

## ESTIMATED NUMBER AND DURATION OF SPINY BOLLWORM, *EARIAS INSULANA* (BOISD.) FIELD GENERATIONS

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### Abstract

The present work was carried out to study the number and duration of spiny bollworm, *Earias insulana* (Boisd.) field generations during three cotton growing seasons of 1993, 1994 and 1995 at Gharbia, Kafr El-Sheikh Governorates and for two tested seasons of 1993 & 1994 at Beheira Governorates. To facilitate the graphical and numerical presentation of the data, each locality was discussed separately for the three years combined. The present results revealed the presence of six overlapping generations during the whole investigation period in each of the three tested localities were estimated.

### INTRODUCTION

Cotton plants are common in the fields of Egypt at different stages of growth for a fairly long period. This period could be extended for about 7 -8 months, possibly from early April to late October. The fruiting stage of cotton plants (first flower appearance in June) provide *Earias insulana* moths with suitable oviposition sites and ensure the availability of food sources for their larvae. In fact, this continuous availability of oviposition and feeding sites through a long period helps the cotton bollworms in building up a considerable large sized populations and consequently, caused tremendous damage. Accordingly, it was found necessary to study the changes in the seasonal abundance of these insects in three different localities. The present investigation was dedicated to study the changes in the population density of spiny bollworm which occur in cotton fields between June and December. The number and duration of spiny bollworm moths were studied according to Audemard & Milaire (1975) and modified by Iacob (1977) with tracing the seasonal abundance curves of this insect. The distinct peaks (bell-shaped) were considered as overlapping generations.

## MATERIALS AND METHODS

The present field trials were carried out at Gemeiza Agricultural Research Station (ARS), Gharbia Governorate and Sakha Agricultural Research Station, Kafr El-Sheikh Governorate for three successive seasons, 1993, 1994 and 1995. The approximated number and duration of spiny bollworm, *Earias insulana* (Boisd.) field generations were estimated using the Delta sex pheromone traps. In Noubaria, Beheira Governorate, the experiments were carried out for two seasons (1993 and 1994).

### Sex pheromone traps

In Gharbia and Kafr El-Sheikh Governorates, 3 Delta baited sexpheromone traps were set in cotton fields during three successive cotton growing seasons. In Noubaria, El-Beheira Governorate, only 2 sex pheromone (Delta) traps were set in two selected cotton growing areas. The baited sex pheromone traps were fixed on metal bars, just above cotton plants. The traps were baited with specific pheromone capsules, replaced every 2-3 weeks by fresh ones. The adhesive sheets were also changed every three days, and the numbers of trapped male moths were counted.

The sex pheromone traps were baited with the synthetic pheromone formulation in polyethelene vials. Every vial contains 1mg of the active ingredient of the synthetic pheromone. The pheromone lure consist of E,E 10-12 hexadecadienyl.

### Estimation of the number and duration of spiny bollworm, *Earias insulana* field generations

The approximated number and duration of the annual field generations of *Earias insulana* moths were worked out depending on the weekly catch figures, and confirmed by adopting (i)-Audemard & Milaire (1957) and Iacob (1977) formula, using semiGaussian paper (scale Gouss) and (ii)-tracing the seasonal activity curves from which the number of field generations were represented by either regression lines or bell-shaped curves.

## RESULTS AND DISCUSSION

### Gharbia district

**The first generation:** The moths started to appear in baited pheromone traps during the third week of January in 1993 and 1995 and one week later for 1994,

Table 1 and prevailed until the 2nd week of May in the 1st two seasons and one week earlier for 1995. The size of this generation was relatively small and lasted for 13-14 weeks.

**The second generation:** This 2nd generation was hardly larger in size and lasted for 11-13 weeks. Spiny bollworm moths were first observed on the 3rd week of April of 1993 and 1995 and two weeks earlier for 1994. The duration of this generation continued until the 3rd week of July on an average.

**The third generation:** The moths of this 3rd generation were first captured during the 2nd half of September. This generation was relatively larger size than both the first and the second ones and lasted for about 13-14 weeks.

**The fourth generation:** Data in Table 1 indicate that the 4th generation was large sized and harboured the highest number of *Earias insulana* moths. Moths started to appear on the 2nd half of July for 1993 and 1994. It lasted between 12-13 weeks on an average.

**The fifth generation:** The moths of this generation were captured in the baited pheromone traps on late July during 1993 and one week later for 1994 and 1995. Moth occurrence continued until late November. The duration was between 15 to 16 weeks, Table 1.

