

The Triassic insect fauna from Argentina: Coleoptera, Hemiptera and Orthoptera from the Potrerillos Formation, south of cerro Cacheuta, Cuyana basin

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ABSTRACT

This contribution describes new fossil insect taxa from the upper section of the Potrerillos Formation at “Quebrada del Durazno” (South of Cerro Cacheuta), Mendoza Province, Argentina. The age of the insect assemblage corresponds to the early Late Triassic. The following new genus and species are proposed: *Argentinosyne duraznoensis* Martins-Neto & Gallego sp. nov. (Schizocoleidae Rohdendorf), and *Cacheutacicada kurtzae* Martins-Neto & Gallego gen. nov., sp. nov. (Hemiptera, Cicadomorpha). Also, *Notopamphagopsis?* sp. 1, previously described from the Los Rastros Formation (del Bermejo basin, La Rioja, Argentina), is reported. These insect records increase the knowledge of Triassic biodiversity and the relationships with other Gondwanan faunas, contributing new evidence for the insect recovery after the end-Permian extinction and their evolution in west Gondwana.

KEY WORDS: Triassic insects. Argentina. Potrerillos Formation. Coleoptera. Hemiptera. Orthoptera.

RESUMEN

En esta contribución se describen nuevos insectos fósiles de la sección superior de la Formación Potrerillos en la “Quebrada del Durazno” (sur del cerro Cacheuta), provincia de Mendoza, Argentina. La edad de la asociación de insectos corresponde al Triásico Tardío temprano. Se proponen un género y dos especies nuevas a saber: *Argentinosyne duraznoensis* Martins-Neto & Gallego sp. nov. (Schizocoleidae Rohdendorf), and *Cacheutacicada kurtzae* Martins-Neto & Gallego gen. nov., sp. nov. (Hemiptera, Cicadomorpha). Además, se informa del hallazgo de *Notopamphagopsis?* sp. 1, descrita previamente para la Formación Los Rastros (Cuenca del Bermejo, provincia de La Rioja, Argentina). Estos registros de insectos incrementan el conocimiento de la biodiversidad triásica y de las relaciones con otras faunas de Gondwana. También brindan nueva evidencia sobre la recuperación de los insectos con posterioridad a la extinción de finales del Pérmico y su evolución en el oeste de Gondwana.

PALABRAS CLAVE: Insectos triásicos. Argentina. Formación Potrerillos. Coleoptera. Hemiptera. Orthoptera.

INTRODUCTION

The Triassic insect fauna from Gondwana is well known since the 19th century from the pioneer works of Etheridge & Olliff (1890), Tillyard & Dunstan (1924), Tillyard (1925, 1926), Wieland (1925, 1926), Cabrera (1928), Zeuner (1939), Pinto (1956), Pinto & Ornellas (1974), Pinto & Purper (1978), Riek (1955, 1962, 1974, 1976), Carpenter (1960), Marquat (1991) and others, from the Australian, South African and South American triassic basins.

In this paper we describe new insect taxa of the orders Coleoptera (beetles), Hemiptera (bugs), and Orthoptera (Ensifera: crickets) from the upper third of the Potrerillos Formation (see Geological Setting) at the “Quebrada del Durazno” (33°04'90"S; 68°07'13"W) site, a classic insect locality south of the cerro Cacheuta, (Mendoza Province, Argentina) (Fig. 1).

These new records allow us to increase knowledge of the biodiversity and probable relationships of the Gondwa-

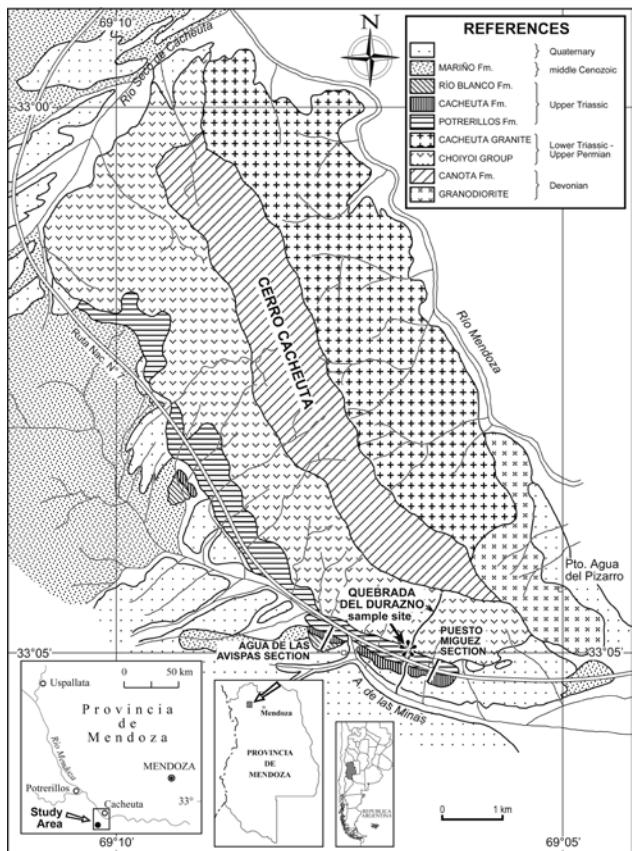


Figure 1. Geological map of the southern cerro Cacheuta area and fossiliferous locality at Quebrada del Durazno, Mendoza Province, Argentina (modified from Morel 1994).

nan triassic insect biota. Also, this fauna augments understanding of insect recovery after the end-Permian extinction and insect evolution in west Gondwana.

Knowledge of the triassic insect fauna from southern South America has increased markedly in recent years through the works of our research team. The history of research and previously described triassic insects species from southern South America were discussed by Gallego (1997), Gallego & Martins-Neto (1999), Martins-Neto & Gallego (1999, 2001, 2006), Martins-Neto et al. (2003, 2005, 2006a, b, 2007) and Gallego et al. (2005). These insects mainly came from levels in the Ischichuca and Los Rastros formations (del Bermejo basin, Argentina), Potrerillos and Cacheuta formations (Cuyana basin, Argentina), Santa Maria Formation (Brazil) and Santa Juana Formation (Chile).

