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Updated checklist of the order Thysanoptera in Colombia

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Abstract

We present here the first comprehensive checklist of Thysanoptera in Colombia. This study is based on a literature review, examination of specimens deposited in museums, and fieldwork conducted from 2012 to 2018 across various agroecosystems in the Andean, Caribbean, and Orinoco regions. Our study reports 38 new records of Thysanoptera for Colombia, bringing the total number of documented species to 183.

Key words: Thripidae, diversity, new records, biogeography

Introduction

Thysanoptera is a diverse order, although relatively small when compared to other groups of insects. It comprises 6,458 species in 788 extant genera of which 187 species in 70 genera are fossils; the order is organized into two suborders and fifteen families (ThripsWiki 2023). Advances in knowledge about Thysanoptera diversity and biological interactions in the Neotropics have been published by Silva and Del-Claro (2010), who noted that most of the published studies focus on pest thrips species. Studies carried out in Panama (Goldaracena *et al.* 2012), Brazil (Silva & Del-Claro 2010; Cavalleri & Mound 2012; Lima & Mound 2016) and Argentina (De Borbón 2013; Alejo & Zamar 2021), demonstrate a great diversity of thrips species with significant implications for biological functions, ecological interactions, and their roles in both natural and agricultural systems. Mound (2002) reports an estimated richness of 2,000 species of Thysanoptera in the Neotropics. Specifically, 300 species have been reported in Mexico and Costa Rica (Mound & Marullo 1996), 246 species in Panama (Goldaracena *et al.* 2012), 627 species in Brazil (Monteiro & Lima 2023), and 154 species in Argentina (De Borbón & Zamar 2024).

Colombia is located in northern South America with a continental area of 1,141,748 km^2 (Ocampo *et al.* 2007; Hernández *et al.* 1992; Giraldo 2013) and is considered the second most biodiverse country in the world due to the uplift of the Andes. This created new habitats and local isolates that favored high speciation rates and endemisms of many taxa (Antonelli & Sanmartin 2011; Josse *et al.* 2012). Additionally, the intricate interplay of biogeographic mosaics spanning the Andean, Orinoco, Guiana, Caribbean, Pacific, and Amazon regions further contributes to Colombia's exceptional biodiversity (Hernández *et al.* 1992; IGAC 2012). Despite Colombia's remarkable floristic diversity, it remains one of the few neotropical nations lacking a comprehensive inventory of its Thysanoptera fauna.

As with other South American countries (Monteiro 2002; Mound 2014) the first studies on Colombian Thysanoptera date from the beginning of the XXth century, when North American and European researchers casually described new species after receiving material. After that, most records came from sporadic reports primarily focused on agroecosystems (Cárdenas & Corredor 1993; Arévalo *et al.* 2003) or specific taxa, such as those documented by Calixto (2005, 2007). Calixto (2005) published a list of 79 species in three families of Terebrantia collected in the

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Bogotá plateau. Her master's thesis (2007) comprises a list of 144 species, 28 genera and four families of Terebrantia in Colombia. The latter research includes 34 species of *Frankliniella* Karny, along with several species identified at the genus level. Unfortunately, these results were never published and lack species confirmation by recognized experts in the field.

In Colombia, the richness of Thysanoptera is little known; however, Ebratt *et al.* (2019), reported 81 species in 20 genera and three taxonomic families, related to 10 cultivated plants in three geographic regions of Colombia. This was the latest broad work on thrips diversity in the country, as an effort to conduct wide surveys in several landscapes, including agroecosystems. Ebratt *et al.* (2019) also found that Thysanoptera species richness gradually decreases as altitude increases in inverse correlation with temperature. However, it was in the altitudinal range between 1,000 and 2,000 masl, where 45.5% of the total of the species was found, possibly due to greater floristic diversity, ecosystems with landscape heterogeneity, greater number of life zones and climatic variability.

The present paper provides the first extensive list of Thysanoptera records for Colombia, based on a literature review, examination of specimens deposited in entomological collections, and fieldwork conducted from 2012 to 2018 across various regions of the country. This checklist provides several new records and will serve as a foundation for carrying out future research on Thysanoptera in the second most diverse nation in the world.

