

A SURVEY OF ECTOPARASITES' INFESTATION ON DOGS (*CANIS SPP*) AT FUNAAB'S COLLEGE OF VETERINARY MEDICINE TEACHING HOSPITAL, ISALE-IGBEIN, ABEOKUTA, OGUN STATE

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ABSTRACT

A survey work on ectoparasites' infestation was carried out on dogs (*Canis sp.*) at the Federal University of Agriculture, Abeokuta Veterinary Teaching Hospital, Isale-igbein, Abeokuta, Ogun State. This survey lasted for six weeks, during this period; thirty four (34) dogs were examined for ectoparasites' infestation. The dogs brought to the Teaching Hospital for treatments were examined with the consent of their owners by the use of questionnaire. Questionnaires were administered to dog owners, where information about the age, sex, location, control method was asked and ticks were collected from the dogs. The results of the survey showed high prevalence of tick infestation on the exotic dogs (65.4%), on the female dogs (66.7%), on the dogs that are 2 years of age and above (88.9%), on the free range dogs (85.7%), on the wooden confined dogs (71.4%) and on the dogs that powder was used as a control method (68.2%) of the infested dogs brought to FUNAAB VTH with no traces of other ectoparasites on the dogs. Only two species of ticks were found *Rhipicephalus sanguineus* and *Rhipicephalus boophilus* during this survey. The high prevalence of tick infestation and no infestation by other ectoparasites in the study carried out shows that the dog owners control the ectoparasites but not as adequate as it ought to be and this inadequate hygienic attention given to the dogs brought about the high infestation of ticks on some of the dogs. Although in this survey mono-infestation was recorded on almost all the infested dogs and only one double-infestation was observed with ticks of cattle namely; *R. boophilus*, this should not be considered as less significant maintenance of the hosts of these ticks.

Key words: Qualitative, Survey, ectoparasites, prevalence, infestation, tick, dog.

INTRODUCTION

Dogs are the most widely kept animals for working, hunting, and companion in human history (Dewey and Bhagat, 2002). According to Coppinger (2001) there are about 400 million dogs in the world. They perform many roles for man such as, hunting, herding, protection, detective work, as pets and also serve as food in different parts of the

world including Nigeria. In Nigeria, several studies have been undertaken on ectoparasites of dogs (Chukwu 1985; Ugochukwu and Nnadozie, 1985; James-Rugu and Iwuala 2002; Agbolade *et al.*, 2008, among others). An ectoparasite is a parasite that lives on the outside of a host's body rather than on the inside. The major ectoparasites of domestic dogs are different species of fleas, ticks, lice

and mites. The ectoparasites of the domestic dogs come from the phylum *Arthropoda*, which includes insects, arachnids and crustaceans. Fleas and lice are parasitic wingless insects, while ticks and mites are both parasitic arachnids.

Among all these ectoparasites; ticks are the most common and less susceptible (capable of submitting to an action) parasite even if the treatments giving to the dogs are very effective. They tend to re-attack dogs when the treatment is not continuous at least minimum of one week interval and the house of these dogs should be fumigated as well. Other ectoparasites are easily controlled by the treatments method be it powdering, spraying or bathing methods, therefore they are not really considered as a threat to dog.

Ticks are parasitic arachnids, along with fleas, they are considered to be of great medical and veterinary importance due to their ability to transmit pathogens to both animals and humans (Tinoco-Gracia, 2009). Among the species of ticks that parasitise dogs, the one most commonly found is the brown dog tick, *Rhipicephalus sanguineus*, which is found worldwide (Silveira, 2009). Ticks are in the order Ixodida. Along with mites, they constitute the subclass *Acarina*. Ticks are ectoparasites (external parasites), living by haematophagy on the blood of mammals, birds, and sometimes reptiles and amphibians. Ticks are vectors of a number of diseases, including Lyme disease, Q fever (disease caused by infection with *Coxiella burnetii*, rare and is more commonly transmitted by infected excreta), Colorado tick fever, Rocky Mountain spotted fever, African tick bite fever, tularaemia (rabbit fever), tick-

borne relapsing fever, Tick paralysis and tick-borne meningoencephalitis.

