

Field Study on the Amber Snail *Succinea Putris* (Linnaeus) (Succineidae: Mollusca)

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Abstract

This study on the amber snail, *Succinea putris* (L.) was conducted in an infested Egyptian clover field (*Trifolium alexandrinum* L.) in AL- ALakma village, Hehia county at Sharkia Governorate during the period from December 2007 till June 2008. Field observations showed that the active season of this snail lasted 3.5 months from December and prolonged to beginning of March. It was found that number of egg clutches and clutch size were significantly changed through this active period. Most clutches were deposited in February with a higher rate of 2.2 clutches. Field examination declared that clutch size was greater during the beginning of active oviposition period than at its end. This size ranged from 8 to 51 eggs with an average of 14.2 ± 3.38 eggs/clutch. This species aestivated as adults and juvenile stages during summer months under weeds, irrigation canals border and in soil cracks. Two years may be required for this snail to complete its life cycle and reach maturity.

Keywords: *S. putris*, active season, clutches, eggs, clutch size

Introduction

Terrestrial molluscs are proved a group of the most serious pests attacking agricultural crops all over the world. They cause costly damage to field crops, and fruit trees as well as ornamental plants (Godan, 1983). In Egypt, *S. putris* is considered one of the most abundant molluscs infesting and causing damage to the Egyptian clover fields (*T. alexandrinum* L.) and some field crops specially in Sharkia Governorate (Ismail, 1997, & Lokma, 2007).

The studies on this pest has been little and restricted to non agricultural habitats; that Datkauskienė(2005) mentioned ; under laboratory conditions ,juvenile of *S. putris* required ten months to reach their sexual maturity and its life span ranged from 13 to 17 months .

Thus, the main objective of this study is to spot more light upon the active period, number of clutches, clutch size, measurements of the shell and eggs as well as general behavior of the amber snail *S. putris* under field conditions at Sharkia Governorate.

Materials and methods

This study was conducted in an area cultivated with Egyptian clover field, (*Trifolium alexandrinum* L.) infested with the amber snail, *S. putris*, at Al-Alakma village, Hehia district, Sharkia Governorate during the period from December 2007 to June 2008 . Five replicates of quadrat sample size (50 × 50 cm.) were randomly chosen and examined. Examination was undertaken monthly during the early morning. All snails found on clover plants or on soil surface as well as clutches in every quadrat were counted. Twenty five snail individuals from each quadrat were collected randomly by hand. The

shell diameter and its height of each snail were measured using vernier caliper, accurate to 0.02mm. Also; number of clutches and clutch size in each quadrat were counted. Two clutches from every replicate were put in polyethylene bag then transferred to the laboratory. From these ten clutches, 30 eggs were randomly chosen and every one was measured under a research using stage micrometer. Average \pm S.D was calculated for number of clutches, eggs, clutch size and number of snails during the active period.

Results and discussion

1- Size- frequency distribution of *Succinea putris*:

Size frequency distribution of *Succinea putris* were detected at monthly intervals during the growing season of Egyptian clover in the period from December 2007 to June 2008, in Al- Alakma village, Hehia district, Sharkia Governorate. Data in Fig. (1) show that numbers of the adult snails in the beginning of the growing season were very low. The newly hatched juveniles shell height measured less than 6 mm during December 2007 and June 2008 . The numbers of juveniles with shell height of the size class (1-2 & 2-3 mm)during February, March and April months of the breeding season (2008) were 1 (4), 3 (3) and 1 (3) snail / sample, respectively. However, during April (2008), the highest number of individuals 10 snail /sample with shell height of (5- 6 mm). It is worthy to indicate that the presence of the snail shell size was used as the main criterion to recognize the adult snails. It was noticed that as the time elapsed the number of juvenile snails were increased, while the adults were obviously decreased. The individuals with shell heights less than 5-6 mm were not observed during May and June(2008), since

