

Review Article

Use of Neem Extracts (*Azadirachta indica*) in Control of Plant Diseases: A Review

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ABSTRACT

The present review paper was focused on control of plant diseases by using neem kernel extract. Since so many years farmers are using neem extract for the control of pest and diseases in plants in atharvanaveda they stated that that neem effectively works on control of diseases. It was controled many seed borne and soil borne pathogens. It was effectively works on control of early blight and wilt of tomato and seed borne diseases of cowpea. Powdery mildew disease can be controlled by using neem kernel extract. The Neem has many medicinal properties in Ayurveda (the ancient book of medicine) which states neem as kalpa vriksha. The aqueous extract of neem and oil shown that it is effective on controlling the soil borne pathogens like *Fusarium oxysporum* (f.sp,ciceri), *Alterneria solani*, *Sclerotium rolfsi*, wilt and rot in gram.

Keywords

neem extract,
powdery mildew,
Fusarium
oxysporum, seed
borne, Alterneria
solani, early blight,
wilt, Ayurveda

Introduction

Recently some higher plant products have attracted the attention of microbiologists to search for some phyto-chemicals for their exploitation as anti-microbial resistance such plant products could be bio degradable and safe to human health (Kumar *et al.*, 2008) (1).

Neem (*Azadirachta indica*) the large tree of India, has been used in our country and all over the world as anti- fungal, insecticide and nematicide and for many other medicinal uses and it is also used as medicine in ayurveda. And very part of the tree has different types of uses (Chaturvedi *et al.*, 2003) some extracts of neem plant have been shown to be toxic to fungal pathogens such as *aspergillus flavus* from soya bean seeds

(Krishna Murthy *et al.*, 2008) *Pyricularia oryzae* in rice crops. (Amadioha, 2000) neem extracts is also used as insecticide which avoid the disease incidence by insects.(2).

Review literature: in this case study I have noted that the effect of aqueous extract of neem shows effect on soil borne pathogens like *Fusarium oxysporum*, sp ciceri, *Rhizoctonia solani*, *Sclerotium rolfsii*, growth of this pathogens was affected by extracts of leat trunk, bark, fruit pulp but oil of neem is more effective leaf extracts of different concentrations 5%, 10%, 15%,20%) aqueous ethanol and ethyl Acetate along with neem and China berry. Neem can be used has a manure, neem can be used as a fertilizer, neem can be used assoil conditioners, neem can be used as urea coating agent.

Chemistry of neem

Neem consist of several thousands of chemical compounds present in neem the most known constituent of neem is Azadirachtin. It is called terpanoids. These neem terpanoids are present all over the Neem plant along with this they are 20 Sulphur compounds present in the Neem oil which are responsible for characteristic smell of neem oil and crushed seeds

Neem botanical classification

Family : meliaceae

Kingdom : plantae

Order : spindales

Genus : Azadirachta

Species : indica

Neem leaves has flavonoid called Nimbin which repels insects and helps in avoid diseases. Neem extract is also used as seed treatment which is effective on seed borne pathogens and it is also used for soil treatment which helps in increasing soil fertility. Neem extracts are bio degradable and cheaply available for the farmers.

Discription of Neem

Neem tree: neem tree is the fastest growing ever green tropical tree related to mahogany. It will grow in a place where rain fall in as low as 18 inches and it can tolerate the extreme heat of 120°F. They are reportedly lived up to 200 years. Leaves: compound alternate rachis 15-25 long, 0.1 cm thick, leaflets with oblique base, opposite, extipulate, lanceolate, acute, serrate 7-8.5cm long and 1-1.7cm wide slightly yellowish green, and bitter to taste. It contains the flavonoid called Nimbin and Azadirachtin.

Bark

Bark varies much in thickness according to age and parts of Tree from where it is taken; external surface rough, fissured and rusty-grey; laminated inner surface yellowish and foliaceous, fracture, fibrous; odour, Characteristic; tastes bitter. Flower, Fruits and Seeds: The tree is often covered in delicate flowers.

