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The analysis of therological investigations made in preparation for the first International Therological Congress (Moscow, 1974) showed distinctly that the greatest number of works on mammal ecology was published in 1962-1972 (Novikov, 1977). This pattern was preserved in the following years; ecology and its specific methods and principles of investigation continued to be inculcated in all sections of therology. It is extremely difficult to establish overall tendencies and trends of ecological investigations and the basic problems of interest to the broad circle of zoologists of different countries in the range of ecological study. To a certain extent this can be established by the subjects and contents of reports delivered at international conferences, and for this reason we felt it necessary to acquaint the readers of the journal "Ékologiya" with the problems of mammal ecology discussed at the second International Therological Congress (Brno, Czechoslovakia, June, 1978), mainly in the section on ecology. We recall that at the first Congress in Moscow, the section on ecology had the largest number of reports and participants. This statistic remained unchanged at the Brno gathering: In nine sessions of the section about 80 papers were delivered by participants from 22 countries. In addition, ecological material was broadly represented in the form of demonstrations (about 20 communications in the scheme of section themes) and discussed at the meetings of some of the specialist groups according to interests. If we take into account that more than 30 papers on the agenda of the ecological section and published in the Congress material were not read in view of the absence of the authors, it becomes obvious that the subject of ecology manifestly predominated at the forum of the-
rologists.

These figures apparently reflect the real situation in therology. The last two or three decades have witnessed a steady increase in the general number of investigations of an ecological nature, a broadening of the themes of these works, and their development in directions that are directly connected with the requirements of agriculture and forestry, medical practice, and other aspects of the activity of man. The same holds true for the "geography" of investigations on mammal ecology: In first place in the number of reports delivered were Soviet therologists (26 papers in the section, 2 communications in the demonstrations, and 19 published works not read), in second place were Polish ecologists (8 papers, 14 demonstrations), and in third place were scientists of the USA (11 reports and 7 published communications).

The theme of investigations of mammal ecology is very broad and diverse. Among the papers presented at the Congress of an autecological character a large number was devoted to experimental ecology. A generalized report on the basic problems of experimental ecology as a method simulating ecological phenomena and processes under rigidly controlled conditions was given by V. N. Bol'shakov and A. V. Pokrovskii (USSR). In a separate paper, A. V. Pokrovskii demonstrated the possibilities of an experimental method in the example of the Pamir vole; a number of earlier unknown ecological features of this species was disclosed under vivarium conditions.

Many of the reports were devoted to the study of different aspects of ecological physiology of mammals. Thus, in his report, A. T. Toktosunov (USSR) examined the morphophysiological features of the mountain population of some of the small mammals, and in their report the American investigators J. F. Merrit and J. M. Merrit dealt with the effect of conditions under snow on the growth and metabolism of rodents. In the last communication there were interesting data on the adaptive significance of winter reduction of weight and metabolism in *Clethrionomys gapperi* in an alpine, snowbound region. These data have something in common with the material on seasonal changes in the size of the vole brain, reported by

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V. Yaskin (USSR). E. Burney and R. Jenniss (USA) described the biosynthesis of ascorbic acid in which there was analyzed the capability of vitamin synthesis and activity of this process in members of 10 orders of mammals: Only bats lack the capability of synthesis of ascorbic acid, all the other species possessing it in one way or the other.

Bioenergetics was broadly reflected at the Congress. Especially, generalized reports based on the ecological-physiological aspect were devoted to the problems of the regulation of energy metabolism in an organism. In particular, P. A. Panteleev (USSR) drew up a convenient list of types of thermoregulatory reactions based on data in the literature. Wide interest was created by N. B. Bashenina's (USSR) report on the regularities determining energy value of respiration in relation to sex, age, functional state, and other features of the organism of small mammals. V. Grodzinsky, who established one of the most intensive working groups in Cracow (Poland) on the investigation of bioenergetics of mammals, made a comparative analysis of the regularities of energy metabolism of small and large mammals. In his theoretical analysis he examined concrete experimental data on the common vole (weight 22 g) and roe deer (22 kg). Interesting and new data on the bioenergetics of five species of Mongolian rodents were contained in the report by A. Goretsky and I. Viner (Poland), in the material on thermoregulation in caribou (N. A. Chermnykh and M. E. Vishnevetskaya, USSR), and others. In all there were more than 10 papers devoted to questions of ecological physiology at the level of the organism.

