

## Original Research Article

# Effect of Sowing Dates on the Population Dynamics of *Helicoverpa armigera* (Hubner) in Chickpea Agro-ecosystem

Salman Ahmad<sup>1\*</sup>, Mohammad Shafiq Ansari<sup>2</sup>, Hadi Husain Khan<sup>3</sup>,  
Nadeem Khan<sup>1</sup> and Md. Abu Nayer<sup>1</sup>

<sup>1</sup>Integral Institute of Agricultural Science and Technology, Integral University, Lucknow, India

<sup>2</sup>Department of Plant Protection, Faculty of Agricultural Sciences,  
Aligarh Muslim University, Aligarh, India

<sup>3</sup>Regional Plant Quarantine Station, Amritsar, India

\*Corresponding author

## ABSTRACT

Effect of different sowing dates was evaluated on the population dynamics of *H. armigera* for three cropping systems. Chickpea was sown at 15<sup>th</sup> October, 30<sup>th</sup> October, 15<sup>th</sup> November, 30<sup>th</sup> November, and 15<sup>th</sup> December in cropping seasons of 2012-13, 2013-14 and 2014-15. Results showed that sowing dates significantly ( $P < 0.05$ ) affected the incidence of *H. armigera* in all the three years of cropping. In early sown crop (15<sup>th</sup> October) larval count and pod damage was not recorded up to 96 DAS, whereas, initial infestation was higher in late sown crop (15<sup>th</sup> December). Density was 1.7 larvae with 2.06% pod damage when chickpea was sown on 30<sup>th</sup> November. Number of larvae as well as pod damage was increased gradually with crop growth; however, pod damage was highest on 15<sup>th</sup> December sown crop at the time of harvesting. Moreover, number of larvae was first increased up to 124 DAS and then decreased gradually up to harvesting with 1.54 larvae on late sown crop (15<sup>th</sup> December). Pod damage was 44.56% on 15<sup>th</sup> October sown crop, while 59.16% on 15<sup>th</sup> December sown crop. It is concluded from that the average yield loss was lowest in the early sown crop than to late sown crop and hence early sowing is recommended.

## Keywords

*Helicoverpa armigera* (Hubner)  
Chickpea,  
Agro-ecosystem

## Introduction

*Helicoverpa armigera* is a serious and polyphagous pest; attacking nearly 200 cultivated and wild host plants and a key constraint in production of several crops including chickpea, pigeon pea, chilli, tomato, okra, cotton, maize, sunflower, tobacco (Singh and Yadav, 2009; Dhillon et al. 2012; Ahmad et al. 2014; Ahmad et al. 2015). Management of this pest through cultural manipulation is considered as possible option as most of the insects infest plant/crop at particular stage and under

certain environmental conditions that may be manipulated by sowing the crop on different dates. Adjustment in sowing times is a good agronomical tool that could be employed to minimize the damage caused by insect pests. Pest appearance, population fluctuation, infestation rate and crop yield are very much dependent on sowing time. Although, *H. armigera* attack chickpea throughout the cropping growth, but damage caused during flowering and pod formation stage that results in substantial yield loss (Ahmad et al. 2016). Larvae of *H. armigera*

start feeding up on the leave and pods whatever available soon after hatching. Generally, population peaks correspond to full bloom and pod formation stage of chickpea (Shah and Shahzad, 2005). The extent of damage inflicted by *H. armigera* to chickpea depends not only on number of larvae but also on the developmental stages of crop (Tripathi and Sharma, 1984; Shah and Shahzad, 2005). Time fitted cultivation as a part of modern IPM is thus found indispensable to minimize *H. armigera* infestation (Nowinszky and Puskas, 2011, Muchhadiya et al. 2014). Shah and Shahzad (2005) reported that population of *H. armigera* flourished during second half of February and outbreak situations were found throughout March. One possible reason may be probably owing to optimum temperature and abundant food supply in the form of pods. In view of its seriousness, effect of time of sowing was studied on the infestation of *H. armigera* on chickpea.

