Beiträge zur
JAGD
&WILD
forschung · 41

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Modern Distribution and Morphology of the Golden Jackal (*Canis aureus*) in Ukraine

Key words: golden jackal, range, steppe zone, Ukraine, immigrant, population, exterior, skull, hunting

Introduction

Despite a large amount of current data available on the distribution and formation of new European populations of the species, some scientists do not quite understand the features of this almost fantastic process.

This particularly applies to Ukraine, traversed by transit routes of Balkan and Caucasian migrants. The reasons for such lack of knowledge lay in the fact that European researchers of the jackal do not bother themselves with studying the results of scientists, published in Slavic languages. Moreover, analyzing the situation in Ukraine and using our materials (Roženko & Volokh 2010), some of them (Rösler 2011) do not mention the cited publications in their list of references, and others (Lapini 2012) say nothing at all about the authors of the research. Let colleagues forgive us, but the copyright has not been cancelled, and we do not like the mentioned method of using our materials. In addition, there is still available only a small number of published articles (Krystufek & Tvrtkovic 1990; Demeter & Spassov 1993), presenting exterior and skull measurements of the jackal.

Therefore, the goal of our research was to refine the species current range in Ukraine and study exterior and craniometric indices in new ecological conditions.

Material and Methods

Over the period from 1998 and 2016 the authors managed to collect data about the jackal records (n = 601) within the territories of Dnipropetrovsk, Donetsk, Zaporizhzhia, Zakarpattia, Odesa, Poltava, Sumy, Kherson Regions of Ukraine and the Autonomous Republic of Crimea. This provided a basis for the historical analysis of the species range dynamics in Ukraine. For better understanding of the phenomena we used results of the genetic studies made with our participation by a team of European scientists (Rutkowski et al. 2015).

Traditional methods, applying by our colleagues in other countries, were used to study morphology (n = 42) and craniology (n = 40). Neurocranium length (Size: Table 3 – N 11) was calculated as the difference between condylobasal and rostrum lengths. It should be noted that a majority of animals studied by us died on roads due to their collision with vehicles and much less number were shot by hunters as it is allowed by Ukrainian laws.

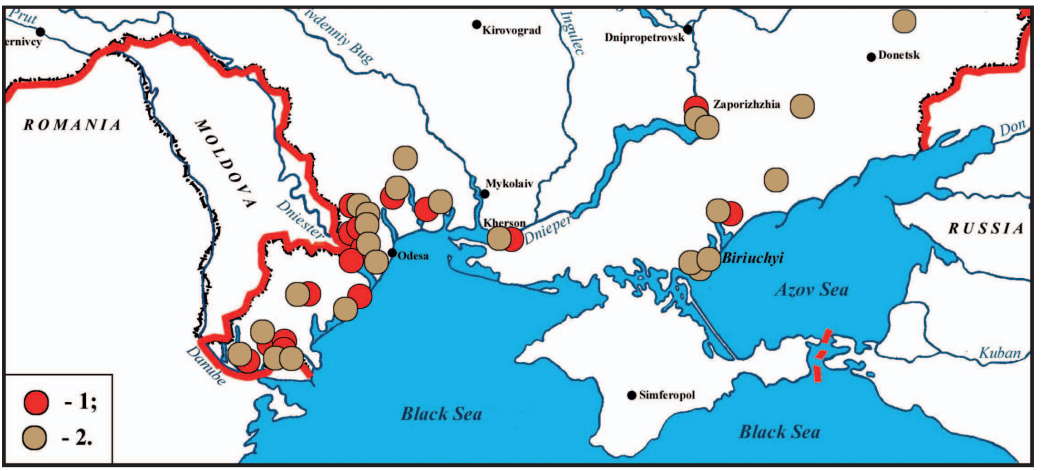

Fig. 1 Sites of studying exterior (1) and skull measurements (2) of the jackal in Ukraine

