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A new genus and species of the family Tajmyraphididae (Hemiptera: Sternorrhyncha) in Early Cretaceous amber from Peñacerrada I (Spain)

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ABSTRACT

Alavesiaphis gen. nov. of the extinct family Tajmyraphididae (Hemiptera: Sternorrhyncha) and its type-species *A. margaritae* sp. nov. are described on the basis of an alate specimen. This new aphid is preserved in Early Cretaceous amber (Upper Aptian-Lower Albian) from Peñacerrada I outcrop (Northern Spain). The family Tajmyraphididae was diverse and had a wide distribution in the North Hemisphere, with representatives in Burma, Canada, Lebanon, Russia and Spain. The new genus of Tajmyraphididae differs from the seven previously known ones mainly in the fore wing venation. It has the basal part of Rs and M1+2 strongly curved, an angle of branching of M around 110°, M1+2 almost as long as the stem of media and slightly more that two times longer than M3+4, M3+4 is a continuation of M, the distance between bases of proximal and distal cubitus-branches slightly longer than proximal cubitus-branch length, which forms an angle around 100° with the main vein. Other important characters are the presence of a rostrum very short and rhinaria ring-shaped.

KEY WORDS: Sternorrhyncha. Tajmyraphididae. New genus, new species. Amber. Early Cretaceous. Aptian-Albian. Spain.

RESUMEN

Se describe *Alavesiaphis* gen. nov. y su especie tipo *A. margaritae* sp. nov. a partir de un ejemplar alado de la extinta familia Tajmyraphididae (Hemiptera: Sternorrhyncha). Este nuevo pulgón está preservado en ámbar del Cretácico Inferior (Aptiense Superior- Albiense Inferior) del yacimiento de Peñacerrada I (Norte de España). La familia Tajmyraphididae fue diversa y tuvo una amplia distribución en el Hemisferio Norte, con representantes en Birmania, Canadá, España, Líbano y Rusia. El nuevo género se diferencia de los siete géneros anteriormente conocidos de la familia Tajmyraphididae principalmente por la venación alar. Las porciones basales de Rs y M1+2 están fuertemente curvadas, el ángulo de bifurcación de M es alrededor de 110°, la longitud de M1+2 es casi igual a la del tronco de M y es ligeramente más larga que el doble de M3+4, M3+4 es una continuación de M, y la distancia entre las bases de las ramas proximal y distal de CuA es ligeramente mayor que la longitud de la rama proximal de CuA, la cual forma un ángulo de 100° con la vena principal. Otros caracteres importantes son la presencia de un rostro muy corto y rinarios anuliformes.

PALABRAS CLAVE: Sternorrhyncha. Tajmyraphididae. Nuevo género, nueva especie. Ámbar. Cretácico Inferior. Aptiense-Albiense. España.

INTRODUCTION

Aphids are rare in both amber and compression Mesozoic deposits, compared to other groups of insects. Only in two Cretaceous amber deposits aphids are relatively common (Siberia and Canada). After Palaeoaphididae Richards 1966, the most diverse extinct family of aphids is Tajmyraphididae, which was erected by Kononova (1975), based on specimens from the Upper Cretaceous amber of Taymyr (Siberia, Russia). Heie (1996) described a new genus and species of this family from Cretaceous amber of Alberta (Canada). Heie (in Heie & Azar 2000) divided Tajmyraphididae into five subfamilies and described two new genera from Lebanese amber. Grimaldi & Engel (2005) figured, but without description, one specimen from Burmese amber. We contribute here to the knowledge of the extinct Tajmyraphididae with the description of one new genus and species found in Spanish amber from Peñacerrada I deposit.

Peñacerrada I deposit is located in the northern slope of Sierra de Cantabria, near the village of Moraza, in the southern limit of the Basque-Cantabrian Basin (Northern Spain). Amber is associated with coal accumulations and appears in a sequence of sandstones and carbonaceous lutites, which contains a decimeter-thick layer of black