### **Materials and Methods**

Field trials were conducted to determine the effect of different sowing dates on the incidence of *H. armigera* during three cropping seasons viz., 2012-13 and 2013-14 and 2014-15 at the Faculty of Agricultural Science, Aligarh Muslim University, Aligarh, India. A spacing of 30x10 cm was maintained by thinning. All agronomic practices were followed as mentioned above to grow commercial crop of chickpea. Standard doses of fertilizers; 20 kg N, 60 kg P<sub>2</sub>O<sub>5</sub> and 30 kg K<sub>2</sub>O/ha were given at the time of sowing. Farm yard manure (FYM) was broadcasted in the field @ 10 tons/ha. Weeding was done at 25 and 60 days of sowing, respectively and field was irrigated three times. Chickpea (var. Avarodhi) was sown @ 75 kg/ha at 15<sup>th</sup> Oct. 30<sup>th</sup> Oct. 15<sup>th</sup> Nov. 30<sup>th</sup> Nov. and 15<sup>th</sup> Dec. of 2012, 2013 and 2014 in randomized block design and

each treatment was replicated five times. Seeds were treated with fungicides (2 g thiram+1 g carbendazim/kg seed) before sowing for protection against soil borne insects and fungal pathogens. Weekly observations were made on the number of larvae/meter row in each plot and replicated five times. Total numbers of damaged and healthy pods were recorded. The data was analyzed statistically and also differences between the treatments were compared using Tukey's HSD test using software SAS 9.1.3.

### **Results and Discussion**

Chickpea was sown at 15<sup>th</sup> October, 30<sup>th</sup> October, 15<sup>th</sup> November, 30<sup>th</sup> November, and 15<sup>th</sup> December in cropping seasons of 2012-13, 2013-14 and 2014-15. Results (Table-1) showed that sowing dates significantly (P<0.05) affected the incidence of *H. armigera*. On 15<sup>th</sup> October 2012 sown crop, initial infestation was first monitored with a density of 1.6 larvae/meter row at 110 DAS. Infestation gradually increased up to maturity of crop and pod damage was also significantly (P<0.05) increased to 44.5% with 5.3 larvae at harvesting. On 30<sup>th</sup> October sown crop, 2.5 larvae were recorded at 103 DAS and pod damage was started on 110 DAS. A total of 48.5% pods were found to be damaged with 6.7 larvae at harvesting. Crop sown on 15<sup>th</sup> November 2012, 48.1% pods were damaged with 7.0 larvae at the time of harvesting. On 30<sup>th</sup> November 2010, larval count was increased from 1.3 to 7.0 larvae at 145 DAS but pod damage was 28.5% and then increased to 52.8% at harvesting. Total larval count was increased from appearance of infestation from 1.3 to 7.0 larvae at 82 and 138 DAS, respectively on 15<sup>th</sup> December 2012 sown crop. Pod damage was 58.5% when chickpea was sown on 15<sup>th</sup> December (late), compared to 44.5% on 15<sup>th</sup> October (early).

In 2013-14, initial infestation of *H. armigera* was first occurred at 110 DAS on 15<sup>th</sup> October, 2011 sown crop which increased to 5.5 larvae at 152 DAS. Pod damage was 43.5% at harvesting, which was lowest among all sowing dates. On 30<sup>th</sup> October 2013 sown crop, only 3.3 larvae were recorded at 103 DAS while, pod damage 10.5% at 110 DAS. But it was increased to 45.5% with 6.0 larvae at harvesting. On 15<sup>th</sup> November 2013 sown crop, pod damage was started at 89 DAS with 2.5 larvae and damage was increased to 49.6% at harvesting (152 DAS). On 30 November 2013 sown crop, only 1.5 larvae were monitored at 75 DAS which increased to 5.0 larvae at 145 DAS then decreased to 2.5 larvae with pod damage of 48.8% at harvesting. On 15<sup>th</sup> December 2013 sown crop, only 2.0 larvae were recorded at 75 DAS then increased to 6.8 larvae at 138 DAS but 1.3 larvae were monitored at harvesting stage. Pod damage (59.5%) was greater on 15<sup>th</sup> December sown crop than to other sowing dates of 2013-14.

