WILD BIRDS--HOSTS OF TICK LARVAE AND NYMPHS IN THE TOMSK FOCUS OF TICK-BORNE ENCEPHALITIS

Yu. V. Fedorov

Army Biological Laboratories
Frederick, Maryland

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WILD BIRDS--HOSTS OF TICK LARVAE AND NYMPHS IN THE TOMSK FOCUS OF TICK-BORNE ENCEPHALITIS

by Yu. V. Fedorov

During the past 20 years Soviet scientists hav made a very successful study of diseases with natural foci.

Especially great success was had in the study of the natural foci of tick-borne encephalitis. In the investigation of ticks as reservoirs and carriers of the virus, particular attention was paid to ascertaining the circle of their feeding-hosts. E.N. Pavlovski points out that notwithstanding the fact that the circle of hosts that feed on the ticks, the carriers of tick-borne encephalitis, is extremely wide, only those species of animals and birds that constitute the bulk of the wildlife population in the given enveromnent make any substantial contribution to maintaining the natural focus of this infection.

There are three reasons why the circle of tick hosts has to be investigated:

a) Animals and birds are the reseroirs of the virus from which the tick draws the infection. In feeding on animals, the donor ticks introduce the virus into the former's organisms via their saliva, while the recipient ticks, sucking the blood of these animals, take up the virus together with the blood. The quantity of virus in the organism of the recipient ticks grows, and the ticks acquire the ability to infect other host.

b) Another important factor is the possibility that infected ticks may be transported over long distances by birds and sometimes by mammals, thus establishing new natural foci of tick-borne encephalitis.

c) Knowing the circle of tick hosts enables us to orhanise the battle against ticks by destroying their hosts. This reduces the size of the virus reservior, its carriers, and hence diminishes the number of infections among humans.

The circle of tick hosts is extremely large. As V. M. Popov's summary indicates, it comprises 55 species of mammals and 59 species of birds. By now the importance of individual species of mammals as hosts to ixodic ticks and as carriers of the virus in the Tomsk focus is more or less fully established (E. D. Ron'zhina, M. K. Tyushnyakova, and v. v. Kryshanovskaya), whereas practically no work has been done on the role played by birds in this connection.

This is why we have set as our objective in the present paper the detetmination of the role of varbous species of wild birds as hosts to the differrnt stages of metamorphosis of the wood tick.

This tesearch was done in the Tomsk focus of tick-borne encephalitis during 1954-1955, ~~in the~~ district of the villagw of zavarzino. Birds were shot down on a year-round basis; in winter, spring, summer, and autumn. We determined the species compoaition of the birds shot, as well as the year.

We shot down 98 birds during the winter, 193 in spring, 327 in summer, and 58 in autumn. Thus, we managed to shoot down and examine a total of 767 wild birds, represinting 29 species.

The following species of birds have been established by V. M. Popov as carriers of ixodic ticks in the focus we investigated: the fieldfare (Turdus pilaris L.) and the nutcracker (Nucifraga carvocatactes L.).

Our investigations indicate that the following species of birds are tick carriers: the tree popot (Anthus trivialis L.); the fieldfare (Turdus pilaris L.); the thrush (Turdus ericetorum Tur.); the great spotted woodpecker (Dryobates major L.); the yellowhammer (Emberiza citrinella L.); the finch (Fringilla coelebs L.); the common bullfinch (Pyrrhula pyrrhula L.); the northern wood warbler (Phylloscopus borealis Blas.); the great titmouse (Parus major L.); the European starling (Sturnus vulgares L.); the jay (Garrulrs glandarius L.); and the goldfinch (Carduelis carduelis L.).

Investigation of the infestation of these species with ticks indicates that some bird species are more tick-infested that others, depending on the season. There are two parameters of tick-infestation of birds: frequency of occurrence and abundance. Frequency of occurrence is measured

by the percentage of animals on which ticks were found; abundance is the mean number of ticks found on one animal examined. It is evident that the tick infestation os birds varies from year to year. The data cited in Table. 1 bear out what we have said.

TABLE 1

Comparative data on the frequency of occurrence and abundance of ticks on wild birds in the Tomsk focus.

