

THE FAMILY KLINCKOWSTROEMIIDAE TRÄGÅRDH WITH DESCRIPTIONS OF TWO NEW SPECIES OF *KLINCKOWSTROEMIELLA* (ACARINA : MESOSTIGMATA : TRIGYNASPIDA) ¹

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MORPHOLOGY	ABSTRACT : The general morphology of male and female klinckowstroemiids is described and illustrated. Adult leg chaetotaxy also is given. The family, genus <i>Klinckowstroemiella</i> , <i>K. prima</i> and <i>K. helleri</i> are rediagnosed. The males and females of <i>K. blumae</i> sp. nov. and <i>K. sexisetosa</i> sp. nov. are described and illustrated.
TAXONOMY	
TRIGYNASPIDA	
MORPHOLOGIE	RÉSUMÉ : La morphologie générale des mâles et des femelles klinckowstroemiids ainsi que la chaetotaxie des pattes des adultes est décrite et illustrée. La taxonomie de la famille, du genre <i>Klinckowstroemiella</i> , de <i>K. prima</i> et de <i>K. helleri</i> est révisée. Les mâles et les femelles de <i>K. blumae</i> sp. nov. et de <i>K. sexisetosa</i> sp. nov. sont décrits et illustrés.
TAXONOMIE	
TRIGYNASPIDA	

INTRODUCTION

The fedrizzioid family Klinckowstroemiidae Trägårdh includes nine species, all passalid beetle associates. The three genera of Klinckowstroemiidae (*Antennurella* Berlese, *Klinckowstroemia* Trägårdh, and *Klinckowstroemiella* Turk) are known only from passalids from Mexico, Central and South America. Our material included new species of *Klinckowstroemia* and *Klinckowstroemiella* and representatives of an undescribed genus. The *Klinckowstroemiella* will be treated in this paper, and the *Klinckowstroemia* and the new genus will be treated in subsequent papers.

Limited morphological information, based on ROSARIO (1985) is given here to aid in identification

of important and/or newly recognized character states. Specific structures have been named and letter abbreviations assigned for each. The morphological structures described here will be referred to in the succeeding papers on the other genera.

MORPHOLOGY OF KLINCKOWSTROEMIIDAE

FEMALE

GNATHOSOMA. The tectum is finely serrate at the anterior margin and has rows of fine teeth on the dorsal surface. The anteromesal margin is extended as a fingerlike projection bearing small teeth (Fig. 1 E).

The hypostome bears four pairs of simple or

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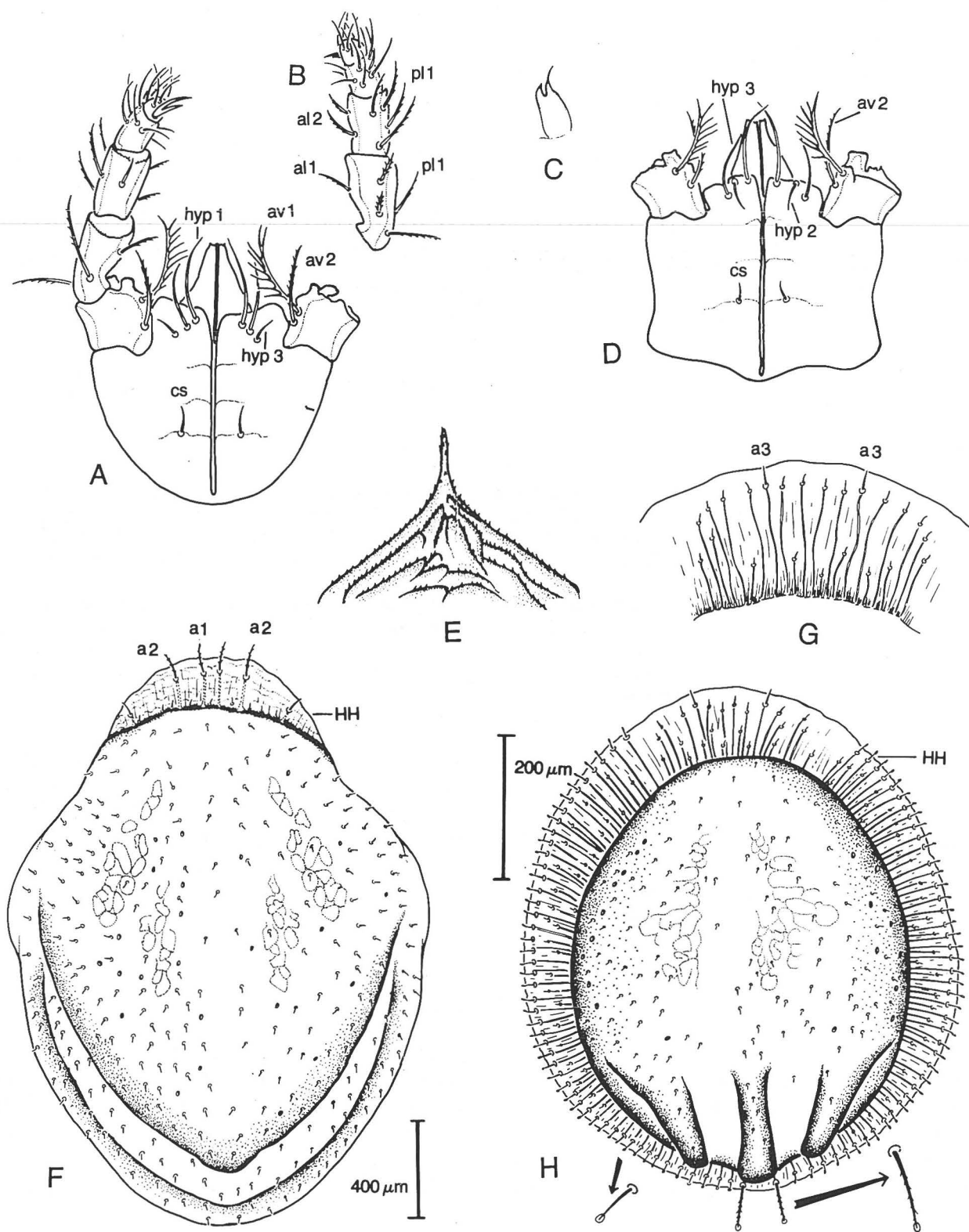


