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## Preparation and evaluation of panchagavya and a novel natural termiticidal product for termiticidal activity on Jamun and neem trees

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**Abstract**

Though termites help in soil fertility they cause huge loss to plants and housing. Panchagavya, a bio pesticide is widely used in agriculture as an insecticide but there were no termiticidal studies on the preparation. In the present work, Panchagavya and a novel natural termiticidal product were prepared and investigated against termite infested Jamun and Neem tree stems. When 10ml of Panchagavya was sprayed on these affected trees termites were died within 3-4 minutes. With 10ml of novel termiticidal product spray on the trees all the termites died within 2minutes and 30seconds. Although Panchagavya was found to be effective as termiticidal the prepared novel, natural termiticidal product was found to be more effective as termiticidal compared to the Panchagavya preparation. The inherent mild termiticidal activity of turpentine oil and the fast- acting irritant nature of red Chilli and black Pepper powders may be responsible for more efficacy of this product.

**Keywords:** Novel termiticidal product, panchagavya, termites, jamun tree and neem tree

**Introduction**

Among 2500 species of termites, belong to order Isopteran 300 are considered as damaging pests. Termites cause significant loss to agriculture, forestry and housing. Generally they feed on dead or living wood, leaf litter, dung and dead plant materials [1]. Based on habitat, termites are subterranean, dry-wood and damp wood [2]. In addition to wood, they also attack leather, rubber, wool [3] and their infestations are reportable in many medicinal plants like Oil palm tree, Eucalyptus species like *Eucalyptus camaldulensis*, *Eucalyptus grandis* [4], *Acacia*, *Casuarina* and *Leucaena* species [5], crop plants like maize, wheat, rice, sugarcane, sorghum, fruit trees like

**Methods and Material**

Mango, oil crops like ground nut, castor, tuber crops like yam, cassava, fibre crops like cotton, beverage crops like tea and coffee [4]. The loss caused by termites in India is many hundred million rupees each year and the world loss should be quite \$10,000 M. In Australia around 20% of homes and in China 90% of homes in south of Yangtze River are tormented by termites (GEI 2005; MRP 2010). Globally the calculable loss because of the termite damage annually is around US\$50 billion (Subekti *et al.* 2015). The economic impact worldwide because of the termite damage is estimated to be raised to US\$40 billion (Rust and Su 2012) [6]. There are many methods to control termites. The methods included are baiting systems, use of asphyxiant gases like CO<sub>2</sub>, N<sub>2</sub> and application of high temperatures [7]. The most common method of termite control is using synthetic pesticides. These methods are expensive and toxic. Turpentine, Cashew nut shell [8], Garlic, Neem, *Jatropha* species [9], *Calotropis*, Castor oil, lime are eco-friendly termiticides [10]. Termites cause more economic loss to medicinal plants, other trees and crops.

Synthetic termiticides show harmful effects like dizziness, blurred vision, tremors and seizures [11] in humans after spraying the product on the infested plants. Chemical termiticides can provide immediate protection, but accumulate in soil and contaminate water resources [12]. There is a need to prepare safe, economic and effective alternative termiticidal products to control termite

Population in order to curb economic loss caused to medicinal plants, other trees and crops.

Panchagavya is reported to be a bio pesticide used to control pests other than termites. Panchagavya plays an important role in promoting growth and provides immunity to the plant

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and thereby provides resistance against pests and diseases. It is less expensive and eco friendly. Panchagavya is reported to be effective against leaf hopper and white fly in Okra and is effective against major pests of teak (Senthilkumar *et al* 2015), diamondback moth of cabbage (Chandrasekharaiah *et al.* 2015), sorghum shoot fly (Mudigora *et al* 2009) [13]. When mixed, Cow urine and Cow dung which are the ingredients of Panchagavya serves as natural pesticide [14]. Therefore in the present work Panchagavya and a novel natural termiticidal product were prepared and evaluated against termite infested Jamun and Neem trees.

## Materials and Methods

### Materials

All the materials required for the study were procured locally from Tirupati.

### Preparation of Panchagavya

The ingredients and composition of Panchagavya was mentioned below.