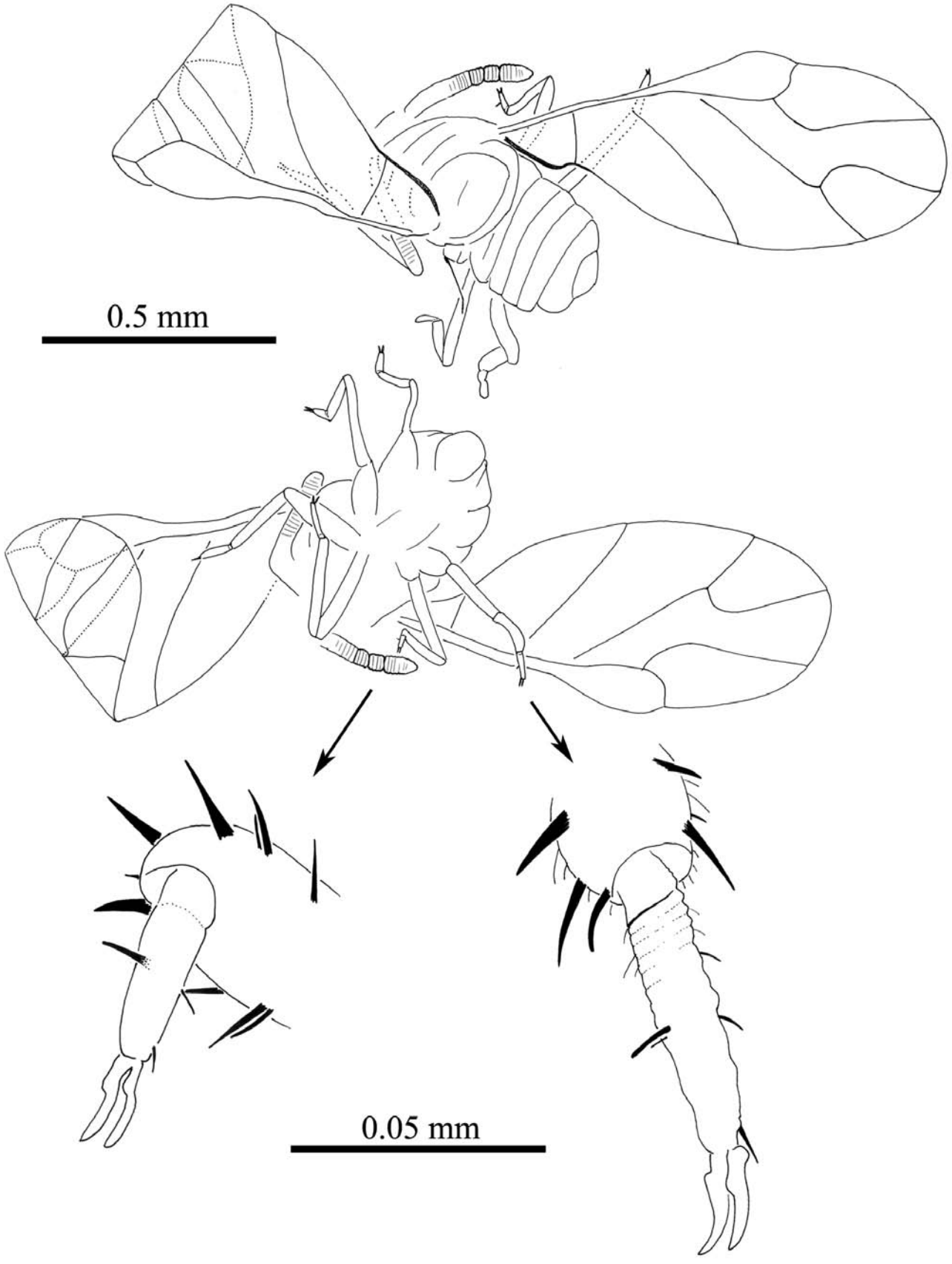

Figure 1. Camera lucida drawings of *Alavesiaphis margaritae* gen. et sp. nov. (Tajmyraphididae) from Early Cretaceous amber of Peñacerrada I (Holotype: MCNA-10021). General habitus in dorsal and ventral views, and details of the distal tibiae and tarsus of the right mid and hind legs.

shales with lacustrine bivalves. The palynological assemblages suggest an Upper Aptian-Lower Albian age (Barrón et al. 2001). The deposits, up to 200 m thick, of the Escucha Formation in this area are represented by a deltaic succession that implies a depositional regression vertical trend in its upper part and a depositional transgression vertical trend in its lower half (Martínez-Torres et al. 2003). The amber bearing strata are in the middle part of the Escucha Formation. This part corresponds to a distal fluvial environment, with several distributary channels crossing the flood-plain, and with a low temporal development of a shallow lacustrine environment (Alonso et al. 2000).

In that deposit has been found an alate aphid of the extinct family Tajmyraphididae, which shows unique characteristics and we describe herein as a new genus and species. The small fragment of amber with the aphid was embedded in epoxy resin as described in Corral et al. (1999). The drawings and photos of the body's details were made using a Microscope Olympus BX51 and a camera lucida Olympus V-DA.

