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AN INVESTIGATION OF THE PALABILITY OF CERTAIN PLANTS FOR THE WHITE GARDEN SNAIL, *Theba pisana* (MÜLLER)

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ABSTRACT

The land snails caused significant problems for a large number of economic plants grown in Egypt. The goal of this study was to measure the palatability and consumption ratio of snails for twelve plants from eight botanical families using a single method of no-choice feeding. Data from the no-choice feeding experiment showed that slices of cucumber, zucchini, and lettuce leaves were the most palatable food for the white garden snail; *T. pisana*. The average consumption weight were 3.90±0.32 g, 2.38±0.27 g, and 2.23±0.15 g for these treated plants, respectively. On the other hand, moderate average consumption was observed for plants such as cabbage, carrot, sowthistle, and watercress with weights of 1.94±0.36 g, 1.80±0.36 g, 1.59±0.08 g, and 1.53±0.03 g, respectively. However, spinach, beetroot, and welsh onion plants had low average consumption weights of 0.80±0.02 g, 0.80±0.01 g, and 0.68±0.06 g, respectively, over six-day. Therefore, it recommended using the most appealing plants to attract terrestrial mollusks in the field as part of their mechanical control approach.

INTRODUCTION

The terrestrial mollusks include many land snails, such as the white garden snail, *T. pisana* (Müller). They consume a wide variety of economic plants, leading to damaged seedlings, limit growth, and reduced yield. In addition, they feed on plants, also produce lesions that allowing harmful fungi to infect the plants. Snails can spread plant pathogens via their mucus trails, potentially contaminating of plants (**Feldkamp, 2002; Lindqvist, *et al.,* 2006; Van Elden, *et al.,* 2015; Bashandy and Awwad, 2022**). The white garden snail is becoming an important agricultural problem in numerous areas of the world, particularly during the rainy season. It is a significant economic pest in Egypt, causing harm to a wide range of economic crops (**Odendaal, *et al.,* 2008; Al-Akraa, *et al.,* 2010; Bashandy, 2018; Harmouzi, *et al.,* 2018; Benhamdoun, *et al.,* 2024**). The goal of the current research is to analyse the consumption and preferences of chosen plant kinds by the white garden snail, *T. pisana,* under lab circumstances.

MATERIAL AND METHODS

Collected Snails

In mid-September 2022, mature *T. pisana* snails were collected manually from citrus trees on the Arish Center's college farm in North Sinai Governorate. The snails were placed in clear bags and transferred to the laboratory of the Plant Production Department, Faculty of Environmental

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Agricultural Sciences, Arish University, (**Godan, 1983; Badawey, 20002; Bashandy, 2018; Bashandy and Awwad, 2022; Al-Harbi *et al.,* 2024**).

Tested Plants

Test leaves for nine plants and slices of the edible part for three plants belonging to six families are shown in Table 1.

Acclimatization of Land Snails

The animals were housed in plastic containers (13 cm in diameter by 10 cm in depth) filled with a mixture of clay and sand soil (approximately one to one) and adequate moisture. The containers were closed, and the covers had several holes to allow for ventilation and prevent the snails from escaping. For two weeks, snails were fed lettuce leaves in a laboratory setting with a temperature of 27±2 ºC and a relative humidity of 65± 5%. There were five replicates, each containing twenty-five mature snails of the same size and weight. So, each cup has five snails. The animals were deprived of food for 48 hours prior to the start of the experiment (**Shetaia, 2005; Bashandy and Awwad, 2024**).

The Potential Daily Consumption of Land Snails

The experiment was designed to assess consumption for terrestrial snails without choice. Three hundred snails were selected for the experiment with approximately the same size and weight. Each treatment had five replicates with five snails for each one. Each container was provided with 5g of fresh leaf plants or slices according to the kind of plants listed in Table 1. For six consecutive days, the containers were covered with lids containing fifteen ventilation holes. Each cup was provided with moisture as needed. The amount of food consumed by the animals was measured daily and refilled as necessary throughout the trial period (**Eshra, 1997; Al-Akraa *et al.*, 2010; Al-Harbi *et al*., 2024**).

Data Analysis

Means and standard errors have been determined for all variables. Prior to analysis, the data were verified for normality. Data were analyzed using one-way ANOVA and LSD test (0.05) with $CoStat_{6.311}$ program.

