http://dx.doi.org/10.5902/2236117026407
Revista do Centro do Ciências Naturais e Exatas - UFSM, Santa Maria
Revista Eletrônica em Gestão, Educação e Tecnologia Ambiental - REGET
e-ISSN 2236 1170 - V. 21, n. 1, jan.- abr. 2017, p.88-96

Tick *Rhipicephalus microplus* Canestrini: Biological, morphological and biological activity

Carrapato *Rhipicephalus microplus* Canestrini: Aspectos biológicos, morfológicos e atividade biológica

Andrina Guimarães Silva Braga[1], Renato Abreu Lima[2], Caroline Oliveira Celestino[3] e Valdir Alves Facundo[4]

[1] Doutoranda em Biodiversidade e Biotecnologia pela Universidade Federal do Amazonas. Departamento de Ciências Biológicas
andrinagsilva@gmail.com
[2] Biólogo, Prof. D.Sc. em Biotecnologia, Universidade Federal do Amazonas, UFAM, Benjamin Constant-AM, Brasil
renatoabreu07@hotmail.com
[3] Graduação em Ciências Biológicas, Faculdade Integradas Aparício Carvalho, FIMCA, Porto Velho-RO, Brasil,
carol-olyver@bol.com.br
[4]Químico, Profº. D.Sc. em Química Orgânica, professor da Universidade Federal de Rondônia, Porto Velho, RO
vfacundo@pq.cnpq.br

Resumo

O rebanho bovino brasileiro é o segundo maior do mundo e o primeiro maior exportador e produtor de carne bovina. Apesar disso, os prejuízos diretos em decorrência do parasitismo pelo carrapato *Rhipicephalus microplus* são devido à perda de peso, baixa produção de leite e diminuição da qualidade do couro. Com isso, o presente trabalho constitui-se de uma revisão bibliográfica sobre o rebanho bovino brasileiro associado com os danos causados por parasitas. Foram utilizadas as bases de dados: LILACS, SciELO e PubMed e por meio de palavras-chave como ectoparasitas, carrapatos e gado brasileiro tornou-se a pesquisa. Constatou-se que nas últimas décadas, tem-se dado uma extrema importância econômica para a agricultura brasileira visando o controle biológico para diminuição do ataque de pragas.

Palavras-chave: *Ectoparasitas. Rhipicephalus microplus. Carrapato bovino. Danos causados por parasitas.*

Abstract

The Brazilian cattle herd is the second largest in the world and the first largest exporter and producer of beef. Nevertheless, the direct losses due to parasitism by *Rhipicephalus microplus* are due to weight loss, low milk production and decreased quality of leather. Thus, this study consists of a literature review on the Brazilian cattle herd associated with damage caused by pests. databases were used: LILACS, SciELO and PubMed and through keywords such as ectoparasites, ticks and Brazilian cattle became the research. It was found that in recent decades has been given an extreme economic importance for Brazilian agriculture aiming to decrease the biological control of pest attack.

Keywords: *Ectoparasites. Rhipicephalus microplus. Tick Bovine. Damage caused by pests.*

Recebido em: 19.03.17 Aceito em: 13.04.17

1 Introduction

The Brazilian cattle herd was recently estimated at 193,393,388 million head, the second largest herd in the world and the first largest exporter and producer of beef (ANUALPEC, 2013 apud TONIN; DEL CARLO, 2014). Despite advances in the industry, the parasites continue to cause many barriers to Brazilian livestock. The direct losses due to parasitism by *Rhipicephalus microplus* are due to weight loss, low milk production, reproductive failure, skin lesions favoring the occurrence of myiasis and decreasing the quality of the leather, transmission of pathogens (*Babesia bovis*, *Babesia bigemina* and *Anaplasma*) and indirect losses as spending on drugs and labor (FARIAS, 2014; SACCO, 2002).

The tick *R. microplus* is a ixodídeo responsible for great economic losses to livestock in tropical and subtropical regions. This tick is a blood-sucking ectoparasites originating in Asia, whose primary host is cattle. Its incidence is higher in large herds America, Africa, Asia and Australia, is considered the tick greatest impact in economic loss in cattle herds in South America (GONZALES et al., 2003; NARI, 1995).

This ectoparasites, known in Brazil as tick of cattle, is a blood-sucking ectoparasites belonging to the phylum Artropoda, Aracnida class, order Acarina, suborder and superfamily Metastigmata Ixodidea, gêneno *Rhipicephalus*, *Boophilus* subgenre. The ticks *Boophilus* were reclassified by means of a molecular phylogenetic study as belonging to the genus *Rhipicephalus* (MURRELL; BARKER, 2003; MURRELL et al. 2000; MURRELL et al., 2001; BEATI; KEIRANS, 2001).

