



An examination of palatableness of some leaf plants utilizing two terrestrial snails in Egypt

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Abstract:

Land snails markedly *Eobania vermiculata* (Müller) and *Theba pisana* (Müller) (Gastropoda: Helicidae) caused many problems to a great number of the economic plants in Egypt. So, the target of this study was to estimate the palatability and consumption ratio of snails invading twelve plants belonging to eight families by two methods: no-choice and free-choice feeding. Data displayed in no-choice feeding that cabbage and lettuce were the most palatable compared to other plants at 5.171 g and 3.763 g. But the lowest consumption leaves of Hibiscus and Swiss chards were 0.862 g and 0.473 g, for Land snails: *E. vermiculata*, respectively. Furthermore, for *T. pisana*, leaves of snow thistle were the most acceptable was 2.516 g, and leaves of spiny emex, and Strawberry disclosed the lowest palatableness rates which were 0.532g and 0.127g respectively, during intervals experimental. On the other hand, in free-choice feeding, berseem leaves showed the most preferred which was 6.829 g and 4.267 g for the two snails, *E. vermiculata* and *T. pisana*, respectively. Moreover, leaves of wheat and strawberry were the lowest consumption of *E. vermiculata*. But the lowest consumption of wheat recorded for *T. pisana* was during five days.

Introduction

Herbivorous pests such as terrestrial mollusks are pests for many plant species in different places in the world (Feldkamp, 2002). The damage to land Mollusca is caused in different ways, direct way by feeding on several plants such as field crops, orchards, and vegetables. While indirect ways as infection by bacteria,

fungi, and viruses due to the feeding of snails by scratching the plants (Lindqvist *et al.*, 2006).

The objective of this study is to assess the consumption and preference of selected food types between free-choice and no-choice by two terrestrial gastropods species: *Eobania vermiculata* (Müller) and *Theba pisana*

(Müller) (Gastropoda: Helicidae) under laboratory conditions.

Materials and methods

1. Tested snails:

Adult snails of *E. vermiculata* and *T. pisana* were collected by hand from *Citrus limon* trees during mid-March 2022 from Buhaira Governorate. Animals were put in transparent bags and transported to the laboratory of Zoology Agricultural and Nematology Department, Faculty of Agriculture, Al-Azhar University to be washed with fresh water (Godan, 1983 and Badawey, 2002).

2. Tested plants:

Test leaves for twelve plants regarding eight families which were Amaranthaceae: swiss chard; *Beta vulgaris* var. *cicla*, Cruciferae: cabbage; *Brassica oleracea* var. *capitata*, london rocket; *Sisymbrium Irio*, turnip; *Brassica rapa*, Compositae: chicory; *Cichorium intybus*, lettuce; *Lactuca sativa*, snow thistle; *Sonchus oleraceus* L., Gramineae: wheat; *Triticum aestivum*, Leguminosae: berseem clover Egyptian; *Trifolium alexandrinum*, Rosaceae: strawberry; *Fragaria* spp., and Malvaceae: hibiscus; *Malva sylvestris*, Polygonaceae: spiny emex; *Emax spovosis*.

3. Adaptation land snails:

For acclimatization, the snails were kept in glass cages (40×20×15) cm full of mixed soil (Clay: Sand) approximately (1:1) with suitable moisture and closed with a muslin cloth to avoid snail escaping (Before the start of the experiment, the soil was sterilized in the oven at a temperature of 150 °C for half an hour, then the soil was left to cool and then used) and fed on leave lettuce for two weeks under laboratory conditions at RH. 70% and Temp. 16.8 °C. Thirty healthy adult snails were chosen from each species for each replicate that was repeated three times. The animals were

starved for 48 hours before beginning the examination (Miller, *et al.*, 1988 and Shetaia, 2005).

4. Capability and daily consumption of snails:

The experiment was divided into two parts the first part for free-choice feeding and the second part for No-Choice feeding.

4.1. No-Choice feeding for land snails:

Sixty healthy animals were chosen for each treatment and then divided into three replicates each of 30 snails with sizes. A known weight from leaves plants was offered to snails in plastic jars (500 gm) and covered with a plastic lid with 15 holes for ventilation, for five successive days. The consumed mass of each foodstuff by snails was recorded daily, and jars were replenished (Eshra, 1997 and Al-Akraa *et al.*, 2010).

