Comparative Study on the Adaptation and Growth Dynamics of the *Helix pomatia* and *Helix aspersa* Muller Terrestrial Snails Under Different Feeding Regimes

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Abstract

We used *Helix pomatia* and *Helix aspersa* species and measure their growth as the snails were approaching the hibernation season. *Helix pomatia* 2yo shown a decrease in weight while being raised in enclosed parcels of 4sqm the younger *Helix pomatia* 1yo as well as *Helix aspersa* Muller demonstrated the ability to adapt relatively fast to the same conditions. We established 5 experimental lots in a *Helix pomatia* farm, GPS coordinates N46.60604^0 E23.59995^0. Control lot contained *Taraxacum officinales, Sonchus oleraceus, Equisetum arvense* and *Atriplex hortensis,* wild flora found within the farm. The other lots contained the same plants as the control lot plus different combinations of imported plants from other areals. The *H. pomatia* 2yo weight decreased in the control lot by a mean of -3.86% while *H. aspersa* 1yo marked an increase of +16.89% in the same lot during the same period. The lot containing *lupinus polyphyllus* delivered snails with weight gain of +24.66% for *H. pomatia* 2yo and an increase of only +1.98% for *H. aspersa* 1yo. As a contrast, *H. pomatia* 2yo gained only +7.72% while *H. aspersa* 1yo gained +28.89%, in the lot containing *Lavanda officinalis, Foeniculum vulgare* and *Hyssopus officinalis* among the other plants.

Keywords: Cornu aspersum, Cluj-Napoca, helicicultura, food selection, ecological farm management, mollusk

1. Introduction

Edible terrestrial snails have been used by humans as food since prehistoric times [1]. In Turkey, Yarimburgaz Cave offers evidences of the use of *Helix pomatia* for consumption relates Meric in his works [2]. Dalby [3] during his archeological works dates snail shell sediments found in Franchthi Cave, Greece, all the way back to 10,700 BC. Edible terrestrial snails, among herbivores, are regarded as major grazers [4]. Previous research upon the use of different plant species as food by terrestrial snails were conducted by Chevalier et al. [4, 5] but the plant species used in the present study have not been studied. Furthermore, the scope of our investigation is to address the productivity issues under intense snail farming conditions rather than the biological and environmental aspects neither the chemical nor biochemical content of snail's feed as decisive factors in snail's food attraction, food selection or their diet. We also intend to observe the practicality of the exploitation of perennial plants as much as possible in the snail farming.

2. Materials and methods

The experimental studies were conducted between July 25-th and September 3-rd 2009.

2.1. The study area – The experiments were conducted in an edible terrestrial snail farm located in Crăieşti town, Cluj County, Romania, GPS coordinates N46.60604^0 E23.59995^0. The GPS coordinates are used in order to facilitate the traceability, the origin of the results and in general

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the traceability food products [6, 7]. Five different lots were built within the farm area and each lot 2m x 2m was provided with top closure to prevent the snails from escaping.

2.2. Soil's status chemical composition and temperature. The status and the chemistry of the soil in the experimental area have been examined by The Institute of Pedology – Cluj Napoca, and it is described in Table 1.

Soil's temperature during the experiment ranged from 15°C to 21°C, averaging 17°C, data collected using a soil thermometer Model: tpi-312 with a resolution of 0.1°C and accuracy of ±1°C and a sampling time of 1.5 seconds.

Table 1.-Soil status and chemical content

Soil's formula:	Probe's Depth	
Aska-k_1d_3-t/l-Tfg/NB-Ar.	-10cm	-20cm
pH	7.65	7.72
$CaCo_3$ (%)	4.80	4.90
Nitrogen (total %)	0.251	0.207
Humus (%)	4.10	3.11
Phosphor (ppm)	5	2
Potassium (ppm)	2960	924
Ca (active) mg	24	16
Magnesium (active)(mg)	4.86	4.86
Probe's GPS coordinates:	N46.60604^0	E23.59995^0

2.3. Weather conditions - The air temperature and humidity indicated in Table 2. were recorded using a USB-502 data logger supporting a range of -35°C to +80°C (±1°C) and 0% to 100% relative humidity.

Table 2.-Weather conditions during experiments

	Temperature	Humidity
maximum	33°C (August 4-th)	92 %
minimum	9°C (August 20-th)	30 %
average	20	74 %

2.4. Snail species – From the age-size-weight point of view, we used in our study as much as possible homogenous populations of *Helix pomatia* 2 years old, *Helix pomatia* 1 year old from the local farm and *Helix aspersa* Muller 1 year old and *Helix aspersa* Muller 30 to 40 days old imported. Groups of each species and age were introduced in all of the experimental lots.

