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PYGMY WHITE-TOOTHED SHREW *SUNCUS ETRUSCUS* (SAVI, 1822) IN NORTH-WESTERN ISTRIA (INSECTIVORA, MAMMALIA)

DISTRIBUZIONE DEL MUSTIOLO, SUNCUS ETRUSCUS *(SAVI, 1822) NELL'ISTRIA NORD-OCCIDENTALE (INSECTIVORA, MAMMALIA)*

Abstract – The distribution of *Suncus etruscus* is mapped in the north-western Istria. The majority (i.e. 92.3%) of the 521 examined specimens originated from owl pellets. The distribution area of *Suncus etruscus* appears to be limited by 0°C isotherm of the coldest month and corresponds well with the distribution of the submediterranean and mediterranean plant communities. However, the species is probably incapable of penetration into the paramediterranean vegetational belt. Discussed are also relations between *Suncus etruscus* and other shrews populating the same area.

Key words: *Suncus etruscus*, Insectivora, North-Western Istria, Zoogeography.

Riassunto breve – *L'articolo riporta la distribuzione del Mustiolo (*Suncus etruscus*) nell'Istria nord-occidentale. La maggior parte (92.3%) dei 521 esemplari esaminati proviene dall'analisi delle borre degli Strigiformi. L'area di distribuzione sembra essere limitata dalla isoterma 0°C del mese più freddo e combacia perfettamente con quella della vegetazione mediterranea e submediterranea. D'altro canto la specie è probabilmente incapace di penetrare nella fascia vegetazionale paramediterranea. Vengono commentate infine le relazioni interspecifiche con le altre specie simpatriche dei topiragno.*

Parole chiave: Suncus etruscus, *Insectivora, Istria nord-occidentale, Zoogeografia.*

Introduction

Pygmy white-toothed shrew *Suncus etruscus* is widely distributed in warmer, mainly Mediterranean regions of the western Palaearctic (SPITZENBERGER, 1970, 1990; CORBET, 1978). The north-eastern Adriatic coast, wherefrom it was mentioned already by MEHELY (1914; according to KAHMANN & ALTNER, 1956), PASZLAVSKY (1918) and DAL PIAZ (1927), is well within the known distribution area (SPITZENBERGER, 1990). However, the species is scarcely known in this region. During our recent studies of

owls in north-western Istria (LIPEJ, 1988) a rich material of small mammals was collected from owl pellets containing an important part of *S. etruscus*. This kind of data is supplemented by the records obtained during general small mammal surveys in Istria and occasionally collected specimens. Our current aim is to describe the distribution, habitat requirements, and status of *S. etruscus* in the submediterranean habitats of north-western Istria.

Material and Methods

Examined were 521 specimens of *S. etruscus*. The material from owl pellets, which form the major part, is kept in the private collection of L. Lipej. The rest (skins, skulls and alcohol specimens) is housed in the Slovene Museum of Natural History. Distributional records are given for 10 km squares of Universal Transfer Mercator Grid (UTM). The data on the vegetation of the study area were taken from JOVANOVIĆ et al. (1986) and the information on the climate from the Climatic Atlas of the Socialist Federative Republic of Yugoslavia (Atlas klime Socialističke federativne republike Jugoslavije; published by the Federal hydrometeorological Institute; not dated).

Results and Discussion

The majority of *S. etruscus* (92.3%, see tab. I) originated from owl pellets. Another 32 specimens were obtained from pitfalls. Twenty four of them were collected from pitfalls intentionally arranged for small mammals, while the rest was obtained from smaller pitfalls arranged for terrestrial arthropods. Eight specimens of *S. etruscus* were obtained by incidence, seven of them falling prey to domestic cat while one only was snap trapped. These results are not surprising, since *S. etruscus* is too light to pull the trigger of a standard Museum special trap. The usefulness of pitfalls in

	N.	%
Owl pellets	481	92.3
Pitfalls	32	6.1
Other	8	1.5
Total	521	100.0

Tab. I - Nature of records of *Suncus etruscus* in north-western Istria.
- *Tipi di segnalazioni di* Suncus etruscus *in Istria nord-occidentale.*

collecting this shrew was demonstrated already by FONS (1975) and SPITZENBERGER (1970) and the appropriateness of owl pellet analysis by KAHMANN & ALTNER (1956), MIKUSKA et al. (1979), LOPEZ-FUSTER et al. (1979) and RZEBIK-KOWALSKA (1985).

