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A new genus and two new species of planthopper in the tribe Cenchreini (Hemiptera: Auchenorrhyncha: Derbidae) from lowland tropical rainforest in Costa Rica

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Abstract

Recent survey work for planthoppers at La Selva Biological Station in Costa Rica found two new species allied with *Cenchrea* Westwood. The cytochrome *c* oxidase subunit I (COI) and 18S were sequenced for the new taxa and used these data to assess the genus-level standing of the new taxa. The new taxa do not cluster with *Cenchrea dorsalis* Westwood, the type species of *Cenchrea.* A new genus *Tico* **gen. n.** described for the reception of new species described as *Tico emmettcarri* **sp. n.** (the type species) and *Tico pseudosororius* **sp. n.** *Cenchrea sororia* Fennah is moved to *Tico* **gen. n.**, to form the new combination *Tico sororius* (Fennah). *Tico* **gen. n.** is compared with allied genera, and review genus-level diagnostic features and the species composition of *Cenchrea*, which appears to be compositionally heterogenous, but additional data is needed to evaluate genus-level placement of most species.

Key words: Derbidae, Costa Rica, Cenchreini, *Cenchrea,* planthopper, phylogenetics, biodiversity

Resumen

Durante un reciente trabajo de investigación de chicharritas llevado a cabo en la Estación Biológica La Selva en Costa Rica, se encontraron dos nuevas especies asociadas con *Cenchrea* Westwood. Se obtuvo la subunidad I del citocromo c oxidasa (COI) y los genes 18S para los nuevos taxones. Se utilizaron estos datos para evaluar su posición a nivel de género. Los nuevos taxones no se agrupan con *Cenchrea dorsalis* Westwood, la especie tipo para *Cenchrea*. Se describe un nuevo género *Tico* **gen. n.** que incluye las nuevas especies descritas como *Tico emmettcarri* **sp. n.** (especie tipo) y *Tico pseudosororius* **sp. n**. También se translada *Cenchrea sororia* Fennah a *Tico* **gen. n.,** para formar la nueva combinación *Tico sororius* (Fennah). Además, se compara *Tico* **gen. n.** con géneros afines y se revisan las características de diagnóstico a nivel de género y la composición de especies de *Cenchrea*, la cual parece poseer una composición heterogénea, pero se necesitan datos adicionales para evaluar la ubicación de la mayoría de las especies a nivel de género.

Palabras clave: Derbidae, Costa Rica, Cenchreini, *Cenchrea*, chicharrita, filogenética, biodiversidad

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Introduction

Recent survey work in Costa Rica has focused on planthoppers (Hemiptera: Fulgoroidea) associated with palms because of a renewed interest in host/vector relationships. The cixiid planthopper *Haplaxius crudus* (Van Duzee) has long been asserted to be involved in the transmission of lethal yellowing (LY) phytoplasmas (e.g., Howard & Thomas 1980) and the recent introduction of lethal bronzing (LB) in Florida (Harrison *et al*. 2008). Survey work of planthoppers associated with palms has been driven by the diversity of palm infecting phytoplasmas throughout the Caribbean basin, the lack of comprehensive survey work of palm-associated planthoppers, and the likelihood that other species may be involved in phytoplasma transmission.

Derbids associated with palms in the Caribbean basin have mostly been from the tribe Cenchreini Muir (Derbinae). Cenchreini is largely defined as a 'less specialized' tribe of Derbinae (i.e., Fennah 1952, Emeljanov 1996) with a foliately expanded pronotal paradiscal (i.e., lateral) region that form large foveae that partially surround the antennae, along with the presence of pits on the lateral carinae of the frons, vertex and veins of the forewing (at least in the clavus). The tribe consists of 24 genera globally, 10 of which are New World, mostly Neotropical, except *Neocenchrea* Metcalf, *Omolicna* Fennah and *Persis* Stål which are also found in the Nearctic region (Bartlett *et al*. 2014; Bourgoin 2020). From this survey work, a new genus (*Agoo* Bahder & Bartlett) of Cenchreini was described, now including 6 species (Bahder *et al.* 2019, 2020a,b; Dollet et al. 2020). Currently, *Agoo* has only been documented on members of the palm family, Arecaceae.

The type genus of Cenchreini, *Cenchrea* Westwood, is currently comprised of five species: *C. bipunctata* (Muir), *C. dorsalis* Westwood (the type species), *C. exquiseta* Uhler, *C. sexguttata* Fennah and *C. sororia* Fennah. The genus *Cenchrea* is recognized within New World Cenchreini by a moderately narrowed frons (lacking a median carina), bearing a transverse carina at the fastigium separating the frons and vertex, an elevated discal region of the pronotum, the SC+R fork in the forewing (usually) near the apex of the wing (distad of the claval apex, defining a short subcostal cell), and the "exuberant" development of processes on lateral margin of the pygofer and gonostyli (Fennah 1952: 129). This last feature was noted probably in reference to *C. exquiseta,* and despite *C. sexguttata* Fennah and *C. sororia* Fennah being reported only from females. More specifically, the median portion of the lateral margins of the pygofer is elongately projected, and the gonostyli bear a large dorsal projection from the inner margin and an angular ventral projection. Fennah (1952: 129) notes that *C. dorsalis* "stands strongly apart from the other species" and that they "may be regarded as comprising two subgenera", but he stopped short of actually defining the subgenera. Fennah notes that *C. dorsalis* has more elongate tegmina than the other four species and that the branches of CuA were relatively straight in *C. dorsalis* and angled in the other taxa.

Herein we describe a new genus and two new species of planthopper that appears allied with *Cenchrea*, reconsider genus-level diagnostic features for *Cenchrea* and discuss the associated species. Cytochrome *c* oxidase subunit I (COI) and 18S genes are obtained for the two new species and maximum likelihood analyses is performed for these taxa in the context of available data for Cenchreini to examine phylogenetic relationships among these taxa.

Materials and methods

Locality and Specimen Collection. Individuals of the novel taxa were collected by sweeping trailside vegetation and were immediately transferred to 95% ethanol. Specimens were collected (permit no. SINAC-ACC-PI-LC-072-2019) at La Selva Biological Station (Fig. 1), Heredia province, Costa Rica (10.431269, -84.005961). Specimens collected were observed along the trails where there were openings and noticeable levels of disturbance (recent clearing for trail maintenance, storm damage). Specimens were exported under permit number DGVS-434-2019 and imported into the U.S.A. under permit number P526-170201-001. All specimens collected were measured, photographed and dissected using a Leica M205 C stereoscope. Images of specimens and all features photographed were generated using the LAS Core Software v4.12. Voucher specimens, including primary types, are stored at the University of Florida—Fort Lauderdale Research and Education Center (FLREC) in Davie, FL, U.S.A. and the Florida State Collection of Arthropods (FSCA) in Gainesville, FL, U.S.A.

Morphological Terminology. Morphological terminology generally follows that of Bartlett *et al*. (2014), except forewing venation following Bourgoin *et al*. (2015) and with male terminalia nomenclature modified after Bourgoin (1988) and Bourgoin & Huang (1990). New taxa are intended to be attributed to Bahder and Bartlett.

FIGURE 1. Host plant and general habitat where specimens were collected; all collected from underside of leaves.

Dissections and DNA Extraction. The terminalia that were dissected also served as the source of tissue for DNA extraction. The terminal end of the abdomens was removed and placed directly into a solution of tissue lysis buffer (buffer ATL) and proteinase K (180 µl ATL and 20 µl proteinase K) from the DNeasy® Blood and Tissue Kit (Qiagen). The abdomen was left to lyse for 24 hours at 56°C. Following lysis, eluate was transferred to a new 1.5 ml microcentrifuge tube and DNA extraction proceeded as per the manufacturer's instructions. The terminalia were then immersed in 200 µl of buffer ATL and 200 µl of buffer AL from the same kit and placed at 95°C for 24 hours to remove fat, wax, and residual tissue. The cleared genitalia were then used for morphological characterization and photography.

PCR Parameters, Sequence Data, and Analysis. To obtain COI sequence data, DNA template from specimens was amplified using the primers TY-J-1460 (5'-TACAATTTATCGCCTAAACTTCAGCC-3') (Simon *et al*. 1994) and HCO2198 (5'-TCAGGGTGACCAAAAAATCA-3') (Folmer *et al*. 1994). To obtain 18S sequence data, the primers developed by Bahder *et al.* (2019) were used and are as follows; forward primer 18SF (5'-ACTGTCGATGGTAGGTTCTG-3'), reverse primer 18SR (5'-GTCCGAAGACCTCACTAAA-3'). PCR reactions contained 5x GoTaq Flexi Buffer, 25 mM $MgCl_2$, 10 mM dNTP's, 10 mM of each primer, 10% PVP-40, and 2.5U GoTaq Flexi DNA Polymerase, 2 µl DNA template, and sterile dH_20 to a final volume of 25 µL. Thermal cycling conditions for COI were as follows: 2 min initial denaturation at 95°C, followed by 35 cycles of 30 sec denaturation at 95°C, 30 sec annealing at 40˚C, 1 min 30 sec extension at 72°C, followed by a 5 min extension at 72°C. Thermal cycling conditions for 18S were as follows: 2 min initial denaturation at 95°C, followed by 35 cycles of 30 sec denaturation at 95°C, 30 sec annealing at 50°C, 2 min extension at 72°C, followed by a 5 min extension at 72°C. PCR products of the appropriate size were purified using the Exo-SAP-IT™ PCR Product Cleanup Reagent (ThermoFisher Scientific, Waltham, Massachusetts, USA). Purified PCR product was quantified using a NanoDropLite spectrophotometer (ThermoFisher Scientific, Waltham, Massachusetts, USA) and sequenced on a SeqStudio Genetic Analyzer (Applied Biosystems) using the LongSeq option. Contiguous files were assembled using DNA Baser (Version 4.36) (Heracle BioSoft SRL, Pitesti, Romania), aligned using ClustalW as part of the package MEGA7 (Kumar *et al.* 2016). A matrix of pairwise differences using number of differences among COI and 18S was calculated with MEGA7 (Kumar *et al.* 2016). The bootstrap method was used for variance estimation at 1,000 replicates and using the p-distance model. Maximum Likelihood trees were generated using the Bootstrap method at 1,000 replicates based on the Tamura-Nei model for both the COI and 18S loci as well as a consensus tree for concatenated COI and 18S sequences. Concatenated COI and 18S data was analyzed for all taxa to generate a consensus tree.

Taxon sampling. COI sequence data was used for the two new species and three species of *Agoo* Bahder & Bartlett (*A. dahliana* Bahder & Bartlett, *A. luzdenia* Bahder & Bartlett and *A. xavieri* Bahder & Bartlett), *Neocenchrea heidemanni* (Ball), *Anchimothon dubia* (Caldwell), five species of *Omolicna* (*O. brunnea* (McAtee), *O. latens* Fennah, *O. puertana* Caldwell, *O. tarco* Fennah and *O. triata* Caldwell), and *Cenchrea dorsalis* (Table 1). 18S sequence data was used for the two new species and three species of *Agoo* (*A. dahliana*, *A. luzdenia*, and *A. xavieri*), *Cenchrea dorsalis*, *Anchimothon dubia*, *Neocenchrea heidemanni*, and five species of *Omolicna* (*O. brunnea*, *O. latens*, *O. puertana*, *O. tarco*, and *O. triata*) (Table 1).

For morphological examination, genitalia of males for *C. dorsalis* (Fig. 2A–F) and *C. exquiseta* (Fig. 3A–F) were dissected and photographed for comparisons.

TABLE 1. GenBank accession numbers for Cenchreini taxa used in assessment of the COI and 18S loci.

