Standardization of Cage Techniques to Screen Chickpeas for Resistance to *Helicoverpa armigera* (Lepidoptera: Noctuidae) in Greenhouse and Field Conditions

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ABSTRACT Because of variations in insect populations and staggered flowering of chickpea, *Cicer arietinum* L., genotypes, it is difficult to compare the genotypic performance across seasons and locations. We standardized a cage technique to screen chickpeas for resistance to *Helicoverpa armigera* (Hübner). Leaf feeding by the larvae was significantly lower on ICC 506 than on ICCC 37 when the seedlings were infested with 20 neonates per five plants at 15 d after seedling emergence or 10 neonates per three plants at the flowering stage. Maximum differences in pod damage were observed when the plants were infested with six third-instar larvae per three plants in the greenhouse, and with eight larvae per plant under field conditions. Larval weights were significantly lower on ICC 506 than on ICCC 37 across growth stages and infestation levels. At the podding stage, percentage of reduction in grain yield was significantly greater on ICCC 37 and Annigeri than on ICCV 2 and ICC 506. The no-choice test can be used to screen segregating breeding material and mapping populations for resistance to *H. armigera*. It also provides useful information on antibiosis mechanism of resistance to *H. armigera*.

KEY WORDS *Helicoverpa*, chickpea, resistance

CHICKPEA, *Cicer arietinum* L., is the third most important legume crop in the world, after dry beans and peas. It is cultivated in >42 countries in South Asia, east Africa, North and Central America, Mediterranean Europe, and Australia. It is cultivated on ~10.4 million ha, with an annual production of 8.04 million tons, with an average yield of 773 kg ha^{-1} (Ali and Kumar 2001). Chickpea yields have remained static over the past two decades because of heavy losses due to insect pests and diseases. Nearly 60 insect species are known to feed on chickpea, of which *Helicoverpa armigera* (Hübner) is the most important pest worldwide. The extent of losses in chickpea due to *H. armigera* damage has been estimated at >$328 million in the semiarid tropics (ICRISAT 1992). Total losses due to *H. armigera* in cotton, grain legumes, vegetables, and cereals may exceed $2 billion, and the cost of insecticides used to control *H. armigera* may be >$500 million annually (Sharma 2001).

H. armigera control is currently based on heavy use of insecticides. As a result, *H. armigera* populations have developed resistance to several groups of insecticides (Kranthi et al. 2002). Environmentally safe techniques such as the release of *Trichogramma* egg parasitoids, sprays of *Bacillus thuringiensis*, *Helicoverpa* nuclear polyhedrosis virus, and pesticides of plant origin (e.g., neem, custard apple) are not yet readily available in rural areas and are too expensive or their effectiveness is highly variable (Sharma 2001). In addition, host plant resistance to insects can play an important role in integrated pest management. Increased levels of resistance to *H. armigera* will contribute to reduce pesticide application for managing this pest on chickpea.

Chickpea germplasm accessions with resistance to *H. armigera* have been identified by several studies (Lateef 1985; Chhabra et al. 1990; Lateef and Sachan 1990; Kotikal et al. 1996; Ahmad and Kotwal 1996; Singh and Yadav 1999a, b; Das and Kataria 1999), and resistance genes have been transferred into breeding lines with low-to-moderate levels of resistance (Srivastava and Srivastava 1989, Chaturvedi et al. 1997, Shukla and Yadav 1998). However, the genotypic responses have been found to be variable across seasons and locations (Sharma et al. 2003).

There are large differences in the flowering times of different chickpea genotypes (35 to >90 d), whereas *H. armigera* infestation varies over space and time. *H. armigera* infestation in chickpea is either too high to cause a complete damage to the crop or too low to result in significant differences among the test genotypes. The onset of infestation also varies over seasons and locations, resulting in differential crop response to damage by *H. armigera*. Because of variation in insect pressure and onset of insect infestation, it is difficult to get reliable results under natural infestation. It is im-

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portant to screen the test materials for resistance to the target insects under optimum and uniform level of insect infestation at the most susceptible stage of the crop (Sharma et al. 1992, Smith et al. 1994). Therefore, we standardized a cage technique to screen for resistance to *H. armigera* under uniform insect pressure in greenhouse and field conditions.

