

Morphological Cranial Study and Habitat Preference of *Mus macedonicus* (Petrov & Ruzic, 1983) (Mammalia: Rodentia) in Lebanon

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Abstract

Fifteen Sherman live traps were set at 20 different locations along Ibrahim River in Mount Lebanon. The 1500 trap nights resulted in trapping 15 *Mus macedonicus*. Morphological and cranial measurements were similar to those recorded in other countries except for the length of the head, body and tail that were moderately larger in the Lebanese specimens. Most animals were caught at an altitude above 800m asl. 53% were caught in the agriculture zone very close to cultivated fields, while the rest were recovered in Mediterranean landscape of tall grasses and bushes. Hence, further molecular assessment is recommended for the taxonomic status of Lebanese species.

Keywords: Macedonian mouse, *Mus macedonicus*, Rodentia, Ibrahim River, Lebanon.

1. Introduction

The Macedonian mouse *Mus macedonicus* (Petrov & Ruzic 1983) occurs in the Eastern Mediterranean basin from Yugoslavia to the Near East and from the Balkans to Cyprus (Harrison and Bates 1991; Boursot *et al.* 1993). It was reported from Syria, Jordan and Arabia (Bates and Harrison 1989; Macholan *et al.* 2007). In Israel, Auffray *et al.* (1990a) described *Mus spretoides* that was later referred to as *Mus macedonicus* (Auffray *et al.* 1990b). The *Mus macedonicus* are confined to Mediterranean environments where they live amongst bushes, long grass, cultivated lands or on stream banks, but was never found in human landscape (Auffery *et al.*, 1990a; Bates and Harrison, 1989)

In Lebanon, Macholan *et al.* (2007) reported the existence of *Mus macedonicus* only from Byblos and assumed that this species could reach the north-eastern part of Lebanon. In a study on owl pellets (Abi-Said *et al.*, 2014), it was speculated that this species may be found in the owl pellets due to the close cranial similarity to *Mus musculus*.

The present study discusses the morphology and the cranial measurement for *Mus macedonicus* based on specimens collected from Lebanon, while comparing them with other populations.

2. Material and Methods

The present study was conducted between May 2016 and May 2017 along Ibrahim River in Mount Lebanon. Fifteen Sherman live traps baited with peanut butter and grain feed mix were used with a total of 1,500 trap nights. Traps were set at 20 different locations and altitudes along the river, representing various vegetation zones namely Thermo-Mediterranean, EuMediterranean, Supra-Mediterranean and Agricultural Zone. Ten stations were fixed beside the river bank and 10 stations at 500m away. Morphometric measurements of the trapped individuals were recorded (Table 1), photos were taken, and skinned animals were kept at the Lebanese University Natural History Museum Faculty of Sciences II, Fanar-Lebanon.

Six external measurements (HB, T, HL, HW, E, and HF) along with twelve cranial measurements (GTL, CBL, ZB, BB, IC, PC, MXC, MDC, M, RL, BU and ZI) were recorded. Measurements were taken in a straight line using a digital caliper (close to 0.01mm).

3. Results and Discussion

3.1. Habitat Preference

Fifteen *Mus macedonicus* were trapped and examined during the entire study period. A single mouse was trapped

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at an altitude of 61m above sea level (asl), while the rest were caught at an altitude above 800m asl. Out of the overall trapped individuals, most (53%) were caught in the agriculture zone very close to cultivated fields, while the rest were recovered in Mediterranean landscape of tall grasses and bushes (20% in Thermo-Mediterranean zone, 20% in Supra-Mediterranean zone and 7% in Meso-Mediterranean zone). No animals were trapped in urban areas. The former two habitats, were in the proximity of a water source either in the form of a river or small streams. Similarly, in Jordan, *M. macedonicus* was collected in both cultivated and semi-wild habitats covered with bushes and long grass (Bates and Harrison, 1989). In the Balkans and Anatolia, it was trapped more often in open areas with tall dense vegetation associated with arable lands and streams and less frequently in cultivated fields (Krystufek and Vohralik, 2006); likewise in Israel, this species inhabited Mediterranean ecosystems (Auffray *et al.*, 1990a).

3.2. Morphological and Cranial Measurements

Mus. macedonicus differs from *Mus. musculus* (house mouse) in its pelage color (Figure 1). The dorsal coat fur is characterized by a brownish color, which changes into creamy color on the abdomen rather than the greyish fur that is observed on the body of the house mouse.

There were a difference in the mean measurements between males and females but these measurements remained within the range. This could be referred to the small sample size of females trapped. The tail of *M. macedonicus* is noticed to be shorter than the head and body length. The ratio of head and body length to tail was 1.28 on average (Table 1). This has been found to be consistent with other reported specimens (Auffray *et al.*, 1990b; Krystufek and Vohralik, 2009; Aulgnier *et al.*, 2009; Harrison and Bates, 1991; Qumsiyeh, 1996). The average ear length (11.40mm) was similar to those reported by Harrison and Bates (1991), Krystufek and Vohralik (2009) and Aulagnier *et al.* (2009). However, the length of the head and body and tail in the Lebanese specimen (Table 1) was found to some extent larger than those reported by Harrison and Bates (1991) from Syria, Jordan and Israel; the reason behind this difference may be explained by the rich habitat and the moderate climate that characterizes the Lebanese landscape.