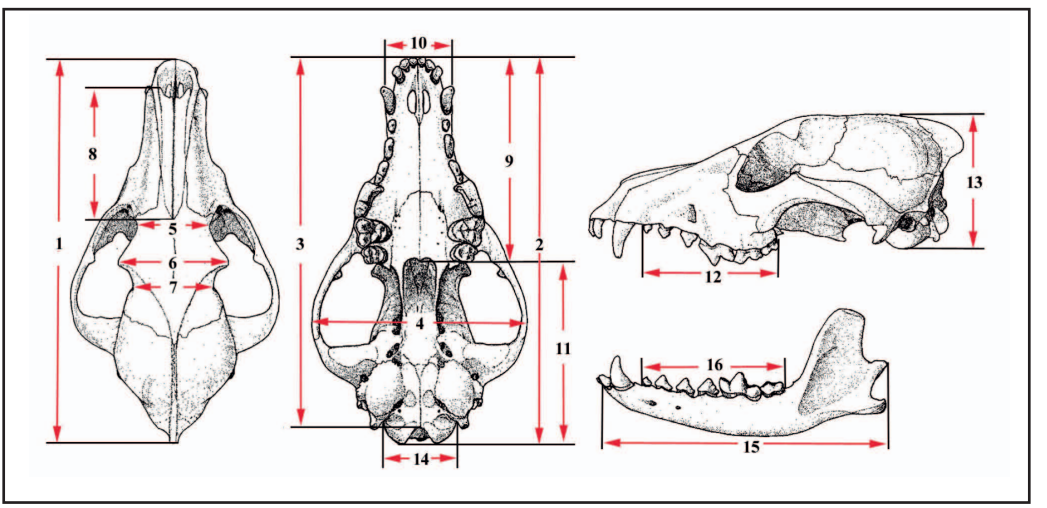

Fig. 2 Measurements of the golden jackal's skull (the numbering corresponds to that in Tables 3, 4)

Discussion

Status of the golden jackal in Ukraine

Since 2010 in Ukraine, according to a new edition of the law "About Hunting Economy and Hunting" the jackal received status of a game species. The same as for the raccoon dog and wolf, its hunting season lasts from 1 November to the end of February. This timing automatically prohibits taking puppies in their birthplaces born in spring-summer months. Besides, jackals are allowed to kill when chasing other animals, of course, in case of the relevant license available. For a jackal hunting it is allowed to use smooth-bore and riffled guns of 5.6 mm and higher caliber. A size of fine for the illegal killing of one jackal is 1000 UAH or as for 1.06.2016 (1 $ = 25.0 UAH) – 39.8 US $. It is a serious financial penalty for citizens of Ukraine.

Being of regional scale, the hunting has not yet a great impact on the jackal number dynamics. According to the data of a game manager

V. Bezsmertnyi, in Kilia District of Odesa Region in 2010/11 a total of 44, and in 2012/13 – 12 jackals were killed. A significant core area of this animal has been formed in the Azov-Syvash National Nature Park (Biriuchyi Peninsula). In the end of 2008 there lived about 20 or 3.1 ind./1000 ha (Domnich et al. 2009), and in the autumn of 2015 – 21 jackals. It gave the density of 2.3 ind./100 ha of terrestrial area or 9.6 ind./1000 ha of wetland and forest lands. From these areas, the animals disperse to adjacent inland territories forming new centres of their inhabitance in especially favourable places. Now these are floodplain islands on the Dnieper to the south of Zaporizhzhia. In 2008, the only one jackal was killed there by hunters, and in 2015/16 already 9 jackals have been shot. It did not interrupt the population growth or influence the distribution rate. Despite the jackal inclusion in the list of game animals of Ukraine, there were no censuses of its abundance in a majority of areas inhabited by this species. The reason is a considerable dispersion of these animals in space and small number of noticeable population groups.

In recent years the number of jackals in the territory of Rostov Region, Russian Federation (adjacent to Eastern Ukraine) has increased, and up to 50 jackals are annually shot (Minoransky & Dobrovolsky 2013).

A remarkable zoogeographic phenomenon of global expansion of this mammal, which until recently was rare in Europe, firstly requires a deep investigation, and only after that – decision-making for its population management.

Current status of the range

Much time passed since discovering of the golden jackal in Ukraine in 1997 (Roženko & Volokh 1999). During this period the species penetrated far to the north of Europe – in Poland (Kowalczyk et al. 2015), and even Estonia (Banea 2013) and Lithuania (Levickaitė 2015). Great changes in the jackal distribution, even impossible to predict, also occurred in other parts of its range.

In the north-west of Ukraine in Zakarpattia Region, where the jackal was for the first time seen in 2001 (Potish 2006), it began occurring very frequently. In 2002–2005, hunters shot 7 jackals in Berehovo and Vynohradov Districts (Bashta & Potish 2007), and in 2011 – another one in Perechyn District. Since that time the species became a regular immigrant penetrating to Ukraine from neighbouring Romania. In December 2009, one jackal was shot at the border of Khmelnytskyi and Vinnytsia Region that would have earlier been regarded as an unbelievable event (Zagorodnjuk & Pirkhal 2013). Even more remarkable was the male, shot in December 2011 in Brest Region (Belarus) as far as several kilometres from the border of Poland (http://ctv.by). Interestingly, in 2015 in West Pomerania Province of Poland, near the border with the Federal Republic of Germany (N 53º.06158, E 14.36186), a dead young jackal male was found on the road. In additions, pictures of two other animals were taken: one – on 01.06 in the Biebrza River valley (N 53.347552, E 22.597319), another one – 10.06.2015 near the village of Piszczac (N 51.947980, E 23.395009) in Lublin Province (Kowalczyk et al. 2015). In a straight line the distance between two these points equalled ~255 km that jackals easily overcome during a year. It should be noted that the last site of photographing was very close (~50 km) to the place of the jackal shooting in Brest Region. In addition to these cases, one more animal was shot in 2014 in the Ubort River valley (Olevsk District, Zhytomir Region) at the border with Belarus (Zhila 2014). Our Poland colleagues compared mtDNA of the jackal perished near the German border with samples from Velyka Mykhailivka District, Odesa Region (N 47.083333, E 30.000000) and found a great resemblance. The distance between these areas constituted 1055 km that indicates very far migrations of some males and family pairs of golden jackals. More likely, they have a step-by-step character, when transgenesis, by analogy with people, is firstly made by parents and then by their children, grandchildren, etc.