size frequency of larger individuals with shell heights of 7-8, 9-10, 11-12, 13-14, 14-15 and 15-16 mm were 3, 4, 5, 1, 2 and 1 snail / sample respectively during May 2008. However, snails with shell height of 5-6, 7-8, 9-10, 11-12 and 14-15 mm during June were 2, 5, 7, 8 and 1 snail / sample, respectively. Data in **Fig.(2)** show that the shell diameter of *S. putris* in the beginning of the growing season of snails with shell diameter of 2-3, 3-4, 4-5, 5-6 and 8-9 mm during December 2008 were 1, 5, 9, 6 and 1 snail /sample, respectively, while the snails with shell diameter of 2-3, 3-4, 4-5, 5-6, 6-7, 7-8 mm were 4,3,3,7,7 and 1 snail/ sample respectively, during January 2008. However, during February 2008 the snail with shells diameter of 2-3, 3-4, 4-5, 5-6, 6-7 mm were 7.7, 7, 3 and 1 snail / sample, respectively. It was noticed that during April the number of snails was 5 & 11 snails /sample of size frequency 2-3 & 3-4 mm respectively. No snails with shell diameter less than 3-4mm were detected during May and June (2008). While, the snails with shell diameter of 3-4, 5-6 and 6-7 mm were 8, 8 and 2 & 10 and 5 snails / sample during May & June 2008, respectively.

It was difficult to continue this study after June 2008 because of harvesting of the Egyptian clover cultivated in the infested field. It was noticed that amber snail *S. putris* aestivated during summer months, closing their shell aperture by a thin, transparent epiphragm. Snails were observed aestivating under damp habitats either under the grasses or edging of the irrigation canals and in soil cracks, moreover, under masses, leaves, in upper layers of soil.

Staikou and Lazaridou –Dimitriadou (1990) in Greece reported that the production period of *M. cartusiana* started between August and November, depending on the year. Newly hatched snails appeared in November or December and the adult died shortly after hatchlings. Newly hatched snails did not show homogenous growth rate. Some of them appeared earlier and grew faster. These snails reached maturity within one year at a size of 8- 10 mm. They could lay eggs immediately upon maturation, died soon afterwards, while the majority of a population reached maturity and laid eggs two years after hatching. All the adult snails died after the productive period. Moreover, **Tomiyama (1993)** studied shell growth and the maturation of the reproductive system in *Achatina fulica*. The growth rate of shell length was estimated based on the increase of peristome thickness. However, in this study, lip reflection was not observed. Shell growth continued for some time after their reproductive systems were fully formed. **Villalobos et al (1995)** showed that the neotropical terrestrial snail *Succinea costaricana* had become a quarantenary pest in ornamental plants (*Dracaena marginata*, *Dracaenaceae*), they reached a density

of 282 900 individuals/ ha. In the field, reproduction of it continued (as is rain fall) and eggs, young and copulating pairs are found mainly under moist litter.

Carlos and Julian (2004) studied the yearly body size distribution of *Succinea costaricana* on an ornamental plant. Body size distribution (measured in the shells) indicated a capacity to reproduce year-round with a peak when perversity decreases in December. At this time of year, the population was dominated by snails under 4 mm in shell length (longest individual: 12.06 mm). However, the yearly rainfall pattern does not correlate with shell length, width or width/length ratio than remain that rainfall alone is not the most important factor affecting population dynamics.

2-Estimation of the number of clutches and eggs laid by *Succinea putris* during the breeding season:

This experiment was undertaken to determine the breeding season of *Succinea putris* which was recognized by the presence of egg clutches in the field. Clutches were laid under leaves, pieces of bark and on the surface of soil, but not in holes in the soil. The eggs are rounding, transparent and surrounded with a jelly-like substance. It was found that the mean of egg diameter \pm S.E. was 1.26736 \pm 1.32678mm, with range of 1.001 up to 1.573 mm.

Stages of life cycle for *Succinea putris* are illustrated in **fig. (3)**. Mating snails can be observed associated in pairs in the field. The eggs were round, transparent, lacking any calcium inclusions, conglutinated and surrounded with a jelly – like substance.. Eggs become brownish before hatching. Newly hatched juveniles are very small in size and became transparent. No external signs of sexual maturation were noticed.

