Rec. zool. Surv. India, **83** (3 & 4) : 141-154, 1986

THE TICKS OF LOCHINVAR NATIONAL PARK, ZAMBIA (ACARINA : IXODIDAE)

Part 1. Taxonomic Account

By

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Introduction

Large wild mammalian herbivores are regarded in many cases as being reservoirs of diseases and parasites transmissible to domestic animals in southern Africa (Neitz, 1967 ; Young, 1969 ; Howard, 1976). Among such pathogens, various species of *Borrelia*, *Rickettsia*, *Coxiella*, *Anaplasma*, *Babesia* and *Theileria* as well as arboviruses and other parasites are transmitted from infected to susceptible animals by ticks. Accordingly, during a study of the health of some of the wild animals at Lochinvar National Park in Zambia, an opportunity presented itself to study the ticks which are usually found on these animals and which may act as vectors of parasites and diseases.

Information on the biology of ticks in Africa is very limited. Checklists of the ticks infesting wild animals in Zambia have been compiled by Colbo (1973) and Ganagarajah (1976) but no information on incidence, prevalence or seasonality is given in these reports. Ecological studies on the ticks of cattle in Zambia have been carried out by MacLeod (1970) MacLeod & Colbo (1976), MacLeod *et al.* (1977) and MacLeod & Mwanaumo (1978), while some Zambian wild-life hosts have been investigated by MacLeod (1970), Colbo & MacLeod (1976) and MacLeod & Mwanaumo (1978) ; but in most cases specific collection data is lacking.

The present study has resulted from systematic tick collections from wild animals taken for other specific purposes in the years 1973 to 1979 and from other animals which occasionally became available in the National Park. It represents part of a study of the arthropod ecto- and endoparasites of wild animals in southern and western Zambia (Howard, 1976, 1977).

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The first step in evaluating the potential of ticks to cause problems for man and domestic animals is an accurate survey of the species that occur in a given area. The present work is intended to provide background information on host-ectoparasite relation for any future epidemiological studies that may be undertaken in the Lochinvar National Park in particular and Kafue flats in general. In all 14 species comprising 7 genera are recorded from the Lochinvar National Park. The present paper gives information by species regarding hosts, distribution taxonomic status and includes a classified host-parasite list of ticks infesting large mammals in Lochinvar National Park. Infestation patterns, seasonal incidence and potentials for disease transmission by these ticks is the subject of a subsequent publication (Howard and Tandon 13, in preparation).

Study Area and Methods

Lochinvar National Park is a small nature reserve of 410 km^2 on the southern side of the Kafue River in the southern Province of Zambia. It covers representative regions of the Kafue flood plain and surrounding woodland and contains a number of large wild mammals as well as many species of birds ; the fauna, flora and topography have been described adequately by Sheppe and Osborne (1971), Sayer and Van Lavien (1975). The most prevalent large mammals are the abundant lechwe antelope and the zebra and wildebeest which often graze with them. Other large herbivores present in smaller numbers are eland, kudu, bushbuck, impala, oribi, duiker and buffalo (Howard, 1977). There is considerable interaction between some of the wild animals and the cattle which graze on three sides of the Park and which are permitted to pass through the Park during their annual migrations to and from the flood plain grazing areas.

Ticks were collected from some of the larger mammals during the course of other research into their health and nutritional status. The animals were shot in the National Park under Special Licences and were immediately examined for ticks before they were skinned. In the case of zebra, a thorough examination was made to ensure that all ticks present were collected. Other specimens were collected as they became available as a result of conservation measures by the Department of National Parks and Wildlife Service.

Adult ticks were placed alive into 75% ethanol and were kept in this preservative for subsequent study. When possible immature ticks were collected alive and then reared to adulthood on laboratory mammals to establish their identity.

