

Use of Neem products for biological control of pest population

Sucheta Prakash

Assistant Professor in Zoology, Shri Murali Manohar Town Post Graduate College Ballia (U.P)

Abstract –

Neem products for biological pest control are based on the use of neem oil extracted from the seeds of *Azadirachta indica*, a tree native to India. Neem products are effective against a wide variety of insects and mites that damage ornamental plants, vegetables, and fruit trees. Neem is also used in organic farming as an insecticide for controlling aphids, whiteflies, mealybugs, and scale insects. It can be used directly on plants or mixed with water sprayers to control these pests without harming beneficial such as bees and butterflies. Neem oil is available in different forms dried, liquid, and powder form. A dried version of neem oil is made from the seeds of a plant that has been grown in hot temperatures. Powder neem products for biological control of pest and termite infestation. The product is available in different colors and shapes, which are used in various applications such as natural termite repellents.

Keywords –*Aphids, Azadirachta indica, Biological pest, Mealybugs, Neem products, Whiteflies*

1. Introduction

The neem tree has been used for centuries by Indian farmers as an insecticide and to control pests on their crops(Girish & Shankara, 2008; Gupta & Dikshit, 2010). Neem oil is extracted from the seeds of this plant using cold or hot water extraction methods(Das, Sarker, & Rahman, 2008). The cold extraction method involves soaking the seeds in water for about 12 hours before removing them and drying them at room temperature until they are completely dry. The hot extraction method involves soaking the seeds in boiling water for about 12 hours before removing them and drying them at room temperature until they are completely dry. A dried version of neem oil can be used directly on plants or mixed with water sprayers to control these pests without harming beneficial such as bees and butterflies(Dodia, Patel, & Patel, 2010). The active ingredient present in neem oil is *azadirachtin*(Copping & Duke, 2007), which acts as an

insecticidal agent against insects like aphids, whiteflies, mealybugs, and scale insects, etc., it also controls mites like spider mites, and thrips, etc., Neem seed extract contains more than 80% *azadirachtin* that has shown activity against many different pest species including various leaf-feeding caterpillars such as *cabbage looper moth larvae*(Sharma, 2008). However, it should not be applied on leaves because it may cause damage to leaves due to its toxicity towards some parts of plants like roots and stems. So nowadays biological pest control is widely being deliberated as a part of organic farming replacing toxic synthetic fertilizers(Chhonkar, 2008), gaining prominence as the most economical way of biological pest control strategies in household and agriculture practices.*Fig.1* shows the benefits of neem as a biopesticide

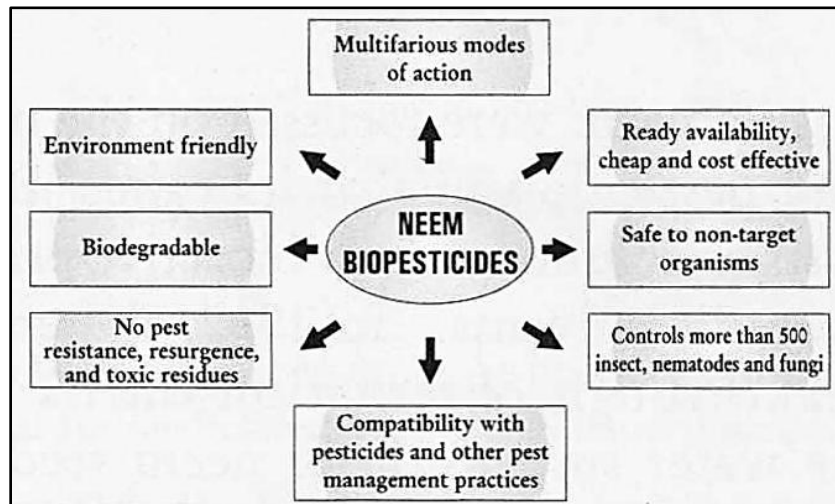


Fig.1Neem as a biopesticide

2. Review of literature

2.1 Farm-level production of *Azadirachta indica* extract

Farm-level extraction of neem products is a common practice in India(Ranga Rao & Rao, 2010).The extract is mostly used as a pesticide and insecticide, but also as an alternative to chemical pesticides. Neem products are widely used for the control of various pests and diseases on fruit trees, vegetables, cotton, and paddy fields.Neem oil is extracted from the seeds of *Azadirachta indica* (neem) by cold pressing or solvent extraction methods. The oil contains over 80% *azadirachtin*, which has been shown to be effective against nematodes and other

insects(Morgan & chemistry, 2009). It can be applied directly to plants or mixed with water for spraying on leaves or soil. Neem seed cake (NSC), which consists mainly of neem seed hulls, is also used as an animal feed supplement. Neem oil can be extracted by steam distillation from the seeds after drying under sunlight.

