INVESTIGATION OF MOSQUITO REPELLENT POTENTIAL FOR MEXICAN MINT (*Coleus amboinicus* Lour.) PLANTS AS A SOLUTION FOR DENGUE VIRUS SPREAD.

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1. INTRODUCTION

Mosquito is a key carrier of human illnesses including dengue, malaria, yellow fever, encephalitis, and filariasis. Dengue fever has been considered a random illness since the 19th century, with 30 times increase in worldwide frequency for the previous fifty years, resulting in epidemics at long intervals (Paixão et al., 2012). Mosquito control can be accomplished by biological, physical, and chemical means. In comparison to the current dengue control program, a sustainable, low-cost, and nature-based alternative is required to manage dengue mosquitos. The long-term polluting and contaminating nature of conventional biocides, such as pesticides and insecticides, on human health and raise public concern. As a result, researchers have become more ambitious in their search for novel biocides that are both effective and biodegradable and eco-friendly.

For thousands of years, people have employed plant repellence, by hanging bruised plants in buildings, a practice that is still frequently used in underdeveloped nations (Maia and Moore, 2011). Plant-based repellents are still commonly utilized in this coventional method across rural communities in the tropics, since they are often the sole source of protection against mosquito bites for many of the poorest groups. As a consequence, plants are seen as a reliable and safe method of mosquito bite prevention, and "natural" smelling repellents are chosen.

Mexican mint (*Coleus amboinicus*) plants are grown in the home gardens, backyards and the home premises for several purposes. The rural people believe that Mexican mint has the potential to repellent the mosquitoes from their home premises. In that concern, the potential of Mexican mint plant against dengue virus vector mosquitoes is important. The objective of this study is to evaluate the mosquito repellent potential of Mexican mint plant against the dengue virus vector mosquitoes.

2. METHODS

2.1 Collection of Mexican mint plant

Different indigenous germplasms of Mexican mint plants will be collected from all around the island. Collected plants will be vegetatively propagated to obtain sufficient number of replications in each variety.

2.2 Collection of Adult mosquitoes

Aedes spp mosquitoes will be reared in the laboratory conditions for experimental requirements. The larvae of *Aedes* spp. will be collected from fresh water bodies. Collected larvae will be reared under 70-85% relative humidity, 27±2°C temperature, and 14:10 light and dark photoperiod cycle (Arjunan et al., 2018). The adult mosquitoes will undergo gender segregation to cull male mosquitoes. The female mosquitoes only will be used in this study.

2.3 Repellent test chamber

The repellent test chamber will be developed with nylon net as cages in optimum size to withheld whole Mexican mint plant. The cages will be made separately for control and treatment study. Small holes will be perforate on the top of the cages to escape the mosquitoes and collected in separate container during the test.

2.4 Laboratory study

The experiment setup will establish with the control and treatments. The control test will perform without the Mexican mint plant whereas the treatments will be performed with replicates of different varieties.

2.5 Repellent efficiency testing

The adult female mosquitoes of *Aedes* spp. with 100 counts will be introduced inside the repellent test chamber while closing the holes on the top. The whole Mexican mint plants will be placed inside the repellent test chamber prior to the introduction of mosquitoes. During the test, number of mosquitoes escape from the hole perforated on the top will be trapped within separate vesicle connected with holes. Number of mosquitoes escape from the repellent test chamber will count for each 10 minutes. The efficiency of the repellence will be calculated using the following Eq. (1). (Rozilawati et al., 2015).

$$\text{Repellent efficiency (\%)} = [C\text{-}T/C] \times 100 \quad (1)$$

where:

C = Number of mosquitoes escape from the control chamber.

T = Number of mosquitoes escape from the test chamber.

2.6 Field trial

The open field trial will be carried out with selected germplasms of Mexican mint plant from laboratory repellent efficiency testing. Sufficient number of Mexican mint plants will be established in the field and repellence at the field condition will be evaluated. The repellence will be evaluated in terms of entomological indices including premises index (2), Container index (3) and Breteau Index (4) (Karunamoorthi et al., 2008).

$$\text{Premises index} = (\text{Positive premises/House inspected}) \times 100 \quad (2)$$

$$\text{Container index} = (\text{Container positive/ Container inspected}) \times 100 \quad (3)$$

$$\text{Breteau Index} = (\text{Total Container positive/ Premises inspected}) \times 100 \quad (4)$$

3. DISCUSSION

Because of their quick suppressive effect, chemical pesticides have been employed for many years to control insect vectors of many human diseases. They are widely used, but have caused problems such as pest resistance and revival, extermination of natural enemies, and toxic residues in food, water, air, and soil that impair human health and alter ecosystems, increasing the likelihood of further environmental harm. Insect repellents that are commonly used are synthetic chemical repellents that are harmful to people, particularly children, and domestic animals because they may induce skin irritation, hot feelings, rashes, or allergies.