Materials and Methods

The experiments were conducted under greenhouse and field conditions at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Andhra Pradesh, India. Four chickpea genotypes (ICC 506, resistant, Lateef 1985; ICCV 2, moderately susceptible; Annigeri, landrace cultivar; and ICCC 37, commercial susceptible cultivar; Sharma et al. 2003) with different levels of susceptibility to *H. armigera* were used to standardize the technique to screen chickpeas for resistance to *H. armigera* under greenhouse and field conditions. There were five replications for each genotype in a randomized complete block design (RCBD). Each genotype was infested with different larval densities as described under each experiment.

Technique to Evaluate Chickpea Resistance to *H. armigera* under Greenhouse Conditions

Plants. The chickpea plants were raised on a sterilized mixture of black soil (Vertisols), sand, and farmyard manure (2:1:1). The soil was filled into medium-sized plots (30 cm in diameter, 30 cm in depth). The seeds were sown 5 cm below the soil surface and watered as needed. The plants were fertilized with diammonium phosphate granules (DAP) 15 d after seedling emergence at 20 g of DAP per pot. Fifteen seeds were sown in each pot, and 10 plants (in clusters of five each) were retained in each pot 5 d after seedling emergence. Of these, five plants were infested with the *H. armigera* instars inside a cage, whereas the other five plants were kept as an untreated control outside the confinement cage.

Insects. *H. armigera* culture was raised in the laboratory on an artificial diet (Armes et al. 1992). The field population was introgressed into the laboratory culture every 6 mo. The field-collected larvae were reared in the laboratory on the natural host for one generation before being introgressed into the laboratory culture to avoid contamination with the nuclear polyhedrosis virus, bacteria, or fungi. The *H. armigera* neonates were reared in groups of 250–300 larvae in a 200-ml plastic cup having a 2–3-mm layer of artificial diet on the bottom and the sides for 5 d. After 5 d, the larvae were transferred individually to six-well plates (each well 3.5 cm in diameter, 2.0 cm in depth) to avoid cannibalism. Upon emergence, 10 pairs of adults were released inside an oviposition cage (30 by 30 by 30 cm). Diaper liners were hung inside the cage as an oviposition site. Freshly emerged neonates or third-instars reared on the artificial diet for 5 d were used for infesting the test plants under greenhouse and field conditions.

Fig. 1. Plastic jar cage used to screen chickpea genotypes for resistance to *H. armigera* under greenhouse conditions (left, ICCC 37; right, ICC 506).

Insect Infestation. The test genotypes were infested at seedling (15 d after seedling emergence), flowering, and podding stages by using a no-choice test. At the seedling stage, five plants were covered with a transparent plastic jar cage (11.5 cm in diameter, 25 cm in height), whereas the other five plants in the same pot were left uninfested outside the cage (Fig. 1). At the flowering and podding stages, three plants were infested in each pot, whereas the other three plants were kept outside the cage as uninfested control. The plastic jar cage had two wire mesh-screened windows of 4-cm diameter at the lower end of the cage, and one at the top to allow for proper aeration. The test plants were covered with the cage, which were pushed 3 cm in depth into the soil to prevent any escape of the larvae. Known numbers of neonates or third instars were released on the plants inside the cage by using a camel's-hair brush. There were five replications for each genotype and/or infestation level, and the pots were arranged in a subplot randomized complete block design, with genotypes as the main treatment and the infestation levels as the subtreatment. The greenhouse was maintained at 27 ± 3°C and cooled with desert coolers, which were operated automatically through a thermostat.

The early instars of *H. armigera* (1–5 d old) usually feed on the leaves and flowers. The third instars onwards feed on the leaves when the pods are not available. Therefore, the genotypic resistance to *H. armigera* was first evaluated against the neonates at the vegetative and flowering stages. At 15 d after seedling emergence, the test genotypes were infested with 5, 10, 15, 20, and 25 neonates of *H. armigera* per five plants. At the flowering stage, only three plants were infested in each pot. The experiments were monitored daily and terminated when >80% of the leaf area was consumed in the susceptible control, and the differences between resistant and susceptible genotypes were most apparent. After terminating the experiments, the larvae were removed from the plants, placed individually in glass vials, and weighed after 4 h.

