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Sarcopromusca pruna (Diptera: Muscidae): forético para os ovos de Dermatobia hominis (Diptera: Cuterebridae) na Colômbia

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Summary

Objective: the finding of Sarcopromusca pruna as a phoretic for Dermatobia hominis eggs is described here. The later is a frequent cattle ectoparasite (human botfly) known as "nuche" in Colombia. Methods: the phoretic flies were captured in a village at San Rafael municipality (Antioquia) using Malaise-type traps installed during the months of June to August, 2004. Each Sarcopromusca specimen carried a minimum of 19 and, in some cases, up to 23 eggs of D. hominis on the right or left side of the abdominal region. Results and conclusion:This is a new report of Sarcopromusca pruna behaving as a phoretic fly for Dermatobia hominis eggs observed in Colombia.

Key words: *Dermatobia hominis, "human botfly", Muscidae, Oestridae, phoretic insects, Sarcopromusca pruna.*

Resumen

Objetivo: Se describe el hallazgo de Sarcopromusca pruna (S. pruna) como forético de huevos Dermatobia hominis (D. hominis) ectoparásito comúnmente conocido en Colombia como "nuche". Metódo: las moscas foréticas fueron capturadas en una vereda del municipio de San Rafael (Antioquia) usando trampas de intercepción tipo Malaise instaladas durante los meses de junio a agosto de 2004. Cada espécimen de Sarcopromusca transportaba un número mínimo de 19 y en algunos casos hasta 23 huevos

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de D. hominis en el lado derecho o en el izquierdo de la región abdominal. Resultados y conclusión: este es un nuevo reporte de S. pruna como forético de huevos de Dermatobia hominis en Colombia.

Palabras clave: *Dermatobia hominis, insectos foréticos, Muscidae, Nuche, Oestridae, Sarcopromusca pruna.*

Resumo

Objetivo: relatamos a descoberta de Sarcopromusca pruna (S. pruna) como forético dos ovos de Dermatobia hominis (D. hominis), ectoparasita comumente conhecido na Colômbia como "nuche" e no Brasil como "mosca-varejeira". Métodos: as moscas foréticas foram capturadas no município de San Rafael (Antioquia), utilizando armadilhas de intercepção tipo Malaise instaladas durante os meses de junho a agosto de 2004. Cada espécime Sarcopromusca carregava entre 19 e 23 ovos de D. hominis no lado direito ou esquerdo da região abdominal. Resultados y conclusões: este é um novo reporte da S. pruna como forético de ovos de Dermatobia hominis na Colômbia.

Palavras chave: *insetos foréticos, Oestridae, parasita.*

Introduction

Dermatobia hominis (Linnaeus, 1781) previously called *D. ovaniventris* (D. cyaniventris) is a fly in the Oestridae family, which in Neotropical America is distributed from northern Mexico to northern Argentina. In its larval stages it mainly affects cattle, dogs and man, which makes it a major public health problem in tropical and subtropical America. Nonetheless, it can also parasitize cats, sheep, rabbits and other animals. (Ribeiro *et al*., 2001; Guimarães, 1998; Aiello, 1998; Saavedra y Schenone, 1998; Sancho, 1988; Acha y Szyfris, 1986). The *Dermatobia* larvae cause myiasis boils or dermatobiosis, which is characterized by the formation of subcutaneous nodules in the host, with one or more larvae inside them. Such myiasis is known under different names, depending on the region or country. For example, in Colombia, is called grub or "nuche", in Brazil "berne" and in Ecuador "tupe". In Bolivia it is called "hairy worm" while in Argentina, Uruguay and Paraguay is called "ura". In Peru is known as "mirunta", in Venezuela is called "macaca worm", in Mexico and Guatemala "moyocuil" or "colmoyote". In English-it is known as "human botfly". (Clyti *et al;* 2008; Guimarães and Papavero, 1998; Gomes *et al*., 1998; Fortes, 1997; Urquhart *et al*., 1990).

