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PREFERENCES OF *DEROCERAS RETICULATUM* (O. F. MÜLLER), *ARION LUSITANICUS* MABILLE AND *ARION RUFUS* (LINNAEUS) FOR VARIOUS WEED AND HERB SPECIES AND WINTER OILSEED RAPE (II GROUP PLANTS)

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ABSTRACT: Palatability of 20 plant species to the slugs *Deroceras reticulatum* (O. F. Müller), *Arion lusitanicus* Mabille and *Arion rufus* (Linnaeus) was estimated in laboratory food tests (multiple-choice and no-choice). The rate and degree of damage to seedlings and leaves of weeds, herbs and winter oilseed rape were determined, and plant species preferred or rejected by particular slug species were identified. *Brassica napus* and *Datura stramonium* were preferred by all the examined slugs, while *Geranium robertianum* was rejected. The slug species differed in their preferences for the remaining plant species.

KEY WORDS: *D. reticulatum*, *A. lusitanicus*, *A. rufus*, weeds, herbs, winter oilseed rape, food preference, acceptability, palatability

INTRODUCTION

Polyphagous slugs of the families Agriolimacidae and Arionidae are pests of agricultural crops and have a wide range of food sources (CHATFIELD 1976, BARRAT et al. 1994, GLEN et al. 1993). Besides arable and vegetable crops, they damage weeds, cultivated herbs and ornamental plants. Particular slug species have specific food preferences. Slugs readily feed on some plant species and completely ignore others (DIRZO 1980, MOLGAARD 1986, COOK et al. 1996, 1997, BRINER & FRANK 1998, KOZŁOWSKI & KOZŁOWSKA 2000, 2003). Knowledge about palatability of particular plant species to slugs is indispensable in studies on alternative pest control methods in arable crops. The pertinent studies concern the use of different weed species as alternative food for slugs (COOK et al. 1997, FRANK & FRIEDLI 1999) and the application of plant extracts or chemical plant compounds for the purpose of reducing pest feeding on arable crops (WEBBE & LAMBERT 1983, MOLGAARD 1986, BRINER & FRANK 1998, BARONE & FRANK 1999). Understanding feeding behaviour of slugs and their reaction to different plant species are prerequisites to such studies.

This paper presents the results of studies on the preference for and acceptability of weed, herb species and winter oilseed rape chosen by the slugs, which attack arable crops in Poland.

MATERIAL AND METHODS

Food choice tests (multiple-choice and no-choice) were carried out on 20 plant species under laboratory conditions (day temperature 19°C, night temperature 16°C, RH 93%, day length 15 h).

Tests with multiple food choice were conducted in semi-transparent plastic containers (80 × 50 × 20 cm), 1/3 filled with soil and divided into 40 plots. The containers were closed and equipped with two holes covered with mill gauze. Nineteen weed and herb species and winter oilseed rape were sown in each container. Ten seeds of each plant species were sown in each container on two plots (2 × 5 seeds). The time of sowing was chosen in accordance with the germination and development rate of each plant species to obtain the possibly most uniform plant material for the tests. After attaining by plants the stage of 1–3 leaves and the height of 5–8 cm, 10 starved (48 h without food) and immature slugs of one species were placed in each container. The mean weight of the slugs was 0.5 g for *Deroceras reticulatum* (O. F. Müller, 1774), 2.8 g for *Arion lusitanicus* Mabille, 1868 and 1.7 g for *A. rufus* (Linnaeus, 1758). During 30 consecutive days, the percentage of plant area consumed by the slugs was estimated using a 5-degree scale (0% = no damage, 25%, 50%, 75% and 100% of consumed plant area). Five seedlings per each of the 20 studied species in 6 replications were tested for each slug species.