Flowers, Fruits and Seeds

In the early summer. The flowers (white and fragrant) are arranged axillary, normally more-or-less drooping panicles which are up to 25 cm long. It has a Semi-sweet, olive-sized fruit. The seed inside is rich in oil with tremendous Medicinal and botanical properties. The oil is easily obtained by pressing the Kernels in a juicer. It generally begins bearing fruit at three to five years, and can produce up to 110 lbs. of fruit annually when mature. Applications of neem: neem Oil extracted from neem has anti- fungal medicinal and insecticidal properties and it is also used in wheat and paddy cultivation.

The Neem cake (which is waste after extraction of oil) is not only increases organic matter but also inhibits the nitrogen loses from the fields by inhibiting nitrification. It also used as nematicide. Neem extracts have found to be have Anti- bacterial, anti – fungal, and nematacidal properties and which is used in rice, wheat and tomato cultivation. Neem used as a fertilizer: The left over os neem oil is used as manure it is a excellent soil conditioner. It acts as a bio- fertilizer which helps in nourishment of nutrients which are helpful to plants. It is used as fertilizer in both cash crops and food crops mainly in rice and sugar cane. It is bio degradable, eco-friendly and excellent soil conditioner. Neem used as a manure: many plants and animal excreta has improved soil fertility and increasing plant growth. Neem is

gaining popularity because of its eco-friendly nature. It helps in increasing nitrogen.

It is rich in phosphorous, calcium and Sulphur, potassium content. It is used to make high quality organic manure.

Neem used as seed coating: neem used for seed coating kills the de-nitrification bacteria present in the soil, Which prevents the loss of urea in the soil.

It is used to kill many caterpillars, mites and soil borne pathogens. Neem coating is present in either powder form or in liquid form. The properties of neem urea coating are pest growth regulators.

Neem used as a soil conditioner: Neem seeds and granules are used as good soil conditioner.

It is applied during time of sowing. it is sprinkled and raked into the soil followed by proper irrigation management so that the product reaches the roots of the plant.

It is a natural soil conditioner which improves soil quality organic soil conditioner is gaining popularity in countries like India and in Australia, and USA, UK.

Neem as a fumigants: It is used against house hold, storage, crop pest. Neem fumigant in present in gaseous state and it is used as a pesticide and dis-infectant.

It is used in commercial basis as many famers and agriculturist. It is being exported to many countries for 100 % natural and nontoxic nature.

It not kills the pest but also negatively on ovi-postiton and feeding distraction, mating distraction. One the major benefit for natural fumigants are pest do not develop resistance

to it. Neem oil extracts has germicidal properties and anti-bacterial properties which helps in killing many pest.

This type of natural fumigants cannot leave residues on the plants. Neem used as pesticide: Neem pesticides are having vital role in agriculture.

There has been a evident shift from synthetic pesticides to non-synthetic fertilizers due to the awareness of effect of synthetic pesticides on plants and other living organisms.

It is great opportunity for manufactures of neem and herbal products and neem products are effective and safe the research is going in several countries on efficiency and safety of neem. (Anis Joseph *et al.*,2010; Vethanayagam and Rajendran,2010).

Azadirachtin is the main constituent of neem based products which helps in protection of crop plants from several pest.

Methodology for preparation of NSKE (5%)
100 lit Basic method : material required :
dried neem seed 5kg, detergent, muslin cloth,
100 lit of water

First we have to take well dried neem seed (5kg)

Grind it well and mix it 100 lit of water

We have to wait till the solution turns milky white. And it well

Filter it with muslin cloth.

Spray it in the field.

