Ticks from European-Asiatic Birds Migrating through Egypt into Africa

Abstract. From 321 of 7381 birds (28 species), 504 immature European-Asiatic ticks were collected: *Ixodes frontalis, Haemaphysalis punctata, Haemaphysalis sulcata, Hyalomma* spp. (probably mostly *m. marginatum*), *Hyalomma aegyptium,* and *Hyalomma m. marginatum.* Many additional detaching ticks were eaten by the hosts. Uninfested bird species numbered 29 (998 individuals).

Permanently established populations or isolated specimens of several tick species which, in their immature stages, infest birds in Asia, Europe, and Africa have been found far from their normal geographic range, almost certainly carried there by migrating birds. Examples are the European-Asiatic *Hyalomma m. marginatum* recovered in Kenya and Sudan (*1*) and in Egypt (*2*) and the following tropical and South African species: *H. marginatum rufipes* and *H. impressum,* found in the U.S.S.R. (*1–3*); *Amblyomma variegatum,* in France (*1*); *A. hebraeum,* in Bulgaria (*1*); and *A. lepidum,* in Palestine (*4*) and in Azerbaijan (*5*).

Because of the unusual ability of ticks to transmit many varied pathogens or to harbor them for long periods, and because of the association of birds with numerous viruses and rickettsia affecting man, an effort was made between September and December of 1959 to determine the incidence and the kind of tick infestation among European-Asiatic birds migrating southward through Egypt into Africa (*6*). African ticks from birds migrating through Egypt northward to Asia and Europe have previously been reported (*2*).

Most of the birds were trapped or netted in Egyptian coastal areas between Port Said and Mersa Matruh; a few were shot near Cairo. The birds were immediately examined for ticks; uninfested ones were released. The hosts were kept alive until the ticks completed engorgement and detached. Wherever possible, immature ticks were reared to adulthood to insure correct species determination.

Of 8379 migrants examined, 7381 belonged to 28 tick-infested species (Table 1) and 998, to 29 noninfested species; 504 ticks were recovered from 321 birds. In early stages of the work, facilities to prevent the hosts from eating the detaching parasites were inadequate, and numerous ticks—probably more than the number recovered—were lost.

The 504 ticks collected were 88 *Ixodes frontalis* (17.46 percent), 84 *Haemaphysalis punctata* (16.68 percent), 2 *H. sulcata* (0.39 percent), 243 *Hyalomma* sp. (probably mostly *m. marginatum*) (48.21 percent), 11 *H. aegyptium* (2.18 percent), and 76 *H. m. marginatum* (15.08 percent).

Both the number of migrants and the rate of infestation were greatest in September. During that month, 5721 birds were examined, of which 296 (5.16 percent) were infested. In October, with an equal amount of effort, 1480 birds were collected; of these only 19 (1.28 percent) were infested. Migrants taken in November and December may have been present in Egypt for some weeks. In November, five of 174 specimens examined were infested; in December, six were examined and one bore ticks.

Egypt receives bird migrants from the north and northeast (probably more from the latter than from the former direction); this area extends from eastern Europe and the U.S.S.R. to the region east of the Caspian basin and to the coasts of Syria and Palestine (*7*). Almost 300 species enter Egypt. The 57 species taken during this study represent those most easily netted and trapped in autumn on the northern coast.

Quails, *Coturnix c. coturnix,* and willow warblers, *Phylloscopus t. trochilus,* both taken in large numbers, carried each of the tick species collected except *Haemaphysalis sulcata.* These birds, which ate many ticks that detached, were therefore much more heavily infested than recovery figures in Table 1 indicate. Host species from which ten or more ticks were recovered were *Emberiza caesia, Anthus t. trivialis, Phylloscopus t. trochilus, P. t. acredula, Sylvia c. communis, Monticola saxatilis, Oenanthe o. oenanthe, Saxicola r. rubetra, Phoenicurus p. phoenicurus, Luscinia luscinia,* and *Coturnix c. coturnix.*

Twenty-nine noninfested species of birds, represented by 998 specimens, were *Carduelis spinus* (62), *Serinus canaria serinus* (15), *Acanthus cannabina mediterranea* (16), *Emberiza c.*

Table 1. Tick-infested fall migrants, 1959.

