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Repellent Action of *Carapa guianensis* and *Caesalpinia ferrea* for flies species of *Calliphoridae* family

Ação repelente de *Carapa guianensis* e *Caesalpinia ferrea* para espécies de moscas da família *Calliphoridae*

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ABSTRACT

Myiases occur by the infestation of fly larvae in tissues of live vertebrate animals, resulting in economic loss. Phytotherapy is considered an important alternative in the control of insects, which may reduce the economic impacts. ***Carapa guianensis*** *is a plant that has been studied as a repellent against mosquitoes and* ***Caesalpinia ferrea*** *is reported in tropical climates, and there are few studies about its repellent action. The present study was designed to evaluate the repellent action of s* ***C. guianensis*** *and* ***C. ferrea*** *plants on flies species of the* ***Calliphoridae*** *family. W.O.T. traps containing deteriorated bovine liver and herbs cream of at concentrations of 20 and 50% were used to catch the flies. It was reported that the creams containing* ***C. ferrea*** *at concentrations of 20 and 50% and* ***C. guianensis*** *at the concentration of 50% have repellent effect against species of* ***Calliphoridae*** *family.*

Key words: *repellency,* ***Calliphoridae****, myasis, ectoparasites.*

RESUMO

Miíases ocorrem pela infestação de larvas de moscas em tecidos de animais vertebrados vivos, resultando em perdas econômicas. Fitoterapia é considerada uma alternativa importante no controle de insetos, o que pode reduzir os impactos econômicos. ***Carapa guianensis*** *é uma planta que tem sido estudada como um repelente contra mosquitos e* ***Caesalpinia ferrea*** *Mart. é encontrada em climas tropicais, e há poucos estudos sobre sua ação repelente. O presente estudo foi desenhado para avaliar a ação repelente das plantas* ***C. guianensis*** *e* ***C. ferrea*** *Mart. em espécies de moscas da família* ***Calliphoridae****. Armadilhas WOT contendo fígado bovino deteriorado e creme de ervas em concentrações de 20 e 50% foram usadas para capturar as moscas. Verificou-se que os cremes contendo* ***C. ferrea*** *Mart. em concentrações de 20 e 50%, e* ***C. guianensis****, na concentração de 50%, têm efeito repelente contra as espécies da família* ***Calliphoridae****.*

Palavras-chave: *repelência,* ***Calliphoridae****, miíases, ectoparasitas.*

INTRODUCTION

The repellency activity exerted by drugs such as ivermectin, pyrethrin or pyrethroid sprays are used to control insects, but it is observed that the use of such products leads to the development of resistance to chemical molecules thus bringing harmful effects to the infested bodies (CHAGAS et al., 2003).

The development of myiases occur by the infestation of larvae of flies in tissues of live vertebrate animals (ORFANOU et al., 2011), causing great losses in farm animals (CRAMER-RIBEIRO et al., 2002) and is a common problem in small animal veterinary practice (CRAMER-RIBEIRO et al., 2002; CARDOZO & RAMADINHA, 2007). Several factors may predispose larval infestation, such as injuries caused by trauma and/or dermatological diseases (CARDOZO & RAMADINHA, 2007). In this context, phytotherapy is considered an important alternative in the control of insects, which can reduce the economic impact (OLIVO et al., 2008). Repellent activity of herbal medicines such as citronella against mosquitoes, flies and ticks has been observed (OLIVO et al., 2008; LACHANGE & GRANGE, 2014).

Carapa guianensis is a tree of the ***Meliaceae*** family, popularly known as "andiroba" or "kinky", cultivated in tropical climates and has been used as a repellent against mosquitoes (RIBAS& CARREÑO, 2010). ***Caesalpinia ferrea*** is a tree of the ***Leguminosae-Caesalpinoidae*** family, known

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as "jucá" or "ironwood", mainly found in tropical climates (LORENZI, 2002), and there are few studies on its repellent action.

Studies with herbal medicine aim to provide a variety of products with similar effectiveness of allopathic medicines, but at a low cost (MACIEL et al., 2002). Considering the biodiversity of the Brazilian plants and the medicinal potential that they have, it was aimed to evaluate the repellent action of andiroba and jucá plants on species of flies of the ***Calliphoridae*** family.

