Annals of Arid Zone 63(2): 171-174, 2024

Short Communication

Infestation of Two Bostrichid Stem Borers on Neem Tree (*Azadirachta indica* A. JUSS.) - First Report from Indian Thar Desert

Richhpal Singh[1*], Kolla Sreedevi[2] and Narpat S. Shekhawat[3]

[1]*Government College Luni, Jodhpur-342802, Rajasthan, India*

[2]*ICAR-National Bureau of Agricultural Insect Resources, Hebbal, Bengaluru 560 024, India*

[3]*Pali Road, Jodhpur 342 005, India*

Received: January 07, 2024 Accepted: March 07, 2024

***Correspondence**
Richhpal Singh
richhpalsinghs@yahoo.co.in

Citation
Singh, R., Sreedevi, K. and Shekhawat, N.S., 2024. Infestation of bostrichid stem borers (Coleoptera: bostrichidae) on neem tree (Azadirachta indica A. Juss.) first report from Indian Thar desert. Annals of Arid Zone 63(2): 171-174

https://doi.org/10.56093/aaz.v63i2.147205

https://epubs.icar.org.in/index.php/AAZ/article/view/147205

Abstract: Neem (*Azadirachta indica* A. Juss.) trees are infested by two powder post stem borers (Coleoptera; Bostrichidae) at Luni (Marwar), Jodhpur, Rajasthan. The powder post stem borers (beetles) attack juvenile and young branches of 5-7-years-old neem trees. The infested trees exhibit severe dieback syndrome, dry and die. The two neem beetle pests are identified as species of *Amphicerus* and *Sinoxylon.* Mode, and patterns of feeding and infestation are studied. Process of tree mortalities are recorded. It is first report on dual attack of insect pest menace to neem tree which is a major source of bioactive molecule azadirachtin and ecosystem services of the fragile ecosystems.

Key words: *Amphicerus*, *Sinoxylon, Azadirachta indica*, Bostrichidae, dieback, Neem, powder post stem borers.

Azadirachta indica (Neem), a plant of family Meliaceae is native to tropical woodlands of north-eastern India and perhaps parts of Asia (Csurhes, 2016), provider of valuable ecosystem services. A major avenue and shade tree of the subcontinent, neem is considered living-/green-/Nature's pharmacy. The plant manufactures variety of pharmaceuticals including potential biopesticides. *A. indica* is one of the most famous limonoid-producers, synthesizing azadirachtin bioactive against approximately 400 species from more than 10 important insect orders including antifeedants, repellants, inhibitors of growth and development causing gastric toxicity and sterilization. Limonoids are a diverse class of plant natural products. The basic limonoid scaffold has 26 carbon atoms (C26). C-seco limonoids possess the highest bioactivities and are derived from *Azadirachta* and *Melia* genera of Meliaceae (Mahogany) a family of a number of tree species valued for high-quality timber and some are the most sought after worldwide in the industry. *Azadirachta indica and Melia azedarach* (Mahaneem/ Bakayan) and the family have been subjects of new biology during the 21st century (Krishnan *et al*. 2016, Bhambhani *et al*. 2017, Dave *et al*., 2023). Cui *et al*., (2023), provided the whole-genome sequence of *Melia azedarach* comprising 237.16 Mb with a contig N50 of 8.07 Mb, and an improved genome sequence

of *Azadirachta indica* comprising 223.66 Mb with a contig N50 of 8.91 Mb. Azadirachtin extracted from the kernel/seeds of *A. indica* is rich source of limonoids, which affects the insect reproductive and endocrine system besides exerting antifeedant activity (Mordue and Blackwell, 1993) Azadirachtin is also an important constituent as climate-safe/-smart product for human/animal health, hygiene and agriculture and industrial uses. However, in era of climate change/global warming of Anthropocene, a number of key-stone species of the Indian Thar Desert/other fragile ecosystems especially *A. indica*, *Prosopis cineraria* and many others face wide-spread threats of canopy dieback resulting in accelerated mortalities (Shekhawat *et al*., 2012). Frequent and extended dry drought, heat-waves and severe cold/ frost stresses coupled with pruning during inappropriate periods make these tree species specifically Neem plants prone to insect/pest attacks (Boa 1995, Mishra and Omkar, 2012, Handa *et al*., 2022).

