



E-ISSN: 2278-4136

P-ISSN: 2349-8234

JPP 2018; 7(4): 2011-2014

Received: 14-05-2018

Accepted: 18-06-2018

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## Bio-efficacy of various insecticides against maize stem borer *Chilo partellus* (Swinhoe) Crambidae: Lepidoptera in Junagadh conditions

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**Abstract**

A Field experiment was carried out to study the relative efficacy of nine different insecticides against maize stem borer *Chilo partellus* at instructional farm J.A.U., Junagadh during the *Kharif* 2017 and the results revealed that Carbofuran 3G @ 0.3 kg a.i.ha<sup>-1</sup>, Spinosad 45SC @ 0.002 % and Chlorantraniliprole 18.5 SC @ 0.006% were found highly effective in reducing the larval population and dead heart and found on par to each other. The next best treatments were Indoxacarb 15.8 EC@0.015%, Flubendiamide 480 SC@0.016%, and Cartap hydrochloride 4G@0.75 kg a.i. /ha. Rest of the treatments was superior over control in reducing stem borer incidence.

**Keywords:** maize, stem borer *Chilo partellus*, insecticides

**Introduction**

Maize is one of the most widely used staple food crops in world after wheat and rice. Like other cereal crops, maize is also highly susceptible to attack of insect pests. Nearly 139 species of insect pests have been observed to cause infestation to maize in India. Out of them, the major one is stem borer, *Chilo partellus* causing 90-95 per cent of the total damage in *Kharif* season (Prakash *et al.* 2017). Infestation of this pest noticed at 3 to 4 weeks after sowing (Gunewardena and Madugalla, 2011) [3]. Usually infestation starts with oviposition on leaves (Ajala and Saxena, 1994) [1]. Upon hatching, the larva starts feeding the green content by scraping the leaves which is the first sign of attack. Later instars cut the leaves and produce pinholes. Under severe infestation, larva feeds on central meristematic tissue leads to death of central shoot and produce 'dead heart' symptom, which ultimately leads to death of the plant (De Groot, 2002) [2]. Pupation takes place inside the larval tunnel in the stem. A loss up to 81 % has been reported by the attack of this pest alone (Rauf *et al.* 2017) [6]. In order to avoid the yield losses and to encourage the cultivation of maize crop, the present investigation was carried out with nine different insecticides including both liquid and granular formulations having different mode of action under field conditions.

**Materials and Methods**

In order to study the bio-efficacy of different insecticides against maize stem borer, the experiment was laid out in a Randomized Block Design with three replications and ten treatments having gross plot size of 5 m x 3 m and net plot of 4.20 m x 1.80 m during *Kharif* 2017-18 at Instructional farm, Department of Agronomy, COA, JAU, Junagadh. Maize variety Sweet-16 was sown at a spacing of 60 cm x 20 cm and all the recommended agronomical practices were adopted to grow the crop. Details of the treatments are given in the table-1.

**Application of insecticides**

Insecticides were applied at 30 and 45 days after sowing. Treatments randomization was done in each block separately and plots was numbered and labeled. The spraying of liquid insecticides was done with the help of knapsack sprayer. Whorl application of granular insecticides was done manually.

**Observations recorded**

For judging the bio-efficacy of the different insecticides against stem borer, *C. partellus*, five plants from each net plot was randomly selected and observations on dead hearts and number of larvae per five plants was recorded and the mean percent was worked out at before 24 hours and at 5, 10, and 15 days after treatment. The data thus obtained was transformed in to Square root and arc sin transformation and analyzed statistically.

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## Methodology

### Mean number of larvae per five plants

The total number of larvae per five plants was recorded by destructive sampling in which three middle rows in net plot were examined and 5 plants were randomly selected. The selected plants were uprooted and all leaves were removed and then the stem was split open to count the number of larvae per plant and observation was recorded.

