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Influence of Morphological Characters of Chickpea Varieties on Damage by Gram Pod Borer (*Helicoverpa armigera* Hubner)

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A B S T R A C T

Helicoverpa armigera (Hubner) is the major constraint for the production of chickpea as it feeds on the pods causing direct economic damage to the farmers. A single *H. armigera* larva feeds 30-40 pods in its life time. It is polyphagous and multivoltine pest which is difficult to control. Farmers generally rely on the insecticides but this pest was reported to show resistance to most of the insecticides used against it. Host plant resistance for managing this pest is best as it is compatible with other pest management practices. The chickpea plant was observed to have certain morphological characters which reduce the preference of the pod borer. In the current experiment, 18 chickpea varieties were studied for the effect of morphological characters viz., plant height, number of primary branches, number of pods per plant, 100 grain dry weight, pod trichome density, pod length and pod width on pod damage by *H. armigera*. It was found that the average pod density was significant and negatively correlated with the per cent pod damage during 2015-16 (r = -0.911) and 2016-17 (r = -0.619) while the other morphological parameters were non significant. The pod trichome density was highest in the variety C-235 during 2015-16 and 2016-17. Further, plant height, number of pods per plant and 100 grain dry weight were observed to be positive and non significantly correlated with per cent pod damage during two years of experiment.

Introduction

Chickpea [*Cicer arietinum* (L.)], commonly known as Bengal gram, "Chana" or gram, originated from South Western Asia, is one of the most important pulse crop grown in India with an area of 95.39 lakh hectares producing 90.75 lakh tones during 2016-17 (Anonymous, 2017). Although all the pulses occupy a unique position in Indian agriculture as well as throughout the world, chickpea is considered as "king of pulses". It is valued for its nutritive seeds with high protein content, 25.3-28.9%, after dehulling (Hulse, 1991). The chickpea seeds are eaten fresh as green vegetables while Dhal (split chickpea without its seed coat) can be dried, fried, roasted or boiled, and used to make thick soup, bread or ground into flour for making snacks, sweets, and condiments (Hulse,1991). The productivity of chickpea is limited by a complex of interacting biotic and abiotic factors. The key pest pod borer,

Helicoverpa armigera (Hubner) is the major biotic constraint and causes serious damage during fruit development (Naresh and Malik, 1986; Deka *et al.*, 1987). Its larvae eat leaves, growing shoots and many pods during their entire life span. A full grown larva feeds on grains by making a hole in the pod and thrusts its head inside pod, while its posterior part of the body remains outside. A single larva can consume 30-40 pods in its life time (Taggar and Singh, 2012) and hence can cause 10-35 per cent reduction in pod yield (Singh *et al.*, 2004). Host plant resistance through varietal resistance remains as the most effective tool in integrated pest management which is compatible with other methods of control with no additional cost to growers. Several chickpea genotypes with less susceptibility to *H. armigera* (the genotypes that have the capability to recover from pod borer damage) have been identified in the past (Dua *et al.*, 2005, Sharma *et al.*, 2005). Among various plant characters, physico-morphic characters govern the extent of damage caused by insect pests. The characters like trichomes, thick seed coat may reduce the feeding preference of *H. armigera*. In the present experiment the effect of the morphological characters of chickpea viz., plant height, number of primary branches, number of pods per plant, 100 grain dry weight, trichome density on pod, pod length and pod width were studied in relation to the per cent pod damage.

Materials and Methods

A field experiment was carried out at Agricultural farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi during 2015-16 and 2016-17 to study the role of various physico-morphic characters of chickpea against pod damage by *H. armigera*. Eighteen chickpea varieties viz., RSG-991, BG-256, L-550, RADHEY, GNG-1581, PUSA-209, HC-3, CSJ-515, GNG-146, C-235, PUSA-261, CSJD-884, RSG-10, DIGVIJAY, GNG-1491, AKGS-1, GCP-101 and ANNIGERI-1 were procured form IIPR, Kanpur were raised in randomized block design with three replications. Standard agronomic practices as per recommendation were followed and no insecticidal sprays were conducted in experimental plot. The larval population per 5 plants and per cent pod damage was recorded on standard week basis and overall mean percentage was calculated. The following physico-morphic (morphological/biophysical) characters of the plant were studied during pod formation stage of crop, when the plants were still green.

