Abasyn Journal of Life Sciences

Open Access

DOI: 10.34091/AJLS.4.2.5

Screening of *Strobilanthes urticifolia Wall.ex Kuntze* for Antitermite and Insecticidal Activities

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Abstract

Leaves, stem, roots and flowers of this plant were extracted with methanol and fractionated with different solvents i.e., *n*-Hexane, Chloroform and Ethyl acetate. Screening of the individual extract and fractions showed that *Strobilanthes urticifolia Wall.ex Kuntze* has significant effects against termite and different insects. The extract and their fractions were evaluated against *Odontotermes obesus*, the test termite. Between the tested extracts, crude methanolic extract (CME) displayed the highest anti-termite potential (100% mortality on day 2) while aqueous fraction showed the lowest mortality rate (64% on day 3). CME and individual fractions were also tested against various insects. CME showed highest result (80%) in terms of mortality against *Tribolium castenum,* while *n*-hexane fraction showed moderate result (60%) in terms of mortality against *Callosbrachus analis* and all other fractions have no or low activity against tested insects. The results obtained from the experiments suggested the potential of *Strobilanthes urticifolia* in the control of termite and insects.

Key words: *Strobilanthes urticifolia Wall.ex Kuntze*, antitermite, insecticidal, CME, Fractions.

Article Info:
Received:
August 21, 2021
Received Revised:
December 26, 2021
Accepted:
December 26, 2021
Available online:
December 31, 2021

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1. INTRODUCTION

White termites, *Odontotermes obesus*, are among the most important insects in agriculture. It tends to cause financial harm to numerous crops and other plant species, commercial timbers, clothing, mattresses and papers etc. and nourishes on carbohydrate containing materials. It has the capability to infest various phases of plant development[1] and cause severe loss in maize, sugarcane, wheat, fruits and other crops etc.[2,3] and it produced 50-100% harvest losses in many crops[4,5]. Many artificial insecticides i.e. chlorodane, indoxacarb and hydroquinone cypermethrin[6-8] and have stayed used to control termite attacks. However, all these artificial chemicals are extremely poisonous and kill non-target species of living organisms[9-12]. Because of their extended residual remaining in the environment, these products are forbidden from use, and it is essential to put concentration on plant-based insect repellent as substitute to overcome the termites.

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Effectiveness of numerous plants and extracts of different parts of the plants have been inspected in in-vitro, also some products i.e. sesquiterpenes, flavonoids, and thiophenes[13,14,15] have been taken from many plant's species i.e. *Calotropis procera, Diospyros sylvatica, Ipomea fistulosa, Chenopodium spp, Maesa lanceolata, Azadirachta indica, Tagetes minuta, Croton macrostachyus, Datura stramonium, Phytolacca dodecandra, Vernonia amygdalina, Nicotiana tobaccum, Ficus vasta* and *Shinus mole*[16-19] against *viscose Cleome, Odontotermes obesus (Rambur), Ipomea carnea,* and *Pavonia glechomifolia* have been used against tea termites, to block the losses produced by termites. Pesticides that are originated by plants are much more harmless and are biodegradable without any difficulty in the media and displayed no residual impact. The literature review advocates that are essential to search for plants and to progress towards making an appropriate and active antitermite herbal formula.

Plants act as ridiculous and cheaper sources of secondary metabolites which can be used for pest control[20,21]. Insect killing actions of numerous plants to counter many pests have been established[22,23]. The harmful impacts of extracts of plants or other clean compounds on pests can be recognized in numerous ways with harmfulness, mortality, anti-feedant development inhibitors, destruction of generative behavior and a decrease in productiveness and fertility. *Tribolium castaneum* and *Rhyzopertha dominica* reason large commercial loss of stockpiled wheat and Callosobruchus analis remain of substantial financial importance as main pests of leguminous plants[24-27].