It is a common method used by the farmers to make neem extracts. Combinations used along with neem and different concentrations neem extract for effective ness. During 1993-94 neem kernel extract 6 % was evaluated different combinations of heliothis nuclear

poly hydro viruses 500 against boll worm.(5)

Neem kernel extract with cow urine (NSKE 3%) it is effective against mustard aphids.(6)

Neem kernel extract 0.15 %. Ww (80% of neem extract) is effective on rhizoctonia solani.(7)

Neem kernel extract of 5%(80%) neem extract is effective on root knot nematode in tomato.(8)

Neem kernel extract of 23.6-32.2% seed borne pathogen in mustard.(9)

Neem kernel extract is more effective with the mix of panchagavya against many insect pest and soil borne pathogens.

Neem kernel extract along with *ocimum sanctum* reduced early blight of tomato by 40 % better than neem extract.(10).

(5%,10%,15%) aqueous extract of neem will effectively suppresses the mycelial growth of both early blight and wilt pathogens.(11).

Patil *et al.*, (2001) found that incidence of *Alternaria* early blight is reduced and yield of tomato is increased from (15,643 -16,856 kg ha-1).(12).

Impact of neem kernel extract with HNPV combined with neem seed kernel extract gave better control of *H.armigera* on chick pea

with neem kernel extract (38).

The NSKE is sprayed in the fields with 10-15 days interval which is effective on the following pests and diseases with recommended doses of researchers. Recommended specifications of neem oil is given below for the preparation of effective neem oil against different types of pest and diseases.

Extracts of neem is bio- de gradable and cheaply available for the farmers. Now a days farmers are slowly moving towards zero budget farming in which neem is good source for pathogen and insect control for the farmers. Neem extract is also used for soil reclamation purposes and it also increases soil fertility. Neem extracts are used kill soil borne pathogens and it is also used to kill seed borne pathogens when it used as seed treatment purposes.

Neem extracts are also used with the combinations of other bio remedies.

Neem extracts are along with use of panchagavya increases soil fertility.

Neem extracts is having flavonoids called Nimbin which helps to avoid the insects and kill some of the insects.

Table.1

Disease	Causal organisms	Management with neem extracts;
1.Sheath rot	<i>Saroclodium oryzae</i>	NSKE 5 % of soil application of 25 kg /ha and foliar spray of 3%
2.Sheath blight	<i>Rhizoctonia solani</i>	Foliar spray of neem oil with 3%
3.Bacterial blight	<i>Xanthomonas oryzae</i>	Spray neem oil 3 % or NSKE 5%
4. <i>Alternaria</i>	<i>Rhizoctonia solani</i>	NSKE 5 %

Insect	Scientific name	Management with neem extracts
Black bug	<i>Scotinophoralurida</i>	Neem oil 3 %, NSKE 5 %, soil application 25 kg/ha
Brown plant hopper	<i>Nilopravata lugens</i>	NSKE 5 %,soil application 25 kg/ha neem oil 3 % foliar spray of 3 %
Mustard fly	<i>Athalia lugens proxima</i>	NSKE 5 %

Table.2 Specifications of neem kernel oil

Characteristics	Requirements
Maximum moisture & Insoluble impurities	0.3% by weight
Maximum acid value	15
Maximum un spoonified Matter	2% by weight
Minimum titre	36°C
Sponification value	180-205

Source: Indian standard institute specifications 4765. The color index indicates the degree of deterioration of non-fatty consistent present in the seed.

It avoids the incidence of diseases through insects. The chemical used in agriculture are showing severe effect on environment now a days researches has been started all around the world to reduce the usage of chemicals in agriculture. In this contrast neem based pesticides has more scope in near future.

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References

Abdul Latif, M, Abu kaoser, M saleh, M Ashik iqbal khan, Habibur Rahman, M Anwar Hossain, Bangladesh journal of microbiology 23(2),168-170,2006.

Ahmad S, Ansari M S and Muslim M. Toxic effects of Neem based insecticides on the fitness of *Helicoverpa Armigera* (Hübner). Crop Prot. 2015; 68:72-78.

Akhtar M, Mahmood I (1997). Control of root-knot nematode *Meloidogyne incognita* in tomato plants by seed coating with suneem and neem oil. J. Pestic. Sci., 22: 37-38.