	GenBank Accession No.			
Species	COI	18S	Locality	Reference
Agoo dahliana	MN496467	MH472754	Costa Rica	Bahder *et al.* 2020a
Agoo luzdenia	MT085818	MN999709	Costa Rica	Bahder *et al.* 2020b
Agoo xavieri	MK443068	MK443073	Costa Rica	Bahder *et al.* 2019
Anchimothon dubia	MN474755	MN474755	Costa Rica	Bahder *et al.* 2020a
Cenchrea dorsalis	MT413387	MN472756	St. Vincent	This study
Herpis sp.	MT085817	MT415405	Costa Rica	Bahder *et al.* 2020b
Neocenchrea heidemanni	MN496473	MT415406	U.S.A., FL	Bahder *et al.* 2020a
Omolicna brunnea	MK443070	MK443071	Costa Rica	Bahder *et al.* 2019a
Omolicna cubana	MT413386	MT415404	Jamaica	Bahder *et al.* 2020c
Omolicna latens	MN496472	MN472757	Costa Rica	Bahder *et al.* 2020a
Omolicna puertana	MN496468	MN472751	Puerto Rico	Bahder *et al.* 2020a
Omolicna tarco	MT422533	MT424914	Jamaica	Bahder *et al.* 2020c
Omolicna triata	MK443069	MK443072	Costa Rica	Bahder *et al.* 2019a
Tico pseudosororius **n. sp.**	MT997938	MT526037	Costa Rica	This study
Tico emmettcarri **n. sp.**	MT085816	MT526036	Costa Rica	This study

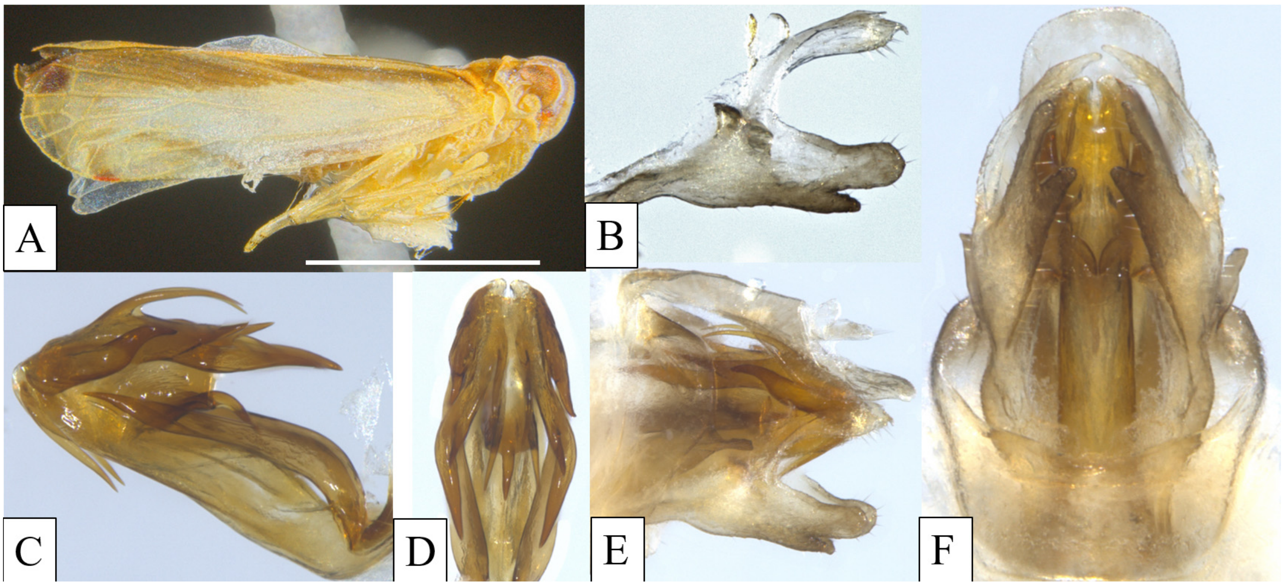

FIGURE 2. *Cenchrea dorsalis*; A) lateral view, B) gonostylus lateral view, C) aedeagus right lateral view, D) aedeagus dorsal view, E) male terminalia lateral view, and F) male terminalia ventral view.

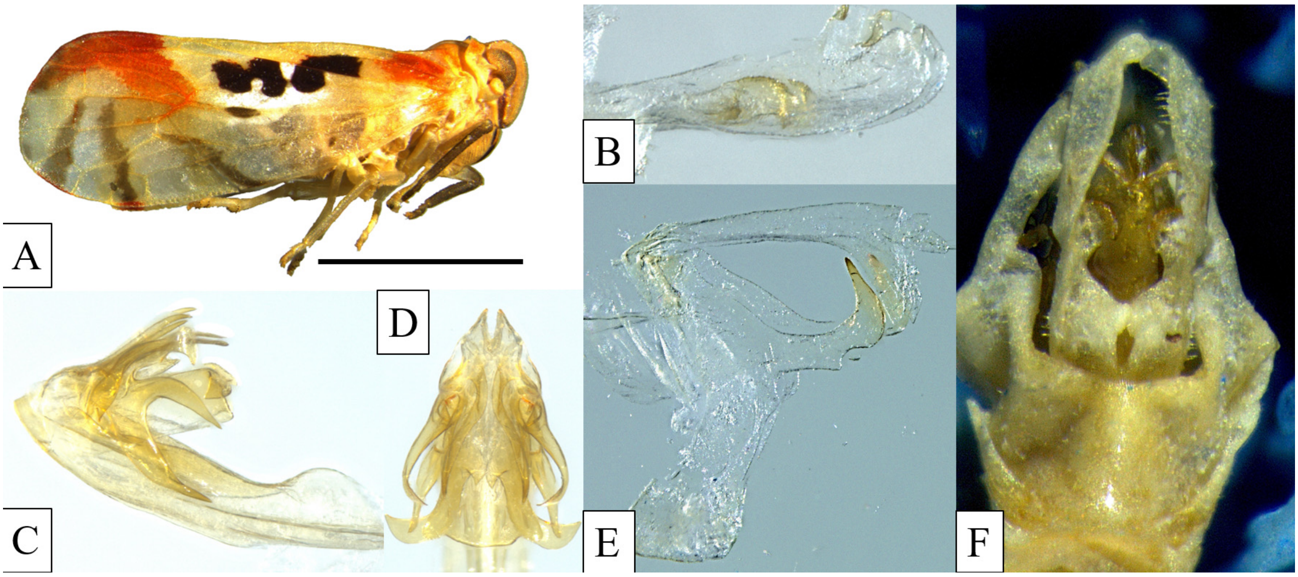

FIGURE 3. *Cenchrea exquiseta*; A) lateral view, B) gonostylus lateral view, C), aedeagus right lateral view, D) aedeagus dorsal view, E) male terminalia lateral view, and F) male terminalia ventral view.

Systematics

Family Derbidae Spinola 1839

Subfamily Derbinae Spinola 1839

Tribe Cenchreini Muir 1913

Tico Bahder & Bartlett, gen. n.

Type species. *Tico emmettcarri* Bahder & Bartlett **sp. n.**

Diagnosis. Small (~3 mm, Tables 2, 3), pale cenchreine derbids with variably marked, clear wings. Frons moderately compressed (length at midline about 4x dorsal width), median carina absent, with transverse carinae near fastigium separating frons from clypeus; lateral carinae of frons and clypeus keeled, bearing row of sensory pustules. Forewing with ScP branch preceding apex of clavus (resulting in long marginal cell). Pygofer with distinct expansion (but not projections) on lateral margins, ventral margin of opening without lobe. Gonostyli long and spatulate, apex rounded, with a medially directed dorsal lobe near midlength (lobes absent on ventral margin). Aedeagus nearly bilaterally symmetrical, lacking subapical projections on shaft, terminating in complex array of retrorse processes. Anal tube elongate, in lateral view ventral margin weakly concave, apex inflected downward, apex truncate; in dorsal view broadly spatulate.

Description. Small, pale species (length with wings 2.98–3.10 mm for included species), with clear wings bearing dark markings. Head with frons moderately compressed (median carina absent), narrowest between eyes, widest at frontoclypeal suture, bearing transverse carina separating frons and vertex (usually marked by small visible hump in lateral view). Lateral carinae of vertex and frons strongly keeled, bearing a row of pits. Vertex roughly triangular, narrowed distally, anterior margin concave between carinae, posterior margin strongly concave between eyes. Pronotum tricarinate on disc (median carina weak), elevated posteriorly; at midline subequal in length to vertex; anteriorly convex, following contours of head, posteriorly weakly concave; lateral paradiscal areas expansively developed into foliations surrounding (and broadly overtopping) the antennae posteriorly. Mesonotum tricarinate, wider than long. Post-tibia lacking lateral spines, apical spinulation (8-7)-(7-6)-6. Forewings broad, clavus apex near midlength; Sc branch just proximad of claval apex; forking of CuA proximad of fork of Sc+RA with RP. Terminalia bilaterally symmetrical or nearly so. Pygofer narrow in lateral view, opening caudally projected on lateral margins (lacking projection on ventral margin). Gonostyli spatulate with dorsal, medially directed projection near midlength, apex rounded. Aedeagus symmetrical, complex endosoma, shaft simple (lacking processes). Anal tube elongate in lateral view, apex truncate and arched downward, paraproct short.

Remarks. *Tico* **gen. n.** as comprised here is composed of three species *Tico emmettcarri* **sp. n.,** (the type species, described below), *Tico pseudosororius* **sp. n.** (described below), and *Tico sororius* (Fennah) **new combination.** Our molecular data supports *Tico emmettcarri* **sp. n.**, and *Tico pseudosororius* **sp. n.** as a clade. *Cenchrea sororia* Fennah is here transferred into *Tico* **gen. n.** to give the **new combination** *Tico sororius* (Fennah) for reasons described below.

The species described here in *Tico* **gen. n.** initially appeared to belong to *Cenchrea*. Results of molecular analyses and consideration of some comments of Fennah (1952) led us to describe these taxa in a new genus. Fennah (1952) emphasized the distinctness of *C. dorsalis* (the type species) relative to the remaining species in *Cenchrea*, and suggested that *C. dorsalis* and the remaining taxa might be placed in different subgenera. Study of available *Cenchrea* specimens, along with available molecular data seems to support Fennah's (1952) assertion. However, because specimens (or photos) of *Cenchrea bipunctata* (Muir) and *C. sexguttata* Fennah (the latter described from females) are not available to us, we are reluctant to speculative on their generic placement. For *C. exquisita* Uhler, differences in morphology (viz. the shape of the face and the presence of large falciform processes on the lateral margins of the pygofer opening, absent in both species placed in *Tico* **gen. n.**) would require a much more expansive definition of *Tico* **gen. n.** than we were comfortable making in the absence of supporting molecular data (sequencing available specimens was not successful). In contrast, we place *Cenchrea sororia* in *Tico* (as *Tico sororius* (Fennah) **comb.**) because of its unmistakable similarity to *T. pseudosororius* **sp. n.** (photos of *Tico sororius* show only slight differences), and the placement removes the diagnostic exception in the key to genus by both Fennah (1952) and O'Brien (1982).

Specifically, the diagnostic feature Cenchreini keys by Fennah (1952: 128) and O'Brien (1982: 308) is "tegmina with subcostal cell short (not extending basad of claval apex)", a feature found in both *Cenchrea* and *Contigucephalus* Caldwell. This feature reflects that the Sc branches at the level of (or distal to) the apex of the clavus, making the marginal cell between the Sc and RA branches short. For species we place in *Tico* **gen. n.,** the Sc branches before the level of the claval apex, resulting in a longer marginal cell then the species we retain in *Cenchrea*. Additional diagnostic comments under 'Remarks' following the amended description of *Cenchrea*.

There is some sexual dimorphism in the genus with males more slender and with narrower forewings than females and males tending to be more darkly marked.

Etymology. The generic name is to be treated as an arbitrary combination of letters, alluding to a colloquial term referencing something from Costa Rica. The term is masculine in gender.

Key to species of *Tico* gen. n.

1. Forewing black spot at base and 4 large blacks spots distally on trailing margin (the dorsal part of the wing when in repose); head with dark marking anterior to eyes 2

-. Forewing without series of 4 dark spots, markings limited to well-separated single spots (including one in coastal cell, one near fork of CuA, and one in cell C3, proximad of an intramedial crossvein; head in front of eyes pale . . . . *T. emmettcarri* **gen et. sp. n.**

2. Ventral processes of first gonapophysis of ovipositor not twisted, apex of dorsal process angled dorsad, bifid; pregenital plate pyramid-shaped . . . . *T. sororius* (Fennah)

-. Ventral processes of first gonapophysis twisted into near-helix, apex of dorsal process not bifid, hooked anteriorly; pregenital plate spade-shaped . . . . *T. pseudosororius* **gen. et. sp. n.**

Tico emmettcarri Bahder & Bartlett sp. n.

(Figs 4–11)

Type locality. La Selva Biological Station, Heredia, Costa Rica.

Diagnosis. A pale species without distinct body markings bearing clear wings with limited, diffuse markings, including a distinct spot near the fork of the CuA and a more diffuse marking at the claval apex among other markings. Sc branching from R proximad of claval apex. RP and CuA collectively have 8 branches reaching wing margin.

The gonostyli have a rounded apex and a dorsal process near midlength including a sclerotized ridge and a large, curved spine angled distad. Aedeagus compact and narrow, shaft arched upward near midlength, devoid of subapical processes, with complex array of apical retrorse processes associated with endosoma. Pygofer with lateral margins of opening convex with a rounded lobe near the anal tube articulation.

Description. *Color*. In life, uniform ivory-white, males with diffuse orange markings on genae (diagonally below antennae), and laterad of lateral carinae on pro- and mesonotum and on median carina of mesonotum. (Figs 4 & 5). Lateral carinae of head embrowned (Fig. 5). Forewings clear, male wings with three prominent black spots; one near midlength in costal cell, second near fork of CuA, third between branches MP_3 and MP_4 proximad to crossvein; additional less prominent markings (some reddish) include large diffuse patch on Pcu; a patch cell between apex of clavus and CuA; weak markings at apical vein in each apical cell, and two poorly defined bands, one arising about at marginal apex of Sc, the second just beyond marginal apex of RA (Fig. 6). Females with similar markings, differing in size and definition, except lacking spots in subcostal cell and Pcu and nearly all markings are fuscous (Fig. 6).

