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Eremias arguta deserti (Reptilia: Sauria) in the Ukraine

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This article reflects the main results of the author's 12-years researches of the biology of Eremias arguta deserti Gmel.

In the Ukraine E. arguta is spread in the limits of the steppe and, partially, the forest-steppe zone. It inhabits the biotopes with sandy and sandy-shells soils with thin psammophilous, steppe and halophilous herbaceous vegetation. It occurs also in young or thinned out plantings of pine, bastard acacia, elaeagnus and tamarisk on sandy soils. As the forest grows and the crowns of the trees close E. arguta gradually disappears. Strict requirements of substrate and light caused a mosaic-strip character of the subspecies area. It was ascertained that E. arguta occurs at many areas of sandy terraces of the Dnieper /with its tributaries Psjol, Vorskla, Orel and Samara/, the Donets /with its tributaries Oskol, Torets, Aidar and Derkul/, on the right bank of the river Molochnaja, in the lower reaches of the Danube and Dniester, on the banks of the South Bug, as well as on nearly all sea spits and parts of the Black Sea and Azov Sea shores with cumulative coasts.

The population density of E. arguta /evaluated per hectare/ fluctuated in different biotopes from 2.5 to 640 individuals /usually 50-200/, biomass - from 0.01 to 3.25 kg. The distribution of individuals and mean density depend, first of all, on the character of the biotope and on the strength of pressure of the anthropic factors. In recent years the sandy areas of the Ukraine have undergone intensive economic reclamation resulting in the reduction and splitting of the area of E. arguta and to a fall in number. In the future the preservation of this species in the Ukraine will be possible only at reservations.

Different populations of E. arguta are distinguished by maximum and mean sizes and mass of the adults' body, by body proportions and by pholidosis characters. The lizards from the river terraces are small as a rule /in different populations $L._{max}$ 60-67 mm, mass 5-7 g/, and those from sea shores are larger /$L._{max}$ 63-76 mm, mass 6.5 - 11.3 g/.

In the south of the Ukraine the first lizards emerge usually in the first week of April, but, some years, in the last days of March or in the middle of April. In the middle of September or at the beginning of October the adults leave for hibernation, while the juveniles remain active till the middle or the end of October and sometimes up to the middle of November. The delayed hibernation of the youngs is caused by the necessity for accumulation of sufficient fat supply and is possible because of their higher temperature flexibility.

The duration and character of daily activity of E. arguta depends on weather conditions, season, character of biotope, foodstuff, age and physiological state /the level of sexual activity, fatness and so on/ of animals. The feeling of hunger is one of the main factors determining the duration and character of daily activity at a certain time. The duration of population activity of E. arguta in the Lower Dnieper region does not exceed 12 hours for adults and 10 hours for the current year's broods; the activity of individuals is essentially shorter. The level of population activity depends directly on the duration of individual activity and on whether an individual comes out from its shelter every day or not. Sharp lowering of the level of activity of adult lizards in August-September creates an impression of early leaving for hibernation that sometimes is interpreted as the presence of aestivation of adult animals.

In spring and autumn the activity of E. arguta has a unimodal character, but from the end of May till the end of July there are two peaks with intervals in the hot period of a day. In July the first juveniles appear, and the picture of daily activity of the population becomes complicated. In August-September one maximum of activity in the middle of the day is observed among the adults while the young are most active in the morning and evening hours. Such delimitation in time of the periods of maximum activity of the young and adults as well as a marked lowering of the level of activity of the latter, leads to a slackening of the food competition between different age groups. This is particularly important in August when the density of insects in the sandy steppe is minimum and the density of lizard population is maximum.

The attitude of lizards to the temperature of the environment depends on season, the time of day, weather conditions, peculiarities of biotope, on age, sex and physiological state of animals. The young are more flexible to temperature, the widening of temperature limits of their activity coming at the expence of lower body temperatures. The young have prefered temperatures lower than the adults. This just determines the difference in the character of activity of these two age groups in August-September. In spring the lizards leave their holes usually at lower temperatures of air and soil than in summer. In autumn the phenomenon of displacement of the temperature minimum is observed clearly only among the young, and the adults are comparatively stable in their attitude to temperatures that is attained by the narrowing of the active periods. As a whole the youngs are active at temperatures of soil surface not below 15°C, of air - not below 8°C /noted in October/, the others - at temperatures not below 17 and 11°C respectively /noted in April/. At soil temperatures above 44-45°C the number of active lizards sharply drops and at temperatures above 56°C we did not meet them on the surface of the soil. Optimum temperatures of substratum are 32-39°C for the young and 37-44° for others.

The body temperature of E. arguta in any moment is determined first of all by the temperature of soil surface, by solar radiation, motional activity, air temperature /the factors follow in order of decreasing importance/ and depends on age, sex and on peculiarities of biotope /on microrelief, soil composition, plant cover, etc./. The body temperature was measured per os by an electrothermometer for 300 individuals. It fluctuated from 18.1 to 37.5°C for active young and from 30.8 to 40.0°C for others. Optimum body temperatures of the lizards in May-July are practically constant /the differences are not significant/ and equal approximately 37.2°C for all individuals except the current year's broods; in April, August and September these temperatures are significantly lower. /Average body temperature of the lizards in the period of the peaks of their daily activity is accepted as optimum/. The young have average body temperature

significantly lower than others /for example, in August - by 1^{o}, t = 3.2/. Because in summer lizards have larger choice of temperatures we consider the body temperature of 37.2^{o}C to be optimum for adults and 34.4^{o}C for the young, but not the lower spring-autumn indices. The fact that the young bear high temperatures worse than the adults we explain by the lack of experience in ecological heat regulation and lesser body mass. The sex does not influence, noticeably, the optimum body temperature and prefered temperatures of substratum except in pregnant females with large ova: their optimum body temperature is slightly higher than the others have /in June-July 37.7 and 36.9^{o}C, t = 2.1/. Solar radiation and motion influence very much the body temperature of E. arguta: the latter can exceed the soil temperature by more than 10^{o}C /registered in April and October/ or can be lower by $15-20^{o}$C /during summer heat/.

