OCCURRENCE OF AMBROSIA BEETLES, *XYLOSANDRUS COMPACTUS* (Eichh) AND *XYLOSANDRUS CRASSIUSCULUS* (Motschulsky) ON AVOCADO IN TAMIL NADU INDIA:PEST RISK ASSESSMENT

Regupathy, A[1]., and R. Ayyasamy[2]

[1]Plant Protection Consultant

Formerly Head of the Department of Entomology, Dean, Agricultural College & Research Institute, Madurai campus,Tamil Nadu Agricultural University, Coimbatore-641003
Email: regupathya@yahoo.com

[2]Department of Entomology, Faculty of Agriculture, Annamalai University,

Annamali Nagar-608002, Tamil Nadu, India

Email:ayyasamy.regu@gmail.com

Avocado was introduced in India from Sri Lanka in the early part of the twentieth century. In a very limited scale and in a scattered way it is grown in tropical or semitropical areas experiencing some rainfall in summer, and in humid, subtropical summer rainfall areas of Tamil Nadu, Kerala, Maharashtra, Karnataka in the south-central India and in the eastern Himalayan state of Sikkim (Ghosh, 2000). In India, avocado is not a commercial fruit crop. However avocado in Tamil Nadu was grown in a limited scale more as shade crop in coffee plantation in Lower Palani Hills which are a mountain range in Tamil Nadu state of South India and eastward extension of the Western Ghats ranges made up of hills 1,000-1,500 m (3,281-4,921 ft) high.

One of the important constraints in avocado production development in Tamil Nadu is the consumer preference. Earlier in the domestic market, the avocado was not liked much by the common people when compared to many other tropical fruits like banana, pomegranate, guava, chickoo and grapes available through out the year and more preferred and more tastier choice fruits like mango and jack by the bulk consumers than avocado. As the literacy rate is going up and due to increasing health consciousness among the educated population and the high nutritive value of avocado, the avocado is gaining market in metropolitan cities like Chennai and Bangalore. At present the planters in Lower Palani Hills are giving more attention to the avocado due to high price offered in selected markets. Avocado hitherto considered as shade crop is now cultivated as intercrop with coffee, orange and perennial hill banana (Fig.1.) The present estimated tree population is about 67,800 (Personal communication from S. Mohanasundaram) spread over in Thandikui (15,000), Kudalankadu (10,000), Nadupatty (7,000), Oothu (15,000), K.C.Patty (20,000), Periyur- Kavuchikombu (3,00),Pannaikadu (5,00) @10-15 trees as shade crop and 25-30 trees as intetrcrop /acre. This may go up as Horticultural Research Station (Tamil Nadu Agricultural University)situated in Lower Palani Hills, is encouraging the planters to take up avocado cultivation by producing and supplying grafts/seedlings on demand.

Avocado still recently was rarely affected by pests though sporadic occurrence of minor pests like ants, *Solenopsis geminata* (F) (Formicidae) causing nuisance to the workers, tea mosquito bug, *Helopeltis* spp.(Miridae) attacking shoots, red banded thrips, *Solenothrips rubricinctus* (Giard) (Thripidae) infesting leaves, nipa mealybug , *Nippacoccus nipae* (Mask.), striped mealy bug, *Ferrisia virgata* (Ckll.) (Pseudococcidae) infesting stem, coconut scale *Aspidiotus destructor* Sign. and trilobite scale *Pseudaonidia trilobitiformis* (Green) (Diaspididae) on fruits and twigs (Hill, 2008) had been reported in India. As avocado was grown as shade tree without intensive cultivation, most of the injurious insects

and mites on avocados are kept at low levels in Lower Palani Hills by parasitoids or predators as had been observed by elsewhere (McMurtry ,1961).

Recently wilting of avocado trees was reported by the planters. Based on the information of serious loss caused by the death of trees from one of the planters in Thandikudi, a one time roving survey was undertaken in 1-5 fields in each of the above seven locations in Lower Palani Hills. Observations were made on the total number of trees and trees affected by the beetles showing bore holes(Fig.2) and wilting of branches in each holding. The shot hole borer attacked apparently healthy plants resulting in wilting of the branches. When the population is more, the wilting of the tree was observed (Fig.1). The extent of damage could be recognized from drying of the branches and trees. The specimens collected from the plantation were sent to, Institute for Forest Genetics and Tree Breeding, Coimbatore and Indian Agricultural Research Institute, New Delhi for identification and confirmation.

