



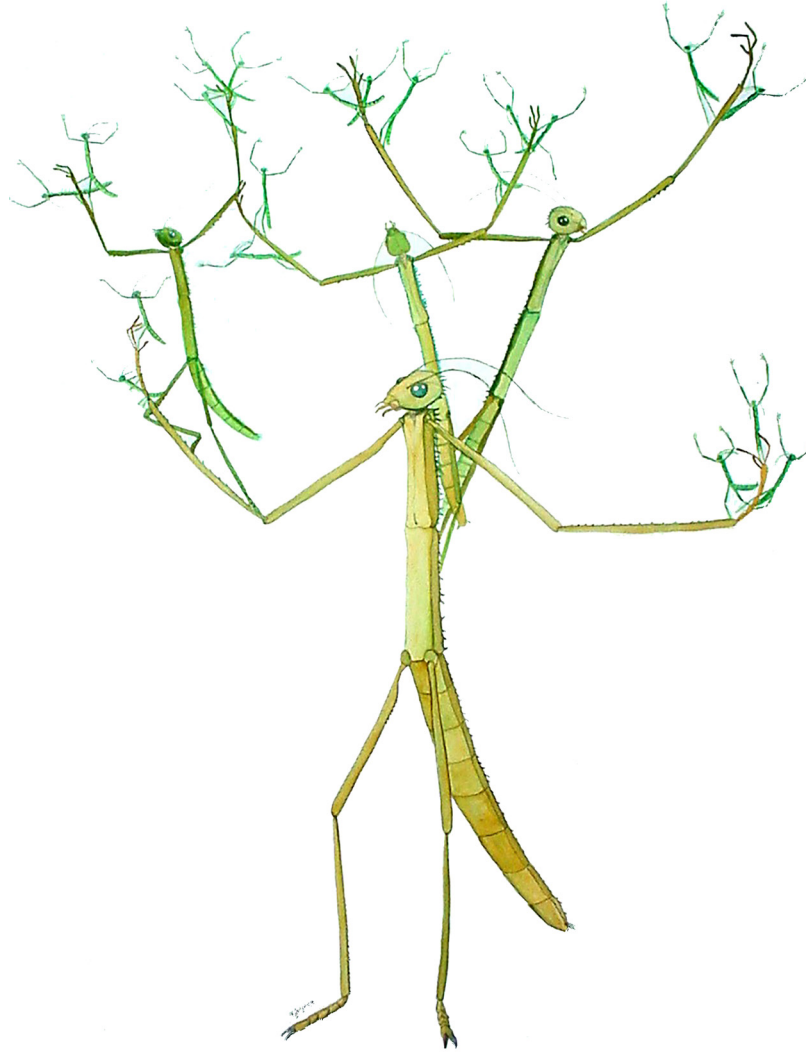
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Artículo

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A new gall midge species *Asphondylia leucaenae* sp. nov. (Diptera: Cecidomyiidae) causing galls on *Leucaena* spp. (Caesalpiniaceae) in Mexico

Una nueva especie de mosquito agallador *Asphondylia leucaenae* sp. nov. (Diptera: Cecidomyiidae) causando agallas sobre *Leucaena* spp. (Caesalpiniaceae) en Mexico

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RESUMEN

Se describe *Asphondylia leucaenae* Skuhrová sp. nov. (Diptera: Cecidomyiidae) de México. Las agallas se producen en los botones florales deformando los frutos de las especies de *Leucaena diversifolia* y *L. leucocephala* (Fabaceae). La presencia de estas agallas imposibilita la formación de frutos y provoca la muerte de la rama. Se describen machos, hembras, larvas, pupas y agallas, y se comenta la biología. Esta nueva especie es la única especie de mosquito de las agallas conocida en el género *Leucaena*.

Key words. Taxonomía, taxonomía, morfología, distribución, biología, América.

ABSTRACT

Asphondylia leucaenae Skuhrová sp. nov. (Diptera: Cecidomyiidae) is described from Mexico. Galls occur in flower buttons deforming the fruits of *Leucaena diversifolia* and *L. leucocephala* galls (Fabaceae). The presence of these make it impossible to form fruits and cause the death of the branch. Male, female, larva, pupa, and gall are described, and the biology is commented. This new species is only the gall midge species known on *Leucaena* genus.

