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Potential of some aromatic medicinal plants antifeedant against cowpea weevil, *Callosobruchus maculatus*, Tamil Nadu, India

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Abstract
The counter feed insect capability of concentrates of five normal plants; *Galic* (*Allium sativum*), *Manjack* (*Cordia millenii*), *African nutmeg* (*Mondora myristica*), Negro pepper (*Xylopia aethiopica*) and Ginger (*Zingiber officinale)* against cowpea weevil, (*Callosobruchus maculatus*) was assessed. The outcomes set up that concentrates of Ginger caused the most grounded taking care of detergency against the creepy crawly bugs with rate taking care of file of 48.3%. The request for the antifeedant strength of the concentrates against *C. maculatus* following 5-hour openness was Z. officinale (43.9%), > *X aethiopica* (48.3%) > *C. millenii* (59.9%) > *A. sativum* (61.6%) > *M. myristica* (64.9%). The examination further talked about the difficulties standing up to specialists and ranchers in basically sending these plant materials for general use in crop security and makes suggestions on suitable arrangements. Plant materials didn't influence the practicality of the seeds. The outcomes acquired propose that the plant materials have insecticidal properties and can be used in shielding put away mung bean from *C. maculatus* pervasion since they are natural cordial, less expensive than engineered insect sprays and more secure for people.

Keywords: *C. maculates*, antifeedant, *Zingiber officinale, Allium sativum*

Introduction

Cowpea, *Vigna unguiculata* is a significant wellspring of protein for a huge number of individuals in Africa and different pieces of the world. Its protection from dry spell and capacity to improve soil ripeness and forestall disintegration makes it a significant financial yield in many non-industrial nations [1]. The cowhide scarab, *C. maculatus* is the main vermin of put away cowpea in India representing between 20 – 30% harm of grains, prompting monetary misfortunes to the ranchers and decrease in nutritive quality. Viable strategies for controlling weevils on put away cowpeas include the utilization of manufactured pesticides especially organochlorines and organophosphorus compounds. This has regularly prompted unsafe consequences for the climate, people and improvement of obstruction by the weevils [2]. Furthermore, engineered pesticides are not early accessible among helpless ranchers at reasonable costs. *Callosobruchus maculatus* (F.) is a significant store grain nuisance of monetarily significant heartbeats in tropical and sub-tropical nations of the World [3]. Fruitful endurance of various topographical strains of cowpea weevil may variable on various host beats. In present examination, life phases of Hyderabad strain of *Callosobruchus maculatus* were seen on four kinds of put away heartbeats to be specific green gram, cowpea, chickpea and dark gram at various research center conditions for the evaluation of host inclination and better administration of capacity [4]. The outcome demonstrated that the *Callosobruchus maculatus* (F.) inclines toward cowpea for its oviposition, in light of the fact that the most noteworthy number of eggs was found on cowpea followed by green gram and chickpea and the least number of eggs was seen on dark gram. The most noteworthy populace was recorded on cowpea followed by green gram, dark gram and chickpea [5]. The short formative time of cowpea weevil was seen on cowpea, green gram and chickpea while longest was on the dark gram [6]. The life span of *C. maculatus* was longer on dark gram while briefest life span was seen on cowpea and green gram. From this examination it was presumed that the cowpea and green gram was most ideal host beats for *C. maculatus*, they were additionally powerless and helpless among every one of the four considered put away seeds while chickpea and dark gram were less good host and have moderate vulnerability to the India strain of *Callosobruchus maculatus* (F.) [7]. Heartbeats (dried seeds) arrive in an assortment of shapes, tones and sizes. They can

