

INFLUENCE OF TEMPERATURE AND RELATIV HUMIDITY ON POPULATION DENSITY OF THE BROAD BEAN LEAF MINER, *Liriomyza trifolii* (BRUGESS) (DIPTERA: AGROMYZIDAE) WHICH INFESTED COMMEN BEAN

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ABSTRACT

Effect of temperature and relative humidity on the population fluctuation of combined larvae; pupae development stages and infested leaves percentage of the broad bean leaf miner (*Liriomyza trifolii*) (Burgess) on fall season at El Behaira-Governorate throughout two successive years (2001/2002 and 2002/ 2003) were investigated. From these result's concluded that these relations in most cases were insignificant negatively. But night temperature show significant positive indicating simple correlation values during the two seasons. The partial regression values demonstrated the same trend were insignificant and negative at 0.05 % probability level. The highest influence on population of insect stages was that of night temperature whereas daytime temperature and relative humidity % were non evident effect on population count during fall seasons. The explained variance percentage (E.V.) it being 56.4%:25.6 % and 51.6%:23.8 % for both years (2002 &2003) respectively.

INTRODUCTION

The American serpentin leaf miner, *Liriomyza trifolii* (Burgess) are considered the most economic pests infesting vegetable leguminous crops especially broad bean and bean *Phaseolus vulgaris* L. which planted under plastic green houses and open field in many countries of the world such as England ; America especially in Egypt, several authors contributed to its ecolog: Hammad (1955); Assem, (1966); Hafez *et al.* (1971)); Parella (1984) Gareth and Mark (1985) ; Heyer and Cruz (1989) ; Attiah, (1990) ;); Doss *et al.* (1992) ; El-Basiony *et al.* (1996); Zhang – Runji *et al.* (2000) . Luo – Kaijun *et al.* (2001);); Abo-Elnaga, (2004) .

Therefore , the present work is aimed to study the effect of temperature and relative humidity on the population fluctuation of *Liriomyza trifolii* infested broad bean at El-Behaira Governorate.

MATERIALS AND METHODS

The experiment were conducted at the experimental farm of Zarzora station; Agricultural Research Center , Ministry of Agriculture , Beheira Governorate ,Egypt during two successive years 2002 and 2003 fall plantation . Common bean (Bronco varitey) were sown on August 15th at first year and August 17th at second year . The experimental area was quarter feddan divided into equal plots; each of them was further divided into 4 replicates. All agricultural practices were carried out as usual and no chemical insecticides were applied .A complete randomized block design was used in field . Samples of 10 leaf were picked up randomly weekly from each replicate and transferred to laboratory in paper pages for examination by

stereo-electronic microscope at seven days intervals . After fifteen days from planting date samples were taken from end of August until mid of November. The mean numbers of mine; larvae ; pupae and infested leaves(%) were recorded. The weather factors considered in this study was obtained from Metrological Research Department (Agriculture Research Center) are the Maximum temperature ;Minimum temperature and Relative humidity percentage for discussing its effects on population densities of mining insect *Liriomyza trifolii* (Burgess) on common bean in Beheira Governorate throughout the experimental periods .

The data in the present study were subjected to statistical analysis of variance analysis and the method of L. S. D. was used to differentiate means, when seemed of value ,as well as ,the method of Duncan (1955) test of variables in SAS program (1989) .Regression method termed the "C" multipliers" were adapted (According to Fisher,(1950) analysis was also computed of simple determinations .

RESULTS AND DISCUSSION

The obtained results on the mean weekly abundance of broad bean leaf miner , *Liriomyza trifolii* (Bruggess) in El – Beheira Governorate during fall plantation for two successive years (2002-2003) are presented in tables (1, 2) ; Figures (1, 2) .

A-Population fluctuation of the broad bean leaf miner *Liriomyza trifolii* infesting Phaseolus plant .

