Damage of Rice Grains caused by the Rice Bug, *Leptocorisa oratorius* Fabricius (Heteroptera: Alydidae)*

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Abstract

The symptoms associated with grain damage caused by the rice bug were examined using grain samples collected from farmers' paddy fields in relation to the occurrence of the insect. The erythrosine dye was used to stain the stylet sheaths produced by rice bugs on damaged grains. The main symptom associated with rice bug damage was the presence of unfilled grains. The unfilled grains showed a dark spot on the grain surface, but not when they were damaged at the very early stage of grain formation. These grains were considered to be damaged by the rice bug when they were re-stained to observe the stylet sheaths which penetrated into the grain. No damage of the ovary before the onset of grain development was observed. Grain damage mainly occurred from the very early stage of grain development to the milk-ripe stage when the rice bug infestation was severe. However, a considerable proportion of grains was damaged at the dough and hard-dough stages when the level of insect infestation was lower.

Additional key words : Sri Lanka, Stylet sheath

The rice bug, *Leptocorisa oratorius* Fabricius, is one of the major pests of rice in tropical Asia. It feeds on the panicles and damages grains. However, only a few studies on the nature of the

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feeding damage under field conditions have been carried out[1,3,6]. The symptoms associated with feeding damage have not been precisely identified. Though it has been mentioned that infested grains may remain empty, be filled partially or develop a brown spot[1], only Reissig et al.[8] described non-spotted partially filled grains. Morita & Dhanapala[6] observed for the first time the presence of a dark-spot on the unfilled grain surface after removal of the glumes. However, their report did not refer to the occurrence of the rice bug. Furthermore, it is difficult to discriminate the grains with rice bug damage from those injured by other factors[1,3,5]

We investigated the symptoms associated with grain damage caused by the rice bug using grain samples collected from farmers' paddy fields in relation to the occurrence of the insect during the 1987 Yala rice cropping season in Sri Lanka. The unfilled grains with rice bug damage were precisely identified by staining the stylet sheaths of the rice bugs which penetrated into the grain with the erythrosine dye after removal of the glumes.

Materials and methods

1) Occurrence of the rice bug

To investigate grain damage in rice with different intensities of rice bug infestation, 8 target paddy fields were set up in three paddy areas, Galahitiyawa, Ja-ela and Pallewela, selected in the Gampaha district. The insect populations in the target fields were sampled by 20-stroke net-sweepings 1 week after rice flowering. *L. oratorius* was the only ear-sucking hemipteran species observed predominantly in the fields.

2) Grain damage

Rice panicles were harvested from the target paddy fields at the yellow-ripe stage at the rate of 10 panicles per field. For the examination of the grain damage, 200 spikelets were sampled for each field. Grain damage was examined in reference to the presence of the stylet sheaths produced by rice bugs on the spikelet surface as well as on the grains after removal of the glumes. The stylet sheaths were stained with the erythrosine dye so that they became more visible than in the natural state as they stained dark-pink. By the use of the erythrosine dye, the staining technique became simpler and faster as compared to the former use of the acid fuchsin dye[5]. The method of examination was as follows: The sampled spikelets were immersed in the dye (0.5% erythrosine in 70% ethyl alcohol, modified from Naito & Masaki[7]) for 5 min. and washed in tap water for a few minutes, to stain the heads of stylet sheaths (Note in Plate 1-above) as previously described[2,5]. After the spikelet surface was examined for the presence of the stylet-sheath heads, the glumes were removed and the symptoms on the grain surface were observed. Then the grains after removal of the glumes were re-stained to observe the stylet sheaths which penetrated into the grain. Undeveloped ovaries and small unfilled grains were observed and re-stained while remaining intact with the palea as shown in Plate 1-above.

The developmental stage of the grain at which the rice bug damage occurred and grain development ceased, was determined according to the length, width and thickness of damaged grain as follows: Grain which did not reach the optimum length and width and were entirely flattened···· Early stage; Grains which reached the optimum length and width and were entirely flattened, partially flattened and approaching optimum thickness···· Milk-ripe, dough and hard-dough stages, respectively. Filled grains with a partial discolouration with distinct margin were found to be pecky grains caused by the rice bug infestation.

