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Study on Biopesticidal Potential of Some Desert Plants

Amandeep Kaur Mann ^{1*} and Meera Srivastava ¹

1. P.G. Department of Zoology, Government Dungar College, Bikaner – 334001, India.
[E-mail: salaonmail@gmail.com]

This study was conducted to determine the biopesticidal potential of extracts of some desert plants against mortality of three stored grain pests *Tribolium castaneum* Herbst., *Rhizopertha dominica* Fab. and *Callasobruchus chinensis* Linn. The study was done by treating them with various formulations of different parts (leaf, stem, root and fruit) of plants *Aerva tomentosa* Linn, *Peganum harmala* Linn. and *Fagonia critica* Linn. using ether extract, aqueous extract and aqueous suspension at various dose concentrations of 1, 2.5, 5 and 10%. The plant parts of *P.harmala* caused 60-80% mortality while of other two plants resulted in 30-50% mortality of the insect among plant parts stem was observed to be least effective while leaf was found to be most effective in causing mortality of the insects.

Keyword: Phytochemicals, Botanicals, Plant Extracts, Mortality

1. Introduction

Biopesticides are certain type of pesticides derived from natural materials like animals, plants and bacteria. They are considered to be important part of IPM (integrated pest management programme) because they are substitute to synthetic pesticides. Throughout history plant products have been successfully exploited as insecticides, insect repellents and insect antifeedents. Research reveals that extracts prepared from plants have variety of properties including insecticidal activity.

Plants are like natural laboratories where a great number of chemicals are biosynthesized and infact they may be considered the most important source of chemical compound . More than 2000 species of plants are known to possess some insecticidal properties.

In recent years, the use of synthetic, organic insecticides in crop pest control programmes around the world has resulted in damage to the environment, pest resurgence, pest resistance to insecticides and lethal effect on non-target organisms. The present research has been carried

out to evaluate the efficacies of some desert plants in stemming the damages to rice, wheat and pulses caused by some grain pests. Pest reduces the grain weight, nutritional value and germination of stored grains. Infestations also causes contamination, odour that reduces the quality of grains and make it unfit for human consumption. Botanicals are basically secondary metabolites that serves as a means of defence mechanism of plants to withstand the continuous selection pressure from the herbivore predators and other environmental factors. Several groups of phytochemicals from plants such as alkaloids, steroids, terpenoids, essential oils and phenolics from different plants have been reported previously for their insecticidal activity. At present, phytochemicals make up to one percent of world's pesticides market ^[3]. The research is based on to offer the people an effective, low cost, sustainable and environment friendly pest management strategy.

