

GOLDEN JACKAL (*CANIS AUREUS* L., 1758) IN THE FAUNA OF THE TRANSCARPATHIAN REGION

Ludvig POTISH, Mykhailo TOFELIUK, Adalbert POTISH, Boris SHARGA

*The golden jackal (*Canis aureus* L.) spreads beyond its native areas in Southeastern Europe to the Central and North-Eastern Europe, particularly to the Transcarpathian region of Ukraine. The expansion of golden jackals living areas in the Middle Danube Lowland has been observed since the end of the 20th century. In the second decade of the 21st century, the golden jackal began to settle in the northern direction along the valleys of the main tributaries of the Tisza River. In this paper we discussed the history and possible causes of golden jackal expansion success in our region. We presented here also the golden jackal skull general morphology and coat fur characteristics based on materials analysis from 10 different age animals collected at various places of Transcarpathia. The presence of young animal supports the idea of local reproduction. The cranium morphology and fur characteristics were typical for the golden jackal. The golden jackal has wide ecological plasticity due to utilizing plants, fruits and animals as feed, scavenger and predator behavior, providing various and plenty fodder components for survival and reproduction. The competition with other predators and scavengers is not significant. The species uses advantages of rural agricultural areas. These allowed golden jackal expand on mostly forest-free places of valleys and on foothills in Transcarpathia.*

Key words: golden jackal (*Canis aureus* L.), living area extension, Ukraine, craniological measurements.

Department of Forestry, Uzhhorod National University, 14, Universytetska Str., Uzhhorod, 88000, Ukraine, e-mail: ludvig.potish@uzhnu.edu.ua; mykhailo.tofeliuk@uzhnu.edu.ua; adalber.potish@uzhnu.edu.ua; boris.sharga@uzhnu.edu.ua

Шакал золотистий (*Canis aureus* L., 1758) у фауні Закарпатської області

Потіш Л., Тофелюк М., Потіш А., Шарга Б.

Шакал золотистий (*Canis aureus* L., 1758) поширюється за межі своїх рідних районів у південно-східній Європі до Центральної та Північно-Східної Європи, зокрема, до Закарпатської області України. Розширення ареалу золотих шакалів у Середньо-Дунайській низовині спостерігається з кінця 20 століття. У другому десятилітті 21 століття золотий шакал почав розселятися в північному напрямку вздовж долин основних приток річки Тиса. У цій статті ми обговорили історію та можливі причини успіху поширення золотистого шакала в нашому регіоні. Тут ми також представили загальну морфологію черепа та характеристики хутра золотого шакала на основі аналізу матеріалів 10 тварин різного віку, зібраних у різних місцях Закарпаття. Наявність молодих тварин підтримує ідею місцевого розмноження. Морфологія черепа та характеристики хутра були типовими для золотистого шакала. Золотистий шакал має широку екологічну пластичність завдяки використанню тварин та рослин в якості кормової бази. Конкуренція з іншими хижаками є незначною. Вид використовує переваги сільськогосподарських територій. Це дозволило шакалу поширитися на здебільшого безлісних місцях долин та передгір'я в Закарпатті.

Ключові слова: золотистий шакал (*Canis aureus* L.), розширення ареалу, Україна, краніологічні вимірювання, хутро.

Кафедра лісівництва, Ужгородський національний університет, вул. Університетська, 14, Ужгород, 88000, Україна, e-mail: ludvig.potish@uzhnu.edu.ua; mykhailo.tofeliuk@uzhnu.edu.ua; adalber.potish@uzhnu.edu.ua; boris.sharga@uzhnu.edu.ua

Introduction

The causes of species' range expansion remain in a focus of attention of many scientists, especially, ornithologists reporting the geographic range size increase for many bird species in Europe. Much fewer of such examples were observed in mammalian fauna of the continent. Therefore, the appearance of the

common jackal (*Canis aureus* Linnaeus, 1758.) in fauna of Central European countries during the two last decades has aroused keen interest in this phenomenon. The publications from Bulgaria, Romania, Hungary, Serbia, Slovakia, the Czech Republic and Poland appear much less frequently in English, than in state languages of these countries. Thus, information about

this species in Central Europe is rather sparse and fragmentary, if not take into account the history and causes of golden jackal spread in Europe, overviewed by Arnold with co-authors (Arnold et al. 2012) and Spassov with Acosta-Pankov (Spassov, Acosta-Pankov 2019).