The plants were then rated visually for the extent of leaf and/or pod damage on a 1-9 damage rating scale (1, <10% leaf area and/or pods damaged; 2, 11-20%; 3, 21-30%; 4, 31-40%; 5, 41-50%; 6, 51-60%; 7, 61-70%; 8, 71-80%; and 9, >80% leaf area and/or pods damaged). At the flowering stage, data also were recorded on the number of flowers and pods in infested and uninfested plants.

At the podding stage, the plants were infested with the third instars (5 d old) reared on artificial diet to evaluate the genotypic response to pod damage by *H. armigera* larvae. Three plants were infested in each genotype with 0, 2, 4, 6, 8, and 10 larvae per three plants. There were five replications, and the pots were arranged in a subplot randomized complete block design, with genotypes as the main treatment and the infestation levels as the subtreatment. The experiments were terminated when >80% of the leaf area/pods were consumed in the susceptible control. Data were recorded on visual damage rating (DR) for leaf/pod damage (1, <10% leaf area/pods damaged; 9, >80% leaf area/pods damaged) and percentage of reduction in grain yield.

No-Choice Test to Evaluate Chickpea Resistance to *H. armigera* under Field Conditions

Under field conditions, the crop was raised on deep black soil (Vertisols) under irrigated conditions during the 2002-2003 postrainy season (October-March). The four chickpea genotypes were raised on ridges, 60 cm apart. The seeds were sown at a depth of 7 cm below the soil surface using a four-cone planter. Each plot was of four rows of 2 m in length. There were three replications. The experiment was arranged in a factorial RCBD. The plants were thinned to a spacing of 10 cm between the plants at 15 d after seedling emergence. Diammonium phosphate was applied at 100 kg ha^{-1} as a basal fertilizer before sowing. Normal agronomic practices were followed for raising the crop. There was no insecticide application in this trial. At the 50% podding stage, 30 plants were selected at random in each plot, and the plants were covered with a wire-framed cylindrical cage (25 cm in diameter, 25 cm in height) made of galvanized iron wire (2 mm in diameter) supported by three vertical bars, which extended 10 cm beyond the lower ring (Fig. 2). The extensions of the vertical bars were pushed into the soil. The wire-framed cages were covered with a muslin cloth bag, and the plants were infested with 2, 4, 6, 8, and 10 third instars per plant. The cages were removed after 7 d when the differences between resistant and susceptible cultivars were most apparent, and data were recorded on total number of pods, pods damaged by the larvae, and numbers of surviving larvae.

Fig. 2. Wire-framed cage used to screen chickpea genotypes for resistance to *H. armigera* under field conditions.

Statistical Analysis

Data were subjected to analysis of variance by using GENSTAT release 5.0. The data were analyzed by factorial analysis in a randomized complete block design. The significance of differences between the treatments was measured by F test, whereas the treatment means were compared using the least significant difference (LSD) at $P = 0.05$.

Results

No-Choice Cage Technique to Screen for Resistance to *H. armigera* under Greenhouse Conditions

Response of Chickpea Genotypes to Neonates of *H. armigera* at the Seedling Stage. Differences in leaf feeding between ICC 506 (DR 5.5) and ICCC 37 (DR 8.5) were significant in 15-d-old seedlings when the plants were infested with 20 larvae per five plants ($F = 6.87$, df = 3, $P = 0.01$) (Fig. 3). Differences in genotypic reaction to feeding by the *H. armigera* larvae were not apparent when the plants were infested with 5, 10, and 15 larvae per five plants. Maximum differences in leaf feeding (DR 4.8-6.5) among genotypes tested were observed at 7 d after infestation. Longer duration taken by the larvae to cause maximum damage may be due to lower rates of feeding because of cooler conditions during January, when the experi-