The large mammals examined were the following species : Burchell's zebra (*Equus burchelli* Gray), Kafue lechwe (*Kobus leche kafuensis* Haltenorth), blue wildebeest (*Connochaetes taurinus* Burchell), eland (*Taurotragus oryx* Pallas), bushbuck (*Tragelaphus scriptus* Pallas), common duiker (*Sylvicapra grimmia* Linnaeus), impala (*Aepyceros melampus* Lichtenstein) and African buffalo (*Syncerus caffer* Sparrman).

TAXONOMIC ACCOUNT

Order ACARINA

Suborder IXODIDES

Family IXODIDAE

Genus **Amblyomma Koch**, 1844

Amblyomma sparsum Neumann, 1899

Amblyomma sparsum Neumann, 1899. *Me'm. Soc. zool. France*, **12** : 247-248.

Material examined : 10 ♂♂ and 1 ♀ off buffalo ; 1 ♂ off impala ; 16 ♂♂ and 8 ♀♀ off tortoises, (*Kinixys belliana* (Gray).

Host : *A. sparsum* is found usually on the common tortoises rhinoceros and buffalo. In Lochinvar this species has also been found on impala, which is a new host record for Zambia. Yeoman and walker (1967) collected 35 specimens from lion in Tanzania.

Distribution : *A. sparsum* is widely distributed in central and southern Kenya and northern Tanzania. It has been found consistently in Uganda and southern Sudan and scattered records are available from Eritria, Ethiopia, French equatorial Africa, Malawi, Mozambique, Angola, Cameroun, Somalia, Senegal and Zambia (Elbl and Anastos, 1966 a).

Remarks : The specimens referred to in this paper agree well with the description given by Elbl and Anastos (1966a).

Amblyomma variegatum (Fabricius 1794)

Acarus variegatus Fabricius, 1994, *Entomologia systematica* : 353.

Material examined : x.1977, 7 ♂♂ and 1 ♀ off buffalo ; 24.xi.1977, 3♂♂ and 1 ♀ off bushbuck ; 1 ♂ off eland ; 17.iii.1974, 1♂ off lechwe ; 25.iii.1975, 2 ♂♂ off lechwe, 6.iv.1977, 1 ♂ and 1 ♀ off wildebeest ; 10.iv.1975, 3 ♂♂ and 2 ♀♀ ; 10.iii.1977, 1 ♂ ; 27.iv.1977, 4 ♂♂ and 2 ♀♀ ; 1.ix.1977, 4 ♂♂ and 1 ♀ ; ix. 1977, 1 ♂ ; 23.ii. 1978, 4 ♂♂ and 1 ♀ ; 31.iii.1978, 11 ♂♂ ; 29.v.1978, 1 ♂ ; 7.vi.1978, 2 ♂♂ ; 23.i.1979, 5 ♂♂ all off Zebra.

Host : *A. variegatum* is primarily a parasite of cattle and practically every reference in the literature pertains to parasitism of cattle by this species. Besides cattle it also attacks a large variety of domestic and game animals throughout Africa. Hoogstraal (1956) and Theiler (1962) gave detailed host lists of this species.

Distribution : According to Hoogstraal (1956) "*A. variegatum* is distributed generally throughout the Ethiopian Faunal Region except in northern Sudan, most of South-West Africa, much of Mozambique and the entire Union of South Africa."

Remarks : The specimens recorded in this paper agree well with the criteria given by Elbl and Anastos (1966a) for the identification of this species. The scutum of some of these specimens was coarsely punctate.

Genus **Aponoma Neumann**, 1899

Aponoma latum (Koch, 1844)

Amblyomma latum Koch 1844, *Arch. Naturgesch* **10** : 231.

Material examined : 2♂♂ and 6 ♀♀ off monitor lizard (*Varanus niloticus*, Linnaeus) no date.

Host : *A. latum* chiefly parasitizes large poisonous snakes ; the occurrence of this species on a monitor lizard in Lochinvar is unusual and is the first record on this host in Zambia.

Distribution : *A. latum*, the snake tick, is found throughout the Ethiopian Faunal Region.