Twelve records of fossil insects from the upper section of the Potrerillos Formation, Cuyana basin (Argentina), have been reported in different papers. Cabrera (1928), Carpenter (1960), Pinto & Purper (1978), Marquat (1991), Martins-Neto & Gallego (1999) and Martins-Neto et al. (2003) describe insects of the orders Orthoptera (*Notopamphagopsis bolivari* Cabrera 1928), Odonatoptera (*Triassothemis mendozensis* Carpenter 1960), Plecoptera (*Gondwanoperlidium argentinarum* Pinto & Purper 1978,

G. mendozensis Pinto & Purper 1978), a plecopteran nymph of the genus *Platyperla* Sinitshenkova, in Gallego et al. 2006), Grylloblattida (*Triasseuryptilon acostai* Marquat 1991, emend. Storozhenko 1997), Miomoptera (*Miomina mendozina* Martins-Neto & Gallego 1999), Hemiptera (*Gallegomorphotila acostai* Martins-Neto 2003, *Argenticocida magna* Martins-Neto & Gallego 1999, *A. minima* Martins-Neto & Gallego 1999 and *Potrerilla nervosa* Martins-Neto & Gallego 1999). Also, we include among these records the species *Tipuloidea rhaetica* Wieland 1925 (Hemiptera) and *Tipulidites affinis* Wieland 1926 (Mecoptera) that probably came from the same section (see Geological Setting).

An insect fauna has previously been recorded by Martins-Neto et al. (2007), from the lower part of the Potrerillos Formation at the Quebrada del Puente locality (cerro Bayo in the Potrerillos area, Mendoza province). From that section, four new species of Blattoptera (*Anablatta compacta* Martins-Neto & Gallego 2007, *Potrerilloblatta stapanicici* Martins-Neto & Gallego 2007, *Delpuentebiella dangeloi* Martins-Neto & Gallego 2007 and *Lariojablatta neiffi* Martins-Neto & Gallego 2007) and one of Coleoptera (*Delpuentesyne menendezi* Martins-Neto & Gallego 2007) were described by Martins-Neto et al. (2007).

The materials described in this paper were collected by two of the authors, AMZ and OFG, on a field trip during 1995.

The terminology here adopted is mainly that of Kukalová-Peck (1991) and Martins-Neto et al. (2005, 2006b).

The repository and institutional abbreviations used here are: **MCNAM-PI**: Paleoinvertebrate Collection, Museo de Ciencias Naturales y Antropológicas “Cornelio Moyano”, Mendoza, Argentina and **CTES-PZ**: Paleozoological Collection, Facultad de Ciencias Exactas, Naturales y Agrimensura, Universidad Nacional del Nordeste, Corrientes, Argentina.

GEOLOGICAL SETTING

The continental succession of the Cuyana rift basin, located in the central western part of Argentina along Mendoza and San Juan provinces, is represented by the Uspallata Group of Middle to Upper Triassic age range. The basement of the basin is formed mainly by Paleozoic rocks and the early Upper Permian-Early Triassic magmatic and effusive complex of the Choiyoi Group. The Uspallata Group consists of alluvial-fan deposits of the Río Mendoza Formation, which are interfingered with more distal clastic facies of the cerro de Las Cabras Formation, corresponding to ephemeral streams and playa-lake-deposits. Unconformably, sandstones, mudstones, bituminous shales and tuffs of braided fluvial systems developed in a flood plain of the Potrerillos Formation grade up-wards to lacustrine deltas and later into the widespread black-shale deposits of euxinic lacustrine environment of the Cacheuta Formation. Uppermost in the section, the fluvial red-bed deposits of

the Río Blanco Formation represent a second sedimentary depositional sequence of the basin.

The Triassic Uspallata Group has well-known floral and faunal records from most of its units (Stipanicic 1983). The macrofloral assemblages referred to as the “*Dicroidium Flora*” (Stipanicic 1983; Stipanicic et al. 1996), as well as the microfloristic records (Zavattieri & Batten 1996; Zavattieri & Prámparo 2006), are quite complete and of great stratigraphic value.

The insect bearing levels occur at the southern flank of the Cacheuta hill in the section called Puesto Miguez ($33^{\circ} 03' 35''$ S; $69^{\circ} 06' 26''$ W) (Fig. 1), where the upper part of the Potrerillos and the Cacheuta formations are well exposed. The lower units of the Uspallata Group, the Río Mendoza and cerro de Las Cabras formations, as well as the lower part of the Potrerillos Formation, are not exposed in this area. The outcropping Potrerillos Formation section in this area is overlain by an angular unconformity on a basalt emplacement, which occurred during the synrift phase of active faulting in the Cuyana basin, and on Devonian metasedimentites forming the southern part of the Cacheuta hill (Fig. 1). Southward the Cacheuta Formation is covered conformably by the fluvial red-beds of the Late Triassic Río Blanco Formation and up-ward unconformably by thick Tertiary sediments. The triassic sequence outcropping south of the Cacheuta hill was described in detail by Morel (1994) and Zavattieri & Prámparo (2006), whose facies analysis is followed herein (Fig. 2).