Plant height

Five plants were randomly selected in each variety and their height was measured from the ground level to the top of the plant canopy with the help of an ordinary meter scale.

Number of primary branches

The branches arising from the basal node were counted from randomly selected five plants in each test variety and the average number of primary branches per plant was calculated.

Number of pods per plant

At maturity, data for number of pods per plant was recorded from five randomly selected plants in each test entry and then the average number was worked out. Only filled pods were included in the count.

100 Grain dry weight

Three samples of hundred grains of each test entry from each plot were taken and weighed in grams using an electric balance and average was worked out.

Hair density per cm^2 on pods

Three pods each from five randomly selected plants of each entry were taken and then hair

density was noted under stereoscopic microscope, which was converted into cm^2.

Pod size

Pod length and pod width

Three mature and full grown pods were taken each from five randomly selected plants of each test entry. The pod length and pod width was determined by Vernier caliper.

Results and Discussion

Plant height

2015-16

Maximum average plant height during pod formation stage (Table 1) was attained by the variety CSJ-515 (53.63 cm), RSG-10 (51.33 cm) and L-550 (50.67cm) which were statistically at par and the corresponding per cent pod damage was 19.14, 22.49 and 20.75%, respectively. An average plant height observed with variety DIGVIJAY was 42.74cm which was closely followed by ANNIGERI-1 (43.74 cm) and RADHEY (44.52 cm) which were at par. Lowest average plant height among all the treatments was attained by the variety GNG-1581 (31.78cm) which was significantly differed from all the test varieties, including AKGS-1 (35.58cm) and GCP-101 (40.62cm).

2016-17

Average plant height during 2016-17 was ranged from 51.84cm to 33.42cm (Table 2). Susceptible check variety ANNIGERI-1 attained 44.71cm height and the corresponding per cent pod damage was observed to be 21.92%. However, maximum average plant height was recorded on varieties CSJ-515 (51.84 cm), GNG-146 (49.33cm) and RSG-10 (48.64cm) which were at par. Lowest average plant height of 33.42cm was again recorded with GNG-1581 also differed significantly with plant height of rest of all varieties including AKGS-1, DIGVIJAY and PUSA-209 with plant height of 38.27cm, 39.45cm and 40.37cm, respectively.

The plant height was observed to be correlated as positive and non significant with per cent pod damage during 2015-16 (r = +0.313) and 2016-17 (r= +0.175) (Table 3).

These results, however, were concurrently in support with the studies of Sanap and Jamadagni (2005) who reported that the preference or non-preference for oviposition on chickpea by female moth may be due to its varying behavioral response possibly due to different canopy structure of the plants.

Primary branches

2015-16

During 2015-16, primary branches per plant were shown in Table 1. Maximum number of primary branches per plant was recorded on PUSA-261 (7.47 branches/plant) which was highest and differed significantly from CSJD-884 (6.73 branches/plant) ANNIGERI-1 (6.61 branches/plant) and PUSA -209 (6.47 branches/plant). A lowest number of 3.42 primary branches per plant were observed on variety RSG-991 followed by varieties BG-256 and GCP-101 with 4.61 and 4.83 primary branches per plant, respectively.

2016-17

Mean number of primary branches recorded on the ANNIGERI-1, susceptible check variety was 6.17 branches per plant (Table 2). However, among different varieties, maximum number of primary branches per plant was recorded on PUSA-261 (6.85 branches/plant) followed by C-235 (6.56 branches/plant) and

CSJD-884 (6.23 branches/plant) which differ significantly among themselves and also with susceptible check variety. A lower mean number of primary branches were observed on GNG-1491 (3.67 branches/plant), RSG-991 (3.84 branches/plant) and BG-256 (4.25 branches/plant).

Correlation studies revealed that the primary branches were correlated as non significantly positive with per cent pod damage during 2015-16 (r = 0.091) while a negative and non significant correlation was observed during 2016-17 (r = -0.014) (Table 3).

These results are in corroboration with finding of Hasan *et al.,* (2008) who obtained a significant positive correlation between pod borer infestation and number of branches plant^{-1}.

