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SOME BIOTIC AND ABIOTIC FACTORS AFFECTING THE BIOLOGY OF *PHYTOSEIUS PLUMIFER* (CANESTRINI AND FANZAGO) (ACARI: PHYTOSEIIDAE)

M.A.M. EL-Enany[1], Z.R. SOLIMAN[2], M.S.NAWAR[2] AND ABLA A. IBRAHM

1 Plant Protection Research Institute, Agricultural Research Centre, Dokki, Giza, Egypt.

2 Faculty of Agriculture, Cairo University, Giza, Egypt.

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Abstract

Some biotic and abiotic factors affecting the biology of the predatory mite *Phytoseius plumifer*(Canestrini & Fanzago) were studied using the two-spotted spider mite *Tetranychus urticae* Koch immatures as a food source. The fermal comanionship with male allover her longevity (multiple mating) gave female shortest longevity (45.2 days), and greatest fecundity (390 eggs / female) ; while single mating gave the longest longevity (52.3 days) and the smallest fecundity (8.2 eggs / female).

T.uricae (adults, 20% ; immatures, 10 % ; eggs 10%)gave the greatest attraction percentage (10%) in the shortest time (5.6, 6.7 and 8.5 minutes, respectively) for fed predator female, while the the scale insect *Parlatoria zizyphus* (Lucas) eggs gave the smallest (5%) and the longest time (91.0 minutes). Also, fed females were better attracted to food than 24 and 48 hours starved females .

Low temperatures 10°C and 5°C decreased total egg hatchability. It decreased from 98% to 72 & from 90% to 40% after one to four weeks at the two degrees, respectively. At 10°C and 5°C female survivability and fecundity ranged from 82 & 54% and 29 & 19 eggs / female to 10 & 0% and 5&0 eggs /female after one to four weeks.

INTRODUCTION

Family phytoseiidae includes some of the most effective and worldwide natural enemies of phytophagous mites. *Phytoseius plumifer* (Canestrini and Fanzago) a member of this family is a potential biocontrol agent for various species of tetranychid mites (zaher *et al.*, 1969; Rasmy and El- Banhawy,1974; El- Bagoury and Nasr 1984). Previous studies dealt mainly with feeding habits, life cycle and general biology. It is imposible to evaluate the biological control potential of a predator without getting enough information on biotic and abiotic factors affecting its biology.

Therefore, the present study deals with some unstudied biotic factors that affect the biology of the predatory phytoseiid mite *P.plumifer*. This will throw some lights on its importance as a biological control agent .

MATERIALS AND METHODS

Phytoseius plumifer was collected from leaf samples of the hollyhok *Conyza dioscoridis* (L.) at Giza . The mite culture was established by placing a copulated female togther with immatures of the two - spotted spider mite *Tetrancyhus urticae* Koch as prey on a bauhinia leaf *Bauhenia variegata* L. situated upside down on cotton wool soaked in water in a 9 cm diameter petri-dish and left to deposit eggs. The edges of the leaf disc were also lined with a wet cotton barrier . Leaf was changed by fresh one when needed (5-7 days), and few drops of water added daily and kept at 25°C.

Experiment 1 : Effect of multiple mating on female longevity, and facundity: Four groups were conducted; 10 newly emerged females for every group were confined singly, each, to a bauhinia leaf disc of about 4 cm^2 placed in a petri-dish on wet cotton wool at 25±1°C and 70±5% R.H. For the first group , a young male was introduced to each female until first copulation occurred, then males were removed.

For the second group, a young male was introduced to each female for 24 hours every five days of female longevity. For the third group a young male was introduced to each female for 24 hours sporodically each five days, while in the fourth group the female was accompanied with male allover her longevity . Oviposition period and number of deposited eggs for females of every group were recorded.