Key words. Taxonomy, morphology, distribution, biology, America.

Leucaena is a genus of flowering plants belonging to order Fabales in the family Fabaceae (subfamily Mimosoideae, Tribe Mimoseae). It contains twenty four species of trees and shrubs which are native to the Americas, ranging from Texas in the United States to the South of Peru. The genus *Leucaena* is distinguished from all other Mimosoid legumes by its hairy anthers which are easily visible with a hand lens. *Leucaena leucocephala* is a small fast growing tree, native to southern Mexico characterized by presenting a white flowering and a fruit relatively wide, blunt disally. It is now naturalized in more than 20 countries on all continents except Europe and Antarctica (GISD 2022). It is spreading naturally in these countries and constitutes in many cases a serious problem for the ecosystem, having been included in the list of 100 of the most harmful invasive alien species in the world (GISD 2022). *Leucaena diversifolia*, native to central America, is characterized by having a pink flowering and a thin fruit, ending in a point; it is also introduced in several countries but so far no known problems derived from its introduction. In both species of *Leucaena* a new gall belonging to *Asphondylia* (Diptera: Cecidomyiidae) has been collected (Barrios-Díaz et al. 2012).

Asphondylia Loew, 1850 is a large cosmopolitan genus of gall midges. Three hundred and eight species are known to occur in the world (Gagné and Jaschhof 2021). About

70 species were described in the Palearctic Region, 80 species in the Nearctic Region, 95 species in the Neotropical Region, 20 species in the Afrotropical Region, 13 species in the Oriental Region and 15 species in the Australian and Oceanian Regions.

Nine species of the genus *Asphondylia* are known from Mexico (Felt 1907, 1935; Gagné 2004; Gagné and Waring 1990; Gagné et al. 2018; Möhn 1959; Rossi and Strong 1990): *Asphondylia amaranthi* Felt, 1935, causing galls on *Amaranthus blitoides* (Amaranthaceae), *Asphondylia auripila* Felt, 1907, on *Larrea tridentata* (Zygophyllaceae), *Asphondylia boerhaaviae* Möhn, 1959 on *Boerhaavia erecta* (Nyctaginaceae), *Asphondylia borrichiae* Rossi and Strong 1990, on *Borrichia frutescens* (Asteraceae), *Asphondylia clavata* Gagné, 1990 in Gagné and Waring (1990), on *Larrea tridentata* (Zygophyllaceae), *Asphondylia pila* Gagné, 2004 (= *Asphondylia pilosa* Gagné 1990 in Gagné and Waring (1990)), on *Larrea tridentata* (Zygophyllaceae), *Asphondylia resinosa* Gagné, 1990 in Gagné and Waring (1990), on *Larrea tridentata* (Zygophyllaceae), *Asphondylia uvarum* Gagné, 2018 in Gagné et al. (2018), on cultivated *Vitis* (Vitaceae) and polyphagous species *Asphondylia websteri* Felt, 1917, causing galls on *Medicago sativa*, *Cyamopsis tetragonoloba*, *Mimosa* sp., *Parkinsonia* spp. (Fabaceae), *Persea americana* (Lauraceae), and *Simmondsia chinensis* (Simmondsiaceae). Details about

these gall midges are given in Gagné and Jaschhof (2021).

MATERIAL AND METHODS

Galls of *Asphondylia leucaenae* Skuhravá sp. nov. were discovered on flower buttons deformed fruits of two *Leucaena* species, by the first autor, in Puente Seco and Totomoxtla (Estado de Puebla, Mexico). Galls were brought in the laboratory being kept in emergency jars. Some of the galls were dissected to obtain mature larvae and pupae, some galls were kept in bags until the emergence of adults. Larvae, pupae and adults were prepared on microscope slides using Canada balsam as medium (Skuhravá collection) or are they preserved in alcohol (Pujade-Villar collection). All pictures have made for the first autor; The galls were photographed with a digital camera and the entomological material (adults, pupae and larvae) with a Leica EZ 4D model stereoscopic microscope with integrated digital camera and Dell inspiron n5010 laptop computer.