**Table 1:** Panchagavya Composition [15]

S.no	Ingredients	Composition
1.	Fresh cow's dung	1.219kg
2.	Cow's urine	731.7ml
3.	Cow's milk	487ml
4.	Cow's curd	487ml
5.	Cow's ghee	121.9ml
6.	Sugarcane juice	731.7ml
7.	Tender coconut water	731.7ml
8.	Banana (ripe)	3 no's
9.	Toddy or black grape juice	487ml
	Total	5l w/v

### Procedure

For the preparation of Panchagavya required quantity of Cow dung was weighed and transferred into a 20L plastic container and measured volume of Cow ghee was added slowly with continuous stirring. The mixture was stirred twice a day for 3 days. On day 4 Cow urine, Cow milk, Cow curd, Sugarcane juice, tender Coconut water, mashed ripe Bananas and Grape juice were added in required quantities in the mentioned sequence. The mixture was stirred twice a day for the next 15 days. On day 19 when the mixture was ready for use the final preparation was stored in a well closed container. On day 20, Panchagavya pH was checked using pH paper. The preparation was also tested for microbial growth on nutrient agar medium by incubating upto 48hrs. From day 21, Panchagavya preparation was used for spraying. The prepared solution was transferred into a well closed container and stored away from sunlight until further use. During storage the preparation thickens over time and has to be diluted with water as per the requirement.

### Preparation of novel natural termiticidal product

The ingredients used and the quantity with which novel natural termiticidal product prepared was mentioned below.

**Table 2:** Composition of Novel Natural Termiticidal Product:

S.no	Ingredients	Quantity
1.	Black pepper powder	5% w/v
2.	Red chilli powder	5% w/v
3.	Turpentine oil	Upto 300ml

### Procedure

About 250ml of turpentine oil was transferred into a 500 ml round bottomed (RB) flask. Accurately weighed black Pepper (15 g) and red Chilli powder (15 g) were added to the flask and mixed well and the volume is made upto 300ml with turpentine oil. The RB flask was plugged with non-absorbent cotton and the mixture was kept for maceration for 48hrs with occasional shaking. After 48hrs the cotton plug was removed and the supernatant layer was decanted and transferred into a well closed amber colored glass bottle and stored away from sunlight until further use.

### Evaluation of Panchagavya and novel natural termiticidal product for termiticidal activity: Study location and Plants selected for the study

Termite infested Jamun (*Syzygium cumini*) and Neem (*Azadirachta indica*) trees located in Sri Padmavati Mahila Visvavidyalayam campus, Tirupati were selected and the study was conducted in the month of February 2019. On each selected tree stem 10x10 cm circles were drawn using a white marker. The parameters noticed during the study were number of insects present in the circles before spraying the preparation. The volume of spray, duration of the spray and the number of termites died and left after the spray were noted during the study. On day 1, the preparations were sprayed on the infested marked areas using a 10 ml syringe and the control areas were sprayed with 10 ml of diluents. The treatment was repeated on day 3 and day 5.

### Evaluation of Panchagavya preparation for Termiticidal activity

#### Procedure

The control areas on the selected Jamun and Neem trees were sprayed with 10ml of distilled water. The procedure was repeated on day 3 and day 5 and the number of termites observed in the areas before and after spraying with water was noted. The test areas on the selected trees were sprayed with Panchagavya preparation. For spraying, about 30 ml of Panchagavya preparation diluted upto 100 ml with distilled water was used. In the test areas, on day 1, 10 ml of Panchagavya preparation was sprayed on both Jamun and Neem trees for a minute and number of termites died noted. The study was repeated on day 3 and day 5. The number of termites died and time taken for their death in minutes were obtained and the data was mentioned in the results.

### Evaluation of novel natural termiticidal preparation for Termiticidal activity:

#### Procedure:

The control areas on the selected Jamun and Neem trees were sprayed with 10 ml of turpentine oil. The procedure was repeated on day 3 and day 5 and the number of termites observed in the areas before and after spraying with turpentine oil was noted. On day 1, the test areas on the selected trees were sprayed with 10 ml of the prepared novel natural termiticidal product without dilution for one minute. The number of termites in the area before and after spray was noted. The study was repeated on day 3 and day 5 to control and check for entry of new termites from other locations to test area. The number of termites died and time taken for death in minutes were obtained and the data was mentioned in the results.

### Precautions while spraying

The preparation being irritant to eyes and skin one should spray the product after wearing glasses and gloves to avoid direct contact of the product with eyes and skin.