There are three families of ticks, one of which – Nuttalliellidae; comprises a single species, *Nuttalliellanaqua*. The remaining two families contain the hard ticks (Ixodidae) and the soft ticks (Argasidae). Ixodidae are distinguished from the Argasidae by the presence of a scutum or hard shield. Ixodidae nymphs and adults both have a prominent capitulum (head) which projects forwards from the body; in the Argasidae, conversely, the capitulum is concealed beneath the body.

Ticks are obligate parasites, which mean that each stage of the tick life cycle requires a host as it develops (Tinoco-Gracia, 2009). Despite this, molting does not occur on the host. Instead, it happens in the environment in between feeding stages. From larva to nymph to adult, ticks will go through a period of feeding on their host and then they will drop off to molt to the next stage (Dantas-Torres, 2008). Even though ticks are dependent on a host for nourishment, they will spend up to 97% of their lives away from the host. When it is time to feed, ticks locate their hosts by a number of stimuli, including chemical. They are also sensitive to vibrations in the air and the body temperature of their hosts. Ticks have many strategies for attaching to a host, including climbing up plants to wait for a host to brush past. *R. sanguineus* is considered a hunter, and will actively seek out a host (Dantas-Torres, 2008). When a suitable host is located, the tick will use its mouthparts to attach to the host's body.

To attach, the tick will insert a part of its mouth called the hypostome into the skin in order to penetrate the blood vessels, then it

secretes a cement-like substance from its salivary glands to more firmly attach it to the host (Dantas-Torres, 2008). While feeding, the tick frequently salivates and regurgitates blood, a process that facilitates the transmission of tick-borne diseases such as Lyme's disease. *Ixodid* ticks are important vectors of major protozoa and rickettsia of livestock. The importance of ticks has also extended to human beings because they have been shown to be vectors of some emerging and re-emerging infections. Argasid ticks in the genus *Ornithodoros* transmit many of the human relapsing fevers, while Lyme disease and Babesiamicroti are transmitted by those of genus *Ixodid* (Nyindo, 1992).

Mites along with ticks are small arthropods belonging to the subclass Acari (also known as Acarina) and the class Arachnida. The scientific discipline devoted to the study of ticks and mites is called acarology. Mites are among the most diverse and successful of all the invertebrate groups. They have exploited an incredible array of habitats, and because of their small size (most are microscopic) go largely unnoticed. Many live freely in the soil or water, but there are also a large number of species that live as parasites on plants, animals, and some that feed on mold. Among the ectoparasites of dogs, the ones that cause the most visible physical damage to dogs are the mites. Of these, one of the most common is *Sarcoptes scabiei*, which can infect both mammals and humans, causing mange and scabies respectively (Kuhn, 2008). Sarcoptic mange is considered to be highly contagious among dogs and is transmitted by direct contact. When a dog becomes infected, *S. scabiei* will burrow into the host's skin and begin laying eggs. During the life cycle of *S. scabiei*, the

mite undergoes three developmental life stages, followed by a molt as it grows to adulthood (Arlian, 1988). In dogs, *S. scabiei* infestations are mostly associated with a mangy appearance, characterized by skin lesions caused by alopecia, crusting, skin thickening, and dermatitis and papules. Intense itching accompanies the skin lesions. Signs of infestation are typical around the face and ears as well as the legs, particularly around the elbows. Sarcoptic mange is usually thought to spread over the body, and cases where the mange is widespread are more identifiable than cases where it is localized. Because of this, sarcoptic mange may be under-diagnosed in dogs, particularly in those who have been treated with anti-flea medications (Pin, 2006). The picture above shows the damaging effects of sarcoptic mange.

