Ticks

Tick identification

Authors: Prof Maxime Madder, Prof Ivan Horak, Dr Hein Stoltsz

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INTRODUCTION

Ticks are one of the best-known groups of parasites and evoke different reactions in different people. Some are revolted, others are afraid, particularly if they have recently been bitten, and others are fascinated, while farmers, whose livelihood may be threatened by tick-borne diseases, think of control. We hope to address some of these aspects in this module and its accompanying modules devoted to disease transmission and control. To many of us ticks are either those little red ones that bite us when we walk in the veld or those big, baggy, blue ones clinging to the sides of cattle or protruding through the hair of our pet dogs. Both the little red ones and the big blue ones are part of the life cycle of every species of tick and we will explain how the two are connected. Many people are surprised to hear that the little red ones may belong to an entirely different species from the big blue ones. Few people, even those who realise that there are more than one species of tick, are able to identify even the most common species of tick infesting our household pets or domestic livestock, and even fewer can identify those species infesting wildlife as small as mice or as large as rhinoceroses and elephants. On completion of this module you should at least be able to identify the most common and important species of ticks as well as some of the less common species.

Ticks belong to an ancient lineage, with specimens found in Burmese amber dating back to about 100 million years ago. They are a very successful group of arthropods and have adapted to feeding on practically every terrestrial mammal, bird and reptile, and have attacked humans and infested the animals that they have domesticated for thousands of years. During the past 150 years they have become an important concern of veterinary and medical research, not only because of the direct effects they have on their hosts, such as injury at their points of attachment, blood loss and paralysis caused by toxins in their saliva, but also because they are efficient vectors of a wide variety of micro-organisms.

Globally a total of close to 900 tick species have been described, of which slightly more than 700 species belong to the Ixodidae or hard ticks and the remainder to the Argasidae or soft ticks. Ticks are particularly abundant in the Afrotropical region with its rich animal fauna and climatic zones ranging from arid to tropical. Approximately 200 ixodid tick species (hard or shield ticks) and 40 argasid tick species (soft ticks or tampans) are present in the Afrotropical region, but only a small number are of veterinary and medical importance. Many of the ticks and tick-borne diseases occur usually in specific geographical areas but with globalisation and climate change their range may expand and may even spread intercontinentally. Although it is common to consider domestic animals as being the preferred host of ticks, most species occur on wildlife, and several would not be able to complete their life cycles without the presence of small wild mammals or birds as hosts for their immature stages. Most importantly, at the livestock/wildlife interface transfer of tick-borne pathogens frequently occurs and poses a risk to livestock farming and development.

Failure to control ticks and tick-borne diseases effectively is a major factor limiting livestock production. The worldwide economic loss due to tick infestation and the additional burden of protecting livestock against ticks and tick-borne diseases is estimated to be in the billions of dollars annually.

IMPORTANCE

Ticks are among the most important vectors of human and animal diseases caused by protozoa rickettsiae, bacteria, viruses and some helminths. They rank second only to mosquitoes as vectors of life threatening or debilitating human and animal diseases. Moreover, ticks transmit a greater variety of infectious agents than any other arthropod group. No wonder that people are afraid of being bitten by a tick.

Apart from the discomfort they cause, these blood-sucking ectoparasites cause considerable production losses especially to improved cattle breeds in the Afrotropical region. Each engorging female tick takes between 1 - 5 ml of blood depending on species and size.

Several *Rhipicephalus* spp. (*R. bursa, R. simus, R. evertsi evertsi, R. evertsi mimeticus, R. exophthalmos* and *R. warburtoni*) and *Ixodes rubicundus* produce toxins that cause paralysis in cattle, sheep, goats or antelope, whereas *Hyalomma truncatum* secretes a toxin in its saliva that causes sweating sickness in cattle and deep and very painful wounds in domestic dogs.

The ear of an animal parasitised by the brown ear tick, *Rhipicephalus appendiculatus*, the vector of the protozoan causing East Coast fever (ECF). Note the size of engorged females compared to the much smaller males

Although most tick species that infest cattle cause a certain amount of damage to their hides, it is particularly those species with long mouthparts that cause considerable direct damage to cattle hides. Secondary

bacterial infections of the wounds caused by the mouthparts of ticks can result in abscesses, while septic wounds on the teats of cows may affect milk production and the suckling of calves. If the udders of heifers are not protected from the bites of ticks with long mouthparts only a single quarter of the udder and one teat may be functional when they calve. In the case of *Amblyomma variegatum*, a relationship with the occurrence of bovine dermatophilosis exists although the exact mechanism is not known.

SYSTEMATICS/TAXONOMY

Both soft (Argasidae) and hard (Ixodidae) ticks are members of the following taxonomic groups:.

Phylum	Arthropoda
Subphylum	Chelicerata
Class	Arachnida
Subclass	Acari
Order	Parasitiformes
Suborder	Ixodida (=Metastigmata)
Family	Ixodidae

Phylum Arthropods: invertebrate, bilateral symmetry, chitinous skeleton with articulating segments and/or appendages.

Subphylum Chelicerata: modified first appendages, **chelicerae**, used for grasping, piercing, cutting and other functions associated with food gathering and feeding. The body is divided into two parts, (1) the **prosoma** and (2) the **opisthosoma** (see figure below).

Class Arachnida bear pedipalps, the modified second pair of appendages and four pairs of walking legs, all found on the prosoma (**gnathosoma** + **podosoma**). In contrast with the insects, arachnids lack a clearly defined head, so that the anterior body segments bearing the chelicerae and palps, are integrated with the posterior segments bearing the walking legs to form the prosoma.

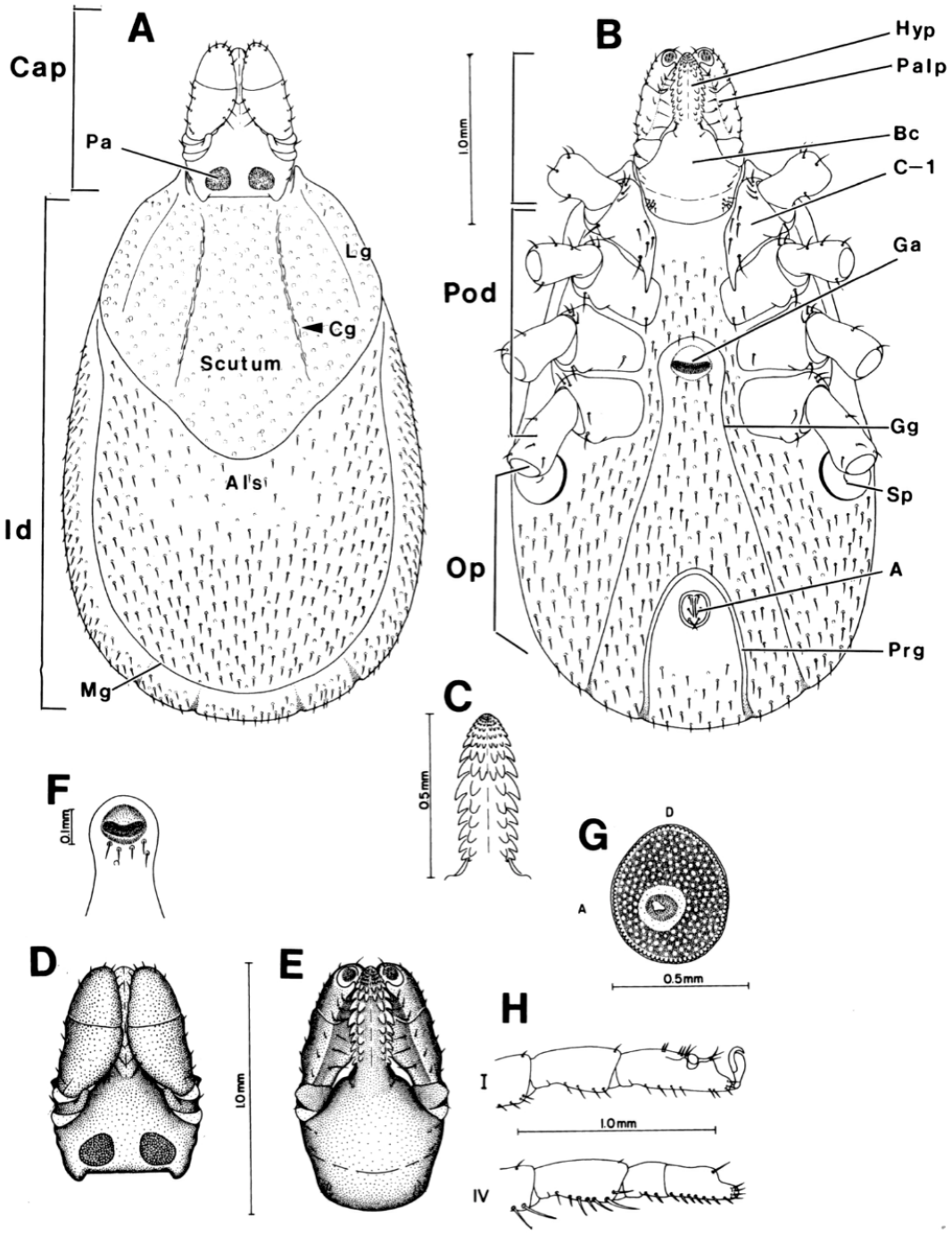
Subclass Acari: exhibit extreme fusion of the body segments. The podosoma and the opisthosoma are fused, forming the **idiosoma**. In contrast with other arachnids, the opisthosomal region lacks distinct segmentation while the mouthparts are joined to a separate body region, the **gnathosoma** (= **capitulum** in ticks). Ticks and mites belong to this Subclass.

Mites comprise a vast assemblage of species, which inhabit terrestrial, marine and fresh water habitats. Mites occur in soil, fresh and brackish and salt water at all depths, in and on vegetation, in nests and burrows of vertebrates, and on the bodies or even in the internal organs of various vertebrate and invertebrate animals. Many are free-living as herbivores, fungivores, and predators; others are parasitic, including both ectoparasitic and endoparasitic adaptations. About 35 000 species have been described, another 1 000 000 undescribed species are believed to exist.

The Acari are subdivided into two major orders:

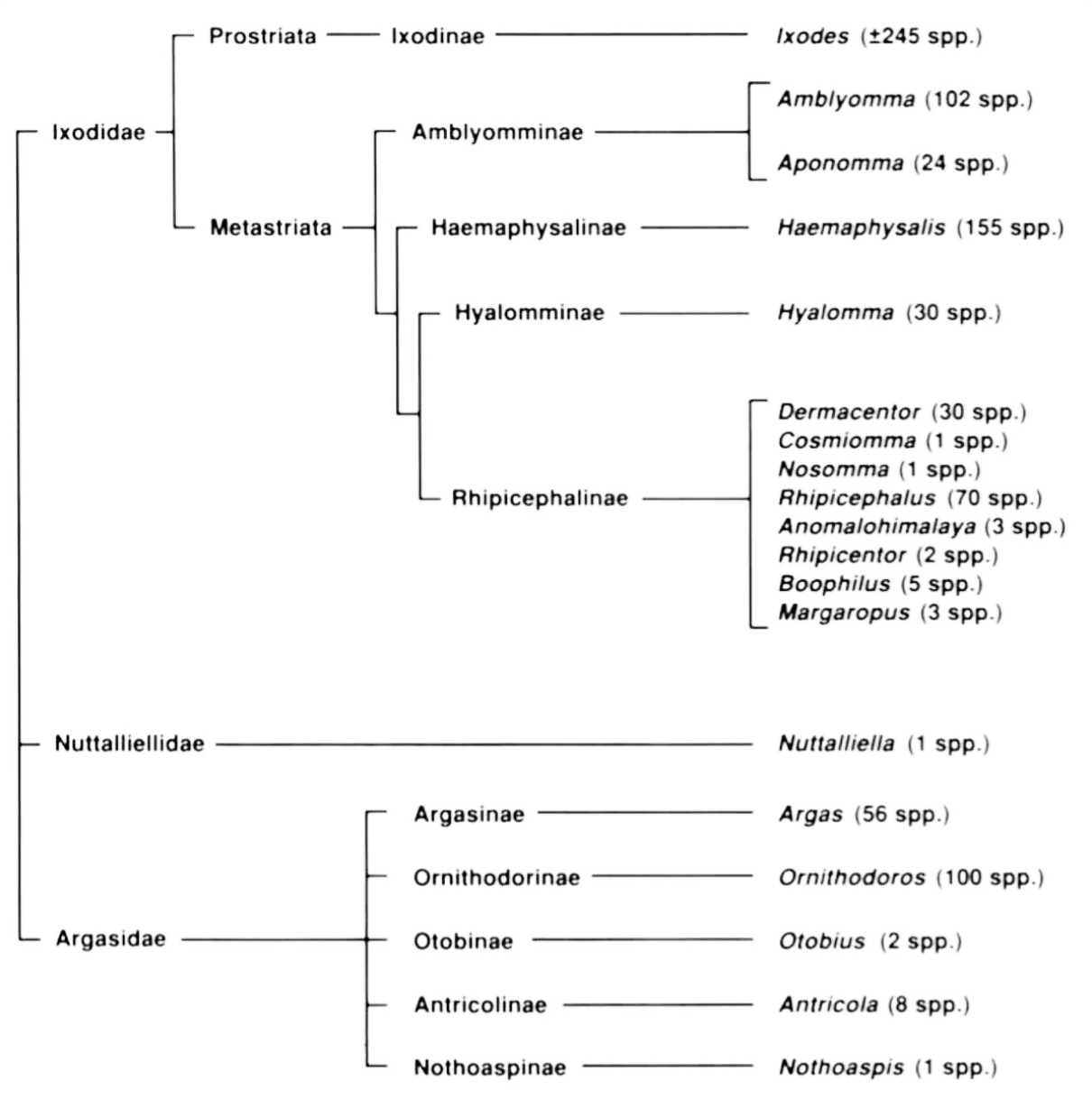
Parasitiformes: which have stigmatal pores (i.e., respiratory pores) on the podosomal and/or opisthosomal portion of the body, and have well-developed, freely articulated coxae,

Acariformes: which lack stigmata and typically have the coxae fused with the ventral body wall.



Diagrams illustrating the external anatomy of a representative ixodid tick female (*Ixodes cookei*). A, Dorsal aspect. B, Ventral aspect. C, Hypostome, ventral aspect. D, Capitulum, dorsal aspect. E, Capitulum, vetral aspect. F, Genital aperture and genital groove. G, Spiracle. H, Terminal segments of legs. I, Trochanter and tarsus of leg. I. A = Anus; Als = alloscutum; Bc = basis capitlu; C-1 = coxa I; CAP = capitulum; Cg = cervical groove; Ga = genital aperture; Gg = genital groove; Hyp = hypostome; Id = idiosoma; Lg = lateral groove; Mg = marginal groove; OP = opisthosoma; Pa = porose area; Pod = podosoma; Prg = preanal groove; Sp = spiracle.

Ticks constitute the suborder Ixodida (=Metastigmata), a suborder of the order Parasitiformes. They are obligate blood-feeding parasites with a single pair of stigmata located posterior to the third or fourth pair of coxae in post-larval stages. In addition, the hypostome is enlarged, protuberant, and bears retrograde denticles for anchoring the tick into its hosts tissue and the dorsal surface of tarsus I bears a distinct sensory organ, Haller's organ.



Genera of the three different tick families

The suborder Ixodida comprises three families:

- **Ixodidae** or hard ticks, with 14 genera and approximately 700 species/subspecies;
- **Argasidae** or soft ticks, with 5 genera and approximately 190 species; and
- **Nuttaliellidae** with only one species *Nuttalliella namaqua.*

SEASONAL OCCURRENCE / LIFE CYCLE

Seasonal occurrence

Long before scientists were aware of biological mechanisms controlling the life cycle of arthropods, early man had already noticed seasonality in certain species, especially edible ones. These were exploited as a source of food and information on the seasonal occurrence of the species was handed down from generation to generation. It was only in the beginning of the previous century that researchers performed well-planned experiments on certain arthropods and since then the number of species in which there is known to be a response to photoperiod and temperature rose logarithmically (Brown and Hodek, 1983). It became clear that most arthropods displayed a photoperiodically (daylength) controlled life cycle to synchronise their development stages with favourable climatic conditions. Some tick species show a semivoltine cycle in which the ticks need more than one year to complete the life cycle, a univoltine (1 cycle per year) or multivoltine (more than 1 life cycle per year) cycle.

Most ticks show seasonality in their life cycles; in most species the adult ticks will become active and feed at the start of the rains. This has been noticed by livestock keepers and scientists for years. Because of the great economic importance of certain ticks as vectors of diseases of domestic livestock and in particular cattle, the study of the seasonal occurrence of ticks is of major importance in the control of ticks and tick-borne diseases.

An increasing number of ticks have been studied during the last decennia and the seasonal responses and adaptations of their life cycles are much more complicated than expected previously. Seasonal activity is mainly determined by the activity or inactivity of the different life cycle stages.

Life cycle

All ticks have four stages: the embryonated egg and three active stages, namely the larva, one or more nymphal stages and the adult. Sexual dimorphism (phenotypic difference between males and females) is evident only in the adult stage. In the Argasidae (soft tick species), development is gradual, with multiple nymphal stages before reaching the adult form (multi-host life cycle), while in the Ixodidae (hard tick species), the development is accelerated, with only one nymphal stage. In most of the ixodid species, each active stage seeks a host, feeds, and drops off to develop further in the natural environment (three-host life cycle), but in few species, fed juveniles remain and develop on the host, shortening the life cycle (two-host and one-host ticks).

Life cycle of hard ticks

The fully fed female detaches and drops off the host and after a few days, known as the pre-oviposition period, lays a single large batch of several thousand eggs in a sheltered spot and then dies. After a period of weeks or even months minute six-legged larvae hatch from these eggs. These larvae are known as "seed" or "pepper" ticks because of their similar morphology to small seeds or crunched pepper corns. The larvae of some species climb up the stems of grasses or other plants and wait for a passing host to which they attach, while the larvae of other species wait for a host on the ground and then climb on and attach. Following attachment, they engorge and a period of

quiescence follows while structural changes (partial metamorphosis) take place inside the skin of each larva. The larvae then moult into nymphs that require a few days for the integument to harden before they will attach. They engorge, go through a period of quiescence and moult to adults that also require a few days for the integument to harden before they will attach. The partially engorged female is attractive to the partially engorged male that migrates to where the female is attached, they mate, and the female engorges, detaches, drops to the ground and lays eggs. The male may remain on the host for months before finally dying. The integument of the female undergoes physiological changes during the last 24 hours of engorgement. These changes make her less susceptible to desiccation and she also becomes less susceptible to the effects of acaricides.