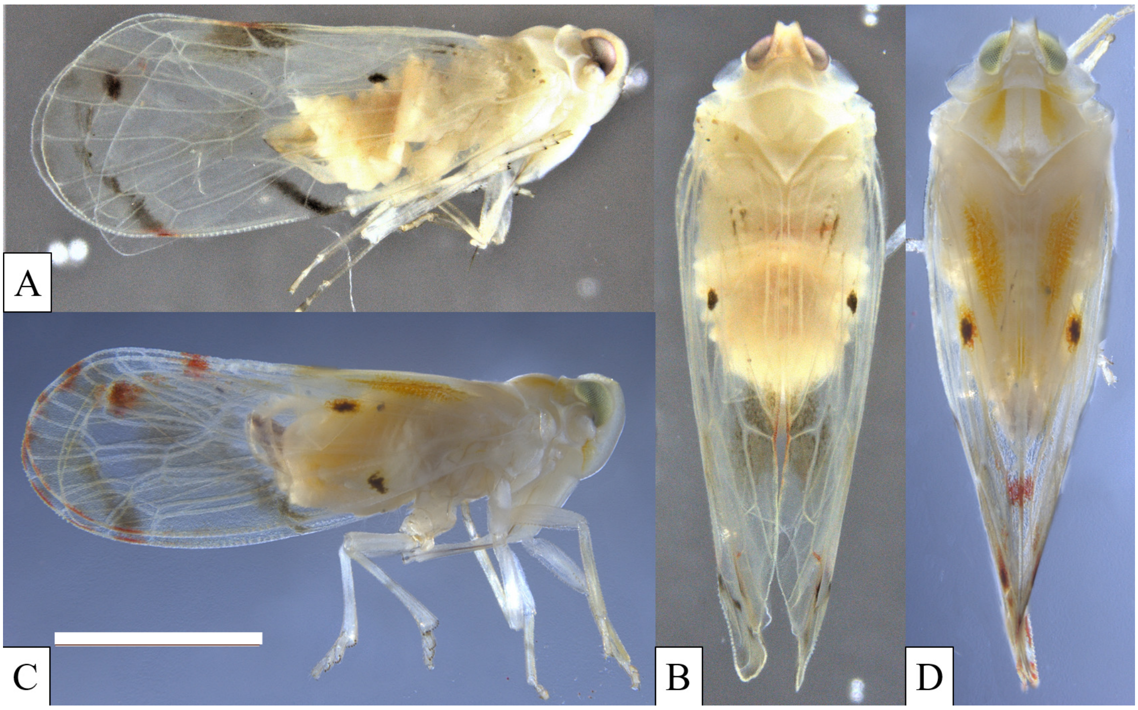

FIGURE 4. Adult habitus *Tico* **gen. n.** *emmettcarri* **sp. n.**; A) female body lateral view, B) dorsal view, C) male body lateral view, and D) dorsal view, scale = 1 mm.

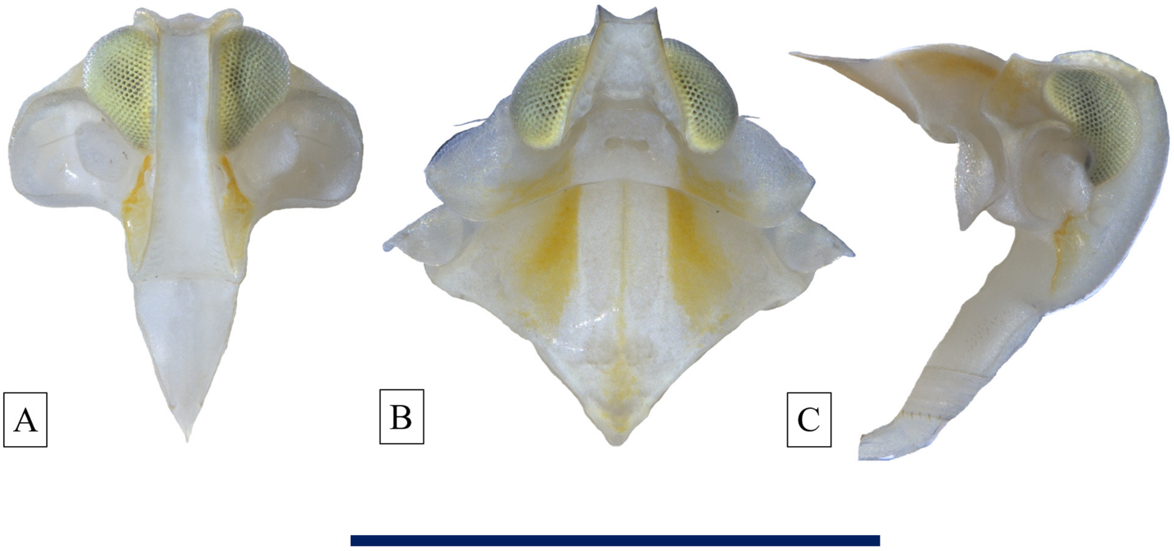

FIGURE 5. Adult *Tico* **gen. n.** *emmettcarri* **sp. n.**; A) head and pronotum frontal view, B) head, pronotum, and mesonotum dorsal view, and C) head, pronotum, and mesonotum lateral view, scale = 1 mm.

Structure. Body length 3.00 mm (males), 2.02 mm (females) (Table 2). Head. In lateral view, generally rounded, slightly humped at transverse carina between vertex and frons (Fig. 5), anterior margin somewhat flattened (Fig. 5). Frons and vertex with lateral margins strongly keeled, bearing sensory pits, median carinae absent (Fig. 5). Antennae short and bulbous. In dorsal view, vertex roughly triangular, widest posteriorly, narrowed anteriorly to transverse carina; anterior margin concave between carinae, posterior margin strongly concave between eyes (Fig. 5). In frontal view, frons relatively broad, lateral margins parallel between eyes, expanding below eyes to frontoclypeal suture; transverse suture between frons and clypeus distinct. Clypeus triangular, bearing median carina.

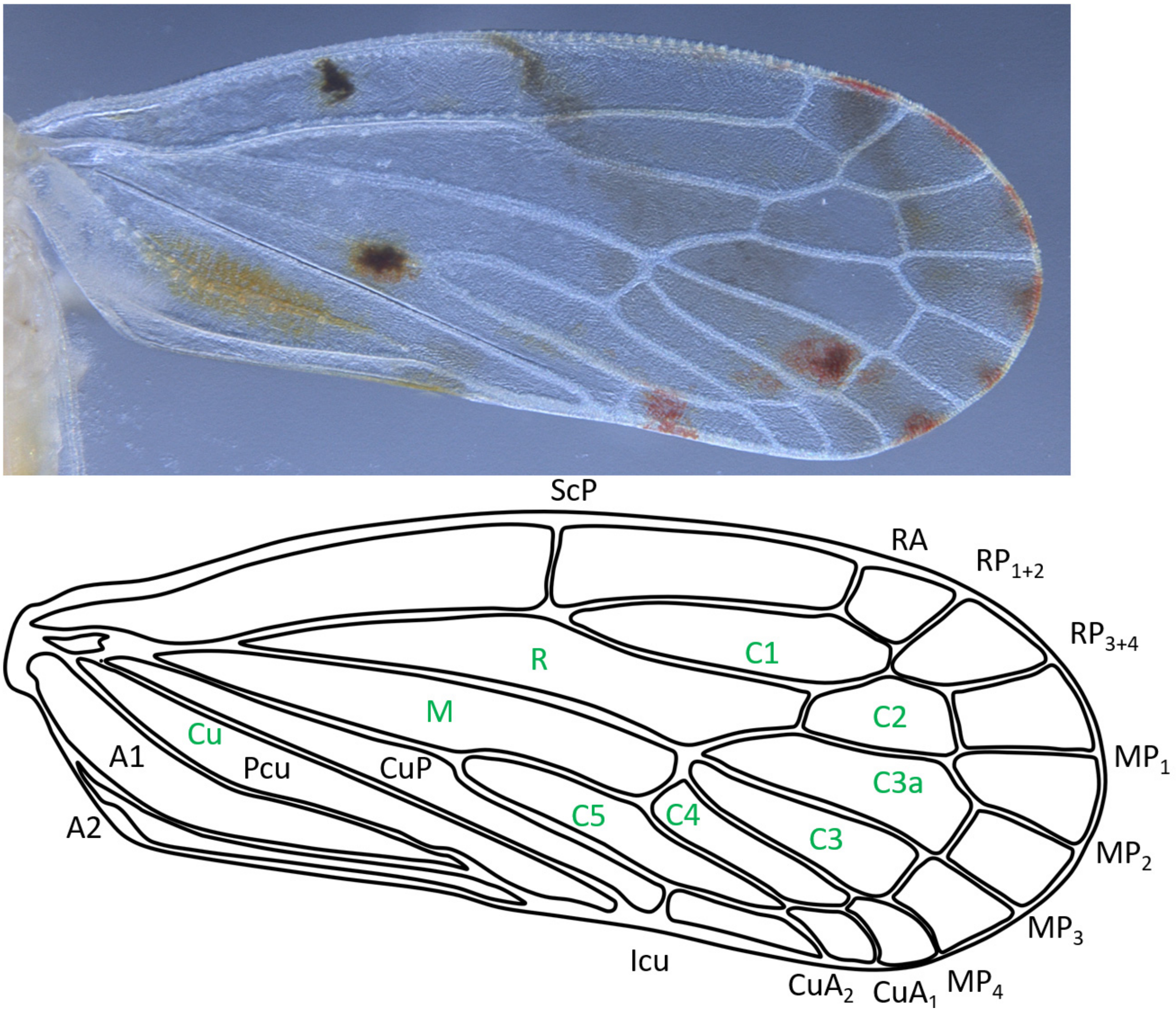

FIGURE 6. Male *Tico* **gen. n.** *emmettcarri* **sp. n.** wing venation; black = vein, green = cell.

Thorax. Pronotum relatively long at midline (subequal to vertex length), weakly tricarinate; anterior margin strongly convex, following contours of head; posterior margin concave; pronotal paradiscal region broadly foliate, forming a cup-like fossa surrounding and strongly overtopping the antennae, foliations appearing semi-quadrate in frontal view (Fig. 9A). Mesonotum slightly wider than long, tricarinate, lateral carinae subparallel, slightly convex (Fig. 5). Rostrum just exceeding hind coxae, apical segment about as long as wide. Hind tibia lacking lateral spines, flared at apex; spinulation of hind leg 7-6-6. Forewing (Fig. 6) with sensory pits along costal, subcostal+radial, and postcubital veins. Sc branching proximad of claval apex and fork of RA and RP. Branching pattern; RA 1-branched, RP 2-branched, MP 4-branched (fork of MP_{3+4} from MP_{1+2} and MP_1 from MP_2 nearly coincident; MP may be 5-branched if RP_{3+4} is assumed to fork), CuA 2-branched (distally fused if RP_{3+4} forks); Sc branch just preceding fork of RA and RP, and proximad of claval apex; CuA fork preceding fork of RA and RP (latter about level of claval apex) (Fig. 10).

Terminalia. Pygofer in lateral view narrow, irregularly sinuate on both posterior and anterior margin, widest ventrally, lateral margin of opening distinctly projecting posteriorly; dorsal margin with ovate lobe near articulation of anal tube (Fig. 7); in ventral view, pygofer lacking medioventral process (Fig. 7); in dorsal view, ovate lobes distinct (Fig. 7). Gonostyli in lateral view spatulate, apex rounded, with proximal angular projection ventrally, dorsal margin near midlength bearing basal, sclerotized hook (apex directed laterad) and distal sclerotized ridge (Figs. 7 & 8); in ventral view, lateral margin irregularly sinuate, inner margins strongly concave, greatly expanded at base forming medial angular projections (Fig. 7); in dorsal view, inner margins with serrulate sclerotized ridge terminating with small spine, approximately ¾ the length of gonostyli, basal portion with dark tubercles (Fig. 8). Aedeagus nearly bilaterally symmetrical, upcurved near midlength (Fig. 9), shaft without subapical processes, but bearing pair median dorsal flanges, dorsally serrate in in left lateral view (dorsum partly occluded by endosoma); aedeagus with single pair of large retrorse processes arising from apex (Fig. 10, A1 & A2, resting above endosoma) and complex endosoma; endosoma symmetrical, compact and complex, bearing large pair of robust elongate ventral processes (E1 & E2) bearing 2 pair of small processes at their base (E3 & E5 on right ride, E4 & E6 on left side) (Fig. 10); two processes arise near aedeagal apex (medial, in dorsal view, Fig. 10, E7, E8), and two pair of apical endosomal processes, 1 pair of long, narrow processes arising from inner margin of endosoma Fig. 10, E9 & E10) and a small median pair of processes visible in dorsal view (Fig. 10, E11 & E12). Anal tube elongate in lateral view, distally downcurved (ventrally convex), apex truncate with ventrally pointed projection dorsal margin irregularly sinuate; in dorsal view anal tube broadly spatulate; paraproct short (Fig. 10C).