The samplings are located in two Mexican municipalities. Tetela de Ocampo is located in the northern part of the State of Puebla with an average altitude of 1,721 m.a.s.l.; its geographical coordinates are: the parallels 19°43'00" and 19°57'06" of north latitude and the meridians 97°38'42" and 97°54'06" of western longitude. Cuautempan is located in the northwestern part of the state of Puebla with an average altitude of 1,376 m.a.s.l.; its geographical coordinates are: the parallels 19°51'00" and 19°58'00" of north latitude and the meridians 97°43'42" and 97°48'42" of western longitude.

To know the period of emergence of the gall inducers and parasitoids, sticky yellow traps (6x6 cm) were placed next to the gall clusters, which were periodically replaced. In the laboratory, the fauna was determined and compared with the emergence of adults from the galls preserved in the laboratory.

Holotype is preserved in the collection of Marcela Skuhravá, which is deposited in the NMP (Entomological Department of the National Museum, Prague, Czech Republic); Paratypes are deposited in NMP and in the collection of Pujade-Villar (Universitat de Barcelona, UB).

RESULTS

Asphondylia leucaenae Skuhravá sp. nov.

(Figs 1-4)

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Type material. Holotype deposited in (NMP): female, *Leucaena diversifolia*, Puente Seco (Tetela de Ocampo, Puebla, Mexico), emergence from February up to May 2012 (A.G. Pérez-García leg.). Paratypes: same data of holotype for five males, seven females, six larvae and five pupae deposited in the collection of NMP; same data but galls collected in 2014 and emerged on 05 April 2014, 3 males (deposited in Pujade-Villar collection).

Additional material. 3 males with deteriorated antennae, nine larvae and 18 pupae from *Leucaena leucocephala*, Totomoxtla (Cuautempan, Puebla, Mexico), emergence on 07 April 2014 (A.G. Pérez-García leg.), deposited in Pujade-Villar collection).

Etymology. The specific name of the new species, *leucaenae*, is derived from the generic name of the host plant, *Leucaena*.

Diagnosis. The adults of *Asphondylia leucaenae* Skuhravá sp. nov. are morphologically very similar to the adults of *Asphondylia sarothamni* Loew, 1850, the type species of the genus *Asphondylia* Loew, 1850. The differences are possible to see in larva and pupa. The larvae of *Asphondylia leucaenae* have on the ventral side of the prothoracal segment the spatula sternalis which is composed of a very short lower narrow part and the upper part which is formed of two very sharp projections, in contrast to the spatula sternalis of *Asphondylia sarothamni* which is formed of the robust lower part and the upper part which is formed of four short spinae. The pupae of *Asphondylia leucaenae* Skuhravá sp. nov. have on the basis of antennal sheaths two long, very slender spinae in contrast to pupae of *Asphondylia sarothamni*, which are short and strong.

Description. Adults of *Asphondylia leucaenae* Skuhravá sp. nov. (Fig. 1a, 1c-e, 1g-h, 2c) are relative large gall midges. Body size of adults 5.1 up to 5.3 mm. Head with large holoptic eyes, ommatidia are circular and large. Mouthparts are reduced. Antennae are 2+12 segmented. Wings are relatively large and broad. The vein costa is interrupted at the point of junction with Rs, subcosta is visible only in the basal part. The vein Cu is forked. Legs are long and covered with hairs. Claws are simple on all legs. Male terminalia are composed of gonocoxites which are thick and ovoid, small and ovoid gonostyli with sclerotized claw apically, cerci are large and hemispherical, hypoproct is small, aedeagus is long and thin. Ovipositor of female is long and very thin.

The larva of *Asphondylia leucaenae* Skuhravá, sp. nov. (Fig. 1b, 2a) is 6.8 – 7.3 mm long. Its body is composed of the head, three thoracal segments and nine abdominal segments. The larva has on the ventral side of the prothoracal segment a special organ, named spatula sternalis, which is characteristic only for the larvae of the family Cecidomyiidae. Spatula sternalis of *A. leucaenae* is composed of a very short lower narrow part and the upper part which is formed of two very sharp projections.

