Ticks of Domestic Animals in Africa: a Guide to Identification of Species

A.R. Walker
A. Bouattour
J.-L. Camicas
A. Estrada-Peña
I.G. Horak
A.A. Latif
R.G. Pegram
P.M. Preston

First published 2003
Revised 2014

ISBN 0-9545173-0-X

Printed by Atalanta, Houten, The Netherlands.

Published by:

Bioscience Reports,
Edinburgh Scotland,U.K.
www.biosciencereports.pwp.blueyonder.co.uk

Production, printing and distribution of this guide-book has been financed by the INCO-DEV programme of the European Union through Concerted Action Project no. ICA4-CT-2000-30006, entitled, *International Consortium on Ticks and Tick Borne Diseases* (ICTTD-2).

Table of Contents

Preface.

The need for this guide became apparent to the authors during their work as researchers and teachers on the biology and control of ticks and tick borne diseases. All of us have struggled with the usual identification keys for ticks to gain our knowledge as specialists. We have witnessed the difficulties that non-specialists encounter when they attempt to identify ticks. The need to identify ticks of domestic animals using morphological, field and clinical characteristics increases through the demand for improved control measures, veterinary interventions, development projects and field research on tick ecology. Despite the recent application of molecular techniques to the identification of ticks there is unlikely to be, in the near future, a comprehensive and simple system for these techniques to be used for general diagnostic purposes. Furthermore to develop such a system the need will remain for collections of ticks reliably identified by morphological characters.

Thus we aim to provide a simple, easily available means of identifying ticks using the equipment likely to found in diagnostic laboratories and using the existing skills of non-specialist personnel.

The ticks that are important to the health of domestic animals in Africa comprise approximately 40 species, plus other very similar species with which they may be confused but which are of unknown importance. Some of these ticks are also a threat to human health, but in Africa it is domestic animals that are severely affected by ticks and the pathogens they transmit. The diseases associated with ticks cause much suffering to animals and economic loss to their owners. They continue to be a major impediment to the improvement of livestock industry in Africa, and this continent is particularly affected because of the large number of tick species and variety of diseases caused.

We hope that this guide will encourage greater diagnostic skills and thereby contribute to the improvement of animal health in Africa.

Comments and suggestions for revisions are welcome. Please contact the publisher or individual authors.

At publication time in 2003 authors were -

Alan Walker: Senior Lecturer, Royal (Dick) School of Veterinary Studies, University of Edinburgh, Roslin EH25 9RG, United Kingdom.

Ali Bouattour: Head of the Unit of Medical Entomology, Institut Pasteur of Tunis, Place Pasteur, BP 74, 1002 Tunis, Tunisia.

Jean-Louis Camicas: Head of the Laboratory of Medical Acarology, Centre I.R.D., Montpellier, France.

Agustin Estrada-Peña: Professor of Parasitology at the Veterinary Faculty, University of Zaragoza, Spain.

Ivan Horak: Emeritus Professor at the Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, Onderstepoort 0110, Republic of South Africa.

Abdalla Latif: Head of Parasitology at the Onderstepoort Veterinary Institute, Private Bag X05, Onderstepoort 0110, Republic of South Africa.

Rupert Pegram: Director of the Caribbean *Amblyomma* Programme, Food and Agriculture Organisation, P.O.Box 1282, St Johns, Antigua.

Patricia Preston: Senior Lecturer in Parasitology at the Institute of Cell, Animal and Population Biology, University of Edinburgh, Edinburgh, United Kingdom.

All artwork has been prepared by the authors: line art - A.R.W., maps - A.E-P., photographs - A.A.L., A.B. & A.R.W.

Postscript to revision of 2014 .
Tick taxonomy continues to be revolutionized by molecular methods. Names of species now follow the world list of valid names for tick of Guglielmone *et al.* 2010, Zootaxa, 2528, 1-28. [See: Further reading, pg 28.]

Acknowledgements.

This guide is directly dependent on studies on ticks going back at least as far as those by G.H.F. Nuttall and C. Warburton. These studies are themselves dependent on the original taxonomic descriptions and revisions of ticks, dating from that of *Ixodes ricinus* by Linnaeus in 1758. There are many of these pioneers who could be named, foremost amongst them for African ticks are: G. Anastos, Murray Colbo, A. Elbl, Harry Hoogstraal, James Keirans, Jean-Marie Klein, John Matthysse, Pierre C. Morel, L.G. Neumann, Gerrit Uilenberg, Jane Walker and Guy Yeoman.

Six identification guides have been special inspirations and sources for this guide. They are detailed at the end of Chapter 2: H. Hoogstraal (1956), J.B. Walker (1960), C.J. Howell, J.B. Walker & E.M. Nevill (1978), J.G. Matthysse & M.H. Colbo (1987), J. Okello-Onen, S.M. Hassan & S. Essuman (1999) and J.B. Walker, K.E. Keirans & I.G. Horak (2000).

The data on tick distributions used to make the maps are from many sources. Most useful was the huge compilation by Graeme S. Cumming (see Chapter 2 for reference). Although we recognise the limitations of some the identifications of species, the value of such use of the original literature has been well demonstrated.

Most of the ticks examined for this guide were from the Natural History Collections of the University of Edinburgh. We thank all those who have contributed to these, specially John Allan Campbell for his curatorial work. Additional specimens were kindly loaned through Paul Hillyard of the Natural History Museum, London, and Jane Walker of the Onderstepoort Veterinary Institute, South Africa. James Matthews of the University of Edinburgh programmed an electronic key ("Multikey 2.1") for identification of these ticks. The need for unequivocally defined characters and their states for Multikey was a crucial discipline in the development of this guide. Gerrit Uilenberg provided much needed objective editorial and factual editing. Stephen Mitchell of the Royal (Dick) School of Veterinary Studies is thanked for electron microscopy services.

The authors are grateful for the various means of support by their host institutions. These are listed in the Preface. Much of the field and laboratory work during which these ticks and ideas about them were accummulated by the authors was funded by various agencies. Notable amongst them were: Danish International Development Agency; Department for International Development (of the U.K.); European Union; Food and Agriculture Organisation; German Agency for Technical Cooperation; United Nations Development Programme; The World Bank.

The collaborative writing of this guide has been fundamental to its nature. This has been made possible by the International Consortium on Ticks and Tick Borne Diseases, funded by the European Union, led by Frans Jongejan, administered by Jona Bovy and assisted by Hans Nieuwenhuijs.

Cover Illustration.

This disgusting little blood sucker has a big role in the history of preventive medicine. It is a cattle tick, *Rhipicephalus* (*Boophilus*) *annulatus*. In 1893 Theobald Smith and Frederick Kilborne published their study of Texas cattle fever. They described how it is caused by *Babesia* protozoa and that these are transmitted between cattle by the feeding of ticks. Thus was first demonstrated the transmission of protozoa by any kind of blood feeding arthropod.

Smith and Kilborne's revolutionary discovery was soon exploited to control cattle fever by eradication of this tick from the United States of America. Eventually this was successful and became the model for other control and eradication schemes throughout the worldwide range of cattle ticks.

Boophilus annulatus is the name by which this tick was known until its recent re-classification within the genus *Rhipicephalus*. This controversial change was the result of studies on the nucleic acids of ticks. Such studies are currently revolutionizing our understanding of tick evolution and taxonomy. Thus the identification and taxonomy of ticks remain dynamic areas of both applied and pure science.

Dedicated to

Caroline Florence Walker

a botanist who learnt the practical way to identify *Ixodes ricinus* in Scottish woodlands.

Chapter 1. Introduction and Glossary.

This pictorial guide describes a simple three-step process for identifying the ticks of domestic animals in Africa. The first step leads to the name of the genus to which a tick belongs, e.g. *Amblyomma*, and its sex. The second step selects the species of that particular genus, that occur in the area where the unidentified tick was collected. The third step identifies the tick at the species level, e.g. *Amblyomma variegatum*.

Steps 1 and 3 involve simple visual matching of specimens to the drawings, using a dissecting microscope or powerful hand lens. Step 2 involves consulting a table showing the occurrence of the tick species in seven different areas in Africa. Step 2 is very useful as it reduces the number of candidate species that need to be considered. The terms 'genus' and 'species' are defined fully in the glossary. Very briefly the species name indicates a population of individuals that can interbreed to produce fertile offspring; a genus (plural: genera) is the smallest taxonomic group to which a species belongs.

The guide is divided into two parts. The first part (Chapters 1 and 2) contains the information needed to identify ticks. Chapter 1 explains how to use the guide and includes a glossary of the morphological and technical terms used to define the different genera and species of ticks. The morphological terms are the characters of body shape, size and texture used for identification; each character has two or more contrasting states. The same words for the terms are used to label the drawings that illustrate each genus and species. All characters and states in the guide are illustrated in the glossary, except for colours. The technical terms relate to taxonomy, climate, etc. The glossary is placed first because it is essential for the identification process and it is easiest to find here.

Chapter 2 outlines general information on tick biology that is useful in the process of identification of ticks, including tick life cycles and veterinary importance. It also explains how to collect and preserve ticks and the procedures used to examine ticks in the laboratory. This chapter should be read completely by anyone without detailed knowledge of ticks. The second part (Chapters 3 and 4) takes the user through the three steps needed to identify tick species. Step 1 is described in Chapter 3 and uses drawings and character states to distinguish between genera and between female and male ticks. Step 2 uses the map and table at the beginning of Chapter 4, that together show the distribution of tick species in different areas of Africa. This indicates to the user which species their own specimens are likely to be. Step 3 uses the information given in Chapter 4, which covers all genera and species of ticks important to domestic animals to identify ticks to the species level. Each species is illustrated by composite drawings made of several tick specimens to show all relevant characters and their states. Labels indicate the unique combination of character states that distinguish a tick species.

A species profile for each species provides information about differential diagnosis (how to differentiate between very similar, closely related ticks), hosts, life cycles, seasonal occurrence, habitats and distribution, including a map. These maps are only intended as aids to identification and should not be used or quoted as accurate descriptions of tick distribution.

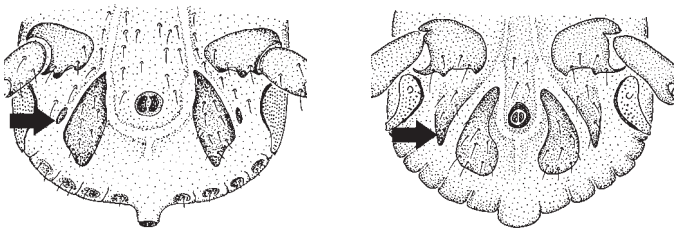
A holistic system is used where all information is made available simultaneously. This is not the usual type of of identification key (= dichotomous key). Groups of defined characters are used and each character exists in two or more states. For example: 'Lateral grooves length' is a character that has two states - 'short ' or 'long'. Another character is 'Lateral grooves texture'; this has three states - 'smooth' or 'wrinkled' or 'distinctly punctate'. Each species has a unique combination of character states. For each species, this combination of character states is listed below the set of drawings for the species. For very similar species there will be only one or two differences in the combinations of character states. In summary, it is a combination of character states that needs to be checked against the actual specimen when identifying a tick to genus or species. All character states are defined in the glossary. Although the guide does not use a dichotomous key, the character states are the same as the features used in such keys by other authors. The advantage of the format of this new guide is that specimens can be compared directly with drawings showing the overall combination of all characters together, as seen on the tick.

For identification it is important to use all the information provided. Include the complete set of character states for each species; and the clinical context such as distribution and hosts. It is important to examine whenever possible both female and male specimens, and a large sample of these if possible. This guide is selective; it covers only 48 species recognised as important to the health of domestic animals in Africa and some similar species with which the important ones may be confused. Ticks of livestock, horses, poultry, dogs and cats are included but not all ticks of zoo animals. Ticks of importance to human health in Africa are, by natural coincidence, within this selection. Adult ticks only are included (with one exception) because immature ticks are difficult to identify. Some character states can be difficult to distinguish and may be very variable. Base your identifications on as many character states as possible. If you remain unsure of an identification consider that your specimen could be a species that feeds mainly on wild animals and is not included in this guide. Consult a dichotomous key that covers all the species, or find an expert to help.

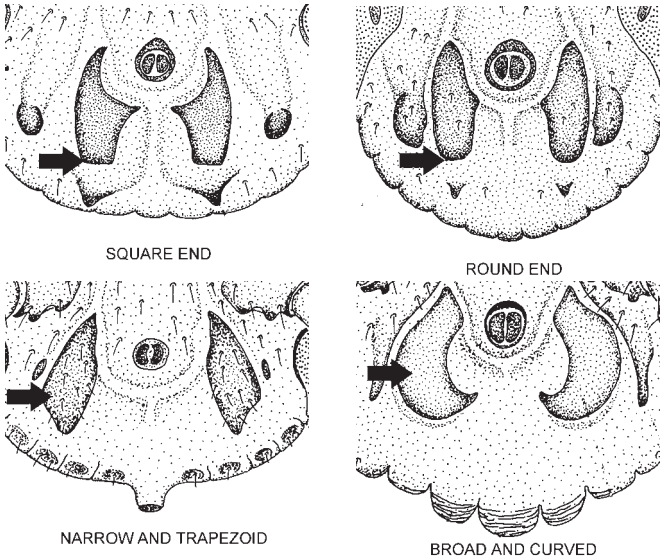
Glossary.

Acari: this is the taxonomic group (an order) that contains the ticks and mites. It is also known as the Acarina. Ticks are very similar to mites, but are larger and all ticks are blood feeding parasites. There are many sub-orders of mites and one sub-order of ticks, the Ixodida.

Accessory adanal plates: these are the pair of ventral plates on the males of some genera of ticks. They occur laterally to the adanal plates which are next to the anus. In *Rhipicephalus* they may be **absent**, or **small**, or **large**. The **absent** state occurs in *Rh. pulchellus* and is not illustrated.



Adanal plates shape: these are a pair of ventral plates on males, they occur close to either side of the anus. The posterior margin may form a **square end**, or a **round end**. Each entire plate may have the shape of a **narrow trapezoid** (a shape of four straight sides none of which are parallel), or it may be **broad and curved**.

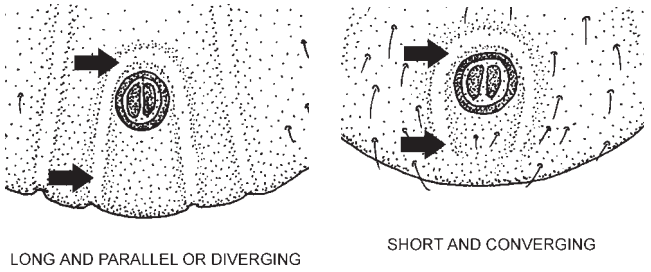


Afrotropical zoogeographical region: an area characterised by groups of related animals. It includes all of Africa south of the central Sahara, also an area of Yemen and the island of Madagascar. Formerly it was called the Ethiopian zoogeographical region when the country of that name was known as Abyssinia. Africa north of the Sahara is in the Palaearctic region.

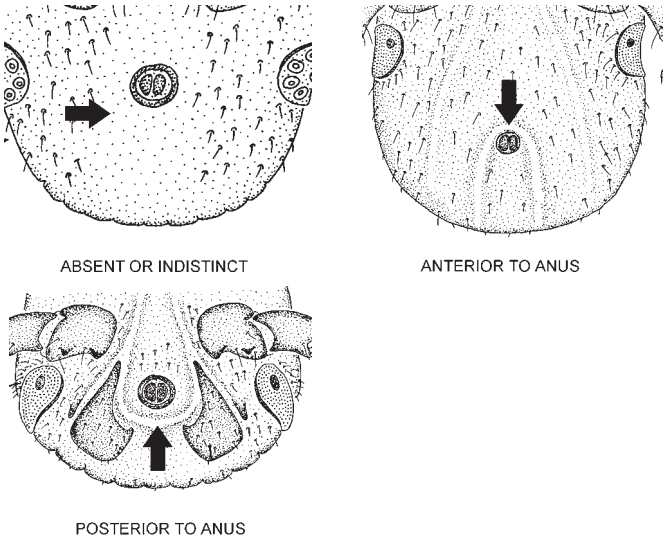
Alloscutum: the dorsal body wall of ixodid ticks in the area posterior to the scutum or conscutum. It is not sclerotized like the scutum or conscutum and expands during feeding. In feeding larvae, nymphs and females this expansion is large and the body becomes rounded like a bean. In males the expansion is much less and usually in a lateral direction. (See Scutum or conscutum.)

Anal plate: (see ventral plates) in male ixodid ticks of the genera *Hyalomma* and *Rhipicephalus* including the sub-genus *Boophilus*, there are two or three pairs of sclerotized plates around the anus. They protrude conspicuously when the male expands slightly during feeding. Similar plates are present as flat sclerotized areas in male *Ixodes*. Male *Amblyomma* sometimes have small sclerotized areas in this position.

Anal groove posterior alignment: in *Ixodes* females the anal groove passes from the anterior of the anus towards the posterior of the body in an alignment (or shape) that is either **long and parallel or diverging**, alternatively the alignment is **short and converging**. In some species not in this guide the anal groove forms a circle around the anus.



Anal groove position: the anal groove is a depression in the integument which forms a loop around part of the anus. It is either **absent or indistinct**, or in *Ixodes* it forms a loop going **anterior to the anus**, or in other genera it forms a loop going **posterior to the anus**.



Anaplasmosis: a disease of domestic animals caused by bacteria of the genus *Anaplasma* which infect red blood cells; the bacteria are transmitted by ticks but also mechanically by blood feeding insects and contaminated instruments. In cattle it is also known as gallsickness.

Anorexia: a disease state characterised by loss of appetite; heavy infestations with ticks may cause this and it leads to loss of body mass (= cachexia) of the host animal.

Anterior: at the front end of an animal, defined by where the head is, or in the case of ticks where the mouthparts are.

Anus: the opening to the exterior of the end of the gut and excretory organs. It occurs towards the posterior of the ventral surface.

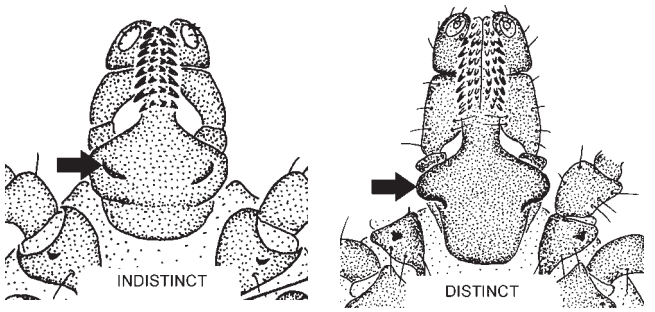
Aperture: a hole or an opening. In ticks this term is applied to the opening of the reproductive duct of both sexes, as the genital aperture, which is situated ventrally between the bases of the legs.

Argasidae: a family of ticks characterised by lack of scutum and pulvilli; often known as the argasids or as soft ticks because of their lack of a hard scutum.

Arthropoda: this is the taxonomic group (a phylum) that contains ticks, mites, spiders, insects, crustaceans and similar animals. They all have a hard exoskeleton which is divided into segments with moveable joints.

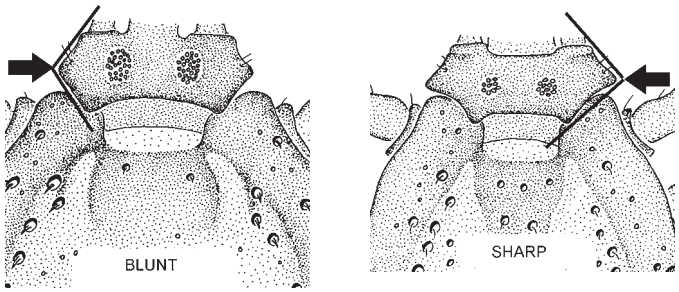
Article: a segment of the palps; there are four articles in the paired palps of ticks, but often only the central articles 2 and 3 are easily visible.

Auriculae: in *Ixodes* the ventral surface of the basis capituli usually has lateral bulges called auriculae; these are either **indistinct**, or **distinct**.

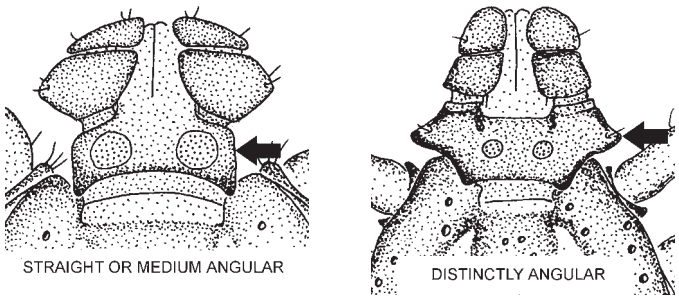


Babesiosis: a disease of cattle, sheep and dogs caused by protozoa of the genus *Babesia* which are transmitted by several genera and species of ticks and which infect red blood cells. In cattle it is also known as redwater fever.

Basis capituli lateral angles: in *Rhipicephalus* the basis capituli has a six sided shape with an angled profile of the lateral margins. In females, if this angle is more than 90º it is **blunt**, if it is 90º or less it is **sharp**. All males have blunt angles. This character is difficult to judge because the angle often appears to be formed by concave profiles; it is the angle formed by the whole margins that should be used, as shown by the lines on the illustration. (This character was measured from electron micrographs in Walker *et al*. 2000).

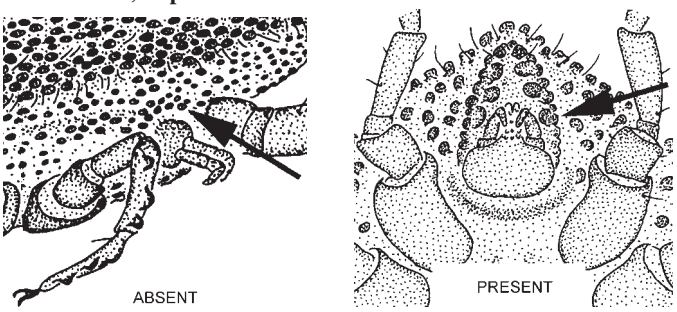


Basis capituli lateral margin: the basis capituli is the single structure on which the mouthparts are mounted. Its lateral margins have a profile that is either **straight or medium angular**, or is **distinctly angular**. This character varies with the sexes in some ticks.

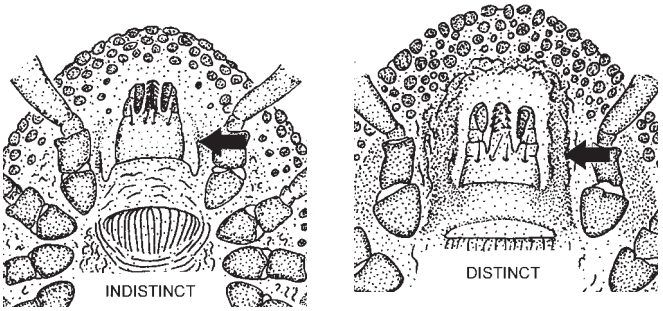


Cachexia: a disease state characterised by loss of body mass, as in wasting diseases. It is associated with infection with pathogens transmitted by ticks and by loss of appetite (= anorexia) caused directly by *Rhipicephalus (Boophilus)* ticks.

Camerostomal cavity: in *Ornithodoros* the basis capituli and palps may be surrounded to the anterior by a fold of the integument which is shaped like a hood. This fold forms a camerostomal cavity which is either **absent**, or **present**.

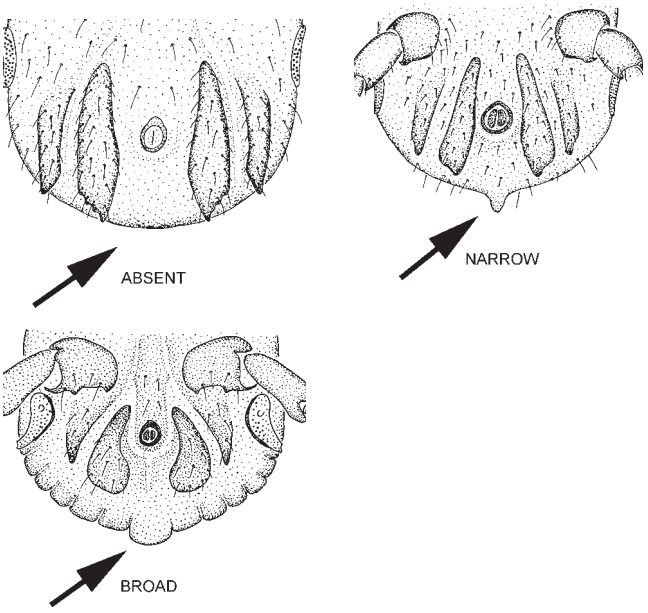


Camerostomal folds: in *Argas* nymphs and adults the mouthparts are located ventrally, just anterior to the coxae of the first legs. A fold of integument occurs at the lateral margins of the basis capituli and when these folds are large a structure like a hood is formed around the mouthparts. This is called the camerostome and the camerostomal folds are either indistinct or distinct.



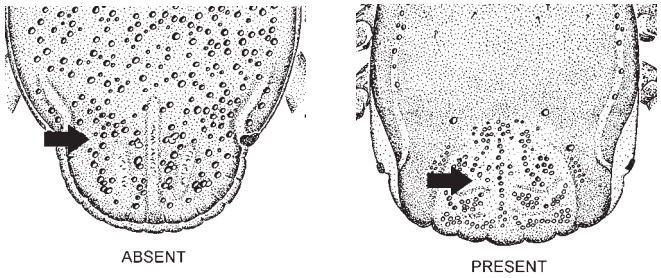
Capitulum: all ticks have their main body divided into two parts. The smaller part at the anterior of the tick is the capitulum (sometime called the gnathosoma) which consists of the basis capituli and the mouthparts. The larger posterior part of the body containing the internal organs is called the opisthosoma.

Caudal appendage: in males of some *Rhipicephalus* a bulge develops at the middle posterior point of the body (or at the central festoon). This is the caudal appendage (or process), it is either **absent**, or **narrow**, or **broad**. It is necessary to examine males which have fed for about one week during which time the body expands slightly away from the conscutum.

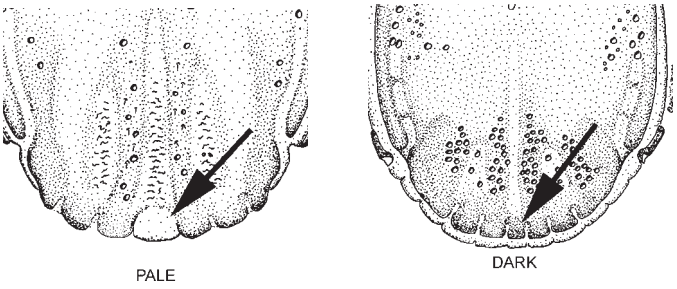


4 Caudal to Chelicerae

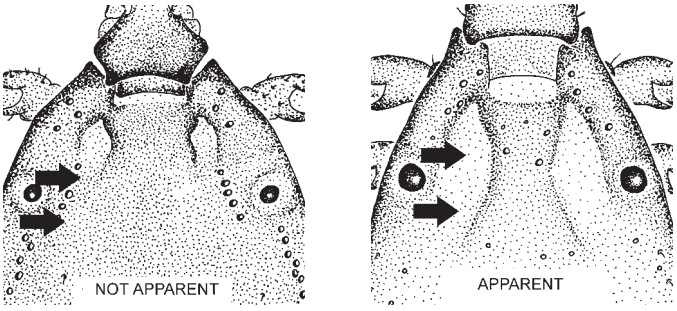
Caudal depression: in *Hyalomma* males the posterior of the conscutum may be broadly convex (caudal depression is **absent**) or it may be broadly concave (caudal depression is **present**).



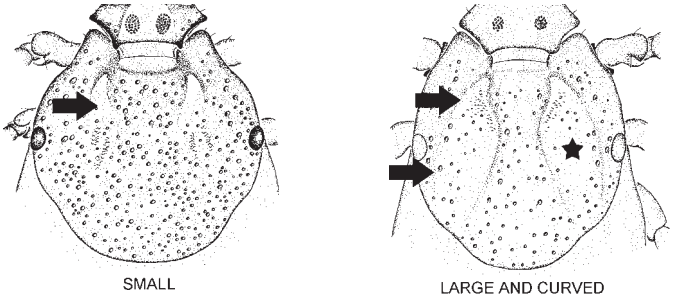
Central festoon: festoons are a regular series of bulges in the posterior margin of many adult ixodid ticks. The central festoon may also be called the parma. It is **pale** coloured, or **dark** coloured.

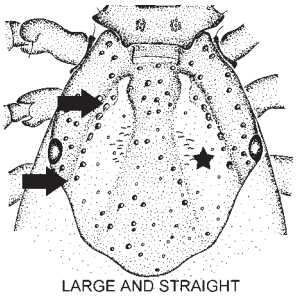


Cervical fields depression: cervical fields are areas on the scutum or conscutum, below and lateral to the cervix (neck). At the points closest to the cervix they have cervical pits. These fields may have a depression which is **not apparent** relative to the surface of the scutum, or conscutum, or the field has a depression which is **apparent**.

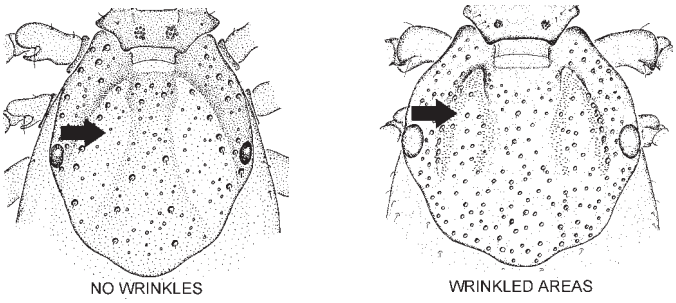


Cervical fields shape: in *Rhipicephalus* females the cervical fields are usually apparent as paired depressions (marked by an asterisk on the illustrations) on either side of the intercervical field. The outer scapular grooves and inner cervical grooves at their margins form the characteristic shapes of the cervical fields. The fields are either **absent or small**, or **large and curved,** or **large and straight**.

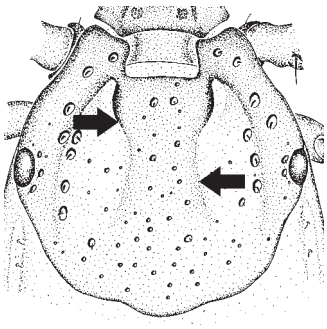




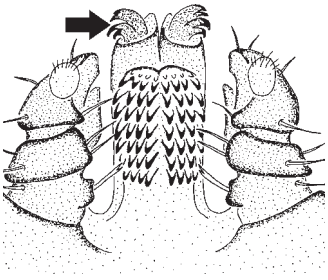
Cervical field texture: the cervical fields are the paired depressions on either side of the centre of the scutum or conscutum. In female and male *Rhipicephalus* the surface may have a characteristic texture in addition to the punctations. This texture is formed in the flat integument between the punctations. There are either **no wrinkles,** or **wrinkled areas** occur. (Other names for various states of these wrinkles are shagreen, reticulation and rugosity.)



Cervical grooves: these are paired depressions near the central anterior part of the scutum of both sexes, they go down from the raised intercervical field into the cervical fields. (Also known as mesial grooves.)



Chelicerae: paired structures of the mouthparts. They are within a cheliceral sheath and are long moveable rods with teeth at the end which cut into the skin of the host. In *Rhipicephalus* (*Boophilus*) species it is important not to mistake the cheliceral teeth for the columns of teeth on the ventral surface of the hypostome which need to be counted to differentiate species.



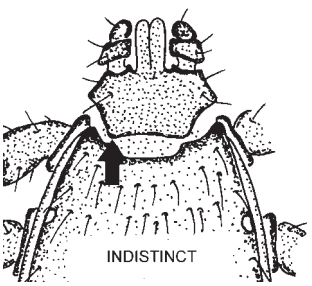
Climate: the characteristic combination of temperature, rainfall and potential evaporation in an area has a very strong influence on the ability of species of ticks to survive in those areas. It is useful to define the distribution of a tick by both geographical area and type of climate. The definitions used here are from the Times Atlas of the World, 10th edition, 2001. **Desert climate**: an arid climate in which the effectiveness of rainfall is limited by very high evaporation, all months above 0ºC; natural vegetation ranges from xerophytic shrub and grass through to barren land; this is mainly the Sahara, the Horn of Africa and the Kalahari. **Mediterranean climate**: a warm humid climate, rainy with mild winters, coolest month above 0ºC but below 18ºC, warmest month above 10ºC, dry season in summer; natural vegetation is dry scrub and shrubland (fynbos in South Africa); confined to the coastal strips of the most northerly and southerly Africa. **Rain forest climate**: this is a tropical rainy climate with no winter, coolest month above 18ºC, constantly moist with rainfall throughout the year; natural vegetation is rain forest; occurs in the Congo river basin and along the coastal areas of western Africa. **Savanna climate**: a tropical humid climate, rainy with no winter, coolest month above 18ºC, dry season in winter, occurs mainly in a large area of central tropical Africa from the west to east coast and from the southern limit of the Sahel to the northern limit of the steppes of South Africa; it surrounds the rain forest climate region of the Congo basin; natural vegetation is grassland with clumps of trees through to areas dominated by dry scrub and dry woodlands; it includes areas known as Guinea savannna, *Combretum* savanna, *Commiphora* woodlands, Miombo and Mopane woodlands. **Steppe climate**: a dry or semi-arid climate in which the effectiveness of rainfall is limited by high evaporation, all months above 0ºC; occurs in narrow zones to the north and south of the Sahara where the dry season is in winter, occurs also in varied areas in eastern Africa and a large area of central southern Africa; natural vegetation is short grass with scrub; it includes areas known as Sudan savanna in the north and the Karoo in South Africa. **Temperate climate**: a warm humid climate, rainy with mild winters, coolest month above 0ºC but below 18ºC, warmest month above 10ºC and below 22ºC; natural vegetation is long grass; confined to highland areas of Ethiopia and east Africa, and to a highland area, which has its dry season in winter, consisting of Lesotho and parts of south eastern South Africa.

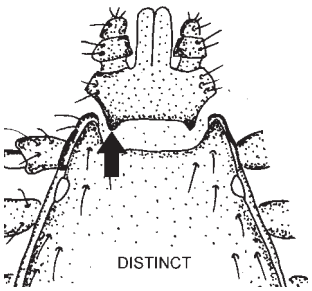
Conscutum: the sclerotized (= hardened) plate which covers most of the dorsal surface of male ixodid ticks. See Scutum for illustration.

Contiguous: structures which are contiguous touch each other along one side or boundary.

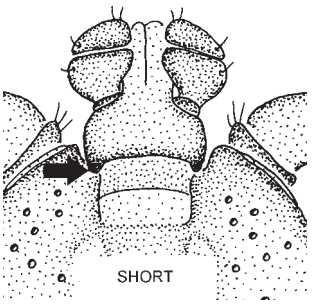
Convoluted: a texture with complex folds or waves.

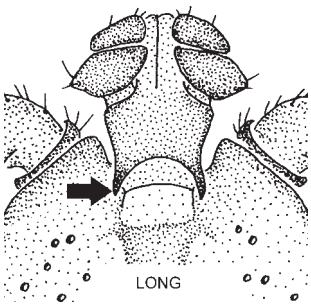
Cornua distinctness: the cornua are paired projections from the outer margins of the posterior dorsal surface of the basis capituli. They may be **indistinct**, or **distinct**.





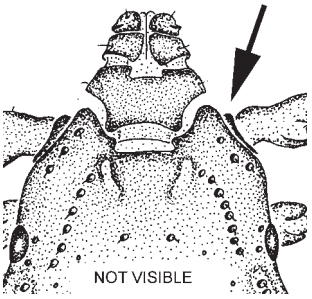
Cornua length: the cornua are paired projections from the outer margins of the posterior dorsal surface of the basis capituli. They vary in length from **short**, to **long**.

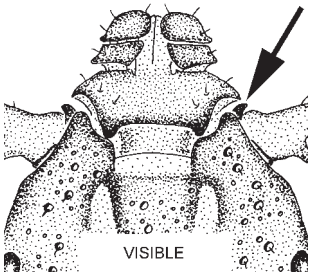




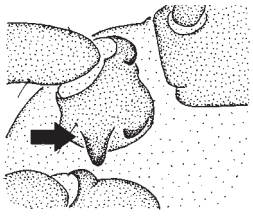
Cowdria: the bacterium *Ehrlichia ruminantium* which is transmitted by *Amblyomma* ticks and infects cells in the brain and other tissues causes the disease heartwater or cowdriosis. The genus *Cowdria* is now considered to be part of the genus *Ehrlichia*.

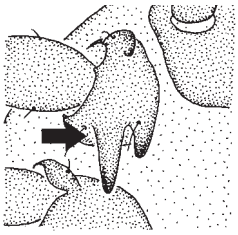
Coxae 1 anterior spurs: coxa 1 is the first segment of the first leg, closest to the body. In male *Rhipicephalus* the coxae of the first legs may have a spur or projection which is visible to the anterior of the leg when viewed from the dorsal surface. This is either **not visible**, or **visible**. The smooth edge of the coxa may be visible but it is a distinct spur projecting from this edge that must be examined.

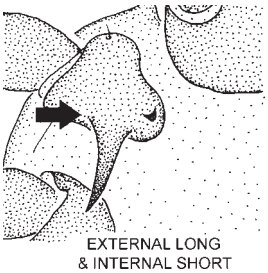




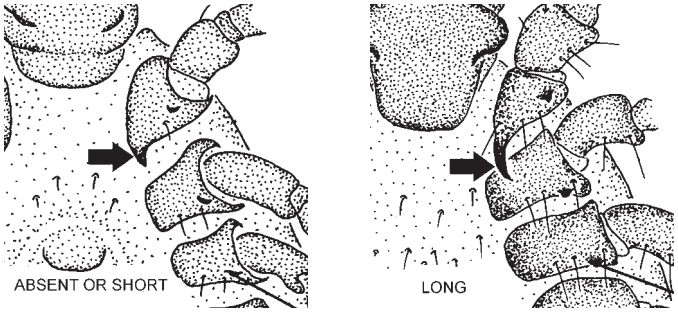
Coxae 1 external and internal spur lengths: in *Amblyomma* ticks the pair of spurs on the coxae of the first legs vary in their relative lengths as follows: **external medium and internal short**, or **external long and internal medium**, or **external long and internal short**.



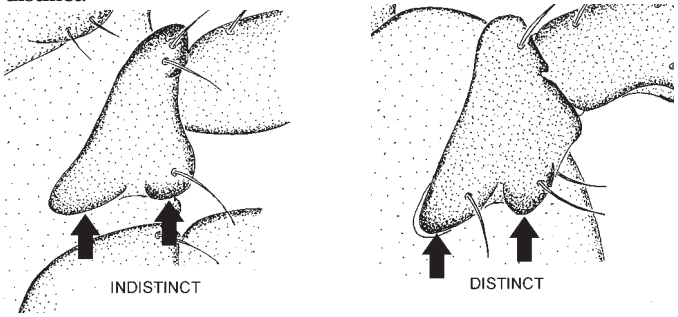




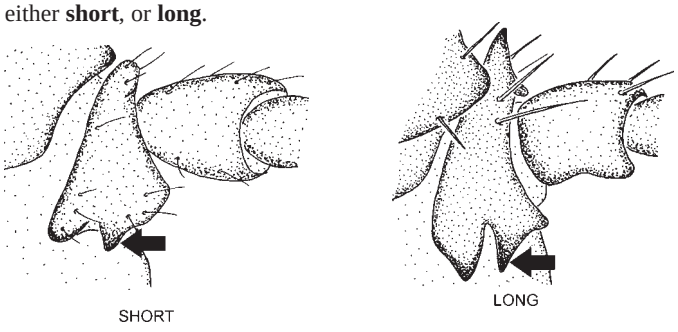
Coxae 1 internal spurs: in *Ixodes* there may be internal spurs on the coxae of the first legs; they are **absent or short**, or they are **long**.



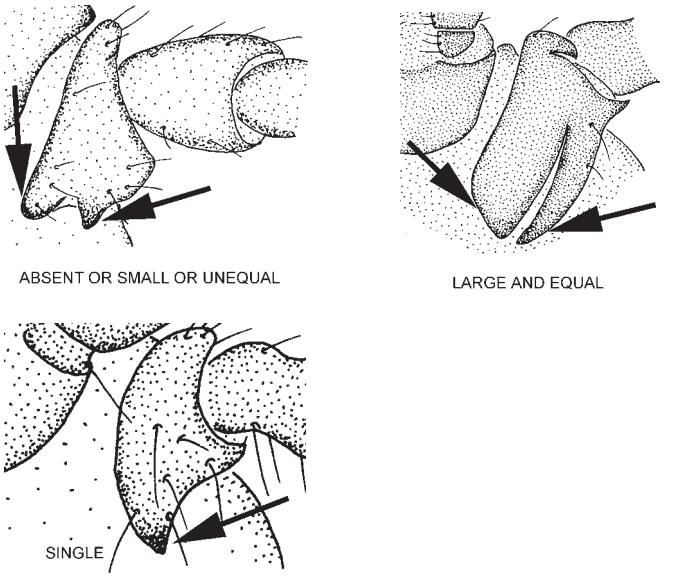
Coxae 1 spurs distinctness: the coxae of the first legs have paired internal and external spurs in some species. They may be **indistinct**, or **distinct**.



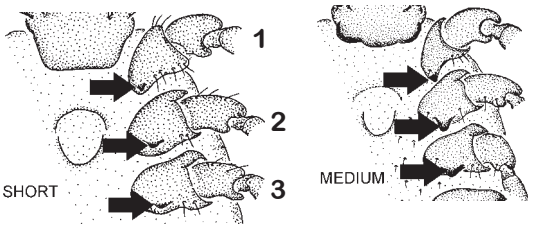
Coxae 1 spurs length: the coxae of the first legs have paired internal and external spurs in some species. The pair may vary in their length, either **short**, or **long**.



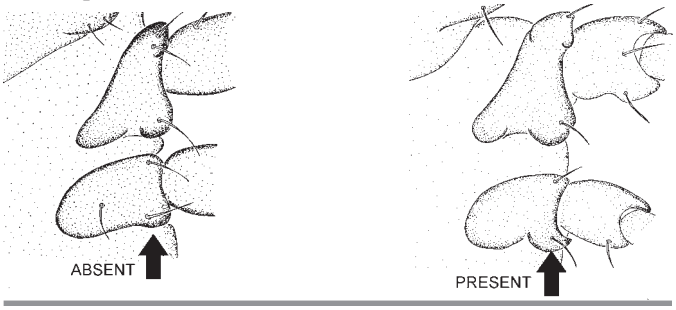
Coxae 1 spurs pairing: the spurs on the ventral surface of coxae of the first legs may be **absent or small or unequal** in some genera. In other genera they are **large and equal**, approximately. An **unequal** spur may be a distinct single spur on each coxa.



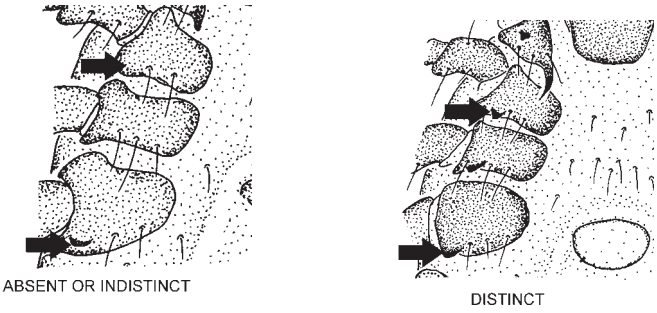
Coxae 1 to 3 spurs length: in *Haemaphysalis* females there are internal spurs on the coxae of legs 1 to 3. These vary in length between species from **short**, to **medium**.



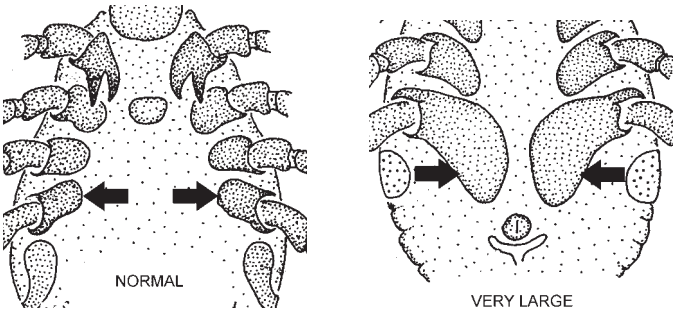
Coxae 2 and 3 spurs presence: in female *Rhipicephalus* (*Boophilus*) species the coxae of legs 2 and 3 may have spurs, they are either **absent**, or **present**.



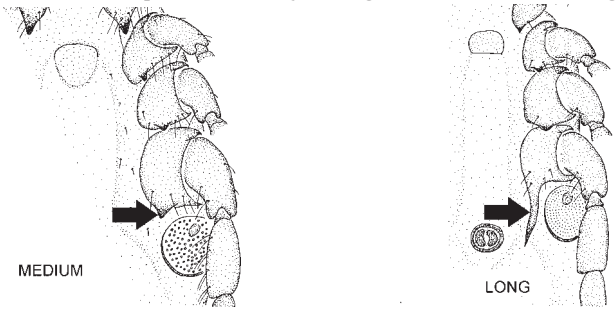
Coxae 2 to 4 external spurs: in *Ixodes* there may be small external spurs on the coxae of legs 2, 3 and 4; these are either **absent or indistinct**, or **distinct**.



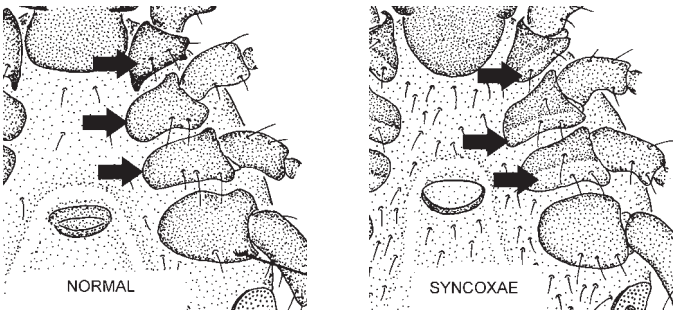
Coxae 4 size: in most genera the coxae of the fourth legs are **normal**, that is, approximately the same size as coxae of the other legs. In *Dermacentor* they are **very large** compared to the other coxae.



Coxae 4 spurs: in *Haemaphysalis* males the coxae of the fourth legs have internal spurs. These vary in length from **medium**, to **long**.



Coxae type: in most ticks the coxae (the first segment of the legs) have a **normal** appearance of a uniform dark colour and smooth texture; in some *Ixodes* species the coxae are known as **syncoxae** because the posterior part of these coxae has a lighter colour and striated texture.



Denticle: see Hypostomal teeth.

Domestic: bred or adapted to living in close association with humans.

Diapause: a mechanism in the behaviour of ticks which enables the tick to survive a harsh period of the seasonal cycle by ceasing activity.

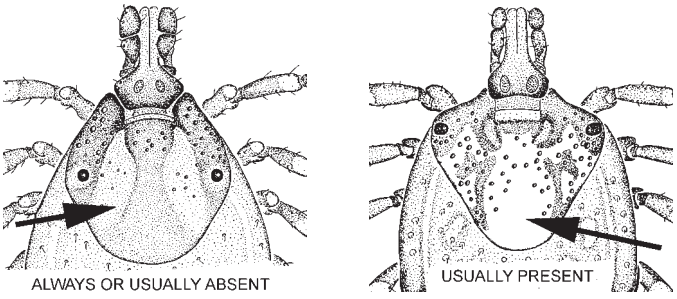
Ditropic: when immature ticks only feed on a different type of host, such as rodents, from the host used by adults, such as ruminants.

Dorsal: in ticks the dorsal position is that which faces away from the ground or other surface on which the tick is standing with its legs.

Ehrlichiosis: disease of cattle, sheep and dogs caused by tick borne bacteria of the genus *Ehrlichia.* See also *Cowdria* and Heartwater.

Enamel colour: in *Amblyomma* the colour of the enamel is predominantly **pink to orange**, or **orange to red**. Enamel is often called ornamentation. It is most conspicuous on the conscutum of males. Enamel ornamentation should be distinguished from pale rings on the legs of *Amblyomma* and *Hyalomma* species; the enamel looks like paint on the surface of the integument, the rings are pale because the depth of the integument is less dark than surrounding areas.

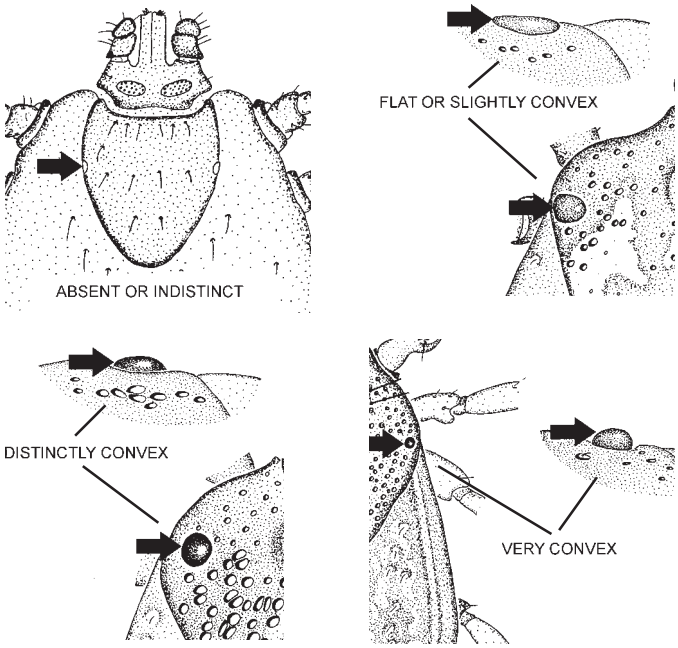
Enamel on scutum or conscutum: enamel is a light coloured pigment within the integument of the scutum, conscutum or legs. It is often called ornamentation because it gives the appearance of a painted surface on the brown base colour. In different genera it is either **always or usually absent** (example is *Hyalomma*), or it is **usually present** (example is *Amblyomma*). Some genera such as *Rhipicephalus* have nearly all species without enamel but four species have enamel.



Endemic: an organism which is endemic to a geographical area is one which has originated there. This term is used in epidemiology as endemic stability, which is a state where most animals in a population have become immune to a pathogen which circulates naturally in that area and thus there is little acute disease.

Endophilic and **exophilic**: when not feeding, endophilic ticks live in the nest of their hosts and exophilic ticks live in open enviroments. Endophilic and nidicolous mean the same. Compare with domestic.

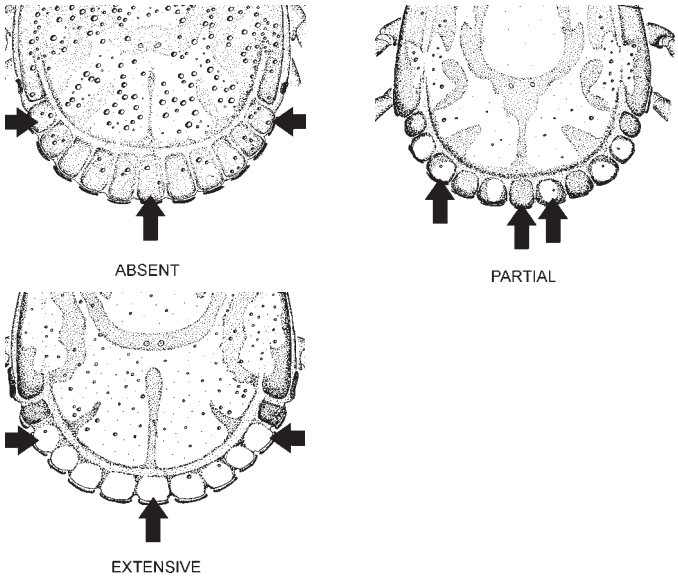
Eyes: these are simple rounded organs on the edge of the scutum in many ixodid ticks; they vary from **absent or indistinct** in some genera or the profile of the eyes relative to the level of the scutum varies from **flat or slightly convex**, or **distinctly convex** (= bulging), or **very convex** (= highly bulging). Some genera have no eyes (*Ixodes* and *Haemaphysalis*), in *Rhipicephalus (Boophilus)* eyes are indistinct and all *Hyalomma* ticks have very convex eyes. In *Ornithodoros*, if eyes are present they are on the anterior lateral surface of the body; other genera of argasid ticks have no eyes.



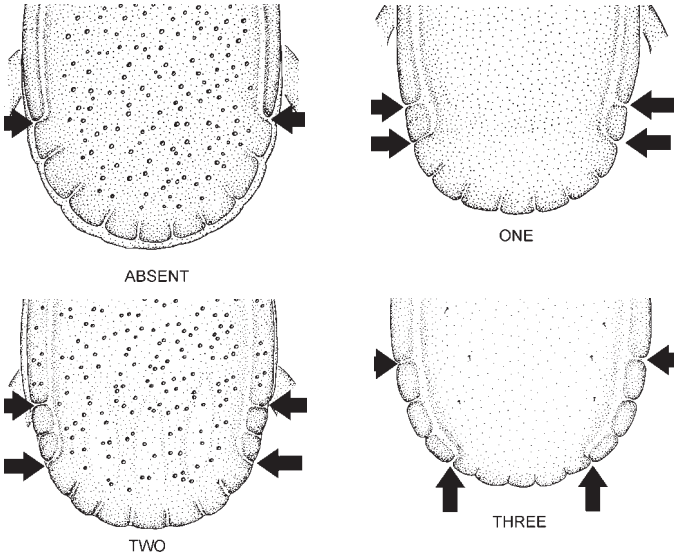
Falciform stripe: in *Amblyomma* ticks the pattern of enamel on the scutum reveals dark areas of the scutum without enamel; these are called stripes. The falciform stripe is the horizontal one below the large central spot of enamel.

Family: in taxonomy this is the next group above genus. There are three families of ticks, the Ixodidae, the Argasidae and also a family of one species, the Nuttalliellidae.

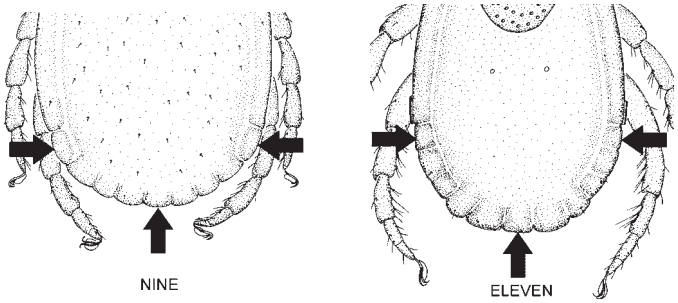
Festoon enamelling: festoons are a regular series of bulges in the posterior margin of females and males (they may be obscured when the tick feeds). In *Amblyomma* males enamel may occur as patches on individual festoons. This enamel pattern may be **absent**, or **partial**, or **extensive**; in the latter case all festoons except the outermost pair have large enamel patches.



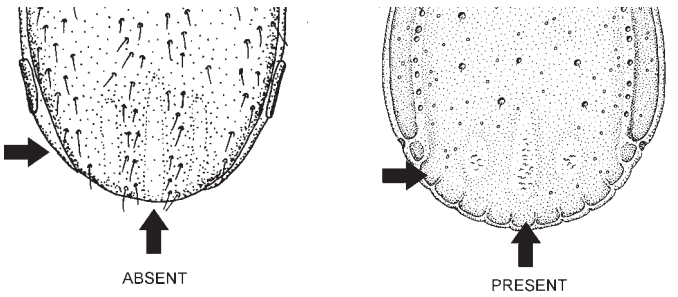
Festoons enclosed by lateral groove: in female and male *Haemaphysalis* and some other genera, the lateral grooves extend into the area where the festoons are. This enclosure, or overlapping, by the grooves may be **absent**, or may enclose **one**, or **two**, or **three** festoons on each side of the tick. This character varies with the sexes. The festoons of females are clearly visible only when the tick is unfed.



Festoons number: festoons are a regular series of bulges in the posterior margin of females and males (they may be obscured when the tick feeds). In *Haemaphysalis* species they vary in number, either **nine**, or **eleven**, counting from the outermost festoon just below the dorsal appearance of the spiracle plate.

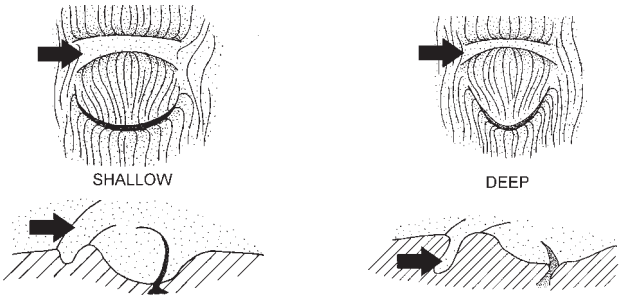


Festoons presence: festoons are a regular series of bulges in the posterior margin of females and males (they may be obscured when the tick feeds). In some genera they are **absent**, in others they are **present**.

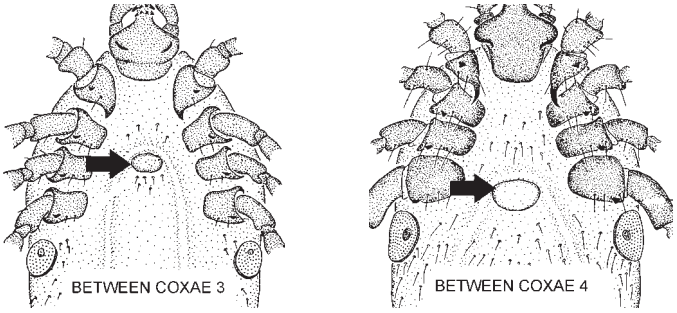


Flaps: paired structures below the surface of the hyaline border of the female genital aperture. They are usually dark coloured (sclerotized) and of supportive function. May also be known as Hyaline flaps. (see Hyaline border.)

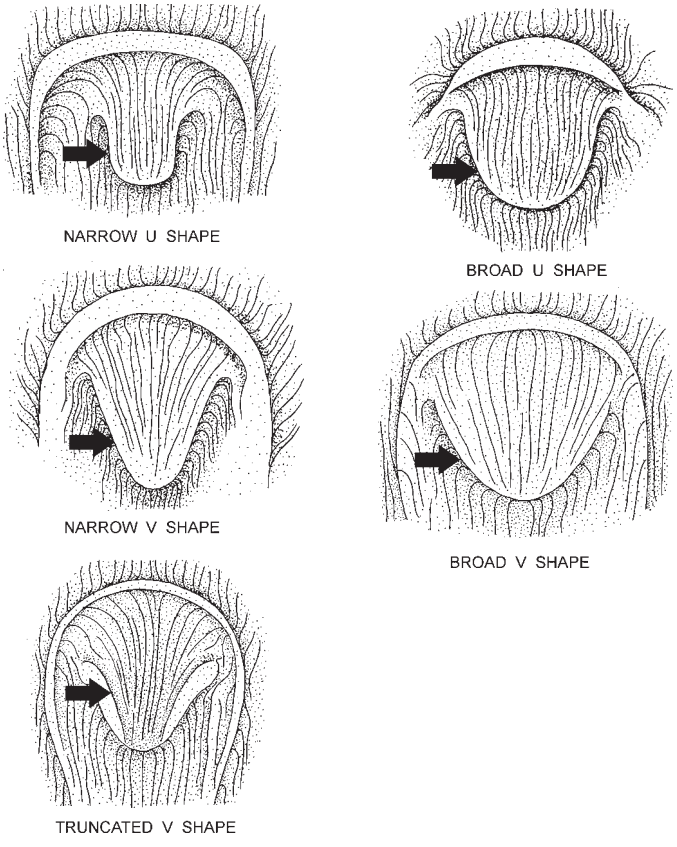
Genital aperture anterior groove: this aperture is the opening of the reproductive organs on the ventral surface. In females a groove may be present just anterior to the aperture, it is **shallow**, or **deep** relative to the general body surface. The drawings show the ventral surface at the top and a vertical cross section at the bottom.



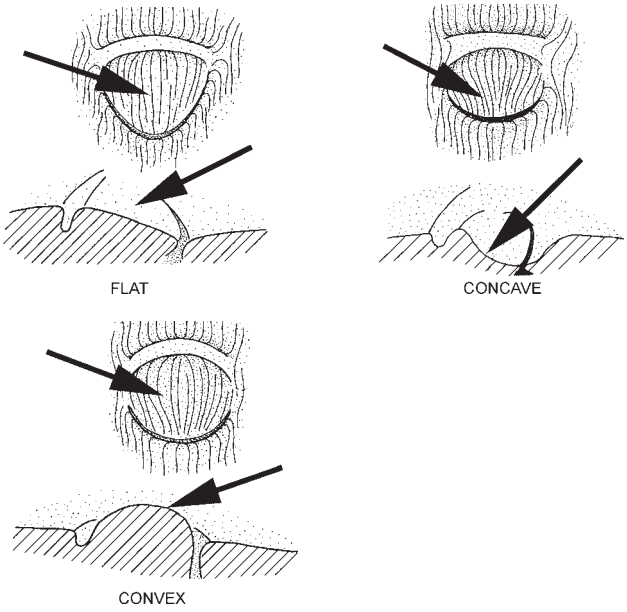
Genital aperture position: in *Ixodes* the female genital aperture may be located **between coxae 3**, or **between coxae 4**.



Genital aperture posterior lips: this aperture is the opening of the reproductive organs. In females the opening to the vagina (or atrium) is formed by two lateral lips of characteristic outlines forming: a **narrow U shape**, or a **broad U shape**, or a **narrow V shape**, or a **broad V shape**, or a **truncated V shape**. Truncated means the cut-off appearance of the shape of the lips in their posterior part and in this case their shape is also formed by a pair of lateral hyaline borders (see Hyaline). The important shape is formed by the interior outline, as arrowed.



Genital aperture preatrial fold: this aperture is the opening of the reproductive organs on the ventral surface. In females the opening to the atrium (= vagina) has a fold of integument between the posterior lips. The surface of this fold may be **flat**, or **concave**, or **convex**. The drawings show the ventral surface at the top and a vertical cross section at the bottom.



Genus: the taxonomic group that consists only of species. All species of animals have a unique name consisting of the genus plus the species name. This is the binominal name which is used throughout the world as the internationally recognised name (see Species). (Binominal may also be called binomial in this context).

Goblets: hollow structures with pores which open in the spiracle plate. Their function is unclear.

Groove: a long narrow depression in the surface of the scutum, the position, size and texture are useful for identification. The groove may be represented only by a depression on one side, as in the scapular groove.

Habitat: this is the physical environment of a tick composed of non-living components such as climate, and living components such as vegetation and host animals.

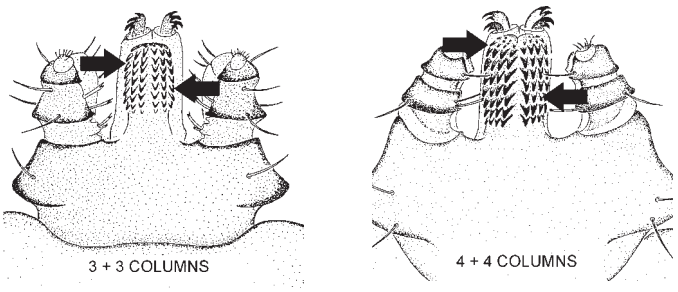
Heartwater: a disease of sheep and cattle caused by the bacterium *Erhlichia ruminantium*. This bacterium was formerly known as *Cowdria ruminantium*. The disease is also known as cowdriosis.

Hexagonal: a shape with six sides and six angles between them, in ticks the dorsal surface of the basis capituli may have this shape.

Hyaline border: in the genital aperture of some species of ticks there are areas with a clear or transparent (= hyaline) appearance on each side of the entrance to the vagina. They help to define the shape of the aperture, usually in a **V** shape. (See Flaps, also Genital aperture posterior lips where the drawing of the state Truncated **V** shape shows hyaline borders on the outer sides of the posterior lips.)

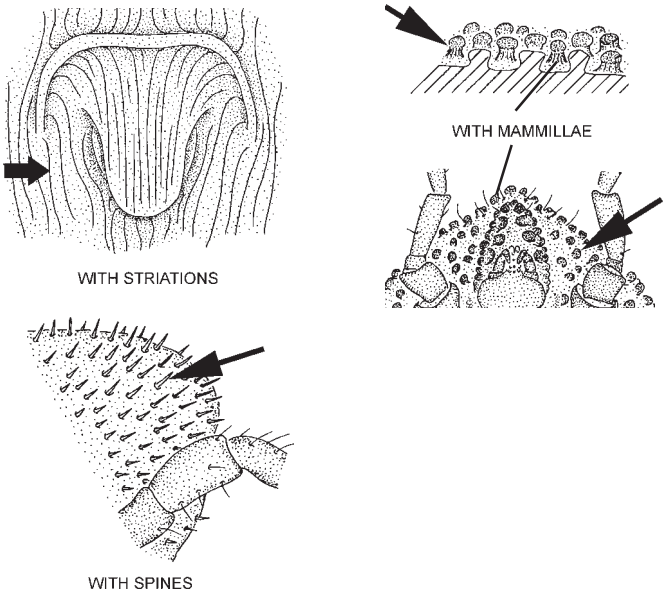
Hypostome: a ventral and central structure of the mouthparts in the form of a pair of blades which penetrates the skin of the host. The gap between it and the sheath below the chelicerae form the blood sucking tube. See Plate 1. The ventral surface of the hypostome has teeth or denticles to grip onto the host; these teeth are useful for identification of *Rhipicephalus* (*Boophilus*) species.

Hypostomal teeth: the ventral surface of the hypostome has teeth (= denticles) in columns arranged from the tip of the hypostome down towards the basis capituli. In *Rhipicephalus* (*Boophilus*) females and males these are in two sets of teeth on either side of the midline, as **3 + 3 columns**, or **4 + 4 columns**. Do not confuse the cheliceral teeth for hypostomal teeth (see Chelicerae). Also be aware that the hypostome may be damaged when removing the specimen from the host. (In taxonomic keys to ticks these columns are usually described as rows, but columns is used in this guide because columns are vertical, as drawn).

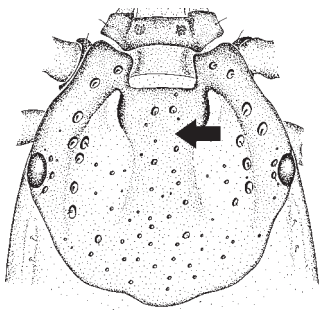


Instar: one of the stages of the tick life cycle. The egg, larva, nymph and adult are four separate instars. Argasid ticks usually have several nymphal instars called first, second etc.

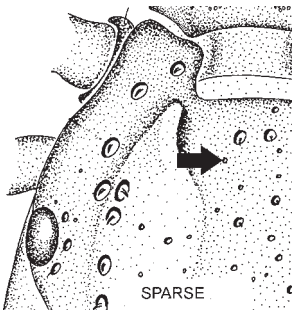
Integument texture: the integument of ticks is the outer body wall. In ixodid ticks the soft areas of integument (excluding the scutum, conscutum and ventral plates) is **with striations** (= fine grooves, see Plate 2). In argasid ticks the integument is **with mammillae** which are distinct small bulges, or the integument main surface is smooth but is also covered **with spines** (the spines are very thick setae).

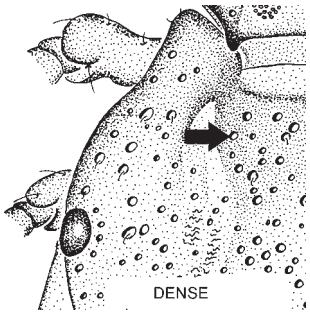


Intercervical field: this is the raised area in the anterior and central part of the scutum and conscutum of ticks; it is defined by the paired cervical grooves. The central area posterior to this is the central field.

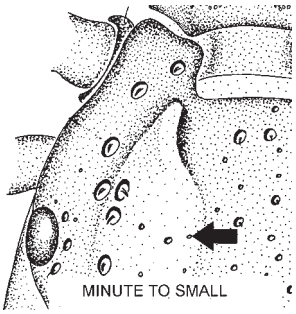


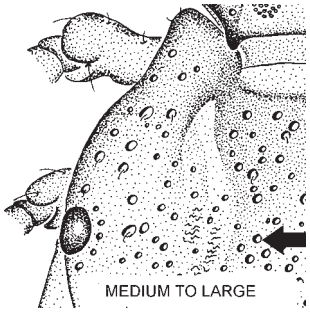
Interstitial punctations distribution: in female and male *Rhipicephalus* the punctations can be divided into those that have visible setae in them (setiferous or pilose) and those without setae, which are called interstitial. The distribution of the interstitial punctations may be **sparse**, or **dense**.


SPARSE


DENSE

Interstitial punctations size: in female and male *Rhipicephalus* the punctations can be divided into those that have visible setae in them (setiferous or pilose) and those without setae. The punctations without setae are called interstitial. The sizes of the interstitial punctations may be **minute to small**, or **small to medium** (not illustrated), or **medium to large**. When minute they appear as dark dots, when large they may equal the setiferous punctations in size.

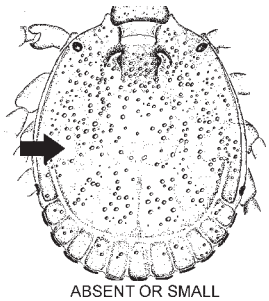

MINUTE TO SMALL

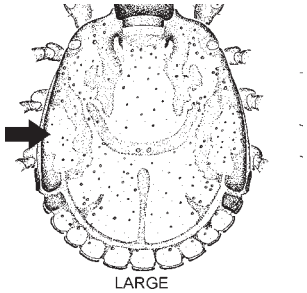

MEDIUM TO LARGE

Ixodida: a sub-order of animals within the order Acari; the Acari are all the mites and ticks, the Ixodida are all the ticks including the families Ixodidae, Argasidae and Nuttalliellidae.

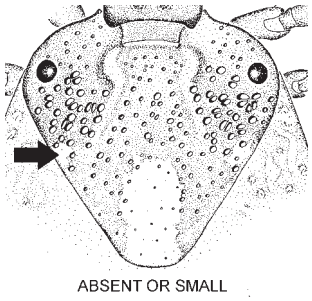
Ixodidae: the family of ticks characterised by presence of a scutum on the dorsal surface and pulvilli between the claws; often known as the ixodids or hard ticks because of the hard surface of the scutum.

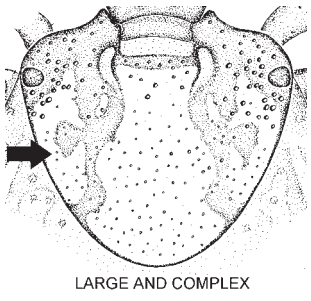
Lateral areas of enamel on conscutum: in male *Amblyomma* the pattern of enamel (= ornamentation) on the conscutum may have a pair of patches on the mid section of the marginal line. These may be **absent or small**, or **large**.


ABSENT OR SMALL

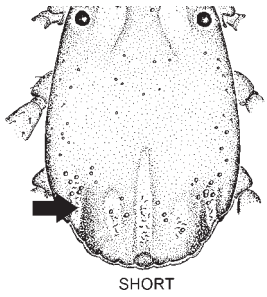

LARGE

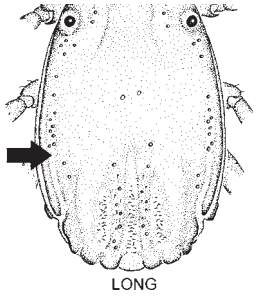
Lateral areas of enamel on scutum: in female *Amblyomma* an area of enamel colour (= ornamentation) on the lateral part of the scutum may be **absent or small**, or **large and complex**.


ABSENT OR SMALL

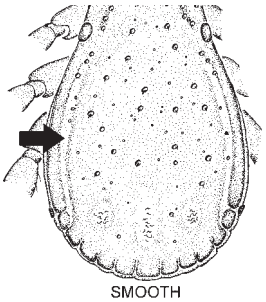

LARGE AND COMPLEX

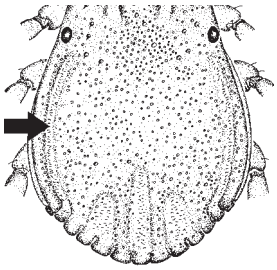
Lateral grooves length: in the conscutum of males a groove may be present in the lateral area, starting most clearly near the position of the spiracles and possibly extending forward to the eyes. These grooves may be **short**, or **long**. (In some books these are called marginal grooves or lines).

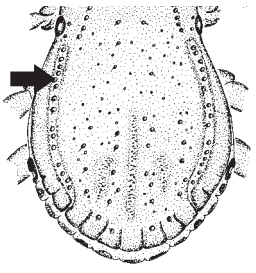

SHORT


LONG

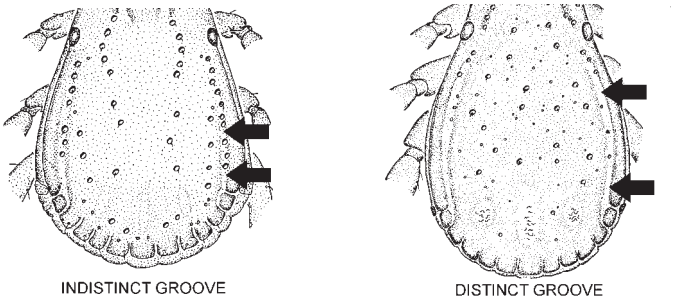
Lateral grooves texture: in male *Rhipicephalus* the lateral grooves at the margins of the conscutum have a texture within the groove that varies from **smooth**, to **wrinkled**, to **distinctly punctate**. When the texture is distinctly punctate the hollow profile of the groove is often obscured.


SMOOTH

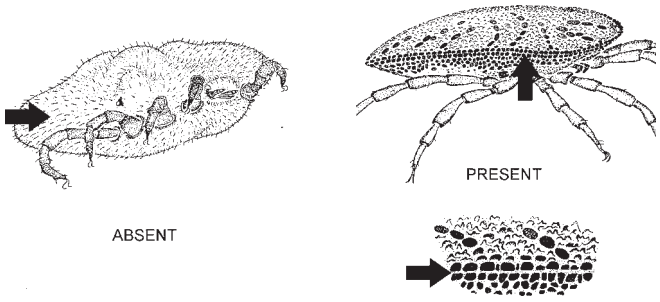

WRINKLED


DISTINCTLY PUNCTATE

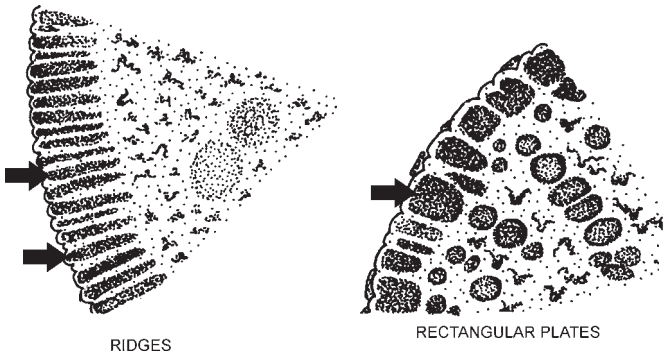
Lateral grooves type: in male *Rhipicephalus* the lateral groove in each long margin of the conscutum is usually a linear depression of the integument. The depression may form an **indistinct groove** which is mainly visible as a line of punctations, or a **distinct groove**.



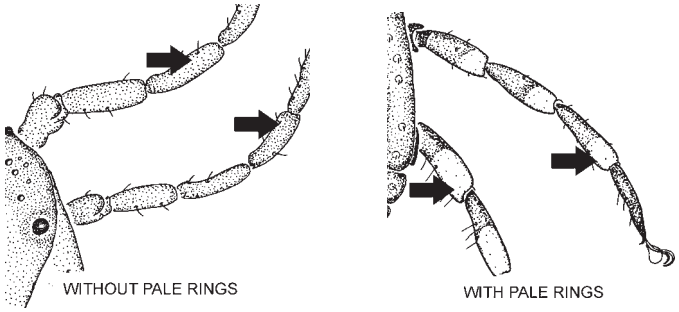
Lateral suture: in *Argas* the body is flattened in a dorsal - ventral direction; the margin between the two surfaces makes a distinctly textured lateral suture **present**. This is **absent** in other genera of argasid ticks. (Lateral suture is also known as marginal suture.)



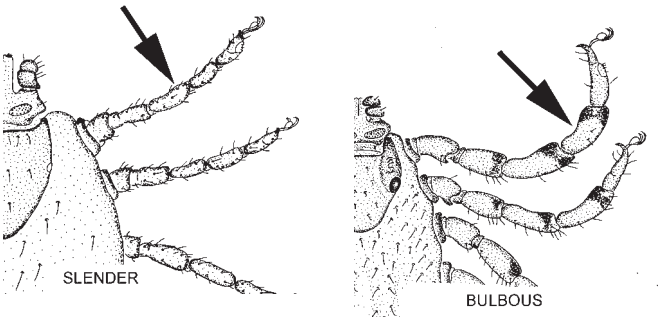
Lateral suture texture: in *Argas* the lateral suture has a texture which can be seen when viewed from the dorsal or ventral surface. This texture forms either narrow **ridges** at right angles to the lateral suture, or **rectangular plates**.



Leg colouration: legs of most genera of ticks are plain brown colour but typically in *Hyalomma* and *Amblyomma* many species have rings of pale colour at the outer ends of most segments of the legs. Some species are **without pale rings** (the entire leg looks yellow or brown), some are **with pale rings**. (Also white enamel occurs on the legs of *Hy. lusitanicum*.)

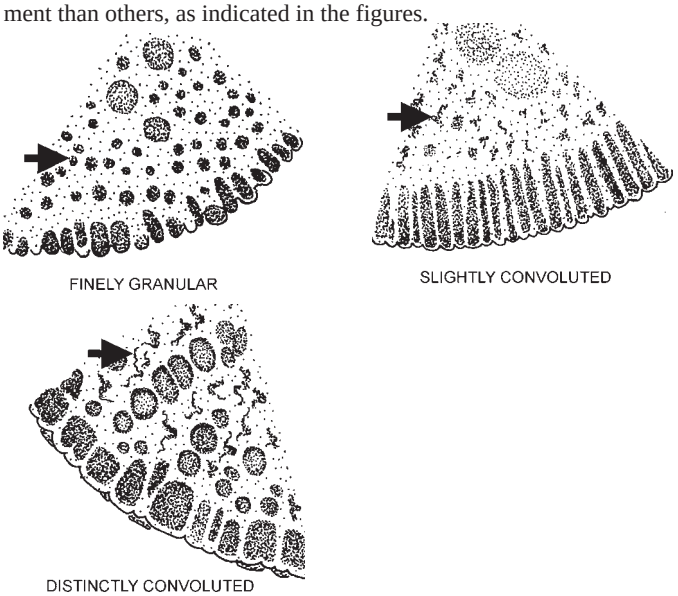


Legs thickness: the legs of ticks are usually **slender** or thin relative to the size of the main body. In *Margaropus* females, illustrated here, they are **bulbous** (in male *Margaropus* they are very bulbous.)

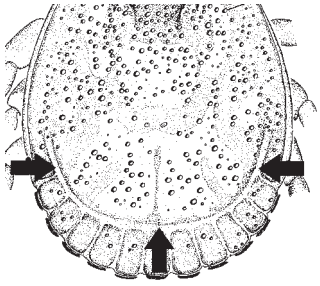


Maintenance host: this is the species of animal on which adult ticks feed such that their reproduction is most successful. The presence of maintenance hosts is essential for a population of ticks to develop in an area. There are usually several different species of animal that can act as maintenance hosts for a single species of tick. Immature ticks are often able to feed successfully on many species of animal in addition to the maintenance host.

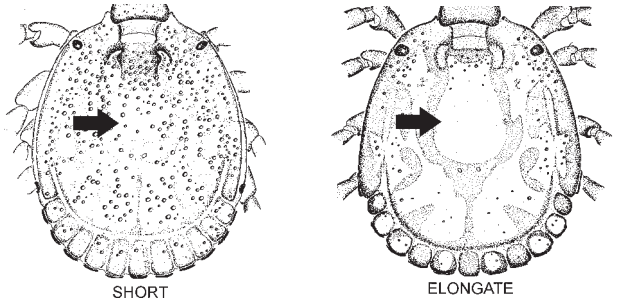
Mammillae and ridges pattern: In argasids the integument may have a texture of small mammillae and large discs. Mammillae are small rounded bumps. The mammillae and ridges are grouped to form patterns of varying degree. These may be **finely granular**, or **slightly convoluted** (convoluted = with complex folds) or **distinctly convoluted**. These patterns are more obvious in some parts of the integument than others, as indicated in the figures.



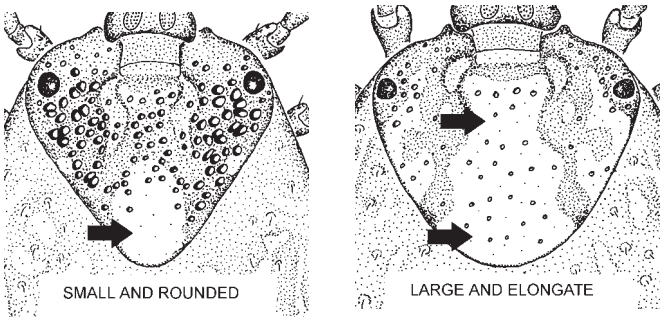
Marginal groove: this occurs in many *Amblyomma* males and divides the very distinct festoons from the rest of the conscutum. This term is used by some authors to mean also the lateral groove of genera such as *Hyalomma* and *Rhipicephalus* (see Lateral grooves length).



Mesial area of enamel on conscutum: in male *Amblyomma* the pattern of enamel on the conscutum usually includes a mesial patch in the central anterior region. This may be **short**, or **elongate**.



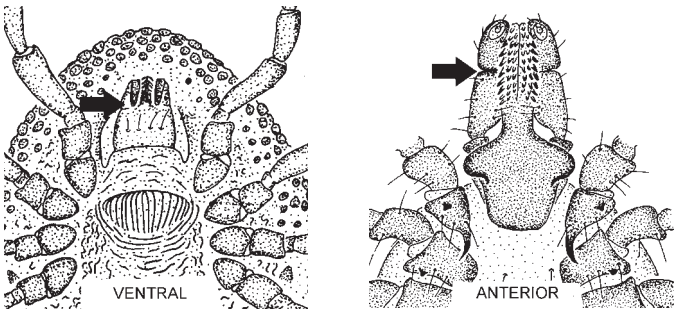
Mesial areas of enamel on scutum: in female *Amblyomma* an area of enamel colour in the lower centre of the scutum varies from **small and rounded**, to **large and elongate**.



Mesial area: the central anterior part of the scutum or conscutum of *Amblyomma* species. In other genera this area may be called the central field.

Monotropic: where the immature stages of a tick feed only on the same type of host, such as ruminants, as the adult ticks.

Mouthparts: consist of the paired palps, the blade shaped hypostome and the paired chelicerae within a sheath. In argasid ticks the mouthparts are situated on the **ventral** surface of the adults. In ixodid ticks the mouthparts project from the **anterior** margin of the adult tick.



Myiasis: a disease caused by the infestation of flesh of mammals by larvae of flies; the infestation may start at wounds caused by ticks.

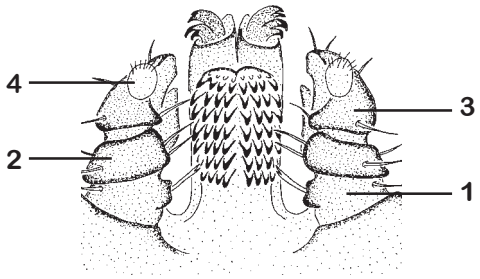
Nidicolous: living in the nest of the host, see Endophilic.

Orbit: a circular groove surrounding the eye of some ticks, very typical of *Hyalomma* species.

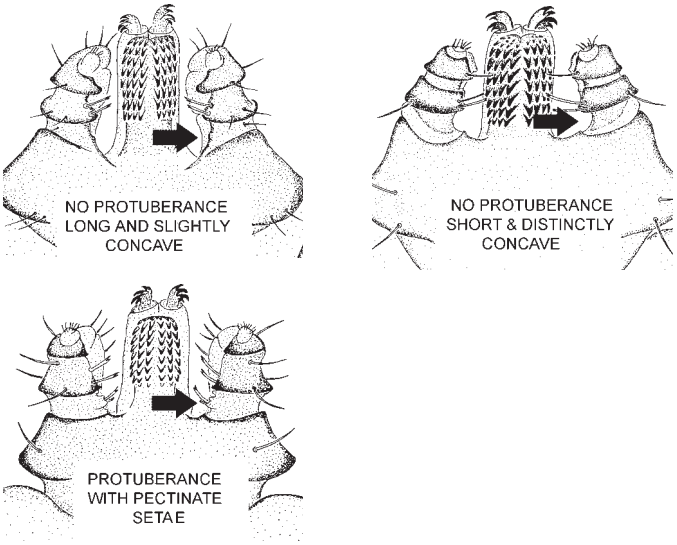
Ornamentation: having a pattern of coloured pigment in the integument of the scutum; this colouration is known as enamel. The term enamel is used in this guide but the terms ornamentation or ornate in other guides and keys mean the same.

Palaearctic zoogeographical region: an area characterised by groups of related animals which includes all of Europe and central Asia and extends into Africa north of the central Sahara. Africa south of the Sahara is in the Afrotropical region. Central and South America are in the Neotropical region.

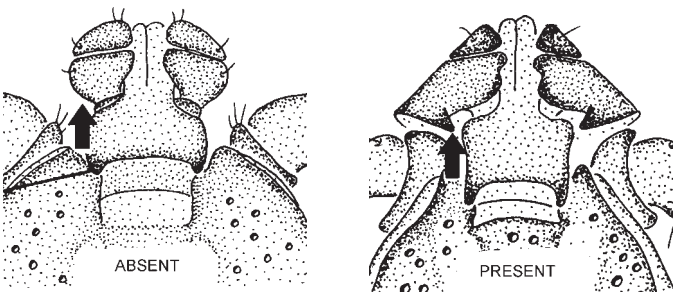
Palps: paired structures of the mouthparts. They are moveable and spread away from the penetrating hypostome and chelicerae to remain outside the skin when the tick is feeding. They consist of four parts like segments, known as articles. Article 4 is very small and has a sensory function used in feeding. The illustration shows the position of palpal articles 1 to 4 on the ventral surface of *Rhipicephalus* (*Boophilus*).



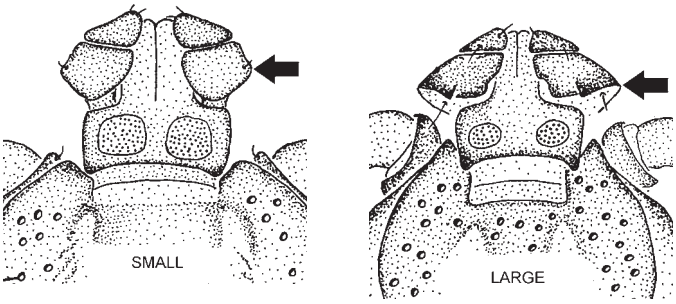
Palpal article 1 internal margin: in *Rhipicephalus* (*Boophilus*) females and males the first article of the palps has a characteristic structure of the internal margin, facing the hypostome. There is either **no protuberance, long and slightly concave profile**. Or there is **no protuberance, short and distinctly concave profile**. Or there is a **protuberance with pectinate setae** (one or two setae on each protuberance, pectinate means split like a comb).



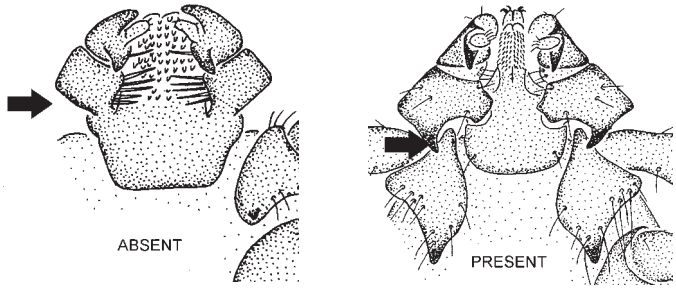
Palp articles 2 dorsal spur: in female and male *Haemaphysalis* there may be a backward pointing spur in the form of an angular projection from the posterior margin of the dorsal surface of the second article of the palps. This is either **absent**, or **present**.



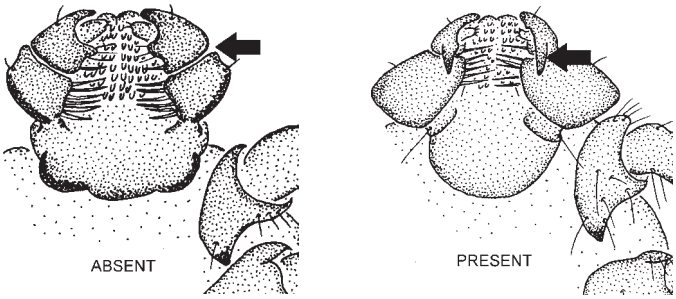
Palp articles 2 lateral extension: in female and male *Haemaphysalis* the second article of the palps is extended or expanded laterally. This extension may be **small**, or **large**. When it is large the palps form a distinct conical profile.



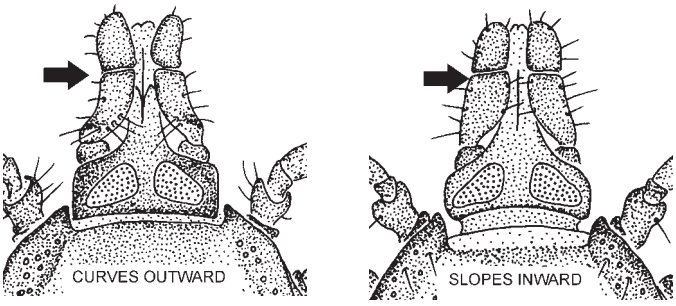
Palp articles 2 ventral spur: in male *Haemaphysalis* there may be a backward facing spur or angular projection from the ventral surface of the second article of the palps. This is either **absent**, or **present**.



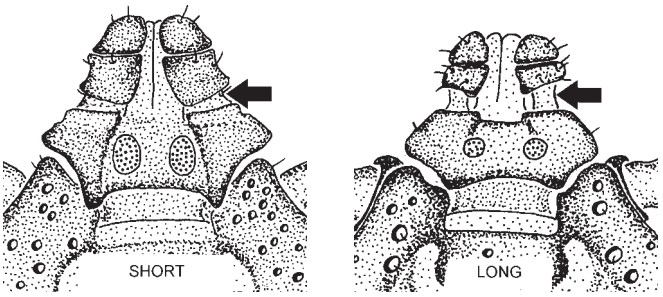
Palp articles 3 ventral spur: in female and male *Haemaphysalis* there may be a sharp spur projecting backwards from where palp articles 3 and 2 are joined. This is either **absent**, or **present**.



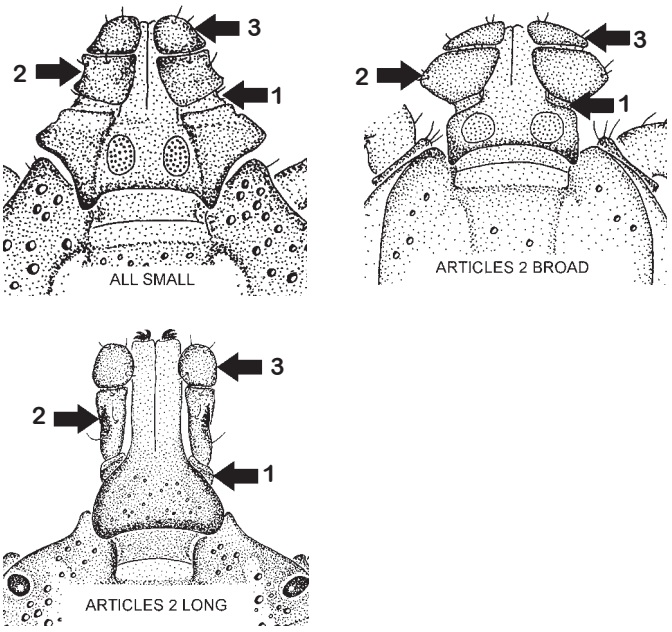
Palps alignment: in *Ixodes* adults articles 2 and 3 of each palp have a vertical alignment which either **curves outward** in a concave profile, or it **slopes inward** in a straight profile.



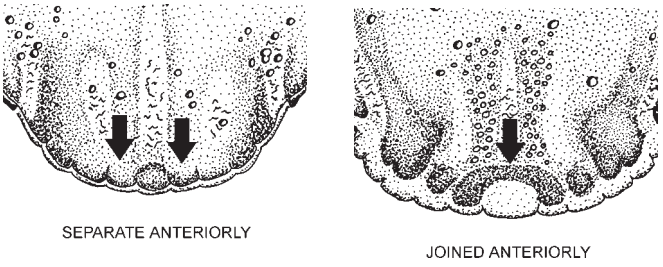
Palp pedicels: in female *Rhipicephalus* the first article of the palps forms a pedicel or stalk on which the second article is situated. From the dorsal surface these pedicels are **short**, or **long**, relative to the size of the second article of the palps.



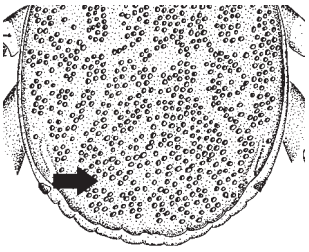
Palp articles shapes: the palps of the mouthparts are comprised of three main pairs of articles (like segments). The fourth articles are very small structures visible on the ventral surface of the third articles. These three main article pairs are either **all small** and similar in shape, or characterised as **articles 2 broad**, or **articles 2 long** in comparison to articles 1 and 3. The illustrations show articles 1 to 3 numbered.

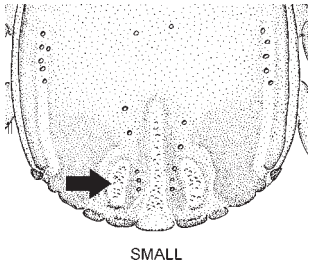


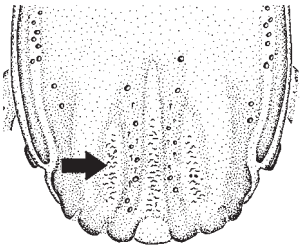
Paracentral festoons: festoons are a regular series of bulges in the posterior margin of the alloscutum of females and males (they may be obscured when the tick feeds). In male *Hyalomma* the pair of festoons next to the central one are paracentral and are usually **separate anteriorly**, but may be **joined anteriorly** to form an arch shape.



Paramedian grooves: in the posterior conscutum of males there may be grooves. The central one is the posteromedian groove and next to it there may be a pair of paramedian grooves (also called posterolateral grooves). The paramedian grooves may be **absent**, or **small**, or **large**.







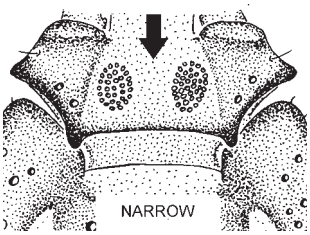
Parma: the central festoon of ticks when it is developed as a distinct structure, separated from the surrounding festoons by grooves.

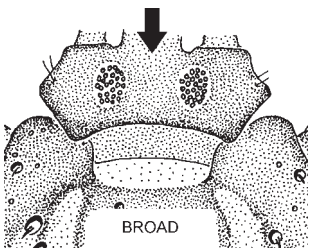
Pectinate: having a forked or comb-like structure; this is characteristic of the some of the thick setae on the inner surface of the palps of *Rhipicephalus* (*Boophilus*) species.

Pedicel: an elongate article 1 of the palps of some species of *Rhipicephalus*, it gives the rest of the palps the appearance of being on a narrow stalk.

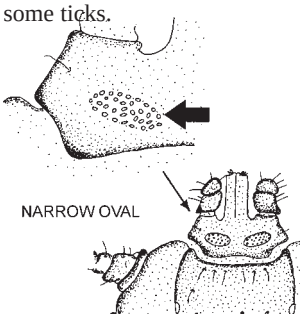
Pilose: having a dense covering of setae giving a hairy appearance. The term pilose means the same. Setae may be called hairs but strictly hair is a characteristic of mammals.

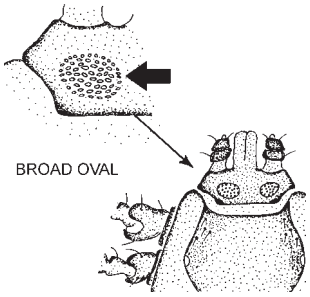
Porose areas separation: porose areas occur on the dorsal surface of the basis capituli of female ixodid ticks, they are the openings of numerous pores involved in the waterproofing of eggs. In female *Rhipicephalus* the porose areas vary in the distance separating them, from **narrow**, to **broad** relative to the diameter of the porose areas. Broad means a separation of two times or more the diameter of one porose area. (This character was measured from electron micrographs in Walker *et al*. 2000.)





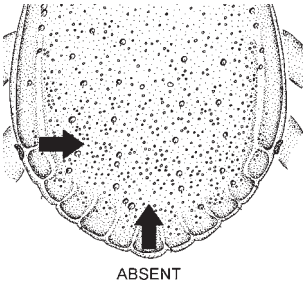
Porose areas shape: porose areas occur on the dorsal surface of the basis capituli of female ixodid ticks. They are the openings of numerous pores involved in the waterproofing of eggs. They vary in outline from a **narrow oval**, to a **broad oval** which may be nearly circular in some ticks.

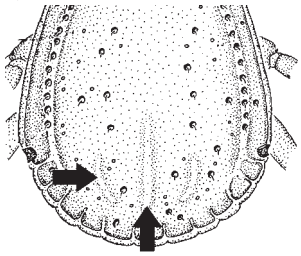


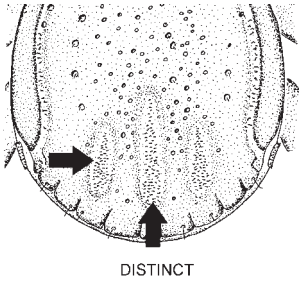


Posterior: at the rear end of an animal, may be defined as the opposite end from where the mouthparts are. Typically the anus is near the posterior.

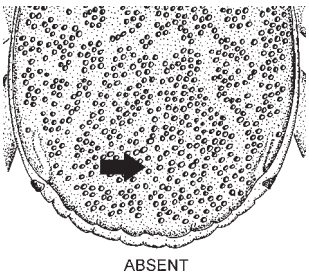
Posterior grooves: in male *Rhipicephalus* the integument in the posterior of the conscutum usually forms three depressions, as a central long groove and a groove or circular depression on either side. These may be **absent**, or **indistinct**, or **distinct**. When they are distinct they often also have a wrinkled texture (see Plate 2).

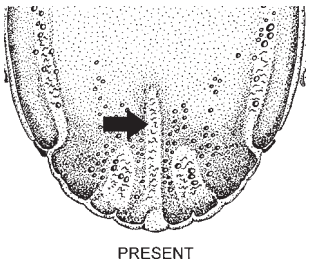




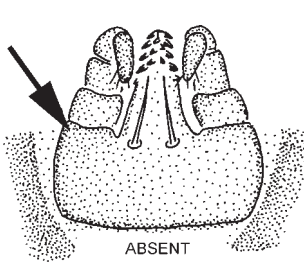


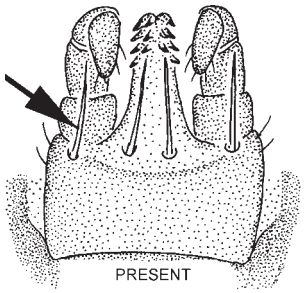
Posteromedian groove: in the posterior region of the conscutum of males there may be grooves. The central one is the posteromedian groove which may be **absent**, or **present**.



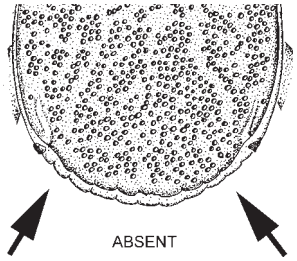


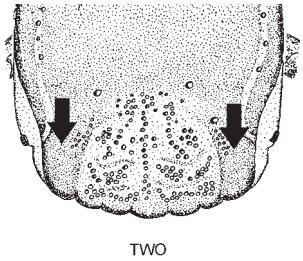
Postpalpal setae: in *Argas* on the basis capituli just posterior to article 1 of each palp there may a single large seta which points toward the anterior of the tick. These paired setae are either **absent**, or **present**. They are difficult to see because they are very pale. In addition there is a similar pair of setae at the base of the central hypostome, so if postpalpal setae are present a row of four setae will be visible.

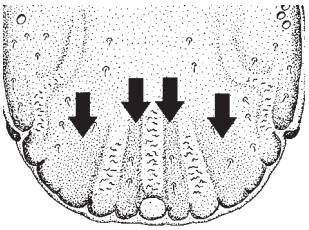




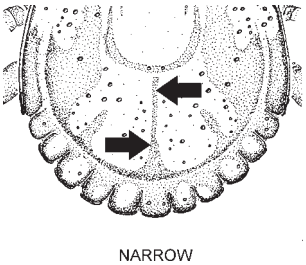
Posterior ridges: in the posterior region of the conscutum of male *Hyalomma* there may be ridges formed in the surface by the position of the posterior grooves and the caudal depression. These ridges may be **absent**, or **two**, or **four** in number.

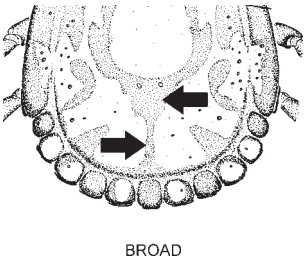






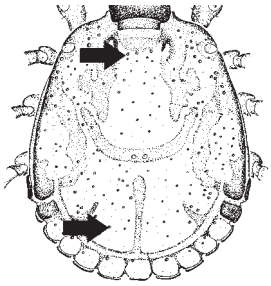
Posterior median stripe: in male *Amblyomma* the pattern of areas of the conscutum without enamel forms brown stripes (enamelling is often called ornamentation). In the centre of the posterior conscutum there is a stripe that is usually **narrow**, but may be **broad** and joining the transverse stripe above it. (This transverse stripe is called the falciform stripe).

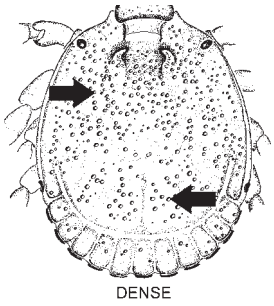


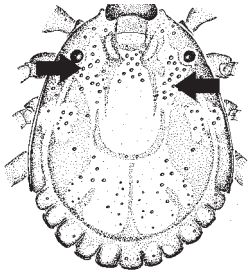


Predilection: a preference, thus the predilection site for attachment and feeding of ticks is where the ticks are attracted to by features of skin and hair coat. Most species of ticks have typical predilection sites and this is an aid in their identification. For example *Rhipicephalus appendiculatus* is called the brown ear tick because it is one of the typical brown ticks of cattle and other bovids and the adults have a strong predilection for the ears of their hosts. However, they will also feed at other sites. Hosts can groom away ticks by licking and scratching; tick predilection sites tend to be difficult for the host to groom.

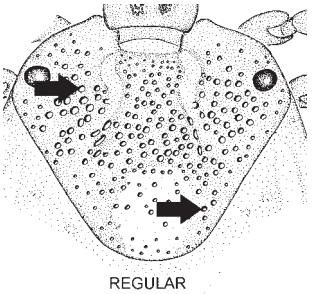
Primary punctation distribution on conscutum: in male *Amblyomma* the primary punctations are the type that are generally large and usually sparse compared to a more common type of finer punctations. Their pattern of distribution varies from **sparse**, to **dense**, to **localized**. This character has different states for the sexes of the same species. These primary punctations are not clearly setiferous. Thus the distinction between these primary and fine punctations in *Amblyomma* ticks is similar to but not the same as setiferous and interstitial punctations in *Rhipicephalus* ticks.

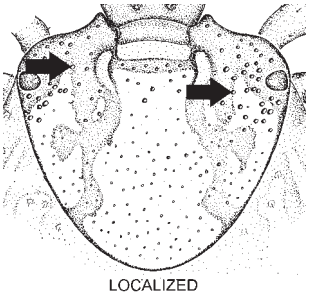




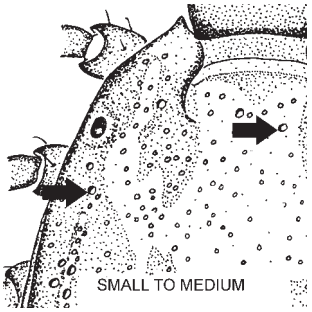


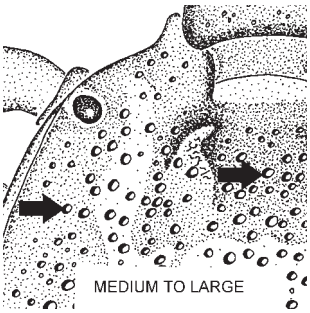
Primary punctation distribution on scutum: in female *Amblyomma* ticks the primary punctations are the type that are generally large and usually sparse compared to a more common type of finer punctations. Their distribution varies from **regular**, to **localized**. (See entry above for difference between primary and setiferous punctations.)



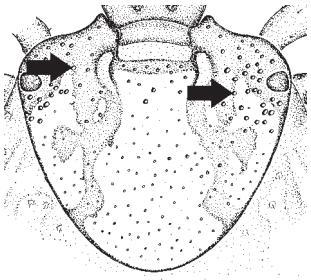


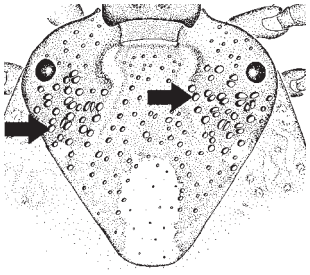
Primary punctation size on conscutum: in male *Amblyomma* the primary punctations are the type that are generally large and usually sparse compared to a more common type of finer punctations. Their size varies from **small to medium**, or from **medium to large**. This character has different states for the sexes of the same species.



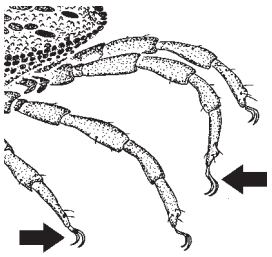


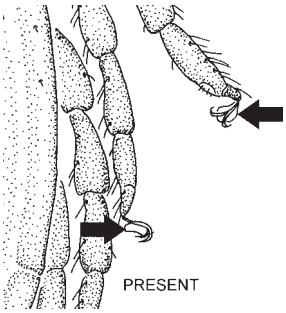
Primary punctation size on scutum: in female *Amblyomma* ticks the primary punctations are the type that are generally large and usually sparse compared to a more common type of finer punctations. Their size varies from **small to medium**, or **medium to large**. This character has different states for the sexes of the same species.


SMALL TO MEDIUM

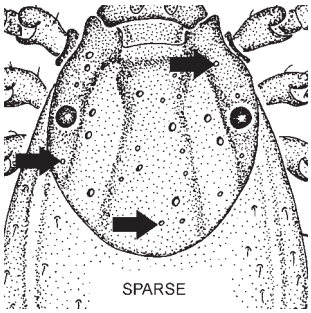

MEDIUM TO LARGE

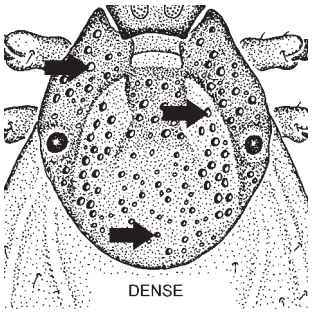
Pulvilli: these are small white pads between the paired claws of ticks. In all argasid ticks they are **absent**, in all ixodid ticks they are **present**. (They enable ixodid ticks to crawl on smooth surfaces.)

