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EFFECT OF PESTICIDES ON SHOT HOLE BORER *EUWALLACEA FORNICATUS* (EICHHOFF) (SCOLYTIDAE: COLEOPTERA) FEEDING PATHOGENIC FUNGI *FUSARIUM BUGNICOURTII* (BRAY FORD)

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Abstract: *Tea is one of the major nonalcoholic beverages in the world. Being a perennial crop, it provides a stable environment for a number of pests and diseases. Pests are important factors limiting the productivity and quality of processed tea. Among the pests, the shot hole borer (SHB), Euwallacea fornicatus (Eichhoff) is a serious pest of tea in south India. These beetles have a symbiotic relationship with the fungus Fusarium bugnicourtii. The fungal spores are carried by the beetles in special organs called mycangia located in the buccal cavity of head. Spores of the ambrosia fungus borne by the female beetles adhere to the walls of the stem galleries. On germination of spores, the grubs and adults feed on the fungus. Hence a novel approach has been attempted to find out the efficacy of pesticides on the fungus, F. bugnicourtii. Results showed 50 % reduction of fungi while tested with Dicofol, Endosulfan, Quinalphos and Lambdacyhalothrin. The high significance was observed in Dicofol and Endosulfan, and no significance was recorded in Lime sulphur, Ethion and control treatments at 0.05 %.*

Keywords: *Shot Hole Borer; Euwallacea fornicatus; Fusarium bugnicourtii; Feeding; Pesticides; Growth inhibition.*

Introduction

Tea is a popular beverage of evergreen and perennial shrub under the family Theaceae. Tea plant is heavily suffered by attacking numerous pests like, insect pest, mites, nematodes, plant pathogens and weeds. Totally, 1034 species of arthropods, 82 species of nematodes and 350 fungal diseases are associated with tea plants. An estimate, about 10-15 % of crop loss was occurred by these pests per annum, in severe cases, it would be 100 % (Chen and Chen, 1989; Wight, 1959). The shot hole borer (SHB), *Euwallacea fornicatus* Eichhoff is a serious pest of tea in south India (Muraleedharan, 1986 and 1997; Muraleedharan and Radhakrishnan, 1989 and 1994), which causes not only the loss in economic yield but also the capital loss of bushes and branch break. The Fusarium is soil inhabiting plant pathogenic fungus which causes diseases in brinjal, pigeon pea, guava, grams and tomato (Kiran, 2006). Newly emerged, creamy white adult beetles turned into light brown and then to characteristic black colour within six to twelve days.

The symbiotic fungus, *Fusarium bugnicourtii* spores are carried by the beetles in special organs called mycangia (buccal cavity) (Parthiban and Muraleedharan, 1996) and spores of ambrosia fungus borne by female beetles adhere to the walls of stem galleries. On the germination of spores, the grubs and adults feed on the fungus (Muraleedharan, 1991). Shot hole borer incidence is higher during April, May, July, October and December. During past one decade, management of this pest is mainly achieved by adopting certain cultural, chemical and biological control measures (Selvasundaram *et al.,* 2001). To overcome these problems different groups of pesticides have been used in tea fields since 1960.

An integrated management strategy involving cultural operations like rejuvenation/hard pruning, manipulation of agronomic practices and application of chemicals has been recommended against SHB management (Selvasundaram *et al.,* 2001). Several insecticides were evaluated while post pruning operations and mid-cycle application in the past few decades and many of them were found effective against SHB (Devadas *et al.*, 1989; Muraleedharan, 1997; Selvasundaram *et al.*, 1999). To combat this problem, different groups of pesticides like organochlorine, organophosphate, pyrethroids, carbamates and some unclassified group have been used in the tea fields, since 1960. The growth of fungus was inhibited by applied pesticides (Das *et al.*, 2003; Sanyal and Shrestha, 2008). The present study is aimed to assess the effect of commonly used pesticides on the growth inhibition of *Fusarium bugnicourtii* and indirectly control the further developmental stage of shot hole borer larva and adult in tea.

