Presence and Distribution of *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) in Colombia

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Abstract

The presence and distribution of *Scirtothrips dorsalis* was reported in Colombia in the Andean, Caribbean, and Orinoquia regions, from 0 to 1,200 meters of altitude (MASL) in the warm climate zone, with less than 2,000 mm rainfall per year and a temperature above 24°C, which corresponds to the tropical dry forest life zone (TDF). Larvae and adults of *S. dorsalis* were found on 13 plant species belonging to 12 genera in 12 families, of 181 plant species sampled from 129 genera in 47 families sampled. The botanical species with *S. dorsalis* presence included cotton (*Gossypium hirsutum* L.), mango (*Mangifera indica* L.), chili pepper (*Capsicum frutescens* L.), bell pepper (*Capsicum annuum* L.), orange (*Citrus sinensis* L.), jasmine orange (*Murraya paniculata* L.), rose (*Rosa* sp.), and the weeds *Sesbania exaltata* (Mill.), *Phyllanthus niruri* L., *Ludwigia hyssopifolia* Vahl, *Euphorbia hypericifolia* L., *Echinochloa colona* L., and *Amaranthus spinosus* (L.). *S. dorsalis* prefers young leaves and floral structures, but in cotton it was also associated with squares. The low number of host plants is evident, far from the extensive lists obtained by other authors in other latitudes. *S. dorsalis* invaded Colombia only in recent years, and this is the first study of the presence and distribution of this thrips in the area.

Key words: distribution, host plant, niche, trips

Resumen

Se reportó la presencia y distribución de *Scirtothrips dorsalis* en Colombia, en las regiones Andina, Caribe y Orinoquia, desde los 0 hasta los 1200 metros de altitud (msnm), en el piso térmico cálido, con precipitación inferior a los 2000 mm anuales y temperatura superior a los 24°C, en correspondencia con la zona de vida bosque seco tropical (bs-T). Se encontraron larvas y adultos de *S. dorsalis* en 13 especies botánicas, 12 géneros y 12 familias, de las 181 especies botánicas, 129 géneros y 47 familias muestreadas. Las especies botánicas con presencia de *S. dorsalis* incluyeron el algodón (*Gossypium hirsutum* L.), mango (*Mangifera indica* L.), ají (*Capsicum frutescens* L.), pimiento (*Capsicum annuum* L.), naranja (*Murraya paniculata* L.), rosa (*Rosa* sp.) y las arvenses *Sesbania exaltata* (Mill.), *Phyllanthus niruri* L., *Ludwigia hyssopifolia* Vahl, *Euphorbia hypericifolia* L., *Echinochloa colona* (L.) y *Amaranthus spinosus* (L.). En todas las especies muestreadas, a excepción del algodón, las preferencias por las estructuras vegetales se orientaron por las hojas jóvenes y estructuras florales, en algodón también se asoció a capsulas. Se evidencia el bajo número de plantas hospedantes, distante de los extensos listados obtenidos por otros autores en otras latitudes. El estudio presentado aquí es el primero en Colombia que examina la presencia y distribución de *S. dorsalis* en áreas que ha invadido en los últimos años.

Palabras clave: distribución, hospedante, nicho, trips
context, the most important species of Thysanoptera for agricultural production are grouped in the genera *Caliothrips* Daniel, *Retithrips* Marchal, *Sericothrips* Haliday, *Thrips* Linnaeus, *Frankliniella* Karny, and *Scirtothrips* Shull (Leigh 1995, Mailhot et al. 2007). The genus *Scirtothrips* has 100 described species (ThripsWiki 2017), distributed in the tropical and subtropical areas of the world, with relevant species considered of economic importance for world agriculture such as *Scirtothrips ananii*, *Scirtothrips citri*, *Scirtothrips perseae*, *Scirtothrips inermis*, *Scirtothrips mangiferae*, *Scirtothrips oligochaeus*, and *Scirtothrips dorsalis* (Hoddle and Mound 2003, EPPO 2005).

*S. dorsalis* Hood has been associated with young leaves, flowers, and terminal shoots in more than 200 species of dicotyledonous plants, in about 40 botanical families (Hoddle and Mound 2003). It preferentially feeds on the epidermis, and occasionally, on palisade tissues in young leaves and tissues of the apex of young fruits, especially when they are still hidden under the calyx. In many hosts, it can feed on upper surfaces of leaves when the levels of infestation are high. Larvae and adults are often located toward the main central vein of young leaves or near the damaged area of leaf tissues. Pupae can be found in the leaf litter on the soil, in the axils of the leaves, in curled leaves or under the calyx (Kumar et al. 2013).

The feeding damage of *S. dorsalis* is characterized by bronzed scars on the leaves, petals, and epidermis of fruits. A concentric ring is often formed in the scarred tissue around the apex, fruit distortion, and premature leaf senescence (Kumar et al. 2013). In addition, it has the capacity to transmit phytopathogenic viral particles of Tospovirus (= Bunyavirales: Tospoviridae: Orthotospoviruses) (Jones 2005, Adams et al. 2017) that cause considerable losses in yields, profitability, and may lead to the implementation of excessive and restrictive control measures in export markets (Riley et al. 2011, Ebratt et al. 2013).

