International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(3): 2648-2651

Received: 07-03-2019
Accepted: 09-04-2019

Insha Hamid
Division of Entomology, Sher-e-Kashmir University of Agricultural Science & Technology, Kashmir, Jammu & Kashmir, India

RK Nehru
Division of Entomology, Sher-e-Kashmir University of Agricultural Science & Technology, Kashmir, Jammu & Kashmir, India

AR Wani
Division of Entomology, Sher-e-Kashmir University of Agricultural Science & Technology, Kashmir, Jammu & Kashmir, India

SS Pathania
Division of Entomology, Sher-e-Kashmir University of Agricultural Science & Technology, Kashmir, Jammu & Kashmir, India

Azra Lateef
Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Science & Technology, Kashmir, Jammu & Kashmir, India

Furqan Hamid
Division of Economics, Sher-e-Kashmir University of Agricultural Science & Technology, Kashmir, Jammu & Kashmir, India

Correspondence
Insha Hamid
Division of Entomology, Sher-e-Kashmir University of Agricultural Science & Technology, Kashmir, Jammu & Kashmir, India

Efficacy of different insecticides against maize stem borer *Chilo partellus* Swinhoe (Lepidoptera: Crambidae) infesting maize in Kashmir

Insha Hamid, RK Nehru, AR Wani, SS Pathania, Azra Lateef and Furqan Hamid

Abstract
The investigation was carried at DARS, Budgam, SKUAST-K during the Kharif season, 2015. The experiment was laid out in the Randomized Block Design with three replications. Studies on efficacy of different insecticides against maize stem borer *Chilo Partellus* (Swinhoe) infesting maize revealed that seed treatment with imidacloprid 48% FS @ 2.4 ml/kg seed followed by spray of Azadirachtin 0.15 EC @ 2 ml/litre of water and whorl application of imidacloprid 0.3% GR @ 10 kg per hectare significantly reduced the pest infestation with respect to leaf infestation and dead heart to the tune of 83.76 and 72.95 per cent respectively over the control. Hence, the above treatment can be suggested best for effective management of maize stem borer infesting maize.

Keywords: Insecticides against maize, *Chilo partellus* Swinhoe, Lepidoptera: Crambidae

Introduction
Maize (*Zea mays* Linn.) is one of the important cereal crop in the world both as food for humans, feed for animals and is also known as "Queen of Cereals" because of its high yield potential. In India, maize is cultivated over an area of about 9.2 million hectares with an annual production of 23.67 million tonnes and productivity of 2.57 tonnes per hectare (Anonymous, 2015) [3]. In the state of Jammu and Kashmir, it is cultivated over an area of about 0.31 million hectares with a production and productivity level of 0.46 million tonnes and 1.49 tonnes per hectare, respectively (Anonymous 2015) [3]. Maize is ranked as the third most important cereal crop after wheat and rice. In India about 28, 11, 48, 12 and 1 per cent maize produced is used for food purpose, livestock feed, poultry feed, wet milling industry and seed, respectively (Sarup *et al.,* 1987 and Siddiqui & Marwaha, 1993) [7, 8]. Among different crops, maize is versatile having high nutritive value, since it contains carbohydrates, vitamins, minerals and proteins. In India, maize crop is being attacked by various species of insect pests with varying degree of damage. Among these maize stem borer (*Chilo partellus* Swinhoe) is one of the most destructive pest causing an average yield loss of 75 per cent with respect to the pest population density and phenological stage of the crop (Latif *et al.,* 1960) [6]. Keeping in view the economic importance of the pest, the present research work was initiated to investigate the efficacy of different insecticides against maize stem borer infesting maize.

Materials and Method
The study was conducted with selected insecticides against *C. partellus* on maize crop during *Kharif*, 2015 at Experimental Field of Dryland (*Karewa*) Agricultural Research Station (DARS), Budgam- a constituent of SKUAST- Kashmir, Shalimar in a Randomized Complete Block Design (RCBD) with ten treatments including check (untreated) each replicated thrice. Maize variety C-15 was sown on 13th April, 2015 in thirty plots each measuring 3 × 2 m with row to row and plant to plant spacing of 60 × 20 cm, respectively. All the recommended agronomical practices were followed (Anonymous, 2011) [2] from time to time to raise the crop successfully as per Package of Practice of SKUAST-Kashmir. After 15 days of seed germination, weekly observations regarding leaf infestation (pin hole and window injury) and dead heart caused by *C. partellus* was recorded throughout cropping season. Ten plants were randomly selected from each plot and were thoroughly assessed to record the impact and efficacy of different insecticides against *C. partellus*.