One-host life cycle

Larvae hatch from eggs, climb on to a host, attach, engorge, moult on the host to nymphs, nymphs attach, engorge, moult on the host to males and females, adults attach, partially engorge, mate, females engorge fully, detach, drop to the ground, lay a single large batch of eggs in a sheltered locality and die. The next generation of larvae hatches from these eggs. The demographic structure of a parasitic population of one-host ticks is **eight** larvae to **four** nymphs to **two** males to **one** female. The population has this structure because it has been calculated that half the larvae do not successfully moult to nymphs. Some are probably lost by the host grooming itself, others during the moulting process. Similarly only half the nymphs will successfully moult to adults. The difference in proportions between adult male and female ticks is possibly due to the larger females being more likely to be removed by host grooming, but more likely because engorged females engorge and detach from the host whereas the males can remain on the host for several weeks, resulting in a preponderance of male ticks.

The advantage of one- and two-host ticks is the relatively protected environment that the hosts offer to the vulnerable larval and nymphal stages. In this way, the immature stages are not exposed to hostile climatic conditions, which reduces mortality.

Disease transmission of one-host ticks is limited to transovarial transmission where infection is passed from one generation to the next via eggs.

Two-host life cycle

Larvae hatch from eggs, climb on to the first host, attach, engorge, moult on the host to nymphs, nymphs attach, engorge, detach, drop to the ground, moult to males and females in a sheltered locality, adults climb on to the second host, attach, partially engorge, mate, the females fully engorge, detach, drop to the ground, lay a single large batch of eggs in a sheltered locality and die.

Transmission of pathogens can be transovarial from one generation to the next via ovaries or transstadial from the nymphal to the adult stage.

In some species, e.g. *Hyalomma anatolicum anatolicum* host availability can influence the life cycle; it can feed on hares as a two-host tick for its entire life cycle and on cattle as a three-host tick.

Three-host life cycle

After oviposition, hatching of the eggs begins after a few weeks or a month depending on the temperature. The emerged larvae disperse into the vegetation or nest to seek hosts after hardening. Once attached to a passing host, larvae feed slowly (several days) to repletion. The engorged larvae drop from their host and find a sheltered micro-environment. Ecdysis (=moulting) starts after several days. The newly emerged nymphs harden and again seek hosts (sometimes the same hosts as those fed upon by the larvae). They in turn attach, feed and drop from the host as engorged nymphs. They too try to find an appropriate niche to shelter and moult into adults. After hardening, male and female ticks start questing, attach, feed and mate after a small initial blood meal. Female ticks engorge to repletion after mating, drop off and find a suitable place to oviposit and finally die. Males on the other hand, can mate several times before they die. The engorgement weight of the females can sometimes be 100 X the unfed adult weight. About 50% of this weight is converted to egg. The largest egg mass ever recorded from a single *Amblyomma nuttalli* consisted of 22 891 eggs.

The three-host life cycle is the most common development pattern and is characteristic of the vast majority of the species. It is the least evolved of the various life cycle patterns and huge losses in numbers occur between the larval and nymph stages and between the nymph stage and adults. . Transmission of pathogens can be transovarial, transstadial and intrastadial.

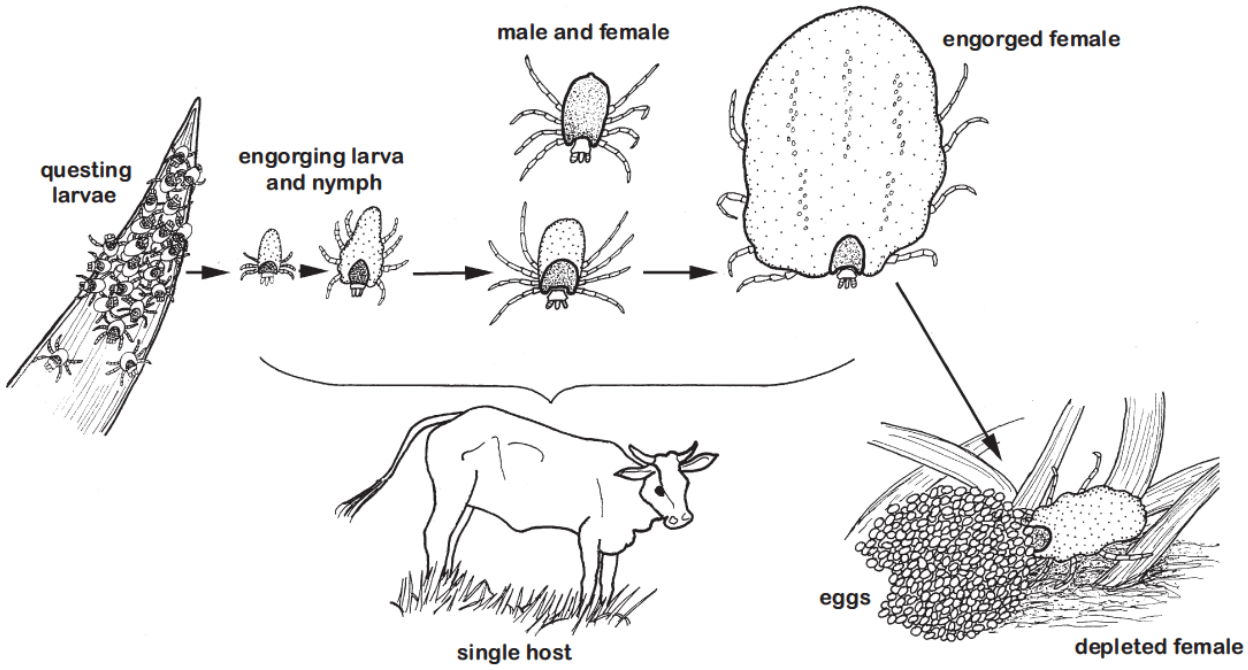
Life cycle of soft ticks

The life cycle of the argasid tick species is more diverse than the much more uniform pattern found in the ixodid tick species. Some soft ticks seek hosts by questing on low-lying vegetation, but the vast majority are nest parasites, residing in sheltered environments such as burrows, caves, or nests. Certain biochemicals such as carbon dioxide as well as heat and movement serve as stimuli that guide host-seeking behaviour. The feeding behaviour of many soft ticks can be compared to that of fleas or bedbugs, as once established, they reside in the nest of the host, feeding rapidly when the host returns. The outside surface, or cuticle, of soft ticks expands, but does not grow to accommodate the large volume of blood ingested, which may be anywhere from 5-10 times their unfed body weight. Argasid ticks feed rapidly, females feed and oviposit frequently (multiple gonotropic cycles) and deposit small egg masses (< 500 eggs/cycle). There are also 2 - 7 nymphal stages (moults) in the life cycle.

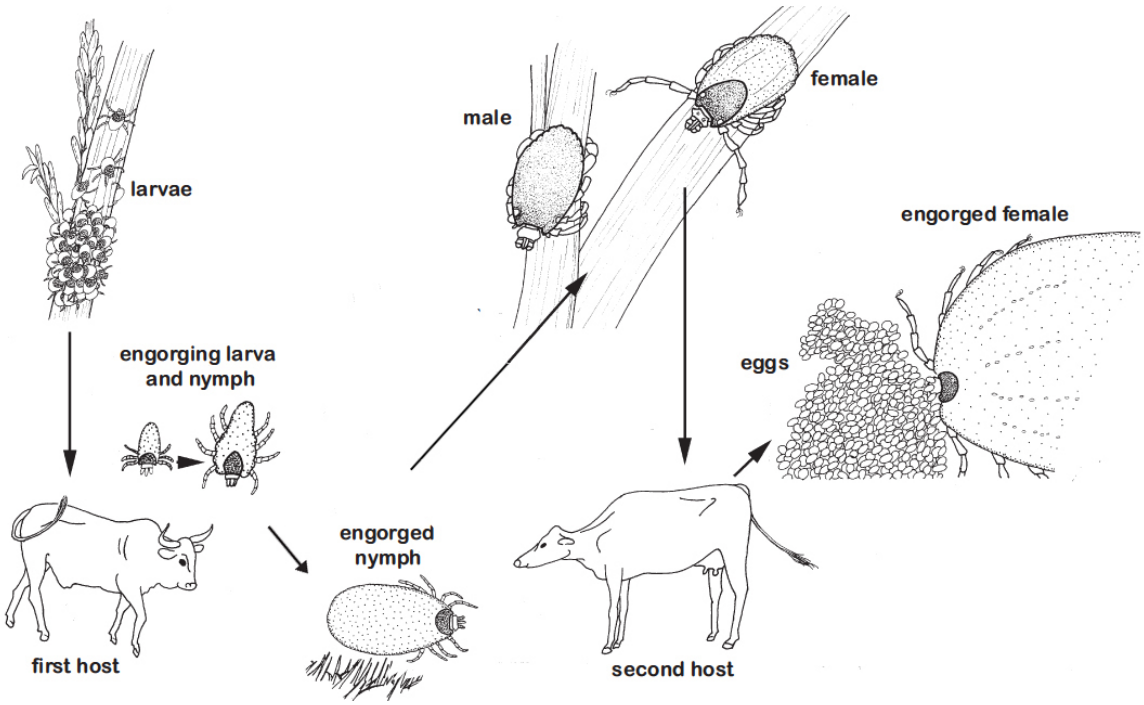
In the majority of species, larvae seek hosts, feed within 15 - 30 minutes and drop off to moult in the sand, duff or cracks and crevices of the natural habitat. *Ornithodoros* larvae don't feed and moult immediately to the nymphal stage. The first stage nymphs resemble the adults, but are smaller, lack the genital pore and any evidence of dimorphism. They in turn attack hosts, feed rapidly and moult again to another nymphal stage. The cycle of host seeking, feeding and moulting can be repeated up to 7 times in the nymphal stage. After the last nymphal moult, adult ticks become sexually active and they do not require a blood meal to initiate gametogenesis. Mating occurs before as well as after feeding, but rarely if ever on the host itself. *Otobius* adults do not feed at all.

Following feeding, oviposition begins and once completed, the ticks remain vigorous, seek new hosts, feed and oviposit again. This pattern of repeated gonotropic cycles enables argasid ticks to

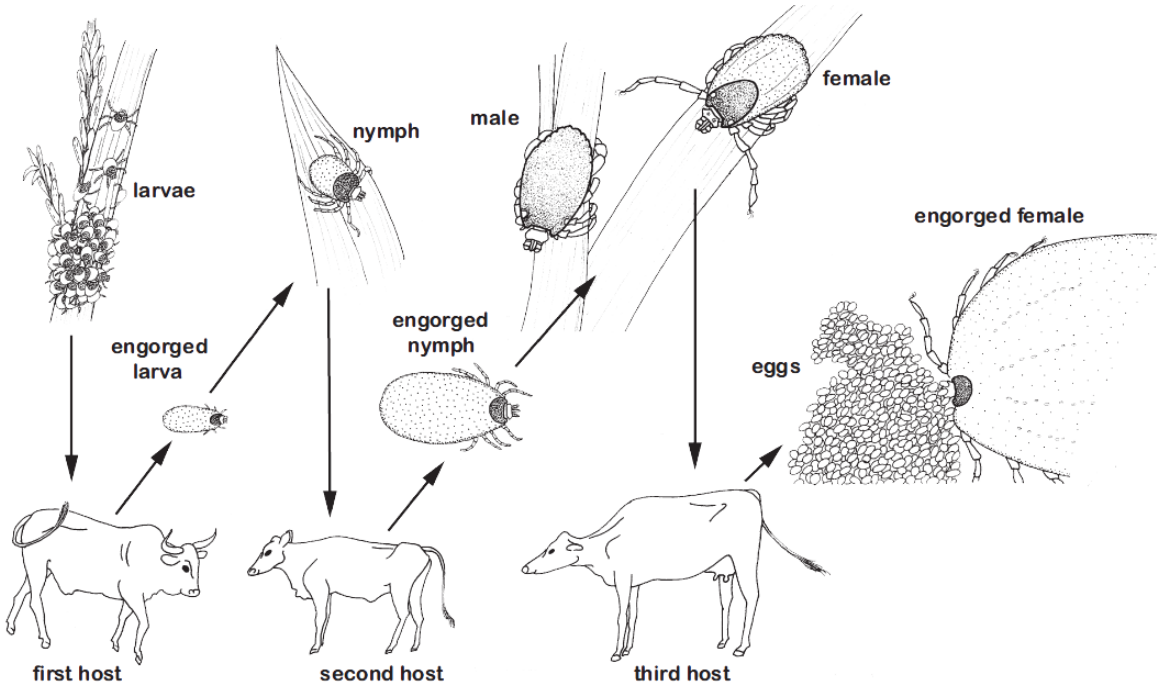
spread their progeny gradually over time, often across a span of many years. Diapause can be a major factor regulating the time of development of many of the argasid species, which survive in empty burrows or nests for periods of many months or years until their hosts return or new hosts arrive.



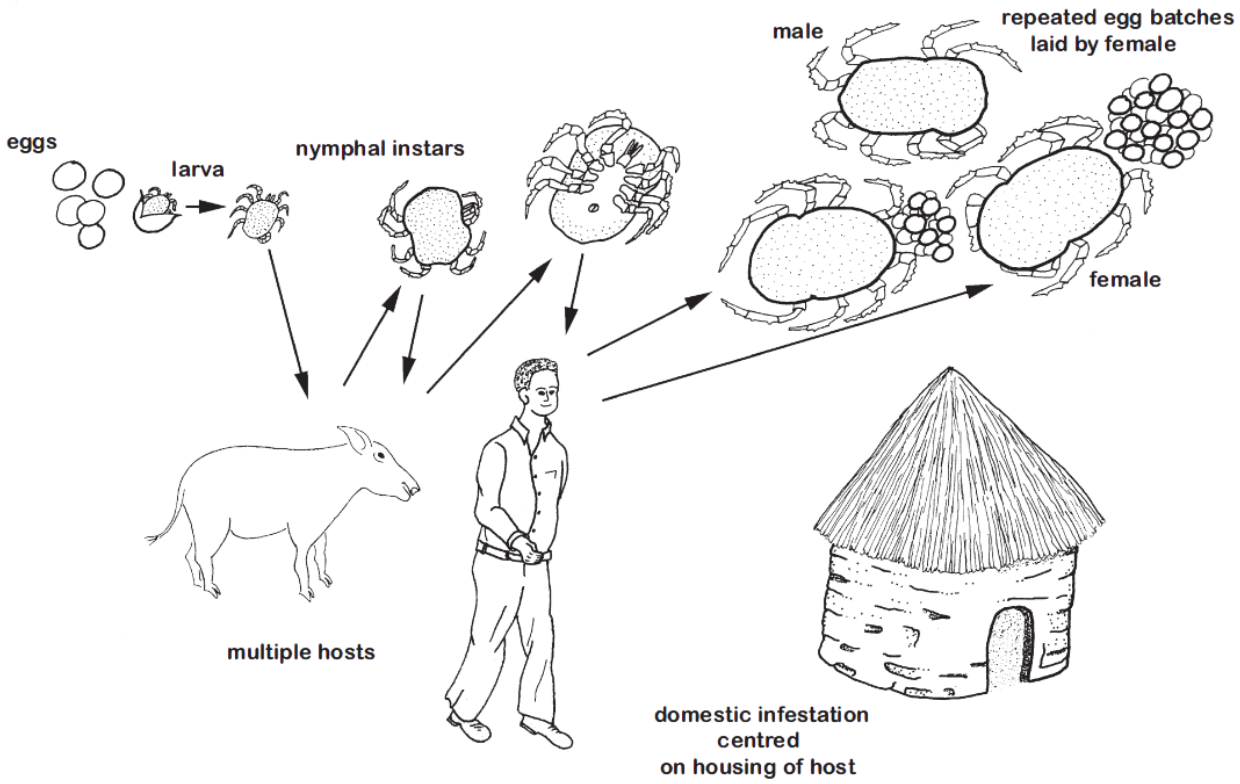
One-host life cycle. The example is *Rhipicephalus decoloratus*. From "Ticks of Domestic Animals in Africa" (Walker et al., 2003).



Two-host life cycle. The example is *Rhipicephalus bursa*. From "Ticks of Domestic Animals in Africa" (Walker et al., 2003).