In the south-west of Ukraine the jackal extends its range especially impetuously. From 2010 to 2016, in this region we have revealed over 50 new areas where this unknown for most of people animal was seen. Earlier its distribution in the region went to the north-west of Odesa Region along the Dniester valley and to the east

– along the Black Sea coast. Now jackals penetrated to the Southern Buh River valley and began occupying new areas in Mykolaiv Region. According to the data of Professor Nakonechnyi, in 2013/2014 three animals were shot by hunters in Berezan Distict near Tylihulskyi Liman, and in 2015/16 – 11 jackals were killed at the western coast of Buhskyi Liman in Ochakiv District of the mentioned region. It indicates not an occasional encountering of single animals but formation of a new micropopulation.

Along with it, the suggestion that the jackal in 1955–1995 penetrated from the southwestern Ukraine and Moldova to Romania (Angelescu 2004; Banea et al. 2012) is erroneous. In the mentioned period this species did not occur at all neither in Moldova (Averin et al., 1979), nor in Odesa Region (Puzanov 1962), Ukrainian Danube Delta (Zhmud 1999) or Ukraine as a whole (Sokur 1960). The only valid case of the jackal registration was reported in 1950 from Moldova (N 48.91761, E 28.171304), the vicinities of Soroki City (Kuznecov 1952), to where it could have penetrated only from Romania or even Bulgaria through Romanian territory. In the former USSR, jackals in different years were shot in Central Russia near the city of Tambov (N 52.432495, E 41.263230), in the Southern Urals near the city of Orenburg (N 51.455993, E 55.06163), and also in other areas far from northern borders of is range. At this, the straight line distance between the points where these jackals were shot and the nearest habitat of the species equalled 900–1100 km (Geptner et al. 1967). In general, we have thoroughly studied the features of the jackal range formation in Ukraine and reflected this in a relevant publication (Roženko & Volokh 2010), which for some reason is unknown to Romanian colleagues.

A population wave in the Caucasus, having formed in 1948–1960 and promoted jackal penetration to the Kuban River delta (Bakeev 1978), in 1972 г. – in the Don Delta, and later to the Manych River floodplain (pers. comm. by A.M. Gineev), by some reason soon ended at the Azov Sea coast. With the increased number of animals in wetlands of the mentioned rivers, approximately since 2000 they began dispersing in various directions and soon were reported from southeastern regions of Ukraine. From the Kuban Delta in the winter of 2001/02, jackals penetrated to the Crimea (Volokh 2004), very quickly occupied the western coast of the Sea of Azov (Lake Syvash), in 2002 appeared on Biriuchyi Peninsula (N 46.072129, E 35.041711), and in 2011 – in the lower reaches of the Dnieper (Volokh & Shestopal 2011). In 2002, most likely from the Don Delta, several specimens penetrated to Artemivsk District of Donetsk Region, where 2 jackals were killed in the winter of 2003. Since that time the animal distribution in a Donetsk-Luhansk direction became well noticeable and soon (2012–2013) 4 jackals were killed by hunters in Dnipropetrovsk and Poltava Regions (Volokh 2014).

In 2016, the jackal range in Ukraine is represented by four separate core areas, where animals constantly live and successfully breed (Fig. 3). The highest area is occupied by a parcellar group, covering river deltas of the Danube and Dniester as well as southern inland areas of Odesa and Mykolaiv Regions. The second group is located in the Crimea, where jackals live in reedbeds at the shores of Lake Syvash, and the third one in Henichesk District of Kherson Region on Biriuchyi Peninsula (Azov-Syvash National Nature Park). Here, due to vast reedbed areas and a high number of hoofed animals, jackals found extremely favourable ecological conditions. The fourth jackal group is successfully developing on the Dnieper islands to the south of Zaporizhzhia, where nearly 35 specimens were counted in the winter of 2015/16.

Extremely favourable for the species are wetlands located in the lower Dnieper within the territory of Kharkiv Region where, until now, one jackal was occasionally shot and several encounters with these unpredictable immigrants were reported (Fig. 3).

