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EFFECT OF PHOTOPERIODS ON THE RATE OF FOOD CONSUMPTION BY THE LAND SNAIL *Monacha cartusiana* (Müller)

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ABSTRACT

This study was carried out to throw some light on the effect of different photoperiod levels, 6, 12 and 24 hours as well as natural light on the rate of food consumption by the glassy clover snail *Monacha cartusiana* (Müller) under laboratory conditions to know its feeding capacity. Data indicated that the rate of food consumption differs according to photoperiod and season of activity. This snail during the end of its season activity (May & June months 2005) fed in light and dark with slightly differs rate of food consumption during the photoperiod 6 or 12 or 24 hour and without any significant as well as the range of food consumption in different treatments approximately similar. It was found that the rate of food consumption of the same snails' group averaged 113 & 113.5 mm^2 during feeding under six hours dark and light from 6.0 a.m. to 12.0 a.m. respectively; while this rate averaged 118.5 & 102.7 mm^2 under the same six hours dark and light from 6.0 p.m. to 12.0 p.m. respectively. At 12.0 hour dark and light this rate averaged 134.2 & 121.5 mm^2 from 6.0 a.m. to 6.0 p.m. respectively; while it averaged at the same period 153.0 & 107.2 mm^2 from 6.0 p.m. to 6.0 a.m. respectively. On the other hand, the daily rate of food consumption averaged 73.5 & 45.4 mm^2 under 24 hour complete dark and natural light respectively; while it averaged 157.8 & 57.2 mm^2 under 24 hour complete light and natural light respectively. While during its active season (November & December months 2005), this snail consumed on rate averaged 328.0 & 161.7 mm^2 when feeding during 24 hour of complete light and complete dark (day after day). On the other hand this rate averaged 174.0 mm^2 during natural light.

Keywords: Photoperiod – Food consumption – Gastropoda – Land snails.

INTRODUCTION

The land snails are becoming a serious pest during the last years which attacking different types of crops at many countries. Thus, the aim of this study is to throw some light upon using exchange photoperiods on the rate of food consumption by snails pest as well as a result to decrease its damage for host plants especially during the seedling period in the nurseries. On the other hand, it is the first time to study the effect of photoperiod on the rate of food consumption by snails, in spite of many investigators studied the effect on rearing snails, their activities and their biological aspects. Bailey (1981) mentioned that a 12 hours photoperiod was commonly used and was recommended for rearing most Gastropods. He added that, shorter photoperiods can induce both hibernation and showed growth of snails *Helix aspersa* (Müller).While, Godan (1983) reported that the greatest activity of the snails was observed at four to six o'clock after darkness. Kralka (1985) recorded that, the most important factors in rearing of gastropods were substrate, moisture, diet and photoperiod. In 1987, Ford and Cook studied the effect of photoperiodic on stimulation of egg-laying in the land snail *H.aspersa*.

In Egypt, Mohamed (1999) studied the effect of 6, 12 and 24 hour of darkness on fecundity and activity of snails; and found that the more preferable darkness hour for snail fecundity was 24 hours because mating and egg-laying usually take place at night. Recently, Abd-El-Karim (2000) studied the effect of five degrees of photoperiod 0, 9, 12, 15 and 24 hour of darkness on some biological aspects (incubation period and hatchability) of the land snails *Eobania vermiculata* (Müller) and *Monacha obstructa* (Ferussac) under laboratory conditions.

Therefore, this study is an attempt to study the effect of different degrees of 6, 12 and 24 hour photoperiods on the rate of food consumption by the glassy clover snail *Monacha cartusiana* (Müller) under laboratory conditions to know its feeding capacity under these photoperiod degrees and choice one for utilizing it as a natural control to reduce the damage occur by this pest especially in nurseries.

MATERIALS AND METHODS

Effect of photoperiod on the rate of food consumption by the glassy land snail *M. cartusiana* was studied under laboratory conditions during two periods, the first at the end of its season activity (May & June months 2005) at an average temperature of 25 ± 2 °C; and the second at its active season (November & December months 2005) at an average temperature of 21 ± 2 °C. For the first period study, 105 adult individuals of this species of similar shell diameter about 10.0 mm. were obtained from laboratory rearing cultures in Zoology and Agricultural Nematology Department at Faculty of Agriculture, Cairo University. These snail individuals were kept singly each in a plastic box (13 cm diameter & 10 cm deep) containing of about high five centimeters moist soil and supplied with a square area of fresh lettuce leaf as a main source of food, then covered with black or white muslin with rubber band.