Materials and methods

Our study involved a review of different sources of information about Thysanoptera from Colombia, namely (i) national digital databases (ICN–Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogota; CTNI–AGROSAVIA–Colección Taxonomica Nacional de Insectos "Luis María Murillo", Bogota; Instituto Alexander von Humboldt–IAvH, Bogota; CEUA–Colección Entomológica Universidad de Antioquia, Medellin; MHN–UPN–Museo de Historia Natural, Universidad Pedagógica Nacional, Bogota); (ii) international museums (USNM–Smithsonian National Museum of Natural History housed in the United States Department of Agriculture, Beltsville, MD, USA; MNCN–Museo Nacional de Ciencias Naturales, Madrid, Spain; NHM–Natural History Museum, London, United Kingdom); and (iii) scientific literature reports, catalogs, taxonomic keys, and species descriptions.

Finally, the checklist provided here includes those taxa collected in Colombia by the present authors. From 2012 to 2018 we conducted 40 sampling excursions, each lasting 10 consecutive days in 23 of the 32 national departments, including 13 life zones and 73 agricultural systems in the Andean, Caribbean and Orinoco biogeographic regions (IGAC 2012) (Fig. 1). Altitude ranges of 500 meters were chosen, from 0 to 3,500 meters above sea level, using the climatic zonation by Caldas-Lang thermal floors or zones and Holdridge life zones (Holdridge 1967; Eslava *et al.* 1986; Pabón *et al.* 2001; Gutiérrez 2002).

We collected insect specimens of Thysanoptera from cultivated and native plants of different botanical families that we found in rural agricultural areas and those surrounding natural biological reserves of the National Natural Parks System (SPPN) and the Regional Autonomous Corporations of Colombia (Barbosa 1992; Giraldo 2013; CAR 2020; Resnatur 2024). In areas with commercial and backyard agroecosystems surveys on arboreal plants were included, according to the inventories conducted by Cárdenas *et al.* (1970), Cárdenas *et al.* (1972), Gómez & Rivera (1987), Escobar *et al.* (1993), Bermúdez (1997), Gamboa (2003), Arrieta *et al.* (2004), Fuentes *et al.* (2011). We determined the taxonomy of the plant material using taxonomic keys from the Flora of Colombia (Gentry 1996; Bernal *et al.* 2016); and we compared the material to specimens in the herbarium of the Instituto de Ciencias Naturales, Universidad Nacional de Colombia. At the end of the study, we obtained 4,495 samples in agroecosystems and wild plants in the Andean (2,563 samples), Caribbean (1,532 samples), and Orinoco (400 samples) regions (Fig. 1).

The thrips were sorted by morphotypes and identified. The specimens were cleared in cold 5% KOH, followed by washing with distilled water. Subsequently, adults were mounted in Hoyer’s medium in slides, and dried in the oven for 48 h at 35–40°C, according to Mound & Marullo (1996). A few specimens of each species were mounted in Canada Balsam for the permanent collection according to Mound & Marullo (1996). The taxonomic determination of adults was carried out based on morphological characters according and available keys (Moulton 1948; Sakimura & O'Neill 1979; Sakimura 1981; Mound & Nakahara 1994; Mound & Marullo 1996; Monteiro 1999; Berzosa & Maroto 2003; Hoddle & Mound 2003; Berzosa 2006; De Borbón & Cardello 2006; Mound &