The insect assemblage was found in dark grey siltstones in the upper part of the Potrerillos Formation at the “Quebrada del Durazno” profile, which is a neighbouring creek of the “Minas de Petróleo” or “Puesto Miguez” section (Fig. 1). The sedimentary facies of the Potrerillos/Cacheuta sequence outcropping in the Puesto Miguez section were detailedly described by Zavattieri & Prámparo (2006, p.1200-1203). A summary follows (see Fig. 2). The outcropping section of Puesto Miguez comprises facies where parallel-laminated yellowish sandstones in tabular strata are interbedded with grey silty layers and dark grey carbonaceous claystones and coals. The thinner layers contain abundant plant remains, conchostracans and fish scales. These deposits are interpreted as fluvial channels that alternated with episodes of flooding where swamp and/or pond sub-environments were developed within the floodplain. Upwards, sedimentary facies comprise amalgamated fine conglomerate lenses and trough and planar cross-bedding sandstone lenses inter-bedding with grey to dark grey siltstones and greenish-grey to dark grey claystones with abundant plant detritus. They are considered as corresponding to environments that are transitional between braided streams, low-sinuosity fluvial channels and overbank deposits of inter-distributary bay facies of lacustrine deltas prograding into the lake system. Upwards greyish-black carbonaceous and black bituminous finely laminated shales, occasionally inter-bedded with parallel-laminated sandstones, suggest deposition in the large, deep, stratified lake of the Cacheuta Formation. Carbonaceous plant remains, abundant fish remains (mainly fish scales), and

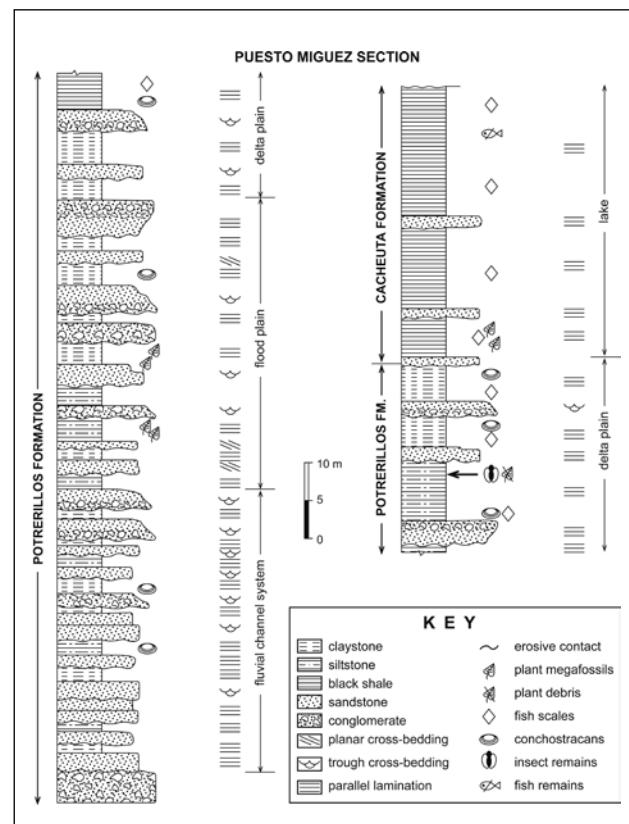


Figure 2. Schematic sedimentary section of the Potrerillos and Cacheuta formations that crop out at Puesto Miguez and “Quebrada del Durazno”, south of cerro Cacheuta, Mendoza, showing insect bearing levels (adapted from Morel 1994).

conchostracans are very common fossils in this lacustrine environment of the Cacheuta section.

Insect levels associated with siltstones beds and black shales and/or coal levels bearing well known plant remains of the “*Dicroidium-type Flora*” (Morel 1994, Stipanicic et al. 1996), which were discussed by Rojo & Zavattieri (2005), are recorded in the upper part of the Potrerillos Formation instead of in the Cacheuta levels as previously thought. Rojo & Zavattieri (2005) demonstrated that the location of the well known plant megafoossils described by Kurtz (1921) and Jain & Delevoryas (1967), among others, as well as the microfloristic assemblage studied by Jain (1968) from the “Minas de Petróleo Beds” (today named Puesto Miguez) of this area indeed belong to the upper part of the Potrerillos Formation. As indicated by Zavattieri & Rojo (2005), in the Potrerillos Formation the vegetation of this region was dominated by pteridosperms, cycadophytes and coniferophytes (Rojo & Zavattieri 2005; Zavattieri & Rojo 2005).

The Potrerillos/Cacheuta Set sequence in the south of the Cacheuta hill has been referred to early Late Triassic (Zavattieri & Prámparo 2006). Therefore, the insect fauna described in this contribution is also assigned to this age.

SYSTEMATIC PALEONTOLOGY

Order: Coleoptera Linnaeus, 1758

Family: Schizocoleidae Rohdendorf, 1961

GENUS: *Argentinosyne* Martins-Neto & Gallego 2006

Type species. *Argentinosyne frenguelli* Martins-Neto & Gallego 2006 (in Martins-Neto et al. 2006b): pp. 596-598, Figs 3A, 4D.

Remarks. The genus *Argentinosyne* is assigned by Martins-Neto et al. (2006a, b) to the Family Permosynidae, however, on the basis of new morphological evidence and following A. Ponomarenko's proposal (2006, pers. comm. 2008), who considers that this morphogenus (of isolated elytra), with smooth elytra (lacking striae on its surface) or elytra without regular rows of puncture, belongs to the Schizocoleidae Rohdendorf 1961.

Argentinosyne duraznoensis Martins-Neto & Gallego sp. nov.

Figure 3A-C

Etymology. Refers to “Quebrada del Durazno”, the locality from which the material came.

Holotype. MCNAM-PI 24304 (Fig. 3A, counterpart), CTES-PZ 5732 (Fig. 3B, part), left elytron flattened or compressed 3D mould of few thickness, composed by an organic (chitinous) layer (not carbonised), damage in the apex (incomplete part and complete counterpart).

Type locality. Quebrada del Durazno (south of the cerro Cacheuta), Mendoza province, Argentina.

Stratigraphic horizon. Siltstones, swamp deposits of flood plain. Upper section of the Potrerillos Formation, Early Late Triassic.

Diagnosis. Ovate elytron relatively narrow, four times as long as wide, narrowed beyond its last third, whole surface with punctuated ornament. Elytron base with a prominent humeral protuberance. Elytron apex acute, with tail-like shape. Sutural and lateral margins sub parallel at the two upper thirds. Sutural margin sigmoid. Lateral margin regularly curved.

