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Comparative study on larvicidal activity of the stem and root of *Andrographis paniculata* (Burm.f.) against the larvae *Aedes aegypti* (Linn.)

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Abstract
Mosquitoes transmit serious problems now a days, causing millions of deaths every year with serious diseases and the development of resistance to chemical insecticides. Plants may be alternative sources of mosquito control agents other than chemical compounds. The present study assessed the larvicidal activity of stem and root of *Andrographis paniculata* **(**Burm.f.**).** Bioactive compounds of the stem and root of *Andrographis paniculata* were extracted using ethanol, acetone, isopropyl alcohol, benzene, n-butyl alcohol. Larvicidal activity conducted by serial dilution methods in different concentrations such as 25, 50, 100, 200, 400 ppm. LC_{50} value and LC_{90} value were calculated by probit analysis. The larval mortality was calculated after 12 h and 24h of the exposure period. All plant extracts showed significant larvicidal activity against *A. aegypti* mosquito larvae. Among the extract tested, the n-butyl alcohol extract recorded the highest activity in both root and stem than other extracts. In stem highest mortality revealed n-butyl alcohol extract, the LC_{50} and LC_{90} values 399.95 and 770.83 after 12h and 262.73 and 555.57 after 24h. In root highest mortality rate showed with n-butyl alcohol extract, the LC_{50} and LC_{90} values are 444.25 and 652.30 after 12h of exposure period and LC_{50} and LC_{90} values are 253.08 and 532.22 after 24h of exposure period. Present study reveals that the extracts of *Andrographis paniculataas* biocidal agent against mosquito larvae, *Aedes egyptii*. Our data suggest that the stem and root of n-butyl alcohol extract of *Andrographis paniculata* have the bio potential activity and have the capacity to control of the *Aedes aegypti* mosquito larvae.

Keywords: larvicidal activity, *Andrographis paniculata, Aedes aegypti.* Serial dilution, n-butyl alcohol, probit analysis

Introduction
Andrographis paniculata, commonly known as kallurukki is an annual herbaceous plant belongs tothe family Acanthaceae, native to India and Sri Lanka. It has the power in the biocidal activity. Mosquitoes are creating many problems from years in different kind. To regulate and controlling the mosquito's population is very difficult (Liu *et al.,* 2006) [7]. The most effective natural method to control mosquitoes is to use plant products which have low side effects (Certin *et al.,* 2004) [1]. To control the mosquito there are chemical insecticides, larvicides, and adulticides are available commercially. The use of these chemical insecticides has harmful effects to humans and environment, and this leads to another kind of problem (Singhi *et al*., 2004) [10]. So, effective alternative method is very necessary.
The dangeros problem of using synthetic chemical insecticides is it create environmental pollution (legar *et al.,* 1996) [6]. Spraying of chemical larvicide affect agricultural field and human health, creating many diseases (Severini *et al*., 1993) [9]. Plant have many biopotential characters because they have the presence of various phytochemical compounds, these compounds have the capacity to the controlling larvae. Plant extract are less toxic,very effective and protecting environment and human health (Ignacimuthu *et al.,* 2000) [4]. present study was carried out to evaluate the larvicidal activity of different solvent extracts of stem and root of *Andrographis paniculata*.

Materials and Methods
Plant material
Healthy stem and root of *Andrographis paniculata* were collected from western Ghats of Tamil Nadu, India. The plant materials were cleaning with running tap water,then air-dried at room temperature for two weeks and powdered with motor and pestle. powder of root and stem of *Andrographis paniculata* is used for the extraction.

Plant extraction
Powdered plant materials were extracted successively by using different solvents of chloroform, ethyl acetate, benzene, n-butyl alcohol, ethanol, petroleum ether, and aqueous extracts in soxhlet apparatus for 2 days and the extract were filtered through Whatman filter paper. then these extracts were kept in airtight bottles used for the further study.

Larvicidal bioassay

Different concentration of solvent extracts of root and stem of *Andrographis paniculata* were used for larvicidal activity against larvae of *Aedes aegypti*. extract was dissolved in one ml of DMSO solution and prepare different concentrations like 25,50,100,200,400 ppm with distilled water. Each treatment was conducted in three replicates. The effects of the plant extracts were calculated through carefully counting the number of dead larvae after 24 and 48 hours of treatment, and the percentage mortality was calculated.