*S. dorsalis* is native to tropical Asia (Dev 1964, Mound and Palmer 1981) but it currently occurs in Australia, the Solomon Islands, Israel, the Caribbean region (Kumar et al. 2013), North America (Nietschke et al. 2008) and South America in Surinam, Venezuela (Cermeli et al. 2009), and Colombia (ICA 2012). In Colombia, this species has been recorded in Huila, Tolima, and Vichada departments (ICA 2012). *S. dorsalis* is successful in expanding its geographical distribution range due to passive transport through human activities, new sites to colonize derived by climate change, and the lack of predators or specific plant defenses in its host that restrict its colonization (Kumar et al. 2013). This could be considered a biological invasion, as it is a nonnatural distribution process caused by human commercial activity (Gutiérrez 2006). Rodríguez (2006) and Kenis et al. (2008), recognize that the invasion of ecosystems by introduced species is one of the greatest threats to biodiversity and the structure of communities, with direct negative impacts of nonnative species on the native biota, with effects on predation, hybridization, generation of changes in ecosystem processes, loss of biodiversity, population imbalances, and competition for habitats.

In order to update the status of this economically important species in Colombia, the purpose of this study was to determine the geographical distribution and identification of plants associated and nonassociated with *S. dorsalis* in three ecological regions of Colombia where main agricultural crops are established.

**Materials and Methods**

**Geographic Location and Sampling**

This study was carried out between 2013 and 2016 and is part of the doctoral thesis project: Diversity and geographical distribution of Thysanoptera: Tripiniae with emphasis on *Frankliniella* Karny in Colombia. Samples were collected covering ranges of 500 meters of altitude from 0 to 3,000 meters above sea level (MASL), in several life zones such as tropical dry forest, lower montane dry forest, lower montane moist forest, tropical moist forest, premontane moist forest, premontane very moist forest, premontane pluvial forest, lower montane very moist forest, tropical very dry forest, and premontane transitional moist forest in the Andean region; tropical dry forest, tropical very dry forest, tropical moist forest, premontane dry forest, premontane very moist forest, premontane pluvial forest, lower montane very moist forest, tropical very dry forest, and premontane transitional moist forest in the Andean region; tropical dry forest, tropical very dry forest, tropical moist forest, premontane dry forest, premontane very moist forest, tropical thorn forest in the Caribbean region and, the tropical dry forest and the tropical rain forest zone of the Orinoquia region (Holdridge 1967, IAvH 2014) in different

![Fig. 1. Presence of *S. dorsalis* in Colombia: A. Total distribution of sampling points (*N* = 1,227). B. Points with presence of *S. dorsalis* in Colombia (*N* = 169).](image-url)
Table 1. Plants host of *S. dorsalis* in Colombia in the tropical dry forest (TDF) life zone