be burned-through in numerous structures including split or entire, as flours or isolated into extractions like starch, fiber and protein [8]. Their admission goes from child diet, poor's just as luxuries of the rich; in Pakistan beats are planted on 1.5 million hectares of land. It is a holometabolic creepy crawly with the egg and grown-up stage found on the grain and the larval and pupal stages living inside the grain [9]. The hatchlings drill into the beat grains and gobble up the endosperms which become inadmissible for human utilization with decreased suitability for replanting or for the creation of fledglings. Today there is an expanding interest in western nations in the growing of seeds as purchasers request negligibly prepared, added substance free, more characteristic, and dietary quality food sources [28]. The seeds might be processed or ground into flour for making noodles, breads and soups. In rustic regions, the juvenile green cases are additionally utilized as vegetable. Mung bean stalks, leaves and husks establish a critical extent of animals feed. Subsequent to picking of the cases, the entire plant might be furrowed in the dirt to improve richness. Like different vegetables, mung bean is assaulted by field to put away bug bugs [11]. Creepy crawly bug can fundamentally diminish mung bean benefit, decreasing both yield and seed quality. To guarantee food security for the populace, excess grains are appropriately protected away. Put away grains as well as filling in as a wellspring of home-grown food supply consistently, serve an as intends to produce income for the cultivating families. Grains are anyway entirely powerless to invasion by bug bothers having a place with two fundamental orders, *Coleoptera* (bug) and *Lepidoptera* (moth), miniature organic entities and to rat bugs away [12]. Ranchers are presently progressively falling back on the utilization of neighbourhood plant materials and concentrates, containing rotenoids, nicotine and pyrethrum to shield put away cowpea from creepy crawly invasion.

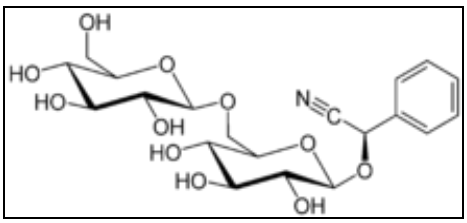

Fig 1: Antifeedant compound

Several studies have evaluated the efficiency of many plant extracts against stored products insects. Insects are the most important among storage pests because apart from their direct damage, they create conditions that allow secondary infection by rot organisms mainly fungi the present study was carried out on green gram under laboratory conditions to reveal its biology by morphometric measurement of egg, larva, pupa and adult for finding out the suitable control measures.

2. Materials and Methods

Preparation of plant powders and crude extracts

The plant materials used were Galic (*Allium sativum*) Maryack (*Cordia millenii*), African nutmeg (*Mondora myristica*), Negro pepper (*Xylopia aethiopica*) and Ginger (*Zingiber officinale*). They were purchased from local market in Thanjavur, Tamil Nadu, India.

The plant materials were washed and cut into smaller sizes. They were sun dried for five days and further dried in an electric oven at 60 °C for another five days [13]. The dried plant materials were pulverized separately with a sprinder and sieved through a 40 hole/mm^2 mesh to obtain fine powders. The large particles which did not pass through the mesh were regrinded and sieved to obtained additional powder. The process was repeated three times.

The crude extracts were obtained by introducing 50g, 75g and 100g of the powders in 100ml of 95% ethanol in separate jars. The jars were regularly shaken and allowed to stand for three days. All supernatants of each plant extract were filtered and slightly heated to completely evaporate the ethanol solvent. The syrup-like crude extracts of each plant materials was stored in a refrigerator at 4 °C.

Preparation cowpea substrate

Uninfested cowpea seeds were purchased from the local market in laboratory and stored in the refrigerator at freezing temperature (-4 °C) for six hours to kill any living insects on the cowpea seeds. The seeds were then equilibrated to the ambient temperature of 30 °C. Only seeds considered free of infestation were used for the study.

Insect pest culture

Test insects, *Callosobruchus* maculatus were cultured using modified method of [14-15]. Batches of heavily infested cowpeas were mixed with larger quantities of uninfested cowpea. Each mixture was distributed into seven kilner jars and covered with polyethene nets fastened around the mouth of the jars with rubber bands. Unsexed adults of the pests were used for the study.

Feeding detergency tests

The antifeedant activities of the five extracts on *C. maculatus* was determined using the filter paper feeding protection method. The tests were conducted in five sets with each preparation in replicates of three. A representative sample filter paper containing 0.5g/ml of each test plant was used for the feeding deterrence tests. Two control filter papers were treated one with ethanol and the other without any treatment. The filter papers were placed in labeled compartment in Petri dishes. 10 adults of *C. maculatus* were selected and starved for 24 hours before being introduced into the center of each compartment and allowed to feed for five days under ambient conditions. The feeding activity of the insects was recorded following methods [16]. The units are made of three conditions.

