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Previous volumes (2010-2015): 250 € / year (4 issues)

Acarologia, CBGP, CS 30016, 34988 MONTFERRIER-sur-LEZ Cedex, France

The digitalization of Acarologia papers prior to 2000 was supported by Agropolis Fondation under the reference ID 1500-024 through the « Investissements d'avenir » programme (Labex Agro: ANR-10-LABX-0001-01)



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A new genus of mites of the subfamily Platyseiinae associated with *Azteca* ant galleries in *Cecropia* trees in Costa Rica (Acari: Mesostigmata: Blattisociidae)

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(Received 10 December 2015; accepted 20 March 2016; published online 01 July 2016)

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ABSTRACT — The genus *Calyptoseius* gen. nov. of the subfamily Platyseiinae Evans is described, based on adults and nymphs of one newly described species associated with ants of the genus *Azteca* occupying hollow stems of *Cecropia* in lowland rainforests of Costa Rica. Several unusual morphological attributes are noted, particularly the autapomorphic presence of four elongated setae on each of telotarsi II to IV. Some perspectives of these mites in the *Cecropia-Azteca* association are discussed, including a possible dispersal link via nematoceran flies to gain access to such an unusual habitat. The definition of the previously monobasic genus *Cheiroseius* is augmented, and also modified in view of an undescribed species at hand, and the subfamily definition is modified to account for morphological aspects of the new genus. A key to the genera of the Platyseiinae is given.

KEYWORDS — Gamasina; Phytoseioidea; ant-plant relationships; *Alepia*

INTRODUCTION

This presentation continues a series of papers centered on description of highly distinctive and biologically interesting new taxa of gamasine mites found to exist in one small area of lowland tropical rainforest of the La Selva Biological Station in Costa Rica (Lindquist and Moraza 2008, 2010, 2012, 2014; Moraza and Lindquist 2011, 2015, 2016). Here, we describe a new genus and species of platyseine mite that is unusual in having a life history perhaps confined to association with *Azteca* ants which are mutualistic occupants of the stem hollows of *Cecropia* trees (Longino 1991a). Other platyseine mites are known as freely living occupants

of a variety of soil and litter substrates worldwide, and are especially abundant in moist habitats, such as along stream and lake margins, in mosses submerged in running water, and seasonally wet substrates. However, some *Cheiroseius* occur in bracket fungi on damp decaying wood in tropical regions (Lindquist 2003), while others occur in drier forms of leaf litter and arable soils (Karg 1993).

MATERIALS AND METHODS

The mites were collected from a funnel-extraction of one field-collection of *Azteca* ant colony material at the La Selva Biological Station, Heredia Province,

Costa Rica in 1995. Extracted mite material was preserved in 80 % ethanol, with specimens mounted from ethanol directly into Hoyer's medium on microslides and sealed with Glpt insulating varnish.

Taxonomic concepts of the superfamilies of mesostigmatic mites, especially the Phytoseioidea and its component families, and the genera of Blattisociidae, follow those presented by Lindquist *et al.* (2009) and Lindquist & Moraza (2010, 2012). Morphological observations, measurements, and illustrations were made using compound microscopes equipped with differential interference contrast and phase contrast optical systems, drawing tubes and stage-calibrated eyepiece micrometers. Setal notation for the idiosoma follows that of Lindquist & Evans (1965) as modified slightly by Lindquist (1994) and adapted for superfamilies of mesostigmatic mites in general by Lindquist *et al.* (2009). Measurements of structures are given in micrometers (μm) and indicate the ranges among specimens measured. Dorsal shield lengths were taken as midline length from the anterior margin anterior to the bases of vertex setae *j1* to the caudal margin posterior to the bases of clunal setae *J5*. Lengths of ventral idiosomatic shields are midline, from the anterior margin to the posterior edge of each structure, including the postanal cribrum. Notation for leg and palpal setation follows that of Evans (1963, 1964). Leg lengths are taken from the base of the coxa to the apex of the tarsus excluding the pretarsus. Distinction of pore-like structures on the idiosomatic integument as either poroids (lyrifissures) or glandular openings (solenostomes), as distinguished morphologically by Athias-Henriot (1969, 1971, 1975) and physiologically by Krantz & Redmond (1987), is presented stylistically in the illustrations; gland pores are shown in circular form, while poroids are shown in elliptical form as in Figure 1A. Notation for pore-like structures of the peritrematal region follows that of Johnston & Moraza (1991). Identification of the ant species was made by John Longino (see acknowledgments).

SYSTEMATICS

The subfamily Platyseiiinae Evans (1957) is a cladistically distinctive group, with its history and con-

cepts being reviewed by Lindquist (2003). Together with the sister group Blattisociinae, they are currently thought to comprise the family Blattisociidae in the superfamily Phytoseioidea (Lindquist *et al.* 2009). Members of the Phytoseioidea share what is hypothesized to be a uniquely apomorphic "phytoseiid-type" of sperm access system, which consists of a weakly sclerotized tube, the major duct, that leads from the solenostome opening externally between the bases of legs III and IV to an atrium with an embolus from which emanates a fine minor duct; the atrium connects to a usually sclerotized calyx which then leads to a blind, sac-like vesicle (Athias-Henriot 1968, Evans 1992, Alberti and Di Palma 2002). The complexity of this system makes it unlikely that it has been derived more than once from a plesiomorphic "laelapoid-type" of sperm access system (Alberti 2002, Moraza and Lindquist 2011). Within this systematic framework, the possibility that platyseiiines may be derived from within the Blattisociinae (e.g., from a *Lasioseius* stock), as noted by Lindquist (2003), is not excluded.

The discovery of *Cheiroseiulus* (Evans and Baker 1991) as a new monobasic genus of Platyseiiinae required modification of the concepts of that subfamily as presented previously by Lindquist & Evans (1965), since adults of that genus are morphologically exceptional, as follows: The dorsal shield is markedly hypotrichous, its podonotum with 17 pairs of setae, its opisthonotum with only five pairs (absence of all but one pair of setae in each of the *J*- and *S*-series); adult females and males have an anal (rather than ventrianal) shield, and metapodal plates are rudimentary or absent; adult females lack metasternal platelets, leaving setae *st4* inserted on soft cuticle; legs II to IV have the paradactyli and median lobe of the pulvillus elongate, but blunt instead of acute apically. Aside from those exceptions, the genus was readily accommodated in the Platyseiiinae by sharing the following apomorphic attributes of that subfamily (Evans and Baker 1991, Lindquist 2003): The fixed digit of chelicerae has a deep subapical receptacle for receiving the apex of the movable chela; the anteriormost pair of hypostomatic setae and inner palptrochanter seta are elongated and somewhat whip-like; the tarsi of

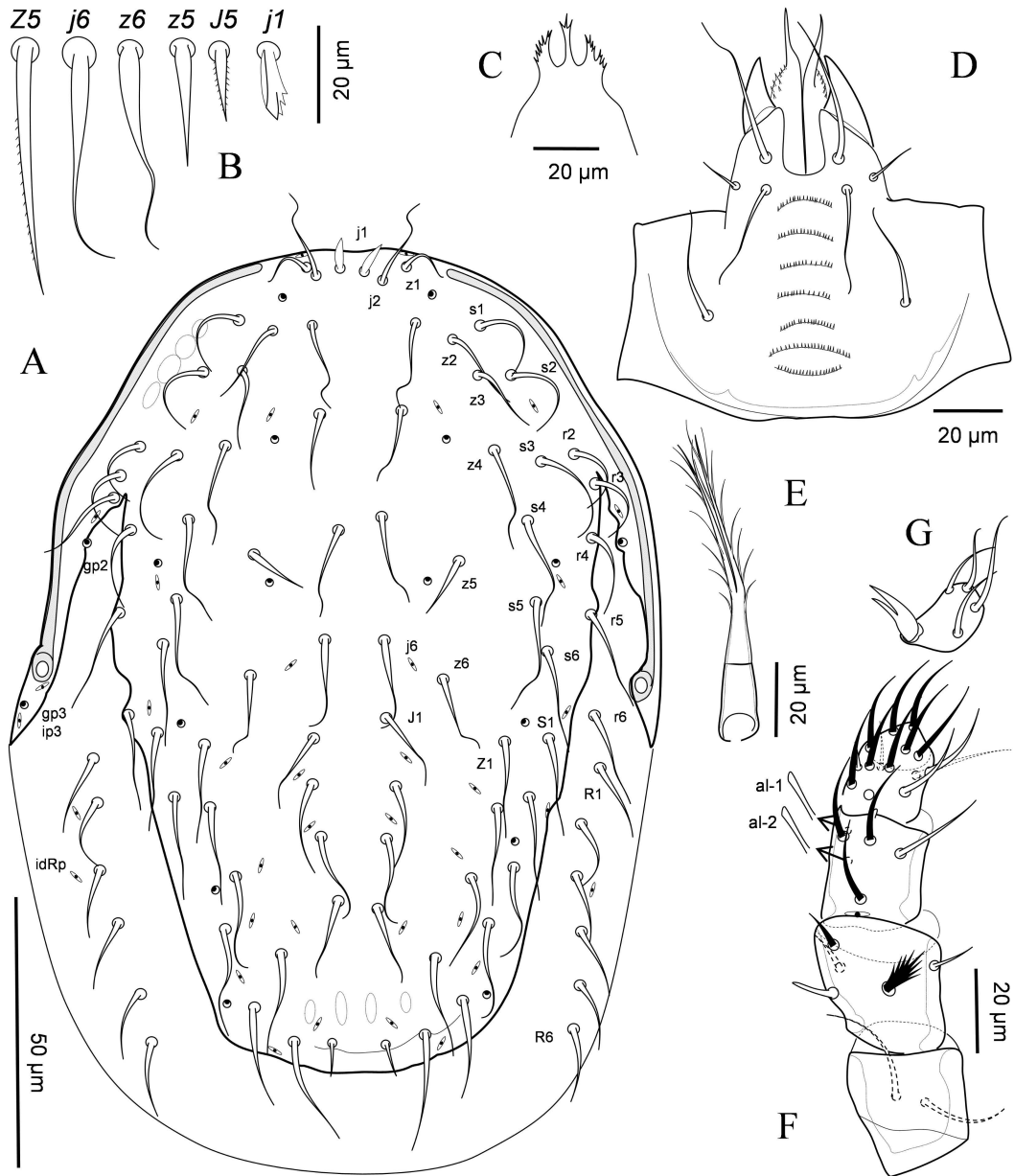


FIGURE 1: *Calyptoseius longinói* n. sp., adult female: A – Idiosoma, dorsal view; B – Detail of denoted dorsal setae; C – Gnathotectum; D – Subcapitulum; E – Tritosternum; F – Palp, dorsolateral view; dorsal setae in solid black color; G – Detail of palptarsus.

legs II to IV have the median lobe of the pulvillus slender (whether blunt or acute apically), and the paradactyli flanking the claws are elongated, often more so than the median pulvillar lobe; tarsi II to IV each have anterodorsal seta *ad-2* elongated and flattened, somewhat strap-like, along much of its length, tapering and curved only near its apex; tarsi II and III have a second seta (*pd-2*) similarly elongated and flattened; the femur of legs I and II has 11 and 10 setae, respectively, each lacking seta *v-3*.

One of us (EEL) has studied an adult female of an undescribed species of *Cheiroseiulus*, which is readily distinguished by the dorsal shield being less hypotrichous than that of the type species. This and other differences are accounted for in our augmented description of the genus, and in our key to platyseine genera in this paper.

Although not emphasized previously, the Platyseinae including *Cheiroseiulus* are also distinctive apomorphically in the form of cheliceral dentition and the prominence of the pseudosymmetric pair of apical dorsal setae (*d-1*) on tarsi II to IV. The fixed digit of the chelicera has a ridge between the apical hook and the pilus dentilis which bears a row of very fine or barely discernible teeth that do not (or hardly) extend proximally beyond the insertion of the pilus dentilis. The denticulate ridge is apposed at either extremity by one of the two teeth of the movable chela (see figures 40 of Lindquist and Evans 1965, 196 of Karg 1993, 2b of Evans and Baker, and 12.55H of Lindquist *et al.* 2009). On the tarsi of legs II to IV, the apical dorsal setae are conspicuous, longer than the pretarsus, and often reach distally to the same area as the apices of the paradactyli (see figures 2c of Evans and Baker, and 22 of Lindquist 2003).

As was the case with *Cheiroseiulus*, placement of our new genus in the Platyseinae requires cladistic rationale; this is presented in the remarks following its description. In turn, the description of the subfamily must be modified slightly, to accommodate this placement (see Discussion).

Calyptoseius, new genus (Figures 1-8)

Type species: *Calyptoseius longinoi* new species.
Monotypic.

