TRANSLATION 122 (T122)

DEPARTMENT OF MEDICAL ZOOLOGY
UNITED STATES
NAVAL MEDICAL RESEARCH UNIT NO. 3
c/o AMERICAN EMBASSY
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TRANSLATION FROM RUSSIAN. FILIPPOVA, N. A. (1962). Distribution and specificity of the life cycle of the tick Argas hermanni Aud., 1827 (Ixodoidea, Argasidae) in Turkmenia. Zool. Inst. Akad. Nauk USSR Leningrad, 41(10):1575-1578.

Many species of the Family Argasidae, including the genus Argas Latr., transmit spirochetes of borreliosis and agents of certain other diseases. In connection with the fact that every strain of spirochetes is adapted to a specific species of ticks, and possibly, also to a subspecies or variety, the diagnosis of these taxonomic units, and their distribution, specific life cycle, and ecology are of major importance.

The bird tick Argas hermanni Aud., 1827 was not distinguished from A. reflexus Fabr., 1794 in our literature until recently. At the present time it is established that A. hermanni is widely distributed abroad (Hoogstraal and Kohls, 1960; Theodor and Costa, 1960). According to our data, this species is encountered in the Soviet Union in Crimea, Caucasus, Kazakhstan, Turkmenia, and Tadzhikistan, and is represented by several ecologico-geographical varieties (Filippova, 1961, 1961a).

In Turkmenia there are two varieties of the tick species in question - A. hermanni vulgaris Fil., 1961 and A. hermanni latus Fil., 1961. A. hermanni latus was found on the western slope of Kugitang-Tau, one of the spurs of the Hissar ridge, in the vicinity of the Svintsovy Rudnik Settlement. These ticks were taken from recesses in cliffs where there were many traces of bird habitation. A. hermanni vulgaris, an abundant parasite of birds, is widely distributed in Turkmenia. In our collections, this species is known from the foothills of the western (environs of Kara-Kala) and central (environs of Ashkhabad) Kopet-Dag, and also from foothill elevations of the Paropamiz - Badkhyz system (Kyzyl-Dzhar Pass) and Karabil (environs of Takhta-Bazar on the right bank of the Murgab river and Kadzhar well).

In the environs of Kara-Kala, this tick species was found in bird nests in sandstone. In the suburbs of Ashkhabad, this species inhabits bird nests in the walls of inspection wells of the kyariz system. In the

Kyzyl-Dzhar area, ticks were collected from cracks in walls of a small artificial cave cut in sandstone. In this cave there was also an inhabited nest of a large predatory bird. In the environs of Takhta-Bazar and in the more elevated part of Kabil, in the area of kolodets Kadzhar, A. hermanni vulgaris was also found in bird nests constructed in the loess cliffs. Here there were numerous nests of sparrows, and jackdaws, kestrels and vultures nested in the upper formation of the cliffs. Apparently any species of bird that lives in or visits nests in the soil may serve as potential hosts of this variety of ticks.

The ticks concentrate in cracks in walls or in the nest chamber or passages, and under the peeling outer layers of the stratum near the nest, or sometimes withdraw a few centimeters from it. When the birds are in the nests, the ticks crawl out of the cracks and suck blood. Judging from laboratory observations, nymphs and adults reach complete engorgement at temperatures between 20 to 22°C at a rate of from 20 minutes to 1 hour. A nest inhabited by ticks may be recognized at once by spots of excrement around the nest and near the cracks. Pelts of immature stages are frequently found outside the cracks but the adult ticks remain deep inside the crack. It is rather easy to collect these ticks. A layer of stratum is lifted with a small crowbar and the ticks are carefully removed from the inner side with forceps. With the aid of a small crowbar or a sharp knife, the cracks inside the tunnels are widened and the ticks are carefully removed. The larvae feed for a few days on birds, and remain attached for this period. The ticks may be also obtained by catching or shooting birds as for ixodid ticks.