The shot hole borer causing wilting of the trees was identified as *Xylosandrus compactus* (Eichh) (Coleoptera:Scolytidae) . The extent of damage was 13.3,10.0, 14.3,38.0,0,10.0, 49.0,12.5 per cent in Thandikui, Kudalankadu, Nadupatty, Oothu, K.C.Patty, Periyur-Kavuchikombu, Pannaikadu locations respectively. Occurrence of black twig borer , *X. compactus* (Eichh) , shot hole borer, *Xyleborus morstatti Hagdn.* and tea shot hole borer, *Xyleborus formicatus* Eichh (Scolytidae) (Hill, 2008) had been reported on avocado in India. Though *X. compactus* causes economic damage on robusta coffee (Regupathy and Ayyasamy,2013) it had not been observed so far in a pest form causing economic damage on avocado in Tamil Nadu.The presence of the wilting terminals significantly reduced the tree growth affecting fruit yield as well. The terminal wilting is caused by ambrosia fungus, *Fusarium solani* (Ngoan et.al.,1976; Hara and Beardsley, 1979). Ambrosia fungus is deposited by the adults and fed on the larvae in the galleries. In coffee,it attacks branches and suckers of robusta coffee and is managed by pruning the branche s and suckers (Regupathy and Ayyasamy,2013).

Sporadic occurrence of granulate ambrosia beetle (once referred to as the 'Asian' ambrosia beetle), *Xylosandrus crassiusculus* (Motschulsky) , was observed in few holdings; the extent being less than 1 per cent. The attack of this beetle on various host plants had been reported under synonyms like *Phloeotrogus crassiusculus* Motschulsky,*Xyleborus crassiusculus* (Motschulsky) ,*Xyleborus semiopacus* Eichhoff,*Xyleborus semigranosus* Blandford, *Dryocoetes bengalensis* Stebbing ,*Xyleborus mascarenus* Hagedorn, *Xyleborus okoumeensis* Schedl , snd*Xyleborus declivigranulatus* Schedl (Atkinson et.al., 2002). *X.crassiusculus* (Syn. *Xyleborus semigranosus*) had been reported to affect common trees like mango, *Eugenia jambolana, Dalbergia, Cinnamoum camphor.Shorea* in India(Beeson, 1941) preferring moist fresh wood. It was observed more abundant in shaded places. The frass is ejected from the entrance hole in coherent cylinders which may reach a length of 3.5 cm before breaking (Fig3.). Attacks of this beetle on living plants usually are near ground level on saplings or at bark wounds on larger trees (Browne 1961; Schedl 1962). Females remain with their brood until maturity.

Management options for *X. compactus* on avocado available are pruning and destruction of beetle-infested plant material, maintaining healthy trees by applying good tree care practices to promote tree vigour and health to aid in recovery from beetle damage encouraging natural enemies , the eulophid parasites (FAO, 2002) and application of insecticide chlorpyrifos causing 83% -100% mortality (Mangold *et al*., 1977; FAO, 2002)mortality of all stages of this black twig borer .Preventive application of synthetic pyrethroids (Hudson and Mizell, 1999; Mizell and Ridley, 2004) on trunks and branches during peak adult period seems to be the best option of deterring attacks by the ambrosia beetle. Pyrethroids have been found to provide control of attacking adults of *X.crassiusculus* if applied prior to the closing of the galleries with frass. Once the beetles are in the tre and have frass packed in the entry holes they are isolated from the outside (Atkinson et.al, 2002). If infestations occur, affected plants should be removed and burned and trunks of remaining plants should be treated with an insecticide and kept under observation. Any obvious conditions causing stress to trees should be corrected. Traps baited with

chemical attractants (Atkinson et.al, 2002; Burbano et.al, 2012) like ethyl alcohol used to capture ambrosia beetles for purposes of monitoring, studying population dynamics. Predicting outbreaks and mass trapping to could be used for timing application of synthetic pyrethroids.

Any major intervention like extension of area and intensive cultivation is likely to cause pest build up. Considering the extent of damage and coffee being alternative host and limited options of available for the management of this pest like, less biocontrol agents, reduced target contact of efficacy of insecticides and less scope for behavioural manipulations in intercropping small scale farming system, *X. compactus* seems to pose high risk on avocado at present.