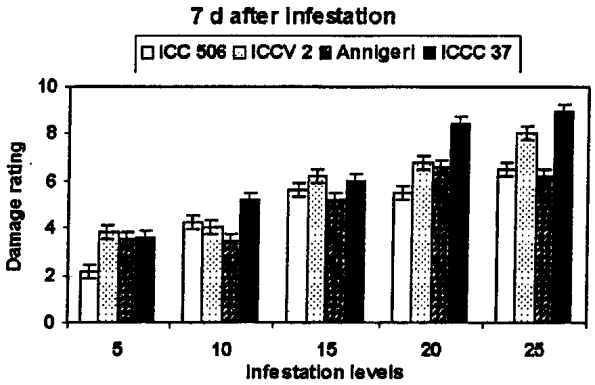

Fig. 3. Leaf feeding damage (1, <10% leaf area damaged; 9, >80% leaf area damaged) to 15-d-old seedlings of four chickpea genotypes 7 d after infestation with 5, 10, 15, 20, or 25 neonate *H. armigera* larvae per five plants in a no-choice test under greenhouse conditions (ICRISAT, Patancheru, 2001).

Table 1. Expression of resistance to *H. armigera* across five infestation levels in four chickpea genotypes at 15 d after seedling emergence under no-choice conditions in the greenhouse (ICRISAT, Patancheru, 2001)

Genotype	Larval wt (mg)					Mean
	5*	10	15	20	25	
ICC 506	36.5	27.6	31.8	27.2	25.1	29.6
ICCV 2	57.0	33.4	42.3	37.9	34.8	41.1
Annigeri	34.7	28.2	33.2	27.2	27.7	30.2
ICCC 37	49.5	39.0	39.5	38.1	35.0	40.2
Mean	44.4	32.1	36.7	32.6	30.7	35.3
LSD (P = 0.05) for comparing						
Genotype (G)			6.94 (F = 6.43, df = 3, P = 0.01)			
Infestation level (L)			7.76 (F = 4.16, df = 4, P = 0.01)			
G × L			15.53 (F = 0.32, df = 12, P = 0.98)			

* Number of larvae released per five plants.

ment was conducted in the greenhouse. Differences in leaf feeding also were significant (DR 3.3–7.4) across infestation levels (F = 29.01, df = 4, P = 0.01), whereas the interaction effects between genotypes x infestation levels were not significant. Larval weights were significantly lower on ICC 506 (29.6 mg) and Annigeri (30.2 mg) than on ICCV 2 (41.1 mg) and ICCC 37 (40.2 mg) across infestation level (F = 6.43, df = 3, P = 0.01) (Table 1). Larval weights decreased significantly (F = 4.16, df = 4, P = 0.01) with an increase in infestation level possibly because of crowding and/or reduced availability of food.

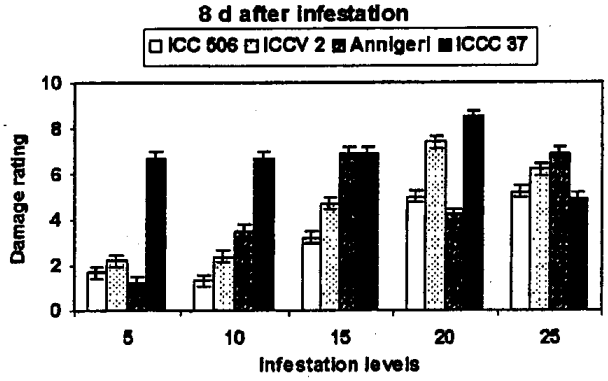

Fig. 4. Leaf feeding damage (1, <10% leaf area damaged; 9, >80% leaf area damaged) by 5, 10, 15, 20, and 25 neonate *H. armigera* larvae per three plants in four chickpea genotypes at the flowering stage in no-choice test under greenhouse conditions (ICRISAT, Patancheru, 2001).

