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ISOLATED POPULATION OF THE YELLOW GROUND SQUIRREL *Citellus fulvus* ON BARSAKEL'MES ISLAND (PHENETIC AND MORPHOMETRIC ASPECTS OF COMPARISON OF ISLAND AND CONTINENTAL POPULATIONS)

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The isolated population of the yellow ground squirrel *Citellus fulvus* Licht. on Barsakel'mes Island is a result of the introduction of animals from northern and Cis-Aral continental populations in 1929-1931. Comparison of the insular and continental populations with respect to a complex of nonmetric skull traits and by the method of the multimeric analysis of craniometric traits showed that in spite of the appreciably differing habitat conditions and the possible hybridization with the southern grouping, the phenological aspect of ground squirrels of the insular population has persistently maintained the properties of the initial form. This makes it possible to assign the insular population to the northern subspecies *C. fulvus fulvus*.

The isolated population of the yellow ground squirrel (*Citellus fulvus*) in Barsakel'mes Island in the Aral Sea arose relatively recently as a result of the introduction to the island of animals from continental populations. The first group of ground squirrels was released in 1929, and the second in 1931. According to Timofeev's (1934) data, the first group comprised 716 animals and the second, 3,754, but according to the reserve's archives, 750 and 1,694 animals, respectively. It is now difficult to decide which data are true. It is only certain that the first group of animals was trapped in the Irgizskii Raion of Aktyubinsk Oblast, and the second, in Aral'skii Raion of Kyzyl-Ordina Oblast. The introduction and subsequent acclimatization were completely successful. In 1935, i.e., after six years the species numbers on the island comprised 55,200 animals and trapping was begun.

In recent times a rich arsenal of methods has become available, making it possible to estimate the phenotypic and genetic differentiation of natural populations. Multimeric morphometric analysis makes it possible to obtain integral estimates of the differences between samples from populations by a complex of traits, i.e., to demonstrate the degree of differences if not for the entire phenotype as a whole then for its major characteristics (Anderson, 1958; Kul'bak, 1967). A special place is occupied by the indirect methods for estimating genetic differences — the phenetic methods (Yablokov, 1980), in particular the method of determining phenetic distances from a complex of the nonmetric threshold traits of the skeleton (Vasil'ev, 1982; Berry, 1963; Hartman, 1980).

Phenetic distances do not yield a strict estimate of the degree of genetic distances, since individual traits in their manifestation are to some extent dependent upon the conditions of the external environment (Searle, 1954). However, they are largely determined by the internal environment of the organism and, as was shown in many special studies, possess a high heritability (Hilborn, 1974; Howe and Parsons, 1967; Self and Leamy, 1978). Therefore, the method of estimating phenetic distances by a complex of nonmetric threshold traits, although not strictly genetic, permits an indirect determination of the order of magnitude of genetic differences between populations. Using both approaches — multimeric morphometric analysis (estimation of phenotypic differences from quantitative traits) and phenetic (indirect estimation of genetic differences from qualitative nonmetric traits) — one can approach an estimate of the genetic and phenotypic differences between populations.

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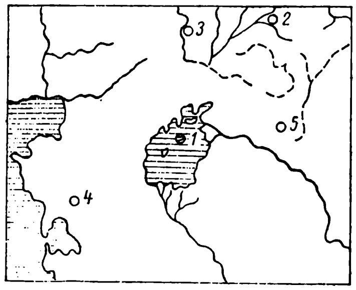

Fig. 1. Geographic location of samples. Populations: 1) insular, 2) Turgai, 3) Karabutak, 4) Mangyshlak, 5) Aryskum.

