The Pharma Innovation Journal 2022; SP-11(8): 1328-1330

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(8): 1328-1330

www.thepharmajournal.com
Received: 02-06-2022
Accepted: 08-07-2022

G Meenakshi
PG Scholar, Department of Entomology, College of Horticulture, Dr. YSR Horticultural University, Venkataramannagudem, West Godavari, Andhra Pradesh, India

N Emmanuel
Associate Professor, Department of Entomology, College of Horticulture, Dr. YSRHU, Venkataramannagudem, Andhra Pradesh, India

Rammiah
Associate Professor, Department of Entomology, College of Horticulture, Anantharajupeta Dr. YSRHU, YSR, Kadapa, Andhra Pradesh, India

Dr. ARNS Subabbanna
Senior Scientist, Department of Agril. Entomology, IIOPR, Pedavegi, West Godavari, Andhra Pradesh, India

Dr. DV Swami
Principal Scientist and Head, PHTRS Controller of Examination, Dr. YSRHU, West Godavari, Andhra Pradesh, India

Corresponding Author
G Meenakshi
PG Scholar, Department of Entomology, College of Horticulture, Dr. YSR Horticultural University, Venkataramannagudem, West Godavari, Andhra Pradesh, India

Toxic effect of sweet flag *Acorus calamus* extracts against invasive pest Bondar nesting whitefly *Paraleyrodes bondari* Peracchi. (Aleyrodidae, Hemiptera)

G Meenakshi, N Emmanuel, Rammiah, Dr. ARNS Subabbanna and Dr. DV Swami

Abstract
An *in vitro* experiment was carried out at college of horticulture, Venkataramannagudem, Dr. YSRHU to study toxic effects of Sweet flag *Acorus calamus* methanol extracts invasive pest Bondar's nesting whitefly. The different concentrations of methonolic extracts were tested against Bondar nesting whitefly *Paraleyrodes bondari* adults by residual method. The results obtained from the experiment reveal that mortality percentage of *P. bondari* adults were 10%, 20%, 50%, 76.67%, 93.33% at 0.1%, 0.2%, 0.5%, 1% and 2% concentration respectively. 100% mortality was found in the methanol extract at 5% concentration with LC_{50} value being 0.470% at 0.5% concentration.

Keywords: *Acorus calamus*, toxic, residual method, *Paraleyrodes bondari*

1. Introduction
Coconut (*Cocos nucifera*) belongs to the Arecaceae family, and important plantation crop in the world, providing food for millions of people, especially in the tropical and subtropical regions and with its many uses it is often called the "tree of life," Tree of heaven", "Tree of abundance", and "Kalpavriksha" (a tree that provides all necessities of life). (Chan 2006) [1]. India is the third largest coconut producing country, after Indonesia and the Philippines, having an area of about 2,150.00 hectares under the crop. Annual production is about 21288 million nuts with productivity of 9901 nuts/ha (APCC 2019). In India, the four south Indian states namely Kerala, Tamil Nadu, Karnataka and Andhra Pradesh account for around 90% of the coconut production in the country.

Over 900 species of pests are linked with cultivated and wild coconut which includes both invertebrates and vertebrates. The pests viz., rhinoceros beetle, *Oryctes rhinoceros* L, red palm weevil, *Rhynchophorus ferrugineus* Olivier; slug caterpillar, *Macroplectra nararia* and coconut black-headed caterpillar, *Opisina arenosella* Walker are the most important destructive insect pests of coconut in main coconut growing areas of the world (Kumara *et al.*, 2015) [9]. Crop loss estimation on the yields of oil palm due to the above pests was in the rangeof20-30percentextendingtothreeyearsafterattack was reported by Kalidas (2012) [8].

First occurrence of Bondar's Nesting Whitefly (BNW), *Paraleyrodes* Bondari Peracchi (Hemiptera: Aleyrodidae) in India is documented on coconut palms from Kerala by Joseph Kumar *et al*. (2019).

