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# Effect of bio pesticides on shoot borer, *Chlumetia transversa* in organic mango

**Snehalben Patel and HV Pandya**

**Abstract**
The experiment was conducted in winter season from 2016-17 to 2018-19 on mango variety '*Kesar*" at instructional Farm, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari. Experiment was laid out in Randomized Block Design with nine treatments and replicated three times using different bio pesticides along with control. Minimum infestation of shoot borer was recorded in treatment azadirachtin 1500 ppm @ 33 ml in 10 lit of water for the management of mango shoot borer. The most effective treatment in present investigation is azadirachtin 1500 ppm @ 33 ml compare to other selected bio pesticides against mango shoot borer. The order of effectiveness of bio pesticides in present investigation is azadirachtin 1500 ppm @ 33 ml > azadirachtin 1500 ppm @ 40 ml > azadirachtin 1500 ppm @ 27 ml > azadirachtin 1500 ppm @ 20 ml > NSKE 500 gm > *Beauveria bassiana* $2x10^8$ CFU/gm > *Metarrhizium anisopliae* $2x10^8$ CFU/gm > *Verticillium lacani* $2x10^8$ CFU/gm.

**Keywords:** Mango shoot borer, azadirachtin, biopesticides, *Chlumetia transversa* walker, mango

## 1. Introduction
Mango, *Mangifera indica* L. (Anacardiaceae) is an important fruit crop having a great nutritional, medicinal or industrial utility to humanity and is grown in as many as 63 countries all over the world (Sahoo *et al*., 2016) [9]. India has third position in mango production in the world, next to Brazil and USA. India has contributing 40.48 per cent of the total world mango production. Mango has been under cultivation in India since 4000 years and over 1200 varieties are said to exist in the country (Mukherjee, 1948) [5]. Mango is grown in tropical as well as subtropical regions of India. It is grown in India in large extent and is considered as a king of all the fruits. The area under mango cultivation in India is 2296 thousand hectare with production of 21378 thousand MT (Anon., 2019) [1]. The states of Andhra Pradesh, Uttar Pradesh, Karnataka, Bihar, Gujarat, Odisha, West Bengal, Kerala, Jharkhand and Maharashtra are major mango producing state of the country. In Gujarat, productivity of mango is 8.13 t/ha (Saxena and Gandhi, 2014) [10]. Gujarat is one of the important mango growing state of India and occupies 166.3 thousand hectare area with production of 12.22 lakh MT. Valsad district of south Gujarat occupies 36.4 thousand hectare area with production of 2.47 lakh MT (Anon., 2020) [2].
Mango fruit is utilized both in its immature and mature stages. Raw fruits are used for making chutney, pickles and juices. The ripe fruits also utilized for preparing several products like squashes, syrups, nectars, jams and jellies. Umpire mangoes are sliced, dried and made into powder for *amchoor*, a traditional Indian preparation used for cooking.
Although, there is tremendous scope for enhancement of productivity of mango but various abiotic and biotic factors are responsible for lowering the productivity. Among the biotic factors, insect pests play important role in deciding the quality production and productivity of mango. Mango trees suffer regularly a colossal loss due to ravages of pests. The crop is attacked by about 492 species of insects, 17 species of mites and 26 species of nematodes at the world level of these, 188 species of insects have been reported from India (Tandon and Verghese, 1985) [12]. More than 300 species of insect-pest attacked on vegetative and reproductive phases of the mango crop in the world level of which 188 species have been reported from India (Bana *et al*., 2018) [3]. Different foliage pest's *viz*., mango hopper (*Idioscopus niveosparsus* Leth), thrips (*Scirtothrips dorsalis* Hood), midge (*Erosomiya indica* Grover), mealy bug (*Ferisia virgata* Stebbins), scale insect (*Aspidiotus destructor* Signoret), shoot borer (*Chlumetia transversa* Walker) and leaf miner (*Acrocercops syngramma* Meyrick) were recorded damaging mango foliage and inflorescence (Munj *et al*., 2019) [6].

