Journal of Ecosystem Science and Eco-Governance (JESEG)
www.jeseg.carsu.edu.ph

Vol. 1 No. 1 | December 2019
PRINT ISSN 2704 4394 | ONLINE ISSN 2782 8522

Comparative Development of Rice Grain Bug, *Paraeucosmetus pallicornis* (Dallas 1852) (Hemiptera:Lygaeidae) on Common Weeds in Ricefields of Agusan del Norte, Philippines

Gerardo F. Estoy Jr[*1], *Belen M. Tabudlong*[1], *Meriam V. Conado*[2], *Jheena Mae E. Viernes*[2] *& Susana B. Montilla*[2]
[1]Philippine Rice Institute, Agusan Basilisa, RT Romualdez, Agusan del Norte, Philippines 8611
[2]Caraga State University, Ampayon, Butuan City, Philippines 8600
*Corresponding Author: gf.estoy@philrice.gov.ph

Received: June 28, 2019
Revised: November 18, 2019
Accepted: December 6, 2019

Cite this article: Estoy, G.F, Tabudlong, B.M., Conado, M.V., Viernes, J.M.E, & Montilla, S. B. (2019). Comparative development of the rice grain bug, *Paraeucosmetus pallicornis* (Dallas 1852) (Hemiptera: Lygaeidae) on common weeds in ricefields of Agusan del Norte, Philippines. *Journal of Ecosytem Science and Eco-Governance 1*(1), 43-47.

A B S T R A C T

Alternate host plants are important factors in the development of pest management strategies to reduce the infestation in rice. The development of the rice grain bug, *Paraeucosmetus pallicornis* (Dallas 1852) was studied on select weeds: *Echinochloa crus-galli*, *E. glabrescens, Cyperus iria, C. difformis,* and *Vigna sesquipedales* under laboratory and screenhouse conditions. Results revealed that all treatments were capable of supporting the growth and development of the rice grain bug from egg to adult stage. Variations in egg incubation periods were recorded (*V. sesquipedales*=6.67 days; *E. crus-galli*= 7.33 days; *C. iria* and *E. glabrescens* = 7.66 days; *C. difformis* = 9.0 days). The newly hatched nymphs of *P. pallicornis* were reddish in color and had enlarged abdomen upon feeding after a few days. The nymphs passed five nymphal instars in 32.1 days in *V. sesquipedales,* 28.1 days in *C. iria,* 27.1 days in *C. difformis*, 25.4 days in *E. crus-galli,* and 23.0 days in *E. glabrescens.* The pre-oviposition periods of the newly emerged female adults were 6.3 days in *C. difformis;* 6.0 days in *C. iria* and *V. sesquipedales;* 5.67 days in *E.crus-galli*; and 5.0 days in *E. glabrescens*. Results of this study could be used as basis for the formulation of appropriate rice crop management. The tested weeds provide refugia, hence, should be managed to prevent pest infestations.

Keywords: *rice grain bug, alternate hosts, ricefield weeds, RGB life cycle*

1 Introduction

Rice production in the Philippines is vital to the food supply in the country and its economy as rice, *Oryza sativa,* is the main staple food of Filipinos. The country's rice production exhibited a decline of 2.2% in October-December 2018 and its annual output was lesser 1.09% from its level in the previous year (Philippine Statistics Authority, 2019). This decline is due to insect pest infestation especially with the influence of the changing climate on pest populations. Yield loss in rice due to insect pests is 27.9% , next to losses due to weed competition which is 37.02% (Mondal et al., 2017). Hence, any decrease in pest damage means a corresponding increase in needed rice production.

All parts of the rice plant are vulnerable to insect feeding from the time it is sown until harvested and this makes it an ideal host for many insect species (Nasiruddin & Roy (2012). Since the introduction of modern rice varieties, distinct changes have occurred in the insect pest complex of rice. Several insect species which were previously considered of low significance are now considered major pests. In addition, new pests are recorded in several areas. Alternate host plants play an important role in the biology of a number of crop pests. Rice insect population of *Chilo suppressalis* mainly reproduces on rice and use water-oat only as minor host, and the water-oat population breeds well on water-oat than on rice (Jiang et al., 2015). Knowledge about the insect's alternate host plants is an important factor in the development of pest management strategies to reduce crop infestation. If the insect pest is utilizing alternate host as an additional food source or as a survival mechanism, farmers will need to adjust crop management strategies to account for these variations.

