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Daizy SarmaDepartment of Entomology,
Assam Agricultural University,
Jorhat, Assam, India**Gaurav Kashyap**Department of Entomology,
Assam Agricultural University,
Jorhat, Assam, India**Inee Gogoi**Department of Entomology,
Assam Agricultural University,
Jorhat, Assam, India

Bioassay of some aqueous plant extracts against leaf and fruit scarring beetle, *Nodostoma subcostatum* (Jacoby)

Daizy Sarma, Gaurav Kashyap and Inee Gogoi

Abstract

Aqueous extracts of three medicinal plants viz., *Nyctanthes arbor-tristis* (Sewali), *Sapindus saponaria* (Monisal) and *Azadirachta indica* (Neem) was evaluated in the laboratory against leaf and fruit scarring beetle, *Nodostoma subcostatum* (Jacoby) to determine its effect on adult mortality. The direct spray method was used in the laboratory at concentrations of 2, 4 and 6 per cent. Among the three plant extracts *Sapindus saponaria* was more effective against *N. subcostatum* than other plant extract with the lowest LC₅₀ value (3.91) followed by *Azadirachta indica* (3.95) and *Nyctanthes arbor-tristis* (4.21). The present study reports that among three botanicals *Sapindus saponaria* has the most effective insecticidal activity to reduce the *N. subcostatum* followed by *Azadirachta indica* and *Nyctanthes arbor-tristis*. Thus, these plant extracts may be utilized as potential insecticides for the management of leaf and fruit scarring beetle of banana.

Keywords: Aqueous extract, management, *Nodostoma subcostatum*, *Nyctanthes arbor-tristis* (Sewali), *Sapindus saponaria* (Monisal), *Azadirachta indica* (Neem)

1. Introduction

Banana is one of the oldest tropical fruit cultivated by man from pre-historic times in India with great socio-economic significance. India ranks first in terms of area (830 ha) and production (29780 mt) with a productivity of 35.9 mt/ha^[8]. In India, major banana (*Musa* spp.) growing states are Maharashtra, Gujarat, Tamil Nadu, Andhra Pradesh, Assam, Bihar, Karnataka, Kerala, Orissa and West Bengal^[4]. The Assam-Myanmar-Thailand, Indo-China region is supposed to be the centre of origin of the banana. In Assam, banana is grown in an area of 47.6 ha with a production of (723.6 mt)^[1]. Production and productivity of banana is being challenged by various biotic and abiotic stresses. Among them, attack of insect pests is considered as one of the major problems in banana cultivation which affects both quality and quantity. Banana is attacked by more than 200 species of insect and non-insect pests^[13, 14]. In India, more than 15 insect pests are associated with the banana which include insects, mites, mollusks and birds^[12].

Singh and Basak detailed the major banana pests of India^[14, 3]. Among the insect pests, banana leaf and fruit scarring beetle *Nodostoma subcostatum* (Jacoby) (Coleoptera: Chrysomelidae) is considered as one of the most economically important pests in Eastern India which is reported to occur in West Bengal and some other parts of India also. The damage done by this beetle has tremendous influence on both quantity and quality of banana. The extent of damage inflicted upon banana crop by this pest has been reported to be around 80 per cent and in case of severe infestation, the percentage of infested orchards and intensity of the pest have been recorded upto 100 per cent^[9].

Among the different management practices to control this pests the use of chemical insecticides is common and found to be effective, but the excessive use of chemical pesticide creates many serious threats such as elimination of beneficial predators and insects, depletion in soil microbial diversity, resistance among the pests and diseases, deposition of toxic residues, etc.^[6]. In recent years, attempts are being made to identify plants having insecticidal property with a view to find out suitable alternatives to replace hazardous synthetic pesticides utilized in large scale in India^[15]. The natural plant products derived from plants effectively meet this criterion and have enormous potential to influence modern agro-chemical research. Botanicals degrade more rapidly than most chemical pesticides and are therefore, considered

Correspondence

Daizy SarmaDepartment of Entomology,
Assam Agricultural University,
Jorhat, Assam, India

Relatively environment friendly. Bioactive compounds of plant origin are considered as ecologically safe alternative and the plant extracts with complex mixtures of compounds have been widely investigated for their insecticidal, repellent, ovicidal, antifeedant and antiovipositional properties [2]. Insecticidal potential of crude, chemically unrefined plant extracts, containing mixtures of bioactive plant compounds rather than the use of the pure individual compounds is being emphasized. Thus, the present study was carried out to evaluate the efficacy of plant extract against the leaf and fruit scarring beetle of banana.

2. Materials and Methods

2.1 Maintenance of *N. subcostatum* culture

The experiment was conducted in the month of August, 2018 in the laboratory of Department of Entomology, Assam Agricultural University, Jorhat. The leaf scarring beetles were collected from Experimental Farm of Assam Agricultural University, Jorhat. A culture of leaf and fruit scarring beetles were maintained in the laboratory condition. Adults were transferred onto fresh banana leaves (5 cm²) placed on petri plates. That rearing plates were kept under controlled conditions where temperature was maintained at 25±2 °C and 70±5 percent relative humidity [7]. Withered leaves were replaced with new ones at three days interval following the method of Handique *et al.*, 2015 with slight modification.