**The sixth generation:** This 6th generation was small sized generation and continued for 15-16 weeks. The moths were observed on the 1st week of September 1993 and one week later for 1994 and 1995.

#### **Kafr El-Sheikh district**

**The first generation:** Moths were first observed in the fields during the 2nd week of January in 1993 and two weeks later for both 1994 and 1995 and continued up till the 1st week of May in the three tested seasons. The duration of this generation was approximately 12-14 weeks, Table 2, on an average.

**The second generation:** Moths of this 2nd generation were first captured in the sex pheromone traps during the 1st half of April for both 1993 and 1995 and one week later for 1994. The duration ranged between 12-13 weeks, Table 2.

**The third generation:** Data in Table 2 show that the moths were occurred in the 3rd week of May in both 1993 and 1995 and also one week later for 1994 and

Table 1. Approximate number and duration of *Earias insulana* generation moths during 1993, 1994 and 1995 seasons at Gharbia Governorate.

Generation number	1993			1994			1995		
	Duration of generation		Duration in weeks	Duration of generation		Duration in weeks	Duration of generation		Duration in weeks
	From	To		From	To		From	To	
1st	3rd week of Jan.	2nd week of May	14	4th week of Jan.	2nd week of May	13	3rd week of Jan.	1st week of May	13
2nd	3rd week of Apr.	3rd week of Jul.	11	1st week of Apr.	3rd week of Jul.	13	3rd week of Apr.	4th week of Jul.	12
3rd	3rd week of May	1st week of Sept.	13	4th week of May	3rd week of Sept.	14	3rd week of June	3rd week of Sept.	13
4th	2nd week of Jul.	1st week of Nov.	13	2nd week of Jul.	1st week of Nov.	12	4th week of Jul.	1st week of Nov.	12
5th	4th week of Jul.	3rd week of Nov.	15	1st week of August	1st week of Dec.	15	2nd week of Jul.	3rd week of Nov.	16
6th	1st week of Sept.	2nd week of Jan.	16	2nd week of Sept.	2nd week of Jan.	15	2nd week of Sept.	2nd week of Jan.	15

Table 2. Approximate number and duration of *Earias insulana* generation moths in Kafr El Sheikh Governo-  
rate during 1993, 1994 and 1995 seasons.

Generations number	1993			1994			1995		
	Duration of generation		Duration in weeks	Duration of generation		Duration in weeks	Duration of generation		Duration in weeks
	From	To		From	To		From	To	
1st	2nd week of Jan.	1st week of May	14	4th week of Jan.	1st week of May	12	4th week of Jan.	1st week of May	12
2nd	2nd week of Apr.	4th week of Jul.	13	3rd week of Apr.	4th week of Jul.	12	1st week of Apr.	4th week of Jul.	12
3rd	3rd week of May	1st week of Sept.	13	1st week of Jun.	2nd week of Sept.	12	3rd week of May	1st week of Sept.	13
4th	2nd week of Jul.	1st week of Oct.	13	4th week of Jul.	2nd week of Nov.	13	2nd week of Jul.	1st week of Nov.	14
5th	3rd week of Jul.	3rd week of Nov.	14	3rd week of Jul.	3rd week of Nov.	14	3rd week of Jul.	2nd week of Nov.	14
6th	1st week of Sept.	2nd week of Jan.	16	---	---	---	2nd week of Sept.	2nd week of Jan.	15



estimated up to the 1st week of September in both 1993 and 1995 and two weeks later for 1994. This generation extended for 12-13 weeks on an average.

**The fourth generation:** The first appearance of spiny bollworm moths of this 4th generation took place on the 2nd week of July in 1993 & 1995 and two weeks later for 1994. The reliable occurrence continued up to the 4th week of October 1993 and 1-2 weeks later for both 1994 and 1995 seasons. This generation lasted for 13-14 weeks duration.

**The fifth generation:** This generation duration lasted for 14 weeks from the 3rd week of July during 1993 and 1995 and one week later for 1994 up till the 2nd half of November.

**The sixth generation:** The moths of this generation started to appear on the 1st week of September in 1993 and one week later for 1995. For 1994, it was found, but in scarcely numbers. The existence continued until the first half of next January with 15-16 weeks.