1. Pure food composed of two untreated filter papers (control) (T).
2. Food with possibility of choice between treated and untreated filter paper (TC) (Choice test).
3. Food with two treated filter papers (TT) (No choice test).

Loss in weight of the filter papers was regarded as a measure of the amount of food consumed. The percentage feeding index (PEI) was calculated using the method employed by [17].

Statistical analysis

Data obtained were subjected to analysis of variance procedure and significant means were separated using Fishers' Protected Least Significant Difference at 5% level of probability.

3. Results and Discussion

The feeding deterrence of the plant extracts on cowpea weevil, cowpea weevil, *Callobruchus maculatus* more than five hours openness period is summed up in Table 1. The outcome set up that the concentrates of ginger *(Z. officinale*) caused the most grounded taking care of discouragement against the bug, *C. maculatus* with rate taking care of file (PFI) of 43.9. The following most remarkable antifeedant against *C. maculatus* was *Negro pepper* (*X aethuipica*), galic *(A. sativum),* and African nutmeg (*M. myristica)* with PFI of 59.9, 61.6 and 64.9 separately. In this way, the request for antifeedant intensity of the concentrates against *C. maculatus* was *Z. officinale* (43.9%) > *X aethiopica* (48.3%) *C millenii* (59.9%) > *A. sativum* (61.6%) > *M myristica* (64.9%) [32]. The measure of food devoured by *C. maculatus* during the 5hours openness to the plant separates is additionally represented in Figure 1. It showed that the distinctions in the rate feedings file (PFI) of *C. maculatus* because of concentrate more than 5 hours openness. Taking care of hindrances are conducts adjusting optional metabolite in plants that act straightforwardly on fringe taste organs of phytophagous bugs consequently keeping them from taking care of or ovipositing [19]. Antifeedant properties are found in the significant classes of auxiliary metabolites like alkaloids, phenolics and terpenoids, some of which especially terpenoids, have been recognized in the plants utilized for this examination [20]. The consequences of this investigation are like discoveries by different specialists who showed taking care of prevention of some organic concentrates against creepy crawlies in the field and research facility preliminaries [21]. Used nutmeg (*M. myristica*) oil to deflect food utilization by rice weevil *Sitophulu zeamais* and the red flour bug, *Tribolium castaneum*. Different investigations [22]. Have revealed that botanicals and certain therapeutic plants fundamental oils have antifeedant properties numerous significant put away item creepy crawlies. The discoveries of this investigation concur with them and further features the antifeedant impacts of *Z. officinale*, *C. millenii* and *X. aethiopica* which had been beforehand unreported as antifeedant against cowpea weevil. The distinction in the bug reactions or the force of the taking care of prevention by the plants could be because of fixation contrasts of the dynamic standards of the concentrates. The five plant removes utilized in this investigation have all shown clear possibilities to secure cowpea seeds away against assault and harm by *C. maculatus*. Regardless of this, different difficulties standing up to scientists and ranchers in essentially sending the plant extricates for general use flourish [23].

Table 1: Antifeedant activities of plant extracts against *Triboolium tribolium* castaneum over 5 hours

Plants insects	Plant part used	Food presented (mg)		Food consumed		PFI
		Control	Test	Control	Test	
C. sativum	Bulb	500	506	230.6	151.5	207
C. millenii	Seed	500	506	230.6	140.7	24.2
M. myristica	Seed	500	506	230.6	118.5	32.1
Z. officinale	Rhizome	500	506	230.6	110.8	35.1
X. aethiopica	Fruit	500	506	230.6	96.5	40.9