| Plant Species      | Family        | Region    | Department | Municipality  | Altitude | Latitude | Longitude | System   | Number of monitored plants | Number of occurrence | Number of adults | Number of larvae |
|--------------------|---------------|-----------|------------|---------------|----------|----------|-----------|----------|----------------------------|----------------------|------------------|-----------------|
| *Amaranthus spinosus* | Amaranthaceae | Caribbean | Cesar      | Bosconia      | 114      | 10,052   | -73,867   | Weed     | 4                          | 1                    | 1                | 1               | 6               |
| *Capsicum annuum*   | Solanaceae    | Andean    | Huila      | Pital         | 960      | 2,188    | -75,817   | Crop     | 10                         | 1                    | 2                | 3               |
|                     |               |           | Tolima     | Coello        | 486      | 4,276    | -75,015   |          | 10                         | 1                    | 5                | 5               |
| *Capsicum sp*       | Solanaceae    | Caribbean | Bolivar    | San Jacinto   | 265      | 9,829    | -75,135   | Crop     | 10                         | 1                    | 2                | 1               |
|                     |               |           | Tolima     | Carmen de Bolivar | 369    | 9,739   | -75,236   |          | 10                         | 1                    | 2                | 1               |
| *Citrus sp*         | Rutaceae      | Caribbean | Magdalena  | Zona Bananera | 40       | 10,765   | -74,147   | Crop     | 10                         | 1                    | 1                | 12              |
|                     |               |           | Tolima     | Espinal       | 318      | 4,205    | -74,881   |          | 10                         | 1                    | 7                | 4               |
| *Echinochloa colona*| Poaceae       | Andean    | Tolima     | Espinal       | 388      | 4,127    | -74,841   | Weed     | 3                          | 1                    | 4                | 5               |
| *Euphorbia hypericifolia* | Euphorbiaceae | Andean    | Huila      | Villavieja    | 387      | 3,196    | -75,229   | Weed     | 3                          | 1                    | 1                | 1               |
| *Gossypium hirsutum* | Malvaceae     | Andean    | Tolima     | Armero        | 312      | 5,042    | -74,905   | Crop     | 10                         | 2                    | 5                | 1               |
|                     |               |           | Tolima     | Espinal       | 368      | 5,111    | -74,890   |          | 10                         | 2                    | 6                | 1               |
|                     |               |           | Tolima     | Espinal       | 318      | 4,152    | -74,854   | Crop     | 10                         | 4                    | 74               | 23              |
|                     |               |           | Tolima     | Espinal       | 356      | 4,177    | -74,926   |          | 10                         | 1                    | 3                | 1               |
|                     |               |           | Tolima     | Espinal       | 319      | 4,134    | -74,847   |          | 10                         | 2                    | 27               | 9               |
|                     |               |           | Tolima     | Espinal       | 342      | 4,157    | -74,949   |          | 10                         | 2                    | 4                | 5               |
| *Natagaima*         |               |           | Andean     | Coello        | 348      | 3,497    | -75,138   | Crop     | 10                         | 4                    | 33               | 7               |
|                     |               |           | Andean     | Coello        | 347      | 3,503    | -75,141   |          | 10                         | 4                    | 22               | 2               |
|                     |               |           | Andean     | Coello        | 348      | 3,509    | -75,135   |          | 10                         | 2                    | 17               | 2               |
|                     |               |           | Andean     | Coello        | 344      | 3,485    | -75,139   |          | 10                         | 2                    | 10               | 8               |
|                     |               |           | Andean     | Coello        | 347      | 3,490    | -75,131   |          | 10                         | 2                    | 9                | 4               |
|                     |               |           | Andean     | Coello        | 333      | 3,684    | -75,104   |          | 10                         | 3                    | 18               | 9               |
|                     |               |           | Andean     | Coello        | 333      | 3,674    | -75,106   |          | 10                         | 4                    | 54               | 2               |
|                     |               |           | Andean     | Coello        | 329      | 3,676    | -75,101   |          | 10                         | 4                    | 17               | 4               |
|                     |               |           | Andean     | Coello        | 263      | 4,424    | -74,839   |          | 10                         | 1                    | 8                | 10              |
| *Citrus*            | Rutaceae      | Caribbean | Magdalena  | Zona Bananera | 374      | 3,382    | -75,172   | Crop     | 10                         | 1                    | 3                | 3               |
|                     |               |           | Tolima     | Espinal       | 373      | 3,374    | -75,171   |          | 10                         | 3                    | 6                | 2               |
|                     |               |           | Tolima     | Espinal       | 387      | 3,260    | -75,237   |          | 10                         | 1                    | 1                | 16              |
|                     |               |           | Tolima     | Espinal       | 402      | 3,210    | -75,254   |          | 10                         | 2                    | 7                | 1               |
|                     |               |           | Tolima     | Espinal       | 387      | 3,213    | -75,230   |          | 10                         | 1                    | 9                | 1               |
|                     |               |           | Tolima     | Espinal       | 383      | 3,218    | -75,230   |          | 10                         | 2                    | 7                | 1               |
|                     |               |           | Tolima     | Espinal       | 386      | 3,213    | -75,228   |          | 10                         | 2                    | 29               | 1               |
|                     |               |           | Tolima     | Espinal       | 376      | 3,354    | -75,198   |          | 10                         | 3                    | 15               | 3               |
|                     |               |           | Tolima     | Espinal       | 377      | 3,355    | -75,204   |          | 10                         | 3                    | 12               | 6               |
|                     |               |           | Tolima     | Espinal       | 365      | 3,307    | -75,189   |          | 10                         | 1                    | 2                | 9               |
|                     |               |           | Tolima     | Espinal       | 364      | 3,345    | -75,175   |          | 10                         | 1                    | 3                | 13              |
|                     |               |           | Tolima     | Espinal       | 361      | 3,349    | -75,185   |          | 10                         | 1                    | 4                | 3               |
|                     |               |           | Tolima     | Espinal       | 361      | 3,349    | -75,181   |          | 10                         | 2                    | 6                | 1               |
|                     |               |           | Tolima     | Espinal       | 362      | 3,348    | -75,182   |          | 10                         | 1                    | 5                | 5               |
|                     |               |           | Tolima     | Espinal       | 366      | 3,345    | -75,173   |          | 10                         | 1                    | 4                | 4               |
| *Campoalegre*       |               |           | Andean     | Campoalegre   | 498      | 2,705    | -75,350   |          | 10                         | 3                    | 19               | 2               |
|                     |               |           | Andean     | Campoalegre   | 507      | 2,711    | -75,358   |          | 10                         | 2                    | 18               | 6               |
| Plant Species | Family | Region | Department | Municipality | Altitude | Latitude  | Longitude  | System      | Number of monitored plants | Number of occurrence | Number of adults | Number of larvae |
|---------------|--------|--------|------------|--------------|----------|-----------|------------|-------------|----------------------------|---------------------|----------------|-----------------|
| Ludwigia hyssopifolia | Onagraceae | Andean | Tolima | Espinal | 388 | 4.17216 | -74.84169 | Weed | 5 | 1 | 3 | 4 |
| Mangifera indica | Anacardiaceae | Caribbean | Magdalena | Zona Bananera | 40 | 10.75645 | -74.14754 | Crop | 10 | 1 | 29 | 2 |
| Murrya paniculata | Rutaceae | Andean | Tolima | Coello | 486 | 4.27647 | -75.01584 | Crop | 10 | 1 | 3 | 5 |
| Phyllanthus niruri | Euphorbiaceae | Caribbean | Magdalena | Zona Bananera | 40 | 10.75646 | -74.14754 | Backyard | 10 | 1 | 1 | 5 |
| Rosa sp | Rosaceae | Caribbean | Bolivar | Carmen de Bolivar | 310 | 9.73419 | -75.22069 | Backyard, | 4 | 1 | 3 | 13 |
| Sesbania exaltata | Fabaceae | Andean | Huila | Villavieja | 383 | 3.21127 | -75.22466 | Weed | 1 | 1 | 7 | 2 |
| **TOTAL** | | | | | 809 | 169 | 1267 | 424 |
agro-ecosystems of the Andean, Caribbean, and Orinoquia regions of Colombia (Fig. 1A).