4.2. Free choice feeding for land snails:

Two groups of wooden boxes for each land snail species that used in the trial. Each group had nine boxes that were divided into three subgroups wooden boxes (50 × 40 × 20 cm) were used for four plants and contained mixed soil with 10 cm depth and 60% moisture. The first group was lettuce, hibiscus, Swiss chard, and strawberry, and the second group was berseem, wheat, cabbage, and turnip, and the third group was chicory, London rocket, snow thistle, and spiny emex. Each box contained 30 animals that were placed in the middle of the box. Around the snails was placed on the four sides of the box a known weight of fresh leaf samples of each plant. The food materials and their sides were altered daily to avoid a preference for a certain location (Mohamed, 2004). The tested leaf samples were changed daily after being weighed. The corrected reductions in weight by snail consumption were estimated for five successive days.

4.3. Data Analysis:

Data were statistically analyzed according to CoStat software version 6.311 using one-way ANOVA analysis and Duncan's multiple range test (0.05) to determine the significance of treatments (Duncan, 1955).

Results and discussion

The present study was conducted to know the most preferred plant leaves by two land snails by two methods.

1. No-choice feeding for land snails:

Data in Table (1) indicated that the average consumption weight of leaves of cabbage was the best susceptibility for *E. vermiculata* followed by lettuce and turnip with an average number of 5.171, 3.763, and 3.658 g after five days, but the Swiss chard, strawberry, berseem, and wheat were the lowest average consumption that was 0.473, 0.384, 0.365 and 1.47g, respectively. Furthermore, the average consumption of leaves weed was high for chicory followed by London rocket and snow thistle that was 3.178, 2.536, and 1.649 g. Therefore, the lowest average consumption of weeds; hibiscus, and spiny emex were 0.862g and 0.166 g after five days. Data in Table (2) revealed that at the average consumption weight of leaves of turnip was the most palatability food leaves for the white garden snail; *T. pisana* was 2.318g. Followed by cabbage, Swiss card, and lettuce were the moderate average consumption, which was 1.819, 1.793, and 1.722g. moreover, the leaves of berseem, wheat, and strawberry were the lowest average consumption that 0.589, 0.269, and 0.127g. besides, the most attractive leaves of weed were snow thistle and chicory. the average consumption for it is 2.516 and 1.906g. but the mean consumption of leaves of hibiscus and London rocket. The lowest consumption one was spiny emex which was 0.532g.

Ultimately, land snails; *E. vermiculata* exhibited the highest agreeable, and consumption rates leave of cabbage and lettuce were 5.171g and 3.763g. It was recorded that the lowest palatable and eating rates of leaves of hibiscus and Swiss chard were 0.862g and 0.473g. In addition, the land snails; *T. pisana* demonstrated that snow thistle was the most consumption and acceptability which was 2.516g. Besides, spiny emex and strawberry disclosed the lowest consumption and palatableness rates, which were 0.532g and .0127g. during intervals experimental.

2. Free choice feeding for land snails:

The statistical analysis of data in Table (3) showed that there was a significant difference between average weight consumption for land snails, *E. vermiculata*. The most consumption was lettuce and hibiscus that was 4.939, and 3.960g, respectively. On the contrary, data in Table (3) displayed the no-significant difference between the average consumption of weight plant leaves for land snails, *T. pisana*. But the meanest average consumption for hibiscus and lettuce was 2.714 and 2.581g, respectively. The lowest one was strawberry leaf consumption for two kinds of land snails that were used in the trial. The statistical analysis of data in Tables (3) and (4) appeared a significant difference between average weight consumption for two land snails. The most consumption was berseem leaves rate of 6.829g and 4.267g. the lowest consumption of wheat leaves was 1.148g and 0.606g for the two snails, respectively. There was statistical analysis showed significant differences in consumption of plant leaves in the third group of Tables (3) and (4). For *E. vermiculata*, the average consumption of chicory was 4.992g. But for *T. pisana* was 3.621, 3.341g, and 3.407g for chicory, snow thistle, and London rocket, respectively.

Further, the lowest consumption of spiny emex leaves was 1.628g and 1.370g, during five days.

Eventually, statistical analysis of data in Tables (3) and (4) appeared a significant difference in the rate of consumption of plant leaves. berseem showed the preferred and consumption leaves for the two snails. On the other hand, wheat and strawberry were indicated as the lowest consumption and palatability for land snails; *E. vermiculata*. on the contrary, land snails; *T. pisana* recorded the lowest acceptability and consumption of wheat during five days.