The mean rate mortality of *C. maculatus* treated with powders of *P. guineense* organic products, *D. tripetala* organic products, *A. sativum* bulbs and *Z. officinale* rhizomes on put away mung bean seeds are appeared on 48 hours after invasion. All the plant powders showed fluctuating levels of insecticidal activities slaughtering C. maculates *P. guineense* caused the most noteworthy mortality of 20.0% followed by *A. sativum* with 15.0%. The most un-mean rate mortality was recorded by *D. tripetala* and *Z. officinale* with 13.30% individually [24]. Rate mortality of grown-up *C. maculatus* presented to plant powder 96 hours after pervasion is appeared in P. guineense caused the most noteworthy mortality 56.70% followed by *A. sativum* 50.00%, *D. tripetala* 45.00% and Z. officinale 43.30%. The mortality impacts of *P. guineense* higher than *D. tripetala* and *Z. officinale* however altogether the equivalent with *A. sativum*. The mean measurement impact on mortality of *C. maculates* grown-ups 96 hours after invasion shows that 2 g/20 g mung bean seeds treatment had the most noteworthy mortality impact of 66.70%. The impact of treat mung bean seeds through plant powders on oviposition by *C. maculatus* is appeared [25]. There was decrease in oviposition in every one of the treated examples contrasted and the control. *P. guineense* had the best protectant activity among the plant powders with mean oviposition check of 58.33%, which was essentially unique in relation to different powders. *Z. officinale* had the least protectant activity with the most elevated mean oviposition tally of 66.80%. Grown-up development check of *C. maculatus* from mung bean seeds treated with plant powders is appeared. Grown-up bruchid development was essentially stifled by all the plant powders when contrasted and the control. Flute player guineense had the most noteworthy concealment impact, with mean check of 36.00 which was genuinely unique in relation to other plant powders [26]. The mean rate germination of mung bean seeds treated with plant powders is appeared in. There was no critical contrast among the plant powders on rate germination of mung bean seeds treated. The dose 0.5 g/20 g mung bean seeds had the least rate germination with 30.00% which varied from others. They adjusted with the properties needed for controlling bugs benefiting from interior plant parts which incorporate; poisonousness to grown-ups, decrease of oviposition, harmfulness to youthful stages before or quickly following infiltration of plant tissues [27]. Poisonousness on mortality began showing 48 hours and advanced to 96 hours after pervasion. At 96 hours, mortality dynamically communicated above 70%. P. quineense fundamentally vary from other powder removes. The outcomes showed that the plant powders were viable in lessening bug pervasion by recording altogether higher mortality when contrasted and the control. P. *guineense* organic product gave the best assurance to put away mung bean by showing an expanded mortality 56.70% contrasted and different medicines at 96 hours after pervasion. *A. sativum* bulb powder positioned second with 50.00% mortality. The outcome acquired uncovered that there was no huge contrast in the rate mortality of *D. tripetala* leafy

foods rhizomes powder. Also the outcomes concur with the report on the harmfulness of different plant materials on *C.maculatus*. The powder removes dissuaded oviposition to *C. maculatus* which may have been because of the dynamic fixing in the plant materials. The outcome was in accordance [28]. As indicated by analysts, ovipositional inclination has been credited to seed coat morphology and seed size. Clearly, more eggs were laid on seeds that are enormous, entire, smooth and immaculate. There was a huge decrease as measurements increments. The outcome was in accordance with powder removes stifled the grown-up rise of the bruchids [29]. Recognized a portion of these difficulties to be the non-accessibility of these strong plant's materials in business amount to ranchers to supplant the manufactured pesticides [30]. Different difficulties are creation issues, just as circulation and promoting of plant-based pesticides. This hence accentuates the need to build up proper stockpile chains that share the advantages of these potential plant insect poisons with the neighbourhood networks from which they are gathered. It has likewise been recommended that powder concentrates could cause the demise of bug bother by the particles hindering the spiracles of the bruchids subsequently disabling breath and causing suffocation and passing. The concealment of the scarabs was dose subordinate. Higher measurements smothered grown-up rise more. The feasibility of the mung bean seeds were not influenced by the plant material powders. There were no huge contrasts among the plant powders. Seeds not assaulted by the creepy crawly developed regularly.

4. Conclusion

The outcomes showed the insecticidal possibilities of the plant materials in shielding put away mung bean seeds from harm by *C. maculatus* with no harmful consequences for feasibility of seeds. All the plant materials showed varing levels of insecticidal capacities in spite of the fact that *Piper guineense* performed best among the plant materials utilized. Also, the plant materials and concentrate didn't influence the appearance, flavor, surface and generally agreeableness of the treated cowpea seeds. We accordingly suggest the utilization of these plant materials particularly *P. guineense* in the control of *Callosobruchus maculates* away as against engineered bug sprays, since it is less expensive, protected, simple to apply, and naturally well disposed.

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6. Conflict of interest

The authors have declared that there is no conflict of interest.

7. Source/s of funding

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