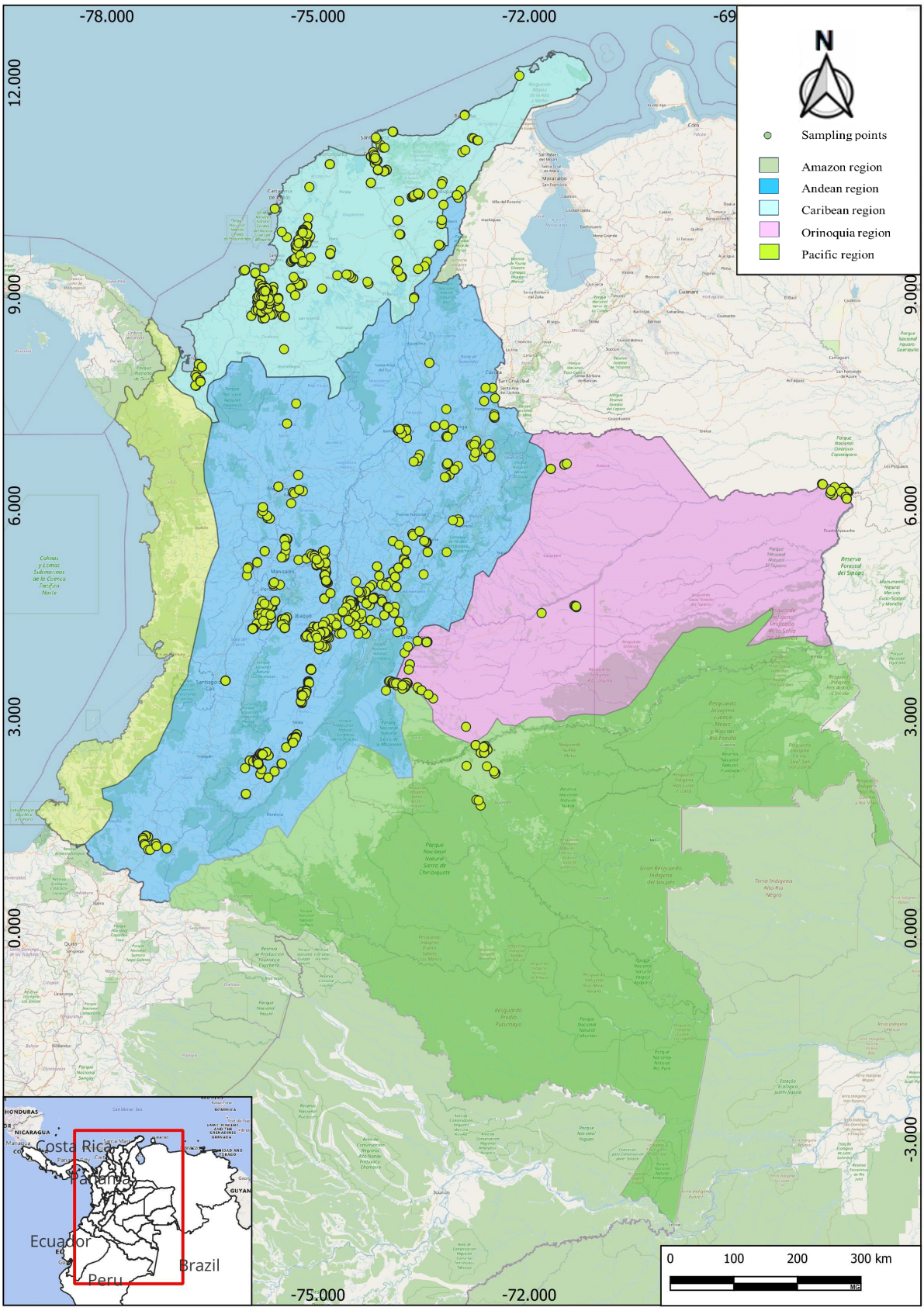

FIGURE 1. Total distribution of sampling points (n = 4,495) and geographic regions of Colombia, from 2012–2018.

Ng 2009; Cavalleri & Mound 2012; De Borbón 2013; Kumar *et al.* 2013; Lima & Mound 2016) with the help of a Nikon SMZ800 stereoscope and a Nikon Type-119YS2-T microscope with phase contrast and the image analysis programs NIS elements F (v. 4.6) and ToupView-x86. We also carried out direct comparisons with specimens kept in the private collection of Dr. Arturo Goldarazena at MNCN. All information regarding the material collected during fieldwork, including collecting data and associated plants, is available at the repository file of the MNCN (https://doi.org/10.5281/zenodo.12595794).

We deposited the Thysanoptera specimens in the Colección Taxonomica Nacional de Insectos "Luis María Murillo" (CTNI) of AGROSAVIA in Tibaitata research center in Mosquera Cundinamarca-Colombia.

