

ALTERNATE USE OF ARECA (*Areca catechu* L.) – ITS MOSQUITOCIDAL ACTIVITY

S. Keshava Bhat*

Introduction

Mosquitoes are mostly vector insects responsible for the transmission of several dreaded diseases such as malaria, filaria, dengue, yellow fever, chikungunya, zika, Japanese encephalitis etc. to man. The species such as *Anopheles gambiae* and *A. stephensi* are the vectors of malaria (Obomanu *et al.*, 2006; Vinayagam *et al.*, 2008); *Aedes aegypti* is the vector of dengue, chikungunya etc. (Jawale, 2014); *Culex quinquefasciatus* is the vector of filaria (Kovendan *et al.*, 2012) and *C. tritaeniorhynchus* is the vector of Japanese encephalitis (Elumalai *et al.*, 2012). For the successful management of these diseases, control of vector mosquitoes is very important.

Mosquitoes breed in standing or stagnant waters. Eliminating their larval stages in such confined habitats is one of the methods for their control. The extensive and indiscriminate uses of chemical insecticides to control the larvae in such habitats are not only hazardous to humans as well as non target animals but also becoming increasingly difficult due to the development of resistance in mosquito larvae. With the growing awareness of environmental pollution and toxicity to humans, his livestock and wild life caused by indiscriminate use of such chemical insecticides there is a persistent demand to find out some environmentally safe, less hazardous and at the same time equally effective natural or botanical bio pesticides for the control of these vectors.

Plants contain many important biologically active compounds such as tannins, saponins, terpenoids, steroids, alkaloids, flavonoids etc., which naturally give them certain amount of protection against several pests and diseases. Such compounds were also reported to exhibit potential larvicidal properties (Deore and

Khadabadi, 2009; Ghosh *et al.*, 2012; Jawale, 2014). Areca palm is very rich in such phytochemicals, especially polyphenols which alone accounts up to 43.85% in the tender stages of its nuts (Mathew *et al.*, 1964).

Accordingly, several studies have been conducted on the mosquitocidal activity of different parts of this palm. Such works were collected by searching old journals, books and by using the internet and reported in this review.

Mosquitocidal activity of areca nut:

Poolpraset *et al.*, (2015) extracted the essential oil from the nuts of areca palm by steam distillation and studied its larvicidal activity against the 3rd and 4th instars of *Culex quinquefasciatus* larvae and found that its oil at 1000 ppm concentration killed 23.3% of such larvae at 24h exposure period.

The extract of areca nut also showed larvicidal activity against *Anopheles* and *Aedes* spp as well. Madang *et al.*, (2018) studied the larvicidal activity of the ethanolic extract of the nuts of areca palm and reported its LC₅₀ and LC₉₀ values against *Anopheles vagus* after exposing its 3rd instar larvae for 24h as 2385.30 ppm and 4496.71 ppm, respectively.

Bharathithasan *et al.*, (2021) studied the larvicidal action of the nuts of areca palm against two species of *Aedes*, viz., *A. aegypti* and *A. albopictus* using its methanolic extract. The authors reported the LC₅₀ and LC₉₅ values of such extract against *A. aegypti* as 621 mg/L and 2264 mg/L, respectively and against *A. albopictus* as 636 mg/L and 2268 mg/L, respectively. Further, the extract did not show any toxic effect against non-target organism such as guppy fish (*Poecilia reticulata*).

* Arecanut Research and Development Foundation, Varanashi Towers, Mission Street, Mangaluru- 575 001, Karnataka.

Repellent and mosquitocidal activity of areca leaf:

The repellent activity of areca leaf is known in village side since very long time. The villagers in India used to burn dry areca leaves in the evening hours and produce smokes to ward off mosquitoes. It was reported that such smoke has a repellent effect on these vectors. Vernede *et al.*, (1994) studied the efficacy of such smoke against *Anopheles karwari* and reported 84.0 % repellency.

The extract of areca leaf showed good larvicidal effect as well. It was reported that areca leaf extract was found even better than its nut extract in killing mosquito larvae. Vinayagam . (2008) studied the larvicidal effect of the methanolic extract of areca leaf on the 3rd instar larvae of the major malaria vector, *Anopheles stephensi* and reported that there was 100 % mortality in the vector larvae within 24h of treatment with 3.0 % concentration of areca leaf methanol extract and within 72h in the treatment with 1.0 % concentration of such extract.

The superiority of areca leaf extract to its nut extract as larvicidal was further proved in another study (Tennyson *et al.*, 2012). The authors tested the larvicidal activity of the methanolic extract of areca leaf against the 3rd instar larvae of the dengue vector, *Aedes aegypti* at concentrations of 62.5, 125, 250, 500 and 1000 ppm and reported the LC₅₀ values as 124.28 and 95.75 ppm respectively after 24 and 48 hours of treatment. The corresponding LC₉₀ values were respectively 271.73 and 221.19 ppm after 24 and 48 hours.

Discussion:

While partially burning areca dry leaf lots of smoke is being generated from it. Though the smoke has a good repellent effect on mosquitoes as reported by Vernede *et al.*, (1994), the effect may be temporary and continuous inhalation of smoke may pose several health problems. Instead, use of areca leaf extract to kill mosquito larvae at their breeding sites will be advantageous.

From the research works cited in this paper it is clear that areca leaf has a great potential, even better than the nut, in terms of mosquitocidal activity. The LC₅₀ value of areca leaf methanolic

extract against the larvae of *A. aegypti* was reported to be 124.28 ppm after 24 h of exposure (Tennyson *et al.*, 2012) and that of areca nut extract 621.00 ppm during the same period (Bharathithasan *et al.*, 2021). The methanolic extract of areca leaf killed all the exposed larvae of *Anopheles stephensi* within 24h at 3.0 % concentration and within 72h at 1.0 % concentration (Vinayagam *et al.*, 2008). Use of such readily available natural plant products for the control of pests and diseases is the need of the hour as they are mostly eco-friendly.

