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CONTRIBUTION TO THE BIOLOGY OF THE TICK ORNITHODOROS PAPILLIPES

[Following is the translation of an article by Academy member Ye. N. Pavlovskiy and A. N. Skrynnik, S. M. Kirov Military-Medical Academy, published in the Russian-language periodical Doklady Akademii Nauk SSSR (Proceedings of the Academy of Sciences USSR), Vol III, No 6, 1956, pages 1403-1405. It was received 1 Oct 1956. Translation performed by Sp/6 Charles T. Ostertag Jr.]

Ticks of the genus Ornithodoros are encountered in many places of the tropics and subtropics; many species are carriers of spirochetes -- the causative agents of tick-borne relapsing fever. The biology of O. papillipes, widely distributed in Central Asia, and several foreign species has been studied basically well. However, collections of many years standing, and in particular the lengthy preservation of live ticks in the laboratory, permitted us to establish a number of facts, unknown in world literature for some other species of this genus.

The new facts are in regard to the life duration of O. papillipes, their capability for prolonged starvation, the slowness of metamorphosis of ticks, and the prolonged preservation of spirochetes in them. We already reported about the 17-year life period of these ticks (2) and expressed the assumption that this term is not the limit. In 1956, 20 years has been fulfilled since the arrival in our laboratory of several groups of ticks. Individual species are still alive though the conditions of their maintenance were far from always being favorable.

Group 35 -- Pamir, Shakh-Dar River, 1936, collection of G. Ya. Zmeyer. For verifying the natural infection state with spirochetes, the ticks were nourished on a guinea pig on 19 Jan 1937. All told there were 46 ticks and 44 of them sucked on the pig; the pig fell ill with spirochetosis. During a subsequent feeding on 15 Mar 1940 there were 40 ticks: 5 males, 4 females, and 31 nymphs. All of them became engorged, and the pig remained healthy.

Subsequently the ticks were left for experiments with starvation. After 10 years, on 15 Mar 1950, 5 nymphs remained alive; of these, 2 were left for further starvation and 3 were planted on a pig. Two nymphs engorged themselves and the third didn't attach and soon died. The engorged nymphs soon molted, one into a female and the other into a nymph again. In March 1954, after four years of a repeated starvation, the ticks were fed, and the female and the nymph engorged themselves. In Jan 1955 the nymph

died, after it had lived in the laboratory for more than 18 years, and yet from the day it was captured it still hadn't transformed into an adult tick (in the laboratory it had fed four times). The second tick, now a female, is living at the present time, that is, for 20 years.

Out of the 2 nymphs which were left for further starvation, one died in the fall of 1951 and the second was fed on 9 Apr 1951, 11 years and 25 days after its previous feeding. The nymph attached to the guinea pig almost immediately, and in 34 minutes was well engorged. In the second half of 1951, in the sixteenth year of life in the laboratory, the nymph molted into a female. In February 1955 the female was fed on a white mouse. Following a check of the ticks on 23 Apr 1956 the female was alive, and when placed in light moved well, but on the next day it died.

Thus, from the observations of only one group the following conclusions can be made:

1. The earlier established duration of a tick's life span is confirmed. Under laboratory conditions it was followed up to 20 years. Out of the group which in 1936 consisted of 46 ticks, 2 lived up to 1956.

2. A record term of starvation was observed. One tick fed only four times during 20 years of life in the laboratory: in 1937, 1940, 1951, and 1955, that is, with intervals between feedings of 3, 11, and 4 years.

3. The unusually slow development of ticks under conditions of starvation was established. One tick remained a nymph for a period of 18 years of life in the laboratory, while under favorable conditions all the development from the egg to imago takes place in less than a year.

Group 45 -- Pamir. Khorog, Khleva, 1937, collection of I. A. Moskvina. Here an even lengthier period for the nymph phase was observed. Feeding of these ticks in the laboratory showed:

On 15 Feb 1938 all 210 ticks were engorged; the guinea pig fell ill with spirochetosis.

On 5 Aug 1940, 187 ticks became engorged (8 males, 10 females, 169 nymphs), 2 ticks did not suck, and the remainder died. The pig was infected.

On 18 Nov 1948, 4 nymphs became engorged, the remaining ticks died. The pig remained healthy.

On 19 Mar 1954, 2 nymphs were engorged, the remaining 2 ticks died.

