Management of *Noorda blitealis* Wlk. on *Moringa oleifera* Lam. using biorationals in the home gardens of Jaffna district, Sri Lanka

K.Sharjana[1], G. Mikunthan[2]

Department of Agricultural Biology, Faculty of Agriculture, University of Jaffna, Sri Lanka

Abstract— *Moringa oleifera Lam. (Moringaceae) is one of the main crops grown for pods and leaves in Jaffna home gardens in Sri Lanka. After the introduction of Periyakulam 1 (PKM 1) Moringa, a leaf eating caterpillar (Noorda blitealis Wlk.) turned out to be a serious pest causing damage to the leaves. Considering the severity of the damage, this study was carried out to find out the suitable biorationals to manage the pest in an eco-friendly method. Using the leaf disc dipping method biorationals such as 1% neem oil, 3% neem seed kernel extract and 2.5g/L neem leaf extract were used to determine the larval mortality. Consumption of the treated leaf area was measured to determine the larval antifeedant activity for 1% neem oil, 3% neem seed kernel extract, (2.5g/L) neem leaf extract, 15% (g/mL) garlic extract and 75% fermented cow urine and ash solution. Distilled water was used as control in both experiments. The experiments were carried out at a temperature of 28.9 ± 1.13°C and 73% relative humidity in complete randomized design. On the 6th day after treatment larval mortality in 1% neem oil, 3% neem seed kernel extract and 2.5g/L neem leaf extract were 85%, 83.33% and 70% respectively. After 24 hours larvae fed with 1% neem oil, 3% neem seed kernel extract, (2.5g/L) neem leaf extract, 15% (g/mL) garlic extract and 75% fermented cow urine and ash solution showed a larval antifeedant activity of 85.51%, 84.84%, 74.18%, 76.13% and 48.16% respectively.*

Keywords— Moringa oleifera, Noorda blitealis, Biorationals, Home garden.

I. INTRODUCTION

The multipurpose *Moringa oleifera* Lam. belongs to the Family Moringaceae which is a well-known tree grown in the home gardens in Northern Province of Sri Lanka. Leaves, pods, flowers, roots, seeds, bark and wood of the tree have nutritional, medicinal and industrial benefits [1]. Families in Jaffna districts consume the pods and leaves for their daily nutritional requirements. As the demand for the organic *Moringa* leaves has increased in local and foreign markets, many farmers have started to show interest in cultivating *Moringa*. An annual bush type, Periyakulam 1 (PKM 1) *Moringa* which was introduced from India is widely cultivated in resettled home gardens in the Jaffna district.

In recent years, PKM 1 *Moringa* crops were severely attacked by a seasonal pest *Noorda blitealis* Wlk. It is a leaf eating caterpillar which belongs to the Family Pyralidae. The larvae is creamy and sometimes ranges from pale green to cream or pink in colour, feeds on the *Moringa* leaves and in severe conditions they completely defoliate the plant. The affected leaves are skeletonized and appear as translucent sheets and finally dry up. In some conditions especially when the tree is pruned the larvae begin to feed on the stem pith and bark of the tree. In this condition they feed either on the corky content inside the stem heart or on the fleshy bark under the skin [2].

Since there is limited information regarding the pest, there were no effective management practices followed by farmers. Considering the economic status and the health issues of the resettled families and other *Moringa* growers in Jaffna district, this study was carried out to identify suitable techniques to manage the pest with low cost and easily available eco friendly biorationals.

II. MATERIAL AND METHOD

Experiments were conducted in the laboratory at the Faculty of Agriculture, University of Jaffna during February to April 2015. Preliminary tests were done for each experiment to choose the best suitable biorationals for the experiment. The larvae of *N.blitealis* were collected from the leaves, shoots and stems of *Moringa oleifera* in Jaffna district. They were reared in plastic rearing chambers at 28.9 ± 1.13°C and 73% relative humidity. Larvae were fed with fresh PKM 1 *Moringa* leaves for every 6 hours. At the final stage of larvae, they were transferred to another container of 1.5cm thickness of sterilized sandy soil for pupation. When the adults emerged, they were provided with 10% honey on cotton wool and PKM 1 annual *Moringa* leaves as oviposition site and as feed. After the eggs were laid, they were allowed to hatch.

2.1 Efficacy of biorationals on mortality of *N.blitealis*

The experiment was carried out with four treatments including the control. The concentration of each bio-rational used is shown in Table 1.

