EFFECT OF DUNG TYPE MIXED WITH SANDY SOIL ON SOME BIOLOGICAL ASPECTS OF THE PUBSECENT ROSE CHAFER, *TROPINOTA SQUALIDA* SCOP. (COLEOPTERA: SCARABAEIDAE)

EL-SAYED, A. M. AND H. B. HOMAM

Plant Protection Research Institute, Nadi El-Said Street, Dokki, Giza Egypt

(Manuscript received 10 August 2003)

Abstract

The present studies focus on the effect of different types of dung mixed with sandy soil on three biological aspects of the pubescent rose chafer, *Tropinota squalida* Scop. (Coleoptera: Scarabaeidae). Studies were conducted under laboratory conditions of 20-25°C and 60-65% RH. Investigated dung types were: cattle, horse, poultry, their mixture compared with separate mud and sandy soils.

It was found that, cattle dung was the most attractive to adults followed by horse and dung mixture. The least attractive one was sand. Oviposited eggs in sandy soil did not develop beyond the second larval instar. Other ones supported development to adult stage. The percentages of survivorship of the larval stage did not differ significantly in the different media types except sandy soil, were it did not exceed 3%. The survivorship of pupal stage ranged between 5.9 and 26.6% with significant differences within dung types.

Shortest duration of different stages was 93.3 days on poultry dung while it ranged 105.7 to 111.3 days on other tested media. Emerged adults longevity of males and females ranged between 19.7 to 22.6 days and 22.5 to 24.6 days, respectively, with no yielded significant differences within tested dung. Female fecundity was highest for one those developed on horse dung medium.

(65.4 eggs/female) and lowest fecundity was recorded in case of using poultry dung medium (54 eggs/female).

The effect of adult's diet type on longevity and female fecundity can be ranked into three groups. The optimal one is *B. kaber* followed by *P. malus* , *V. faba* and *B. capitata* occupied the same rank ,while *C. sinensis* was the least optimal one.

Generally, tested dung in soil is essential for governing insect stages to develop.

INTRODUCTION

The pubescent rose chafer, *Tropinota squalida* Scop. (*Coleoptera: Scarabaeidae*) has recently become a serious pest on different crops in various parts of Egypt, especially in new reclaimed lands. It causes great damage to various plantations (Ali and Ibrahim, 1988 and Homam, 1994). This scarabaeid pest was first recorded in Egypt by Alfiieri, 1976. Adults of *T. squalida* feed on flowers, pollen grains, young fruits and in few cases on apical parts of young plant leaves (Jannane, 1947, Ali and Ibrahim, 1988, El-Deeb, 1992 and Homam 1994). Females are commonly attracted to the odors of dung to oviposit their eggs in soil characterized with rich organic matter components around the roots of host plants, where larvae and pupae completed their development. Larvae of *T. squalida* feed on decaying organic matter (Stewart and Toor, 1983). Farmers in Egypt are using different types of dung for manuring and amending the new reclaimed lands characters.

The aim of this work is to study the effect of adding different types of dung to sandy soil on different biological aspects of *T. squalida*. In addition to study the effect of feeding on different flowers type on the adult longevity and fecundity of *T. squalida* females.

MATERIALS AND METHODS

I - Biological studies on different types of dung

Insects used in these experiments were collected as adults of *T. squalida* from manure piles at El-Sadat area (Menoufia Governorate) during February 2001. Collected adults were transferred in glass jars to the laboratory located at Faculty of Agriculture, Shebin El-Kom, Menoufia University to establish the stock culture. Maintaining for one year to produce new generations which were used in the experiments objectives. Various organic dung were selected according to what used by Egyptian farmers for fertilizing new reclaimed lands. Various dung types and mud, which used in the present study, were collected from the experimental farm of El-Rahib (Faculty of Agriculture Shebin El-Kom). Dung types included cattle, horse and poultry were tested. In addition, the mixed dung (cattle + horse + poultry) in the equal volume. This mature organic dung was then freezed for 3 months at - 12°C to get red of any