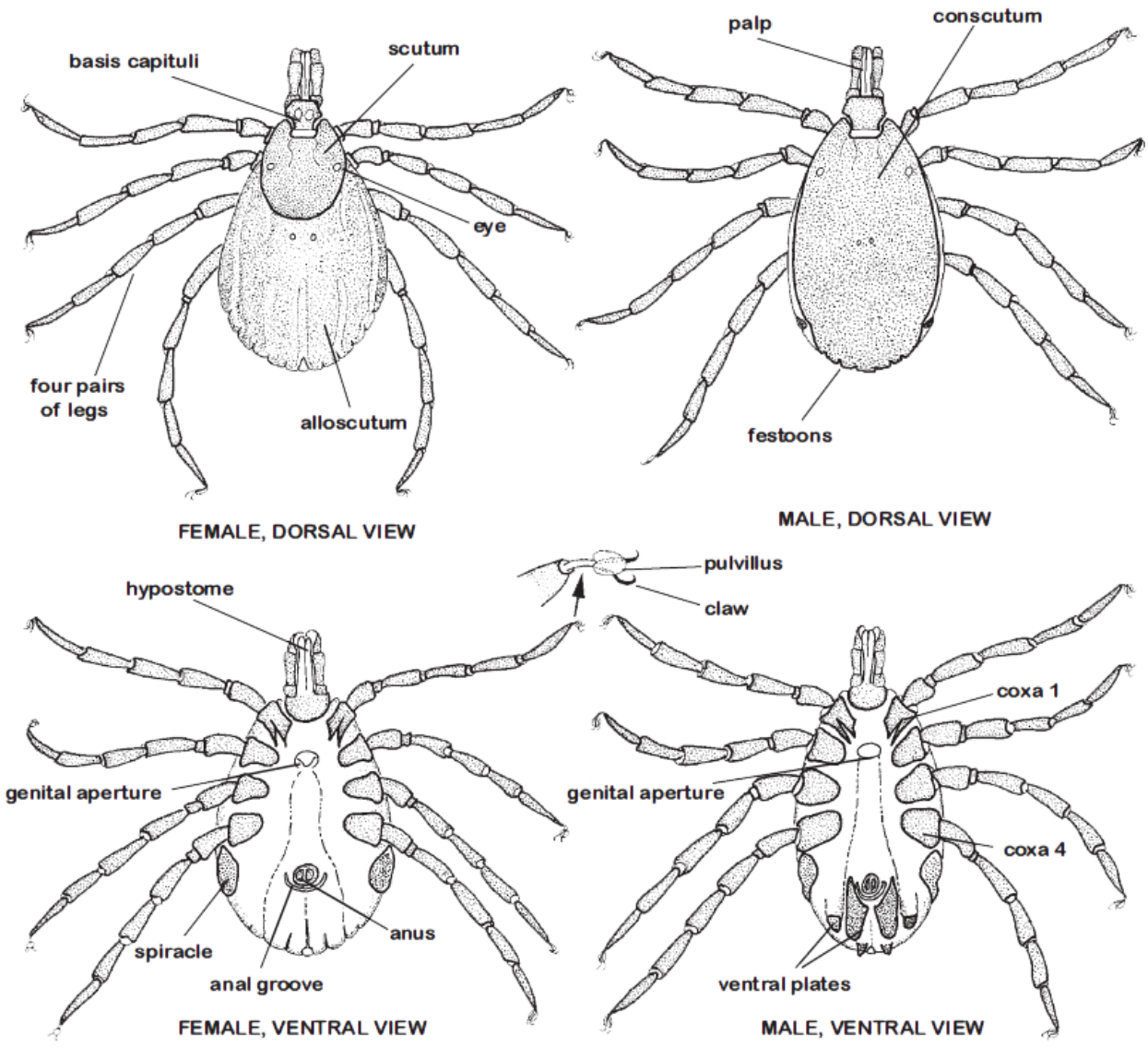
Three-host life cycle. The example is *Rhipicephalus appendiculatus*. From "Ticks of Domestic Animals in Africa" (Walker et al., 2003)



Argasid tick life cycle. The example is *Ornithodoros moubata* group, other argasid ticks may differ considerably. From "Ticks of Domestic Animals in Africa" (Walker et al., 2003).

MORPHOLOGY

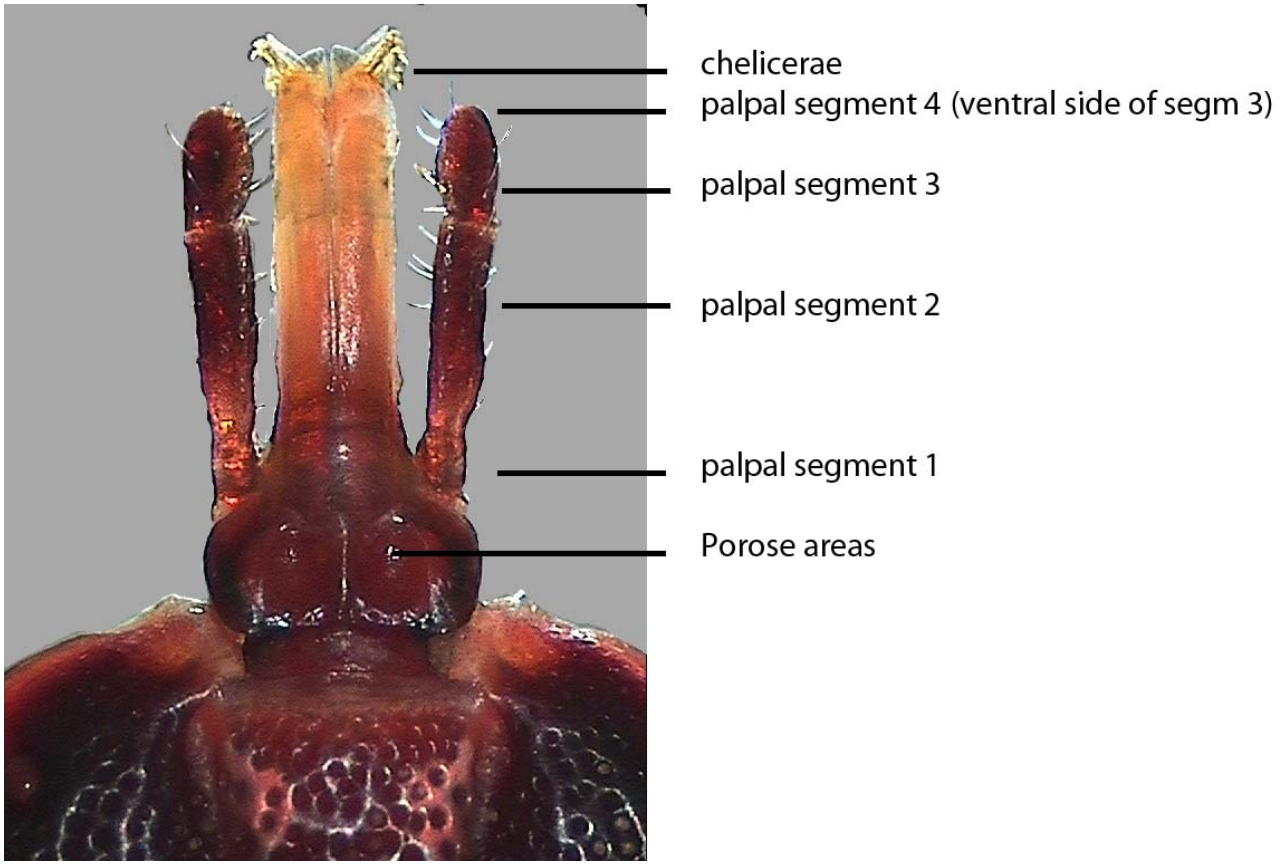
The Ixodidae are characterized by the presence of a tough sclerotised plate on the dorsal body surface, the scutum, covering the entire dorsal body surface in males (sometimes named conscutum), and limited to the anterior approximately one third of the dorsal body region in unfed females, nymphs and larvae. The folded cuticle posterior to the scutum constitutes the alloscutum. Both scutum and alloscutum are covered with numerous small setae. Sexual dimorphism is apparent only in the adult stage. The scutum is the site of attachment of various dorso-ventral body muscles, cheliceral retractor muscles, and many other muscle groups in the Ixodidae. Eyes, if present, are located on the lateral margins of the scutum.



General anatomy of male and female hard ticks. From "Ticks of Domestic Animals in Africa" (Walker et al., 2003)

Anterior to the scutum, the mouthparts protrude beyond the body and are readily visible dorsally. The mouthparts include the paired chelicerae dorsally and the segmented palps, and ventrally the denticulate hypostome, all mounted on the basis capituli. These structures constitute the capitulum. In all ixodid ticks, the palps consist of 4 segments (=articles), but the tiny sensilla-bearing terminal (4th) segment is recessed in a cavity on the ventral surface of segment III.

Females have a pair of porose areas (= *areae porosae*) on the dorsal surface of the basis capituli.



Mouthparts of Amblyomma spp., dorsal view

Ventrally, nymphs and adults bear a pair of spiracular plates (= stigmata) located immediately posterior to the fourth coxae, with the spiracle, a single opening, within each plate.

Pad-like pulvilli occur just proximal to the claws on the tips of the tarsus (last segment of the legs), enabling ticks to climb virtually any surface.

Nymphs and larvae resemble the adults, but lack the external genital pores and porose areas.

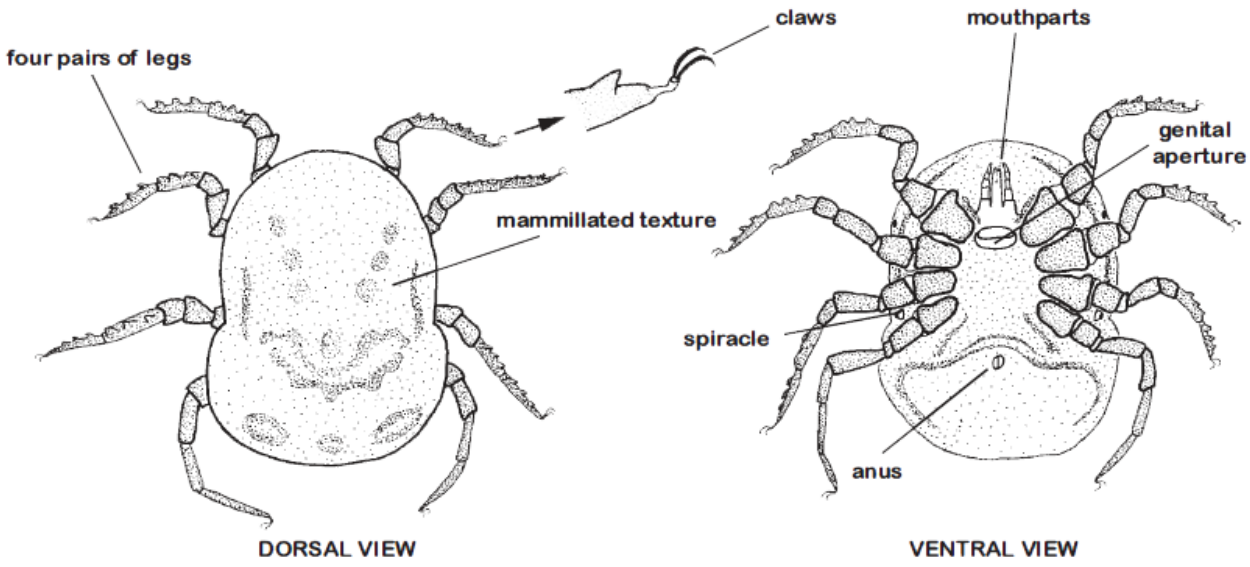
The Argasidae are characterized by a tough leathery integument in all but the larval stage.

The capitulum is recessed ventrally near the anterior end and is not visible dorsally (except in larvae).

Eyes when present are on the lateral surface of the body.

The spiracles or stigmata occur in the supracoxal folds between the coxae of legs III and IV.

Nymphal and adult argasids also bear a pair of tiny pores, coxal pores, representing the openings of the coxal glands, located between the paired coxae of legs I and II. Excess fluid filtered from the bloodmeals they take is excreted via these pores.



External structure of adult argasid ticks (the example is *Ornithodoros*). From "Ticks of Domestic Animals in Africa" (Walker et al., 2003)

IDENTIFICATION / GENERAL CHARACTERISTICS OF TICK GENERA (HARD AND SOFT TICKS)

Although most people consider ticks to be either small and red or large and blue, on closer inspection many species are extremely colourful when examined under a stereoscopic microscope. The range of colours or ornamentation on the scutum, particularly of the males of certain species, is spectacular, from metallic mauve, shiny dark orange, bright yellow to iridescent green. The legs of certain species may also differ in colour from that of the scutum and the posterior edge of each segment of the legs may be encircled by an ivory-coloured band. Some of these features can readily be seen with the naked eye and the ticks have been given common names by farmers and researchers. Thus we have bont (brightly coloured) ticks, bont-legged ticks with ivory-coloured bands around their legs, red-legged ticks whose legs vary from light to dark orange, yellow dog ticks, and blue ticks, the last mentioned ticks acquiring their common name from the slaty blue colour of their engorged females.

The various genera of hard ticks can easily be differentiated by a set of features unique to each genus: mouthparts, basis capituli, scutum, eyes, festoons, adanal, subanal and accessory anal plates, coxae, anal groove.

The differentiating features of adult ticks of the different genera are listed below. If you master these you are nearly halfway to identify the tick to species level. An **identification key to the families and genera** can be downloaded here

Characteristics of the different genera of hard ticks

Amblyomma

- Mouthparts very long, elongate second segment of palps
- Conscutum and scutum ornate
- Eyes present
- Festoons present
- Adanal plates on males absent, or when present very small
- Banded legs
- Three-host ticks

Amblyomma (previously *Aponomma*)

- Mouthparts long
- Conscutum and scutum ornate or inornate. Conscutum circular to laterally oval
- Eyes absent
- Festoons present, but inconspicuous in some species
- No adanal plates on males
- Three-host ticks

Rhipicephalus (previously *Boophilus*)

- Mouthparts very short, proximal margins of palpal segments II and III sclerotized and have the appearance of two protruding rings
- Conscutum often so poorly sclerotized that the dark pattern of the caeca can be seen from above
- Eyes present but not conspicuous
- No festoons
- Adanal plates and accessory adanal plates of males well developed
- Caudal process may be present in males
- One-host ticks

Dermacentor

- Mouthparts medium-length and broad
- Basis capituli rectangular
- Scutum ornate
- Eyes present
- Festoons present
- No adanal plates on males
- Males have large coxae, particularly the fourth pair. First pair with prominent posteriorly directed spurs
- Most species three-host, but some are one-host ticks

Haemaphysalis

- Mouthparts short and broad
- Basis capituli rectangular
- Scutum inornate
- Eyes absent
- Festoons present
- No adanal plates on males
- Three-host ticks

Hyalomma

- Mouthparts long, second segment of palps elongate
- Scutum pale to dark brown
- Eyes present and convex
- Festoons present
- Adanal, sub-anal, and accessory anal plates present on males
- Coxae of first pair of legs with long, prominent posteriorly directed spurs
- Banded legs
- Two or three-host ticks

Ixodes

- Mouthparts long.
- Auriculae latero-ventrally on basis capituli

- No eyes
- No festoons
- No adanal plates on males
- Anal groove conspicuous and anterior to the anus
- Legs appear to be grouped anteriorly
- Three-host ticks

Margaropus

- Mouthparts very short
- Conscutum thin and transparent and the dark pattern of the caeca can be seen from above
- Eyes present but not conspicuous
- No festoons
- Adanal plates on males well developed
- Caudal process and tufts of hairs present on posterior margin of males
- Banded legs
- The segments of the fourth pair of legs in males are markedly enlarged
- One-host ticks

Rhipicentor

- Mouthparts of medium length
- Eyes present
- Festoons present
- Adanal plates absent
- Coxae of first pair of legs with very prominent, long posteriorly directed spurs
- Coxae of fourth pair of legs in males very large, each with two long, narrow, pointed posteriorly directed spurs
- Three-host ticks

Rhipicephalus

- Mouthparts short to medium length.
- Basis capituli generally hexagonal in shape.
- Scutum usually uniformly brown, but four species have ivory-coloured ornamentation.
- Eyes present.
- Festoons present.
- Adanal plates, and usually also accessory adanal plates, present on males.
- Coxae of first pair of legs with long, prominent posteriorly directed spurs.
- Majority are three-host ticks, but a few species require only two hosts.

In summary the most prominent features that you must focus on when deciding to which genus a particular specimen of a tick belongs to are:

- Length of mouthparts

- Eyes or eyeless
- Conscutum ornate or inornate
- Colour of legs
- Festoons or no festoons
- Anal plates or no anal plates

Characteristics of the different genera of soft ticks

Argas

- Integument leathery
- Mouthparts recessed ventrally and not visible from above (except in larvae)
- Eyes absent
- Spiracular plate postero-laterally between 3rd and 4th pair of legs
- Numerous symmetrically arranged discs on dorsal side of body
- Lateral margin sharp with row of quadrangular cells on both the dorsal and ventral surfaces
- Sexual dimorphism limited mainly to the genital aperture
- Several nymphal stages

Otobius

- Dark, violin-shaped adults
- Mouthparts recessed ventrally and not visible from above (except in larvae)
- No lateral suture line on adults
- Nymphs diamond-shaped becoming violin-shaped with numerous spines on the body
- Larvae pear-shaped with clearly visibly anteriorly projecting mouthparts

Ornithodoros

- Leathery-mammillated integument
- Mouthparts recessed ventrally and not visible from above (except in larvae)
- Body margin rounded
- Supra-coxal fold
- Eyes absent or two pairs in the supra-coxal fold

TICKS OF VETERINARY IMPORTANCE / DIFFERENTIAL DIAGNOSIS

Photos, distribution maps, importance and hosts of all ticks described below and of other ticks of veterinary and human importance can be found online at:
http://www.itg.be/photodatabase/African_ticks_files/index.html or offline in the Tick database.

A holistic approach should be followed in the identification of ticks. Thus besides the morphological features that we make use of to identify ticks to species level, we also make use of their ecological requirements to assist with an accurate diagnosis. Consequently the geographic locality at which they were collected, the hosts from which they were collected, the body site on the host from which they were collected, and the season of the year during which they were collected are all important aids. Ideally anyone who sends in ticks for identification should supply all this information. Perhaps most important of all is that male ticks must be included in any collection sent for identification as they have more distinct taxonomic features that can be recognized than the females. Even more importantly a label containing all the important collection data and written in pencil should be included with the ticks inside the vial or tube or bottle in which the ticks have been placed. If an outside label is pasted onto the container it must be written in pencil, ball point writing dissolves the moment the alcohol used for tick preservation spills onto it.