Materials and Methods

Sample collection and Pathogen isolation:

The stem of shot hole borer infected tea plant was cut at the range of 15 cm height and 2 cm width, and then brought to the laboratory. Immediately, they were cut into small pieces, and then surface sterilized with 75 % of ethyl alcohol and fixed on the Potato Dextrose Agar medium. The plates were incubated under controlled conditions of 25±1^0 C, 75±5 % relative humidity and 16:8 hours light: dark photoperiod.

Pesticides:

In vitro sensitivity of pathogen to nine recommended pesticides, like Lime sulphur (1: 40), Ethion (750 ml/ha), Deltamethrin (500 ml/ha), Fenpropathrin (200ml/ha), Propargite (500 ml/ha), Lambdacyhalothrin (250 ml/ha), Quinalphos (1000 ml/ha), Endosulfan (1000 ml/ha), and Dicofol (1000 ml/ha) was tested.

Pathogenicity test:

Pathogenicity test was carried out on shot hole borer larval feeding and adult transmitting the spores of fungus infested tea. For that, the recommended pesticides were mixed with Potato Dextrose Agar medium, and the plates were inoculated with the pathogen by placing an agar disk of 0.5 mm diameter in the centre, and then culture trays were kept under controlled conditions of 25±1^0 C, 75±5 % relative humidity and 16:8 hours light: dark photoperiod. The radial growth of fungus was measured after inoculation of 3rd, 5th and 7th day.

Data analysis:

The data was recorded during the course of analysis. The calculation was drowning on the basis of analysis of variance, ANOVA. The calculated value of F was compared with table value at 0.05 % levels of significance.

Results and Discussion

The recommended pesticides like Lime sulphur, Ethion, Deltamethrin, Fenpropathrin, Propargite, Lanbdacyhalothrin, Quinalphos, Endosulfan and Dicofol were tested against fungus *F. bugnicourtii* prepared with Potato Dextrose Agar medium. Among the tested pesticides, the Dicofol is effective against *F. bugnicourtii,* whereas, the growth was 0.00, 0.08 and 0.10 cm for 3rd, 5th and 7th day respectively (Table 1). The radical growth of *F. bugnicourtii* on 7th day against

Endosulfan, Quinalphos, Lambdacyhalothrin, Propargite, Fenpropathrin, Deltamethrin, Ethion and Lime sulphur showed 0.13 cm, 0.15 cm, 0.60 cm, 0.68 cm, 0.72 cm, 0.77 cm, 0.85 cm, 1.80 cm and 1.98 cm respectively when compared to untreated control 1.98 cm.

Results obtained with DQ value of Dicofol (0.90) on radical growth of *F. bugnicourtii* indicated that it was an effective to reduce the fungus growth. The DQ value for Endosulfan (0.87), Quinalphos (0.85), Lambdacyhalothrin (0.53), Propargite (0.48), Fenpropathrin (0.46), Deltamathrin (0.44), Ethion (0.39) and Lime sulphur (0.04) were recorded. The maximum myceilial growth was observed in untreated control. The high significance level was observed for Dicofol, Quinalphos, Lambdacyhalothrin and Propargite and no significance was recorded for Lime sulphur on 3rd, 5th and 7th day observation at 0.05 %.

Table.1
Growth reduction of shot hole borer feeding fungus, *Fusarium bugnicourtii*
With recommended concentration of pesticides

