A Mosquito Repellent *Karanj Kunapa* from *Pongamia pinnata*

Aboli Lale[1] and DK Kulkarni[2]

1. Department of Environmental Science, University of Pune, Pune 411007, Maharashtra, India
2. Plant Science Division, Agharkar Research Institute, GG Agarkar Road, Pune 411004, Maharashtra, India (email: dilipkkulkarni@gmail.com)

Insect pests affect plants, animals, and humans. Chemical pesticides are often used indiscriminately to control these pests. But most of these pesticides are toxic and non-biodegradable and have adverse effects on the environment by polluting soil and water and affecting health. Therefore, there is a need to develop suitable plant-based pesticides.

Nene (2003) reviewed plant protection in ancient and medieval India. Kautilya's Artha-sastra (c. 300 BC) is probably the oldest document, which describes the use of organic materials to control crop disorders. Varahamihira (c. 600 AD) mentioned the use of milk, ghee (clarified butter), and cow dung for dressing of seeds and smoking them by burning animal flesh or turmeric before sowing. Surapala's Vrikshayurveda mentions some materials and practices that were recommended for the protection of crops (Sadhale, 1996). Some of these materials and practices need our attention. In Vrikshayurveda by Surapala, preparation of *kunapa* or *kunapajala* (liquid manure) with various organic materials is documented and *kunapa* is stated to be highly nourishing for trees. Nene (2006) has given a comprehensive review on *kunapajala* and has reported its use in ancient period and in farm experiments recently in India.

Chakrapani Mishra in Vishvavallabha (Chapter 8, verse 39) recommends the powder of the bark of *Cassia fistula*, *Sapindus emarginatus*, *Pongamia pinnata*, *Alstonia scholaris*, and *Embelia ribes* to be soaked overnight in cow urine and pasted on affected parts of trees to control external insects (Sadhale, 2004). Ayangarya (2005) prepared *kunapa* by fermenting *safari* fish in cow urine and named it Indsafari. Foliar sprays with Indsafari at 1% concentration on tea bushes controlled the attack by the tea mosquito *Helopeltis theivora*. Other formulations of *kunapa* were successfully used at the tea estate in Arunachal Pradesh in Northeast India (Ayangarya, 2006a, 2006b).

Literature survey suggests that very little work has been done on the microbial aspects of *kunapa*. There are few reports suggesting an increase in population of *Azospirillum*, *Azotobacter*, *Rhizobium*, *Pseudomonas*, etc. (Glickmann *et al*., 1998;

Jared, 2003; Saritha Kumari *et al*., 2009). Steps involved in *kunapa* preparation (Sadhale, 1996, 2004) clearly indicate that fermentation is an important aspect and hence the role of microbes in *kunapa* cannot be denied. Taking the clue from the above literature as well as experimental results in the tea estate, we carried out an experiment to see the effect of *kunapa* prepared with *karanj* (*Pongamia pinnata*; family Papilionaceae) on mosquito, a common blood-sucking insect.

Materials and methods

Karanj kunapa was prepared by using plant material of *P. pinnata*. Different plant parts such as seeds, leaves, and pod shell were the main ingredients and cow dung and cow urine were components of *Karanj kunapa*. Four different solutions of *Karanj kunapa* were prepared as follows:

- Solution 1: *Pongamia* seeds were collected, dried, and powdered. The seed powder was mixed in cow dung with cow urine. All these materials were taken in 1:1 proportion and fermented for 5 days.
- Solution 2: *Pongamia* seed powder, dried and chopped *Pongamia* leaves, and cow dung with cow urine were mixed in 1:1 proportion and fermented for 5 days.

Surapala's Vrikshayurveda mentions some materials and practices that were recommended for the protection of crops. Some of these materials and practices need our attention.

Chakrapani Mishra in Vishvavallabha (Chapter 8, verse 39) recommends the powder of the bark of* Cassia fistula, Sapindus emarginatus, Pongamia pinnata, Alstonia scholaris, *and* Embelia ribes *to be soaked overnight in cow urine and pasted on affected parts of trees to control external insects.

