

## STATUS AND POPULATION DYNAMICS OF BANANA LEAF ROLLER, *ERIONOTA TORUS* EVANS IN HILL ECOSYSTEM OF UTTARA KANNADA, KARNATAKA, INDIA

Shreedhar Chatter\*, Roopa S. Patil<sup>1</sup>, H. Basappa<sup>2</sup> and Akkamahadevi Agasimani<sup>3</sup>

Department of Agricultural Entomology, College of Agriculture, Dharwad - 580 005, India.

<sup>1</sup>ICAR, KVK, Sirsi - 581 407, India.

<sup>3</sup>ICAR, KVK, Dharwad - 580 005, India.

University of Agricultural Sciences, Dharwad - 580 005, India.

<sup>2</sup>Principal Scientist, ICAR - IIOR, Hyderabad, Telangana - 500 030, India.

\*e-mail: shridharchatter0705@gmail.com

(Received 27 February 2020, Revised 30 May 2020, Accepted 7 June 2020)

**ABSTRACT :** The study was conducted mainly to know the status of banana leaf roller which created havoc in coastal and malnad regions Karnataka from 2012 to 2014. Roving survey for banana leaf roller carried out in hill ecosystem of Uttar Kannada district viz., Sirsi, Yellapur, Mundgod, Siddapur taluks revealed that the higher incidence was recorded in Yellapur taluk (43.06%) whereas, lowest was recorded in Mundgod taluk (23.20%). Among the two fixed plot studies, the highest per cent of infestation was recorded during the second fortnight of November 2017. In Sirsi, the infestation of banana leaf roller was 58.67 and 18.00 per cent in Ney Poovan and Grand Naine cultivar, respectively. Only in Ney Poovan cultivar infestation was recorded up to 39.67 per cent in Mundgod. An egg parasitoids *Ooencyrtus pallidipes* and a pupal parasitoid *Xanthopimpla* spp., an ant predator (*Oecophylla smaragdina*) and two avian predators (both house crow and crow pheasant) were recorded as biocontrol agents against this insect pest. The avian predators recorded during the studies were more effective than any other natural enemies in reducing the banana leaf roller population.

**Key words :** Banana leaf roller, Grand Naine cultivar, Ney Poovan cultivar, per cent infestation, population dynamics.

### INTRODUCTION

Banana, *Musa* species are very important tropical fruit crop origin to South-East Asia and Western Pacific regions. It serves as food and their leaves play an important role as biological plates. The world's largest producers of banana in 2016 were India with the production of 29.50 MT and China with 11.00 MT, which together accounted for 28 per cent of total production (Anonymous, 2016). Overall, 470 species of insects and mites recorded globally on banana as major and minor pests, among them 250 feed on foliage. Among the different defoliators on banana, leaf roller, *Erionota torus* Evans is a serious defoliator. The leaf roller also is known by its other names like as banana skipper, red palm eye, Sikkim palm red-eye etc., the roller is more often observed in South-East countries and initially, in India, it was restricted to North-East region, but later spread to Southern parts of the country states like North Kerala, Coimbatore, Southern parts of Karnataka and from Andaman and Nicobar Islands (Veenakumari and Mohanraj, 1991).

In Karnataka, the pest outbreak was reported during the year 2012-2014 from Coastal belts (Dakshina

Kannada, Udupi and Uttar Kannada) and then spread to Malnad regions (Sharanabasappa *et al*, 2016). *Musa paradisiaca* cv. Puttabale (AB group) is the most popular indigenous cultivar in Malnad and Coastal regions of Karnataka. The current changing climate scenarios would have helped the pest to extend its range towards the South confirming the geographical expansion. The possible dispersal mechanisms of this skipper may be (a) flight of adults, (b) transportation of eggs or neonate larvae across borders along with the leaves, used for wrapping, (c) attraction to lights in boats and loading air-crafts. Recently, a few egg masses have been found on bunches and this could also be a potential dispersal method (Okolle, 2006). The larvae are voracious feeders and as the larvae grow, the size of rolls also changes so as to accommodate the growing larva. The white protective and waxy powdery substance secreted on the larval body is believed to be a by-product of metabolism (Waterhouse *et al*, 1998). The leaf roller is relatively new to the hill ecosystem of Uttara Kannada region and little is known about its pest status. Hence, the study was undertaken to know the present scenario of pest incidence of banana roller in this region.