R. microplus ectoparasites monóxeno (a single host), depending on only one host in their life cycle, preferably cattle and secondarily other species such as buffalo, horses, sheep, goats and deer. Its biological cycle divided into two phases, the free-living and parasitic (FERRETTO, 2013). According Grisi et al. (2014), the tick *R. microplus* is responsible for significant losses to the Brazilian cattle ranching, estimates showed that the annual economic impact may be greater than $324 billion. The damage caused by this ectoparasite is divided into direct and indirect damages. Direct damage is caused by: Direct action on the host, estimated 1-3 ml of blood to complete its life cycle in an animal. Therefore, it can cause anemia and loss of nutrients. Moreover, the irritation caused by ticks leads to a reduction of food intake by animals, depreciation of the leather due to skin damage, and high infestations predispose installation miíses.

Thus, all these factors have a negative impact on weight gain, milk production and the optimization of leather. In indirect highlight to the transmission of pathogens that Sadness Parasitic Bovina (the *Babesia* protozoa of the genus and the bacterium *Anaplasma* genus) (FERRETTO, 2013; CORDOVAN, 1999; ROAD-PEÑA; JONGEJAN, 1999; PAROLA; RAOULT 2001; GONZALES et al., 2003; NARI, 1995). In recent decades, the chemical control of cattle tick has been realized as the predominant form, to be practical, effective and economical. However, excessive use of acaricide without understanding the ecology and epidemiology of tick ally failures in detecting and application led to good resistance development of the drugs available in the market (SPAGNO; PARANHOS; ALBUQUERQUE, 2010; GUERRERO et al., 2014; ALVES-WHITE et al., 2008; GULIAS-GOMES, 2009; BULLMAN et al., 1996; ROCHA, 1996; LEITE et al., 1995; LEAL et al., 2003; FURLONG; SILVER, 2006).

The need for new active ingredients for the control of *R. microplus* is a reality, the identification of new molecules with acaricide activity can be found from studies with plant extracts. For, from the 90s, with the rise of these obstacles to livestock production, research seeking alternative acaricide control from herbal measures stood out (BUZATTI et al., 2011; FERRETTO, 2013).

The species of *R. microplus* stands out in agricultural research due to concern generated by use of conventional chemicals for its control, which lead to two major problems, the rapid development of resistance to the active ingredient and waste in origin products animal, which has caused great concern in society is government agency. This study aimed to analyze the damage caused by *R. microplus* and the search for new molecules to with acaricide action, exposing their effectiveness and identifying substances with the active ingredient through literature.

2 Materials and Methods

This work consisted in a bibliographic qualitative study, descriptive and exploratory, about action and damage caused by *R. microplus*, from electronic search databases, as well as the Google Scholar access, Scientific Electronic,
Library Online (SciELO) and Capes Journal, have been evaluated by scientific articles means, dissertations, theses, books and monographs the years 1995-2015 in Portuguese, English and Spanish, selecting those that brought relevant scientific knowledge bolvino tick in question to gather a single document information on the species *R. microplus*.

According to Rodrigues (2007), the literature search is a search mode in which scientific knowledge and recovered by a problem in which the exploratory research and provides greater depth with the problem, going through lifting bibliographies or interviews, and a qualitative research approach is one that describes and that the information can not be described in numbers. According to Tozoni-Kings (2010), all the search modes require literature review [...], but only the bibliographical research is the literature data collection field. To Lima; Mioto, (2007), the literature is more labor intensive, because demand more attention to the work is not affected.

3 Results and Discussion

The plant allelochemicals were used in plant protection of the late nineteenth century to World War II when the use of pesticides organossintéticos was widespread (REGNAULT-ROGER; PHILOGÈNE, 2008; ROSSEL et al., 2008). However, due to increasing environmental concern after the Green Revolution, and in order to solve or minimize the damage caused by the indiscriminate use of synthetic insecticides, new studies seek to facilitate management strategies that include insecticidal plants (VENDRAMIM, 1997).

The plant has been an important source of substances with different chemical structures and different activities against arthropods (VIVAN, 2005). Thus, it is believed that the use of plant extracts in an isolated form or associated can cause a much slower development of strength. Another important factor and the waste problem of the reduction and its biodegradable characteristics.