No-choice tests were carried out in closed plastic containers (22 × 18 × 13 cm) with small ventillation holes, and filled with a 5 cm-layer of soil. Five seeds of each plant species (total of 20 plant species examined) were sown in each container. When the plants reached the stage of 1–3 leaves and were 5–8 cm tall, a single starved slug (48 h without food) was placed in a container. The mean weight of the slugs was 0.5 g for *D. reticulatum* and 1.6 g for *A. lusitanicus*. During 15 consecutive days, the percentage of plant area consumed by the slugs was estimated, like in the previous experiment. Five seedlings were tested for each of the 20 studied plant species in 10 replications.

The leaf acceptability (at the stage of 4–6 leaves) to the slugs was estimated in no-choice tests. The experiments were performed under laboratory conditions in the darkness, at the temperature of 16°C. Disks of 346 mm^2 area or parts of leaves with the total area of 346 mm^2 were cut out from leaves of 20 plant species collected in the field. Three disks of each plant species were placed on a moistened filter paper in a tightly closed semi-translaminar plastic container (of 0.5 l capacity and 10 cm in diameter). The slugs were starved for 24 h before the tests. Prior to testing, each slug was weighed to make the total of their weights similar for each plant species. The mean mass of the slugs was 0.4 g for *D. reticulatum*, 2.1 g for *A. lusitanicus* and 1.8 g for *A. rufus*. A single slug was placed in each container and after 12 h it was removed. The leaf area not consumed by the slug was measured with millimeter ruled paper. The data were converted to percentage of the leaf area consumed by the slugs. Six replications were performed for each slug and plant species.

All the data obtained in the tests were statistically processed using variance analysis and Tukey's test at α=0.05.

RESULTS

Deroceras reticulatum

In multiple-choice tests, on the first day of observations, *D. reticulatum* fed only on *Brassica napus* L. var. *oleifera* L. (plants were damaged to 8.3%) and *Cichorium intybus* L. (3.3%) (Table 1). Two days later, damage was observed on another three plant species: *Solanum nigrum* L., *Artemisia vulgaris* L. and *Centaurea cyanus* L., but other plants under study were not damaged. After six days of feeding, eight plant species remained undamaged. Seedlings of *C. intybus* were the most seriously damaged (34.2%). *Datura stramonium* L., *Cirsium arvense* (L.) Scop., *B. napus* and *S. nigrum* were also seriously damaged (27.5%–30.8% after six days of slug feeding). Fourteen days later, *D. stramonium* and *C. intybus* were consumed in 85.8% and 80%, respectively, and *B. napus* – in 62.5%. However, *Geranium robertianum* L. and *Plantago indica* L. remained intact again. Four plant species: *Aegopodium podagraria* L., *Poa annua* L., *Anagallis arvensis* L. and *Lithospermum arvense* L. were the least damaged. The degree of seedling damage of these species ranged from 0.8% to 3.3%. After 25 days, the most severely damaged species were: *Tanacetum vulgare* L. (100%), *Brassica napus* (99.2%), *D. stramonium* (96.7%) and *C. intybus* (90.8%), and only *Geranium robertianum* remained undamaged. The first symptoms of feeding on plants of this species were observed on day 30 of the experiment (plants damaged in 0.8%). Besides *G. robertianum*, the least damaged after 30 days were: *A. arvensis*, *P. annua*, *P. indica*, *L. arvense* and *A. podagraria,* the degree of damage to these plants ranging from 5% to 10%. However, *Taraxacum officinale* Web., *D. stramonium* and *Verbascum thapsus* L. were damaged to over 95%, while *T. vulgare* and *B. napus* were damaged to 100%.

In no-choice tests (Table 2) after one day of *D. reticulatum* feeding, serious damage was recorded on *B. napus* seedlings (27%). Seedlings of *D. stramonium* were also badly damaged (15%). Slugs did not feed on seedlings of five plant species. After two days, seedlings of *B. napus* were damaged in 40.5%, and those of *D. stramonium* in 28.5%. The degree of damage to *A. vulgaris* (13.5%) was considerable. The plant undamaged by slugs during the first two days was *G. robertianum*. After six days of feeding the most seri-

Table 1. Rate of seedling damage of weed and herb species and oilseed rape by *Deroceras reticulatum* in tests with multiple choices and results of Tukey's test at α=0.05