The breeding season of *S. putris* was determined by the presence of egg clutch in the Egyptian clover field. **Table (1)** (n=7) showed that *S. putris* laid its eggs during 3.5 months started from December 2007 to March 2008. Eggs were not detected before or after this period. In the beginning of egg- laying period, the average number of eggs was gradually increased from 20.2 \pm 14.0 in the half of December 2007 up to 47.2 \pm 41.52 eggs during February 2008, then it was gradually decreased to average 2.6 \pm 5.81 eggs at the end of the active period (March 2008). On the other hand, the average number of clutch increased from 0.8 \pm 1.09 to reach 2.2 \pm 1.30 clutches during December 2007 and February 2008 then it was gradually decreased to average 0.2 \pm 0.44 clutch at the end of the active period (March 2008). Regarding, the average total number of clutches laid by *S. putris* during the entire active period was 1.20 \pm 0.37 clutches per 50 \times 50 cm.

Clutch size (number of eggs per clutch) during the active period of *S. putris* ranged between 8 to 51 with average of 14.2 \pm 3.38 eggs / clutch. On the other hand, clutch size was relatively low at the

beginning of egg laying period, but showed a noticeable increase in its second half of January (2008), with average 22.2 ± 13.47 eggs / clutch. However, in March (2008) clutch size was gradually decreased to 2.6 ± 5.81 eggs / clutch. Data in **Table (2)** showed that average numbers of the adult and juvenile snails in the beginning of December (2007) were 5 ± 2 and 5 ± 2.1 snails / sample. While, number of adults decreased gradually in February, March and April with averages 2.4 ± 1.14 , 3 ± 3.6 and 2 ± 1.4 snail/

sample respectively, while those increased in February, March and April with averages 7.2 ± 3.42 , 16.4 ± 12.89 and 20 ± 10.65 , respectively. However, at the end of active period season June (2008), the averaged of juveniles number were increased compared to adult stage with average 1.2 ± 1.3 & 5 ± 5.24 respectively. Discussing the biology of *Succinea* sp. It was found that the literature reports showed inconstant results in this respect.