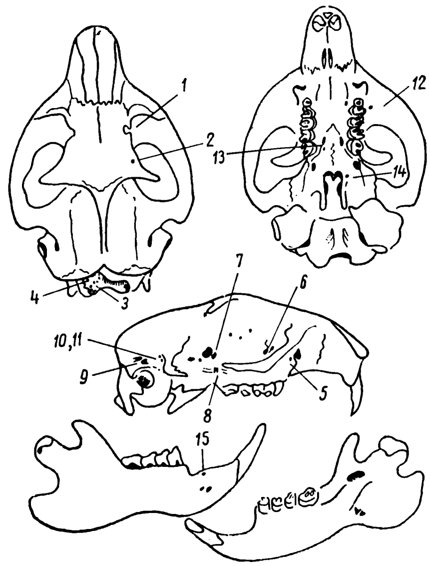

Fig. 2. Position of nonmetric traits on skull of yellow ground squirrel: 1-15) trait numbers (see text).

The goal of the present paper was to apply these approaches to compare the isolated insular population of the yellow ground squirrel with continental groups and to attempt to answer the question of its species membership. In this connection, we briefly touch on the current concepts of the subspecies of the yellow ground squirrel.

According to Gromov et al. (1965), the USSR contains four (possibly five) contemporary subspecies: *C. fulvus orlovi*, distributed in the Volga—Ural interfluve; *C. fulvus fulvus*, the largest form, populating Western and Central Kazakhstan; *C. fulvus oxianus*, a comparatively small form of ground squirrel, occupying the deserts of Uzbekistan and nortern Turkmenia (possibly, it is found in southern Turkmenia and northern Afgnanistan); *C. fulvus nigrimontanus*, the smallest subspecies, characterized by the juvenile structure of the skull and confined to the regions of Southeastern Kazakhstan.

Ognev (1937, 1947) pointed out that the boundary of the precise differentiation of the nominative subspecies of the ground squirrel *C. fulvus fulvus* from the northwestern *C. fulvus orlovi* and the southern *C. fulvus oxianus* would be difficult to establish, since the subspecies markedly overlap one another. However, according to Ognev, the typical *C. fulvus fulvus* is found in the east from the Mugodzharskie Mountains in the northern part, starting from the Irgiz. Consequently, the first group of ground squirrels introduced to Barsakel'mes I. doubtlessly belonged to this large nominative form. In all likelihood, the boundary regions between *C. fulvus fulvus* and *C. fulvus oxianus* runs through the Aral'skii Raion of Kyzyl-Ordina Oblast (from which the second sample was taken for introduction), since the southern Kyzyl Kum is inhabited by typical representatives of the southern subspecies (Ognev, 1977) characterized by relatively small size.

TABLE 1. Variation (in parentheses C_V, %) of Craniometric Traits of Insular and Continental Yellow Ground Squirrel Populations (males), mm

Trait	Insular n=57	Turgai n=11	Karabutak n=6	Mangyshlak n=6	Aryskum n=54
Condylobasal length	59,75±0,21 (2,7)	62,49±0,65 (3,5)	61,83±0,67 (2,6)	57,06±0,44 (1,9)	53,42±0,23 (3,2)
Length of facial part	34,35±0,10 (2,2)	35,65±0,35 (3,2)	35,35±0,39 (2,7)	32,73±0,35 (2,6)	30,81±0,12 (2,9)
Diastemal length	15,09±0,08 (4,22)	17,19±0,29 (5,6)	16,03±0,46 (7,1)	14,63±0,14 (2,4)	12,96±0,10 (5,4)
Length of upper tooth row	15,20±0,06 (3,0)	15,18±0,16 (3,5)	15,40±0,14 (2,3)	14,68±0,27 (4,5)	14,14±0,06 (3,0)
Zygomatic width	44,94±0,16 (2,7)	47,36±0,61 (4,3)	46,30±0,35 (1,9)	42,19±0,16 (0,9)	39,38±0,15 (2,8)
Interocular width	11,91±0,09 (5,8)	12,62±0,28 (7,3)	12,45±0,37 (7,4)	11,47±0,15 (3,3)	10,58±0,10 (7,2)
Skull height	19,82±0,06 (2,5)	20,52±0,29 (4,7)	20,17±0,06 (0,7)	10,45±0,12 (1,5)	17,86±0,07 (2,7)
Length of lower tooth row	14,39±0,07 (3,7)	14,30±0,21 (4,9)	14,40±0,31 (5,2)	13,40±0,35 (6,4)	13,07±0,07 (3,7)