#### **Beheira district**

The data in Table 3 show that the spiny bollworm moths underwent 6 overlapping generations at Beheira during the three studied seasons as follows:

**The first generation:** Moths of this generation started to appear as early as the 1st week of January 1993 and two weeks later for 1994 and continued up till the 1st half of May. The duration lasted for 15 weeks, Table 3.

**The second generation:** The first appearance of this generation moths occurred on the 2nd week of April in 1993 & 1994 and lasted up to the 4th week of July in 1993 and 2 weeks earlier for 1994. The duration ranged between 11-13 weeks.

**The third generation:** The duration of this generation extended for 12 weeks from the 3rd week of May in 1993 and two weeks later for 1994.

**The fourth generation:** The spiny bollworm moths tended to occur in reliable numbers from the 2nd half of June 1993 and 1994 seasons. It prevailed up till the end of October. The duration ranged between 12-15 weeks.

**The fifth generation:** Moths started to appear during the 3rd week of July in 1993 and two weeks later for 1994. Moths were captured in reliable numbers up to the 2nd week of November for 1994 season. The duration of this generation lasted

Table 3. Approximate number and duration of *Earias insulana* generation moths at Beheira Governorate during 1993 and 1994 seasons.

Generation number	1993		Duration in weeks	Duration of generation		Duration in weeks
	Duration of generation			Duration of generation		
	From	To		From	To	
1st	1st week of Jan.	1st week of May	15	3rd week of Jan.	4th week of May	15
2nd	2nd week of Apr.	4th week of Jul.	13	2nd week of Apr.	2nd week of Jul.	11
3rd	3rd week of May	4th week of Oct.	12	1st week of Jun.	2nd week of Sept.	12
4th	4th week of Jun.	2nd week of Oct.	15	3rd week of Jul.	4th week of Oct.	12
5th	3rd week of Jul.	2nd week of Nov.	14	1st week of August	3rd week of Nov.	13
6th	2nd week of Sept.	3rd week of Jan.	116	2nd week of Sept.	2nd week of Jan.	15

for 13-14 weeks.

**The sixth generation:** The occurrence of this generation moths started from the 2nd week of September in 1993 and 1994 and continued up till the 3rd & 4th week of January, respectively. This generation extended for 15-16 weeks.

**The simultaneous changes in the population activity of *Earias insulana* moths during the three combined seasons**

**The first generation:** This generation moths were first captured in the baited pheromone traps as early as the 1st half of January in Gharbia, and two weeks later for both Kafr El Sheikh and Beheira. This generation existed up to the 2nd week of April at Gharbia (11 weeks) and 12 weeks for Kafr El-Sheikh and Beheira, Tables 4-6 and Figs. 1-3. The captured male moths/night/trap reached 7.6/Gharbia, 8.3/Kafr El Skeikh and 6.5/ Beheira.

Table 4. Approximated number and duration of *Earias insulana* moths during 1993, 1994 and 1995 seasons combined at Gharbia.

Generation number	Duration of generation		Duration in weeks	Average number of moths / night / trap
	From	To		
1 st	2 nd week of Jan.	2 nd week of Apr.	11	7.6
2 nd	1 st week of Mar.	2 nd week of Jun.	11	13.2
3 rd	4 th week of Apr.	1 st week of Aug.	12	20.6
4 th	4 th week of Jun.	1 st week of Oct.	12	64.6
5th	4 th week of Jul.	3 rd week of Nov.	13	77.8
6 th	2 nd week of Sept.	1 st week of Jan.	13	52

**The second generation:** The moths of this 2nd generation started to appear early during March in Gharbia and two weeks later for Kafr El-Sheikh and Beheira, i.e the same trend observed before for the 1st generation and continued up to the 1st half of June at Gharbia and lasted 2 weeks more for Kafr El-Sheikh and Beheira. The number of captured male moths/night/trap was 13.2/Gharbia, 15.9/Kafr El-Sheikh and 24.8/Beheira. The duration of this 2nd generation lasted for 11 weeks in Gharbia and 1-2 weeks more for Kafr El-Sheikh and Beheira, Tables 4-6 and Fig 1-3.



**Third generation:** The spiny bollworm moths were first observed during the second half of April for the tested three localities. The duration ranged between 12 and 14 weeks. The number of captured male moths/night/trap was low, i.e. 20.6, Gharbia, 38.5 Kafr El-Sheikh 38.5 and 56.1 Beheira comparatively.

