International e-Conference on New Horizons And Multidisciplinary Applications In Science And Technology
In Association withInternational Journal of Scientific Research in Science and Technology
Volume 9 | Issue 6 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)

Rheostat Effects of Leaves Extracts of Some Indigenous Plants on Household Insect Pests, Red Imported Fire Ant, Solonepsisgeminata Fabricius

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ABSTRACT

Red imported fire ants are dominant in altered areas and live in a wide variety of habitats. They can be found in rain forests, disturbed areas, deserts, grasslands, alongside roads and buildings, and in electrical equipment. Colonies form large mounds constructed from soil with no visible entrances because foraging tunnels are built and workers emerge far away from the nest. The highest mortality rate and repellent activity was noted at 10% ethanolic plant extract of Ipomea cornea (Beshram) among the plants used for experiments. The evaluation of experimental data revealed that Azadirachta indica (Neem), Ipomoea carnea (Beshram) and Vitex negundo(Nirgudi)the plants species synthesized numerous volatiles known to exhibit toxic, insecticidal and repellent properties to the household pests. Testing of the ethanolic extract of plants leaves for the control of household pest help in the development of new synthetic insecticides which do not appears post hazard effect on human. The laboratory experimental evaluation of the leaves of commonly occurring of such indigenous plants shows highest toxicity and repellent activities against the red imported fire ant, Solonepsisgeminata. Theexperimental resultsindicate the potential of ethanolic plant extracts to control the commonly occurred household pest red antsas compared with the commercial highly toxic, synthetic pesticides such as Boric powder and Lindane.

Key words: Solonepsisgeminata, Ethanolic plant extract, toxicity, bioformulation.

I. INTRODUCTION

Pesticides are the key component of Integrated Pest Management (IPM), help out an important role to control the agricultural pest and the household pests but led to the environmental problems including health hazards to humans. The heavy usage of pesticides created a great concern especially in case of household control of pests left higher level of insecticide residues. These chemical insecticides find in above maximum residue limits in the samples of milk, cattle drinking water, fodder, feed collected from cattle colony [17]. The rapidly rising human population and sustainable development cause global warming on the earth which affects on insects pest population. Some of the insect in addition not only damages the crops but spreads the dangerous diseases and harmful to human health. Awareness regarding the food safety has increased the demand for organically produced food, which necessitates evaluating the performance of plant-basedpesticides as safer alternatives to

conventional insecticides [1]. *Azadirachtaindica* (Neem), *Ipomoea carnea(*Beshram/sadafuli)an *Vitex negundo* (Nirgudi)are plants having diverse pest control properties. Many plants, like Neem, Sadafuli, Nirgudi, Kambarmodi andKaranj have the alkaloids, phenolics, glycosides and tannins types of chemical defensive compounds when mixed with ethanolic groupsaffects on the insect feeding and unpalatable to the insects[3]. However, these compounds act as the toxins and repellent to kill the insect pests. These ethanolic formulations being as a safer alternative to the synthetic insecticides as an environment friendly product. Whereas the application of these herbal pesticides is limited due to the instability which needs its application at short time intervals[10,12]

II. MATERIAL METHOD

The fresh leaves of the respective plants were chopped in to small pieces with a knife and dried in shade (Fig. 1). These dried pieces were then grounded in grinder to make coarse powder. The 10 mg of each plant powder packed and processed in Soxhlet Appratus (Fig. 2) using 150 ml ethanol asstock solvent.The dried ethanolicplant extracts of*Azadirachtaindica* (Neem), *Ipomoea carnea(*Beshram/sadafuli) and *Vitex negundo* (Nirgudi)in ethanolprepared in 5%, 10%, 15%and 20%formulations as working formulation.The set of 30 adult life stages of the household pest,red fire ant,*Solonepsisgeminata*collected in the separate glass containers to check the % mortality after 24hour. Each set was tested and compared with control set (treated with water) and a conventional synthetic insecticideLindane as check in 0.2% formulation (Aqueous).