The control of bovine mite that has been researched. The use of toxic and medicinal plants in pest control is of great importance for agriculture and sustainable development. The great diversity of plants found in the Amazon enables the research of new products that may replace or reduce the use of synthetic acaricides (SILVA, 2008). In the Amazon, there are numerous plants that stand out the great economic potential present in their chemical composition, secondary metabolites with activity insecticide, miticide, fungicide and bactericide (SEQUEIRA et al., 2009; ALECIO et al., 2010; SANTOS et al., 2011).

The use of plant extracts in tick control has also been the focus of research in several countries (CHUNGSAMARNYART et al., 1991; WILLIAMS, 1993; Vatsya et al., 2006; ALVAREZ et al., 2008). In Brazil, studies that use eucalyptus oil (*Eucalyptus* spp.) (Myrtaceae), extracted rotenoids the timbó (*Derris annatto*) (Fabaceae) (VERISSIMO, 2004) and azadirachtin present in Meliaceae family plants (Melia azedarach) (BORGES et al., 2003) have shown promise in control of this parasite.

The use of plants with insecticidal properties is a very ancient practice (ROEL, 2001; GALLO et al., 2002), but currently resurfaces as search object of new alternative molecules to control and integrated pest management (COSTA et al., 2004). Plants produce biochemical defenses, also known as secondary metabolites (FRIGHETTO, 1997), which according to Rodríguez and Vendramim (1996) cause mortality and act negatively on the behavior and physiology of insects. Vendramim (1997) reported two approaches to the use of plants for activity on insects: the discovery of new molecules that permit the formulation of synthetic products and obtaining natural botanical insecticides for direct use in pest control.

For Fazolin et al. (2002), the choice of the best approach is related to the chemical structures, which are very large, complex, difficult to isolate and synthesize, and the considerations of economic and technological. According to Vendramim (1997), the insecticide plants can be used in various ways, most commonly your job as a dry powder, oils, aqueous and non-aqueous. For this author, powders and aqueous extracts, constitute the best option because they are easy to obtain and application.

Currently exist in Brazil, many studies on the fitoinseticida potential of some native plants (PERON; FERREIRA, 2012), among which, those belonging to the Piperaceae family has stood out with some promising species in the control of various pests. Several studies have demonstrated the feasibility of using bioactive compounds derived from plants to control pests, because of its efficiency, generally inexpensive, safe for consumers and the environment (SHAAYA et al., 1997; HUANG et al., 2000; BOUDA et al., 2001; DEMISSIE et al., 2008).

They may be used as powders, aqueous or organic extracts, essential oils, with toxic by contact, ingestion and fumigation (KARR; COATS 1988; RAJENDRAN; SRIRANJINI, 2008). These products cause mortality, repellency, deference in feeding and oviposition and affect the growth of insects (HUANG et al., 2000; MARTINEZ; VAN EMDEN, 2001). Many compounds of vegetable origin have been isolated, such as the terpenoids, limonoids, rocaglamidas, furanocumarina, chromene, alkaloids and acetogenins, having insecticidal properties (VIEIRA et al., 2007).

The presence of amides with insecticide and acaricide in *Piper* species has led to an intense phytochemical study of this kind. Piperine amide was the first to be isolated from the fruits of Piper species and their chemical constituents have often been investigated, among which the unsaturated lipophilic amides. These, in addition to being the main group of plant metabolites are primarily responsible for insecticidal activity (PARMAR et al., 1997).

Studies with *Piper* species in Asia and Africa show that lignans and isobutylamides are compounds with higher activity defense against insects (BERNARD, 1995). In Brazil, *P. aducum* L. species, *P. hispidinervum* C. DC., and *P. tuberculatum* have recently been evaluated against various insect pests (Castro et al., 2010). The extracts of *Piper tuberculatum* Jacq leaves have been used as insecticides (TRINITY et al., 2012), and against the food of insects and essential oils have been used as miticides (Castro et al., 2008). However, there are few studies to evaluate the use of extracts *P. tuberculatum* against ticks (Chagas et al., 2012).

According to Lima et al. (2014) the acaricidal efficiency may vary depending on the method of extraction, solvent polarity, and part of the plant used for the extraction. Lima et al. (2014) evaluated the fruit of *P. tuberculatum* in different solvents, hexane, ethyl ether, methanol and ethanol against larvae and engorged female *R. microplus*. In larvae extracts with lower polarity showed the best results, hexane (LC50% = 0.04 mg / ml) followed by ethyl ether extracts (LC50% = 0.08 mg / ml), ethanol (LC50 = 2.73 mg% / ml) and finally metamol (LC50% = 4.49 mg / ml). In engorged female oviposition reduction showed better results for the hexane extracts (100%) and ethyl ether (88.1%). The highest efficiency was checked by ethyl ether extract (% LC50 = 18.4 mg / ml), followed by methanol extract (LC50% = 105.6 mg / ml) and ethanol (LC50% = 140.0 mg / mL).

