

SOME EPIZOOTOLOGICAL CHARACTERISTICS OF TOXOPLASMA GLAREOLI ERHARDOVÁ, 1955 INFECTION IN REDBACKED VOLES (CLETHRIONOMYS)

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Abstract. The paper presents the results obtained from studies concerning the occurrence of *Toxoplasma glareoli* Erhardová, 1955 in more than 3,900 bank voles (*Clethrionomys glareolus*) and northern redbacked voles (*C. rutilus*), trapped in the Udmurt Autonomous Soviet Socialist Republic. It became evident that in the period of reproduction of redbacked voles (from April until October) there was no transmission of the parasite. During that period *T. glareoli* was maintained in specimens which had passed the winter. The infection took place from November to March, i.e. in the period when the voles lived under the snow cover. During the summer season the level of incidence of infection in animals which had overwintered was decreasing; this fact points out the increased probability of an elimination of infected specimens. Both species of redbacked voles inhabiting the area studied got infected with *T. glareoli* equally. The territorial distribution of *T. glareoli*, however, was found to be irregular. The voles trapped in localities covered with broad-leaved and dark coniferous forests were parasitized more frequently than those animals inhabiting localities overgrown with small-leaved trees. The parasite was not found in voles trapped in pine forests.

Toxoplasma glareoli was described in 1955 by Erhardová who found this protozoan in the brains of two bank voles (*Clethrionomys glareolus*) in the environs of Prague. In the following years the parasite was also found in northern redbacked voles (*C. rutilus*) and large-toothed redbacked voles (*C. rufocanus*) in the Altai, USSR (Zasukhin, Shevkunova, Karulin 1958), in bank voles in Czechoslovakia (Černá 1959; Jírovec et al. 1961; Šebek 1963; Čatár et al. 1967), in Sweden (Enemar 1963, 1965), France and Poland (Doby et al. 1965), in the regions of Saratov (Krasnova 1966; Krasnova, Orlov, Viakhirev 1971), Tula, Moscow, Kalinin, Vologda, Murmansk and the Udmurt ASSR (Kalyakin, Myasnikov 1966; Kalyakin et al. 1966; Kalyakin 1971) in the German Federal Republic (Kepka 1969), in northern redbacked voles in the regions of Tyumen and Udmurt and in large-toothed redbacked voles in the Murmansk region (Kalyakin 1971). *T. glareoli* was also found in the Norwegian lemming (*Lemmus lemmus*) in Sweden (Enemar 1965). This parasite apparently occurs sometimes in shrews (*Sorex*): in the common shrew—*S. araneus* (Šebek 1963, Čatár et al. 1967)* as well as the pygmy shrew—*S. minutus* (Kalyakin, Myasnikov 1966). The distribution of this parasite is possibly much wider than it is known today. It is quite possible that it also parasitizes redbacked voles in North America. Our studies have shown that

* These reports may refer to M-organism (*Frenkelia Bioeca*, 1968) Frenkel, 1953 (synonym: *Toxoplasma microti* Findlay, Middleton 1934).

latitudinally the range of occurrence of *T. glareoli* coincides with the distribution area of redbacked voles, stretching in the south from the southern border line of broad-leaved forests of the Tula region (western part of the USSR) and the small insular groves of Western Siberia to the border between taiga and tundra in the Murmansk region in the north (Kalyakin 1971).

The above-mentioned papers show that the main hosts of *T. glareoli* are some species of the genus *Clethrionomys*, representing some of the most numerous and widespread holarctic rodents. This fact has been confirmed by data obtained from our studies, during which about 1,400 different forest mammals were investigated; the mammals were trapped in the same habitats where redbacked voles occurred (among them 600 specimens represented the genera *Microtus*, *Arvicola* and *Ondatra*) and in not a single case *T. glareoli* was discovered (Kalyakin 1971). A considerable specificity of the parasite to the host is evidenced by negative results in the attempts to infect experimentally white mice (Erhardová 1955; Černá 1959; Kepka 1969), white mice of different inbred lines and common voles (*M. arvalis*) (Kalyakin, unpubl. data). Also unsuccessful were the attempts to infect young bank voles which had been fed the brains of two adult animals of the same species infected with *T. glareoli* (Kalyakin, unpubl. data). Possibly not all stages of the parasite's life cycle (particularly merozoites) are infectious even for natural hosts.