In 2014-15, only 0.3 larvae were found at 103 DAS on 15<sup>th</sup> October 2014 sown crop (Table-1). A total of 45.5% pods were found to be damaged and this value was lowest in comparison to other sowing dates. On 30<sup>th</sup> October 2014 sown crop, 48.5% pods were damaged with 6.2 larvae at harvesting stage. On 15<sup>th</sup> November 2014 sown crop, 6.7 larvae were recorded with 49.9% pod damage. However, initial infestation (2.3 larvae) occurred at 75 DAS on 30<sup>th</sup> November sown crop, but not a single larva was recorded up to 89 DAS. A total of 5.8 larvae were monitored at 145 DAS that decreased to 5.0 larvae with pod damage of 50.6% at harvesting. On 15<sup>th</sup> December 2012 sown crop, infestation was found to be 2.5 larvae at 75 DAS which increased to 6.0 larvae at 145 DAS then decreased to 2.0 larvae at harvesting stage. Damaged pods were highest (59.9%) on 15<sup>th</sup> December

2014 sown crop compared to other sowing dates of 2014-15.

Results (Table-2) showed that three years average population of *H. armigera* varied significantly ( $P < 0.05$ ) with different sowing dates in three cropping seasons. In early sown crop (15<sup>th</sup> October) larval count and pod damage was not recorded up to 96 DAS, whereas, initial infestation was higher in late sown crop (15<sup>th</sup> December). Density was 1.7 larvae with 2.06% pod damage when chickpea was sown on 30<sup>th</sup> November. Number of larvae as well as pod damage was increased gradually with crop growth; however, pod damage was highest on 15<sup>th</sup> December sown crop at the time of harvesting. Moreover, number of larvae was first increased up to 124 DAS and then decreased gradually up to harvesting with 1.54 larvae on late sown crop (15<sup>th</sup> December). Pod damage was 44.56% on 15<sup>th</sup> October sown crop, while 59.16% on 15<sup>th</sup> December sown crop.

Modification in sowing times is a good agronomical tool which could be employed to minimize the damage caused by insect pests. *Helicoverpa armigera* begins to lay eggs on chickpea at seedling stage but this behaviour is influenced by adverse climatic and geographical conditions (Tahhan et al. 1982). Larvae of *H. armigera* start feeding upon the young shoots, leave and pods whatever available soon after hatching and infestation may be skipped by manipulation in sowing dates. Pest appearance, population fluctuation, infestation rate and yield are also very much dependent on sowing time. Shah and Shahzad (2005) reported that pest population was low during 49<sup>th</sup> to 6<sup>th</sup> std wks but increased from 7<sup>th</sup> std wk onwards and declined again during 14<sup>th</sup> std wk while, Hossain (2008) showed that incidence of *H. armigera* started from 2<sup>nd</sup> to 4<sup>th</sup> wk of January irrespective of sowing dates.

**Table.2** Two way analysis of three years of sowing dates for population dynamics of *H. armigera*

	75 DAS	82 DAS	89 DAS	96 DAS	103 DAS	110 DAS	117 DAS	124 DAS	131 DAS	138 DAS	145 DAS	152 DAS
15th Oct	0.00d	0.00d	0.00e	0.00d	0.10d	1.56d	1.72d	2.10e	2.36e	2.96c	3.10d	5.46c
30th Oct	0.83c	0.00d	3.10b	0.00d	3.23c	3.28c	3.32c	3.10d	3.00d	5.23b	6.36a	6.30b
15th Nov	0.76c	2.70a	3.60a	3.71b	4.13b	3.83b	4.30b	3.58c	5.33b	5.04b	5.90b	6.86a
30th Nov	1.70a	1.03c	1.90d	3.56c	4.03b	3.53bc	4.20b	3.86b	3.74c	5.66a	5.93b	3.50d
15th Dec	1.50b	1.60b	2.70c	4.20a	5.16a	5.46a	6.20a	6.50a	6.30a	5.00b	3.80c	1.54e
LSD	0.1618	0.1109	0.1421	0.1256	0.1644	0.3392	0.2504	0.2334	0.3206	0.3151	0.337	0.2198
F-values (df)												
DOS (df=4)	24.6	112.3	11.5	114.6	99.4	36.8	40.5	80.33	17.8	88.5	28.8	21.5
DAS (df= 11)	44.6	185.99	15.21	150.23	100.54	35.7	65.01	90.43	30.65	93.99	30.55	20.03
DOS*DAS (df= 44)	53.10	204.96	15.70	265.14	108.04	34.37	41.92	83.32	23.32	93.53	33.87	22.88
P-value	0.0045	0.0020	0.0040	0.0010	0.0010	0.0030	0.0002	0.0004	0.0500	0.0015	0.0010	0.0001
<b>Pod damage</b>												
15th Oct	0.00c	0.00d	0.00e	0.00d	0.00d	1.90d	7.73e	14.66d	17.30e	24.43d	32.05d	44.56e
30th Oct	0.00c	0.66c	2.66d	0.00d	0.00d	8.61c	9.33d	12.20e	19.30d	25.30c	35.66c	47.50d
15th Nov	0.00c	0.00d	8.43b	8.46c	9.80bc	12.83b	17.96b	21.56b	24.97b	31.76a	41.06b	49.20c
30th Nov	2.06a	3.06b	6.73c	11.13b	11.80b	12.23b	14.60c	17.36c	21.53c	29.86b	36.43c	51.73b
15th Dec	0.36b	4.20a	10.60a	16.70a	16.56a	21.05a	21.93a	24.70a	30.13a	31.41a	47.60a	59.16a
LSD	0.0615	0.0562	0.3271	0.5592	2.51	0.6277	1.01	0.9052	0.8929	0.8304	1.04	1.6267
F-values (df)												
DOS (df=4)	119.3	998.3	115.3	112.5	8.4	33.5	20.05	70.91	18.5	88.5	22.6	25.7
DAS (df= 11)	116.9	820.4	118.5	130.5	20.4	38.3	18.55	88.43	55.7	90.5	38.7	22.77
DOS*DAS (df= 44)	1812.00	1202.40	253.16	100.05	4.43	27.84	39.45	81.28	60.50	96.67	56.21	16.70
P-value	0.0010	0.0010	0.0020	0.0010	0.0010	0.0130	0.0010	0.0004	0.0500	0.0020	0.0020	0.0001

