersal of insects. The majority of the research on the influence of such factors has been on migratory species of Lepidoptera, Hemiptera, Orthoptera, and Diptera (references cited by Johnson, 1969; Blackmer and Byrne, 1993). Among the beetles, the bostrichids represent an important family including many major field-to-store grain pests. However, little information is available on their flight behavior and dispersal mechanisms.

The larger grain borer *Prostephanus truncatus* (Horn) (Coleoptera: Bostrichidae) is an exotic species in Africa, where it has become a serious pest of stored maize and dried cassava (Hodges, 1986). Its distribution in Africa is still expanding and field trapping of the beetle has revealed its presence in the wild (Nang’ayo *et al*., 1993). The lack of information concerning the influence of extrinsic and intrinsic factors on the insect’s flight has, however, contributed to the difficulty in explaining pheromone trap catch patterns and prediction of its dispersal tendencies.

In the laboratory, adult *P. truncatus* in old, high-density culture jars have been observed to take off more than those in new and low-density culture jars (H. Fadamiro, personal observation). This observed high flight activity in old jars may be due to many factors including age of beetles, food quality, density in culture, immediate density, and pheromone. Which factors are most important?

This paper reports studies on the effects of population density, age, resource quality, and sex on the flight activity of *P. truncatus* as a part of the information needed to decipher its dispersal tendency. In an earlier paper (Fadamiro and Wyatt, 1995), we reported the optimum conditions of temperature, humidity, and time of day for flight activity and these optima have been taken into account in the design of the current experiments.

MATERIALS AND METHODS

Insects

Stock cultures of adult Tanzanian strains of *P. truncatus* [Natural Resources Institute (NRI), Chatham, Kent, UK] were reared on whole clean maize. Cultures for an experiment on the effect of age on flight were established on milled grains that passed through an Endecotts sieve of mesh size 3.35 mm for ease of removal of insects from culture. All cultures were maintained at 30 ± 1°C and 65 ± 5% RH under a 12:12 L:D photoperiod.

Beetles were sexed under a light microscope at ×50 magnification examining the clypeal tubercles, which are more prominent and spaced farther apart in females (Shires and McCarthy, 1976).