SYSTEMATIC PALAEONTOLOGY

Order Hemiptera Linnaeus 1758

Suborder Sternorrhyncha Amyoy and Serville 1843

Infraorder Aphidodea Morduilko 1914

Family Tajmyraphididae Kononova 1975

GENUS: ***Alavesiaphis*** gen. nov.

Type species: ***Alavesiaphis margaritae*** sp. nov.

Diagnosis: Rostrum very short. Rhinaria ring-shaped at least on the four distal antennal segments. Fore wing with basal part of Rs and M1+2 strongly curved. Angle of branching of M around 110°. M3+4 is a continuation of M, M1+2 almost as long as the stem of media and slightly more that 2 times longer than M3+4. Proximal cubitus-branch short, forming an angle around 100° with the main vein. Distance between bases of proximal and distal cubitus-branches slightly longer than proximal cubitus-branch length. Siphunculi absent or not visible.

Etymology: Named for its occurrence in Álava amber (a generic name that includes the Peñacerrada I and P II ambers), and "aphis".

Alavesiaphis margaritae sp. nov.

Figs 1-2; Pl. 1

Holotype: Alate specimen MCNA-10021, sex unknown, deposited in the Museo de Ciencias Naturales de Álava Collection (Álava Province, Spain). Specimen complete (Fig. 1), in contact with a reflecting and turbid surface, with the body flattened and slightly distorted, covered with abundant fungi hyphae, which makes it difficult to study of the body's characteristics. The holotype is into a small piece of transparent amber (7 x 3 x 1 mm) and was embedded in epoxy resin (piece 10 x 9 x 1 mm) to permit optimal study. It was possible to study the specimen in dorsal, ventral and lateral views.

Etymology: The specific epithet honors Dr. Margarita Belinchón, palaeontologist and curator of the Museo de Ciencias Naturales de Valencia (Spain), and a friend of one of the authors (E.P.).

Type locality: Peñacerrada I (Moraza), Burgos Province (Spain). For more information about the outcrop see Alonso et al. (2000) and Delclòs et al. (2007).

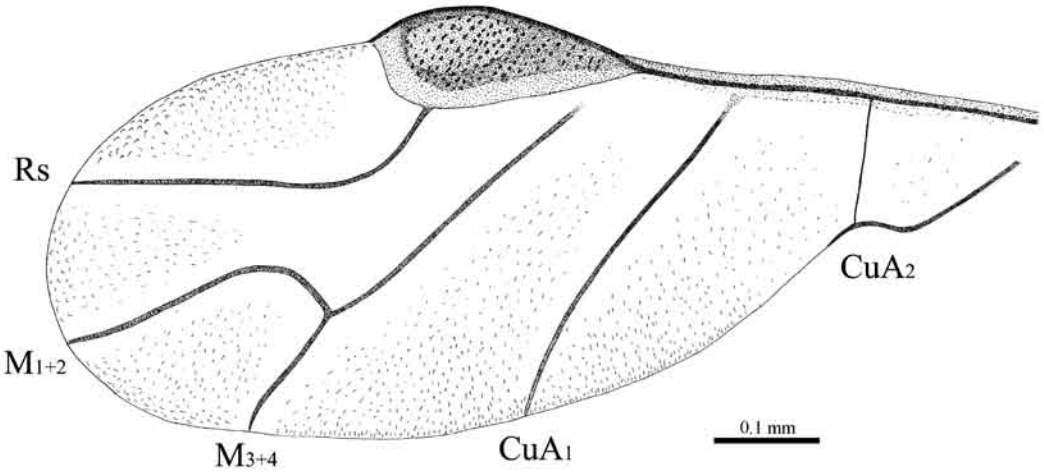

Figure 2. Right fore wing of *Alavesiaphis margaritae* gen. et sp. nov. (Tajmyraphididae) from Early Cretaceous amber of Peñacerrada I (Holotype: MCNA-10021).