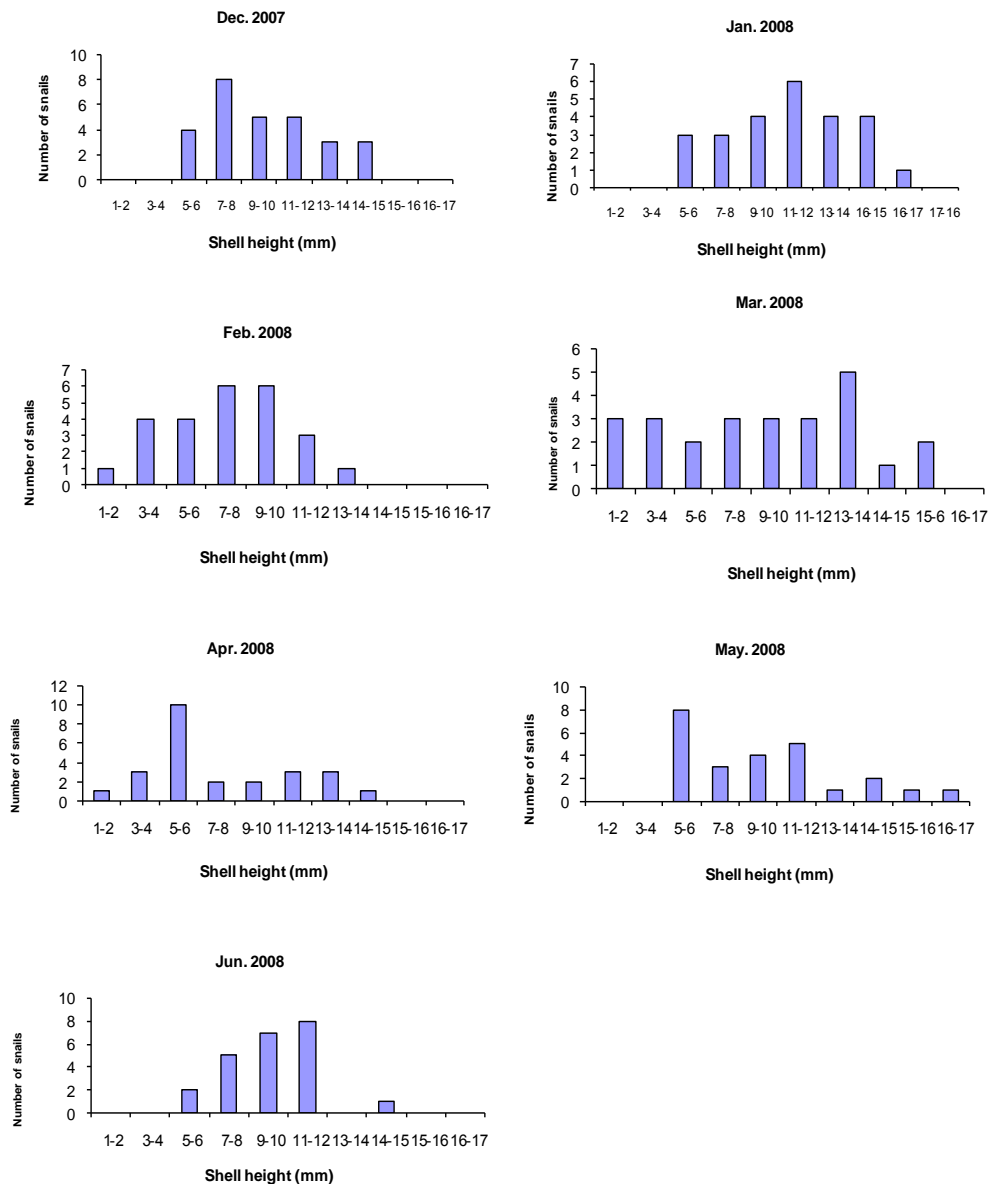


Fig. (1): Size - frequency histogram (shell height) of *Succinea putris* on Egyptian clover in Al-Alakma village, Hehia district, Sharkia Governorate during the period from December, 2007 to June, 2008.

