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THE IDENTIFICATION OF LARVAE OF THE GENUS ARGAS (ACARINA : ARGASIDAE)

BY

Daniel E. Sonenshine 1, Carleton M. Clifford 2 and Glen M. Kohls 2.

Until recently, specific identification of larval ticks has been hindered because systematic studies on this developmental stage have been limited. In the past few years several detailed studies dealing with immature ixodid ticks have been published. Some of these investigations involved a search for new diagnostic features, such as chaetotaxy as discussed by Clifford et al. (1961). Several studies have also been made that consider features for identifying larval argasid ticks. Dumbleton (1958) dealt with a small number of bat infesting species of the genus Ornithodoros. Hoogstraal (1955, 1956, 1957, 1958), Hoogstraal and Kohls (1960 a, 1960 b), Kohls and Hoogstraal (1960, 1961) and Kohls, Hoogstraal and Clifford (1961) give information regarding the larvae of several species of the genus Argas. However, none of the above studies includes a comprehensive analysis of the various features that could be used for identifying argasid larvae.

The present study was undertaken to determine if chaetotaxy, in conjunction with other features, would be useful in identification of larvae of the genus Argas. The larvae of 12 species, about half the total number of known species in this genus, were available for study. The results obtained show that chaetotaxy in conjunction with other features, affords useful diagnostic characters for subgeneric and specific recognition and a key is provided to demonstrate their practical use. Figures of all the various species except Argas pusillus are provided to aid in using the key.

Similar studies on identification of species of Ornithodoros larvae are in progress.

1. Department of Biology, University of Akron, Akron, Ohio. Present address: Biology Department, The Norfolk College of William and Mary, Norfolk, Virginia.

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Material Examined.

All the larvae used were laboratory reared specimens except where otherwise indicated. They were prepared for study by clearing in hot lactic acid and mounted in Hoyer’s medium according to the method outlined by Clifford and Anastos (1960).

The following species were examined:

*Argas (Argas) brevipes* Banks, 1908; 13 specimens reared from adults collected from nest of cactus wren near Tucson, Arizona, U.S.A.

*Argas (A.) cooleyi* Kohls and Hoogstraal, 1960; 12 paratype specimens reared from adults collected near nests of cliff swallows, Granite County, Montana, and at Fishtrap Lake, Lincoln County, Washington, U.S.A.

*Argas (A.) neglmei* Kohls and Hoogstraal (in press); 3 paratype specimens reared from adults collected near Calama, Chile.

*Argas (A.) reflexus hermanni* Audouin, 1827; 15 specimens reared from adults collected in pigeon house, Ezbet Chenuwa, Mesir, Kafr el Sheikh Province, Egypt.

*Argas (A.) reflexus reflexus* (Fabricius), 1794; 10 reared specimens from Belgium.

*Argas (A.) persicus* (Oken), 1818; 6 specimens from chicken house, Rio de Janeiro, Brazil, and 11 specimens reared from adults from chicken house, College Park, Maryland, U.S.A.

*Argas (Chiropterargas) boueti* Roubaud and Colas-Belcour, 1933; 13 specimens reared from adults collected from *Nycteris* sp., bat cave, El Karnak, Luxor, Qena Province, Egypt.

*Argas (Ch.) confusus* Hoogstraal, 1955; 10 paratype specimens reared from adults collected in bat cave, Abu Rawash, Imbaba, Giza Province, Egypt.

*Argas (Carius) pusillus* Kohls, 1950; 9 paratype specimens from bat, Palawan Island, Philippines.

*Argas (Ca.) vespertilionis* (Latreille), 1802; 11 specimens, data as for *Argas confusus*.

*Argas (Secretargas) transgargisphas* (White), 1846; 17 specimens, data as for *Argas confusus*.

*Argas (Ogadenus) brumpti* Neumann, 1907, 6 specimens reared from adults from Paraechinus?, coastal plain north of Gebel Elba, southeastern desert, Egypt.