Lima et al. (2013), also evaluated in vitro *P. tuberculatum* fruit extracts with different solvents on larvae and engorged females of *R. microplus*. The selected solvents: hexane, ethyl ether, ethanol and methanol. Both assays were performed with five different concentrations for each of the extracts. The hexânico extracts showed the highest larvicidal activity against *R. microplus*. The *P. tuberculatum* fruits extracts were also effective against engorged females, and the ethyl acetate extract more efficient to LC50 = 18%, 4 mg / ml, followed by methanolic LC50% = 105.6 mg / ml % ethanolic LC50 = 140.0 mg / mL and LC50% hexane = 297,4mg / ml.

Santos et al. (2013) evaluated 21 species of plants against larvae and adults of R. microplus, but only *L. canescens*, *M. latifolia*, *C. castaneifolia*, *S. hispida*, *H. volubilis*, and *H. mutabilis* were active on tick larvae with 95% effectiveness at the concentration of 400 mg / ml. Santos et al. (2013) evaluated a concentration of 400 mg / ml. Chagas et al. (2012) evaluated the crude extract of *P. tuberculatum* leaves on larvae and engorged females of *R. microplus*. Larvae were evaluated in five dilutions (0.31%, 0.63%, 1.25%, 2.5%, 5% and 10%) which was obtained LC50 0.41% LC90% and 0%, 63%).

In engorged females was found an efficacy of 91.66% at a dilution of 10%, which according to the authors was due to the effect on the eggs hatch. Still verified a high percentage of 5% mortality (63.34%), which was obtained LC50 and LC90% 3.76% 25.03%%. Barros et al. (2010) also tested in triplicate crude extract of *P. tuberculatum* (in concentrations ranging from 10% to 0.04%), hexane partition (5% to 0.02%) and dichloromethane partition (5% to 0,08%), and the isolated piperine (5% to 0.08%) and piplartine (1.25% to 0.02%) and 13 synthetic substances called structurally similar to piperine in a concentration of 0.15% in immersion test and 0.5% in the impregnated paper test.

The control consisted of 3% Tween 80 and distilled water. The data obtained were used to determine the effectiveness of the product. For females, the crude extract of *P. tuberculatum* 10% and 5% hexane partition presented the best efficacies with 91.97% and 74.29% respectively. As for the larvae, the 5% crude extract and 2.5% and the hexane partition from 2.5% to 0.31% were 100% effective. Research management opportunities using resources of natural origin to control *R. microplus*, as the use of plant molecules with potential acaricide, can provide the development of viable methods to reduce chemical contamination in livestock and minimize one of the major problems faced by farmers and increased *R. microplus* resistance to synthetic acaricides.

Conclusion

Infections caused by ectoparasites are responsible for damages to the creation of beef cattle. The control of these infections is essential to the success of ruminant production systems. In addition to the observation of animals susceptible to various parasites, should be highlighted viable alternatives such as biological control as a form of management practice for so reduce the population of parasites guided by the use of active ingredients of medicinal plants.

Acknowledgements

The authors thanks the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and Fundação de Amparo à Pesquisa do Estado do Amazonas (FAPEAM).

References

ALECIO, M.R.; FAZOLIN, M.; COELHO NETO, R.A.; CATANI, V.; ESTRELA, J.L.V.; ALVES, S.B.; CORREA, R.S.; ANDRADE NETO, R.C.; GONZAGA, A.D. 2010. Ação inseticida do estrato de *Derris amazônica* Killip para *Cerotoma arcuatus* Olivier (Coleoptera: Chrysomelidae). **Acta Amazonica,** v. 40, n. 4, p. 719-728.

ÁLVAREZ, V. et al. Control *in vitro* de garrapatas (*Boophilus microplus*; Acari: Ixodidae) mediante extractos vegetales. **Revista de Biologia Tropical**, v. 56, n. 1, p. 291-302, 2008.

ALVES-BRANCO, F.P.S.; PINHEIRO, A.C.; SAPPER, M.F.M.; MERCIER, P.; WHITE, C.R. Carrapato dos Bovinos (*Boophilus microplus*) "Controle e Resistência a Carrapaticidas no Rio Grande do Sul". In: V SEMINÁRIO DE PECUÁRIA DE CORTE. p. 84, 2008, Bagé. **Palestras**...Bagé, 2008.

