International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 03-11-2023, Accepted: 18-11-2023, Published: 04-12-2023
Volume 8, Issue 12, 2023, Page No. 11-14

Evaluation of toxicity of *Sargassum wightii* with pungam oil against *Cnaphalocrocis medinalis*

Balamurugan S*, R Kannan
Department of Entomology, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Tamil Nadu, India

Abstract
This study aimed to evaluate the insecticidal efficacy of solvent extracts of *Sargassum wightii* alone and in combination with pungam oil against the rice leaf folder, *Cnaphalocrocis medinalis*. The research was conducted in the Department of Entomology, Faculty of Agriculture, Annamalai University, India between 2022 to 2023. The insecticidal efficacy of seaweed extracts at concentrations of 6%, 7% and 8% alone and in combination with pungam oil at concentrations of 0.5% and 1% was evaluated against the rice leaf folder. The results were compared to the standard check of pungam oil at a concentration of 1%. The highest larvicidal activity of 73.33 percent was recorded in seaweed extract @ 8% + pungam oil @ 1% concentration after 72 hours of treatment. The larva to adult conversion ratio was 1:0.13 in seaweed extract @ 8% + pungam oil @ 1% whereas the ratio of untreated control was 1:1.

Keywords: *Sargassum wightii,* larvicidal, insect growth regulator activity, pungam oil @ 0.5% and 1%, *Cnaphalocrocis medinalis.*

Introduction

Rice serves as a staple food for over half of the world's population, cultivated across approximately 162 million hectares of land, yielding an annual production of 755 million tonnes (Shaheen *et al*., 2022) [16]. Rice cultivation faces numerous biotic stresses with insect pests being a major contributor to severe crop damage during the tillering stage. Among the most destructive and economically significant rice pests in Asian countries is the rice leaf folder, *Cnaphalocrocis medinalis* Guenee (Bilal *et al*., 2021) [4]. The larva folds the leaves while stitching both sides open with silken threads. Longitudinal white streaks appear as a result of larvae feeding by scraping the green stuff that remains inside the folded leaves. When two or three leaves are stitched together, larvae feed inside the fold (Bodlaha *et al*., 2023) [5]. The extensive use of chemical insecticides as the primary method for managing rice leaf folders has led to a number of drawbacks including the development of insecticide resistance, pest resurgence and the persistence of pesticide residues in the environment (Uhl and Bruhl, 2019) [17]. The limitations of insecticides have prompted the exploration of alternative pest control strategies including the utilization of natural resources like seaweeds. With their abundance in oceans and seas worldwide, seaweeds have garnered significant research attention due to their production of diverse secondary metabolites exhibiting a broad spectrum of biological activities (Perez *et al*., 2016) [14].

Materials and methods

Collection of seaweed

Sargassum wightii was collected from the coast of Rameswaram, Tamil Nadu, India. The seaweed was collected by hand-picking method and collected algae washed in seawater to remove sand, pebbles, shells and salt and washed thrice with tap water. The washed algae were shade dried for a fortnight and the dried seaweed was stored in room temperature under dry conditions.

Mass culturing of Rice leaf folder

Taichung Native-1 (TN1) seeds were sown in plastic cups and the seedlings were maintained inside the nylon mesh cage upto 35-40 days at 25°C temperature and 60% RH. Adult moths were collected from the field and released 10 pairs for oviposition. Adults were provided with 20% honey solution administered using a cotton swab for nourishment. After a three-day pre-oviposition period, adults were transferred to mature TN1 plants for oviposition. The resulting eggs were carefully collected and preserved for further development. Freshly laid rice leaf folder eggs were collected and transferred to moist filter paper inside Petri plates. Upon hatching, the first instar larvae were individually transferred to the axils of rice plants using a fine-tipped camel hair brush. The larvae consumed the leaves by scraping off the green tissue. Third instar larvae from this stock culture were subsequently utilized for bioassay (Javvaji *et al*., 2021) [10].