The *D. hominis* larvae remain on cattle for a period of 40 to 60 days, during which they cause significant damage to the skins, reducing their commercial value. (Gomes *et al*., 1988; Moya, 1982; Jobsen y Mourier, 1972). Losses caused by the *D. hominis* larvae in cattle are reflected by a low milk production, decreased weight gain and therefore meat production. Leather is the product that undergoes a higher depreciation, leading to a decreased commercial value, as the larvae are usually located in the skin areas with more value for the leather industry, which makes it unusable up to a 70%. (Grisi *et al*., 2002; Ribeiro *et al*., 2001; Aiello, 1998; Oliveira, 1991; Sancho E, 1988; Gomes *et al*., 1988). These authors estimate that the Brazilian livestock industry, for example suffers an annual loss of around $ 250 million due to the action of *D. hominis*.

In the adult fly, the mouthparts are atrophied and therefore it does not feed, getting its nourishment only from food reserves accumulated during the parasite stage. (Grisi *et al*., 2002; Pinto *et al*., 2002; Sancho, 1988).

Females do not lay eggs directly on vertebrates tissues, but on other blood-sucking arthropods, (mainly smaller flies and mosquitoes) caught in flight and on which abdomens they deposits and adhere accumulations of eggs, such transportation phenomena is called phoresy and the vehicles are known as phoretic. This particular feature of using other diptera to carry their eggs was first recorded

in Brazil by Raphael Morales (1911) cited by Neiva and Gomes (1917).

There are more than 50 identified species of Diptera belonging to the families Muscidae, Culicidae, Simuliidae, Anthomyiidae, Tabanidae, Fanniidae, Sarcophagidae, Calliphoridae and Cuterebridae as phoretic on *D. hominis*. However, *Sarcopromusca pruna*, *Stomoxys calcitrans*, *Musca domestica*, *Fannia pussio* and *Haematobia irritans* are considered the most important species in transporting *D. hominis* eggs (Azevedo *et al*., 2007; Gomes *et al*., 2002; Silva *et al*. 1999; Guimarães y Papavero,1998; Moya, 1982).

In southern Brazil *Fannia tumidifemur* (Diptera: Fanniidae) has been reported as a vector of *D. hominis* eggs in Paraná by Pinto *et al.* (2002); *F. heydenii* (Diptera: Fanniidae), *M. domestica* (Diptera: Muscidae) and *Morellia humeralis* (Diptera: Muscidae) in Santa Catarina by Paloshi *et al.* (1991). Finally Ribeiro *et al.* (1985) and Brum *et al.* (1998) reported in Rio Grande do Sul *S. calcitrans*, *M. domestica* and *F. punctipennis* as vectors of eggs *of D. hominis*.

According to Silva *et al*, 1999, *Sarcopromusca pruna, Musca domestica, S. calcitrans, H. irritans, Hydrotaea aenecens* and *Fannia* spp, have been identified as the most important vectors of *D. hominis* eggs under field conditions in Brazil. While other dipterans such as *Cochliomyia macellaria*, *C. hominivorax*, *Chrysomya albiceps* and *C. putoria*, have been found less often carrying this fly's eggs (Paloschi *et al*., 1991; Oliveira, 1986; Maia and Gomes, 1988).

S. pruna, *S. calcitrans*, *M. domestica*, *Fannia pusio* and *H. irritans* are considered the most important species transporting this ectoparasite's eggs in several tropical countries (Gomes *et al*., 2002; Silva and Moya, 1999, Guimarães and Papavero, 1998; Sancho, 1988).

According to Neel (1955) and Zeledon (1979), an average of 27 insects was reported as *D. hominis* eggs carriers in Costa Rica. In Colombia, Bates (1943) studied the oviposition behavior of *D. hominis*, on different diptera species and found that the vectors must have zoophilic habits, be diurnal, of moderate activity, and similar or slightly smaller in size than *Dermatobia*. This research, similarly to that of Mateus in 1967, describes the vector species involved in the life cycle of this ectoparasite in some regions of Colombia. In Brazil, work performed by Oliveira(1986); Maia and Gomes (1988), Paloschi *et al.,* (1991), Brum *et al*., (1996), Gomes *et al*., (1998), Rodriguez (1998), Guimarães and Papavero (1998), and more recently, Azevedo *et al*., (2007) reported diptera species involved so far in *D. hominis* life cycle.