At present there is a rather limited knowledge on the epizootological characteristics of infection caused by *T. glareoli*. It is known that redbacked voles occurring in various habitats of certain regions may get infected with this protozoan to a different degree (Zasukhin, Shevkunova, Karulin 1958; Enemar 1965; Kalyakin, Myasnikov 1966; Kalyakin et al. 1966; Kalyakin 1971) and that considerable seasonal changes do exist in the incidence of infection in them (Kalyakin et al. 1966; Kalyakin 1971). Enemar (1963) reports data on the changes in the incidence of infection with *T. glareoli* in bank voles of different age and in different months. Out of 63 adult voles examined the parasite was found in 38 and of 15 young specimens it was detected in 1; these results indicate that the incidence of infection is higher in adult animals. Unfortunately 78 voles examined by Enemar had been trapped in the course of 4 years and the table showing the incidence of infection in different months (from March to October) had been arranged according to summary data. However, the incidence of infection in the animals in different years was dissimilar: about 50 % in 1953 and 1956 and about 80 % in 1954. It is not clear, of what significance might have been the biotopic changes in the incidence of infection in the voles, what and how exact was the method used in the determination of their age and also what was the actual age (absolute age) of two age groups mentioned: adultus and juvenis (the latter is usually used for the characterization of generative condition, and not the age proper).

Up till now the data on the probable pathogenous effects of *T. glareoli* on its hosts are lacking. Jírovec, Jíra, Sinnecker (1962), Enemar (1963, 1965) observed the absence of any inflammatory reaction around cysts of the parasite; by the way, this reaction has been neither observed around cysts of other toxoplasms studied in many experimental investigations: *T. gondii*, *B. besnoiti*, *B. darlingi* and *B. jellisoni*.

The present paper contains data on the epizootology of infection caused by *T. glareoli* in redbacked voles; the data were obtained during studies carried out in the Malaya Purga district, Udmurt ASSR (about 40 km southward from the town Izhhevsk). Material was collected by the authors during a complex zoological-parasitological expedition on tick-borne encephalitis (headed by E. I. Korenberg).

MATERIAL AND METHODS

The studies were carried out in May—August 1968 and August—September 1970 in a permanent field station covering a wooded area of about 25 km². Additionally short-term investigations were conducted in a similar wooded area 20 km away from the station. The territory studied is situated within the southern part of south taiga sub-zone, almost at its border with coniferous broad-leaved forests. As for the vegetation cover, the territory constitutes an alternation of relatively small areas of old, mainly lime-tree-fir-spruce forests with secondary small-leaved forests of different age and small sections of recently felled area.

The trapping of redbacked voles was done during the summer of 1968 by several methods. The basic material was obtained while counting the numbers of small mammals using the method of trap-lines. These lines (consisting of 25 break-back traps each) were arranged in the area studied according to regular-random principle. Each count was done during 8—10 days twice in the summer; in the second half of June and in the first half of August. During the counts in the area of the forest station 100 trap-lines were laid in the same strictly limited sites (on an average 4 trap-lines per 1 km²). The arrangement of trap-lines was marked on a large-scale map where the borders of sections, covered with different plant groups, were visible.

Additional materials were collected by trapping small mammals in ditches which were continuously operating during the whole expedition. There was a total of 9 ditches in the area of the field station, each 50 m long. Apart from those animals also redbacked voles were investigated which had been caught for special purposes in different periods in live-traps and break-back traps.

In 1970 the animals were caught in break-back traps only.

Irrespective of the method used, the site where each animal studied had been trapped, was registered on the map.

All animals collected were dissected, their species identified and generative condition determined by common methods (Tupikova 1964). The age of all redbacked voles was determined in accordance with tests proposed by Tupikova et al. (1968, 1970). The chart showing the distribution of redbacked voles has been arranged on the basis of mapping the territorial distribution of small mammals, carried out after methods of Kucheruk et al. (1965) and Tupikova (1965).