TABLE 2. Variation (in parentheses C_V, %) of Craniometric Traits of Insular and Continental Yellow Ground Squirrel Populations (females) mm

Trait	Insular n=43	Turgai n=7	Karabutak n=6	Mangyshlak n=21	Aryskum n=38
Condylobasal length	56,84±0,24 (2,8)	60,41±0,29 (1,3)	58,32±0,33 (1,4)	54,09±0,31 (2,6)	52,54±0,25 (2,9)
Length of facial part	32,61±0,12 (2,4)	34,70±0,19 (1,4)	33,52±0,35 (2,6)	31,35±0,17 (2,4)	30,13±0,12 (2,5)
Diastemal length	14,25±0,11 (5,0)	16,35±0,21 (3,4)	14,57±0,21 (3,3)	13,88±0,13 (4,4)	12,85±0,11 (5,4)
Length of upper tooth row	15,13±0,06 (2,6)	15,05±0,22 (3,9)	14,93±0,19 (3,2)	14,32±0,09 (2,8)	14,09±0,07 (3,1)
Zygomatic width	43,20±0,23 (3,5)	45,80±0,31 (1,8)	44,28±0,49 (2,7)	40,65±0,22 (2,5)	39,05±0,20 (3,1)
Interocular width	11,28±0,08 (4,9)	12,25±0,20 (4,4)	11,82±0,18 (3,8)	11,11±0,12 (5,2)	10,62±0,13 (7,6)
Skull height	18,90±0,07 (2,6)	19,89±0,22 (2,9)	19,30±0,24 (3,1)	18,73±0,14 (3,3)	17,82±0,07 (2,6)
Length of lower tooth row	14,18±0,08 (3,8)	13,79±0,20 (3,8)	14,10±0,28 (4,9)	12,73±0,12 (4,4)	13,08±0,07 (3,1)

Series of skulls of adult ground squirrels (two to three years of age) of both sexes were used in the study. The great spatial separation permits a highly reliable assignment of the samples taken to the different populations. The populations were named for convenience of exposition of the material. Samples were studied from the following populations (Fig. 1): 1) insular (Barsakel'mes I., 1982), 2) Turgai (vicinity of Amantogai setelement, Turgai Oblast, 1977), 3) Karabutak (vicinity of Karabutak settlement, Aktyubinsk Oblast, 1981), 4) Mangyshlak (vicinity of Uzen' settlement and region of Tyuesu sands on Mangyshlak Peninsula, 1968), 5) Aryskum (Aryskum sands in Kyzyl-Ordina Oblast, 1946). It should be noted that the Karabutak and Turgai populations in their geographic location are assigned to the nominative subpopulation. "The yellow ground squirrel from Mangyshlak Peninsula may belong to a special *natio*, while specimens from Kyzyl-Ordina Oblast (Aryskum sands) appear transitional to *C. fulvus nigrimontanus*" (Gromov et al., 1965, p. 282).

A total of 462 yellow ground squirrel skulls were studied; moreover, the male and female skulls were studied separately. The sample volumes with respect to males and females for each geographic region are presented in the corresponding tables.*

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Eight major skull measurements were used for craniometric analysis. A comparison was also made of the relative sizes (indices) reflecting the uniqueness of skull proportions. The indices were calculated as the ratio of the measurements to the condylobasal length in percentages.

Employed in the study was the method of mean divergences, a method of multimeric statistical analysis (Anderson, 1954; Kul'bak, 1967, Rao, 1968) making it possible to estimate the difference in compared samples with respect to a complex of traits. A complex of five measurements was used (condylobasal length, alveolar length of the upper and lower tooth rows, zygomatic length, and skull height). Canonical analysis was performed for the graphic presentation of the mutual position of the vectors of the sample means of the studied populations in the space of the traits (Blakith and Reyment, 1971). This method makes it possible to present the studied means in the space of the least dimensionality with a minimal loss of information on the different means. In the case of the selection of the first two canonical variables (usually including the greatest information about the differences in the means), this space represents a plane. Projections of the vectors of the sample means in our study were constructed in the space of two canonical variables λ_1 and λ_2.