2.2 *Azadirachta indica* as a bio – pesticide

Azadirachtin has been found to have insecticidal effects against many species of insects including aphids (Khalequzzaman & Nahar, 2008; Kraiss & Cullen, 2008), beetles (Kavallieratos et al., 2007), caterpillars (Isman & Akhtar, 2007), cicadas (Sivčev, Sivčev, & Ranković-Vasić, 2010), flies (Kraiss & Cullen, 2008), mites (Duso et al., 2008), mosquitoes (Alouani, Rehim, & Soltani, 2009; Dua et al., 2009; Mordue et al., 2010), planthoppers(Nathan et al., 2008; Paik, Kalaivani, Kim, & Safety, 2008); plant lice such as *Phyllocoptrutaoleivora*(Gerson, Gafni, Paz, Szejnberg, & Ticks, 2008); scale insects such as *Homoptera spp.*(Nathan et al., 2007); *whiteflies*(Lynn, Song, Shim, Kim, & Lee, 2010); *thrips*(Nderitu, Mwangi, Nyamasyo, & Kasina, 2010); *leafhoppers*(Paik et al., 2008); *mealybugs*(Ghorpade & Khilari, 2010); mites like *AcarapiswoodwaspMitellaseptempunctata* , *Aulacorthumsolani* ; root-knot nematodes such as *Meloidogyne spp.*(Ntalli, Menkissoglu-Spiroudi, Giannakou, & Prophetou-Athanasiadou, 2009); slugs & snails (Ntalli et al., 2009). Other arthropods include Dermapterans (Acari): *Demodex folliculorum* ; *Collembola* (Springtails): *Odonata*)(Homopteroideans); *Chilopoda* (Centipedes): *Lithobiomorpha*); *Isopoda* (Millipedes): *Diplura*); *Crustacea* Invertebrates) ; Arachnida invertebrates) . The efficacy varies depending upon host species and pest type. For example it was found that *azadirachtin* at a concentration 100 times lower than its LD 50 had no effect on some types of spider mites while another study showed it killed all stages except egg in the life cycle of spider mite *Acarus californicus*.

3. Neem products for pest control

3.1 Neem seed karnal extract

Neem seed karnalextracts is a natural product that has been used for centuries in India(Mohanty, Patra, & Chhonkar, 2008). It is an excellent insecticide, fungicide and anti-fungal agent. Neem seed karnal extract kills all kinds of pests including insects, mites, worms and fungi with its

powerful oil content. It also helps to control the growth of bacteria on fruits and vegetables as it breaks down the cell walls of bacteria. The neem seed karnal extracts are effective against all types of fungal diseases such as ring rot, brown rot, grey mould etc.(Ahlawat, 2008), which can be seen on various crops like paddy grains or other crops like wheat grains or maize grains after they have been harvested from fields.



Fig.2 Neem seed karnal extract

3.2 Neem cake

Neem cake is a by-product of the neem oil extraction process. It is made up of crushed neem seeds, which are then mixed with water and left to ferment for about two weeks before it is dried and used as organic manure. Neem cake contains potassium, phosphorus, calcium, nitrogen, and other micronutrients that help plants grow strong and healthy(Srivastava, 2009). The leaves of the neem tree can be used in place of mulch(Bhowmik, Chiranjib, Tripathi, & Kumar, 2010) or composting material(Ravi Kumar, Jayaram, Somashekar, & Policy, 2009) to control weeds in gardens. Because it has such a high level of nutrients, it does not need to be watered as often as other types of fertilizer.



Fig.3 Neem cake

3.3 Neem oil

Neem oil is a bio-pesticide that can be used to control many common pests and diseases. It has been found effective against aphids, mites, whiteflies, thrips, and spider mites(Ambethgar, 2009). Neem oil is a natural insecticide that kills insects by interfering with the nervous system of the pest(Guleria & Tiku, 2009). The most important reason for its effectiveness as an insecticide is that it does not kill beneficial insects such as bees or butterflies(Mader & Adamson, 2009). This makes neem oil very useful in organic farming systems where these important pollinators are present on crops grown in areas where they are not normally found (such as organic farms). Neem also has some potential use against other pests including weeds and fungi(Gupta & Dikshit, 2010).The oil works by disrupting their nervous systems and causing them to stop feeding. This means they die within two or three days of being sprayed with neem oil.