In order to detect the cysts of *T. glareoli* in the brains of the voles studied preparations of crushed brain tissue were examined under microscope. By this method two preparations from each animal were examined. In addition macroscopic method as described by Bell, Jellison, Glesne (1964) was also widely employed. A total of 456 animals were investigated by parallel use of both methods. The results obtained in both cases proved to be the same, as confirmed by the data published earlier (Kalyakin, Zasukhin 1969). Therefore the remaining voles were examined macroscopically. However, all cases of macroscopic demonstration of the parasite were controlled and confirmed by microscopic method, including the preparations stained after Romanovsky—Giemsa. Impression preparations of internal organs (liver, spleen, kidney, lungs and heart) taken from all voles whose brains contained cysts of *T. glareoli* were examined microscopically.

The impression preparations were fixed in methyl alcohol, stained after Romanovsky—Giemsa and examined with immersion objective for 15 minutes. All other redbacked voles (more than one hundred specimens) spontaneously infected with *T. glareoli* and trapped in other regions were investigated by the same methods, but the data concerning them have not been included in the present communication. However, in all cases *T. glareoli* was detected in the brain only. Of the other protozoans parasitizing in tissues, *Hepatozoon erhardovi* Krampitz, 1964 was found in bank voles and northern redbacked voles. This parasite was demonstrated almost in all investigated voles of mentioned species from the territory of the Udmurt, Tula, Moscow and Tyumen regions, while in redbacked voles from the Kalinin, Vologda and Murmansk regions it was not found in a single case. In the brains of some bank voles trapped in the Udmurt and Tula regions cyst-like conglomerations of spores of the *Encephalitozoon (Nosema) cuniculi* type were detected. *Sarcocystis* was not found in *Clethrionomys* at all (Kalyakin, unpubl. data).

RESULTS

A total of 3,940 redbacked voles were examined on the presence of *T. glareoli*. 2,189 animals were examined in 1968, 1,751 animals in 1970.

An analysis of the age grouping of redbacked voles studied showed that almost 90 % represented young specimens born directly in the year of investigation. The voles born in the previous year (overwintering specimens) constituted about 12 % of all specimens studied. The proportion between the numbers of voles born in

different periods shows up distinctly in the diagram (Fig. 1), where the total number of redbacked voles studied is regarded as 100 %.

The data on the incidence of infection with *T. glareoli* in redbacked voles of different age are given in Table 1. They are divided into two parts by blank spaces running diagonally across the table. The blank spaces account for winter interval in the reproduction of redbacked voles. The left hand bottom part of the Table reflects results obtained from investigations of young animals. The right hand upper part of the Table represents data concerning animals which have overwintered. The *T. glareoli* cysts were found only in overwintering animals. Out of 419 voles of this group investigated in 1968 the parasite was detected in 60 (i.e. in 14.3 ± 1.7 %). On the

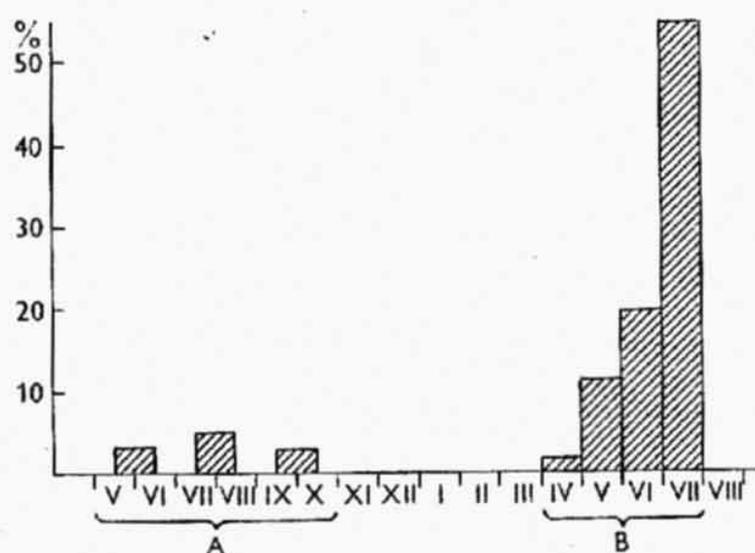


Fig. 1. Proportion between the number of redbacked voles born in different months (The total number of studied animals considered as 100 %).

Explanations: A — overwintering animals born in the year prior to the investigations; B — young voles born directly in the year of investigations.

