Effect of Intensity of Weed Infestation on the Occurrence of *Leptocorisa oratorius* Fabricius (Heteroptera: Alydidae) in Paddy Fields of Sri Lanka*

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Abstract

The occurrence of *Leptocorisa oratorius* in weedy sites of farmers' paddy fields was investigated in reference to the adult-nymphal structure and ovarian development in female adults. Results indicated that nymphal development takes place in paddy fields before rice flowering when the fields were infested with adults whose ovaries had already matured by feeding on panicles of weeds or early-flowering rice plants. It is thus considered that weed control should be emphasized to eliminate panicle-bearing weeds in and around paddy fields before the onset of rice flowering so as to prevent advanced ovarian maturation in the adult populations which immigrate into paddy fields to lay eggs. Synchronous rice cropping is also essential for the same purpose.

Additional key wards: Rice bug, alternate host plants, ovarian development

The rice bug, *Leptocorisa oratorius*, feeds on rice panicles and causes serious damage of grains[10, 11]. Various graminaceous weed species have been reported to be food plants of the insect[1, 4, 6, 8]. Especially *Echinochloa crus-galli*, *E. colona* and *Digitaria adscendens* (=*D. ciliaris*), the most common weeds in and around paddy fields, are considered to be the principal alternate hosts

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based on field surveys[4, 8, 9] and rearing experiments related to nymphal development[5, 6, 12] and fecundity[12]. However, there are only a few reports on the relation between the presence of weeds and the insect occurrence in paddy fields[3, 5, 9].

To study the role of weeds in the infestation of rice plants by *L. oratorius*, we investigated the insect occurrence in weedy sites of farmers' paddy fields in reference to the adult-nymphal structure and ovarian development in female adults.

Materials and Methods

There are two main rice cropping seasons in a year in Sri Lanka; Maha (major) season (Nov.-Feb.) with rainfall all over the country and Yala (minor) season (Apr.-Jul.) with rainfall in the southwestern part of the country. The investigation was conducted in the 1989 Yala season.

The populations of *L. oratorius* which occurred on panicle-bearing weeds in and around paddy fields, were sampled by 20-stroke net-sweeping using an insect net, 36cm in diameter. The sampling was conducted in paddy fields with rice plants around the flowering stage, in the beginning of rice flowering, from mid-June to early July, in six paddy areas (Haramitipana, Beminiwatta, Ganetanna, Dewanagala, Attalapitiya and Mawela) around Hingula and Mawanela, Kegalla district. In only a few fields did rice plants start to flower in each area at the time of sampling. The samples collected from paddy fields in Ganetanna, Attalapitiya and Mawela were the same as those used in the study on the relation between the insect population density and the damage of rice grains[11]. The insect populations were also sampled 8 days after flowering in the fields with late-flowering plants (flowered on August 4) adjacent to the fields with early-flowering plants in Mawela (cf. Fig. 1).

Adult-nymphal structure and ovarian development in female adults were examined in the samples collected by net-sweeping. Ovarian development was examined by the observation of the presence of eggs in the abdomen by incision and opening on one side with a forceps. Ovaries were classified into two grades as follows; Immature: Eggs not found and/or some greenish immature eggs found, Mature: Abdomen filled with many mature and immature eggs and/or only mature eggs found.

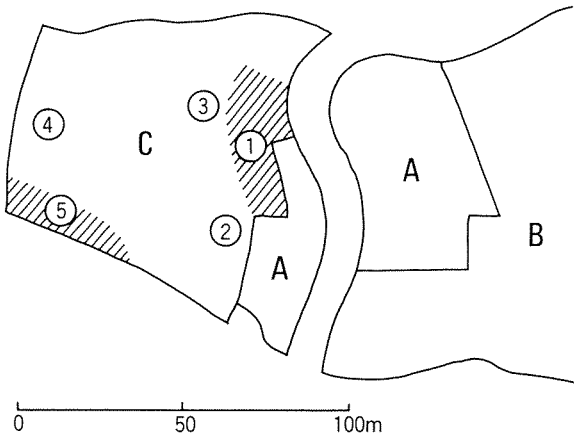

Fig. 1. Schematic map of paddy fields where the bugs were collected in Mawela (see Table 2). A, B and C: Fields with early-flowering plants, main fields and fields with late-flowering plants, which flowered on July 8, July 20 and August 4, respectively. ////: Fields with *E. crus-galli*. ①~⑤ :Sites where the bugs were sampled.