Larvae of a few other species have been described, but specimens were unavailable and they are so poorly characterized in the literature that they could not be included in this study.
Chaetotaxy.

The results of this study indicated that chaetotaxy is one of the most useful features for separating both subgenera and species. Of particular value was the total number and arrangement of setae on the dorsal and ventral surfaces; however, differences in the number of setae on the palpi, the number of setae on tarsus I, as well as differences in setal length and position on various structures are also useful.

Chaetotaxy of the body. Several differences in both the number and arrangement of setae occur on the dorsal surface of the body, but fewer differences are found on the ventral surface. Fig. 1 shows the location and nomenclature of the various body setae.

The wide differences in the dorsal setae allow separation of subgenera by means of this feature in several instances (Table I).

Chiropterargas and Carios both have less than 17 pairs of dorsal setae, whereas all the other subgenera have 22 or more pairs. The overlap noted between Chiropterargas and Carios and between Argas and Secretargas presents little difficulty since these subgenera are readily separated by means of other morphological features.

**Fig. 1.** — Arrangement of body setae in the genus Argas. A, dorsal view. B, ventral view.

Abbreviations. C, central; AL, anterolateral; DL, dorsolateral; PL, posterolateral; A, anal; PM, posteromedian; PH, posthypostomal; ST, sternal; CA, circumanal.
The total number of dorsal setae is also useful for the separation of species within subgenera in several instances. *A. (Chiropterargas) boueti* has 15-16 pairs of dorsal setae while *A. (Chiropterargas) confusus* generally has 12-14 pairs. Fifteen setae were noted on one side of two specimens of *A. confusus*, which could limit the use of this feature. In the subgenus *Argas* this feature is more useful if *Argas persicus*, which has a wide range in the number of dorsal setae, is eliminated first by means of other characters. Once *Argas persicus* is thus eliminated from consideration, further differentiation is possible, i.e., *Argas reflexus reflexus* with 36-37 pairs of dorsal setae, *A. cooleyi* and *A. neghmei* with 28-30 pairs and *A. reflexus hermanni* and *A. brevipes* with 23-24 pairs.

On the dorsum, the setae are usually arranged along the outer margin (dorsolaterals) and in the central region near the dorsal plate (centrals). The subgenus *Chiropterargas* is an exception since the dorsal setae are arranged in anterior and posterior groups rather than around the margin. This arrangement of the dorsal setae permits the rapid recognition of this subgenus.

Among other subgenera the number of pairs of dorsolateral setae is as follows: *Caros* 10-12; *Ogadenus* 15; *Secretargas* 19-20; and *Argas* with 14-27 (Table I). This wide range in the number of dorsolateral setae in the subgenus *Argas* provides a useful character for the separation of species, i.e., *Argas r. reflexus* with 26-27
pairs, *A. cooleyi* and *A. neghmei* with about 19-21 pairs and *A. persicus, A. r. hermanni* and *A. brevipes* with about 14-16.

The arrangement of setae in the central region has more limited usefulness due to the relatively uniform number present among the subgenera (Table I). However, the subgenus *Carios* can be recognized by this feature since it has only 3 pairs of central setae and all the other species have at least 7 pairs. Another feature of value was noted in the subgenus *Argas* in which *A. persicus* has 3-4 pairs of central setae anterior and lateral to the dorsal plate, *A. neghmei* and *A. brevipes* have 2 pairs and all the remaining species have only one pair in this region.

On the ventral surface of the body, excluding the setae on the coxae, there are 7 pairs of setae in all species studied except *A. transgarutts, A. vesperti­lionis* and *A. pusillus*, which have the 7 pairs plus an extra posteromedian seta (Table I). The setae on the ventral surface of these three species are arranged as follows: 3 pairs sternals, 3 pairs circumanals, 1 pair anal; and 1 posteromedian seta (Fig. 1).