Name of bird	V.M. Popov's findings		Our findings	
	Frequency	Abundance	Frequency	Abundance
Nutcracker	40.0	0.5	-	-
Tree pipit	-	-	42.0	2.47
Siberian blackcapped chickadee	-	-	1.0	0.01
Fieldfare	29.5	0.37	30.0	1.53
Great spotted woodpecker	-	-	3.6	0.4
Yellowhammer	-	-	18.0	0.93
Finch	-	-	12.6	0.37
Common bullfinch	-	-	3.	0.13
European bullfinch	-	-	18.0	0.43
Northern wood warbler	-	-	8.7	0.08
Great titmouse	-	-	5.0	0.05
European starling	-	-	15.4	0.54
Thrush	-	-	46.1	1.15
Whitecapped bunting	-	-	22.2	1.22
Jay	-	-	25.0	0.37
Goldfinch	-	-	50.0	1.25

We see in Table 1 that the frequency of occurrence and the abudance of ticks are highest in the tree popot: 2.47; the fieldfare: 1.53; the thrush: 1.15; the whitecapped bunting: 1.22; and the goldfinch: 1.25.

The greater tick infestation of these species is attributable to their ecological characteristics. The life of these birds is directly linked to their living on the ground, feeding of nesting there and sometimes both together. Species of birds that build their nests in trees and feed on the wing, only rarely alighting on the ground, are not tick aarriers as a rule (the common oriole, the long-tailed titmouse, etc.).

Our findings listed in Table 1 differ somewhat from those of V.M. Popov. For example, we were unable to find any ticks on the nutcracker, whereas V.M. Popov found both frequency and abudance to be fairly high in that species. This may be due to the fact that we did not shoot down nutcrackers, by and large, in the same season of the year as was the case in V.M. Popov's research.

We shot down birds during various seasons of the year; the wood ticks in various stages of development found on them are gimen in Tables2 and 3.

Before we proceed to an analysis of the data given in the tables, we should point out that from December, 1964, to Februauy, 1955, we shot down 98 specimens of various species (20 crossbills, 21 nutcrackers, 29 Siberian chickadees, 14 great spotted woodpeckers, 13 linnets and 1 European bullfinch) without finding a single Ixodes persulaatus tick on any of them.

The ticks found on wild birds during the period March-May, 1955, are listed in Table 2. In addition to the species listed in the table, we brooght down 15 great spotted woodpeckers, 11 European starlings, 6 finches, 6 long-tailed titmece, 5 spruce crossbills, 3 whitecapped buntings, 2 white wagtails, 2 nutcrackers, and 1 jay, linnet, turtledove, cuckoo, and common bullfinch (totaling 54 specimens). We found no ticks on these species during the period from march to May, and their frequency of occurrence and

abundance varied widely on the birds that had them.

TABLE 2

Number of birds and of metamorphosis stages of the tick Ixodes Persulcatus

Parasitic on them during the months of March, April, May, 1955

Name of bird	No. shot down	No. infested with ticks			No. ticks per bird			% birds with ticks		Abundance
		L	N	A	L	N	A	N	A	
Yellowhammer	32	-	2	1	-	2	1	6.2	3.1	0.09
Fieldfare	32	-	2	-	-	2	-	6.2	-	0.06
Tree pipit	28	-	2	-	-	2	-	3.6	-	0.07
European bullfinch	17	-	2	-	-	2	-	11.8	-	0.12
Great titmouse	9	-	1	-	-	1	-	11.0	-	0.11
Siberian black-capped chickadee	7	-	1	-	-	1	-	14.3	-	0.14
Northern wood warbler	7	-	2	-	-	2	-	28.6	-	0.29
Thrush	6	-	2	-	-	5	-	33.3	-	0.83
Jay	1	-	1	-	-	1	1	100	100	2.0
Totals	139	-	15	2	-	18	2			

Note: L-larvae; N-nymphs; A-adults.