FIG. 1 : *Klinckowstroemiella blumae* sp. nov. : A. — Ventral view of gnathosoma of female ; B. — Dorsal view of palp femur, genu, tibia and tarsus of female ; C. — Corniculus ; D. — Ventral view of male gnathosoma ; E. — Tectum ; F. — Dorsal shield. *Antennurella troussarti* Berlese : G. — Anterior hyaline hood ; H. — Dorsal shield. (See text for abbreviations of characters).

pilose setae arranged in the manner and with relative lengths as illustrated in Fig. 1 A. Deutosternal teeth are absent. The corniculi are bifid, the inner tooth tapers to a point (Fig. 1 C).

Palpal chaetotaxy of the trochanter to the tibia is the same as that given by EVANS (1964) for the Antennophorina. Setae are either pilose, barbed or simple (Fig. 1 A). Setae on the tarsi are mostly simple. The apotele is two-tined. Trochanteral seta *av1* is strongly pectinate, and seta *av2* is pilose (Fig. 1 A). The anterior margin of the trochanter is produced into protuberances, and the anteroventral margins of the femora and genua are serrated.

The chelicerae are well-developed and chelate-dentate (Fig. 4 E). The movable digit usually has 3 large teeth and bears filamentous excrescences. One of the filaments is long and serrate on both sides, another is small and leaflike; the other filaments are beaded. The fixed digit usually bears 3 small teeth and 2 larger teeth, and has a bifid tip.

IDIOSOMA. The dorsal shield is entire, strongly sclerotized and reticulated, and concave giving the mite a turtle-like appearance. The shield exhibits hypertrichy, but the setae are small and indiscernible except under high magnification. The posterior portion of the dorsal shield may bear ridges (Fig. 1 H), which when present, are found on both males and females.

The hyaline hood (*HH*) is a membranous extension of the dorsal shield. This hood forms a crescent over the gnathosoma and extends posteriorly along the lateral margins of the dorsal shield, or may surround the dorsal shield (Fig. 1 H). Pilose or simple setae arise from the dorsal side of the hood. The length and type of the outermost row of setae (always the longest setae) on the anterior portion of the hood are diagnostic characters at the generic and species levels. These paired setae have been named the *a* (anterior hood) setae and are designated as *a1*, *a2*... *a6* starting from the median pair (Figs. 1 F-G).

The tristosternum (*Tri*, Fig. 5 F) is composed of a pair of pilose laciniae arising from a tristosternal base which is usually retracted behind the tetartosternum. The shape of the base differs among species.

The tetartosternum (*Tst*, fused jugular shields, Figs. 2 A-B) bears sternal setae 1 (*st1*) and sternal pores 1. The shape of the tetartosternum is often distinctive and may differ in males and females of the same species. The anterior margin of the tetartosternum has an indentation, the *tetartosternal notch* (*TstN*, Fig. 2 F); the degree of indentation varies among species. On its internal surface, the tetartosternum has a pair of thickenings (the tetartosternal apodemes), each located equidistant between the meson and lateral edges of the shield (Fig. 2 A).

The sternal shield (*StS*, Fig. 2 B) bears sternal setae 2-4 (*st* 2-4) and sternal pores 2. Along its internal margins the shield bears thickenings which continue posteriorly following the outline of the shield and are fused to the internal thickenings surrounding coxal cavities II-IV. These thickenings are referred to as the *sternopodal apodemes* (*SpA*, Fig. 2 A).

The female genital shields (Fig. 4 F) are composed of a well developed sternogynial, two latigynials and a mesogynial shield. The sternogynial shields (*SgS*) is inversely triangular and thought to be derived from the sternal plate (CAMIN and GORIROSSI, 1955; KETHLEY, 1977). It bears sternal pores 3 and may bear secondary setae. A pair of vaginal apodemes are found on the internal surface of the sternogynial shield. These apodemes have posteriorly projecting elements arising from the internal lateral margins of the sternogynial shield and form a pair of arms which fuse medially. The region of fusion of these arms appears membranous (Fig. 4 F). KETHLEY (1977) also noted that vaginal apodemes were associated with the posterior margin of the sternal shield in other trigynaspids. He believed that these apodemes probably represent elements that have undergone a transverse separation from the posterior margin of the sternal shield and consequently, the condition of well-developed vaginal apodemes is a derived condition. KETHLEY (1977) referred to this particular apodeme as the sternovaginal sclerite. For nomenclature consistency we call this thickening the *sternogynial apodeme* (*SgA*). In species where the sternogynial shield is relatively large, the sternogynial apodeme is reduced.

