



Research Article

Studies on natural enemies of Pink pineapple mealybug, *Dysmicoccus brevipes* (Cockerell) (Hemiptera: Pseudococciade) in Kerala

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ABSTRACT: Purposive survey was conducted to document the natural enemies associated with *Dysmicoccus brevipes* in pineapple growing areas of Kerala. The survey was carried out between January to May 2016 at monthly intervals. Infested fruits were collected from pineapple fields and observed for natural enemies. The natural enemies recorded included four predators [*Spalgis epeus* (Westwood), *Cacoxenus perspicax* (Knab) and two species of *Scymnus* which are yet to be identified], one parasitoid (*Chartocerus* sp.) and the fungus *Aspergillus* sp.

KEY WORDS: *Dysmicoccus brevipes*, parasitoid, predator, *Spalgis epeus*

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INTRODUCTION

Pink pineapple mealybug, *Dysmicoccus brevipes* is reported as serious pest of pineapple in (KAU, 2002). It is also found infesting various crops viz., the roots and basal stem region of pepper (Devasahayam *et al.*, 2009), rhizome of white ginger flower, *Hedychium coronarium* Koenig (Hernandez and Martinez, 2012) on Arecanut (*Areca catechu* L.) (Basavaraju *et al.*, 2013). Apart from direct damage, it also causes indirect damage by transmitting two types of viruses namely Pineapple Mealybug Wilt associated virus-1 [PMWaV-1] and Pineapple Mealybug Wilt associated virus-2 [PMWaV-2] (Sether *et al.*, 2001). Infested plants show the symptoms of yellowing of leaves, stunting, wilting and rotting of roots followed by reduced yield and low plant population (Bua *et al.*, 2013). Mealybugs are difficult to get controlled with chemicals since they are covered with wax coating. Management of mealybugs using of synthetic insecticides results in residual toxicity in fruits and may cause human health hazards. Therefore, adopting biological control measures is more appropriate. The objective of the present study is to identify the natural enemies associated with *D. Brevipes* in pineapple plantation.

MATERIALS AND METHODS

Selection of areas for the collection of natural enemies

Purposive survey was carried out in major pineapple

growing districts of Kerala viz., Ernakulam, Idukki and Thrissur. Among these districts, different locations were selected for the survey, depending on the extent of pineapple cultivation (Table 1) and GPS co-ordinates of the selected location were recorded. The survey was carried out at monthly intervals from January to May, 2016. Two infested fruits as well as plants along with the mealybugs were collected from the farmer's fields and observed for the presence of natural enemies like predators, parasitoids and diseased insect.

Table 1. Locations selected for conducting survey

Districts	Locations
Ernakulam	Kaloor, Kalloorkkad, Vazhakulam, Nadukkara, Peramangalam
Idukki	Kumaramangalam, Thodupuzha
Thrissur	Vellanikkara, Kootala, Poomala

Collection of natural enemies

Infested pineapple fruits and roots collected from the surveyed localities were examined for the presence of predators. The immature stages of predators were collected and reared to the adult stage. After the emergence of the adults, they were separated from polythene cover and preserved in alcohol (70%) and got identified. The predators got identified at the Department of Agricultural Entomology, College of Horticulture, Kerala Agricultural University,

Thrissur. Similar procedure was followed for the parasitoids also. After its emergence from parasitized mealybugs, the parasitoids collected were preserved in alcohol (70%). The preserved specimens were got identified from Aligarh Muslim University, Uttar Pradesh, India.

Identification of ant species associated with the *Dysmicoccus brevipes*

Ants were found associated with the mealybugs in pineapple fields under natural conditions. The ants were collected from the field and preserved in alcohol (70%). Specimens were got identified from St. Xavier’s College, Aluva.

Isolation of entomopathogenic fungus of *Dysmicoccus brevipes*

Mealybug samples from infested fruits collected from pineapple fields were observed for the presence of dead mealybugs. The mycosed mealybug specimens were removed using a fine camel hairbrush and surface sterilized with sodium hypochlorite (1%) solution for one minute and then washed three times with sterile distilled water. Then it was transferred aseptically to Petri dishes lined with moist filter paper and incubated at room temperature of (29±1°C) for two

days to observe for mycelial growth, if any. Once the fungal growth was visible externally, the specimens were carefully picked up with needle and kept in Petri dish of 8.5 cm diameter containing Potato Dextrose Agar medium (PDA). The Petri dishes were incubated at room temperature and examined daily for the growth of fungal mycelia.