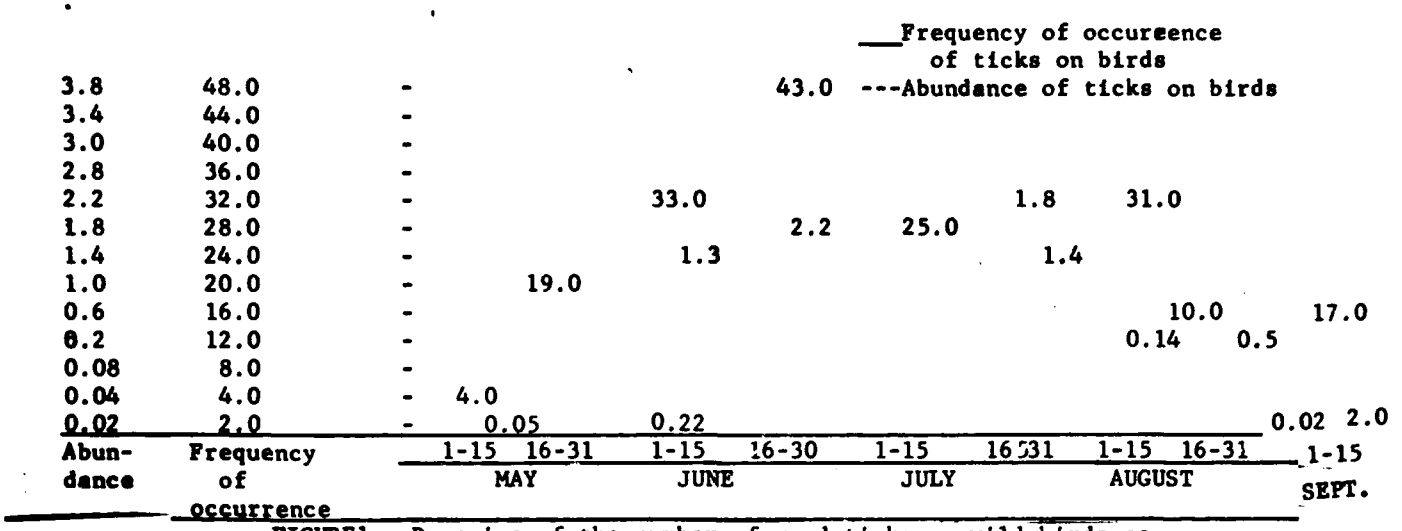

FIGURE1. Dynamics of the number of wood ticks on wild birds as a function of the season of the year.

Table 3 lists the ticks found on wild birds during the period from June to August, 1955. In addition to the birds listed in the table, we brought down 44 Siberian chickadees, 16 northern wood warblers, 14 long-tailed titmice, 9 common orioles, 9 nutcrackers, 8 great titmice, 3 robins, 2 cuckoow, 2 magpies, and 1 land rail, white wagtail, croesbill, gray hen, and a small spotted woodpecker (tetaling 99 specimens), without finding a single wood tick on any of them.

During September we took in 58 specimens, representing 9 different species of wild birds, including 14 long-tailed titmece, 12 Siberian chickadees, 8 great spotted woodpeckers, 8 common bullfinches, 5 finches, 4 thrushes, 3 great titmice, 2 jays, and 2 tree pipits. In all these species we found only one wood tick numph during thes period, on a thrush. Analysis of frequency of occurrence and of abundance of ticks on birds as a function of the time they were shot down indicates that in 1955 ticks appeared on them on May 9th. Wi subsequently observed two increases in tick frequency: during the second half of June and the second half of August. The dunamics of tick frequency on wild birds in illustrated in Figure 1.

TABLE

Number of birds and of metamorphosis stages of the tick Ixodes persulcatus parasitic on them during the months of June, July, August, 1955

Name of bird	No. shot down	No. infested with tick. L	N	A	No. ticks per bird L	N	A	% birds with ticks L	N	A	Abundance
Meadow lark	70	22	31	-	128	117	-	31.1	44.3	-	0.8
finch	28	2	4	-	2	12	-	7.0	14.0	-	0.5
Fieldfare	24	4	10	2	16	68	2	16.7	12.0	8.3	3.6
Yellowhammer	23	3	6	1	10	38	1	13.0	26.0	4.4	2.1
Siberian bullfinch	21	1	1	-	1	3	-	4.6	4.6	-	0.2
Great spotted Woodpecker	18	2	-	-	2	-	-	11.0	-	-	0.11
Whitecapped bunting	6	1	2	-	1	10	-	16.0	33.3	-	1.8
European bullfinch	10	3	3	-	6	4	-	30.0	30.0	-	1.1
Jay	5	-	1	-	-	1	-	-	20.0	-	0.2
Godfinch	4	2	2	-	2	3	-	50.0	150.0	-	1.25
Thrush	3	2	3	-	2	9	-	66.6	100.0	-	3.7
European starling	2	2	1	-	6	1	-	100.0	50.0	-	3.2
TOTALS	214	44	64	3	176	266	3				

NOTE: L-larvae; N-nymphs; A-adults.