2.2 Collection and preparation of extract

The matured leaves of *Nyctanthes arbor-tristis* (Sewali), *Sapindus saponaria* (Monisal) and *Azadirachta indica* (Neem) were collected from different location of Jorhat, Assam for preparation of extract. Then the leaves were shade dried and powdered by using an electric grinder and passed through a 20 mesh sieve and kept in polypropylene bag. Different quantities (20, 40 and 60g) of the *Nyctanthes arbor-tristis*, *Sapindus saponaria* and *Azadirachta indica* powder were weighed and put separately into plastic containers and mixed with 1 L of distilled water to make 2, 4 and 6% W/V concentration respectively and kept for 24 h. Each

concentration of the crude aqueous extracts were separated by using double folded muslin cloth.

2.3 Effect of aqueous extracts against adult *N. subcostatum*

To determine the efficacy of aqueous extract in laboratory culture the adult mortality was recorded for which, 10 number of healthy *N. subcostatum* were released onto healthy detached matured banana leaves. A final count of them were taken after 4 hours of proper settlement. Each concentration were sprayed on both surfaces of the leaf. The number of live insects were counted at 24, 48 and 72 hr after treatments. Each treatment was replicated five times. From the observed adult mortality corrected per cent mortality was calculated using Abbott's formula [10].

3. Results and Discussion

The present study revealed that the aqueous extracts of three plants evaluated against *N. subcostatum* under laboratory condition showed the lethal effect. From the average mortality percentage we observed that the extracts caused significant mortality on the target insect and it was seen from the bioassay that the toxic effect of aqueous extract of *Nyctanthes arbor-tristis*, *Sapindus saponaria* and *Azadirachta indica* was proportional to both time and concentration. When the insect exposed to different concentration (2, 4 and 6% W/V), it was observed that they exhibit different percentage of mortality at different time interval (24, 48 and 72hr). The result revealed that, among the three plant extract *Sapindus saponaria* was more effective against *N. subcostatum* than the other two plant extracts. It gives 100% mortality at 6% concentration after 72 hours, followed by *Azadirachta indica* (98.00±0.29) and *Nyctanthes arbor-tristis* (98.00±0.38) (Table 1). In present investigation, the efficacy of *S. saponaria* was more than the other plant extracts. According to Eddaya *et al.* there is biological activity of *S. saponaria* against *Thysanoplusia* (Semilooper) which was proportional to its concentration [5]. Strong insecticidal property of this plant extract may be due to presence of saponin in the plant which is known to cause mortality to insects [16].

Table 1: Toxicity of aqueous extracts of *Nyctanthes arbor-tristis*, *Sapindus saponaria* and *Azadirachta indica* on adults of *Nodostoma subcostatum* compared to control

| Treatment | Concentration (%) | Adult mortality(%) after (Mean* ± SE) | | |
|---------------------------------|-------------------|---------------------------------------|-------------|-------------|
| | | 24 hr | 48 hr | 72 hr |
| <i>Nyctanthes arbor-tristis</i> | 2 | 26.00± 0.34 | 36.00± 0.38 | 54.00±0.38 |
| | 4 | 50.00± 0.34 | 68.00± 0.38 | 80.00±0.38 |
| | 6 | 82.00± 0.34 | 92.00± 0.38 | 98.00±0.38 |
| <i>Sapindus saponaria</i> | 2 | 32.00± 0.40 | 60.00±0.36 | 82.00±0.20 |
| | 4 | 60.00± 0.40 | 84.00±0.36 | 90.00±0.20 |
| | 6 | 82.00± 0.40 | 96.00±0.36 | 100.00±0.20 |
| <i>Azadirachta indica</i> | 2 | 30.00±0.36 | 50.00±0.35 | 76.00±0.29 |
| | 4 | 56.00±0.36 | 72.00±0.35 | 86.00±0.29 |
| | 6 | 82.00±0.36 | 94.00±0.35 | 98.00±0.29 |
| Control | | 0.0±0.00 | 0.0±0.00 | 2.00±0.50 |

*Mean of five observation

Table 2: Insecticidal toxicity of *Nyctanthes arbor-tristis*, *Sapindus saponaria* and *Azadirachta indica* on adults of *Nodostoma subcostatum*

| Treatment | LC ₅₀ (µg/l) | (Fiducial limits 95% confidence) | |
|---------------------------------|-------------------------|----------------------------------|-------|
| | | Lower | Upper |
| <i>Nyctanthes arbor-tristis</i> | 4.21 | 3.89 | 4.60 |
| <i>Sapindus saponaria</i> | 3.91 | 3.58 | 4.29 |
| <i>Azadirachta indica</i> | 3.95 | 3.63 | 4.33 |

The above findings (Table 2) revealed that the insecticidal toxicity of *Nyctanthes arbor-tristis*, *Sapindus saponaria* and *Azadirachta indica* on adults of *Nodostoma subcostatum* after 24 hours. From the Table.2 the lowest LC₅₀ value was found in *Sapindus saponaria* i.e. 3.91 followed by *Azadirachta indica* (3.95) and *Nyctanthes arbor-tristis* (4.21). Thus the extracts of *S. saponaria* has the more toxic effect followed by *A. indica* and *N. arbor-tristis*. The earlier work of Sharma *et al.* against *P. xylostella* revealed the insecticidal activity of

Spilanthol^[11]. Handique *et al.* also showed the acaricidal activity of *Sapindus mukorossi* against *Oligonychus coffea*^[7].

