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A brief perspective on Gmelina tree insect pest *Craspedonta leayana*

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Abstract
Craspedonta leayana is a coleopteran insect pest of economically important tree Gmelina (*Gmelina arborea*). Its report from North-Eastern region of India is comparatively recent. This is a short account corresponding to a small observation of the insect's infestation inside the campus of Tezpur University, Assam, which also embraces about sixty Gmelina trees within. Interestingly, this insect has only single host to live upon. Few other conspicuous features of the insect draws attention and here is an attempt to discuss these in brief.

Keywords: Gmelina tree; Chrysomelidae; leaf skeletonizer; monophagy

1. Introduction

Tezpur Central University located at Tezpur, Assam, India (latitude 26° 42′ 2.88″ N & longitude 92° 49′ 49.08″ E) is an upcoming premier institute of the country. The University encompasses about 300 acres of land area, which is well-groomed with number of state-of-art constructions. The campus also embraces copious greenery with varied kind of herbs, shrubs and deciduous trees at different stages of development. Amidst these are about sixty Gmelina trees (local name Gamhari), in their mid-stage of growth, standing upright on either side of a sub-way close to the University playground. During May-June months, at the beginning of the monsoon in Assam, it is observed that these Gmelina trees endure severe defoliation. Extent of defoliation can be appreciated from the illustrations [Figure 1(a) and 1(b)] observed during that period. A close look would be indispensable for any one passing by, for one can be bewildered by the scene of such a pilage affecting all the plants so identically! This came out of as an observation in year 2013 that about 80% of the Gmelina tree leaves were completely damaged. Interestingly, an insect *Craspedonta leayana*, of order Coleoptera had caused such an upheaval. A conspicuous feature regarding its attack is that tree leaves are left completely skeletonized as visible in the Figures 1(a) and 1(b).

Insect order Coleoptera (beetles) comprises near about 3,50,000 species [1, 2] of which family Chrysomelidae is a major phytophagous group. It includes over 38,000 living species [3]. *Craspedonta leayana* (Latreille) [previously known as *Calopepla leayana* (Latreille, 1807)] is a member of this Chrysomelidae family (and subfamily Cassidinae) and is eventually a serious insect pest of the economically important timber-wood Gmelina (Gmelina arborea (Roxb.)). Gmelina is a deciduous tree belonging to family Verbenaceae [4] which naturally occurs in more than 11 countries in Asia including India and in several other countries it' s plantation has been initiated [5]. Gmelina has multitude of utilities in agroforestry, industries and several others [5, 6, 7, 8]. *C. leayana* causes immense depreciation to Gmelina by devouring upon leaves, young shoots, and buds thereby diminishing photosynthesizing capacity and growth of the plant. A subsequent second and third incursion is often fatal for the plant [9].

Life cycle of *C. leayana* involves five instar larval stages. They mostly feed on undersurfaces of leaf. Last two larval instars devour upon foliages leaving only the midrib and veins. Adults lie dormant for about 8-10 months and recur with commencement of rain and emergence of new leaf, shoot and buds. They lay eggs in conspicuous casings called 'oothecae' and are observable underneath stem-branches. Egg fertilizes giving rise to first instar larva. Larva undergoes ecdysis through five instars and becomes adult [10, 11, 12]. Images of some stages of the defoliator can be seen through Fig.2 (a, b, c, d) that was taken during the recorded period inside the university campus.

Fig 1(a):

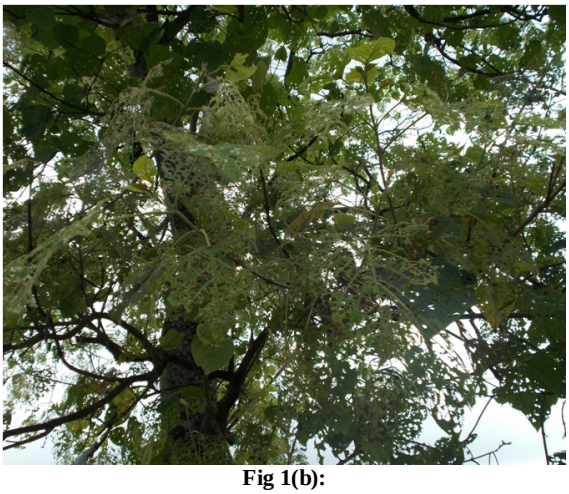

Fig 1(b):

Fig 1(a) & 1(b): Images of two *Gmelina arborea* Roxb. trees with severe infestation of *C. leayana*, taken in May-June, 2013. Defoliation is conspicuous as only the leaf veins and midribs are apparent. A similar 2-3 invasion by the insect can kill the entire tree [9].

