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INFORMATION

MORTALITY OF NEEM (*AZADIRACHTA INDICA* L.) BY PHANEROGAMIC PLANT PARASITE *DENDROPHTHOE FALCATA* (L.F.) IN KARNATAKA

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Abstract: Studies undertaken on the health status of trees on road sides revealed mass mortality of neem trees bordering the roads as well as the trees bordering farmer's field in Chitradurga and Tumkur districts of Karnataka. It was confirmed that the trees were dying due to severe infestation of *Dendrophthoe falcata* (L.f.) (Loranthaceae) and hence the need for protecting these trees to get the innumerable ecosystems services in sustainable way is discussed.

Keywords: *Dendrophthoe falcata*, Medicinal properties, Mortality, Neem, Parasite

INTRODUCTION

Neem (*Azadirachta indica* L.) is a tree native of India, called by many as "The village pharmacy" or "Divine tree" or "The tree to solve global problems" because of its multifarious uses including cure for many diseases like malaria, bacterial, viral, fungal andhelminth infections, and anti-carcinogenic properties (Ketkar, 1976). From time immemorial, around 4500 years ago, Neem is being utilized to support healing properties and even today it is worshipped as a standout amongst the most versatile plants known. It provides shade, ornamental look, shelterbelt, fuel wood, construction wood, and also helps in reclamation of degraded land and soil conservation activities (Anon, 1988). Because of its legendary, it is being identified as "the most promising of all plants" and at the present moment it is the source of most promising natural pesticides also. It is introduced as an agroforestry species in dry areas all over the world (Sundararaj and Murugesan, 1997) and it is known to increase soil fertility and water holding capacity. Thus largescale plantations of neem trees are recommended to combat desertification, deforestation, and soil erosion, and to reduce excessive global temperature (Sateesh, 1998). Today, modern societies, finding themselves confounded on the web of their creation, are willing to revert to nature for remedies and neem tree provides a promising means in this matter. Neem has a high rate of photosynthesis and liberates more oxygen than many other tree species, thus purifying the atmosphere (Randhawa and Parmar, 1993). The temperature under the neem has been found to be ~10^0C less than the surrounding temperature, during hot summer months in the northern parts of India (Karmakar *et al*., 2012). Its flower is a commodity that comes at a big price at Ugadi festive season in South India (Singh, 2018).

Neem is a preferred species for road side plantations as it is a fast growing evergreen tree and has high drought tolerance and is well adapted to stress conditions (Gupta and Kumar, 2002). Planting roadside trees is an important welfare measures since olden days, as they throw shade over thousands of villages and millions of grateful travelers every day. They give relief to humans, birds and animals from summer heat and even in the olden days the Kings and Nobles used to tie their horses on the roadside trees and the whole group take rest under the canopy of well foliage trees. As new foliage of neem emerges during summer which gives a cool shade for the pedestrians and long running vehicles and if such trees are continuous on the road sides, the travel feels good, as the breeze seeping will be a few degrees lesser than that in open roads without trees.

During our survey on the health status of road side trees, we could observe unusual mass death of neem(Figure-1) bordering the roads as well as the trees bordering farmer's field in Chitradurga and Tumkur districts of Karnataka andour observation confirmed the death of neemtrees primarily due to the severe infestation by the large bushy evergreen stem hemiparasite *Dendrophthoe falcata* (L.f.) (Figure-2). *D. falcata* is found infesting in dense cluster covering the branches of neemtrees with

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smooth broad leaves and tubular yellowish-red flowers (Figure-3).

An assessment revealed a mean of 98 per cent of the trees infested by *D. falcata* at varying levels, with death of 12 per centneem trees (Figure-4). Astudyreported that the infestation of *D. falcata* ranged from 0 to 75 per cent with an average of 23.8 per cent of 10 to 15 trees in dried and dying stagein Madurai,Tamil Nadu(Kalaichelvi *et al*., 2020).In the present survey, in some areas 5 to 6 neem trees in a stretch were found dead (Figure-1). The severity of infestation of *D. falcata* and their subsequent removal by cutting the infested branches accelerates the death of neem (Figure-5). It seems to be threatening for the survival of neem due to the severe infestation of *D. falcata* on the trees which already experiencing additional stresses due to climate changeand thereby losing invaluable ecosystem services provided by them.This forms the first report of death of neem trees in Karnataka by the infestation of *D. falcata*.