MATERIALS AND METHODS

Carapa guianensis oil and the hide of ***Caesalpinea ferrea*** fruit were obtained from the Universidade Federal de Rondônia (UFR). Both were collected from the city of Ji-Paraná (RO- Brazil) in January 2011. ***C. guanensis*** was identified in the herbarium at the Faculdade São Lucas/Porto Velho (RO) and a specimen is registered under the accession number 3672. ***C. ferrea*** was identified at the herbarium at the Centro Universitário Luterano de Ji-Paraná (CEULJI/ ULBRA) under the accession number 244.

To assess the repellent effect, pure ***C. guanensis*** oil, and the powdered hide of ***C. ferrea*** fruit were mixed and homogenized with petrol jelly (CAS nº 8009-03-8), containing fatty acids and glycerol (GEBARA et al., 2005). These mixtures were made at a concentration of 20% and 50%. Treatment groups were then divided as: Andiroba 20% (A20 - 80% petrol jelly and 20% oil), and 50% (A50- 50% petrol jelly and 50% oil); and Jucá 20% (J20 - 80% petrol jelly and 20% powdered fruit hide) and 50% (J50 - 50% petrol jelly and 20% powdered fruit hide).

WOT (Wind Oriented Trap) traps were constructed according to the model of VIANNA et al. (2004), using deteriorated bovine liver as an attractive. Five hundred grams of deteriorated beef liver were placed inside each trap as bait. The bait was placed in a plastic pot with water in order to keep it moist. In each trap 5ml of the cream treatments A20, A50, J20, J50 were added, and one trap containing only deteriorated beef liver was used as a positive control (PC) (PC – 100% petrol jelly in deteriorated bovine liver).

The experiment was conducted in January, in the town of Capão do Leão (31° 45'00'' S, 52° 30'00'' W, altitude 21.00m), state of Rio Grande do Sul, Brazil. The region has a subtropical climate, and six repetitions of the assay were conducted. During the experiment, temperatures ranged from 15ºC to 34ºC and humidity from 20% to 80% (CLIMATEMPO, 2012). WOT Traps were placed in an area equivalent to two acres in open fields with native pasture. Five traps were used and installed ten meters equidistant from each other, suspended at 1.20 meters above the ground. The traps stayed in place for 24 hours, after which the flies were collected, the liver and herbal medicine changed, and a new repetition started. After the capture period, the amount and species of the flies within each trap were identified. These were placed in glass vials, frozen at -20°C and compared to the identification key proposed by CARVALHO & RIBEIRO (2000).

For data analysis, the protection index (%) was used based on the formula of ABBOTT (1925), in which it is determined the number of flies present in the control group (C) and number of flies in the present treatments (T) [(C - T)/C] x 100. The Kruskal-Wallis test was used at a significance level of 5% for statistical analysis using Statistics 9.0 software.

RESULTS

Flies of the ***Calliphoridae*** family, captured in WOT traps during the experiment were: ***Lucilia eximia*** (32.81%); ***Chrysomya albiceps*** (25%); ***Chrysomya megacephala*** (21.31%), ***Lucilia sericata*** (7.40%), ***Lucilia cuprina*** (1.5%) and ***Sarconesia chlorogaster*** (1.5%) (Table 1). The largest number of flies caught occurred in the collection days with the highest temperature and humidity, respectively days 2 and 5 with temperatures of 29ºC and 25ºC, and humidity 80% and 77%, respectively (Table 1). Flies were found in every repetition in the traps treated with the positive control (PC), while the best repellency activity was observed in the traps with ***C. ferrea*** at concentrations of 20% (J20) and 50% (J50). No flies were captured in traps with ***C. ferrea*** of 50%, while only one fly (genus ***Lucilia eximia***) was found in those treated with ***C. ferrea*** of 20%. In the ***C. guianensis*** trap with 50% (A50) three flies were captured in the six days of collection, and in the treatment with ***C. guianensis*** of 20% (A20) several species of flies were collected, demonstrating less repellent action of the herbal medicine at this concentration.

In the repellency evaluation of plants by the use of the ABBOTT (1925) formula, it is possible to observe that traps containing ***C. ferrea*** at 20% (J20) and 50% (J50) presented a higher repellency, with 97.5% and 100%, respectively, than those containing ***C. guianensis*** at 50% (A50) and 20% (A20) with 92.5% and 60% repellency, respectively. As for the repellency of herbal medicines compared with the positive control group, significant differences were

Table 1 - Demonstration of the repellency activity of ***Caesalpinia ferrea*** and ***Carapa guianensis*** against flies caught in WOT traps.

