



Neem oil based formulation is effective for the management of whitefly, *Aleurocanthus arecae* David & Manjunatha and wax scale, *Chrysomphalus aonidum* (Linnaeus) on arecanut

VINOD KUMAR DUBEY, B. K. SHIVANNA and C. M. KALLESHWARASWAMY*

Department of Agricultural Entomology, College of Agriculture, Navile, University of Agricultural and Horticultural Science, Shivamogga- 577 204, Karnataka, India

*E-mail: kalleshwaraswamycm@uahs.edu.in

ABSTRACT: The efficacy of different insecticides were evaluated against whitefly, *Aleurocanthus arecae* David & Manjunatha (Hemiptera: Aleyrodidae) and wax Scale, *Chrysomphalus aonidum* (Linnaeus) (Hemiptera: Diaspididae) in arecanut during 2019-2020 at two different locations. Among the different insecticides tested for the management of *A. arecae* and *C. aonidum*, the neem oil based formulation 10,000ppm @ 2ml/l showed maximum per cent reduction against the whiteflies (72.92) and wax scales (81.60). This treatment was followed by chlorpyrifos 20 EC (62.09 %) for whiteflies and dimethoate 30 EC (66.51 %) for wax scales compared to other treatments. Considering that arecanut palms require high insecticidal solution to drench the foliage, inflorescence/nuts, the results provide important insight to use this economically viable insecticide to avoid negative environmental impact.

Keywords: *Areca catechu*, insecticide, neem oil, sucking pests

INTRODUCTION

Arecanut is one of the major commercial plantation crops in India. Arecanut is majorly cultivated in the plains as well as in the hills of Western Ghats and North Eastern part of India. In India, arecanut is extensively grown in states like Karnataka, Kerala, Assam and West Bengal. Among all the arecanut growing states, Karnataka alone produces 70.33 per cent of arecanut (6.00 lakh tonnes) from an area of 2.79 lakh hectare (Anonymous, 2019). Among the districts of the Karnataka state, Shivamogga stands first in both area (21.06%) and production (21.30%) followed by Davanagere, Dakshina Kannada, Tumkur, Chikkamagaluru and Chitradurga. These districts together account 83.63 per cent of the total area and 82.10 per cent of the total production of arecanut in the state (Anonymous, 2018).

The arecanut crop is infested by more than 102 insect and non-insect pests (Nair and Daniel, 1982). Among the pests, white grub, *Leucopholis lepidophora* Blanchard (Scarabaeidae: Coleoptera), spindle bug, *Carvalhoia arecae* Miller and China (Miridae: Heteroptera), inflorescence caterpillar, *Tirathaba mundella* Walker (Pyralidae: Lepidoptera) and mite, *Raoiella indica* Hirst (Tenuipalpidae: Acarina) are important in causing economic damage (Nair and Menon, 1963; Kalleshwaraswamy *et al.*, 2015 ; Kalleshwaraswamy *et al.*, 2016). Different species of wax scales, soft scales, aphids, mealybugs and whiteflies infest the under surface of the arecanut leaves. Honeydew secreted by these insect pests leads to the formation of the sooty mould

fungus, which interfere with the photosynthetic activity of the crop. These insects suck the sap with the help of stylets from the leaves, inflorescence, nuts and causing the severe economic damage in arecanut plantation. If the infestation will be severe in young seedlings, results in blotching and drying of leaves (Daniel, 2003). Scales, mealybugs, whiteflies and aphids occupy important places with possibilities of becoming severe pests of plantation crops. The most important sternorrhynchan insect pests in arecanut are wax scales *Chrysomphalus aonidum* (Linnaeus) and whiteflies *Aleurocanthus arecae* David & Manjunatha. These insects are becoming the major pests in arecanut growing areas of Karnataka causing severe economic losses to the farmers. In order to find the better insecticide for the management of these pests, field experiments were conducted and the results are reported here under.

MATERIALS AND METHODS

Experiment was conducted to evaluate the different insecticides against whitefly, *A. arecae* and wax scale, *C. aonidum* on arecanut. The field experiment was laid out in a Randomized Complete Block Design (RCBD) in two different locations viz., College of Agriculture, Shivamogga (13°54' N latitude and 75°40' E, 611 msl) and Holehatti village (13°53' N latitude and longitude of 75°42' E ;518 msl) near Shivamogga in farmer fields. Twenty-four labeled infested palms were randomly selected in each plot and eight treatments comprising with different insecticides were applied with three

Table 1. Efficacy of selected insecticides for the management of whitefly, *Aleurocanthus arecae* David & Manjunatha (Pooled data of 2 sprays)

