Hard-bodied ticks of the Western United States. Parts II and III

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HARD-BODIED TICKS
OF THE WESTERN UNITED STATES

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HARD-BODIED TICKS OF THE WESTERN UNITED STATES1

Parts II and III

PICTORIAL KEYS FOR THE SEPARATION OF GENERA IN NYMPHAL AND LARVAL STAGES

by

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and

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INTRODUCTION

Part I, published as a separate study (Brinton & Beck, 1963), was concerned with the identification of adult hard-bodied ticks to the generic level. Parts II and III conclude the pictorial keys composed for the taxonomic separation of the several ixodid genera found in the Western United States. With keys prepared for the classification of immature ticks and adults of all genera, the next logical step is the application of the same approach to the species of all genera. These additional studies will comprise the publication of subsequent parts of the overall study of the hard-bodied ticks of the Western United States.

We feel that illustrated keys of this type will be a valuable aid to workers concerned with the identification of ticks, especially at the larval and nymphal stages of development.

METHODS

In preparing both larvae and nymphs to be observed microscopically, procedures must be used which will result in clear anatomical detail and a minimum of distortion. We found the following clearing and mounting procedure best among several which were tried.

Specimens were removed from the preservative, 70 percent ethyl alcohol, and placed in Nesbitt’s solution where they were allowed to remain at room temperature. An hourly check on clearing was advisable. An additional period of not more than three hours was allowed beyond the time when the specimen first appeared to be cleared. Overcleaning is undesirable as this inhibits extension of the legs. It was not always necessary to puncture engorged specimens for some readily cleared without puncturing.

Best results in mounting the specimens on microslides were obtained by taking them directly from Nesbitt’s solution and placing them in a drop of Hoyer’s medium previously applied to the slide. Before the cover slip was applied, specimens were oriented in the medium to a desired position. This facilitated later observation under high power magnification. The mounted specimen was warmed over an alcohol lamp at brief intervals until the legs had been uniformly extended by the warmed medium. The prepared slide was then placed in a warming oven for 48 hours at a temperature of about 50°C. This caused further clearing and solidification of the mounting medium.

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If at the end of 12 to 24 hours the legs had contracted from the extended position, rewarming over a flame usually caused them to extend again. Mounted slide specimens were ringed with Zut slide ringing compound.

Live specimens which had been immediately placed in preservative (70 percent ethyl alcohol) cleared much faster than dead specimens which had been removed from the host body. Laboratory-reared specimens should be allowed three to five days after hatching before they are placed in the preservative. This waiting period permits sclerotization of the integument to take place.

Toward the end of our study, we began preserving our ticks in Oudemans' fluid. This preservative has definite advantages over 70 percent ethyl alcohol, in that the specimens die with their legs fully extended. In addition, glycerol which is in the fluid will prevent complete dessication of the specimen should the alcohol evaporate. Our preparation of Oudemans' fluid is as follows:

\[
\begin{align*}
70\% \text{ ethyl alcohol} & \quad 87 \text{ parts} \\
\text{Glycerin} & \quad 5 \text{ parts} \\
\text{Glacial acetic acid} & \quad 8 \text{ parts}
\end{align*}
\]

It is our suggestion that all laboratory specimens be preserved in the above fluid, and the same be applied to field collected specimens when possible.

Drawings of the immature stages were made from slide specimens selected from series of slides examined with the use of a Zeiss phase-contrast microscope. Selected specimens were then placed on a Leitz microslide projector, and the body outline was reproduced on Quadrille paper ruled ten squares to the inch. A penciled general outline of the specimen showing general anatomical arrangement was sketched on the Quadrille paper. Dorsal and ventral aspects were drawn. Details of anatomical and morphological structure were obtained and added to the sketch, by careful examination of each selected specimen with the use of the phase-contrast microscope. Final drawings were accomplished by comparing the semi-completed sketch with unmouted specimens observed with a Leitz stereomicroscope at magnifications of 120-216 diameters. Best illumination for the latter was obtained by use of two A.O. Universal Illuminators located about four inches from the specimens. This final comparative examination is important. In making drawings of the specimen compressed by the cover slip some distortion may be expected.

Workers using our pictorial keys will be dealing with both mounted and unmounted specimens. Initially we used Polyvinyl alcohol (PVA) as a mounting medium. Several disadvantages were found in using it. The follow-

ing are some examples. When mounted specimens are flamed over the alcohol lamp, they often become distorted due to swelling. This is especially true for the intersegmental membrane between the coxa and trochanter. Specimens which had been mounted for a period of about three to four weeks were found to be distorted due to excessive flattening caused by contraction of the PVA under the cover slip. We are also of the opinion that PVA reduces the clarity as observed by the phase-contrast microscope.

Palp article two in all stages of development in *Haemaphysalis* of the new world species has a distinct lateral angular projection. While this character is common to all known new world species—i.e., *H. leporis-palustris* (Packard), *H. chordelis* (Packard) and *H. juxtakochi* Cooley (Kohls, 1960)—it is not common to all old world and Asian species. The drawings made for this study were *H. leporis-palustris*.

The posterior scutal margin of the different stages of development for *Dermacentor* in the Western United States are generally constant with only slight variation. The genus *Ixodes* in the Western United States shows a distinct variation of the posterior scutal margin in all stages of development.

