

# An updated checklist of myiasis-inducing Diptera species in livestock in Northeastern Brazil

Barbosa, T.M. and Vasconcelos, S.D.\*

Necrophagous Insects Research Group. Departamento de Zoologia. Universidade Federal de Pernambuco. Recife. Brazil.

## ADDITIONAL KEYWORDS

*Cochliomyia*.  
*Dermatobia*.  
Calliphoridae.  
Sarcophagidae.  
Goats.  
Sheep.

## PALAVRAS CHAVE ADICIONAIS

*Cochliomyia*.  
*Dermatobia*.  
Calliphoridae.  
Sarcophagidae.  
Caprinos.  
Ovinos.

## INFORMACIÓN

Cronología del artículo.  
Recibido/Received: 8.10.2014  
Aceptado/Accepted: 13.5.2015  
On-line: 10.6.2015  
Correspondencia a los autores/Contact e-mail:  
simaovasconcelos@yahoo.com.br

## INTRODUCTION

In Northeastern Brazil, livestock is a crucial economic activity that comprises mainly extensive rearing of cattle, sheep and, especially, goats. Over 95% of goat herd of the country is reared in the region, where the meat and milk are almost entirely consumed on small holdings (Pinheiro *et al.*, 2000; Farias *et al.*, 2014). However, a considerable part of this activity has been associated with low sanitary conditions of animal rearing and slaughtering, a scenario that allows for the occurrence of ectoparasites that can cause obligatory or facultative myiasis.

Overall economic loss derived from myiasis caused by *Cochliomyia hominivorax* (Diptera: Calliphoridae) in Brazil reaches 150 million dollars/year (Grisi *et al.*, 2002). Additionally, losses caused by the botfly *Dermatobia hominis* (Diptera: Oestridae) in domestic animals

## SUMMARY

We present here an updated checklist, based upon data from the literature and from field surveys performed from 2009 to 2013, related to the occurrence of myiasis-inducing Diptera species in Northeastern Brazil, according to the environment and host on which the species was observed. Most cases of myiasis involved sheep and have not had their causal agent identified. Nineteen species previously known as obligatory or facultative agents were registered in several environments, including the semi-arid region, where goats are often farmed. Only two species were actually identified as causal agents of myiasis on domestic animals, *Cochliomyia hominivorax* and *Dermatobia hominis*. The presence of invasive species may be associated with local expansion of secondary myiasis in domestic animals.

## Uma lista atualizada das espécies de Diptera causadoras de miíases na pecuária no Nordeste do Brasil

## RESUMO

Apresentamos aqui uma lista atualizada, baseada em dados da literatura e em estudos de campo realizados de 2009 a 2013, relacionada à ocorrência de espécies de Diptera causadoras de miíases na região Nordeste do Brasil, de acordo com o ambiente e o hospedeiro no qual a espécie foi observada. A maioria dos casos de miíases envolveu ovelhas e não teve seu agente causal identificado. Dezenove espécies previamente conhecidas como agentes obrigatórios ou facultativos foram registrados em vários ambientes, incluindo a região semi-árida, onde caprinos são frequentemente criados. Somente duas espécies foram identificadas como agentes causadores de miíases em animais domésticos, *Cochliomyia hominivorax* e *Dermatobia hominis*. A presença de espécies invasoras pode estar associada com a expansão local de miíases secundárias em animais domésticos.

surpass 250 million dollars/year due to loss in milk and meat production and damage to leather for commercial use (Grisi *et al.*, 2002). These alarming figures have prompted national public agencies to include the myiasis caused by *C. hominivorax* in the list of animal health problems of mandatory notification to local authorities in the country.

Ecological and socio-economical restraints in Northeastern Brazil are associated with deficient animal health monitoring. For example, increasing demands for quality control of milk, cheese and meat have yet to be met by local farmers and the replacement of native forest for pasture and the arrival of exotic insect species may lead to an increase in ectoparasitism. However, despite the importance of sheep and goat rearing to local economy, surveys of myiasis-inducing Diptera species are scarce non-existent, even though species of Calliphoridae, Muscidae and Sarcophagidae of veterinary importance

**Table I.** Occurrence of myiasis-inducing Diptera species in Northeastern Brazil, according to the type of environment and substrate (Ocorrência de espécies de Diptera de indução de miíases no Nordeste do Brasil, de acordo com o tipo de ambiente e substrato).

