

Assessment of Yield Loss Due to Aleyrodid Flies *Singhiella pallida* (Singh) and *Aleurocanthus rugosa* Singh and Control of *Singhiella pallida* (Singh) in Betelvine (*Piper betle* L.) Ecosystem

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Abstract

Two field trials were conducted to assess the actual yield loss in betelvine due to the attack of two aleyrodid flies, betelvine whitefly, *Singhiella pallida* (Singh) and blackfly, *Aleurocanthus rugosa* Singh and to evaluate the bioefficacy of some botanical insecticides against aleyrodid flies with an aim to search for probable alternative to conventional insecticides. The results reveal that there was a reduction of 13.39% in leaf yield when mean population of flies was 43.4 per vine. Over all monetary loss was 29.63%. The application of CAL-MB (0.15%) was found to be more effective in the management of betelvine whitefly, *Singhiella pallida* (Singh) than the recommended synthetic dichlorvos (0.05%). Neem oil (0.3%) and CAL Paste (0.3%) were also effective which were at par with dichlorvos (0.05%).

Key words : *Singhiella pallida*, *Aleurocanthus rugosa*, *Piper betle*, **Crop loss, Control.**

Betelvine (*Piper betle* L.) is a perennial dioecious evergreen creeper grown in shady condition with high humidity. It belongs to the order Piperales and family Piperaceae and is probably a native of Malaysia (1). Betelvine is next to black pepper (*Piper nigrum* L.) in its economic importance among the members of the family Piperaceae (2). India has a long ancient history of betelvine culture as mentioned in *Atharva Veda* (3). The crop is now commercially cultivated in India, Bangladesh, Sri Lanka and to a limited extent in some other Asian countries for its leaves mainly used for chewing (4). In India, it is cultivated over 50,000 ha as cash crop (5). West Bengal accounts for nearly 40% of the production of the country covering an area of 19,400 ha (6). This crop has great market value both inside and outside India with a trade worth of Rs 7,000 million every year (2) and leaves are exported to countries like Pakistan, Bangladesh, Indonesia, Malaysia, Myanmar and Thailand (4). Besides being a masticatory, it is also used in Indian system of medicine as cure for many diseases and disorders (7, 8). Traditionally, the roots of *P. betle* were said to be used as a contraceptive by women (9). Research in recent years is exploring the

scientific basis of the traditional uses of this plant and discovering new molecules in betelvine to be used as drug. It has been shown that extract of betel leaves has antioxidant activity (10, 11), hypolipidemic activity (12), antibacterial activity (13—15), anti-carcinogenic properties due to presence of chavicol and hydroxy-chavico (4, 16).

Betelvine is one of the least land-intensive and highly labor-intensive crop. Cultivation of betelvine on a plot of 15 decimals (0.15 acre) of land can sustain a family of five members (17) and can generate employment opportunity for five agricultural workers throughout the year (18). In West Bengal, it is cultivated under artificially erected structure, known as *boroj* which is a kind of hut with its sides and roof made of jute stick or straw on a light frame work of bamboos. It provides shade and high humid environment to the crop needed for a good harvest. In spite of the tremendous potentiality of the crop, cultivation of betelvine is highly risky and returns are uncertain because of its vulnerability to several pests and diseases, only aggravated by the moist and humid conditions inside the plantation. The pest scenario too, is changing due to rapid change in management

Table 1. Incidence of white fly and black fly/vine in untreated plots.

Month	Aug		Sep		Oct		Nov		Dec		Average
Fortnight	I	II	I	II	I	II	I	II	I	II	
Population vine	7.9	22.2	38.1	42.3	62.7	57.8	62.3	56.5	48.7	35.5	43.4

practices. A good number of hemipteran insect pests occur in betelvine ecosystem which causes substantial damage (2). Among these, two aleyrodid flies (Hemiptera), betelvine whitefly, *Singhiella (Dialeurodes) pallida* (Singh) and blackfly, *Aleurocanthus rugosa* Singh are major pests which occur sympatrically in the betelvine conservatories in West Bengal causing severe damage to the foliage (19). The insecticides like malathion (0.05%), endosulphan (0.05%) and dichlorvos (0.05%) are extensively sprayed on the leaves to control these pests (20, 21). The standard practice of synthetic chemical pesticides application against betelvine pests is risk prone in terms residual toxicity on betel leaves causing health hazard (22). The current studies were undertaken to assess the actual crop loss due to the attack of two aleyrodid flies betelvine whitefly, *Singhiella pallida* (Singh) and blackfly, *Aleurocanthus rugosa* Singh and to evaluate the bioefficacy of some botanical insecticides against *Singhiella pallida* with an aim to search for probable alternative to conventional insecticides.

Methods

Assessment of Yield Loss due to Betelvine Whitefly and Blackfly

A trial was conducted to estimate the crop loss due to the infestation of two sympatric aleyrodid flies in betelvine. The experiment was carried out in a closed conservatory (*boraj*) inside which betelvines are grown in the Indo-Gangetic plains, located at Research Farm of Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal during 2004-2005.

The variety used was Simurali Deshi (Bangla type). Paired plot technique with 16 replications were followed for the study. In each replication both treated and untreated plots were maintained. Two adjacent rows containing 200–225 vines were taken as unit experimental plot. Each plot was separated by a buf-

fer row. The treatments were applied in August. Imidachloprid (0.003%) was sprayed at an interval of one and half month during the period of study to keep the treated plots free from fly infestation. The adult fly populations were recorded in the untreated plots at fortnightly intervals from August–December 2004. Direct counts of adult flies were taken from ten randomly selected vines from each plot.