## MATERIALS AND METHODS

### Roving survey

The roving survey was carried out in Sirsi, Mundgod, Siddapur and Yellapur taluks of Uttara Kannada district from October to December 2017. In each taluk, three villages were selected covering five farmers per village. Visual observations were recorded looking to the symptoms of leaf roll. As the number of plants in the different field varied in the survey area, observations was made uniformly *i.e.* on 50 plants.

During the survey, information on the name of the farmer, area of the plantation, crop stage, varieties grown, the total number of plants infested, number of leaves infested per plant, no. of rolls of larvae or pupae per leaf, length of leaf used for the pupal case were recorded. Plants with at least one leaf roll per leaf was considered to be infested. The percent infestation was calculated by using the following formula,

$$\text{Infestation (\%)} = \frac{\text{Number of plants infested}}{\text{Total number of plants observed}} \times 100$$

### Fixed plot survey

It was carried out in farmer's field in Mundgod and Sirsi taluk on two varieties *viz.*, Ney Poovan and Grande Naine variety during 2017-18. The methodology suggested by Okolle *et al* (2006) was followed to study the population dynamics of banana leaf roller and associated natural enemies if any. Growing Ney Poovan as an intercrop in areca nut plantation and Grande Naine as a sole crop is a very common practice in Uttara Kannada district.

Sampling procedures were done at fortnightly intervals starting from 15 days after planting till the harvest of the main crop. Observations on the number of plants infested were recorded by observing 60 plants individually, from four different spots in the field (15 plants were selected from each spot). In the infested plants, the total number of leaves with rolls (larvae) and in each leaf, the total number of leaf rolls were counted. Also, natural enemies collected from the field were preserved in 70 per cent alcohol and sent for identification to Dr. Sharanabasappa Deshmukh, Assistant Professor, Department of Agricultural Entomology, UAHS, Shivamogga.

## RESULTS AND DISCUSSION

### Roving survey

Among the surveyed taluks, Yellapur recorded the highest mean per cent infestation (43.06%) of banana leaf roller followed by Sirsi (40.53%), Siddapur (32.93%) and Mundgod taluk (23.20 %) (Table 1). The number of

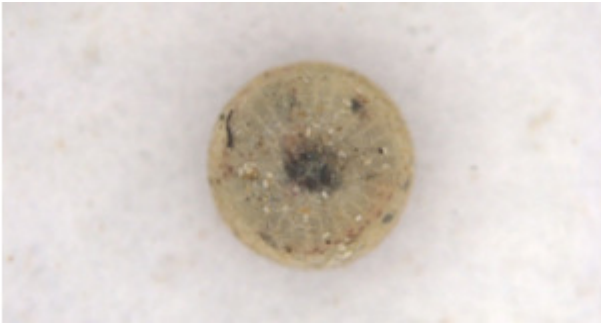
infested plants varied from 4 to 29 from 50 sampled plants. The number of leaves infested per plant ranged from 1 to 7. The length of the leaf used for the roll ranged between 15.4 to 45.2 cm and the height of roll ranged between 14.1 to 18.2 cm for the pupal case. In general, the highest mean numbers of eggs, earlier and later larval stages were recorded from the pre-flowering stage (Fig. 1) probably because: (i) pre-flowering stage is found below BP (bunched plants), FP (flowering plants) and above BLF (broad-leaf follower), NLF (narrow-leaf



Fig. 1 : Banana plant severely infested by of banana leaf.

Table 1 : The infestation of banana leaf roller *Erionota torus* on banana plantation in Uttar Kannada.

S. No.	Taluk	Village Name	Per cent infestation
1	Sirsi	Kulve	42.40
		Unchalli	36.00
		Tataguni	43.20
	<b>Mean</b>		<b>40.53</b>
2	Yellapur	Kerehosalli	41.20
		Manchikeri	45.20
		Kavadikere	42.80
	<b>Mean</b>		<b>43.06</b>
3	Mundgod	Koppa	21.20
		Pala	32.80
		Chigalli	15.60
	<b>Mean</b>		<b>23.20</b>
4	Siddapur	Harsikatta	25.20
		Unchalli	36.40
		Kansur	37.20
	<b>Mean</b>		<b>32.93</b>