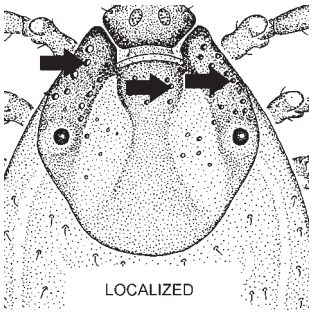

ABSENT


PRESENT

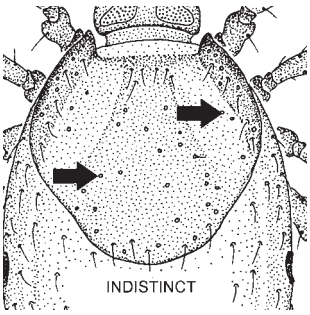
Punctation distribution: punctations are pits in the surface of the scutum and conscutum. In several genera they have a pattern of distribution on the scutum or conscutum as **sparse** all over the surface, or **dense** all over the surface, or **localized** to be mostly in one region of the surface.

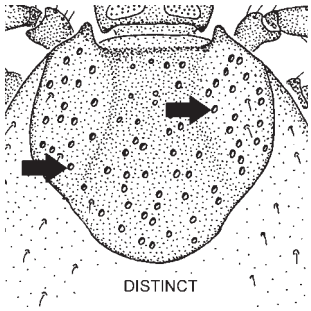

SPARSE


DENSE

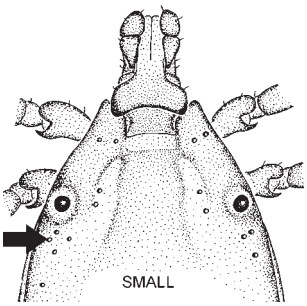

LOCALIZED

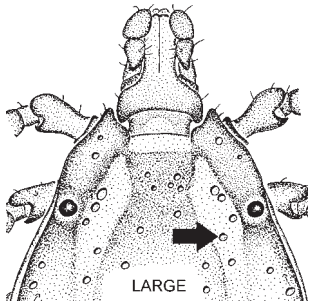
Punctation distinctness: in *Ixodes* adults the punctations on the scutum (and conscutum) are either so small or sparse as to be **indistinct**, or are a **distinct** feature of the scutum.


INDISTINCT


DISTINCT

Punctation size: punctations are pits in the surface of the scutum and conscutum. In a species of tick they can often be characterised as mostly **small**, or mostly **large** in diameter.


SMALL

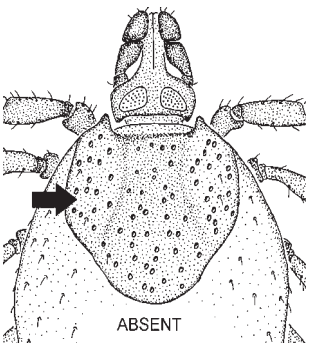

LARGE

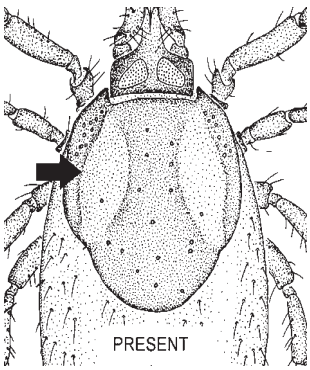
Questing: this is the behaviour used by some ixodid ticks to get onto their hosts. The ticks wait on vegetation for long periods. When they sense a host approaching they stretch out their front legs and will grasp the hair coat of their host.

Reticulation: a rough appearance of the integument in the pattern of a net.

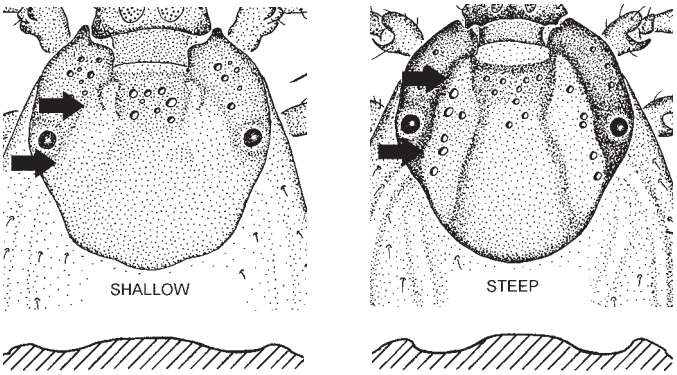
Rugosity: a rough appearance of the integument in the pattern of fine waves or wrinkles.

Scapular groove presence: in *Ixodes* the cervical fields are often not well developed. In some species the scapular groove at the outer margin of the cervical field is **absent**, but usually some form of groove is **present** as a rise in the level of the scutum toward the outer margin. These grooves are also known as lateral carinae in *Ixodes* species.


ABSENT


PRESENT

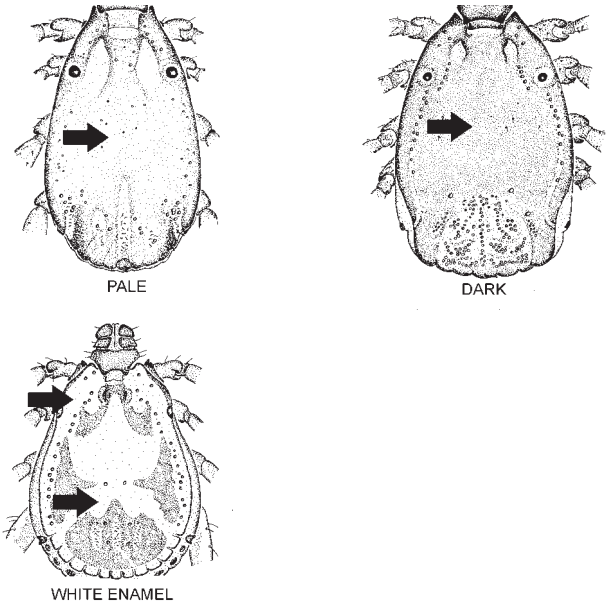
Scapular grooves profile: on the scutum or conscutum there is on each side a cervical field and a scapular field in the lateral area. The margin between the cervical field and the scapular field is known as the scapular groove. It often appears as a change in level between the depressed cervical field and the raised scapular field. This groove may be **shallow**, or **steep**. The lower drawings are cross sections.



Scapulae: the paired points of the scutum or conscutum that are next to the basis capituli; they are like shoulders.

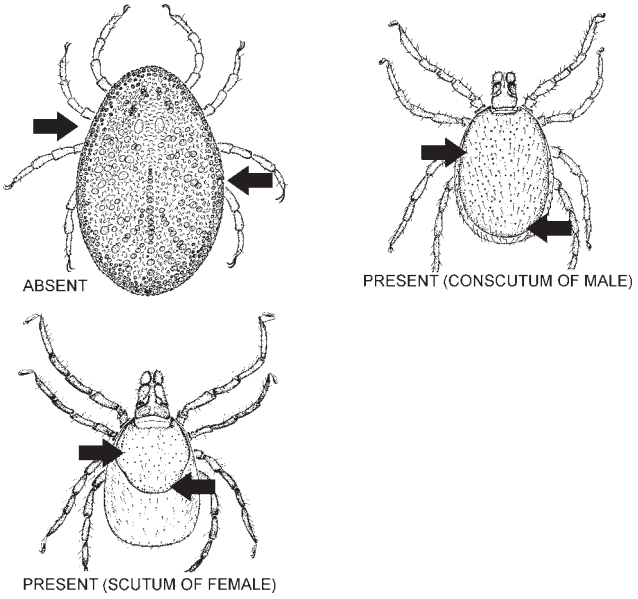
Sclerotized: hardened, as in the case of the scutum and anal plates, in comparison with the softer and flexible integument on the rest of ixodid ticks. May be called sclerotinized, after the substance sclerotin.

Scutum or conscutum colour: the scutum is the hard plate on the anterior dorsal surface of females, in males a similar plate called the conscutum covers nearly all the dorsal surface. The colour may sometimes be **pale** yellowish but is usually **dark** brown, in some ticks in addition to the brown base colour there is **white enamel** or ornamentation (other ticks have different colours of enamel, see Plate 1 and 4).

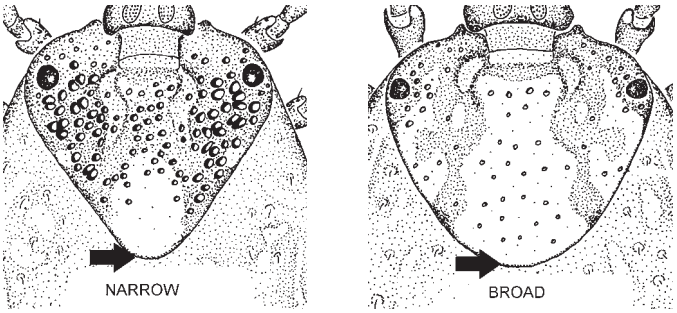


Scutes: these are sclerotized or hardened plates on the ventral surface of the festoons of some ticks, particularly species of *Amblyomma*.

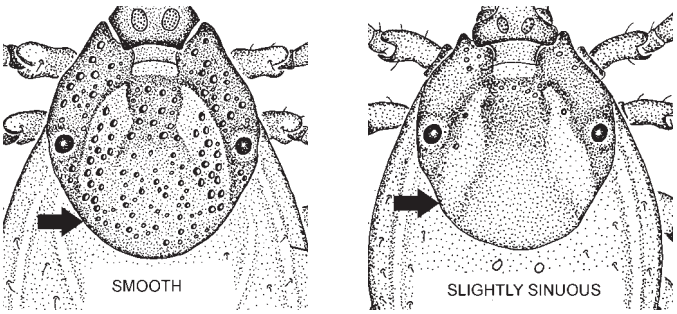
Scutum or conscutum: ticks are grouped either in the family Argasidae (argasids) in which a hard plate (scutum in females and conscutum in males) is **absent** from the dorsal surface, or in the Ixodidae (ixodids) in which this hard plate is **present**. In ixodids the females have a scutum which covers the anterior half of the dorsal surface; males have a conscutum which covers most of the dorsal surface.

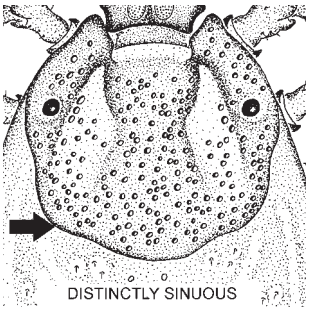


Scutum posterior angle: the scutum is the hard plate on the anterior dorsal surface of female ixodid ticks. In *Amblyomma* the posterior angle of the scutum may form a **narrow** curve, or a **broad** curve.

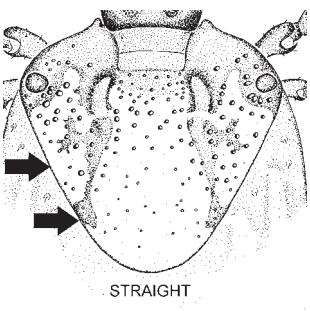


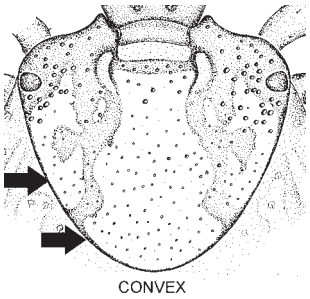
Scutum posterior margin: the scutum is the hard plate on the anterior dorsal surface of females. It has a characteristic shape, often with a sinuous (= wavy) appearance. The margin may form a **smooth** outline, or be **slightly sinuous**, or **distinctly sinuous**.





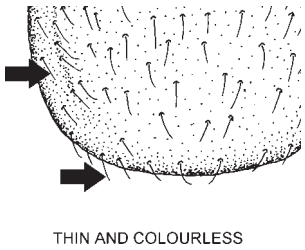
Scutum sides: the scutum is the hard plate on the anterior dorsal surface of females. In *Amblyomma* females the shape of the lateral margin of the scutum varies from almost **straight**, to **convex**.

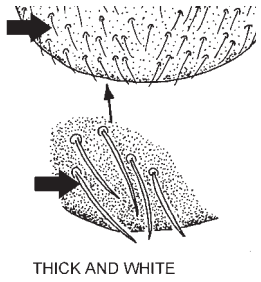




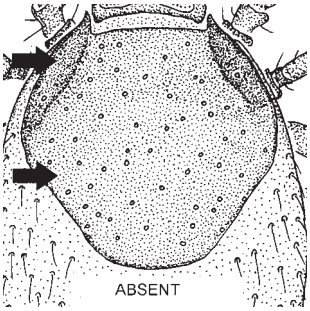
Segment: the articles of the palps and components of the legs are often called segments. A more fundamental definition of segments in arthropods is repeated and similar divisions of the main body such as in a millipede but this type of segmentation is obscured by the adaptations of the tick body.

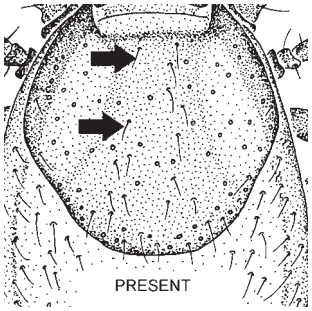
Setae on alloscutum: in *Ixodes* females these setae are either individually **thin and colourless**, or they are individually **thick and white** coloured against the dark background of the integument. In the latter case they can give the posterior part of the tick a shining appearance. Some other ticks such as *Rhipicephalus pulchellus* have thick white setae.



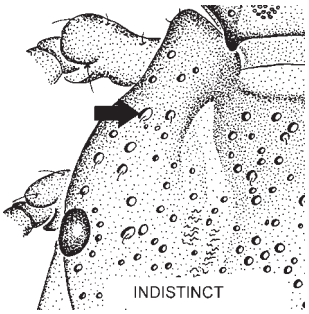


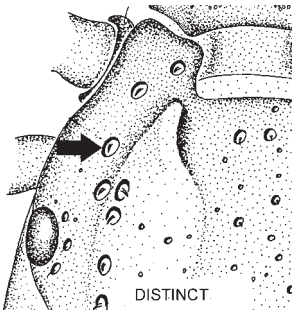
Setae on scutum: in *Ixodes* adults the scutum (and conscutum) setae may be **absent** giving a smooth appearance, or setae may be **present**, either sparsely or thickly.





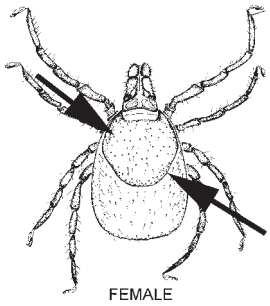
Setiferous punctations: in female and male *Rhipicephalus* the punctations can be divided into those that have visible setae in them (setiferous or pilose) and those without setae which are called interstitial (see Plate 2). The setiferous punctations are usually fewer in number and larger than the interstitials. They tend to occur in 6 vertical columns. On each side: one column along the scapular field, one along the scapular groove and one at the margin of the central field. This is conspicuous in *Rhipicephalus simus* and is often called the *simus* pattern of punctation. These punctations and this pattern are either **indistinct**, or **distinct**.

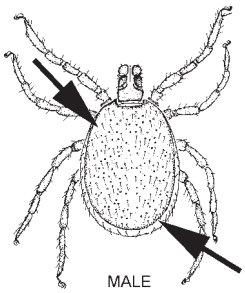




Setose: having a dense covering of setae. The term pilose means the same. Setae may also be called hairs, but strictly, hair is a characteristic of mammals.

Sex: it is important to know what sex a specimen of an ixodid tick is for identification to species. Ixodid ticks have mouthparts protruding to the anterior and pulvilli pads between the claws of the legs. In **female** ixodids there is a scutum (hard plate on integument) in the dorsal anterior region. In **male** ixodids there is a similar conscutum but this covers most of the dorsal surface. For identification of argasid ticks it is not usually necessary to know the sex. Argasid ticks have no scutum or conscutum, the mouthparts are ventral and there are no pulvilli pads between the claws. Argasid females have a large genital aperture which spans the area between the coxae, in males it is half this width (Plate 3).



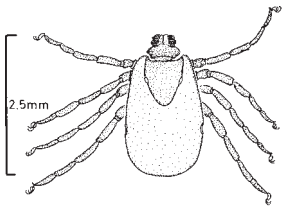


Shagreen: a rough appearance of the integument in a pattern of many small fine points; often appears as wrinkles.

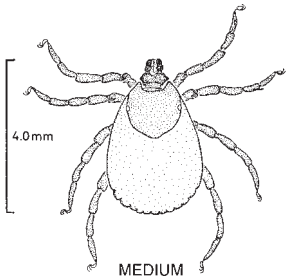
***Simus* pattern**: in *Rhipicephalus* species the setiferous punctations are often in four irregular columns down the scutum or conscutum. This pattern of four columns is very distinct in *Rhipicephalus simus.* There is usually another column of setiferous punctations to the outside of each lateral groove.

Sinuous: having an outline of a complex curve, forming a wave.

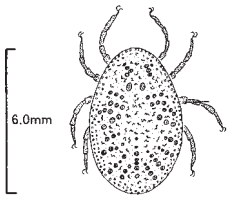
Size of adult: unfed adult ticks of different genera vary in size from **small** (2mm to 3mm long including mouthparts), to **medium** (4mm to 5mm), to **large** (6mm to 8mm). However, within species there may be large variations in size of the sexes, and of any adults depending on how well they fed as nymphs.



SMALL



MEDIUM

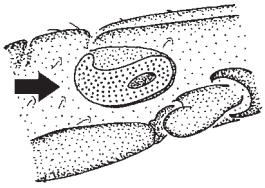


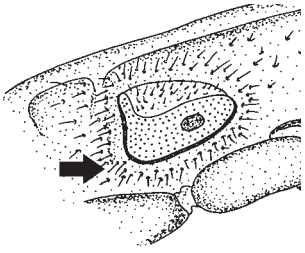
LARGE

Species: in the case of ticks this is the name given to a population in which the individuals are all capable of interbreeding to produce fertile offspring of the same kind. It is very difficult to define species in practice. For example some populations of different species can interbreed sufficiently to produce fertile hybrid young. Species have a binominal name consisting of the genus name (for example *Hyalomma*) and the specific name (for example *dromedarii*). (The term binomial is also used in this context.) Well known ticks often have a vernacular or common name, for example: The camel tick, for *Hy. dromedarii*. It is clearest to use the scientific name. Difficulties in defining species hve lead to trinominal names for sub-species such as *Hyalomma anatolicum excavatum*. The concept of species is one of the fundamental problems in biology. Thus readers of this book should be cautious when they use species names and should expect that some of the names used here will change. This has happened often in tick biology and many older species names for ticks are no longer valid. The 2014 revision of this guide follows the list of species names by Guglielmone *et al.* 2010, Zootaxa, 2528, 1-28.

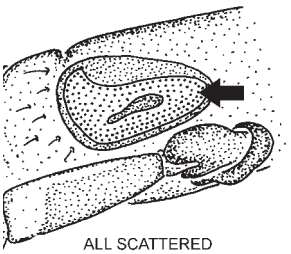
Spiracle: the opening of the air breathing tubes (= tracheae) onto the surface of the tick. In ixodids it has the form of large pore within a large hard plate posterior to the fourth legs. Argasid spiracles are smaller.

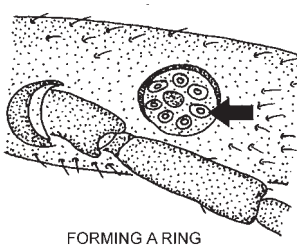
Spiracle areas: on the integument of females and males in the area of the spiracles there are setae. In most ticks there are **sparse** setae, in some ticks there are **dense setae** in this area (a setose appearance).


SPARSE SETAE


DENSE SETAE

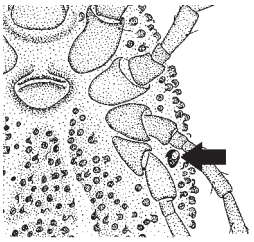
Spiracle goblets: the spiracles are the openings of the air breathing tubes (= tracheae) which occur as large pores in plates on the integument of ixodid ticks. Also on the spiracle plate are pores of the goblet structures. These pores are usually **all scattered** over the surface of the plate but in *Dermacentor nitens* they are shaped **forming a ring**.

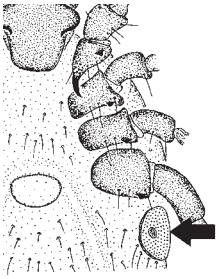

ALL SCATTERED


FORMING A RING

Spirochaetosis: a disease caused by infection with spirochaete bacteria, for example *Borrelia* species causing borreliosis in cattle, fowl spirochaetosis, and endemic relapsing fever in humans.

Spiracular plates: the spiracles are the openings of the air breathing tubes (= tracheae) which occur centrally as pores in plates on the integument. In argasid ticks these plates are **small and between legs 3 and 4**, in ixodid ticks they are **large and posterior to legs 4**.


SMALL AND BETWEEN LEGS 3 & 4

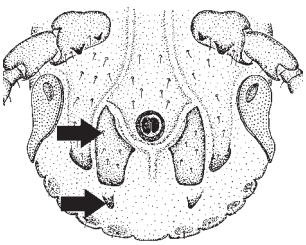

LARGE AND POSTERIOR TO LEGS 4

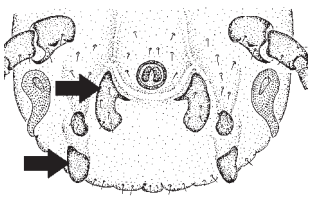
Spur: a sharp projection from any sclerotized part of the surface of a tick. On the coxae there may be an internal and an external spur. Internal means next to the area in the midline of the tick and external means close to the outer margin of the tick.

Striations: very narrow folds which look like parallel lines on the integument of ixodid ticks. They occur in those areas where the integument is not sclerotized such as the alloscutum. The striations are folds which permit some expansion of the body during feeding.

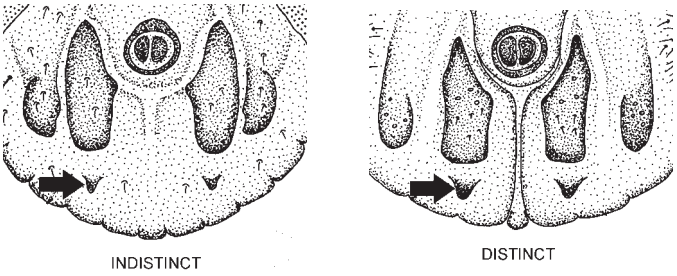
Stripe: areas on the scutum or conscutum of *Amblyomma* ticks without enamel, thus having the usual dark colour of a plain scutum.

Sub-anal plates alignment: these are a pair of ventral plates typical of *Hyalomma* males. They occur posterior to the adanal plates. Usually they are in vertical alignment (= in-line) **with adanal** plates but they may be aligned more laterally **outside adanal** plates. This character is clearest in unfed males, when they feed the relative positions may become distorted.


WITH ADANAL


OUTSIDE ADANAL

Sub-anal plates distinctness: these are a pair of ventral plates typical of *Hyalomma* males, they occur below the level of the adanal plates. They may be **indistinct** due to small size or pale colour, or they may be **distinct** due to larger size and darker colour.



Syncoxa: in *Ixodes* species the coxae may appear to be in two parts with different textures of their anterior and posterior parts.

Tarsus: the last segment of the legs, on which the claws occur.

Taxonomy: the science of placing living organisms into groups based on similarities of structure and other characters. (Systematics is the study of classification systems.)

Teeth: see Hypostomal teeth.

Theileriosis: a disease of cattle and sheep caused by infection with protozoa of the genus *Theileria*. The two most important forms are known as East Coast fever and tropical theileriosis.

Telotropic: when the immature stages of a tick are able to feed on both different types of host and same types of host as the adult ticks. For example, rodent hosts and ruminant hosts can support immature stages.

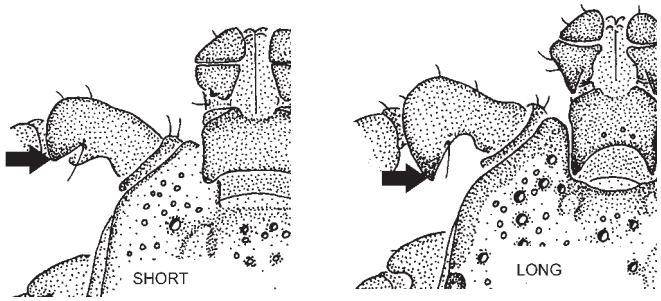
Trachea: the tubes within a tick that permit diffusion of air for respiration into the tick, they connect to the outside at the spiracle.

Transovarial transmission: when a microorganism is transmitted from one vertebrate host to another by infecting a female vector then passing through the eggs to the larvae. When the larvae or later stages feed the microorganism passes to another host.

Transstadial transmission: when a microorganism is transmitted between vertebrate hosts by infecting one stage of the vector then passing to the next stage of the life cycle of the vector during moulting. When the next stage feeds the microorganism passes to another host.

Trapezoid: a structure with an irregular four sided shape. The sides are of unequal length and the angles between the sides are unequal.

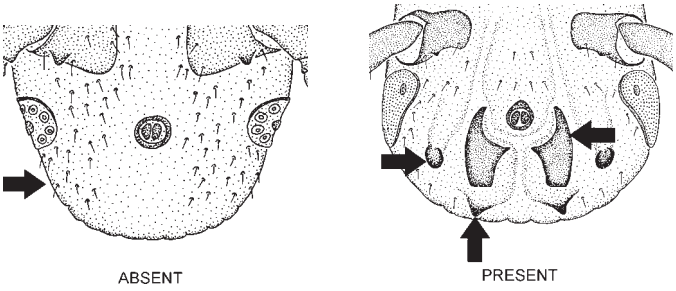
Trochanter 1 posterior spur: the trochanter is the second segment of the leg, it usually protrudes from the body margin. In female and male *Haemaphysalis* there is a triangular shaped spur pointing to the posterior from the trochanter. This is **short**, or **long**.



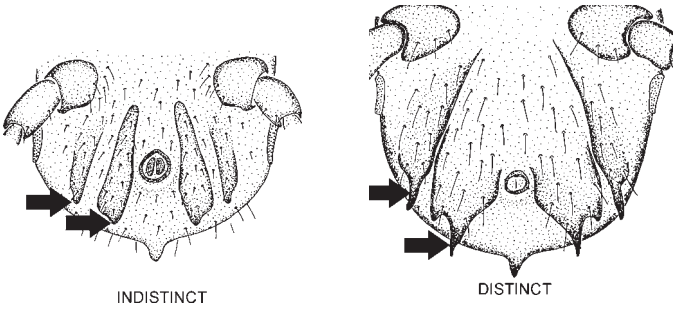
Truncated: having a shape which appears to be cut short.

Vector: in the study of disease relationships (= epidemiology) this means an insect, mite or tick that transmits infectious agents to vertebrate animals. The transmission is active because it depends on the feeding of the vector which transfers itself and the infectious agent to new hosts. Ticks are vectors of many viruses, bacteria and protozoa.

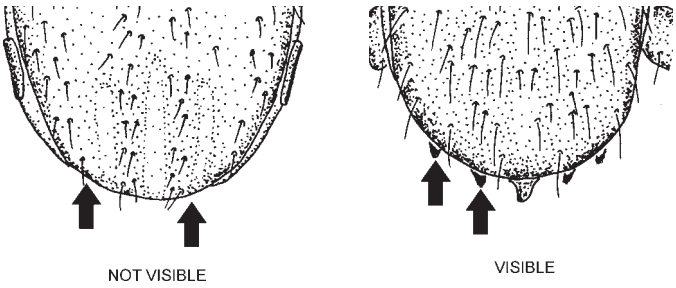
Ventral plates: in males hard plates may occur on the ventral surface of the integument. They may be **absent or indistinct**, or they are clearly **present**. When present in *Hyalomma*, and *Rhipicephalus* they form the adanal, accessory adanal and sub-anal types of plate grouped around the anus. They are also known in general as anal plates.



Ventral plate spur distinctness: the ventral plates of male *Rhipicephalus* (*Boophilus*) vary in the distinctness of the spurs which project to the posterior of the adanal plates and the accessory adanal plates. They are either **indistinct**, or **distinct**. This character is related to the character below of the visibility from the dorsal surface of these spurs.



Ventral plate spur dorsal visibility: in male *Rhipicephalus* (*Boophilus*) the spurs which project from the posterior of the adanal plates and accessory adanal plates are either **not visible** from the dorsal view, or are **visible** from the dorsal view. This character is related to the previous one of the distinctness of these spurs when seen ventrally.



Ventral: the surface of an animal that faces towards the ground when the animal is in its normal moving position with its legs on the ground. In ticks the legs, anus and genital pore are all on the ventral surface.

Wrinkled: having a rough texture in the form of fine corrugations or points that are like a series of small folds or waves. More detailed terms for variations of this character that are used in some tick indentification keys are: reticulation, rugosity and shagreen. (See these entries in this glossary and Plate 2.)

Chapter 2. Biology of Ticks and Methods for Identification.

Relationship to other animals.
Ticks are related to animals such as spiders and insects. These are all animals without a spine (= invertebrates) belonging to a group called the phylum Arthropoda. All members of this group have an external skeleton (= exoskeleton). This is a hard outer covering to which the muscles are attached internally. The exoskeleton also contains and protects organs such as the gut and reproductive apparatus. Arthropods include crustaceans, insects, spiders, scorpions and mites. Ticks are within a group called the order Acari, which consists mostly of mites. Ticks are very similar to mites but are larger and all of them only feed as parasites. There are two main groups of ticks called the families Argasidae or argasids, and the Ixodidae or ixodids. Argasid ticks are often called soft ticks because they do not have hard plates on their bodies. The ixodids with these plates are often called hard ticks. There are at least 866 described species of tick in the world.

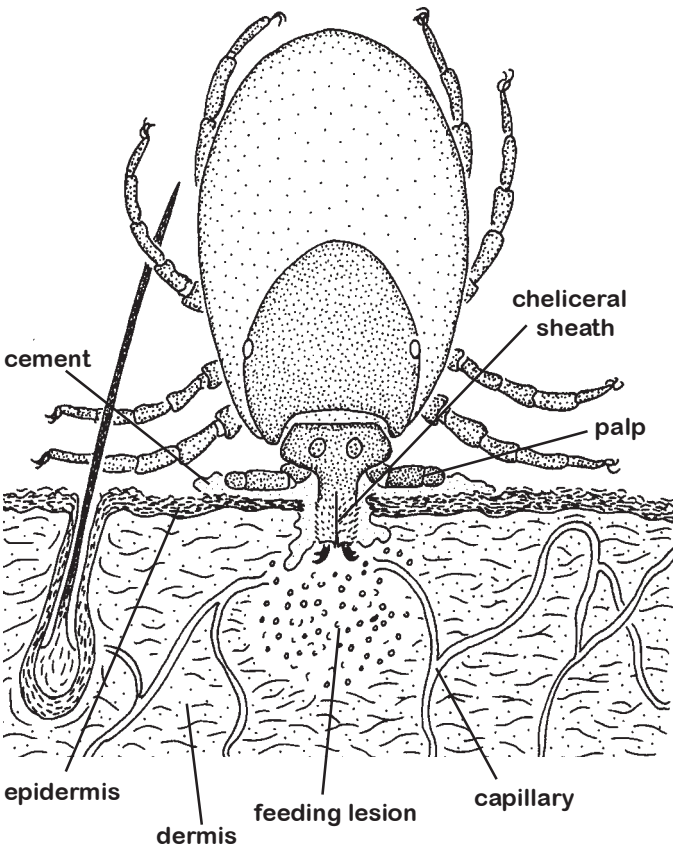
The relationship of ticks to other arthropods.

Arthropoda (a phylum) = insects, ticks, crustaceans ... ...
Arachnida (a class) = spiders, ticks, mites ... ...
Acari (an order) = ticks and mites
Ixodida (a sub-order) = ticks
Argasidae (a family) = soft ticks
Argas (a genus)
Argas persicus (a species)
Ixodidae (a family) = hard ticks
Amblyomma (a genus)
Amblyomma gemma
(a species)

Feeding.
All feedings of ticks at each stage of the life cycle are parasitic. Ticks feed only on the blood of their hosts. The ticks crawl onto their host and attach to the skin with their mouthparts. These consist of chelicerae, hypostome and the palps (see drawing opposite and Plate 1). The chelicerae and hypostome form a tube which penetrates the host's skin. Often a material (= cement) is secreted in the saliva. This glues the palps to the outer epidermis and glues the rough cheliceral sheath and toothed hypostome to the dermis. The chelicerae consist of moveable rods with sharp claws at the end. These cut a hole in the dermis and break the capillary blood vessels very close to the surface of the skin, forming a feeding lesion. The ticks feed on the blood and lymph released into this lesion.

The feeding of ixodid ticks is slow because the body wall needs to grow before it can expand to take a very large blood meal. Larvae take typically 3 to 5 days to fully engorge with blood, nymphs 4 to 8 days, and females 5 to 20 days. When the ticks have fully engorged with blood they detach from the host's skin and drop to the ground. Males of most types of ticks feed but do not expand like the females. They feed enough for their reproductive organs to mature. Males in the genus *Ixodes* have active reproductive organs when they moult from the nymphal stage and do not need to feed. The argasids feed more rapidly, for up to several hours. They only take small blood meals but take many of them in each stage of the life cycle. They do not have the complex attachment to the skin that ixodid ticks have.

Feeding of an ixodid female tick at skin of host.



Ticks find their hosts in several ways. Some ticks live in open environments and crawl onto vegetation to wait for their hosts to pass by. This is a type of ambush and the behaviour of waiting on vegetation is called questing (see Plate 1). Thus in genera such as *Rhipicephalus*, *Haemaphysalis* and *Ixodes* the larvae, nymphs and adults will quest on vegetation. The ticks grab onto the hosts using their front legs and then crawl over the skin to find a suitable place to attach and feed. Adult ticks of the

genera *Amblyomma* and *Hyalomma* are active hunters, they run across the ground after hosts nearby. The general behaviour of seeking hosts in an open environment is described as exophilic. Ticks such as argasids and many *Ixodes* species spend their entire life cycle in their host's nest and attach to their hosts there. This is called endophilic or nidicolous behaviour. Some species such as the dog tick *Rhipicephalus sanguineus*, have adapted to living in housing. This is called domestic behaviour.

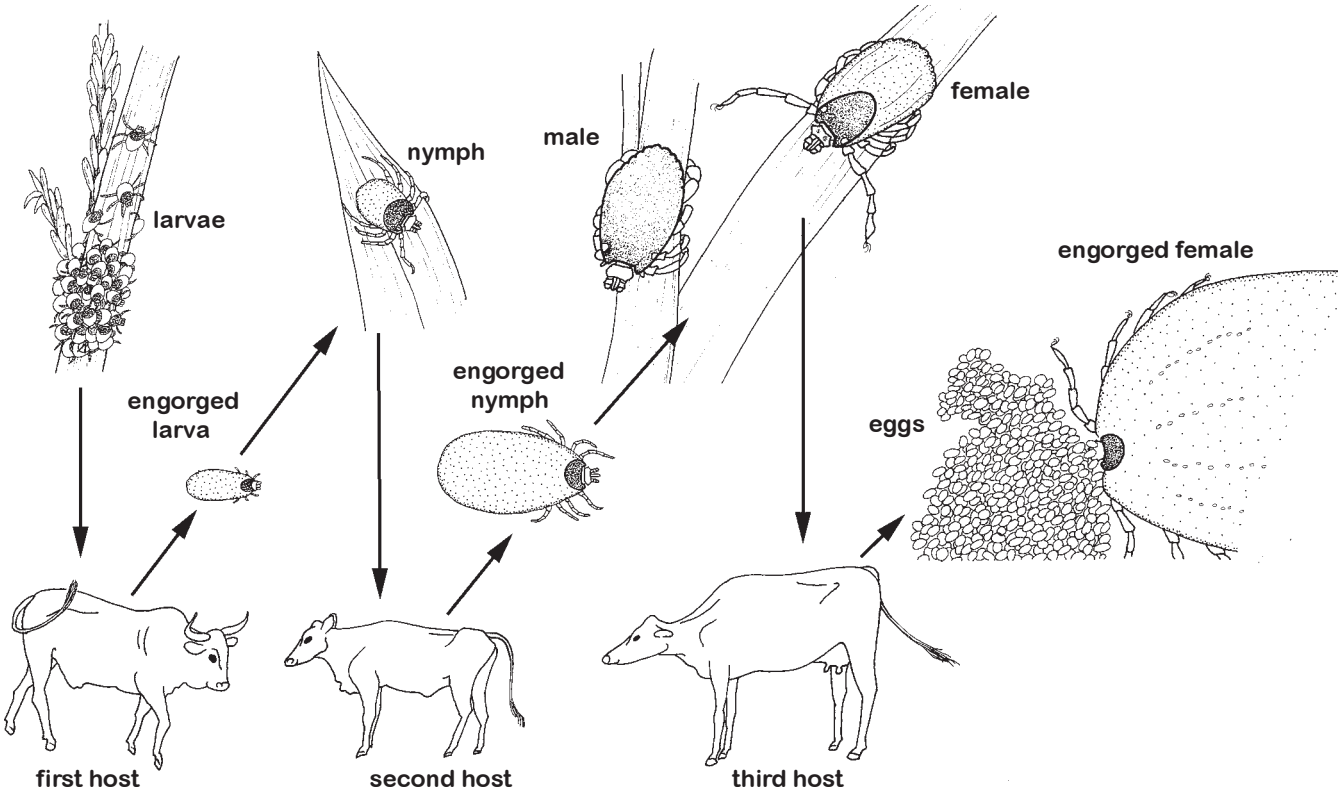
Reproduction.
In the hard ticks mating takes place on the host, except with *Ixodes* where it may also occur when the ticks are still on the vegetation. Male ticks remain on the host and will attempt to mate with many females whilst they are feeding. They transfer a sac of sperm (= spermatheca) to the female (see Plate 2). The females mate only once, before they are ready to engorge fully with blood. When they finally engorge they detach from the host and have enough sperm stored to fertilize all their eggs. Female hard ticks lay many eggs (2 000 to 20 000) in a single batch. Female argasid ticks lay repeated small batches of eggs. Eggs of all ticks are laid in the physical environment, never on the host.

Three-host tick life cycle.
The illustration below shows the sequence of feeding and moulting during the life of individual ticks of a typical three-host species. This is the commonest type of life cycle. Larvae develop in the eggs until ready to hatch, usually in several weeks. Larvae feed once on a host, then detach from the host and hide in sites such as soil or vegetation. They moult to nymphs. Nymphs feed once and moult in the same way as larvae. From the nymphal moult either a female or male hatches. The female feeds once and lays one huge batch of eggs. The depleted female then dies. The male may take several small feeds, mate and then die. Ticks that have recently hatched from eggs or from moulting have soft bodies and are inactive for one to two weeks until the external body wall hardens. The life cycle of three-host ticks is slow, from six months to several years.

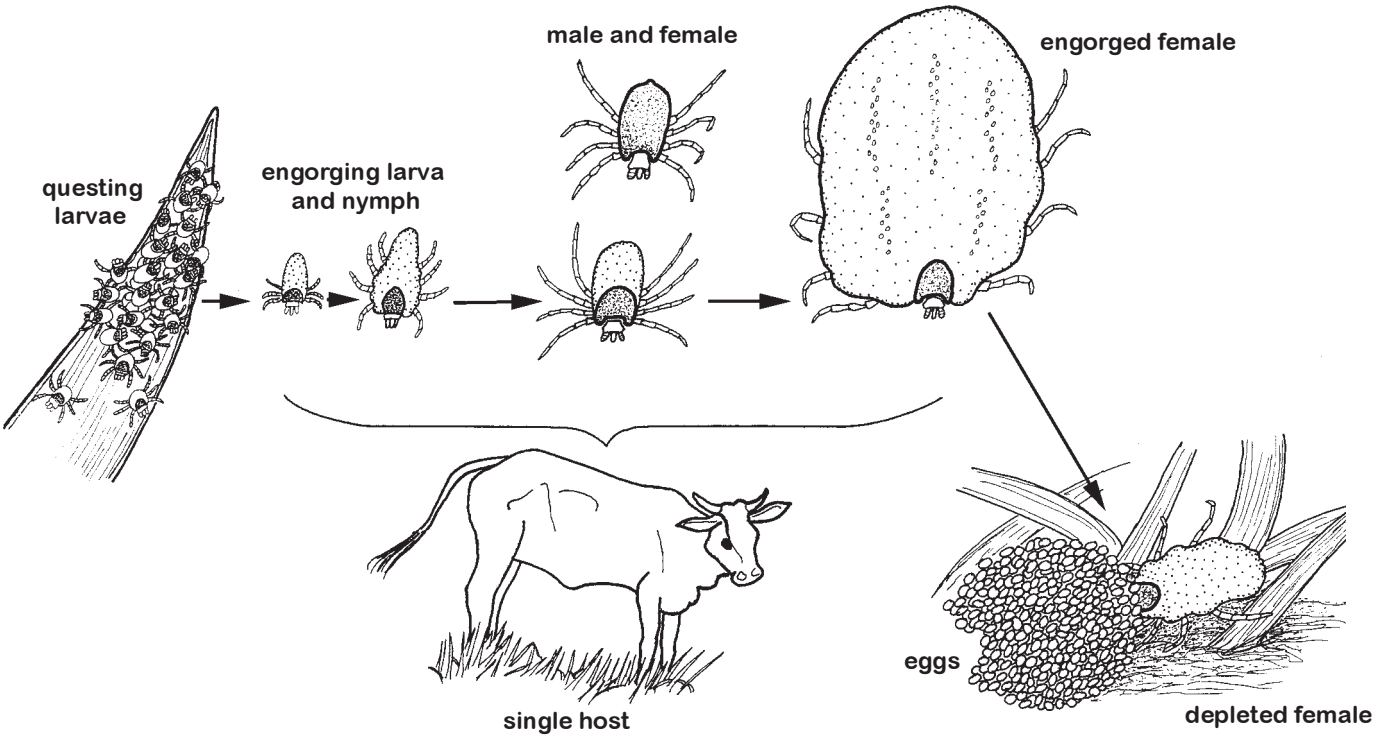
One and two-host tick life cycles.
The illustration overleaf shows the sequence of feeding and moulting during the life of individual ticks of a typical one-host species. This is a less common type of life cycle but it occurs in all the *Boophilus* sub-genus of the *Rhipicephalus* genus and in other genera. Eggs are laid on soil. Larvae hatch after several weeks of development and crawl onto vegetation to quest for a host. When they have completed feeding they remain attached to the host and moulting occurs there. The nymphs then feed on the same host and also remain attached. After another moult the adults hatch and then feed on the same host. The adults will change position on the same host for mating. Thus all three feedings of any individual tick occur on the same individual host. The life cycle of one-host ticks is usually rapid, for *Rhipicephalus* (*Boophilus*) it takes three weeks for the feedings on one host and two months for egg laying and larval development. The two-host life cycle is similar but only the larvae and nymphs feed on the same individual host, and the adults will feed on another host. *Hyalomma detritum* and *Rhipicephalus evertsi* have two-host life cycles.

Argasid tick life cycle.
The illustration overleaf shows the sequence of feeding and moulting during the life of individual ticks of an argasid species. Most argasids are multi-host ticks, but *Otobius megnini*

Three-host tick life cycle (the example is *Rhipicephalus appendiculatus*).

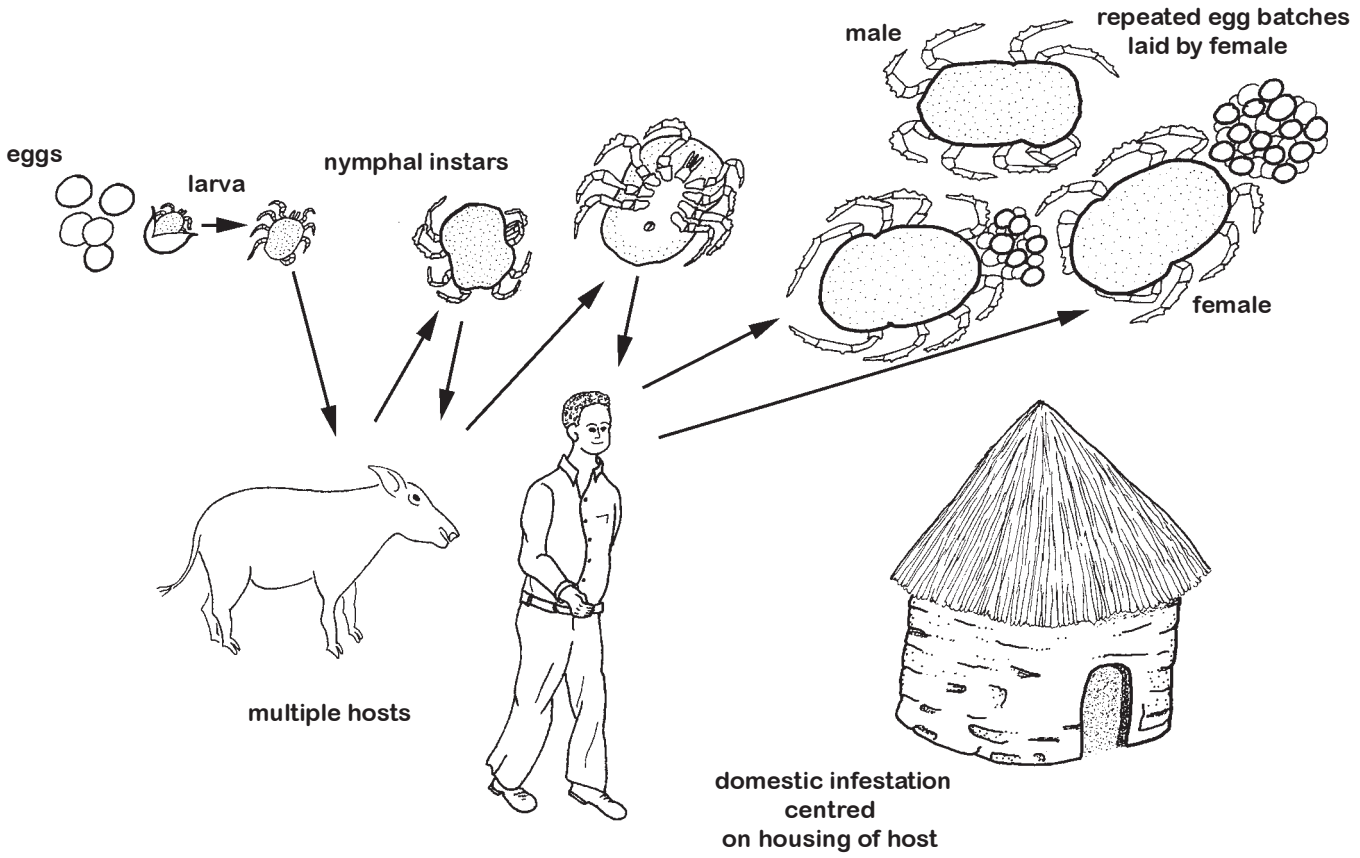


One-host tick life cycle (the example is *Rhipicephalus* (*Boophilus*) *decoloratus*).



has a one-host life cycle. Larvae either feed rapidly, or during several days in many species, then detach from their host and moult. In some argasids the larvae do not feed, they moult directly to the first nymphal stage. The first nymphal stage feeds rapidly then moults to a further nymphal stage. Similar feedings follow on different individual hosts and there are often a variable number of nymphal stages. When adults develop the females feed rapidly on an individual host, then produce a small batch of eggs

Argasid tick life-cycle (the example is *Ornithodoros moubata* group, other argasid ticks may differ considerably).



(100 to 500). Argasid eggs are larger than ixodid eggs. The females repeatedly feed then lay eggs, with up to six feedings and egg layings. Mating occurs off the hosts.

Habitats.
A tick's habitat is composed of the variety of living and non-living things in the space in which it lives that are good or bad for its survival. Ticks are adapted to two extremely contrasting components of their habitat: the physical environment and their host. When ticks are moulting and then questing in the physical environment they are in danger of drying out, starving and freezing. They are also exposed to predators such as ants and to pathogens such as fungi. These adverse factors limit the type of habitats that a species will be found in and knowledge of the typical physical habitat of a species is an aid to identification. The needs of the same tick when feeding alter fundamentally because it is no longer in danger of drying out or starving but is in danger of being removed by the host's grooming or having its feeding reduced by host immunity. Most ticks have adaptations in their behaviour and physiology of feeding to reduce these host reactions. Usually these adaptations work best for a certain type of host. The preferences of hosts for certain habitats will influence distribution of hosts and the ticks on them.

Hosts.
Ticks have characteristic species of hosts to which they are adapted. Hosts are usually in a group of similar species. For example all the *Rhipicephalus* (*Boophilus*) species are adapted to feed on cattle, but some may survive by feeding on sheep or antelope. Because *Rhipicephalus* (*Boophilus*) are one-host ticks all stages must be able to feed on the same species of host. Compare this with *Rhipicephalus appendiculatus* which is found most commonly on cattle. All stages feed well on cattle and similar hosts in the family Bovidae such as sheep and many wild species such as buffalo. Species of ticks in which the immature stages only feed on the same hosts as the adults are monotropic. Species in which the immature stages only feed on different types of hosts from the hosts of adults are ditropic. Finally species in which the immature stages can feed on both different types and same types (for example rodents and ruminants) of hosts as the adults are telotropic.

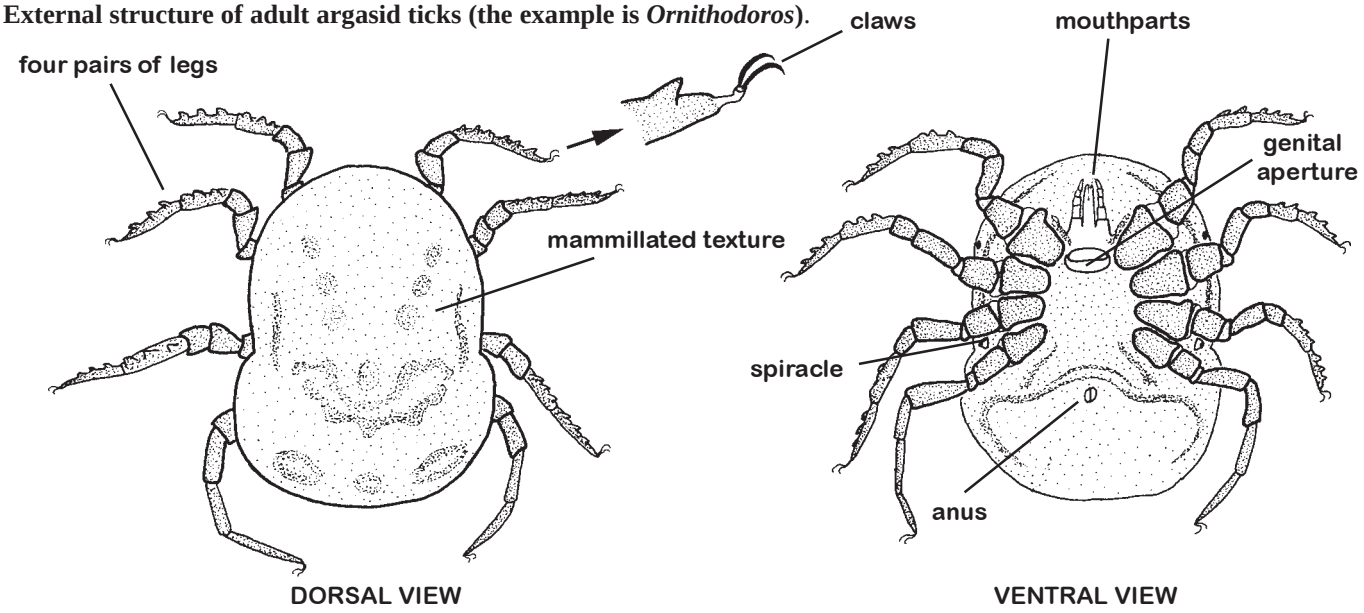
The survival of a population of ticks depends on the presence of hosts suitable for reproduction by the adults. These hosts are known as maintenance hosts. These hosts are more limited in variety than the hosts on which larvae and nymphs of three-host ticks can survive. They are also more limited than those on which adults may attempt to feed but not necessarily survive. To use information of tick hosts for identification it is important to realize that a species of tick has a characteristic range of host species but may be found much less commonly on many other kinds of host species. For example, carnivorous mammals may be infested temporarily with ticks which have transferred from their herbivorous prey.

Seasonal occurrence.
Many species of ticks are adapted to seasonal variations in climate within their geographical range. In the tropics this is usually to overcome the adverse effects of prolonged dry seasons. Dry environmental conditions are a serious danger to ticks, particularly to the questing larvae which are very susceptible to drying out fatally. The survival of many species is improved if they have a seasonal cycle which reduces these risks. For example *Rh. appendiculatus* in southern Africa has diapause mechanisms which reduce the activity of some parts of the life cycle so that the reproduction of adults is at the beginning of the single wet season. This is followed by peak numbers of larvae toward the end of the wet season when humidity is highest. Knowledge of the time of year when adults of a species are likely to be found on their hosts is thus an aid to identification.

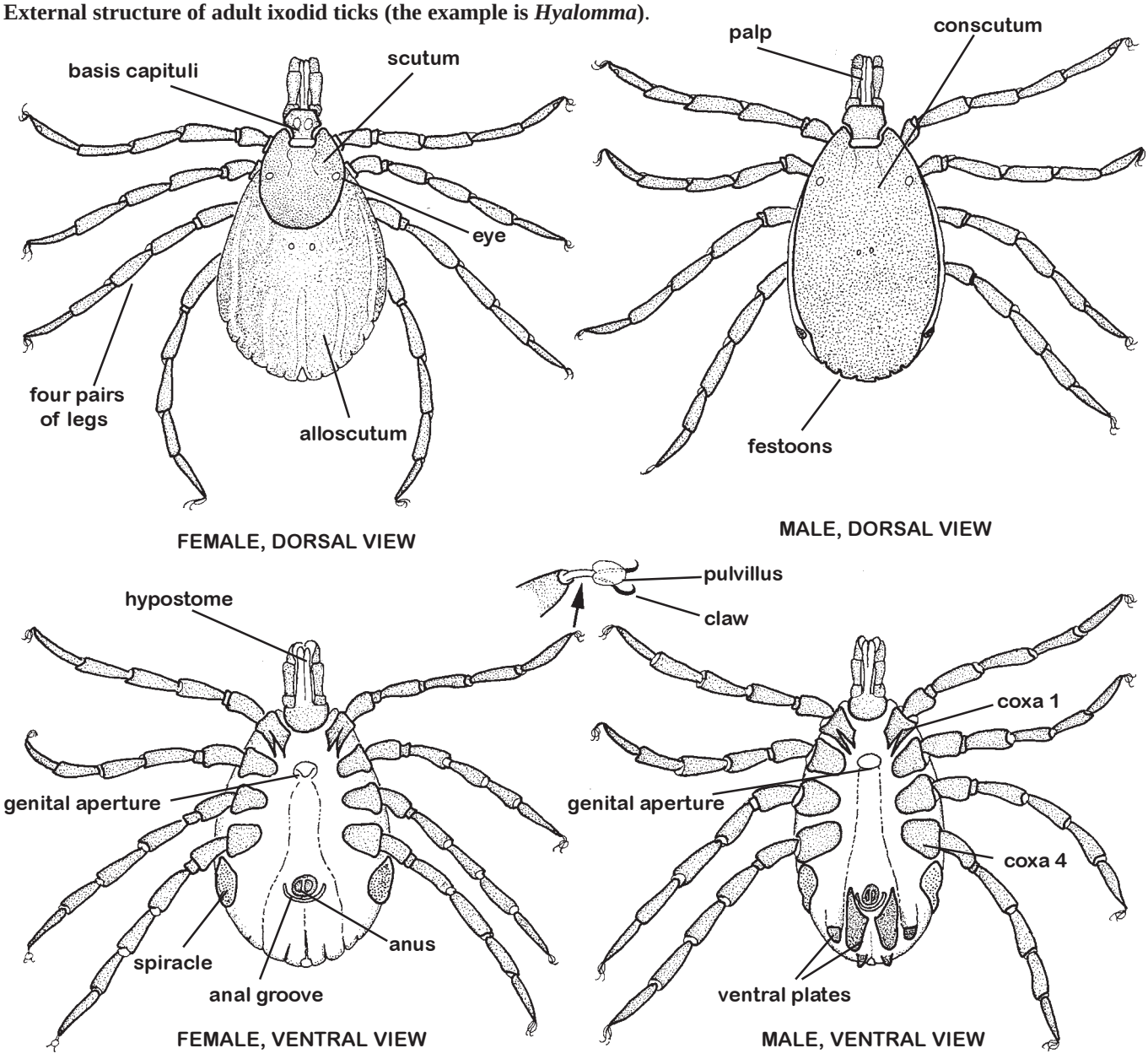
Geographical distribution.
For some ticks there are many published records of the sites in which they have been found. These records can be converted into maps which indicate where the species is likely to be found. If a species has only been recorded north of the Sahara then it is unlikely to be found south of the Sahara. However this aid to identification has several complications. For example the type of habitat in which the species is found is likely to be much more widely distributed than the current geographical range of the tick. Thus a tick found in a similar habitat but a far away geographical area from its usual distribution could have become imported recently. It may be most important to verify this. Popular livestock trading routes are an important clue because ticks are carried very far on livestock in lorries or ships. Another complication is that distribution maps usually only indicate presence or absence of a species. Thus within the general range of a species there are likely to be many smaller areas in which it is absent. However, such areas of sparse numbers are likely to have an unsuitable habitat. The maps in this guide use historical data and current distributions may have expanded or contracted due to environmental or agricultural influences. Historical records of the distribution of ticks may be inaccurate because of mistakes in identification or because the name of the tick has changed. The maps in this guide are derived from a wide variety of sources, mostly published but some unpublished, and some records have been ignored because of their unreliability. These maps are not definitive statements of tick distribution and should not be used or quoted as if they are because they are intended only as aids to tick identification. The island of Madagascar (Democratic Republic of Madagascar) is included in this guide because the domestic animals there share some of the important tick species found in Africa.

External structure.
The illustrations overleaf show the external structure (= morphology) of ticks. Also shown in the diagrams of the life cycles and in Plate 1 are comparisons of immature and adult, unfed and fed ticks. Larvae have three pairs of legs and no genital aperture. Nymphs have four pairs of legs and no genital aperture. Females have four pairs of legs and a large genital aperture. Males have four pairs of legs and a genital aperture in the same position as the female. All ixodid ticks have a scutum or a conscutum as a hard plate on the dorsal surface. Argasid ticks lack this scutum. Larvae and nymphs can usually be placed in the correct genus by comparison with the mouthparts, coxae and other similar features of adults. Identification of immature ticks to species is usually work for an expert but for some studies it is possible to identify immature ticks to species if they are closely associated with a dominant species of adult.

External structure of adult argasid ticks (the example is *Ornithodoros*).



External structure of adult ixodid ticks (the example is *Hyalomma*).



Diseases associated with ticks.
Ticks are harmful parasites that directly cause a variety of disease states in their hosts. Damage can occur without any other pathogen or parasite being transmitted by the ticks. For example *Amblyomma variegatum* adults cause scarring on teats of cattle sufficient to reduce suckling efficiency. Ticks are most notorious as the transmitters (= vectors) of other organisms, such as bacteria, that cause disease (= pathogens). It is to reduce these diseases that much money and effort is spent on the control of ticks using a wide variety of treatments and management techniques. It is beyond the scope of this book to describe the associated diseases but the combined knowledge of these diseases and the ticks associated with them helps in the diagnosis of both.

Collection of ticks from hosts.
Tick specimens are usually obtained from their hosts. It is seldom feasible to examine the whole of a livestock animal for ticks, but in some studies the animal is cast to the ground or held in a crush then one half of the body is searched fully. It is often more efficient to examine a sample of fixed areas of the host. This is very useful for ticks which are known to have sites where they prefer to feed (= predilection sites). For example, on a herd of cattle in the highveld of Zimbabwe expect to find: *Rh. appendiculatus* adults on the ears; *Am. variegatum* adults on the dewlap, axillae, udder and groin; *Rh.* (*Boophilus*) *decoloratus* or *Rh.* (*Boophilus*) *microplus* generally on the shoulders, dewlap, and belly; *Hy. truncatum* adults mostly around the anus. (Axillae = between forelegs and body, dewlap = flap of skin on lower surface of neck, muzzle = front of head, flank = side of main body, groin = between backlegs and body, perineum = between anus and genital organs, sternum = ventral surface of thorax.) An effective way to detect adult ticks, specially when they are engorging, is to feel the hair coat of the host with the palm of your hand. Smaller domestic animals in a clinic can be examined in the same way. To find immature ticks or unfed adults the hair can be parted systematically using forceps. Protect yourself from ticks attaching to you when collecting them.

To remove ticks from host skin whilst retaining their good condition for identification use good quality steel forceps. These should be of medium size with blunt points and serrated inner surfaces. The forceps is used to grip the tick firmly over its scutum and mouthparts as closely to the host skin as possible, then pull strongly and directly out from the skin. Usually the mouthparts will be removed with the rest of the tick and often with a plug of cement (see Plate 2). This can be removed later using two fine forceps under a dissecting microscope. For identification of *Rhipicephalus* (*Boophilus*) species it is important to examine the mouthparts for arrangement of teeth. However, these may be damaged during removal of the tick from the host. For this group and other genera it is very useful to have males in addition to females for identification. Take care to remove the males which often re-attach for mating pressed to the ventral side of engorging females, near their mouthparts (see Plate 2).

If the ticks are required live for further studies they should be placed in strong tubes containing a piece of damp paper. During collection it is useful to seal the tube with a rubber membrane made from rubber gloves or similar material and held with a rubber band or tape. This should have a small slit cut in it through which the ticks are pushed. For transport to the laboratory use a separate ventilated plug. This can be made of cotton wool or a perforated screw cap. These tubes should be labelled then kept in a sealed plastic bag containing wet cotton wool or paper to maintain high humidity. The ticks should be kept cool over ice but take care not to freeze them fatally. To preserve the ticks at the collection site place them directly into 70% alcohol (8 parts laboratory alcohol = 90% ethanol, plus 2 parts water), or 5% formalin (5 parts concentrated formaldehyde solution plus 95 parts water). If the ticks are to be used for any form of analysis of their nucleic acids or for searches for nucleic acids of transmitted pathogens then the specification of the ethanol or formaldehyde should be conform to the needs of the tests used. Ticks should be collected in 25ml capacity glass tubes with thick walls and metal screw caps. These are usually known as Universal tubes and their thick glass walls make them more durable than plastic tubes. To label collection tubes in the field the best method is to use a lead pencil to write a small label on white card. This label is placed **inside** the tube with the ticks. Labels on the outside of the tubes should only be written on tape wrapped completely around the tube. Field collection data should include date, site, collector, host species and other information relevant to the study.

Collection of ticks from vegetation and other environments.
Some species of ticks can be collected whilst they are unfed and questing on vegetation. If they are sufficiently dense in numbers adult *Rhipicephalus* and other ticks can be picked by hand from grass stems. More often it is efficient to use a trap which mimics a host. This consists of a 1m square piece of white cloth such as cotton towelling. It is fitted with a bar at the front and a cord for pulling it slowly across the vegetation for 5m to 10m (for approximately 30 seconds of walking, and repeated after removing the ticks). Larvae, nymphs and adults will grip temporarily onto the dragging cloth and can be collected with a forceps.This method works well for larvae and nymphs of questing species but is less efficient for adults and hunting species. Endophilic ticks can be collected directly from the nests or shelters of their hosts using forceps to probe in cracks and under pieces of dry dung, spider webs etc. This is very effective for moulting nymphs and adults of *Hyalomma* ticks in cattle sheds. *Ornithodoros* ticks can be collected in the same way. Ticks are auto-fluorescent in ultraviolet light. This makes them visible in the dark if illuminated with a portable ultraviolet lamp.

Preservation and labelling of ticks.
Long term collections of ticks are stored wet. Laboratory alcohol (= 90% ethanol) at 80%, plus water at 15% and glycerol at 5% is best. The glycerol prevents drying out when the ticks are examined in air. Colours of ticks fade in alcohol but this can be reduced if 1% percent of chloroform is added to the alcohol. This is mainly useful if photographs are required of the ticks. For photography it is helpful to first kill the ticks in a way that prevents the legs from curling up. Use Boardman's solution (17% ethanol, 3% ether, 80% water) for 24 hours, then transfer the ticks to the usual preservative. The tubes ideal for storing ticks in a collection are those with thick glass walls and metal screw caps with a rubber washer, of 5ml capacity and known as Bijou tubes.

Labels for tick collections should be written on card using only India ink (= China ink). This is carbon based and will not dissolve when placed in preservative. A fine draughtsman's pen is necessary to use this ink. The label should include name of the species (if known), date, collector, species of host, site and country of collection. The site should be given as both a permanent place name and as **latitude and longitude**. The use of village names or similar changeable features makes difficulties for later workers. The universally accepted system is to use the global coordinates of latitude and longitude, to at least the nearest minute. These are read from a map of the area, or an instrument to read the global positioning system from satellites.

Example of a label for insertion in a tick specimen bottle.

Boophilus geiggi 5♀3♂ 10imm.
14 June 1994, E.B.M. Koney
from cattle, Kumasi, Ghana
6°45'N 1°37'W

Observing and recording ticks.
Ticks can be identified to genus using the naked eye or a simple hand lens of x10 magnification. To identify most species in this guide a dissecting microscope is required. This is a low power stereoscopic microscope. It must have a range of magnification from x10 to x40, and very preferably up to x80. Intense lighting is essential, from a halogen filled lamp bulb or light emitting diodes.

For preliminary sorting keep the ticks in a dish under the preserving liquid. For some features such as leg colouration it is often useful to observe the ticks under liquid. For final identification it is important to examine ticks dry and cleaned of deposits of glycerol from the preservative. Use tissue paper to blot them dry. When dry the ticks often then appear dirty. The best way to clean them is using an ultrasonic cleaner for 5 minutes whilst they are immersed in 5% sodium or potassium hydroxide solution in water. Alternatively, obtain a very fine artist's brush then cut the bristles down to a small stump. Immerse the tick in a solution of detergent and use this stump to brush the tick clean. If cement adheres to the mouthparts use a fine forceps to pull it

off whilst gripping the tick with a medium forceps. It is most important to view the tick from different angles to observe features of superficial texture such as punctations and grooves. Use a piece of soft wax or artist's modelling material such as "Plasticine". Stick it in a small dish and mould it into a stand with various angles on which to view the tick. The strong lighting will dry out the tick and make it brittle. To avoid this replace it in the preservative regularly, or surround the stand with water and place a lid over the viewing dish when not in use.

The genital aperture of some ticks has important features for identification, specially in *Hyalomma* and *Rhipicephalus*. For detailed examination it is best to cut out the area of integument including the aperture and mount it on a microscope slide with cover slip. Examine the aperture with an ordinary microscope. Use a mounting medium which preserves and clarifies the specimen on the slide. Berlese's medium is suitable: dissolve of chloral hydrate in 20ml of water, add 5ml of concentrated (glacial) acetic acid and 10ml of glycerol, then add 16g of gum arabic (= gum acacia), mix and keep the mixture at 40ºC in a water bath long enough for impurities to sink to the bottom, remove the clear medium above and store this in a dark glass bottle. The genital aperture can be mounted directly into this when removed from a tick stored in 70% ethanol (see Plate 2).It is sometimes useful to rear ticks from immature stages to adults to simplify identification. This requires the ticks to be fed on a suitable host in the laboratory. The ticks are confined in cloth bags fixed to the host. The engorged ticks are then moulted to the next stage at a temperature of 25ºC to 30ºC and 85% relative humidity. The humidity is maintained by keeping the ticks in a sealed container with an open pot of saturated potassium chloride in the bottom. Methods for colonies are described in *Biology of Ticks* by D.E.Sonenshine, below. Obey your local regulations for ethical treatment of animals when doing this.

Features of ticks confusing for identification.
These are illustrated in Plates 1and 2. The relative sizes of larvae, nymphs and adults when unfed and fed is typified in the photograph of the life cycle of *Rh. appendiculatus*. It is most important to be familiar with these different sizes. Engorged female ticks are difficult to examine but most of the necessary features remain visible if the tick is correctly positioned on a viewing stand. The mouthparts may appear unusual because the palps remain splayed apart after the tick has been removed from its host. Additionally a lump of attachment cement may adhere to the mouthparts. Occasionally a male spermatheca remains attached to the genital aperture of a preserved female, appearing as a white sac. The male may remain in the mating position on the female. On the same cattle in some areas there will be *Amblyomma* and *Rhipicephalus* (*Boophilus*) ticks feeding simultaneously. An engorged nymph of *Amblyomma* may appear as large as an engorged female of *Rh*. (*Boophilus*). Examine the mouthparts to differentiate them - long in *Amblyomma*, short in *Rh*. (*Boophilus*). Punctations and female genital apertures need very careful observation under a stereoscopic microscope. The higher magnification images in Plate 2 should assist your understanding of what to expect.

Further reading.
The following publications are recommended for more information on the biology and identification of ticks likely to be found on domestic animals in Africa. Some of the older books use different names for various ticks, and some are out of print.

Bowman, A.S. & **Nuttall, P**. (Editors) 2008. Ticks: biology, disease and control. Cambridge University Press, UK. [21 chapters by 56 authors.]

Camicas J.-L., **Hervey J.-P.**, **Adam F**. & **Morel P.-C**. 1998. The *Ticks of the World*, (Acarida, Ixodida) *Nomenclature, Described stages, Hosts, Distribution*. Éditions de l'Orstom, Paris. [Detailed list of all tick names and synonyms.]

Cumming G.S. 1999. *The Evolutionary Ecology of African Ticks*. PhD thesis, Faculty of Biological Sciences, University of Oxford, U.K. [Analysed thousands of distribution / host records.]

Cumming G.S. 1999. Host distribution does not limit the species range of most African ticks (Acari: Ixodida). *Bulletin of Entomological Research*, **89**, 303-327. [Used the database of tick distribution / host relationships.]

Elbl A. & **Anastos G**. 1966. Ixodid ticks (Acarina, Ixodidae) of Central Africa. Musée Royal de l'Afrique Centrale, Tervuren Belgique. Vol. I. General Introduction, genus *Amblyomma*; vol. II. *Ixodes*; vol. III. *Rhipicephalus*; vol. IV. *Aponomma*, *Boophilus*, *Dermacentor*, *Hyalomma* and *Rhipicentor*. [A detailed account of tick species in this region.]

Hoogstraal H. 1956. African Ixodoidea, Volume 1, *Ticks of the Sudan*. Research Report NM 005 050.29.07 of the Naval Medical Research Unit 3, Cairo. [Identification and biology of many of the important species of African ticks. Only volume 1 was produced. Taxonomic details often much outdated now.]

Horak I.G., **Camicas J.-L**. & **Keirans J.E**. 2002. The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida): a world list of valid tick names. *Experimental and Applied Acarology,* **28**, 27-54. [A complete list of tick names considered valid at 2002.]

Howell C.J., **Walker J.B**. & **Nevill E.M**. 1978. *Ticks, mites and insects infesting domestic animals in South Africa*. Republic of South Africa Department of Agricultural Technical Services Science Bulletin 393, Pretoria. [Simple illustrated descriptions of species important in South Africa.]

Matthysse J.G. & **Colbo M.H**. 1987. *The Ixodid Ticks of Uganda*. Entomological Society of America, Maryland. [Illustrated identification and biology of most of the important species found in eastern and central Africa.]

Okello-Onen J., **Hassan S.M**. & **Essuman S**. 1999. *Taxonomy of African Ticks, an Identification Manual*. International Centre for Insect Physiology and Ecology Press, Nairobi. [An illustrated identification guide to most species of importance to domestic animals.]

Sonenshine D.E. & **Roe R.M.** (Eds) 2014. *Biology of Ticks*, volumes 1 & 2. Oxford University Press, New York, [Multi-author detailed reviews of all aspects of tick biology and disease relationships.]

Troncy P.M., **Itard J**. & **Morel P.-C**. 1981. *Précis de Parasitologie Vétérinaire Tropicale*. Institut d'Elevage et de Médecine Vétérinaire des Pays Chaud, Maisons-Alfort, France. English translation: **Shah-Fischer M**. & **Ralph Say R**. 1989. *Manual of Tropical Veterinary Parasitology*. CAB International, Wallingford, U.K. [Part III by **P.-C.Morel** on Tick-borne diseases of Livestock in Africa has information on biology and identification.]

Uilenberg G., **Hoogstraal H**. & **Klein J.-M**. 1979 *Les Tiques (Ixodoidea) de Madagascar et leur Role Vecteur*. Archives de l'Institut Pasteur de Madagascar Numero Special, Antananarivo. [Identification and biology of all species known from Madagascar.]

Walker J.B. 1960. *Notes on the Common Tick Species of East Africa*. Cooper, McDougall & Robertson (E.A.) Ltd, Nairobi. [An identification guide in booklet form, the original inspiration and model for this guide.]

Walker J.B., **Mehlitz D**. & **Jones G.E**. 1978. *Notes on the Ticks of Botswana*. German Agency for Technical Cooperation (GTZ), Eschborn. [Identification and biology of ticks of Botswana, useful for many southern African countries.]

Walker J.B., **Keirans J.E**. & **Horak I.G**. 2000. *The Genus Rhipicephalus* (*Acari, Ixodidae*), *a Guide to the Brown Ticks of the World*. Cambridge University Press, Cambridge. [Detailed information on biology plus keys and many drawings and scanning electron micrographs for identification of all 74 species of this predominantly African genus.]

Walker J.B. 1974. *The Ixodid Ticks of Kenya, a Review of present Knowledge of their Hosts and Distribution*. Commonwealth Institute of Entomology, London. [Detailed information on tick distribution but not a guide to identification.]

Yeoman G.H. & **Walker J.B**. 1967. *The Ixodid Ticks of Tanzania, a Study of the Zoogeography of the Ixodidae of an East African Country*. Commonwealth Institute of Entomology, London. [Detailed information on tick distribution but not a guide to identification.]

Postscript.

Guglielmone A.A., Robbins R.G., Apanaskevich D.A., Petney T.N., Estrada-Peña A., Horak I.G., Shao R. & **Barker S.C.** 2010, The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida) of the world: a list of valid species names. Zootaxa, 2528, 1-28. [This paper has been used for the 2014 revision for all species names. Notably the list contains only binominal names, without sub-species.This simplifies matters except for the former *Hyalomma detritum detritum* which is now *Hyalomma scupense*, with their recommendation that (= *H. detritum*) be added because of the well known economic importance of this species. This paper also references other revisons relevant to the guide since its original publication.]

Chapter 3. Genera of Ticks.

How to identify different genera of ticks.
This chapter describes **Step 1** of identifying ticks collected from domestic animals in Africa. As explained overleaf, this involves using the information given below to help select a genus or group of genera to which the tick probably belongs. Then a decision is made on which is the correct genus by examining the set of labelled drawings of male and female ticks representing the ten genera infesting domestic animals in Africa. This chapter also describes and illustrates some genera that are found on wild animals but are never, or only rarely, found on domestic animals.

Genera of ticks commonly found infesting domestic animals in Africa.
In Africa, ten genera of ticks commonly infest domestic animals: three are argasids; seven are ixodids (see Chapter 2 for the general differences between argasid and ixodid ticks). Note that controversial research on tick nucleic acid idicates that the old genus *Boophilus* should be a sub-genus within the genus *Rhipicephalus*. We accept this and call these ticks *Rhipicephalus* (*Boophilus*) followed by the species name; listed separately.

Two genera of the argasids (*Argas* and *Ornithodoros*) only attach to their hosts for short periods; they are more commonly found within the nest or housing of their hosts. The other genus of argasid, *Otobius*, attaches to its hosts only as larvae and nymphs and only within the ear canal. All genera of ixodids feed slowly (see Chapter 1) and attach to their hosts for long periods, depending upon the stage.

Unfed ticks of different genera may be classed as either small (2-3 mm in length), medium (3-5 mm in length) or large (6-7mm in length). As the table below shows, the ten different genera may be divided among five groups based on size and a few basic features. Members of the three genera of argasid ticks are all large (6-7 mm) (**Group 1**) with a plain dorsal surface (without a scutum) and ventral and short mouthparts. They are usually eyeless. Their legs end in a pair of claws but without a pulvillus between the claws.

Ixodid ticks are of many sizes (**Groups 2 - 5**). Their mouthparts project forward in front of the tick; they always have a scutum and often eyes which are visible dorsally. In the genus *Ixodes* (the prostriate ticks) the anal grove passes to the anterior of the anus. In all other genera of ixodid ticks (the metastriate ticks), the anal groove passes posterior to the anus, or is absent. **Group 2**: two genera of large ixodid ticks (6-7mm) are *Amblyomma* and *Hyalomma*. They have long mouthparts, which project to the anterior of the body and large eyes. These two genera both have pale rings on most segments of their legs. **Group 3**: medium size ticks (3-5mm) with long mouthparts, but no eyes, and plain dark legs belong to the genus *Ixodes*. Their coxae 1 have a large single spur. The anal groove passes anterior to the anus. **Group 4**: a second genus of medium size ticks (3-5mm), but with short mouthparts and eyes is *Rhipicephalus*. Its coxae 1 have large and equal paired spurs. The third genus of medium size ticks with similar features to *Rhipicephalus* is *Dermacentor*. Its importance in Africa is described below.

Main features of genera of ticks found on domestic animals.

Group	Size	Mouthparts	Other features	Genera
Group 1	Large,	ventral and short,	scutum absent, pulvilli absent .	*Argas*, *Ornithodoros*, *Otobius*.
Group 2	Large,	anterior and long,	pale rings on legs, eyes present and large.	*Amblyomma*, *Hyalomma*.
Group 3	Medium,	anterior and long,	plain dark legs, eyes absent.	*Ixodes*
Group 4	Medium,	anterior and short,	eyes present and large, coxae 1 with paired spurs.	*Dermacentor*, *Rhipicephalus*.
Group 5	Small,	anterior and short,	eyes small or absent, coxae 1 with small paired spurs or single spur.	(*Boophilus*), *Margaropus*, *Haemaphysalis*.

Group 5: the small sized ticks (less than 3mm) ((*Boophilus*), *Margaropus* and *Haemaphysalis*), all have anterior and short mouthparts, their eyes are small ((*Boophilus*), *Magaropus*) or absent (*Haemaphysalis*). Coxa 1 has small paired spurs ((*Boophilus*), *Magaropus*) or a single spur (*Haemaphysalis*). *Magaropus* occurs mainly on horses in South Africa.

The genus *Dermacentor* is important to domestic animals mainly in the Americas, Europe and Asia. *Dermacentor marginatus* is found on cattle in North Africa and so is included in this guide. The unusual species *Dermacentor nitens* is also included because, although it does not occur in Africa, it is an important parasite of horses and could be accidentally imported into new areas on transported horses, as happened with *Otobius megnini*. Two other *Dermacentor* species found in Africa are *Dermacentor circumguttatus*, which infests elephants, and *Dermacentor rhinocerinus*, which infests rhinoceroses. These are large robust ticks, which have conspicuous patterns of white enamel on the scutum. A similar genus with white enamel and a very large size is represented by a single species, *Cosmiomma hippopotamensis*, which infests hippopotamus.

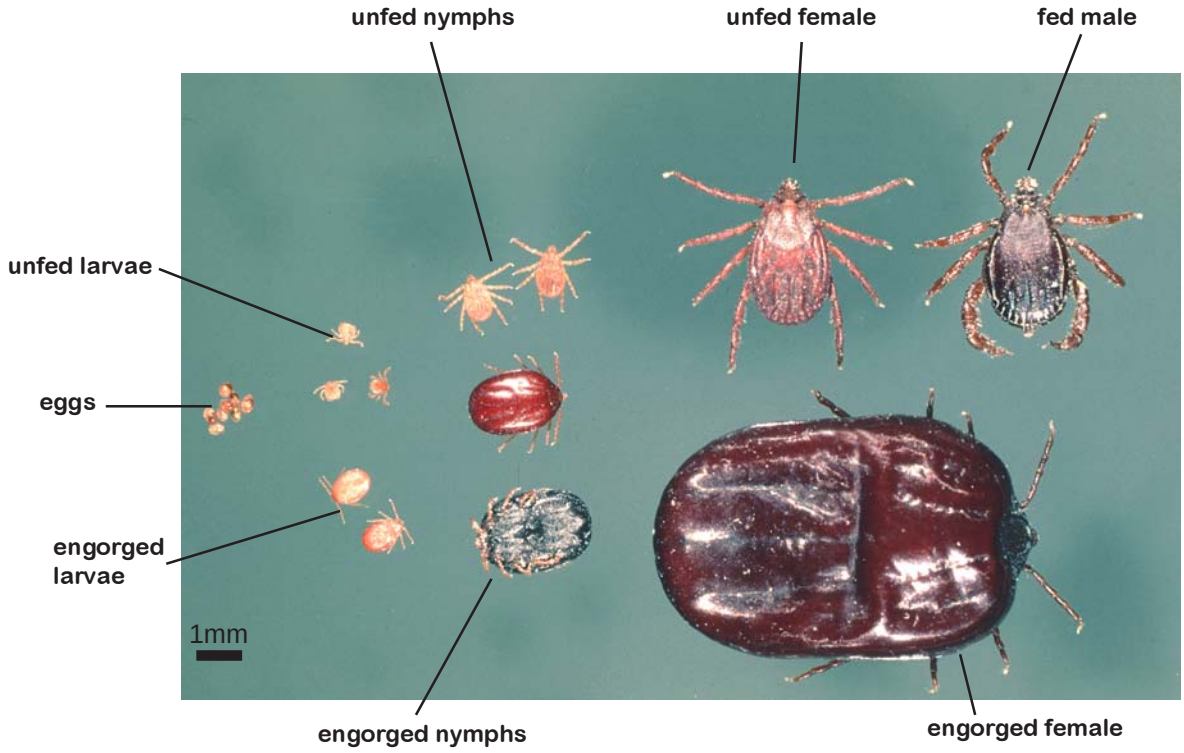
The six other genera listed in the table below either do not occur in Africa, or are generally not found on domestic animals. Only *Rhipicentor* in central Africa may be found on cattle. Ticks found on snakes and lizards in the tropics are usually of the genera *Amblyomma* and *Bothriocroton* (the previous genus *Aponomma* which included these reptile ticks is no longer considered valid as a genus). The genera of ticks commonly found infesting domestic animals are illustrated in Plates 3 to 6. The types of ticks of wild animals are illustrated in Plates 4 and 5, but no further details are provided.

Step 1 of identification - which genus?
Use the information and drawings of the different genera of ticks presented in this chapter to identify the genus to which your tick belongs. First, compare your specimen with the above description of the ten genera of ticks commonly found infesting domestic animals in Africa and consult the table that shows the ten genera placed in five groups with shared features. Select the genus or group of genera, which shares the same features as your tick and to which your tick probably belongs. When you have selected a genus or group of probable genera, compare your tick with the set of drawings of these tick genera and with the full lists of character states below the drawings. If it is an argasid, the sex of your tick does not matter. If it is an ixodid, its sex is important, so make sure you have identified the sex of your specimen before comparing it with the drawings on the genera. When you have identified a genus proceed to Chapter 4 which gives all 48 species in a single alphabetical sequence of genera and species within each genus. Each genus of argasid ticks is included within this sequence.

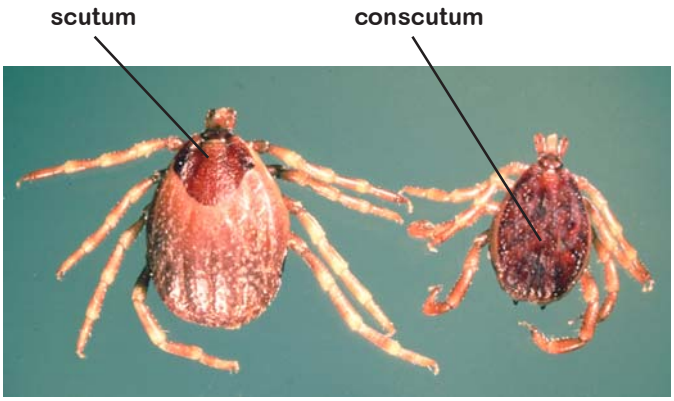
Other worldwide genera of ticks rarely or never found on domestic animals.

Genus	Some typical features
Anomalohimalaya,	similar to *Rhipicephalus*, occurs in Asia.
Bothriocroton,	similar to *Amblyomma* but small and feed mainly on reptiles, worldwide in distribution.
Carios,	argasid ticks which feed on many types of host and are widely distributed.
Nosomma,	similar to *Hyalomma*, occur in Asia.
Nuttalliella,	in a separate tick family (Nuttallielidae) with features of both argasids and ixodids, feeds on hyraxes and birds in Africa.
Rhipicentor,	similar to *Rhipicephalus*, all coxae have two long spurs, males have no ventral plates, two species only, which may be found on cattle in Africa.

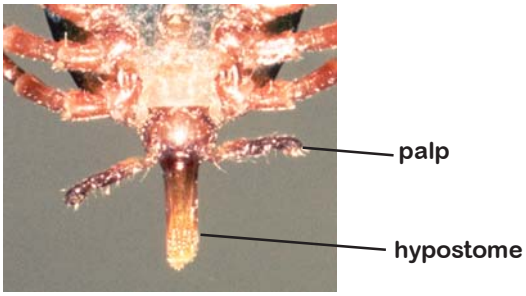
Three-host tick life-cycle showing relative sizes of the instars and unfed and engorged ticks, approximately 4 times life size (*Rhipicephalus appendiculatus*). The fed male has not expanded but shows a caudal appendage.



Female on left, male on right, both dorsal (*Hyalomma excavatum*).



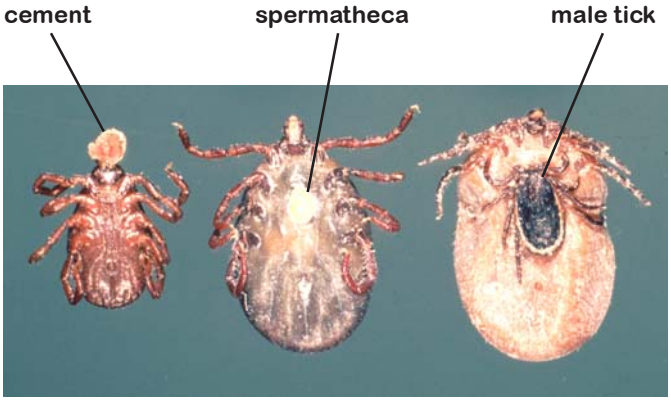
Hypostome and palps, ventral view showing palps spread out to enable only the hypostome and chelicerae to penetrate the host (*Amblyomma hebraeum*).



Enamel ornamentation, female on left, male on right, white enamel on scutum of female and conscutum of male (*Rhipicephalus pulchellus*).

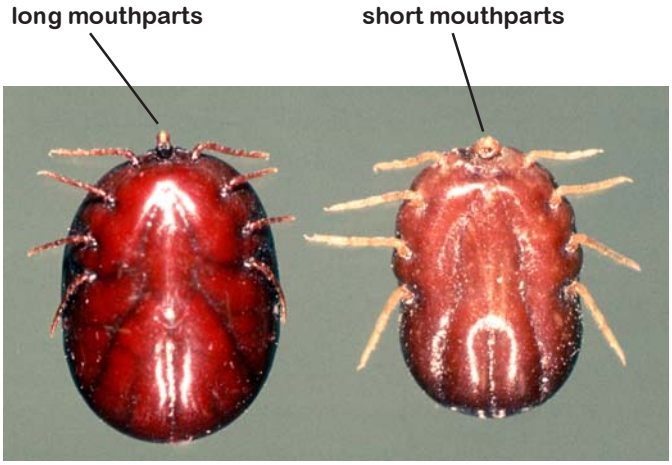
Questing tick on grass (female *Ixodes ricinus*).

Confusing additional features on ticks. Cement is often found on the mouthparts of both sexes. Females may show a spermatheca at the genital aperture. Females may have a male in mating position at the genital aperture.



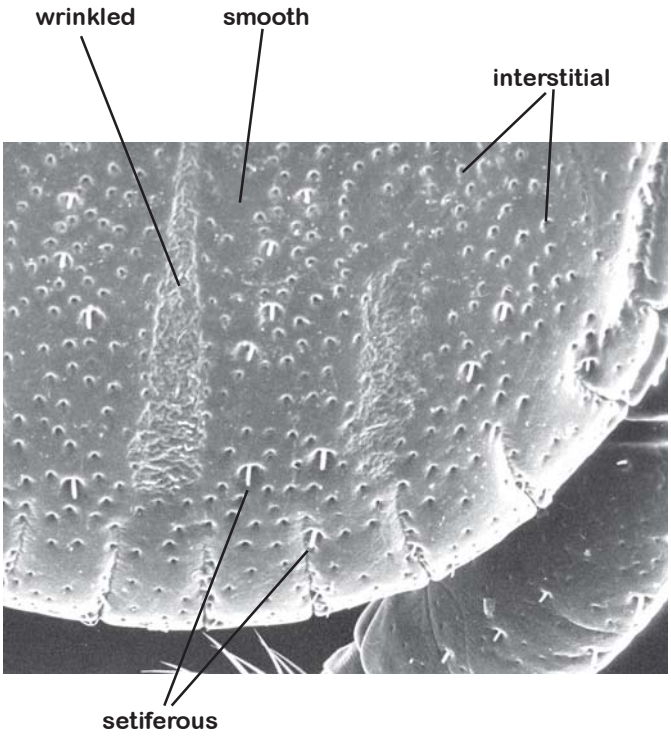
Rhipicephalus *Rhipicephalus* *Ixodes*

Engorged nymph of *Amblyomma* compared with engorged female of *Boophilus* sub-genus, ventral view. The two species shown may occur at the same time on the same cattle. They can be distinguished by the shape of their mouthparts.

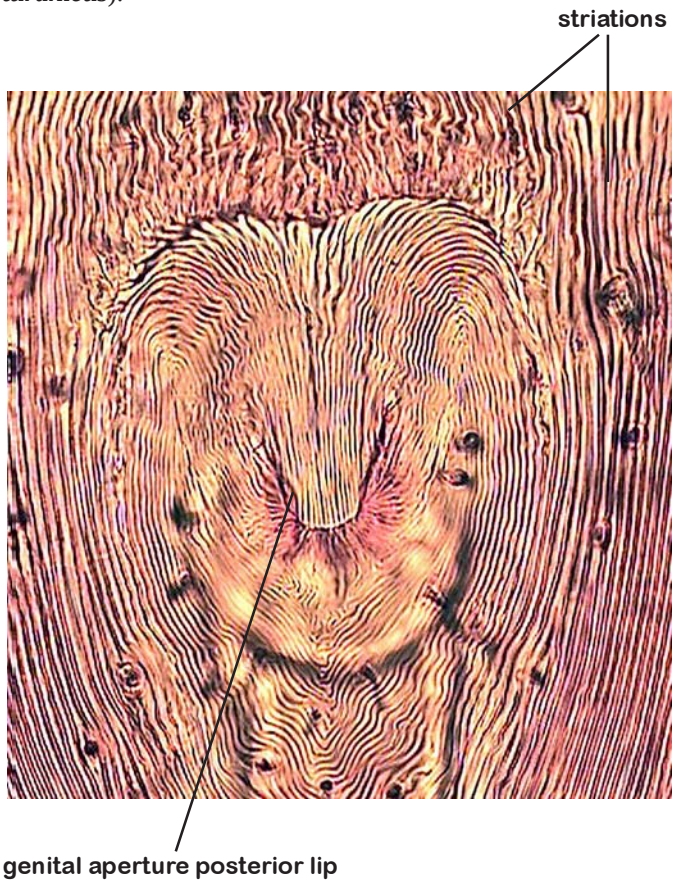


Amblyomma variegatum *Rh.* (*Boophilus*) *microplus*

Punctations and texture. Appearance of posterior conscutum by scanning electron microscopy. Comparison of setiferous with interstitial punctations. Also wrinkled texture in the posteromedian groove and smooth texture of surrounding integument (***Rhipicephalus appendiculatus***).



Genital aperture of female and integument texture with striations. Appearance after mounting on a microscope slide and seen with an ordinary microscope (***Rhipicephalus turanicus***).



***Argas persicus*, dorsal, female. Shape is flattened, with a distinct lateral margin. Texture of integument has mammillae and flat discs.**

***Argas persicus*, ventral, male, showing characteristic flat discs. Male's genital aperture is smaller than the female's.**

***Ornithodoros savignyi*, female, dorsal. Shape is rounded and irregular. Texture of integument has mammillae but no flat discs.**

***Otobius megnini*, 2nd nymph, dorsal. Texture of integument has spines.**

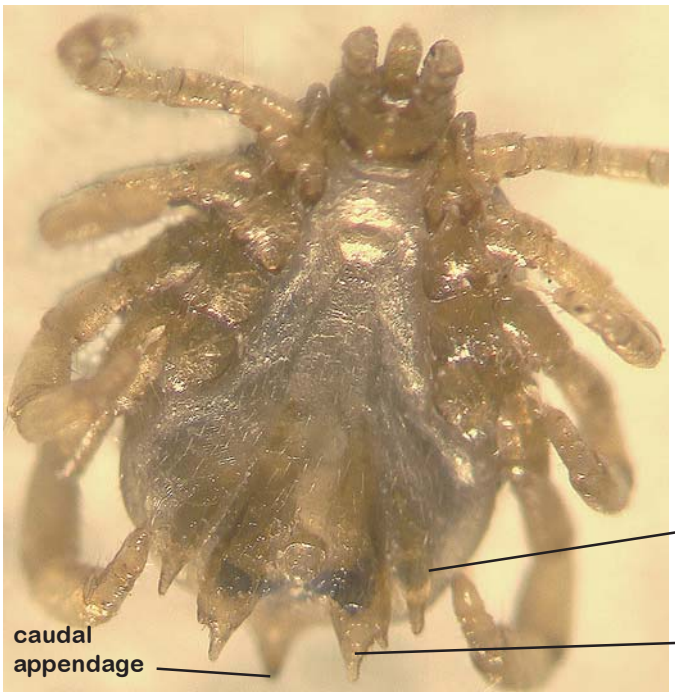
***Amblyomma variegatum*, dorsal, female at left, male at right. Legs have pale rings and scutum or conscutum has enamel. Mouthparts are long. These are large ticks, 6mm long.**

***Amblyomma latum*, dorsal, female at left, male at right. This species is a typical parasite of reptiles in tropical countries. They are small, 3mm long, and almost circular in outline.**

***Boophilus* sub-genus, dorsal, female at left, male at right, *Rhipicephalus* (*Boophilus*) *microplus*.**

***Boophilus* subgenus, male, dorsal. Conscutum is plain and mouthparts are short. *Rhipicephalus* (*Boophilus*) *decoloratus*.**

***Boophilus* sub-genus, male, ventral. Ventral plates are conspicuous. *Rhipicephalus* (*Boophilus*) *decoloratus*.**



***Margaropus winthemi*, dorsal, male. Note the very thick legs.**

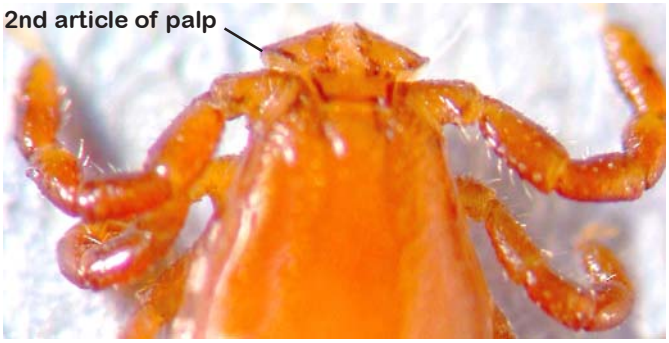
***Cosmiomma hippopotamensis*, dorsal, female at left, male at right. A genus of one species, found on hippopotamuses, not on domestic animals.**

***Dermacentor rhinocerinus*, dorsal, male. A species found on rhinoceroses, not on domestic animals.**

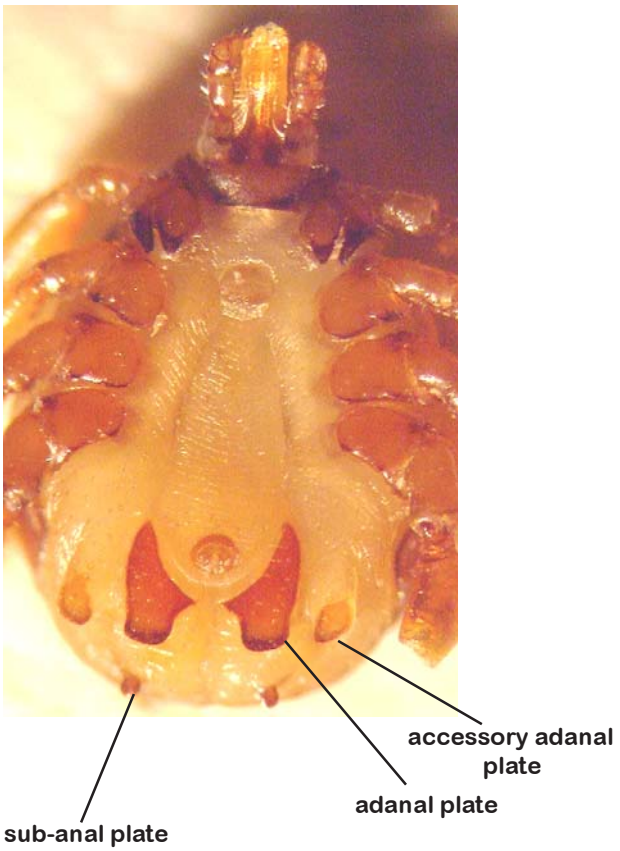
***Dermacentor marginatus*, dorsal, female at left, male at right. Note indistinct enamel on scutum and conscutum.**

***Haemaphysalis punctata*, dorsal, female at left, male at right.**

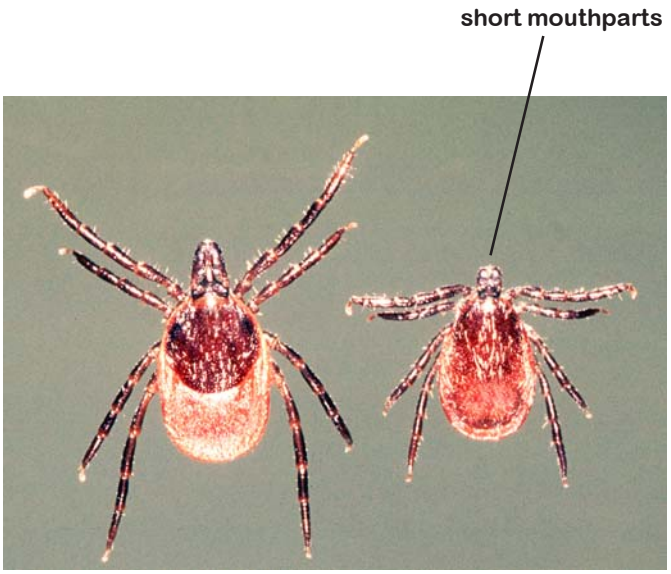
***Haemaphysalis leachi* group, dorsal male. Note palps.**



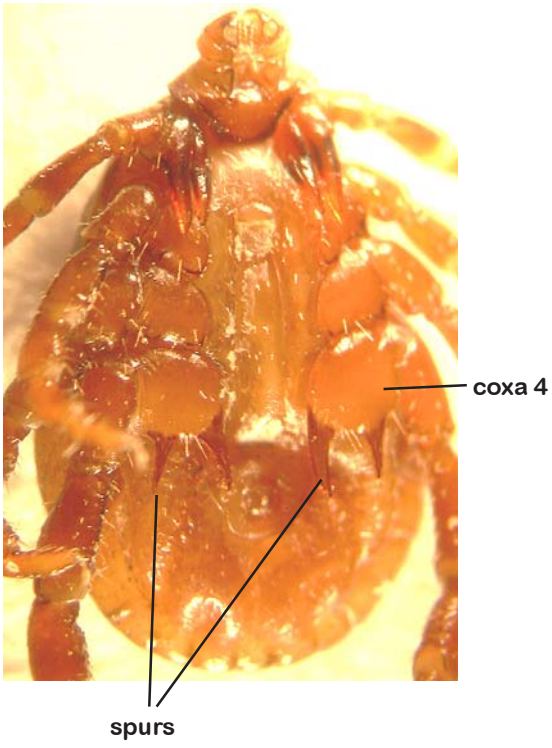
***Hyalomma truncatum*, ventral, male. Note the ventral plates.**



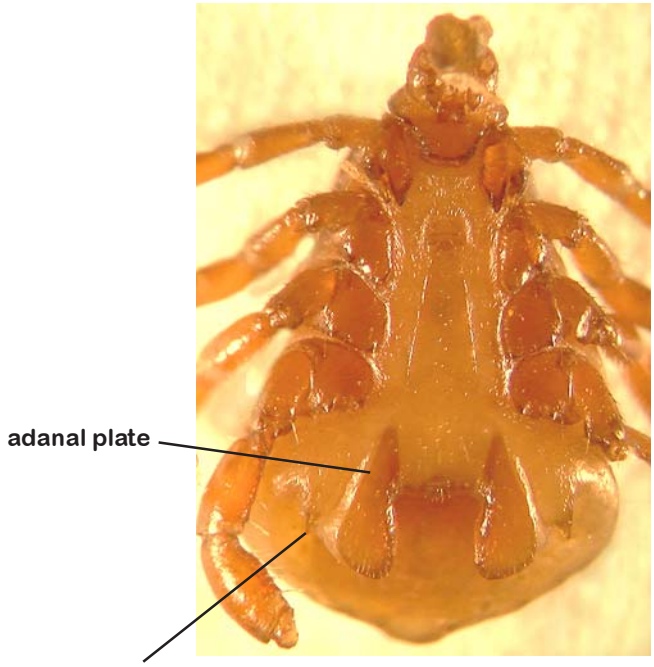
***Ixodes ricinus*, dorsal, female at left, male at right. Note that male is smaller than female and has shorter mouthparts.**



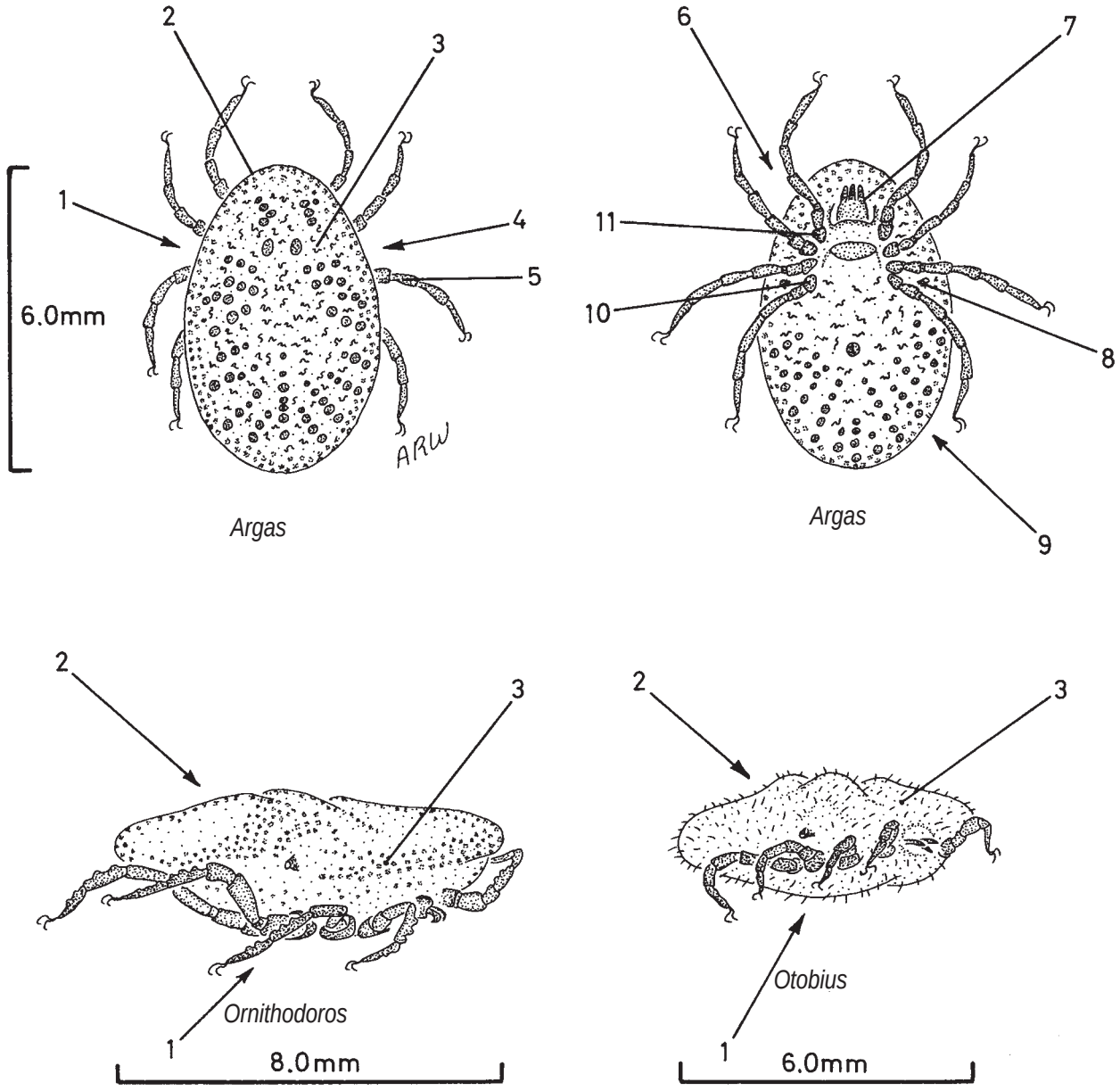
***Rhipicentor bicornis*, ventral, male. Note the long spurs on coxae 4 and lack of ventral plates. Ticks of this genus may be found on cattle.**



***Rhipicephalus sanguineus*, ventral, male. Note the ventral plates.**

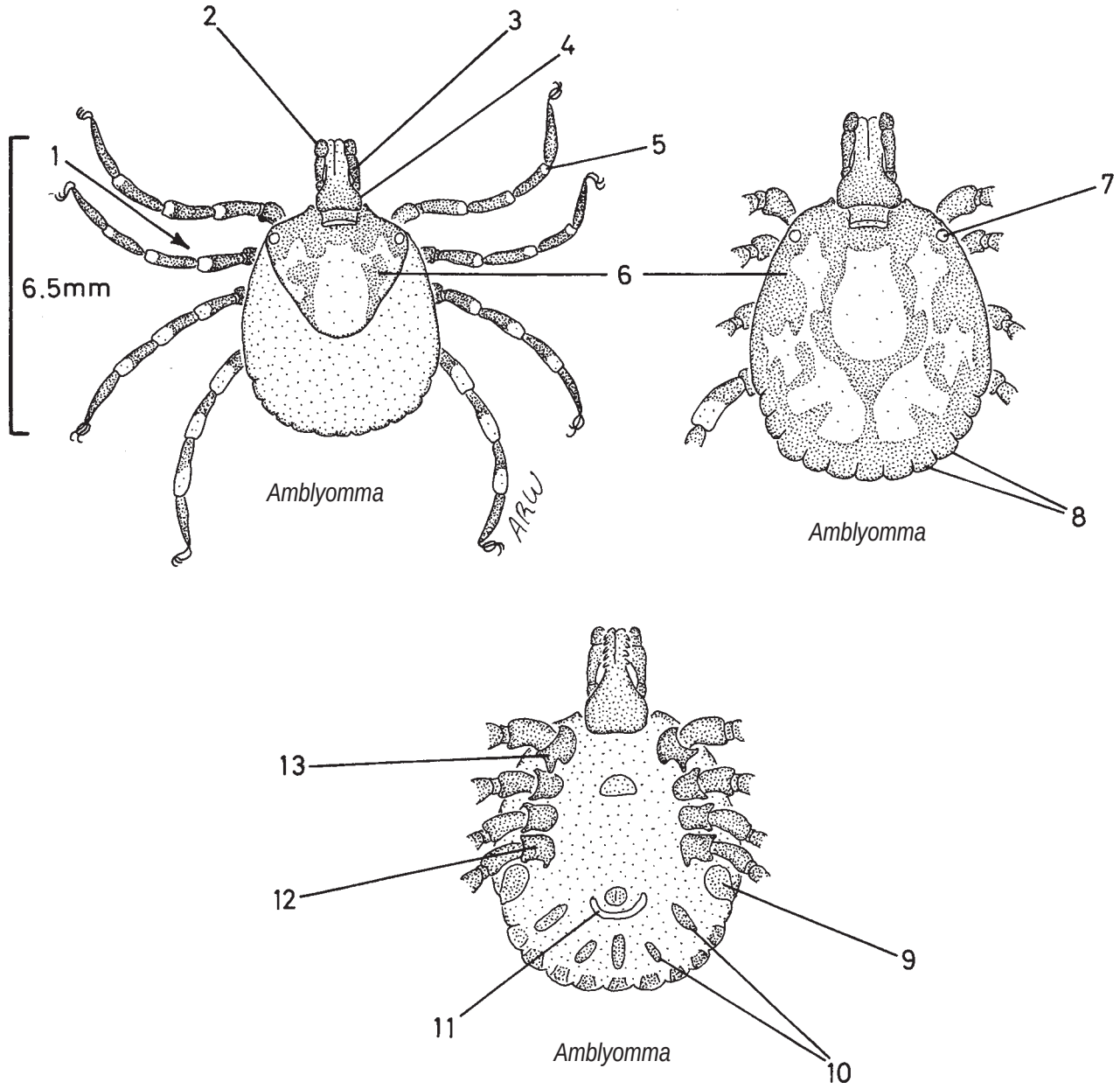


***Argas* genus**, **female dorsal at upper left**, **female ventral at upper right** (all features apply to both sexes);
***Ornithodoros* genus**, **female lower left** (only those features differing from *Argas* are labelled);
***Otobius* genus**, **2nd instar nymph**, **lower right** (only those features differing from *Argas* are labelled).