	----------Climate----------		***Calliphoridae*** flies	----------Treatment and number of flies----------				
	TempC°	Humid %		CP	A 20	A50	J20	J50
1	27	55	***Lucilia eximia***	1	0	0	0	0
2	25	77	***Lucilia eximia***	9	1	0	0	0
3	35	40	***Sarconesia chlorogaster***	1	0	0	0	0
4	33	45	***Lucilia eximia***	3	0	0	0	0
5	29	80	***Chrysomya albiceps***	6	8	0	0	0
			Chrysomya megacephala	8	3	1	0	0
			Lucilia cuprina	1	0	0	0	0
			Lucilia eximia	7	0	2	1	0
			Lucilia sericata	2	2	0	0	0
6	25	67	***Chrysomya albiceps***	1	2	0	0	0
			Chrysomya megacephala	1	0	0	0	0

observed: J50 ($P<0.01$), J20 ($P<0.01044$) and A50 ($P<0.01077$).The efficacy assessment among the different plant extracts showed that, treatment with A20 was significantly more effective ($P<0.0026$) when compared to the other groups (A50, J20, and J50) (Table 2).

DISCUSSION

The assessment of ***C. ferrea*** and ***C. guianensis***'s repellent action on flies of the ***Calliphoridae*** family yielded promising results, especially for the jucá (***C. ferrea***) compound. The flies of the ***Calliphoridae*** family captured during this study are common agents causing larval infestations in veterinary medicine. Furthermore, these species have a particular importance in public health, acting as vectors to other pathogens, aggravated by their synantropic nature (CARVALHO & RIBEIRO, 2000).

The largest amount of captured flies was on days with higher temperatures and relative humidity. This was expected, and has been repeatedly demonstrated by other authors (GOMES et al., 2000; CORRÊA et al., 2010). These species of flies are seasonal, occurring in greater numbers in months and regions with high temperatures and rainfall.

Table 2 - Average number of flies present in traps, standard deviation and Protection Index calculated.

Preparation	Mean (S.D.)	Protection Index calculated (%)
A20	3.3 (6.3) a	60
A50	0.5 (1.2) b	92.5
J20	0.5 (1.2) b	97.5
J50	0.0 (0.0) b	100
CP	7.5 (9.9) a	0

Different letters represent statistically different results in the column (Kruskal Wallis $P<0.05$).

According to NERIO et al. (2010), the repellent capacity of a given plat extract will depend on the specific compounds, and their concentration, present in the extract. To produce the creams used in this study, petroleum jelly (Vaseline) was used. As an oily with inodorous substance, this vehicle has no effect on its own, but probably allowed the aggregation of the active substances in the plant extracts. Furthermore, petroleum jelly has been shown to allow a controlled and moderate release of volatile compounds in these extracts, enhancing the period of effect.

The treatment of larval infestations in veterinary practice is usually done through topic or systemic application of chemicals to kill the larvae, with the mechanical removal of accessible instars, often requiring anesthesia and anti-inflammatory/ antibiotic support (MORETTI & THYSSEN, 2006; CARDOZO & RAMADINHA, 2007). Using natural products to avoid infestations is a safe way to improve pet´s quality of life, avoiding unnecessary discomfort, and appealing to consumer demands. Likewise, the low cost of such products make them particularly for preparations aimed at livestock protection, associated with environmental modifications which have been shown to reduce the number of infestations in these species. (MORETTI & THYSSEN, 2006; CARDOZO & RAMADINHA, 2007). Plant based products can be produced at reasonable costs with satisfactory results, as shown in this study. Although further research should be carried out on the effects of these plants on other arthropods, such as ticks and mites, and in combination with other dematological

products, there is no doubt that they efficiently repeal flies of the ***Calliphoridae*** family.

CONCLUSION

In the conditions considered here, preparations containing Andiroba at 50%, and Jucá, both at 20 and 50%, have repellant effect against ***Chrysomya albiceps***; ***Chrysomya megacephala***, ***Lucilia cuprina***, ***Lucilia eximia***, ***Lucilia sericata*** and ***Sarconesia chlorogaster***, all flies of the ***Calliphoridae*** family.

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