Different treatment modules evaluated against maize stem borer, *C. partellus* at DARS, Budgam during *Kharif*, 2015

Treatment Module Details			
Treatment Module No.	**Before crop owing**	**15 Days after sowing (15 DAS)**	**30 Days after sowing (30 DAS)**
T_1	Seed treatment with Imidacloprid 48% FS @ 2.4 ml/kg seed	X	X
T_2	Seed treatment with Imidacloprid 48% FS @ 2.4 ml/kg seed	Azadirachtin 0.15 EC @ 2 ml/l of water	X
T_3	Seed treatment with Imidacloprid 48% FS @ 2.4 ml/kg seed	Dimethoate 30 EC @ 1 ml/l of water	X
T_4	Seed treatment with Imidacloprid 48% FS @ 2.4 ml/kg seed	X	Whorl application of Carbofuran 3G @ 10 kg ha^{-1}
T_5	Seed treatment with Imidacloprid 48% FS @ 2.4 ml/kg seed	X	Whorl application of Imidacloprid 0.3% GR @ 10 kg ha^{-1}
T_6	Seed treatment with Imidacloprid 48% FS @ 2.4 ml/kg seed	Azadirachtin 0.15 EC @ 2 ml/l of water	Whorl application of Carbofuran 3G @ 10 kg ha^{-1}
T_7	Seed treatment with Imidacloprid 48% FS @ 2.4 ml/kg seed	Azadirachtin 0.15 EC @ 2 ml/l of water	Whorl application of Imidacloprid 0.3% GR @ 10 kg ha^{-1}
T_8	Seed treatment with Imidacloprid 48% FS @ 2.4 ml/kg seed	Dimethoate 30 EC @ 1 ml/l of water	Whorl application of Carbofuran 3G @ 10 kg ha^{-1}
T_9	Seed treatment with Imidacloprid 48% FS @ 2.4 ml/kg seed	Dimethoate 30 EC @ 1 ml/l of water	Whorl application of Imidacloprid 0.3% GR @ 10 kg ha^{-1}
T_{10}	Untreated (check)		

Per cent leaf infestation

Post treatment observation on pin hole and window injury caused by newly hatched larvae of *C. partellus* was observed on weekly basis starting from 18th Standard Week (SW) (1st week of May) and was calculated by using the formulae :

$$\text{Per cent infestation} = \frac{\text{No. of infested leaves}}{\text{Total No. of leaves}} \times 100$$

Per cent dead heart

Post treatment observation on dead hearts caused by borer larvae was observed on weekly basis starting from 20th SW (3rd week of May) and was calculated as:

$$\text{Per cent dead heart} = \frac{\text{No. of dead hearts}}{\text{Total No. of plants}} \times 100$$

All the treatments mentioned above were compared with another by obtaining the critical difference at 5 per cent level of significance.

Result and Discussion

The investigation was framed so that a proper management strategy of maize stem borer under Kashmir conditions could be developed. The module T_7 comprising of seed treatment with imidacloprid 48% FS @ 2.4 ml/kg seed followed by a single spray of Azadirachtin 0.15 EC @ 2 ml/litre of water after 15 days of sowing and whorl application with imidacloprid 0.3% GR @ 10 kg/ha after 30 days of seed treatment recorded the lowest cumulative mean leaf infestation of 5.61 per cent which accounted to maximum reduction of 83.76 per cent in leaf infestation over control and was designated as the most effective module in present findings. However, in module T_6 comprising seed treatment with imidacloprid 48% FS @ 2.4 ml/kg seed followed by single spray of Azadirachtin 0.15 EC @ 2 ml/litre of water after 15 days of seed treatment and whorl application with carbofuran 3G @ 10 kg/ha after 30 days of seed treatment was found second best in recording mean leaf infestation of 6.90 per cent substantiating to 80.03 per cent reduction in leaf infestation over untreated check (Table 1). The present findings were supported by work carried by Siddalingappa *et al.* (2010) [9] and Bhanukiran & Panwar (2005) [4]. The efficacy of imidacloprid in managing *C. partellus* infestation has also been reported by Zewar *et al*. (2003) [10] as the best treatment which is in close proximity with the present findings.