To our knowledge, golden jackal spread was not described yet properly in Transcarpathian region of Ukraine also.

The aim of our study was to provide new data on expansion of golden jackal in the Tisza River basin, the part of the Pannonian Lowland, and thus complete the information about this species in the northeastern part of the Middle Danube Lowland.

Material and methods

The monitoring of this species began in 2004 after we received the information about unusual canid killed at hunting in the 2000–2001 season (Potish 2006). During more than 20 years, by participating in hunts and using questionnaires, interviews, by inspecting private collections and captured animals (including analysis of photos from camera traps and from social networks), we collected the new information about the golden jackal living area expansion on our territory. The region geographically belongs to the Tisza river basin, the largest tributary of the Danube River (Fig. 1).

Special attention we paid for the description of craniological material. Since no special collection was carried out (targeted by a specific research program), the privately collected material (dead animals,

particularly, found hit by vehicles) was treated using generally accepted methods to prepare the skulls ($n = 10$). All specimens used in this work were obtained legally in accordance with the ethic norms and current legislation on the territory of Transcarpathian region of Ukraine. The skull characteristics were analyzed according to the approaches presented by A. Volokh and N. Rozenko (2016).

Results

The appearance of the jackal in the Transcarpathian region of Ukraine was preceded by its expansion in Hungary (Nagy et al. 2013). There it spread along the two large water arteries, the Danube and Tisza rivers. The northern direction of invasion was confirmed by the detection in Slovakia (Urban et al. 2017) and the Czech Republic (Pyšková et al. 2016).

Its appearance in the upper Tisza basin became understandable (Bashta, Potish 2018). Although the extraction point near the Korolevo Village (48.1546, 23.1352) is more close to the Romanian border than to the Hungarian ones, we consider the golden jackal movement upstream along the Tisza riverbed from Hungary as most evident. The natural jackal spread to the Transcarpathian region of Ukraine can be divided into two periods, 2000–2010 and 2011–2024. The directions and territories chosen by the species are illustrated on the map in shaded areas (Fig. 2).

As can be seen from the map of the jackal's invasion during the years 2000–2024, it first migrated in eastern direction of the region along the riverbed