Diagnosis — Adults (and deutonymphs) of the new genus are immediately distinguished autapomorphically from those of other platyseines as well as from other members of the superfamily Phyto-seioidea in having the tarsi of legs II to IV each with four elongated, strap- or whip-like setae (*ad-2*, *pd-2*, *al-2*, *pl-2*); those of other platyseine genera have at most three setae (*ad-2*, *pd-2*, *pl-2*) strap-like on tarsus II and two (*ad-2*, *pd-2*) strap-like on tarsi III-IV. They are also distinguished apomorphically from other platyseines in having the third pair of sternal setae alone clearly longer than the other sternal setae, the dorsal and lateral setae of most leg segments collectively palmate-ciliated, and the male having a discrete ventral shield between the sternitigenital and anal shields. They are distinguished plesiomorphically from those of other platyseines in having 12 and 11 setae on the femur of legs I and II, respectively (by retaining *pv-2*), and 11 and 9 setae on the genu of legs II and III (by retaining *pv-1*). Among the genera of Platyseinae, *Calyptoseius* shares with *Cheiroseiulus* the following apomorphic attributes: opisthogaster of female and male with an anal shield; gland pores *gv3* on soft integument adjacent to anal shield; and legs I to IV with paradactyli and medial lobe of pulvillus untapered, blunt-tipped. However, adults of *Calyptoseius* are similar plesiomorphically to those of *Cheiroseiulus* in having a holotrichous dorsal shield with 21 to 23 pairs of setae on the podonotal region and 15 to 18 pairs on the opisthonotal region, and in having 10 setae on tibia II (seta *pd-2* present).

Description:

Idiosomatic dorsum — Adult female. Dorsal shield entire, without lateral incisions, moderately well sclerotized, surrounding soft integument smoothly striate. Dorsal shield with complement of 38 pairs of setae, including 23 podonotal pairs (*j1-j6*, *z1-z6*, *s1-s6*, *r2-r6*) and 15 opisthonotal pairs (*J1-J5*, *Z1-Z5*, *S1-S5*), sometimes *r6* asymmetrically off shield; setae collectively of similar, smooth, attenu-

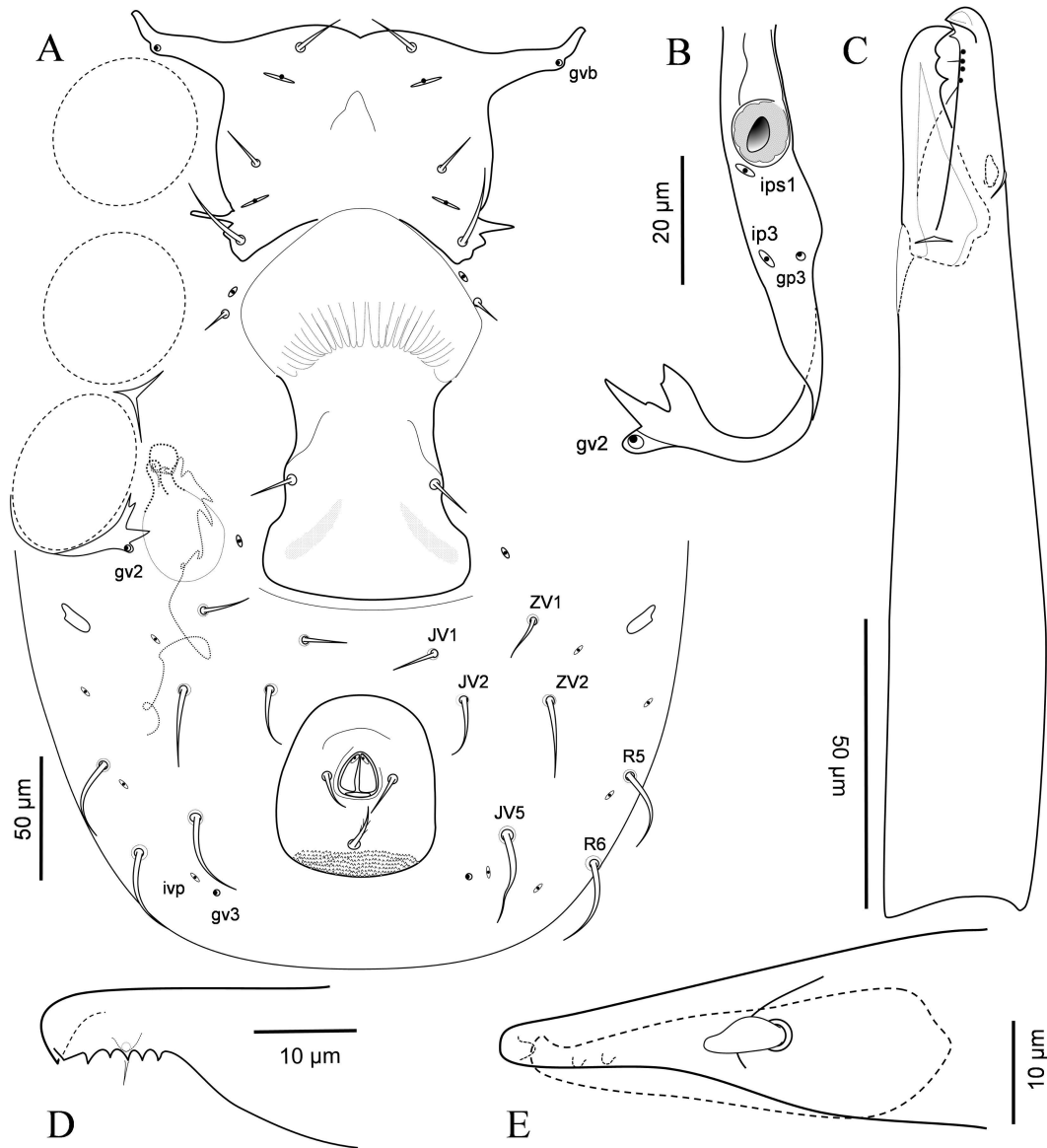


FIGURE 2: *Calyptoseius longinoides* n. sp., adult female: A – Idiosoma, ventral view; B – Detail of proximal region of peritrematal shield and its fusion with exopodal strip; C – Chelicera, anterolateral view; D – Fixed cheliceral digit, lateral detail of distal region; E – Dorsum of fixed digit, with detail of dorsal cheliceral seta.

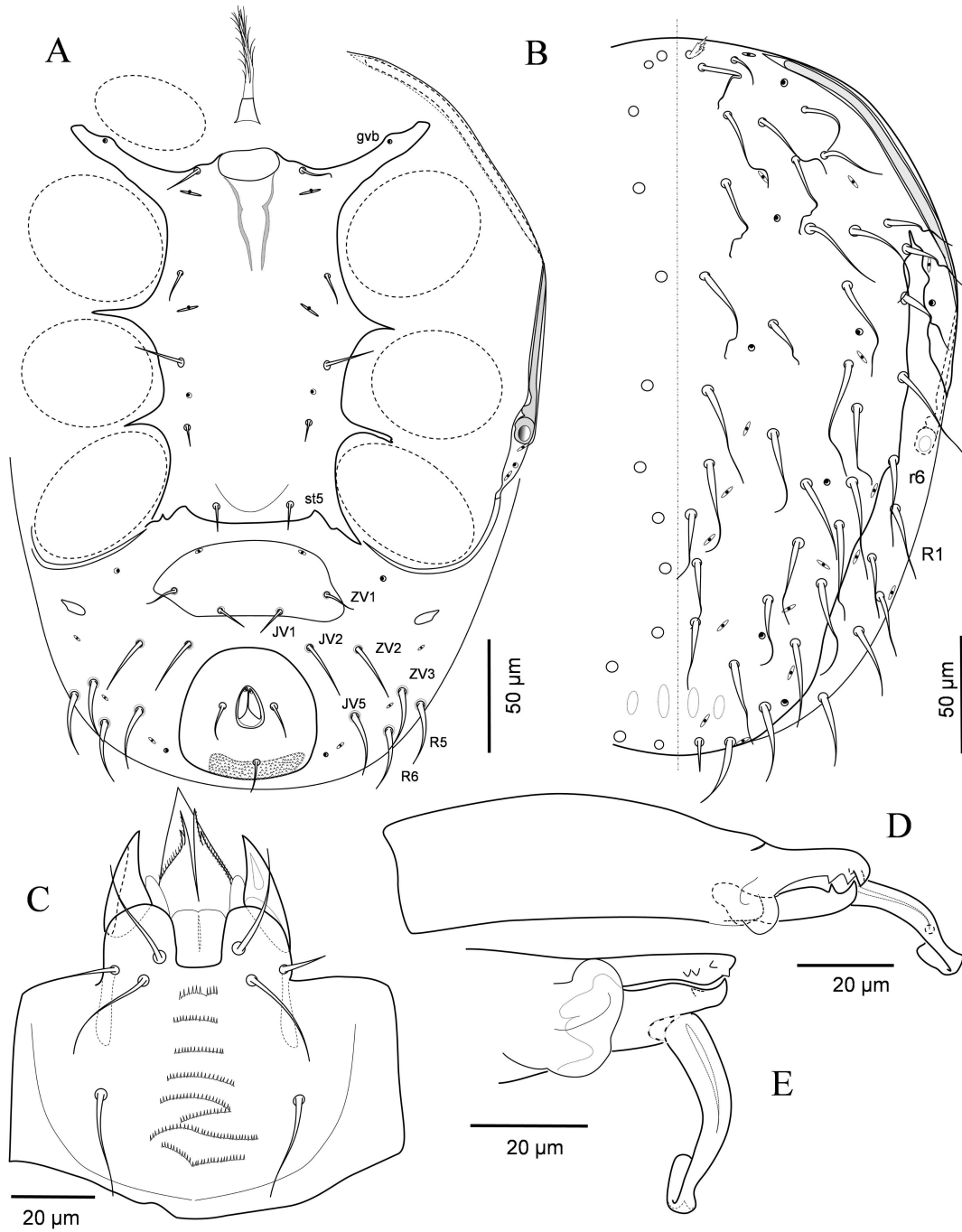


FIGURE 3: *Calyptoseius longinoi* n. sp., adult male: A – Idiosoma, ventral view; B – Idiosoma, dorsal view; C – Subcapitulum; D – Chelicera and spermatodactyl, lateral view; E – Detail of cheliceral digits and spermatodactyl.

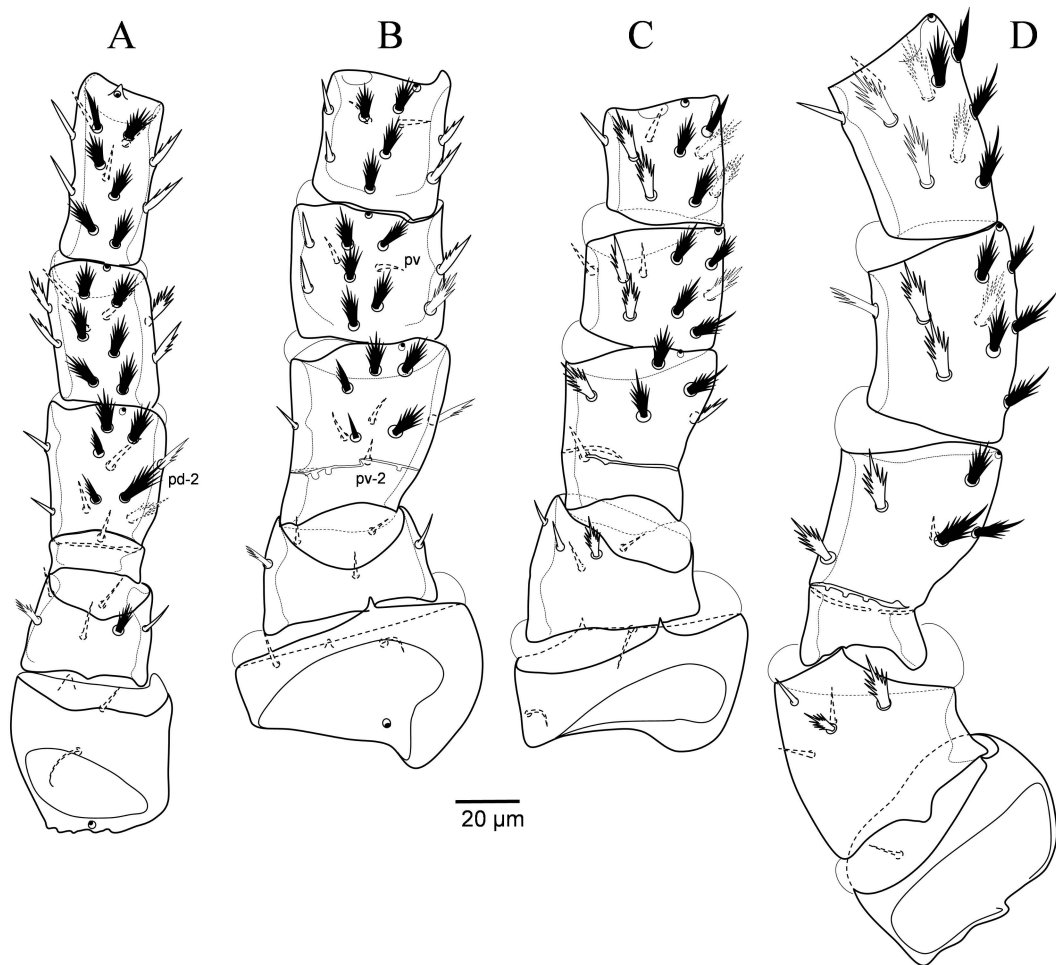


FIGURE 4: *Calyptoseius longinoi* n. sp., legs I-IV excluding tarsus, adult female: A – Leg I, dorsal view; B – Leg II, dorsal view; C – Leg III, anterolateral view; D – Leg IV, anterolateral view. Dorsal setae in solid black color.