### Mean per cent dead heart

The total number of dead hearts due to stem borer was recorded from five randomly selected plants from net plot and mean percent dead hearts was worked out by using the following formula:

$$\text{Per cent dead heart} = \frac{\text{Number of dead hearts}}{\text{Total number of plants}} \times 100$$

**Table 1:** Treatment Details

| Sr. No.         | Technical Name              | Concentration    | Dosage       | Trade name |
|-----------------|-----------------------------|------------------|--------------|------------|
| T <sub>1</sub>  | Profenofos 50 EC            | 0.05%            | 10 ml/10 l   | Curacron   |
| T <sub>2</sub>  | Chlorantraniliprole 18.5 SC | 0.006%           | 3.2 ml/10 l  | Coragen    |
| T <sub>3</sub>  | Flubendiamide 480 SC        | 0.016%           | 0.33 ml/10 l | FM 480     |
| T <sub>4</sub>  | Spinosad 45 SC              | 0.002%           | 0.44 ml/10 l | Tracer     |
| T <sub>5</sub>  | Chlorpyrifos 10 G           | 0.75 kg a.i. /ha | 7.5 kg/ha    | Suldrin Gr |
| T <sub>6</sub>  | Carbofuran 3 G              | 0.3 kg a.i. /ha  | 7.5 kg/ha    | Furadan    |
| T <sub>7</sub>  | Indoxacarb 15.8 EC          | 0.015%           | 10 ml/10 l   | Avaunt EC  |
| T <sub>8</sub>  | Cartap hydrochloride 4 G    | 0.75 kg a.i. /ha | 18.75 kg/ha  | Caldan     |
| T <sub>9</sub>  | Imidacloprid 17.8SL         | 0.0045%          | 2.5 ml/10 l  | Confidor   |
| T <sub>10</sub> | Control                     | -                | -            | -          |

## Results and Discussion

### (1) Mean number of larvae per five plants (First treatment)

#### (a) 5 days after treatment

Among the treatments, Carbofuran 3G recorded the lowest larval number (0.99) which was at par with Spinosad 45SC (1.09) and Chlorantraniliprole 18.5 SC (1.16). Untreated plots recorded the maximum mean larval number (3.72). The next best treatments in the order of efficacy were Indoxacarb 15.8EC (1.81) which is at par with Flubendiamide 480 SC (2.09) and Cartap hydrochloride 4G (2.13). All other treatments like Chlorpyrifos 10 G, Imidacloprid 17.8SL and Profenofos 50 EC were significantly superior over control which recorded the larval number of 2.72, 2.89 and 2.96, respectively.

#### (b) 10 days after treatment

Lowest larval number of 0.56 was recorded in the plot treated with Carbofuran 3G which was at par with Spinosad 45SC (0.66) and Chlorantraniliprole 18.5 SC (0.76). The next best treatment is T<sub>7</sub> (Indoxacarb 15.8EC) (1.24) which is at par with T<sub>3</sub> (Flubendiamide 480 SC) (1.41) and T<sub>8</sub> (Cartap hydrochloride 4G) (1.50). All other treatments were superior over the control and untreated plots recorded the maximum of 3.66 mean numbers.

#### (c) 15 days after treatment

All the insecticides were significantly superior over control in reducing larval the population. Maximum larval number (3.70) was recorded in the control plots. Lowest number of 0.73 was recorded in the plot treated with Carbofuran 3G which was at par with Spinosad 45SC (0.76) and Chlorantraniliprole 18.5 SC (1.01). The next best treatment is Indoxacarb 15.8EC (1.13) which is at par with Flubendiamide 480 SC (1.42) and Cartap hydrochloride 4G (1.48). Treatments like Chlorpyrifos 10 G, Imidacloprid 17.8SL and Profenofos 50 EC were least effective compare to other treatments which recorded mean values of 2.03, 2.13 and 2.29, respectively.

### Mean number of larvae per five plants (Second treatment)

#### (a) 5 days after treatment

At 5 days after treatment Carbofuran 3G recorded the lowest

larval number (0.57) which was at par with Spinosad 45SC (0.63) and Chlorantraniliprole 18.5 SC (0.87). Untreated plots recorded the maximum of 3.83 mean larval numbers. The next best treatments were Indoxacarb 15.8EC (0.90), Flubendiamide 480 SC (1.29) and Cartap hydrochloride 4G (1.38) which are at par with each other. All other treatments like Chlorpyrifos 10 G, Imidacloprid 17.8SL and Profenofos 50 EC were significantly superior over the control.

