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THE REPRODUCTION IN TWO LOCAL POPULATIONS OF LIBYAN JIRD (*Meriones libycus* Lichtenschtein, 1823) IN AZERBAIJAN

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Abstract. A comparative analysis of reproduction in two local populations of Libyan Jird (Meriones libycus) inhabiting in the semi-desert areas and foothill steppes of Azerbaijan, the Jeyranchol population is met most in the Western and the Absheron population most in the Eastern of Azerbaijan. The studied reproductive characteristics (sex composition, the relative ratio of the pregnant females and number of the embryos) are subject to the seasonal variation and geoclimatic factors determine largely the breeding success, according to observed indicators higher in the Jeyranchol population.

Keywords: *Absheron, breeding intensity, embryo number, Jeyranchol, the relative ratio of the pregnant females, sex composition.*

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1. Introduction

A widespread and common rodent species of the arid landscapes in Azerbaijan, the Libyan Jird is the key vector and reservoir of a number of the zoonotic diseases in the natural foci of the country (Alakbarov *et al*., 1967), including plague, having 3 historical foci and in the last three centuries 16 epidemies (Ozsan *et al*., 1976; Gurbanov & Akhmedova, 2010).

Eigelis (1980) grouped Azerbaijan populations of the Libyan Jird into three geographical units, further divided into 10 local population units, including Jeyranchol population (Je) most in the Western and the Absheron population (Ab) most in the Eastern of Azerbaijan.

Although comprehensive literature data exists on the ecological characteristics of the geographical units such as morphometry, population dynamics, reproduction (Alakbarov *et al*., 1967; Alakbarov & Erofeeva, 1978; Eigelis & Lobanova, 1974; Eigelis, 1980; Hakhiyev, 2019), there is scarce information concerning local populations (Hasanov & Guliyev, 2000; Hasanov, 2001).

The survey of the ecological characteristics of the rodents of ethe pizootic significance is of great importance from the perspective of the control or management over the population via certain human interventions.

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The aim of the study is to analyse the reproductive features of the Jeyranchol and Absheron local populations of Libyan Jird, from the seasonal point of view on the basis of long-term archive data and new material.

2. Material and methods

Study area

Absheron peninsula is considered to be the extreme South-Eastern end of the Caucasus and its territory is the strongest urbanized and industrialized area in the region. The largest industrial cities of the region, Baku and Sumgait are situated here. Altitude ranges between -28 m in the East up to 120-200 m in the Western border. The habitats of Libyan Jirds in this area are associated with the aeolian-sandy biotopes along the Caspian Sea coasts. Having the least rainfall (311 mm in the central parts, lowering to 200 in Sumgait and 150 mm in Southern fringe of the peninsula), Absheron peninsula is characterized by Salsola-wormwood-ephemeral associations (Museyibov, 2000).

Jeyranchol plain at the North-Western border with Georgia on the other hand has a mild semi-desertic and dry steppe climate with mild winters, and in the North-Eastern part has a mild-hot climate with dry winters. Annual precipitation in the area is 300-400 mm. Jeyranchol plain is mostly pristine and located at an altitude of 730 m above sea level. Jeyranchol has a sparse xerophytic shrub vegetation composed of wormwood and capers (Museyibov, 2000).

Being located in the semi-desert zone, both areas are characterized by ephemeral and ephemeroid plants with short vegetation periods in spring and autumn, differing though relatively by landscape, substrate, altitude and precipitation.

Materials

The data on 6336 individuals of Libyan Jirds obtained from the territory of Jeyranchol between 2017 and 2019 is compared with similar data of 1758 individuals obtained from the Absheron peninsula in 1990-2007s in the paper. Rodents were caught by means of Hero traps (Figure 2), (Tolkachev, 2019) and live-catch traps. The sex ratio was presented without considering the age characteristics of the individuals. The sex composition and relative ratio of pregnant females were analyzed separately per each season.