whereas, DOS- Date of sowing, DAS- Days after sowing,

**Table.1 Effect of date of sowing on the population dynamics of *H. armigera***

2012-13										
DAS	15th Oct		30th Oct		15th Nov		30th Nov		15th Dec	
	No. of	% pods								
	larvae	infested								
75	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0
82	0.0	0.0	0.0	0.0	3.0	0.0	1.5	6.7	1.3	0.0
89	0.0	0.0	0.0	0.0	4.5	5.6	4.5	6.7	1.9	9.2
96	0.0	0.0	0.0	0.0	5.5	5.6	5.9	8.9	6.0	16.5
103	0.0	0.0	2.5	0.0	5.5	5.0	5.9	9.1	6.6	16.9
110	1.6	0.0	2.6	3.5	5.6	10.6	6.0	9.5	6.8	18.5
117	1.6	2.6	2.0	4.9	5.9	13.9	5.3	12.7	6.9	20.8
124	2.0	8.5	2.5	9.5	5.9	22.5	3.2	13.8	7.0	20.5
131	2.0	16.9	2.6	22.6	7.0	23.5	3.0	19.6	6.9	31.6
138	1.6	22.6	5.9	28.0	7.5	37.1	6.9	27.5	7.0	33.9
145	3.0	35.0	6.9	32.6	7.2	42.9	7.0	28.5	2.3	50.6
152	5.3	44.5	6.7	48.5	7.0	48.1	3.0	52.8	1.3	58.5
LSD	0.3	3.2	0.5	2.5	0.4	3.2	0.6	2.6	0.6	2.6
P-value	0.002	0.003	0.001	0.005	3E-04	0.001	0.003	0.0007	0.005	6E-04
F value	1.44	2.65	1.73	2.99	1.65	22.55	21.64	17.9	18.99	20.04
2013-14										
75	0.0	0.0	0.0	0.0	1.3	0.0	1.5	0.0	2.0	0.0
82	0.0	0.0	0.0	0.0	2.5	0.0	1.6	0.0	1.0	12.6
89	0.0	0.0	0.0	0.0	2.5	3.0	1.2	3.8	3.5	11.3
96	0.0	0.0	0.0	0.0	2.1	2.9	1.5	9.9	3.6	16.8
103	0.0	0.0	3.3	0.0	3.0	7.4	2.5	10.5	4.8	19.4
110	1.2	2.8	3.3	10.5	2.0	10.5	1.0	10.9	4.6	22.5
117	1.5	13.7	3.5	10.9	3.2	14.5	3.3	11.6	5.5	22.5
124	2.0	23.5	2.1	11.4	3.1	15.8	4.0	15.5	5.9	26.8
131	2.5	22.6	3.9	14.7	4.6	21.9	4.6	19.5	6.0	29.4
138	2.9	26.8	4.8	21.4	3.0	24.6	4.3	22.6	6.8	30.0
145	3.0	27.9	6.3	37.5	5.2	36.4	5.0	36.7	3.1	46.1
152	5.5	43.7	6.0	45.5	6.9	49.6	2.5	48.8	1.3	59.5
LSD	0.3	1.6	0.4	1.9	0.4	2.5	0.5	1.4	1.2	1.8
P-value	0.005	0.007	0.002	0.0008	0.001	0.003	0.004	0.0006	0.003	0.002
F value	2.6	1.64	3.22	2.75	4.6	3.55	2.86	18.49	19.03	18.54
2014-15										
75	0.0	0.0	0.0	0.0	1.0	0.0	2.3	0.0	2.5	1.1
82	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	2.5	12.6
89	0.0	0.0	0.0	0.0	3.8	16.7	0.0	9.7	2.7	11.3
96	0.0	0.0	0.0	0.0	3.6	16.9	3.3	14.6	3.0	16.8
103	0.3	0.0	3.9	0.0	3.9	17.0	3.7	15.8	4.1	19.4