Remarks : The specimens reported in this paper agree well with the criteria given by Hoogstraal (1956) for the diagnosis of this species.

Genus **Boophilus Curtice**, 1891

Boophilus decoloratus (Koch)

Rhipicephalus decoloratus Koch, 1844, *Arch. Naturgesch.*, **10** : 239.

Material examined : 1♂, 3♀♀ off eland ; vii.1977 3♂♂ and 2♀♀ off impala ; 6.iv.1977, 2♂♂ ; 10.viii.1977, 3♂♂ ; 1.xi.1977, 2♂♂ and 9♀♀ ; 7.vi.1979, 1♀ ; 26.ii.1979, 12♂♂ and 47♀♀ ; 25.iii.1979, 3♂♂ all off Zebra.

Host : *Boophilus decoloratus* is typically a parasite of cattle but is also found on sheep, goats, donkeys, dogs, and cats. Large game animals are also attacked by this species. Extensive information on its host-specificity is given by Hoogstraal (1956) and Theiler (1962).

Distribution : This tick is very widely distributed throughout most of the African continent. Theiler (supracit) has summarised in detail the distribution of this species in Africa.

Remarks : The specimens recorded in this paper agree well with the criteria given by Hoogstraal (supracit) for the identification of this species.

Genus **Haemaphysalis Koch**, 1844

Haemaphysalis (Rhipistoma) leachii (Audouin) 1827

Ixodes leachii Audouin, 1827, in Savingy, *Descrition del' Egypte, 2 Ed., 22. Zool.*, : 428.

Material examined : 2♂♂ and 5 ♀♀ off leopard *Panthera pardus* (Linnaeus), on date.

Host : *H. (R) leachii* in the adult stage chiefly parasitizes domestic dogs, cats and also some wild carnivores. The reported host-lists also include birds. Hoogstraal (1956 and 1958) and Theiler (1962) summarize the available host data on this species.

Distribution : This tick is found throughout most of the Ethiopian Region. Its occurrence at Lochinvar may persist on the smaller cats, but leopard, lion and cheetah are now very rare in this National Park (Howard, 1976).

Remarks : The specimens listed here agree well with the criteria given by Hoogstraal (1956) for identification of species.

Haemaphysalis (Rhipistoma) spinulosa Neumann, 1906.

Haemaphysalis spinulosa Neumann, 1906, *Arch. Parasit. Paris* **10** : 212-213.

Material examined : 9.iii.1971, 4♂♂ and 1 ♀ off slender mongoose (*Herpestes sanguineus* Ruppell).

Host : This species is known to parasitise Canidae, large cats and mongoose.

Remarks : *H. spinnlosa* was first described and figured by Neuman (1906) from two females from Uganda. Hoogstraal (1964) redescribed this tick from the lectotype female and from a male specimen from Kenya. Our specimens agree with the criteria given by Hoogstraal (1964) for identification of this species.

Genus **Hyalomma** Koch, 1844

Hyalomma rufipes Koch 1844

Hyalomma rufipes Koch, 1844, *Arch. Naturgesch.* **1** : 221.

Material examined : vii.1977, 3♂♂ and 5 ♀♀ off buffalo ; and viii.1977, 3 ♀♀ off buffalo ; x.1977, 1♂ and 1 ♀ off buffalo ; 27.iv.1978, 1♂ off zebra ; 23.i.1979, 1 ♀ off zebra.

Host : *H. rufipes* is known to infest a wide range of mammals and birds. Hosts of the adults are usually bigger animals like cattle, sheep, goats, horses and certain wild ungulates. Theiler (1962) has given a detailed list of hosts attacked by this species.

Distribution : According to Hoogstraal (1956) *H. rufipes* is widely distributed in many drier parts of Africa. Theiler (1962) has given a detailed summary of its distribution in Africa.

Remarks : The specimens listed here agree well with the criteria given by Hoogstraal (1956) for identification of this species.

Hyalomma truncatum Koch, 1844

Hyalomma truncatum Koch, 1844, *Arch. Naturgesch.* **1** : 222.