Table 1. Incidence of infection with *T. glareoli* in redbacked voles of different age (numerator indicates the number of specimens infected, denominator—the number of specimens investigated).

Date	Age of voles investigated, in months							undetermined
	1—2	3—4	5—6	7—8	9—10	11—12	12—16	
May 1968	—	—	—	$\frac{0}{3}$	$\frac{0}{6}$	$\frac{0}{6}$	$\frac{1}{4}$	—
June 1968	$\frac{0}{356}$	—	—	$\frac{11}{52}$	$\frac{10}{75}$	$\frac{8}{24}$	$\frac{4}{13}$	$\frac{0}{18}$
July 1968	$\frac{0}{658}$	$\frac{0}{50}$	—	—	$\frac{2}{30}$	$\frac{16}{107}$	$\frac{4}{43}$	$\frac{0}{11}$
August 1968	$\frac{0}{630}$	$\frac{0}{36}$	$\frac{0}{5}$	—	—	$\frac{1}{7}$	$\frac{3}{49}$	$\frac{0}{6}$
August—September 1970	$\frac{0}{1,524}$	$\frac{0}{117}$	$\frac{0}{56}$	$\frac{0}{5}$	—	—	$\frac{3}{41}$	$\frac{0}{8}$

other hand, no cysts of *T. glareoli* were found in 1,735 young voles investigated that year. Among 41 overwintering voles investigated in 1970 three were infected with *T. glareoli*, while among 1,702 young voles there was not a single one in which the parasite could be detected. High observed values of the significance criterion of difference in fractions compared for both years of observation ($t_d = 8.1$ for 1968 and $t_d = 6.1$ for 1970) make it possible to assert that the revealed differences in the incidence of infection in overwintering and young rebacked voles are highly significant. The mentioned data also make it possible to conclude that during the period of investigations carried out in the summer season, no infection of rebacked voles with *T. glareoli* occurred. This conclusion has been also confirmed by data resulting from the microscopic examination of detected cysts. In the brain tissue of all 63 infected rebacked voles large cysts of the parasite (up to 500-800 μ in diameter) were found. This fact is an evidence of a considerably long period of infection and of a practically lifelong maintenance of *T. glareoli* by the infected rebacked voles. Moreover, after analyzing the age groups and the incidence of infection in overwintering voles it may be said with considerable certainty that no infection with the parasite occurs even during the whole period of the animals' reproduction. Indeed, the data given in Fig. 1 show that the reproduction period of rebacked voles in the area studied lasts from April to October. All overwintering voles examined may be divided into three age groups. The first group consists of animals born in May-June of the year prior to the year of our studies; the second group includes voles born in July-August and the third group-voles born in September-October of that year. The parasite was found in 17 out of 126 voles born in May-June; in 29 out of 212 voles born in July-August; in 17 out of 122 voles from the autumn litter. Consequently 13.5 ± 3.1 %, 13.7 ± 2.3 % and 14 ± 3.1 % of the overwintering voles of all three generations respectively were infected with *T. glareoli* to the same extent. This fact shows that the rebacked voles of all three age-groups had an equal chance to get infected with the parasite. It could happen only in the case when the massive infection of rebacked voles with *T. glareoli* occurred after the end of their reproduction period. As the reproduction period of rebacked voles in the southern Udmurtia lasts from April to October, the infection of the animals apparently takes place from November to March, i.e. in the period of snow.

Very important from the epizootological aspect was the problem of the role of different species of rebacked voles in the existence of *T. glareoli*. As mentioned above, no cases of fresh infection with *T. glareoli* were observed during the summer season and the parasite was detected only in animals which had overwintered. Hence, the epizootological role of *C. glareolus* and *C. rutilus* can be assessed only if the incidence of infection in overwintering specimens of these two species are compared. The cysts of *T. glareoli* were found in 58 out of 370 overwintering *C. glareolus* (i.e. in 14 ± 1.7 %) and in 10 (i.e. 11 ± 3.3 %) out of 90 overwintering *C. rutilus*. It is evident that both species of rebacked voles were infected with the parasite to the same degree. Despite the fact that the numbers of these species in the area studied were considerably different (there were 76 % of bank voles in the total number of rebacked voles) they had an equal chance to get infected with *T. glareoli*. With considerable certainty it may be therefore assumed that *T. glareoli* parasitizes equally *C. glareolus* and *C. rutilus* voles inhabiting the same territory. Thus the epizootological role of the voles of these two species in the existence of *T. glareoli* infection is proportionate to their numbers. Therefore, we shall henceforth consider these species together.