TABLE 4

Comparative data on the proportion of satiated to hungry ticks found on wild birds (April-May, 1955).

Name of bird	No. shot down	No. birds with ticks		Larvae		Nymphs	
		L	N	hungry	Sated	Hungry	Sated
Tree pipit	28	-	2	-	-	1	1
Fieldfare	32	-	2	-	-	2	-
Thrush	6	-	2	-	-	-	5
Yellowhammer	32	-	2	-	-	2	-
European bullfinch	17	-	2	-	-	1	1
Jay	1	-	1	-	-	-	1
Great titmouse	9	-	1	-	-	1	-
Northern wood warbler	7	-	2	-	-	-	2
Siberian chickadee	7	-	1	-	-	-	1
TOTALS	139		15			7	11

The greatest rise in tick frequency during the second half of June is apparently due to the increased acyivity of the birds after the nesting period, rather than to an increase in the number of ticks. Among the arthropods we not infrequently find the phenomenon of phoresis, their utililzing vertebrates as agencies of transportation for further settlement. In this connection we determined the stage of the ticks at the instant they were removed from the birds. We made separate counts of hungry and satiated ticks. These data are given in Tables 4 and 5. The data clearly show that a large number of ticks feed on birds.

TABLE 5

Comparative dats showing the proportion of hungry and satiated ticks found on wild birds (June-August, 1955).

Name of bird	No. shot down	No. birds with ticks		Larvae		Nymphs	
		L	N	Hungry	Sated	Hungry	Sated
Tree pipit	70	22	31	72	56	67	50
Fieldfare	24	4	10	9	7	41	27
Song thrush	3	2	3	-	2	6	3
Yellowhammer	23	3	6	6	4	22	16
Whitecapped bunting	6	1	2	1	-	2	8
European bullfinch	10	3	3	4	2	3	1
Great spotted woodpecker	18	2	-	2	-	-	-
Goldfinch	4	2	2	2	-	2	-
Jay	5	-	1	-	-	1	-
Siberian bullfinch	21	1	1	1	-	1	2
Finch	28	2	4	1	1	2	10
European starling	2	2	1	2	4	1	-
TOTALS	214	44	64	102	76	148	117

SUMMARY

1. In the natural conditions of the Tomsk focus the following birds may act as carriers of various stages in the metamorphosis of the wood tick: tree pipit, Siberian chemkadee, fieldfare, thrush, great spotted woodpecker, finch, yellowhammer, whitecapped bunting, common bullfincb, European bullfingh, northern wood warbler, great titmouse, European starling, jay, and goldfinch.

2. The occurrence of ticks on wild birds depends upon the season of the year. Tick appeared on birds on May 9th in 1955. Peak frequency of occurrence and peak abundance were found in the second half of June, after which the abundance of ticks gradually declined until the first ten days of August, the frequency of occurrence dropping fairly sharply during the first half of July. At the end of that month the frequency was fount to increase, after which it again dropped off to a minimum by the first half of August.

Both parameters exhibit a second rise during the second half of August. The last ticks were found at the middle of September. According to our findings, no ticks are found on birds during the winter

3. In the Tomsk natural focus of tick-borne encephalitis birds are hosts to the larvae and nymphs of the tick.

NOTE
The following minor discrepancies appeared in the printed text from which the English translation was made:
Page 2, line 17. As calculated from later tabulations the subtotals for spring and summer are 194 and 326.
Page 4, line 31. The total of figures cited for March-May period is 55.
Page 6, Figure 1. The first two points on the broken line representing abundance of ticks on birds do not correspond to figures in the Abudance column.
Line 6. The total of figures cited for June-August period is 103.
Table 3. Meadow larks should perhaps be changed to tree pipits; cf. Table 5 and the Summary.
Table 5. The actual total of unengorged larvae is 100.