related natural enemies in these dung materials. Sand soil was obtained from El-Sadat area. Each dung type was mixed as 15% in sandy soil by weight. Plastic pots (25 cm. in diameter) were filled with 3 Kg /plot as an experimental unit, (replicate). Three replicates of six treatment were used to study the percentages of survivorship and duration of *T. squalida* stages on different dung types. Each three pots were filled to their rims with each mixture. All pots were marked and arranged randomly inside a big cage covered with wire net (120 x 120 x120 cm.). Moisture was adjusted at moderate level by adding suitable amount of water daily in pots. Adult, males and females of *T. squalida* were kept inside metal cage (80 x 80 x 80 cm.) for one week after collected it from the stock culture to allow it to mate and provided with *Vicia faba* flowers daily as food. A number of 112 matted adult females of *T. squalida* were introduced to the experimental cage containing the treatments pots and provided daily with new flowers of *Vicia faba*. All pots were inspected each two days, to estimate the attractiveness of females to the different pots. Deposited eggs of each media were gently removed by means of a brush from pots. Eggs laid in (each treatment three replicates) were kept and maintained in other pots. Hatched larvae were carefully transferred to another pot of the six treatments, which replaced twice till pupation. Pupal cells were placed in pots of each treatment and wetted to maintain adequate moisture for adult emergence. Duration of each immature stage and adult stage were recorded and percentages of survivorship on each stage were estimated. Adult's longevity and fecundity were estimated.

Analysis of variance was applied to test the differences between the treatments and Duncan multiple range test was used for mean separations according to Sendecor and Cochran (1967).

II - Effect of different flower types on adult longevity and fecundity of *T. squalida* females

Flowers of apple, *Pyrus malus* L., black mustard, *Brassica nigra* L.,broad bean, *Vicia faba* L., orange, *Citrus sinensis* L. and cabbage, *Brassica oleriaceae* were tested as food for adults and to study their effect on longevity and fecundity of *T. squalida* females. Pairs of males and females were kept in glass jars furnished at bottom with mixture of sand and cattle dung. Five groups of glass jars maintained in the

laboratory. Each group was provided with fresh flowers of one of the species mentioned previously. All glass jars were examined daily, laid eggs were counted and removed to another jars. Flowers were changed daily and adults of *T. squalida* were provided with fresh flowers.

RESULTS AND DISCUSSION

I - Effect of different types of dung on some biological aspects of *T. squalida*

a - Attraction of *T. squalida* females to different dung media Obtained results are presented in Table 1. It indicates that, the tested dung media had a significant effect in attracting adult females of *T. squalida*. Cattle media was the most attractive one. Mean number of attracted females was 9.3, followed by mixture dung media, horse media, mud, poultry media and sand (7.3, 6.7, 5.5, and 4.0 females, respectively). These results are agreement with that obtained by Smith *et al.*, 1983, who mentioned that females of *T. squalida* were attracted predominantly to dung. Also, in the same trend Homam (1994) mentioned that the population density of *T. squalida* in the farm fertilized with organic manure was higher about 2.5 to 3.0 folds than that of unfertilized farm.

b – Fecundity Statistical analysis of obtained data shown in Table 1 revealed that, egg laid by the attracted females of *T. squalida* was significantly different according to dung types which were mixed with sand. Horse, cattle and mixture media resulted in increasing fecundity rate to maximum of 23.6, 23.6, and 20.9 egg / female respectively. The least fecundity rate was observed in sand soil (3.7 egg / female). Some authors mentioned that mixing dung in soil changes the texture relatively according to type of used dung. Mindo (1966) mentioned that heavy infestation of *T. squalida* confined to a single vineyard results from the proximity of cattle enclosures and manure pits which formed excellent oviposition site.

