

OCCURRENCE, DAMAGE, COLOUR MORPHISM AND NATURAL ENEMIES OF *MONOLEPTA LONGITARSUS* JACOBY (COLEOPTERA: CHRYSOMELLIDAE), A DEFOLIATING PEST OF CASHEW

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ABSTRACT

The present study aimed at investigating the occurrence, damage pattern and natural enemies of a chrysomelid beetle *Monolepta longitarsus* Jacoby (Chrysomelidae: Coleoptera). Occurrence of the beetle was noticed in cashew plantations at Puttur and Shantigodu, Dakshina Kannada of Karnataka, India during 2012 and 2013. These beetles appeared immediately in large numbers after south-west monsoon showers (June) and infestation was continued on cashew, up to August. Dispersal of this pest did not follow a consistent pattern. Beetles in groups of 60-75 were capable of causing complete drying of cashew shoots within 2-3 days and thus the damage spread was fast. Four different colour morphs of beetles were noticed, in which, reddish orange colour morphs were dominant (> 60 %) throughout the observation period followed by black shouldered red and random mating was observed between all four colour morphs. A few species of reduviids and praying mantises were recorded as predators and *Beauveria bassiana* as entomopathogenic fungus of these beetles.

Key words: Chrysomelid beetle, Cashew, Shoot damage, Pruning, Colour morphism.

Introduction

Cashew (*Anacardium occidentale* L.), is an important commercial nut crop grown in many parts of the world. In India, cashew is grown in an area of 9.82 lakh hectares of land, producing over 7.28 lakh tonnes of raw cashew nuts annually (DCR, 2014). Cashew is reported to be damaged by more than 180 pests, feeding on various plant parts during different periods (Sundararaju *et al.*, 1999). Apart from two major pests *viz.*, cashew stem and root borer (*Plocaederus* spp.) and tea mosquito bug (*Helopeltis* spp.), there are a few pests that also cause considerable damage to the crop. The chrysomelid leaf beetle, *Monolepta longitarsus* Jacoby was recorded as an important pest damaging shoots of cashew (Rai, 1980). Adult beetles are generally reddish in colour and measures about 3.2- 4.2 mm in length. The body of the beetle is dome shaped, smooth and the abdomen is not fully covered by elytra (NRCC, 1988).

Earlier, it was reported as a cashew pest in southern and eastern parts of India (Rai, 1980; Sundararaju *et al.*, 1999; AICRP-C, 2012). Initial damage symptom is seen as small skeletonised patches on one side of leaves and as the damage progresses, the leaves are completely skeletonised, and damaged tender shoots dry off. Rapid spread of populations results in a burnt up appearance of cashew fields in a short period. During the present investigation, these beetles were

found to cause severe damage in few cashew plantations of Karnataka, India during south-west monsoon period of 2012 and 2013. Several aspects of this pest like damage pattern, preference towards different age groups of cashew trees, alternate hosts and natural enemies are not known and the literature related to this pest is very meagre. Hence, the present study was carried out to document the occurrence, damage pattern and natural enemies of the pest.

Material and Methods

Field survey

a. Occurrence of leaf beetles : Field surveys were undertaken in an area of 108 ha of cashew plantations at Puttur and Shantigodu, Dakshina Kannada district of Karnataka, India (12.45° N, 75.4° E; 90 m a.s.l.). Surveys were done during morning hours from June to October during 2012 and 2013 to record leaf beetles infestation as this was the period for the prevalence of leaf beetles in cashew plantations. Representative beetle samples were preserved in vials containing 70 % ethanol for their identification. The voucher specimens were deposited in the National Pusa Collection, Indian Agricultural Research Institute, New Delhi, India.

b. Intensity of damage, dispersion pattern, alternate hosts and natural enemies : The cashew plantations noticed with beetle infestation were categorized into (a) current year limb pruned young trees (4-7 years old)

Four colour morphs of chrysomelid beetle, *Monolepta longitarsus* were found infesting cashew foliage during 2012 and 2013 causing drying of shoots in Dakshina Kannada of Karnataka.

(pruned during May), (b) unpruned young trees (2-10 years old) and (c) unpruned old trees (> 10 years old) and an area of 4 ha in each category was surveyed weekly to record the number of trees infested. To record the number of beetles/ shoot and number of damaged shoots/ tree, a total of 20 trees were marked in each category. Dispersion pattern of the beetles from infested trees was also recorded at successive observations by examining the spread of damage. Existence of alternate hosts, predators as well as pathogens of this beetle was also recorded simultaneously and identification was made by taxonomists. Representative beetles were brought to laboratory and maintained with cashew shoots for any parasitoid emergence.