Despite the fact that during the summer season no infection with *T. glareoli* occurs in rebacked voles, a change in the percentage of the overwintering rebacked voles infected with this parasite was observed throughout the summer. The

characteristic of the change of the level of infection was determined by comparing the results of parasitological investigation of the overwintering voles which had been trapped during the count of small mammals' numbers in the area of the research station in 1968. The cysts of *T. glareoli* were detected in 19 (i.e. $24 \pm 4.7\%$) out of 81 overwintering redbacked voles trapped in the second half of June. However, in mid-August the parasite was found in 3 (i.e. $7 \pm 4.2\%$) out of 43 overwintering voles. The revealed differences in the incidence of infection in overwintering voles are significant to a considerably high level, so far as $t_d = 2.9$, and at $P_3 = 0.999$ and

$v = 122$, $t_i = \begin{Bmatrix} 2.0 \\ 2.6 \\ 3.4 \end{Bmatrix}$. The fact that the location of the count lines both in June and

August was absolutely the same, i.e. the voles in both counts were trapped in the same sites, suggests that the mentioned differences may be associated only with seasonal changes of the infection level in the overwintering animals.

We tried to elucidate the peculiarities of territorial distribution of redbacked voles infected with *T. glareoli*. As mentioned above, the studied voles were trapped during the counts of their numbers in the area of the field station. The fixation of sites where the animals were trapped on a large-scale map enabled to mark all points of the parasite's detection. It became clear that within the boundaries of the forest area studied *T. glareoli* is widely distributed all over it. However, the frequency of its incidence in different sites was not equal. The data on the incidence of infection of overwintering redbacked voles trapped in the sites with miscellaneous plant groups are given in Table 2. As the materials in the Table show, the highest incidence of infection of overwintering animals was observed in the forests, young growths and shrub forests of broad-leaved species as well as in dark coniferous forests where it reached 20-30%. In stands of small-leaved species the incidence of infection was 3-6 times lower. In young growths of pine-trees no voles infected with *T. glareoli* were trapped at all. A very simple statistical treatment of mentioned data showed a considerably high level of significance of differences revealed.

The fact that *T. glareoli* is irregularly distributed over the territory indicates that in sites covered with different plant groups the conditions for the parasite's circulation are not equal. We have presumed that one of the factors influencing the unequal

Table 2. Degree of *T. glareoli* infection in overwintering redbacked voles in different plant groups

Plant groups	Number of voles studied	Number of infected	Degree of infection (in %)
Medium-aged, growing and mature forests with dominance of lime-tree and other broad-leaved species	7	2	29.6 ± 17.1
Young growths and brush of lime-tree and other broad-leaved species	48	11	22.9 ± 5.9
Medium-aged, growing and mature dark coniferous forests	161	30	18.7 ± 3.0
Medium-aged, growing and mature small-leaved forests	29	2	6.9 ± 4.8
Young growths and brush of small-leaved species	42	2	4.8 ± 3.3
Young growths of pine-tree	19	0	0 ± 5.5

character of biotopes with regard to *T. glareoli* is the level of numbers of redbacked voles relevant to these biotopes. Table 3 shows the data on relative numbers of redbacked voles trapped during the August counts of small mammals' numbers in 1967 and 1968 in sites covered with main types of forest plants. Parallely are presented the data on the incidence of infection in overwintering animals based on the materials collected during the summer season of 1968. As mentioned above, the Table contains the data of the August count of numbers, carried out in 1967. In our opinion these data are of interest because they suggest the numbers of those voles, among which infected specimens were found the following year, considering that in August 90 % of redbacked vole populations represent young animals. The Table contains summary data on biotopes with similar indices of the incidence of infection in overwintering voles.

As the Table shows, a positive correlation between the late summer level of vole numbers in sites of the field station covered with a forest of different types and the level of incidence of infection in overwintering voles trapped in the sites, was observed. The data presented in the Table also show that indices of the abundance of redbacked voles inhabiting the types of forest studied differentiated to a considerably lesser degree than did the levels of infection incidence in overwintering specimens. In 1967, when the numbers of redbacked voles had been on the average twice their numbers in 1968, the differences in the vole numbers in different biotopes were rather insignificant.