The traditional approach to regulate these pests have been with the usage of bug sprays, which may be are directly added to grains or through gas disinfection[28]. But then their mutual usage has led to some issues with the growth of some bug strains unaffected by insect repellent due to resistance[29,30], deadly residues on stockpiled grain, hazard to purchasers and expanding expenses of application. Thus, it is an ominous necessity to create harmless options with low prices that are advantageous to utilize and ecologically responsive.

Indigenous knowledge and literature review revealed that no reference is available about the medicinal values of *Strobilanthes urticifolia Wall.ex Kuntze* and no studies have yet been reported on its antitermite and insecticidal activities. Thus, the purpose of our study was to evaluate the 'antitermite' and 'insecticidal' activities of the various extracts from *Strobilanthes urticifolia Wall.ex Kuntze*.

2. MATERIALS AND METHODS

2.1 Plant material

The whole plant was taken from District Swat in the Khyber Pakhtunkhwa province of Pakistan, in 2016.The plant was recognized by Mr. Ghulam Jelani, who is a taxonomist working in the Department of Botany, University of Peshawar, Khyber Pakhtunkhwa, Pakistan.

2.2 Extraction and Fractionation

The whole plant (12 kg) collected was dried in the shade at room temperature and grinded into fine powder. Powder was mixed in methanol for 15 days, twice. The filtrate was filtered by means of Whatman No. 1 filter paper available in the laboratory. The filtrate was concentrated by means of rotary evaporator at reduced pressure and at a temperature of 40°C to obtained crude extract. Then 500 ml distilled water was added with extract (880 g) and soaked for 24 hours, then partitioned with n-hexane, chloroform ($CHCl_3$), ethyl acetate (EtOAc) to get their soluble fractions. The residual was considered as water soluble aqueous fraction.

2.3 Anti-Termite action

The anti-termite action of the plant was checked succeeding the process of [31]. Stock solution of the trial samples was set-up by dissolving 2mg/ml of methanol and applied to sterilized blotting paper kept in various sterilized petri dishes. Afterward the evaporation of menthol, approximately 25 termites were transferred to every petri dish positioned in desiccator with water at the bottommost to hold moisture. The whole activity was examined after 24 (1 Day), 48 (after 2 days) and 72 hours (after 3 days) and the quantity of killed termites were examined. Termisolve B-PRO was used as reference anti-termite drug. Percentage killing of termites was calculated by means of the following formula;

$$\% \text{ Death of termites} = \frac{\text{No of termites killed by sample}}{\text{Total No of termites}} \times 100$$

2.4 Insecticidal action

The test models were evaluated for insecticidal action against various insects by the using toxicity protocol [32]. Stock solution of different extracts were prepared by mixing 200 mg in 3 ml of methanol and added to filter paper reserved in Petri dishes (90 mm diameter). The Petri dishes were kept for 12-18 hour (overnight) by the goal that the solvent get degenerate. Next day, approximately 10 salubrious test organisms from the test species (*Tribolium castaneum, Rhizopertha dominica* and *Callosbruchus analis*) were relocated to the plates with the avail of a brush and left for 24 hours then after that death count was done. For reference insect repellent, Permethrin (235.71 µg/cm^2) was used.

3. RESULTS AND DISCUSSIONS

3.1 Anti-Termite activity

Various extracts of *S. urticifolia* were examined for termites. The data is listed in fig 1. The CME revealed substantial activity toward termites and the overall mortality rate on Day 1 was 88% whereas the termite's mortality rate on Day 2 was 100%. Similarly, the n-hexane portions were tested for anti-termite operation. Results indicated 52-72 % deaths on 24 to 48 hours respectively. The action was noteworthy on day 3 (92%). The finding of the $CHCl_3$ fraction showed that the termites killed on Day 1 were 48%. The death percentage was approximately 80% on the second day. On day 3 termites were found dead with a death rate of 100 %. The experimental duration of the ethyl acetate fraction was also 3 days. 56% of the termites were killed on Day 1. The mortality rate was 84 % on the second day of the experiment and no termite survived on the third day (100% death). The aqueous portion of the plant extract was the most inactive, killing approximately 28, 44, and 64 percent on days 1 and 2 (24-48 and 72 hours), respectively. Termisolve B-PRO was observed as a helpful control and destroyed all termites on Day 1. According to the above findings, it can be inferred that the CME was more successful in countering termites in comparison to other fractions.