Remains of *S. etruscus* were found in the pellets of three owls, namely Barn owl (*Tyto alba*), Tawny owl (*Strix aluco*) and Little owl (*Athene noctua*). Only 1.6% and 1.8% of specimens were from the diet of *Strix aluco* and *Athene noctua*, respectively. The rest (96.6%) was from Barn owl. The majority of the pellet samples of Tawny owl originated from elevations above 400 m where *S. etruscus* is absent (see below). On the other hand, Little owl is a typical insectivorous predator occasionally capturing small mammals in NW Istria (LIPEJ, 1988).

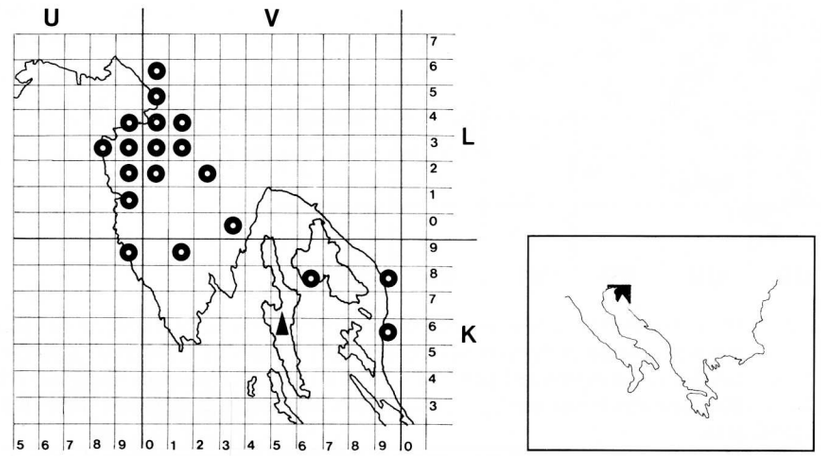

Fig. 1 - Distribution of *Suncus etruscus* along the north-eastern coast of the Adriatic and in NW Istria. The presence in a 10 km square of UTM grid is indicated by circles. Triangle indicates a locality which cannot be precisely located (Island of Cres; DAL PIAZ, 1927). Localities from other 10 km squares are described in connection with fig. 2.
- *La distribuzione del* Suncus etruscus *lungo la costa nord-orientale Adriatica e nell'Istria nord-occidentale. La presenza viene indicata con i cerchietti nella rete UTM con i quadrati di 10 km di lato. Il triangolo indica il punto che non è stato determinato con precisione (L'isola di Cres-Cherso;* DAL PIAZ, *1927). Le località degli altri quadrati sono descritte nella fig. 2.*

VL06 Dutovlje (specimens in the Slovene Museum of Nat. Hist.; leg. B. Macarol); VL05 Trieste (DAL PIAZ, 1927); VL30 Lazarići, Sinkovići (KOVAČIĆ et al., 1984); UK99 Rovinj (KAHMANN & ALTNER, 1956); Rovinj, Ulma (KOVAČIĆ, 1984); VK19 Kranjčići (KOVAČIĆ et al., 1984); VK68 town Krk on the Island of Krk (specimen in the Naturhistorisches Museum Wien); VK98 Senj (MEHELY, 1914, according to KAHMANN & ALTNER, 1956); VK96 Gornja Klada (TVRTKOVIĆ et al., 1985).

S. etruscus is known from nineteen 10 km squares of the UTM grid in the north-western Istria (fig. 1). The localities range from the sea coast up to the elevations of 320 m (Dutovlje) and 360 m (Gornja Klada). It is worth mentioning that *S. etruscus* is missing from only two out of 12 examined owl pellet samples in north-western Istria (fig. 3). These two localities were at the altitudes of 350 m and 800 m, respectively.