### Results and Discussion

Termites cause more economic loss to medicinal plants, other trees and crops. Synthetic termiticide show harmful effects like dizziness, blurred vision, seizures and tremors in humans after spraying the product on the infested plants [11]. There is a need to prepare safe, economic and effective alternative termiticidal products to control termite population in order to curb economic loss caused to medicinal plants, other trees and crops. From the reported literature it was evident that Panchagavya, a bio pesticide was not screened for termiticidal activity so far. In the present study, Panchagavya and a natural product using Turpentine oil, red Chilli powder and black Pepper powder were prepared and evaluated for termiticidal activity.

Neem isn't entirely resistance to termite attack however the antifeedant properties of its wood and the toxic nature of its bark support the utilization of the tree for farming in areas wherever termites are a haul [16]. *Syzygium densiflorum* which is suitable to use as a rootstock for

*Syzygium cumini* is resistant to attack of termites [17]. However, in our university campus many

Of the Neem and Jamun trees were infested with termites and hence, these two were considered for the study. The prepared products were evaluated for termiticidal activity on these selected trees. In the study, Panchagavya and a novel natural termiticidal product were prepared and evaluated for termiticidal activity. The prepared Panchagavya was tested for pH and was found to be 6.5 on day 20. The final preparation was also tested for microbial growth on nutrient agar medium by incubating upto 48 h and no growth of microorganisms

was observed. The novel natural termiticidal product was prepared using 5% w/v black Pepper powder, 5% w/v red Chilli powder in turpentine oil. The preparation was strong in odour and colourless.

### Evaluation of Panchagavya preparation for Termiticidal activity

The number of termites died and time taken for their death in minutes were average values calculated for 3 control areas and 3 test areas respectively and the results are given below (in table 3, table 4 and shown in figures 1a, 1b, 1c, 2a, 2b, 2c). During evaluation of termiticidal activity of Panchagavya, in the control area, termites were not died on both the selected Jamun and Neem trees after spraying the control substance, but immediately the termites moved to another area from the water treated area. This may be due to their exposure to strange conditions. Upon repeating the treatment on day 3 and day 5, the number of insects observed decreased compared to day one. The decrease in termite number was not significant next day most of them were back reflecting the diluent (distilled water) has no termiticidal effect. In the test areas, on day 1, after spraying Panchagavya preparation 10ml for a minute some of the termites died within 3-4 minutes on both Jamun and Neem trees. On repeating the Panchagavya preparation spray in the test circles on day 3 and day 5 most of the termites were died, a few were left. The total number of termites left after day 5 was relatively less on Jamun tree compared to Neem tree indicating Panchagavya more effective on Jamun tree stem as a termiticide compared to Neem tree. Panchagavya is reported to be a bio pesticide which contains Cow urine and Cow dung which serves as a natural pesticide. The bio pesticide action of Panchagavya may be responsible for the termiticidal activity of Panchagavya preparation [14].

**Table 3:** Evaluation of panchagavya on jamun tree stem for termiticidal activity:

Trial	No. of termites in the 'Control' area before and after spray						No. of termites in the 'Test' area before and after spray					
	Day 1		Day 3		Day 5		Day 1		Day 3		Day 5	
	Before spray	After spray	Before spray	After spray	Before spray	After spray	Before spray	After spray	Before spray	After spray	Before spray	After spray
1.	5	4	5	4	5	4	5	2	3	2	1	0
2.	6	5	6	5	6	6	8	5	2	1	0	0
3.	7	4	7	6	6	5	8	4	2	1	1	0
Mean=6							Mean=7					

**Table 4:** Evaluation of panchagavya on neem tree stem for termiticidal activity:

Trial	No. of termites in the 'Control' area before and after spray						No. of termites in the 'Test' area before and after spray					
	Day 1		Day 3		Day 5		Day 1		Day 3		Day 5	
	Before spray	After spray	Before spray	After spray	Before spray	After spray	Before spray	After spray	Before spray	After spray	Before spray	After spray
1.	8	7	7	6	8	7	6	4	3	2	2	0
2.	4	4	4	3	4	4	7	5	4	3	3	0
3.	6	5	6	5	6	5	8	6	5	3	3	0
Mean=6							Mean=7					