No. of pods per plant

2015-16

There was significant difference in number of pods per plant during crop maturity in different varieties (Table 1) with maximum 35.62 pods on BG-256 and 34.84 on RSG-10 which were at par with each other followed by GNG-146 (31.84), HC-3 (29.80), L-550 (29.67), AKGS-1 (26.87), PUSA-209 (26.82) and ANNIGERI-1 (26.72). Lowest number of pods per plant was recorded on varieties C-235 (16.36) and GNG-1581 (20.41) and was at par with each other.

2016-17

During 2016-17, mean number of pods per plant among the varieties was ranged between 33.67-17.84 pods per plant (Table 2). Among the varieties, maximum number of pods per plant was recorded on RSG-10 (33.67) which was not significantly different to number of pods observed on BG-256 (32.38) and GNG-146 (29.87). A lowest number of 20.81 and 17.84 pods per plant recorded on varieties DIGVIJAY and C-235, respectively.

During two years of experimentation a non significant positive correlation was observed between per cent pod damage and number of pods per plant (Table 3).

100 grain weight

2015-16

Average 100 grain weight of the varieties under study varied from 19.84 to 25.54g (Table 1). The susceptible check variety *i.e.* ANNIGERI-1 had recorded 100 grain weight of 21.44 g and the highest 100 grain weight was recorded in the L-550 (25.54g) followed by HC-3 (24.67g), CSJ-515 (23.15g) and RSG-991 (23.16g). Whereas 100 grain weight of 20.44 g was recorded on GNG-1491, GNG-1581 and C-235. Lowest 100 grain weight was observed from PUSA-261 (19.85g) and AKGS-1 (19.84g) varieties and the average grain weight differed significantly from the 100 grain weight of rest of all varieties.

2016-17

During 2016-17, 100 grain weight of varieties under study was shown in the Table 2. Highest 100 grain weight was recorded in the L-550 (26.89g) which was significantly different from susceptible check ANNIGERI-1 (23.86) and closely followed by HC-3 (26.17g), RSG-991 (25.74), CSJ-515 (25.33g) and ANNIGERI-1 (23.86). Again, lowest 100 grain weight of 18.33g was recorded in varieties PUSA-261 and AKGS-1 and this weight of 100 grains differed significantly from the 100 grain weight of all the test varieties.

A positively non significant correlation was observed between 100 grain weight and per cent pod damage during 2015-16 (r = 0.162) and 2016-17 (r= 0.056) (Table 3).

Hair density per centimeter on pods

2015-16

The number of trichomes per cm^2 of pods was highest on C-235 (435.21 per cm^2) and differed significantly with other varieties. The corresponding per cent pod damage was 9.78% (Table 1). Hair density on GNG-1581, DIGVIJAY, RSG-991 and GNG-1491 was observed to be 385.67, 380.45, 372.45, and 370.45 per cm^2. Lowest trichome density of 261.56 trichomes per cm^2 leaf area was recorded on variety PUSA-209 and the corresponding per cent pod damage was 24.54% which was followed by trichome density on RADHEY (265.11 per cm^2), HC-3 (286.14 per cm^2) RSG-10 (296.26 per cm^2) and AKGS-1 (344.26 per cm^2).

2016-17

The number of trichomes on pods varied significantly between various varieties and the highest number of trichomes per cm^2 pod area were again recorded on variety C-235 (497.71 per cm^2) which differed significantly from the trichome density observed on the susceptible check ANNIGERI-1 (368.11 per cm^2). C-235 was closely followed by trichome density on pods of GNG-1491 (426.75 per cm^2), GNG-1581 (413.18 per cm^2), PUSA-261 (401.67 per cm^2) and RSG-991 (399.84 per cm^2).

A Significantly lowest number of 307.26 trichomes per cm^2 was recorded on PUSA-209 and next lowest pod hair density of 324.67, 327.14 and 331.82 trichomes per cm^2 was recorded on the RADHEY, HC-3 and DIGVIJAY, respectively (Table 2).

From the correlation analysis it was observed that the trichome density on pods was correlated as significantly negative with per cent pod damage during 2015-16 (r = -0.911) and 2016-17 (r = -0.619).

Similar findings of high trichome density contributing to low per cent pod damage was reported by Girija *et al.,* (2008), Hasan *et al.,* (2008), Hossain *et al.,* (2008), Kanchana *et al.,* (2005) and Shahzad *et al.,* (2005).

