THE AGE-BASED STRUCTURE FOR UROPODINA POPULATIONS (ACARINA: ANACTINOTRICHIDA: UROPODINA) WITH PARTHENOGENETIC REPRODUCTION

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Abstract. The present paper puts forward the structure upon age criterion and the succession of generations for the populations of certain Uropodina species with parthenogenetic reproduction (*Urodiaspis tecta*, *Trachytes aegrota* and *Trachytes tesquorum*). The research has been conducted on a 2 years period (2003-2004), in 3 forest ecosystems (Făget, Budeasa and Mărăcineni), using a graphical method for the illustration of the generations' succession. In the researched populations, a generation takes from 6 to 13 months, with 2 complete generations in the 2 research years.

Keywords: Uropodina mites, parthenogenetic species, the structure of the populations upon age, succession of generations.

Rezumat. Structura pe vârste a unor populaţii de uropodine (Acarina: Anactinotrichida: Uropodina) cu înmulţire partenogenetică. Lucrarea prezintă structura pe vârste şi succesiunea generaţiilor în populaţiile unor specii de uropodine cu înmulţire partenogenetică (*Urodiaspis tecta*, *Trachytes aegrota* şi *Trachytes tesquorum*). Cercetarea a fost realizată pe parcursul a 2 ani (2003-2004), în 3 ecosisteme forestiere (Făget, Budeasa şi Mărăcineni), utilizându-se o metodă grafică pentru ilustrarea succesiunii generaţiilor. Pentru populaţiile studiate durata unei generaţii variază între 6-13 luni, apărând 2 generaţii complete în cei doi ani de studiu.

Cuvinte cheie: acarieni uropodine, specii partenogenetice, structura pe vârste a populaţiilor, succesiunea generaţiilor.

Introduction

There is relatively little research on the ecology of Uropodina populations, and most of them have targeted the establishment of a numerical dynamic for certain populations (density dynamic), not so much the demography (establishing a structure on age, duration for stages of development, distribution of the development stages in population). Researcher Marina Huţu studies the variation of the populations according to seasons for 13 Uropodina species in a mixed deciduous forest in N Moldavia (Huţu, 1978), and reaches the conclusion that, in the respective conditions, the Uropodina have had up to 4 generations per year. Bloszyk *et al*. (2006) study the demographics of *Cilliba rafalskii* species in a mixed deciduous forest litter, near Pniewy, and concludes that it has one year life cycle.

Studies of more length on the Uropodina demographics are conducted by Francoise Athias-Binche, who identifies development duration from larva to adult of 8 to 11 months for *Olodiscus minimus*, *Neodiscopoma catalonica*, *Urodinychus carinatus* and *Trachytes lamda* species from beech forest in Massane, thus having 2 complete generations in 2 years of research (Athias-Binche, 1985, 1989).

Interesting demographic data are obtained by the author on the population of *Allodinychus flagelliger* species, which she studies for 6 years, with samples took from the trunk of a decomposing beech (Athias-Binche, 1978). In this case the mean development duration from larva to adult was of 12 months, with a maximum of 22 months because deutonymphs are foretics (present a passive movement, attaching to bugs, and leave the tree in spring time to return during autumn, thus the much extended length of the life cycle).

Useful information on the length of the life cycle of Uropodina mites have been provided by the growing individuals in lab conditions (Athias-Binche & Haberssat, 1988; Constantinescu & Cristescu, 2007; Huțu, 1978). It has been observed that in lab conditions, Uropodina reach maturity much quicker (3-4 months), as compared to individuals from the populations studied outdoors, due to favourable conditions of humidity and temperature.

The purpose of the present research has been of establishing the age-based structure and the generations' succession for 3 species of litter Uropodina (*Trachytes tesquorum, Urodiaspis tecta* and *Trachytes aegrota),* which have been observed on a 2 years period, in 3 forest ecosystems near Pitești (Făget hornbeam-beech forest, Budeasa hornbeam-oak forest, and Mărăcineni hornbeam forest).