These 105 snail individuals were divided into seven groups each of 15 individuals. The first group exposed to six hours dark from 6.0 a.m. to 12.0 a.m. for four days then exposed to six hours light from the same period in the next four days. The second exposed to six hours dark from 6.0 p.m. to 12.0 p.m. for four days then the same group exposed to six hours light at the same period in the next four days. The third exposed to 12 hour dark from 6.0 a.m. to 6.0 p.m. then exchanged to 12 hours light at the same period for four days also. The fourth group exposed to 12 hours dark from 6.0 p.m. till 6.0 a.m. then exposed to another 12 hours light at the same period (6.0 p.m. to 6.0 a.m.) for four days. The fifth group exposed to 24 hours complete darkness for 15 days then exposed to natural light (day & night) for another 15 days. The sixth group exposed to 24 hours complete lightness for 15 days then exchanged to 15 days of natural light. The last seventh group exposed to natural light as a control treatment. While, for the second period; 30 adult individuals of the same species were chosen and divided to two groups each of 15 individuals. The first groups exposed to 24 hour completely light then exposed 24 hour completely dark (day after day) for eight days; while the second group exposed to natural light (day & night) as a control; at the same period. Thus, the total number of snails was 135 individuals were used during the two periods of study.

The plastic boxes were examined daily after the end of each photoperiod as well as control and the consumed lettuce leaf area was calculated then replaced with another fresh leaf area. Precise estimates of the amount of food consumed by each snail individual, within a certain photoperiods were made by determining the edges of the eaten lettuce leaf area, with a fine pencil on a graph paper, then counting the number of square millimeters.

RESULTS AND DISCUSSION

All review of literatures on photoperiods were appertained only in their effect on snails activity or on its some biological aspects such as fecundity, incubation period and hatchability. While, the present work is the first attempt to study the effect of photoperiod on the rate of food consumption by the glassy clover snail *M. cartusiana* to throw some light upon the ability of utilizing it to reduce the damage occur by snails infestation to host plants specially during the seedling period in the nurseries. Thus, six and twelve photoperiods at different times of the day (a.m. or p.m.) as well as 24 hour photoperiod were studied under laboratory conditions to determine their role in efficacy on the rate of food consumption by this phytophagous land snail species.

Table (1) Average food consumption rate in millimeters per snail individual during 6& 12 hour photoperiods at different day times.

	Rate of food consumption in mm^2 at							
	6.0a.m.-12.0a.m.		6.0p.m.-12.0p.m.		6.0a.m.-6.0p.m.		6.0p.m.-6.0a.m.	
	Dark	light	Dark	light	Dark	light	Dark	light
Average	113.0± 72.5	113.5± 69.1	118.5± 67.3	102.7± 69.4	134.2± 34.1	121.5± 7.0	153.0± 48	107.2± 18.6
Range	13.5-248.5	37.8-247.8	13-247.3	12.5-228.8	44.8-206.5	103.3-129.8	54-207.8	66.8-153.8

Data in this table indicate that the rate of food consumption, in general, increased at dark photoperiod than light during May and June months but not significant in both ante meridiam (a.m.) and post meridiam (p.m.) periods under laboratory conditions. It was also noticed that the greatest rate of food consumption during the dark photoperiod (from 6.0 p.m. till 12.0 p.m.) was 118.5 mm^2 and this formed 22.5% of the second greatest rate (153.0 mm^2), which occurred in the period from 6.0 p.m. till 6.0 a.m. This result agreed with Godan (1983), who mentioned that light influences the activity of terrestrial gastropods in their remaining in hides during the day and they emerge to go in search for food at night.

Therefore, it could be useful if the hours of light especially at the first six hours of beginning night would be increased to reduce the rate of food consumption as means of utilizing photoperiod control to reduce the damage occurs by the snails especially in nurseries.Data in table (2) indicate that complete darkness for a long time decrease the rate of food consumption (73.4 mm^2/day) than in complete light (157.8 mm^2/day) and this formed of about 53.5%.