3. Results

In Jeyranchol (Je) and Absheron (Ab) populations, pregnant females were found throughout of the year, while the breeding process would stop under unfavorable conditions during winter. The relative ratio of pregnant females in the population demonstrate seasonal variation (Tables 1 and 2), found to be highest (16.6% Je and 15.8 Ab) in the spring and autumn (10.4% Je and 8.15 Ab), with a significant drop in the summer (5.9% Je and 9.7 Ab).

In Absheron population, the peak of breeding occurs mainly in spring (15.8%), with a gradual decrease towards winter, whereas the Jeyranchol population obviously exhibits two peaks (spring 16.6 and autumn 10.4). The minimum relative ratio of pregnant individuals is discovered in both populations during the winter (5% Je, 1.5% Ab).

According to the Jeyranchol material, males slightly predominate over females in all seasons except spring (Table 3), while throughout the year in Absheron population, except for 2002-2007 winter period (Table 4).

The number of embryos in the females of the Libyan jird in Absheron is 2 to 9 (Eigelis, 1980; Hasanov & Guliyev, 2000; Hasanov, 2001), varying between 2 to 11 in Jeyranchol. The average number of embryos per female is 6.4 in spring, 6.6 in summer, 5.6 in autumn and 4.9 in winter in Absheron. The number of embryos for this species in eastern Georgia, geographically very close to Jeyranchol, varies between 2 to 12 and is 5.6-6.4 in spring and 5.6-6.2 in autumn (Vardoshvili, 1977).

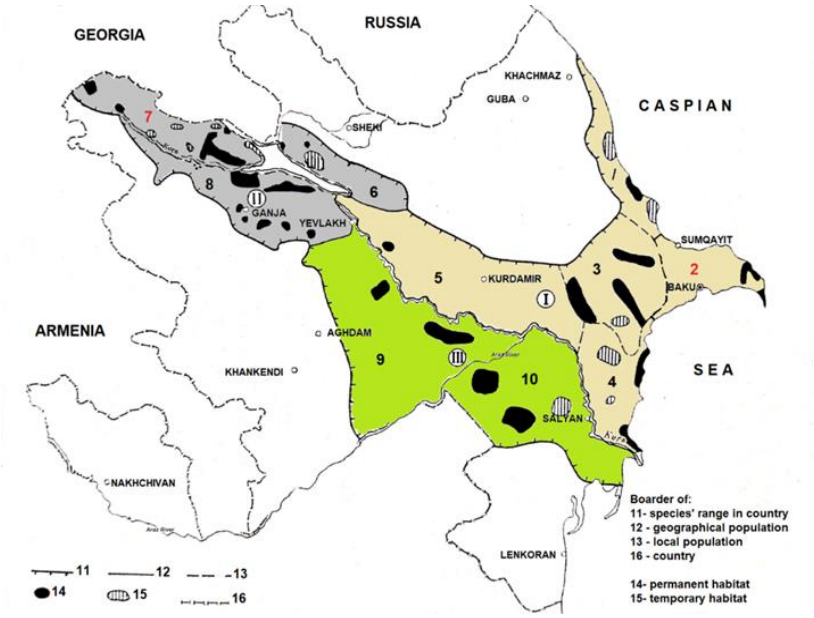

Figure 1. Distribution of Meriones libycus in Azerbaijan (Eigelis,1980), showing borders of geographical and local populations (1-10 from which 2 - Absheron, 7 – Jeyranchol)

Figure 2. M.libycus in the Jeyranchol, caught by Hero type trap

Table 1. Relative ratio of pregnant *M. libycus* females in the Jeyranchol population

Year	Spring			Summer			Autumn			Winter		
	TF	PF		TF	PF		TF	PF		TF	PF	
		n	%		n	%		n	%		n	%
2017	485	71	14.6	140	9	6.4	312	36	11.5	83	4	4.8
2018	397	62	15.6	118	7	5.9	426	43	10.1	76	3	3.9
2019	467	92	19.7	93	5	5.4	524	51	9.7	47	3	6.4
Average			**16.6**			**5.9**			**10.4**			**5**
TF - total number of females; **PF** - the number of pregnant females												