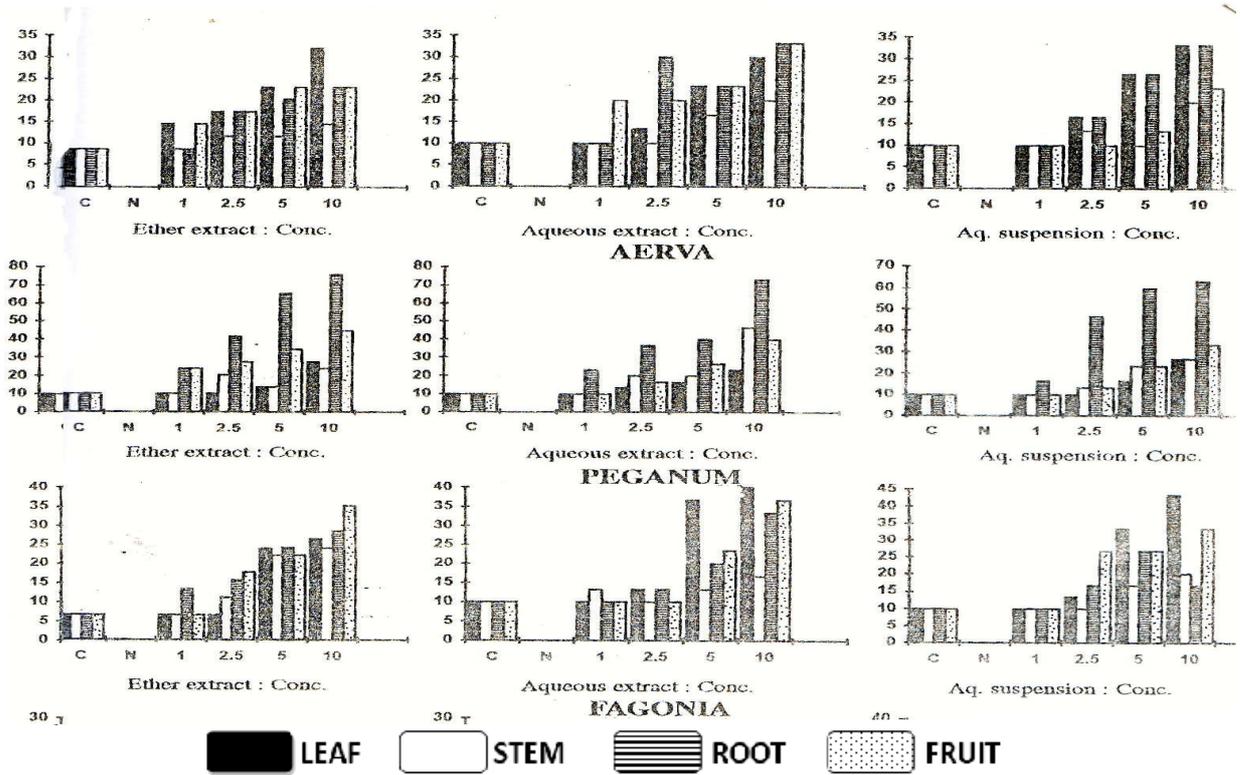


Fig 1: Effect of Different Formulations of Some Parts of Various Plants on the Adult Mortality (%) of Pest *Tribolium Castaneum*

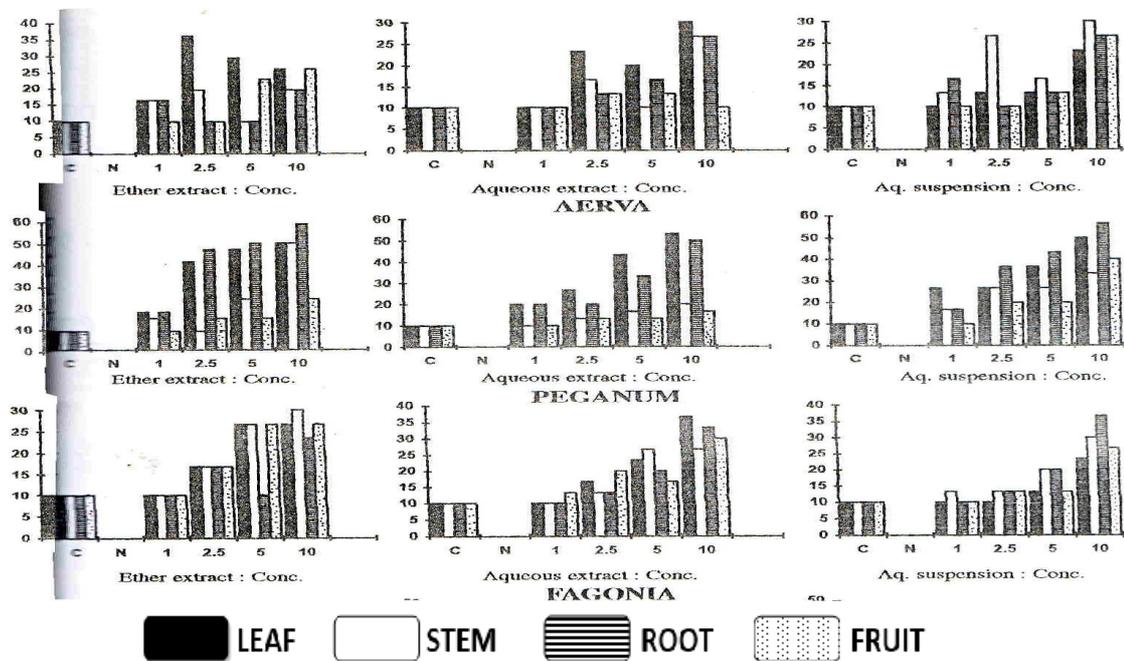


Fig 2: Effect of Different Formulations of Some Parts of Various Plants on the Adult Mortality (%) of Pest *Rhizopertha Dominica*