Table 1: Efficacy of different treatments in reduction of leaf infestation by *Chilo partellus* in maize at Dryland (*Karewa*) Agricultural Research Station during *kharif* 2015.

Treatment	Per cent leaf infestation																	Per cent reduction over control
	18 SW	19 SW	20 SW	21 SW	22 SW	23 SW	24 SW	25 SW	26 SW	27 SW	28 SW	29 SW	30 SW	31 SW	32 SW	33 SW	Cumulative Mean	
T1	3.29 (10.45)	5.72 (13.84)	8.05 (16.49)	11.33 (19.67)	14.57 (22.45)	17.35 (24.62)	19.52 (26.23)	21.82 (27.86)	23.80 (29.21)	25.52 (30.35)	25.88 (30.59)	25.88 (30.59)	25.88 (30.59)	25.88 (30.59)	25.88 (30.59)	25.88 (30.59)	19.14 (25.95)^{i}	44.61
T2	3.43 (10.67)	2.05 (8.23)	5.95 (14.12)	6.00 (14.18)	6.34 (14.59)	7.58 (15.98)	8.23 (16.67)	9.88 (18.32)	10.08 (18.52)	10.82 (19.21)	10.82 (19.21)	10.82 (19.21)	10.82 (19.21)	10.82 (19.21)	10.82 (19.21)	10.82 (19.21)	8.45 (16.90)^{d}	75.54
T3	5.47 (13.53)	5.03 (12.96)	5.22 (13.21)	6.57 (14.85)	6.77 (15.08)	7.68 (16.09)	8.02 (16.45)	8.85 (17.31)	9.02 (17.48)	10.00 18.44)	10.00 (18.44)	10.00 (18.44)	10.00 (18.44)	10.00 (18.44)	10.00 (18.44)	10.00 (18.44)	8.28 (16.73)^{c}	76.04
T4	3.37 (10.58)	5.95 (14.12)	6.78 (15.10)	2.27 (8.66)	4.75 (12.59)	7.70 (16.11)	9.50 (17.96)	10.50 (18.91)	11.00 (19.37)	12.66 (20.85)	12.66 (20.85)	12.66 (20.85)	12.66 (20.85)	12.66 (20.85)	12.66 (20.85)	12.66 (20.85)	9.40 (17.86)^{f}	72.80
T5	4.36 (12.05)	6.57 (14.85)	9.27 (17.73)	8.25 (16.70)	10.82 (19.21)	12.57 (20.77)	13.38 (21.46)	14.20 (22.14)	14.80 (22.63)	15.65 (23.31)	15.65 (23.31)	15.65 (23.31)	15.65 (23.31)	15.65 (23.31)	15.65 (23.31)	15.65 (23.31)	12.73 (20.91)^{h}	63.16
T6	5.28 (13.29)	5.03 (12.96)	8.27 (16.72)	5.00 (12.92)	4.55 (12.32)	5.03 (12.96)	5.72 (13.84)	6.44 (14.70)	7.32 (15.70)	8.27 (16.72)	8.27 (16.72)	8.27 (16.72)	8.27 (16.72)	8.27 (16.72)	8.27 (16.72)	8.27 (16.72)	6.90 (15.23)^{b}	80.03
T7	2.27 (8.66)	2.05 (8.23)	5.37 (13.40)	2.00 (8.13)	2.27 (8.66)	4.10 (11.68)	5.47 (13.53)	6.33 (14.57)	7.00 (15.34)	7.56 (15.96)	7.56 (15.96)	7.56 (15.96)	7.56 (15.96)	7.56 (15.96)	7.56 (15.96)	7.56 (15.96)	5.61 (13.70)^{a}	83.76
T8	4.36	4.11	8.94	8.02	9.27	10.08	10.26	11.47	12.00	12.57	12.57	12.57	12.57	12.57	12.57	12.57	10.40	69.90