110	1.5	2.9	4.0	10.5	3.9	17.4	3.6	16.3	5.0	22.5
117	2.0	6.9	4.2	14.2	4.0	25.5	4.0	19.5	6.2	22.5
124	2.3	12.0	4.7	15.7	1.8	26.4	4.4	22.8	6.6	26.8
131	2.6	12.4	2.5	20.6	4.4	29.5	4.3	25.5	6.0	29.4
138	3.0	23.9	4.0	26.5	4.9	33.6	5.7	39.5	5.9	30.0
145	3.3	32.9	5.9	36.9	5.3	43.9	5.8	44.1	6.0	46.1
152	5.9	45.5	6.2	48.5	6.7	49.9	5.0	50.6	2.0	59.5
LSD	0.2	1.9	0.3	3.3	1.1	2	0.2	1.5	0.4	2.3
P-value	0.004	0.046	0.004	0.006	0.002	0.006	0.004	0.0001	0.005	0.003
F value	3.6	2.8	3.9	8.1	18.4	3.6	4.6	5.1	22.83	55.81

Initial infestation occurred at 103 DAS on early sown crop (15<sup>th</sup> Oct) in 2012-13 and at 110 DAS in 2010-11 and 2011-12 in the present study. In late sown crop, early infestation was low at early stage and gradually increased up to maturity and then decreased at harvesting. This may be due to change in climatic conditions as the temperature increased and humidity decreased. Sherzad and Kumar (2014) found that population of *H. armigera* increased and reached its peak level of 3.8% per plant during 3<sup>rd</sup> wk of March (std wk 11<sup>th</sup>). Pandey et al. (2014) studies revealed that larval population of *H. armigera* fluctuated with environmental factors and reached its maximum of 14.55/ 10 plants during 3<sup>rd</sup> wk of March (11<sup>th</sup> std wk) and then decline with maturity of chickpea. Our results were similar to that of Hossain et al. (2009) who reported that fluctuation of *H. armigera* population depends on dates of sowing. Pod borer population was higher in early sown crops (October 15 to November 01), while population was decreased and then increased again on late sown crops (November 01 to 30). It was observed that both early (October 15 to November 01) and late sown (December and onward) crops received higher pod borer damage and produced lower yield. But mid sown (November 08 to 30) crops harboured less pod borer damage and produced higher yield than to other sowing dates. However, Pandey et al. (2005) reported that chickpea sown before 20<sup>th</sup>