Table 2. Relative ratio of pregnant *M. libycus* females in the Absheron population

Year	Spring			Summer			Autumn			Winter		
	TF	PF		TF	PF		TF	PF		TF	PF	
		n	%		n	%		n	%		n	%
1990-1993	1124	145	12.9	457	23	5.0	1588	79	5.0	256	4	1.6
1996-2001	408	83	20.3	50	3	6.0	90	7	7.8	58	1	1.7
2002-2007	226	50	22.1	101	33	32.7	986	131	13.3	1	1	100.0
Average			**15.81**			**9.70**			**8.15**			**1.90**
TF - total number of females; **PF** - the number of pregnant females												

Table 3. Seasonal variability of *M. libycus* sex composition in the Jeyranchol population

Year		Spring		Summer		Autumn		Winter	
		♂	♀	♂	♀	♂	♀	♂	♀
2017	n	370	485	212	140	342	312	76	83
	%	43.2	56.7	60.2	39.8	52.3	47.7	47.8	52.2
2018	n	404	397	120	118	447	426	78	76
	%	50.4	49.6	50.4	49.6	51.2	48.8	50.6	49.4
2019	n	427	467	140	93	502	524	63	47
	%	47.8	52.2	60.1	39.9	48.9	51.1	57.3	42.7
Average	**%**	**47.1**	**52.9**	**56.9**	**43.1**	**50.8**	**49.2**	**51.9**	**48.1**
♂ - male, ♀ - female									

Table 4. Seasonal variability of *M.libycus* sex composition in the Absheron population

Year		Spring		Summer		Autumn		Winter	
		♂	♀	♂	♀	♂	♀	♂	♀
1990-1993	n	1187	1129	732	457	2413	1588	402	256
	%	51.3	48.7	61.6	38.4	60.3	39.7	61.1	38.9
1996-2001	n	518	399	96	53	109	92	98	58
	%	56.5	43.5	64.4	35.6	54.2	45.8	62.8	37.2
2002-2007	n	482	307	199	101	1370	1010	20	22
	%	61.1	38.9	66.3	33.7	57.6	42.4	47.6	52.4
Average	**%**	**59.1**	**40.9**	**65.4**	**34.6**	**59.6**	**40.4**	**60.4**	**39.6**

Table 5. Embryo indicators of *M libycus* in Absheron population (1987-2007)

Season	PF	The number of embryos										AEI
			1	2	3	4	5	6	7	8	9	
Spring	231	n			2	16	24	81	61	38	9	6.44 ±0.05
		%			0.9	6.9	10.4	35.1	26.4	16.5	3.9	
Summer	99	n				4	13	32	24	25	1	6.57 ±0.12
		%				1.7	5.6	13.9	10.4	10.8	0.4	
Autumn	212	n		1	9	49	37	60	42	10	4	5.57 ±0.07
		%		0.4	3.9	21.2	16.0	26.0	18.2	4.3	1.7	
Winter	7	n		1		1	2	3				4.86 ±0.59
		%		0.4		0.4	0.9	1.3				
Total	549											
Average number of embryos:								**6.1**				
PF- the number of pregnant females, **AEI** – Average embryo indicator												

4. Discussion

Psammophile species *M. libycus* is highly polymorphic throughout its range extending from Mauritania to Eastern Turkestan. Of the subgenus *Pallasiomys* Heptner, 1933, populations in the isolated range in Eastern Transcaucasia is generally assigned to Asiatic subspecies *M. l. erythrourus* (Gray, 1842), or sometimes to a separate subspecies, *M. l. caucasius* Brandt, 1855 (Pavlinov *et al*., 2010; Dianat *et al*., 2020).