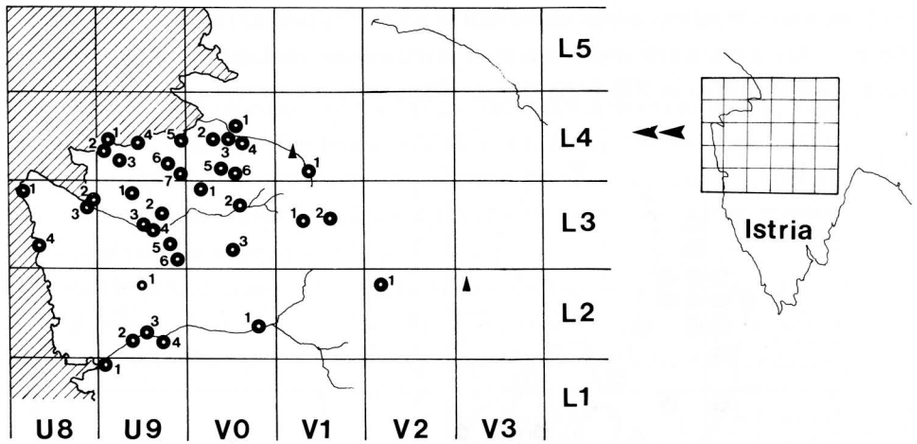

Fig. 2 - Microdistribution of *Suncus etruscus* in north-western Istria. The localities (dots) are given according to the corresponding 10 km squares of UTM grid. Triangles indicate locations of two owl pellet samples which lack in remnants of *Suncus etruscus*. The localities based merely on owl pellets are indicated by asterix in the following text.

- *Microdistribuzione del* Suncus etruscus *nell'Istria nord-occidentale. Le singole località sono presentate in accordo con i corrispondenti quadrati di 10 km della rete UTM. I triangoli indicano le località di due campioni di borre di Strigiformi dove non è stata confermata la presenza del* Suncus etruscus. *Nel testo sottostante sono indicate con l'asterisco le località che si riferiscono ai campioni trovati di borre degli Strigiformi.*

UL94: 1 * Ronek; 2 - Strunjan; 3 - * Mala Seva; 4 - Izola (old town); 5 - Semedela; 6 - Gažon; 7 - * Šmarska vala; VL04: 1 - * Moretini; 2 - Prade; 3 - * Polje; 4 - Sermin; 5 - * Vanganel; 6 - Bonini; VL14: 1 - Hrastovlje (KRYŠTUFEK, 1983); UL83: 1 - Savudrija (KRYŠTUFEK, 1983); 2 - Sečoveljske soline, stare soline (KRYŠTUFEK, 1983); 3 - Sečoveljske soline, Kostijera; 4 - * Umag (MIKUSKA et al., 1979); UL93: 1 - * Korte; 2 - * Sveti Štefan; 3 * Stena near Dragonja river; 4 - * Argila; 5 - * Momjan; 6 - * Marušiči; VL03: 1 - * Labor pri Pomjanu; 2 - * Gunjači; 3 - * Hrvoji; VL13: 1 - * Sočerga; 2 - Movraž, Movraška vala; UL92: 1 - * Kontarini (near Buje); 2 - * valley of Mirna river 1; 3 - * valley of Mirna river 2; 4 - * Baštija; VL02: 1 - Livade (KOVAČIĆ et al., 1984); VL22: 1 - * Čiritež (KOVAČIĆ et al., 1984); UL91: 1 - estuary of Mirna river (KOVAČIĆ et al., 1984).

Thus, we may presume that an increasing altitude may prevent the spreading of *S. etruscus* into the continent. The distribution area of *S. etruscus* corresponds well with the distribution of the eumediterranean community *Orno - Quercetum ilicis* (which is of a fragmentary occurrence in the study area) and the distribution of submediterranean communities, mainly of the *Querco - Carpinetum orientalis, Orno - Quercetum pubescentis, Seslerio autumnalis - Ostryetum* and *Seslerio - Quercetum petraeae* types. In the belt of beech forests with autumn moor-grass (*Seslerio autumnalis - Fagetum*), which forms the parameditterranean vegetational zone on the elevations between 600 and 1000 m, *S. etruscus* is not present any more. The absence of *S. etruscus* from this thermophilous beech forest belt is clearly evident in eastern Istria (fig. 3).