Material examined : vii.1977, 1 ♀ off buffalo ; viii.1977, 1 ♂ on buffalo ; x.1977, 3 ♂ ♂ off buffalo ; 25.iii.1978, 2 ♂ ♂ off lechwe ; 24.xi. 1975, 3 ♂ ♂ and 1 ♀ of bushbuck ; 22.v.1976, 6 ♂ ♂ and 2 ♀ ♀ off wildebeest ; 13.vii.1976, 1 ♂ off wildebeest 6.vi.1977, and 3 ♀ ♀ off wildebeest ; 10.iv.1975, 24 ♂ ♂ and 12 ♀ ♀ ; 27.iv.1977, 17 ♂ ♂ and 5 ♀ ♀ ; ix.1977, 2 ♂ ♂ ; 23.ii.1978, 5 ♂ ♂ ; 31.iii.1978, 8 ♂ ♂ and 2 ♀ ♀ ; 4.v.1978 4 ♂ ♂ and 3 ♀ ♀ ; 23.i.1979, 2 ♂ ♂ ; 26.ii.1979 1 ♂ ; 25.iii.1979 15 ♂ ♂ and 4 ♀ ♀ all off zebra.

Host : *Hyalomma truncatum* chiefly parasitizes domestic cattle and goats, but other large game and domestic animals may be infested. Small mammals, wild carnivores, birds and tortoises are very rarely recorded as hosts. Hoogstraal (1956) and Theiler (1962) have given detailed host lists of this species in Africa.

Distribution : *Hyalomma truncatum* is endemic to Ethiopian region and has been recorded from almost everywhere in Africa except in the forests of Western Africa.

Remarks : The specimens listed here agree well with the criteria given by Hoogstraal (1956) for identifying this species. The scutum of majority of these specimens were reddish black, however a few were entirely black.

Genus **Ixodes** Latrelle, 1795

Ixodes cavipalpus Nuttal and Warburton, 1908

Ixodes cavipalpus Nuttal and Warburton, 1908, *Proc. Cambridge Phil. Soc.*, **14** : 394.

Material examined : 16.iii.1973, 1 ♀ off eland ; 21.iii.1974, 1 ♀ off eland.

Host : The hosts reported for *I. cavipalpus* include a variety of domestic and wild animals. Theiler (1962) summarizes the host-list of this species in Africa. In Zambia this tick has been collected mainly from domestic cattle, goats, and cats. Amongst game animals it is recorded from eland and hartebeest (*Alcelaphus lichtensteini*) (Peters), but hartebeest are no longer found at Lochinvar.

Distribution : *Ixodes cavipalpus* is well distributed in Africa and it ranges in southern Africa from South Africa to Zimbawe, Malawi, Zambia in the north to Angola, Zaire, as well as to Camerouns in Central Africa, to Tanzania, Kenya and Uganda in east Africa. The northern limit of its distribution is the Sudan (Hoogstraal, 1956).

Remarks : The specimens recorded in this paper agree well with criteria given by Arthur (1965) for the identification of this species.

Genus **Rhipicephalus** Koch, 1844

Rhipicephalus appendiculatus Neumann, 1901

Rhipicephalus appendiculatus Neumann, 1901, *Me'm. Soc. Zool.* **14** (2-3) : 270.

Material examined : 23.ii.1978, 6♂♂ and 5♀♀ ; 31.iii.1978, 4♂♂ and 1♀ ; 23.i.1979, 2♂♂ and 2♀♀ ; 26.ii.1979, 2♀♀ all zebra.

Host : *R. appendiculatus* parasitizes mainly domestic cattle while other frequent hosts are goats, sheep and buffalos, antelope and zebras in National Parks. It has also been found to infest wild carnivores and domestic dogs. Its absence on the Lochinvar buffalo is surprising.

Distribution : In the Ethiopian region this tick is mainly a Central and East African species. Hoogstraal (1956) and Theiler (1962) have summarised in detail the distribution of *R. appendiculatus* in Africa.