#### (b) 10 days after treatment

Observations recorded at 10 days after treatment revealed that Carbofuran 3G was most effective and recorded the lowest larval population (0.23) which was at par with Spinosad 45SC (0.29) and Chlorantraniliprole 18.5 SC (0.44). The next best treatment is Indoxacarb 15.8EC (0.83) which is at par with Flubendiamide 480 SC and Cartap hydrochloride 4G with 0.92 and 0.96 mean numbers, respectively. All other treatments like Chlorpyrifos 10 G, Imidacloprid 17.8SL and Profenofos 50 EC were least effective and recorded the values of 1.33, 1.53 and 1.69, respectively. Untreated plots recorded the maximum of 3.80 mean numbers.

#### (c) 15 days after treatment

Lowest larval number of 0.32 was recorded in the treatment T<sub>6</sub> (Carbofuran 3G) which was at par with T<sub>4</sub> (Spinosad 45SC) and T<sub>2</sub> (Chlorantraniliprole 18.5 SC) which recorded the mean number of 0.46 and 0.53, respectively. The next best treatment is T<sub>7</sub> (Indoxacarb 15.8EC) (0.88) which was at par with T<sub>3</sub> (Flubendiamide 480 SC) and T<sub>8</sub> (Cartap hydrochloride 4G) with 1.04 and 1.10 mean numbers, respectively. All other treatments like T<sub>5</sub> (Chlorpyrifos 10 G), T<sub>9</sub> (Imidacloprid 17.8SL) and T<sub>1</sub> (Profenofos 50 EC) were least effective compare to other treatments.

### (2) Per cent dead heart (First treatment)

#### (a) 5 days after treatment

Lowest percent dead heart of 1.72 was recorded in the treatment T<sub>6</sub> (Carbofuran 3G) which was at par with T<sub>4</sub> (Spinosad 45SC) (2.13%) and T<sub>2</sub> (Chlorantraniliprole 18.5 SC) (2.33%). The next best treatments were T<sub>7</sub> (Indoxacarb 15.8EC) (3.05%), T<sub>3</sub> (Flubendiamide 480 SC) (3.16%) and T<sub>8</sub> (Cartap hydrochloride 4G) (3.37%). Treatments like T<sub>5</sub> (Chlorpyrifos 10 G), T<sub>9</sub> (Imidacloprid 17.8SL) and T<sub>1</sub>

(Profenofos 50 EC) were least effective Untreated plots recorded the maximum of 6.81 per cent dead heart.

#### (b) 10 days after treatment

Maximum dead hearts of 6.88 per cent recorded in the control plots. Treatment T<sub>6</sub> (Carbofuran 3G) recorded lowest per cent dead heart (1.29%) which was at par with T<sub>4</sub> (Spinosad 45SC) (1.69%) and T<sub>2</sub> (Chlorantraniliprole 18.5 SC) (1.80%). The next best treatment is T<sub>7</sub> (Indoxacarb 15.8EC) (2.61%) which is at par with T<sub>3</sub> (Flubendiamide 480 SC) (2.76%), T<sub>8</sub> (Cartap hydrochloride 4G) (2.85%) and T<sub>5</sub> (Chlorpyrifos 10 G) (4.07%). Treatments T<sub>9</sub> (Imidacloprid 17.8SL) and T<sub>1</sub> (Profenofos 50 EC) were least effective.

#### (c) 15 days after treatment

Treatment T<sub>6</sub> (Carbofuran 3G) recorded minimum dead heart per cent of 1.49 which was at par with T<sub>4</sub> (Spinosad 45SC) (1.75%) and T<sub>2</sub> (Chlorantraniliprole 18.5 SC) (2.00%). The next best treatment is T<sub>7</sub> (Indoxacarb 15.8EC) (2.65%) which is at par with T<sub>3</sub> (Flubendiamide 480 SC) (2.85%) and T<sub>8</sub> (Cartap hydrochloride 4G) (3.09%). All other treatments like T<sub>5</sub> (Chlorpyrifos 10 G) (4.15%), T<sub>9</sub> (Imidacloprid 17.8SL) (4.20%) and T<sub>1</sub> (Profenofos 50 EC) (4.40%) were next best treatments.

