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Hymenopterous Parasitoids of the Rice Gall Midge, *Orseolia oryzae* (Wood-Mason) in the Maha Season in Sri Lanka

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Abstract
Hymenopterous parasitoid species and their parasitism rates were investigated in paddy fields of 11 districts in Sri Lanka including 3 districts located in the dry zone from late December, 1991 to mid-January 1992 during the Maha monsoon season. The same surveys were conducted during the Yala monsoon season in 1989 and the dry season just before the Maha season in 1990. Following 4 species were collected during the current and previous surveys; *Platygaster oryzae* (Cameron), *P. foersteri* (Gahan), Neanastatus cinctiventris Girault and *Obtusiclava oryzae* Subba Rao. On the other hand, samples of *Eurytoma* sp. which were collected for the first time in Sri Lanka in 1990, could not be obtained during this survey. *P. oryzae* was widely distributed throughout all the climatic zones and the mean value of 21% for the percentage of parasitism, which was the highest among the 4 species was comparable to that recorded during the previous surveys. Mean percentage of parasitism of *P. foersteri* was about 1%, next to that of the former species. The percentage of parasitism of these 2 parasitoid species decreased from the wet zone to the dry zone. For example, the percentage of parasitism of *P. oryzae* was about 31, 20 and 3% in the wet, intermediate and dry zones, respectively, presumably due to the difference in the population density of the rice gall midge in these zones. Namely, the rice gall midge may maintain higher population levels in the wet zone where rice plants are cultivated twice in rain-fed paddy fields during the Yala and Maha monsoon seasons due to the larger amount of precipitation than in the other zones.

Discipline: Insect pest
Additional key words: *Neanastatus cinctiventris, Obtusiclava oryzae, Platygaster foersteri, Platygaster oryzae*

Introduction

Hymenopterous parasitoids of the rice gall midge were surveyed in Sri Lanka from late December 1990 to late January 1991 during the Maha monsoon season, especially in the dry zone. Attempts were also made to collect additional samples of *Eurytoma* sp. for further

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taxonomic identification because only 2 samples of adults of the species had been collected for the first time in Sri Lanka in 1990. The same surveys were conducted during the monsoon season and at the end of the dry season, namely from mid-June to early July during the Yala monsoon season in 1989 and in October just before the Maha monsoon season in 1990. During the survey that covered a 2-year period, five species of Hymenopterous parasitoids were observed[4,5]. This paper presents the results of the third survey.

Materials and methods

Galls of the rice gall midge, *Orseolia oryzae* were collected at 22 sampling sites by random sampling in the 11 districts with different amounts of annual precipitation as indicated in Table 1[1].

The galls were split lengthwise with a sharply pointed forceps and the inside of the galls was examined under a binocular microscope to identify the parasitoids. Parasitoid larvae of pupae in the galls were carefully isolated in glass vials (15 × 40 mm) and reared until they reached the adult stage.

The parasitism rates by each parasitoid species were expressed by the ratios of the galls containing mummies, larvae or pupae to the total number of galls examined, as previously reported by Kobayashi et al.[4,5].

Table 1. Locations where galls of the rice gall midge were collected in different climatic zones

Climatic zone	Location		Annual precipitation[a] (mm)	Sampling date
	District	Village or town		
Wet zone	Matale	Ukuwela	1,270	Dec. 31, 1991
	Kandy	Yatawara	1,270	Dec. 31, 1991
		Ulapane	1,397	Jan. 16, 1992
		Peradeniya	1,397	Jan. 16, 1992
	Kalutara	Bombuwela	1,524	Jan. 9, 1992
		Delduwa	2,540	Jan. 9, 1992
		Milleniya	2,540	Jan. 9, 1992
	Galle	Labuduwa	1,524	Jan. 10, 1992
	Matara	Thihagoda	1,905	Jan. 10, 1992
	Ratnapura	Kahawatta	1,905	Jan. 11, 1992
	Kegalla	Rabukanna	1,905	Jan. 14, 1992
		Hingula	1,905	Jan. 14, 1992
Intermediate zone	Kurunegala	Batalagoda	1,016	Jan. 2, 1992
		Ibbagamuwa	1,016	Jan. 2, 1992
		Kathupota (2 sites)	1,016	Jan. 3, 1992
Dry zone	Anuradhapura	Maha Illuppallama (2 sites)	762	Jan. 6, 1992
	Polonnaruwa	Kaduruwela	762	Jan. 7, 1992
		Palugasdamna	762	Jan. 7, 1992
		Minneriya	762	Jan. 7, 1992
	Hambantota	Ambalantota	762	Jan. 11, 1992