Preparation of binary mixture of *S. wightii* extracts with pungam oil

S. wightii was partially powdered and weighed separately @ 6, 7 and 8 g before being mixed in 100 ml acetone and dissolved at room temperature for 12 hours until extracts were filtered (Kombiah and Sahayaraj, 2012) [12]. Pungam oil @ 0.5 and 1% concentration was obtained by mixing pungam oil @ 0.5 and 1 ml with the required amount of acetone (Chinnamma, 2017) [6]. The prepared concentration of seaweed extracts @ 6, 7 and 8% alone as well as their binary combination with pungam oil @ 0.5 and 1% was used for experiments. For binary combinations, individually prepared seaweed extracts and pungam oil were blended at a 1:1 ratio (Ali *et al*., 2018) [1].

Poison food bioassay

Rice leaves were sectioned into five centimeter leaf bits and immersed in a 1% Tween 20 solution for five minutes to effectively removal of wax layer. The leaf bits were exposed to various concentrations of seaweed extracts. Solvent control and untreated control was maintained to compare the effectiveness of the seaweed extracts against the larvae. One percent acetone solvent control was also included to compare the effect of the solvent against leaf folder. Five leaf bits were placed in glass Petri plates on moist filter paper after being air-dried. Four-hour pre-starved third instar larvae were evenly distributed within each Petri plate and provided with treated leaf bits for feeding. After the treated leaf bits, the larvae were given with untreated leaves for continuous observation (Kannan and Bharathkumar, 2016) [11]. The experiment was performed under CRD with three replicates. Larval mortality was recorded at 24, 48 and 72 hours of exposure. The experiment was then continued to evaluate the IGR activity of the seaweed treatments by assessing pre-pupal mortality, pupation percentage and adult emergence of the rice leaf folder. The experimental data was compiled and subjected to statistical analysis and the results were presented (Gomez and Gomez, 1984) [7].

Result and discussion

The larval mortality was observed higher in seaweed extract @ 7% + pungam oil @ 1% and seaweed extract @ 8% + pungam oil @ 1% concentration with 46.66 percent whereas least mortality of 13.33 percent was exerted by seaweed extract @ 6% concentration after 24 hours (Fig. 1). The data revealed after 48 hours, seaweed extract @ 6% concentration has demonstrated the least level of larval mortality with 20.00 percent wherein the maximum impact of 60.00 percent was exerted by seaweed extract @ 8% + pungam oil @ 1% concentration (Fig. 2). At 72 hours, larval mortality in seaweed extract @ 8% + pungam oil @ 1% concentration exhibited 73.33 percent mortality (Fig. 3). Pre pupal mortality was recorded more in combination extract with 13.33 percent. The maximum pupation and adult emergence was observed at the seaweed extract @ 6 and 7% concentration with 60.00 percent. The minimum pupation and adult emergence was observed 13.33 percent in seaweed extract @ 8% + pungam oil @ 1% concentration (Fig. 4). The larval to adult conversion ratio was higher in untreated control with 1:1.00 and lower in seaweed extract @ 8% + pungam oil @ 1% concentration with 1:0.13 (Table 1). The current study demonstrated that the combination of 8% seaweed extract and 1% pungam oil exhibited superior efficacy against *C. medinalis*. Similar studies have explored the larvicidal potential of *Sargassum* seaweed extracts. The methanol extracts of the brown algal seaweed *S. cristaefolium* exhibited a higher level of larval mortality and insect growth regulator activity against *Spodoptera litura* (Gowthish and Kannan, 2018) [9]. A study investigating the repellent and insecticidal properties of *C. sertularioides*, *Laurencia johnstonii*, and *S. horridum* extracts against *Diaphorina citri* yielded promising results (Gonzalez-Castro *et al*., 2019) [8]. The extracts of *S. wightii* showed larvicidal and IGR activity against *C. medinalis* (Balamurugan and Kannan, 2022a) [2]. The brown algal seaweed, *S. wightii* with neem leaf extract performed better against rice leaf folder (Balamurugan and Kannan, 2022b) [3]. *Spodoptera littoralis* larvae exposed to *Spirulina platensis* and *S. vulgar* extracts exhibited increased mortality across all larval instars (Rashwan and Hammad, 2020) [15]. The highest larvicidal activity was observed in methonolic extracts of *S. wightii* against diamondback moth *Plutella xylostella* (Lisha *et al*., 2023) [13].

