

University of Florida Book of Insect Records

Chapter 31 *Largest Blood Meal*

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The methods used to determine the size of blood meals are varied and controversial, and published data on largest blood meal is scarce. One source stated that the tick Hyalomma asiaticum takes a blood meal with a volume exceeding 8.00-ml. However, there are no publications stating that this is the largest blood meal taken by an arthropod species.

Knowing the amount of blood taken in by a particular vector is important epidemiologically. It is known that many pathogens are found inside red blood cells and therefore enter a vector during blood meals. Species that accrue more red blood cells during individual feedings could increase their chances of becoming infected with pathogens (Rechav et al. 1994). Finding the species that takes the largest blood meal is a very complicated matter, especially among ticks. Ticks concentrate blood meals by excreting waste products and lymph back into the host animal through the salivary glands while still feeding on the animal. This can make accurate determination of amount of blood meal very difficult. (Sauer et al. 1995).

Methods

Professors and graduate students were asked to propose candidates, these candidates were then researched using library search services and materials suggested by professors.

Results

All nominations centered on one group of arthropods: ticks, of the genus *Amblyomma*. Several species from this genus were suggested to

have the largest blood meal—namely, *Amblyomma variegatum*, *A. tuberculatum*, *A. hebraeum*, and *A. maculatum*. These species have been studied in detail for their ability to transmit diseases, and persons queried usually had a favorite for the largest blood meal. The consensus was that *Amblyomma variegatum* took the largest blood meal. Professors suggested that this tick could take in as much as 3 ml at one feeding, however no one could provide documentation. Dr. Sekouba Bengaly (personal communication) suggested that between *A. variegatum* and *A. hebraeum*, the former produced the largest egg mass after engorgement. Yet, there was no documentation of a correlation between the size of a blood meal and the size of the egg mass. While researching the *Amblyomma spp.*, another candidate was found. Sauer et al. (1995) stated that *Hyalomma asiaticum* females can take extremely large blood meals.

Eventually I located studies comparing plasma volumes, average blood volume imbibed, and blood volume equivalents. Of the ticks compared, discussions centered on only three candidates, *A. americanum*, *A. maculatum*, and *A. hebraeum*. *A. americanum* from one study had a blood volume equivalent of 0.806-ml (Koch & Sauer 1984) and in another study its average blood volume was 0.740-ml (Sauer & Hair 1972). *A. maculatum* on the other hand showed a blood volume equivalent of 2.344-ml (Koch & Sauer 1984). In a more recent study, *A. hebraeum* had a plasma volume of 1.780-ml (Rechav et al. 1994). There was no research suggesting an average blood meal amount for ei-

ther *A. variegatum* or *A. tuberculatum*. Sonenshine (1991) reported that Balashov (1972) found *Hyalomma asiaticum* to take a blood volume equivalent of 8.856-ml.

Discussion

I could not find one source, primary literature or otherwise, that stated which tick took the largest blood meal; however, many studies dealt with the amount of blood taken by certain tick vectors. The primary method of determining the volume of blood ingested is by weighing pre-fed ticks and then weighing the same ticks after a blood meal (Rechav et al. 1994). This method is not very accurate because ticks not only ingest blood, but they also take in some non-blood tissue. They also inject waste materials into the host as they are feeding (Koch & Sauer 1984). Difficulties arise when trying to determine the rates at which different species ingest non-blood tissue or the rate at which waste is injected by individual species. Another method of blood volume determination is a colorimetric analysis, in which ticks are homogenized and a hematin compound added to the homogenization. The hematin binds to all red blood cells and the remaining hematin is washed away. Spectrophotometric analysis compares the solution to known amounts of the hematin compound to give an estimate of the total number of red blood cells present in the homogenization. This method is also very controversial, due to physiological differences among tick species; such as, varying rates of metabolism. Some species may start breaking down blood cells more quickly than others, even before removal from the host. A final method described is the use of different isotopes as blood markers in order to determine the degree of concentration of red blood cells by certain tick species (Rechav et al. 1994).

There are many tick species not mentioned, primarily because they were too small for consideration. Of course there may be more Ixodid ticks, such as *A. variegatum* and *A.*

tuberculatum, on which no published data is recorded. This does not suggest that other ticks do not potentially take the “largest blood meal”; these ticks have just not been studied in this respect.

Among the candidates that I investigated, the literature suggests that *Hyalomma asiaticum* had the largest blood meal followed by *Amblyomma maculatum*. However, “due to varied analytical methods” the comparability of the determined blood volumes is questionable. Even though these studies were not all done using the same analysis, the difference in methods could not feasibly cause a discrepancy of 6.6ml between the winner and the runner-up. This large of a difference between first and second place, suggests that *H. asiaticum* is the winner of the title “largest blood meal”.

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