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# EFFECT OF AGRONOMIC FACTORS ON THE INCIDENCE OF *HELIOTHIS ARMIGERA* (HUBN.) AND ITS PARASITE *CAMPOLETIS CHLORIDEAE* (U.) IN CHICKPEA FIELD

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Sowing date has significant effect on the larval population density of *Heliothis armigera* (Hubn.) in chickpea field. Plant population has insignificant effect on the larval density. The pupal population density of the larval parasite. *Campoletis chlorideae* (Uchida) was neither affected by sowing date nor by the plant population. However, pupal density of *C. chlorideae* was found a quadratic function of the larval density of *H. armigera*. All these findings can be utilized for monitoring the population of *H. armigera* in the field.

***Key Words :*** *Heliothis armigera, Campoletis chlorideae, Chickpea*

## Introduction

The chickpea pod-borer *Heliothis armigera* (Hubn.) is the most serious pest of chickpea crop in Pakistan, particular during the spring season. An echneumonid parasitoid, *Campoletis chlorideae* (Uchida) is one of the most important natural enemies of this pest. During routine survey of the chickpea crop, it has often been considered that incidence of *H. armigera* is greatly affected by agronomic practices and so is the degree of parasitization of this pest by *C. chlorideae*.

Wiseman [1] reviewed several aspects of *Heliothis* crop interaction. Sithanantham [2] studied the effect of plant population on *Heliothis* density and reported that *Heliothis* population increased with closer plant spacing. Sithanantham and Navarajan [3] conducted studies on control of *Heliothis* species by augmentative releases of predators and parasites. Lingren [4] undertook studies on the maintenance of population of *Campoletis sonorensis* on tobacco bud worms in a field cage. Sithanantham [3] reported utilisation of Trichogrammatid parasites - problems and prospects. Only scanty information is available on the effect of pest incidence as related to agronomic factors.

Present study was undertaken to analyse the effect of sowing dates and plant density on the occurrence of *H.armigera* and its parasitoid *C. chlorideae* in the chickpea field at NARC.

## Materials and Methods

Chickpea cultivar CM-72 was planted in four replication trial following split plot design with four sowing dates, each with 15 days interval starting from 15th September (D1), 30th September (D2), 15th October (D3) and 30th October (D4) as main plot and four plant populations, 10 rows (p1), 8 rows (P2), 7 rows (P3) and 6 rows (P4) per plot as subplot, keeping the row length 4 meter, plant to plant distance 10 centimeter and plot size 12 meter square.

Larvae of *H. armigera* and pupae of *C. chlorideae* were sampled four times on three sowing dates (D1, D2 & D3). The sampling was done at the early stage of the crop (from 3rd week of Nov. to 2nd week of Jan.) Both larvae and the pupae were counted on all individual plants of the trial and the record was maintained in accordance with the sampling design for analysis of variance.

Regression analysis was carried out between parasitoid density (pupae/plant of *C. chlorideae*) and absolute pest density (*Heliothis* larvae/plus pupae of *C. chlorideae*/plant) in order to work out an empirical relation between the two.

## Results and Discussion

The results of the analysis of variance of larvae/plant of *H. armigera* and pupae/plant of *C. chlorideae* counted on four different plant populations with three different sowing dates of chickpea variety CM-72 showed that only sowing dates significantly affected the *Heliothis* larval population density at all the four sampling times (Table 1). The pupal population density of *C. chlorideae* was not significantly affected by any agronomic factor presently employed (Table 2). Tables 3 showed mean values of larval density (larvae/plant) of *H. armigera* on chickpea planted on three sowing dates and with four plant populations as recorded four times(four samplings). As compared with the results of Anova (Table 1), only sowing date means showed significant differences (Table 3). On the 1st sampling date, earliest sown crop showed highest larval population while crop of later two sowing dates differed insignificantly with respect to larval populations. On the 2nd and 3rd sampling dates, all three different aged crops bore significantly different populations of *H. armigera*. However, the original order of the infestation was restored on the last sampling date. Sowing date and plant

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TABLE 1. ANOVA OF LARVAL DENSITY (LARVAE/PLANT) OF *H. ARMIGERA* ON CHICKPEA ON 3 SOWING DATES AND 4 PLANT POPULATIONS AS RECORDED ON 4 SAMPLING DATES

| | | Sampling dates | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Source of variation | D.F | 1st Mean square | F | 2nd Mean square | F | 3rd Mean square | F | 4th Mean square | F |
| Main plot | 11 | — | — | — | — | — | — | — | — |
| replicates | 3 | 0.000730 | 2.06 | 0.000071 | 1.63 | 0.000017 | 2.23 | 0.000056 | 1.22 |
| Sowing date(s) | 2 | 0.009839 | 27.78* | 0.000893 | 20.52* | 0.000263 | 34.58* | 0.001167 | 25.71* |
| Error (a) | 6 | 0.000354 | — | 0.000043 | — | 0.000008 | — | 0.000045 | — |
| Plant population (P) | 3 | 0.000666 | 2.12 | 0.000048 | 1.02 | 0.000009 | 0.50 | 0.000013 | 0.99 |
| S X P | 6 | 0.000730 | 2.33 | 0.000026 | 0.56 | 0.000010 | 0.59 | 0.000005 | 0.37 |
| Error (b) | 27 | 0.000313 | — | 0.000047 | — | 0.000018 | — | 0.000013 | — |
| Total | 47 | | | | | | | | |