Table 1: Larval to Adult conversion ratio of toxicity of *Sargassum wightii* with pungam oil against rice leaf folder, *Cnaphalocrocis medinalis*

Treatment	Larval: Adult conversion ratio
SW 6%	1:0.60
SW 7%	1:0.60
SW 8%	1:0.53
SW 6%+PO 0.5%	1:0.40
SW 7% +PO 0.5%	1:0.26
SW 8% +PO 0.5%	1:0.26
SW 6% + PO 1%	1:0.20
SW 7% + PO 1%	1:0.20
SW 8% + PO 1%	1:0.13
PO 0.5%	1:0.73
PO 1%	1:0.66
Solvent control	1:1
Untreated control	1:1

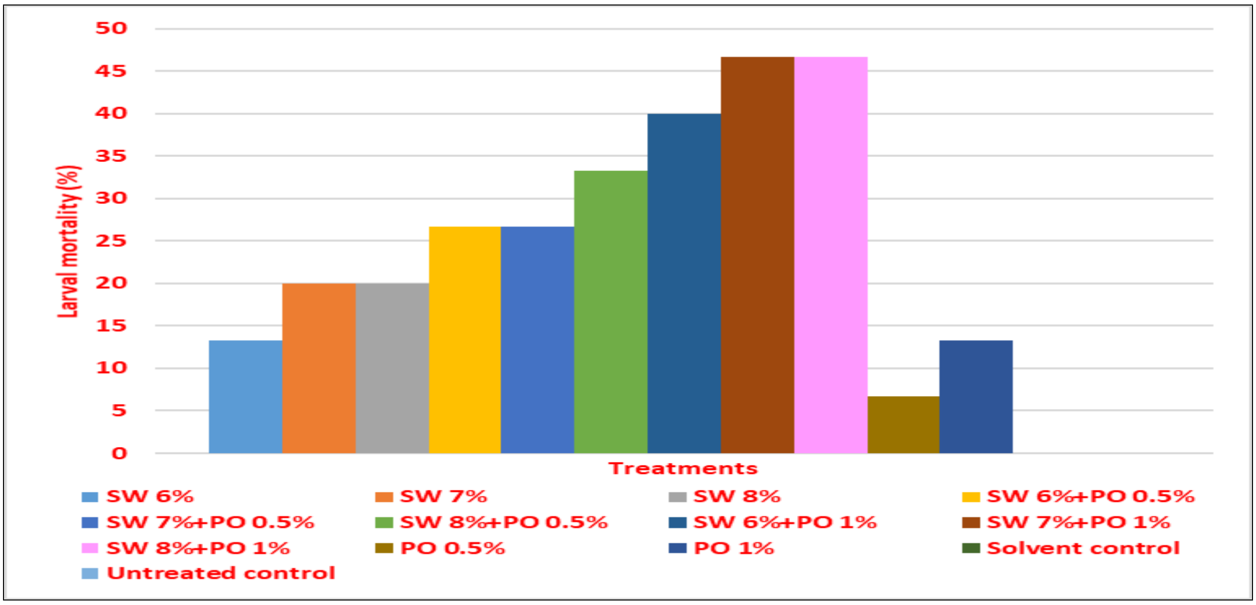

Fig 1: Toxicity of *S. wightii* alone and its combination with pungam oil against Rice leaf folder at 24 hours of treatment