Fi.4 Neem oil extract

3.4 Commercial manufacturers of neem-based products

Application	Product	Manufacturer
Fertilizer	Ozoneem Cake [®]	Ozone Biotech (India)
	Plan "B" Organics – Neem Cake [®]	Plan "B" Organics (USA)
	Fortuneem Cake [®]	Fortune Biotech (USA)
	Bio Neem Oil Foliar [®]	FUSA – Fertilizers of the USA
	Neem Cake [®]	Unibell Corporation (Russia)
	Ozoneem Coat [®]	Ozone Biotech (India)
	Parker Neem Coat [®]	Parker Neem (India)
	Neem Urea Guard [®]	Neemex (India)
	Fortuneem Coat [®]	Fortune Biotech (USA)
<i>Azadirachtin-based products</i>		

Table.1 Commercial manufacturer of neem-based products

3.5 Benefits of neem based Bio-pesticides

- i. 100% biodegradable and non-toxic.
- ii. Sometimes it is known as an effective enhancer for some synthetic fertilizers when mixed with them.
- iii. It does not destroy eco-friendly pests and beneficial predators, so act as a conscious pest controller.
- iv. Neem-based bio-pesticides are known to be effective against more than 200 pests, making them as popular pest controllers.

4. Conclusion

Neem-based bio-pesticides hold a wide prospectus in controlling pests, making them the most eco-friendly and economical choice. While the entire globe including India is focussing on sustainable agriculture and pest management practices, the use of bio-pesticides is certainly a viable choice.

References

- Ahlawat, Y. (2008). Crop Diseases and their Management. In.
- Alouani, A., Rehim, N., & Soltani, N. J. J. J. o. B. S. (2009). Larvicidal activity of a neem tree extract (Azadirachtin) against mosquito larvae in the Republic of Algeria. 2(1), 15-22.
- Ambethgar, V. J. J. o. B. (2009). Potential of entomopathogenic fungi in insecticide resistance management (IRM): A review. 2(2), 177-193.
- Bhowmik, D., Chiranjib, Y. J., Tripathi, K., & Kumar, K. J. J. C. P. R. (2010). Herbal remedies of *Azadirachta indica* and its medicinal application. 2(1), 62-72.
- Chhonkar, P. (2008). *Organic farming and its relevance in India*: Scientific Publishers, Jodhpur, India.
- Copping, L. G., & Duke, S. O. J. P. M. S. f. P. S. (2007). Natural products that have been used commercially as crop protection agents. 63(6), 524-554.
- Das, B. C., Sarker, P. K., & Rahman, M. M. J. J. o. P. S. (2008). Aphidicidal activity of some indigenous plant extracts against bean aphid *Aphis craccivora* Koch (Homoptera: Aphididae). 81(3), 153-159.
- Dodia, D., Patel, I., & Patel, G. (2010). *Botanical pesticides for pest management*: Scientific Publishers.
- Dua, V. K., Pandey, A. C., Raghavendra, K., Gupta, A., Sharma, T., & Dash, A. P. J. M. J. (2009). Larvicidal activity of neem oil (*Azadirachta indica*) formulation against mosquitoes. 8(1), 1-6.
- Duso, C., Malagnini, V., Pozzebon, A., Castagnoli, M., Liguori, M., & Simoni, S. J. B. C. (2008). Comparative toxicity of botanical and reduced-risk insecticides to Mediterranean populations of *Tetranychus urticae* and *Phytoseiulus persimilis* (Acari Tetranychidae, Phytoseiidae). 47(1), 16-21.
- Gerson, U., Gafni, A., Paz, Z., Szejnberg, A. J. D. o. M., & Ticks. (2008). A tale of three acaropathogenic fungi in Israel: *Hirsutella*, *Meira* and *Acaromyces*. 183-194.
- Ghorpade, S., & Khilari, J. J. J. o. M. A. U. (2010). Evaluation of insecticides against pink mealy bugs and thrips in grape ecosystem in Maharashtra. 35(2), 257-261.
- Girish, K., & Shankara, B. S. J. E. j. o. B. (2008). Neem—a green treasure. 4(3), 102-111.

