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RESEARCH NOTE

Bio-efficacy of medicinal leaf powders against drug store beetle, *Stegobium paniceum* Linn. (Coleoptera: Anobiidae) infesting coriander seeds

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ABSTRACT: Bio-efficacy of leaf powders of medicinal plants *viz.*, *Andrographis paniculata* Wall., *Azadiracta indicia* A. Juss., *Eucalyptus globules* Labill. and *Vitex negundo* L. was evaluated for their efficacy against adult drugstore beetle, *Stegobium paniceum* Linn. on coriander seeds under laboratory conditions at Annamalai University, India. Observations were recorded at 12 h interval up to 84 h after treatment. Two percent concentration of all leaf powders showed mortality effect on test insect. *Azadiracta indica* leaf powder 2 % concentration inflicted cent per cent mortality at 84 hours after treatment. This was followed by *A. paniculata* 2 %, *A. indica* 1%, *V. negundo* 2%, *E. globules* 2%, *A. paniculata* 1 %, *E. globules* 1% and *V. negundo* 1%.

Keywords: Drug store beetle, *Stegobium,* leaf powder, mortality

Coriandrum sativum is an annual herb, known for its culinary and medicinal value and cultivated as an important spice crop. Several insects cause damage to coriander seeds under storage conditions. Among them drugstore beetle, *Stegobium paniceum* Linn. (Coleoptera: Anobiidae) is one of the major pests of seeds in storage godowns and gene banks. Its damage also affects the germination of the seed. Botanicals are one of safer means of management of drugstore beetle. Several plants reported with insecticidal, acaricidal, anti-feedent and repellent property in store product pest management (Asawalam *et al*. 2006; Rosman *et al*. 2007; Saravanaraman *et al.* 2020).

Several studies have reported the efficacy of plant powders against storage pests. For instance, powders from *Annona muricata*, *Jatropha curcas*, *Azadirachta indica*, and *Eucalyptus tereticornis* have shown effectiveness against *Sitophilus zeamais* (Asmanizar et al., 2012; Mandudzi & Edziwa, 2016). Similarly, *Azadirachta indica*, *Lantana camara*, and *Tephrosia vogelii* demonstrated anti-feedent activity against *Prostephanus truncatus* (Chebet et al., 2013). Moreover, leaf powders from *Moringa oleifera* and *Allium sativum* have been tested on *Trogoderma granarium*, showing promising results in controlling both adult and larval stages (Musa, 2013).This study aims to evaluate the efficacy of leaf powders in controlling *S. paniceum* in stored coriander seeds.

Coriander seeds infested with *S. paniceum* were collected, and the test insect culture was maintained in 1 kg plastic containers sterilized with ethanol. Each container was filled with 500 g of infestation-free coriander seeds, and 100 pairs of freshly emerged adult male and female *S. paniceum* were released. The containers were covered with muslin cloth and kept at room temperature (28 ± 2ºC). Two containers were maintained as the mother culture throughout the study. Leaves of *Andrographis paniculata*, *Azadirachta indica*, *Eucalyptus globulus*, and *Vitex negundo* were collected, washed, shade-dried for five days, ground, and sieved through a 30-mesh sieve. The resulting leaf powders were stored in airtight containers. For the experiment, 10 g of healthy, disinfested coriander seeds were placed in 9 cm diameter petri plates. Two concentrations of leaf powders (1% and 2% w/w) were mixed thoroughly with the seeds. Each treatment, along with a control, was replicated three times. Twenty freshly emerged *S. paniceum* adults were introduced into each petri plate and covered with muslin cloth to prevent insect escape (Belmain *et al.,* 2001). Mortality was recorded at 12, 24, 36, 48, 60, 72, and 84 hours after treatment. The data were square root-transformed and analyzed using a completely randomized design (CRD).

After 12 h of treatment, the maximum mortality recorded in 2% W/W concentration of *A. paniculata* (6.33 %) followed by 2% W/W concentration of *V. negundo* (5.67 %) and *A. indica* (5.33 %). The same pattern was followed at 24 h after treatment as 2 % *A. paniculata* (8.33%), 2%, *V. negundo* and *A. indica* (7.33%), 2% *E. globules* (6.33%) and 1% *V. negundo* (6.33%). At 48 h after treatment maximum mortality recorded was 2% *A. indica*, (14.67), 2% *A. paniculata* (13.67%), 1% *A.*