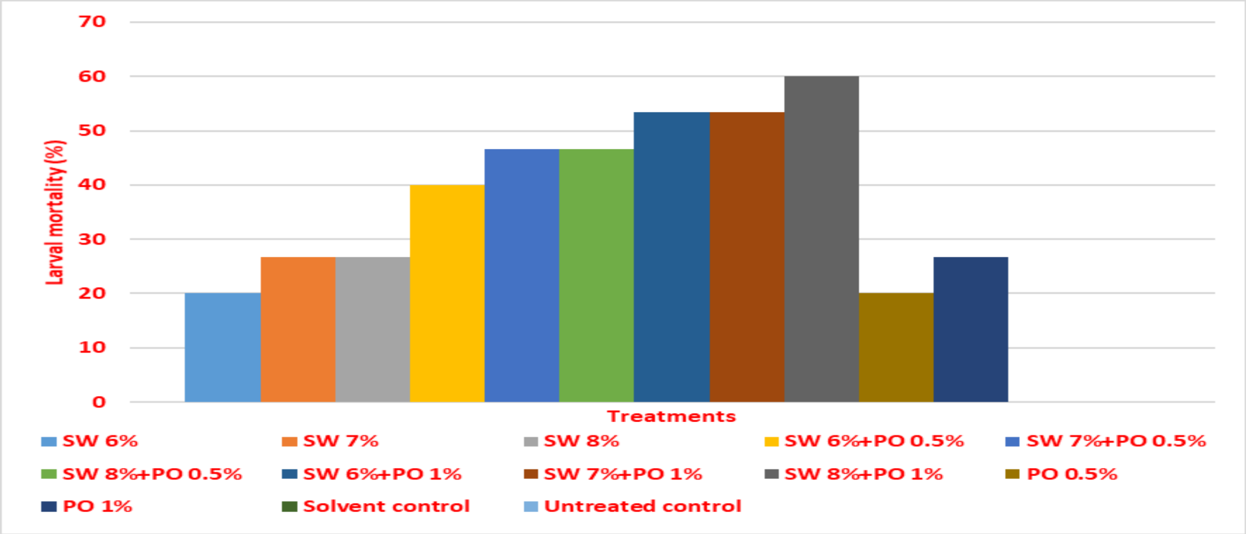

Fig 2: Toxicity of *S. wightii* alone and its combination with pungam oil against Rice leaf folder at 48 hours of treatment