BARROS, F., VINHOS, F., RODRIGUES, V.T., BARBERENA, F.F.V.A., FRAGA, C.N. 2010. Orchidaceae in R.C. Forzza, et al (org.). Catálogo de plantas e Fungos do Brasil. **Jardim Botânico do Rio de Janeiro**. v.2., p.1344- 1426.

BEATI, L., KEIRANS, J. E. Analysis of the systematic relationships among ticks genera Rhipicephalus and Boophilus (Acari: Ixodidae) based on mitochondrial 12S ribosomal DNA gene sequences and morphological characters. **Journal of Parasitology**. V.87 n.1, p. 32-48, 2001.

BERNARD, C.B.; KRISHANMURTY, H.G.; CHAURET, D.; DURST, T.; PHILOGNE, B.J.R.; SNCHEZ-VINDAS, P.; POVEDA, L.; SAN ROMÉN, L.; ARNASON, J.T. Inseticidal defenses of Piperaceae from the neotropics. **Journal of Chemical Ecology**, v.21, p. 801-814, 1995.

BOUDA, H.; TAPONDJOU, L.A.; FONTEM, D.A.; GUMEDZOE, M.Y.D. Effect of essential oils from leaves of *Ageratum conyzoides*, *Lantana camara* and *Chromolaena odorata* on the mortality of *Sitophilus zeamais* Mots., 1865 (Coleoptera, Curculionidae). **Journal of Stored Products Research,** v. 37, p. 103-109, 2001.

BORGES, L. M. F. et al. *In vitro* efficacy of extracts of *Melia azedarach* against the tick *Boophilus microplus*.**Medical and Veterinary Entomology**, v. 17, n. 2, p. 228-231, 2003.

BULLMAN, G.M.; MUÑOS CABENAS, M. E.; AMBRÚSTOLO, R.R. El impacto ecológico de las lactonas macrociclicas (endectocidas): una actualizacion compreensiva y comparativa. **Veterinária Argentina**, v. 8, p. 3-15, 1996.

BUZATTI, A.; KRAWEZAK, F.S.; PIVOTO, F.L.; VOGEL, F.S.F.; BOTTON, S.A.; ZANETTI, G.D.; MANFRON, CASTRO, M.J.P.; SILVA, P.H.S.; PÁDUA, L.E.M. Potencial de extratos de frutos frescos e desidratados de *Piper tuberculatum* Jacq. (Piperaceae) no desenvolvimento da lagarta-do-cartucho do milho. **Magistra Cruz das almas,** v. 22, n. 2. Bahia, 2010.

CASTRO, M.J.P.; SILVA, P.H.S.; PÁDUA, L.E.M. Atividade de extratos de *Piper tuberculatum* Jacq. (Piperaceae) dobre *Shodoptera frugiperda* (J.E. Smith). **Revista Ciências Agronômicas**, v. 3, p. 437-442, 2008.

CHAGAS, A.C.S.; BARROS, L.D.; COTINGUIBA, F.; FURLAN, M.; GIGLIOTI, R.; OLIVEIRA, M.C.S.; BIZZO, H.R. In vitro efficacy of plant extracts and synthesized substances on *Rhepicephalus* (*Boophilus*) *microplus* (Acari: Ixodidae). **Parasitology Revist,** v. 110, p. 295-303, 2012.

CHUNGSAMARNYART, N.; JIWAJINDA, S.; JANSAWAN, W. Acaricidal effect of plant crude-extracts on tropical cattle tick (*Boophilus microplus).* **Kasetsart Journal**, (*Natural Sciences Supplement*), v. 25, p. 90-100, 1991.

COSTA, E. L. N.; SILVA, R. F. P.; FIUZA, L. M. Efeitos, aplicações e limitações de extratos de plantas inseticidas. **Acta Biologica Leopoldensia**. São Leopoldo, v. 26, n. 2, p.173-185, 2004.

CORDOVÉS, C.O. **Carrapatos**: controle e erradicação. Alegrete: Galha, 1999, p. 130.

DEMISSIE, G.; TESHOME, A.; ABAKEMAL, D.; TADESSE, A. Cooking oils and "Triplex" in the control of *Sitophilus zeamais* Motschulsky (Coleoptera: Curculionidae). **Journal of Stored Products Research**, v. 44, p. 173-178, 2008.

DOS SANTOS, M.R.A.; LIMA, R.A.; SILVA, A.G.; TEIXEIRA, C.A.D.; LIMA, D.K.S.; POLLI, A.R.; FACUNDO, V.A. Atividade inseticida do extrato de raiz de *Piper hispidum* H.B.K. (Piperaceae) sobre *Hypothenemus hampei* Ferrari. **Revista saúde e pesquisa,** v. 4, n. 3, p. 335-340, 2011.