**The fourth generation:** The duration of this generation varied between 12 weeks in Gharbia to 14 weeks in others. The moths started to appear during the 4th week of June in Gharbia and Beheira and one week earlier at Kafr El-Sheikh and prevailed up to the 1st week of October in Gharbia and Kafr-El-Sheikh and one week more for Beheira. The number of captured male moths/night/locality/trap was again the highest in Beheira (127.2) as compared with either Kafr El Sheikh (78.0) or El Gharbia (64.6).

**The fifth generation:** The first appearance of this generation moths took place in cotton field during the 2nd half of July in both Gharbia and Kafr El-Sheikh, and two weeks later for Beheira. This generation demonstrated with the fourth generation the highest number of captured *Earias insulana* moths during the three seasons. The size of this generation at Beheira was 149.4, 88.0 Kafr El-Sheikh and 77.8 El Gharbia moths/night/trap. The duration extended 13 weeks in both Gharbia and Kafr El-Sheikh and one week more for Beheira, Tables 4-6.

**The sixth generation:** The moths of this generation were abundant from the 2nd week of September at Gharbia (one week later for Kafr El Sheikh and Beheira) up to January of the next year. The duration completed 13 weeks in Gharbia and one and two weeks more for both Beheira and Kafr El-Sheikh. The size of this generation at Beheira reached 116.8 moths/night/trap, thus dominated Kafr El-Sheikh (67.1) and El Gharbia (52).

From the obtained results, it could be concluded, however, that when the three years data combined in the three tested localities were considered in the present analysis, 6 overlapping generations of moths were observed for the spiny bollworm during the whole season. The inconsistency in the observations caused by the reliable occurrence of high-moth catches in Beheira and a simultaneous reduction in the corresponding moth figures at Gharbia could be attributed to the potential activity of the natural enemies (Parasites and predators) occurred at that time in Gharbia cotton fields as compared with Kafr El Sheikh and Beheira ecosystems.

Our findings were in close agreement with the findings of Hammad et al. (1967), Hiadari (1967), Hafez et al. (1970), Taher (1977), Nasr et al. (1980) and Hussein (1990) whom concluded that *Earias insulana* underwent 6 generations a year.

Table 5. Approximate number and duration of *Earias insulana* moths during 1993, 1994 and 1995 seasons combined at Kafr El Sheikh.

Generation number	Duration of generation		Duration in weeks	Average number of moths / night / trap
	From	To		
1 st	3 <sup>rd</sup> week of Jan.	4 th week of Apr.	13	8.3
2 nd	3 rd week of Mar.	3 rd week of Jun.	12	15.9
3 rd	3 rd week of May	3 rd week of Aug.	12	38.5
4 th	3 rd week of Jun.	1 st week of Oct.	14	78.0
5th	3 rd week of Jul.	1 st week of Nov.	13	88.0
6 th	1 st week of Sept.	3 rd week of Jan.	15	67.1

Table 6. Approximate number and duration of *Earias insulana* moths during 1993 and 1994 seasons combined at Kafr El Sheikh.

Generation number	Duration of generation		Duration in weeks	Average number of moths / night / trap
	From	To		
1 st	4 th week of Jan.	1 st week of May	13	6.5
2 nd	3 rd week of Mar.	4 th week of Jun.	13	24.8
3 rd	3 rd week of May	1 st week of Sept.	14	56.1
4 th	4 th week of Jun.	2 nd week of Oct.	13	127.2
5th	1 st week of Aug.	4 th week of Nov.	14	149.4
6 th	3 rd week of Sept.	1 st week of Jan.	14	116.8