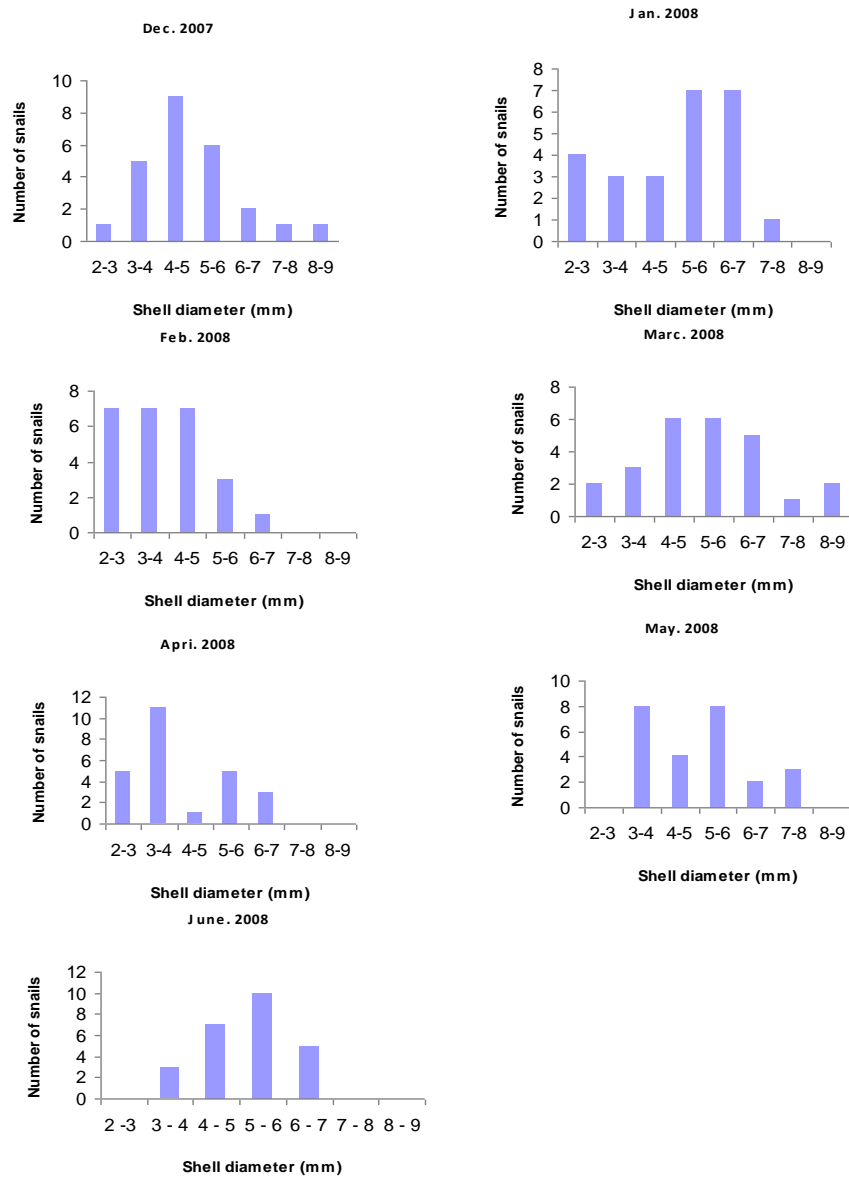


Fig. (2): Size - frequency histogram (shell diameter) of *Succinea putris* on Egyptian clover in Al-Alakma village, Hehia district , Sharkia Governorate during the period from December , 2007 to June, 2008.