Among the insect-pests mango hoppers, stem borer, fruit fly, shoot borer, leaf webber, mealy bug, leaf gall midge, leaf damaging insect (ash grey beetle and leaf miner), scale insect, mite, red ants, hairy caterpillar, bark eating caterpillar, semi-looper and fruit borer are recorded (Patel *et al*., 2013) [7]. The present study provides essential information for understanding appropriate management strategies of shoot borer in south Gujarat mango using biopesticides in organic conditions.

## 2. Materials and Methods

The present investigation was carried out at Instructional Farm**,** ASPEE College of Horticulture and Forestry**,** Navsari Agricultural University, Navsari which is situated on the coast of Arabian Sea at $20^0$-57' North latitude, $72^0$-54' East longitude and at height of 10 meters above the MSL. It is about 13 km away from the historic place "Dandi Memorial" on the Arabian Sea coast where the Father of Nation "Mahatma Gandhi" launched a salt satyagrah "Dandi" march in the year of 1930.

The experiment on "Effect of bio-pesticides on shoot borer, *Chlumetia transversa* Walker in organic mango" was conducted during the period of winter (October-January) 2016 to 2019 on mango variety '*Kesar*". Experiment was carried out in Randomized Block Design with nine treatments and replicated three times with different Biopesticides along with control.

Among nine treatments four treatments having different doses of Azadirachtin 1500 ppm i.e. 20 ml, 27 ml, 33 ml and 40 ml and others were NSKE 500 gm, *Verticillium lacani* $2x10^8$ CFU/gm 40 gm, *Beauveria bassiana* $2x10^8$ CFU/gm, *Metarrhizium anisopliae* $2x10^8$ CFU/gm and control.

Each treatment was given to three trees and considering one tree as one replication. Observations were taken from randomly selected five twigs of about 2.0 meter length per tree from four directions *viz*., north, south, east and west at vegetative and inflorescence stage by visual and inspection count method. In all, total 20 twigs per tree were observed. Thus, from each treatment sixty observations were recorded at 24 hours before spray and 7 and 14 days after each spray.

From each twig, only fresh/live infestation of shoot borer (Plate.1) was recorded from tender shoots (new flushes) and axis of inflorescence which having presence of excreta in and around the holes. Shoot which showed withering away or hanged on twigs or wilted were not taken into consideration as it was considered as a previous damage.

First spray was given few days before initiation of flowering when infestation was started and subsequently second spray was given at 15 days after the first spray.

**Plate 1:** Infestation of Mango shoot borer

## 3. Results and Discussion

In the tropics and subtropics, shoot borer, *C. transversa* has become one of the most serious pest problems, causing crop losses through direct feeding by boring. The efficacy of different biopesticides against mango shoot borer, *C. transversa* was observed separately on randomly selected five twigs. The data regarding the effectiveness of various treatments at different intervals are described below in detail.

Data presented in Table-1 and graphically depicted in Fig.1 revealed that minimum per cent infestation of shoot borer was recorded (10.00%) in treatment azadirachtin 1500 ppm @ 33 ml in 10 lit of water so it is highly effective against shoot borer compare to other Biopesticides in this experiment. The treatment azadirachtin 1500 ppm @ 27 ml (15.42%), azadirachtin 1500 ppm 40 ml (16.25%) and azadirachtin 1500 ppm @ 20ml (17.08%) are found moderately effective against mango shoot borer. The treatment NSKE 500 gm (25.42%), *Beauveria bassiana* $2x10^8$ CFU/gm 40gm (28.33%), *Metarrhizium anisopliae* $2x10^8$ CFU/gm 40gm (29.17%) and *Verticillium lacani* $2x10^8$ CFU/gm 40 gm (34.58%) found least effective treatments against mango shoot borer. The period x treatment interaction was non-significant indicating consistent performance of treatments over periods.

