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SPECIES COMPLEX OF LEAF ROLLER INFESTING LITCHI (*LITCHI CHINENSIS* SONN.) IN WEST BENGAL WITH THEIR SEASONAL INCIDENCE

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ABSTRACT

An experiment was conducted at Fruit Research Station, Mandauri, Bidhan Chandra Krishi Viswavidyalaya with a view to rule out the leaf roller species complex associated with litchi (*Litchi chinensis*) in West Bengal. The result revealed that three species namely litchi leaf roller, *Gatesclarkeana* sp. (Lepidoptera: Tortricidae); leaf webber, *Dudua aprobola* Meyrick (Lepidoptera: Tortricidae); litchi leaf roller, *Statherotis leucaspis* Meyrick (Lepidoptera: Tortricidae) were associated with the crop and hence their seasonal incidence and interaction with abiotic factors have also been studied. Among the species *Gatesclarkeana* sp. was found least abundant and occasionally observed during fruiting season while *Dudua aprobola* observed only in copper leaf stage or in soft tender leaves. *Statherotis leucaspis* was observed as most dominant species in basin of West Bengal which has not yet been reported from the state. The pest remained very active from 26th standard meteorological week and continued upto 47th standard week. Interestingly the same pest was observed during panicle initiation stage to flowering stage, attacking the panicle (maximum 23.75%) which led direct yield loss.

Key words: *Litchi chinensis*, Tortricidae, leaf roller, *Gatesclarkeana* sp., *Dudua aprobola*, *Statherotis leucaspis*

Litchi (*Litchi chinensis* Sonn) is an important subtropical evergreen fruit crop belonging to family Sapindaceae. India secured second position in litchi production after China, with an area and production of approx. 95,000 ha and 7, 27,000 MT respectively during 2018-19 (NHB database, 2018). Bihar, Jharkhand, West Bengal and Tripura are the major litchi growing states in India and contribute almost 85% of the total litchi production in the country. Like other crops, the biotic and abiotic stress are the limiting factors in litchi production where insect pests are the major biotic constraints (Mathur and Tandon, 1974; Butani, 1979) reported more than 40 insect and mite species used to attack litchi at different stages of plant growth and fruiting. However, from last 20 years litchi fruit borer (*Conopomorpha* sp.) and litchi leaf roller (*Dudua aprobola*) have acquired the status of major pests of litchi in some states of India (Kumar et al., 2011; Choudhary et al., 2013; Kumar et al., 2013).

The status of litchi in West Bengal depicted that litchi is preferred by the people of West Bengal because of their attractive colour, flavour and juicy nature. There is no doubt that the litchi fruit borer (*Conopomorpha* sp.) is a major limiting factor of litchi production in West Bengal but apart from this pest, a number of insects were observed causing direct or indirect crop loss. There are very limited literature available on status of insect pests of litchi in West Bengal where only the fruit borer *Conopomorpha* sp was mentioned. During the present survey it was observed that a number of species were associated with litchi leaves and causing symptom of leaf roll or fold or web. These species directly or indirectly cause economic loss to the crop and remain active almost throughout the year and keeping these information in mind the present research work was formulated with a target to best bit the insect species causing leaf roll or fold or web in litchi of west Bengal with their seasonal incidence and relationship with abiotic factors. This research findings will enrich the present status of litchi insect pests in West Bengal.

MATERIALS AND METHODS

An experiment was undertaken in experimental field of litchi under All India Coordinated Research Project on Fruits at Mandauri, Mohanpur, Nadia during 2020 and 2021 to study the seasonal occurrence and impact of weather parameters with litchi leaf roller species. The experimental field location was 22.56˚ N and 88.32˚E. Ten well managed litchi trees, of 7-8 years old were selected for the experiment purpose where all the trees were kept unsprayed condition to provide better environment for the pest multiplication. 10 twigs from

each side i.e. east, west north and south were tagged for recording the data. A total 40 twigs were selected and out of which 10 leaves/ twig were considered for recording data. The data were taken at weekly interval to rule out the incidence of insect species causing leaf roll, fold and web. The percent leaf infestation was calculated by using formula (Charak et al., 2020). In order to study the effect of weather parameters on pests incidence, the data of physical factors of environment viz rainfall (RF), wind speed (WS), maximum (MaxT) and minimum (MinT) temperature, relative humidity (RH) were correlated. Standard Week-wise data on various parameters were recorded from the portal Crop Weather Outlook, All India Coordinated Research Project on Agrometeorology (AICRPAM). The periodic mean incidence of the pests were worked out and the values of individual year were pooled and used for discussing seasonal occurrence of insect pests. Simple correlation and multiple regression analysis were worked out between various leaf roller species using their weekly mean damage and data analysis was done using software SPSS version 21.

