Evaluation of some Biological Aspects of Slug, *Leidyula floridana* (Leidy, 1851) in the Laboratory, and its Control in the Field

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INTRODUCTION

In many areas of Egypt, the slug, *L. floridana* has spread to gardens and nurseries, becoming a pest that reduces agricultural productivity. This particular slug was first discovered in Egypt together with another member of the same family, which multiplies rapidly and harms plants severely, (Herbert and Kilburn, 2004; Brodie and Barker, 2012a; 2012b; Das and Parida, 2015; Ali, 2017 and Awwad 2021). Particularly important as intermediate hosts of nematodes in this species are *Angiostrongylus cantonensis* (Chen, 1851) (Strongylida: Metastrongylidae) and *A. costaricensis* (Diaz, 2010; Wang, *et al.* 2008 and Rueda, *et al.* 2002). According to Morera and Cespedes (1971), consumption of mollusks containing *A. cantonensis* can cause eosinophilic meningitis in humans. Due to the slug’s recent fast growth in Egyptian fields and development as a pest of horticultural and field plants, this study sought to focus on some of its biological characteristics in a lab setting over the course of four seasons with field control. In terms of the biological component, the findings indicated that the winter had higher pre-egg, egg quantity, incubation, and post-ovulation periods. While the spring had the greatest hatching rate of 95.1±0.47%. Even yet, the incubation period in the summer was the shortest at 12.26±0.40 days, while the longest was 35.2±0.98 days in the winter. The findings for containing this slug in a field showed that the fungicide (carbendazim 50% SC) generated a high mean mortality rate of 71.84±6.20% at the conclusion of the experiment. Additionally, it had a significant residual impact on slug aggregation, with a drop of (87.69±3.60%) in field circumstances. Therefore, using carbendazim as a molluscicide is advised.

Keywords: *Leidyula floridana*, biological aspects, control, carbendazim

ABSTRACT

Due to the slug’s recent fast growth in Egyptian fields and development as a pest of horticultural and field plants, this study sought to focus on some of its biological characteristics in a lab setting over the course of four seasons with field control. In terms of the biological component, the findings indicated that the winter had higher pre-egg, egg quantity, incubation, and post-ovulation periods. While the spring had the greatest hatching rate of 95.1±0.47%. Even yet, the incubation period in the summer was the shortest at 12.26±0.40 days, while the longest was 35.2±0.98 days in the winter. The findings for containing this slug in a field showed that the fungicide (carbendazim 50% SC) generated a high mean mortality rate of 71.84±6.20% at the conclusion of the experiment. Additionally, it had a significant residual impact on slug aggregation, with a drop of (87.69±3.60%) in field circumstances. Therefore, using carbendazim as a molluscicide is advised.

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1. Biological experiment

To start a breeding colony, slug samples were conducted at the nursery in the Zagazig district. They were grown in wet potting soil that included 2% clay, 1% silt, and 1% sand in plastic containers that measured 18×13×4 cm (LxWxD). Romaine lettuce: *Lactuca sativa* L., was given to the slugs under laboratory circumstances. In plastic boxes, 20 newly hatched slugs were placed. Each plastic box produced ten replicas with two people in each. The pre-oviposition duration, number of eggs, hatching rate, post-oviposition, and incubation period were a few biological features that were examined in the lab. The slugs received more than enough lettuce at intervals of 2-3 days to satiate their desire.

2. Field investigation

In May 2022, a fungicide (carbendazim 50% SC) was tested against the slug *L. floridana* in a nursery for ornamental plants in the Zagazig area. For the required concentration of carbendazim (60 gm/100L) under field circumstances, the research area was split into ten plots (50*50 cm) for the spray technique. Additionally, as a check and control, another was not given any therapy (Mortada, 2002). Before application, one, three, seven, and fourteen days following treatment, the number of slugs was counted in a half-meter square in the check and treatment area (Ismail and Shetaia, 2009). According to the Henderson and Tilton (1955) formula, the decrease % was determined as follows.

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RESULTS AND DISCUSSION

1. Some biological aspects under lab. conditions

Data in Table (1) demonstrated certain biological features in four seasons under lab. settings. The newly hatched eggs were divided into plastic containers after hatching, and they were monitored every day until maturation and oviposition. It was challenging to distinguish between young and old slugs based on their exterior size or form. As a result, the life cycle, which includes the pre-oviposition stage, lasted 53–115 days from hatching to juvenile maturity, with an average of 83.5±1.04, 78.26±7.47, 80.96±3.71 and 85.3±3.13 days in the winter, spring, summer, and autumn, respectively. While the typical number of eggs in the four seasons was (144.1±249.58), (153.1±15.018), 125.13±11.45, and (139.06±6.33) eggs, respectively, in the winter, spring, summer, and autumn. These findings concur with those of Herbert and Kilburn (2004). They claimed that L. alte produces batches of up to 100 eggs at a time. In contrast, Laevicaulis stuhlmanni aegypti was able to lay eggs in culture boxes in clutches of up to 190 (Ali, 2017). The hatching rate was 91.86±1.16%, 88.86±3.51%, and 92±1.28% in the three seasons (winter, summer, and fall), respectively. However, the spring saw the greatest rate of egg hatching at 95.1±0.47%. Furthermore, this slug's post-oviposition phase lasted for 32.6±0.95, 26.03±3.07, 18±1.70 and 31±0.11 days, respectively. In addition, the Incubation time was noted in the seasons of winter, spring, and fall (35.2±0.98, 23.3±5.98, and 31.7±0.66) days, respectively. In contrast, according to Ali (2017), the Incubation period throughout the summer was 12.26±0.40 days, acting as the shortest amount of time. But according to Nagabhushanam and Kulkarni (1970a), it took around 17 days. In addition, the average number of egg masses in the winter, spring, summer, and autumn were (10±0.00, 16.66±3.33, 20±0.00, and 10±0.00 egg masses, respectively). Reproduction often takes place over four seasons, according to Herbert and Kilburn (2004). They said that during the rainy season, there is a high rate of reproduction, and that sexual maturity happens after about five months. Leidyula floridana is a hermaphrodite species, meaning that each individual has both male and female sexual organs. They also discovered reproduction after seven months (Brodie and Barker, 2012). The slug may self-fertilize if kept in isolation. In addition, they said that maturity was attained at 2.5 months and that reproduction is higher during the rainy season (Rueda, et al., 2002; Garcia, et al., 2007, and Ali, 2017).

