Studies of the Shrew Mole (*Urotrichus talpoides*) I.

Age determination, population structure and behavior

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Small mammals were collected at Yukyuzan Park located about 3 kilometers east of Nagaoka Station in Niigata prefecture. The flora of the area consists of *Fagus, Castanea* and *Pinus*, or of *Cryptomeria*. Summer climate in this region is sultry with maximum temperatures rising above 30°C. During the research period, the first snow fall was in December 1, 1964 and the last on April 21, 1965. The maximum snow depth reached 1.5 m. In the course of this study the shrew mole proved to be the second most dominant species among seven small mammals collected: Japanese field mouse (*Apodemus speciosus*), Japanese long-tailed field mouse (*Apodemus argenteus*), Japanese mouse (*Mus musculus*), Japanese field vole (*Microtus montebelli*), Lesser Japanese mole (*Mogera wogura imaizumii*), Japanese shrew more (*Urotrichus talpoides*) and Dsinezumi shrew (*Crocidura dsinezumi*).

Studies of shrew mole populations were reported by DALQUEST (1942) and by MIYAO *et al.* (1963). MIYAO (1965) estimated the life span of *Dymecodon pilirostris* from the frequency distribution tables of body weight. The breeding habits of *Urotrichus talpoides* were reported by YUKAWA (1965). But little is known about the life cycle of the shrew moles. The present paper will deal with the age criteria and the population structure of *Urotrichus talpoides*.

**Material**

The present study was based on 208 skulls of 227 specimens of *Urotrichus talpoides* collected at Nagaoka city from April 1964 to March 1965 by the author. Most of the shrew moles were caught with snap traps in Yukyuzan Park of about 2.5 acres. Fifty-one hundred snap traps were daily set almost throughout one year (approximately 20,000 trap-nights). Most specimens were skinned and their skulls were stored for age determination. Despite constant trapping, no specimen was caught in August, and only two were caught in July but these skulls were lost. This problem will be discussed later.

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Age Determination

Previous workers stated that degree of tooth-wear is most useful for age determination. Attempts were therefore made to divide the samples into several age classes.

Method 1: If the breeding seasons of animals are confined to one season, by restricting the sample to individuals taken at only one season of the year, one might reasonably expect that the dentition in similar ages would be sufficiently similar to form discernible groups. Examination of the individuals collected in May and April with a low-powered binocular microscope revealed that the degree of tooth-wear falls into four distinct groups. The resultant groups of similarly worn specimens were termed “wear-classes”. The whole specimens were classified according to this standard wear-classes of their lower jaw.

Four wear-classes by comparison of lower jaws

Wear-class 1: Teeth are very sharp. All the spring specimens of this class retain at least some milk teeth, and the permanent dentition is not yet complete. In all the autumn and winter specimens, the milk teeth are completely replaced by permanent ones, except for two individuals in which some milk teeth were still retained. In every case, however, no tooth-wear is discernible, what makes this wear-class easily distinguishable from the others.

Wear-class 2: The cusps of molars are more or less worn so that their tips are not sharp. The third premolar begin to wear, but the canine, the first and the second premolars show no trace of wear yet. The third premolar seems to be smaller than the newly-replaced third premolar of the class 1 specimens.

Wear-class 3: The molars of all specimens in the modal group of this class displayed fairly heavy wear. With the exception of each protoconid of the 2nd and 3rd premolars, the cusps of the three
molars are all worn. The 3rd premolar is heavily worn so that the crown seems rather rectangular than triangular when seen laterally. Wear on the 1st and the 2nd premolars proceeds to some extent.

Wear-class 4: No high sharp cusps remain. All the cusps are extremely worn, almost to the gum line of the buccal side. One of two specimens of this class has lost the second premolar and the canine, and the other has the canine only.

Method 2: In order to show successive stages of tooth-wear clearly, soft X-ray photographs of the lower right jaws of all the specimens were taken and measurements were made on the images of the molars enlarged eight times. The jaws were put close to the plates when photographed. The younger the specimens were, the sharper their images, because of less degree of ossification.