Louse (plural: lice) is the common name for members of over 3,000 species of wingless insects of the order Phthiraptera; three of which are classified as human disease agents. They are obligate ectoparasites of every avian and mammalian order except for monotremes (the platypus and echidnas), bats, whales, dolphins, porpoises and pangolins. Most lice are scavengers, feeding on skin and other debris found on the host's body, but some species feed on sebaceous secretions and blood. Most are found only on specific types of animals, and, in some cases, only to a particular part of the body; some animals are known to host up to fifteen different species, although one to three is typical for mammals, and two to six for birds. For example, in humans, different species of louse inhabit the scalp and pubic hair. Lice generally cannot survive for long if removed from their host (Hoell *et al.*, 1998).

Fleas are wingless insects (1/16 to 1/8-inch (1.5 to 3.3 mm) long) that are agile, usually

dark colour (for example, the reddish-brown of the cat flea), with tube-like mouth-parts adapted to feeding on the blood of their hosts. Their legs are long, the hind pair well adapted for jumping; a flea can jump vertically up to 7 inches (18 cm) and horizontally up to 13 inches (33 cm) (William, 2006) This is around 1200 to 2200 times their own body length, making the flea one of the best jumpers of all known animals (relative to body size), second only to the froghopper. They are insects forming the order Siphonaptera with mouthparts adapted for piercing skin and sucking blood. Fleas are external parasites, living by hematophagy of the blood of mammals and birds.

Of all the ectoparasites that parasitize dogs, fleas are perhaps the most important from a medical and veterinary standpoint (Gracia, 2008). Fleas can serve as vectors for several zoonotic agents, such as the dog tapeworm *Dipylidium caninum*. There are several species of fleas that parasitize dogs, including; Cat flea (*Ctenocephalides felis*), Dog flea (Dog Fleas) (*Ctenocephalides canis*), Human flea (*Pulex irritans*), Moorhen flea (*Dasypsyllus gallinulae*), Northern rat flea (*Nosopsyllus fasciatus*), Oriental rat flea (*Xenopsyllacheopis*), (Durden, 2005; Rust, 1997).

AIMS AND OBJECTIVES

The aims and objectives of the study are to:

- compare the ectoparasites' infestation on different breeds of dogs (exotic dogs and local dogs), whether breeds determine level of infestation.
- compare ectoparasites' infestation on the age, sex, location and dogs' confinement, whether these factors encourage infestation.

- determine what type of ectoparasites' control method is more effective among; spraying method, bathing method and powdering method.
- look at the prevalence species of ectoparasites present in some parts of Abeokuta.

MATERIALS AND METHOD

STUDY AREA

The research work was done at the Federal University of Agriculture, Abeokuta Veterinary Teaching Hospital, Isale-igbein, Abeokuta, Ogun State.

QUESTIONNAIRE ADMINISTRATION AND COLLECTION OF SPECIMENS

Thirty four (34) dogs were examined for ectoparasites' infestation within six weeks. Questionnaires were administered to dog owners, where pieces of information about the age, sex, location, control method were asked. With the consent of the owner, each dog was held while each body part was examined for presence of ectoparasites. The ectoparasites were collected by picking them out with forceps from the hair, as well as brushing out of the hair with a fine comb. Specimens taken from each body region (head/neck, back, abdomen, pelvic/anal regions, and limbs/interdigital spaces) were collected into labelled specimen bottles containing 70% ethanol. Attached herewith is the format of the questionnaire as an appendix.

IDENTIFICATION OF SPECIMENS

The morphological features of the ectoparasites were used to separate them into males and females and the species identification was done at the College of Veterinary Medi-

cine (COLVET), Federal University of Agriculture, Abeokuta.