The genetic differences between populations were estimated indirectly by determining the phenetic distances with respect to a complex of threshold nonmetric skull traits. The basis of the method and its statistical apparatus havebeen described in a number of papers (Vasil'ev, 1982; Berry, 1963, 1964; Hartman, 1980).

The nonmetric traits found on the skull of the yellow ground squirrel usually differed greatly from those known for many rodents. The Latin nomenclature of nonmetric traits has not yet been worked out in detail in the world literature. Therefore, when presenting the list of traits we shall give Russian names for the traits that are described for the first time. The trait numbers in the list presented below correspond to the numbers in Fig. 2 and in the tables.

1. Presence of processes on the margins of supraorbital incisure. The supraorbital incisure is a typical feature of the skull structure in ground squirrels. The presence of small horizontal processes of the opposite outer margins of the incisure, directed towards one another, was classified. In the extreme expression of the trait the processes may fuse and form a closed communicating foramen. This variant in structure is normal for *Citellus musicus* (Gromov et al., 1965).

2. Communicating foramen in the supraocular process — distinct and usually situated in the anterior part of the base of the supraocular process (size may vary).

3. A supplemental foramen hypoglossum — four sublingual foramina on the inner lateral sides of the base of the occipital bone (usually three foramina are found), readily apparent through the foramen occipitale magnum.

4. A single "suprasublingual" foramen — a small foramen on the lateral inner surface of the occipital bone at the level of the occipital condyle above the f. hypoglossum (observed through the foramen occipitale magnum).

5. A supplemental infraorbital foramen — varying in size, a relatively small foramen on the outer surface of the maxillary bone behind the infraorbital foramen, closer to its dorsal margin.

6. A double "infralacrimal" foramen — the main foramen is situated in the anterior lower part of the orbit above the exit of the infraorbital canal at the junction of the lower margin of the lacrimal bone with the maxillary bone. A double foramen was classified.

7. Absence of lower ocular foramen — usually two communicating ocular foramina are present in the center of the orbit, formed by the margins of the presphenoid bone. The trait was classified in the presence of the complete reduction of the lower ocular foramen.

8. The presence of a bony intersection on the "median alveolar foramen" in the depression of the maxillary artery — a large foramen of an oval form situated in the depression of the maxillary artery below the boundary in the middle between the foramen of the infraocular canal and the ocular foramina, somewhat above the alveolus M^2. The presence of both a complete, thin bony bridge, dividing the foramen in the oral—caudal direction, as well as distinct opposed processes incompletely separating the foramen, was classified.

TABLE 3. Relative Skull Sizes (indices, %) of Insular and Continental Yellow Ground Squirrel Populations (males)

Trait	Insular $n=57$	Turgai $n=11$	Karabutak $n=6$	Mangyshlak $n=6$	Aryskum $n=54$
Length of facial part	57,46±0,11 (1,5)*	57,05±0,38 (2,2)	57,17±0,15 (0,7)	57,32±0,24 (1,0)	57,66±0,12 (1,5)
Diastemal length	25,19±0,11 (3,3)	27,48±0,25 (3,0)	25,92±0,53 (5,0)	25,63±0,14 (1,3)	24,23±0,13 (3,8)
Length of upper tooth row	25,42±0,11 (3,2)	24,25±0,31 (4,2)	24,90±0,23 (2,2)	25,70±0,50 (4,7)	26,46±0,13 (3,7)
Zygomatic width	75,23±0,21 (2,1)	75,75±0,39 (1,7)	74,90±0,47 (1,5)	73,97±0,56 (1,9)	73,73±0,25 (2,5)
Interocular width	19,90±0,14 (5,4)	20,19±0,38 (6,2)	20,10±0,60 (7,4)	20,10±0,37 (4,5)	19,79±0,20 (7,28)
Skull height	33,14±0,11 (2,5)	32,84±0,40 (4,0)	32,38±0,34 (2,6)	34,05±0,25 (1,8)	33,40±0,15 (3,3)
Length of lower tooth row	24,03±0,14 (4,3)	22,88±0,42 (6,1)	23,27±0,52 (5,4)	23,47±0,48 (5,0)	24,46±0,13 (4,0)

*In parentheses C_V, %.