- Guleria, S., & Tiku, A. J. I. p. m. i.-d. p. (2009). Botanicals in pest management: current status and future perspectives. 317-329.
- Gupta, S., & Dikshit, A. J. J. o. B. (2010). Biopesticides: An ecofriendly approach for pest control. 3(Special Issue), 186.
- Isman, M. B., & Akhtar, Y. (2007). Plant natural products as a source for developing environmentally acceptable insecticides. In *Insecticides design using advanced technologies* (pp. 235-248): Springer.
- Kavallieratos, N. G., Athanassiou, C. G., Saitanis, C. J., Kontodimas, D. C., Roussos, A. N., Tsoutsas, M. S., & Anastassopoulou, U. A. J. J. o. f. p. (2007). Effect of two azadirachtin formulations against adults of *Sitophilus oryzae* and *Tribolium confusum* on different grain commodities. 70(7), 1627-1632.
- Khalequzzaman, M., & Nahar, J. J. U. J. o. Z., Rajshahi University. (2008). Relative toxicity of some insecticides and azadirachtin against four crop infesting aphid species. 27, 31-34.
- Kraiss, H., & Cullen, E. M. J. P. M. S. f. P. S. (2008). Insect growth regulator effects of azadirachtin and neem oil on survivorship, development and fecundity of *Aphis glycines* (Homoptera: Aphididae) and its predator, *Harmonia axyridis* (Coleoptera: Coccinellidae). 64(6), 660-668.
- Lynn, O. M., Song, W.-G., Shim, J.-K., Kim, J.-E., & Lee, K.-Y. J. J. o. t. K. S. f. A. B. C. (2010). Effects of azadirachtin and neem-based formulations for the control of sweetpotato whitefly and root-knot nematode. 53(5), 598-604.
- Mader, E., & Adamson, N. L. J. P., OR: Xerces Society. http://www.windhamcommunitygarden.org/uploads/9/6/1/8/9618026/organic_pesticides-july-3-12.pdf. (2009). Organic-approved pesticides.
- Mohanty, S., Patra, A. K., & Chhonkar, P. K. J. B. t. (2008). Neem (*Azadirachta indica*) seed kernel powder retards urease and nitrification activities in different soils at contrasting moisture and temperature regimes. 99(4), 894-899.
- Mordue, A., Morgan, E., Nisbet, A., Gilbert, L., Gill, S. J. I. c. b., & agents, s. (2010). Azadirachtin, a natural product in insect control. 185-197.
- Morgan, E. D. J. B., & chemistry, m. (2009). Azadirachtin, a scientific gold mine. 17(12), 4096-4105.

- Nathan, S. S., Choi, M. Y., Paik, C. H., Seo, H. Y., Kim, J. D., & Kang, S. M. J. C. (2007). The toxic effects of neem extract and azadirachtin on the brown planthopper, *Nilaparvata lugens* (Stål)(BPH)(Homoptera: Delphacidae). *67*(1), 80-88.
- Nathan, S. S., Choi, M. Y., Seo, H. Y., Paik, C. H., Kalaivani, K., Kim, J. D. J. E., & Safety, E. (2008). Effect of azadirachtin on acetylcholinesterase (AChE) activity and histology of the brown planthopper *Nilaparvata lugens* (Stål). *70*(2), 244-250.
- Nderitu, J., Mwangi, F., Nyamasyo, G., & Kasina, M. (2010). Utilization of synthetic and botanical insecticides to manage thrips (Thysan.: Thrip.) on snap beans (Fabaceae) in Kenya.
- Ntalli, N., Menkissoglu-Spiroudi, U., Giannakou, I., & Prophetou-Athanasidou, D. J. C. P. (2009). Efficacy evaluation of a neem (*Azadirachta indica* A. Juss) formulation against root-knot nematodes *Meloidogyne incognita*. *28*(6), 489-494.
- Paik, C. H., Kalaivani, K., Kim, J. D. J. E., & Safety, E. (2008). Effect of azadirachtin on acetylcholinesterase (AChE) activity and histology of the brown planthopper *Nilaparvata lugens* (Stal) \$. *70*, 244-250.
- Ranga Rao, G., & Rao, V. R. J. I. J. o. P. P. (2010). Status of IPM in Indian agriculture: a need for better adoption. *38*(2), 115-121.
- Ravi Kumar, P., Jayaram, A., Somashekar, R. J. C. T., & Policy, E. (2009). Assessment of the performance of different compost models to manage urban household organic solid wastes. *11*(4), 473-484.
- Sharma, H. C. (2008). *Biotechnological approaches for pest management and ecological sustainability*: CRC Press.
- Sivčev, B., Sivčev, I., & Ranković-Vasić, Z. J. J. o. A. S. (2010). Plant protection products in organic grapevine growing. *55*(1), 103-122.
- Srivastava, A. K. J. C. I. T. F. S. B. (2009). Integrated nutrient management: Concept and application in citrus. *3*, 32-58.