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TAXONOMIC VALUE OF M_1 MEASUREMENTS IN *MICROTUS AGRESTIS* (LINNAEUS, 1761) AND *MICROTUS ARVALIS* (PALLAS, 1779)

TAKSONOMICZNA WARTOŚĆ POMIARÓW M_1 U *MICROTUS AGRESTIS* (LINNAEUS, 1761) I *MICROTUS ARVALIS* (PALLAS, 1779)

An analysis was made of the variations in the measurements of M_1 teeth and position of *foramen mandibulare* in two species of voles, *M. agrestis* (n = 272) and *M. arvalis* (n = 118). The weight of M_1 is of some assistance. M_1 teeth weighing $>$ 10.3 mg correspond to 47.9% of the individuals of *M. agrestis*, while $M_1 <$ 7.3 mg — 53.4% of *M. arvalis*. The relationship between the weight and height of crown of M_1 on a correlation diagram, make it possible to distinguish 68.8% of *M. agrestis* and 64.1% of *M. arvalis*. This method may be of practical assistance in identifying fossil material cr material originating from owl pellets.

The two species of voles — *M. agrestis* and *M. arvalis*, differ in respect of skull dimensions and certain descriptive characters of the teeth and mandible (cf. Zimmermann, 1955). Morphological characters are not, however, permanent and vary to a greater or lesser degree (cf. Rörig & Börner, 1905; Reichstein & Reise, 1965). In two other species of European voles, it is known that they show additional triangles on their M^2 (Kowalski, 1957; Ruprecht, 1967), however, this characteristic has never been found in the aboral end of this tooth, as it was sometimes observed in *M. arvalis*. On the other hand in *M. agrestis* a tendency has been observed to reduction of this part of M^2. The position of *foramen mandibulare* also cannot always be considered reliable in identification of these two species on account of the occurrence of intermediate variations (cf. Krommenhoek & Slob, 1967; Dienske, 1969). Difficulties of a taxonomic nature increase with the degree of damage to the bone material, which may occur in fossil material or that obtained from owl pellets. Therefore Krommenhoek & Slob (1967) and Dienske (1969) considered both the size, and descriptive characters of the skull, mandible and teeth to differentiate between *M. agrestis* and *M. arvalis*.

The purpose of this study was to assess the usefulness of M_1 measurements in distinguishing between these two species in sympatric populations.

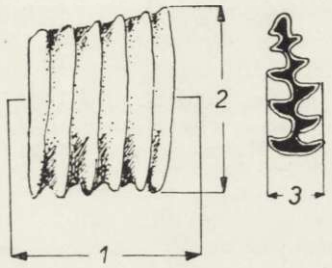

Fig. 1. Explanations of M_1 measurements.
1 — length of the crown, 2 — height, 3 — breadth.

The material available consisted of skulls of *M. agrestis* (n = 272) and *M. arvalis* (n = 118), obtained from the Białowieża National Park and Białowieża Glade (52°42′N, 23°50′ E). Analysis was made of variations in measurements of M_1 and position of *foramen mandibulare*. M_1 were

Table 1

Variations in the position of *foramen mandibulare* in sympatric populations of *M. agrestis* and *M. arvalis*.

Species	Arrangement: Typical +		Intermediate +—		Atypical —	
	n	%	n	%	n	%
M. agrestis	250	91.9	18	6.6	4	1.5
M. arvalis	107	90.7	10	8.5	1	0.8

Table 2

Variations in values of measurements of M_1 in sympatric populations of *M. agrestis* and *M. arvalis*.

Measurement of the crown of M_1	*Microtus agrestis* (n=269)		*Microtus agrestis* (n=103)	
	$\bar{x} \pm SD$	C.v.	$\bar{x} \pm SD$	C.v.
Weight in mg	10.4 ± 1.5	14.8	7.4 ± 1.1	15.4
Height, mm	3.8 ± 0.3	7.0	3.4 ± 0.3	8.8
Length, mm	2.8 ± 0.2	8.8	2.6 ± 0.2	7.7
Breadth, mm	1.2 ± 0.1	8.6	1.0 ± 0.1	9.5

removed after boiling whole mandibles in 6% $NaHCO_3$, water solution. The air dried teeth were weighed on an analytical balance with accuracy to 0.1 mg and the length, height and breadth of the crown measured with accuracy to 0.1 mm (Fig. 1). The teeth were stored for several months, and during this time, their weight did not vary.

The position of *f. mandibulare* did not completely separate the two species of voles. A typical arrangement was observed in 91.9% of the *M. agrestis* individuals, and in 90.7% of *M. arvalis* individuals. An intermediate and atypical arrangement in the *f. mandibulare* was found in 8.1% of the individuals of *M. agrestis;* these showed 4-triangled enamel of M^2. This unusual position of the *f. mandibulare* was also recorded in 9.3% of the individuals of *M. arvalis,* and these had 3-triangled enamel of M^2 (Table 1). The position of the *f. mandibulare* can thus be used only as a supplementary aid to identification.