Despite its insecticidal properties, neem is known to be infested by 63 species of insect pests from all over the world and 37 species of insect pests from Indian subcontinent which includes the geometrid moth, *Ascostisselenaria* (Beeson, 1953), scale insects *Megapulvinaria maxima* and *Aspidotus orientalis*, lepidopteranpest *Helopeltis theivora*, limacodid moth, *Thosea bipartita* (Sundararaj and Murugesan, 1997) and the defoliating pest *Cleora cornaria* (Mishra and Omkar, 2012). The infection of *Phomopsis azadirachtae* was reported on neem of all age and size in Karnataka, causing die-back with the symptoms of blight and fruit-rot resulting in almost 100 per cent loss of fruit production (Girish and Bhat, 2006).Recently severe infestations of tea-mosquito bug, *Helopeltis antonii* on neem causing tree's foliage appear lifeless with burnt appearanceand the subsequent infection of *Phytopthora* sp., resulted in degeneration of the entire branch anddie-back disease across Telangana and Andhra Pradesh.

The hemiparasitic *D. falcata*is a phanerogamic belongs to the family Loranthaceae (mistletoe family), can capture food from the host trees by means of penetrating roots called the haustoria which are found at the point of attachment as a bulged stem or knotty outgrowths on the stem(Figure-6) of the host. It is also called the "Showy Mistletoes" due to its often specular bright red and yellow flowers of more than 20 cm long. This epiphytic parasite is reported on various host plants in large amounts worldwide and causes much damage to economical cultivated plants and associated with tropical trees, specifically the mango trees and rarely few timbers yielding trees (Subhashini *et al*., 2019). It is a stem hemi parasite on teak, mango, citrus, custard apple, eucalyptus, apple, peach, and guava in India. It is a glabrous shrub with green leaves but without a true root system and produces a long and tubular flower system in clusters which are small, and may be either unisexual or bisexual.

D. falcata are characteristically Ornithophilous primarily by "Flower-peckers". The seeds in the bird faecal matter get attached to the branches with the help of non-digestive gummy mucilage around the seed.Thus, it gets the attachment on the host branches and germinates in the bark, and it prefers to grow only on top of the canopy of host (Subhashini *et al*., 2019).These parasites establish relationship with host vascular elements to draw nutrients. Once the parasite established, it steals minerals and water, as well as block sunlight by covering the encroached place. The shoot length, root length and biomass components (leaves, stem and root) of the neem seedlings were significantly reduced after mistletoe infection and its continued growth kill the host as well as mistletoe (Karunaichamy *et al*., 2005).The nutrient derived from the host plant results in poor growth, low yield, less quality of fruit and finally leads to die-back and death of the host plant after 4 to 5 years of its infestation. Also, *D. falcata* die along with the host plant as their food source dries up and our findings confirms above fact as the parasite were found dying along with the neem trees (Figure-7).