Experiment 2 : Effect of attractancy to different foods : A petri - dish of 9 cm in diameter was filled with a wet cotton wool pad upon which a clean leaf of bauhinia was placed upside down. A group of each prey stage: (10 adults, 15 immatures, and 25 eggs of tetranychid mites *Tetranychus urticae* Koch, *T.cucurbitacearum* (Sayed), and *Eutetrancychus orientalis* (Klein), 30 moving stages of the eriophyid mite *Eriophyes dioscoridis* soliman & Abou Awad and 25 eggs of the scale insect *Parlatoria zizyphus* (Lucas) as well as date palm, *Phoneix dactylifera* L. pollen grains were stuck on a small piece of a double scotch tape placed at equal distances of 1cm on the circumference of a circle, about 5 cm in diameter, on the plant leaf at 25±1°C and 70±5% R.H. Moving prey individuals were placed on its dorsum on the scotch tape. Ten predator females of each fed and starved for 24 and 48 hours were tested by introducing it singly in a successive order to the center of the circle and kept under observation till reaching its preferable food. Percentage of females that reached every food and began to feed upon was recorded as well as time to reach the food.

Experiment 3 : Effect of low temperatures on egg incubation period and

hatchability and female survivability and fecundity : sixteen groups, each of twenty five newly deposited eggs of the predator *P.plumifer* were collected from a culture and each group was kept a cylindrical plastic cup (2.0 x 1.2 cm) with a filter at its bottom . Relative humidity was maintaind by adding few water drops on the filter paper when needed. Eight cups were kept at $10^{o}C$ and other eight at $5^{o}C$ by two three cups for every temperature were moved to room temperature after one, two three and four weeks. Also, two groups, each of 25 newly emerged and mated females were confined singly to Munger cages. Each was composed of a glass slide 5 X 10 X 0.3 cm completely covered with filter paper on which a bauhinia leaf was placed. A prespex block, 5 X 1 cm with a central circuler hole 3.5 cm diameter rest on top of the plate. The predator mite was confined in the cage and repeatedly supplied with immatures of *T.urticae*. A second glass slid as cover and the hole set was secured by rubber bands. Addition of few drops of water to the filter paper was daily practiced to delay dryness of the plant leaf. Four groups were kept, each, at $10^{o}C$ and $5^{o}C$ and a group of every temperature was moved to room temperature after one, two, three and four weeks for evaluation.

RESULTS AND DISCUSSION

1. Effect of Multiple Mating on Female Longevity and Fecundity :

Multiple mating increased egg deposition, but decreased longevity of *P. phumifer* female, Table 1. The highest number of eggs deposited per female was noticed for female accompanied with male allover her longevity (39 .8 eggs total and 1.4 eggs daily rate). On the contrary, the lowest number of eggs was observed for female kept with male for 24 h. which suggested to be a single mated female (8.2 eggs and 0.6 egg daily rate). Data also showed that multiple mating decreased female longevity. This period averaged in the dessending order, 52.3 49.7, 47.9 and 45.2 days for a female associated 24 hours with a male, twice associations, a female with a male for 24 h. periodically every 5 days (multiple mating), and a female accompanied with a male allover her longevity (multiple mating with complete companionship), respectively. On the Other hand, multiple mating prolonged oviposition as it averaged 14.2, 25.5, 29.7 and 30.4 days for the so- called single mating, double, several presence of male and female with a male allover her longevity, respectively. The statistical analysis proved that multiple mating significantly increased oviposition period, and fecundity, but decreased female longevity as female association with one male allover her longevity, resulted in depositing the greatest number of eggs (39.8 eggs). Thus, it could be concluded that several matings resulted in increasing predator population, especially during full male companionship. Similar re-

sults were reported on *Phytoseius persimilis* Athias-Henriot and *Amblyseius bibens* Blommers by Schulten *et al.* (1978), and on *Typhlodromus pyri* Scheuten and *A.potentillae* (German) by Overmeer *et al.* (1982).

Thus, it could be concluded that several matings increasing *P.plumifer* population, especially during full male companionship.

Table 1. Effect of multiple matings on female longevity and fecundity of *P.plumifer* fed on *T.urticae* immatures, at 25°C.