Table1. Effect of some medicinal plant powders against *Stegobium paniceum*

Treatment	Concentration (%)	Cumulative mortality (in numbers)							Mortality (%) over control @ 84 HAT
		12 HAT	24 HAT	36 HAT	48 HAT	60 HAT	72 HAT	84 HAT	
Andrographis paniculata	1.0	4.00 (2.22)^{bc}	6.00 (2.62)^{bc}	8.67 (3.10)^{b}	12.00 (3.60)^{bc}	12.67 (3.69)^{cd}	15.67 (4.08)^{de}	18.00 (4.35)^{ab}	**90.00**
Andrographis paniculata	2.0	6.33 (2.70)^{a}	8.33 (3.05)^{a}	12.00 (3.60)^{a}	13.67 (3.82)^{ab}	15.67 (4.08)^{b}	16.67 (4.20)^{cd}	19.67 (4.54)^{a}	**98.35**
Azadiracta indica	1.0	3.67 (2.15)^{c}	6.00 (2.64)^{bc}	7.33 (2.88)^{bc}	12.33 (3.65)^{bc}	15.33 (4.03)^{b}	18.33 (4.39)^{b}	19.33 (4.50)^{a}	**96.65**
Azadiracta indica	2.0	5.33 (2.51)^{ab}	7.33 (2.88)^{ab}	11.33 (3.51)^{a}	14.67 (3.95)^{a}	18.33 (4.39)^{a}	20.00 (4.58)^{a}	20.00 (4.58)^{a}	**100.00**
Eucalyptus globules	1.0	3.67 (2.15)^{a}	5.00 (2.44)^{c}	6.33 (2.70)^{c}	8.33 (3.05)^{e}	12.00 (3.60)^{d}	15.67 (4.08)^{de}	17.33 (4.28)^{b}	**86.65**
Eucalyptus globules	2.0	5.00 (2.44)^{abc}	6.33 (2.70)^{bc}	7.00 (2.82)^{bc}	11.00 (3.46)^{cd}	14.67 (3.95)^{bc}	17.33 (4.27)^{bc}	18.67 (4.43)^{ab}	**93.35**
Vitex negundo	1.0	5.00 (2.44)^{abc}	6.33 (2.70^{bc}	7.00 (2.82)b^{c}	10.00 (3.00)^{e}	12.33 (3.65)^{d}	14.67 (3.95)^{e}	16.67 (4.20)^{b}	**83.35**
Vitex negundo	2.0	5.67 (2.58)^{ab}	7.33 (2.88)^{ab}	7.67 (2.93)^{bc}	10.33 (3.36)^{d}	12.67 (3.69)^{cd}	15.00 (3.99)^{e}	18.67 (4.43)^{ab}	**93.35**
Control	0.0	0.00 (1.00)^{d}	0.00 (1.00)^{d}	0.00 (1.00)^{d}	0.00 (1.00)^{f}	0.00 (1.00)^{e}	0.00 (1.00)^{f}	0.00 (1.00)^{c}	--
SE.d		0.15	0.12	0.15	0.11	0.12	0.08	0.06	
CD (p=0.5)		0.33	0.27	0.34	0.24	0.26	0.18	0.13	

Mean of three replications; Values in parentheses are square root transformed values
In a column means followed by a common letter are not significantly different by DMRT (P=0.05)

indica (12.33%), 1% of *A. paniculata* (12.00%), 2% *E. globules* (11.00%) and 2% *V. negundo* (10.33%). The same pattern followed in 60 hrs after treatment. Data at 72 hrs after treatment were shown the mortality on different treatments 2% *A.indica* caused cent percent mortality (20.00%), 2% *E. globule* (17.33%),1% *A. indica* (18.33%), 2% *A. paniculata* (16.67), 1% *A. paniculata* and 1% *E. globule* (15.67%), 2 and 1 % *V. negundo* viz 15.00% and 14.67% observed. At 84 h after treatment mortality data recorded in the treatments are 2% *A. indica* (20.00%), 2% of *A. paniculata* (19.67%), 1% *A. indica* (19.33%), 2% *E. globules* (18.67%), 2 % *V. negundo* (18.67%), 1% *A. paniculata* (18.00 %), 1% *E. globules* (17.33 %) and 1 % *V. negundo* (16.67 %).

The present indicated that *A. indica* at both 1.0% and 2.0% concentrations was the most effective treatment against derugstore beetle. This is consistent with previous research indicating the high efficacy of neem-based treatments in pest control due to the presence of azadirachtin, a potent insecticidal compound that disrupts pest growth and reproduction (Isman, 2006; Gopalakrishnan et al., 2013).

A. paniculata, another widely used botanical in pest management, also demonstrated significant insecticidal activity, with the 2.0% concentration causing 98.35% mortality. This result aligns with studies showing that Andrographis extracts contain bioactive compounds such as andrographolide, which have shown insecticidal and antifeedant properties (Singh et al., 2014). The slightly lower mortality observed in the 1.0% concentration (90%) suggests that higher concentrations are necessary for maximum efficacy. *E. globulus* and *V. negundo* exhibited moderate insecticidal activity, with both achieving over 80% mortality at their highest concentrations (93.35% and 93.35%, respectively). Previous studies have indicated that essential oils from Eucalyptus contain compounds such as 1,8-cineole and p-cymene, which have shown repellent and toxic effects on various insect pests (Batish *et al.,* 2008). Similarly, *V. negundo* has been shown to possess insecticidal properties, likely due

to the presence of alkaloids and flavonoids that interfere with insect metabolism (Mishra *et al*., 2015).

The statistical analysis showed that the efficacy of all botanical treatments was significantly higher compared to the control group (no mortality), where no treatment was applied. The performance of these botanicals supports their potential use in integrated pest management (IPM) systems as eco-friendly alternatives to chemical pesticides. Given the rising concerns about pesticide resistance and environmental sustainability, botanicals like *A. indica* and *A. paniculata* offer promising avenues for sustainable pest control (Isman, 2015; Dubey *et al.,* 2011). Moreover, the time-dependent increase in mortality across the treatments suggests that the bioactive compounds in these leaf powders maintain their efficacy over time, providing a prolonged protective effect. This study confirms that leaf powders, especially *A. indica* and *A. paniculata*, are highly effective in controlling pests when used at appropriate concentrations. The findings support the use of these plants in sustainable pest management programs, offering an environmentally friendly alternative to synthetic pesticides. Future research could explore the synergistic effects of these botanical extracts with other biological control agents to enhance their efficacy and further reduce dependency on chemical inputs.

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