Response of Chickpea Genotypes to Feeding by Neonates of *H. armigera* at the Flowering Stage. Maximum differences in leaf feeding among the genotypes tested were observed at 8 d after infestation (DR 3.3–6.7) (Fig. 4). There were significant differences in leaf damage between the genotypes (F = 30.02, df = 3, P = < 0.01) and infestation levels (F = 25.91, df = 4, P = 0.001). The interaction effects between genotypes and infestation levels were also significant (F = 7.09, df = 12, P = 0.01). Maximum differences between ICC 506 (DR 1.3) and ICCC 37 (6.7) were observed when the plants were infested with 10 larvae per three plants. Larval weights were significantly lower on ICC 506 than on ICCC 37 and ICCV 2, except at five larvae per three plants (F = 5.39, df = 3, P = 0.01) (Table 2). There were no significant differences in larval weights across infestation levels.

Percentage of reduction in flowers was significantly greater on ICC 506 (92.0–100.0%) and ICCC 37 (65.3–90.2%) than on ICCV 2 (22.9–65.7%) and Annigeri (45.4–73.9%) when infested with 5, 10, and 15 larvae per three plants (F = 5.44, df = 3, P = < 0.01) (Table 3). However, such differences were not apparent when the plants were infested with 25 larvae per three plants. At 15, 20, and 25 larvae per three plants, there was >90% reduction in pods on the infested plants, except in ICC 506 at 15 larvae per three plants (F = 2.82, df = 3, P = 0.05). Percentage of reduction in pod setting was significantly lower in ICC 506 and ICCV 2 than on Annigeri and ICCC 37 at 5, 10, and 15 larvae per three plants, except in ICCV 2 at 15 larvae per

Table 2. Expression of resistance to *H. armigera* at the flowering stage across five infestation levels in four chickpea genotypes under no-choice conditions in the greenhouse (ICRISAT, Patancheru, 2001)

Genotype	Larval wt (mg)					Mean
	5*	10	15	20	25	
ICC 506	30.5	28.9	46.6	42.7	39.7	37.7
ICCV 2	25.0	49.1	152.2	76.6	70.7	74.7
Annigeri	56.9	55.0	58.4	62.5	70.1	60.6
ICCC 37	149.1	108.7	68.2	91.9	55.6	94.7
Mean	65.4	60.4	81.4	68.4	59.0	66.9
LSD (P = 0.05) for comparing						
Genotype (G)			29.7 (F = 5.39, df = 3, P = 0.01)			
Infestation level (L)			33.21 (F = 0.59, df = 4, P = 0.67)			
G × L			66.42 (F = 2.13, df = 12, P = 0.04)			

* Number of larvae released per three plants.

Table 3. Effect of different levels of infestation with *H. armigera* neonate larvae on flower and pod setting in four chickpea genotypes under greenhouse conditions (ICRISAT, Patancheru, 2001)

Genotype	Reduction in flowers (%)					Mean	Reduction in pods (%)					Mean
	5*	10	15	20	25*		5	10	15	20	25	
ICC 506	100.0	92.0	93.9	98.4	76.0	92.1	33.3	66.7	66.7	100.0	100.0	73.3
ICCV 2	22.9	65.7	47.9	79.1	77.2	58.7	52.8	67.6	97.2	100.0	94.4	82.4
Annigeri	45.7	73.9	45.4	67.7	85.6	63.7	76.8	97.4	93.3	100.0	100.0	93.5
ICCC 37	65.3	90.2	88.2	97.8	58.3	80.0	86.2	100.0	100.0	100.0	97.0	96.6
Mean	58.5	80.5	68.9	85.8	74.3	73.6	62.3	82.9	89.3	100.0	97.9	86.5
LSD (P = 0.05) for comparing												
Genotype (G)	18.57 (F = 5.44, df = 3, P = 0.01)						18.21 (F = 2.82, df = 3, P = 0.05)					
Infestation level (L)	21.10 (F = 2.06, df = 4, P = 0.11)						20.36 (F = 4.54, df = 4, P = 0.01)					
G × L	42.2 (F = 1.24, df = 12, P = 0.30)						40.73 (F = 0.71, df = 12, P = 0.73)					

* Number of larvae released per three plants.

three plants. Pod setting decreased with an increase in infestation level.