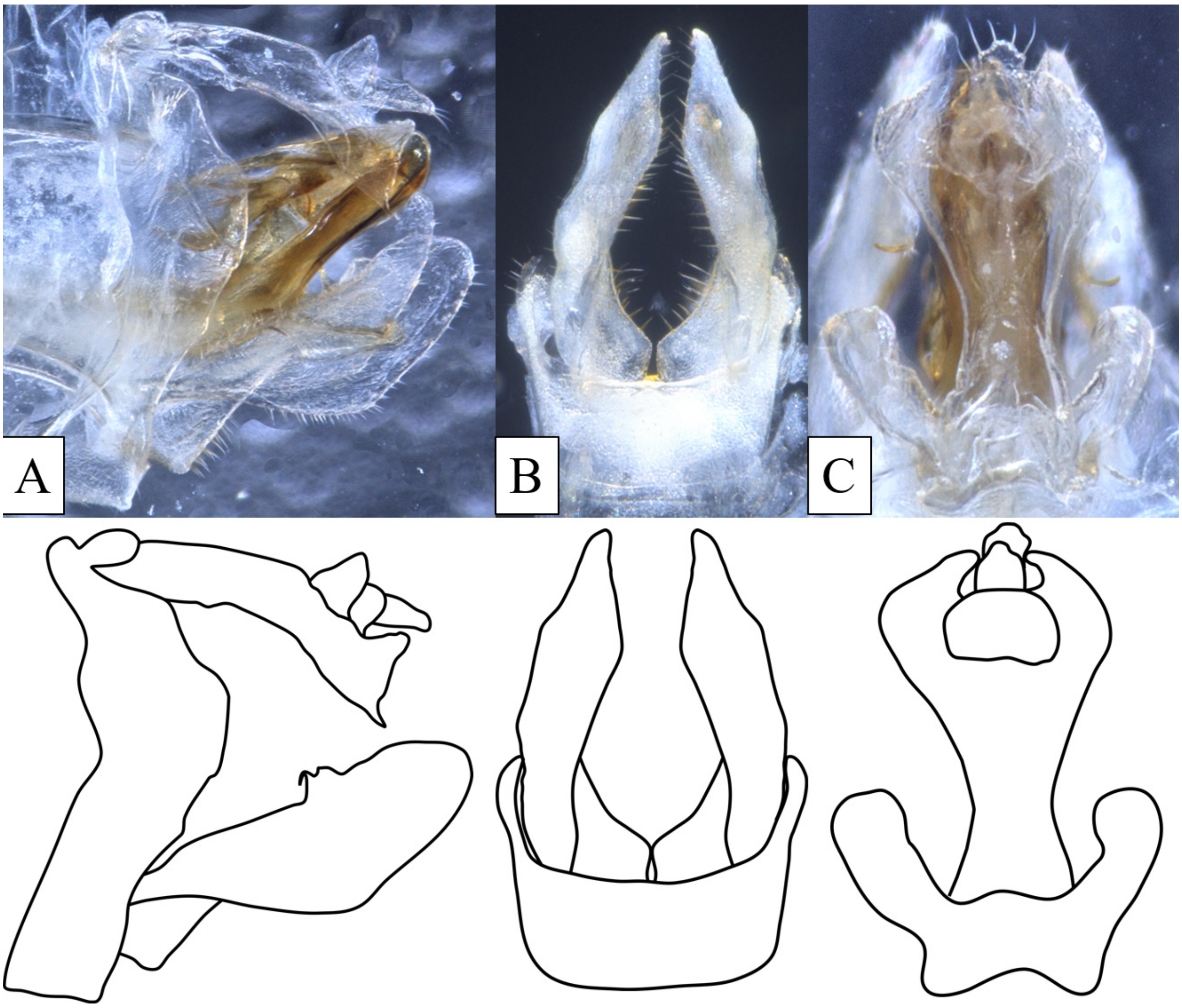

FIGURE 7. Male *Tico* **gen. n.** *emmettcarri* **sp. n.** terminalia; A) lateral view, B) ventral view, and C) dorsal view.

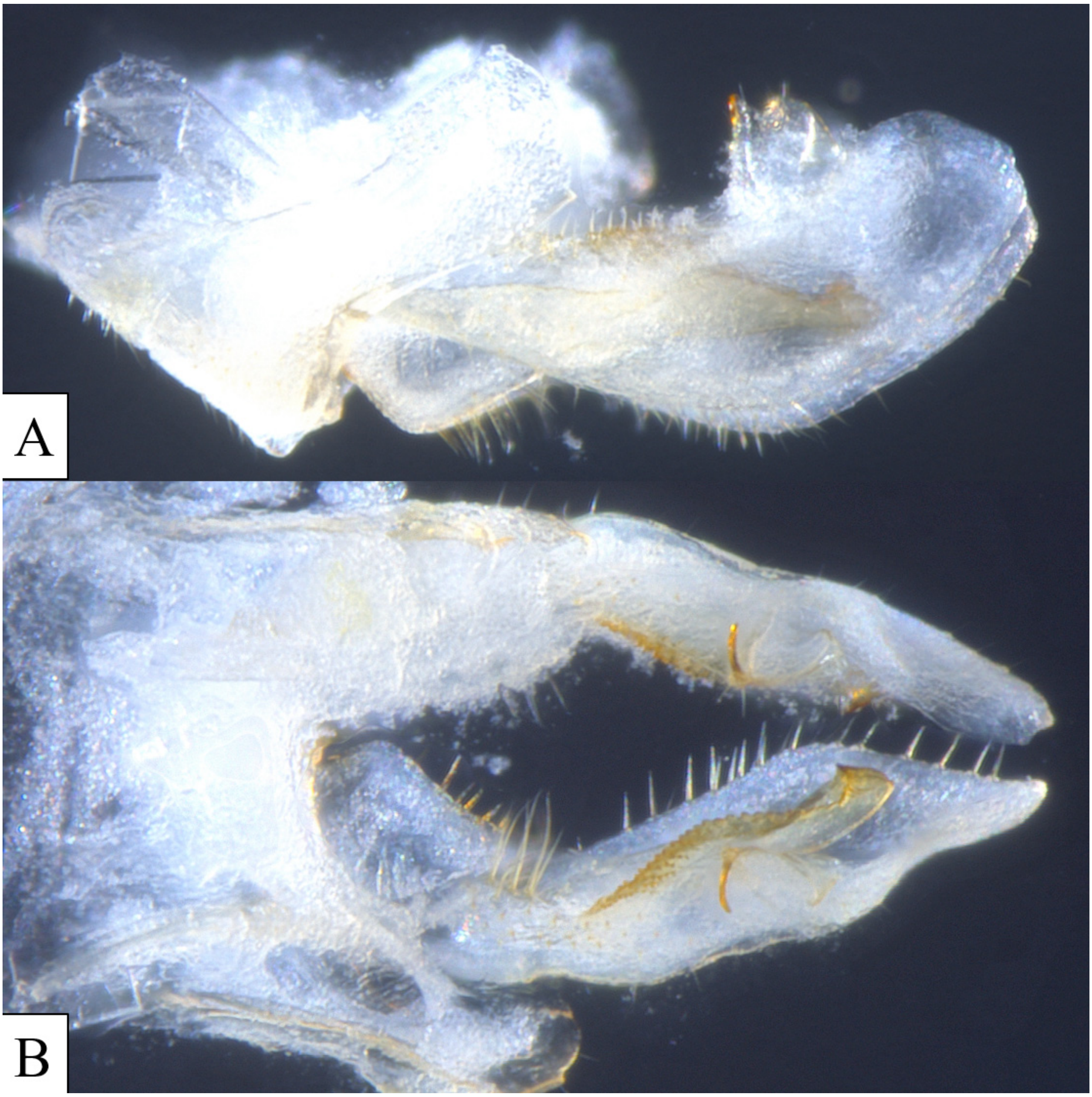

FIGURE 8. Gonostylus of *Tico* **gen. n.** *emmettcarri* **sp. n.**; A) lateral view demonstrating ventral-angular projection and dorsal process and B) inner surface demonstrating sclerotized ridge with tubercles and spinose apex.

Female terminalia: Subgenital plate subtriangular, widest at base, lateral margins sinuate, converging slightly basally, distal margin broad, sinuate (Fig. 11A). First gonapophyses of ovipositor bifid at apex, ventral process robust, curved dorsad, dorsal process slightly curved upward, strongly serrate on dorsal margin near apex, serrations irregular (Fig. 11B).

Plant associations. *Asplundia* sp. (Cyclanthaceae)

Distribution. Costa Rica (Heredia).

Etymology. The specific name is given in honor of the young entomologist Emmett Carr who has a natural passion for palms, their insect pests and pathogens.

Material examined. Holotype male, “Costa Rica, Heredia / La Selva Biological Station / B.W.Bahder, 22.VI.2019 / Host: *Asplundia* sp. // Holotype / *Tico* / *emmettcarri*” (FLREC). Paratypes, 2 males, 3 females, same data as holotype, (FSCA).

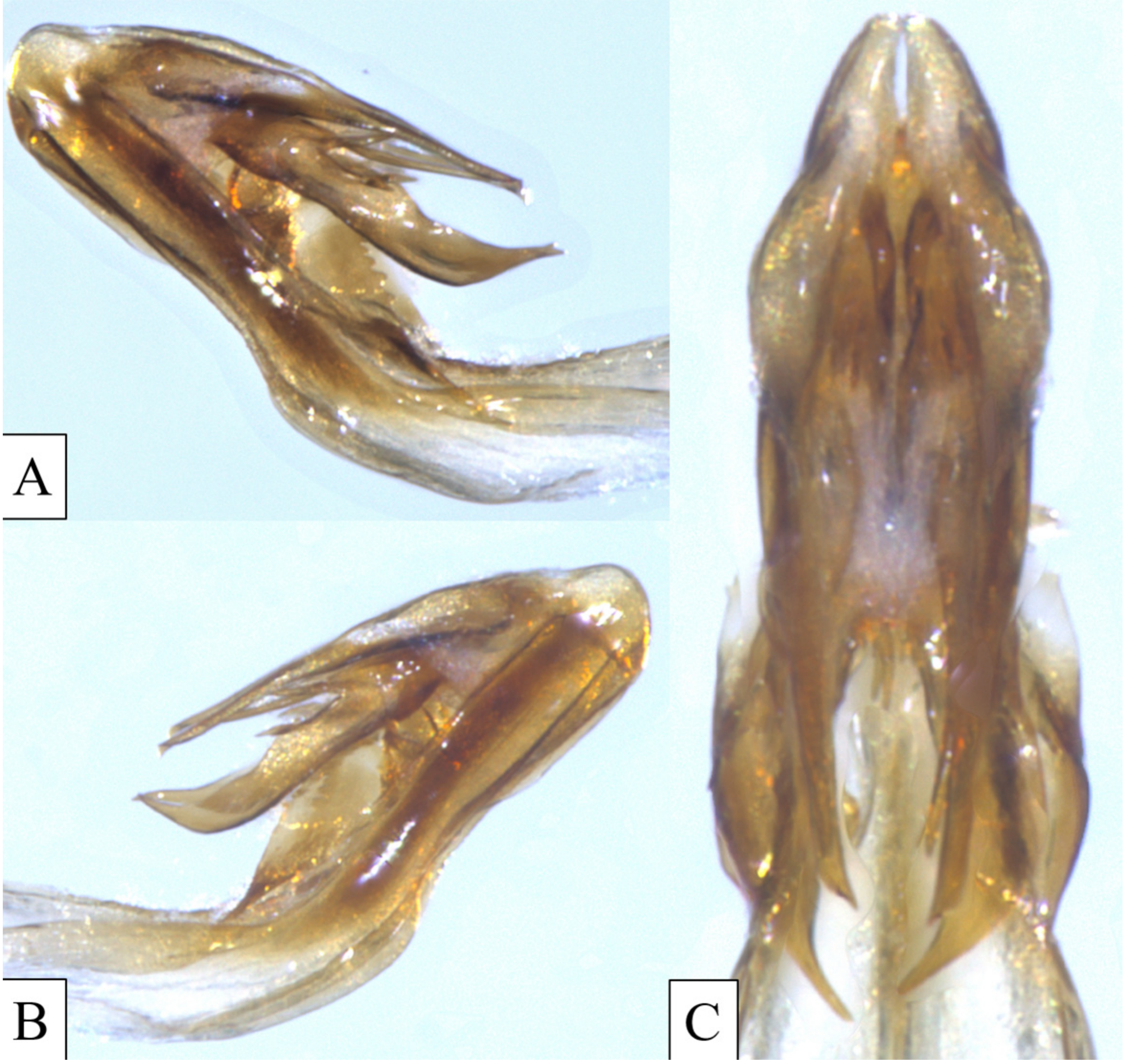

FIGURE 9. Aedeagus of adult male *Tico* **gen. n.** *emmettcarri* **sp. n.**; A) right lateral view, B) left lateral view, and C) dorsal view.