FARIAS, J.A. Efeito acaricida *in vitro* de extratos de ***Baccharis trimera*, *Vernonia nudiflora* e *Eupatorium buniifolium* (Asterales: Asteraceae) EM LARVAS E ADULTOS DE *Rhipicephalus* (*Boophilus*) *microplus* (Acari: Ixodidae).** Dissertação (Mestrado em Ciência Animal). Universidade do Estado de Santa Catarina, Lages, 2014.

FRIGHETTO, R.T.S. Preparação e avaliação da bioatividade de extratos vegetais. In: CONGRESSO BRASILEIRO DE ENTOMOLOGIA, 16., 1997, Salvador. **Resumos...** Salvador: SEB; Cruz das Almas: EMBRAPA-CNPMF, 1997. p. 10.

ESTRADA-PENÃ, A.; JONGEJAN, F. Ticks feeding on humans: a review of records on human-biting Ixodoidea with special reference to pathogen transmission. **Experimental and Applied Acarology**, v. 23, p. 685-715, 1999.

FAZOLIN, M.; ESTRELA, J.L.V.; LIMA, A.P.; ARGOLO, V.M. **Avaliação de plantas com potencial inseticida no controle da vaquinhado-feijoeiro (*Cerotoma tingomarianus* Bechyné)**. Rio Branco: Embrapa Acre, 2002. 42 p. Embrapa Acre. Boletim de Pesquisa e Desenvolvimento, 37).

FERRETTO, R. **Revisão de literatura sobre *Rhipicephalus* (*Boophilus*) *microplus***. Monografia em medicina veterinária, Faculdade de Veterinária. 46f., 2013.

FURLONG, J.; PRATA, M. **Controle estratégico do carrapato dos bovinos de leite.** Juiz de Fora: EMBRAPA-CNPGL, 2006. 2 p. (Circular Tecnica, 38).

GALLO, D; NAKANO, O; NETO, S. S; CARVALHO, R. P. L; BAPTISTA, G. C; FILHO, E. B; PARRA, J. R. P; ZUCCHI, R. A; ALVES, S. B; VENDRAMIM, J. D; MARCHINI, L. C; LOPES, J. R. S; OMOTO, C; **Manual de Entomologia Agrícola**. Ed Fealq: Piracicaba-SP, p. 920, 2002.

GONZALES, J. C. **O controle do carrapato do boi**. 3.ed. Passo Fundo: Universidade de Passo Fundo, 2003. 128 p.

GULIAS-GOMES, C.C. O Carrapato-do-Boi e o Manejo da Resistência aos Carrapaticidas. **Comunicado Técnico 70**. Bagé, p. 5, 2009.

GRISI, L.; LEITE, R.C.; MARTINS, J.R.S.; BARROS, A.T.M.; ANDREOTTI, R.; CANÇADO, P.H.D.; LEÓN, A.A.P.; PEREIRA, J.B.; VILLELA, H.S. Reassessment of the potential economic impact of cattle parasites in Brazil. **Revista Brasileira de Medicina Veterinária**, v. 23, p. 150-156, 2014.

HUANG, Y.; LAM, S.L.; HO, S.H. Bioactivies of essential oil from *Ellateria cardamomum* (L.) Maton. to *Sitophilus zeamais* Motschulsky and *Tribolium castaneum* (Herbst). **Journal of Stored Products Research,** v. 36, p.107-117. 2000.

KARR, L.L.; COATS, J.R. Insecticidal properties of d-limonene. **Journal Pesticide Scienc**, v. 13, p. 287-289, 1988.

LEAL, A. T.; FREITAS, D. R. J. de; VAZ JUNIOR, I. da S. Perspectivas para o controle do carrapato bovino. **Acta Scientiae Veterinariae**, v. 31, n. 1, p. 1-11, 2003.

LEITE, R.C.; LABRUNA, M.B.; OLIVEIRA, P.R.; MONTEIRO, A.M.F.; CAETANO JÚNIOR, J. In vitro susceptibility of engorged females from different populations of Boophilus microplus to commercial acaricides. **Revista Brasileira de Parasitologia Veterinária**, v. 4, n. 2, p. 283-294, 1995.

LIMA, T.C.S.; MIOTO, R.C.T. Procedimentos metodológicos na construção do conhecimento científico: a pesquisa bibliográfica. **Rev.Katál**., v. 10, n.esp., p. 37-45, 2007.