III. RESULTS

The present study based on application of ethanolic leaf extracts of five different plants treated as the potent insecticide against the household pest, imported red fire ant,*Solonepsisgeminata*. The treatment of these leaf extracts applied in viz., 5%, 10%, 15 %, and 20% formulations at the interval of 24, 48 and 72 hours. The exposed groups of carpenter ant divided into two chambers such as Experimental and Control set. The treatment of the 20% ethanolic leaf extracts indicated maximum lethal effects and percent mortality only after the interval of 72 hours against the adult stage of the carpenter ant as compared to synthetic insecticides. Also to determine the sublethal effects of 20% ethanol leaf extracts among all the plants estimations of biochemical constituents in the midgut of carpenter ants studied after each interval of 24, 48 and 72 hours of treatment (Table- 1 and 2). The biochemical composition of total protein, carbohydrate and lipid in the midgut of experimental set of carpenter ants shows significant decreasing concentrations as compared to control group. The greenhouse trials revealed that the 20% methanol leaf extracts may acts as the stomach poisons with higher repellent activity showing non-target toxicity at highest mortality rate of adult red fire ants (Table-1).

Figure no.- 1 : Ethanolic Leaves Extracts of plants

Figure no.- 2 : Experimental setup of Glass Container

Table - 1: Effect of 20 % Methanolic Leaves Extract on the Biochemical composition of Midgut of the red fire ant,*Solonepsisgeminata* after 72 hours (Exp.-Experimental group of ants)

S. No.	Leaves Extract of Plants	Percentage Mortality/ hour			
		5%	10%	15%	20%
1	*Azadirachta indica*	11.55± 1.62	15.61± 2.41	21.55± 5.73	82.3± 6.45
2	*Vitex negundo*	31.4± 3.93	23.5± 3.32	39.3± 6.26	82.2± 8.71
3	*Ipomoea carnea*	32.± 4.35	32.5± 5.22	48.8± 8.28	91.1± 10.85
4	Check-I / Boric powder	11.1± 2.21	12.4± 2.12	24.1± 3.12	82.± 5.21
5	Control	0	0	0	0

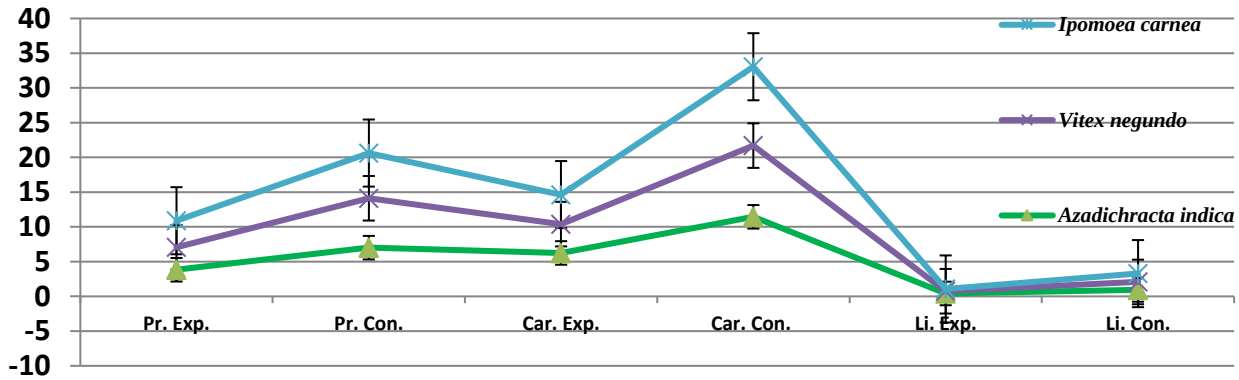
(P< 0.001)

In the present study the ethanolic leaves extracts of were tested and applied in comparison with synthetic insecticides viz. (0.2% Stock solution)Lindane with emphasis on their residual determination. The present study revealed that these formulations are acts as stomach and contact toxins with higher repellent activity with disturbed metabolism and suppressive oviposition rate. The highest % ofethanolic plant extracts like 20 % after time period of 72 hoursgave at the best in toxicity and repellent trials showing non-target toxicity at maximum % mortality rate of adults of red fire ant (Table-2 and Graph-2).