**Fig. 2 :** Banana leaf roller egg parasitized by *Ooencyrtus pallidipes*.



**Fig. 3 :** Adult *Ooencyrtus pallidipes*.



**Fig. 4 :** Banana leaf roller pupa parasitized by *Xanthopimpla* spp.

follower) and therefore covered by the larger leaves of these stages, which provide a suitable microclimate favourable for female adult oviposition; (ii) increased mortality of young instars since the entry of water into leaf rolls after heavy rainfall has been reported to cause



**Fig. 5 :** Adult *Xanthopimpla* spp. emerged from host pupa.



**Fig. 6 :** Weaver ant (*Oecophylla smaragdina*) predated on banana leaf roller larva.



**Fig. 7 :** Roll of banana leaf roller showing the typical symptom of bird predation.

the drowning of young instars (Gold *et al*, 2002). Since the pre-flowering stage is protected from heavy rains by the taller and larger growth stages, the adult female could have possibly learned to prefer the pre-flowering stage for oviposition as a strategy to ensure better survival of larvae during rainy periods. The results are in line with the findings of Sivakumar *et al* (2014).

In Uttara Kannada district predominantly the areca nut based cropping system is followed and the incidence of banana leaf roller was as high as 34 per cent as

**Table 2** : Population dynamics of *Erionota torus* on banana cv. Ney Poovan (AB) as an intercrop in areca nut plantation (Sirsi).

Period	Stage of the crop	Infestation of plant (%)	No. of leaves affected/ plant	No. of closed rolls/ leaf
1 <sup>st</sup> FN June 17	Narrow-leaf followers (Up to two months)	-	-	-
2 <sup>nd</sup> FN June 17		-	-	-
1 <sup>st</sup> FN July 17		-	-	-
2 <sup>nd</sup> FN July 17		3.67	0.40	1.20
1 <sup>st</sup> FN August 17		5.33	0.80	2.40
2 <sup>nd</sup> FN August 17		9.67	1.20	3.00
1 <sup>st</sup> FN September 17	Broad-leaf followers (3-4 months)	13.33	2.00	3.80
2 <sup>nd</sup> FN September 17		20.67	3.40	4.80
1 <sup>st</sup> FN October 17		29.00	4.80	6.60
2 <sup>nd</sup> FN October 17		39.33	6.60	7.40
1 <sup>st</sup> FN November 17	Pre-flowering period (5-7 months)	48.00	7.80	8.20
2 <sup>nd</sup> FN November 17		58.67	8.60	9.60
1 <sup>st</sup> FN December 17		45.33	7.00	8.80
2 <sup>nd</sup> FN December 17		36.67	5.40	7.80
1 <sup>st</sup> FN January 18		18.00	4.20	7.20
2 <sup>nd</sup> FN January 18		6.67	1.20	1.80
1 <sup>st</sup> FN February 18	Flowering period (8-11 months)	-	-	-
2 <sup>nd</sup> FN February 18		-	-	-
1 <sup>st</sup> FN March 18		-	-	-
2 <sup>nd</sup> FN March 18		-	-	-
1 <sup>st</sup> FN April 18		-	-	-
2 <sup>nd</sup> FN April 18		-	-	-
1 <sup>st</sup> FN May 18	Harvesting	-	-	-
2 <sup>nd</sup> FN May 18		-	-	-
<b>Mean</b>		13.93	2.23	3.03

compared to sole crop i.e. 12 per cent. Similar observations were also made by Javaregowda *et al* (2016). It was also noticed that, the adult female banana leaf roller lays eggs during the dusk or early dark in the group on the lower side of the leaves. The preference for the intercropping system may be because of enough space the adult butterfly will get for its movement unlike in banana cultivated as a sole crop and also the presence of shade. Another reason for this may be in sole banana plantation the leaves are exposed to the strong wind which leads to the tearing of the leaves. The torn leaves are unfit for the construction of rolls. Amongst the above-cited reasons weather is an important factor playing a major role directly and also indirectly. As per Gold *et al* (2002), heavy rainfall and strong winds are highly unsuitable conditions for banana leaf roller as water in leaf rolls drowns young instars and wind-torn leaves are unsuitable for construction of leaf rolls.

### Fixed plot survey

The fixed plot survey studies revealed that in Ney Poovan cultivar the infestation ranged from 3.67 to 58.67 per cent and 2.33 to 39.67 per cent in Sirsi (Table 2) and Mundgod (Table 4), respectively. The peak incidence was recorded during the second fortnight of November 2017. The number of leaves affected per plant ranged between 0.40 to 8.60 in Sirsi and 0.40 to 7.20 in Mundgod.

