



# *Macrocheles muscaedomesticae* (Acari: Macrochelidae) associated with *Stomoxys calcitrans* (Diptera: Muscidae) in the municipality of Sabanalarga, Antioquia

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## ABSTRACT

**Objective.** To identify mites in Diptera in a wooded area of Sabanalarga, Department of Antioquia, Colombia. **Materials and methods.** Two “stable flies” (*Stomoxys calcitrans*) were collected in a corral used temporarily to move cattle located in a wooded area of the municipality of Sabanalarga, Antioquia-Colombia. The flies were stored in Eppendorf tubes containing 70% ethyl alcohol for further processing. In the laboratory, the flies were identified, and then the mites they carried on their ventral area were removed and counted. Subsequently, the mites were stored in 70% ethyl alcohol to be rinsed on slides and identified under a light microscope. **Results.** A total of 15 specimens of a mite of the order Mesostigmata, family Macrochelidae of the species *Macrocheles muscaedomesticae*, parasitizing the flies *S. calcitrans*, were identified. **Conclusions.** This is the first report on the parasitic association between phoretic mites *Macrocheles muscaedomesticae* and stable flies *Stomoxys calcitrans* in Sabanalarga, Antioquia-Colombia.

**Keywords:** Mites; arthropods; diptera; ectoparasites; manure; parasitism (Source: DECS, CAB).

## RESUMEN

**Objetivo.** Identificar ácaros presentes en dípteros en una zona boscosa de Sabanalarga, Departamento de Antioquia, Colombia. **Materiales y métodos.** Se colectaron dos “moscas de los establos” (*Stomoxys calcitrans*) en un corral utilizado temporalmente para el traslado de ganado, ubicado en una zona boscosa del municipio de Sabanalarga, Antioquia-Colombia. Las moscas fueron almacenadas en tubos Eppendorf con alcohol etílico al 70%, para su posterior procesamiento. En el laboratorio, las moscas fueron identificadas, y se les retiraron y contaron los ácaros que ellas portaban en su zona ventral. Luego, los ácaros fueron almacenados en alcohol al etílico 70%, para luego ser

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aclarados en láminas portaobjetos e identificados al microscopio de luz. **Resultados.** Se identificó un total de 15 especímenes de un ácaro del orden Mesostigmata, familia Macrochelidae de la especie *Macrocheles muscaedomesticae*, parasitando las moscas *S. calcitrans*. **Conclusiones.** Se reporta por primera vez la asociación parasítica entre ácaros foréticos *Macrocheles muscaedomesticae* y la "mosca de los establos" *Stomoxys calcitrans* en Sabanalarga, Antioquia-Colombia.

**Palabras clave:** Ácaros; artrópodos; díptera; estiércol; parasitismo (*Fuentes: DECS, CAB*).

## INTRODUCTION

The association between mites on the species of Muscidae (Diptera) has been little studied in our country; however, this report serves as a basis for further studies on the interaction of species of the Macrochelidae family with species of Diptera. This is possible due to the phoretic and predatory interaction between them, which could be important in the implementation of a biological control model.

Mesostigmata mites of the Macrochelidae family are found in the manure of various mammals and in poultry manure, as well as on eusocial insects such as bees and flies, which contribute to their spread and feeding. The species *Macrocheles muscaedomesticae* (Scopoli, 1772), corresponds to a predator of eggs and first instar larvae of the species *Musca domestica*, *Stomoxys calcitrans*, and *Haematobia irritans* (1,2,3,4). The mite cycle comprises egg, larva, protonymph, deutonymph, and adult. Females can be parthenogenetic; when the male is involved in the fertilization, offspring of both sexes (males and females) is produced. When there is no fertilization, they only produce males. This mite has been used as a biological control in different Diptera (4, 5).