**Day one**



**Fig 1: a)** Evaluation of termiticidal activity of Panchagavya on Jamun tree:

**Day three**



**Fig 1: b)** Evaluation of termiticidal activity of Panchagavya on Jamun tree

**Day five**



**Fig 1: c)** Evaluation of termiticidal activity of Panchagavya on Jamun tree:

**Day one**



**Fig 2: a)** Evaluation of termiticidal activity of Panchagavya on Neem tree

**Day three**



**Fig 2: b)** Evaluation of termiticidal activity of Panchagavya on Neem tree

**Day five**



**Fig 2: c)** Evaluation of termiticidal activity of Panchagavya on Neem tree

### Evaluation of novel natural termiticidal preparation for Termiticidal activity

The number of termites died and time taken for their death in minutes were average values calculated for 3 control areas and 3 test areas respectively and the results are given below (in table 5, table 6 and are shown in figures 3a, 3b, 3c, 4a, 4b, 4c).

In the evaluation of novel natural termiticidal product, in the control areas on day 1 after spraying with 10 ml of turpentine oil for 1 minute, a few of the termites died on both the selected Jamun and Neem trees. On repeating the study on day 3 and day 5, some more termites died. On day 5, a few termites were observed in both the control areas indicating the weak termiticidal activity of the vehicle (turpentine oil) compared to novel termiticidal product. The number of termites left on Jamun tree was relatively less compared to

Neem tree, implying that the vehicle was more effective on Jamun tree. In the test areas, on day 1 after spraying 10 ml of the product for a minute all termites died on both the selected Jamun and Neem trees within 2 and half minute reflecting its fast action. The study was repeated on day 3 and day 5 to check whether any new termites appeared in the test area. But no termites were found in the test area indicating that a single application of the product is effective as termiticide. Extracts from black Pepper inhibits

Oviposition and reduce the progeny emergence in insect pests<sup>[18]</sup>. As the present product was prepared using turpentine oil, red Chilli and black Pepper the termiticidal activity of the product may be attributed to the insecticide nature of Turpentine oil and fast acting irritant insect repellent activity of red Chilli and black Pepper.

**Table 5:** Evaluation of novel natural termiticidal preparation on jamun tree stem for termiticidal activity:

Trial	No. of termites in the 'Control' area before and after spray						No. of termites in the 'Test' area before and after spray		
	Day 1		Day 3		Day 5		Day 1		Day 3 and Day 5
	Before spray	After spray	Before spray	After spray	Before spray	After spray	Before spray	After spray	Before and after spray
1.	6	4	4	3	3	1	7	0	0
2.	4	2	2	1	1	0	6	0	0
3.	5	3	3	2	2	1	8	0	0
	Mean=5						Mean=7		

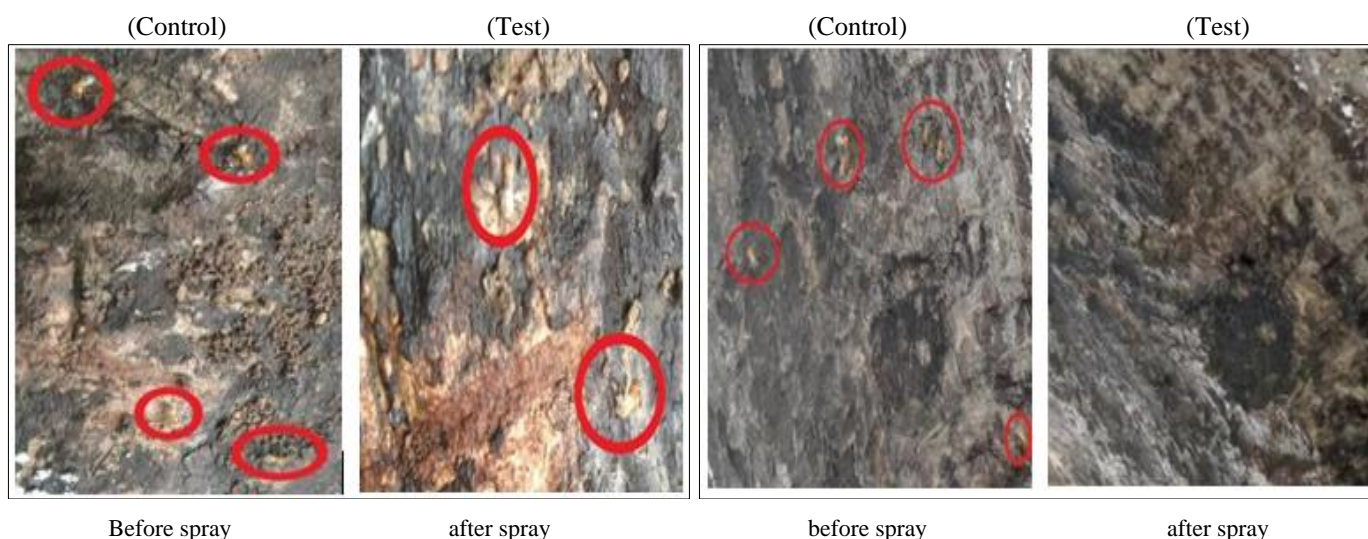
**Table 6:** Evaluation of novel natural termiticidal preparation on neem tree stem for termiticidal activity:

