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AGE STRUCTURE AND GROWTH RATE OF *AEGOPINELLA EPIPEDOSTOMA* (FAGOT, 1879) (GASTROPODA: PULMONATA: ZONITIDAE)

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ABSTRACT: Growth rate and age structure of *Ae. epipedostoma* (Fagot) were studied based on monthly samples from a population in Muszkowice (SW. Poland). The life cycle is probably a three-year cycle: juveniles hatch from July till September, and winter over at a size of 2.6–3.5 whorls. The growth rate is ca. 0.5 whorl/month. In their second season, the snails resume growth in spring to reach 4 whorls in May-July; they reproduce in the same season and at least some of them winter over again.

KEY WORDS: terrestrial pulmonates, Zonitidae, *Aegopinella epipedostoma*, growth rate, age structure

INTRODUCTION

Aegopinella epipedostoma (Fagot, 1879) is a montane species whose distribution is rather incompletely known due to frequent confusion with *Ae. nitens* (Michaud, 1831). It is known from the Pyrenees and their northern foothills where it is common, from Deux Sèvres (western France), the Taunus Mts (Germany), the Sudetes and the Carpathians; it is probably present also in Slovenia. An isolated northern outpost is located near Novgorod. The Pyrenees with their foothills are inhabited by the nominotypical subspecies; the form found in the east, among others in the Carpathians and the Sudetes, is called *Ae. epipedostoma iuncta* Hudec (RIEDEL 1988). The status of the two subspecies and their distribution require more detailed studies.

Fig. 1. Individuals of *Aegopinella epipedostoma* in their typical microhabitat in Muszkowice

In Poland the species occurs in the Sudetes and their foothills, in the Carpathians (except for the Tatra) and the Subcarpathian region (RIEDEL 1988). It inhabits montane forests where it shelters in the litter or, more often, under the litter in humid soil (Fig. 1). It prefers cool and humid places near streams (Figs 2, 3). It is regarded as rare and red-listed in Poland (WIKTOR & RIEDEL 2002), though not included in the Red Data Book (GŁOWACIŃSKI 2004).

Since there are almost no literature data on zonitid life cycles (for review of literature on life histories of terrestrial pulmonates see MALTZ 2003), the aim of this paper is to present the results of field observations on some life cycle parameters in *Ae. epipedostoma*.

Figs 2, 3. Fragments of the habitat of the Muszkowice population of *Aegopinella epipedostoma*

MATERIAL AND METHODS

Seasonal changes in the age structure of the population of *Ae. epipedostoma* were estimated based on quantitative samples taken in Muszkowice near Henryków (SW. Poland), close to the border of the nature reserve Muszkowicki Las Bukowy (Fig. 4). The Muszkowice population represents *Ae. epipedostoma iuncta*. Samples were taken each month from April till November 2005, with both visual search and OEKLAND's (1930) method, modified according to KUŹNIK (1997): each month four surface samples of a total area of 1 m^2. Only live individuals were considered. Whorls were counted according to EHRMANN (1933). The division into age classes was based on the number of whorls.

Fig. 4. Map showing localition of the study plot (arrow)

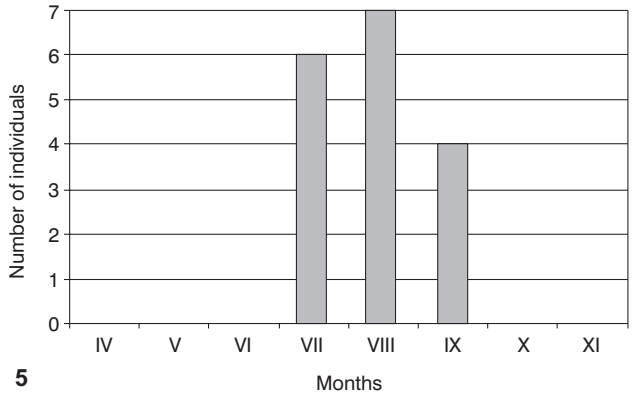
RESULTS

The number of embryonic whorls (hatchlings) ranged from 1.1 to 1.7 (KUŹNIK-KOWALSKA in prep.). Mature individuals have up to 5.25 whorls (e.g. WIKTOR 2004); the highest recorded number of whorls in the studied population was 5.0.