Description. Ovate asymmetrical elytron, four times as long as wide. Slightly convex and relatively narrow beyond its last third. Elytron base less wide than the elytron mid length with a prominent humeral protuberance. Sutural and lateral margins sub parallel at the two upper thirds. Both borders narrow; the post-sutural wider than the others. Sutural margin sigmoid. Lateral margin regularly curved. Elytron apex acute with tail-like shape. Surface of the elytron ornamented by a dense set of spotted pits and slightly evident veins crossing the sutural area and a probable medial long furrow. A likely short schiza, evident in the lateral border. With two postero-lateral projections that probably correspond to the femora of the third pair of legs (Figs. 3A-C).

Measurements. Elytron length 15.8 mm; width 4.3 mm. Length/width ratio 3.7.

Remarks. The new species differs from others of the genus, mainly by having an asymmetrical ovate outline, “ovate” (with straight sutural and convex lateral margin) in *Argentinosyne frenguelli* Martins-Neto & Gallego 2006 and *A. rugosa* Martins-Neto & Gallego 2006 (from Martins-Neto et al. 2006b); a “boat like” outline (with both margins convex), such as in *A. gonaldiae* Martins-Neto & Gallego 2006, *A. losrastrosensis* Martins-Neto & Gallego 2006 (from Martins-Neto et al. 2006b) and *A. bonapartei* Martins-Neto & Gallego 2006 (from Martins-Neto et al. 2006a). Besides, *Argentinosyne duraznoensis* differs from others species of the genus, by its larger size, different ornamentation pattern (*A. gonaldiae* and *A. rugosa* being rugose and *A. frenguelli* and *A. bonapartei* with granulate pattern) and greater length/width ratio (*A. gonaldiae*: 2.4; *A. rugosa* and *A. bonapartei*: 2.9, *A. gualoensis*: 3.3 and *A. frenguelli*: 3.5).

The new species shares with *A. losrastrosensis* and *Argentinosyne* sp. from the Ischichuca Formation (del Bermejo basin, Argentina), the sigmoid sutural margin (only in the last one) and the presence of a humeral protuberance, although both are smaller in size. Three triassic coleopteran elytra assigned to the morphogenus *Lobites* Dunstan described from the Ipswich series (Australia) by Tillyard and Dunstan (1924) resemble the new species in the general outline, one sigmoid margin, acute elytron apex and punctuated ornamentation like in *Lobites granulatus* Dunstan, *L. trivittatus* Dunstan and *L. tuberculatus* Dunstan (Pl. 5, Figs 40, 41 and 44.). *L. granulatus* and *L. tuberculatus* have lateral sigmoid margin instead sutural margin such as in *A. duraznoensis*. Both of them are smaller in size and they have smaller length/width ratio (*L. tuberculatus*: 3.22 and *L. granulatus*: 2.76). By the other hand, *L. trivittatus* has similar size (length 12.5 mm, width 3.4 mm) and length/width ratio (3.67), but differs from *A. duraznoensis* in the slightly straight lateral margin, slightly convex sutural margin and also in the elytron ornament being composed by three microgranulate furrows.

Order: Hemiptera Linnaeus, 1758

Suborder: Cicadomorpha Martynov, 1926

Superfamily: Scytinopteroidea Handlirsch, 1906

Family uncertain

GENUS: *Cacheutacicada* Martins-Neto & Gallego gen. nov.

Type species. *Cacheutacicada kurtzae* Martins-Neto & Gallego sp. nov.

Etymology. Derived from cerro Cacheuta, a local geographic unit, and *Cicada*, from cicadid.

Diagnosis. Forewing tegminous, costal margin thickened basally, with ScR and M origin close to the base; both veins having a short common stem, r-m close to the wing apex; RP origin located little before the wing mid length, CuA leaves basal cell separately, m-cu veinlet (arculus) strongly oblique next to the anal margin, narrow medial area.