TABLE 4. Relative Skull Sizes (indices, %) of Insular and Continental Yellow Ground Squirrel Populations (females)

Trait	Insular $n=43$	Turgai $n=7$	Karabutak $n=6$	Mangyshlak $n=21$	Aryskum $n=38$
Length of facial part	57,37±0,12 (1,4)*	57,56±0,26 (1,2)	57,45±0,50 (2,1)	57,95±0,19 (1,5)	57,34±0,14 (1,5)
Diastemal length	25,01±0,14 (3,8)	27,03±0,38 (3,7)	24,95±0,23 (2,2)	25,64±0,18 (3,3)	24,4±0,15 (3,8)
Length of upper tooth row	26,58±0,16 (4,0)	24,93±0,35 (3,7)	25,60±0,25 (2,4)	26,47±0,16 (2,8)	26,81±0,15 (3,1)
Zvgomatic width	75,94±0,27 (2,3)	75,66±0,70 (2,5)	75,92±0,75 (2,4)	75,17±0,36 (2,2)	74,33±0,33 (2,7)
Interocular width	19,81±0,15 (5,1)	20,27±0,37 (4,9)	20,27±0,22 (2,7)	20,53±0,22 (4,9)	20,21±0,24 (7,4)
Skull height	33,21±0,10 (2,0)	32,91±0,49 (3,9)	33,08±0,32 (2,4)	34,60±0,24 (3,2)	33,92±0,16 (2,9)
Length of lower tooth row	24,92±0,18 (4,9)	22,80±0,31 (3,6)	24,17±0,51 (5,2)	23,45±0,21 (4,1)	24,88±0,12 (3,0)

*In parentheses C_V, %.

9. Closed lower prelambdoid (squamous) foramen — the presence of the trait was classified if the ventral (mastoid) margin of the foramen was surrounded by the squamous bone proper and did not adjoin the upper margin of the petrosal bone.

10. Absence of foramen of the temporal duct at the base of the zygomatic process of the squamous bone (Fig. 1 presents the double foramen, see below).

11. Double foramen of temporal duct at base of zygomatic process of squamous bone.

12. Single foramen on ventral surface of base of zygomatic process of maxillary — usually situated at the pm^2 level.

13. Foramen platinum major duplicatum — double large palatine foramina (see Berry and Searle, 1963).

14. Presence of foramen in caudal part of pterygoid process of palatine bone. Foramen always lies on palatine bone orally to the palatopterygoid suture.

15. Foramen on diastema of mandible — foramen lies on the dorsal part of the diastema in its center or closer to the alveolar premolar teeth.

In classifying the ground squirrel skulls the presence was noted of one or another trait on the skull of each individual (for bilateral traits, the presence of the trait on the left, right, or both sides was noted), and then the frequency of the traits was calculated for each sample. The frequency of encounter of a trait was calculated by the number of sides on which it was found, while the volume of all observations corresponded to the number of all skull sides studied. The frequency of encounter of palatolateral (unitary) traits was determined relative to the quantity of the skulls studied. Traits with a sporadic frequency of encounter, in particular the presence of six teeth in the upper tooth row (one adult individual was found on Barsakel'mes I. with the trait on both sides), and those associated with age were removed from consideration as uninformative. The phenetic classification and calculation of frequencies were done separately for males and females, since differences in the frequency of encounter in the different sexes were found for most traits. A new modification of the formulas presented by Hartman (1980) were used to calculate phenetic distances. The mean squared deviation was calculated by a formula presented by Sikorski (1982).