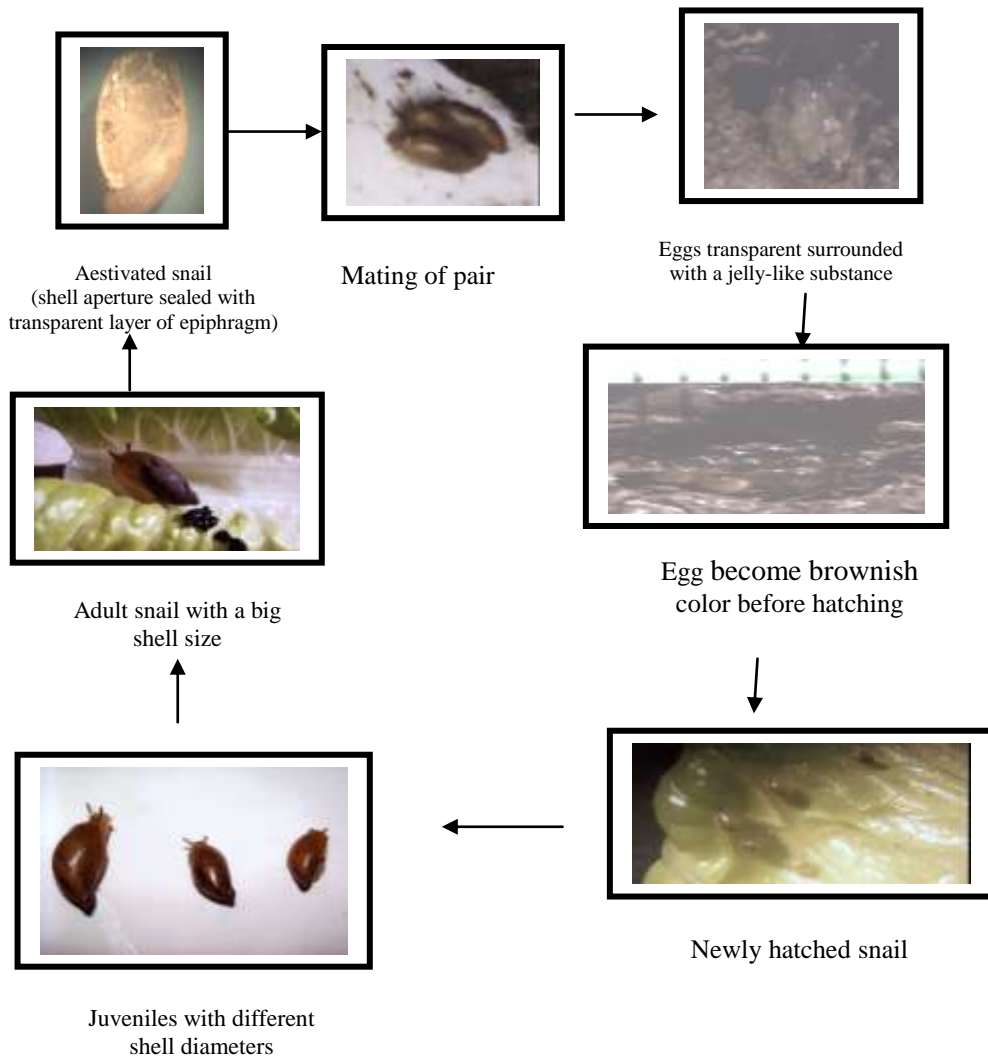


Fig. (3): Stages of *Succinea putris* life cycle.

Table 1. Number of clutches eggs in 50 × 50 cm and clutch size of *Succinea putris*. in Egyptian clover field during the period from December 2007 to March 2008 under field conditions

Variables		Sampling time/biweekly						General of Avera ± S. D	
		Dec. (1) 2007	Dec. (15)	Jan. (1) 2008	Jan. (15)	Feb. (1)	Feb. (15)		Mar. (1) 2008
Eggs	Avera	20.8	20.2	42.6	40.4	47.2	10.2	2.6	26.28
	±	±	±	±	±	±	±	±	±
	S. D	31.79	14.0	28.51	35.44	41.52	14.70	5.81	13.12
Clutches	Avera	0.8	0.8	2.0	1.8	2.2	0.6	0.2	1.20
	±	±	±	±	±	±	±	±	±
	S. D	1.09	0.44	1.22	1.30	1.30	0.89	0.44	0.37
Clutch size	Avera	10.4	20.2	19.0	22.2	17.46	7.0	2.6	14.2
	±	±	±	±	±	±	±	±	±
	S. D	15.89	14.60	12.65	13.47	12.53	9.64	5.81	3.38

Table 2. Number of adult and juvenile in 50 × 50 cm of *Succinea putris*. in Egyptian clover field during the period from December 2007 to June 2008 under field conditions.

Variables		Sampling time/biweekly						General of Avera ± S. D	
		Dec. 2007	Jan. 2008	Feb.	Mar.	Apr.	May.		Jun.
Adult	Avera	5.0	3.8	2.4	3.0	2.0	2.0	1.0	2.66
	±	±	±	±	±	±	±	±	±
	S. D	2.0	2.6	1.14	3.6	1.4	1.0	1.3	0.94
Juvenile	Avera	5.0	3.6	7.2	18.4	20.0	4.6	5.0	8.28
	±	±	±	±	±	±	±	±	±
	S. D	2.1	1.51	3.42	12.89	10.65	3.78	5.24	4.39

For instance, **Patterson (1973)** indicated that succineid snails were able to persist through dry periods in an aestivating state. **Baur (1990)** showed that the individual of the land snail *Arianta arbustorum*. (L) reproduction in the field, ranged from 0.4 to 5.2 clutches during the entire breeding season. Transplanted snails laid 1.3 – 11.5 times more clutches than did resident from the corresponding populations. Clutch size tended to increase at the beginning of the laying-period, but showed a significant decrease in its second half. Eggs were laid either in batches in the soil or singly on the soil surface. **Villalobos et al (1995)** studied the life cycle of the neotropical terrestrial snail *Succinea costaricana* in the laboratory, the following are the mean values; 7 eggs / clutch, 1.4 mm egg diameter; 0.25 and 0.84 mm embryo and newborn shell length, Respectively; 11 days (embryo development at 24°C); 16mm locomotion speed (Young). The animals can reproduce at 12 weeks (lifespan: 44 weeks). The pigmentation pattern is defined after seven weeks.

