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Adult Food and Soil Mixture as Factors Affecting Egg-Laying in *Pachnoda fasciata* F. (Coleoptera : Scarabaeidae)

With 2 tab. and 1 figur

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Abstract

Flowers of *Pelargonium zonal*, 10% honey-water solution and drops of concentrated honey were separately offered as food to adults of *Pachnoda fasciata* F. The highest amount of eggs (50.58%) were produced by females fed on diluted honey, followed by those fed on concentrated honey (29.96%) and *Pelargonium* flowers (19.46%), respectively. In another experiment six soil mixtures based on clay, sand, cattle - dung (c.d.) and peat moss (p.m.) were tested for their attractiveness to *P. fasciata* females as oviposition media. A mixture of equal volumes of clay, c.d. and p.m. appeared to be the most favourable one in which 37.30% of the eggs were laid followed by a mixture of sand, clay, c.d. and p.m. (28.63%) and sand, clay and c.d. (21.29%). Neither clay nor sand was solely preferred by female of *P. fasciata*.

Zusammenfassung

Blüten von *Pelargonium zonal*, 10 % Bienenhoniglösung und normaler Bienenhonig wurden als Nahrung für *P. fasciata* Adulte geprüft. Höchste Eiproduktion (50,58 %) lag bei Fütterung auf Honiglösung, gefolgt von der auf Honig (29,96 %), dann auf *Pelargonium* (19,46 %). Sechs unterschiedliche Bodenmischungen von gleichen Mengen aus Klei, Sand, Kuhmist und Beatmoos wurden gleichzeitig zur Präferenz für die Eiablage untersucht. Die Weibchen legten den größten Anteil ihrer Eier (37,30 %) in der Mischung Klei + Kuhmist + Beatmoos (28,63 %), dann in der Mischung Sand + Klei + Kuhmist (21,29 %). Weder Klei noch Sand allein waren für die Eiablage geeignet. Diese Ergebnisse wurden erfolgreich für die Laborzucht dieses Schädlings ausgenutzt.

Introduction

Considerable increase have been observed among the population of some scarabaeid species in Egypt during the recent few years causing damages indicating that these beetles may turn to be serious agricultural pests in certain cases. Field observations showed that adults of the peach cockchafer, *Pachnoda fasciata* F. attack flowers and soft fruits of several orchard trees and ornamental plants (Kamel, 1988). Although, *P. fasciata* was recorded in Egypt many years ago, nothing was published about its biology up to the works of ABOU BAKER et al. (1989) and HELMY et al. (1989) on its immature and adult stages. The steady increase in the population of *P. fasciata* attracted our attention to search for establishing a reliable technique for rearing and maintenance of this insect in the laboratory and/or under simulated-field conditions as an essential step for testing different biological and chemical control methods against the various stages of this insect.

Although there is a general agreement among entomologists that rearing of many scarabaeid species in the laboratory is a difficult task, valuable knowledge were given in this field by HURPIN and FRESNEAU (1964 and 1969) and LEE and PENG (1982) who discussed some factors that may influence the rearing of some scarabaeids. Further information on the significance of adult's diet composition as a factor governing egg production of *P. sinuata flaviventris* were reported by DONALDSON (1985). The present work deals with the adult food and type of oviposition media as two important factors that may affect egg-laying activity of *P. fasciata* females.

Materials and Methods

Effect of adult food on the number of eggs laid by females:

Three diets were tested as adult food to examine their effect on females'egg-production; flowers of *Pelargonium zonal*, honey diluted in water (10% solution) and drops of concentrated honey (without dilution). Pairs of males and females each was kept in one- kgm glass jars furnished at the bottom with sterilized mixture of clay, sand and cattle dung (1:1:1 v/v) with suitable moisture. Jars were maintained in the laboratory at 30.3°C. (28-34°C). A group of three jars were provided with *Pelargonium* flowers (A), another three jars were provided with pieces of cotton-wool saturated with 10% honey solution (B) and the last group (c) was provided with stripes of papers on which drops of pure honey were distributed. All jars were examined daily, laid eggs were counted and removed, adult food were renewed and soil mixture was readjusted. This experiment lasted a period of 16 days.