The developmental cycle of species of the genus Argas includes the egg and three active stages - larval, nymphal, and adult. The nymphal stages may be represented by I to IV instars but more frequently by II or III instars that are separated from each other by molting. It was demonstrated, for example, that in A. persicus Oken, 1818, depending on the amount of blood imbibed and on temperature conditions, males may appear at one of three times during the developmental cycle - after molting of I instar nymph (rarely), after molting of II instar nymph (generally), or after molting of III instar nymph (rarely), and the females four times, i. e. after molting of every one of the I - IV nymphal instars, although most frequently the females molt after II or III nymphal instar (Balashov, 1962). In regard to A. reflexus, there are data that this species passes one or two nymphal instars (Skrynnik, 1960) when maintained at a temperature of 26°C; according to other authors (Galuso, 1953, Matikashvili, 1955), A. reflexus develops in three nymphal instars. In trying to separate two independent species in the former A. reflexus complex (Filippova, 1961a) there is no positive proof that all these data concern A. reflexus s. str. There are no literature data on the number of nymphal instars in the life cycle of A. hermanni.

In the laboratory, at temperatures from 26 to 28°C, and with normal feeding in all of numerous cultures of A. hermanni vulgaris bred from parents from different localities - Crimea, Kazakhstan, Turkmenia, and Tadshikistan - females and males appeared in different relationships after II and III nymphal instars. In only one case one nymph in the IV instar was obtained in a culture that originated from a Crimean population. In order to determine the number of nymphal instars in the life cycle of A. hermanni vulgaris in natural conditions, morphological peculiarities were demonstrated; these permit us to differentiate females and males that had passed a different number of nymphal instars. With this aim, many morphological structures of females and males that were bred in the laboratory from II and III instar nymphs were investigated. The most stable differences proved to be in the sensory setae on the ventral side of tarsi on legs I and II (Table 1).

The number of paired ventral setae on the tarsi of legs I and II in nymphs in instar III is always less than in adults that had passed three nymphal instars, and was identical to those of females and males that molted after two nymphal instars. Analogous to this, we consider adult ticks from nature that have the number of ventral setae on tarsi I and II identical to those in nymphs in the II instar, to have passed only one nymphal instar. Other morphological structures, by which nymphal instars are easily distinguished from each other, could not, in the present case, be applied to diagnosis of the age of females and males owing to considerable variability and overlapping of characters, which exceed admissible limits.

Based on the properties shown in Table 1, 265 adult specimens of A. hermanni vulgaris from four populations in our collection were investigated. In tables 2 and 3, the percentage correlation of individuals of each sex that had passed different number of nymphal instars is shown. The populations of ticks are conditionally designated by names of the nearest inhabited localities - Ashkhabad, Takhta-Bazar, gorges in Badkhyz - Kyzyl-Dzhar, and the Kadzhar well in Karabil.

In the population from the environs of Takhta-Bazar there were single ticks (males) with criteria of a II instar nymph, i. e. one that had passed a single nymphal instar. Sometimes we found ticks that had less than the number of setae that there should have been during development of two nymphal instars; these ticks were entered into the column as: "females (males) with criteria insufficient for development with two nymphal instars." Apparently this is one of the setal variations during development with two nymphal instars. Rather frequently,

an unequal number of setae was observed on the left side and the right side; these are employed for diagnesis, i. e. on the tarsi on one side the number of setae was like that of development in two nymphal instars, and on the tarsi on the other side, as during development in three nymphal instars. Suck ticks were entered in the column in the table as: "females (males) with mixed criteria of development with three nymphal instars.

As may be seen from the data in tables 2 and 3, adult ticks that have passed two nymphal instars predominate in natural populations. This is particularly true of males: in three populations (from the environs of Ashkhabad, Takhta-Bazar, and Kyzyl-Dzhar Pass), 84 (93%) had molted from II instar nymphs and only 6 (7%) individuals from III instar nymphs. Among the males from Kadzhar, approximately an equal number of individuals had passed two and three nymphal instars, 52 and 48% respectively. In populations from the environs of Takhta-Bazar, 4% was composed of males that had molted after one nymphal instar, and 6% was composed of males with mixed properties of development with one or two nymphal instars. In populations from the environs of Ashkhabad, only 3% of males had mixed properties of development with two and three nymphal instars.