DATA ANALYSIS

The data were analyzed using SPSS. (Statistical package for social science students), version 16.0

RESULTS

Breed, sex and age of dogs in relation to ticks' infestation

Of the 34 dogs examined (19 males and 15 females; 26 exotic and 8 local), tick was the only ectoparasite observed on the dogs. 22 (64.7%, 22/34) dogs were infested by ticks while 12 (35.3%, 12/34) were free of infestation. 12 (63.2%, 12/19) males were in-

festated and 7 (36.8%, 7/19) were un-infested while 10 (66.7%, 10/15) females were infested and 5 (33.3%, 5/15) un-infested. Out of the 26 exotic dogs recorded 17 (65.4%, 17/26) infested, 9 (34.6%, 9/26) un-infested and out of the 8 local dogs 5 (62.5%, 5/8) infested, 3 (37.5%, 3/8) un-infested. The age of the dogs examined ranged from 1month - 2years above. 0-6months were 8, 3 (37.5%) were infested and 5 (62.5%) un-infested, 6-12 months were 6, 4 (66.7%) were infested and 2 (33.3%) were un-infested, 1-2 years were 11, 7 (66.6%) were infested and 4 (33.4%) were un-infested, 2 years above were 9, 8 (88.9%) were infested and 1 (11.1%) was un-infested.

Table 1: Different ectoparasites of dogs examined at FUNAAB VTH, Abeokuta.

	Frequency	Percent	Valid percent	Cumulative Percent
Tick	22	100.00	100.00	100.00
Flea	0	0	100	100.00
Mite	0	0	0	100.00
Lice	0	0	0	100.00
Total	22	100.00	100.00	

Table 2: Breeds of dogs examined in relation to ticks' infestation

	Frequency	Percent	Infested	Un-infested
Exotic	26	76.5	17(65.4%)	9(34.6%)
Local	8	23.5	5(62.5%)	3(37.5%)
Total	34	100.0	22	12

Table 3: Sex of dogs examined in relation to ticks' infestation

	Frequency	Percent	Infested	Un-infested
Male	19	55.9	12(63.2%)	7(36.8%)
Female	15	44.1	10(66.7%)	5(33.3%)
Total	34	100.0	22	12

Table 4: Age ranges of dogs examined in relation to ticks' infestation

	Frequency	Percent	Infested	Un-infested
0 - 6 Months	8	23.5	3(37.5%)	5(62.5%)
6 - 12 Months	6	17.6	4(66.7%)	2(33.3%)
1 - 2 Years	11	32.4	7(66.6%)	4(33.4%)
2 Years Above	9	26.5	8(88.9%)	1(11.1%)
Total	34	100.0	22	12

Housing of the dogs in relation to ticks' infestation

The housing given to the dogs was also considered; 27 dogs were confined with 16 (59.3%) infested and 11(40.7%) un-infested while 7 were free range living with 6(85.7%)

infested and 1(14.3%) un-infested. Of the 27 that were confined, 14 (51.8%) were wooden cage with 10(71.4%) infested and 4(28.6%) un-infested, 8 (29.6%) were metal cage with 4(50.0%) infested and 4(50.0%) un-infested, 5 (18.5%) were brick cage with 2(40.0%) infested and 3(60.0%) un-infested.

Table 5: Housing of the dogs examined and the ticks' infestation based on the housing system

	Frequency	Percent	Infested	Un-infested
Confined	27	79.4	16(59.3%)	11(40.7%)
Free Range Living	7	20.6	6(85.7%)	1(14.3%)
Total	34	100.0	22	12

Table 6: Different confinement given to the dogs in relation to ticks' infestation

	Frequency	Percent	Infested	Un-infested
Wooden Cage	14	51.9	10(71.4%)	4(28.6%)
Metal Cage	8	29.6	4(50.0%)	4(50.0%)
Brick Cage	5	18.5	2(40.0%)	3(60.0%)
Total	27	100.0	16	11

Level of ticks' infestation on dogs examined

Of the 22 cases of infestation, 21(95.5%) were mono-infestation (only one species of ticks' infestation) while 1(4.5%) was double

infestation (two species of ticks' infestation). 9(40.9%) dogs were of mild infestation, 7 (31.8%) were of moderate infestation, 4 (18.2%) were severe, 2(9.1%) were very severe. Dogs aged 2yrs – above showed the

most significantly infested with ticks while ed.
 dogs aged 0-6 months were the least infest-

