

**Study on some sex phromone aspects of *Attagenus fasciatus* (thunberg)
(Dermestidae: coleoptera)**

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ABSTRACT

Virgin females of *Attagenus fasciatus*, (Thunberg) produce a sex pheromone. The females begin pheromone release at 5-10 days age and the release continues with the same level at all older ages. Male response is associated with pheromone release. The pheromone is released after 50-80 minutes from the onset of the photophase (12:12 L:D) and continues for 4.5 hr. with a peak level after 2 hr and 50 minutes for one and half hour. Starvation does not affect either pheromone release or male response. Mating strongly reduces pheromone release.

Keywords: *Attagenus fasciatus*, sex pheromone, age, daytime, starvation , mating.

INTRODUCTION

Attagenus fasciatus (Thunberg) larvae have an economic importance as a destructive pest for stored materials particularly woolen textiles. Some biological information on this insect has been reported, (Ali; 1992; 1993; Ali *et al.*; 1997), however, no pheromone information are available for this pest, therefore, the aim of the present study is to investigate the presence of an attractant pheromone using a simple trap. The effect of age of female on the response of males was observed with a simple bioassay.

MATERIALS AND METHODS

Larvae of *A. fasciatus* were reared on child milk contains the follwing nutritives /100g:11.9g protein,27.7g fat, 55.4g carbohydrate, plus pure wool textiles at 35C, 70–80 % r.h. pupae were separated, sexed, and confined in small vials (5/3 cm) and kept at the rearing conditions. Sexed pupae were examined daily for adult emergence. Adults were fed on tiny drops of honey placed on a sheet of paper.

Traps used for this study were plastic containers (13 × 7 cm) (Fig. 1), each filled with soapy water (5 cm depth). Live adults were housed each in an opaque plastic vial (5×3 cm) covered with secured wire net and placed in the center of the container above another covered one filled with water (setting in the soapy water) and confined inside a 10 × 20 cm plastic cylinder to permit a shade for insect and to prevent any possibility for visual cues. The traps were positioned in a row with a distance of 1.5 meter between each at 16 m height on the wall shelf of the Biology dept; north of a small farm cultivated with some flowers, weeds containing bines weed flowers and small shrubs.

To determine which sex is the producer of the pheromone, fed females or fed males each one week old were placed in the insect trap. Five traps for each sex were left for 10 days feeding on honey. Also control traps without insects were used. Attracted adults were removed daily from each trap, counted and sexed by means of internal genitalia.

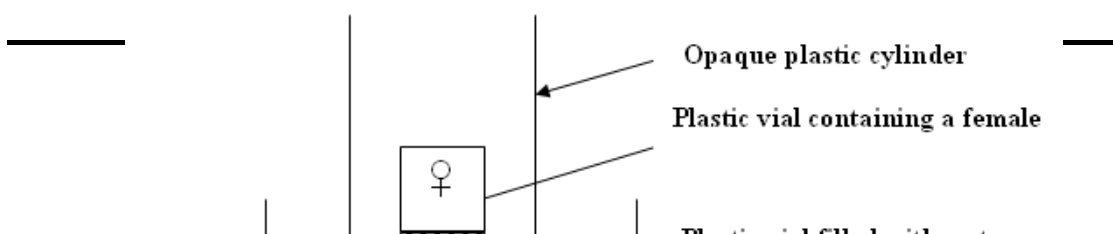


Fig. 1: A simple trap baited with female to trap males

To determine the ages at which the pheromone is released, females, as determined from the previous experiment that were the producers of the sex pheromone, were placed individually (0-1 days old) in each trap and left for more than 50 days (14: 10 L: D) with tiny drops of honey on a small piece of paper, renewed whenever needed. Traps were examined every 5 days to count the number of trapped males.

To determine which ages of males are responsive to pheromone, male groups each of different age were bioassayed against 2 one week old females, using a simple bioassay method (Fig. 2). A plastic bowl 40 cm

radius was used with two holes (83 cm) in its vertical sides opposite to each other. Two one-week old virgin females were confined in small wire cage (22cm) and placed on the floor of the plastic bowl, (8-10) cm beside another empty wire cage. Tested males were released on the far side of the plastic bowl (14: 10 L: D). The two females, males and the two holes were in straight line. The bowl was covered with a transparent glass sheet. A Toshiba air fan operated at the lower speed was placed 50 cm from the bowl facing the two holes to permit air flow. The number of attracted males attracted to females was counted during 20 minutes.