We have also tried to compare the *T. glareoli* distribution with territorial distribution of redbacked voles by means of cartography (Fig. 2), omitting the calculation of mean values from corresponding geobotanical data. While analyzing the presented chart, we see that on the whole the infected overwintering animals occurred more frequently in sites where the vole abundance had been recorded in August of the previous year. Thus, a positive correlation may be observed between the level of vole numbers at the end of summer and the frequency of *T. glareoli* detection in overwintering animals in summer of the following year. This conclusion should be regarded as a purely tentative one, since the statistical treatment of the given data showed a rather low significance of the differences revealed.

Table 3. Relative numbers of redbacked voles and indicators of the incidence of *T. glareoli* infection in overwintering animals in the field station sites covered with miscellaneous groups of vegetation

Main types of forest plants occurring in the area of field station	Relative numbers of redbacked voles (mean number of voles trapped in one count line)		Degree of infection in overwintering voles (in %)
	August 1967	August 1968	
Broad-leaved and dark coniferous forests	9.8	5.9	20 ± 2.6
Small-leaved forests	8.5	3.7	5.6 ± 2.3
Young growths of pine-tree	6.8	2.8	0 ± 5.5

DISCUSSION

The most notable characteristics of epizootology of *T. glareoli* infection in redbacked voles are as follows. First, the infection has a life-long latent or chronic course in carriers and in this respect it is similar to toxoplasmosis the causative agent

of which (*T. gondii*) is closely related to *T. glareoli*. Secondly, there is a definite seasonal dependence of the epizootic process. It consists in a very long interepizootic period lasting at least from April to October under the conditions of southern Udmurtia. During this period there is practically no *T. glareoli* transmission. According to our data the redbacked voles get infected between November and March, i.e. during the snow period. This fact has been confirmed by previously published materials obtained during the studies on the infection of redbacked voles in the Tula region (Kalyakin, Myasnikov 1966; Kalyakin et al. 1966) and some other regions of the USSR (Kalyakin 1971). A similar seasonal character of the development of epizootics was described by a number of authors as regards toxoplasmosis caused by *T. gondii* in some species of mammals (Kalyakin 1970, 1971).

The observed decrease in the level of incidence of *T. glareoli* infection in overwintering redbacked voles during the summer apparently indicates a more probable elimination of infected animals as compared with uninfected voles of the same age. In our opinion this fact suggests possible pathogenous effects of *T. glareoli* on its hosts.