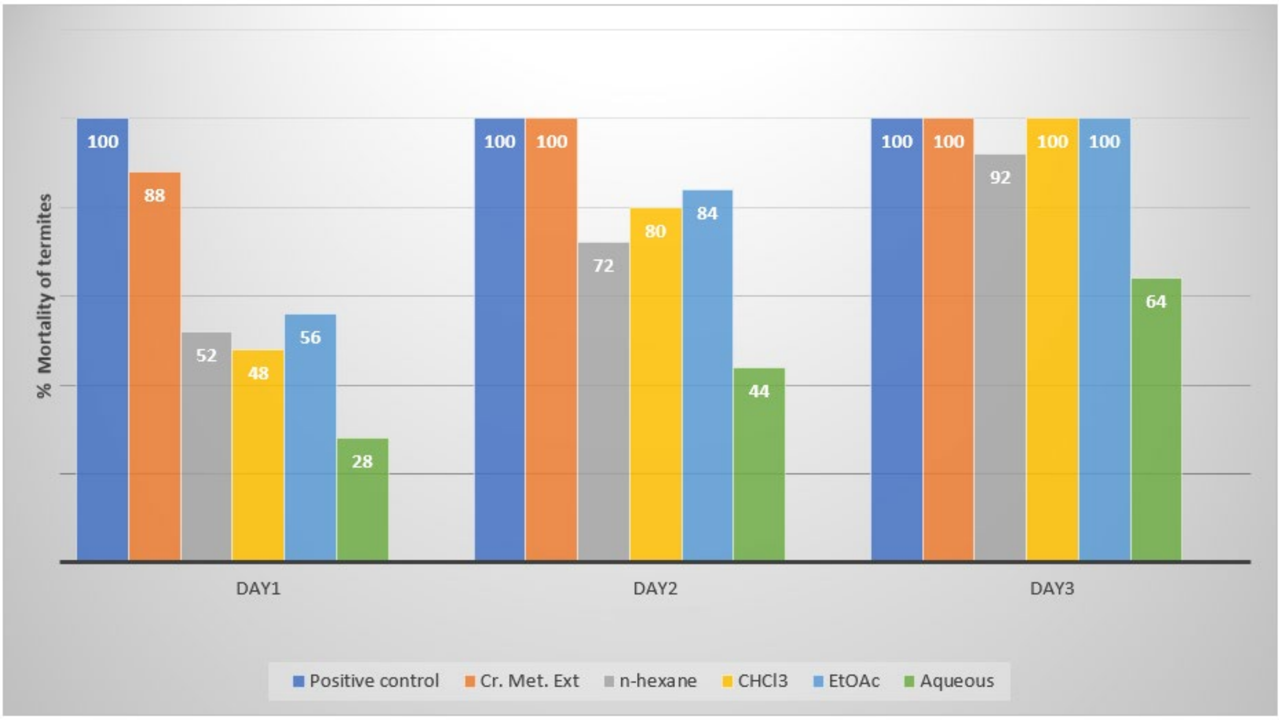

Fig 1. %age Mortality of termites after Day 1, 2 and 3

3.2 Insecticidal activity

The insecticidal action of plant extracts of *S. urticifolia* was checked against three insect's species i.e. *R. dominica, T. castaneum,* and *C. analis*. The outcomes are stated in fig 2. The CME showed highest substantial activity i.e. about 80 % against T. castaneum, weakest activity towards *R. dominica* i.e. about 20 % and no functional activity against C. analis. Good behavior i.e. about 60% was seen by a fraction of *n*-hexane against C. analis and there was no action against other two insects. The fractions chloroform ($CHCl_3$) and Ethyl acetate (EtOAc) showed activity only against *T. castaneum* approximately 20% and *R. dominica* approximately 25%, while just aqueous fraction showed activity against *R. dominica* about 20% and *C. analis* was about 20%. Methanol and permithrine were used as a negative and positive indicator respectively. Negative control did not kill any insects while positive control killed all insects.