2.5. Plants species – In Table 3 are listed the plants used to feed the snails. Most of them are perennial. The plants in the control lot V1-M are basically representative of the majority of plant population found in the farm and observed as constituting food for snails. They are *Taraxacum officinales Sonchus oleraceus, Equisetum arvense,* and *Atriplex hortensis*. The other lots will also contain plants found in the control lot but in a lower density, therefore making room for additional species such as:

In lot V2-E we added in *Lupinus polyphyllus (perenis*) a species imported from a different areal were we observed as being highly preferred by snails.

In lot V3-E we added *Rumex acetosa and Rheum officinale (R. Rhaponticum).*

In lot V4-E we added other highly preferred plants by snails such as *Armoracia rusticana, Arctium lappa (Linn.)* along with *Thymus vulgaris.*

In lot V5-E we added *Lavanda officinalis, Foeniculum vulgare* and *Hyssopus officinalis.*

2.6. Measurements - At the beginning of the study, the *Helix pomatia* and *Helix aspersa* 1 and 2 years old snails were divided in 10 groups for each species and age, having 5 snails in each group and *Helix aspersa* 30-40 days old in 5 groups of 40 snails each. All groups were measured in weight using an AWS weight scale precision ±0.01 grams. Snail's behavior has been observed such as its favorite resting places and its appetite for specific plants (Figure 1.).

Figure 1. – *Helix pomatia* Linn. feeding on *Foeniculum vulgare*

Table 3. – The major plant population constituting food for snails in the control and experimental lots

Lots	Romanian name	English name	Scientific name (Latin)
V1 - M	Papadie	Dandellion	*Taraxacum officinales*
	Susai	Sowthistle, Sonchus	*Sonchus oleraceus*
	Coada calului	Horse Tail, Horsetail, peek-a-bear	*Equisetum arvense*
	Loboda	Garden Orache	*Atriplex hortensis*
V2 – E	Papadie	Dandellion	*Taraxacum officinales*
	Susai	Sowthistle, Sonchus	*Sonchus oleraceus*
	Coada calului	Horse Tail, Horsetail, peek-a-bear	*Equisetum arvense*
	Loboda	Garden Orache	*Atriplex hortensis*
	Lupin	Lupinus	*Lupinus polyphyllus (perenis)*
V3 – E	Papadie	Dandellion	*Taraxacum officinales*
	Susai	Sowthistle, Sonchus	*Sonchus oleraceus*
	Coada calului	Horse Tail, Horsetail, peek-a-bear	*Equisetum arvense*
	Loboda	Garden Orache	*Atriplex hortensis*
	Macris	Common Sorrel	*Rumex acetosa*
	Rabarbar, Revent	Rhubarb	*Rheum officinale,R. rhaponticum*
V4 – E	Papadie	Dandellion	*Taraxacum officinales*
	Susai	Sowthistle, Sonchus	*Sonchus oleraceus*
	Coada calului	Horse Tail, Horsetail, peek-a-bear	*Equisetum arvense*
	Loboda	Garden Orache	*Atriplex hortensis*
	Hrean	Horseradish	*Armoracia rusticana*
	Brusture	Burdock	*Arctium lappa (Linn.)*
	Cicoare	Thyme	*Thymus vulgaris*
V5 – E	Papadie	Dandellion	*Taraxacum officinales*
	Susai	Sowthistle, Sonchus	*Sonchus oleraceus*
	Coada calului	Horse Tail, Horsetail, peek-a-bear	*Equisetum arvense*
	Loboda	Garden Orache	*Atriplex hortensis*
	Lavanda	Lavender	*Lavanda officinalis*
	Fenicul	Fennel	*Foeniculum vulgare*
	Isop	Hyssop	*Hyssopus officinalis*

2.7. Statistics - For data statistical interpretation and the generation of graphics we used statistical software GraphPad 5.03 and Excel module from Microsoft Office 2003. Column statistics and ANOVA test incorporating the Dunnett's Multiple Comparison Test.

3. Results and discussion

Upon our investigation we observed (Table 4.) that in the control lot, namely V1-M, *Helix pomatia* 2 y.o. experienced a decrease in weight of 4±0.22 g, corresponding to a -3.86±0.21 % increase value (actually a decrease, being a negative value), having minimum gain values of -5.15g or -4.97% and maximum values of -2.90g or -2.81% respectively, while in the other lots *Helix pomatia* 2 y.o. registered an increase in weight, topping a 24.66±0.28% (corresponding to 21.20±0.20 grams) weight gain in lot V2-E immediately followed by a 20.23±0.22% in lot V4-E. The minimum values are 20.20g or 23.31% with maximum values of 21.90g or 25.74% for V2-E while in V4-E we obtained minimums of 17.60g or 18.85% and maximums of 19.50g or 21.09%.

