

Management of *Callosobruchus analis* by using Different Medicinal Plants Powder on Gram

M. Bhubaneshwari Devi

Laboratory of Entomology, P.G. Department of Zoology,
D.M. College of Science, Imphal – 795001, Manipur, India
Email: mbhubaneshwari@yahoo.com; Cont.: 9856806660

N. Victoria Devi

Laboratory of Entomology, P.G. Department of Zoology,
D.M. College of Science, Imphal - 795001, Manipur, India
Email:naorem.victoria@yahoo.com

Abstract – In the present study, powder prepared from parts of six botanical plants viz, *Melia azadarach*, *Perthenium hysterophorus*, *Phlogocanthus thyrsoflorus*, *Vitex trifolia*, *Zanthoxylum acanthopodium* and *Azadirachta indica* were tested against *Callosobruchus analis* on gram in the laboratory condition. All these powders reduce significantly on rate of oviposition, rate of adult emergence, percentage grain damage and weevil perforated index effect. An adult insect were exposed to 5 g plant powder treated gram 100 seeds and was assessed after 7 days of treatment. The result obtained showed that plant powder *Z. acanthopodium* was recorded highly effective in lower number of eggs, prohibiting the adult emergence and reduction in grain damage per cent over other treatment. It was concluded that *M. azadarach*, *A. indica* and *Z. acanthopodium* could be used for the protection of stored rice from infestations of *Callosobruchus analis*.

Keywords – Plant Powder, Adult Emergence, Percentage Grain Damage, Weevil Perforated Index, Gram, *Callosobruchus analis*.

I. INTRODUCTION

The cow pea weevil *Callosobruchus analis* (F.), (Coleopteran: Bruchidae) is the most common pest of stored gram. This pest has been observed infesting seeds of 15 genera, including peanut, chickpea, bean, pea, cowpea and soya bean [12]. Among different legumes seeds, the gram is most preferred host for oviposition and development of the bruchid *Callosobruchus* under common storage conditions [11]. It has been reported that seed quality of chick pea during storage is significantly affected in the damage seed. The use of naturally occurring plant materials to protect agricultural product against a variety of insect pest is an old –age practice in some parts of the world [8]. Moreover, botanicals are preferred over other methods since they are easily available for large or small storages, biodegradable and least toxic to non- target organism [13]. Certain plants possess secondary metabolites, which act as antifeedents, oviposition, deterrents, larvicidal and insect growth regulator [14]. Extracts from different plants have been confirmed useful against a wide range of insect should be encouraged because of greater environmental protection and food safety concerns. Plant products have proved useful in industrialized countries for the protection of grain from storage pests Fields, but these can also play a much role in the production and postharvest protection of food in developing countries [4]. Such botanicals used have well-known volatile and act as natural fumigants that kill adult pests and their progeny. The present study

investigated the efficacy of botanical insecticides against *C. analis* for a sustainable pest control strategy.

II. MATERIALS AND METHODS

The experiment was carried out at the Laboratory of Entomology, D.M.College of Science, Imphal during May 2014. Material used and the technique employed during the course of investigation for conducting the experiments were presented here.

Test insects and maintenance

The pulse weevil, *C.analis* F. was used for the present experiments. A small population of *C. analis* weevil was obtained from Entomology laboratory stock. They were reared and bred under laboratory condition on diet of the seeds of gram inside a growth chamber at $27 \pm 2^\circ$ C and 70 ± 5 % RH. Initially 50 pairs of 1-2 day-old adults were placed in a jar containing green gram seeds. The jars were sealed and a maximum of 1 week were allowed for mating and oviposition. Then parent stocks were removed and gram seeds containing eggs was transferred to fresh green gram seeds in the breeding jars that were covered with pieces of cloth fastened with rubber bands to prevent the contamination and escape of insects. The subsequent progenies of the beetles were used for all experiments.

Preparation of native botanical powders

Fresh leaves of *Melia azadarach*, *Perthenium hysterophorus*, *Phlogocanthus thyrsoflorus*, *Vitex trifolia*, *Zanthoxylum acathopodium* and *Azadirachta indica* were collected from the surrounding of D. M College campus. Afterward they were washed in running water. The plant materials were kept in shade for air- drying and then they were dried in the oven at 60° C to gain constant weight. The powdered samples were prepared by pulverizing the dried leaves and seed with the help of a grinder. The ground samples were passed through a 25-mesh sieve to obtain fine and uniform dust. The extracts were preserved in airtight jar and stored in a refrigerator until their use for insect bioassay.

Effect of the plant powder on Callosobruchus analis on gram.

For this experiment, the grains were sterilized in an incubator, about 24 hour at 60° C to disinfect them. About 100 seeds of gram at 12% moisture content was measured in electronic balance and transferred into petridishes (9 cm) in diameter. The plant powders of 5 g were added gram seeds and mixed thoroughly. 8 newly emerged adults were released into each petridish and kept in the laboratory. For control no extract was applied on grain.

The experiment was conducted at 19°C and 82.4% relative humidity under laboratory condition.

