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Incidence pattern of wood borer (*Sinoxylon anale* Lesne) on *Dalbergia sissoo* Roxb

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Abstract
The current shift in agroforestry practices from multispecies to monoculture has brought drastic changes in the tree based ecosystem and exposed these systems to greater risks of pest epidemics, as natural regulatory factors fail to operate in this system. *D. sissoo* is an important multipurpose tree species which yields timber, fodder, fuelwood and it is observed that the wood quality is mainly affected by wood borer (*S. anale*) in Bundelkhand region. Studies on incidence pattern of *S. anale* on the *D. sissoo* was carried out during 2016 at ICAR-CAFRI, Jhansi. The highest and lowest incidence was noticed on middle (56.00±11.31) and bottom (14.50±9.19) parts of the stem, respectively. The incidence was more on primary branches (17.46/branch) than secondary branches (7.26/branch). Uniform distribution of pest was noticed with less frequent bored holes in the bottom (8.97±3.35 cm distance), whereas more frequent holes were observed in middle and upper part of the tree (3.26± 2.31 and 2.03 ±1.45 cm distance, respectively).

Keywords: Bored holes, Branches, *Dalbergia sissoo, Sinoxylon anale*

Multipurpose trees and shrubs (MPTs) play a vital role in agroforestry systems and have a good potential in raising the ruminants'productivity by lessening the gap between demand and supply of fodders, since the deficit of feed resources being the main constraint in most parts of the world including India (Datt *et al.,* 2008). In semi-arid conditions of Bundelkhand region, sissoo grows naturally in the forest and farmlands, and it has been considered as a potential species to meet wood and feed demands (Rai *et al*., 2001). *Dalbergia sissoo* is one of the most useful timber species of India. Apart from this, young branches and foliage form an excellent fodder with a dry-matter content of 32.46% and crude protein of 2.7-24.1% (Orwa *et al*., 2009). Importance of this tree as medicinal, insecticidal, harbouring of honey bee, charcoal formation, green manuring and a means of nitrogen fixation have also been recognized in the recent past (Shah *et al*., 2010).

Biotic and abiotic constraints are involved in quality timber production of *D. sissoo*. Of the many biotic constraints, disease and insect pest infestation attained as major factors. Several diseases such as die back, root disease, foliage diseases, stem and branch canker, pod fungi have been found on plantation. There are about 125 species of insect pests known to attack *D. sissoo*, of which only 10 species have attained economic status as a potential pests (Rajendra, 2015). Insect pests, belonging to nine families of Lepidoptera, ten Coleoptera, five Hemiptera, one Orthoptera, and Diptera have been considered as pests of *D. sissoo*. Among them *Plecoptera reflexa* Guenee (Lepidoptera: Noctuidae) and *Apoderus sissoo* Marshal (Coleoptera: Curculionidae) are most common and destructive (Rajendra, 2015). It was found that grubs of Coleopteran beetles were most predominant in dead and drying trees in most of the areas. However, in certain case termites *Macrotermes gilvas* and *Odontotermes grandiceps* and bark eating caterpillars were also found associated with sissoo trees (Intari *et al.,* 1995; Sharma *et al.,* 2003). Recent years fig wax scale *Ceroplastes rusci* (Linn.) is an emerging pest of *D. sissoo* (Kumar, 2013), this pest has also been reported from India (Hamon and Mason, 2011). The scale insects feeds on tender parts of the plant and sucks cell sap and secretes honey dew hampers the photosynthesis process after sooty mould development, infested plant part loses its turgidity causing yellowing of plants (Al-Momany and Al-Antary, 2008).

In Bundelkhand region of Central India, mortality of few *D. sissoo* was observed during August to October, 2015. The characteristic symptoms were yellowing and death of leaves and branches from top as a result, the whole tree appeared yellow. In advance stages the leaves were shed rendering the branches bare, the affected trees showed signs of wilting and ultimately died within few months. The symptoms of the die back and subsequent mortality might be due to the fungus *Fusarium* sp. (Bakshi, 1995) and later attacked by a wood borer *Sinoxylon anale* Lesne. The attack of this insect appea-

-red to be secondary after the trees were weakened by the fungal attack. Therefore, *S. anale* is considered as one of the most destructive wood borers in India, attacking great variety of plants (Fisher, 1950; Bajpai, 2010). Apart from *D. sissoo* it is found to feed on *D. latifolia*, *Xylia dolabrifornis, Shorea robusta, Terminalia bellerica, Mallotus roxburghianus* (Lesne, 1906), *Bambusa* sp., *Elettaria cardamomum*, capsules and grains of *Dolichos uniflorus* and *D. lablab* (Beeson and Bhatia, 1937). Therefore, keeping in view the importance of *D. sissoo* and infestation of *S. anale* as one of the major pests, this study was undertaken to know the pattern and level of *S. anale* incidence on *D. sissoo* in Bundelkhand region.

