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Effect of few Commercial Neem-Based Insecticides in the Management of Coffee Berry Borer, *Hypothenemus hampei* Ferrari (Coleoptera: Curculionidae)

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Abstract

The potential of neem based products are well exploited in agriculture for the effective management of pests. Insect pests are one of the major threats to coffee industry and coffee berry borer is one among them. Several pesticides have been screened and recommended since many years for the control of berry borer, Several plant based products are now available for management of pests. Present paper discusses efficiency of few commercial neem based insecticides in field as well as in laboratory to control berry borer. Jawan, Nimbicidin, Neem guard and Achook at 1% and 2% dosages were tested in lab as well as in field. The study concluded that the field efficacy of neem products is poor compared to laboratory trials. Field trial using neem oil on berry borer infestation showed that neem has a pronounced repellent action on the pest. Being a beverage the quality of coffee is of prime concern and the relevance of experiments with biopesticides which leaves no residue on the final product after application gains importance.

Keywords: *Azadirachta indica,* Biopesticides, Botanicals, Coffee berry borer, *Hypothenemus hampei*, Neem extract, Coleoptera, Curculionidae.

1. Introduction

Botanical insecticides have long been touted as attractive alternatives to synthetic chemical insecticides for pest management because botanicals reputedly pose little threat to the environment or to human health [1]. The active ingredients in neem influenced fecundity, fertility and adult emergence in *Bactrocera cucurbitae* and *Bactrocera dorsalis* [2]. The yellow, bitter oil has a garlic odour and contains approximately 2% of bitter principles including nimbidin, nimbrin, nimbinin, nimbidol and other related minor limonoid triterpense [3]. The active substances showed considerable potentialities against various pest of stored and filed crops, primarily through repellent, antifeedant, growth regulatory and toxic effects [4,5,6,7,8,9]. The antifeedant action of neem on the larvae of *Ostrinia nubilalis* (Hubner) [10] and on the diamond back moth, *Plutella xylostella* L. [11] is well documented.

Insect pests are severe threat to coffee world over which cause economic loss to industry. Berry borer attacks coffee in field and even at the time of storage. History of pesticides on berry borer management in India dates back to 1990s, when it was first noticed in Nilgiris of Tamil Nadu [12]. Persistence of pesticides in the ecosystem is dangerous to living organisms as well as to the coffee quality. As an exporting commodity it is necessary to meet the quality of coffee as best. Integrated Pest Management has been recommended for the management of berry borer [13]. IPM aims to reduce the reliance on chemicals by incorporating other components to suppress the pest.

2. Materials and Methods

2.1 Laboratory Trial:

In this study neem extracts available in the market such as Jawan, Nimbicidin, Neem guard and Achook each at 1.0% and 2% dosages were used. A control with water spray also was employed. All the treatments were replicated thrice with 15 fruits each. The spray solution was prepared in water adding wetting agent Sandovit 1ml/L. The insecticide solution was sprayed on ripe robusa (*Coffea canephora*) fruits collected from the field using a hand sprayer. Fruits kept as control was sprayed only with water. The tested fruits were drained off water and placed in injection vials of 5 ml capacity and a healthy female beetle was released in to each vial covered with wire mesh. Observations were recorded on the mortality of these insects on the 7th and 15th day.

2.2 Field Trial 1:

A field trial was conducted at a private estate using neem products used in the laboratory trial viz. Jawan, Nimbicidin, Neem guard and Achook at 1% and 2% dosages. All the treatments were replicated thrice with four berry borer infested plants each per replication After the spray application of these extracts 50 infested fruits were collected from each group on the 7th day and 15th day. The fruits were split open to record the live and dead beetles.

2.3 Field Trial 2:

Another bulk field trial was conducted to assess the repellent action of neem oil at 2% against the pest. An half acre plot with 220 plants of robusta cv. S. 274 were sprayed with neem oil and another plot of the same area with water as control twenty five plants each from these plots were marked randomly and the number of infested fruits and total fruits on four branches selected in each plant were counted before and after spray applications. Data were recorded on the 7th and 15th day after treatment.

3. Results

Table 1: represents the data obtained after screening different neem derivatives in the laboratory. On 15th day Jawan, a neem product at 1% gave 28.57% mortality. And when the concentration was doubled it affected 42.57% mortality. Nimbicidine gave 45.97% mortality at 2% level where as the effect was 32.75% on the 15th day at 1% concentration. Neem guard yet another neem product at 2% gave 52.21% mortality on the 15th day. Achook at 2% effected 54.28% mortality on the 15th day of treatment which is the highest mortality amongst all the extracts tested.