In lot V3-E a gain of 5.84±0.09% and in lot V5-E a gain of 7.72±0.10% has been obtained.

Performing ANOVA test and Dunnett's Multiple Comparison Test, on the gain values data obtained from *Helix pomatia* 2 yo snails

Table 4. - Weight values response on *Helix pomatia* Linn. 2 years old at the end of 40 days of experimental feeding conditions

	V1 - M gain		V2 - E gain		V3 - E gain		V4 – E gain		V5 – E gain	
Repetitions using grups of 5 snails each	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%
R 1	-4.15	-4.02	20.45	23.68	5.90	5.94	18.30	19.61	8.20	7.91
R 2	-5.15	-4.97	21.85	25.74	5.95	5.98	18.65	19.97	8.65	8.36
R 3	-3.85	-3.74	20.20	23.31	5.90	5.94	19.50	21.09	7.95	7.63
R 4	-3.70	-3.59	21.20	24.64	5.90	5.94	19.20	20.78	7.85	7.53
R 5	-2.90	-2.81	21.65	25.12	5.95	6.00	17.60	18.85	7.70	7.41
R 6	-3.30	-3.19	21.80	25.62	5.70	5.72	19.05	20.45	7.90	7.61
R 7	-5.05	-4.84	20.40	23.54	6.35	6.40	18.40	19.80	7.80	7.48
R 8	-4.00	-3.84	21.25	24.54	5.55	5.59	19.40	20.89	8.30	7.98
R 9	-4.10	-3.95	21.90	25.57	5.40	5.44	18.75	20.13	7.60	7.28
R10	-3.80	-3.68	21.30	24.81	5.40	5.43	19.30	20.73	8.30	7.97
n	10	10	10	10	10	10	10	10	10	10
Minimum	-5.15	-4.97	20.20	23.31	5.40	5.43	17.60	18.85	7.60	7.28
Maximum	-2.90	-2.81	21.90	25.74	6.35	6.40	19.50	21.09	8.65	8.36
$\sum X$	-40.00	-38.63	212.00	246.56	58.00	58.37	188.15	202.31	80.25	77.17
$\bar{x} = \frac{\sum x}{n}$	-4.00	-3.86	21.20	24.66	5.80	5.84	18.82	20.23	8.03	7.72
s	±0.22	±0.21	±0.20	±0.28	±0.09	±0.09	±0.19	±0.22	±0.10	±0.10
$s\% = \frac{s \times 100}{\bar{x}}$	17,30	17,03	3,02	3,62	5,04	5,10	3,17	3,43	4,07	4,27

raised in the control lot V1-M and V2-E, V3-E, V4-E, V5-E lots, results as being presented in Table 8, we conclude that the results are positive very high significant differences.

Figure 2. and Figure 3., reveal synoptically the dynamics of the snail's weight gain by incorporating the data from Table 4. with data from Table 5., respectively. Obviously, *Helix pomatia* 1 y.o, in the control lot V1-M, did not experience a decrease of weight but on the other hand the increase was the smallest from all lots, with a mean of 27.02±0.41%. As in exchange, in lot V2-E we found a gain of 94.68±1.02% second to the top value obtained, this time from snails raised in the lot V4-E, value going as high as 122.17±1.63%.

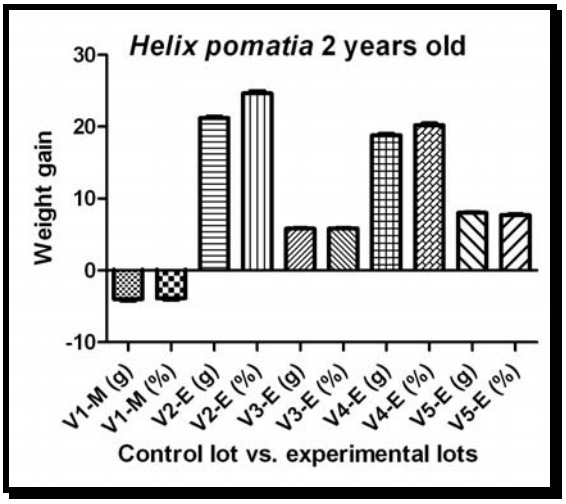

Figure 2. – Weight gains distribution on *Helix pomatia* Linn. (2 years old)