Jordaens et al (2004) studied the mate choice and sperm reciprocity patterns in the hermaphroditic land snail *Succinea putris*. Mate choice was random with respect to shell size. However, in mating where the partners were of unequal size, significantly more matings were observed where a small active

individual mated on top of a larger inactive individual than the reverse. **Datkauskiene (2005)** reported that the life span of *Succinea putris* (L.) under laboratory conditions varies from 13 to 17 months. The period of mating continues from March to September-October in the field, whereas under laboratory conditions it is life-long. The average number of eggs in the clutch is 48 ± 12.11 in natural biotopes and 12.7 ± 6.77 under laboratory conditions. The development of embryos from eggs to juveniles lasts 10- 20 days in the first and 30 days in the second laboratory snail generation. The development of juveniles to sexual maturity lasts 10 months under laboratory conditions which exert an influence on the reproduction development and growth of *S. putris*. **Lokma (2007)** studied the breeding season of *M. cartusiana* by the presence of egg clutches in the Egyptian clover field; the eggs were laid during three months started from mid-November 2001 to mid February 2002. General mean number of clutches and eggs, at biweekly intervals, were gradually increased to reach its peak during December with values of 2.70 & 2.75 clutches and 78.92 & 63.5 eggs per 0.25m² respectively. The majority of egg clutches were laid during November and December months as compared to lower values during January and February. **Kurt et al (2008)** . studied mate choice and sperm reciprocity patterns in the hermaphroditic land snail *S. putris*. Mate choice was

random with respect to shell size. However, in matings where the partners were of unequal size, significantly more matings were observed where a small active individual mated on top of a larger inactive individual than the reverse. It is suggested that this may be the result of mating on a vertical substrate or hanging underneath a horizontal substrate, because under these conditions it may be easier for a larger, inactive individual to carry a smaller, active one, than vice versa. **Lobke et al. (2010)** reported that the effect of body size of focal individuals and partners on (1) mating frequency and mating interval, (2) courtship role and (3) number of sperm donated in successive copulations in the land snail *Succinea putris*. They found that body size-dependent differences in mating behaviour between small and large individuals are: (1) smaller individuals of mating pairs were more likely to adopt the active role, (2) small individuals seemed to prefer inseminating larger partners, (3) a positive relation between body size and sperm number donated was found, (4) large individuals adjusted sperm number to their partner's body size, and (5) the smallest number of sperm was donated by large focal individuals to small partners. In addition, the number of sperm donated (1) increased with longer mating intervals and (2) decreased in later copulations indicating that the number of previous matings may affect male resource allocation. **Silva et al (2009)** studied the growth, fertility and life span of the land snail *Habroconus semenlini* under laboratory growth is indeterminate and the species is capable of self-fertilization with high reproductive success. Snails had lower fecundity than the animals that were kept in isolation, and has a short life span and only one reproductive period, which characterizes the occurrence of semelparity.

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دراسة حقلية على القوقع سكسينيا بوترس

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تمت هذه الدراسة البيولوجية على القوقع سكسينيا بوترس فى حقل برسيم مصاب فى قرية العلاكمة مركز هميا محافظة الشرقية خلال الفترة من ديسمبر 2007 إلى يونيه 2008. أوضحت المشاهدات الحقلية أن موسم النشاط لهذا القوقع استغرق ثلاثة شهور ونصف من شهر ديسمبر وحتى بداية شهر مارس. ووجد أن عدد كتل البيض وحجم الكتلة تغير معنويا خلال موسم النشاط. ووضعت معظم الكتل فى شهر فبراير بمعدل مرتفع 2.2 كتلة. ووضحت الاختبارات الحقلية أن حجم الكتلة كان مرتفع فى بداية فترة نشاط وضع البيض عن نهايته، وتراوح حجم الكتلة من 8 إلى 51 بيضة/كتلة بمتوسط 14.2 ± 3.38 بيضة / كتلة. ويدخل هذا القوقع البيات الصيفى فى الاطوار البالغة والغير بالغة خلال شهور الصيف تحت الحشائش وعلى حواف قنوات الري أو فى شقوق التربة. ويحتمل أن القوقع يحتاج عامين لإستكمال دورة حياته والوصول للبلوغ.