Materials and Methods

For the present research, 720 samples of litter (of 100 cm^2 surface) have been collected monthly, on a 2 years period (2003-2004), and a total of 5265 Uropodina individuals were identified (1426 individuals from *Urodiaspis tecta* species, 1772 from *Trachytes aegrota* and 2067 from *Trachytes tesquorum*).

Sample extraction has been made after Tullgren-Berlese method, modified by Balogh that is based on the extreme sensitivity of edaphic fauna to dryness and light. It leaves the sample as soon as it notices a lowering of humidity, by migrating to the basis of the sample, from where the animals fall in plastic collecting with alcohol.

After the extraction from the sample of the fauna material, the content of the collecting tube has been displayed on filter paper and, upon binocular magnifier, the Uropodina species have been separated from the rest of the soil fauna. All the Uropodina individuals have been kept in lactic acid for clarifying, afterwards determined up to the species. A data sheet has been made for each sample, containing the place from which the sample was collected, the date of collection, biotope, number of females and pre-adults (larvae, deutoymphs, protonymphs) for each species. For the pregnant females, the number of eggs found in the endogynium has been marked.

In order to identify the succession of the generations and the number of generations on the 2 years of research, a very important indicator was the number of eggs of the females. The data obtained through lab growing of Uropodina species show that the females can lay between 30 and 60 eggs in their entire life, and the microscope examination usually reveals 2 up to maximum 4 eggs at the same time in the endogynium. They are laid one by one at 24 hours distance, predominantly in certain periods determined both by the genetic constitution of the species, and the congruence of a complex of favourable environment conditions.

Because of laying the eggs gradually, the identification of the life duration of each development stage is difficult; nevertheless, one can estimate the duration of a generation and the succession of generations. The period when a peak in the number of females was observed, as well as a large number of eggs in endogynium, coincides with population maximum in the respective generation. This maximum has been followed by the decline of the number of females, for after laying eggs and fulfilling the role of species perpetuation, they live 2 more months at most. From the eggs laid by one generation, especially in the maximum of population period, the next generation is formed. In other words, the population peak of one generation and an increased number of eggs mark the beginning of the next generation, and in one, two months at most after this peak, the adults of the initial population are mostly gone. One can observe that the two generations partially overlap.

In order to establish a structure based on age, succession and duration of the generations of the studied Uropodina populations, I have used a graphic method. For

Trachytes tesquorum, *Urodiaspis tecta* and *Trachytes aegrota* species that multiply asexually through thelytok parthenogenesis, the lack of males and the presence of a large number of eggs in the females have simplified the interpretation of the graphics and identification of the succession of the development stages.

An inconvenience in establishing the succession of the generations and the number of generations per year was the reduced number of larvae from the samples. The explanation is on one hand, that they are very fragile and little and most of them destroyed during extraction. And on the other hand that they represent the development stage of the most reduced duration and, as a consequence, the probability of capturing them is very low compared with the other stages.

Results and Discussion

The aged-based structure and the succession of the generations for the populations of *Urodiaspis tecta* species. As the graphics below demonstrate, *Urodiaspis tecta* species develops best in the second year of study. In Făget (Fig. 1) a first important generation of females appears in February –April 2003, when one can also observe a large number of deutonymphs, successively exuviating and becoming adults up until April. The females of this first generation lay eggs in February-April, afterwards larvae appear, (a small number appears in samples in July) the protonymphs starting July, and deutonymphs from July to November. Deutonymphs exuviate and transform into the females of the second generation, appearing in December 2003-February 2004. In this last period, a very important number of eggs are to be observed in the females, from which the 3rd generation of the population appears. The eggs are laid by the females until February, protonymphs appear step by step in November 2003-February 2004 interval, they exuviate, and starting with March one could observe the deutonymphs. Deutonymphs gradually transform into females, in April-July interval, when the females of the 3rd generations appear. They lay a large number of eggs, from which the 4th generations of protonymphs appear (determined in samples in July), then deutonymphs in September-November. Deutonymphs exuviate in their turn, and the females of the 4th generation appear in October-December, and start laying eggs preparing the next generation.