1-Mines density in leaves :-

Phaseolus plants received a general mean of 29.8 mines /10 leaves during 2002 fall season .Mines ranged between 16.9 to 51.8 mines/10 leaves .Two peaks were recorded . The first one reached $(36.0 \pm 5.5 \text{ mines})$ & 3.0% infested leaves in 29 of Aug. and the second $(51.8 \pm 7.96 \text{ mines})$ & 3.32% infested leaves in 17 of Oct. at least significant differences 2.08. In 2003 fall season mines/10 leaves ranged between 12.5 to 38.6 mines/10 leaves .Three peaks were recorded .The first one $(32.5 \pm 4.98 \text{ mines})$ & 2.71% infested leaves during 31 of Aug.; The second $(38.0 \pm 5.86 \text{ mines})$ & 3.75% infested leaves in 12 of Oct. and the third $(38.6 \pm 5.97 \text{ mines})$ & 3.5% infested leaves in 19 of Oct. The general mean reached 23.9 mines ; at least significant differences 1.66 it was lower than in the former year of study .

2-Larval fluctuation :-

The population fluctuation of the broad bean leaf miner larvae/10 leaves in 2002 recorded a general mean 35.1 larvae/10 leaves ranged between 10.0 to 62.5 larvae/10 leaves .Three peaks were estimated .The first one $(58.3 \pm 8.93 \text{ larvae})$ & 2.85% infested leaves in 5 of Sep. ; the second $(55.4 \pm 8.62 \text{ larvae})$ & 3.32% infested leaves in 10 /10/2002 and the third $(62.5 \pm 9.57 \text{ larvae})$ & 3.32% infested leaves at 17/10/2002 at least significant differences 2.26 . In 2003 fall season recorded a general mean 17.5 larvae /10 leaves ranged between 10.0 to 23.2 larvae /10 leaves .Three peaks were recorded .

Table (1): Weekly mean number of leaf miner, *L. trifolii* (Burgess) larvae, mines and percentage of infested leaves of bean (Bronco) and the corresponding weekly mean of temperature and relative humidity during 2002 fall plantation, in El- Beheira, Governate .

Inspection date	Mean no. /10 leaves (± S. E.)				Mean weather factors		
	mines	larvae	pupae	%infested leaves	Max. temp.	Min. temp.	R.H.(%)
Aug. 29	36.0 ± 5.52	28.8 ± 4.47	00.0 ± 0	3.00	33.9	23.0	54.6
Sep. 5	35.3 ± 5.49	58.3 ± 8.93	14.8 ± 2.34	2.85	33.3	24.0	55.2
12	28.5 ± 4.37	22.4 ± 4.48	12.9 ± 1.99	1.00	34.8	23.0	54.1
19	22.9 ± 3.53	20.4 ± 3.14	11.8 ± 1.81	1.80	35.9	23.6	48.7
26	21.0 ± 3.22	19.5 ± 2.99	13.8 ± 2.14	2.16	34.4	20.9	52.2
Oct. 3	28.7 ± 4.4	23.8 ± 3.69	20.3 ± 3.13	2.31	32.8	22.5	53.1
10	38.0 ± 5.88	55.4 ± 8.62	26.3 ± 4.04	4.11	32.2	20.1	51.4
17	51.8 ± 7.96	62.5 ± 9.57	36.8 ± 5.64	3.32	31.4	21.2	54.5
24	32.9 ± 5.12	60.0 ± 9.19	21.5 ± 2.30	3.22	29.8	19.8	55.2
31	27.5 ± 4.25	47.5 ± 7.29	15.8 ± 2.43	2.18	28.5	19.5	56.1
Nov. 7	18.0 ± 2.77	12.5 ± 1.94	12.6 ± 1.95	1.52	29.5	17.2	51.4
14	16.9 ± 2.59	10.0 ± 1.56	9.0 ± 1.38	1.12	25.9	16.3	55.8
General mean	29.79	35.09	16.03	2.51	31.87	20.93	53.53
F.0.05 %	11.54 ***	40.16 ***	37.49 ***				
L.S.D.0.05%	2.08	2.26	1.08				
Correlation coefficient (r ²)	larvae				-0.35	0.59*	-0.46
	pupae				-0.32	0.56*	-0.29
Partial Regression	larvae				-0.36	0.64 **	-0.18
	pupae				-0.17	0.62**	-0.12
Explained Variance %	larvae				56.4		
	pupae				25.6		

Table (2) : Weekly mean number of leaf miner, *L. trifolii* (Burgess) larvae, mines and percentage of infested leaves of bean (Bronco) and the corresponding weekly mean of temperature and relative humidity during 2003 fall plantation, in El- Beheira, Governate .