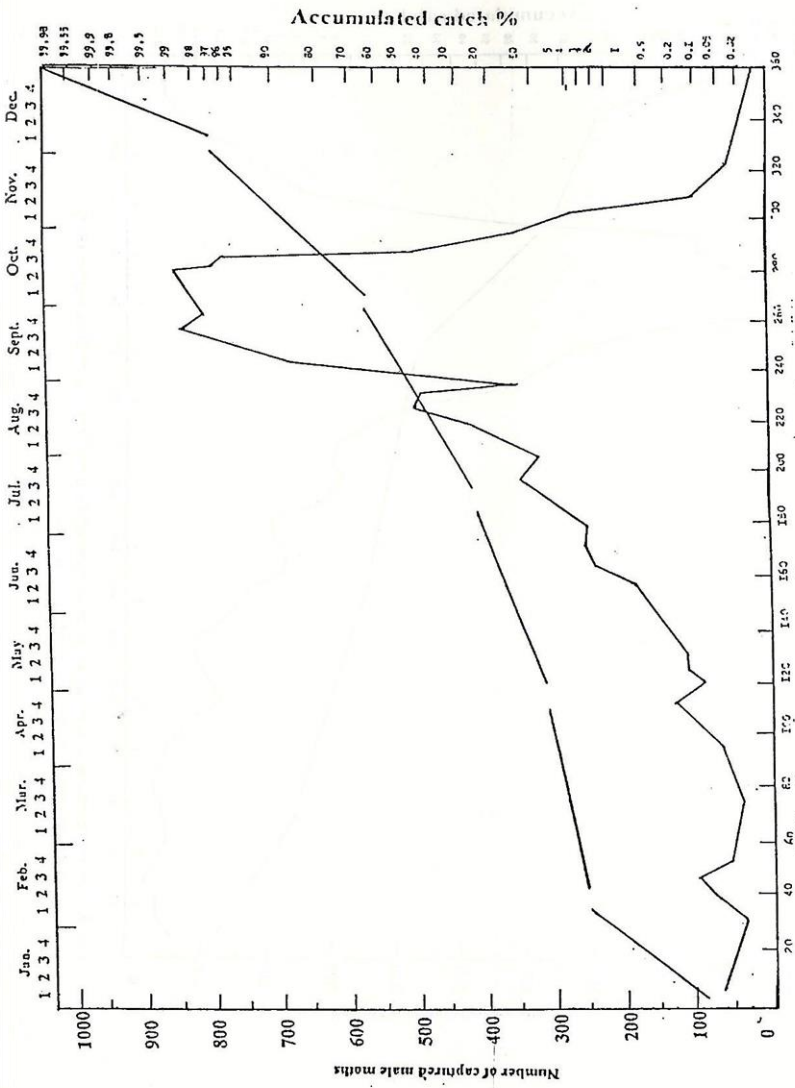


Fig. 1. The approximate and actual average number of field generations of SBW moths (Gharbia - 1993, 1994 and 1995 combined).