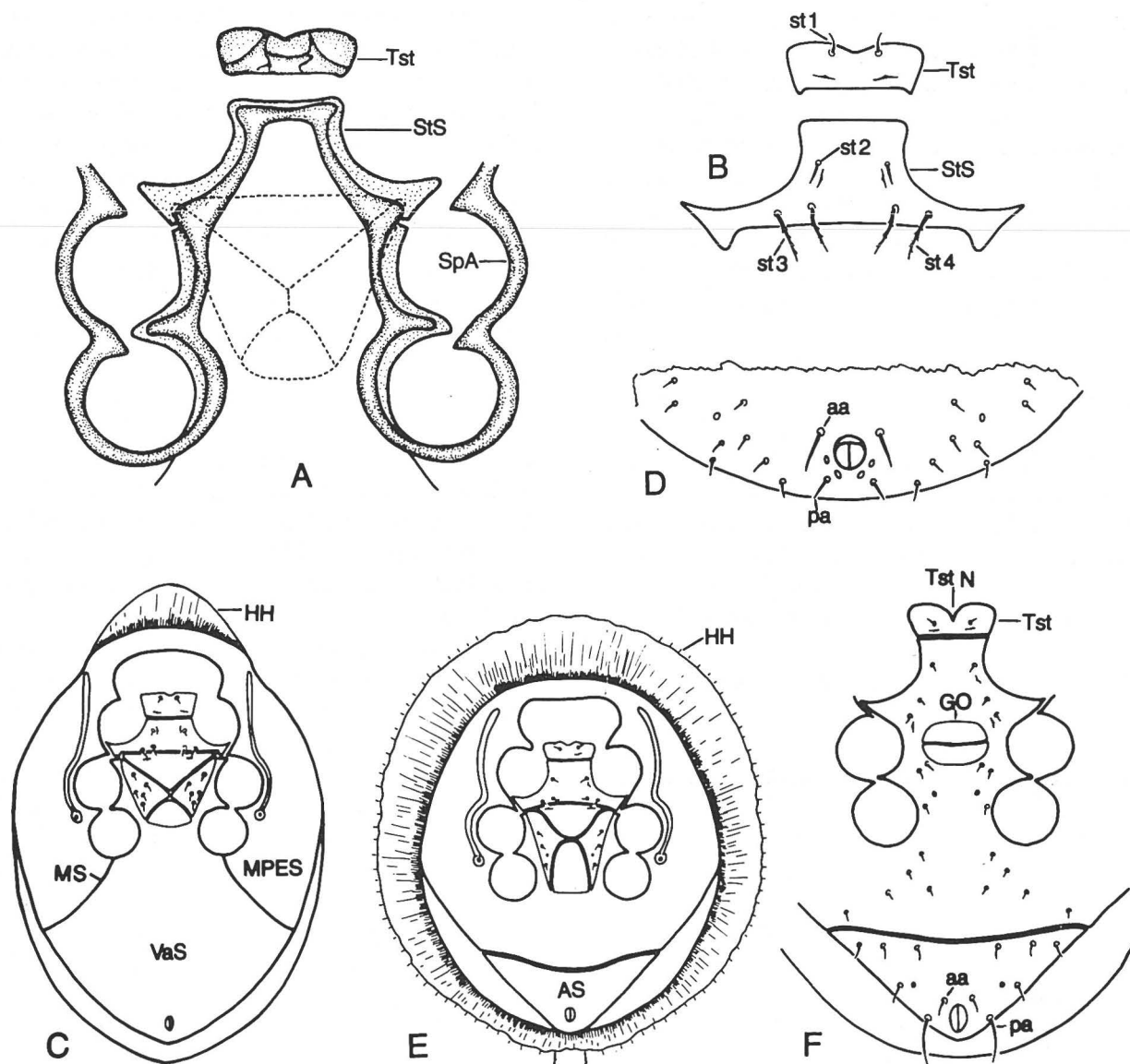


FIG. 2 : *Klinckowstroemiella blumea* sp. nov., female : A. — Internal view of the tetartosternum and sternal shield ; B. — Tetartosternum and sternal shield ; C. — Ventrum. *K. sexisetosa* sp. nov., female : D. — Posterior portion of ventrianal shield. *Antennurella troussarti* Berlese : E. — Ventrum of female ; F. — Ventrum of male (See text for abbreviations of characters).

The shape of the latigynial shields (*LgS*, Fig. 4 F) is one of the most species-distinguishing character states. The number of setae borne on the latigynials varies among species, in individuals of the same species, and even on each individual shield in a specimen. Setae number is therefore not a reliable taxonomic character. The shape and length of the seate, however, appear important in characterizing a species.

Associated with the inner surface margins of each latigynial shield is a characteristic thickening, the *latigynial apodeme* (*LgA*, Fig. 4 F). This apodeme starts from the anterolateral corner of the latigynial shield and appears to form a pivot point with the sternogynial apodeme. The latigynial apodeme follows the medial margin of the latigynial shield. Near the middle of the latigynial shield the latigynial apodeme curves anteriorly at the

