

**EFFECT OF PEA VARIETIES ON DIFFERENT
BIOLOGICAL ASPECTS OF CHROMATOMYIA
HORTICOLA (GOUREAU) (Dipteau : AGROMYZIDAE)**

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ABSTRACT : *Biological aspects of Phytomyza atricornis Meign [Chromatomyia horticola (Goureaux)] were studied on some pea varieties under laboratory conditions. The obtained results indicated that the females laid their eggs successfully and varying significantly according to the tested varieties. The assessed aspects were positive for insect surviving and reproduction among the individuals reared on the leaves of Birophiction variety, whereas, Little-Marvel variety was the least compatible variety. Mortality percentage reached about 51.6 % on Little-Marvel, while it was 28.3 % on Birophiction. It can be recommended to cultivar Little-Marvel. Since, the expected density of this pest will be relatively lower than that of other tested varieties.*

Key Words : *Pea leafminer, Chromatomyia horticola, Pea varieties, Fecundity, Mortality, Hatchability and Development time.*

INTRODUCTION

Leafmining Diptera frequently attack the leaves of nearly all families and groups of plant causing serious injury. Agromyzid pest, *Phytomyza atricornis* Meign [*Chromatomyia horticola* (Goureaux)] one of economic importance insects and had become serious insect pest which cause considerable damage for leguminous leaves resulting in reducing seeds yield. Some publications were conducted either in Egypt by Saleh and Guirguis (1976); Hassanein *et al.* (1988); Hassanein (1989); El-Sheikh *et al.* (1990) and El-Sayed and El-Dash (1993) or in some other countries by Prasad (1993), Parchamiaraghi (1996), Parihar and Ramkishore (1997), and Sood *et al.* (1998), all of them confirmed the economic importance of this insect on various tested plants all over the world. The biology of insects vary considerably between species of host plant and between varieties, therefore, the food plant is very important in determining the biology of *C. horticola*, pest management programs for this insect, especially those using population models, should be based on biological informations. The present work was conducted to compare the ovipositional preference, oviposition period, oviposition rate, incubation period, fecundity, hatchability, the durations of developmental stages and mortality of *C. horticola* on some of pea varieties.

MATERIALS AND METHODS

This experiment was carried out under laboratory conditions of $25 \pm 2^\circ\text{C}$ and $75 \pm 5\%$ R.H. Highly infested pea leaves were collected to be a source of adult flies. Pea seedlings of five weeks old of four varieties, Lincoln, Master, Little-Marvel and Birophiction were prepared for the experiment. The main points of investigation were conducted according to the following topics.

(i) Preferable host for Egg laying :

To study the host preference to lay the egg, three seedlings of each of the four tested varieties were ordered at random in a 60 x 60 x 100 cm cage covered with muslin cloth. Fifty newly emerged flies were released into the cage for about three days for mating and the beginning of oviposition. Filter papers with 10 cm diameter dipped into 10 % honey solution as a source of carbohydrates for the adults (Sharaf El-Din, 1994). The number of deposited eggs were counted on the tested varieties.

(ii) Fecundity, Oviposition period, Oviposition rate and Hatchability :

To determine deposited egg per female on the tested varieties, a pair of newly emerged flies were confined in a glass chimney covered with muslin cloth contains seedling of each tested varieties and 10 % honey solution was dropped onto the muslin. Each pair of flies were transferred into new seedling every day until female died (Leibee, 1984). Individuals deposited eggs were located and counted daily by the aid of stereoscopic microscope. Fecundity was defined as total numbers of eggs per female, rate of oviposition, oviposition period and hatching percentage (Hatchability) were computed.

(iii) Development time, Mortality and Incubation period :

Incubation period was determined by ringing sixty eggs for each variety until hatching. The larvae were observed and development time of larvae and pupae and survived numbers were calculated.

Data were subjected to ANOVA test and L.S.D. values were estimated to arrange the tested varieties according to significance.

RESULTS AND DISCUSSION

A. Preferable host for egg laying :

According to the results presented in Table (1) when *Chromatomyia horticola* (G.) females have been given chance to select more compatible host to deposit their eggs. The highly numbers were laid on Birophiction variety being 124 eggs / plant, whereas, the lowest numbers occurred on the leaves of little-Marvel variety (83 eggs / plant). Highly significant differences appeared between the highest and lowest numbers on Birophiction and Little-Marvel varieties, respectively, while, it showed significant differences between most varieties.

Effect of pea varieties on different biological aspects of chromatomyia

B. Incubation Period :

Table (1) show that the development time of egg varied significantly according to the tested pea varieties. The longest period was lasted on Birophiction variety when, it was 5.0 ± 0.13 days, differed significantly with the other tested varieties, while, the lowest incubation period occurred on Master leaves with mean of 3.2 ± 0.06 days.