Plant species	Days of feeding					
	1	2	6	14	25	30
Aegopodium podagraria	0.0 b	0.0 c	0.0 b	0.8 f	5.8 de	10.0 e
Agrostemma githago	0.0 b	0.0 c	2.5 ab	19.2 def	17.5 cde	20.8 de
Anagallis arvensis	0.0 b	0.0 c	0.8 ab	2.5 f	3.3 de	5.0 e
Artemisia vulgaris	0.0 b	5.8 bc	13.3 ab	30.0 cdef	39.2 bc	40.8 cd
Brassica napus	8.3 a	15.8 a	28.3 ab	62.5 abc	99.2 a	100.0 a
Centaurea cyanus	0.0 b	1.7 bc	5.0 ab	29.2 cdef	83.3 a	89.2 a
Cichorium intybus	3.3 ab	4.2 bc	34.2 a	80.0 ab	90.8 a	90.8 a
Cirsium arvense	0.0 b	0.0 c	30.0 ab	55.0 abcd	86.7 a	92.5 a
Datura stramonium	0.0 b	0.0 c	30.8 ab	85.8 a	96.7 a	97.5 a
Geranium robertianum	0.0 b	0.0 c	0.0 b	0.0 f	0.0 e	0.8 e
Lithospermum arvense	0.0 b	0.0 c	0.0 b	3.3 f	5.8 ce	8.3 e
Lycopsis arvensis	0.0 b	0.0 c	10.0 ab	23.3 cdef	42.5 bc	57.5 bc
Plantago indica	0.0 b	0.0 c	0.0 b	0.0 f	4.2 de	8.3 e
Poa annua	0.0 b	0.0 c	0.0 b	1.7 f	4.2 de	5.8 e
Polygonum convolvulus	0.0 b	0.0 c	0.0 b	5.0 ef	33.3 cd	40.8 cd
Setaria glauca	0.0 b	0.0 c	0.0 b	4.2 f	15.0 cde	15.8 de
Solanum nigrum	0.0 b	10.0 ab	27.5 ab	61.7 abc	70.8 ab	80.0 ab
Tanacetum vulgare	0.0 b	0.0 c	0.0 b	40.0 bcdef	100.0 a	100.0 a
Taraxacum officinale	0.0 b	0.0 c	3.3 ab	45.0 bcde	86.7 a	95.0 a
Verbascum thapsus	0.0 b	0.0 c	1.7 ab	10.0 ef	85.8 a	97.5 a

Values followed by the same letter within columns do not differ statistically in Tukey's test

Table 2. Rate of seedling damage of weed and herb species and oilseed rape by *Deroceras reticulatum* in tests without choices and results of Tukey's test at α=0.05

Plant species	Days of feeding			
	1	2	6	14
Aegopodium podagraria	2.5 c	2.5 c	8.0 de	22.5 efg
Agrostemma githago	3.0 c	7.5 c	19.5 bcde	45.0 bcdef
Anagallis arvensis	0.0 c	0.5 c	3.0 de	25.5 efg
Artemisia vulgaris	6.0 bc	13.5 bc	37.5 bc	60.0 bcd
Brassica napus	27.0 a	40.5 a	78.5 a	97.0 a
Centaurea cyanus	0.5 c	2.0 c	17.0 cde	49.0 bcde
Cichorium intybus	0.0 c	1.0 c	9.5 de	42.0 cdef
Cirsium arvense	0.0 c	6.0 c	20.5 bcde	61.5 bcd
Datura stramonium	15.0 b	28.5 b	43.0 b	71.0 abc
Geranium robertianum	0.0 c	0.0 c	1.0 e	4.0 g
Lithospermum arvense	5.0 bc	7.0 c	16.5 cde	56.5 bcd
Lycopsis arvensis	1.0 c	4.5 c	19.5 bcde	42.5 cdef
Plantago indica	6.0 bc	8.5 c	17.5 bcde	65.5 bcd
Poa annua	0.0 c	2.5 c	11.5 de	14.5 fg
Polygonum convolvulus	6.5 bc	9.5 c	27.5 bcd	60.5 bcd
Setaria glauca	2.0 c	3.5 c	9.0 de	36.0 def
Solanum nigrum	2.0 c	2.5 c	8.0 de	23.0 efg
Tanacetum vulgare	2.0 c	4.5 c	10.5 de	46.0 bcde
Taraxacum officinale	3.0 c	6.0 c	23.5 bcde	74.5 ab
Verbascum thapsus	3.0 c	3.0 c	4.0 de	21.0 efg