True age: The monthly frequency of the tooth-wear classes through one year is shown in Fig. 3. This figure shows that when plotted against the month of capture, the measurements fall into four groups. These groups will represent four different age groups.
It can therefore be concluded that age determination by means of tooth-wear is possible also in this shrew mole species. Although most young specimens were caught in May, it is likely that they had been born in April, for they showed a more advanced rate of dental replacement when compared with specimens captured in April. These individuals form the wear class 1 population. It follows therefore that the maximum longevity of this shrew mole is three full years, where each tooth-wear class represents one age class.

**Population Structure**

*Age ratio and sex ratio*: The age class 1 forms the largest part of the catch, i.e., 65 males, 75 females and 4 sex unknown. Age class 2 consists of 30 males and 22 females; age class 3, three males and seven females and the oldest age class 4, only two females. The sex ratio of the total 227 specimens is 109 males to 114 females and 4 unknown. The figures do not differ significantly from the hypothetical 50:50 ratio. But for age class 2, females are about 0.73 per male. On the other hand in age classes 3 and 4, females are 3.0

![Fig. 3. Progressive wear on teeth of the shrew moles](image-url)

\[
y = \left(\frac{a^4}{a^3} + \frac{b^4}{b^3} + \frac{c^4}{c^3}\right) \times 8
\]
Longevity and turnover rate: Fig. 3 shows that the maximum longevity of the shrew mole is three full years. PETRIDES (1946) estimated the probable population turnover period to be:

\[ T = \frac{\log 0.005}{\log 1 - j} + 1 \]

Fig. 4. Each total number and each sex ratio of different age classes

is the percentage of young in the population. The turnover rate of the shrew mole population is:

\[ T = \frac{\log 0.005}{\log 1 - 0.698} + 1 = 5.6 \text{ years} \]

This theoretical turnover period exceeds by much the maximum longevity (three years) estimated by means of tooth-wear in this study. Briefly, the formula can be of no use for estimating the turnover period of shrew moles. One might suppose that the maximum longevity of shrew moles is much shortened by excessive tooth-wear which is accelerated by soil in their food. CROWCROFT (1957) discussed, however, the possibility for tooth-wear to cause death of shrews as follows: "We can tell from the rate at which a shrew's teeth wear down, that if it lived through a second winter it would have teeth which were little more than stumps. At this stage it would undoubtedly have difficulty in holding and chewing prey; but we are less sure that teeth as worn as those of the adults are when they disappear, are sufficiently useless to hasten their deaths". After all, more studies are needed to solve the problem.

Behavior

In this field work, it was very interesting that only a few specimens were obtained in the summer. YUKAWA (op. cit.) pointed out that collecting shrew moles in summer is extremely difficult. PEARSON (1959) reported that the shrew, Sorex ornatus, avoided surface runways during the dry summer months.

According to the thermograph set near by the research area, the
days when minimum temperatures exceeded 20°C numbered 59 in summer. Only one specimen was captured during the hotter days. Humidity was very high through the year. But many specimens of shrew moles were easily obtained in highlands during August; for example Oze, Yatsugatake, Asagiri Plateau, of Honshu, Japan. It is therefore likely that *Urotrichus talpoides* may avoid the surface runways during the summer months in the lowlands as well as *Sorex ornatus*. Consequently, it is difficult to collect them with snap traps and specimens were lacking in this season.

Patrols along the snap traps set in the research area were made twice a day during April, May and June (8 a.m., 7 p.m.). Fifty five specimens were caught on 8 a.m. patrols and six at 7 p.m. The shrew mole appears to have a tendency for nocturnal activity. The present author has often seen, however, the shrew mole running at the hole of the tunnel in day time. The sound of cars seems to influence their daytime activity. It is certain that the shrew mole is really active also during the daytime.

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**Literature Cited**