For the development of the monitoring activities, we conducted collection tours to each geographical region and in different agricultural areas of 23 departments in Colombia. Six agricultural crops were selected, 10 plants per hectare were sampled and in each plant three structures. For the weeds and wild plants one to five plants were sampled. In total, 11,590 of entomological samples were collected in 4,555 monitoring points; 674 entomological samples corresponded to cotton, 33 to chili pepper, 33 to bell pepper, 221 to mango crops, 75 to orange, 225 to rose flower, 608 for weeds, and 9,721 to other plant species.

Samples were collected by beating of leaves, floral structures, and fruits in different agricultural production systems, in weeds, backyard, and wild plants using a 0.00 caliber brush moistened with 70% ethanol, and white plastic plates were used to collect the individuals. Finally, the specimens were deposited in 1.5 ml Eppendorf tubes with 70% ethanol. Each sample was assigned with a unique identification code.

Treatment of the Sample
From the specimens obtained, the larval stages were separated from the adults. The thrips were sorted by morphotypes and they were identified. The specimens were cleared in cold 5% KOH, followed by washing with distilled water. Subsequently, larvae and adults were mounted in Hoyer’s medium in slides, and dried in the oven for 48 h at 35–40°C, according to Mound and Marullo (1996). Few specimens of each species were mounted in Canada Balsam for the permanent collection according to Mound and Marullo (1996). The taxonomic determination of adults was carried out based on morphological characters according to available keys (Hoddle and Mound 2003, Kumar et al. 2013) and larvae were identified based on Vierbergen et al. (2010) with the help of a Leica ZOOM 2000 stereoscope and a Nikon morphological type-119YS2-T microscope.

Identification of Plants
Taxonomic keys of the Flora of Colombia were used (Gentry 1996, Bernal et al. 2015) and comparisons were made with the herbarium of the Institute of Natural Sciences of the National University of Colombia.

Data Analysis
The association of \textit{S. dorsalis} with the plants according to the botanical family, genus, species, and plant structure was also determined. Based on the abundance of adults in plant structures (young leaf, floral bud, flower, and fruit), the similarity among them was

![Fig. 2. Abundance of S. dorsalis in correlation with altitude (MASL), average annual temperature (°C), and average annual precipitation in Colombia.](image)

![Fig. 3. Estimated probability of the presence of S. dorsalis in Colombia, at different temperatures (°C) (N = 1,057; \( r^2 = 0.8462 \); area under the curve (AUC) = 0.760; \( P = 0.0001 \)) and altitudinal gradient in meters (N = 1057; \( r^2 = 0.9987 \); AUC = 0.685; \( P = 0.001 \)).](image)
The presence of *S. dorsalis* was correlated with the climatic variables temperature (°C—annual average), precipitation (mL—annual average), and altitude (MASL) by means of Spearman ranges; in addition, the probability of encounter based on the climatic variables was determined through logistic regressions. The software ArcGIS 10.1 (ArcMap version 10.1), and the programs STATISTICA v10, InfoStat v2008, Past v3, and SAS v9.2 were used.

**Results**

**Presence of *S. dorsalis* in Colombia**

The presence of larvae and adults of *S. dorsalis* was recorded in 169 (13.77%) of 1227 sampled sites (Fig. 1A). One hundred and thirty two sampled sites (78.24%) in the Andean region, especially in the warm valley of the upper Magdalena (departments of Tolima, Huila, and Cundinamarca); 27 (15.88%) in the Caribbean region in the departments of Córdoba, Sucre, Bolívar, Magdalena, and Cesar; and 10 (5.88%) in the Orinoquia region, in the natural savannah of the municipality of Puerto Carreño, northeast of the department of Vichada (Fig. 1B). All samples of *S. dorsalis* were collected in the tropical dry forest zone (TDF).