Remarks. *Tico emmettcarri* **sp. n.** can be readily separated from the other two species in *Tico* **gen. n.** by the nature of the markings on the wings and the lack of a black marking in front of the eyes. The collective number of branches of RP and CuA reaching the wing margin is 8, such that an additional cell (relative to other included species) is defined (here identified as C3a, Fig. 6). The species is also distinctive in possessing proximal lobes and a dorsal sclerotized ridge on the gonostyli, the aedeagal shaft is arched upward near midlength and devoid of processes (although dorsal flange visible below retrorse flagellum, flange dorsally serrate from left view). The anal tube is elongate, distally downcurved and apically truncate. In contrast, both *Tico pseudosororius* **sp. n.** and *T. sororius* (Fennah) **comb. n.** bear a row of 4 spots on the wing and have a dark marking in front of the eyes. Also, in both of these species, the cumulative number of veins reaching the wing margin from RP and CuA is 7, such that cell C3a is not formed (compare Fig. 6 with Fig. 14). *Tico pseudosororius* **sp. n.** has evident differences in the terminalia including the dorsal lobe of the gonostyli is thumb-like (dorsal flange absent); also, the longest retrorse process on the aedeagus in dorsal view is a large flattened flange bearing a few large teeth. The anal tube is elongate, distally downcurved into rounded apices.

The male terminalia of *Tico sororius* are not known. When discovered, we anticipate that they will have features in common with described species in *Tico* **gen. n**., and their description would further elaborate genus-level features genera allied with *Cenchrea*.

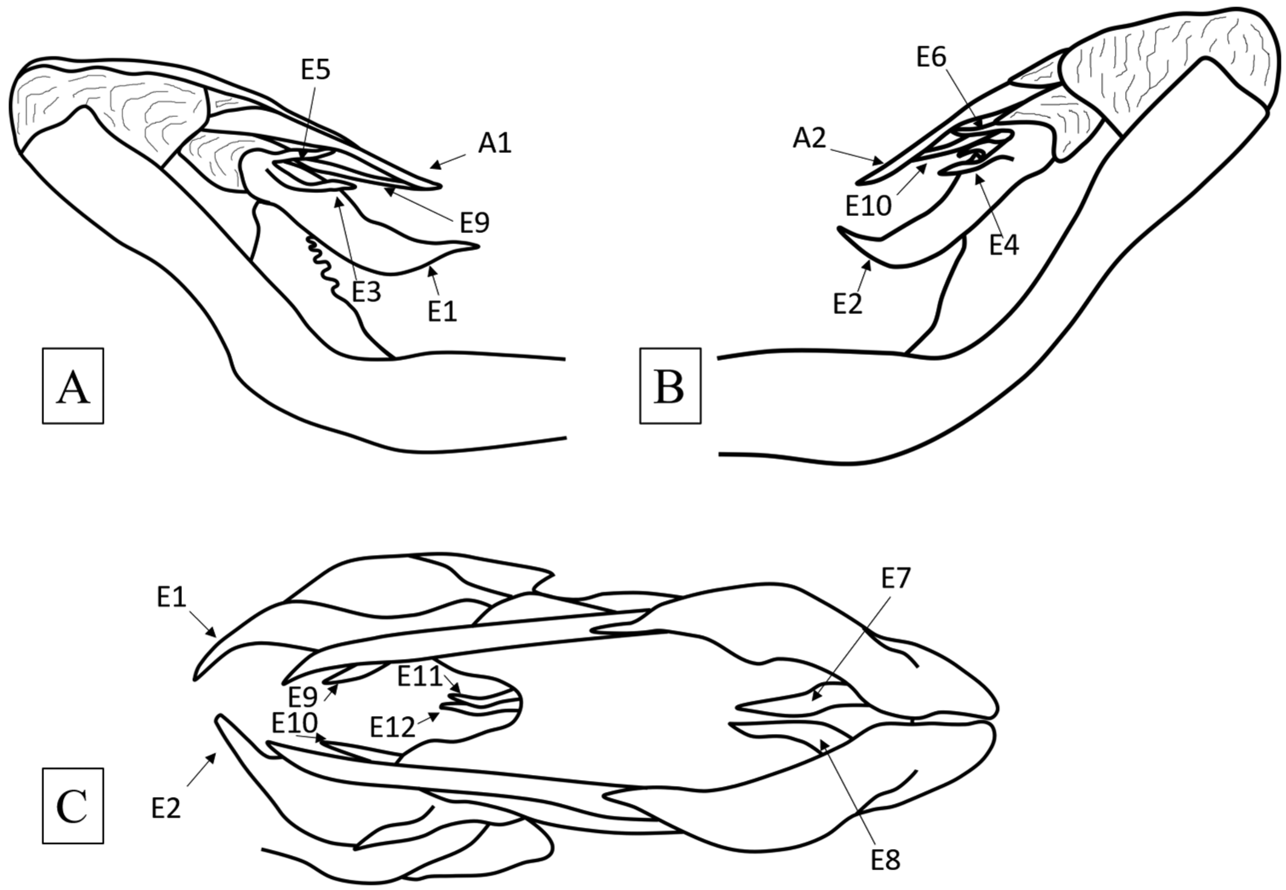

FIGURE 10. Illustration of aedeagus of adult male *Tico* **gen. n.** *emmettcarri* **sp. n.**; A) right lateral view, B) left lateral view, and C) dorsal view.

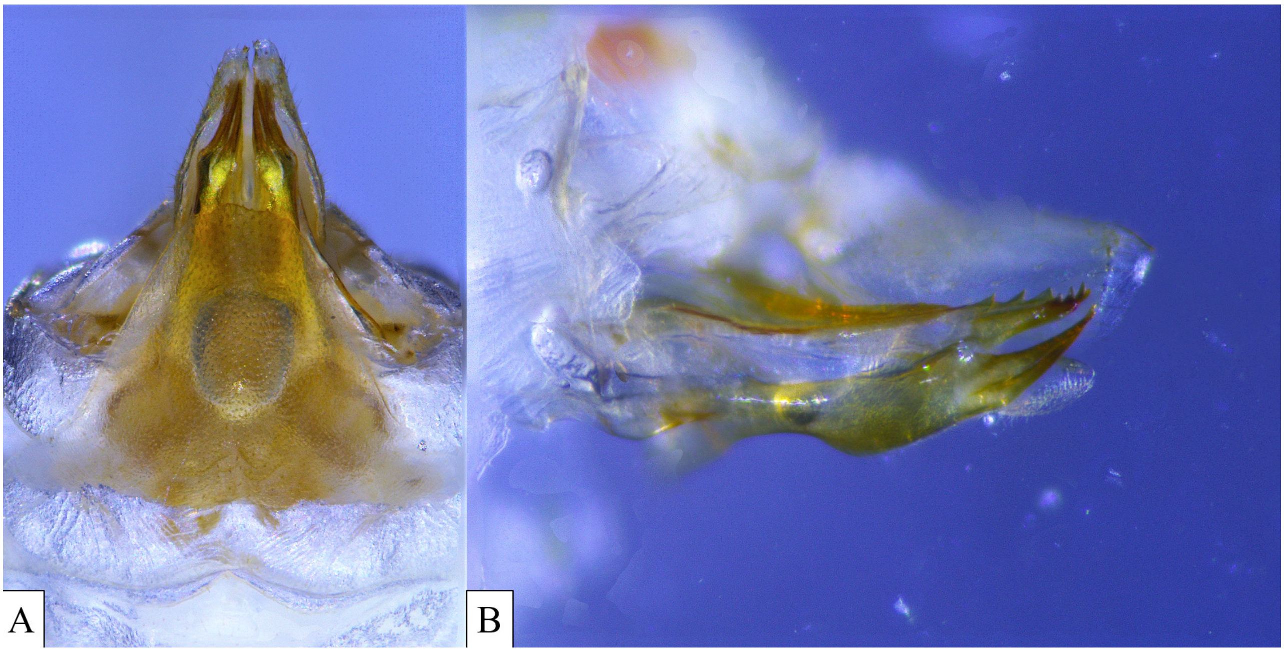

FIGURE 11. Female genitalia of *Tico* **gen. n.** *emmettcarri* **sp. n.**; A) pregenital plate ventral view and B) first gonapophysis of ovipositor.

TABLE 2. Biometric data for *Tico emmettcarri* **gen. et. sp. n.**; values = mm.

	Male (*n*=3)		Female (*n*=3)	
Metric	Range	Avg.±SE	Range	Avg.±SE
Body length, with wings	2.98–3.01	3.00±0.02	3.02–3.04	3.03±0.01
Body length, without wings	1.87–1.90	1.89±0.02	1.90–1.93	1.92±0.02
Forewing length	2.56–2.59	2.58±0.02	2.62–2.63	2.63±0.01
Vertex length, midline	0.13–0.14	0.14±0.01	0.14–0.15	0.15±0.01
Vertex width, basal margin	0.20–0.21	0.21±0.01	0.22–0.23	0.23±0.01
Vertex width, distal margin	0.09–0.10	0.10±0.01	0.10–0.13	0.12±0.02
Frons length, midline	0.46–0.47	0.47±0.01	0.47–0.48	0.48±0.01
Frons width, dorsal margin	0.09–0.10	0.10±0.01	0.10–0.13	0.12±0.02
Frons width, frontoclypeal suture	0.19–0.20	0.20±0.01	0.20–0.21	0.21±0.01
Frons width, narrowest point	0.09–0.10	0.10±0.01	0.10–0.13	0.12±0.02
Frons width, widest point	0.19–0.20	0.20±0.01	0.20–0.21	0.21±0.01
Clypeus length	0.29–0.30	0.30±0.01	0.30–0.31	0.31±0.01
Pronotum length, midline	0.12–0.13	0.13±0.01	0.13–0.14	0.14±0.01
Mesonotum length, midline	0.45–0.46	0.46±0.01	0.46–0.47	0.47±0.01
Mesonotum width	0.66–0.67	0.67±0.01	0.67–0.68	0.68±0.01

Tico pseudosororius Bahder & Bartlett, sp. n.

(Figs 12–19)

Type locality. La Selva Biological Station, Heredia, Costa Rica.

Diagnosis. A pale species, with a dark mark in front of eyes (lateral view), on pronotum (lateral of lateral carinae) and on scutellum. Wings clear with row of four dark patches on the forewing (proximal two incompletely separated) plus one in the trailing margin of the clavus. RP and CuA combined with 7 branches reaching wing margin. The gonostyli are spatulate with a rounded apex and a thumb-like dorsal process near midlength, process bearing a sharp, laterally hooked sclerotized spine near midlength. Aedeagus with complex array of apical sclerotized retrorse processes and flanges associated with endosoma. Pygofer with lateral margins of opening. Anal tube long with apex downcurved and rounded.

Description. *Color*. Body yellowish-white, head with fuscous mark in front of eyes, (lateral view), on pronotum (lateral of lateral carinae) and on scutellum (Fig. 12). Wings clear with row dark patches on the forewing (appearing to be four with proximal two incompletely separated) and a dark spot in the trailing corner of the clavus; also a poorly defined subapical dark band.

Structure. Body length 2.66 mm (males), 2.68 mm (females) (Table 3). <u>Head</u>. In lateral view, generally rounded, slightly humped at fastigium (marking position of transverse carina between vertex and frons; Fig. 13), anterior margin weakly rounded (Fig. 13). In frontal view frons compressed, median carina absent, lateral margins strongly keeled (bearing sensory pits), weakly sinuate, narrowest dorsally, becoming wider below eyes to frontoclypeal suture; transverse suture between frons and vertex present. Clypeus elongate triangular, bearing median carina. Antennae short and bulbous. In dorsal view, vertex roughly triangular, with lateral margins strongly keeled, bearing sensory pits, median carinae absent, narrowed anteriorly to transverse carina, anteriorly strongly concave between lateral keels; posterior margin concave and truncate between eyes (Fig. 13).