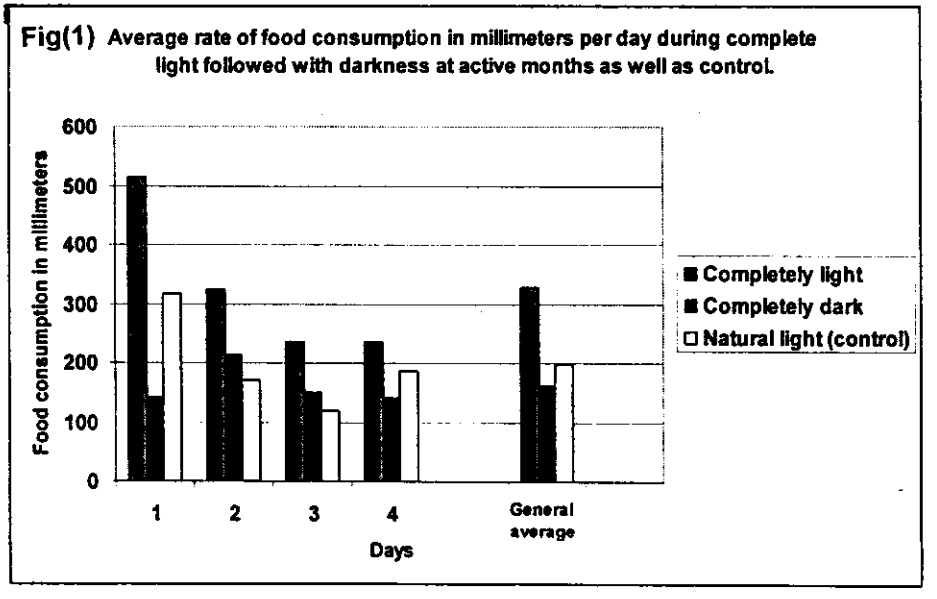
Table (2):Average rate of feed consumption in millimeters per day by *M. cartusiana* during fifteen days of different photoperiods.

Photoperiod	Average rate in mm^2 per days															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	General average
24 hr complete dark	303.7 ± 152	138.8 ± 146	92.3 ± 128.3	136.5 ± 143.8	43.0 ± 62.3	21.7 ± 40.3	66.1 ± 83.7	27.8 ± 47.3	50.7 ± 102.2	36.6 ± 67.3	56 ± 128	31.1 ± 87.5	32.7 ± 65.1	26.8 ± 57.0	37.5 ± 97.0	73.4 ± 18.7
24 hr natural light (after complete dark)	18.4 ± 40.4	20.7 ± 48.0	54.7 ± 116.3	16.7 ± 53.2	42.0 ± 73.7	33.8 ± 46.7	62.0 ± 92.7	43.7 ± 75.1	82.1 ± 106.4	52.9 ± 94.4	73.7 ± 110.6	76.2 ± 103.7	44.3 ± 61.5	30.6 ± 64.9	28.9 ± 39.2	45.4 ± 21.0
24 hr complete light	297.3 ± 142.0	245.0 ± 129.1	331.6 ± 172.2	322.3 ± 161.0	191.7 ± 182.0	127.0 ± 100.0	123.4 ± 135.7	58.5 ± 76.4	109.3 ± 112.3	128.2 ± 146.0	66.9 ± 80.0	43.5 ± 42.6	117.1 ± 123.0	77.9 ± 90.7	127.9 ± 117.2	157.8 ± 26.0
24 hr natural light (after complete light)	46.0 ± 77.2	63.0 ± 115.5	62.2 ± 92.0	58.0 ± 107.3	24.8 ± 38.0	31.0 ± 80.0	86.4 ± 109.4	157.7 ± 186.0	95.6 ± 169.6	21.7 ± 40.4	40.1 ± 87.7	86.7 ± 123.6	25.6 ± 70.1	58.4 ± 111.4	48.4 ± 93.4	60.4 ± 29.0
Control (24hr natural light)	119 ± 140.3	129.4 ± 115.1	55.3 ± 92.4	55.2 ± 75.0	81.1 ± 135.0	31.5 ± 44.2	88.3 ± 149.0	42.33 ± 66.0	78.8 ± 91.5	31.0 ± 36.1	12.5 ± 29.2	19.1 ± 29.3	24.3 ± 65.0	47.0 ± 58.1	42.9 ± 62.0	57.2 ± 54.2