Fig. 1. Transcarpathian region of Ukraine, the Central European region

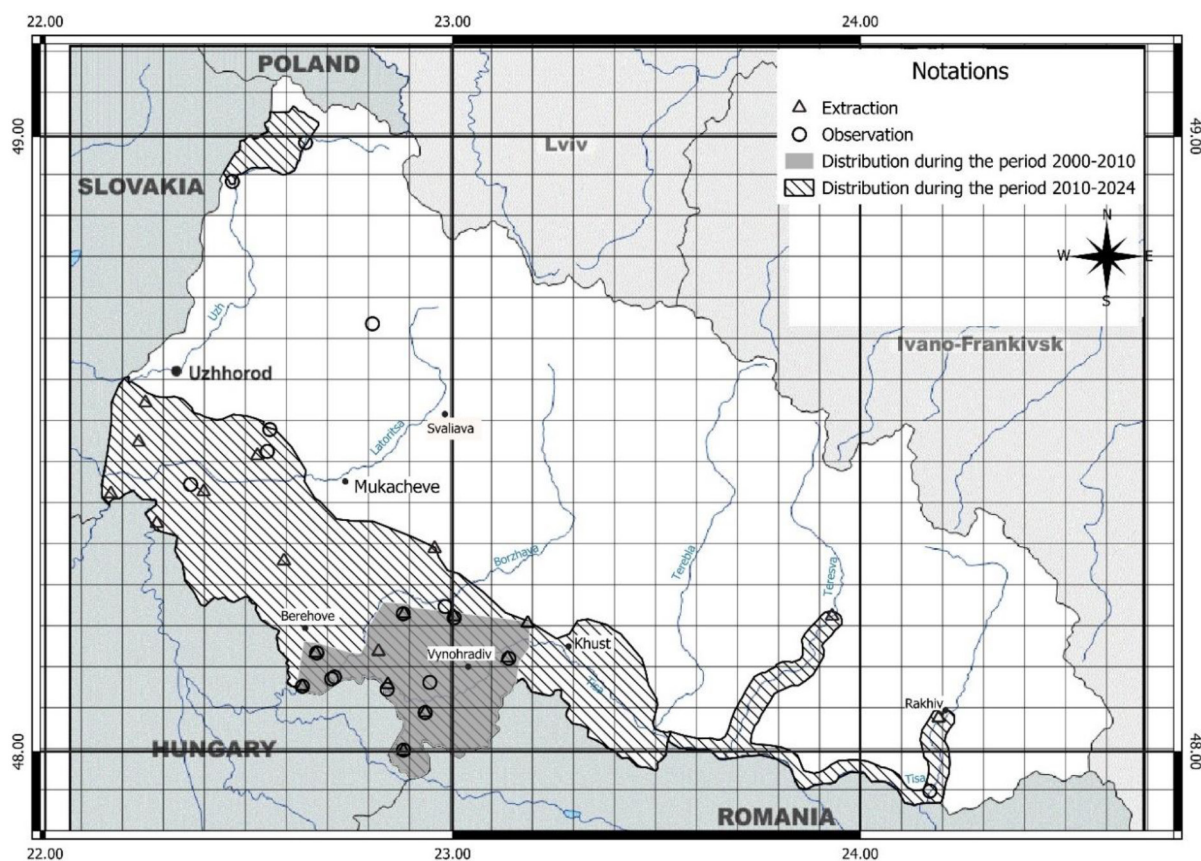


Fig. 2. Golden jackal (*Canis aureus* L.) invasion in the territory of Transcarpathia

of the Tisza and only from the second decade the direction changed to north-eastern and northern. The analysis of the golden jackal detection dates and hunting periods demonstrates that the animal was observed mainly in the autumn and winter times. The predominance of jackal encounters in winter and its correlation with winter hunting is mainly due to the specifics of game management in the region. November-January is the time of most extensive hunting of fur-bearing animals, when a large number of hunters organized to participate in the hunt. Rare spring and summer encounters of jackals are recorded mainly by the gamekeepers as a part of their work duties and less often, when they organize individual hunting for male roe deer.

In our opinion, the golden jackal settlement along the Tisza riverbed is due to the character of biotope nature of this area. Particularly, the riverbed starting from the Ukrainian state border near the village Vilok (48.1107, 22.8417) and to the village Veriatsia (48.1669, 23.1581) is located in a wide space between two dams. The villages in mainly agricultural areas are situated outside of the floodplain, but at close enough distance. The disturbance factor for the jackal in such conditions is minimal, because floodplains of the Tisza in these lands are used seasonally as pastures and to a lesser

extent as recreation zones during the warm seasons. After the establishment of the “Prytysiansky” regional landscape park in 2009, the exploitation of the floodplains of Tisza and Latorytsia rivers as summer pastures decreased drastically. This allowed golden jackals to inhabit these areas near the Tisza by gradual movement upstream during the first decade of 21st century. In its second decade, after appearing in the vicinity of Solomonovo village (48.4321, 22.1618), the species began to occupy the floodplain of the river Latorytsia in the direction to the village Nove Davydkovo (48.4410, 22.6258).

As biotopes the flood-lands of the Tisza and Latorytsia rivers differ from each other. Particularly, here the floodplain area of the Tisza river is larger and represents a middle course of the river, while the floodplain of the Latorytsia river is smaller in area and is the lower, valley part of the river.

The hydrological regimes of these rivers parts differ in duration of flooding also. The floodplain of the Latorytsia river has a longer flooding period. Small settlements and agricultural lands located in valleys and, particularly, close to the floodplains of both rivers in the region. According to Z.B. Nagy with co-authors (Nagy et al. 2013), similar settlements are usual for the Tisza river

basin on the north-eastern part of the Middle Danube Lowland.

Using the main river-beds of the Tisza, Latorytsia, and Borzhava rivers by 2010, the golden jackal began to settle along their numerous tributaries.

