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Evaluation of Botanicals against Rice Case Worm *Parapoynx stagnalis* Zeller. (Lepidoptera: Pyralidae)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Short Communication

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ABSTRACT

Rice, *Oryza sativa* L. is the staple food of two thirds of world population. Several insect pests are reported to cause damage to rice crop. Rice case worm, unlike other lepidopteran rice pests, have an aquatic larval period and hence depends on dissolved oxygen in the water drop it carries in its case, made from rice leaf. Application of insecticide spray, does not give much control of this pest. No botanicals are yet reported as effective against this pest. In the present study, six botanicals were tested on rice case worm under laboratory and field conditions. Of the six plants, *Anamirta cocculus* gave promising results at five percent concentration followed by *Glyricida sepium* under both field and laboratory conditions.

Keywords: Rice case worm; Anamirta cocculus; Glyricida sepium; single dose assay; multiple dose assay; caterpillars; larval stage; pest management.

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1. INTRODUCTION

Of the different larval caterpillars infesting rice, *P. stagnalis* is having a complete aquatic larval stage and uses gills for respiration. It respires from oxygen dissolved in a drop of water which it carries in the case made from rice leaves. Larvae remain inside the cases and float on water to move from one plant to another. It makes sharp right angle cut to rice leaves and make cases. It is difficult to see cases in rice field, but on slight shaking of plant all the cases will drop down to water. Rice in seedling stage is easily attacked by the pest and it is found more in fields with continuous standing water. It moves from one field to another through interconnecting drainage channels. If infestation is unnoticed, plants will be made into mere stumps and crop stand will be lost.

Under practical field conditions, it was found that insecticide spray alone cannot manage the pest. Hence farmers pour insecticides directly into the rice fields in larval infested areas. This increases the risk of pesticidal contamination in water bodies which must be addressed seriously. Environmental safety and safety to non-target organism are unique property of botanicals, which make them potent candidates in integrated pest management. Since they have diverse mode of action, they can well be exploited for resistance management too. However, the pesticidal properties of botanicals is still a maiden area and needs to be studies in detail. Potent toxic chemical when they are of biological origin are highly biodegradable. The bright side of this is the shorter residual effect on environment.

Some botanicals like neem, tobacco, chrysanthemum etc. are largely studied for their pesticidal properties. More than fifty per cent mortality of leaffolder larvae was recorded after direct exposure to neem azal 5% treatment as reported by Saikia and Parameswaran [1]. Vitex leaf extract at 5% concentration showed good efficacy against the hoppers and leaffolder under laboratory conditions in the study conducted by Mahapatra and Pannurasan [2]. There are other potent indigenous plants, which if we investigate will be proved very useful in some specific pest management. One such pest is rice case worm, due to its aquatic habitat, information regarding effective botanicals against rice case worm is lacking and hence the study was taken to evaluate the potential of locally available botanicals against rice case worm.

2. MATERIALS AND METHODS

Botanicals selected for the study under *in vitro* conditions are dried and powdered leaves of *Eupatorium odoratum*, *Ageratum conyzoides, Gliricidia sepium*, *Calotropis gigantea*, seeds of *Anamirta cocculus* and *Azadirachta indica* (neem cake) and *Madhuca longifolia* (mahua cake). All the botanicals are locally collected from area in and around RARS, Pattambi.

The collected botanicals were dried in hot air oven and powdered in a grinder and stored in air tight containers.

For conducting single dose assay, dried powder (50 g) was taken in small muslin cloth bags and immersed in 1000 l water for 24 hrs. Three replications were maintained and 10 third instar larva were released into each replication. Observations were taken on the behaviour and mortality of larvae and was taken till complete mortality was observed in any replication of any treatment. The results obtained were subjected to ANOVA using the software, WASP 1.0.

For conducting multiple dose bioassay, six different concentrations, 0.5,1, 2,3,4 and 5 per cent were taken and experiment was done as mentioned in single dose assay. The results were done probit analysis for getting effective dose.

3. RESULTS AND DISCUSSION

At one hour after release of live larvae, treatment with anamirta had mortality of 54.99 per cent which was statistically on par with glyricidia (52.78%) and calotropis (50.85%). LarvaNeem cake recorded larval mortality of only 9.46 per cent followed by ageratum (6.75%). Mahua and eupatorium were on par with no mortality. At 2 hours after treatment, anamirta had the highest mortality of 68.85 per cent which was significantly superior to all other botanicals and was followed by gliricidia and (66.15 %) calotropis (66.15%). In treatment with neem cake, mortality increased to 21.15 and in eupatorium treatment, it was 15.30 per cent only. The effect of ageratum and mahua was significantly lower than the other treatments and per cent mortality was only 6.75 per cent. At 3HAT, anamirta recorded first cent per cent mortality with cumulative mortality of 89.08 followed by glyricidia (83.25) and calotropis (71.57). Neem cake and eupatorium showed statistically similar mortality of 26.57 and 21.15 per cent, respectively.

