

An alternative technique of mating disruption in the control of *Ephestia kuehniella* Zell. (Lepidoptera Pyraloidea, Phycitidae)

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Abstract

The results obtained in a food storage facility (3800 m³) infested by *Ephestia kuehniella* Zell. (Mediterranean flour moth) are reported. An original dispenser made of a cylindrical neoprene “lace” (3 mm in diameter) activated with 50 mg of TDA per linear meter was installed, in particular under infested equipment. This “lace” was designed to daily release 250 – 300 µg /m of TDA for more than three months. The estimated dose of TDA was 0.39 mg/m³ with daily distribution of 2 µg/ m³. The captures of *E. kuehniella* registered every 15 days during 8 months with 6 Funnel Traps are compared with data registered in the past two years before the application of this method. Further examinations were carried out in a Peet Grady Chamber (39 m³), where a 30 cm “lace” (corresponding to 15 mg of TDA) was applied. After one week 10 virgin females and 10 males were released. In the Peet Grady Chamber 4 Petri dishes (12 cm diameter) with food for oviposition were placed. The absence of oviposition was verified. A daily distribution of 2 µg / m³ of TDA is sufficient to control an infestation of *E. kuehniella*.

Keywords: mating disruption; pheromones; Mediterranean flour moth; *Ephestia kuehniella*; TDA

1. Introduction

Previous studies report the possibility to idisrupt mating of *Ephestia kuehniella* with the use of different kinds of dispensers activated with TDA (Süss and Trematerra, 1985; Süss et al., 1996; Süss et al., 1999). More recently Ryne et al. (2007); Siemiska et al. (2009) and Trematerra and Spina (2013) referred of interesting results in the mating disruption of *E. kuehniella* in mills and in indoor warehouses, but they confirmed that this method is successful only if it is accompanied by a general cleaning. Our new experiments were carried out in a laboratory and in mills infested with this moth. It was also necessary to integrate the use of high concentrations of TDA with accurate targeted cleaning to remove the debris from the most neglected nooks in the crevices of the infested machineries. In the case of our experience it is difficult to eliminate localized infestations in crevices within field sites due to the complexity of machinery and equipment.

2. Materials and Methods

The test was done in a food facility (3800 m³) with a high infestation of *E. kuehniella*. Unfortunately in practical tests it is impossible to replicate this test in another site with the same configuration. The true density of the population is difficult to determine (Süss et al., 1996).

For our test, 30 of an original dispenser made of a cylindrical neoprene “lace” (3 mm in diameter) activated with 50 mg of TDA per linear meter, were installed under infested

equipment. This “lace” was designed to daily release 250-300 µg/m. of TDA for more than three months. The estimated dose of TDA was 0.39 mg/m³, with daily distribution of 2 µg/m³.

Moth captures were registered with 6 Funnel Traps sampled about every 15 days during 8 months and compared with the data registered in the 8 months immediately before the application of the “lace” and with the data registered during the 8 corresponding months after the application.

The reduction in male trap catch doesn't guarantee the full success of the application (in fact the males can copulate at least one time before the capture); as a consequence, further experiments were carried out in a Peet Grady Chamber (39 m³) at our Laboratory of Applied Entomology. In this case a test without “lace” was carried out as a control: 10 virgin females and 10 males of this moth were released and in the Chamber 4 Petri dishes (12 cm diameter) with special food for oviposition were placed. After this test, a 30 cm “lace” (corresponding to 15 mg of TDA) was set in the Chamber; after one week other 10 virgin females and 10 males were released; the oviposition was verified after 2 weeks.

3. Results and Discussion

In the Laboratory test without “lace” a very high oviposition in 2 Petri Dishes was verified, but some tests using TDA activated “lace” confirmed the absence of oviposition. In the department of food industry it was possible to verify a very high reduction of captures in the Funnel Traps.

During the months before the application numerous captures were verified despite a localized treatment with pyrethrum and many accurate general cleanings in the plant and on the machineries, excluding the crevices. (Tables 1-2-3).

Table 1 Catches during 8 months corresponding to those during which the trial was made.