The largest Transcarpathian towns Mukachevo (48.4494, 22.7115), and Uzhhorod (48.6212, 22.2891), situated on Latorytsia and Uzh rivers, respectively, represented the serious barriers for further golden jackal spread upstream. Settling north of the settlement zone, the jackal is detected on the outskirts of villages and in bushes along the highways, ditches and ravines.

We think the melioration canals network best serves for golden jackal spread on the territory of Transcarpathian plain. The significant density of villages did not limit the golden jackal invasion, but rather facilitated it. The reports of jackal attacks on poultry and other small domestic animals became more frequent. This suggests the local population of golden jackal increase.

In the second decade of the 21st century the golden jackal is found during hunting throughout the foothills of Carpathians. It avoids forests, staying in more or less open areas at the outskirts of villages.

Along the floodplains line Uzhhorod – Seredne – Nove Davydkovo – Dorobratovo – Siltse – Rokosovo – Iza – Zolotarevo – Boroniavo – Bushtyno, the golden jackal's conquest of the Transcarpathian valley and foothills was completed. As of the end of 2024, this animal was first time recorded by a camera trap near the Turia-Poliana village (48.7002, 22.8022) in the basin of the Turia River. According to the guard report of the Uzhansky National Nature Park, the species was noted in the vicinity of the village Zhornava (48.9899, 22.6361) of the Uzhhorod district. In January 2024, one animal was caught not

far from the village of Babychi (48.4399, 22.9052), Mukachevo district.

The collected craniological material allowed us to analyze the age of the capture animals. This was done on the basis of wear of the teeth and ossification of the skull. These data were compared to the collected parameters from other regions of Central Europe (Stoyanov 2020).

Most of the studied crania were from young animals in which the characteristic dentition of the incisors is clearly visible ($n = 6$) (Fig. 3, *a*). Only in four animals ($n = 4$) skulls showed significant wear of the teeth to the crowns (Fig. 3, *b*). The presence of young animals suggesting their possible local birth and good population state.

Thus, we assumed that in the nucleuses of the golden jackal spread zone, namely, the outskirts of the villages Solomonovo (Uzhhorod district) and Korolevo (Berehovo district) the population of the species consists of animals with different age. Further studies of the skulls allowed us to identify more clearly the areas of sustainable existence of the species.

According to the Table 1, the craniological measurements of the skulls of golden jackals collected in the Transcarpathian region showed clear sexual dimorphism expressed as the difference in the skull size between females and males, which is also characteristic of populations described in southern Ukraine (Volokh, Rozenko 2016).

The fur is rather sparse, coarse and dull. The coat is monotonous, agouti with a reddish-golden tint, worse in quality than that of a fox (Fig. 4).

Conclusions

The expansion of golden jackals in the Middle Danube Lowland has been observed since the end of the 20th century. The animal has also advanced

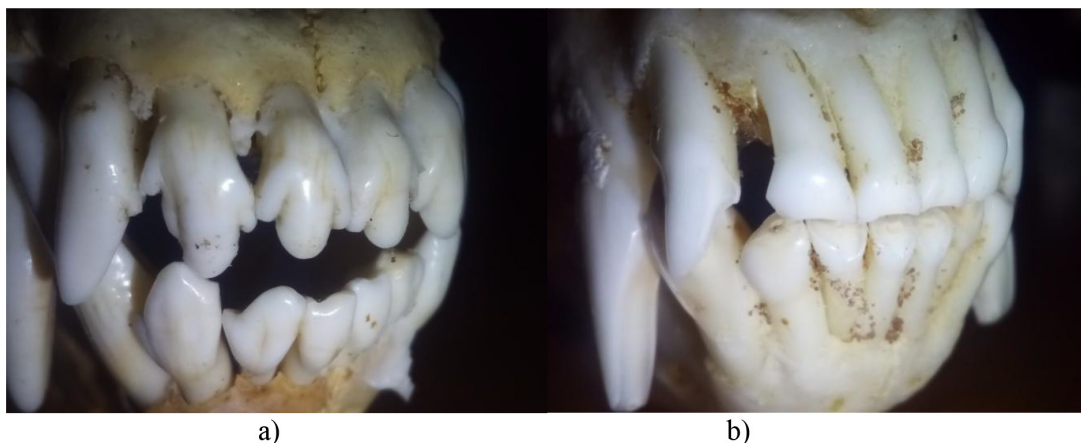


Fig. 3. Characteristic serration of incisors (a) and wear of teeth to crowns (b)