Table 5. - Weight values response on *Helix pomatia* Linn. 1 year old at the end of 40 days of experimental feeding conditions

		V1 - M gain		V2 - E gain		V3 - E gain		V4 – E gain		V5 – E gain	
		(g)	%	(g)	%	(g)	%	(g)	%	(g)	%
Repetitions using grups of 5 snails each	R 1	7.05	26.86	22.74	97.55	19.95	94.33	29.29	128.41	12.44	47.19
	R 2	7.58	29.19	22.36	95.19	20.00	94.79	27.58	117.51	11.65	43.80
	R 3	6.62	25.38	22.23	93.92	19.97	95.19	28.42	120.02	13.00	48.96
	R 4	7.24	27.84	21.97	93.17	20.20	96.42	29.63	125.18	12.80	48.03
	R 5	6.80	26.51	21.72	92.31	19.59	93.91	29.97	127.91	12.25	45.88
	R 6	7.20	27.69	22.12	95.02	20.24	96.56	29.27	123.09	12.70	47.57
	R 7	6.87	26.34	21.78	91.63	18.98	90.73	28.17	118.46	13.35	50.86
	R 8	7.19	27.59	23.24	101.22	19.45	92.62	29.38	127.63	13.20	49.72
	R 9	7.27	28.04	22.53	96.61	18.32	86.91	28.01	120.52	13.00	49.34
	R10	6.45	24.86	21.72	90.20	18.82	89.70	27.27	113.01	13.60	51.71
n		10	10	10	10	10	10	10	10	10	10
Minimum		6.45	24.86	21.72	90.20	18.32	86.91	27.27	113.01	11.65	43.80
Maximum		7.58	29.19	23.24	101.22	20.24	96.56	29.97	128.41	13.60	51.71
$\sum X$		70.27	270.30	222.41	946.82	195.52	931.16	286.99	1221.70	127.99	483.06
$\bar{x} = \frac{\sum x}{n}$		7.03	27.03	22.24	94.68	19.55	93.12	28.70	122.17	12.80	48.31
s		±0.11	±0.41	±0.16	±1.02	±0.21	±0.99	±0.29	±1.63	±0.18	±0.74
$s\% = \frac{s \times 100}{\bar{x}}$		4,84	4,82	2,22	3,39	3,33	3,36	3,23	4,21	4,47	4,86

Further examination of the results obtained from *Helix aspersa* 1 yo, as seen in Table 6., it points to the control lot V1-M as offering a substantial weight gain of 16.89±0.90% in exchange for a weight loss, (please see next page Figure 4) namely a negative gain of -7.69±0.98% in lot V3-E were *Helix pomatia* of the same age 1 y.o. had a positive gain of 93.12±0.99%.

A positive gain of 5.84±0.09% has also been obtained from *Helix pomatia* 2 yo raised in lot V3-E.

Performing ANOVA test and Dunnett's Multiple Comparison Test, on the gain values data obtained from *Helix pomatia* 1 yo snails,

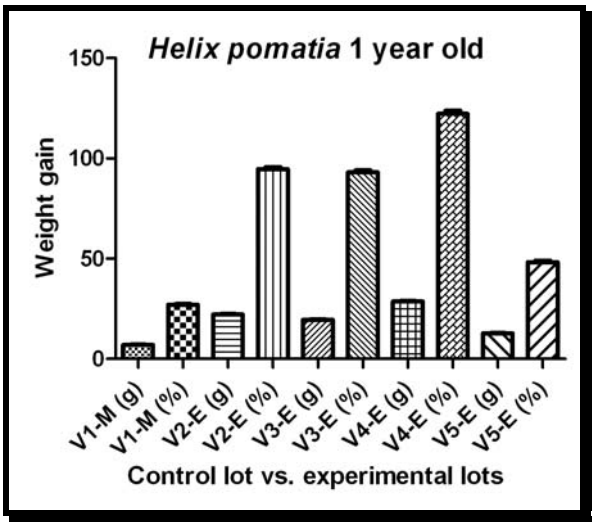

Figure 3. – Weight gains distribution on *Helix pomatia* Linn. (1year old)

Table 6. - Weight values response on *Helix aspersa* Muller 1 year old at the end of 40 days of experimental feeding conditions