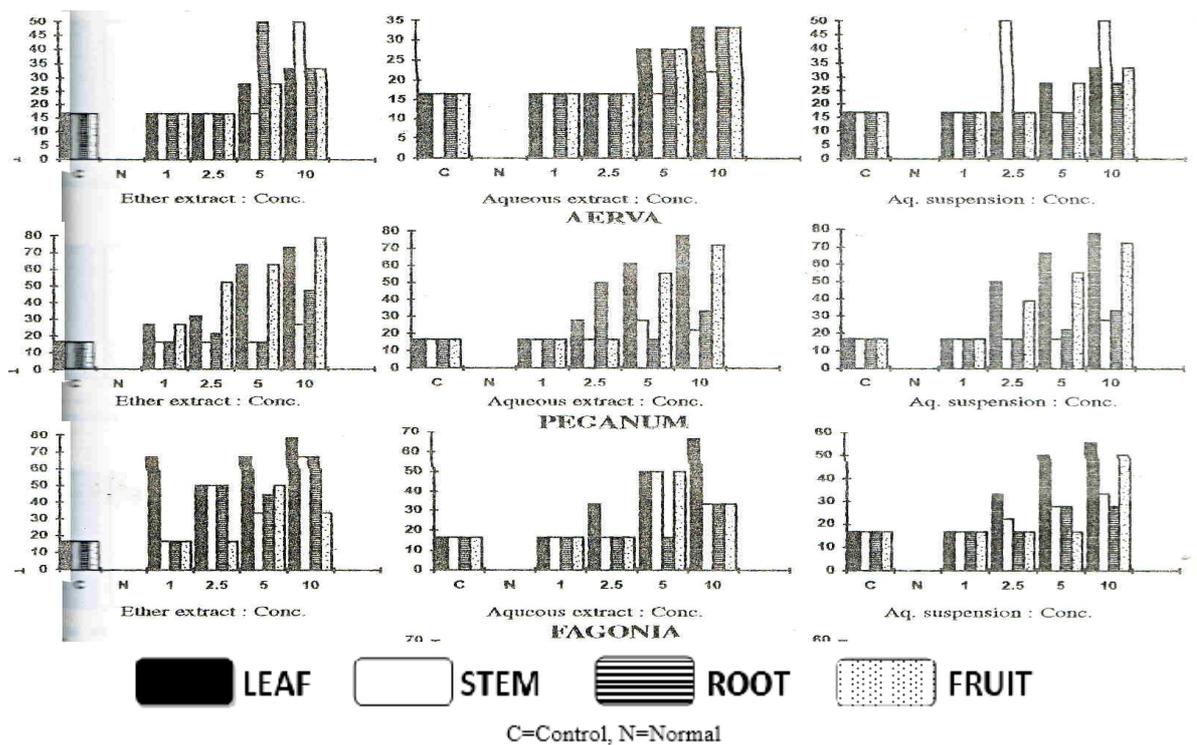


Fig 3: Effect of Different Formulations of Some Parts of Various Plants on the Adult Mortality (%) of Pest Callasobruchus Chinensis

2. Materials and Methods

The pest insects selected for the study were reared in the laboratory at a temperature of 28±2C and 70 % RH. The plants *Aerva tomentosa*, *Peganum harmala* Linn; *Fagonia cretica*, Linn; were collected from Bikaner, Rajasthan and its vicinity. The different parts viz leaf; stem; root and fruit were separated and shade-dried and then used for preparation of extracts. Aqueous suspension, aqueous extract and ether extracts of 1, 2.5, 5 and 10% concentrations were prepared. The experimental insect sets were treated with these extracts and mortality was noted along with these sets normal and control sets were also maintained. The results were statistically analyzed using ANOVA and t-test.