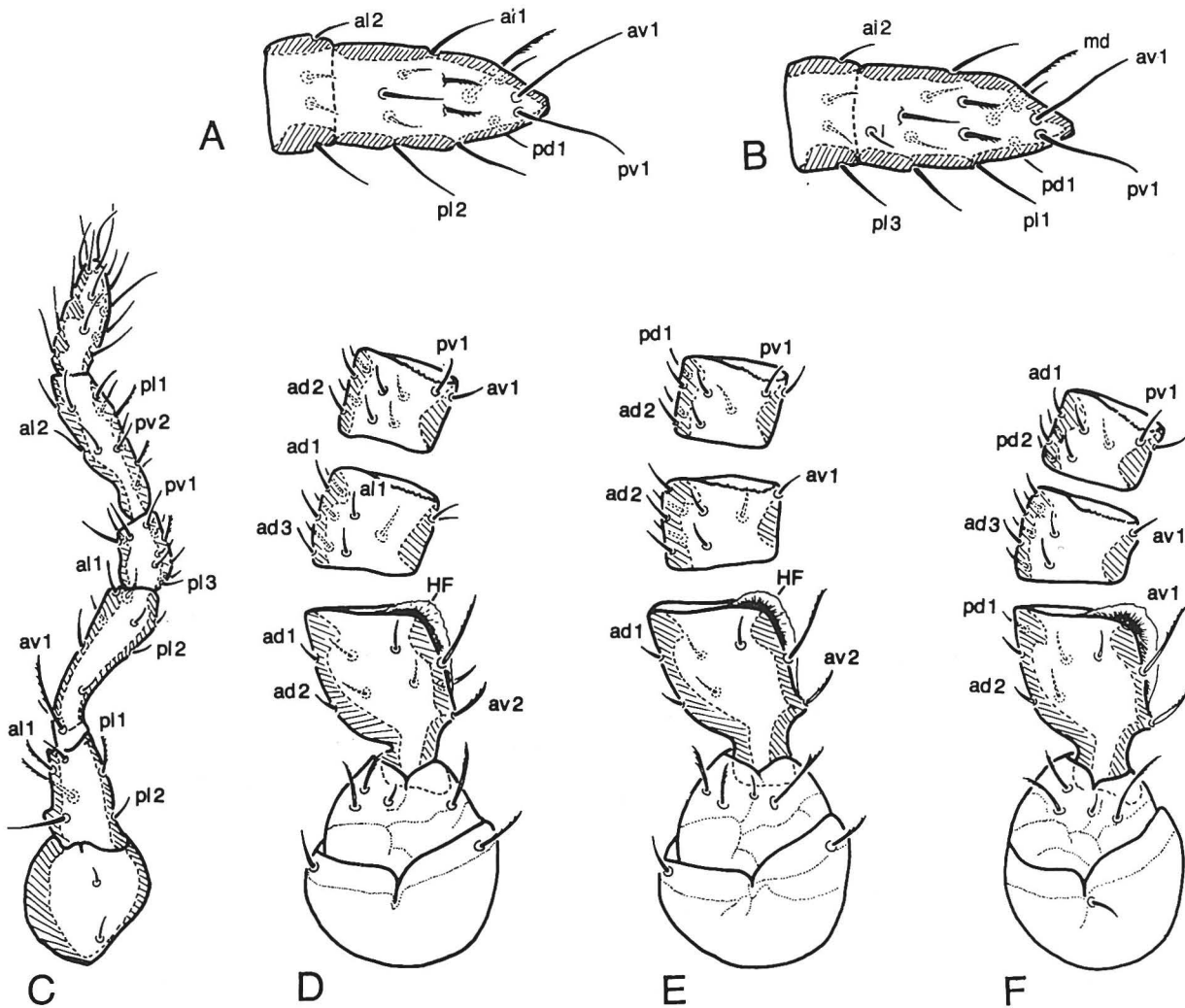


FIG. 3 : Leg chaetotaxy of *klinckowstroemiella blumae* sp. nov.

A. — Tarsus III; B. — Tarsus IV; C. — Leg I; D. — Coxa, trochanter, femur, genu and tibia II; E. — Coxa, trochanter, femur, genu and tibia III; F. — Coxa, trochanter, femur, genu and tibia IV. (See text for abbreviations of characters).

point where the sternogynial apodeme arises. The latigynial apodeme has a knob-like extension, the *latigynial condyle* (LgC), which projects inward (Fig. 4 F).

The mesogynial shield (MgS, Fig. 4 F) is basically trinagular; however, the shape of the anterior margin, and the shield's relative size vary among species. This shield lacks pores but may bear secondary setae. The mesogynial shield gives rise to the *mesogynial apodeme* (MgA), which is formed by medial thickenings along the lateral margins of the shield. The MgA has two knob-like extensions, the

mesogynial condyles (MgC, Fig. 4 F) which connect medially to form a bar. The latigynial condyle discussed above appear to fit into the curves of the mesogynial condyles.

The function(s) of the apodemes associated with the different genital shields is/(are) unknown; however, some speculation is possible based on their shape and location. Aside from strengthening the genital shields during ovoposition, the apodemes may act as egg guides, especially the sternogynial apodeme. The latigynial condyles, the mesogynial condyles and the curve in the anteromedian portion