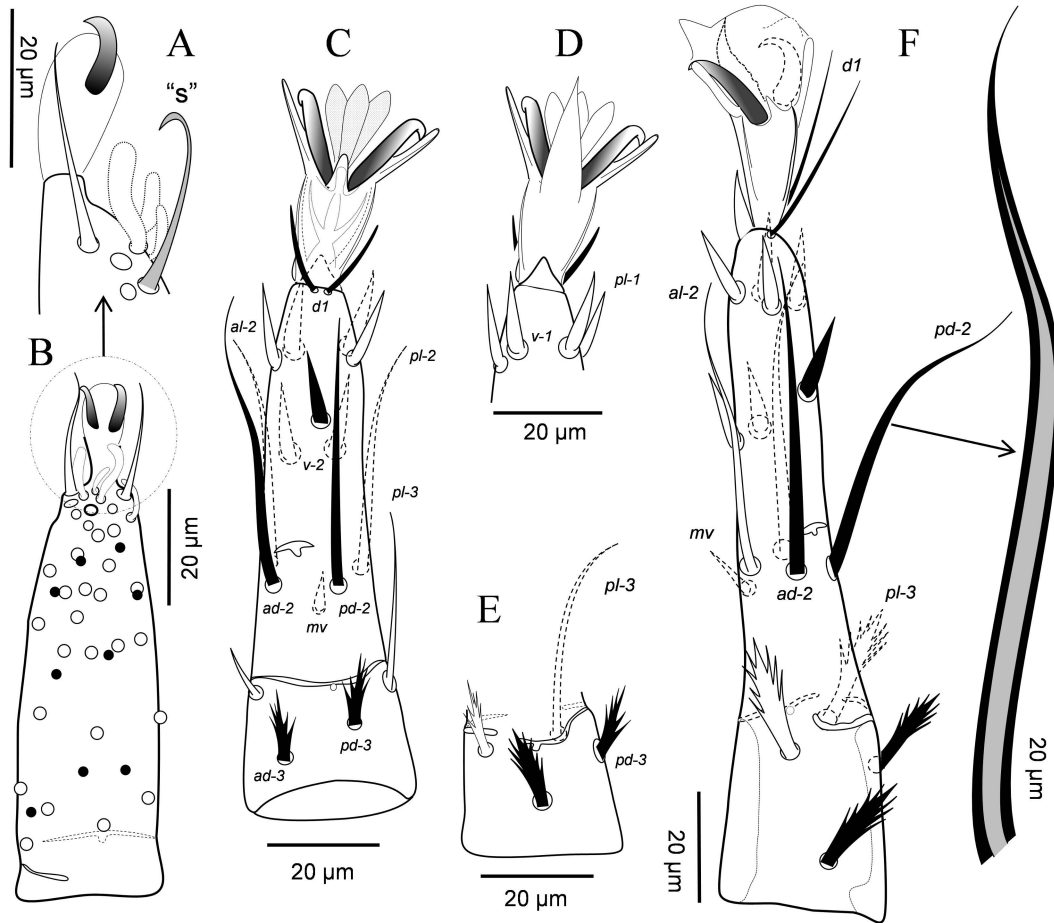


FIGURE 5: *Calyptoseius longinoi* n. sp., adult female: A – Tarsus I, detail of distal seta "s"; B – Tarsus I, dorsal view; C – Tarsus II, dorsal view; D – detail of pretarsus, ventral view; E – Detail of basitarsus III; F – Tarsus IV, anterolateral view and detail of dorsal strap-like seta. Fig. B, solid black circles refer to ventral setae; Figs. C-F, dorsal setae in solid black color.

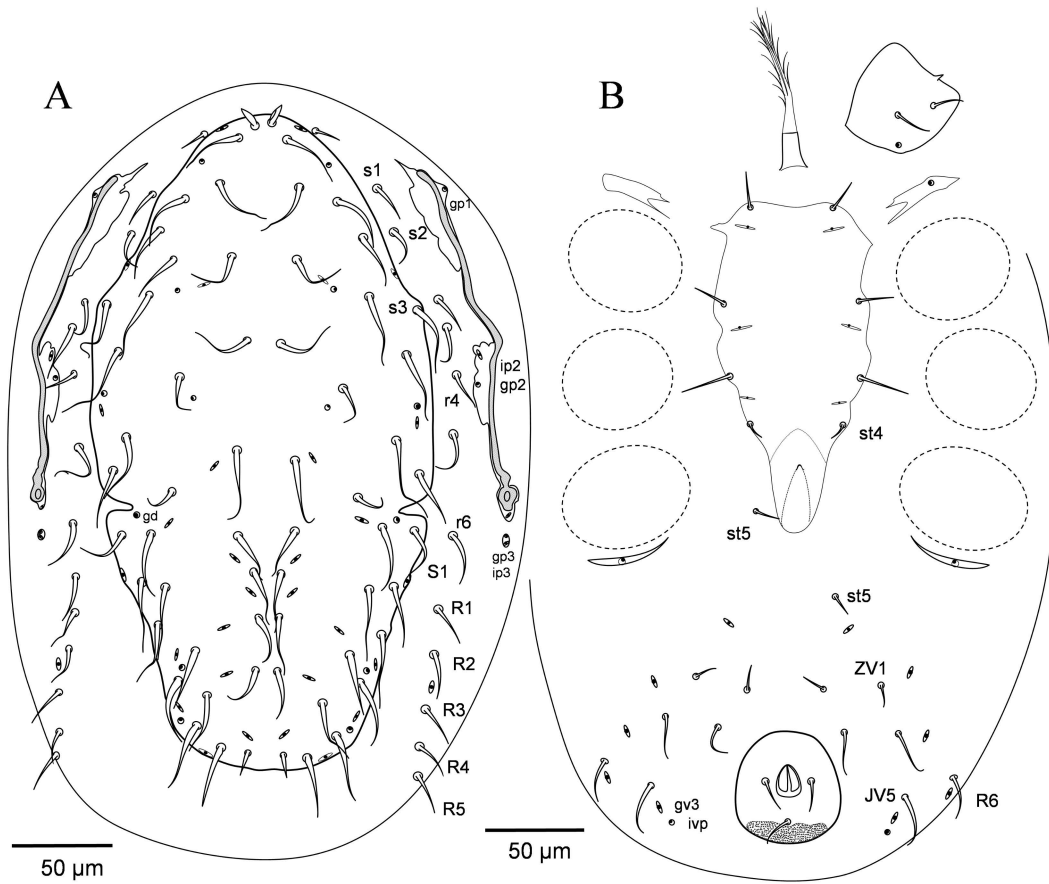


FIGURE 6: *Calyptoseius longinoi* n. sp. deutonymph: A – Idiosoma, dorsal view; B – Idiosoma, ventral view.

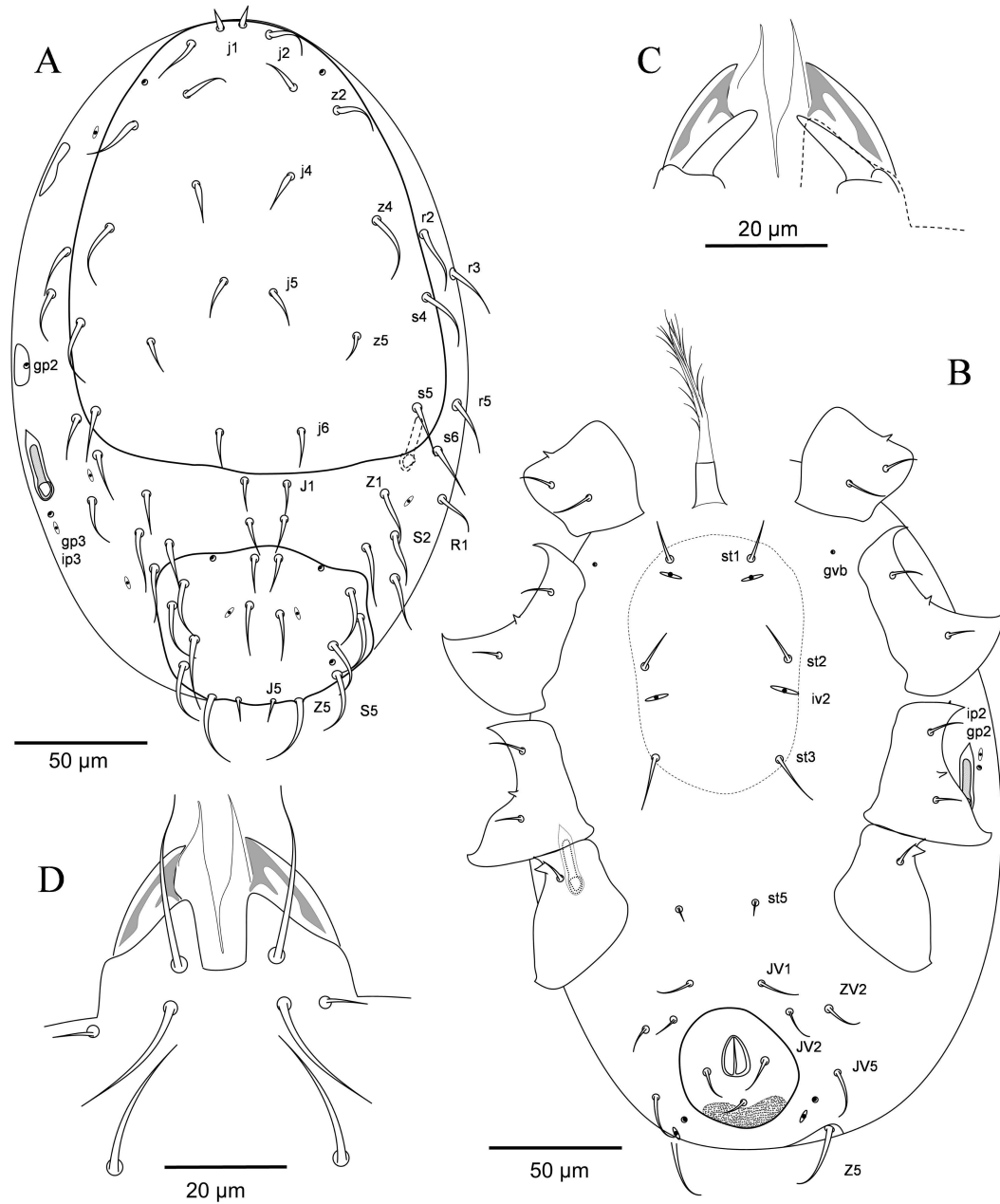


FIGURE 7: *Calyptoseius longinoi* n. sp. protonymph: A – Idiosoma, dorsal view; B – Idiosoma, ventral view; C – Detail of corniculi and salivary styli; D – Detail of apex of subcapitulum.

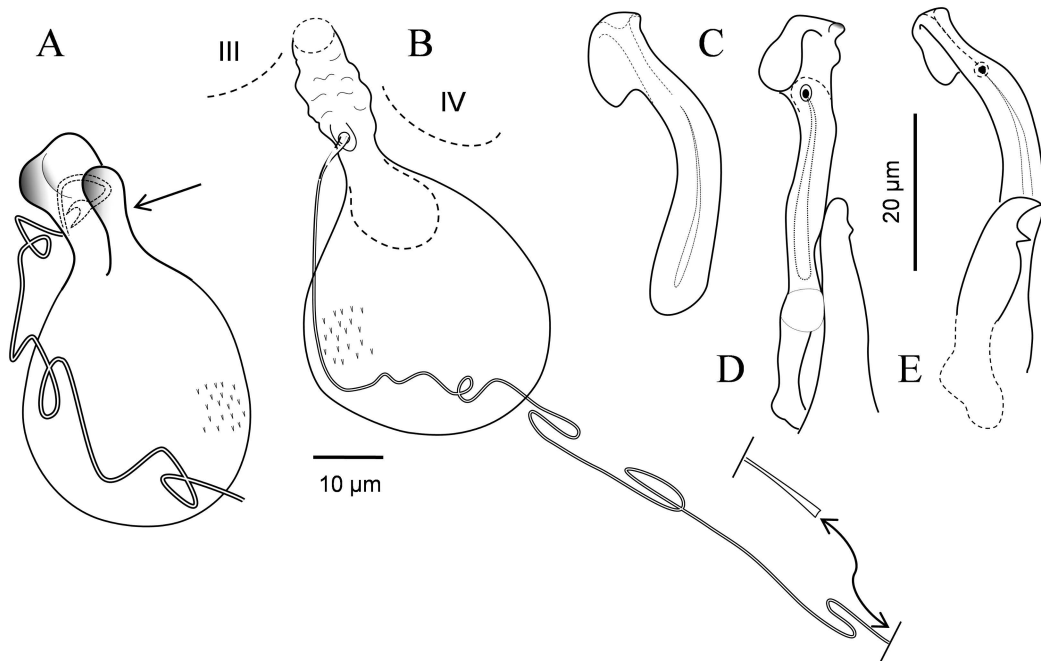


FIGURE 8: *Calyptoseius longinói* n. sp.: A, B – Female, spermathecal structures, different views, arrow pointing to diverticular lobe; C–E – Male, spermatodactyl, different views.

ated form and lengths except *j1* shorter, palmate-serrate, and *J5* shorter, slightly spiculate. Dorsal shield with complement of 23 pairs of discernible pore-like structures (nine podonotal, 14 opisthonotal), of which seven pairs (four podonotal, three opisthonotal) superficially appear secretory (gland pores) and 16 pairs (five podonotal, 11 opisthonotal) non-secretory (poroids). Soft surrounding cuticle with six or seven pairs of *R*-marginal setae and two pairs of marginal poroids including *idRp*, lacking *UR*-setae. Peritrematal plates broadly united anteriorly with dorsal shield to level of setae *r3*; peritremes well developed, reaching to level between setae *s1* and *z1*.