In the ecological section, investigations on a population level easily dominated in number of works and diversity of themes, methods, and approaches to the problem; these came to about two-thirds of all the presentations. Many of them contained descriptions of general data on the ecology of different species. For example, there were the reports by O. N. Nurgel'dyev (USSR) on the biology of the long-clawed ground squirrel of Turkmenia, by G. Markov and L. Khristov (Bulgaria) on the common rebacked vole of Bulgaria, material on the biology of bats (I. Hajsler, Czechoslovakia; V. Hanak, Czechoslovakia; R. Grachik, Poland), A. Ruzich (Yugoslavia) on the biology of the common hamster, and S. Sulkary (Finland) on the biology of feeding of the common rebacked vole, in addition to the interesting report by B. Herzing-Strashil (Austria) on the suslik *Xerus xerops* inhabiting the arid regions of South Africa. It is only to be regretted that the number of such "classical" autecological investigations in recent years have been steadily declining; this undoubtedly reflects the reorientation of many zoologists to the "modern" trends, a situation which is absolutely incorrect since precisely in order to determine many of these trends (comparison of geographical populations, investigation of adaptive mechanism on a population level, evaluation of energetics of populations), a knowledge of the ecological details of the species is an essential condition.

It was characteristic that many of the autecological works presented at the Congress were concerned with the biological features of the reproduction of different species: papers by V. Lidiker, J. Wolf (USA), M. Taylor (Canada), J. Calaby (Australia), P. Viro (Finland), F. Dieterlen (West Germany), Kh. M. Alekperov, S. N. Erofeeva (USSR), and others. Many of these works contained interesting material; the formation of these investigations were very timely since the dynamics of reproduction lies at the basis of animal population fluctuations.

The problem of the dynamics of numerical strength in the last few decades has occupied a central position in ecological investigations throughout the world. This is determined not only by its enormous practical significance but also by the fact that the dynamics of numerical strength reflects the entire sum of reactions of the species (population) to the complex of external influences that is transformed via the system of mechanisms of population autoregulation. Thus, the dynamics of numerical strength represents an integrated reply of the population to the dynamic ecological conditions of its life. It is therefore not fortuitous that in recent years the term "dynamics of numerical strength" is being replaced increasingly more by the concept "population dynamics." There are now available abundant data demonstrating that throughout the entire population cycle there change not only the numerical strength but also the age and genetic structure, physiological features of the individuals, and other population parameters.

The problem of population dynamics also occupied a central place at the second congress of zoologists. In many of the reports there was material on the changes in number of different species throughout long periods of time, often combined with data on the dynamics of other population parameters. Thus, in his communication Z. A. Shakhmardanov (USSR) presented data on the population of many species of mammals of Dagestan and examined the theoretical

bases of optimization of population and its dynamics in relation to a series of Ungulata. A. Pinter (USA) analyzed in great detail the population dynamics of *Microtus montanus* from the northwest USA, primarily in relation to the influence of different factors on the reproduction of this species. It was shown that this influence is particularly effective in the early spring and middle of summer, mainly by the change in participation in reproduction of the young, delivered in the current year. In the report by R. Tamarin (USA) there are presented interesting data on the population regulation of number in the insular population of *Microtus breweri*; in this species fluctuations in number in optimal habitats are nearly absent, the rodents always live at high density, a restricting factor is represented by the conditions of the external environment, a situation that is not usually common to rodents. Population regulation of numbers under such conditions is effected mainly by the spatial dispersion of individuals. Very interesting results on lemming cycles were contained in the report by F. B. Chernyavskii (USSR) who noted that during the population cycle a number of demographic and physiological indices change as well as the genetic structure of the lemming populations.