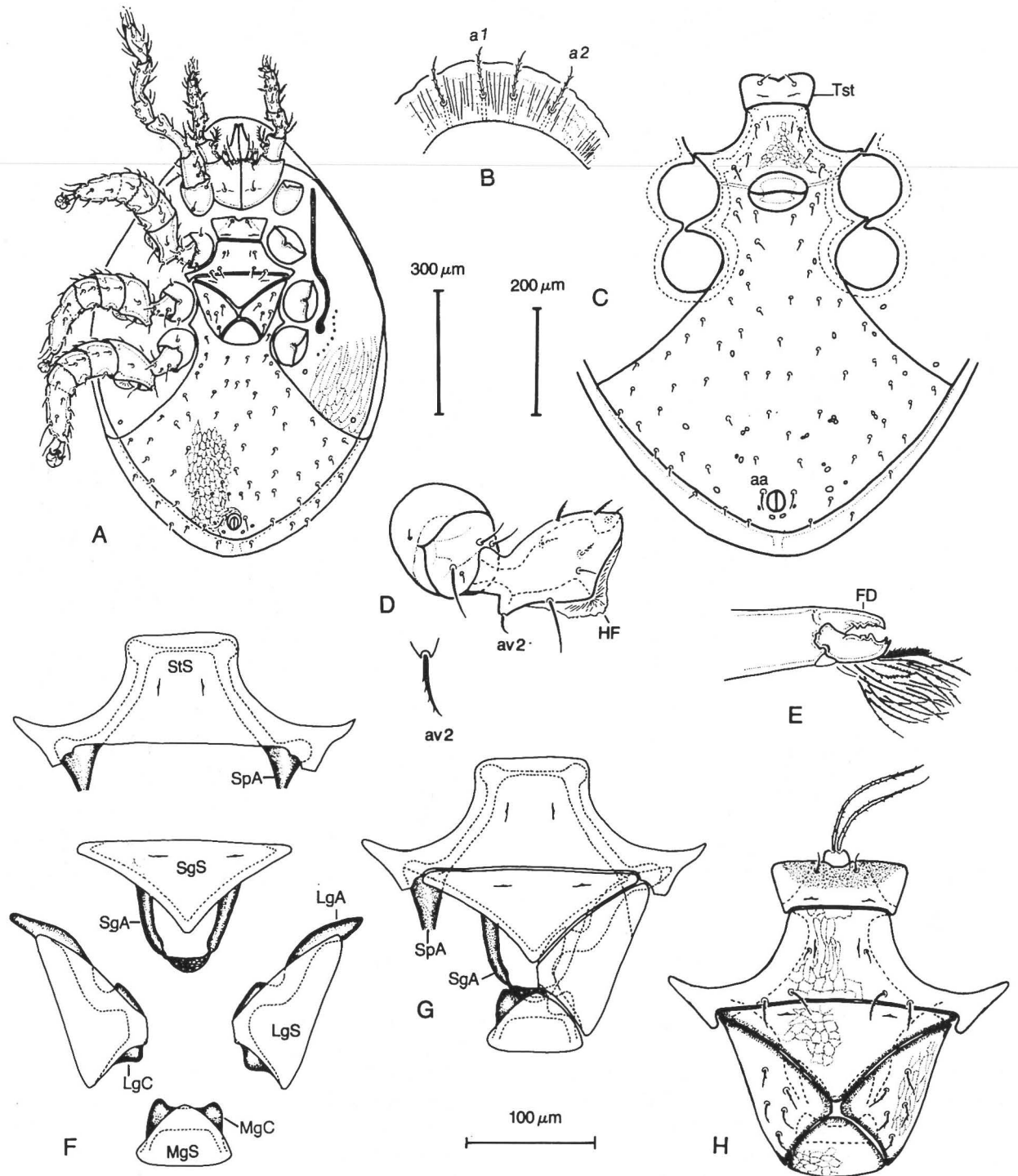


FIG. 4 : *Klinckowstroemiella blumae* sp. nov.

A. — Ventral view of female; B. — Anterodorsal view of hyaline hood; C. — Male ventral shields; D. — Coxa, trochanter and femur IV; E. — Female chelicera; F. — Exploded view of female sternal and genital shields; G. — Female sternal and genital shields; H. — Female tritosternum, tetartosternum, sternal and genital shields. (See text for abbreviations of characters).

of the latigynial apodeme could act as locking devices to hold the genital shields closed.

The remaining ventral shields of female klinckowstroemiids have undergone various fusions. The degree of fusion of the shields provides an important character for separation of genera. The metapodal suture (*MS*, Fig. 2 C) may be absent or present and the ventral shield (*VS*) may be fused with the metapodal-exopodal-peritremal shield (*MPES*, Fig. 2 C). The anal shield (*AS*) may be distinct (Fig. 2 E) or fused to the ventral shield to form the ventrianal shield (*VaS*, Fig. 2 C).

The number of setae on the ventral or ventrianal shield varies among species and may be different on both sides of the shield in an individual specimen. Ventral setae are generally minute and simple, rarely spinelike and/or pilose. In the area of the anal opening are two pairs of taxonomically important setae, the anteroanal setae (*aa*) and the paranal setae (*pa*) (Fig. 2 D, 2 F).

The anal shield (*AS*) is reticulate and bears three pairs of pores, one pair near the anterior corners of the anal shield and two pairs lateral to the anal opening.

The metapodal-peritremal-exopodal shield is also reticulate starting from the metapodal line and extending anteriorly to the level of coxae I. A series of porelike openings lateral to the peritreme may be present. A pair of larger, oval pores is oftentimes present near the metapodal suture.

LEGS. A pair of claws and a pulvillus are present on legs II to IV but are absent on legs I. The ventral portion of femora II-IV bears a protuberance. Associated with this protuberance is seta *av2* (Figs. 3 D-F) which is often thicker than other setae on the segment. A hyaline flange (*HF*, Figs. 3 D-F) is associated with the ventral portion of the femora. The anteroventral margins of the genua and tibiae are serrated. Legs I lack the hyaline flange and protuberances on the femora.

Leg chaetotaxy is constant in the family. The number of setae on coxa, trochanter, femur, genu and tibia I-IV are as follows : I — 2, 6, 10, 11, 11 ; II — 2, 4, 9, 11, 10 ; III — 2, 4, 7, 9, 9 ; IV — 1, 4, 8, 9, 9. Tarsi II and III each bear 17 setae, tarsus IV bears 18 setae. Chaetotaxic formulae for the differ-

ent leg segments (following EVANS, 1963) is given by ROSARIO (1985).