Trial	No. of termites in the 'Control' area before and after spray						No. of termites in the 'Test' area before and after spray		
	Day 1		Day 3		Day 5		Day 1		Day 3 and Day 5
	Before spray	After spray	Before spray	After spray	Before spray	After spray	Before spray	After spray	Before and after spray
1.	7	5	5	3	3	3	6	0	0
2.	6	4	4	2	2	1	4	0	0
3.	5	3	3	1	1	1	8	0	0
	Mean=6						Mean=6		

The prepared novel, natural termiticidal product was found to be more effective compared to the prepared Panchagavya preparation against termite infested Jamun and Neem trees. May be the fast acting, irritant nature of black Pepper powder and red Chilli (Capsaicin as an insecticide, Richard Hoyt) and may be mild termiticidal activity of turpentine oil were

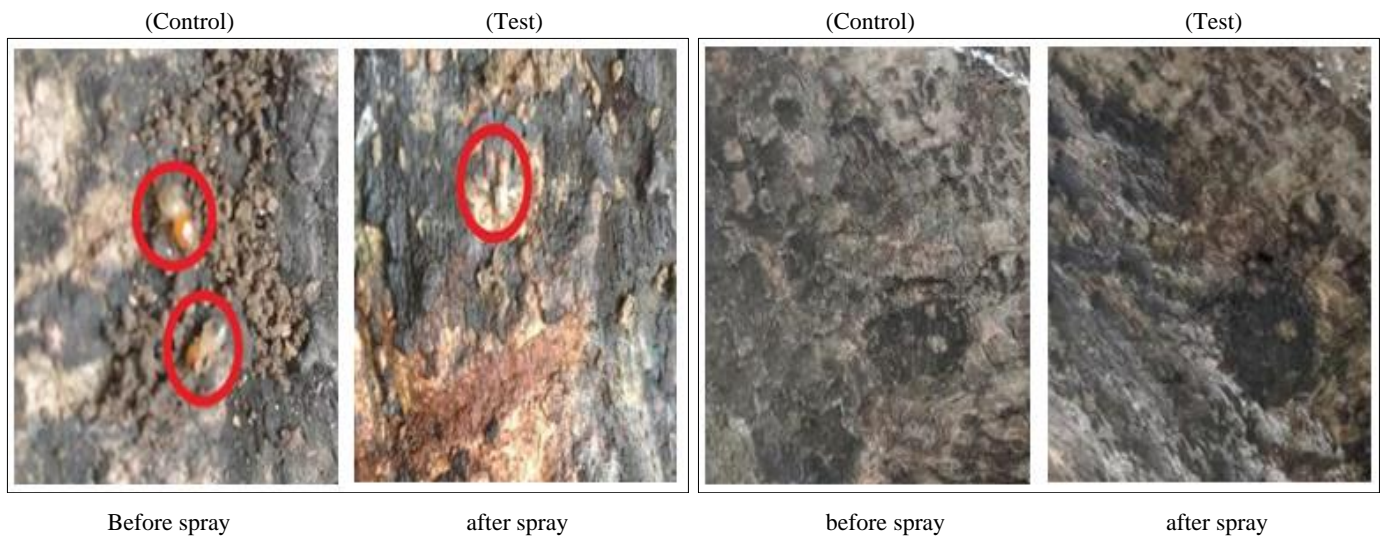
responsible for its effectiveness on termites. Water which was used as diluent in Panchagavya preparation is free from termiticidal activity, which may be a contributing factor for less termiticidal activity of Panchagavya preparation.