Pod length (cm)

2015-16

An average pod length of 1.90 cm was recorded on the L-550 which was at par with pod length of 1.89cm, 1.86cm and 1.84cm recorded on GNG-1491, HC-3 and DIGVIJAY, respectively (Table 1). These varieties were closely followed by the BG-256 (1.78cm), RSG-991 (1.76cm) and CSJ-515 (1.64cm). A lowest average pod length of 1.40, 1.42, 1.49 and 1.51cm was observed on the varieties GNG-1581, CSJD-884, AKGS-1 and GCP-101, respectively and no significant difference in pod length was observed among all the test varieties.

2016-17

During 2016-17, pod length of the various varieties under study was observed to be in a range of 1.33 to 1.85 cm (Table 2) and the difference of mean was observed to be statistically non significant.

Highest pod length of 1.85cm was recorded with the pods of HC-3 followed by L-550(1.84cm), RSG-991 (1.82 cm), GNG-146 (1.82cm), PUSA-261 (1.78cm) and BG-265 (1.76cm). The lowest average pod length was recorded from the pods of variety CSJD-884 (1.33cm) and GNG-1581 (1.39cm).

Pod length and per cent pod damage was correlated as negatively non significant during first year (r = -0.073) and second year (r = -0.126) of experiment (Table 3).

Table.1 Morphological characters of chickpea varieties/genotypes during 2015-16

Varieties/Genotypes	*Overall mean no. of larvae per 5 plants	*Overall mean per cent pod damage	*Plant height (cm.)	*Primary branches/plant	*No. of pods/plant	*100 grain weight (g.)	*Average pod trichome density/cm^2	*Pod length (cm.)	*Pod width (cm.)
RSG - 991	1.63	15.15	47.15	3.42	25.11	23.16	372.45	1.76	1.04
BG - 256	2.14	18.29	44.67	4.61	35.62	21.62	358.12	1.78	1.02
L- 550	2.88	20.75	50.67	5.21	29.67	25.54	355.42	1.90	0.88
RADHEY	3.79	22.02	44.52	4.84	21.67	19.86	265.11	1.57	0.84
GNG - 1581	1.36	12.19	31.78	5.81	20.41	20.44	385.67	1.40	0.76
PUSA- 209	4.81	24.54	44.67	6.47	26.82	22.26	261.56	1.54	0.81
HC-3	3.14	21.90	49.37	5.28	29.80	24.67	286.14	1.86	1.01
CSJ - 515	2.47	19.14	53.63	5.83	25.42	23.15	349.24	1.64	0.94
GNG - 146	2.52	19.24	47.42	5.65	31.84	22.43	347.44	1.70	0.84
C – 235	1.15	9.78	45.28	6.28	19.33	20.44	435.21	1.48	0.71
PUSA - 261	1.82	16.67	46.67	7.47	20.67	19.85	361.75	1.58	0.84
CSJD - 884	1.69	15.56	44.83	6.73	21.80	22.36	366.12	1.42	0.73
RSG – 10	4.20	22.49	51.33	5.41	34.84	21.45	296.26	1.54	0.84
DIGVIJAY	1.41	12.79	42.74	5.44	21.27	21.02	380.45	1.84	0.96
GNG – 1491	1.59	14.77	47.89	3.80	22.67	20.44	370.45	1.89	0.96
AKGS – 1	2.23	19.05	35.58	5.41	26.87	19.84	344.26	1.49	0.81
GCP – 101	1.93	17.69	40.62	4.83	25.67	22.36	365.26	1.51	0.80
ANNIGERI - 1	2.02	18.16	43.74	6.61	26.72	21.44	351.78	1.54	0.64
SEm	-	-	**1.12**	**0.13**	**1.59**	**0.71**	**2.81**	**0.19**	**0.13**
C.D.	-	-	**3.45**	**0.37**	**4.72**	**2.18**	**8.39**	**NS**	**NS**

*Average of three replications.