Date	Trap 1	Trap 2	Trap 3	Trap 4	Trap 5	Trap 6	Total	Treatments
09/11/2012	15	12	10	0	0	10	49	
22/11/2012	10	10	6	1	7	12	46	
06/12/2012	10	10	7	3	2	0	32	Cleaning and pyrethrum
21/12/2012	10	7	5	3	8	5	38	
11/01/2013	20	30	0	2	6	20	78	
22/01/2013	10	10	7	1	1	8	37	
08/02/2013	12	15	5	1	5	5	43	
19/02/2013	10	10	14	10	15	8	67	
08/03/2013	10	8	15	3	13	8	57	Cleaning and pyrethrum
19/03/2013	0	0	0	1	1	8	10	Cleaning and pyrethrum
12/04/2013	15	30	0	3	1	25	74	Only cleaning
22/04/2013	18	13	1	1	1	2	36	Only cleaning
10/05/2013	8	15	4	2	1	1	32	Only cleaning

Table 1 (Con.).

Date	Trap 1	Trap 2	Trap 3	Trap 4	Trap 5	Trap 6	Total	Treatments
21/05/2013	6	12	6	1	0	1	28	
07/06/2013	11	10	10	3	0	0	35	
18/06/2013	10	8	10	2	2	3	35	Only cleaning
Total of catches							697	

Table 2 Catches during 8 months preceding the trial beginning.

Date	Trap 1	Trap 2	Trap 3	Trap 4	Trap 5	Trap 6	Total	Treatments
19/03/2013	0	0	0	1	1	8	10	
12/04/2013	15	30	0	3	1	25	74	Only cleaning
22/04/2013	18	13	1	1	1	2	36	Only cleaning
10/05/2013	8	15	4	2	1	1	32	Only cleaning
21/05/2013	6	12	6	1	0	1	28	
07/06/2013	11	10	10	3	0	0	35	
18/06/2013	10	8	10	2	2	3	35	Only cleaning
04/07/2013	15	30	20	0	1	1	67	Only cleaning
23/07/2013	13	30	0	0	12	10	65	Cleaning and pyrethrum
09/08/2013	6	20	12	0	2	0	40	
20/08/2013	6	8	3	1	1	3	22	
18/09/2013	0	4	4	0	0	0	12	Only cleaning
30/09/2013	0	0	0	0	0	0	0	
11/10/2013	3	0	0	0	0	0	12	Only cleaning
22/10/2013	2	3	5	0	0	1	11	Only cleaning
Total of catches							479	

Table 3 Catches during 8 months of the trial.

Date	Trap 1	Trap 2	Trap 3	Trap 4	Trap 5	Trap 6	Total	Treatments
08/11/2013	10	5	4	0	0	0	20	first use of “lace”
19/11/2013	3	4	4	0	0	5	16	
13/12/2013	1	0	1	0	0	0	2	
23/12/2013	0	0	2	0	0	1	3	
10/01/2014	1	1	1	0	0	3	6	
24/01/2014	0	0	0	0	0	0	0	
07/02/2014	1	1	0	0	0	0	3	
24/02/2014	0	2	0	0	0	0	2	change of “lace”
07/03/2014	0	0	1	0	0	0	1	
24/03/2014	0	1	0	0	0	0	1	
11/04/2014	2	2	0	0	0	0	4	
28/04/2014	0	0	0	0	0	0	0	
09/05/2014	0	2	1	0	3	3	9	change of “lace”
23/05/2014	0	0	0	0	0	0	0	
13/06/2014	0	0	1	0	0	0	1	
27/06/2014	0	1	0	0	0	0	1	
Total of catches							69	

Note: data collected on 08/11/2013 refer to the catches during the 15 days preceding the use of the “lace”.

4. Conclusion

In practice, the number of captures carried out with pheromone traps confirm the success of the application of this method. It is possible to state that a concentration of 0,39 mg/ m³ of TDA with a daily distribution of 2 µg/m³ is enough to stop an infestation of *E. kuehniella*. The use of this neoprene “lace” is very practical and serviceable, especially in “difficult” departments of food industries.

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