Female preference to different soil mixtures as oviposition media:

Six soil mixtures based on main four ingredients, i.e. sand, clay, cattle dung and peat-moss in different proportions (v/v) were tested for their attractiveness as oviposition media to *P. fasciata* females.

Initial soil moisture was adjusted at the level of the balling point and then kept at that level by adding suitable amount of water daily. Each treatment was triplicated; three plastic boxes (15x10x10 cm)

Mixture No	ingredients			
	Sand	Clay	Cattle dung	Peat moss
1	-	1	-	-
2	-	-	1	-
3	1	1	1	-
4	1	1	1	1
5	-	1	1	1
6	-	1	1	-

were filled to their rims with each mixture. The total of 18 boxes were labeled and placed in a randomized arrangement inside a field cage (63x63x134 cm) located outside the laboratory under natural climatic conditions. Thirty young pairs of *P. fasciata* beetles were introduced into the cage and provided with 10% honey solution as food. Minimum and maximum temperature were recorded daily. All containers were inspected weekly. Eggs found in each box were counted and removed; then all boxes were returned to the cage in different distribution. This experiment lasted a period of seven weeks from 5 July to 16 August, 1988 where temperature ranged between 22 and 44 °C with an average of 30.79 ± 2.3 °C.

Results and Discussion

Effect of adult food on the number of eggs laid by females:

Eggs produced by *P. fasciata* females varied remarkably when the adults were offered three types of food. As shown in Table 1 females fed on 10% honey solution produced 130 eggs throughout the 16-day experimental period with daily average of 8.13 ± 4.50 eggs. The total eggs produced by these females amounted as 1.54 times as the number produced by females fed on concentrated honey (total : 77 and daily average of 4.75 ± 3.38 eggs) and as 2.6 times as eggs laid by females allowed to feed on *Pelargonium* flowers (total 50 and daily average of 3.8 ± 3.97 eggs). In the case of feeding on diluted honey, egg production was more regular and continuous compared to the other two tested treatments. Moreover, oviposition declined rapidly and ceased on the 13th day among females fed on *Pelargonium* flowers. Results obtained indicate that diets of adults is of a great value in terms of egg-production when *P. fasciata* maintained in the laboratory for experimental purposes. The favourability of diluted honey as adult food could be attributed to its high nutritional value on one hand (DONALDSON, 1985) and its availability and suitability for the adults, on the other. Moreover, preliminary observations in another separate field cage experiment showed that when *P. fasciata* beetles were supplied with three types on food in the same cage, i.e. fresh *Pelargonium* flowers, 10% honey solution and over-ripe peach fruits, the great proportion of the beetles readily attracted to the honey solution followed by peach fruits. In the presence of the two mentioned foods insects never approach *Pelargonium* flowers.

Table 1: Number of eggs laid by *P. fasciata* females fed on three of food during 16 days.

Type of food	Daily number of eggs																ΣX	$X \pm S.D$
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th	16th		
(A) <i>Pelargonium</i> flowers	1	9	11	9	9	9	1	5	2	2	2	1	0	0	0	0	50	3.8 ± 3.97
(B) Diluted honey (10%)	3	2	8	12	11	8	15	7	5	1	14	13	3	5	14	9	130	8.13 ± 4.50
(C) Concentrated honey	1	7	8	4	0	5	1	4	10	5	3	6	3	0	12	7	77	4.75 ± 3.38

Female preference to different soil mixtures as oviposition media:

Results during a seven-week experiment are summarized on Table 2 and Fig. 1. A soil mixture composed of clay, cattle dung and peat moss in equal proportions (Mixture No. 5) attracted *P. fasciata* females very early from the first week of the experiment; they laid 95.45% of eggs produced during this week in the boxes containing this mixture. The 2nd and 3rd weeks witnessed the largest amount of eggs produced in all tested boxes, nearly 50% of the total amount recorded in 7 weeks. However, the mixture No. 5 continued to be the most favorable one during these two weeks of the oviposition peak (33.72 and 35.93% of the total egg production in 2nd and 3rd weeks). With the exception of 4th and 5th weeks, records of the same mixture (No.5) proved its superiority to the other tested media, since 37.30% of the total eggs were laid in it. This fact was confirmed when a comparison was made between the six tested mixtures in terms of the weekly average number of eggs

