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"Rodens & Spatium IV"				

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NONSPECIFIC TRIGGER MECHANISM OF TWO TYPES OF GROWTH AND DEVELOPMENT OF CYCLOMORPHIC RODENTS

Two alternative pathways of ontogenetic development, typical of mice-like rodents, were analyzed in a bank vole natural population. There is an attempt to show that every specimen inherits two alternative programs of ontogenic development: 1) monophasic growth and autumn mortality; 2) biphasic growth, temporal retardation of growth until spring. Environmental conditions switch on one or the other program within one genotype.
Key words: Rodents, pathways, trigger mechanism, phenetic approach, functional approach.

1. INTRODUCTION

The possibility of two alternative pathways of growth and development regularly followed during ontogenesis (monophasic and biphasic growth) was demonstrated in a natural bank vole *Clethrionomys glareolus* Schreb. population (South Urals-South taiga subzone).

Three Physiological Functional Groupings (*PFG*) could be distinguished (Olenev 1981, 1989). The study aimed to reveal genetic peculiarities of a populations structural-functional grouping (*PFG*) and the possible role of the genetic component in the two pathways of ontogenetic development, based on the ecological peculiarities of *PFG*.

The study used the phenetic method and multivariant morphometric analysis for evaluation of genetic peculiarities in intrapopulational groupings.

2. METHODS

During 1975–1992, field investigations were conducted in the Il'menskii Reserve (a band of pine-birch forests in the forest-steppe zone of the South Urals). The CMR method was used for field work. Ca 4 000 specimens were caught in similar biotopes and studied by method of morphophysiological indicators (Shvarts, Smirnov and Dobrinski 1968). Age was determined by the methods of Bashenina (1975) with modifications (Olenev 1989).

The main criterion for distinguishing intrapopulational units was similarity character of functioning for individuals within each group and through time. Having adopted functional status (the functional condition associated with specific of growth, development and reproductive conditions) as the basis for separation of groups, the author has suggested (Olenev 1981, 1989) that three Physiological Functional Groups (*PFG*) should be distinguished.

First type of ontogenetic development. Specimens breed in the birth year (*PFG* 3). 70–90% of the animals come from the first cohorts; reproduction begins at the age of 25–45 days. Monophasic growth and fast aging are typical. The early stage of tooth root formation occurs at the 65th–75th day.

Second type of ontogenetic development. Specimens do not breed in the birth year (*PFG* 2). The majority are from the last cohorts, but there are always non-breeding representatives from the first cohorts (10–30%). Reproduction begins the next year (biphasic growth). Tooth root formation occurs only on the 120th – 130th day. Aging is lower by half.

Overwintered specimens, formerly *PFG* 2, become *PFG* 1. The first method employed here was to compare populations for a large number of non-metrical skeleton traits (Barry and Searl 1963). Estimating phenetic distances with a complex of non-metrical threshold traits allows a relative quantitative evaluation of the differences between the samples analyzed. The majority of the threshold craniological characters were according to Vasiliev (1984); 114 skulls were selected.

The second method used for the same samples was multivariant morphometric discriminant analysis of mandible size and form, (Festing 1972). This method allows integral estimates of the differences between population samples for a series of traits, i.e. the main species characteristics or even the whole phenotype (Anderson 1963).

Samples were grouped by the age of the animals. Animals of the 3rd and 2nd *PFG* and animals in early ontogenesis, before the division into the two pathways, were compared.

PFG 3 Samples – Mature, breeding specimens, captured 25–28 July. Molars show an absolute age of ca 50 days.

PFG 2 Samples – Not mature, not breeding during the birth year. First phase of ontogeny; captured 26–30 July. Molars show age changes of teeth (*ACT*)

corresponding to an absolute age of ca 80 days. Due to the different *ACT* between the 2rd and 3rd *PFG*, show values identical to those in the 3rd *PFG*.

Juvenile animal samples – captured 14 June to 5 July. Absolute age (by body weight) 14 to 28 days.

Table 1
Phenetic distances between samples of bank voles

Samples	PFG 3	Juvenile
PFG 2	0.025	0.106
Juvenile	0.100	

3. RESULTS

As may be seen in Table 1, the largest phenetic distance were found between "Juv." and the other two groupings (*PFG* 3 and *PFG* 2). The shortest phenetic distances were between the first and second samples ($D = 0.025 \pm 0.018$) which belonged to *PFG* 3 and *PFG* 2 and corresponded to the two development pathways.

Samples *PFG* 3 and *PFG* 2 are closer, their "D" values being of the same order (Table 2). Greater differences were found between "Juv." and the other two groupings. Thus the results obtained by the two methods corresponded.

Table 2
Mahalanobis distance "D" on complex mandible, measured between samples of bank voles

Samples	PFG 3	Juvenile
PFG 2	2.27	3.52
Juvenile	3.7	

4. CONCLUSIONS

Phenetic analysis allows natural populations to be studied in regard to their genetic characters, but based on morphological data.

Comparative analysis of the phenetic distances between intrapopulational groupings of the bank vole by complex nonmetric indicators suggests that *PFG* 3 and *PFG* 2 (two pathways of development) have no expressed genetic heterogeneity.

The results of multivariant morphometric analysis are in agreement with the conclusions obtained by the phenetic method.

Thus in populations of cyclomorphic rodents, genetic determination of the divergence individuals along two pathways of ontogenetic development seems unlikely.

Based on these analyses, one cannot judge the genetic heterogeneity of the functional groupings (two pathways of ontogenetic development).

The possibility of two alternative pathways of growth and development, are in my opinion, a manifestation of polyvariant development of the animals. Probably here we are dealing with the phenomenon of polyvalency i.e. the inheritance of a program of ontogenetic development that is not singular. On the basis of one genotype, a specific ontogenetic program can be realized, expressed in one pathway of development (*PFG* 2 or *PFG* 3).

One can suppose that dual pathways of development are inherent in the majority of species of cyclomorphic rodents.

5. REFERENCES

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