#### Day one



**Fig 3:** a) Evaluation of termiticidal activity of novel termiticidal product on Jamun tree

**Day three**



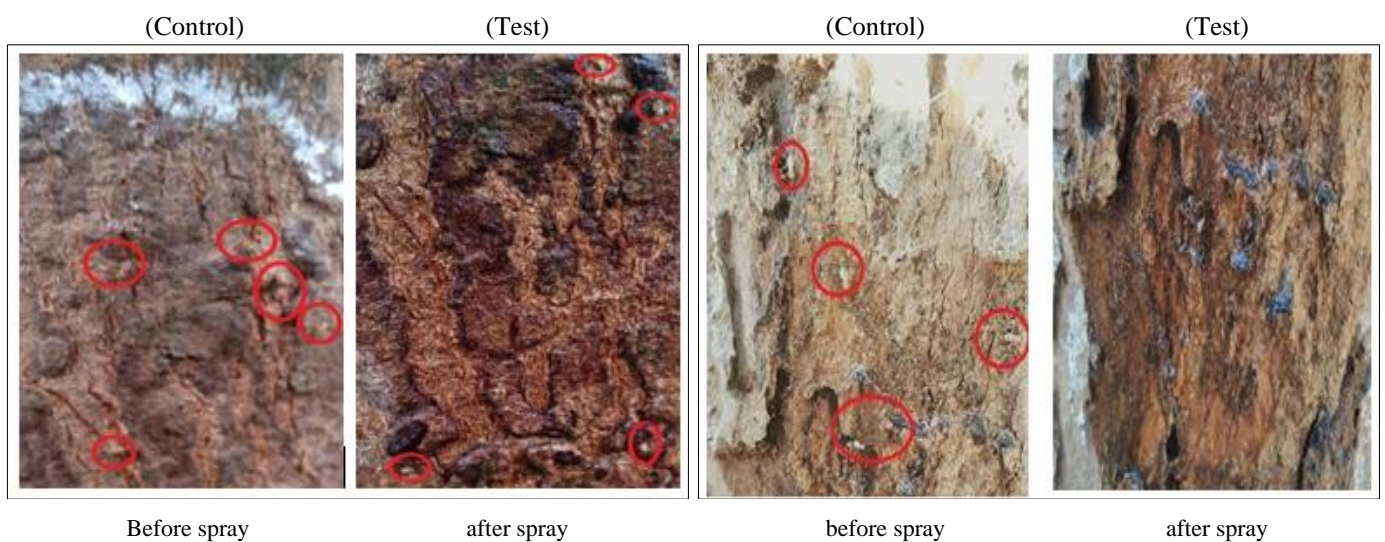
**Fig 3: b)** Evaluation of termiticidal activity of novel termiticidal product on Jamun tree