Among females individuals that had passed two nymphal instars also predominate but the percentage in the population is lower than among males, while the percentage of individuals that had passed three nymphal instars is higher than in males. In three populations (environs of Ashkhabad, Takhta-Bazar, and Kyzyl-Dzar Pass), 62 (67%) of females had passed two nymphal instars in their developmental cycle, and in populations from the environs of Ashkhabad, Takhta-Bazar, and Kadzhar, 31 (39%) of females had three nymphal instars in their development cycle. In population of females from Kadzhar that had developed with two nymphal instars, there were fewer (50%)*, and females that had passed three nymphal instars, more (39%)*, than in the remaining populations. The small number of females in the population from Kyzyl-Dzhar that had three nymphal instars in their cycle (7%), may be explained by the increased number of individuals with mixed developmental criteria of 2 or 3 nymphal instars, some of which may include those that had passed three nymphal instars.

In contrast to males, no females were encountered with criteria of the second nymphal instar, i. e. which had only one nymphal instar

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* sic (H.H.).

in the cycle. Individuals with mixed criteria of two or three nymphal instars are encountered more frequently among females than males, and are present in all investigated populations. Among ticks from the environs of Takhta-Bazar, only 2% of females had diagnostic setae insufficient for two nymphal instars.

Among the immature ticks collected, the number of males and females was approximately equal. In nature, 70% developed with two nymphal instars and 23% with three nymphal instars. The others were males that had passed only one nymphal instar and representatives of both sexes with mixed criteria of two or three nymphal instars or with an insufficient number of diagnostic setae for two nymphal instars. Among ticks which had terminated the cycle with two nymphal instars, 55% were males and 45% were females.

The data pertaining to the number of nymphal instars in the life cycle of A. hermanni vulgaris in natural conditions correspond to those of this subspecies in the laboratory. While rearing the three groups of A. hermanni vulgaris which originated from Tadzhikistan parents in incubators with temperatures from 26 to 28°C, no less than 70% were females. Such similarity of field and laboratory data indicate that the development of A. hermanni vulgaris in the investigated Turkmenian and Tadzhik populations proceeds chiefly with two nymphal instars.

The investigated ticks were collected by the authors in Turkmenia and Tadzhikistan in 1958, 1959, and 1961.

Summary (Original in English).

The ticks Argas hermanni Aud., 1827 are widely distributed in Turkmenia and represented by two varieties: A. hermanni vulgaris Fil., 1961, and A. hermanni latus Fil., 1961. A. hermanni vulgaris is an abundant parasite of birds dwelling in soil nests. The life cycle of the ticks proceeds in different earth cracks near the nest chamber and tunnels. Generally the ticks in Turkmenian populations develop with two nymphal stages. The percentage of the females developing with three nymphal stages is higher than in males. Single males molt after one nymphal stage.

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Table 1.

Criteria for establishing the number of nymphal instars in the developmental cycle of *A. hermanni vulgaris*.

Criteria	Sex and age			
	Female from second instar nymph	Male from second instar nymph	Female from third instar nymph	Male from third instar
Number of ventral pairs of setae on tarsus I.....	4, exceptionally 5	4, exceptionally 5	5 or 6	5 or 6
Number of ventral pairs of setae on tarsus II.....	3, exceptionally 4	3	4 or 5	4 or 6

Table 2.

Percentage of correlation of A. hermanni vulgaris females with different number of nymphal instars in the developmental cycle in four Turkmenian populations.

Age	Population			
	Ashkhabad	Takhta-Bazar	Kyzyl-Dzhar	Kaakhar
Females molted from first instar nymphs.....	0	0	0	0
Females molted from second instar nymphs.....	64	62	67	50
Females molted from third instar nymphs.....	31	32	7	30
Females with mixed criteria of development with two-three nymphal instars.....	5	4	26	11
Females with criteria insufficient for development, with two nymphal instars.....	0	2	0	0

Table 3.

Percentage of correlation of A. hermanni vulgaris males with different number of nymphal instars in the developmental cycle in four Turkmenian populations.

Age	Population			
	Ashkhabad	Takhta-Bazar	Kyzyl-Dzhar	Kadzhar
Males molted from first instar nymphs..	0	4	0	0
Males molted from second instar nymphs.....	91	84	93	52
Males molted from third instar nymphs.....	6	6	7	48
Males with mixed criteria of development with two-three nymphal instars....	3	0	0	0
Males with criteria insufficient for development, with two nymphal instars..	0	6	0	0