Statistical analysis

The lethal concentrations LC_{50} and LC_{90} and their 95% upper and lower confidence levels calculated by probit analysis. (SPSS, version 11.5)

Results and discussion

Larvicidal Efficacy of stem Extracts

Plant derived material may serve as suitable alternative to control the laravae than the chemical insecticides because they are safe, low cost, environment friendly available everywhere in the world. larvae were more susceptible to the maximum concentration (400 ppm) of the treatment. the maximum larval mortality was observed in 400 ppm concentration. As concentration increases percentage of mortality increases and LC_{50} and LC_{90} values increases. Figure 1 and 2 shows the larvicidal mortality of *Aedes aegypti* mosquito larvae treated in five various concentrations of plant extracts. after 12 hours of treatment, In stem, highest mortality reported in n-butyl alcohol with the LC_{50} and LC_{90} values of 399.95 and 770.83 after 12h and 262.73 and 555.57 respectively after 24h of exposure period followed by ethanol, acetone, isopropyl alcohol. Lowest larval mortality was observed with the benzene extract with after12h LC_{50} 797.68 and LC_{90} 1084.95 ppm and after 24h exposure period LC_{50} 696.23 and LC_{90} 929.85 ppm against the larvae *Aedes aegypti*.

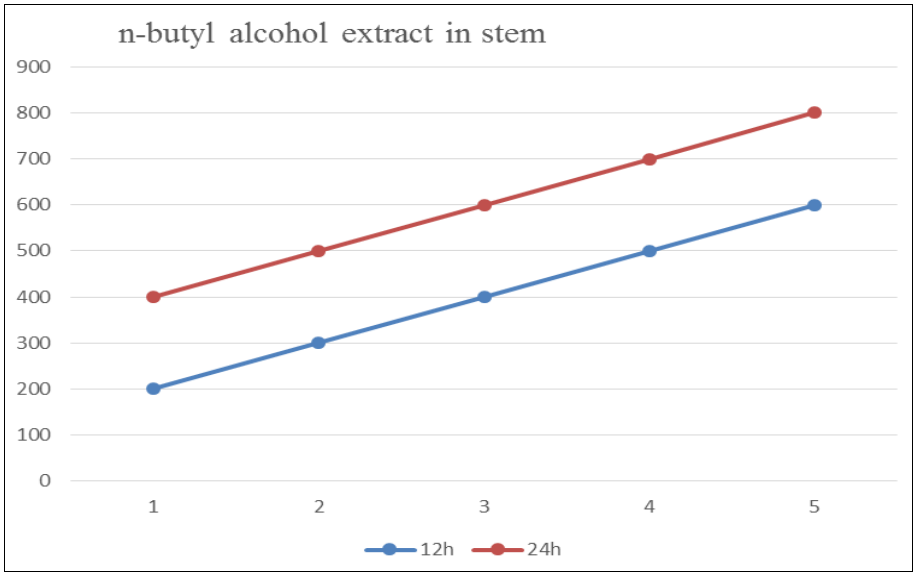

Fig1: LC_{50} and LC_{90} values of n-butyl alcohol extract in stem

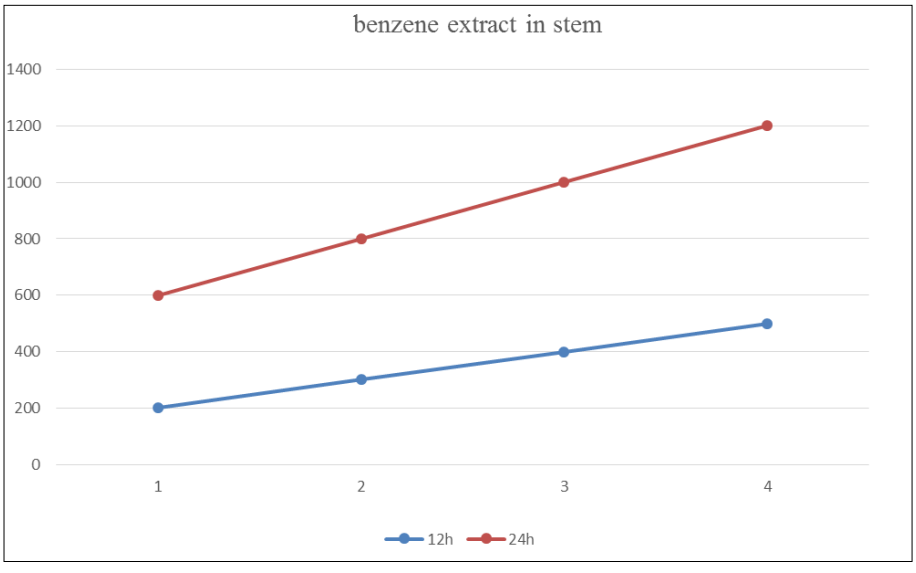

Fig 2: LC_{50} and LC_{90} values of benzene extract in stem

Larvicidal Efficacy of root Extracts

Figure 3 and 4 shows the larvicidal mortality of *Aedes aegypti* mosquito larvae treated in five various concentrations of plant extracts. after 12 hours of treatment, In root, highest mortality n-butyl alcohol with the LC_{50} and LC_{90} values of 444.25 and 652.30ppm against *Aedes aegypti* after 12h of exposure period and LC_{50} and LC_{90} values of 253.08 and 532.22 ppm against *Aedes aegypti* after 24h of exposure period. Followed by ethanol, acetone, isopropyl alcohol. Lowest larval mortality was observed with the benzene extract with after12h LC_{50} 596.57 and LC_{90} 986.11 ppm and after 24h exposure period LC_{50} 385.50and LC_{90} 690.10 ppm against *Aedes aegypti*. the maximum larval mortality was observed in 400 ppm concentration. Time interval increases mortality rate increases. Percentage of mortality increases with time intervals. After 12h mortality rate reaches 55%. After 24h mortality rate reaches 95%.