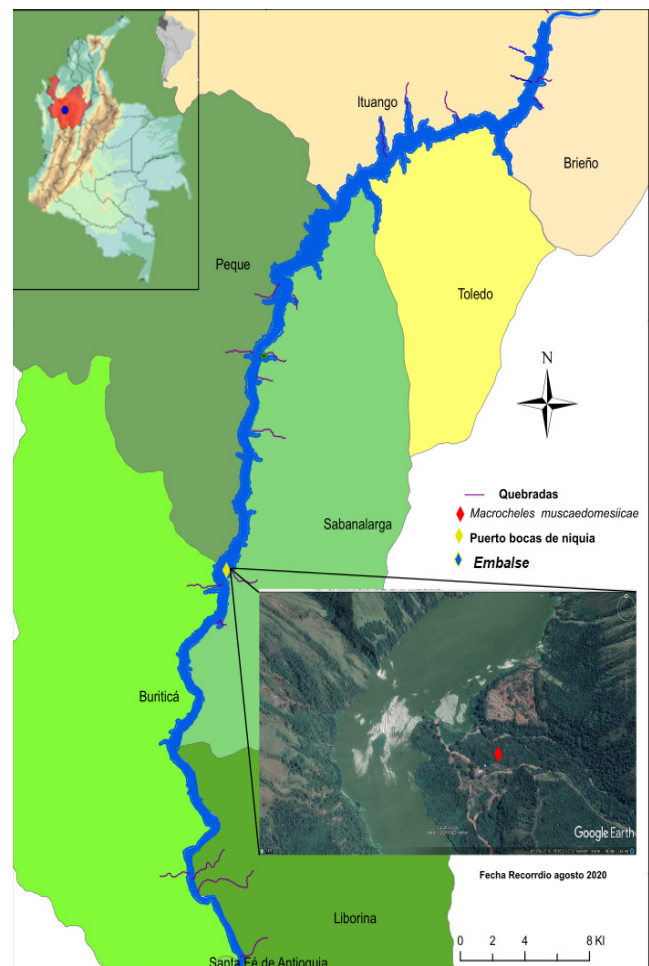
Flies are epidemiologically important because they are mechanical vectors for many pathogens harmful to humans and animals, with high reproductive potential. *S. calcitrans* causes severe economic losses because they affect all animal species and humans, because of its painful bite, the transmission of pathogens, and because it is difficult to control (6).

## MATERIALS AND METHODS

**Study area.** The flies having mites were collected in a corral located less than 100 m from the ferry port, which is mainly used as a transfer for cattle, located in an area of Tropical Dry Forest in the Bocas de Niquia village (6°52'1.24"N, -75°50'24.85"W) in the municipality of Sabanalarga in western Antioquia

and which connects Sabanalarga with the municipalities of Buriticá and Peque (Figure 1).

For the collection, Van Someren-Rydon traps were used, baited with 120 grams of sardine, and placed between the corral, a wooded riparian area and the forest.



**Figure 1.** Collection site for *Macrocheles muscaedomesticae* mites associated with *Stomoxys calcitrans* flies in an intervened Tropical Dry Forest area in the municipality of Sabanalarga. Antioquia-Colombia.

The flies captured were kept in 1.5 ml Eppendorf vials with 70% ethyl alcohol to be later transported

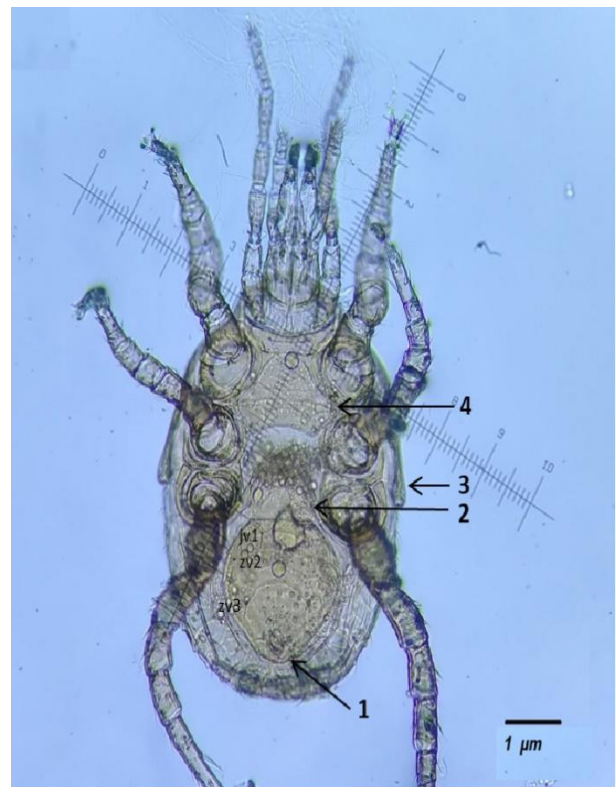
to the Medical Entomology Laboratory of the National Faculty of Public Health of the University of Antioquia, Medellín - Colombia.