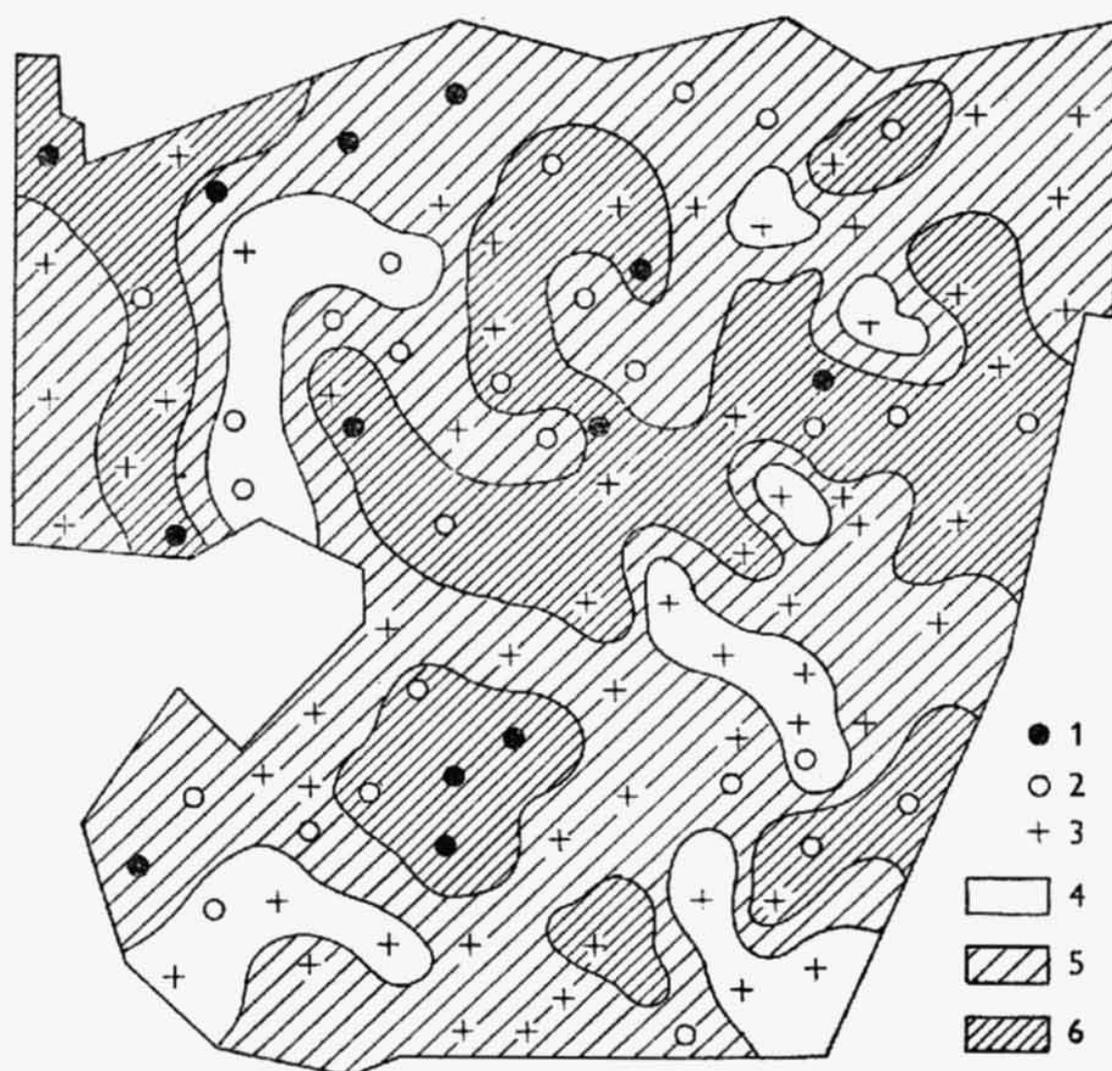


Fig. 2. Distribution of animals infected with *T. glareoli* during the summer 1968 and the numbers of redbacked voles in August 1967 in the area of field station.

Explanations: 1—3: trap-lines in which 1—overwintering redbacked voles infected with *T. glareoli* were captured; 2—overwintering uninfected animals were captured; 3—no overwintering voles were captured. 4—6: per one trap-line the following number of voles were captured: 4—up to 4 voles; 5— from 5 to 9 voles; 6— from 10 to more voles.

In the area studied considerably sharp differences in biotopic dependence of *T. glareoli* were detected. There is no doubt that this fact must be in some definite way connected with ecological dissimilarity of biotopes studied, both as regards the rebacked voles and the successful circulation of *T. glareoli* in their populations. Our attempts to reveal the dependence of the level of the incidence of infection in the voles upon their numbers indicated the existence of such tendency, but yielded no clear results. In this respect it should be noted that the method used in the estimate of animal numbers is rather relative.

Undoubtedly the knowledge on the modes by which the rebacked voles get infected with *T. glareoli* might be of great importance for understanding epizootological characteristics of the infection. However, the mechanism of *T. glareoli* transmission remains to be still unknown. On the ground of the peculiar localization of the parasite, long-lasting character of its maintenance in the host and most probable similarity of its biology with the biology of *T. gondii* it may be presumed that rebacked voles get infected by some of the alimentary routes. The elucidation of a possible fecal-oral *T. glareoli* transmission of the coccidial type, as quite recently demonstrated concerning *T. gondii* (Hutchison et al. 1970; Frenkel et al. 1970; Sheffield, Melton 1970) would be of great interest in this connection.