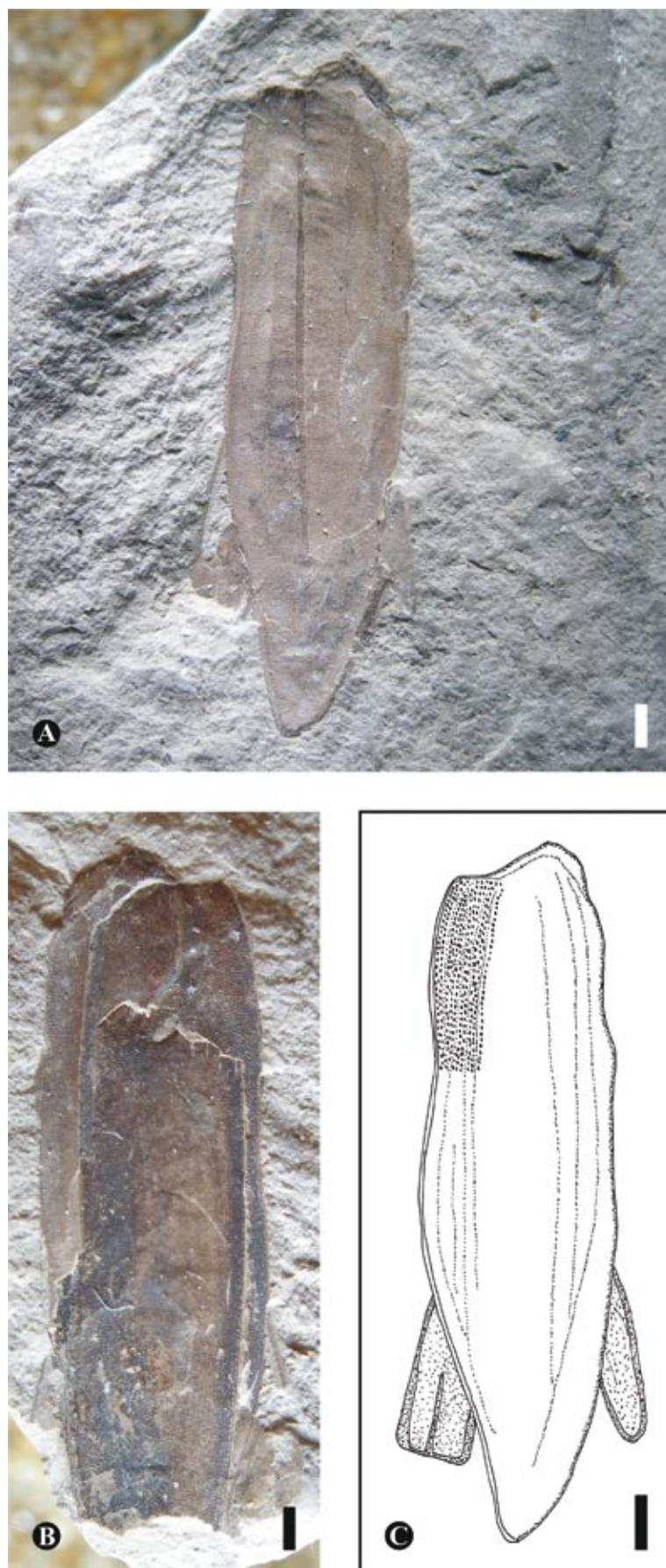


Figure 3. *Argentinosyne duraznoensis* Martins-Neto & Gallego sp. nov., early Upper Triassic from Argentina. A. Photograph of the holotype (counterpart) MCNAM-PI 24304. B. Photograph of the holotype (part) CTES-PZ 5732. C. Line drawing from the holotype (counterpart). Scale bars: 1 mm

Discussion. *Cacheutacicada* gen. nov. is included in the Superfamily Scytinopteroidea Handlirsch 1906, based on the following diagnostic characters: forewing tegminous, costal margin commonly thickened basally, veins usually thin, SC obsolescent, cross veins few, only a few closed cells between R, M and CuA. Although the new genus is similar in general habitus to *Argentinocicada* Martins-Neto

& Gallego 1999 and *Tipuloidea* Wieland 1925, described for the same sequence, it has a set of distinctive characters that are absent in the other known genera attributable to the superfamily. *Tipuloidea*, *Argentinocicada* and *Cacheutacicada* share the absence of clavus area, as a common taphonomic character. The nomenclatural status of the name *Tipuloidea* is discussed in Gallego (1997). Compa-

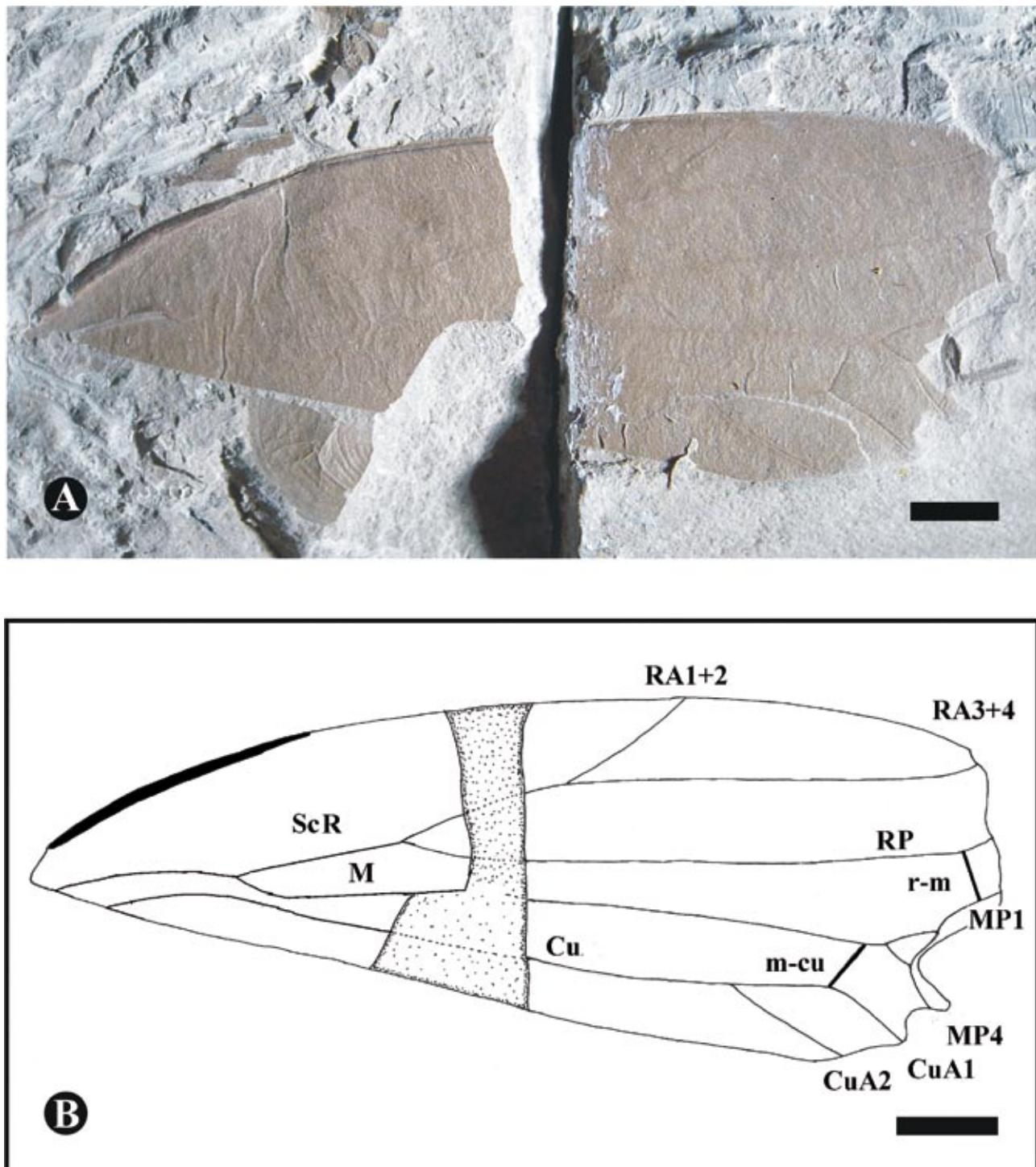


Figure 4. *Cacheutacicada kurtzae* Martins-Neto & Gallego sp. nov., early Upper Triassic from Argentina. A. Photograph of the holotype MCNAM-PI 24305. B. Line drawing from the holotype. Scale bars 2 mm.

risons between *Argentinocicada* and *Tipuloidea* are made and figured extensively in Martins-Neto & Gallego (1999) and Martins-Neto et al. (2003).