MALE

Except for the ventral shields, relative lengths of the hypostomal setae, and general body size, the morphology of male klinckowstroemiids resembles that of the female.

The tetartosternal notch of the males of most species is more pronounced. The sternal shield may be separated from the ventral shield by an unsclerotized line, the *sternoventral suture* (*SvS*), which bends slightly posterior at the level of coxae III (Fig. 5 C), or this suture may be absent (Fig. 2 F). The sternal shield bears 3 pairs of setae and 2 pairs of lyriform pores. The genital opening is oval and located at the level of coxae III or between the levels of coxae II and III. Hypostomal seta 2 is shorter than hypostomal setae 1 and 3 (Fig. 1 D).

KLINCKOWSTROEMIIDAE Trägårdh, 1945

DIAGNOSIS. The family Klinckowstroemiidae is characterized as follows : hyaline hood present and forming an anterior crescent over gnathosoma, extending posteriorly along lateral margins of idiosoma, or surrounding entire idiosoma ; dorsum of hyaline hood bearing setae. Dorsal shield convex, reticulate, bearing minute setae with no apparent pattern. Palpal trochanter with seta *av1* large, pectinate ; seta *av2* pilose. Jugular shields fused forming tetartosternum, bearing sternal setae I and sternal pores I. Sternal shield bearing sternal setae 2, 3 and 4 and sternal pores 2. Anal, ventral and metapodal-peritremal-exopodal shields contiguous or fused. Sternogynial, latigynial and mesogynial shields well developed in the female, each with a vaginal apodeme on the internal surface ; latigynials with setae, mesogynial and sternogynial normally without setae. *Fovae pedales* present. Femora II-IV with flangelike extension ; with a protuberance on ventral portion bearing seta *av2*. Male genital opening oval, wider than long and between coxae II or III.

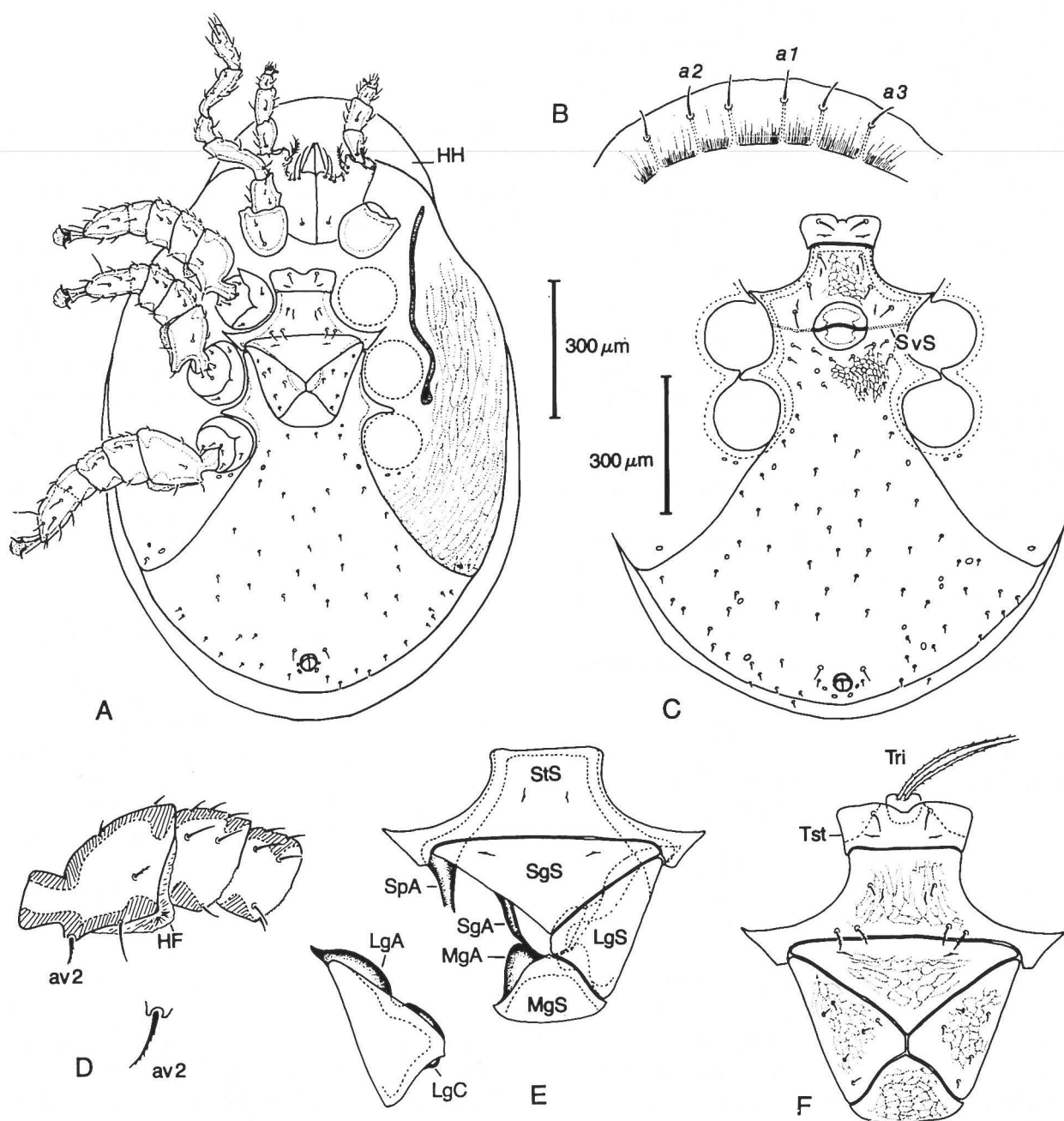


FIG. 5 : *Klinckowstroemiella sexisetosa* sp. nov.