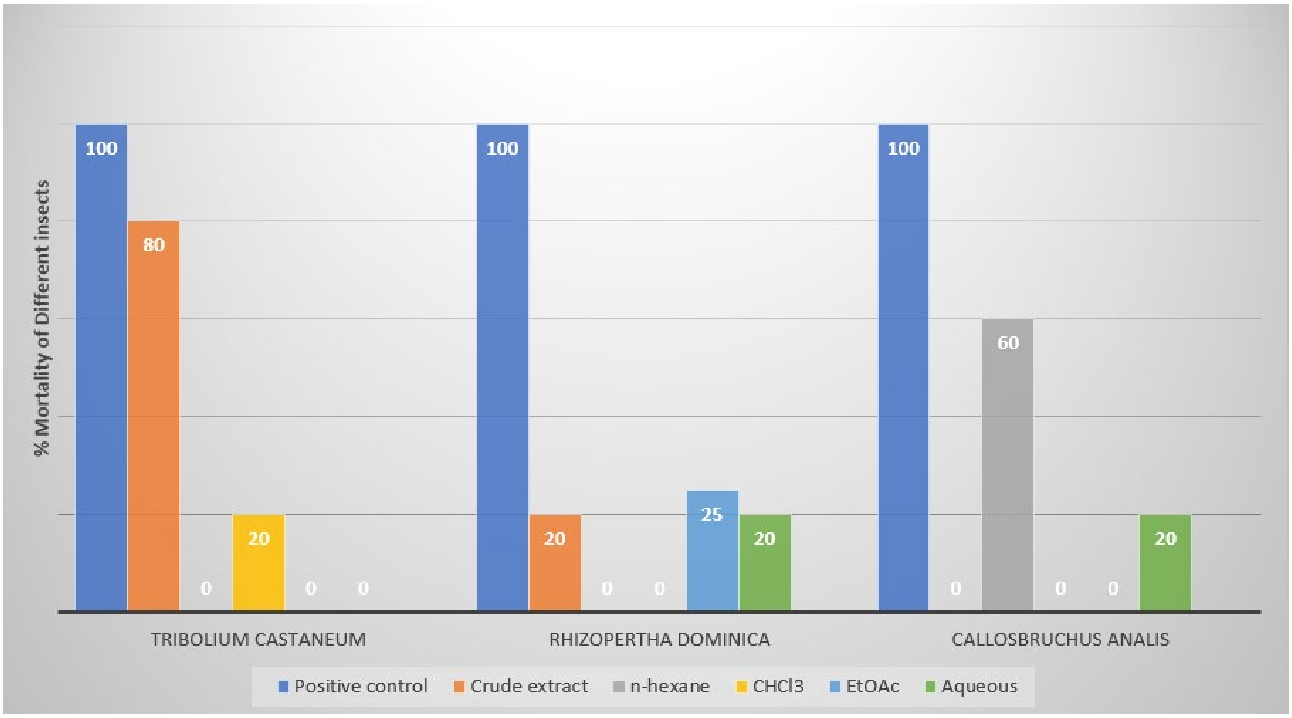

Fig 2: Percentage Mortality of different insects

The study showed that both CME and *n*-hexane fraction was more competitive against some insects relative to less efficient $CHCl_3$, EtOAc and aqueous fraction

4. CONCLUSIONS

Based upon the above findings, it can be concluded that the *S. urticifolia* crude extract and fractions tested might have toxic effects on termites (*Odontotermes obesus*) and different insects (R. dominica, *T. castaneum* & *C. analis*); especially methanolic crude extract and further studies to investigate its potential as a biopesticide is commendable.

ACKNOWLEDGMENT

Authors would like to acknowledge the support of Centre of Biotechnology and Microbiology (COBAM), University of Peshawar, Pakistan for laboratory facilities.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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