The pupa of *Asphondylia leucaenae* Skuhravá sp. nov. (Figs. 1f, 2b) is 6.3 – 7.1 mm long, orange-brown coloured. Its body is composed of a head part, a thoracal part with sheaths of wings and legs and of nine abdominal segments. The pupa has on the head part at the basis of antennal segments two long, very slender spinae.

Gall. They are located on the flower buttons attacking young fruits, fleshy in consistency, spherical or fusiform (sometimes with a long distal projection), briefly pedunculated (Figs 3a-e). Epidermis smooth and shiny, green in color turning to reddish in those parts where there is more sun exposure (the finding under the tree's foliage remain always green). The average size (n = 500) is 2.27 cm long x 1.65 cm wide. The larval chamber is central (Fig. 3f), oval, surrounded by a fleshy tissue, first gummy when young, hardening when maturing. When they are attacked by Eulophidae, various spherical larval chambers are observed. Pupation occurs in the larval chamber (Fig. 3g). The emergence hole is located at the top of the gall, near the anterior projection (Fig. 3h). After adults emerged the galls dehydrate acquiring a dark color and a lignified

consistency.

Host. Galls on *Leucaena* spp. (Fabaceae: Mimoseae). Collected from *L. diversifolia* (Lam.) deWit. and *L. leucocephala* de Wit, 1961.

Damage. The presence of these galls makes it impossible to obtain fruits (Fig. 3c) and causes the death of the affected branches (Fig. 4). The emergence of adults results in the invasion of fungi and organisms that decompose or consume the gall tissues.

Life history. Bivoltine species. In January or early February the females oviposit on the flowers; galls are visible after 20-30 days; upgrowth occurs in March, maturing in April. The adults of the first generation emerge in the field in the months of June and July (at the end of April to May in the laboratory). During the months of June and July, *Leucaena* has a second flowering so that in the months of August to September is possible to observe new galls although in a lower percentage of infestation than that of the first generation. Second generation adults emerge in December (in the laboratory) and in January (in the field). In the laboratory they emerged before the *Leucaena* flowering.

Distribution. Known only from Mexico: Puente Seco (Tetela de Ocampo, Puebla) and Totomoxtla (Cuautempan, Puebla).

DISCUSSION

Although in Mexico we find the Nearctic and Neotropical regions, *Asphondylia* is poorly represented with only 10 species (80 species in the Nearctic Region, 95 species in the Neotropical Region). Most of the species cited from Mexico are also found in the United States (*A. amaranthi*, *A. auripila*, *A. borrichiae*, *A. clavata*, *A. pila*, *A. tridentata* and *A. uvarum*); a single species is known from Mexico and El Salvador (*A. boerhaaviae*); and *A. websteri* is found in Mexico and in several Central American countries (Gagné and Jaschhof 2021). The new species, *A. leucaenae*, is only known from Mexico but surely its distribution will be very large according to distribution of *Leucaena* genus.

Plant families Amaranthaceae, Nyctaginaceae, Asteraceae, Vitaceae have associated a single *Asphondylia* species; four species are associated to Zygophyllaceae family and a single species found galls in several genera of Fabaceae (*Medicago*, *Cyamopsis*, *Mimosa* and *Parkinsonia*), also in Lauraceae (*Persea*) and Simmondsiaceae (*Simmondsia*). The species here described found galls in Fabaceae (*Leucaena*), being the first record of *Asphondylia* in this host.

Asphondylia leucaenae produces large, aggregated galls on flower buds attacking young fruits. Some species (such as *Leucaena leucocephala*) have edible fruits and seeds, used in animal forage feed, in green manures, soil conservation, seeds for collars. Then, the only explanation that this species has not been described until today is undoubtedly the absence of taxonomists. This is not the first time it has happened; in Mexico a few years ago two new species of Cynipidae (*Ambibolips hidalgoensis* Pujade-Villar and Melika and *A. zacatequensis* Melika and Pujade-Villar) were described producing very common galls with a similar size as a tennis ball (Melika *et al.* 2011). Based on all these data, we do not doubt that the number of species in Mexico will increase considerably with new samplings.