	V1 - M gain		V2 - E gain		V3 - E gain		V4 – E gain		V5 – E gain	
	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%
Repetitions using grups of 5 snails each										
R 1	4.55	17.14	0.50	1.64	-3.00	-9.35	3.15	11.43	8.00	28.32
R 2	3.90	14.61	-1.75	-5.62	-1.95	-6.08	3.75	14.59	8.40	29.84
R 3	4.55	17.43	-1.55	-5.02	-1.90	-5.92	4.15	15.99	7.50	27.37
R 4	4.40	16.89	0.55	1.87	-0.50	-1.61	1.80	6.43	8.20	30.83
R 5	5.70	22.01	-0.80	-2.61	-3.85	-11.76	3.85	14.81	7.50	27.73
R 6	4.10	15.89	1.20	4.06	-3.35	-10.28	3.75	13.86	8.70	33.33
R 7	5.30	20.42	2.90	10.23	-1.65	-5.39	2.60	9.35	9.95	37.62
R 8	3.10	11.63	1.20	4.20	-2.65	-8.39	3.70	14.18	7.65	26.42
R 9	4.35	16.17	1.95	6.70	-2.25	-7.11	3.45	12.68	6.55	23.06
R10	4.45	16.70	1.30	4.35	-3.65	-10.98	5.05	19.77	6.80	24.37
n	10	10	10	10	10	10	10	10	10	10
Minimum	3.10	11.63	-1.75	-5.62	-3.85	-11.76	1.80	6.43	6.55	23.06
Maximum	5.70	22.01	2.90	10.23	-0.50	-1.61	5.05	19.77	9.95	37.62
$\sum X$	44.40	168.89	5.50	19.80	-24.75	-76.87	35.25	133.09	79.25	288.89
$\bar{x} = \frac{\sum x}{n}$	4.44	16.89	0.55	1.98	-2.48	-7.69	3.53	13.31	7.93	28.89
s	±0.23	±0.90	±0.48	±1.61	±0.33	±0.98	±0.28	±1.16	±0.31	±1.35
$s\% = \frac{s \times 100}{\bar{x}}$	16,04	16,91	273,84	257,07	41,69	40,13	24,90	27,53	12,34	14,83

raised in the control lot V1-M and V2-E, V3-E, V4-E, V5-E lots, results as being presented in Table 8, we conclude that all the results are positive very high significant differences.
Helix aspersa 1 yo, as seen in Table 6., manifests (Figure 4.) a substantial gain in lot V5-E, measuring 7.93±0.31g or considering the initial weight a 28.89±1.35%.

Performing ANOVA test and Dunnett's Multiple Comparison Test, on the gain values data obtained from *Helix aspersa* 1 yo snails, raised in the control lot V1-M and V2-E, V3-E, V4-E, V5-E lots, results as being presented in Table 8, we conclude that all the results are positive highly significant, both comparing the weight gain values in grams as well as expressed in percentages, excepting the V1-M vs. V4-E, both type of values being compared we obtained not significant differences (ns).

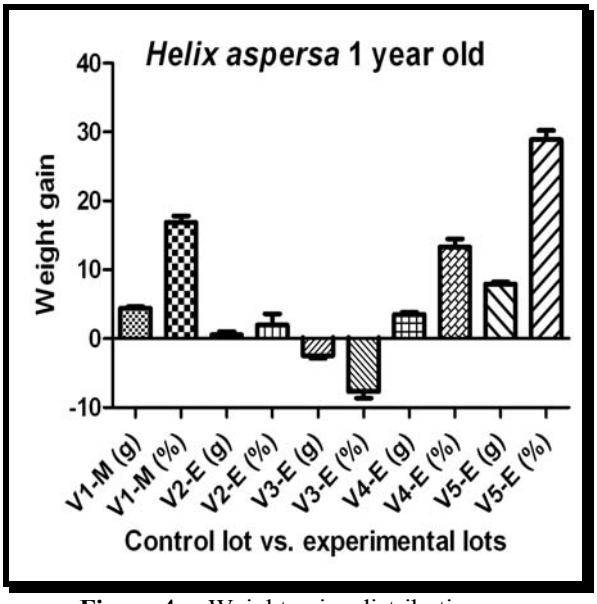

Figure 4. – Weight gains distribution on *Helix aspersa* Muller (1year old)

Table 7. - Weight values response on *Helix aspersa* Muller 30-40 days old at the end of 40 days of experimental feeding conditions