In Budeasa hornbeam-oak forest (Fig. 2) a big proportion of pre-adults (larvae, protonymphs and deutonymphs) appear in February 2003 and exuviate gradually until May, transforming into the first generation of females of the year, with a maximum in April, from which the protonymphs of the 2nd generation will appear in June-September, deutonymphs in July-November, and the 2nd generation of females in July-October. The females of the 2nd generation lay eggs in October-December, from which the larvae of the 3rd generation appear in January-February 2004, protonymphs in January-March, deutonymphs in May-June, and through their exuviations the 3rd generation females appear in May-August. The 3rd generation of females lays eggs in May-June, a small number of larvae appear in June samples, from which protonymphs will appear in August-October, then deutonymphs from September-December will gradually exuviate and the 4th generation females will appear starting October. In this month a large number of eggs can be observed in the females' endogynium, from which a new generation of larvae will appear (they are observed on the graphic of December).

In Mărăcineni hornbeam forest (Fig. 3) a first generation of females appears in March-May 2003, in May 2nd generation eggs are identified in the females, from which larvae soon appear (the same month), then protonymphs until the end of July, deutonymphs and the females of the 2nd generation in September 2003-February 2004. The females of the 2nd generation lay eggs gradually until February, protonymphs appear until April and deutonymphs in February-My. They exuviate and the 3rd generation of females appears in May-August. A peak of pregnant females in observed in May (a large

number of eggs), in June-July the larvae leave the eggs, in July and August protonymphs appear, deutonymphs are afterwards observed in samples until December. From these deutonymphs the 4th generation of females appears, with a maximum in November-December. These females lay eggs in November-December, and the larvae of a new generation appear.

One can observe that in the case of this species, the length of a complete development cycle is in between 6 and 8 months, and longer in autumn-winter; during the 2 years of studies, only 2 complete generations were identified. Also, the maximums of the populations do not coincide with a new generation emerges in the population. A new generation coming to place is clearly marked, besides the population peak, by the presence of a large number of eggs in the females' endogynium and, in the next stage, by the presence of larvae in samples.

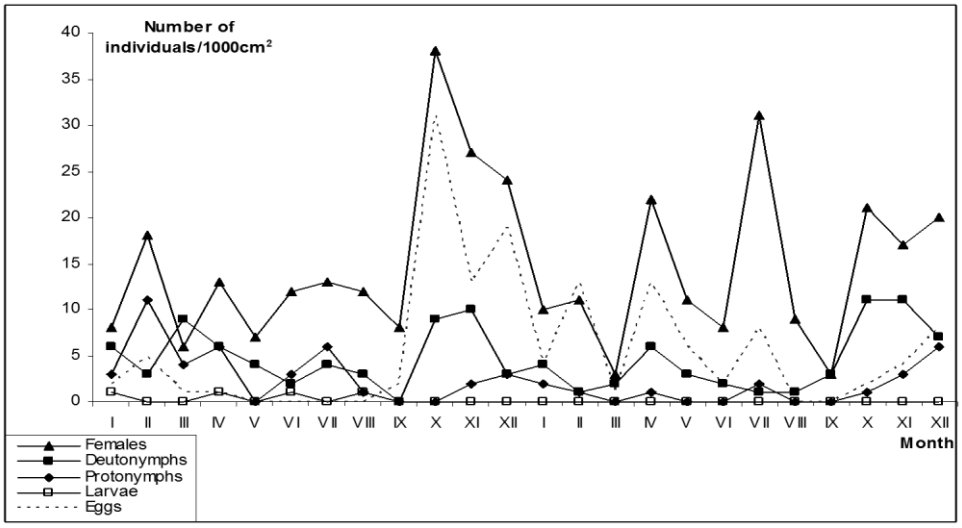

Figure 1. Phenology of the *Urodiaspis tecta* population in the hornbeam-beech forest from Făget.