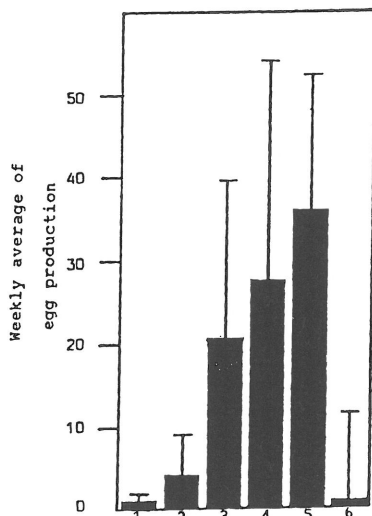


Fig. (1): Eggs produced weekly by *P. fasciata* females on six types of soil mixtures under simulated-field conditions.

* Figures 1-6 point to the six mixtures tested, c.f. table 2.

** bars indicate to S.D.

Table 2: Number and percentage of eggs laid by *P. fasciata* during a 7-week-field-cage experiment.

Soil Mixture (V/V)	Weekly number of eggs							ΣX	$\bar{X} \pm S.D.$
	1st 5/7	2nd 12/7	3rd 19/7	4th 26/7	5th 2/8	6th 9/8	7th 16/8		
1. clay %	2 4.54	2 1.16	- 0	1 1.45	2 1.89	- 0	- 0	7 1.03	1 \pm 1
2. Cattle dung (c.d.) %	- 0	1 0.58	15 8.98	- 0	- 0	9 10.59	- 0	25 3.67	3.57 \pm 5.58
3. Sand + Clay +c.d. 1 : 1 : 1 %	- 0	45 26.16	45 26.95	36 52.17	15 14.17	3 3.53	1 2.63	145 21.29	20.7 \pm 19.19
4. sand+clay.+ c.d.+peat 1 : 1 : 1 : 1%	- 0	33 19.19	47 28.14	11 15.94	59 55.66	29 34.12	16 42.11	195 28.63	27.86 \pm 19.14
5. clay+c.d.+ peat 1 : 1 : 1 %	42 95.45	58 33.72	60 35.93	16 23.19	23 21.70	34 40.00	21 55.26	254 37.30	36.29 \pm 16.45
6. clay+c.d. 1:1 %	- 0	33 19.19	- 0	5 7.25	7 6.60	10 11.76	- 0	55 8.08	07.86 \pm 10.89
Total %	44 6.46	172 25.26	167 24.52	69 10.13	106 15.57	85 12.48	38 5.58	681 100.0	

laid in each soil mixture; 36.29 ± 16.45 eggs were laid in mixture No. 5 followed by 27.86 ± 19.14 and 20.7 ± 19.19 eggs laid in mixture No. 4 (sand, clay, c.d. and p.m.) and mixture No. 3 (sand, Clay and c.d.), respectively. The two latter mixtures recorded 28.63 and 21.29% of the total eggs, respectively.

It is observed that the presence of clay and cattle dung together in the tested soil mixture in addition to sand and/or peatmoss induced egg production among *P. fasciata* females if they were provided with appropriate food (such as diluted honey).

The present results confirm what was previously found by HURPIN and FRESNEAU (1964) or *Oryctes nasicornis* and *Phyllognathus silenus*; HURPIN and FRESNEAU (1969) on *Oryctes elegans* and DONALDSON (1985) on *Pachnoda sinuata flaviventris*. However females of *P. fasciata* showed very slight attraction to boxes containing clay (1.03%) or cattle dung (3.67%) as a sole component. Nevertheless when clay and cattle dung were added together without any third component, only 8.08% of the total produced eggs were laid in such a mixture. These results could be explained not only in relation to the balanced food contents, necessary to the forthcoming larvae in the given soil mixture, but also due to the physical structure of the mixture which may facilitate or hinder the female attempts to find its way through the soil particles. This finding was supported by our field observations, since larvae of *P. fasciata* have not been found in manure heaps located on the borders of peach orchards or near the trees of *Lawsonia alba*. On the other hand, larvae could be collected from soil under the latter trees.

Conclusion

Large number of eggs could be obtained for experimental purposes if females of *P. fasciata* were provided with 10% honey solution and if rearing cages were furnished with a mixture of clay, cattle dung and peat-moss in equal parts as oviposition medium. The insects could be successfully maintained in field cages during July and August.

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