Values followed by the same letter within columns do not differ statistically in Tukey's test

ously damaged were still *B. napus* seedlings (78.5%). Badly damaged were *D. stramonium* (43%) and *A. vulgaris* (37.5%). The smallest damage was observed on the seedlings of *G. robertianum* (1%). Besides these species, plants slightly damaged by slugs were, among others, *A. arvensis* (3%) and *V. thapsus* (4%). After 14 days of slug feeding, the most severely damaged were seedlings of *B. napus* (97%), *T. officinale* (74.5%) and *D. stramonium* (71%). Seedlings of *G. robertianum* were significantly the least damaged (4%). Slightly damaged were also seedlings of *P. annua* (14.5%), as well as those of *V. thapsus*, *A. podagraria*, *S. nigrum* and *A. arvensis* (21%–25.5%).

In tests on the acceptability of leaf disks, *D. reticulatum* consumed mostly leaves of *P. annua* (39.1%) (Table 3). Leaves of *D. stramonium* (15.9%) and *B. napus* (13.3%) were also consumed rather readily. The slugs virtually did not feed on the leaves of *L. arvense* (0.1%), *A. arvensis* (0.5%) and *G. robertianum* (0.5%). Slightly consumed were also leaves of *S. glauca* (L.) Beauv. (0.9%), *T. vulgare* (1.9%) and *C. arvense* (2.2%).

Arion lusitanicus

In multiple-choice tests, *A. lusitanicus* damaged a half of the plant species on the first day of its feeding (Table 4). After two days, the most damaged were seedlings of *B. napus* (45.8%). The slugs did not feed on *P. indica*, *D. stramonium*, *P. annua* and *S. glauca*. After six days of feeding, plants of *A. podagraria* were damaged in 93.3%, those of *S. nigrum*, *B. napus* and *V. thapsus* in 80.0%–83.3%. The slugs did not damage seedlings of *P. annua*. Significantly less damaged (3.3%–6.7%) were *P. indica*, *C. arvense* and *A. vulgaris*. After two weeks, besides *A. podagraria*, *S. nigrum*, *V. thapsus*, *T. officinale* and *D. stramonium* were damaged to 100%. Plants of *P. annua* were not damaged, whereas *P. indica* and *G. robertianum* were damaged to 25% and 25.8%, respectively. As the amount of plants got reduced, the slugs fed on all the remaining plants, which were slightly damaged during two weeks of the experiment. After 25 days of slug feeding, the damage degree of the studied plants species ranged from 49% to 100%. Plants of *P. annua* (49%) were the least damaged and *G. robertianum* was also injured slightly (58%).

In no-choice tests, on the first day of *A. lusitanicus* feeding, seedlings of *D. stramonium* were the most damaged (56%) (Table 5), though the slugs did not feed on *P. indica*, *T. vulgare* and *G. robertianum*. After two days of feeding, the damage degree of the examined plant seedlings was much higher. No damage was observed on *G. robertianum*. After six days of observations, seedlings of *D. stramonium* were completely destroyed (100%). Seriously damaged were *C. intybus* (68.5%), *C. arvense* (65%) and *T. officinale* (63%), while the least damaged were seedlings of *G. robertianum* (3%). Less injured were also *P. annua* (5.5%) and *L. arvensis* (6%). After 14 days, besides the earlier damaged plants of *D. stramonium*, the most damaged were seedlings of *T. officinale* and *C. arvense* (about 97%). The least injured were again seedlings of *G. robertianum* (5%), *L. arvensis* L. (10.5%) and *P. annua* (13%).