Laboratory studies

a. Parasitoid and pathogen occurrence : A polythene bag (20 x 25 cm) was held carefully underneath an infested shoot and the instantly falling adult beetles were collected. Around 250 beetles were collected at weekly intervals and maintained in individual glass containers of 2 lit capacity having fresh cashew shoots as feed. Temperature and relative humidity were $26 \pm 3^\circ \text{C}$ and $91 \pm 3\%$ respectively during the study. Beetles were observed daily for emergence of any parasitoids and development of entomopathogenic infection up to 15 days.

b. Colour morphs and sexual behaviour : During the survey, four colour morphs of these beetles were noticed and hence to determine the proportion of colour morphs, observations were made at weekly intervals for a period of 60 days. A total of 3059 beetles were observed at field and the colour morphs were grouped by visual observation. To study the sexual behaviour, 100 beetles comprising 25 beetles in each colour morph were kept together in big glass jars (30x15x15 cm LBH) provided with fresh cashew shoots as feed. The top of the jar was covered with muslin cloth while the bottom was covered with two cm layer of field collected soil and fifteen mating pairs were observed for their sexual behaviour.

Results and Discussion

a. Survey for leaf beetle occurrence : During the surveys, occurrence of *M. longitarsus* was noticed in cashew

plantations in a scattered fashion from June to August of 2012 and 2013. Occurrence of this pest appeared one to two weeks after first shower of the monsoon. Then there was a steady increase in population reaching the peak during second week of July which remained high till the end of July and then abruptly reduced during first week of August but very few were noticed until third week of August (Fig. 2). During second week of July 2013, they caused even 80 per cent shoot damage in 0.25 per cent of cashew trees spread over 108 ha. Previously, damage up to 5 % of the cashew shoot was reported under moderate infestation of leaf beetles (Rai, 1984).

Nature of damage

Field observations demonstrated that the beetles settled in groups especially on third or fourth leaf of a shoot, started feeding and gradually devoured the whole shoot. They scraped the green matter from both the leaf surfaces thus the leaf dried off consequently (Fig 4a). A maximum of 786 beetles were seen damaging a single shoot during peak infestation. It is observed that a group of 60-75 beetles are capable of causing complete drying of shoots in 2-3 days. Limb pruned young trees were very susceptible, since beetles prefer very tender shoots for feeding (Fig.1 and 2). In case of unpruned trees, initial damage occurred on the dorsal side of leaves and further damage caused drying of whole shoot leaving only the stump. The intensity of damage on different age groups of cashew plants was represented in Fig 2. Death of the shoot was certain when these damaged shoots were succumbed to further fungal infection. In cashew, it was noticed that the buds just below the cut end becomes active between 22 and 28 days after pruning. Thus, when these new shoots got damaged especially during mid July or later, there will be sizeable reduction in production of flowering laterals and further yield. Repeated shoot damage by the beetles might result in delayed panicle emergence as recorded for cashew leaf roller (Pathummal *et al.*, 1993).

b. Dispersion pattern and alternate hosts : Dispersion of this pest is not in a definite pattern, but random. After damaging a shoot, beetles were found not necessarily migrating to neighbouring trees but to trees situated in different directions of the plantation. Hence, spread of damage was very scattered. The pattern of occurrence

Table 1 : Number of colour morphs of *M. longitarsus* observed at fortnightly intervals during 2013-14

Colour morph	Beetle numbers at fortnight interval (Sum of 10 samples)			
	June 1 st fortnight	June 2nd fortnight	July 1 st fortnight	July 2 nd fortnight
Black	30	52	44	67
Dark red	63	75	59	58
Black shouldered red	136	143	131	136
Reddish orange	470	494	658	443
SED	6.55	6.45	33.17	20.11

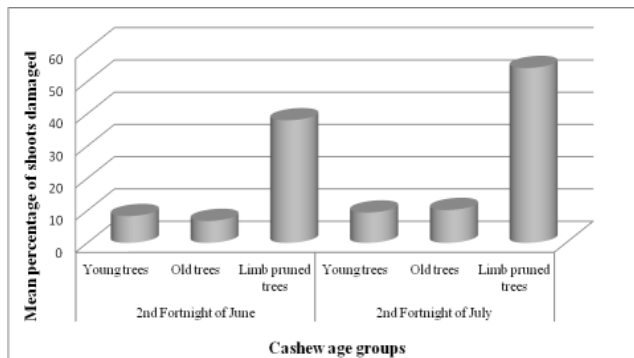


Fig. 1 : Differential damage by *M. longitarsus* on various age groups of cashew trees