Amadioha A. C. and P. N. Uchendu, 2003. Post harvest Control of tomato fruit rot caused by *Fusarium With* extracts of *A. indica*. Discovery and Innovation. 15(1-2), 83-86.

Anonymous: Proposal on national network on integrated development of neem. GoI, India.1999. Journal of Pharmacy Research Vol.4.Issue 6. June 2011, pg no 1824-1827.

Ayurvedic Pharmacopeia of India, Government of India. 1(2), 131-132.

Biopesticides ed. Singh D., editor. (New Delhi: Springer;) 2014 173-205.

Byomukesh Dash, N N padhi, Indian journal of nematology 28 (2),163-167,1998.

Cao J, Zeng K, Jiang W (2006). Enhancement of postharvest disease

- Resistance in YaLi pear (*Pyrus bretschneideri*) fruit by salicylic acid Sprays on the trees during fruit growth. *Eur. J. Plant Pathol.*, 114:363-370.
- Chaturvedi, R, Razdan, M K Bhojwani S S (2003). Production haploids of neem(*Azadirachta indica* A. Juss) by another culture plant cell. Source:TNAU Agritech portal.in (www.agritech.tnau.ac.in/org).
- Dheebea B, Niranjana R, Sampathkumar P, Kannan K, Kannan M. Efficacy of neem (*Azadirachta indica*) and tulsi (*Ocimum sanctum*) leaf extracts against early blight of tomato. Proceedings of the National Academy of Sciences, India Section B: Biological Sciences. 2015;85(1):327-36.
- Facoonee, I. 1984. Germination tests with neem seeds. In proceedings of the 2nd International Neem Conference, Rauischholz-hausen, West Germany.
- Gonzalez-Coloma A, Reina M, Diaz C E, Fraga B M, Santana-Meridas O. Natural product-based biopesticides For insect control, in Reference Module in Chemistry, Molecular Sciences and Chemical Engineering, 2013.
- Grace R, 1991 and MSDS for Margosan-O. Washington Research Center, Columbia. Indian Agricultural Research Institute. 1983. Specifications For neem kernel oil, 4765.
- Gupta, M P. CSIR, 2005 Natural Product Radiance-mar.2005.
- Hassanein, N M, M A Abou Zeid, K A youssef, D A mohmoud Aust. J. basicAppl.Sci 2(3), 763-772,2008.
- Hill, J. E. 2002, Subramanian V. Direct seeding of rice in Asia: emerging issues and strategic research needs for the 21st century. In: Proceedings of the International Workshop on Direct Seeding in Asian Rice Systems Strategic Research Issues and Opportunities, january 2000, Bangkok, Thailand, Los Baños (Philippines):International Rice Research Institute.
- Khan, M. and Wassilew, S. W., in Natural Pesticides from the Neem Tree and Other Tropical Plants (eds Schmutterer, H. and Asher, K. R. S.), GTZ, Eschborn, Germany, 1987, pp. 645–650.
- Kraus, W., in The Neem Tree: Source of Unique Natural Products for Integrated Pest Management, Medicine, Industry and Other Purposes (ed. Schmutterer, H.), 1995, pp 35–88.
- Kumar A, Shukla R, Singh P, Prasad C S, Dubey NK(2008) Assessment of *Thymus vulgaris* L. essential oil as a safe botanical preservative against post-harvest fungal infestation of food commodities.innov.foodsci.Emerg.,4:57 5-580.
- Kumar M G, Kumar R J, Regupathy A, Rajasekharan B. Neem Update. 1995, 1:4.
- Marimuthu, R., Manivannan, Babu S, V. and Kumar, S. R. 2001. Effect of organic and inorganic manures on growth and yield of rice. *Agricultural Science Digest.*, 21(4): 232-234.
- Martineau Jess, 1994. Agri Dyne Technologies, Inc. January 26, 1994, MSDS for Azatin-EC Biological Insecticide. Rossner, J. and Zebitz, C. P. W. 1986. Effect of soil treatment with neem products on earthworms Proceedings of the 3 International Neem Conference, Nairobi, kenya 1986.
- Mohanty S, Patra A and Chhonkar P. Neem (*Azadirachta Indica*) seed kernel powder retards urease and Nitrification activities in different soils at contrasting Moisture and temperature regimes. *Bioresour.Technol.*2008; 99: 894–899.
- Naziha M. Hassanein, Mohamed A. Abou Zeid, Khayria A. Youssef and Dalia A. Mahmoud Department of Microbiology,

