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Biology of the rice gall midge, *Orseolia oryzae* (Wood-Mason) in southern Karnataka

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Abstract : The studies on biology of the rice gall midge carried out under Mangalore conditions revealed that the pest completed its life cycle in 20±3.75 days on Jaya with egg, larval, pupal periods and adult longevity of 2.84±0.68, 9.75±2.02, 4.75±0.92 and 2.5±0.60 days, respectively. Under laboratory conditions the insect completed its life cycle in 15.5±3.0 days with egg, larval, pupal period and adult longevity of 2.25±0.75, 8.37± 1.37, 3.25±0.75 and 2.0±0.5 days, respectively. During the off season the pest survived on sprouts from the rice stubbles left over after the harvest of the paddy crop. None of the plants growing wild around the plots served as alternate hosts for the pests at both the locations. Monitoring of rice gall midge adults at revealed that adults did not follow a definite trend in their emergence pattern at both the locations. However, maximum adults were trapped during September and July at Mangalore. While, the maximum number of adults were trapped during October at Mandya. Observations on natural enemies of rice gall midge revealed that *Platygaster oryzae* was the dominant species.

Key words: *Orseolia oryzae,* biology, southern Karnataka, rice

Introduction

Rice (*Oryza sativa* L.) is the most important crop in the world. Rice is grown in 117 countries, being a staple food of 2.7 billion people in Asia alone. Rice crop is subjected to attack by a number of insect pests of which gall midge *Orseolia oryzae* (Wood-Mason) is the most important and causes extensive damage. The studies on the biology and its occurrence help to coin location specific management strategies. Hence the present studies were undertaken.

Material and methods

Observations on biology of rice gall midge (RGM) were recorded at the Agricultural Research Station (ARS), Kankanady, Mangalore during wet season (Kharif*)* July to November. Blocks of rice cultures were maintained in field conditions. These rice accessions were naturally (1x1x1m) infested by the RGM. Clumps showing silver shoots were enclosed in a nylon mesh chamber, which conveniently housed the rice clumps without affecting the plant growth and development. In a block, ten such chambers were maintained and on all ten rice clumps of Jaya were utilized for the purpose. Method followed by Joshi *et al.* (1990) was used. Records were maintained on adult emergence, oviposition, larval duration, pupal duration and adult longevity to confirm field observations. Twelve un-infested clumps of Jaya were enclosed in nylon mesh chamber (50x40x60 cm) and one pair of adults was released. Records on different life cycle stages were maintained. The data on weather parameters during the period of study was collected and their influence on the life cycle of RGM was determined. Besides this, a survey was conducted in farmers fields in coastal region (in and around Mangalore (12°54' N, 74°51' E, 30m AMSL) and in Cauvery command area (in and around Mandya (19° N, 76°E, 695 AMSL.)) and observations on alternate hosts of RGM, natural enemies, survival of the pest during off season, light trap catches were recorded at weekly intervals during the peak activity of the pest.

In laboratory, one pair of wild caught males and females of RGM were enclosed in an oviposition cage 75x75x85 cm containing potted 20 days old rice seedlings of Jaya. Ten such pots (15x15 cm) were maintained separately. After 24 hours of infestation the numbers of eggs laid by each female were counted. Everyday, adults were provided with fresh potted seedlings. After two days, the potted plants with eggs were transferred to a cage (77.5x60x75 cm). High humidity was maintained inside the cage by spraying water with hand sprayer at every two hour interval during day time. Data were recorded on total number of eggs laid by each female, incubation period of eggs, total maggot period, pupal duration and adult longevity.

After four days, the cage was placed in a metallic tray (123x85x21 cm) filled with water upto 3cm. This was done in order to facilitate optimum humidity and prevent parasitization and predation of RGM life stages. When galls are observed on shoots, the potted seedling was transferred to adult emergence cage, adults were collected every day between 18.00 and 21.00 h. A zero watt red bulb was provided in the cage to concentrate adults for collections using aspirator. Adequate population of RGM under natural conditions is a pre-requisite for conducting valid field screening trials. In order to determine the adult density of rice gall midge (RGM) 250 watt mercury vapor lamp was used. This light trap was placed at one end of the cultivated paddy fields in an elevated spot and was covered by a metallic zinc sheet overhead.