and distribution of this beetle was found to be similar to that of *M. australis*, where elevated populations swarm and rapidly strip the foliage over large areas in Australia (Neal, 1993). Besides cashew, for the first time, this beetle was also found to defoliate on *Semecarpus* sp. (Anacardiaceae) a wild cashew relative, *Buchanania lanzan* Spreng (Anacardiaceae), a common weed plant and *Terminalia arjuna* (Combretaceae) during July and August 2013, but the incidence was less than 1 %. Previously, *Terminalia arjuna*, *T. paniculata* (NRCC, 1983), tapioca (Rai, 1980) and cocoa (Mariamma, 2009) were recorded as alternate host plants for *M. longitarsus*. The present study widens its host range by adding *Semecarpus* sp. and *B. lanzan* to the list. Hence, while taking up management strategy, infestation on these plants, if found nearby, should also be taken care to minimize the spread of the pest.

c. Natural enemies under field conditions : Under field conditions predators like reduviids viz., *Sphedanolestes* sp., *Endochus albomaculatus* Staal, *Epidius bicolor* and *Panthous bimaculatus* Dist. (Reduviidae: Hemiptera) were found preying these beetles. Besides, spiders (viz., *Oxyopes* sp., *Tetragnatha fletcheri*, *Telemonia dimidiata* and *Myrmarachne* sp.) (Arachnida), praying mantis (*Creobroter* sp) and robber flies were also noticed as predators of these beetles.

Laboratory experiments

a. Natural enemies : Out of 3000 beetles observed, no parasitoid emerged, indicating nil parasitism on adult stage. But, parasitism of adult beetles of *M. australis*, by the tachinid, *Monoleptophaga caldwelli* Baranov was noticed in Australia (Fay et al., 1993). Three field collected *Monolepta* beetles became mycosed and died within two days of collection. They became mummified and covered fully with white mycelial growth and the entomopathogenic fungus was identified as *Beauveria bassiana* (Bals.) at National Bureau of Agriculturally Important Insects, Bengaluru, India.

b. Colour morphs and sexual behaviour : Four different

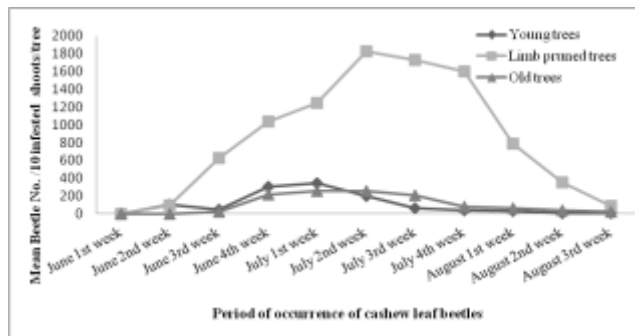


Fig. 2 : Seasonal occurrence of *M. longitarsus* on cashew trees during 2013-14

colour morphs of the beetles were observed, where the whole body appeared light orange while elytra and antennae were in different shades. The elytral colours are: black, dark red, black shouldered red and reddish orange (Fig. 5). The weekly occurrence of colour morphs indicated that reddish orange was dominant invariably during all the weeks followed by black shouldered red (Table 1). Relative abundance of reddish orange was dominant (> 60 %) followed by black shouldered red beetles (14 -20 %), while dark red and black beetles represented < 10 % of beetles population throughout the observation period (Fig 3). The current study revealed that four colour morphisms is found in *M. longitarsus*. Presence of colour morphs in 15 different Afrotropical *Monolepeta* spp. and related Galerucinae was reported earlier by Stapel et al. (2008) but there was not mentioned about colour morphism of *M. longitarsus*. According to Lus (1928, 1932), polymorphism is controlled by a number of alleles at a single gene locus, with melanics dominant to non-melanics. Temporal variation in elytral colour polymorphism was observed in *Hippodamia variegata* (Honek et al., 2012) and *Harmonia axyridis* (Yu, 2008).

