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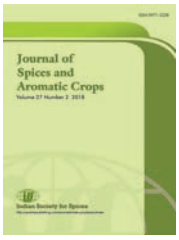

Post-flood outbreak of *Xylosandrus crassiusculus* and *Diuncus corpulentus* (Coleoptera: Curculionidae: Scolytinae: Xyleborini) on tree spices in Kerala

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Abstract

Massive outbreak of *Xylosandrus crassiusculus* and *Diuncus corpulentus* (Coleopera: Curculionidae: Scolytinae: Xyleborini) on clove (*Syzygium aromaticum*) and nutmeg (*Myristica fragrans*) is reported from Kerala, India. Infestation results in drying up of branches and death of trees. This is the first report of the ambrosia beetle genera *Xylosandrus* and *Diuncus* on clove and nutmeg.

Keywords: ambrosia beetles, clove, India, insects, new records, nutmeg, pests

Clove (*Syzygium aromaticum* (L.) Merr. & Perry) and nutmeg (*Myristica fragrans* Houtt.), both originated in the Molucas islands of the Malay Archipelago, are free of major insect pests in India. Devasahayam & Koya (1993), Kumar *et al.* (1994), and Veenakumari *et al.* (1994) provided information on the pests of tree spices in India.

Massive outbreak of two ambrosia beetles, *Xylosandrus crassiusculus* (Motschulsky) (Figs 1 to 3) and *Diuncus corpulentus* (Eggers) (Figs 4 to 6) (Coleoptera: Curculionidae: Scolytinae: Xyleborini), has been observed on clove and nutmeg, following incessant rains during July–August in northern Kerala. Farmers reported drying up of branches and death of trees (Fig. 7) in August 2018. A field visit to Chappanthottam in Kavilumpara Panchayath, Kozhikode District, one of the most severely affected localities, on 4th September revealed near total infestation on clove and nutmeg. Infestation was also observed on mahogany (*Swietenia macrophylla* King). Farmers reported the pest attack on neem (*Azadirachta indica* A. Juss.) and sapota (*Manilkara zapota* (L.) P. Royen), which could not be confirmed as the affected plants were already uprooted and destroyed.

The initial symptom of infestation was typical of ambrosia beetles – extrusion of wood powder in the form of dust or cream-colored threads from the bore-holes (Figs. 8 to 10). Infestation was

Figs. 1 – 3. *Xylosandrus crassiusculus* – female. (1) dorsal view, (2) lateral view, (3) elytral declivity

observed on the main stem and branches of the trees. Adults bore into the stem and construct galleries. All life stages could be observed within the galleries (Figs. 11 to 13). *Xylosandrus crassiusculus* construct radial, irregular galleries with in the sap wood (Figs. 11 & 12) and extrude wood powder and frass in the form of a single thread (Fig. 9), while the galleries of *D. corpulentus* are more or less vertical and irregular (Fig. 13) and extrude shapeless mass of wood powder through the bore holes (Fig. 10). Shedding of leaves, drying up of branches and death of trees (Fig. 7) were observed.

A second field visit to the same plantations was carried out on 9th December 2018. Detailed observations were carried out in a plantation of about four acres (N 11° 42' 01.2" E 075° 49' 32.6"; altitude 337 m above msl; owned by Mr Jose, Alappat, Chappanthottam, Calicut 673513) having 128 grown up clove plants and 15 nutmeg trees. During our first visit on 4th September, no tree completely free of symptoms of infestation was observed. The farmer had thoroughly drenched the stem twice with Bordeaux mixture and Fenvalerate 20 EC (Trade name - TATAfen), at a dose of 5 ml/ l. It was observed that following insecticide applications, majority of the plants recovered and started putting forth new flush. However, eighteen clove trees out of 128 (14%) were completely dead or were on the verge of death. Trees those recovered from the pest infestation, put forth new flushes, instead of flowers, thus adding to the financial loss greatly. In nearby plantations, where no control measure was taken up, the extent of damage was much higher. In an adjoining house hold, all 4 grown up clove trees were observed dead. Nutmeg trees suffered less damage as all except one (6.6%) recovered. It was also observed

Figs 4 – 6. *Diuncus corpulentus* – female. (4) dorsal view, (5) lateral view, (6) elytral declivity

that trees in the southern slope of the plantation, those receive more sunshine, suffered less compared to those on the northern slope.