**Table 1:** Effect of Biopesticides on per cent infestation of shoot borer (2016-17)

| Treatments | Before spray | 7DAS1 | 14DAS1 | 7DAS2 | 14DAS2 | Pooled |
|---|---|---|---|---|---|---|
| T1 | 39.20 (40.00) | 20.75 (13.33) | 26.44 (20.00) | 21.33 (13.33) | 27.58 (21.66) | 24.03 (17.08) |
| T2 | 37.24 (36.67) | 22.59 (15.00) | 24.04 (16.67) | 19.30 (11.66) | 25.30 (18.33) | 22.80 (15.42) |
| T3 | 39.20 (40.00) | 18.04 (10.00) | 16.59 (8.33) | 18.04 (10.00) | 19.88 (11.66) | 18.14 (10.00) |
| T4 | 39.14 (40.00) | 22.59 (15.00) | 24.04 (16.67) | 24.03 (16.67) | 24.04 (16.66) | 23.67 (16.25) |
| T5 | 38.20 (38.33) | 25.30 (18.33) | 37.11 (36.67) | 28.77 (23.33) | 28.65 (23.33) | 29.96 (25.42) |
| T6 | 42.11 (45.00) | 35.24 (33.33) | 39.13 (40.00) | 34.22 (31.67) | 35.20 (33.33) | 35.95 (34.58) |
| T7 | 43.07 (46.67) | 33.15 (30.00) | 33.15 (30.00) | 29.91 (25.00) | 32.08 (28.33) | 32.07 (28.33) |
| T8 | 42.10 (45.00) | 32.00 (28.33) | 32.99 (30.00) | 32.00 (28.33) | 33.15 (30.00) | 32.54 (29.17) |
| T9 | 41.15 (43.33) | 44.98 (50.00) | 45.94 (51.67) | 44.98 (50.00) | 45.94 (51.67) | 45.46 (50.84) |
| S.E.M.± (T) | 1.73 | 2.55 | 2.36 | 2.40 | 1.92 | 1.13 |
| C.D. at 5% (T) | NS | 7.65 | 7.08 | 7.19 | 5.75 | 3.18 |
| S.E.M. ± (P X T) | - | - | - | - | - | 2.32 |
| C.D. at 5% (P X T) | - | - | - | - | - | NS |
| CV% | 7.46 | 15.60 | 13.18 | 14.81 | 11.00 | 13.60 |

Figure in the parenthesis are original mean values while outside are arc sin transformed value