- Faculty of Science, Ain-Shams University, 11566 Elkhalfa El-Mamoun street Abbassia, Cairo, Egypt.
- Patil M J, Ukey S P and Raut B T. Evaluation of fungicides and botanicals for the management of early blight (*Alternaria solani*) of tomato. PKV-Research Journal. 2001;25: 49–51.
- Poonam Kumari, Neelam Geat, Shivam myura and Sakshi Meena Journal of Pharmacognosy and Phytochemistry 2020; 9(1): 1995-2000.
- Premila R., Anis joseph,, V. G., Soorya Rajendran and Sarika Mohan, S. Nisha K. S. 2010. Safety of neem products to Tetragnathid spiders in rice ecosystem. Journal of Biopesticides, 3(1): 88-89.
- Puri, H.S. “Neem: The Divine Tree. *Azadirachta indica*”, Amsterdam: Harwood Academic Publications, 1999.
- Raguraman S and Kannan M. “Non-target effects of Botanicals on beneficial arthropods with special reference To *Azadirachta indica*,” in Advances in Plant
- Rengasamy S, Kaushik N, Kumar J, Koul O, Parmar BS. In: Singh RP (ed) World Neem Conf.Oxford and IBHCO, New Delhi. 1993, p 207.
- Sanjeet K, Upadhyay J P and Sanjeev K. Evaluation of Plant extracts for control of *Alternaria* leaf spot of *Vicia faba*. Annals of Plant Protection Sciences. 2005;13(1): 258–259.
- Sarode, S V, P P patil, S L borkar, journal of entomological research 19 (3),219-222,1995.
- Senthil Nathan S, Kalaivani K, Sehoon K and Murugan K. The toxicity and behavioural effects of neem Limonoids on *Cnaphalocrocis medinalis* (Guenée), the Rice leaf folder. Chemosphere. 2006; 62: 1381–1387.
- Singh U. P., H. B. Singh and R. B. Singh, 1980. The fungicidal effect of neem (*Azadirachta indica*) extracts on Some soil-borne pathogens of gram (*Cicerarietinum*). Mycologia 72, 1077–1093.
- Subba lakshmi lokanadhan, P muttu krishnan, and Jeyraman, Agriculture application of neem products, J. Biopest,5 (supplimentary): 72- 76(2012).
- The Fankanso women marketing federation, brikmaba, A guide to organic pesticide preparation neem seed extract (pg no: 3-7).
- Tripathi S, Dhyani S, Inder D (2004). (Preliminary screening of neem leaf extractives against *Poria monticolad-a* wood Destroying fungus.) J. Indian Acad. Wood Sci.
- Urkey, S. P., Patil M. J, and B. T. Raut, 2001. Evaluation of fungicides and botanicals for the management of early blight of tomato. PKVResearch journal 25, 49–51.
- Vanna, G. S., Miracles of Neem Tree, Rasayan Pharmacy, New Delhi, 1976.
- Vethanayagam, S. M. and Rajendran, S. M. 2010. Bioefficacy of neem insecticidal soap (NIS) on the disease incidence of bhendi, *Abelmoschus esculentus* (L.) Moench under Field conditions. Journal of Biopesticides, 3(1): 246-249.
- Walia K. K., N. Mehata and D. C. Gupta, 1994. Effect of Green manuring on Rhizoctonia and root-knotnematode complex on tomato. Nematologia Mediterranea 22, 131–133.