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STUDIES ON THE TOXICITY AND RELATIVE TOXICITY OF DIFFERENT PLANT EXTRACTS TO DIFFERENT LEAF FEEDING INSECTS OF TELANGANA FOREST INDIA

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ABSTRACT

Relative toxicity of (07) seven plant extracts (*Azima tetracantha, Chloroxylon sweietenia, Clerodendrum viscosum, Cleistanthus collinus, Lippia javanica, Ocimum americanum* and *Sphearanthus indicus)* to (04) four test insects (*Hyblea purea Tinolius eburneigutta, Eutectona machearalis,* and *Atteva fabricella)* at different concentrations of was done and toxicity was observed in all the plant extracts based on the feeding behavior of the test insect and arranged in the descending order is 1.0%>0.8%>0.6%>0.4%>0.2%>0.1% concentrations and uncontrol. All insect cultures were maintained in a growth chamber in the laboratory at a temperature of 27 ± 2° C, 12: 12 L:D and with 70 ± 5 % RH during the experiments. Among all plant extracts *O. americanum* (LC_{50}-0.3169 and LC_{50}-0.3115 against *H. purea* and *E. machaeralis*) followed by *C viscosum* (LC_{50}-0.4316 and LC_{50}-0.5253 against *T. eburguneita* and *A. fabricella)* were found to be effective and more toxic against selected major insect pests that tested**.**

Keywords**:** Toxicity, Ethnobotany, Leaf feeders, Plant extracts, Insect.

Introduction

Insect pests are one of the major limiting factors in crop production. Synthetic organic insecticides have emerged as major tools of pest management. However, due to indiscriminate use of synthetic chemicals, insect pests have developed resistance to insecticides. Resurgence of secondary pests, reduction in the population of natural enemies and harmful residues in food, feed and fodder are some of the aftermaths of the use of pesticides. These concerns have led to the surge of alternative pest control technologies by which relatively environmentally safe pesticides/insecticides solely of biological origin are intended to develop. The pesticide formulations based on extractives from organisms have attracted particular attention because of their specificity to insect pests, biodegradable nature and a potential for commercialization.

The plant world comprises of a rich array of biochemicals that could be tapped for use as insecticides. The toxic constituents present in plants represent the secondary metabolite groups. Their particular role in many of the plant species are not completely known to the science. However, it is assumed that they have only insignificant role in the primary physiological processes in plants that synthesize them. Some of the secondary metabolites are merely end products of aberrant biosynthetic pathways and others excretory products.

Knowledge of the toxic plants, and the toxic principles and their biological activity is important not only to utilize them as natural insect control agents and replace the toxic commercial chemical insecticides but also to understand the nature of their toxicity in non-targeted species. Over 2,000 plant species out of about 2,50,000 have been reported to possess insecticidal activity in which only a fraction of them are analyzed for biocidal properties and many more insecticidal plants awaits discovery.

Method and Materials

The extraction was carried out in the Soxhlets extraction apparatus. The samples containing leaves of the selected plant materials were air-dried for 6-7 days. After complete drying the plant parts were pulverized into powder with the help of mixer grinder. The plant material was extracted by Soxhlet extraction method.

Soxhlet Extraction

The ordinary method of extraction was not efficient to yield good amount of active principle of the plant material. To extract more active principle from all the plant materials, Soxhlet extraction was used. Known amount (100g) of plant material of each species was filled into the Soxhlet apparatus. A cotton plug was used at the place of thimble to top the entry of the crude material into the siphoning tube. The required solvent (ethanol/methanol) was filled up five times more than total amount of the sample material into the flask of the apparatus. The apparatus was then connected with the water supply to the condenser. The temperature of the heating mantle was maintained. The process was carried out for 6 to 8 hours for each sample (Maru, 2012). The extracts were collected into the round bottom flask and excess solvent was distilled, until about a volume of 50 ml of the extract along with the solvent was retained. The extracts thus obtained were transferred into volumetric flasks. Same procedure was followed for all plant materials.

From the above preparation, about 20ml of Soxhlet extract was taken in a weighed porcelain dish separately and solvent was completely evaporated on a steam water bath. The dish was kept in a desiccators for 15-20 minutes and weight was recorded. The dish was again kept in water bath for about 10 minutes and the weight was recorded again. This procedure was repeated until a constant weight was obtained. Thus obtained final weight of extract was determined and it was considered as "crude extract" and regarded as 100 per cent concentration of the active principles of test plants. Similar procedure was followed to obtain the crude extracts of all test plant materials and extracts were stored in a deep freezer at -5^{0}C further testing.