A. — Ventral view of female; B. — Anterodorsal view of hyaline hood; C. — Male ventral shields; D. — Trochanter, femur and genu IV; E. — Female sternal and genital shields; F. — Female tritosternum, tetartosternum, sternal and genital shields (See text for abbreviations of characters).

Genus *Klinckowstroemiella* Türk, 1951

Klinckowstroemiella TÜRK, 1951 : 410 ; CAMIN and GORI-ROSSI, 1955 : 52 ; KETHLEY, 1977 : 137.

DIAGNOSIS. Anal shield coalesced with ventral shield. Metapodal, peritremal and exopodal shields fused, separated from ventral shield by metapodal suture. Hyaline hood forming crescent over gnathosoma, never extending posteriorly beyond level of coxa I ; seta *a1*, *a2* and sometimes *a3* present on anterior portion of hood, setae subequal in length. Dorsal shield with a visible constriction in region of coxae I, extending into a flange in region of coxae II-III ; posterior portion of shield without ridges. Seta *av2* of femora II-IV arises from tip of protuberances. Anteroanal setae longer than other setae on posterior portion of ventroanal shield. Female latigynial shields triangular ; sternogynial and mesogynial shields without setae. Sternoventral suture present in males.

TYPE-SPECIES : *Klinckowstroemiella prima* Türk, 1951 (by subsequent designation).

In the following descriptions, all measurements are given in microns (μm). Designation for holotype and paratype depositions of new species as follows : NMNH — The Smithsonian Institution, National Museum of Natural History, Washington, D.C. ; UGA — Department of Entomology, University of Georgia, Athens, Georgia ; FMNH — Field Museum of Natural History, Chicago, Illinois ; AL — Acarology Laboratory, Ohio State University, Columbus, Ohio ; UNAM — Universidad Nacional Autónoma de México, México D.F., México.

Klinckowstroemiella prima Türk

Klinckowstroemiella sp. (sp. n. ?) TÜRK, 1948 : 96.
Klinckowstroemiella prima TÜRK, 1951 : 410 ; HYATT, 1964 : 501 ; KETHLEY, 1977 : 137.

DIAGNOSIS. Hyaline hood extending posteriorly to level of coxae I ; seta *a1* and *a2* simple, subequal

to sternal seta 4. Seta *av2* on femora II-IV slightly barbed. Sternal setae simple in both male and female, seta 3 longest. Latigynial setae short, about 9 long.

TYPE LOCALITY. Trinidad, British West Indies, from unidentified passalid beetle.

OTHER LOCALITIES. Two localities in Venezuela : Río Caura, Bolívar and San Juan de Manapiare, Amazonas, from unidentified passalid beetles.

Three female, 1 male (slide labelled type) specimens from Trinidad and 1 female, 1 male specimens from Venezuela were examined.

LOCATION OF TYPES. British Museum (Natural History), London.

Klinckowstroemiella helleri (Oudemans)

Fedrizzia helleri OUDEMANS, 1929 : 448.
Klinckowstroemiella helleri (Oudemans) : WOMERSLEY, 1959 : 283 ; KETHLEY, 1977 : 137.

DIAGNOSIS. Hyaline hood extending posteriorly to level of coxae I ; seta *a1* and *a2* simple, shorter than sternal seta 4. Seta *av2* on femora II-IV sparsely pilose. Sternal setae simple in both sexes, setae 3 and 4 longest. Latigynial setae simple, about 29 long.

TYPE LOCALITY. Paramaribo, Surinam (Dutch Guiana), from *Passalus* sp.

OTHER LOCALITIES. Piracicaba and São Paulo, Brazil, from unidentified passalid ; Simla, Arima Valley, Trinidad, also from unidentified passalid.

Holotype female, allotype male, female and male paratypes were examined.

LOCATION OF TYPES. Rijksmuseum van Natuurlijke Historie, Leiden, the Netherlands.

Klinckowstroemiella blumae sp. nov.

FEMALE. Body oval (Fig. 4 A) ; idiosoma 894 + 53 long, 603 + 32 wide (N = 25).

Reticulations over entire dorsal shield, posterior part of shield with trough-like depression (Fig. 1 F). Hyaline hood extending posteriorly to level of coxae I; setae *a1* and *a2* long, pilose (Fig. 4 B).

Tritosternal base rounded (Fig. 4 H). Tetartosternum (Fig. 4 H) 39 long, 109 wide, anterior margin with shallow notch; sternal pore 1 posterior to sternal seta 1, pore near posterior margin of shield; sternal seta 1 simple, near anterior margin of shield. Sternal shield 78 long, 255 wide; sternal seta 2 arising laterad to pore 2; setae 3 and 4 weakly pilose, arising near posterior margin of shield, base of 3 arising anterior to 4, setae 1 and 2 shortest; reticulations as illustrated. Sternogynial shield triangular, sternogynial apodeme with posterior arms extending posteriorly to level of latigynial and mesogynial condyles (Fig. 4 G). Latigynial shields each with 4-5 pilose setae, shield margins blunt medially (Fig. 4 H). Mesogynial shield triangular in shape, rounded anteriorly, mesogynial condyles extend to level of apex of shield (Fig. 4 F, 4 H). Shape of vaginal apodemes as illustrated (Figs. 4 F, 4 G). Ventroanal shield 390 long (from posterior margin of mesogynial to posterior margin of shield), greatest width 520; with 25-27 pairs of fine, simple setae, 1-3 unpaired setae on middle of shield; oval or circular pores on shield.