Adult male — Dorsal shield with form and sclerotization as in female except more broadly united to peritrematal shields at level of setae *r4*. Dorsal shield with complement and form of setae similar to that of female, except with usually two more pairs of marginal setae including *r6* and sometimes *R1*. Lateral soft cuticle with five or six pairs of *R*-marginal setae. Peritremes as in female.

Deutonymph — Dorsal shield with short lateral incisions, similarly sclerotized as in adults. Dorsal shield with complement of 30 pairs of setae, including 15 podonotal and 15 opisthonotal pairs, of similar length and shape as in adult; 14 pairs of dorsal setae on surrounding soft integument (*z1*, *s1*, *s2*, *r2-r6*, *R1-R6*). Dorsal complement of discernible pore-like structures as in adult. Peritrematal shields free, limited to a narrow strip with two widened areas, one at anteriormost dorsal region bearing *gp1*, one at medial area bearing *gp2*, *ip2*; a short poststigmatic extension with *ips1*; gland pore *gp3* and poroid *ip3* on a tiny platelet on soft cuticle behind stigma; peritremes well developed, narrow, extending to level of setae *s1*.

Protonymph — Dorsal shields weakly sclerotized. Podonotal shield with 11 pairs of setae (*j1-j6*, *z2*, *z4*, *z5*, *s4*, *s5*) similar in moderate length and simple form, except *j1* shorter palmate-spiculate, flanked by four pairs of setae (*r2*, *r3*, *r5*, *s6*) on soft lateral cuticle; pygidial shield with eight pairs of setae (*J3-J5*, *Z3-Z5*, *S4*, *S5*) of similar size and simple

form except *J5* shorter, slightly spiculate, and three pairs of pore-like structures discernible (two pairs of gland pores, one pair of poroids); soft cuticle between shields with seven pairs of dorsal setae (*J1, J2, Z1, Z2, S2, S3, R1*). Peritrematal shields fragmented and free, and peritremes short, alongside coxae III and IV; poroids *gp2* on small peritrematal platelet, *gp3, ip3* on soft cuticle behind the stigma.

Idiosomatic venter — Adult female. Tritosternum with pilose laciniae free for most of length, their fused section and base without elaborations (Fig. 1E). Ventral shields unornamented, weakly sclerotized. Presternal region without platelets. Sternal shield entire, with well developed endopodal extensions between coxae I-II bearing gland pore *gvb* distally, and with those poorly developed between coxae II-III; shield with three pairs of setae, *st3* the longest, and two pairs of lyrifissures; setae *st4* and lyrifissures *iv3* on soft cuticle (Fig. 2A). Endopodal strips between coxae III and IV free, weakly defined, distant from sternal shield. Epigynal shield with its convex hyaline anterior margin between legs II-III abutting or barely overlapping posterior edge of sternal shield, its posterior margin slightly convex; setae *st5* on shield's lateral margins, paragenital poroids *iv5* on soft cuticle; postgenital furrow present, its strip of transverse platelets hardly discernible. Soft opisthogastric integument with small, undivided metapodal platelets, five pairs of setae (*JV1, JV2, JV5, ZV1, ZV2*), and four pairs of poroids, flanked by posteriormost two pairs of *R*-setae. Opisthogaster with anal shield ovoid, with paranal setae inserted at midlevel of anus, and similar in size to postanal seta; anal valves with euanal poroids; shield with a well-developed cribrum behind level of postanal seta; gland pores *gv3* on soft cuticle well removed from shield. Peritrematal shield connected with exopodal strips curving behind coxa IV, with two poroids (*ip3, ips1*) and one gland pore (*gp3*) in area behind stigma; shield with poroid *ip2* and gland pore *gp2* along widened area below level of setae *r3-r4* (Figs 1A, 2B). Exopodal strip weakly developed freely alongside peritrematal shield by coxae II-IV, with small extensions between I-II, II-III, III-IV (not shown in figures). Spermathecal apparatus of

phytoseioid-type, with minor duct emanating from embolus near base of sclerotized calyx, and with major duct leading from calyx to solenostome between coxae III-IV (Figs 8A, B).

Adult male. Aspects of tritosternum and presternal area as in female. Ventral shields unornamented, weakly sclerotized. Sternitigenital shield with five pairs of setae and three pairs of poroids, and fully contiguous with well developed endopodal extensions between coxae I-II, II-III, and III-IV (Fig. 3A); relative lengths of sternal setae as in female. Opisthogaster with discrete ventral shield bearing one or two pairs of setae (*ZV1* laterally and *JV1* on or barely off posterior margin); soft opisthogastric integument with metapodal platelets as in female, four or five pairs of setae (*JV2, JV5, ZV2, ZV3*, sometimes *JV1*), and three pairs of poroids, flanked by posteriormost two pairs of *R*-setae. Opisthogaster with discrete anal shield, with aspects of its form, three circumanal setae, and cribrum as in female. Posteriorly and laterally, peritrematal shield, peritreme, and exopodal strip as in female.

Deutonymph. Tritosternum and presternal area as in female. Ventral shields unornamented, weakly sclerotized. Sternal shield with four pairs of setae and three pairs of poroids (*iv3* present); setae *st5* and poroids *iv5* on soft cuticle; shield without endopodal extensions, but endopodal fragment well developed, apically with gland pore *gvb*, between coxae I and II; endopodal fragments between coxae II-III indiscernible (Fig. 6B); narrow rim of exopodal plate behind coxa IV with gland pore *gv2*. Opisthogaster similar to female; soft integument with five pairs of setae, three pairs of poroids, and gland pore *gv3*. Anal shield with aspects of its form, three circumanal setae and cribrum as in female.

Protonymph. Tritosternum and presternal area as in deutonymph. Sternal shield weakly delineated, with three pairs of setae and one pair of poroids (*iv1* indiscernible); endopodal extensions between coxae I-II hardly discernible but *gvb* present (Fig. 7B); intercoxal soft cuticle with tiny setae *st5* between bases of legs IV. Opisthogaster with well delineated anal shield surrounded by soft integument with four pairs of setae (*JV1, JV2, ZV2,*

JV5) and two pairs of discernible pore-like structures including *gv3*. Anal shield with structures much as in deutonymph, except postanal seta somewhat shorter than paranal setae.

Gnathosoma — Gnathotectum with three denticulate branches (Fig. 1C), median branch not elongated. Chelicera slender, its shaft moderately elongated (but dimorphically shorter on male), without any conspicuous process along antiaxial or paraxial lateral surfaces near bases of the digits; fixed digit with setiform pilus dentilis and row of few small teeth along apical one-third of masticatory surface, and an offset tooth (gabelzahn) subapically (Figs 2C, D); movable cheliceral digit of female and nymphs bidentate, with margin of arthrodial envelope smooth; movable digit of male unidentate with spermatodactyl digitiform, free to its connection at base, directed anteriorly and somewhat ventrally. Deutosternum with usually seven (variably eight) transverse rows of denticles, anterior five rows similarly moderately wide, sixth and seventh rows somewhat wider; all rows similarly spaced from one another, multidenticulate and indistinctly connected by lateral edges. Corniculi normal in form, entire, well separated from base to apex, with blunt-tipped salivary styli appressed to dorsal cornicular faces; male with blunt lobe medial to insertion of corniculus (Fig. 3C); internal malae normal in form, somewhat longer than corniculi, fimbriated laterally, not subdivided. Subcapitular setae similarly smooth, attenuate, *hp1* slightly longer, more whip-like than *hp3* and *pc*, which clearly longer than lateral *hp2* (Fig. 1D). Palpi with normal setation as described for Gamasina by Evans (1964); palp-trochanter with inner seta longer, more whip-like, than outer seta; palpfemur with seta *pd* palmate, spiculate, like most dorsal setae on legs, and with *al* spatulate; palpgenual setae *al-1* and *al-2* more or less spatulate; palptarsal apotele two-tined (Figs 1F, G).

Legs — Legs I to IV with pretarsi bearing paired claws, those of II-IV with blunt paradactyli, pulvillae with three blunt lobes, and one slender ventral acuminate lobe (Figs 5C, D). Legs I the thinnest, legs IV especially elongate and stronger; legs II to IV with tarsus two to three times as long as tibia. Dis-

tal margins of coxae I-IV lacking serrations or spur-like processes. Tarsus I without markedly elongated setae apically, and with sensilla *s* conspicuous, its apex slightly lanceolate (Fig. 5A). Tarsi II-IV each with apical setal processes *ad-1*, *pd-1* as long as pretarsi, and with four elongated, strap- or whip-like setae, *al-2* and *pl-2* nearly as long as *ad-2* and *pd-2*. Complement of setae on segments of legs I-II-III-IV differs in several respects (indicated by boldface) from that of other Platyseiniinae as presented by Lindquist & Evans (1965): coxae, 2-2-2-1; trochanters, 6-5-5-5; femora, 12 (2 3/1 2/2 2) – 11 (2 3/1 2/2 1) – 6 (1 2/0 1/1 1) – 6 (1 2/0 1/1 1); genua, 13 (2 3/1 3/2 2) – 11 (2 3/1 2/1 2) – 9 (2 2/1 2/1 1) – 9 (2 2/1 3/0 1); tibiae, 13 (2 3/1 3/2 2) – 10 (2 2/1 2/1 2) – 9 (2 1/1 2/1 2) – 10 (2 1/1 3/1 2); femora I and II each with a third ventral seta (*pv-2*, sometimes denoted as *v-3*) added to deutonymph; genua II and III each with deutonymphal seta *pv-1*, genu IV lacking *pv-1*; tibia II with 10 setae, *pd-2* present (Figs 4A-D). Other than on tarsi, dorsal and lateral leg setae collectively palmate-spiculate, and ventral setae mostly smooth. Legs of male without conspicuous dimorphically modified setae; dorsal setae of tibiae I and II smooth; dorsal setae of genua I and II less palmate-spiculate.

Immature instars. Structures of legs and shapes of setae in nymphal instars, and leg chaetotaxy of deutonymph as in adults. Leg chaetotaxy of protonymph typical of general pattern presented for free-living Gamasina by Evans (1963): coxae, 2-2-2-1; trochanters, 4-4-4-4; femora, 10 (2 3/1 1/1 2) – 8 (1 2/1 2/1 1) – 5 (1 2/1 1/0 0) – 4 (1 2/0 1/0 0); genua, 8 (1 2/1 2/1 1) – 6 (1 2/0 2/0 1) – 6 (1 2/0 2/0 1) – 5 (1 2/0 2/0 0); tibiae, 8 (1 2/1 2/1 1) – 7 (1 1/1 2/1 1) – 7 (1 1/1 2/1 1).

Etymology

The genus name is a Latinized combination of the term *calypto*, based on the Greek *kalyptos*, meaning 'concealed' or 'covered', and *seius* or *sejus*, a Roman surname used by many authors to form names for genera of mesostigmatic mites. The name is masculine in gender, and is intended to refer to the hidden niche in which these mites are found associated with ants in *Cecropia* trunks.

Distribution and habitats

The new genus is currently based on one newly described species. Nymphs and adults are known only from one cohabitation of a nest of *Azteca* ants in a stem hollow of the trunk of a *Cecropia* tree (see discussion).