Results

Our survey reports 183 Thysanoptera species for Colombia, belonging to the families Aeolothripidae, Heterothripidae, Phlaeothripidae, and Thripidae (Table 1). The fieldwork revealed 38 new species records for the country, most of which are *Frankliniella* species (14 spp.).

TABLE 1. Checklist of the Thysanoptera from Colombia compiling new records (*) identified through fieldwork conducted between 2012 and 2018, as well as specimens reviewed in collections and literature reports (Moulton 1933; USDA 1937, 1941; Díaz *et al*. 1978; Sakimura & O´Neill 1979; Cárdenas & Corredor 1993; Zapata *et al.* 1994; Mound & Marullo 1996; Marullo & Mound 2000; Arévalo *et al.* 2003; Calixto 2005; Berzosa 2006; Goldaracena & Mound 2010; NHM 2014; Cavalleri & Kaminski 2014; Ebratt *et al.* 2018, 2019; Pereyra *et al.* 2019).

Family	Subfamily	Species
Aeolothripidae		*Aeolothrips surcalifornianus* Johansen
		Ambaeolothrips microstriatus (Hood)
		Erythrothrips diabolus Priesner
		**Erythrothrips stygicus* Hood
		Franklinothrips orizabensis Johansen
		Franklinothrips vespiformis (Crawford DL)
		**Stomatothrips flavus* Hood
Heterothripidae		*Aulacothrips tenuis* Cavalleri & Kaminski
		Heterothrips alvarezi Johansen
		Heterothrips analis Hood
		Heterothrips bolivianus Stannard
		**Heterothrips condei* Moulton
		Heterothrips decoratus Hood
		**Heterothrips flavidus* Hood
		**Heterothrips pedicellatus* Pereyra & Cavalleri
		**Heterothrips prosopidis* Crawford JC
		Heterothrips sericatus Hood
		Heterothrips watsoni Bailey & Cott
		Scutothrips byrsonimae Mound & Marullo
		Scutothrips incaensis Stannard
		**Scutothrips peruvianus* (Hood)
Phlaeothripidae	Idolothripinae	*Diceratothrips picticornis* Hood
		**Elaphrothrips laevicollis* (Bagnall)
	Phlaeothripinae	**Adraneothrips pulchellus* Hood
		Eupathithrips dentipes Bagnall
		Gomphiothrips mercedes Mound & Marullo

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TABLE 1. (Continued)

Family	Subfamily	Species
		Gynaikothrips ficorum (Marchal)
		Haplothrips gowdeyi (Franklin)
		Haplothrips graminis Hood
		**Holopothrips* sp.
		Hoplandrothrips flavipes Bagnall
		Hoplandrothrips nigricestus Hood
		**Karnyothrips flavipes* (Jones)
		Karnyothrips merrilli (Watson)
		Leptothrips columbianus Johansen
		Liothrips salti Moulton
		Macrophthalmothrips hemipteroides (Priesner)
		Psalidothrips conciliatus Hood
		Psalidothrips sturmi zur Strassen
		Rhinoceps jansei Faure
		Trachythrips albipes Hood
Thripidae	Panchaetothripinae	**Caliothrips phaseoli* (Hood)
		Dinurothrips hookeri Hood
		Heliothrips haemorrhoidalis (Bouché)
		Parthenothrips dracaenae Heeger
		Selenothrips rubrocinctus (Giard)
	Sericothripinae	*Hydatothrips sternalis* (Hood)
		Hydatothrips tricinctus (Hood)
		Hydatothrips volcano Mound & Marullo
		Neohydatothrips basilaris (Hood)
		Neohydatothrips burungae (Hood)
		Neohydatothrips gracilipes (Hood)
		Neohydatothrips humberto Mound & Marullo
		**Neohydatothrips inversus* (Hood)
		Neohydatothrips mirandai (Johansen)
		Neohydatothrips rapoporti Johansen
		Neohydatothrips signifer (Priesner)
		Neohydatothrips tibialis (Priesner)
	Thripinae	*Anaphothrips obscurus* (Müller)
		Anaphothrips sudanensis Trybom
		Apterothrips apteris (Daniel)
		Aptinothrips rufus Haliday
		Arorathrips fulvus (Moulton)
		Arorathrips mexicanus (Crawford DL)
		Arorathrips xanthius (Hood)
		Aurantothrips orchidaceus (Bagnall)
		Aurantothrips orchidearum (Bondar)
		Baileyothrips limbatus (Hood)
		**Bolacothrips striatopennatus* (Schmutz)