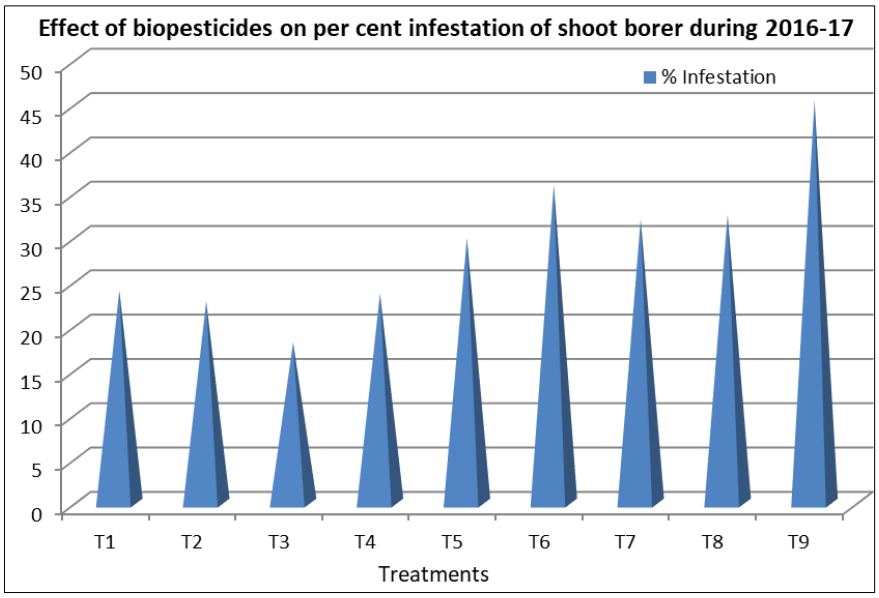


**Fig 1:** Effect of Biopesticides on per cent infestation of shoot borer (2016-17)

Result of pooled data (Table-2 and Fig.2) of 7 and 14 days after first and second spraying revealed that minimum infestation of shoot borer (12.50%) was recorded in treatment azadirachtin 1500 ppm @ 33 ml in 10 lit of water. It was followed by azadirachtin 1500 ppm @ 27 ml (15.42%) and azadirachtin 1500 ppm @ 40 ml (17.50%). The other treatments *viz*., *Verticillium lacani* $2x10^8$ CFU/gm 40 gm (36.67%), *Metarrhizium anisopliae* $2x10^8$ CFU/gm 40gm (32.92%), *Beauveria bassiana* $2x10^8$ CFU/gm 40gm (25.83%) and NSKE 500 gm (22.92%) found least effective and control treatment recorded highest per cent infestation of shoot borer.

**Table 2:** Effect of Biopesticides on per cent infestation of shoot borer (2017-18)

| Treatments | Before spray | 7 DAS 1 | 14 DAS 1 | 7 DAS 2 | 14 DAS 2 | Pooled |
|---|---|---|---|---|---|---|
| T1 | 35.86 (33.33) | 26.04 (18.33) | 26.04(18.33) | 28.4 (21.67) | 26.04 (18.33) | 26.63 (19.17) |
| T2 | 39.82 (40.00) | 23.58 (15.00) | 22.18(13.33) | 26.04(18.33) | 23.41 (15.00) | 23.80 (15.42) |
| T3 | 35.86 (33.33) | 20.77 (11.67) | 19.04(10.00) | 23.41(15.00) | 22.18 (13.33) | 21.35 (12.50) |
| T4 | 38.82 (38.33) | 24.81 (16.67) | 23.41(15.00) | 28.40(21.67) | 24.64 (16.67) | 25.31 (17.50) |
| T5 | 38.82 (38.33) | 28.40 (21.67) | 29.53(23.33) | 28.40(21.67) | 30.59 (25.00) | 29.23 (22.92) |
| T6 | 38.82 (38.33) | 37.82 (36.67) | 36.84(35.00) | 37.85(36.67) | 38.83 (38.33) | 37.84 (36.67) |
| T7 | 38.83 (38.33) | 30.66 (25.00) | 31.72(26.67) | 29.53(23.33) | 32.77 (28.33) | 31.17 (25.83) |
| T8 | 39.80 (40.00) | 34.85 (31.67) | 35.86(33.33) | 34.85(31.67) | 36.84 (35.00) | 35.60 (32.92) |
| T9 | 40.78 (41.67) | 39.8 (40) | 40.78(41.67) | 40.78(41.67) | 41.74 (43.33) | 40.77 (41.67) |
| S.Em.± (T) | 1.47 | 1.23 | 1.57 | 1.14 | 1.73 | 0.78 |
| C.D. at 5% (T) | NS | 3.69 | 4.72 | 3.42 | 5.20 | 2.20 |
| S.Em.± (P X T) | - | - | - | - | - | 1.10 |
| C.D. at 5% (P X T) | - | - | - | - | - | NS |
| CV% | 6.61 | 7.20 | 9.24 | 6.41 | 9.76 | 8.92 |

Figure in the parenthesis are original mean values while outside are arc sin transformed value