Results and discussion

Field observations in rice fields during July to August 2003 revealed presence of gall midge eggs at lower surface of paddy leaves. Eggs were laid parallel to the midrib either singly or in groups. When in groups, the eggs were glued parallel to each other. In each group 2-4 eggs were found. Freshly laid eggs were tubular, with light pink shade. However, in Mandya the gall midge eggs were light pink, shiny, transluscent laid in groups on the underside near the base of the rice leaves. The

incubation period lasted for 2.2 to 3.5 days under conditions of Mangalore, when temperature, relative humidity fluctuated between 28-30 ºC and 90-92% RH. Newly hatched maggots moved between leaf sheath until it reached a growing point of apical or lateral buds. The newly hatched maggots were grayish with a pointed anterior end. The maggot fed inside the developing bud. The presence of an active maggot at the meristem stimulated the formation of a gall and suppressed the growth cone. The total maggot period lasted on an average, 8.0 to 11.5 days. The pupal period lasted on an average between 4.0 to 5.5 days. Details on biology are found in Jagadeesha Kumar (2004).

Adult emergence was observed between 19.00 h to 5.30 h in the morning. The adult male lived for one to two days and the female on an average lived for two to three days. Each female laid 188-208 eggs under field conditions of Mangalore during August 2003. Adult copulated soon after the emergence and within 6 h of emergence females were observed laying eggs. The total life cycle under field conditions varied from 16.5 to 23.5 days in Mangalore. An interesting feature in the biology of gall midge observed was a female laid eggs of only one sex; either male or female. In field the maggot period varied from 8 to 11.5 days and in laboratory, from 7 to 9.75 days. The pupal period under field conditions varied from 4 to 5.5 days and under laboratory, from 2.5 to 4.0 days. Under field conditions total life cycle varied from 16.5 to 23.5 days with fecundity per female varying from 188 to 208 eggs. Corresponding figures under laboratory conditions were 12.5 to 18. 5 and 90 to 115 eggs, respectively (Fi.1).

To confirm field observations on the life stages and life cycle of rice gall midge, biology of the pest was also studied in laboratory in Mangalore. The incubation period of eggs on an average varied from 1.5 to 3.0 days, when temperature fluctuated between 32^0-34^{0}C and relative humidity touched almost 100% under caged condition. Eggs were laid in clusters under laboratory conditions on underside of the leaf sheath. Freshly laid eggs were tubular with pink shade. Before hatching egg colour changed to dark brown, on hatching the tiny young maggots moved down between leaf sheath and attacked the lateral buds.

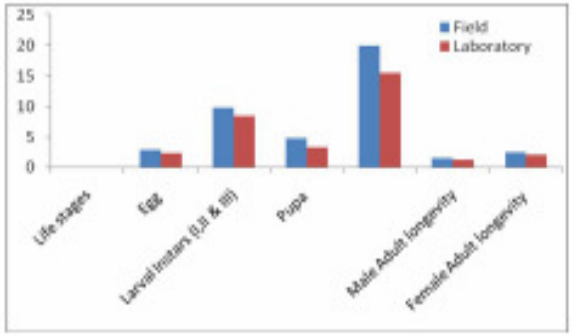

Figure 1. Field and laboratory biology of rice gall midge *Orseolia oryzae* at Mangalore

Maggot completed development within 7.0 to 9.75 days. As the larva continued feeding inside the gall, the gall enlarged and the whole tiller gave the appearance of an onion shoot. Pupation occurred inside the gall and the pupal period, on an average inside the cage varied from 2.5 to 4.0 days. Adult longevity in male spanned between 1 to 1.5 days. In female the corresponding value on an average was between 1.5 to 2.5 days. On an average a female laid 90-115 eggs which was smaller than that laid under field conditions, the total life cycle of the midge required shorter time of 12.5 to 18. 5 days.