Effect of plant powder on egg laid, adult emergence and grain damage.

The experiment was replicated thrice. After 7 days the dead adults were removed and eggs laid on grain were recorded. The grains with beetle eggs were continuously kept till adult emergence (35 days). The emerging adults were taken out of treated grain and recorded daily up to 10 days. The grain weight loss in each infested sample was recorded after sieving the frass. Per cent weight loss was determined using control samples. Grains that were riddle with exit -holes were counted the percentage damage (PD) and weevil perforation index (WIP) of the weevil to the grains were calculated using the methods in [2] and [3] respectively.

Percentage damage =

$$\frac{\text{Total number of treated grains perforated}}{\text{Total number of grains}} \times 100$$

Weevil perforation index =

$$\frac{\% \text{ treated grains perforated}}{\% \text{ of control grains perforated} + \% \text{ of treated grains perforated}} \times 100$$

Statistical analysis

The experiment was carried out by adopting analysis of variance one way classification and the data thus collected were statistically analysed by using SPSS software in a microcomputer. The F-values and Critical Difference was calculated from the ANOVA table of analysis of variance.

III. RESULTS AND DISCUSSION

Number of laid eggs

The data presented in table 1 indicate that among different botanical tested, *Z. acanthopodium* recorded significantly less number of eggs with 68.3% after 7 days of treatment followed by *A.indica* with 81.6% eggs. The order of effectiveness in reducing fecundity was *M.azadarach*, *P. hysterothorus* with 85% eggs and *P.thyrsiflorus* with 85.6% eggs. All the material provided significantly less number of eggs compared to the control. The maximum number of egg was recorded significantly in untreated control grain with 215% eggs.

Adult emergence

The mean number of *Callosobruchus analis* adults that emerged after 35 days of treatment is presented in Table 1. The result revealed that significantly higher mean number of adults emerged that significantly higher mean number of adult emerged in the control 130.3% mean when compared with the other treatments. *Vitex trifolia* was the highest among the six treatments with 67.6 % mean followed by *P. hysterothorus* with 66.6% mean number of adult emerged while *P. thyrsiflorus*, *M.azadarach*, *A. indica* and *Z. acanthopodium* recorded respectively as 60.6%, 54%, 52% and 43.3% mean number of adult emergence of *C.analis* in gram grain protected with different plant powders (Table 1) when compared with the other treatments during the infestation at 35 days after treatment. The reduction in adult population is probably

due to egg mortality or larval mortality or even reduction in hatching of eggs and also might be due to presence of toxic substance [6].

Effect of grain weight

Table 2 represents the effects of plant powder extracts on grain damage. The mean percentage damage of gram grain treated with the plant powder at 35 days after treatment (DAT) followed a similar trend with the mean adult emergence. The mean percentage damage of gram grains treated with *Z. acanthopodium* dried leave powder was significantly lower than the other treatment. The percentage damage of gram grains due to infestation by *C.analis* varied from 1.13% (*A. indica* leave powder) to 29% (untreated control). The treatment with *M. azadarach*, *Z. acanthopodium*, *P. hysterothorus*, *P.thyrsiflorus*, *V. trifolia*, leave powders were also found to be significantly superior to the untreated control. Grain weight loss indicated the quantitative loss in stored grains due to the insect showing a direct relationship between insects showing a direct relationship between insect populations and weight loss. These findings were also supported by [7] who reported that treatment with powder of *Citrus lemon*, *Annona squamosa*, *Acorus calamus*, *Capsicum annum*, *Ocimum sanctum*, *Lantana camera*, *Datura stramonium*, *A.indica*, *Vitex negundo*, *Aegle marmelos* resulted in lower *Callosobruchus chinensis* fecundity and weight loss than the untreated control.

The percentage damage value show the activities of different plant materials at 5g concentrations while the weevil perforation index (WIP) compares the activities of species of different plant extracts used. From this study, it is evident that *Z.acanthopodium* and *A.indica* displayed some potential as antifeedants and repellents. The results therefore suggest the possibility of using the powder of these plants as toxicants, repellent and antifeedant agents against *C.analis*. [9] reported that the use of dry leave of *Z. acanthopodium* in seasoning of dry chillies avoiding pests and pathogens. These leave possessed a strong pungent smell which act as pest repellent. The insecticidal effect of plant powder might attribute to one or more of the following properties including repellent, antifeedant, stomach poisoning effect where insects fed on admixed grains and picked up lethal doses of treatment particles and these powders might reduce insect movement and also cause death through occlusion of their spiracles, thereby preventing respiration via trachea [10]. This finding supported the finding of [1] who showed the effectiveness of neem leaf powder and ash from various sources against different stored grain pest.

IV. CONCLUSION

Hence the present findings show that among the botanical plant powder treatments *Z. acanthopodium* and *A.indica* powder was found as effective grain protectants, oviposition deterrent, suppression of the adult emergence and less percentage of gain damage on gram. Luo et al (1995) reported that these plants have a range of chemicals which isolated and used for pest control. The test plants

being medicinal would yield environmentally sound chemicals having no harmful effects on the non target organisms.