Inspection date	Mean no. /10 leaves (± S. E.)				Mean weather factors		
	mines	larvae	pupae	%infested leaves	Max. temp.	Min. temp.	R.H.(%)
Aug. 31	32.5 ± 4.98	18.6 ± 2.86	0.0 ± 0	2.71	35.0	23.5	52.8
Sep. 7	26.8 ± 4.11	21.8 ± 3.35	12.1 ± 1.86	2.25	34.6	24.8	54.5
14	22.5 ± 3.45	17.5 ± 2.7	11.2 ± 1.73	1.00	34.7	22.6	54.2
21	17.5 ± 2.68	15.2 ± 2.36	10.9 ± 1.88	1.75	32.7	21.2	55.7
28	15.8 ± 2.47	12.1 ± 1.9	11.4 ± 1.76	1.50	35.5	23.3	53.0
Oct. 5	24.5 ± 3.76	17.4 ± 2.68	13.0 ± 1.99	2.15	32.0	20.2	51.1
12	38.0 ± 5.86	21.1 ± 3.24	24.2 ± 3.71	3.75	31.9	16.6	53.2
19	38.6 ± 5.97	23.2 ± 3.56	28.1 ± 4.33	3.50	30.4	19.9	54.1
26	25.5 ± 3.93	22.5 ± 3.46	13.3 ± 2.05	2.49	30.4	20.8	53.4
Nov. 2	18.5 ± 2.88	19.6 ± 3.09	12.5 ± 1.92	1.75	26.8	20.4	54.2
9	14.5 ± 2.24	11.0 ± 1.69	10.6 ± 1.67	1.50	27.9	17.0	53.4
16	12.5 ± 1.94	10.0 ± 1.54	8.0 ± 1.25	1.10	26.9	17.4	54.4
General mean	23.93	17.50	12.94	2.22	31.57	20.64	53.67
F.0.05%	14.44 ***	6.47 ***	29.84 ***				
L.S.D.0.05%	1.66	1.28	0.94				
Correlation coefficient (r ²)	larvae				-0.22	0.58*	-0.43
	pupae				-0.40	0.57*	-0.32
Partial Regression	larvae				0.23	0.61**	0.13
	pupae				0.15	0.58**	0.09
Explained Variance %	larvae				51.6		
	pupae				23.8		

The first one (21.8 ± 3.35 larvae) & 2.25% infested leaves in 7 of Sep. ; the second (21.1 ± 3.24 larvae) & 3.75% infested leaves in 12 of Oct. 2003 and the third (23.2 ± 3.56 larvae) & 3.50% infested leaves in 19/10/2003 with least significant differences 1.28 .

3- Pupal fluctuation:-

The population fluctuation of pupae /10 leaves in 2002 fall season ranged between 0.0 to 36.8 pupae /10 leaves , with general mean of (16.0 pupae /10 leaves) recording two peaks .The first one (14.8 ± 2.34 pupae /10 leaves) & 2.85% infested leaves and the second (36.8 ± 5.64 pupae) & 3.32% infested leaves at 17/10/2002 at least significant differences 1.08 .In 2003 season mean number of pupae/10 leaves ranged between 0.0 to 28.1 pupae / 10 leaves recording its highest population at 19th of Oct. at least significant differences 0.94. The general mean number recorded lower value than the first year of study (13.1 pupae /10 leaves) .This results obtained from study harmony with Fadel, A.EL-Aziz, M.(2001) ; Hady, S.A. (1999)

