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Management of fruit borer, *Meridarchis scyrodes* Meyrick (Carposinidae: Lepidoptera) in ber, *Zizyphus mauritiana*

Rajeshwari, G*, Srinivasulu, B, Deepthi, P and Subramanyam, K
Dr. Y.S.R. Horticultural University, [1]Horticultural Research Station, Rekulakunta, Anantapuramu, A. P
*Corresponding author's e-mail: raji.ento@gmail.com
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The Ber, *Zizyphus mauritiana* belongs to family Rhamnaceae is an important arid zone fruit crop cultivated all over India. The major ber growing states are Madhya Pradesh, Bihar, U. P, Panjab, Haryana, Rajasthan, Gujarat, Maharastra and Andhra Pradesh. Ber is most drought hardy fruit tree which can stand salinity and saline water. Some of the xerophytic characters and its ability to stand drought makes it as a "king of fruits" of arids. Among insect-pests belonging to 33 families attacking ber (Nair, 1986), Fruit borer *Meridarches scyrodes* Meyrick is a major pest causing 70 per cent yield loss under severe infestation (Karuppaiah, 2013). The borer damage was mainly observed in southern and western India (Pareek and Nath, 1996 and Sonawane and Dorge, 1971). A field survey in Karnataka indicated fruit borer is a major pest in ber (Balikai, 1999). The reddish larvae of fruit borer bore into the fruit and feed on the pulp and accumulate faecal frass which are visible when fruit is opened, within affecting the fruit quality. The moths are small, dark brownish in colour. Keeping in view the severe losses, the present study is conducted to evaluate the newer insecticides and botanicals which are effective against the fruit borer.

Field experiment was laid out in randomized block design with six treatments comprising both synthetic and botanical insecticides viz., Spinosad 2.5 SC, Indoxacarb 14.5 EC, 5 % NSKE, Azadirachtin-3000 ppm, Azadirachtin-10000 ppm and one untreated check and each treatment replicated four times. The ber cultivar Gola was selected for the study. The treatments were imposed by spraying chemicals on marble sized fruits when the moth activity was observed in the orchard. A total of three sprays were given at twenty days interval. At each harvest, hundred fruits were collected randomly (covering four sides of the tree) and per cent borer infestation was recorded. Data were subjected by analysis of variance (ANOVA).

$$\text{Per cent borer infestation} = \frac{\text{sum of damaged fruits}}{\text{total number of fruits collected}} \times 100$$

The results of the field experiments revealed that application of different treatments can provide control of larval population which is comparable with untreated check. Observations were recorded for eight years from 2008 to 2015 and data presented in Table.1. The mean pooled data of eight years revealed that, all the treatments differed significantly with control in reducing the per cent borer infestation in ber. However, significant differences between ecofriendly management strategies and synthetic chemical insecticides were observed with respect to fruit damage and yield. Lowest per cent borer infestation with significantly higher yield (80.91 kg/plant) was recorded with Indoxacarb 14.5 EC @ 1ml/l (18.06) followed by spinosad 2.5 SC @ 1ml/l (22.02). Highest per cent borer infestation was recorded with control (43.72) followed by azadirachtin 10000 ppm @ 1ml/l (34.88), azadirachtin 3000 ppm @ 2.5 ml/l (32.41) and NSKE 5% (32.11). The present findings are also in agreement with findings of Sudheer and Subramanyam (2001), who reported that botanicals were less effective for fruit borer control in ber. The bioefficacy of synthetic insecticides in the management of fruit borer was superior to botanical insecticides.

The variation in fruit damage and yield in different treatments might be due to the slow rate of kill in ecofriendly management strategies compared to synthetic insecticides. The efficacy of spinosad in the control of fruit borer on ber has been reported earlier by Adiroubane and Raghuraman, 2008. These results are in agreement with the findings of Ravi *et al.* (2008). The mean per cent borer infestation was relatively high in all the treatments as compared to Indoxacarb 14.5 EC @ 1ml/l.

Table 1. Effect of different insecticides against ber fruit borer during 2008 to 2015 (pooled for 8 years)

S. No.	Treatments	Mean per cent borer infestation		Mean Fruit yield (kg/plant)	Cost:Benefit ratio
1.	Spinosad 2.5 SC @1ml/l	22.02	(27.98)*	70.71	1:0.78
2.	Indoxacarb 14.5 EC @1ml/l	18.06	(25.15)	80.91	1:1.54
3.	NSKE @ 5%	32.11	(34.50)	65.38	1:1.13
4.	Azadirachtin 3000 ppm @ 2.5 ml/l	32.41	(34.68)	63.81	1:1.09
5.	Azadirachtin 10000 ppm @ 1ml/l	34.88	(36.18)	62.45	1:1.05
6.	Control	43.72	(41.38)	54.42	1:0.79
SE.m±		0.21		0.49	
CD at 5%		0.64		1.48	

*Figures in the parentheses indicate the arc-sine transformed values

Significant differences were also observed among the treatments for fruit yield per plant in ber. Highest fruit yield per plant was recorded in Indoxacarb 14.5 EC @ 1ml/l (80.91 kg/plant) followed by Spinosad 2.5 SC @ 1 ml/l (70.71 kg/plant). Lowest fruit yield per plant was observed with azadirachtin 10000 ppm (62.45 kg/plant) and 3000 ppm (63.81 kg/plant) and NSKE 5% (65.38 kg/plant) treated plots and were significantly differed with control. With regard to cost:benefit ratio, highest cost:benefit ratio was recorded with Indoxacarb 14.5 EC @ 1ml/l (1:1.54) followed by NSKE 5% (1:1.13) and were significantly differed with control (1:0.79).

The per cent infestation of ber fruit borer was decreased (21.40 to 14.41) over years from 2008 to 2015 with Indoxacarb 14.5 EC @ 1ml/l followed by spinosad 2.5 SC @ 1ml/l (23.13 to 17.91). Highest borer infestation was recorded with control treatment (48.03) in 2011 than other years.

Spraying of Indoxacarb 14.5 EC @ 1ml/l at twenty days interval starting from marble size fruits was found effective in management of fruit borer in ber. The Cost:Benefit ratio was also high in Indoxacarb 14.5 EC @1ml/l treated fruits.

Fig. 1: Effect of different insecticides against ber fruit borer over years

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Fig 2: (A) Fruit borer typical symptoms on fruit (B) Larvae inside the fruit when split open (C) Accumulated faecal frass