Remarks : The specimens listed here agree well with the criteria given by Hoogstraal (1956) for identification of this species. The majority of these specimens were usually heavily punctate in comparison with specimens from domestic stock.

Rhipicephalus evertsi evertsi Neumann, 1897

Rhipicephalus evertsi Neumann, 1897, *Me'm. Soc. Zool. Fr.*, **10** : 405.

Material examined : 2♂♂ off buffalo (no date) ; 26.iii.1975, 22♂♂ and 6♀♀ of buffalo ; 16♂♂ and 5♀♀ off buffalo (no. data). iii.1977. 1♂ off duiker ; 24.xi.1975, 2♂♂ and 1♀ off bushbuck ; 7.vii.1977, 3♀♀ off bushbuck ; 11.v.1974, 1♀ ; 25.iii.1975, 1♂ ; 23.vi.1975, 1♂ and 3♀♀ ; 23.ix,1976, 16♂♂ and 2♀♀ All specimens off lechwe. 13.vii.1976, 5♂♂ and 4♀♀ ; 23.xi.1976, 16♂♂ and 2♀♀ ; 6.iv.1977, 6♂♂ and 6♀♀ ; 29.ix.1977, 5♂♂ and 5♀♀ ; 4.v.1977, 50♂♂ and

18♀♀. All specimens off wildebeest. 10.iv.1975, 19♂♂ and 2♀♀; 10.iii.1977, 6♂♂ and 1♀; 27.iv.1977, 126♂♂ and 20♀♀; 29.ix.1977, 5♂♂ and 2♀♀; 1.xi.1977, 15♂♂ and 4♀♀; 23.ii.1978, 13♂♂ and 13♀♀; 31.iii.1978, 48♂♂ and 3♀♀; 4.v.1978, 41♂♂ and 13♀♀; 29.v.1978, 21♂♂ and 3♀♀; 7.vi.1978, 50♂♂ and 2♀♀; 23.i.1979, 66♂♂ and 11♀♀; 26.ii.1979, 22♂♂; 25.iii.1979, 50♂♂ and 2♀♀. All specimens off zebra.

Host: According to Hoogstraal (1956) *R. evertsi evertsi* is usually found on domestic cattle, equines, goats and sheep and on wild antelopes, zebras and few other large game animals. Mathyssee (1954) recorded this tick in Zambia besides domestic animals on sable antelope, eland, wildebeest and hartebeest. In Lochinvar the red-legged tick is fairly common on lechwe, wildebeest and zebras.

Distribution: *R. evertsi evertsi* is widely distributed throughout most of the Ethiopian faunal region including the mountains of Yemen (Hoogstraal, 1956). It ranges from Ghana in the west to Somalia in the east and from South Africa in the south to the Sudan in the north. There are no records of its occurrence so far from Mauritania, Gambia, Sierra Leone, Liberia, Ivory Coast and Dahomey (Elbl and Anastos, 1966b).

Remarks: The specimens examined agree well with the description given by Elbl and Anastos (1966b). The majority of these specimens were usually thickly punctate, however a few had still heavier punctation.

Rhipicephalus sanguineus (Latreille, 1806)

Ixodes sanguineus Latreille, 1806, *Gen. Crust. et. Ins.* **1** : 157.

Material examined: 22.vii.1975, 1♀ off lechwe, 1♂ (No. date) off slender mongoose. 27.iv.1977, 1♂ and 5♀♀; 23.ii.1978, 2♂♂ and 2♀♀; 31.iii.1978, 1♂; 4.v.1978, 1♂ and 1♀ 29.v.1978, 6♂♂ and 9♀♀ all off zebra.

Host: *R. sanguineus* is known to parasitise a large variety of wild birds and mammals, as well as dogs and various other farm and domestic animals throughout its natural zones of distribution (Hoogstraal 1956). Its occurrence on the slender mongoose is the first record for this host in Zambia.