The per cent infestation in Grande Naine cultivar ranged from 3.33 to 18.00 in Sirsi. The number of leaves affected per plant ranged from 0.40 to 4.60 (Table 3). In Mundgod there was no infestation of banana leaf roller on Grande Naine cultivar. The main reason for this may be due to the direct exposure of plants to rainfall, sunlight and wind. The Grande Naine cultivar planted in Sirsi were surrounded by the tall forest trees on the border, which may prevent the wind damage to the banana leaves. The

**Table 3** : Population dynamics of *Erionota torus* on banana cv. G9 as a sole crop (Sirsi).

Period	Stage of the crop	Infestation of plant (%)	No. of leaves affected/ plant	No. of closed rolls/ leaf
1 <sup>st</sup> FN June 17	Narrow-leaf followers (Up to two months)	-	-	-
2 <sup>nd</sup> FN June 17		-	-	-
1 <sup>st</sup> FN July 17		-	-	-
2 <sup>nd</sup> FN July 17		-	-	-
1 <sup>st</sup> FN August 17	Broad-leaf followers (3-4 months)	3.33	0.40	1.20
2 <sup>nd</sup> FN August 17		5.67	0.80	1.80
1 <sup>st</sup> FN September 17		7.00	1.00	2.20
2 <sup>nd</sup> FN September 17		8.67	1.60	2.60
1 <sup>st</sup> FN October 17		12.33	2.40	3.20
2 <sup>nd</sup> FN October 17		14.67	3.60	4.20
1 <sup>st</sup> FN November 17		16.33	3.80	5.20
2 <sup>nd</sup> FN November 17		18.00	4.60	5.80
1 <sup>st</sup> FN December 17	Pre-flowering period (5-7 months)	13.33	2.60	4.40
2 <sup>nd</sup> FN December 17		7.00	1.80	2.60
1 <sup>st</sup> FN January 18	Flowering period (8-11 months)	4.67	0.40	1.40
2 <sup>nd</sup> FN January 18		-	-	-
1 <sup>st</sup> FN February 18		-	-	-
2 <sup>nd</sup> FN February 18		-	-	-
1 <sup>st</sup> FN March 18		-	-	-
2 <sup>nd</sup> FN March 18		-	-	-
1 <sup>st</sup> FN April 18		-	-	-
2 <sup>nd</sup> FN April 18		-	-	-
1 <sup>st</sup> FN May 18	Harvesting	-	-	-
2 <sup>nd</sup> FN May 18		-	-	-
<b>Mean</b>		4.47	0.96	1.52

banana plants at pre-flowering stage in both the cultivar were found more vulnerable followed by broad leaf follower stage compare to the other stages of crop.

#### Natural enemies

During the survey, two parasitoids were recorded *i.e.* *Ooencyrtus pallidipes* (an egg parasitoid) (Figs. 2 and 3) and *Xanthopimpla* spp. (pupal parasitoid) (Figs. 4 and 5). Among three predators, one belongs to Hymenoptera (Weaver ant - *Oecophylla smaragdina*) (Fig. 6) and two avian predators (House crow - *Corvus splendens* and Crow pheasant - *Centropus sinensis*). Birds activity can be easily identified as they feed on larvae and pupae of banana leaf roller by tearing leaf rolls from one side (Fig. 7). Predation by birds was found very effective in reducing the pest population which necessitated least insecticidal sprays against this pest. Moreover, in many parts of Karnataka banana leaves are used as plates.

#### CONCLUSION

The study had provided vital information about the current scenario of the infestation of recently introduced pest- banana leaf roller. The peak per cent infestation of the roller was recorded during the second fortnight of November 2017 in areca nut based cropping system. The avian predators (both house crow and crow pheasant) were found more effective than any other natural enemies in reducing the population of banana leaf roller. The ant predator was found more in areca nut + banana + cocoa plantation compared to areca nut + banana plantation. These natural enemies help to avoid the chemical measures against the roller and thus they help farmers to reduce the input cost.

#### ACKNOWLEDGEMENTS

The authors duly acknowledge Dr. Sharanabasappa Deshmukh, Assistant Professor, Department of

**Table 4 :** Population dynamics of *Erionota torus* on banana cv. Ney Poovan (AB) as an intercrop in areca nut plantation (Mundgod).