Most setae on legs barbed except for some on tarsi, each seta *av2* on femora II-IV weakly barbed (Fig. 4 D). Other leg setae illustrated (Figs. 3 A-F).

All gnathosomal setae simple, capitular seta shortest, hypostomal seta 3 shorter than hypostomals 1 and 2.

MALE. Idiosoma 915 ± 40 long, 614 ± 34 wide, ($N = 20$). Dorsal and leg characters as in female. Tetartosternal notch more V-shaped (Fig. 4 C). Sternal shield with 3 pairs of setae, 2 pairs of pores; reticulations as illustrated. Genital opening oval, 57 long, 83 wide. Ventroanal shield with 4 pairs of long simple setae near genital opening and 31 to 36 pairs of smaller setae; shield reticulate.

TYPES. Described from 133 females and 77 males all from Costa Rica. Holotype female. Holotype, 23 females and 18 males paratypes collected at

Amubri, Provincia Limon, 18 March 1979, from *Passalus* (*P.*) *jansoni*, C. K. STARR. Paratypes with same data as holotype except as follows: 19 females, 9 males, 20 January 1979; 21 females, 8 males, 23 January 1979; 18 females, 5 males, 26 January 1979; 4 males, 19 January 1979; 7 females, 2 males, 22 January 1979; 4 females, 2 males, Sirena, Prov. Puntarenas, 14 March 1979, from *Verres hageni*; 9 females, 6 males, Sirena, Prov. Puntarenas, 12 March 1979, from *P. punctiger*; 3 females, Amubri, Prov. Limon, 26 January 1979, from *V. platyrhinus*; 1 male, Amubri, Prov. Limon, 27 January 1979, from *P. (Pertinax)* spp. Other paratypes from unidentified passalid beetles, also from Costa Rica, as follows: 1 female, Sirena, Osa Peninsula, Prov. Puntarenas, 2 March 1981, R. W. MATTHEWS; 16 females, 8 males with same data except collected on 8 March 1981; 9 females, 7 males, Amubri, Prov. Limon, 18 March 1979, C. K. STARR; 4 females, 1 male, La Selva, no other data given; 7 females, 4 males 300 m Ridge, Rincon, Osa Peninsula, 20 June 1970, M. S. BLUM.

Holotype, 10 females and 10 males paratypes deposited in NMNH; 2 females and 2 males each to FMNH, AL and UNAM. All other paratypes deposited in UGA.

ETYMOLOGY. This species is named in honor of Nancy Ann BLUM.

REMARKS. This species closely resembles *K. helleri* except for the following characters: setae *a1* and *a2* long, pilose; shape of the male and female tetartosternum is different; dorsal trough-like depression absent in *K. helleri*. This was the most common species of *Klinckowstroemiella* found on Costa Rican passalids.

Important diagnostic characters or those characters which vary from the description of *K. blumae* will be described for the next species.

Klinckowstroemiella sexisetosa sp. nov.

FEMALE. Body oval (Fig. 5 A); idiosoma 1383 long, 1014 wide (average of 2 specimens).

Hyaline hood extending posteriorly to level of

coxa I; 3 pairs of *a* setae, all simple, subequal in length (Fig. 5 B).

Tritosternal base round. Tetartosternum (Fig. 5 F) 52 long, 163 wide, with shallow tetartosternal notch; sternal seta 1 simple, arising near anterior margin of tetartosternum. Sternal shield (Fig. 5 F) 100 long, 384 wide; seta 2 simple, arising anterolateral to pore 2, setae 3 and 4 weakly pilose, seta 3 arising anterior to 4, seta 2 shortest; reticulation as illustrated. Genital shields and reticulations as illustrated (Fig. 5 F). Posterior arms of sternogynial apodeme reaching level of mesogynial condyles. Latigynial shields blunt medially, with 4-6 small simple setae. Mesogynial shield triangular, generally rounded anteriorly, pointed at apex, posterolateral corners bending slightly anteriorly, mesogynial condyles extend well beyond level of apex of shield (Fig. 5 E). Shape of vaginal apodemes as illustrated (Fig. 5 E). Ventroanal shield 634 long, 764 wide, broadly triangular, with 20-26 small simple setae, 1-3 unpaired setae on middle of shield. A pair of pores and 1 pair of short, simple setae on metapodal-peritremal-exopodal shield near metapodal suture.

Seta *av2* on femora II-IV weakly pilose (Fig. 5 D).

MALE. Both specimens with dorsal shield cracked. Dorsal and leg characters as in female. Tetartosternum more sharply incised (Fig. 5 C). Sternal shield with 3 pairs of subequal simple setae, 2 pairs of pores; reticulations as illustrated. Genital opening oval, 400 long, 447 wide. Ventroanal shield with 4-5 pairs of longer setae near genital opening, 31-36 pairs of smaller setae plus longer anteroanals.

TYPES. Holotype female, 1 female and 2 male paratypes, Toro, Rio Chagera, Panama, 17 September 1961, from unidentified passalid, C. E. YUNKER.

Holotype and 1 male paratype deposited in NMNH. Other paratypes deposited in UGA.

ETYMOLOGY. The species name *sexisetosa* (sexi, L. — six; setosa, L. — hairs) refers to the 3 pairs of *a* setae on the anterior hyaline hood.

REMARKS. *Klinckowstroemiella sexisetosa* differs from other mites in the genus by having 3 pairs of *a* setae. Other mites in this genus have 2 pairs.

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