**Chaetotaxy of the palpi.** Setae are lacking on palpal article I of all the species examined.

Some separation of the subgenera is possible by use of the number of setae on the other three articles (Table I). For example, the subgenera *Argas, Secretargas* and *Ogadenus*, with 5 setae on article II, can be separated from *Chiropterargas* and *Carios* which have only 4 setae on this segment.

Somewhat different possibilities are furnished by article III. The subgenus *Secretargas* has 5 setae, *Argas* has 4-5, and *Chiropterargas, Carios*, and *Ogadenus* each have 4 on this article. The 4-5 difference noted among the various species of the subgenus *Argas* may be useful in the identification of species. However, differences that involve a single seta should be used as accessory characters only, since a few specimens in each series have an extra seta present on one of the palpal articles.

The number of setae on article IV allows separation of the subgenera similar to that accomplished with article II, i.e., *Argas, Secretargas* and *Ogadenus* have 11-12 setae on article IV, whereas *Chiropterargas* and *Carios* have only 6-9 setae on this segment. The variation noted among the various species in each of the above subdivisions is not of practical value for species identification due to the difficulty of counting the setae on article IV accurately.

**Chaetotaxy of tarsus I.** The number and arrangement of the setae of this tarsus were found to be of taxonomic significance (Figs. 13 to 24 and Table I). The system of nomenclature used is based on that of Dumbleton (1958). However, the following changes were found to be necessary: the hair-tuft setae are combined with the paracapsular setae ("paramedian capsulars" of Dumbleton) and the prebasal setae are combined with the posteromedians. Further, we name an extra pair of ventrals, present in some species of the subgenus *Argas*, the premid-
Fig. 3.—*A. (A.) cooley*. A, dorsal view. B, palp, ventral view. C, hypostome, ventral view. D, ventral view. (From Kohls and Hoogstraal, 1960).

ventrals. Fig. 13 shows the location of the various setae. The setae in the anterior depression and capsule of Haller’s organ were not considered in this study.

On the ventral surface of the tarsi each species examined had one pair of apicoventral and one pair of midventral setae. All species seen except *A. brevipes*, *A. cooley*, and *A. transgariepinus* consistently had a pair of basal setae. In these three species one or both setae of this pair were occasionally missing. Four species of the subgenus *Argas* consistently had an extra pair of setae, the premidventrals.

Every species examined had a single pair of anterolateral setae, except *A. brevipes* and *A. brumpti* which have the lateral setae located proximally enough to be called posterolaterals. In addition, three specimens of *A. r. reflexus* had an extra seta in the posterolateral position.

On the dorsal surface a pair of apical and a pair of basal setae were present on tarsus I of all species studied. However, some of the other setal groups showed differences which may be of taxonomic significance. For example, species of the subgenera *Chiropterargas* and *Secretargas* had a distomedian seta which was not present in the other subgenera. Considerable variation was noted in the number of paracapsular setae: the subgenus *Argas* had from 2-5, *Chiropterargas* and *Carios*
always had 5 and Secretargas and Ogadenus had 6 in this area. The differences noted within the subgenus Argas were useful for separating the closely related species in this group.

The setae in the posteromedian area were also variable in number: the subgenus Argas had from 0-3, Chiropterargas and Carios had 1 and Secretargas and Ogadenus lacked setae in this area. Again the differences noted in the subgenus Argas were helpful for specific identification.

Setal length and position. Differences in the length and position of several groups of setae were found to be useful for identification of subgenera and species.

A comparison of the length of the anteriormost dorsal body setae (anterolateral) with that of the posteriormost body setae (posterolateral) in the genus Argas demonstrates the usefulness of this feature (Table II). In the subgenus Argas, A. r. reflexus has anterolateral setae that are much longer than the posterolaterals. In A. persicus these setae are about equal in length and in A. brevipes, A. cooleyi, A. r. hermanni, and A. neghmei the anterolaterals are shorter than the posterolaterals. A further separation of these last four species is possible by use of setal length, since the length of these setae is greater in A. cooleyi and A. neghmei than it is in A. r. hermanni and A. brevipes.
The two species of *Chiropterargas* can also be separated by comparing the length of these setae. In *A. boueti* the anterolaterals are considerably longer than the posterolaterals, whereas in *A. confusus* the anterolaterals are shorter or about equal to the posterolaterals.