Preparation of standard solutions

Before actually making the required test concentrations, stock solution was prepared for each plant extract. The stock solutions were prepared as and when necessary instantly and were preserved in the deep freezer at -5^o C, for few days. Since the extracts are soluble in different organic solvents, each was dissolved in any one of the selected solvents viz. Acetone, Methanol, Petroleum ether or Chloroform. These extracts were weighed individually in an Ainsworth electrical monopan balance as per the required quantity, stock solutions were prepared on weight/ volume (w/v) basis.

Dilution of different concentration from stock solutions

For the present studies, six to seven concentrations were prepared from each plant extract (viz., 1,000, 2,000, 4,000, 6,000, 8,000, 10,000 and 12,000 ppm) and the plant extracts were tested at the above said concentrations on the test insects. The required concentrations for each extract were prepared from stock solutions of 20,000 ppm (2%). In the process of dilution of the stock solution to prepare different concentrations, Acetate was used as a solvent.

Assessment of Results

The insecticidal effect on the test insect was assigned according to Pradan (1994) Accordingly the dead and the moribund individuals were taken into account for mortality counts. The percentage mortalities, using Abbot's formula (1925). The Lethal concentrations (LC_{50}) values have been worked out, subjecting the corrected percentage mortality date to "probit analysis" as suggested by Finney (1952).

Results and Discussion

A perusal of the results presented in Table-1. Indicate the LC_{50} values and relative toxicity of different plant extracts to ***T. eburneigutta***. It is seen from the table that *S. indicus* recorded the lowest LC $_{50}$ value. The LC_{50} values of the plant extracts tested against ***T. eburneigutta*** are arranged in the descending order are *S. indicus* (0.4168)> *C. collinus* (4.214) *C. viscosum* (0.4316)> *O. americanum* (0.5960)> *A. tetracantha* (0.6001) > *Lippia javanica* (0.6471). The relative toxicity of different plant extracts against *T. eburguineta* based on LC_{50} values arranged in the descending order is *S. indicus > C. collinus > C. viscosum> O. americanum > A. tetracantha > Lippia javanica.*

A perusal of the results presented in Table-1. Indicate the LC_{50} values and relative toxicity of different plant extracts to ***H. purea.*** It has seen from the table that *O. americana* recorded the lowest LC_{50} value. The LC_{50} values of the plant extracts tested against ***H.purea*** are arranged in the descending order are *O. americanum* (0.3169)> *C. viscosum* (0.4390) *C. collinus* (0.5069) *A. tetracantha* (0.5253) > *C. collinus* (0.5372) > *C. sweietenia* (0.6071)> *S. indicus* (0.6194) > *L. javanica* (0.6298). The relative toxicity of different plant extracts to *H. purea,* based on LC_{50} values arranged in the descending order is *O. americanum > C. viscosum> A tetracantha >C. collinus > C. sweietenia > S. indicus > L. javanica.*

A perusal of the results presented in Table-1. Indicate the LC_{50} values and relative toxicity of different plant extracts to ***E. macheralis***. It is seen from the table that *O. americanum* recorded the lowest LC_{50} value. The LC_{50} values of the plant extracts tested against ***E. macheralis*** are arranged in the descending order are *O. americanum* (0.3115) > *C. collinus* (0.4775) >*C. viscosum* (0.5373) > *A. tetracantha* (0.5480) > *L. javanica* (0.6228) > *S. indicus* (0.6455) > *C. sweietenia* (0.6998). The relative toxicity of different plant extracts to *Eutectona macheralis* arranged in the descending order is *O. americanum > C. collinus > C. viscosum> > A. tetracantha > L. javanica > S. indicus > C. sweietenia.*

A perusal of the results presented in Table-1. Indicate the LC_{50} values and relative toxicity of different plant extracts to ***A. fabricella*** It is seen from the table that *S. indicus* recorded the lowest LC_{50} value. The LC_{50} values of the plant extracts tested against ***A. fabricella*** are arranged in the descending order are *C. viscosum* (0.5253) > *S. indicus* (0.6001) > *A. tetracantha* (0.6525) > *C. collinus* (0.6642) > *O. Americanum* (0.7015). The relative toxicity of different plant extracts against *A. fabricella* arranged in the descending order is *C. viscosum> S. indicus > A. tetracantha > C. collinus > O. americanum.*

Table 1: Toxicity and relative toxicity of different plant extracts against certain leaf feeding insects.