Treatment	Mean number of whiteflies/5cm ² leaf area				Mean	Reduction over untreated control (%)
	1 DBS	7 DAS	14 DAS	21 DAS		
T1 Dimethoate 30% EC @ 1.7 ml/l	27.33 (5.27)	18.83 (4.39) ^c	13.50 (3.73) ^{cd}	10.67 (3.34) ^c	14.33 (3.84) ^{cd}	46.26
T2 Imidacloprid 17.8% SL @ 0.5 ml/l	25.33 (5.06)	19.67 (4.48) ^{bc}	15.00 (3.93) ^c	11.67 (3.48) ^c	15.44 (3.99) ^c	42.10
T3 Spinosad 45% SC @ 0.5 ml/l	25.17 (5.04)	19.50 (4.46) ^{bc}	15.50 (3.99) ^c	11.83 (3.50) ^c	15.61 (4.00) ^c	43.15
T4 Buprofezin 25% SC @ 1.0 ml/l	24.83 (5.01)	17.16 (4.19) ^{cd}	11.00 (3.38) ^{de}	7.50 (2.79) ^d	11.89 (3.51) ^{de}	55.41
T5 Chlorpyrifos 20% EC @ 2.0 ml/l	23.33 (4.87)	14.83 (3.89) ^{de}	9.33 (3.12) ^{ef}	6.16 (2.57) ^d	10.11 (3.24) ^e	62.09
T6 Neem oil based formulation 10,000ppm @ 2.0 ml/l	26.00 (5.14)	13.16 (3.67) ^e	7.00 (2.71) ^f	1.50 (1.40) ^e	7.22 (2.71) ^f	72.92
T7 Sulphited fish oil @ 4.0 ml/l	25.83 (5.12)	23.50 (4.89) ^{ab}	21.33 (4.67) ^b	19.50 (4.46) ^b	21.44 (4.67) ^b	19.61
T8 Untreated control	25.67 (5.10)	26.67 (5.19) ^a	26.83 (5.21) ^a	26.50 (5.19) ^a	26.67 (5.20) ^a	-
F value	NS	*	*	*	*	-
SEM±	0.15	0.16	0.14	0.13	0.15	-
CD(P=0.05)	0.46	0.48	0.42	0.41	0.45	-
CV%	5.22	6.32	6.33	7.05	6.70	-

*Significant at (P≤0.05); NS-Non significant; Figures within the parentheses indicates $\sqrt{x+0.5}$ transformed values; Mean followed by the same letter do not differ significantly by DMRT (P=0.05); DBS= Day before spray; DAS= Day after spray

replications. Before each application the sprayer was calibrated with the help of water. The treatments were imposed with the help of Knapsack sprayer. Observation on number of insects were made a day before spraying, seven days, 14 days and 21 days after treatment on selected plants of 5×1cm² leaf area. The leaf samples were brought to the laboratory and examined for nymphal population using stereo binocular microscope at 10x to 40x. Efficacy were computed as reduction in number of insects as compared to untreated check. The data on the mean number of insect pests were considered for statistical analysis after square root transformation by using the software Statistical Package for social science (SPSS) V. 18.

RESULTS AND DISCUSSION

Efficacy of insecticides against whitefly, *Aleurocanthus arecae*

The mean number of whiteflies was found uniform in all the treatments at one day before spraying, as indicated by non-significant differences among all the treatments which ranged from 23.33 to 27.33/5cm² leaf area. The perusal of the pooled data indicated that the mean number of whiteflies in different treated plots reduced significantly compared to untreated control. Neem oil 1% (72.92%) revealed highest per cent reduction of the whiteflies population compared to other treatments. The next best effective insecticides were chlorpyrifos 20 EC (62.09 %), which was on par with buprofezin 25 EC (55.61 %). The sequence of moderately effective insecticides was dimethoate 30 EC (46.26 %), spinosad 45 SC (43.15 %) and imidacloprid 17.8 SL (42.10 %). The sulphited fish oil (19.61 %) was least effective against whiteflies compared to untreated control (Table 1).

Efficacy of Insecticides against wax scale, *Chrysomphalus aonidum*

A day before spraying, the mean number of wax scale population was uniform in all the treatments as showed by non-significant differences among the different treatments which ranged from 15.33 to 18.33/5 cm² leaf area. The pooled data on the efficacy of different insecticides from both the locations after seven days after spraying and 14 days after spraying for the effective management of wax scales indicated that, the mean number of wax scales reduced significantly in all the treatments compared to untreated control. Among all the treatments, neem oil 1% (81.60%) showed highest per cent reduction of wax scales population compared to all other treatments. The next best effective insecticides were dimethoate 30 EC and chlorpyrifos 20 EC with 66.51

and 57.49 per cent reduction, respectively. The order of moderately effective insecticides based on per cent reduction were spinosad 45 SC (41.62%), imidacloprid 17.8 SL (39.05%) and buprofezin 25 EC (35.60%). The sulphited fish oil (22.72 %) showed minimum efficacy against wax scales compared to untreated control (Table 2).

