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تخصص گونه‌ای و ترجیح جنسی به ماده جلب‌کننده بیولور برای سه گونه مگس گلرنگ (Diptera:Tephritidae)

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چکیده

مگس‌های گلرنگ از آفات مهم گلرنگ (*Carthamus tinctorious* L.) در ایران هستند. تغذیه لاروهای مگس گلرنگ رشد گیاه را مختل کرده و منجر به کاهش جوانه‌های گل می‌گردد. معمولا دو هفته بعد از تشکیل قوزه‌ها آلودگی آن‌ها به لاروهای مگس‌های گلرنگ شروع می‌شود. در مطالعات آزمایشگاهی بر خلاف ماده‌های مگس *Trellia luteolla* اختلاف معنی‌داری در جلب مگس‌های ماده *Acanthiophilus helianthi* Rossi, *Chaetrollia carthami* به ماده جلب کننده بیولور وجود نداشت. مگس‌های ماده *Acanthiophilus helianthi* Rossi با بیشتر از پانزده روز سن به ماده جلب‌کننده بیولور جلب می‌شدند.

واژه‌های کلیدی: کارایی، تله طعمه‌ایی، کنترل، مگس‌های گلرنگ، بیولور، جلب‌کننده‌ها

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suggests that the knowledge of physiological ages of flies is important in control program of the fruit flies.

Danne *et al*. (2005) reported that 1% of Biolure® along with 0.5% Malathion or 0.1% carbaryl with monthly replacement was most effective against *B. dorsalis*. However, Cunningham *et al*. (1994) used 83% of Biolure® along with 10% naled and 7% thixein for management of *B. dorsalis*.

Table 1- Cummulative number of virgin females of *A. helianthi* attracted to Biolure®

Age (days)	n	Total no. of flies caught within				
		1hr.	2hr.	3hr.	4hr.	Mean/h
4	80	4	5	5	5	4.8^{d}
8	80	4	8	0	0	3.0^{d}
12	80	14	21	25	25	21.3^{c}
16	80	38	44	47	47	44.0^{b}
20	80	67	71	72	72	70.5^{a}

Means followed by the same letters are not significantly different at 5 % level as determined by Duncan's Multiple Range Test.

Heath *et al*., (2004) tested 0.025, 0.05, 0.075 and 0.1 ml of Biolure® impregnated on 2 cm² cotton wads and found no significant differences in the efficacy when replenished at weekly interval. Under field conditions he observed that single application of Biolure® at 0.075 ml was most effective for up to 17 days for capturing *B. dorsalis* fruit flies if population was low (0-22 fruit flies/trap/week) and up to 32 days when the population was high (0-81 fruit flies/trap/ week).

Katsoyannos and Papadopouls (2004) showed that 10% (mixture of 10% Biolure® and 90% cue lure) and 20% BC (mixture of 20% Biolure® and 80% cue lure) attracted more fruit fly than Biolure® alone. Heath *et al*., (2004) showed that 10% BC was an effective lure for *B. cucurbitae*. Danne *et al*., (2005) reported a significant reduction in *B. dorsalis* population by using 0.1% Biolure® baited traps in the guava orchard. Korneyev and Konovalov (2010) reported that 100:0 and 90:10 ratios of Biolure® and cue lure attracted the maximum number of fruit flies compared to other proportions.

Conclusion

*A. helianthi*is in southwestern Iran (Gachsaran) is the main safflower pest. The laboratory studies showed a various responses of safflower flies to Biolure®. Females of *A. helianthi* and *C. carthami* were equally attracted to the sex attractant but *T. luteola* was less attracted to the chemical .With virgin females of *A. helianthi*, the response to the attractant increased with increasing the age of the flies.