#### Mean per cent dead heart (Second treatment)

##### (a) 5 days after treatment

Treatment T<sub>6</sub> (Carbofuran 3G) recorded minimum percent of 1.09 which was at par with T<sub>4</sub> (Spinosad 45SC) (1.47%) and T<sub>2</sub> (Chlorantraniliprole 18.5 SC) (1.60%). The next best treatment is T<sub>7</sub> (Indoxacarb 15.8EC) (2.33%) which is at par with T<sub>3</sub> (Flubendiamide 480 SC @ 0.016%) (2.55%) and T<sub>8</sub> (Cartap hydrochloride 4G) (2.64%). All other treatments like T<sub>5</sub> (Chlorpyrifos 10 G), T<sub>9</sub> (Imidacloprid 17.8SL) and T<sub>1</sub> (Profenofos 50 EC) were significantly superior over control and recorded 3.81, 3.87 and 4.09, respectively. Untreated plots recorded the maximum of 7.05 dead heart per cent.

#### (b) 10 days after treatment

Observations recorded at 10 days after treatment revealed that maximum dead hearts (6.95%) was recorded in the control plots. Minimum percent was recorded in the treatment T<sub>6</sub> (Carbofuran 3G) (0.98%) which was at par with T<sub>4</sub> (Spinosad 45SC) (1.35%) and T<sub>2</sub> (Chlorantraniliprole 18.5 SC) (1.45%). The next best treatment is T<sub>7</sub> (Indoxacarb 15.8EC) (2.19%) which is at par with T<sub>3</sub> (Flubendiamide 480 SC) (2.44%), T<sub>8</sub> (Cartap hydrochloride 4G) (2.53%) and T<sub>5</sub> (Chlorpyrifos 10 G) (3.36%). Treatments like T<sub>9</sub> (Imidacloprid 17.8SL) and T<sub>1</sub> (Profenofos 50 EC) were least effective which recorded dead heart per cent 3.50 and 3.94, respectively.

#### (c) 15 days after treatment

Treatment T<sub>6</sub> (Carbofuran 3G) recorded minimum per cent of dead hearts (0.74%) which was at par with T<sub>4</sub> (Spinosad 45SC) (0.93%) and T<sub>2</sub> (Chlorantraniliprole 18.5 SC) (1.00%). The next best treatment is T<sub>7</sub> (Indoxacarb 15.8EC) (1.68%) which is at par with T<sub>3</sub> (Flubendiamide 480 SC) (1.95%) and T<sub>8</sub> (Cartap hydrochloride 4G) (2.02%). All other treatments like T<sub>5</sub> (Chlorpyrifos 10 G), T<sub>9</sub> (Imidacloprid 17.8SL) and T<sub>1</sub> (Profenofos 50 EC) were next best treatments which recorded 2.86, 2.99 and 3.43 per cent, respectively.

#### Conclusion

From the overall results it can be concluded that Carbofuran 3G @ 0.3 kg a.i.ha<sup>-1</sup> was highly effective against *C. partellus* followed by Spinosad 45SC @ 0.002 % and Chlorantraniliprole 18.5 SC @ 0.006% which can be used for effective management of this pest. More or less similar observations were recorded by Saleem *et al.* (2014) showed that Carbofuran 3G recorded as most effective followed by Fipronil 4G. Gupta *et al.* (2010) studied on efficacy of synthetic insecticides and neem based formulation against maize stem borer and showed that carbofuran was the best among all the tested insecticides in reducing *C. partellus* infestation.

**Table 2:** Bio-efficacy of various insecticides against larval population of *C. partellus* on maize after first treatment