Figure 1. Mass death of neem trees at Chitradurga district

Figure 2. Severe infestation of *Dendrophthoe falcata* on neem

Figure 3. Dense clusters of *D. falcate* with flowers covering the neem

Figure 4. Drying the branches of neem due to the infestation of *D. falcata*

Figure 5. Pruning of infested branches of neem

Figure 6. Outgrowth of *D. falcata* on the stem of neem tree

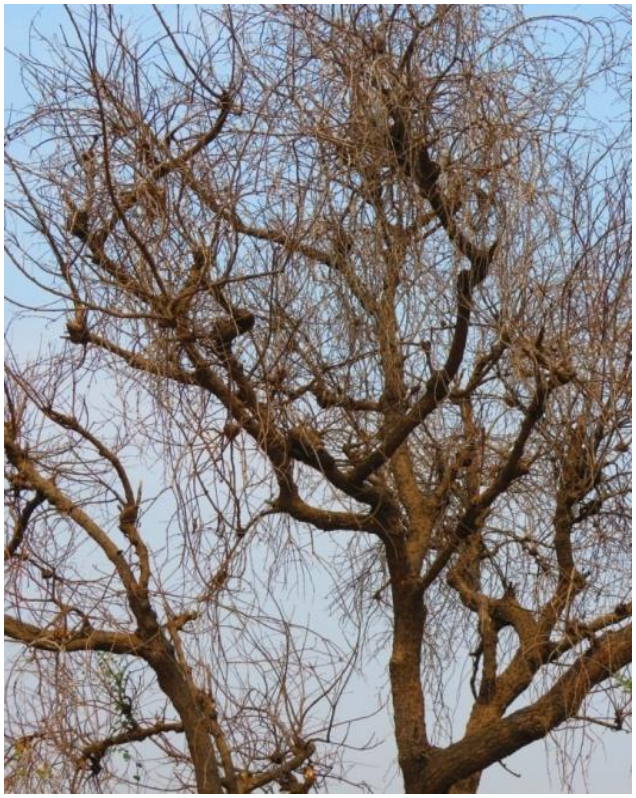

Figure 7. Death of *D.falcata* along with neem

Once a common tree in households and roadsides, the neem is fast disappearing from the landscape of Hyderabad and other parts of states due to the parasite loranthus making the neem flowers are hard to find. Neem can be protected by removing the parasite in the early stages of its growth and chemical measures were not effective in controlling *D. falcata*. Experts attribute the disappearance of neem due to Honey Suckle Mistletoe that affects the tree's growth at Hyderabad. Though neem has a strong bark, deep

root system and has a great ability to regenerate, but most of the neem in road sides and farmer's fields of dry regions are in danger due to the infestation of *D. falcata*. Hence, focused research is requiredaiming for developing more economical and environmental friendly management strategies for the effective management of *D. falcata*on valuable trees like neem so that the innumerable ecosystems services of such trees can be sustained.

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REFERENCES

Anonymous (1988). *Azadirachta indica* A. de Jussieu. *Bois et Forets des Tropiques*, **217**: 33-47.
Google Scholar

Beeson, C.F.C. (1953). The Ecology and Control of the Forest Insects of Indian and the Neighboring Countries. Government of India Press, New Delhi, 2nd edn, pp:767.
Google Scholar

Girish, K. and Bhat, S.S. (2006). *Phomopsis azadirachtae*- The Die-Back of Neem Pathogen. *Electronic Journal of Biology*, **4**(3):112-119.
Google Scholar

Gupta, V.K. and Kumar, R.V. (2002). Thrust on neem is need of today. In: Employment news, July 20-26. New Delhi, India.
Google Scholar

Karmakar, A., Karmakar, S. and Mukherjeem, S. (2012). Biodiesel production from neem towards feedstock diversification: Indian perspective. *Renewable and Sustainable Energy Reviews*, **16**(1):1050-1060.
Google Scholar

Karunaichamy, K.S.T.K., Paliwal, K. and Arp, P.A. (2005). Biomass and nutrient dynamics of mistletoe (*Dendrophthoefalcata*) and neem (*Azadirachtaindica*) seedlings.*Biomass and Nutrition Studies*, **25**(30):1-5.
Google Scholar

Ketkar, C.M. (1976). Final Technical Report. Khadi and Village Industries Commission, Directorate of Non-Edible Oils and Soap Industry, Hyderabad, pp: 279.
Google Scholar

Mishra, G. and Omkar, O. (2012). Neem, the wonder tree, under attack: a new major pest. *Current Science*, **102**(7):969-970.
Google Scholar

Randhawa, N.S. and Parmar, B.S. (1993). Neem: Research and development. Society of Pesticide Science, IARI, New Delhi, India.
Google Scholar

Sateesh, M.K. (1998). Microbiological investigations on die-back disease of neem (*Azadirachta indica* A. Juss.). Ph.D. thesis. University of Mysore. Mysore, India.
Google Scholar

Subhashini, K., Kumar, P.R. and Gaddeyya, G.A. (2009). Comprehensive review on *Dendrophthoefalcata* (L.f.) Ettingsh (Loranthaceae).*Tropical Plant Research*, **6**(3): 514-520.
Google Scholar

Sundararaj, R. and Murugesan, S. (1997). Record of *Thosea bipartita* (Limacodidae: Lepidoptera) on neem from Jodhpur. *Indian Forester*, **123**(3): 261.
Google Scholar