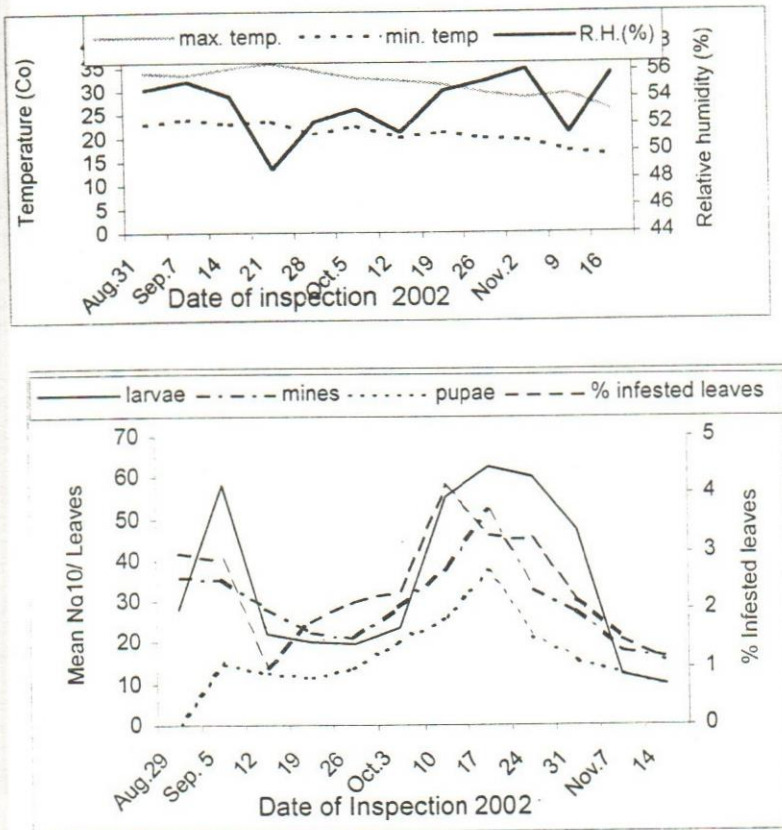


Fig. (1) : The population fluctuation of *L. trifolii* on fall plantation as related to temp. and relative humidity during 2002.

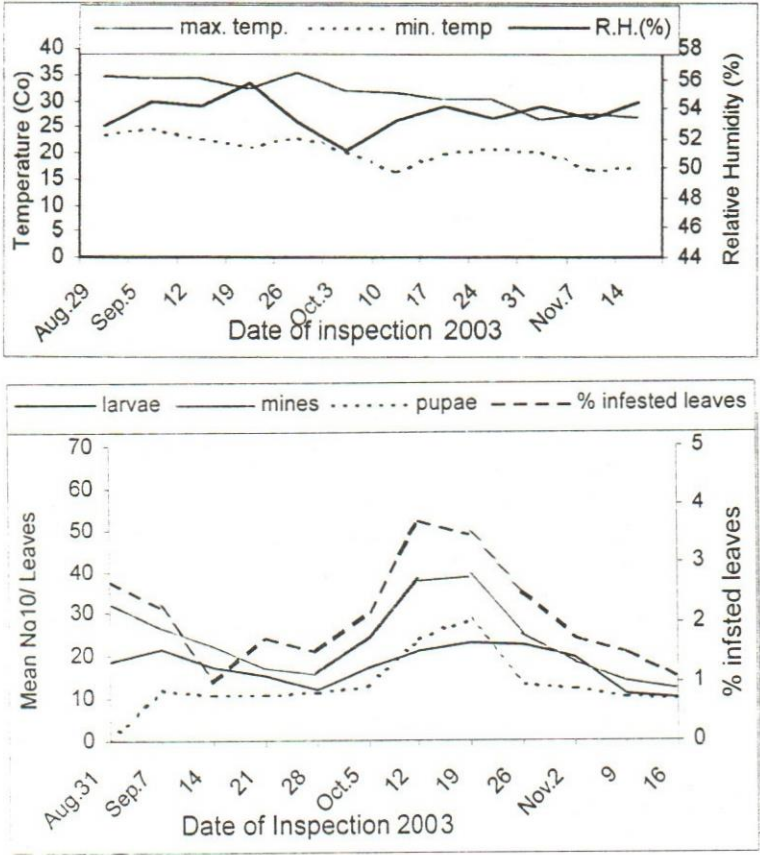


Fig. (2) : The population fluctuation of *L. trifolii* on fall plantation as related to temp. and relative humidity during 2003.

B- Effect of certain weather factor's on the population fluctuation larval and pupal stages of *Liriomyza trifolii* .

Computer statistical analysis of data were done to study each of three weather factor's (daytime temperature; night temperature and relative humidity %) in relation to the counted number of *L. trifolii* stages . Daytime temperature expressed as Maximum temperature ;night temperature also were expressed as Minimum temperature and Relative humidity % .