Most of the data on the dynamics of population structure in the course of numerical cycles that appear in the world literature were obtained on different species of rodents. In this context, particular interest was aroused by H. Hendrich's report (West Germany) in which he showed, on the basis of many years of observations of East African Ungulata (*Redunca redunca*, *Kobus defassa*), that the social organization of their populations changes as the number and density of the population changes.

Many of the papers were devoted to the generalization of patterns of population dynamics in the form of mathematical models. In particular, N. C. Stenset (Norway) constructed an imitation model on the basis of field data on the population dynamics of field voles in Scandinavia in which there were calculated a series of biological parameters, including energetics. He drew up a general theoretical report on the significance of mathematical models in applied ecology, proceeding from the argument that with a correct calculation of ecological data, a mathematical model may become the base for the organization of the control of the numerical strength of rodents. Under the guidance of this scientist, a special group worked on the problem "Theoretical aspects of the cycles of rodent population."

Ya. Kozlovsky (Poland) presented in his communication a mathematical model of the dynamics of population productivity of the common rebacked vole based on parameters easily obtained during ordinary vole investigations: population density, distribution by weight groups, and percentage of females pregnant. During computer processing of these data there is input of additional indices about the energetics of the organism which are well known for the given species from earlier experiments; several calculations each year are needed for complete data on productivity. In the author's opinion a similar model could be used in calculating the annual productivity and its dynamics for any species of small rodents.

D. Tskipurishvili and coauthors (USSR) demonstrated a mathematical model of the dynamics of population and spatial structure of the great gerbil. The statistically probabilistic model of burrow settlements of gerbils at different phases of the change in numerical strength was in good agreement with empirical data and indicated the regular character of the territory used. In complete agreement with the theoretical concepts of population ecology the model showed the significant role of spatial structure and heterogeneity of conditions in the population dynamics of the investigated species.

A species trend in population ecology is the investigation of the structure of populations and intrapopulation relations as bases of the integrity and stability of population systems. Several generalized reports of a theoretical nature dealt with this theme. I. A. Shilov (USSR) presented material on the patterns of population structural formations of rodents. He pointed out the role of ecological-physiological mechanisms in the formation and maintenance of the structure of interrelations in intrapopulation groups. On the basis of experimental and field data there was demonstrated the important role of the typological features of the central nervous system and stress reaction in intrapopulation processes. Emphasized in particular was the significance of the qualitatively different individual in the population composition during the formation of stable groups. The significance of stress in population phenomena was also considered in the report by A. Lee and coauthors (Australia). Using *Clethrionomys gapperi* as an example, V. Fuller (Canada) demonstrated the relation of population density to the rate of sexual maturation, disclosing in this way one of the mechanisms of autoregulation of density at the population level. D. Stoddart (Great Britain),

known for his researches on olfactory communication of rodents, discussed the role of the parotid scent glands in bandicoots.

The theoretical paper delivered by K. Ota (Japan) dealt with the problem of different types of curves of survival in large-toothed redbacked voles under different conditions; in the latter case the different curves were obtained for groups living under conditioned and unconditional situations. Survival of animals born at different times of the year also differs. K. Obar (Japan) examined the possible ways of evolutionary formation of different types of intraspecific organization of mammals.

New materials on the spatial and age structure of populations of different species were demonstrated in many of the reports (J. Murray, M. Harris, Canada; G. Nadieu, West Germany; A. I. Muntyanu, USSR; D. Happold, Australia, and others). Polish ecologists presented many interesting data on the structure and dynamics of rodent populations in the form of demonstrations.

Some of the communications of Soviet scientists were concerned with the problem of differentiating a specific settlement at the level of populations. A lengthy theoretical report on the role of the morphological approach to this problem (question of phenetics of populations) was delivered by A. V. Yablokov. A good illustration of this was contained in the report by N. S. Moskvitina and N. G. Suchkova on epigenetic polymorphism of populations of northern redbacked vole in Western Siberia. The problem of physiological-genetic differentiation of mammals were examined by Yu. O. Raushenbakh. V. N. Bol'shakov, M. V. Popov, N. G. Solomonov, and T. S. Gladkina presented concrete material on the differences in ecological-physiological characteristics of populations settling in different geographical regions.