Table - 2: Effect of 20 % Methanolic Leaves Extract on the Biochemical composition of Midgut of the red fire ant,*Solonepsisgeminata* after 72 hours (Exp.-Experimental group of ants)

S. No ..	Leaves Extract of Plants	Biochemical Composition in µg/mg, after 24 hr					
		Protein		Carbohydrate		Lipid	
		Exp.	Control	Exp.	Control	Exp.	Control
3	*Azadirachta indica*	2.83± 0.13	7.01± 0.23	4.25± 0.03	10.5± 0.33	0.41± 0.018	1.15± 0.06
4	*Vitex negundo*	2.25± 0.01	6.21± 0.32	4.15± 0.21	9.25± 0.74	0.31± 0.02	1.1± 0.04
5	*Ipomoea carnea*	1.33± 0.95	7.51± 0.88	2.35± 0.85	11.15± 0.94	0.22± 0.75	1.22± 0.11

Figure 4: Effect of 20 % Methanolic Leaves Extract on the biochemical composition of Midgut after 72 hours.



Concentrations of Biochemical constituents in midgut (µg/mg)after 24 hr.
[Denoted as Pr.-Protein, Ca.-Carbohydrate, Li.-Lipid, Exp.,- Experimental, Con.-Control]

IV. DISCUSSION AND CONCLUSION

Ant behavior depends upon a number of environmental conditions one of which is the availability of different food resources[5,8]. The imported red fire ant,*Solonepsisgeminata* along with some other ants, form a group of household insect pests causing consistent nuisance and damaging store grains, food materials, bakery products, sweets and ornamental as well as vegetable plants [10,11,12]. In general by applying an ant bait consisting boric acid at variable concentrations used to control the developmental stages of household ants and colony

population. These substances are, moreover found to be inducing high mortality of chicks and poisoning food and bakery products [1,10]. The Annona seed extracts effects on the reduction of total protein content influencing adversely the protein metabolism and the vital process in insect life [6]. Derivatives of local plants such as kernel powder and seed oils of *Azadirachta indica* [21] were also reported to be effective against coleopteran pests due to their antifeedant, ovicidal, insecticidal and other growth regulatory actions. The treatment of these oral toxins distributed among the nest mates and larvae through regurgitation during trophyllaxis [7,8,14]. Such synthetic insecticides give maximum mortality by exerting nervous, digestive and respiratory toxin [13,19]. In the red fire ant,*Solonepsisgeminata* the midgut is lined with enteric epithelium with thin peritrophic membrane as the innermost layer. It is the main site for the synthesis of different enzymes and biochemical components that carry out the digestion and metabolism similar to hymenopteran bees [24].The histopathological studies on midgut of red fire ant,resulted in degradation of the basal membrane and degeneration in the epithelial lining after the treatment of 20% methanol leaf extracts of the plant, *Ipomoea carnea*. These observations were almost similar to that reported in *Hieroglyphusnigrorepletus* [20], *Heliothisherrata*[18] and *in Periplaneta Americana* [22] after the treatment some synthetic insecticides.

The present study determined the action and sublethal concentration ofleaf extracts of *Ipomoea carnea* extracts as the potent insecticide directly affected on biochemical constituents such as total proteins, carbohydrates and lipids[15]. This is the first study suggesting sublethal effects of the 20 % formulations of leaf extracts of locally available indigenous plants on digestion, absorption and metabolism ultimately leading to death of the ants. It becomes apparent that these insecticidal effects of the plant extracts are exerted due to the action of toxic substances like alkaloids and enzymes as discussed above[23]. Therefore this study revealed the effective use and broad spectrum mode of action of botanical insecticides as the stomach and contact insecticides against red fire ant,*Solonepsisgeminatawhich* exercises knock down effects in future and reduces the use of synthetic insecticides.

V. REFERENCES

[1] . Akbar, M. F., N. Yasmin, F. Naz And T. A. Latif, 2009. Effectiveness Of Different Spray Schedules Against Population Of Whitefly, BemisiaTabaci (Genn.) On Okra Crop. Pak. J. Entomol. Karachi, 24 (1&2): 45-48.

[2] . Alley, E. G. The use of mirex in the control of imported fire ant. J. of Environ.Quality. 2(1): 52-61. Amer. 60 : 298-308, 1973.

[3] . Amrithraj, M. P. And William, J. (1999). The Efficacy Of Two Botanicals As Repellants Against Monomorium Pharaonis (Hymenoptera: Formicidae) In Biopesticide In Insect Pest Management, (Ed. By-Ignacimuthu And Sen), Phonex Publ. House Pvt. Lt.New Delhi. 144-151.

[4] . Amrithraj, M. P. And William, J. The efficacy of two botanicals as repellants against Monomorium pharaonis (Hymenoptera: Formicidae) in biopesticide in insect pest management, (ed. By- Ignacimuthu and Sen), Phonex Publ. House Pvt. Lt. New Delhi. 144-151,1999.