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AUTHOR'S PROFILE



Dr. M.Bhubaneshwari Devi

Date of Birth: 01-01-1962
 Birth Place: Imphal, Manipur, India.
 Bsc. (Hons) Zoology (Manipur University)
 Specialization in Master Degree in Entomology (Manipur University)

Ph. D. work & Title: Entomology“Physiological aspects on the growth and Development of mango fruit weevils (Coleoptera: Curculionidae) in relation to seasonal changes in Manipur”(Manipur university)
 Currently working as Associate Professor in the D.M College of Science, Imphal, Manipur, India.

Minor Research project undertaken: “Study on the seasonal abundance, behavioural biology and control measures of the insect pests of Cabbage.” Sponsoring Agency by UGC, NERO, Guwahati .

Major Research project undertaken: “Studies on the seasonal incidence, behavioral biology of major insect pests of mango in Manipur and their control measures by using plant extracts Sponsoring agency by UGC, New Delhi

(II) “Study on the spider fauna of Manipur”.Sponsoring Agency: UGC, New Delhi, currently working as Co-PI

(III) “Study on the diversity of insect fauna of Loktak Lake of Manipur” Sponsoring agency by Ministry of Environment and Forest, New Delhi. is currently undergoing

(IV) “Study on the behavioural biology of the stored grain pests in the Godown of Manipur and their control measure by using plant extracts” Sponsoring agency by DST, Ministry of Science and Technology, New Delhi is currently undergoing

(V) “Development of database on Bio-resources of North-East India” Sponsoring agency by Department of Biotechnology (NER-Division) Status: Undergoing as Co-PI

17. Guideship: Approved M.Phil. (Zoology) guide of: Periyar Institute of Distance Education (PRIDE), Periyar University, and Salem; Vinayaka Missions University, Salem; Global Open University, Nagaland; CMJ University, Meghalaya

18. No. of Scholar: 7

19. Paper Published : 42 papers

21.Membership : Member of Annals of Plant Protection Sciences ,Indian Journal of Entomology and Zoological society of Manipur.

22.Books published : 3(three) books for B.Sc Practical Zoology for 1st and 2nd Semester -2010, 3rd and 4th Semester -2011 and 5th and 6th Semester -2013.

Email: mbhubaneshwari@yahoo.com



Naorem Victoria Devi

Place of Birth: Imphal, Manipur, India

Date of Birth: 01-02-1985

Education Qualification

B.Sc. (Hon) Zoology (Manipur University)

M.Sc. Agriculture Entomology (Sam Higginbottom Institute of Agriculture, Technology and Science (Deemed to

be University, Allahabad) completed on the thesis “Study on Indigenous Plant Extracts with Cow urine against *Plutella xylostella* and *Spodoptera litura* on Cabbage”.

Qualified National Eligibility Test (NET-ICAR) which was held on 24 February, 2013 in the discipline of Agricultural Entomology.

Currently I am working as a Research fellow on the Major Research Project entitle “Study on the behavioural biology of the stored grain pests in the Godown of Manipur and their control measure by using plant extracts” Sponsoring agency by DST, Ministry of Science and Technology, New Delhi. Working place D.M Collage of Science, Imphal, Manipur, India. from June 2012 to till date.

Membership : Member of Indian Journal of Entomology .

Paper published: 18

Email: naorem.victoria@yahoo.com

Table 1: Effect of plant extracts on *Callosobruchus analis* egg laid and adult emergence on gram seed.

Treatment	Doses	Egg Laid (Mean±SM)	Adult Emergence (Mean±SM)
T1- <i>Melia azadarach</i>	5g	85±2.35	54±1.69
T2- <i>P. hysterothorus</i>	5g	85±4.98	66.6±7.57
T3- <i>P.thyrsiflorus</i>	5g	85.6±4.95	60.6±4.22
T4- <i>Vitex trifolia</i>	5g	107±7.46	67.6±3.03
T5- <i>Z.acanthopodium</i>	5g	68.3±14.25	43.3±8.01
T6- <i>Azadirachta indica</i>	5g	81.6±3.60	52±3.29
T7-Control	–	215±2.86	130.3±16.40
F-value p>0.05	–	33.861	11.485
C.D	–	10.21	5.93

Table 2: Effect of plant extracts on grain damage.

Treatment	Doses	Total No. of Grains	No. of Perforated Grain	Unperforated Grain	Grain Damage %	Weevil Perforation Index
T1- <i>Melia azadarach</i>	5g	300	205	95	68.33	40.75
T2- <i>P. hysterothorus</i>	5g	300	176	124	58.66	37.12
T3- <i>P.thyrsiflorus</i>	5g	300	198	102	66	39.29
T4- <i>Vitex trifolia</i>	5g	300	249	51	83	45.52
T5- <i>Z.acanthopodium</i>	5g	300	156	144	52	34.36
T6- <i>Azadirachta indica</i>	5g	300	214	88	71.33	41.79
T7-Control	–	300	298	2	99.33	50