| Sr. No. | Treatment                   | Concentration    | Mean larval number/5 plants |            |            |            |      | Mean  | Percent reduction over control |
|---------|-----------------------------|------------------|-----------------------------|------------|------------|------------|------|-------|--------------------------------|
|         |                             |                  | BT                          | 5DAT       | 10DAT      | 15DAT      |      |       |                                |
| 1.      | Profenofos 50 EC            | 0.05%            | 1.84(3.40)                  | 1.72(2.96) | 1.50(2.25) | 1.51(2.29) | 2.72 | 25.47 |                                |
| 2.      | Chlorantraniliprole 18.5 SC | 0.006%           | 1.82(3.33)                  | 1.08(1.16) | 0.87(0.76) | 1.00(1.01) | 1.56 | 57.26 |                                |
| 3.      | Flubendiamide 480 SC        | 0.016%           | 1.79(3.20)                  | 1.45(2.09) | 1.19(1.41) | 1.19(1.42) | 2.03 | 44.38 |                                |
| 4.      | Spinosad 45 SC              | 0.002%           | 1.84(3.38)                  | 1.05(1.09) | 0.81(0.66) | 0.87(0.76) | 1.47 | 59.72 |                                |
| 5.      | Chlorpyrifos 10 G           | 0.75 kg a.i. /ha | 1.91(3.63)                  | 1.65(2.72) | 1.46(2.12) | 1.43(2.03) | 2.62 | 28.21 |                                |
| 6.      | Carbofuran 3G               | 0.3 kg a.i. /ha  | 1.83(3.35)                  | 1.00(0.99) | 0.75(0.56) | 0.85(0.73) | 1.40 | 61.64 |                                |
| 7.      | Indoxacarb 15.8EC           | 0.015%           | 1.73(2.99)                  | 1.35(1.81) | 1.11(1.24) | 1.06(1.13) | 1.79 | 50.95 |                                |
| 8.      | Cartap hydrochloride 4G     | 0.75 kg a.i. /ha | 1.80(3.26)                  | 1.46(2.13) | 1.22(1.50) | 1.22(1.48) | 2.09 | 42.73 |                                |
| 9.      | Imidacloprid 17.8SL         | 0.0045%          | 1.85(3.43)                  | 1.70(2.89) | 1.47(2.16) | 1.46(2.13) | 2.65 | 27.39 |                                |
| 10      | Control                     | -                | 1.88(3.53)                  | 1.93(3.72) | 1.91(3.66) | 1.92(3.70) | 3.65 | -     |                                |
|         | S.Em ±                      | -                | 0.07                        | 0.09       | 0.08       | 0.06       | -    | -     |                                |
|         | C.D. at 5%                  | -                | NS                          | 0.26       | 0.26       | 0.19       | -    | -     |                                |
|         | C.V.%                       | -                | 6.46                        | 10.61      | 12.59      | 8.94       | -    | -     |                                |

BT = Before Treatment, DAS = Days After Treatment.

Data in the parenthesis indicate original values, while outside are Sq. root values.

**Table 3:** Bio-efficacy of various insecticides against larval population of *C. partellus* on maize after second treatment

| Sr. No. | Treatment                   | Concentration    | Mean larval number/5 plants |            |            |            |      | Mean  | Percent reduction over control |
|---------|-----------------------------|------------------|-----------------------------|------------|------------|------------|------|-------|--------------------------------|
|         |                             |                  | BT                          | 5DAT       | 10DAT      | 15DAT      |      |       |                                |
| 1.      | Profenofos 50 EC            | 0.05%            | 1.51(2.29)                  | 1.48(2.19) | 1.30(1.69) | 1.33(1.77) | 1.98 | 47.75 |                                |
| 2.      | Chlorantraniliprole 18.5 SC | 0.006%           | 1.00(1.01)                  | 0.93(0.87) | 0.66(0.44) | 0.73(0.53) | 0.71 | 81.26 |                                |
| 3.      | Flubendiamide 480 SC        | 0.016%           | 1.19(1.42)                  | 1.14(1.29) | 0.96(0.92) | 1.02(1.04) | 1.16 | 69.39 |                                |
| 4.      | Spinosad 45 SC              | 0.002%           | 0.87(0.76)                  | 0.79(0.63) | 0.54(0.29) | 0.68(0.46) | 0.53 | 86.01 |                                |
| 5.      | Chlorpyrifos 10 G           | 0.75 kg a.i. /ha | 1.43(2.03)                  | 1.38(1.90) | 1.15(1.33) | 1.18(1.40) | 1.66 | 56.20 |                                |

|     |                         |                  |            |            |            |            |      |       |
|-----|-------------------------|------------------|------------|------------|------------|------------|------|-------|
| 6.  | Carbofuran 3G           | 0.3 kg a.i. /ha  | 0.85(0.73) | 0.75(0.57) | 0.48(0.23) | 0.57(0.32) | 0.46 | 87.86 |
| 7.  | Indoxacarb 15.8EC       | 0.015%           | 1.06(1.13) | 1.00(0.99) | 0.91(0.83) | 0.94(0.88) | 0.95 | 74.93 |
| 8.  | Cartap hydrochloride 4G | 0.75 kg a.i. /ha | 1.22(1.48) | 1.17(1.38) | 0.98(0.96) | 1.05(1.10) | 1.23 | 67.54 |
| 9.  | Imidacloprid 17.8SL     | 0.0045%          | 1.46(2.13) | 1.42(2.02) | 1.24(1.53) | 1.25(1.57) | 1.81 | 52.24 |
| 10. | Control                 | -                | 1.92(3.70) | 1.96(3.83) | 1.95(3.80) | 1.96(3.83) | 3.79 | -     |
|     | S.Em ±                  | -                | 0.06       | 0.07       | 0.06       | 0.08       | -    | -     |
|     | C.D. at 5%              | -                | 0.19       | 0.20       | 0.18       | 0.24       | -    | -     |
|     | C.V.%                   | -                | 8.94       | 9.86       | 10.32      | 13.12      | -    | -     |