**Identification of ectoparasites:** A total of 48 diptera were collected, represented by the families Muscidae, Calliphoridae, Sarcophagidae, and Tachinidae, and two flies carrying mites were separated. The flies were observed through an optical stereomicroscope (Olympus SZ-61) and identified using Carvalho's keys (7) as dipterans of the species *S. calcitrans* (Linnaeus, 1758). The mites were removed and stored in 70% ethyl alcohol. The specimens were then clarified in lactophenol and mounted on slides with Hoyer's solution for later identification, according to the Doreste methodology (8). The identification was carried out using an optical microscope (Motic BA310 with a 40 and 100x objective), and the Lindquist, Klimov, and Horn keys (9) were used for classification.

## RESULTS

Fifteen mites were found attached to the ventral area of two specimens of *S. calcitrans* flies. The specimens were identified as adults of the species *M. muscaedomesticae*. This was the first time the parasitic association between these mites and muscidae flies, specifically with *S. calcitrans*, was reported in the department of Antioquia, in the wild.

The mites were identified as adults (15 females) of the species *M. muscaedomesticae* (Figure 2), belonging to the Macrochelidae family. The morphological characters, such as the presence of stigmata near the coxae, the shield with a ventral and dorsal sclerotized plate, the coxa four without metopodal sclerites, and the ventri-anal shield area with three setae (jv1, zv2 and zv3) where the anal zone is located, as described by Kontschán and Hornok (10), were all taken into account. The mites adhered to the ventral area of the thorax (prosternum and mesosternum), and the abdomen (sternites), of the *S. calcitrans* flies (Figure 3). Table 1 shows the specific location of the mite adhesion zone on flies.



**Figure 2.** Photograph of a female *Macrocheles muscaedomesticae*, ventral view (40x, Motic BA310).

1. Ventral shield with setae (jv1, zv2 and zv3).
2. Epigynal shield and sclerite.
3. Peritreme with loop attached to the stigma.
4. Sternal shield.



**Figure 3.** Anatomical location of *Macrocheles muscaedomesticae* in *Stomoxys calcitrans* (Olympus SZ-61).

**Table 1.** Number of *Macrocheles muscaedomesticae* mites found in the ventral area of *Stomoxys calcitrans* flies.

Anatomical area of adhesion	<i>Stomoxys calcitrans</i>	
	Specimen 1	Specimen 2
Prosternum	1	0
Coxa 1	2	2
Trochanter 1	2	2
Sternopleuron	2	2
Abdominal sternite 1	0	2

## DISCUSSION

Phoresis is a commensal relationship between individuals where one uses the other as a means of transportation to discover and colonize new feeding or reproduction habitats. It is the most common type of interaction between mites and insects. The transported individual is recognized as a phoretic, while the one who transports is called a carrier (11,12). A widely used definition is the one proposed by Houk, which refers to phoresy as "a phenomenon in which an organism (the phoretic) receives an ecological or evolutionary advantage by migrating from natal habitat while surface-attached to a selected interspecific host for a period of the phoretic's life." Therefore, the benefit provided to the phoron is measured in terms of spread, not being a form of parasitism (13).

The term *phoresis* was registered in some countries of the world where programs of integrated management and biological control of eggs and larvae of synanthropic flies in stables and chicken coops have been developed. However, according to the Municipal Technical Assistance Unit (UMATA) of Sabanalarga, this control program has not been implemented in this municipality for either livestock or the poultry sector.