Family / Species	Urban area	Rain forest	Agro ecosystem	Dry forest	Littoral	Substrate
<b>Calliphoridae</b>						
<i>Chrysomya albiceps</i>	x	x	x	x	x	ab ac
<i>Chrysomya megacephala</i>	x	x	x	x	x	ab ac
<i>Chrysomya putoria</i>	x	x	x	x	x	ab ac
<i>Cochliomyia hominivorax</i>	x	—	—	x	—	ab ac la
<i>Cochliomyia macellaria</i>	x	x	x	x	x	ab ac
<i>Lucilia cuprina</i>	x	—	—	—	—	ac
<i>Lucilia eximia</i>	x	x	x	x	x	ab, ac
<i>Lucilia sericata</i>	—	x	—	—	—	ac
<b>Muscidae</b>						
<i>Musca domestica</i>	x	x	x	x	x	ab ac
<i>Stomoxys calcitrans</i>	—	—	—	x	—	ac
<b>Fanniidae</b>						
<i>Fannia canicularis</i>	—	x	—	—	x	ab ac
<i>Fannia scalaris</i>	x	—	—	—	x	
<b>Phoridae</b>						
<i>Megaselia scalaris</i>	x	x	x	x	x	ab ac
<b>Piophilidae</b>						
<i>Piophilidae casei</i>	x	x	—	x	x	ab ac
<b>Sarcophagidae</b>						
<i>Sarcodexia lambens</i>	x	—	—	x	x	ab ac
<b>Stratiomyidae</b>						
<i>Hermetia illucens</i>	—	x	—	—	—	ab ac
<b>Cuterebridae</b>						
<i>Dermatobia hominis</i>	—	—	x	x	—	la
<b>Oestridae</b>						
<i>Hypoderma bovis</i>	—	—	x	—	—	
<b>Syrphidae</b>						
<i>Ornidia obesa</i>	—	x	—	x	—	ac

ab= animal bait; ac= animal carcass; la= live animal.

have been detected in urban zones, rainforest fragments and agroecosystems (Vasconcelos and Araujo, 2012).

This study aimed at providing an updated checklist of myiasis inducing Diptera species in Northeastern Brazil, according to the type of environment and substrate/host on which the species has been observed. Implications for animal health in the region are discussed focusing on the reality of small-scale livestock.

## MATERIAL AND METHODS

This study is based on a bibliographical survey on databases from Web of Science®, PubMed, Google Scholar, and the Scientific Electronic Library Online. Key words used in the search included general terms (in both Portuguese and English) and scientific names related to myiasis in wild and domestic animals (e.g., myiasis, botfly, screw-worm fly, Calliphoridae, *Dermatobia*, *Cochliomyia*), adding references to Northeastern

Brazil. Unpublished data were not included. Whenever possible, the sources were analyzed under the following criteria: insect taxonomical identification, animal host, characteristics of the myiasis (obligatory, facultative) and type of environment (urban zone, forest etc.) where the species was recorded.

Additionally, we used data obtained in field surveys performed in several environments typical from Northeastern Brazil. A rainforest fragment in the municipality of Recife, Pernambuco State (08°09'17"S; 34°52'05"W) was surveyed in 2008 and 2009. As attractant to adult flies we used two 15-kg pig carcasses and traps containing animal tissue baits, consisting of 200 g of decomposing chicken liver (Vasconcelos *et al.*, 2013). An area of seasonally dry tropical forest, known as *Caatinga*, which is typical of Northeastern Brazil, was also sampled in 2010. In that case, three 15 kg pig carcasses were used as baits in a conserved fragment in the municipality of Serra Talhada (07°59'31"S; 38°17'54"W) (Vasconcelos and Salgado, 2014).

Data obtained in two field surveys were incorporated. The first study was performed in 2009, using chicken, pork and fish baits, in two types of environment: a sugarcane plantation in the municipality of Ipojuca (08°20'00"S; 35°03'45"W), and in the urban zone in Recife. The second survey was carried out along the littoral of Pernambuco State, Northeastern Brazil in 2011 and 2012, using two types of bait: decomposing chicken liver and sardine.