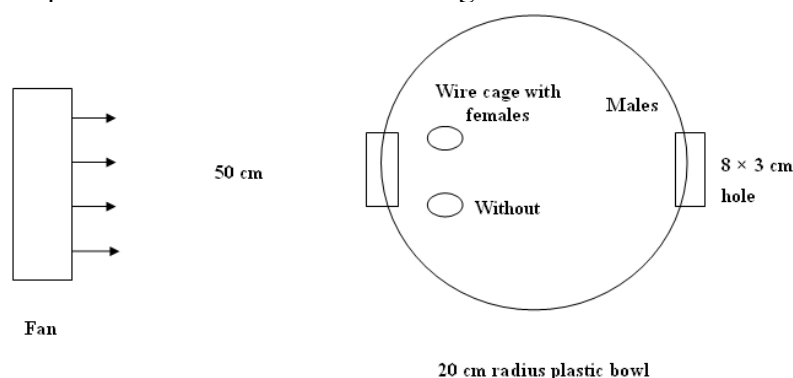


Fig. 2: Bioassay method for testing male response

To determine at which time of the photophase, the pheromone is released, 5 traps each containing one week-old female were set for 9 days (12.30–11.30–L:D). The traps were checked daily for trapped insect every

half hour during the period from 7 am to 12.30 pm (according to a preliminary observation), then checked at 7 am next morning. Number of males caught (based on male genitalia) was counted at each interval.

Larvae feed on stored materials confined in places, whereas adults feed on flower nectar, in some cases emerged female adults could not get from larval habitat to their feeding habitat, however, for any reason if female adults are starved, are they able to release sex pheromone to attract males. Therefore, to investigate the effect of starvation on pheromone release 0-1 day-old females were confined individually in a trap and left 20 days deprived from food (non-mated female adults can remain starved for 30.04 5.41 days, Ali, 1992) and number of caught males was counted every 5 days.

To investigate the effect of starvation on male response, starved twenty days-old males were tested against one week-old virgin female and compared with fed males at the same age (only this test was achieved inside the laboratory as mentioned in the introduction).

To investigate the effect of mating on pheromone release, as the insect mates several time during its life, fed pairs each of 0 to 1 day old female and 0-1 day old male adults were confined in a trap for twenty days and compared with fed virgin females. Number of caught males was counted every 5 days.

The data obtained were subjected to statistical analysis using F-test.

RESULTS

Pheromone producing sex:

Table 1 indicates that virgin females are the only sex producing a sex pheromone, as the mean number of trapped males per virgin female baited trap during ten days was 20.2+ 10.35 with a rang of 12-38 males (the range per trap per day was 1-6 males), whereas neither females nor males were trapped male-baited traps or for insect-free traps.

Table1: Pheromone producing sex of *A. fasciatus*.

Baited sex	Number of males caught per trap/10 days						
	Trap number					Total mean per trap	
	1	2	3	4	5	10 days	one day
Female	15(1-5)*	12(1-3)	20(1-4)	16(1-4)	38(1-6)	20.2+10.35	2.02+1.48
Male	0	0	0	0	0	0	0
Control	0	0	0	0	0	0	0

*range per day

Effect of age on pheromone release:

Data presented in Table 2 show that virgin females could not produce sex pheromone, as estimated by percent male caught , during the period of 0-5 days only three females out of 22 could. Females had started pheromone released and apparently in

a high performance at ages of 5-10 days and continued the emission through all age groups with the same performance where there was no significant difference (p<0.05) among the mean numbers of trapped males by females at all age groups.

Table 2: Number of males trapped by virgin female adult of *A. fasciatus* during 5-day intervals, using simple field traps.

Females	Tested	Age period									
		0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	~ 50
Fed	Mean ±	0.36 a	5.73 b	7.14 b	5.90 b	5.25 b	5.64 b	5.17 b	5.86 b	4.25 b	5.25 b
	S.E.	0.22	0.87	1.16	0.84	0.86	1.38	0.75	1.20	1.03	0.25
	Range	0-4	0-19	0-22	0-16	0-12	0-20	1-9	1-10	2-7	5-6
	No. of traps	22	22	22	21	16	14	12	7	4	4
Starved	Mean ±	0.27 a	5.45 b	6.55 b	5.50 b						
	S.E.	0.14	0.89	1.47	0.60						
	Range	0-1	0-9	1-16	2-8						
	No. of traps	11	11	11	10						
Mated	Mean	0.55 a	1.64 a	0.8 a	1.43 a						
	S.E.	0.39	0.61	0.33	0.48						
	Range	0-4	0-7	0-3	0-3						
	No. of traps	11	11	10	7						

Means with the same letter are not significantly different at $P < 0.05$.