c – Hatchability Hatchability of oviposited eggs in different media types ranged between 73.3 and 82.7% with non significant differences, Table 1. This obtained results are in agreement with the finding that obtained by El - Deeb, (1992).The hatchability % of *T. squalida* eggs were 70.4, 72.8 and 76.8% at 20-25°C, at room temperature.

d – Survivorship rates of larvae and pupae Survivorship rates of first larval stage (presented as percentages) did not differ significantly between different media, Table 1. This value ranged between 32.7 and 55.5%. Similar trend was observed for second larval stage except for sand, where it did not exceed 3% Table 1. Survivorship rates on other tested media ranged between 26.2% on poultry to 42.4% on cattle dung. Hatching larvae in sand medium did not reach to the third larval stage, Table 1. Survivorship of third larval stage in other media ranged between 14.8 on horse dung and 28.8% on mixed media. Regarding the survivorship of pupal stage, it ranged between 5.9 and 26.6%. Mixed media recorded the highest survivorship where poultry media gave the lowest survival, Table 1. These results may explain the changing in the survivorships among *T. squalida* stages thus indicating the reliable reduction in survivors' percent as stages progressed. The only significant difference was observed between pupal survivorship rates according to dung type tested. The dung type used offers proper habitat suitable for larval stage development, where it represent the main source of nutrition. In this respect, Macfarlane (1987) concluded that, the application of the mulch of grass increased beetle damage of *Papuana vuinodis* on taro *Colocoasia esculenta*, perhaps by providing conditions suitable for oviposition and larval development. In addition, Bishara (1959) mentioned that organic matter retains the moisture content and provides a certain heat during the process of decomposition, which helps the larva of *Pentodon bispinosus* Kun to withstand the low temperature of the soil during winter.

II - Effect of different media on durations of *T. squalida* reared under laboratory conditions

a - Egg stage Eggs are non feeding stage. Variations in their developmental duration depends on temperature figures and soil moisture content. The mean incubation period of *T. squalida* eggs ranged between 16.9 and 19.4 day in poultry and cattle media, Table 2. Tested dung can be ranked into two significant groups. The first one included cattle,mud and horse,while the second group included mixed dungs and poultry media. El-Deeb, 1992 found that the average of incubation period of *T. squalida* were 11.2, 21.7 and 16.4 at 20-25°C.

b - Larval stage In sandy media most of larvae failed to complete their development and died before reaching the pupal stages, Table 2. Duration of first larval stage ranged between 10.7 and 13.8 days on poultry dung and mud, respectively. Second larval stage durations did not vary significantly between media used. It reached 18.6, 18.9, 18.1, 17.6 and 18.5 days on mud, horse, cattle, poultry and mixed media, respectively. The variance in third larval stage duration was more evident and significant. The shortest duration occurred in poultry dung medium as 25.6 days, while the longest duration was in horse dung medium as 34.3 days ,Table 2. Stewart and Toor (1983) found that larvae of *T. squalida* feed on decaying organic matter.

c - Pupal stage The same trend was noticed for pupal stage duration. As have been observed for larval stages, the shortest duration was recorded in case of developing the pupae in poultry dung medium (i. e. 22.4 days). This duration was significantly shorter than that durations observed for larvae developed in other medium, Table 2.

d - Life cycle durations Life cycle duration on poultry dung medium was significantly shorter than that recorded for used media, Table 2 i.e 93.3 days for poultry dung medium while it ranged between 105.7 days and 111.3 days on other medium, Table 2. Variances of life cycles durations obtained may reflect furnish nutriment components on tested dung on larval stage.

e - Adults longevity and females fecundity Longevity of males reared on different media ranged between 19.7 and 22.6 days, Table 2 with no significant effect of the used media. Similar trend was observed for the females where it ranged between 22.5 and 24.6 days.