Table.2 Morphological characters of chickpea varieties/genotypes during 2016-17

Varieties/Genotypes	*Overall mean no. of larvae per 5 plants	*Overall mean per cent pod damage	*Plant height (cm.)	*Primary branches	*No. of pods/plant	*100 grain weight (g.)	*Average pod trichome density/cm^2	*Pod length (cm.)	*Pod width (cm.)
RSG - 991	2.26	19.19	48.36	3.84	23.67	25.74	399.84	1.82	1.21
BG - 256	3.12	20.63	41.22	4.25	32.38	20.33	365.74	1.76	1.38
L- 550	4.77	27.02	48.95	5.32	28.33	26.89	373.52	1.84	1.04
RADHEY	5.08	28.82	41.55	4.66	25.89	20.11	324.67	1.61	0.96
GNG - 1581	1.74	15.92	33.42	5.71	27.76	21.67	413.18	1.39	0.64
PUSA- 209	3.97	23.71	40.37	6.35	23.52	23.84	307.26	1.48	0.93
HC-3	4.36	26.35	47.62	5.83	27.88	26.17	327.14	1.85	0.94
CSJ - 515	3.82	23.65	51.84	6.10	26.75	25.33	385.67	1.55	0.96
GNG - 146	3.57	23.54	49.33	5.42	29.87	23.64	359.71	1.82	0.74
C – 235	1.32	11.12	43.16	6.56	17.84	19.67	497.71	1.65	1.17
PUSA - 261	2.45	19.47	44.33	6.85	21.71	18.33	401.67	1.78	0.89
CSJD - 884	2.11	18.30	47.83	6.23	23.45	21.64	393.27	1.33	0.85
RSG – 10	4.74	26.39	48.64	5.37	33.67	20.71	341.58	1.57	0.77
DIGVIJAY	1.52	12.79	39.45	5.88	20.81	21.33	331.82	1.92	0.95
GNG – 1491	2.95	20.41	45.03	3.67	23.74	22.37	426.75	1.66	1.03
AKGS – 1	4.11	23.91	38.27	5.73	25.89	18.33	384.16	1.57	0.86
GCP – 101	3.05	20.55	42.33	4.58	24.31	23.03	391.33	1.48	0.91
ANNIGERI - 1	3.34	21.92	44.71	6.17	27.78	23.86	368.11	1.46	0.57
SEm	-	-	**1.38**	**0.09**	**1.44**	**0.77**	**2.62**	**0.18**	**0.16**
C.D.	-	-	**4.21**	**0.27**	**4.26**	**2.28**	**7.94**	**NS**	**NS**

*Average of three replications

Table.3 Correlation coefficient (r) of per cent pod damage with physico-morphic parameters during 2015-16 and 2016-17

	Plant height	Primary branches	No. of pods/plant	Average pod trichome density	Pod width	Pod length	100 grain weight
% Pod damage 2016	0.313	0.091	0.148	-0.911**	-0.032	-0.073	0.162
% Pod damage 2017	0.175	-0.014	0.087	-0.619**	0.186	-0.126	0.056

* Correlation is significant at the 0.05 level

Pod width (cm)

2015-16

An average pod width observed on susceptible check i.e. ANNIGERI-1 (0.64cm) was lowest among the varieties under study and a highest pod width of 1.04cm was recorded on RSG-991 which was followed by the variety BG-256 (1.02cm) and HC-3 (1.01cm) (Table 1). However, no significant difference with respect to average pod width was observed among the varieties under study.

2016-17

Among the varieties, lowest average pod width of 0.57 cm was recorded on susceptible check i.e. ANNIGERI-1 followed by GNG-1581 (0.64cm), GNG-146 (0.74cm) and RSG-10 (0.77cm). Highest average pod width was observed on BG-256 (1.38cm) followed by RSG-991 (1.21cm), C-235 (1.17cm), L-550 (1.04cm) and GNG-1491 (1.03cm). These varieties had no significant difference with respect to average pod width (Table 2).

During 2015-16, pod width was correlated as negative and non significant (r = -0.032) with per cent pod damage whereas positively non significant correlation (r = 0.186) was observed between per cent pod damage and pod width during second year of experiment (Table 3).

These findings are in accordance with results of Kanchana *et al.,* (2015) and Katti and Bhatia, 1993 who reported a positive correlation between pod length, pod width and per cent pod damage.