Test insect/ Plant extracts	*C. collinus*	*S. indicus*	*O. americanum*	*L. javanica*	*A. tetracatha*	*C. viscosum*	*C. sweietenia*
A. LC_{50} Values of different plant extracts against certain leaf feeding insects							
T.eburneigutta	0.4214	0.4168	0.5960	0.6471	0.6001	0.4316	--
H. purea	0.5372	0.6194	0.3169	0.6298	0.5253	0.4390	0.6071
E.machearalis	0.4775	0.6455	0.3115	0.6228	0.5480	0.5373	0.6998
A. fabricella	0.6642	0.6001	0.7015	--	0.6525	0.5253	--
B. Relative toxicities of different plant extracts against certain leaf feeding insects							
T.eburneigutta	1.024	1.035	0.724	0.667	0.719	0.725	--
H. purea	0.817	0.709	1.385	0.697	0.836	1.023	1.051
E.machearalis	1.125	0.832	1.725	0.863	0.98	0.958	0.824
A. fabricella	0.791	0.875	0.749	--	0.805	1.083	--

A perusal of literature indicates that several workers conducted investigation with *C. viscosum* and found it to contain insecticidal properties. The important among them are Berenbaum (1995) against bugs and ethyl acetate. Sree latha and Geetha (2011) against *Oryctes rhinoceros* (linn): Pugazhvadan et al (2009), Walintlah and yeasmin (2014) against *Tribolium castameum*; Husaim and Hasam (2008) against *T.confusam*; Sahayaraj (2003) against *Spodoptera litura* (Fab.) Pereira and Gurudutta (1990) against *Culex quinquefasciatus* (Say) Kumari *et al* (2003) against *Earias vitella* and *Spodoptera litura*; Patil *et al* (2006) against *Aedes aegypti*; Yankanchi (2015) against *Achaea janata* (L); Vasala & Gokuldas (2015) against *Collosobruches Chinensis*. From the results of above all workers LC_{50} value compared to several plant extracts and found to possess insecticidal properties. *C. viscosum* has been tested by Waliullah and Yeasmin (2014) and he indicated possessing of insecticidal properties by it. *C. viscosum* leaf extract of ethyl acetate fraction was showed possessing LC $_{50}$ values 0.78 mg/ml aganist *T castneaum*. In the present investigation *C. viscosum* recorded 0.53 mg/ml. It can be concluded that this ethyl alcohol fraction of this chemical is highly effective on *A. fabricella* and higher antifeedant activity against *T. eburnigutta* and *A. fabricella* (0.341 and 4.356) at 1.0% and 1.2% concentration. We have recorded LC_{50} values 0.32 mg/ml against Teak defoliator; Teak skeletonizer compared to several plant extracts and found to possess insecticidal properties. In the present investigation also *S. indicus* has been recorded to be the most toxic *to T eburnigutta* as LC_{50} value 0.4168 mg/ml at 1000ppm. The relative toxicity of different plant extracts against *T eburnigutta* arranged in the desending order is *S. indicus*> *C. collinus*> *C. viscosum*> *O. americanum*> *A. tetracantha* and *L. javanica*. It is worth mentioning that in the present investigations this extracts excelled the other extracts in possessing the insecticidal properties and recorded 0.094 mg/ml against *H. purea*, However, the above workers did not clearly mention either the dose or the antifeedancy with their test insects. In the present investigations, the *chloroxylon sweteiana* is found to be toxic against *E machaearilis* LC $_{50}$ value 0.6998 mg/ml. Chikukura *et al*. (2011) found *L. javanica* powdered leaf extracts to have insecticidal properties with potential to control grain damage by 21–33%. In the present investigation *Lippia javanica* shows toxicity LC_{50} values 0.65 mg/ml for all for test insects (Teak defoliator, Teak skeletonizer, Semilooper and web worm) it found that effective natural pesticide which can be used for control of all. The LC_{50} *C. collinus* against third instar larvae at 24, 48 and 72 h (hexane, chloroform and ethyl acetate) was, 377.86 ppm and at 24 h; *C. collinus* LC_{50} values was 375.34. This is an ideal ecofriendly approach for the control of vector control programmes. In the present investigation also *C. collinus* leaf extract at 1000, 2000, 4000, 6000, 8000, 10,000, and 12000 ppm caused a significant mortality of *Hyblaea puera, Eutectona machaeralis, Atteva fabriciella* and *Tinolius eburneigutta.* The LC_{50} *C. collinus* against third instar larvae at 24h was 0.5372, 0.4775, 0.6642 and 0.4214 mg/ml.

Conclusion

The present findings point out that among all plant extracts *O. americanum* (LC_{50}-0.3169 and LC_{50}-0.3115 aganist *H. purea* and *E. macheralis*) followed by *C viscosum* (LC_{50}-0.4316 and LC_{50}-0.5253 aganist *T. eburguneita and A. fabricella)* found to be effective and more toxic against selected major insect pests that tested**.** Thus it is concluded that the degree of antifeedant activity and toxicity of different plant extracts varied from insect to insect, hence depending upon the pest problem and a particular type of extract has to be applied for effective control of the pest.

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