Six species of plants in and around cultivated paddy fields at Mangalore were examined for rice gall midge life stages throughout the year. Observations were recorded on cultivated paddy crop during 2003 and 2004 (upto August 2004) revealed that gall midge was not present on cultivated paddy crop during February and March at Mangalore (Table 1). Negligible GM infestation (less than 1%) was found during April and May, both the years.

At V.C. Farm, Mandya, nine species of plants in and around cultivated paddy fields were examined for rice gall midge life stages throughout the year. Observations recorded during 2003 and 2004 (upto August 2004) revealed that gall midge was not present on cultivated paddy crop during March, July and August (Table 1). However, negligible infestation (less than 5%) of cultivated paddy crop by gall midge was observed during these three months. However, continuous monitoring of gall midge populations at monthly intervals during 2003 and 2004 revealed that, sprouts from left over rice stubbles after harvest of the paddy crop contained GM infestation during 2003 and 2004.

At Kankanady, Mangalore also RGM infestation was detected on stubbles of Jaya cultivar during off-season that is during April 2004. This suggested that rice stubbles served as an important host for multiplication and perpetuation of rice gall midge populations. Destruction of rice stubbles or deep ploughing after the harvest of the paddy crop will adversely affect gall midge population. A comprehensive study made by Descamps (1956) reveals that after harvest of the rice crop, the pest infests wild rice; *Oryza barthii,* which grows abundantly in and around water. As it dries up in summer most of the larvae

Table 1. Seasonal occurrence of rice gall midge at Mangalore and Mandya

Months	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Mangalore	$	-	-	±	±	+	+	+	+	+	+	±
Mandya	±	±	-	$	±	$	-	-	+	+	+	+

+ = Abundant population (0.5/day/trap), $ = Negligible population (1/day/trap),

± = Minimum population (1-5/day/trap), - = No population (0/day/trap)

Table 2. Occurrence of rice gall midge on alternate host plants in Mangalore and Mandya

Plants observed	Mangalore			Mandya		
	Date of observation	No of clumps/ plants scored	Life stages of RGM	Date of observation	No of clumps/ plants scored	Life stages of RGM
Cynodon dactylon	04.2.2004	205	A	8.12.2003	165	A
Panicum repens	14.2.2004	108	A	-	-	-
Brachieria Sp.	24.2.2004	98	A	02.1.2004	93	A
Echinochloa Sp.	05.3.2004	27	A	18.11.2003	47	A
Oryza species	15.3.2004	15	A	-	-	-
Chloris barbata	25.3.2004	58	A	23.11.2003	95	A
Ratoon rice stubbles	26.3.2004	110	P	04.1.2004	150	P
Eleucine indica	-	-	-	14.11.2003	55	A
Cyperus rotendus	-	-	-	23.12.2003	185	A
Cynodon creveatum	-	-	-	25.12.2003	255	A
Imperata cylindrica	-	-	-	28.12.2003	170	A
Eragrastis sp.	-	-	-	31.12.2003	87	A

A = Absent, P = Present

enter diapause in the buds of the plants. Under favorable moisture conditions, development may continue throughout, otherwise the diapause continues for many months.

Maximum numbers of adult gall midge were trapped during September 2003 again during August 2004 at Mangalore. However, the presence or absence of adult gall midge in the field could be detected from this data. No gall midge adult was trapped during February and March 2004 in Mangalore, because during this time the paddy crop in most areas is not available and the gall midge population was found on stubbles left over after the harvest of the paddy crop. This observation corroborates with our earlier observations on gall midge presence or absence data (Table 1).

The adult midge population was also monitored at Mandya on an average 0.23, 0.45 and 2.25 per month adult gall midges were trapped during June, July and August 2003, respectively. In April and June 2004 only 0.7 and 0.46 adults per month were trapped. These data confirmed that a very low population of gall midge occurred during the above months. Parasitization of GMR was observed during October, November and December 2003. The per cent parasitization varied from 7.27-15.71 per cent. The parasitoid was identified as *Platygaster oryzae.*

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