TABLE 1
BIORATIONALS AND THEIR CONCENTRATIONS USED FOR MORTALITY TEST

Treatment number	Name of the treatment	Concentration
T1	Neem (*Azadirachta indica*) oil	1 % (v/v)
T2	Neem seed kernel extract	3% (w/v)
T3	Neem leaf extract	2.5g/L
T4	Control (Distilled water)	

The concentrations suggested were based on the literature of corresponding botanical results against *N.blitealis* according to the literature and preliminary tests done in the laboratory [2,3]. For each treatment 20 larvae were used with three replicates. Fresh PKM 1 even aged *Moringa* leaf discs were dipped into respective biorationals and were allowed to dry at the room temperature for 30 minutes. Larvae were starved previously for three days and were allowed in rearing chambers. Treated leaf discs were placed in rearing chambers. The number of dead larvae was counted at 1^{st}, 2^{nd}, 3^{rd}, 4^{th}, 5^{th} and 6^{th} days after treatment.

2.2 Antifeedant activity of *N.blitealis* against biorationals

The antifeedant activity of *N.blitealis* larvae on five biorationals were determined by using leaf dipping method with 24 replicates. The biorationals used for this experiment is shown below in Table 2.

TABLE 2
BIORATIONALS AND THEIR CONCENTRATIONS USED FOR ANTIFEEDANT ACTIVITY TEST

Treatment number	Name of the treatment	Concentration
T1	Neem leaf extract	2.5g/L
T2	Neem oil	1% (v/v)
T3	Neem seed kernel extract	3% (w/v)
T4	Garlic extract	15%(g/mL)
T5	Three days fermented cow urine and ash solution	75%(v/v)
T6	Control (Distilled water)	

Larvae were fed with treated leaf discs in the container. After 24 hours the consumption of the leaf area by the larvae was measured by using grid method. The antifeedant activity was calculated using the following equation (1):

$$\text{Percentage of antifeedant activity} = \frac{C-T}{C+T} \times 100 \quad (1)$$

Where,

C - Leaf area consumed in the control

T - Leaf area consumed in the treatment

TABLE 3
CLASSIFICATION OF ANTIFEEDANT ACTIVITY

Activity level	Percentage
Strong activity	>80%
Moderate activity	61-80%
Weak activity	40-60%
Little activity	<40%

2.3 Statistical analysis

All experiments were designed according to complete randomization design (CRD) and the data were statistically analyzed using SPSS and SAS packages.

III. RESULTS AND DISCUSSION

3.1 Efficacy of biorationals on mortality of *N.blitealis*

The percentage of mortality of the three biorationals are shown in Table 4. The mortality percentage increased with time period. The percentage of mortality of all biorationals were significantly different from the control in all time periods. The highest mortality of 85% was observed in 1% (v/v) neem oil on the 6th day. Larval mortality percentages in 6th day of 3% (w/v) neem seed kernel extract and 2.5g/L neem leaf extract were 83.33% and 70% respectively. Similar results were reported by studies conducted in India [2], [3].

TABLE 4
EFFECT OF BIORATIONALS ON MORTALITY PERCENTAGE OF *N.blitealis* LARVA IN DIFFERENT INTERVAL

Treatment number	Treatment	Mortality percentage *					
		1st day	2nd day	3rd day	4th day	5th day	6th day
T1	Neem oil 1% (v/v)	3.33^{a}	15.00^{a}	38.33^{a}	51.66^{a}	80.00^{a}	85.00^{a}
T2	Neem seed kernel extract 3% (w/v)	1.66^{a}	15.00^{a}	35.00^{a}	50.00^{a}	76.66^{a}	83.33^{a}
T3	Neem leaf extract 2.5g/L	1.66^{a}	6.66^{ab}	15.00^{b}	40.00^{b}	68.33^{a}	70.00^{a}
T4	Control	0.00^{b}	0.00^{b}	0.00^{c}	0.00^{c}	0.00^{b}	0.00^{b}

**** All the values with the means of three replicates. Figures having same letters in a column indicate that the values are not significantly different at 0.05 α***

3.2 Antifeedant activity of *N.blitealis* against biorationals

The antifeedant activity of the larvae on five biorationals was significantly different from the control (Table 5). Strong antifeedant activity was observed on 1% (v/v) neem oil and 3% (w/v) neem seed kernel extract with an antifeedant activity of 85.51% and 84.84%. Larvae provided with 15% (v/v) garlic extract and 2.5g/L neem extract showed moderate antifeedant activity of 74.18% and 76.13% respectively. However larvae showed weak antifeedant activity of 48.16% on fermented cow urine and ash treated leaves.