Beetles readily mated even under confinement and multiple matings were seen. Male mounted on the female from its back and tapped the dorsum of the female abdomen with antennae (Fig. 5). Once the female

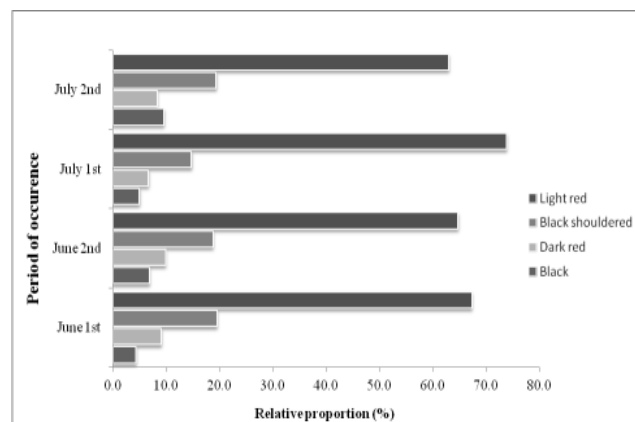


Fig. 3 : Proportion of colour morphs of *M. longitarsus* in cashew

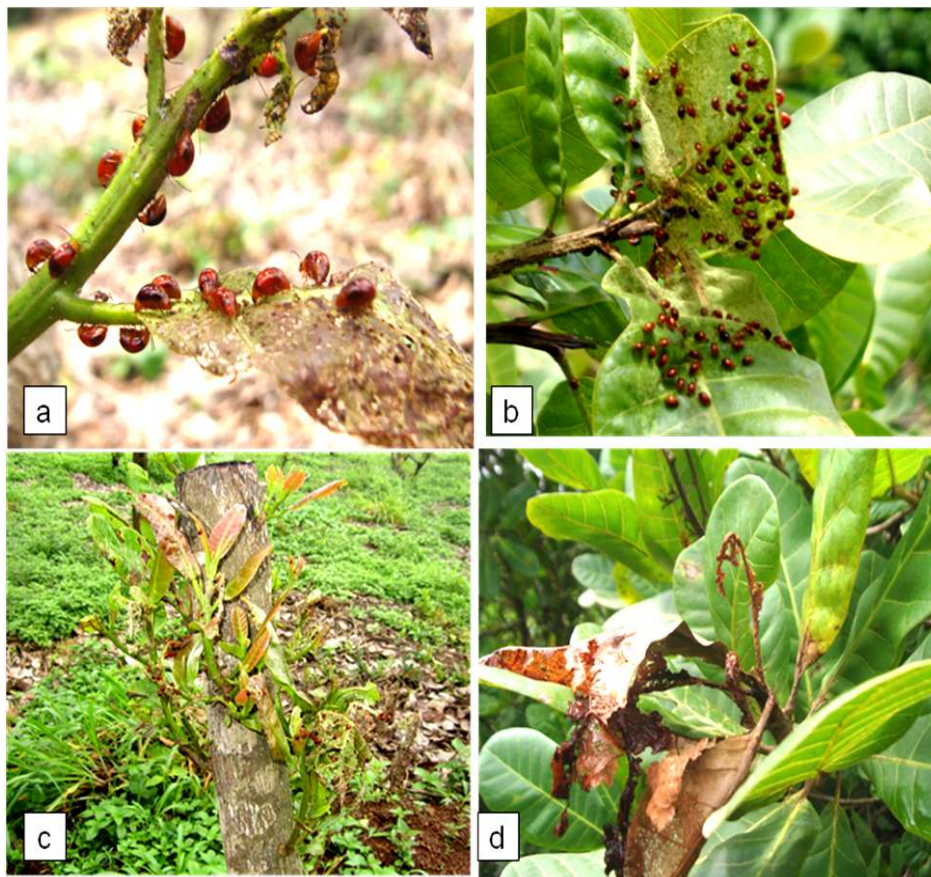


Fig. 4. (a-d.) : Damage of *M. longitarsus* on a. tender shoot b. mated shoot c. tender flushes of limb pruned tree d. dried shoot due to beetle damage

