

## A new genus and species of gall-inducing thrips (Thysanoptera: Tubulifera) from the neotropical region

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**ABSTRACT.** A new genus of gall-inducing thrips is described for Costa Rica. This taxon seems to be close to *Plagiathrips*, and can be distinguished by several morphological features, where the most relevant is the presence of an occipital process and the development of a pelta-shaped structure in abdominal segments III to VIII. This new species is associated with the Sapotaceae family, one of the six most important families of trees in the wet tropical forest. Particularly with the species *Sarcaulus brasiliensis*, which seems to be one of the rarest species. Its distribution is localized and of difficult access which makes the collects of this tree is difficult.

**RESUMEN.** Un nuevo género de thrips galígeno se describe para Costa Rica. Este taxon parece estar cercanamente relacionado con *Plagiathrips*, pero es fácilmente diferenciable por numerosos caracteres morfológicos, de los cuales los más relevantes son la presencia de un proceso occipital no presente en ninguna otra especie del grupo, y el desarrollo de una estructura similar a la pelta en los tergos abdominales III-VIII. Esta nueva especie se halla asociada con la familia Sapotaceae, una de las seis familias más importantes de árboles en el bosque tropical. Particularmente con la especie *Sarcaulus brasiliensis*, aparentemente una de las más raras, con una distribución muy localizada y de difícil acceso, lo que dificulta la recolecta de material de estudio.

**KEYWORDS.** *Johansenthrips galligena*, Phlaeothripidae, Phlaeothripinae, *Sarcaulus*, Costa Rica

About 300 species of thrips in 57 genera are known, or at least are supposed to be gall-inducers. A gall is an unnatural growth of the parenchyma of the leaves, in some cases thrips presence appears as a clear fact, but in other cases it is not very easy to establish as in the gall induced by *Gynaikothrips*.

Galls are caused by one or more adults feeding, on actively growing plant tissue (Crespi *et al.* 1997). Almost any plant deformation caused by thrips is termed as "gall" (Mound 1994) and is characterized by a more intimate biological association between insects and their host plants, a feature well documented among thrips (Ananthakrishnan 1984, Morris *et al.* 1999, Mound 1994, Crespi *et al.* 1997).

Almost 75% of the gall-inducing thrips are confined to the so called *Liothrips*-lineage (Mound & Marullo 1996). From the geographical viewpoint distribution of gall-forming thrips is closely related with the tropics, particularly with the Old World

tropics, thus relatively poor in the Neotropical areas (Ananthakrishnan 1984).

According to Raman & Ananthakrishnan (1986), nearly 85% of the known species of gall-forming thrips occurs in the Peninsular Indian - Indo Malayan - Indonesian - North East Australian belt with a few elements distributed sparsely and randomly in the neighborhood. On the whole, gall inducing thrips elements appear restricted to the region extending between the Tropic of Cancer and Tropic of Capricorn, and in a general way, from the 40°N to 40°S of the Earth.

Mound (1971) listed seventeen genera and fifty-five species of Phlaeothripinae associated with the leaves and phyllodes of Australian *Acacia* trees. This author (1994) includes a list of 57 genera of gall-forming Phlaeothripinae and mentioned that few thrips have been collected from galls in the Neotropics.

The present paper describes and discusses a new genus and species of gall thrips from Costa Rica, found in *Sarcaulus brasiliensis* trees in Guanacaste, and includes a comparative table between this genus and *Plagiothrips*.

