

ETHOLOGICAL RELATIONS IN THE COMMUNITIES OF TWO SPECIES OF WOOD MICE *Apodemus uralensis* AND *Apodemus sylvaticus*

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Abstract. The identified complexes of the acquaintance, aggressive, protective (defensive), conflict, friendly, comfortable behaviour includes 22 elements, shown by wild mice in pair encounters. Intraspecific interactions in *Apodemus uralensis* populations are tenser than in *A. sylvaticus* populations, which is connected with the presence in males of the first species of well pronounced complex of aggressive behaviour. Generally, interspecific relations were peaceful: in *A. sylvaticus* male contacts, the elements of aggression were practically missing, while in *A. uralensis* males the number of attacks decreased by 4 times and of fights by 10 times in comparison with the intraspecific indexes. In female encounters, on the contrary, elements of aggression were revealed from both species, which were missing in intraspecific contacts.

Keywords: behaviour, *Apodemus uralensis*, *A. sylvaticus*, communities, males, females.

Rezumat. Interacțiunile etologice în comunitățile a două specii de șoareci de pădure *Apodemus uralensis* și *Apodemus sylvaticus*. Complexele identificate de comportamente de familiarizare, agresivitate, apărare, conflict, confort includ 22 elemente, manifestate de șoareci în experiențele de așezări în cuplu. Interacțiunile intraspecifice în populațiile de *Apodemus uralensis* sunt mai tensionate decât în cele de *A. sylvaticus*, ceea ce este legat de prezența unui complex bine pronunțat de comportament agresiv la masculii primei specii. Interacțiunile interspecifice sunt, în general, pașnice: în interacțiunile masculilor de *A. sylvaticus* elementele agresive practice lipseau, iar la cei de *A. uralensis* numărul atacurilor a scăzut de 4 ori, cel al luptelor – de 10 ori în comparație cu indicii intraspecfici. În interacțiunile între femele, dimpotrivă, au fost înregistrate elemente agresive din partea ambelor specii, care lipseau în contactele intraspecifice.

Cuvinte cheie: comportament, *Apodemus uralensis*, *A. sylvaticus*, comunități, masculi, femele.

INTRODUCTION

The elaborate complex of animal behaviour in natural conditions represents a universal powerful population adaptation system, responsive to any changes of the external factors into their complex interplay (MANTEIFEL, 1987). Behavioural adaptation system is characterized by a relatively constant and at the same time, by its huge variability. Knowledge of the laws of the functioning of behavioural adaptation system is of great importance for the conservation of species diversity and equilibrium maintenance in species populations and communities in constantly changing conditions of their existence.

MATERIAL AND METHODS

The studies were accomplished on sexually mature individuals of *A. uralensis* (PALLAS, 1811) and *A. sylvaticus* (LINNAEUS, 1758) of both sexes, caught on experimental sectors of Sociteni village (Centre of R. Moldova) in different seasons of the year. In order to study the interspecific relations the standard methods were used: pair interactions on a neutral field (COIRNS & SCHOLZ, 1973; GOLTSMAN et al., 1977). To accomplish the task pairs of same age and weight were selected, interactions were studied between the same or different sexes. Several series of experiences were performed, during which the character of intraspecific and interspecific relations of males and females of the above mentioned species were studied. At the whole 85 pair encounters were performed with the participation of 46 males and 24 females.

RESULTS AND DISCUSSIONS

During the behaviour study of *A. uralensis* and *A. sylvaticus* the stereotyped behaviour of the animals was emphasized, as well as their species and sex peculiarities. At first the generalized description of the behaviour of animals in the experimental conditions will be given.

In the first minutes of activity in neutral field the animals intensely studied the new environment and the orientation-exploratory behaviour was one of the main ethological reactions within the total behaviour activity pattern. It was expressed in the free movements of the animals within the camera, sniffing, sometimes licking the corners, tactile activity, examination of the walls and floor.

After or during the exploration of the new environment followed the attempt of individuals to get familiarized with each another and the initiative of contact usually comes from one of the partners. At mutual interest in each other different types of olfactory contacts were registered: naso-nasal, naso-lateral, naso-dorsal, naso-ventral, and for mixed pairs there are particularly common naso-anal and naso-genital contacts (Fig. 1). The contact initiative could result in assault, fleeing of one of the partners, mutual friendly contact and peaceful separation of the individuals to "their own" corners.