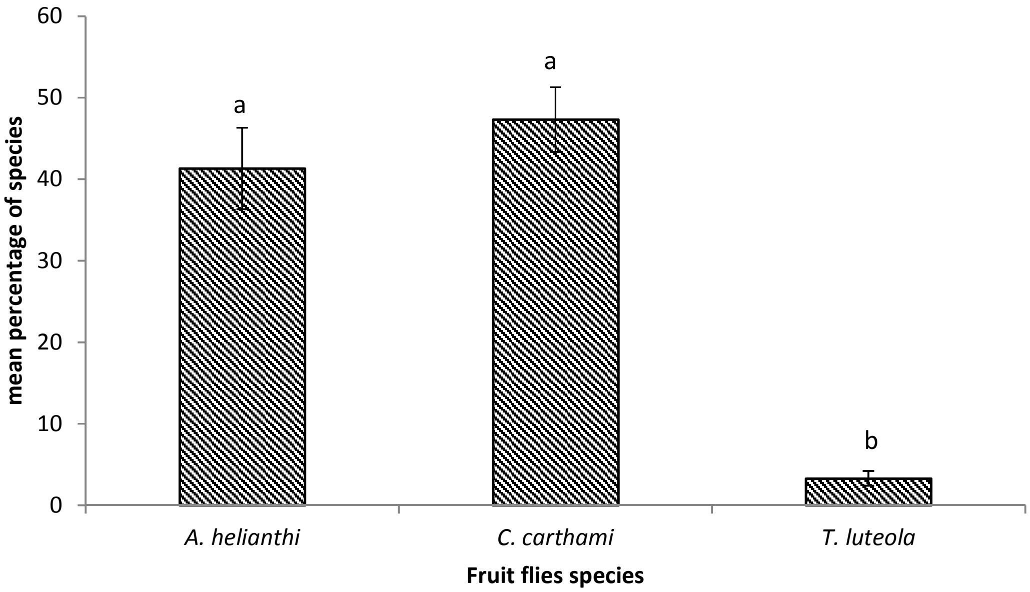

Fig. 1- Percentage of flies caught by traps according to species in laboratory study

Table 02- Number of each fruit fly species attracted to Biolure® in safflower fields

species	sex	Total No	Average catch/ trap/ month
Acanthiophilus helianthi	Female	3559	443.47
	Male	44	
Chaetrollia carthami	Female	16	0.25
	Male	2	
Terellia luteola	Female	5	0.11
	Male	5	

Total number of fruit flies caught was 3, 603 and the dominant fruit flies were the females of *A. helianthi*. (Table 1). The number of male flies caught was extremely low. This finding was similar to those of Heath *et al*. (1997, 2004) that showed Biolure® rarely attracts the males. The other two species caught in traps were *C. carthami* and *T. luteola*, which were significantly (P <0.05) few in number.

The number of fruit flies caught in traps showed a marked monthly fluctuation with the peak periods in late April and early May following the boll-set stage. Hejazi and Moursi (1983) reported an increase in number of fruit fly population at the onset of flower heads ripening. Once the entire boll had been bagged, there was a decline in population. This could possibly be due to absence of flower heads available for oviposition. Inspection of flower heads in the field showed that the fly oviposited as early as 15 days after flower heads set. The flies prefer to oviposit on ripe flower heads but in the absence of the flowers they oviposit on green flower heads.

The place of traps also influences the number of fruit-flies caught. Traps which were placed at the periphery of the field had higher counts than those placed in the center. This suggests that peripheral traps had better access to wind movement. A research showed that *Biolure®* is capable to attract flies from a distance of 0.6 km. (Heath *et al*., 2004).

The attraction of *A. helianthi* to Biolure® was related to the age of the flies (Table2) .The attraction was greatest for 20 days old, Since Biolure® is a sex attractant; it will attract flies of a specific physiological age. Danne *et al*., (2005) observed that female fruit flies were not attracted to Biolure® until the ninth day, suggesting that sexual maturity may play a prominent role. This

Laboratory studies of safflower flies

Three species of fruit-flies viz : *A. helianthi*, *C. carthami* and *T. luteola* were reared from infested flower heads of safflower. The larvae were allowed to pupate in nylon-meshed cages (82 cm × 66 cm × 66 cm) filled with infested flower heads. The newly-emerged adults were provided with water, sugar solution (10%) and protein hydrolysate.

Trial 1

Thirty male fruit-flies of each species which had been kept in captivity with females for 10 days were tested for their response to Biolure®. A total of 90 males belonging to three different species were released in a Perspex cage (1 × 1 × 1 m). A small trap (8 cm × 12 cm) of similar shape to the field trap was used in each cage. The trap was baited with three drops of Biolure®, one drop of Malathion and one ml of sucrose solution. Recordings were made at hourly intervals for four consecutive hours on all the tested species of the fruit flies.

Trial 2

To evaluate the relation of adult's age and attraction to Biolure® ,the fruit-flies were reared using artificial diet (Bromumas *et al*., 2002). Twenty virgin male flies of varying ages of 4, 8, 12, 16 and 20 days were placed in separate cages containing Biolure®, Malathion and sucrose solution.The number of flies caught in the traps was recorded at hourly intervals for four hours. Both laboratory trials were replicated four times using the Completely Randomized Design.

Field trapping of safflower flies

This study was done over three months beginning on 1st of May 2012. Plastic traps (10 cm × 10 cm) with circular openings measuring 2.4 cm in diameter at both ends were used for trapping the fruit-flies. A total of eight traps were placed at straight positions in the field. Each trap was baited with a mixture of 0.5 ml Biolure®, 0.5 ml of Malathion EC 56 and 2 ml of sucrose solution soaked in cotton rolls. The Traps were hung from the branches of plants at the height of 80 cm from the ground. At the chosen height, there was no effect on capture of fruit flies (Burracka *et al*., 2008). Collection of the fruit flies and re-charging the poisoned baits were made every four day between 6 - 7 pm .The flies were separated by sex and identified.

Data Analysis

Data for both experiments were analyzed by one way ANOVA and means were compared by the Duncan Multiple Range Tests.