These outcomes concur with Bishara *et al.* (1968) found that the snail *Thepa* sp. fed mostly on Egyptian clover and somewhat on beans and rice. Also, El-Okda (1984) uncovered that the land snails, *Monacha* sp. also, *Oxychillus* sp. made high injury to the Egyptian clover (*Trifolium alexandrinum*) and broad leaf weeds. In addition, Chang (1991) announced that the new leaf plate structure lettuce was more like to land snail, *Cepeae nemoralis*, either under lab or field conditions. Too, Asran (1994) revealed that the day-to-day normal food consumption ranged from 0.005 to 0.026 g/day for the land snail *Helix aspersa*. Nakhla and Tadros (1995) found a huge food inclination of banana plants for *E. vermiculata*, banana plants, orange trees for *H. vestalis*, the weed, *Medicago polymorpha* for *T. pisana*, and orange trees for *Rumina decollate*. As well, Abd El-Hak (1997) showed that new leaves of lettuce were more liked for land snails; *Monacha* sp., and *Eabania* sp. followed by peas and cabbage while garden rocket leaves were the most reduced. Besides, Arafa (1997) displayed that the mean

consumption daily (mg/snail) of *Eobania* sp. for 7 days was 1.1, 1.2, 1.4, 1.3, 1.5, 1.4, and 1.9 mg/snail on lettuce, sweet peas, cabbage and nursery rocket, individually. Additionally, Eshra (1997) inferred that lettuce leaves were the most choice competed with cabbage leaves, fruits of carrot and squash fruits showed the least one. Moreover, Shoeib (1997) tracked down that *E. vermiculata* ate up Dahlia leaves more than cabbage and lettuce. But, Mahrous *et al.* (2002) detailed that cabbage and lettuce held onto the biggest quantities of *Monacha cartusiana* snails. While pepper, pea, and tomato pulled in lower numbers. Plus, Mohamed (2004 and 2016) showed that the land snail favored to cabbage and lettuce compared to other plants. Asran *et al.* (2016) appeared that *E. vermiculata* elected lettuce followed by squash, carrots, and potatoes. Bashandy (2018) observed that cabbage was the most palatable and had an average consumption rate of 0.552g, further London rocket and Snow thistle were the lowest consumption for it that 0.244g and 0.215g, for the march slug; *Deroceras leave*, respectively.

From this, we conclude that cabbage and lettuce, and other plants' leaves are more palatable to land snails compared to other plants. Some weeds are also preferable to terrestrial snails, which are considered alternative hosts in the absence of the most preferred crop. Therefore, we recommend the possibility of using cabbage and lettuce as snail-trapping plants in the field as one of the mechanical control methods for them. Also, those favorite weeds must be disposed of during the agricultural operations of the field.

Table (1): Consumption average of certain fresh leaves of vegetables and weeds for the land snail, *Eobania vermiculata* under laboratory conditions

Plants	Strawberry	Lettuce	Cabbage	Turnip	Swiss chard	Wheat	Berseem	Snow Thistle	Chicory	Spiny Emex	Hibiscus	London rocket
Consumption average/day	1 st	3.208	4.647	4.091	0.590	0.101	0.424	1.604	2.849	0.166	0.852	2.563
	2 nd	3.763	5.479	3.339	0.491	0.140	0.349	1.745	3.470	0.175	0.875	2.643
	3 rd	4.353	5.538	3.387	0.447	0.179	0.307	1.641	3.159	0.167	0.857	2.436
	4 th	3.728	5.019	3.817	0.365	0.168	0.398	1.607	3.232	0.157	0.862	2.503
	5 th	3.763	5.171	3.659	0.473	0.147	0.345	1.649	3.178	0.166	0.862	2.536
Mean	3.763 b	5.171 a	3.658 b	0.473 _g	0.147 h	0.365 gh	1.649 e	3.178 c	0.166 h	0.862 f	2.536 d	

Means with the same letter are not significantly different ($p < 0.05$) according to Duncan's multiply range test. LSD 0.05 = 0.4298

Table (2): Consumption average of certain fresh leaves of vegetables and weeds for the land snail, *Theba pisana* under laboratory conditions