BT = Before Treatment, DAS = Days After Treatment.

Data in the parenthesis indicate original values, while outside are Sq. root values.

**Table 4:** Bio-efficacy of various insecticides against dead heart caused by *C. partellus* infesting maize after first treatment

| Sr. No. | Treatment                   | Concentration    | Mean percent dead hearts /5 plants |             |             |             |      | Percent reduction over control |
|---------|-----------------------------|------------------|------------------------------------|-------------|-------------|-------------|------|--------------------------------|
|         |                             |                  | BT                                 | 5DAT        | 10DAT       | 15DAT       | Mean |                                |
| 1.      | Profenofos 50 EC            | 0.05%            | 13.20(5.21)                        | 12.36(4.58) | 11.74(4.14) | 12.11(4.40) | 4.58 | 32.54                          |
| 2.      | Chlorantraniliprole 18.5 SC | 0.006%           | 14.31(6.11)                        | 8.77(2.33)  | 7.72(1.80)  | 8.14(2.00)  | 3.06 | 54.93                          |
| 3.      | Flubendiamide 480 SC        | 0.016%           | 13.92(5.78)                        | 10.25(3.16) | 9.56(2.76)  | 9.72(2.85)  | 3.63 | 46.53                          |
| 4.      | Spinosad 45 SC              | 0.002%           | 14.89(6.60)                        | 8.39(2.13)  | 7.46(1.69)  | 7.61(1.75)  | 3.04 | 55.22                          |
| 5.      | Chlorpyrifos 10 G           | 0.75 kg a.i. /ha | 14.13(5.96)                        | 12.18(4.45) | 11.63(4.07) | 11.75(4.15) | 4.65 | 31.51                          |
| 6.      | Carbofuran 3G               | 0.3 kg a.i. /ha  | 15.47(7.11)                        | 7.55(1.72)  | 6.53(1.29)  | 7.01(1.49)  | 2.90 | 57.29                          |
| 7.      | Indoxacarb 15.8EC           | 0.015%           | 14.45(6.22)                        | 10.06(3.05) | 9.29(2.61)  | 9.36(2.65)  | 3.63 | 46.53                          |
| 8.      | Cartap hydrochloride 4G     | 0.75 kg a.i. /ha | 13.85(5.73)                        | 10.58(3.37) | 9.71(2.85)  | 10.13(3.09) | 3.76 | 44.62                          |
| 9.      | Imidacloprid 17.8SL         | 0.0045%          | 14.16(5.98)                        | 12.32(4.55) | 11.65(4.07) | 11.83(4.20) | 4.70 | 30.78                          |
| 10.     | Control                     | -                | 14.80(6.52)                        | 15.12(6.81) | 15.20(6.88) | 15.31(6.97) | 6.79 | -                              |
|         | S.Em ±                      | -                | 1.29                               | 0.71        | 0.79        | 0.74        | -    | -                              |
|         | C.D. at 5%                  | -                | NS                                 | 2.10        | 2.35        | 2.20        | -    | -                              |
|         | C.V.%                       | -                | 15.6                               | 11.39       | 13.64       | 12.45       | -    | -                              |

BT = Before Treatment, DAS = Days After Treatment.