	(12.05)	(11.70)	(17.40)	(16.45)	(17.73)	(18.52)	(18.69)	(19.80)	(20.27)	(20.77)	(20.77)	(20.77)	(20.77)	(20.77)	(20.77)	(20.77)	(18.82)^{g}	
T9	4.52 (12.28)	4.16 (11.77)	7.25 (15.62)	5.40 (13.44)	6.34 (14.59)	7.22 (15.59)	8.27 (16.27)	10.08 (18.52)	10.73 (19.13)	11.68 (19.99)	11.68 (19.99)	11.68 (19.99)	11.68 (19.99)	11.68 (19.99)	11.68 (19.99)	11.68 (19.99)	9.10 (17.56)^{e}	73.66
T10	6.00 (14.18)	10.45 (18.87)	14.68 (22.54)	18.20 (25.26)	24.20 (29.48)	28.50 (32.28)	35.20 (36.40)	40.66 (39.63)	43.44 (41.25)	46.20 (42.84)	47.58 (43.63)	47.58 (43.63)	47.58 (43.63)	47.58 (43.63)	47.58 (43.63)	47.58 (43.63)	34.56 (36.02)j	-
Cumulative mean	4.23 (11.87)^{A}	5.11 (13.07)^{A}	7.97 (16.40)^{B}	7.30 (15.68)^{B}	8.98 (17.44)^{C}	10.78 (19.17)^{D}	12.35 (20.58)^{E}	14.02 (22.00)^{F}	14.91 (22.72)^{F}	16.09 (23.66)^{G}	16.26 (23.79)^{G}	16.26 (23.79)^{G}	16.26 (23.79)^{G}	16.26 (23.79)^{G}	16.26 (23.79)^{G}	16.26 (23.79)^{G}	-	-

C.D = ($P \leq 0.05$)
Week = 1.27
Treatment = 0.10
Week: Treatment=0.40
- Figure in parentheses are arc sin transformation
- The value in individual columns superscripted by similar letter(s) do not differ significantly.
SW - Standard week

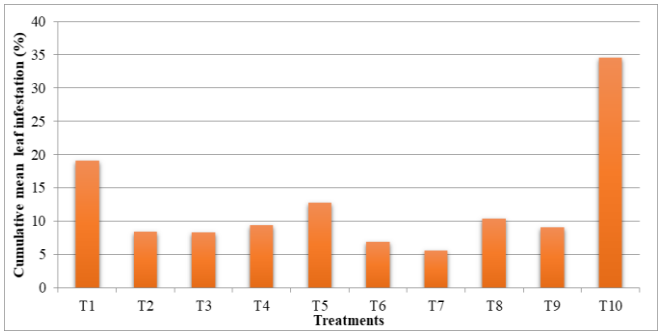

Fig 1: Efficacy of different treatments against leaf infestation by *C. partellus* (Swinhoe)

Perusal of Table-2 indicated that in the present investigation, module T_7 comprising seed treatment with imidacloprid 48% FS @ 2.4 ml/kg seed followed by a single spray of Azadirachtin 0.15 EC @ 2 ml/litre of water after 15 days of seed treatment and whorl application with imidacloprid 0.3% GR @ 10 kg/ha after 30 days of seed treatment registered lowest cumulative mean of 6.14 per cent dead heart which accounted to 72.95 per cent reduction in dead heart over untreated check. It was most effective to all other treatment applications. However, the treatment module T_6 consisting of seed treatment with imidacloprid 48% FS @ 2.4 ml/kg seed followed by single spray of Azadirachtin 0.15 EC @ 2 ml/litre of water after 15 days of seed treatment and whorl application with carbofuran 3G @ 10 kg/ha after a month of seed treatment was second best application strategy in recording cumulative mean of 6.32 per cent dead heart and registered 72.15 per cent reduction in dead heart over untreated check. The present findings were supported by Khan and Amjad (2000) [5] and Ameta and Kumar (2003) [1].