Since ancient times, plants have been utilized to control and repel insects. *Artemisia absinthium, Ferula asafetida, Cassia spp, Ficus carica, Allium sativum, Urgenia maritima* and *Citrus medica* were used as insect deterrents and for personal protection (Moore et al., 2007). Strong repellent actions of *Azadirachta indica, Cymbopogon martini* var sofia, *Cybopogon citratus*, *Cymbopogon nardus* and *Ocimum* sp. have been reported against some mosquitoes (Makhaik et al., 2005). Several plants were used locally to repel mosquitoes: Lantana (*L. camara* L.); neem *(Azadirachta indica* A. Juss); Lemongrass (*Cymbopogon citratus* L.); several members of the genus Ocimum were used including *Ocimum americanum* L., *Ocimum kilimandscharicum* Guerke and *Ocimum suave* Wild (Mng'ong'o et al., 2011).

C. *amboinicus* is a low-cost and environmentally acceptable source of natural mosquito larvicidal agent for mosquito vector control/reduction (Senthilkumar and Venkatesalu, 2010). Carvacrol (monoterpenoid), caryophyllene (bicyclic sesquiterpene), patchoulane, and flavanoids (quercetin, agpigenin, luteolin, salvigenin, and genkwanin) are found in the Coleus amboinicus plant [Narayanan and Sakthivel, 2011). In many rural regions, Mexican mint is said to offer mosquito repellent properties. As a result, in many rural places, Mexican mint plants are mostly grown in home gardens and on private property.

The repellence potential of different varieties of Mexican mint plant could be evaluated at the laboratory and field conditions against dengue virus vector mosquitoes. In general female mosquitoes act as a vectors of dengue virus and spread by biting humans. Therefore, mosquito larvae will be collected from fresh water bodies and reared under laboratory conditions. The adult mosquitoes will be segregated for gender to cull male mosquitoes as female mosquitoes only used in this study. The control and treatment test chamber will be maintained in uniform condition in every means other than Mexican mint plant. After performing the test, we can evaluate the repellence potential of the dengue vector mosquitoes using the repellence efficiency (%) under laboratory conditions.

When we consider the field trials, the repellence potential of the dengue vector mosquitoes could be evaluated using the entomological indices such as premises index, Container index and Breteau Index. The field trials will be performed after establishing considerable numbers of Mexican mint plants in the field against control field condition. The entomological indices will be compared between the control and the test field trial conditions to evaluate the repellence potential at the field condition.

4. CONCLUSION

Dengue fever is considered as sporadic disease which reason for considerable amount of death annually. Natural plants have biocidal and repellence potential for mosquitoes. The study of repellence potential of Mexican mint against the vector mosquitoes for dengue virus is a timely needed study to overcome the dengue spread. Therefore, laboratory and field trials for the repellence of mosquitoes is important to evaluate the potential of Mexican mint plants against dengue vector mosquitoes.

REFERENCES

Arjunan, N., Murugan, K., Madhiyazhagan, P., Kovendan, K., Prasannakumar, K., Thangamani, S., and Barnard, D. R. (2012). Mosquitocidal and water purification properties of Cynodon dactylon, Aloe vera, Hemidesmus indicus and Coleus amboinicus leaf extracts against the mosquito vectors. *Parasitology research, 110*(4), 1435-1443.

Karunamoorthi, K., Mulelam, A., and Wassie, F. (2008). Laboratory evaluation of traditional insect/mosquito repellent plants against Anopheles arabiensis, the predominant malaria vector in Ethiopia. *Parasitology research*, *103*(3), 529-534.

Maia, M. F., and Moore, S. J. (2011). Plant-based insect repellents: a review of their efficacy, development and testing. *Malaria journal*, *10*(1), 1-15.

Makhaik, M., Naik, S. N., and Tewary, D. K. (2005). Evaluation of anti-mosquito properties of essential oils. *Journal of Scientific and Industrial Research*, *64*, 129-133.

Mng'ong'o, F. C., Sambali, J. J., Sabas, E., Rubanga, J., Magoma, J., Ntamatungiro, A. J., ... and Moore, S. J. (2011). Repellent plants provide affordable natural screening to prevent mosquito house entry in tropical rural settings—results from a pilot efficacy study. *PLoS One*, *6*(10), e25927.

Moore, S. J., Hill, N., Ruiz, C., and Cameron, M. M. (2007). Field evaluation of traditionally used plant-based insect repellents and fumigants against the malaria vector Anopheles darlingi in Riberalta, Bolivian Amazon. *Journal of Medical Entomology*, *44*(4), 624-630.

Narayanan, K. B., and Sakthivel, N. (2011). Extracellular synthesis of silver nanoparticles using the leaf extract of Coleus amboinicus Lour. *Materials Research Bulletin*, *46*(10), 1708-1713.

Paixão, E. S., Teixeira, M. G., and Rodrigues, L. C. (2018). Zika, chikungunya and dengue: the causes and threats of new and re-emerging arboviral diseases. *BMJ global health*, *3*(Suppl 1), e000530.

Rozilawati, H., Tanaselvi, K., Nazni, W. A., Mohd Masri, S., Zairi, J., Adanan, C. R., and Lee, H. L. (2015). Surveillance of Aedes albopictus Skuse breeding preference in selected dengue outbreak localities, peninsular Malaysia. *Tropical biomedicine*, *32*(1), 49-64.

Senthilkumar A, Venkatesalu V (2010) Chemical composition and larvicidal activity of the essential oil of Plectranthus amboinicus (Lour.) Spreng. against Anopheles stephensi: a malarial vector mosquito. Parasitol Res 107(5):1275–1278.