Results

As shown in Table 1, in the paddy areas surveyed in the beginning of rice flowering, *L. oratorius* populations which occurred in paddy fields with plants around the flowering stage showed the following structure; There was a considerable proportion of female adults with immature ovaries and a smaller proportion of nymphs in the populations in the fields with panicle-bearing *E. crus-galli* and on bunds with *D. adscendens*, in the surveys conducted from mid-June to late June. However, the populations showed a smaller proportion of immature females and a larger proportion of nymphs in the fields in which rice flowered in early July in Attalapitiya and Mawela, where a small amount of weeds grew in the fields but the insect adults had been observed

on the weedy bunds. The latter adult-nymphal structure with a larger proportion of nymphs, indicated that the apparent increase in the number of nymphs had been initiated in the fields with plants before flowering. The same condition was also observed in the fields with later flowering dates from mid-July to early August in Beminiwatta, Ganetanna and Mawela in another study[11].

As shown in Table 2, the population density of *L. oratorius* in the fields with late-flowering plants (C fields in Fig. 1) was higher in the sampling sites within a short distance from adjacent fields with early-flowering plants (A fields in Fig. 1) and lower in those within a longer distance, and was conspicuously higher in the fields with panicle-bearing *E. crus-galli* as compared to those with a small amount of weeds. The insect populations in the weedy fields displayed a higher proportion of females with immature ovaries and a higher

Table 1. Occurrence of *Leptocorisa oratorius* in and around paddy fields in relation to the presence of panicle-bearing weeds, in the beginning of rice flowering in paddy areas surveyed in the 89 Yala season.

Paddy area	Sampling site	Rice growth stage	Weeds[a]	Date	Female adult[b]		Male	Nymph[c]	
					Mature	Immature	adult	Young	Old
Haramitipana	Paddy	Booting	*E. crus-galli* +	June 16	42	36	78	3	0
do.	do.	3 days after flowering	*E. crus-galli* +	June 16	18	6	24	24	1
Beminiwatta	Paddy[d]	Ear-formation	*E. crus-galli* +	June 24	22	10	28	2	0
Ganetanna	Paddy[d]	Flowering	*E. crus-galli* +	June 16	34.7	15.0	33.3	1.0	0.0
do.	do.	7 days after flowering	*E. crus-galli* +	June 23	67.5	4.5	46.5	14.0	2.0
Dewanagala	Bund	Ear-formation[f]	*D. adscendens*	June 17	14	27	33	4	0
Attalapitiya	Bund	15 days before flowering[f]	*D. adscendens*	June 24	17	7	13	0	0
	Paddy[d, e]	Flowering	*E. crus-galli* –	July 9	6.4	1.5	7.6	19.5	6.5
Mawela	Bund	9 days before flowering[f]	*D. adscendens*	June 29	23	17	16	11	9
	Paddy[d, e]	Flowering	*E. crus-galli* ±	July 8	26.3	0.5	22.0	39.0	17.5

a): Panicle-bearing *E. crus-galli* plants were observed, –:seldom, ±: below 1 panicle/m^2, +: a few to several panicles/m^2.
b): Mature and Immature: Female adults were classified according to the grade of ovarian development as described in the text.
c): Young and Old: 1st~3rd instar nymphs and 4th~5th instar nymphs, respectively.
d): Samplings were conducted in 2 fields in Ganetanna and Attalapitiya, and 4 fields in Mawela.
e): The bugs were collected in paddy fields near the bunds with *D. adscendens*.
f): Growth stage of rice plants in paddy fields near the bunds.

Table 2. Occurrence of *L. oratorius* in relation to the intensity of infestation with panicle-bearing *E. crus-galli* palnts in the paddy fields with late-flowering plants adjacent to the fields with early-flowering plants in Mawela (cf. Fig. 1).

Sampling site[a]	Weed intensity[b]	Female adult[c]		Male	Nymph				
		Mature	Immature	adult	1st	2nd	3rd	4th	5th instar
1	++	18	70	88	82	24	22	122	426
2	–	10	39	68	21	9	4	17	35
3	–	19	32	38	14	11	6	1	3
4	–	8	4	22	4	2	0	1	9
5	++	4	36	38	20	28	13	13	101

a): Sampling was conducted 8 days after rice flowering. 1~5 correspond to ①~⑤ in Fig. 1.
b): Panicle-bearing *E. crus-galli* plants were observed, –:seldom, ++: around 10 panicles/m^2.
c): Mature and Immature: as in Table 1.

proportion of nymphs at the 5th instar. These facts indicate that the apparent increase in the number of nymphs had been initiated in the weedy fields long before rice flowering, and that new adults were already emerging from the nymphs bred in the fields. It is assumed that the new adults had developed from the eggs laid in the weedy fields in the middle of July by the adults whose ovaries had already matured by feeding on rice panicles in the fields with early-flowering plants, because the development of the insect takes an average of 26~28 days and a minimum of 19 days from oviposition to adult emergence[2, 8].

