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Source: Florida Entomologist, 100(4) : 823-825

Published By: Florida Entomological Society

URL: https://doi.org/10.1653/024.100.0412

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Notes on biology of the stink bug *Cyptocephala alvarengai* Rolston (Hemiptera: Pentatomidae) feeding on rice panicles

José Alexandre Freitas Barrigossi[1,], Carlos Vinícius da Silva[1], Juliana Duarte de Souza Alonso[1], Edson Hirose[2]*

Rice (*Oryza sativa* L. [Poaceae]) is one of the most important agricultural crops worldwide, and its yield could be increased if crop losses due to insect pests are mitigated. Stink bugs are the main economically important pests that damage rice in Brazil (Ferreira et al. 2001). The primary species are the rice stink bugs (*Oebalus poecilus* Dallas and *O. ypsilongriseus* De Geer [Hemiptera: Pentatomidae]) that feed on grains (Barrigossi 2008) and the stem rice stink bug (*Tibraca limbativentris* Stål [Hemiptera: Pentatomidae]) that feed on rice stalks (Ferreira et al. 1997). Beside those species, there are several other species reported to feed on rice, such as *Mormidea* spp. and *Thyanta perditor* (Fabricius) (both Hemiptera: Pentatomidae) among others (Ferreira et al. 2001). In the past few years, other species of stink bugs not previously described as rice pests also have been observed damaging rice (Alves et al. 2012; Farias et al. 2012). In 2012, *Cyptocephala alvarengai* Rolston (Hemiptera: Pentatomidae) was first observed feeding on panicles of irrigated rice in Goianira, Goiás, Brazil.

Cyptocephala alvarengai is a stink bug, described from specimens collected in the states of Ceará, Bahia, Minas Gerais, and Pernambuco. The adults are small with length of 5.2 to 8.3 mm, excluding hemelytral membrane, and are typically light brown to green in color. Rolston (1986) gives a detailed morphological description of the species. However, the article gives only its taxonomic description and distribution based on where samples were collected, with no mention of plant hosts. The biology and ecology of the *C. alvarengai* are completely unknown. In this study, we present data on nymph and adult biology of *C. alvarengai* on rice panicles as a foundation for future work on pest management strategies for this species.

Cyptocephala alvarengai adults were initially observed feeding on rice panicles at the Embrapa experimental farm near Goianira, Goiás (16.5055 °S, 49.4202 °W), in Aug 2012. Specimens were sent to the Department of Zoology, Universidade Federal do Rio Grande do Sul – Porto Alegre, State of Rio Grande do Sul, for identification, where voucher specimens are deposited. A colony was established with individual adults (N=40) collected from the same location in Apr and May 2013. Colony individuals were kept in cages at room temperature (25 ± 7 °C, 60 ± 20% RH, 14:10 L:D photoperiod.

On 3 Sep 2013, 22 egg masses (total 314 eggs) were removed from the rice panicles, transferred to a Gerbox (J. Prolab Indústria e Comércio para Laboratório LTDA, São José dos Pinhais, Paraná, Brazil) (0.11 × 0.11 × 0.035 m), which was lined with a filter paper moistened with distilled water. They were kept in the laboratory and observed daily to determine egg hatching. After hatching, nymphs remained clumped close to the eggshells until they molted to the 2nd instar when they start feeding. The same d, groups of 15 second instar nymphs were transferred to rice panicles (milky stage) using a small brush. Rice panicles and nymphs were kept in cages in the laboratory until the nymphs completed their development. The development of each individual nymph was followed throughout the adult stage by daily visual inspections and counting. Any nymph that dropped from the rice panicle to the base of the cage during evaluations was returned to the rice panicle. During evaluations, cage and panicle were completely inspected. Any dead or missing individuals were recorded. The developmental time for each instar was calculated, and the number of surviving individuals was recorded daily. At adult emergence, the sex of all individuals was determined based on morphology of their external genitalia, as described by Campos & Grazia (1998) for *Glyphepomis spinosa* Campos & Grazia (Hemiptera: Pentatomidae). Survival was calculated as the difference between the numbers of individuals alive in 2 consecutive stages. The sex ratio was determined by dividing the number of emerged females by the total number of emerged adults.

Adult survivorship and female fecundity of *C. avarengai* were determined in the laboratory. Emerged adults were separated into individual couples (1 male to 1 female) and held in cages with rice panicles as previously described for feeding and reproduction. Cages with panicles and insects were checked daily to assess adult longevity and egg laying. The eggs laid by each couple were transferred to Petri dishes (70 mm diameter), kept in the laboratory, and observed daily for assessment of the incubation period, female fecundity, and fertility. In addition, the pre-oviposition, oviposition, and post-oviposition periods also were calculated.

Cyptocephala alvarengai eggs are barrel-shaped, circular, with a convex operculum, arranged in double rows with grayish brown coloration. The number of eggs per egg mass ranged from 6 to 20, with a mean of 11.8 ± 0.8 (SE). Eggs were laid on leaves, spikelets, and the surface of the cage walls. First instar nymphs remained motionless close to the eggshells until they molted to 2nd instar when they started to feed and disperse, remaining distributed throughout the rice panicle during their lives. Older nymphs (3rd to 5th instars) were preferentially located at the top of the panicles.