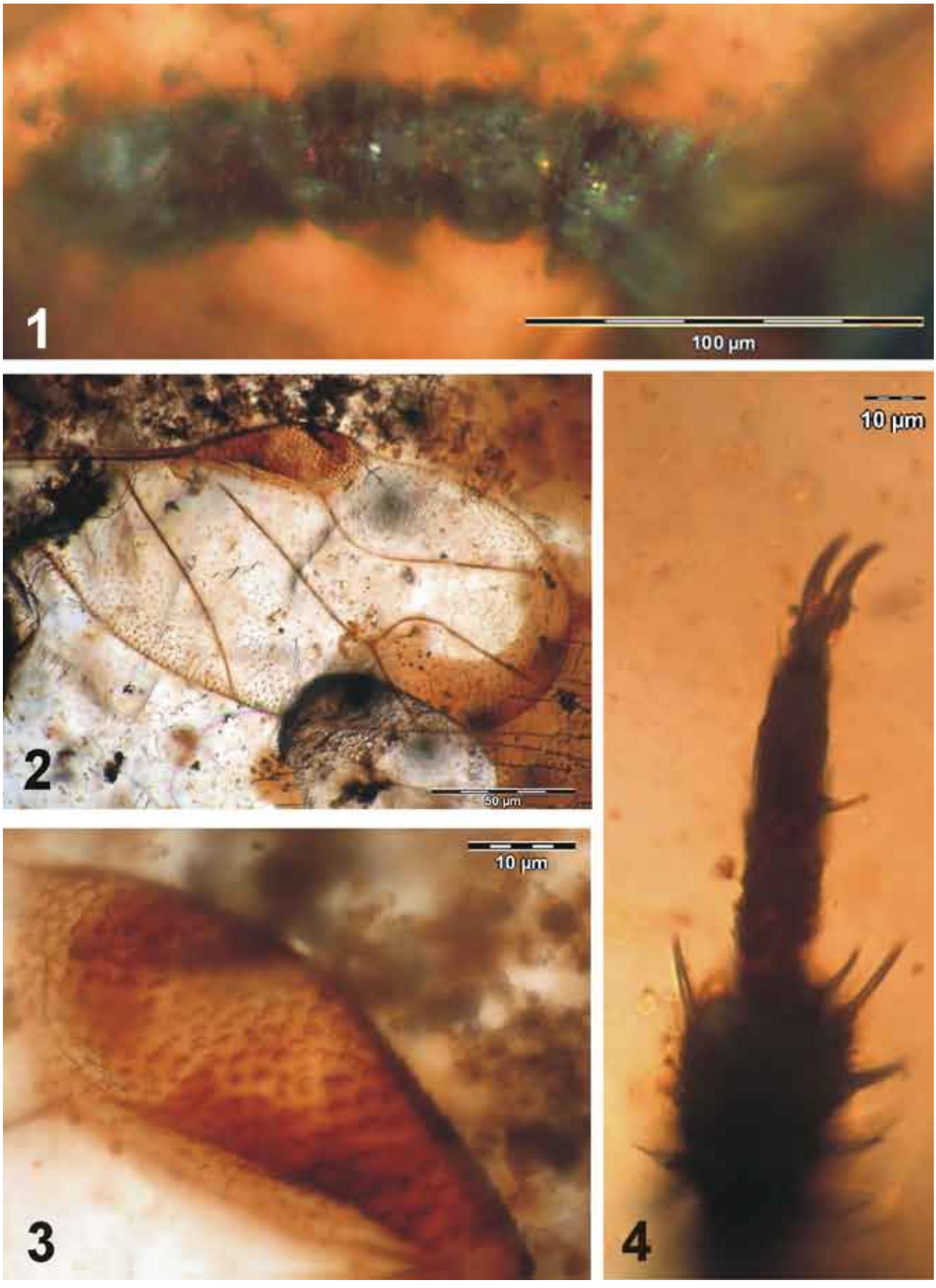

Plate 1. Photomicrographs of *Alavesiaphis margaritae* gen. et sp. nov. (Tajmyraphididae) from Early Cretaceous amber of Peñacerrada I (Holotype: MCNA-10021). 1) Detail of the right antenna, 2) Right fore wing, 3) Pterostigma, 4) Detail of the right hind leg. All images were made with some consecutive pictures taken at successive focal planes, and for this reason the fore wing seems shorter (see fig. 1 for its actual proportions).

Stratum typicum: The amber bearing strata are in the middle part of the Escucha Formation, which corresponds to a distal fluvial environment and is Early Cretaceous in age (Upper Aptian-Lower Albian, see Barrón et al. 2001).

Diagnosis: As for the genus.