**Geographic and Altitudinal Distribution**

*S. dorsalis* was reported in the Andean, Caribbean, and Orinoquia regions with an estimated altitudinal distribution from 0 to 1,200 meters (n = 295; \( r = -0.8003; P = 0.00001 \)), average annual temperatures higher than 24.4°C (n = 295; \( r = 0.7789; P = 0.00001 \)), and average annual precipitation less than 1683.4 mL (n = 295; \( r = -0.4554; P = 0.00001 \)) (Table 1, Fig. 2). The logistic regression model adjusted for the variable temperature (\( P_{S. dorsalis} = 1/1 + e^{(-31.798 - 1.237)} \)) suggests that there is a probability ≥50% \( (r^2 = 0.8462, \text{area under the curve (AUC) } = 0.760; P < 0.001) \) of absence of *S. dorsalis* in areas with temperature ≤20°C, and altitudinal ranges above ≥1,200 MASL (\( P_{S. dorsalis} = 1/1 + e^{(-0.813 - 0.022)} \)) (\( r^2 = 0.9987; \text{AUC} = 0.685; P = 0.001 \)) (Fig. 3).

**Distribution According to the Life Zone**

One hundred percent (100%) of the positive reports of *S. dorsalis* were located in the TDF in the Andean, Caribbean, and Orinoquia regions (Table 1).

**Host Botanical Species and Preferences for Structures**

Of the 184 botanical species sampled, which were grouped into 131 genera and 44 families, *S. dorsalis* was found in 13 species of 12 genera and 10 botanical families, all angiosperms. The 13 botanical species were related to agricultural systems in cotton, orange, bell pepper, chili pepper, and mango crops; the presence in plants of *Rosa sp.* It was also evidenced in gardens and backyards in the municipalities of Carmen de Bolívar (Department of Bolívar, Caribbean region), Flandes, and Guamo (Department of Tolima, Andean region). All plant species with presence of *S. dorsalis* corresponded to true host plants due to the report of larvae stages and suggest a first list of host plants for the presence in the botanical families Malvaceae, Anacardiaceae, Solanaceae, Rutaceae, Poaceae, Amaranthaceae, Euphorbiaceae, Onagraceae, Rosaceae, and Fabaceae (Table 1).

Larvae and adult stages of *S. dorsalis* were found in leaves, flower buds, and squares of cotton (*Gossypium hirsutum*); in leaves and inflorescences of mango (*Mangifera indica*) crop; in leaves and flowers of orange (*Citrus sinensis*), and in leaves and flowers of bell pepper and chili pepper (*Capsicum annum*, *Capsicum frutescens*).

*S. dorsalis* prefers young leaves (38.46%, \( n = 65 \) occurrence), followed by flowers (22.48%, \( n = 38 \) occurrence), fruits (21.89%, \( n = 37 \) occurrence in cotton squares), and flower buds (17.16%, \( n = 29 \) occurrence). The Bray–Curtis similarity index showed that *S. dorsalis* preferred young leaves and buds, compared with the other structures of the host plants (Fig. 4).

In this study, *S. dorsalis* is nonhost in 175 botanical species in 119 genera (Table 2).

**Discussion**

**Presence of *S. dorsalis* in Colombia**

*S. dorsalis* is a nonnative polyphagous species of recent report in Colombia (Seal et al. 2010, ICA 2012) with a high capacity to occupy large areas and geographic distribution. It is also a species with a high degree of environmental and phytosanitary risk since it could generate negative effects on the native flora and on the expected yields in cultivated plants of economic interest for the agriculture of Colombia. It is evident that the introduction and establishment of species such as *S. dorsalis* would be able to affect existing trophic networks and could alter processes of population dynamics that allow the regulation of species (Morse and Hoddle 2006).

The presence of *S. dorsalis* in the warm climate zone of the Andean, Caribbean, and Orinoquia regions of Colombia, in tropical dry forest areas (TDF) (Holdridge 1967), coincides with the results obtained by other authors (Cermelli et al. 2009) and could provide elements to characterize and potentially delimit the occupation and invasion areas, by recognizing the optimal climatic variables of its ecological niche. In Colombia, tropical dry forests correspond to a plant formation that presents a continuous, nKDense forest cover. They are distributed between 0 and 1,000 MASL, with one or two periods of drought per year.