Acknowledgement: The authors are grateful to Dr V.V. Ramamurthy, Principal Scientist ,Division of Entomolgy,Indian Agricultural Research Institute, New Delhi for identification of *Xylosandrus compactus*.

Literature Cited

Atkinson T.H., Foltz, J. L., Wilkinson, R. C. and R. F. Mizell, 2002. Granulate ambrosia beetle,scientific name: *Xylosandrus crassiusculus* (Motschulsky) (Insecta: Coleoptera: Curculionidae: Scolytinae University of Florida.Originally published as DPI Entomology Circular 310.in 2000. Publication Number: EENY-131.

Beeson, C.F.C. 1941. *The Ecology and Control of the Forest Insects of India and the Neighbouring Countries*. Forest Research Institute, Dehra Dun, India.1007p.

Burbano, E.G., Wright, M.G., Gillette ,N.E., Mori S, Dudley, N., Jones T. and Kaufmann, M. 2012.Efficacy of traps, lures, and repellents for Xylosandrus compactus (Coleoptera: Curculionidae) and other ambrosia beetles on Coffea arabica plantations and Acacia koa nurseries in Hawaii. Environ. Entomol. 2012 Feb;41(1):133-40. http://www.ncbi.nlm.nih.gov/pubmed/22525068

Browne F.G. 1961. The biology of Malayan Scolytidae and Platypodidae. Malayan Forest Records 22: 1-255.

FAO.Global Invasive Species Data base.Preventative measures: ***Xylosandrus compactus*** In 2002, United Nation FAO's (Food and Agriculture Organization) Interim Commission on Phytosanitary Measures imposed a global standard for treating wood packaging International Standard for Phytosanitary Measures No. 15 to stop the spread of invasives.
http://www.issg.org/database/species/management_info.asp?si=175&fr=1&sts=sss&lang=EN

Ghosh, S.P. 2000 Avocado Production in India..In: Avocado production in Asia and the Pacific.. FAO Corporate Document Repository.rap Publication Regional Office for Asia and the Pacific. http://www.fao.org/docrep/ 003/x6902e/x6902e06.htm

Hara A.H. and J.W. Jr. Beardsley. 1979. Biology of the black twig Borer, *Xylosandrus compactus* (Eichhoff), in Hawaii. *Proceedingsof the Hawaiian Entomological Society*, **13**(1): 55-70
Hill D. S. 1983. Agricultural insect pests of the tropics and their control. Second edition. Cambridge University Press, Cambridge, UK. xii + 746 pp.

Hudson W and Mizell RF. 1999. Management of Asian ambrosia beetle, *Xylosandrus crassiusculus*, in nurseries. Proceedings of the Southern Nursery Growers Association 44:198-201.

Mangold J.R., Wilkinson R.C. and D.E. Short .1977. Chlorpyrifos sprays for control of *Xylosandrus compactus* in flowering dogwood. J. Econ. Entomol 70: 789-790.

McMurtry J. A. 1961. Current research on biological control of avocado insect and mite pests. California Avocado Society 1961 Yearbook 45: 104-106 .
http://www.avocadosource.com/CAS_Yearbooks/CAS_45_1961/CAS_1961_PG_104-106.pdf

Mizell R. and T.C.Ridley. 2004.Evaluation of insecticides to control the ambrosia beetle,Xylosandrus crassiusculus,in nurseries.Proceedings of the Southern Nursery Associ Research Conference.49:152-155.

Ngoan N.D. Wilkinson R.C., Short D.E., Moses C.S.and J.R. Mangold. 1976. Biology of an introduced ambrosia beetle, *Xylosandrus compactus*, in Florida. Ann.Entomol. Soc. America 69: 872-876.
Regupathy, A. and R.Ayyasamy. 2013. V Edition. *A Guide on Crop Pests*, Namrutha , 280p. (1989 I Edn;1994 II Edn, 1997 III Edn., 2003 IV Edn.). Namrutha Publications, Chennai 600116.

Schedl K.E. 1962. Scolytidae und Platypodidae Afrikas. II. Rev. Ent. Mozambique 5: 1-594.

Fig.1

Fig.2a

Fig2.b.

Fig3.a

Fig3.b

Fig. 1. Wilting of avocado plants cultivated as intercrop with coffee and oranges. Fig.2.a,b. Entrance holes caused by *X. compactus* on avocado branches. Fig.3.a,b. Frass ejected by *X.crassiusculus* from the entrance hole in coherent cylinders.