The study was conducted at ICAR-Central Agroforestry Research Institute, Jhansi representing Bundelkhand region in Central India (24° 112 N altitude, 78° 172 E longitude and 271 m above MSL) during February to April, 2016. The *D. sissoo* plantation was established in the year 2011, with a spacing of 6 m X 5 m. A few dying trees were selected for this experiment. Infested material (Fig 1) was collected and brought to the laboratory, kept under rearing cages for adult emergence. Infested trees were divided into three equal parts (lower, middle, top) and number of *S. anale* bored holes present on the main stem were analysed. In each part, numbers of bored holes on primary and secondary branches were also counted. To know the spatial distribution pattern of the pest, distance was measured between the bored holes on the main stem, primary and secondary branches. The obtained data were analysed statistically for interpretation.

Fig 1. Infested tree, bore holes and larvae of the *S. Anale*

The bostrichid genus *Sinoxylon* Duftschmid contains 52 species, all of which are native to Asia, Africa, and Southern Europe (Borowski and Wegrzynowicz, 2007). *Sinoxylon* species utilize a wide variety of hosts, including numerous trees, shrubs, herbaceous plants (Filho *et al*., 2006). *S. anale* damage is typically caused by the boring of adults and larvae in the stems, branches, or twigs of dead, damaged, or stressed hosts (Nair, 2007). Infestation of *S. anale* was noticed 56-85cm above the ground level. Number of bored holes on the main stem revealed that the maximum infestation were noticed in middle part of the stem (56.00± 11.31) and the minimum infestation were noticed on bottom part of the stem (14.50±9.19) (Table 1). The highest number of bored holes were noticed on primary branches (17.46/branch; N= 28) than in secondary branches (7.26/ branch; N= 48). This beetle preferred to feed on the primary branches than the secondary branches. The highest number of bored holes was noticed on middle (20.85±8.22) and top (20.12±6.12) canopy primary branches than the bottom (6.16±1.94) canopy primary branches. This could be attributed to more availability of starch and sugar in the primary branches.

Table 1. Number of *S. anale* bored holes recorded in the main stem, primary and secondary branches of *D. Sissoo*

Tree height (m)	Main stem	Primary branches	Secondary branches
Bottom (0-2)	14.5±9.19	6.16±1.94	2.25±1.89
Middle (2-4)	56±11.31	20.85±8.22	1.34±0.49
Top (> 4)	26.5±12.02	20.12±6.12	2.44±0.83

Infestation was more on upper and middle part of the tree branches, comparatively less incidence was on bottom part of the tree branches (Table 1). The infestation might have started at the bottom portion of the main stem and gradually moved to the upper stem region. It was also observed that number of bored holes increased from lower portion to the middle and top portion of the tree. The corresponding increase could be due to increase in population and consumption rate. *S. anale* adults and larvae feed on the sap woody tissue of the host plants and derive nutrition by feeding on the starches and sugars in the plants tissue (Tomimura, 1993). These starches and soluble sugars are the most important energy sources of powder post beetle.

Uniform distribution of pest infestation was noticed (x> ó²) on the tree. In the bottom part of the tree, average spacing between bored holes was 8.97±3.35 cm followed by middle and top part of the tree (3.26± 2.31 cm and 2.03 ±1.45 cm, respectively) (Fig 2). That means

more distance between the holes was in the bottom part of the tree, whereas less distance between holes was in middle and upper part of the tree. This type of distribution in insects are noticed when there is severe intraspecific competition for resources. Uniform distributions are found in population in which the distance between neighbouring individuals is maximized (Banerjee, 1976). The need to maximize the space between individuals generally arises from competition for a resource.

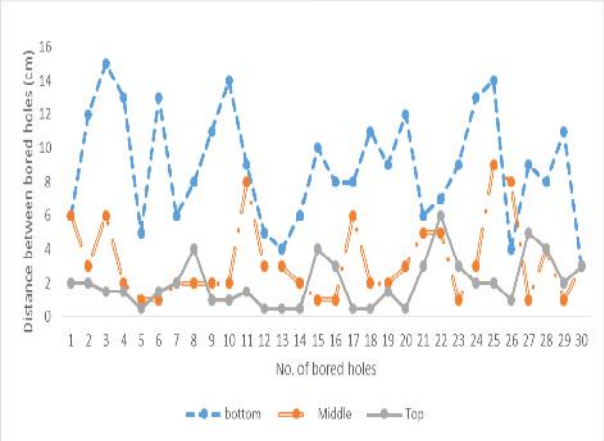

Fig 2. Pattern of *S. anale* infestation at different heights of the *D. sissoo*

D. sissoo is an important commercial agroforestry tree species having multipurpose uses. With advancement in technology most of our multispecies systems are converted into monoculture, increasing their susceptibility for pest infestation. In this study *D. sissoo* was found vulnerable to *S. anale*. Therefore, early detection of infestation, identification and development of pheromone monitoring traps and host plant resistance as part of an integrated pest management program will help in averting huge scale economic losses.

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