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First record and biology of coffee bean weevil, *Araecerus fasciculatus* De Geer, on pesticide plant, *Melia azedarach* L. from Iran

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Abstract

Araecerus fasciculatus was recorded for the first time in Iran on the seeds of medicinal and pesticide plant, *Melia azedarach* L. About 25% of the mature seeds were found infected by this pest. Biological studies carried out on the collected specimens during 2012 – 2013 showed that females lay eggs on the immature, mature as well as dried harvested seeds. Larval nutrition, development and pupation occurred within the seeds. All motile stages of the pest developed throughout the year in dried seeds. Adult male and female emerged through chewing of exit holes of the infected seeds. Multiple and overlapping generations of larvae, pupae, and adults were also visible in the infected seeds. The pest completed its life cycle within 43 day under laboratory conditions.

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Introduction

Ever since the successful documentation of strong pesticidal activities of neem plant in the 20th century in India, members of the family Meliaceae are being intensely prospected for their pesticidal efficacy (Singh and Sitaramiah, 1967; Shmutter, 1995; Gran and Ahmad, 1998; Biswas *et al.,* 2002). Among other phyto constituents, azadirchtin has been found to be most common active pesticidal ingredient in such plants (Chitwood, 2002). *Melia azedarach* tree is one such as nematodes; insects, fungi, bacteria, mites etc have been thoroughly investigated (Gran and Ahmad, 1988; Konstantopoulou *et al.,* 1994; Nardo *et al.,* 1997; Alkhail, 2005; Coria *et al.,* 2008; Khan *et al.,* 2011; Ardakani, 2012; Neycee *et al.,* 2012). *M. azedarach,* which is also known as bead tree, chinaberry, Paradise tree, Persian lilac or white cedar is an indigenous tree of Himalayan region that grows widely in northern Iran (Mozaffarian, 1998; Taghavi and Ghasemi, 2010). The plant is known to possess a high level of resistance to insect pests and has excellent adaptability to a wide range of soil and agro-climate (Ardakani, 2012; Neycee *et al.,* 2012). During an investigation on the evaluation of nematicidal action of *M. azedarach* on root knot nematode, *Meloidogyne incognita* in Iran, we observed for the first time the presence of unknown pest in the seeds of this tree.

Present investigation was done in order to identify the pest and its behavior. Based on the our results, The pest was known as coffee bean weevil (*Araecerus fasciculatus* De Geer) which was feeding in the seeds of this tree (Fig 1 A-D). The coffee bean weevil of the family Anthribidae is a world-wide serious insect pest of cocoa and coffee (Valentine, 2005). It is originally an Indo-Malayan species (Bousquet, 1990), Which is now well represented in tropical, sub-tropical regions including the central and southern America, Asia, tropical Pacific and Australia (Mphuru, 1974; Chitwood, 2002).

Coffee, cocoa, yains, maize, groundnut, Brazil nut, nutmeg, ginger, citrus and sweet potato plants are the most preferred and widely reported hosts of *A. fasciculatus* (Mphuru, 1974; Lin, 1976; Childers, 1982; Rint and Rejesus, 1988; Valentine, 2005), but it was not reported as *M. azedarach* pest which is known as pesticide plant. Therefore, necessary care should be exercise to find the life cycle and behavior of *A. fasciculatus* as it operates in the infected immature, mature and dried harvested seeds of *M. azedarach* under natural as well as laboratory condition.

Materials and methods

Seed sampling and insect rearing

Immature, matured and dried seeds of *M. azedarach* were collected during summer and autumn seasons in 2012 and 2013 from Sari Mazandaran province of northern Iran. Percentage of seeds showing coffee bean weevil infection was recorded at each sampling time. The seed samples were brought to the Department of plant protection of Agricultural and Natural Resources Research centre at Yasouj, Iran. The seeds were stored in insect growth vessels maintained at 27°C and 60% humidity under normal day light. The seeds were examined daily for the emergence of the insects. The insects that appeared were stored in 75% ethanol until sent for identification. Data pertaining to insect life cycle observations were recorded under both natural and laboratory conditions.

Pest identification

Adult beetles were examined using a binocular microscope (Zeiss Stemi SV11). Male genitalia were dissected, macerated and cleared in concentrated lactic acid and mounted on the same card with the specimen. Pictures of the beetles were taken with a digital camera (Cannon, IXUS 3.2) and processed by Photoshop CS5 software. Identification of the insect was confirmed by Dr. P. Baňař of Moravian Museum, Brno, Czech Republic and Dr. M. Trýzna of Czech University of Life Sciences, Prague, Czech Republic.

Results and discussion

Araecerus fasciculatus De Geer is recorded for first time from the seeds of *M. azedarach* seeds in Iran. Based as its general features, *A. fasciculatus* can

easily be confused with other species of bruchids found as pest of stored products but presence of an antennal club, the entire eye and the elytra without distinct striation can distinguish it from related bruchid insects (Bright, 1993). Body length of the adult beetles has been reported to be about 3–5 mm (El-sayed, 1935; Bright, 1993; Robinson, 2005). Observations made in the present study matched with this dimension range (4mm; Fig 1E).