- Solution 3: *Pongamia* seed powder, dried and chopped *Pongamia* leaves, pod shell, and cow dung with cow urine were mixed in 1:1 proportion and fermented for 5 days.
- Solution 4: Cow dung and cow urine were mixed in 1:1 proportion. This solution was used as a control.

The four solutions were diluted with water. But the quantity of water was not measured as it was added to the solutions just to make a thin paste. Each solution was taken in an electrical vaporizer (Fig. 1) and tested for

Figure 1. An electrical vaporizer containing *Karanj kunapa*.

20 days. The effect on mosquitoes was observed.

Observations and discussion

The repellent effect of four solutions of *Karanj kunapa* on mosquitoes is depicted in Figure 2. Solution 1 showed about 50% repellent effect on mosquitoes while Solution 3 showed about 70% repellent effect. Solution 2 showed maximum repellent effect of about 95%. The control Solution 4 (without *Pongamia*) did not show repellent effect on mosquitoes.

Literature survey has shown that *Pongamia* is a medicinal as well as insecticidal plant. Dried leaves are used in stored grains to repel insects. More than six decades ago when the use of pesticides was not common, farmers used different parts of *Pongamia* to protect paddy crop. It was also a common practice to plant *Pongamia* near paddy fields. The presence of *Pongamia* trees near paddy fields helped in repelling harmful insects. In order to check the spread of green leafhoppers in paddy fields, the natives or tribals used the aqueous extract of *Pongamia* leaves as foliar spray (Oza, 2003). Leaves of *Pongamia* contain chemicals such as furanoflavone, karanjin, janjone, and pongapin (Asolkar *et al.*, 1992). In the present study, we observed that Solution 2 showed 95% repellence on mosquitoes while Solution 3 had 70% repellent effect. This effect may be due to the chemical composition of *Pongamia*. We also observed that application of *Karanj kunapa* had repellent activity on cockroaches and houseflies.

India is one of the largest consumers of chemical pesticides, which destroy the natural enemies of non-target pests. Also, insect pests have developed resistance to several insecticides. Malarial mosquitoes too have developed resistance to chemical pesticides. This situation is alarming. Therefore, there is a need to shift towards use of biological control or use of plant resources in controlling insects and pests. Secoy and Smith (1983) and Yang and Tang (1988) reported several plants used for agricultural and domestic pest control in China and other countries. The promising plant sources of insecticides belong to families such as Apocynaceae, Asteraceae, Bixaceae, Celastraceae, Chenopodaceae, Rutaceae, Simarubiaceae, Solanaceae, and Pedaliaceae.

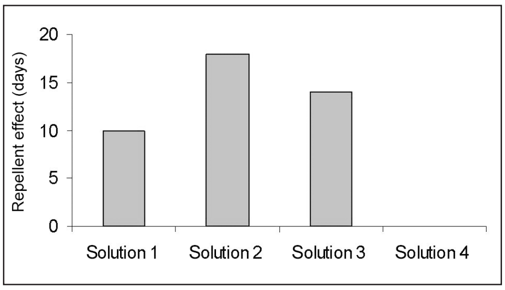

Figure 2. Repellent effect of *Karanj kunapa* solutions on mosquitoes.

Karanj kunapa *was prepared by using plant material of* Pongamia pinnata. *Different plant parts such as seeds, leaves, and pod shell were the main ingredients and cow dung and cow urine were components of* Karanj kunapa.

Kunapa is prepared with naturally available plant resources such as *karanj*, neem (*Azadirachta indica*), and *bhava* (*Cassia fistula*) and fermented in a proportionate mixture of cow urine and cow dung. Other plant resources traditionally used by local or tribal people for pest control can also be tested for *kunapa* preparation and its effectiveness (Kulkarni and Kumbhojkar, 1996, 2003). Plant resources having insect-repellent or anti-feedant property when fermented with cow urine and cow dung can be used as probable insecticides. Mosquito repellents are substances that are designed to make surfaces unpleasant or unattractive to mosquitoes. They typically contain an active ingredient that repels mosquitoes as well as a secondary ingredient, which aids in delivery and cosmetic appeal. They are available in many forms such as cream, lotion, and oil but are often sold as aerosol products. Traditionally various types of substances such as smoke, plant extracts, oil, tars, and mud have been used to repel mosquitoes. As the insect repellent technology became more sophisticated, individual compounds were discovered and isolated. *Kunapa* can be used to formulate new and more efficient forms of mosquito repellents. It is necessary to carry out chemical analysis of *kunapa* solutions to know the chemical and microbial properties in detail due to fermentation. There are many opportunities for researchers to develop new technologies from the practices mentioned in old literature. The basic prerequisite is a genuine respect for the wisdom of our ancestors.