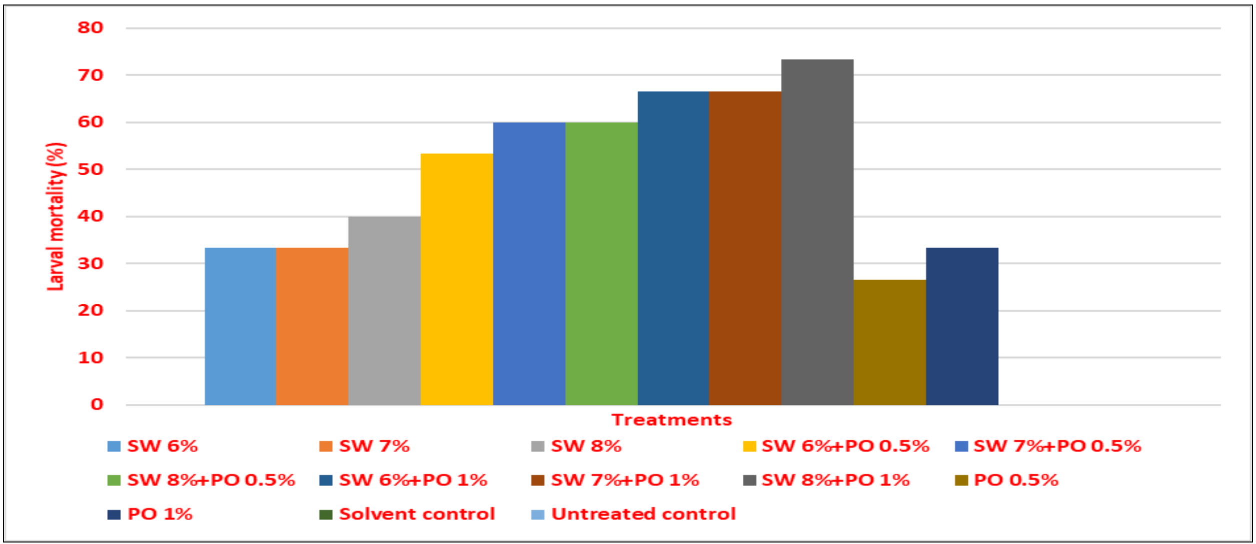

Fig 3: Toxicity of *S. wightii* alone and its combination with pungam oil against Rice leaf folder at 72 hours of treatment

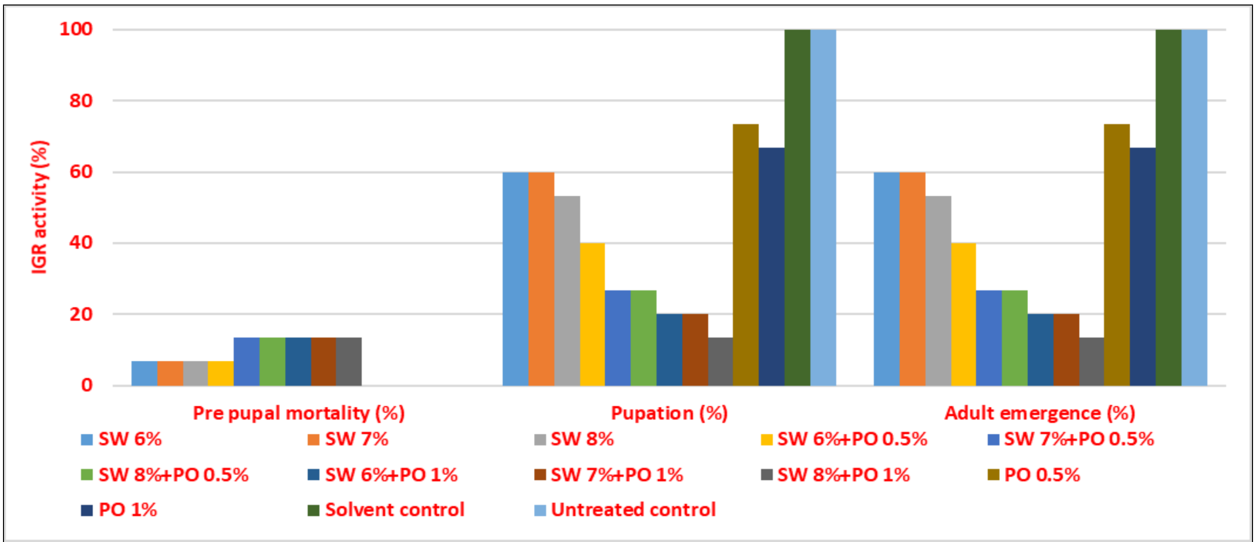

Fig 4: IGR activity of *S. wightii* alone and its combination with pungam oil against Rice leaf folder

Conclusion

The present investigation showed that *S. wightii* seaweed extract @ 8% with pungam oil @ 1% performed better against rice leaf folder management.

References

1. Ali S, Farooqi MA, Sajjad A, Ullah MI, Qureshi AK, Siddique B, *et al*. Compatibility of entomopathogenic fungi and botanical extracts against the wheat aphid,