Distribution: Hoogstraal (surapcit) "This species is present almost everywhere in Africa except possibly in the most extreme situations of the great deserts of northern and south-western Africa and perhaps in

a few of the most isolated oases". Theiler (1962) givea a summary of the distribution up to 1962.

Remarks : The specimens examined here agree well with the criteria given by Hoogstraal (1956) for the identification of this tick.

Rhipicephalus simus simus Koch, 1844

Rhipicephalus simus Koch, 1844, *Arch. f. Naturagesch.*, **10** : 238.

Material examined ; 10.iv.1975. 2 ♂♂ and 1 ♀ off zebra ; 23.iv. 1979, 1 ♂ off zebra.

Host : *R. simus simus* infests a wide range of mammals both domestic and wild animals. Zumpt (1958) recorded a single female from a bird which he consideres as incidental. According to Hoogstraal (1956), "the buffalo and pigs are also favourite hosts, whereas antelopes are usually second choice-hosts". Humans are frequently attacked by this tick and it is known to cause paralysis in man (Zumpt and Glychen, 1950). Its restriction to zebra as the only host at Lochinvar is surprising.

Distribution : This tick is widely distributed throughout all the Ethiopian region ; in west Africa it is more or less widely replaced by the subspecies *senegalensis* Koch. A good regiew of its distribution is given by Hoogstraal (1956) and Theiler (1962).

Remarks : The specimens listed here agree well with the criteria given by Hoogstraal (1956) for the identification of this tick.

Rhipicephalus tricuspis Donitz, 1906

Rhipicephalus tricuspis Donitz, 1906, *Sitzungsber Ges, Naturf. Fr. Berlin*, **5** : 146.

Material examined : 23.ii.1978, 1 ♂ off zebra ; 23.i.1979, 3 ♂♂ and 1 ♀ off zebra.

Host : *R. tricuspis* infests a wide variety of domestic and larger wild animals. Detailed information on the hosts can be found in Hoogstraal (1956) and Theiler (1962). In Tanzania Yeoman and Walker (1967) have found this tick mainly on cattle and to a lesser extent on dogs in rather localized areas.

Distribution : *R. tricuspis* is distributed throughout most of Africa.

Remarks : The specimens identified in the collections as *R. tricuspis* agree with the published description of Theiler (1947).

Discussion

The material examined in this study represents specimens that become available from time to time and does not purport to be a comprehensive coverage of the ticks of all the wild animals of Lochinvar National Park. The availability of hosts for collection is obviously limited in a National Park to those animals that are found by coincidence or are sacrificed for some justifiable purpose. For this reason, a systematic survey of hosts is impossible under the conditions of protection of animals that must occur in a National Park. Accordingly, we emphasise the need for such collections to continue when possible so that eventually a more complete picture of the distribution of ticks will emerge. Such an overall view of tick infestation is essential in understanding the epidemiology and epizootiology of tick-borne diseases, especially in an area like Lochinvar N. P. which is not only surrounded by human habitation but is in one of the most important cattle rearing areas of the country. A summary of the information listed above is given in Appendix 1 together with other records of tick infestations from Lochinvar N. P.

Equally important in the study of tick-borne diseases of an area is an understanding of the distribution and abundance of ticks in relation to hosts and seasons. This aspect has been analysed for most of the ticks recorded above and is the subject of a subsequent report (Howard and Tandon, 13, in preparation) which also includes a summary of the potential tick-borne diseaess of the region.

Summary

Fourteen species of ticks in seven genera are recorded for Lochinvar National Park from wild animals as follows : *Amblyomma sparsum*, *A. variegatum* ; *Aponoma latum* ; *Boophilus decoloratus* ; *Haemaphysalis* (*Rhipistoma*) *leachii* ; *H.* (*R.*) *spinulosa* ; *Hyalomma rufipes*, *H. truncatum* ; *Ixodes cavipalpus* ; *Rhipicephalus appendiculatus* ; *R. evertsi evertsi* ; *R. sanguineus*, *R. simus simus* and *R. tricuspis*. Host and locality records are given for each species with notes on distribution and hosts. A classified host-parasite list of ticks infesting large mammals in the Park is also provided.