Pathogenicity test

Pathogenicity test was carried out by spraying the spore suspension prepared from the isolated fungus on the healthy mealybug.

RESULTS AND DISCUSSION

Survey and documentation of natural enemies of *Dysmicoccus brevipes*

Samples collected from different locations of Ernakulam, Idukki and Thrissur consisted of four species of predators, a parasitoid and a fungus. Predators included *Cacoxenus perspicax* (Knab) (Drosophilidae: Diptera), *Spalgis epeus* (Westwood) (Lycaenidae: Lepidoptera), two species of *Scymnus* (Coccinellidae: Coleoptera), parasitoid, *Chartocerus* sp. (Signiphoridae: Hymenoptera) and the fungus *Aspergillus* sp. (Table 2).

Table 2. Presence of natural enemies in selected locations of Ernakulam, Idukki and Thrissur districts in Kerala

Districts	Location	GPS Co-ordinates	Natural enemies														
			January 2016			February 2016			March 2016			April 2016			May 2016		
			Pr	Pa	F	Pr	Pa	F	Pr	Pa	F	Pr	Pa	F	Pr	Pa	F
Ernakulam	Kaloor	9°59'49.524'' N 76°18'10.134'' E	Sc.	-	-	Sc	-	-	Sc	-	-	Sc	-	-	Sc	-	-
	Kalloorkkad	9°58'11.744'' N 76°40'18.743'' E	Sc, Sp	-	As	Sc, Sp	-	-	Sc	-	-	Sc, Sp	-	-	Sc, Sp	-	-
	Peramangalam	10°34'24.848'' N 76°10'10.844'' E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Nadukkara	9°56'26.056'' N 76°36'54.997'' E	Sc	-	-	Sc	-	-	Sc	-	-	Sc, C	-	-	Sc	-	-
	Vazhakulam	9°56'49.049'' N 76°36'9.241'' E	-	-	-	-	-	-	Sc	-	-	Sc	-	-	Sc	Ch	-
Idukki	Kumaramangalam	9°56'30.887'' N 76°42'58.810'' E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Thodupuzha	9°53'34.728'' N 76°43'19.589'' E	Sc	-	-	Sc	-	-	Sc	-	-	Sc, Sp	-	-	Sc, C	-	-
Thrissur	Kootala	18°27'38.290'' N 73°54'50.119'' E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Poomala	10°36'34.438'' N 76°14'2.558'' E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Vellanikkara (PRS)	10°32'42.770'' N 76°16'26.324'' E	Sc, Sp, C	Ch	As	Sc, Sp, C	-	As	Sc, C,	-	-	-	-	-	-	-	-

Pr-Predator, Pa-parasitoids, F-Fungus, Sc-*Scymnus* sp., Sp- *Spalgis epeus*, C- *Cacoxenus perspicax*, Ch- *Chartocerus* sp., A- *Aspergillus* sp.
GPS- Global Positioning System

Relative abundance of the natural enemies in different locations

Among different natural enemies collected from selected locations of Ernakulam, Idukki and Thrissur districts, *Scymnus* sp. was found to be the most abundant in all the six locations and it accounted for 68.75 per cent of the total natural enemies reported from all the locations (Table 3). It was followed by *Spalgis epeus*, which was reported in larger numbers only from three locations viz., Kalloorkkad, Thodupuzha and Vellanikkara with the occurrence of 37.5, 28.12 and 18.42 per cent, respectively. Similarly, *Cacoxenus perspicax* was also collected from three locations which includes Nadukkara (10%), Thodupuzha (9.37%) and Vellanikkara (21.05%). During the survey while, few numbers of parasitoid, *Chartocerus* sp. was observed and was reported from only in Vazhakulam and Vellanikkara.

Aspergillus sp. infection was noticed on *D. brevipipes* in Kalloorkkad and Vellanikkara. It appeared to be a chance infection. However, under laboratory condition the isolated *Aspergillus* sp. failed to cause infection when sprayed the same on the mealybugs.