The abundance of individual age classes in consecutive months is presented in Figs 5-12. The youngest age class (1.1–1.5 whorl) appeared in July and was still present in September. The breeding season included these three months (Fig. 5). Age class II (1.6–2.0 whorls) appeared in August and September (the spring hatchlings) (Fig. 6). The next class (III: 2.1–2.5 whorls) was first observed in September, was present in October and became the most abundant in November. The juveniles of this size probably wintered over (Fig. 7). Age class IV (2.6–3.0 whorls) was present from May till November (Fig. 8). The spring individuals of this age class were probably last year hatchlings. Class V (3.1–3.5 whorls) was the most abundant in August, September and October (Fig. 9). Individuals of class VI (3.6–4.0 whorls) were less abundant in June and July, and the most numerous from September till November (Fig. 10). The distribution of age class VII (4.1–4.5 whorls) was unven. It was the most abundant in May, and also rather numerous in June, July and November (Fig. 11). The last age class (VIII: >4.6

Table 1. Overall abundance of consecutive age classes of *Aegopinella epipedostoma*; values from seven months combined

Age class	Number of individuals
I (1.1–1.5)	17
II (1.6–2.0)	19
III (2.1–2.5)	25
IV (2.6–3.0)	22
V (3.1–3.5)	84
VI (3.6–4.0)	279
VII (4.1–4.5)	274
VIII (>4.6)	19



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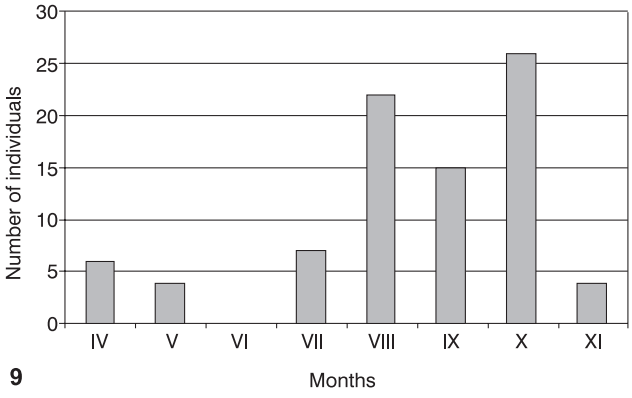

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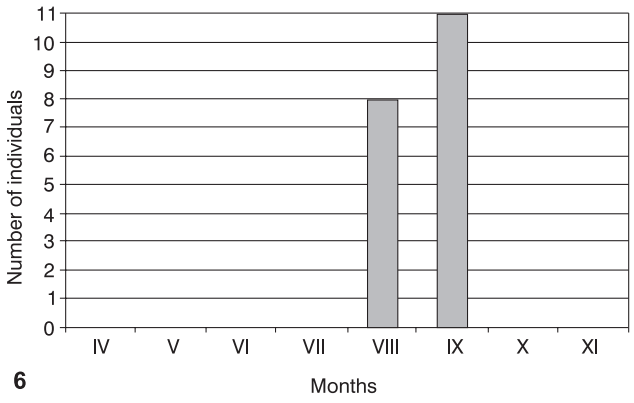

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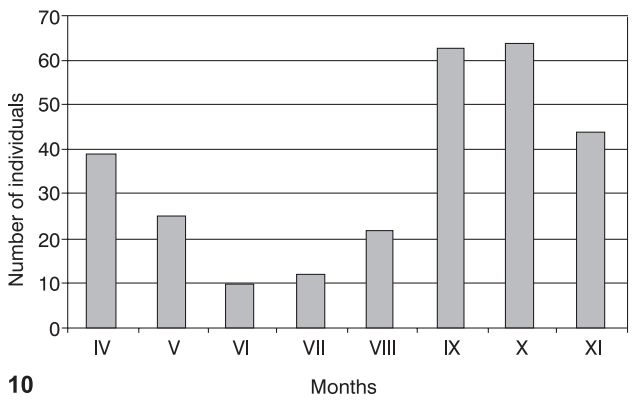

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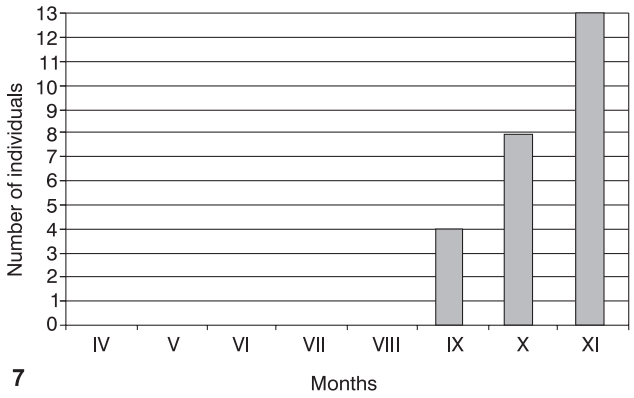