RESULTS

According to statistical analysis, there were notable variations in the pace at which plants were consumed by snails throughout the experiment (Table 2). The results showed that, the highest midpoint mean consumption weight of plants during the first day was zucchini, carrots, sowthistle, and cauliflower. While the highest mean consumption weight on the second day was spinach, with beetroot being the lowest mean consumption food among the other plants for land snails. Furthermore, plants such as cucumber, lettuce, and cabbage had the highest mean consumption for land snails during the third day of the trial. All these plants showed significant differences in consumption by the animals over the six days. On the other hand, there were non-significant differences in the rate of mean consumption for watercress, and chard during the trial days. Additionally, a statistical examination of the data in Table 2 revealed that the mean intake of snails varied significantly throughout the six consecutive days of the trial. It displayed the following: the most consumed meal for the white garden snail, *T. pisana*, was cucumber slices, with a median consuming weight of 3.90±0.32 g, followed by slices of zucchini, and lettuce leaves, which were 2.38±0.27g, and 2.23±0.15g, respectively. The moderate average consumption for land snails was 1.94±0.36g, 1.80±0.36g, 1.59± 0.08g, and 1.53±0.03g for plants such as cabbage, carrots, sowthistle, and watercress, respectively. Spinach, beetroot, and welsh onion had the lowest average consumption that was 0.80±0.02g, 0.80±0.01g, and 0.68± 0.06g, respectively.

Table 1. Twelve plants from six botanical families were used to evaluate the consumption experiment for the terrestrial snail, *T. pisana*, in the laboratory

Family	Scientific name	Common name	Arabic name	Part of used
Brassicaceae	*Brassica oleracea* var. *capitata*	Cabbage	الكرنب	Leaf
	Nasturtium officinale	Watercress	الجرجير	
	Brassica oleracea var. *botrytis*	Cauliflower	القرنبيط	
	Beta vulgaris var. *rubra*	Beetroot	البنجر	
Amaranthaceae	*Spinacia oleracea*	Spinach	السبانخ	
	Beta vulgaris var. *vulgaris*	Chard	السلق	
Amaryllidaceae	*Allium fistulosum*	Welsh onion	البصل الويلزى	
Asteraceae	*Lactuca sativa*	Lettuce	الخس	
	Sonchus oleraceus	Sowthistle	الجعضيض	
Cucurbitaceae	*Cucumis sativus*	Cucumber	الخيار	slices of the edible part
	Cucurbita pepo	Zucchini	الكوسة	
Umbelliferae	*Daucus carota*	Carrot	الجزر	

Table 2. The mean consumption of twelve plants by the white garden snail, *T. pisana*, *in vitro* Consumption average for 25 land snails (g/day)

Days / Plants	1st	2nd	3rd	4th	5th	6th	Mean ± SE	$LSD_{0.05}$
Cabbage	1.49^{b}	1.34^{b}	3.73^{a}	1.63^{b}	1.76^{b}	1.66^{b}	1.94 ± 0.36^{c}	0.47
Cucumber	3.88^{bc}	2.70^{d}	4.88^{a}	4.56^{ab}	3.05^{cd}	4.33^{d}	3.90 ± 0.32^{a}	0.47
Watercress	1.56^{a}	1.62^{a}	1.41^{a}	1.46^{a}	1.61^{a}	1.51^{a}	1.53 ± 0.03^{de}	0.49
Beetroot	0.79^{ab}	0.83^{a}	0.84^{a}	0.76^{b}	0.80^{ab}	0.78^{b}	0.80 ± 0.01^{g}	0.06
Welsh onion	0.55^{c}	0.47^{c}	0.62^{bc}	0.88^{a}	0.79^{ab}	0.81^{ab}	0.68 ± 0.06^{g}	0.19
Spinach	0.72^{b}	0.86^{a}	0.80^{ab}	0.72^{b}	0.88^{a}	0.82^{ab}	0.80 ± 0.02^{g}	0.11
Chard	1.05^{a}	1.11^{a}	1.07^{a}	1.10^{a}	1.04^{a}	1.14^{a}	1.09 ± 0.01^{f}	0.23
Lettuce	2.36^{ab}	2.61^{a}	2.59^{a}	1.62^{c}	2.10^{bc}	2.08^{bc}	2.23 ± 0.15^{b}	0.48
Zucchini	3.62^{a}	2.64^{b}	1.74^{c}	2.12^{bc}	2.13^{bc}	2.01^{bc}	2.38 ± 0.27^{b}	0.69
Carrot	3.63^{a}	1.55^{b}	1.34^{b}	1.52^{b}	1.50^{b}	1.31^{b}	1.80 ± 0.36^{cd}	0.29
Cauliflower	1.51^{a}	1.15^{b}	1.10^{b}	1.20^{ab}	1.21^{ab}	1.43^{ab}	1.27 ± 0.06^{ef}	0.35
Sowthistle	1.78^{a}	1.51^{b}	1.23^{c}	1.64^{ab}	1.72^{ab}	1.67^{ab}	1.59 ± 0.08^{d}	0.23
$LSD_{0.05}$							**0.28**	

The mean values with the same letter did not differ significantly ($p<0.05$) according to Duncan's multiple rang test (**Duncan, 1955**). Twenty-five land snails (five animals per container) for every plant.