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TABLE 1. (Continued)

Family	Subfamily	Species
		**Bravothrips kraussi* (Crawford JC)
		**Bravothrips mexicanus* (Priesner)
		Ceratothripoides brunneus Bagnall
		Ceratothripoides chilticus Johansen
		**Ceratothripoides claratris* (Shumsher)
		Ceratothripoides funestus (Hood)
		Ceratothripoides silvestris (Hood)
		Chaetanaphothrips orchidii (Moulton)
		Charassothrips incomparabilis (Johansen)
		Charassothrips macroseta Goldarazena & Mound
		Charassothrips piperaffinis (Johansen)
		Charassothrips urospathae Hood
		Chirothrips manicatus (Haliday)
		Corynothrips stenopterus Williams
		Echinothrips caribbeanus Hood
		Frankliniella aliaepennae Berzosa
		**Frankliniella aureominuta* Johansen
		Frankliniella auripes Hood
		Frankliniella bagnalliana Hood
		Frankliniella bicolor Moulton
		Frankliniella borinquen Hood
		Frankliniella brevicaulis Hood
		**Frankliniella breviseta* Moulton
		Frankliniella bruneri Watson
		Frankliniella brunnea (Priesner)
		Frankliniella caseariae Moulton
		Frankliniella cassiae Berzosa
		Frankliniella caudiseta Sakimura & O´Neill
		Frankliniella cephalica (Crawford DL)
		Frankliniella chamulae Johansen
		Frankliniella citripes Hood
		Frankliniella colombiana Moulton
		**Frankliniella condei* John
		Frankliniella cotubrusensis Retana & Mound
		Frankliniella crawfordi Sakimura & O'Neill
		Frankliniella curta (Hood)
		**Frankliniella davidsoni* Moulton
		Frankliniella desmodii Mound & Marullo
		Frankliniella distinguenda Bagnall
		Frankliniella diversa Hood
		Frankliniella espeletiae Berzosa
		Frankliniella fallaciosa Priesner
		Frankliniella fulvipennis Moulton

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TABLE 1. (Continued)

Family	Subfamily	Species
		**Frankliniella fulvipes* Bagnall
		Frankliniella gardeniae Moulton
		Frankliniella gemina Bagnall
		Frankliniella gossypiana (Hood)
		Frankliniella insularis (Franklin)
		Frankliniella invasor Sakimura
		Frankliniella kelliae Sakimura
		Frankliniella lorena Mound & Marullo
		**Frankliniella mekokara* Mound & Marullo
		Frankliniella melanommata Williams
		Frankliniella minuta (Moulton)
		Frankliniella musaeperda Hood
		**Frankliniella nakaharai* Sakimura & O'Neill
		**Frankliniella nigricauda* Hood
		Frankliniella occidentalis (Pergande)
		**Frankliniella oxyura* Bagnall
		Frankliniella panamensis Hood
		Frankliniella paramorum Berzosa
		Frankliniella parvula Hood
		Frankliniella peruviana Hood
		Frankliniella pestinae Sakimura & O´Neill
		**Frankliniella pulchella* Hood
		Frankliniella regentis Berzosa
		Frankliniella rostrata Priesner
		Frankliniella salviae Moulton
		Frankliniella schultzei (Trybom)
		Frankliniella senckenbergiana Berzosa & Maroto
		**Frankliniella serrata* Moulton
		Frankliniella simplex Priesner
		**Frankliniella sueoa* Mound & Marullo
		Frankliniella trisetosa Hood
		Frankliniella tritici (Fitch)
		**Frankliniella tuberosi* Moulton
		Frankliniella tympanona Hood
		Frankliniella valdiviana Sakimura & O´Neill
		Frankliniella vargasi Retana & Mound
		**Frankliniella varipes* Moulton
		Frankliniella verbesinae Sakimura
		Frankliniella williamsi Hood
		Microcephalothrips abdominalis (Crawford DL)
		Nexothrips perseae Marullo & Mound
		**Oxythrips* sp.
		Psectrothrips delostomae Hood

