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Association of Insect Pests with Neem, *Azadiracta indica* with Special Reference to Biology of Ash Weevils, *Myllocerus* sp in Jaffna, Sri Lanka

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Abstract: In spite of remarkable spectrum of activity of neem, *Azadirachta indica* (Family: Meliaceae) against pests, does the tree itself not immune to them. Many insects such as ash weevils, tortricid moth, peacock moth, scale and thrips were found associated with this tree in Sri Lanka. The biology of ash weevils, *Myllocerus* sp., was studied as heavy defoliators. Four species of *Myllocerus* such as *M.viridis*, *M.discolor, M.subfaciatus* and *M.maculosus* were found damaging the leaves. Adults of *Myllocerus* sp were small and had a dense covering of greyish to green with black cuticular marks. Female weevils laid eggs in clusters of 35.16±7.13 on muslin cloth covered the rearing chamber. Fecundity of weevil was 237.5±30.4 eggs. The mean incubation period of egg was 4.57±0.53 days at 28.9±1°C. The percent hatchability of egg was 68.12±11.15 at 28.9±1°C. The neonate grubs were small, creamy white with brown head, but just prior to pupal formation they enlarged in size. They burrowed through the soil and fed on the rootlets of *Vernonia cinerea*. The mean grub period was 50.6±1.51 days at 29.1±1°C. Pupation was observed in an earthen brown coloured puparium. Mean pupal period was 7.83±0.75 days at 29.1±1°C. *V. cinerea* is the highly preferred weed hosts of *Myllocerus* sp. The dicot weed was served an identical breeding site there by facilitating the survival and development of weevils through out the year. Because the leaves of *V. cinerea* were fed by adult weevils whilst grubs fed on its rootlets.

Kew words: Neem · *Azadirachta indica* · Ash weevil · *Myllocerus* sp · Pests

INTRODUCTION

Neem, *Azadirachta indica*, is a multipurpose tree native to the Indian subcontinent and has been widely planted through out the tropical and subtropical regions. It is adapted favorably to severe drought, poor, shallow and even saline soil [1]. In our Island, neem is planted in all towns and villages and is exploited as a source of shade, firewood and medicinal purpose. The pesticidal activity of neem span a wide spectrum having repellent, antifeedant, insect growth regulatory, anti-ovipositional and minimizing the fecundity of insects [2]. Nowadays many insect pest species are associated with neem tree. One of the major insect pests of neem is ash weevil, *Myllocerus* sp, which is capable of causing severe damage to the foliage of the tree.

In Sri Lanka, serious pests have not been reported yet. However, relatively few are known to cause severe damage [3]. The grub also burrows through the soil feeding on the roots of host plant [4]. Apparently several insecticides are effective against adult weevils. However, the chemical treatment may be of little or no economic value because of the prohibitive expense and the limited period of vulnerability.

Keeping in view of these severe foliage infestations, this research was aimed with the following objectives to

- Report the pests attacking on neem in Jaffna
- Study the biology of *Myllocerus* sp

MATERIALS AND METHODS

The following experiments were carried out during the research period.

Report on the Pests Attacking on Neem in Jaffna District: The damage on the neem trees created by different kind of pests was observed at several locations of Jaffna District. These pests were also identified and their damaging stage, part of tree damaged and pattern of damage were also observed.

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Biology of *Myllocerus* Species

Eggs of *Myllocerus* Species: Neonate adult weevils of *Myllocerus* sp were released into a rearing cage. Soon after mating females were separated and kept in individual cages to facilitate egg laying. The color and shape of eggs were observed with stereomicroscope and size of eggs was measured using a calibrated ocular micrometer. Soil was placed in a cage of which leaves and stem were also added to find out the site of egg laying. Incubation period was estimated by transferring the eggs immediately after laying in to an incubation cage. Hatchability of eggs was also determined.

Grubs of Ash Weevil: A layer of sterile soil wetted with distilled water was kept in the rearing chamber. Three or four grubs were released in to a cage and allowed to feed on *Vernonia cinerea*. The grubs were also observed to find out the morphological features with the help of stereomicroscope. With the aid of calibrated ocular micrometer head capsule width and body length of grubs were measured. The grubs were released into cages with fresh leaves, stem and roots of its host Plants to determine the feeding site.