Craniometric Variation. The largest skull sizes were in animals of the two northern populations: Turgai and Karabutak (Tables 1 and 2). A difference between the males of these populations was observed only in the diastemal length ($p < 0.05$). The females were distinguished by a larger number of parameters (see Table 2); moreover, the skulls of Turgai females were somewhat larger than those of Karabutak. The facial part of the skull and the diastema in these animals were more elongated, the zygomatic arches were wider, and the width of the interocular space was greater. The differences in the rest of the traits were statistically insignificant.

Ground squirrels of the Arysk population had the smallest skulls for both sexes. The Mangyshlak animals occupied an intermediate position with respect to skull size between the northern and Arysk, but were closer to the latter.

The ground squirrels of the insular population were similar in absolute skull size to the animals of the northern populations, in particular the Karabutak, inhabiting the upper reaches of the Irgiz R. Characteristically, the differences with respect to the most important taxonomic traits — the length of the lower and upper tooth rows — were statistically insignificant between the Barsakel'mesk and northern animals. The Mangyshlak and Arysk ground squirrels were close to one another with respect to these traits.

The males were larger than the females in the majority of the skull measurements (see Tables 1 and 2). The differences between sexes were least pronounced in the Aryskum population. The individual variation of traits in the compared populations was slight, which was expressed in the comparatively low values of the coefficients of variation. The insular population was not characterized by a depressed variation, which might be expected by virtue of the peculiarities of its origin.

The proportions of the skull were most distinct in the ground squirrels of the Turgai (northern most) and Aryskum (southern most) populations (Tables 3 and 4). The Turgai animals compared with the Aryskum were characterized by a relatively longer diastemal interval, shorter upper and lower tooth rows (we recall that their absolute sizes are greater in Turgai ground squirrels), and relatively more widely placed zygomatic arches. As a whole, the skull configuration of the animals of the northern populations seemed more mature than that in the Aryskum. The proportions of the skull of both northern populations as well as the Barsakel'mes and Karabutak animals differed negligibly. The skull proportions of the Mangyshlak ground squirrels were unique: In the males and females of this population the index of the skull height was subsequently greater than in the animals of the other populations.

Multimeric Analysis of Craniometric Traits. The least morphometric distances (parameters of mean divergence D^2) were found (Table 5) between both northern populations (Turgai and Karabutak), as well as between them and the insular population. The Aryskum and Mangyshlak samples were similar. The maximum differences in both sexes were observed between the ground squirrels of the Turgai and Aryskum populations. Interpopulational differences were more sharply pronounced in the samples of males, but the fundamental picture of the morphometric differentiation showed good agreement for males and females. This is shown particularly well by the results of canonic analysis (Fig. 3). The first two canonic variables λ_1 and λ_2 include 96.8% of the total variation for males and 97.2% for females; moreover, the fraction of the first variable λ_1 accounted for 68.9% in males and 81.9% in females.

Interpreting the results of the canonic analysis (see Fig. 3), it can be stated that the first variable characterizes the variation of linear skull traits. In fact, the greater the absolute value of λ_1, the larger the dimensions in the corresponding sample (see Tables

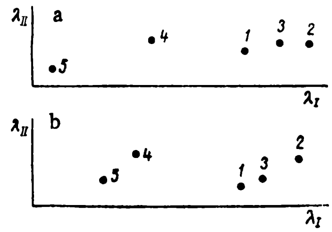

Fig. 3. Mutual arrangement of vector means with respect to complex of craniometric traits for different yellow ground squirrel populations (a denotes males; b, females) in space of first two craniometric variables (λ_1, λ_2). Populations: 1) insular, 2) Turgai, 3) Karabutak, 4) Mangyshlak, 5) Aryskum.

1 and 2). Thus, in the space of the smallest dimensionality it is clearly apparent that the insular and Karabutak populations are closest with respect to the complex of traits. The Turgai sample is also quite close to them. The Mangyshlak population occupies an intermediate position between the smallest Aryskum ground squirrels and the largest animals of the northern populations.

Phenetic Distances. The frequency of encounter of threshold nonmetric traits varies appreciably in the samples compared (Table 6).