It was not possible to separate the two species of the subgenus *Carios* by using the length of the dorsal setae; however, the relative shortness of these setae is helpful in recognizing this subgenus.

![Diagram of *A. (A.) persicus*](image)

**Fig. 5.** — *A. (A.) persicus*. A, dorsal view. B, palp, ventral view. C, hypostome, ventral view. D, ventral view. (From Hoogstraal and Kohls, 1960b).

The two species in the monotypic subgenera *Secretargas* (*A. transgariepinus*) and *Ogadenus* (*A. brumpti*) are easily separated from all others studied except *A. r. reflexus* and *A. boueti*, since the length of the anterolateral setae greatly exceeds that of the posterolaterals.

Useful differences in the length of the posthypostomal setae were also noted. The subgenera *Chiropterargas* and *Secretargas* both have long posthypostomal setae (over .050 mm.) while in the remaining subgenera these were much shorter (below .032 mm.). Although both species of *Chiropterargas* have what are considered long posthypostomal setae they can be differentiated by means of this feature since PH₁ ranges from .076 to .092 mm. long in *A. boueti* and from .052 to .062 mm. long in *A. confusus*.

In addition to the length of the posthypostomal setae the relative distance between the two pairs was found to differ and may be helpful for separation of
the different subgenera (Table II). For example, in the subgenera *Argas*, *Secretargas* and *Ogadenus*, the distance between the setae of PH₂ is about 1 1/2 to 2 times greater than the distance between the setae of PH₁; whereas in the subgenus *Chiroptergargas* the distance between the setae of PH₂ is 2 1/2 to 3 times greater than between the setae of PH₁. In the subgenus *Carios*, *A. pusillus* was similar to species in the subgenus *Argas*, while *A. vespertilionis* had distances between the posthypostomal setae that were more like those in the subgenus *Chiroptergargas*. This difference is useful in separating these two species.


In one instance a single seta will allow the immediate recognition of a species in the genus *Argas*, i.e., *A. boueti* which has an unusually long whiplike seta on the tibia of leg I that is not found on any of the other species examined. This seta ranges from .150 to .161 mm. in length and is as long as or longer than the tibia itself.
Other Morphological Characters.

In addition to differences in chaetotaxy, differences such as the shape and dentition of the hypostome, length of palpal articles, and shape and length of tarsus I were found to provide useful characteristics for recognition.

Hypostome. Differences were found among the several subgenera and species with regard to the length, shape and dentition of the hypostome (Table II).

In the subgenera Argas, Chiropterargas and Secretargas, the hypostome is bluntly rounded distally while in the subgenera Carios and Ogadenus it is pointed. Finally, in contrast to all the other species examined, the hypostome of Ogadenus is broad posteriorly and narrows abruptly at midlength.

The dentition of the proximal portion of the hypostome is constant with 4 files (2/2) in every species examined. The dentition of the distal portion is more variable and bears 4 files (2/2) in Chiropterargas and Ogadenus, 4 or 6 files (2/2

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Fig. 7. — A. (A.) neghmex. A, dorsal view. B, capitulum, ventral view. C, ventral view. (After Kohls and Hoogstraal, 1961.)
or 3/3 in Argas, 6 files (3/3) in Secretargas and 8 files (4/4) in Carios (Table II). The difference noted in the dentition of the subgenus Argas is extremely useful for separation of species.

Differences in the number of denticles per file will also aid in recognition of some of the subgenera and species (Table II). However, the number of denticles in a file may vary among specimens of the same species; therefore, no significance can be attached to minor differences.