Areca palm has a compact crown encircled with 7-12 leaves on different stages of maturity. The leaf is quite big (about 1.65 m in length) with numerous leaflets (30 - 60 cm length and 5.8 - 7.0 cm breadth) on both sides of the rachis (Ananda 2004). On an average 6.3 leaves are shed from each areca palm every year. This accounts to about 5.0 to 8.5 tonnes of areca leaves from each hectare of areca plantation (Bhat *et al.*, 2016). As the 2020-21 figures show, the total area under arecanut in India is around 8.0 lakh hectares. This shows that there is ample scope for utilising areca leaves, which are available in plenty in our country, for developing huge quantity of commercial bio pesticide against mosquitoes.

Conclusion:

In areca leaf, the leaf sheath is extensively used for making several value added products such as disposable plates, cups, packing materials, etc. But, there is no effective value added product developed so far from its leaf portion. As these leaves show potential larvicidal activity against mosquitoes, the Pharmaceutical Industry may utilise this knowledge fully and develop an effective bio pesticide using this raw material which is abundantly available in India and several other Asian and southeast Asian countries.

References

- Ananda, K.S. 2004. Botany. In: *Arecanut*. (Eds: D. Balasimha and V. Rajagopal). Central Plantation Crops Research Institute, Kasaragod: 671 124, Kerala, India. pp7-50.
- Bharathithasan, M., Ravindran D.R., Rajendran, D., Chun, S.K., Abbas, S.A., Sugathan, S.,

- Yahaya, Z.S., Said, A.R., Oh, W.D., Kotra, V., Mathews, A., Amin, M.F.M., Ishak, I.H. and Ravi, R. 2021. Analysis of chemical compositions and larvicidal activity of nut extracts from *Areca catechu* Linn against *Aedes* (Diptera: Culicidae). PLoS ONE 16(11): e0260281. 14pp.
- Bhat, R., Sujatha, S., Bhavishya and Karthika, K.S. 2016. Nutrient management for sustained productivity of arecanut. *Indian Journal of Arecanut, Spices and Medicinal Plants*, 18 (4) 26-29.
- Deore, S.L. and Khadabadi, S.S. 2009. Larvicidal activity of the saponin fractions of *Chlorophytum borivilianum* Santapau and Fernandes. *J. Ent. Nema*. 1: 64-66.
- Elumalai, K., Dhanasekaran, S. and Krishnappa, K. 2012. Toxicity of saponin isolated from *Gymnema sylvestre* R. Br. (Asclepiadaceae) against *Culex tritaeniorhynchus* Giles (Diptera: Culicidae), Japanese Encephalitis vector Mosquito in India. *Rev. Inst. Med. Trop. Sao Paulo* 54: 337 - 344.
- Ghosh, A., Chowdhury, N. and Chandra, G. 2012. Plant extracts as potential mosquito larvicides. *Indian J. Med. Res.* 135: 581-598.
- Jawale, C.S. 2014. Larvicidal activity of some saponin containing plants against the dengue vector *Aedes aegypti*. *Trends Biotech. Res. (TBR)*, 3: 1-9.
- Kovendan, K., Murugan, K., Panneerselvam, C., Kumar, P.M., Amerasan, D., Subramaniam, J., Vincent, S. and Barnard, D.R. 2012. Laboratory and field evaluation of medicinal plant extracts against filarial vector, *Culex quinquefasciatus* Say (Diptera: Culicidae). *Parasitol. Res.* 110: 2105 – 2115.
- Mading, M., Kazwaini, M., Utomo, B., Arwati, H. and Yotopranoto, S. 2018. Effects of *Areca catechu* L. seed extract on mortality *Anopheles vagus* larvae. *KEMAS* 13 (3): 366-373.
- Mathew, A.G., Venkataramu, S.D. and Govindarajan, V.S. 1964. Studies on arecanut: part 1. Changes in chemical composition and physical characteristics of nuts with maturity. *Indian J. Tech.* 2: 90 – 96.
- Obomanu, F.G., Ogbalu, O.K., Gabriel, U.U., Fekarurhobo, G.K. and Adediran, B.I. 2006. Larvicidal properties of *Lepidagathis alopecuroides* and *Azadirachta indica* on *Anopheles gambiae* and *Culex quinquefasciatus*. *African J. Biotech.* 5: 761 - 765.
- Poolpraset, P., Pama, W., Chammui, Y. and Thongchai, W. 2015. Screening of medicinal plants extracts for larvicidal activity against *Culex quinquefasciatus* (Diptera: Culicidae). *Proceedings on the International Conference on Herbal and Traditional Medicine (HTM 2015)*, January 28-30, 2015. pp 228-233.
- Tennyson, S., Arivoli, S., Raveen, R., Bobby, M. and Dhinamala, K. 2012. Larvicidal activity of *Areca catechu*, *Nicotiana tabacum* and *Piper betle* leaf extracts against the dengue vector *Aedes aegypti* (L.) (Diptera: Culicidae). *Int. J. Res. Biol. Sci.* 2: 157- 160.
- Vernede, R., van Meer, M.M. and Alpers M.P. 1994. Smoke as a form of personal protection against mosquitos, a field study in Papua New Guinea. *Southeast Asian J Trop Med Public Health*, 25 (4): 771-775.
- Vinayagam, A., Senthilkumar, N. and Umamaheswari, A. 2008. Larvicidal activity of some medicinal plant extracts against malarial vector *Anopheles stephensi*. *Res. J. Paracitol.* 3: 50-58.