Pesticides derived from plants have the potential to play a major role in pest management for sustainable agriculture production. Plants produce a range of chemical substances to protect themselves from insect pests. Such chemicals are secondary metabolites and include alkaloids, terpenoids, flavonoids and acetogenins (Parmar and Singh, 1993) [14]. The naturally occurring phytochemicals present in plants exert a wide range of behavioural and physiological effects on insects and therefore, it is difficult for insects to develop resistance to these pesticides. Amongst neem (*Azadirachta indica* A Juss.) has been the focus for large number of studies over the past five decades. Neem contains terpenoids (Schmutterer, 1984) [18] that are phagodeterrent (Pradhan *et al*., 1962) [15] growth inhibitors (Emmanuel and Dhingra, 2005) [4] and oviposition suppressant (Sharma and Gupta, 2009) [19].

Considering the lack of information on the activity of botanicals against Bondar's Nesting Whitefly (BNW), It is highly essential to evaluate the efficacy of botanical insecticides against

BNW under laboratory conditions.

2. Materials and Methods

The studies on bioefficacy of *A. calamus* against *P. bondari* was conducted at College of Horticulture, Venkataramannagudem, Andhra Pradesh.

2.1 Collection and processing

A. calamus rhizomes the rhizomes of *A. calamus* were collected from tribal areas viz., Rampachodavaram of East Godavari and Buttayyagudem, Jeelugumilli of West Godavari districts of Andhra Pradesh. The rhizomes were shade dried and later crushed in grinder to fine powder. The grounded powder was thus used for solvent extraction.

2.2 Preparation

Of *A. calamus* rhizome extracts the preparation of indigenous plant extract with the solvent methanol was made.

2.2.1 Preparation of methanol extract

The rhizomes were further extracted with 2l methanol using the mechanical stirrer. The blend was thoroughly stirred for half an hour and left overnight for 24 hours. The supernatant was then filtered and subjected to vacuum distillation at 40 ºC temperature to obtain methanol concentrate.

2.3 Collection

Of *P. bondari* adults from the fields: The leaf bits with adults were collected the infested field in a plastic containers.

2.4. Treating of adults with methanol extracts

The glass vials were taken and the different concentrations were labled and methanol extract was uniformly spread with fresh leaf bit of coconut and allowed to dry under shade. (Dry film method). Each treatment replicated three times. Adults were slowly released in to treated glass vials and percent mortality was calculated at 6, 12, 24 Hours after treatment.

$$\text{Percent Mortality} = \frac{\text{Number of insects dead}}{\text{Total Number of insects}} \text{ X } 100$$

2.5 Statistical analysis

The data was analyzed statistically using completely randomized block design. The data recorded for various parameters viz., antifeedancy, larval mortality and normal adult emergence inhibition, were subjected to probit analysis for the calculation of LC_{50} by using SAS 9.3 software program (LC_{50}- Lethal concentration (%)).

3. Results and Discussion

Bio efficacy of sweet flag *A. calamus*, methanol extracts *was* tested against *P. bondari* aduts maximum cumulative adult mortality of *P. bondari* (100 per cent) was recorded at 5.0 concentration followed by 90.00, 70.00, 50.00, 20.00,10.00, per cent mortality at 2.0, 1.0, 0.5, 0.2, 0.1 per cent concentrations, respectively. However, at the lowest concentration (0.1%) adult mortality was 10.00 per cent only. It is evident from table 7 that the concentration required to give 50 per cent adult mortality (LC_{50}) being 0.470 percent concentration at fiducial limits range of 0.372-0.632 per cent.

Toxic properties of *A. calamus* is attributed to the presence of contain β-asarone, α-asarone, cis-asarone, Trans asarone, acoramone and other sesquiterpenes in the rhizomes. It also contains a bitter glycoside named acorine along with eugenol, pinene and camphene (Imam *et al*. 2013). Further, Desai and Patil (2000) [3] and Singh *et al.* (2001) reported that acetone and aqueous extract of *A. calamus* yielded 96.07 and 100.00 per cent inhibition in feeding by *S. litura* and *H. armigera*.

Lee *et al.* (2002) [10] reported 100.00 and 67.00 per cent larval mortality of *P. xylostella* due to cis-asarone and trans-asarones of *A. calamus*. Aqueous extract of *A. calamus* caused 72.22, 38.43 and 67.95per cent mortality of *P. xylostella*, L. *erysimi* and *A. gossypii* at 2.5 and 0.5% concentration (Pandey *et al.* 1983 [13]; Rathod *et al.* 2002 [16] and Devi *et al.* 2003) [2]. Tewary *et al.* (2005) [21] also identified 88.00 and 29.00 per cent mortality of *H. armigera* and *P. xylostella* from petroleum ether extract of *A. calamus* at 10,000 ppm concentration, respectively.