A new insect pest of rice, *Paraeucosmetus pallicornis* (Dallas) also known as rice grain bug (RGB), was reported to have infested rice farms in Dimasalang, Masbate. The pest was also reported to occur in the Caraga Region, Samar, Leyte, Iloilo, Capiz, Aklan, Negros Oriental, Occidental and Bohol Island on areas towards the highlands. It was observed that the pest was found to be infesting the rice panicle from flowering to milking stages which results in unfilled and discoloured grains and eventually reducing yield by as much as 50% (De la Trinidad, 2012). The RGB is usually active when the temperature becomes hotter (9 am-4 pm) and less active on cooler parts of the day (Estoy & Tabudlong, 2014). It can also move easily in water and can move fast or hide underneath leaves, panicle and stubbles. It was also noted that they damage the rice grain far more seriously than the rice bug, Leptocorisa oratorius because the affected grains became discoloured and moldy. Little is yet known about its life cycle, habits, and alternate hosts which could be the basis for developing a protocol for the control and management of this pest. This study was conducted to compare the development of the rice grain bug on different species of weeds associated in the rice field.

2 Materials and Method

Collection and identification of possible alternate host of RGB

Potential alternate host plants of rice grain bug were collected within the infested rice fields and its adjacent areas through direct visual observation. Plants with rice grain bugs were collected and brought to the laboratory for possible identification.

Stock culture of RGB

Rice grain bug adults that were used in the screenhouse experiments were collected on the infested rice fields of Alegria and Kitcharao, Agusan del Norte. Collection of RGB was made through tapping method. Ten (10) randomly selected plants in and around the infested area were sampled for rice grain bug infestation. A plastic container was stationed at the base of the rice plant and the plant was tapped or shaken lightly for the insects to be dislodged and fall off into the container .The collected insects were transferred to a labelled container, brought to the laboratory for rearing, and fed with rice grain panicles.

Host Range

Rice grain bug adults that were used in the screenhouse experiments were collected from the infested rice fields of Alegria and Kitcharao, Agusan del Norte. Common weeds in ricefields which are potential alternate host plants of RGB which include *Echinochloa crus-galli, Echinochloa glabrescens, Cyperus iria, Cyperus difformis* and *Vigna sesquipedales* were collected from those infested areas since the insects were attracted to their flowers. Each plant was transplanted into the pots inside the screenhouse. The pots (n = 20) were arranged in a completely randomized design (CRD) in the screenhouse under natural temperature, humidity, and lighting conditions. At flowering stage of the plants, ten (10) pairs of newly emerged RGB adults reared on rice were introduced to each plant that was enclosed with mylar net cage. The survival and mortality of the rice grain bug (RGB) on the potential alternate host plants were observed and recorded.

Life History

For the study on the biology of the RGB, eggs were collected from the mylar net cages and placed in a petri dish containing moist filter paper and kept for hatching. After hatching, neonate nymphs (1 nymph/ container and was replicated twenty times) were transferred to transparent glass containers. Each set was fed with its corresponding host plant.

The data gathered include: (a) incubation period which is the period of time it takes for the eggs to hatch after being laid, (b) nymphal period which is the period in which nymphs emerged after hatching until they become adult. After the nymphal period, a pair of newly emerged adult male and female bugs was enclosed in one container, for the identification of its biological characteristics and the (c) pre-oviposition period– which is the period of time between the emergence of the adult female and the start of egg laying.

Statistical Analyses

All data were subjected to Analysis of Variance (ANOVA) and multiple comparisons of the means were evaluated by Post-Hoc tests. Statistical analyses were carried out using Statistical Analysis Software (SAS,1998) and Statistical Package for the Social Sciences (SPSS, 2008).

3 Results and Discussion

Alternate Host Plants

The survival of rice grain bug differed on what host plant they are reared (Table 1). Eighty percent (80%) of rice grain bug adults survived in *V. sesquipedales* within a three-week period. This was followed by *C. iria* with 53% then *E. crus-galli* and *E. glabrescens* with 50% and 40% bug adults surviving. The *C. difformis* obtained the lowest survival percentage at 23% among the weed species used.

Table 1. Survival (%) of rice grain bug on five host plants under screenhouse conditions. PhilRice Agusan, Basilisa, RTRomualdez, Agusan del Norte[1].

Host Plant		Survival (%)	
Scientific Name	Family	Mean	Std. Dev
Echinochloa crus-galli	Graminae	50.0 [a]	± 30.0
Echinochloa glabrescens	Graminae	40.0 [a]	± 20.0
Cyperus iria	Cyperaceae	53.3 [a]	± 23.1
Cyperus difformis	Cyperaceae	23.3 [a]	± 5.7
Vigna sesquipedales	Fabaceae	80.0 [b]	± 20.0

[1]In a column, means followed by a common letter are not significantly different at 5% level of significance.