Completely unexpected for us was the penetration of jackals to Briansk Forest located in Polissia at the border of Seredyna-Buda District of Sumy Region of Ukraine and Briansk Region of the Russian Federation. On a former maize field, not far from the forest near the border of Desniansko-Starohutskyi National Nature Park (N 52.152097, E 33.393585) on 22.01.2016, hunters saw two jackals which allowed people to approach as close as 20 m. One of the animals, a male, was shot. The straight

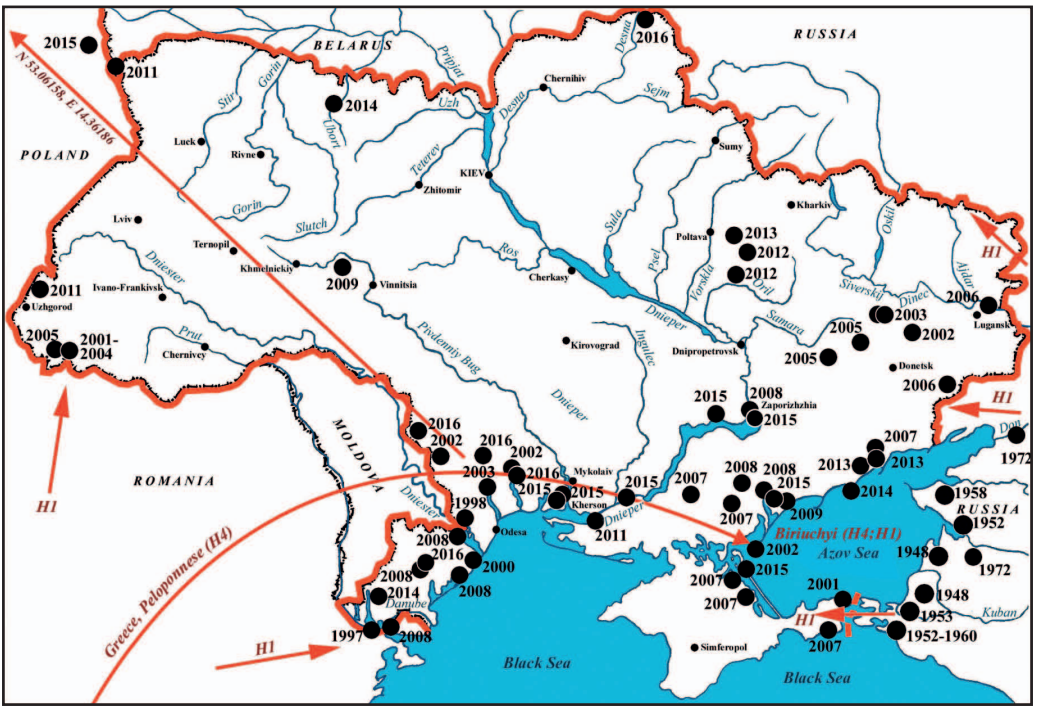

Fig. 3 The golden jackal range in Ukraine in the beginning of 2016 (using data from: Kowalczyk, R. et al., 2015; Rutkowski, R. et al., 2015)

line distance to the closest permanent habitat of the species (Zaporizhzhia) was 530 km.

Due to genetic studies, made by a team of European scientists (Rutkowski et al. 2015), it became known that in Ukraine the jackal populations were represented by two haplotypes – H1 and H4. Carriers of the first one occurs practically in all places where we took samples (Biliaivka, Velyka Mykhailivka, Ivanivka and Kilia Districts of Odesa Region; Henichesk (Biriuchyi Peninsula) and Tsiurupinsk Districts of Kherson Region; Karlivka District of Poltava Region, and also the vicinity of Zaporizhzhia). The haplotype H1 is also typical for jackals in Georgia, Serbia, Slovenia, Romania, Hungary, Lithuania, Estonia, Croatia, Mountainous Karabakh and, partly, – for Greece. It shows that occupation of Ukrainian territory by the species took place earlier and is still on-going at the expense of the jackal immigration from two sides – from South Europe and the North Caucasus.

We had already told about this, though not having yet the data of genetical analysis and basing on the chronology of animal appearance in different geographic areas of Ukraine (Roženko & Volokh 2010). However, quite unexpected was a discovery in Ukraine in the territory of the Azov-Syvash National Nature Park (Biriuchyi Peninsula) an animal represented by the haplotype H4, earlier registered only on Peloponnese Island in Greece (Rutkowski et al. 2015). Prior to this finding, we had suggested that due to the close location of the Crimean Peninsula (being an important zoogeographic link between the Caucasus and inland regions of South Ukraine) the core areas of the jackal inhabitance at the left bank of the Dnieper is of Caucasian origin. Now it is clear that Balkan migrants also participated in the process of their formation; their descendants successfully crossed the Danube, Dniester, Southern Buh, Dnieper and reached Biriuchyi Peninsula in the Sea of Azov. It should be noted that until now the haplotype 4 was discovered in no European country, listed above, except for Greece and Ukraine. Moreover, in the jackal on Pelopon-

nesus Island the haplotype H1 was also found. The presence of the haplotype H4 confirms a relict type of the studied parcellar group of the species in Greece, while H1 indicates a genetic relation with inland populations of Western Europe, provided by continental emigrants (Rutkowski et al. 2015).