Cyptocephala avarengai required 33.2 d to develop from egg to adult, when reared at 25 ± 7 °C, 60 ± 20% RH, 14:10 h L:D photope-

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riod (Table 1). From the total number of eggs evaluated (n = 314), 78% hatched (n = 245), and 45% of nymphs reached adulthood (n = 141). *Cyptocephala alvarengai* required 33.2 d from first instar to adult, very close to that observed in other bugs of rice panicle. The complete life cycle of *C. alvarengai* is presented in Figure 1.

Mortality was highest in the egg (22.0%) and second instar (25.3%) stages and low in all other stages (Table 1). Alves et al. (2012) also observed high mortality in egg stage for *G. spinosa*, but for *O. ypsilongriseus* and *T. perditor*, the highest mortality was observed in last instars (Panizzi & Herzog 1984). Duration of egg development ranged from 4 to 7 d. First, 2nd, and 3rd instars had a very similar developmental time (4 d) and were shorter than the 4th and 5th instars (5.9 and 7.2 d, respectively) ($F = 53.33$, $P < 0.05$) (Table 1). The duration of *C. alvarengai* development (egg to adult) lasted 33.2 d.

Among the 314 eggs followed, 176 became adults. The sex ratio was 1.2 male to 1 female ($\chi^2 = 0.71$; $P > 0.05$). Longevity ranged from 16 to 46 d, with mean of 35.0 ± 0.5 d. *Cyptocephala alvarengai* reproduced freely in the artificial environment provided in the cages. Adults started to copulate between 48 and 72 h after emergence. Copulation and oviposition were observed on panicles and on cage walls. The preoviposition period ranged from 4 to 15 d, with a mean of 7.0 ± 1.1 d. Egg fertility was high (100 %) for eggs from females, with up to 12 d, but fertility decreased by 35% by the end of reproductive phase.

Longevity of stink bugs seems to vary with species and sex. *Thyanta perditor,* when fed on wheat (*Triticum aestivum* Linnaeus [Poaceae]), showed a longevity of 20 d for males and 30 d for females (Panizzi & Herzog 1984). However, *Nezara viridula* (Linnaeus) (Hemiptera: Pentatomidae) had a longevity of 45 d for female and 38 d for male when fed on sesame (*Sesamum indicum* Linnaeus [Pedaliaceae]) as nymphs, but only 12 d for female and 9 d for males when fed on soybeans (*Glycine max* Merril [Fabaceae]) as nymphs.

In the literature, we found no information on host plants of *C. alvarengai*, or on its biology, natural enemies, or economic importance for any cultivated plants. Therefore, the possible significance of *C. alvarengai* as a pest of cereal has not been assessed. *Cyptocephala alvarengai* has all the characteristics of other stink bug pests that feed on rice panicles including feeding behavior, developmental time, and resulting spikelet damage. From the above-mentioned data, it seems that if the population of *C. alvarengai* increases, this insect can cause economic damage to commercial rice plantations in Brazil. *Cyptocephala alvarengai* biology has several characteristics similar to other stink bugs associated with rice panicles, which allows us to conclude that this species has the potential to reach pest status in the Brazilian rice agrosystem in the future.

We thank Dr. Luis Alexandre Campos for species identification, Edmar C. de Moura and José Francisco A. e Silva for assistance. This study was supported by The National Council for Scientific and Technological Development (CNPq Grant 562621/2010-5) and Brazilian Agricultural Research Corporation (Embrapa – Grant 0211-05).

Summary

The development of the stink bug *Cyptocephala alvarengai* Rolston (Hemiptera: Pentatomidae) was studied on rice panicles under laboratory conditions. Adults were collected in rice fields in Goianira, Goiás, Brazil. The number of eggs per egg mass ranged from 6 to 20, with a mean of 11.8 ± 0.8. The egg to adult developmental time was 33.2 d.