In the tests on the acceptability of leaf disks by *A.lusitanicus*, the most consumed were *B. napus* (98.4%), *A. podagraria* (96.2%) and *D. stramonium* (96%) (Table 3). The slugs did not feed on the leaves of *V. thapsus*. Leaves of *G. robertianum* were consumed to the smallest degree (1.1%). Less damaged were also *A. arvensis* (10.9%) and *L. arvense* (15.3%).

Arion rufus

In multiple-choice tests, *A. rufus* fed on plants of 13 species for the first 24 hours (Table 6). The most severely damaged were *B. napus* seedlings (18.3%). After two days the most damaged were *B. napus*, (29.2%), *A. podagraria* (25%), *C. cyanus* (23.3%) and *S. nigrum* (23.3%). The slugs showed no interest in *A. arvensis*, *C. arvense*, *G. robertianum*, *L. arvense*, *P. indica* and *P. convolvulus* L. After six days of feeding, seedlings were damaged to 95% in *A. podagraria*, to 74.2% in *S. nigrum*, to 63.3% in *B. napus* and to 60% in *C. intybus*. The slugs did not feed on the seedlings of *L. arvense* and *P. indica*, and plants of *G. robertianum* were damaged only to 0.8%. After 14 days, plants of *A. podagraria* were completely destroyed (100%). Moreover, seedlings of *S. nigrum*, *C. intybus* and *C. cyanus* were damaged to 92.5%–97.5%. *P. indica* remained undamaged. The slightest damage was observed on *L. arvense* (0.8%) and on *G. robertianum* (0.8%). After 25 days of feeding, plants of 12 species were completely or almost completely damaged, and plants of six species were damaged in 30%–80%. Plants of *L. arvense* and *G. robertianum* were the least damaged (5.8% and 8.3%, respectively).

In the tests on the acceptability of leaf disks, *A. rufus* slugs consumed 80.7% of the leaf area of *P. indica* and 75.6% of that of *A. podagraria* (Table 3). Leaves of *B. napus* were comparatively seriously damaged (68.4%). The least consumed were leaves of *V. thapsus* (0.2%). A group of slightly consumed plants included also *S. glauca* (8.3%) and *L. arvensis* (10.7%).

Table 3. Percentage of consumed area of leaves of weed and herb species and oilseed rape during 12 h by three slug species and results of Tukey's test at α=0.05

Plant species	Slug species		
	D. reticulatum	*A. lusitanicus*	*A. rufus*
Aegopodium podagraria	2.0 cd	96.2 a	75.6 a
Agrostemma githago	8.3 bcd	73.3 ab	39.9 abcd
Anagallis arvensis	0.5 d	10.9 efg	14.2 bcd
Artemisia vulgaris	5.9 bcd	60.9 abcd	36.9 abcd
Brassica napus	13.3 bc	98.4 a	68.4 ab
Centaurea cyanus	5.0 bcd	69.7 abc	46.1 abcd
Cichorium intybus	6.2 bcd	29.0 cdefg	29.4 abcd
Cirsium arvense	2.2 cd	40.0 bcdefg	52.1 abcd
Datura stramonium	15.9 b	96.0 a	13.6 bcd
Geranium robertianum	0.5 d	1.1 fg	18.1 bcd
Lithospermum arvense	0.1 d	15.3 efg	16.3 bcd
Lycopsis arvensis	6.5 bcd	28.7 cdefg	10.7 cd
Plantago indica	3.6 bcd	66.1 abc	80.7 a
Poa annua	39.1 a	48.8 bcde	57.8 abc
Polygonum convolvulus	7.1 bcd	43.2 bcdef	25.9 abcd
Setaria glauca	0.9 cd	19.6 defg	8.3 cd
Solanum nigrum	6.5 bcd	42.8 bcdefg	42.3 abcd
Tanacetum vulgare	1.9 cd	29.1 cdefg	46.4 abcd
Taraxacum officinale	7.7 bcd	68.2 abc	33.9 abcd
Verbascum thapsus	5.2 bcd	0.0 g	0.2 d