After this feeding the nymphs molted, one into a female, the other --again into a nymph. At the present time both ticks are alive; in 19 years of life in the laboratory they have fed four times with intervals of 2, 8, and 5 years. From 1937 up until 1956, out of 210 ticks 2 have lived, one of which is in the nymph phase just as 19 years ago.

A 20-year life span for O. papillipes was also observed in other groups.

Group 37 -- Kishlak Bigma, cattle yard, 1936. Initially there were 12 ticks in the group, at the present time one female is living. Over the 20 years of living in the laboratory the ticks fed 11 times (1936, 1938, 1940, 1943, 1946, 1948, 1950, 1951, 1953, 1954, 1955); the longest interval between feedings was 3 years.

Group 17 -- Pamir, Langar, Vakhan, barn in the left (?) kishlak, 21 August 1936, collection of G. Ya. Zmerveva. There were 168 ticks in the group, after 20 years 1 male remained alive. The ticks fed 12 times (1937, 1940, 1941, 1943, 1946, 1948, 1949, 1951, 1952, 1953, 1954, 1955); the greatest interval between feedings was three years.

Group 12 -- Pamir, Vakhan, Langarskaya outpost, old barn, 24 Aug 1936. The group consisted of 110 ticks, O. papillipes and O. lahorensis; after 20 years 1 female O. lahorensis was alive; it fed seven times (1937, 1940, 1941, 1943, 1948, 1953, 1955). Consequently, O. lahorensis may also live very long.

Table 1 presents data concerning the oldest O. papillipes ticks in laboratories.

Table 1

Year of collection or uncovering of ticks	Number of live ticks in 1956	of these		
		Male	Female	Nymph
1936	4	1	3	0
1937	41	30	10	1
1939	84	57	20	7
1940	210	89	110	11

It is remarkable that with such a long life, some of the O. papillipes still did not reach maturity.

Reproduction of ticks was observed in the laboratory in the 17th, 18th, and 20th year of life.

Recently in literature, confirmations have appeared that full grown ticks cannot preserve spirochetes long and with the course of time lose the infecting ability (1, 3). A negative result following the feeding of naturally infected ticks was also observed by us repeatedly. But the ticks feed rarely, an average of once a year, and with each subsequent feeding the number of ticks decreases, since some of the ticks die. Therefore, it is completely probable that a negative result is caused by the death of the infected ticks and those that have not lost the infecting capability.

We could present a number of facts testifying to the fact that full

grown ticks infected experimental animals repeatedly. We will limit ourselves to one example.

Group 108 -- Tadzhikistan, Kishlak Gishun, Construction, 18 Sep 1937, G. Ya. Zmeyerova. Following the feeding of ticks in 1938, 1940 and 1944, the pigs remained healthy; on 25 Sep 1946, 15 ticks (9 males, 2 females and 4 nymphs) fed on an infected pig; all 15 ticks sucked. Subsequently the ticks fed on healthy pigs:

29/X/48 -- 8 males and 4 females fed -- pig was infected
29/VI/50 -- 5 males and 3 females fed -- pig was infected
29/VIII/51 - 1 male fed -- pig was infected
23/IV/53 -- 2 males fed -- result negative
30/IX/54 -- 1 male fed -- pig was infected
27/IV/56 -- 1 male fed -- result negative

Here, full grown ticks infected guinea pigs four times in the course of six years.

The most important epidemiological factor is the overall longevity of preservation of spirochetes in the ticks, independent of the phase of metamorphosis of the latter. Such a longevity was traced by us up to 15 years. We will present one example. Group 7 -- 1939. O. papillipes ticks were hatched in the laboratory in 1939 from infected ticks collected in Kara-Kalpakiya, and received the spirochete by the transovarian route. All told, 356 larvae were nourished; at the present time only 5 live ticks remain from this group. They are all males. Over a 17 year period of living in the laboratory, these ticks fed 10 times; only during the first feeding, when they were larvae, and the last one in April 1956, when 5 males fed -- these ticks failed to infect the test animals. Following the remaining eight feedings in the period between 1940 and 1954, the ticks caused spirochaetosis of guinea pigs. Consequently, ticks from the progeny of females infected in 1939 still in 1954 preserved the infecting capability.

All that has been said above gives a foundation to consider the Ornithodoros ticks as the main reservoir of tick-borne relapsing fever in nature.

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