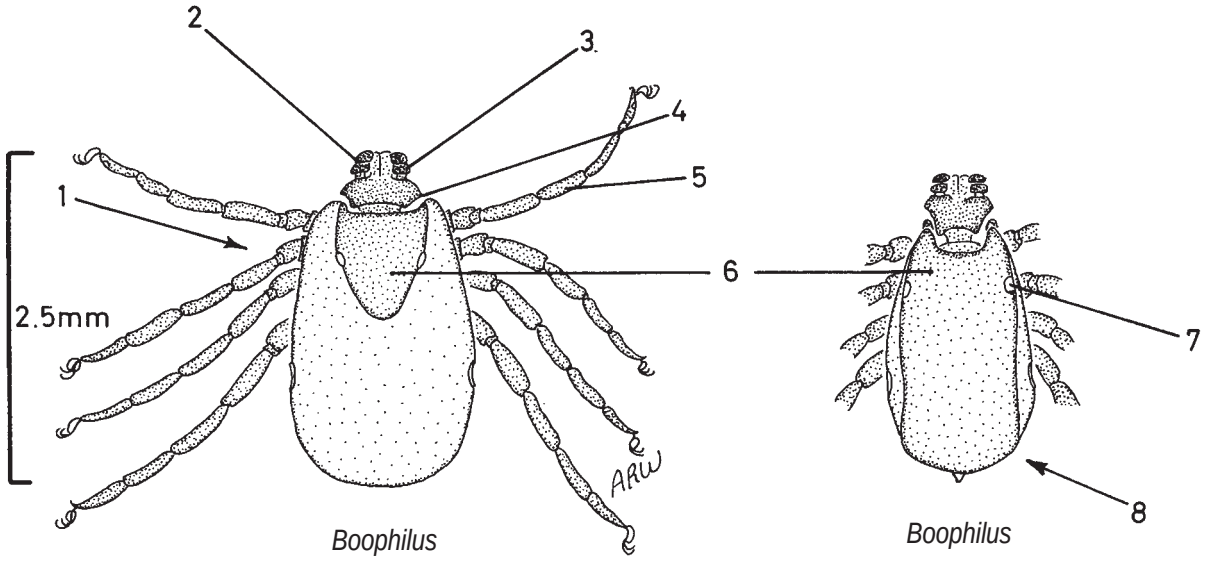
1 Size is large, 6mm in *Argas* and *Otobius*, 8mm in *Ornithodoros*.
2 Lateral suture is present in *Argas* but absent in *Ornithodoros* and nymph of *Otobius*.
3 Integument texture has mammillae in *Ornithodoros* and *Argas* and spines in *Otobius*.
4 Scutum or conscutum is absent.
5 Legs have no pale rings. Legs are slender. Pulvilli are absent.
6 Eyes are absent in *Argas* and *Otobius* and usually absent in *Ornithodoros*.
7 Mouthparts are ventral (they may be anterior in larvae and nymphs of some species of *Argas* and in *Otobius*). Palp articles are all small. Basis capituli has straight lateral margins.
8 Spiracular plates are small and between legs 3 and 4.
9 Festoons are absent from males. Ventral plates are absent from males. Anal groove is absent from both sexes.
10 Coxae 4 are of normal size.
11 Coxae 1 paired spurs are absent.

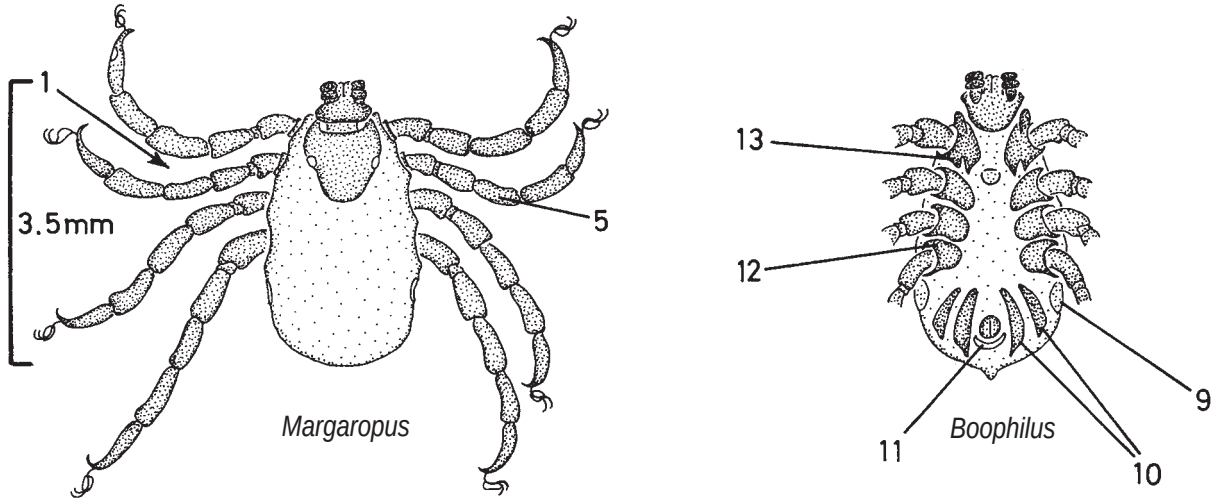
***Amblyomma* genus**, **female dorsal at upper left**, **male dorsal at upper right**, **male ventral at lower central** (all features apply to both sexes, except where stated).



1 Size of unfed ticks is large (6 to 7mm) including mouthparts. Lateral suture is absent. Integument texture has striations.
2 Mouthparts are anterior.
3 Palp articles 2 are longer than articles 1 and 3.
4 Basis capituli has straight lateral margins.
5 Legs usually have pale rings. Legs are slender. Pulvilli are always present.
6 Scutum is present in the female (a conscutum in the male). Enamel (= ornamentation) is present on the scutum and conscutum of many species.
7 Eyes are always present and may be flat or convex (some times difficult to see).
8 Festoons are present in males (and in females but unclear when females are fed).
9 Spiracular plates are large and posterior to legs 4. Spiracle goblets are scattered over the spiracle plates.
10 Ventral plates in males are indistinct (in the form of small flat plates posterior to the anus, also the ventral surface of the festoons have plates known as scutes).
11 Anal groove is posterior to the anus.
12 Coxae 4 are of normal size.
13 Coxae 1 have unequal paired spurs.

***Boophilus* sub-genus** (**within *Rhipicephalus* genus**), **female dorsal at upper left**, **male dorsal at upper right**, **male ventral at lower right** (all features apply to both sexes except where stated);
***Margaropus* genus**, **female dorsal at lower left** (only those features differing from *Boophilus* are labelled).

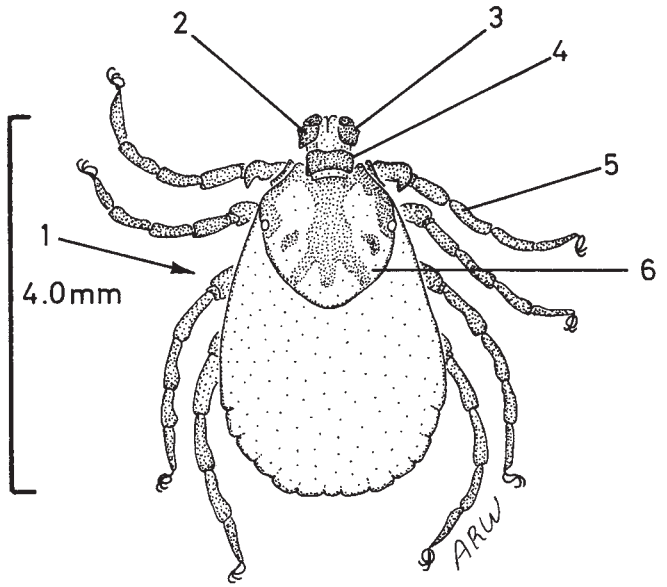




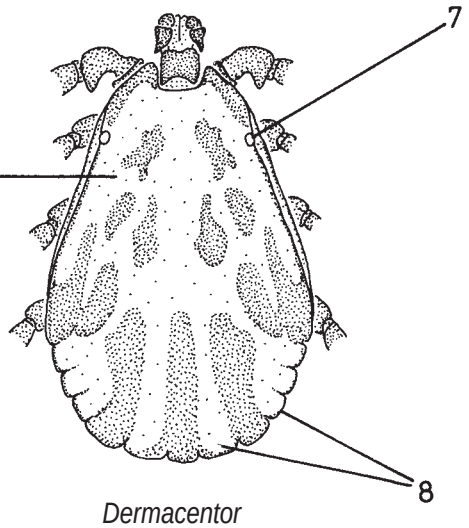
1 Size of unfed ticks is small (2 to 3mm) for *Boophilus*; and 3mm for *Margaropus* including mouthparts. Lateral suture is absent. Integument texture has striations.
2 Mouthparts are anterior.
3 Palp articles are all small.
4 Basis capituli has angular lateral margins.
5 Legs have no pale rings. Legs are slender in *Boophilus* and bulbous in *Margaropus* (they are very bulbous in *Margaropus* males). Pulvilli are always present.
6 Scutum is present in the female (a conscutum in the male). Enamel (= ornamentation) is absent from the scutum and conscutum.
7 Eyes are present but indistinct (very indistinct in the males).
8 Festoons are absent from females and males.
9 Spiracular plates are large and posterior to legs 4. Spiracle goblets are scattered over the spiracle plates.
10 Ventral plates are present in males only. In *Margaropus* the adanal plates are distinctly long and sharp.
11 Anal groove is indistinct (it is posterior to the anus if visible).
12 Coxae 4 are of normal size.
13 Coxae 1 have small paired spurs (very small in the fe males).
(Also: genital aperture of females is a small **U** or **V** shape in *Boophilus* but is a wide oval in *Margaropus*.)

***Dermacentor* genus**, **female dorsal at upper left**, **male dorsal at upper right**, **male ventral at lower right** (all features apply to both sexes except where stated).

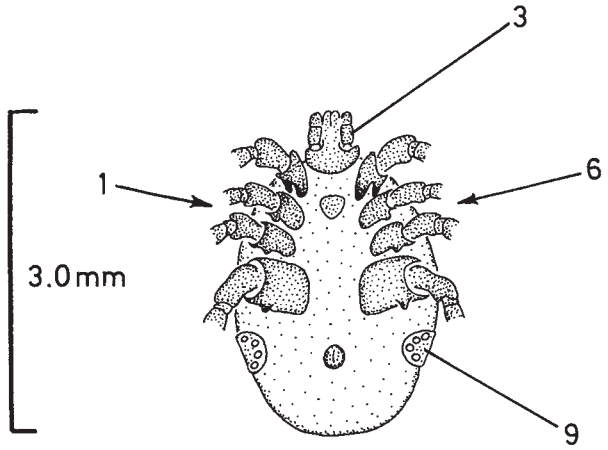
***Dermacentor nitens* is shown as a male**,**ventral**, **at lower left** (this species does not occur in Africa)**.**



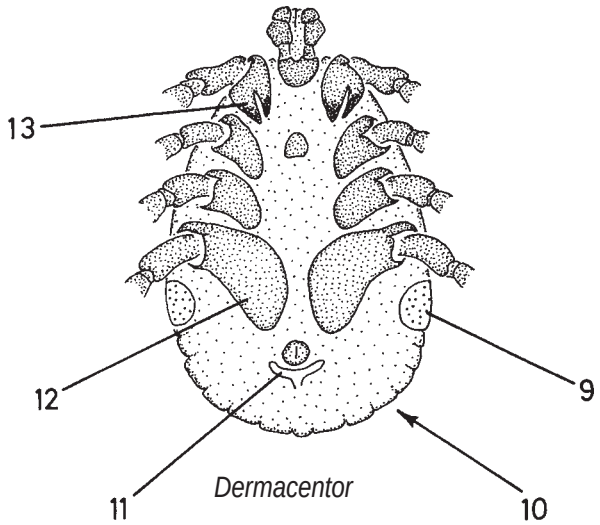
Dermacentor



Dermacentor



De. nitens



Dermacentor

1 Size of unfed ticks is medium (4 to 5mm) for *Dermacentor*; size is small (3mm) for *De. nitens*, including mouthparts. Lateral suture is absent. Integument texture has striations.

2 Mouthparts are anterior.

3 Palp articles 2 are broad in *Dermacentor*; in *De. nitens* palp articles are all small.

4 Basis capituli has straight lateral margins and dorsally it is rectangular.

5 Legs have no pale rings. Legs are slender. Pulvilli are always present.

6 Scutum is present in the female (a conscutum is present in the male). Enamel (= ornamentation) is present on scutum and conscutum of most of *Dermacentor,* forming a white pattern. Enamel is absent from *De. nitens*.

7 Eyes are present and usually flat to slightly convex in *Dermacentor*. Eyes are indistinct in *De. nitens*.

8 Festoons are present in males.

9 Spiracular plates are large and posterior to legs 4. Spiracle goblets are scattered over the spiracle plates in *Dermacentor*; in *De. nitens* they form a ring.

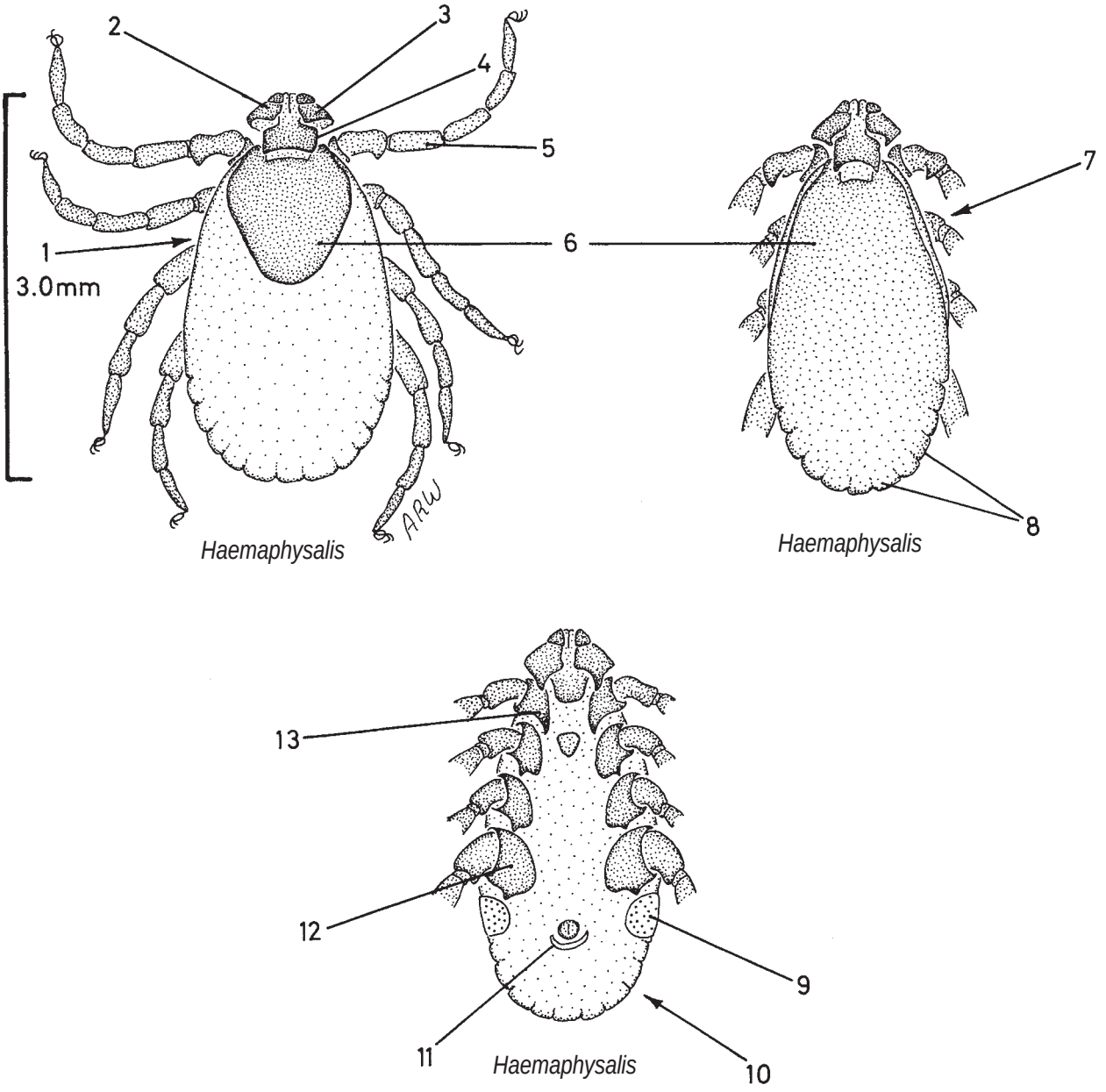
10 Ventral plates are absent from males.

11 Anal groove is posterior to the anus in *Dermacentor*. In *De. nitens* the anal groove is indistinct.

12 Coxae 4 are very large.

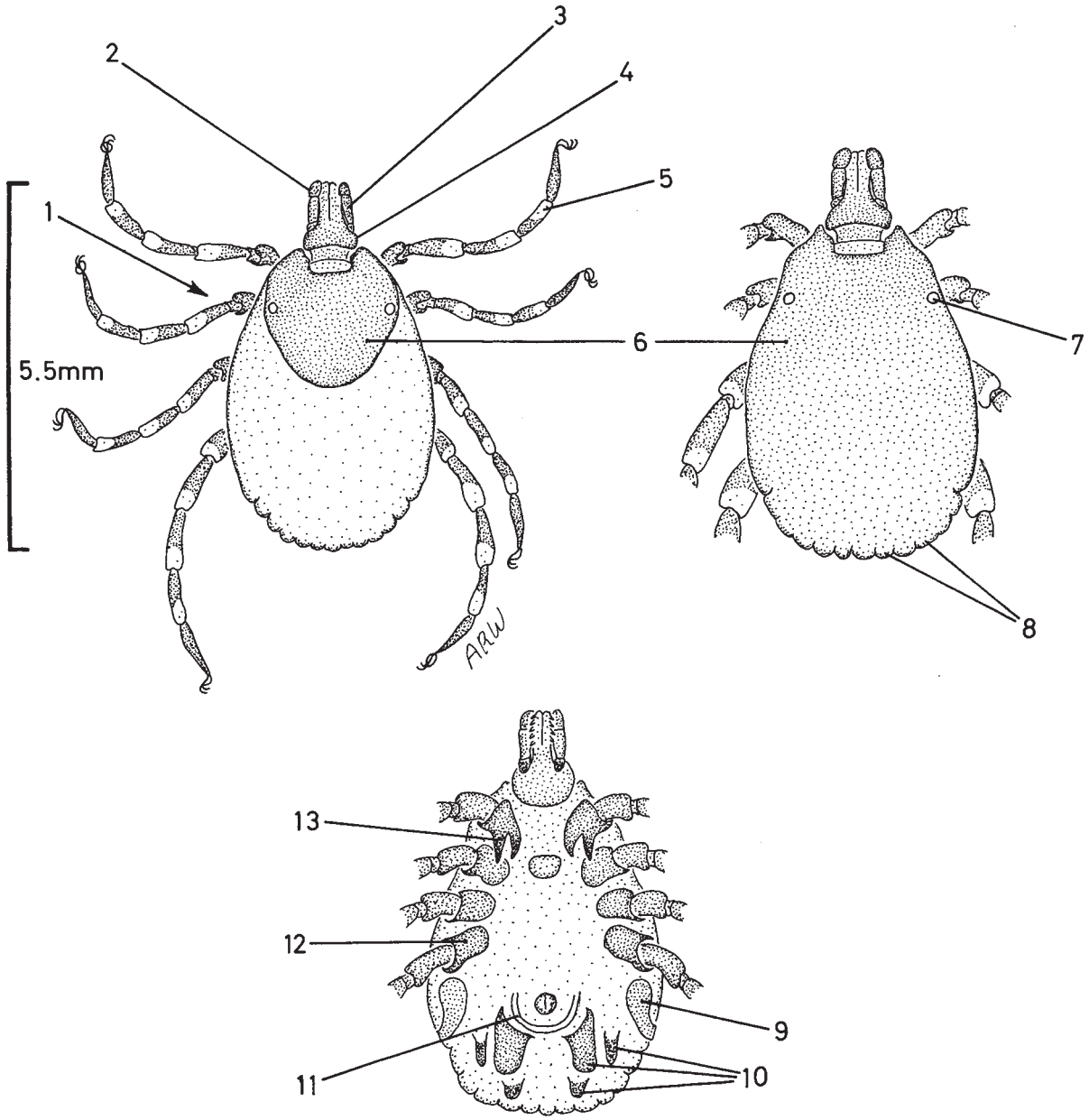
13 Coxae 1 have large and equal paired spurs.

***Haemaphysalis* genus**, **female dorsal at upper left**, **male dorsal at upper right**, **male ventral at lower central** (all features apply to both sexes except where stated).



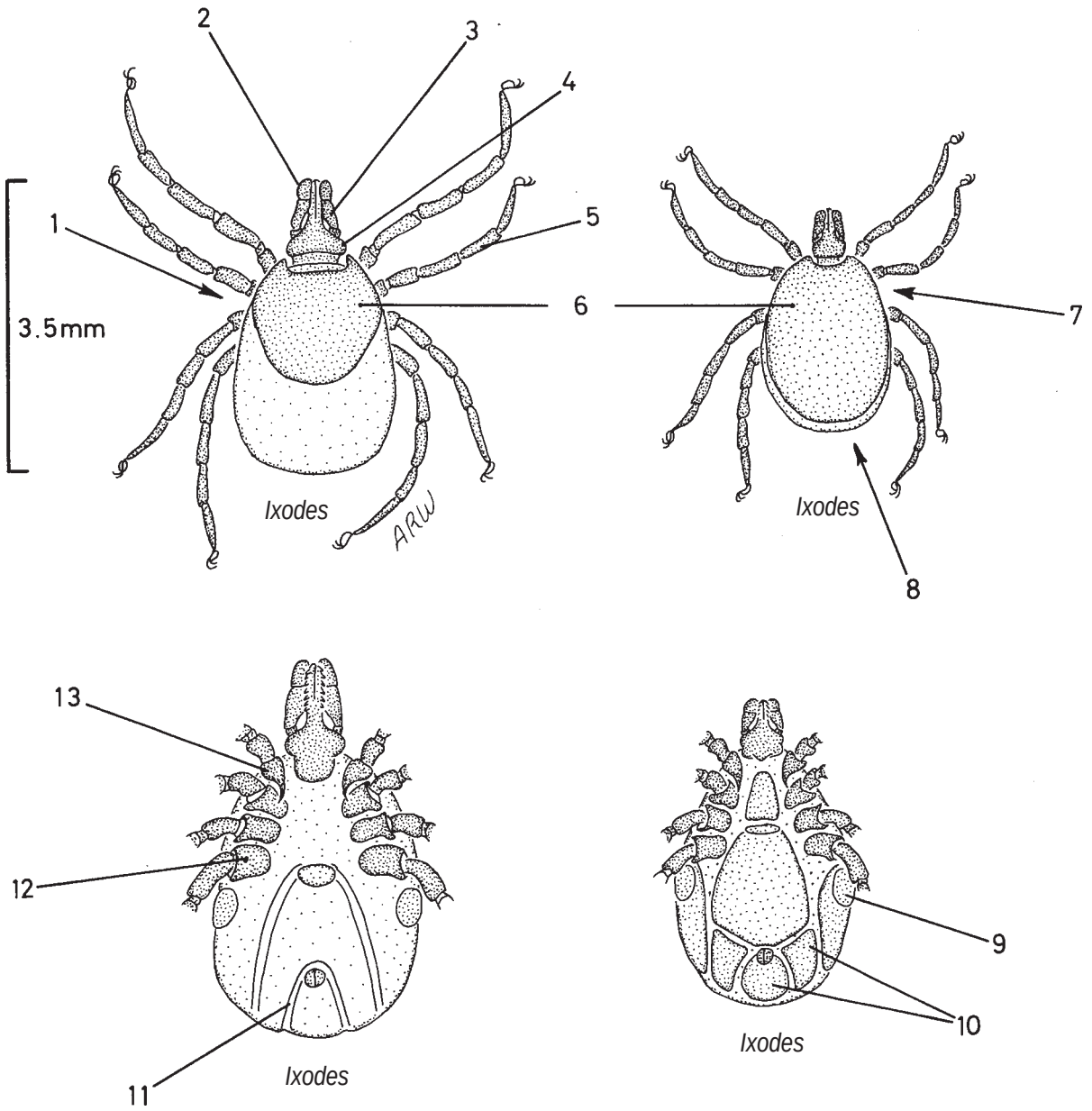
1 Size of unfed ticks is small (3mm) including mouthparts. Lateral suture is absent. Integument texture has striations.
2 Mouthparts are anterior.
3 Palp articles 2 are usually broad (only in some species do they form a distinct conical shape as shown).
4 Basis capituli has straight lateral margins.
5 Legs have no pale rings. Legs are slender. Pulvilli are always present.
6 Scutum is present in the female (a conscutum in the male). Enamel (= ornamentation) is absent from the scutum and conscutum.
7 Eyes are always absent.
8 Festoons are present in males (and in females but unclear when females are fed).
9 Spiracular plates are large and posterior to legs 4. Spiracle goblets are scattered over the spiracle plates.
10 Ventral plates are absent from males.
11 Anal groove is posterior to the anus.
12 Coxae 4 are of normal size.
13 Coxae 1 have unequal paired spurs (only a single internal spur is present).

***Hyalomma* genus**, **female dorsal at top left**, **male dorsal at top right**, **male ventral at bottom central** (all features apply to both sexes except where stated).



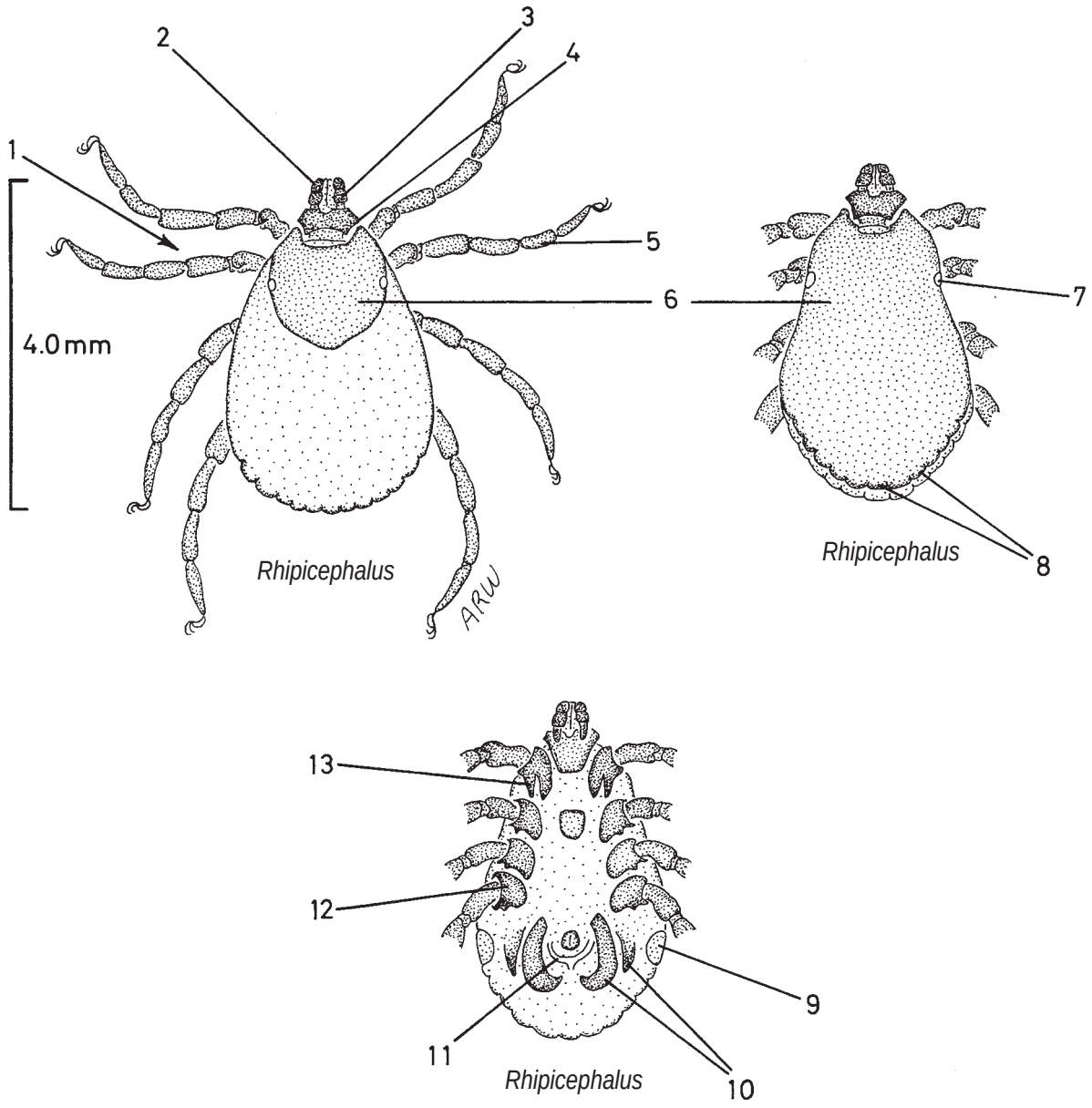
1 Size of unfed ticks is large (5 to 6mm) including mouthparts. Lateral suture is absent. Integument texture has striations.
2 Mouthparts are anterior.
3 Palp articles 2 are longer than articles 1 and 3.
4 Basis capituli has medium angular lateral margins.
5 Legs usually have pale rings. Legs are slender. Pulvilli are always present.
6 Scutum is present in the female (a conscutum is present in the male) and these are coloured brown. Enamel (= ornamentation) is usually absent from the scutum and conscutum (*Hy. lusitanicum* is an exception).
7 Eyes are always very convex.
8 Festoons are present in males (and in females but unclear when females are fed).
9 Spiracular plates are large and posterior to legs 4. Spiracle goblets are scattered over the spiracle plates.
10 Ventral plates are present in males only (usually three distinct pairs).
11 Anal groove is posterior to the anus.
12 Coxae 4 are of normal size.
13 Coxae 1 have large and equal paired spurs.

***Ixodes* genus**, **female dorsal at top left**, **male dorsal at top right**, **female ventral at bottom left**, **male ventral at bottom right** (all features apply to both sexes except where stated).



1 Size of unfed ticks is medium (3 to 4mm) including mouthparts (but note that males of this genus are usually smaller than females). Lateral suture is absent. Integument texture has striations.
2 Mouthparts are anterior.
3 Palp articles 2 are longer than articles 1 and 3.
4 Basis capituli has straight lateral margins.
5 Legs never have pale rings. Legs are slender. Pulvilli are always present.
6 Scutum is present in the female (a conscutum in the male). Enamel (= ornamentation) is always absent from the scutum or conscutum.
7 Eyes are always absent.
8 Festoons are absent from males (and females).
9 Spiracular plates are large and posterior to legs 4. Spiracle goblets are scattered over the spiracle plates.
10 Ventral plates are present in males only (in the form of large flat plates over much of the ventral surface).
11 Anal groove forms a loop anterior to the anus (in some species the anal groove forms a circle around the anus).
12 Coxae 4 are of normal size.
13 Coxae 1 have unequal paired spurs (varies from no spurs, to one internal spur to two spurs).

***Rhipicephalus* genus**, **female dorsal at top left**, **male dorsal at top right**, **male ventral at bottom central** (all features apply to both sexes except where stated). (See also *Boophilus* subgenus within *Rhipicephalus*, pg 39.)



1 Size of unfed ticks is medium (3 to 5mm) including mouthparts. Lateral suture is absent. Integument texture has striations.
2 Mouthparts are anterior.
3 Palp articles are all small.
4 Basis capituli has distinctly angular lateral margins (making a hexagonal shape of the entire basis capituli).
5 Legs have no pale rings. Legs are slender. Pulvilli are always present.
6 Scutum is present in the female (a conscutum in the male). Enamel (= ornamentation) is usually absent from the scutum or conscutum but there are four species with enamel.
7 Eyes are present and flat to slightly convex (but in *Rh. evertsi* the eyes are very convex or highly bulging).
8 Festoons are present in males (and in females but unclear when females are fed).
9 Spiracular plates are large and posterior to legs 4. Spiracle goblets are scattered over the spiracle plates.
10 Ventral plates are present in males only (usually as two pairs of plates).
11 Anal groove is posterior to the anus.
12 Coxae 4 are of normal size.
13 Coxae 1 have large and equal paired spurs.

Chapter 4. Species of Ticks.

This page describes Steps 2 and 3 of identifying ticks. Information on geographical distribution of ticks can be very helpful for identifying ticks. Step 2 therefore uses the data on the distribution of ticks in Africa given in the map below and the table overleaf to indicate to the user which species a tick is likely to be, according to the area in which it was collected. Step 3 uses the drawings of female and male ticks belonging to 48 species of ticks that infest domestic animals to find the correct species.

The 48 species of ticks are presented in alphabetical order of genus and species within each genus. However, the sub-genus *Boophilus* is listed separately at the start of the section on *Rhipicephalus* genus in which it now belongs. There are also four species partially described in conjunction with the main 48 species. We have followed the naming of ticks given in the *Ticks of the World* by Camicas *et al*. (1998), with recent revisions listed in Horak *et al*. (2002). With each full description of each species, the author and date for the original description is given. If this is in parentheses ( ) it indicates that the original description has been revised at a later date. For each illustration there is a selection of the characters and their states relevant to that illustration. Some comments are in parentheses to indicate either modifications of the basic description of the character state or to provide additional information other than the character states.

Step 2 of identification - which geographical area?
When you know the genus to which your tick belongs (see Chapter 3) consult the map below which shows Africa divided into seven areas relevant to tick distribution. Then consult the table overleaf showing the distribution of ticks in different areas of Africa and find the column that lists the ticks from the same area as your tick. These ticks are **candidate species** for your tick. To confirm which of these species are found in the country in which you found your tick, check the distribution and host data in their **species profiles**. This step should help to reduce to the minimum the number of tick species you have to consider. Please note that the maps are intended only as an aid to identification; they are derived from confirmed records and expert opinion but are not supported here by the original references so they should not be used as definite statements of tick distribution.

Step 3 of identification - which species?
When you have selected candidate species for your tick go to the illustrations of these species. Compare your tick with the drawings of these species of the relevant sex. The labels below the drawings list the unique combinations of character states that identify a tick species. Character states are sometimes difficult to see or too variable to be sure of. For this reason it is important to check the specimen for the complete list of character states given. **Important note**: it is the unique combination of character states defining a species that needs to be checked against your specimen. For very similar species there will be only one or two differences in the combination of the character states. At this stage you will find it helpful to read the section on differential diagnosis in the species profiles of the species you are considering. Once you have chosen a possible identification for your specimen, compare what you know about your specimen with the species profile of your chosen tick species. Check the information on biology, hosts and distribution of the tick. Do not identify a specimen to species unless it fits the majority of character states listed: it may not be described in this book.

An example of Steps 2 and 3.
Suppose you are in Morocco and have made a collection there of ticks from cattle. You have gone through Step 1 and the information in Chapter 3 to identify the specimen as belonging to the genus *Rhipicephalus*, but not in the sub-genus *Boophilus*. Step 2 consists of consulting the map below of tick distribution areas for the name - North Africa. Then in the table overleaf, in the column for North Africa you will find the following species of *Rhipicephalus* listed: *Rh. bursa, Rh. camicasi, Rh. praetextatus, Rh. sanguineus* and *Rh. turanicus*. Step 3 takes you directly to the species profiles and drawings of these five species only. When you check the biological information in the species profiles you will find that *Rh. praetextatus* has never been recorded from Morocco. *Rhipicephalus sanguineus* is only rarely found on cattle. *Rhipicephalus bursa* is a very distinctive *Rhipicephalus* species, as shown in the drawings. Suppose your tick is clearly not *Rh. bursa*, then finally concentrate on comparing your specimens against the drawings and labelled character states for the differences between *Rh. camicasi* and *Rh. turanicus*, but also consider that it could be *Rh. sanguineus* if dogs were present.

Areas of Africa relevant to tick distribution.

Approximate distributions of ticks in areas of Africa (these areas are derived from tick distributions only). An asterisk after a species indicates it has been recorded rarely from an area. *Or. moubata* includes *Or. moubata* and *Or. porcinus*. Madagascar is listed separately, below the table.

North	Sahara, Sahel	West	Central	North East	East	Southern
Ar. persicus *Ar. reflexus* *Ar. hermanni*	*Ar. persicus*	*Ar. persicus*	*Ar. persicus* *Ar. walkerae**	*Ar. persicus* *Ar. hermanni*	*Ar. persicus*	*Ar. persicus** *Ar. walkerae*
	 Am. lepidum *Am. variegatum*	 *Am. variegatum*	 *Am. pomposum* *Am. variegatum*	*Am. gemma* *Am. lepidum* *Am. variegatum*	*Am. gemma* *Am. lepidum* *Am. variegatum*	 *Am. hebraeum* *Am. variegatum*
De. marginatus						
Ha. leachi *Ha. punctata* *Ha. sulcata*	*Ha. leachi*	*Ha. leachi*	*Ha. leachi*	*Ha. leachi*	*Ha. leachi*	*Ha. leachi*
Hy. anatolicum *Hy. excavatum* *Hy. scupense* *Hy. dromedarii* *Hy. impeltatum* *Hy. lusitanicum* *Hy. marginatum* *Hy. rufipes** *Hy. turanicum**	*Hy. anatolicum* *Hy. excavatum* *Hy. scupense* *Hy. dromedarii* *Hy. impeltatum* *Hy. impressum* *Hy. rufipes* *Hy. truncatum*	 *Hy. rufipes* *Hy. truncatum*	 *Hy. rufipes* *Hy. truncatum*	*Hy. anatolicum** *Hy. excavatum** *Hy. dromedarii* *Hy. impeltatum* *Hy. impressum** *Hy. marginatum** *Hy. rufipes* *Hy. truncatum*	 *Hy. dromedarii* *Hy. impeltatum* *Hy. rufipes* *Hy. truncatum*	 *Hy. rufipes* *Hy. truncatum* *Hy. turanicum*
Ix. ricinus						*Ix. pilosus* *Ix. rubicundus*
						Ma. winthemi
*Or. moubata** *Or. savignyi*	*Or. moubata** *Or. savignyi*	*Or. moubata** *Or. savignyi*	*Or. moubata* *Or. savignyi**	*Or. moubata** *Or. savignyi*	*Or. moubata* *Or. savignyi*	*Or. moubata* *Or. savignyi*
					*Ot. megnini**	*Ot. megnini*
Rh. annulatus (Sub-genus *Boophilus*)	*Rh. annulatus** *Rh. decoloratus* *Rh. geigyi**	*Rh. annulatus* *Rh. decoloratus* *Rh. geigyi*	*Rh. annulatus* *Rh. decoloratus* *Rh. geigyi**	*Rh. annulatus** *Rh. decoloratus*	*Rh decoloratus* *Rh. geigyi** *Rh. microplus*	*Rh. decoloratus* *Rh. microplus*
Rh. bursa			*Rh. appendiculatus*		*Rh. appendiculatus*	*Rh. appendiculatus*
Rh. camicasi	*Rh. camicasi*			*Rh. camicasi*		
	Rh. e .evertsi	*Rh. evertsi*	*Rh. evertsi*	*Rh. evertsi*	*Rh. evertsi*	*Rh. evertsi*
	Rh. guilhoni	*Rh. guilhoni*		*Rh. guilhoni*		
	*Rh. lunulatus**	*Rh. lunulatus*	*Rh. lunulatus*	*Rh. lunulatus*	*Rh. lunulatus*	*Rh. lunulatus*
	Rh. muhsamae	*Rh. muhsamae*	*Rh. muhsamae*	*Rh. muhsamae*	*Rh. muhsamae**	
Rh. praetextatus	*Rh. praetextatus*		*Rh. praetextatus**	*Rh. praetextatus*	*Rh. praetextatus*	
				Rh. pravus	*Rh. pravus*	
				Rh. pulchellus	*Rh. pulchellus*	
Rh. sanguineus	*Rh. sanguineus*	*Rh. sanguineus*	*Rh. sanguineus*	*Rh. sanguineus*	*Rh. sanguineus*	*Rh. sanguineus*
	*Rh. senegalensis**	*Rh. senegalensis*	*Rh. senegalensis*		*Rh. senegalensis**	
			*Rh. simus**		*Rh. simus**	*Rh. simus*
Rh. turanicus	*Rh. turanicus*	*Rh. turanicus**	*Rh. turanicus**	*Rh. turanicus*	*Rh. turanicus*	*Rh. turanicus*
			*Rh. zambeziensis**		*Rh. zambeziensis**	*Rh. zambeziensis*

Madagascar has the following species on domestic animals: *Am. variegatum, Or. moubata, Ot. megnini, Rh. (Bo.) microplus* and *Rh. sanguineus.*

Amblyomma gemma Dönitz, 1909.

General.
Amblyomma gemma is a species which needs to be distinguished from other *Amblyomma* species of more importance to domestic animals.

Differential diagnosis.
Amblyomma gemma is grouped with *Amblyomma cohaerens* and *Amblyomma hebraeum*, all have flat eyes close to the margin of the scutum. The female is very similar to *Am. hebraeum* but the enamel of *Am. gemma* is more extensive and has fine connections between the central and lateral spots. Also the medium size punctations of *Am. gemma* are confined to the anterior area of the scutum. The male of *Am. gemma* has 6 of 11 festoons with enamel ornamentation and medium punctations around the eyes. *Amblyomma gemma* and *Am. hebraeum* are distributed far apart from each other. *Amblyomma gemma* does however overlap in distribution with *Amblyomma lepidum*, but the latter species has convex eyes.

Hosts.
Amblyomma gemma adults feed on domestic animals such as cattle and camels, but large herbivores such as giraffes and buffaloes are the preferred hosts of this tick species.

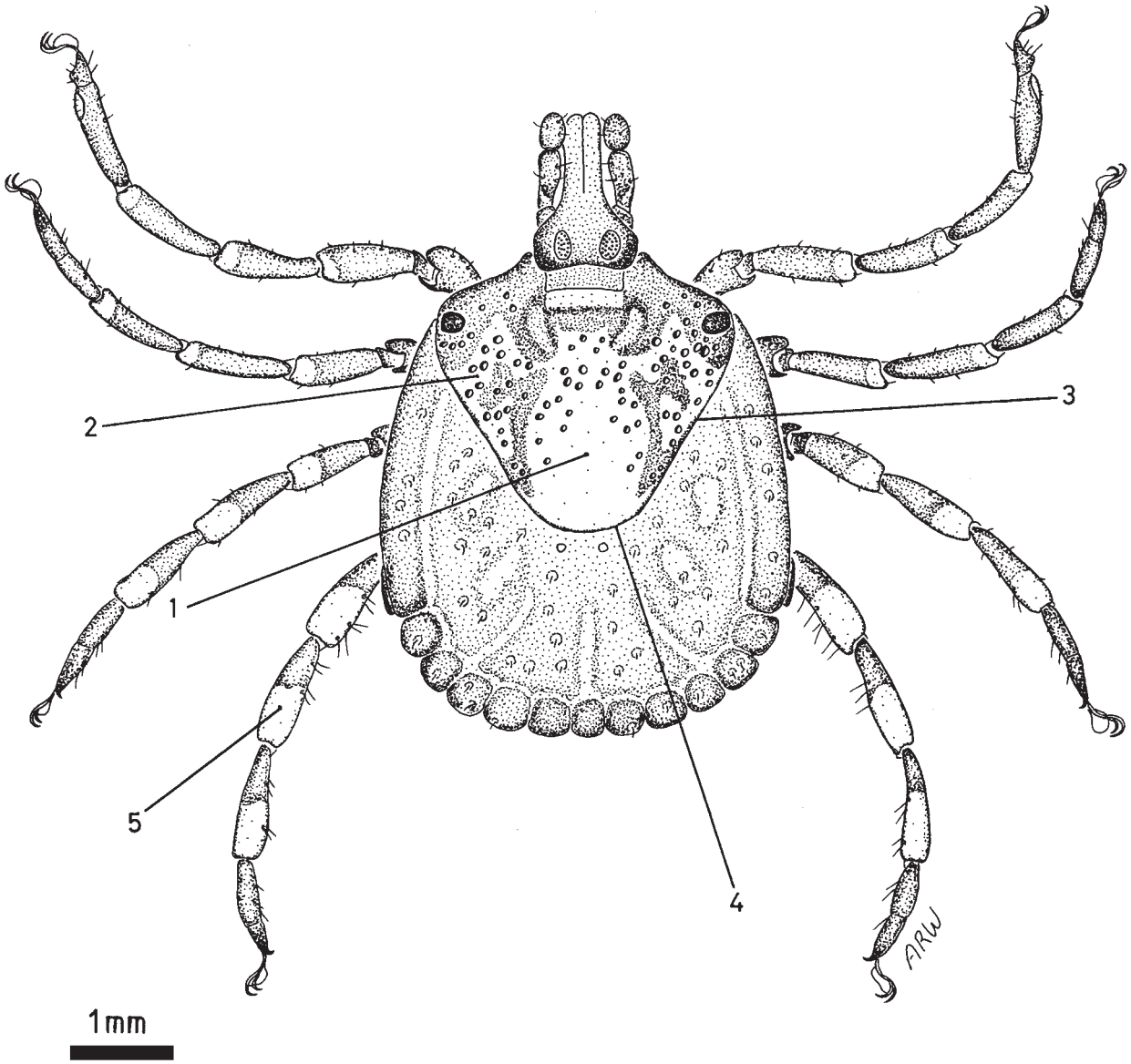
Life cycle and seasonal occurrence.
This species is a three-host tick.

Disease.
Amblyomma gemma is not known to be important to the health of domestic animals.

Habitat and distribution.
This tick has been recorded from areas with climates ranging from temperate (highland), through steppe to desert. It is mainly distributed in eastern Ethiopia, northern and southern Somalia, Kenya and north-eastern Tanzania.

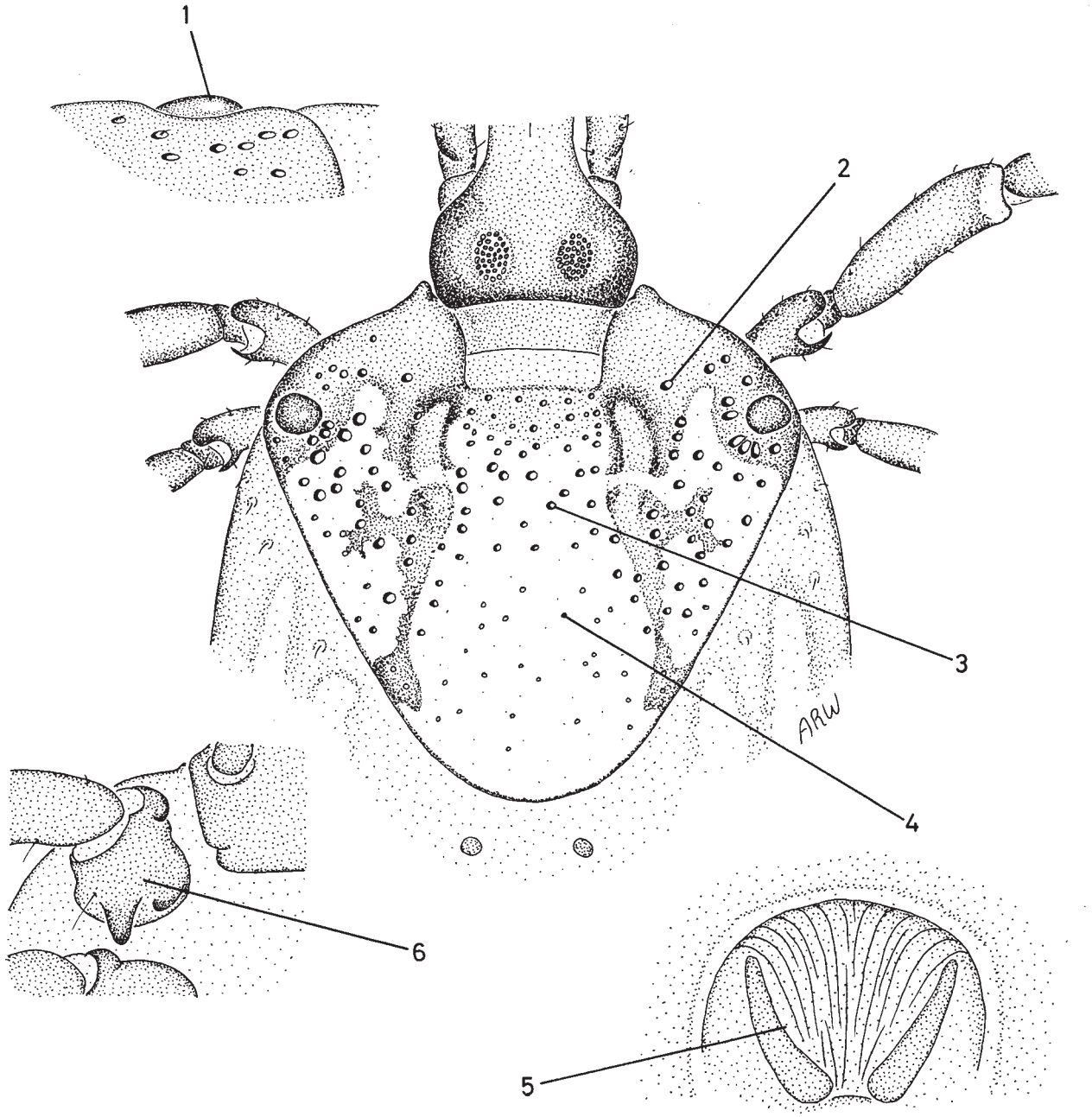
Distribution of *Amblyomma gemma*.

***Amblyomma gemma* female, dorsal.**



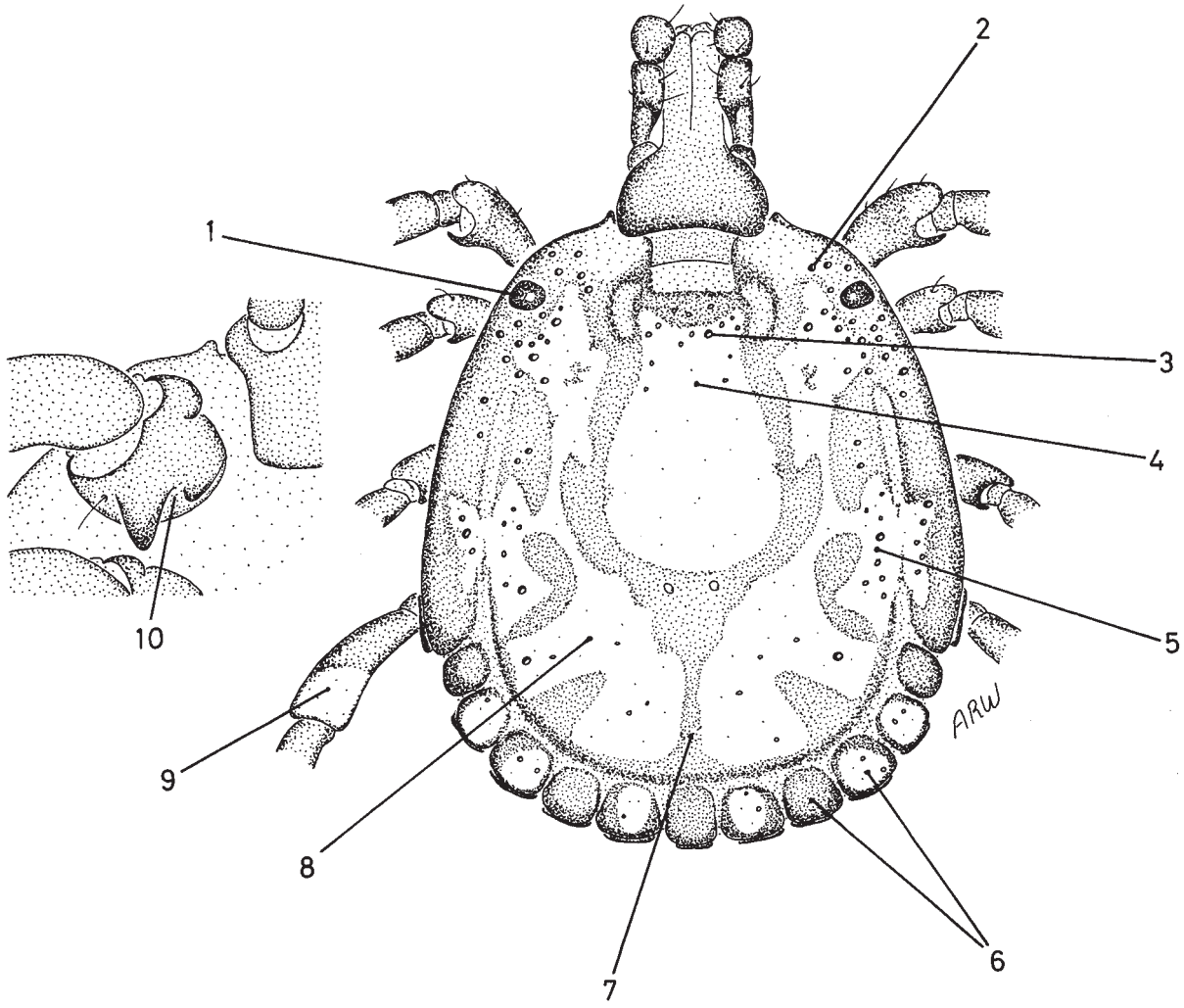
1 Mesial area of enamel ornamentation on scutum is large and elongate.
2 Lateral areas of enamel ornamentation on scutum are large and complex.
3 Scutum sides are straight.
4 Scutum posterior angle is broad.
5 Leg colouration is with pale rings.

***Amblyomma gemma* female, scutum at top, genital aperture at bottom right and coxa 1 at bottom left.**



1 Eyes are slightly convex.
2 Primary punctation sizes on scutum are small to medium.
3 Primary punctation distribution on scutum is localized (between the eyes).
4 Enamel colour is pink to orange.
5 Genital aperture posterior lips have a narrow **V** shape.
6 Coxae 1 external and internal spur lengths are: external medium and internal short.

***Amblyomma gemma* male, dorsal.**



1 Eyes are slightly convex (as shown for the female).
2 Primary punctation sizes on conscutum are small to medium.
3 Primary punctation distribution on conscutum is localized (between the eyes).
4 Mesial area of enamel ornamentation on conscutum is elongate.
5 Lateral median areas of enamel ornamentation on conscutum are large and complex.
6 Festoon enamelling is partial (6 of 11 festoons with enamel).
7 Posteromedian stripe is broad (in most populations of this species it also joins with the falciform stripe which runs transversely below the mesial area of enamel).
8 Enamel colour is pink to orange.
9 Leg colouration is with pale rings.
10 Coxae 1 external and internal spur lengths are: external medium and internal short.

Amblyomma hebraeum Koch, 1844.

General.
Amblyomma hebraeum is known as The South African bont tick ("bont" refers to the coloured pattern on the scutum but note that *Hyalomma* species are also called bont legged ticks because of the coloured rings on their legs). This species is notorious as the main vector of *Ehrlichia ruminantium* (= *Cowdria ruminantium*) in southern Africa, and as a cause of direct damage to its host's tissues.

Differential diagnosis.
Amblyomma hebraeum is grouped with *Amblyomma cohaerens* and *Amblyomma gemma*, all have flat eyes close to the margin of the scutum. The female is very similar to *Am. gemma* with a complex pattern of enamel but without connections between the central and lateral spots. However, the distribution of this tick does not overlap with that of *Am. gemma*. The medium and small punctations of *Am. hebraeum* are fairly evenly spread over the scutum. The male has distinctive enamel ornamentation on 9 of 11 festoons, only the two outermost ones are plain. The medium sized punctations are widespread.

Hosts.
Adult ticks prefer large hosts such as cattle and large wild ruminants, particularly giraffes, buffaloes, elands and rhinoceroses. They do, however, also infest sheep and goats. The adults prefer the hairless areas under the tail, in the lower perineal region, on the udder, around the genitalia and in the axillae of cattle, as well as around the feet of sheep and goats. The immature stages feed on the same hosts as the adults and also on small antelopes, scrub hares, helmeted guineafowls, and tortoises. The immature stages of this tick very rarely infest rodents; when they do they seem unable to engorge and usually die. The larvae are found on the feet, legs and muzzle of their hosts; the nymphs attach on the feet, legs, groin, sternum and neck. On the larger ground frequenting birds, nymphs and larvae attach mainly on the head and neck.

Life cycle and seasonal occurrence.
This species is a three-host tick. 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 and the larvae wait for hosts on the vegetation. Once attached to a host they 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 approximately 6 days) are present will the females attach. The pheromones secreted by the mature male ticks not only attract female ticks but other males 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 two months or longer. The life cycle usually takes one year to complete but may extend for longer.

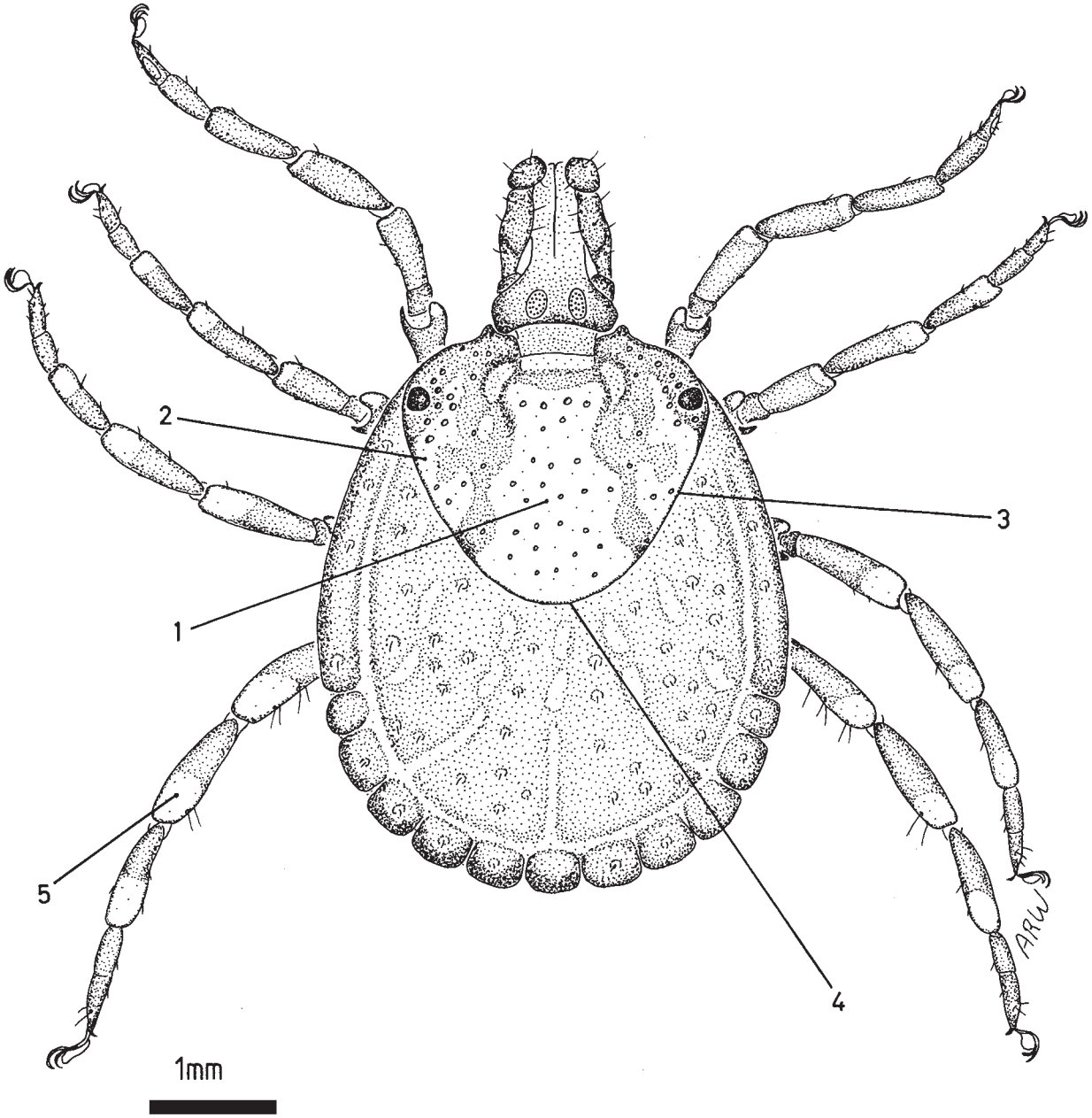
The larvae are most active during late summer and autumn, the nymphs during winter and early spring and the adults during summer. In the north-eastern lowveld regions of the KwaZulu-Natal, Northern and Mpumalanga provinces of South Africa and in southern Zimbabwe, the life cycle continues throughout the year.

Disease.
Amblyomma hebraeum is most important for the stage to stage transmission of *Eh. ruminantium*, the cause of heartwater in cattle, sheep and goats and also in susceptible wild antelope species. Transmission of *Eh. ruminantium* by wandering male ticks that have already fed can also take place. This tick transmits the bacteria *Rickettsia africae* and *Rickettsia conorii*, causing tick typhus in humans, and the protozoan *Theileria mutans* causing benign theileriosis in cattle. Heavy infestations will cause a reduction in growth rate: 10 engorging female ticks per day on cattle can decrease live-weight gain by 20kg over a three month period. The long mouthparts may cause sores that become infected with bacteria leading to abscessation. Foot abscesses develop in sheep and goats. The wounds caused by the mouthparts are attractive to the blowfly *Chrysomya bezziana* and the larvae of this fly can cause severe myiasis.

Habitat and distribution.
Amblyomma hebraeum occurs in a variety of climatic regions from Mediterranean (South African) and temperate, through savanna to steppe. It requires moisture and warmth, brush and bush, and does not survive in open grassland. The tick is confined to south eastern Africa. In South Africa it is found along the coastal belt. It is also most commonly found in eastern Swaziland, southern Mozambique, eastern Botswana and in southern and eastern Zimbabwe as well as parts of the Zimbabwean highveld.

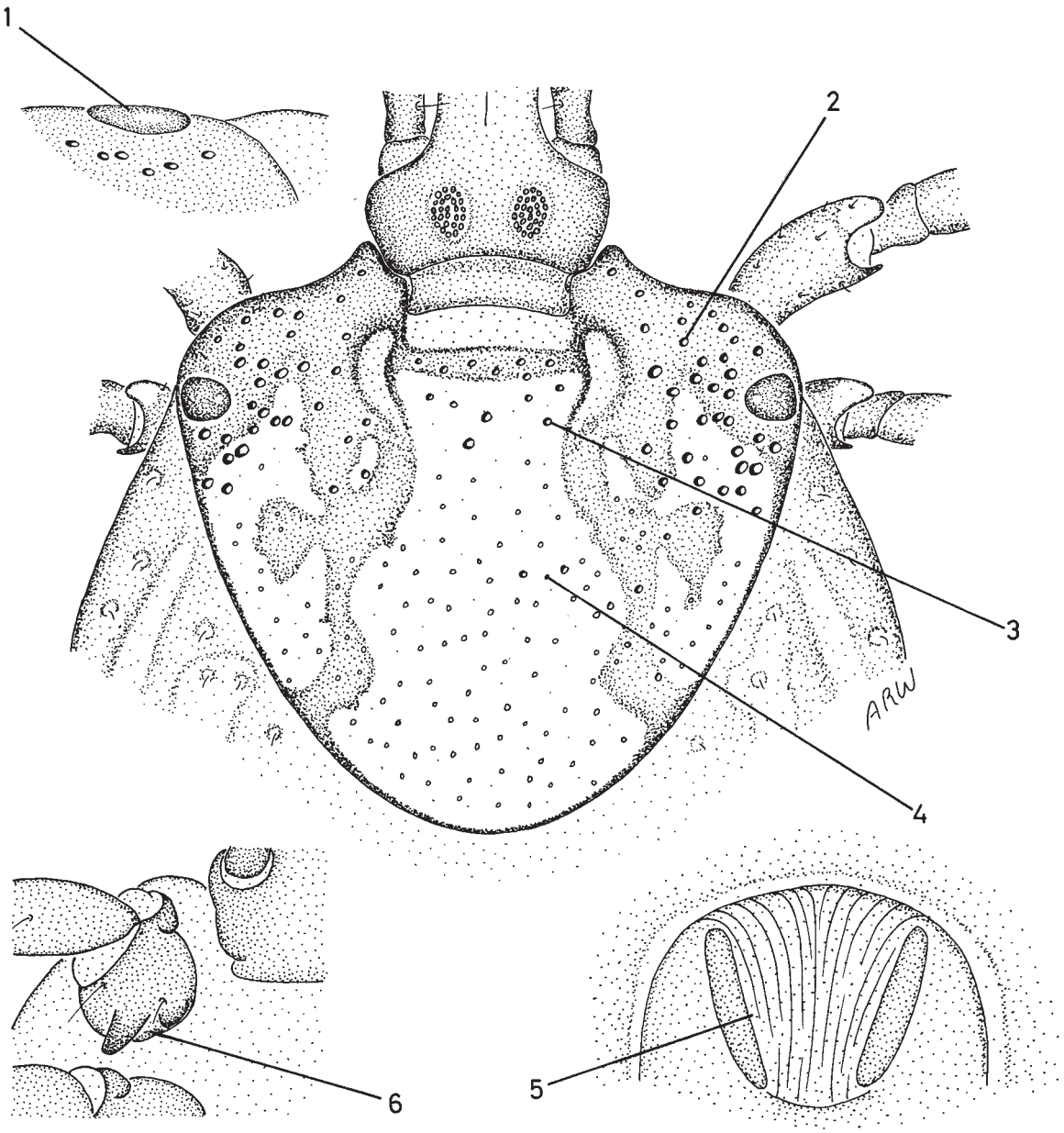
Distribution of *Amblyomma hebraeum*.

Amblyomma hebraeum **female**, **dorsal**.



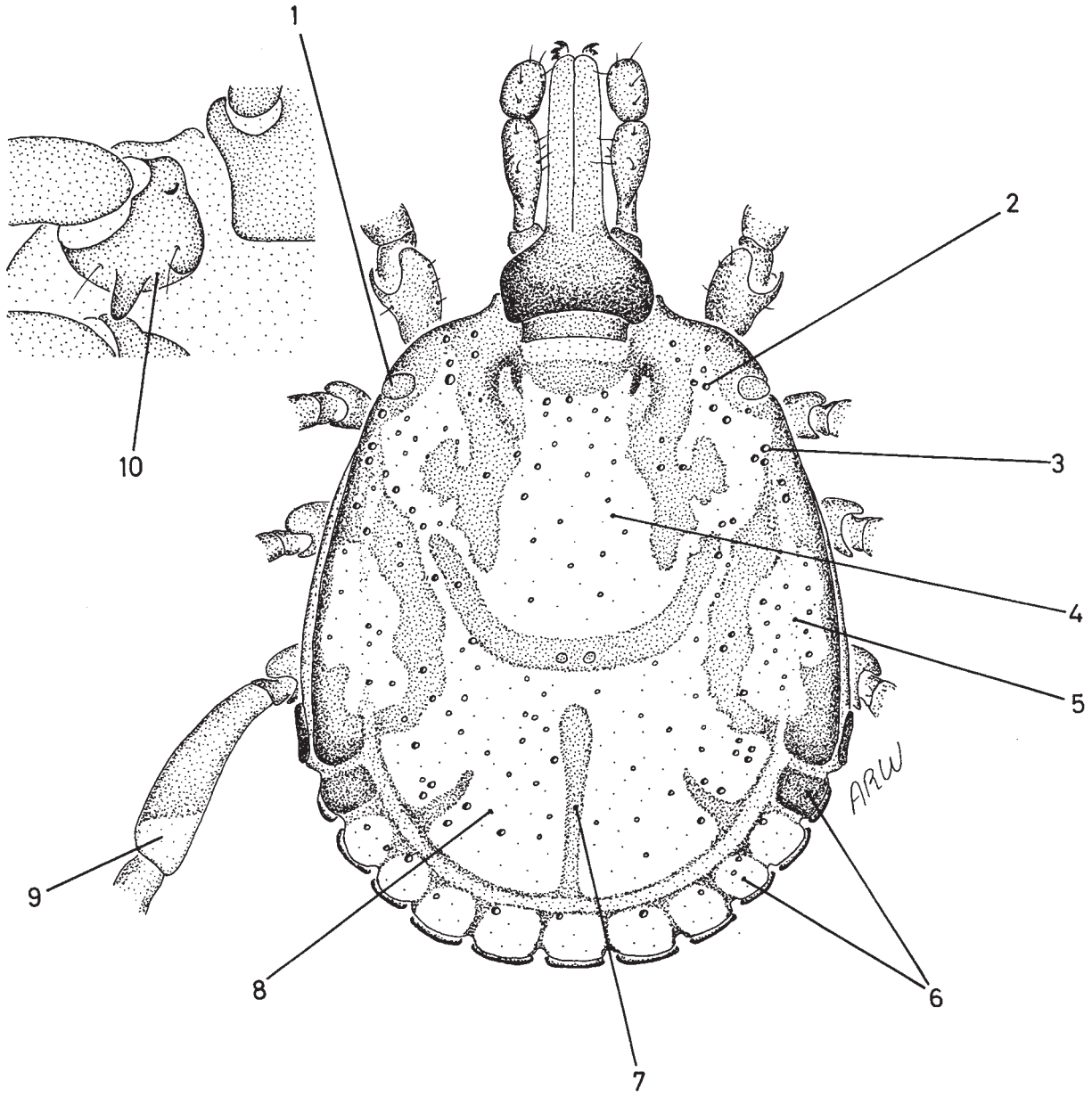
1 Mesial area of enamel ornamentation on scutum is large and elongate.
2 Lateral areas of enamel ornamentation on scutum are large and complex.
3 Scutum sides are convex.
4 Scutum posterior angle is broad.
5 Leg colouration is with pale rings.

***Amblyomma hebraeum* female, scutum in centre, genital aperture at bottom right and coxa 1 at bottom left.**



1 Eyes are flat (they are also close to the margin of the scutum).
2 Primary punctation sizes on scutum are small to medium.
3 Primary punctation distribution on scutum is localized (between the eyes).
4 Enamel colour is pink to orange.
5 Genital aperture posterior lips have a narrow **V** shape.
6 Coxae 1 external and internal spur lengths are: external medium and internal short.

Amblyomma hebraeum **male**, **conscutum, and coxa 1 at top left**.



1 Eyes are slightly convex (as shown for female, they are also close to the margin of the conscutum).
2 Primary punctation sizes on conscutum are small to medium, (nearly all small).
3 Primary punctation distribution on conscutum is sparse.
4 Mesial area of enamel ornamentation on conscutum is elongate.
5 Lateral median areas of enamel ornamentation on conscutum are large and complex.
6 Festoon enamelling is extensive (9 of 11 are distinctly enamelled, the two outermost festoons are not enamelled).
7 Posteromedian stripe is narrow (it is confined within the enamel area, rarely reaching the falciform stripe which runs transversely below the mesial area of enamel).
8 Enamel colour is pink to orange.
9 Leg colouration is with pale rings.
10 Coxae 1 external and internal spur lengths are: external medium and internal short.

Amblyomma lepidum Dönitz, 1909.

General.
Amblyomma lepidum needs to be distinguished from the more important *Amblyomma variegatum* with which it may coexist.

Differential diagnosis.
Amblyomma lepidum is grouped with *Am. variegatum* and *Amblyomma pomposum*, all have distinctly convex eyes which are separate from the margin of the scutum. Female *Am. lepidum* have conspicuously large punctations. The posterior lips of the female genital aperture form a narrow **V** shape. The male has an enamel pattern with lateral spots and spots of enamel on 6 to 8 out of the 11 festoons. In contrast, *Am. variegatum* and *Am. pomposum* males have no enamel on the festoons. *Amblyomma lepidum* has pink to orange enamel in contrast to the orange to red enamel of *Am. pomposum*. The distributions of *Am. lepidum* and *Am. pomposum* do not overlap.

Hosts.
Adult *Am. lepidum* prefer cattle as hosts, although camels may also harbour large infestations. Other livestock animals can be infested as well as a number of species of wild ungulates. Adults are predominantly found attached on the ventral surface of the host from the lower dewlap to the sternum, including the axillae, genital areas and udder.

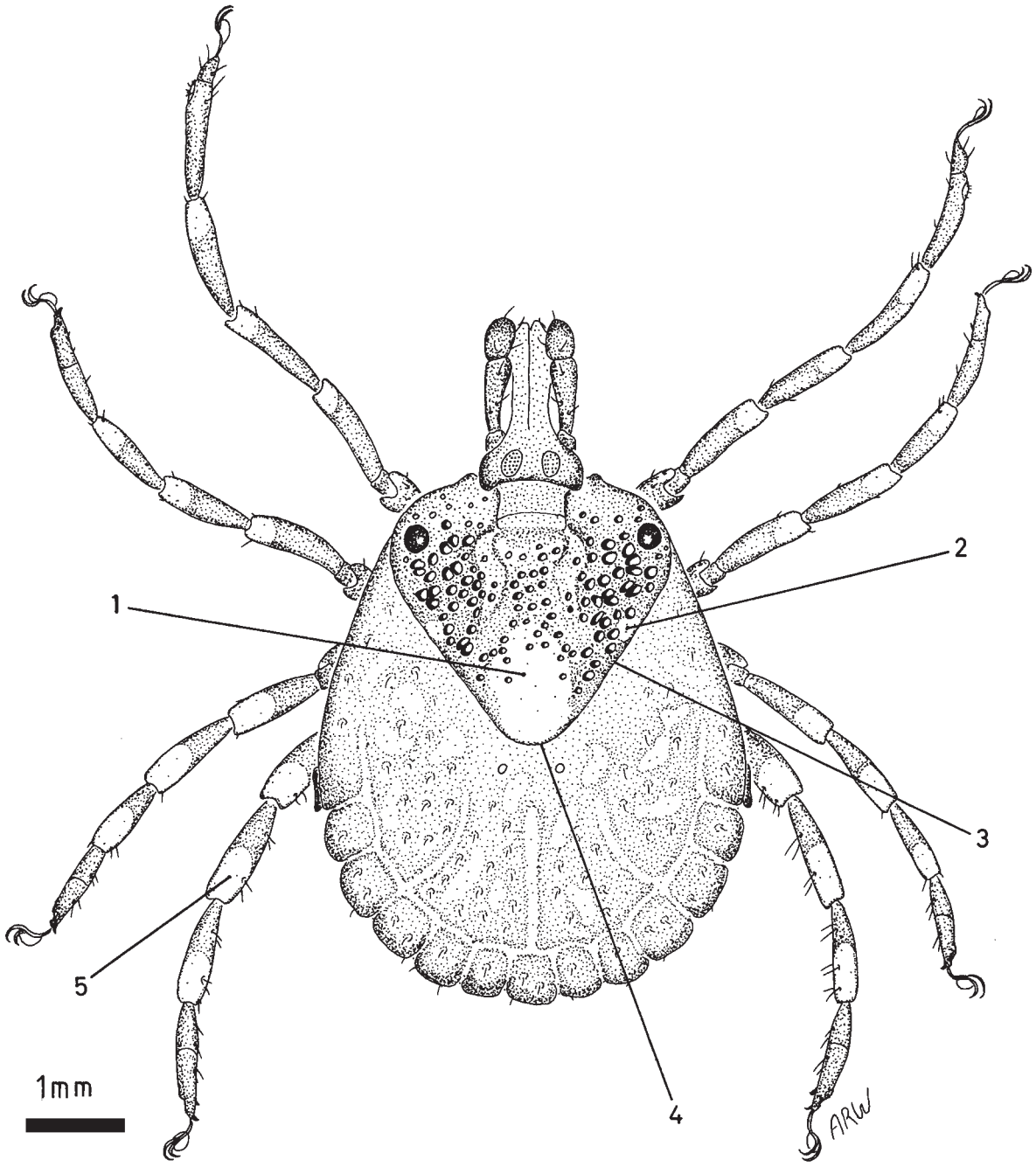
Life cycle and seasonal occurrence.
This species is a three-host tick. In Tanzania, which lies south of the equator, adult ticks are most abundant between October and February. Infestations begin either shortly before or after the onset of the rainy season, but there may be considerable variation in the timing of the peak. In Ethiopia, north of the equator, adults peak during the rainy season in May to June.

Disease.
This tick transmits the bacterium *Ehrlichia ruminantium* (= *Cowdria ruminantium*), which causes heartwater in cattle, sheep and goats, and the protozoans *Theileria mutans* and *Theileria velifera* which cause benign bovine theilerioses.

Habitat and distribution.
Amblyomma lepidum occurs in a wide variety of climatic regions, from temperate (highland), to savanna, steppe and desert, but it most commonly inhabits arid habitats with 250 -750mm rainfall. It is widespread in central and eastern Sudan, Ethiopia, southern Somalia, eastern Uganda, Kenya and the northern region of central Tanzania. This species coexists with *Am. variegatum* in limited locations.

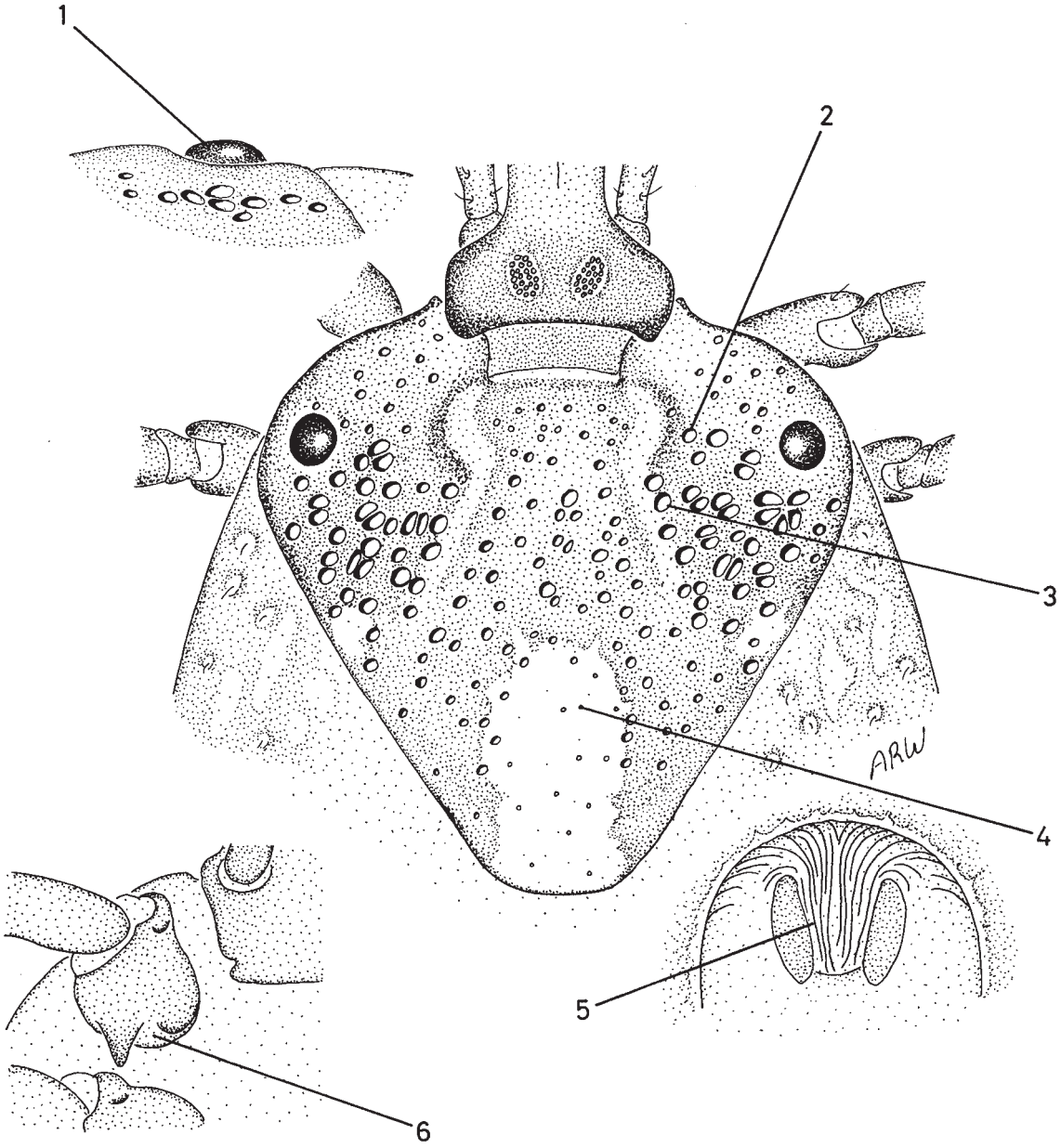
Distribution of *Amblyomma lepidum*.

***Amblyomma lepidum* female, dorsal.**



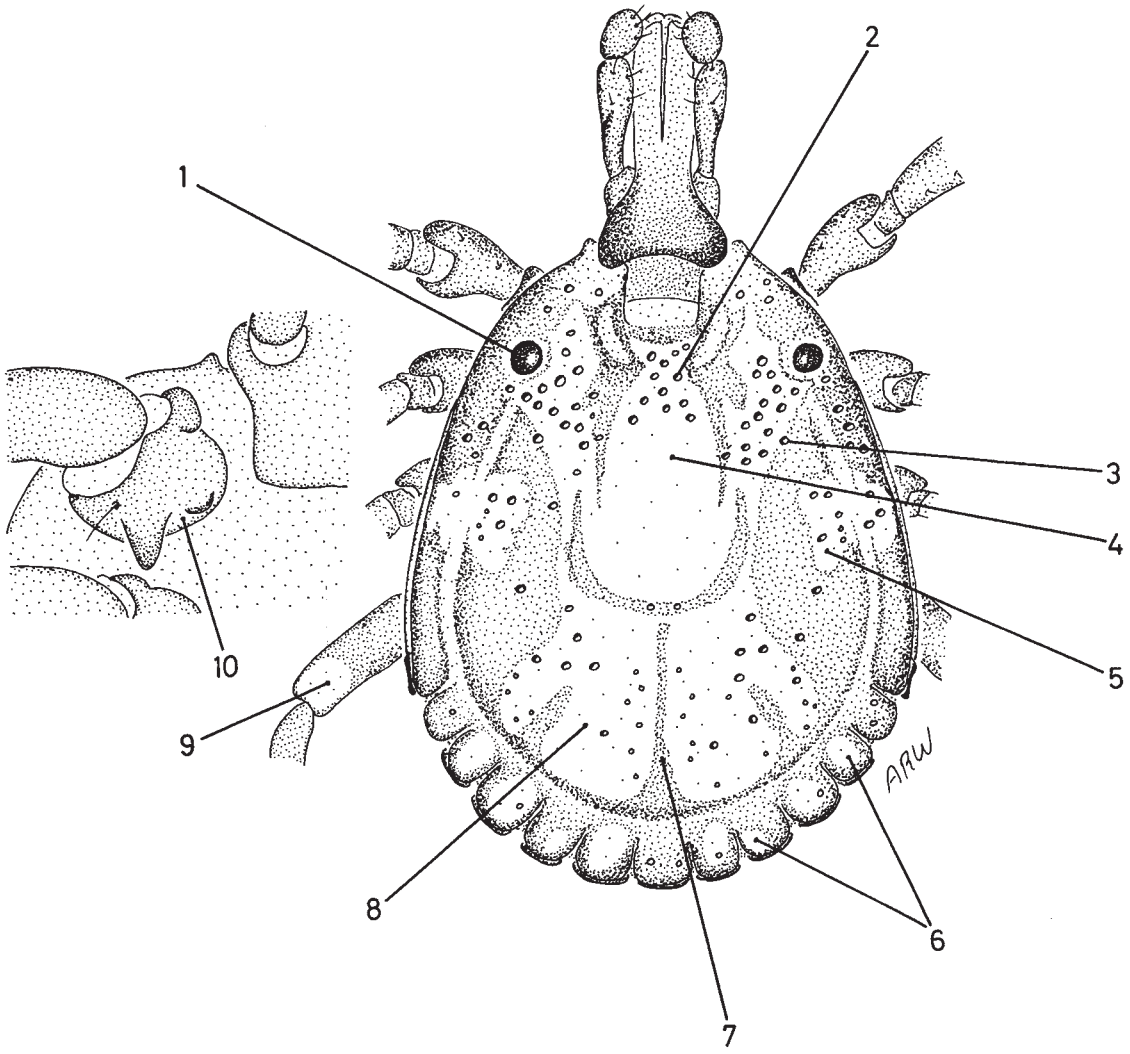
1 Mesial area of enamel ornamentation is small and rounded.
2 Lateral areas of enamel ornamentation are small.
3 Scutum sides are straight.
4 Scutum posterior angle is narrow.
5 Legs colouration is with rings.

***Amblyomma lepidum* female, scutum in centre, genital aperture at bottom right and coxa 1 at bottom left.**



1 Eyes are distinctly convex.
2 Primary punctation sizes on scutum are medium to large.
3 Primary punctation distribution on scutum is localized (mainly between the eyes, and almost joining in the denser areas).
4 Enamel colour is pink to orange.
5 Genital aperture posterior lips have a narrow **V** shape.
6 Coxae 1 external and internal spur lengths are: external medium and internal short.

***Amblyomma lepidum* male, conscutum, and coxa 1 at left.**



1 Eyes are distinctly convex (as shown for female).
2 Primary punctation sizes on conscutum are small to medium.
3 Primary punctation distribution on conscutum is localized (mostly between the eyes).
4 Mesial area of enamel ornamenation on conscutum is elongate.
5 Lateral median areas of enamel ornamentation on conscutum are large.
6 Festoon enamelling is partial (6 to 8 of 11 festoons have variable enamel, there is no enamel on the central and two outermost festoons).
7 Posteromedian stripe is narrow.
8 Enamel colour is pink to orange.
9 Leg colouration is with pale rings.
10 Coxae 1 external and internal spur lengths are: external medium, internal short.

Amblyomma pomposum Dönitz, 1909.

General.
Amblyomma pomposum is a highly characteristic species with a distribution restricted mostly to southern central Africa.

Differential diagnosis.
Amblyomma pomposum is in a group with *Amblyomma variegatum* and *Amblyomma lepidum*, all have convex eyes within an orbit and separate from the margin of the scutum. Both sexes of *Am. pomposum* can be differentiated from *Am. variegatum* and *Am. lepidum* by having the scutum or conscutum evenly covered with large primary punctations and an orange to red colour of enamel. The male *Am. pomposum* has festoons without enamel.

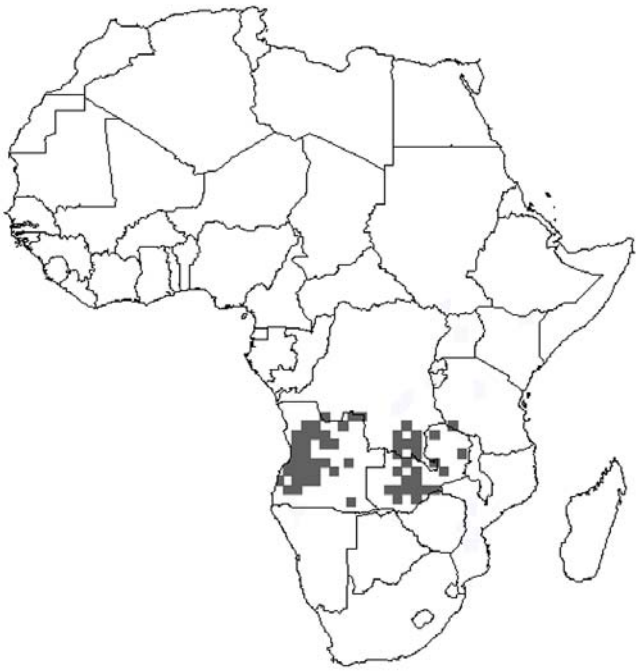
Hosts.
This species has a similar host range to *Amblyomma hebraeum* and *Am. variegatum*. It infests cattle and large wild ruminants but will also infest sheep and goats. The adults most frequently attach on the undersides of cattle.

Life cycle and seasonal occurrence.
Amblyomma pomposum has a three-host life cycle similar to those of *Am. hebraeum* and *Am. variegatum*. In Angola, nymphs and adults are most abundant during the rainy season.

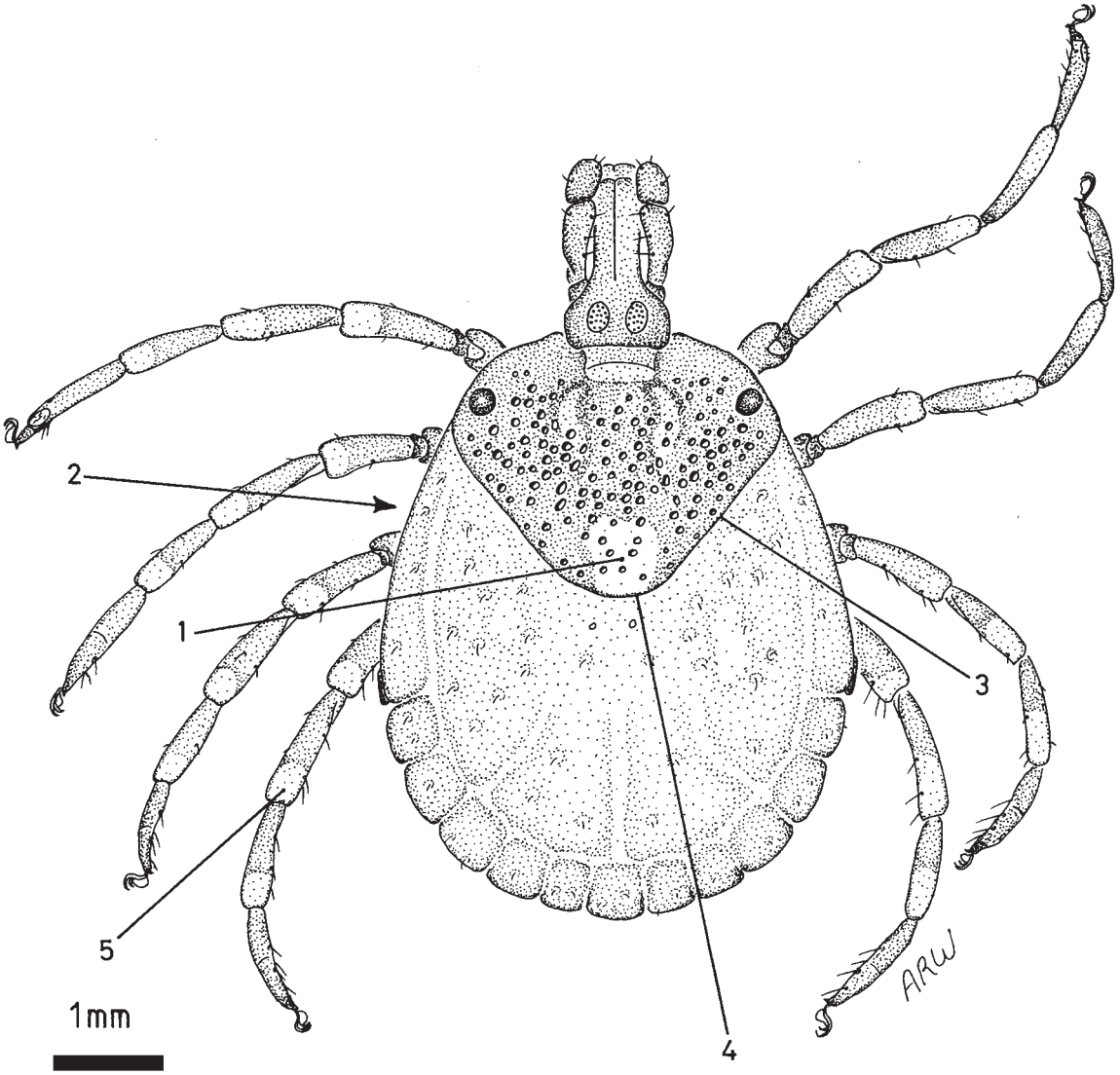
Disease.
It transmits the bacterium *Ehrlichia ruminantium* (= *Cowdria ruminantium*) which causes heartwater in cattle, sheep and goats. The feeding of *Am. pomposum* causes severe damage to skin and leads to loss of production.

Habitat and distribution.
This tick is restricted to savanna climatic regions in Angola, western Zambia and southern Democratic Republic of Congo. Unlike other vectors of *Eh. ruminantium* in southern Africa, *Am. pomposum* occurs mostly in habitats of wet highland areas of savanna and forest.

Distribution of *Amblyomma pomposum*.

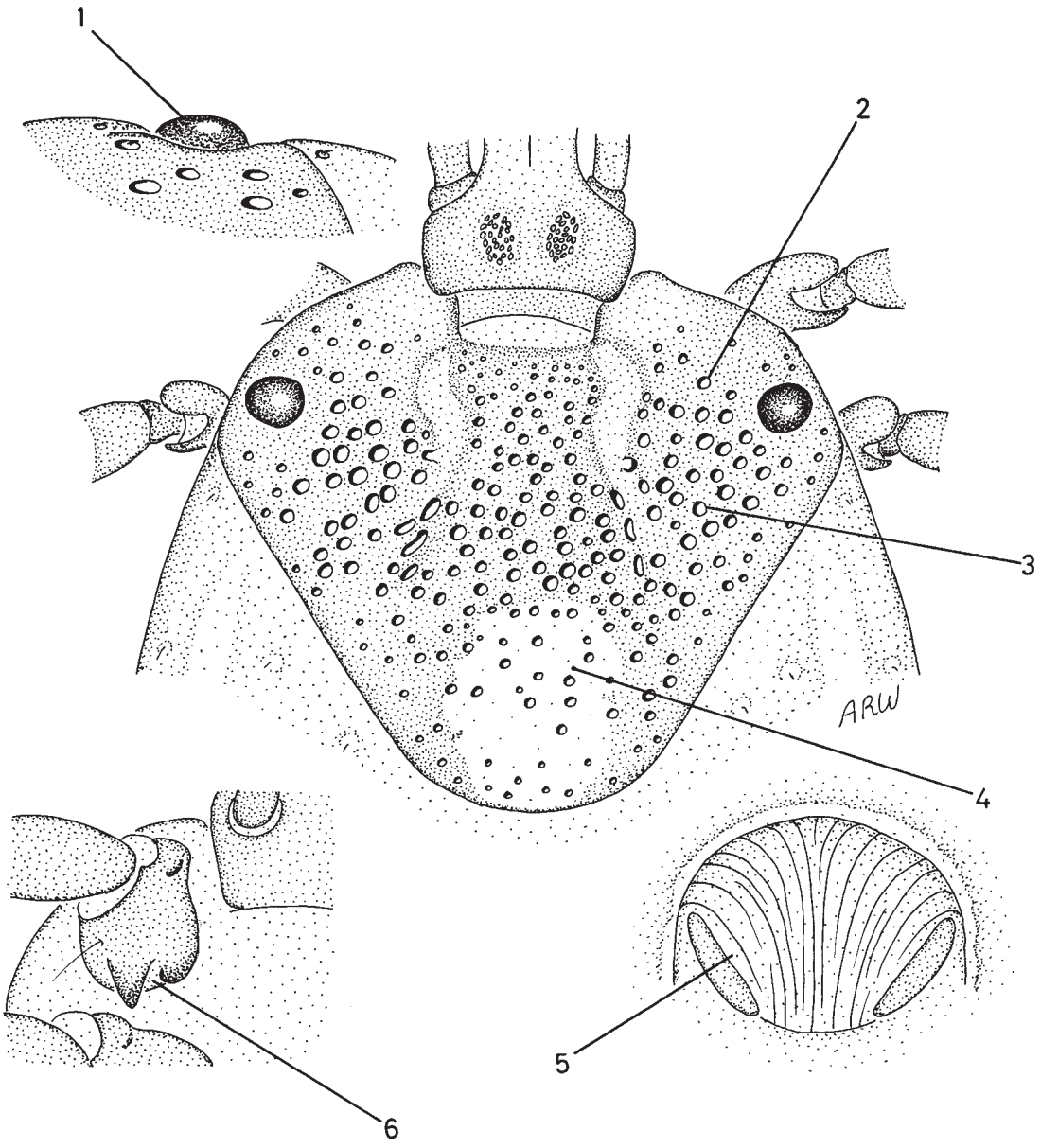


***Amblyomma pomposum* female, dorsal.**



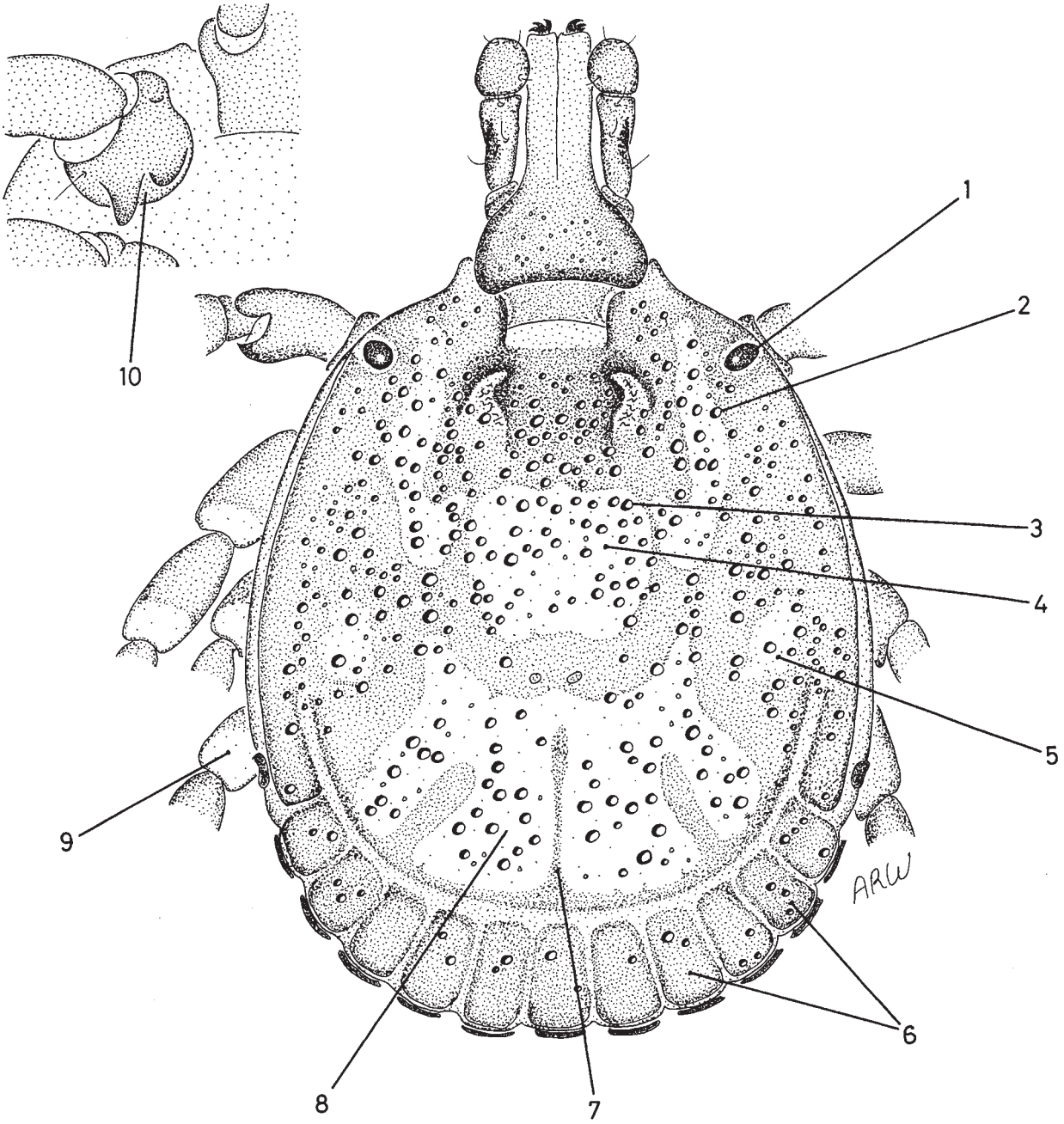
1 Mesial area of enamel ornamenation on scutum is small and rounded (it may be very indistinct).
2 Lateral areas of enamel ornamentation on scutum are absent.
3 Scutum sides are straight.
4 Scutum posterior angle is broad.
5 Leg colouration is with pale rings.

***Amblyomma pomposum* female, scutum in centre, genital aperture bottom right and coxa 1 bottom left.**



1 Eyes are distinctly convex.
2 Primary punctation sizes on scutum are medium to large (most are large).
3 Primary punctation distribution on scutum is regular.
4 Enamel colour is orange to red.
5 Genital aperture posterior lips have a broad **V** shape.
6 Coxae 1 external and internal spur lengths are: external medium and internal short.

***Amblyomma pomposum* male, conscutum, and coxa 1 at top left.**



1 Eyes are distinctly convex (as shown for the female).
2 Primary punctation sizes on consuctum are medium to large (most are large).
3 Primary punctation distribution on conscutum is dense.
4 Mesial area of enamel ornamentation on conscutum is short.
5 Lateral median areas of enamel ornamentation on conscutum are small.
6 Festoon enamelling is absent.
7 Posteromedian stripe is narrow.
8 Enamel colour is orange to red.
9 Leg colouration is with pale rings.
10 Coxae 1 external and internal spur lengths are: external medium and internal short.

Amblyomma variegatum (Fabricius, 1794).

General.
Amblyomma variegatum is known as The tropical bont tick ("bont" refers to the coloured pattern on the scutum but note that *Hyalomma* species are called bont legged ticks because of the coloured rings on their legs). This species is one of the commonest and most widely distributed ticks on livestock in Africa. It is notorious as the most predominant vector of the causative organism of heartwater and for having spread to the Caribbean on imported cattle.

Differential diagnosis.
Amblyomma variegatum is grouped with *Amblyomma lepidum* and *Amblyomma pomposum*, all have distinctly convex eyes which are separate from the margin of the scutum. Both sexes of *Am. variegatum* can be differentiated from *Am. lepidum* and *Am. pomposum* by having small to medium punctations. The posterior lips of the *Am. variegatum* female genital aperture form a wide **U** shape. Males have an enamel pattern usually without lateral spots (some populations may have these spots) and there is no enamel on the festoons. The enamel of both sexes is pink to orange in colour.

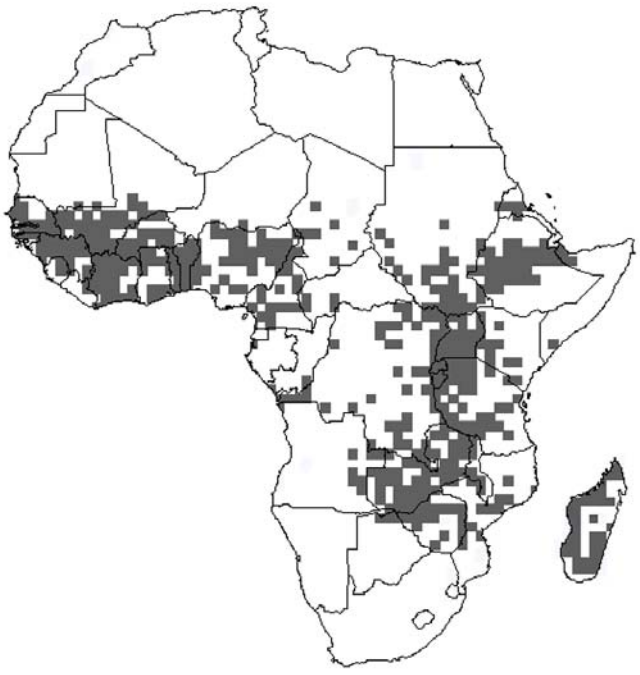
Hosts.
All stages of this tick infest cattle, sheep and goats. Buffaloes and other large herbivores are also hosts. Nymphs occasionally feed on birds. Adults attach on the dewlap, sternum, flanks, areas around the genitalia, and the udders. The host range is similar to that of *Amblyomma hebraeum*.

Life cycle and seasonal occurrence.
Amblyomma variegatum is a three-host tick with a life cycle similar to that of *Am. hebraeum*. It differs from *Am. hebraeum* in that it has a more clearly defined pattern of seasonal occurrence. In Zambia adults are most abundant in the wet season (October to February), larvae from March to May and nymphs from May to September. This pattern of seasonal abundance can arise from morphogenetic diapause (= delay in development) in the females, resulting in a delay in oviposition. Similar observations of only one generation being completed each year have been made in other regions that have a single annual rainy season. In Zimbabwe adults can be present throughout the year with heavier infestations in the warmer months (September to May), and nymphs present only from June to September.