Therefore, the importance of some Muscidae in transporting *D. hominis* eggs in tropical countries is quite evident. The scarce and outdated research performed in this regard in Colombia, motivated the development of the present study, with the aim of identifying the main Muscidae genres and species, acting as phoretic of *D. hominis* in an enzootic region of Antioquia, and further comparing them with those in other areas in the Department and the country.

Materials and methods

Type of study

What performed a cross sectional descriptive study, using the Malaise interception system to trap diptera from different families, looking for possible transporters of *D. hominis eggs*.

Methods

Catches were made in a village in the municipality of San Rafael. This municipality is located in the Eastern sub-region of Antioquia, 104 miles from Medellin, latitude: 6° 18‘ N, length: 75º 01’ W and at 1,000 above sea level. The climate is temperate and the municipality has an average temperature of 23 ºC (Gobernación de Antioquia, 1991)

Here as well as in other villages of the municipality, traditional and artisanal double purpose livestock has been practiced, stocking about two animals per hectare in native grass. Due to the fact that adult flies of *D. hominis* inhabit semi-

forested areas, we selected two pastures on the same farm that were close to shrubs (semi-forested areas) with highly infested cattle. The parasite burden was diagnosed quantitatively by inspection, counting the number of nodules by live larvae on the subcutaneous tissue, on the second and third instars, with the corresponding characteristic exudates. I observed animals with an average infestation of 15 to 36 active boils, and those were deemed as having a high parasitic infestation.

Two Malaise interception traps were installed from June to August 2004, selecting those months based first on convenience, and second because they correspond to the dry season, and are characterized by dry and sunny days, important factors in many flies' eco-epidemiology. These captures were carried out as part of the enrichment of the collection and private museum of veterinary parasitology and entomology, as well as in honor of the emeritus professor of Veterinary Parasitology, at the Faculty of Agricultural Sciences, University of Antioquia, Dr. Jorge Alberto Quijano Correa.

The traps were examined every two weeks, and captured insects were placed in vials with 70% ethanol. They were later taken to the Veterinary Parasitology, laboratory belonging to Faculty of Agricultural Sciences, University of Antioquia, where the preliminary identification of morpho-species was made.

This identification used the taxonomic keys described by Soulsby, (1976) and the dichotomous keys described by Pratt and Stojanovicch (1969) by means of a NIKON binocular stereomicroscope model SMZ1.

Results

Out of the collected insects only nine specimens were carrying *D. hominis'* eggs and they all belonged to the Muscidae family. From them, five i.e. 55.56% of the phoretic corresponded to *S. pruna*, two (22.22%) to *H. irritans*, one (11.11%) to *M. domestica* and one (11.11%) to *S. calcitrans.*

Sarcopromusca specimens were confirmed in their identification and recognized by Dr. Claudio José Barros de Carvalho from the Federal University of Parana, specialist in Muscidae family systematics. This identification was carried out in one of the practical modules of the Neotropical Muscidae course offered in 2006 at the University of Antioquia.

Dr. Carvalho used his own keys for Neotropical Region Muscidae's genera and species, which includes the number of species for Brazil and the region above mentioned (Carvalho and Couri, 2002; Couri and Carvalho, 2002).

As shown in figures 1 to 5, the eggs were arranged in clusters to the right or left side, only in the abdominal region of each phoretic fly. No oviposition was found on both sides of the same fly. Egg numbers ranged between19 and 23. Some larvae had not hatched from their eggs giving the appearance of human fingers. In other cases the operculum from where they hatched could still be seen, as detailed in figure 2. In figure 3, in addition to the insect's genitalia, some hatched eggs as well as some unhatched eggs (a), giving the appearance of human fingers as noted above, can be seen in detail (Figures 4 and 5).

Figure 1. Dorsolateral view of a *Sarcopromusca pruna* specimen with *Dermatobia hominis'* eggs on the right abdomen.