4. Conclusion

The present study revealed that among three botanicals *Sapindus saponaria* has the most effective insecticidal activity to reduce the *N. subcostatum* followed by *Azadirachta indica* and *Nyctanthes arbor-tristis*. Thus, there is the possibility of developing a source of alternate insecticidal agent for sustainable management of insect pests of the banana. Thus, this may be a way to reduce the toxic effect of chemical by incorporating the plant extracts which are found to be less hazardous and are the important component of the present ecofriendly environment.

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6. References

1. Anonymous. Indian Horticulture Database, 2011. www.nhb.gov.in
2. Arivoli S, Tennyson S. Antifeedant activity, developmental indices and morphogenetic variations of plant extracts against *Spodoptera litura* (Fab) (Lepidoptera: Noctuidae). J Entomol. Zool. Studies. 2013; 1:87-96.
3. Basak G, Banerjee A, Bandyopadhyay B. Studies on some bio-ecological aspects and varietal preference of banana aphid, *Pentalonia nigronervosa* Coquerel (Hemiptera: Aphididae). Journal Crop and Weed. 2015. 11(2):181-186.
4. Bauri FK, De A Misra DK, Bandyopadhyay B, Debnath S, Sarkar SK, Avani P. Improving yield and quality of banana cv. Martaman (Musa AAB, Si lk) through micronutrient and growth regulator application. Journal of Crop Weed. 2014; 10:316-19.
5. Eddaya T, Boughdad A, Sibille E, Chaimbault P, Zaid A, Amechrouq A. Biological activity of *Sapindus mukorossi* Gaerten (Sapindaceae) aqueous extract against *Thysanoplusia orichalcea* (Lepidoptera: Noctuidae). Ind. Crops Prod. 2013; 50:325-32
6. Gupta AK, Suthar J, Muralikrishnan S, Patel K, Chauhan V, Koradia D, Rawal A, Pastakia A, Shukla S, Chand VS. Farmers Innovations for Sustainable Resource Management and Conservation of Biological Diversity. Published in the proceedings of the International Symposium on Food Security & Innovations: Successes and Lessons Learned at University of Hohenheim (Eds. Franz Heidhues/Andrea Fadani), Frankfurt, Berlin Peter Lang, 1997, 97-112.
7. Handique G, Barua A, Bora FR, Roy S. Potential of *Nyctanthes arbor-tristis* L., *Phylogacanthus thyrsoformis* Nees and *Sapindus mukorossi* L. as novel acaricides of natural origin. Res. On crops. 2015; 16(3):590-597
8. Mishra H, Bora DK, Bhattacharyya B, Das D, Baruah K. Population dynamics of banana leaf and fruit scarring beetle, *nodostoma subcostatum jacobyni* in assam. Indian Journal of Entomology. 2015; 77(3):226-229
9. Roy RS, Sharma C. Disease and pest of banana and their control. Indian Journal of Horticulture. 1952; 9(4):39-52.
10. Roy S, Rahman A, Phukan AK, Muraleedharan NN. *Terminalia chebula* Retz. (Combretaceae): source of a

- botanical acaricide against *Oligonychus coffeae* Nietner (Acarina: Tetranychidae). Int. J Acarol. 2014; 42:138-44.
11. Sharma A, Kumar V, Rattan RS, Kumar N, Singh B. Insecticidal Toxicity of Spilanthol from *Spilanthus acmella* Murr. Against *Plutella xylostella* L. American Journal of Plant Sciences. 2012; 3:1568-1572
12. Shukla A. Insect pests of banana with special reference to weevil borers. International Journal of Plant Protection. 2010; 3(2):387-393.
13. Simmonds NW. Pests. In Bananas. 2nd Ed. Longman. London, 1966, 334-360.
14. Singh JP. Insect pests of bananas. Allahabad Farmer. 1970; 44(5):295-303.
15. Tennyson S, Ravindran KJ, Arivoli S. Screening of 25 plant extracts for larvicidal activity against *Culex quinquefasciatus* Say (Diptera: Culicidae). Asian Pac. J Trop. Biomed. Trop. Sao Paulo. 2012; 54:273-80.
16. Upadhyay A, Singh DK. Pharmacological effects of *Sapindus mukorossi*. Rev. Inst. Med. Trop. Sao Paulo. 2012; 54:273-80.