Hair colouration

During first years of expansion in the southwest of Ukraine (1998–2000) all studied jackals had a coarse red fur with a typical cross-shaped pattern on their shoulders (Fig. 4: A, B). It continued like an almost black belt along the back and tails which is a typical feature of the subspecies *Canis aureus moreotica* Geoffroy, 1835 (Lapini 2012). Later, on Biriuchyi Peninsula both animals with black and dark brown tips of top hair were seen (Fig. 4: C). And in Poltava Region that, the most likely, could shelter jackals from Rostov Region or even from Kalmykia (RF) were captured several individuals with an unusually light fur colouration and weakly expressed cross-shaped pattern on the shoulders (Fig. 4: D).

It should be noted that on the Dnieper islands the hair colouration was practically the same in all killed jackals (n ≈ 15) (Fig. 5). We consider it as a consequence of the depleted genotype because only 1 or 2 pairs participated in the micropopulation formation.

Comparing the first (2008) and last (2016) immigrants from the Caucasus to Ukraine we can easily see the identity of their colouration (Fig. 6), despite the large difference in time (8 years) and space (815 km of the straight line distance across the Sea of Azov). This similarity certainly emphasizes genetic monomorphism of the jackals, dispersing from the Caucasus to Ukraine through Kerch Strait and bypassing the Sea of Azov from the north-east.

Weight and body measurements

In Ukraine the jackal males reliably dominate over females in body weight, height at shoulders and torso girth (Table 1).

Among the studied adult females body weight of 30.0 % ranged within 8.0–9.0, 25.0 % – 9.1–10.0, 25.0 % – 10.1–10.5, 15.0 % – 11.0–11.5, and 15.0 % – 12.0–13.0 kg. Body weight in 12.5 % of adult males fluctuated within 8.5–9.0, in 8.3 % – 9.1–10.0, in 20.8 % – 10.1–11.0, in 20.8 % – 11.1–12.0, in 20.8 % – 12.1–13.0, in 12.5 % – 13.1–14.0, and 1 male (2.3 %) weighted 16.5 kg. Weight predominance of males over females is well visible in the graph (Fig. 7),

Fig. 4 Hides of the golden jackal from Ukraine: A, B – Odesa Region; C – Kherson Region (Biriuchyi Peninsula); D – Poltava Region

Fig. 5 Hide fragments of the jackals killed by hunters on the Dnieper islands near Zaporizhzhia in 2015–2016 (Photo by A. Koval)

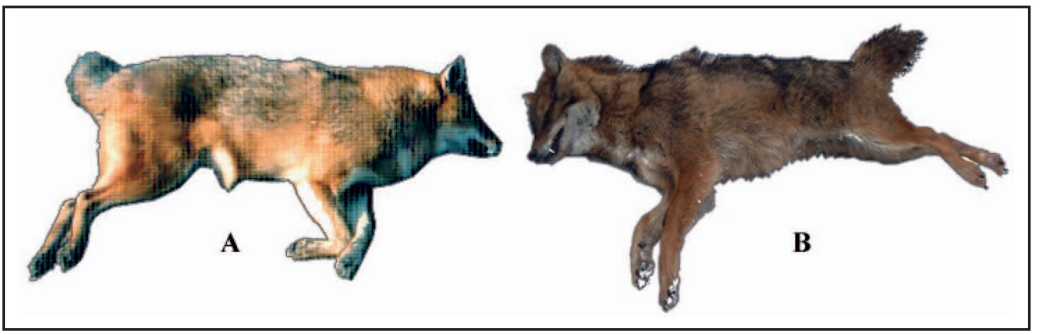

Fig. 6 Male colouration of the golden jackal from the Autonomous Republic of Crimea: A – 14.01.2008; from the northeastern Ukraine: B – 22.01.2016 (Photo by B. Kuliev & Soroka G.)

Table 1 Body measurements of adult jackals (n = 44) from Ukraine

Measurements	Sex	n	M±m	Min	Max	Std. Dev.	CV, %	t
Body weight, kg	♂	24	11.7±0.38	8.5	16.5	1.85	15.78	3.23
	♀	20	10.1±0.32	8.0	13.1	1.42	14.07	
Body length, cm	♂	21	79.5±1.12	71.1	89.9	5.15	6.48	1.41
	♀	20	77.3±1.11	70.0	85.0	4.96	6.42	
Height at shoulders, cm	♂	5	53.3±1.53	48.1	57.5	3.41	6.41	4.29
	♀	7	44.1±1.46	40.0	49.1	3.87	8.78	
Torso girth, cm	♂	20	51.2±1.10	44.9	65.0	4.92	9.62	3.02
	♀	19	46.3±1.20	39.1	62.0	5.25	11.34	
Tail length, cm	♂	21	25.4±0.67	20.5	31.4	3.05	12.03	1.09
	♀	20	24.1±0.47	20.0	28.0	2.10	8.71	
Length of hind leg, cm	♂	11	15.7±0.49	11.6	17.3	1.63	10.38	1.53
	♀	10	14.6±0.45	12.9	17.0	1.41	9.62	
Length of ear, cm	♂	21	8.5±0.17	7.0	10.0	0.77	9.00	1.36
	♀	19	8.2±0.47	7.0	10.0	0.84	10.28	