Mating regime	N	Oviposition priod (days)	Longevity* (days)	No. of eggs/female	
				Total average*	Daily rate
A 24 hour association	10	14.2±2.9	52.3±4.2	8.2±1.1	0.6
Double associations	10	25.5±3.7	49.7±4.5	22.5±2.4	1.0
Four periodic associations	10	29.7±3.4	47.9±2.2	34.1±3.7	1.1
Female with male allover longevity	10	30.4±4.8	45.2±3.4	39.8±4.0	1.4

L.S.D.0.05 for :

Oviposition period	= 1.7
Longevity	= 1.8
Total	= 1.4
Daily rate	= 0.1

2. Attractancy to Different Food Kinds and Types: Comparing predator attractance to different prey species and stage, Table 2, *T.urticae* adult females attracted 20% of tested normal predator females followed by its immatures and eggs; adults of *T.cucurbitacearum*; moving stages of the eriophyid mite *E.dioscoridis*, and date palm pollens each attraced 10% of the predator females, other tested prey gave the least percentage 5%. Starved females for 24 and 48 hours followed nearly similar trend as fed ones. The results were also supported by time taken to reach each food as it took for fed *P.plumifer* female an average of 5.6, 6.7 and 8.5 minutes to reach adults, immatures, and eggs of *T.urticae*; 9.5,12.0, and 50.5 minutes to those of *T.cucurbitacearum*; and 13.5, 27.0, and 30.7 minutes to those of *E.orientalis*, respectively; 42.2 minutes to reach moving stage of the eriophyid mite

E.dioscoridis; 91.0 minutes to the eggs of the scale insect *P.zizyphus*; and 52.0 minutes to reach date palm pollens. Concerning starved predator females, they showed similar attitude as that of fed ones except reaching their targets in longer time than their fed counterparts. This, might be due to deficiency in water contents for starved females which in turn limited its movement and sense (Dicke and Groenevels, 1986). Female predator reached adult prey in shorter time than to prey immatures. This meant that prey adult attracted the predator more than immatures and the latter more than the eggs. This agrees with the findings of Jackson and Ford (1973),Afifi *et al.* (1988), and Rasmy *et al.* (1991).

Table 2. Attractancy of *P.plumifer* to different food kinds and types.

Food type	Fed female		Starved female for 24h		Starved female for 48h	
	Percentage of attracted females	Time in minutes	Percentage of attracted females	Time in minutes	Percentage of attracted females	Time in minutes
Tetranychus urticae						
Adult	20	5.6	15	8.5	20	10.5
Immatures	10	6.7	10	9.2	10	12.2
Eggs	10	8.5	10	19.0	10	23.2
Tetranychus cucurbitacearum						
Adult	10	9.5	15	11.5	15	15.5
Immatures	5	12.0	5	15.0	5	21.0
Eggs	5	50.5	5	32.5	5	31.5
Eutetranychus orientalis						
Adult	5	13.3	5	13.0	5	17.5
Immatures	5	27.0	5	31.0	5	38.0
Eggs	5	30.7	5	35.5	5	45.5
Eriophyes dioscoridis						
Moving stage	10	42.2	10	50.0	5	52.5
Parlatoria zizyphus						
Eggs	5	91.0	5	98.0	5	112.0
Date palm pollen grains	10	52.0	10	56.0	10	61.2

3. Effect of Low Temperature on Egg Incubation Period, Hatchability and Female Survivability and Fecundity: The sum of egg hatchability percentage through and after cold storage decreased as cold storage increased, Table 3. This decrease obviously appeared at 5°C than at 10°C. On the opposite, incubation period prolonged with less temperature and increased storage. However, hatchability percentage decreased from 98% to 72 % and from 90% to 40% after one to four weeks of cold storage at 10°C and 5°C, respectively. The incubation period prolonged from an average 4.2 to 17.8 days and from 5.8 to 19.7 days, through one to four weeks of cold storage at 10°C and 5°C, respectively. During the second week of cold storage 68% and 62% of eggs hatched. This storage of eggs is not successful except for only one week of cold storage at 10°C and 5°C. On the other hand, female percentage survivability decreased as time of cold storage increased wih greater rate at the lower temperature, Table 3. Number of female survivors decreased to 82%, 63% then to 10% at 10°C and from 54%, 28% then to 0% at 5°C when females stored for one, two then four weeks. This agrees with the findings of Gillespie and Ramey (1988) on *Amblyseius cucumeris* Oudemans and Aly (1994) on *A.swirskii* Athias-Henriot. Low temperature also decreased female fecundity as the total number of deposited eggs per female decreased from 29 to 23 then to 5 eggs from 19 to 16 then to zero eggs, after one, two then four weeks of storage at 10°C and 5°C, respectively. Thus, it could be concluded that females are better than eggs to be stored at 10°C for only two weeks as 63% still alive and deposited an average of 23 eggs.