a): 75% expectancy value of annual rainfall.

Table 2. Hymenopterous parasitoids of the rice gall midge, *Orseolia oryzae* observed in the Maha season (1991/1992) in Sri Lanka

Parasitoids	Distribution (Districts)[a]											No. of parasitoid samples
	Wet zone							Intermediate zone	Dry zone			
	Ma	Ka	Ke	Kl	Gl	Mt	Ra	Ku	An	Po	Ha	
P. oryzae	+	+	+	+	+	+	+	+	+	+	+	1,041[b]
P. foersteri	+	+	+	+		+		+			+	47[b]
N. cinctiventris				+			+	+			+	7[c]
O. oryzae							+				+	3[c]

a): Ma; Matale, Ka; Kandy, Ke; Kegalla, Kl; Kalutara, Gl; Galle, Mt; Matara, Ra; Ratnapura, Ku; Kurunegala, An; Anuradhapura, Po; Polonnaruwa, Ha; Hambantota.
b): No. of mummies containing pupae of the parasitoids.
c): No. of parasitoid pupae.

Results and discussion

During this survey, 4 species of hymenopterous parasitoids, *Platygaster oryzae* (Cameron), *P. foersteri* (Gahan), *Neanastatus cinctiventris* Girault and *Obtusiclava oryzae* Subba Rao were collected. These species had also been collected during the surveys conducted in the previous 2 years. However, *Eurytoma* sp. could not be detected in any of the samples collected presently.

P. oryzae was collected in all the 11 districts including 7 districts in the wet zone, 1 in the intermediate zone and 3 in the dry zone. One thousand forty-one mummies of the rice gall midge containing pupae of *P. oryzae* were collected during this survey.

A total of 47 mummies formed by *P. foersteri* were collected in 5 districts of the wet zone and 1 district each of the intermediate zone and dry zone.

Seven pupae of *N. cinctiventris* were collected in 4 districts, although about 40 to 70 individuals of *N. cinctiventris* had been collected in the previous 2 years. Only 3 pupae of *Obtusiclava oryzae* were collected in 2 districts (Table 2). The number of samples of this species collected during the previous surveys was also small ranging from 1 to 5 individuals.

The mean parasitism rate of *P. oryzae* was 21% in all the zones. This rate was the highest among the 4 parasitoid species, followed by *P. foersteri* (0.91%), *N. cinctiventris* (0.15%) and *O. oryzae* (0.1%). These results which indicated that *P. oryzae* was the predominant parasitoid of the rice gall midge in Sri Lanka were in agreement with those obtained during surveys conducted in the previous 2 years[4,5] (Tables 3 & 4).

Mean percentage of parasitism by *P. oryzae* showed the highest value of 30.5% in the wet zone, an intermediate value of about 20% in the intermediate zone and the lowest value of about 3% in the dry zone. Mean rate of parasitism by *P. foersteri* showed the highest value of about 1.5% in the wet zone, about 1% in the intermediate zone and 0.1% in the dry zone (Table 3).

Percentage of galls containing pupae of *N. cinctiventris* ranged from 0.1 to 0.2% in all the climatic zones. Mean percentage of galls containing *O. oryzae* was very low and ranged between 0–0.1% in the 3 zones (Table 4).