Plants	Strawberry	Lettuce	Cabbage	Turnip	Swiss chard	Wheat	Berseem	Snow Thistle	Chicory	Spiny Emex	Hibiscus	London rocket
Consumption average/day	1 st	1.550	2.113	2.771	1.968	0.313	0.696	3.695	2.608	0.692	1.259	1.414
	2 nd	1.786	1.990	1.739	1.936	0.370	0.588	2.390	1.833	0.427	1.276	1.299
	3 rd	1.881	1.720	2.889	1.639	0.252	0.569	2.266	1.947	0.607	1.115	1.142
	4 th	1.701	1.260	2.656	1.858	0.210	0.539	2.115	2.020	0.499	1.444	1.086
	5 th	1.690	2.013	1.536	1.565	0.204	0.554	2.118	1.126	0.435	1.583	1.044
Mean	1.722 cd	1.819 c	2.318 _{ab}	1.793 _c	0.269 f	0.589 f	2.516 a	1.906 _{bc}	0.532 f	1.335 de	1.197 e	

Means with the same letter are not significantly different ($p < 0.05$) according to Duncan's multiply range test. LSD 0.05 = 0.4298

Table (3): Daily consumption of some plant leaves by *Eobania vermiculata* under laboratory conditions.

Plants	Group I					Group II					Group III				
	Strawberry	Lettuce	Hibiscus	Swiss Chard	Cabbage	Turnip	Wheat	Berseem	Snow Thistle	Chicory	Spiny Emex	London Rocket			
Consumption average (g)/ day	1.044	10.687	8.611	7.856	6.346	4.724	1.021	7.124	6.397	10.631	1.986	2.093			
1 st	1.796	3.499	4.633	3.238	4.293	6.382	1.104	6.228	4.368	4.514	1.559	4.902			
2 nd	1.120	3.756	3.085	1.992	3.137	1.504	1.183	7.908	2.761	2.825	1.556	5.349			
3 rd	0.352	3.665	1.153	1.701	2.972	1.865	1.453	5.262	2.023	3.274	1.481	3.979			
4 th	1.210	3.032	2.320	2.860	2.667	1.456	0.980	7.624	2.145	3.720	1.557	2.602			
5 th	1.104 b	4.928 a	3.960 ab	3.529 ab	3.883 b	3.186 b	1.148 c	6.829 a	3.539 ab	4.992 a	1.628 b	3.785 ab			
Mean															
LSD 0.05		3.372				1.956				2.701					
Mean	1.104 c	4.928 ab	3.960 bc	3.529 bc	3.883 bc	3.186 bc	1.148 c	6.829 a	3.539 bc	4.993 ab	1.628 c	3.785 bc			

Means with the same letter are not significantly different (p<0.05) according to Duncan's multiply range test. LSD 0.05 = 2.586

Table (4): Daily consumption of some plant leaves by *Theba pisana* under laboratory conditions.

Plants	Group I					Group II					Group III				
	Strawberry	Lettuce	Hibiscus	Swiss Chard	Cabbage	Turnip	Wheat	Berseem	Snow Thistle	Chicory	Spiny emex	London Rocket			
Consumption average (g)/ day	2.168	3.963	1.971	0.663	7.591	3.27	0.979	3.953	3.224	3.397	1.188	3.073			
1 st	2.892	4.622	5.001	1.464	3.457	4.569	0.75	3.421	4.256	4.954	1.481	3.673			
2 nd	2.08	1.047	3.284	1.086	2.076	1.45	0.199	4.416	3.099	4.059	1.348	4.621			
3 rd	1.499	0.977	1.638	0.994	1.725	1.161	0.155	4.907	3.49	3.216	1.726	2.791			
4 th	1.061	2.297	1.679	0.977	1.909	0.874	0.949	4.637	2.635	2.479	1.108	2.879			
5 th	1.940 a	2.581 a	2.714 a	1.037 a	3.351 a	2.265 ab	0.606 b	4.267 a	3.341 a	3.621 a	1.37 b	3.407 a			
Mean															
LSD 0.05		1.561				2.025				0.916					
Mean	1.94 bcd	2.581 abc	2.715 abc	1.037 cd	3.352 ab	2.265 bc	0.606 d	4.267 a	3.341 ab	3.621 ab	1.3702 cd	3.4074 ab			

Means with the same letter are not significantly different (p<0.05) according to Duncan's multiply range test. LSD 0.05 = 1.487

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