Remarks

Placement of this new monobasic genus requires modification of the concepts of the subfamily Platyseiniinae as presented previously by Lindquist (2003), since adults of this genus are morphologically exceptional, as follows. On deutonymphs and adults, autapomorphically the telotarsi of legs II to IV each have four setae modified as elongated strap- or whip-like setae, while plesiomorphically, the femora of legs I and II have 12 and 11 setae, respectively, each having three ventral setae (*pv*-2 present), and the genua of legs II and III have 11 and 9 setae, respectively, each having two ventral setae (*pv* present). Also, adult males have a discrete ventral shield separate from an anal shield, an apomorphic attribute otherwise noted for a few species of the ascid genus *Arctoseius*, e.g., *A. weberi* Evans (Lindquist 1961). A basically more complete chaetotaxy of the leg femora and genua is the same as for the family Blattisociidae as a whole, thus eliminating one of the apomorphic distinctions between the Platyseiniinae and its sister subfamily Blattisociinae. However, such aspects of leg chaetotaxy are prone to homoplasy, and as noted above, a conceptual rationale for the Platyseiniinae remains on firm cladistic footing, with both apomorphic and plesiomorphic differences accommodated in the revised description of the subfamily in the discussion.

Aside from those exceptions, *Calyptoseius* is readily accommodated in the Platyseiniinae by sharing the following apomorphic attributes of that subfamily (Evans and Baker 1991, Lindquist 2003): The cheliceral structure of the fixed digit includes a deep subapical receptacle for receiving the apex of the movable chela, followed by a ridge between the apical hook and the pilus dentilis that bears a row of very fine or barely discernible teeth, and is apposed at either extremity by one of the two teeth

of the movable chela. The anteriormost pair of hypostomatic setae and inner palptrochanter seta are elongated and somewhat strap- or whip-like. On legs II to IV, the pretarsi have the median lobe of the pulvillus slender (whether blunt or acute apically), and the paradactyli flanking the claws are elongated, often more so than the median pulvillar lobe; the apical dorsal setae (*d*-1) of the tarsi are prominent, longer than the pretarsi to the base of the claws; the anterodorsal seta *ad*-2 is elongated and flattened, somewhat strap-like, along much of its length, tapering and curved only near its apex, and the posterodorsal seta (*pd*-2 on tarsi II and III) is similarly elongated and flattened. A revised description of the subfamily is provided in the discussion.

Calyptoseius longinoi new species (Figures 1-8)

Diagnosis — The diagnostic attributes of the genus distinguish this species from others described among genera of Platyseiniinae. In addition, dorsal shield with setae *j*1 short, thick, serrated, in distinction to all other, attenuated dorsal setae, and setae *z*5 clearly shorter than all other dorsal setae excepting *j*1, *z*1 and *J*5. The short, palmate-spiculate form of the dorsal and lateral setae collectively on the femora, genua, tibiae and basitarsi of the legs, also matched by the dorsal seta of the palpgenu, is distinctive.

Description:

Adult female — Idiosoma 364 – 400 long, 250 – 275 wide; dorsal shield 331 – 362 long, 208 – 220 at its greatest width at level slightly posterior to insertions of setae *r*3 (*n* = 5). Dorsal shield slender, about 1.6 as long as wide, suboval, tapered along posterior half, with slightly rounded posterior margin (Fig. 1A); shield unornamented over entire surface, with conspicuous glandular pores, four podonotal pairs, and three opisthonotal pairs; shield with distribution of 16 pairs of poroids as shown in figure 1A. Dorsal shield with 37-38 pairs of setae of mostly similar lengths and attenuate form (Fig. 1B), all, excepting shortest *j*1 and *J*5, smooth, some with rather thin sinuous apices; *j*1 (13 – 15) widened with serrate lateral margins, *j*2- *j*6 (33 – 42) with nearly equal

transverse intervals between insertions, *z1* (19–20), *z5* (25–29), *z2-z6* (37–45), *s1* (35–37), *s2-s6* (37–48), *r2-r6* (36–42); *J1-J4* (36–42), *J5* (14–16) slightly barbed, *Z1-Z5* (36–48), *S1-S5* (37–50). Lateral soft cuticle with six or seven pairs of marginal setae (27–43), *r6* off or on shield, *R2*, *R3* usually somewhat shorter (ca. 27–30) (Fig. 1A). Anterior extremity of peritrematal shield fused to dorsal shield at level of setae *r2-r3*, with pore *gp1* on ventral margin at level of setae *s1*, and *gp2* and poroid *ip2* on dorsal margin at level of setae *r2-r3*; peritremes thin, extending nearly to setae *z1* (Fig. 1A).

Tritosternum with base clearly longer (17–20) than basal width (10–12), with laciniae fused for about 0.3 of total length (67–80 excluding base), their fused length with base nearly bare, but free extensions with long, thin pilosity (Fig. 1E). Presteral area weakly transversely striate. Sternal shield mid-length (82–88) less than width at level of setae *st2* (95), with anterior margin slightly indented medially, posterior margin broadly concave, and surface unornamented except for faint mid-sternal marking. Sternal setae *st1*, *st2* subequal in length (16–18), *st3* clearly the longest (27–32), and *st4* the shortest (10–11) on soft cuticle. Endopodal fragment between coxae III-IV free from strip behind coxa IV. Epigynal shield smooth, 158–162 long, including expansive hyaline flap length of 70–75, narrowest width 52–61, and width 77–82 at level of slightly rounded posterior margin (Fig. 2A); with setae *st5* (15–17) similar in length to *st1-st2*. Paragenital poroids *iv5* well removed on soft cuticle from rounded posterolateral corners of epigynal shield. Anal shield ovate, smooth, its greatest width (59–65) slightly less than its mid-length (64–72), including cribrum; postanal seta (12–15) smooth or slightly barbed, nearly as long as paranal setae (14–17); cribrum thick (ca 45–55 wide, 10 long), confined to level behind postanal seta (Fig. 2A). Soft opisthogastric cuticle with gland pore *gv3* adjacent to poroid *ivp* well removed from anal shield, and with five pairs of setae of dissimilar lengths, *JV1* (13–17), *ZV1* (15–19), *JV2* (21–26), *ZV2* (29–39), and *JV5* (33–45) similar in thicker yet attenuated form to flanking marginal setae *R5*, *R6*. Peritrematal shield and its pore-like structures as de-

scribed for genus (Figs 1A, B). Spermathecal apparatus with components difficult to delineate in specimens at hand, but with a long minor duct emanating from embolus at base of an ovoid, indiscernibly sclerotized, finely spiculated calyx with small diverticular bulge near base of wide major duct leading to solenostome between bases of legs III and IV: minor duct with terminus simple, slightly thickened, in posterior region of opisthosoma (Figs 8A, B).

Gnathotectum (Fig. 1C) triramous, with lateral branches wider, denticulated antiaxially, central branch somewhat longer, denticulated at tip. Cheliceral shaft, excluding basal section 145–158 long (ca 0.4 dorsal shield length), with moderately small digits (Fig. 2C); dorsal face of fixed digit with basally widened dorsal seta (Fig. 2E); fixed digit with offset subapical tooth by apical hook, and with pilus dentilis and file of three or four small teeth on ridge in apposition between two teeth of movable digit (length 36–41) (Fig. 2D). Corniculi horn-like, 25–30 long; internal malae (ca. 25) projecting somewhat beyond tips of corniculi; labrum (50) extending beyond tips of internal malae (as in Fig. 3C) to anterior edge of palpgenu. Subcapitulum with apical five rows of deutosternal denticles similar in width, number (25–30) and fine size of denticles, sixth row the widest, sixth and seventh row sometimes irregular or with an eighth row. Subcapitular setae with *hp1* (40–46) the longest, somewhat whip-like, *hp3* (22–31), *hp2* (11–13), and *pc* (27–31). Palpus length (111–114); palpfemur (30–33) nearly as long as palpgenu (24–29); palptrochanter with inner seta longer (26–30) than outer seta (20–22) but not markedly whip-like; palpfemur with dorsal seta distinctively palmate-spiculate (Fig. 1F).

Legs IV the longest of legs (Figs 4A–D), clearly (about 1.3) longer than dorsal shield length; leg lengths, excluding pretarsi: I 288–325, II 300–324, III 290–322, IV 415–460. Leg I tarsus (70–75) about 1.3–1.5 longer than each of femur (55–59), genu (45–50), and tibia (53–59). Tarsus I with short pretarsus (10–11 to base of claws) and claws smaller than on other legs (Fig. 5B). Legs II, III with tarsus/tibia length ratio about 2.1, IV with that ratio about 1.8–1.9. Tarsi II–IV with ventroapical process spade-shaped apically (Figs 5D, F); apical setal

processes (*d-1*) relatively short (10 – 13), not reaching to bases of claws on tarsi II, III (Fig. 5C), but well developed (26 – 33), reaching to tips of claws on tarsus IV (Fig. 5F); paradactyli blunt, well developed, as long as claws (13 – 19); pretarsus length to base of claws (16 – 22); pulvillus with three dorsal blunted lobes and one slightly longer, ventral, acuminate process (14 – 17) (Figs 5C, D); of elongated setae, (*l-2*) (40 – 55) whip-like, slightly shorter than strap-like (*d-2*) (50 – 60); setae (*l-1*), (*v-1*), (*v-2*), *md* spine-like, of similar length (13 – 15), *mv* shortest (10 – 11) (Figs 5C, D, F); seta *pl-3* of basitarsus II, III smooth, attenuate (38 – 40), longer than basitarsus length (Figs 5C, E), *pl-3* of basitarsus IV of short (22 – 23) spiculated form similar to other three basitarsal setae (Fig. 5F). Legs I to IV with chaetotactic formulae of segments as described for genus, including presence of 12 setae on femur I (with *pd-2*), 11 on femur II (with *pv-2*), and 11 and 9 setae on genua II and III, respectively (each with *pv*). Leg segments with dorsal and lateral setae collectively palmate-spiculate, ventral setae smooth.

Adult male — Idiosoma ca 293 – 330 long, ca 204 – 226 wide. Dorsal shield 310 – 313 long, 184 – 205 wide at level of setae *r6* ($n = 5$); shield ornamentation, complement of pore-like structures and setation as in female except slightly more expanded laterally so as to bear setae *r6* and sometimes *R1* (Fig. 3B). Dorsal shield with 39 – 40 pairs of setae, their form and lengths as in female, except *J4*, *Z5* slightly barbed like *J5*: *j1* (8 – 12), *j2-j6* (37 – 42), *z1* (14 – 22), *z5* (12 – 29), *z2-z4*, *z6* (29 – 42), *s1-s2* (33 – 35), *s3-s6* (29 – 42); *J1-J4*, *Z1-Z5*, *S1-S5* (35 – 42), *J5* (11 – 14). Lateral soft cuticle with five or six pairs of *R*-setae (26 – 34), *R1* on or off shield. Form of peritrematal shields and extent of peritremes as in female.

Tritosternum much as in female, but with base no longer (6 – 11) than width (8 – 11), and laciniae (54 – 56) fused for only about 0.1 of total length. Presternal region unornamented as in female. Sternitigenital shield length ca 155 – 162, width 72 – 75 at level of coxae II; shield mostly smooth, slightly marked near posterior margin; setae *st1-st5* of dissimilar lengths as in female, *st1-st2* (13 – 18), *st3* the longest (21 – 26), *st4* (8 – 11), *st5* (10 – 14); poroids *iv3* sometimes hardly discernible. Ventral shield un-

ornamented, 28 – 30 long, 73 – 84 wide, with setae *ZV1* (17 – 21) inserted near bluntly angled lateral corners; anterior margin slightly convex, with pair of poroids barely on its edge, and posterior margin slightly concave, with setae *JV1* (12 – 17) barely on its edge. Anal shield and cribrum similar in form as in female, its greatest width (55 – 57) nearly equal to its length (55 – 62, including cribrum ca. 7 – 9 long, 35 – 39 wide); *gv3* on soft cuticle at level of postanal setae; postanal seta smooth (12 – 14), nearly as long as paranal setae (14 – 17). Soft opisthogastric cuticle with four pairs of setae, *JV2* (18 – 28), *ZV2* (33 – 38), *JV5*, *ZV3* similar in slightly thicker form and size to adjacent flanking dorsal setae *R5*, *R6* (26 – 34), and with gland pore *gv3* adjacent to poroid *ivp* well removed from anal shield (Fig. 3A).

Gnathotectum as in female. Cheliceral shaft, excluding short basal section, 99 – 102 long (ca 0.3 dorsal shield length) (Figs 3D, E); fixed digit with offset subapical tooth followed by pilus denticilis and two moderate-sized teeth (Fig. 3D); movable digit (29 – 34) unidentate; spermatodactyl 34 – 40 long, 5 – 8 wide at base, extending anteriorly 26 – 30 beyond apex of digit, with widened (9 – 10) head apically (Figs 3D, E and 8C-E). Corniculi slightly more widely spaced than in female, 23 – 25 long, and flanked medially by pair of short (ca 10) blunt processes of separate origin (Fig. 3C); internal malae and labrum as in female. Subcapitulum with seven or eight rows of deutosternal denticles much as in female but gradually widened, first row the narrowest with fewer (10-15) teeth, sixth row the widest with 25-40 teeth; hypostomatic setae *hp1* (26 – 28) slightly longer, *hp2* and *pc* subequal (22 – 27), *hp3* shortest (10 – 12). Palpi (length 103 – 110) similar in structure, form of setae as in female; palptrochanter with inner seta longer (23 – 24) than outer seta (18) but not markedly whip-like.