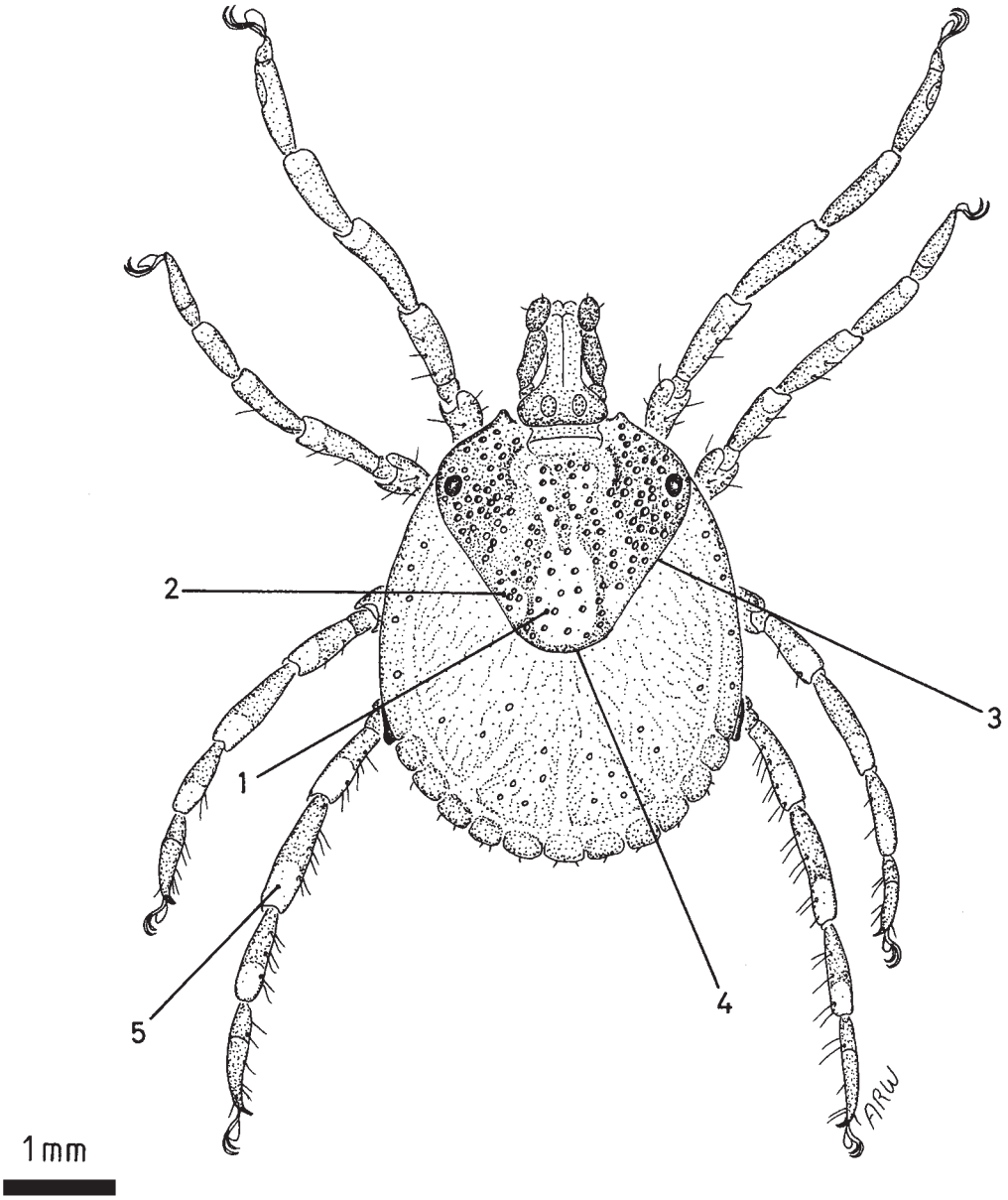
Disease.
This tick transmits the bacterium *Ehrlichia ruminantium* (= *Cowdria ruminantium*) which causes heartwater in cattle, sheep and goats. It also transmits the bacterium *Ehrlichia bovis*, causing bovine ehrlichiosis, and the protozoans *Theileria mutans* and *Theileria velifera* causing benign bovine theileriosis. Heavy infestations suppress the immunity of cattle, making worse the bacterial skin disease dermatophilosis. Heavy infestations also damage teats and reduce productivity.

Habitat and distribution.
Amblyomma variegatum occurs in areas with a wide variety of climates, from rain forest, temperate (highland), savanna through to steppe. It is widely distributed through West, Central 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 *Am. hebraeum* with which it shares similar habitats, hosts and sites of attachment. On cattle transportations it has spread to most of the Caribbean islands and to Madagascar.

Distribution of *Amblyomma variegatum*.

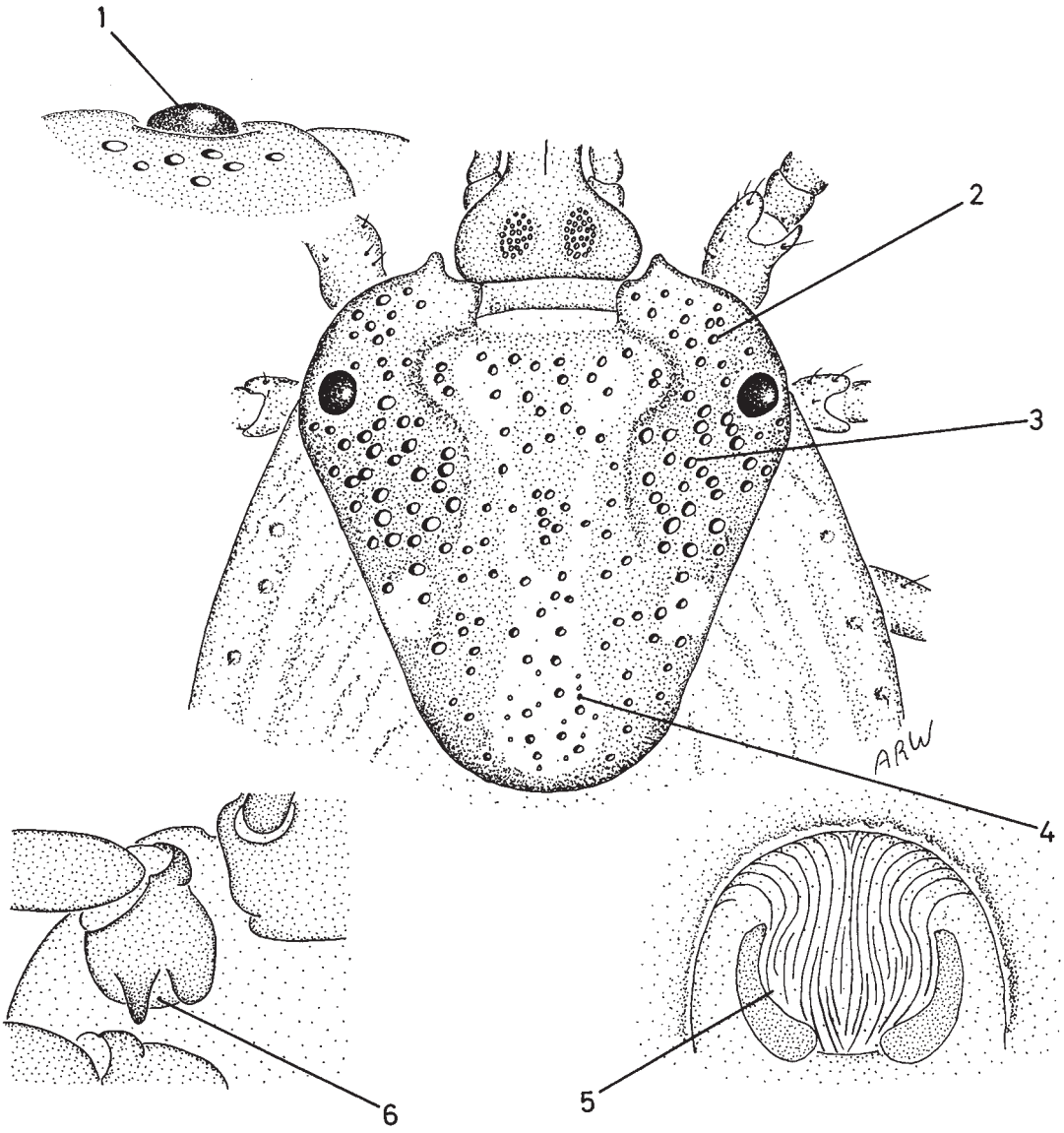


Amblyomma variegatum **female**, **dorsal**.



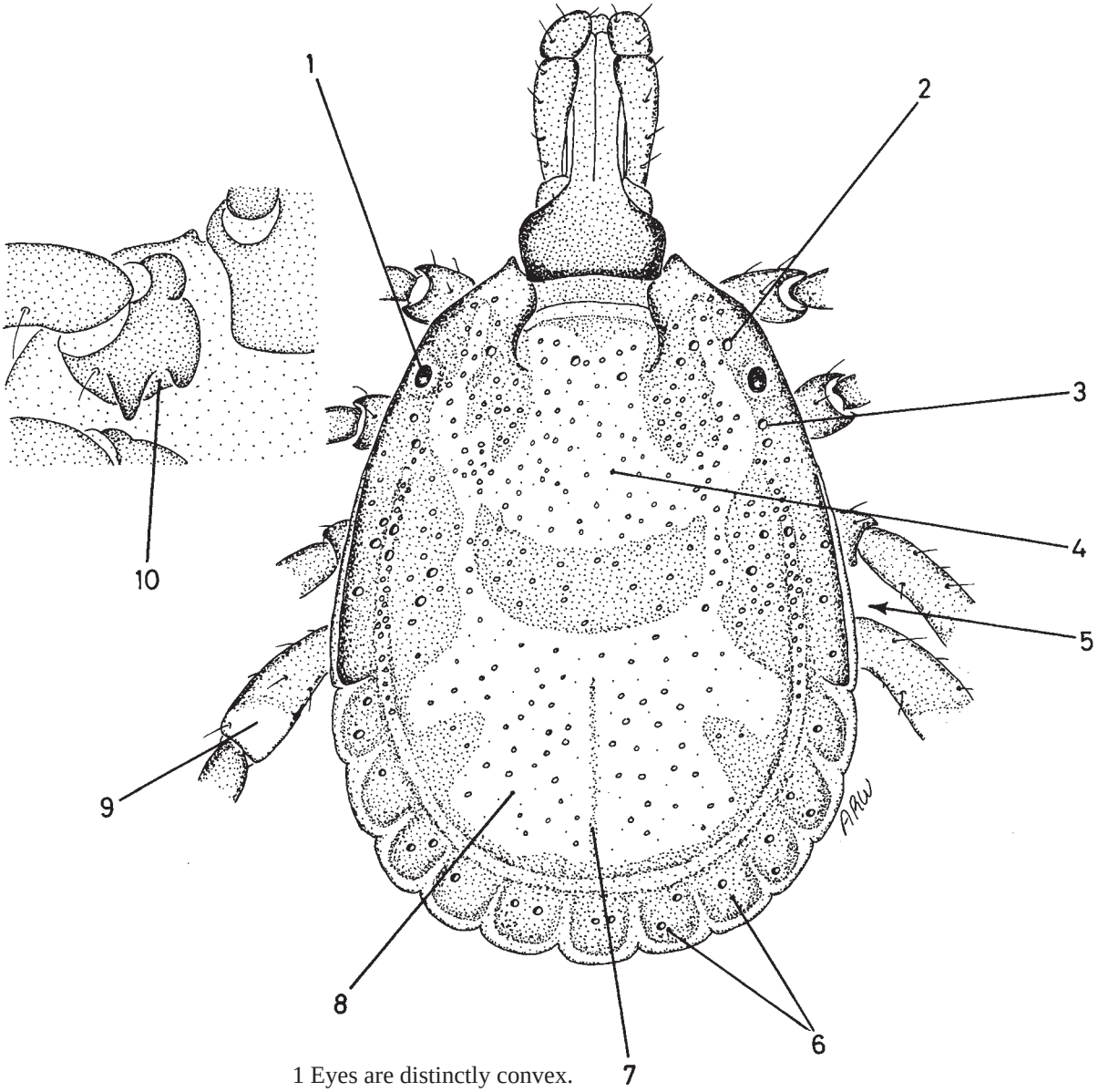
1 Mesial area of enamel ornamentation on scutum is elongate (it may be indistinct in its anterior part).
2 Lateral areas of enamel ornamentation on scutum are small.
3 Scutum sides are straight.
4 Scutum posterior angle is broad.
5 Leg colouration is with pale rings.

***Amblyomma variegatum* female, scutum in centre, genital aperture at bottom right and coxa 1 at bottom left.**



1 Eyes are distinctly convex.
2 Primary punctation sizes on scutum are small to medium.
3 Primary punctation distribution on scutum is regular.
4 Enamel colour pink to orange.
5 Genital aperture posterior lips have a broad **U** shape.
6 Coxae 1 external and internal spur lengths are: external medium and internal short.

***Amblyomma variegatum* male, conscutum, and coxa 1 at top left.**



1 Eyes are distinctly convex.
2 Primary punctation sizes on conscutum are small to medium.
3 Primary punctation distribution on conscutum is sparse.
4 Mesial area of enamel ornamentation on conscutum is elongate.
5 Lateral median areas of enamel ornamentation on conscutum are absent (small areas may occur in some populations of this tick).
6 Festoon enamelling is absent.
7 Posteromedian stripe is narrow.
8 Enamel colour is pink to orange.
9 Leg colouration is with pale rings.
10 Coxae 1 external and internal spur lengths are: external medium and internal short.

Argas persicus (Oken, 1818) (with notes on *Argas reflexus* (Fabricius, 1794).

General.
Argas persicus is an argasid tick that has spread widely because of its close association with domestic birds. It is known as The fowl tick or The fowl tampan.

Differential diagnosis.
Argas species are difficult to differentiate. On domestic birds in Africa *Ar. persicus* needs to be distinguished from *Argas reflexus* and *Argas hermanni* in northern Africa, and *Argas walkerae* in southern Africa. *Argas persicus* has the lateral suture at the body margin marked by rectangular plates. In *Ar. reflexus* this margin is marked by fine ridges radiating outward. *Argas hermanni* is a generally smoother tick than *Ar. persicus* or *Ar. reflexus*. *Argas walkerae* is a larger tick, with a less distinctly convoluted pattern of mammillae and distinct camerostomal folds. Identification of male *Argas* species uses the same character states as used for the females. Males tend to be slightly darker and smaller and the genital pore is half the width of that of the female (see Plate 3).

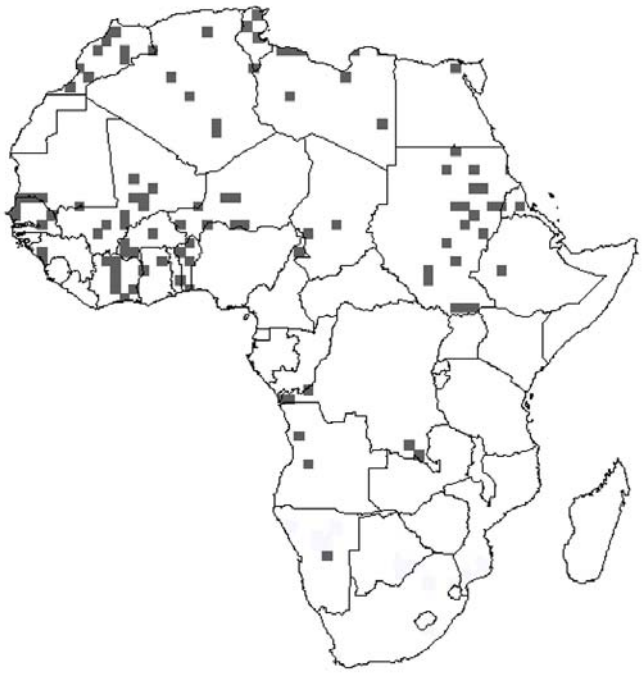
Hosts.
Domestic fowls, turkeys, ducks and geese are the hosts to which this tick is specialised. It also feeds on pigeons and a variety of wild birds. *Argas reflexus* is known as The pigeon tampan because it usually infests pigeons and thus comes into contact with humans in buildings where pigeons nest or roost.

Life cycle and seasonal occurrence.
The life cycle is typical of argasid ticks. The females lay batches of 20 to 100 eggs after each blood meal. The eggs hatch in approximately three weeks. The larvae attach and feed on a host for 5 to 10 days, usually under the wings. They detach then 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 four nymphal stages, each requiring a blood-meal before moulting to the next stage. Moulting occurs in cracks and crevices and the moult to the adult can occur from the second nymphal stage onwards. The final nymphal stage moults to the adults, these also feed only for a short while and, like the nymphs, usually feed at night when the birds are roosting. The adults feed about once a month. The females produce a batch of eggs after each blood-meal and they may produce six or seven batches during their lifetime. The larvae can survive for two months or more, the nymphs for one year and the adults for up to three years without a blood-meal. In climates with a winter season the larvae and first nymphal stage are most active in early summer, nymphal stages 2 to 4 in mid-summer, adults late summer and autumn. The tick over-winters in the adult stage or as eggs.

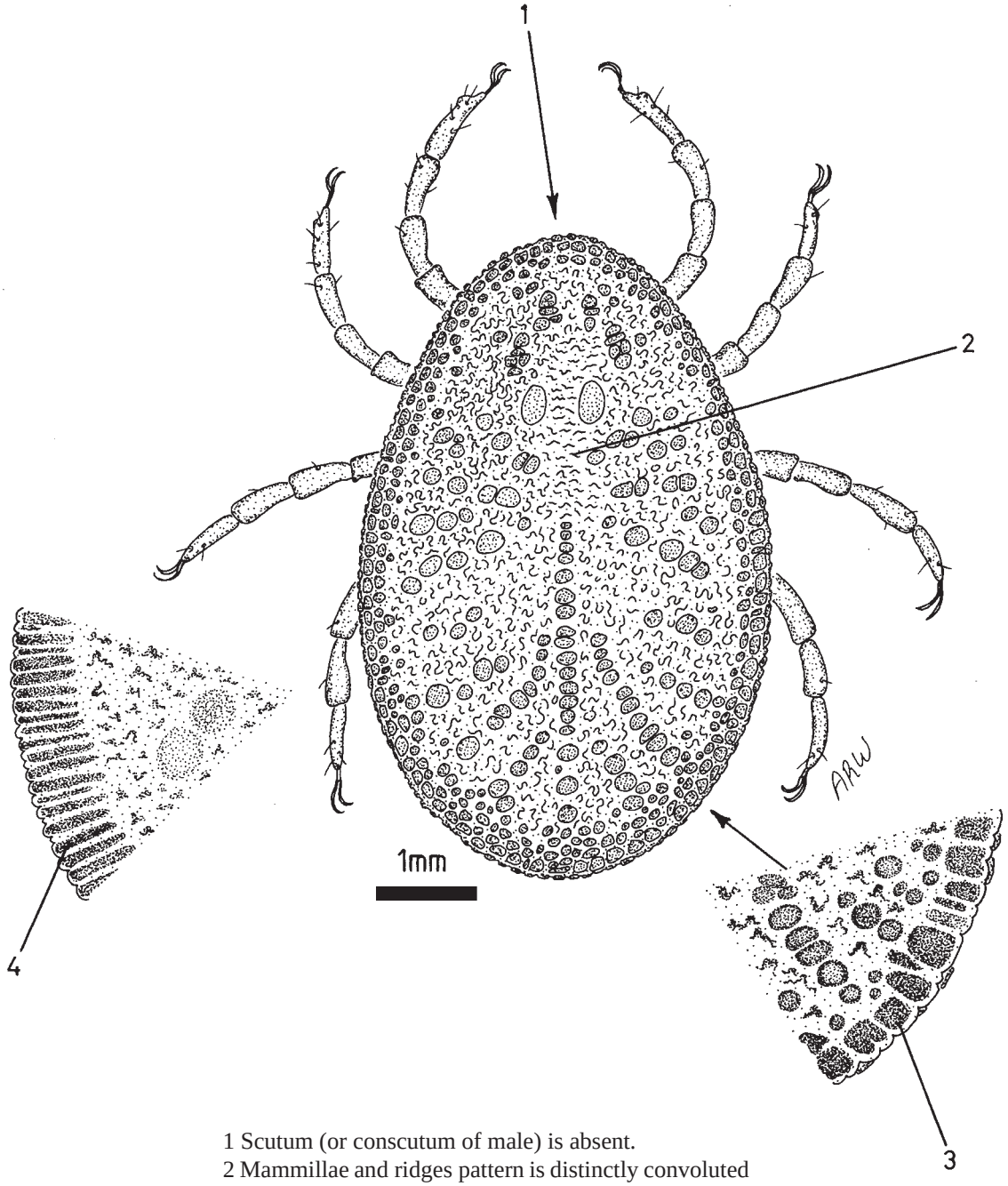
Disease.
Argas persicus transmits the bacterium *Borrelia anserina* causing avian spirochaetosis, and the bacterium *Aegyptianella pullorum*. Very large populations of ticks can build up rapidly in untreated poultry houses and severe anaemia can develop. Heavy infestations of poultry may also cause toxicosis. The larval ticks produce a toxin that causes paralysis in chickens and ducks similar to that seen in botulism.

Habitat and distribution.
Argas persicus is found in areas with climates from desert to Mediterranean temperate and to rain forest. It is a domestic and endophilic tick, found in the fabric of poultry houses and bird nests and roosting sites. *Argas persicus* has spread in the tropics and sub-tropics in association with poultry, but its only confirmed location in southern Africa is at Windhoek in Namibia. Older reports of its distribution in South Africa, Namibia and Botswana are thought to be misidentifications of *Ar. walkerae* which was not described until 1969. Records of its distribution in eastern Africa are thought to be misidentifications. *Argas reflexus* is a tick of the Middle East and Europe including the Mediterranean basin where it has been reported from Algeria.

Distribution of *Argas persicus*.

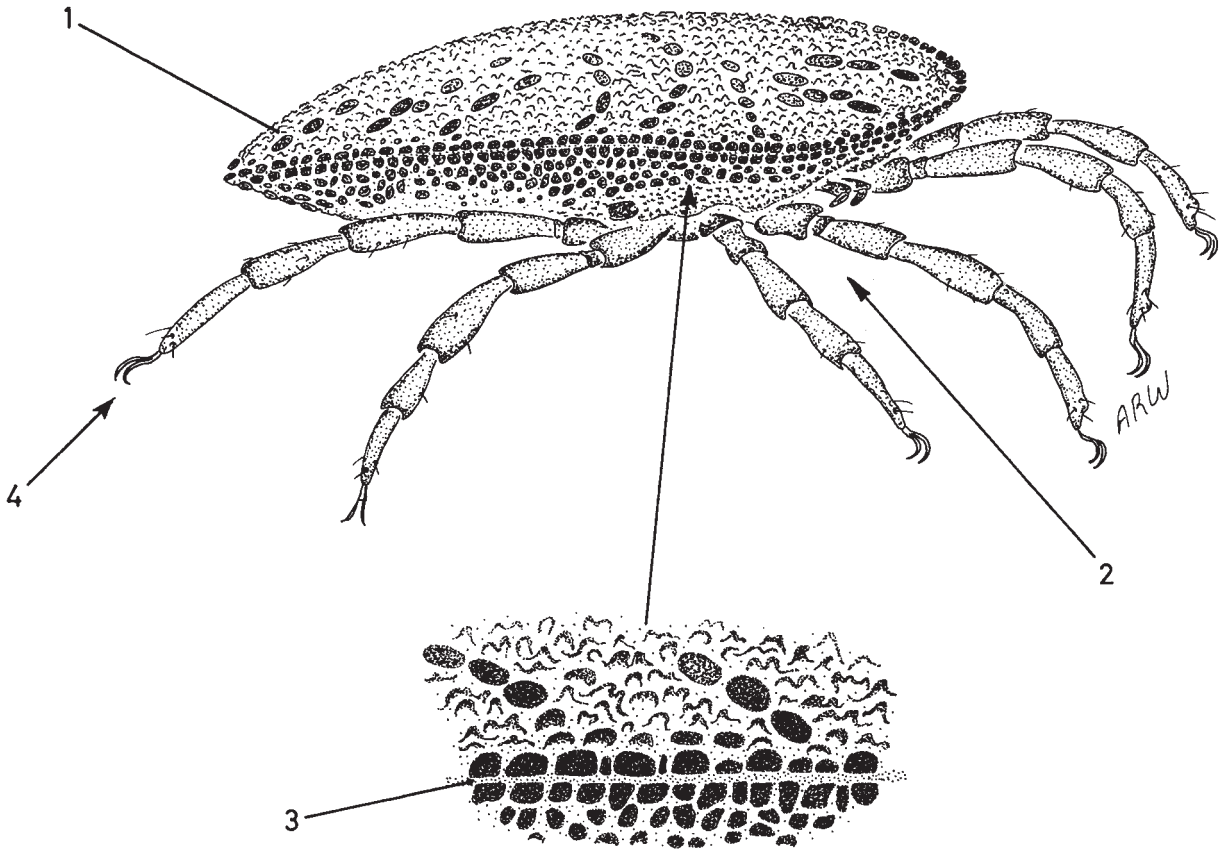


***Argas persicus* female, dorsal (*Argas reflexus* at bottom left).**



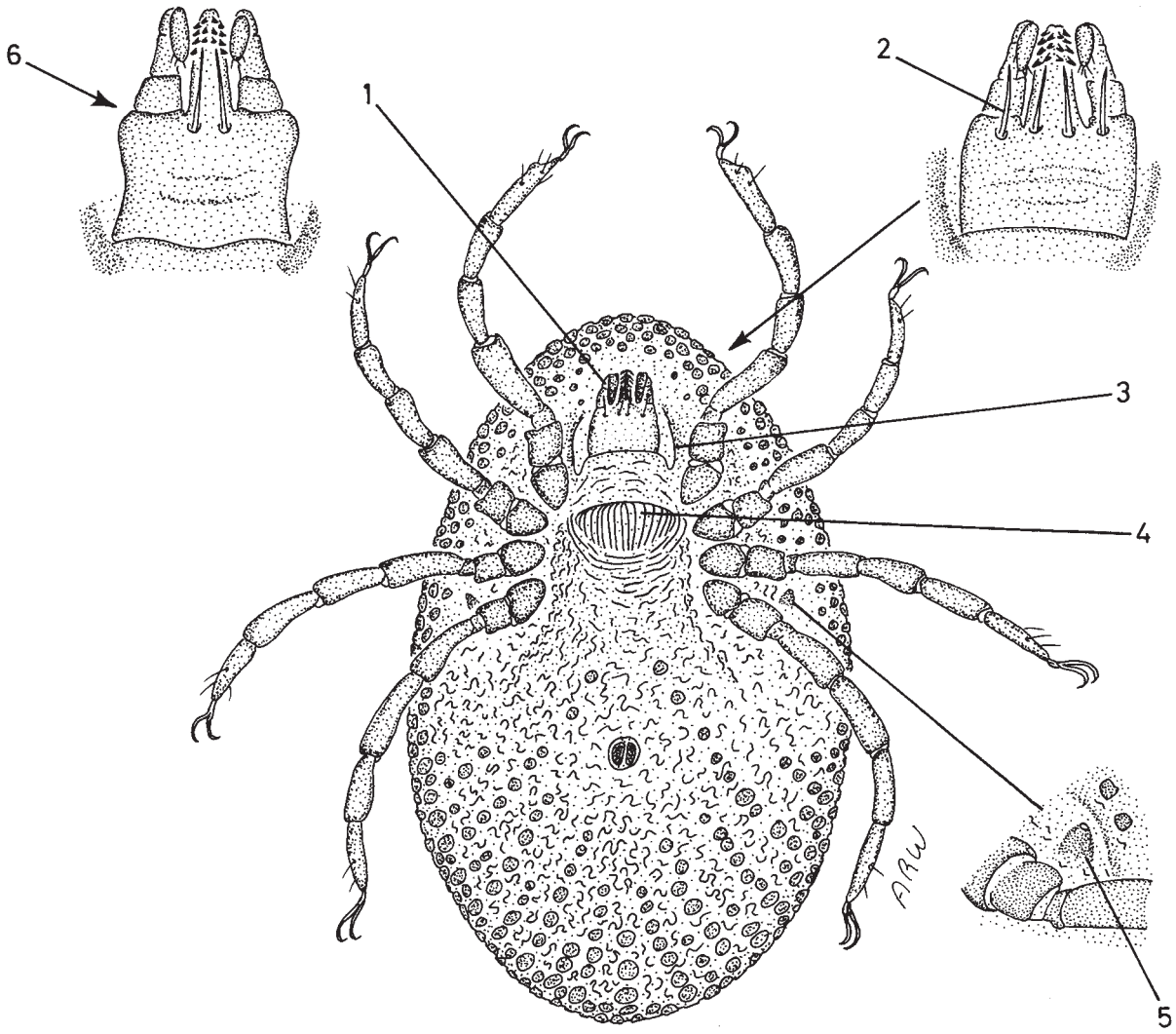
1 Scutum (or conscutum of male) is absent.
2 Mammillae and ridges pattern is distinctly convoluted (raised discs are also present; the discs are numerous, smoothly flat and well defined).
3 Lateral suture texture is marked by rectangular plates (dorsally and ventrally).
4 *Argas reflexus* has a lateral suture marked by fine ridges giving a corrugated appearance. The lateral suture is also curved upward slightly (hence the name *reflexus*). The mammillae pattern is slightly convoluted. The raised discs on the integument are less numerous and less well defined than in *Ar. persicus*.

***Argas persicus* female, lateral.**



1 Body is flattened dorso-ventrally.
2 Eyes are absent.
3 Margin of body forms a lateral suture; the texture of this suture consists of rectangular plates both dorsally and ventrally. Integument texture is convoluted.
4 Pulvilli are absent from the ends of the legs (but there is a pair of claws on each tarsus).

***Argas persicus* female, ventral (*Argas reflexus* at top left).**



1 Mouthparts are ventral and small. They consist of a central toothed hypostome and a pair of palps.
2 Postpalpal setae are present, at the base of each of the two palps is a single long seta (these setae are difficult to see because they are transparent, in addition there is a pair of similar posthypostomal setae).
3 Camerostomal fold is indistinct.
4 Female genital aperture is a broad horizontal slit (males have a genital aperture in the same position but it is approximately half the width of that of the female and more oval in outline, see Plate 3).
5 Spiracle shape is a cone (indistinct and situated above the coxae of legs 3 and 4).
6 Postpalpal setae are absent from the bases of the palps of *Argas reflexus* but a pair of posthypostomal setae are present.

Argas walkerae Kaiser & Hoogstraal, 1969 (with notes on *Argas hermanni* Audouin, 1827).

General.
Argas walkerae is an argasid tick that was described only recently and is named after the acarologist Jane B. Walker. Knowledge of the biology of *Ar. walkerae* is confused because it is believed that it has been often mistaken for *Ar. persicus* and described as such in the literature.

Differential diagnosis.
Argas walkerae closely resembles *Ar. persicus* but has a more distinct camerostomal fold around the mouthparts than *Ar. persicus*. *Argas walkerae* adults are generally larger than other *Argas* species which may be found infesting domestic birds. *Argas hermanni* has a lateral suture with indistinct ridges giving a slightly striated appearance and the pattern of mammillae is smoother than in *Ar. walkerae*.

Hosts.
Domestic fowls are the host to which this tick is specialised. It probably also infests tree nesting and roosting wild birds.

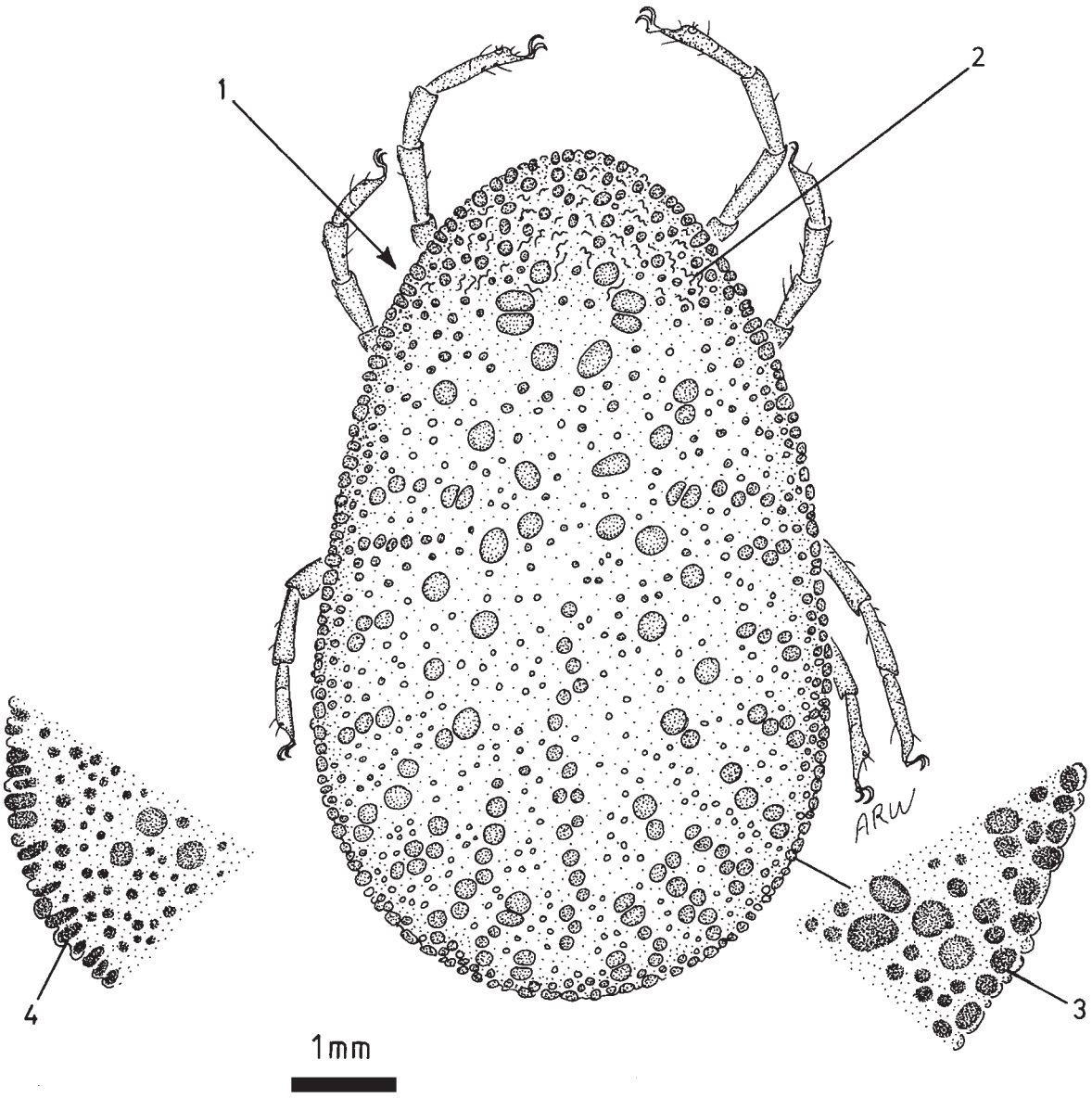
Life cycle and seasonal occurrence.
Little is known about the life cycle of *Ar. walkerae* but the general features of argasid ticks, as described for *Ar. persicus*, may well prove to represent those of *Ar. walkerae*.

Disease.
Large populations of the *Argas* species that infest domestic birds can build up in poultry houses and nests and cause loss of production. The specific role of *Ar. walkerae* as a vector of pathogens causing disease is not clearly understood and needs to be differentiated from that of *Ar. persicus* by further research .

Habitat and distribution.
Argas walkerae is found in areas with steppe climate. Its confirmed distribution is limited to southern Africa, including an undefined location in Namibia. This tick may be more widely distributed together with domestic fowl in southern Africa. As an aid to differential diagnosis note that the only confirmed location of *Ar. persicus* in southern Africa is Windhoek in Namibia. Information on the distribution of *Argas hermanni* is sparse but it appears to be limited in Africa to Egypt and Ethiopia.

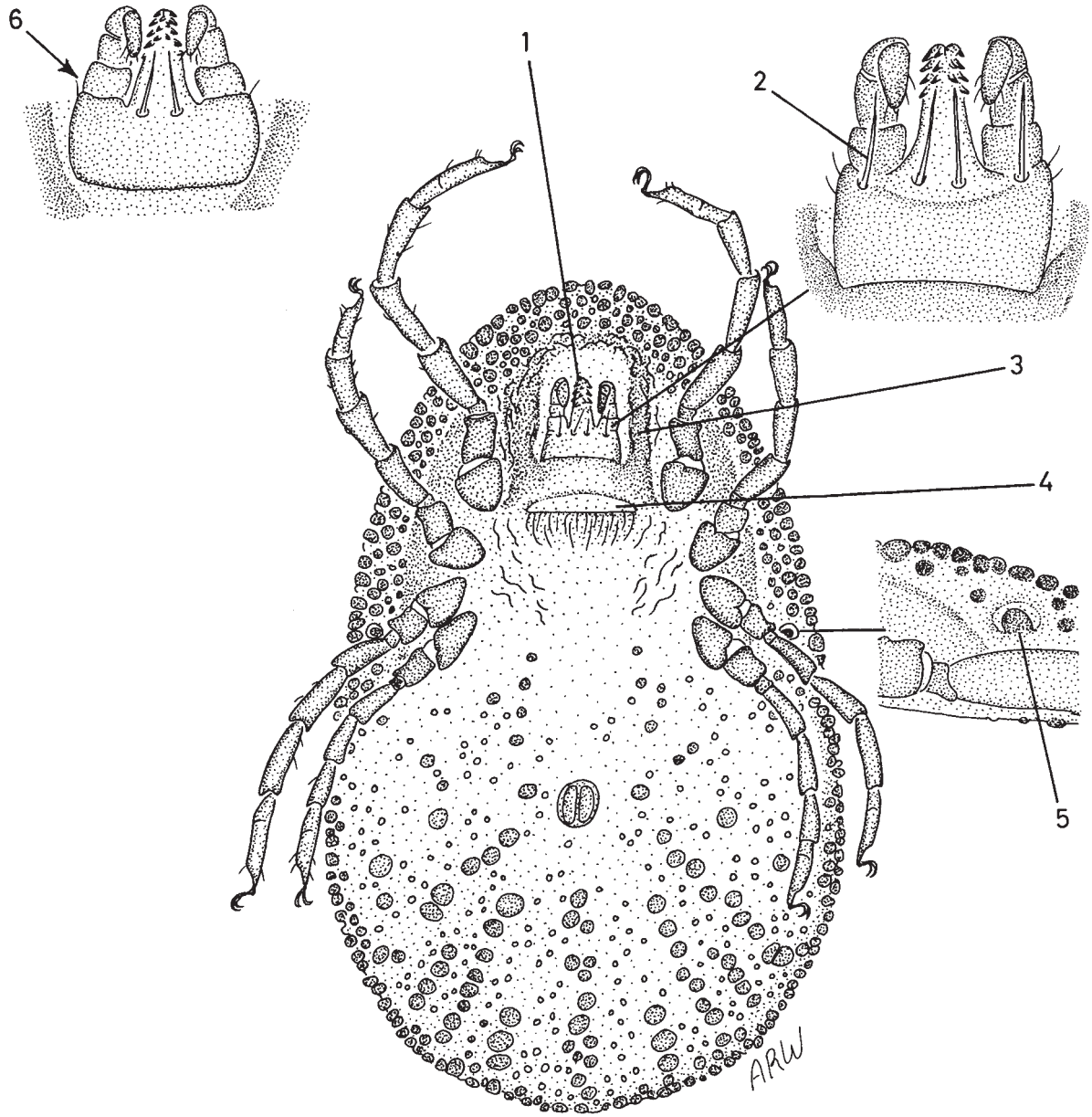
Distribution of *Argas walkerae*.

***Argas walkerae* female, dorsal (*Argas hermanni* at bottom left)**.



1 Scutum (or conscutum of a male) is absent.
2 Mammillae and ridges pattern is slightly convoluted (raised discs are also present, the discs are numerous, smoothly flat and well defined).
3 Lateral suture texture is marked by rectangular plates (these occur dorsally and ventrally but tend to be irregular and often not clearly rectangular).
4 *Argas hermanni* has a lateral suture marked by indistinct ridges giving a slightly striated appearance. The mammillae pattern is finely granular. The raised discs on the integument are less numerous and less well defined than in *Ar. persicus* or *Ar. walkerae*. Thus *Ar. hermanni* has a generally smoother appearance than the other *Argas* species in this guide.

***Argas walkerae* female, ventral (*Argas hermanni* at top left).**



1 Mouthparts are ventral and small. They consist of a central toothed hypostome and a pair of palps.
2 Postpalpal setae are present, at the base of each of the two palps is a single long seta (these setae are difficult to see because they are transparent, in addition there is a pair of similar posthypostomal setae).
3 Camerostomal fold is distinct.
4 Female genital aperture is a broad horizontal slit (males have a genital aperture in the same position but it is approximately half the width of that of the female and more oval in outline, see Plate 3).
5 Spiracle shape is a cone (indistinct and situated above the coxae of legs 3 and 4).
6 Postpalpal setae are absent from the bases of the palps of *Argas hermanni* but a pair of posthypostomal setae are present.

Dermacentor marginatus (Sulzer, 1776).

General.
Dermacentor marginatus is known as The ornate sheep tick. It is the only representative of the genus *Dermacentor* that infests domestic animals in Africa. There are two *Dermacentor* species found on wild animals in Africa: *Dermacentor circumguttatus* on elephants and *Dermacentor rhinocerinus* on rhinoceroses (see Plate 5). *Dermacentor marginatus* occurs mainly in Europe but is found very locally in North Africa. *Dermacentor* species are more commonly found elsewhere in the Palaearctic region and other zoogeographical regions.

Differential diagnosis.
Knowledge of the character states of the genus is most useful for identifying this species of tick when collected from domestic animals in Africa, because this is the only *Dermacentor* species that is likely to be found. The characteristics of the genus *Dermacentor* are mainly: mouthpart are short with a basis capituli of straight lateral margins, both sexes usually have white enamel ornamentation and the males have very large fourth coxae. *Dermacentor marginatus* has white enamel on the scutum or conscutum. The other species found in the same area with similar white enamel is *Hyalomma lusitanicum* but this species has the characteristic long mouthparts and well developed ventral plates of the genus *Hyalomma*.

Hosts.
In Africa adults infest cattle, sheep and goats. Dogs may be infested with adults and humans are liable to infestation with immature stages. Immature stages feed mostly on rabbits and other small mammals and also birds.

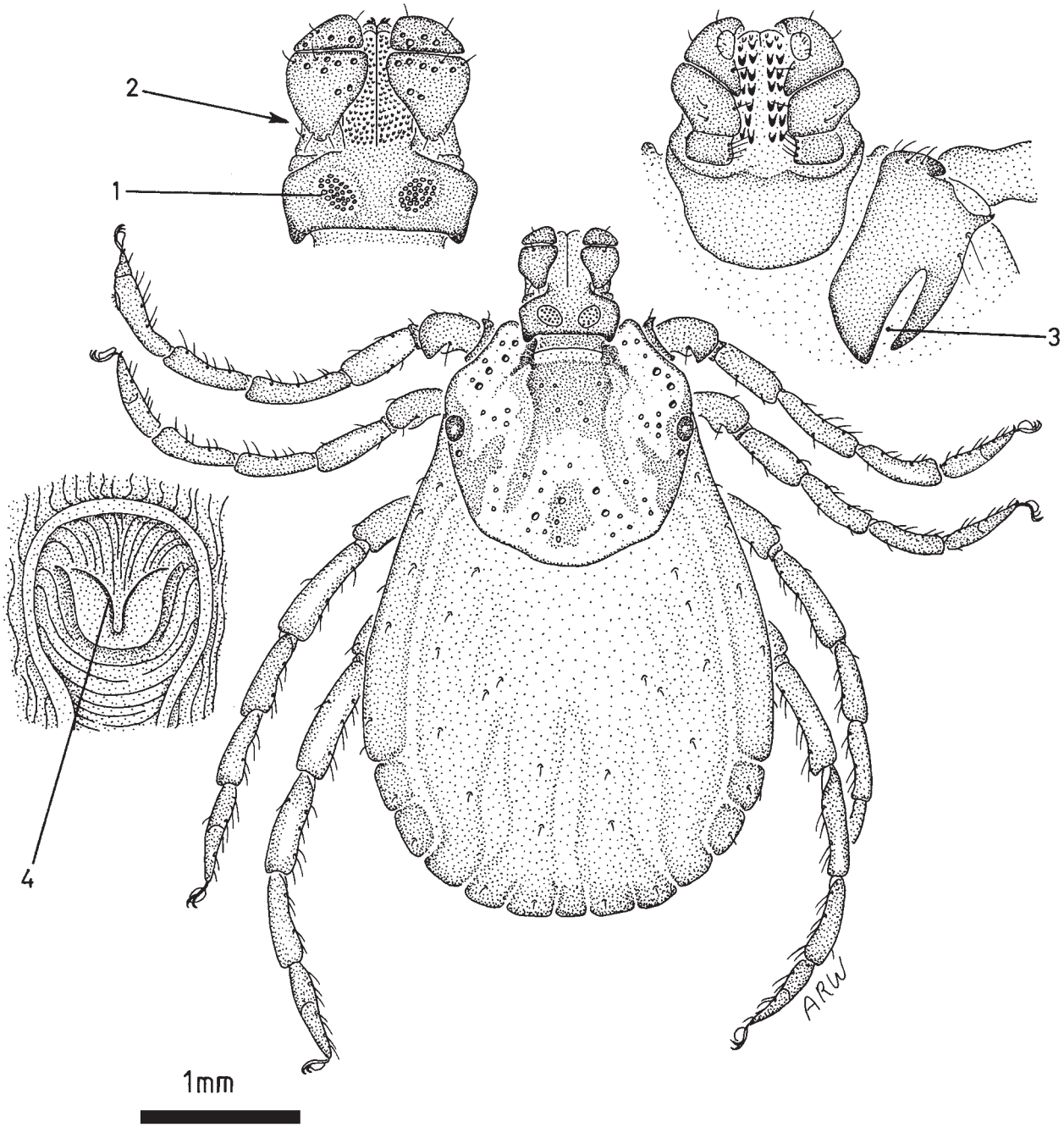
Life cycle and seasonal occurrence.
This is a three-host tick and the entire life cycle can be completed in one year. Adult activity is during the end of autumn through into winter.

Disease.
Dermacentor marginatus can transmit the protozoan *Babesia canis* to dogs causing canine babesiosis and the bacterium *Rickettsia conorii* to humans causing tick typhus or boutonneuse fever.

Habitat and distribution.
Dermacentor marginatus is found in the cooler and more humid parts of the Mediterranean climatic region associated with the Atlas Mountains. It is restricted to small areas of Morocco and Tunisia. In North Africa this tick is restricted to the same type of habitat as *Ixodes ricinus*.

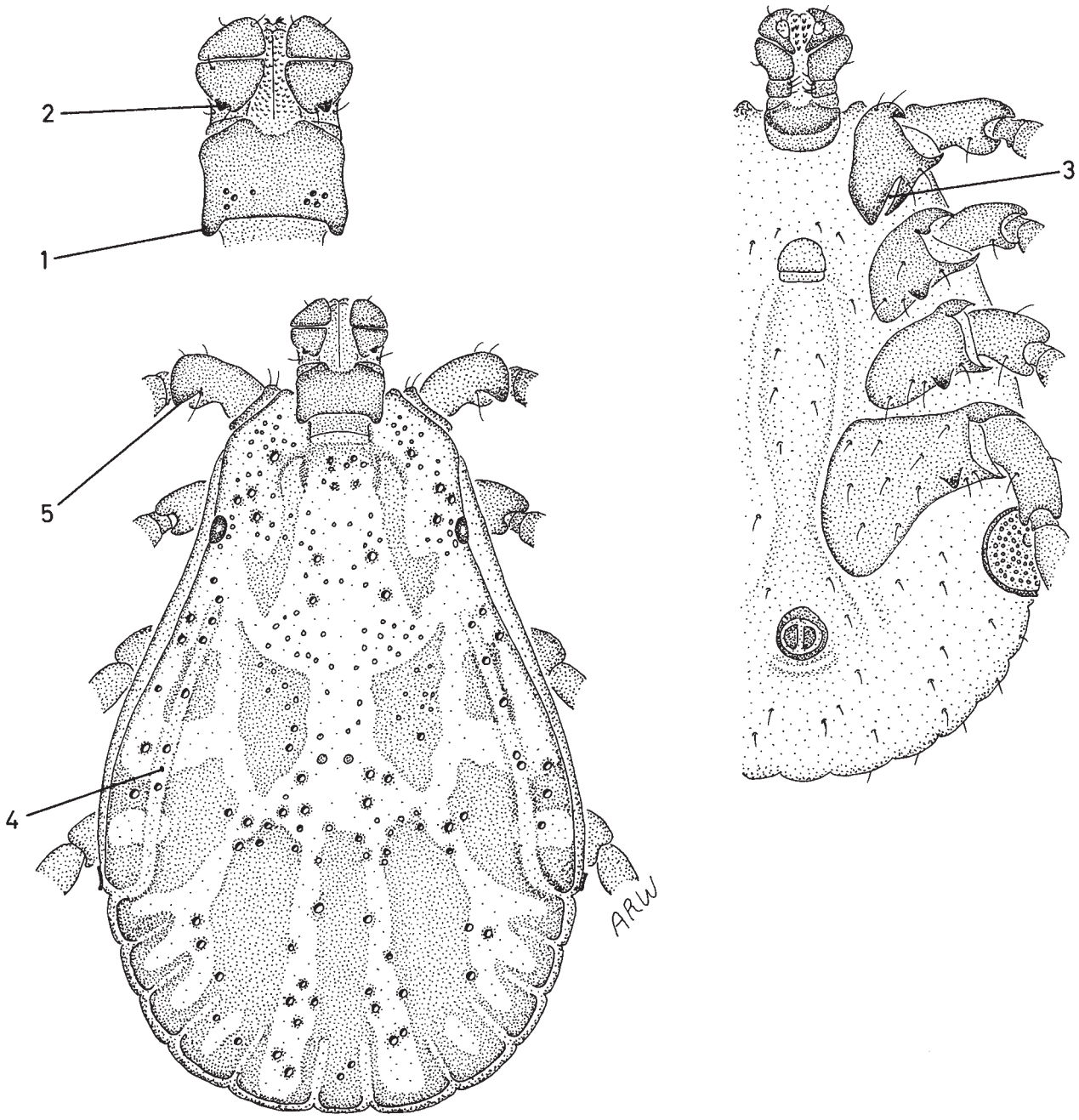
Distribution of *Dermacentor marginatus*.

***Dermacentor marginatus* female, dorsal in centre, inset at top left is dorsal mouthparts, inset at top right is ventral coxa, inset at lower left is genital aperture.**



1 Porose areas shape is a narrow oval (also they are slanting).
2 Palp articles 2 posterior spur is absent from the dorsal surface.
3 Coxae 1 external and internal spurs gap is medium (also the external spur is slightly shorter than the internal spur).
4 Genital aperture posterior lips have a narrow **V** shape.

Dermacentor marginatus **male dorsal at bottom left, inset at top left is of dorsal mouthparts, inset at top right is ventral body.**



1 Cornua length is short.
2 Palp articles 2 posterior spur length is short on the dorsal surface.
3 Coxae 1 external and internal spurs gap is medium (also the external spur is slightly shorter than the internal spur).
4 Lateral groove type is an indistinct groove (the groove is more conspicuous than the punctations it contains).
5 Trochanter 1 posterior spur is short on the dorsal surface.

Haemaphysalis leachi (Audouin, 1826) (with notes on *Haemaphysalis spinulosa* Neumann, 1906, and *Ha. elliptica* Koch, 1844).

General.
Haemaphysalis leachi is also known as The yellow dog tick. It is one of the two ticks adapted to feeding on domestic dogs in tropical and sub-tropical areas and is found on domestic dogs in sub-Saharan Africa. The other dog tick is *Rhipicephalus sanguineus*.

Differential diagnosis.
Haemaphysalis leachi has conspicuous lateral extensions to palp articles 2, forming mouthparts with a distinctive conical shape. In addition the coxae 4 of males have only medium length spurs. In comparison *Haemaphysalis punctata* and *Haemaphysalis sulcata* both have small extensions to palp articles 2 and very conspicuous spurs on coxae 4 of males. *Haemaphysalis spinulosa* is very similar to *Ha. leachi* but the female has spurs on the ventral surface of palp articles 2. Other species within the *leachi* group such as *Haemaphysalis paraleachi, Haemaphysalis punctaleachi* and *Haemaphysalis moreli* are difficult to distinguish from *Ha. leachi* and their host associations are similar. Thus special care is needed before making definite statements about the identity of specimens within this group.

Hosts.
Domestic dogs and wild carnivores, such as the larger cats, foxes, jackals and wild dogs, are the main hosts of adult *Ha. leachi*. The immature stages prefer murid rodents, but may occur on the same hosts as the adults. The literature contains many references to *Ha. leachi* feeding on cattle and other livestock, but this species is primarily specialized to feed on carnivores and the records from livestock may result from the close association between domestic dogs and livestock. Adults attach on the head, neck and shoulders but in severe infestations they attach all over the body. (*Haemaphysalis spinulosa* is more specialized to feeding on domestic and wild cats, in contrast to *Ha. leachi* which is rare on domestic cats.)

Life cycle and seasonal occurrence.
This species is a three-host tick. The female feeds for 1 to 2 weeks, engorging slowly initially but rapidly on the last day before detachment. She lays approximately 5 000 eggs within 7 to 28 days of detaching from the host animal. The eggs hatch within 2 to 9 weeks. After feeding, the larvae moult within 2 to 26 weeks and the nymphs within 2 to 7 weeks. Adults are present throughout the year with peak numbers either from winter to early summer or from spring to late summer.

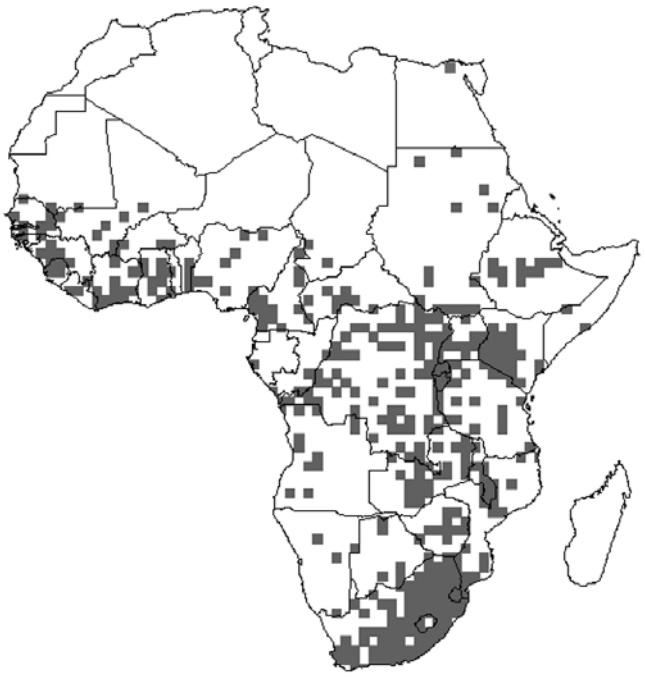
Disease.
Haemaphysalis leachi transmits the protozoan *Babesia canis* to dogs, causing canine babesiosis. In South Africa this tick is the major vector of *Ba. canis*. Transmission is by the transovarial and transstadial paths. It also transmits the bacterium *Rickettsia conorii* to humans, causing tick typhus.

Habitat and distribution.
Haemaphysalis leachi occurs in a wide range of climatic regions from rain forest through to desert but it is sparse in desert areas. It prefers warm and humid conditions, but apparently can occur wherever the rodent hosts for the immature stages are present in association with dogs as hosts for the adults. This tick is very widespread in association with domestic dogs thoughout much of sub-Saharan Africa but is often sparse on domestic dogs. There are some records of its occurrence north of the Sahara, specially in the Nile delta.

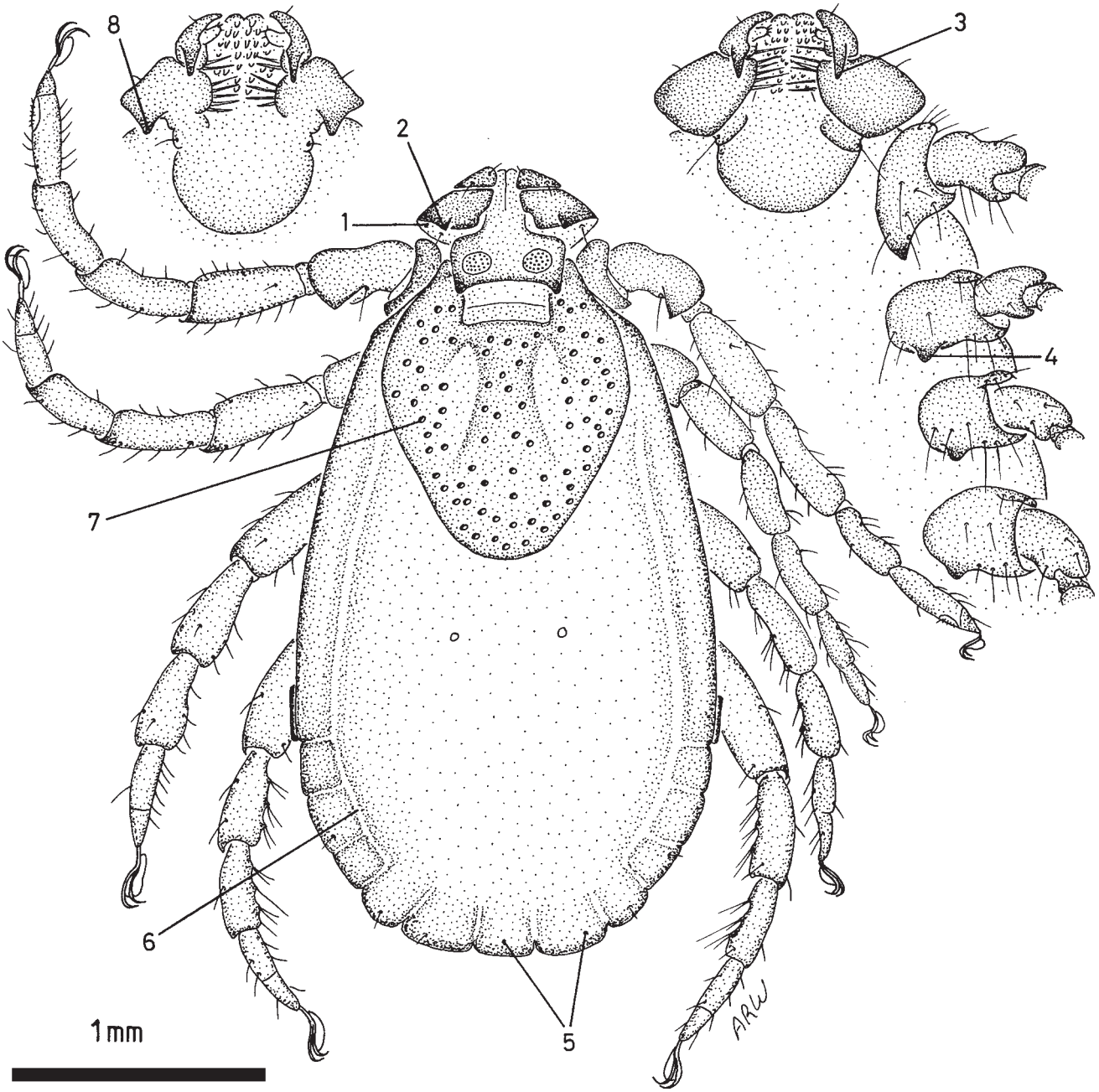
Note: *Haemaphysalis elliptica*.
In 2007 ticks collections previously described as *Ha. leachi* were examined and many specimens were found to conform to another species: *Ha. elliptica*. The authors concluded that many of the southern and east African ticks previously indentified as *Ha. leachi* are actually *Ha. elliptica*. The **map below** is based on the original information about *Ha. leachi* and thus requires substantial revision based on more field collections and recording of the sources of re-examined museum specimens. These two species are very similar morphologically.

Apanaskevich, D.A., Horak, I.G. & Camicas, J-L. 2007. Onderstepoort Journal of Veterinary Research, **74**, 181-208

Distribution of *Haemaphysalis leachi* (including *Ha. elliptica*).

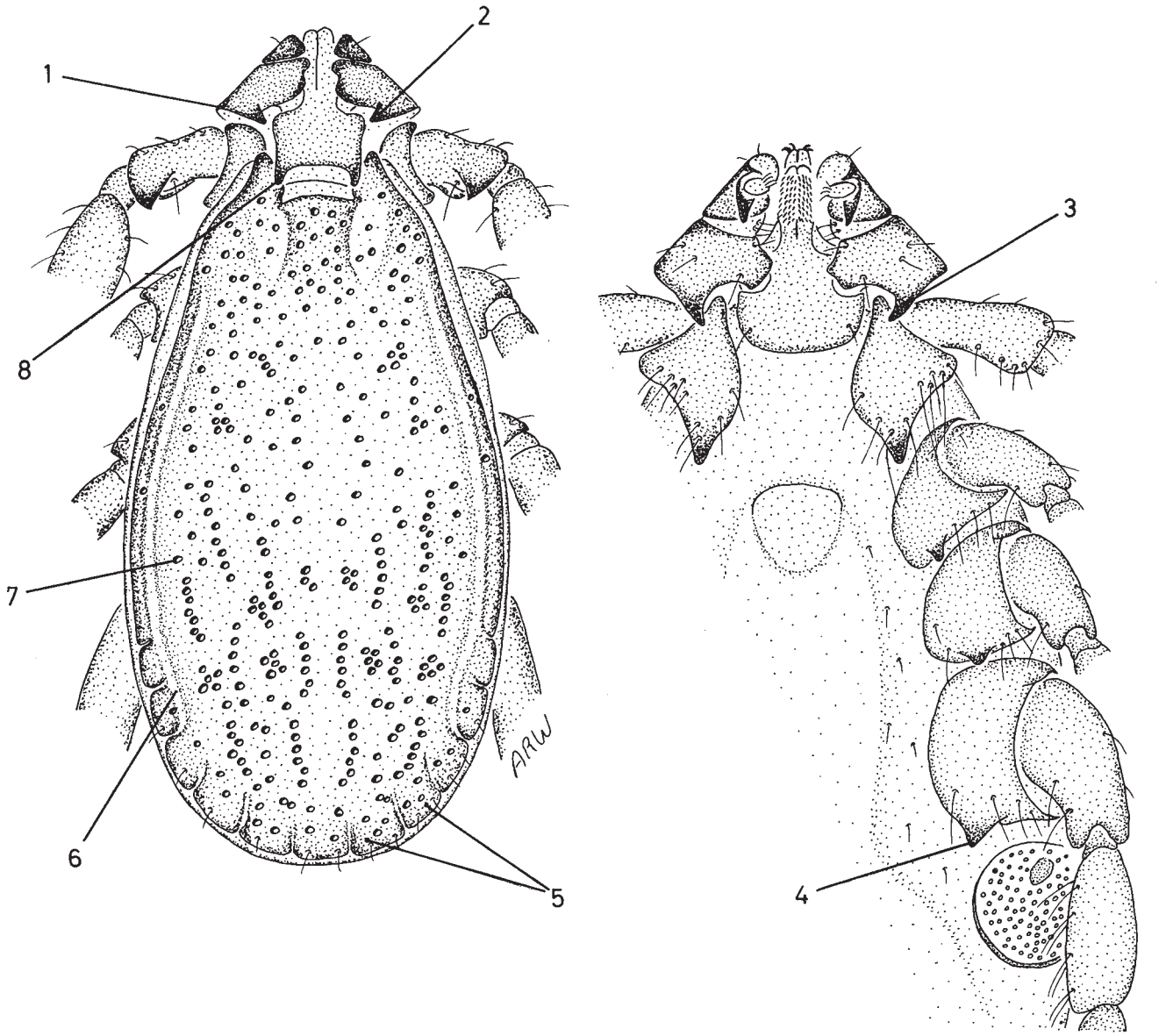


***Haemaphysalis leachi* female, dorsal in centre, ventral at right (inset at upper left is *Haemaphysalis spinulosa*).**



1 Palp articles 2 lateral extension is large (the palps form a distinctly conical shape).
2 Palp articles 2 dorsal spur is present.
3 Palp articles 3 ventral spur is present.
4 Coxae 1 to 3 spurs length is medium.
5 Festoons number eleven.
6 Festoons enclosed by each lateral groove number three (sometimes only two).
7 Punctation distribution is dense.
8 *Haemaphysalis spinulosa* differs from *Ha. leachi* by the female having spurs on the ventral surface of palp articles 2, forming an angular shape to the posterior margins of these articles.

***Haemaphysalis leachi* male, dorsal at left, ventral at right.**



1Palp articles 2 lateral extension is large (the palps form a distinctly conical shape, see Plate 5).
2 Palp articles 2 dorsal spur is present.
3 Palp articles 2 ventral spur is present.
4 Coxae 4 spurs length is medium.
5 Festoons number eleven.
6 Festoons enclosed by each lateral groove number two.
7 Punctation distribution is dense.
8 Cornua length is long.

Haemaphysalis punctata Canestrini & Fanzago, 1878.

General.
Haemaphysalis punctata, also known as The red sheep tick is mainly a tick of sheep in Europe. It has many similarities with *Ixodes ricinus* in its distribution but is distinct in its physical characters from *Ix. ricinus*, which is similarly known as The sheep tick.

Differential diagnosis.
As the females and males of *Ha. punctata* both have palp articles 2 with only a small lateral extension the mouthparts do not form the distinctly conical shape seen in some species of this genus. *Haemaphysalis punctata* is one of the two species of *Haemaphysalis* that are likely to be found on livestock in North Africa and needs to be distinguished from *Haemaphysalis sulcata*. The females of *Ha. punctata* have 11 festoons; three are enclosed by the lateral groove on each side (visible when the specimen is unfed). The females also have medium size spurs on coxae 1 to 3. *Haemaphysalis sulcata* females have nine festoons; only one of them being enclosed by the lateral groove, and the females' spurs on coxae 1 to 3 are smaller than in *Ha. punctata*. Male *Ha. punctata* have short cornua and the conspicuous spur on coxa 4 is longer than in *Ha. sulcata*. Compared to *Haemphysalis* ticks *Ixodes* ticks are larger, darker and have longer mouthparts.

Hosts.
This species of tick feeds on sheep and cattle, it is also found on goats, horses, antelope and may attach to humans.

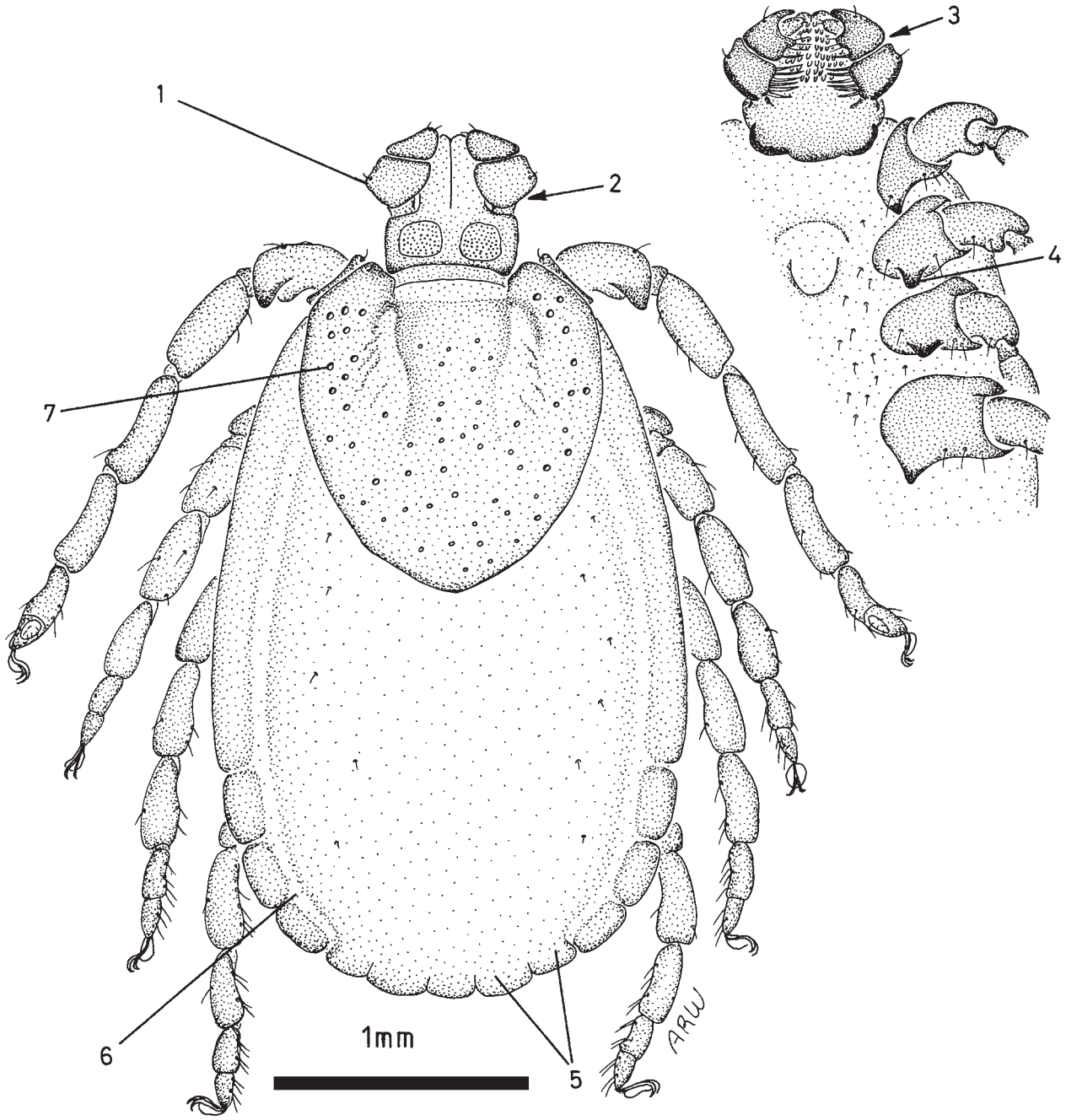
Life cycle and seasonal occurrence.
This species is a three-host tick. In humid climates adults may be found feeding from October to March. The life cycle can be completed in one year but usually takes three years.

Disease.
Haemaphysalis punctata transmits the protozoan *Babesia motasi* and possibly other *Babesia* species. It transmits the protozoans *Theileria ovis* and *Theileria buffeli* causing forms of ovine and bovine theileriosis.

Habitat and distribution.
Haemaphysalis punctata is adapted to a wide range of habitats. In Africa it occurs in areas with cool and humid Mediterranean climates to the steppe of North Africa. This is a tick mainly of Europe, the northern Mediterranean and eastwards in central Asia, but it also extends into North Africa.

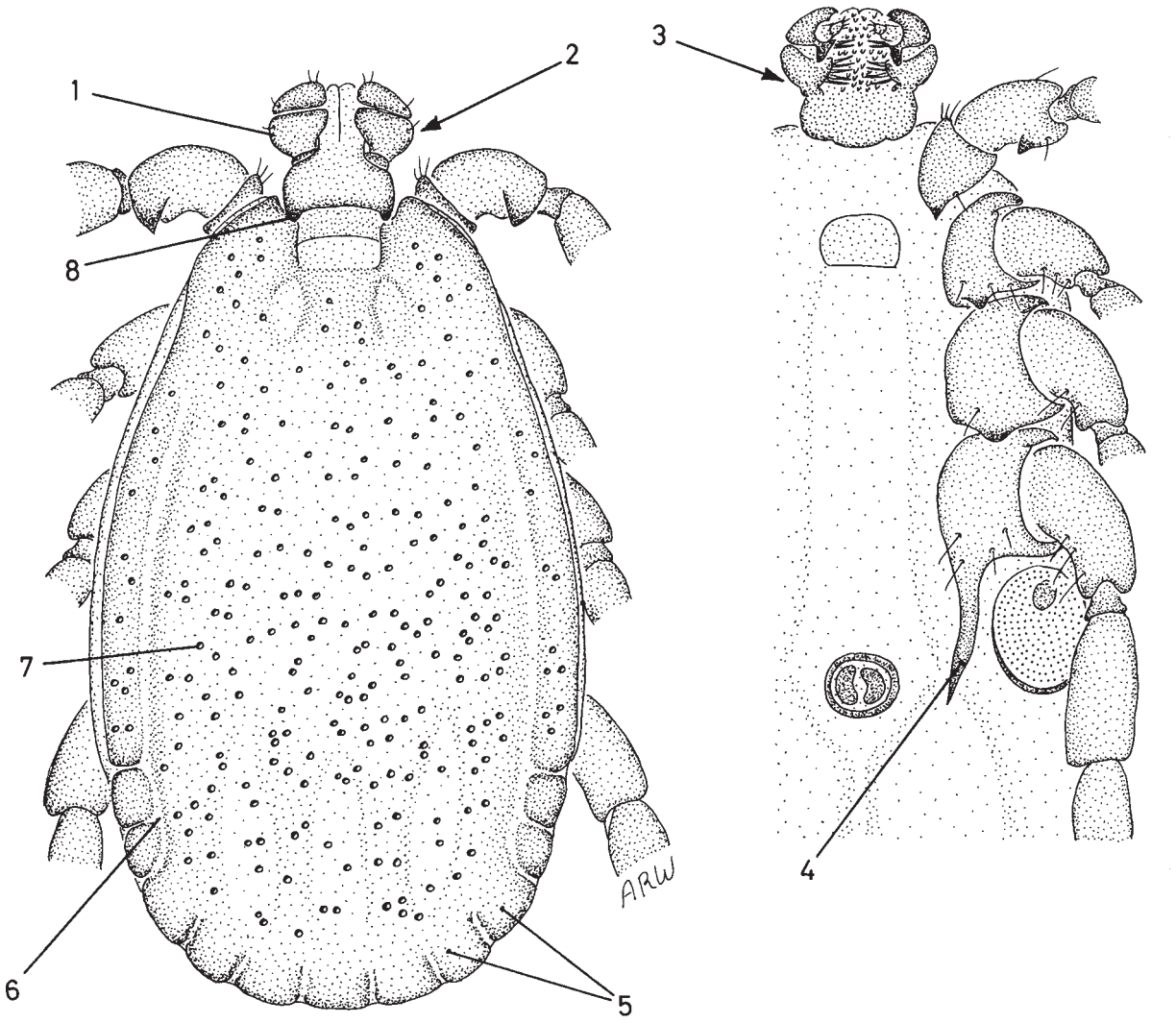
Distribution of *Haemaphysalis punctata*.

***Haemaphysalis punctata* female, dorsal in centre, ventral at upper right.**



1 Palp articles 2 lateral extension is small.
2 Palp articles 2 dorsal spur is absent.
3 Palp segments 3 ventral spur is absent.
4 Coxae 1 to 3 spurs length is medium (also coxae 4 spurs are distinct).
5 Festoons number eleven.
6 Festoons enclosed by each lateral groove number three.
7 Punctation distribution is dense.

***Haemaphysalis punctata* male, dorsal at left, ventral at right.**



1 Palp articles 2 lateral extension is small.
2 Palp articles 2 dorsal spur is absent.
3 Palp segments 2 ventral spur is absent.
4 Coxae 4 spurs length is long (spurs extend to level of posterior margin of anus and they curve inwards).
5 Festoons number eleven.
6 Festoons enclosed by a lateral groove number two.
7 Punctation distribution is dense.
8 Cornua length is short.

Haemaphysalis sulcata Canestrini & Fanzago, 1878.

General.
Haemaphyalis sulcata is one of the two species of *Haemaphysalis* that are likely to be found on livestock in North Africa; it needs to be distinguished from *Haemaphysalis punctata*.

Differential diagnosis.
The females of *Ha. sulcata* have nine festoons, only one of which is enclosed by the lateral groove on each side (visible when the specimen is unfed). They also have only short spurs on coxae 1 to 3. *Haemaphysalis punctata* females have 11 festoons, three being enclosed by the lateral groove, and the spurs on coxae 1 to 3 are of medium length. Male *Ha. sulcata* have conspicuously long cornua and the long spur on coxa 4 is shorter than that of *Ha. punctata*.

Hosts.
Adults of this species feed on ungulates. Small ruminants, particularly sheep, are the most common hosts. Their preferred feeding sites are the neck, shoulder and back. Immature stages feed on reptiles such as lizards.

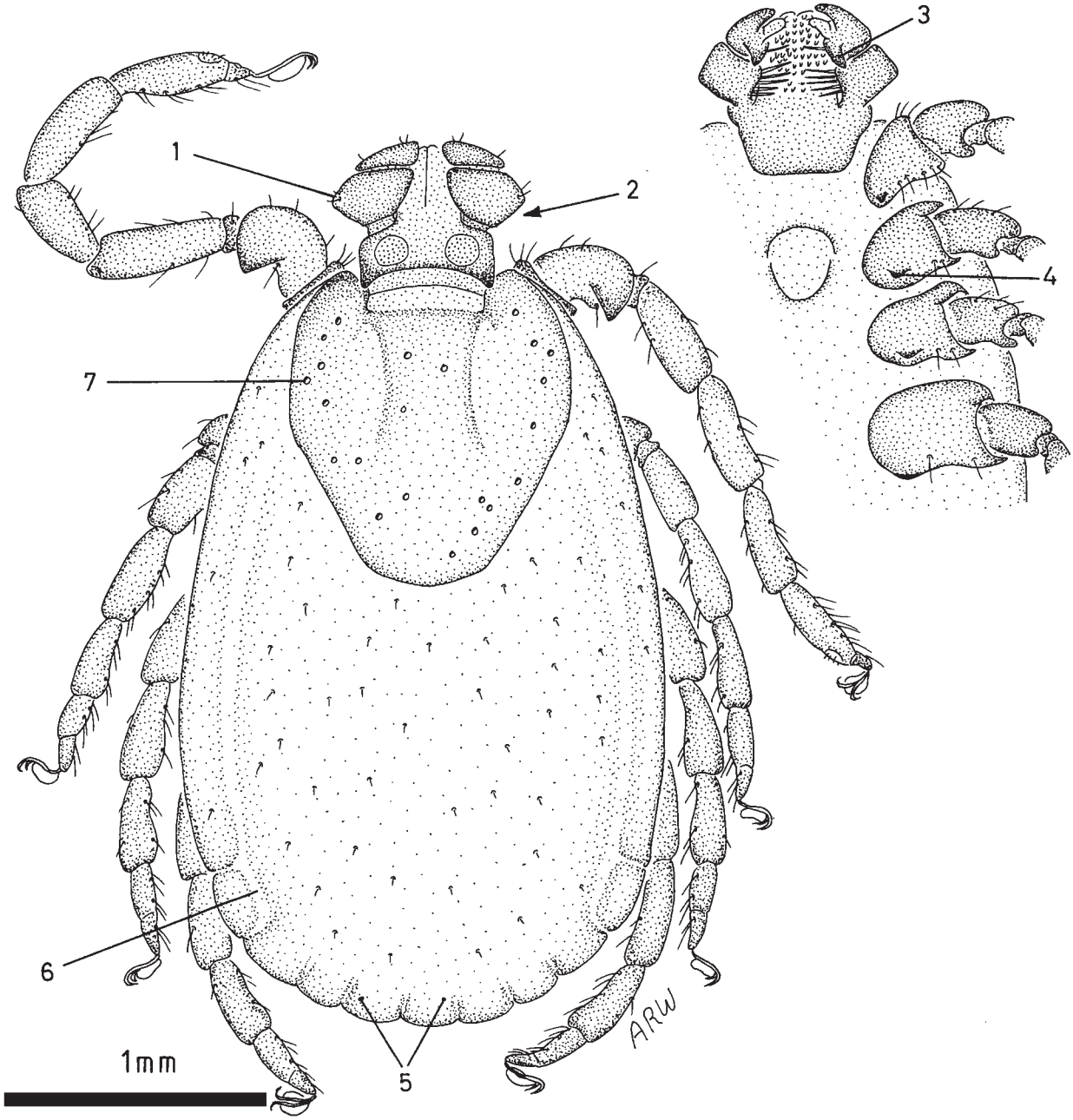
Life cycle and seasonal occurrence.
Haemaphysalis sulcata is a three host-tick. Adults are active in autumn and winter between October and March. Larvae and nymphs feed on reptiles in spring and summer (April and July).

Disease.
This species of tick transmits the bacterium *Anaplasma ovis* causing ovine anaplasmosis.

Habitat and distribution.
Haemaphysalis sulcata occurs in a wide range of climatic regions from Mediterranean to steppe and desert. In North Africa, *Ha. sulcata* occurs in Morocco, Algeria, Tunisia and Libya. This species is also widely distributed in Asia (Pakistan, India, Afghanistan, Iran, Saudi Arabia, Iraq, Jordan), Transcaucasia, and in the Mediterranean region (Syria, Cyprus, Turkey, Greece, Romania, Yugoslavia, Hungary, Italy, France, Spain).

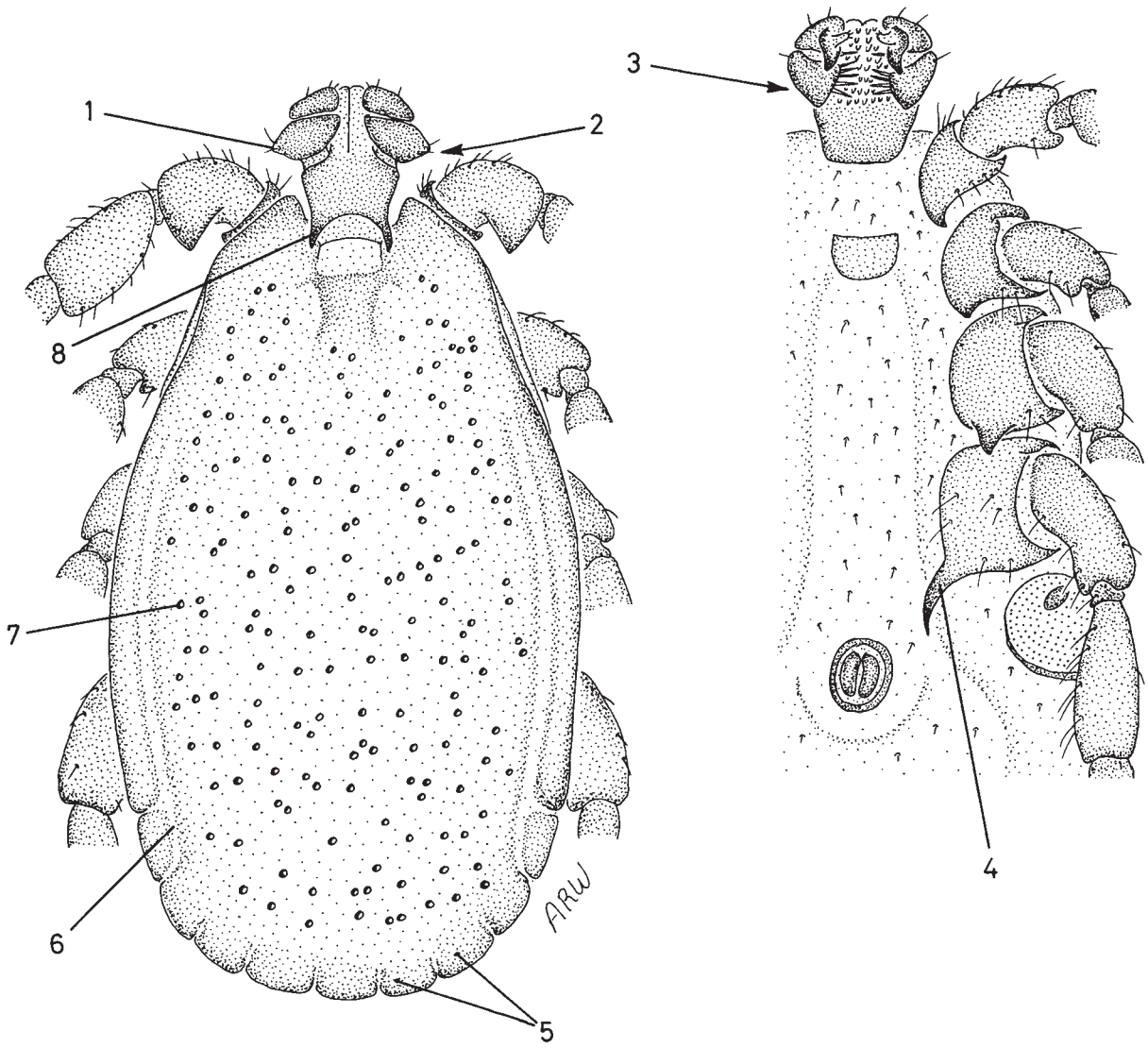
Distribution of *Haemaphysalis sulcata*.

***Haemaphysalis sulcata* female, dorsal in centre, ventral at upper right.**



1 Palp articles 2 lateral extension is small.
2 Palp articles 2 dorsal spur is absent.
3 Palp articles 3 ventral spur is present.
4 Coxae 1 to 3 spurs are short (also coxae 4 spurs are indistinct).
5 Festoons number nine.
6 Festoons enclosed by each lateral groove number one.
7 Punctation distribution is sparse.

***Haemaphysalis sulcata* male, dorsal at centre, ventral at right.**



1 Palp segments 2 lateral extension is small.
2 Palp segments 2 dorsal spur is absent.
3 Palp segments 2 ventral spur is absent.
4 Coxae 4 spurs length is long (spurs extend to level of anterior margin of anus and they curve outwards).
5 Festoons number nine.
6 Festoons enclosed by a lateral groove number one.
7 Punctation distribution is sparse.
8 Cornua length is long.

Hyalomma anatolicum Koch, 1844.

General.
Hyalomma anatolicum is important over widely scattered areas from North Africa to India as a vector of the causative organism of tropical theileriosis of cattle.

Differential diagnosis.
Hyalomma anatolicum is closely similar to *Hyalomma excavatum*, particularly the females (formerly sub-species: *H. a. anatolicum* and *H. a. excavatum*). The distributions of these two species overlap in some areas. It is important to examine males to distinguish them. *Hyalomma anatolicum* is unusually small, thin and pale for a *Hyalomma* species. The females have shallower cervical fields with parallel sides. The males of *Hy. anatolicum* have a less distinctly depressed area at the posterior of the scutum and the paracentral festoons are not joined anteriorly to form an arch, compared to the arch formed in *Hy. excavatum*.

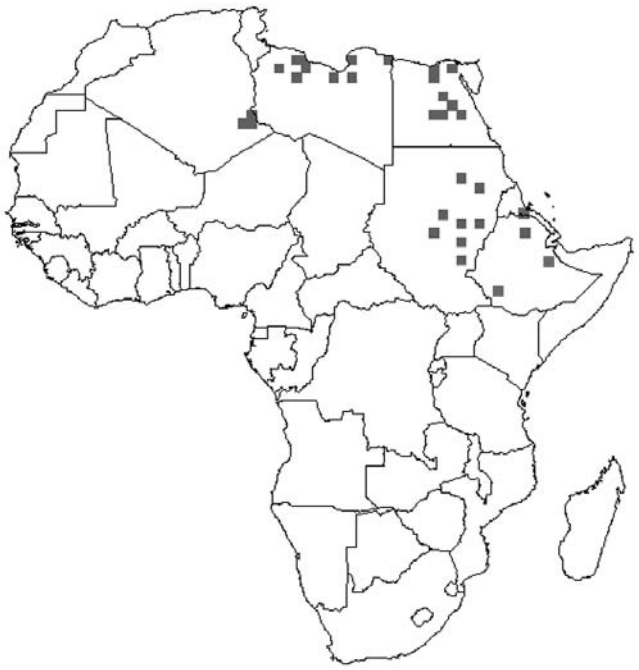
Hosts.
Cattle, also sheep, goats, camels, horses and donkeys are fed on by adult *Hy. anatolicum*. Adults feed on cattle in the axillae and groin, the genital areas and perineum and the udder. This species behaves often as a monotropic and domestic tick with all stages feeding on cattle. In more natural situations *Hy.. anatolicum* can behave as a telotropic tick with immature stages feeding on hares and rodents, particularly gerbils and jirds, in addition to large animals. Immature stages will also feed on humans. These feeding behaviours are in contrast to those of *Hy. excavatum* which has a ditropic behaviour. *Hyalomma anatolicum* may have a mixed two-host and three-host feeding pattern when fed on different hosts. When *Hy. anatolicum* feeds on normal hosts such as cattle, horses, sheep, goats, it has a strict three-host cycle.

Life cycle and seasonal occurrence.
Hyalomma anatolicum is adapted to conditions in dry areas where a constant supply of hosts may not be available. It can feed on hares as a two-host tick for its entire life cycle. On cattle it can feed as a three-host tick for its entire life cycle. As a three-host tick it may feed as larva or nymphs on gerbils, then on cattle or sheep as adults. Many populations have adapted to a domestic behaviour, feeding entirely on cattle kept in intensive housing. This is in contrast to *Hy. excavatum*. All stages of *Hy. antolicum* can be found on cattle, with moulting occurring in the fabric of the buildings. Feeding activity is restricted mainly to the summer in areas with a distinct winter season but it may be active all year. *Hyalomma anatolicum* has a great diversity of diapause mechanisms which regulate its seasonal activity and developmental rhythms in cold climates. Diapause of the morphogenetic type (= delay in development) has been found in the nymphal and the engorged female stages of the tick in Palaearctic regions. In North Africa, *Hy. anatolicum* adults also undergo diapause of the behavioural type (= delay in feeding activity) coinciding with shorter and less cold winter seasons. However, where both seasonal and daily changes in environment are minimal, as in Sudan, all stages of the tick are active throughout the year.

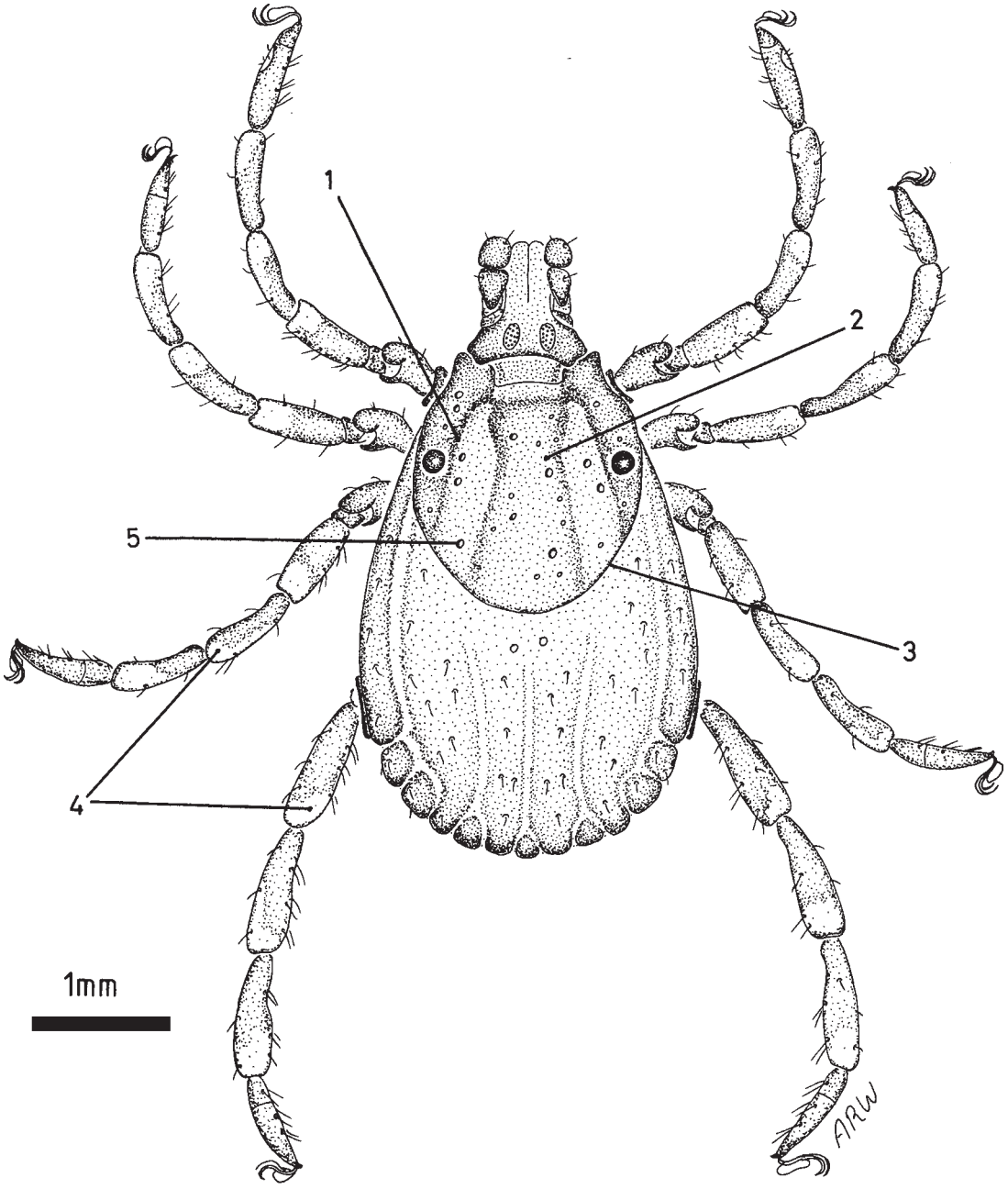
Disease.
This tick species transmits transstadially and transovarially a variety of protozoal parasites and is a threat to animal improvement programmes. It transmits the protozoans: *Theileria annulata* causing tropical theileriosis in cattle; *Theileria lestoquardi* causing malignant ovine theileriosis; *Theileria equi* causing equine theileriosis; *Babesia caballi* causing equine babesiosis; *Trypanosoma theileri* causing benign bovine trypanosomiasis. Crimean-Congo haemorrhagic fever virus is transmitted to humans by this tick.

Habitat and distribution.
Hyalomma anatolicum is adapted to areas of Mediterranean and steppe climates of North Africa, and to steppe and desert climates elsewhere in its extensive range in two continents. In Africa it ranges from Ethiopia across into North Africa where it occurs in Algeria, Libya and Egypt. It extends as far south as northern parts of central Sudan but it does not appear to be well established south of the Sahara. It is also found in other parts of the Mediterranean basin and Turkey, and extends eastwards into the Middle East, Southern Russia, Iran, India and China.

Distribution of *Hyalomma anatolicum*.

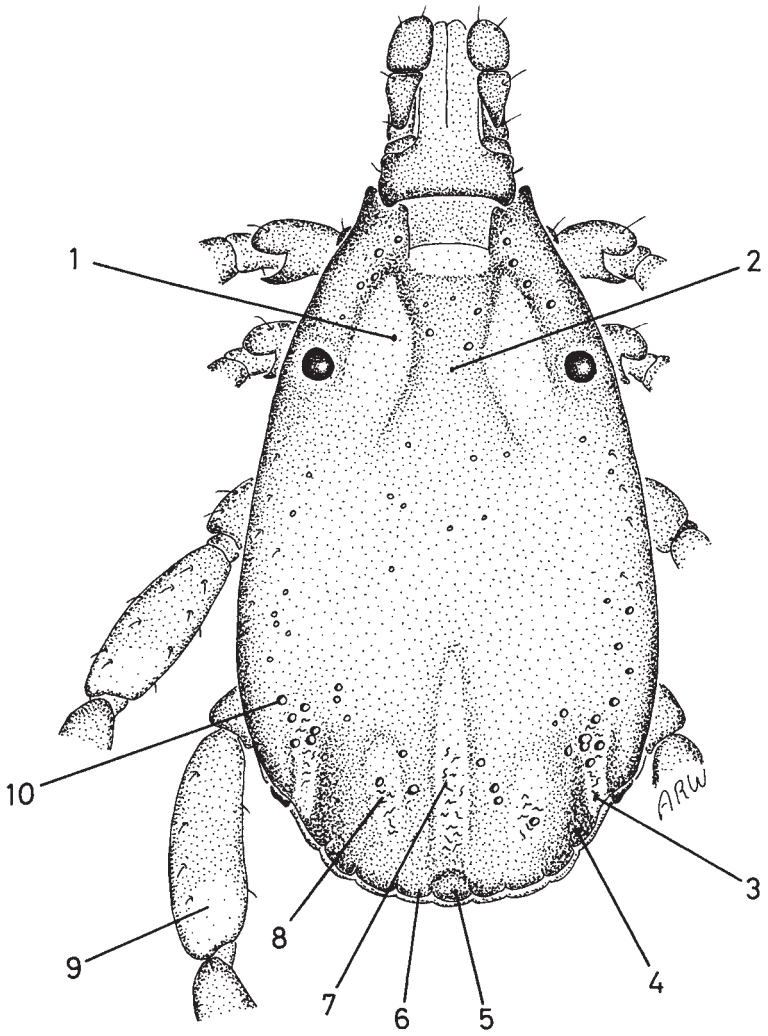


***Hyalomma anatolicum* female, dorsal.**



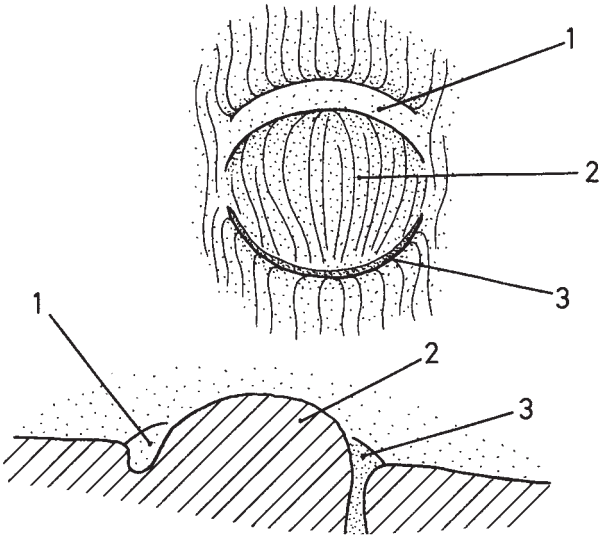
1 Scapular grooves profile is shallow (grooves reach the posterior margin of scutum).
2 Scutum is pale coloured.
3 Scutum posterior margin is smooth.
4 Leg colouration is with pale rings (but the legs are also pale in a patchy or marbled pattern, thus the rings are indistinct).
5 Punctation size is small. Punctation distribution is sparse.

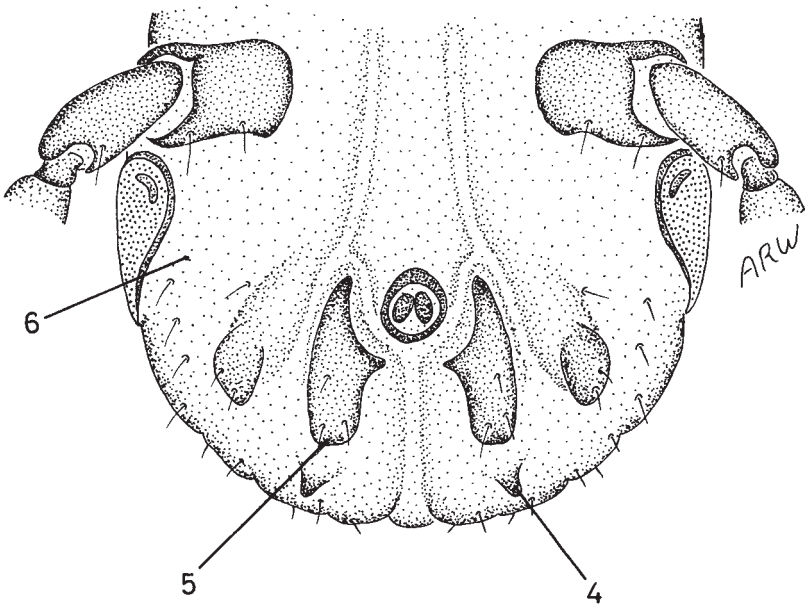
***Hyalomma anatolicum* male, dorsal.**



1 Cervical fields depression is apparent.
2 Conscutum is pale coloured.
3 Lateral grooves are short.
4 Posterior ridges number two (indistinct). Caudal depression is present.
5 Central festoon is dark coloured.
6 Paracentral festoons are separate anteriorly.
7 Posteromedium groove is present (it is long and narrow).
8 Paramedian grooves are small (they may be very indistinct).
9 Leg colouration is with pale rings (but the legs are also pale in a patchy or marbled pattern, thus the rings are indistinct).
10 Punctation sizes are small. Punctation distribution is sparse (but with some concentrations of larger punctations at the lateral grooves).

***Hyalomma anatolicum*, female genital pore top left, male ventral plates bottom right.**





1 Genital aperture anterior groove is shallow.
2 Genital aperture preatrial fold is convex (it is a distinct bulge).
3 Genital aperture posterior lips have a broad **U** shape (may alternatively have a broad **V** shape).
4 Subanal plates alignment is with the adanal plates. Subanal plates are indistinct (they are very small and may be absent).
5 Adanal plates shape has a round end.
6 Spiracle areas have sparse setae.

Hyalomma excavatum Koch, 1844.

General.
Hyalomma excavatum is significant because it is very similar to *Hyalomma anatolicum* and the two species overlap in distribution. (Formerly sub-species: *H. a. excavatum* and *H. a. anatolicum*.) However, because of the feeding preferences of *Hy. excavatum* its status as a vector of *Theileria* protozoa is weaker than that of *Hy. anatolicum*. Epidemiological studies on theileriosis therefore require these two species to be distinguished wherever they occur together.

Differential diagnosis.
Hyalomma excavatum is closely similar to *Hy. anatolicum*. *Hyalomma excavatum* is a robust and dark coloured tick with the ringed legs and large size typical of the genus *Hyalomma.* It is about 25% larger than *Hy. anatolicum*. The females are differentiated by the shape of their cervical fields, in *Hy. excavatum* these have steep sides and curved margins. It is important to compare the males to separate these two species because the females are very similar. Males of *Hy. excavatum* have a distinctive depressed area in the posterior scutum, with steep sides. They have a distinctive formation of the festoons such that the paracentral festoons are joined anteriorly to form an arch, also the central festoon is pale.

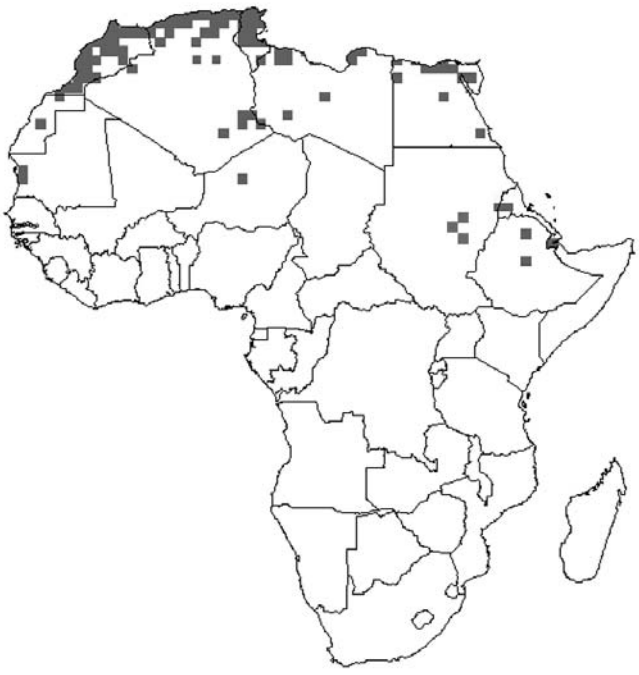
Hosts.
Cattle, sheep, goats, camels, horses and donkeys are the hosts of adult *Hy. excavatum*. The adults attach on the hindquarters of their hosts (perineum, udder). Larvae and nymphs feed on hares, hedgehogs, and rodents particularly gerbils and jirds. *Hyalomma excavatum* is a ditropic tick and in contrast to *Hy. anatolicum* the larvae and nymphs of *Hy. excavatum* do not naturally feed on cattle and other large hosts.

Life cycle and seasonal occurrence.
This tick can feed as a two-host or three-host tick depending on availability of hosts. It is a robust tick able to feed during most of the year, even in climates with a distinct winter. This is not a domestic tick; unlike *Hy. anatolicum* it is not closely associated with livestock housing. It may coexist in the same region with *Hy. anatolicum* but in this case it usually occupies the more ecologically harsh and marginal areas. Where these two species coexist the *Hy. anatolicum* population becomes more numerous and uniformly distributed than *Hy. excavatum*. In North Africa adult *Hy. excavatum* are found on livestock throughout the year with a peak in spring and a reduction in numbers in winter.

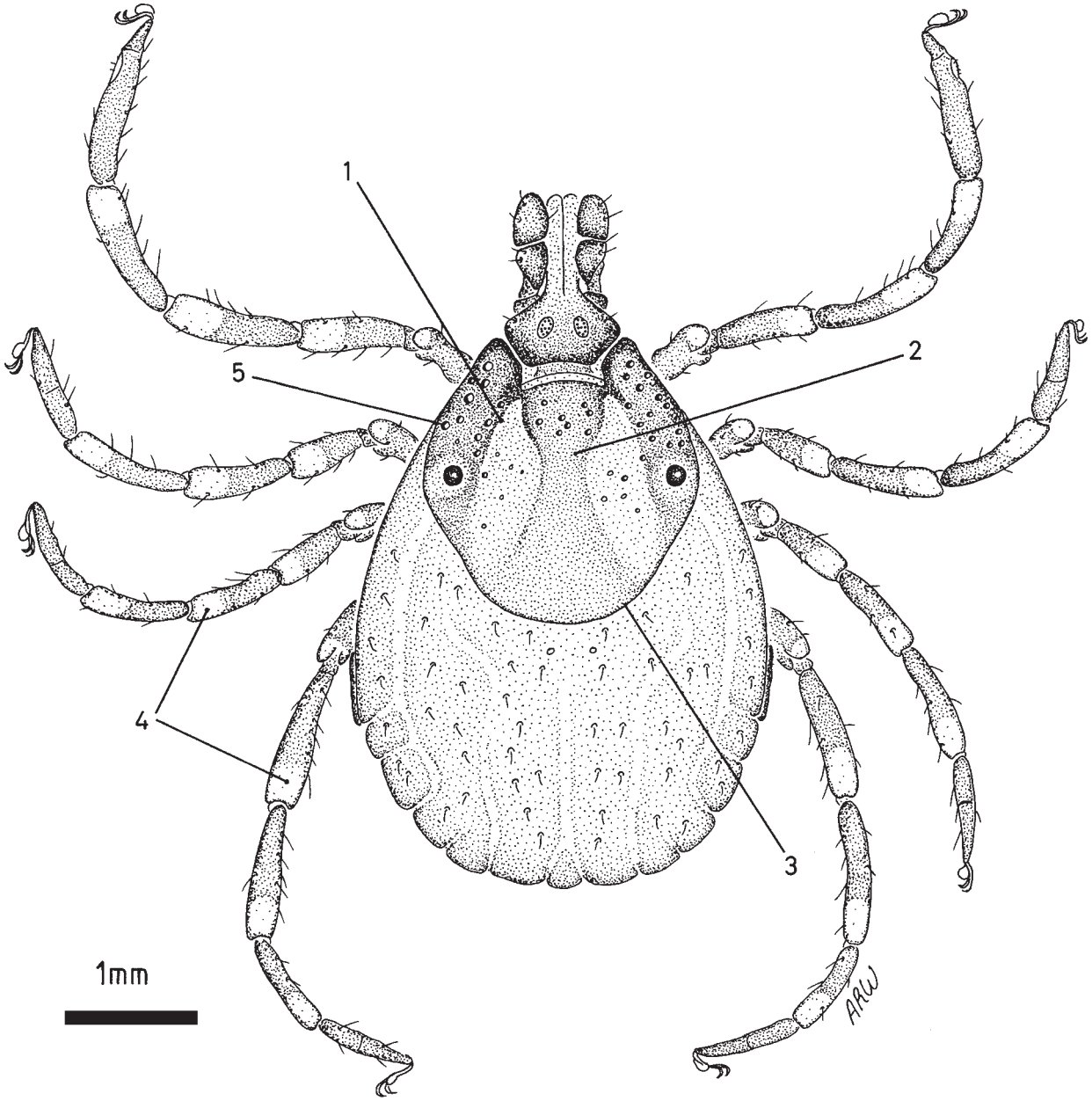
Disease.
The disease relationships of *Hy. excavatum* are poorly known. The immature stages under natural conditions characteristically feed on rodents and small vertebrates and not large animals. Thus the ability of this tick to act as a vector of pathogens such as *Theileria,* which are transmitted transstadially, is not fully known. *Hyalomma excavatum* has not been reported as an important field vector of *Theileria* but can transmit it under experimental conditions.