Table 7: Level of ticks' infestation on dogs examined

	Frequency	Percent	Valid Percent	Cumulative Percent
None	12	35.3	35.3	35.3
Mild	9	26.5	26.5	61.8
Moderate	7	20.6	20.6	82.4
Severe	4	11.8	11.8	94.1
Very Severe	2	5.9	5.9	100.0

Control methods in relation to ticks' infestation

Information on care of the 34 dogs by their owners is as presented in Table 8. Only 9 of the 34 dogs received bath treatment, with 5 (55.6%) infested with ticks and 4 (44.4%)

un-infested, 3 dogs received spray with 2 (66.7%) infested and 1 (33.3%) un-infested and 22 used powder with 15 (68.2%) infested and 7 (31.8%) un-infested.

Table 8: Control method used for the dogs in relation to ticks' infestation

	Frequency	Percent	Infested	Un-infested
Spray	3	8.8	2 (66.7%)	1 (33.3%)
Bath	9	26.5	5 (55.6%)	4 (44.4%)
Powder	22	64.7	15 (68.2%)	7 (31.8%)
Total	34	100.0	22	12

The species of ticks on the dogs examined

Two species of ticks were found *Rhipicephalus sanguineus* and *Rhipicephalus boophilus*. *R. sanguineus* had statistically the highest preva-

lence of 100% and was statistically the commonest species recorded found in all the infested dogs examined while *R. boophilus* was detected on only one dog.

Table 9: Species of ticks on the dogs examined and the percentage infestation on the dogs

Ticks	Number (%) infestation
<i>R. sanguineus</i>	22 (100%)
<i>R. boophilus</i>	1 (4.5%)

DISCUSSION

Thirty four (34) dogs were brought to the Teaching Hospital within the period of survey but none was actually brought because of ectoparasites' infestation but for other complaints. Out of the 34 dogs examined during this survey 26 were exotic while only 8 were local therefore, comparison of ticks' infestation in relation to breeds of dogs was limited because much of exotic dogs were seen. Also, comparison of ticks' infestation between adult dogs and puppies in relation to age difference was limited because much of the adult dogs were brought to the Teaching Hospital.

The results of the infested dogs brought to FUNAAB VTH with no traces of other ectoparasites on the dogs shows a high prevalence of ticks' infestation on the exotic dogs (65.4%) against the local dogs (62.5%) because much of exotic dogs were seen, high prevalence of ticks' infestation on the female dogs (66.7%) against the male (63.2%), high prevalence of ticks' infestation on the adult dogs especially those that are 2 years above (88.9%) against puppies of 0-6 months (37.5%) because much of adult dogs were seen, high prevalence of ticks' infestation on the free range dogs (85.7%) against the confined dogs (59.3%); even to the frequency of the free range living dogs (7) is smaller to the frequency confined dogs (27), the free range dogs' percentage infestation is more than that of the confined dogs; this is due to the fact that the free range dogs move around the vicinity and probably going around bushes or playing around where cattle are reared ticks will definitely jump on their body which increases their level of infestation, high prevalence of ticks' infestation on the wooden confined dogs (71.4%) against metal (50.0%) and brick's confinement (40.0%).

Also high prevalence of ticks' infestation on the dogs that ectoparasitic powder was used as a control method (68.2%) against spraying method (66.7%) and bathing method (55.6%), this is because there minimal penetration of the powder to the dogs' skin compare to the spay and bath method.