It is important to highlight that there are no nearby poultry or livestock pens or human settlements in the collection area. The area is only considered a transit area between the municipalities of Sabanalarga, Buriticá, and Peque, and there are only a few corrals where cattle or horses are temporarily kept to wait for the ferry to pass through. There is a large amount of decomposing organic material on the

site, either floating (bunches of water extracted from the dam), and piles of wood that is in the process of being harvested as a result of felling trees in the flood zone. This adds other habitats to those previously reported in other articles stating that these main habitats are decomposing plant material, cattle manure (14), and poultry manure (4).

According to the findings, it can be stated that the existing phoretic rate between *M. muscaedomesticae* and *S. calcitrans* can be considered high in this area since the number of individuals is high (15 mites on two flies).

According to previous reports, in Panama, 54 mites were reported to adhere to 23 specimens of Calliphoridae flies of the species *Chrysomya megacephala*, *C. rufifacies* and *C. chloropyga*. Another record of phoretic rate was carried out in Malaysia; the result was 64.4 *M. muscaedomesticae* per 1000 *M. domestica* (5). In Brazil, a field study reported 123 Diptera collected, and only six of them had seven mites distributed as follows: Family Erythraeidae (*Leptus* sp., five individuals), Family Macrochelidae (*M. muscaedomesticae*, one individual) and lastly from the family Digamasellidae (*Longoseius brachypoda*, one individual) (2).

Many mite species of this Macrochelidae family are considered beneficial for humans, as they feed on housefly eggs (3) or other harmful arthropods. The mites of the families Macrochelidae and Anophetidae are cosmopolitan, except for Antarctica.

The association of mites with *M. domestica* has been documented in Panama (15), Brazil (7, 16), and Argentina (17, 18). Likewise, the species of the Macrochelidae family have been found both in soil and in different vertebrates and invertebrates and are characterized by the use of arthropods as a means of paraphagia and transport (19).

According to the literature, about twenty species of Macrochelidae mites belonging to the *Macrocheles* genera (Latreille, 1829); *Glypholaspis* (Filipponi and Pegazzano, 1960); and the genus *Holostaspella* (Berlese, 1903) have been found in 31 species of insects of the orders Diptera, Hymenoptera, Coleoptera, Orthoptera, among others (20). Of these, the order Diptera has reported 11 species of flies associated with these mites (21).

Some reports describing this phoretic association with species of the order Diptera include the following species: *Musca domestica*, *M. sorbens*, *M. vetustissima*, *Muscina stabulans*, *Fannia canicularis*, *Australophyra rostrata*, *Lucilia cuprina*, *S. calcitrans*, *Chrysomya megacephala*, *Ophyra chalcogaster*, *Eristalis tenax*, and *Drosophila hydei* (2, 3, 10, 22, 23, 24). According to the above, there are few records on the interaction between the mite *M. muscaedomesticae* and the stable fly *S. calcitrans*.

In conclusion, there are no poultry or livestock pens in the area. The only one found is used for passing through since animals are only locked up there while they wait their turn to be transferred by ferry. There is organic matter from wood felling piled up in piles to be subjected to ripping or decomposition and composting process. Part of the material that was deforested for the dam's flood zone is located on this site. In the area, there are also deposits of floating material extracted from the reservoir, which is somewhat consistent with the presence of these mites in biosolid fields.

On the other hand, there are records that the fly *S. calcitrans* is a carrier of the mites *M. glaber*, *M. perglaber*, *M. muscaedomesticae* and *M. subbadius*, so it would be convenient and opportune to analyze the presence of other species of these arachnids both in this fly and in others of the Calliphoridae and Fanniidae families in the area.

These findings suggest the possibility of a research project aimed at determining the possible role of *M. muscaedomesticae* in the biological control of the *S. calcitrans* fly and contributing to the control of the resistance of the Diptera to all the chemical compounds available in the market.

### Conflict of interest

There is no conflict of interest between the authors with the publication of this manuscript.

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