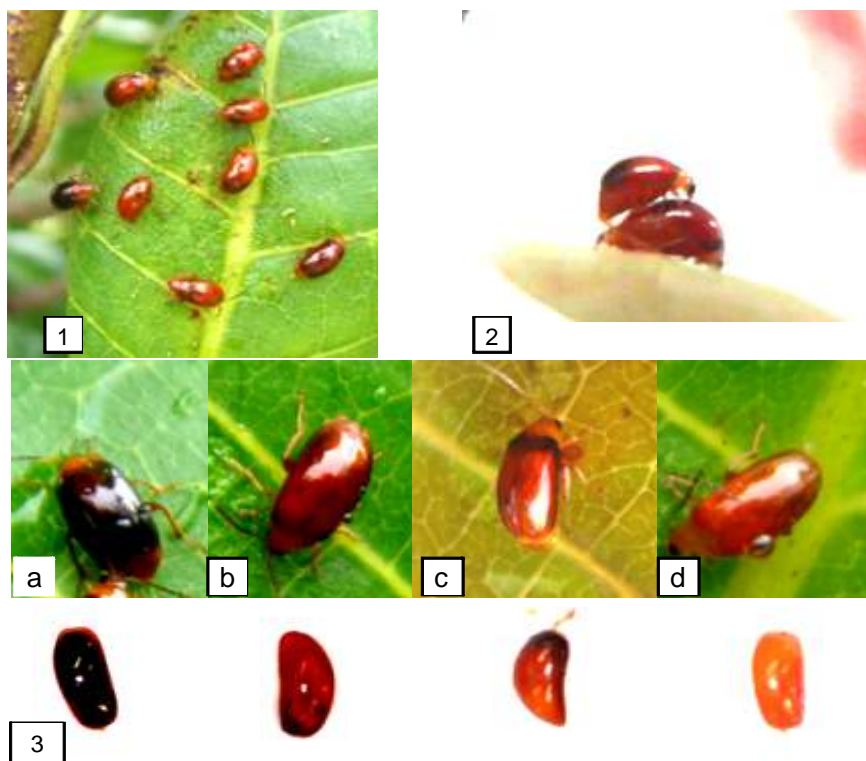


Fig. 5. (1-3): 1. Presence of colour morphs of *M. longitarsus* in a single leaf and 2. mating pair (Dark red male and black shouldered red female) 3. colour morphs and their elytra (a- black, b- dark red, c- black shouldered red, d- reddish orange)

responded, courtship occurred. Male continuously struck the back of the female both with its antennae and head 8-18 times with an interval of 5-8 seconds. Mounting and copulation lasted for 2-3 minutes and some just mated females were noticed to couple with another partner immediately. Beetles which continued genital contact for 2 min were regarded as having complete copulation and matings lasting 2 min reached the 'body shaking' stage, which signals sperm transfer as observed in other coleopteran beetles. Random mating was noticed among and between all the four colour morphs of this species both in field and laboratory conditions. The pattern of mating in the previous generation may also be a reason for colour morphs as

reported by Osava and Nishida (1992). In the present study also, mating between different morphs may play a crucial role in maintenance of colour morphisms in this beetle.

Conclusion

The *Monolepta* beetles are found as regular seasonal pests of cashew in western and eastern ghats of India that occur in huge numbers during the onset of south west monsoon. This study reveals that monitoring the plants during the onset on monsoon especially the pruned trees can help to manage this pest. Conservation of natural enemies like reduviids and praying mantises and spraying of *B. bassiana* will be able suppress this pest.

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**मोनोलीप्टा लॉगिटार्सस जैकोबी (कॉलीओप्टीरा : क्रीसोमीलिडा), काजू का एक निष्पत्रक नाशी जीव,
की प्राप्ति, क्षति, रंग आकारिकी एवं प्राकृतिक शत्रु
के. वनिथा, पी.एस. भट्ट, टी.एन. रविप्रसाद एवं के.के. श्रीकुमार**

सारांश

वर्तमान अध्ययन का उद्देश्य एक क्रीसोमीलिड भृंग मोनोलीप्टा लॉगिटार्सस जैकोबी (क्रीसोमीलिडा : कॉलीओप्टीरा) की प्राप्ति, क्षति पैटर्न और प्राकृतिक शत्रुओं की जांच करना है। भृंग की उपस्थिति 2012 और 2013 के दौरान कर्नाटक, भारत के पूरु एवं शान्तिगोड्ड, दक्षिण कन्नड़ में काजू रोपणों में देखी गई। ये भृंग दक्षिण-पश्चिम मानसूनी बौछार (जून) के बाद तत्काल बड़ी संख्या में दिखाई पड़ते हैं और काजू पर उत्पीड़न लगातार अगस्त तक जारी रहता है। इन नाशी जीव का छितराव एक सुसंगत पैटर्न में नहीं होता है। 60-75 के समूह में भृंग 2-3 दिन के भीतर काजू प्ररोहों को पूरी तरह सुखाने में सक्षम होते हैं और इस प्रकार क्षति फैलाव तेज था। चार अलग-अलग रंग के भृंगों के मार्फ देखे गए जिसमें सम्पूर्ण प्रेक्षण अवधि में रक्ताभ नारंगी रंग के मार्फ प्रधान (> 60 प्रतिशत) थे इसके बाद काले कांधदार लाल थे और सभी चार रंग वाले मार्फों के बीच बेतरतीब संगम देखा गया। रीडूविड्स और शिकारी मेन्टिसों की कुछ प्रजातियों को परभक्षियों के रूप में अभिलिखित किया गया तथा इन भृंगों के कीटरोगजनक कवक के रूप में ब्यूवरिया बेसियाना अभिलिखित किया।

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