Ants associated with *Dysmicoccus brevipipes*

Two species of ants, *Camponotus mitis* (Smith) (Formicidae: Formicinae) and *Technomyrmex albipes* (Smith) (Formicidae: Dolichoderinae) were found associated with *D. brevipipes* in the pineapple fields (Plate 13). These ants were collected from the mealybug infested pineapple plants of Nadukkara (Ernakulam district) and found tending the mealy bugs below the ground.

Survey and documentation of natural enemies of *Dysmicoccus brevipipes*

Among the total number of natural enemies collected from different locations of Ernakulam, Idukki and Thrissur district during January to May 2016, *Scymnus* sp. was the most abundant predator with 68.75 per cent relative abundance in all the locations (Table 3). Avre *et al.* (2011) observed that the increase in the population of *Scymnus coccivora* was proportional to the incidence of *Phenacoccus solenopsis* infesting on hibiscus plant commencing first fortnight of October (0.36 per 25 plants) and attaining the maximum during second fortnight of November (1.12/25 plants).

Incidence of *Spalgis epeus* was first recorded in *D. brevipipes* and it accounted for about 17.61 per cent of the total insect natural enemies collected from all the locations. Thangamalar *et al.* (2010) observed large number of *S. epeus* in the mulberry ecosystem infested by *Paracoccus marginatus* especially between June to October when other natural enemies were absent, while declined during October and November, when the presence of other natural enemies like *Cryptolaemus montrouzeiri* Mulsant and *Scymnus* sp. were abundant. This finding supports the reason for low population of *S. epeus* amidst high population of *Scymnus* sp. Cham *et al.* (2013) also reported high number of *S. epeus* in the papaya plantation infested with *P. marginatus* accounting for an average of 35 larvae between September 2010 to March 2011, whereas 80 per cent of *S. epeus* was collected during January and February. The minimum occurrence of *S. epeus* during the earlier months was due to the low incidence of mealybugs, *D. brevipipes*.

Table 3. Relative abundance of predators and parasitoid of *Dysmicoccus brevipipes* in selected locations of Ernakulam, Idukki and Thrissur districts

Location	Number of natural enemies	Number of predators			Number of parasitoid	Relative abundance of predators		Relative abundance of parasitoid	
		<i>Scymnus</i> sp.	<i>Spalgis epeus</i>	<i>Cacoxenus perspicax</i>		<i>Chartocerus</i> sp.	<i>Scymnus</i> sp.	<i>Spalgis epeus</i>	<i>Cacoxenus perspicax</i>
Kaloor	26	26	-	-	-	100	-	-	-
Kalloorkkad	40	25	15	-	-	62.5	37.5	-	-
Nadukkara	20	18	-	2	-	90	-	10	-
Vazhakulam	20	14	-	-	6	70	-	-	30
Thodupuzha	32	20	9	3	-	62.5	28.12	9.37	-
Vellanikkara	38	18	7	8	5	47.36	18.42	21.05	13.15
Total	176	121	31	13	11	68.75	17.61	7.39	6.25

The drosophilid predator, *Cacoxenus perspicax*, accounted for 7.39 per cent of the total insect natural enemies collected from few places viz., Nadukkara, Thodupuzha and Vellanikkara. Goolsby *et al.* (2002) also collected *C. perspicax* on the *Maconellicoccus hirsutus* from different location in Australia and found to be density dependent. Similarly, Sundararaj (2008) collected few numbers of *C. perspicax* from spherical mealybug, *Nipaecoccus viridis* infesting sandalwood.

Chartocerus sp., was also recorded (6.25%) from Vazhakulam and Vellanikkara. Beltra *et al.* (2012) recorded sporadic occurrence of about 0.9 per cent of *Chartocerus* sp. of the total number of parasitoid collected.

During the survey, two ant species viz., *Camponotus mitis* and *Techomyrmex albipes* were found symbiotically associated with *D. brevipes*. Similar association by *C. compressus* in arecanut plant infested with *D. brevipes* (Basavaraju *et al.*, 2013) and *Paracoccus marginatus* with *C. compressus* and *T. albipes* (Gowda *et al.*, 2013) were reported.

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