Ability of the larval ectoparasitoid *Habrobracon hebetor* (Hymenoptera: Braconidae) to locate the rice moth *Corcyra cephalonica* (Lepidoptera: Pyralidae) in bagged and bulk stored rice

Charles Adarkwah[1,2], Daniel Obeng-Ofori[3], Cornel Adler [2], Carmen Büttner[1], Christoph Reichmuth and Matthias Schöller[2]

[1]Humboldt University of Berlin, Institute for Horticultural Sciences, Section Phytomedicine, Königin-Luise-Str. 19, D-14195 Berlin, Germany:phytomedizin@agrar.hu-berlin.de/lesadark@yahoo.com
[2]Federal Research Centre for Cultivated Plants – Julius Kühn - Institut, Institute for Ecological Chemistry, Plant Analysis and Stored Product Protection, Königin-Luise-Str. 19, D-14195 Berlin, Germany
[3]University of Ghana, School of Agriculture, Legon, P.O. Box 68, Accra, Ghana

Introduction

Rice is the most important food in many countries, especially in the tropics. The rice moth *Corcyra cephalonica* is one of the most serious pests of durable stored produce throughout the world. Besides, the pest infests all types of produce from plant origin including maize, wheat, cocoa beans, dried fruits, nuts and cereal products. The use of natural enemies such as parasitoids and biopesticides for the control of stored-product pests has been considered for many years but insecticides are still the primary tool for controlling pests in stored goods worldwide.

Material and Methods

Host finding by *H. hebetor* in bagged rice

In the first experiment, jute bags (Fig. 1) were filled with 5 kg organic rice grains containing sixty larvae of the rice moth and placed in an empty climatized room with an area of 12.3 m^2. Sixty *H. hebetor* adults (sex ratio of 1 male: 2 females) were released at a distance of 1.6 m away from the jute bag. The number of *H. hebetor* adults that entered the jute bag was counted daily for 8 days by opening the bag and counting the parasitoids. In a second experiment, 60 *C. cephalonica* larvae were placed inside a wire gauze cage which was immersed 4 cm deep into un-infested rice kernels within the jute bag. Ten *H. hebetor* adults aged 2 days old were released into the jute bag for 12 days. After the 12 days exposure period the cage was removed from the bag.

Fig. 1.: A small jute bag measuring 18 × 16 cm.

The content was kept at 25°C and 65% rh. (n=5). The emergence of *C. cephalonica* was recorded daily in both samples until the 21st day. The number of *H. hebetor* F_1 generation emerging was recorded.

Host finding by *H. hebetor* in bulk rice

Another experiment was carried out in glass cylinders (Fig. 2). Sixty larvae of *C. cephalonica* were placed into wire mesh gauze cages (width 0.5 mm) as described in SCHMIDT (1979), consisting of aluminium plates (9 × 12 cm, 5 mm thick) with holes of 5 cm Ø, closed with the gauze**.** The larvae were exposed at depths of 7 and 14 cm for 23 d in the middle of the column. the cages were removed from the cylinder and placed in a 250 l glass jar which was kept in the growth cabinet at 25°C and 65% rh. The number of F_1 adult progeny of *H. hebetor* that emerged was recorded daily after 7 days for a period of 14 days.

Fig. 2: A glass cylinders (50 cm height, Ø = 25 cm) with organic rice with a moisture content of 14%.

Results and discussion: bags

Altogether only 3%, i.e. two out of 40 female and 20 male adult *H. hebetor* released into the climatized room 1.6 m away from the jute bag entered the jute bag. When *H. hebetor* adults were inserted into the jute bag, they were able to locate the host larvae between the rice kernels, to parasitize *C. cephalonica* and produce F_1 progeny. The emergence of *H. hebetor* progeny started on day 9 after the introduction of the parasitoids. The highest number of F_1 adults was recorded on the 16th day, and emergence continued until day 21 (Fig. 3).

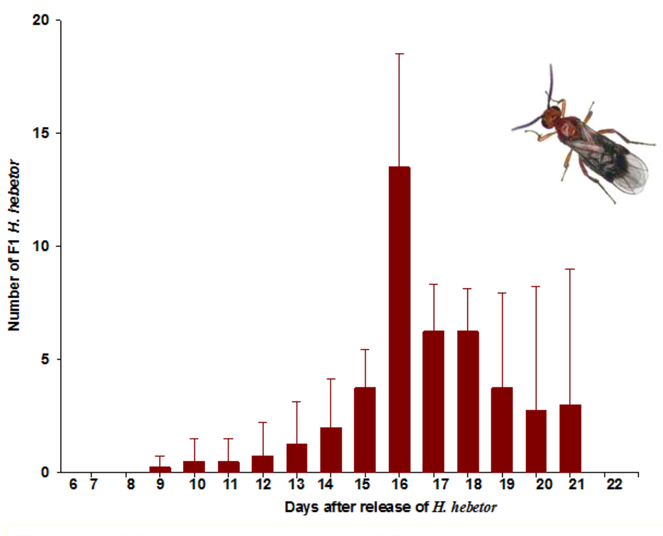

Fig. 3: Mean number (+ SD) of *Habrobracon hebetor* F1 progeny that emerged from the wire gauze cage immersed in an small jute bag containing organic rice infested by *C. cephalonica*; n = 5.

