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NEW RECORD OF INSECT PESTS ATTACKING *BUTEA MONOSPERMA* – A COMMERCIAL HOST FOR CULTURING LAC INSECT, *KERRIA LACCA* (KERR)

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ABSTRACT

***Butea monosperma* is one of the major commercial lac hosts for raising *rangeeni* strain of Indian lac insect, *Kerria lacca* (Kerr). In changing climatic scenario, pest complex in lac production system is also changing. Comprehensive and intensive lac host plant surveillance and field collections of insect pests from commercial lac host, *Butea monosperma (palas)*, the flame of forest trees carried out during last five years reveal the occurrence of some new pests. Scale insects namely *Aulacaspis* sp., (Hemiptera: Diaspididae) and *Pseudaulacaspis cockerelli* (Cooley) (Hemiptera: Diaspididae), sweet potato bug, *Physomerus grossipes* Fabricius (Hemiptera: Coreidae) as well as curculionids *viz*., *Myllocerus discolor* Boheman (Coleoptera: Curculionidae); *Amblyrrhinus poricollis* Marshall (Coleoptera: Curculionidae) and *Peltotrachelus* sp. (Coleoptera: Curculionidae) were recorded for the first time from India on *Butea monosperma.* Interestingly some insect pests reported as minor and sporadic by earlier workers have been replaced by another species and its occurrence noticed regularly as in case of curculionids attacking commercial lac hosts. In recent past, it has been observed that those species which were not recognized as economically important have now become major pests and *vice-versa*. Considerable variations in their period of occurrence and activity have also been noticed.**

Key words: New record, *Butea monosperma*, *Kerria lacca*, lac insect, lac host

India is the largest producer of lac in the world. lac is the only natural resin of insect origin derived mostly from a few species of *Kerria* (Coccoidea: Tachardiidae) belonging to a specialized group of scale insects that are phytosuccivorous and thrive on specific plants called lac-hosts. Resin, dye and wax are the three commercially potential products obtained from lac, which find application in diverse areas such as food, pharmaceuticals, cosmetics, paints and varnishes, automobile and electrical sectors. In view of bio-safety and stress on natural products the demand potential of lac is upbeat. Besides, being a source of livelihood to millions of economically backward population especially tribes in Jharkhand, Madhya Pradesh, Chhattisgarh, Maharashtra, Odisha and West Bengal etc. In India lac is mainly derived from the Indian lac insect, *Kerria lacca* (Kerr) represented by two forms *rangeeni* and *kusmi*. Both the strains complete two cycles in a year producing two crops. But these two forms differ in life cycle patterns due to their genetic differences in their developmental response to temperature. Thus, these two forms exhibit differences in their vulnerability to deviations from the normal climatic conditions. *K. lacca* is associated with a large pest complex comprising mainly of predatory and parasitic insects. Ninety-seven species of lac insect-pests have been reported, but only a few of them are economically important from lac production standpoint causing significant damage to the lac crop. There are about 19 major and 61 sporadic and minor pests of important lac hosts namely *palas*, *kusum*, *ber*, *khair*, *ghont* and *bhalia* have been recorded so far in India (Bhattacharya, 2002). Narayanan (1962) enlisted 14 insect pests attacking exclusively on *B. monosperma* and about 6 insect pests attacking more than one lac host plants. Grey weevils belonging to *Myllocerus* spp. (Curculionidae: Coleoptera) are important weevil pests invading numerous agricultural and horticultural crops (Hill 1987). Ramamurthy and Ghai (1988) described 73 species in this genus from the Indian subcontinent. From Asia, especially from South- East Asia, the Indian subcontinent, Africa, North America, the Palearctic and Australia, a total of 336 species are currently reported and recognized as valid in this genus (O'Brien *et al*., 2006).

There are about 400 plant species which have been reported as lac host, but *Schleichera oleosa (kusum*), *Butea monosperma (palas*) and *Ziziphus mauritiana (ber*) are the three major lac host trees which are being exploited commercially for lac cultivation in all the lac growing tracts of the country. All the three major lac

hosts are contributing about 96 per cent of the total national lac production and other hosts are contributing only 4 per cent. *Butea monosperma* is a commercial lac host tree for raising *rangeeni* strain of lac insect with excellent recopies and multiplication capacity. This host plant multiplied by root suckers and seeds hence visible in patches as well as found on borders of paddy field. The leaf fall normally started from February and flowering appeared in March. The new tender leaves appeared sometimes in April and host plant is full of new foliage in May and June. The tender and new leaves invite infestation for a number of insect pests. The healthy leaves are utilized for several religious purposes as well as for preparing of food plate in different parts of the country. In order to increase lac production of the country, it is not only necessary to bring more host trees and more areas under lac cultivation but also to pay due attention for the proper management of the host trees as well as protection of lac crops from the ravages of enemies insects. The effect of pest population of lac host plants is not detrimental always; however peak occasional occurrence can cause hazardous effects. Thus the effect of inimical insects affects the vigour of the host plants and never causes a complete damage. Among the species mentioned most of the species are of common occurrence and the difference in feeding behavior contributes for the difference in severity of attack.