An example of the use of this feature for the separation of subgenera is seen by comparing A. (Og.) brumpti, which has over 20 denticles per file, with all the other subgenera which have at most 15 denticles in any file.

Within the subgenus Argas, A. r. hermanni with 4-5 large teeth in file 3 can be immediately recognized since all the other species have fewer and less well-developed teeth in this file. Further, a species such as A. cooleyi with about 5 teeth per file can easily be separated from A. neghmei which has about 10 denticles per file. These two species are very similar in other respects.

Palps. The relative length and width of certain palpal articles was found useful for differentiating some of the subgenera and species (Table II). For example, the subgenus Secretargas is easily recognized since articles 1 and 2 are fused and
appear as one long proximal article. The subgenus *Argas* can be easily identified since it is the only subgenus in which article 4 is always as long or longer than any of the other articles. In one species, *A. persicus*, article 4 is nearly twice as long as any of the other palpal segments. In *Chiropterargas* and *Ogadenus*, article 2 is the longest. Finally, the subgenus *Carios* shows an entirely different situation, i.e., in *A. vesertilionis* articles 2 and 3 are about equal in length and longer than articles 1 and 4, while in *A. pusillus* all 4 articles are approximately the same length.

![Fig. 9. — *A. (Ch.) confusus*. A, dorsal view. B, hypostome, ventral view. C, ventral view. (After Hoogstraal, 1955.)](image)

**Tarsus I.** Differences in the length, distal attenuation, and presence or absence of an elongated internal sensillum extending posteriorly from the capsule of Haller's organ were found to be useful for taxonomic discrimination of several species.

The length of tarsus I is mainly helpful for separation of species in the subgenus *Argas* (Table II). For example, the length is below .2 mm. in *A. brevipes*, above .2 mm., but below .3 mm. in *A. cooleyi* and *A. r. hermanni* and above .3 mm. in *A. r. reflexus*, *A. persicus*, and *A. neghmei*.

In all species of *Secretargas*, *Carios* and *Ogadenus* tarsus I is attenuated abruptly, while in the 2 species of *Chiropterargas* it is attenuated gradually. The subgenus *Argas* has both conditions, *A. r. reflexus*, *A. persicus*, *A. neghmei* and *A. r. hermanni* have gradually attenuated tarsi I while in *A. cooleyi* and *A. brevipes* they are moderately to strongly attenuated.

In all species of the subgenus *Argas* except *A. persicus* there is an elongate internal sensillum extending in a posterior direction from the capsule of Haller's
Fig. 10. — A. (Ca.) vespertilionis. A, dorsal view. B, hypostome, ventral view. C, ventral view. (After Hoogstraal, 1958.)

Fig. 11. — A. (Se.) transgariepinus. A, dorsal view. B, ventral view. (After Hoogstraal, 1957.)
organ. This feature will not only separate *A. persicus* from all the other species in the subgenus *Argas*, but will also differentiate these species from all the species in other subgenera.

**Host Preference and Distribution.**

Considerable differences in host preference and distribution occur among the various species of *Argas* and this information is extremely useful for identifying the subgenera and species. For example, *A. brevipes* and *A. r. hermanni* are very similar morphologically and if certain key features are not visible they will be difficult to distinguish. However, the distribution of *A. brevipes* is limited to the southwestern part of North America and *A. r. hermanni* is found only in Africa. This information is summarized in table III.

![Fig. 12. — *A. (Og.) brumpti*. A, dorsal view. B, ventral view.](image)

The following key illustrates how the features discussed in this paper may be used for the practical identification of several of the subgenera and species in the genus *Argas*.