Often passive staying of one or both animals in their corners was observed, peaceful sitting next to each other, self-grooming and partner grooming (allogrooming), sometimes mutual or alternately. In friendly contacts the animals stay together in the corner, climb above, under and over one another, often changing places.

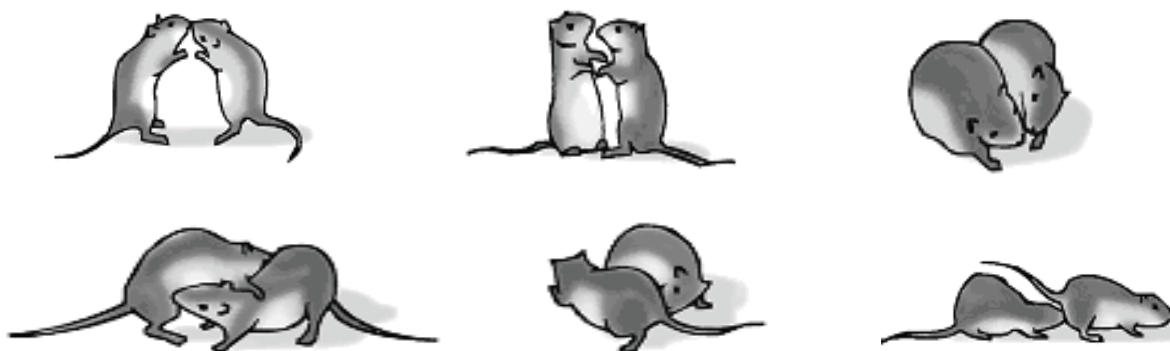


Figure 1. Various types of friendly contacts. / Figura 1. Diverse tipuri de contacte prietenoase.

Most varied were the elements connected with agonistic interactions, among which there can be mentioned attacks, fight, chase, escape without an attack and after it, winning the battles, pushing and boxing, aggressive stands (Fig. 2), squeaks, and sometimes it was registered active seizure of foreign territory (occupation). To this group interactions there can be also attributed avoiding contact with the partner, intense surveillance from the corner over the actions of the partner, as well as relations of domination-subordination, in which the subordinate animal lay on his back to avoid aggressive contact with the dominant, bowed his head in front of him, allow to climb on itself, to sit on top of itself or to be trampled by the dominant etc.



Figure 2. Various types of aggressive contacts. / Figura 2. Diverse tipuri de contacte agresive.

According to the functional importance the described elements were grouped into: meeting, aggressive, defensive, conflictual, friendly behaviour.

Meeting behaviour was expressed in the initiation of the contact, various types of olfactory contacts, exploratory behaviour.

Aggressive behaviour included attacks, fights, chase that sometimes finished with winning over the partner (it laid down on its back and the chase was over), occupation of the territory, aggressive stands. The sequence and the set of antagonistic behaviour elements were varied: attack-fight-chase-winning; attack-aggressive stand-boxing-fight; attack-fight-occupation; attack-aggressive stand-chase etc.

Defensive behaviour: running before or after attack, boxing, watching the partner in order to maintain the safe distance from it, pushing, squeak, freezing, subordination postures (lying on its back, head bowing in front of the partner).

Conflictual behaviour was expressed in ignoring the contact initiation, domination-subordination, grooming, allogrooming. The contact ignoring was expressed in that one of the animals at the initiative of contact from the other continued to commit the same acts that occurred prior to this. At the superiority of one of the partners the relations of domination-subordination were observe. In this case the subordinate animal allows to be trampled by the dominant, walking, sitting on itself, and when attempted to escape the dominant tried to keep the subordinate by force. We distinguish these elements from above mentioned subordinate postures that occur during the aggressive contacts.

Friendly behaviour is formed by the following elements: going after the partner, getting together, climbing above, under, over the partner, allogrooming.

Allogrooming was assigned, on the one hand, to conflictual behaviour, because there might have occurred relations of domination-subordination, and sometimes even aggressive grooming was observed: the dominant animal was biting while cleaning the subordinate. On the other hand, with equal partners the allogrooming is an element of friendly behaviour (Fig. 3).