Relative leg thicknesses and lengths, excluding pretarsi, similar to those of female, I 279 – 286, II 275 – 287, III 263 – 275, IV 387 – 405. Legs with segment length ratios as in female. Tarsus I with short pretarsus (4 – 7), claws 9 – 12 long. Tarsi II-IV with ventroapical process and pretarsal structures formed as in female, pretarsus lengths 16 – 18 excluding claws (15 – 20). Apical setal processes (*d-1*) relatively short

(ca 12), not reaching to bases of claws on tarsi II, III, but well developed (23 – 27), reaching to tips of claws on tarsus IV; of elongated setae, (*l*-2) (35 – 50) whip-like, slightly shorter than strap-like (*d*-2) (46 – 56); length and form of other setae much as in female; seta *pl*-3 of basitarsus II, III smooth, attenuate (36 – 38), but *pl*-3 of basitarsus IV of short (21 – 22) spiculated form similar to other three basitarsal setae. Scant male dimorphism discerned among leg setae except dorsal setae nearly smooth on tibiae I and II, and less spiculated on genua I and II.

Deutonymph — Dorsal shield weakly sclerotized, 280 – 315 long, 145 – 157 wide at its greatest width at level of setae *z*5 (*n* = 3), with short lateral incisions reaching only to gland pores; shield with setae *j*1-*j*6, *z*2-*z*6, *s*3-*s*6, *J*1-*J*5, *Z*1-*Z*5, *S*1-*S*5, and with seven pairs of glandular pores, 15 pairs of poroids; dorsal setae *z*1, *s*1, *s*2, *r*2-*r*6, *R*1-*R*6 inserted on soft integument near lateral margins of shield (Fig. 6A). Form and relative lengths of dorsal setae as in adult female, except *J*3, *J*4, *S*5, *Z*4, *Z*5 sometimes slightly barbed, like *J*5; on shield, *j*1 (10 – 11), *j*3 (30 – 33), *j*2, *j*4-*j*6 (20 – 25), *z*3 (20 – 27), *z*2, *z*4, *z*6 (27 – 31), *s*3-*s*6 (31 – 35), *J*1, *J*2 (24 – 28), *J*3-*J*4 (21 – 23), *Z*1-*Z*3 (26 – 31), *Z*4-*Z*5 (24 – 27), *S*1-*S*5 (28 – 34), clunal *J*5 (11 – 12); on soft cuticle, *z*1 (11 – 14), *s*1, *s*2, *r*2, *r*4, *R*2-*R*6 (17 – 20), *r*3-*r*6, *R*1 (23 – 28). Peritrematal plate a thin strip, reaching anteriorly slightly beyond level of setae *st*1, discernibly widened anteriorly alongside setae *s*1-*s*2, where *gp*1 inserted ventrolaterally, and at midlevel where *ip*2 and *gp*2 inserted dorsolaterally; post-peritrematal pore-like *ip*3, *gp*3 on soft cuticle (Fig. 6A). Peritreme long (175 including stigma) extending anteriorly to level of setae *s*1.

Tritosternum similar in form to that in female, with base clearly longer (18 – 20) than basal width (12), but with laciniae fused for only about 0.1 of total length (56 – 68 excluding base). Presternal area devoid of ornamentation. Intercoxal shield length 150 – 165, weakly sclerotized, bearing four pairs of setae and three pairs of poroids; setae *st*1-*st*2 (15 – 17), *st*3 longer (22 – 24), *st*4 shorter (7 – 11), sometimes asymmetrically off shield edge; setae *st*5 (12 – 14) on soft cuticle, either flanking posterior edge of shield or together with *iv*5 closer to opisthogastric setae (Fig. 6B). Free endopodal fragment with gland

pore *gvb* present between coxae I and II. Anal shield nearly smooth, slightly ovate as in female (length 52 – 54 including cribrum 8, width 32); postanal seta (9 – 14) barbed, slightly shorter than paranal setae (12 – 16); gland pores *gv*3 off shield close to *ivp*. Soft opisthogastric integument with complement of setae and pore-like structures as in female, *JV*1 (12-13), *JV*2 (17 – 21), *ZV*1 (10 – 15), *ZV*2 (23 – 24), *JV*5 slightly thicker (21 – 25) (Fig. 6B).

Gnathotectum, chelicerae, subcapitulum, and palpal structures as in female. Cheliceral shaft, excluding basal section, 98-120 long (ca 1.3 – 1.4 dorsal shield length); movable digit 29 – 31 long. Palpus length 93 – 100, with normal deutonymphal complement of setae.

Leg lengths, excluding pretarsi, I (238 – 264), II (238 – 256), III (230 – 251), IV slightly stouter and clearly the longest (312 – 352). Leg setation with normal deutonymphal complement of setae as given for adult female. Tarsi II to IV with ventroapical process and pretarsal structures formed as in female; apical setal processes (*d*-1) relatively short (11 – 12), not reaching to bases of claws on tarsi II, III, but well developed (18 – 23), reaching to tips of claws on tarsus IV; of elongated setae, (*l*-2) (32 – 41) whip-like, slightly shorter than strap-like (*d*-2) (40 – 50); length and form of other setae much as in female; seta *pl*-3 of basitarsus II, III smooth, attenuate (30 – 35), but *pl*-3 of basitarsus IV of short (16) spiculated form similar to other three basitarsal seta.

Protonymph — Idiosoma 237 – 255 long, 167 – 198 wide at level of setae *r*5 (*n* = 3), with weakly sclerotized dorsal shields (Fig. 7A); podonotal shield 145 – 167 long, 135 – 170 at widest level between setae *s*4 and *s*5; pygidial shield 49 – 57 long, 74 – 80 at widest level between setae *S*4. Form and relative lengths of dorsal setae as in subsequent instars, except *j*1 less spiculate; *J*3, *J*4, *Z*3-*Z*5, *S*5 slightly barbed, like *J*5. Setal lengths on podonotal shield, *j*1 (7 – 9), *j*2-*j*6 (13 – 21), *z*4, *s*4 (21 – 28), *z*5 clearly smaller (11 – 12), *j*5, *s*5 (21 – 24); on pygidial shield, *J*3, *J*4 (12 – 16), *J*5 (7 – 11), *Z*3, *Z*4, *S*4, *S*5 (20 – 24), *Z*5 longest (25 – 26); on soft cuticle, *s*6, *r*2, *r*3, *r*5, *R*1 (17 – 22), *J*1, *J*2 (12 – 16), *Z*1, *Z*2, *S*2, *S*3 (20 – 23). Peritreme short (19-23 including stigma) extending anteriorly to mid-level of coxae III; per-

itrematal plate discernible for short extent anterad peritreme, but leaving pore-like structures *ip3*, *gp3* on soft cuticle posteriorly (Figs 7A, B) and *gp2* on free small peritrematal platelet anteriorly, where *ip2* not discernible (Fig. 7A).

Tritosternum with base 18 – 25 long, 10 – 12 wide, with laciniae fused for only about 0.1 of total length (46 – 55). Presternal area devoid of ornamentation. Sternal shield hardly delineated, seemingly with endopodal extensions bearing gland pores *gvb* between coxae I and II (Fig. 7B); shield bearing setae *st1*, *st2* (14 – 17), *st3* (17 – 22) and poroids *iv1*, *iv2*; *st5* short (4 – 5), on soft cuticle between coxae IV, where poroids *iv* not discernible if present. Anal shield smooth, slightly ovate as in female (length 39 – 42 including cribrum 7, width ca 39); gland pores *gv3* off shield at level of paranal setae, and poroids *ivp*; postanal seta (9 – 11) barbed, shorter than paranal setae (12 – 14). Soft opisthogastric integument with setae of dissimilar lengths, *JV1* (10 – 13), *JV2*, *ZV2* (12 – 16), *JV5* longest (15 – 18), and with adjacent gland pores *gv3* and poroids *ivp* (Fig. 7B).

Gnathotectum, chelicerae, and subcapitular structures as in female. Cheliceral shaft, excluding basal section, 80 – 86 long; movable digit 24 – 28 long, bidentate; fixed digit with offset subapical tooth and short file of two or three fine teeth. Relative lengths of subcapitular setae as in adult (Fig. 7D). Palpus length 80 – 82, with normal protonymphal complement of setae.

Leg lengths, excluding pretarsi, I 200 – 210, II 190 – 206, III 180 – 194, IV the longest and stouter, 220 – 235. Leg setation with normal protonymphal complement of setae as given for genus. Tarsi II-IV with ventroapical process and pretarsal structures formed as in female; apical setal processes (*d-1*) relatively short (ca 15), slightly shorter than pretarsi (12 – 14) to bases of claws on tarsi II, III, but well developed (20 – 22), reaching to tips of claws on tarsus IV; of elongated setae, (*l-2*) (ca 40) whip-like, slightly shorter than strap-like (*d-2*) (ca 45); length and form of other setae much as in subsequent instars; seta *pl-3* of basitarsus II, III smooth, attenuate (28), but *pl-3* of basitarsus IV of short (13) spiculated form similar to other three basitarsal seta.

Larva — Unknown.

Type material

All specimens extracted from one sample of a colony of *Azteca constructor* Emery from galleries in the hollow internode system of a large tree, *Cecropia obtusifolia* Bertol., felled near the comedor at the La Selva Biological Station, Heredia Province, Costa Rica (10°26'1"N, 84°12'W, elevation 50-150 m): HOLOTYPE: adult female, 16 May 1995, coll. J. Longino and R. Vargas C. PARATYPES: 6 adult females, 5 adult males, 3 deutonymphs, 3 protonymphs, with same data as holotype. The holotype and one paratype male deposited in the Instituto Nacional de Biodiversidad (INBio) of Costa Rica, Santo Domingo de Heredia; other paratypes are deposited in the Canadian National Collection of Insects and Arachnids (CNCI), Science and Technology Branch, Agriculture & Agri-Food Canada, Ottawa, and the Museum of Zoology, University of Navarra (MZU-NAV), Pamplona, Spain.

Etymology

The specific epithet honors our colleague John (Jack) T. Longino, a world authority of the systematics and ecology of ants, and one of the key initiators of the Arthropods of La Selva Project (ALAS), Costa Rica. He collected the sample from which mites were extracted and used to describe this new taxon, and he continues to support a wide variety of investigations relevant to Project ALAS.

Remarks

Adult males of *Calyptoseius longinoi* have a peculiarly formed pair of structures associated with the corniculi. Each is a short, blunt lobe arising medially, closely beside where the corniculus inserts into the subcapitulum (Fig. 3C). Unlike the process that arises from the corniculus base in both sexes of some melicharine mites (Moraza & Lindquist 2015), this one does not appear to emanate from the corniculus and is not evident in females. It is not to be confused with the longer, somewhat blunt apex of the salivary stylet, which may be projected into that area from distortion in slide preparations (as shown in Fig. 7C of a protonymph).

DISCUSSION

Some morphological aspects of *Calyptoseius longinoi*

Weak sclerotization of idiosomatic shields — The dorsal shield and the ventral shields of the coxisternal and opisthogastric regions of adult *Calyptoseius longinoi* are similar in being relatively weakly sclerotized and nearly unornamented. This condition contrasts with the typically well sclerotized and conspicuously ornamented dorsal and ventral shielding found among adults of species of *Cheiroseius* and *Platyseius*, and with the dorsal shield of *Cheiroseiulus*. Strong shielding may serve as both physical armor and protection against water loss in these free-living mites, which (as mentioned above) occur in a wide variety of habitats, often subject to considerable swings in moisture content. Weakly sclerotized shields seem to correlate with adaptations to living in sequestered habitats, in this case perhaps an existence largely confined to the hollow spaces in nodes of *Cecropia* stems, where both the host plant and perhaps even the tolerance of the ant associates provide protection.

Epigynal shield proportions — The hyaline flap of the epigynal shield is expansive in area, its length occupying nearly forty percent of the shield's entire length, its anterior margin broadly rounded, and its width exceeding that of the more sclerotized posterior portion. Such a configuration would seem a modification to accommodate either larviparity or extrusion of a very large egg (none of the females examined were gravid).

Sperm access system configuration — Although components of this system are difficult to discern among the few females of *Calyptoseius* at hand, they are clearly of the phytoseioid type, with a long minor duct emanating from an embolus in the calyx region. As in the new taxon, a weak or indiscernible sclerotization of the calyx region, along with a diverticular lobe where the minor duct is connected, has been noted or illustrated for species of *Platyseius* (Lindquist 2003), and also for *Cheiroseiulus reniformis* (Evans & Baker 1991, Lindquist 2003); although a minor duct wasn't discerned for the latter, one is present in the undescribed form of *Cheiro-*

seiulus at hand. Other than the description and illustrations for two species of *Cheiroseius* from South Africa by Jordaan *et al.* (1987) and one from South America by Mineiro *et al.* (2009), the spermathecal apparatus has been ignored in descriptions of well over 100 other species in other parts of the world. Typically, among females of many species of *Cheiroseius* we have examined, a sclerotized calyx is present, from which a long, minor duct emanates and extends into a mass of convolutions, as shown to some extent by the figures of Jordaan *et al.* (1987). In this respect, the configuration of the system in *Calyptoseius longinoi* is more similar to that of *Platyseius* and *Cheiroseiulus* than to *Cheiroseius*.