In conclusion, investigations on the effect of biophysical parameters on the per pod infestation by *H. armigera* revealed that the during two years of experimentation, plant height, number pods per plant and 100 grain dry weight was correlated as positive non significant with per cent pod damage. The number of primary branches per plant was observed to show non significant positive correlation (r=+0.091) and negative non significant correlation (r=-0.014) during 2015-16 and 2016-17, respectively. However, trichome density was significant and negatively correlated with per cent pod damage during 2015-16 (r=-0.911) and 2016-17 (r=-0.619). while a negative non significant correlation was observed between per cent pod damage and pod length during both years of experiment. It was observed that trichome density had a significant influence on the pod damage and the moderately resistant varieties i.e. C-235, GNG-1581 and DIGVIJAY had high trichome density.

References

Anonymous, (2017) *Annual report 2016-17* Government of India, Directorate of Pulses development.

Deka, N.K., D. Parshad and P. Chand. (1987) Succession and incidence of insect pests in chickpea, *Cicer arietinum* L. Giornal Italiano di Entomol. 3: 421-428.

Dua RP, Gowda CLL, Kumar S, Saxena KB, Govil JN, Singh BB, Singh AK, Singh RP, Singh VP and Kranthi S. (2005) Breeding for resistance to *Heliothis/Helicoverpa*: Effectiveness and limitations. In: Sharma H C (Ed), *Heliothis*/*Helicoverpa* management: Emerging Trends and Strategies for Future Research. Oxford and IBH Publishers, New Delhi, India. Pp 223-242.

Girija, P., Salimath, M., Patil, S. A., Gowda, C. L. L and Sharma, H.C. (2008) Biophysical and biochemical basis of host plant resistance to pod borer (*Helicoverpa armigera* Hubner) in chickpea (*Cicer arietinum* L.). *Indian J*

Genet 68: 320-23.

Hasan, M. K. Alam, M. J. and Kamruzzaman, M. (2008) Screening of some chickpea genotypes against *Helicoverpa armigera* on the basis of physical parameters grown at two locations of Bangladesh. *J. Agrofor. Environ*. 2(2): 183-186

Hossain, M. Altaf., Haque, M. Azizul and Prodhan, M.Z.H. (2008) Incidence and Damage Severity of Pod Borer, *Helicoverpa armigera* (Hubner) in Chickpea (*Cicer arietinum* L.). *Bangladesh J. Sci. Ind. Res.*, 44 (2): 221-224.

Hulse S.H. (1991) Nature, composition and utilization of grain legumes, P. 11-27. In uses of tropical legumes: Proceedings of a consultant meeting 27-30 march, 1989. ICRISAT Centre Patancheru, AP 502-324, India.

Kanchana, R, Lakshmi, K.V and Sekhar, P.R. (2005) Morphological and biochemical bases of host plant resistance to *Helicoverpa armigera* (Hubner) in chickpea. *Journal of Plant Protection and Environment.* 2(1):12-17.

Katti, G and Bhatia, V. S. (1993) Preliminary studies on the influence of pod characters on pod damage in chickpea. *Indian J Pulses Res* 6: 215-16.

Naresh, J.S. and V.S. Malik. (1986) Observations on the insect pests of chickpea (*Cicer arietinum* L.) in Haryana. Bull. Entomol. 27: 75-77.

Sanap, M.M and Jamadagni, B.M (2005) Screening of chickpea for resistance to pod borer *Helicoverpa armigera* (Hubner) at Rahuri, Maharashtra, India. *ICPN* 12: 37-39.

Shahzad, K., Iqbal, A., Khalil, S. K. and Khattak, S. (2005) Response of Different Chickpea (*Cicer aritinum*) Genotypes to the Infestation of Pod Borer (*Helicoverpa armigera*) with Relation to Trichomes. *Research Journal of Agriculture and Biological Sciences* 1(1): 120-124.

Sharma HC, Pampapathy G, Lanka SK and Ridsdill-Smith TJ. (2005) Antibiosis mechanism of resistance to pod borer (*Helicoverpa armigera*) in wild relatives of chickpea. Euphytica 142: 107-117.

Singh, H., Mahajan, G. and Singh, I. (2004) Efficacy of different insecticides against gram pod borer (*Helicoverpa armigera*) on chickpea (*Cicer arietinum* L.). Legume Res., 27: 233-234.

Taggar GK and Singh R. (2012) Integrated management of insect pests of rabi pulses. In: R Arora, B Singh and AK Dhawan (Eds), Theory and Practice of Integrated Pest Management. Scientific Publishers, India. Pp 454-72.

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