Results and Discussion

1) Identification of grains damaged by the rice bug

The unfilled grains with stylet-sheath heads showed a characteristic dark-bluish discolouration around a spot on the grain (Plate 1-below) as observed earlier[6]. These grains were considered to be damaged by the rice bug, since they occurred in the spikelets with stylet-sheath heads, and

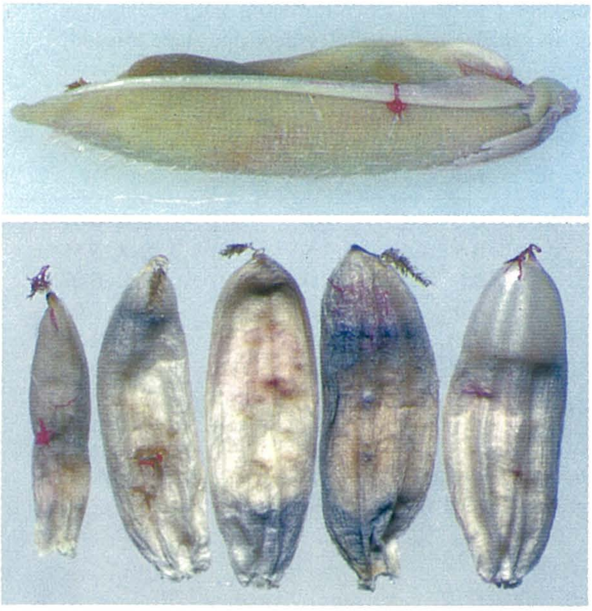

Plate 1. Damage of rice grains caused by the rice bug, *Leptocorisa oratorius*.
Above: Stylet sheath that penetrated into the grain, stained with erythrosine dye after removal of the lemma of the spikelet. Note that the head of stylet sheath is located at the junction of the glumes as observed earlier[2,5]. Below: Unfilled grains into which the stylet sheaths were found to penetrate.

furthermore, the stylet sheaths were found to penetrate into the grain (Plate 1-below). However, the grains whose development had ceased at the very early stage of grain formation only showed flattening and a ligh-brownish discolouration, and were considered to be damaged by the rice bug only when they were re-stained to observe the stylet sheaths which penetrated into the grain (grain on the far left in Plate 1-below). Grains showing such symptoms were also detected among the spikelets without stylet-sheath heads (Figures in the column with parenthese in Table 1). Therefore it is considered that the stylet-sheath heads had been detached from the spikelets after the insect attack.

The percentage of unfilled spikelets, mainly with undeveloped ovaries without any symptoms, ranged from 1.5 to 17.5% in the spikelet samples analysed. However, a smaller number of unfilled grains were considered to be affected by unidentified diseases. These grains showed a dark-discolouration at the base and/or apex or the entire grain.

Morita & Dhanapala[6] diagnosed the bug damage on the basis of the presence of a dark-spot on the unfilled grain surface. On the other hand, Litsinger et al.[5] reported that the technique for staining the heads of stylet sheaths of rice bugs on the spikelet surface enabled to distinguish the unfilled grains with rice bug damage from those affected by fungi, bacteria, etc. According to the present study some of the damaged grains did not show conspicuous symptoms and the stylet-sheath heads may drop. Therefore, it is essential to stain the stylet sheath with the grain opened for precisely identifying the unfilled grains with rice bug damage.

2) Characteristics of grain damage by the rice bug

As shown in Table 1, grain damage was found to be generally proportional to the intensity of rice bug infestation of paddy fields, whereas Ito et al.[3] did not observe a clear relationship between the rice bug population density and grain damage due to the difficulty in discriminating the grains with rice bug damage from those injured by other factors.

The main symptom associated with rice bug damage was the presence of spikelets with unfilled grains whose development ceased at different stages of development (Plate 1-below, Table 1). Lower percentages of pecky grains were observed irrespective of the level of grain damage. Since the stylet sheath never penetrated into an undeveloped ovary, it is thus considered that the rice bug hardly attacks the ovary before the onset of grain development.