Finally, the genus *Leucaena* has been introduced on all continents. Furthermore, one of the species (*L. leucocephala*) presents serious ecological problems in different countries as an invasive alien species. It remains to be seen if the species here described (*Asphondylia leucaenae*) has also been introduced in any country by introducing vegetable hosts.

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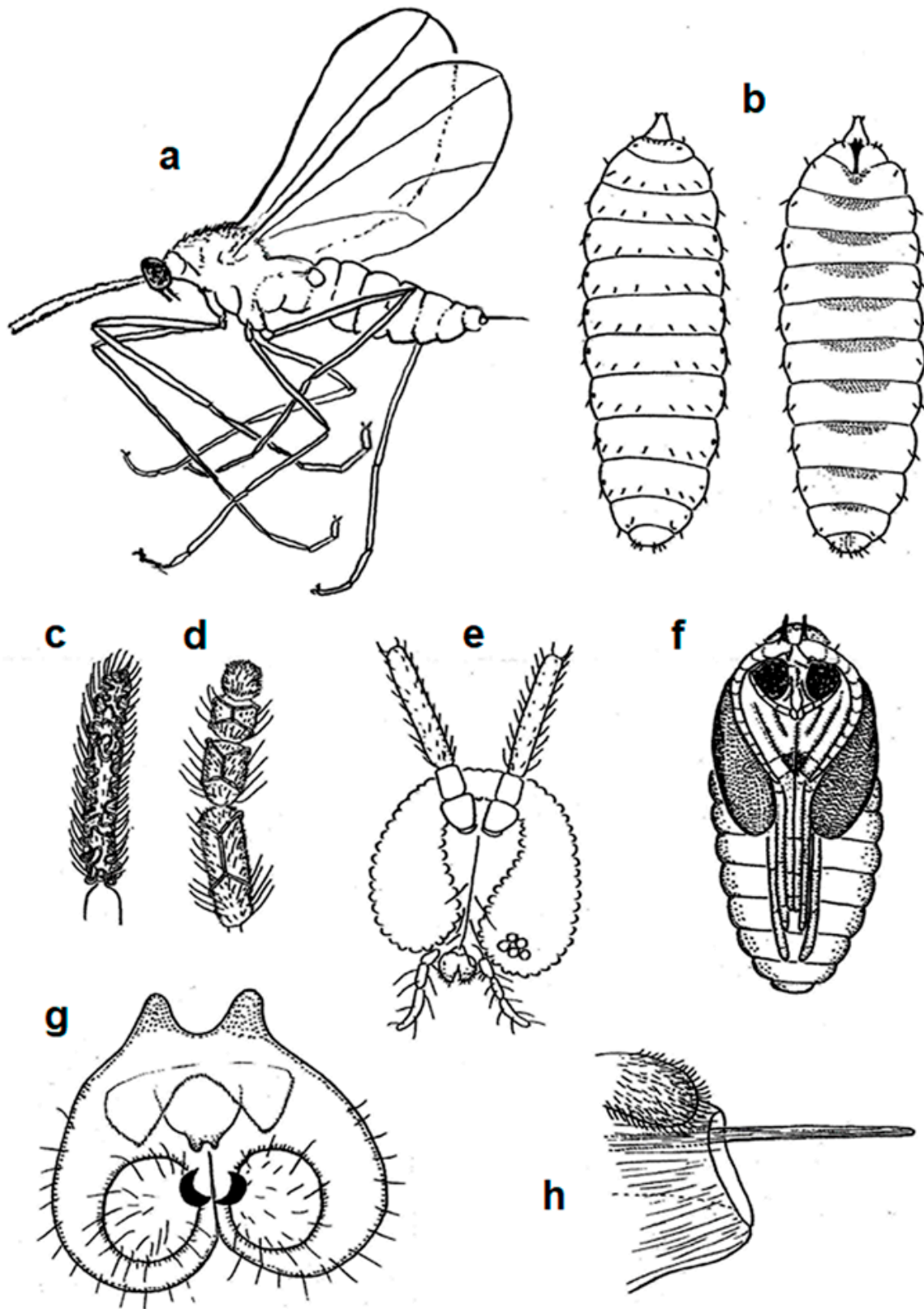


Figure 1. *Asphondylia leucaenae* Skuhrová, sp. n.: (a) Female, (b) larva (upper part of the body on the left side, ventral side of the body on the right side, with spatula sternalis on the prothoracal segment), (c) last antennal segments of a male, (d) last antennal segments of a female, (e) head of a male in frontal view with large holoptic eyes and basal part of antenna and small mouth parts and short palpal segments, (f) pupa in ventral view, (g) hypopygium of a male, (h) end of the abdomen of a female with shifted ovipositor.