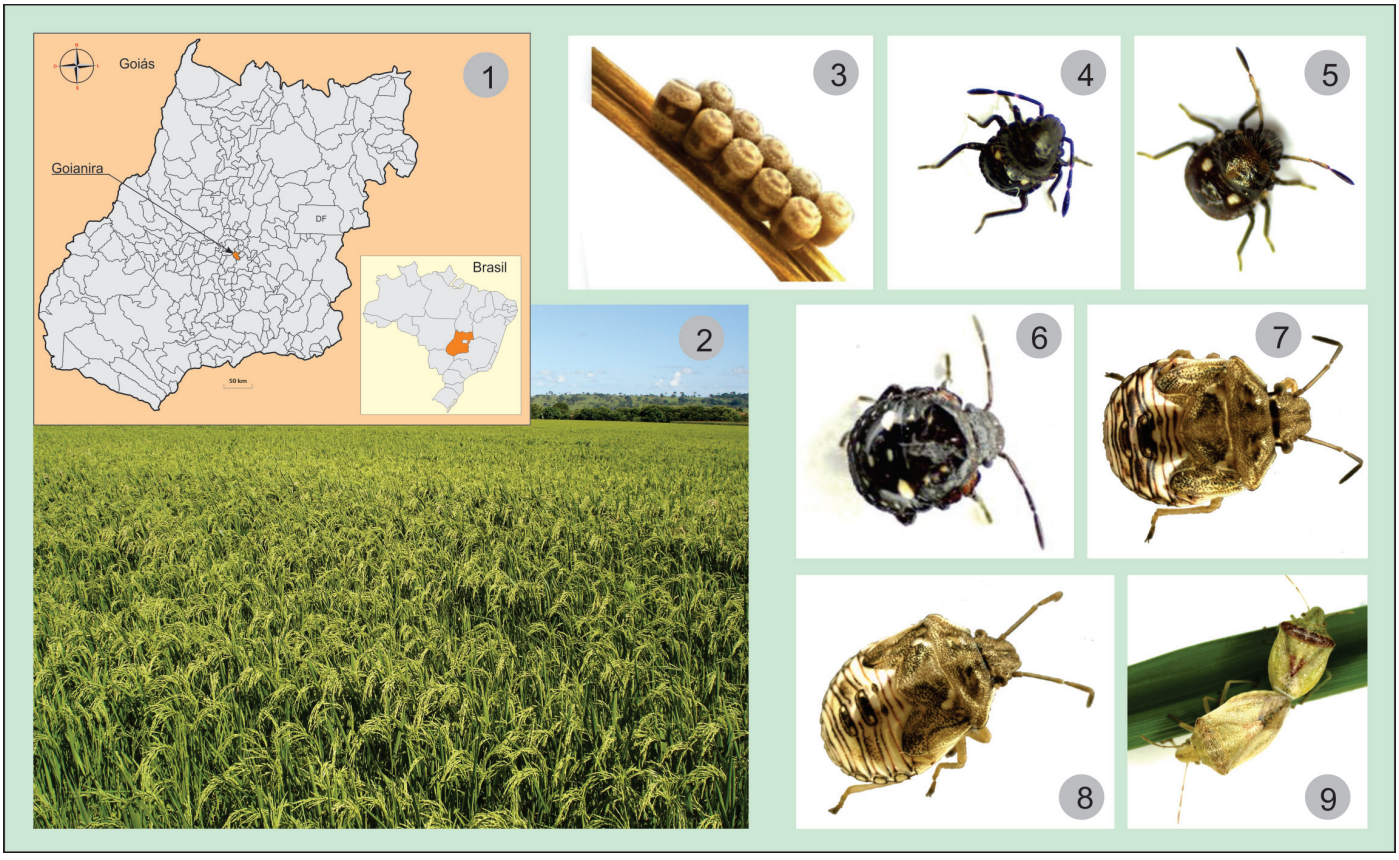


Fig. 1. Study area and insect photographs: 1 and 2, Location map and rice field view where species was found; 3 to 9, Life stages of *Cyptocephala alvarengai*.

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Table 1. Instar-specific duration (mean ± SE) for *Cyptocephala alvarengai* kept under laboratory conditions (25 ± 7 °C, 60 ± 20% RH, 14:10 h L:D photophase).

Stage	Stadium	Duration (d)	Range (d)	Mortality (%)
Egg		6.21 ± 0.41	4 – 7	22.4
Nymph	First	4.73 ± 0.92	3 – 6	1.34
	Second	4.40 ± 0.53	3 – 6	25.30
	Third	4.16 ± 0.74	3 – 6	3.74
	Fourth	5.91 ± 1.21	5 – 8	1.19
	Fifth	7.22 ± 0.31	6 – 9	2.45
	Egg–adult	33.19 ± 0.73		56.02

Adult longevity ranged from 16 to 46 d. The pre-oviposition, oviposition, and post-oviposition periods were 7.0, 22.3, and 6.3 d, respectively. Fertility was 82.3%. *Cyptocephala alvarengai* presents biological similarities to other stink bugs that feed on rice panicles, and has potential as a rice pest.

Key Words: Heteroptera, Pentatomidae, Hemiptera, rice pest

Sumario

O desenvolvimento do percevejo *Cyptocephala alvarengai* Rolston (Hemiptera: Pentatomidae) foi estudado em condições de laboratório. Os adultos foram coletados em plantas de arroz em Goianira, Goiás. O número de ovos por postura variou de 6 a 20, com média de 11,8±0,8. O tempo de desenvolvimento de ovo a adulto foi de 33,2 d. A longevidade dos adultos variou de 16 a 46 d. Os períodos de pré-oviposição, oviposição e pós-oviposição foram 7,0, 22,3 e 6,3, respectivamente. A fertilidade foi 82,3%. *Cyptocephala alvarengai* apresenta semelhanças biológicas com outros percevejos de panícula de arroz e possui potencial como praga de arroz.

Palavras-chave: Heteroptera, Pentatomidae Hemiptera, arroz praga

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