RESULTS AND DISCUSSION

The experimental result revealed that three species of tortrix leaf roller or folder or webber causing damage to the crop namely *Gatesclarkeana* sp. (Lepidoptera: Tortricidae); Leaf Webber, *Dudua aprobola* Meyrick (Lepidoptera: Tortricidae); Litchi Leaf Roller, *Statherotis leucaspis* Meyrick (Lepidoptera: Tortricidae). Among them *Statherotis leucaspis* was found most dominant species during present investigation and mentioned for the first time as pest from West Bengal. However, Chakraborty and Samanta (2005) reported *D. aprobola* as major pest of litchi in West Bengal. So, it may be replacement of the species *D. aprobola* by similar species *Statherotis leucaspi* belonging to same family (Tortricidae).

Gatesclarkeana sp. also commonly named as tortrix leaf roller and found associated with litchi leaf at copper leaf stage. The species was observed active from 25th standard week to 39th standard week (Fig. 1). This species was observed least abundant species among all the leaf roller species recorded. 1.5% of leaf sample was found infested during 25th standard meteorological week while in 26th standard week incidence increased to 1.75% and there after the population was declined and observed occasionally after 39th standard meteorological week. The forewing of adult moth was dark brown, rugose with few micro spots while the hind wing was transparent.

The abiotic variables or weather parameters showed positive and negative correlation with the damage of *Gatsclarkeana* sp. The experimental result revealed non-significant relationship with all the weather parameters except evening relative humidity which showed significant positive correlation (r= 0.404**) (Table 1) with the pest damage. The equation of multiple regression indicated that increase in one unit of maximum temperature, minimum temperature, morning relative humidity, evening relative humidity and rainfall resulted with increase of pest damage by 0.012, 0.012, 0.011, 0.011, 0.003 while with the increase of one unit

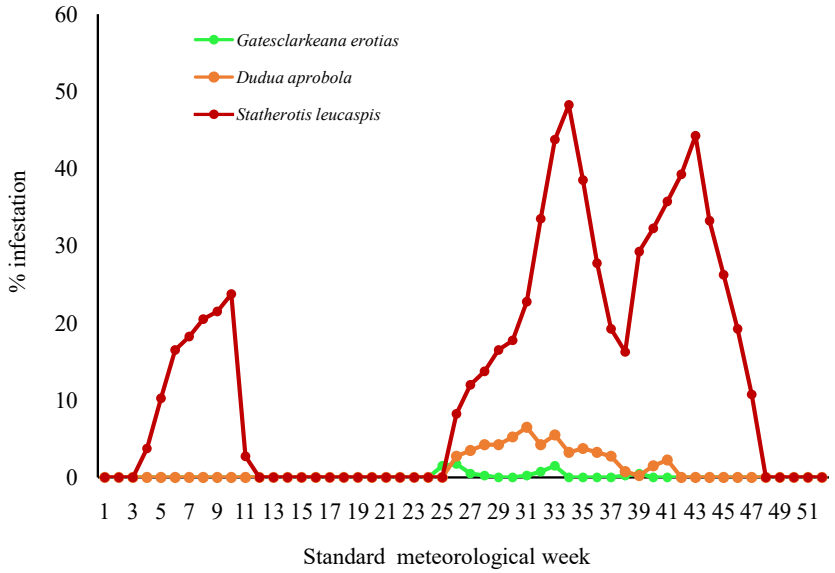

Fig. 1. Seasonal incidence of leaf roller species of litchi in West Bengal

Table 1. Correlation coefficient (r) between weather parameters and leaf roller species of litchi in West Bengal

Variables	Temperature		Relative humidity		Rainfall	Sunshine	Wind speed
	Max	Min	Morning	Evening			
Gatesclarkeana sp.	0.125^{NS}	0.182^{NS}	0.248^{NS}	0.404^{**}	0.073^{NS}	0.056^{NS}	-0.071^{NS}
Dudua aprobola	0.336^{*}	0.296^{*}	0.498^{**}	0.363^{**}	0.468^{**}	0.598^{**}	-0.053^{NS}
Statherotis leucaspis	0.247^{NS}	-0.002^{NS}	0.611^{**}	0.194^{NS}	0.493^{**}	0.658^{**}	-0.155^{NS}

Table 2. Multiple regression equation of weather parameters and leaf roller species of litchi in West Bengal