In conclusion, several matings increasing *P.plumifer* population, adults and immatures of the two-spotted mite *T.urticae* was the best attractant food, and its females could be stored at 10°C better than eggs.

Table 3. Effect of low temperatures on egg incubation period, hatchability, female survivability, and fecundity of *P.plumifer*.

Parameter	Cold storage time in weeks							
	10°C				5°C			
	1	2	3	4	1	2	3	4
Incubation period in days T.C.S.	4.2	11.0	12.0	17.8	5.8	11.8	13.4	19.7
Incubation period in days A.C.S.	1.9	1.5	-	-	2.2	2.0	-	-
Hatchability % T.C.S.	14	68	82	72	12	62	50	40
Hatchability % A.C.S.	84	22	-	-	78	14	-	-
Hatchability % total	98	90	82	72	90	76	50	40
Survivability of females	82	63	43	10	54	28	16	0
No. of eggs/ female/10 days	29	23	15	5	19	16	12	0

T.C.S. = Through cold storage
A.C.S. = After cold storage, kept at room temprature

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تأثير بعض العوامل الحيوية وغير الحيوية على بيولوجيا فايتوسيس بلوميفر (كانسترينى وفانزاجو) (أكارى فيتوسيدى)

محمد عطيه العنانى[1]، زينهم رمضان سليمان[2]،
محمد سامى نوار[2]، عبلة عبد الوهاب إبراهيم[1]

١- معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقى - الجيزة .
٢- كلية الزراعة - جامعة القاهرة - الجيزة.

تناولت الدراسة تأثير بعض العوامل الحيوية وغير الحيوية على بيولوجيا الاكارس المفترس فايتوسيس بلوميفر (كانسترينى فانزاجو) باستخدام الافراد غير الكامله للحلم العنكبوتى ذو البقعتين تترانيكس كوخ كمصدر للغذاء.

ولقد أعطت الرفقة الكاملة الانثى مع الذكر طيلة حياتها (تعدد التلقيحات) أقصر طول حياة للأنثى (٤٥,٢ يوما) وأعلى خصوبة (٣٩,٨ بيضة / أنثى) بينما أعطى التلقيح الواحد أطول فترة حياة للأنثى (٢٥ يوما) وأقل خصوبة (٨,٢ بيضة / أنثى).

أعطت تغذية إناث المفترس على تترانيكس پوريتسى (٢٠ ٪ إناث كاملة، ١٠٪ أطوار غير كاملة، ١٠٪ بيض) أكبر نسبة مئوية للانجذاب فى أقل وقت (٥,٦-٧و ٦-٨,٥ دقيقة على التوالى) بينما أعطت التغذية على بيض الحشرة القشرية بارلاتوريا زيزيفس (لوكاس) أقل نسبة إنجذاب (٥٪) وأكبروقت (٩١) دقيقة.

وجد أيضا أن إناث المفترس المتغذية كانت أحسن إنجذاب من الاناث الصائمة لمدة ٢٤ أو ٤٨ ساعة ولقد أنقصت درجة الحرارة المنخفضة ١٥° م ، ٥° م النسبة المئوية لفقس البيض الكلى حيث نقصت من ٩٨٪ الى ٧٢٪ ومن ٩٠٪ الى ٤٠٪ بعد أسبوع على درجتى الحرارة السابقتين على التوالى وعلى درجة ١٥° م ، ٥° م ترواحت حيوية وخصوبة الانثى من ٨٢ ، ٥٤٪ و ٢٩ ، ١٩ بيضة/ أنثى إلى ١٠، صفر و ٥ ، صفر بيضة / أنثى بعد اسبوع الى ٤ أسابيع.