Chaetotaxy was not used to characterize the several genera of ixodid ticks studied for the Western U.S. For example, the pattern of arrangement in *Dermacentor*, *Arocetor*, and *Rhipecephalus* was markedly similar. In *Haemaphysalis* and *Ixodes* however there was an obvious difference in the pattern of arrangement.

Sufficient observation of the setal organization was not made with the nymphs of several genera used in this study to allow generalizations to be made about the patterns of arrangement. The same approach was taken with respect to the adults. The reason that setal examination was not thoroughly investigated and used extensively is that other more obvious characteristics were found that could be used for generic separation. Although we have made relatively limited use of setae in this study, we nevertheless use the same terminology established by Gleshinskaya-Babenko (1949) as adapted by Clifford and Anastas (1960).

The only integumentary sense organs included in this study were the sensilla sagittiformia located posterior to each coxal plate and a dorso-lateral pair on the opisthosoma in the larvae (Schultz, 1942, Dimirk and Zumpt, 1949). See couplet 2 in the key for the identification of the larvae. Also see Figures 33, 35, 37, and 39. The nymphal (and adult) specimens of *A. nitens* were densely hirsute on the idiosoma. Hirsuteness was considered as sparse in the other genera. See Figures 27, 28, and 29, 30.
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PICTORIAL KEY FOR SEPARATION OF NYMPHS

1. Eyes present .................................................. 2

Eyes absent ...................................................... 4

2. Goblet cells very large, usually three to four in number.
Seven festoons present ........................................ Anocentor
See Figures 27 and 28 for dorsal and ventral views of nymph.
Goblet cells small to moderate, more than four in number. Eleven festoons present 3.

3. Postanal groove distinct. Palp article I not visible dorsally, small and angular ventrally. Rhipicephalus
See Figures 29 and 30 for dorsal and ventral views of nymph.

Postanal groove indistinct. Palp article I inconspicuous dorsally, not small and angular ventrally. Dermacentor
See Figures 25 and 26 for dorsal and ventral views of nymph.
4. Palp article II laterally triangular. Postanal groove conspicuous and posterior to anus

\[ \text{Haemaphysalis} \]

See Figures 23 and 24 for dorsal and ventral views of nymph.

-PALP ARTICLE II
-POSTANAL GROOVE

Palp article II not laterally triangular. Preanal groove extending anterior to anus

\[ \text{Ixodes} \]

See Figures 21 and 22 for dorsal and ventral views of nymph.

-PALP ARTICLE II
-PREANAL GROOVE
PICTORIAL KEY FOR
SEPARATION OF LARVAE

1. Eyes present.......................................................... 2

   Eyes absent ........................................................................ 4

2. Four pairs of marginal dorsal setae anterior to sensilla sagittiformia. Apex of palps narrowly rounded, tending to be somewhat acute. *Rhipicephalus*
   See Figures 39 and 40 for dorsal and ventral views of larva.
Three pairs of marginal dorsal setae anterior to sensilla sagittiformia. Apex of palps not narrowly rounded, tending to be evenly rounded

3. Basis capitulum laterally angulate or moderately rounded. *Dermacentor*
See Figures 35 and 36 for dorsal and ventral views of larva.
Basis capitulum laterally truncate (square) .......... Anocentor
See Figures 37 and 38 for dorsal and ventral views of larva.

4. Sensilla sagittiformia present. Palp article II laterally triangulate
.......................................................... Haemaphysalis
See Figures 33 and 34 for dorsal and ventral views of larva.

Sensilla sagittiformia absent. Palp article II not laterally triangulate Ixodes
See Figures 31 and 32 for dorsal and ventral views of larva.
Fig. 22.—Ventral view nymphal *Ixodes*

Fig. 21.—Dorsal view nymphal *Ixodes*.
Fig. 23.—Dorsal view of nymphal *Haemaphysalis*

Fig. 24.—Ventral view nymphal *Haemaphysalis*
Fig. 25.—Dorsal view of nymphal *Dermacentor*

Fig. 26.—Ventral view of nymphal *Dermacentor*
Fig. 27.—Dorsal view of nymphal Anocentor

Fig. 28.—Ventral view of nymphal Anocentor
Fig. 29.—Dorsal view of nymphal *Rhipicephalus*

Fig. 30.—Ventral view of nymphal *Rhipicephalus*
Fig. 31.—Dorsal view of larval *Ixodes*

Fig. 32.—Ventral view of larval *Ixodes*
Fig. 33.—Dorsal view of larval *Haemaphysalis*

Fig. 34.—Ventral view of larval *Haemaphysalis*
Fig. 35.—Dorsal view of larval Dermacentor

Fig. 36.—Ventral view of larval Dermacentor
Fig. 37.—Dorsal view of larval Anocentor

Fig. 38.—Ventral view of larval Anocentor
Fig. 39.—Dorsal view of larval *Rhipicephalus*

Fig. 40.—Ventral view of larval *Rhipicephalus*
SELECTED REFERENCES


Kohls, G. M., 1960 Records and new synonymy of new world Haemaphysalis ticks, with descriptions of the nymph and larva of H. juxtakochi Cooley.


Mokatcheva, E. A. 1948 To the question of morphology of the larvae and nymphs of the tick Dermacentor marginatus (Sulz.). (In Russian.) Trudy Belorussev Cel’Khoz. Inst. 13(2):162-168.