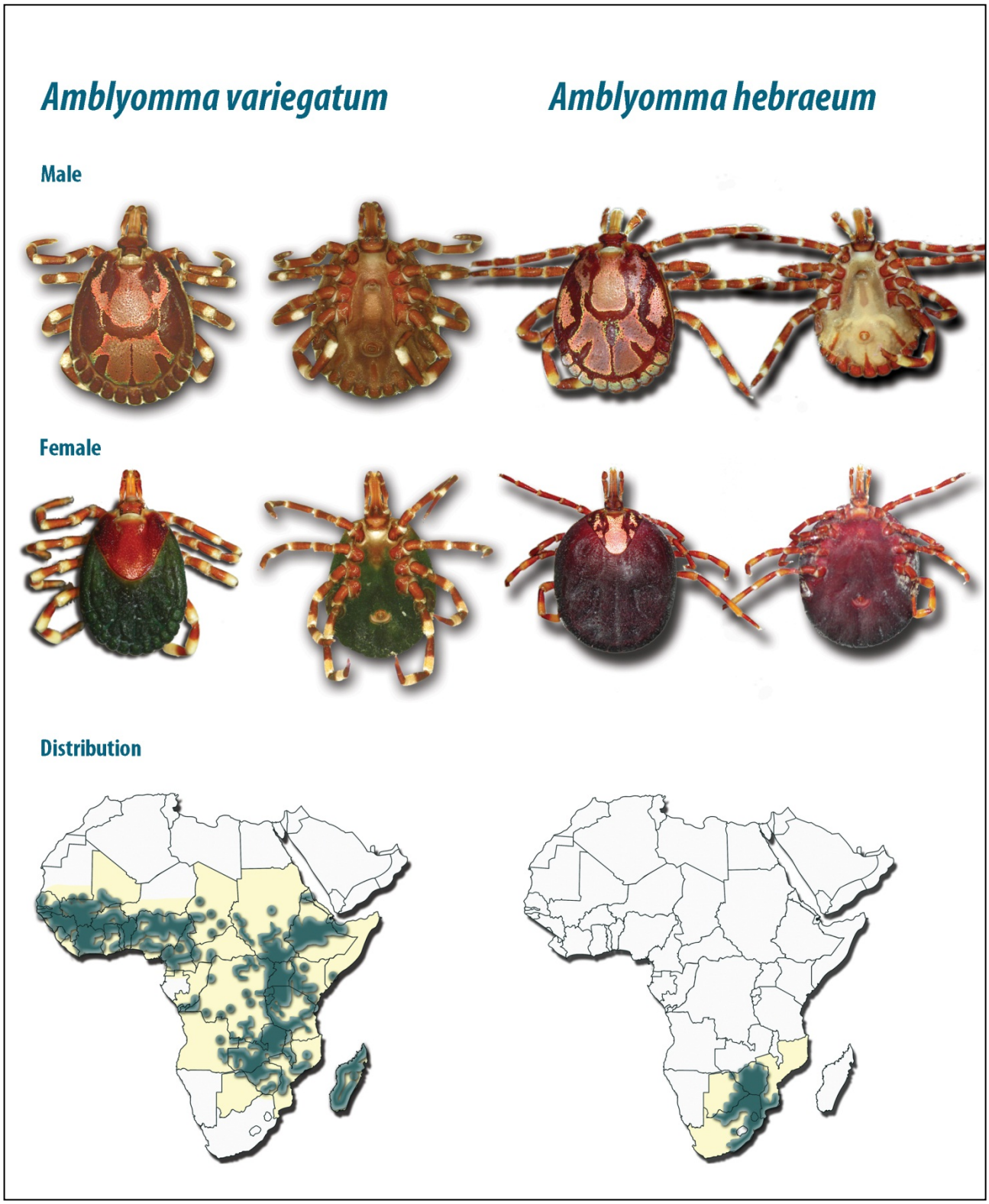
Besides the ticks whose common names are derived from their colour, farmers and researchers have also named ticks according to the geographic locality in which they are present, or the season during which they occur, or the condition they may cause, or the host on which they may feed or where they attach. Thus we have the Karoo paralysis tick, the winter horse tick, the kennel tick, the brown ear tick, the fowl tampan and the sand tampan. As you can gather from the foregoing these names are very descriptive and immediately give you a clue as to which tick you are dealing with.

The Ixodidae

Amblyomma spp.

Amblyomma hebraeum – the South African bont tick

Amblyomma hebraeum is a medium-sized to large tick with long mouth-parts and banded legs, its eyes are flat, the conscutum of the male is ornate with two discrete lateral patches of colour, and with the exception of the first festoon on either side the festoons are uniformly yellow in colour. It closely resembles *A. gemma*, an East African tick, but has the two discrete lateral patches of colour on the conscutum which are joined to the main colour pattern in *A. gemma*, and the festoons of *A. gemma* are variably dark-brown and yellow. Its distribution does not overlap with that of *A. gemma* (see Tick database for pictures and more information).



Adults feed on cattle, sheep, goats and large wild ruminants, particularly giraffes (*Giraffa camelopardalis*), African buffalo (*Syncerus caffer*) and eland (*Taurotragus oryx*), also on warthogs (*Phacochoerus africanus*) and black (*Diceros bicornis*) and white (*Ceratotherium simum*)

rhinoceroses. Immatures infest the same hosts as the adults but also small antelopes, scrub hares (*Lepus saxatilis*), helmeted guineafowls (*Numida meleagris*), and tortoises (e.g. *Chersina angulata, Geochelone pardalis*). The immature stages of this tick do not infest rodents (rats, mice, squirrels or gerbils), if they do they seem unable to engorge and usually die. The adults prefer the hairless areas under the tail, in the lower perineal region, on the udder and testes, around the prepuce and in the axilla of cattle, as well as around the feet of sheep and goats. The larvae are found on the feet, legs and on the muzzle, the nymphs attach on the feet, legs, groin, sternum and neck.

Amblyomma hebraeum is a three-host tick, like all other species of this genus. The adults and nymphs are "hunters", scuttling along the ground when a suitable host is in the vicinity. After detaching the engorged female will lay up to 20 000 eggs. These eggs hatch after two to three weeks depending on the temperature and the larvae wait for hosts on the vegetation, from which very large numbers can be collected by drag-sampling the vegetation with flannel cloths. Once attached the larvae engorge in 7 to 14 days, detach and moult. The nymphs engorge in 7 to 14 days, detach and moult. The adult males attach and start engorging. Only when sexually mature males (i.e. males that have been attached for ± 6 days) are present will the females attach. The pheromones secreted by the mature male ticks also attract more male and female ticks as well as nymphs which all attach to the host, usually in the vicinity of the mature males. The males and females mate and the females engorge in 7 to 9 days and detach. The males may remain on the host animal for 2 to 4 months. The life cycle usually takes 1 year to complete, but may extend for longer.

This tick requires moisture and warmth, brush and bush and does not survive in open grassland. In South Africa it is found along the coastal belt from Port Elizabeth in the Eastern Cape Province, through KwaZulu-Natal and thence across Mpumalanga, Gauteng, Limpopo and North-West Provinces, north of a line running approximately through Pretoria to the Botswana border. It is also present in eastern Swaziland, southern Mozambique, eastern Botswana and in southern and eastern Zimbabwe.

Amblyomma hebraeum transmits *Ehrlichia ruminantium* (heartwater) to domestic and wild ruminants, and *Theileria mutans* (benign bovine theilerioses) to cattle and *Rickettsia africana*, the cause of African tick-bite fever in humans. The larvae of *A. hebraeum* are probably more responsible than any other tick for tick bites in humans.

***Amblyomma variegatum* – the tropical bont tick**

Adults of *A. variegatum* have long mouthparts and banded legs like *A. hebraeum*, but have different colour patterns on the conscutum and scutum, the colour pattern on the male conscutum is dark-orange. Their eyes are beady, and the males have uniformly dark festoons.

It is widely distributed through West, Central, North-East and East Africa and in southern Africa extends into Zambia, north-eastern Botswana, the Caprivi Strip of Namibia, north-western Zimbabwe and central and northern Mozambique. Its spread southwards appears to be limited by interspecific competition with *A. hebraeum* with which it shares similar habitats, hosts and sites of attachment and by the drier conditions in the south. It has also been imported onto the Caribbean islands where

attempts to eradicate it have cost millions of dollars without success, mainly because of the variety of hosts it infests, particularly the immature stages, and its re-introduction by birds infested with the immature stages flying from one island to the next.

Amblyomma variegatum transmits heartwater (*E. ruminantium*), benign bovine theilerioses (*Theileria mutans, T. velifera*), bovine ehrlichiosis (*E. bovis*), the virus of Nairobi sheep disease and is associated with acute bovine dermatophilosis (*Dermatophilus congolensis*).

Hyalomma spp.

Hyalomma dromedarii – the camel tick

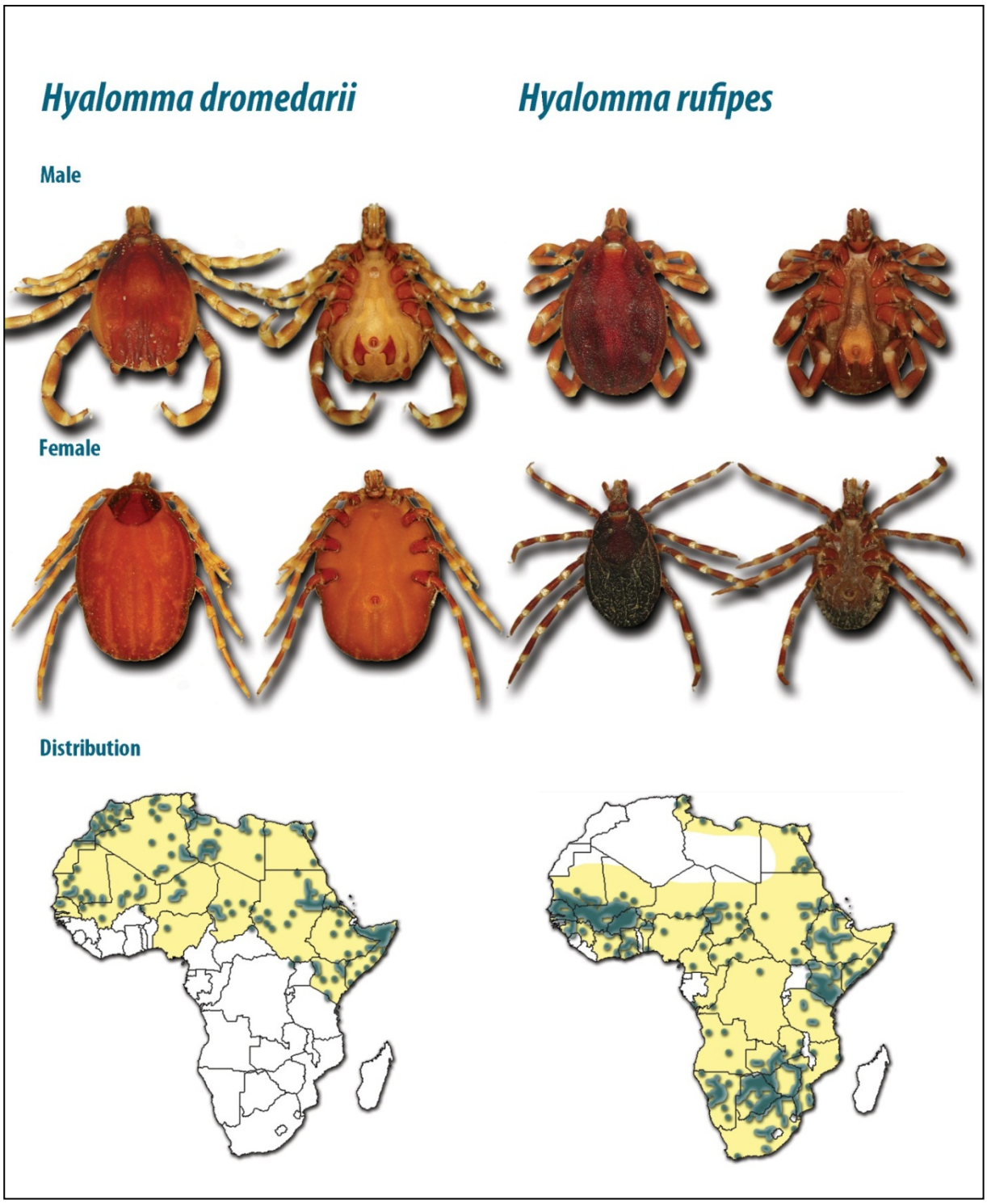
Adult *H. dromedarii* are large yellow-brown to nearly black ticks with long mouthparts. The legs are paler than the scutum and may be ringed by paler bands. The lateral grooves are short and deep and limited to the posterior third of the conscutum, the postero-median groove is deep and narrow, extending from a distinct parma to midlength of the conscutum. This groove is bounded on either side by converging ridges and lateral to these ridges are the deep and wide postero-lateral grooves. The sub-anal plates on the male are distinctly laterally placed in relation to the adanal plates and may extend beyond the posterior margin of the body in engorged specimens. The genital aperture of the female is narrowly elongate and triangular.

The preferred hosts are camels (*Camelus dromedarius)*, but cattle, sheep, goats and horses may also be infested. The larvae and the nymphs feed on small burrowing animals and on hares, but the nymphs may also infest camels, cattle and horses. Adults attach on the inner thighs, udder and scrotum and in the outer nostrils of camels.

Hyalomma dromedarii has a two or a three-host life cycle. The larvae may feed and moult to nymphs on small mammals or hares and the adults feed on large domestic herbivores. Alternatively the larvae may feed on small mammal hosts, drop off and moult to nymphs, which can then either attach to other small mammal hosts or feed on the same large animals as the adults. The life cycle appears to be continuous throughout the year.

It is present in the arid regions of north Africa from Mauritania in the west to Egypt in the east; it is also present in Sudan, Ethiopia, Somalia and Kenya in North East Africa. It was introduced into Namibia on camels and continues to exist there on these animals in arid regions.

It transmits *Theileria annulata* the cause of tropical theileriosis, is also a mechanical vector of camel pox and has been incriminated in a case of tick paralysis in children in Egypt.



***Hyalomma rufipes* –** large, coarse bont-legged tick

Until recently this tick was known as *Hyalomma marginatum rufipes*, a subspecies of *Hyalomma marginatum*, but it has now been established as a valid species and given full specific status as *Hyalomma rufipes*.

Dark-brown to nearly black conscutum of male is is broadly oval and the entire surface is covered with medium-sized, coarse punctations. The brown legs are brightly-banded with ivory-coloured rings. The adanal plates have square ends, and the sub-anal plates are distinct but small and aligned with the adanal plates. The genital apron of the female is convex, the genital aperture is very broadly v-shaped, and there are numerous setae in the circumspiracular area.

With the exception of Lesotho, the eastern Free State, the coastal areas of KwaZulu-Natal and the coastal areas and adjoining inland regions of the Western Cape Province, *H. rufipes* is present throughout South Africa. It is widespread in Botswana, Zimbabwe and northern Namibia as well as in Kenya, Ethiopia and Somalia and the southern countries of West Africa.

Hyalomma rufipes adults feed on cattle, sheep, goats, horses, and large wild herbivores including rhinoceroses. The immature stages feed on scrub hares and ground-frequenting birds (e.g. guineafowl). Adults attach in the hairless area of cattle around the anus and on the genitalia and are also found around the hooves of sheep. The immature stages are found on the necks of scrub hares and on the heads and necks of birds.

Hyalomma rufipes is a two-host tick. The adults are “hunters”. The females feed for 7 to 14 days and then detach and lay 2 000 to 10 000 eggs and die. The larvae hatch in 30 to 60 days and infest hares or birds on which they engorge and moult to nymphs. The engorged nymphs detach, drop to the ground and moult to adults. The life cycle takes 1 year to complete. The adults are active mainly during the summer months from October to March. The immature stages feed on hares and birds from autumn to spring.

The long mouthparts cause tissue damage in cattle and sheep and secondary bacterial infections may lead to abscess formation. The tick also causes lameness in lambs. Injuries caused by the long mouthparts are attractive to the blowfly *Chrysomya bezziana*. It can transmit *Anaplasma marginale* to cattle causing bovine anaplasmosis or gallsickness and also *Babesia occultans* causing benign babesiosis in cattle; it can also transmit *R. conori* to humans. Ticks of the genus *Hyalomma* can transmit Congo Haemorrhagic fever virus to humans: *H. rufipes* would appear to be the most efficient vector of the virus.

***Hyalomma glabrum* – pale-legged bont-legged tick**

Until recently this tick was classified as a subspecies of *Hyalomma marginatum* and was known as *H. marginatum turanicum*. It has subsequently been reinstated as an old taxon bearing the specific name *Hyalomma glabrum*. It is fairly similar in appearance to *H. rufipes,* but the dorsal aspects of its banded legs are ivory-coloured. Its hosts are the same as those of *H. rufipes.*

***Hyalomma truncatum* – small smooth bont-legged tick**

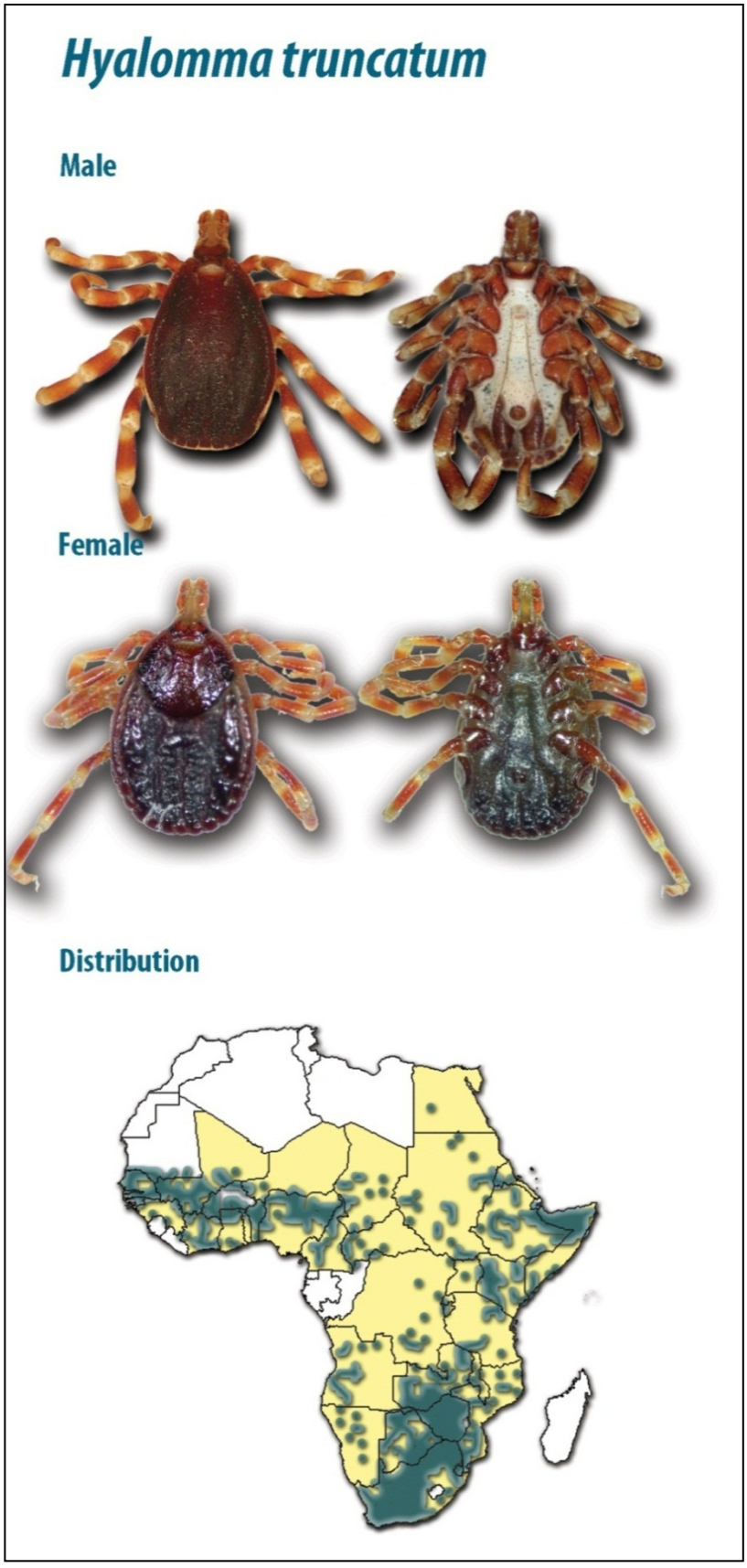
Dark-brown conscutum of male is fairly narrow, glossy with few punctations anteriorly, with a semi-circular indentation posteriorly that is covered with coarse punctations. The brown legs are brightly-banded with ivory-coloured rings. The adanal plates have square ends, and the sub-anal plates are distinct but small and aligned with the adanal plates. The genital apron of the female is concave, the genital aperture nearly semicircular in shape, and the circumspiracular area is nude.