## RESULTS AND DISCUSSION

When data from the bibliographical survey and the field experiments are combined, a total of 19 species belonging to 10 families with previous record as causal agents of myiasis are found in Northeastern Brazil (**table I**). The species were reported in several environments such as urban area, agroecosystems, rainforest, coastal environments and in the *Caatinga*. *Chrysomya albiceps* (Wiedemann), *Chrysomya megacephala* (Fabricius), *Chrysomya putoria* (Wiedemann), *Cochliomyia macellaria* (Fabricius), *Lucilia eximia* (Wiedemann), *Musca domestica* Linnaeus, *Megaselia scalaris* (Loew) and *Piophilha casei* (Linnaeus) were found in all sampled environments. Regarding their geographical origin, three species are exotic: *C. albiceps*, *C. megacephala* and *C. putoria*.

The species were registered on a variety of substrates that included mostly decomposing animal tissue used as baits and animal carcasses, and, on a smaller proportion, living animals. The obligate parasitic species *Cochliomyia hominivorax* was detected in a wider variety of substrates when compared to the other species. Only two species were actually reported as the causal agents of myiasis in the region: *C. hominivorax* in sheep and goats (Bezerra *et al.*, 2010) and ostriches (Almeida *et al.*, 2008) and *Dermatobia hominis* (Cuterebridae) in goats (Brito *et al.*, 2005). This suggests that accurate identification of species in the region could include other species of medical and veterinary importance reported elsewhere such as *Lucilia eximia*, *Peckia* (*Sarcodexia*) *lambens* (Wiedemann), *C. albiceps*, *Lucilia sericata* (Meigen), *M. domestica* and *M. scalaris* (Zumpt, 1965; Schnur *et al.*, 2009).

Several factors justify the low number of species diagnosed as causal agents of myiasis in Northeastern Brazil: the focus of veterinarians in animal treatment frequently overlooks the accurate identification of the insect species involved. Difficulties in species identification – due to lack of formal systematic training or lack of laboratory conditions for insect rearing larvae until the adult stage compromise a correct mapping of the occurrence of native and exotic Diptera species.

In Northeastern Brazil, sheep and goats are most frequently parasitized by *C. hominivorax* (Brito *et al.*, 2005; Bezerra *et al.*, 2010). Additionally, goats have been particularly affected by infestation by *D. hominis* (Brito *et al.*, 2005). Both species are obligatory agents known for severe economic losses and affect sheep in Brazil (Madeira *et al.*, 2000). Although *Lucilia* species cause deleterious effects on sheep in several countries (Wall, 2012), *L. eximia*, *L. cuprina* and *L. sericata* have received little attention as myiasis-inducing agents in South America, as no case was observed in this study.

Myiasis in sheep is increasingly reported in Northeastern Brazil (Pinheiro *et al.*, 2000; Bandeira *et al.*, 2007). In a seven-year study performed in the semi-arid region, myiasis was the most frequent skin disease among goats (Macedo *et al.*, 2007). Because of its extensive farming for milk, meat and leather in the region, more attention should be paid to ectoparasite monitoring and control.

The expansion in the geographical distribution of nonnative *Chrysomya* species – first reported in the 1970's in Southern Brazil – across several types of environment should cause concern due to their capacity to transmit helminthes, bacteria and viruses to domestic animals (Greenberg, 1973). Although it is known that domestic and wild animals can suffer from facultative/secondary myiasis caused by *Chrysomya* species (Zumpt, 1965; Schnur *et al.*, 2009), no case has been related in non-human animals in Northeastern Brazil so far.

The majority of species listed were facultative agents of myiasis, with exception of *C. hominivorax*, *D. hominis*, *Hypoderma bovis* (Linnaeus) and *S. lambens*, which are classified as obligate parasites (Zumpt, 1965; Francesconi and Lupi, 2012). Nevertheless, secondary myiasis can cause mortality in sheep and goat cubs and damage commercial characteristics such as weight gain and leather quality; also the lesions cause irritation and subsequent lower feeding, weight loss and reduced milk production (Grisi *et al.*, 2002; Wall, 2012). Recent advances in the use of entomological evidence to support judicial investigations regarding negligence and animal welfare are within the scope of veterinary forensic sciences and stress out the importance of mapping the occurrence of myiasis-inducing species (Cooper and Cooper, 2008). Myiasis in dogs and cats can be associated with abuse and negligence, especially because fly species tend to benefit from bruises, undernourishment and lack of hygiene.