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TABLE 1. (Continued)

Family	Subfamily	Species
		Psectrothrips interruptus (Hood)
		Psectrothrips palmerae Mound & Marullo
		Pseudothrips retanae Mound & Marullo
		Rhamphothrips pandens Sakimura
		**Salpingothrips minimus* Hood
		**Scirtidothrips torquatus* Hood
		Scirtothrips bisbravoae Johansen
		Scirtothrips dorsalis Hood
		Scirtothrips euthyntus Mound & Marullo
		Scirtothrips hansoni Mound & Hoddle
		**Scirtothrips ikelus* Mound & Marullo
		Scirtothrips lumarius Mound & Marullo
		Scirtothrips manihoti (Bondar)
		Scirtothrips multistriatus Hood
		Scirtothrips panamensis Hood
		Scirtothrips perseae Nakahara
		Scolothrips tenuipennis zur Strassen
		Stenchaetothrips biformis (Bagnall)
		Tenothrips frici (Uzel)
		Thrips australis (Bagnall)
		**Thrips brevipilosus* Moulton
		**Thrips florum* Schmutz
		Thrips helianthi Morgan
		Thrips palmi Karny
		Thrips simplex (Morison)
		Thrips tabaci Lindeman
		**Thrips trehernei* Priesner
		Thrips vulgatissimus Haliday

Thripidae is the most diverse family, with 142 species. Within this family, the richest genera are *Frankliniella* with 67 species, followed by *Scirtothrips* with 10 species and *Thrips* with nine species. This makes Colombia the South American country with the highest richness of the speciose genus *Frankliniella* (Ortíz 1977; Cavalleri & Mound 2012; Lima & Miyasato 2017; De Borbón & Zamar 2018; Cazorla-Perfetti 2019), which reflects the wide altitudinal and floristic Colombian diversity. On the other hand, only five of the almost 30 Panchaetothripinae species in South America (Lima *et al.* 2021) are recorded in Colombia. This indicates that the richness of thrips in Colombia is still underrepresented, and more surveys should be conducted in the country. All these species are primarily phytophagous, and some are mentioned as pests (Mound *et al.* 2022). The family Heterothripidae comprises 14 species in four genera in Colombia. All *Heterothrips* and *Scutothrips* species feed exclusively on flowers, whereas *Aulacothrips* species are ectoparasites of treehoppers (Mound & Marullo 1996; Cavalleri & Kaminski 2014).

Aeolothripidae is represented by seven species in five genera. This family includes facultative or obligatory predatory species, such as those in the genera *Franklinothrips* and *Stomatothrips*, and the flower-living *Aeolothrips* (Mound & Marullo 1996). Additionally, 20 species are classified in Phlaeothripidae, with 18 belonging to the large subfamily Phlaeothripinae, which includes species with a wide range of feeding behaviors. The two species recorded in the subfamily Idolothripinae are known to ingest fungal spores (Mound & Marullo 1996).

Phlaeothripidae currently comprises more than 3,700 species worldwide and is the richest group in the order (ThripsWiki 2023). The relatively low number of species in this group in our list likely results from the lack of extensive sampling in specific microhabitats such as leaf litter, dead twigs, and galls, where these insects tend to be more diverse.

The species *Frankliniella bagnalliana* Hood (catalog number NHMUK014233252, NHMUK014233188) and *Liothrips vernoniae* Moulton (catalog number NHMUK014745045, NHMUK014745063, NHMUK014745044, NHMUK014745062, NHMUK014745064, NHMUK014745049, NHMUK014745050) were included in this article, from specimens previously collected in Colombia and deposited at NHM, however, they are not mentioned in the scientific literature. Concerning the identification labels for the *L. vernoniae* slides, curiously, the species is not indicated. Only the genus is mentioned. It is necessary to conduct a subsequent review of these slides to corroborate the information.

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