	V1 - M gain		V2 - E gain		V3 - E gain		V4 – E gain		V5 – E gain	
	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%
Repetitions using grups R 1	8.00	17.70	4.80	9.84	8.00	17.70	1.20	2.03	9.20	20.18
R 2	6.40	13.79	3.60	7.20	9.20	20.54	-3.60	-6.08	8.00	17.39
R 3	5.20	11.40	4.80	9.76	9.60	21.62	0.00	0.00	9.20	20.54
R 4	4.40	9.32	4.00	7.87	6.80	15.18	-0.40	-0.68	8.80	19.13
R 5	4.40	9.40	1.20	2.34	7.60	16.52	-4.40	-7.38	7.20	15.79
n	5	5	5	5	5	5	5	5	5	5
Minimum	4.40	9.32	1.20	2.34	6.80	15.18	-4.40	-7.38	7.20	15.79
Maximum	8.00	17.70	4.80	9.84	9.60	21.62	1.20	2.03	9.20	20.54
$\sum X$	28.40	61.61	18.40	37.01	41.20	91.56	-7.20	-12.11	42.40	93.03
$\overline{x} = \frac{\sum x}{n}$	5.68	12.32	3.68	7.40	8.24	18.31	-1.44	-2.42	8.48	18.61
s	±0.69	±1.57	±0.66	±1.37	±0.52	±1.21	±1.09	±1.83	±0.39	±0.89
$s\% = \frac{s \times 100}{\overline{x}}$	27,00	28,54	40,23	41,30	13,99	14,78	168,51	168,58	10,23	10,72

As for *Helix aspersa* 30-40 days old, the weight gains, as presented in Table 7., are negative this time belonging to snail raised in lot V3-E, a mean of -7.69±0.98% (corresponding to -2.48±0.33g) with a minimum of -11.76% or -3.85g and a maximum of -1.61% or -0.50g.

The 2-nd to the top numbers were obtained in the controll lot V1-M, a gain of 16.89±0.90% coresponding to 4.44±0.23g, the same lot were *Helix pomatia* 2 y.o registered a strong negative gain, a weight loss namely.

The 1-st to to top are the gains obtained on snails raised in lot V5-E, cuantified at 28.89±1.35% proportional gain standing for a gain of 7.93±0.31g, situation were we registered minimum of 23.06% or 6.55g and maximum of 37.62% or 9.95g.

Here is about time to bring to the reader's attention the fact that the procentual values are much more relevant to „put on stage", not only graphicaly as seen in Figure 5. but also, as it can be observed, by examining the rest of the graphics.
We can „feel" the magnitude of the procentual value that is always compared to the initial, starting point value, in our case, the initial snail's weight.

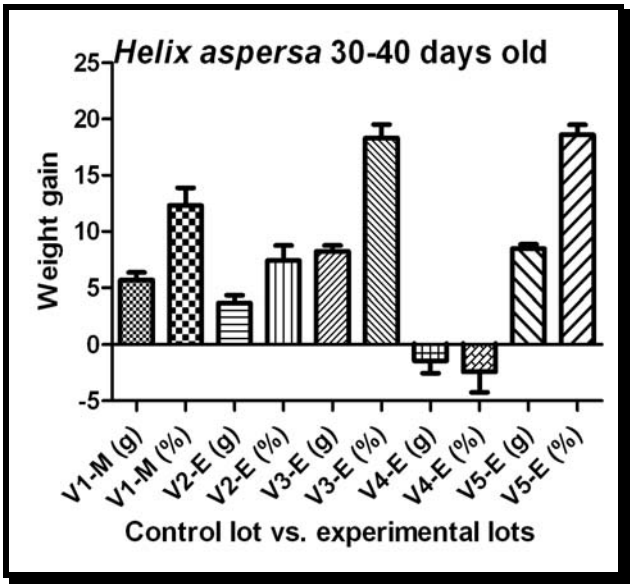

Figure 5. – Weight gains distribution on *Helix aspersa* Muller (30-40 days old)

Table 8. - Statistical Analysis on the snail's growing rate dynamics at the end of 40 days of experimental feeding conditions - ANOVA TEST - Dunnett's Multiple Comparison Test on Weight Gain