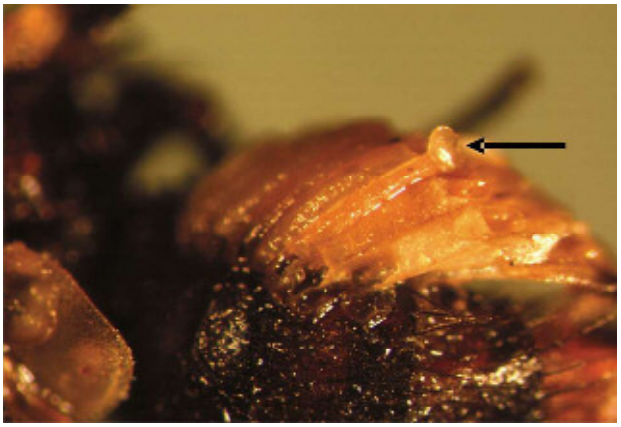

Figure 2. The detail shows a *Sarcopromusca pruna* specimen with *Dermatobia hominis'* hatched eggs on the right abdomen. The operculum can still be seen (arrow).

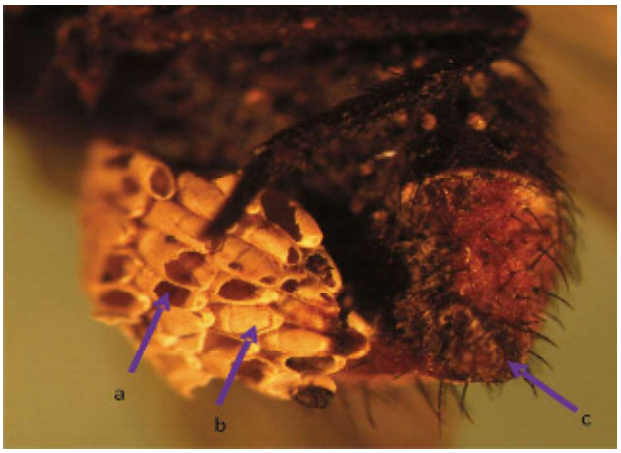

Figure 3 Close up of *Dermatobia hominis'* oviposition on a *Sarcopromusca pruna's* abdomen, where some hatched eggs (a), some unhatched eggs (with the appearance of human fingers) (b) and genitalia (c) can be seen in detail.

Figure 4. Close up showing *Dermatobia hominis* egg masses on the right and left abdomen, some unhatched eggs give the appearance of human fingers.

Figure 5. Close up of *Dermatobia hominis'* eggs on the abdomen of *Sarcopromusca pruna*, unhatched eggs can be seen in detail and also emerging larvae lifting the operculum (a).

Discussion

Pedroso de Paiva (1996) states that *S. pruna* (Shannon and Del Ponte, 1926) (Diptera: Muscidae) is a species of fly with a short life cycle whose adults feed by licking the wounds caused by blood-sucking insects and biting flies such as *S. calcitrans* . Therefore, beginning in the 50's and further decades, several authors including Neel *et al*., (1955), Koon and Banegas (1959), Lombardero and Fontana (1968) and Silva *et al*. (1989) have stated that in Latin America, this fly can be an important phoretic for *D. hominis*' eggs. This study confirms the occurrence of *S. pruna* as foretic for *D. hominis*' eggs in the enzootic region of Antioquia in which it was performed. This in turn agrees with Nihei (2005), Guimarães and Papavero's findings (1998), who propose that *Sarcopromusca* and *D. hominis* have similar geographical distribution.

This study's findings, even in its relatively short period of collection, are also consistent with Silva *et al*., (1989) who after two years of collection, confirmed the appearance of *S. pruna* as the main transporting host of *D. hominis eggs* among cattle ranches, in the mid east of the state of Bahia (Brazil). Their study showed the coincidence of two peaks of abundance of this fly as well as that of *D. hominis*. Similarly Azevedo *et al*., (2007) noted the occurrence of *S. pruna* as phoretic for *D. hominis'* egg in the south of that country.

Silva *et al*., (1999) studied under laboratory conditions, *D. hominis* oviposition capacity in

four Muscidae species (*M. domestica, S. pruna, H. irritans and S. calcitrans*) and two Calliphoridae species (*C. macellaria* y *Lucilia caprina*). They found in descending order that the main phoretic were members of the family Muscidae and M. *domestic* (25.0%), *S. pruna* (16.7%), *H. irritans* (12.5%) and *S. calcitrans* (11.7%). In this work *M. domestic* was considered the most important vector under laboratory conditions. Such findings differ from those of the present study under field conditions in a specific region of Antioquia. Ecoepidemiológic variables related to population dynamics and biological habits of each genus of this Diptera family, may have influenced the results, such situations in most cases are difficult to manage or are not taken into account in lab studies.