Table 1. Craniometry of the golden jackal in the Transcarpathian region, mm ($n = 10$)

Cranium measurements	Mean value		min		max		CV, %	
	♂	♀	♂	♀	♂	♀	♂	♀
Condylobasal length	166,43	151,48	162,77	139,72	171,23	160,88	2,31	5,02
Total cranium length	166,99	152,82	163,64	139,8	171,34	163,81	2,35	5,67
Facial part length	97,28	91,73	94,12	84,8	105,23	101,3	4,65	6,55
Neurocranial part length	72,64	63,95	68,91	60,43	76,05	68,7	3,94	5,56
Nasal bone length	55,61	55,04	52,82	50,71	59,15	60,38	4,40	6,69
Hard palate length	84,42	73,79	81,31	65,85	87,49	77,68	2,86	6,20
Upper teeth row length	83,47	77,13	80,38	73,8	85,19	82,47	2,35	4,68
Upper molar row length	59,69	54,84	57,8	51,6	61,37	57,51	2,42	4,84
Lower teeth row length	85,44	77,76	80,17	71,72	87,6	82,06	3,62	5,17
Lower molar row length	65,88	60,95	61,89	58,05	68,03	63,9	3,70	4,46
Zygomatic width	89,3	81,4	86,62	69,32	95,56	88,5	4,18	9,57
Interorbital width	26,35	24,70	24,46	21,55	29,7	27,59	7,50	8,78
Width between supraorbital processes	43,34	39,34	40,44	32,17	46,93	45,38	5,58	13,13
Postorbital width	27,12	26,26	23,9	21,95	32,26	29,95	11,71	13,24
Mastoid width	52,62	41,41	50,31	35,48	53,8	48,74	2,60	11,95
Braincase width	52,13	49,51	51,13	45,8	53,37	51,36	1,67	4,52
Nasal width	27,79	28,63	26,13	27,14	29,61	30,54	4,59	5,30
Width above canines	29,91	27,42	27,63	23,6	32,15	28,88	5,57	7,91
Inter canine width	19,11	17,09	18,64	13,91	19,67	19,41	2,42	11,78
Upper canine width	8,42	7,57	7,36	6,68	10,03	8,26	12,80	8,10
Upper canine height	20,81	17,87	16,7	16,49	25,3	19,62	15,46	7,68
Lower canine width	7,98	6,75	7,5	5,53	8,97	8,06	7,84	16,98
Lower canine height	18,26	15,98	15,74	13,23	19,62	17,8	9,04	10,85
Skull height	58,57	54,26	56,2	49,9	60,2	59,6	2,73	6,71
Mandibular height	47,00	43,25	42,63	34,72	50,03	51,18	6,97	15,87
Mandibular length	121,41	113,61	118,75	103,92	122,92	122,46	1,36	6,36

Fig. 4. Dorsal views of the of the golden jackal (*Canis aureus* L.) skulls (a) and coat (b) collected in Transcarpathian region

to its northeastern part, the upper part of the Tisza river basin (Transcarpathian region of Ukraine). In the research area, the species used floodplains of the Tisza and Latorytsia Rivers as natural corridors for its spread in the eastern direction.

In the second decade of the 21st century, the golden jackal began to settle the region in the northern

direction along the valleys of the main tributaries of the Tisza River. In the valleys of Uzh and Latorytsia rivers, the large towns, namely, Uzhhorod and Mukachevo were a restraining factor on the jackal expansion. However, detection of the golden jackal beyond these towns upstream is evidence of its further spread in the northern direction. By migrating along

the Carpathians the species had appeared in Dnister River basin (Zagorodniuk 2014) and with a slight delay spread in the Danube River basin to the north and is actively overcoming the Carpathian ridges along the tributaries of the Tisza River.

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