Many papers were devoted to the place of mammals in natural and anthropogenic ecosystems. A general report on this theme came from L. Ryszkovsky (Poland) and N. French (USA), who were members of the supervisory center of the International Working Group on Small Mammals within the framework of IBP. Described were the role of mammals in trophic and metabolic relations in an ecosystem, their influence on vegetation, and also the significance of these processes in different types of habitats and in relation to man's activity. Many reports examined this problem in its application to concrete communities: M. Cristaldi and coauthors analyzed the synecological features of communities of small mammals of central and southern Italy, R. Dieckehut (West Germany) the ecological role of these animals on protected territories, etc. In other reports there were discussions on some forms of biogeocoenotic interrelations. Thus, J. Piccimenti (USA) gave an interesting analysis of the distribution of ecological niches of members of two genera of Peruvian rodents (*Phyllotis* and *Akodon*). Among the 12 species investigated, not one pair proved to have corresponding spectra of feeding or distribution of habitat; each species occupied a specific ecological niche. F. Ellenbrok (Netherlands) analyzed a similar question in relation to two species of shrews. On the basis of field and laboratory experiments he revealed that *Sorex araneus* and *S. minutus* differed in preference of habitat and this led to differentiation in nature and the reduction in level of competition. A decrease in competitive force through separation at the time of reproduction was established for several species of rodents in Israeli deserts (U. Ritte). Czechoslovak zoologists (R. Obrtel, J. Zajda, V. Holishova) presented some interesting data on "predator-prey" interrelations in their observations of the dynamics of destructive chewing on *Diprion pini* by forest rodents.

In investigating the role of mammals in ecosystems increasingly more attention is being focused on anthropogenic changes of the landscape and their effect on animals, on questions of active interference in the composition of fauna for the purpose of raising effectiveness of reproduction and exploiting useful species, and control of harmful populations. These questions were reflected in the materials of the Congress. The largest report on this problem was delivered by G. A. Voronov (USSR) who analyzed the different types of anthropogenic successions in the example of small mammals of the taiga. The effect of large-scale felling of trees on therofauna was demonstrated in the paper by G. Kirkland (USA). Some communications in the sessions and in the form of demonstrations were concerned with the investigation of the composition and dynamics of communities of mammals in agrosystems (M. Mikes, M. Todorovich, I. Savich, Yugoslavia; K. Andrzejewska, Poland, and others). Some reports touched on other aspects of man's influence on therofauna: formation of city populations of rodents (I. Glivich and coauthors, Poland), acclimation (N. P. Lavrov, USSR), and others. In all about 20 papers were delivered on the biogeocenological theme in the section.

On the whole, the reports delivered in the section on ecology reflected the broad plane on which investigations of mammals are being conducted at different levels (organism, population, ecosystem) through the use of modern methods. The clearcut practical direction of most of these investigations is characteristic. We should stress the especially successful development of the population direction; great successes have been achieved in this sphere, both on the theoretical plane (development of concepts of populations as integral self-regulating systems) as well as in the applied aspect (use of patterns of the population level as a basis to forecast numerical strength and work out measures of control). In hand with this the eye is caught by the lessening of attention to autecological investigations (except for questions of bioenergetics) and the still insufficient development of an ecosystem approach to the investigation of mammals.

It must be borne in mind, however, that the work of only one section on ecology was not indicative of the volume of ecological investigations of mammals represented at the Congress. At the meetings of the section there were grouped the generally theoretical reports concerned nearly exclusively with small mammals. The overwhelming number of works in other sections (commercial-game, protection of mammals applied therology, behavior) pertained to other groups (Ungulata, Carnivora) and also investigations of the ecology of small mammals of an applied character. Therefore the true scope of investigations of the ecology of mammals is broader than that visualized in analyzing the work of only the section on ecology. We will illustrate this in the example of some of the above-noted sections.