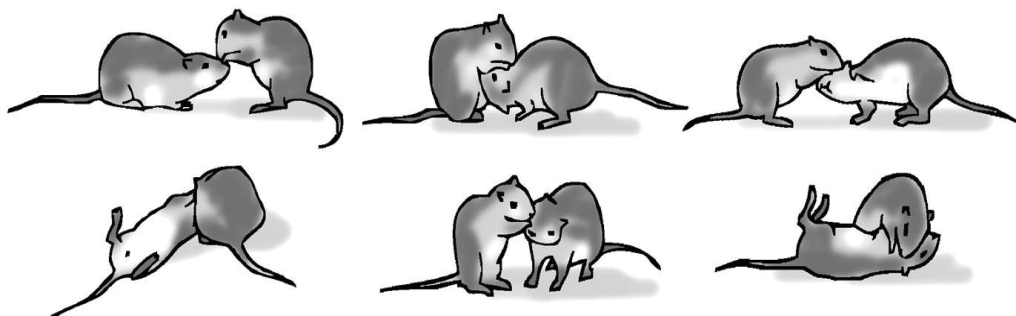


Figure 3. Various types of allogrooming. / Figura 3. Diverse tipuri de allogrooming.

The grooming was assigned to conflictual behaviour because it often represents a manifestation of shifted activity. At the same time it can be an element of comfortable behaviour.

We have to point out that not all the mentioned elements were registered in each individual; the most varied was the behaviour of *A. uralensis* males.

Among the variety of behavioural responses the elements related to agonistic interactions are the most important, because it is known the role of aggression in the mechanisms of regulation of small mammals population number (GROMOV, 2008; CHITTY, 1957; KREBS & DAVIES, 1993; MYERS & KREBS, 1971), so when characterizing the behaviour of the described species, we pay attention first of all to the degree of aggressiveness of animal contacts.

The aggressiveness of male contacts in *A. uralensis* was rather low: in average at pair interactions there were recorded 4 attacks, 9 fights, 9 aggressive stands and 1.5 chases. "Noise degree" of these interactions was low, of only 5.5 squeaks. Most of the duration of the experiment the animals explored the environment (46.7% of the time) and freeze (22.3%); for grooming they allotted little time: 4.4%. Contact initiation by one of the partners rarely caused negative reactions from the other (on 11 initiations 2.5 rejections), most often it led to mutual naso-nasal, naso-lateral and naso-ventral contacts. Allogrooming was completely absent.

The interactions of the females of this species were friendly, the aggressions was practically absent: on 9 contact initiations there were 1.5 rejections and 4 aggressive postures. "Noise effect" of these contacts constituted 4.3 squeaks, while attacks, fights and chases were absent. 81% of the time was devoted to exploratory activity (34.9% which is 1.3 times less than in males) and freezing (46.1%, which is 2 times higher than in males). Grooming constituted 3.8% of the time, 1-2 friendly allogroomings were registered at each pair encounter.

Intraspecific contacts of the males of *A. sylvaticus* were rather friendly: only in one from two encounters could be recorded one attack and one fight and not each of these aggressive elements leads to pursuit (0.92). The degree of "noise" was also low - 1.29, on each 4 encounters 5 squeaks were registered. Most of the time (48.7%) the males sited quietly in their own corner and explored the territory (28.3%), the grooming occupied 5.3% of the time. Mutual interest was manifested in contact initiations (10.58 per encounter), which sometimes led to rejection (2.0) or to aggressive posture (1.2), but more often to mutual friendly contacts and allogrooming (2.63).

In the contacts of *A. sylvaticus* females the aggression was almost completely missing, but they were more emotional. Thus, the contact initiations increased only 1.2 times, while the number of "noise" effects - 5.3 times. For every 12.5 contact initiations there were registered 2.7 rejections, 2.5 aggressive postures and 3.2 allogroomings; no attacks, fights and pursuits were recorded. Overall 79.4% of the time was used by the females for exploratory activity (33.8%) and for quiet sitting in the corner (45.6%).

Interspecific relations of the studied mice species were generally peaceful. Thus, in *A. uralensis* males the aggressiveness level in contacts with *A. sylvaticus* males decreased significantly in comparison with the intraspecific ones. There were registered one attack (instead of 4, particular for the intraspecific contacts) and 0.9 fights (instead of 9), at the same time the "noise" level increased almost 2 times, no pursuits were recorded (instead of 1.5 in the intraspecific contacts of the species).