## MATERIAL AND METHODS

The specimens were collected in Guanacaste, Volcán Cacao, Costa Rica and deposited in MIUCR (Museo de Insectos de la Universidad de Costa Rica), IBUNAM (Instituto de Biología de la Universidad Nacional Autónoma de México) and SMF (Senckenberg Museum Frankfurt, Germany). Other material examined was obtained from USJ (Herbario de la Escuela de Biología, Universidad de Costa Rica). The digital images were made with Olympus IX 51 binocular with digital camera (CIEMic, Universidad de Costa Rica). Abbreviations in text: BMNH: British Museum of Natural History, London, England. BNHM: Natural History Museum, Bergen, Norway. CIEMic: Centro de Investigación en Estructuras Microscópicas, Universidad de Costa Rica. DNHM: Natural History Museum, Dresden, Germany. IBUNAM: Instituto de Biología de la Universidad Autónoma de México. INBio: Instituto Nacional de Biodiversidad, Costa Rica. MIUCR: Museo de Insectos, Universidad de Costa Rica. SMF: Senckenberg Museum, Frankfurt, Germany.

## RESULTS

### *Johansenthrips* gen. nov. (Plate 1, figs. 1-3)

**Description.** Body colour dark brown, major setae acute and pale amber. Fore tibiae and tarsi yellow; tarsi of medial and hind legs brownish-yellow. Head 1.2-1.3 times longer than wide, two pairs of acute postocular setae. Occipital process in the posteromedial margin of the head (Pl. 1, Fig. 1a,b). Stylets separated medially and extended above the postocular setae without medial bridge. Antennal segment III longer than IV, segments III-IV with two sense cones (Pl. 1, Fig. 2a,b); all segments with pedicel, segment VIII shorter and sesil. Pronotum trapezoidal, major setae acute, anteroangular, posteroangular and epimerals setae well developed anteromarginal and discal setae minute, midlateral setae absent. Two pairs of notopleural setae. Notopleural sutures complete.

Wings hyaline and wide, with 12-15 duplicated cilia. Mesonotum without sculpture with two pairs of setae, one in the posterior margin, and one in the medial angle. Metanotum elongated with polygonal reticulation in the posterior two thirds (2/3), one pair of long setae behind the anterior margin. Pelta triangular with polygonal reticulation and one pair of campaniform sensillae on the posterior margin. Abdominal segments with two pairs of well developed wing retaining setae, and a short additional pair. Abdominal segments III-VIII with a medial pelta-shape structure with a pair of campaniform sensillae (Pl. 1, Fig. 3a,b). Segment IX with an area of dorsal minute discal setae, and twice the diameter of the tube. With setae B1 and B3 well developed, B2 reduced. Both pairs of setae longer than segment X (tube).

### **Type species** *Johansenthrips galligena* new species

**Comments:** This new genus is closed to *Plagiothrips eugeniae*, but can be distinguished by several aspects presented in table 1. One of them is the presence of a pelta-shaped structure in abdominal segments III-VIII in *Johansenthrips*. This character is also present in the genus *Pristothrips* Hood, which has the fore tibiae with subapical or medial tubercles, and the fore femora have a stout subapical tubercle on the inner margin (Mound & Marullo 1996). The maxillary stylets in *Pristothrips* are prolonged to compound eyes. One unusual character in *Johansenthrips* is an occipital process on the head, not observed in *Plagiothrips* and other genera of Phlaeothripidae.

**Etymology:** This genus is named in honour and recognition to Dr. Roberto Johansen Naime, for his many years of excellent work and dedication for studying the taxonomy, ecology and biology of the Mexican thrips.

### *Johansenthrips galligena* n. sp. (Plate 1. figs. 1-3)

**Description.** Macropterous female: Dark brown, major setae acute and pale amber. The fore tibiae and tarsi yellow; tarsi of medial and hind legs brownish-yellow. Head 1.2-1.3 times longer than wide, two pairs of acute postocular setae. Occipital process in the posteromedial margin of the head (Pl. 1, Fig. 1a,b). Stylets separated medially and

extended above the postocular setae. Antennal segment III longer (100µm) than IV and others, segments III-IV with two sense cones (Pl. 1, Fig. 2a,b); segment VIII short and sessile (42.5µm). Pronotum trapezoidal with major setae long and acute, except the anteromarginal setae. Notopleural sutures complete and notopleuron with a pair of long and acute setae. Wings hyaline and wide, with 12-15 duplicated cilia. Mesonotum without sculpture with two pairs of setae. Metanotum elongated with polygonal reticulation. Pelta triangular, with polygonal reticulation and one pair of campaniform sensillae in posterior margin. Abdominal segments with two pairs of well developed wing retaining setae and a short additional pair. Abdominal segments III-VIII with medial structure pelta-shaped with a pair of campaniform sensillae (Pl. 1, Fig. 3a,b). Segment IX with setae B1 and B3 well developed and B2 reduced. Both pairs of setae longer than tube.