Values followed by the same letter within columns do not differ statistically in Tukey's test

Table 4. Rate of seedling damage of weed and herb species and oilseed rape by *Arion lusitanicus* in tests with multiple choices and results of Tukey's test at α=0.05

Plant species	Days of feeding				
	1	2	6	14	25
Aegopodium podagraria	0.0 b	20.8 abcd	93.3 a	100.0 a	100.0 a
Agrostemma githago	9.2 ab	10.0 bcd	30.8 bcd	72.5 abc	100.0 a
Anagallis arvensis	0.8 ab	3.3 cd	14.2 cd	61.7 abcd	100.0 a
Artemisia vulgaris	0.0 b	3.3 cd	6.7 d	74.2 abc	100.0 a
Brassica napus	12.5 ab	45.8 a	83.3 ab	99.2 a	100.0 a
Centaurea cyanus	16.7 a	31.7 abcd	62.5 abc	98.3 a	100.0 a
Cichorium intybus	2.5 ab	9.2 bcd	47.5 abcd	99.2 a	100.0 a
Cirsium arvense	0.0 b	5.0 bcd	5.0 d	51.7 bcd	91.7 a
Datura stramonium	0.0 b	0.0 d	34.2 bcd	100.0 a	100.0 a
Geranium robertianum	0.0 b	5.8 bcd	12.5 cd	25.8 de	58.3 bc
Lithospermum arvense	5.0 ab	13.3 abcd	32.5 bcd	70.8 abc	99.2 a
Lycopsis arvensis	0.8 ab	5.0 bcd	15.8 cd	87.5 ab	100.0 a
Plantago indica	0.0 b	0.0 d	3.3 d	25.0 de	94.2 a
Poa annua	0.0 b	0.0 d	0.0 d	0.0 e	49.2 c
Polygonum convolvulus	0.0 b	1.7 d	10.8 cd	50.8 bcd	99.2 a
Setaria glauca	0.0 b	0.0 d	6.7 d	35.8 cde	77.5 ab
Solanum nigrum	6.7 ab	31.7 abcd	80.0 ab	100.0 a	100.0 a
Tanacetum vulgare	0.0 b	0.8 d	11.7 cd	43.3 bcde	88.3 a
Taraxacum officinale	0.8 ab	36.7 abc	62.5 abc	100.0 a	100.0 a
Verbascum thapsus	10.0 ab	38.3 ab	83.3 ab	100.0 a	100.0 a

Values followed by the same letter within columns do not differ statistically in Tukey's test

Table 5. Rate of seedling damage of weed and herb species and oilseed rape by *Arion lusitanicus* in tests without choices and results of Tukey's test at α=0.05

Plant species	Days of feeding			
	1	2	6	14
Aegopodium podagraria	12.5 bcde	17.0 cdef	31.5 cdef	73.5 bcd
Agrostemma githago	6.0 cde	21.0 cdef	46.5 bc	89.5 abc
Anagallis arvensis	6.0 cde	10.0 def	18.5 defg	58.5 de
Artemisia vulgaris	3.5 cde	6.5 ef	25.0 cdefg	84.0 abc
Brassica napus	14.0 bcde	22.0 bcde	31.5 cdef	67.5 cd
Centaurea cyanus	5.0 cde	12.5 cdef	48.0 bc	88.5 abc
Cichorium intybus	28.5 b	43.5 b	68.5 b	82.5 abcd
Cirsium arvense	19.5 bc	32.5 bc	65.0 b	96.5 ab
Datura stramonium	56.0 a	82.0 a	100.0 a	100.0 a
Geranium robertianum	0.0 e	0.0 f	3.0 g	5.0 g
Lithospermum arvense	12.0 cde	17.5 cdef	31.5 cdef	82.5 abcd
Lycopsis arvensis	3.5 cde	3.5 ef	6.0 fg	10.5 fg
Plantago indica	0.0 e	2.0 ef	15.0 defg	66.5 cd
Poa annua	1.5 de	2.5 ef	5.5 fg	13.0 fg
Polygonum convolvulus	11.5 cde	19.5 cdef	42.0 bcd	76.0 abcd
Setaria glauca	1.5 de	5.0 ef	14.0 efg	34.5 ef
Solanum nigrum	5.0 cde	10.5 def	21.5 cdefg	39.5 e
Tanacetum vulgare	0.0 e	2.5 ef	41.0 bcde	85.0 abc
Taraxacum officinale	17.0 bcd	28.5 bcd	63.0 b	97.0 ab
Verbascum thapsus	5.5 cde	5.5 ef	35.0 cde	85.5 abc