<u>Thorax</u>. Pronotum at midlength shorter than vertex, tricarinate (median weak, lateral originating behind inner eye margin, diverging, just reaching hind margin); anterior margin nearly truncate between eyes, laterally following contours of head; posterior margin concave; pronotal paradiscal region expansively foliate, forming a cup-like fossa surrounding and overtopping the antennae, foliations appearing semi-quadrate in frontal view (Fig. 13). Mesonotum slightly wider than long, weakly tricarinate, carinae just reaching posterior margin, lateral carinae subparallel (Fig. 13). Rostrum exceeding hind coxae, apical segment about as long as wide. Hind tibia lacking lateral spines, flared at apex; spinulation of hind leg 8-7-6. Forewing (Fig. 14) with sensory pits along costal, subcostal+radial, and post-

cubital veins. Branching pattern; RA 1-branched, RP 2-branched, MP 3- or 4-branched (fork of MP_{3+4} from MP_{1+2} and MP_1 from MP_2 nearly coincident; MP_{3+4} may be assumed for fork distally), CuA 2-branched (if MP_{3+4} forks, branches of CuA fuse distally); Sc branch just preceding fork of RA and RP, and proximad of claval apex; CuA fork preceding fork of RA and RP (latter about level of claval apex) (Fig. 14).

FIGURE 12. Adult habitus *Tico* **gen. n.** *pseudosororius* **sp. n.**; A) lateral view and B) dorsal view, scale = 1 mm.

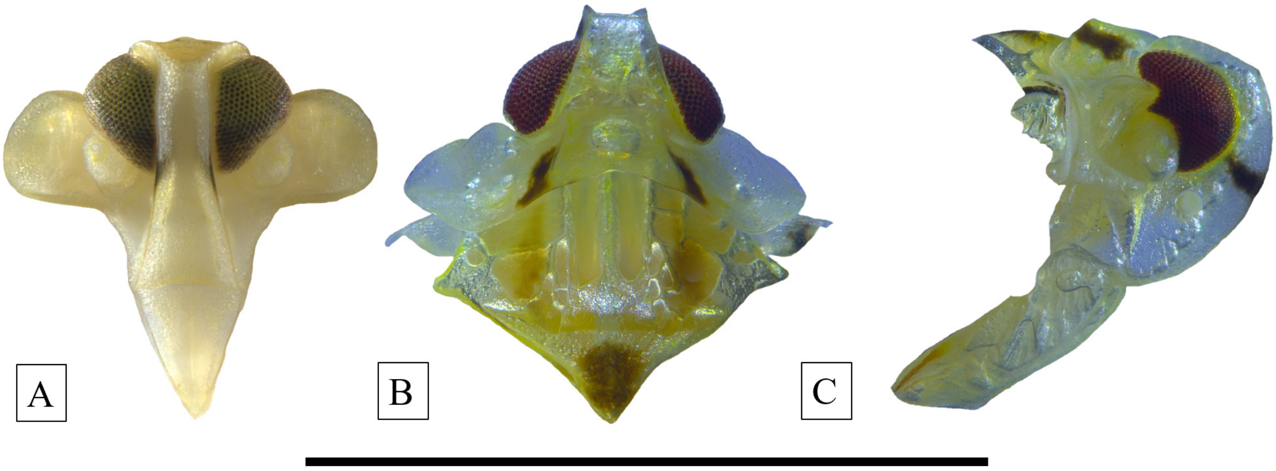

FIGURE 13. Adult *Tico* **gen. n.** *pseudosororius* **sp. n.**; A) head and pronotum frontal view, B) head, pronotum, and mesonotum dorsal view, and C) head, pronotum, and mesonotum lateral view, scale = 1 mm.

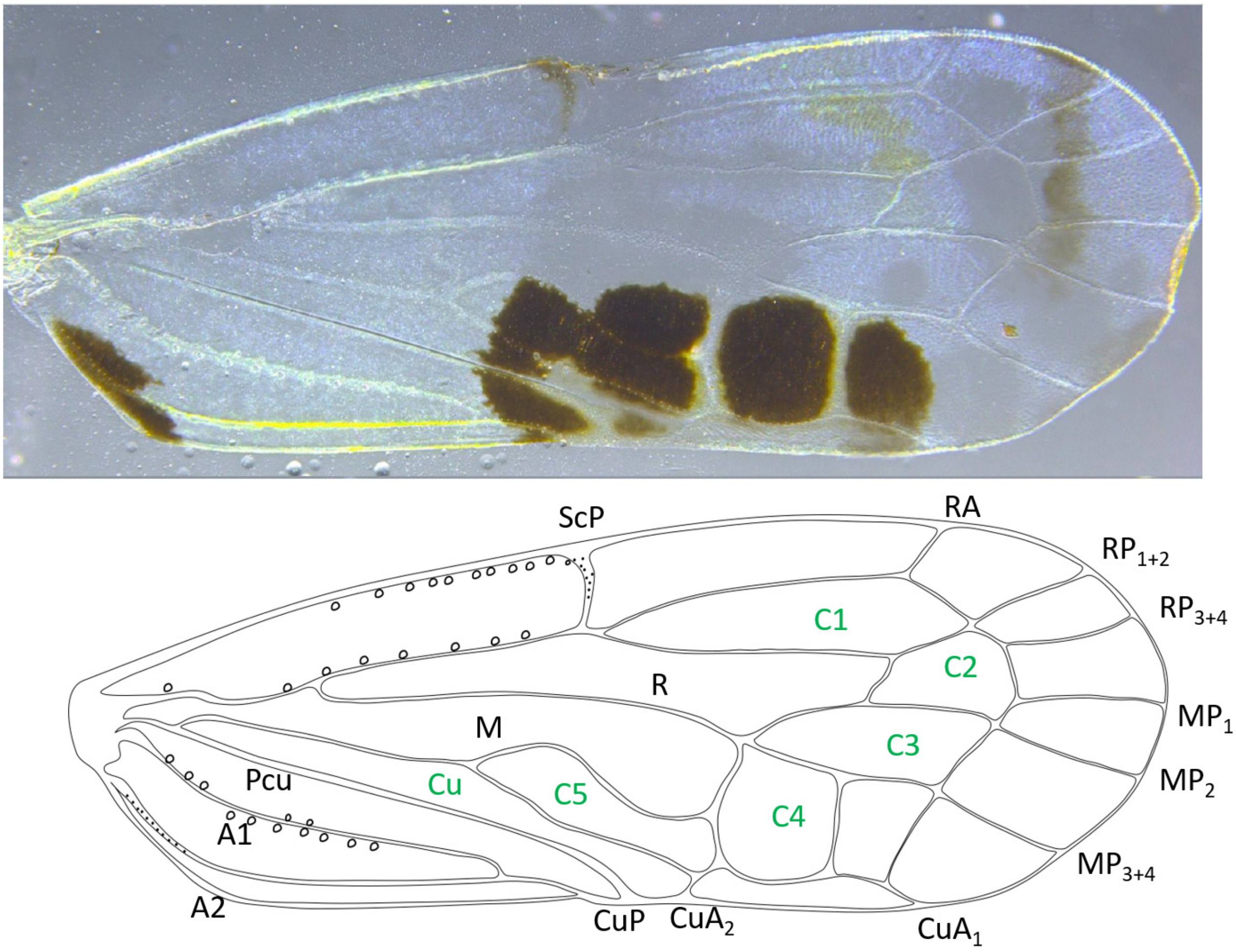

FIGURE 14. Male *Tico* **gen. n.** *pseudosororius* **sp. n.** wing venation; black = vein, green = cell.

Terminalia. Male pygofer in lateral view narrow, irregularly sinuate on both posterior and anterior margin, widest ventrally, lateral margin of opening distinctly projecting posteriorly (Fig. 15); in ventral view, pygofer lacking medioventral process (Fig. 15). Gonostyli in lateral view spatulate, apex rounded, with proximal angular projection ventrally, dorsal margin near midlength bearing large process with sclerotized hook at midlength (Fig. 16); in ventral view, lateral margin irregularly sinuate, inner margins concave, greatly expanded at base forming medial angular projections, inner margins with serrulate sclerotized ridge comprised of three apices, basal and distal apices large and rounded, middle apex greatly reduced, approximately ¾ the length of gonostyli, basal portion with dark tubercles (Fig. 16). Aedeagus nearly bilaterally symmetrical, shaft with two pairs of processes, first pair situated subapically on shaft (A1 & A2), at junction with flagellum, angled anterior, curved dorsad (Figs 17, 18), second pair (A3 & A4) arising at apex of aedeagus, angled anterior. Flagellum, large, without armature, slightly ovoid in lateral view (Figs 17, 18). Endosoma highly complex large, very broad, heavily serrate processes. Three pairs of broad processes (E1–E6) and a single pair of well-defined processes (E7 & E8). Dorsal most processes narrower, shorter and bifid (E1 & E2; Fig. 18), well defined processes (E7 & E8) ventrad to E1 & E2, E3 and E4 ventrad to E7 and E8, moderate length and width, right process (E3) serrate, left process (E4) bifid (Fig. 18), ventral-most processes longest and widest (E5 & E6; Fig 18), extending to base of aedeagus, both strongly serrate at apex with large subapical, lateral process (Fig. 18). Anal tube elongate in lateral view, distally downcurved (ventrally convex), apex rounded, dorsal margin irregularly sinuate; in dorsal view anal tube broadly spatulate; paraproct short (Figs 15A, 15C).

Female terminalia: Pregenital plate spade-shaped (Fig. 19A), widest at base, immediately constricting to approximately 2/3 basal width, lateral margins parallel, constricting at distal 1/3, forming acute apex (Fig. 19A). First gonapophyses of ovipositor bifid at apex, ventral process split into two processes, twisted in helical form, dorsal process strongly hooked dorsad and slight anteriorly, strongly serrate on dorsal margin near apex, serrations of uniform size (Fig. 19B).

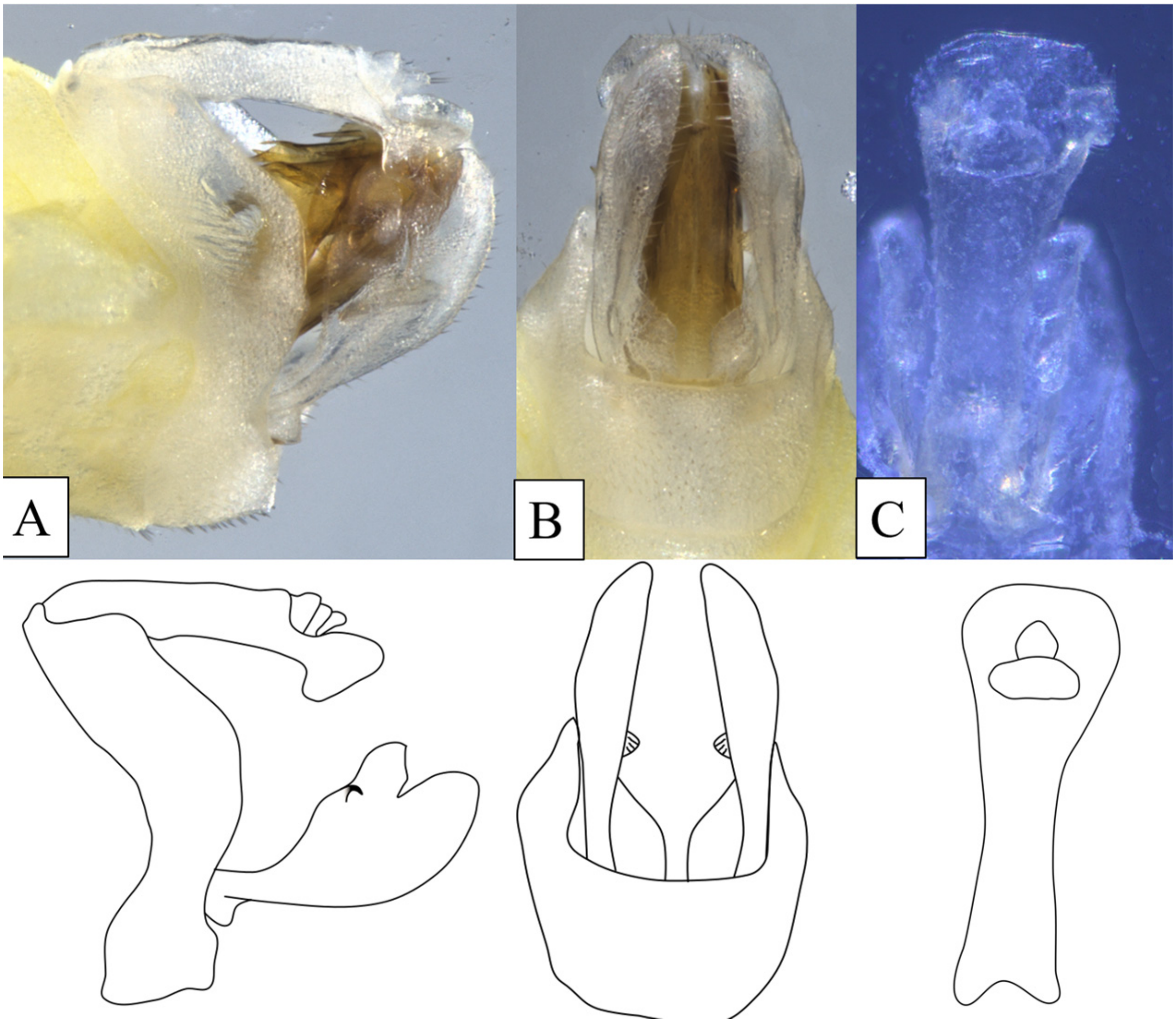

FIGURE 15. Male *Tico* **gen. n.** *pseudosororius* **sp. n.** terminalia; A) lateral view, B) ventral view, and C) dorsal view.