[5] . Bharti, H. And G.D. Alpert, (2007). Ants Of India. Downloaded From Www.Antdive Rsity.Com.

[6] . Boreddy, Y., Chitra, K. C. And Eswar Reddy, N. P. Studies on sublethal concentration (LC30) of Annona Seed Extract on total proteins of Spodoptera litura (Fab.) Ento. 25(4): 351-355, 2000.

[7] . Davidson, D. W. Elemental stoichiometry of ants in a new world rain forest. Oeologia., 142: 221- 231, 2005.

[8] . Dejean, A., Mckay, D., Giberhau, M., And Berlin, M. The arboreal ant mosaic in a Cameronian rainforest (Hymenoptera: Formicidae). Sociobio. 35: 403- 23, 2000.
[9] . Dubois, M., Gilles, K. A., Hamilton, J. K., Rebers, R. A. And Smith, F. (Annl. Chem. 28: 350, 1956).
[10] . Kadu Seema G.(2016). Species Richness And Diversity Of Ants In Nagpur City (Ms), Indiai J R B A T, Vol. Iv, Issue (3), 38-40
[11] . Kadu, S. G. and Kulat, S. S. (2015). Control of household pest red imported fire ant, Solenopsisinvicta Buren (Hymenoptera: Formicidae) Using Herbal Extracts. IJRBAT, Special Issue A-3: pp-187-191.
[12] . Kadu, S. G., Tembhare, D. B., Barsagade, D. D., Efficasy of Botanical extracts against the household pest, carpenter ant Camponoutuscompreessus(Fabricius), J. Soil and Crops 20(2) 314-317, 2010.
[13] . Lee, S., Peterson C.J., Coats, J.R., Fumigation toxicity of monoterpenoids to several stored product insects. Journal of Stored Products Research, 39 ; pp. 77-85, 2003.
[14] . Maillux, A. C., Jeans-Louis, D. And Detrain, C. How do ants assess food volume ? Anim. Behav. 59: 1061-1069, 2000.
[15] . Nawrot J., Harmatha J., Natural products as antifeedants against stored product insects. Post Harvest News and Information, 5 ; pp. 17N-21N, 1994.
[16] . Parveen, Z. and Masud, S. Z. Organochlorine pesticide residues in cattle drinking water. Pak. J.Sci. Ind. Res., 31: 53–56. 1988B
[17] . Parveen, Z. And S.Z. Masud, 1988b. Organochlorine Pesticide Residues In Cattle Drinking Water. Pak. J.Sci. Ind. Res., 31: 53–56.
[18] . Patil, S. B., Wagh, S. R., Nikam, S. D. And Bhawane, G. P. Effect of Insecticide on the midgut of H. serrata Fab. (Coleoptera: Scarabaedae). Ind. J. of Comp. Animal Physio., Vol. 21. pp. 20-23, 2003.
[19] . Peterson C. J., R. Tsao, J.R., Naturally occurring cyanohydrins, analogues and derivatives as potential insecticides. Pest Management Science, 56;pp. 615-61, 2000.
[20] . Rizvi, S. S. A. And Khan, M.A. Observation on pathological effects of certain stomach poisons on the histology of the midgut and caecae of third instar hoppers of (HieroglyphusnigroreplitusBoliver) (Orthoptera: Acrididae). Ind. J. Zool. 2: B: 7-94, 1973.
[21] . Shafeek, A., Rachelkumari, M., Nagaraja, S. And Rajarami Reddy, G. Alterations in moulting pattern and protein levels in Grasshopper, Piocelocerus pictus, exposes to synthetic prethroid, Cypermethrin. Ind. J. Comp. Anim. Physio. Vol. 16: 38- 45,1998.
[22] . Sunanda Majumdar, Mohammad Amir, Ritika Gupta and Shagufta Yasmeen. Histopathological effect of deltamethrin on the midgut of American cockroach, Periplaneta americana (Linn.) (Dictyoptera: Blattidae). Jou. Ent. and Zoo. Studies, 4(5): pp13-16, 2016.
[23] . Ware, G. W., The pesticide book, 5th ed. Thomson Publications, Fresno, California. 415 pp. 2000.
[24] . Wigglesworth, V. B. (). The Principle of Insect Physiology. I. 741. Methecen, London,1977.