In several countries the distribution of *S. etruscus* was explained by such simple climatic factors as isotherms. Its area is limited by a July mean temperature of 20°C in France (FAYARD, 1984). The only two localities in Bulgaria are within the region with a mean annual temperature over 12°C (POPOV & NIJAGOLOV, 1991). The yearly isotherm of +12°C was suggested to be limiting for *S. etruscus* already by KAHMANN & ALTNER (1956) although they mentioned some exceptions. SPITZENBERGER

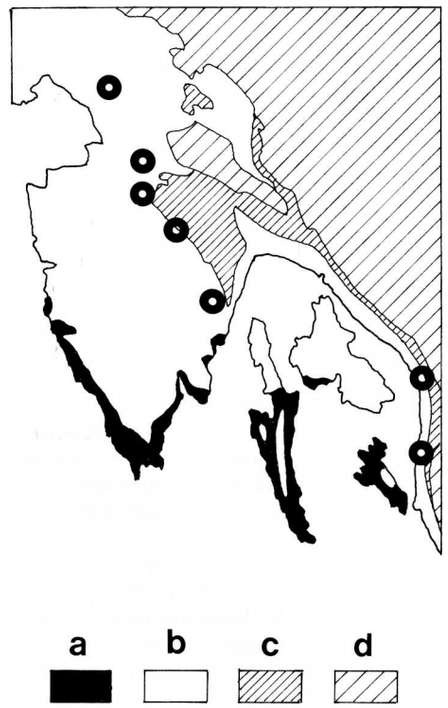

Fig. 3 - Distribution of vegetational types on the north-eastern Adriatic coast and in Istria (modified after JOVANOVIĆ et al., 1986). Marginal records of *Suncus etruscus* are indicated by circles.

- *Distribuzione dei tipi di vegetazione della costa Adriatica nord-orientale e Istria. I cerchietti indicano le località che costituiscono il limite orientale estremo della distribuzione del* Suncus etruscus.

Abbreviations: a - mediterranean vegetation; b - submediterranean vegetation of *Querco - Carpinetum orientalis, Ostryo - Quercetum pubescentis* and *Seslerio - Quercetum petraeae* types; c - parameditterranean vegetation of *Seslerio autumnalis - Fagetum* type; d - continental vegetation.

(1990) concluded that in spite of some exceptions *S. etruscus* is preponderantly a Mediterranean species. Namely, the species was reported also from high altitudes (up to 1000 m above sea level) as well as from an area with an extremely low winter temperature (-20°C; see SPITZENBERGER, 1990, for a rewiev).

The July isotherm of 20°C is of special interest in our study area. An "island" of lower temperature is evident in the north-eastern part of Istria (fig. 4), and along its south-western margin are linked the bordering localities of *S. etruscus*. Let it be mentioned that the January isotherm of 0°C corresponds perfectly with the July isotherm of 20°C. The lower temperature "island" is identical with the geographic region of Mt. Učka. and the plateau of Čičarija where TVRTKOVIĆ et al. (1985) identified all characteristic mammalian forest elements from the continental regions.

The yearly isotherm of 12°C provides a less persuasive explanation of *S. etruscus* distributional border. Although the majority of the records lies in the area with a yearly mean temperature of 12°C or more, several localities are to be found also on the other side of the isotherm (e.g. Kranjčići, VK 19; fig. 4). *Suncus etruscus* being a thermophilous rather than psychrophilous species we may presume that within the study area its distribution is limited by 0°C isotherm of the coldest month.