Host species	No. examined	No. infested	Ticks (No.)						Total
			Ixodes frontalis	*Haemaphysalis*		*Hyalomma*			
				punctata	*sulcata*	*sp.*	*aegyptium*	*m. marginatum*	
Sturnus vulgaris purpurascens	6	1				1			1
Oriolus o. oriolus	102	3				2		1	3
Carduelis carduelis niediecki	11	1				1			1
Chloris chloris chlorotica	35	1				1			1
*Emberiza caesia**	3	3				28	1		29
*Emberiza hortulana**	2	2				3			3
*Anthus c. campestris**	3	3				9			9
Anthus t. trivialis	30	5		12		5	1	13	31
Motacilla flava subsp.	1	1			1				1
Lanius cristatus collurio	411	7	2			2		4	8
Muscicapa s. striata	99	8	2	1		6			9
Phylloscopus t. trochilus†	1126	95	33	2		109			144
Phylloscopus trochilus acredula	1	1	1			9			10
Phylloscopus c. collybita	1	1	1			1			2
Sylvia c. communis	227	3	14			1			15
Monticola saxatilis	2	1						10	10
Oenanthe sp.	55	2		1		2			3
Oenanthe isabellina	50	2				3			3
Oenanthe o. oenanthe	112	4		1	1	10			12
Saxicola r. rubetra	217	9	1	3		12			16
Phoenicurus p. phoenicurus	322	27	12			22		13	47
Luscinia luscinia‡	62	9	19	1				2	22
Luscinia m. megarhyncha‡		3	1	1				1	3
Merops apiaster	4	1						1	1
Coracias g. garrulus	36	1						1	1
Jynx t. torquilla	12	1				3			3
Cuculus c. canorus	20	1				1			1
Coturnix c. coturnix†	4431	125	2	62		12	9	30	115
Total	7381	321	88	84	2	243	11	76	504

* Each bird was trapped on a different day, suggesting different family groups. † These birds ate many detaching ticks. ‡ *Luscinia* spp. infested with ticks were identified as to species; those not infested were either *L. luscinia* or *L. m. megarhyncha.*

calandra (47), *Motacilla a. alba* (34), *Lanius minor* (96), *Phylloscopus* sp. (63), *Acrocephalus* sp. (39), *Hirundo r. rustica* (26), *Upupa e. epops* (39), *Alcedo a. atthis* (11), *Streptopelia t. turtur* (501), *Cursorius c. cursor* (16), and 16 other species (totaling 33 specimens), represented by one to five specimens each.

The human diseases with which *Hyalomma m. marginatum* and *Haemaphysalis punctata* have been epidemiologically or experimentally associated in the areas from which the ticks in question originate are Crimean hemorrhagic fever, Q fever, tularemia, tick typhus, and brucellosis. These species are also vectors of several pathogens causing diseases in domestic animals.

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References and Notes

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Electrophoretic Analysis of Young Alligator Serum

Abstract. Serum from 30 young alligators was examined by free boundary, starch block, and cellulose acetate strip electrophoresis. The patterns obtained showed that the alligator serum proteins differ significantly from those of other chordates in that an α-globulin is the major component. The average ratio of α-globulin to albumin in the serum is 3.4. In this respect it resembles serum of human beings with renal disease in which the α-globulin ratio to albumin ratio reaches 3.0.

Upon making an electrophoretic analysis of alligator serum for another study, we noted that the pattern (Fig. 1) was significantly different from other chordate patterns (*1*) in that the major component is not albumin but an α-globulin. Since then, we have examined the sera from over 30 individual animals, and in all cases, we have obtained patterns similar to the one shown.

Table 1. Mobility and percentage composition of alligator serum proteins as measured from ascending patterns of free-boundary electrophoresis. Mobilities are average of nine measurements showing mean deviation. Percentage composition of six individual alligators, measured by a planimeter, is given.

Component	Mobility (10^{-5} cm^2/v sec)	Relative composition (%)
Albumin	7.69 ± 0.34	13.88 ± 2.74
α_1-Globulin	5.54 ± 0.28	32.59 ± 3.19
α_2-Globulin	4.41 ± 0.24	15.27 ± 3.60
β_1-Globulin	3.58 ± 0.28	21.88 ± 3.71
β_2-Globulin	2.10 ± 0.14	11.40 ± 3.55
γ-Globulin	0.51 ± 0.11	4.93 ± 1.55

The average ratio of α-globulin to albumin in alligator serum is 3.4. In this respect it resembles serum of human beings with renal disease in which the ratio of α-globulin to albumin reaches 3.0 (*2*).