We shall consider the phenetic distances with respect to males (Table 7). The least phenetic distances were found between the insular and Turgai, as well as between the Turgai and Karabutak populations (respectively, 0.032± 0.008 and 0.034±0.019). The Karabutak and insular populations differed slightly more at 0.091±0.016. Interestingly, the phenetic distance between the Mangyshlak and Aryskum populations (most distant, but situated at approximately the same latitudes) were of the same order of magnitude at 0.079-0.016. The Mangyshlak population was in equal measure distinguished from both the northern and insular populations; moreover, these differences were approximately twice those between the Mangyshlak and Aryskum ground squirrels. The Aryskum population was very distant from the northern populations and approached the subspecies level of differences with respect to them (Vasil'ev, 1982). The Karabutak population was distant with respect to the Aryskum and more distant from it than the more closely positioned Turgai population. As a whole, the measure of uniqueness (average value of all phenetic distances in the sample) of the Aryskum population was much higher than in the other populations. The insular population differed from the Aryskum just as did the northern populations.

The greatest proximity, for both females and males, was found between the insular and Turgai populations (0.28±0.012), the same order of differences was found between the Mangyshlak and Aryskum, while the Aryskum in turn differed appreciably from both northern populations. However, a great distance between Turgai and Karabutak samples was noted for females, while the Mangyshlak population was closer to the northern populations. Nevertheless, the correlation coefficient during the pairwise comparison of phenetic distances between the corresponding samples showed a very strong association for males and females ($r = 0.909$). In other words, the character of the phenetic differentiation of compared samples was highly coincident in both males and females.

CONCLUSION

The comparison of the insular and continental yellow ground squirrel populations by the two methods showed the following. The northern populations (Turgai and Karabutak) are very similar phenotypically and genetically, which indicates their membership to a single subspecific form, *C. fulvus fulvus*. The certain degree of phenetic differentiation in the females does not contradict this assertion. The Aryskum population differs appreciably both phenotypically and genetically from the northern populations; the differences between groupings reach the level of subspecific differences. With respect to its characteristic features (juvenile nature of skull of adult animals, small dimensions, appreciable phenetic differentiation from northern form), the Aryskum sample should apparently be assigned to the subspecies *C. fulvus nigrimontanus*.

TABLE 5. Values of Mean Divergence (D^2) for Complex of Craniometric Traits between Compared Yellow Ground Squirrel Populations

Populations	1	2	3	4	5
Insular	—	1,95	7,68	4,59	26,33
Karabutak	1,65	—	14,48	1,55	37,76
Mangyshlak	15,10	16,97	—	19,12	10,34
Turgai	8,79	3,52	24,03	—	47,39
Aryskum	17,28	22,16	5,48	36,90	—

Note. Upper triangular matrix contains values of mean divergence (D^2) for males; lower, for females.

TABLE 6. Frequencies of Encounter of Nonmetric Threshold Traits of the Skull in the Yellow Ground Squirrel in Compared Populations, %

Trait numbers	Insular		Turgai		Karabutak		Mangyshlak		Aryskum	
	males $n=132$	females $n=138$	males $n=64$	females $n=38$	males $n=28$	females $n=52$	males $n=26$	females $n=86$	males $n=180$	females $n=160$
1	16,0	39,9	12,5	34,2	7,1	19,2	38,4	42,3	53,3	53,8
2	7,5	2,9	1,5	5,3	0	0	0	2,3	5,5	12,5
3	9,0	6,5	12,5	2,6	3,6	11,5	3,9	10,5	12,2	10,6
4	37,1	35,5	37,5	39,5	67,9	69,2	61,5	60,5	56,6	68,7
5	34,8	42,0	23,4	39,5	32,1	30,7	50,0	61,6	76,7	71,9
6	51,1	60,9	60,9	52,6	28,6	40,4	52,0	52,3	91,1	78,7
7	3,0	2,2	9,4	0	3,5	7,7	0	5,8	3,3	0,6
8	27,3	31,2	15,6	44,7	14,3	17,3	42,3	20,9	35,0	40,6
9	11,4	9,4	7,8	7,9	0	9,6	30,7	31,3	33,9	37,5
10	9,0	8,7	14,1	15,8	21,4	15,4	3,8	3,4	2,2	0
11	10,6	2,9	4,7	5,3	3 6	0	19,2	17,4	15,5	18,7
12	39,4	23,9	56,3	47,4	71,4	63,4	88,4	68,6	87,8	90,6
13	3,8	3,6	6,3	5,3	3,6	0	0	1,6	2,8	5,6
14	31,8	30,4	46,9	57,9	46,4	50,0	26,9	60,5	55,5	50,6
15	8,3	6,5	23,4	10,5	21,4	32,7	34,6	22,1	38,9	32,5