With the exception of Lesotho, the eastern Cape Province, the eastern half of the Free State, south-eastern Gauteng and south-eastern Mpumalanga and southern KwaZulu-Natal, *H. truncatum* is present throughout South Africa. It is present throughout Zimbabwe and much of Mozambique. It occurs in south-eastern and north-western Botswana, central and northern Namibia, and southern Angola. In Tanzania and in Kenya it is present mainly in the south-west, and with the exception of the eastern and western regions it occurs throughout Ethiopia and from there to the West African coast.

Hyalomma truncatum adults feed on cattle, sheep, goats, horses, large wild herbivores and particularly on giraffes and eland and occasionally on dogs. The immature stages feed on scrub hares and on various species of small rodents (e.g.bushveld gerbils (*Gerbilliscus leucogaster*), and four-striped mice (*Rhabdomys pumilio*)). On cattle the adults of *H. truncatum* attach in the tail switch, around the anus, on the lower perineum and on the legs. They are also found around the hooves of sheep. The immature stages attach on the necks of scrub hares. *Hyalomma truncatum* is a two-host tick. The adults are “hunters”. The females feed for 7 to 14 days and then detach and lay 2 000 to 10 000 eggs and die. The larvae hatch in 30 to 60 days and infest hares or rodents, on which they engorge and moult to nymphs. The engorged nymphs detach, drop to the ground and moult to adults. The life cycle takes 1 year to complete.

The adults are active mainly during the summer months from October to March. The immature stages are active and feed on hares and rodents from autumn to spring.

Certain strains of *H. truncatum* contain a toxin in their saliva that causes sweating sickness, an acute dermatitis in cattle, particularly calves. When the ticks infest dogs they tend to cluster at one site and can cause severe skin necrosis. The long mouthparts cause tissue damage in cattle and sheep and secondary bacterial infections may lead to abscess formation. The tick also causes lameness in lambs. Injuries caused by the long mouthparts are attractive to the blowfly *Chrysomya bezziana*. Ticks of the genus *Hyalomma* can transmit Congo Haemorrhagic fever virus to humans, and *H. truncatum* can transmit *R. conori* to humans.


Hyalomma truncatum
Male
Female
Distribution

Hyalomma albiparmatum

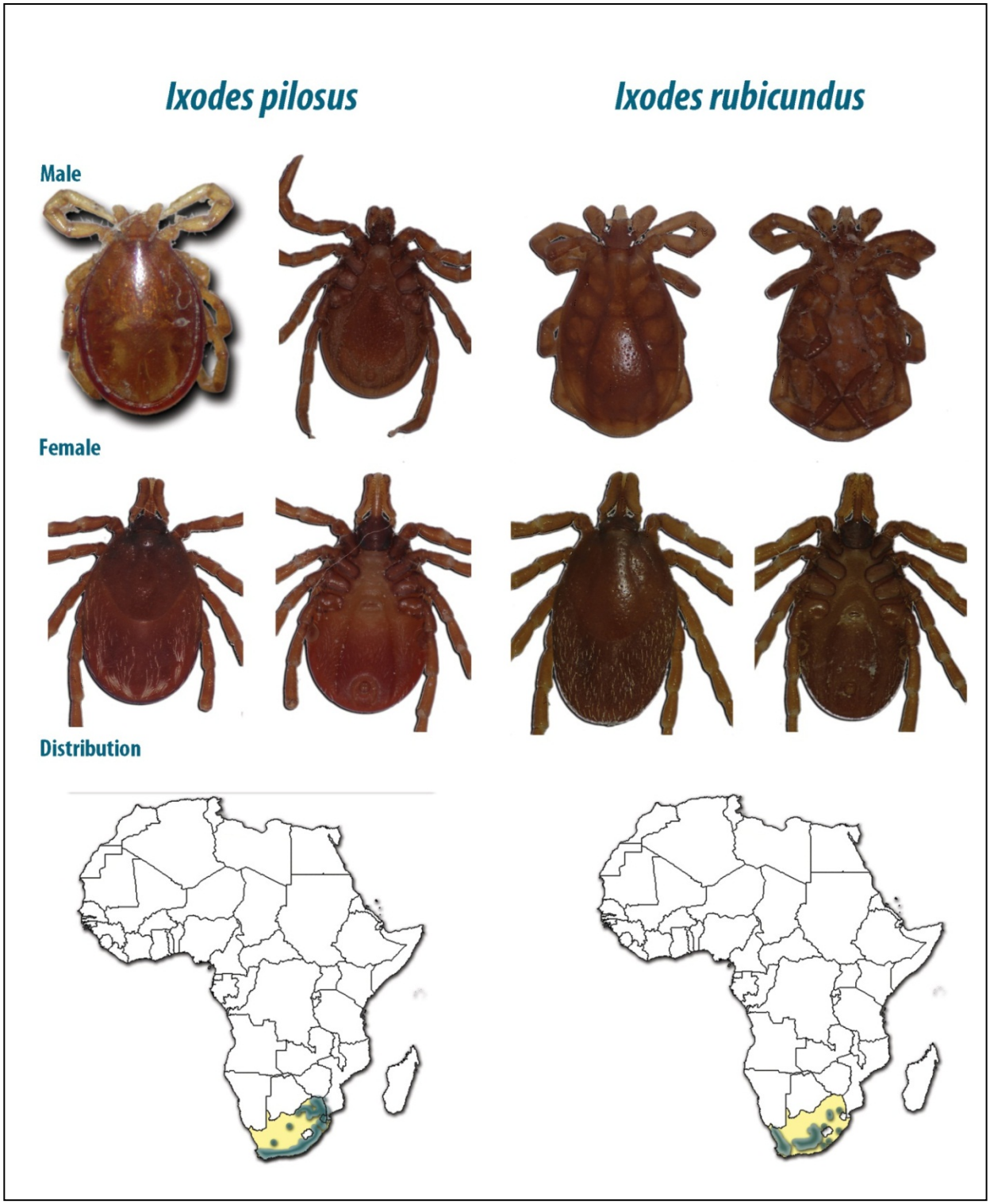
All stages of this East African tick are identical in appearance to *H. truncatum* with the exception of an ivory-coloured central festoon in the male of *H. albiparmatum*.

Ixodes pilosus (group) - Sourveld tick

There are probably three different tick species within this grouping of which only one has been described. The female is similar in appearance to *Ixodes rubicundus*, but the auriculae protrude laterally on the ventral aspect of the basis capituli, and there are spurs medio-posteriorly on the first pair of coxae. The alloscutum bears four longitudinal rows of long, stout setae dorsally. The posterior alignment of the anal groove is short and converging. In the male the genital aperture is present in an inverted U-shaped area formed by the ventral shields.

All stages of development of *I. pilosus* infest cattle, sheep, dogs, grey rhebok (*Palea capreolus*), bushbuck (*Tragelaphus scriptus*), caracal (*Caracal caracal*) and scrub hares. It attaches around the the head.

This tick is present in the southeastern sourveld coastal regions of the Western and Eastern Cape Provinces, and there are foci around Nelspruit and in the Northern Province near Polokwane. It is a three-host tick, with adults present in summer, larvae in autumn and nymphs in spring. This species is not known to transmit diseases.



***Ixodes rubicundus* - Karoo paralysis tick**

Ixodes rubicundus is a reddish-brown colour and the mouthparts are long relative to the size of the tick. The palps are club-shaped and denticles are visible on the lateral aspects of the hypostome. Eyes are absent. The legs are long and slender and appear to be grouped anteriorly. A prominent lateral groove is evident on the conscutum of the male and festoons are absent. The anal groove surrounds the anus anteriorly in both sexes. The ventral surface of the male is covered with a number of shields and its genital aperture is present in an inverted V-shaped area formed by these shields. There are no adanal plates. The auriculae of the female do not protrude prominently laterally on the ventral aspect of the basis capituli, and the medio-posterior aspect of the first pair of coxae is rounded and has no spur.

Adults feed on sheep, goats, dogs, caracals (*Caracal caracal)*, and mountain reedbuck (*Redunca fulvorufula*). Immatures are found on rock elephant shrews (*Elephantulus myurus*), red rock rabbits (*Pronolagus rupestris*) and caracals. Females are present in the wool-line on the limbs and belly of sheep. Males rarely attach to host animals, but are frequently found attached to females. *Ixodes rubicundus* is a strictly South African tick. It is present in the Karoo, southern Free State and small foci near the towns of Bronkhorstspruit, Belfast and Heidelberg in Gauteng and Mpumalanga Provinces. The presence of hilly or mountainous veld and of the wild olive tree (*Olea africana*), the shrub “besembos” (*Rhus erosa*), and the gras “suurpol” (*Merxmeullera disticha*) all support the existence of the tick as does the presence of rock elephant shrews (eastern rock sengis) and red rock rabbits. The ticks also prefer the southern slopes of the hills that are cooler than the northern slopes.

This is a three-host tick. The females remain on the host for about 7 days, they then detach and lay 2 000 to 4 000 eggs and die. The eggs "over-summer" and only hatch the following autumn. The larvae feed on red rock rabbits and rock elephant shrews during autumn and winter and the nymphs during winter and spring. The engorged nymphs, which drop from these small mammals, "over-summer" and moult to the adult stage the following autumn. The females remain on the host for about 7 days. The life cycle takes 2 years to complete. Suurpol, besembos and wild olives afford protection for the hares and shrews and the mat of leaves that forms under this vegetation supplies shelter to the ticks and their eggs. This mat also ensures that the relative humidity is high, which is essential for the hatching of the eggs. Adult ticks quest on the grass at a height of about 40 cm within 2 metres of “besembos” or “wild olives”. They react to vibrations, shadows and odours. The questing height of the adults corresponds to the belly height of their preferred hosts, mountain reedbuck and sheep.

Adults are most abundant on sheep and on antelopes during autumn to spring of one year, during the following year larvae are most abundant on rock elephant shrews and on red rock rabbits during late summer to winter and nymphs during winter to spring. Adult ticks appear on the vegetation and on host animals earlier in the year in the south of South Africa than in the north.

The female ticks produce a toxin that causes paralysis, particularly in sheep and goats, but young calves and antelopes may also be affected. Peak numbers of adult ticks are present within 4 weeks of activity having commenced, and the number of female ticks per kg of host mass is important in the

causation of paralysis. Initially a paralysis of the legs is noted and this may progress until paralysis of the respiratory system and death supervenes. A few cases of paralysis may be seen in February or March, reaching a peak in April or May, and are associated with a drop in environmental temperature and with moist conditions. If the ticks are removed timeously the clinical signs are reversed within a few hours.

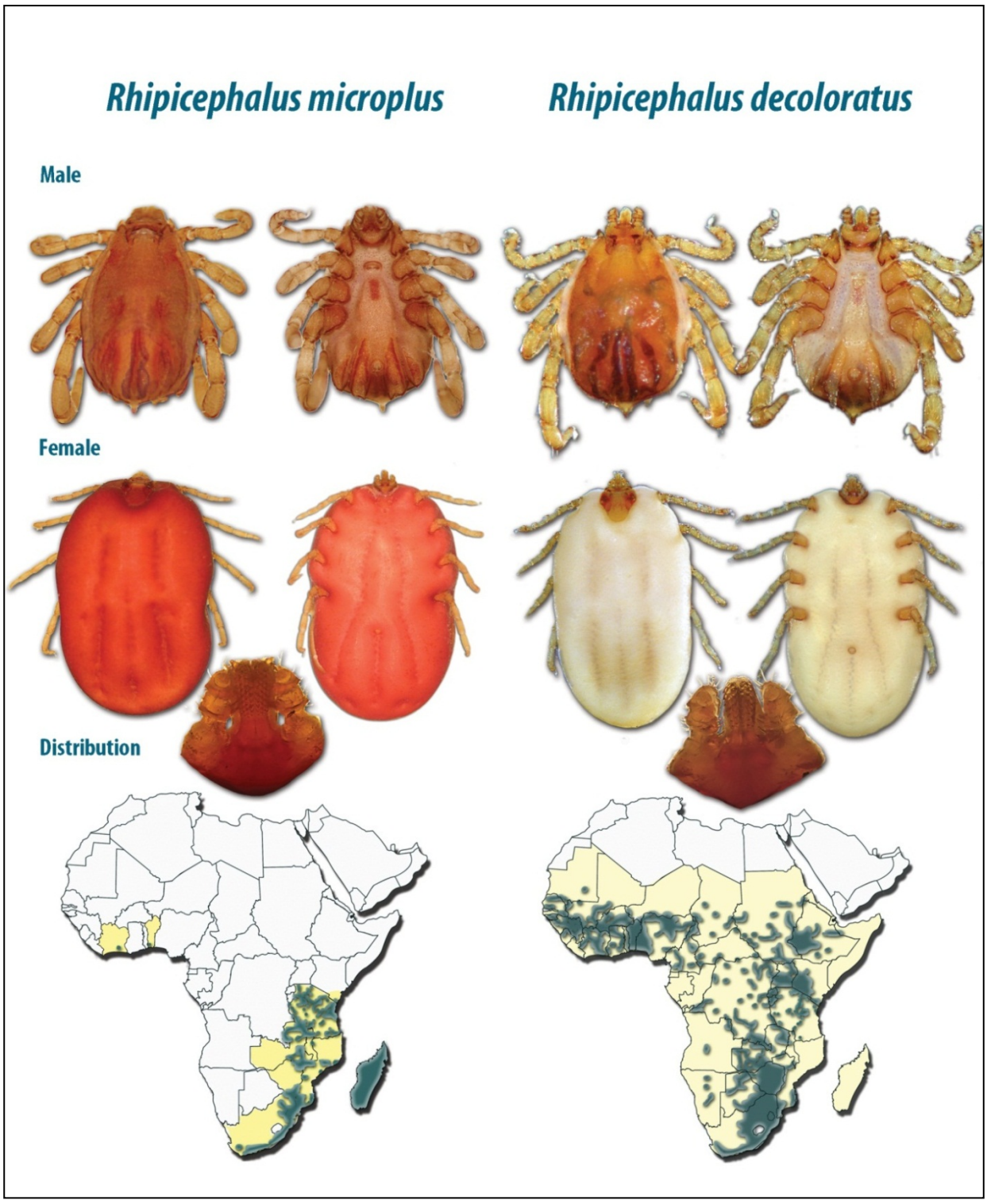
Rhipicephalus spp.

The first two tick species we have to do with in this genus are arguably the best-known tick in the world (*Rhipicephalus microplus*), and in southern Africa (*Rhicephalus decoloratus*). These ticks were previously known as *Boophilus microplus* and *Boophilus decoloratus*. Their names were changed to *Rhipicephalus (Boophilus) microplus* and to *Rhipicephalus (Boophilus) decoloratus* in 2003 and in a list of valid tick names that was published in 2010 they are now simply known as *Rhipicephalus microplus* and *Rhipicephalus decoloratus*. These name changes have caused a lot of controversy, but as they have been well motivated by respected acarologists *R. microplus* and *R. decoloratus* are likely to become the accepted scientific names.

Rhipicephalus (Boophilus) decoloratus – African blue tick

The mouthparts are short and the dentition on the hypostome is arranged in two columns, each consisting of numerous rows each of which consists of three denticles (3/3 dentition). The internal margin of the first segment of each palp has a bristle-bearing protuberance. The basis capituli is hexagonal in shape. The conscutum of the male is yellowish in colour and often so poorly sclerotized that the outlines of the gut can be seen through it. There are numerous fine hairs on the conscutum of males and the scutum of females. The eyes are difficult to see, and in the female two distinct grooves divide the scutum into a central yellow area and two lateral areas that are reddish-brown. There are no festoons. A small caudal process is present on the males and the adanal plates have a long, narrow posteriorly directed internal spur and a shorter external spur. The tips of the adanal and accessory adanal plates can be seen from above where they protrude beyond the posterior margin of the conscutum. The engorged female is blue in colour, frequently with a constriction in its middle and a rather soft-looking integument. The segments of the pale yellow, slender legs are beady in appearance.

Cattle, impalas (*Aepyceros melampus*), eland, nyalas (*Tragelaphus angasii)* bushbuck (*Tragelaphus scriptus*), greater kudu (*Tragelaphus strepsiceros*) and also horses and zebras are hosts of *R. decoloratus*. The sides of the body, shoulders, neck and dewlap are preferred sites of attachment. The immature stages may be found on the tips and upper edges of the ears and on the legs.