Effect of age on male responsiveness:

Unmated males at ages of 0-5 days showed less response to one-week old virgin females (significant

difference) than older males (Table 3). The response continued nearly at the same level at all later age groups.

Table 3: Response of fed males of *A. fasciatus* at different ages to one week old virgin female

Test		Age in days									
		0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50
% mean	Exp.	16.2±4.11	47.8±10.1	68.2±6.40	67.5±7.98	47.1±9.41	78.3±9.22	71.4±9.33	48.0±15.9	55.0±5.0	66.7±33.3
	±	b	A	a	a	a	a	a	a	a	A
S.E.	Cont.	13.0±7.64	11.6±4.94	10.6±2.14	7.88±2.65	7.86±4.07	0.63±0.63	9.0±5.57	0	0	0
		b	b	b	b	b	b	b	b	b	B

Means with the same letter are not significantly different at $P > 0.05$

Effect of daytime on pheromone release:

Data are presented in Table 4. Virgin females started sex pheromone release after 50-80 minutes (7.30 am – 8.0 am local time) from sun-rise and the release occurred at a low level even after 2 hours and 20 minutes (9.0 am).

Then the release significantly increased reaching high value after 2 hours and 50 minutes later (10.30 am).

Then it significantly decreased after 4 hours and 20 minutes (11.0 am) and continued at the same level till 5 hour and 20 minutes later (12.0 noon). No males were caught after 12.0 noon.

Table 4: Number of caught males by one week old virgin female adults of *A. fasciatus* during one half hour intervals during the photophase (5 traps left for 9 days).

Time	Total number of attracted males	%	% Mean of all 5 traps / day	S.E
7.0- 7.30 am	0	0	0	0
7.30 - 8.0	3	1.67	0.19 b	0.19
8.0 - 8.30	15	8.33	0.93 b	0.35
8.30 - 9.0	12	6.67	0.74 b	0.19
9.0 - 9.30	42	23.33	2.59 a	0.48
9.30 - 10	44	24.44	2.72 a	0.56
10 - 10.30	36	20.0	2.22 a	0.43
10.30 - 11	12	6.67	0.74 b	0.19
11 - 11.30	5	2.78	0.31 b	0.13
11.30 - 12	11	6.11	0.68 b	0.37
12 - 12.30 pm	0	0	0	0
12.30 pm – 7am	0	0	0	0

Mean with the same letter are not significantly different at $P < 0.05$.

ation on

Table 2

indicate that starved female adults released the sex pheromone as fed ones, where the mean number of

captured males by starved females at each age group was similar to that of respective age of ones.

Effect of starvation on male response:

Newly emerged male adults which had been starved for twenty

days responded to female sex pheromone as well as fed ones where the percent starved male response was 61.95 % comparing to 68 % for the fed ones (Table 5).

Table 5: Response of starved and fed males each of twenty days old of *A. fasciatus* to one week old virgin female.

Test		% Mean \pm S.E	
Starved	Exp.	61.9 a	7.35
	Cont.	11.7 b	5.03
Fed	Exp.	68.3 a	1.57
	Cont.	0	0

Means with the same letter are not significantly different at $P < 0.05$

Effect of mating on pheromone release:

Mating of adults female significantly decreased sex pheromone release, since mated females attracted a lesser number of males than unmated ones, where the mean number of trapped males was 0.55 ± 0.39 , 1.64 ± 0.61 , 0.80 ± 0.33 and 1.43 ± 0.48 for mated females compared with 0.36 ± 0.22 , 5.73 ± 0.87 , 7.14 ± 1.16 and 5.90 ± 0.84 for unmated ones during the periods of age 0-5, 5-10, 10-15 and 15-20 days, respectively (Table 2).

DISCUSSION

The present study indicates that only sexually mature female adults of *A. fasciatus* produce the sex pheromone since males were trapped by virgin female baited traps. Sex pheromone-producing females have been reported for other related species and related genera (Burkholder and Dicke, 1966; Burkholder *et al.*, 1974; Barak and Burkholder, 1977; 1978; Abdel-Kader and Barak, 1979).

Females of *A. fasciatus* start pheromone release and apparently at a high level at age group 5-10 days old and they continue the release in the same performance through all age groups. At the same time, male

response is associated with pheromone release. Barak and Burkholder (1977) reported that *A. elongatulus* females contained a lower level of pheromone at age of 0-1 day than females 1-2 days old and the titre did not differ significantly from the older age groups (up to 8 days old) and male response started later at 3-4 days old. They did not investigate ages older than ten days.