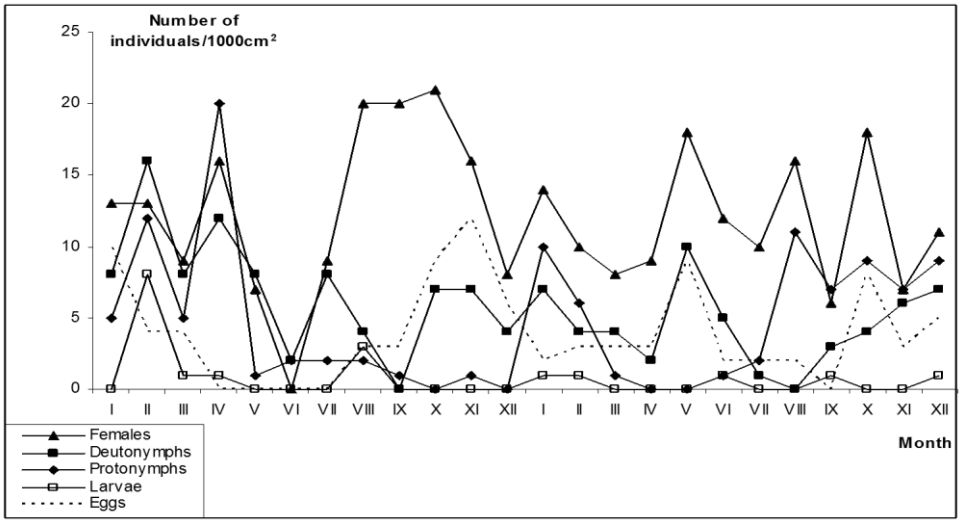

Figure 2. Phenology of the *Urodiaspis tecta* population in the hornbeam-oak forest from Budeasa.

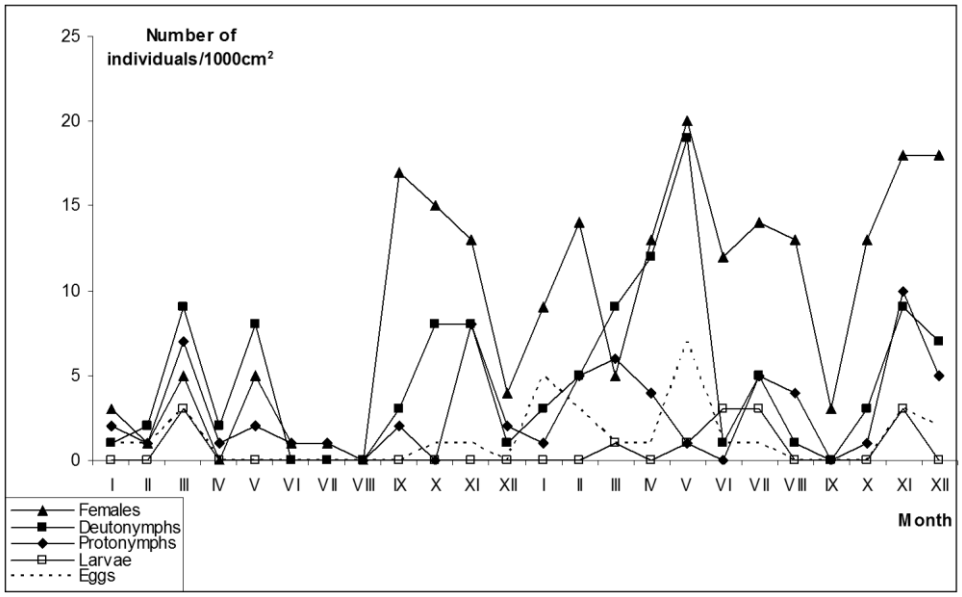

Figure 3. Phenology of the *Urodiaspis tecta* population in the hornbeam forest from Mărăcineni.