Figure 1. A male *Mus macedonicus* trapped in the Agricultural Zone along Ibrahim River

The morphometric difference between *M. macedonicus* and *M. musculus* in tail length, tail to body and head length was consistent with Auffray *et al.* (1990a). Additionally, it was observed that the ears of *M. macedonicus* are shorter than those reported by Lewis *et al.* (1967) and Harrison and Bates (1991) for *M. musculus*.

Table 1. Body measurements of *Mus macedonicus* (N=15) (weight in g, length in mm)

	Male (N=13)			Female (N=2)		
	Mean	SD	Range	Mean	SD	Range
Body Weight	12.18	1.98	10.00 – 17.00	12.50	2.83	10.50 – 14.50
Head and Body (HB)	83.27	3.47	77.36 – 89.16	85.30	7.81	79.78 – 90.82
Tail Length (T)	65.37	3.86	57.66 – 70.35	68.17	3.53	65.68 – 70.67
Head length (HL)	24.08	0.88	22.81 – 25.78	24.85	0.07	22.85 – 24.90
Head width (HW)	11.69	0.46	11.01 – 12.59	11.86	0.52	11.49 – 12.23
Ear (E)	11.40	1.01	9.29 – 13.00	11.73	2.43	10.02 – 13.45
Hind Foot (HF)	17.46	0.82	15.26 – 18.85	18.72	0.04	18.69 – 18.75
Head & Body/Tail	1.28	0.08	1.16 – 1.42	1.27	0.28	1.25 – 1.29

The cranial and teeth (Figure 2) measurements were identical with those reported by Krystufek and Vohralik (2009) and Harrison and Bates (1991). The Zygomatic Index (ZI) (width of malar process/width of the anterolateral part of the zygomatic arch) which is considered among the determination keys for *Mus macedonicus*, is reported to be not less than 0.52 (Orsini *et al.*, 1983; Auffray *et al.*, 1990; Harrison and Bates, 1991; Macholan, 1996; Krystufek and Vohralik, 2009; Qumsiyeh, 1996). In these specimens the ZI was within the reported ranges with a mean of 0.81 (range 0.67 – 0.91) for males and 0.84 (0.79 – 0.89) for females (Table 2).

Table 2. Cranial and dental measurements (mm) of *Mus macedonicus* (N=15)

	Male (N=13)			Female (N=2)		
	Mean	SD	Range	Mean	SD	Range
GTL	21.96	0.65	20.66 – 22.59	22.01	0.06	21.97 – 22.06
CBL	20.81	0.82	19.31 – 21.59	20.54	0.42	20.25 – 20.84
ZB	11.01	0.47	10.52 – 11.75	11.13	0.40	10.85 – 11.42
BB	9.78	0.30	9.40 – 10.17	10.01	0.35	9.77 – 10.26
IC	3.50	0.06	3.40 – 3.62	3.60	0.64	3.56 – 3.65
PC	6.53	0.31	6.15 – 6.89	6.38	0.37	6.12 – 6.65
MXC	3.46	0.15	3.27 – 3.73	3.38	0.08	3.32 – 3.44
MDC	3.12	0.18	2.80 – 3.40	2.93	0.28	2.74 – 3.13
M	11.30	0.49	10.34 – 11.70	11.08	0.64	10.63 – 11.53
RL	10.64	0.62	9.82 – 11.78	11.19	0.18	11.07 – 11.32
BU	3.56	0.17	3.23 – 3.77	3.66	0.07	3.61 – 3.71
ZI	0.81	0.09	0.67 – 0.91	0.84	0.07	0.79 – 0.89

(GTL= greatest length of the skull, CBL= condylobasal length; ZB= zygomatic breadth; BB= breadth of brain case; IC= interorbital constriction; PC= postorbital constriction; MXC= maxillary cheekteeth; MDC= mandibular cheekteeth; M= mandible length; RL= length of rostrum; BU= bullae; ZI= zygomatic index)



Figure 2. *Mus macedonicus*, dorsal (a), ventral (b) and lateral (c) view of the cranium, and a view of the mandible (d)

4. Conclusion

The habitat preference of this species minimizes its encounter with the house mouse. However, due to the expanding urbanization which is in favour of the house mouse, both species might overlap resulting in house mouse domination and exclusion of the Macedonian from its habitat. In another note, Macholan *et al.* (2007) raised an important question on the genetic characteristic of this species in Lebanon. Hence, molecular assessment of the *Mus macedonicus* population in Lebanon defining its taxonomic status is unambiguously essential. Additionally, the new record of this species along Ibrahim River (0 m asl – 1100 m asl) urges more field studies for assessing its presence in various habitats. It is worth mentioning that intensive human disturbance and habitat destruction have been initiated near Ibrahim River, as a result of dam construction, consequently leading to a threat towards many species.

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