	Experimental lots		Mean Diff,	q	P < 0,05?	Summary	95% CI of diff
Helix pomatia Linn. 2 years old	V1-M vs V2-E	(g)	-25,200	100,61	Yes	***	-25,840 to -24,560
	V1-M vs V3-E	(g)	-9,8000	39,125	Yes	***	-10,440 to -9,1595
	V1-M vs V4-E	(g)	-22,815	91,084	Yes	***	-23,455 to -22,175
	V1-M vs V5-E	(g)	-12,025	48,007	Yes	***	-12,665 to -11,385
	V1-M vs V2-E	(%)	-28,52	99,08	Yes	***	-29,26 to -27,78
	V1-M vs V3-E	(%)	-9,700	33,70	Yes	***	-10,44 to -8,964
	V1-M vs V4-E	(%)	-24,09	83,71	Yes	***	-24,83 to -23,36
	V1-M vs V5-E	(%)	-11,58	40,23	Yes	***	-12,32 to -10,84
Helix pomatia Linn. 1 year old	V1-M vs V2-E	(g)	-15,214	54,993	Yes	***	-15,921 to -14,507
	V1-M vs V3-E	(g)	-12,525	45,273	Yes	***	-13,232 to -11,818
	V1-M vs V4-E	(g)	-21,672	78,336	Yes	***	-22,379 to -20,965
	V1-M vs V5-E	(g)	-5,7720	20,864	Yes	***	-6,4794 to -5,0646
	V1-M vs V2-E	(%)	-15,214	54,993	Yes	***	-15,921 to -14,507
	V1-M vs V3-E	(%)	-12,525	45,273	Yes	***	-13,232 to -11,818
	V1-M vs V4-E	(%)	-21,672	78,336	Yes	***	-22,379 to -20,965
	V1-M vs V5-E	(%)	-5,7720	20,864	Yes	***	-6,4794 to -5,0646
Helix aspersa Muller 1 year old	V1-M vs V2-E	(g)	3.89	7.9475	Yes	***	2,6384 to 5,1416
	V1-M vs V3-E	(g)	6.915	14.128	Yes	***	5,6634 to 8,1666
	V1-M vs V4-E	(g)	0.915	1.8694	No	ns	-0,33656 to 2,1666
	V1-M vs V5-E	(g)	-3.485	7.1201	Yes	***	-4,7366 to -2,2334
	V1-M vs V2-E	(%)	14.909	8.2873	Yes	***	10,309 to 19,509
	V1-M vs V3-E	(%)	24.576	13.661	Yes	***	19,976 to 29,176
	V1-M vs V4-E	(%)	3.58	1.99	No	ns	-1,0202 to 8,1802
	V1-M vs V5-E	(%)	-12	6.6703	Yes	***	-16,600 to -7,3998
Helix aspersa Muller 30-40 days old	V1-M vs V2-E	(g)	2	2.6597	No	ns	-0,036302 to 4,0363
	V1-M vs V3-E	(g)	-2.56	3.4044	Yes	*	-4,5963 to -0,52370
	V1-M vs V4-E	(g)	7.12	9.4686	Yes	***	5,0837 to 9,1563
	V1-M vs V5-E	(g)	-2.8	3.7236	Yes	**	-4,8363 to -0,76370
	V1-M vs V2-E	(%)	4.92	3.4178	Yes	*	1,0217 to 8,8183
	V1-M vs V3-E	(%)	-5.99	4.1611	Yes	**	-9,8883 to -2,0917
	V1-M vs V4-E	(%)	14.744	10.242	Yes	***	10,846 to 18,642
	V1-M vs V5-E	(%)	-6.284	4.3653	Yes	**	-10,182 to -2,3857

Performing ANOVA test and Dunnett's Multiple Comparison Test, on the gain values data obtained from *Helix aspersa* 30-40 days old snails, raised in the control lot V1-M and V2-E, V3-E, V4-E, V5-E lots, results as being presented in Table 8, we conclude that:

Comparing the gains values given in grams between V1-M and V2-E the results are no significant differences (ns) whereas comparing the percent values they are positive significant differences.

V1-M vs. V3-E the results are positive significant differences on gram values whereas the percent values are positive distinctive significant differences.

V1-M vs. V4-E the results are positive highly significant differences on both type of values.

V1-M vs. V5-E results are positive distinctive significant differences on both type of values, grams or percent.

The values for s % (CV or V %) are most useful for variables that are always *positive* [8, 9]. When the mean value is near zero, the coefficient of variation is sensitive to small changes in the mean, limiting its usefulness (Tables 6, 7.).

4. Conclusions

The terrestrial snails *Helix pomatia* Linn. and *Helix aspersa* Muller comport a different behavior, food selection, adaptation to enclosed lots, feed and weight gain is function of their environment they have been used to. The age, the degree of development, are also criterias that conduct to a different growing rate. In the snail farming conditions, the farmers must decide the species will make the object of their activity for the best performance and growing rate. It is known, as Avagnina in his work mentions [10] and is obvious from our study, that in the case of *Helix aspersa* we encount a very good adaptability not as high as the in the case of *Helix pomatia* 1 year old that was collected for the experiment from inside the farm. *Helix pomatia* 2 years old, registered a resistance to the enclosure of V1-M control lot, but it displayed a good weight gain in the lots that were provided with plans imported into the farm, the meal was, in this case we can assume, new to them and paletable. The plants that should predominate are the one that can grow in the soil and the weather conditions speific to the particular area the farm is located. Perenial plants can be used but other particularities of snails breeding technics must be observed as well, such as reproduction, lots rotation for the regeneration of the soil, etc.