TABLE 7. Phenetic Distances between Insular and Continental Yellow Ground Squirrel Populations with Respect to Nonmetric Skull Traits

Populations	1	2	3	4	5
1. Insular	—	0,032±0,008	0,091±0,016	0,142±0,016	0,313±0,005
2. Turgai	0,028±0,012	—	0,034±0,019	0,153±0,020	0,286±0,008
3. Karabutak	0,124±0,010	0,111±0,017	—	0,150±0,027	0,370±0,015
4. Mangyshlak	0,142±0,012	0,075±0,014	0,107±0,012	—	0,079±0,016
5. Aryskum	0,303±0,012	0,227±0,012	0,271±0,009	0,078±0,007	—

Note. Upper triangular matrix contains parameters of differentiation (phenetic distances) with mean squared deviations for males; lower, for females.

The Mangyshlak population with respect to morphometric and phenetic features occupies an intermediate position between the northern and Aryskum ground squirrels, approaching the latter with respect to metric and nonmetric traits. Its subspecies affinity is undetermined. We believe that this is a highly differentiated grouping with the subspecies *C. fulvus fulvus*. Gromov et al. (1965) consider the Mangyshlak ground squirrels as belonging to a special *natio*. In spite of the appreciable morphometric peculiarities of this population with respect to the northern form, in a genetic respect it is much closer to the northern than the Aryskum and, apparently, does not reach the level of subspecific differentiation.

The phenetic similarity with respect to both sexes between the Mangyshlak and Aryskum ground squirrels was somewhat unexpected and compels the postulate of the existence of the close genetic association of the population of the parts of the distribution range by way the dispersal of generations. The question can be clarified only by a detailed investigation of the species distribution range.

Of special interest is the position of the insular population. The similarity of the northern populations permits them to be considered as a single large aggregate with kinship to the population from which the first animals were taken for the foundation of the insular population. We recall that the insular population is of hybrid origin, since the second batch of ground squirrels was imported to the island one year later from the Aral'skii Raion. These animals, as indicated in the Reserve records, were small, presumably belonging to the subspecies *C. fulvus oxianus*. It would be expected that the phenotype of the insular animals after acclimatization and, possibly, hybridization will recall the phenotype of the ground squirrels of the southern populations or an intermediate phenotype between northern and southern populations. However, as already mentioned, the Barsakel'mes ground squirrels are morphometrically similar to Karabutak and Turgai squirrels and differ sharply from animals of the southern populations.

A comparison of contemporary continental samples shows that the skull sizes of ground squirrels decline towards the south. The southern populations (Aryskum and Mangyshlak) are situated at a similar latitude and live under relatively similar conditions, sharply different from the conditions of life of the northern populations. The ecological conditions of the yellow ground squirrel on Barsakel'mes I. are as a whole similar to those in the southern populations.

The stable retention in the course of many generations of the phenotypic characteristics of the northern subspecies in spite of the appreciably different habitat conditions and the possible mixing with the southern form indicates the dominance of the hereditary properties of the phenetic aspect of the northern form in ground squirrels of the insular population. On the other hand, this indicates the absence of modificational changes in the population in the direction of the southern groupings. The phenetic similarity of the insular population to northern form is consistent with these assertions.

Thus, the modern isolated population of the yellow ground squirrel of Barsakel'mes I. can with respect to all characteristics be assigned to the northern subspecies *C. fulvus fulvus*.

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