**A Key to Larvae of the Genus *Argas* 1.**

1. At the present time it is impossible to distinguish larvae of the genus *Argas* from those of *Ornithodoros* in every instance. However, since all larvae of *Argas* except *A. (Og.) brumpti* are essentially parasites of birds and bats, the number of *Ornithodoros* species with which they can be confused is greatly reduced. Further, all species of *Ornithodoros* examined that parasitize bats and birds have an extra pair of setae on the ventral surface of the body just posterior to coxae III, the postcoxals, that are not present on any of the *Argas* species. *A. brumpti* is found only in Africa and due to the distinctive features of the larvae they can readily be distinguished from the *Ornithodoros* species that parasitize similar hosts in this area. It is hoped that the study now in progress on larvae of the genus *Ornithodoros* will disclose features for separating these two genera.
Fig. 13. — Setal arrangement on tarsus I in the genus *Argas.*
Abbreviations: A, apical; DM, distomedian; PC, paracapsular; PM, posteromedian; B, basal;
AV, apicoventral; PMV, premidventral; AL, anterolateral; MV, midventral; PL, postero-
lateral; BV, basoventral; black = ventral or lateral; white = dorsal.

Fig. 14. *A. (A.) brevipes,* tarsus I. A, lateral view. B, dorsal view. — Fig. 15. *A. (A.) coo-
leyi,* tarsus I. A, lateral view. B, dorsal view. — Fig. 16. *A. (A.) v. hermanni,* tarsus I.
A, lateral view. B, dorsal view. — Fig. 17. *A. (A.) persicus,* tarsus I. A, lateral view.
B, dorsal view. — Fig. 18. *A. (A.) r. reflexus,* tarsus I. A, lateral view. B, dorsal view.

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Does not include a few species the larvae of which are unknown or inadequately described.

1. Dorsum of the body with 22 or more pairs of setae. Article II of palp with 5 setae article IV with 11-12 setae................................................ 2

Dorsum of the body with 16 or less pairs of setae. Article II of palp with 4 setae; article IV with 6-9 setae................................................ 9
2. Palpal articles I and II fused. Body ventrally with 7 pairs of setae plus 1 posteromedian seta. Parasite of bats and possibly gecko .............................. Subgenus Secretargas; A. transgariepimts (Figs. 11 and 23)
Palpal articles I and II not fused. Body ventrally with 7 pairs of setae, posteromedian seta lacking. Parasite of birds, except A. brumpti which is found on mammals and lizards......................................................... 3

3. Dentition 4/4, with over 20 denticles per file, hypostome sharply pointed. Palpal article II longer than other segments. With 6 paracapsular setae on tarsus I. Parasite of mammals and lizards. Subgenus Ogadenus; A. brumpti (Figs. 12 and 24)
Dentition not more than 3/3, with less than 12 teeth per file, hypostome bluntly rounded. Palpal article IV as long as or longer than other segments. With 2-5 paracapsular setae on tarsus I. Parasites of birds. Subgenus Argas.................. 4

4. Anterolateral and posterolateral body setae of approximately equal length; with 3-4 pairs of central setae anterior and lateral to midlength of squamous area. Tarsus I lacks elongate sensillum extending posteriorly from capsule of Haller’s organ.
A. persicus (Figs. 5 and 17)
Anterolateral and posterolateral body setae of different lengths; with 1 or 2 pairs of central setae anterior and lateral to midlength of squamous area. Tarsus I with elongate sensillum extending posteriorly from capsule of Haller’s organ........... 5

5. With 28 or more pairs dorsal body setae including 19-21 pairs dorsolateral setae.. 6
With 24 or less pairs dorsal body setae including 14-15 pairs dorsolateral setae.. 8

6. With 36-37 pairs dorsal body setae including 26-27 pairs dorsolateral setae. Anterolateral setae longer than posterolaterals. Distribution, Europe............... A. r. reflexus (Figs. 6 and 18)
With 28-30 pairs dorsal body setae including 19-21 pairs dorsolaterals. Anterolateral setae shorter than posterolaterals. Distribution, New World........... 7