![Fig. 4. Preferences for plant structures, using the Bray–Curtis similarity index in 13 botanical species associated with *S. dorsalis* in three geographic regions of Colombia (N = 169; Cophenetic corr. = 0.948; read cases = 169; omitted cases = 0; P < 0.05).](image-url)
| Plant species       | Family            | Region | Number of monitored plants | Plant species       | Family            | Region | Number of monitored plants | Plant species       | Family            | Region | Number of monitored plants |
|---------------------|-------------------|--------|----------------------------|---------------------|-------------------|--------|----------------------------|---------------------|-------------------|--------|----------------------------|
| Acacia sp           | Fabaceae          | A      | 2                          | Emilia sp           | Asteraceae        | A,O    | 2                          | Pium sativum       | Fabaceae          | A      | 5                          |
| Ageratum sp         | Asteraceae        | C      | 1                          | Euphorbia catinfolia| Euphorbiaceae     | C,O    | 2                          | Pithecellobium      | guachapele         | A      | 1                          |
| Allium cepa         | Amaryllidaceae    | A      | 4                          | Euphorbia heterophylla | Pris tlapulaceae | Verbenaceae    | A      | 1                          |
| Allium fistulosum   |                    | A      | 1                          | Euphorbia hirta     | Prunus domestica  | Rosaceae      | A      | 2                          |
| Allium sativum      |                    | A      | 3                          | Euphorbia postrata  | Prunus persica    | A      | 3                          |
| Amananthus sp       |                    | A      | 1                          | Pragaria ananassa   | Prunus sp         | A      | 1                          |
| Amananthus dubius   |                    | A      | 5                          | Funastrum clausum   | Psyidium guajava  | Myrtaceae    | O      | 9                          |
| Ambunum sp          | Araceae           | A      | 1                          | Fungastra satum     | Pruna communis   | Rosaceae      | A      | 1                          |
| Anacida puncto      | Fabaceae          | A,C    | 4                          | Funica adina        | Funica adina     | A      | 4                          | Quercus sp         | Fabaceae          | C      | 2                          |
| Asparagous          | Asparageae        | A      | 1                          | Galinsoga pasiflora  | A      | 1                          | Raphanus sp       | Brassicaceae       | A      | 7                          |
| Baccharis prunifolia| Asteraceae        | A      | 1                          | Galinsoga sp        | A      | 1                          | Raphanus sp       | A      | 5                          |
| Bashina forficata   | Fabaceae          | C      | 1                          | Glrisida sepium     | A,C,O            | 9                  | Rhyndosia minima  | Fabaceae          | A,C    | 7                          |
| Bidens pilosa       | Asteraceae        | A      | 1                          | Helichryum coronarium | A      | 1                          | Ricinus communis  | Euphorbiaceae      | A      | 1                          |
| Bixa orellana       | Bixaceae          | A      | 10                         | Helianthus ananuas  | A      | 1                          | Rubus glaucus     | Rosaceae          | A      | 26                         |
| Boerhavia decumbens| Nyctaginaceae     | A      | 1                          | Heliotropium argyropetum | A      | 3                  | Rubus sp         | Rubus sp          | A      | 1                          |
| Boerhavia erecta    | Rubiaceae         | A      | 1                          | Heliotropium indicum | C      | 1                          | Ruelka tuberosa   | Acanthaceae       | A      | 1                          |
| Bororera capiata    | Rubiaceae         | C      | 2                          | Heliotropium sp     | A      | 1                          | Ruta sp          | Rutaceae          | A      | 1                          |
| Bororera laevis     | A      | 1                          | Homoepis alternata      | A      | 1                          | Sambucus sp      | Adoxaceae        | O      | 1                          |
| Brassica napa       | Brassicaceae      | A      | 1                          | Hvea brasiensis     | Euphorbiaceae     | O      | 5                          | Sarcostemma clausum | Acanthaceae       | A      | 1                          |
| Caesalpina coiraria | Fabaceae          | C      | 1                          | Holcus lanatus      | Poaceae          | A      | 1                          | Saurana scabna    | Actinidiaceae     | A      | 1                          |
| Caesalpina sp       | Fabaceae          | C      | 1                          | Hypochaeras radicata| A      | 1                          | Scoparia dulcis   | Scrophylaceae     | A      | 1                          |
| Callandia surinamensis |                 | C      | 1                          | Hyptis mutabilis    | Lamiaceae        | C      | 1                          | Senna occidentalis | Fabaceae          | A      | 1                          |
| Callandia trimenina |                    | C      | 1                          | Inga densiflora     | Fabaceae          | C      | 1                          | Senna sp          | A,C    | 7                          |
| Calistrops gigantia  | Apocynaceae       | A      | 2                          | Ing edulis          | A      | 2                          | Senna varum      | A      | 1                          |
| Camasa indica       | Cannaceae         | A      | 1                          | Ipomoea pes-caprae  | Convulvulaceae    | O      | 3                          | Sida acuta        | Malvaceae         | A      | 1                          |
| Cannabis sp          | Cannabaceae       | A      | 1                          | Ipomoea sp          | A      | 1                          | Sida paraflorea   | A      | 1                          |
| Cassa acanthomene   | Fabaceae          | A      | 1                          | Kaltrooema maxima   | Zygophyllaceae    | A      | 2                          | Sida thornflica    | A      | 2                          |
| Cassia fistula      |                     | C      | 1                          | Lachemilla orbiculata| Rosaceae        | A      | 1                          | Sibyllum marianum  | A      | 1                          |
| Centrosoma acutifolium |                 | A      | 2                          | Lactua sativa       | A      | 1                          | Solanum tuberosum | A      | 8                          |
| Chamaecria sp       | A      | 1                          | Lagusca mollis        | A      | 2                          | Solanum crotonfolium | A      | 1                          |
| Chrysanthemum sp    | Asteraceae        | A      | 2                          | Lantana camara      | Verbenaceae      | A      | 3                          | Solanum lycopersicum | A      | 5                          |