Pupae of *Myllocerus* Species: With the aid of stereomicroscope morphological characters of pupae were identified. With that the length of pupae was determined by using a calibrated ocular micrometer Grubs were released in to the cages with sterile moist soil and roots of *V.cinerea* to find out the site of pupation. It was observed daily to find out the pupal period of ash weevil until the adults emerged out.

Adults of *Myllocerus* Species: The morphometric measurements of adult weevils were also taken by using a calibrated ocular micrometer. Sex ratio was also determined by counting the number of males and females from field collected population. The female weevils were separated and transferred in to cages soon after the mating to determine the fecundity of this weevil.

The courtship behavior of adult weevils was studied by facilitating the mating between newly emerged male and female weevils. Mating pair was separated and kept in individual cages to study the courtship behaviour and to determine the copulation period. This was replicated in 15 pairs.

RESULTS AND DISCUSSION

Report the Pests Attacking on Neem in Jaffna District: In Sri Lanka serious pest have not been reported on neem [3]. But the damage on neem trees created by various kinds of pests was observed. Following pest species were identified as pests of neem tree in Jaffna (Table 1).

***Myllocerus* Species:** Among the insect pests of neem, ash weevil, *Myllocerus* species were the heaviest coleopteran defoliators that inflicted severe damage on leaves of neem trees in Jaffna. Four species of *Myllocerus* such as *M.viridis*, *M.discolor, M.subfaciatus* and *M.maculosus* were found damaging the leaves. *M.viridis* was found in significant numbers compared to other species.

Loboschiza Koenigiana: The tortricid moth, *Loboschiza koenigiana* (Lepidoptera: Tortricidae) was one of the important defoliator of neem. It caused considerable damage to seedlings and young plants by boring in to the terminals. Caterpillars of this species rolled the leaves of their host, joining it together with silk and lived and pupated with in this leafy shelter. The caterpillars in general were small with soft smooth skins and fine sparse hairs. They often wriggled backward when disturbed, trying to withdraw in to a narrow gap in a surface. The caterpillar often dropped down from the tree using its silken thread.

The adult moth had yellow fore wings, each with a broad brown margin and were covered in irregular bright orange line and spots. The female moth laid eggs on the tender shoots. On hatching, the young larvae bored in to tender shoots and fed. Then mined and fed in rolled leaves or in between the super imposed leaves, spun with silk. Total lifespan of this species was 10-12 days.

Table 1: List of insect pests of neem in Jaffna

Common name	Entomological name	Family	Order	Damaging stage
Ash weevil	*Myllocerus* sp	Curculionidae	Coleoptera	Adult
Tortricid moth	*Loboschiza koenigiana*	Tortricidae	Lepidoptera	Larvae
Peacock moth	*Macaria notata*	Geometridae	Lepidoptera	Larvae
Scale	*Aonidiella orientalis*	Diaspididae	Homoptera	Adult

***Macaria notata*:** Peacock moth, *Macaria notata* was also one of the important defoliator of neem. On hatching, the young larva was light green color as the later instar was brown color. This looper cut and fed the whole leaves from margin except the midrib. Pupation occurred at 6-7 days of hatching with in the pupal case. Pupae were obtect and brown in color. After 12-14 days of pupation adult was emerged. This moth had white colored fore wings, each with a black wavy lines and large in size.

***Aonidiella orientalis*:** Normally scale insect, *Aonidiella orientalis* cause much damage in East Africa [5]. But in Jaffna scale insect was not yet harmful in neem trees. It formed small colonies consisting of adults on upper surface of leaflets. Due to the feeding activity of insects, the attacked parts or the leaflets turned yellowish.

***Scritothrips* Species:** Thrips was found on the apical growing shoots of neem and then these shoots developed callus structures due to excessive gum exudation and thrips moved fastly on these gum exudates. As a result of which trees exhibited a forked appearance.

Biology of *Myllocerus* Species

Eggs of *Myllocerus* Species: The freshly laid eggs of *Myllocerus* species were pale yellow and slightly oval in shape but, these became dark yellow on maturity. Just before hatching one side of the egg was changed in to brown. The surface of the egg was smooth and shiny. Eggs were laid in clusters of 35.16±7.13 in number and were found attached on the muslin cloth or wall of rearing cages. However, weevils also deposited eggs on the leaves rarely. The mean length of egg was 0.66±0.07 mm and the mean width across the widest point of egg was 0.40±0.03 mm. The mean incubation period was 4.57±0.53 days at 28.9±1°C. These findings in agreement with Atwal [6] as he reported that the eggs hatched in three to five days. The fecundity of weevil is 237.5±30.9 and the percent hatchability of egg was 68.12±11.15 at 28.9±1°C over a period of 30 days. Atwal [6] reported that *M.undecimpustulatus* laid on average of 360 eggs over a period of 24 days.