7. With 1 pair central setae anterior and lateral to the midlength of squamous area. Tarsus I with 5 paracapsular setae; posteromedian setae absent. Parasite of cliff swallows. Distribution, western U.S.A......................... A. cooleyi (Figs. 3 and 15)
With 2 pairs central setae anterior and lateral to midlength of squamous area. Tarsus I with 2 paracapsular and 3 posteromedian setae. Parasite of domestic chickens and pigeons. Distribution, Chile, South America........ A. neghmei (Figs. 7 and 19)

8. Dentition 3/3, with about 5 denticles in file 3. Tarsus I with 8 ventral setae; 1 posteromedian seta present. With 1 pair central setae anterior and lateral to midlength of squamous area. Distribution, Africa.................. A. r. hermanni (Figs. 4 and 16)
Dentition 2/2. Tarsus I with 4-5 ventral setae; posteromedian setae absent. With 2 pairs central setae anterior and lateral to midlength of squamous area. Distribution, Arizona and California, U.S.A., and Baja California, Mexico.................. A. brevipes (Figs. 2 and 14)

Dorsal body setae arranged in anterior and posterior groups. Posthypostomal setae 1 long (greater than .050 mm.). Tarsus I long; with distal median seta present. Body ventrally without posteromedian setae. Hypostome dentition 2/2 through entire length.............................. Subgenus Chiropterargas 11
10. Distance between posthypostomal setae two 1 1/2 to 3 times greater than distance between posthypostomal setae r. Hypostome arises from the basis capituli on a definite base. Distribution, Europe, Africa and Asia..........................

   A. vespertilionis (Figs. 10 and 22)

Distance between posthypostomal setae two 1 1/2 to 2 times greater than distance between posthypostomal setae r. Hypostome does not arise from the basis capituli on a definite base. Distribution, Philippine Islands, Malaya..............

   A. pusillus (no figures)

II. Tibia I with unusually long whiplike seta as long as or longer than tibia itself. With 15-16 pairs dorsal body setae; anterolateral setae longer than posterolaterals. Posthypostomal setae r long (range .076-.092 mm.)....

   A. boueti (Figs. 8 and 20)

Tibia I without unusually long whiplike seta. With 13-15 (usually 13-14) pairs dorsal body setae; anterolateral setae shorter than posterolaterals. Posthypostomal setae moderate in length (range .052-.062 mm.).

   A. confusus (Figs. 9 and 21)

**Summary.**

Study of larvae of 12 species of the genus *Argas* showed that chaetotaxy in conjunction with other features affords useful diagnostic characters for subgeneric and species identification.

Chaetotaxic features that had the greatest value were the number, arrangement and length of setae on the body, palpi and leg segments.

In addition to chaetotaxy, features such as the shape and dentition of the hypostome, length of the palpal articles, shape and length of tarsus I, as well as host preference and distribution, were found to provide useful recognition characters. A key is provided to demonstrate the practical use of these features.

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Table I

Chaetotaxy of Several Structures on the Larvae of 12 Species of the Genus *Argas.*

<table>
<thead>
<tr>
<th>Species</th>
<th>Body Setae (Pairs)</th>
<th>Palpal Setae</th>
<th>Tarsal Setae</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dorsal</td>
<td>Dorsolateral</td>
<td>Central</td>
</tr>
<tr>
<td><em>A. (A.) brevipes</em></td>
<td>23-24</td>
<td>14-15</td>
<td>8-9</td>
</tr>
<tr>
<td><em>A. (A.) cooleyi</em></td>
<td>28-30</td>
<td>19-21</td>
<td>7-9</td>
</tr>
<tr>
<td><em>A. (A.) neghmei</em></td>
<td>28-29</td>
<td>20</td>
<td>8-9</td>
</tr>
<tr>
<td><em>A. (A.) r. hermanni</em></td>
<td>23-24</td>
<td>14-15</td>
<td>8-9</td>
</tr>
<tr>
<td><em>A. (A.) r. reflexus</em></td>
<td>30-37</td>
<td>26-27</td>
<td>9-11</td>
</tr>
<tr>
<td><em>A. (A.) persicus</em></td>
<td>26-30</td>
<td>14-16</td>
<td>10-14</td>
</tr>
<tr>
<td><em>A. (Ch.) bueti</em></td>
<td>15-16</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td><em>A. (Ch.) confusus</em></td>
<td>12-15</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td><em>A. (Ca.) pusillus</em></td>
<td>13-15</td>
<td>10-12</td>
<td>3</td>
</tr>
<tr>
<td><em>A. (Ca.) vespertilionis</em></td>
<td>13</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td><em>A. (Se.) transgariepinus</em></td>
<td>30-34</td>
<td>19-20</td>
<td>11-15^5</td>
</tr>
<tr>
<td><em>A. (Og.) brumpti</em></td>
<td>22-23</td>
<td>15</td>
<td>7-8</td>
</tr>
</tbody>
</table>