R. sanguineus is reported as the commonest species. This corroborates with earlier findings from studies elsewhere in Nigeria (Ugochukwu *et al.* 1985; Etim *et al.* 1996; James-Rugu and Iwuala 2002; Agbolade *et al.* 2008; Amuta *et al.* 2010 and other parts of the world such as Gonzalez *et al.* 2004, Niithikathkul *et al.* 2005). The similarity in mono and double infestations observed in this study may suggest similarity in conditions for development of tick species in this study area. A tick infestation preference for older dogs was observed, particularly with *R. sanguineus*. This preference may be attributed to the condition and care given to younger dogs; as puppies there is much contacts by owners with them because they would want to play with them as pets and the owners tend to see ticks' infestation on the puppies faster while playing with them than in the older ones.

Information obtained in this study revealed that most of the infested dogs brought to FUNAAB VTH are used primarily as house guards and as house guards; not much contacts with them because they are majorly for security purpose and not as pets that would be easy for them to examine their body therefore little attention is paid to the hygienic conditions of their dogs except the condition of the dogs is critical and not eating any longer. The dogs used as pets among the dogs were infested with little or no infestation because infestation is seen early and controlled. The high prevalence of ticks' in-

festation and no infestation by other ectoparasites in the study carried out shows that the dogs' owners control the ectoparasites but not as adequate as it ought to be and this inadequate hygienic attention given to the dogs brought about the high infestation of ticks on some of the dogs. Dogs that are bathed for by owners have little infestation because much attention is given to them and the ectoparasites are easily seen by the owners doing the act of bathing them. Of much interest to dogs' owners is the fact; giving regular control alongside treatment with acaricides, by so doing ticks' infestation can be controlled.

CONCLUSION

Two species of ticks were recovered from the dogs, of these; *R. sanguineus* was the most abundant. The high prevalence of tick infestation and no infestation by other ectoparasites in the study carried out shows that the dogs' owners control the ectoparasites but not as adequate as it ought to be and this inadequate hygienic attention given to the dogs brought about the high infestation of ticks on some of the dogs. Although in this survey mono-infestation was recorded on almost all the infested dogs and only one double-infestation was observed with ticks of cattle namely; *R. boophilus*, this should not be considered as less significant maintenance of the hosts of these ticks.

RECOMMENDATION

Further surveys should be carried out at FUNAAB VTH and Abeokuta in general. These surveys should pay much attention to other ectoparasites of dogs rather than ticks also should pay attention to the occurrence and geographic distribution of *R. boophilus* and attention should also be paid to collection of ticks from other hosts of ticks (such as cat, cattle etc) that may be infested by

ticks.

REFERENCES

- Agbolade, O. M., Soetan, E. O, Awesu, A. S, Ojo, J. A, Somoye O. J, Raufu, T. S.** 2008. "Ectoparasites of Domestic Dogs in some Ijebu Communities, Southwest Nigeria". *World Applied Sciences Journal* 3(6): 916-920
- Amuta, E. U., B. O. Atu, R. S. Houmsu, J. G. Ayashar** 2010. "Prevalence of *Rhipicephalus sanguineus* infestation and *Babesiacanis* infection in dogs with respect to breed, type, and degree of freedom in Makurdi, Benue State, Nigeria". *The Internet Journal of Parasitic Diseases*. 4: 1-5.
- Arlian, I.G.** 1988. "Parasites of domestic and wild animals in south Africa. The seasonal prevalence of *Rhipicephalus sanguineus* and *Ctenocephalides spp.* on kenneled dogs in Pretoria north". *Onderstepoort Journal of Veterinary research*, 54: 397-403
- Chukwu, C. C.** 1985 Ectoparasitic infestation of dogs in Bendel State, Nigeria. *International Journal of parasitic diseases* 2(2): 56-72
- Coppinger R.,** (2001) "Dogs" *A starting New understanding of Canine Origin, Behaviour and Evolution*, New York: Scribner p352
- Dantas-Torres, T.T.** 2008. "Tick-borne diseases". *Infectious Diseases and Arthropods*. Springer. ISBN 978-1-60327-399-2.
- Dewey, T., Bhagat, S.** 2002. *Canis lupus familiaris*, (On-line) Animal Diversity webhttp://animaldiversity.unmz.umich.edu/site/accounts/information/canislupusfamiliaris.html.