Acknowledgements

We are thankful to Dr. S. M. Silangwa, Secretary General, National Council for Scientific Research for fascilities and encouragements during the course of this work. The final draft of the paper has been

prepared at Zoological Survey of India, Calcutta and one of us (S. K. T.) is grateful to Dr. B. K. Tikader, former Director, Zoological Survey of India for fascilities and encouragements.

Many of the wild animals sampled in this study were sacrificed under Special Licences granted by kind permission of the Minister of Lands, Natural Resources and Tourism, Government of Zambia. Permission to work in the National Park was granted by the Director, National Parks and Wildlife Service and considerable assistance was given by the Biologist and Ranger-in-charge of Lochinvar National Park whose services are gratefully acknowledged. Our thanks are also due to Messrs M. M. Seemani and M. M. Chilapatisha of NCSR for technical assistance. Part of this work was supported by the Kafue Basin Research Committee and the Research Grants Committee of the University of Zambia. Transport was made possible by the invaluable services of a landrover generously donated by the Zambia Electricity Supply Corporation Ltd.

APPENDIX 1

Classified parasite list of ticks infesting wild animals at Lochinvar National Park with their recorded hosts.

ACARINA : IXODOIDEA : IXODIDAE

Genus **Amblyomma** Koch, 1844

1. *Amblyomma sparsum* Neumann, 1899 HOSTS : Buffalo, impala tortoise.
2. *Amblyomma variegatum* (Fabricius, 1794) HOSTS : Buffalo, bushbuck, eland, lechwe, wildebeest, zebra.

Genus **Aponomma** Neumann, 1899

3. *Aponomma latum* (Koch, 1844) HOST : Monitor lizard

Genus **Boophilus** Curtice, 1891

4. *Boophilus decoloratus* (Koch, 1844) HOSTS : Eland, impala, zebra.

Genus **Haemaphysalis** Koch, 1844

5. *Haemaphysalis* (*Rhipistoma*) *leachii* (Audouin, 1827) HOST : leopard
6. *Haemaphysalis* (*Rhipistoma*) *spinulosa* Neumann, 1899 HOSTS : Slender mongoose

Genus **Hyalomma** Koch, 1844

7. *Hyalomma rufipes* (Koch, 1844) Hosts : Buffalo, zebra.
8. *Hyalomma truncatum* Koch, 1844 Hosts : Buffalo, bushbuck, lechwe, wildebeest, zebra.

Genus **Ixodes** Latreille, 1795

9. *Ixodes cavipalpus* Nuttal & Warbuton, 1908 Host : Eland.

Genus **Rhipicephalus** Koch, 1844

10. *Rhipicephalus appendiculatus* Neumann, 1901 Hosts : Lechwe, zebra.
11. *Rhipicephalus evertsi evertsi* Neumann, 1897 Hosts : Buffalo, bushbuck, duiker, eland, impala, lechwe, wildebeest, zebra.
12. *Rhipicephalus sanguineus* (Latreille, 1806) Hosts : Lechwe, mongoose, zebra,
13. *Rhipicephalus simus simus* Koch, 1844 Host : Zebra.
14. *Rhipicephalus tricuspis* Donitz, 1906 Host : Zebra.

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Elbl, A. and Anastos, G. 1966c. Ixodid ticks (Acarina : Ixodidae) of Central Africa. Volume IV. Genera *Aponoma* Neumann, 1899, *Boophilus* b. *F.* 1891, *Dermacentor*, Koch, 1844, *Haemaphysalis* Koch, 1844, *Hyalomma* Koch, 1844 and *Rhipicentor* Nuttal and Uarburton, 1908. Lists and Bibliography. *Ann. Mus. R. Afr. Cent., Ser. 8vo, s. Sci. Zool.*, (148), 412pp.

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