Also, alternative exposure of the individuals from complete darkness to natural light decreased the rate of food consumption from 73.4 to 45.4 mm^2/day which formed a reduction of about 38.1%. The same result was found when changing from complete light to natural light which decreased this rate from 157.8 to 60.4 mm^2 and this formed 61.7%.As general, the lettuce leaf area consumed by one individual of M.cartusiana during 24 hours in both dark and light ranged from 45.4 to 157.8 mm^2 (Table 2) and these results are nearly agree with those of Abd-El-Aal (2001) who mentioned that the leaf area consumed by one snail of the same species during 24 hours ranged between 0.232 to 1.161 cm^2. From table (3) and fig (1) it was noticed that the opposite trend was occurred during active months (Nov. & Dec.).It was found that the rate of food consumption increased in complete 24 hours light (327.9 mm^2) then decreased in every other day followed with complete 24 hours dark (161.7 mm^2) and this gives an reduction of 50.7%. Also, darkness days give a least rate of food consumption (161.7 mm^2) than in natural light (198.5 mm^2) and this formed 18.5%.

Table (3): Average rate of food consumption in millimeters per day during complete light followed with darkness at active months.

Photoperiod	Average rate of food consumption in mm^2/day				General Average
	1	2	3	4	
Completely light	515± 284	324.3± 189.3	236.2± 144.3	236.1± 200.0	327.9± 113.9
Completely dark	141.0± 121	212.6± 153.7	151.1± 104.9	142.2± 104.9	161.7± 29.6
Natural light	317.5± 210.7	170.5± 116.4	118.4± 132.0	187.4± 135.1	198.5± 73.3



Therefore, it could be useful if we use completely dark then natural light or complete light ever other day to disturb the common behavior of the snails as ecological factors to utilize as a natural control to reduce the rate of food consumption as well as the damage occurs by these pests between 18.5 - 50.7% especially in the nurseries.

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تأثير فترات الاضاءة على معدل استهلاك الغذاء للقوقع الارضى موناكا كارتيزيانا (ميللر)

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اشارت الابحاث السابقة الى تاثير الفترات الضوئية على نشاط القواقع و بعض مظاهرها البيولوجية كحضانة البيض و نسبة الفقس .. فى حين ان هذا البحث يعتبر اول دراسة عن تاثير الفترات الضوئية على معدل استهلاك الغذاء لقوقع البرسيم الزجاجى موناكا كارتيزيانا بهدف استخدامها لتقليل الضرر الناشئ عن هذه الافه للعوائل النباتية خاصة فى طور البادرات فى المشاتل .

لقد تمت دراسة تاثير الفترات الضوئية عاى معدل التغذية خلال اشهر مايو و يونيو ٢٠٠٥ (قبل انتهاء موسم النشاط) ، نوفمبر و ديسمبر ٢٠٠٥ (خلال موسم النشاط) و اسفرت النتائج على ان القوقع خلال اشهر مايو و يونيو يتغذى بمعدل اكثر فى حالة الظلام عن الاضاءة تحت فترات اضاءة ٦ ، ١٢ ، ٢٤ ساعة .. و ان كانت هذه الزيادة طفيفة و غير معنوية و يكون معدل التغذية خلال الفترة المسائية من ٦-١٢ مساءا اكثر منه فى الفترات الاخرى .. مما يلزم بزيادة معدل الاضاءة فى هذه الفترة لتقليل الضرر الناتج عن هذه الافة .

اما خلال اشهر نشاط القوقع (نوفمبر و ديسمبر) فوجد ان معدل التغذية يكون اكثر فى حالة الاضاءة عنه فى الظلام و ان هذا المعدل يقل بمقدار ٥٠،٧% فى الاظلام عنه فى حالة الضوء التام .. كما انه يقل بمقدار ١٨،٥% عن معاملة الكنترول فى الضوء الطبيعى .

كما اسفرت الدراسة عن ان تبادل فترات الاضاءة مع الاظلام (يوم بعد يوم) يؤدى الى خلل فى السلوك الطبيعى للقوقع مما يؤدى الى تقليل معدل التغذية و بالتالى قلة الضرر الناتج على العوائل النباتية . و يمكن استخدام هذه الطريقة فى المشاتل كاحد العوامل البيئية التى تستخدم كمكافحة طبيعية لتقليل الضرر الناتج عن هذا القوقع بمعدل من ١٨،٥ الى ٥٠،٧% .