The aged-based structure and the succession of generations for the populations of *Trachytes aegrota* species. This species is better developed in Făget and Budeasa, while in Maracineni one could observe a decline in number, especially in 2004.

In hornbeam-beech forest (Fig. 4) a 1st female generation appears in February-April 2003, and lay eggs in a prolonged interval of several months (February-June), protonymphs start appearing in June-July, deutonymphs in April-September, and in October-December, a 2nd generation females appears. The females have a large number of eggs in the endogynium, and they are laid in November 2003-April 2004. Protonymphs of the 3rd generation are observed in July, and deutonymphs in July-August. The 3rd generation females appear starting August, but the maximum of this generation of females is in December, when a large number of eggs are also laid, marking the next generation emerge.

In hornbeam-oak forest (Fig. 5) the 1st generation of females appears during February-April 2003 period, but a significant proportion of protonymphs and deutonymphs from this generation still appear, which will later exuviate. The 1st generation females lay eggs especially in February-March; protonymphs appear in June-September, deutonymphs in August-November, and the 2nd generation females in the same period. The 2nd generation females appear in the sample for a long time, until May 2004, and the eggs are laid gradually throughout this entire period, larvae appear in samples in July, protonymphs especially in July-August and most of deutonymphs in August-November. Deutonymphs exuviate and become the 3rd generation females, especially in October-December, while in December a large number of eggs appears, marking the beginning of a new generation.

In hornbeam forest population (Fig. 6) a first generation of females appears in February-April, but here too a large number of protonymphs and deutonymphs are not yet exuviated and this will happen later, prolonging the 1st generation of females up to July. The 1st generation females lay a large number of eggs in February-April, from which 2nd generation of protonymphs appear in July and deutonymphs in July-October. Through their exuviations, the 2nd generation of females appears, with a maximum in October.

Continuing, the 2nd generation females lay eggs in December 2003-March 2004, but the population suffers a very important decline and the larvae, protonymphs and deutonymphs mostly disappear, those that resist reach maturity in July, providing the 3rd generation females, afterwards the population maintains a surviving limit number until the end of 2004.

One can observe that in the case of this species 2 complete generations appear in the 2 years of research, and the length of these generations varies very much, from 8-9 months in the first year of study, to 13 months in the second.