**Measurements of female holotype (µm).** Body length: 2550. Head length: 310. Head width at compound eyes level: 220. Internal postocular setae length 117.5 and external pair 125. Antennal segments length: I 50, II 60, III 100, IV 95, V 87.5, VI 75, VII 67.5, VIII 42.5. Pronotum setae length: anteroangular setae 52.5; posteroangular setae 100; notopleural setae 120. Metanotum medial setae 72.5. Abdominal segment IX setae: B1 262.5; B2 275 y B3 262.5. Tube length: 260.

**Type series.** Holotype: Macropterous female (NaOH). COSTA RICA: Guanacaste, Estación Biológica "Cacao". X-1999 forming galls in *Sarcaulus brasiliensis* (Sapotaceae). Paratypes: 67 Same data than holotype (treated with NaOH) and others preserved in AGA. Material deposited in CIEMic, MIUCR, IBUNAM, SMF, BMNH, INBio, BNHM, DNHM.

## DISCUSSION

**The mess of *Holopothrips* complex.** Mound & Marullo (1996) synonymized the genera *Phrasterothrips* Priesner 1921, *Homorothrips* Hood 1954, *Anoplothrips* Hood 1954 and *Caraibothrips* Bournier 1993 with *Holopothrips* Hood 1914. On the other hand, Bhatti (1993) synonymized the

genus *Plagiothrips* Priesner 1968 with *Homorothrips*, considered now as *Holopothrips*. This author does not consider the particular development of the tarsal tooth in *Plagiothrips* not found in *Holopothrips* and *Homorothrips*. Mound & Marullo (1996) in the extensive review of the material from Central and South America re-established the genus *Plagiothrips* as a valid name for the only one species *P. eugeniae* described by Costa Lima (1935). These authors suggested that the morphological variation of these genera is included in the structural variation of the species in *Holopothrips*. This appreciation seems to be true, but the morphological structure of the species included in *Holopothrips* is not constant and we can define several different groups of species with particular morphological characters (Mound & Marullo 1996). *Holopothrips* may be considered as a generic group where is necessary more detailed studies in phylogenetic relationships to define the real boundaries of these genera (Retana-Salazar & Nishida 2007). Cotype (SMF7478) material recently examined by the senior author of *H. conducans* suggests that *Phrasterothrips* is a valid name and the synonymy proposed by Mound & Marullo (1996) seems to be established without the analysis of the original types.

**Why *Johansenthrips*?** With the criteria exposed before and in absence of good works in phylogeny of the group (that leads the natural groups of species in this case), we use the morphological variation and the morphological comparison of structures such the maxillary stylet, the postoccipital process, the sensoria formula and the particular biology of this species, to erect the new genus *Johansenthrips*. Several features do not coincide with *Plagiothrips* Costa Lima 1935, *Myxothrips* Stannard 1968, and *Holopothrips* Hood 1914 complex. To consider this species in some of these genera only increases the mess of the species group and genera boundaries.

**Biological traits.** Dissecting the galls (more than 20), it is possible to find a great number of adults (35-50 individuals per gall) and a few larvae and pupae. This species feed on the internal tissue of the leaves, the life cycle occurred in the gall, considering the presence of larvae. Adults exposed to light exhibit a negative phototaxis. On the other hand, from several specimens examined, castes were not observed in this species, since they

did not exhibit wing reduction; the specimens showed a fully developed tarsal tooth and enlarged forelegs (Crespi *et al.* 1997).