Differences among local populations of Libyan Jird in Azerbaijan in the literature have been studied and some distinct geographical patterns (Figure 1), like nocturnal and mainly diurnal habits of Absheronand central populations respectively, have been implied (Eigelis, 1980). However, there is no recent comparative study on populations except for morphology (Hasanov, 2008; Hakhiyev, 2019)

Population densities of *M.libycus* in Azerbaijan, where it is by far the most common gerbil, have been known to fluctuate over years and occasional significant outbreaks may occur in some populations (Eigelis, 1980). Hence, abundance of this species of epizootic significance has long been monitored by APS (Anti-Plague Station in Baku) (Morris *et al*., 2013).

Seasonality is observed in the majority of small mammals in arid regions in reproductive activity, restricted largely to spring and early summer as in the Arabian and African populations of the Libyan Jird, reproduction takes place year-round in both Absheron and Jeyranchol populations, although the breeding activity slows down in summer and winter periods. The species is largely a granivore and frugivore, while green parts and insects are consumed to a lesser scale. Decrease in reproduction during summer period is linked with food shortage and increased reptilian predator activity. Contrary to literature data (Alakbarov *et al*., 1967), summer drought does not stop reproduction, and during winter, when the species become gregarious and largely rely on cache food, reproductive activity is greatly reduced.

Photoperiod and temperature seem to trigger reproductive cycle in males and rainfall in females (Hart *et al*., 2018). Ovarian activity has been shown to be indirectly regulated by seasonal fluctuations (Smai-Hamdidouche *et al*., 2013), while there are findings suggesting that females can delay reproduction (Tchabovsky & Bazykin, 2004). In Azerbaijan and Central Asia, the species is known to be reproductively responsive to

weather conditions and occasional outbreaks can be observed, the species become a pest in orchards and fields. Opportunistic character of this large rodent species in habitat selection (Daly & Daly, 1975; Scott & Dunstone, 2000) and reproduction apparently contribute to abundance and broad distribution in general.

An indicator of breeding intensity is the approximation of females to or predominance over males. In Jeyranchol population although the greatest approximation of males and females occurs in autumn (females predominate in spring), the males outnumber females throughout the year, especially during winter and summer period. In Absheron population, however, such contrast is sharper (Table 4), which indicate a higher breeding intensity in Jeyranchol population.

In the Jeyranchol population, as opposed to Absheron population, two breeding peaks (spring and autumn) are observed. Increased breeding intensity of autumn may be linked with the rise of relative humidity after the hot and dry summer months. Another finding of the study is the much lower winter breeding indicators observed in the Absheron population than in Jeyranchol (PF 5% Je, 1.5% Ab). During colder months (December and January) of severe winters, almost no pregnant females are recorded in both populations. Accordingly, slightly better reproductive indicators of the Libyan Jird for Jeyranchol (an inland location with higher altitude and precipitation) as compared to a Peri-Caspian flatland location (Absheron Peninsula). Morris (Morris *et al*., 2013) indicate a strong relationship with high abundance of *M. libycus* with warmer and wetter conditions, which may confirm our results. However, as the Absheron Peninsula has much higher population density, anti-plague monitoring of the population is of great importance.

In the Absheron population, where the embryo data is available, it has been observed that most pregnant females during spring and early summer are the overwintered individuals of the autumn generation. Till mid-summer (July-August), when food becomes scarce, despite fewer breeding females, interestingly, embryo number per female increases (Table 5), slowing down (5.6) during autumn and both number of pregnant females and embryos per females (4.9) reach their minimums. In winter, the population mainly consists of the individuals born in the autumn and the individuals reaching pubescence in the spring of the following year. Low-potential females of spring-summer generation are involved in breeding. Thus, the females with 7-9 embryos were not recorded in this season. The number of females with 6 embryos is much higher in all seasons among pregnant individuals and therefore 6 embryos can be considered the optimal number of embryos in the study area for the Libyan Jirds (Table 5). The least common individuals are the females with 2, 3, 8 and 9 embryos among the studied material.

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