Life History

The rice grain bug passes through the egg, five nymphal stadiums and adult stages. Eggs of rice grain bug are laid singly, in pairs, or in rows and not in a complete mass. Eggs are yellowish in color and translucent when newly laid. They are slender, oval and elongated and turn bright red as they mature. The eggs are deposited on the base of the stems near the ground.

Incubation period lasted for 6.67 days in *V. sesquipedales* followed by *E. crus-galli* with 7.33 days (Fig. 1). On both *C. iria* and *E. glabrescens*, incubation period took 7.66 days while in *C. difformis* incubation period lasted for 9.0 days. The result implies that the incubation period of rice grain bug was longest in *C. difformis* and shortest in *V. sesquipedales*.

Table 2. Duration (days) of the different nymphal instars of *P. pallicornis* reared on five host plants under screenhouse conditions. PhilRice Agusan, Basilisa, RTRomualdez, Agusan del Norte[1].

Host Plant	NYMPHAL INSTARS					Total Nymphal period
	1st	2nd	3rd	4th	5th	
E. crus-galli	8.0 [ns]	3.0 [a]	3.9 [a]	4.8 [a]	5.7 [a]	25.4
E. glabrescens	8.0	3.1 [a]	2.3 [b]	4.5 [a]	5.1 [a]	23.0
C. iria	8.2	4.6 [b]	2.5 [b]	5.5 [b]	7.7 [b]	28.1
C. difformis	7.8	3.4 [a]	2.6 [b]	5.7 [b]	7.6 [b]	27.1
V. sesquipedalis	8.0	4.3 [b]	5.2 [c]	6.3 [b]	8.3 [b]	32.1

[1]In a column, means followed by a common letter are not significantly different at 5% level of significance.

Newly hatched nymphs are reddish in color and after a few days the abdomen enlarges upon feeding. The nymphs passed five nymphal stadiums in 32.1days in *V. sesquipedales* followed by *C. iria* in 28.1 days then *C. difformis* in 27.1 days (Table 2). The nymphal period was relatively shorter in *E. crus-galli* with 25.4 days followed by *E. glabrescens* with 23.0 days. It also shows the period it took for rice grain bugs on each nymphal stadium. Nymphal moltings occurred in a range of 4.3, - 8.3 days on *V. sesquipedales* and in 2.5 8.2 days on *C. iria*. On *C. difformis*, moltings occurred in a range of 2.6- 7.8 days while on *E. crus-galli*, moltings occurred in a range of 3.0- 5.7 days. In *E. glabrescens* molting observation took place in 8.0, 3.1, 2.3, 4.5, and 5.1 days. Moreover, the different nymphal instars of RGB were significantly affected by the different host plants except in first nymphal instar where no significant variations were obtained on the different host plants. However, the first nymphal instar exhibited the longest duration ranging from 7.8 - 8.2 days followed by the fifth nymphal instar with 5.1– 8.3 days (Table 2). The total nymphal duration was shorter (20-27 days) when the RGB was reared on rice (Estoy et al., 2014).

Table 3. Duration (days) of the pre-oviposition period of P. pallicornis reared on five host plants under screenhouse conditions. PhilRice Agusan, Basilisa, RTRomualdez, Agusan del Norte[1].

Host Plant	Mean	Std. Dev
Echinochloa crus-galli	5.7 [a]	± 1.2
Echinochloa glabrescens	5.0 [a]	± 1.0
Cyperus iria	6.0 [a]	± 1.0
Cyprus difformis	6.3 [a]	± 1.2
Vigna sesquipedales	6.0 [a]	± 1.0

[1]In a column, means followed by a common letter are not significantly different at 5% level of significance.

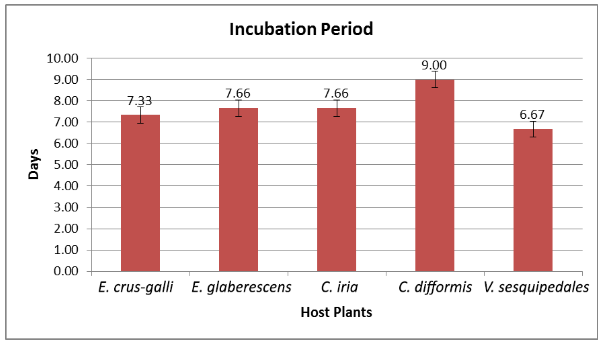

Figure 1. Duration (days) of egg incubation period of rice grain bug on five host plants. PhilRice Agusan, Basilisa, RTRomualdez, Agusan del Norte.