Values followed by the same letter within columns do not differ statistically in Tukey's test

Table 6. Rate of seedling damage of weed and herb species and oilseed rape by *Arion rufus* in tests with multiple choices and results of Tukey's test at α=0.05

Plant species	Days of feeding				
	1	2	6	14	25
Aegopodium podagraria	10.8 a	25.0 a	95.0 a	100.0 a	100.0 a
Agrostemma githago	2.5 a	5.8 a	21.7 def	53.3 bcdef	79.2 ab
Anagallis arvensis	0.0 a	0.0 a	5.8 f	25.8 defg	75.0 ab
Artemisia vulgaris	7.5 a	8.3 a	17.5 ef	64.2 abcde	97.5 a
Brassica napus	18.3 a	29.2 a	63.3 abc	83.3 abc	99.2 a
Centaurea cyanus	13.3 a	23.3 a	47.5 bcde	92.5 ab	100.0 a
Cichorium intybus	6.7 a	13.3 a	60.0 abcd	95.8 ab	100.0 a
Cirsium arvense	0.0 a	0.0 a	9.2 ef	44.2 cdefg	97.5 a
Datura stramonium	6.7 a	11.7 a	29.2 cdef	67.5 abcd	100.0 a
Geranium robertianum	0.0 a	0.0 a	0.8 f	0.8 g	8.3 de
Lithospermum arvense	0.0 a	0.0 a	0.0 f	0.8 g	5.8 e
Lycopsis arvensis	1.7 a	4.2 a	26.7 cdef	66.7 abcd	100.0 a
Plantago indica	0.0 a	0.0 a	0.0 f	0.0 g	58.3 bc
Poa annua	1.7 a	1.7 a	3.3 f	10.8 fg	38.3 cd
Polygonum convolvulus	0.0 a	0.0 a	13.3 ef	27.5 defg	63.3 bc
Setaria glauca	4.2 a	6.7 a	11.7 ef	20.0 efg	65.0 bc
Solanum nigrum	4.2 a	23.3 a	74.2 ab	97.5 ab	100.0 a
Tanacetum vulgare	0.0 a	1.7 a	18.3 ef	54.2 abcdef	97.5 a
Taraxacum officinale	0.8 a	2.5 a	23.3 cdef	71.7 abcd	100.0 a
Verbascum thapsus	5.8 a	9.2 a	32.5 cdef	87.5 abc	100.0 a

Values followed by the same letter within columns do not differ statistically in Tukey's test

DISCUSSION

Among the 20 examined plant species, *D. reticulatum*, *A. lusitanicus* and *A. rufus* preferred seedlings and leaves of *Brassica napus* and *Datura stramonium*, but did not accept seedlings and leaves of *Geranium robertianum*. Similar results were obtained by other authors for *D. reticulatum* and *A. lusitanicus*, originating from populations occurring in agricultural environments of Switzerland (BRINER & FRANK 1998, BARONE & FRANK 1999). Plants of *Centaurea cyanus*, *Cirsium arvense* and *Tanacetum vulgare*, mentioned by some authors (BRINER & FRANK 1998) as those preferred by *A. lusitanicus*, were evaluated in our studies as acceptable or moderately acceptable to this slug. *Taraxacum officinale*, preferred by *Agriolimax caruanae* Pollonera (DIRZO 1980) and *D. reticulatum* (COOK et al. 1997), in our investigations was accepted at the seedling stage equally by *A. lusitanicus*, *D. reticulatum* and by *A. rufus* as moderately acceptable at the stage of 4–6 leaves.