Period	Stage of the crop	Infestation of plant (%)	No. of leaves affected/ plant	No. of closed rolls/ leaf
1 <sup>st</sup> FN June 17	Narrow-leaf followers (Up to two months)	-	-	-
2 <sup>nd</sup> FN June 17		-	-	-
1 <sup>st</sup> FN July 17		-	-	-
2 <sup>nd</sup> FN July 17		2.33	0.40	1.20
1 <sup>st</sup> FN August 17		4.33	0.80	1.50
2 <sup>nd</sup> FN August 17		6.00	1.20	1.80
1 <sup>st</sup> FN September 17	Broad-leaf followers (3-4 months)	10.67	1.80	2.40
2 <sup>nd</sup> FN September 17		18.67	3.40	4.80
1 <sup>st</sup> FN October 17		25.00	4.00	5.40
2 <sup>nd</sup> FN October 17		28.67	5.20	6.60
1 <sup>st</sup> FN November 17	Pre-flowering period (5-7 months)	33.33	6.40	7.80
2 <sup>nd</sup> FN November 17		39.67	7.20	8.20
1 <sup>st</sup> FN December 17		28.00	5.60	6.80
2 <sup>nd</sup> FN December 17		22.67	3.80	5.20
1 <sup>st</sup> FN January 18		14.67	3.60	4.80
2 <sup>nd</sup> FN January 18		8.33	1.80	3.40
1 <sup>st</sup> FN February 18	Flowering period (8-11 months)	-	-	-
2 <sup>nd</sup> FN February 18		-	-	-
1 <sup>st</sup> FN March 18		-	-	-
2 <sup>nd</sup> FN March 18		-	-	-
1 <sup>st</sup> FN April 18		-	-	-
2 <sup>nd</sup> FN April 18		-	-	-
1 <sup>st</sup> FN May 18	Harvesting	-	-	-
2 <sup>nd</sup> FN May 18		-	-	-
<b>Mean</b>		10.09	1.90	2.50

Agricultural Entomology, UAHS, Shivamogga, Karnataka, India for providing valuable suggestions and for natural enemy identification.

### REFERENCES

- Anonymous (2016) www.fao.org.
- Gold C S, Pinese B and Pena J E (2002) Pests of bananas. In: *Tropical Fruit Pests and Pollinators, Biology, Economic Importance, Natural Enemies and Control* (Jorge E P, Jennifer L S and Wysoki M eds.), CABI pub., Wallingford, Oxfordshire, United Kingdom, pp. 13-25.
- Javaregowda, Roopa S P and Basappa H (2016) Outbreak of skipper, *Erionota thrax* L. (Hesperiidae: Lepidoptera) in Uttara Kannada district, Karnataka. In: *National Symposium on Behavioural Ecology and Management of Agriculturally Important Insects and Other Animals*, 27-28 December 2016, University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka, India, pp. 30-31.
- Okolle J N (2006) Population dynamics, within-field and within-plant distribution of the banana skipper (*Erionota thrax* L.) (Lepidoptera: Hesperiidae) and its parasitoids in Penang, Malaysia. *Ph. D. Thesis*, School of Biological Sciences, Science University of Malaysia.
- Okolle J N, Mansor M and Abu H A (2006) Spatial distribution of banana leaf roller (*Erionota thrax* L.) (Hesperiidae: Lepidoptera) and its parasitoids in a Cavendish banana plantation, Penang, Malaysia. *Insect Sci.* **13**, 381-389.
- Sharanabasappa, Kalleshwara C M, Nagarajappa A and Lavanya M N (2016) Population dynamics and natural enemies of *Erionota torus* Evans (Hesperiidae: Lepidoptera) on two cultivars of banana in Karnataka. *Pest Manage. Hortic. Ecosyst.* **22**(1), 34-39.
- Sivakumar T, Jiji T and Anitha N (2014), Field observations on banana leaf roller *Erionota thrax* L. (Hesperiidae: Lepidoptera) and its avian predators from southern peninsular India. *Curr. Biotica* **8**(3), 220-227.
- Veenakumari K and Mohanraj K (1991) *Erionota thrax* L. (Lepidoptera: Hesperiidae), a new record to Andaman Islands. *J. Andaman Sci. Assoc.* **7**, 91-92.
- Waterhouse D F, Birribi D and David V (1998) Economic benefits to Papua New Guinea and Australia from biological control of banana skipper (*Erionota thrax*). *Biol. Control* **12**(2), 87-94.