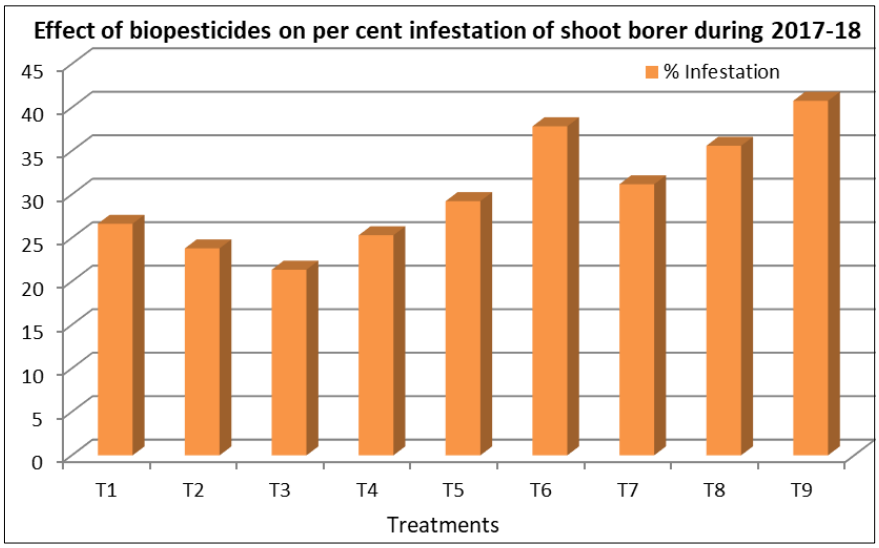


**Fig 2:** Effect of biopesticides on per cent infestation of shoot borer in organic mango (2017-18)

It can be seen from the data presented in Table-3 and graphically depicted in Fig. 3 that all the treatments were significantly superior over control. However the lowest infestation of shoot borer was recorded (12.92%) in treatment azadirachtin 1500 ppm @ 40 ml in 10 lit of water. It was at par with azadirachtin 1500 ppm @ 33 ml in 10 lit of water (13.33%).

**Table 3:** Effect of biopesticides on per cent infestation of shoot borer (2018-19)

| Treatments | Before spray | 7 DAS 1 | 14 DAS 1 | 7 DAS 2 | 14 DAS 2 | Pooled |
|---|---|---|---|---|---|---|
| T1 | 40.78(41.67) | 32.77 (28.33) | 31.65 (26.67) | 29.46 (23.33) | 30.59 (25.00) | 31.12 (25.83) |
| T2 | 41.74(43.33) | 30.66 (25) | 28.3 (21.67) | 26.04 (18.33) | 27.27 (20.00) | 28.07 (21.25) |
| T3 | 41.74(43.33) | 26.04 (18.33) | 23.41 (15.00) | 19.04 (10.00) | 19.04 (10.00) | 21.88 (13.33) |
| T4 | 42.7(45.00) | 26.04 (18.33) | 23.41 (15.00) | 17.64 (8.33) | 19.37 (10.00) | 21.61 (12.92) |
| T5 | 39.8(40.00) | 30.59 (25.00) | 27.17 (20.00) | 27.17 (20.00) | 26.04 (18.33) | 27.74 (20.83) |
| T6 | 41.74(43.33) | 38.78 (38.33) | 37.85 (36.67) | 37.85 (36.67) | 36.84 (35.00) | 37.83 (36.67) |
| T7 | 37.82(36.67) | 31.72 (26.67) | 29.53 (23.33) | 28.4 (21.67) | 27.17 (20.00) | 29.20 (22.92) |
| T8 | 43.66(46.67) | 38.83 (38.33) | 36.84 (35.00) | 36.84 (35.00) | 38.83 (38.33) | 37.84 (36.67) |
| T9 | 37.8(36.67) | 40.78 (41.67) | 42.7 (45.00) | 40.78 (41.67) | 42.7 (45) | 41.74 (43.33) |
| S.Em.± (T) | 1.60 | 1.25 | 1.88 | 1.47 | 1.52 | 0.84 |
| C.D. at 5% (T) | NS | 3.76 | 5.65 | 4.39 | 4.57 | 2.37 |
| S.Em.± (P X T) | - | - | - | - | - | 1.18 |
| C.D. at 5% (P X T) | - | - | - | - | - | NS |
| CV% | 6.79 | 6.60 | 10.45 | 8.68 | 8.87 | 9.42 |

Figure in the parenthesis are original mean values while outside are arc sin transformed value