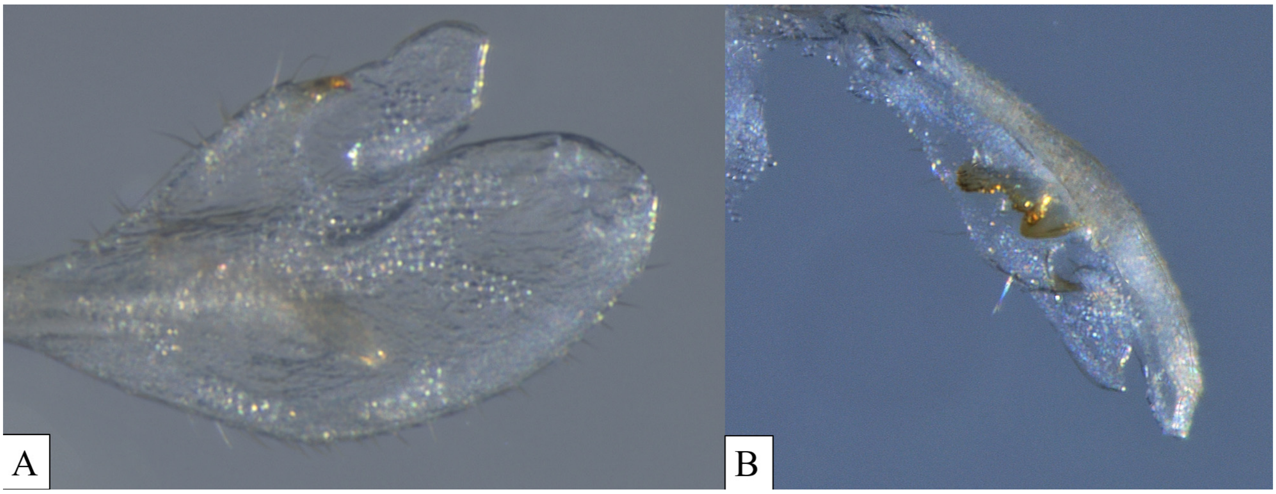

FIGURE 16. Gonostylus of *Tico* **gen. n.** *pseudosororius* **sp. n.**; A) lateral view demonstrating dorsal process and B) inner surface demonstrating sclerotized ridge with trifid process.

FIGURE 17. Aedeagus of adult male *Tico* **gen. n.** *pseudosororius* **sp. n.**; A) right lateral view, B) left lateral view, and C) dorsal view.

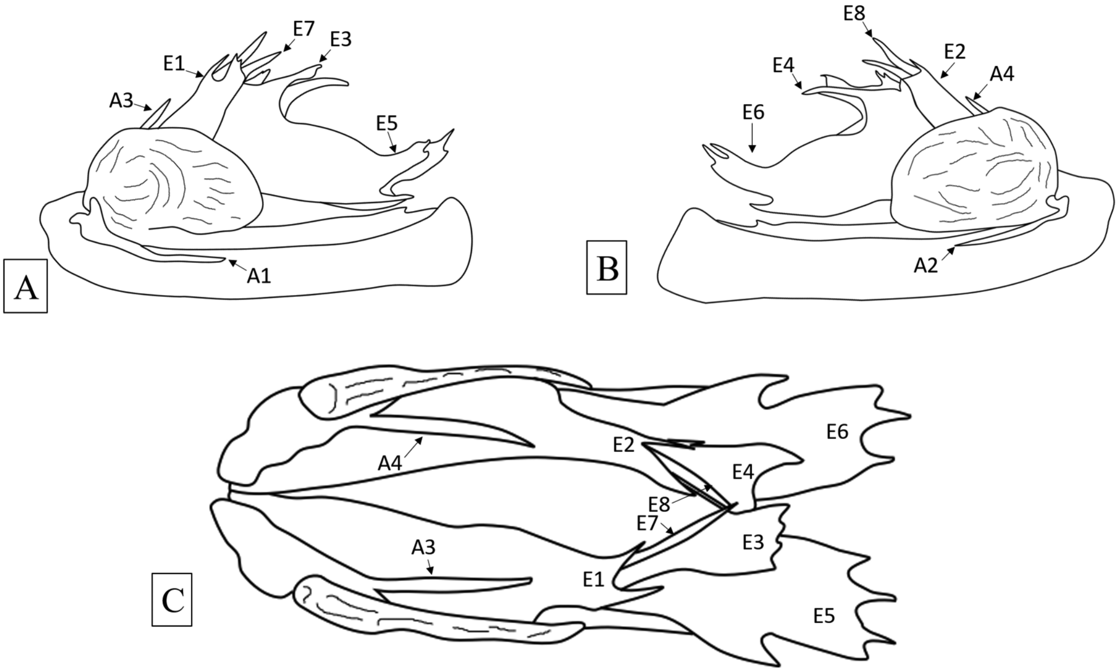

FIGURE 18. Illustration of aedeagus of adult male *Tico* **gen. n.** *pseudosororius* **sp. n.**; A) right lateral view, B) left lateral view, and C) dorsal view.

Plant associations. *Asplundia* sp. (Cyclanthaceae)

Distribution. Costa Rica (Heredia).

Etymology. The prefix '*pseudo*-' is from Greek term '*pseudes*', meaning false; '*sororia*' is derived from the Latin word *soror,* meaning sister, with the masculine termination '*-ius*' appended to agree in gender to *Tico* **gen. n.** The name is in reference to *Cenchrea sororia*, which this species strongly resembles and for which it was initially mistaken.

Material Examined. Holotype male, "Costa Rica, Heredia / La Selva Biological Station / B.W.Bahder, 22.VI.2019 / Host: *Asplundia* sp. // Holotype / *Tico* / *pseudosororius*" (FLREC). Paratype, 3 males, 7 females, same data as holotype (FSCA).

Remarks. Diagnostic features between *Tico pseudosororius* **sp. n.** and *T. emmettcarri* **sp. n.** are elaborated on in remarks under the latter species. *Tico pseudosororius* **sp. n.** and *Tico sororius* (Fennah) are very similar externally and, until males of the latter species are found, are best separated by features of the female terminalia and color patterns observed on the forewing as diagnosed in the key.

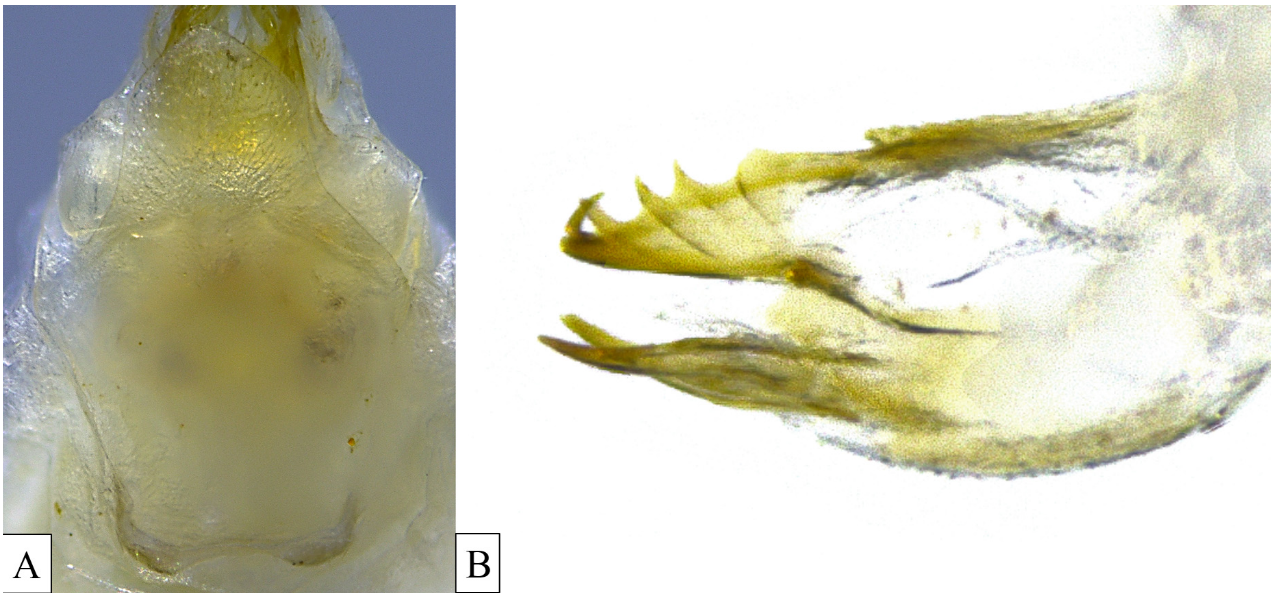

FIGURE 19. Female genitalia of *Tico* **gen. n.** *pseudosororius* **sp. n.**; A) pregenital plate ventral view and B) first gonapophysis of ovipositor.

TABLE 3. Biometric data for *Tico pseudosororius* **gen. et. sp. n.**; values = mm.

	Male (*n*=4)		Female (*n*=7)	
Metric	Range	Avg.±SE	Range	Avg.±SE
Body length, with wings	2.65–2.67	2.66±0.01	2.67–2.68	2.68±0.01
Body length, without wings	1.76–1.78	1.77±0.01	1.77–1.78	1.78±0.01
Forewing length	2.34–2.35	2.34±002	2.30–2.31	2.31±0.01
Vertex length, midline	0.12–0.13	0.13±0.01	0.13–0.14	0.14±0.01
Vertex width, basal margin	0.50–0.52	0.51±0.01	0.52–0.53	0.53±0.01
Vertex width, distal margin	0.09	0.09±0.00	0.09	0.09±0.00
Frons length, midline	0.37	0.37±0.00	0.37	0.37±0.00
Frons width, dorsal margin	0.08	0.08±0.00	0.08	0.08±0.00
Frons width, frontoclypeal suture	0.18–0.19	0.19±0.01	0.19	0.19±0.00
Frons width, narrowest point	0.08	0.08±0.00	0.08	0.08±0.00
Frons width, widest point	0.18–0.19	0.19±0.01	0.19	0.19±0.00
Clypeus length	0.21–0.22	0.22±0.01	0.22–0.23	0.23±0.01
Pronotum length, midline	0.12–0.13	0.13±0.01	0.11	0.11±0.00
Mesonotum length, midline	0.39–0.40	0.40±0.01	0.39–0.40	0.40±0.01
Mesonotum width	0.57	0.57±0.00	0.57	0.57±0.00

Sequence Data and Analysis

For the novel taxa, a 1,587 bp product was amplified and sequenced for the 18S locus for *Tico emmettcarri* **gen. et. sp. n.** (GenBank Accession No. MT526036) and *Tico pseudosororius* **gen. et. sp. n.** (GenBank Accession No. MT526037). Based on the Maximum Likelihood phylogenetic analysis, there was strong bootstrap support (100) for the novel taxa being placed in a clade separate from *Cenchrea dorsalis* (Fig. 7A). There was moderate bootstrap support (86) for *C. dorsalis* grouping closer to *Anchimothon* and *Neocenchrea* than to the novel taxon (Fig. 20A). The pairwise comparison showed that with the genus *Agoo*, there is an average of 1.0% difference among species and in the genus *Omolicna*, there is average of 0.9% difference among species (Table 4). Additionally, among the genera of cenchreines analyzed in this study, there is an average of 8.9% variability among genera, ranging from 2.6% to 15.0% (Table 4). The novel taxa were 0.6% different from each other and between 2.6% and 2.7% different from *C. dorsalis* (Table 4).

A 580 bp product was amplified and sequenced for the COI locus for both *Tico emmettcarri* **gen. et. sp. n.** (GenBank Accession No. QIC50735) and *Tico pseudosororius* **gen. et. sp. n.** (GenBank Accession No. MT997938). Based on the Maximum Likelihood phylogenetic analysis, there is moderate support (83) for a clade including both novel taxa (Fig. 20B) and *C. dorsalis* weakly grouping among *Neocenchrea* and *Agoo* (Fig. 20B). The pairwise comparison showed within the genus *Agoo* there was an average of 16.2% difference among species and 12.9% difference on average among species in the genus *Omolicna* (Table 5). The difference between the novel taxa was 13.7% while the difference was 20.8% and 23.4% between the novel tax and *C. dorsalis* (Table 5). The average variability among the genera analyzed was 19.8% whereas the average intrageneric variability was 14.3%.

The consensus tree generated using concatenated data for COI and 18S shows strong support (100) for *Tico* **gen. n.** as a clade with weak support (58) for resolving adjacent to *Cenchrea*. Regardless, these results do not support placement of the new taxa in *Cenchrea* or any of the other genera included in these analyses based on independent analyses of COI and 18S as well as a consensus between the two loci.