Table 2: Efficacy of different treatments in reduction of dead heart by *Chilo partellus* in maize at Dryland (*Karewa*) Agricultural Research Station during *kharif* 2015.

Treatment	Per cent dead heart																	Per cent reduction over control
	18 SW	19 SW	20 SW	21 SW	22 SW	23 SW	24 SW	25 SW	26 SW	27 SW	28 SW	29 SW	30 SW	31 SW	32 SW	33 SW	Cumulative Mean	
T1	-	-	5.45 (13.50)	7.40 (15.79)	12.68 (20.87)	16.80 (24.20)	18.16 (25.22)	21.44 (27.59)	24.71 (29.82)	24.71 (29.82)	24.71 (29.82)	24.71 (29.82)	24.71 (29.82)	24.71 (29.82)	24.71 (29.82)	24.71 (29.82)	17.47 (24.71)^{i}	23.34
T2	-	-	3.50 (10.78)	5.51 (13.58)	7.70 (16.11)	9.70 (18.15)	11.15 (19.51)	13.29 (21.39)	15.47 (23.17)	15.47 (23.17)	15.47 (23.17)	15.47 (23.17)	15.47 (23.17)	15.47 (23.17)	15.47 (23.17)	15.47 (23.17)	10.91 (19.29)^{g}	51.93
T3	-	-	4.11 (11.71)	5.11 (13.07)	6.34 (14.58)	8.62 (17.08)	10.74 (19.14)	12.64 (20.83)	14.40 (22.31)	14.40 (22.31)	14.40 (22.31)	14.40 (22.31)	14.40 (22.31)	14.40 (22.31)	14.40 (22.31)	14.40 (22.31)	10.17 (18.60)^{f}	55.19
T4	-	-	4.45 (12.18)	2.21 (8.55)	5.75 (13.87)	7.49 (15.89)	9.85 (18.29)	11.91 (20.19)	12.81 (20.98)	12.81 (20.98)	12.81 (20.98)	12.81 (20.98)	12.81 (20.98)	12.81 (20.98)	12.81 (20.98)	12.81 (20.98)	9.00 (17.46)^{d}	60.35
T5	-	-	4.16 (11.77)	2.70 (9.47)	6.61 (14.90)	9.46 (17.92)	11.50 (19.82)	12.46 (20.68)	13.18 (21.29)	13.18 (21.29)	13.18 (21.29)	13.18 (21.29)	13.18 (21.29)	13.18 (21.29)	13.18 (21.29)	13.18 (21.29)	9.52 (17.98)^{e}	58.06
T6	-	-	2.58 (9.25)	1.41 (6.83)	4.06 (11.63)	5.60 (13.69)	6.61 (14.90)	7.30 (15.68)	9.20 (17.66)	9.20 (17.66)	9.20 (17.66)	9.20 (17.66)	9.20 (17.66)	9.20 (17.66)	9.20 (17.66)	9.20 (17.66)	6.32 (14.56)^{b}	72.15
T7	-	-	2.68 (9.42)	0.93 (5.54)	4.48 (12.22)	5.91 (14.07)	6.58 (14.87)	8.25 (16.70)	8.68 (17.14)	8.68 (17.14)	8.68 (17.14)	8.68 (17.14)	8.68 (17.14)	8.68 (17.14)	8.68 (17.14)	8.68 (17.14)	6.14 (14.35)^{a}	72.95
T8	-	-	5.81 (13.96)	4.85 (12.72)	7.22 (15.59)	10.55 (18.96)	13.30 (21.39)	15.38 (23.10)	17.78 (24.95)	17.78 (24.95)	17.78 (24.95)	17.78 (24.95)	17.78 (24.95)	17.78 (24.95)	17.78 (24.95)	17.78 (24.95)	12.46 (20.68)^{h}	45.15
T9	-	-	3.65 (11.01)	2.21 (8.55)	5.78 (13.91)	7.65 (16.06)	8.68 (17.14)	9.76 (18.21)	10.86 (19.25)	10.86 (19.25)	10.86 (19.25)	10.86 (19.25)	10.86 (19.25)	10.86 (19.25)	10.86 (19.25)	10.87 (19.25)	7.79 (16.21)^{c}	65.68
T10	-	-	9.88 (18.32)	14.51 (22.40)	18.36 (25.38)	21.38 (27.55)	21.14 (27.38)	28.05 (31.99)	31.25 (34.00)	31.25 (34.00)	31.25 (34.00)	31.25 (34.00)	31.25 (34.00)	31.25 (34.00)	31.25 (34.00)	31.25 (34.00)	22.70 (28.46)^{j}	-
Cumulative mean	-	-	4.62 (10.65)^{A}	4.68 (13.24)^{B}	7.89 (15.90)^{C}	10.31 (18.35)^{D}	11.77 (19.96)^{E}	14.04 (21.63)^{F}	15.83 (23.05)^{G}	15.83 (23.05)^{G}	15.83 (23.05)^{G}	15.83 (23.05)^{G}	15.83 (23.05)^{G}	15.83 (23.05)^{G}	15.83 (23.05)^{G}	15.83 (23.05)^{G}	-	-