Hexane extract of *A. calamus* rhizome caused 44.70 and 100.00 per cent mortality of *T. granarium* and *S. litura* at 4.0% concentration (Hasan *et al.* 2006 and Singh *et al.* 2012) [5, 20]. Meenakshisundaram *et al.* 2014 observed highest mortality of housefly adults when treated with 6% concentration of *A. calamus* bait. Melani *et al.* 2016 [11] observed 92.50 per cent mortality of second instar larvae of *S. litura* when treated with various concentrations of *A. calamus*. Mounika *et al.* (2020) [12] reported 100 per cent larval mortality of *P. xylostella* at 5.0% concentration of methonolic extract of *A. calamus* followed by 93.33, 83.33, 73.33, 63.33, 53.33 per cent mortality at 3.0, 1.0, 0.5, 0.1, 0.05% concentration. However, at the lowest concentration (0.01%) it was recorded only of 34.22 per cent larval mortality. The per cent pupal mortality was maximum of 6.67 per cent at 3.0 and 1.0 per cent concentration. The normal adult emergence was 13.33, 30.0, 33.33, 43.33 and 53.33 per cent at 1.0, 0.5, 0.1, 0.05 and 0.01 per cent when compared to 96.67 per cent in control.

Table 1: Effect of methanol extract of *A. calamus* against *P. bondari*

Conc.%	Adult Mortality (%)		
	6 HAT	12 HAT	24 HAT
5.0	80.00 (63.42)	93.33 (75.15)	100 (90.00)
2.0	73.33 (58.89)	80.00 (63.42)	93.33 (75.15)
1.0	60.00 (50.75)	66.67 (54.72)	76.67 (56.77)
0.5	43.33 (40.37)	46.67 (43.07)	50.00 (44.98)
0.2	6.67 (14.95)	10.00 (18.42)	20.00 (26.55)
0.1	0.00 (0.00)	6.67 (14.96)	10.00 (18.42)
control	0.00 (0.00)	3.33 (10.61)	6.67 (14.95)
SE(m)	0.496	0.744	0.682
CD (P=0.05)	1.518	2.28	2.089
CV	2.623	3.22	2.530

Values in the parenthesis are Arcsine transformed values.
HAT-Hours after treatment

Table 2: Toxic effect of methanol extract of *A. calamus* on *P. bondari*

Toxic effects	Heterogeneity χ^2 (df = 4)	Regression equation Y=	Median dose (%)	Fiducial limits
Cumulative adult mortality	0.830	0.458+2.787 X	LC_{50} -0.470	0.372 - 0.632

LC_{50} - Median lethal concentration to give 50.00 per cent mortality

4. Conclusion

The highest mortality of *P. bondari* adults (100 per cent) was achieved through treatment by 5.0 concentration followed by 2.0% (90.00) and 1.0% (70.00) and rest of the concentrations yielded mortality of less than 50%. Noxious properties of *A. calamus* is ascribed to the occurrence of β-asarone, α-asarone, cis-asarone, transasarone, acoramone and other sesquiterpenes in the rhizomes. Hence, the extracts of *A. calamus* may be incorporated into IPM practices against BNW in coconut and oil palm plantations in combination with other bio agents.

5. Acknowledgements

I hereby take this opportunity to thank Dr. N. Emmanuel, Associate Professor, Department of Entomology, COH, Dr. YSRHU, and Venkataramannagudem for his continuous inspiration and much needed suggestions.