MATERIALS AND METHODS

Keeping in view of changing climatic scenario, a comprehensive and intensive crop surveillance and field collections of insect pests associated with *B. monosperma* were carried out during last 5 years (2008-09 to 2012-13) from *Butea monosperma* plantations in the Research Farm of Indian Institute of Natural Resins and Gums (IINRG), Ranchi, Jharkhand. Samples were collected from host plants by regular monitoring on different host plants. Occurrence of Curculionid pests were recognizable because of typical feeding pattern marked by usually circular holes on the leaves of host plants. Larvae and adults were searched under such leaves. Insect samples having visible morphological variation were collected regularly and brought to the laboratory. The period of occurrence, level of infestation and increase/decrease in population of specific pest on specific lac host plants were also closely monitored. Specimens were preserved and sent to Insect Identification Services of Division of Entomology, Indian Agricultural Research Institute, New Delhi for identification. The pests were identified at National Pusa Collection, Division of Entomology, Indian Agricultural Research Institute, New Delhi and the voucher specimens were deposited at the Center.

RESULTS AND DISCUSSION

Insect samples were collected from *Butea monosperma* plantations of IINRG Research Farm by extensive field survey throughout the experimental periods. Some of the new insect pests recorded for the first time in lac production system on *Butea monosperma* and their period of occurrence and nature of damage are as below:

a) Scale insect, *Aulacaspis* sp. (Hemiptera : Diaspididae)

Although scale insects may be spread short distances by wind dispersal of crawlers, but the long distance spread of this scale insect might be due to transport of infested plants. Females normally go through three instars, and the average life cycle from egg hatching to adult stage varied from 28-30 days. Females can lay more than 100 eggs which hatch in 8-12 days. Most females do not live longer than 75 days. Damage caused by the scale, initially appears as chlorotic spots, but most of the fronds eventually become brown and desiccated. Highly infested twigs are almost completely coated with a white crust that includes scales of live and dead insects. Scales of males, which are less than half the length of scales of females, are always more than those of females. Severely affected shoots may become useless for lac cultivation as the pest attacks the same regions of the host trees on which the lac insect settles down to draw nourishment and secrete the resin. Incidence of this pest on host trees was noticed during the month of February, 2009 in Research Farm of IINRG, Ranchi. The pest is occurring regularly on this host. Occurrence of this pest on *B. monosperma* has been reported for the first time from India.

The bionomics of the cycad *Aulacaspis* scale insect was studied by Howard *et al.*, (1999). The detailed biology and ecology of armored scale, *Pseudaulacaspis cockerelli* have been studied and reported by Beardsley and Gonzalez (1975).

b) False oleander scale, *Pseudaulacaspis cockerelli* (Cooley) (Hemiptera: Diaspididae)

False oleander scale was first described in California from palms taken in quarantine from China. It is now

widespread and invasive in many parts of the world. Females lay tiny, yellow, oval eggs under the armor. Active nymphs (called "crawlers") hatch from the eggs and walk to other shoots. Newly settled nymphs insert their piercing, sucking mouth parts into plant tissue and start feeding on plant sap, they secrete a waxy liquid that hardens over their bodies to form the shield. As they grow larger, they secrete more wax, and their shield also gets larger. Scales take about 4-6 weeks to complete a generation from eggs to adults. Adult males are tiny, winged and fly to search for females for mating. But, adult females remain under their shields for their entire life. Female armored scales are not capable of wandering once they have settled and starts feeding hence do not move to new bushes to lay eggs; instead, it is only the young crawlers that infest new bushes. The insect uses its sharp tube-like mouthparts to pierce the leaf or shoot and suck the sap. Like aphids, scales excrete a sugary liquid that causes sooty mold to grow on the leaves which reduces photosynthesis. The pest was observed to be of regular occurrence on this host. Infestation was found to be more pronounced after the rainy season from October–November to February-March on *B. monosperma* (*palas)* trees. White powdery patches/spots on twigs and leaves of host trees were observed mostly on tender twigs. Incidence of this pest on host trees was noticed during the month of January, 2010 in Research Farm of IINRG, Ranchi. Severely affected shoots may become useless for lac cultivation as the pest attacks the same regions of the host trees on which the lac insect settles down to draw nourishment and secrete the resin. Occurrence of this pest on *B. monosperma* has been reported for the first time from India (Fig.1).