In South Ukraine, E. arguta matures usually in its 10-12th month /i.e. in May-July/, with body length of 47-50 mm or more and mass about 3 g. As a rule these are the lizards that have been born in July-August of the previous year. Some of the year-old lizards /mainly those that were born in September/ have insufficient time to mature by July and produce offspring only after the second wintering, i.e. in their 21-23rd month. Nonsynchronous lizards' maturation leads to prolonging of periods of mating, oviposition, egg incubation and emergence of the young.

The majority of populations usually oviposits once a year. The period of eggs laying last 50-60 days /usually June-July/ which creates an impression of a second oviposition. The latter is marked only among lizards from the sea shore of Novoazovsk and Vilkovo environs. A clutch consists of 2-7, more frequently 3-4 eggs. The fertility of sea shore populations significantly exceeds that of the river terrace ones. Positive correlation is marked between fertility and length of the females' body /for different populations: $y = 0.12x - 3.86$, $y = 0.17x - 6.84$ and others/. The length of fully developed eggs was 11.4 - 18.9 mm, the width was 6.8 - 9.2 mm. The size and mass of eggs are approximately the same for lizards of different populations, but they depend on the size of a clutch: the females with a few /2-3/ eggs in oviducts have eggs significantly larger than those of the females with 4-5 eggs /t = 3.7, 2.5 and 2.2 for length, width and mass of the eggs, n = 41 and 42/.

The duration of an egg's incubation depends on the time of oviposition /it is connected with seasonal changes of environmental factors/ and on weather peculiarities of a particular year and equals 30-40 days for early clutches and 55-70 days for late ones. First young emerge usually in the third ten-day period of July, but some year earlier or later /in 1975 - on July 6, in 1978 - on August 5/ and they continue to hatch till the end of September - the beginning of October.

Our observations on marked individuals have shown the rate and character of lizards' growth to be dependent on weather conditions of that year, on birth time and sex of the animal and they undergo considerable individual variation. The young recently born have a body length of 27.5 - 33.7 mm. Lizards born in July and at the beginning of August grow the most rapidly and before hibernation reach a length of 37-49 mm /mean increment 10 mm/. Young that have appeared at the end of August and in September reach by winter only 32-36 mm /mean increment 2.7 mm/. Lizards born at the end of September hardly grow. After hibernation the growth rate is maximum in May and June and equals, in different years, 4.0 - 8.3 mm per month. After the time of maturation the growth rate lowers and the growth almost stops by the end of August. After the second winter the increment of different individuals was 1-7 mm in 6 months. The duration of life of E. arguta is usually 3 years, but some individuals live longer.

As long as the lizards continue to grow, their body proportions change: the relative length of pileus and tail decreases, particularly among females. This leads to intensification of sexual distinctions with age.

The adults moult 2-3 times a year /in April-May, June and August-September/, the young do so approximately once a month. Due to great individual variability of the dates of moult the moulting animals can be found from April till October.

The diet of E. arguta depends on their age and sex and on available food, which is determined by the character of biotope, by season and peculiarity of the year. The analysis of nutriment of 227 individuals has displayed the diet of E. arguta to consist of invertebrates, mainly insects /93.7 % from the total and in 100 % of stomachs/. These lizards eat great number of pests: in one stomach of a young up to 8 larvae of the leaf beetle Chrysomela carnifex, up to 20 mealy bugs and up to 50 aphids were registered. During the outbreak of a plague of Loxostege sticticalis, which brought great damage to agriculture of the South Ukraine in 1975, E. arguta exterminated a lot of caterpillars and butterflies of this pest /for example in July the remains of 72 caterpillars were found in one alimentary canal/. The grains of sand, little stones and pieces of shells discovered often in alimentary canals of the lizards are not gastroliths as it is usually considered, but they are taken with the lizard's prey accidentally. One case of cannibalism was noticed. Food selection is influenced mainly by the size, mobility and degree of chitinization of prey. The young, and pregnant females with eggs in oviducts, consume smaller and less mobile insects. The intensity of feeding of lizards changes during their active period and depends on weather conditions, age and sex of animals /more exactly - on changes of fatness and the level of sexual activity that are determined by sex/.

In some biotopes of the South Ukraine, E. arguta is the most numerous vertebrate and plays an important role in the ecosystem. For example, in the sandy steppe of the Black Sea reservation, in 1975, on an area of 0.25 ha the number of lizards was maximum in August /46 adults and 114 youngs/ and minimum in October /34 youngs/. The largest biomass of invertebrates the lizards consumed was in July. At that time an adult or subadult consumed an average 6.6 specimens and 0.32 g of different insects per day, a juvenile - 8.0 specimens and 0.056 g. Evaluation per hectare showed that all the lizards /52 youngs and 364 others/ consumed, during a month, 87370 insects with mass of 3.7 kg, that formed 14.9% of the numbers and 33.4% of the biomass of invertebrates in the steppe /their census was done by a biocenometer/. The most intensive influence the lizards had upon the number of insects was in August.