**Day five**

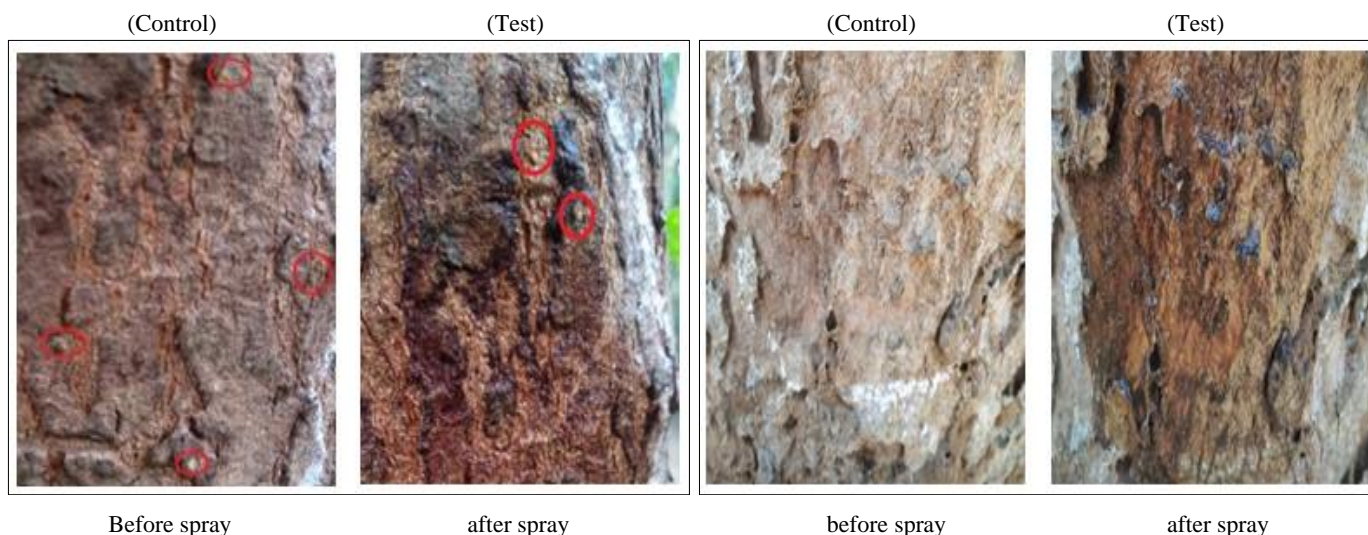
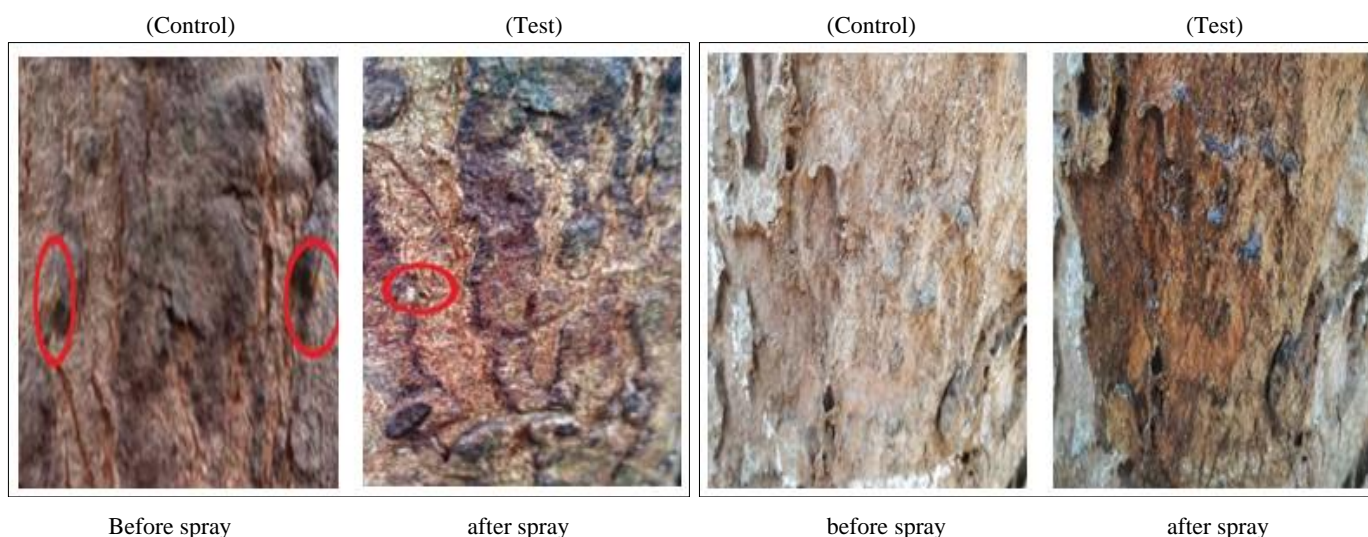


**Fig 3: c)** Evaluation of termiticidal activity of novel termiticidal product on Jamun tree

**Day one**



**Fig 4: a)** Evaluation of termiticidal activity of novel termiticidal product on Neem tree

**Day three****Fig 4: b)** Evaluation of termiticidal activity of novel termiticidal product on Neem tree**Day five****Fig 4: c)** Evaluation of termiticidal activity of novel termiticidal product on Neem tree**Conclusion**

Panchagavya preparation and the prepared novel termiticidal product were safe and economic termiticides compared to synthetic termiticides. The prepared novel natural termiticidal product, more effectively controlled termites developed on Jamun and Neem tree stems compared to Panchagavya preparation.

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