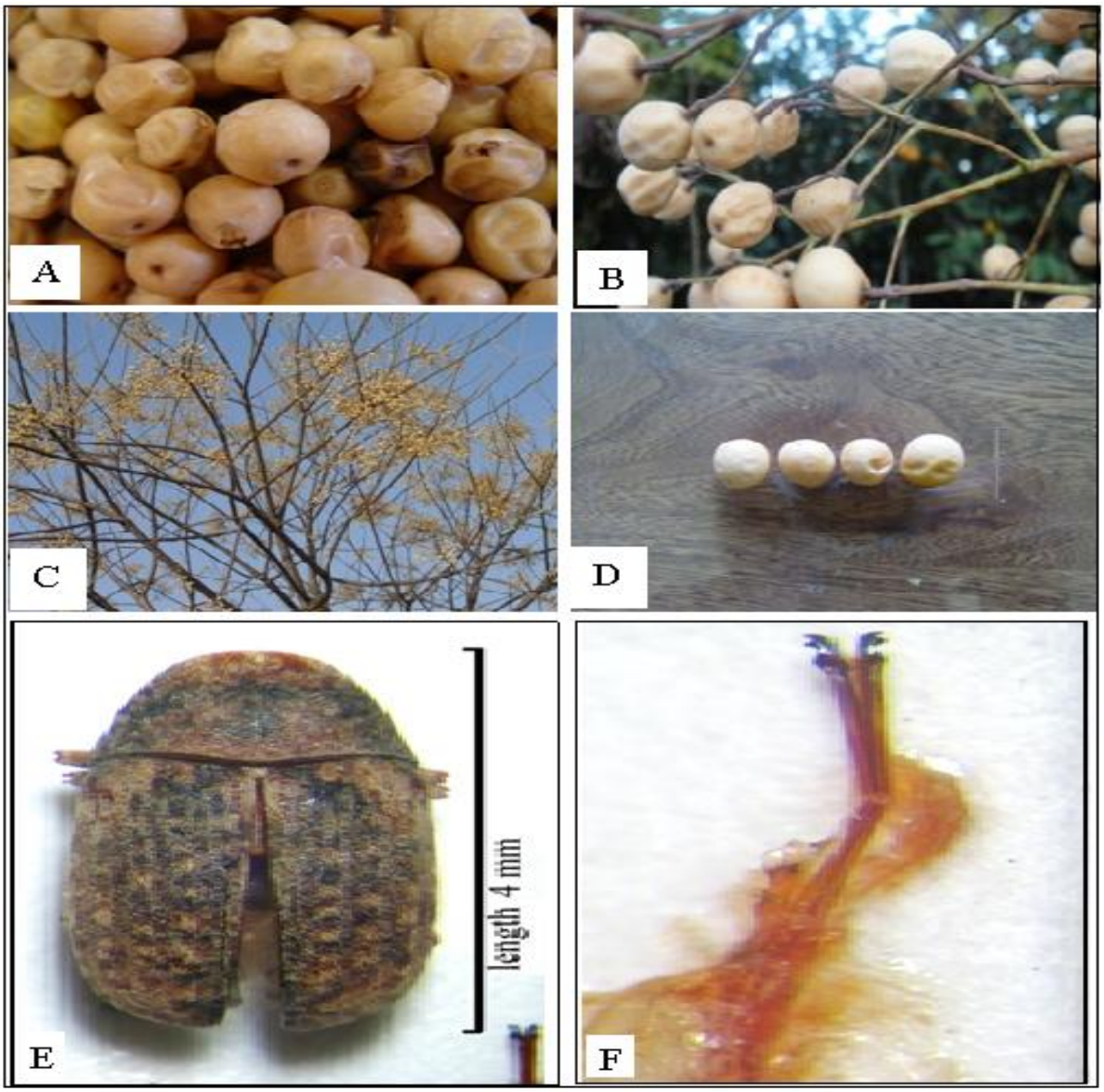

Fig. 1. (A-F): Seeds of *M. azedarach* infected with *A. fasciculatus* (A, B); infected seeds of *M. azedarach* remaining on the tree during winter (C); healthy seeds of *M. azedarach* (D); adult/habitus of *A. fasciculatus* (E); Male external genitalia of the pest (F).

Sexual dimorphism was seen between males and females. Males had the last exposed tergum vertical and therefore distinct from females that had tergum inclined and distinct. Field and laboratory observations also indicated that egg laying frequency in the immature and mature seeds present on the plant were comparable with that in harvested and dried seeds. Normally, the clusters of dried seeds remained on the trees after defoliation until next spring (Fig 1C). The seed damage was primarily caused by the larvae. The larvae fed, developed and pupated within the seeds. Adults bored the circular holes and emerged from the seeds. Except seeds no other plant part was found to be attacked by the pest.

All motile stages of the insect fed and developed throughout the year in the dried seeds. Our results also showed that multiple and overlapping generations of the insect with larvae, pupae, and adults were present in the infected seeds. In earlier studies on this pest six overlapping generations per year were recorded in China (Lin, 1976; Childers, 1982). However in another study only 3-4 generations in a year and 5 generations in a special year were observed (Li and Li, 2010). These workers have reported that numbers of the insect generations was dependent on variation in whether condition during the year. We have also observed that the over-wintering of *A. fasciculatus* was depended on its larvae. In the natural condition, the adults were not visible during winter conditions. Life cycle of the *A. fasciculatus* in our experiments completed after 43 day under the lab condition. It can be concluded from the results of this study that through coffee, cocoa, yains, maize, groundnut, Brazil nut, nutmeg, ginger, citrus and sweet potato plants are the most preferred and widely reported hosts of *A. fasciculatus* (Mphuru, 1974; Lin, 1976; Childers, 1982; Rint and Rejesus, 1988; Valentine, 2005), but the pest is capable of attacking the bitter seeds of *M. azedarach* in the absence of its favorite hosts in north Iran. Therefore, necessary care should be exercise in promoting extensive cultivation of *M. azedarach* as a pesticidal crop in the tropical countries to control the spread of this devastating insect pest.

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