Structural peculiarities of leg tarsi II to IV — While seta *pl-3* is simple and attenuated on basitarsi II-III, it is bushy and short, similar to the other three setae of that segment on basitarsus IV. Strangely, this contrasts with the form of the pseudosymmetric dorso-apical pair (*d-1*), which is relatively short, blunt on telotarsi II-III, yet attenuate on telotarsus IV. Scant attention has been given to these aspects in previous descriptions of platyseine mites. A somewhat similar pattern of differential elongation of seta *pd-3* on basitarsi II-III versus basitarsus IV was noted and illustrated by Lindquist (2003) for two species of *Platyseius*, yet setae (*d-1*) were consistently/uniformly attenuated on telotarsi II-IV. Whether this pattern of differential elongation of *pd-3* on basitarsi II-IV generally holds for members of the genus *Platyseius* is uncertain, and the literature provides no information in this respect for members of the more speciose genus *Cheiroseius*, leaving no basis for phylogenetic considerations.

Although the subfamily Platyseinae is defined in part by the apomorphic modification of setae (*d-2*) being elongated and straplike on tarsi II and III, there is some convergence evident among some species of *Lasioseius* (Naeem *et al.* 1985, our personal observations). The general pattern among those species is that seta *ad-2* is modified on tarsi II and III, seta *pl-2* is similarly so (or less straplike) on tarsus II, and with or often without such a modified seta (either *al-2* or *pl-2*) on tarsus IV. Such a convergence was part of the rationale for Krantz to place

his newly proposed genus *Hyattella* in the Platyseiine, rather than as an aberrant subset of *Lasioseius* (Krantz 1962). However, the pattern is not only sporadic among the over 100 species we have studied, but varies in several respects. For examples, tarsus IV may have a similarly modified seta, but it is *al-2*, as in *Lasioseius* (= *Hyattella*) *epicrioides* (Krantz, 1962) and *L.* (= *H.*) *americanella* (De Leon, 1964) (EEL personal observations), and *L. elegans* Naeem *et al.* and *L. chelaserratus* Naeem *et al.*, 1985), or that seta may be whip-like and *pd-2*, as in *L. peterfuldi* (Ohmer *et al.* 1991); tarsus II may be the only tarsus with a modified (whip-like) seta, but it is *pl-2*, as in several other species of *Lasioseius* (Mineiro *et al.* 2009, Brito *et al.* 2011); or setae (*d-2*) may be long and attenuated but not strap-like, not distinctly different from adjacent tarsal setae (EEL, unpublished observations). A similar convergence is seen in the monobasic blattisociine genus *Arrhenoseius*, in which the elongated strap-like setae are *ad-2* on tarsi II to IV and *pl-2* on tarsus IV (there being only one such seta on tarsus III) (Walter & Lindquist 2001). These examples demonstrate the plasticity in form and homologies of such modified setae among blattisociine taxa, yet emphasize the homogeneity of expression of these setae among platyseiiine taxa.

Apart from being autapomorphic for the genus *Calyptoseius*, the striking elongation of four setae (*d-2*, *l-2*) on each of tarsi II to IV is an enigmatic attribute in terms of its functional significance. In general, the legs of platyseiiine mites have two such elongated setae on telotarsi II-III and one on telotarsus IV, along with at least a somewhat elongated setal pair (*d-1*), elongated paradactyli, and an acuminate medial lobe of the pulvillus, all of which are thought to be adaptations for movement in moist substrates (Evans & Hyatt 1960, Karg 1981). Perhaps, the presence of four elongated setae on tarsi II-IV may be a further adaptation to moving in moist or sticky substrates. The stem hollows of *Cecropia* plants invaded by *Azteca* ants contain highly moist mounds of matter (see below) (Longino 1991a, 1991b). Strangely, however, in contrast with most other platyseiiines, the pretarsal structures (paradactyli, pulvillar lobes) of *Calyptoseius* are less strongly modified.

Cecropia-Azteca niche dynamics

In view of many hundreds of samples taken from a wide variety of substrates at the La Selva Biological Station, the finding of mites of *Calyptoseius* only in a single sampling of a colony of *Azteca* ants in a trunk hollow of *Cecropia* indicates a particular association with this niche. The sample size is small (a total of 20 specimens were retrieved), but its inclusion of protonymphs and deutonymphs as well as both sexes of adults indicates that the life history of this mite occurs in that niche. Although very little is known about the feeding habits of platyseiiine mites, the rather uniform morphology of their cheliceral structure (as noted above) and limited feeding experiments indicate they prey on nematodes and soft-bodied microarthropods, often in regularly or periodically moist substrates (Karg 1971, Hinton 1971). The hollow internodes of *Cecropia* stems occupied by *Azteca* ants are very damp, fully humid, but not inundated, as they are well above any part of the tree that would be flooded. Nesting behavior and structure of *Azteca* ants differs among different species of the ants. In the case of *Azteca constructor* Emery, the so-called "carton nest" is typically a spindle-shaped mass, some 30cm long, inside a swollen internode section of the central bole of the tree. The carton consists of a crusty black material altered by the ants from the inside parenchyma pith walls of the stem and shaped into a honeycomb of passages and chambers. The carton nest is well separated from a variable series of domatia in internodes of higher branches of the tree. The domatia contain regular mounds of brown, sticky, bran-like material called "knollen", composed primarily from pith scraped by the ants from the internode walls. Internal passages through the internodes are made and maintained by the ants to the knollen, which writhe with numerous nematodes and fly larvae (Longino 1991a). The primary fly that undergoes its life history in the knollen is *Alepiea longinoi* Quate and Brown, 2004 (Longino, personal note, 22 November 2015). Whether *Calyptoseius* mites may access all of these components of the ant colony as sources of prey via the ants' passageways is uncertain. Mites were observed, both in the nest and amidst the knollen, but their

identities were undetermined (Longino, personal note, 16 May 1995, personal correspondence 19 May 2015; Ronald Vargas C., personal correspondence 23 November 2015).

The *Cecropia*-*Azteca* association has been found to be an interacting community of species, even in a local area like the La Selva Biological Station in Costa Rica, where disturbed lowland rainforest with second-growth trees includes two or three species of *Cecropia* growing sympatrically and supporting two to four species of *Azteca*, all obligate inhabitants of *Cecropia* (Longino 1991a, 1991b). As there is no absolute host plant specificity, with each *Azteca* species being found in a variety of *Cecropia* species, competition may be intense, with multiple queens and multiple species initiating colonies in individual saplings and vying for dominance. On one hand, there are more than 100 species of *Cecropia* in the Neotropical region, and on the other, *Azteca* is a diverse genus of ants, with over 150 species, many of which are associated with myrmecophytes other than *Cecropia*. Beyond that, there are other obligate ant inhabitants of *Cecropia*, including several species of the ponerine genus *Neoponera*. Although never as abundant as the dominant *Azteca* specialists, they are widespread in the Neotropics, and almost certainly represent multiple independent colonizations of *Cecropia* from within the genus *Neoponera* (Longino, pers. obs.). Thus, the extent or range of association of *Calyptoseius longinoi* within this plant-ant association, or whether there may be a variety of such congeneric mites, is completely problematical.

Adaptation by these mites to a coexistent way of life with ants as part of the *Cecropia* niche dynamic involves another challenge – their dispersal between such specialized niches. Wingless working caste *Azteca* ants restrict their movement to the host tree itself; they do not forage off the host tree (Longino 1991a). Thus, any dispersal of the mites would seem to depend on winged insects, whether the alate ants or associated flies like *Alepia longinoi* that come to coinhabit the ants' nests and knollen. Based on limited observations, a general pattern among platyseine mites that occupy transient niches may be their behavioral preference for

dispersal on nematoceran flies, whose larvae live in a remarkable diversity of damp to fully aquatic habitats, some in unusual substrates (Whitsel & Schoeppner 1973, Rack 1976, Ishikawa 1979, Walter & Lindquist 1995). Perhaps such dispersals offer opportunistic access to niches available for specialized colonization. If this scenario is the case with *Calyptoseius longinoi*, then access to an association with ants in *Cecropia* trees would be secondary to the mites' colonization of such a habitat by way of dispersal on *Alepia* flies. Dispersal to such a particular niche would depend on a phoront with such preference for this niche. *Alepia longinoi* is known only from this niche and from two widely separated and ecologically distinct localities in Costa Rica, one in lowland rainforest, and one in cloud forest at 1190 m (Quate & Brown 2004).

Descriptive notes for the genus *Cheiroseiulus* Evans & Baker

The original descriptions of this monobasic genus and its type-species did not provide a variety of morphological details significant for comparisons with other platyseine genera. Also, our study of an adult female of an undescribed species of this genus has facilitated some distinction between genus- and species-group attributes. Thus, the following descriptive notes are based on observations by one of us (EEL) of the type material of *Cheiroseiulus reniformis*, as well as of the undescribed form, along with further observations by Ann Baker (personal correspondence, June 1994).

Augmented description of genus *Cheiroseiulus*

Dorsal shield of adult female and male moderately sclerotized, reticulated or sparsely ornamented over some of surface, with 22 to 25 pairs of setae, including 16 or 17 podonotal pairs (*j1-j6*, *z2*, *z4*, *z5*, *s3-s6*, *r2*, *r3*, sometimes *z6*, *s1*, *r4*) and five to nine opisthonotal pairs (*J5*, *Z1*, *Z4*, *Z5*, *S4*, sometimes *J2*, *Z2*, *S2*, *S3*, *S5*); setae collectively smooth, acuminate, except *j1* slightly thicker and *J5* spiculate. Soft lateral cuticle with four to six pairs of marginal setae, including *r5*, *R1* and two to four subsequent pairs, lacking *UR*-setae. Peritrematal plates united anteriorly with dorsal shield at level varying from

setae *r3* nearly to *j2*; peritremes well developed, reaching to level near setae *j2*, without poststigmatic projection.

Tritosternum with base elongated (two to four times as long as wide), with pilose laciniae free for most (70 – 80 %) of length. Ventral shields unornamented or weakly so; presternal region without platelets. Female sternal shield with well developed endopodal extensions between coxae I-II and moderately so between II-III, with three pairs of attenuated setae of similar length; lyrifissures *iv3* and adjacent setae *st4* (sometimes absent) on soft cuticle. Female epigynal shield with convex hyaline anterior margin abutting or barely overlapping posterior edge of sternal shield, its posterior margin slightly convex; paragenital poroids *iv5* on soft cuticle; postgenital furrow present, its strip of transverse platelets hardly discernible. Male sternitigenital shield with four pairs of setae (*st4* absent) and three pairs of poroids, and fully contiguous with endopodal extensions between coxae I-II, II-III and III-IV. Opisthogaster of female and male with metapodal plates rudimentary or absent; with anal shield oval or oboval, its paranal setae inserted at midlevel of anus, and clearly (ca 3x) longer than postanal seta; soft cuticle with four pairs of setae, and gland pores *gv3* well removed from anal shield. Peritrematal shield well connected with exopodal strips curving behind coxa IV. Components of female spermathecal apparatus difficult to discern, with a weakly or indiscernibly sclerotized calyx region with a diverticular lobe where minor duct emanates (if discernible).

Gnathotectum with three denticulate branches, median one slightly longer. Chelicerae slender, its shaft elongated (excluding basal section, ca 0.6 dorsal shield length); fixed digit with short file of fine to hardly discernible teeth on ridge flanked by two teeth in apposition on movable digit. Deutosternum with seven transverse rows of denticles, distance between sixth and seventh rows less than that between fifth and sixth or other successive rows. Subcapitulum with setae *hp1* longer, more strap- or whip-like than *hp3*, *pc* sometimes also attenuated but not whip-like. Palptrochanter with inner seta longer, sometimes more whip-like, than outer seta;

palpfemur with dorsal setae smooth, attenuate, and with seta *al* slightly spatulate; palpgenual setae *al-1*, *al-2* slightly spatulate.

Legs I to IV with pretarsi bearing paired claws, those of II-IV with blunt, somewhat fleshy paradactyli, pulvilli with blunt lobes, and with or without a slender ventral acuminate lobe. Tarsi II-IV with dorso-apical setal processes (*d-1*) as long as pretarsi; II and III each with two elongated strap-like setae (*d-2*), and IV with one such seta (*pd-2*). Complement of setae on segments of legs I-II-III-IV, respectively: trochanters, 6-5-5-5; femora, 11 (2 3/1 2/1 2) – 10 (2 3/1 2/1 1) – 6 (1 2/0 1/1 1) – 6 (1 2/0 1/1 1); genua, 13 (2 3/2 3/1 2) – 9 (2 3/1 2/0 1) – 8 (2 2/1 2/0 1) – 9 (2 2/1 3/0 1); tibiae, 13 (2 3/2 3/1 2) – 8 or 9 (2 1/1 2/1 1 or 2) – 8 (2 1/1 2/1 1) – 10 (2 1/1 3/1 2); femora I and II each with two ventral seta (lacking *pv-2*); genua II-IV each lacking seta *pv-1*; genu II lacking *pl-2*; tibia II with or without *pl-2*. Other than on tarsi, dorsal and lateral leg setae collectively smooth, slightly thicker than smooth ventral setae. Legs of male without dimorphically modified setae except for a few spinelike subapical setae slightly thicker.