A. fasciatus females began to release the pheromone 50-80 minutes after the onset of day light (12:12 L:D) and continued the release during only 4.5 hours of the photophase (7.30 am to 12 noon) and the release reached its peak during one and one half hour (9.0-10.30 am). In contrast, for *A. elongatulus* females, pheromone release continued during all the period of daylight (16:8 L:D), and rapidly increased from a low level at the onset of light (7 am) to a period of significantly higher pheromone content (9 am - 1 pm), then gradually decreased to the lower level (2 pm-11 pm) (Barak and Burkholder, 1977). As in *A. elongatulus*, the dermestid beetle *D. maculatus* females produce the sex pheromone during all the photophase period (12:12 L:D) (Abdel-Kader and Barak, 1979), however, females extracted at the earlier hours of the photophase had a lower pheromone titre than females extracted at the late 4 hours, indicating that

a significant increase in pheromone production takes place at about 3 pm and continues at the same level till the end of the photophase period.

Starvation of female adults did not affect pheromone release, since newly emerged ones starved for twenty days did emit the pheromone in the same level as their respective fed ones. Also starvation of male adults has no effect in their response.

Mating significantly reduced pheromone release. The release ceased in most cases for a period ranging from two to four days, after mating the period of the pre-oviposition, then the release began again with the onset of oviposition (unpublished data). Abdel-Kader and Barak (1979), stated that females of *D. maculatus* extracted 24 hr after mating had a lower extractable pheromone content than virgin female of the same age. They did not extract females after more than 24 hr after mating.

REFERENCES

- Ali , M. F. (1992). Food preference and effect of starvation and high temperature on *Attagenus fasciatus* (Thunberg) (Coleoptera: Dermestidae). J. Egypt. Ger. Soc. Zool., 7 (A): 287– 296.
- Ali, M.F. (1993). Biological studies on immature and adult stages of *Attagenus fasciatus* (Thunberg) (Coleoptera: Dermestidae). J. Stored Prod. Res. 29(3):237-242.
- Ali M . F.; Abdel - Reheem, Elham F. M. and Abdel- Rarhman, H. A.(1997). Effect of temperature extremes on the survival and biology of the carpet beetle *Attagenus fasciatus* (Thunberg) (Coleoptera : Dermestidae). J. Stored Prod. Res., 33 (2): 147-156.
- Abdel-Kader, M. M. and Barak, A.V. (1979). Evidence for a sex pheromone in the hide beetle, *Dermestes maculatus* (DE GEER) (Coleoptera:Dermestidae). J. Chem. Ecol., 5(5):805-813.
- Barak, A.V. and Burkholder, W.E. (1977). Behavior and pheromone studies with *Attagenus elongatulus* Casey (Coleoptera: Dermestidae). J. Chem. Ecol., 3(2):219-237.
- Barak, A.V. and Burkholder, W.E. (1978). Interspecific response to sex pheromones, and calling behaviour of several *Attagenus* species (Coleoptera: Dermestidae). J. Chem. Ecol., 4(3):451-461.
- Burkholder, W.E. and Dicke, R.J. (1966). Evidence of sex pheromones in females of several species of Dermestidae. J. Econ. Entomol., 59(3):540-573.
- Burkholder, W. E.; M.A, M. Kuwahara Y. and Matsumura, F. (1974). Sex pheromone of the furniture carpet beetle, *Anthrenus flavipes* (Coleoptera: Dermestidae). Can. Entomol., 106:835-839.

ARABIC SUMMARY

دراسة بعض مظاهر جاذبات الجنس لحشرة أتاجينس فاشياتس (ثبيريغ) (ديرميستيدى : كوليوبترا)

محمود فضل على

قسم علم الحيوان- كلية العلوم - جامعة المنيا

ادت نتائج الدراسة الى ان الاناث العذراء البالغة لحشرة اتاجينس فاشياتس (ثبيريغ) تنتج جاذب الجنس (الفيرومون) وتبتدى في اطلاق الفيرومون عند عمر يتراوح ما بين 5-10 يوم و اطلاق الفيرومون يستمر عند نفس المعدل في كل الاعمار . وى نطلق الفيرومون بعد زمن يتراوح من 50-80 دقيقة بعد طلوع الشمس ويستمر لمدة أربع ساعات و نصف و يكون اعلى مستوى بعد ساعتين و خمسين دقيقة و لمدة ساعة و نصف. و تجويع الحشرة لا يؤثر على كل من اطلاق الفيرومون و استجابة الذكور و تزواج الاناث يكون له تأثير قوى على اطلاق الفيرومون.