DISCUSSION

Being polyphagous, snails consume a variety of plant component, such as fruits and leaves, as well as decomposing organic waste. According to research on feed preference, snails allowed free choice feeding are able to select their own food. Also, different terrestrial snails have different eating habits and food preferences. Study findings revealed that white garden snails, *T. pisana* had significant (P≤0.05) preferences for various foods. Slices of cucumber, zucchini and lettuce leaves were the most preferred foods

Similarly, **Bishara *et al.* (1968)** reported that the white garden snail mostly consumed Egyptian clover, with a small amount from grains and beans. **El-Okda (1984)** found that wide leaf weeds and Egyptian clover were attacked by *Monacha* sp. and *Oxychillus* sp. **Chang (1991)** declared that, in both lab and field new leaf lettuce was more attractive to terrestrial mollusk, *Cepeae nemoralis*.

In addition, the normal consumption for the land snail *Helix aspersa* was 0.005 to 0.026 g per day (**Asran, 1994**). While land snails, *Eobania vermiculata, H.vestalis, T. pisana* preferred banana plants, orange trees and the weed, *Medicago polymorpha*, respectively (**Nakhla and Tadros, 1995).** *E. vermiculat* and *Monacha* sp. were more likely to consume the lettuce leaves, peas and cabbage, respectively while the London rocket weed was less preferred by them (**Abd El-Hak, 1997**). Similarly, Arafa **(1997)** found that the most palatable plants for *E. vermiculata* were lettuce, sweet peas and cabbage during seven days. **Eshra (1997), Shoeib (1997) and Mahrous *et al.* (2002)** found that *E. vermiculata* and *M. cartusiana* preferred lettuce and cabbage. Giant African snails consumed cabbage and cucumber leaves (**Okafor, 2001; Akintomide, 2004**). Cabbage and lettuce were the most acceptable plants for *M. cartusiana* and *H. vestalis* (**Mohamed, 2004; 2016**). **Asran, *et al.*** (**2016**) proved that *E. vermiculata* ate more of lettuce, squash, carrots and potatoes. Moreover, **Bashandy (2018)** found that cabbage was the most consumed plants and Snow thistle was the least palatable for *Deroceras leave*. **Bashandy and Awwad (2022)** found that cabbage and lettuce leaves were the most palatable of all plants for land snails in the no-choice trial.

Conclusion

Land snails preferred cucumber slices, zucchini, and lettuce leaves over other plants. They showed the moderate average consumption for plants such as cabbage, carrots, sowthistle, and watercress, respectively. The lowest average consumption for snails observed for spinach, beetroot, and welsh onion during a period of six days. As a result, it may recommend using the most appealing plants to attract terrestrial mollusks in the field as part of their mechanical management strategies.

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الملخص العربي

دراسة استساغة وقبول قوقع الحدائق الابيض *Theba pisana* لبعض النباتات معمليا

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تسببت القواقع الأرضية العديد من المشاكل للكثير من النباتات الاقتصادية بشكل ملحوظ في مصر. كان الهدف من الدراسة هو تقييم مدى استساغة وكمية استهلاك القواقع لاثني عشر نوعا من النباتات تنتمي إلى ثماني عائلة نباتية باستخدام التغذية بدون اختيار، وقد أظهرت النتائج أن شرائح الخيار والكوسة وأوراق الخس كانت أكثر الأطعمة استساغة لقوقع الحدائق الأبيض؛ *T. pisana* وكان متوسط وزن الاستهلاك للقواقع هو ٣,٩٠ ± ٠,٣٢ جم و٢,٣٨ ± ٠,٢٧ جم و٢,٢٣ ± ٠,١٥ جم على التوالي.، وكان متوسط الاستهلاك المتوسط للقواقع لنباتات الكرنب والجزر والجعضيض والجرجير ١,٩٤ ± ٠,٣٦ جم و١,٨٠ ± ٠,٣٦ جم و١,٥٩ ± ٠,٠٨ جم و١,٥٣ ± ٠,٠٣ جم على التوالي. ومن ناحية أخرى، كان أقل متوسط استهلاك للقواقع من نباتات السبانخ والبنجر والبصل الويلزى ٠,٨٠ ±٠,٠٢ جرام، ٠,٨٠±٠,٠١ جرام، ٠,٦٨±٠,٠٦ جرام، على التوالي، خلال ستة أيام.

الكلمات الاسترشادية: قوقع الحدائق الأبيض، بدون اختيار، الاستساغة، استهلاك الطعام.

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