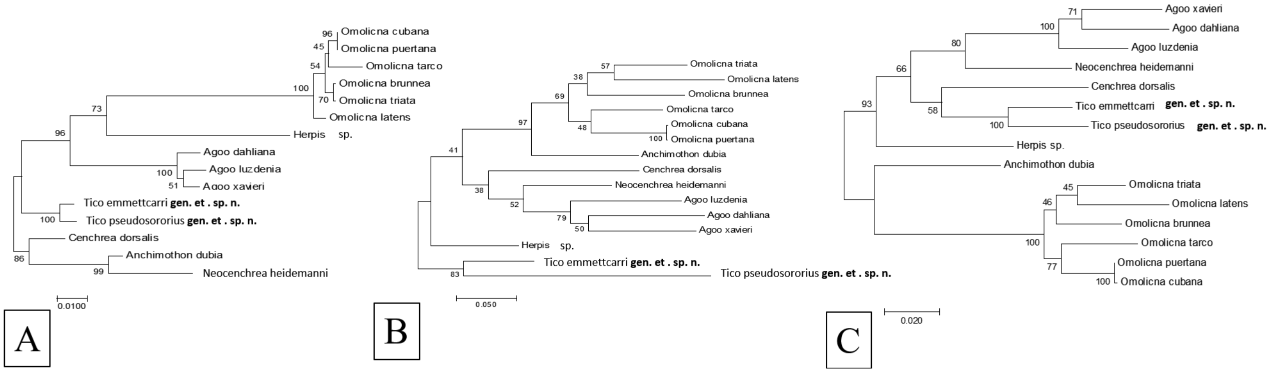

FIGURE 20. Maximum likelihood phylogenetic trees (1,000 replicates) demonstrating the relationship of the novel taxa, *Tico emmettcarri* **gen. et. sp. n.** and *Tico pseudosororius* **gen. et. sp. n.** relative to other genera within the Cenchreini based on the; (A) 18S gene, (B) COI gene, and (C) consensus tree of combine 18S and COI data; scale bar = percent nucleotide difference.

Cenchrea Westwood, 1840

Type species. *Cenchrea dorsalis* Westwood, 1840.

Amended Diagnosis. Small (~3.0–3.7 mm), pale cenchreine derbids with variably marked wings. Frons moderately compressed (length at midline exceeding 2-3/4x dorsal width, median carina absent, with transverse carinae near fastigium separating frons from clypeus; lateral carinae of frons and clypeus keeled, bearing row of sensory pustules. The discal region of the pronotum is slightly elevated posteriorly. Forewing with ScP branch at or distad apex of clavus (resulting in short marginal cell). Pygofer with lateral margins bearing caudally directed projections (except 'slightly convex' in *C. bipunctata*; Muir 1918: 419), ventral margin of opening without lobe. Gonostyli long and spatulate, apex rounded to truncate, bearing dorsal projection (very large in *C. dorsalis*), and medial ventral projection. Aedeagus nearly bilaterally symmetrical, with (*C. dorsalis*) or without (*C. exquisita*) apical ventral pro-

TABLE 4. Pairwise comparison for the 18S gene based on 1,000 bootstrap replications using the p-distance method; numbers on bottom left=percent difference, numbers in upper right=standard error, orange cells = intrageneric variability, blue cells = intergeneric variability.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	*Tico emmettcarri* **gen. et. sp. n.**		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	*Tico pseudosororius* **gen. et. sp. n.**	0.6		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	*Cenchrea dorsalis*	2.6	2.7		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	*Agoo dahliana*	5.6	5.7	5.6		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	*Agoo luzdenia*	5.4	5.4	5.5	1.2		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	*Agoo xavieri*	5.4	5.4	5.7	1.1	0.7		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	*Anchimothon dubia*	4.3	4.4	3.2	6.7	6.6	6.7		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	*Herpis* sp.	7.7	7.6	7.8	8.7	8.4	8.5	8.9		0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	*Neocenchrea heidemanni*	11.1	11.4	11.2	12.8	12.3	12.7	8.3	15.0		0.0	0.0	0.0	0.0	0.0	0.0
10	*Omolicna brunnea*	8.9	8.8	8.5	8.9	8.7	8.7	8.7	10.4	13.9		0.0	0.0	0.0	0.0	0.0
11	*Omolicna cubana*	9.1	9.2	8.4	9.1	9.0	9.0	8.6	10.8	13.8	0.6		0.0	0.0	0.0	0.0
12	*Omolicna latens*	9.0	9.1	8.5	9.0	8.9	8.9	8.9	10.4	14.1	0.8	1.0		0.0	0.0	0.0
13	*Omolicna puertana*	9.1	9.2	8.4	9.1	8.9	9.0	8.6	10.8	13.8	0.6	0.0	1.0		0.0	0.0
14	*Omolicna tarco*	9.8	9.7	9.3	9.8	9.6	9.7	9.4	11.3	14.6	1.1	1.2	1.6	1.2		0.0
15	*Omolicna triata*	9.0	8.8	8.6	9.0	8.8	8.8	8.7	10.6	13.9	0.2	0.6	0.8	0.6	1.1	

TABLE 5. Pairwise comparison for the COI gene based on 1,000 bootstrap replications using the p-distance method; numbers on bottom left=percent difference, numbers in upper right=standard error, orange cells = intrageneric variability, blue cells = intergeneric variability.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	*Tico emmettcarri* **gen. et. sp. n..**		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	*Tico pseudosororius* **gen. et. sp. n.**	13.7		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	*Cenchrea dorsalis*	20.7	29.4		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	*Agoo dahliana*	18.2	26.3	21.5		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	*Agoo luzdenia*	18.0	26.0	20.1	16.6		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	*Agoo xavieri*	18.3	26.6	19.9	15.9	16.1		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	*Anchimothon dubia*	17.8	28.0	20.9	19.7	19.4	20.9		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	*Herpis* sp.	15.2	23.9	18.0	18.9	19.4	20.4	18.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	*Neocenchrea heidemanni*	15.6	25.8	17.3	17.0	15.9	15.6	17.1	15.7		0.0	0.0	0.0	0.0	0.0	0.0
10	*Omolicna brunnea*	18.3	25.4	19.7	20.9	19.7	20.4	15.6	17.0	18.0		0.0	0.0	0.0	0.0	0.0
11	*Omolicna cubana*	18.9	27.0	23.2	21.3	21.5	23.9	15.9	18.0	21.1	13.3		0.0	0.0	0.0	0.0
12	*Omolicna latens*	18.2	26.1	20.4	19.9	18.3	21.1	15.1	17.5	20.2	13.5	15.2		0.0	0.0	0.0
13	*Omolicna puertana*	19.0	28.0	22.3	22.3	19.9	22.2	17.5	16.3	20.8	13.2	14.7	13.3		0.0	0.0
14	*Omolicna tarco*	17.8	27.5	22.2	20.8	20.2	20.9	13.8	17.3	18.9	12.3	15.1	10.9	13.7		0.0
15	*Omolicna triata*	18.2	26.1	20.4	19.7	18.2	20.9	15.1	17.5	20.2	13.5	15.2	0.17	13.3	10.9	

cesses; endosoma complex bearing complex array of retrorse processes. Anal tube elongate, in lateral view ventral margin weakly concave, apex past epiproct and paraproct inflected caudad (*C. dorsalis*) or ventrad (*C. exquisita*); in dorsal view broadly spatulate.

Etymology. The etymology of *Cenchrea* was not provided, but it may have been derived from a Greek town of that name in Troas, where Homer may have resided for a time. The names of Greek towns are typically feminine in gender (as evidenced by the *–a* termination).

Remarks. Our review of descriptions and available specimens of *Cenchrea* appear to support Fennah's (1952: 129) assertion that "… the typical ([subgenus] *Cenchrea*) includes only *C. dorsalis* while the other includes *exquisita* and its allies …". However, the wing venation features described by Fennah do not appear to be sufficient to define a new genus-group, and available data (both molecular and morphological) is not yet sufficient to support genus-groupings as he proposed. The available descriptions of *Cenchrea sexgutatta* (viz. Fennah 1952: 132) and *Cenchrea bipunctata* (viz. Muir 1918: 418–419, as *Phaciocephalus* Kirkaldy) suggests that these taxa may better be placed in *Tico* **gen. n.** once sufficient support is available, except that the position of the Sc vein (distad of the claval apex) suggests *Cenchrea*. *Cenchrea exquisita* is more anomalous with the presence of a large process on the lateral margins of the pygofer, the shorter and broader face (vs. *Tico* **gen. n.**), and the position of the Sc vein do not support placement in *Tico* **gen. n**. Additional data, particularly molecular, is desirable to help resolve the phylogenetic placement of these taxa.

Curiously, the stated distinction between *Cenchrea* and *Contigucephalus* in both keys is a "medioventral process present on pygofer" (Fennah 1952: 128, O'Brien 1982: 309). We have not observed a ventral process on the opening of the pygofer, such as seen in *Omolicna* (e.g., Bahder 2020a, fig. 4), *Agoo* (Bahder 2020a, fig. 10B), and *Phaciocephalus* (e.g., Fennah 1967, figs. 112, 116, 120) on the male of any species *Cenchrea*. It is possible that the intended feature was either the *mediolateral* process of the male, or (more doubtfully) the pregenital sternite of the female. A better diagnostic feature among the two genera might be that the frons of *Contigucephalus* is dorsally much more strongly compressed (see Caldwell, 1944, plate 1, fig. 5) than in *Cenchrea* (Fig. 2). Also, Caldwell (1944: 101) describes red markings on the wings of *Contigucephalus* (*viz*. "A scarlet stripe present basad across elytra and mesothorax, another stripe present across furcation of main veins, and a large scarlet spot present at apex of clavus extending almost halfway across elytra"). We have photographs of the species (of uncertain providence) obtained some years ago from Lois O'Brien that support the presence of these markings.

Discussion

The description of a new genus within the derbid tribe Cenchreini is supported by molecular and morphological data. There is strong molecular evidence for both COI, 18S, and a consensus between the two to support *Tico* **gen. n.** as a distinct clade. The level of variability among genera for both loci also is consistent for genus level placement of the new taxa. While the molecular support for *Tico* **gen. n.** being closest to *Cenchrea* is weak, the consensus analysis appears to somewhat support this relationship. Considering some large similarities in morphology between *Tico* **gen. n.** and *Cenchrea*, it seems likely that these two genera are sister taxa that could be further strengthened in the future as more molecular data is generated for both *Cenchrea* and *Tico* **gen. n.** as well as *Neocenchrea* due to the weak support observed for the relationship among these groups. Also, an important molecular feature of *Tico pseudosororius* **gen. et. sp. n.** is that a pseudogene was detected in this species for the COI locus (data not shown). The pseudogene was identified on the gel as a strong secondary band slightly smaller in size than the true COI gene and when sequenced was identical to the true gene but possessed an approximately 130 bp deletion in the middle of the barcoding region. While the presence/absence of pseudogenes may not be of taxonomic or phylogenetic importance, it may help further distinguish it from *T. sororius*, which thus far, appears very similar. Hopefully, future survey efforts will allow to collect fresh material of *T. sororius* to confirm this.

Morphological differences in structure between *Cenchrea* and *Tico* **gen. n**. include the gonostyli, aedeagus, and the anal tube. The position of the Sc branch such that it forms a long (*Tico* **gen. n.**) or short (*Cenchrea*) marginal cell is a useful diagnostic feature. However, we anticipate that once morphological or molecular data gaps are assessed, *C. bipunctata* (Muir) and *C. sexguttata* Fennah (at least) may be transferred to *Tico* **gen. n**.

In our interpretation of the wing venation, we have carefully followed Bourgoin et al. (2015), but in some cases more than one interpretation is possible without an obvious mechanism to select among them. An example here is whether or not the MP_{3+4} veins are distally forked. If it is assumed that MP_{3+4} forks (e.g., in Fig. 6), it shifts placement of the mp-cu crossvein, and the CuA_1 and CuA_2 fuse before the wing margin (closing cell C5 and reaching the margin as the combined CuA_{1+2}). Survey of many derbid forewings of related taxa would help develop rules for interpretation, although this partly relies on an uncertain derbid phylogenetic hypothesis (viz. Emeljanov 1996). We certainly would welcome phylogenetic studies of derbids that would help place context for evolutionary interpretation.

Recent survey work in Costa Rica has focused primarily on palms and *Tico* **gen. n.** *emmettcarri* **sp. n.** is the first taxon documented on a non-palm host. *Asplundia* was initially confused with a palm in the field and despite this, we benefitted by documenting novel taxa and contributing to our understanding of the Cenchreini. While other derbid taxa are known to be associated with palms (Halbert *et al.* 2014, Dollet *et al.* 2020), the plant associations of *Cenchrea* and *Tico* **gen. n.** has yet to be established.

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