The combination of widespread occurrence of dipteran species with the poor sanitary conditions of rearing in Northeastern Brazil implies that the actual gravity of myiasis in the region is underestimated. Increasing demands for quality control need to be met in the region, which stimulates further studies on its occurrence in small farms, distant from sanitary inspection.

## ACKNOWLEDGMENT

We thank *Fundação de Amparo à Ciência e Tecnologia do Estado de Pernambuco* and *Conselho Nacional de Desenvolvimento Científico e Tecnológico* for financial support.

## BIBLIOGRAPHY

- Almeida, M.A.O.; Duarte, L.F.C.; Rocha, J.S.; Silva, M.S.A.; Guimarães, J.E. e Ayres, M.C.C. 2008. Ocorrência de ectoparasitos em avestruzes (*Struthio camelus*) criadas no semi-árido baiano. *Rev Bras Parasitol Vet*, 17: 155-157.
- Bezerra, A.D.S.; Soares, H.S.; Vieira, L.S. e Ahid, S.M.M. 2010. Ectoparasitos em caprinos e ovinos no município de Mossoró, Rio Grande do Norte. *Ciênc Anim Bras*, 11: 114-120.

- Brito, D.R.B.; Santos, A.C.G. e Guerra, R.M.S.N.C. 2005. Ectoparasito em rebanhos de caprinos e ovinos na Microrregião do Alto Mearim e Grajaú, Estado do Maranhão. *Rev Bras Parasitol Vet*, 14: 59-63.
- Cooper, J.E. and Cooper, M.E. 2008. Forensic veterinary medicine: a rapidly evolving discipline. *For Sci Med Pathol*, 4: 75-82.
- Farias, J.L. de S.; Araújo, M.R.A. de; Lima, A.R.; Alves, F.S.F.; Oliveira, L.S. and Souza, H.A. de. 2014. Socioeconomic analysis of smallholder producing goats and sheeps in the semiarid cearense, Brazil. *Arch Zootec*, 63: 13-24.
- Francesconi, F. and Lupi, O. 2012. Myiasis. *Clin Microbiol Rev*, 25: 79-105.
- Greenberg, B. 1973. Flies and Disease. Vol. 2. Biology and Disease Transmission. Princeton Univ. Press. Princeton, NJ.
- Grisi, L.; Massard, C.L.; Moya Borja, G.E. e Pereira, J.B. 2002. Impacto econômico das principais ectoparasitoses em bovinos no Brasil. *Hora Vet*, 21: 8-10.
- Madeira, N.G.; Amarante, A.F.T. and Padovani, C.R. 2000. Diversity of ectoparasites in sheep flocks in Sao Paulo. Brazil. *Trop Anim Health Prod*, 32: 225-232.
- Pinheiro, R.R.; Gouveia, A.M.G.; Alves, F.S.F. e Haddad, J.P.A. 2000. Aspectos epidemiológicos da caprinocultura e ovinocultura cearense. *Arq Bras Med Vet Zoo*, 52: 534-543.
- Schnur, H.J.; Zivotofsky, D. and Wilamowski, A. 2009. Myiasis in domestic animals in Israel. *Vet Parasitol*, 161: 352-355.
- Vasconcelos, S.D. and Araújo, M.C.S. 2012. Necrophagous species of Diptera and Coleoptera in Northeastern Brazil: state of the art and challenges for the Forensic Entomologist. *Rev Bras Entomol*, 56: 7-14.
- Vasconcelos, S.D.; Cruz, T.M.; Salgado, R.L. and Thyssen, P.J. 2013. Dipterans associated with a decomposing animal carcass in a rainforest fragment in Brazil: Notes on the early arrival and colonization by necrophagous species. *J Insect Sci*, 13: 145-146.
- Vasconcelos, S.D. and Salgado, R.L. 2014. First record of six Calliphoridae (Diptera) species in a seasonally dry tropical forest in Brazil: Evidence for the establishment of invasive species. *Florida Entomol*, 97: 814-816.
- Wall, R. 2012. Ovine cutaneous myiasis: Effects on production and control. *Vet Parasitol*, 189: 44-51.
- Zumpt, F. 1965. Myiasis in man and animals in the Old World. A Textbook for Physicians, Veterinarians and Zoologists. Butterworths. London. 267 pp.