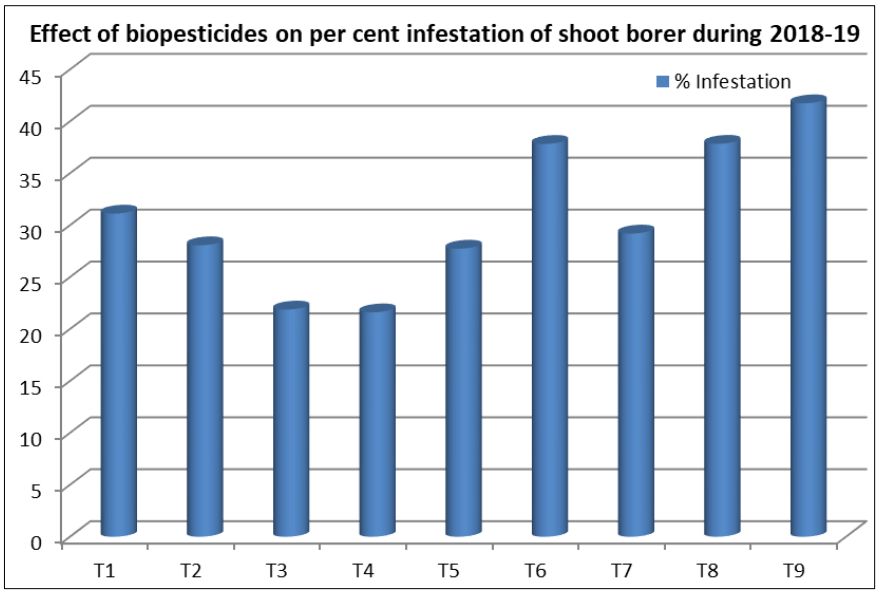


**Fig 3:** Effect of biopesticides on per cent infestation of shoot borer (2018-19)

Data presented in Table-4 and graphically depicted in Fig. 4 revealed that minimum infestation of shoot borer (11.94%) was recorded in treatment azadirachtin 1500 ppm @ 33 ml in 10 lit of water. It was followed by (15.56%) azadirachtin 1500 ppm @ 40 ml and azadirachtin 1500 ppm @ 27 ml (17.36%). The period x treatment interaction was non- significant indicating consistent performance of treatments over periods.

The descending chronological order of effectiveness of remaining biopesticides were azadirachtin 1500 ppm @ 40 ml (15.56%) > azadirachtin 1500 ppm @ 27 ml (17.%) > azadirachtin 1500 ppm @ 20 ml (20.69%) > NSKE 500gm (23.06%) > *Beauveria bassiana* 2x$10^8$ CFU/gm (25.69 mean number of damage shoot) > *Metarrhizium anisopliae* 2x$10^8$ CFU/gm (32.92 mean number of damage shoot) > *Verticillium lacani* 2x$10^8$ CFU/gm (35.97 mean number of damage shoot). Previously Dhingra *et al.* (2008) [4] observed that azadirachtin-A, its reduced derivative tetrahydroazadirachtin- A and other neem pesticides provided significant control of the major okra shoot and fruit borer. The use of azadirachtin is thus promising for the control of insect pests of okra. Reddy *et al.* (2018) [8] showed that neem oil at 5 ml/l two times at fortnightly intervals from the emergence of new flush found effective against mango shoot borer. It can be said that the present findings are more or less similar to earlier reports.