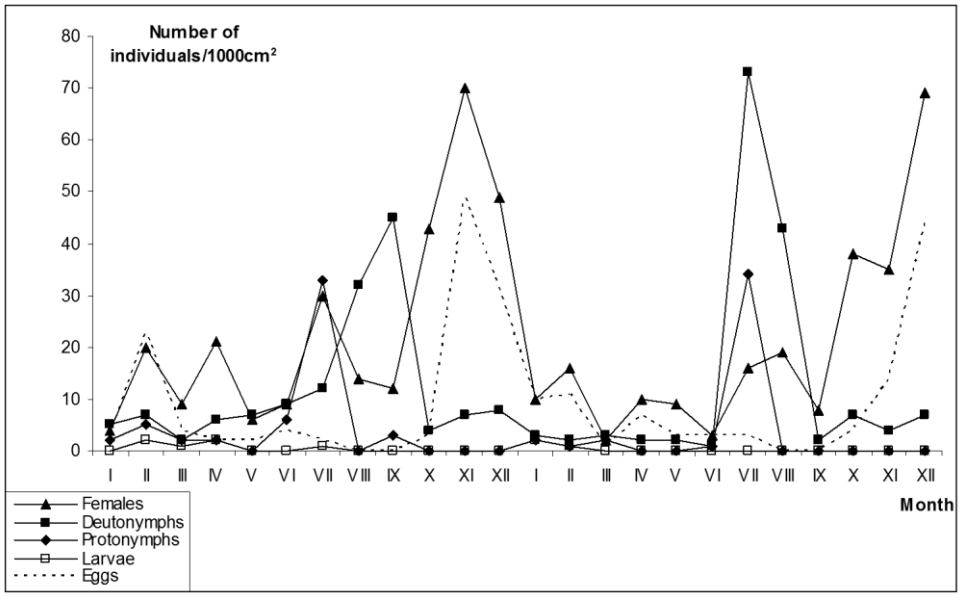

Figure 4. Phenology of the *Trachytes aegrota* population in the hornbeam-beech forest from Făget.

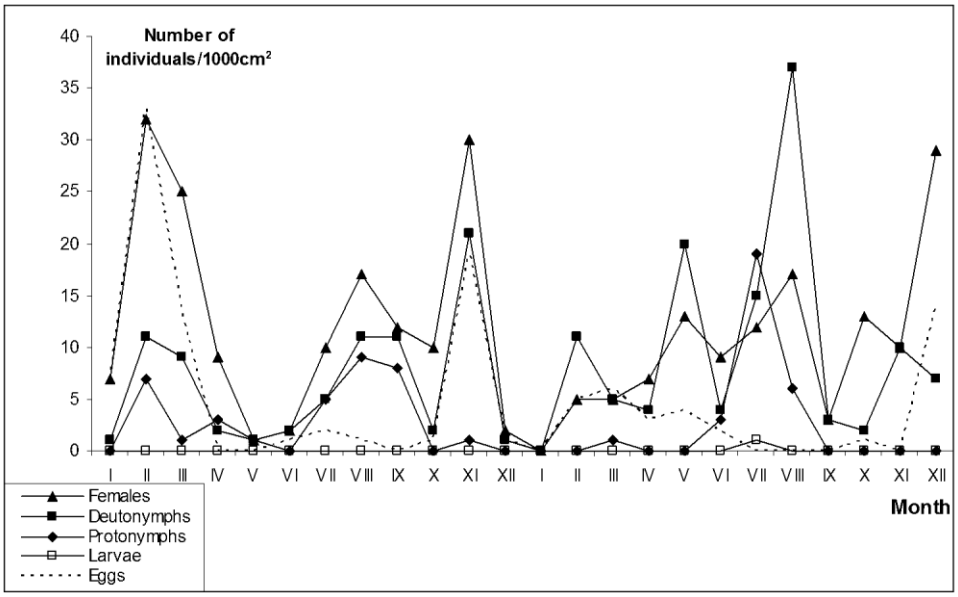

Figure 5. Phenology of the *Trachytes aegrota* population in the hornbeam-oak forest from Budeasa.