*P<0.001

TABLE 2. ANOVA OF PUPAL DENSITY (PUPAE/PLANT) OF *C. CHLORIDEAE* ON CHICKPEA ON 3 SOWING DATES AND 4 PLANT POPULATIONS AS RECORDED ON 4 SAMPLING DATES

| | | Sampling dates | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Source of variation | D.F | 1st Mean square | F | 2nd Mean square | F | 3rd Mean square | F | 4th Mean square | F |
| Main plot | 11 | — | — | — | — | — | — | — | — |
| Replicates | 3 | 0.000153 | 0.35 | 0.000043 | 0.12 | 0.000031 | 1.00 | 0.000002 | 0.48 |
| Sowing date(s) | 2 | 0.000476 | 1.10 | 0.000215 | 0.61 | 0.000146 | 4.67 | 0.000004 | 1.12 |
| Error (a) | 6 | 0.000431 | — | 0.000350 | — | 0.000031 | — | 0.000004 | — |
| Plant population (P) | 3 | 0.000090 | 0.75 | 0.000026 | 0.34 | 0.000003 | 0.53 | 0.000003 | 1.31 |
| S X P | 6 | 0.000205 | 1.71 | 0.000052 | 0.66 | 0.000003 | 0.53 | 0.000001 | 0.66 |
| Error (b) | 27 | 0.000119 | — | 0.000078 | — | 0.000006 | — | 0.000002 | — |
| Total | 47 | | | | | | | | |

*P<0.001

TABLE 3. MEAN LARVAL DENSITY (LARVAE/PLANT) OF *H. ARMIGERA* .ALL SOWING DATE MEAN WHICH DO NOT SHARE COMMON LETTER ARE SIGNIFICANTLY DIFFERENT FROM ONE-ANOTHER AT (P<0.05)

| | | Plant population | | | | |
|---|---|---|---|---|---|---|
| Obsèrvations (Sampling) | Sowing date | P1 | P2 | P3 | P4 | Sowing date mean |
| | D1 | 0.068750 | 0.060156 | 0.050893 | 0.050000 | 0.057450 a |
| 1st | D2 | 0.000114 | 0.000110 | 0.005402 | 0.041667 | 0.011823 a |
| | D3 | 0.012500 | 0.017188 | 0.011339 | 0.028175 | 0.017801 |

*(Contd.....)*

*Contd. Table 3.*

| Observations (Sampling) | Sowing date | Plant population P1 | P2 | P3 | P4 | Sowing date mean |
|---|---|---|---|---|---|---|
| | Plant population mean | 0.027121 | 0.025818 | 0.022322 | 0.039931 | |
| 2nd | D1 | 0.000625 | 0.000000 | 0.000893 | 0.000000 | 0.000379 |
| | D2 | 0.013125 | 0.019531 | 0.009821 | 0.018750 | 0.015307 |
| | D3 | 0.007500 | 0.009375 | 0.006250 | 0.010414 | 0.008383 |
| | Plant population mean | 0.007083 | 0.009635 | 0.005655 | 0.009722 | |
| 3rd | D1 | 0.005000 | 0.005496 | 0.002679 | 0.005208 | 0.004589 |
| | D2 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| | D3 | 0.007500 | 0.010938 | 0.008929 | 0.005208 | 0.008144 |
| | Plant population mean | 0.004167 | 0.005469 | 0.003869 | 0.003472 | |
| 4th | D1 | 0.016875 | 0.016406 | 0.017857 | 0.014583 | 0.016430 a |
| | D2 | 0.004375 | 0.005469 | 0.002679 | 0.001042 | 0.003391 a |
| | D3 | 0.000625 | 0.000781 | 0.000000 | 0.000000 | 0.000352 |
| | Plant population mean | 0.007292 | 0.007552 | 0.006845 | 0.005208 | |

population showed insignificant effect on the mean pupal density (pupae/plant) of *C. chlorideae*.

The results of regression analysis showed a highly significant (<0.001) quadratic relation between density of *C. chlorideae* (pupae/plant) and that of *H. armigera* (larvae/plant). The quadratic regression equation is diagrammatically represented in Fig. 1 alongwith original observations. The curve showed that pupal density of *C. chlorideae* was almost a linear function of larval density of *H. armigera* below the density levels of the later at 10 larvae/100 plants. Beyond that the pupal density tended to increase only slightly with further increase in the larval density. The maximum larval density of the pest at which the pupal density of the parasitoid became constant was 17/100 plants whereby the pupal density became 4 pupae/plant.

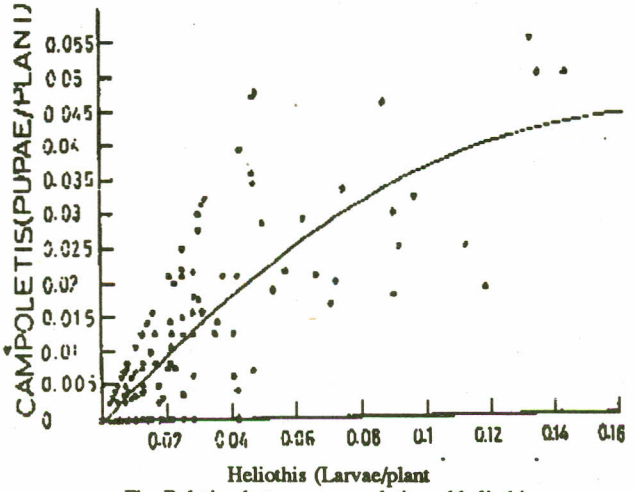


Fig. Relation between compoletis and heliothis

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