**Table 4:** Effect of biopesticides on per cent infestation of shoot borer (Overall Pooled)

| Sr. No | Treatments | Dose | I-Year (2016-17) | II-Year (2017-18) | III-Year (2018-19) | Overall Pooled |
|---|---|---|---|---|---|---|
| T1 | Azadirachtin 1500 ppm | 20 ml | 24.83 (17.08) | 26.63 (19.17) | 31.12 (25.83) | 27.73(20.69) |
| T2 | Azadirachtin 1500 ppm | 27ml | 23.63 (15.42) | 23.80 (15.42) | 28.07 (21.25) | 25.34(17.36) |
| T3 | Azadirachtin 1500 ppm | 33 ml | 19.12 (10.00) | 21.35 (12.50) | 21.88 (13.33) | 20.98(11.94) |
| T4 | Azadirachtin 1500 ppm | 40 ml | 24.46 (16.25) | 25.31 (17.50) | 21.61 (12.92) | 23.97(15.56) |
| T5 | NSKE | 500 gm | 30.65 (25.42) | 29.23 (22.92) | 27.74 (20.83) | 29.33(23.06) |
| T6 | *Verticillium lacani* 2x$10^8$ CFU/gm | 40 gm | 36.57 (34.58) | 37.84 (36.67) | 37.83 (36.67) | 37.44(35.97) |
| T7 | *Beauveria bassiana* 2x$10^8$ CFU/gm | 40 gm | 32.72 (28.33) | 31.17 (25.83) | 29.20 (22.92) | 31.09(25.69) |
| T8 | *Metarrhizium anisopliae* 2x$10^8$ CFU/gm | 40 gm | 33.19 (29.17) | 35.60 (32.92) | 37.84 (36.67) | 35.60(32.92) |
| T9 | Control (Without any pesticidal spray) | - | 46.05 (50.83) | 40.77 (41.67) | 41.74 (43.33) | 42.86(45.28) |
| | S.Em.± (T) | | 1.16 | 0.78 | 0.84 | 0.52 |
| | C.D. at 5% (T) | | 3.29 | 2.20 | 2.37 | 1.48 |
| | S.Em.± (P X T) | | 1.65 | 1.10 | 1.18 | 0.74 |
| | C.D. at 5% (P X T) | | NS | NS | NS | NS |
| | S.Em.± (S X T) | | 1.65 | 1.10 | 1.18 | 0.74 |
| | C.D. at 5% (S X T) | | NS | NS | NS | NS |
| | S.Em.± (Y X T) | | 13.37 | 8.92 | 9.42 | 0.68 |
| | C.D. at 5% (Y X T) | | | | | NS |
| | CV% | | | | | 5.94 |

Figure in the parenthesis are original mean values while outside are arc sin transformed value.

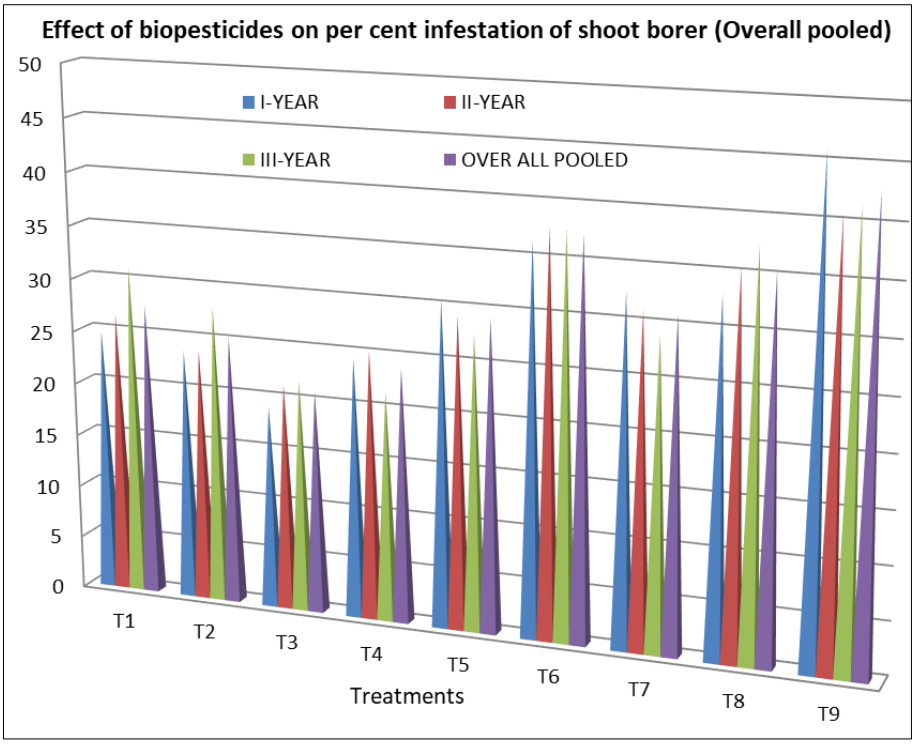


**Fig 4:** Effect of biopesticides on per cent infestation of shoot borer (Overall Pooled)

## 4. Conclusion

It is concluded that, azadirachtin 1500 ppm @ 33 ml in 10 lit of water found effective compare to other selected biopesticides against mango shoot borer.

## 5. Acknowledgements

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