Cacheutacicada gen. nov. (Fig. 4) exhibits R as well as M far from Cu origin, distant from the wing base (M originates from the R base more close to the wing base in *Argentinocicada*, Figs 5B, C, E, F, as well as *Tipuloidea* Wieland 1925, *sensu* Wieland 1926 restoration, Figs 5A, D). The veinlet r-m is close to the wing apex in *Cacheutacicada* gen. nov. (versus relatively far from the wing apex in both *Argentinocicada* and *Tipuloidea*). CuA leaves the basal cell separately in *Cacheutacicada* gen. nov. (versus arising from M in *Argentinocicada* and *Tipuloidea sensu* Tillyard 1925 restoration). The arculus (m-cu veinlet) is strongly oblique and located next to the anal margin (vertical in *Argentinocicada* and oblique in *Tipuloidea* and located far from the anal margin in both species). Although the posterior margin of the discal cell is not preserved in *Cacheutacicada* gen. nov., this cell is perhaps larger than in the other two known genera. Additionally, *Cacheutacicada*

gen. nov. has the RP origin far from the wing base, contrary to both *Argentinocicada* and *Tipuloidea* which has the RP origin close to the wing base. The medial area of *Cacheutacicada* is notably reduced when compared with the two other known genera. The costal margin seems to be thickened (more than the mid length of the costal margin in *Cacheutacicada*, next to the mid length in *Tipuloidea* and only takes up the basal portion in *Argentinocicada*).

Cacheutacicada kurtzae Martins-Neto & Gallego sp. nov.

Figure 4A, B

Etymology. Named in honour of Federico Kurtz for his great contribution to Argentinean Paleobotany.

Holotype. MCNAM-PI 24305, incomplete right forewing (missing the clavus), tegminous, preserved as an impression of few microns thickness, composed by a thin organic (chitinous) layer (not carbonized), damaged in the apex.

Type locality and stratigraphic horizon. As in *Argentinocicada duraznoensis* sp. nov.