where a peak of parabola in males coincides with the value of 11.7, and in females – 10.1 kg. Generally, according to their average weight, Ukrainian jackals are somewhat lighter than males (12.2: 8.0–15.0 kg) and females (11.5: 7.0–14.0 kg) from the Caucasus (Aliev 1968). Body length in 40.0 % of adult jackal females from Ukraine ranged within 70.0–75.0, 30.0 % – 75.1–80.0, 25.0 % – 80.1–85.0 and 1 (5.0 %) – 94.1 cm. The maximal value of this parameter was recorded in the oldest specimen among all the jackals studied by us. This female had old traumas (only 1 toe remained on the right fore leg) and died as a result of motor vehicle collision in 1998. In 19.4 % of males from Ukraine the body length ranged within 71.0–75.0 cm, in 42.9 % – 75.1–80.0, in 28.6 % – 80.1–85.0, and in 9.4 % – 85.1–90.0 cm (Fig. 8). According to their body length the Ukrainian jackals were some smaller than males (90.0: 65.0–105.0) and females (80.0: 52.0–100.0 cm) from Azerbaijan (Aliev 1968), that may be explained by insufficient amount of data: 41 animals (Ukraine) and 410 (Caucasus).

Interestingly, the jackal females had no any correlation between body length and weight though it was rather significant in males. The closest relationship between these parameters was recorded in females having body length of 75.8 cm and weight slightly over 10 km, and in males – 80 cm and 12 kg, respectively (Fig. 9). Despite comparatively large values of these important morphological indices, the jackal has small ears – 8.5±0.17 in males, and 8.2±0.17 (7.0–10.0) cm in females, whereas males (n = 53) of red foxes (*Vulpes vulpes*) have ears reaching 9.4±0.14 (7.4–14.0), and 8.6±0.14 (6.7–11.0) cm in females (n = 43). The golden jackal also has a very short tail which, along with other ectosomatic organs (ear, leg) plays an important role in physical thermoregulation. Such animals as the red fox and wolf, stretching their ranges from tundra to subtropics, have the largest tail length/body length ratio. At the same time, the raccoon dog, naturally distributed in a comparatively cool China-Himalaya subregion of Holarctic, shows the smallest value of this parameter (Table 2). In a panthropic jackal the

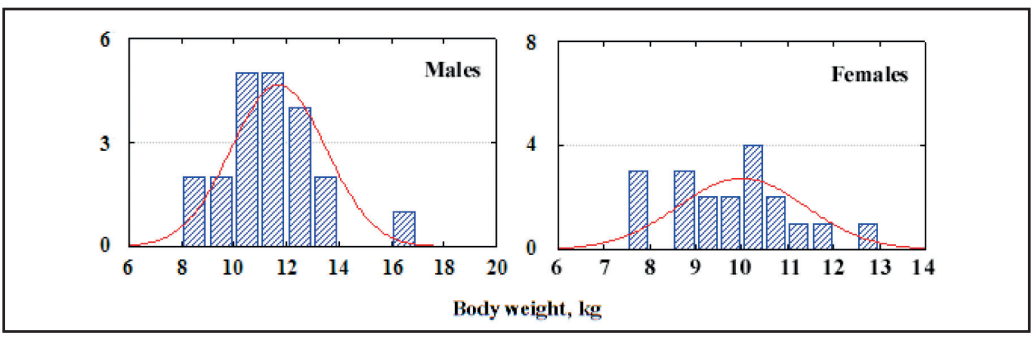

Fig. 7 Distribution of jackals according to their body weight

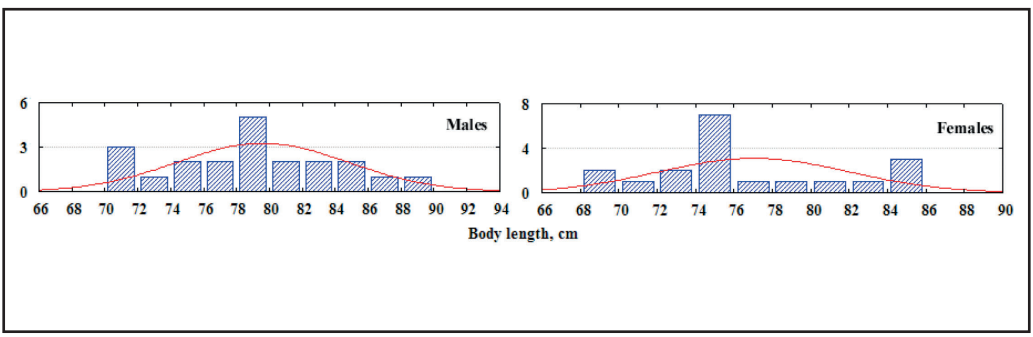

Fig. 8 Distribution of jackals according to their body length

largest tail length/body length ratio is closest to the wolf despite the significant reliable differences between males (t = 5.29) and females (t = 4.94) of these animals.