Habitat and distribution.
Hyalomma excavatum is adapted to the Mediterranean and steppe climatic regions of North Africa and to steppe climatic regions elsewhere in its wide range. This tick is often less commonly found on livestock than *Hy. anatolicum* but it has a wider geographical distribution and is found in much of North Africa from Mauritania to Egypt and also into Sudan, Ethiopia and Eritrea. It is not found commonly south of the Sahara but it is found eastwards through to Iran and Turkmenistan.

Distribution of *Hyalomma excavatum*.

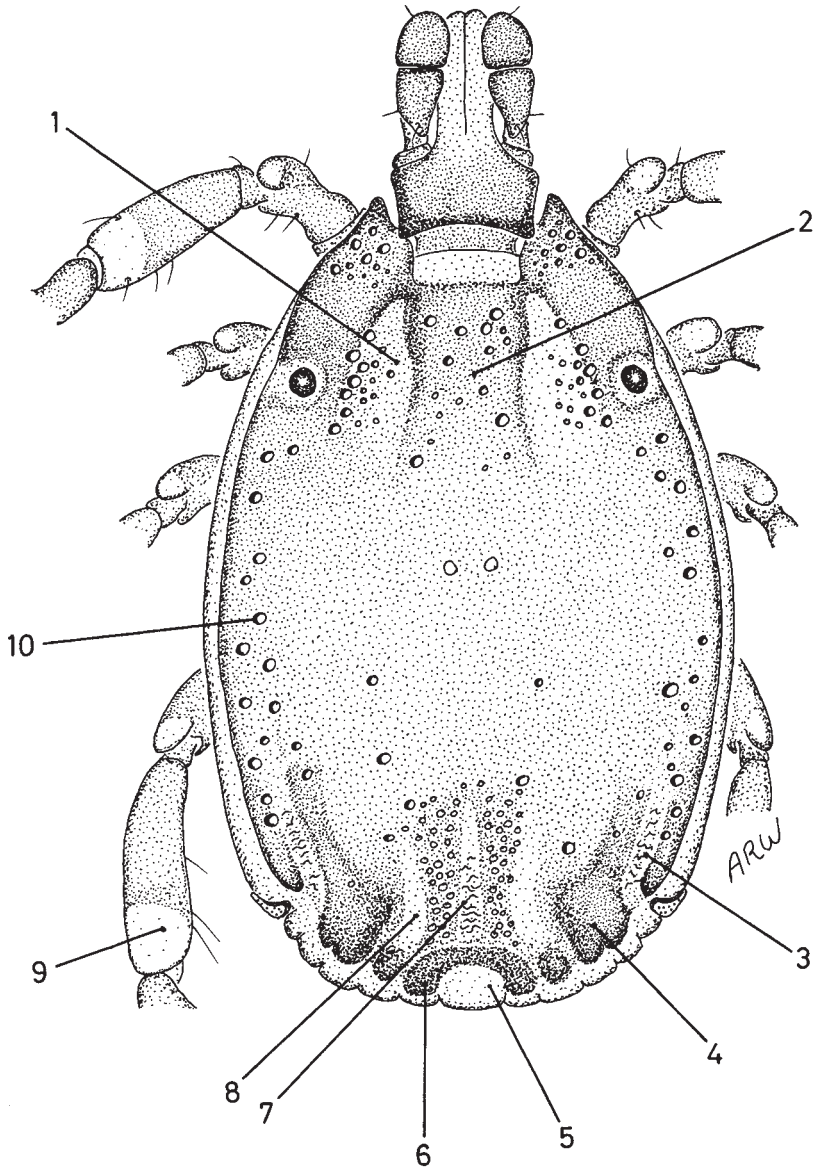


***Hyalomma excavatum* female, dorsal.**



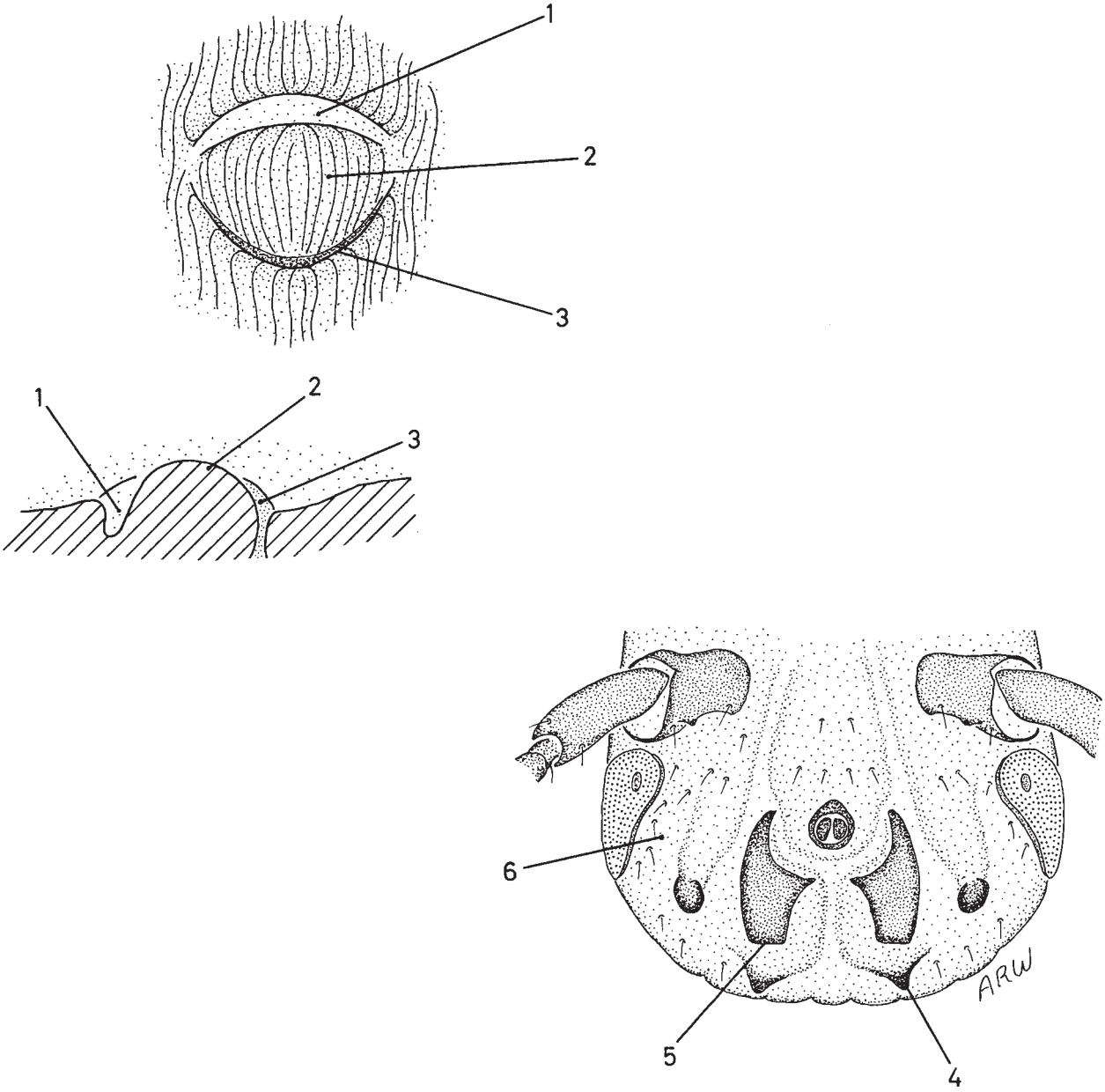
1 Scapular grooves profile is steep (grooves reach close to the posterior margin of the scutum).
2 Scutum is dark coloured.
3 Scutum posterior margin is slightly sinuous.
4 Leg colouration has pale rings (distinct because legs are mainly dark, also the pale colour is irregular or marbled).
5 Punctation size is small. Punctation distribution is localized (medium numbers mainly on anterior of the scutum).

Hyalomma excavatum **male**, **dorsal**.



1 Cervical fields depression is apparent.
2 Conscutum is dark coloured (it is heavily sclerotised).
3 Lateral grooves are short (but distinct and with rough surface).
4 Posterior ridges number two. Caudal depression is present.
5 Central festoon is pale.
6 Paracentral festoons are joined anteriorly.
7 Posteromedian groove is present.
8 Paramedian grooves are small (they may be indistinct).
9 Leg colouration is with pale rings (distinct because legs are mainly dark, also the pale colour is irregular or marbled).
10 Punctation size is large. Punctation distribution is localized (in cervical fields, caudal depression and margins of conscutum).

***Hyalomma excavatum*, female genital aperture at top left, male ventral plates at bottom right.**



1 Genital aperture anterior groove is deep.
2 Genital aperture preatrial fold is convex.
3 Genital aperture posterior lips have a broad **U** shape (alternatively they may have a broad **V** shape).
4 Subanal plates alignment is with the adanal plates. Subanal plates are distinct.
5 Adanal plates shape has square ends.
6 Spiracle areas have sparse setae.

Hyalomma scupense Schulze, 1919 (= *H.detritum* Schulze 1919).

General.
Hyalomma scupense is the most important vector of *Theileria annulata* in some areas of North Africa. It needs to be distinguished from other vectors which occur in the same geographical areas. This tick also was formerly called *H. detritum detritum* to distinguish it from what was considered to be the sub-species *H. detritum scupense*. The name *detritum* is no longer considered valid but may be used additionally to designate this tick well known for its high economic importance.

Differential diagnosis.
Hyalomma scupense is similar to both *Hy. anatolicum anatolicum* and *Hy. excavatum*. *Hyalomma scupense* is relatively small and lacking in punctations compared to other *Hyalomma* species. When seen live in the field *Hy. scupense* is unusual for *Hyalomma* ticks because it does not have pale rings on the legs.

Hosts.
Domestic cattle are the most common hosts for this species, but horses, sheep, goats and camels may also be infested. This is a monotropic tick, all stages of development feed on the same host species. Adult ticks attach on the inner thighs, udder, genital areas and perineum of cattle. Immature stages attach particularly to the neck and the shoulder.

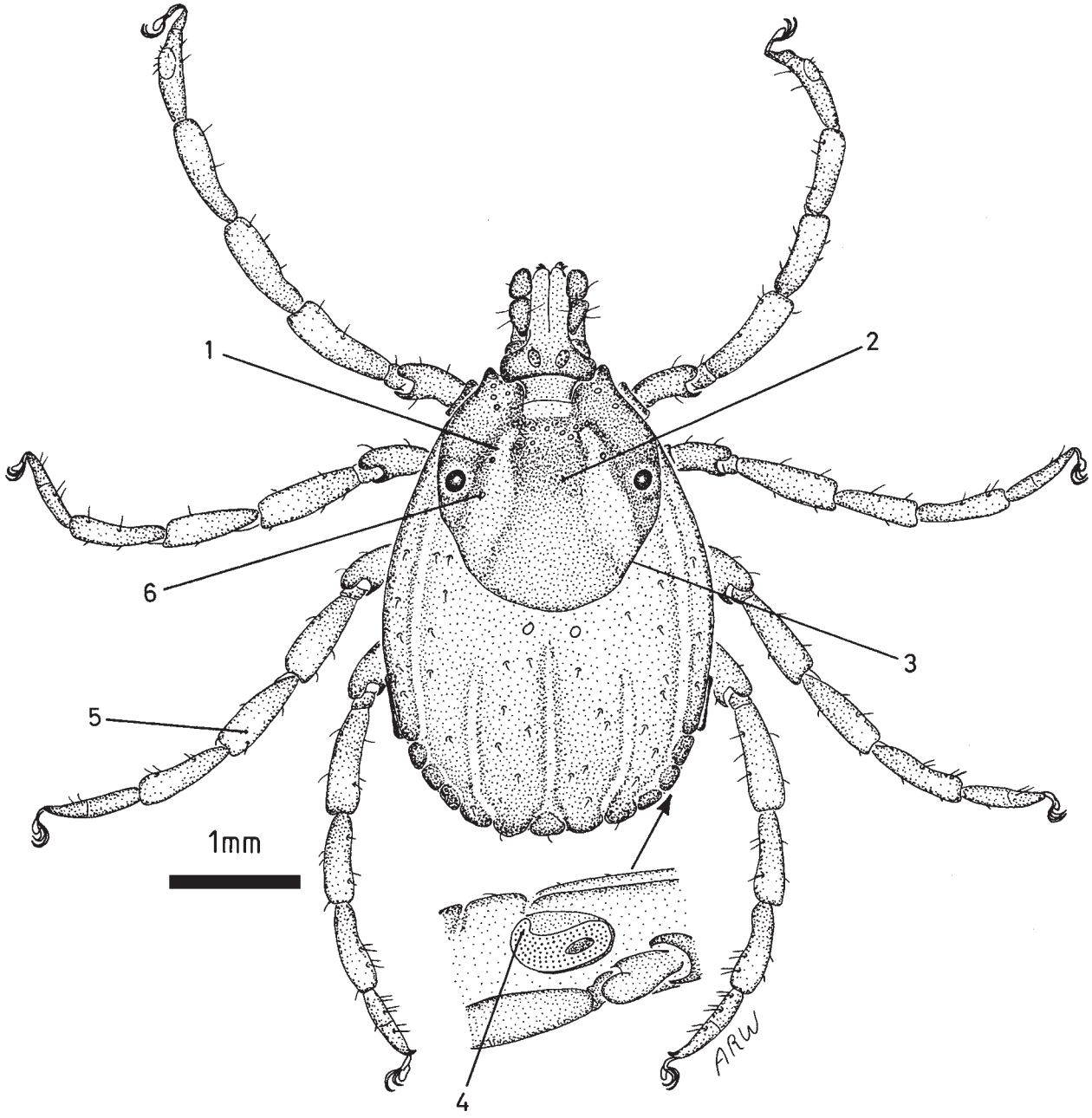
Life cycle and seasonal occurrence.
Hyalomma scupense has a two-host life cycle that takes one year to complete. Adults of *Hy. scupense* appear on cattle in the late spring with a peak in July and disappear at the beginning of September. The larvae and nymphs feed on cattle in autumn, September to November. This tick is usually domestic; infestation is often associated with livestock barns, stables, sheds and pens. Livestock become infested when they are housed in these structures. Detached engorged nymphs moult in various sheltered sites in livestock housing such as crevices and cracks in walls, under rocks and dried cattle dung. The nymphs enter a winter diapause and moult to adults the following summer.

Disease.
Hyalomma scupense transmits the protozoan *Theileria annulata* which causes tropical theileriosis in cattle. Where this pathogen is transmitted by *Hy. scupense* the disease frequently occurs on small farms where livestock are closely associated with barns and stables. This tick also transmits *Theileria equi* to horses and donkeys, causing equine piroplasmosis. This tick transmits the bacterium *Coxiella burnetii* to livestock, small domestic animals and humans, causing Q fever.

Habitat and distribution.
This tick species occurs in the areas with Mediterranean climate of northern Africa from Morocco to Tunisia. It also occurs in the desert and steppe climatic areas of north-central Sudan. This area may have been invaded by *Hy. scupense* from the Red Sea coast or along the valley of the River Nile. Its distribution continues eastwards in many widespread areas through to central Asia. *Hyalomma scupense* is the most abundant ixodid tick infesting cattle in Morocco and Tunisia. It appears to be absent from Libya but isolated populations have been reported from Egypt and central Sudan.

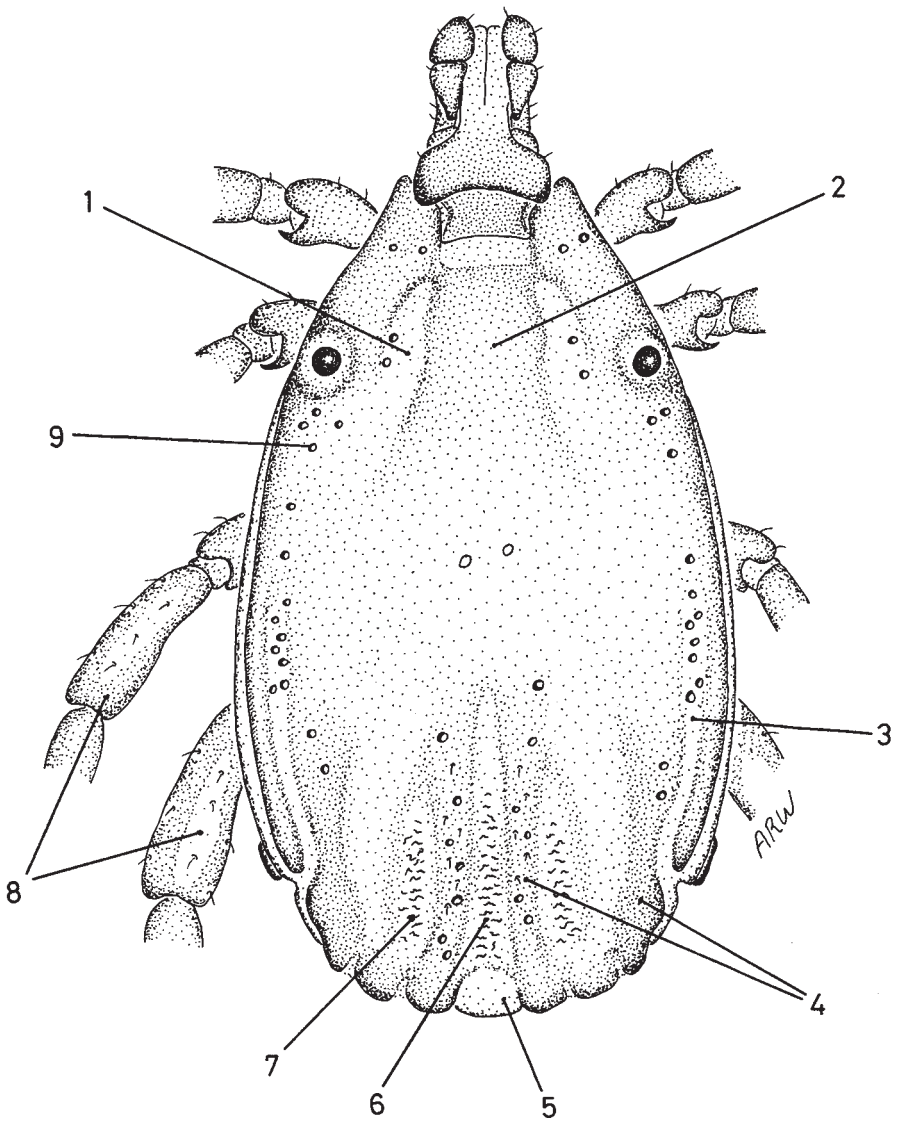
Distribution of *Hyalomma scupense*.

***Hyalomma scupense* female, dorsal.**



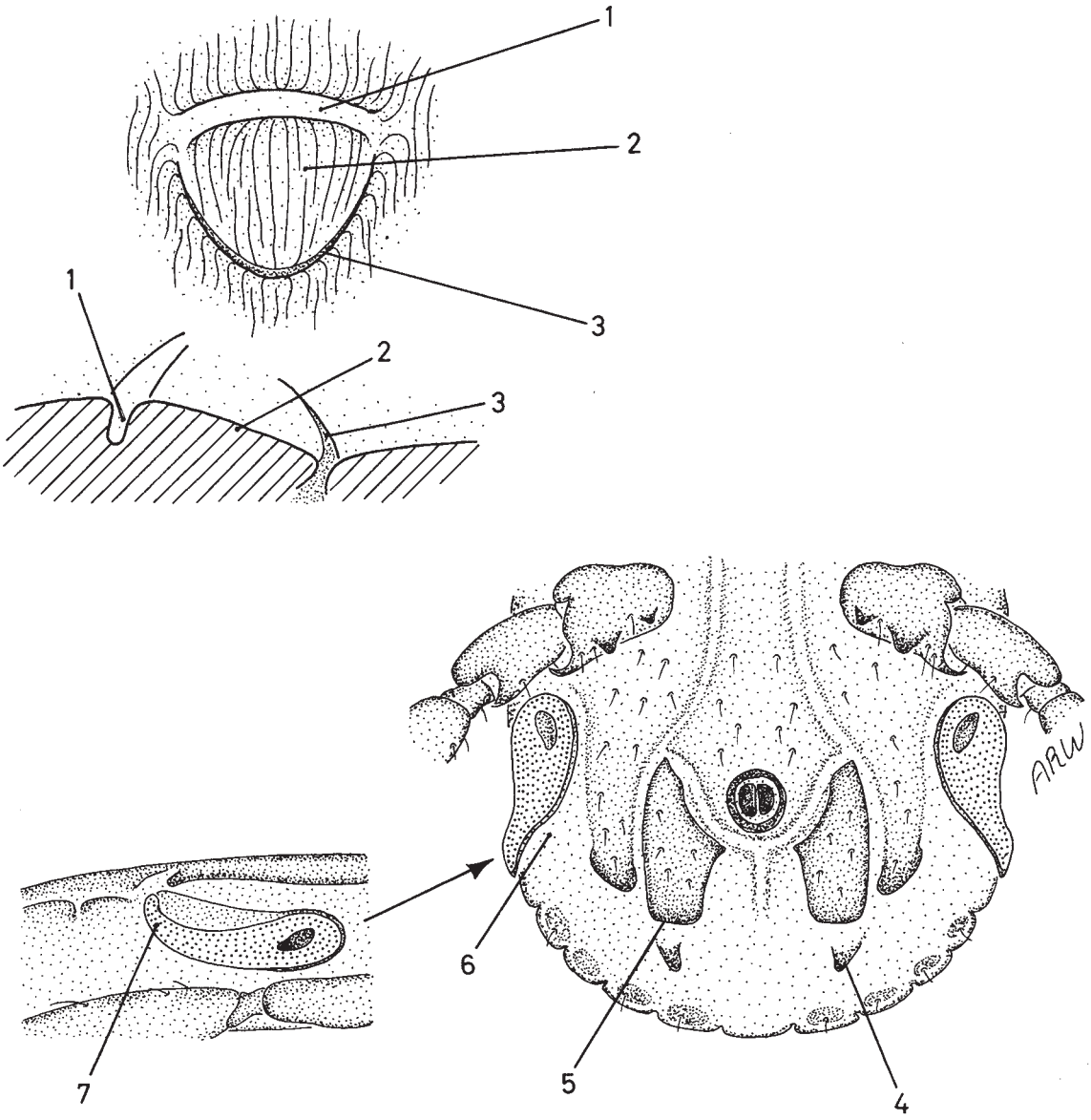
1 Scapular grooves profile is shallow (grooves reach to the posterior margin of the scutum).
2 Scutum is dark coloured.
3 Scutum posterior margin is slightly sinuous.
(4 Spiracular plates have tails with a narrow curve towards the dorsal surface.)
5 Leg colouration is without pale rings (there may be indistinct pale patches on the dorsal surface of leg segments, legs have a yellow to pale orange colour and are unusually long).
6 Punctation size is small. Punctation distribution is localized (small numbers on anterior of scutum, giving it a smooth shiny appearance).

***Hyalomma scupense*, dorsal**.



1 Cervical fields depression is apparent (but small).
2 Conscutum is dark coloured.
3 Lateral grooves are long (they are distinct grooves for one third of the length of the conscutum then continue towards eyes as lines of punctations).
4 Posterior ridges number four. Caudal depression is present (it is large but partially obscured by ridges and posterior grooves).
5 Central festoon is pale coloured (but may be dark). Paracentral festoons are separate anteriorly.
6 Posteromedian groove is present.
7 Paramedian grooves are large.
8 Leg colouration is without pale rings (there may be indistinct pale patches on the dorsal surface of leg segments, legs have a yellow to dull orange colour and are unusually long).
9 Punctation size is small. Punctation distribution is localized (on lateral areas, giving conscutum a smooth and shiny appearance).

***Hyalomma scupense*, female genital pore at top left, male ventral plates at bottom right, spiracular plate at bottom left.**



1 Genital aperture anterior groove is deep.
2 Genital aperture preatrial fold is flat.
3 Genital aperture posterior lips have a broad **V** shape.
4 Subanal plates alignment is with the adanal plates. Subanal plates are distinct.
5 Adanal plates shape has square ends.
6 Spiracle areas have sparse setae.
(7 Spiracular plates have tails with a narrow curve towards the dorsal surface.)

Hyalomma dromedarii Koch, 1844.

General.
Hyalomma dromedarii is also known as The camel *Hyalomma*. It is a very characteristic tick closely associated with camels (the single humped dromedary) after which it is named.

Differential diagnosis.
The males of this tick are easily distinguished from other *Hyalomma* ticks in Africa because their sub-anal plates are aligned outside the adanal plates. The adanal plates also have a characteristic shape with both long margins strongly curved in parallel. The males resemble *Hy. scupense* in having four posterior ridges on the scutum. The female genital aperture has posterior lips with a narrow **V**. *Hyalomma impeltatum* females have similar genital apertures but the posterior margin of their scutum is distinctly sinuous compared to a slightly sinuous margin in *Hy. dromedarii*.

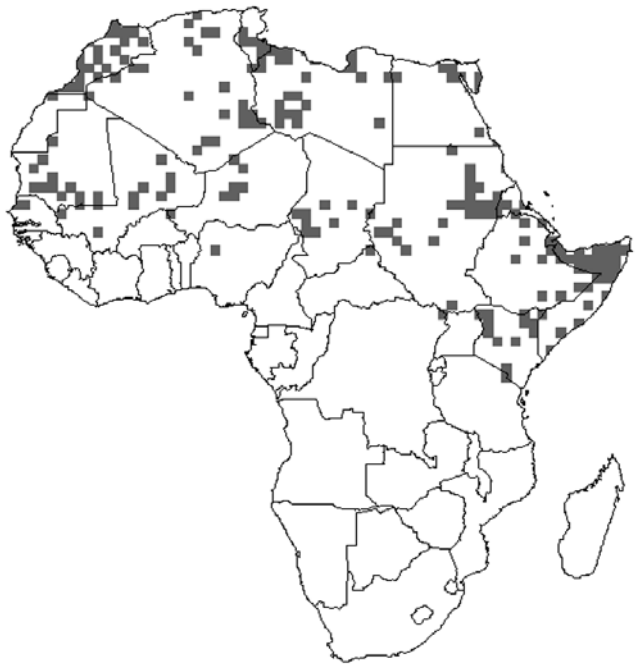
Hosts.
Camels are the preferred hosts of *Hy. dromedarii*, but cattle, sheep, goats and horses are also infested. In areas where camels are now less common it seems that cattle can support populations of this tick. Adults attach on the inner thighs, udder and genital areas of camels. Larvae and nymphs feed on small burrowing animals and on hares, but the nymphs may also infest the same animals as the adults.

Life cycle and seasonal occurrence.
Hyalomma dromedarii has a two-host or three-host life cycle. As two-host ticks the larvae may feed and moult to nymphs on small mammals or hares and the adults feed on large herbivores. As three-host ticks the larvae may feed on small mammals, detach and moult to nymphs, which can then either attach to other small mammals or feed on the same large animals as the adults. These types of feeding combine characters of both ditropic and telotropic behaviours. The close association with camels is in some ways similar to the domestic behaviour of other tick species but *Hy. dromedarii* is not adapted to living in housing. The life cycle appears to be continuous throughout the year.

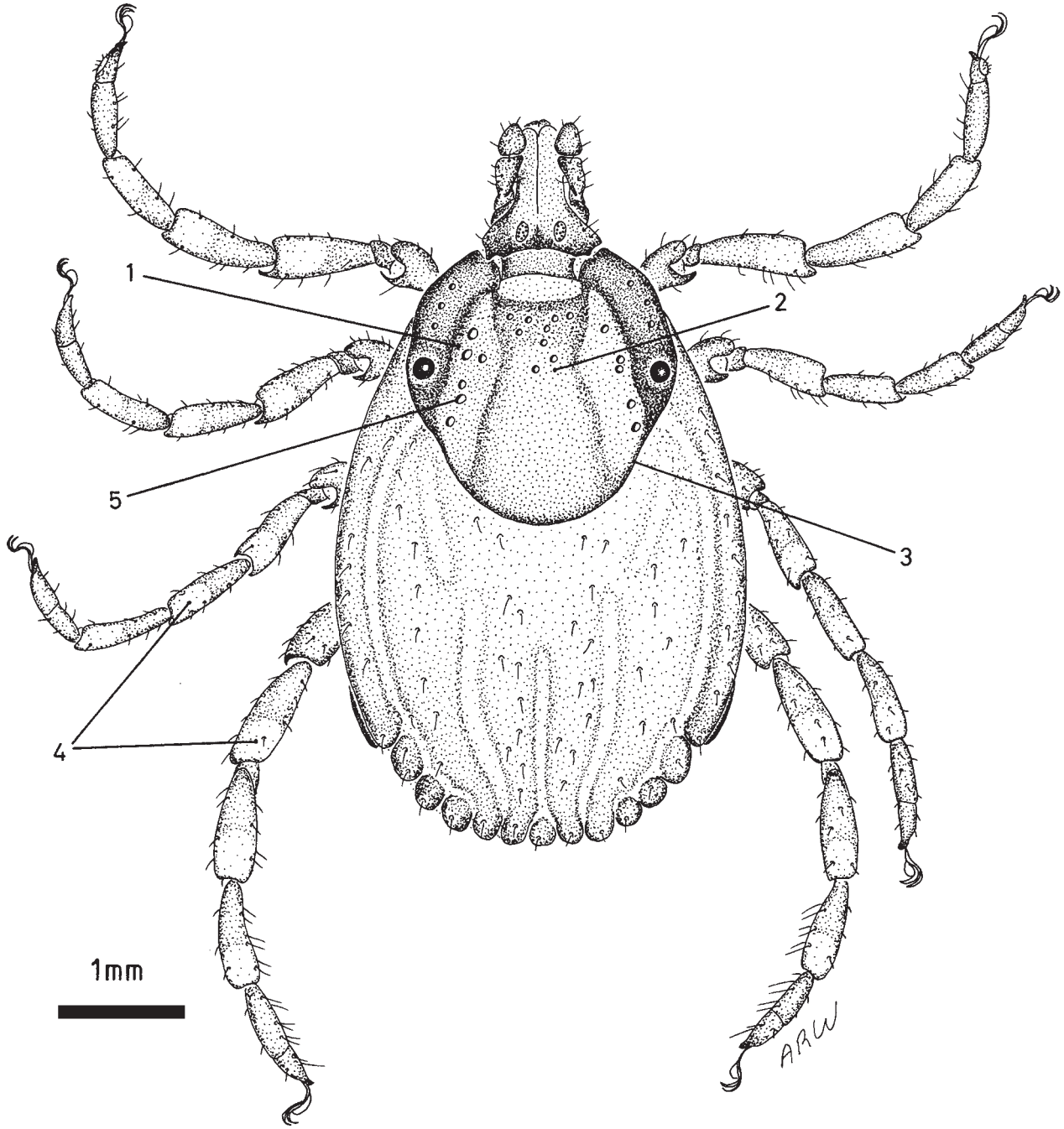
Disease.
The natural disease relations of this tick are not well understood. *Hyalomma dromedarii* can transmit the protozoan *Theileria annulata* to cattle under laboratory conditions but because the immature stages often feed on small animals and the preferred hosts of adults are camels it may not be generally important. However, in Mauritania *Th. annulata* infection of cattle is widespread because of the feeding of nymphs and adults of *Hy. dromedarii* on cattle where they mix with camels. This infection does not cause disease there in the local breeds of cattle.

Habitat and distribution.
Hyalomma dromedarii is common in regions with Mediterranean, steppe and desert climates that are north of the equator in Africa. It is well adapted to extreme dryness of habitat and to camel hosts. Thus it is found wherever camels occur and is distributed in Africa, and the Near, Middle and Far East as far as India, Mongolia and Tibet. The extensive distribution of this tick in the Sahara is conspicuous in comparison with all other species of tick except *Hy. impeltatum*. This is due to its close association with draught camel trains on trade routes throughout this desert. In North Africa it occurs in all countries from Mauritania to Egypt. In North East and East Africa it occurs in Sudan, Eritrea, northern, eastern and southern Ethiopia, northern Kenya and north-eastern Uganda.

Distribution of *Hyalomma dromedarii*.

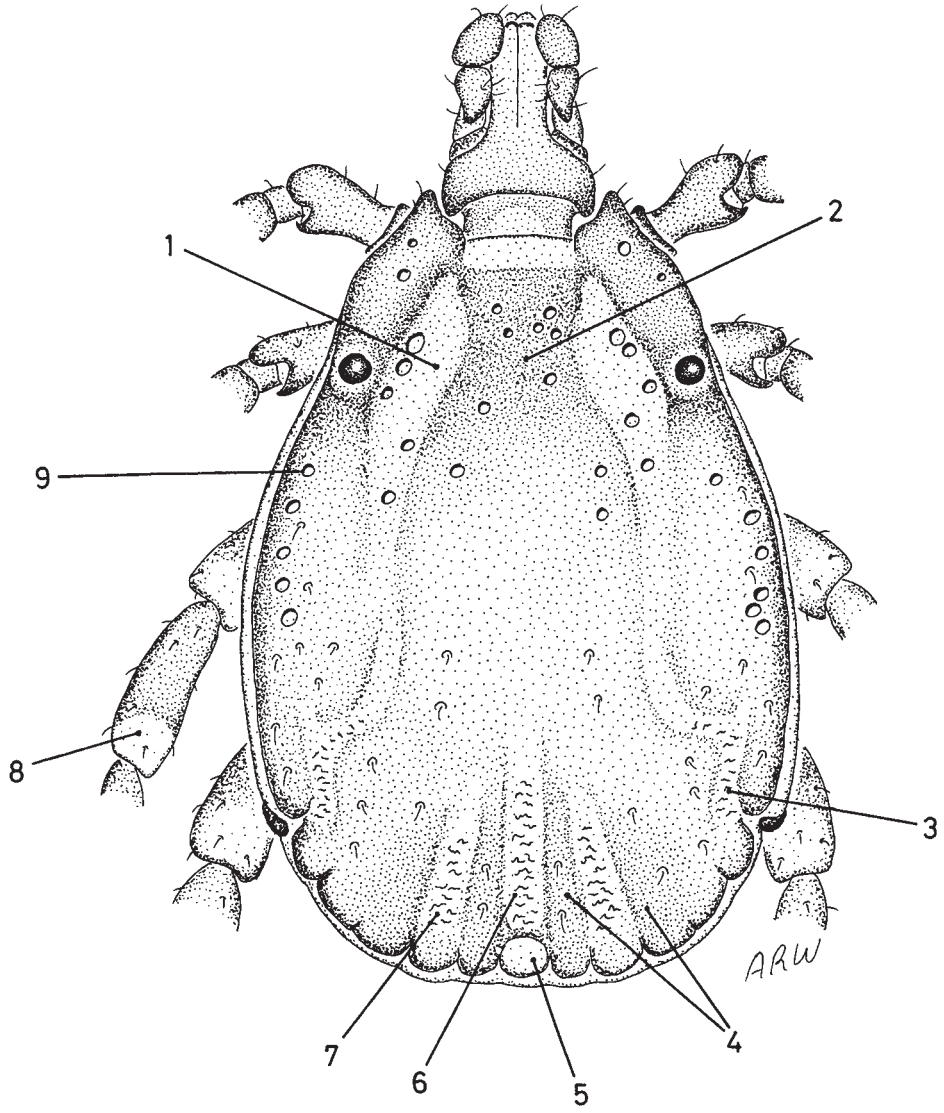


***Hyalomma dromedarii* female, dorsal.**



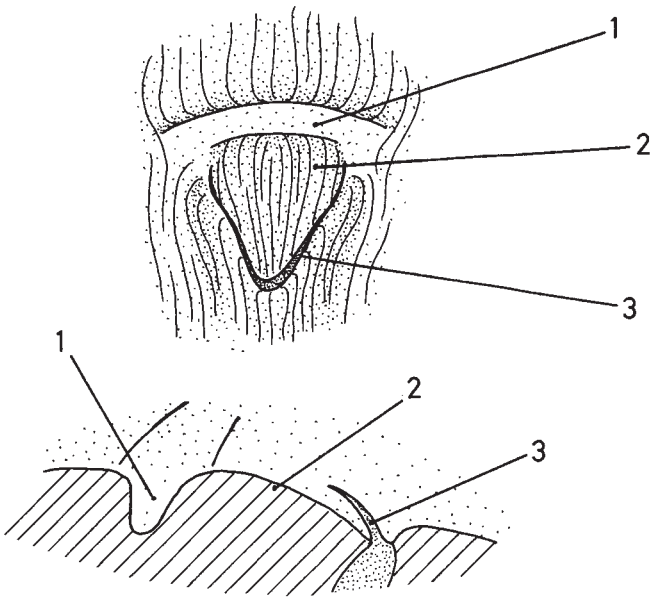
1 Scapular grooves profile is steep (grooves are irregular in outline and reach the posterior margin of the scutum).
2 Scutum is dark coloured.
3 Scutum posterior margin is slightly sinuous.
4 Leg colouration is with pale rings.
5 Punctation size is large. Punctation distribution is sparse.

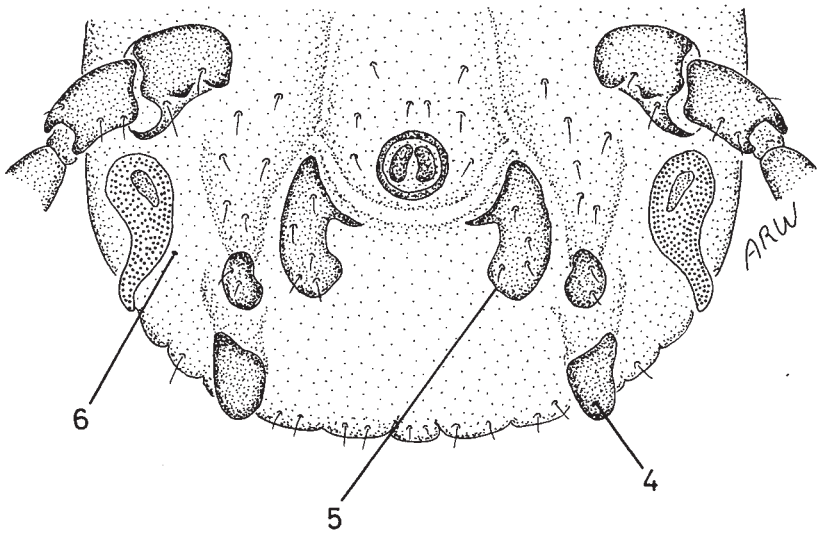
***Hyalomma dromedarii* male, dorsal.**



1 Cervical fields depression is apparent.
2 Conscutum is dark coloured.
3 Lateral grooves are short.
4 Posterior ridges number four. Caudal depression is present (but partially obscured by posterior ridges).
5 Central festoon is pale coloured. Paracentral festoons are separate anteriorly.
6 Posteromedian groove is present.
7 Paramedian grooves are large.
8 Leg colouration is with pale rings.
9 Punctation size is large. Punctation distribution is sparse.

***Hyalomma dromedarii*, female genital pore at top left, male ventral plates at bottom right.**





1 Genital aperture anterior groove is deep.
2 Genital aperture preatrial fold is convex (only slightly so).
3 Genital aperture posterior lips have a narrow **V** shape (this is distinctly narrow and in some specimens may be more elongate than shown here).
4 Subanal plates alignment is outside the adanal plates (in unfed specimens they are close to the accessory adanal plates but in fed specimens they move further away beyond the posterior margin of the body, as shown here). Subanal plates are distinct.
5 Adanal plates shape has round ends (also the lateral margins are distinctly curved in parallel).
6 Spiracle areas have sparse setae.

Hyalomma impeltatum Schulze & Schlottke, 1930.

General.
Hyalomma impeltatum needs to be distinguished from *Hyalomma dromedarii*, with which it shares similar morphological features, hosts and geographical areas.

Differential diagnosis.
The scutum of female *Hy. impeltatum* has a distinctly sinuous posterior margin compared to slightly sinuous in *Hy. dromedarii*. The genital aperture of *Hy. impeltatum* has a convex preatrial fold which bulges anteriorly and depresses posteriorly. In *Hy. dromedarii* this fold is also convex but only slightly so. The posterior lips of the genital aperture form an elongate **V** shape similar to *Hy. dromedarii* but shorter, wider and not so narrowly pointed at the posterior apex. The genital aperture is bordered on each side by a slight bulge that gives the genital area a trilobed appearance distinctive to this species.

The males of *Hy. impeltatum* have a conscutum with long lateral grooves and two posterior ridges, compared to short grooves and four ridges in *Hy. dromedarii*. The small sub-anal plates of *Hy. impeltatum* in unfed specimens appear to be in vertical alignment with the adanal plates. This contrasts with the conspicuously large sub-anal plates of *Hy. dromedarii* which are distinctly outside the alignment of the adanal plates in unfed and fed ticks. This feature in *Hy. impeltatum* is confusing as these plates may be seen lying outside the alignment of the adanal plates but this only occurs when the *Hy. impeltatum* males have fed and expanded. Then these plates appear at the end of large extensions of the ventral body wall beyond the normal margin of the body.

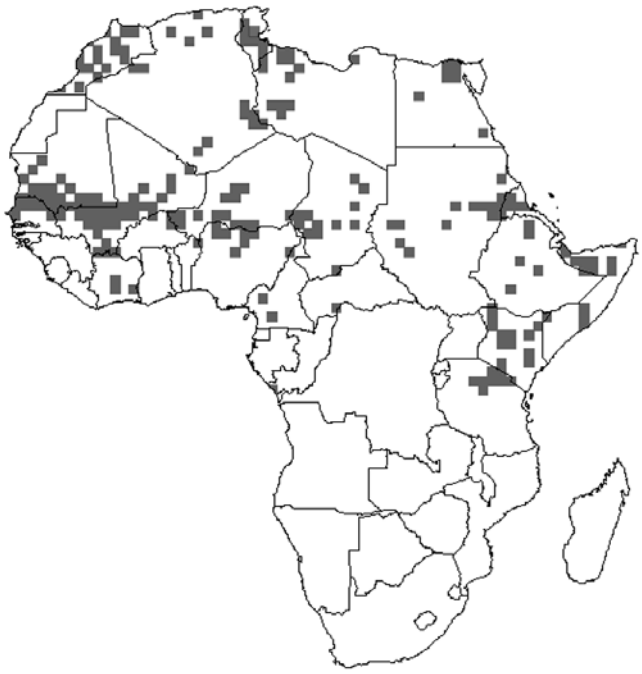
Hosts.
All large domestic animals can serve as hosts of adult *Hy. impeltatum*, particularly cattle on which high infestations are recorded. Camels are also commonly infested. The immature stages feed on small animals like rodents, hares and ground birds.

Life cycle and seasonal occurrence.
Under laboratory conditions this tick had a three-host life cycle. Adults are present on animals throughout the year. Immature stages infest their hosts in summer and autumn.

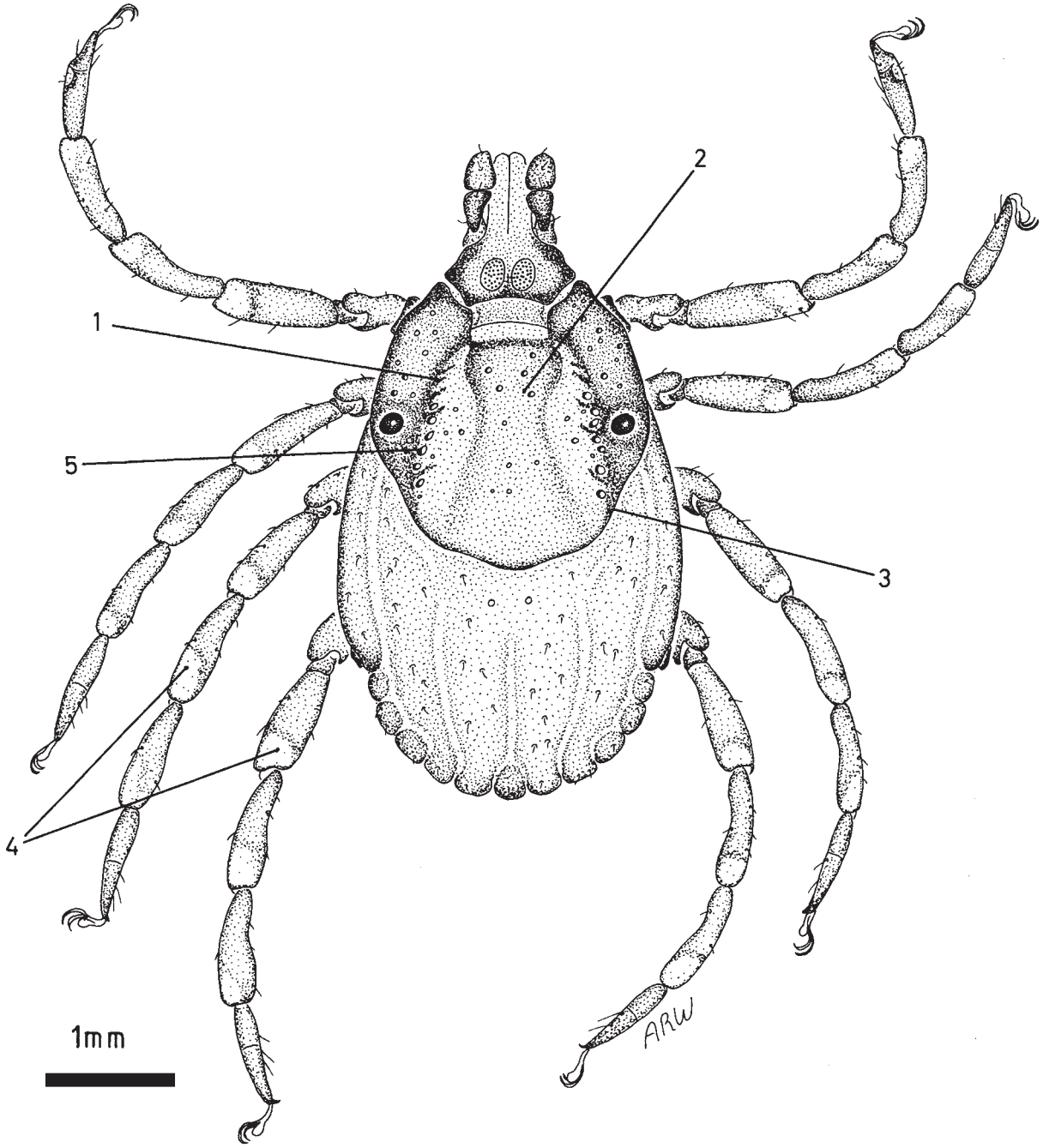
Disease.
The natural disease relationships of *Hy. impeltatum* are not well understood. Under experimental conditions the tick has transmitted *Theileria annulata* to cattle. It has been reported as capable of transmitting the virus of Crimean-Congo haemorrhagic fever to humans.

Habitat and distribution.
Hyalomma impeltatum occurs mainly in areas of Mediterranean, steppe and desert climates. Its extensive distribution in the Sahara is conspicuous in comparison with all other species of ticks, except *Hy. dromedarii*. This is due to its association with draught camel trains on trade routes in this desert. The range of *Hy. impeltatum* includes the North African countries and Sudan, Eritrea, Somalia, Northern Kenya, northern Tanzania, Chad and those West African countries with steppe climates. It also extends into Iran and other Middle Eastern countries.

Distribution of *Hyalomma impeltatum*.

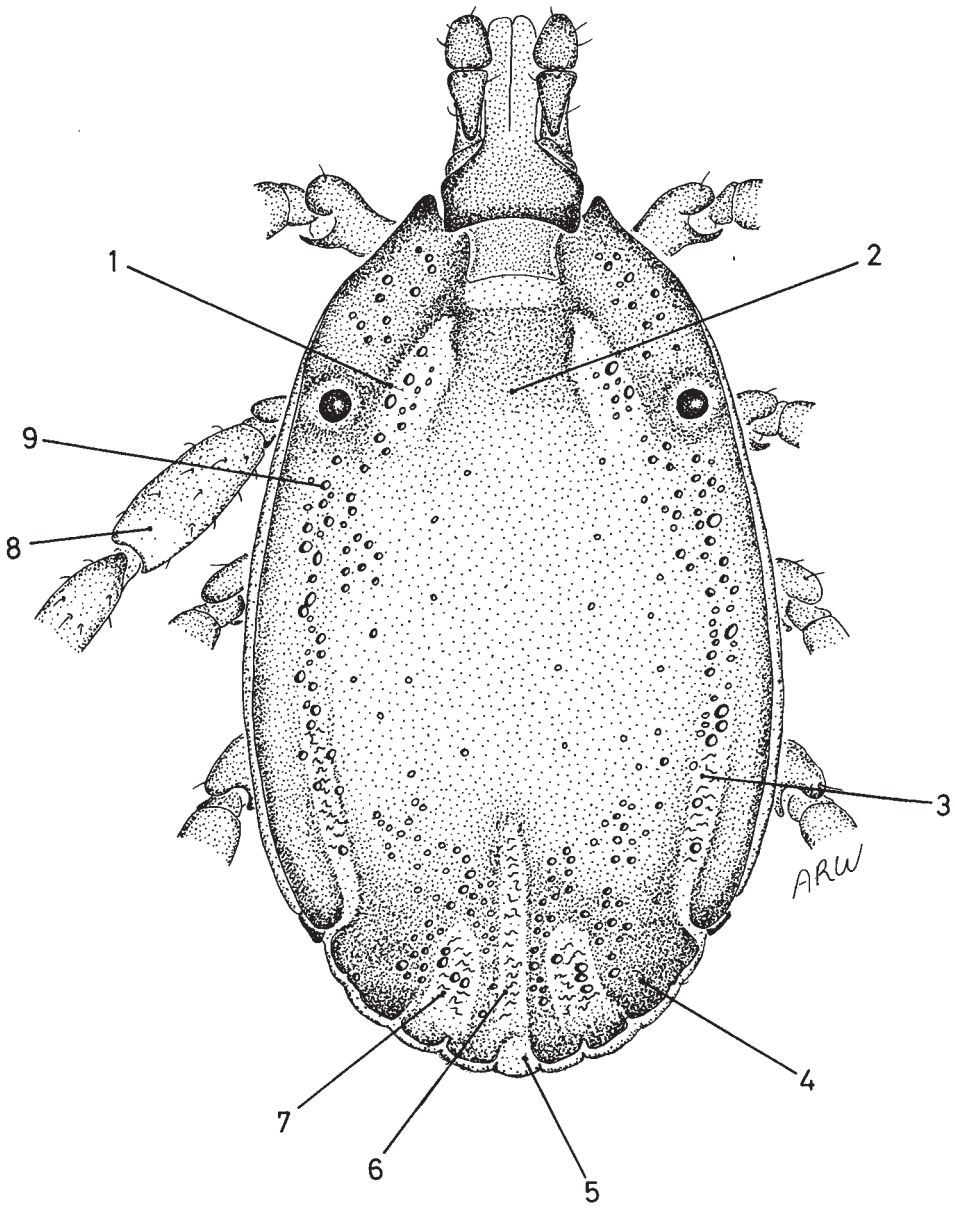


***Hyalomma impeltatum* female, dorsal.**



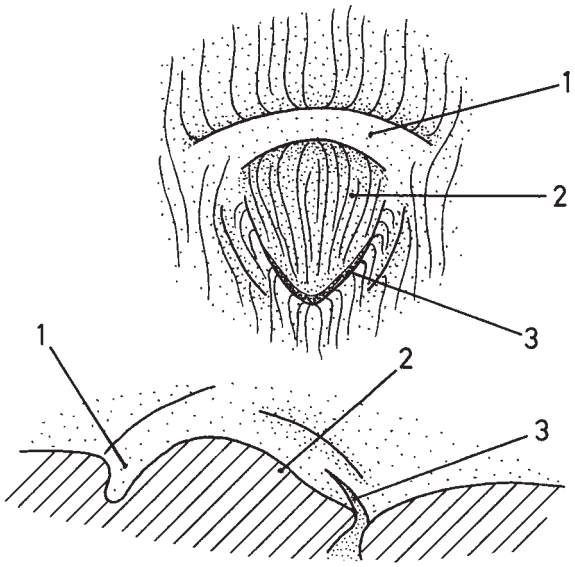
1 Scapular grooves profile is shallow (marked by columns of punctations and rough surface).
2 Scutum is dark coloured.
3 Scutum posterior margin is distinctly sinuous.
4 Leg colouration is with pale rings (these are indistinct).
5 Punctation size is large. Punctation distribution is localized (on scapulae and at scapular grooves).

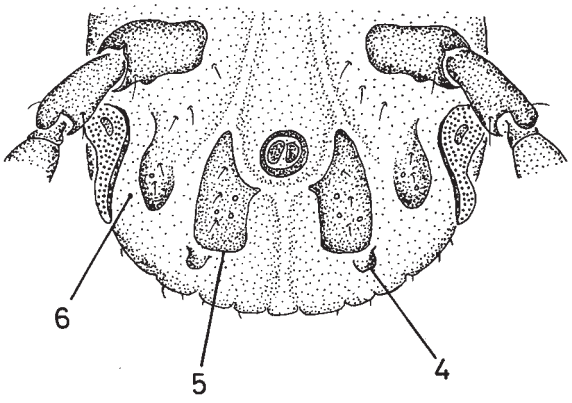
***Hyalomma impeltatum* male, dorsal.**

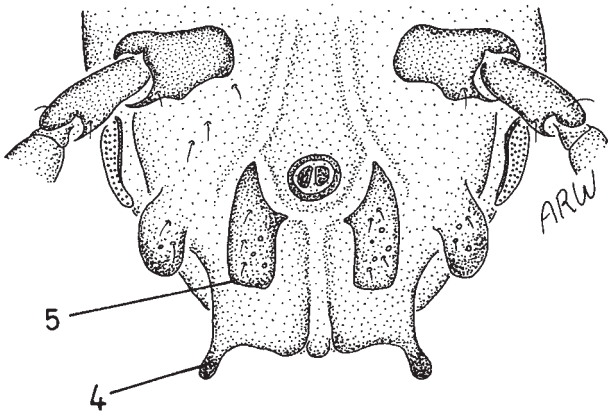


1 Cervical fields depression is apparent (but small).
2 Conscutum is dark coloured.
3 Lateral grooves are long (distinct grooves in posterior part then continuing toward eyes as lines of punctations).
4 Posterior ridges number two. Caudal depression is present.
5 Central festoon is pale coloured. Paracentral festoons are separate anteriorly.
6 Posteromedian groove is present (it is long).
7 Paramedian grooves are large.
8 Leg colouration is with pale rings (these are indistinct).
9 Punctation size is large. Punctation distribution is localized (on cervical fields and lateral grooves and punctations may be numerous around the caudal depression; also some populations have more dense punctations than shown).

***Hyalomma impeltatum*, female genital pore at top left, male ventral plates at top right (unfed tick) and bottom right (fed tick).**







1 Genital aperture anterior groove is deep.
2 Genital aperture preatrial fold is convex.
3 Genital aperture posterior lips have a narrow **V** shape (there is also a pair of long bulges parallel to the lips, these bulges together with the preatrial fold give the genital aperture a three-lobed shape).
4 Subanal plate alignment is with the adanal plates (in unfed specimens they appear to be in this position but in fed specimens they move outside the line of the adanal plates and beyond the posterior margin of the body, as shown in the lower illustration). Subanal plates are distinct.
5 Adanal plates shape has square ends.
6 Spiracle areas have sparse setae.

Hyalomma impressum Koch, 1844.

General.
Little is known about *Hyalomma impressum*. However, it needs to be distinguished from the similar *Hyalomma rufipes* which occurs on similar hosts and in the same geographical areas.

Differential diagnosis
The female scutum in *Hy. impressum* is heavily punctate and has a smoothly curved posterior margin. This posterior margin in female *Hy. rufipes* is distinctly sinuous. The area of body wall around the spiracles of females and males has only sparse setae in *Hy. impressum* but dense setae in *Hy. rufipes*. The males of *Hy. impressum* are very distinctive from other *Hyalomma* species due to a constriction of the conscutum posterior to the spiracles.

Hosts.
The chief hosts of *Hy. impressum* adults are cattle but this tick has also been reported from camels.

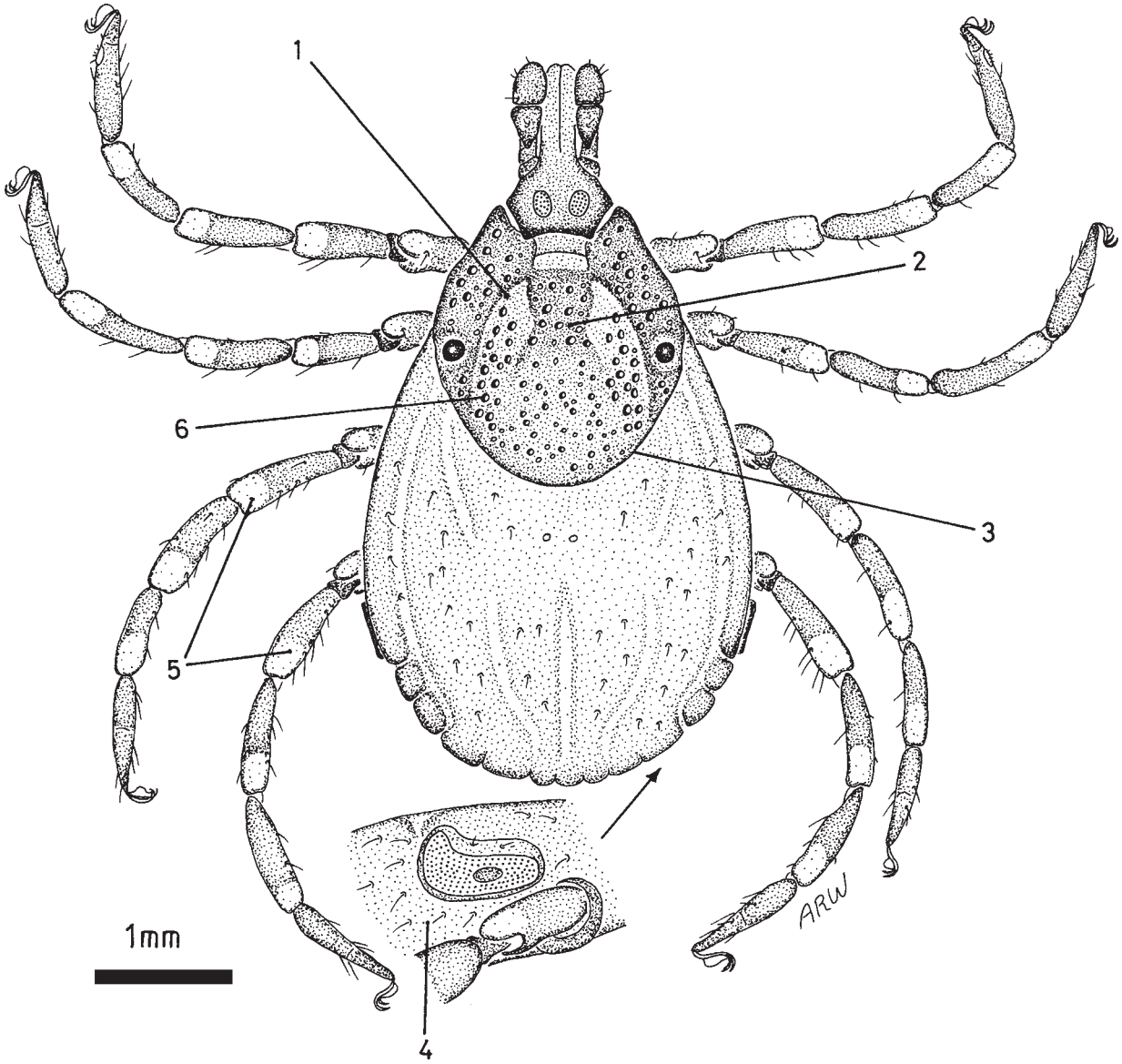
Life cycle and seasonal occurrence.
These features have not been studied.

Disease.
The tick is not known as a vector of disease organisms or a direct cause of disease of domestic animals.

Habitat and distribution.
Hyalomma impressum occurs in areas with savanna and steppe climates. It is mainly a West African tick but its range extends eastwards into Sudan and Ethiopia.

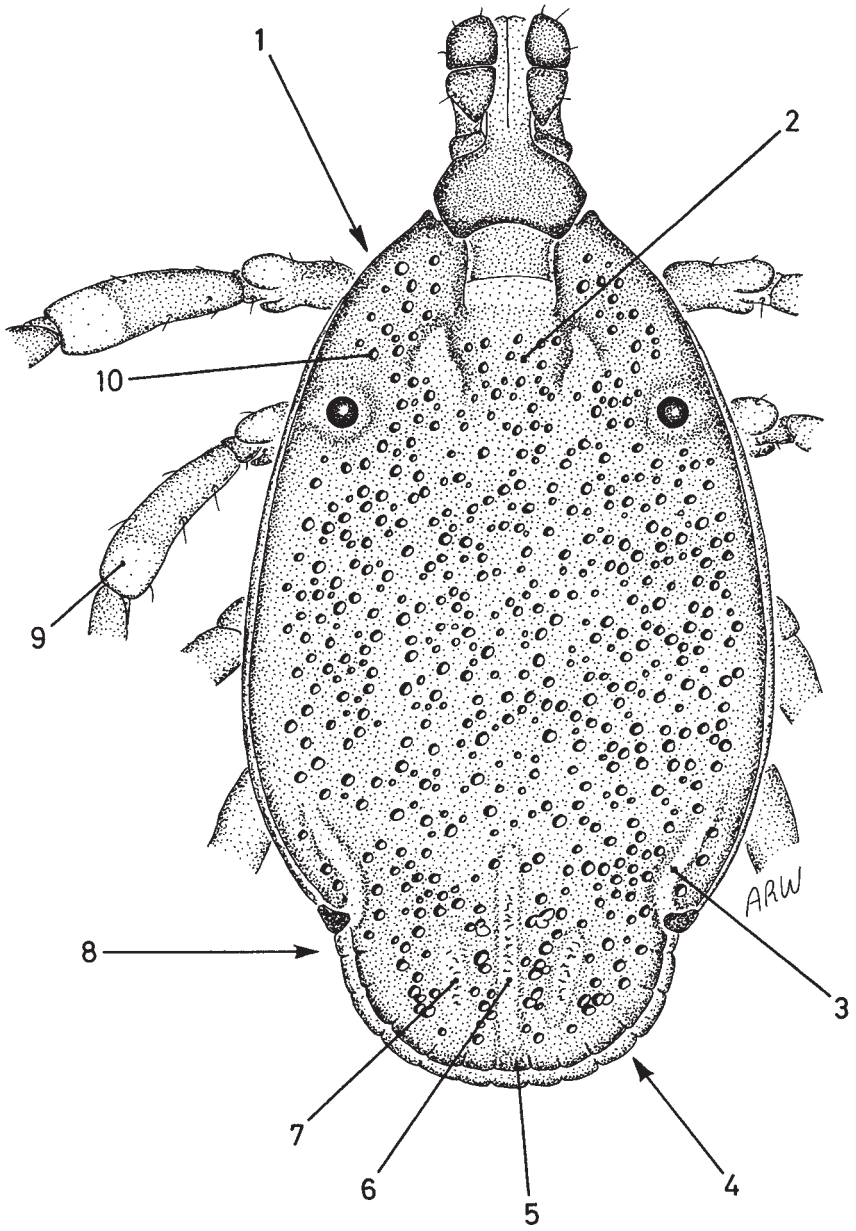
Distribution of *Hyalomma impressum*.

***Hyalomma impressum* female, dorsal.**



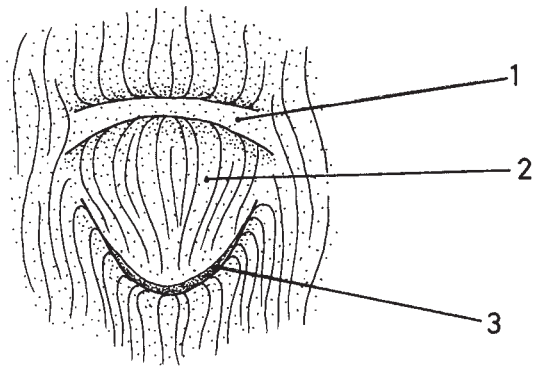
1 Scapular grooves profile is steep (grooves reach the posterior margin of scutum).
2 Scutum is dark coloured.
3 Scutum posterior margin is smooth.
4 Spiracle areas have sparse setae.
5 Leg colouration is with pale rings.
6 Punctation size is small. Punctation distribution is dense (evenly covering whole scutum).

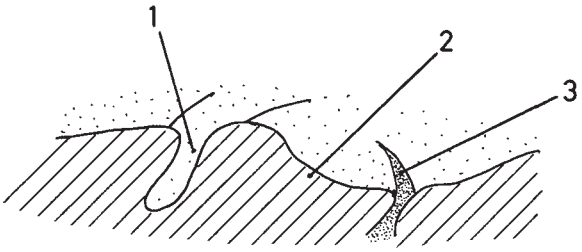
***Hyalomma impressum* male, dorsal.**

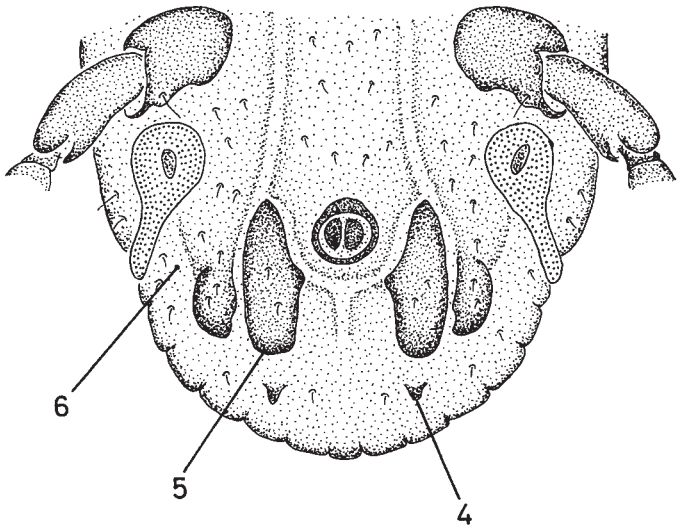


1 Cervical fields depression is not apparent.
2 Conscutum is dark coloured.
3 Lateral grooves are short.
4 Posterior ridges are absent. Caudal depression is absent.
5 Central festoon is dark (all the festoons are small and indistinct). Paracentral festoons are separate anteriorly.
6 Posteromedian groove is present.
7 Paramedian grooves are small (these grooves are indistinct).
(8 Conscutum narrows posterior to the level of the spiracle, this is a unique feature of this species.)
9 Leg colouration is with pale rings.
10 Punctation size is small. Punctation distribution is dense.

***Hyalomma impressum*, female genital pore at top left, male ventral plates at bottom left.**







1 Genital aperture anterior groove is deep.
2 Genital aperture preatrial fold is concave.
3 Genital aperture posterior lips have a broad **V** shape.
4 Subanal plate alignment is with the adanal plates. Subanal plates are indistinct.
5 Adanal plates shape has round ends.
6 Spiracle areas have sparse setae.

Hyalomma lusitanicum Koch, 1844.

General.
Hyalomma lusitanicum is a common tick of the European and Middle Eastern parts of the Mediterranean basin, but it also occurs in some areas of North Africa.

Differential diagnosis.
Hyalomma lusitanicum is a very characteristic tick, with a combination of exceptionally large punctations and white enamel on the legs. The enamel may also be visible on the scutum and conscutum. It is larger and more robust in appearance than *Hy. anatolicum* and *Hy. scupense* which occur in the same areas of North Africa. *Hyalomma lusitanicum* is more similar to *Hy. excavatum* but it has very short lateral grooves and the central festoon is often not visible. *Hyalomma rufipes* is also large and found in the same area as *Hy. lusitanicum* but is distinguished by having dense setae around the spiracles.

Hosts.
Adults of *Hy. lusitanicum* are found on cattle and other ruminants. Immature stages are found on small animals including rabbits.

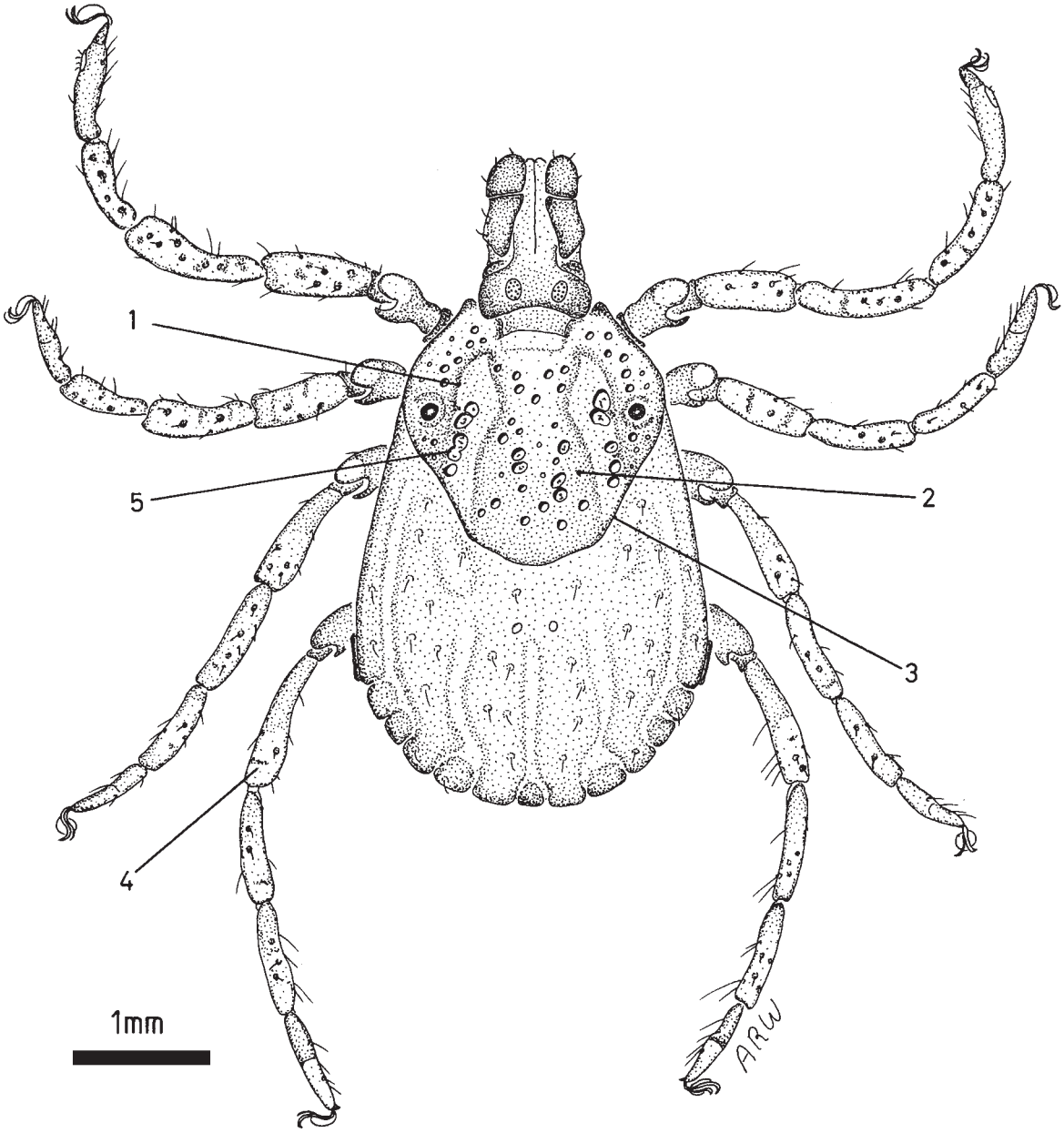
Life cycle and seasonal occurrence.
This is a three-host tick. Activity of the adults occurs throughout the year but with a peak in May to July and another peak in October and November. Larvae are active from May to September and nymphs from July to September.

Disease.
Hyalomma lusitanicum has been reported as a field vector in Spain of *Theileria annulata* protozoa, causing theileriosis in cattle. This tick also transmits the bacterium *Coxiella burnetii* to humans, causing Q fever.

Habitat and distribution.
In Africa this tick is found in areas of Algeria and Morocco with Mediterranean and steppe climates. It is not widely or densely distributed in these countries.

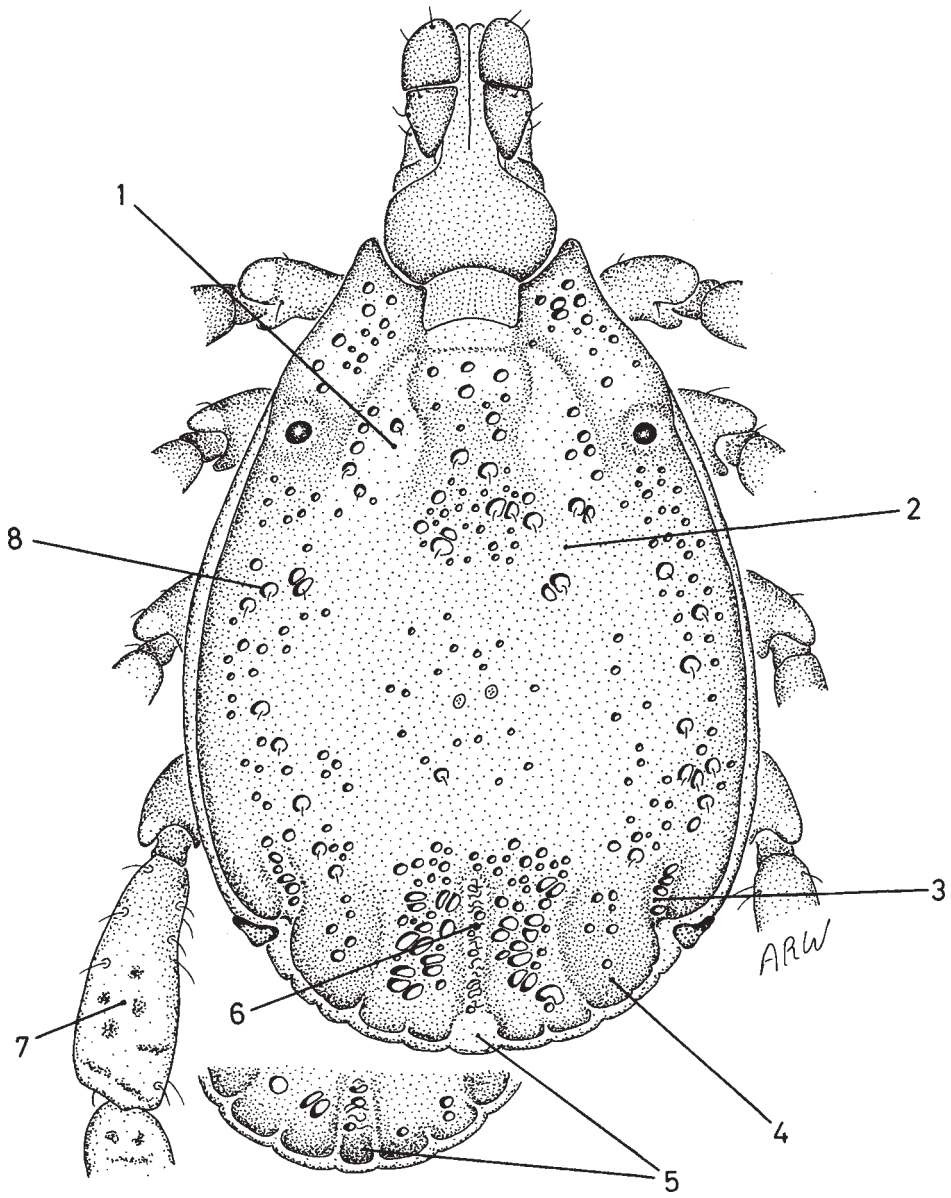
Distribution of *Hyalomma lusitanicum*.

***Hyalomma lusitanicum* female, dorsal.**



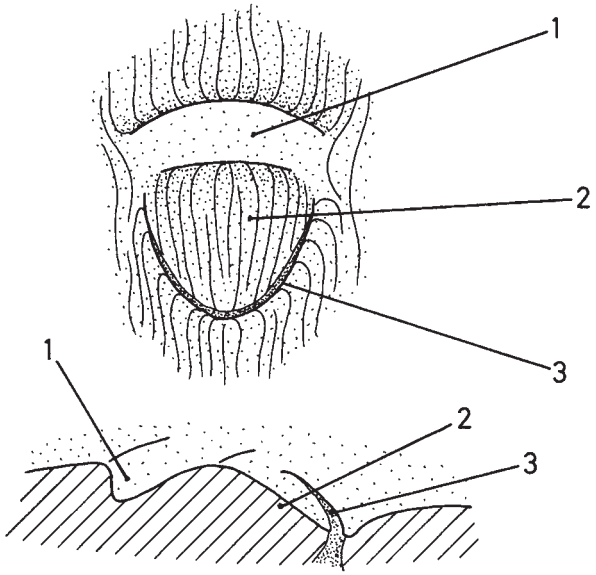
1 Scapular grooves profile is steep (grooves are obscured by lines of large punctations, but they reach posterior margin of scutum).
2 Scutum is dark coloured (but has faint white enamel ornamentation on the scapulae).
3 Scutum posterior margin is distinctly sinuous (with distinctly concave outlines posterior to the eyes).
4 Leg colouration is with white enamel ornamentation (as irregular patterns on their dorsal and lateral surfaces).
5 Punctation size is large (but there are some small ones and some very large ones; these large punctations are shallow, often joined together and with a rough internal surface). Punctation distribution is localized (with the large ones in the cervical fields and central areas).

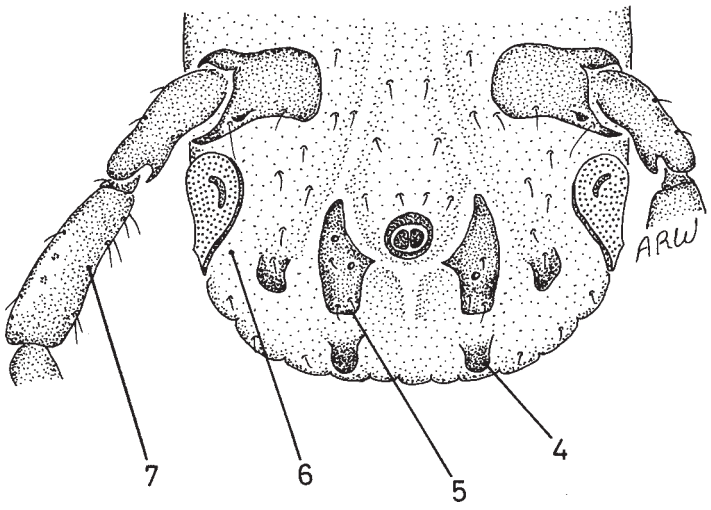
***Hyalomma lusitanicum* male, dorsal.**



1 Cervical fields depression is apparent.
2 Conscutum is dark coloured (but may have faint white enamel ornamentation on the scapulae).
3 Lateral grooves are short.
4 Posterior ridges number two. Caudal depression is present.
5 Central festoon is pale coloured (but may be dark coloured as shown in the inset). Paracentral festoons are separate anteriorly.
6 Posteromedian groove is present. Paramedian grooves are absent.
7 Leg colouration is with white enamel ornamentation (as irregular patterns or marbling on their dorsal and lateral surfaces).
8 Punctation size is large (also there are small and very large punctations). Punctation distribution is localized (largest punctations in marginal areas and caudal depression).

***Hyalomma lusitanicum*, female genital aperture at top left, male ventral plates at bottom right.**





1 Genital aperture anterior groove is shallow.
2 Genital aperture preatrial fold is convex.
3 Genital aperture posterior lips have a broad **V** shape.
4 Subanal plates alignment is with the adanal plates. Subanal plates are distinct.
5 Adanal plates shape has square ends.
6 Spiracle areas have sparse setae.
(7 Legs have ventral surfaces without white enamel.)

Hyalomma marginatum Koch, 1844.

General.
Hyalomma marginatum is also known as The Mediterranean *Hyalomma*. (Formerly it had the sub-species name *Hyalomma marginatum marginatum.*) It is one of the important *Hyalomma* species in North Africa and is notorious as the vector of the virus causing Crimean-Congo haemorrhagic fever in humans.

Differential diagnosis.
Hyalomma marginatum is a species distinct from *Hy. rufipes*. Both sexes of *Hy. marginatum* are easily distinguished from *Hy. rufipes* by their lack of dense setae around the spiracles and their lack of dense punctations. The posterior lips of the female genital aperture form a very broad **U** shape compared to a broad **V** shape in *Hy. rufipes*. This genital aperture is most characteristic. The male of *Hy. marginatum* has a caudal depression, with posterior grooves. The characteristic light coloured areas on the dorsal surface of the middle segments of legs are a useful feature to distinguish *Hy. marginatum* from most *Hyalomma* species, but may be obscure in some specimens. These light coloured areas are unlike white enamel as seen on some other species such as *Hyalomma lusitanicum* in North Africa. *Hyalomma marginatum* is very similar to *Hy. impeltatum.* The male of *Hy. marginatum* can be distinguished from *Hy. impeltatum* by having a distinct and brown coloured central festoon compared to the pale central festoon of *Hy. impeltatum*. Female *Hy. impeltatum* have a narrow **V** shape to the posterior lips of the genital aperture and the preatrial fold is only moderately convex compared to the very convex fold of *Hy. marginatum*. The species *Hy. turanicum* is very similar to *Hy. marginatum*; it has been recorded in Africa mainly from the south of the continent and is very rare in North Africa. Males of *Hyalomma turanicum* have no paramedian grooves compared to the small grooves of *Hy. marginatum*.

Hosts.
Adults of this two-host tick infest cattle and other ungulates (horses, sheep, goats, camels). The immature stages feed on small mammals such as hares and rabbits; the site of attachment on these hosts is the ears. They also feed on hedgehogs and birds; they attach to the heads of these hosts. Like other *Hyalomma* ticks the adults of this species attach only to the hindquarters of animals (perineum, genital areas and udder).

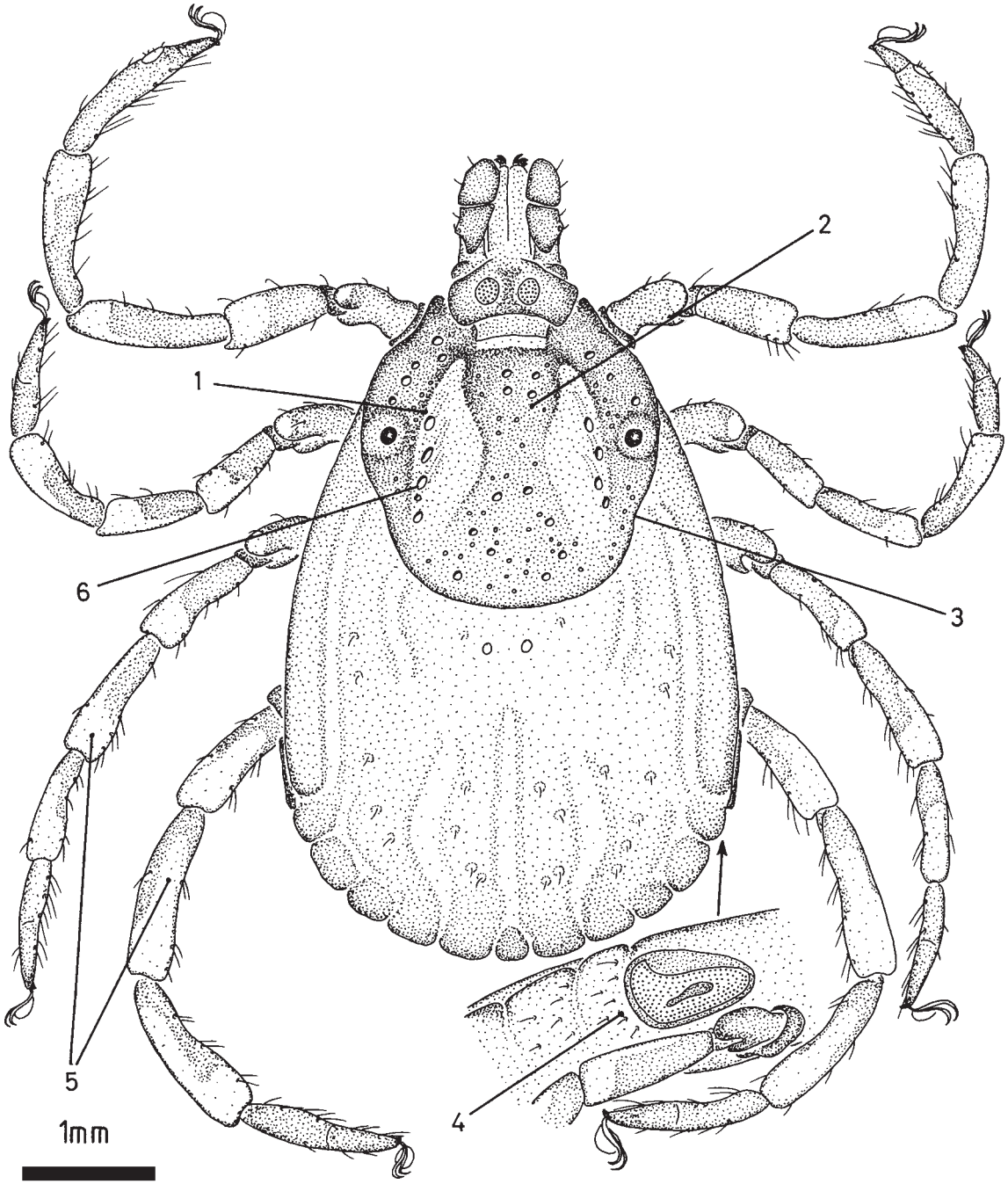
Life cycle and seasonal occurrence.
This tick has a two-host life cycle. Adults are present on animals between March and November with a peak of activity in spring (April to May). Immature stages are active in summer between May to September

Disease.
Hyalomma marginatum transmits the protozoan *Babesia caballi* causing babesiosis in horses and it is known to transmit *Theileria annulata* under laboratory conditions. It is also responsible for the transmission to humans of the virus causing Crimean-Congo haemorrhagic fever and may be the main vector of this virus in Europe.

Habitat and distribution
This tick occurs in areas with the humid Mediterranean climate of northern Africa and southern Europe and of steppe climates further eastwards. It cannot survive under desert conditions. *Hyalomma marginatum* is widely distributed in North Africa and is commonly reported from Morocco, Tunisia, Algeria, and more sparsely in Egypt, Sudan and Ethiopia. It is also present in southern Europe and other countries as far east as India.

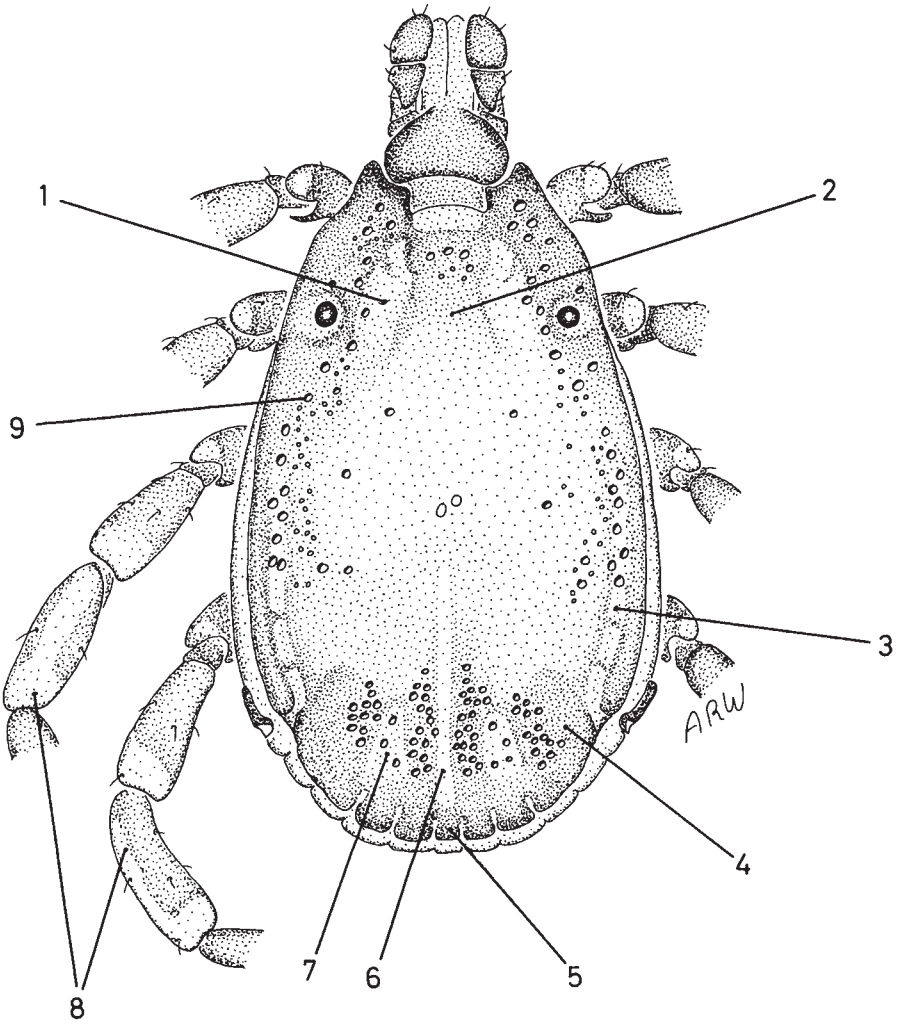
Distribution of *Hyalomma marginatum*.

***Hyalomma marginatum* female, dorsal.**



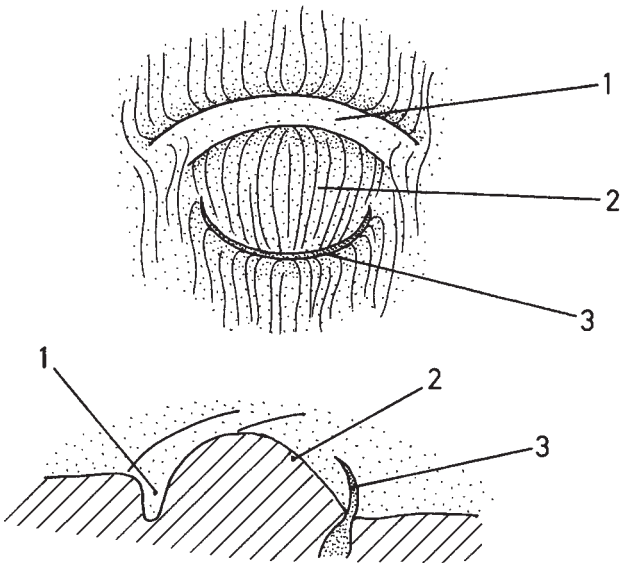
1 Scapular grooves profile is steep (grooves do not reach the posterior margin of the scutum).
2 Scutum is dark coloured.
3 Scutum posterior margin is distinctly sinuous.
4 Spiracle areas have sparse setae.
5 Leg colouration is with pale rings (also there are patches of pale colour along the dorsal surfaces of the central segments of all legs).
6 Punctation size is small. Punctation distribution is sparse.

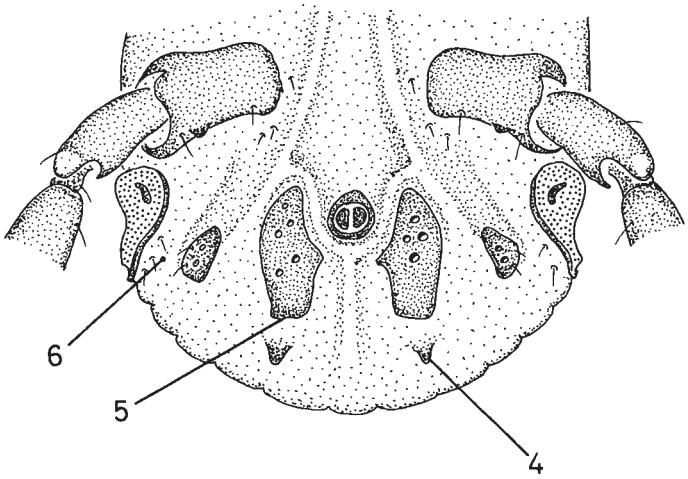
***Hyalomma marginatum* male, dorsal.**



1 Cervical fields depression is apparent.
2 Conscutum is dark coloured.
3 Lateral grooves are long (they continue towards eyes as lines of punctations).
4 Posterior ridges number two. Caudal depression is present (but shallow).
5 Central festoon is dark coloured. Paracentral festoons are separate anteriorly.
6 Posteromedian groove is present.
7 Paramedian grooves are small (all the posterior grooves are shallow and may be indistinct).
8 Leg colouration is with pale rings (also there are patches of pale colour along the dorsal surfaces).
9 Punctation size is small. Punctation distribution is sparse (some populations have denser punctations than shown).

***Hyalomma marginatum*, female genital aperture at top left, male ventral plates at bottom right.**





1 Genital aperture anterior groove is deep.
2 Genital aperture preatrial fold is convex (it forms a distinct bulge).
3 Genital aperture posterior lips have a broad **U** shape.
4 Subanal plate alignment is with adanal plates. Subanal plates are distinct (but small).
5 Adanal plates shape has square ends.
6 Spiracle areas have sparse setae.

Hyalomma rufipes Koch, 1844.

General.
Hyalomma rufipes is also known as The hairy *Hyalomma* or The coarse-legged *Hyalomma*. (Formerly it was know by the subspecies name *Hyalomma marginatum rufipes.*) It is the most widespread *Hyalomma* in Africa and is notorious as a vector of the virus causing Crimean-Congo haemorrhagic fever in humans.

Differential diagnosis.
This is a large, robust, shiny black tick. Both sexes of *Hy. rufipes* are differentiated easily from *Hy. marginatum* and *Hy. turanicum* by the dense even covering of punctations on the scutum and conscutum, and by dense setae on the area of integument surrounding the spiracles. The conscutum of the male is very characteristic, evenly rounded and lacking the grooves and depressions seen on other species. The genital aperture of *Hy. rufipes* has posterior lips forming a broad **V** shape and the preatrial fold bulges strongly from a deep anterior groove and posterior indentation.

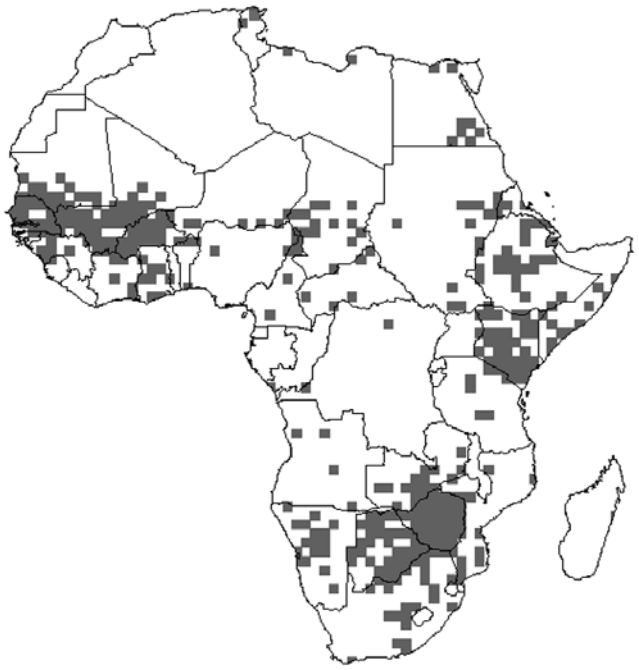
Hosts.
The main hosts of adult *Hy. rufipes* are cattle; also sheep, goats, horses and wild ungulates are infested. The adults attach in the hairless peri-anal region and on the lower perineum and genitalia. The immature stages feed on hares as well as on ground-frequenting birds.

Life cycle and seasonal occurrence.
Hyalomma rufipes has a two-host life cycle that takes a year to complete. The adults are most numerous during the early part of the wet season and the immature stages during the dry season.

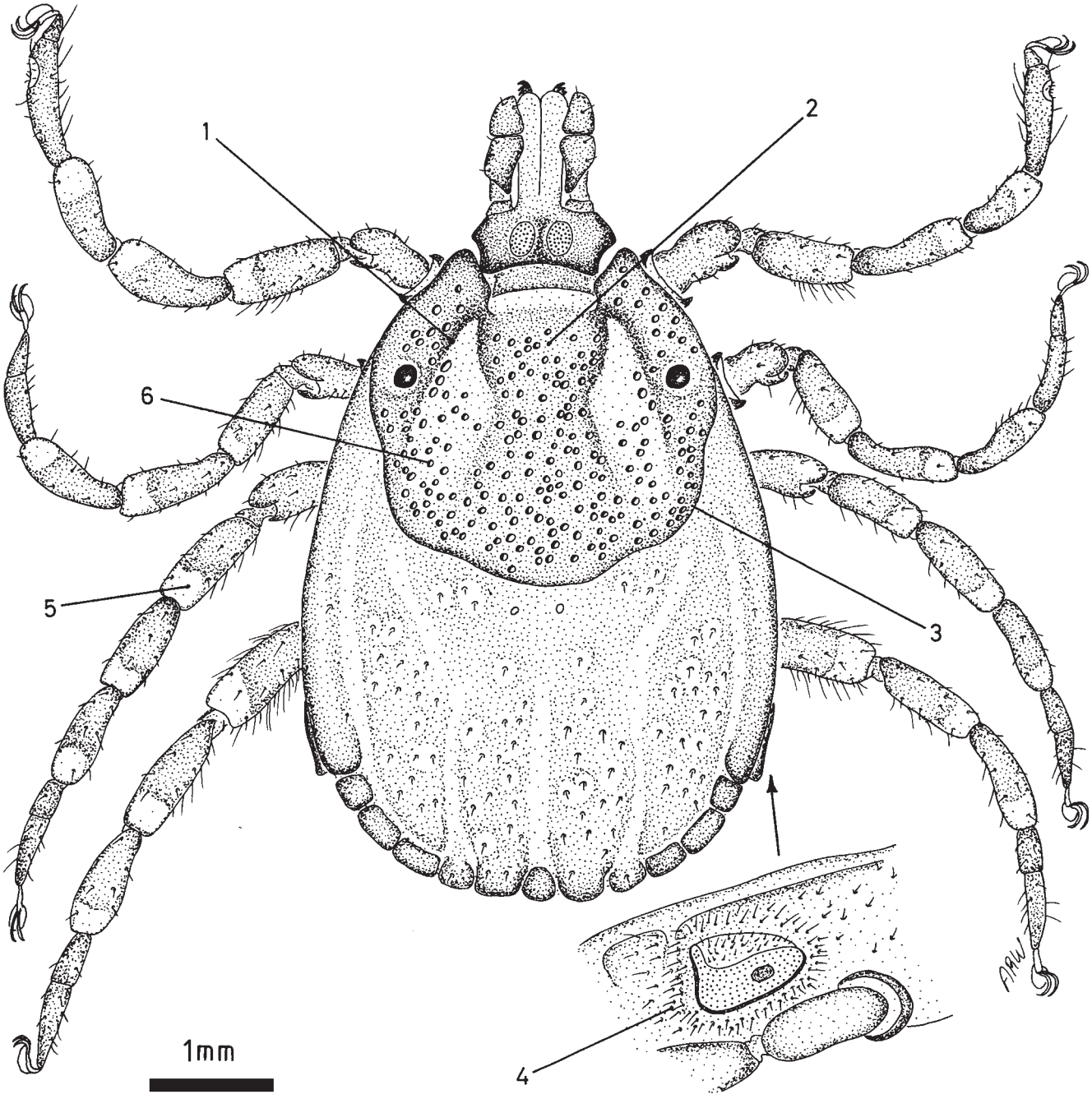
Disease.
This tick species is the most important vector in southern Africa of the virus causing Crimean-Congo haemorrhagic fever in humans. It also transmits the bacterium *Anaplasma marginale* to cattle causing bovine anaplasmosis (= gallsickness), the bacterium *Rickettsia conorii* causing tick typhus in humans and the protozoan *Babesia occultans* to cattle. The feeding of adults on cattle causes large lesions at the attachment sites, leading to the formation of severe abscesses.

Habitat and distribution.
Hyalomma rufipes is widely distributed in much of Africa and has been recorded from every climatic region from desert to rain forest. However the distribution is patchy and it is probably commoner in the drier areas. The infestation of birds by the immature stages of this tick contributes to its extensive distribution. It also occurs in southern Europe and extends eastwards to central Asia.

Distribution of *Hyalomma rufipes*.

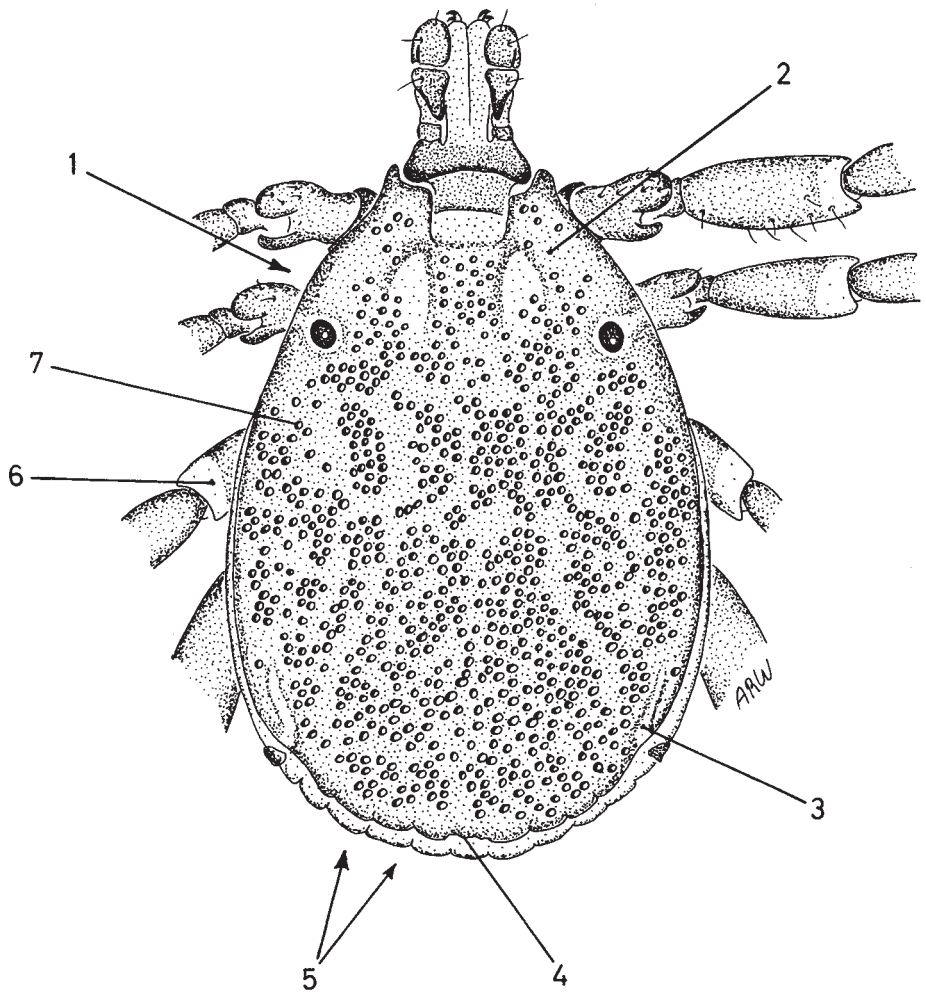


***Hyalomma rufipes* female, dorsal.**



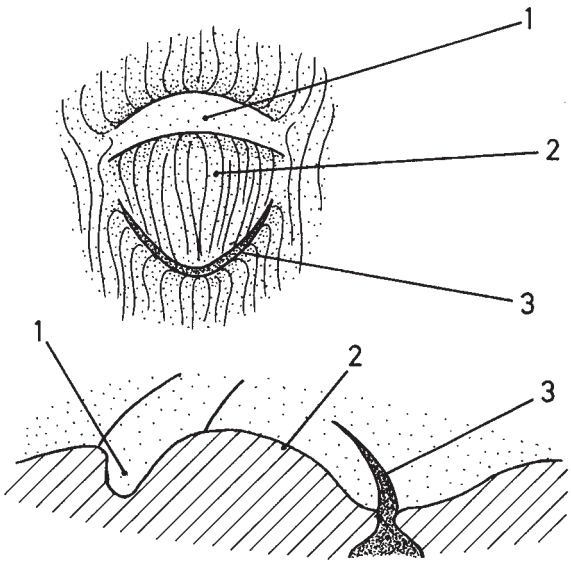
1 Scapular grooves profile is steep.
2 Scutum is dark coloured.
3 Scutum posterior margin is distinctly sinuous.
4 Spiracle areas have dense setae.
5 Leg colouration is with pale rings.
6 Punctation size is small. Punctation distribution is dense.

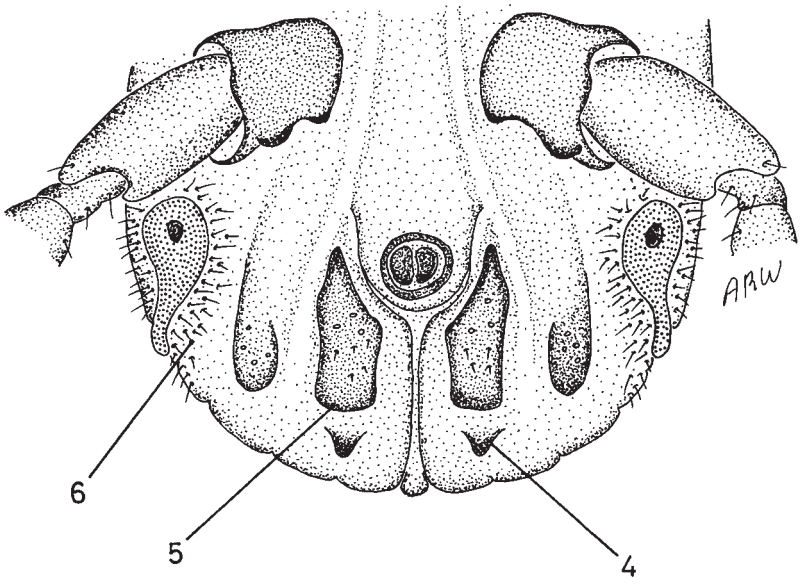
***Hyalomma rufipes* male, dorsal.**



1 Cervical fields depression is not apparent.
2 Conscutum is dark coloured.
3 Lateral grooves are short.
4 Posterior ridges are absent. Caudal depression is absent.
5 Central festoon is dark coloured (form of festoons is indistinct). Paracentral festoons are separate anteriorly.
5 Posteromedian groove is absent. Paramedian grooves are absent.
6 Leg colouration is with pale rings.
7 Punctation size is small. Punctation distribution is dense.