October, escaped damage caused by *H. armigera* because larval population reached to its peak after harvesting. Sowing of gram after 20<sup>th</sup> October, grain production was reduced because infestation was increased rapidly due to decreased parasitic activity by *C. chloridae*. Patnaik (2004) found that extent of pod damage and grain yield in chickpea was mostly influenced by sowing dates. November 30<sup>th</sup> sown crop has yielded high (>15 q/ha) production despite of high pod damage by borer species. Similarly, Garg (1990) showed that pod damage being lowest in early sown crop (5<sup>th</sup> October) and highest in late sown (15<sup>th</sup> November). Highest larval population was recorded in 4<sup>th</sup> wk of March, 2012 (12<sup>th</sup> std wk) with 15.3 mean larvae/10 plants. Population has significantly positive correlation with both minimum and maximum temperatures and correlation coefficient was 0.62 and 0.64, respectively (Pandey et al. 2012). Chickpea sown on 30<sup>th</sup> October and 30<sup>th</sup> November had high grain yields (11.8-15.2 and 15.6-20.7 q/ha) despite of high levels of pod damage (4.6-11.1 and 14.5-16.7%) caused by *H. armigera*. However, based on yield and pod damage, sowing chickpea on 30<sup>th</sup> October was considered optimum (Patnaik, 2004). It is concluded from the present study that average yield loss was lowest (44.56%) in the early sown crop (15<sup>th</sup> Oct) compared to 15<sup>th</sup> Dec sown crop (59.16%) and hence early sowing is recommended.

## References

- Ahmad S., Ansari M.S and Husain M 2014. Effect of insecticides on the management of *Helicoverpa armigera* in chickpea agro-ecosystem. *Annals of Plant Protection Science* 22(1): 107-111.
- Ahmad S, Ansari MS and Muslim M 2015. Toxic effects of neem based insecticides on the fitness of *Helicoverpa armigera* (Hübner). *Crop Protection* 68: 72-78.
- Ahmad S, Ansari MS Siqqiqui MH and Hussain M 2016. Effect of intercrops on management of *Helicoverpa armigera* in Chick pea agro-ecosystem. *Annals of Plant Protection Science* 24(2): 208-212.
- Dhillon M.K. Pampapathy G, Wadaska RM, Sharma HC 2012. Impact of Bt transgenic cottons and insecticides on target and non-target insect pests, natural enemies and seed cotton yield in India. *The Indian Journal of Agricultural Sciences* 82(3).
- Hossain MA 2008. Monitoring and Evaluation of Chickpea Pod-Borer, *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) by using pheromone traps. *Bangladesh Journal of Science and Industrial Research* 43(3): 419-426.
- Hossain MA, Haque MA, Prodhan MZH 2009. Incidence and damage severity of pod borer, *Helicoverpa armigera* (Hubner) in chickpea (*Cicer arietinum* L.). *Journal of Science Industrial Research* 44(2): 221-224.
- Muchhadiya DV, Saradava DA, Kabaria BB 2014. Population dynamics of insect pests and some of their natural enemies and their correlation with weather parameters on Bt cotton. *The Indian Journal of Agricultural Sciences* 84(5).
- Nowinszky L, Puskás J 2011. Light trapping of *Helicoverpa armigera* in India and Hungary in relation with the moon phases. *The Indian Journal of Agricultural Sciences* 81(2)
- Pandey BM, Tripathi, MK and Lakshmi V 2012. Seasonal incidence of gram pod borer *Helicoverpa armigera* (Hub.) on chickpea. *Annals of Plant Protection Sciences* 22(1): 190-203.
- Pandey RK, Singh GR Tripathi A and Shams A 2005. Role of natural enemies on larval population of *Helicoverpa armigera* on chickpea sown on different dates. *Shashpa* 12(1): 35-37.
- Patnaik HP 2004. Influence of sowing dates, spacing and varieties on the incidence of *Helicoverpa armigera* (Hubner) in chickpea in northern Orissa. *Legume Research* 27(2): 129-133.
- Shah ZA and Shahzad MK 2005. Fluctuation patterns of different developmental stages of *Helicoverpa armigera* (Lepidoptera: Noctuidae) on chickpea (*Cicer arietinum*) and their relationship with the environment. *Entomologia Fennica* 16: 201-206.
- Sherzad A and Kumar A 2014. Comparative efficacy of insecticides and *Beauveria bassiana* in management of *Helicoverpa armigera* (Hubner). *Annals of Plant Protection Sciences* 22(2): 268-271.
- Singh SK and Yadav DK 2009. Life table and biotic potential of *Helicoverpa armigera* (Hübner) on chickpea pods. *Annals of Plant Protection Sciences* 17: 90-93.
- Tahhan O, Sithanatham S, Hariri G and Reed W 1982. *Heliothis* species infesting chickpeas in northern Syria. *International Chickpea Newsletters* 6: 21.