1. One seta is located posterior enough to be considered either in the paracapsular or posteromedian area.
2. Present on only 3 specimens.
3. Central setae variable in position as well as number.

Abbreviations: AV, apicoventral; MV, midventral; PMV, premidventral; BV, basoventral; AL, anterolateral; PL, posterolateral; A, apical; DM, distomedian; PC, paracapsular; PM, posteromedian; B, basal.
**TABLE II**

Morphological Features on the Larvae of 12 Species of the Genus Argas.

<table>
<thead>
<tr>
<th>Species</th>
<th>Hypostome</th>
<th>Palp</th>
<th>Tarsus I</th>
<th>Setae</th>
<th>Distance Between Setae of</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Distal Dentition</td>
<td>No. Denticles per file</td>
<td>Length of Articles</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>A. (A.) brevipes</td>
<td>2/2</td>
<td>8</td>
<td>7</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>A. (A.) cooleyi</td>
<td>2/2</td>
<td>5-6</td>
<td>5</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>A. (A.) neghmei</td>
<td>3/3</td>
<td>10</td>
<td>10</td>
<td>0-1</td>
<td>—</td>
</tr>
<tr>
<td>A. (A.) r. hermanni</td>
<td>3/3</td>
<td>10-11</td>
<td>9-10</td>
<td>4-5</td>
<td>—</td>
</tr>
<tr>
<td>A. (A.) r. reflexus</td>
<td>3/3</td>
<td>10-17</td>
<td>9-10</td>
<td>1-2</td>
<td>—</td>
</tr>
<tr>
<td>A. (A.) persicus</td>
<td>3/3</td>
<td>7</td>
<td>6</td>
<td>2-3</td>
<td>—</td>
</tr>
<tr>
<td>A. (Ch.) boueti</td>
<td>2/2</td>
<td>11-12</td>
<td>11-12</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>A. (Ch.) confusus</td>
<td>2/2</td>
<td>14-15</td>
<td>13-14</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>A. (Ca.) vespertilionis</td>
<td>4/4</td>
<td>13</td>
<td>13</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>A. (Ca.) puerulus</td>
<td>4/4</td>
<td>13</td>
<td>11-12</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>A. (Se.) transgariepinus</td>
<td>3/3</td>
<td>8</td>
<td>8</td>
<td>3-4</td>
<td>—</td>
</tr>
<tr>
<td>A. (Og.) brempiti</td>
<td>2/2</td>
<td>23</td>
<td>22</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

1. Measurements in millimeters.
2. Teeth on corona not included.
3. Hypostome dentition essentially 2/2, file 3 may contain up to 3-4 denticles.
4. Articles 1 and a fused.

Abbreviations: AL, anterolateral; PL, posterolateral; PH, posthypostomal.
### Table III

Host Predilection and Distribution of 12 Species of the Genus *Argas*.

<table>
<thead>
<tr>
<th>Species</th>
<th>Hosts of Predilection</th>
<th>Distribution</th>
<th>Source of Information</th>
</tr>
</thead>
</table>
REFERENCES