Rhipicephalus decoloratus requires moisture and warmth. In South Africa it is found in the coastal regions of the Western and Eastern Cape Provinces, throughout KwaZulu-Natal, Mpumalanga, Gauteng, Limpopo and North West Provinces and the eastern half of the Free State. It is distributed through most of the wetter regions of South Africa, except for those localities at which it has been replaced by *R. microplus*. However, it also occurs in cold mountainous areas such as the

Drakensberg range and parts of Lesotho. It is absent from the drier parts of South Africa, which receive an average annual rainfall of less than 380 mm, including the western Free State, the central Karoo, Bushmanland and little Namaqualand. In the generally arid territory of Namibia it is present only in localized areas in the north, and in Botswana it is restricted to the higher rainfall eastern border areas and a few scattered localities in the north. It is also present in the eastern half of Zimbabwe, Angola, much of Zambia, Malawi, southwestern and northern Tanzania, Burundi, Uganda, western Kenya and in the wetter highlands and sub-highlands of Ethiopia. It is also found in most countries of sub-Saharan West-Africa.

Rhipicephalus decoloratus is a one-host tick. The engorged females lay 1 000 to 2 500 eggs about 1 week after detaching from the host. These eggs hatch in 3 to 6 weeks and the larvae climb up the vegetation and wait there for a host. They attach, engorge and moult to the nymphal stage on the host after a week, the nymphs attach, engorge and moult to adults on the host after a week, the adults attach, partially engorge, mate and the females fully engorge and drop off after a week. They therefore spend about 3 weeks on the host animal and the life cycle, including the non-parasitic phase, can be completed in approximately 2 months. More than one life cycle can be completed annually.

The ticks are active throughout the year where the climate is warm enough, with a peak in abundance during spring and another during late summer and autumn. Large numbers of synchronously hatching larvae are present on the vegetation and on hosts in spring. In cooler regions there may be little activity in the winter months.

Rhipicephalus decoloratus transmits *Babesia bigemina* to cattle. This infection is transmitted only by the nymphal and adult stages after it has passed transovarially from one generation to the next. The incubation period in cattle is 12 to 14 days. Once established in the tick host *B. bigemina* can be transmitted by many successive generations of ticks without their acquiring new infection. *Rhipicephalus decoloratus* also transmits *Anaplasma marginale* to cattle, and *Borrelia theileri*, the cause of spirochaetosis, to cattle, sheep, goats and horses.

***Rhipicephalus microplus* - Asian blue tick**

Adults of *R. microplus* are slightly larger than those of *R. decoloratus*, and the scutum is slightly redder in colour, but they are otherwise very similar in general appearance. The dentition on the hypostome is arranged in two columns each consisting of numerous rows and each row consists of four denticles (4/4 dentition). The inner margin of the first segment of the palps is concave and bears no bristle. A small caudal process is present on the males and the internal spur on the adanal plates is approximately as long as the external spur and is not as prominent as that of *R. decoloratus*.

Domestic cattle are probably the only really effective hosts of this tick, but domestic goats sharing pastures with infested cattle have now also been found to be infested and as female ticks successfully engorge on the goats it is possible that the life cycle of *R. microplus* can be completed in the absence of cattle. More and more records of *R. microplus* on wildlife are being reported and ticks have been found on grey rhebok and eland in the Western Cape Province and on deer in South America.

It has been postulated that *R. microplus* was introduced into East and South Africa from Madagascar, where it had originally arrived with cattle from southern Asia. In South Africa it is now established in ever increasing areas along the southern and eastern coasts of the Western and Eastern Cape Provinces and of KwaZulu-Natal. It is also present in the coastal regions of Mozambique, Tanzania and Kenya. In the interior it is found in scattered localities in Mpumalanga and Limpopo Provinces, South Africa, in parts of the eastern and central provinces of Zambia, throughout Malawi and to the east and north of Lake Malawi in Tanzania. There is evidence that where favourable moist and warm climatic conditions exist it competes with and is able to replace the indigenous *R. decoloratus*. *R. microplus* spread into Zimbabwe in the 1970s, when dipping was disrupted during the pre-independence war, and replaced *R. decoloratus* in several areas. By 1988 it had disappeared, possibly because of drought and the reintroduction of dipping. In Zambia, though, its westward spread appears to be continuing. In Mozambique it has completely displaced *R. decoloratus* at least as far north as Tete Province, while it has also recently been introduced into West Africa where it is apparently flourishing. It would seem that *R. microplus* has adapted to most conditions in Africa: the constant warm and moist regions of West Africa with its lush vegetation, the coastal areas of South Africa with their adjoining drier regions, the inland regions of the north-eastern regions of the Eastern Cape Province, where snow may fall in winter, and the extremely hot and dry regions of Tete Province, Mozambique, where there is scarcely a blade of grass to be found during winter and spring.

Rhipicephalus microplus has a one-host life cycle of which the parasitic portion takes approximately 21 days to complete on the host. Its total life cycle (including the off host period during which the detached female lays eggs, the larvae hatch from the eggs and the larvae quest for hosts from the vegetation) is approximately 1 week shorter than that of *R. decoloratus*. Females lay approximately 500 eggs more than do *R. decoloratus* females, and like *R. decoloratus* it is able to complete several generations in one year.

Rhipicephalus microplus may be present in variable numbers throughout the year. The largest numbers of larvae are usually present on pastures and on hosts in spring, and successive lesser waves of questing larvae then occur through the summer and into the cooler autumn and early winter months. Theoretically, only larvae of this one-host tick should quest for hosts from the vegetation, but male ticks have also been collected from the vegetation, implying that they must have detached shortly before or after moulting and were now questing from the vegetation for a second host.

The tick transmits bovine babesiosis (*Babesia bovis* and *B. bigemina*). *Babesia bovis* infection is acquired by the adults of one generation of ticks and transmitted transovarially by the larvae of the next generation and all infestation is then lost by them. It also transmits bovine anaplasmosis (*Anaplasma marginale*) and spirochaetosis (*Borrelia theileri*).

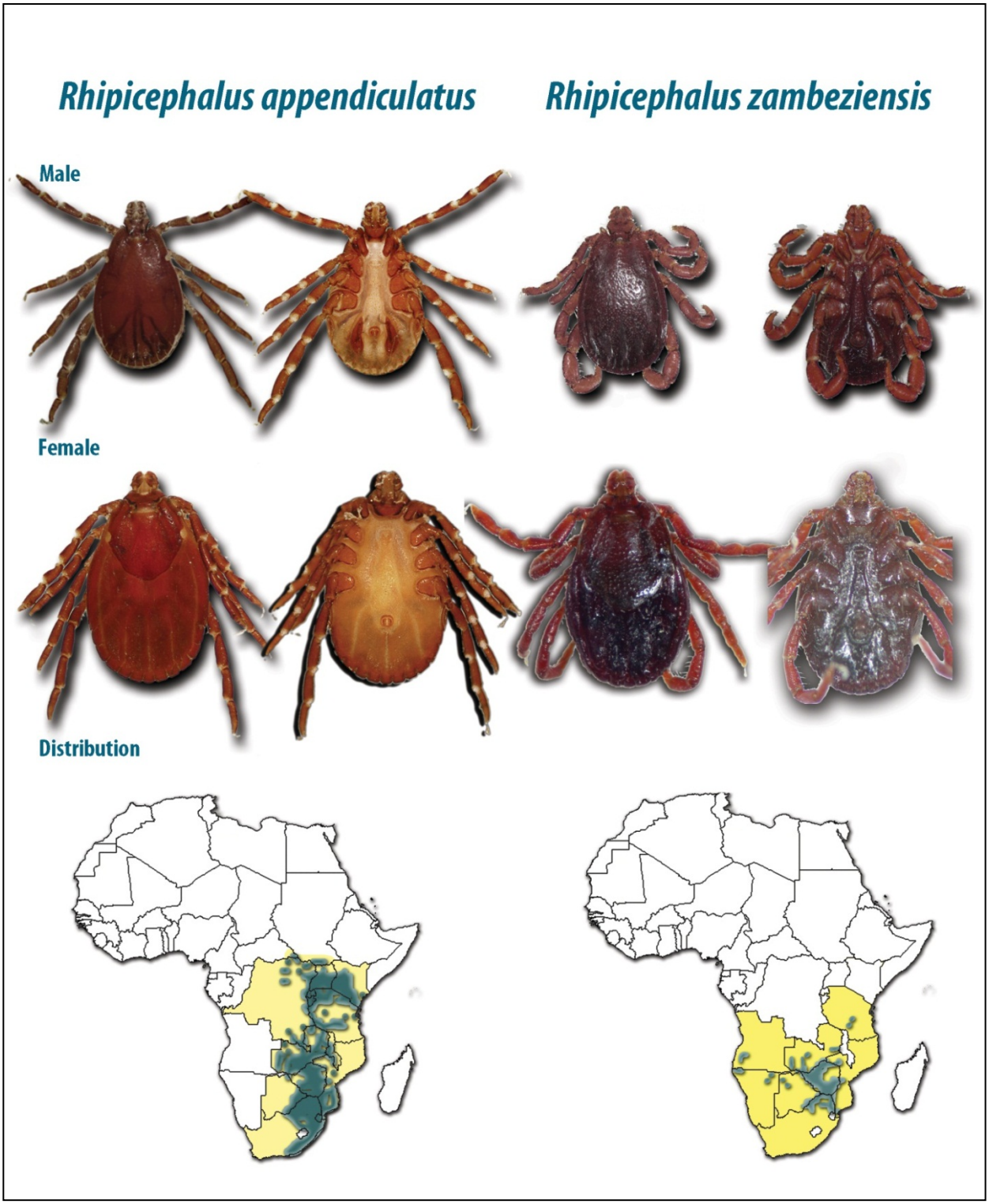
***Rhipicephalus appendiculatus* -** Brown ear tick

The tick is a uniform brown colour. The mouthparts are short and the basis capituli, particularly of the female, is hexagonal in shape. The anterior process of coxa I is visible from the dorsal surface. The cervical fields are the shape of scalpel-shaped depressions. The eyes are flat. There is a mixture of medium-sized and fine punctations present in the middle of the conscutum and the scutum. The postero-median groove and the postero-lateral grooves on the male conscutum are fairly long and narrow. The adanal plates are fairly long and in engorged males a caudal appendage is present. In males the legs increase in size from I to IV.

Large numbers of both adult and immature ticks can be found on cattle, goats, African buffalo, eland, male nyala, greater kudu and sable antelope (*Hyppotragus niger*). Some adults and large numbers of immatures can occur on smaller antelopes such as impalas and only immatures on scrub hares.

The adults are found particularly on the inner and outer surfaces of the ears but do not go into the ear canals. In heavy infestations they are also found on the eyelids, around the horns, on the upper surfaces of the neck, in the tailbrush and around the anus. On cattle the immature stages attach mainly on the neck and dewlap, the cheeks, eyelids, muzzle and ears.

This tick is an eastern, central and southern African species. Its distribution extends from southern Sudan, Uganda, south-western Kenya, eastern Democratic Republic of the Congo, Rwanda and Burundi, to northern, north-eastern, central and south-western Tanzania. In southern Africa it is confined to the moister regions, which include the highlands of Malawi, Zambia, Mozambique (Angonia and Chimoio Districts), and Zimbabwe. It is also present in eastern Botswana and in Swaziland. The extent of its distribution in the coastal regions of Mozambique is unknown. In South Africa it is present in Limpopo, North-West, Gauteng and Mpumalanga Provinces, along the east coast of KwaZulu-Natal and the coastal regions of the Eastern Cape Province to Grahamstown in the west of the latter province. There are also foci in the Ermelo and Carolina districts in Mpumalanga and Vredefort in the Free State.



Rhipicephalus appendiculatus survives best in woodland and woodland savanna regions with good vegetation cover. It tends to die out if overgrazing occurs and it does not survive on open plains. It was introduced into the south-eastern lowveld of Zimbabwe during the commencement of a wet cycle in 1973, and by 1982 it was estimated that more than 1 million ha of the lowveld were infested.

It started to disappear from this region towards the end of a dry cycle in 1983 and by 1985 it could no longer be found.

This is a three-host tick. It feeds rapidly in all stages of development requiring only 4 to 7 days to engorge. The engorged female lays 3 000 to 5 000 eggs after detaching from the host. These eggs hatch in 20 to 90 days. The entire life cycle can be completed in 3 months but in the southern regions of the tick's distribution it probably takes a year to complete.

Rhipicephalus appendiculatus has a strictly seasonal, single annual life cycle in southern Africa. Adults occur during the rainy period (December to March), larvae in the cooler late summer to winter period after the rains (March to July) and nymphs in the winter and early spring (July to October). The pattern of seasonal occurrence is regulated by the unfed adults, which enter diapause and do not engage in host seeking until the rains start. In regions close to the equator more than one life cycle can be completed annually and no clear pattern of seasonal abundance may be evident.

This tick is the main vector of *Theileria parva*, the causative organism of East Coast fever in cattle. Transmission takes place from stage to stage. Benign bovine theileriosis caused by *Theileria taurotragi*, bovine ehrlichiosis (*E. bovis*) and the virus of Nairobi sheep disease are also transmitted by this tick species. It is also responsible for the transmission of *Rickettsia conori* to humans. It is hypothesized that the saliva of *R. appendiculatus* contains a toxin and if large numbers of ticks infest an animal this toxin can interfere with the immune processes of the host resulting in a loss of condition and outbreaks of babesiosis, anaplasmosis and heartwater in animals that were previously immune to these diseases. Severe infestations can lead to crumpling of the ear and infestations of the ear with the larvae of *Chrysomya bezziana* may occur.

***Rhipicephalus zambeziensis* - Lowveld brown ear tick**

Rhipicephalus zambeziensis is closely related to *R. appendiculatus*, and the two are morphologically very similar. The major difference between the adults of the two species is that *R. zambeziensis* has more conspicuous punctations on the scutum. In the females the genital aperture of *R. appendiculatus* is shaped like a deep bowl with sloping sides, whereas that of *R. zambezienis* is shaped like a pot with nearly upright sides. The immature stages are more easily differentiated than the adults.

The tick has the same hosts as those used by *R. appendiculatus* during its adult and immature stages. Adults are found on the head and ears and on the muzzles, and immatures on the feet and legs.

Rhipicephalus zambeziensis replaces *R. appendiculatus* in the hot, dry river valley systems of south-eastern Africa (Luangwa, Kafue, Zambezi, Sabi and Limpopo Valleys) that separate the major highland areas. It is present in the dry environments of northern Namibia and in the lowland areas of the Mozambique interior. The distributions of *R. zambeziensis* and *R. appendiculatus* overlap where there are gradual transitions between wet and dry areas. This occurs in parts of the eastern and southern provinces of Zambia bordering the Zambezi Valley, eastern Botswana and in North-West, Limpopo and Mpumalanga Provinces, South Africa. Some interspecific hybridization may occur. *R. zambeziensis* is absent from semi-desert and desert areas.

This is a three-host tick. Adults are most numerous in the late summer, larvae during autumn and winter and nymphs during winter and spring.

Rhipicephalus zambeziensis is the vector of Corridor disease (*T. parva*), benign bovine theileriosis (*T. taurotragi*) and ehrlichiosis (*E. bovis*).

***Rhipicephalus evertsi evertsi* -** the red-legged tick.

Conscutum and scutum are densely punctate and very dark brown contrasting with the reddish-orange body wall. The eyes are convex and orbited and the legs are reddish-orange. The adanal plates are triangular in shape and large, and the circum-spiracular integument is covered with dense prominent setae.

Adults prefer horses, zebras, elands, cattle and sheep. Larvae and nymphs utilise the same hosts as the adults and also scrub hares and various antelopes. The adults are found on the hairless area around the anus as well as the inguinal region of equids and sheep. The immature stages attach deep in the ear canals. Several hundred of these may be recovered from the ear canals of zebras.

Of the 60 or more *Rhipicephalus* spp. that occur in Africa *R. evertsi evertsi* is the most widespread, with the majority of sub-Saharan countries reporting its presence. It is most common in the eastern part of the continent, from Eritrea and Sudan in the north to South Africa in the south. With the exception of the Northern Cape Province, where its distribution is somewhat limited, it occurs virtually throughout South Africa. It tolerates a wide range of climatic conditions and in southern Africa the main factor limiting its distribution in the west is increasing aridity, with the critical rainfall level being about 250 to 280 mm per annum.

This is a two-host tick. After dropping from the host the engorged females lay 5 000 to 7 000 eggs and then die. The eggs hatch and the larvae climb on to the vegetation and then on to the first hosts and attach deep in the ear canals where they moult to the nymphal stage after about 1 week. The nymphs engorge in about 1 week and then detach and drop off the host to moult to the adults. The adults attach to the second and final host on which they remain for about 6 to 12 days.

These ticks are active mainly during the summer but are present throughout the year in warm regions. In KwaZulu-Natal, South Africa, the immature stages are active from November to June and the adults from January to May. In Limpopo Province the immature stages are most abundant from April to September and the adults from September to March. More than one life cycle can be completed in a year.