| Plant species          | Family         | Region | Number of monitored plants | Plant species          | Family         | Region | Number of monitored plants | Plant species          | Family         | Region | Number of monitored plants |
|------------------------|----------------|--------|----------------------------|------------------------|----------------|--------|----------------------------|------------------------|----------------|--------|----------------------------|
| Chrysobalanus icaco    | Chrysobalanaceae | A, C   | 2                          | Lantana sp             | A              | 1      |                            | Solanum melongena     | A, C           | 6      |                            |
| Cissus verticillata    | Vitaceae       | A      | 1                          | Leptodictya scabra     | Poaceae        | A      | 11                         | Sorghum bicolor       | Poaceae        | C      | 1                            |
| Citrus lanatus         | Cucurbitaceae  | O      | 1                          | Licania sp             | Chrysobalanaceae| C      | 1                          | Sphagnicola triloba   | A              | 2      |                            |
| Citrus aurantifolia    | Rutaceae       | A, O   | 6                          | Ludwigia sp            | Onagraceae     | A      | 1                          | Spinacia oleracea      | Amaranthaceae   | A      | 1                            |
| Citrus limon           | A              | 2      |                            | Malus domestica        | Rosaceae       | A      | 1                          | Tabebuia rosea        | Bignoniaceae    | C      | 1                            |
| Citrus reticulata      | A, O           | 5      |                            | Malvaviscus americannus| Malvaceae      | A      | 3                          | Talinum fruticosum    | Portulacaceae    | A      | 2                            |
| Citrus sinensis        | A, C, O        | 35     |                            | Malvaviscus carolinus  | A              | 1      |                            | Talinum paniculatum   |                             | A      | 1                            |
| Cleome affinis         | Cleomaceae     | A      | 1                          | Mandragora esculenta   | Euphorbiaceae  | A, C, O| 50                         | Tamarindus indica     | Fabaceae        | C      | 1                            |
| Cleome spinosa         | C              | 1      |                            | Melochia parvifolia    | Malvaceae      | A      | 6                          | Tanaxacum officinale  | Asteraeae       | A      | 5                            |
| Cleosperma sp          | A              | 1      |                            | Melochia pyramidata    | A              | 2      |                            | Tanaxacum sp          |                             | A      | 1                            |
| Cnidoscolus setosus    | Rubiaceae      | A, C   | 31                         | Musa paradisiaca       | Musaceae       | A, C, O| 65                         | Tecoma stans          | Bignoniaceae    | A      | 2                            |
| Coffea arabica         | A              | 1      |                            | Momordica charantia    | Cucurbitaceae  | A      | 2                          | Tephrosia sp          | Fabaceae        | A      | 1                            |
| Cordia allidora        | Boraginaceae   | A      | 1                          | Musa sp               | C, O           | 2      |                            | Thevetia peruviana    | Apocynaceae      | A      | 1                            |
| Cordia dentata         | A              | 7      |                            | Nicotiana tabacum      | Solanaceae     | A, C   | 2                          | Tithonia diversifolia | Asteraeae       | A, O  | 4                            |
| Corlandia spinosa      | Apiaceae       | A      | 3                          | Parthenium hysterophorus| Ateraceae     | A      | 1                          | Tithonia sp           |                             | A, O  | 2                            |
| Crescentia cujete      | Bignoniaceae   | C      | 1                          | Passiflora edulis      | Passifloraceae | A, C, O| 39                         | Tridax procumbens    |                             | A, C  | 6                            |
| Crotalaria juncea      | Fabaceae       | A      | 1                          | Passiflora edulis Sims| A              | 2      |                            | Trifolium pratense     | Fabaceae        | A      | 3                            |
| Croton leptostachys    | Euphorbiaceae  | A      | 1                          | Passiflora ligularis   | A              | 4      |                            | Trifolium repens      | Fabaceae        | A      | 4                            |
| Cyathula adyramboideae | Amanthaceae    | A      | 1                          | Passiflora maliformis  | O              | 2      |                            | Trifolium sp          |                             | A      | 5                            |
| Dahlia sp              | Asteraceae     | A      | 3                          | Passiflora quadrangularis |                  | O      | 1                          | Ternae strobilifera   |                             | A      | 1                            |
| Datura innoxia         | Apioaceae      | A      | 1                          | Passiflora tambramiana | A              | 3      |                            | Vicia faba            |                             | A      | 6                            |
| Delphiadelpa scandens  | Euphorbiaceae  | A      | 1                          | Pavonia setum          | Malvaceae      | A      | 1                          | Zantedeschia aethiopica|                             | A      | 2                            |
| Dioscorea sp           | Fabaceae       | A      | 2                          | Persea americana       | Lauraceae      | A, C, O| 151                        | Zea mays             | Poaceae         | A, O  | 48                           |
| Eclipta alba           | Asteraceae     | A      | 1                          | Phaseolus vulgaris     | Fabaceae       | A, C  | 19                         |                             |                             | A      | 1                            |
| Emilia sonchifolia     | A              | 12     |                            | Physalis sp            | Solanaceae     | A      | 1                          |                             |                             | A      | 1                            |
year; they consist of 8,146,000 hectares, which correspond to 11.3% of the territory of Colombia and have distinctive floristic and faunal affinities compared to other life zones (IAVH 2014). According to Hernández (1990), this formation is also known as moist temperate forest, tropical deciduous forest, or drought-deciduous tropical lowland forest in other classification systems. These forests are currently under a high degree of intervention, degradation, use, and extensive over exploitation for agricultural and livestock production.