From the results, it can be inferred that, the neem oil 1% is the best chemical compared to other tested insecticides against whitefly, *A. arecae*. The present results corroborate with the findings of Mohan *et al.* (2017) and Ranjith *et al.* (1996). Neem oil and organophosphorus insecticides are highly effective against whiteflies, which is in accordance with Bandyopadhyay *et al.* (2000). Buprofezin 25 EC was also effective in reducing the whiteflies population, similar kind of results were obtained by Kumar *et al.* (2018). Neem oil and chlorpyrifos 20 EC are highly effective insecticides against whiteflies, which is in harmony with Dubey and Sundararaj, 2004.

Neem oil based formulation (81.60) showed highest per cent reduction of wax scales compared to other treatments. The next best effective insecticides were dimethoate 30 EC and chlorpyrifos 20 EC with 66.51 and 57.49 per cent reduction, respectively. The supremacy of the neem oil 1% against wax scale, *C. aonidum*, which is in harmony with Basavaraju *et al.* (2013) and Singh and Rao, (1997). Dimethoate 30 EC is the next best effective insecticide, which is in agreement with Ibrahim *et al.* (2019).

Among the different insecticides tested against whitefly, *A. arecae* and wax scale, *C. aonidum* the neem oil 1% was the most effective insecticide against these two sucking pests. This may be due to formation of coating layer over the insect body which block the respiratory system (spiracle) and insect will die due to asphyxiation (Locke, 1994). Considering the bio efficacy and eco –friendly benefits, neem oil can be used for the effective management of these pests in Arecanut.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. R. Sundararaj (Institute of Wood Science and Technology, Bengaluru, Karnataka) for whitefly identification and Dr. Sunil Joshi, ICAR-National Bureau of Agricultural Insect Resources, Bengaluru, Karnataka for wax scale identification. The authors are also thankful to Dr. D. Thippesha and Dr. B. Gangadhara Naik, UAHS, Shivamogga, for their encouragement. The authors gratefully acknowledge the arecanut farmer, Mr. Prakash, Arakere who provided field for conducting experiment.

Table 2. Efficacy of selected insecticides for the management of scale, *Chrysomphalus aonidum* (Linnaeus) (Pooled data of 2 sprays)

Treatment	Mean number of scales/ 5cm ² leaf area			Mean	Reduction over control (%)
	1 DBS	7 DAS	14 DAS		
T1 Dimethoate 30% EC @ 1.7 ml/l	16.83 (4.14)	7.83 (2.82) ^{de}	5.16 (2.36) ^e	6.50 (2.61) ^e	66.51
T2 Imidacloprid 17.8% SL @ 0.5 ml/l	15.33 (3.95)	12.00 (3.50) ^b	11.67 (3.480) ^c	11.83 (3.49) ^c	39.05
T3 Spinosad 45% SC @ 0.5 ml/l	16.83 (4.16)	11.50 (3.46) ^{bc}	11.16 (3.41) ^c	11.33 (3.43) ^c	41.62
T4 Buprofezin 25% SC @ 1.0 ml/l	15.67 (4.01)	12.33 (3.58) ^b	12.67 (3.62) ^c	12.50 (3.60) ^{bc}	35.60
T5 Chlorpyrifos 20% EC @ 2.0 ml/l	16.33 (4.10)	8.67 (3.00) ^{cd}	7.83 (2.88) ^d	8.25 (2.94) ^d	57.49
T6 Neem oil based formulation 10,000ppm @ 2.0 ml/l	17.00 (4.18)	5.67 (2.47) ^e	1.83 (1.44) ^f	3.75 (2.04) ^f	81.60
T7 Sulphited fish oil @ 4.0 ml/l	17.16 (4.20)	14.33 (3.83) ^b	15.67 (4.02) ^b	15.00 (3.93) ^b	22.72
T8 Untreated control	18.33 (4.34)	19.16 (4.43) ^a	19.67 (4.489) ^a	19.41 (4.46) ^a	-
F value	NS	*	*	*	-
SEM±	0.14	0.15	0.12	0.10	-
CD(P=0.05)	0.42	0.46	0.37	0.32	-
CV%	5.86	7.74	6.72	5.66	-