Female fecundity ranged between 54 eggs/female, when females developed on poultry dung medium and 65.4 eggs/female, when females developed on horse dung. Fecundity seemed to be in harmony with life cycle duration, Table 2.

III - Effect of feeding on different flower species on longevity and fecundity of *T. squalida*

Obtained results are presented in Table 3. Male longevity ranged between 25.6 and 34.7 days when it feed on *C. sinensis* and *B. kaber* flowers, respectively. There were significant differences among the tested flowers, Table 3. *C. sinensis* resulted the

shortest longevity of *T. squalida* females (23.6 days).The other types of flowers used as diet gave a range of 29.7 to 31.9 days with no significant differences among them Table 3. In the same trends, Homam (1994) found that not only the color of flowers which governed the attraction of *T. squalida* but also the odor which played a significant role in attraction of *T. squalida*. Also he mentioned that the number of *T. squalida* adult on apple flowers is higher than that on pear flowers.

Female fecundity of *T. squalida* followed some what similar trend to male longevity, Table 3. Maximum female fecundity occurred when females were fed on *B. kaber* flowers (26.9 eggs/female) while the minimum fecundity occurred when *C. sinensis* flowers were used as diet (21.8 eggs/female). Considering the obtained results rank for each tested diet, we can conclude that the tested flowers, as diet for *T. squalida,* can be ranked into three groups. The optimal one is *B. kaber* followed by *P. malus*, *V. faba* and *B. capitata* occupied the same rank, while *C. sinensis* was the least optimal one.

CONCLUSION

Generally, any tested dung in soil is essential for governing insect stages to develop. Dung type had a significant effect in attracting adults females, their fecundity and survivorship of pupal stage, while it was non significant differed on the three larval instars. This, it must be controlled the different stages in dung before distributed in soil. The variance on the effect of flower types on longevity and female fecundity was more evident and significant differed.

Acknowledgement

We would like to express our deep gratitude to Prof. Dr. El-Sheikh, A. Professor of Pest Control, Faculty of Agriculture, Shebin El-Kom, Menofioua, University for helping us during conducting the present studies.

Table 1. Effect of dung type on the attractiveness, fecundity, hatching of deposited eggs and survivorship of *T. squalida* stags

Type of dung added	Mean numbers of attracted females	Fecundity	Hatching%	Survivroship			
				Larval stages			Pupal stage
				First	Second	Third	
Sand	4.0^{d}	3.7^{d}	73.3^{a}	32.7^{a}	2.8^{b}	-	-
Mud	5.0^{cd}	16.8^{b}	79.2^{a}	45.2^{a}	34.5^{a}	21.7^{a}	9.8^{b}
Horse	6.7^{bc}	23.6^{a}	74.4^{a}	55.5^{a}	34.7^{a}	14.8^{a}	13.7^{a}
Cattle	9.3^{a}	23.2^{a}	73.8^{a}	56.1^{a}	42.4^{a}	21.7^{a}	6.9^{a}
Poultry	5.0^{cd}	9.6^{c}	82.7^{a}	54.8^{a}	26.2^{a}	24.9^{a}	5.9^{bc}
Mixture	7.3^{b}	20.9^{a}	70.8^{a}	52.4^{a}	40.8^{a}	28.8^{a}	26.6^{a}
F value	9.79^{**}	43.8^{**}	0.31	1.06	6.5^{*}	2.7	14.2^{**}

Means in each column with the same letter are not significantly different, ($P < 0.05$) using Duncan multiple range test.