Treatments	Day of Observation (cm/day)			DQ Value
	3rd day	5th day	7th day	
Control	1.0±0.08 [a]	1.45±0.07 [a]	1.98±0.03 [a]	0.00
Lime sulphur (1:40)	1.0±0.00 [a]	1.37±0.03 [a]	1.80±0.05 [b]	0.04
Ethion (750 ml/ha)	0.25±0.06 [c]	0.62±0.02 [b]	0.85.0.04 [cd]	0.39
Deltamethrin (500ml/ha)	0.27±0.02 [c]	0.47±0.03 [cd]	0.77±0.04 [de]	0.44
Fenpropathrin (200 ml/ha)	0.43±0.03 [b]	0.48±0.03 [c]	0.72±0.06 [e]	0.46
Propargite (500 ml/ha)	0.05±0.02 [d]	0.37±0.05 [d]	0.68±0.03 [e]	0.48
Lambdacyhalothrin (250 ml/ha)	0.17±0.08 [c]	0.42±0.17 [b]	0.60±0.21 [c]	0.53
Quinalphos (1000 ml/ha)	0.00±0.00 [d]	0.15±0.02 [e]	0.15±0.02 [f]	0.85
Endosulfan (1000 ml/ha)	0.00±0.00 [d]	0.00±0.00 [f]	0.13±0.06 [f]	0.87
Dicofol (1000 ml/ha)	0.00±0.00 [d]	0.08±0.04 [ef]	0.10±0.04 [f]	0.90

Values are Mean±SD of six replications. Mean in the same column followed by the same letter are not significantly differ according to Turkey's test (Significance at 0.05 % confidential level).

Application of these tested pesticides with recommended dose has been showed its detrimental effect on the growth of *F. bugnicourtii*. The results are similar with Simpson *et al.* (2001) they recorded the effect of fungicide Triazoles against *Fusarium sp.* Allen *et al.* (2004) reported the potential effect of Benomyl to control the *F. solani, F. oxysporum* and *F. Proliferatum* at 10µg/ml. The fungicides, Iprodione + Carbendazim, Benomyl and Carbendazim inhibit the fungal growth at 10 to 100 ppm (Etebarian, 1992). The application of Roundup (2.5, 5.0 and 10.0 µg/g soil) as seed treatment before sowing to infected soil also reduce the Wilt disease, where the reduction was increasing with increase the concentration (Hamed *et al.*, 2009).

Lambdacyhalothrin significantly reduced the fusarium ear rot caused by *F. verticollides* (Blandino *et al.*, 2008). Olajire and Oluyemisi (2009) reported that Karate insecticides at different concentration have been significantly reduced the mycelial growth of *A. flavus* and *F. monilliformes*. The plant infesting beetles can be control directly using contact or systematic pesticides (Cranham, 1966). There no significance was recorded in Lime sulphur at 1:40, which was similar to the application of Karate on *Fusarium oxysporum* at lower concentration (Olajire and Oluyemisi, 2009)

Several fungicides are used by planters in India for the control of blister blight, brown blight and other pathogenic moulds. Our findings have shown that the pesticides tested in this study caused the potential reduction in mycelial growth of *F. bugnicourtii.* The pesticides like Dicofol, Quinalphos, Propargite, Deltamethrin, Ethion and Lime sulphur are applying to control the red spider mites, tea mosquito bug, thrips, leaf roller and leaf folder, consequently Lambdacyhalothrin are used to control the shot hole borer population in tea. Therefore, the pesticide application is new approach to minimize the fungal pathogen *F. bugnicourtii*. The tested pesticides are qualified to control the shot hole borer *E. fornicatus* larval feeding pathogenic fungi *F. bugnicourtii*, consequently which reduce the chemical pollution by using other pesticides and fungicides in the same field. The pesticides reduce the fungi diseases, therefore, no need to apply fungicides at the time of insect and fungi present in the same field. Furthermore, the effect of these tested pesticides on fungal control in the field condition is needed.