6. References

1. Chan E, Elevitch CR. Species profiles for Pacific island agroforestry, 2006. [Online]. Available from: www.traditionaltree.org [Accessed on November 03, 2010].
2. Devi MN, Singh TK, Devi LC. Efficacy of certain botanical insecticides against cotton aphid, Aphis gossypii Glover on brinjal. Pestology. 2003;27(3):6-9.
3. Desai SK, Patil RS. Antifeedant properties of some plants material extracts against *Spodoptera litura*. Pestology. 2000;24(8):62-64.
4. Emmanuel Nathala, Swaran Dhingra. Antifeedant activity of aqueous extracts from seeds and leaves of *Caesalpinia crista* (Lin) and *Melia azedarach* (Lin) against *Helicoverpa armigera* (Hub) In: Proceedings of the National Symposium on Biopesticides F, 2005 Apr, 20-21, 21-22.
5. Hasan M, Sagheer M, Ullah E, Ahmad F, Wakil W. Insecticidal activity of different doses of *Acorus calamus* oil against *Trogoderma granarium* (Everts). Pakistan Journal of Agricultural Science. 2006;43(1):55-58.
6. Imam H, Zarnigar, Sofi G. Mosquito larvicidal efficay of *Acorus calamus* extracts against *Aedes aegypti* L. larvae. Asian Pacific Journal of Tropical Disease. 2014;4:181-185.
7. Joseph Rajkumar, Chandrika Mohan, Merin Babu, Arya Krishna, Krishnakumar V, Vinayaka hedge, *et al*. First record of the invasive bondar's nesting whitefly, *Paraleyrodes bondari* Peracchi on coconut from India. phytoparasitica. 2019;47:333-39.
8. Kalidas. Pest problems of oil palm and management strategies for sustainability. Agrotechnology. 2012S;111(3):1-3.
9. Kumara ADNT, Chandrashekharaiah M, Kandakoor SB, Chakravarthy AK. Status and management of three major insect pests of coconutin the tropics and subtropics. New Horizons in Insect Science: Towards Sustainable Pest Management, 2015, 359-81.
10. Lee HK, Park C, Ahn YJ. Insecticidal activities of asarones identified in *Acorus gramineus* rhizome against *Nilaparvata lugens* (Homoptera: Delphacidae) and *Plutella xylostella* (Lepidoptera: Yponomeutoidae). Applied Entomology and Zoology. 2002;37(3):459-464.
11. Melani D, Himawan T, Afandhi A. Bioactivity of Sweet Flag (*Acorus calamus* Linnaeus) Essential Oils against *Spodoptera litura* Fabricius (Lepidoptera: Noctuidae). Pest Management Science. 2016;13:78-84.
12. Mounika NM, Emmanuel N, Suneetha DRS. Antifeedant, toxic and biochemical effects of sweet flag, *Acorus calamus* against diamondback moth, *Plutella xylostella* (Linn) (Plutellidae: Lepidoptera). Journal of Entomology and Zoology Studies. 2020;8(2):20-24.
13. Pandey UK, Srivastava A, Pandey M, Singh A. Evaluation of some plant origin insecticides against gram caterpillar, *Heliothis armigera* Hubn. Indian Journal of Entomology. 1983;45(2):211-212.
14. Parmar BS, Singh RP. Neem in Agriculture. India Agricultural Research Institute, New Delhi, India, 1993, 85.
15. Pradhan S, Jothwani MG, Rai BK. The neem seed deterrent to locusts. Indian farming. 1962;12:7-11.
16. Rathod AT, Tandale MB, Aherkar SK, Lande GK. Bioefficacy of herbal products against mustard aphid, Lipaphis erysimi (Kalt) and its parasite *Diaeretiella rapae*. Pestology. 2002;26(6):17-19.
17. Rembold H, Sharma GK, Czoppwelt CH, Schmutterer H. Evidence of growth disruption in insects without feeding disruption by neem seed fractions. Zeitschrift-fur-Pflanzenkrankheiten-und-Pflanzenschutz. 1980;87:291-97.
18. Schmutterer H. Neem Research in the Federal Republic of Germany since the first international neem conference. In: Natural Pesticides from the Neem Tree and other Tropical Plants. Op. cit, 1984, 21-30.
19. Sharma A, Gupta R. Biological activity of some plant extracts against *Pieris brassicae* (Linn.). Journal of biopesticides. 2009;2(1):26-31.
20. Singh KM, Singh MP, Sureja AK, Bhardwaj R. Insecticidal activity of certain plants of Zingiberaceae and Araceae against *Spodoptera litura* F. and Plutella xylostella Saunders in cabbage. Indian Journal of Entomology. 2012;74(1):62-68.
21. Tewary DK, Bhardwaj A, Shanker A. Pesticidal activities in five medicinal plants collected from mid hills of Western Himalayas. Industrial Crops and Products. 2005;22:241-247.