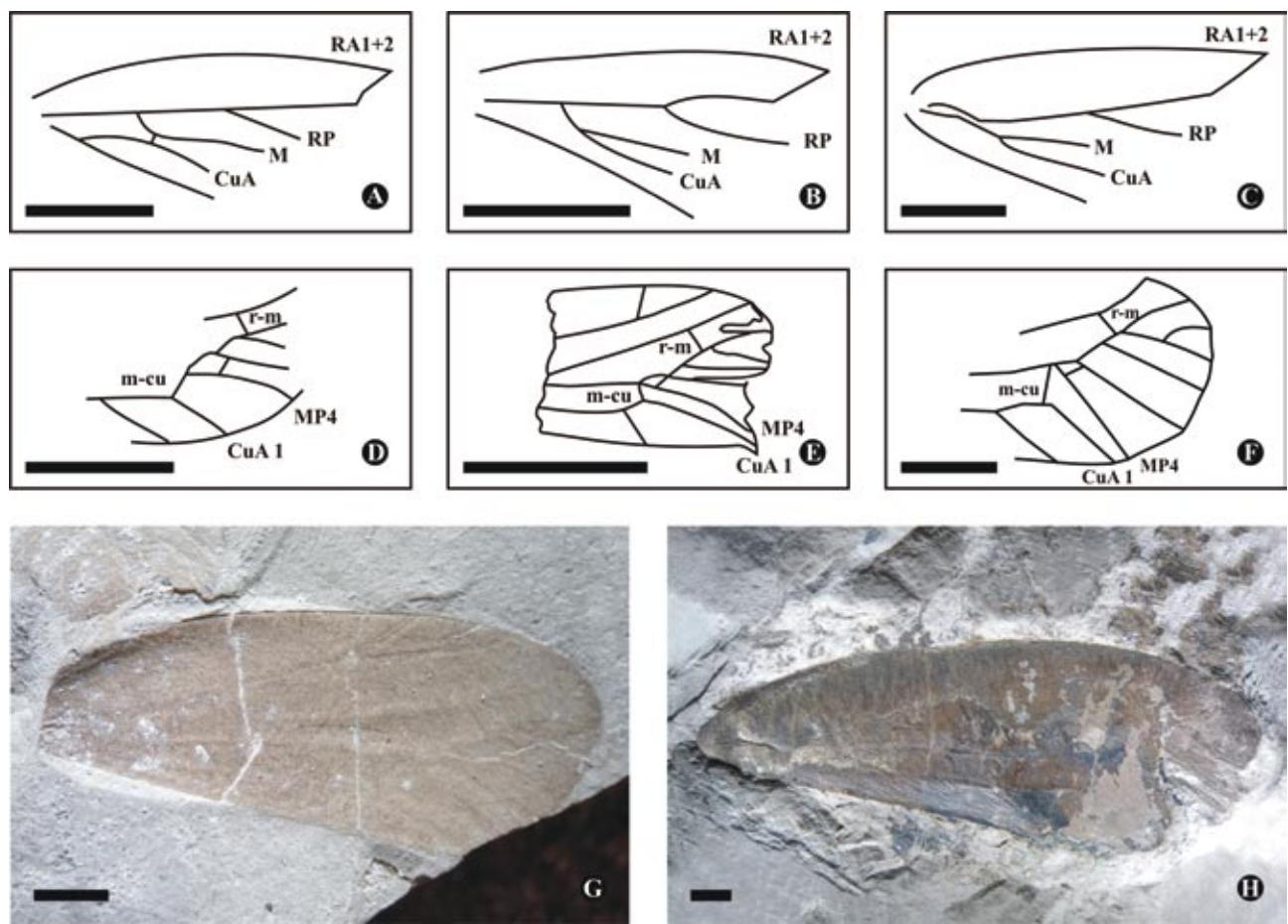


Figure 5. A, D. *Tipuloidea rhaetica* Wieland 1925, early Upper Triassic from Argentina. Line drawing of the basal and distal wing portion (modified from Wieland 1926), scale bar: A. 5 mm, D. 7 mm. B, E, G. *Argentinocicada minima* Martins-Neto & Gallego 1999, early Upper Triassic from Argentina. B. Line drawing of the basal area, supplementary material CTES-PZ 5733. E. Line drawing of the distal area, holotype CTES-PZ 5776 (B and E modified from Martins-Neto & Gallego 1999), scale bars: 5 mm. G. Photograph of the supplementary material CTES-PZ 5733, scale bar: 2 mm. C, F, H. *Argentinocicada magna* Martins-Neto & Gallego 1999, early Upper Triassic from Argentina. C, F. Line drawing from the holotype CTES-PZ 5729 (modified from Martins-Neto & Gallego 1999), scale bars: 5 mm. H. Photograph of the holotype CTES-PZ 5729, scale bar: 2 mm.

Diagnosis. As for the genus.

Description. Right forewing tegminous, with clavus not preserved. Costal area broad at wing base, narrowing slightly towards the apex, strong costal margin at 1/3 of the total length. ScR and M origin close to the base; both veins with a short common stem. RA long, slightly curved, branching after half the distance to the wing apex, branching into RA₁₊₂ that is relatively long. RP long and its origin occurs approximately at the basal 1/3 of the wing length, following in parallel mode the RA₃₊₄ vein, preserved just after r-m cross vein which is very close to the wing apex. CuA long, originating at wing base, leaves basal cell separately. Long straight m-cu veinlet (arculus), strongly oblique before M fork, and next to the anal margin. CuA₁ curved, deflecting toward the apical margin, convergent to MP₄ and parallel to CuA₂.

Measurements. Forewing length 22 mm; width 8.50 mm.

Remarks. Although this species is generally similar to *Argentinocicada magna* Martins-Neto & Gallego 1999, they exhibit important morphological differences, as discussed previously for the genus. *Cacheutacicada kurtzae* sp. nov. is smaller than the former (28 mm and 22 mm long, respectively) but is larger than *Argentinocicada minima* Martins-Neto & Gallego 1999 (15 mm long) and exhibits the smallest medial area when compared with all the other known species.

Order: Orthoptera Olivier 1789

Infraorder: Tettigoniidea Stoll 1788
(*sensu* Gorochov 2005)

Superfamily: Hagloidea Handlirsch 1906
(*sensu* Gorochov 2005)

Family: Hagliidae *incertae sedis* (*sensu* Gorochov 2005)

GENUS: *Notopamphagopsis* Cabrera 1928
(*emend.* Martins-Neto & Gallego 1999)

Type species. *Notopamphagopsis bolivari* Cabrera 1928, emend. Martins-Neto & Gallego 1999: pp. 198-200, Fig. 3A.

Notopamphagopsis? sp. 1 (from Martins-Neto et al. 2003)

Figure 6A, B

Material. CTES-PZ 7390.

Occurrence. Quebrada del Durazno (south of the cerro Cacheuta), Mendoza province, Argentina. Siltstones, swamp deposits of flood plain. Upper section of the Potrerillos Formation, early Late Triassic.

Description. Probable forewing basal fragment. MA (branched) and CuA strongly divergent and curved, with twelve cross-veins (as preserved) relatively long forming squarish cells. Cubital area with four cross-veins (three of

them branched), maybe forming the harp of the stridulatory apparatus.

Measurements. Forewing fragment length 14 mm (as preserved).

Remarks. This fragment closely resembles the specimen of *Notopamphagopsis?* sp. 1 (PURL-I 223, Figs 3B, 4D) described by Martins-Neto & Gallego (1999) and Martins-Neto et al. (2003) from the Los Rastros Formation (La Rioja Province, Argentina). If this fragment has been correctly interpreted then it is the first record of these taxa from the Potrerillos Formation, therefore it extends distribution to the Cuyana basin. Also, this discovery may indicate the broad distribution of this endemic and rare (with ten specimens of the genus) taxa across the central-west triassic basins from Argentina.

FINAL COMMENTS

Comparisons among the Argentinian and Gondwanan triassic insect faunas (Gallego & Martins-Neto 2005) show that the lower and upper Potrerillos insect assemblages (Martins-Neto et al. 2007 and this paper), are the most different taking into account the diversity of the total Argentinian insect assemblage (nine orders represented), the number of species in some taxa (four in Blattoptera, six in Hemiptera) and the low diversity of other taxa (two in Coleoptera) recorded in the Potrerillos Formation. The hemipteran record (28%) is the best represented group in the Potrerillos Formation, in contrast with its third place in the total insect biodiversity from Argentina (21%). According to these data, the Potrerillos assemblage is more closely related to the Ipswich fauna than to the Molteno insect fauna. The major fossil insect groups recorded in the Potrerillos Formation assemblage (Hemiptera, Coleoptera and Blattoptera) show different representation (percentages) in comparison with the six biome proportions defined by Anderson et al. (1998) from the Molteno Formation (South Africa).

Nevertheless, the presence of *Argentinosyne* in the Ischichuca-Los Rastros and Potrerillos (first record)-Cacheuta formations confirms the relatively (at least in part) coeval age of these faunas. This proposal is also supported by the record of other taxa, such as the Blattoptera, *Miomina* (Miomoptera), and ?*Notopamphagopsis* (Orthoptera, Hagliidae). On the other hand, other taxa, such as Hagiidae, Scytinopteroidea and Dysmorphotilidae (Hemiptera, Gallegomorphoptilinae), support the Gondwanan correlations with Ipswich, Australia and Molteno, South Africa.