These results indicate that the percentage of parasitism by *P. oryzae* and *P. foersteri* was high in the wet zone and low in the intermediate and dry zones. Therefore, the relationship between the annual rainfall and percentage of parasitism by *P. oryzae* and *P. foersteri* was

Table 3. Proportion of galls containing the parasitoids, *P. oryzae* and *P. foersteri* collected in different climatic zones in the Maha season (1991/1992) in Sri Lanka

Climatic zones	Annual precipitation (mm)	No. of sampling sites	No. of galls observed	Percentage of galls containing pupae of					
				P. oryzae			*P. foersteri*		
				Max.	Min.	Mean	Max.	Min.	Mean
Wet zone	1,270–2,540	12	2,717	65.71	0.36	30.53	5.02	0	1.47
Intermediate zone	1,016	4	998	43.72	0	19.93	1.51	0	0.62
Dry zone	762	6	1,052	12.35	0	2.92	0.40	0	0.08
All zones		22	4,767	65.71	0	21.07	5.02	0	0.94

Table 4. Proportion of galls containing the parasitoids, *N. cinctiventris* and *O. oryzae* collected in different climatic zones in the Maha season (1991/1992) in Sri Lanka

Climatic zones	Annual precipitation (mm)	No. of sampling sites	No. of galls observed	Percentage of galls containing pupae of					
				N. cinctiventris			*O. oryzae*		
				Max.	Min.	Mean	Max.	Min.	Mean
Wet zone	1,270–2,540	12	2,717	1.05	0	0.12	1.05	0	0.09
Intermediate zone	1,016	4	998	0.75	0	0.18	0	0	0
Dry zone	762	6	1,052	0.98	0	0.16	0.49	0	0.08
All zones		22	4,767	1.05	0	0.15	1.05	0	0.07

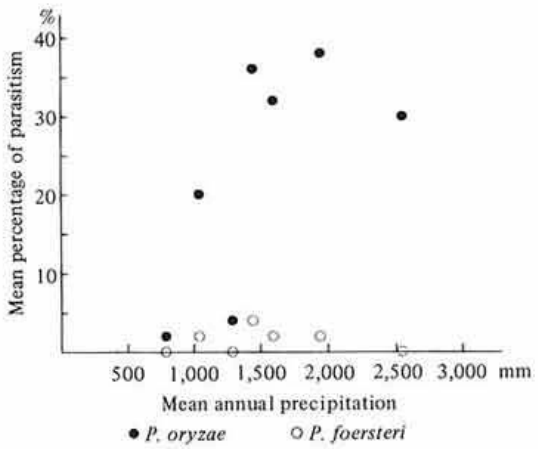

Fig. 1. Relation between mean annual precipitation and mean percentage of parasitism of the rice gall midge by *P. oryzae* (●) or *P. foersteri* (○)

analyzed and the mean percentage of parasitism of the gall midge by *P. oryzae* tended to increase with the increase in annual rainfall during the Maha monsoon season as shown in Fig. 1. However, the percentage of parasitism of *P. foersteri* remained under 6%, regardless of the fluctuations of annual rainfall (Fig. 1).

These findings suggested that there was a geographical gradient of parasitization by the parasitoids, especially in the case of *P. oryzae* in these zones. This difference may be attributed to the following factors. Rice is cultivated in rain-fed paddy fields during both the Yala and Maha monsoon seasons in the wet zone. On the other hand, rice cultivation is restricted to the Maha monsoon season from October to February in the rain-fed paddy fields of the dry zone[6]. Therefore, the rice gall midge can maintain higher population levels in the wet zone where rice plants are cultivated over wide areas, not only in the irrigated areas but also in rain-fed paddy fields during the 2 monsoon seasons. Consequently, the population level of *P. oryzae* may also increase with the increase of the host population density in the wet zone, because *P. oryzae* is an r-strategist and shows a density-dependent response to the host populations[3], while other species such as *P. foersteri* which are K-strategists are unable to increase their population levels with the increase of the host population density.

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