***Hyalomma rufipes*, female genital aperture at top left, male ventral plates at bottom right.**





1 Genital aperture anterior groove is deep.
2 Genital aperture preatrial fold is convex.
3 Genital aperture posterior lips have a broad **V** shape.
4 Subanal plate alignment is with the adanal plates. Subanal plates are distinct.
5 Adanal plates shape has square ends.
6 Spiracle areas have dense setae.

Hyalomma truncatum Koch, 1844 (with notes on *Hyalomma albiparmatum* Schulze, 1919).

General.
Hyalomma truncatum is also known as The shiny *Hyalomma* because of the smooth surface of the male. It is found predominantly in Africa south of the Sahara where it is the commonest *Hyalomma*. This species of tick is notorious for causing a variety of types of direct damage to its hosts. It is a distinctive species which is easily identified, but in a few parts of Africa it needs to be differentiated from *Hyalomma albiparmatum*.

Differential diagnosis.
Hyalomma truncatum is a distinctive *Hyalomma* tick when seen in collections which contain males. These have the unusual combination of a conscutum which is mainly smooth, shiny and dark but has a single large concave or depressed area in the posterior (caudal) area. This caudal depression has dense punctations giving a contrasting rough appearance. Males of *Hyalomma albiparmatum* are very similar except they have a central festoon in the form of a large white parma. In *Hy. truncatum* the central festoon is not well defined enough to form a parma. Females of *Hy. truncatum* have a genital aperture with posterior lips forming a broad **U** shape and the profile of the preatrial fold is concave. This concave preatrial fold is shared with *Hyalomma impressum* but the female of this latter species does not have the distinctive cervical fields and sinuous posterior margin to the scutum of *Hy. truncatum*.

Hosts.
The preferred hosts of adult *Hyalomma truncatum* are large domestic herbivores (cattle, sheep, goats, camels and horses) and also wild herbivores. Giraffes can be particularly heavily infested. Domestic dogs are often infested. The adult ticks attach to herbivores in the tail switch, around the anus, on the lower perineum, and on the legs, including around the feet. The immature stages feed on hares and on rodents, particularly gerbils. Immature ticks will attach to humans. *Hyalomma albiparmatum* adults feed on cattle, sheep and goats and the immature stages feed on small mammals.

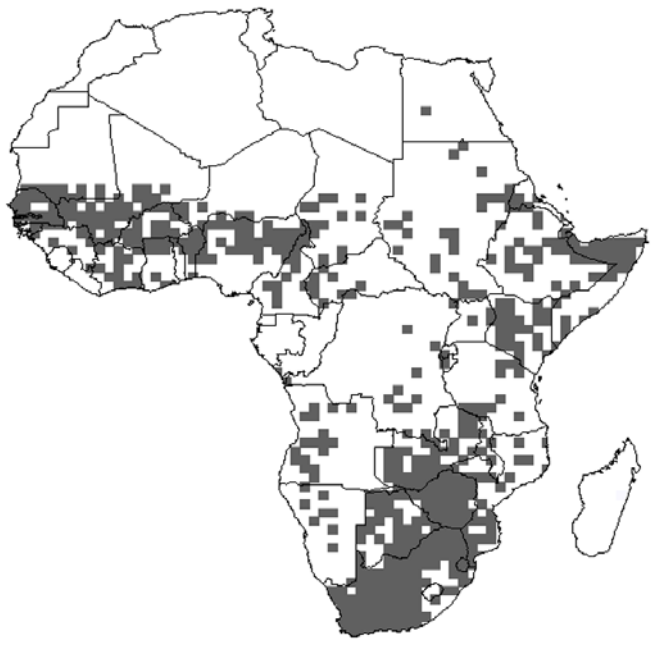
Life cycle and seasonal occurrence.
Hyalomma truncatum has a two-host life cycle, which normally takes a year to complete. Adults are present in the largest numbers in the late wet summer months and the immature stages in the dry autumn to spring months.

Disease.
Certain strains of *Hy. truncatum* have a toxin in their saliva that causes the skin disease known as sweating sickness in cattle, particularly calves. The long mouthparts cause tissue damage in cattle and sheep and secondary bacterial infections may lead to infected abscesses. The injuries caused by the long mouthparts are attractive to the blow fly *Chrysomya bezziana* and this leads to infestation of the flesh with maggots (= myiasis). The attachment of adult ticks to the interdigital clefts (on the feet) and fetlocks of lambs almost always results in lameness. When these ticks infest dogs they tend to cluster at one site and can cause severe skin necrosis. *Hyalomma truncatum* transmits the protozoan *Babesia caballi* to horses causing equine piroplasmosis, and the bacterium *Rickettsia conorii* to humans causing tick typhus.

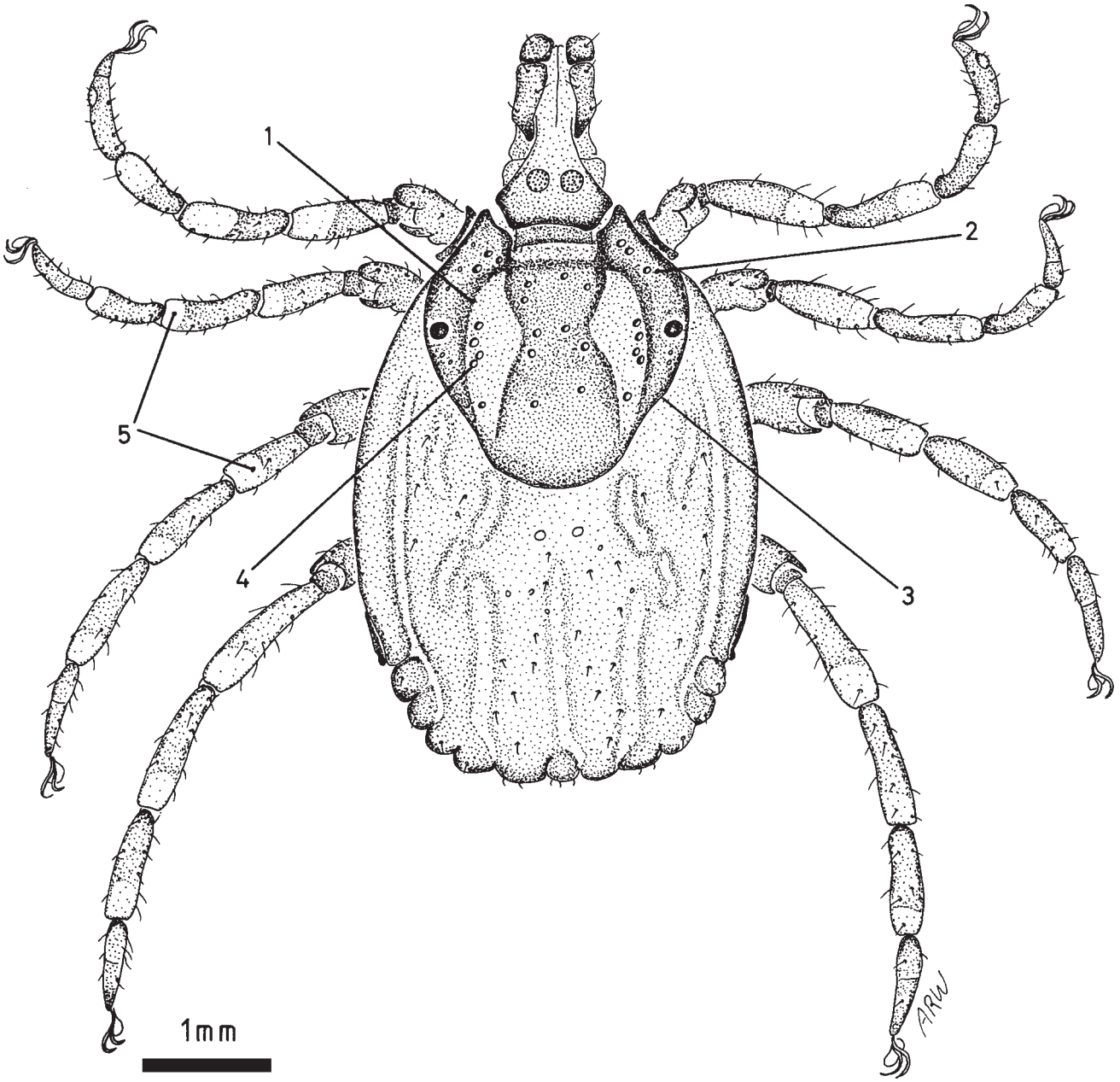
Habitat and distribution.
This species of tick is adapted to dry habitats and is commonest in desert, steppe and savanna climatic regions, but is also recorded from temperate (highland) climates. This tick is endemic to the Afrotropical zoogeographical region and thus is generally restricted to areas south of the Sahara although it has been recorded from northern Sudan and from Egypt. In sub-Saharan Africa *Hy. truncatum* is very widespread and often common but at a local level its abundance may be influenced by the abundance of hares that are the preferred hosts of the immature stages. *Hyalomma albiparmatum* occurs in southern Kenya and northern Tanzania.

Some of the records of *Hyalomma truncatum* shown on the map in the wetter areas in West and Central Africa are likely to be the result of confusion with *Hyalomma nitidum*. This latter species differs from *Hy. truncatum* in having no pale rings on the legs. Also the genital aperture is completely different from that of *Hy. truncatum*: *Hy. nitidum* has a distinctly convex preatrial fold of the genital aperture. *Hyalomma nitidum* has been found in Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Equatorial Guinea, Guinea, Ivory Coast, Mali, Nigeria and Senegal. It infests cattle, goats and horses.

Distribution of *Hyalomma truncatum*.

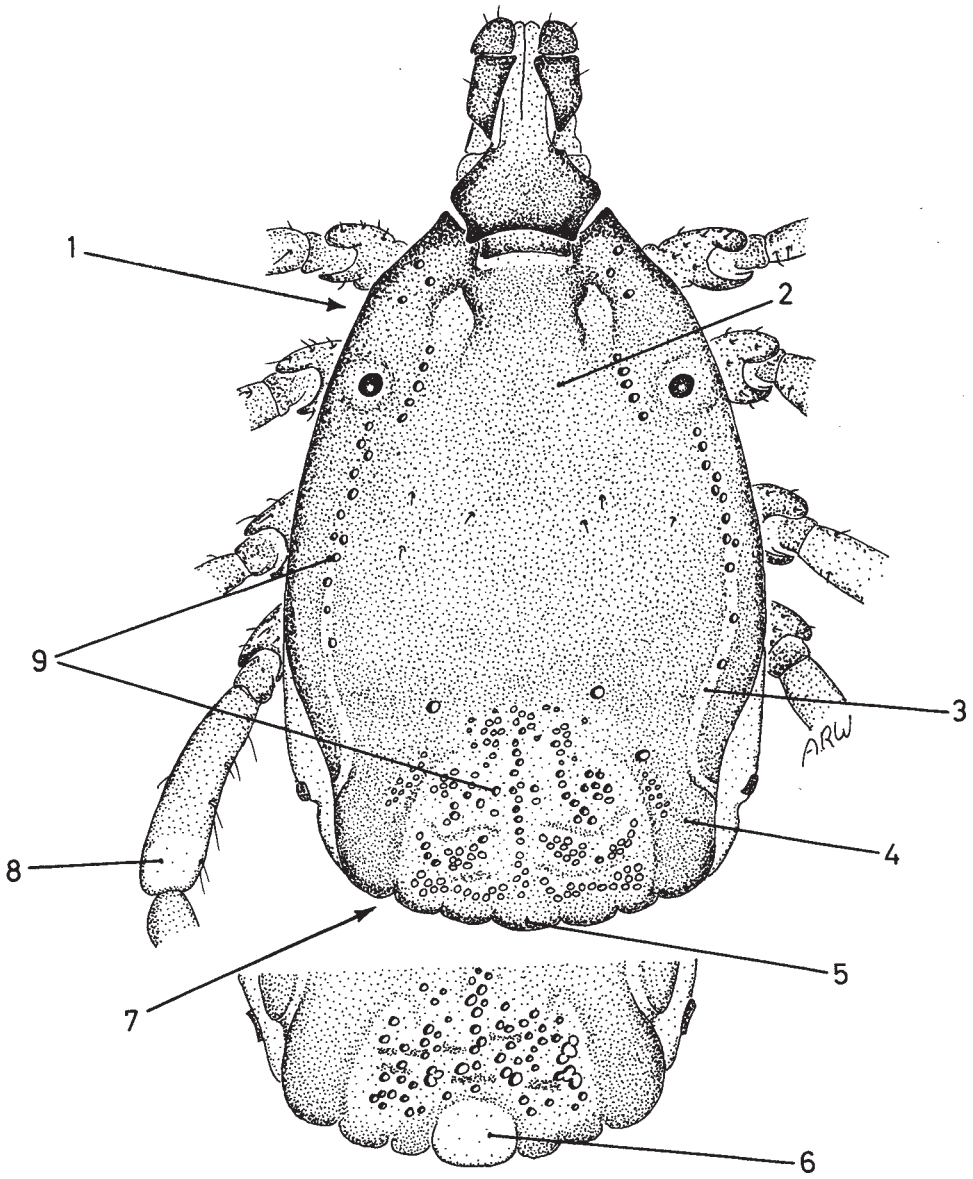


***Hyalomma truncatum* female, dorsal.**



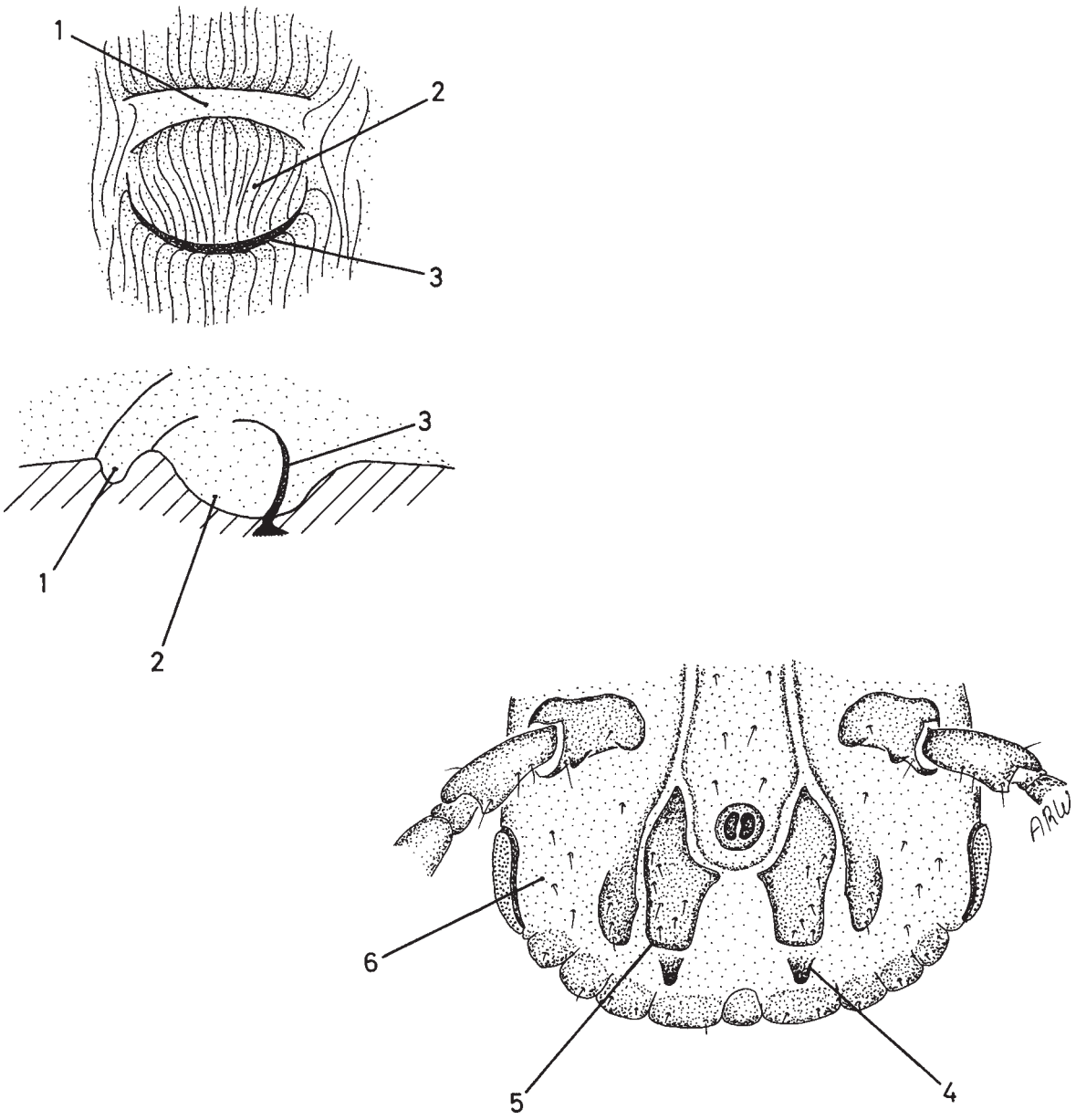
1 Scapular grooves profile is steep (grooves reach the posterior margin of scutum).
2 Scutum is dark coloured.
3 Scutum posterior margin is distinctly sinuous.
4 Leg colouration is with pale rings.
5 Punctation size is small. Punctation distribution is localized (on cervical fields and scapulae).

***Hyalomma truncatum* male, dorsal (inset at bottom shows male *Hyalomma albiparmatum*).**



1 Cervical fields depression is not apparent.
2 Conscutum is dark coloured (appears smooth and shiny).
3 Lateral grooves are long (distinct grooves in posterior part, extending as lines of punctations towards eyes).
4 Posterior ridges number two. Caudal depression is present (conspicuously deep and with large punctations).
5 Central festoon is dark coloured. Paracentral festoons are separate anteriorly.
(6 Central festoon of *Hyalomma albiparmatum* is pale white and forms a distinct parma.)
7 Posteromedian groove is absent. Paramedian grooves are absent.
8 Leg colouration is with pale rings.
9 Punctation size is small. Punctation distribution is localized (restricted to marginal areas and caudal depression, central area is smooth and shiny).

***Hyalomma truncatum*, female genital pore at top left, male ventral plates at bottom right.**



1 Genital aperture anterior groove is shallow.
2 Genital aperture preatrial fold is concave.
3 Genital aperture posterior lips have a broad **U** shape (distinctly wider than long).
4 Subanal plate alignment is with the adanal plates. Subanal plates are distinct (but small).
5 Adanal plates shape has square ends.
6 Spiracle areas have sparse setae.

Hyalomma turanicum Pomerantsev, 1946.

General.
Hyalomma turanicum is also known as The pale-legged *Hyalomma* or the The enamel legged *Hyalomma*. (Formerly sometimes called by the sub-species name *Hyalomma marginatum turanicum.*) *Hyalomma turanicum* originates from the Middle East. It was introduced accidentally into southern Africa on imported sheep and has become an important pest there. It has also been recorded from Libya and Ethiopia. In these areas it needs to be differentiated from *Hyalomma rufipes*.

Differential diagnosis.
Hyalomma turanicum is closely similar to *Hy. marginatum* but in Africa the latter species is confined to northern and north eastern African countries whilst *Hy. turanicum* occurs mainly in southern Africa with isolated populations recorded from Libya and Ethiopia. *Hyalomma turanicum* is more heavily punctate and the punctations are localized compared to the more sparse punctations of *Hy. marginatum*. Females of *Hy. turanicum* have large areas of pale colouration on the central segments of all legs and this is more prominent than the usual pale rings of most *Hyalomma* species. In southern Africa this species occurs together with *Hy. rufipes* to which it is similar. The easiest character to differentiate *Hy*. *turanicum* and *Hy. rufipes* of both sexes is the distribution of setae around the spiracle. In *Hy. turanicum* the integument in this area has sparse setae compared to conspicuously dense setae in *Hy. rufipes*. The punctations on the conscutum of male *Hy. turanicum* are less dense and more localized than those of *Hy. rufipes*. The female genital aperture of *Hy. turanicum* has posterior lips forming a broad **U** shape compared to a broad **V** shape in *Hy. rufipes*.

Hosts.
Adults feed on cattle, sheep, goats, horses and large wild herbivores particularly elands. Immature stages feed on scrub hares and ground frequenting birds.

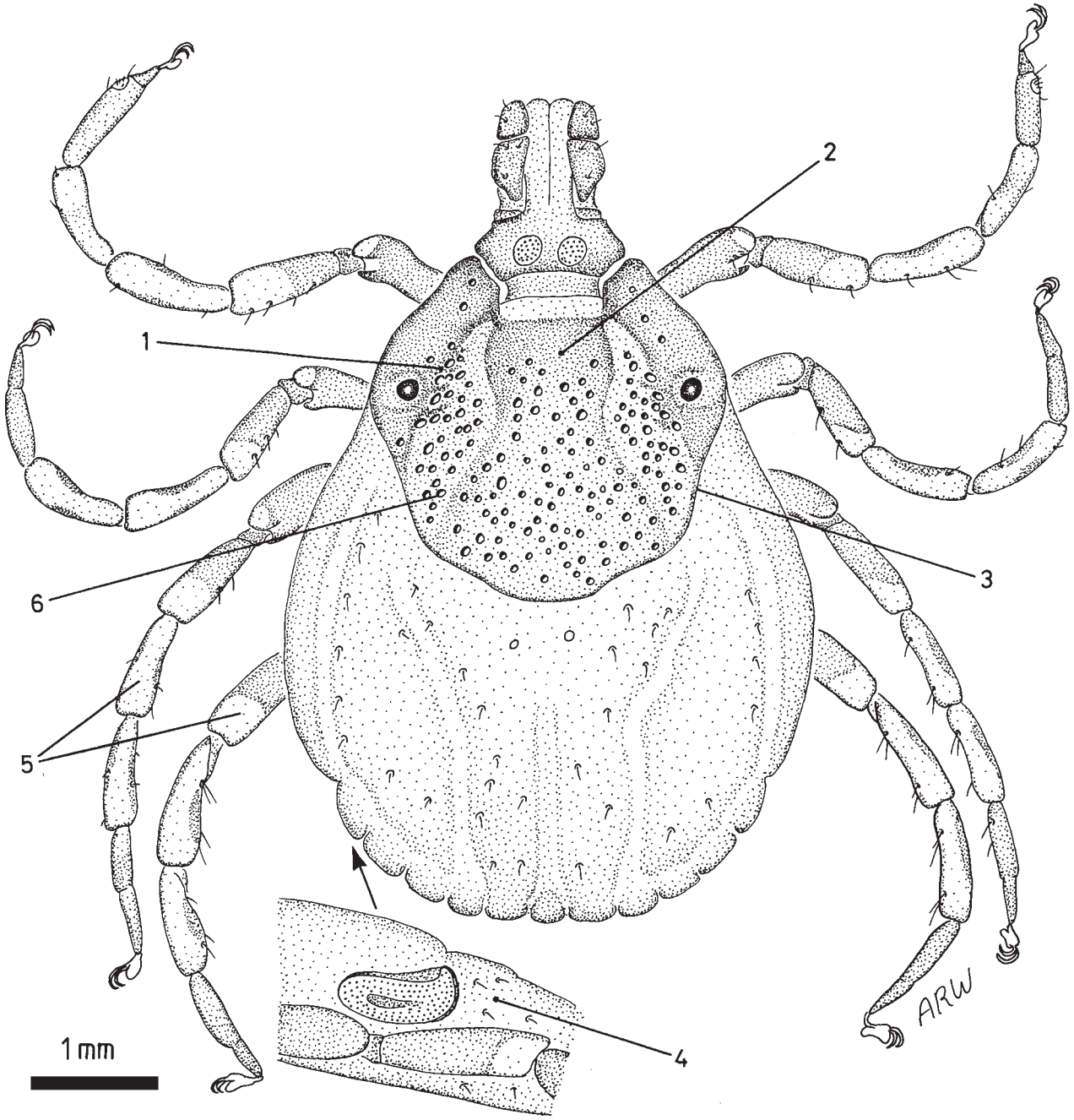
Life cycle and seasonal occurrence.
This tick has a two-host life cycle. The larvae infest hares and birds on which they engorge and moult to nymphs. The engorged nymphs detach, drop to the ground and moult to adults. The life cycle takes one year to complete. The adults find their hosts by active hunting. They are active mainly during the summer months from October to March in southern Africa. The immature stages are active from autumn to spring.

Disease.
Hyalomma turanicum is not known to be a main vector of pathogens causing disease to domestic animals but is considered a vector of the virus causing Crimean-Congo haemorrhagic fever in humans. Its feeding on domestic animals causes serious direct damage to the skin at the attachment site.

Habitat and distribution.
Hyalomma turanicum is a tick of areas with steppe and desert climates. In Africa it occurs mainly in the central and western arid regions of southern Africa. The Karoo and south-western Free State of South Africa is the main focus of the distribution of this tick in Africa. It also occurs in Botswana and Namibia. This tick has a widely dispersed range with its origin in the Middle East, having been recorded from countries such as Iran, Kazakstan and Afghanistan. Thus it can be expected in some African sites north of the Sahara; there are records of its occurrence in Libya and Ethiopia.

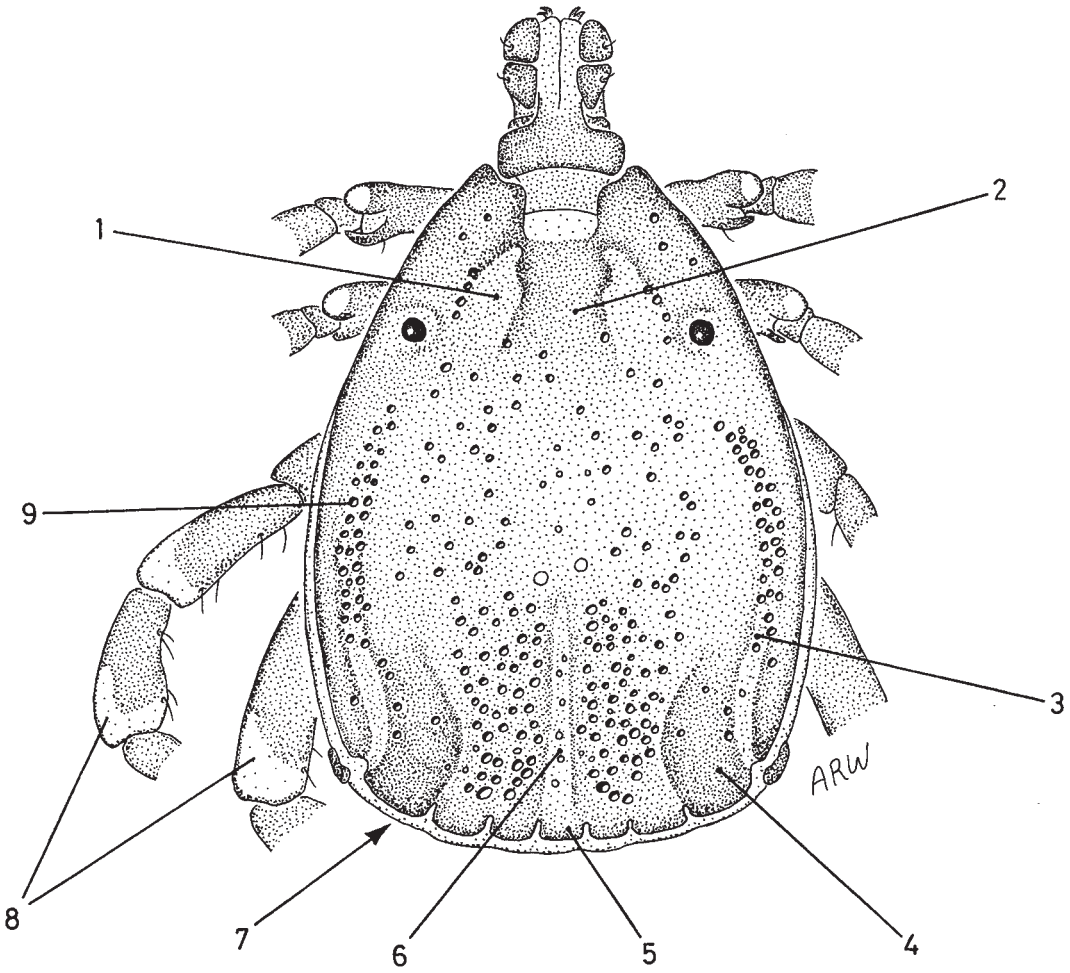
Distribution of *Hyalomma turanicum*.

***Hyalomma turanicum* female, dorsal.**



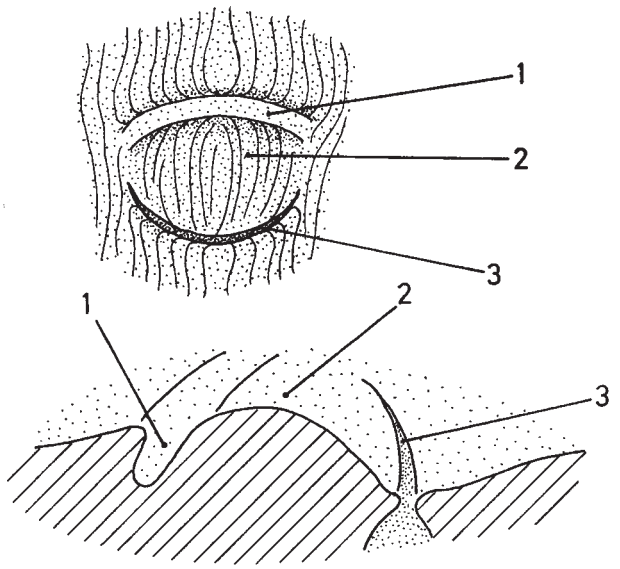
1 Scapular grooves profile is steep.
2 Scutum is dark coloured.
3 Scutum posterior margin is distinctly sinuous.
4 Spiracle areas have sparse setae.
5 Leg colouration is with pale rings (also there are large patches of pale colour along the dorsal surfaces of the central segments of all legs).
6 Punctation size is small. Punctation distribution is localized (mainly in the scapular grooves and central field).

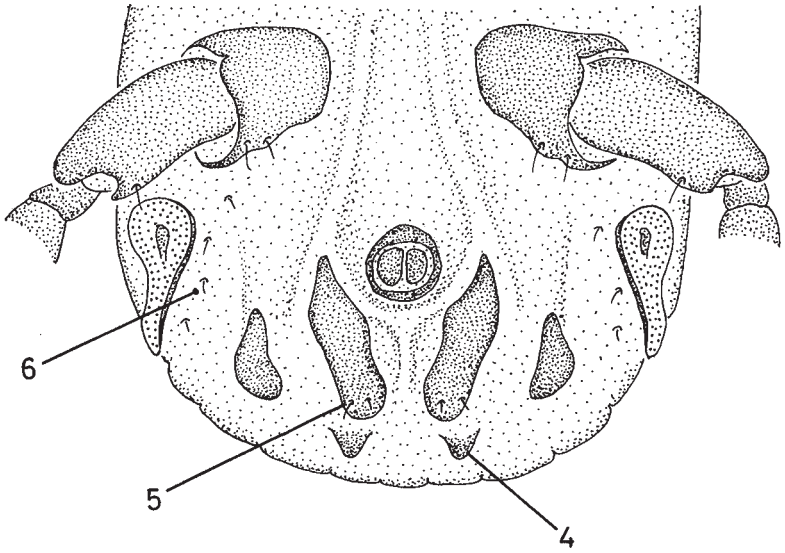
***Hyalomma turanicum* male, dorsal.**



1 Cervical fields depression is apparent.
2 Conscutum is dark coloured.
3 Lateral grooves are long (they continue towards eyes as lines of punctations).
4 Posterior ridges number two. Caudal depression is present (but shallow).
5 Central festoon is dark coloured. Paracentral festoons are separate anteriorly.
6 Posteromedian groove is present (but narrow and shallow, and may be obscured in more densely punctate specimens).
7 Paramedian grooves are absent.
8 Leg colouration is with pale rings (the pale colouration extends onto the dorsal surface of the legs).
9 Punctation size is small. Punctation distribution is localized (to the caudal depression and anterior part of the lateral grooves).

***Hyalomma turanicum*, female genital aperture at top left, male ventral plates at bottom right.**





1 Genital aperture anterior groove is deep.
2 Genital aperture preatrial fold is convex (it forms a distinct bulge).
3 Genital aperture posterior lips have a broad **U** shape.
4 Subanal plate alignment is with adanal plates. Subanal plates are distinct.
5 Adanal plates shape has round ends (some specimens may be more square).
6 Spiracle areas have sparse setae.

Ixodes pilosus Koch, 1844.

General.
Ixodes pilosus is also known as The sourveld tick. The specific name refers to the pilose (= hairy) appearance of the tick which has conspicuous white setae. *Ixodes pilosus* occurs in some of the same areas as the more important *Ixodes rubicundus* and these two species need to be differentiated. *Ixodes pilosus* is a member of the *pilosus* group of ticks and its status in this group is uncertain. Thus its name may change in the future. The following biological data is thought to be valid for the group.

Differential diagnosis.
Details are given of female ticks only. Male *Ix. pilosus* are not illustrated because it is females that are usually found in collections from hosts. (A male *Ixodes ricinus* is illustrated later to demonstrate the general features of male *Ixodes* ticks.) *Ixodes pilosus* is very similar to *Ix. rubicundus*. In both species the females have large white setae on the dorsal alloscutum which tends to give the ticks a shining white appearance but this effect is more distinct in *Ix. pilosus.* On *Ix. pilosus* these setae are arranged in four columns, in *Ix. rubicundus* they are scattered over the dorsal alloscutum. *Ixodes pilosus* females have a scutum with a slightly sinuous posterior margin compared to the distinctly sinuous margin in *Ix. rubicundus,* which often in this latter species show a distinct constriction in the posterior part of the scutum. The auriculae on the ventral surface of the basis capituli are more distinct in *Ix. pilosus* than in *Ix. rubicundus*. The anal groove in *Ix. pilosus* forms a short and converging pair of grooves in the area posterior to the anus compared to a long and parallel pair in *Ix. rubicundus*.

Hosts.
Cattle, sheep, goats, dogs and wild ungulates are infested with this tick. On both cattle and sheep it prefers to feed on the ears, eyes and neck.

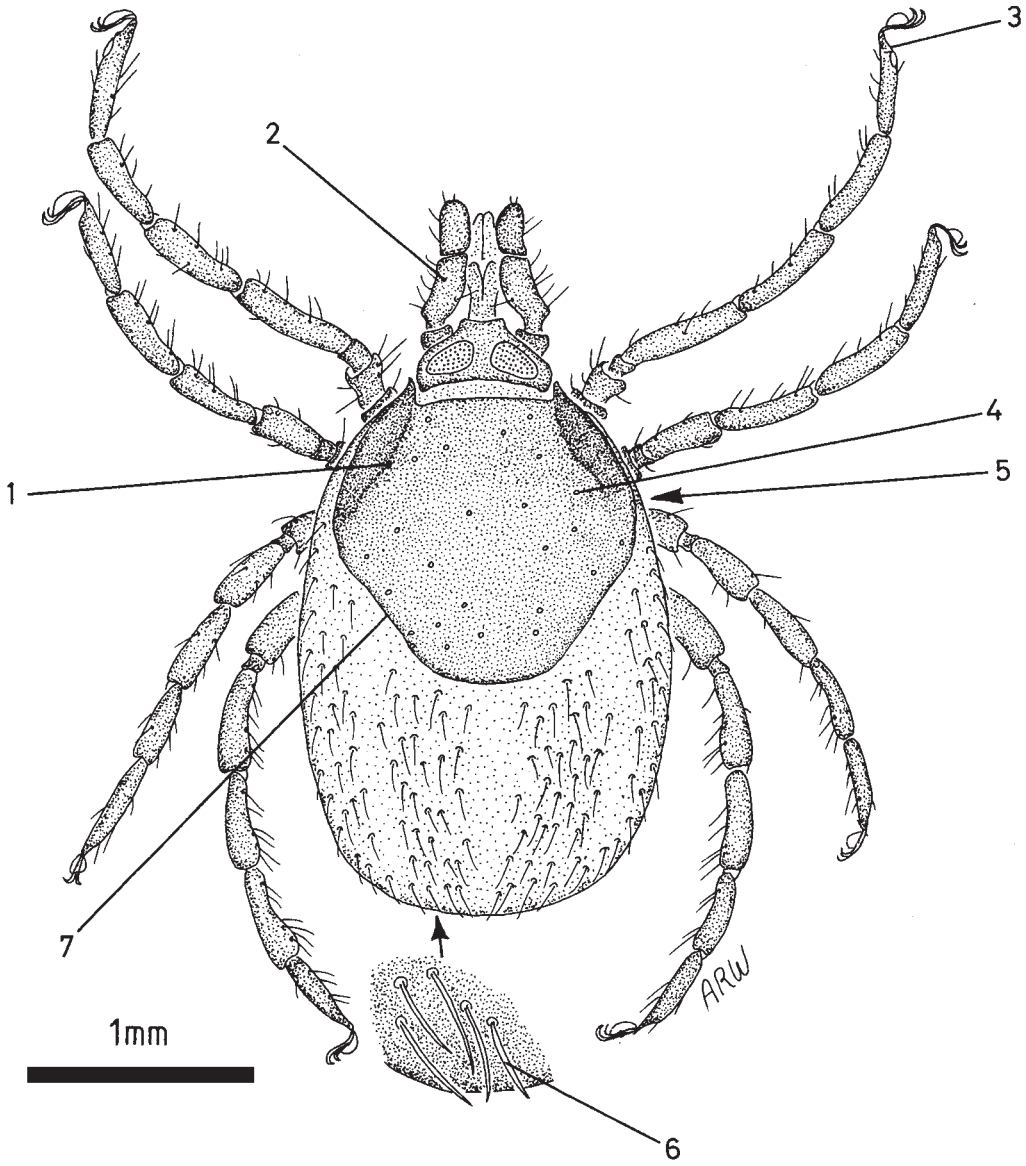
Life cycle and seasonal occurrence.
This is a three-host tick. In warmer parts of its range it can be active all year but in the coastal regions adult feeding activity is mainly in the spring and early summer.

Disease.
Ixodes pilosus is not known to transmit any pathogens. Adults may be found on dogs in large numbers which are likely to cause biting stress.

Habitat and distribution.
The *pilosus* group of ticks occurs in the region with Mediterranean and savanna climates along the southern and eastern coasts of South Africa (typically sourveld areas). It also extends to scattered inland regions in the north east of South Africa and Swaziland.

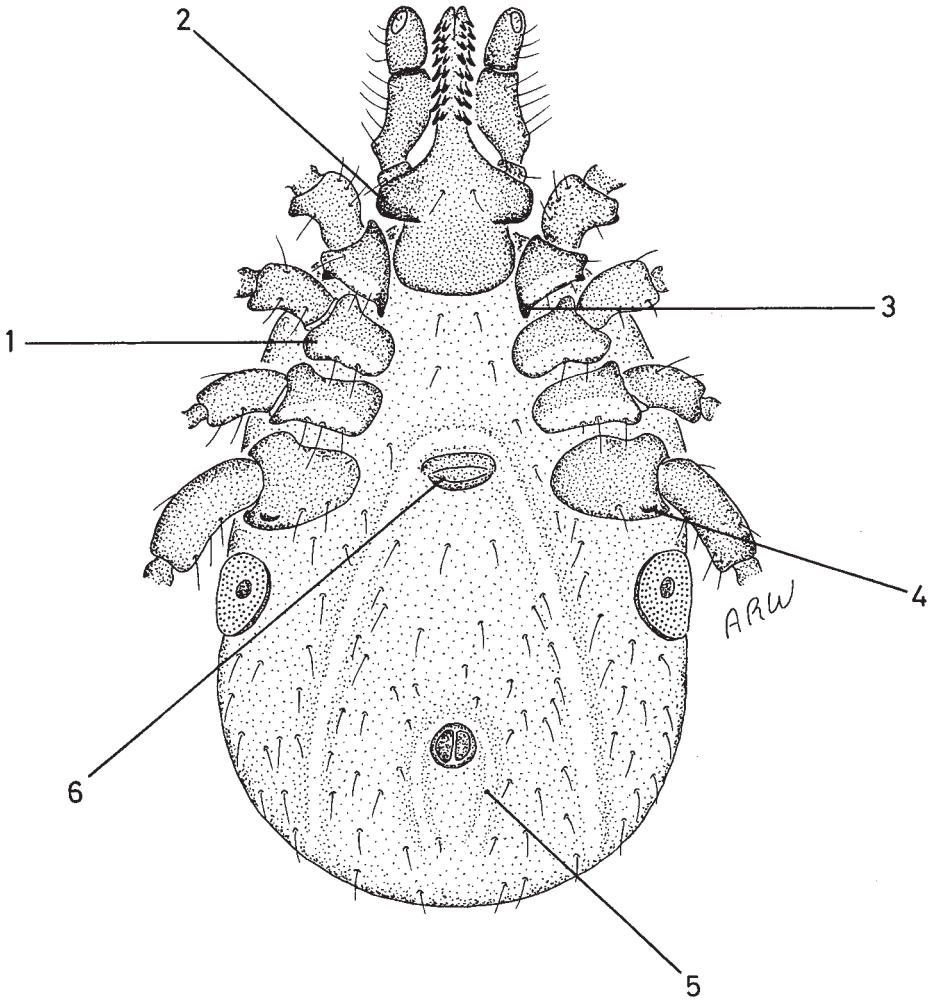
Distribution of *Ixodes pilosus*.

***Ixodes pilosus* female, dorsal.**



1 Scapular grooves are present.
2 Palps alignment curves outward.
3 Tarsi are tapered toward the claws.
4 Punctations are indistinct.
5 Setae on the scutum are absent.
6 Setae on the alloscutum are thick and white coloured (also they are arranged in four columns).
7 Scutum posterior margin is slightly sinuous.

***Ixodes pilosus* female, ventral.**



1 Coxae type is syncoxae (with different textures in anterior and posterior parts).
2 Auriculae are distinct.
3 Coxae 1 internal spurs are short (but distinct).
4 Coxae 2 to 4 external spurs are absent or indistinct.
5 Anal groove posterior alignment is short and converging.
6 Genital aperture position is between the coxae 4.

Ixodes ricinus (Linnaeus, 1758).

General.
Ixodes ricinus is also known as The sheep tick, and in Europe as The wood tick or The deer tick. Small populations occur in North Africa, feeding on sheep and cattle. *Ixodes ricinus* is a tick mainly of the Paleaerctic region and typically is found in cool humid environments of Europe such as woodlands, with deer as its main host. This tick was one of the earliest to be formally described and has been intensively studied in Europe because of its role there in the transmission of a wide range of pathogens to domestic animals and humans.

Differential diagnosis.
In North Africa this tick is easily distinguished as the only *Ixodes* species likely to be found on livestock. Thus it is important to recognise the features of this genus. A male *Ix. ricinus* is illustrated to demonstrate the general features of male *Ixodes*. Males of this genus are not usually found in collections from hosts. If they are found there it is normally because they are already mating with females after coupling when both sexes of tick were on the vegetation (see Plate 2). Male *Ixodes* are smaller than the females and the mouthparts are not obviously long. Females of *Ixodes* have long mouthparts and need to be distinguished from the other genera with long mouthparts - *Amblyomma* and *Hyalomma*. In contrast to these two genera *Ixodes* have dark brown to black body and legs, without enamel. *Ixodes* ticks also have no eyes. The genus *Ixodes* form a large group of ixodid ticks (the Prostriata) which is separate from all other ixodid ticks (the Metastriata). An obvious unique feature of this genus is the anal groove which passes to the anterior of the anus compared to passing posterior to the anus in all the metastriate ticks. This characteristic is most obvious in female *Ixodes*, in males the anal groove passes between large flat ventral plates.

Hosts.
In Tunisia and Algeria adults of *Ix. ricinus* occur in large numbers only on cattle. However, in Morocco, they parasite mainly sheep. The preferred attachment sites of female *Ix. ricinus* on cattle are the perineum, the groin and the axilla. In North Africa the immature stages feed mainly on lizards, for example *Psammodromus algirus*. They attach often around the eyes and on the axilla of these hosts. *Ixodes ricinus* has a telotropic type of behaviour.

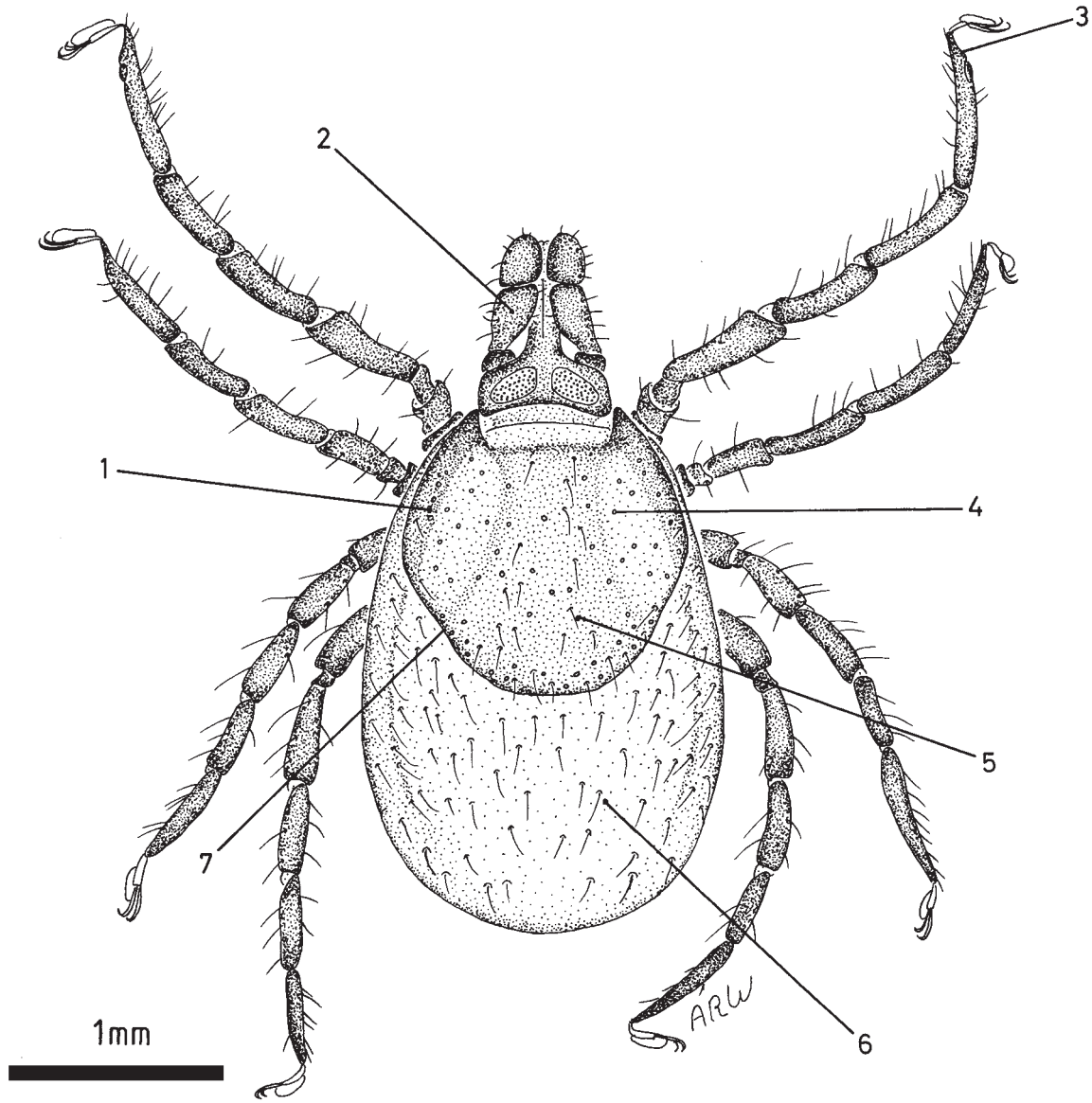
Life cycle and seasonal occurrence.
Ixodes ricinus is a three-host tick. All stages climb vegetation for transfer to the host. The activity of the adults starts in the autumn (October) and finishes by the middle of March. The larvae and nymphs are active at the same time on lizards and vegetation between April and July (spring and summer).

Disease.
In North Africa *Ix. ricinus* is a vector mainly of the bacteria *Borrelia lusitaniae* and *Borrelia garinii*. In addition, in Tunisia it is also a vector of *Babesia divergens* causing bovine babesiosis.

Habitats and distribution.
Ixodes ricinus in Africa is restricted mainly to the cooler and more humid areas (rainfall of more than 800mm per year) of the Mediterranean climatic region that are associated with the Atlas mountains. It occurs in Tunisia, Algeria and Morocco. The population density of *Ix. ricinus* decreases greatly from Tunisia to Morocco. However, in Tunisia, small populations have also been collected in a few sites in the sub-humid zone. The habitat of this species is the oak formation (*Quercus faginea* and *Qu. suber*) with an under tree cover consisting of cirsium (= ferns) predominantly of the species *Pteridium aquilinum*.

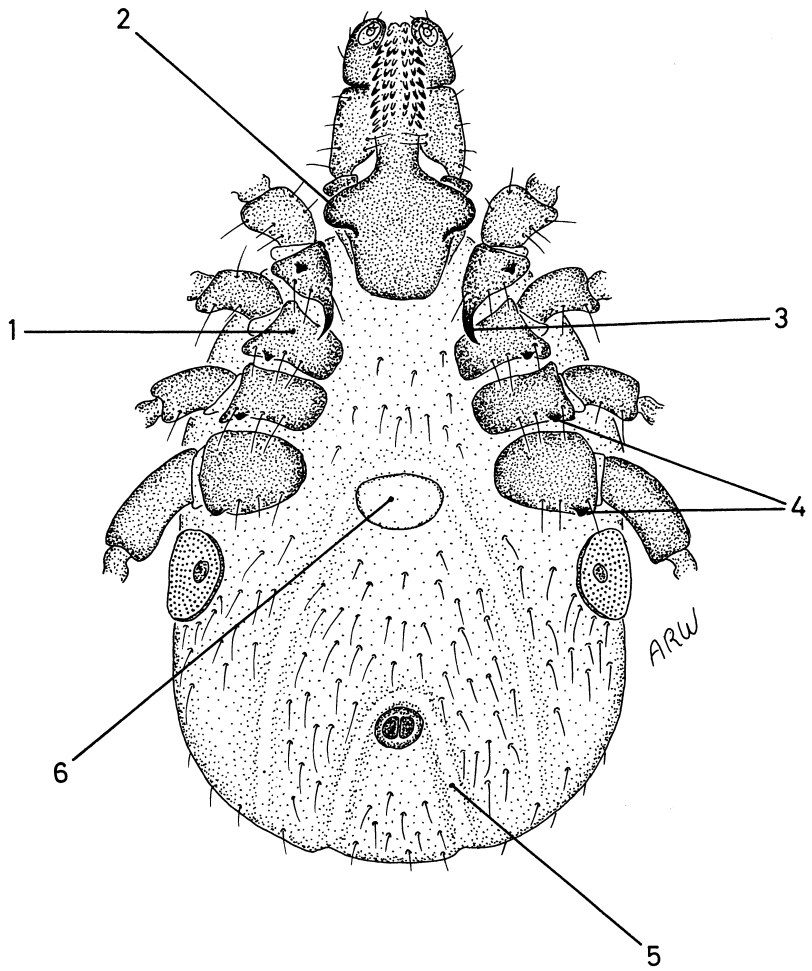
Distribution of *Ixodes ricinus*.

***Ixodes ricinus* female, dorsal.**



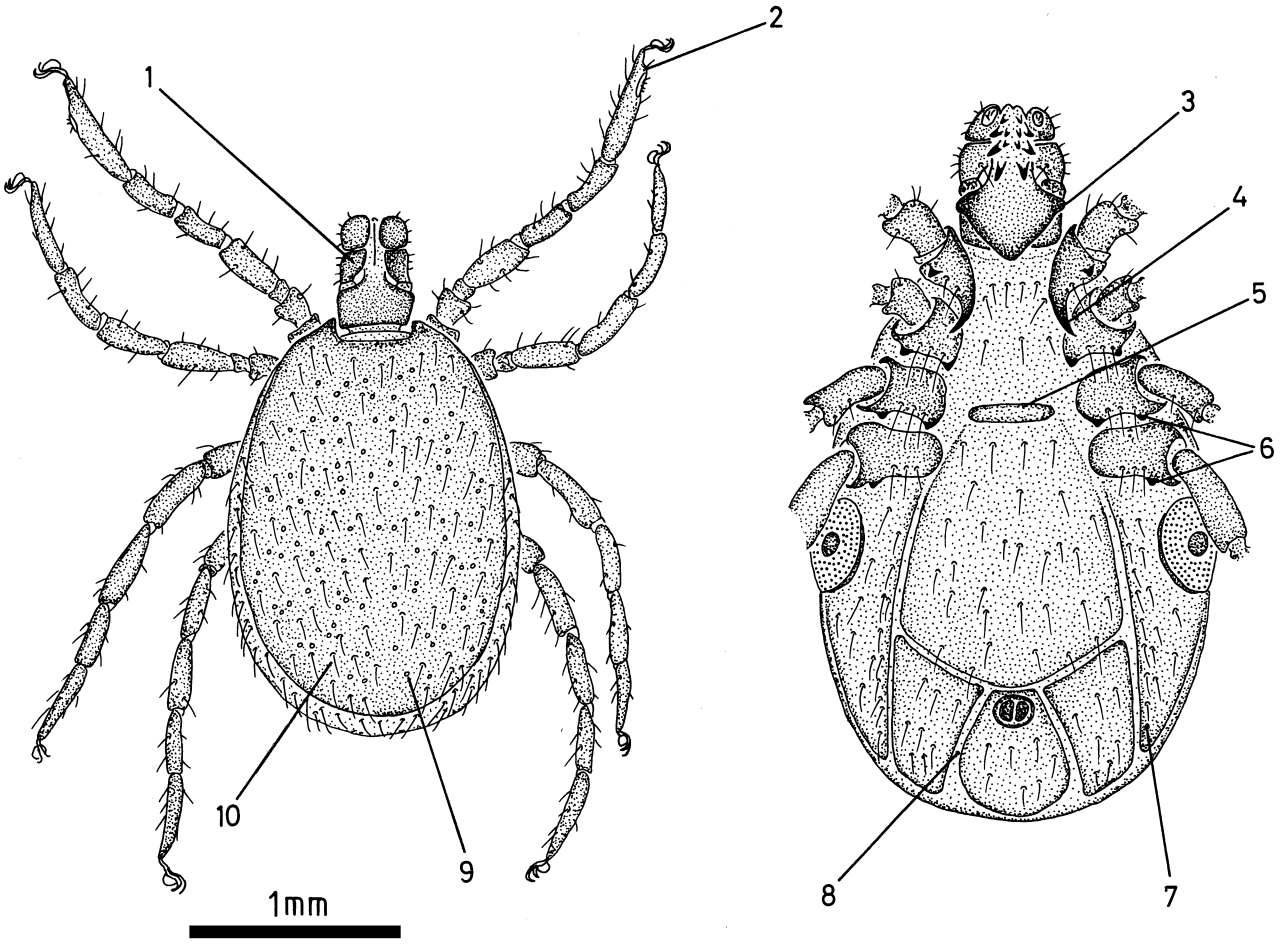
1 Scapular grooves are present.
2 Palps alignment slopes inward.
3 Tarsi are tapered toward the claws.
4 Punctations are distinct.
5 Setae on the scutum are present.
6 Setae on the alloscutum are thin and colourless.
7 Scutum posterior margin is slightly sinuous.

***Ixodes ricinus* female, ventral.**



1 Coxae type is normal (not syncoxae).
2 Auriculae are distinct.
3 Coxae 1 internal spurs are long.
4 Coxae 2 to 4 external spurs are distinct.
5 Anal groove posterior alignment is long and diverging.
6 Genital aperture position is between coxae 4.

***Ixodes ricinus* male, dorsal at left, ventral at right.**



1 Mouthparts of male are shorter than those of the female (relative to the basis capituli).
2 Tarsi are tapered towards the claws.
3 Auriculae are distinct.
4 Coxae 1 internal spurs are long.
5 Genital pore position is between coxae 3.
6 Coxae 2 to 4 external spurs are distinct.
7 Ventral body surface has 2 paired and 2 single sclerotized plates.
8 Anal groove is formed between margins of the single anal plate and the paired adanal plates.
9 Punctations are distinct.
10 Setae on the scutum are present.

Ixodes rubicundus Neumann, 1904.

General.
Ixodes rubicindus is also known as The Karoo paralysis tick. It is notorious for causing paralysis of some of its hosts, particularly sheep.

Differential diagnosis.
Details are given only of female ticks. Male *Ix. rubicundus* are not illustrated because it is the females that are usually found in collections from hosts. (A male *Ixodes ricinus* has been illustrated earlier to demonstrate the general features of male *Ixodes* ticks.) *Ixodes rubicundus* needs to be distinguished from *Ix. pilosus*, to which it is very similar. In both species the females have large white setae on the dorsal alloscutum which tend to give to the ticks a shining white appearance. On *Ix. rubicundus* these setae are scattered over the dorsal alloscutum, on *Ix. pilosus* the setae are larger and occur in four columns. Also the scutum of females should be compared; in *Ix. rubicundus* there is a distinctly sinuous posterior margin which often shows a distinct constriction, compared to *Ix. pilosus* which has a scutum with a slightly sinuous posterior margin. *Ixodes rubicundus* has small auriculae on the ventral surface of the basis capituli, in *Ix. pilosus* they are distinctly larger. The anal groove in *Ix. rubicundus* extends to the posterior margin of the body as a long parallel pair of grooves compared to a short and converging pair in *Ix. pilosus*.

Hosts.
Caracal (lynx) are the natural host of adult *Ix. rubicundus* but this tick also readily infests sheep, goats and mountain reedbuck. The immature stages prefer elephant shrews, red rock hares and also feed on caracals. Females attach in the wool-line on the limbs and belly of sheep.

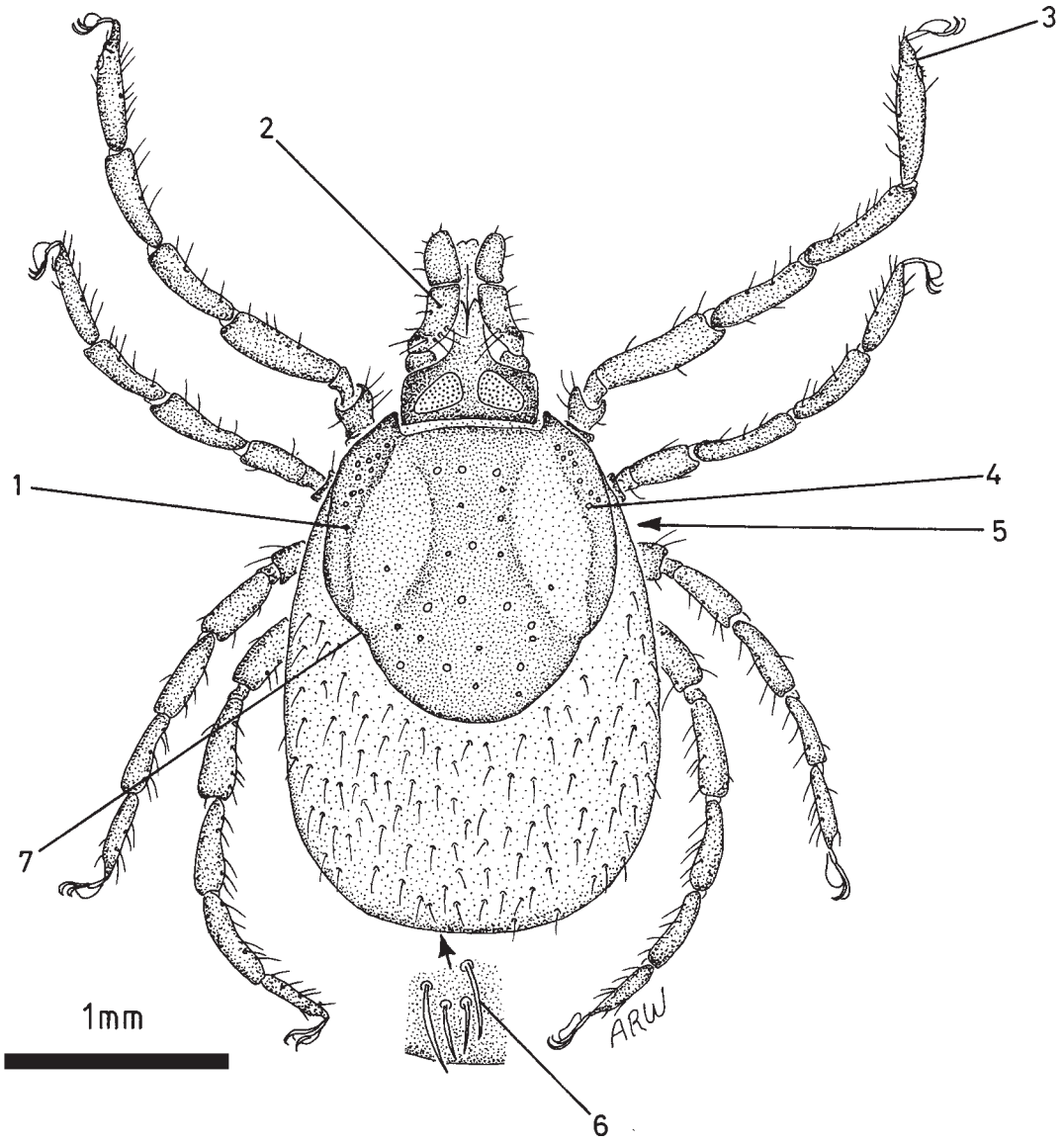
Life cycle and seasonal occurrence.
Ixodes rubicundus is a three-host tick. The females remain on the host for about seven days, they then detach and lay 2 000 to 4 000 eggs and die. The eggs remain undeveloped during summer and only hatch the following autumn. The immature stages feed on red rock hares and elephant shrews. The engorged nymphs, which drop from these small mammals remain undeveloped during summer then moult to adults the following autumn. The life cycle takes two years to complete. Grass tussocks, woody shrubs and wild olive trees 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. Adult ticks quest on the grass at a height of approximately 40cm within 2m of wild olive trees. Adults are most abundant on sheep and antelopes during autumn to spring of one year. During the following year larvae are most abundant on the shrews and hares during late summer to winter, and nymphs during during winter to spring. Adult ticks appear on the vegetation and on host animals earlier in the year in the south of the country than in the north.

Disease.
The females of *Ix. rubicundus* produce a toxin in their saliva 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 weight of host is important in the causation of paralysis. Paralysis starts in legs and may progress until it fatally affects the respiratory system. 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 temperature and with moist conditions. If the ticks are removed the symptoms are reversed within a few hours.

Habitat and distribution.
Ixodes rubicundus is typically found in areas of steppe climate (Karoo) of South Africa but also in Mediterranean climate areas along the southern coast. Elsewhere in South Africa it is found in the southern Free State and in small foci at 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 grass "suurpol" (*Merxmeullera disticha*) together with the species of shrews and hares typical of this habitat all support the survival of *Ix. rubicundus*. These ticks also prefer the southern slopes of the hills that are cooler than the northern slopes.

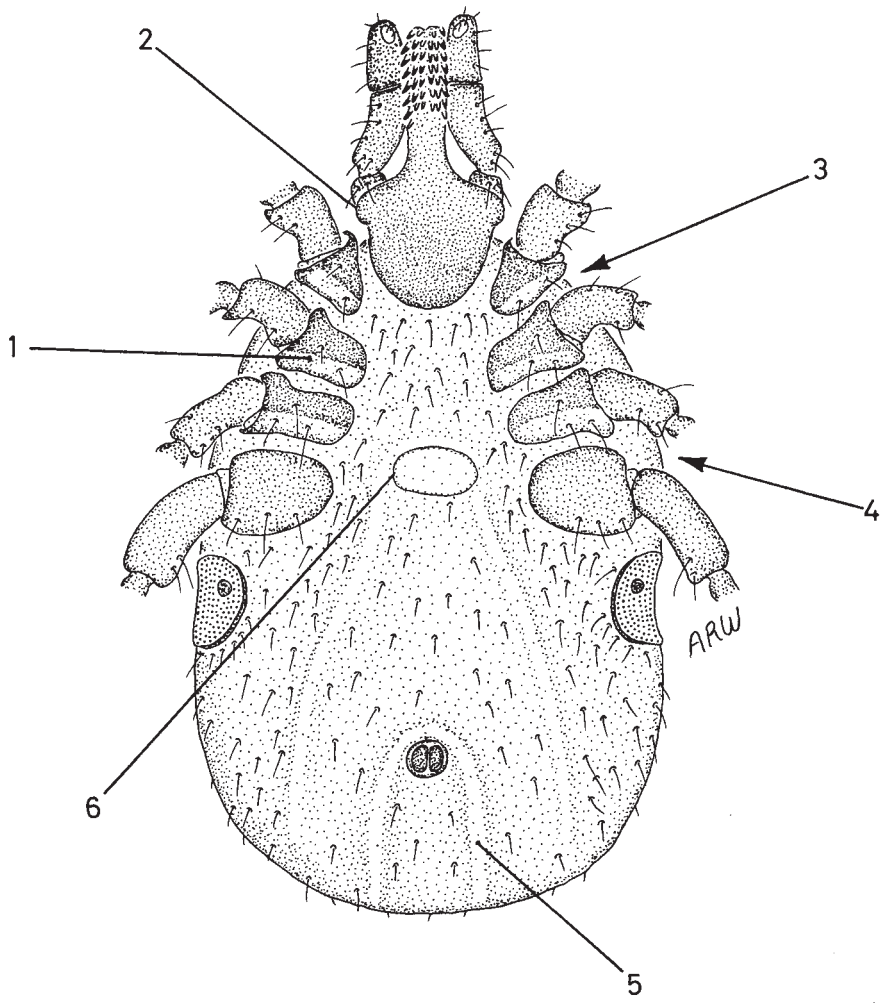
Distribution of *Ixodes rubicundus*.

***Ixodes rubicundus* female, dorsal.**



1 Scapular grooves are present.
2 Palps alignment curves outward.
3 Tarsi are tapered toward the claws.
4 Punctations are distinct (but fairly sparse).
5 Setae on the scutum are absent.
6 Setae on the alloscutum are thick and white coloured (they are distributed evenly).
7 Scutum posterior margin is distinctly sinuous (usually in the form of a distinct constriction in the posterior part).

***Ixodes rubicundus* female, ventral.**



1 Coxae type is syncoxae (different textures in the anterior and posterior parts).
2 Auriculae are indistinct.
3 Coxae 1 internal spurs are absent.
4 Coxae 2 to 4 external spurs are absent.
5 Anal groove posterior alignment is long and parallel.
6 Genital aperture position is between coxae 4 (but may appear intermediate between coxae 3 and 4, specially in engorged ticks).

Margaropus winthemi Karsch, 1879.

General.
Margaropus winthemi is also known as The winter horse tick, or The South African beady-legged tick. It belongs to a genus of three species and this genus is superficially similar to the sub-genus *Boophilus* within *Rhipicephalus*. They are specialised and of restricted distribution and only *Ma. winthemi* is of veterinary importance.

Differential diagnosis.
Both sexes of adults are distinguished from *Rhipicephalus* (*Boophilus*) species by the thick legs; these are very conspicuous in males. *Margaropus winthemi* is larger than ticks of the *Boophilus* sub-genus. The only species of *Margaropus* found on domestic animals is *Ma. winthemi*. The other two species, *Margaropus wileyi* and *Margaropus reidi* are found only on giraffes, in Kenya and Sudan respectively.

Hosts.
Horses and cattle are the hosts of larvae, nymphs and adults of *Ma. winthemi*. It also infests zebras and elands. The preferred feeding sites of all stages of the tick are widely spread on their host's body but are commonest on the face, neck and flanks.

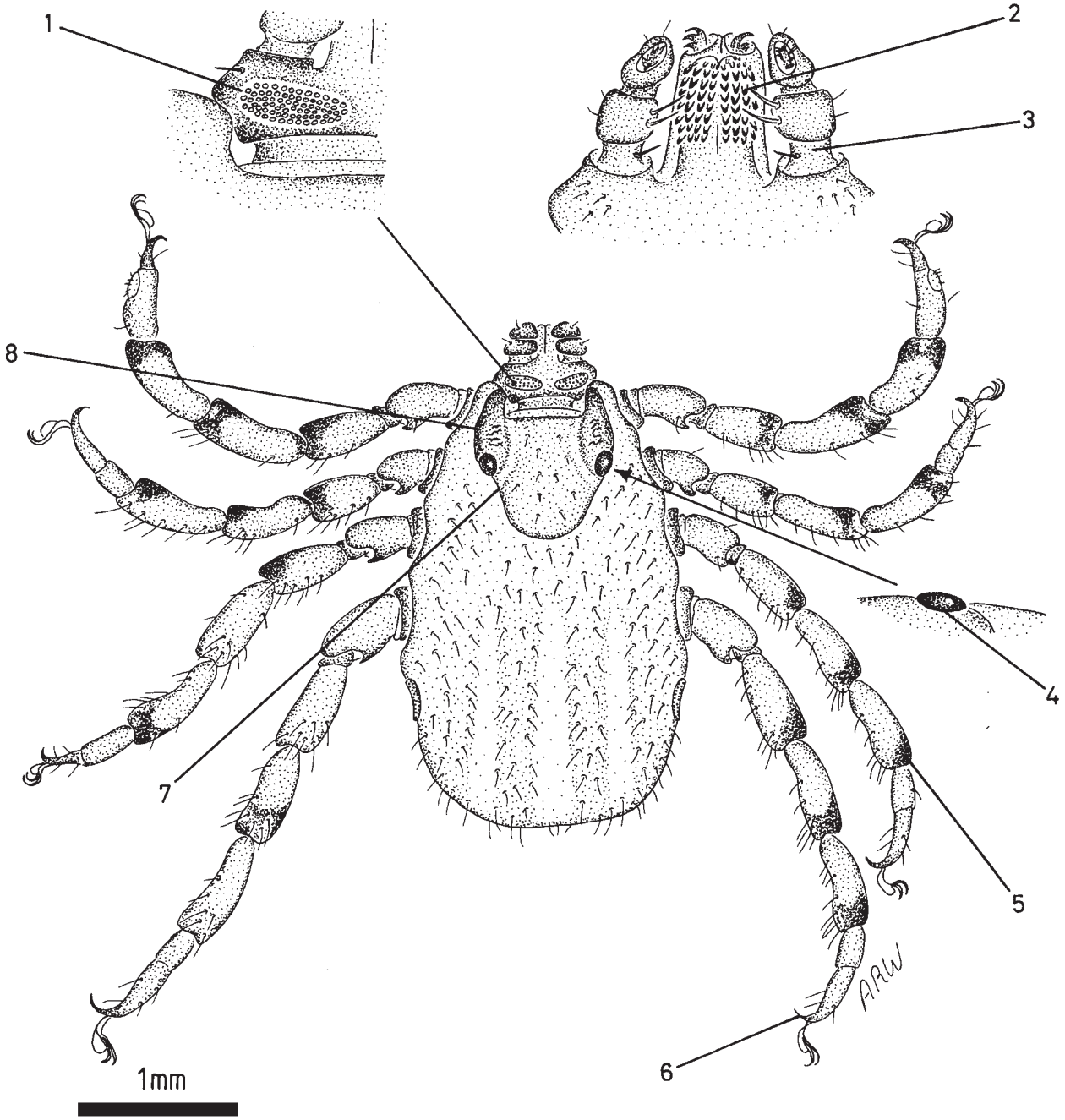
Life cycle and seasonal occurrence.
This species is a one-host tick. It withstands cold climates and is active only in winter during which very large numbers of these ticks may be active.

Disease.
Margaropus winthemi is not known to transmit any pathogens but it may infest horses in such large numbers during winter as to cause loss of condition.

Habitat and distribution.
Margaropus winthemi occurs in a wide variety of climatic regions: temperate (highland), South African Mediterranean and steppe. It is restricted to small and widely scattered areas of South Africa and Lesotho and probably into neighbouring countries. In South Africa it occurs in southern, central, eastern and western parts of the Free State, the higher regions of the Western and Eastern Cape Provinces and of KwaZulu-Natal and Mpumalanga with isolated foci in North West Province.

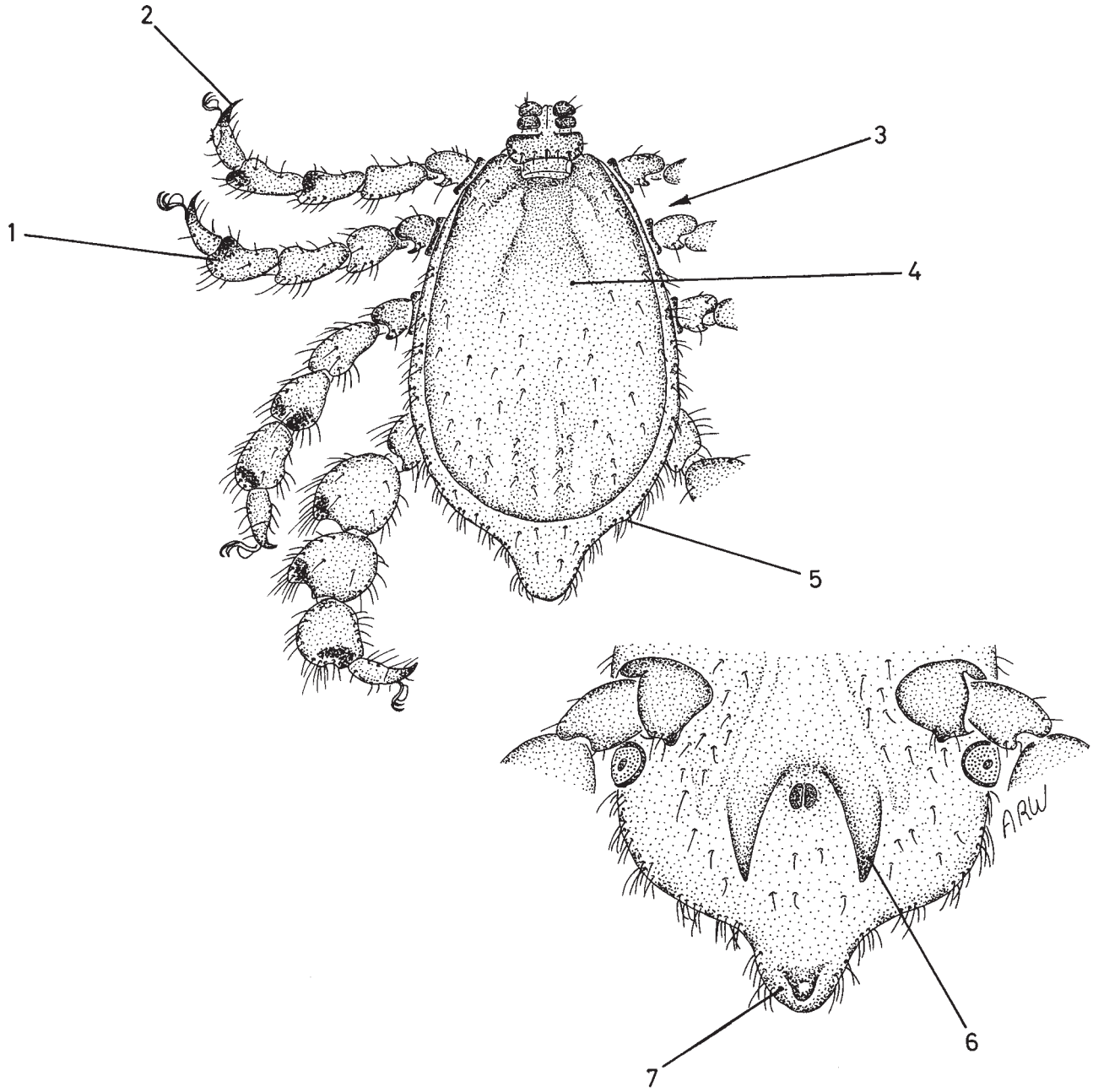
Distribution of *Margaropus winthemi*.

***Margaropus winthemi* female, dorsal in centre, ventral mouthparts at upper right.**



1 Porose areas shape is a narrow oval.
2 Hypostomal teeth are in 4 + 4 columns.
3 Palp articles 1 have a smooth inner surface with a single seta projecting inwards.
4 Eyes are present.
5 Legs are bulbous; also they have dense long setae and the outer part of most segments have dark brown patches or rings.
6 Legs have long extensions of each tarsus as a claw in addition to the pair of small claws with the pulvillus.
7 Scutum posterior margin is distinctly sinuous and a scapular groove is present from the cervix to the posterior margin.
8 Scutum in the areas anterior and external to the cervical grooves is slightly wrinkled and darker than the rest of the scutum.

***Margaropus winthemi* male, dorsal in centre, ventral posterior at bottom right.**



1 Legs are bulbous, particularly the 4th pair which resemble strings of beads (also all legs have dense long setae and the outer part of most segments have dark brown patches).
2 Legs have long extensions of each tarsus as a claw in addition to the pair of small claws with the pulvillus.
3 Eyes are indistinct in males.
4 Scutum is smooth, with sparse setae.
5 Alloscutum at posterior end has clusters of dense long setae.
6 Adanal plates are large and narrowly pointed (there are no accessory adanal or subanal plates).
7 Caudal appendage is broad and has a hook on the ventral surface.

Ornithodoros moubata (Murray, 1877) with notes on *Ornithodoros porcinus* Walton, 1962.

General.
Ticks of the *Ornithodoros moubata* species complex are known as The eyeless tampans. These ticks are notorious for a close association with humans - for sheltering in their houses and feeding on their blood. Under these conditions they are important as vectors of the pathogen of human relapsing fever. They are also important in the transmission of the virus causing African swine fever.

The *Or. moubata* species complex or group contains *Or. porcinus*. (Formerly the complex contained the sub-species *Ornithodoros porcinus domesticus; Ornithodoros porcinus porcinus;* and the species *Ornithodoros moubata*.) It is beyond the scope of this guide to describe separately these very similar ticks. The taxonomic problems with these species need resolution to improve epidemiological studies and disease controls.

Differential diagnosis.
The ticks of this complex are typical of the family Argasidae and the features of the genus *Ornithodoros* are most useful to distinguish them from the similar genus *Argas*. Ticks of the *Or. moubata* complex are very similar to *Ornithodoros savignyi* but have no eyes.

Hosts.
Domestic pigs, poultry and humans are the main hosts of all stages of *Or. moubata*. Warthogs are the main hosts of *Or. porcinus*. Both these sub-species of tick have telotropic types of behaviour.

Life cycle and seasonal occurrence.
The following description applies generally to both species. The whole life cycle takes place within the housing or burrow of its host. After a blood-meal and mating the female produces a batch of approximately 300 eggs. Six-legged larvae hatch from these eggs. These do not feed but they moult to the first nymphal stage after 1 to 2 days. The nymphs seek a host and take the first blood-meal and moult to the next nymphal stage. This process is repeated for each of the four or five nymphal stages. Each of these nymphal stages may survive for as long as two 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 tick hide in crevices in the host's housing or burrow during the day.

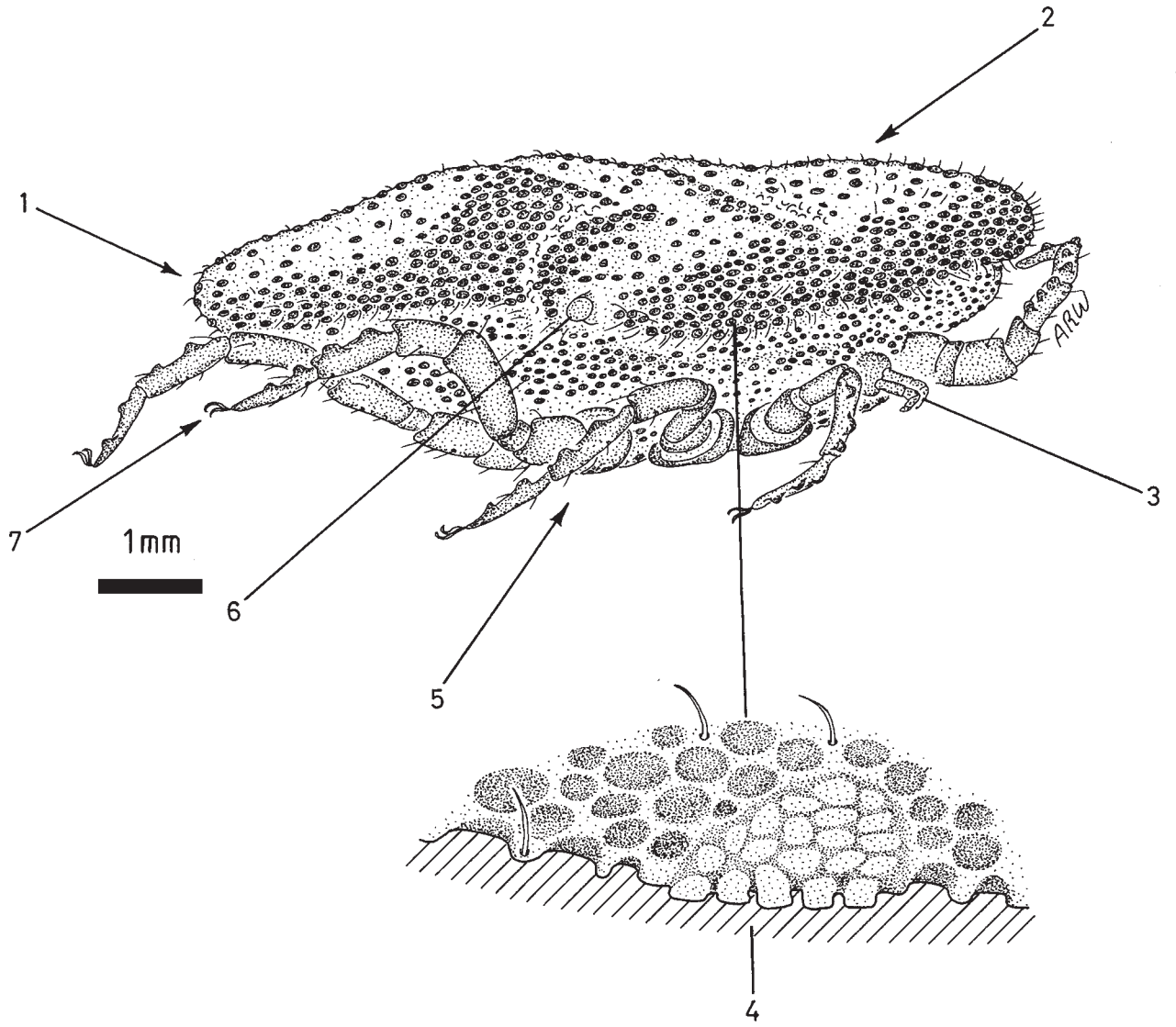
Disease.
Ornithodoros moubata transmits the bacterium *Borrelia duttoni*, the cause of relapsing fever in humans. This pathogen is transmitted by means of saliva and also the coxal fluid that is produced while the tick is feeding and which contaminates the feeding wound. Both species transmit the virus of African swine fever to domestic pigs. Warthogs serve as carriers of swine fever but the viraemia is usually very low. The feeding of these ticks also causes biting stress.

Habitats and distribution
The habitats of these ticks are defined by the housing and nests of their hosts: humans; poultry; domestic pigs; warthogs; antbears; porcupines. Large numbers of nymphs may occur on free-ranging warthogs out of their burrows during the day and infestation is probably spread in this way. Ticks of the *Or. moubata* complex have potentially a very wide distribution in many climatic regions including steppe, savanna and temperate. They occur scattered throughout sub-Saharan Africa and have been reported from a few locations north of the Sahara. However these ticks have been confused with *Ornithodoros savignyi* in countries north of the Sahara so these records need to be confirmed. These ticks are also found in Madagascar.

The map below is general for both *Or. moubata* and *Or. porcinus*.

Distribution of *Ornithodoros moubata* species complex.

***Ornithodoros moubata* female, lateral.**



1 Lateral suture is absent (body is without a distinct margin between dorsal and ventral surfaces).
2 Scutum is absent (and there is no conscutum on the male).
3 Mouthparts are ventral and small. There is no camerostomal cavity around the mouthparts.
4 Integument texture is with mammillae. The mammillae are without stalks. There are also areas which are sunken and roughly textured.
5 Eyes are absent.
6 Spiracle plates are small and situated above the area between 3rd and 4th legs.
7 Pulvilli are absent from the ends of the legs.

(The male is very similar but has a smaller and circular genital aperture, situated in the same position as in the female, between coxae 2.)

Ornithodoros savignyi (Audouin, 1827).

General.
Ornithodoros savignyi is also known as The eyed tampan or The sand tampan. It is notorious as a cause of severe biting stress and toxaemia.

Differential diagnosis.
This species is a typical tick of the family Argasidae and the features of the genus *Ornithodoros* are most useful to distinguish it from ticks of the similar genus *Argas*. *Ornithodoros savignyi* is very similar to ticks of the *Or. moubata* species complex but has two pairs of distinct eyes compared to the eyeless ticks of the *Or. moubata* complex.

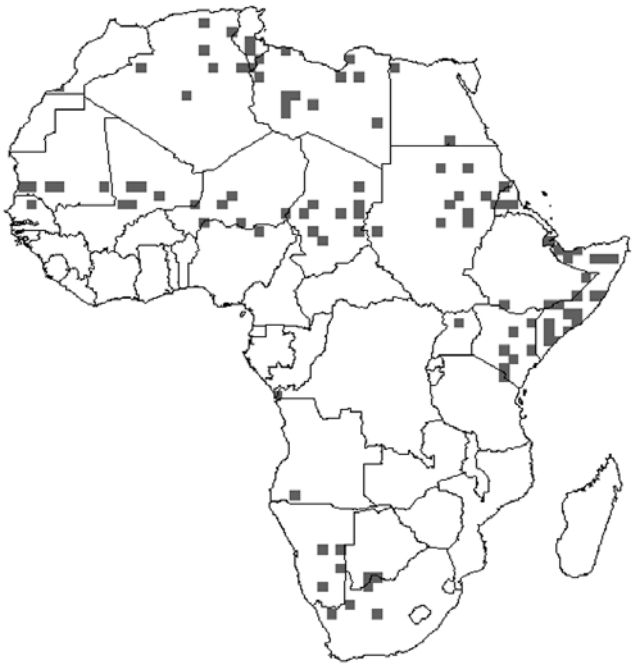
Hosts.
Camels and cattle are the preferred hosts. Donkeys and humans may be bitten.

Life cycle and seasonal occurrence.
The life cycle of *Or. savignyi* is typical of argasid ticks. Larvae do not feed, but moult rapidly to the first nymphal stage. There are four or more nymphal stages. Nymphs and adults feed within about 30 minutes and do not remain longer on their hosts. Adults feed repeatedly during that stage of the life cycle. The female lays repeated small batches of eggs. All stages, when not feeding, are found in dry sandy soil in shaded areas where their hosts are likely to rest. *Ornithodoros savignyi* is a partially domestic and partially exophilic tick, common at both livestock holding areas and under shade in open rangeland. It feeds at any season and any time of the day or night, depending on when its hosts become available. This species of tick is very long lived and will rapidly respond to the new presence of hosts after an absence of any hosts for several years.

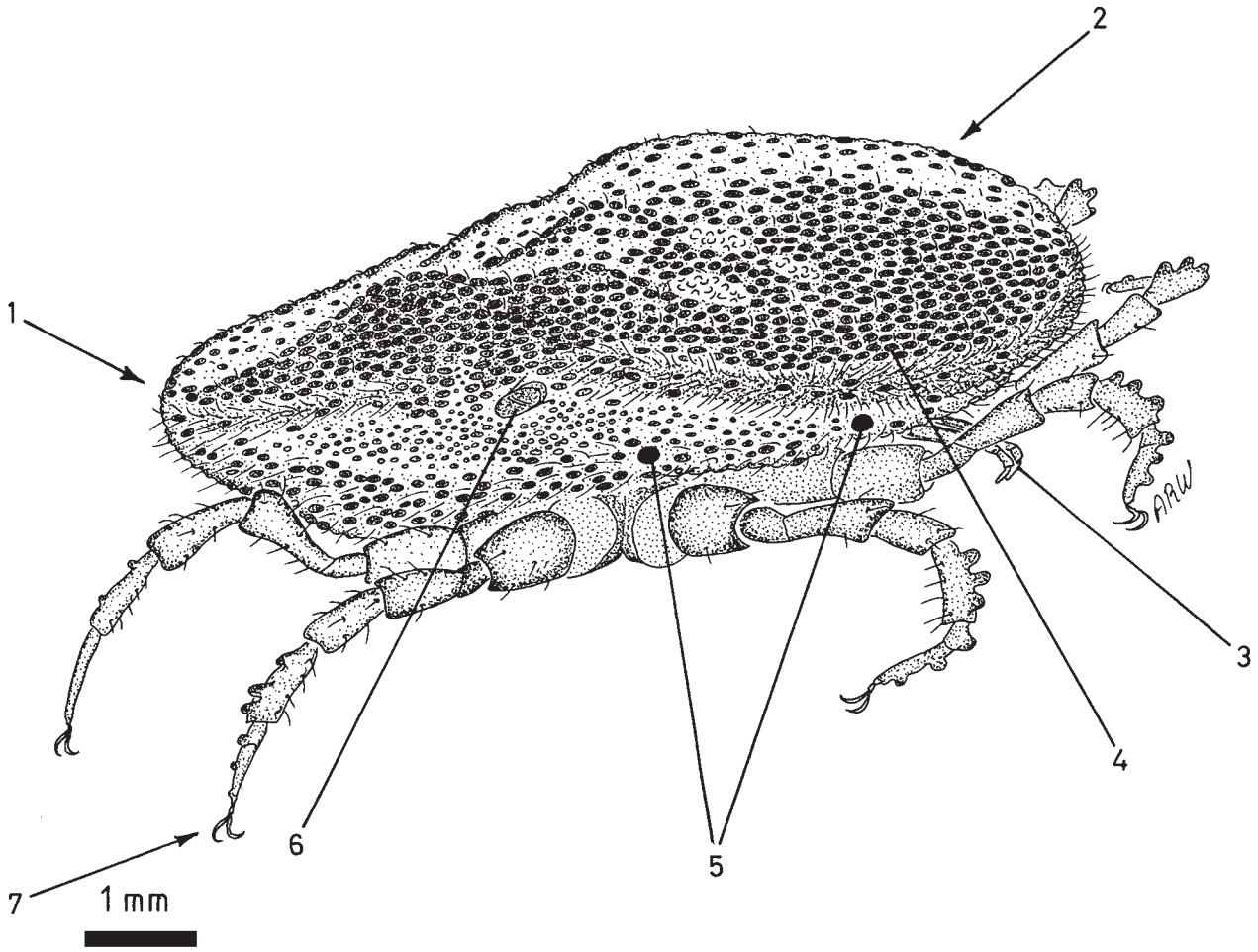
Disease.
This tick is not known to transmit any pathogens. Severe biting stress is frequently caused when these ticks accummulate in large numbers at camel or cattle pens and kraals. Massive numbers will feed on the lower legs of their hosts and toxins in the tick's saliva can cause paralysis and a toxaemia which is sometimes fatal.

Habitat and distribution.
Ornithodoros savignyi is a tick of desert and steppe climatic regions and populations occur widely scattered areas throughout Africa. It also occurs eastwards through to India.

Distribution of *Ornithodoros savignyi*.



***Ornithodoros savignyi* female, lateral.**



1 Lateral suture is absent (body is without a distinct margin between dorsal and ventral surfaces).
2 Scutum is absent (and there is no conscutum on the male).
3 Mouthparts are ventral and small. There is no camerostomal cavity around the mouthparts.
4 Integument texture is with mammillae (as shown for *Ornithodoros moubata*). The mammillae are without stalks. There are also sunken areas of rough texture.
5 Eyes are present as a pair on each lateral margin of thebody, they are distinctly convex, black and shiny.
6 Spiracle plates are small and situated above the area between 3rd and 4th legs.
7 Pulvilli are absent from the ends of the legs.

(The male is very similar but has a smaller and circular genital aperture, situated in the same position as in the female, between coxae 2.)

.

Otobius megnini (Dugès, 1883).

General.
Otobius megnini is also known as The spinose ear tick. This unusual and harmful tick was accidentally introduced into Africa from the Americas. It belongs to a genus of three species of ticks, in the family Argasidae.

Differential diagnosis.
This species of tick is easy to distinguish from any other because of its unusual feeding behaviour as an argasid tick. However, it is important to know that only the larvae and nymphs are parasitic; the adults do not occur on the hosts. The larvae have six fairly long legs and the mouthparts are situated anteriorly. As the larvae engorge they become shaped like a violin. They are white or pink in colour. The nymphs are diamond shaped and then become violin shaped, similar to the adults. The mouthparts of nymph are situated ventrally and there is no genital aperture in the nymphs. The nymphs are covered with short, rigid setae in the form of spines, from which the tick derives its common name. These setae are less rigid posteriorly. The adults are dark grey in colour and violin shaped. Numerous small pits are present on the adult integument. The lateral margin of the body is broad, without a definite lateral suture. The adult's mouthparts are rudimentary and situated on the ventral surface of the body. *Otobius megnini* is eyeless as nymph and adult.

Hosts.
Cattle, sheep, goats, horses, donkeys and mules are the preferred domestic hosts of *Ot. megnini*. It also infests dogs and cats. Sometimes humans who are exposed through close contact with horses become infested, with painful results. The parasitic larvae and nymphs feed deep in the external ear canal of their hosts. Adult *Ot. megnini* do not feed.

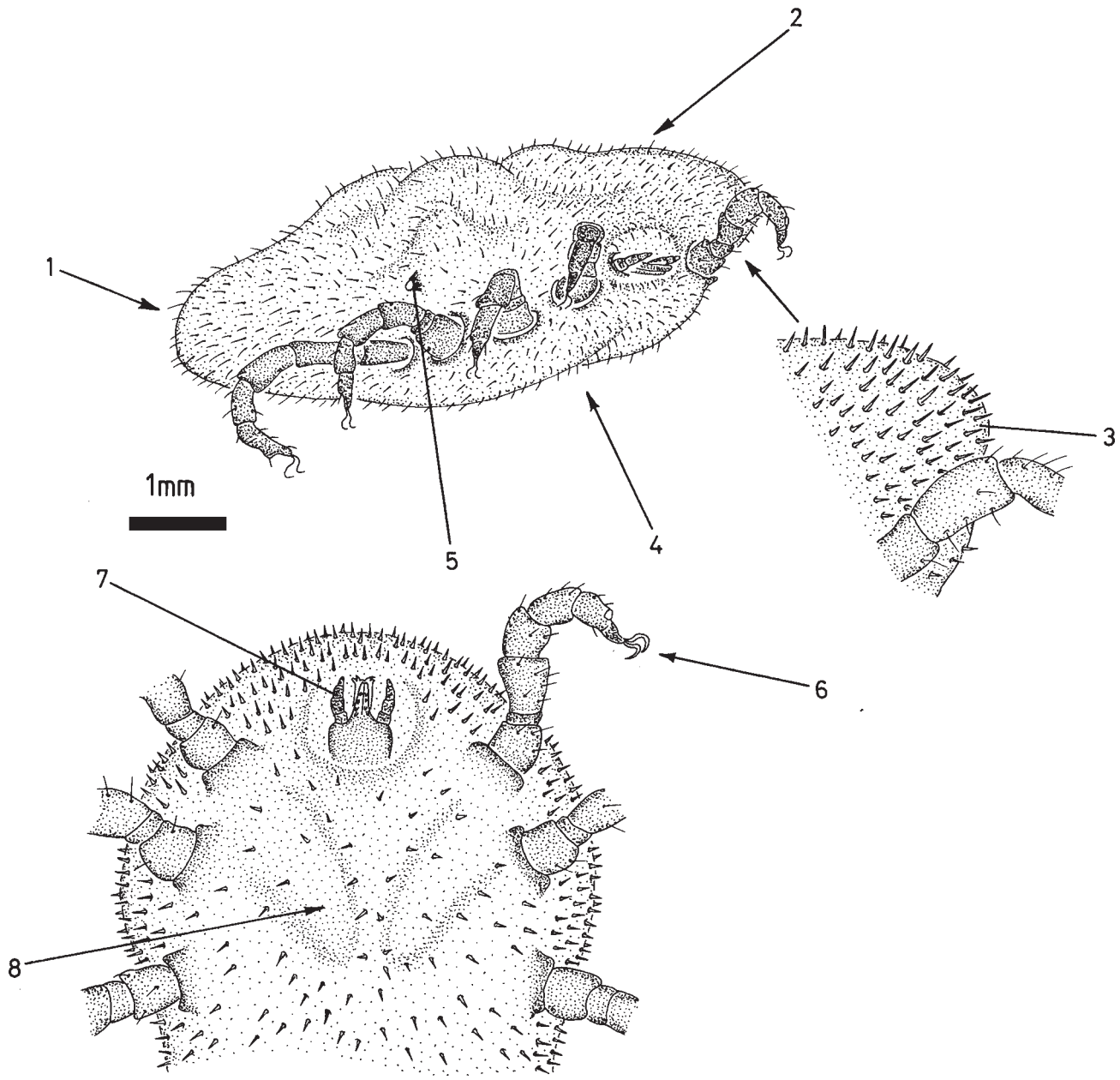
Life cycle and seasonal occurrence.
This is a one-host tick which is domestic, being centred on cattle kraals and horse stables. The female tick lays 300 to 1500 eggs in batches over a period of months. These eggs are laid in cracks and crevices in kraals, pens and stables. The eggs hatch in about three weeks giving rise to six-legged larvae. The larval stage lasts 1 to 2 weeks and the larvae moult in the ear canal and give rise to the nymph which is eight-legged and also attaches in the ear. The number of nymphal stages is uncertain but moulting and attachment of nymphs occurs in the ear canal. The nymphs remain in the ear for 3 to 6 months and then the nymphs engorge, detach and drop to the ground. The nymphs moult to adults which then mate. The feeding behaviour is the monotropic type. The adults are non-parasitic and remain in cracks and crevices in ground. Infestations can occur throughout the year and the life cycle requires six months to two years to complete.

Disease.
Otobius megnini is not known to transmit any pathogen. The ticks feeding in the ear canal and the spines on their bodies result in considerable irritation and infested animals lose their appetite (= anorexia) and thus lose condition (= cachexia). The ear becomes inflamed and tissue necrosis or secondary bacterial infections may develop. These infections may attract myiasis flies and can be fatal.

Habitat and distribution.
Otobius megnini is endemic to North America where its natural host is the pronghorn antelope. It was accidentally introduced from the Americas in about 1898, probably during re-stocking after the rinderpest pandemic. It occurs most commonly in areas with steppe and semi-desert climates such as the Karoo and semi-desert areas of the Kalahari and Free State in South Africa. Because of the long period of infestation hidden in host's ears, these ticks are easily carried to new localities when their hosts are transported. It has spread to Namibia, Botswana, Zimbabwe, Kenya and even as far as Turkey.

Distribution of *Otobius megnini*.

***Otobius megnini* nymph, lateral at top, ventral anterior at bottom (this is a 2nd or later nymphal stage).**



1 Lateral suture is absent (body is without distinct margin between dorsal and ventral surfaces).
2 Scutum or conscutum is absent.
3 Integument texture is with spines (between the spines the integument is smooth).
4 Eyes are absent.
5 Spiracle plates are small and situated above the area between 3rd and 4th legs.
6 Pulvilli are absent from the ends of the legs.
7 Mouthparts are small and ventral (in the first nymphal stage the mouthparts are anterior, in later nymphal stages they are ventral).
8 Genital aperture is absent from nymphs.

.

Rhipicephalus (*Boophilus*) *annulatus* (Say, 1821).

General.
Rhipicephalus (*Boophilus*) *annulatus* is a famous tick due to early work on the biology and control of babesiosis of cattle. It is a typical one-host tick of the *Boophilus* sub-genus within the genus *Rhipicephalus*. The front cover of this guide features a female *Rh*. (*Bo*.) *annulatus.* The discovery in the United States of America that *Babesia* protozoa were transmitted from cow to cow by this tick species was the first time that such a route of transmission of a pathogen was described and was one of the advances leading to the science of vector biology.

This species and the others in the *Boophilus* sub-genus within the genus *Rhipicephalus* are so well known in their original classification as members of the full genus *Boophilus* that the former names are likely to remain in use for many years without confusion. The character states that have been used for this subgenus are separate from the rest of the genus *Rhipicephalus*.

Differential diagnosis.
Rhipicephalus (*Boophilus*) *annulatus* is very similar to *Rh*. (*Bo.*) *microplus*, but their distributions do not overlap in Africa. Both species are without a protuberance bearing a seta on the inner margin of the first palp articles. This differentiates them from *Rh*. (*Bo*.) *decoloratus* and *Rh*. (*Bo*.) *geigyi*. The internal margin of the first palp article of *Rh*. (*Bo*.) *annulatus* is long and slightly concave, in *Rh*. (*Bo*.) *microplus* this margin is short and deeply concave. In addition, the spurs and cleft between the spurs on the first coxa of *Rh*. (*Bo*.) *annulatus* females are less distinct than those of *Rh*. (*Bo*.) *microplus* females. The second coxa of *Rh*. (*Bo*.) *annulatus* females is without a spur but there is a small one on the second coxa of *Rh*. (*Bo*.) *microplus* females. The male of *Rh*. (*Bo*.) *annulatus* lacks a caudal appendage but male *Rh*. (*Bo*.) *microplus* have a caudal appendage.

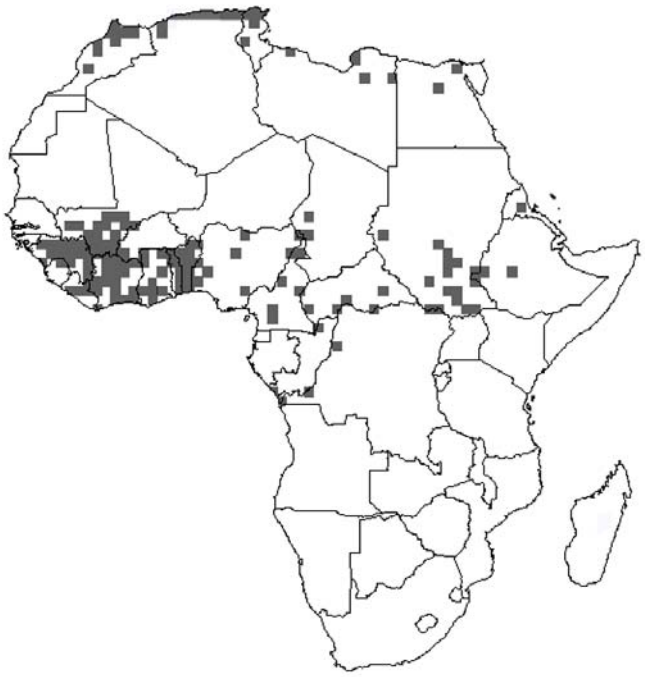
Hosts.
Cattle are the main hosts of *Rh*. (*Bo*.) *annulatus* but also occasionally sheep, goats and wild ungulates can support successful completion of the life cycle. Cattle are probably the only maintenance host for this tick and infestations of other hosts will only occur when a population of this tick is maintained by cattle. The preferred feeding sites are legs, belly, neck and dewlap but in heavy infestations the tick may be found over the back and shoulders.

Life cycle and seasonal occurrence.
Rhipicephalus (*Bo*.) *annulatus* is a one-host tick with a monotropic type of behaviour. The period of infestion of cattle is approximately three weeks. The life cycle can be completed in two months, and six generations per year are possible under conditions of continuous high temperature and humidity. In North Africa, where there are distinct summer and winter seasons, the tick's activity begins in late summer and extends from September to January with a peak in autumn (October).

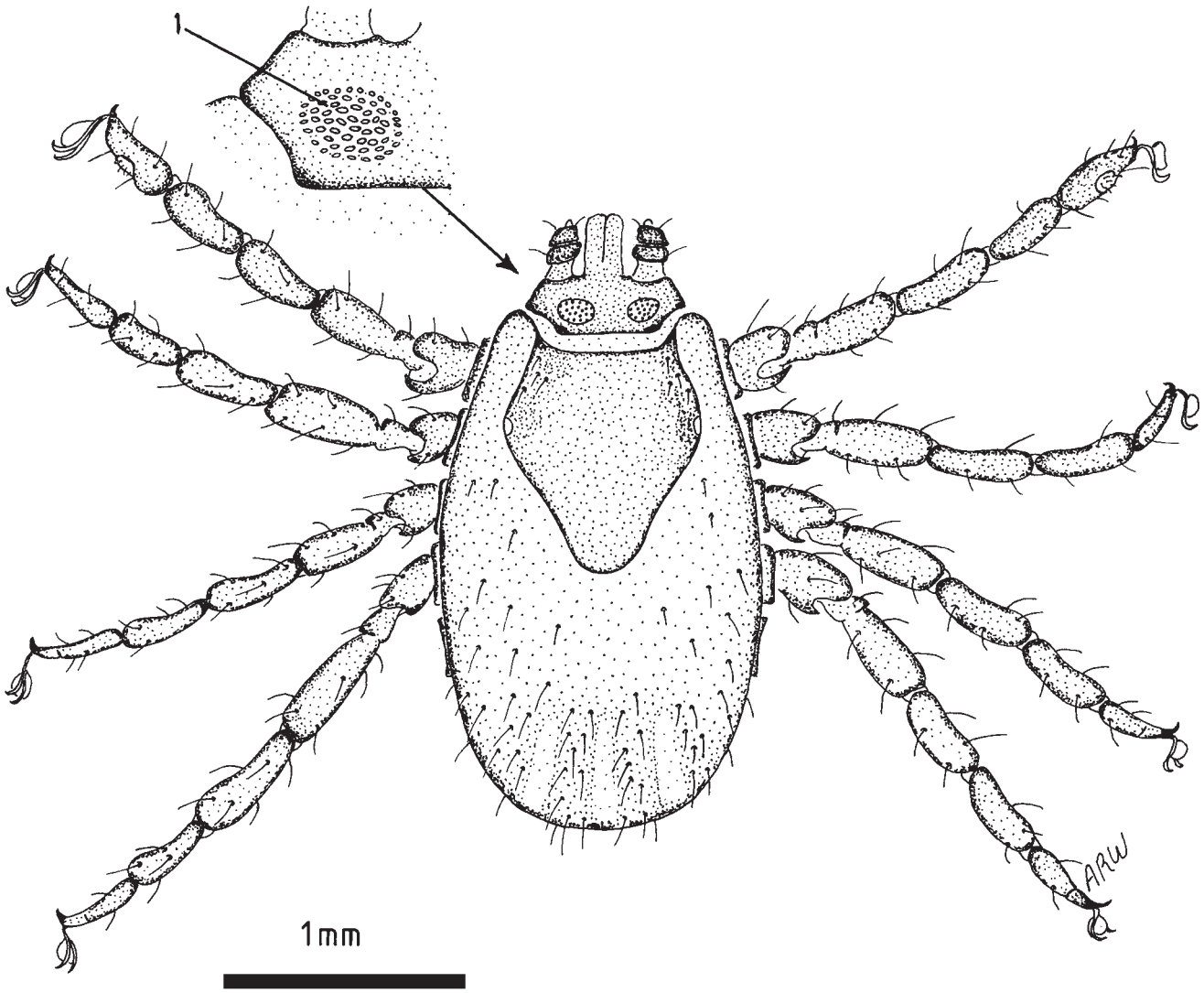
Disease.
This species of tick transmits the protozoans *Babesia bigemina* and *Babesia bovis* to cattle, both causing bovine babesiosis (= redwater). It also transmits the bacterium *Anaplasma marginale* to cattle, causing bovine anaplasmosis (= gallsickness). Heavy infestations cause damage to hides and probably lead to a reduction in the rate of growth of cattle.