In the present study, we observed that Solution 2 showed 95% repellence on mosquitoes while Solution 3 had 70% repellent effect. This effect may be due to the chemical composition of* Pongamia. *We also observed that application of* Karanj kunapa *had repellent activity on cockroaches and houseflies.

Acknowledgments

Authors are thankful to Dr PP Kanekar, Acting Director, Agharkar Research Institute (ARI), Pune and Dr VS Ghate, In-charge of Botany Group, ARI for providing facilities for the present work, and also to Dr GK Wagh, Editor, ARI for valuable suggestions on the manuscript. The first author is also thankful to Head, Department of Environmental Science, University of Pune for giving an opportunity to work in ARI for MSc (Dissertation).

References

Asolkar LV, Kakkar KK, and **Charkre OJ.** 1992. Glossary of Indian Medicinal Plants with Active Principles. Part I (A–K) (1965–1981). CSIR, New Delhi, India. pp. 265–266.

Ayangarya Valmiki Sreenivasa. 2005. INDSAFARI – an organic pesticide for tea. Asian Agri-History 9(4):317–319.

Ayangarya Valmiki Sreenivasa. 2006a. *Mushika kunapa*. Asian Agri-History 10(2):157–159.

Ayangarya Valmiki Sreenivasa. 2006b. Cowper: An organic fungicidal paste. Asian Agri-History 10(2):165–166.

Glickmann E, Garden L, Jacquet S, Hussain S, Elasri M, Petit A, and **Dessaux Y.** 1998. Auxin production is a common feature of most pathovars of *Pseudomonas syringae*. Molecular Plant-Microbe Interactions 11(2):156–162.

Jared RL. 2003. Cultivation of recalcitrant microbes: cells are alive, well and revealing their secrets in the 21st century laboratory. Current Opinion in Microbiology 6:274–281.

Kulkarni DK and **Kumbhojkar MS.** 1996. Pest control in tribal area – an ethnobotanical approach. Ethnobotany 8:56–59.

Kulkarni DK and **Kumbhojkar MS.** 2003. Ethno-agricultural study of Mahadeokolis in Maharashtra, India. Asian Agri-History 7(4):295–312.

Nene YL. 2003. Crop disease management practices in ancient, medieval, and pre-modern India. Asian Agri-History 7(3):185–201.

Nene YL. 2006. *Kunapajala* – a liquid organic manure of antiquity. Asian Agri-History 10(4):315–321.

Oza P. 2003. *Karanj* (*Pongamia pinnata* syn. *P. glabra*, family: Papilionaceae) as medicinal herb in Chhattisgarh, India. (Botanical.com)

Sadhale Nalini. (Tr.) 1996. Surapala's Vrikshayurveda (The Science of Plant Life by Surapala). Agri-History Bulletin No. 1. Asian Agri-History Foundation, Secunderabad 500009, India. 104 pp.

Sadhale Nalini. (Tr.) 2004. Vishvavallabha (Dear to the World: The Science of Plant Life). Agri-History Bulletin No. 5. Asian Agri-History Foundation, Secunderabad 500009, India. 134 pp.

Saritha Kumari B, Raghu Ram M, and **Mallaiah KV.** 2009. Studies on exopolysaccharide and indole acetic acid production by *Rhizobium* strains from *Indigofera*. African Journal of Microbiology Research 3(1):10–14.

Secoy DM and **Smith AE.** 1983. Use of plant in control of agricultural and domestic pests. Economic Botany 37(1):28–57.

Yang RZ and **Tang CS.** 1988. Plants used for pest control in China – literature review. Economic Botany 42(3):376–406.