Table 2. Effect of dung type on biology of laboratory reared *T. squalida at 20-25*°C

Type of dung added	Egg stage	Larval stage			Pupal stage	Life cycle	Adult longevity		Fecundity
		1st	2nd	3rd			Male	Female	
Sand	18.2^{ab}	10.9^{bc}	-	-	-	-	-	-	-
Mud	19.2^{a}	13.8^{a}	18.6^{a}	30.4^{b}	27.2^{a}	109.2^{a}	21.5^{a}	23.0^{a}	62.7^{a}
Horse	19.1^{a}	12.2^{abc}	18.9^{a}	34.3^{a}	26.8^{a}	111.3^{a}	19.7^{a}	22.5^{a}	65.4^{a}
Cattle	19.4^{a}	11.9^{bc}	18.1^{a}	29.7^{b}	26.6^{a}	105.7^{a}	22.6^{a}	23.4^{a}	59.4^{ab}
Poultry	16.9^{b}	10.7^{c}	17.6^{a}	25.6^{c}	22.4^{b}	93.3^{b}	20.7^{a}	24.6^{a}	54.0^{b}
Mixture	17.6^{b}	12.6^{ab}	18.5^{a}	31.5^{ab}	27.8^{a}	108.0^{a}	21.6^{a}	23.8^{a}	62.7^{a}
F value	3.8^{**}	3.5^{**}	3.5^{**}	9.14^{**}	6.9^{**}	11.3^{**}	0.3	0.3	4.5^{**}

Means in each column with the same letter are not significantly different, ($P < 0.05$) using Duncan multiple range test.

Table 3. Effect of food type on longevity of *T. squalida* adults and females fecundity at (20-25°C and R. H. 50-60%).

Species of flowers	Adult longevity		Fecundity (eggs/female)
	Male	Female	
Pyrus malus	28.5^{cd}	29.7^{a}	24.1^{abc}
Brassica kaber	34.7^{a}	30.8^{a}	26.9^{a}
Vicia faba	33.1^{ab}	30.6^{a}	22.5^{c}
Citrus sinensis	25.6^{d}	23.6^{b}	21.8^{c}
Brassica capitata	30.7^{bc}	31.9^{a}	25.6^{a}
F values	11.6^{**}	7.4^{**}	3.4^{**}

Means in each column with the same letter are not significantly different, ($P < 0.05$) using Duncan multiple range test.

REFERENCES

1. Alfieri, A. 1976. The Coleopteran of Egypt. A systematic list of the fauna, its distribution over the country, monthly occupancy, ecological information and taxonomic notes. Bull. Entomol. Soc. Egypt, 5 Pp 361.
2. Ali, M. A. and I. L. Ibrahim. 1988. Preliminary study on occurrence and abundance of *Tropinota squalida* Scop. (Coleoptera : Scarabaeidae) infesting certain ornamental plants and fruit crops. Al-Azhar J. Agric. Res., 9: 1-14.
3. Bishara, S. I. 1959. Studies on some scarabaeid beetles injurious to agriculture in Egypt with special reference to the biology of *Pentodon bispinosus* Kun (Scarabaeidae: Coleoptera). M. Sc. Thesis, Fac. of Sci., Cairo Univ., 146 pp.
4. El-Deeb, M. A. 1992. Biological and ecological studies on *Tropinota squalida* Scop at Sharkia governorate. Zagazig J. Agri. Res. 19 (3):1421-1429.

5. Homam, B. H. 1994. Ecological and toxicological studies on certain scarabaeid beetles of economic importance. M. Sc. Thesis. Fac. of Sci., Ain Shams Univ., 100 pp.
6. Jannane, G. 1947. A limentazione a denni delle cetonielle (the mode of feeding of cetoniids and the damage due to them). Agric. Puglies., 1: 10-12.
7. Macfarlane, R. 1987. Cultural and chemical control of taro beetle, *Papuna uninodis*. Soloman islands, Ministry of Agriculture and Lands, Res. Dept. Dodo Creek Research Station: 7-9.
8. Mindo, G. 1966. A heavy infestation by hai cetoniids on vines in Sicilye, *Tropinola hirta* Poda and *T. squalida* Scop. Bull. Ist Ent. Agric. Oss. Fitopat. Palermo, 5: 307-316.
9. Snedecor, G.W. and G.W. Cochran 1967. Statistical Methods (The lower State Univ. Press Ames. 534pp.)
10. Smith, T. J. R., T. A. Weiz and S. B. Peck. 1983. Dung beetles (Scarabaeidae): Active in forest habitats in Southwestern Australia dung winter. J. Aust. Entomol. Soc., 22 (4): 307-309.
11. Stewart, K. M. and R. Toor. 1983. Control of grass grub *Costelytra zealandica* (White) by heavy rolling . New Zealand Journal of Experimental Agriculture, 11 (3): 265-270.