*Significant at (P≤0.05); NS-Non significant; Figures within the parentheses indicates $\sqrt{x+0.5}$ transformed values; Mean followed by the same letter do not differ significantly by DMRT (P=0.05); DBS= Day before spray; DAS= Day after spray

REFERENCES

- Anonymous, 2018. Final estimates of district wise area, production and yield of principal crops in Karnataka for the year 2017-18, Directorate of Economics and Statistics, Government of Karnataka, Bengaluru, Karnataka. pp. 1-44.
- Anonymous, 2019. Annual report 2018-19. Directorate of Arecanut and Spices Development, Ministry of Agriculture and Farmers Welfare, Government of India, Calicut, Kerala. pp. 1-136.
- Basavaraju S. L., Revanappa, S. B., Prashant, K., Rajkumar Kanatti, A., Sowmya, H. C., Gajanan, K. D. and Srinivas, N. 2013. Bio-ecology and management of arecanut scale, *Parasaissetia nigra* (Neitner) and mealybug, *Dysmicoccus brevipes* (Cockerell). *Indian Journal of Agricultural Research*, **47**: 436-440.
- Bandyopadhyay, U. K., Santhakumar, M. V., Das, K. K. and Sen, S. K. 2000. Efficacy of neem oil and alkali in regulating whitefly (*Dialeuropora decempuncta* Quaintance and Baker) infesting in mulberry. *Annals of Agricultural Research*, **21**: 388-391.
- Daniel, M. 2003. NATP Final report on Development of IPM packages for plantation crops. CPCRI, Kasargod, pp.1-184.
- Dubey, A. K. and Sundararaj, R. 2004. Evaluation of some neem products against the spiraling whitefly, *Aleurodicus dispersus* Russell (Aleyrodidae: Homoptera) on *Bauhinia variegata* and *Michelia champaca*. *Indian Journal of Plant Protection*, **32**: 126-128.
- Ibrahim, F., Hadush, T., Abraha, G. and Alemu, A. 2019. Evaluation of some botanical extracts against major insect pests (leaf miner, armored scale and woolly whitefly) of Citrus plants in central zone of Tigray, North Ethiopia. *Momona Ethiopian Journal of Science*, **11**: 258-275.
- Kalleshwaraswamy, C. M., Adarsha, S. K. and Naveena, N. L. 2015. Incidence of arecanut white grubs (*Leucopholis* spp.) in hilly and coastal regions of Karnataka, India. *Current Biotica*, **8**: 423-424.
- Kalleshwaraswamy, C. M. Adarsha, S.K. Naveena, N. L. and Sharanabasappa. 2016. Adult emergence pattern and utilization of females as attractants for trapping males of *Leucopholis lepidophora* (Coleoptera: Scarabaeidae) infesting areca nut in India. *Journal of Asia-Pacific Entomology*, **19**: 15-22.
- Kumar, V., Francis, A., Avery, P. B., McKenzie, C. L. and Osborne, L. S. 2018. Assessing compatibility of *Isaria fumosorosea* and buprofezin for mitigation of *Aleurodicus rugioperculatus* (Hemiptera: Aleyrodidae) an invasive pest in the florida landscape. *Journal of Economic Entomology*, **111**: 1069-1079.
- Locke, J. 1994. Neem oil locks out spores. *Agricultural Research*, **16**: 1-13.
- Mohan, C., Josephraj Kumar, A., Merin Babu, Prathibha, P. S., Krishnakumar, V., Hegde, V. and Chowdappa, P. 2017. Invasive rugose spiralling whitefly on coconut. Technical Bulletin No. 117, ICAR-CPCRI, Regional Station, Kayamkulam, Kerala (India). pp.1-16.
- Nair, R. B. and Menon, R. 1963. Major and minor pests of arecanut crop, *Areca catechu* Linn. *Arecanut Journal*, **14**: 139-147.
- Nair, C. P. R. and Daniel, M. 1982. Pests in Bavappa *et al.* (eds): The Arecanut palm. (Bavappa, K. V. A., Nair, M. K. and Prem Kumar, T. editors). CPCRI. Kasaragod, pp. 151-184.
- Ranjith, A. M., Rao, D. S. and Thomas, J. 1996. New host records of the mealy whitefly, *Aleurodicus dispersus* Russell in Kerala. *Insect Environment*, **2**: 35-36.
- Singh, S. P. and Rao, N. S. 1977. Effectiveness of different contact insecticides against soft green scale, *Coccus viridis* Green (Coccidae: Homoptera) on citrus. *Pesticides*, **11**: 33-36.

MS Received: 24 October 2020
MS Accepted: 29 November 2020