Response of Chickpea Genotypes to Feeding by Third Instars of *H. armigera* at the Podding Stage. Maximum differences in leaf feeding between the genotypes tested were observed at four (DR 1.0–5.3) and six (DR 3.2–6.7) larvae per three plants at 5 d after infestation (Fig. 5). Percentage of reduction in grain yield was significantly greater on ICCC 37 (96.1%) and Annigeri (89.0%) than on ICCV 2 (58.61%) and ICCV 506 (63.11%) (F = 21.10, df = 3, P = 0.01) (Table 4).

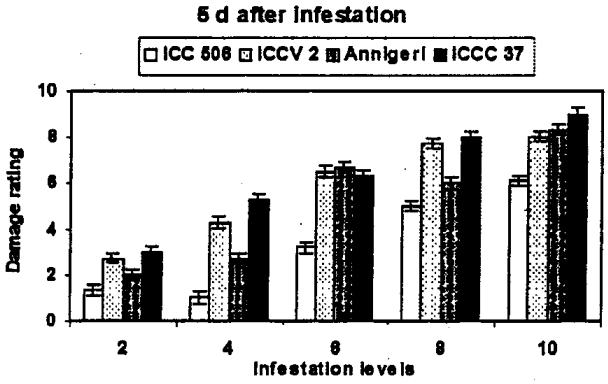

Fig. 5. Leaf feeding damage (1, <10% leaf area damaged; 9, >80% leaf area damaged) by 2, 4, 6, 8, and 10 third instars of *H. armigera* larvae in four chickpea genotypes at the podding stage in no-choice test under greenhouse conditions (ICRISAT, Patancheru, 2001).

Percentage of reduction in grain yield increased with an increase in infestation level.

No-Choice Cage Technique to Screen for Resistance to *H. armigera* under Field Conditions

There were significant differences in percentage of pod damage across infestation levels (F = 10.27, df = 4, P = 0.01) (Table 5). Percentage of pod damage in ICC 506 (10.5%) and ICCV 2 (6.8%) was significantly lower than on Annigeri (19.3%) and ICCC 37 (18.7%) across infestation levels (F = 10.04, df = 3, P = 0.01). Maximum differences in pod damage were recorded when the plants were infested with eight larvae per plant (5.06–32.70%). Larval survival was significantly lower on ICC 506 (52.2%) and ICCV 2 (47.1%) than on Annigeri (81.4%) (F = 3.42, df = 4, P = 0.01). Differences in larval survival were also significant across infestation levels (F = 9.66, df = 4, P = 0.01), whereas the interaction effects were not significant.

Discussion

Maximum differences in leaf feeding at the seedling stage (15 d after seedling emergence) between resistant (ICC 506) and susceptible (ICCC 37) genotypes were observed when the plants were infested with 20 neonate larvae per five plants, whereas maximum differences at the flowering stage were observed with 10 larvae per three plants. Differences in pod damage between the resistant and susceptible genotypes were

Table 4. Expression of resistance to third instars of *H. armigera* and reduction in grain yield across five infestation levels at the podding stage in four chickpea genotypes under no-choice conditions in the greenhouse (ICRISAT, Patancheru, 2002)

Genotype	Reduction in grain yield (%)					Mean
	2*	4	6	8	10	
ICC 506	44.3	49.7	68.8	73.8	79.0	63.1
ICCV 2	6.7	75.2	74.5	59.1	77.5	58.6
Annigeri	57.9	90.5	96.8	100.0	100.0	89.0
ICCC 37	90.2	100.0	96.1	94.1	100.0	96.1
Mean	49.8	78.9	84.1	81.8	89.1	76.7
LSD (P = 0.0%) for comparing						
Genotype (G)	11.63 (F = 21.10, df = 3; P = 0.01)					
Infestation level (L)	13.00 (F = 1.21, df = 4, P = 0.01)					
G × L	26.01 (F = 0.39, df = 12, P = 0.05)					

* Number of larvae released per three plants.