Plant species from the lots that registered the most weight gain can be used such as to satisfy the need of the snail along de different development stages when its apetite is always changing. Snails are attracted to plants given their inorganic chemical content [5] and perhaps to their protein content as well but it is not strict necessary since snails do feed with soil from where they aquire bacteria. *Helix pomatia* as well as *Helix aspersa* are also hosting bacterias [11] in their gut and intestines. Particular studies shows in *Helix aspersa* high levels of *Enterococcus casseliflavus*, [12] all known to be able to fix inorganic nitrogen.

The percent values of weight gain are more relevant in expressing the dynamics (Figure 6.) of the results in case of populations that have very low initial weights, situations when one gram or two it can posibly mean double or triple the initial weight within even a relative short period of time.

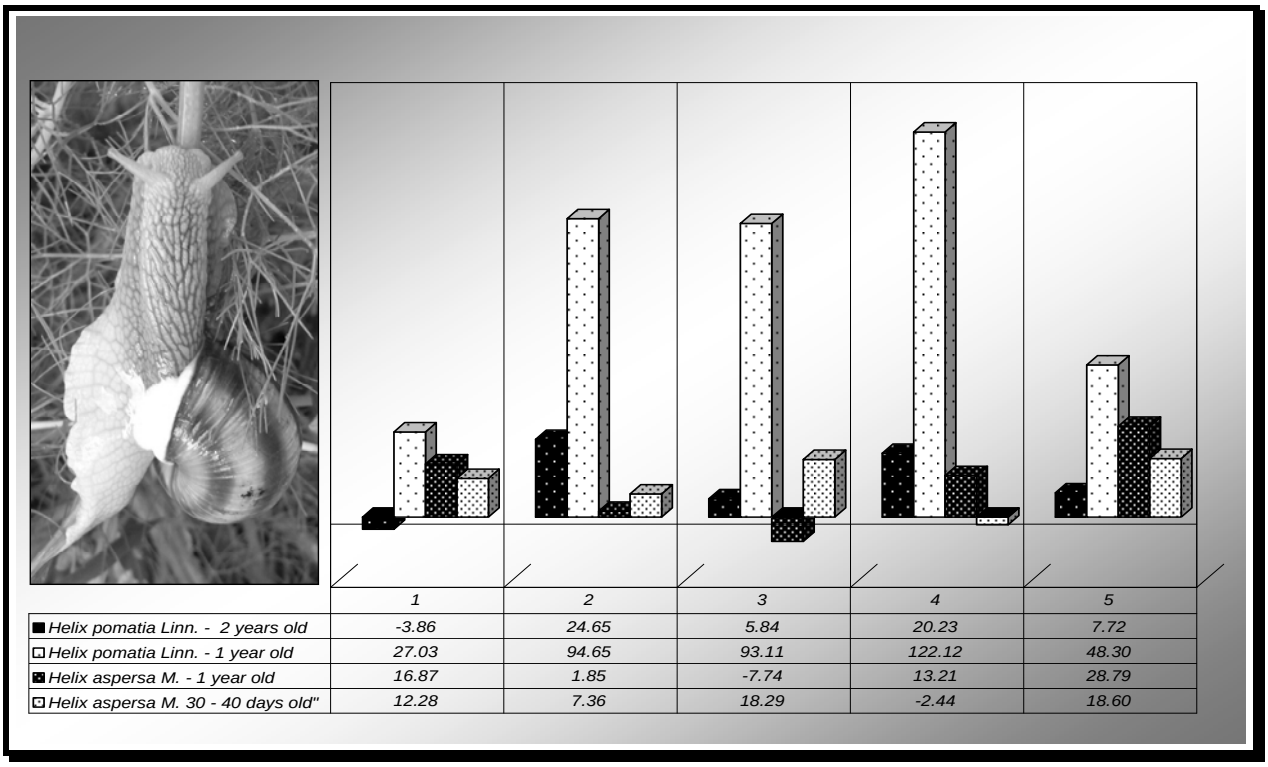

Figure 6. - Relative growing rate dynamics of Helix pomatia and Helix aspersa under different feeding regimes

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