Cockerel scale is known to infest over 100 plant species and the major crops damaged are mango, cashew, custard apple, coconut, banana, calotropis, sunflower, etc. Occurrence of Pseudaulacaspis cockerelli on different hosts in India has been reported from Andaman and Nicobar Islands, Andhra Pradesh, Bihar, Gujarat, Karnataka, Kerala, Sikkim, Maharashtra, Tamil Nadu, Uttar Pradesh and West Bengal. But the occurrence of this pest on Butea monosperma is hereby reported for the first time from India.

c) *Amblyrrhinus poricollis* Marshall (Coleoptera: Curculionidae)

Amblyrrhinus poricollis is a polyphagous weevil pest occurring regularly on *Butea monosperma*. Young weevils feed on roots, whereas the adult weevils feed on the foliage of the plants. Adult weevils are small, brown blackish in colour and abdomen is fully coloured with black elytra (Fig. 3 a, b). Weevils are active throughout the year with its peak activity during the months of March to June. Its population dwindles during the rainy and winter months. Tender leaves are more severely attacked as compared to mature leaves. Initially they cut irregular holes and gradually eat up entire leaves leaving only the midribs (Fig. 2). Amongst the Curculionids, the population of this pest was relatively high as compared to others. Incidence of this weevil was observed on almost every plant. Occurrence of this pest on *B. monosperma* has been reported for the first time from India.

d) *Peltotrachelus* sp. (Coleoptera: Curculionidae)

Adults are defoliators of lac host trees and were observed infesting leaves of *Butea monosperma* (Fig. 4 a, b). The adult weevils were found to feed from the margin of the leaves proceeding inwards leaving the midrib and thick veins in an irregular shape. The adults

Fig.1. *Pseudaulacaspis cockerelli* incidence on *B. monosperma*

Fig. 2. Symptom of weevil attack on *B. monosperma*

Fig. 3 *Amblyrrhinus poricollis* (male) attack on *B. monosperma* leaf

Fig. 4 *Peltotrachelus* sp. attack on *B. monosperma*

normally appeared on host trees trees in March and remained feeding on them till October-November. They confined themselves on the undersurface of leaves during sunny hours and scattered during cool hours. Tender leaves were more severely attacked than the older ones. The pest was found to be of regular occurrences on this host. This is new host plant record for this species from India.

The genus *Peltotrachelus* is represented by three species in India. *Peltotrachelus juvencus* Fst, *P. pubes* Fst. and *P. albus* Pascoe had been reported infesting *Acacia catechu* W.A., *Citrus aurantium* L., *Tectona grandis* L.f. and *Ziziphus jujube* Lam. in India (Bhasin and Roonwal, 1954; Roonwal and Singh, 1958: Mathur and Singh, 1961). Siddappaji and Lingappa (1977) reported *Peltotrachelus cognatus* Mshl. as a new pest of orchard crops. Rao (1992) reported the occurrence of weevils (*Peltotrachelus pubes, Amblyrhinus poricollis* and *Myllocerus discolor*) on soap-nut (*Sapindus* sp). Occurrence of *Peltotrachelus* sp. in lac production system on *B. monosperma* has been reported for the first time from India.

e) Apple weevil, *Myllocerus discolor* Boheman (Coleoptera: Curculionidae)

Adult weevils have brown/black colored head with rectangular snout. Antennae are 12 segmented laterally, geniculate with first being the longest. Prominent black eyes are present at the base of rostrum. Abdomen is fully covered with prominent elytra (Fig. 5). Legs are similar in size, bearing a pair of claws at the tip covered with brownish hairs and scales. Mesothorax rectangular and hairy. The pest is active throughout the year with its peak activity during March to June. Adult specimens from the infested plants were collected during the month of March, 2010 and occurrence of this pest

Fig. 5. *Myllocerus discolor* attack on *B. monosperma*

was observed from 45-50% host plants. The damage caused by the weevil is very characteristic due to feeding on the leaves making round holes or 'C' shape cut on leaves of host plants. The pest is of regular occurrence on this host plant and sometimes adult weevils cause severe defoliation. Incidence of this pest on *B. monosperma* has been reported for the first time from India.