The present research communication is based on surveys, field observations and studies by the authors on new emerging pest infestation of neem trees in the vicinity/premises of the campus of Government College, Luni, Jodhpur, Rajasthan. During 2022-23 severe senescence, defoliation and drying of young branches of neem trees was recorded. Six, out of 20, five to seven-years old trees were found infested and exhibiting dieback syndrome and drying/ mortalities (Fig. 1 a and b). On examination of drying and dead plants, at the surface and at broken ends of resultant pieces/parts of dried branches, two types of holes (small and large) inhabited by two types of insects (resting/digging the internal tissues of these branches) were observed. The insects were collected and sent to ICAR-National Bureau of Agricultural Insect Resources (NBAIR), Bengaluru and Division of Entomology ICAR-Indian Agricultural Research Institute (IARI), New Delhi for identification. These have been identified and recognized as species of genera, *Amphicerus* (IARI: 613/22) and *Sinoxylon* (IARI: 614/22) of family Bostrichidae, Coleoptera. The *Sinoxylon sudanicum* and *Amphicerus bimaculatus* were reported as tree pest of many economically important plants (Chase *et al*. 2012, Andreadis *et al*. 2016)**.** *Sinoxylon* sp. is reported as most serious powder post beetles that infest the wood of several timber wood species, mostly the fresh cut logs.

The dual infestation of *Amphicerus* sp. (Fig. 1 c and d) and *Sinoxylon* sp. (Fig. 1 e) on neem plants caused die-back and mortality. Both the beetles drilled round entrance holes about 2.5-6.0 mm in diameter for penetration/infestation into the neem tissue. Resource partitioning is evident where, the smaller insect, *Sinoxylon* inhabited the branches of host plant making small sized holes of 2.5-3.0 mm diameter (Fig. 1 f) and starts damaging the cortical tissues along the peripheral region of the stem or branch at specific distance (Fig. 1 g). The path of damage observed to be almost circular. The *Amphicerus* species bore a comparatively large sized hole of 5.0-6.0 mm in diameter ((Fig. 1 h) and penetrates vertically in the inhabited stem and branches both and damage vascular tissues (Fig. 1 i). There are a few examples of Bostrichidae attacking living trees and breeding there but there are more reports of damage caused by young adults tunnelling in juvenile stems and shoots to feed before breeding therefore, it is called maturation feeding (Liu *et al*., 2008). Probably this combine attack for maturation feeding of *Sinoxylon* sp. and *Amphicerus* sp. destroyed the cortical as well as central vascular region of the stems of neem plants. The central pith region and outermost region i.e., bark and thin layer of cortical region remained intact. The combine attack of both the species blocks the supply of nutrients and water to the various parts of the affected plants. It was observed that these adult beetles bore into living healthy branches to feed and get shelter therefore, the living branches wilt, droop and finally die-back. Probably it is a first report on combine attack of two Bostrichidae species on same plant at the same time without affecting or influencing each other's niche and harvesting the resources of host plant efficiently. In Mango, the two species of borers belonging to Cerambycidae of Coleoptera, *Batocera rufomaculata* and *Glenea multiguttata* were found to partition the resources with clear niche demarcation between the species, where *B. rufomaculata* inhabited main trunk while *G. multiguttata* inhabited the lateral branches (Reddy *et al*., 2014).

We observed that the first symptoms were appeared as drying of leaves and young branches followed by whole drying of bored