Based on the tests it was found that *Deroceras reticulatum*, besides *B. napus* and *D. stramonium*, preferred seedlings of *T. officinale* and *C. arvense* and leaves of *P. annua*. The slug completely rejected seedlings of *P. annua* and seedlings and leaves of *G. robertianum*, and accepted *A. arvensis*, *A. podagraria*, *P. indica* and *L. arvense* only to a small degree. *A. lusitanicus*, besides *B. napus* and *D. stramonium*, preferred plants of *A. podagraria* and seedlings of: *C. intybus*, *A. vulgaris*, *V. thapsus*, *T. officinale*, *C. arvense*, *A. githago* and *C. cyanus*. Apart from *G. robertianum*, this slug accepted seedling of *P. annua* and leaves of *V. thapsus* to a slight degree. *A. rufus* preferred seedlings and leaves of *A. podagraria*. This slug readily fed also on *B. napus*, *S. nigrum*, *C. cyanus*, *C. intybus* and on the leaves of *P. indica*. The least acceptable, apart from *G. robertianum*, were *L. arvense* seedlings and *V. thapsus* leaves.

It was observed that the preference for and acceptance of some plant species by slugs changed with the plant age. *L. arvense* seedlings were accepted by *A. lusitanicus*, but leaves were accepted only to a slight degree. *A. lusitanicus* and *A. rufus* readily fed on *V. thapsus* seedlings, but leaves were consumed by these slugs only to a slight degree.

The analysis shows that plants of most of the studied species present different degrees of attractiveness to particular slug species. For example, seedlings and leaves of *A. podagraria* were readily consumed by *A. lusitanicus* and *A. rufus*, and only reluctantly consumed by *D. reticulatum*. *L. arvense* seedlings, slightly acceptable to *D. reticulatum* and *A. rufus*, were accepted relatively well by *A. lusitanicus*. *A. lusitanicus* readily fed on seedlings of *A. arvensis*, while *D. reticulatum* ignored them. These examples indicate that particular slugs species show a specific preference for plant food. This confirms the results of our earlier studies on the acceptability of different weed and herb species to *D. reticulatum*, *A. lusitanicus* and *A. rufus* (KOZŁOWSKI & KOZŁOWSKA 2000, 2003). Similar conclusions were drawn by other authors, for example DIRZO (1980) and BRINER & FRANK (1998), in their studies concerning *Agriolimax caruanae* and *Arion lusitanicus* on various herb plants. A differential reaction of slugs to plant food might result from a specific plant morphology or a specific effect of plant chemicals, characteristic of individual plant species. This is supported by investigations of some authors on feeding behaviour of slugs on different plant species (DIRZO 1980, DIRZO & HARPER 1982, WEBBE & LAMBERT 1983, MOLGAARD 1986, BARONE & FRANK 1999). The place of origin, developmental stage and also other factors associated with the environment have a significant impact on morphological and biochemical properties of plants, which determine the attractiveness to slugs.

Our experiments showed great differences between the 20 studied plant species in respect of their attractiveness to slugs. Several plant species, preferred and entirely not tolerated by *D. reticulatum*, *A. lusitanicus* and *A. rufus*, were selected for further research on the possibility of their use for crop protection against slugs.

CONCLUSIONS

1. *D. reticulatum*, *A. lusitanicus* and *A. rufus* preferred *Brassica napus* and *Datura stramonium* plants, but showed no interest in *Geranium robertianum*.
2. With regard to the remaining plant species under study, food preferences of particular slug species varied, which is indicative of their specific food requirements.
3. Attractiveness of host plants to slugs, besides their species-specific properties, is determined by the developmental stage of plants and by other factors connected with their environment.

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