Genus-group affinities among the Platyseiiinae

In his review of generic concepts in the subfamily Platyseiiinae, Lindquist (2003) concurred with Evans and Baker (1991) that the genus *Cheiroseius* may have phylogenetic affinities with *Platyseius*, in distinction to *Cheiroseius*. The former two genera share the putatively apomorphic attributes of an incomplete series of *J*-setae on the opisthonotum, nine setae on tibia II (*pd-2* absent), and a dissimilar spacing of the proximal rows of hypognathal denticles. In contrast, the more speciose genus *Cheiroseius* was not readily definable apomorphically, as it is distinguished by a series of attributes, all of which are plesiomorphic within the subfamily. A previous review of *Cheiroseius* by Karg (1981) included recognition of two subgenera; however, it presented both nomenclatural difficulties and systematic inconsistencies, with attributes used to distinguish each subgenus not holding for its constituent species (Lindquist 2003). Therefore, Karg's subgeneric concepts were not accepted, and

the genus *Cheiroseius*, with its disparity of nearly 120 described species (personal records, Erika Britto and Gilberto de Moraes, December 2015), still remains in need of revision on a cladistic basis.

The new genus *Calyptoseius* shares with *Cheiroseiulus* the following attributes: the opisthogaster of both the female and male has an anal shield (rather than an expansive ventrianal shield as in other platyseiines), which may be an ontogenetic retention of the deutonymphal form of the anal shield; the paranal setae are inserted at mid-level of the anal opening (rather than more posteriorly); the female has sternal setae *st4* (when present) and lyrifissures *iv3* inserted freely on soft cuticle (rather than on metasternal platelets); and tarsi II to IV have the paired pulvillar lobes blunt (rather than more broadly rounded). However, in other respects, particularly differences in dorsal idiosomatic chaetotaxy, leg chaetotaxy, and different form of certain setae of tarsi II to IV (as presented in the following key to genera), a sister-group relationship between *Cheiroseiulus* and *Calyptoseius* is highly problematical. Also, mites of these taxa were collected from such completely different habitats as to leave it difficult to link the two genera ecologically. While a small population of *Calyptoseius longinoi* was extracted from the gallery system of *Azteca* ants in a *Cecropia* tree bole, four females and one male of *Cheiroseiulus reniformis* were collected from two water pools on epiphytes in Jamaica, and a single female of the undescribed form of *Cheiroseiulus* was extracted from an unspecified substrate in Crystal Cave, Pierce County, Wisconsin, USA (although this taxon was not included in the published survey of invertebrate cave faunas by Peck & Christiansen, 1990, they noted mites of a variety of oribatid taxa extracted from litter from the same cave, with same collection date). A basal link between *Cheiroseiulus* and *Platyseius* on one hand, and a separate link between *Calyptoseius* and some element or subset of *Cheiroseius* on the other, may be more probable, and a hypothesis worth testing, eventually with the help of molecular analyses.

Revised description of subfamily Platyseiinae (apomorphic attributes italicized)

Gnathosoma — Gnathotectum triramous, each branch usually denticulate, median projection usually not greatly elongated. Fixed digit of chelicerae with setiform pilus dentilis, with few to many small to fine teeth *restricted to a ridge on apical one-third of masticatory surface*, and with *deep subapical receptacle for receiving apex of movable chela*; fixed digit without hyaline rim near base on paraxial surface. Movable digit of adult female and nymphs usually bidentate, occasionally with one or three teeth, without ventral mucro; arthrodistal envelope at base of movable chela small, not fringed. Movable digit of male unidentate, with spermatodactyl freely extending anteriorly or anteroventrally, its form highly differing between species. Infracapitulum with usually seven transverse rows of deutosternal denticles, each row wide, finely denticulate, sixth row usually slightly widest; lateral lines connecting rows arcuate or weakly formed or obliterated; anterior pair of hypostomatic setae *hp1 elongated, whiplike or flattened strap-like along part of length*; corniculi simple, widely spaced basally, never forked or convergent apically. *Palptrochanter with inner seta elongated, similar in form to hp1*; palptarsal apotele two-tined.

Idiosomatic dorsum — Dorsal shield entire in adult (opisthonotal region rarely with incisions between setae *S2* and *S3*), with lateral incisions in deutonymph; podonotal region usually with 19 to 22 pairs of setae, but exceptionally, vertical setae *j1* suppressed to alveolar vestiges in adults though well developed in immature instars (*Platyseius italicus* species-group), or setae *z1*, *z3* and either or both of *s1*, *s2* lacking (*Cheiroseiulus*); opisthonotal region usually with 12 to 15 pairs of setae in the *J*-, *Z*- *S*-series, occasionally lacking one to all of *J1*-*J3* (*Platyseius* spp.), rarely more hypotrichous with 5 to 9 pairs, lacking *J1*-*J4* and several of *Z*- and *S*-series (*Cheiroseiulus*). Of marginal series, *r2*-*r5* usually inserted on dorsal shield; *r6* and *R*-series on soft cuticle in adult females but variably on margin of dorsal shield in adult males. Submarginal *UR*- setae usually absent.

Idiosomatic venter — Female: sternal shield with three pairs of setae and two pairs of lyrifissures.

fissures, fully consolidated with endopodal strips alongside coxae I-III, and with apices of strong endopodal extensions bearing a gland pore *gob* between coxae I and II; third pair of lyrifissures associated with fourth pair of sternal setae usually on small metasternal plates, or rarely inserted in soft cuticle, and with *st4* present or absent; epigynal shield with lateral margins usually only slightly widened posteriorly, with posterior margin gently convex or truncate, with sternal setae *st5* inserted on shield margins but paragenital poroids on soft cuticle. Male: sternitigenital shield fully consolidated with endopodal strips alongside coxae I-IV, the endopodal extensions between coxae I-II and II-III as in female; setae *st4* present or reduced or absent (sometimes ontogenetically suppressed); sternitigenital shield abutting but not coalescing with ventrianal shield. Female and male usually with well-developed ventrianal shield or rarely anal shield present in both sexes (*Cheiroseiulus*, *Calyptoseius*); insertions of paranal setae usually even with or behind posterior margin of anal opening, exceptionally at midlevel of opening (*Cheiroseiulus*, *Calyptoseius*); postanal seta usually shorter than paranal setae (subequally as long in *Calyptoseius*). Peritrematal shield broadly united anteriorly to dorsal shield, well united posteriorly to exopodal strip beside coxa IV, free or confluent with anterolateral margins of ventrianal shield in male; peritremes fully developed, extending anteriorly to vertex, and with or without poststigmatic projection; exopodal shield developed as continuous strip beside coxae II-IV, often confluent along most of its extent with peritrematal shield. Metapodal plates usually present as a small pair, free or sometimes appended to (but not integrated with) peritrematal shields on females, integrated in ventrianal shield on males, but free on males of *Calyptoseius* and exceptionally absent in both sexes of *Cheiroseiulus*.

Legs — Tarsus I with a usually conspicuously clavate-tipped seta *s* (as in Fig. 5A), and usually with ambulacrum and paired claws; rarely, ambulacrum and claws absent, or claws sessile. Tarsi of legs II to IV with well developed ambulacrum with paired claws and lobate pulvillus; median lobe of pulvillus slender, acuminate apically (exceptionally,

apically blunt in *Cheiroseiulus*); paradactyli flanking claws of tarsi II-IV elongated, often more so than median lobe of pulvillus, acuminate apically (but apically blunt in *Cheiroseiulus*). Tarsi II to IV with apical dorsal setae (*d-1*) conspicuous, longer than pretarsus, often reaching distally to same area as apices of paradactyli; tarsi II-IV each with anterodorsal seta *ad-2* elongated and flattened, strap-like, along much of its length, tapering and curved only near apex; tarsi II and III with a second seta (*pd-2*) similarly elongated and flattened; femora of legs I and II maximally with 12 and 11 setae, respectively, but usually with 11 and 10, each lacking a third ventral seta, *pv-2*; genua of legs II and III with 11 and 9 setae, respectively, but usually with 10 and 9, each lacking seta *pv-1*. Leg II of male never crassate or armed with spurs, and with minimal dimorphism in form of setae.

Key to subfamily and genera of Platyseiinae

1. Pretarsus of legs II to IV with paradactyli elongated, slightly to usually much longer than claws, acuminate or rarely blunt apically, and with median lobe of pulvillus slender, acuminate or rarely blunt apically; tarsi II-IV with dorso-apical pair of setae longer than pretarsus, often reaching distally to same area as apices of paradactyli; gnathosoma with anterior pair of hypostomatic setae and inner pair of palptrochanter setae elongated, often whip- or strap-like subfamily Platyseiinae 2

— Pretarsus of legs II to IV with paradactyli usually inconspicuous, generally no longer than claws, and with median lobe of pulvillus broadly rounded; tarsi II-IV with dorso-apical pair of setae shorter than pretarsus, not reaching distally to same area as apices of claws or paradactyli; gnathosoma with anterior pair of hypostomatic setae and inner pair of palptrochanter setae usually not elongated. subfamily Blattisociinae

2. Opisthogaster of female and male with well developed ventrianal shield; paranal setae inserted at level of, or behind, posterior edge of anal opening; female with sternal setae *st4* usually inserted alongside sternal poroids on metasternal platelets; tarsi II

to IV with paired pulvillar lobes acuminate.....3

— Opisthogaster of female and male with anal shield, that of male sometimes also with separate ventral shield; paranal setae inserted at mid-level of anal opening; female with sternal setae *st4* inserted freely on soft cuticle; tarsi II to IV with paired pulvillar lobes blunt.....4

3. Opisthonotum holotrichous, including five pairs of setae in the *J*-series; tibia II with 10 setae, *pd-2* present; tarsi II to IV with dorso-apical setae (*d-1*) moderately elongated, similar in length to or not more than 1.5 times longer than paradactyli; adults without transverse row of platelets flanking base of tritosternum; sternal setae *st1-st3* similar in length; deutosternum with distance between fifth and sixth rows of denticles similar to or but slightly greater (1.0 to 1.3 times) than that between fourth and fifth rows; female opisthogaster usually with setae *ZV1*.....*Cheiroseius*

— Opisthonotum lacking one to four pairs of setae (consistently *J1*) in the *J*-series; tibia II with nine setae, *pd-2* absent; tarsi II to IV with dorso-apical setae (*d-1*) greatly elongated, nearly twice length of paradactyli flanking claws; adults with transverse row of platelets flanking base of tritosternum; sternal setae *st1* distinctly (0.2-0.5) shorter than *st2* and *st3*; deutosternum with distance between fifth and sixth rows of denticles distinctly greater (1.6 to nearly 2 times) than that between fourth and fifth rows; female opisthogaster lacking setae *ZV1*.....*Platyseius*

4. Opisthonotal region of dorsal shield holotrichous, with 15 pairs of setae, each of *J*-, *Z*-, *S*-series complete, with five pairs of setae; sternal setae *st1-st2* conspicuously shorter than *st3*; tarsi II-IV each with four elongated, strap- or whip-like setae; genua II, III each with two ventral setae; tibia II with 10 setae, *pd-2* present.....*Calyptoseius* new genus

— Opisthonotal region of dorsal shield hypotrichous, with only five to nine pairs of setae, each

of *J*-, *Z*-, *S*-series incomplete, *J*-series with one or two pairs, *Z*- and *S*-series together with only four to seven pairs of setae; sternal setae *st1-st3* similar in length; tarsi II, III each with two strap-like setae, tarsus IV with one; genua II, III each with one ventral seta (lacking *pv*); tibia II with 9 setae, *pd-2* absent.....*Cheiroseius*

ACKNOWLEDGEMENTS

Our thanks to Jack Longino (University of Utah, Salt Lake City) for providing personal notes about his collections and observations of *Azetca* ant nests, and to Ronald Vargas Castro for his technical expertise and personal comments in extraction of mites from those ant nests in his former role as a parataxonomist in Project ALAS (Arthropods of La Selva). Their work and field work of one of us (EEL) at La Selva, Costa Rica, was supported by National Science Foundation Grants BSR-9025024, DEB-9401069 and DEB-9706976. Additional descriptive notes on type material of *Cheiroseius reniformis* were provided by Ann Baker (The Natural History Museum, London), and a current tally of numbers of species of *Cheiroseius* was provided by Erika Britto and Gilberto de Moraes (Universidade de São Paulo, Brazil). The careful reviews and interesting comments by the reviewers are appreciated.

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