Influence of Host Plant Resistance on Biocontrol of *Helicoverpa armigera* in Pigeonpea

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Cotton bollworm / legume pod borer, *Helicoverpa armigera* (Hubner) is one of the most important pests of field crops, including pigeonpea, and crop failures due to pod borer damage are quite common (Sharma, 2001). Because of over-dependence on insecticides to minimize the losses due to *H. armigera*, this pest has developed very high levels of resistance to several insecticides (Kranthi *et al.*, 2002). Germplasm accessions with low to moderate levels of resistance have been identified in the germplasm collection, and resistance has been transferred into a few high-yielding lines such as ICP 187-1, ICPL 84060, and ICPL 332 (Lateef, 1992).

The activity and abundance of the natural enemies, particularly the hymenopteran parasitoids in pigeonpea is quite low (Bhatnagar *et al.*, 1982), because of possible adverse effects of the glandular exudates, which play an important role in host plant selection and feeding by the *H. armigera* larvae (Green *et al.*, 2003). While such adverse effects of the glandular trichomes on the egg parasitoid, *Trichogramma* spp. have been studied in detail (Romeis *et al.*, 1997, 1998), there is no clear idea about the overall effects of insect-resistant genotypes on the mortality of *H. armigera* larvae. Therefore, the present studies were undertaken to determine the effect of *Helicoverpa*-resistant cultivar, ICPL 332 on the extent of larval mortality due to biocontrol agents in large plots under field conditions.

A *Helicoverpa*-resistant (ICPL 332) and a susceptible commercial cultivar (ICPL 87119) of pigeonpea were grown in large plots (0.5 ha) under rainfed conditions at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Andhra Pradesh, India, during the 1999-2003 rainy seasons. The rows were spaced 75 cm apart, and the seedlings were thinned to a spacing of 30 cm between the plants at 30 days after seedling emergence.

At the flowering stage, 250 eggs were collected from the center of each plot/cultivar in 5 ml glass vials, and kept in the laboratory for emergence of egg parasitoids. The vials were examined after five days to record data on parasitoid emergence. At the podding stage, 25 third- to fifth-instar larvae were collected from five spots (4 rows, 4 m long) marked diagonally across the field and brought to the laboratory. The larvae were reared individually in glass vials (15 ml capacity) under ambient conditions (27 ± 2°C, and 60 ± 5% RH). Data were recorded on the larval mortality due to parasitoids/pathogens, pupation, and adult emergence of *H. armigera*. At crop maturity, five plots of 3 x 4 m were marked diagonally across the field. All the mature pods were harvested by hand from the marked plots, and data were recorded on total number of pods, and the pods damaged by *H. armigera*. After recording the insect damage, the pods were threshed and grain yield was recorded for each plot. The data were subjected to analysis of variance to compute standard error of mean for each genotype.

There was no emergence of egg parasitoids from the eggs collected from either of the pigeonpea cultivars, confirming the earlier observation that there was very little egg parasitism of *H. armigera* on pigeonpea (Bhatnagar *et al.*, 1982). Per cent pod damage by *H. armigera* was lower in ICPL 332 than in ICPL 87119, although the differences were small during the 2001 rainy season (Fig. 1A). Quite often, the first flush in ICPL 87119 was completely damaged by the pod borer, and the second flush, which occurred 20 to 25 days later, suffered less pod borer damage. As a result, the apparent differences in pod damage between the two test cultivars were not very large. Pod borer incidence was low during the 1999 season (18.1 to 24.6% pods damaged), moderate during 2000 (47.6 to 49.3% pods damaged), and very high during the 2001 and 2003 rainy seasons (91.5 to 99.4% pods damaged). Larval mortality due to parasitoids/pathogens ranged from 19.0 to 72.0% (Fig. 1B). Most of the mortality was due to polyhedrosis virus, bacteria and pathogen infection. Parasitoids emergence was recorded in less than 5% larvae. Therefore, only total mortality was taken into consideration. Percentage mortality was greater in larvae collected from ICPL 332 than those collected from ICPL 87119 during the 2000 and 2001 rainy seasons. However, there were no differences in larval mortality during the 1999 rainy season, when the *H. armigera* incidence was low because of prolonged drought conditions. Grain yield in ICPL 332 plots