LIMA, A.S.; SOUZA, J.G.N.; PEREIRA, S.G.; GUILLON, M.S.P.; SANTOS, L.S.; COSTA, L.M. Acaricide activity of different extracts from *Piper tuberculatum* fruits againt *Rhipicephalus microplus*. **Parisitol Revist**, v. 113, p. 107-112, 2014.

LIMA, W.Q. F. L.; PEREIRA, T. C. D.; PEREIRA, M. G. M.; BRITO, N. J. N.; ZAMPIERON, R. G.; SILVA, G. A. Avaliação fitoquímica e antioxidante de plantas medicinais do norte do Mato Grosso. **Revista Brasileira de Farmacognosia**, 2013.

MARTINEZ, S.S.; VAN EMDEN, H.F. Growth disruption, abnormalities and mortality of *Spodoptera littoralis* (Boisduval) (Lepidoptera: Noctuidae) caused by azadirachtin. **Neotropical Entomologia,** v. 30, p. 113-124, 2002.

MURREL, A.; BARKER, S.C. Synonymy of *Boophilus* Curtice, 1891 with *Rhipicephalus* Koch, 1844 (Acari: Ixodidae). **Syst Parasitology, Queensland,** v. 56, n. 3, p. 169-172, 2003.

MURREL, A.; CAMPBELL, N.J.H.; BARKER, S.C. Phylogenetic analyses of Rhipicephaline ticks indicate that the genus *Rhipicephalus* is paraphiletic. **Molecular Phylogenetics and Evolution**, v. 16, n. 1, p. 1-7, 2000.

MURRELL, A.; CAMPBELL, N.J.H.; BARKER, S.C. Totalevidence phylogeny of ticks provides insights into the evolution of life cycles and biogeography. **Molecular Phylogenetics and Evolution**, v. 21, n. 2, p. 244-258, 2001.

NARI, A. Strategies for the control of one-host ticks and relationship with tickborne diseases in South America. **Vet. Parasitol**., v. 57, p. 153-165, 1995.

PAROLA, P.; RAOULT, D. Tick- borne bacterial diseases emerging in Europe. **Clin Microbiol Infest**, v. 7, p. 80-83, 2001.

PARMAR, V.S.; JAIN, S.C.; BISHT, K.S.; JAIN, R.; TANEJA, P.; JHA, A .; TYAGI, O. D.; PRASAD, A.K.; Wengel, J.; Olesen, C.E; Boll, P.M. Phytochemistry of the Genus Piper. **Phytochemistry**, v. 46, n. 4, p. 597-673. 1997.

PERON, F., FERREIRA, G.C.A. Potencial inseticida de extrato de sementes de mamona (*Ricinus communis* L.) no controle da lagarta-do-cartucho (*Spodoptera frugiperda*). **Anais...** VI Mostra Interna de Trabalhos de Iniciação Científica, 2012.

REGNAULT-ROGER, C.; PHILOGENE, B.J.R. Past and current prospects for the use of botanicals and plant allelochemicals in integrated pest management. **Pharm. Biol,** v. 46, n. 1–2, p. 41−52, 2008.

RAJENDRAN, S.; SRIRANJINI, V. Plant products as fumigants for stored-product insect control. **Journal of Stored Products Research,** v. 44, p. 126-135, 2008.

ROCHA, C.M.B.M.; OLIVEIRA, P.R.; LEITE, R.C. Percepção dos produtores de leite do município de Passos, MG, sobre o carrapato *Boophilus microplus* (Acari: Ixodidae), 2001. **Ciência Rural,** v. 36, n. 4, p. 1235-1242, 2006.

RODRIGUES, W. C. **Metodologia Científica**. FAETEC/IST. Paracambi, 2007.

RODRÍGUEZ, H.C.; VENDRAMIM, J.D. Toxicidad de extractos acuosos de Meliaceae em *Spodoptera frugiperda* (Lepidoptera: Noctuidae). **Manejo Integrado de Plagas**, Costa Rica, n. 42, p. 14-22, 1996.

ROEL, A.R. Utilização de plantas com propriedades inseticidas: uma contribuição para o desenvolvimento rural sustentável. **Rev. Internacional de Desenvolvimento Local**, v.1, n.2, p.43-50, 2001.

ROSSEL, G.; QUERO, C.; COLL, J.; GUERREIRO, A. Biorational insecticides in pest management, **Journal of Pest Science**, Berlin, v. 33, n. 02, p. 103-121, 2008.

SACCO, A. M. S. Profilaxia da Tristeza Parasitária Bovina: Por quê, quando e como fazer. **Circular Técnica 28**. Bagé, p. 12, 2002.