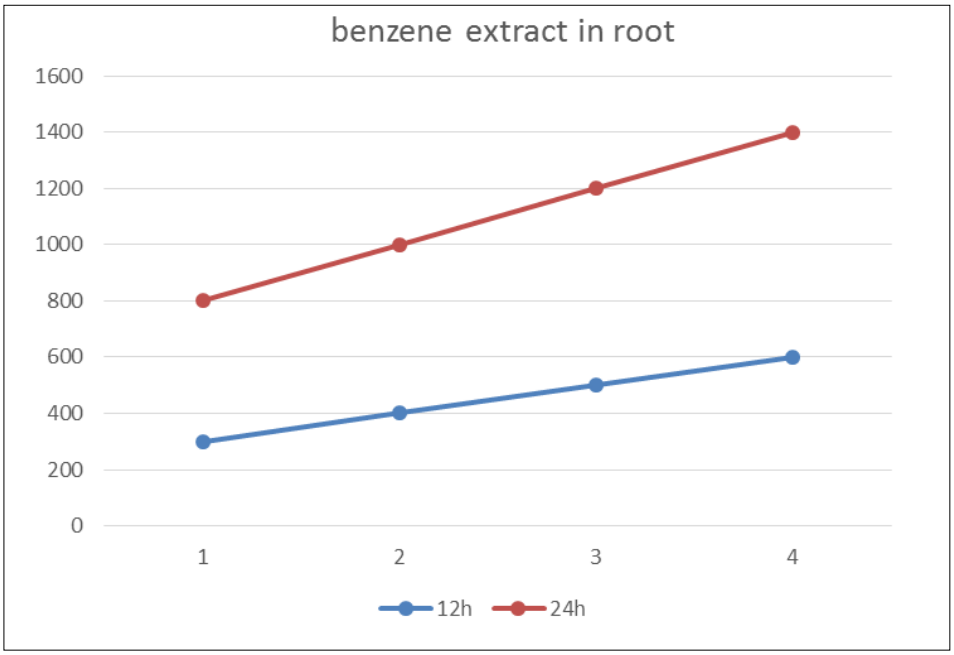

Fig 3: LC_{50} and LC_{90} values of benzene extract in root

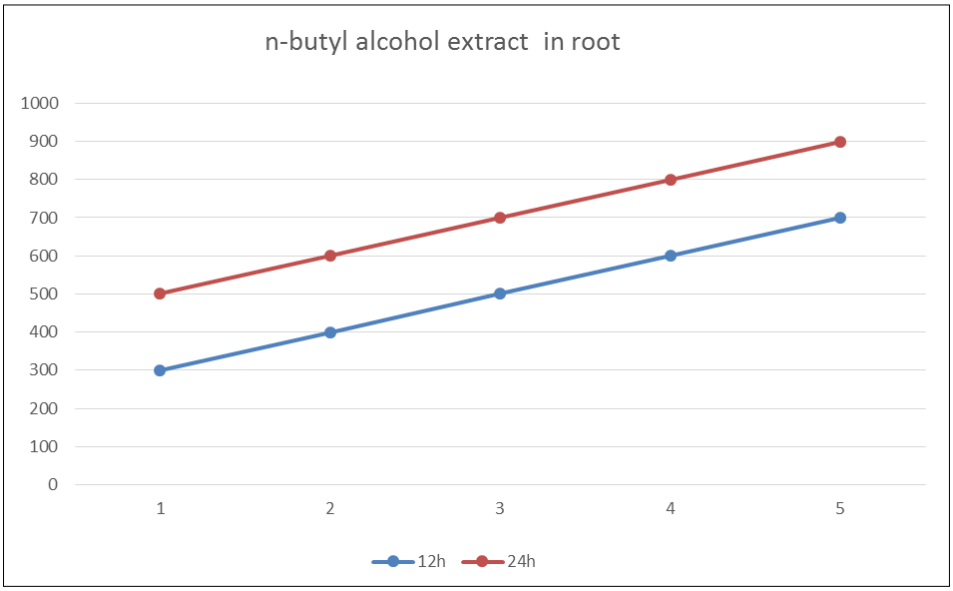

Fig 4: LC_{50} and LC_{90} values of n-butyl alcohol extract in root

Comparison of Larvicidal efficacy in stem and root extract

Comparing stem and root extract both are show good larvicidal activity with different concentration. Concentration increases larvicidal activity increases, as well as time of exposure increase larvicidal activity increases. Stem shows highest larvicidal activity than root. N-butyl extract shows more activity than other extract in both stem and root. After 12h reach 60% of mortality in both stem and root and after 24h reach 95% mortality in root and 100% of mortality in stem .