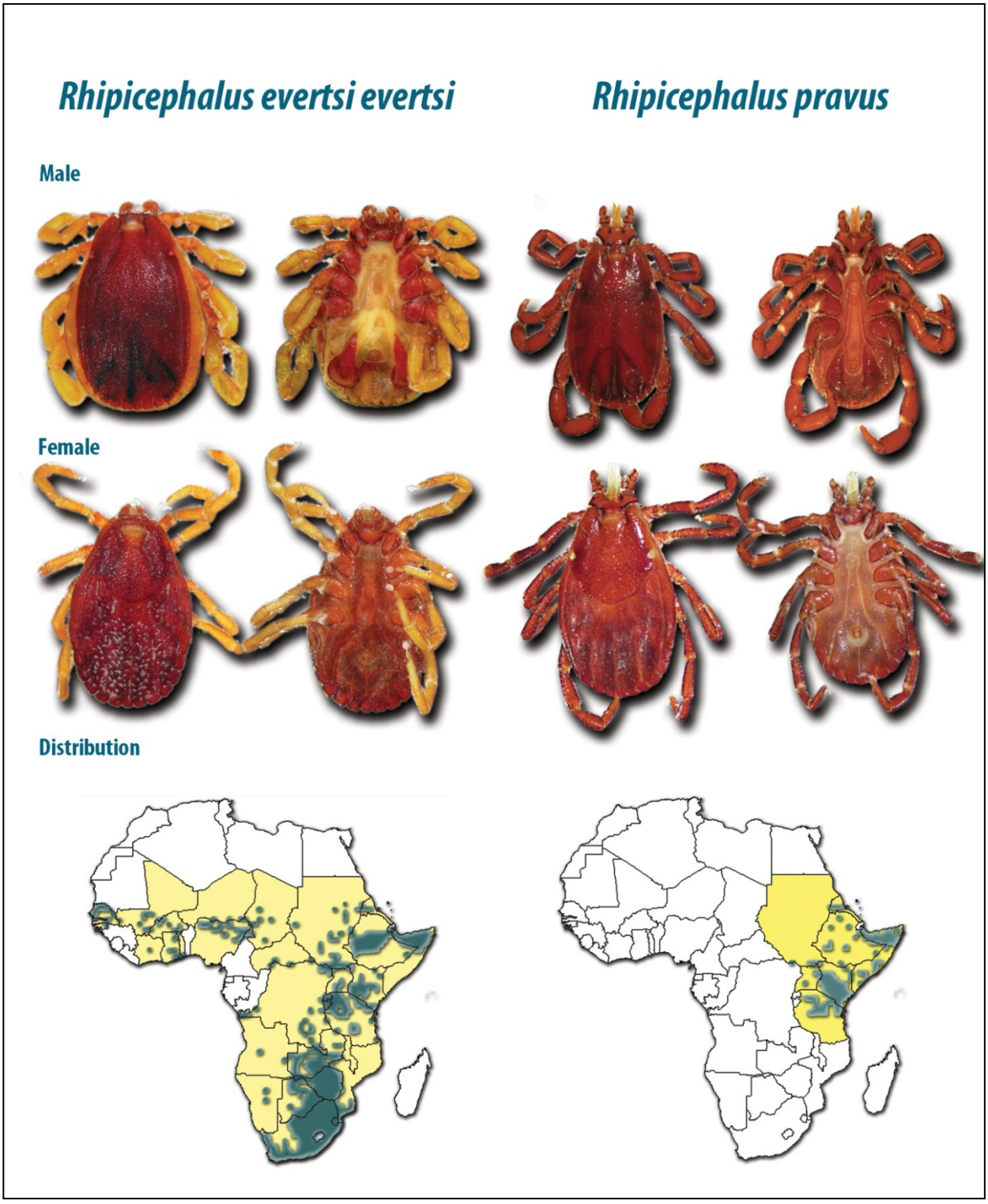
Rhipicephalus evertsi evertsi may play a role in the transmission of *T. parva* to cattle, but if it does it is not an important vector. It transmits *Theileria equi* and *Babesia caballi* to horses stage to stage only. *T. equi* and *B. caballi* are also transmitted intra-uterinely in horses. It has been demonstrated experimentally that it can transmit *B. bigemina* transovarially to cattle. Stage to stage transmission of *Theileria separata* to sheep also occurs. Transmission of *B. theileri*, the cause of spirochaetosis in cattle, horses, sheep and goats has also been reported. The saliva of engorging female ticks contains a toxin that causes paralysis, particularly in lambs, but it may also affect calves and adult sheep. This toxicosis is known as spring lamb paralysis because of its seasonal occurrence. In the

eastern highveld regions of the Mpumalanga and Free State Provinces, South Africa the synchronous moulting of free-living over-wintered nymphs gives rise to large numbers of adults on spring-born lambs. Several females are necessary to produce paralysis and they must have fed for about 5 days and weigh between 15 and 21 mg each. The clinical signs can be reversed by removal of the ticks. Large infestations of immature ticks may damage the ear canal of its host.

A very similar tick, *Rhipicephalus evertsi mimeticus,* known as the Namibian red-legged tick, looks like *R. evertsi evertsi*, but has red and ivory-coloured banded legs similar to those of certain *Hyalomma* spp. However, the structure of its capitulum and its shorter mouthparts readily distinguish it from the *Hyalomma* spp.

Rhipicephalus evertsi mimeticus would seem to have the same host preferences, predilection attachment sites and life cycle as *R. evertsi evertsi*. The adults are most numerous from November to May and the immature stages in February and March and from May to September. This tick occurs in western Botswana, central and northern Namibia and southern and western Angola.

R. evertsi mimeticus transmits*Theileria equi,* the cause of equine piroplasmosis, and *Theileria separata,* the cause of ovine theileriosis.



Rhipicephalus pravus

Its conscutum and scutum narrow and punctate, eyes convex and prominent and cervical fields narrow and nearly parallel with each other. Large triangular adanal plates present on males and engorged males have a narrow fairly long caudal process.

All stages of development infest hares, adults on cattle, sheep and goats and wild ruminants. Immature stages are found on elephant shrews. Adults attach on the head and ears, and also on the lower neck, abdomen, udder, perineum, groin and heels of their larger hosts.

Rhipicephalus pravus is present in eastern Ethiopia, Somalia, Kenya, and north-eastern Tanzania.

It is a three-host tick. A long dry season seems important in the life cycle of this tick. Adults are most numerous during the rainy season in Ethiopia. The immature stages are present on hares during the dry season in Kenya.

***Rhipicephalus simus* - Glossy brown tick**

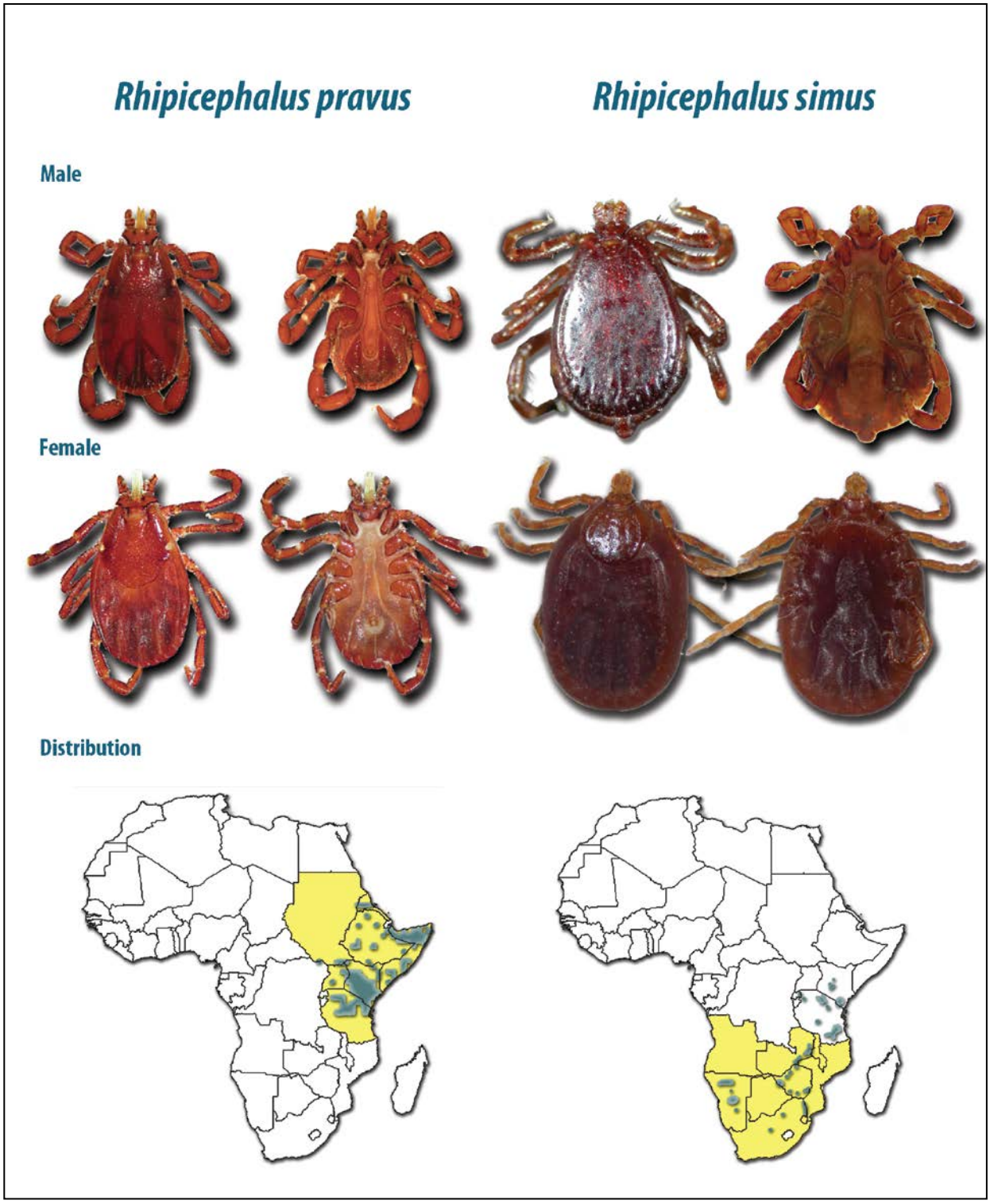
(In East Africa *R. simus* is replaced by *Rhipicephalus praetextatus*, which morphologically is nearly identical to *R. simus*)

The conscutum and scutum are shiny and dark or reddish-brown. There are four definite longitudinal rows of large punctations referred to as the “simus” pattern on the conscutum of the male, on which there are also numerous small to minute punctations. Posterior grooves are absent or very indistinct. The caudal process is bluntly rounded in engorged males, and the adanal plates are large and almost kidney-shaped. The posterior margin of the female scutum is usually smoothly rounded and the external margin of the broad cervical fields is clearly demarcated by irregualar rows of punctuations. The shape of the female genital aperture is a truncated U-shape, diverging anteriorly.

Adult ticks infest cattle, sheep goats, horses and dogs, large carnivores, zebras, warthogs, rhinoceroses. The larvae and nymphs infest rodents. The adults are found in the tail switch of cattle and zebras and on the head and shoulders of dogs and warthogs, as well as around the feet of sheep and cattle.

Rhipicephalus simus is widespread in the moister eastern regions of southern Africa, but is never very numerous. It is a three-host tick of which the adults are present in summer, larvae autumn to winter on their rodent hosts, and the nymphs winter to spring on rodents.

Rhipicephalus simus can transmit *Anaplasma marginale*, the cause of anaplasmosis or gallsickness in cattle, stage to stage and intrastadially.



The Argasidae

Subfamily: Argasinae

Argas walkerae and *Argas persicus* - The fowl tick or fowl tampan

The ticks are flat and their outline egg-shaped (ovate). The capitulum of the adults and nymphs is present on the antero-ventral surface of the body and not visible from above. The integument of the body is leathery and on both the dorsal and ventral surfaces there are numerous symmetrically arranged discs. The margin of the body is sharp, clearly defined and differentiated morphologically from the rest of the integument by a row of quadrangular cells on both the dorsal and ventral surfaces. Eyes are absent.

It infests domestic fowls, ducks, geese and turkeys. The female tampan lays a batch of 20 to 100 eggs after each blood meal. The eggs hatch in approximately 3 weeks. The six-legged larvae will attach and feed on a host for five to 10 days, usually under the wings. They drop off to moult in cracks and crevices in the poultry house. The nymphs will feed for 5 minutes to a few hours and then moult. There can be 4 nymph stages each requiring a blood meal before moulting to the next stage. Moulting to the adult can occur from the 2nd stage onwards. The final nymph stage moults to the adult which also feeds for a short while and like the nymphs usually only at night when the birds are roosting. The adults feed about once a month and the females produce a batch of eggs after each blood meal, they may produce some six or seven batches during their lifetime. The larvae can survive for 2 months or more, the nymphs for 1 year and the adults for up to 3 years without a blood meal. Very large populations of ticks can build up rapidly in untreated poultry houses.

Larvae and the first nymphal stage in early summer; nymphal stages 2 to 4 are present in midsummer; adults late summer and winter. The ticks over-winter as adults or eggs.

The two *Argas* spp. can transmit a number of diseases to poultry (e.g. avian spirochaetosis and piroplasmosis). The larval ticks excrete a toxin causing paralysis in chickens and in ducks.

Subfamily: Ornithodorinae

Otobius megnini - spinose ear tick

Adult ticks are dark-grey in colour and violin-shaped. Numerous small pits are present on the integument. The lateral margin of the body is thick without a definite suture line. The mouthparts are rudimentary and the capitulum is situated on the antero-ventral surface of the body. The adults do not feed. The tick is eyeless.

The larvae have six fairly long legs and the capitulum is situated anteriorly. As the larvae engorge they become pear-shaped. They are white or pink in colour. There are a number of nymph stages. The earlier ones are diamond-shaped and the later ones assume a violin-shape, similar to that of the adults. The capitulum is situated antero-ventrally under the body. The nymphs are covered with short, rigid spines from which the tick derives its common name.

Otobius megnini infests cattle, sheep, goats, horses, donkeys, mules and cats and occasionally humans.

This tick was introduced from South America in about 1898 after the rinderpest. It is found in the drier areas of the country such as the Karoo, Kalahari and Free State but is still spreading and has been found in the Pretoria district.

The female tick lays 300 to 1500 eggs in batches over a period of months. These eggs are laid in cracks and crevices in kraals, stables and catteries. The eggs hatch in about three weeks giving rise to a six-legged larva, which, after locating a host, attaches in the ear canal. The larval stage lasts 1 to 2 weeks and the larva then moults in the ear and gives rise to the first nymph stage, which is eight-legged and also attaches in the ear. The number of nymph stages is unknown but moulting and attachment of each stage occurs in the ear. The nymphs remain in the ear for 3 to 6 months and the final nymph stage engorges, detaches and drops out in the kraal. These nymphs moult and the resulting adults mate; 18 months may pass before mating takes place. The adults are non-parasitic and remain in cracks and crevices in the kraal. The life cycle may extend for a period of 2 years.

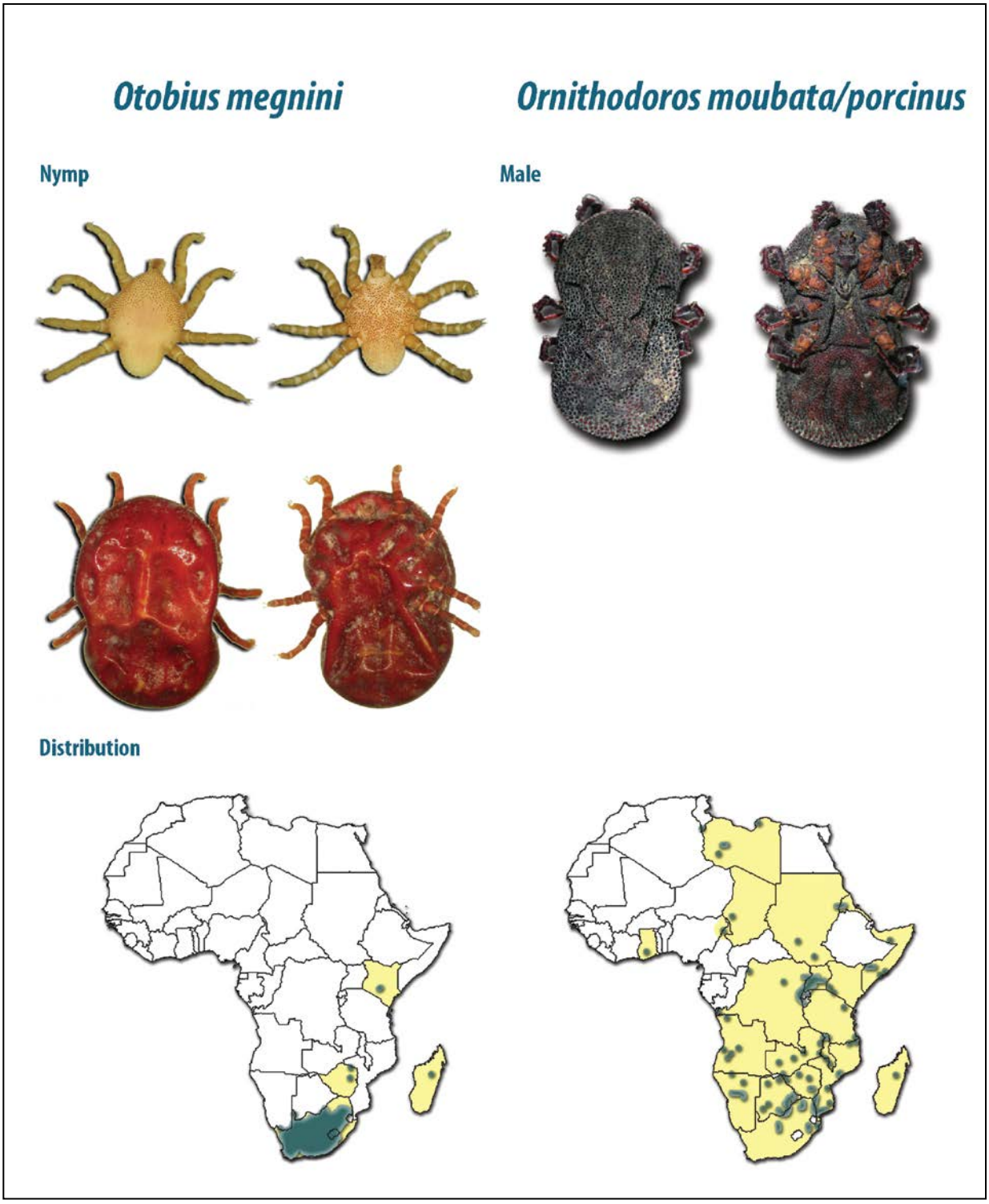
Otobius megnini is essentially a kraal infestation and the ticks are carried to new localities in the ears of infested animals. The ticks feeding in the ear canal and the spines on their bodies result in considerable irritation and infested animals do not feed well.

***Ornithodoros moubata/porcinus* - eyeless or hut tampan, warthog tampan**

The adults are grey-brown in colour with a leathery mammilated integument, the margins of the body are rounded and a supracoxal fold is present. They are similar in appearance to *Ornithodoros savignyi* but have no eyes.

Hosts are humans, poultry, domestic pigs and warthogs.

The distribution of ticks of the *O. moubata* complex that parasitize warthog follows that of their warthog hosts, which still occur in large areas of southern Africa. However, as the density of human habitation increases, these areas are decreasing in size and in number and wildlife reserves are becoming the foci of warthog distribution. Locally the ticks are spread via their nymphal stages, which are commonly found on warthog foraging outside their burrows. These tampans are widespread in the more arid western and northern regions of North West, Limpopo and Mpumalanga Provinces, South Africa. They are also present in Botswana, Namibia, Zimbabwe, Tanzania, Kenya, Uganda, Ethiopia, Somalia and Sudan, and in Central and few records are from West Africa.