Table (1) : Oviposited egg number per plant, incubation period and hatchability of *Chromatomyia horticola* (G.) on tested pea varieties.

HOST	Egg No. / plant	Incubation period		Hatchability (%)	
		Range	Mean \pm SE	Range	Mean \pm SE
Lincoln	116 ^{ab}	3 - 4	3.6 ± 0.14 ^{bc}	(78-87)	81.9 ± 0.7 ^a
Master	102 ^b	3 - 4	3.2 ± 0.06 ^c	(75-85)	79.3 ± 0.6 ^a
Little Marvel	83 ^c	3 - 5	4.2 ± 0.30 ^b	(58-68)	60.2 ± 1.5 ^b
Birophiction	124 ^a	4 - 6	5.0 ± 0.13 ^a	(84-90)	86.2 ± 1.1 ^a
L.S.D. at 5 %	16.5		0.73		10.7
1 %	22.3		0.97		14.2

Each value followed by the same letter is not significant in all Tables.

C. Hatchability :

Pea varieties were divided significantly into two groups, the first one included Little-Marvel variety with mean of 60.2 ± 1.5 %, whereas, the another group consists of the remained tested varieties, since, it ranged between 79.3 ± 0.6 and 86.2 ± 1.1 %, the highest percentage of hatching occurred within the egg deposited on the leaves of Birophiction variety (Table 1). Wang and Yan (1986) stated that, the hatching rate of *P. horticola* was about 97 %.

D. Fecundity, Oviposition period and Oviposition rate :

Tested varieties were exposed to *C. horticola* females separately to lay their eggs. Data as shown in Table (2) revealed that the egg numbers per female ranged between 70 and 115 eggs / female on the tested varieties. There are significant differences between Birophiction and Lincoln varieties on one hand and Master and Little-Marvel on the other hand. More egg

numbers were deposited on Birophiction and Lincoln varieties (111.8 ± 5.1 and 103.2 ± 6.2 eggs / female, respectively) followed by Master (83.3 ± 6.0) and the least mean numbers was deposited on Little-Marvel variety being 76.8 ± 6.6 eggs / female.

The period of egg deposition varied significantly on the different varieties recording the longest period on Master and Little-Marvel (13.2 ± 0.48 and 13.8 ± 0.55 days, respectively), whereas, the shortest period was 10.2 ± 0.62 and 11.4 ± 0.79 days on Birophiction and Lincoln varieties, respectively.

Table (2) : Fecundity, oviposition period and oviposition rate of *Chromatomyia horticola* (G.) on tested pea varieties.

HOST	Egg No. / Female		Oviposition period		Mean No. of Egg / female / day	
	Range	Mean \pm SE	Range	Mean \pm SE	Range	Mean \pm SE
Lincoln	98 - 107	103.2 ± 6.2^a	10 - 14	11.4 ± 0.79^a	6.8 - 10.7	8.5 ± 0.44^b
Master	77 - 86	83.3 ± 6.0^b	12 - 15	13.2 ± 0.48^b	5.1 - 7.2	6.4 ± 0.13^b
Little Marvel	70 - 82	76.8 ± 6.6^b	12 - 15	13.8 ± 0.55^b	4.7 - 6.7	5.6 ± 0.14^b
Birophiction	106 - 115	111.8 ± 5.1^a	9 - 13	10.2 ± 0.62^a	8.8 - 12.7	11.1 ± 0.52^a
L.S.D. at 5 %		15.3		1.5		2.3
1 %		20.4		2.1		3.0

As for, the oviposition rate (Egg No. / female / day) ranged between 4.7 and 12.7 eggs on the leaves of four tested varieties (Table 2). Statistical analysis detected that the daily mean numbers of eggs per female differ significantly between various varieties. *Cromatomyia*, females deposited daily maximum egg numbers attained on Birophiction 11.1 ± 0.52 , while daily minimum eggs were recorded on Little-Marvel variety (5.6 ± 0.14). Highly significant differences showed between mean number of eggs / female on Birophiction and both Master and Little-Marvel varieties, whereas, significant differences occurred between the oviposition rate of females reared on Birophiction and that reared on lincoln variety.

E. Survived numbers and Mortality percentage among *Chromatomyia horticola* stages :

Alive and dead numbers of *Chromatomyia* governed by the range of food compatibility for developmental stages of insect. The results obtained in Table (3) indicated that the more survived numbers were 52 and 43 of pupae and adults attained on Birophiction variety; whereas, the lowest numbers appeared on Little-Marvel (34 and 29, respectively). Mortality percentage reached the maximum within the larval individuals reared on Little-Marvel (43.3 %), while, it was 15.0 % among pupal stage on Birophiction variety. Total mortality percentage was observed with highly value (51.6. %) on Little-Marvel and the lawest value occurred on Birophiction variety being 28.3 % . Generally larval stage suffer from death more than pupal stage on the different tested varieties. Mortality was 65 % of larvae and 17 % of pupae according to the mentioned data of (Wang and Yan, 1986).