SANTOS, L.B.; SOUZA, J.K.; PAPASSONI, B.; BORGES, D.G.L.; JUNIOR, G.A.D.; SOUZA, J.M.E.; CAROLLO, C.A.; BORGES, F.A. Efficacy of extracts from plants of the Brazilian Pantanal against *Rhipicephalus (Boophilus) microplus*. **Revista Brasileira de Parasitologia Veterinária**, v. 22, p. 532-538, 2013.

SEQUEIRA, B.J.; VITAL, M.J.S.; POHLIT, A.M.; PARAROLS, I.C.; CAÚPER, G.S.B. Antibacteria and antifugal activity of extracts and exudates of the Amazonian medicinal tree *Himatanthus articulates* (Vahl) Woodson (common name: *sucuba*). **Memórias do Instituto Oswaldo Cruz,** v. 104, n. 4, p. 659-661, 2009.

SHAAYA, E.; KOSTJUKOVSKI, M.; EILBERG, J.; SUKPRAKARN, C. Plant oils as fumigants and contact insecticides for the control of stored-product insects. **Journal of Stored Products Research,** v. 33, p. 7-15, 1997.

SILVA, F.F.; SOARES, M.C.S.C.; ALVES, L.C.; LIMA, M.M.; SILVA, L.V.A.; FAUSTINO, M.A.G. SILVA, F.F. Avaliação comparativa da eficácia de fitoterápicos e produtos químicos carrapaticidas no controle do *Boophilus microplus* (Canestrini, 1887) por meio do biocarrapaticidograma. **Medicina Veterinária**, Recife, v. 2, p. 1-8, 2008.

SPAGNO, F.H.; PARANHOS, E.B.; ALBUQUERQUE, G.R. Avaliação *in vitro* da ação sobre o *Rhipicephalus (Boophilus) microplus,* Canestrini, 1887 (Acari: Ixodidae) de bovinos leiteiros no município de Itamaraju, Bahia, Brasil. **Ciência Animal Brasileira. Goiânia,** v. 11, n. 3, p. 731-736, 2010.

TRINDADE, T. T. F., STABELI, R. G., FACUNDO, V. A., CARDOSO, C. T., SILVA, M. A., GIL, L. H. S., JARDIM, I. S., SILVA, A. A. Evaluation of larvicidal activity of the methanolic extracts os *Piper alatabaccum* branches and *P. tuberculatum* leaves and compounds isolated against Anopheles darling. **Rev. Bras. Farmacogn,** 2012.

TONIN, F.; DEL CARLO, R. J. Estatísticas Brasileiras. Números da Medicina Veterinária e Zootecnia no Brasil. **Revista do Conselho Federal de Medicina Veterinária**. n. 61, ano XX, jan-abr., p.86, 2014.

TOZONI-REIS, M. F. C. **A pesquisa e a produção de conhecimentos.** In: PINHO, S. Z. (Org.). Cadernos de Formação: Formação de Professores. Educação, Cultura e Desenvolvimento. Volume 3. São Paulo: Cultura Acadêmica. v. 3, p. 111-148. 2010.

VATSYA, S. et al. *In vitro* acaricidal effect of some medicinal plantas against *Boophilus microplus*. **Journal of Veterinary Parasitology**, v. 20, n. 2, p. 141-143, 2006.

VENDRAMIM, J.D. Uso de plantas inseticidas no controle de pragas. In: CICLO DE PALESTRAS SOBRE AGRICULTURA ORGÂNICA, 2, 1997, Campinas. **Anais**... Campinas: Fundação Cargill, 1997, p. 64-69.

VERÍSSIMO, C. J. **Controle biológico e alternativo do carrapato do boi.** São Paulo: APTA/SAA-SP, 2004. 3 p.

VIEIRA, P.C.; MAFEZOLI, J.; BIAVATTI, M.W. Inseticidas de origem vegetal, p.105-120. In: CORRÊA, A.G.; VIEIRA, P.C. (eds.), **Produtos naturais no controle de insetos**. São Carlos, EdUFSCar, 150p. 2007.

VIVAN, M. P. **Uso do cinamomo (*Melia azedarach*) como alternativo aos agroquímicos no controle do carrapato bovino (*Boophilus microplus*).** Florianópolis, 2005. 72 p. Dissertação (Mestrado) – Universidade Federal de Santa Catarina.

WILLIAMS, L. A. D. Adverse effects of extracts of *Artocarpus altilis* Park. and *Azadirachta indica A. Juss.* on the reproductive physiology of the adult female tick, *Boophilus microplus* (Canest.). **Invertebrate Reproduction and Development**, v. 23, n. 2-3, p. 159-164, 1993.