Table 5. Expression of resistance to third instars of *H. armigera* across five infestation levels under no-choice cage conditions in the field at podding stage (ICRISAT, Patancheru, 2002/03)

Genotype	Pod damage (%)					Mean	Larval survival (%)					Mean
	2*	4	6	8	10		2	4	6	8	10	
ICC 506	6.16	6.47	6.51	14.52	18.8	10.5	50.0	41.7	61.1	51.5	56.7	52.2
ICCV 2	2.12	3.97	8.42	5.06	14.3	6.8	50.0	33.3	44.4	57.8	50.0	47.1
Annigeri	12.84	14.28	15.08	32.70	21.8	19.3	100.0	58.3	88.9	100.0	60.0	81.4
ICCC 37	12.35	13.88	15.08	22.88	29.3	18.7	83.3	58.3	61.1	49.3	66.7	63.7
Mean	8.37	9.65	11.27	18.79	21.1	13.8	70.8	47.9	63.9	64.7	58.3	61.1
LSD ($P = 0.05$) for comparing												
Genotype (G)	4.74 ($F = 10.04$, df = 3, $P = 0.01$)						19.61 ($F = 3.42$, df = 3, $P = 0.02$)					
Infestation level (L)	5.81 ($F = 10.27$, df = 4, $P = 0.01$)						24.02 ($F = 9.66$, df = 4, $P = 0.01$)					
G × L	11.62 ($F = 1.23$, df = 12, $P = 0.29$)						48.03 ($F = 0.55$, df = 12, $P = 0.87$)					

* Number of larvae released per plant.

maximum when infested with four to six larvae per three plants in the greenhouse, and eight larvae per plant under field conditions. The insect density and the time taken by the larvae to result in maximum differences between resistant and susceptible genotypes or the test material has to be carefully balanced to avoid cannibalism at higher larval densities (>20 larvae) or prolonged confinement of the larvae with the test plants as the later instars (third instar onward) are cannibalistic. Therefore, consideration should be given to the insect density that results in maximum differences between the resistant and susceptible genotypes.

Larval weights were significantly lower on ICC 506 than on ICCC 37 across growth stages, whereas the trends larval survival across growth stages were not consistent. Percentage of reduction in flowers was significantly greater on ICC 506 and ICCC 37 than on ICCV 2 and Annigeri, which was contrary to the extent of larval feeding on leaves. Percentage of reduction in grain yield was significantly greater on ICCC 37 and Annigeri than on ICCV 2 and ICCV 506.

The ability to collect precise quantitative data on *H. armigera* damage is a critical element for successful development of resistant varieties and reliable marker-assisted selection systems. Percentage of damage to pods is the most common parameter used for determining genotypic susceptibility to *H. armigera* under field conditions (Sharma et al. 2003). However, this criterion often leads to unreliable results due to variations in insect populations and the stage at which the crop is infested. In addition, the damage to foliage, flowers, and small pods, which are devoured by the larvae, is not reflected in percentage pod damage. This criterion also does not take into account the genotypic ability to produce a second flush in case the first flush is lost due to *H. armigera* damage. To overcome these problems, the test materials can be evaluated for foliar damage by the neonates at the seedling and flowering stages, and pod damage by the third instars at the podding stage. Measurement of yield reduction indicates direct feeding injury to plants. This also takes into account the effects of leaf feeding on grain yield at the seedling stage, and tolerance or recovery from *H. armigera* damage during the vegetative phase. Reduction in grain yield also provides a good measure of agronomic performance and the genotypic ability to withstand *H. armigera* damage at different growth stages and under different insect densities.

Caging the test plants with insects is a dependable method of screening for resistance to *H. armigera*. In this method, considerable control can be exercised on maintaining uniform insect pressure on the test materials, and the plants can be infested at the same phenological stage. This also prevents insects from moving away from the test plants, and the larvae also are protected from the natural enemies. For valid comparison, resistant and susceptible checks of appropriate maturity should be infested at the same time as the test genotypes. The no-choice test can be used to screen chickpea plants for resistance to *H. armigera* at the seedling and reproductive stages and provides information on antibiosis mechanism of resistance to *H. armigera*. This technique can also be used to measure genotypic resistance at different growth stages of plant and at different insect densities.

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