Sitobion avenae (Fab.) (Hemiptera: Aphididae). *Egyptian Journal of Biological Pest Control*,2018:28(1):1-6.
2. Balamurugan S, Kannan R. Larvicidal and insect growth regulator activity of a brown algal seaweed, *Sargassum wightii* (Greville) against rice leaf folder, *Cnaphalocrocis medinalis* Guenee. *International Journal of Entomology Research*,2022a:7(7):10-14.
3. Balamurugan S, Kannan R. Enhanced toxicity of brown algal seaweed *Sargassum wightii* Greville with organic inputs against rice leaf folder *Cnaphalocrocis medinalis* Guenee (lepidoptera: crambidae) under laboratory conditions. *Uttar pradesh Journal of Zoology*,2022b:43(18):26-31.
4. Bilal M, Hussain M, Umer M, Ejaz N, Noushahi HA, Atta B, *et al*. Population incidence and efficacy of chemical control against rice leaf folder (*Cnaphnalocrocis medinalis* Guenee) (Pyralidae: Lepidoptera). *Asian Plant Research Journal*,2022b:2:1-7.
5. Bodlaha MA, Mohsina A, Younasa A, Bodlahb I, Asifc M, Rasheedd MT. Insect pests of rice in pakistan: a comprehensive review of biology, damage and management, *Agriculture Extension in Developing Countries*,2023:1(2):36-42.
6. Chinnamma CA. Influence of Neem Oil on the Egg Hatching of Uzifly *Exorista Bombysis*. *International Journal of Innovative Science and Research Technology*,2023:2(5):130-134.
7. Gomez KA, Gomez AA. Statistical procedures for agricultural research. John Wiley & Sons, Singapore, 1984, 608.
8. Gonzalez-Castro AL, Munoz-Ochoa M, Hernandez-Carmona G, Lopez-Vivas JM. Evaluation of seaweed extracts for the control of the Asian citrus psyllid *Diaphorina citri*. *Journal of Applied Phycology*,2019:31:3815-3821.
9. Gowthish K, Kannan R. Bioefficacy of brown algal seaweed, *Sargassum cristaefolium* C. against a cosmopolitan pest, *Spodoptera litura* Fabricius (Lepidoptera: Noctuidae). *Multilogic in Science*,2018:8:56-7.
10. Javvaji S, Maheswari Telugu U, Damarla Bala Venkata R, Sheshu Madhav M, Rathod S, Chintalapati P, *et al*. Characterization of resistance to rice leaf folder, *Cnaphalocrocis medinalis*, in mutant Samba Mahsuri rice lines. *Entomologia Experimentalis et Applicata*,2021:169(9):859-875.
11. Kannan R, Bharathkumar R. Bio-efficacy of two sea weeds methanol extract on growth and development of *Spodoptera litura* Fabricius. *Annals of Plant Protection Sciences*,2016:24(1):1-5.
12. Kombiah P, Sahayaraj K. Repellent activity of *Caulerpa scalpelliformis* extracts and its formulations against *Spodoptera litura* and *Dysdercus cingulatus* (Fab.). *Journal of biopesticides*,2012:5:145.
13. Lisha JM, Srinivasan G, Shanthi M, Mini ML, Vellaikumar S, Sujatha K. Phytochemical profiling and toxicity effect of various seaweed species against diamondback moth, *Plutella xylostella* L. (Lepidoptera: plutellidae). *International Journal of Tropical Insect Science*, 2023, 1-16.
14. Perez MJ, Falque E, Dominguez H. Antimicrobial action of compounds from marine seaweed. *Marine drugs*,2016:14(3):52.
15. Rashwan RS, Hammad DM. Toxic effect of *Spirulina platensis* and *Sargassum vulgar* as natural pesticides on survival and biological characteristics of cotton leaf worm *Spodoptera littoralis*. *Scientific African*,2020:8:323.
16. Shaheen SM, Antoniadis V, Shahid M, Yang Y, Abdelrahman H, Zhang T, *et al*. Sustainable applications of rice feedstock in agro-environmental and construction sectors: A global perspective. *Renewable and Sustainable Energy Reviews*,2022:153:111791.
17. Uhl P, Bruhl CA. The impact of pesticides on flower-visiting insects: A review with regard to European risk assessment. *Environmental toxicology and chemistry*,2019:38(11):2355-2370.