تأثير خلط بعض أنواع الروث مع التربة الرملية علي بعض الصفات البيولوجية لحشرة جعل الورد الزغبي (تربينوتا سكواليدا – سكوب) عائلة سكربيدي رتبة غمدية الأجنحة

عبد الغني محمد السيد و همام بخيت همام

معهد بحوث وقاية النباتات– مركز البحوث الزراعية – وزارة الزراعة – الدقي – جيزة – مصر

أجريت الدراسة لمعرفة أثر خلط بعض أنواع الروث مع التربة الرملية (منطقة السادات) بنسبة ١٥% علي الصفات البيولوجية لأطوار حشرة جعل الورد الزغبي (تربينوتا سكواليدا) تحت ظروف المعمل. وتم جمع روث الماشية والخيل والدواجن وخليط منهم بنسب متساوية والطمي (التربة العادية) من مزرعة كلية الزراعة –شبين الكوم – مزرعة الراهب وتم التخلص من جميع المتطفلات التي قد توجد في بعض هذه المخلفات بحفظها لمدة ٣ شهور علي –١٢°م.

وتتلخص النتائج في الأتي:–

١) كانت أكثر البيئات جذبا للحشرات هي روث الماشية ثم خليط البيئات والخيل بالترتيب علي التوالي. و أقلها كانت بيئة الرمل بدون إضافات وأن هذه الاختلافات معنوية.

٢) أختلف عدد البيض الموضوع حسب نوع الروث المضاف للرمل اختلافا معنويا وأكبر عدد من البيض (٢٣,٦ – ٢٣,٢ – ٢٠,٩ بيضه / أنثى) وضع في بيئة الخيل والماشية ثم الخليط من البيئات المختلفة وأقل كمية بيض (٣,٧ بيضه / أنثى) وضعت في بيئة الرمل بدون أي إضافة ولا يوجد اختلافات معنوية في النسبة المئوية لفقس البيض.

٣) تم حساب القدرة البقائية للأطوار المختلفة علي هذه البيئات حيث وجد أن هناك اختلاف معنوي واضح للأعمار اليرقية. وفشلت جميع اليرقات في إكمال دورة حياتها علي بيئة الرمل وكانت أفضل البيئات هي خليط من أنواع الروث ثم الدواجن ثم الطمي وكذلك الحال بالنسبة لطور العذراء.

٤) تم دراسة دورات الحياة لحشرة جعل الورد الزغبي علي البيئات الستة السابقة.

أ) لا يوجد اختلاف معنوي بين فترات حضانة البيض على البيئات المختلفة

ب) يوجد اختلافات معنوية في مدة الطور اليرقي الأول والثالث وطور العذراء.

ج) لا يوجد اختلافات معنوية بين فترة حياة الحشرة الكاملة (ذكر أو أنثي).

ء) يوجد اختلاف معنوي بين عدد البيض الذي تضعه الإناث المر باه علي البيئات المختلفة وكان اكبر عدد ٦٥,٤ بيضه / أنثى(بيئة الخيل) و اقل عدد ٥٤,٠ بيضه / أنثى (بيئة الدواجن).

٥) ثبت أن هناك اختلاف معنوي في طول فتره حياه الحشرة الكاملة و عدد البيض الموضوع بواسطة الأنثى نتيجة لاختلاف نوع الأزهار التي تتغذي عليها الإناث.