H. hebetor was able to significantly reduce the number of *C. cephalonica* emerging from the bagged rice (Student-Newman-Keuls Test, $P < 0.05$) (Fig. 4), the ABBOTT (1925) corrected mortality due to the parasitoid release was 92.13%.

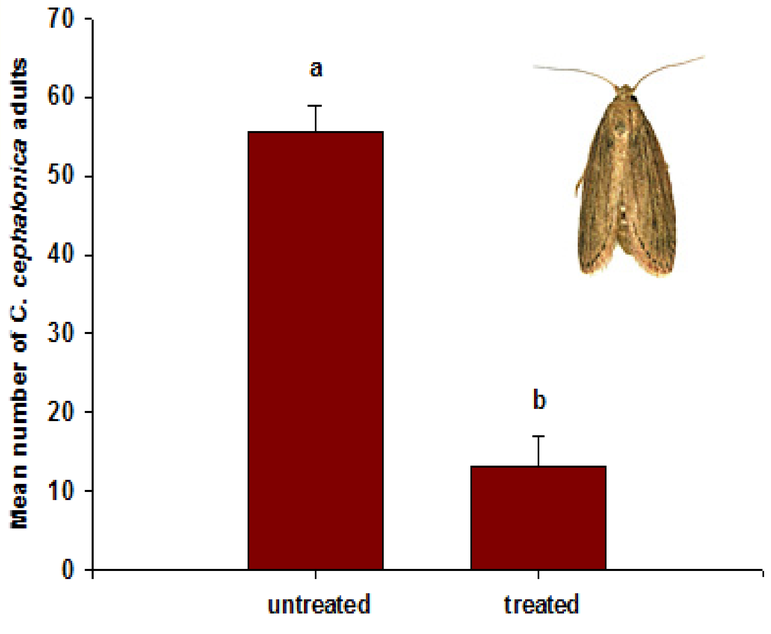

Fig. 4: Mean percentage adult emergence of *Corcyra cephalonica* (+ SD) recorded daily in both *Habrobracon hebetor* treated and untreated rice samples; t-test ($P < 0.001$).

Results and discussion: cylinder

In the experiment where *C. cephalonica* larvae were inserted 7 and 14 cm deep inside the glass cylinders filled with rice significantly more *H. hebetor* adults emerged from wire gauze cages placed 7 cm deep than those placed 14 cm deep within the grain column (paired samples t-test, t = –4.3, df = 14, P = 0.001). The highest number of F1 adults was recorded between days 20 and 26 after the introduction of the parasitoids (Fig. 5).

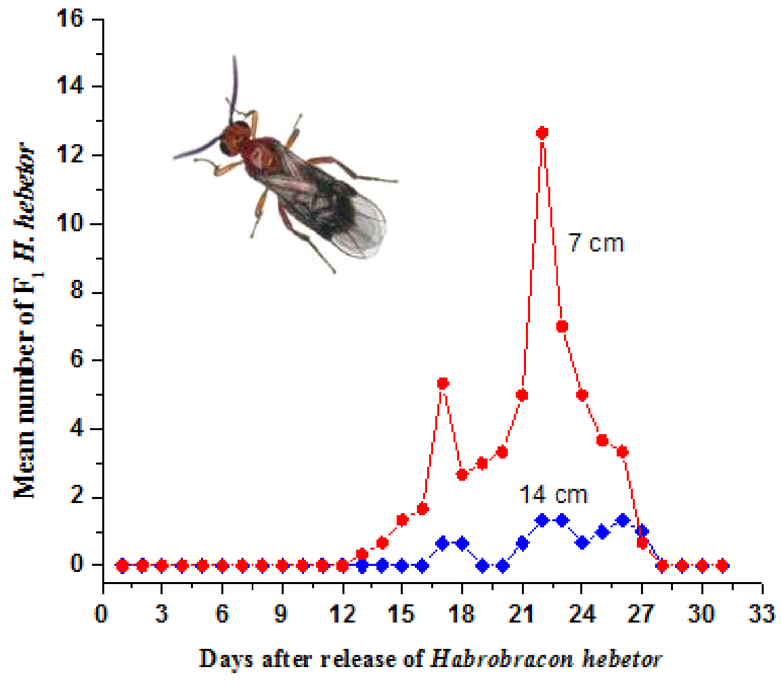

Fig. 5: Mean number *Habrobracon hebetor* F_1 progeny that emerged from wire gauze cages with *Corcyra cephalonica* larvae immersed 7 cm and 14 cm deep after release of parental *H. hebetor* adults on top of a glass cylinder with uninfested organic rice.

Conclusion: Biological control with parasitoids that are able to find their hosts in a jute bag over a large distance in a room containing bag stacks would be an interesting component for integrated stored product protection.

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