Description: Alate specimen (Figs. 1-2 & Pl. 1). Body surely hairy, broad and 0.53 mm long (body covered with abundant fungi hyphae). Rostrum very short (not visible, it do not reaching the fore coxae). Total length of antenna ca. 0.37 mm (measured in a frontal view of the specimen), number of segments unknown (basal part of the antennae obscured). Antenna with rhinaria ring-shaped (Pl.1, fig. 1) at least on the four distal segments (apical segment 0.07 mm long, 0.04 mm wide; previous two segments equal in size, 0.04 mm long, 0.04 mm wide). Fore wing 0.98 mm long, 0.41 mm greatest wide (at level of the pterostigma), distally very wide, with a well rounded tip (Fig. 2 & Pl. 1, fig. 2). Membrane with microtrichia only close the wing margin except around the veins. Subcostal area extremely narrow. Pterostigma short and broad (0.25 mm long, 0.09 mm greatest wide), distally very wide (Fig. 2 & Pl. 1, fig. 3). Its anterior margin distinctly protrudes beyond the wing. Vein Rs long (0.36 mm long), near one third the length of the wing, leaving the distal part of the pterostigma. Basal part of Rs strongly curved. Vein M two-branched, departing from the base of the pterostigma. Stem of media 0.31 mm long. Angle of branching of M on fore wings is ca. 110°. M1+2 strongly curved basally, near as long as stem of media (0.29 mm long), slightly more that two times longer than M3+4 (0.14 mm long). CuA branches separated at base (distance slightly longer than proximal cubitus-branch length). The CuA distal-branch (0.37 mm long) leaving the main vein at an angle of 57° and 0.13 mm from the root of the proximal branch, slightly curved towards the wing base. CuA proximal-branch short (0.11 mm long), pale and thin, and forming an angle of 100° with the main vein. The posterior wing margin sinusoidally incised at the point where it meets CuA2. Hind wing not visible. Legs short (fore leg 0.49 mm, mid femur 0.20 mm, hind femur 0.14 mm). Tibiae with strong setae (Fig. 1 & Pl. 1, fig. 4). Tarsi two-segmented, 2nd segment in mid and hind legs with a strong hair on the middle (Fig. 1 & Pl. 1, fig. 4). Length of the hind tarsus 0.06 mm. Shape of the posterior end of the abdomen rounded (not bilobed). Siphunculi absent or not visible. Ovipositor absent or not visible.

DISCUSSION

The new genus belongs to the family Tajmyraphididae in having fore wings apically rounded, pterostigma short and broad, Rs leaving the distal part of the pterostigma, M leaving its base, CuA-branches separated at bases (proximal one is short), siphunculi absent, and antennae and legs short. One of the characteristics of the Kononova's diagnosis (Kononova 1975) has been not checked, because the number of antennae segments has been not established. The angles of proximal and distal cubitus-branches with the main vein are slightly superior in value in respect to the ranges in the Kononova's diagnosis (100° *vs*. 75-90° and 57° *vs*. 35-50°, respectively). The angle of branching of M is ca. 110° (*vs*. the range 50-80°). These different angles indicate that the family actually comprises ranges of 75-100° and 35-57° for CuA-branches, respectively, and 50-110° for the bifurcation of M. The new aphid has the Rs and M1+2 with the most curved basal part into the family, while the Kononova's diagnosis indicated a Rs straight or slightly curved.

It was not possible to assign *Alavesiaphis margaritae* gen. et sp. nov. with confidence to any of the five subfamilies established by Heie for the family Tajmyraphididae, however it resembles more to the subfamily Retinaphidinae, constituted by the species *Retinaphis glandulosa* Kononova 1975 and *Tajmyraphis rasnitsyni* Kononova 1975 from Siberian amber, but its posterior end of the abdomen is rounded, there are not visible two pairs of lobes. Still, in all species of the family Tajmyraphididae described from Taimyr and Canadian ambers, the bases of cubital veins lie very close to each other. With regard to the wing structure, *Alavesiaphis margaritae* gen. et sp. nov. is closest to *Megarostrum azari* Heie 2000 and a species from Burma amber, still undescribed (Grimaldi & Engel 2005). The position of media, in particular the place and angle at which M1+2 and M3+4 branch, resembles the wing of *Megarostrum azari*. So far known species of Tajmyraphididae from regions closer to the equator have very long rostrum, while rostrum in the new fossil is short.

The described specimen is the only individual found in Peñacerrada amber (one specimen in ca. 2,400), thus aphids are quite rare, in contrast to coccoids. This situation (aphids *vs*. coccoids) is identical in ambers from Lebanon, New Jersey and Burma, and it is different in Siberian and Canadian ambers (Grimaldi & Engel 2005). According to these authors this likely reflects the more seasonal paleoclimate of the deposits of Siberia and Canada, to which aphids would have been better adapted.

Tajmyraphididae includes eight genera (*Tajmyraphis* Kononova 1975, *Retinaphis* Kononova 1975, *Khatangaphis* Kononova 1975, *Jantardakhia* Kononova 1975, *Grassyaphis* Heie 1996, *Megarostrum* Heie 2000, *Lebanaphis* Heie 2000 and *Alavesiaphis* gen. nov.) and it is present in Burma, Canada, Lebanon, Russia (Siberia) and Spain deposits, thus it had a widely distribution around the Early and Late Cretaceous limit, at least in the Northern Hemisphere.

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