Data in the parenthesis indicate original values, while outside are Sq. root values

**Table 5:** Bio-efficacy of various insecticides against dead heart caused by *C. partellus* infesting maize after second treatment

| Sr. No. | Treatment                   | Concentration    | Mean percent dead hearts/5 plants |             |             |             |      | Percent reduction over control |
|---------|-----------------------------|------------------|-----------------------------------|-------------|-------------|-------------|------|--------------------------------|
|         |                             |                  | BT                                | 5DAT        | 10DAT       | 15DAT       | Mean |                                |
| 1.      | Profenofos 50 EC            | 0.05%            | 12.11(4.40)                       | 11.66(4.09) | 11.45(3.94) | 10.68(3.43) | 3.96 | 42.27                          |
| 2.      | Chlorantraniliprole 18.5 SC | 0.006%           | 8.14(2.00)                        | 7.27(1.60)  | 6.92(1.45)  | 5.73(1.00)  | 1.51 | 77.98                          |
| 3.      | Flubendiamide 480 SC        | 0.016%           | 9.72(2.85)                        | 9.19(2.55)  | 8.98(2.44)  | 8.02(1.95)  | 2.44 | 64.43                          |
| 4.      | Spinosad 45 SC              | 0.002%           | 7.61(1.75)                        | 6.98(1.47)  | 6.68(1.35)  | 5.54(0.93)  | 1.37 | 80.02                          |
| 5.      | Chlorpyrifos 10 G           | 0.75 kg a.i. /ha | 11.75(4.15)                       | 11.26(3.81) | 10.57(3.36) | 9.73(2.86)  | 3.54 | 48.39                          |
| 6.      | Carbofuran 3G               | 0.3 kg a.i. /ha  | 7.01(1.49)                        | 6.00(1.09)  | 5.67(0.98)  | 4.95(0.74)  | 1.07 | 84.40                          |
| 7.      | Indoxacarb 15.8EC           | 0.015%           | 9.36(2.65)                        | 8.78(2.33)  | 8.52(2.19)  | 7.44(1.68)  | 2.21 | 67.78                          |
| 8.      | Cartap hydrochloride 4G     | 0.75 kg a.i. /ha | 10.13(3.09)                       | 9.36(2.64)  | 9.15(2.53)  | 8.17(2.02)  | 2.57 | 62.53                          |
| 9.      | Imidacloprid 17.8SL         | 0.0045%          | 11.83(4.20)                       | 11.35(3.87) | 10.79(3.50) | 9.96(2.99)  | 3.64 | 46.93                          |
| 10.     | Control                     | -                | 15.31(6.97)                       | 15.40(7.05) | 15.28(6.95) | 14.75(6.48) | 6.86 | -                              |
|         | S.Em ±                      | -                | 0.74                              | 0.74        | 0.72        | 0.54        | -    | -                              |
|         | C.D. at 5%                  | -                | 2.20                              | 2.18        | 2.14        | 1.61        | -    | -                              |
|         | C.V.%                       | -                | 12.45                             | 13.10       | 13.24       | 11.02       | -    | -                              |

BT = Before Treatment, DAS = Days After Treatment.

Data in the parenthesis indicate original values, while outside are Sq. root values.

## References

- Ajala SO, Saxena KN. Interrelationship among *Chilo partellus* (Swinhoe) damage parameters and their contribution to grain yield reduction in maize (*Zea mays* L.). Applied Entomology and Zoology. 1994; 29(4):469-476.
- De Groote H. Maize yield losses from stem borers in Kenya. International Journal of Tropical Insect Science. 2002; 22:89-96.
- Gunewardena KNC, Madugalla SRK. Efficacy of selected granular insecticides for the control of maize-stem borer (*Chilo partellus*) (Lepidoptera: Pyralidae). Tropical Agricultural Research & Extension. 2011; 14(1): 12-15.
- Gupta S, Handore K, Pandey IP. Effect of insecticides against *Chilo partellus* (Swinhoe) damaging *Zea mays* (maize). International Journal of Parasitology Research. 2010; 2(2):04-07.
- Prakash V, Singh DV, Singh R, Singh G, Kumar S. Efficacy of some novel insecticide against maize stem borer, *Chilo partellus* (Swinhoe) in maize. Journal of Pharmacognosy and Phytochemistry. 2017; SP1:481-484.
- Rauf A, Ayyaz M, Baig F, Naqqash MN, Arif MJ. Response of *Chilo partellus* (Swinhoe) and entomophagous arthropods to some granular and new chemistry formulations in *Zea mays* L. Journal of Entomology and Zoology Studies. 2017; 5(3):1351-1356.
- Saleem Z, Iqbal J, Khattak SG, Khan M, Muhammad N, Iqbal Z, et al. Effect of different insecticides against maize stem borer infestation. International Journal of Life Sciences Research. 2014; 2(1):23-26.