Many of the reports presented in the section devoted to the study of mammal behavior were distinctly of an ecological-ethological direction. Thus, for example, H. Hossou (Austria) evaluated the role of hierarchical structure in social organization and the better synchronization of activity in herds of alpine red deer. I. I. Myslenkov (USSR) and P. I. Veinberg (USSR) presented data on the family-group way of life, safety, and marking sections of habitat and features of parcelling groups of goral and tur. I. Horacek Czechoslovakia, who investigated the social structure and organization of *Myotis*, convincingly demonstrated that in the study of the biology of bats great attention must be paid to their social life.

Reporting on individual aspects of social behavior of mammals — maternal behavior of maral and gerbils, the role of color in intraspecific communication — were A. K. Fedosenko (USSR), V. E. Sokolov, S. I. Isaev, O. A. Patnikova (USSR), J. Rood (West Germany), and the American ecologists J. Svendsen and Van Heller. The second group of phenomenological data on ecological aspects of behavior were concerned with the diurnal activity of Canadian bighorn sheep (A. Farr, F. Bunnell, Canada), nine-banded armadillo (J. Line, D. Glover, USA), water shrew (F. Ellenbrok, Netherlands).

In the series of communications by V. E. Sokolov and coauthors (USSR) devoted to the problem of analysis of the pheromone of aggressiveness and pheromone of affiliation of the individual to his species there is discussed a possibility of interest to ecologists, namely the determination of the social rank of rodents by the combination of a series of biochemical characteristics.

Although special ecological reports were not presented in the section on paleontology, ecological approaches to the solution of problems of phylogeny, problems of extinction of some species and groups, and the transformation of therological complexes are applied by many paleontologists. This was particularly characteristic of the works of Soviet investigators: For example, K. K. Flerov broadly examined the problem of the change of therofauna of the Northern hemisphere in the Pleistocene and Holocene epochs because of the effect of different ecological factors, including the anthropogenic. Similar investigations of a regional character were described by L. Kordos (Hungary) for the Holocene in Hungary and K. Kovalsky (Poland) for the Pleistocene of the Balkans. N. G. Smirnov (USSR) discussed the application of an historical-ecological approach to the study of formation of the feature of contemporary populations.

Detailed knowledge on the ecology of commercial and hunting animals is required for their rational exploitation. The ecological content of many reports presented in the section on commercial-game animals centered on this factor. The largest number of papers were devoted to the role in ecosystems of trophic links of Ungulata and Carnivora. Among the intrapopulation investigations the first place in number of reports was taken by investigations of the spatial structure of the population, territorial behavior, and size of individual sections (16%). Many reports described the sex and age structure of populations of different species.

A comparatively small number of investigations, against expectations, was devoted in this section to anthropogenic influence: In seven of the ten reports there was described the effect of hunting on the wild population. Virtually absent were theoretical investigations devoted to drawing up principles of rational exploitation of populations of commercial-game animals.

In the section on morphology the interest of ecologists was caught by the report of S. Sulkav (Finland) devoted to the geographical and biotopic variability of morphological characters of the common shrew of northern Finland. The author found substantial differences in the metric characters of body size and its parts and tooth structure in animals of different local populations.

The effect of periodic phenomena of nature on hematological and biochemical indices of blood of the common seal was examined by M. L. Johnson and coauthors (USA). L. N. Skurat (USSR) discussed the role of ecological factors in morphological features of the merocrine sweat glands of rodents.

The clearcut ecological approach to the study of the most varied problems of mammal biology by members of the Soviet delegation should be noted. Their reports not only dominated in number but demonstrated the high theoretical level and far-reaching practical significance of works on the ecology of mammals in the USSR. The broadest theoretical papers in virtually all the trends presented at the Congress were delivered by Soviet ecologists. Investigations of mammal ecology in the USSR are conducted on a large scale that encompasses all the natural zones and the most diverse groups of mammals.

In conclusion, tribute must be paid to the enormous amount of work accomplished by the organizers - Czechoslovak zoologists who did everything possible to ensure the success of the Congress.

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