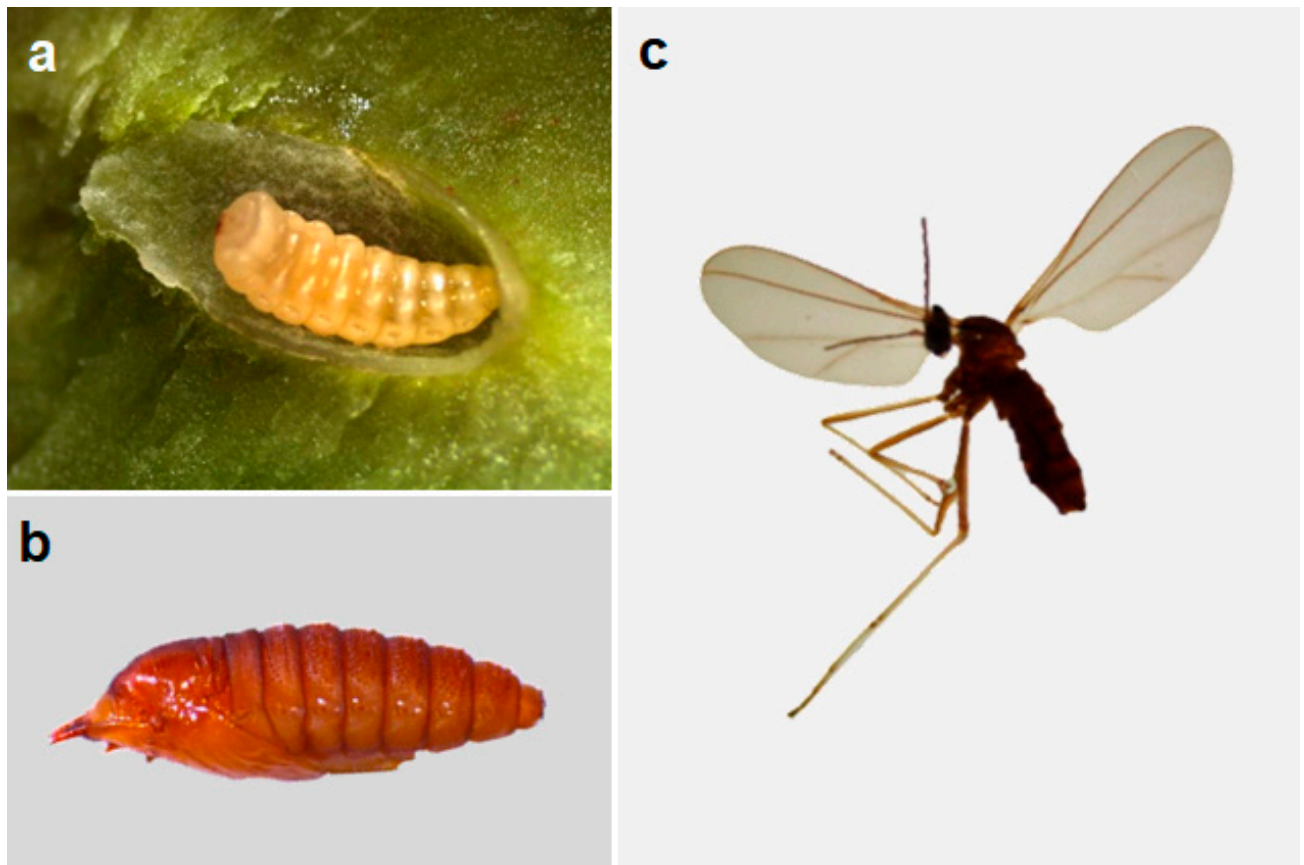


Figure 2. *Asphondylia leucaenae* Skuhrová, sp. n.: (a) larva, (b) pupa, (c) adult male.