In this research, eggs were found sometimes on the right side and others on the left side of each phoretic, coinciding with information reported by Silva *et al*., (1989), who state that there are no preferences regarding the side on which *D. hominis* laid eggs on *S. pruna*. The authors stated that oviposition may occur simultaneously on both sides of the same fly, and there is a direct relationship between abdomen size and the number of eggs laid. Simultaneous oviposition on both sides of the fly's abdomen was not proved in this study.

In 2007, Azevedo *et al*., first reported *S. pruna* as a vector of *D. hominis* eggs in southwestern Brazil. The captured fly was carrying18 eggs on the right latero-ventral portion of the abdomen. These results are very close to those obtained in this study in which the number of eggs arranged in clusters ranged from 19 to 23. However, top value oviposition ranges found here, markedly differ from those reported by Paloschi *et al*., (1991), who reported a similar average of 21.6 but a higher value up to 55 eggs on the phoretic's abdomen. In this study we never found more than 23 eggs per fly, which also differs with the high values evidenced by Rodriguez (1998) that ranged between 7 and 63 *D. hominis'* eggs on each vector fly's abdomen.

In regards to the presence of vectors of *D. hominis* eggs there isn't a lot of known research, except for the one that has been conducted for years in Brazil, and more recently by researchers such as Paloschi *et al*., (1991), Brum *et al*., (1996), Gomes *et al*., (1998), Rodriguez (1998), Silva and Moya (1999) and Pinto (2001). Their work has shown the epidemiological importance in dermatobiosis, not only of *Sarcopromuca* and other members of the Muscidae family but that of the *Fannia* genus.

For example, in Mato Grosso do Sul Gomes *et al*., (1998), found *Fannia* sp. as a *D. hominis* phoretic, carrying an average of 16.4 eggs. Similarly Brum *et al*., (1996) reported specimens of *Fannia punctipennis* as phoretics, in the municipality of Pelotas, Rio Grande do Sul, Brazil. They averaged 16.3 eggs of *D. hominis* on their abdomen. Gomes *et al*., (2002) in Campo Grande, Mato Grosso do Sul, Brazil, captured a total of 40,629 flies of the Fanniidae family, belonging to five species of the *Fannia* genus, where the most common species was *F. pusio*, representing 63.20% of the total, followed by *F. heydenii* which represented 28.82% of this family's phoretics. Besides *Fannia* (Diptera: Fanniidae) and members of the Muscidae family, we have identified here, as well as in other reported research, more flies and mosquitoes involved in transporting *D. hominis* eggs, such as members of the families *Calliphoridae*, *Sarcophagidae* and *Tabanidae*.

As we see, in different tropical countries, where these parasites have great impact on the livestock industry, several investigations have been conducted, aiming to identify their main phoretics. This highlights the need to extend the identification process of different dipterans involved in the life cycle of *D. hominis* in Antioquia as well as in different areas of the country where dermatobiosis is enzootic. In the suggested studies, it would also be interesting to include the abundance of species, the phoretic's seasonality and their relation to eco-epidemiological conditions, in order to implement non-chemical measures to prevent and / or control this important parasite in cattle.

In Colombia, in the Research Centre –"El Nus- CORPOICA regional cuatro" (San Roque, Antioquia), Mateus (1967) reported *Orthelia pruna* as the most common phoretic host for *D. hominis'* eggs. Pamplona (1990), states that *S. pruna* is synonymous with *Orthelia pruna* and *S. arcuata*, so this finding constitutes a new report

in which this diptera acts as an egg carrier of one of the most important myiasis in Colombian livestock, mainly in regions below 2000 m above sea level. The captured specimens are stored in the Museum Collection of Veterinary Entomology and Parasitology, which the author has dedicated to his professor, the emeritus Veterinary Parasitologist from the Faculty of Agricultural Sciences, University of Antioquia, Doctor Jorge Alberto Quijano Correa. These specimens are kept in vials with 70% alcohol, properly labeled.

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