Generally, the weight and body length of Ukrainian jackals have values close to those of animals from Bulgaria (Atanasov 1953), Serbia and Croatia (Krystufek & Tvrtkovic 1990).

Craniometry

Sexual dimorphism in the jackal is also pronounced in cranium sizes. Among 16 craniometric indices the males significantly dominate over females in 8 indices (50.0 %). For such indices as zygomatic width and rostrum length the significant difference was revealed at p = 0.02, and for occipital condyle width – at p = 0.01. According to the coefficient of variation (CV, %), the highest variability is typical for circumorbital cranium section of females that is connected with a great difference between maximal and minimal values of interorbital, postorbital width and a great distance between right and left postorbital processes of the frontal bone in animals of this sex (Table 3). The condylobasal length and mandibular length of Ukrainian jackals are slightly bigger, and zygomatic width is smaller than those in animals from Southern Europe. However, this difference is statistically insignificant. According to their craniometrical indices, the Ukrainian jackals are also similar to Azerbaijan animals that is apparently explained by a genetic relationship between Caucasian and South European populations.

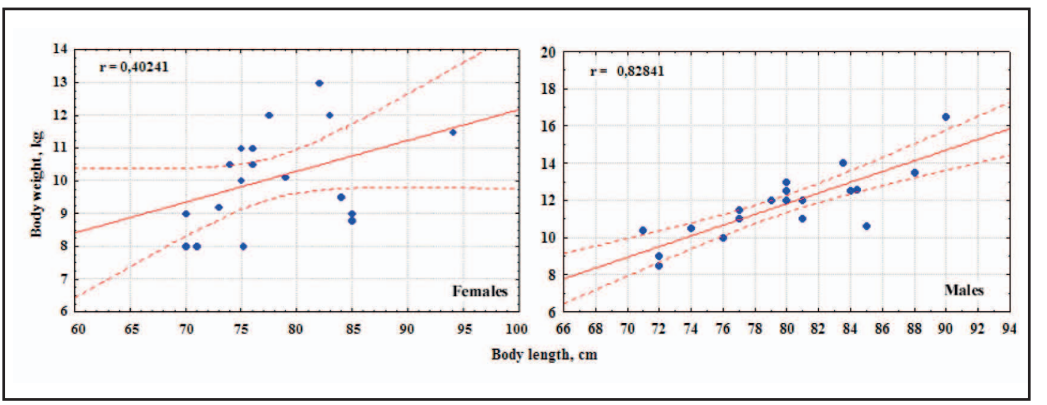

Fig. 9 Correlation between body length and weight in jackals

Table 2 Tail length to body length ratio in predators from Ukraine, %

Species	n	M±m	Min	Max	Std. Dev.	CV. %
Females						
Vulpes vulpes	51	56.14±0.75	46.48	69.23	5.34	9.52
Nyctereutes procyonoides	22	28.65±0.97	21.52	37.73	4.53	16.37
Canis lupus	22	35.98±0.45	31.96	40.78	2.12	5.90
Canis aureus	20	31.10±0.69	24.02	36.01	3.08	9.89
Males						
Vulpes vulpes	57	56.00±0.65	45.33	67.12	4.92	8.78
Nyctereutes procyonoides	22	26.61±1.00	19.75	36.63	4.71	17.70
Canis lupus	21	34.58±0.51	30.17	39.45	2.32	6.71
Canis aureus	21	31.33±0.61	25.99	34.03	2.80	8.93