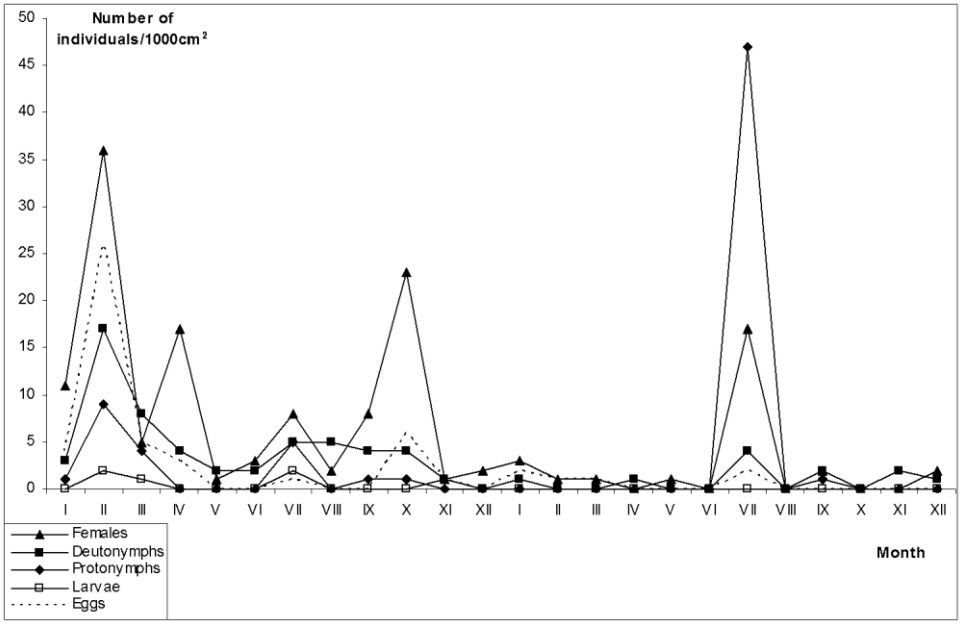

Figure 6. Phenology of the *Trachytes aegrota* population in the hornbeam forest from Mărăcineni.

The aged-based structure and the succession of generations for the populations of *Trachytes tesquorum* species. *Trachytes tesquorum* species is well developed in Mărăcineni and Budeasa, more in the 2nd year of study. In Făget, the number of identified individuals was very small (31), thus a relevant graphical representation and a data analysis were impossible.

In Mărăcineni (Fig. 7), a 1st female generation appears in January-April 2003, with large number of eggs in the females' endogynium, marking the beginning of the 2nd generation. A small number of larvae appears in July, protonymphs in September-October, and deutonymphs from September 2003 to January 2004 gradually transform into 2nd generation females. These females lay eggs from November to April, and 3rd generation protonymphs emerge in July, while the deutonymphs July-November, and a 3rd generation females in October-December. One can observe how the 3rd generation females lay eggs in November, preparing the next generation.

In hornbeam-oak forest (Fig. 8), 1st females generation appears in February-April, when a large number of eggs are determined under the microscope, especially in February and March. From these eggs, the 2nd generation protonymphs appear in March-July, deutonymphs starting August 2003 up until February 2004. These deutonymphs gradually exuviate in the prolonged interval, forming the 2nd females' generation, in October 2003-April 2004. The 2nd females' generation gradually lays eggs all this time, and in June-August the 3rd protonymphs generation appears, in July-September deutonymphs, and starting October and up until the end of 2004 the 3rd females generation. They lay eggs starting November.

One can observe that this species has 2 complete generations in the 2 years of study, and the length of a generation is of approximately 10 months in 2003 and 11 months in 2004 for both populations.