Geographic and Altitudinal Distribution
Taking into account the objective sampling area that was included in this study and that the first report for Colombia was in the year 2012, it was determined that S. dorsalis is not widely distributed, possibly due to the negative influence of climatic conditions and the presence of different geographic barriers. Temperature is important for the developmental rate of S. dorsalis with a critical threshold between 9.7 and 32°C with an optimal generation rate of 25°C (Tatara 1994, Shibao 1996). In this study, this species was found in an average temperature of 24.4°C in all ecological regions, which means an advantageous condition for its establishment. Additionally, S. dorsalis density has been positively correlated with temperature but negatively correlated with relative humidity and precipitation (Mannion et al. 2014). Because the Andean and Caribbean regions are characterized by a bimodal precipitation regimen with changing seasonal average temperatures, but Orinoquia regions have a monomodal rain regime between April and November with more constant average temperature throughout the year (Pacheco and León-Aristizabal 2001), we expect that geographical dispersion and establishment of S. dorsalis will be different for these three regions.

It is evident that S. dorsalis does not adapt to cold environments with minimum daily temperatures of −4°C for at least 5 d a year; however, in subtropical and tropical environments with warm climate and prolonged droughts, 18 generations can be obtained per year with high population densities (Nietschke et al. 2008, Kumar et al. 2013). Seal et al. (2010) determined that, under the influence of subtropical environmental conditions, S. dorsalis could reach a generation every 27 d, at temperatures >20°C with food sources preferably based on young tissue of host plants such as jalapeño pepper and rose. This circumstance makes the arrival of S. dorsalis, like the arrival of any other invasive organism, reach a level of important phytosanitary risk, given the difficulty to evaluate the impacts generated on natural, intervened, and agricultural ecosystems.

Climatic conditions, which could restrict the presence and establishment of populations of S. dorsalis in the geography of Colombia, have to do with average annual temperatures below 24°C, rainfall above 2,000 mm per year and interactions related to the altitude-temperature at altitudes above 1,200 MASL. These conditions could negatively influence the biology and behavior of the insect and become a natural environmental limit for the distribution, establishment, and reproduction of the species, since they become unfavorable habitats (Nietschke et al. 2008). According to Pulido et al. (2015), to determine these habitats, it is necessary to make predictive models to recognize the distribution according to the ecological niches and potential occupation areas of S. dorsalis.

Host Botanical Species and Preferences for Structures
The larval stages of S. dorsalis were found in 13 plant species that constitute a true hosts (Table 1), where S. dorsalis can develop and complete its life cycle (Mound and Marullo 1996, Marullo 2004, Alves-Silva et al. 2013, Burckhardt et al. 2014). Our results are far less diverse than the reports of CABI (2018) and USDA-APHIS (2006), since S. dorsalis infests a wide variety of host plants belonging to more than 100 plant taxa among 40 families (Mound and Palmer 1981). These records does not necessarily make them true host plants, without the evidence of immature states present in them. The above is relevant, considering that Colombia is the second country with the highest plant biodiversity in the world, with heterogeneous local habitats and isolation, which historically have favored high rates of speciation and endemism in many taxa, benefited by the of climates, floristic mosaics, and biogeographical overlaps between the Andean, Orinoquia, Guyanese, Caribbean, Pacific, and Amazonia regions (Gentry 1988, Josse et al. 2012).

S. dorsalis showed preferences for young leaves and flower buds of different crops, weeds, and wild plants. The preferences for structures were oriented toward young leaves and flower buds in chili pepper, bell pepper, mango, jasmine orange, orange, and rose. In cotton crops, it was reported in the young leaves, flower buds, and fruits. This agrees with Seal et al. (2006) and this species prefers to feed on tender tissues in young leaves in some plant species, and could be limited by the adverse conditions to low temperatures and high rainfall. In general, young leaves infested by thrips have high contents in soluble protein and total nitrogen (Paine 1992). Schoonhoven et al. (2005) propose that high concentrations of secondary metabolites support the direct defense of the plant, which is effective against several species of herbivores, so insect populations must develop efficient strategies for detoxification or regulation of their intake.

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