Table 3 Craniometric indices of adult jackals from Ukraine, mm

N	Cranial measurements	Sex	n	M±m	Min	Max	CV, %	t
1.	Total cranial length	♂	17	166.5±1.32	158.4	177.8	3.27	4.58
		♀	16	158.2±1.21	149.0	165.0	3.06	
2.	Condylobasal length	♂	17	157.5±1.12	150.0	167.5	2.94	4.21
		♀	15	150.0±1.39	140.0	161.3	3.59	
3.	Basal length	♂	14	148.1±1.04	141.2	153.3	2.64	3.52
		♀	15	141.9±1.40	132.2	149.8	3.82	
4.	Zygomatic width	♂	16	88.7±1.06	80.5	95.2	4.77	2.47
		♀	15	85.0±1.08	77.2	92.2	4.94	
5.	Interorbital constriction	♂	16	26.7±0.44	24.0	30.1	6.61	1.71
		♀	15	25.4±0.65	20.0	31.1	9.87	
6.	Postorbital constriction	♂	15	41.3±0.90	36.4	48.0	8.46	0.65
		♀	15	40.4±1.01	35.1	50.2	9.68	
7.	Postorbital width	♂	16	28.8±0.43	26.7	33.0	5.96	
		♀	15	30.1±0.83	26.7	39.3	10.75	1.31
8.	Nasal length	♂	15	59.2±0.69	55.8	65.2	4.49	3.68
		♀	14	55.3±0.82	51.5	61.2	5.55	
9.	Rostrum length	♂	15	78.8±1.19	71.7	85.0	5.83	2.60
		♀	15	74.9±0.90	70.1	80.2	4.65	
10.	Rostrum width	♂	15	29.4±0.31	27.8	31.5	4.09	1.84
		♀	15	28.2±0.58	23.1	31.3	7.94	
11.	Neurocranium length	♂	14	75.5±0.63	70.9	80.5	3.14	3.69
		♀	15	69.6±1.43	62.1	82.6	7.98	
12.	Upper molar row length	♂	13	59.2±0.66	56.1	65.5	4.03	1.72
		♀	15	57.5±0.74	51.5	62.2	4.99	
13.	Cranium height	♂	16	57.4±0.62	52.5	62.2	4.32	0.80
		♀	15	57.2±0.51	54.2	60.3	3.46	
14.	Occipital condyle width	♂	16	30.5±0.28	28.3	31.9	3.61	2.90
		♀	15	29.2±0.35	26.9	31.5	4.58	
15.	Mandibular length	♂	15	121.7±0.80	115.4	125.7	2.54	1.75
		♀	14	119.0±1.35	109.0	125.5	4.24	
16.	Lower molar row length	♂	13	63.6±0.91	55.0	67.2	5.16	2.03
		♀	14	61.4±0.57	57.8	65.0	3.49	

Comparing the craniometric indices of Ukrainian animals with representatives from other European populations (Geptner et al. 1967; Aliev 1968; Demeter & Spassov 1993) we should note that they do not go beyond variability limits of the subspecies *Canis aureus moreotica* (Geoffroy 1835).

Acknowledgements

Authors are sincerely thankful to all colleagues and friends who helped in carrying out this research and also shared their interesting data and materials. Among them there are W. Bogdanowicz (Museum & Institute of Zoology, Polish Academy of Sciences), A. Koval (LLC «Kamelot-Invest» Hunting Farm), N. Lebedeva (Zaporizhzhia National University), V. Lobkov

Table 4 Comparison of some craniometric indices of jackals from different populations, mm

Cranial measurements	Ukraine	Southern Ukraine*	t	Azerbaijan**
Males				
Total cranial length	166.5±1.32 (158.4-177.8)	–	–	165.0 (155-176)
Condylobasal length	157.5±1.12 (150.0-167.5)	156.0±5.76	0.26	157.0 (147-165)
Zygomatic width	88.7±1.06 (80.5-95.2)	89.3±4.87	0.12	91.0 (86-98)
Mandibular length	121.7±0.80 (115.4-125.7)	121.6±5.79	0.02	–
Females				
Total cranial length	158.2±1.21 (149.0-165.0)	–	–	152.0 (151-166)
Condylobasal length	150.0±1.39 (140.0-161.3)	146.1±6.76	0.57	150.0 (141-159)
Zygomatic width	85.0±1.08 (77.2-92.2)	87.1±3.77	0.54	85.0 (77-89)
Mandibular length	119.0±1.35 (109.0-12.5)	117.3±6.13	0.27	–

* Demeter & Spassov 1993; ** Aliev 1968

(Odesa National University), O.N. Manuilova (National Museum of Natural History), I. Nakonechny (Mykolaiv National University), V. Peristy (Karlivka District Council of the Hunters and Fishermen Union of Poltava Region, Ukraine), V. Syrenko (Ukrainian Steppe Reserve), G. Stepanenko (Desna-Starohuta National Nature Park), N. Tkhor (Azov-Syvash National Nature Park).

Abstract

Modern Distribution and Morphology of the Golden Jackal (*Canis aureus*) in Ukraine

In 2010–2016, the golden jackal in Ukraine has continued to occupy coastal habitats of the Sea of Azov and Black Sea and some animals penetrated far to the north until the border of Belarus and Russia. Now its range in the country is represented by four core areas which jackals permanently inhabit. They are 1) inland areas of Odesa and Mykolaiv Regions, and also deltas of the Danube and Dniester; 2) territory of the Autonomous Republic of Crimea, adjacent to Lake Syvash; 3) Biriuchyi Peninsula in Henichesk District of Kherson Region; 4) Dnieper islands to the south of Zaporizhzhia. The formation of jackal micropopulations in Ukraine was participated by animals from Southern Europe and Caucasus that is confirmed by mtDNA analysis.

Since 2010, the golden jackal has become a game species in Ukraine, and its hunting season lasts from 1 November to 28–29 February. The penalty for one animal bagged illegally was circa 40 US $ as for 01.06.2016.

Body weight and sizes as well as skulls of Ukrainian jackals are similar to those from Bulgaria, Serbia and Croatia. According to their body length, males and females from Ukraine were found to be slightly smaller than Azerbaijan animals, though their indices do not go beyond variability limits of the subspecies *Canis aureus moreotica* (Geoffroy, 1835).

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