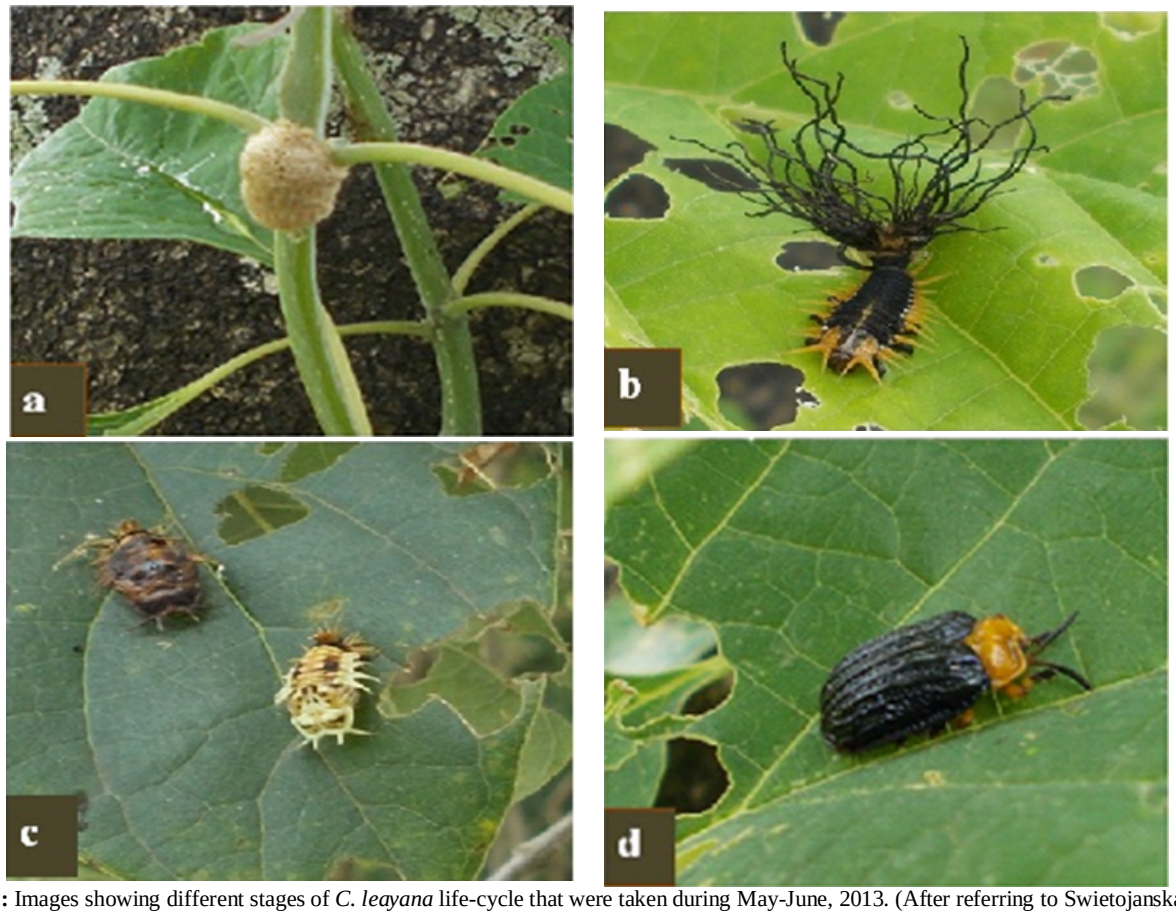

Fig 2: Images showing different stages of *C. leayana* life-cycle that were taken during May-June, 2013. (After referring to Swietojanska and Ghate, 2003)

(a) Distinct casings called "oothecae" where the adult *C. leayana* lays eggs underneath the leaf petioles or stem-branches.
(b) Last instar larval stage (of the total five instars) when the chrysomelid voraciously feed up-on the leaves.
(C) Pupal stage of *C. leayana.* Generally pupation takes place on the leaf itself.
(d) Adult *C. leayana* before it prepares for mating and subsequent events of life-cycle.

Few interesting features with respect to this insect are quite engrossing**.** *C. leayana* is said to have single tree-host to survive upon and no other host has been reported yet [13]. This can be indicative of the insect's confinement to a particular geographical location where the host is present. Monophagy in *C. leayana* is riveting for that leaves no alternate niche for the insect. Association of *C. leayana* with Gmelina plant is also captivating for evolution of host-parasite relationship is itself a

poorly understood phenomenon. At what point of time amidst evolutionary process, parasite encountered its host and preferred to use and live upon it is still to be elucidated. The insect can also be an indicator of the ecological status like ambient environment, lack of potential predatory species within its niche.

Apart from others (six species of parasitoids, a pentatomid predator, an unidentified nematode parasite), an avian species has been reported to be the insect's natural enemy [13]. The last instar larva of *C. leayana* is a voracious feeder of the leaves and buds. Axiomatically, predatory threats do surround them. Interestingly, larva at this stage has a unique defense strategy. The faecal matters released by the larvae are usually retained as filamentous strings that remain loosely attached to the base of larval skin in their anal region [14]. When confronted with any predatory threat they tend to flick these filaments up and down to distract the enemy [13].

Earlier, first observation of the insect in North-East region of India was recorded from Meghalaya in 1995[15] although it had been reported from other parts of the country [10, 16, 17, 18]. Dependence of the insect on the increment in temperature and precipitation for persistence and damage of the host has been revealed [19]. During that recorded period, Tezpur area witnessed 35-38 °C diurnal temperature in average and this certainly favored the pest to sustain. Exact estimation of the extent of predation and destruction posed by *C. leayana* has not been possible due to the fact that it's report of invasion in this part of the sub-continent being quite recent. This may be considered a threat to Gmelina cultivation in immediate future since *C. leayana*'s vehement eruption with temperature fluctuation may no longer be a rare case for this region unlike before.

C. leayana may be considered a suitable model organism to study evolutionary phenomena such as monophagy in detail. In depth study of biology and chemistry behind its choice for Gmelina as a host might give several clues to yet un-answered queries in host-insect parasite evolutionary dynamics. Behavioral study of the insect during its dormant and active stages might be fruitful in understanding nature of other phytophagous coleopterans too! Importantly, dependence of the parasite and host in their individual growth and maturation states for their association draws attention. Any alteration in the seasonal growth and maturity in either of the host or parasite is going to affect the interaction! How the synchronization attained between both the multicellular organisms has resulted in such an intimate association will be a challenging theme before the evolutionary biologists to delve into. The role of insect species like this and many others in the maintenance of ecological balance would be another interesting area of quest. It is anticipated that researchers would come up with several other interesting findings relating to *C. leayana* and many similar ones in forthcoming days!

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