Table (3) : Mortality percentage and durations of *Chromatomyia horticola* (G.) larvae and pupae affected by pea varieties.

HOST	Observed No. of larvae	Survived No. of		Mortality (%) of			Duration of Larvae		Duration of Pupae	
		Pupae	adult	Larvae	Pupae	Total	Range	Mean ± SE	Range	Mean ± SE
Lincoln	60	46 ^{ab}	39 ^{ab}	23.3 ^{ab}	11.7 ^b	35.0 ^{ab}	8-11	9.4 ± 0.10 ^b	10-12	10.4 ± 0.12 ^b
Master	60	42 ^b	37 ^b	30.0 ^b	8.3 ^c	38.3 ^b	8-10	9.6 ± 0.2 ^b	10-11	10.8 ± 0.07 ^c
Little Marvel	60	34 ^c	29 ^c	43.3 ^c	8.3 ^c	51.6 ^c	8-12	10.4 ± 0.65 ^c	9-12	10.5 ± 0.30 ^{bc}
Birophiction	60	52 ^a	43 ^a	13.3 ^a	15.0 ^a	28.3 ^a	8-9	8.5 ± 0.08 ^a	9-11	9.8 ± 0.13 ^a
L.S.D. at 5%		7.0	5.5	11.7	3.0	9.1		0.72		0.40
1%		9.4	7.3	15.6	4.0	12.1		0.97		0.53

F. Duration of Larval and Pupal Stages :

The development time of larvae and pupae presented in Table (3). The larval duration lasted a period existed between 8 and 12 days on the various

varieties. The shortest development time occurred among the larvae reared on the leaves of Birophiction variety (8.5 ± 0.08 days), while, the longest period was 10.4 ± 0.65 days, within, the larvae fed on the Little-Marvel leaves.

C. horticola pupated lasting varied periods according to the tested varieties. Mean of pupal development time occurred with minimum value on Birophiction variety (9.8 ± 0.13 days). The least value showed highly significant differences with other tested varieties which ranged between 10.4 ± 0.12 and 10.8 ± 0.07 days.

G. Adult longevity and Total life-cycle :

Data obtained as shown in Table (4) indicated that, adult females lived less time (13.8 ± 0.69 days) on Birophiction leaves with highly significant differences than that of other three varieties and insignificant differences showed within them. The longest period was 17.4 ± 0.65 days of adult females reared on Little-Marvel variety.

On the other hand, total life-cycle varied significantly on various pea varieties lasting minimum period on Birophiction leaves (37.1 ± 1.4 days), whereas, the total development time ranged between 40.1 ± 3.1 and 42.5 ± 2.1 days on the remained varieties.

Table (4) : Adult longevity and total life-cycle of *Chromatomyia horticola* (G.) affected by pea varieties.

HOST	Longevity of adult female		Total life-cycle	
	Range	Mean \pm SE	Range	Mean \pm SE
Lincoln	13 - 19	16.7 ± 1.10^b	34 - 45	40.1 ± 3.1^b
Master	16 - 19	17.3 ± 0.57^b	37 - 44	40.9 ± 1.6^{bc}
Little Marvel	15 - 19	17.4 ± 0.65^b	39 - 48	42.5 ± 2.1^c
Birophiction	13 - 17	13.8 ± 0.69^a	34 - 40	37.1 ± 1.4^a
L.S.D. at 5 %		1.6		2.1
1 %		2.1		2.8

Effect of pea varieties on different biological aspects of chromatomyia

The above mentioned results, about the biological aspects which were evaluated on four pea varieties throughout this investigation indicated that Birophiction variety is more compatible variety for *C. horticola* relative to another tested varieties, while, the least one occurred when the insect reared on Little-Marvel leaves, since, some of biological aspects less about 30 % than that of on Birophiction, in addition, mortality percentage reached about duplex the value on Birophiction (1, 82 times) (Table 5), therefore, it can be recommended that Little-Marvel more suitable to avoid *Chromatomyia* injury in pea plantations as one of safety control methods. Agrawal (1991) found highly differences between the resistance of pea varieties to attack by *Phytomyza atricornis* (*Chromatomyia horticola*). Mehta et al. (1998) mentioned that the majority of the tested cultivars were highly infested by *C. horticola* including lincoln cultivar.

Table (5) : Relative values of *C. horticola* (G.) biological aspects on pea varieties comparing with Birophiction variety.