A. sylvaticus males were even more peaceful toward the males of other species than to the conspecifics: the low level of aggressiveness described above decreased 2 times. The interest toward the males of *A. uralensis* by comparison to the males of their own species was 2 times higher, the same index in *A. uralensis* males decrease by 1.5 times. Therefore, in intraspecific contacts the contact initiations from *A. sylvaticus* part increased by almost 3 times than from *A. uralensis* part. On every contact initiation (20 initiations of one encounter) the males of *A. uralensis* responded by rejection (3.5 rejections, which is 1.4 times higher than the intraspecific index) and aggressive posture (15.5 aggressive postures, which is 1.7 time higher than the intraspecific index).

On contact initiation from the part of *A. uralensis* the males of *A. sylvaticus* responded by friendly allogrooming (2.0 per encounter), by mutual olfactory contact or completely ignored it and continued to explore the

environment (42.1% of experiment duration, which is 1.5 times higher than the analogical index for intraspecific relations), or sited quietly in their corner (66.3%, which is 1.4 times lower, correspondingly).

In interspecific contacts of the females in opposite to the intraspecific ones, there were registered aggressive elements, but in low number. On every encounter in *A. uralensis* females there were recorded 2 attacks and 1 fight, while in *A. sylvaticus* on 10 encounters - 8 attacks and 9 fights, pursuits were not recorded.

The females of *A. sylvaticus* explored the environment (36.9% of experiment duration) and tried actively to get acquainted with the partner (number of contact initiations increased 2 times by comparing with intraspecific contacts and was 2.4 times higher than the analogical index of females of *A. uralensis*). In *A. uralensis* females it considerably increased the complex of defensive behaviour: practically on every contact initiation they responded by aggressive posture or by squeaks. The duration of freezing was 2 times longer than of exploratory activity, while the last one decreased 1.3 times. By comparison with intraspecific contacts the "noise" level increased 3.7 times and the number of aggressive postures 5.2 times.

CONCLUSIONS

Animal behaviour is complex. The identified complexes of the acquaintance, aggressive, protective (defensive), conflict, friendly, comfortable behaviour includes 22 elements, shown by wild mice in pair encounters.

Animal behaviour has species specificity. Thus, intraspecific interactions in *A. uralensis* populations are tenser than in *A. sylvaticus* populations, which is connected with the presence in males of the first species of a well pronounced complex of aggressive behaviour.

Interspecific relations in *A. uralensis* and *A. sylvaticus* communities are also specific. Generally they were peaceful. In *A. sylvaticus* male contacts the elements of aggression were practically missing, while in *A. uralensis* males the number of attacks decreased 4 times and of fights 10 times in comparison with the intraspecific indexes. In female encounters, on the contrary, elements of aggression were revealed from *A. uralensis* part as well as from *A. sylvaticus* part, which were missing in intraspecific contacts. The emotionality of *A. uralensis* females also increased.

Taking into account the importance of aggressiveness in the mechanisms of number regulation, we can presume that in the regulation of the population number the males have the leading role, while in the regulation of communities as a whole - the females.

REFERENCES

- CHITTY D. 1957. *Self – regulation of numbers through changes in viability*. Cold Spring Harber Simposia of Quantitative Biology. **22**: 277-280.
- COIRNS C. & SCHOLZ P. 1973. *Fighting in mice: dyadic escalation and what is earned*. Journal of Comparative & Physiological Psychology. **85**(3): 540-550.
- GOLTSMAN M. E., NAUMOV N. P., NIKOLSKII A. A., OVSIANNIKOV N. G., PASKHINA N. M., SMIRIN V. M. 1977. *Sotsialnoe povedenie bolshoi peschanki (Rhombomys opimus Licht.)* in Povedenie Mlekopitayushchikh. Edit. Nauka. Moskva: 5-69. [In Russian].
- GROMOV V. S. 2008. *Prostranstvenno-etologicheskaja struktura populiatsii gryzunov*. Edit. Nauka. Moskva: 267-283. [In Russian].
- KREBS J. R. & DAVIES N. B. 1993. *An introduction to behavioural ecology*. 3rd. edition. Blackwell Scientific Publishing Cambridge, Mass. 420 pp.
- MANTEIFEL B. P. 1987. *Ecologicheskie i evolitsionnye aspekty povedenia zjivotnyh*. Edit. Nauka. Moskva. 272 pp. [In Russian].
- MYERS J. H. & KREBS C. J. 1971. *Sex rations in open and enclosed vole populations: demographic implication*. American Naturalist. Ecology. **105**: 344-352.

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