References

1. Allen, T.W., S.A. Enebak and Carey, W.A. 2004. Evaluation of fungicides for control of Fusarium of longleaf pine seed. Crop Protec. 23: 979-982.
2. Blandino, M., A. Reyneri, F. Vanara, M. Rascale, M. Haidukowski and Saporiti. 2008. Effect of sowing date and insecticide application against European corn borer (Lepidoptera: Crambidae) on fumonisin contamination in maize kernels. Crop Protec. 27(11): 1432-1436.
3. Chen, Z and Chen, X. 1989. An analysis of the world tea pest fauna. J. Tea Sci. 9: 13- 22.
4. Cranham, J.E., 1966. Shot-hole borer (*Xyloborus fornicatus* Eichh) of tea in Ceylon. Chemical control and population dynamics. Bull. Entomol. Res. 56: 481.
5. Das, A.C., A. Chakravarty, P. Sukul and Mukherjee, D. 2003. Influence and persistence of phorate and carbofuran insecticides on microorganisms in rice field. Chemosphere. 53: 1033-1037.
6. Devadas, V., C. Kandasamy, N. Muraleedharan, K.V.S.N. Rao, K.G. Udayabanu and Varatharajan, R. 1989. Midcycle chemical control of *Xyleborous fornicatus* (Eichhoff) (Scolytidae: Coleoptera), the Shot hole borer of tea. J. Plantation Crops. 16: 179-183.
7. Etebarian, H.R., 1992. Studies of Fusarium wilt to tomato and its chemical control in Varamin area. Iranian J. Agri. Sci. 23: 1-14.
8. Hamed, E.R., M.H.F. AbdEl-Sayed and Heba Shehata, S. 2009. Suppression of fusarium wilt of watermelon by biological and chemical control. J. Appl. Sci. Res. 5(10): 1816-1825.
9. Kiran, K., S. Linguraju and Adiver, S. 2006. Effect of plant extract on *Sclerotium rolfsii*, the incident of stem rot of ground nut. J. Mycol. Pl. Pathol. 36: 77-79.
10. Muraleedharan, N., 1986. Studies on the Bio-ecology, damage potential and control of *Xyleborus fornicatus* (Scolytidae: Coleoptera) in south Indian tea plantations. In: Final report of ICAR Research Scheme. 8-9.
11. Muraleedharan, N., 1991. Pest Management in Tea. The United Planters Association of southern India, Tea Research Institute, Valparai 642 127, Coimbatore District. India. 130 pp.
12. Muraleedharan, N., 1997. Tips on shot hole Borer control. Newsletter UPASI Tea Research Institute. 7(2): 8-9.
13. Muraleedharan, N and Radhakrishnan, B. 1989. Effect of mid cycle chemical control of shot hole borer on tea yield. Planters' Chronicle. 84: 97-98.
14. Muraleedharan, N and Radhakrishnan, B. 1994. Chemical control of *Euwallacea fornicatus* (Eichhoff) (Scolytidae:Coleoptera) the shot hole borer. J. Plantation Crops. 22 (1): 47-49.
15. Olajire, D.M and Oluyemisi, F.B. 2009. In vitro effect of some pesticides on pathogenic fungi associated with legumes. Australian J. Crop Sci. 3(3): 173-177.
16. Parthiban, M and Muraleedharan, N. 1996. Biology of the shot hole borer *Euwallacea fornicatus* (Eich.) of tea. J. Plantation Crops. 24: 319-329.
17. Sanyal, D and Shrestha, A. 2008. Direct effect of herbicides on plant pathogen and disease development in various cropping systems. Weed Sci. 56: 155-160.
18. Selvasundaram, R., N. Muraleedharan and Sudhakaran, R. 1999. Midcycle control of shot hole borer with new insecticides. Newsletter UPASI Tea Research Institute. 9(1): 2-3.
19. Selvasundaram, R., N. Muraleedharan, R. Sudhakaran and Sudarmani, D.N.P. 2001. A new strategies for the management of shot hole borer of tea. Bull. UPASI Tea Research Foundation. 54: 82-87.
20. Simpson, D.R., G.E. Weston, J.A. Turner, P. Jennings and Nicholson, P. 2001. Differential control of head blight pathogens of wheat by fungicides and consequences for mycotoxin contamination of grain, European J. Plant Pathol. 107: 421-431.
21. Wight, W., 1959. Nomenclature and classification of the tea plants. Nature. 183: 1726- 1728.

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