Discussion

Corbett[1] observed that adult *L. oratorius* individuals appeared in swarms on weeds which flowered just before the rice plants burst to flower and then migrated to early flowering rice plants. Ito et al.[3] observed that insect infestation was more severe in the paddy fields with weeds than in those without weeds. Sands[9] reported that the abundance of insect populations in bushland and grass surrounding the rice crop was the major factor influencing the level of grain damage. Based on rearing experiments, Morrill et al.[5] reported that early nymphal development takes place in paddy fields before rice flowering when the fields are infested with early flowering weeds, since the weeds make the fields more attractive to the adults and support the development of nymphs.

According to the present study, early nymphal development was not observed in weedy fields in the beginning of rice flowering in the paddy areas surveyed, but was observed in those adjacent to the fields with early-flowering plants, as well as in the fields with a small amount of weeds where the insect adults had been present on weedy bunds before rice flowering. This difference in nymphal development is considered to be due to the difference in ovarian maturation in the adult populations which immigrated into paddy fields as follows: Female adults gradually initiated oviposition in early-flowering plants[8]. On the other hand, a large proportion of the females which immigrated into a field with late-flowering plants was already mature and ovipositing even when few rice plants bore panicles[8]. It is thus considered that early nymphal development takes place when paddy fields with plants before flowering were infested with adults whose ovaries had already matured by feeding on panicles of weeds or rice plants.

Although it has been reported that nymphs survived only on rice and weeds after panicle-bearing in rearing experiments[5], according to the present study, early nymphal development occurred even in paddy fields with a small amount of weeds. It remains to be determined how nymphs initiate their development on rice before panicle-bearing under field conditions.

Morrill et al.[5] indicated that nymphs which had been born before rice flowering injure panicles for a longer period of time and hence cause a more severe damage of grains as compared to those born after rice flowering. Thus nymphal development in fields before rice flowering should be controlled. It is considered that weed control in paddy fields and surrounding areas, which may reduce the insect survival during the cropping and fallow periods[6, 7, 13] should be emphasized to eliminate weeds which bear panicles prior to the onset of rice flowering so as to prevent advanced ovarian maturation in the adult populations which immigrate into paddy fields to lay eggs. Synchronous rice cropping[7, 13] is also essential for the same purpose.

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スリランカの水田におけるタイワンクモヘリカメムシの発生に及ぼす雑草の影響

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摘　要

熱帯アジアにおける稲作重要害虫の一つで，稲穂から吸汁して稔実を阻害するタイワンクモヘリカメムシは稲のほか種々のイネ科雑草の穂を食餌とし，中でもヒエ類やメヒシバ近縁種が主要な野生寄主となっている。しかし水田における雑草の存在と本害虫発生との関係についての報告はきわめて少ない。

筆者らはスリランカにおいて，水田やその周辺での本害虫の成・幼虫生息状況を雌成虫の卵巣の発育状況との関連のもとに調査した。開花期初期（６月中旬～７月上旬）の調査では稲が開花中及び開花前後の，ヒエの穂が多い水田で多くの成虫が見られたが，そこでは幼虫生息数はわずかであった。しかし，稲の開花以前からその堤や畦のメヒシバ近縁種の穂上に成虫が生息していた水田では，田内に雑草が少なかったにもかかわらず，開花時にすでに多数の幼虫の生息が見られた。また，このような開花前からの幼虫多発は早期開花水田（７月上旬開花）に隣接した後期開花水田（８月上旬開花）内のヒエの多いところでも見られた。これらの結果と雌成虫の卵巣発育状況から，幼虫の早期多発は雑草や稲の穂を吸汁して卵巣が十分成熟した成虫が開花前の水田に侵入産卵することによってひき起こされると推察された。開花前に発生した幼虫は開花後に発生したそれに比べて稲穂を加害する期間が長く，米粒の被害を増加させると考えられる。したがって本害虫の発生抑制のため，これまで稲の栽培期，休閑期を通じて水田及びその周辺の除草が奨励されてきたが，水田に侵入する成虫の卵巣の早期成熟を防ぐために，稲の開花期直前に水田地帯内に発生している出穂雑草を除去することに重点を置くべきである。同じ目的のために水田地帯における稲の開花期の整一化の励行も重要であると考えた。

キーワード：稲害虫，タイワンクモヘリカメムシ，卵巣発育，野生寄主植物，雑草

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