Suncus etruscus populates only warmer and lower lying regions in Istria. Northwestern Istria is under a strong continental influence, which is evident also from

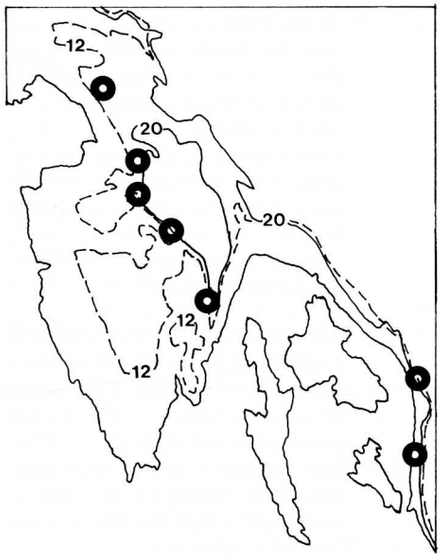

Fig. 4 - July isotherm of 20°C (uninterrupted line) and mean yearly isotherm of 12°C (interrupted line) on the north-eastern Adriatic coast and in Istria. Explanation for circles as in fig. 3.
- *Isoterma di 20°C di luglio (linea continua) e isoterma annuale media di 12°C (linea tratteggiata) della costa Adriatica nord-orientale e in Istria. La spiegazione per i cerchietti è identica alla fig. 3.*

a fragmentary distribution of mediterranean plant communities (fig. 3). We may presume that even the lower lying parts of NW Istria are on the very border of *S. etruscus* habitat requirements. This means that the species is incapable of any further penetration into the paramediterranean belt.

Microdistribution of *S. etruscus* in NW Istria, where most of our data originate from, reveals how this species is common in suitable habitats (fig. 2). Within its distribution area *S. etruscus* was found in each pellet sample of Barn owl. Its frequency in samples varied between 0.7% and 33.33% (median = 5.63%). Surprisingly, GERDOL et al. (1982) did not find *S. etruscus* among 418 small mammal remains obtained from the pellets of three owl species (*Asio otus*, *Strix aluco* and *Athene noctua*) collected on the Trieste Karst (Carso Triestino). This can be ascribed rather to the feeding ecology of the studied owls than to the absence of *S. etruscus* from Carso Triestino. Little owl preys on insects while Tawny owl, which is a woodland species, captures mainly forest species of shrews. On the other hand, the absence of *S. etruscus* from the diet of Long-eared owl can be explained by the size-related capture capabilities of this owl (JANES & BARSS, 1985).

The area which is so densely populated by *S. etruscus* in NW Istria is under a strong anthropogenic influence. The autochthonous broad-leaved forests are degraded to the brushland of *Quercus pubescens*, *Q. cerris*, *Carpinus orientalis* and *Ostrya carpinifolia*. Large areas are cultivated and urbanized. We found *S. etruscus* in different habitats, from salt-marsh reeds on the coast to dry xerothermic slopes on limestone with degraded bushy vegetation. Specimens were found in gardens near houses, and even in the old city center of Izola. It is obvious that *S. etruscus* is a relatively synanthropic species.

The following shrews were found to be sympatric with *S. etruscus*: *Crocidura suaveolens*, *C. leucodon*, *Neomys anomalus* and *Sorex minutus*. *Crocidura suaveolens* is the most common and the most widely spread shrew in this area (KRYŠTUFEK, 1983). In the owl pellet samples it is from 0.8 to 73.3-times more common than *S. etruscus* (median = 5.3-times). It is of interest that by using pitfalls FONS (1975) found *S. etruscus* to be more dominant than *Crocidura suaveolens* in France. However, *C. russula* outnumbered both species together. The ratio was 1 *S. etruscus* : 0.55 *C. suaveolens* : 5.34 *C. russula*. The size of white toothed shrews increases in the same direction as their abundance. In Istria, where *Crocidura leucodon* is the largest white toothed shrew, such ratio as obtained from the food of the Barn owl, was 1 *S. etruscus* : 6.8 *C. suaveolens* : 2.4 *C. leucodon*. Our results suggest that size and dominancy are not necessarily correlated in the community of white toothed shrews i.e. that size as such is

not responsible for competitive advantage. It should be noted, however, that our sample was collected by a different method than the one by FONS (1975), which prevents direct comparisons. Other two shrews, *Neomys anomalus* and *Sorex minutus*, are very rare in Istria, so they are syntopic with *S. etruscus* only on three localities each.

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