Feeding Habit

The insect caused damage by feeding on the inflorescence of the plants and sucking its contents. Excessive feeding caused yellowing and wilting of the inflorescence. Batay-an and Burdeos (2013) conducted a potted experiment and assessed the yield loss and damage caused by the rice grain bug. The authors reported that the rice plants infested with 3, 5, 10 and 15 RGB adults per pot significantly reduced the rice yield ranging from 20 to 41.67%. In addition, yield loss was attributed to high percentage of unfilled grains ranging from 77.97 to 87.93% and percent damaged grains ranging from 20 to 40%.

Newly emerged adults undergo pre-oviposition period (Table 3) at an average of 5.0 days in *E. glabrescens* followed by 5.67 days in *E. crus-galli*. In both *C. iria* and *V. sesquipedales*, female adults took 6.0 days to pre-oviposit while in *C. difformis*, the newly emerged female adults undergo a period of 6.33 days for pre-oviposition. The results imply that the rice grain bug feeding on different species of weeds completed its developmental period from egg to adult stage.

4 Conclusion

The *E. crus-galli, E. glabrescens, C. iria, C. difformis,* and *V. sesquipedales* are alternate hosts of rice grain bug, *P. pallicornis* since they support growth and development of RGB. Although there were variations in the development of the insect pest on each of the host plants, all host plants were capable of supporting growth and development of the insect pest. In general, the study generated the developmental information of the rice grain bug which is of great help in the formulation of appropriate management measures for the rice grain bug.

Based on the above findings,it is recommended that the alternate host plants should be managed to prevent pest infestations since they provide their refugia. Other aspects of the biology of rice grain bug such as mating behaviour, foraging behaviour and others should be gathered. Further studies on the alternate host plants of rice grain bug and its life history should be conducted in the field to validate and determine a wider host range. Awareness campaign should be done on rice farmers on the unaffected rice areas.

5 Acknowledgment

Funding for this research was partly provided by the Department of Agriculture Regional Field Office - XIII and is gratefully acknowledged.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

6 References

Batay-an, E.H. & Burdeos, C.A. (2013). Yield loss and damage assessment caused by the rice grain bug: a new insect pest of rice in Caraga region. *Philippine Entomologist, 27* (2): 212.

De la Trinidad, E. A. (2012). Technical awareness on rice grain bug. In Luzon-wide Conference on Rice Grain Bug, Ragay, Camarines Sur. E.B. Bordado, Ed. *BCARRD Report.*

Estoy, G.F. JR. & Tabudlong, B.M. (2014). Biology, ecology and management of the rice grain bug (Hemiptera: Lygaeidae) – a new emerging pest of rice. *2014 National Rice Research and Development Highlights*. Crop Protection Division. Phillippine Rice Research Institute. Maligaya, Science City of Muñoz, Nueva Ecija. Pp. 17.

Estoy, G. F., JR., Tabudlong, B. M. , Montilla, S.B, Henilo, M.D., Alas, P.C., & Duan, J.J. (2014). Biology of the rice grain bug, *Paraeucosmetus pallicornis* (Dallas) (Hemiptera: Lygaeidae), under laboratory conditions. *Philippine Entomologist, 28*(2): 205.

Jiang, W.H., LI, H.D., Cheng, X.F., Ye, J.R., Feng, Y.B. & Han, Z.J..(2015). Study on host plants for reproduction of *Chilo suppressalis*. *Journal of Asia-Pacific Entomology, 18*(3):591-595.

Mondal, D., Ghosh, A., Roy, D., Kumar, A., Shamurailatpam, D., Bera, S., Ghosh, R., Bandopadhyay, P. & Majumder, A., (2017). Yield loss assessment of rice (*Oryza sativa* L.) due to different biotic stresses under system of rice intensification (SRI). *Journal of Entomology and Zoology Studies, 5(*4): 1974-1980.

Nasiruddin, M., & Roy, R. (2012). Rice field insect pests during the rice growing seasons in two areas of Hathazari, Chittagong. B*angladesh Journal of Zoology, 40*(1): 89-100.

Philippine Statistics Authority (2019). Rice and Corn Situation and Outlook, January 2019 Round. Retrieved December 16, 2019 from https://www.psa.gov.ph/ricosit-main

SAS Institute (1998). StatView (version 5) for Windows. SAS Institute, Cary, North Carolina, USA.

SPSS Incorporated (2008). SPSS (version 16) for Windows. SPSS Incorporated, Chicago, Illinois, USA.