Habitat and distribution.
Rhipicephalus (*Bo*.) *microplus* survives mainly in areas with Mediterranean and savanna climates but in Sudan occurs in humid localities within steppe areas that have very hot dry seasons. This is mainly a tick of West and North Africa but it is found elsewhere such as south east Sudan, Central African Republic and Democratic Republic of Congo. In the Americas this tick occurs in Mexico but has been eradicated from the U.S.A. *Rhipicephalus* (*Bo*.) *annulatus* is often found together with *Rh*. (*Bo*.) *decoloratus*. Hoogstraal (1956) was of the opinion that this tick originated in the Americas, but Morel (1958) considered that it originated in the Mediterranean area.

Distribution of *Rhipicephalus* (*Boophilus*) *annulatus*.

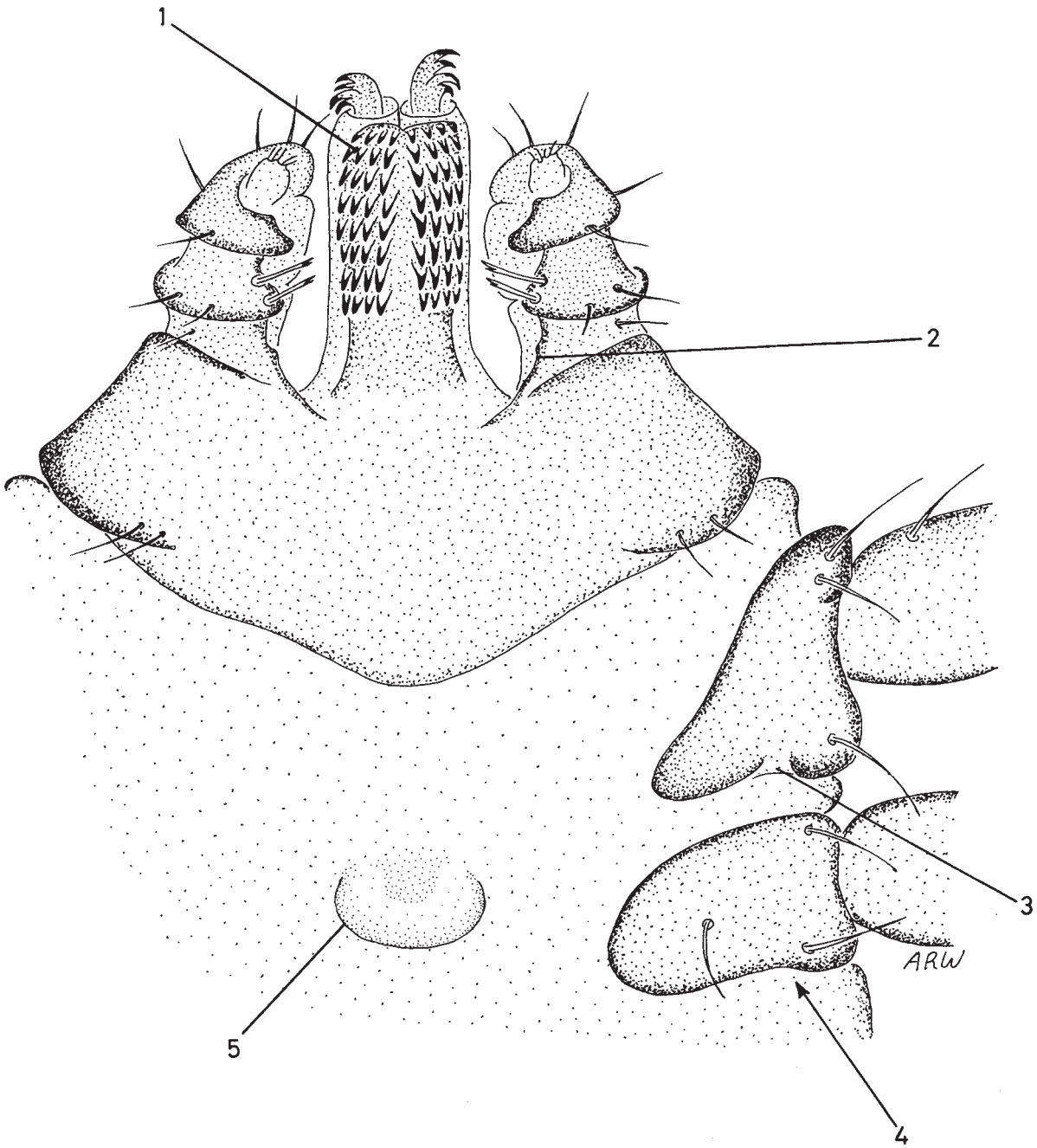


Rhipicephalus (***Boophilus***) ***annulatus*** **female**, **dorsal**.



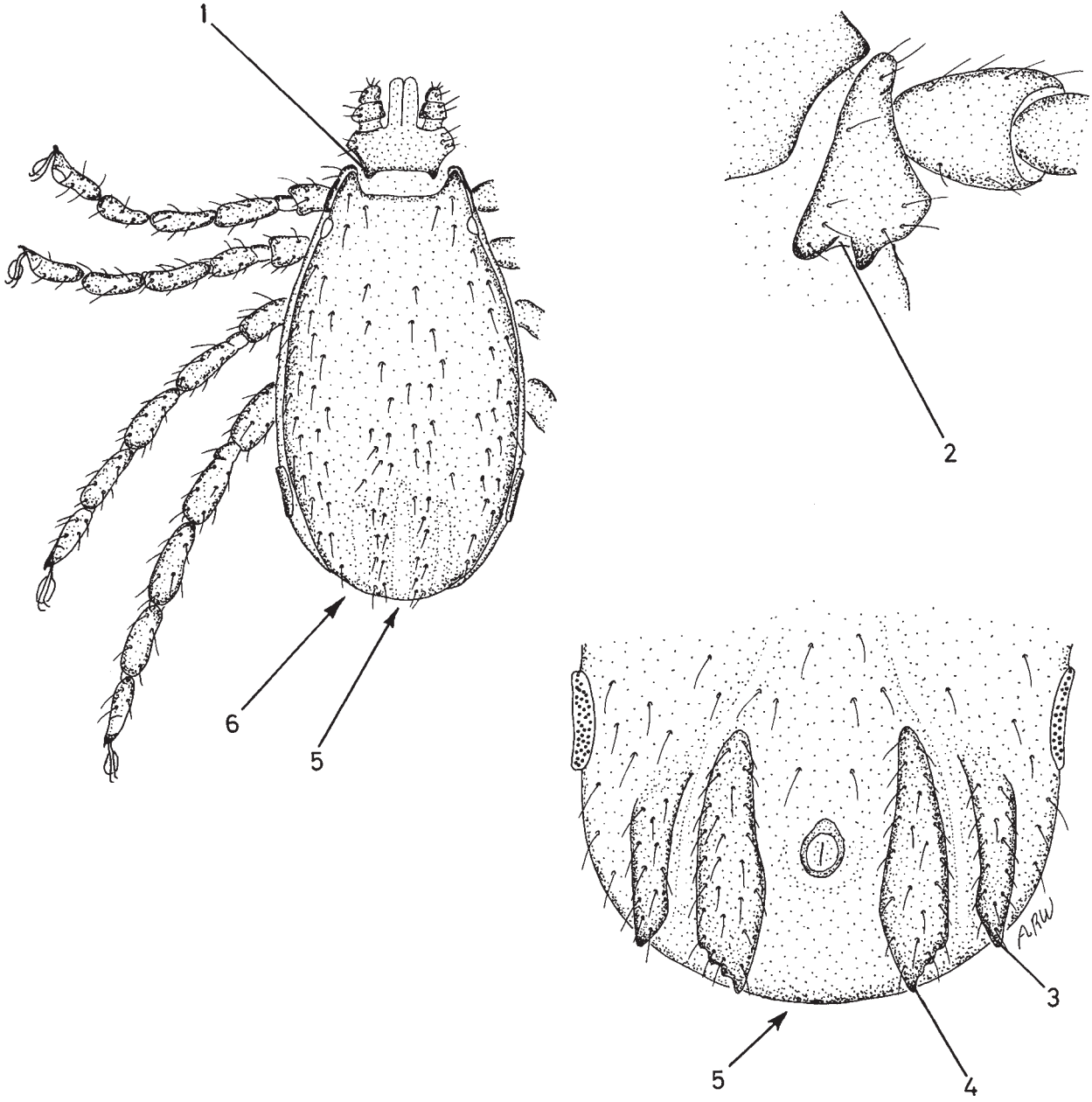
1 Porose areas shape is a broad oval.

***Rhipicephalus* (*Boophilus*) *annulatus* female, ventral, mouthparts, coxae and genital aperture.**



1 Hypostomal teeth are in 4 + 4 columns.
2 Palp articles 1 internal margins have no protuberance and are long and slightly concave.
3 Coxa 1 spurs are indistinct.
4 Coxae 2 and 3 spurs are absent.
5 Genital aperture posterior lips have a broad **U** shape.

***Rhipicephalus* (*Boophilus*) *annulatus* male, dorsal on left, coxa at top right, and ventral plates at bottom right.**



(Note: male mouthparts are similar to those shown for the female.)

1 Cornua are distinct
2 Coxa 1 spurs length is short (the spurs are faintly sclerotized).
3 Ventral plate spurs are indistinct (3 = accessory adanal plate).
4 Ventral plate spurs are indistinct (4 = adanal plate).
5 Caudal appendage is absent from males.
6 Ventral plate spurs are not visible dorsally.

Rhipicephalus (*Boophilus*) *decoloratus* (Koch, 1844).

General.
Rhipicephalus (*Boophilus*) *decoloratus* is also known as The blue tick because of the colour of engorged females. It is the commonest, most widespread and frequent of the one-host cattle ticks in Africa.

This species and the others in the *Boophilus* sub-genus within the genus *Rhipicephalus* are so well known in their original classification as members of the full genus *Boophilus* that the former names are likely to remain in use for many years without confusion. The character states that have been used for this subgenus are separate from the rest of the genus *Rhipicephalus*.

Differential diagnosis.
Rhipicephalus (*Bo*.) *decoloratus* is the only species of the subgenus *Boophilus* with 3 + 3 columns of teeth on the hypostome. It also has a protuberance on the internal margin of the first articles of the palps and this protuberance bears two pectinate setae. This protuberance plus one seta on the first article of the palps also occurs in *Rhipicephalus* (*Boophilus*) *geigyi*, but this latter species has 4 + 4 columns of teeth on the hypostome.

Hosts.
Cattle are the main host of *Rh*. (*Bo*.) *decoloratus* but it also feeds on horses, donkeys, sheep, goats and wild ungulates. Cattle are probably the only maintenance host for this tick and infestations of other hosts will only occur when a population of ticks is maintained by cattle. The preferred feeding sites of all stages on cattle are, in order of preference: back, upper legs, neck, shoulders, dewlap and belly.

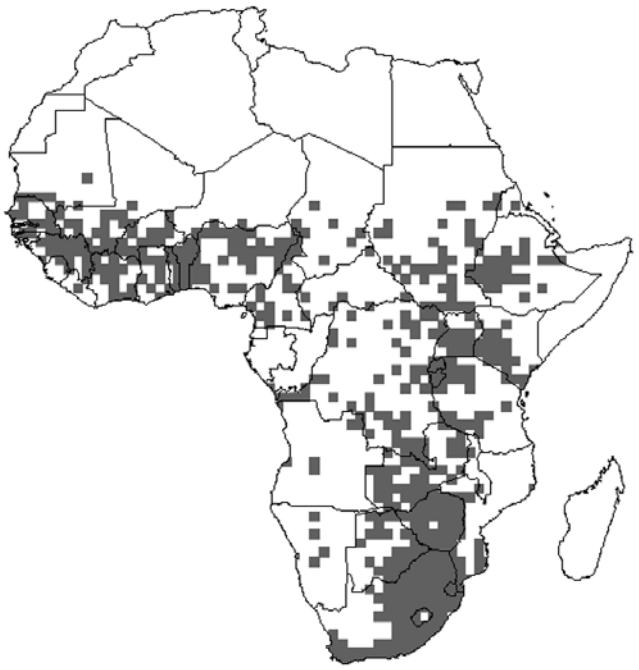
Life cycle and seasonal occurence.
Rhipicephalus (*Bo*.) *decoloratus* is a one-host tick with a monotropic type of behaviour. The engorged females lay 1 000 to 2 500 eggs about one week after detaching from the host. The eggs hatch in 3 to 6 weeks and the larvae ascend the vegetation and wait there for a host. The larvae attach, engorge and moult to nymphs on the host after a week. The nymphs attach on the same host, engorge and moult to adults after a week. Finally the adults attach on the same host, partially engorge, mate and the females fully engorge and drop off after a week. The three stages spend a total of about three weeks on the same host and the life cycle, including the non-parasitic phase, can be completed in approximately two months.

More than one life cycle can be completed annually. In southern Africa larval hatching from eggs that have over-wintered is synchronised as the temperature rises in spring, and large numbers of larvae are present on the vegetation at this time. Because of the tick's short life cycle several generations of larvae occur throughout the summer and into the cooler months of May and June. After the spring rise the largest numbers of ticks are present on cattle in southern Africa during the summer and autumn to early winter months. On wild herbivores in this region the highest burdens are usually recorded only in spring and, unless these animals are stressed, their late summer and autumn burdens remain low. North of the Equator, *Rh*. (*Bo*.) *decoloratus* is most abundant on cattle during the rainy season or in autumn.

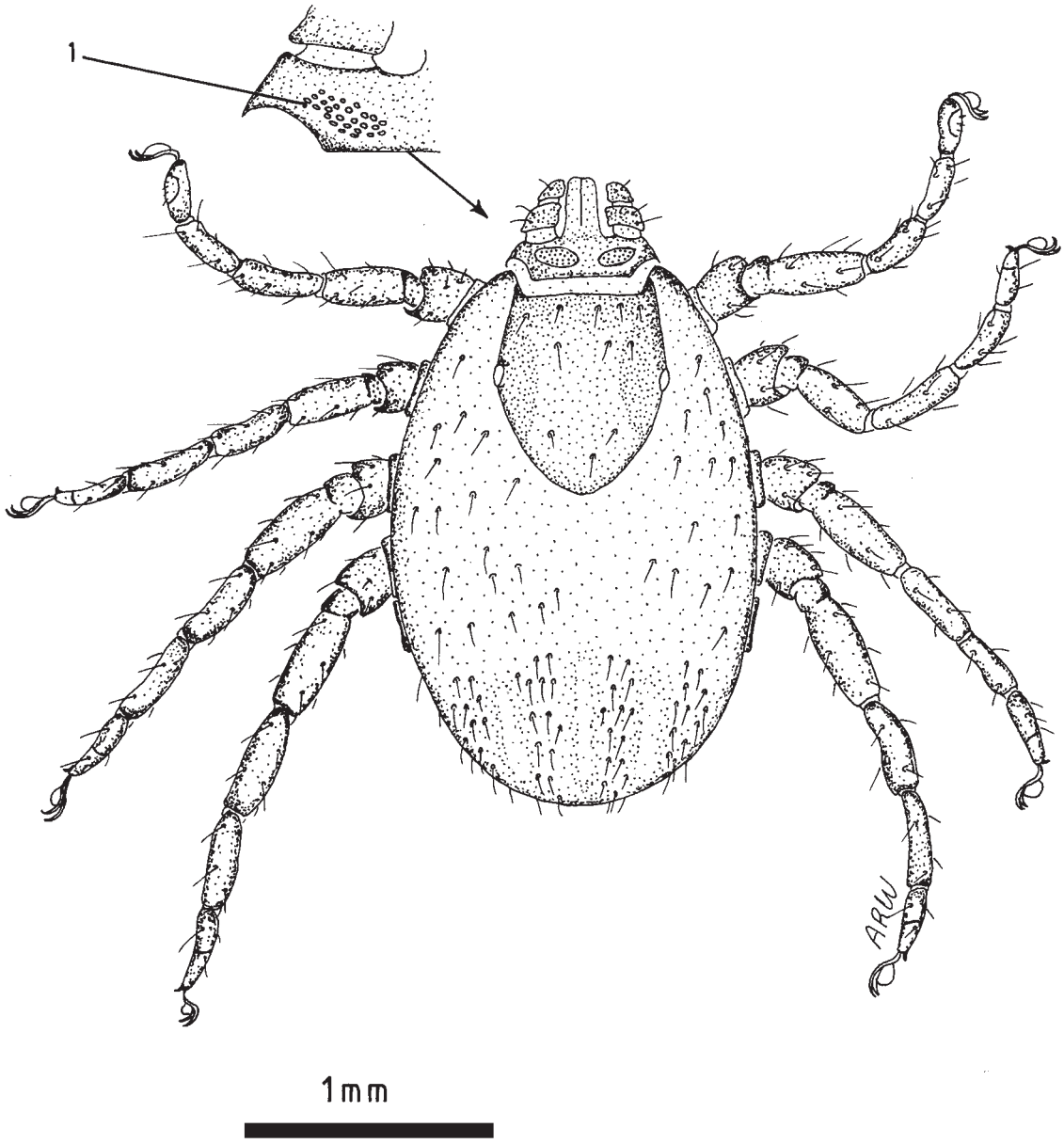
Disease.
Rhipicephalus (*Bo*.) *decoloratus* transmits the protozoan *Babesia bigemina*, causing bovine babesiosis (= redwater) in cattle. The *Babesia* is transmitted only by the nymph and adult after it has passed transovarially from the previous generation of ticks. Once established in the tick host, *Ba. bigemina* can be transmitted by many successive generations without their acquiring new infections. This tick transmits the bacteria *Anaplasma marginale*, the cause of bovine anaplasmosis (= gallsickness) and *Borrelia theileri*, the cause of spirochaetosis in cattle, sheep, goats and horses. Heavy infestations of *Rh*. (*Bo*.) *decoloratus* are likely to cause damage to hides and to reduce the rate of growth of cattle.

Habitat and distribution.
This tick species occurs in regions with savanna and temperate climates, typically in grasslands and wooded areas used as cattle pasture. It is very widely distributed in suitable habitats throughout Africa south of the Sahara. It tends to be absent from the drier areas of countries such as Namibia, South Africa and Botswana. In West Africa it occurs together with *Rh*. (*Bo*.) *annulatus* and *Rh*. (*Bo*.) *geigyi*; in East Africa and southern Africa it occurs together with *Rh*. (*Bo*.) *microplus*. It has not been recorded in Madagascar.

Distribution of *Rhipicephalus* (*Boophilus*) *decoloratus*.

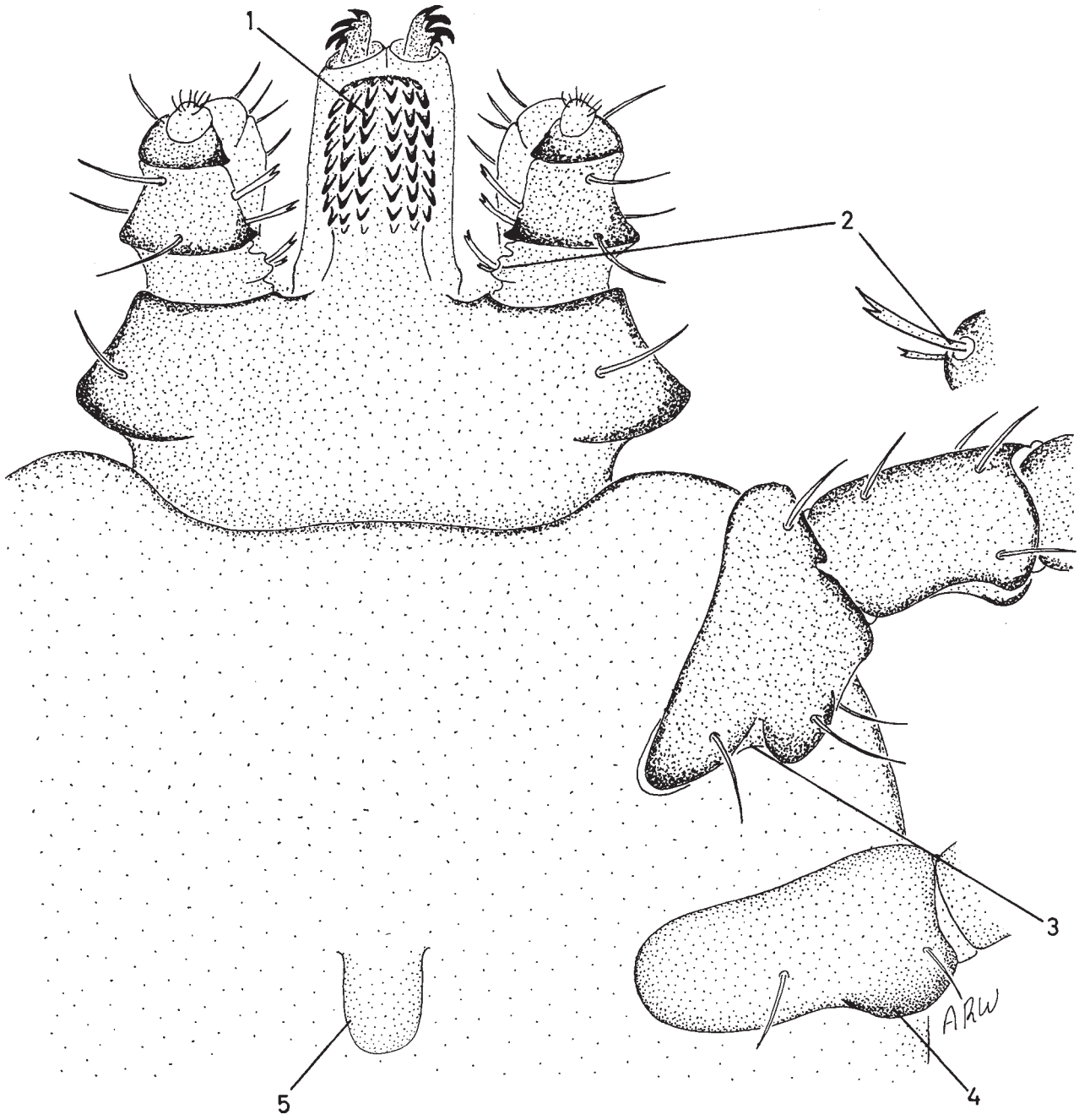


***Rhipicephalus* (*Boophilus*) *decoloratus* female, dorsal.**



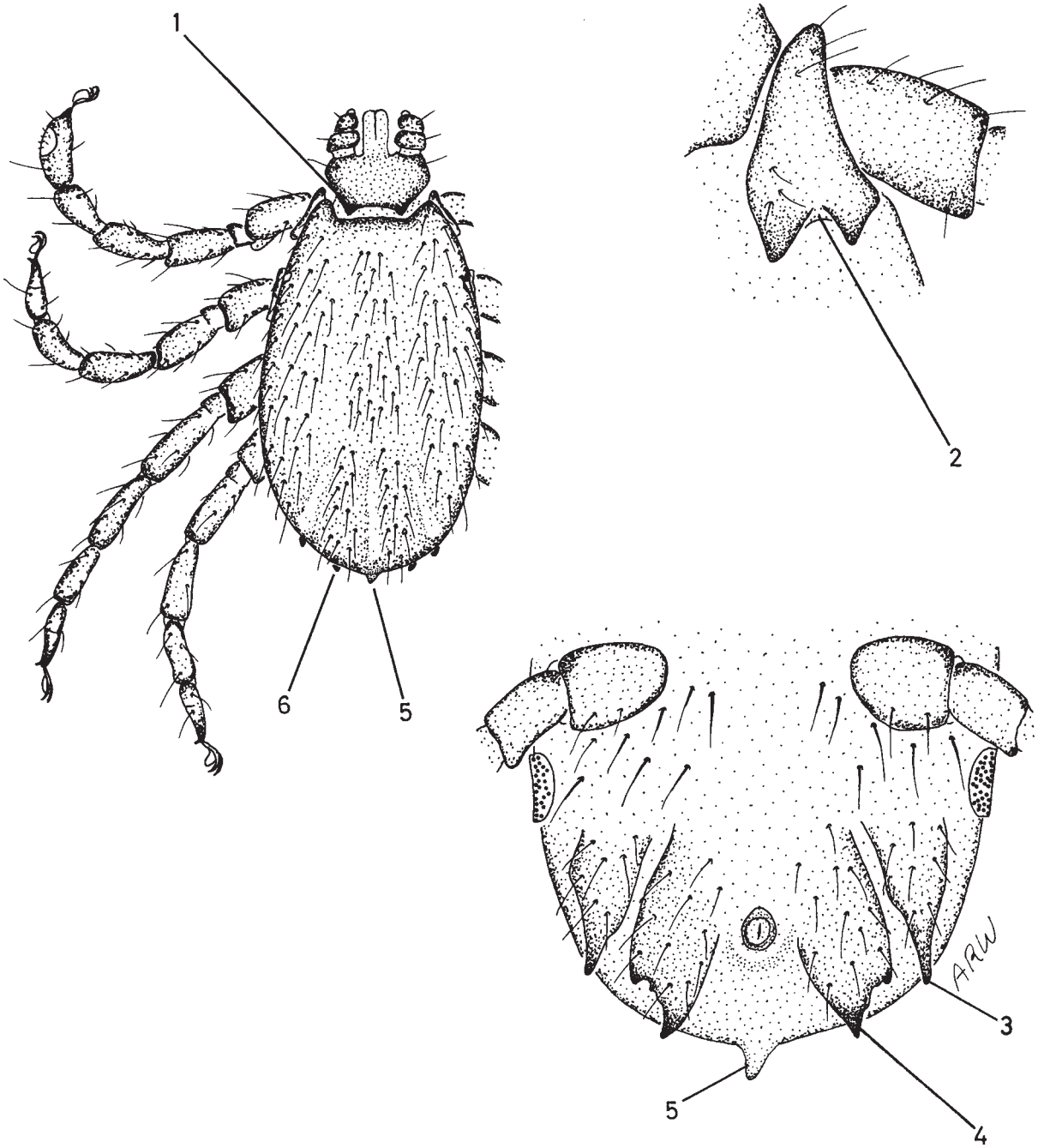
1 Porose areas shape is a narrow oval.

***Rhipicephalus* (*Boophilus*) *decoloratus* female, ventral, mouthparts, coxae and genital aperture.**



1 Hypostomal teeth are in 3 + 3 columns.
2 Palp articles 1 internal margin has a protuberance with pectinate setae.
3 Coxae 1 spurs are distinct.
4 Coxae 2 and 3 spurs are present.
5 Genital aperture posterior lips have a narrow **U** shape.

***Rhipicephalus* (*Boophilus*) *decoloratus* male, dorsal on left, coxa at top right, and ventral plates at bottom right.**



(Note: male mouthparts are similar to those shown for the female.)

1 Cornua are distinct.
2 Coxae 1 spurs length is short.
3 Ventral plate spurs are distinct (3 = accessory adanal plate).
4 Ventral plate spurs are distinct (4 = adanal plate).
5 Caudal appendage is narrow in males.
6 Ventral plate spurs are visible dorsally.

Rhipicephalus (*Boophilus*) *geigyi* (Aeschliman & Morel, 1965).

General.
Rhipicephalus (*Boophilus*) *geigyi* is a typical species within the sub-genus *Boophilus*. However, it has a much more limited distribution, being confined to West Africa. Another species, *Rhipicephalus* (*Boophilus*) *kohlsi*, has been reported from West Africa and is endemic to Near Eastearn countries but is of unknown importance to domestic animals and is not included in this guide.

The species in the *Boophilus* sub-genus, within the genus *Rhipicephalus*, are so well known in their original classification as members of the full genus *Boophilus* that the former names are likely to remain in use for many years without confusion. The character states that have been used for this sub-genus are separate from the rest of the genus *Rhipicephalus*.

Differential diagnosis.
Rhipicephalus (*Bo*.) *geigyi* is very similar to *Rh*. (*Boophilus*) *decoloratus* and needs to be distinguished from it because both species can be found in the same areas. *Rhipicephalus* (*Bo*.) *geigyi* has a protuberance bearing a seta on the internal margin of the first palp, similar to the appearance of *Rh*. (*Bo*.) *decoloratus*. However it has 4 + 4 columns of teeth on the hypostome in contrast to the 3 + 3 columns of *Rh*. (*Bo*.) *decoloratus*. In addition the males can also be distinguished by the cornua which in *Rh*. (*Bo*.) *geigyi* are indistinct in comparison with the more distinct cornua of *Rh*. (*Bo*.) *decoloratus*.

Hosts.
Cattle are the maintenance host of this tick. It is also found on sheep and wild ungulates.

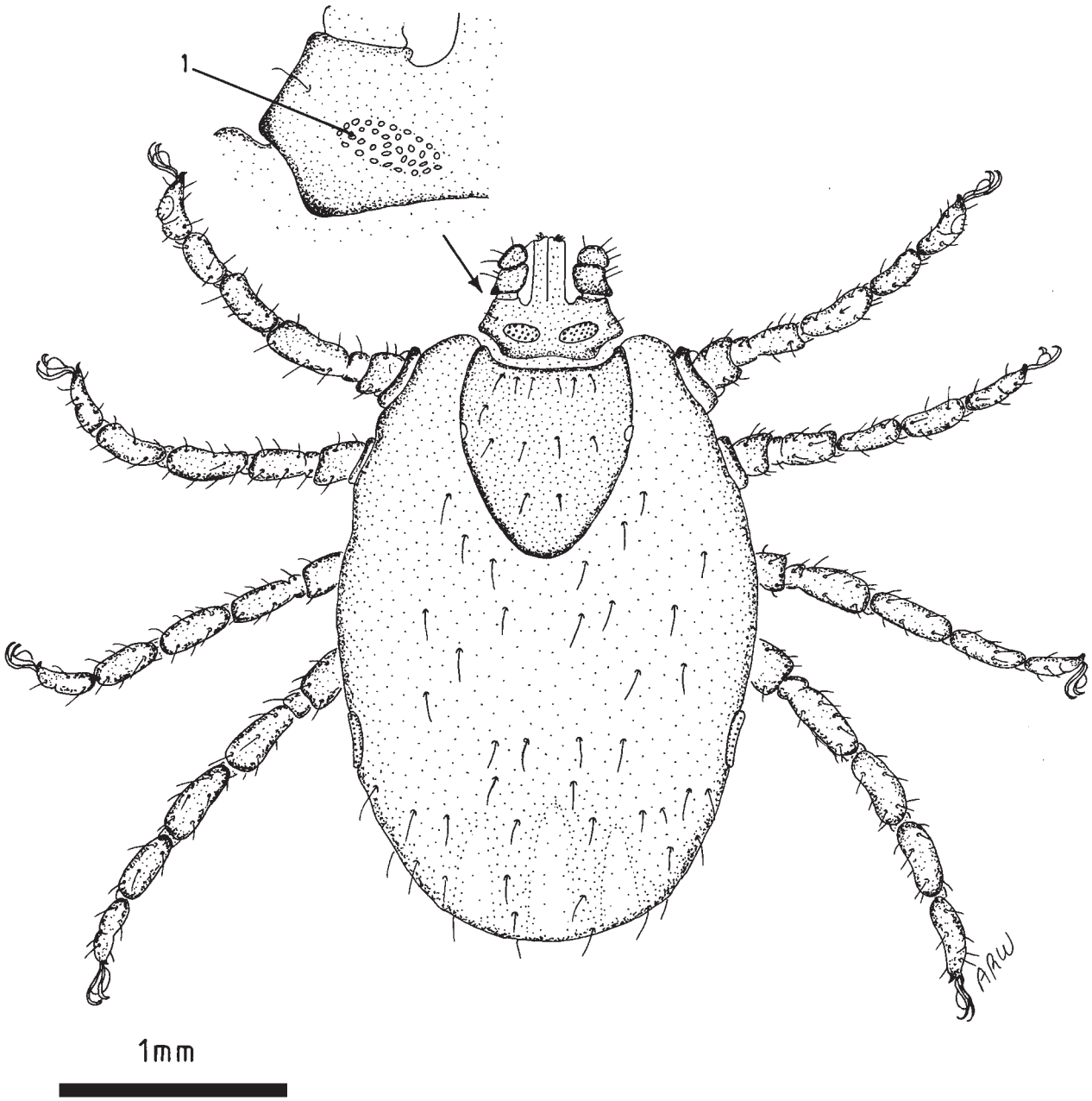
Life cycle and seasonal distribution.
This is a one-host tick with a monotropic type of behaviour. The feeding of all three stages on cattle takes approximately three weeks. Egg laying takes one month thus the life cycle can be completed in approximately two months and repeated generations can occur each year.

Disease.
The disease relationships of this tick are poorly known.

Habitat and distribution.
Rhipicephalus (*Bo*.) *geigyi* occurs in savanna climatic regions with warm humid wooded grasslands and is probably most common when such areas are used as cattle pasture. This tick occurs mainly in West Africa, with a scattered populations eastwards to Uganda.

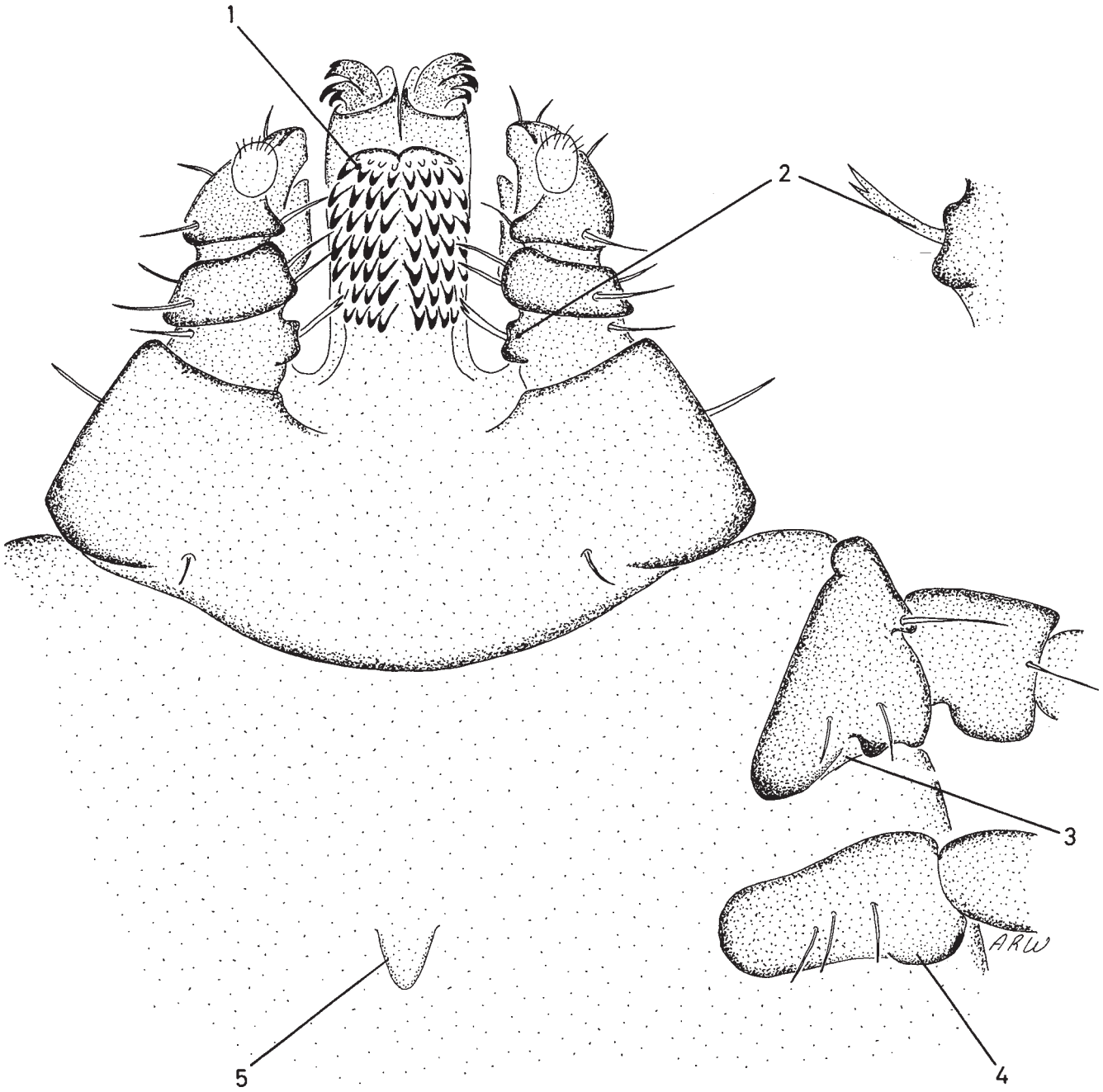
Distribution of *Rhipicephalus* (*Boophilus*) *geigyi*.

***Rhipicephalus* (*Boophilus*) *geigyi* female, dorsal.**



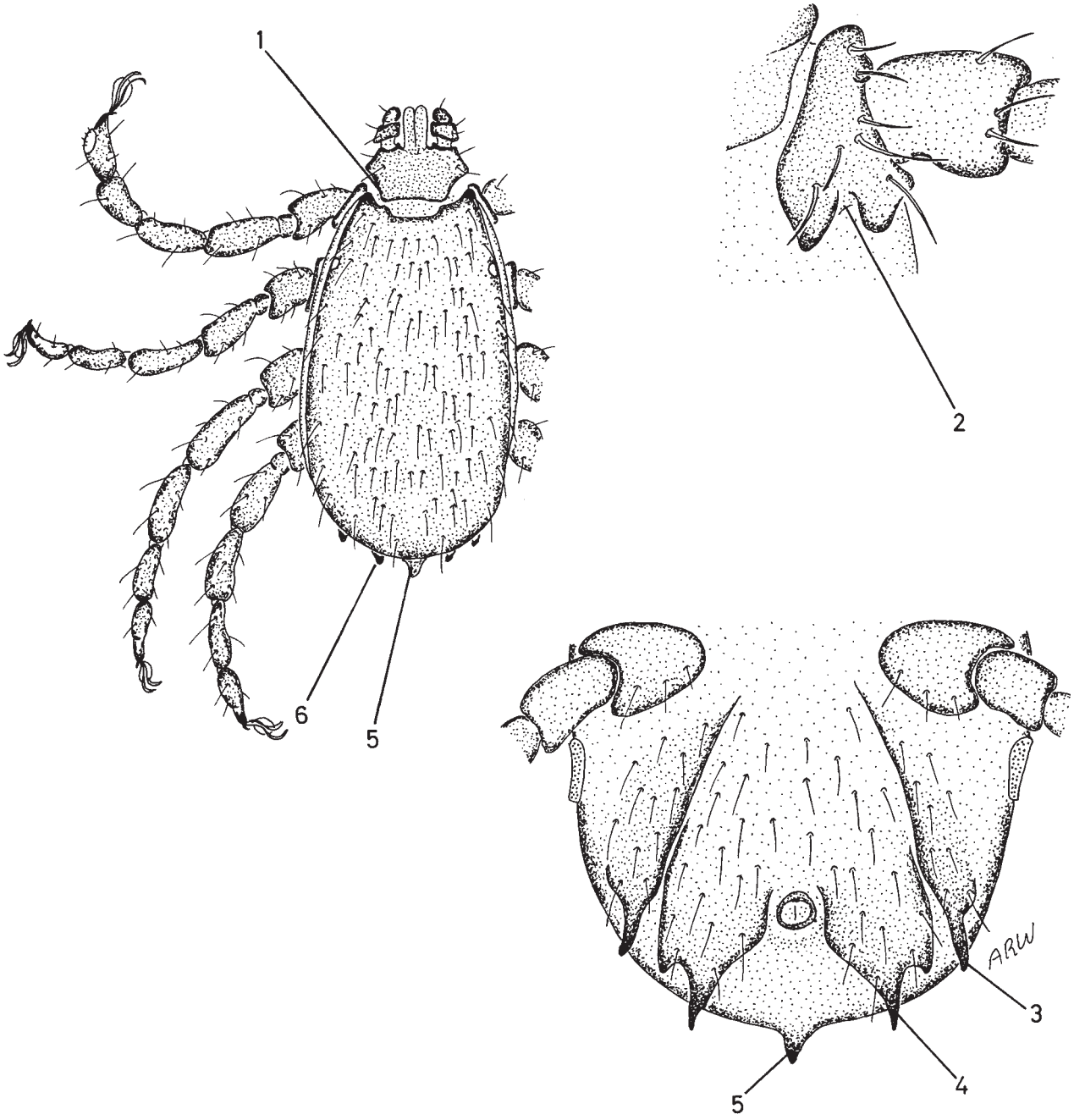
1 Porose areas shape is a narrow oval.

***Rhipicephalus* (*Boophilus*) *geigyi* female, ventral, mouthparts, coxae and genital aperture.**



1 Hypostomal teeth are in 4 + 4 columns.
2 Palp articles 1 internal margin has a protuberance with a pectinate seta.
3 Coxae 1 spurs are distinct.
4 Coxae 2 and 3 spurs are present.
5 Genital aperture posterior lips have a narrow **V** shape.

***Rhipicephalus* (*Boophilus*) *geigyi* male, dorsal on left, coxa at top right, and ventral plates at bottom right.**



(Note: male mouthparts are similar to those shown for the female.)

1 Cornua are indistinct.
2 Coxae 1 spurs length is short.
3 Ventral plate spurs are distinct (3 = accessory adanal plate).
4 Ventral plate spurs are distinct (4 = adanal plate).
5 Caudal appendage is narrow in males.
6 Ventral plate spurs are visible dorsally.

Rhipicephalus (*Boophilus*) *microplus* (Canestrini, 1888).

General.
In many parts of the world *Rhipicephalus* (*Boophilus*) *microplus* is known simply as The cattle tick. This is specially so where it has spread from its origin in south east Asia to major cattle ranching areas like South America. This spread has been accidental, on commercial cattle transportations. In Africa this tick has established in much of southern and eastern Africa and it is widespread in Madagascar. *Rhipicephalus* (*Bo*.) *microplus* is more dangerous than *Rh*. (*Boophilus*) *decoloratus* because it transmits both *Babesia bovis* and *Babesia bigemina*, in comparison to *Rh*. (*Bo*.) *decoloratus* which transmits only *Ba. bigemina*, the less pathogenic of the two protozoans. For this reason the ability to identify *Rh*. (*Bo*.) *microplus* is most important as an aid to prevention of the spread of *Ba. bovis*.

This tick species and the others in the *Boophilus* sub-genus within the genus *Rhipicephalus* are so well known in their original classification as members of the full genus *Boophilus* that the former names are likely to remain in use for many yers without confusion. The character states that have been used for this sub-genus are separate from the rest of the genus *Rhipicephalus*.

Differential diagnosis.
It is necessary to distinguish *Rh*. (*Bo*.) *microplus* from *Rh*. (*Bo*.) *decoloratus* because they are likely to be found together in southern and eastern Africa. *Rhipicephalus* (*Bo*.) *microplus* has 4 + 4 columns of teeth on its hypostome and *Rh*. (*Bo*.) *decoloratus* has only 3 + 3 columns. *Rhipicephalus* (*Bo*.) *microplus* has no protuberance bearing setae on the inner margin of palp article 1 but this protuberance is present in *Rh*. (*Bo*.) *decoloratus*. *Rhipicephalus* (*Bo*.) *microplus* is very similar to *Rh*. (*Boophilus*) *annulatus*, but their distributions do not overlap in Africa. To differentiate these two species it is simplest to examine the males, *Rh*. (*Bo*.) *microplus* has a caudal appendage, *Rh*. (*Bo*.) *annulatus* has none.

Hosts.
Cattle are probably the only effective hosts of this tick to maintain a population. Provided cattle are present, other livestock and wildlife may also be parasitized. Infestations are found on belly, dewlap, shoulders and flanks.

Life cycle and seasonal occurrence.
Rhipicephalus (*Bo*.) *microplus* is a one-host tick with a monotropic type of behaviour. The time spent by the three stages on the host is about three weeks and egg laying can be completed in about four weeks. This is faster than *Rh*. (*Bo*.) *decoloratus*, moreover female *Rh*. (*Bo*.) *microplus* lay approximately 500 eggs more than *Rh*. (*B*.) *decoloratus* females. The steady spread of *Rh*. (*Bo*.) *microplus* in Africa is assisted by this higher reproductive potential which enables it to compete successfully against *Rh*. (*Bo*.) *decoloratus* where these ticks occur together in climates that are most favourable to *Rh*. (*Bo*.) *microplus*. Large numbers of larvae are usually present on the vegetation in late spring, and successive generations of larvae then occur through the summer and into the cooler autumn and early winter months.

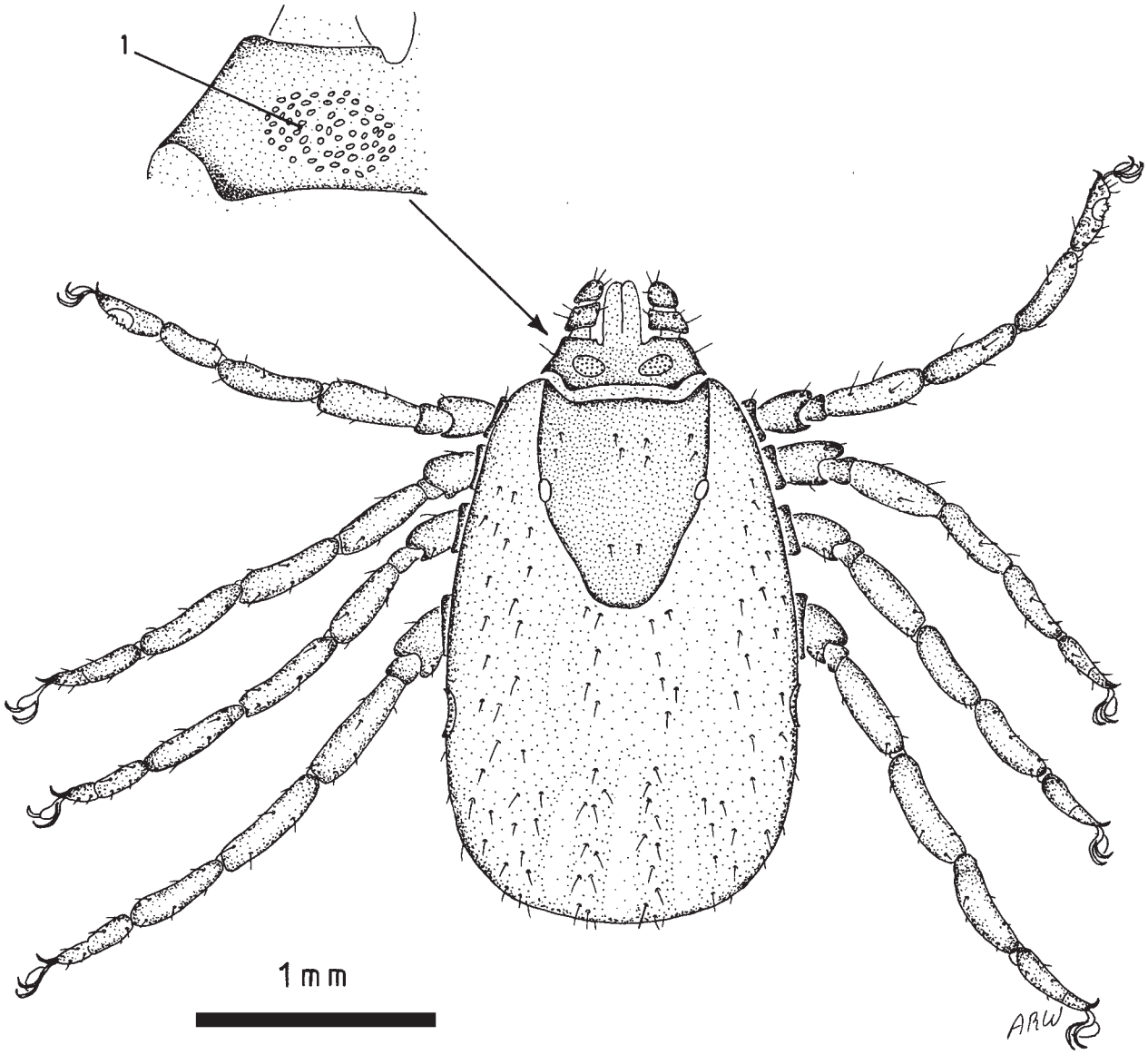
Disease.
Rhipicephalus (*Bo*.) *microplus* transmits the protozoans *Ba. bovis* and *Ba. bigemina*, causing bovine babesiosis (= redwater) in cattle. *Babesia bovis* infection is acquired by the adults of one generation of ticks and is transmitted transovarially by the larvae of the next generation. This tick transmits the bacteria *Anaplasma marginale* causing anaplasmosis (= gallsickness) in cattle, and *Borrelia theileri* which cause spirochaetosis in cattle. Heavy infestations will directly lead to commercially important damage to hides by the formation of scar tissue (= granuloma) at the feeding sites. Experiments in Australia have shown that for each female tick that completes feeding there is a loss of 0.6g of potential growth by cattle.

Habitat and distribution.
This tick species occurs in savanna climatic regions where there are habitats of wooded grassland used as cattle pasture. It has been suggested that *Rh*. (*Bo*.) *microplus* was introduced into East and South Africa from Madagascar, where it had originally arrived with cattle from south east Asia. In South Africa it is now established in scattered areas along the southern and eastern coasts of the Western and Eastern Cape Provinces and of KwaZulu-Natal. In the interior it is found in Mpumalanga and Northern Provinces. Further north it occurs in parts of the eastern and central provinces of Zambia, throughout Malawi and to the east and north of Lake Malawi in Tanzania. It is also present in the coastal regions of Mozambique and Tanzania and has spread into the southern coastal strip of Kenya.

Since 2007 this highly invasive tick has been found in West Africa: southern districts of Ivory Coast and Benin.

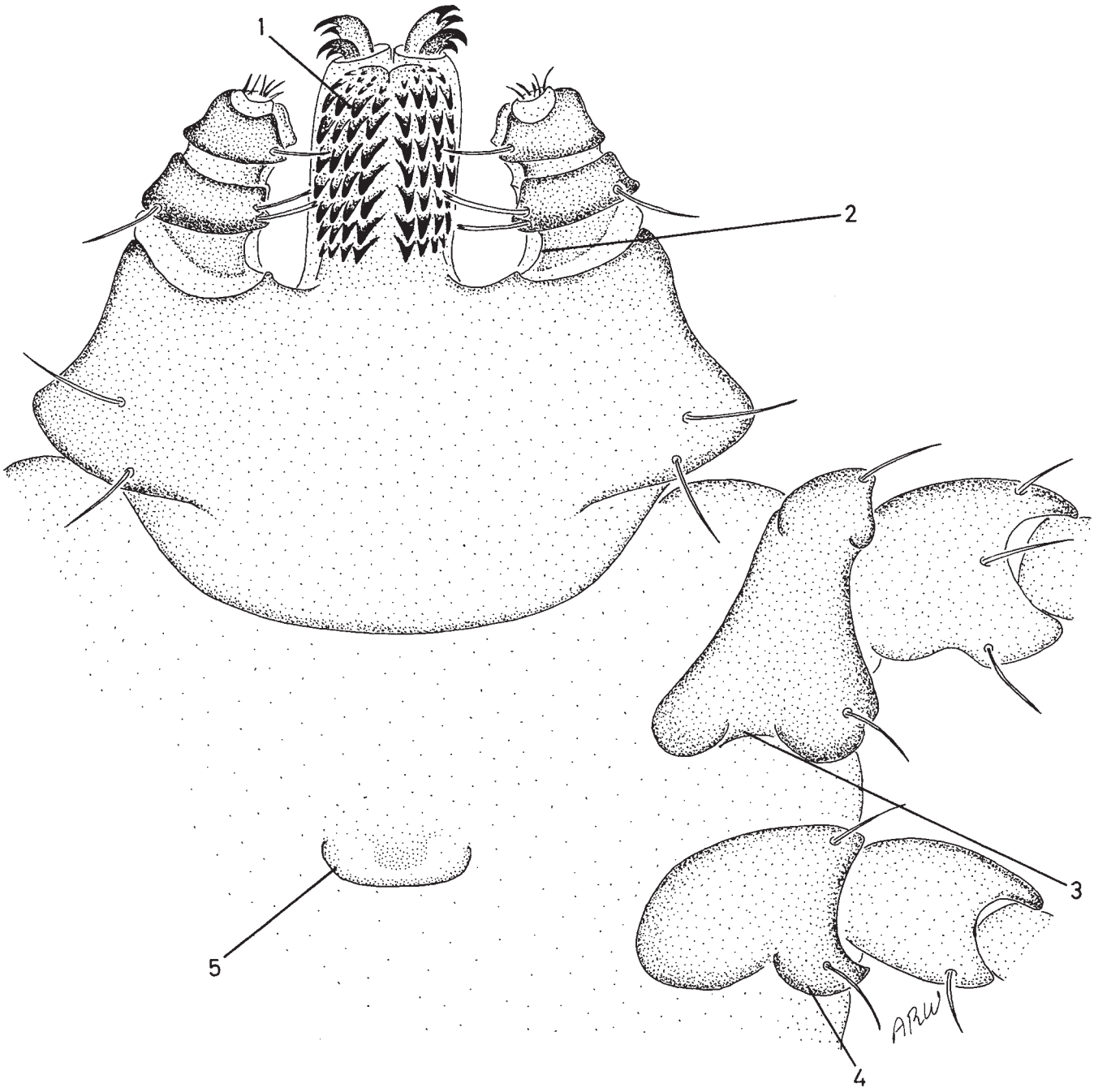
Distribution of *Rhipicephalus* (*Boophilus*) *microplus*.

***Rhipicephalus* (*Boophilus*) *microplus* female, dorsal.**



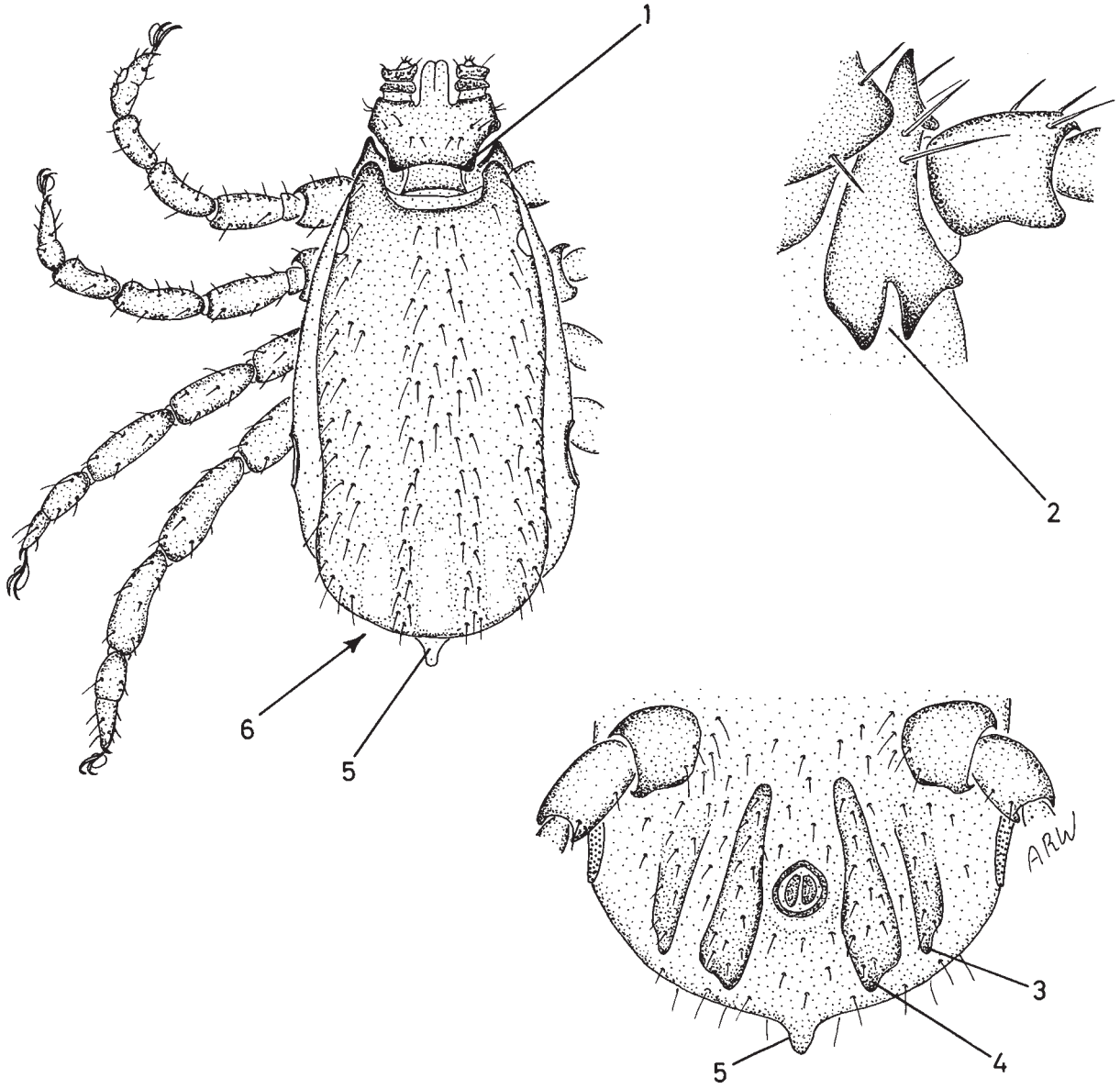
1 Porose areas shape is a broad oval.

***Rhipicephalus* (*Boophilus*) *microplus* female, ventral.**



1 Hypostomal teeth are in 4 + 4 columns.
2 Palp articles 1 internal margin has no protuberance and is short and distinctly concave.
3 Coxae 1 spurs are distinct.
4 Coxae 2 and 3 spurs are present.
5 Genital aperture posterior lips have a broad **U** shape.

***Rhipicephalus* (*Boophilus*) *microplus* male, dorsal on left, coxa at top right, and ventral plates at bottom right.**



(Note: male mouthparts are similar to those shown for the female.)

1 Cornua are distinct.
2 Coxae 1 spurs length is long (also the anterior spurs of coxae 1 are conspicuous dorsally).
3 Ventral plate spurs are indistinct (3 = accessory adanal plate).
4 Ventral plate spurs are indistinct (4 = adanal plate).
5 Caudal appendage is narrow in males.
6 Ventral plate spurs are not visible dorsally.

Rhipicephalus appendiculatus Neumann, 1901.

General.
Rhipicephalus appendiculatus is also known as The brown ear tick because of its colour and preference for feeding on the ears of cattle. It has has been the subject of many studies aimed at its control because of its association with East Coast fever of cattle.

Differential diagnosis.
Species similar to *Rh. appendiculatus* are: *Rhipicephalus punctatus*, *Rhipicephalus pravus*, *Rhipicephalus zambeziensis* and *Rhipicephalus duttoni*. The males of all these species have a prominent anterior spur on coxa 1which is visible from the dorsal side. Compared to the above species male *Rh. appendiculatus* have broader cervical fields with sharply raised margins, fewer punctations, slightly convex eyes and the posterior grooves are not deeply sunken. Female *Rh. appendiculatus* have cervical fields similar to the male, fewer punctations, slightly convex eyes and the genital pore is a shallow **V** shape. Two *Rhipicephalus* species may be confused with *Rh. appendiculatus*, because of their occurrence on cattle in East African environments with a temperate highland climate: *Rhipicephalus jeanneli* and *Rhipicephalus hurti*. Both sexes of this pair of ticks are without the distinct cervical fields of *Rh. appendiculatus*. Also very similar to *Rh. appendiculatus* is *Rhipicephalus duttoni* but this tick occurs separately in western Angola and into neighbouring countries.

Hosts.
Cattle, goats, buffaloes, elands, waterbucks, nyalas, greater kudus and sable antelopes are the main hosts. Dogs and sheep are also infested. This tick has become well adapted to the presence of domestic cattle and can be maintained by all stages feeding on cattle. Immature ticks can feed on smaller antelopes and scrub hares, thus this tick species has a telotropic type of behaviour with a tendency to the monotropic type. The adults prefer to feed on the ear pinna but not in the ear canal. In heavy infestations adults are also found around the eyelids and horns, on the upper neck, in the tail-brush and around the anus. On cattle the immature stages attach mainly on the neck and dewlap, the cheeks, eyelids, muzzle and ears.

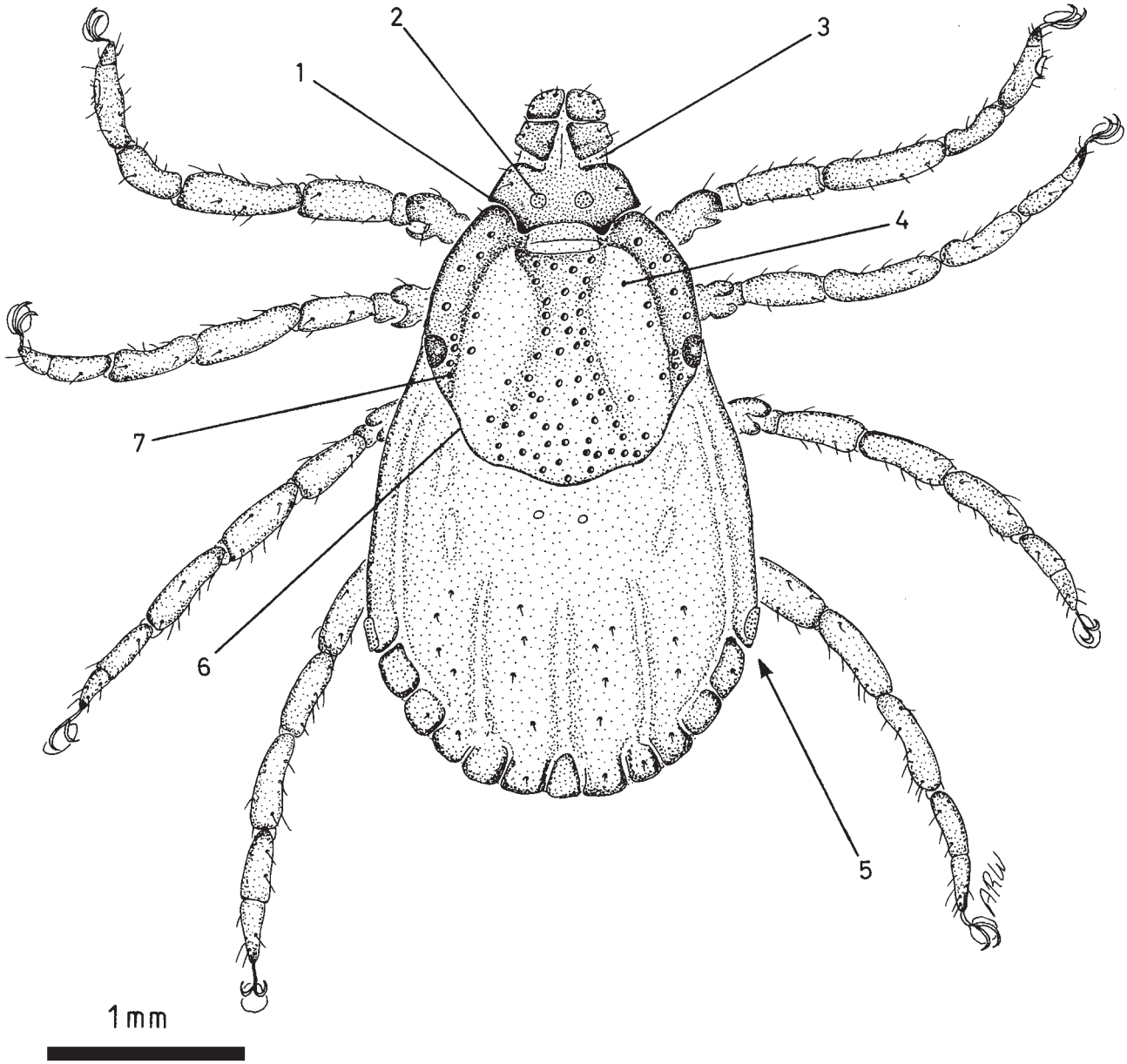
Life cycle and seasonal occurrence.
Rhipicephalus appendiculatus is a three-host tick. All stages of development engorge within 4 to 7 days. The engorged female lays 3 000 to 5 000 eggs. These hatch in 20 to 90 days. The whole life cycle can be completed in three months under the most favourable conditions. In southern Africa *Rh. appendiculatus* has a strictly seasonal, single generation. Adults occur during the rainy period (December to March), larvae in the cooler late summer to winter period after the rains (April to August) 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 of the behavioural type and do not engage in host-seeking until the rains start. In hot regions close to the equator with rainfall more evenly spread during the year, several overlapping generations can be completed annually and no clear pattern of seasonal abundance may be evident.

Disease.
Rhipicephalus appendiculatus transmits the protozoan *Theileria parva*, the cause of East Coast fever in cattle, and it transmits the different strains of *Th. parva* that cause Corridor or Buffalo disease and Zimbabwean theileriosis. It transmits *Theileria taurotragi* causing benign bovine theileriosis. Bacteria transmitted are *Anaplasma bovis* (=*Ehrlichia bovis*) causing bovine ehrlichiosis, and *Rickettsia conorii* causing tick typhus in humans. The virus causing Nairobi sheep disease is transmitted. Heavy infestions cause reduction of weight gain and immune suppression.

Habitat and distribution.
Rhipicephalus appendiculatus is characteristic of savanna and temperate climatic regions, ranging from hot coastal areas to cool highland plateau as long as the climate is humid. It is found from southern Sudan, through to the south eastern coast of South Africa. There is controversy over how far west it extends but it is reliably recorded from western Zambia and central Democratic Republic of Congo. In South Africa it is present in the Northern, North West, Gauteng and Mpumalanga Provinces, the coastal regions of KwaZulu-Natal and Eastern Cape Province down to Grahamstown. There are also foci in the Ermelo and Carolina districts in Mpumalanga and Vredefort in the Free State. The map below is derived from historical records; in some countries such as South Africa *Rh. appendiculatus* has been subject to prolonged and intensive control treatments and its current distribution may differ from that indicated.

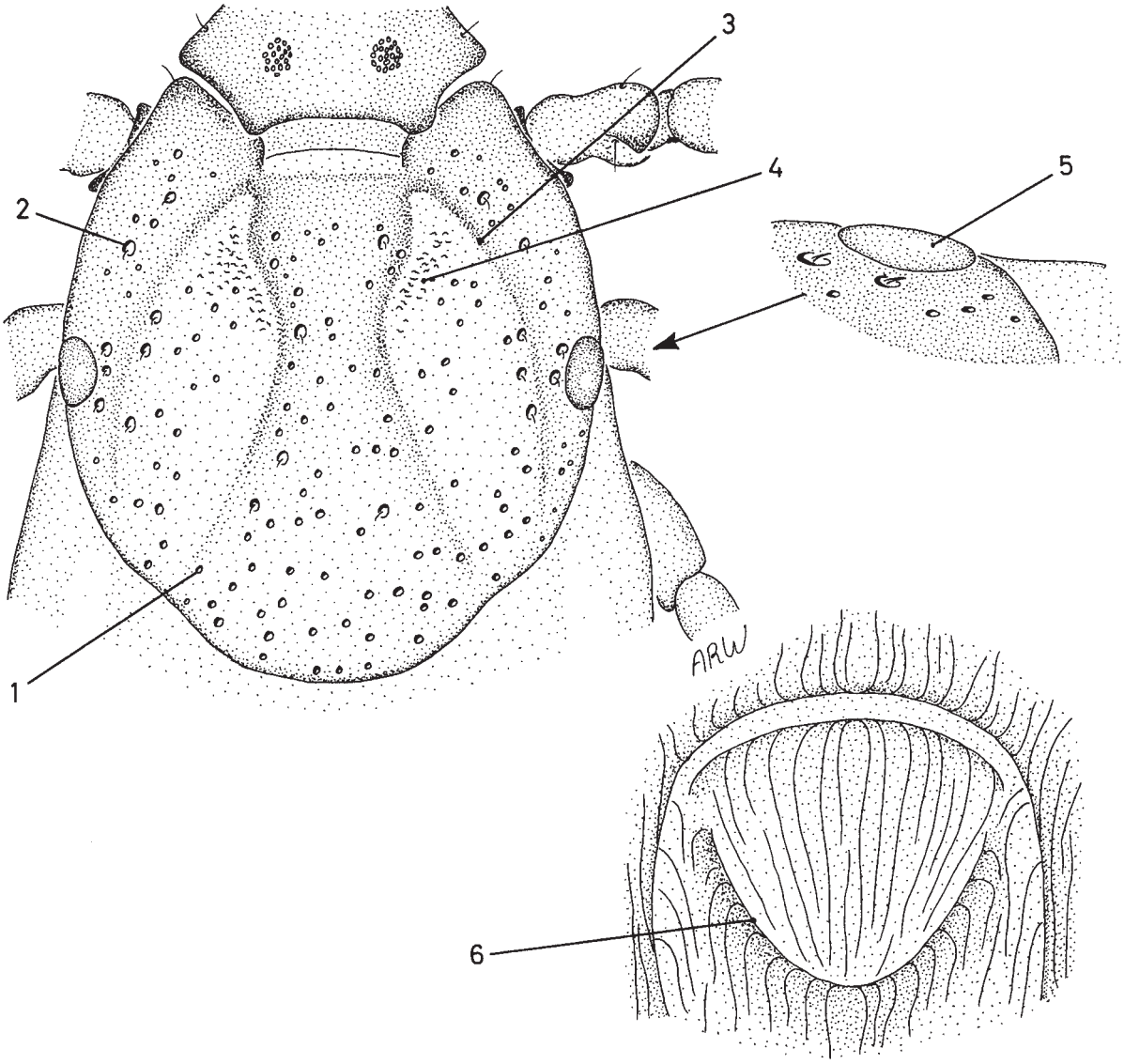
Distribution of *Rhipicephalus appendiculatus*.

Rhipicephalus appendiculatus **female**, **dorsal**.



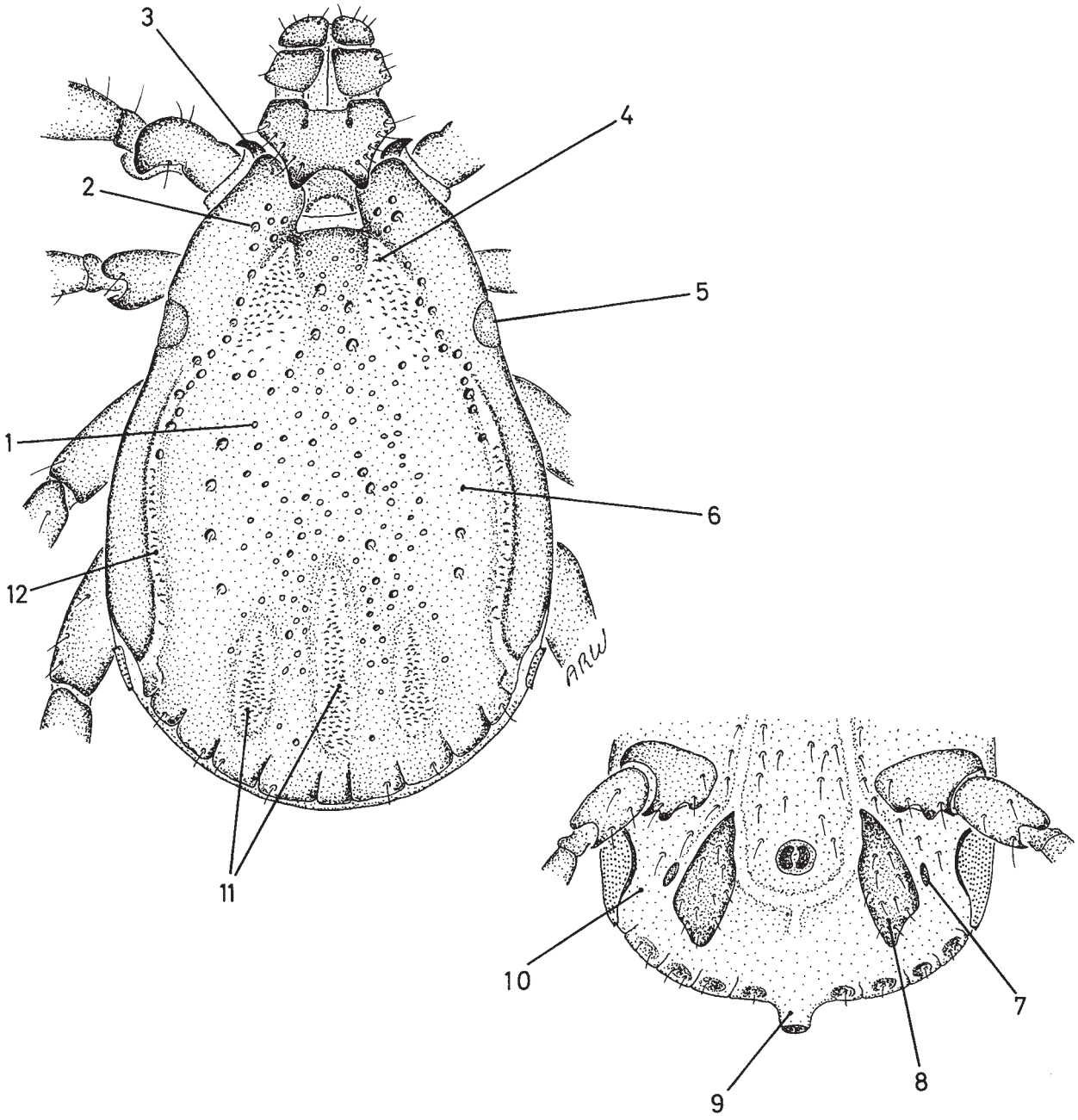
1 Basis capituli lateral angles are blunt.
2 Porose areas separation is broad.
3 Palp pedicels are short.
4 Cervical fields shape is large and curved.
5 Spiracle areas have sparse setae (not shown).
6 Scutum posterior margin is distinctly sinuous.
7 Scutum colour is dark.

***Rhipicephalus appendiculatus* female, scutum at top left, genital aperture at bottom right.**



1 Interstitial punctation size is small to medium. Interstitial punctations distribution is sparse.
2 Setiferous punctations are indistinct.
3 Scapular grooves profile is shallow.
4 Cervical fields texture has wrinkled areas.
5 Eyes are slightly convex.
6 Genital aperture has posterior lips forming a broad **V** shape.

Rhipicephalus appendiculatus **male**, **conscutum at top left**, **ventral plates at bottom right**.



1 Interstitial punctation size is small to medium. Interstitial punctation is sparse.
2 Setiferous punctations are indistinct.
3 Coxae 1 anterior spurs are visible dorsally.
4 Cervical fields depression is apparent. Cervical fields texture has wrinkled areas.
5 Eyes are slightly convex (as shown for the female).
6 Conscutum colour is dark.
7 Accessory adanal plates are small.
8 Adanal plates shape is narrow and trapezoid.
9 Caudal appendage is narrow in fed males.
10 Spiracle areas have sparse setae.
11 Posterior grooves are distinct (shallow and with wrinkled texture).
12 Lateral grooves type is a distinct groove. Lateral grooves texture is wrinkled.

Rhipicephalus bursa Canestrini & Fanzago, 1878.

General.
Rhipicephalus bursa is one of the common *Rhipicephalus* species of livestock in northern Africa.

Differential diagnosis.
This is a highly distinctive species of *Rhipicephalus*. The male has a combination of an anterior spur on coxa 1 which is visible dorsally, a conscutum without apparent cervical fields, distinct lateral and posterior grooves, a densely punctate scutum and broad adanal plates. The scutum of the female is similar to the conscutum of the male in being densely punctate and without apparent cervical fields. Both sexes have a highly characteristic concentration of setae around the spiracles. *Rhipicephalus bursa* occurs in the same areas and on the same hosts as *Rhipicephalus turanicus* but this latter tick has no spurs on coxa 1 visible dorsally in the male and the male's adanal plates are narrow and trapezoid. Neither female nor male of *Rh. turanicus* have dense setae around the spiracles.

Hosts.
Sheep, goats, cattle, horses are the preferred hosts of *Rh. bursa*. Adult ticks feed on the tail, groin and udder. The preferred sites of attachment on sheep are the inner and outer surfaces of the ears, the udder and at peri-anal and groin regions. This tick usually has a monotropic type of behaviour, with immature stages feeding on the same host species as the adult tick stages. However, the immature stages can also feed on rodents and rabbits.

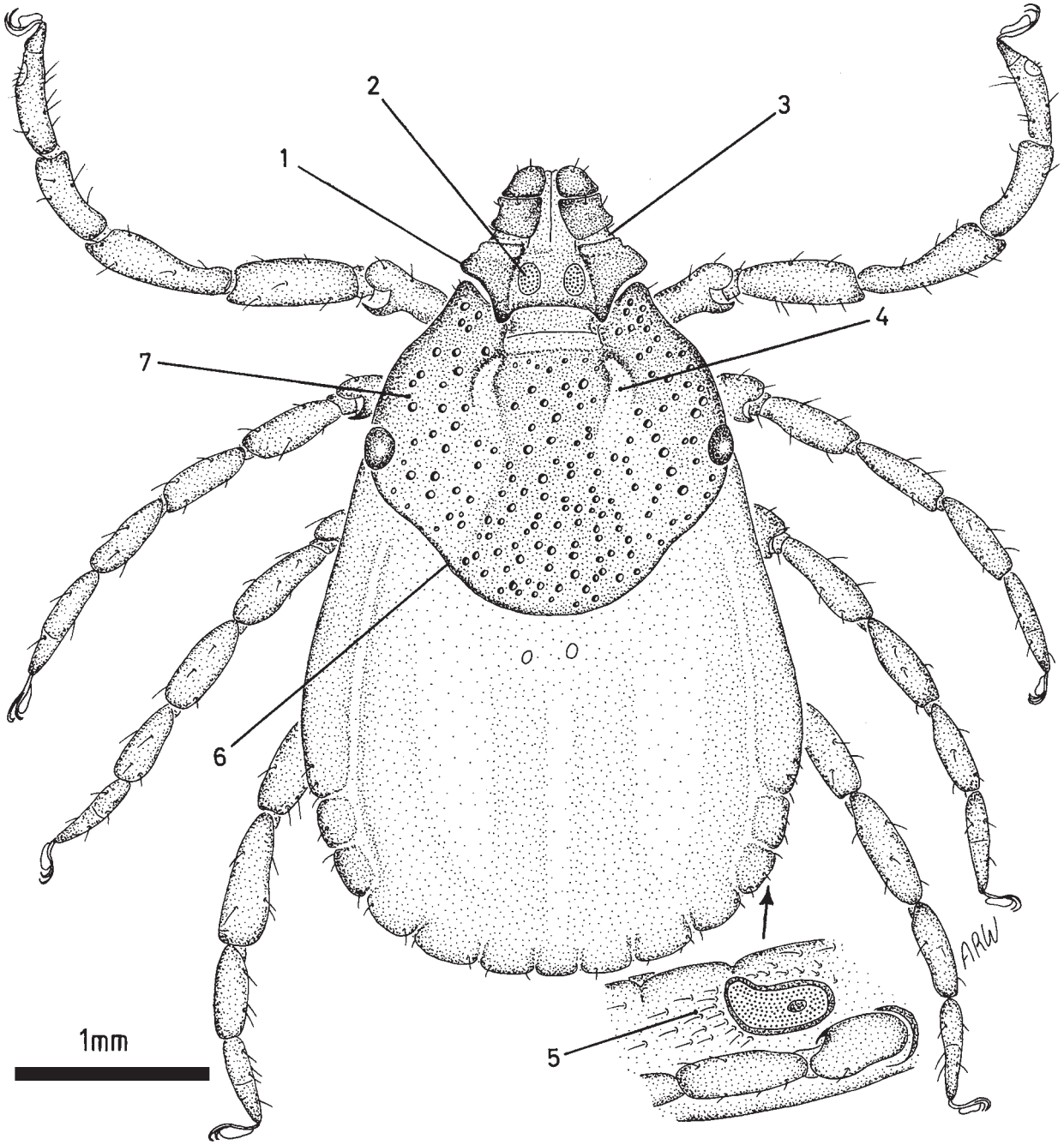
Life cycle and seasonal occurrence.
Rhipicephalus bursa is a two-host species. Only one life cycle is completed in a year.

Disease.
Rhipicephalus bursa transmits the protozoans *Babesia bigemina* and *Babesia bovis* to cattle, causing babesiosis. It transmits *Babesia caballi* and *Theileria equi* (= *Babesia equi*) to horses, both causing forms of equine piroplasmosis, and *Babesia ovis* to sheep, causing ovine babesiosis. It also transmits *Anaplasma* bacteria to cattle and sheep, causing anaplasmosis.

Habitat and distribution.
This is a tick of the Mediterranean climatic region in the basins of the Mediterranean, Black and Caspian seas. In Africa it is confined to the coastal areas from Morocco to Libya.

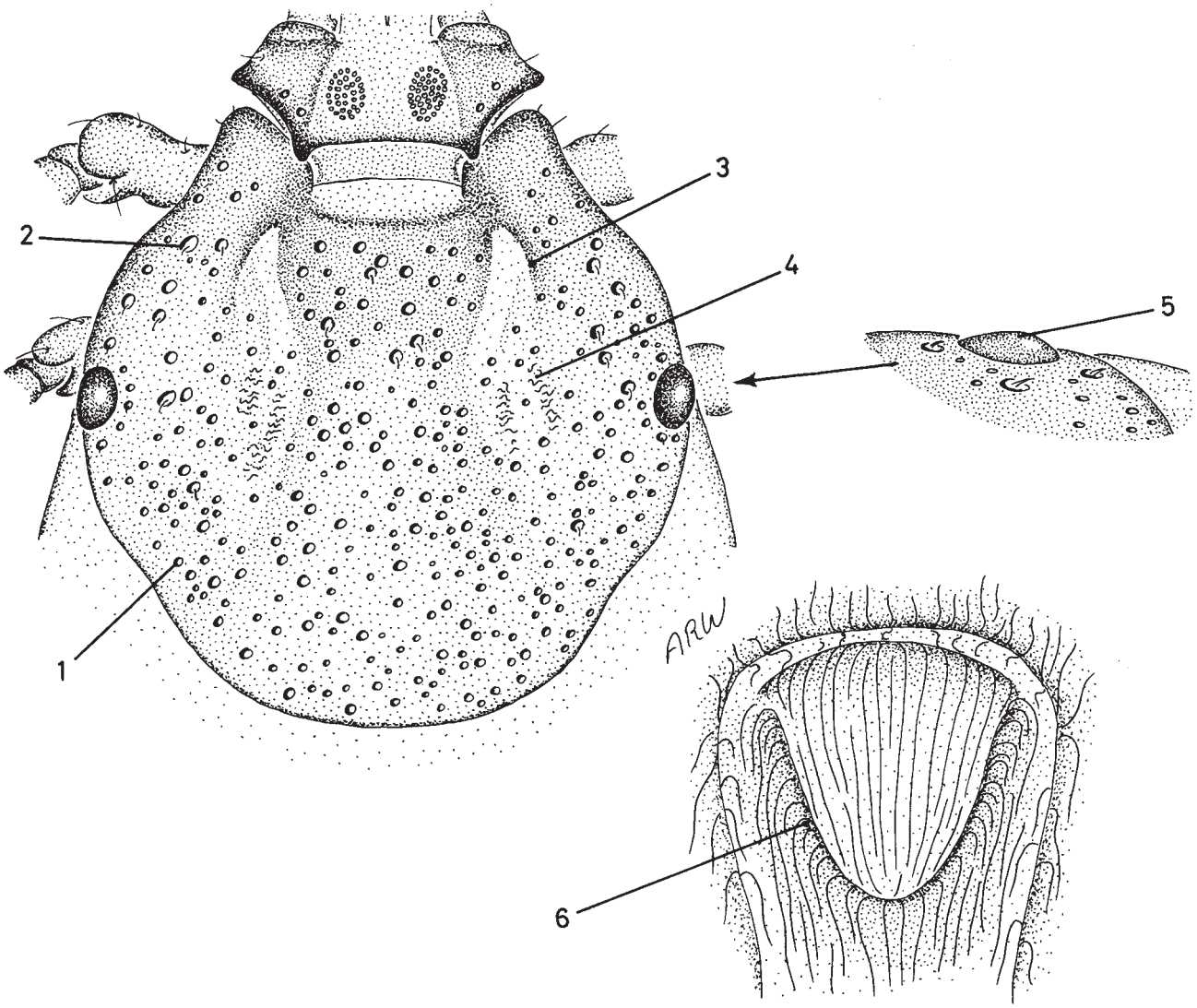
Distribution of *Rhipicephalus bursa*.

***Rhipicephalus bursa* female, dorsal.**



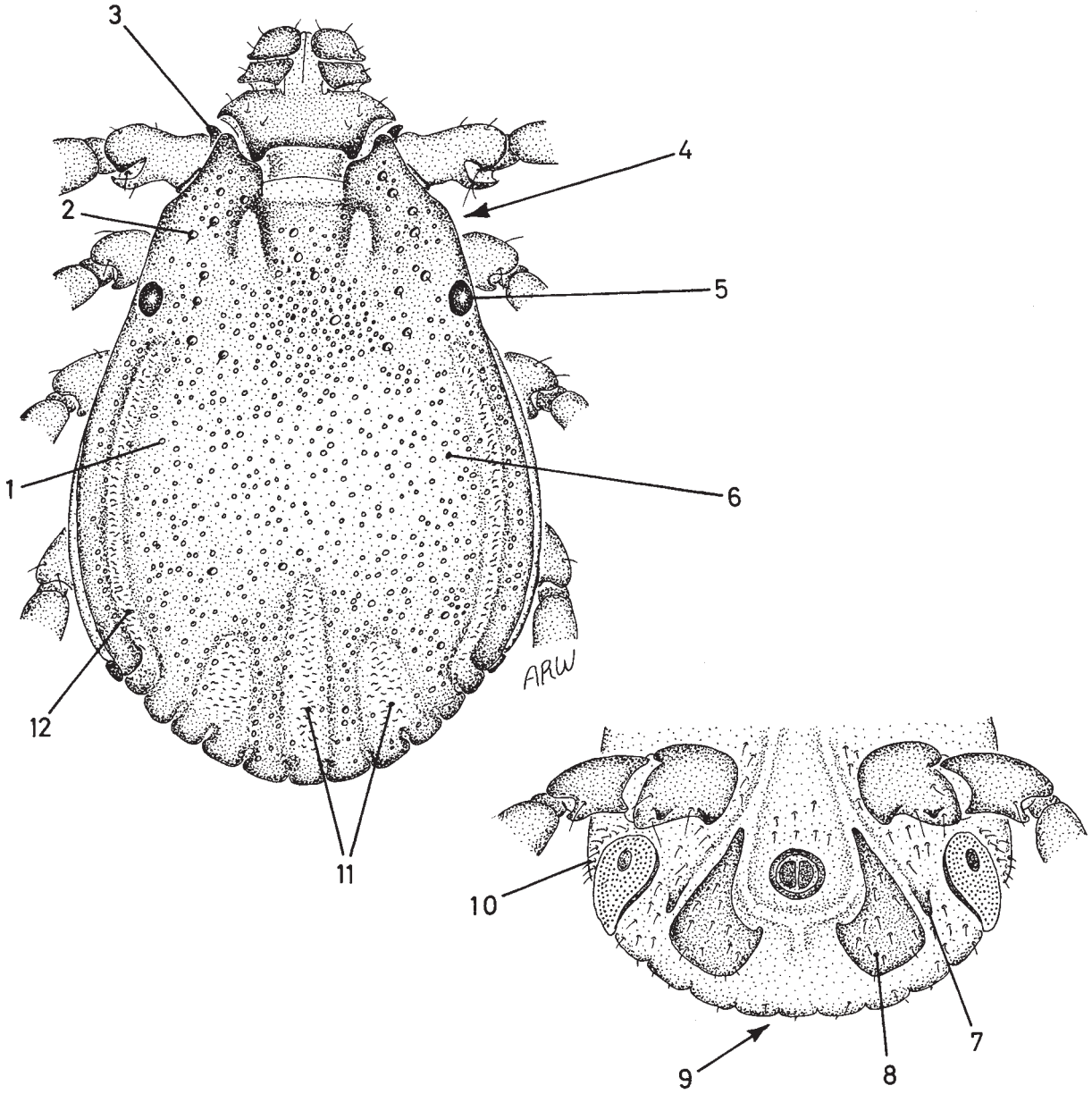
1 Basis capituli lateral angles are sharp.
2 Porose areas separation is narrow.
3 Palp pedicels are short.
4 Cervical fields shape is not apparent.
5 Spiracle areas have dense setae.
6 Scutum posterior margin is distinctly sinuous.
7 Scutum colour is dark.

***Rhipicephalus bursa* female, scutum at top left, genital aperture at bottom right.**



1 Interstitial punctation size is medium to large. Interstitial punctation distribution is dense.
2 Setiferous punctations are indistinct.
3 Scapular groove profile is shallow.
4 Cervical fields texture has wrinkled areas.
5 Eyes are distinctly convex.
6 Genital aperture posterior lips have a narrrow **V** shape.

Rhipicephalus bursa **male**, **dorsal at top left**, **ventral plates at bottom right**.



1 Interstitial punctation size is medium to large. Interstitial punctation distribution is dense.
2 Setiferous punctations are indistinct.
3 Coxa 1 anterior spurs are visible dorsally.
4 Cervical fields depression is not apparent. Cervical fields texture has no wrinkles.
5 Eyes are distinctly convex (as shown for the female).
6 Conscutum colour is dark.
7 Accessory adanal plates are small.
8 Adanal plates shape is broad and curved.
9 Caudal appendage in fed males: no information.
10 Spiracle areas have dense setae.
11 Posterior grooves are distinct (shallow with a slightly wrinkled texture).
12 Lateral grooves type is a distinct groove (almost reaching the eyes). Lateral grooves texture is wrinkled.

Rhipicephalus camicasi Morel, Mouchet & Rodhain, 1976.

General.
Rhipicephalus camicasi is a recently described species about which relatively little is known. It is important to be able to distinguish it from *Rhipicephalus sanguineus* in the areas where both occur.

Differential diagnosis.
This tick belongs to the *Rh. sanguineus* group. It closely resembles the other members of this group, those described in this guide are: *Rh. sanguineus*, *Rhipicephalus guilhoni* and *Rhipicephalus turanicus*. In *Rh. camicasi* the scapular groove profile of females is shallow and in males the cervical fields depression is apparent. In female *Rh. camicasi* the genital aperture posterior lips have a narrow **U** shape whilst they are broadly **U** shaped in *Rh. sanguineus* and a truncated **V** shape in *Rh. guilhoni* females. The spiracle plates of *Rh. camicasi* of both sexes have tails which are narrow, half the width of the adjacent festoon. These spiracle plates are similar in *Rh. sanguineus* but the tails are broad in *Rh. guilhoni* and *Rh. turanicus.*

Hosts.
Cattle, sheep, goats and camels are the preferred hosts of adult *Rh. camicasi*. It also feeds on zebras and Cape hares. The hosts of the immature stages are unknown.

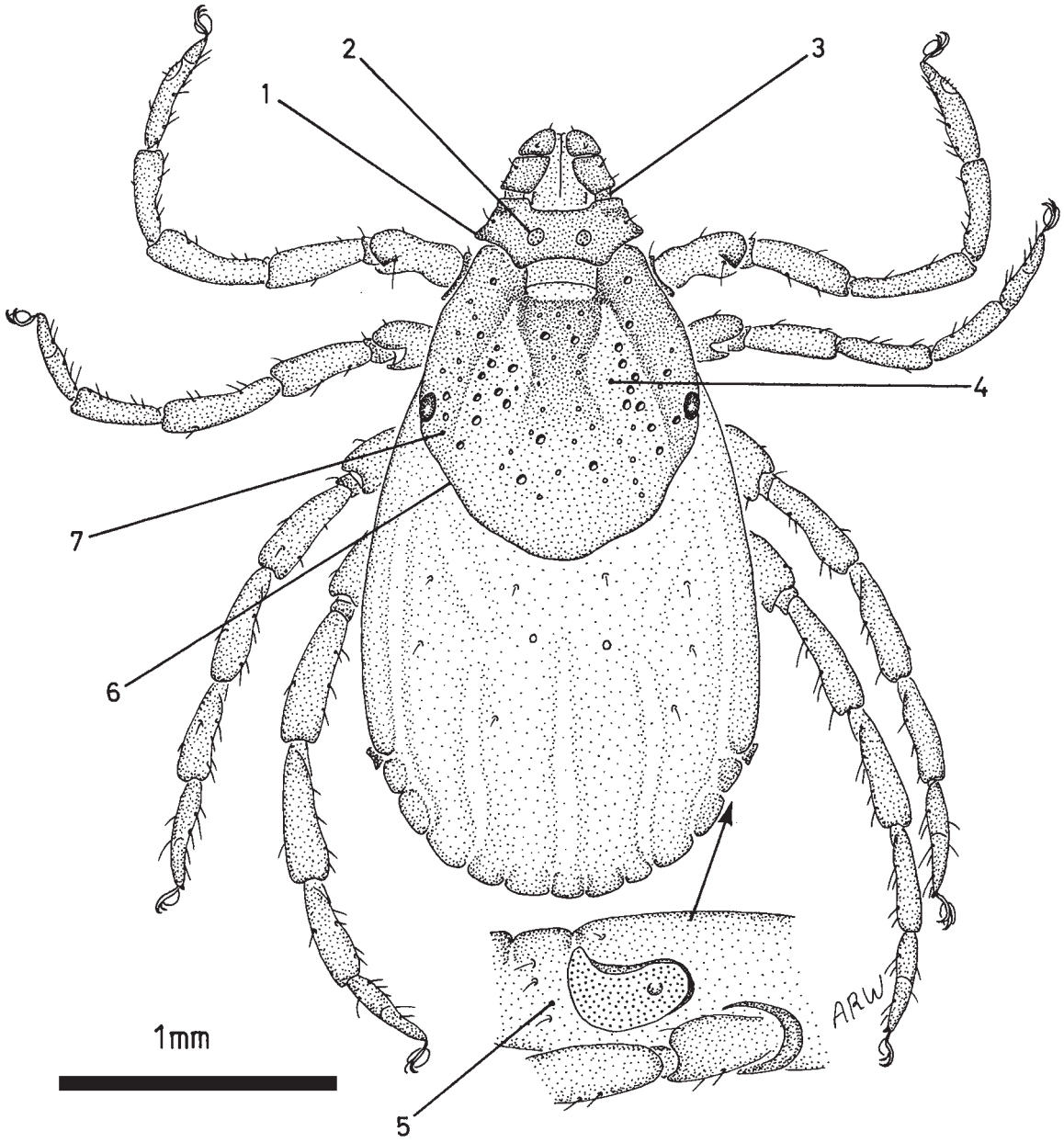
Life cycle and seasonal occurrence.
This is a three-host species that appears to be most numerous during the dry season.

Disease.
It is not known if this tick transmits any pathogen or causes any other disease.

Habitat and distribution.
Rhipicephalus camicasi is a tick of steppe and desert climatic regions of north-eastern Africa concentrated in Sudan, Ethiopia, Somalia and Kenya, as well as outlying populations in the Yemen Arab Republic, Saudi Arabia, Jordan and Lebanon. In the Yemen Arab Republic it is the most common *Rhipicephalus* species on livestock. The taxonomic status of the population of this tick in Tunisia is unclear.

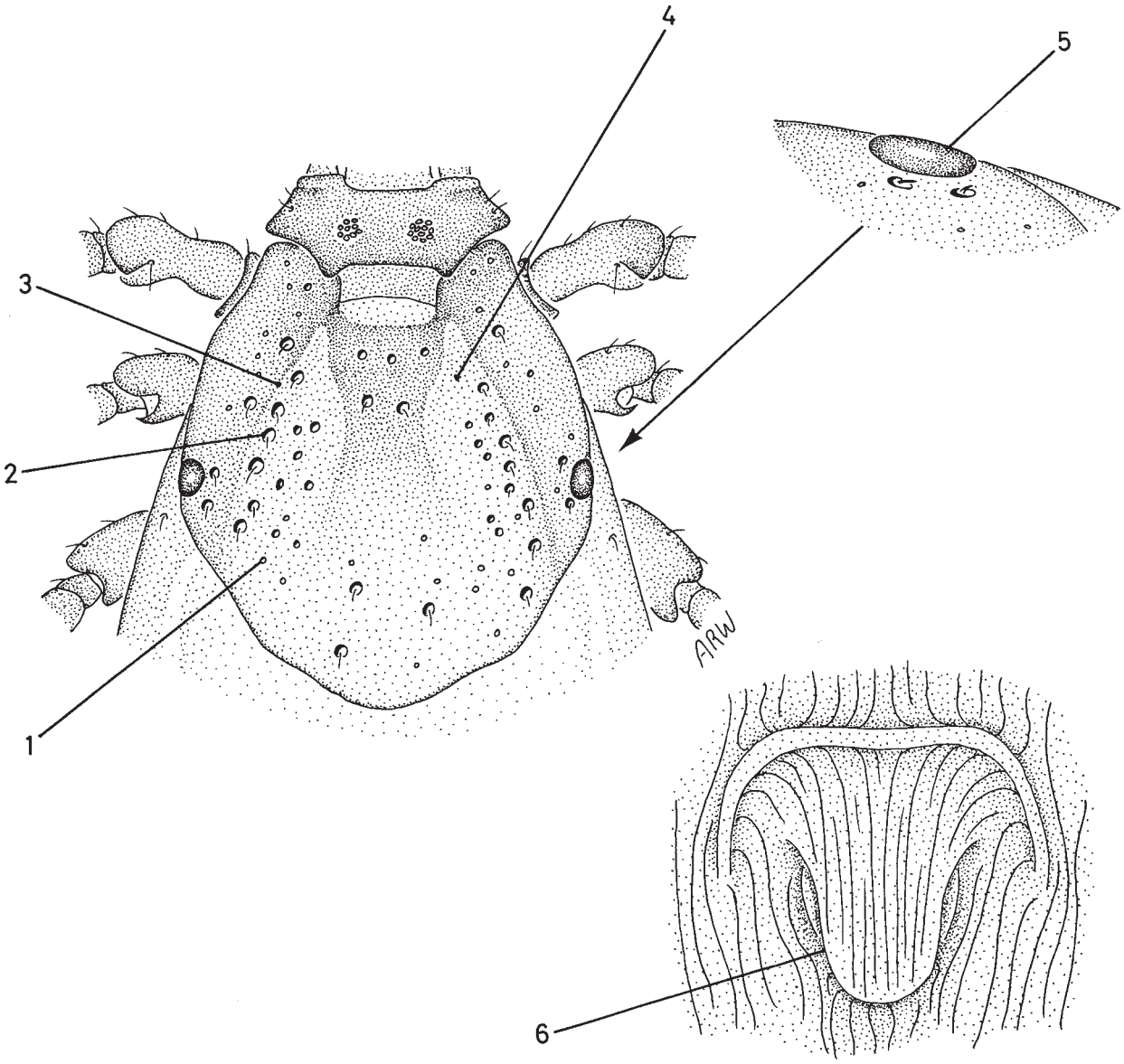
Distribution of *Rhipicephalus camicasi*.

***Rhipicephalus camicasi* female, dorsal.**



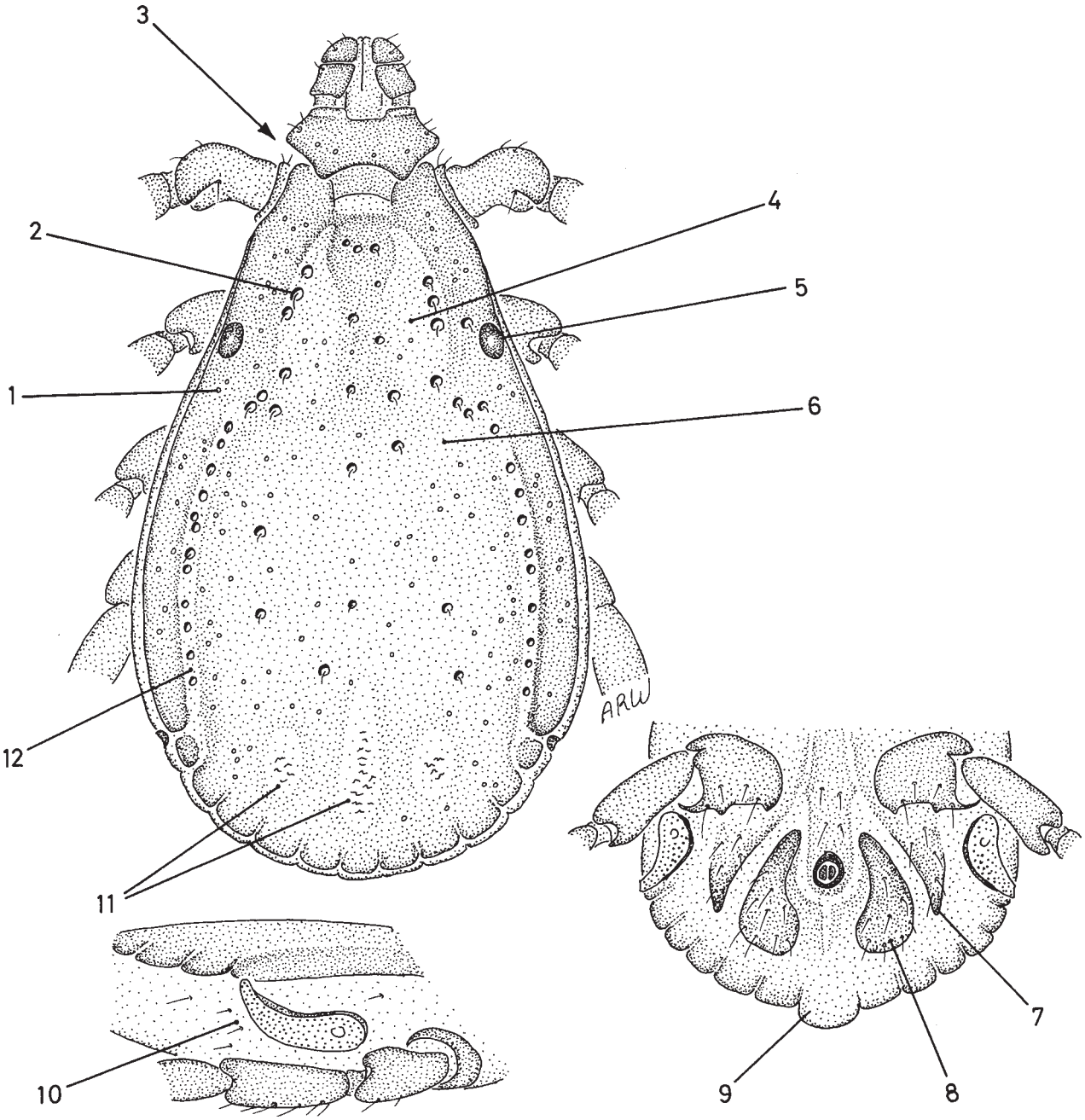
1 Basis capituli lateral angle is sharp.
2 Porose areas separation is broad.
3 Palp pedicels are short.
4 Cervical fields shape is large and straight.
5 Spiracle plate areas have sparse setae. (Spiracle plates have narrow tails, half the width of adjacent festoon.)
6 Scutum posterior margin is distinctly sinuous.
7 Scutum colour is dark.

***Rhipicephalus camicasi* female, scutum at top left, genital aperture at bottom right.**



1 Interstitial punctation size is small to medium. Interstitial punctation distribution is sparse.
2 Setiferous punctations are distinct.
3 Scapular grooves profile is shallow.
4 Cervical fields texture has no wrinkles.
5 Eyes are flat.
6 Genital aperture posterior lips have a narrow **U** shape.

***Rhipicephalus camicasi* male, conscutum at left, ventral plates at right, and spiracle at bottom left.**



1 Interstitial punctation size is small to medium. Interstitial punctation distribution is sparse.
2 Setiferous punctations are distinct.
3 Coxae 1 anterior spurs are not visible dorsally.
4 Cervical fields depression is apparent. Cervical fields texture has no wrinkles.
5 Eyes are flat (as shown for the female).
6 Conscutum colour is dark.
7 Accessory adanal plates are large (these are very variable and may be small).
8 Adanal plates shape is narrow and trapezoid.
9 Caudal appendage is broad in fed males (it protrudes as a slight bulge).
10 Spiracle areas have sparse setae. (Spiracle plate tails are narrow, half width of adjacent festoon.)
11 Posterior grooves are distinct (shallow depressions with small wrinkled areas).
12 Lateral grooves type is a distinct groove (but may be indistinct in some specimens). Lateral grooves texture is distinctly punctate.

Rhipicephalus evertsi Neumann, 1897.

General.
Rhipicephalus evertsi is also known as The red-legged tick. This robust and damaging tick is widely distributed and common on livestock throughout much of Africa.

Differential diagnosis.
This is the largest and most distinctive *Rhipicephalus* species. It is easy to differentiate from all other *Rhipicephalus* species by its very convex beady eyes and scutum is covered with many punctations.

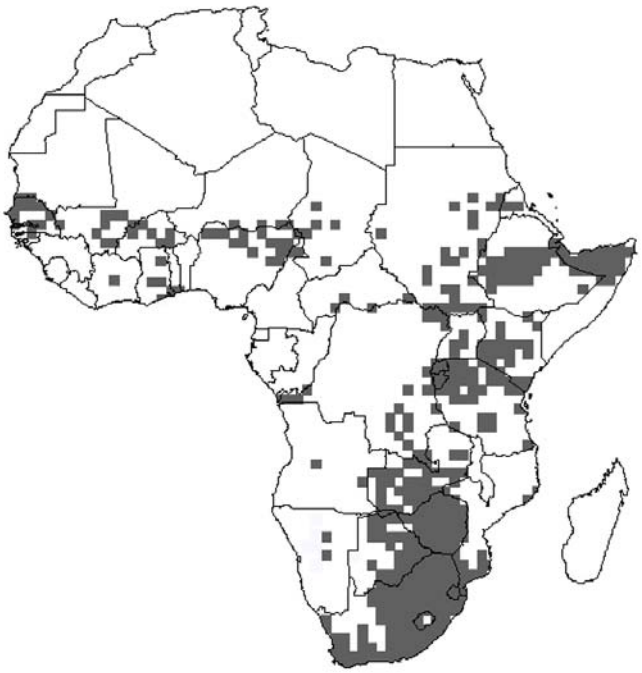
Hosts.
Horses, donkeys, cattle and sheep are the preferred domestic hosts of adults *Rh. evertsi*. Larvae and nymphs infest the same hosts as the adults and also infest scrub hares and various smaller antelope species. A very wide variety of wild ungulates and other animals are infested by all stages of this tick. The feeding behaviour is of the telotropic type. The adults are found on the hairless area around the anus as well as the groin region of equids, cattle and sheep. The immature stages attach on the deeper parts of the inner surface of the ear and in the outer ear canal.