Larval stage :

Maximum temperature affected the population fluctuation of the broad bean leaf miner *L. trifolii* larval stage insignificant negative in 2002 fall season ($r^2 = -0.35$).This effect was insignificantly negative in 2003 season ($r^2 = -0.22$).The minimum temperature were significantly positive effect on the larval density in 2002 ($r^2 = 0.59$) .That effect gave the same trend significant positive in 2003 ($r^2 = 0.58$). The relative humidity had insignificant and

negative effect during 2002 and insignificantly negative in 2003. That may be attributed to the effect of other unconsidered environmental factor's in 2003 ($r^2 = -0.46$) and ($r^2 = -0.43$) respectively. Partial regression take the same trend it was very significant during minimum temperature $R=0.64$ and $R=0.61$ during 2002 and 2003 respectively. The explained variance % of factors effect on the count of *L.trifolii* larval stages showed the minimum temperature effective during 2002 and 2003 fall seasons were 56.4 % and 51.6% respectively.

Pupal stage :

Simple correlation values between means of Maximum temperature and means counts pupal stages of *L. trifolii* were negatively insignificantly on bean during fall seasons 2002 and 2003 (Table 1 and 2) at EL-Behaira governorate where's r^2 (-0.32) and r^2 (-0.40) at maximum temperature and r^2 (0.56 and 0.57) at minimum temperature where's relative humidity r^2 (-0.29 and -0.32) during 2002 and 2003 respectively. The combined effect of these three climatic factors on the population of *L.trifolii* pupal stages as indicated by variance explained by them was 25.6 % in 2002 and 23.8 % in 2003 respectively. Relationship between the above- mentioned three factors and the number of *L. trifolii* stages infesting common bean in the field. These relations were insignificant negatively except night temperature was positively significant (Table 1 and 2) indicating simple correlation. As shown in the mentioned tables during fall season. The effect of daytime temperature and relative humidity on *L. trifolii* stages, as calculated from the partial regression, was insignificant negatively at 0.05 except night temperature were significantly positive. It may be concluded from the obtained results that the highest influence on the activity of the pest stages was the night temperature. Several investigator had done some work related to this subject, but under plastic green house, on other bean cultivars such as Doss *et al.* (1995) and Elferen and Yathom (1989).

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تأثير درجة الحرارة والرطوبة النسبية على التقلبات العددية لطوري اليرقة و العذراء والكثافة العددية للاتفاق والنسبة المئوية للأوراق المصابة بذبابة أوراق الفول (*Liriomyza trifolii* (Burgess) (Diptera: Agromyzidae)

والتي تصيب نباتات الفاصوليا

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أجرى هذا البحث لدراسة تأثير متوسط درجة الحرارة العظمى والصغرى والنسبة المئوية للرطوبة النسبية على التقلبات العددية لطوري اليرقة والعذراء وكذلك على النسبة المئوية للأوراق المصابة لنباتات الفاصوليا صنف (برونكو) في محطة البحوث الزراعيه (زرزورة) محافظة البحيرة بذبابة أوراق الفول (*Liriomyza trifolii* (Burgess) في الموسم النيلى خلال عامى الدراسه ٢٠٠٢، ٢٠٠٣ فكانت النتائج الآتية :

١- الكثافة العددية للاتفاق :

تراوحت نسبة الإصابة بين ١٦,٩ - ٥١,٨ نفق / ١٠ ورقات مسجلة قمتين للإصابة عام ٢٠٠٢ الأولى في ٢٩ أغسطس وكانت نسبة الأوراق المصابة ٣,٠% والأخرى في ١٧ أكتوبر وكانت النسبة المئوية للورق المصابة ٣,٣٢% بمتوسط عام ٢٩,٨ نفق / ١٠ ورقات . وكان أقل فرق معنوي ٢,٠٨ أما في عام ٢٠٠٣ تراوحت نسبة الإصابة بين ٢١,٥ - ٣٨,٦ نفق / ١٠ ورقات مسجلة ثلاث قمم للإصابة الأولى في ٣١ أغسطس وكانت النسبة المئوية للأوراق المصابة ٢,٧١% بينما كانت القمة الثانية في ١٢ أكتوبر وكانت النسبة المئوية للورق المصابة ٣,٥% أما القمة الثالثة فكانت في ١٩ أكتوبر ونسبة الأوراق المصابة ٣,٥% وكان المتوسط العام للإصابة ٢٣,٩ نفق / ١٠ ورقات وأقل فرق معنوي ١,٦٦ ويتضح أن الإصابة في عام ٢٠٠٣ كانت أقل من عام ٢٠٠٢ .