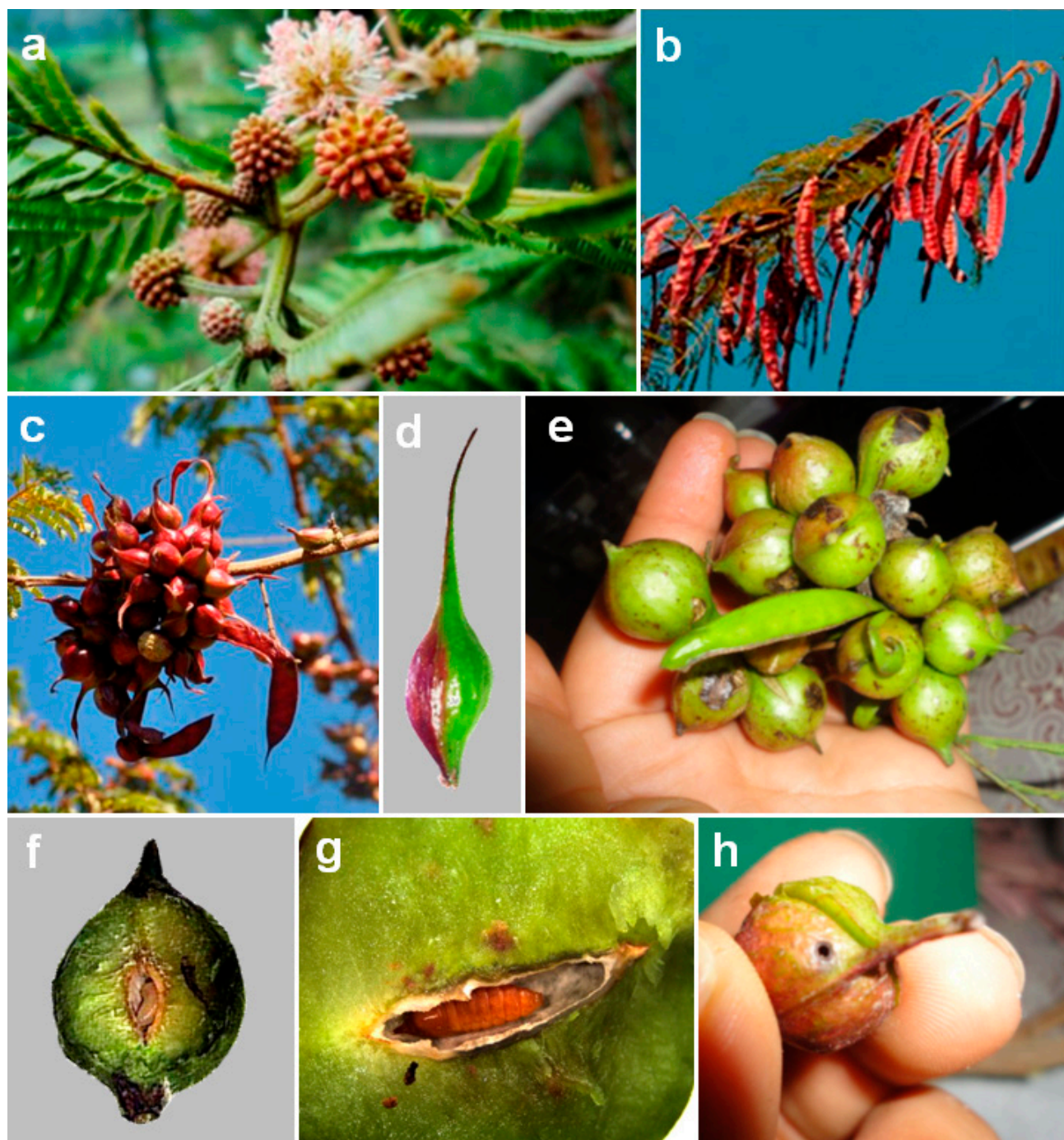


Figure 3. *Asphondylia leucaenae* Skuhrová, sp. n. on *Leucaena*: (a) flower buds of *L. diversifolia*, (b) fruits of *L. diversifolia*, (c) branch with multiple galls on the flower bud, (d) detail of a fusiform gall in which the area of the gall that has had sunstroke can be seen in red, (e) spherical galls, (f) cross section, *A. leucaenae* larva inside the larval chamber, (g) pupa of *A. leucaenae* inside the larval chamber, (h) emergence hole.