**Gall structure.** The gall is totally closed when the leaf is recently colonized (Plate 2, Figs. 1-4), it is necessary to open the gall with a cutter for the extraction of the thrips. They live upon the internal wall of the gall feeding on the cells of the adaxial face of the leaf. Initially the gall is very symmetric (Pl. 2, Figs. 2-4) and adults and nymph of thrips are placed in the same tissue (Pl. 2, Fig. 1). A non-identified fungus is found in the lumen of the gall, the dead thrips are found in the mycelia of the fungus (Pl. 2, Fig. 1). This fungus may be a saprophytic one and possibly helps the colony to destroy the waste products.

In botanical samples of the same species of plant-host collected and preserved in the herbarium of the University of Costa Rica, we found some older galls. The parenchyma grew without order, forming a giant-gall with several ducts that connect the different chamber of the gall to the exterior.

This species could be parthenogenetic, since of several galls (more than 20) dissected. Males have never been collected. This kind of system suggests a high endogamy pattern where the male is rarely present or has disappeared.

#### ACKNOWLEDGMENTS

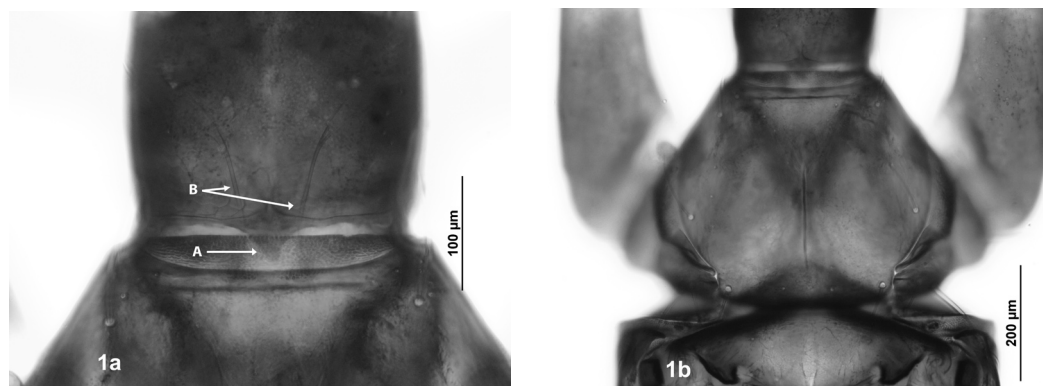
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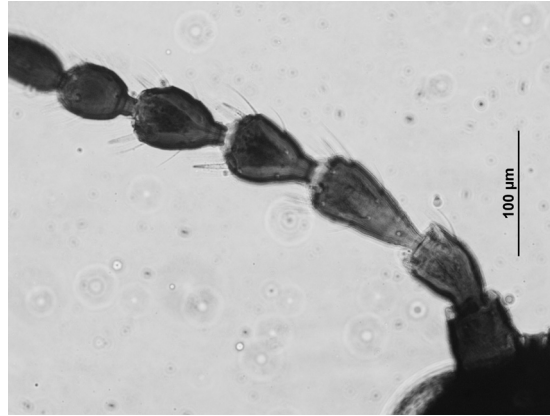
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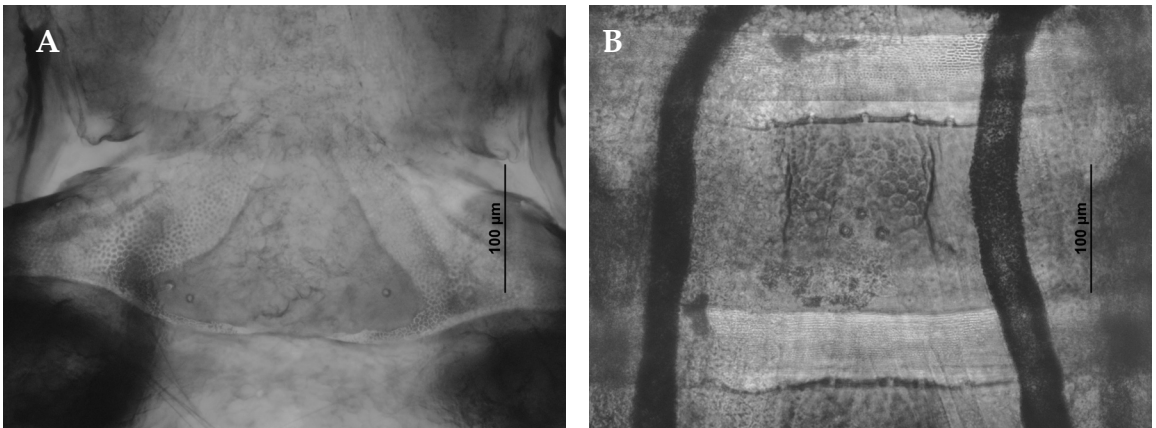
**Table 1.** Comparative characters between *Plagiothrips* and *Johansenthrips* gen.nov.