Variable (Y)	Multiple regression analysis	R^2 value
Gatesclarkeana sp.	$Y = -2.034 + 0.012 (X_1) + 0.012 (X_2) + 0.011 (X_3) + 0.011 (X_4) + 0.003 (X_5) – 0.002 (X_6) -0.014 (X_7)$	0.237
Dudua aprobola	$Y = -8.094 + 0.010 (X_1) + 0.062 (X_2) + 0.050 (X_3) + 0.027 (X_4) + 0.002 (X_5) + 0.110 (X_6) + 0.013 (X_7)$	0.514
Statherotis leucaspis	$Y = -123.280 -0.127 (X_1) + 0.113 (X_2) + 1.623 (X_3) – 0.301 (X_4) + 0.043 (X_5) + 0.688 (X_6) -0.963 (X_7)$	0.585

of other abiotic factors such as sunshine hours and wind speed resulted with decrease of pest damage by 0.002 and 0.014 respectively (Table 2).

D. aprobola which is commonly known as litchi leaf webber was observed at copper leaf stage and the larvae concealed themselves in between folded leaves. The forewing of adult moth with colour ranging from an overall brownish shade to dark greyish-blue with blackish spots while the hind wing is greyish. The species was found restricted to copper leaves only and never observed at fruiting stage. The incidence of pest was started in 26th standard week and remain active up to 41st standard week with peak incidence during 31st standard week (6.5%) to 33rd standard week (5.5%) and there after incidence decreased. Ray and Mukherjee (2013) observed maximum population during July-February while in present study maximum population observed during July- August and remain upto October which is in support to the previous investigators; Chakraborty and Samanta (2005) also reported that the litchi leaf roller, *D. aprobola* Meyrick is one of the economically important pests causes severe damage to litchi foliage in Bihar, Uttar Pradesh and West Bengal which contradict with the present finding where *S. leucaspis* was recorded as major pest causing economic damage.

The result of influence of abiotic factors on pest incidence depicted that all the abiotic factors such as maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, rainfall showed significant positive relationship (r = 0.336, 0.296, 0.498, 0.363, 0.468, 0.598, respectively) (Table 1) with the pest damage except wind speed which showed non-significant negative relationship (-0.053). The result of regression equation represented that with increase of one unit of maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, rainfall, wind speed the pest damage incidence increased by 0.010, 0.062, 0.050, 0.027, 0.002, 0.110, 0.013 (Table 2).

S. leucaspis which is commonly known as litchi leaf roller become a threat to litchi production in West Bengal. During the study period, it was observed that this species *S. leucaspis* was the most dominant species in fruit research station, Mandauri, Nadia, and West Bengal. The adult moth with black coloured forewing decorated with a greyish yellow spot while the hind wing is greyish. The pest incidence was observed in 26th standard week and continued up to 47th standard week with peak incidence during 33rd and 34th standard week (43.75 and 48.25, respectively). After 47th standard week the pest was not observed in the field, however, another peak incidence was observed at panicle initiation stage (Fig. 1). More than 20% panicles were found infested with this peat from 8th to 10th standard week (20.5, 21.5, and 23.75% respectively) and thereafter very interestingly the pest was almost disappeared from the field. Randhawa et al., (2015) reported 81 per cent damage to the new growth/ flush in District Gurdaspur and later on in 2016 Singh and Kaur again recorded its severity during June-September 2015 at FRS, Gangian and Mukerian in District Hoshiarpur. However, this insect was never mentioned as a pest of litchi from West Bengal and in this paper for the first time the pest is mentioned and observed that it could become a threat to litchi production in West Bengal

the pest not only causing damage to new flush but also cause a severe damage to panicle.

S. leucaspis or litchi leaf roller showed significant positive relationship with the morning relative humidity, rainfall and sunshine hours (r= 0.611, 0.493, 0.658, respectively) while maximum temperature, evening relative humidity showed non-significant positive correlation with pest incidence, however minimum temperature and wind seed showed non-significant negative relation (Table 1). The equation of regression analysis indicated that with increase of one unit of minimum temperature, morning relative humidity, rainfall, sunshine hours the pest damage increased by 0.113, 1.623, 0.043, 0.688 while with increase of one unit of maximum temperature, evening relative humidity and wind speed the pest damage incidence decreased by 0.127, 0.301, 0.963 (Table 2).

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AUTHOR CONTRIBUTION STATEMENT

The senior author planed the experiment, taken data, analysed and prepared the manuscript while D. Majhi, K. Chakraborti and D. Misra helped inexecution of work, data collection and preparation of manuscript.

CONFLICT OF INTEREST

No conflict of interest.

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