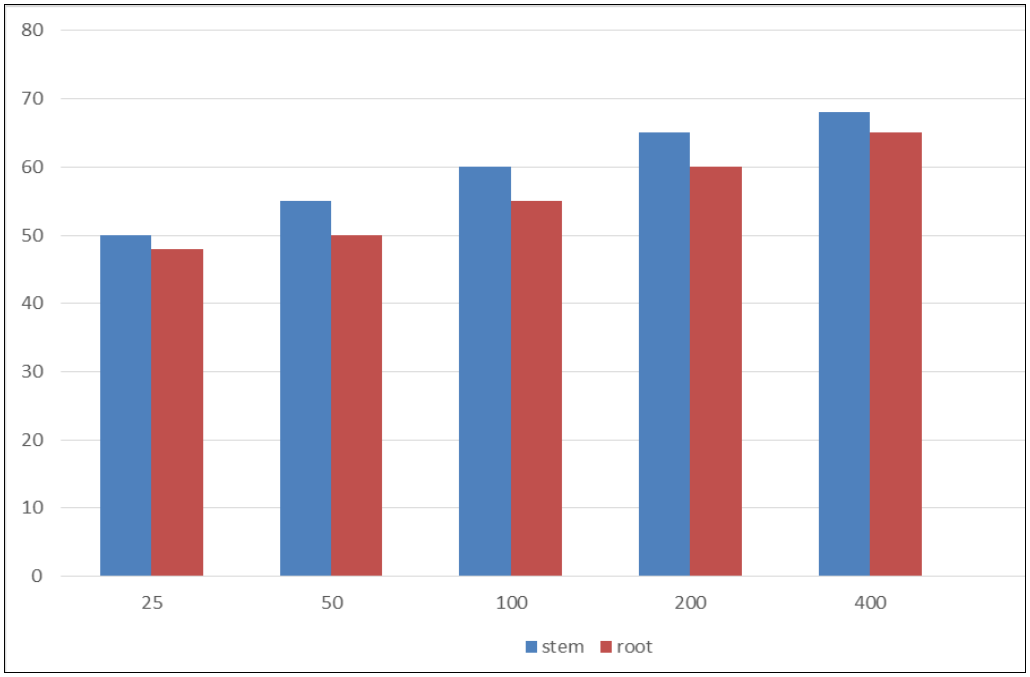

Fig 5: Comparison of percentage of mortality in n-butyl alcohol after 12h

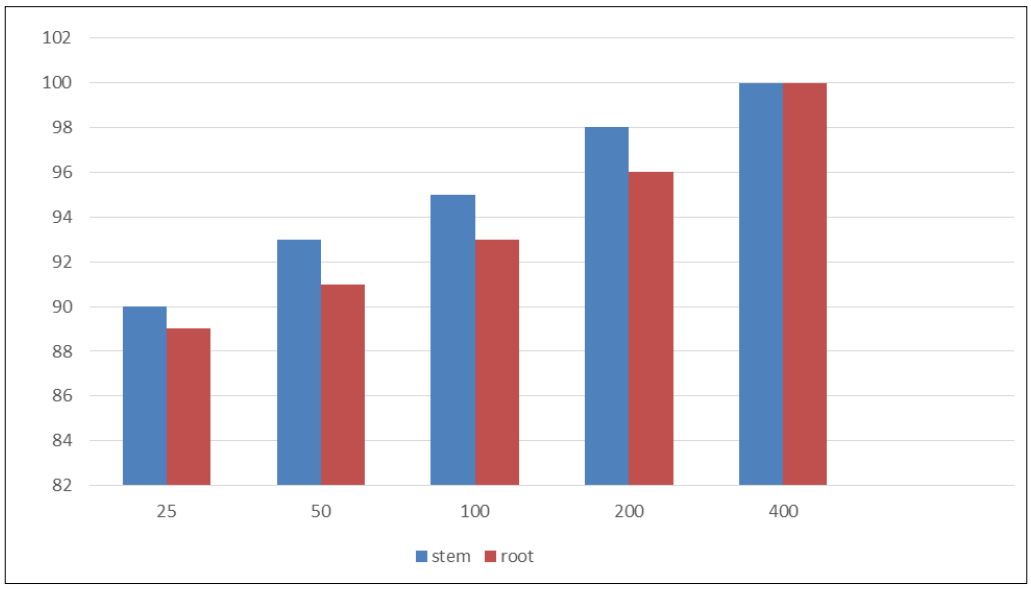

Fig 6: Comparison of percentage of mortality in n-butyl alcohol after 12h

In the present investigation, the mortality percentage was increasing with the increasing concentration in all extract. Similarly increased rate of mortality with an increasing time was observed by promsiri *et al.*, (2006). Similar trend was noticed many researchers Ramar and Jeyasankar (2014) [8]. Jayasankar *et al.*, 2015 demonstrates the efficacy of leaf extract of *A. paniculata* as an effective larvicide against larvae of *Aedes aegypti*, *An. stephensi* and *Cx. quinquefasciatus*. These findings support current study.

Conclusion

Stem and root possessed different range of larvicidal activity in different solvent extract. *Andrographis paniulata* Plant extracts can play an important role in the management of the mosquitoes. Because this natural product has no side effect in agriculture and human health. In this study it was proved that n- butyl alcohol of *Andrographis paniculata* extracts were considered the best in terms of LC_{50} values, LC_{90} values as well as in terms of percent mortalities as compared to other extracts. Stem show highest activity than root. So according to these findings revealed that to add these extracts in mosquitoes controlling and this product have no side effect and promote build a better future.

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References

1. Certin H, Erler F, Vanikoglu A. Larvicidal activity of botanical natural products, Akse Bio, against Culex pipens. Fitoterapia,2004:75:724-728.
2. Forget O. Pesticides, necessary but dangerous poison. The IDRC reports,1989:18:7-13.