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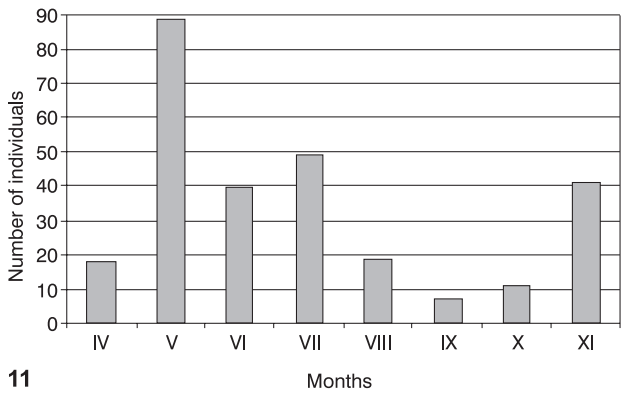

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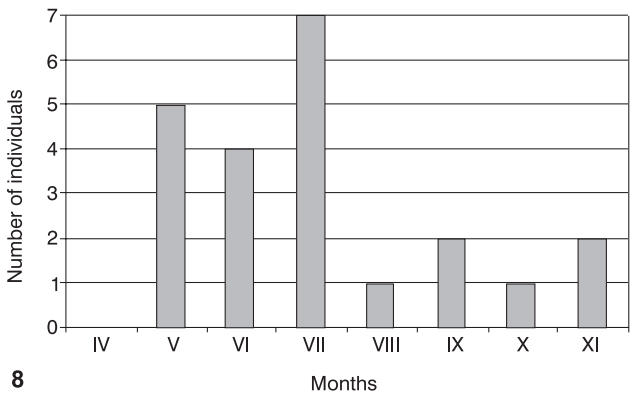

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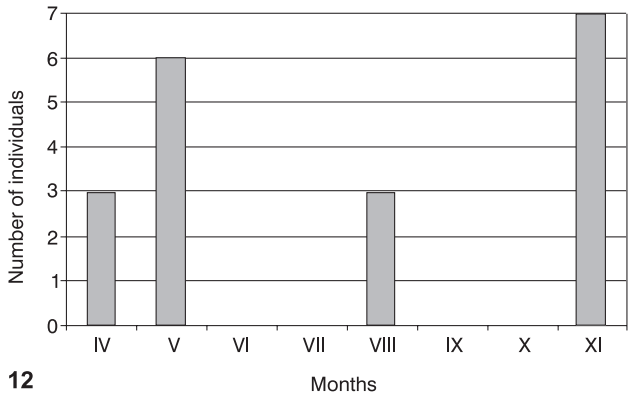

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Figs 5–12. Abundance of consecutive age classes of *Aegopinella epipedostoma* from April till November: Fig. 5. Class I (1.1–1.5 whorl), Fig. 6. Class II (1.6-2.0 whorls), Fig. 7. Class III (2.1–2.5 whorls), Fig. 8. Class IV (2.6–3.0 whorls), Fig. 9. Class V (3.1–3.5 whorls), Fig. 10. Class VI (3.6–4.0 whorls), Fig. 11. Class VII (4.1–4.5 whorls), Fig. 12. Class VIII (>4.6 whorls)

whorls) comprised few individuals and was present only in April, May, August and November (Fig. 12).

Overall abundance of consecutive age classes of *Aegopinella epipedostoma* is presented in Table 1. It indicates a high mortality of juveniles of classes I–IV and of the oldest individuals (class VIII). The number of individuals in the intermediate classes (V, VI, VII) is higher.

DISCUSSION

The seasonal changes in the age structure of the population of *Ae. epipedostoma* (Figs 5–12) make it possible to reconstruct the life cycle of the species and its growth rate. Juveniles hatch from July till September. The individuals that were the earliest to hatch reach 3.0 whorl in the same season. Snails of 2.6–3.5 whorls winter over. The growth rate is probably ca. 0.5 whorl/month. In their second season, the snails resume growth in spring to reach 4 whorls in May–July, when they begin to reproduce.

The low abundance of the youngest age class may result from the difficulty to find hatchlings in the field (*Ae. epipedostoma* lays eggs deep in moss, and the hatchlings have shells of ca. 1 mm diameter). The oldest age class, also poorly represented, probably includes old individuals which have terminated reproduction.

In all probability individuals of *Ae. epipedostoma* in the studied population reach maturity in the second year of their life, when they begin to reproduce. The presence of individuals from the two oldest age classes (VII and VIII) in April samples indicates that at least some snails winter over for the second time, as adults. The life cycle is thus basically a three-year cycle. The hatchlings, present from July till September, may result from the reproduction of individuals which reached maturity in the previous (earliest hatchlings) or the same year (later hatchlings).

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