CD = ($P \leq 0.05$)
Week= 0.14
Treatment = 0.11
Week: Treatment = 0.46
- Data in parentheses is arc sin transformation
- The value in individual columns superscripted by similar letter(s) do not differ significantly.
- SW – Standard week

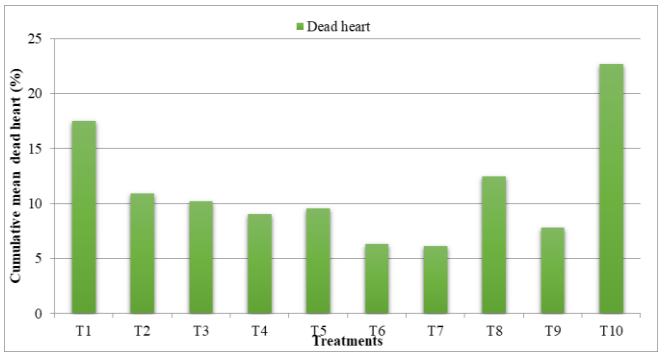

Fig 2: Efficacy of different treatments against dead heart by *C. partellus* (Swinhoe)

References

1. Ameta OP, Kumar A. Relative efficacy of botanicals against shoot borers and midges infesting sorghum. Indian Journal of Applied Entomology. 2003; 17(1):12-14.
2. Anonymous, Cereal Crops (Kharif and Rabi) Package of Practices, 2011; 3:19-34.
3. Anonymous, Annual Report of Indian Institute of maize Research, New Delhi, 2015.
4. Bhanukiran Y, Panwar VPS. Efficacy of Neem and *Bt* formulations alone and in combination with pesticides against Chilo partellus (Swinhoe). Indian Journal of Entomology 2005; 67(1):34-38.
5. Khan SM, Amjad M. Varietal performance of maize against stem borer (*Chilo partellus* Swinhoe). Pakistan Journal of Biological Sciences. 2000; 3(3):521-522.
6. Latif A, Cayyum A, Piracha MA. Maize Stem Borer *Chilo partellus* (Swinhoe) and its control. Agriculture in Pakistan. 1960; 11:25-36.
7. Sarup P, Siddiqui KH, Marwaha KK. Trends in maize pest management research in India together with Bibliography. Journal of Entomology. 1987; 11(1):19-68.
8. Siddiqui KH, Marwaha KK. The vistas of maize Entomology in India. Kalyani Publishers, Ludhiana, 1993.
9. Siddalingappa, Thippeswamy C, Hosamani V. Yalavar S. Evaluation of new insecticide molecules, botanicals and biopesticides against maize stem borer, *Chilo partellus* (Swinhoe) Crambidae: Lepidoptera. International Journal of Plant Protection 2010; 3(1):124-126.
10. Zewar H, Zaki FA, Wani AR. Evaluation of some insecticides and bio-pesticides against cutworm *Agrotis ipsilon* Hufnagel infesting maize under rainfed conditions of Kashmir Valley. Oriental Sciences, 2003 8:97-102.