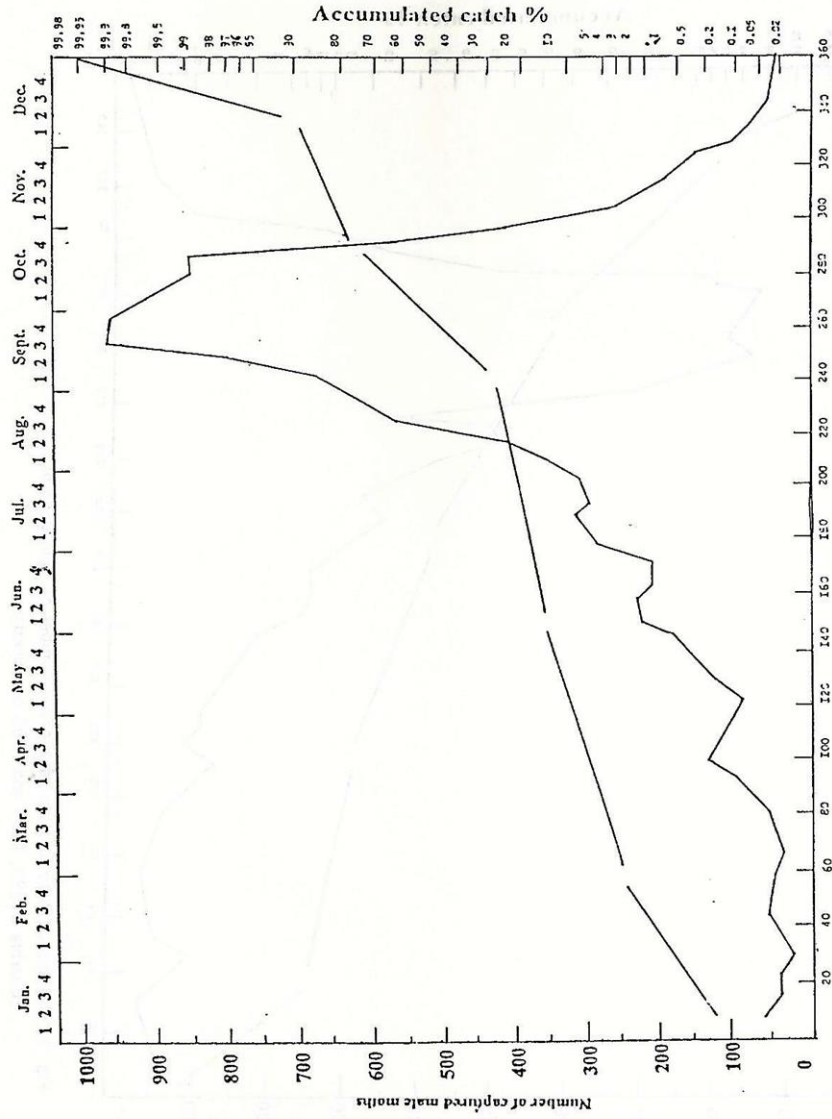


Fig. 2. The approximate and actual average number of field generations of SBW moths (Kafr El-Sheikh-1993, 1994 and 1995 combined)

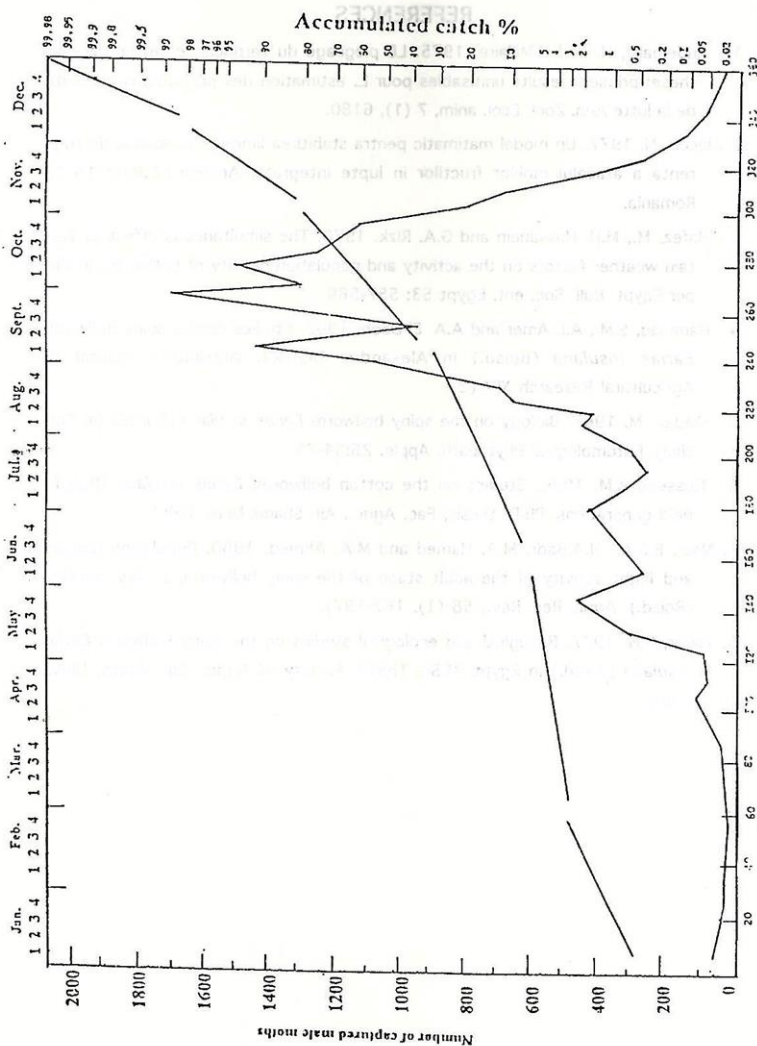


Fig. 3. The approximate and actual average number of field generations of SBW moths (Beheira - 1993 and 1994 combined).



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### حساب عدد أجيال دودة اللوز الشوكية باستخدام المصائد الجاذبة الجنسية

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تضمنت الدراسة تقدير عدد أجيال دودة اللوز الشوكية وفترة كل جيل خلال مواسم نمو القطن ١٩٩٣ و ١٩٩٤ و ١٩٩٥ في محافظتي الغربية وكفر الشيخ ولمدة موسمين (١٩٩٣ و ١٩٩٤) بمحافظة البحيرة.

ولتسهيل العرض البياني والعدي - نوقشت كل محافظة علي حده لمدة ثلاث سنوات. وقد أوضحت النتائج أن لهذه الحشرة ستة أجيال متداخلة في السنة - خلال مدة البحث - في كل من المناطق الثلاث.