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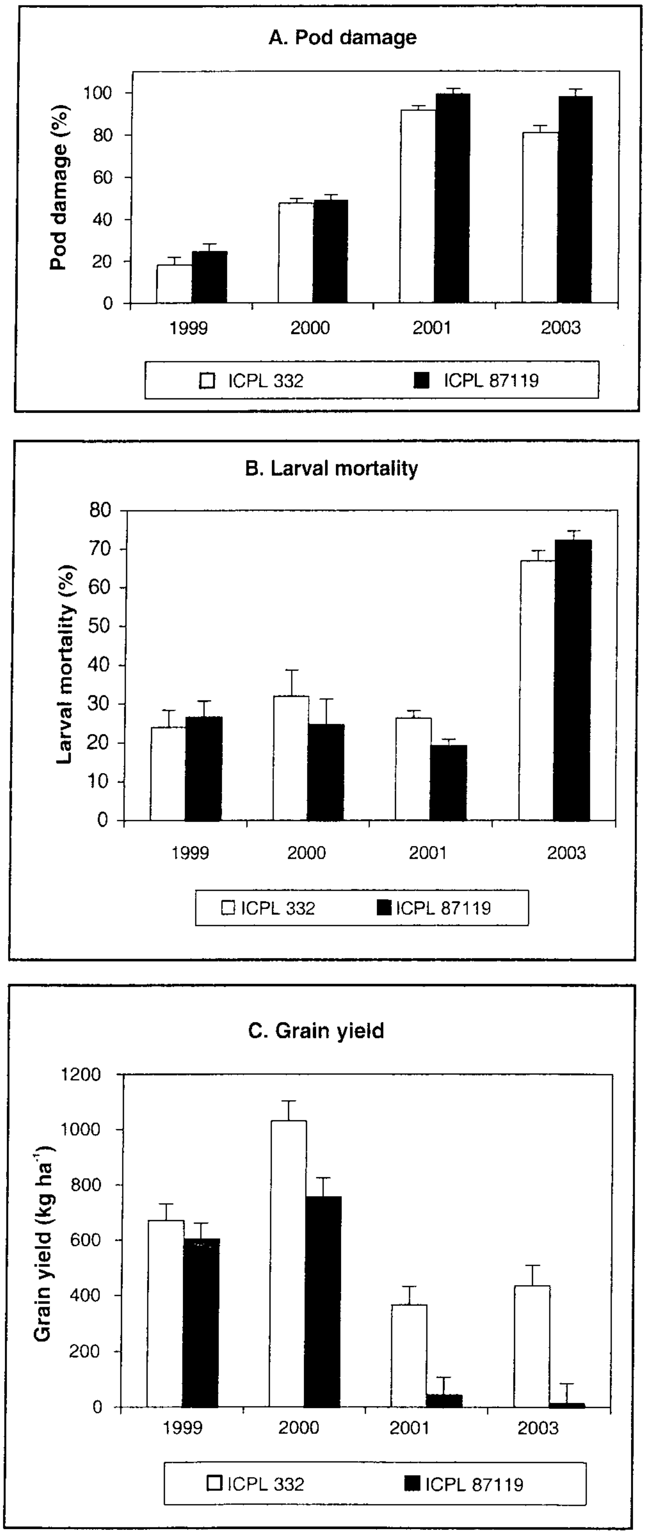

Figure 1. Percentage Pod damage (A) mortality of *Helicoverpa armigera* larvae due to parasitoids and pathogens (B) and grain yield (C) of *Helicoverpa* - resistant (ICPL 332) and *Helicoverpa* - susceptible (ICL 87119) pigeonpea cultivars

was significantly greater than those of the susceptible cultivar ICPL 87119, which suffered complete loss during the 2001 rainy season (Fig. 1C). However, the yield of the second flush in ICPL 87119, which escaped *H. armigera* damage, was quite high.

The results suggested that *Helicoverpa*-resistant cultivars do not have an adverse effect on the natural mortality of this pest. Sithanantham *et al.*, (1983) suggested that parasitism of *H. armigera* larvae was lower on cultivars resistant to this pest as compared to that on the susceptible ones. However, the differences in larval parasitism between the resistant and susceptible cultivars were only 8% in pigeonpea, which was also attributed to density dependent parasitism. An increase in plant density resulted in greater abundance of pod borer larvae, and as a consequence, increased parasitism by the natural enemies. Also, the adverse effects of *Helicoverpa*-resistant cultivars were greater on *Carcelia illota* Curran than on *Goniophthalmus halli* Mes. (Sithanantham *et al.*, 1983). There is no clear evidence of adverse effects of resistant cultivars on the activity and abundance of natural enemies of *H. armigera*. Therefore, *Helicoverpa*-resistant pigeonpea can be deployed in integrated pest management without any adverse effects on the activity of larval/pupal parasitoids. However, the influence of *Helicoverpa*-resistant cultivars needs to be studied further, particularly on the major hymenopteran and dipteran parasitoids.

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