Species of *Xylosandrus* were revised by Dole & Cognato (2010). *Xylosandrus crassiusculus*, commonly called granulate ambrosia beetle or Asian ambrosia beetle, is a noxious invasive pest distributed throughout the world, and has a very wide host range (Dole & Cognato 2010). *Diuncus corpulentus*, known from north-east India, Andaman islands, Nepal, Tibet and China, can be differentiated from *X. crassiusculus* by the light brown pronotum and dark brown elytra (Fig. 4) (pronotum and elytra uniformly red brown in *X. crassiusculus* – Fig. 1) and the posterior elytral declivity with short adpressed setae and without granules (Fig. 6) (posterior elytral declivity in *X. crassiusculus* is granulose and profusely set with long erect setae – Fig. 3). *Xylosandrus crassiusculus* (2.20 – 2.50 mm) is smaller than *D. corpulentus* (2.90 – 3.05 mm). *Diuncus corpulentus* was found to be the numerically dominant species. Adults of *D. corpulentus* and *X. crassiusculus* were collected in the ratio 2.3 : 1. Infestation was mixed and galleries of both the species were observed adjacent to each other. Species of *Diuncus* Hulcr & Cognato are secondary invaders those locate and exploit fungus "gardens" of other ambrosia beetles (Hulcr & Cognato 2009). Hulcr & Cognato (2009) reported parasitic exploitation of galleries of *Hydrodemius globus* (Blanford) by *D. corpulentus*. *Diuncus corpulentus* was reported on *Albizzia lebbek* (L.) Wild., *Artocarpus chaplasha* Roxb. *Canarium euphyllum* Kurz, *Sterculia villosa*

Figs 7 – 13. Symptoms and life stages of *Xylosandrus crassiusculus* & *Diuncus corpulentus*. (7) dead nutmeg tree, (8) stem with frass extrusion, (9) frass extrusion by *X. crassiusculus*, (10) frass extrusion by *Diuncus corpulentus*, (11) *X. crassiusculus* colony within gallery, (12) cross section of radial gallery of *X. crassiusculus*, (13) colony of *Diuncus corpulentus* inside vertical gallery.

Roxb. *ex* DC. and *Vatica lanceaefolia* Blume by Beeson (1930). Maiti & Saha (2004) added *Acrocarpus fraxinifolius* Arn. and *Cryptocarya wightiana* Thwaites amongst the hosts of *D. corpulentus*. However, they did not provide any information on the primary borers associated with *D. corpulentus*. *Xylosandrus crassiusculus* must be the primary invader that initiates infestation.

Kerala received incessant rains resulting in unprecedented floods and landslides during July – August in 2018. As per the data released by the India Meteorological Department, there has been an excess of 23% rainfall from 1stJune to 30th September 2018. None of the plantations here mentioned were directly affected by submergence or water logging as this is a hilly area and the plantations are on hill slopes. It may be safely assumed that the current outbreak is due to the unique climatic conditions resulting from continuous rainfall and subsequent dearth of sunlight. Heavy rains also enhance soil acidity by leaching down alkaline elements (Helyar *et al*. 1990), affecting the overall health of plants. Managing soil pH and nutrition may play a crucial role in the control of ambrosia beetles. Incidence of different species of ambrosia beetles was also observed on rubber and coconut respectively, in the nearby Kannur and Kasaragod districts in northern Kerala (Prathapan & Hiremath, unpublished data). Ranger *et al*. (2015), who studied the factors driving the shift of *X. crassiusculus* and *X. germanus* (Blanford) from dying/dead hosts to living and healthy ones, demonstrated that beetles attacked flood-intolerant tree species over more tolerant ones within three days of initiating flood stress. The stressed plants emit ethanol which acts as an attractant for scolytid aggregation.

Ranger *et al*. (2016) reviewed information on the biology, ecology and management of *X. crassiusculus.* According to them, no insecticide treatment provides total protection and no curative treatment exists for ambrosia beetle infestation once they have tunneled into the wood. Trunk application of insecticides at fortnightly intervals is recommended in ornamental plant nurseries in the United States. Pyrethroids such as cypermethrin and bifenthrin provided the best results while acephate, cyfluthrin, endosulfan, fenpropathrin, imidacloprid and thiamethoxam were ineffective as sprays.

No Scolytinae is known to infest nutmeg or clove in India. Scolytids reported on nutmeg elsewhere include *Cocotrypes dactyliperda* (Fabricius) and *Microperus diversicolor* (Eggers) (*Thamnurgides myristicae*) in Western Samoa, and *Hyledius nitidicollis* Wood & Bright (*Phloeosinus asper*), *Hyledius cribratus* (Blandford) (*Phloeosinus cribratus*), *Microperus diversicolor* and *Euwallacea fornicatus* (Eichhoff) (*Xyleborus fornicatus*) in Malaysia (Reddy 1977). This is the first report of the ambrosia beetle genera *Xylosandrus* and *Diuncus* on clove and nutmeg. Association of *D. corpulentus* with *X. crassiusculus* is also recorded for the first time. This report extends the range of distribution of *D. corpulentus* to south India.

Voucher specimens of *X. crassiusculus* (Accession nos NBAIR/Col/Scol-1/2018 to NBAIR/Col/Scol-5/2018) and *D. corpulentus* (Accession nos NBAIR/Col/Scol-6/2018 to NBAIR/Col/Scol-10/2018) are deposited in the Travancore Insect Collection, Kerala Agricultural University, Vellayani and the ICAR-National Bureau of Agricultural Insect Resources (ICAR-NBAIR), Bangalore.

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