Results and Discussion

In the laboratory study 1, result showed that *A. helianthi* and *C. carthami* were equally attracted to Biolure® ($p<0.05$), however both were significantly more attracted to *T. luteola*. In the field, *A. helianthi* was caught in higher number compared to other species (Table 1). This can be due to their abundance in the field.

Introduction

The safflower fly *Acanthiophilus helianthi* Rossi (Diptera: Tephritidae) also known as synonyms *Acinia eluta* (Meigen), *Musci helianthi* Rossi and *Trypanea eluta* (Meigen) is one of the most important pests of safflower throughout the world (Kutuk & Ozgur, 2003; Gilasian & Merz, 2008; Korneyev & Konovalov, 2010).The safflower fly was first observed at the Sarry Agricultural Research Station in Iran in 1965 and gradually spread out to the northern provinces of the country and other provinces including Ghom, Esfahan, Yazd and Kohgiluyeh and Boyerahmad (Gharajedaghi *et al.,* 2012).

Trapping is a common tools for the study and control of fruit flies (Cohen and Yuval, 2000) and is used to attract the pest and determine its distribution range, define the control schedule and the effectiveness of control methods, determintion the hosts and the hosts sequence population dynamics, the time of their emergence and the early detection of the fruit fly species, and also estimate the economic injury level (Bueno, 1986; IAEA, 2007). This method is now widely used in the countries in the Mediterranean Basin to control the Mediterranean fruit fly, Medfly, *Ceratitis capitata* (Weidman) and *Bactrocera olea* (Bromumas *et al*., 2002). In Spain, about 30,000 hectares of citrus orchards are treated against medfly by mass trapping (Navarro-Lloopis *et al*., 2008). In a similar way, perimeter trapping around the fruit orchards has shown promise in the control of Medfly in Israel (Cohen & Yuval, 2000).

Among the various strategies available for the management of fruit flies, the use of Biolure® traps stands as the most outstanding alternative (Heath *et al*., 1997; Epsky *et al*., 1999; Miranda *et al*., 2001; Alemany *et al*., 2004a). Biolure® initiates an olfactory response which attracts fruit flies from a distance of 800 m (Roomi *et al.*, 2001) and has a phagostimulatory action (Heath *et al*., 2004). When it is impregnated with an insecticide into a suitable substrate it can be used as a female annihilation technique as was done for several *Bactrocera* species (Cunningham, 1989). In Spain, Biolure® has been very useful in their mass trapping of *C. capitata* on peach (Sastre *et al*., 1999), apple (Alemany *et al*., 2006) and citrus fruits (Alemany *et al*., 2004b). Application of Biolure® with Tephri-traps has been successfully used in controlling Medfly in Australia (Broughton & Delima, 2002), Israel, Portugal and Honduras (IAEA, 2007). Considering the importance of using mass trapping in fruit flies control programmes on a large scale, the FAO has recommended the application of the new and more effective attractants such as Biolure® and the use of more efficient traps like the Tephri- trap and multiple bait traps to control safflower capsule fly (IAEA, 2007).

Biolure® is made of three chemicals, namely tri-ethylamine, ammonium acetate, and putrescine. The discovery of this chemical brought about an increase in the efficiency of mass trapping as an economical method for the control of fruit flies (Gazite *et al*., 1998; Katsoyannos *et al*., 1999; Katsoyannos & Papadopoulos, 2004). Biolure® along with the Tephri trap, a modified form of the Mcphall trap which has four openings to allow the fruit flies to enter (Miranda *et al*., 2001), is widely used for the mass trapping of fruit flies. (Miranda *et al*., 2001).

This study aimed at examining the efficiency of Biolure® as an attractant for mass trapping safflower capsule flies in Gachsaran southwestern Iran. Factors such as catching efficiency of target and non target insects, the economic aspects, ease in application in different climatic condition have been also studied.

Materials and Methods

Laboratory and field studies were conducted to assess the efficacy of Biolure® on safflower flies. Laboratory trials were conducted in a room at ambient temperature (34° ± 2°C). The field trial was conducted in a1600 m^2 plot in the center of a 1.5 ha safflower field at the Agricultural Research Station in Gachsaran (50° 50´ N latitude and 30° 20´ longitude) during March to May 2012.

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Species specificity and sex preference to Biolure® attractant for three species of safflower flies (Diptera: Tephritidae)

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Abstract

The safflower flies (Diptera: Tephritidae) are important pests of safflower (*Carthamus tinctorious*) in Iran. Larval feeding disrupts plant growth resulting reduction in flower buds. Infestation of bolls began 15 days after the formation of flower heads. In the laboratory study there was no statistical difference in attraction to Biolure® amang the females of *Acanthiophilus helianthi* Rossi and *Chaetrollia carthami*. In contrast, *Trellia luteolla* females were significantly less attracted to the lure. Females of *A. helianthi* with more than 15 days old were attracted to the Biolure®.

Keywords: Efficacy, bait trap, control, safflower flies, Biolure®, attractants

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