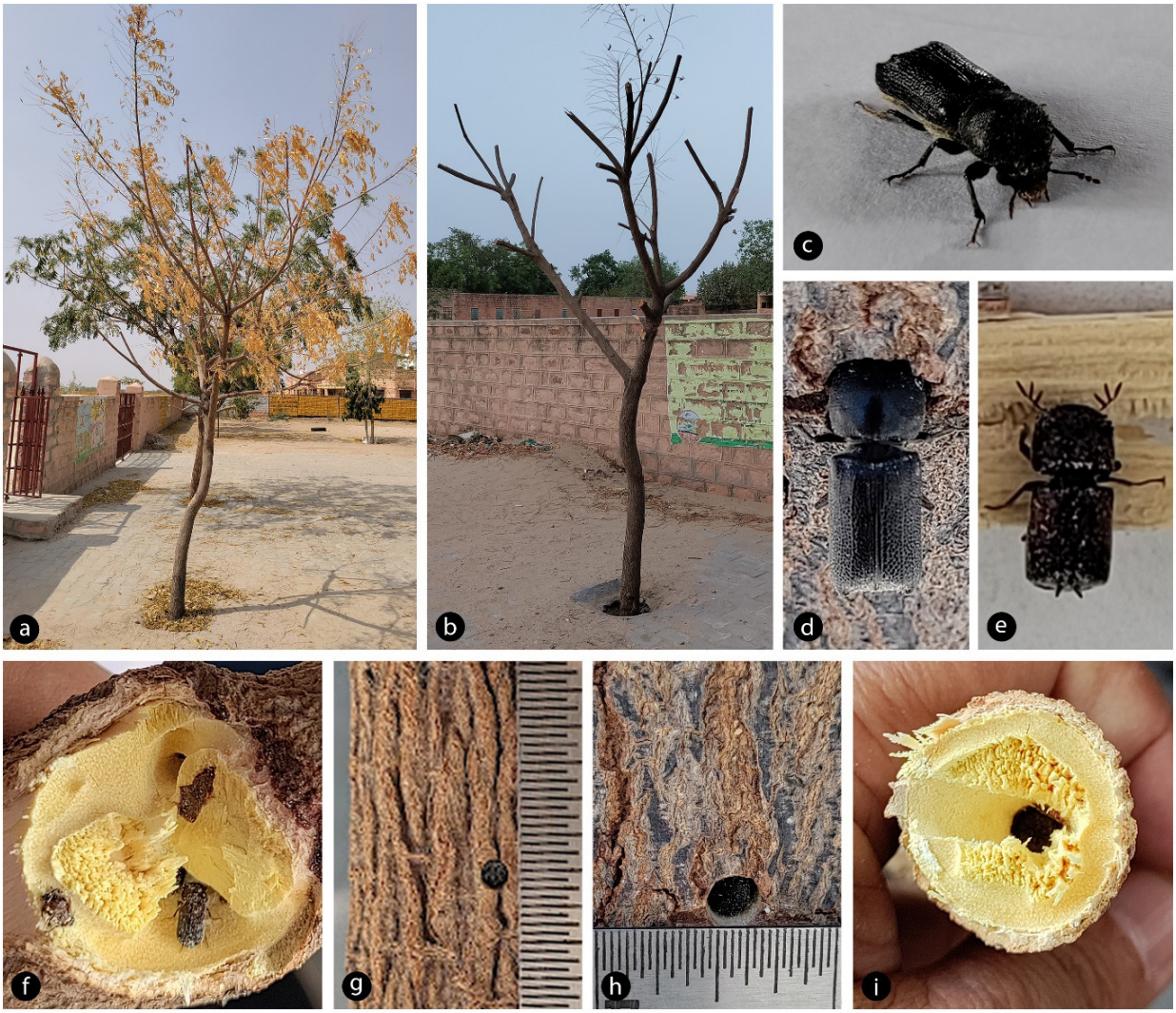

Fig. 1. a and b - powder post beetle infested neem tree; c and d - adult Amphicerus sp.; e - adult Sinoxylon sp.; f - Sinoxylon sp. in circular/peripheral tunnel at nodal region of the branch; g - entrance hole of Sinoxylon sp.; h - entrance hole of Amphicerus sp.; i - Circular and vertical gallery/tunnels drilled by Sinoxylon sp. and Amphicerus sp. respectively.

plant with intact branches. A small mechanical force or wind jerks created by high wind velocity during summers was enough to break the branches at different intervals as monocot stems (nodal breaking) and finally lodging of the plant. The dual attack of these two Bostrichidae is very destructive for neem trees and it kills susceptible neem plants. The neem trees are important component of social forestry of Indian Thar desert therefore, much studies are further warranted on biology and management of these borer pests. Conservation of the neem tree species is all the more important in this era of rapid extinction.