The new insect species described in this paper reinforces the previous ideas on the great diversity of the Argentinian triassic palaeoentomofauna. It also demonstrates the high degree of endemism of this fauna owing to the large number of new taxa. Nevertheless, it is important to take into account that, with the exceptions of the well known Australian (Ipswich) and African (Molteno) palaeoentomofaunas (also unevenly studied), little is known yet about the west Gondwanan triassic insect records.

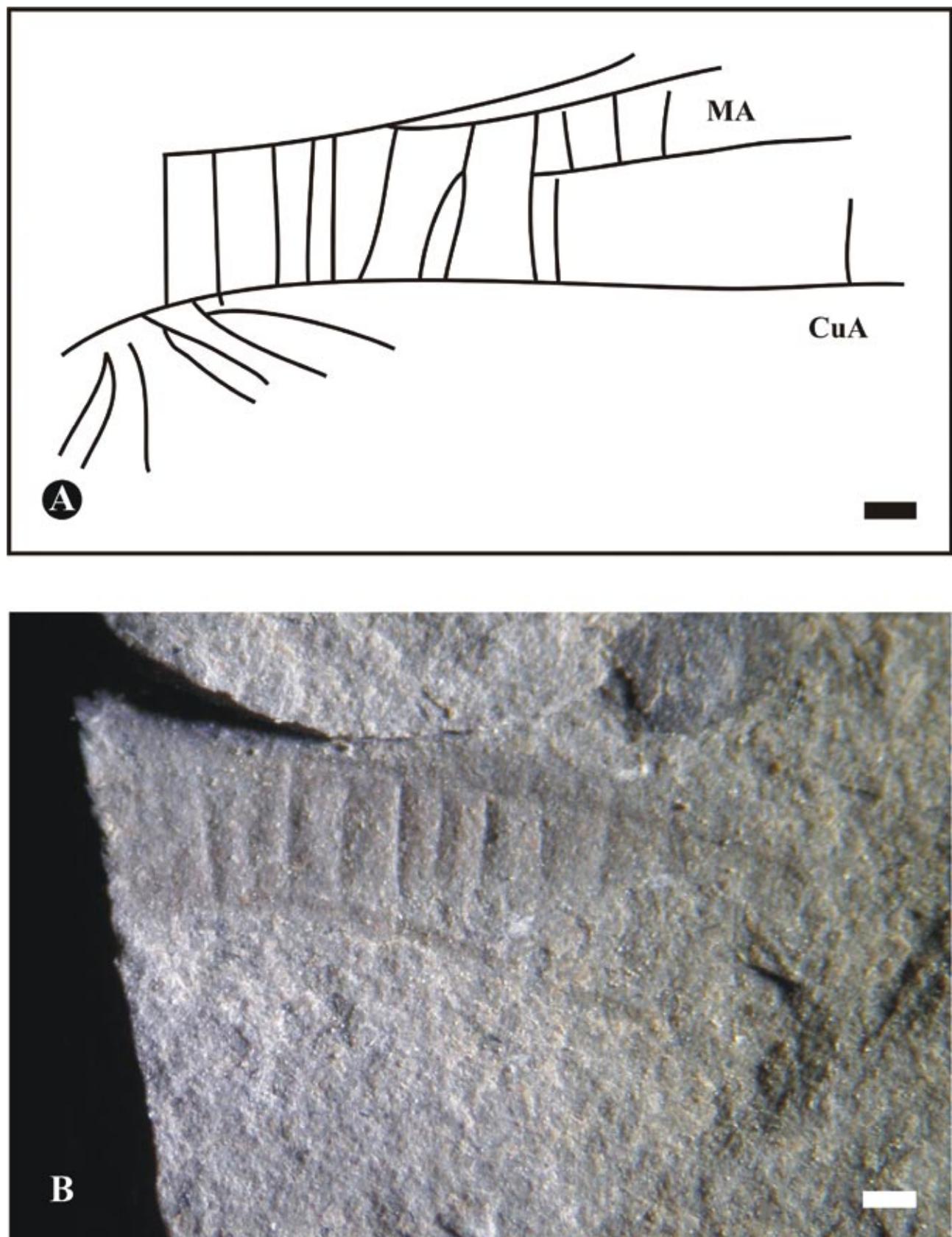


Figure 6. *Notopamphagopsis?* sp. 1 Martins-Neto & Gallego 1999, early Upper Triassic from Argentina. A. Line drawing from the material CTES-PZ 7390. B. Photograph from the material CTES-PZ 7390, scale bars: 1 mm.

Still under study, is the record of plant-insect interactions in the Triassic of Argentina and Chile (Gallego et al. 2003, 2004) that enlarges the knowledge of the insect diversity and brings new information on feeding strategies, trophic network and parallel evolution of these groups in western Gondwana.

Labandeira & Eble (in press) argue that the global absence of any Early Triassic and early Middle Triassic insects deposits and the parallel absence of coal and carbonate reefs indicates an interval of minimal diversity following the terminal Permian extinction. As a consequence of the pre-break up of the Gondwana supercontinent, since the early Late Permian to Early Triassic or even early Middle Triassic (as proposed by some authors), the region along the western margin of South America was widely occupied by extended magmatic and volcanic rocks as a result of the Choiyoi event. Thus, the older synrift sequences of Early Triassic and early Middle Triassic are of very restricted development in Argentina.

On the other hand, Labandeira & Eble (in press) propose that this high late Middle and Late Triassic insect diversification "was promoted by three groups of insects that invaded environments with expanded food resources". These groups include insects that inhabit freshwater ecosystems, and two other groups that occupied the land as: "colonization of other insects by parasitoids, and associations between new lineages of seed plants and various phytophagous holometabolous and orthopteroid insects".

The highly diverse and abundant terrestrial floras (miospores and fossil plant remains) are typical characteristics of the Gondwanan triassic realms. Both fossil floras and palynofloras of most western Gondwanan regions indicate moist and temperate to warm-temperate climates that are highly seasonal. These climatic characteristics produced favourable conditions for the diverse forests where insect faunas could be developed.

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