Multiple dose assay of *A.cocculus* and *G. sepium* the botanicals with promising results from first experiment was done at varying concentrations of 0.5,1,2,3,4 and 5%. Three replications with ten larvae per replication was used for the study and probit analysis was done to find out LC50 and LC90. Mortality of larvae in Anamirta treatment varied from 3.33 to 56.67 at 1 HAT, and it varied from 10.00 to 66.67 at 2 HAT. At 3 HAT, 96.67 per cent mortality was observed in 5 per cent treated pots. The mortality varied from 20.00 to 86.67 in concentrations varying from 0.5 to 4 per cent. Probit analysis resulted in 4.29. 3.53 and 1.53 per cent concentration as LC 50 at 1, 2 and 3 HAT respectively. Corresponding LC90 values were 26.43,31.87 and 6.85 per cent respectively. Regarding, gliricidia treatment, mortality at 1 HAT varied from 3.33 to 53.33, at 2 HAT from 10.00 to 66.67 and at 3 HAT from 16.67 to 83.33 per cent respectively. LC50 at 1,2 and 3 HAT were 4.69,3.97 and 2.57 per cent respectively and the corresponding LC 90 values were 29.39,33.02 and 25.13 per cent.

Field evaluation was conducted at RARS Pattambi. One m^2 plots were selected and water level was maintained at 1 cm. 5 cloth bags each with 100 g was placed in the fields for 5 per cent concentration. Other treatments were Bt @ 400g/acre, cartap hydrochloride 7.5% + emamectin benzoate 0.25%@7.5 kg ai/ha, carbosulfan 6% G @1 kgai/ha, cartap hydrochloride 4% G@750 gai/ha. Mortality of larvae and percentage leaf damage was observed for three days after application. At 1DAT, anamirta and gliricidia treated plots recorded mortality of 41.12 and 39.88 per cent respectively which was statistically on par with cartap (43.73%) and carbosulfan (40.52%). The combination insecticide had the highest mortality of 89.48 followed by carbosulfan (40.52). Bt treated plots had mortality of 20.32 per cent. At 2 DAT, mortality of larvae in anamirta treated plots was 59.64 per cent which was statistically on par with carbosulfan (58.25). In Glyricidia treated plots, mortality was 53.42 per cent while in cartap treated plots mortality per cent recorded was 67.61. At 3 DAT, anamirta and carbosulfan recorded statistically similar mortality percent of 61.98 and 58.94 per cent respectively. On comparing the per cent damage of leaves infested, treatment with cartap hydrochloride 7.5% + emamectin benzoate 0.25% had the lowest damage of 6.17 per cent and in botanical treatment. anamirta had the lowest damage of 18.74 and gliricidia had 20.82 only. The effect of botanicals at 1 DAT was on par with that of carbosulfan (17.75) at 2 DAT, among the botanicals, anamirta had the lowest leaf damage of 20.70 and it was statistically on par with carbosulfan (19.35). Similar trend was observed at 3 DAT with 20.99 per cent leaf damage in anamirta treated plots and 20.09 in carbosulfan treated plots.

The study revealed the potential insecticidal effect of anamirta and glyricidia against larvae of rice case worm. The dried berries of *A. cocculus* have been used in India to stupefy fish as cited by Drury [3]. Agarwal et al., [4] reported picrotoxin, a nerve toxin from anamirta, which being a product of biosynthesis are liable to potential degradation. Jyothivel and Paul, [5] reported the piscicidal property of *A. cocculus*. The larvae of rice case worm use tracheal gills for respiration. The common mode of respiration might have attributed to the increased efficacy of anamirta against rice case worm. The mosquitocidal property of anamirta against *Aedes aegypti* was reported by Qadir, [6]. The evaluation of the insecticidal property of anamirta against agriculturally important pest is meagre, except a few. Paul et al. [7] recorded antifeedant effect of *A. cocculus* against *Spodoptera litura.* Mosquito repellent activity of gliricidia was reported by Nazli et al. [8] whereas Anju et al, [9] reported larvicidal effect of *A.cocculus* against *Aedes* and *Culex* species of mosquitoes. Jose and Sugatha [10] have reported anti feedant activity of methanol extract of *G. sepium* to the tune of 63 per cent against larvae of *Helicoverpa armigera.* The toxicity of aqueous and methanolic extracts of *G. sepium* against, the papaya mealybug *P. marginatus* has been reported by Kanedi [11].

4. CONCLUSION

Anamirta cocculus proved very effective in causing mortality to larvae of rice case worm followed by glyricidia. Both botanicals can be considered as underexploited botanicals as not much references are available about their studies against major agriculturally important pests. This study proved the potential of these two botanicals against rice case worm. When locally available potent botanicals are available, unscientific use of chemical insecticides can be reduced if timely research for development of biopesticides based on this crop can be done.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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