Distribution of *Myllocerus discolor* Bohemann (Curculionidae) in different regions on *Ziziphus mauritiana* have been reported by various workers viz., Punjab, Bengal, Orissa and Hazrapur (Marshall, 1916); Assam, Himachal Pradesh, Jammu and Kashmir, Karnataka, Orissa, Punjab, Tamil Nadu, Uttar Pradesh, Myanmar and Srilanka (Ramamurthy and Ghai, 1988), Poonch and Rajouri (Azam, 2007). But the occurrence of this pest in lac production system on *Butea monosperma* has been reported for the first time from Ranchi, Jharkhand, India.

f) Sweet potato bug, *Physomerus grossipes* Fabricius (Hemiptera: Coreidae)

Adult bugs are brown in colour with black legs, about 2 cm long, oval shaped with segmented antennae, a numerously veined forewing membrane, a metathoracic stink gland and enlarged hind tibia (Fig. 6). *P. grossipes* oviposits its eggs on the undersides of leaves. The female of *P. grossipes* is very protective and caring of young ones. Mothers guard their eggs and sometimes generate strong-smelling fluid from metathoracic gland to protect them from the natural enemies. The eggs hatch in about two weeks. The insect goes through five nymphal stages ranging from 85-90 days before reaching full maturity. The bugs normally suck the sap from lower surface of preferably tender leaves. The pest was found to be of sporadic nature on this host. The occurrence of bugs on host tree, *Butea monosperma* was observed during the month of May, 2013 in IRF, Ranchi. This is new host plant record for this species from India.

g) Leaf folder (Lepidoptera: Pyralidae)

Leaf-folder is a pest of regular occurrence on Butea monosperma. Its greenish caterpillars are very agile and feed inside the fold made by fastening together the edges of a leaf. The young larvae feed on tender leaves without folding them. Whereas the older larvae

Fig. 6. *Physomerus grossipes* incidence on *B. monosperma*

fasten the margins of leaf together with a stick substance and feed inside the fold by scrapping the green matter resulting leaves become membranous, turn white and finally wither. A single larva may damage a number of leaves as it migrates from one leaf to another. The pest is active on this host from March to October. Full grown larvae pupate either on the plant inside the rolled leaves or among plant debris in the soil.

Here we are reporting the occurrence of above pests for the first time in lac production system on *Butea monosperma* from Ranchi, Jharkhand. The Research Farm of Indian Institute of Natural Resins and Gums (IINRG) was the study site. The location stands at an altitude of 650 m above mean sea level, 23°23" N latitude and 85°23" E longitude. The area experiences mild, salubrious climate, with a rather heavy rainfall pattern of about 1400 mm average, of which about 1250 mm is during the monsoon. The mean maximum daily temperature during the hot weather (April-October) ranges from 28.1°C to 39.9°C and the mean minimum temperature from 15.7°C to 26.2°C. The mean maximum temperature during winter (November-March) ranges from 15.4°C to 34.2°C and the mean minimum temperature from 2.8°C to 18.1°C. The Institute Research Farm which form an integral part of the IINRG campus cover an area of about 36 ha has all conventional and cultivated lac host plants for research experiments. The Institute Research Farm has approximately 1550 host trees of *Schleichera oleosa* (*kusum*), 2480 trees of *Butea monosperma* (*palas*), 1351 trees of *Ziziphus mauritiana* (*ber*) and 8700 other minor host plants. The field gene bank of the Institute has 12 genera and 53 species covering tree, medium and bushy type of lac host plants. Altogether 89 collections of 53 lac host species collected from different agro climatic regions have been planted in field gene bank of the Institute. Interestingly some of the insect pests which were reported as minor and sporadic pests by earlier workers have been replaced by another species as in case of curculionids attacking on commercial lac hosts. In recent past, it has been observed that those species which were not recognized as economically important have now become major pests and *vice-versa*. Considerable variations in their period of activity and intensity of damage have also been noticed.

Fig. 7. Leaf folder incidence on *B. monosperma*

Narayanan (1962) reported the occurrence *Myllocerus cardoni* Marshl. (Curculionidae: Coleoptera) on *ber, ghont, palas and kusum*; *Pachyonix quadridens* Chevr. (Curculionidae: Coleoptera) – A gall producing weevil on *palas* leaf petioles; *Myllocerus discolor* Mshll. (Curculionidae: Coleoptera) and *Myllocerus viridanus* Fabr. attacking on *kusum* leaves. But in our present investigation, the occurrence of *M. cardoni, M. viridanus* and *P. quadridens* was not noticed on *palas* trees, clearly indicating the shift in pest complex in changing climatic scenario.

It is clearly evident from the above findings that the pest complex in lac production system is also changing in prevailing changing climatic scenario. In recent past, due to changing climatic scenario, pest complex and bio-diversity in lac production system are also changing. It has been observed that those species which were prevalent earlier in lac ecosystem on different lac host trees has now been replaced by new species as well as those species which were not recognized as economically injurious have now assumed the status of serious pest. Regular monitoring of the pest dynamics associated with the host plants of lac insect will be required.

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