- Durden, J.M.** 2005. "Ticks infesting dogs in the Salisbury area of southern Rhodesia". *Journal of the South African Veterinary Medical Association*, 34: 609-610.
- Etim, S. E., Akpan, P. A,** in Calabar". *The Nigerian Journal of Parasitology*, 17 (8): 153-155
- González, A., D. C. Castro, and S. González** (2004). "Ectoparasitic species from *Canis familiaris* (Linné) in Buenos Aires province, Argentina". *Veterinary Parasitology* 120 (1-2): 123-129
- Gracia, W. C.** (2008). "Long-term cetirizine treatment reduces allergic symptoms and drug prescriptions in children with mite allergy". *Annals of Allergy, Asthma & Immunology* 87 (2): 222–226.
- Hoell, J. T, Doyen, M. M., Purcell, A. H.** (1998). "Introduction to Insect Biology and Diversity (2nd ed.)". *Oxford University Press*. pp. 407–409.
- [Http://www.en.m.wikipedia.org/wiki/ectoparasitesofdogs](http://www.en.m.wikipedia.org/wiki/ectoparasitesofdogs). May, 2012
- [Http://www.en.m.wikipedia.org/wiki/mites](http://www.en.m.wikipedia.org/wiki/mites). May, 2012
- [Http://www.en.m.wikipedia.org/wiki/ticks](http://www.en.m.wikipedia.org/wiki/ticks). May, 2012
- [Http://www.en.m.wikipedia.org/wiki/lice](http://www.en.m.wikipedia.org/wiki/lice). May, 2012
- [Http://www.en.m.wikipedia.org/wiki/fleas](http://www.en.m.wikipedia.org/wiki/fleas). May, 2012
- Koehler, P. G., Oi, F. M.** 1993, "Effect of ectoparasites on hosts: Provided by the University of Florida" *Journal of Veterinary Research* 23: 56-80
- Kuhn, O. V.** 2008. "Ehrlichiosis in anemic, thrombocytopenic, or tick-infested dogs from a hospital population in South Brazil". *Veterinary Parasitology*, 117 (4): 285-290.
- Nithikathkul, C. R., Polseela, J. T., Iamsaard, C. K., Wongsawad, S. S., Jit-tapalaping, S.P.** 2005. "A study of ectoparasites of *Canis lupus familiaris* in Mueng district, KhonKaen, Thailand" *Southeast Asian Journal of Tropical Medicine and Public Health*. 36 (Suppl. 4): 149-151
- Nyindo M. B.** 1992. "Animal diseases due to protozoa and rickettia". *Veterinary Protozoology*, Nairobi Kenya. Pp. 119-130
- Pin, G. T.** 2006. "Wild rodents and novel human pathogen *Candidatus Neoehrlichia mikurensis*, southern Sweden". *Emerging Infectious Diseases* 17 (9): 1716–1718.
- Rust, D. C** 1997. "The effectiveness of Helmeted Guinea fowl in the control of the deer tick, the vector of Lyme disease (PDF)". *Wilson Bulletin* 104 (2): 342–345.
- Silveira, H. K.** 2009. "Small but powerful – the oribatid mite *Archezogetes longisetosus* Aoki (Acari, Oribatida) produces disproportionate high forces". *Journal of Experimental Biology* 210 (17): 3036–3042.
- Tinoco-Gracia, R. H.** 2009. "The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida) of the world: a list of valid species names (PDF)". *Zootaxa* 2528: 1–28.
- Ugochukwu, E. I., Nnadozie, C. C.** 1985. Ectoparasitic infestation of dogs in Bendel State, Nigeria. *International Journal of Zoonoses* 12(4): 308-314

William, F. L. 2006. "Small but powerful – tionate high forces". *Journal of Experimental*
the oribatid mite *Archegozetes longisetosus* *Biology* 210 (17): 3036–3042.
Aoki (Acari, Oribatida) produces dispropor-

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