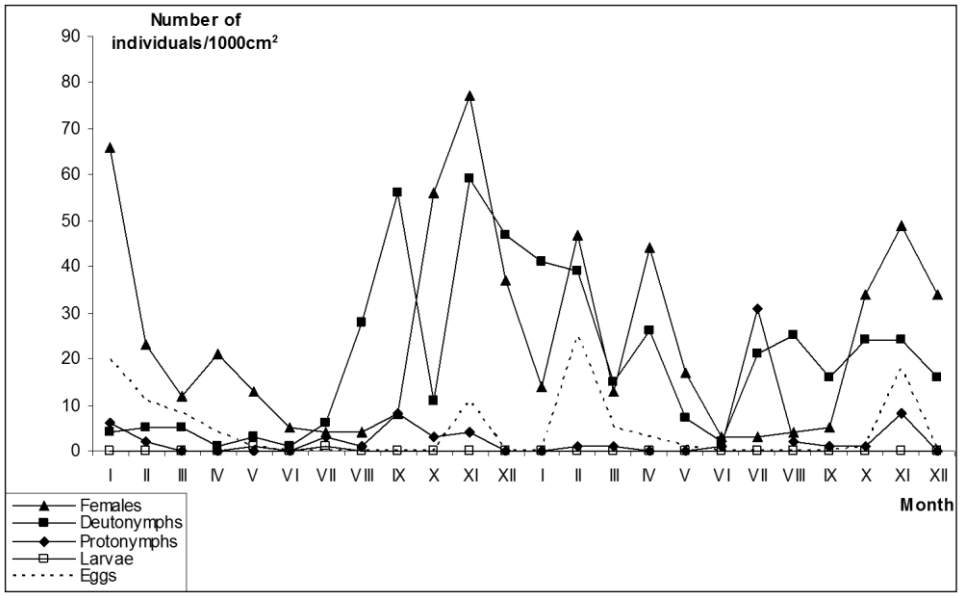

Figure 7. Phenology of the *Trachytes tesquorum* population in the hornbeam forest from Mărăcineni.

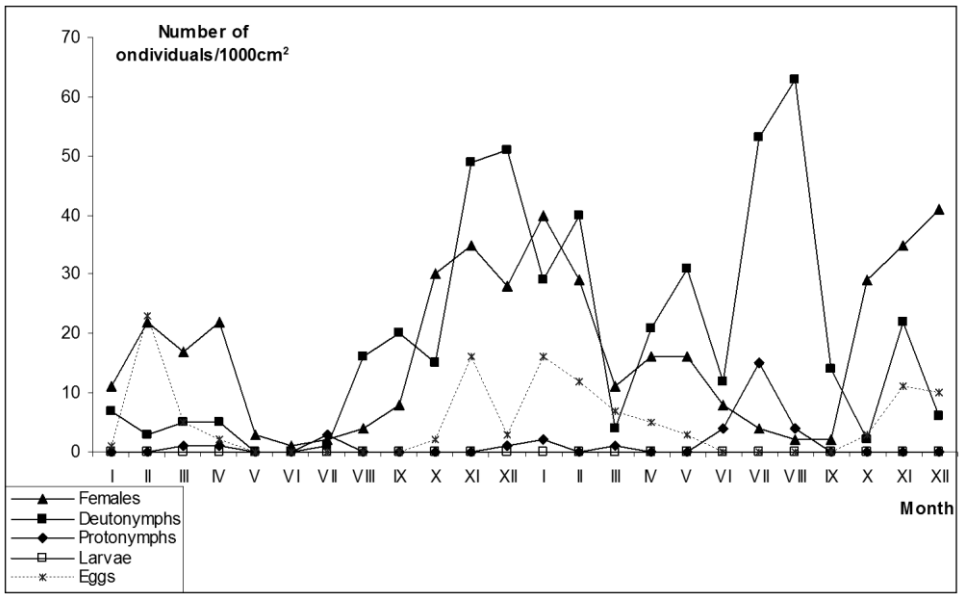

Figure 8. Phenology of the *Trachytes tesquorum* population in the hornbeam-oak forest from Budeasa.

Conclusions

One can observe that in all the 8 populations researched there are 2 complete generations in the 2 years of study, and their length varies between 6 and 13 months.

The populations of *Urodiaspis tecta* species from Făget, Budeasa and Mărăcineni evolves similarly, the length of a complete development cycle is between 7 and 10 months, shorter in the 1st year of study. A 1st generation appears in the population in

January-March 2003 and reaches maturity in October-November 2003; a 2nd appears in October-November 2003 and reaches maturity in April-May 2004.

In the case of *Trachytes aegrota* species, the populations from Făget and Mărăcineni have a very similar evolution - a 1st generation of 9 months appears in February 2003 and reaches maturity in November 2003, the 2nd takes 13 months and appears in November 2003, reaching maturity in December 2004. In Mărăcineni the evolution of the population resembles the former in the 1st year of study, but in the 2nd a very strong decrease in number is registered, few individuals could reach maturity in a shorter time period (9 months).

Trachytes tesquorum species only appears in Budeasa and Mărăcineni ecosystems. The 2 populations evolve similarly, with a 1st generation in January-February 2003, reaching maturity in November 2003 (9-10 months), the 2nd generation from November 2003 reaches maturity in November 2004 (12 months).

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