Table 1: Efficacy of Neem products (Laboratory)

Botanicals	Percentage mortality on	
	7th day	15th day
Jawan1%	24.84 (29.87)	28.57 (32.33)
Jawan2%	37.13 (37.52)	42.57 (40.74)
Nimbicidin1%	28.27 (32.14)	32.75 (34.94)
Nimbicidin2%	40.72 (39.64)	45.97 (42.65)
Neem guard 1%	42.70 (40.80)	47.13 (43.13)
Neem guard 2%	47.71 (43.68)	52.21 (46.26)
Achook 1%	41.57 (40.16)	49.69 (44.83)
Achook 2%	52.47 (46.43)	54.28 (47.47)
F test	**	**
C.D at 5%	**2.29**	**2.98**
C.D at1%	**3.16**	**4.10**

The data from the field trial with neem derivatives is shown in Table 2. Jawan at 2.0% gave 26.3% mortality on the 15th day whereas the lower concentration of 1% was effective only for 14.28%. Nimbicidine at 1 and 2% were equally effective both on 7th and 15th day. Neem guard at 2% produced 34.24% mortality and at 1% it effected only 32.25% mortality. Achook at 1% induced 29.6% death of beetles on the 15th day while at 2% it was 37. 84%.

Table 2: Efficacy of neem products in the field

Neem products	Percentage mortality on	
	7th day	15th day
Jawan1%	13.15 (21.30)	14.28 (22.22)
Jawan 2%	21.22 (27.42)	26.35 (30.92)
Nimbicidin 1%	28.18 (32.08)	28.35 (32.20)
Nimbicidin 2%	28.18 (32.08)	32.25 (34.63)
Neem guard 1%	30.12 (33.17)	34.24 (35.79)
Neem guard 2%	32.36 (34.70)	34.24 (35.79)
Achook 1%	27.35 (31.56)	29.46 (32.90)
Achook 2%	37.70 (37.88)	37.84 (37.94)
F test	**	**
C.D at 5%	**3.47**	**4.04**
C.D at1%	**4.78**	**5.57**

Table 3: Provides the data obtained from the field trial with neem oil. Neem oil application brought down the pest infestation considerably to a low level compared to the control. After the second application of neem oil the infestation level was only 3.9% where as in the adjacent plot kept as control recorded 18.10% infestation.

Table 3: Effect of neem oil on the control of berry borer infestation in the field.

Treatments	**First application Percent infestation**			**Second application Percent infestation**	
	Initial	**7th day**	**15th day**	**7th day**	**15th day**
Neem oil at 2%	2.31	2.06	1.93	2.27	3.09
Control	2.70	4.05	7.59	12.52	18.10
F test	**NS**	**NS**	**NS**	**NS**	**NS**

From the laboratory trial it is clear that neem products cause 57% mortality even on the 15th day after application. The efficacy of neem was found to be low in the field than in the laboratory in all the trials. Lack of efficacy may be due to the rapid degradation of the plant extracts in the exposed conditions. Bulk trial using neem on berry borer infestation showed that neem has a pronounced repellent action on the pest. It has been found that neem degrades fairly rapidly in sunlight and hence the most successful applications have been on the storage pests rather than field pests [14]. In the context of agricultural pest management, botanical insecticides are best suited for use in organic food production in industrialized countries but can play a much greater role in the production and post harvest protection of food in developing countries [1]. Being safe, cheap and renewable, neem extract can be effectively used as an excellent alternative to synthetic insecticides [2]. The effect of crude aqueous extracts of *Azadirachta indica* (neem) against the larvae of *Anopheles* mosquito was studied and found that exposure of the larvae to undiluted extracts of neem seed oil, leaf and bark resulted in100% mortality of the larvae [15].

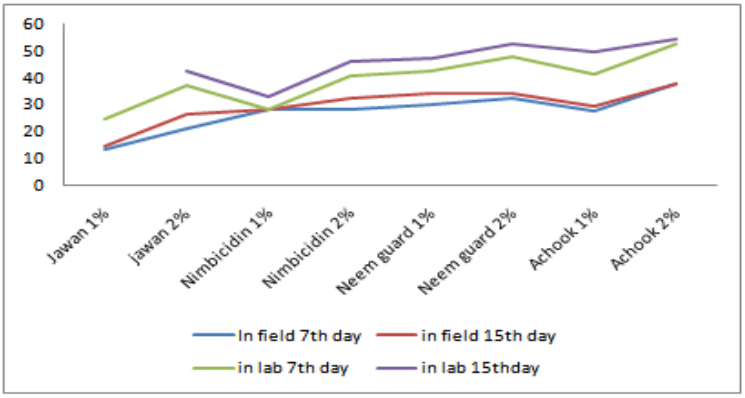

Fig 2: Efficacy of neem products in lab and field

4. Conclusion

It is concluded from the study that efficacy of neem products in field is very low due to rapid degradation in open conditions than in laboratory. It could be more effective in shaded plantations where less exposed and suitable microclimatic conditions occur.

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