Acknowledgements

Authors are thankful to Division of Entomology, ICAR-IARI, New Delhi and Indian Agricultural Research Institute ICAR-National Bureau of Agricultural insect Resources (NBAIR), Bengaluru for identification of insect specimens.

References

Andreadis, S.S., Navrozidis, E.I. and Katerinis, S. 2016. First record of the grape cane borer, *Amphicerus bimaculatus* (Oliver, 1790) (coleoptera: Bostrichidae), on pomegranate in Greece, *Turkish Journal of Zoology* 40: 286-289.

Bhambhani, S., Lakhwani, D., Gupta, P., Pandey, A., Dhar, Y.V., Bag, S.K., Asif, M.H. and Trivedi, P.K. 2017. Transcriptome and metabolite analyses in *Azadirachta indica:* identification of genes involved in biosynthesis of bioactive

triterpenoids. *Scientific Reports* 7: *5043* DOI: 10.1038/s41598-017-05291-3. pp 1-12

Boa, E.R. 1995. A guide to the identification of diseases and pests of neem *(Azadirachta indica*), Food and Agriculture Organization of the United Nations (FAO) Bangkok, p. 34.

Chase, K.D., Schiefer, T.L. and Riggins, J.J. 2012. First incidence of *Sinoxylon indicum* and *Sinoxylon sudanicum* (Coleoptera: Bostrichidae) in Mississippi. *Florida Entomologist* 95(3): 767-770.

Csurhes, S. 2016. Pest Plant Risk Assessment: Neem Tree *Azadirachta indica*. Biosecurity Queensland Department of Primary Industries and Fisheries, State of Queensland.

Cui, G., Li Y., Yi, X., Wang, J., Lin, P., Cui, L., Zhang, Q., Gao, L. and Zhong, G. 2023. Meliaceae genome provides insights into wood development and limonoids biosynthesis. *Plant Biotechnology Journal* 21: 574–590.

Dave, N., Iqbal, A., Patel, M., Kant, T, Yadav, V.K., Sahoo, D.K. and Patel, A. 2023. Deciphering the key pathway for triterpenoid biosynthesis in *Azadirachta indica* A. Juss.: a comprehensive review of omics studies in nature's pharmacy. *Frontiers in Plant Science* 14: 1256091. doi: 10.3389/fpls.2023.1256091

Handa, A.K., Sirohi, C., Arunachalam, A., Ramanan, S.S., Rajarajan, K., Krishna, A. and Kolse, R.H. 2022. Surge in neem mosquito bug incidence in India. *Current Science* 122(6): 651.

Krishnan, N.M., Jain, P., Gupta, S., Hariharan, A.K., Panda, B.B. 2016. An Improved Genome Assembly of *Azadirachta indica* A. Juss. *G3 (Bethesda)* 6(7): 1835-1840.

Liu Lan-Yu, Schonitzer K. and Yang Jeng-Tze, 2008. A review of the literature on the life history of Bostrichidae (Coleoptera). *Mitteilungen der Münchner Entomologischen Gesellschaft* 98: 91-97.

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

Mordue, A.J. and Blackwell, A. 1993. Azadirachtin: An update. *Journal of Insect Physiology* 39(11): 903-924.

Reddy, P.V.R., Chakravarthy, A.K., Sudhagar, S. and Kurian, R. 2014. A simple Technique to capture, contain and monitor the fresh-emerging beetles of tree borers. *Current Biotica* 8(2): 191-194.

Shekhawat, N.S., Phulwaria, M., Harish, Rai, M.K., Kataria, V., Shekhawat, S., Gupta, A.K., Rathore, N.S., Vyas, M., Rathore, N., Vibha, J.B., Choudhary, S.K., Patel, A.K., Lodha, D. and Modi, R. 2012. Bioresearches of fragile ecosystem/desert. *Proceedings of the National Academy of Sciences, India - Section B: Biological Sciences* 82(2): 319-334.

Printed in June 2024