3. Results and Discussions

This paper sheds light on important plants having pesticidal efficacy and their activities against agricultural products .

The percent adult mortality of three have been presented in figures 1-3. No adult mortality was observed in normal sets while in control sets in case of *T.castaneum* and *R.dominica*, it was 10%

and in case of *C.chinensis*, it was 16.66%. Among insects the percent mortality of *C.chinensis* was significantly ($P<0.01$) greater than the mortality of *T.castaneum* and *R.dominica* in most of the experimental sets.

With respect to the effect of different plants, it was observed that *P.harmala* was most effective causing significantly high mortality (60 – 80%). A significantly high adult mortality in *T.castaneum* was also caused by the treatment of leaf, root and fruit of *F.cretica* (40 – 60%) In case of *R.dominica* significantly high mortality was caused by the treatments of all parts of *F.cretica* (25 – 35%) while of *C.chinensis* by the treatments of leaf of *F.cretica*.

The adult mortality was observed to have a direct relationship with the concentration of the formulations being more when treated with the extracts of 10% concentration as compared to lower doses. Overall observation showed that the treatments of 10% extract of plant *P.harmala* resulted in highest mortality (60-80%) of three insect species.

The results are in conformation with the findings of Singh et al (1988) [6] who reported that refined

and crude soyabean oil at 0.5ml/100g of pigeonpea causes 100% adult mortality of *Callasobruchus chinensis* within one day as compared to lower doses of 0.25 and 0.10 ml/gm causing 40 – 60% adult mortality. The population of *Callasobruchus chinensis* was observed to be more effectively reduced when edible oils were applied at 3ml/kg of grains as compared to 0.5ml/kg by Begum and Quinones (1991) ^[1]. Sharma et al (1989) ^[7] also reported 70% and 64% mortality in *Rhizopertha dominica* and *Sitophilus oryzae* respectively, at a low dose of 0.5g/100g grain, reaching to 100% in both insects at as dose of 3.0g/100g of grains. Khanam et al. (1990)^[4] used ether extracts of leaves of *Vitex negundo*, *Polygonum hydropiper* and *Aphanamixis polystachya* against *Tribolium confusum* and found that four greatest doses of all the three extracts caused highest mortality.

Extracts of many plant species possess insecticidal properties which result in the mortality of the insects and therefore play a major role in the pest management strategies. The results of present investigations revealed that the treatments of one or other plant parts in the form of some extracts at a certain dose concentration resulted in significantly high adult mortality. The extract of *P.harmala* at 10% concentration was found to be most effective.

The study further revealed that besides *P.harmala* the extract of *A.tomentosa* and *F.cretica* also influenced adult mortality suggesting the toxic properties of these plants. Although, in case of *T.castaneum* and *R.dominica*, the leaf and root formulations were found to be effective but in case of *C.chinensis*, all plant parts resulted in significant increase in adult mortality. This could be due to variable concentration of the toxic substances in different plant parts. *T.castaneum* and *R.dominica* being sturdy beetles as compared to *C.chinensis* are effected only by those plant parts possibly containing high concentration of toxic substances while *C.chinensis* was sensitive to the treatments of even those plant parts which have low concentration of toxic substances. The present findings are in agreement with the earlier works of Mathur et al. (1985) ^[5] who observed 70 – 80% mortality in *Callasobruchus chinensis* on

black gram after five days of treatment with different plant products. A similar result was observed by Das (1986) ^[2] against *Callasobruchus chinensis*. Su et al (1991) ^[8] used calamus oil against stored product pest *Sitophilus zeamais*, *Tribolium castaneum*, *Oryzaephilus surinamen* and *Rhizopertha dominica* and reported to cause mortality ranging from 89.5% to 100%. The results revealed that all the tested materials had repellent and lethal effect against the tested pest as compared to untreated check. They can be mixed with other synthetic pesticides and also enhances their actions.

5. References

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