HOST	Egg No./ plant	Hatchability (%)	Egg No./ female	Egg No./ female/day	Total life cycle	Mortality (%)	Survived No.
Little-Marvel	0.67	0.70	0.69	0.51	1.15	1.82	0.61
Master	0.82	0.92	0.75	0.58	1.10	1.35	0.86
Lincoln	0.94	0.95	0.92	0.77	1.08	1.24	0.91

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تأثير أصناف البسلة على مختلف النواحي البيولوجية

لذبابة أوراق البسلة

Chromatomyia horticola (Goureau)

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الملخص العربى

إن الدراسات البيولوجية لبعض الحشرات الهامة من الناحية الاقتصادية كآفات لبعض المحاصيل تعد بالغة الأهمية خصوصا لاختلاف هذه النتائج باختلاف نوع وصنف العائل النباتى .. لذلك فإن الغذاء عامل مهم فى دراسة بيولوجى الحشرات .. وبالتالي فى برامج المكافحة لهذه الحشرات .. وقد أجريت هذه الدراسة لمقارنة بعض النواحي البيولوجية لحشرة صانعة أنفاق أوراق البسلة على بعض أصناف نباتات البسلة . وقد خلصت هذه الدراسة إلى النتائج التالية :

- ١ - وضعت الإناث بيضها على الأصناف الأربعة المختبرة وكان أعلى معدل على صنف بيروفكشن بينما أقل معدل كان على صنف لتل مارفل مع وجود فروق معنوية بين الأصناف المختبرة .
- ٢ - أطول فترة حضانة للبيض كانت على صنف بيروفكشن ثم صنف لتل مارفل مع وجود فروق معنوية بينهما ، أما صنف ماستر وإنكولن لم يختلفا معنويا .
- ٣ - بلغت النسبة المئوية للفقس أعلاها على صنف بيروفكشن (٨٦.٢ ± ١.١ %) وأقلها ٦٠.٢ ± ١.٥ % على صنف لتل مارفل مع وجود فروق عالية المعنوية بينهما .
- ٤ - بلغ معدل وضع البيض للأثنى ١١١.٨ ± ٥.١ ، ١٠٣.٢ ± ٦.٢ بيضة على كل من صنف بيروفكشن وإنكولن بينما كان المعدل ٨٣.٣ ± ٦ ، ٧٦.٨ ± ٦.٦ على كل من صنف ماستر ولتل مارفل مع عدم وجود فروق معنوية داخل كل مجموعة بينما توجد فروق عالية المعنوية بين المجموعتين .
- ٥ - استغرقت عملية وضع البيض أطول فترة على صنف لتل مارفل (١٣.٨ ± ٥.٥ : يوم) بينما أقصر فترة كانت ١٠.٢ ± ٠.٦٢ : يوم على صنف بيروفكشن مع وجود فروق عالية المعنوية .
- ٦ - المعدل اليومي لوضع البيض كان أعلاه على صنف بيروفكشن ١١.١ ± ٥.٢ . بينما أقل معدل كان ٠.١٤ ± ٠.١٤ : على صنف لتل مارفل .
- ٧ - عانت الحشرات المرياة على صنف لتل مارفل من أعلى نسبة موت بلغت ٥١.٦ % خلال طورى اليرقة

والعذراء - بينما أقل نسبة كانت على صنف البيروفكشن (٢٨,٣%) وقد سجلت فروقا معنوية بين الأصناف المختبرة .

٨ - قضى الطور اليرقى والعذرى فترات مختلفة معنويا على أصناف البسلة الأربعة .

٩ - عاشت الإناث البالغة أقل فترة (١٣٨) يوم على صنف بيروفكشن مسجلة فروقا معنوية عالية بينها

وبين الأصناف الثلاثة الباقية بينما عاشت أطول فترة ١٧ يوم على صنف لتل مارفل.

١٠ - قضت الحشرات أقل دورة حياة ٣٧,١ ± ١٤ يوم على صنف بيروفكشن بينما أطول دورة حياة

كانت ٤٢,٥ ± ٢,١ يوم على صنف لتل مارفل بفروق معنوية بين الأصناف المختلفة للبسلة خلال الدراسة .

من النتائج السابقة يمكن القول أن صنف لتل مارفل بمقارنته بصنف بيروفكشن أقل ملائمة لذبابة أوراق

البسلة حيث قلت القيم البيولوجية لهذه الحشرة بحوالى ٣٠% أو أكثر ، كما بلغت نسبة الموت على ذات

الصنف حوالى ضعف المعدل الموجود على صنف بيروفكشن . وهذا يوضح أن معدل الإصابة على صنف لتل

مارفل يمكن أن يقل بكثير عن الأصناف الأخرى مما يشجع على زراعته لتقليل الضرر الناشئ عن الإصابة

بهذه الآفة كأحد الوسائل البديلة لتقليل معدل استخدام الطرق الكيماوية .