٢- التقلبات العددية لليرقات :

تراوحت التقلبات العددية لليرقات بين ١٠-٦٢,٥ يرقة / ١٠ ورقات مسجلة ٣ قمم في عام ٢٠٠٢ الأولى في ٥ سبتمبر وكانت نسبة الأوراق المصابة ٢,٨٥% أوراق مصابة والثانية في ١٠ أكتوبر وكانت نسبة الأوراق ٤,١١% أما القمة الثالثة فكانت في ١٧ أكتوبر وكانت نسبة الأوراق المصابة ٣,٣٢% بمتوسط عام ٣٥,١ يرقة / ١٠ ورقات وكان أقل فرق معنوي ٢,٢٦ أما في عام ٢٠٠٣ فتراوحت التقلبات العددية لليرقات بين ١٠-٢٣,٢ يرقة / ١٠ ورقات مسجلة ٣ قمم الأولى في ٧ سبتمبر وكانت نسبة الأوراق المصابة ٢,٢٥% والثانية في ١٢ أكتوبر وكانت نسبة الأوراق المصابة ٣,٧٥% أما القمة الثالثة في ١٩ أكتوبر وكانت نسبة الإصابة ٣,٥% وكان أقل فرق معنوي ١,٢٨ بمتوسط عام ١٧,٥ يرقة / ١٠ ورقات .

٣- التقلبات العددية للعذراء :

تراوحت التقلبات العددية للعذراء بين صفر - ٣٦,٨ عذراء / ١٠ ورقات في عام ٢٠٠٢ مسجلة قمتين الأولى في ٥ سبتمبر وكانت نسبة الأوراق المصابة ٢,٨٥% أما الثانية في ١٧ أكتوبر وكانت نسبة الأوراق المصابة ٣,٣٢% بمتوسط عام ١٦,٠٣ وكان أقل فرق معنوي ١,٠٨ . أما في عام ٢٠٠٣ تراوحت التقلبات العددية بين صفر - ٢٨,١ عذراء / ١٠ ورقات مسجلة قمتين الأولى في ٧ سبتمبر وكانت نسبة الأوراق المصابة ٢,٢٥% أما الثانية فكانت في ١٩ أكتوبر نسبة الأوراق المصابة ٣,٥% أوراق مصابة وكان أقل فرق معنوي ٠,٩٤ بمتوسط عام ١٢,٩٤ عذراء / ١٠ ورقات .

٤- علاقة درجة الحرارة اليومية، درجة الحرارة الليل والرطوبة النسبية باعداد طوري اليرقة والعذراء لذبابة أوراق الفول (*Liriomyza trifolii* على نباتات الفاصوليا خلال عامى الدراسة ٢٠٠١/٢٠٠٢ ؛ ٢٠٠٢/٢٠٠٣ في الزراعة النيلية فقد اثبتت النتائج :-

أن هذه العلاقات في معظم الحالات كانت غير معنوية سالبه مشيرة الى قيم ارتباطيه بسيطه لكنها كانت موجبه الارتباط مع درجة حرارة الليل وسلكت قيم الارتباط الجزئي نفس الاتجاه حيث كانت غير معنويه سالبه مع درجة حرارة النهار والرطوبة النسبية في حين كان الارتباط موجب معنوي مع درجة حرارة الليل عند مستوى احتمال ٠,٠٥% واثبتت النتائج ان التأثير الكبير في اعداد طوري الحشرة كان راجعا لدرجة الحرارة الليلية وبالنسبة لتأثير العوامل الثلاث على طوري الحشرة فقد اظهر انها مسنولة بقدر ٥٦,٤% ، ٢٥,٦% في العام الأول مع التغير في العام الثاني ٥١,٦% ، ٢٣,٨% من مجموع طوري اليرقة والعذراء على التوالي وأن ٢٣,٢% ، ٢٤,٤% في العام الأول ، ٤٨,٤% ، ٧٦,٢% في العام الثاني يرجع الى عوامل أخرى قد تكون بيئية أو بيولوجية أو وراثية غير مدروسة و ان كل من الطورين يتأثر بنسب معينه مع كل متغير من المتغيرات الثلاث تبعاً لكثافة اعداد كل طور من طوري الحشرة .