Neem is the source of tetranortriterpenoid azadirachtin and other extractives which have potential value in insect control. It is responsible for both antifeedant and toxic effects in insect [4, 5, 6]. Thus the strong antifeedant activity of *N.blitealis* on 1% (v/v) neem oil and 3% (w/v) neem seed kernel extract is due to the Azadirachtin present in the neem. In this study garlic

extract showed a moderate antifeedant activity against *N.blitealis* larvae. According to Amonkar and Banerji, major compounds such as diallyl di-sulphide, diallyl tri-sulphide and diallyl sulfide in garlic are antagonistic to pests [7]. In Ethiopia farmers use fermented cow urine in the indigenous pest management; Banana fly *Drosophila melanogaster* and cowpea aphid *Aphis craccivora* were controlled by fermented cow urine[8].

TABLE 5
ANTIFEEDANT ACTIVITY (AA %) OF *N.blitealis* LARVA

Treatment number	Treatment	Mean	Antifeedant activity %	Antifeedant activity class
T1	Neem leaf extract 2.5g/L	1.37^{c}	76.13	Moderate activity
T2	Neem oil 1% (v/v)	0.79^{c}	85.51	Strong activity
T3	Neem seed kernel extract 3% (w/v)	0.83^{c}	84.84	Strong activity
T4	Garlic extract15% (g/mL)	1.50^{c}	74.18	Moderate activity
T5	Fermented cow urine and ash solution 75%(v/v)	3.54^{b}	48.16	Weak activity
T6	Control	10.12^{a}		

Figures having same letters in a column indicate that the values are not significantly different at 0.05 α

IV. CONCLUSION

Larvae fed with 1% neem oil, 3% neem seed kernel extract showed higher mortality percentages and strong antifeedant activity. In Jaffna home gardens compared to the chemical pesticides, neem based products are easily available and economic to suppress the pest population build-up. The demand of organic *Moringa* leaves in export sector has increased in recent years; therefore there is a need for good quality organic leaves in the market. Neem products such as 1% neem oil, 3% neem seed kernel extract and 2.5g/L neem leaf extract can be sprayed on the leaf surface to prevent leave damage by the larvae.

REFERENCES

[1] Broin, Melanie; de Saint Sauveur, Armelle. 2010. Growing and processing moringa leaves. Moringa Association of Ghana (MAG), Accra, Ghana, pp: 5-57

[2] Satti, A. A., Nasr, O. E. H., Fadelmula, A., and Ali, F. E. 2013. New record and preliminary bio-ecological studies of the leaf caterpillar, *Noorda blitealis* Walker (Lepidoptera: Pyralidae) in Sudan. *International Journal of Science & Nature*, 4(1): 57-62.

[3] Ragumoorthi, K. N. and Arumugam, R. 1992. Control of moringa fruitfly *Gitona* sp., and leaf caterpillar *Noorda blitealis* with insecticides and botanicals. *Indian Journal of Plant Protection*, *20*(1): 61-65.

[4] Mordue (Luntz), A.J., and Nisbet, A.L. 2000. Azadirachtin from neem tree Azadirachta indica: its action against insects. *Anais da Sociedade Entomológica do Brasil*, 29(4): 615-632.

[5] Ascher, K.R.S., 1993. Non conventional insecticidal effects of pesticides available from neem tree, *Azadirachta indica*. *Archives of Insect Biochemechistry and Physiology*, 22: 433-449.

[6] Isman, M.B., 1999. Neem and related natural Products. In F.R.Hall and J.J. Menn (eds.) Biopesticides: Use and Delivery. Humana Press, Totowa, NJ, pp: 139-153.

[7] Amonkar, S.V. and Banerji, A., 1971. Isolation and characterization of the larvicidal principle of garlic. *Science*, 174:1343-1344.

[8] Tesfaye, A. and Gautam, R.D., 2003. Traditional pest management practices and lesser exploited natural products in Ethiopia and India: *Indian Journal of Traditional Knowledge*, 2(2):189-201.