Table 1. Average of some features of biology for slug, L. floridana during four seasons (mean ±SD.).

<table>
<thead>
<tr>
<th>Season</th>
<th>Pre-oviposition period (days)</th>
<th>Number of eggs</th>
<th>Hatching %</th>
<th>Post-oviposition period (days)</th>
<th>Incubation period (days)</th>
<th>Number of egg Masses</th>
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<tbody>
<tr>
<td>Winter</td>
<td>83.5±1.04</td>
<td>144.1±249.58</td>
<td>91.86±1.16</td>
<td>32.6±0.95</td>
<td>35.2±0.98</td>
<td>10±0.00</td>
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<td>Spring</td>
<td>78.26±7.47</td>
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<td>Summer</td>
<td>80.96±3.71</td>
<td>125.13±11.45</td>
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<td>18±1.70</td>
<td>12.26±0.40</td>
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<td>Autumn</td>
<td>85.3±3.13</td>
<td>139.06±6.33</td>
<td>92±1.28</td>
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SD = standard deviation

Fig. 1. (a) The first egg mass contains a small number of eggs. (b) An egg mass during the laying period contains many eggs. (c) The mass of eggs is interconnected in the form of a chain.

2. Toxicological studies

The efficacy of the Fungicide carbendazim 50%SC was evaluated against the slug, Leidyula floridana under field conditions.

The Fungicide efficiency of carbendazim was evaluated as a spray method against the slug. Leidyula floridana infested ornamental plants under field conditions of a nursery in the Zagazig district during May 2022. Data in Table (2) revealed that carbendazim was more toxic for this slug. Since it gave a high residual effect on the slug population with a % reduction of (87.69±3.60)%. Regarding the general means, carbendazim was the most in reducing the population density of individuals slug, it achieved (71.84±6.20)% reduction. Generally, it could be reported that the recommended Fungicide pesticide carbendazim was the most effective in controlling Leidyula floridana under

\[
% \text{ Reduction} = \left[1 - \frac{t_2 \times r_1}{t_1 \times r_2}\right] \times 100
\]

Where:
- \(t_1\) = number of a live snails before treatment in untreated plots.
- \(t_2\) = number of a live snails after treatment in treated plots.
- \(r_1\) = number of a live snails before treatment in untreated plots.
- \(r_2\) = number of a live snails after treatment in untreated plots.
field conditions. Our finding is in harmony with those which obtained by carbendazim (fungicide) Affected radula and feeding activity of different ages of land slug, *Arion limaera*, and effects led animals to refrain from feeding bringing death. (El-Deeb, et al., 2003; Soha and Randa, 2014).

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>1st</th>
<th>3rd</th>
<th>Initial effect</th>
<th>7th</th>
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### CONCLUSION

It should be noted that this particular slug is not thought of as a seasonal pest but rather as a pest that may proliferate all year long and pose harm to agriculture. Furthermore, that carbendazim substance can defend plants against slug attacks.

### REFERENCES


### Table 2. In-field effectiveness of a specific fungicide in eradicating *Leidyula floridana* infestations on ornamental plants in the Zagazig area.

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Tقييم بعض الجوانب البيولوجية للبزاقة *(Leidy, 1851)*

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جامعة الأزهر

الملخص

تعتبر النمل السريع من أصناف الوركية من أكثر الأصناف الوركية الأضرار التي تسببها للزراعة، حيث تحدث هذه الاضرار بسبب النمل السريع (Lesidyla floridana) يقوم النمل السريع بإدراجه في الأعشاب، وينتج عن ذلك تلف النبات. وتعتبر هذه الاضرار على مستوى الكثافة الإنتاجية، حيث سبق تناول دراسات تمثلت في عدة ملاحظات تشير إلى أن النمل السريع كان آتي علوا على معدل الفص في العناصر الفطرية (Leidyula floridana). ومع ذلك كانت هذه نسبة فصول النمل السريع في الفص في الأعشاب (Leidyula floridana) بنسبة (60%)، بينما سجلت النمل السريع في الأعشاب الرقم الفص في الفص في الأعشاب (Leidyula floridana) بنسبة (40%). وتم دراسة الاضرار النهائية في Retrieve from feeding bringing death. (El-Deeb, et al., 2003; Soha and Randa, 2014).

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