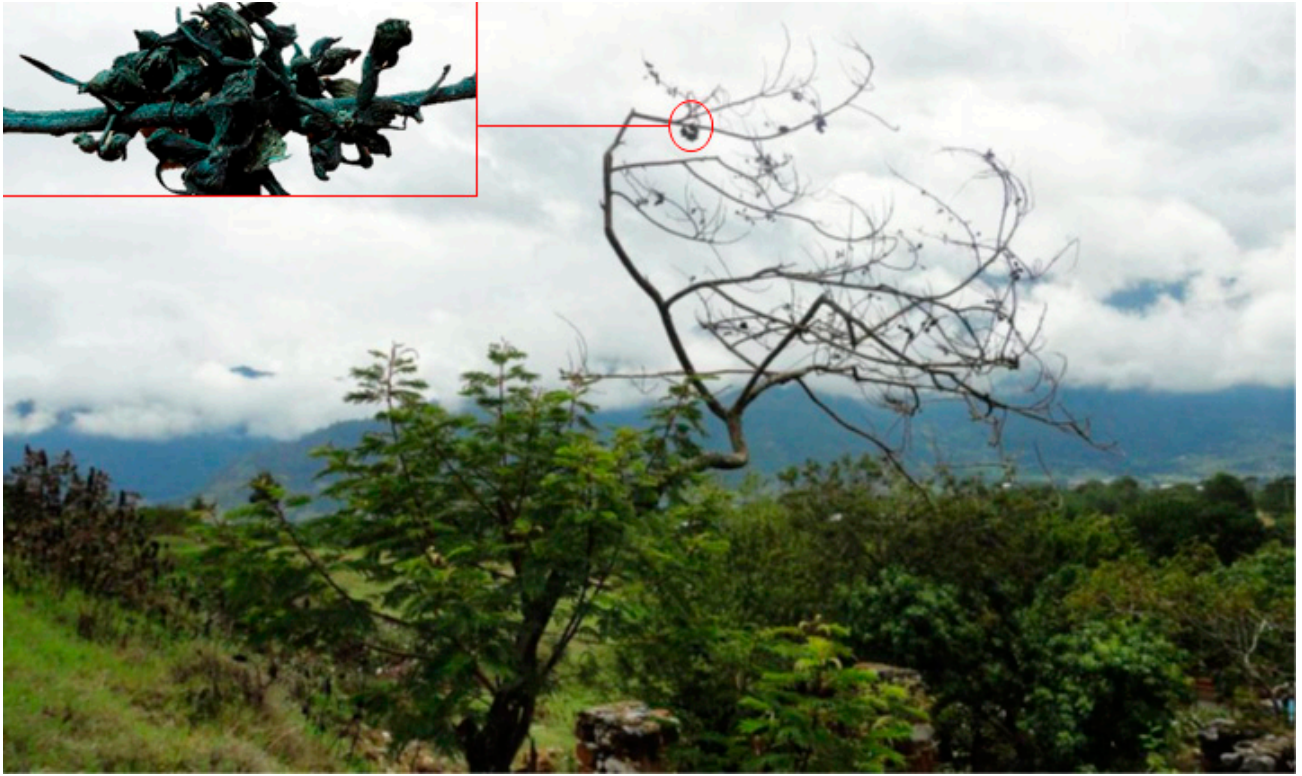


Figure 4. *Leucaena diversifolia* branches of *Leucaena diversifolia* at the locality Totomoxtla in the year 2012 which got dry due to the attack by the gall midge *Asphondylia leucaenae* (picture taken in 2012).

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