The presence of such large globulin-to-albumin ratios can be misleading in electrophoretic analysis, since it is possible to conclude, on the basis of mobilities, that a component is present in the serum which migrates ahead of the albumin, such as is observed in synovial fluid (*3*). Therefore, the following experimental results are presented in support of our conclusion that the major (33 percent) component of alligator serum behaves as an α-globulin.

The serum was obtained from young alligators (*Alligator mississipiensis*), approximately 60 cm long, by cardiac puncture. Both fresh and stored frozen sera were used in this study, and no significant differences in electrophoretic behavior were observed between them. Serum was examined by moving-boundary electrophoresis in the Perkin-Elmer model 38 apparatus, by starch block electrophoresis, and by the cellulose acetate strip method of Kohn (*4*). Prior to analysis, serum was dialyzed against several changes of sodium diethylbarbiturate buffer, *p*H 8.6, with constant stirring for 48 hours at 4°C. The ionic strength of the buffer for the moving boundary and starch electrophoresis was 0.1; that for the acetate strip method, 0.05.

The ascending patterns from the moving-boundary analysis were used for all mobility and percentage composition measurements because the ascending pattern gave better resolution between the components. A typical pattern is shown in Fig. 1; Table 1 gives the mobilities and the percentage composition of the various components. For purposes of identification the peaks were arbitrarily labeled in order of decreasing mobility as albumin, α_1, α_2, β_1, β_2, and γ-globulin. In order to study the sedimentation behavior of the leading components, fractionation was carried out by zone electrophoresis with potato starch, washed three times in distilled water and once in buffer, as the medium. One-centimeter sections were extracted with 6 ml of 1 percent sodium chloride and examined in the Spinco model E analytical ultracentrifuge at 56,100 rev/min at 25°C. The albumin fraction had one component with an $S_{20,w}$ value of 4.1 *S*. The α-globulin fraction contained a major component (90 percent) with an $S_{20,w}$ value of 16.6 *S* and a minor component, $S_{20,w}$ of 3.4 *S*. These sedimentation coefficients are similar to those reported for other serum albumins and α-globulins (*5*). The 16.6 *S* component of the α-globulin fraction could account for most of a major sedimentation component of alligator serum (13.9 *S* in serum).

The alligator albumin and α-globulin fractions also were added to rabbit serum and examined by the cellulose acetate method of Kohn (*4*), by which a relatively large separation between the albumin and globulins is obtained. It was found that alligator albumin migrated with the rabbit albumin, and the alligator α-globulin with the rabbit globulin. Further experiments were carried out with the moving-boundary apparatus in which it was found that bovine serum albumin (Armours No. 2266), when added to alligator serum, moved with the alligator albumin. Hyaluronic acid (Nutritional Biochemicals) also was added to alligator serum, because the mucin clot obtained under certain conditions indicated its possible presence (*6*). However, the added hyaluronic acid migrated ahead of the alligator albumin (mobility of 8.2×10^{-5} at *p*H 8.6).

Finally, it was found that the alligator globulin precipitates out in 30–40 percent saturated ammonium sulfate solutions while the albumin is soluble at 50 percent saturation.

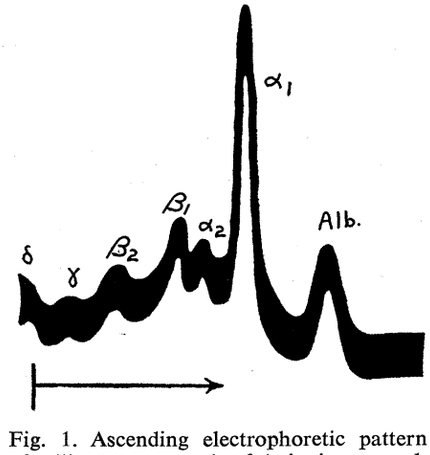

Fig. 1. Ascending electrophoretic pattern of alligator serum in 0.1 ionic strength diethylbarbiturate buffer of *p*H 8.6 after 120 minutes at 6.0 volt/cm.