Character	<i>Plagiothrips</i>	<i>Johansenthrips</i>
Body length ( $\mu\text{m}$ )	1475-1825 (n=7)	3000-4050 (n=40)
Epimeral sutures	Incomplete	Complete
Tarsal tooth	Less developed	Fully developed
Tube	Short (155-212.5)	Longer (360-400)
Setae B1-B3	Shorter than tube	Longer than tube
Pseudopelta in segments III-VIII	Absent	Present
Pronotal longitudinal division	Absent	Present
Head	Short (157.5-205)	Long (310-360)
Fore femora	Less developed	Fully developed
Major setae of pronotum	Expanded at apex	Acute
Head middle setae	Shorter than po setae	Similar to po setae
Occipital process on head	Absent	Present
Body coloration	General brown, except the fore tibiae yellow shaded brown	Brown, except fore tibiae yellow; abdominal segments VIII and X dark brown
Antennal coloration	Segment I brown, II brown with yellow at apex, III-VIII brownish yellow	All segments brown

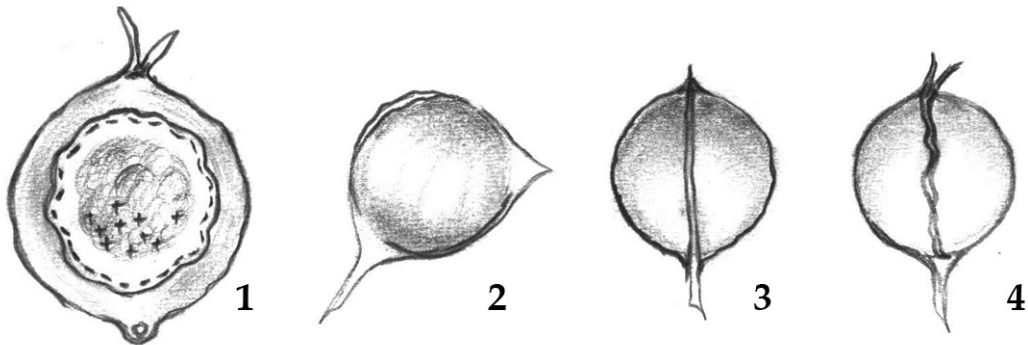
**Figure 1.** *Johansenthrips galligena* n.gen. n.sp. 1.a. Head A) occipital process, B) stylets 1.b. Pronotum (400X) .



**Figure 2.** *Johansenthrips galligena* n.gen. n.sp. Antennae showing the sensorial cones, (400X)



**Figure 3.** *Johansenthrips galligena* n.gen. n.sp. a) Pelta, b) Abdominal tergum V.



**Figure 4.** Young gall of *Johansenthrips galligena*. 1. Transversal section. 2. Lateral view. 3. Dorsal view. 4. Ventral view.