Grubs of *Myllocerus* Species: The newly hatched grubs were small, cylindrical and thread like worms. They were creamy white with brown head. On hatching, mean body length and width of head capsule were 1.09±0.05 mm and 0.12±0.01 mm, respectively. But just prior to the pupal formation they were 4.1±0.07 mm and 0.37±0.01 mm, respectively. The larvae burrowed the soil and fed on the rootlets of *V. cinerea*, but it did not feed rootlets of *A. indica*. However O'Brien *et al.* [7] reported that grubs of *Myllocerus* species feed on the roots of their host plants. The mean grub period was 50.6±1.51 days at 28.9±1°C. This is in agreement with Atwal [6] as he reported that the young grubs of *M. undecimpustulatus* completed their development in one to two months.

Table 2: Morphometrics of adult *Myllocerus* species

Measurements	Male (mm)	Female (mm)
Body length	4.09±0.21	6.04±0.68
Abdomen width	1.13±0.68	2.16±0.14
Head capsule width	0.51±0.06	0.62±0.08

Pupae of *Myllocerus* Species: Pupation was observed in earthen puparium. The pupal case was brown and slightly thick. Mean length of pupae was 3.82±0.03 mm; the mean pupal period was 7.83±0.75 days at 28.9±1°C. Atwal [6] reported that the pupation occurred in the soil inside earthen cells and took about one week. The final instar of grub was wriggled out of the soil layer, which was placed at the bottom of the rearing cages. Soon after the entrance of final instar, the grubs were enclosed within an earthen cell and remain unexposed to sunlight.

Adults of *Myllocerus* Species: Adults of *Myllocerus* species were small and had a dense covering of grayish to green, some what shining scales with black cuticular marks. Most of these weevils were metallic green in color. It had much smaller eyes. The adults emerged from the soil fed on a wide variety of host plants. Butani [8] reported that the adult weevils of *Myllocerus* species fed on leaves, nibbling the leaves from the margins and eaten away small patches of leaf lamina. Sex ratio of adult weevils was 1:1.

Size of the female weevil was slightly larger than the male weevil. Morphometric measurements were measured (Table 2). The antennae were serrate with 10 segmented and its terminal was wider than other segments. Fore wings were metallic green where as hind wings were membranous. Hind wings were comparatively larger than fore wings. Regarding legs, hind legs were enlarged and had spurs.

Courtship behaviour was observed in early morning as well as in the evening. During mating the male weevil jumped quickly over the female and trapped its body with fore and middle legs while the hind legs kicked the posterior end of the abdomen of the female on either sides. During this period female was exerted a vigorous agitation for a short period and eventually accepted the

male weevil. The male weevil brought down its posterior end of abdomen while the female weevil slightly raised its abdomen to facilitate copulation. The mean copulation period was estimated as 44.8±2.28 minutes.

CONCLUSION

Ash weevils, *Myllocerus* sp. were the heaviest coleopteran defoliators on neem. In addition to that various kind of pest species were observed on neem such as *Loboschiza koenigiana, Macaria notata, Aonidiella orientalis* and thrips. *V.cinerea* is the highly preferred weed hosts of *Myllocerus* sp. The fecundity of *Myllocerus* sp. was 237.5±30.9 and the percent hatchability of egg was 68.12±11.15. Incubation period of egg was 4.57±0.53 days at 28.9±1°C. Eggs were laid in clusters of 35.16± 7.13 on the muslin cloth. The newly hatched grubs were small, cylindrical and thread like worms. They were creamy white with brown head. The mean grub period was 50.6±1.51 days at 28.9±1°C. The larvae burrowed the soil and actively fed on the rootlets of *V. cinerea.* Pupation of ash weevils was occurred with in an earthen puparium. pupal period was 7.83±0.75 at 29.1±1°C. Most of the ash weevils were metallic green in color with black cuticular marks. Sex ratio of adult weevils was 1:1.

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