After a blood meal and mating the female produces a batch of approximately 300 eggs, which are well hidden. Six-legged larvae hatch from these eggs, but do not feed and then moult to the first nymph stage after 1 to 2 days. The nymphs seek a host and take a blood meal and then moult to the next nymph stage. This process is repeated for each of the four or five nymph stages. Each of these nymph stages may survive for as long as 2 years without a blood meal. The adults seek a host and

take a blood meal that may take 20 to 30 minutes. While they are feeding they void large volumes of coxal fluid through the coxal openings between coxae I and II. Feeding in all stages usually takes place at night. After each blood meal the females lay a batch of eggs. The adults can survive for 4 to 5 years without food. All stages of the hut tampan hide in cracks and crevices in the hut walls during the day. Those of the warthog tampan hide in crevices in the warthog's burrow during the day. Large numbers of nymphs may be present on free-ranging warthogs out of their burrows during the day and infestation is probably spread in this way.

The warthog species, *O. porcinus* plays a role in the transmission of the virus causing African swine fever. Transovarial and trans-stadial transmission of the virus occur and it may also pass from male to female ticks during mating via the spermatophore. Adult warthogs serve as carriers of African swine fever virus but the viraemia in these animals is usually very low and transmission of the virus from warthogs to domestic pigs is effected by *O. porcinus*. Infection of warthogs usually occurs in the first 4 – 6 weeks of life via infected ticks in the burrows. *Ormithodoros moubata* transmits *Borrelia duttoni*, the causative organism of African relapsing fever in humans. This infection is transmitted to humans by means of the coxal fluid that is produced while the tampan is feeding and thus contaminates the feeding wound. Furthermore the *O. moubata* complex of ticks transmits *Borrelia anserina* the causative organism of fowl spirochaetosis and *Aegyptianella pullorum* to chickens.

Ticks of dogs

This section is devoted to the ticks that are commonly encountered on dogs.

Haemaphysalis elliptica – southern African yellow dog tick

For many years this tick was referred to as *Haemaphysalis leachi*, with which it had been lumped. We now know that it is a valid species in its own right and that all previous records of *H. leachi* in South Africa actually refer to *H. elliptica*.

The hypostome and palps are short. The second segment of the palps is extended laterally giving the capitulum a triangular appearance. The basis capituli has well-developed posterior processes (cornua). The scutum is yellow in colour and is covered with numerous small punctations and festoons are present. Eyes are absent. There are no adanal plates in the males.

Adults are found on dogs, cats and larger wild carnivores, particularly the large wild felids. Larvae and nymphs infest rodents. Adults attach to the head, neck and shoulders, but in severe infestations they are present over the entire body.

Haemaphysalis elliptica is present in the eastern part of the country from East London through KwaZulu-Natal to the Zimbabwean border, as well as the Provinces of Gauteng, North West Province, Mpumalanga, Limpopo and north-eastern Free State in South Africa. It is also present in numerous large foci in the Eastern and Western Cape Provinces. The ticks prefer high rainfall, but may occur wherever the rodent hosts for the immature stages are present. Because the hosts of the immature stages are rodents, this tick generally infests dogs in large domestic plots, small-holdings and farms.

Haemaphysalis elliptica is a three-host tick. The female feeds for 1 to 2 weeks, expands slowly initially but engorges rapidly on the last day. Female ticks lay about 5000 eggs within 14 days of detaching from the host. The eggs hatch in 1 to 4 months. The larvae and nymphs usually infest common murid rodents but may also be found on dogs.

Adults are present throughout the year with peak numbers from winter, spring to late summer. *Haemaphysalis elliptica* is the vector of *Babesia rossi,* the cause of canine babesiosis.

Rhipicephalus gertrudae

The conscutum and scutum are dark or reddish-brown and very heavily punctate. Posterior grooves are absent or very indistinct. The caudal process is bluntly rounded in engorged males, and the adanal plates are large and almost kidney-shaped. The posterior margin of the female scutum is usually smoothly rounded and the external margin of the broad cervical fields is clearly demarcated by irregular rows of punctations.

Adults occur on dogs, cats, sheep and antelopes (e.g. eland). Immature stages are found on rodents. The adults attach to the head and shoulders of dogs. Because the hosts of the immature stages are rodents, this tick generally infests dogs kept on large domestic plots, small-holdings and farms. It is a three-host tick and the adults are present from late winter to early summer.

It replaces *R. simus* in the Western and Northern Cape Provinces, western Free State.

Rhipicephalus sanguineus – the kennel tick

The conscutum and scutum are yellowish to reddish-brown and, apart from a variable number of punctations, often appears smooth. The eyes are distinct and slightly convex. The marginal grooves in the male are sharply defined. The posterior grooves on the conscutum of the male may be well-defined or inconspicuous. The bodywall of the male has a salmon-pink colour and when engorged extends beyond the conscutum. The basis capituli of the female has broad lateral angles, and the cervical fields are slightly depressed and scalpel-shaped.

Dogs are the preferred, if not the only hosts, for all stages of development. Larvae are found particularly on the stomach and sides, nymphs on the ears and shoulders, and adults on the ears, neck and shoulders of dogs. Adults and nymphs may also be present between the toes.

Its distribution is world-wide between 50°N and 35°S. In South Africa it is found particularly in the warm and moist areas, it also occurs in dry areas but not in the desert-like conditions in the west of the country. The immediate distribution of its free-living stages is confined to kennels, domestic dwellings and other human-made structures. This tick is well-adapted to living in kennels and houses. Except when it is present on dogs it does not occur outside of these structures.

Rhipicephalus sanguineus is a three-host tick. The engorged female detaches and lays 3000 to 5000 eggs within 1 to 8 weeks. These eggs hatch in 3 to 8 weeks. The larvae engorge in 3 to 8 days and moult in 3 to 4 weeks. The nymphs engorge in 4 to 10 days and moult in 3 to 26 weeks. The adults may engorge in 7 days but the female can stay on the dog for 3 weeks and the male for considerably longer. The life cycle can be completed in 10 weeks under ideal conditions. In warm temperate and summer rainfall areas all stages are found on dogs from October to May. Infestation over-winters as the pre-moulted nymph stage and possibly as engorged females. More than one life cycle per year is possible. The females may lay their eggs under the dogs' bedding or in cracks and crevices or they may climb up the walls and lay eggs in cracks and crevices in the walls. The larvae and nymphs usually moult in the same sites as the females lay their eggs. Dogs that are tied up or caged may become heavily infested. In artificially heated houses the life cycle may continue during winter.

Rhipicephalus sanguineus is the vector of *Ehrlichia canis,* the cause of canine ehrlichiosis or tropical pancytopaenia in dogs.

Rhipicephalus simus - Glossy brown tick

The conscutum and scutum are shiny and dark or reddish-brown. There are four definite longitudinal rows of large punctations referred to as the “simus” pattern on the conscutum of the male, on which there are also numerous small to minute punctations. Posterior grooves are absent or very indistinct. The caudal process is bluntly rounded in engorged males, and the adanal plates are large and almost kidney-shaped. The posterior margin of the female scutum is usually smoothly rounded and the external margin of the broad cervical fields is clearly demarcated by irregualar rows of punctuations. The shape of the female genital aperture is a truncated U-shape, diverging anteriorly.

Adult ticks infest dogs, cats, cattle, sheep, goats, horses, large carnivores (e.g. lions), zebras, warthogs, and rhinoceroses. Because the hosts of the immature stages are rodents, this tick generally infests dogs kept on large domestic plots, small-holdings and farms. The adults are found on the head and shoulders of dogs.

Rhipicephalus simus is widespread in the moister eastern regions of southern Africa, but is never very numerous. It is a three-host tick of which the adults are present in summer, larvae in autumn to winter on their rodent hosts, and the nymphs from winter to spring on rodents.

Ticks of reptiles

Amblyomma marmoreum – South African tortoise tick

It is a very large tick with long, robust mouthparts. The conscutum and scutum are dull yellow to beige with dark-brown markings and numerous prominent, deep punctations.

All stages of development, especially the adults, feed on tortoises, and more particularly leopard tortoises, *Geochelone pardalis*. Adults very rarely parasitize domestic livestock, but the immature stages, especially larvae, are frequently encountered on these animals, as well as on wild carnivores

and antelopes and also on scrub hares and on helmeted guineafowls and other ground-frequenting birds. On tortoises the ticks attach to the soft parts around the base of the legs and tail.

Amblyomma marmoreum is widespread in South Africa and Zimbabwe and is probably more prevalent in Mozambique, Botswana and Namibia than current records seem to indicate.

It is a three-host tick. On tortoises all stages remain attached for 2 to 7 weeks, or longer. The adults are most abundant during summer, the larvae from autumn to spring and nymphs from spring to summer. The life cycle may take longer than 1 year to complete.

Amblyomma sylvaticum

It is a small species of *Amblyomma*. The conscutum of the males is dark brown to nearly black with ivory colouring on its lateral edges. The female scutum is also dark-brown with ivory-coloured ornamentation particularly in the lateral fields and the eyes are surrounded by dark patches. Angulate tortoises (*Chersina angulata*) are the preferred hosts of *Amblyomma sylvaticum*, although other tortoise species may also be infested.

Amblyomma (previously Aponomma)

Amblyomma exornatum

It is a very small ornate tick. Mouthparts are long in relation to the small size of its body. It is an eyeless tick. The conscutum of males is oval to nearly circular in some specimens. Ornamentation on the male conscutum is in the form of nine iridescent green coppery to yellow markings on a dark-brown background. The female scutum is dark-brown with three patches of ornamentation, two laterally and one on the posterior field of the scutum. *Amblyomma exornatum* is a tick of varanid lizards and male ticks frequently cluster in the nostrils of these reptiles.

Amblyomma latum

It is a very small tick with long mouthparts. The tick is eyeless. The conscutum of the male is virtually circular in shape and uniformly brown. The female scutum is brown. *Amblyomma latum* is a tick that attaches under the scales of snakes.

Amblyomma transversale

It is a very small tick with long mouthparts. It is an eyeless tick. The conscutum of males are laterally oval and light-brown, seeming to cover only the first 4/5ths of the dorsal surface. *A. transversale* is a tick of pythons.

Ornithodoros compactus

It is a small soft tick or tampan infesting particularly Namaqualand speckled padloper tortoises, *Homopus signatus signatus,* in South Africa. Unlike the nymphs and adults of other *Ornithodoros spp*. many *O. compactus* may be present on their tortoise hosts.

Some beautiful or unusual ixodid ticks

Rhipicephalus pulchellus – the zebra tick

This is a medium-sized large *Rhipicephalus* spp. with a striking dark-brown and and ivory-coloured pattern on the conscutum, while the whole scutum of the female is ivory-coloured except for brown patches around the eyes. The other morphological features of this tick are similar to those of of *R. appendiculatus*.

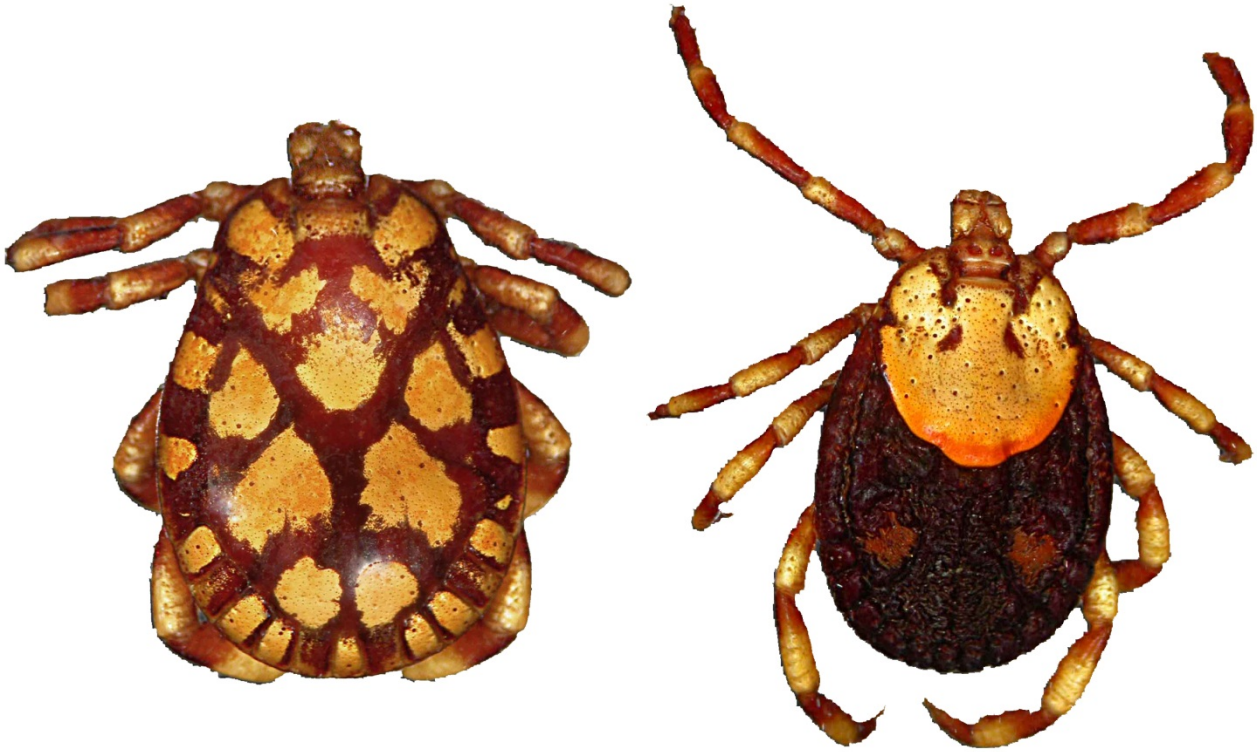
All stages of development infest cattle, sheep, goats, camels, zebras, African buffaloes and elands. The immature stages may also occur on hares. On cattle and sheep and other hosts the adults attach to the ears and the underside of the body.

It is present in the Horn of Africa and east of the Rift Valley from Eritrea in the north to north-eastern Tanzania in the south. It is a three-host tick. The adults appear to be most abundant during the rainy season.

In Somalia *Rhipicephalus pulchellus* was found to be a vector of Nairobi sheep disease virus.

Dermacentor rhinocerinus - the rhinoceros tick

It is a large tick a rectangular basis capituli with medium-length, robust palps. The conscutum of male is chocolate-brown with orange patches of ornamentation, much like a gaint ladybird. Festoons are present but there are no adanal plates on the male. The coxae are large and the legs are banded.The female scutum is entirely ivory-coloured with a tinge of orange, except for a patch of brown around the eyes. Two prominent patches of white setae are present on the alloscutum of female ticks.



Dermacentor rhinocerinus infests black and white rhinoceroses (*Diceros bicornis* and *Ceratotherium simus*). The hosts of the immature stages are rodents. It is present within the distribution ranges of rhinoceroses in Africa. It is a three-host tick. The adults quest for their rhinoceros hosts from the stems of thick grass at height of 1 to 2 metres.

Margaropus winthemi - winter horse tick

The male is small and eyes are present, but difficult to see. Festoons are absent. There are tufts of hair along the posterior margin of the body of the male, the caudal process is large and the adanal plates are sharply pointed posteriorly and fused anterior to the anus. The segments of especially the fourth pair of legs of the male are markedly expanded. The mouthparts of both males and females are short and their light coloured legs have brown bands.

This tick infests particularly horses, zebras, eland and also cattle. It prefers to attach to the sides of the host animal.

Margaropus winthemi is absent in the coastal belt of South Africa and occurs in foci in Lesotho, southern, central, eastern and western parts of the Free State, the higher regions of the Western and Eastern Cape and KwaZulu-Natal Provinces with isolated foci in the North West Province of South Africa.

This is a one-host tick. Very large numbers of ticks are present on its preferred hosts in mid and late winter, with mountain zebras near Cradock in the Eastern Cape Province harbouring 40 000 ticks or more in mid-winter. None to hardly any ticks are present in summer.

This tick does not transmit any diseases, but large infestations during winter can lead to a loss of condition and to the death of zebra foals. During winter starlings will make opportunistic use of the abundant food supply supplied by this tick on infested hosts.

Rhipicentor nuttalli

This is a brown tick superficially resembling *Rhipicephalus* spp. Eyes and festoons are present. There are no adanal plates on the males. Coxae I with two long, pointed, posteriorly directed spurs. All coxae are large; particularly coxae IV on the males, coxae IV each have two long, sharp, posteriorly directed spurs arising from their posterior margins.

Adult ticks infest hedgehogs and carnivores, the immature stages infest elephant shrews. The tick is probably more widely distributed in South Africa than present distribution records show. It has been recorded in isolated localities in the Western, Northern and Eastern Cape Provinces, Free State, Gauteng, North West and Limpopo Provinces and in Zimbabwe and Namibia.

It is a three-host tick of which the adults can cause paralysis in dogs.

TICK DISTRIBUTION

A considerable amount of data is available on the geographical distribution of some tick species of veterinary or human importance. The distribution is highly dependent on a number of factors including ecological and other requirements, host preference and availability and land-use and cover.

In most cases, the requirements are met in a larger area than the current geographical range of the particular tick species. As a result of anthropogenic activities and globalization, ticks can thus be found in a similar habitat far from their original distribution. It is important to be able to verify these observations as the importation of ticks into regions in which they did not originally occur could result in disease outbreaks and displacement of local tick species. Some of the recent examples are the introduction of cattle from Tanzania onto Grand Comoros resulting in East Coast fever outbreaks in 2003-2004, transmitted by *Rhipicephalus appendiculatus* to local cattle, and the introduction of *Rhipicephalus microplus* into West Africa as a result of the importation of Girolando cattle from Brazil between 2000 and 2009.

The distribution of the African ticks of veterinary importance can be found at http://www.itg.be/photodatabase or the off-line site.

REFERENCES

1. Walker and Bouattour, 2003. Ticks of domestic animals in Africa: a guide to identification of species. Bioscience Reports
2. Tick website of African ticks: http://www.itg.be/photodatabase/African_ticks_files/index.html