3. Howard AFB, Zhou G, Omlin FX. Malaria mosquito control using edible fish in western Kenya. preliminary findings of a controlled study. B.M.C Pub. Hlth,2007:7:199-204.
4. Ignacimuthu S. The root of botanicals in combating mosquitoes. Abstracts, Proceedings of symposium on recent trends in combating mosquitoes, Loyola College, Chennai, India, 19, 2000.
5. Jeyasankar, G Ramar. Larvicidal activity of *Andrographis paniculata* (Acanthaceae) againstimportant human vector mosquitoes (Diptera: Culicidae) Int. J. Adv. Res. Biol. Sci,2015:2(10):156-160.
6. Legar RJ, Joshi L, Bidochka MJ, Roberts DW. Constriction of and improved mycoinsecticides over expressing a toxic protease. Proceed. National Acad. Sci., USA,1996:93:6349-6354.
7. Liu M, Hanafi-Bojd, AA Iranshahi, M Vatandoost, H Hanafi-Bojd. Larvicidal efficacy of latex and extract of Calotropis procera (Gentianales: Asclepiadaceae) against Culex quinquefasciatus and Anopheles stephensi (Diptera: Culicidae). J Vec. Born. Dis,2006:47:185-189.
8. Ramar G, Jeyasankar A. Larvicidal activity of Tragia involucrata Linn. (Euphorbiacea) leaf extracts against chikungunya vector, *Ae. aegypti* (Linn.) (Diptera: Culicidae). J. Coastal Life Med,2014:2(7):555-55.
9. Severini C, Rom R, marinucci M, Rajmond M. Mechanism of insecticide resistance in field population of Culex pipiens from Italy. J Amer. Mosq. Contr. Assoc,1993:9:164-168.
10. Singhi M, Joshi V, Sharma RC, Sharma K. Ovipositioning behaviour of Aedes aegypti on different concentrations of latex of Calotropis procera: studies on refractory behaviour and its sustenance across gonotrophic cycles. Deng. Bull,2004:28:185-188.
11. Sukumar K, Perich MJ, Boobar LR. Botanical derivatives in mosquito control: A review. J Amer Mosquito Control Association,1991:7:210-237.