CONCLUSIONS

The data obtained in the massive investigation of bank voles (*Clethrionomys glareolus*) and northern rebacked voles (*C. rutilus*) on the maintenance of *T. glareoli* revealed the following facts:

1. The *T. glareoli* infection in rebacked voles is characterized by a long-lasting, practically life-long maintenance of the parasite in the host.
2. The seasonal development of *T. glareoli* epizootics is characterized by the presence of long-lasting inter-epizootic period including the reproduction season of rebacked voles (from April to October), during which practically no cases of infection in voles are observed. The *T. glareoli* transmission under conditions of southern Udmurtia takes place between November and March, i.e. under the snow cover. Due to this fact the infected specimens are met with only among overwintering rebacked voles.
3. Bank and northern rebacked voles, despite the differences in the level of their members in the area studied, get equally infected with *T. glareoli*.
4. During the summer season the level of the incidence of *T. glareoli* infection in overwintering rebacked voles decreases, indicating a probable elimination of infected specimens, i.e. possible pathogenous effects of the parasite upon its hosts.
5. The territorial distribution of *T. glareoli* is irregular. The voles, which were caught in broad-leaved and dark coniferous forests, were infected with the parasite in the greatest extent. The incidence of infection in voles trapped in small-leaved forests proved to be 3-6 times lower. In sites covered with stands of pine-trees no voles infected with *T. glareoli* were trapped.

НЕКОТОРЫЕ ЭПИЗООТОЛОГИЧЕСКИЕ ОСОБЕННОСТИ ИНВАЗИИ,
ВЫЗЫВАЕМОЙ *TOXOPLASMA GLAREOLI* ERHARDOVÁ, 1955
У ЛЕСНЫХ ПОЛЕВОК (*CLETHRIONOMYS*)

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Резюме. Сообщаются результаты исследования на наличие *Toxoplasma glareoli* Erhardová, 1955 у более 3900 рыжих (*Clethrionomys glareolus*) и красных (*C. rutilus*) полевок, отловленных в Удмуртской АССР. Было показано, что в течение периода размножения лесных

полевков (с апреля по октябрь) передачи паразита практически не происходит. На протяжении всего этого периода *T. glareoli* сохраняется в перезимовавших особях. Заражение происходит с ноября по март, т. е., в период подснежного существования полевков. На протяжении летнего сезона наблюдается снижение уровня пораженности перезимовавших зверьков, что указывает на большую вероятность элиминации именно зараженных особей. Оба обитающих в районе исследования вида лесных полевков поражаются *T. glareoli* в одинаковой степени. Отмечена неравномерность территориального распределения *T. glareoli*. Чаще паразитом были поражены полевки, отловленные на участках, занятых широколиственными и темнохвойными лесами; в значительно меньшей степени были заражены зверьки, обитавшие на участках, поросших мелколиственными породами. У полевков, отловленных в сосняках, паразит обнаружен не был.

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Academician K. I. Skryabin, one of the foremost helminthologists of the world, founder of the Soviet school of helminthology, and of helminthology as a science, died on October 17, 1972, at the age of 94 years. Soviet science and biological sciences throughout the world have suffered a great loss from his departure.

K. I. Skryabin was born on December 7, 1878 in Petrograd to the family of a transport engineer. After leaving secondary school, he entered the Veterinary College at Yuriev and, upon graduation, worked as a veterinarian in Central Asia. In these neglected parts of the Czarist Turkestan, K. I. Skryabin found heavy infections with parasitic worms in all domestic animals. He assembled an extensive collection of worms, which he took to Petrograd for identification. At that time, however, there was no expert in helminthology in Czarist Russia who would have been capable of identifying these worms. This fact instigated Skryabin's study on parasitic worms and his attempts of finding effective measures for their control. His basic sphere of scientific activities was the development of helminthological research in the Soviet Union, and the application of the results to the veterinary and medical practice. All his time was devoted to research work on helminths, and to the control of infections, caused by them, in man, animals and plants. With his collection of worms from Central Asia he went to Western Europe. There, he worked at various laboratories under the guidance of renowned helminthologists, e.g., Bermann,



Fuhrmann, etc., who helped him in identifying the worms.

In 1920, he returned to Moscow and, within a considerably short time organized three institutions, i.e., the "Helminthological Department" State Veterinary Institute, renamed later "Vsesoyuzniy Institut Gelmintologii imeni Skryabina (VIGIS)"; the "Helminthological Department" Moscow Tropical Institute, and the "Helminthological Cabinet", Physico-Mathematical Faculty, Moscow State University. In