The data on yield (number of leaves) were taken from both the treated and untreated plots in December and compared; the monetary loss was calculated on the basis of market price of betel leaves.

Control of Aleyrodid Flies with Botanicals

For insecticidal trial, three adjacent rows of betelvine (variety Simurali Bhabna) containing about 300 vines were taken as unit experimental plot. It was conducted in a completely randomized design with three replications to test the efficacies of three commercial botanicals each in two concentrations: CAL-MB (0.10%, 0.15%), neem oil (Tanida-7) 0.20%, 0.30%), CAL paste (0.20%, 0.30%). Dichlorvos (nuvan 76 EC) (0.05%) was kept as recommended check. Insecticides were applied three times with a compressed air hand held sprayer at 15 days intervals. Triton AD at 1 ml/liter was mixed with spray liquid; water was sprayed with triton AD in untreated control.

Botanical pesticides CAL-MB and CAL-paste were supplied by Camson Biotechnologies Limited, Bangalore and Neem oil from Tanida Products, Kolkata. Compositions of CAL-MB are *Andropogon nardus* ((30%), *Annona reticulate* (20%), Fernesol (10%), Fatty acid (20%) and dissolving agent (15%). Compositions of CAL paste are *Pongamia pinnata* oil (25%), *Jatropha curcos* oil (25%), *Azadiracta indica* oil (25%), *Curcuma longa* oil (10%) and dissolving agent (10%).

The effects of treatments on the whitefly were

Table 2. Assessment of yield loss in betelvine due to white fly and black fly (5 months period, August to December).

	Leaf yield (lakh/ha)	Per-cent reduction in leaf yields	Ave- rage mar- ket rate (1,000 leaves) (Rs)	Total return (Rs)	Loss (mone- tary)
Treated	7.184		80.00	57472	
Untreated	6.222	13.39%	60.00	40443	29.63%
Calculated					
<i>t</i> value	14.11**				
Table <i>t</i> value					
(<i>P</i> = 0.01)	2.947				

determined by counting the number of nymphs/puparia found on leaves at 15 days after third spray. Five vines from each plot were selected randomly and three leaves from each vine, of which one each from the upper, middle and lower sections of the vine were taken to the laboratory to see the number of whitefly nymphs/puparia under stereo-binocular microscope. The data were statistically analyzed.

Results and Discussion

Assessment of Yield Loss due to Betelvine Whitefly and Blackfly

Results revealed that the unprotected plots recorded incidences of white fly and black fly ranging from 7.9 to 62.7 per vine during the period of study with a mean of 43.4 per vine (Table 1). The protected plots harboured negligible number of flies. The yield data show that there was a reduction of 13.39% marketable leaf yield in unprotected plot (Table 2). In the infested plant, the larval skins are attached on the lower surface of the leaves making the unsuitable for marketing. At the same time, the quality of leaves in unprotected plots was also inferior (smaller sized, bad texture and loss of lustre) which fetched lower price (Rs 60/-per 1,000 leaves) than the leaves from protected plot (Rs 80/-per 1,000 leaves). Over all monetary loss due to pest damage was Rs 17,029/ ha for five months. Though apparent reduction in the yield of marketable leaf due to the fly complex was not re-

Table 3. Mean numbers of white fly nymph/puparium per 15 leaves in insecticide-treated and control plots (average of three replications). Figures in the parentheses are log transformed values.

Treatments	Mean white fly nymph/pupa	Percent reduction over control
CAL-MB (0.1%)	128.66 (2.106)	63.82
CAL-MB (0.15%)	68.66 (1.834)	80.69
Neem oil (0.2%)	178.66 (2.251)	49.76
Neem oil (0.3%)	148.33 (2.170)	58.29
CAL paste (0.2%)	191.66 (2.282)	46.11
CAL paste (0.3%)	140.00 (2.142)	60.63
Dichlorvos (0.05%) (recommended)	136.33 (2.133)	61.67
Untreated control	355.66 (2.551)	
CD at 5% level	0.071	

markable, ultimate monetary loss was substantial accounting 29.63%. These pests generally occur regularly throughout the year in West Bengal except in winter months when their activities are low and (unpublished data). So these aleyrodid fly complex can be considered as important pests of betelvine.

Control of Betelvine Whitefly with Botanicals

The results show that CAL-MB (0.15%) was superior to all the treatments and recorded highest reduction (80.69%) of whitefly population over the control treatment while the recommended synthetic dichlorvos (0.05%) recorded a reduction of only 61.67% (Table 3). Neem oil (0.3%) and CAL paste (0.3%) were also effective which were statistically at par with recommended synthetic dichlorvos (0.05%). So the tested botanicals if applied in proper doses, can suppress the whitefly population even much more effectively than the recommended chemical insecticide.

Due to masticatory nature of the consumption of betel leaf, control of insect pests by synthetic chemical pesticides cause health hazard (22). The cost of pesticides and a great demand for residue free produce in domestic and international markets necessitates the avoidance of chemical pesticides. Moreover, it may cause imbalance to the delicate betelvine ecosystem thereby development of pesticide resistance, vast destruction of beneficial organisms, rapid

resurgence of target pest population and uncontrolled outbreak of secondary pests may occur. The suitable botanical insecticides if used for the key pests of betelvine, can more effectively substitute the use of synthetic chemicals.

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