M_1 exhibits some differentiation of size in both species. In *M. agrestis* these teeth are on an average heavier, higher, longer and broader than the corresponding dimensions in *M. arvalis* (Table 2). Maximum variation was observed in the case of weight (C. v. = 14.8—15.4%) and

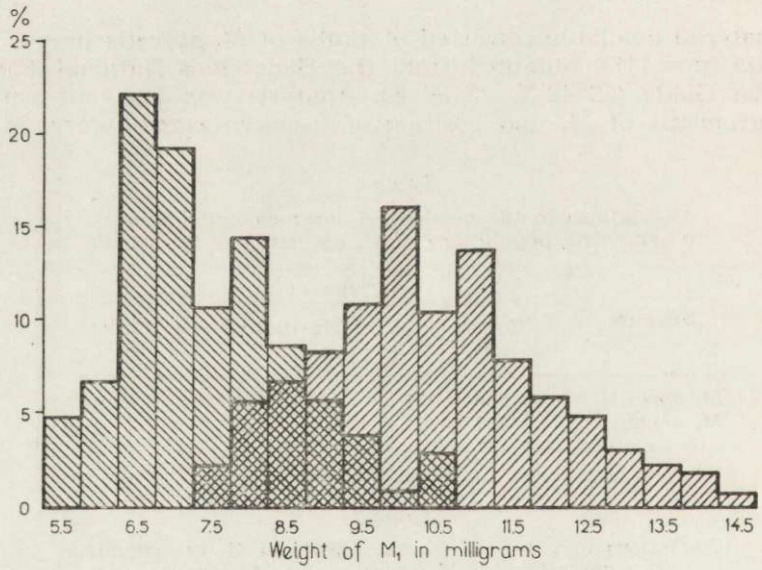

Fig. 2. Variations in weight of M_1 in *M. agrestis* and *M. arvalis*.
The zone where values of measurements in classes 7.5—10.5 mg overlap each other is indicated by double shading.

breadth of crown (C. v. = 8.6—9.5%). Variations were correspondingly less in the height and length of crown in the two species (C. v. = 7.0—8.8%) — Table 2.

None of the four measurements or indices based on these measurements applied individually provide a satisfactory means of distinguishing between the two species of voles.

The weight of M_1 is, however, of some assistance (Fig. 2). The common range of values of this measurement falls in both species in the middle classes 7.5—10.5 mg (extreme values of these classes come within limits of 7.3—10.7 mg). On the basis of this character weights of $M_1 > 10.3$ mg apply to 47.9% of the individuals of *M. agrestis,* while weights of

$M_1 < 7.3$ mg — to 53.4% of *M. arvalis*. The application of two dimensions of the teeth — weight and height of crown of M_1, on the correlation table, where the position of the given individual is defined by the values of these two parameters, enables 68.8% of *M. agrestis* and 64.1% of *M. arvalis* to be distinguished (Fig. 3).

The results obtained confirmed our original assumption that *M. agrestis*, being the larger of the two species of voles, would possess the larger teeth. On the other hand the considerable degree of overlapping of measurements in both species indicates that the size of teeth is of little taxonomic value (cf. also Haitlinger & Ruprecht, 1967). The

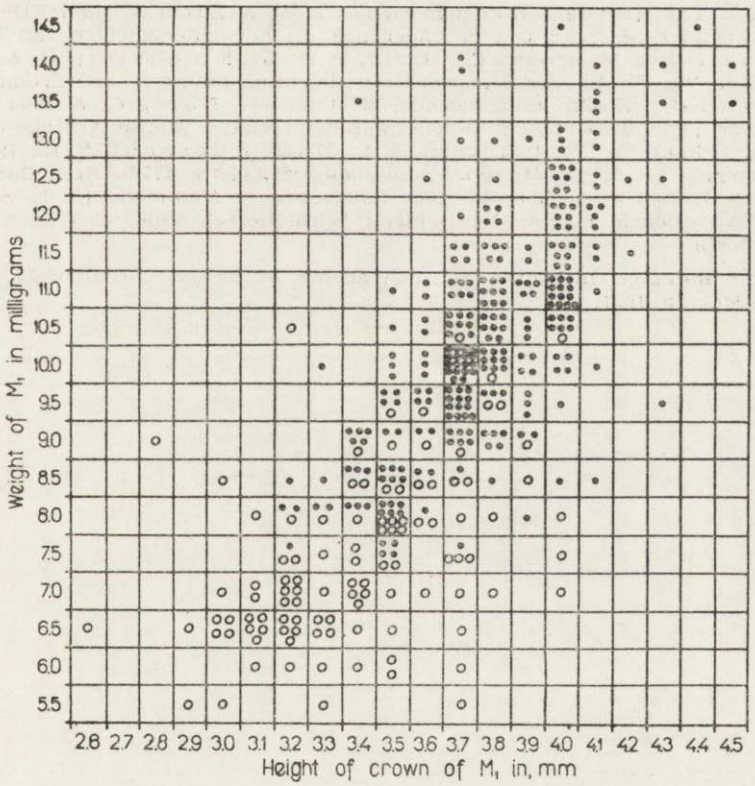

Fig. 3. Relationship of the weight and height of the crown of M_1 in *M. agrestis* — ●, and *M. arvalis* — ○.

degree of overlapping of dimensions found in the two species is very similar to the overlapping of skull measurements obtained by Krommenhoek & Slob (1967) and Dienske (1969).

Analysis of the descriptive and measurement characters (Dienske, 1969) gave more satisfactory results. This author obtained almost complete separation of these two species as the result of the statistical calculations based on discrimination analysis which he made of the material.

Our results also show that simple measurements of M_1, when treated jointly, can be useful in examinating the bone fragments of *M. agrestis* and *M. arvalis* in owl pellets and fossil material, although this is possible in only about 50% of the specimens.

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