So far, the rice bug has been considered to prefer grains at the milk-ripe stage. It has been observed in cage tests that the insect adults and nymphs fed on panicles at the milk-ripe, dough and hard-dough stages[2]. However, it has also been observed that the adults damaged a larger number of grains when panicles were attacked at the early post-flowering stage as compared to the attack at

Table 1. Number of rice bugs collected by 20-stroke net-sweepings 1 week after rice flowering and percentage of unfilled and pecky rice grains with rice bug damage in panicles harvested at yellow-ripe stage in paddy fields surveye.

Paddy area	Date of Collection	No. of rice bugs			Unfilled grains[a)]				Pecky grains	Total[b)]
		Nymphs	Adults	Total	E	MR	D	HD		
Galahitiyawa	Jul.14	2	6	8	1.0	4.5	2.0	1.5	0.5	9.5(6.5)
Pallewela	Jul.15	10	3	13	0.5	0.5	2.5	3.5	1.0	8.0(5.5)
Pallewela	Jul.15	23	6	29	6.5	0.5	1.5	9.0	3.0	20.5(6.0)
Ja-ela	Jul.14	27	38	65	7.5	8.0	3.5	13.0	2.5	34.5(7.0)
Pallewela	Jul.15	55	18	73	9.5	12.5	9.0	22.5	2.0	55.5(9.5)
Ja-ela	Aug.11	0	35	35	10.5	5.0	5.5	6.0	1.5	28.5(16.0)
Ja-ela	Aug.11	0	48	48	17.5	12.5	9.0	11.0	0.5	50.5(28.5)
Ja-ela	Aug.11	37	192	229	39.5	25.5	8.5	6.5	0.5	80.5(6.0)

a):E,MR, D, and HD: Developmental stages of grain: early, milk-ripe, dough and hard-dough stages, respectively.
b):Figures in parentheses indicate the percentages of damaged grains detected among spikelets without stylet-sheath heads.

the milk-ripe and later stages[3,4,9]. Morita & Dhanapala[6] observed that in field-collected panicle samples severe damage mainly occurred at the very early stage of grain development. According to the present study, as indicated in Table 1, the major grain damage occurred from the very early stage of grain development to the milk-ripe stage when the grain damage was very severe as observed by Morita & Dhanapala[6]. However, a considerable proportion of grains was damaged at the dough and hard-dough stages when the grain damage was below 60%. The latter damage is assumed to be due to an apparent increase in the number of nymphs and new adults in rice plants at the later stage of grain development.

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タイワンクモヘリカメムシによる米粒の被害

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摘　要

タイワンクモヘリカメムシは熱帯アジアにおける稲作重要害虫の一つで，稲穂を吸汁するが，そのために生ずる米粒の被害の症状はまだ確認されておらず，被害粒と病害その他によるそれとの判別が難しい。

筆者らはスリランカにおいて，本害虫による米粒被害の症状を害虫発生量との関連のもとに調査した。被害調査にあたっては本害虫による被害粒と他の要因によるそれとを確実に判別するため，被害粒上に形成された本害虫の口針鞘を籾殻の除去前及び除去後にエリスロシンで染色して，籾表面における口針鞘頭部の存在及び，籾殻除去後の米粒における口針鞘貫入状況を観察した。

その結果，本害虫による被害粒が口針鞘頭部の存在を伴わない籾の中からも検出され，口針鞘頭部が本害虫の加害後に籾表面から脱落することがあり得ると考えられた。被害の主体は発育停止粒の発生で，斑点米の発生はわずかであった。また発育開始以前の胚が加害された形跡は見られなかった。発育停止粒の大半は粒の中央付近に１個の暗色の点がみられたが，稔実過程の初期に加害され発育が停止した粒はそういう明確な症状を示さなかった。これら症状の明らかな粒及び不明確な粒のいずれも染色処理により，粒に口針鞘が貫入していることを観察することによって本害虫による被害粒であることが確認された。被害粒率はおおむね，調査対象水田における開花１週間後の本害虫生息密度に比例した。激しい被害は主として稔実過程の初期から乳熟期に起こるが，被害粒率が60％未満の比較的少被害の場合には糊熟期以降に生ずる被害粒の割合がかなり高いことが認められた。

キーワード：稲害虫，タイワンクモヘリカメムシ，口針鞘，スリランカ

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