Life cycle and seasonal occurrence.
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 host and attach in the ear where they moult to the nymphal stage after about a week. The nymphs engorge in about a week and then detach and drop off the host to moult to adults. The adults attach to the second and final host on which they remain for about 6 to 12 days. More than one life cycle can be completed in a year. These ticks are active mainly during the summer but are present throughout the year in warm regions. In the South African area of KwaZulu-Natal the immature stages are active from November to June and the adults from January to May and in Northern Province the immature stages are most abundant from April to September and the adults from September to March.

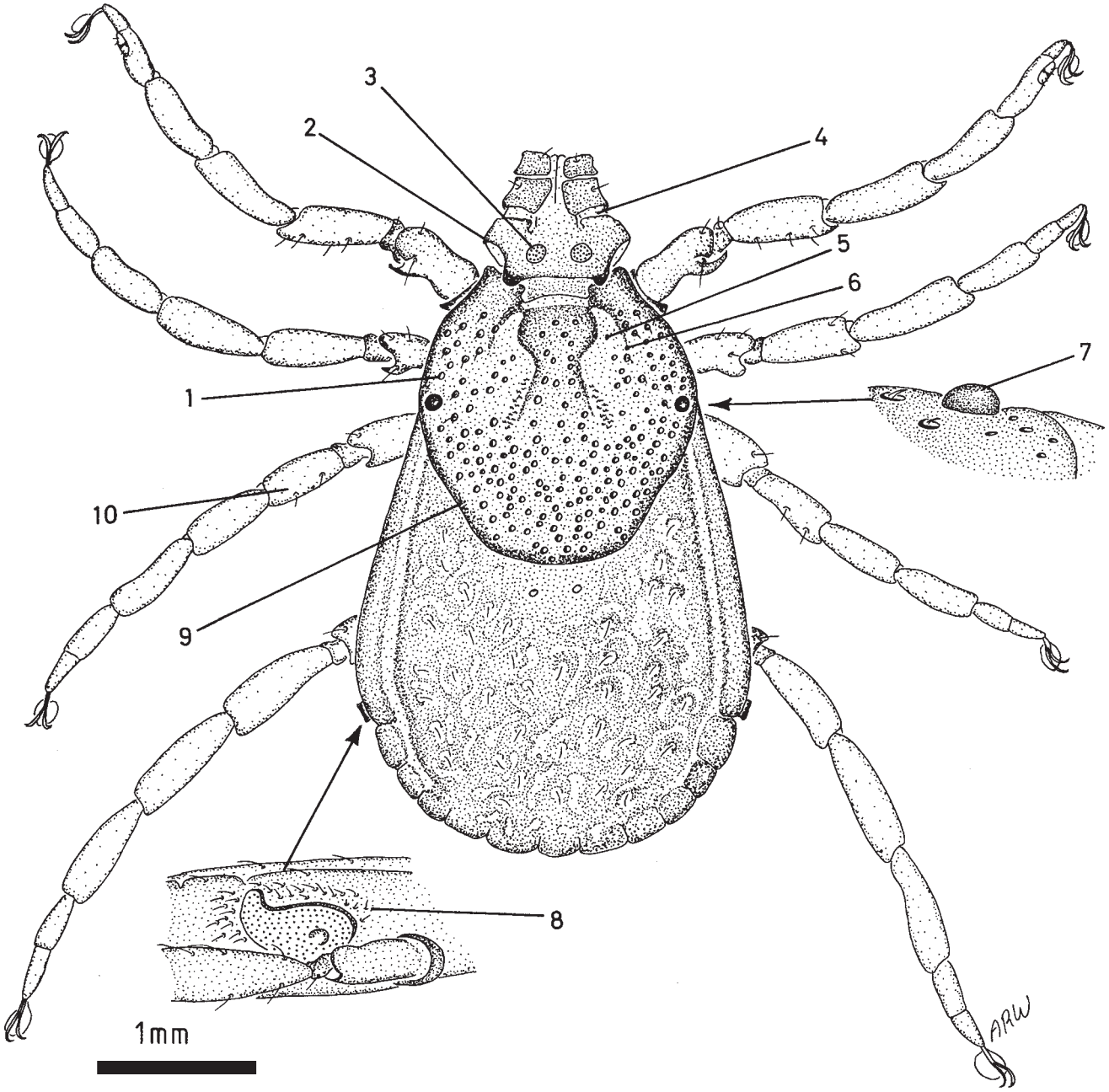
Disease.
Rhipicephalus evertsi transmits the protozoans *Babesia caballi* and *Theileria equi* (= *Babesia equi*) to horses, both causing forms of equine piroplasmosis. This tick transmits the bacterium *Anaplasma marginale* to cattle causing bovine anaplasmosis (= gallsickness). The saliva of female 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 of South Africa the synchronous moulting of free-living, over wintered nymphs gives rise to large numbers of adults on spring-born lambs. The females engorging on these lambs cause paralysis, and the number of female ticks per kilogramme of host mass is important in the causation of paralysis. The symptoms can be reversed by removal of the ticks.

Habitat and distribution
Rhipicephalus evertsi is the most widespread of all the *Rhipicephalus* species occurring in Africa, although it is confined to the Afrotropical zoogeographical region in sub-Saharan Africa. Its distribution includes desert, steppe, savanna and temperate climatic regions. It has also been recorded from rain forest climatic areas of Democratic Republic of Congo. It is recorded from a few sites in Namibia and Angola. The very similar *Rh. e. mimeticus* occurs commonly in Namibia and Angola and it also occurs in Botswana, Democratic Republic of Congo and is known to have been introduced to a few sites in the Republic of South Africa.

Distribution of *Rhipicephalus evertsi*.

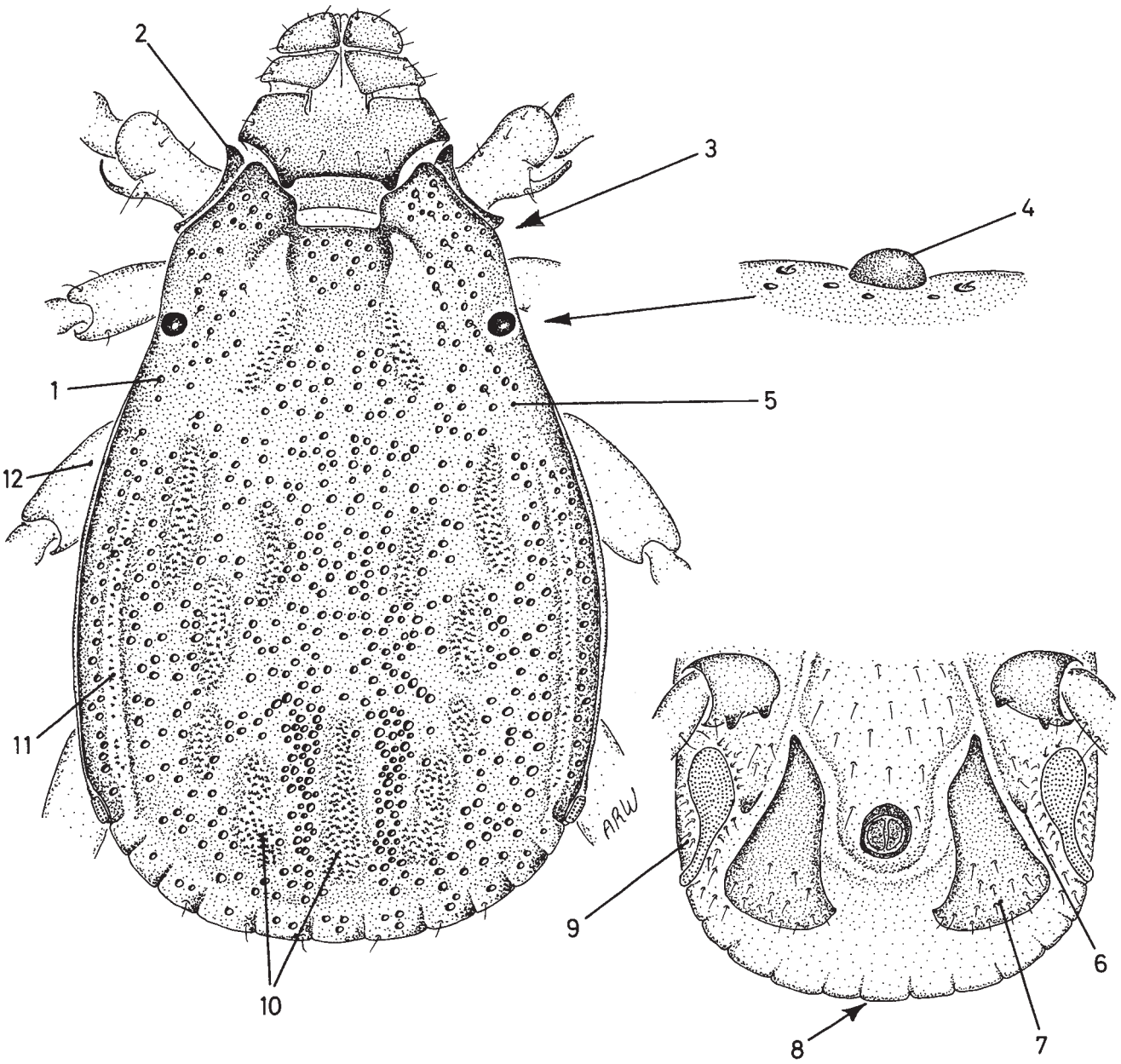


***Rhipicephalus evertsi* female, dorsal.**



1 Interstitial punctation size is small to medium. Interstitial punctation distribution is dense. Setiferous punctations are indistinct.
2 Basis capituli lateral angles are blunt.
3 Porose areas separation is narrow.
4 Palp pedicels are short.
5 Cervical fields shape is not apparent. Cervical fields texture has wrinkled areas.
6 Scapular grooves profile is shallow.
7 Eyes are very convex.
8 Spiracle plate areas have dense setae.
9 Scutum posterior margin is slightly sinuous. Scutum colour is dark.
(10 Legs are coloured a distinctive pale orange, uniformly over each segment.)

***Rhipicephalus evertsi* male**, **dorsal at left**, **ventral plates at bottom right**.



1 Interstitial punctation size is small to medium. Interstitial punctation distribution is dense. Setiferous punctations are indistinct.
2 Coxae 1 anterior spurs are visible.
3 Cervical fields depression is not apparent. Cervical fields texture has wrinkled areas.
4 Eyes are very convex.
5 Conscutum colour is dark.
6 Accessory adanal plates are small (they may be absent).
7 Adanal plates shape is broad and curved (in some specimens it may have straighter sides than illustrated).
8 Caudal appendage is absent in fed males.
9 Spiracle plate areas have dense setae.
10 Posterior grooves are indistinct (represented by three flat posterior areas of wrinkled texture).
11 Lateral grooves type is a distinct groove. Lateral grooves texture is wrinkled.
(12 Legs are coloured a distinctive pale orange, uniformly over each segment.)

Rhipicephalus guilhoni Morel & Vassiliades, 1963.

General.
Rhipicephalus guilhoni is a member of the *sanguineus* group within the genus *Rhipicephalus*. It can be a common tick in the drier areas in a horizontal band south of the Sahara.

Differential diagnosis.
Rhipicephalus guilhoni must be distinguished from other members of the *sanguineus* group. Other members of this group described in this guide are: *Rhipicephalus camicasi*, *Rhipicephalus sanguineus* and *Rhipicephalus turanicus*. Female *Rh. guilhoni* share with *Rh. camicasi* and *Rh. sanguineus* the sharp lateral angles to the basis capituli, but *Rh. guilhoni* have large and curved cervical fields marked by a steep profile of the scapular groove. The cervical fields of female *Rh. camicasi* and *Rh. sanguineus* are large and straight. In this group only *Rh. guilhoni* has the female genital aperture with posterior lips forming a truncated **V** shape. *Rhipicephalus guilhoni* closely resembles *Rh. turanicus* but both sexes of *Rh. guilhoni* have denser interstitial punctations, and the males of *Rh. guilhoni* have no apparent depression of the cervical fields.

Hosts.
Cattle, sheep, horses and dogs as well as wild carnivores and birds are the preferred hosts of adults *Rh. guilhoni*. The immature stages feed on rodents.

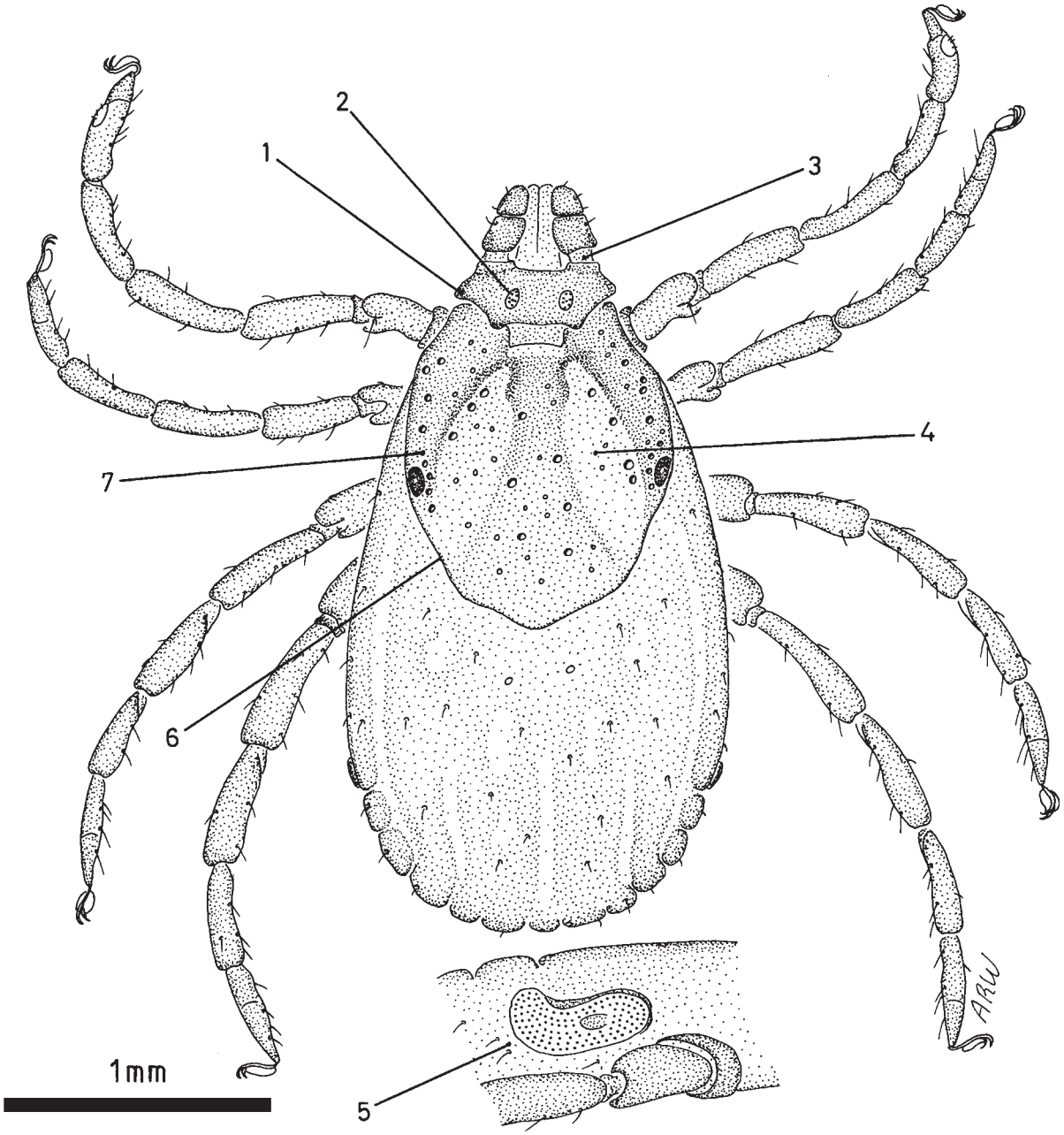
Life cycle and seasonal occurrence.
This tick has a three-host life cycle that takes a year to complete. The adults are most numerous from May and June in the rainy season until December and January in the cooler season.

Disease.
It is not known whether this species of tick is associated with any disease.

Habitat and distribution.
This tick is found in steppe and savanna climatic regions. Although most widespread in West Africa, *Rh. guilhoni* is present in a broad band roughly between 6° and 18°N across Africa from Senegal in the west to Ethiopia in the east.

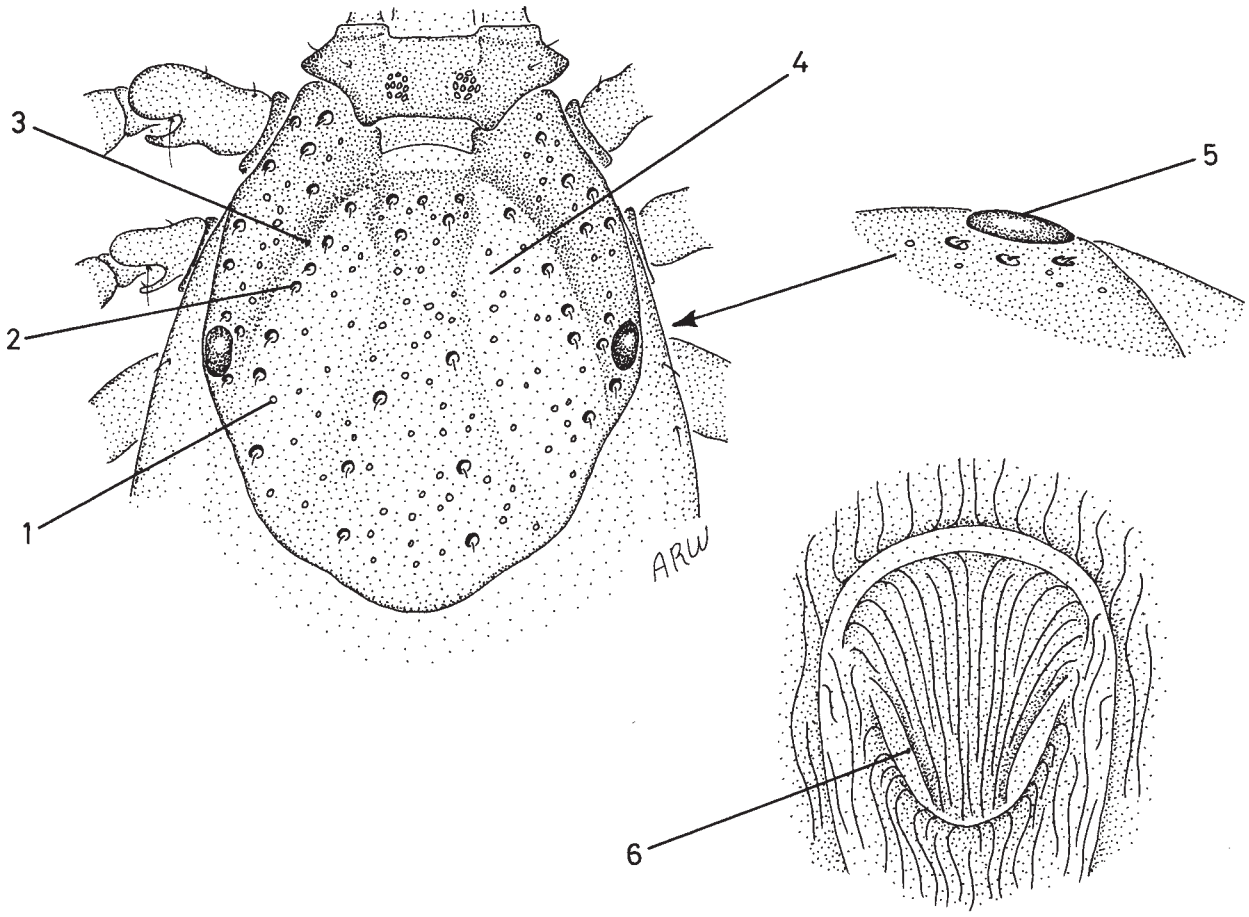
Distribution of *Rhipicephalus guilhoni*.

***Rhipicephalus guilhoni* female, dorsal.**



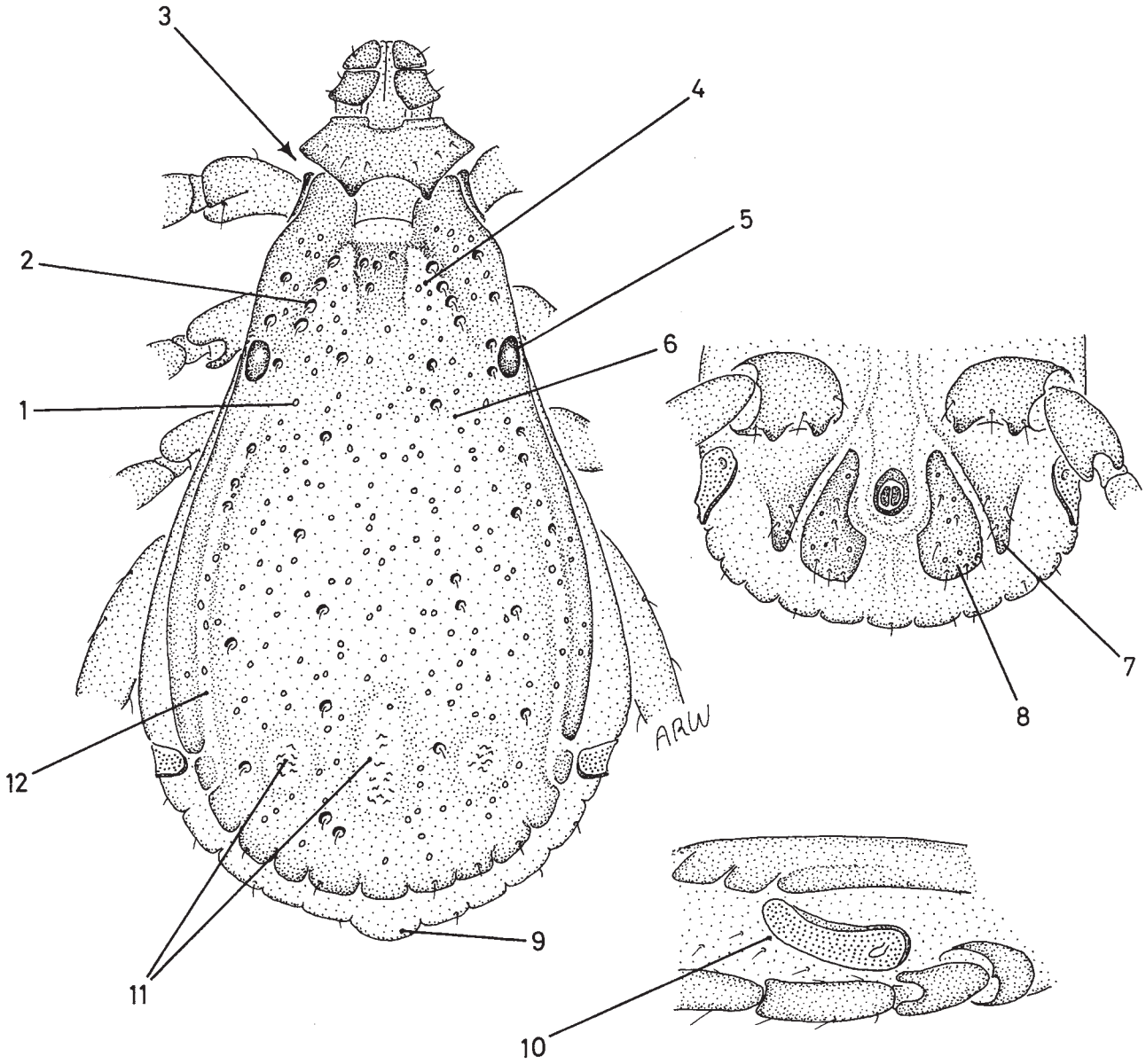
1 Basis capituli lateral angles are sharp.
2 Porose areas separation is broad.
3 Palp pedicels are short.
4 Cervical fields shape is large and curved.
5 Spiracle plate areas have sparse setae.
6 Scutum posterior margin is distinctly sinuous.
7 Scutum colour is dark.

Rhipicephalus guilhoni **female**, **scutum at top left**, **genital aperture at bottom right**.



1 Interstitial punctations size is small to medium. Interstitial punctation distribution is dense.
2 Setiferous punctations are distinct.
3 Scapular grooves profile is steep.
4 Cervical fields texture has no wrinkles.
5 Eyes are flat.
6 Genital aperture posterior lips have a truncated **V** shape.

***Rhipicephalus guilhoni* male, conscutum at top left, ventral plates at right, and spiracle at bottom.**



1 Interstitial punctations size is small to medium. Interstitial punctation distribution is dense.
2 Setiferous punctations are distinct.
3 Coxae 1 anterior spurs are not visible dorsally.
4 Cervical fields depression is not apparent. Cervical fields texture has no wrinkles.
5 Eyes are flat (as shown for the female).
6 Conscutum colour is dark.
7 Accessory adanal plates are large.
8 Adanal plates shape is narrow and trapezoid.
9 Caudal appendage is broad in fed males (it protrudes as a slight bulge).
10 Spiracle areas have sparse setae. (Spiracle plate tails are broad, same width as the adjacent festoon.)
11 Posterior grooves are distinct (deep and with wrinkled texture).
12 Lateral grooves type is a distinct groove. Lateral grooves texture is distinctly punctate.

Rhipicephalus lunulatus Neumann, 1907.

General.
Rhipicephalus lunulatus a widespread tick of some veterinary importance but knowledge of its biology has been confused by its being made synonymous with *Rhipicephalus tricuspis* on several occasions.

Differential diagnosis.
The unusual shape of the adanal plates of the male make *Rh. lunulatus* very similar to *Rh. tricuspis* and *Rhipicephalus interventus* (neither are described in this guide). These plates are triangular in shape with the posterior side concave in profile. The term "tricuspis" refers to three points (= cusps) being formed in this position, one by the accessory adanal plate and two on the lower side of the adanal plate. Both female and male *Rh. lunulatus* have the first palp articles in the form of long pedicels and the female genital pore is an exceptionally broad **U** shape. *Rhipicephalus tricuspis* males have numerous very small interstitial punctations widely distributed over the scutum but in *Rh. lunulatus* males the very small interstitial punctations are sparse. *Rhipicephalus tricuspis* usually feeds on small wild mammals and occurs mainly in southern Africa. *Rhipicephalus interventus* is a rare species, found on cattle in eastern Africa. Another tick with a small number of large setiferous punctations is *Rhipicephalus turanicus* but its male has adanal plates without a concave profile on the posterior side.

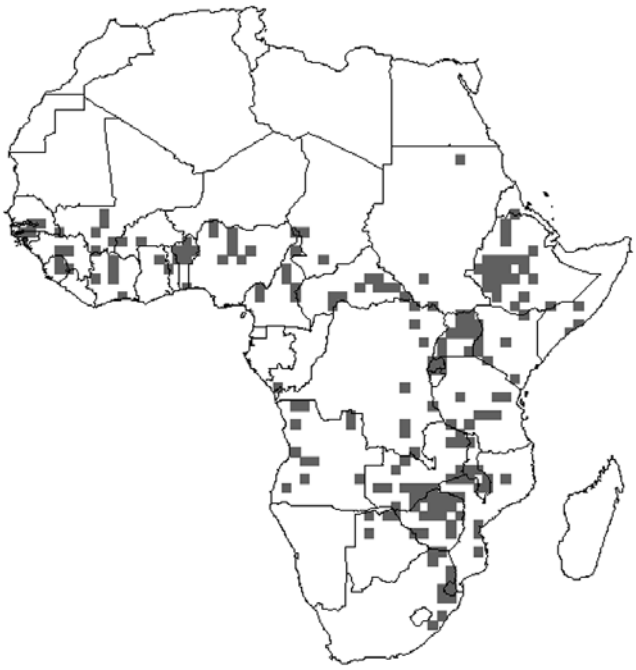
Hosts.
Cattle, sheep, pigs and dogs are the preferred domestic hosts of adult *Rh. lunulatus*. It also feeds on horses and camels. On cattle it attaches on the legs, including the feet, and in the tailbrush. Its main wild hosts are warthogs, bushpigs and African buffaloes. The hosts of the immature stages are rodents and hares.

Life cycle and seasonal occurrence.
This tick species is a three-host tick. The adults appear to be most active during the rainy season.

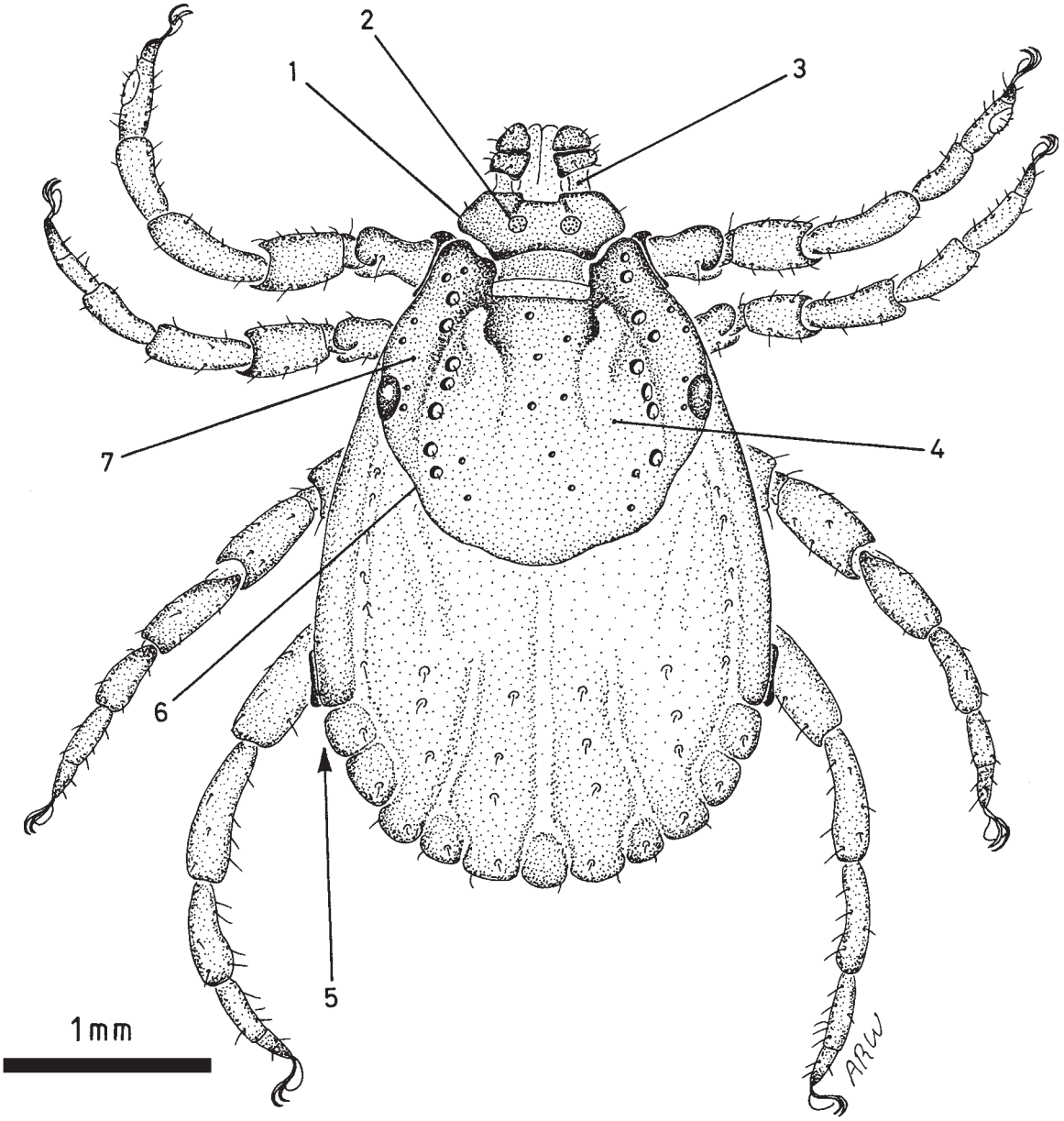
Disease.
Rhipicephalus lunulatus is associated in Zimbabwe with a toxicosis causing paralysis of lambs, sheep and calves. Its status as a vector of pathogens is not well established.

Habitat and distribution.
Rhipicephalus lunulatus occurs mainly in savanna climates but also in the temperate climate of the Ethiopian highlands. It has an extensive distribution range, from Senegal in the west to Somalia in the east and thence southwards, mainly in the eastern half of the continent, to north-eastern South Africa.

Distribution of *Rhipicephalus lunulatus*.

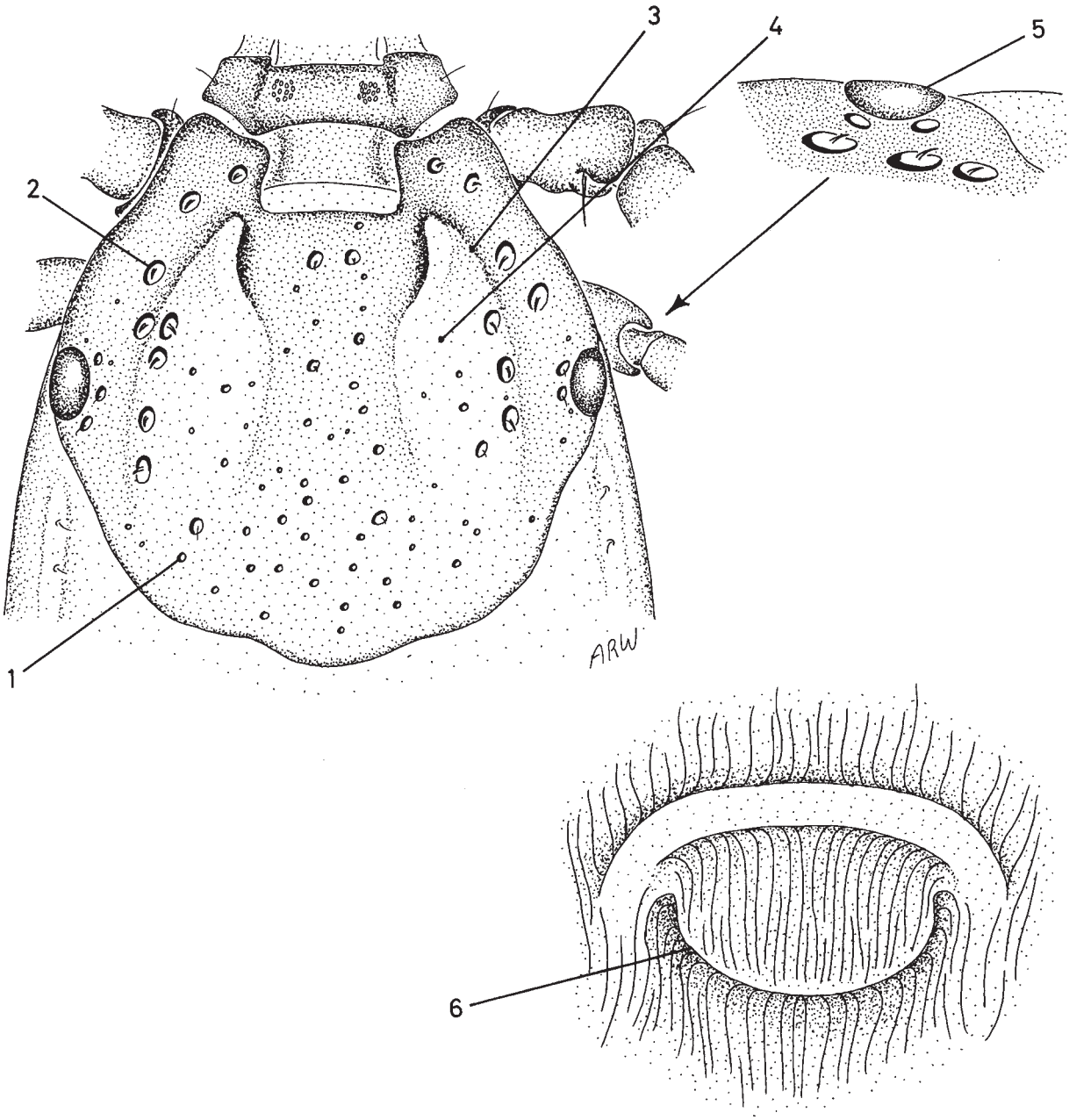


***Rhipicephalus lunulatus* female, dorsal.**



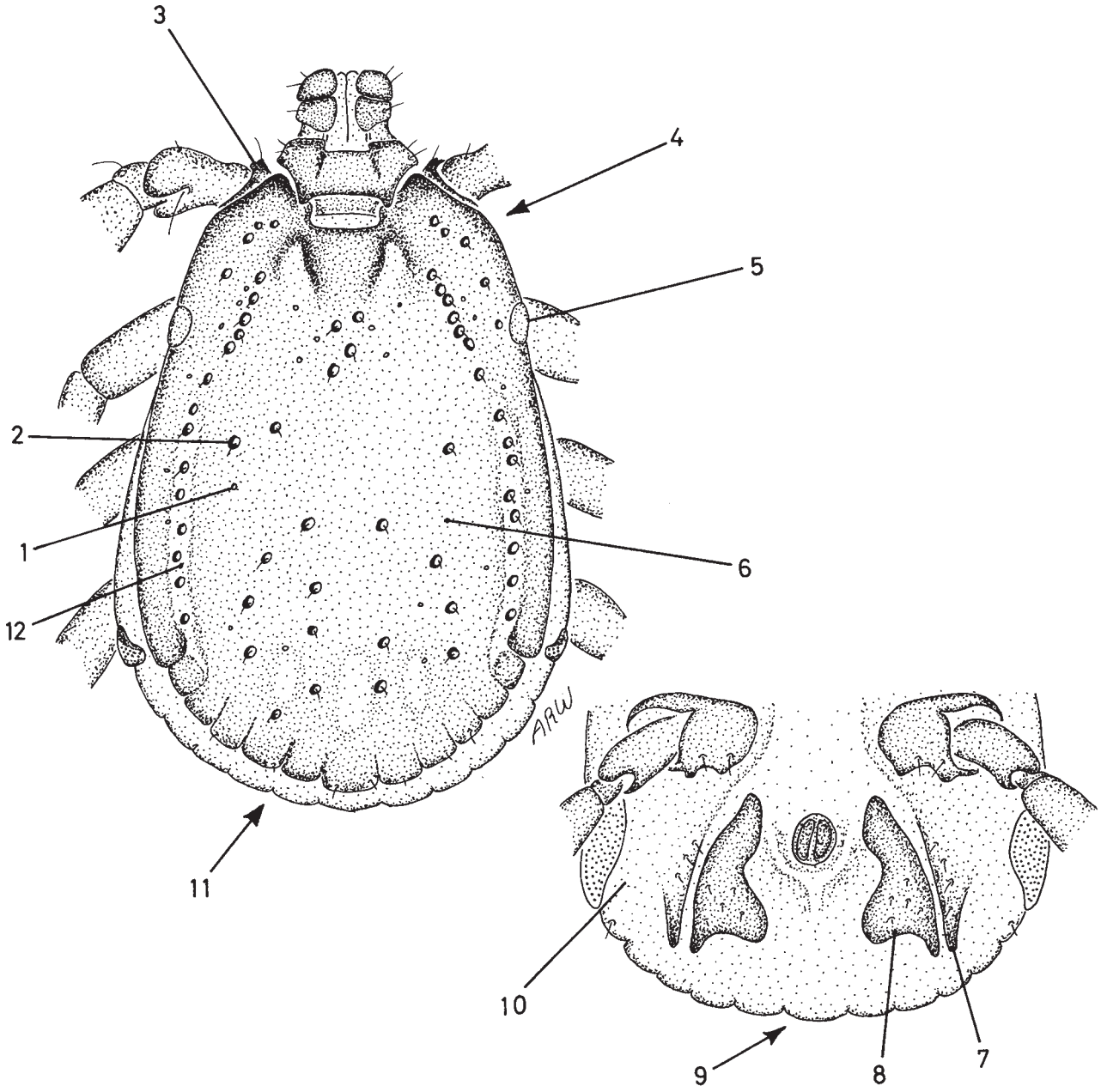
1 Basis capituli lateral angles are blunt.
2 Porose areas separation is broad.
3 Palp pedicels are long.
4 Cervical fields shape is large and curved.
5 Spiracle plate areas have sparse setae (not shown).
6 Scutum posterior margin is distinctly sinuous.
7 Scutum colour is dark.

Rhipicephalus lunulatus **female**, **scutum at upper left**, **genital aperture at lower right**.



1 Interstitial punctation size is minute to small. Interstitial punctation distribution is sparse.
2 Setiferous punctations are distinct.
3 Scapular grooves are shallow.
4 Cervical fields texture has no wrinkles.
5 Eyes are flat.
6 Genital aperture posterior lips have a broad **U** shape (exceptionally broad).

***Rhipicephalus lunulatus* male, conscutum at upper left, ventral plates at lower right.**



1 Interstitial punctation size is minute to small. Interstitial punctation distribution is sparse.
2 Setiferous punctations are distinct.
3 Coxae 1 anterior spurs are visible dorsally (but are indistinct).
4 Cervical fields depression is not apparent. Cervical fields texture has no wrinkles.
5 Eyes are flat (as shown for the female).
6 Conscutum colour is dark.
7 Accessory adanal plates are large.
8 Adanal plates shape is broad and curved (there is usually a concave outline and point at their posterior margin; together with the posterior points of the acessory adanal plates two pairs of sharp points are formed, but in some specimens the adanal plates have a more square posterior margin).
9 Caudal appendage in fed males: no information.
10 Spiracle plate areas have sparse setae.
11 Posterior grooves are absent (may be present as shallow areas).
12 Lateral grooves type is a distinct groove. Lateral grooves texture is distinctly punctate.

Rhipicephalus muhsamae Morel & Vassiliades, 1965.

General.
Rhipicephalus muhsamae is one of the characteristic *Rhipicephalus* species of cattle in West and Central Africa.

Differential diagnosis.
Rhipicephalus muhsamae is a member of the *simus* group which also contains *Rhipicephalus simus* and *Rhipicephalus praetextatus*. Females of this group have the two outermost festoons enclosed by each lateral groove (this is clear only in unfed females). Males of this group vary in this feature so it has not been included as a character for identification. Females of this group have a genital aperture with hyaline borders, giving a truncated **V** shape to the posterior lips. The females of *Rh. muhsamae* are very similar to those of *Rh. praetextatus*. In *Rh. muhsamae* the interstitial punctations are usually denser, the scapular grooves are more distinct, and the hyaline borders of the genital aperture are broader than in *Rh. praetextatus*. The males of *Rh. muhsamae* are distinguished from the males of *Rh. praetextatus* by having lateral grooves with more distinct edges, and posterior grooves which are present although faint. *Rhipicephalus senegalensis* is similar but the males of this species have distinct lateral and posterior grooves and large adanal plates shaped as crescents. The females of *Rh. senegalensis* have genital apertures with a narrow **V** profile to the posterior lips, not the truncated **V** of females of the *simus* group of ticks.

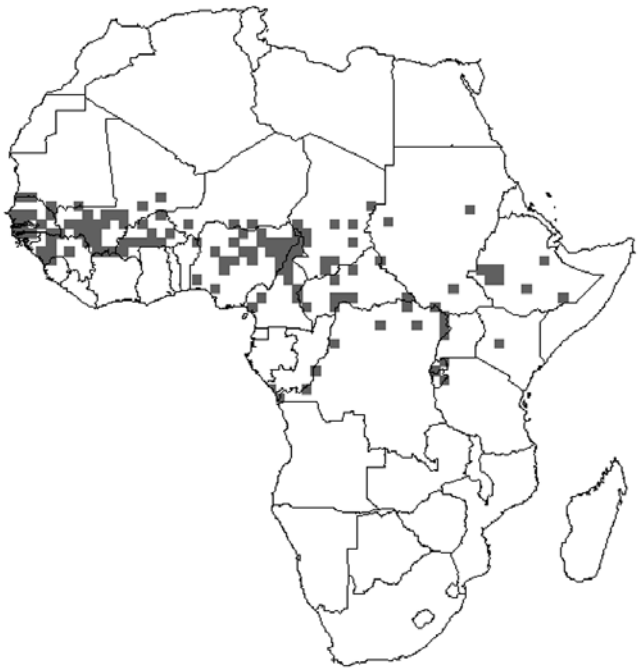
Hosts.
Cattle, dogs, wild carnivores and warthogs are the preferred hosts of adult *Rh. muhsamae*. The adults attach on cattle at the ears, neck, dewlap, genitalia and hooves. Rodents are the preferred hosts of the immature stages.

Life cycle and seasonal occurrence.
This species is a three-host tick. In the north of its distributional range adults may be present on cattle throughout the year, while in the south peak numbers may be present both in the dry and the wet season.

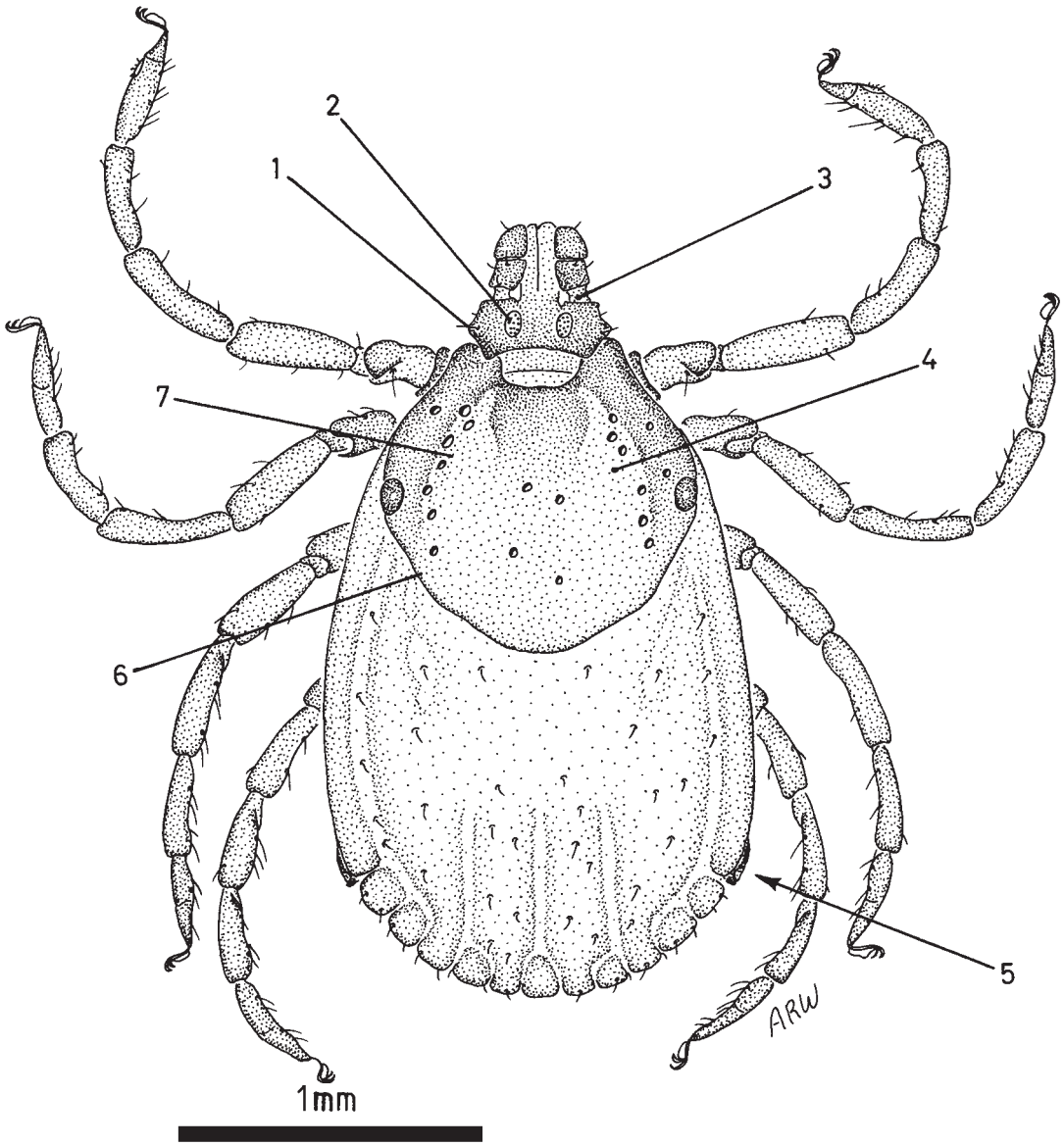
Disease.
It is not known whether *Rh. muhsamae* transmits any pathogens.

Habitat and distribution
Rhipicephalus muhsamae occurs in a broad band with a savanna climate between 0° and 18°N across Africa, from Senegal in the west to Ethiopia in the east. In East and North East Africa its distribution overlaps with that of *Rh. praetextatus*.

Distribution of *Rhipicephalus muhsamae*.

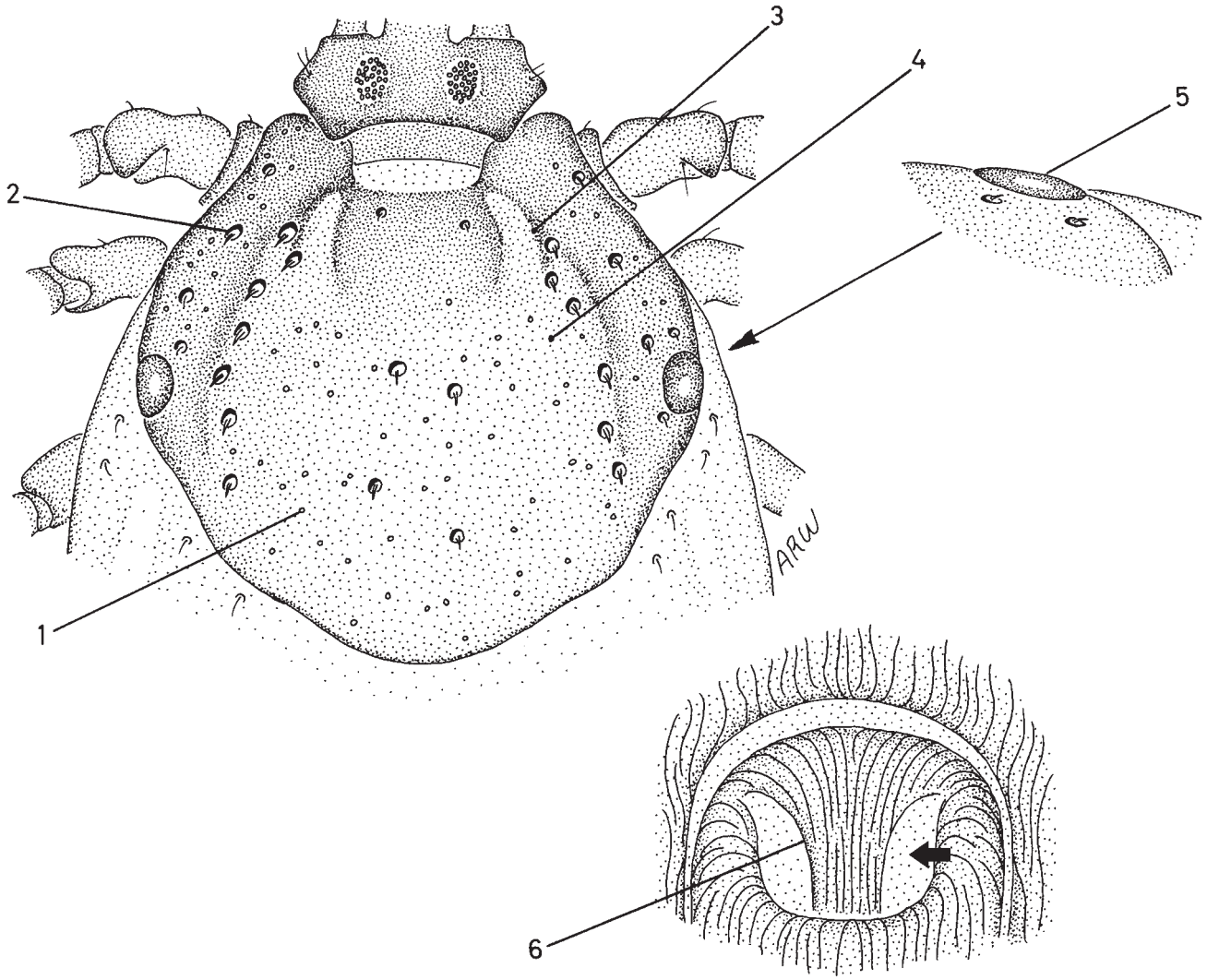


***Rhipicephalus muhsamae* female, dorsal.**



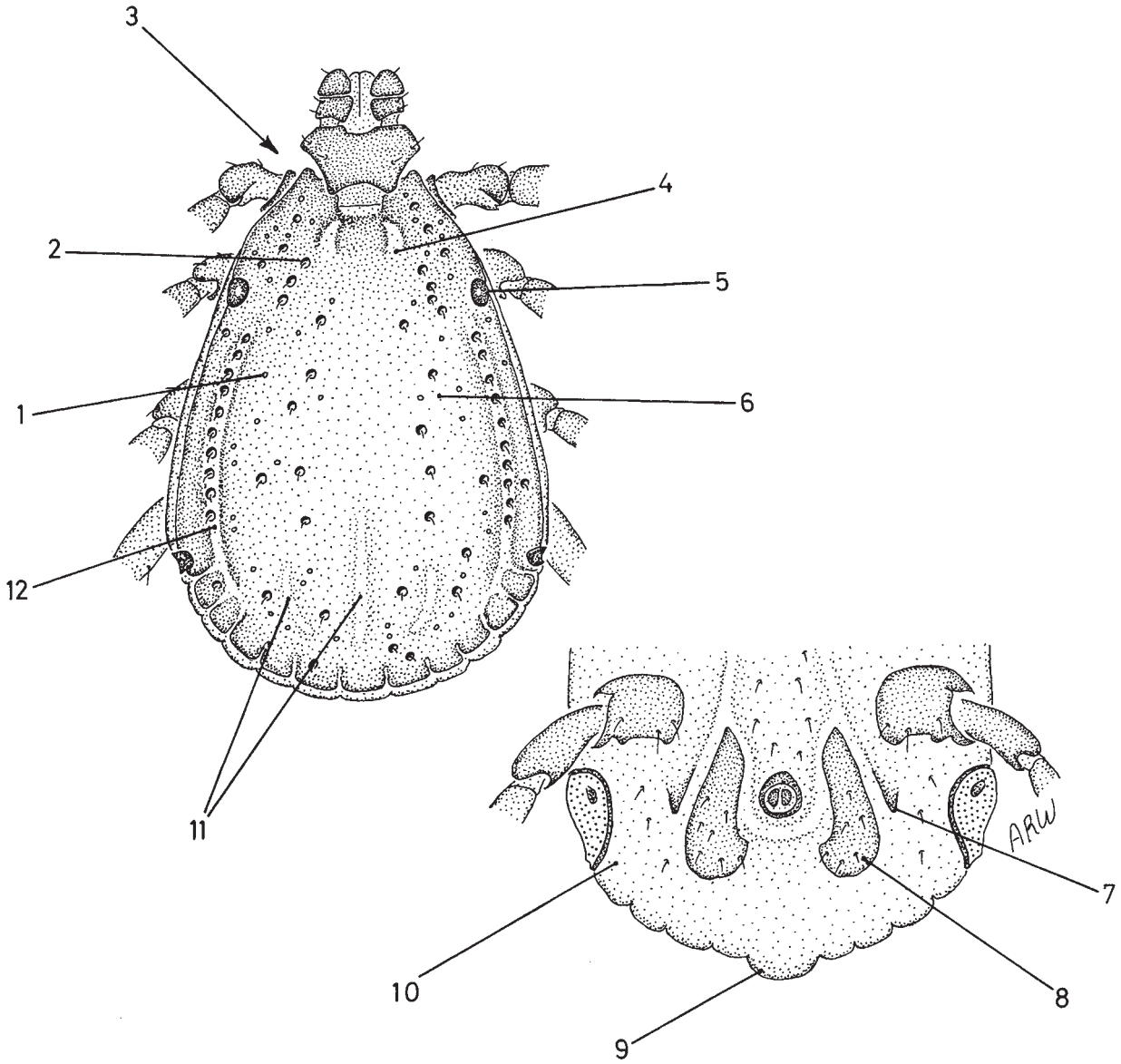
1 Basis capituli lateral angles are blunt.
2 Porose areas separation is broad.
3 Palp pedicels are long.
4 Cervical fields shape is large and curved.
5 Spiracle plate areas have sparse setae (not shown).
6 Scutum posterior margin is slightly sinuous.
7 Scutum colour is dark.

Rhipicephalus muhsamae **female**, **scutum at top left**, **genital aperture at bottom right**.



1 Interstitial punctation size is minute. Interstitial punctation distribution is sparse (but the minute punctations make this distribution indistinct, also the state of this character is highly variable).
2 Setiferous punctations are distinct.
3 Scapular grooves profile is shallow.
4 Cervical fields texture has no wrinkles.
5 Eyes are flat.
6 Genital aperture posterior lips have a truncated **V** shape (the hyaline border, arrowed, is very conspicuous in this species).

Rhipicephalus muhsamae **male**, **conscutum at left**, **ventral plates at right**.



1 Interstitial punctation size is minute to small. Interstitial punctation distribution is sparse.
2 Setiferous punctations are distinct.
3 Coxae anterior spurs are not visible dorsally.
4 Cervical fields depression is not apparent. Cervical fields texture has no wrinkles.
5 Eyes are flat (as shown for the female).
6 Conscutum colour is dark.
7 Accessory adanal plates are small.
8 Adanal plates shape is broad and curved.
9 Caudal appendage is broad in fed males.
10 Spiracle areas have sparse setae.
11 Posterior grooves are indistinct (tend to be shallow and narrow).
12 Lateral grooves type is a distinct groove (they often enclose two festoons on each side). Lateral grooves texture is distinctly punctate.

Rhipicephalus praetextatus Gerstäcker, 1873.

General.
Rhipicephalus praetextatus a characteristic *Rhipicephalus* species of cattle in East Africa and North East Africa. This species has been often confused with *Rhipicephalus simus* and thus information on the biology of these two species tends to be confused.

Differential diagnosis.
Rhipicephalus praetextatus is a member of the *simus* group which also contains *Rhipicephalus simus* and *Rhipicephalus muhsamae*. Females of the *simus* group have the two outermost festoons enclosed by each lateral groove (this is clear only in unfed females). The males vary in this characteristic. *Rhipicephalus praetextatus* is most closely similar to *Rh. simus*. Compared with *Rh. simus* both sexes of *Rh. praetextatus* have no or very sparse interstitial punctations. Because there are few punctations and there are no rough areas on the scutum, the scutum or conscutum has a smooth shiny appearance. Females of the *simus* group have a genital aperture with hyaline borders, giving a truncated **V** shape to the posterior lips. The lateral grooves of the male are indistinct and marked only by a column of punctations. Another similar species, but not in the *simus* group, is *Rhipicephalus senegalensis*. The males of this species have distinct lateral and posterior grooves and large adanal plates shaped as crescents. The females of *Rh. senegalensis* have genital apertures with a narrow **V** profile to the posterior lips, not the truncated **V** of *simus* group females.

Hosts.
Cattle, camels, dogs, large wild carnivores, zebras and warthogs are preferred as hosts by adult *Rh. praetextatus*. The immature stages prefer murid rodents. On cattle the adults attach mainly in the tail-brush and around the feet.

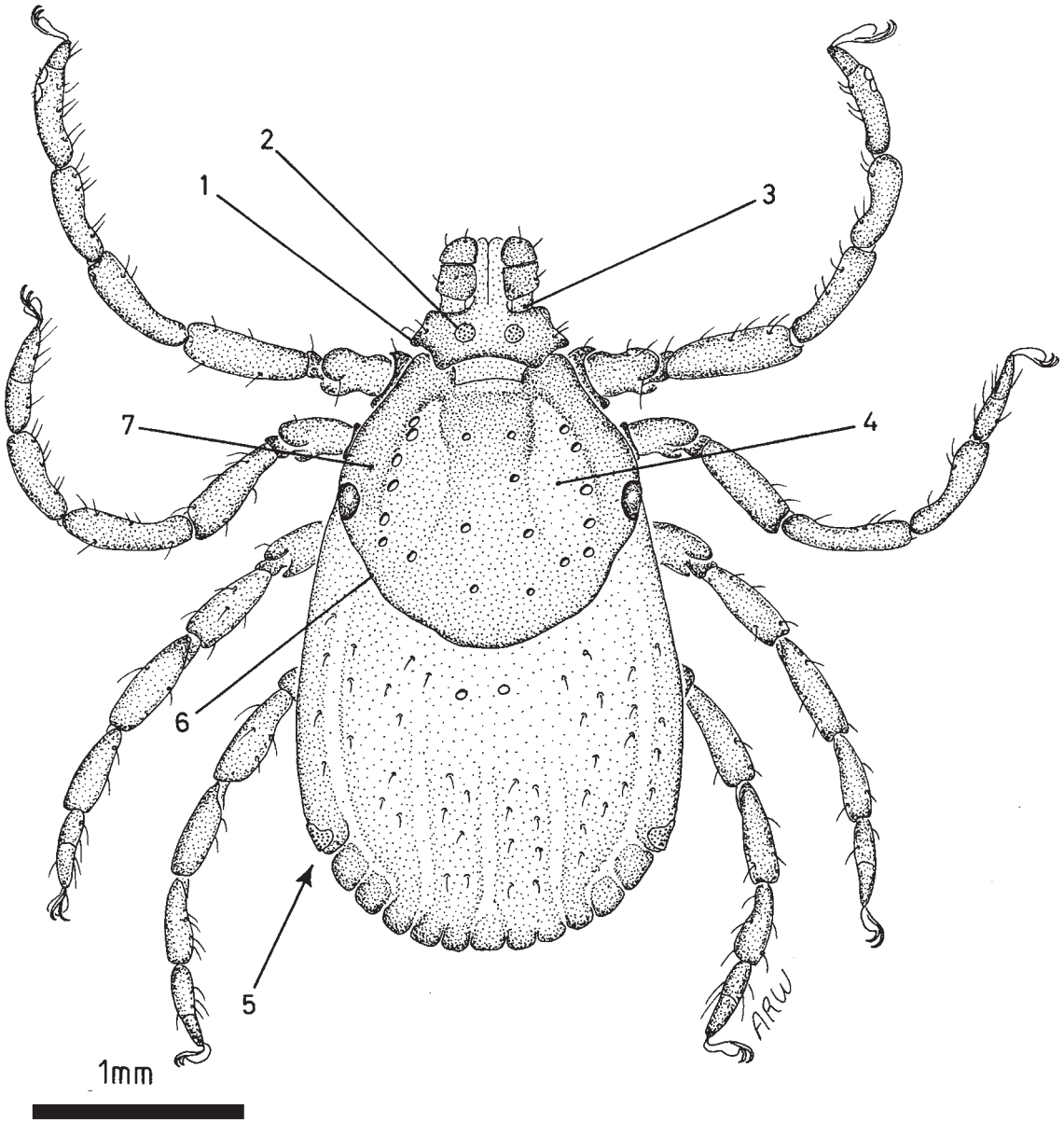
Life cycle and seasonal occurrence.
Rhipicephalus praetextatus is a three-host tick and adults of this species are most abundant during the rainy season.

Disease.
This species of tick can transmit the virus of Nairobi sheep disease, causing the disease of the same name in sheep. The feeding of this tick species can cause toxicosis in cattle, resulting in paralysis.

Habitat and distribution.
Rhipicephalus praetextatus occurs in a wide range of climatic regions from temperate highland areas of Ethiopia and Kenya, through to savanna and steppe of East Africa to the desert climates in North East Africa and the eastern Sahara. This tick species is widespread in most of the eastern countries from northern Egypt down to southern Tanzania. Its most southerly distribution may overlap that of *Rh. simus*. The most westerly distribution of *Rh. praetextatus* overlaps the most easterly distribution of *Rh. senegalensis*.

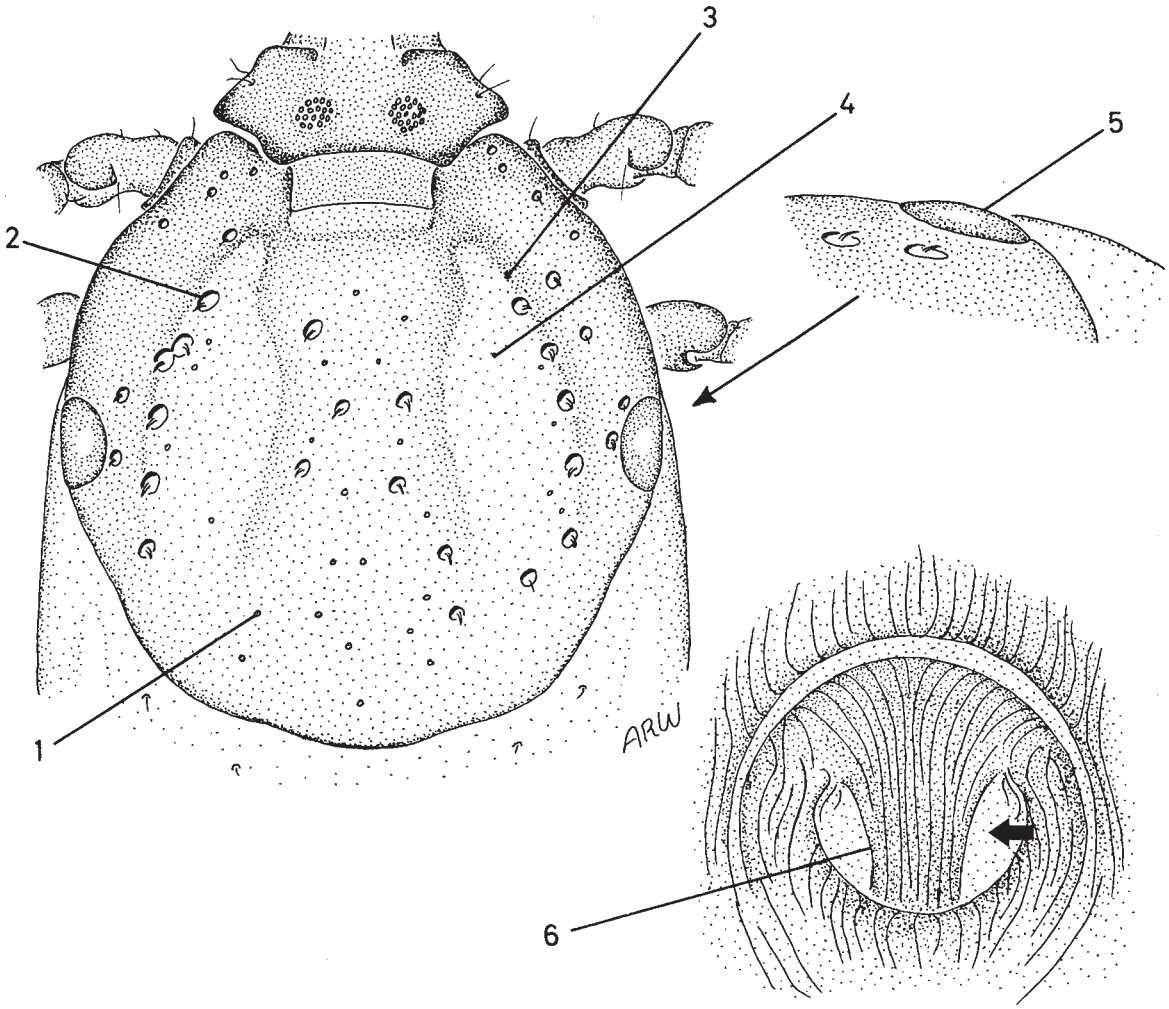
Distribution of *Rhipicephalus praetextatus*.

***Rhipicephalus praetextatus* female, dorsal.**



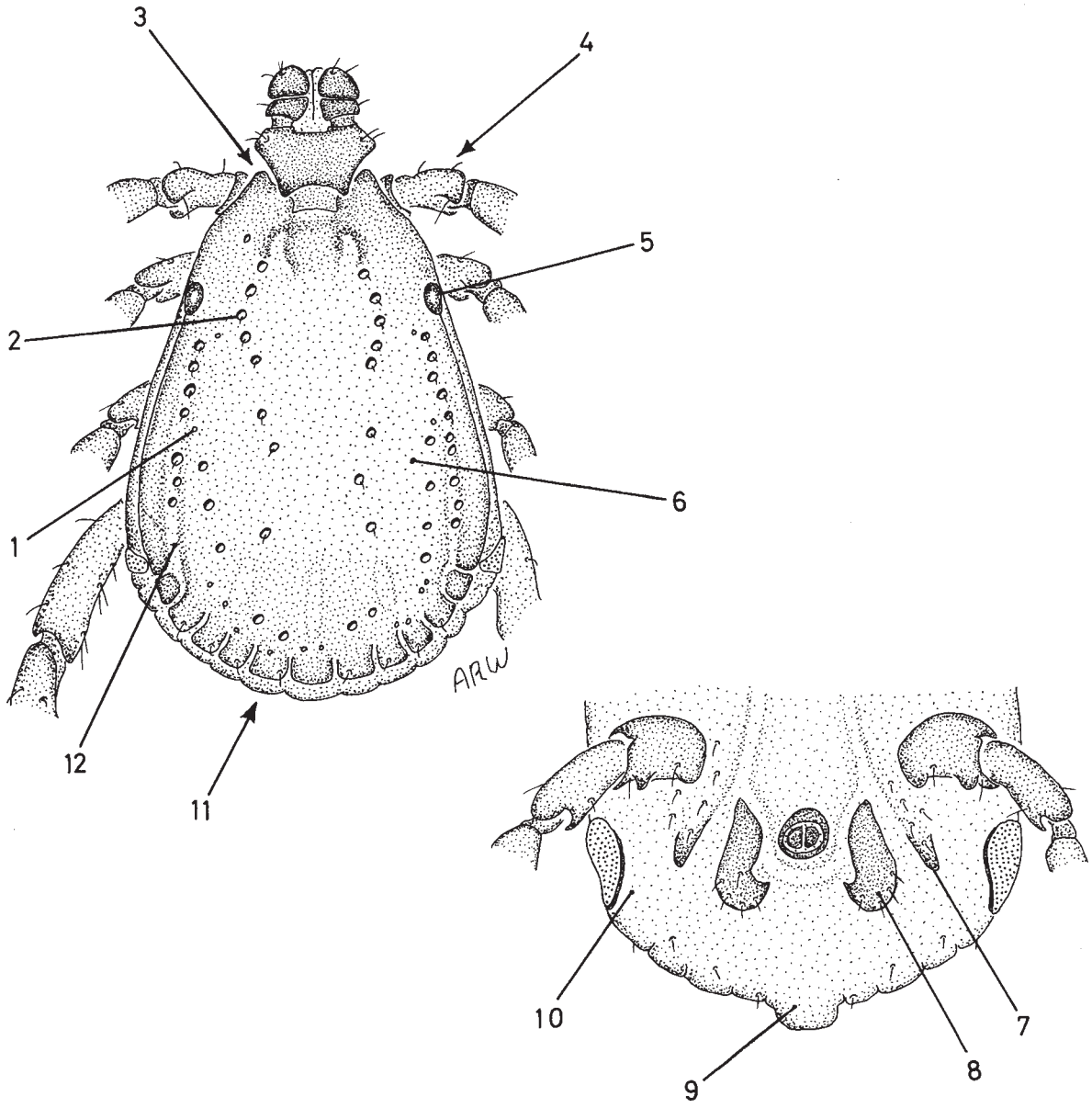
1 Basis capituli lateral angles are blunt.
2 Porose areas separation is broad.
3 Palp pedicels are long.
4 Cervical fields shape is large and curved.
5 Spiracle plate areas have sparse setae (not shown).
6 Scutum posterior margin is slightly sinuous.
7 Scutum colour is dark.

Rhipicephalus praetextatus **female**, **scutum at top left**, **genital aperture at bottom right**.



1 Interstitial punctation size is minute to small. Interstitial punctation distribution is sparse (these punctations are indistinct so the scutum appears smooth and shiny).
2 Setiferous punctations are distinct.
3 Scapular grooves profile is shallow.
4 Cervical fields texture has no wrinkles.
5 Eyes are slightly convex.
6 Genital aperture posterior lips have a truncated **V** shape (the hyaline border, arrowed, is large).

***Rhipicephalus praetextatus* male, scutum at left, ventral plates at bottom right.**



1 Interstitial punctation size is minute to small. Interstitial punctation distribution is sparse (these punctations are indistinct so the scutum appears smooth and shiny).
2 Setiferous punctations are distinct.
3 Coxae 1 anterior spurs are not visible.
4 Cervical fields depression is not apparent. Cervical fields texture has no wrinkles.
5 Eyes are slightly convex (as shown for the female).
6 Conscutum colour is dark.
7 Accessory adanal plates are large.
8 Adanal plates shape is broad and curved.
9 Caudal appendage is broad in fed males.
10 Spiracle plate areas have sparse setae.
11 Posterior grooves are absent (very shallow grooves may be visible)
12 Lateral grooves type is an indistinct groove (the grooves enclose one festoon on each side). Lateral grooves texture is distinctly punctate (the column of punctations in this position is more prominent than the groove).

Rhipicephalus pravus Dönitz, 1910.

General.
Rhipicephalus pravus is one of the ticks that is easily mistaken for the more important *Rhipicephalus appendiculatus* when collections are made from cattle in East Africa.

Differential diagnosis.
Rhipicephalus pravus needs to be differentiated from *Rh. appendiculatus*. Other species requiring the same differentiation are: *Rhipicephalus hurti*, *Rhipicephalus jeaneli*, *Rhipicephalus duttoni*, *Rhipicephalus punctatus* and *Rhipicephalus zambeziensis*. However, only *Rh. pravus* and *Rh. zambeziensis* are common enough to justify inclusion in this guide. *Rhipicephalus pravus* of both sexes have cervical fields that are smaller than in *Rh. appendiculatus* and which are defined by straight scapular grooves. Both sexes of *Rh. pravus* also have distinct setiferous punctations and dense interstitial punctations. There is also an undefined species very closely similar to *Rh. pravus* which occurs in a southern African population.

Hosts.
Cattle, sheep, goats, camels, dogs are the preferred hosts of adult *Rh. pravus*. They can also be found on horses, donkeys, pigs, several species of antelope and on hares. They attach to the ears, head, neck and dewlap of cattle. The immature stages prefer to feed on elephant shrews and hares.

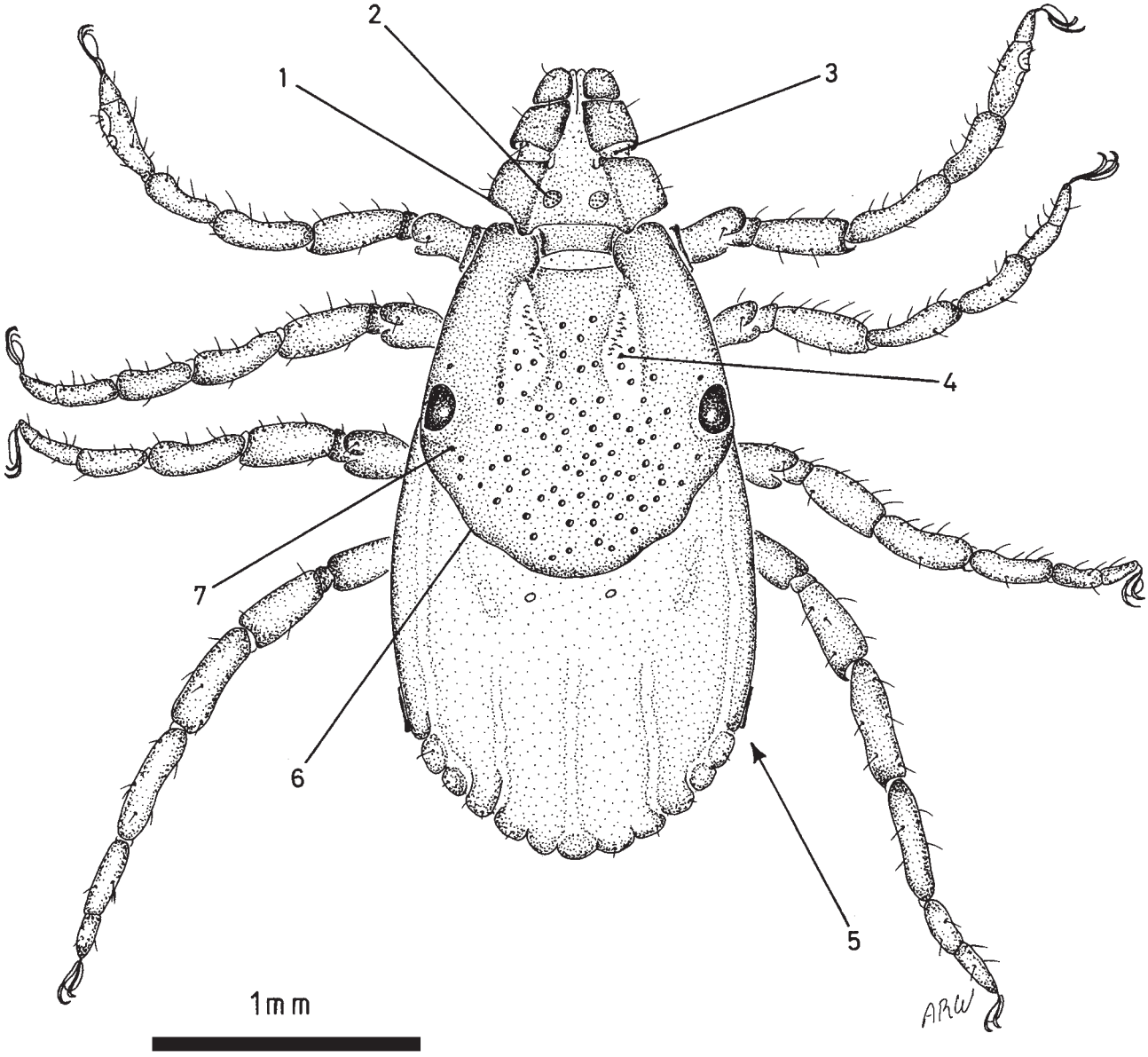
Life cycle and seasonal occurrence.
This species is a three-host tick. In the north of its distribution range adults are more prevalent during the rainy season, but in the south no seasonal trends are obvious.

Disease.
Little is known about this tick's association with disease.

Habitat and distribution.
Rhipicephalus pravus is a tick of temperate highland, savanna, steppe and desert climatic regions. It is found commonly in all the countries of East and North East Africa. It is often found in the same areas as *Amblyomma gemma* and is capable of surviving in much drier areas than *Rh. appendiculatus*. *Rhipicephalus pravus* extends southwards as far as 8ºS in Tanzania. The undefined species closely related to *Rh. pravus* occurs exclusively in southern Africa, below 16ºS.

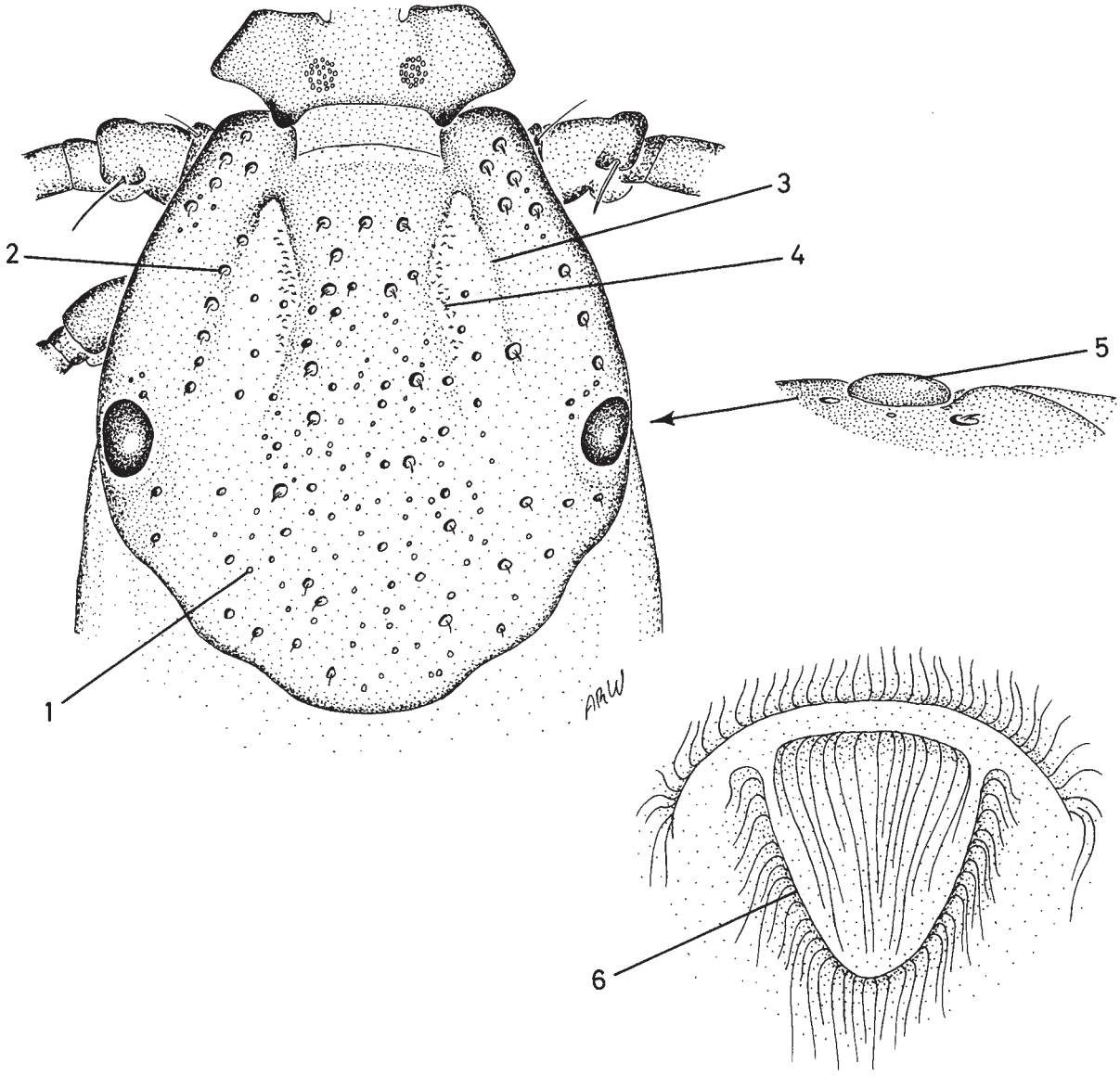
Distribution of *Rhipicephalus pravus*.

***Rhipicephalus pravus* female, dorsal.**



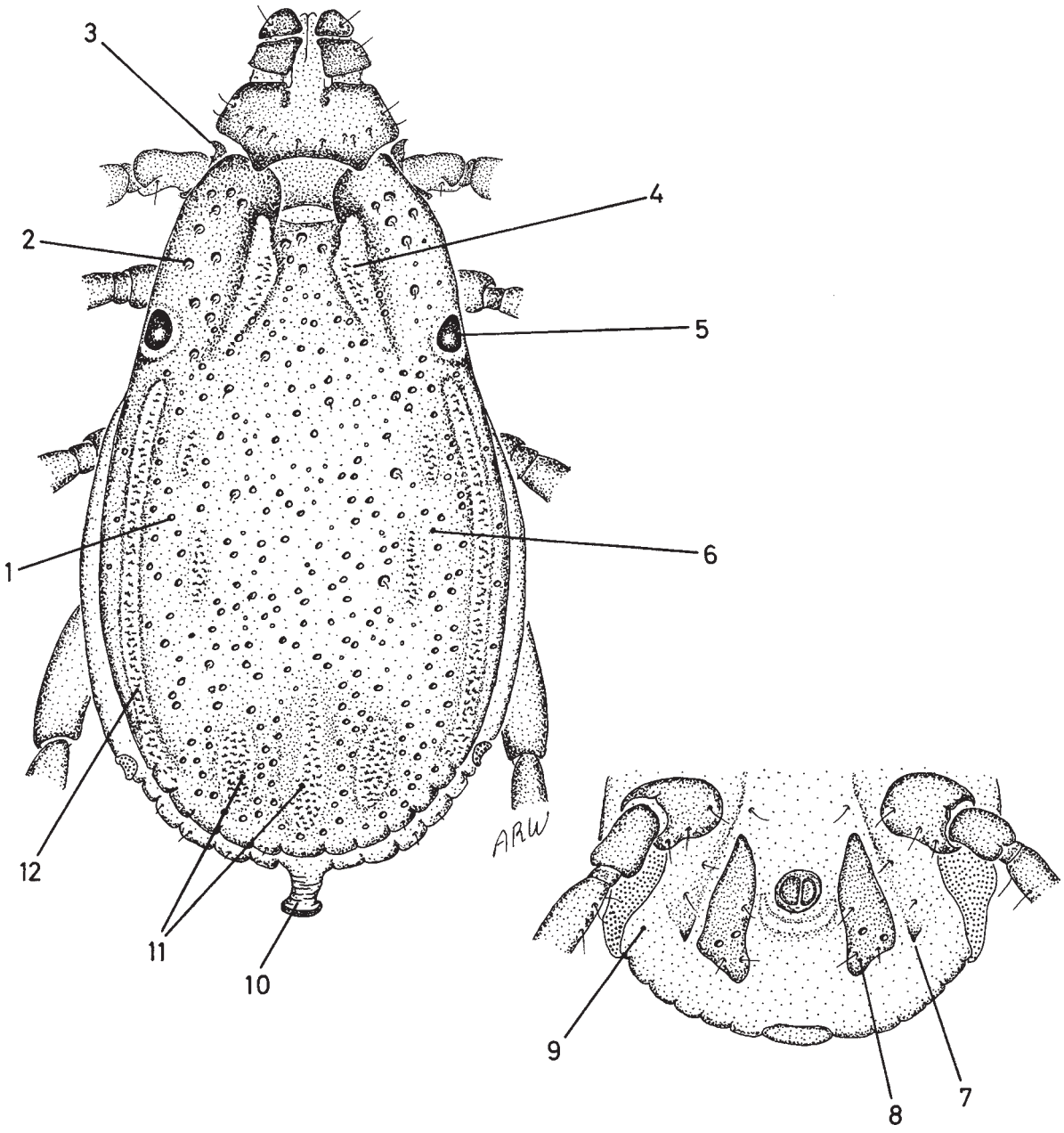
1 Basis capituli lateral angles are blunt.
2 Porose areas separation is broad.
3 Palp pedicels are short.
4 Cervical fields shape is small (and narrow).
5 Spiracle plate areas have sparse setae (not shown).
6 Scutum posterior margin is distinctly sinuous.
7 Scutum colour is dark.

Rhipicephalus pravus **female**, **dorsal scutum at top left**, **genital aperture at bottom right**.



1 Interstitial punctation size is minute to small. Interstitial punctation distribution is dense.
2 Setiferous punctations are distinct.
3 Scapular grooves profile is shallow.
4 Cervical fields texture has wrinkled areas.
5 Eyes are distinctly convex (and in shallow orbits).
6 Genital aperture posterior lips have a narrow **V** shape.

***Rhipicephalus pravus* male**, **dorsal at left**, **ventral plates at bottom right**.



1 Interstitial punctation size is minute to small. Interstitial punctation distribution is dense.
2 Setiferous punctations are distinct.
3 Coxae 1 anterior spurs are visible dorsally.
4 Cervical fields depression is apparent (forming a narrow cervical field). Cervical fields texture has wrinkled areas.
5 Eyes are distinctly convex (and in shallow orbits, as shown for the female).
6 Conscutum colour is dark.
7 Accessory plates are small (may be absent).
8 Adanal plates shape is narrow and trapezoid (in some specimens the shape is a broader trapezoid than illustrated here).
9 Spiracle plate areas have sparse setae.
10 Caudal appendage is narrow in fed males.
11 Posterior grooves are distinct (deep and with rough texture).
12 Lateral grooves type is a distinct groove (they extend almost to the eyes). Lateral grooves texture is wrinkled.

Rhipicephalus pulchellus (Gerstäcker, 1873).

General.
Rhipicephalus pulchellus is also known as The zebra tick. It is very well known where it occurs because it is so conspicuous, common and readily infests a wide range of hosts, including humans. It is called The zebra tick because of its white on black stripes and its use of zebras as a favourite host.

Differential diagnosis.
This is the main tick species likely to be found on livestock in Africa in which the males have, over their entire conscutum, a pattern of stripes of white enamel on a dark brown background. In the same endemic area as *Rh. pulchellus* there is another *Rhipicephalus* species with white enamel. This is *Rhipicephalus humeralis* in which the males have white spots on the scapulae (= shoulders) but no overall pattern of stripes. The females of these two species are much more difficult to differentiate; in *Rh. pulchellus* the punctations are less distinct but the white setae on the alloscutum are more distinct than in *Rh. humeralis*. However, collections of the common *Rh. pulchellus* are usually so large that the females are most easily identified by association with the unique males. *Rhipicephalus humeralis* may occur in dense infestations on cattle in some areas, for example in Somalia. The other ticks in Africa south of the Sahara, with white enamel on the scutum, are the large robust *Dermacentor* and *Cosmiomma* ticks on elephants, rhinoceroses and hippopotamuses (see Plate 5).

Hosts
Cattle, as well as camels, sheep and goats are the preferred hosts of adult *Rh. pulchellus*. They attach in large numbers on cattle. They attach primarily on the ears and the underside of the body, including the chest, belly, genital and peri-anal areas. Their preferred wild hosts are zebras, black rhinoceroses, elands and gemsboks. The immature stages feed on these animals as well as on hares. When walking through savanna which supports dense populations of potential hosts of this tick, it is common to find many immature and adult *Rh. pulchellus* crawling on one's clothing and the immature stages will readily attach.

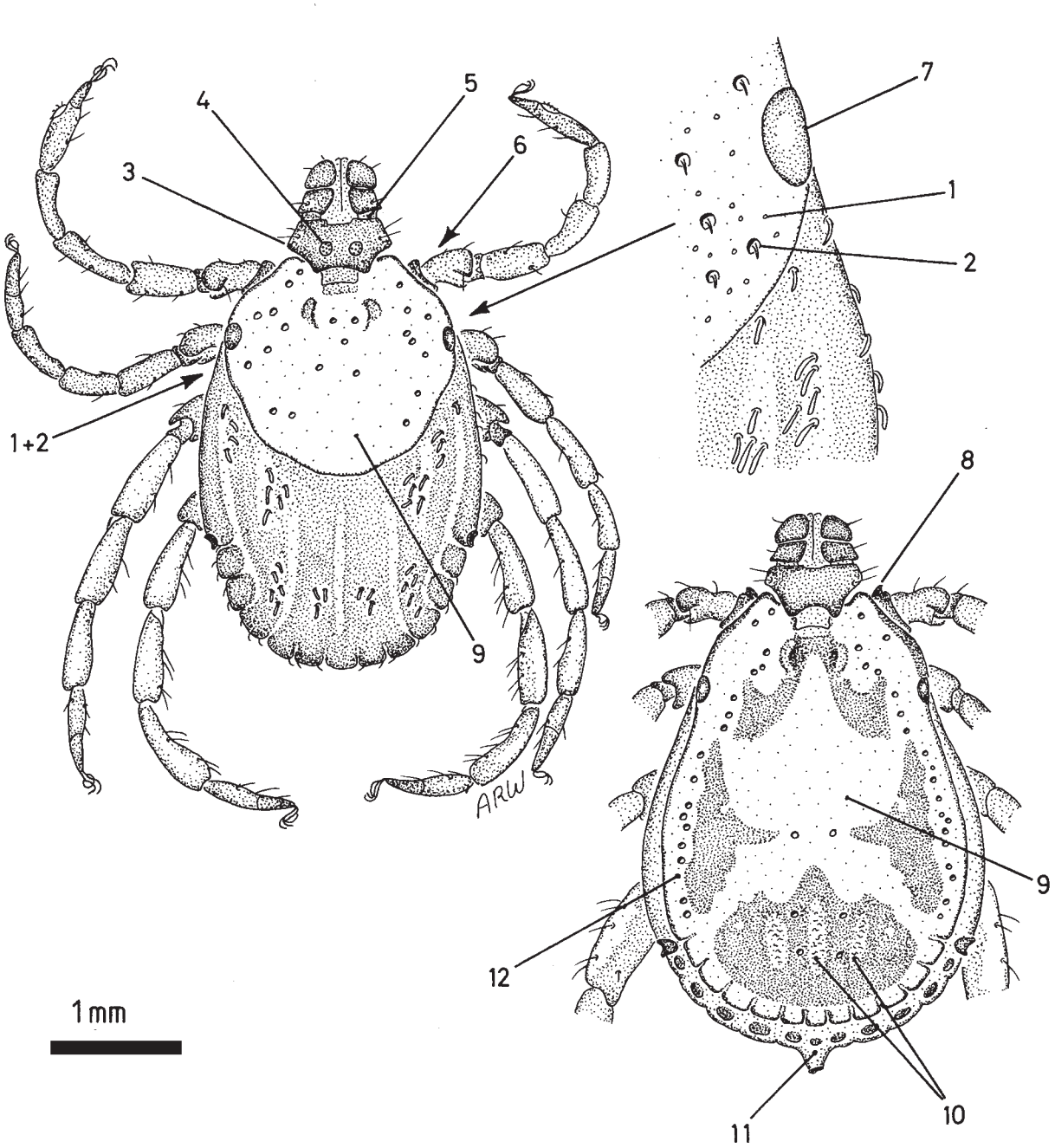
Life cycle and seasonal occurrence.
Rhipicephalus pulchellus has a three-host life cycle. The adults appear to be most active during the rainy season.

Disease.
This tick species transmits the protozoan *Theileria taurotragi* which causes benign bovine theileriosis. It also transmits Nairobi sheep disease virus causing the disease of the same name in sheep. It can be a risk to humans because of its transmission of the bacterium *Rickettsia conorii,* causing tick typhus, and transmission of the virus of Crimean-Congo haemorrhagic fever. It may occur on some hosts in sufficient numbers to cause direct parasitic harm.

Habitat and distribution
Rhipicephalus pulchellus is a tick of savanna, steppe and desert climatic regions. It is one of the commonest ticks present in North East Africa, the Rift Valley and also east of the Rift Valley from Eritrea in the north to north-eastern Tanzania in the south. It is not found further west than about 35ºE

Distribution of *Rhipicephalus pulchellus*.

***Rhipicephalus pulchellus* female, dorsal, top left; and a male, dorsal, bottom right.**



1 Interstitial punctation size in both sexes is minute to small.
Interstitial punctation distribution is dense in both sexes.
2 Setiferous punctations are distinct in both sexes.
3 Basis capituli lateral angles are blunt.
4 Porose areas separation is narrow.
5 Palp pedicels are short.
6 Cervical fields shape is not apparent in either sex.
7 Eyes are flat in both sexes.
8 Coxae 1 anterior spurs are visible on males.
9 Female scutum colour is with enamel ornamentation (ivory white all over).
Male conscutum colour is with enamel ornamentation (an ivory white in a pattern against a dark brown background).
10 Posterior grooves are distinct.
11 Caudal appendage is narrow in fed males.
12 Lateral grooves type is punctations only. Lateral groove texture is distinctly punctate.

Rhipicephalus sanguineus (Latreille, 1806).

General.
Rhipicephalus sanguineus is also known as The kennel tick or The pan-tropical dog tick. This species has become the most widespread tick throughout the tropics and sub-tropics because of its specialised feeding on domestic dogs.

Differential diagnosis.
This species is a small *Rhipicephalus*, usually of a dull yellow colour but some populations may be a mid brown colour. It has often been confused with other ticks in what is now known as the *sanguineus* group. The other species of this group included in this guide are: *Rhipicephalus camicasi*, *Rhipicephalus guilhoni* and *Rhipicephalus turanicus*. Females of *Rh. sanguineus* are differentiated from those of *Rh. camicasi* and *Rh. turanicus* by the genital aperture which is usually a broad **U** shape in *Rh. sanguineus* compared to a narrow **U** in *Rh. camicasi* and *Rh. turanicus*. Both sexes of *Rh. sanguineus* have spiracle plates with tails which are narrow, less than the width of the adjacent festoon. In *Rh. guilhoni* and *Rh. turanicus* these tails are broad. Males of *Rh. sanguineus* do not have a depression of the cervical fields when compared to the small depression seen in *Rh. camicasi*. The original description and naming of *Rh. sanguineus* has become confused and there remains a need for further clarification of all species in the *Rh. sanguineus* group of ticks.

Hosts.
Domestic dogs are the host for which *Rh. sanguineus* is specialised, but it may be found on cattle. Dogs are hosts for all stages of development. The behaviour of this tick is both domestic and generally monotropic. Adults attach on the ears, neck and shoulders, nymphs are also found on the ears and shoulders, and larvae attach particularly to the belly and flanks. Immature stages of this tick attempt to attach to humans. Hosts other than dogs are usually only infested when dogs are present to maintain a population of the tick.

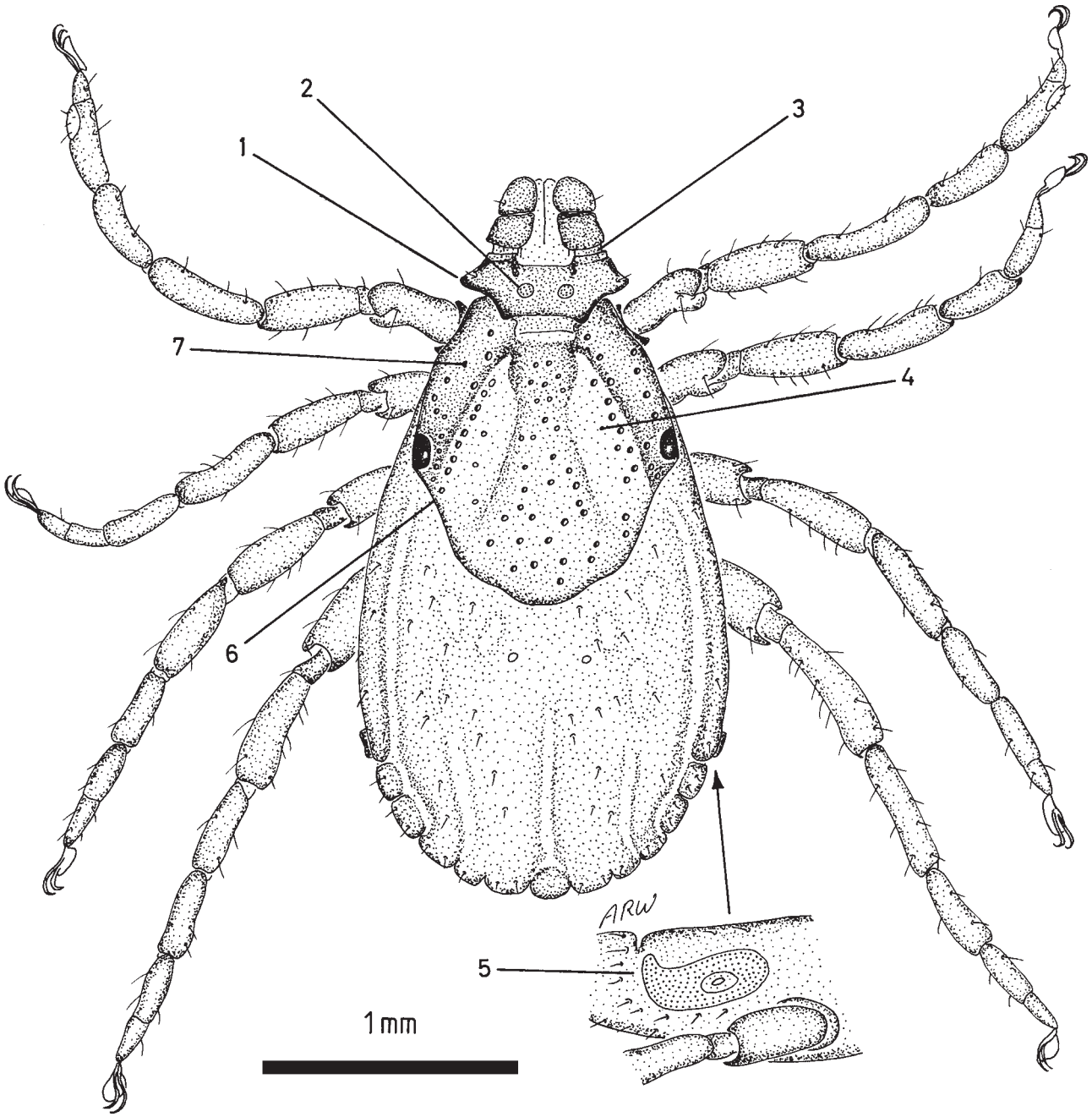
Life cycle and seasonal occurrence.
This is a three-host tick. The engorged female detaches and lays approximately 3 200 eggs within 7 to 28 days of detaching from a dog. The eggs hatch within 3 to 10 weeks. The larvae engorge in 3 to 8 days and moult within 2 to 6 weeks. The nymphs engorge in 4 to 10 days and moult within 2 to 26 weeks. The females may engorge in 7 days but they can stay on the dog for 3 weeks if unmated and the males remain for several months for repeated matings. The life cycle can be completed in 10 weeks under ideal conditions. Although this tick can survive in open environments it is highly adapted to living in dog kennels and in the homes of humans. Thus it is untypical of *Rhipicephalus* ticks which are usually exophilic. The females climb up the walls and lay eggs in cracks and crevices in these structures or they may lay eggs under the dog's bedding or in nearby cracks and crevices. The larvae and nymphs usually moult in the same sites as the females lay their eggs. Dogs that are tied up repeatedly in the same kennel may become heavily infested. In artificially heated homes the tick's feeding activity may extend into winter.

Disease.
Rhipicephalus sanguineus transmits the bacterium *Ehrlichia canis* to dogs causing canine ehrlichiosis, this infection may develop into the chronic form known as canine tropical pancytopaenia. It transmits the bacterium *Rickettsia conorii* causing boutonneuse fever (= Mediterranean spotted fever), in humans. However, in sub-Saharan Africa this relationship for *Rh. sanguineus* is less distinct than it is in the Mediterranean basin. Other species of ticks are more important for transmission of rickettsias such as *Ri. africae* south of the Sahara. *Rhipicephalus sanguineus* transmits the protozoans *Babesia canis* and *Babesia gibsoni* to dogs, causing canine babesiosis. The protozoan *Hepatozoon canis* is transmitted from tick to dog when the dog swallows the tick during grooming; this pathogen causes hepatozoonosis.

Habitat and distribution.
Because of its association with domestic dogs this tick occurs in all climatic regions of Africa. It can also survive in sheltered kennels in cool temperate climatic regions and thus has spread globally between 50°N and 35°S. However, it has denser populations in warm and moist climates and is sparse in desert climates. Because of the confused identifications of many *Rh. sanguineus* in the past a map showing block locations is not provided. The map below is a general indication of where *Rh. sanguineus* is likely to be found in Africa and Madagascar. This is based on reliable records combined with the assumption that it will be infesting most populations of domestic dogs and thus follow the distribution of human populations.

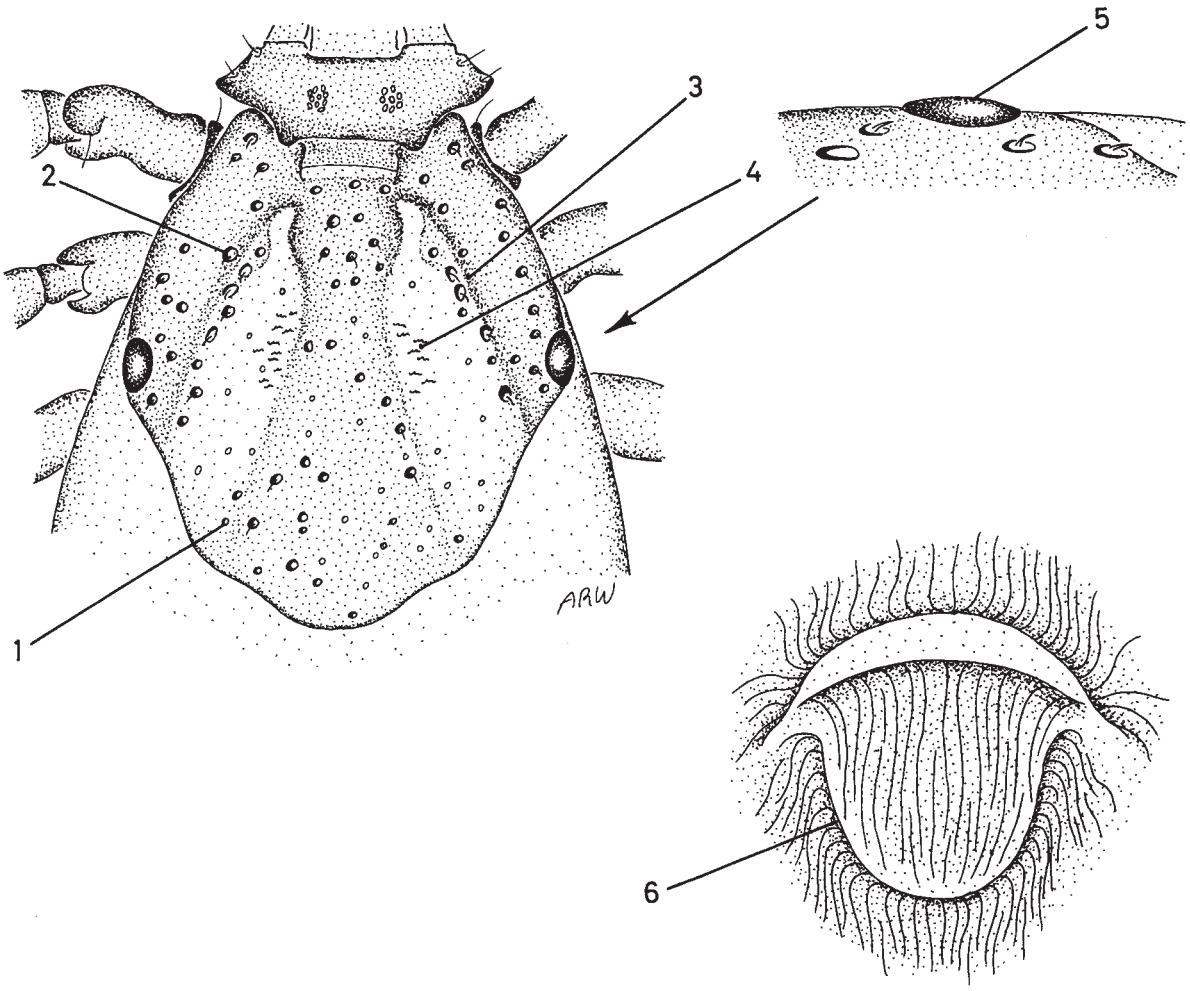
Distribution of *Rhipicephalus sanguineus*.

***Rhipicephalus sanguineus* female, dorsal, spiracle plate at bottom right.**



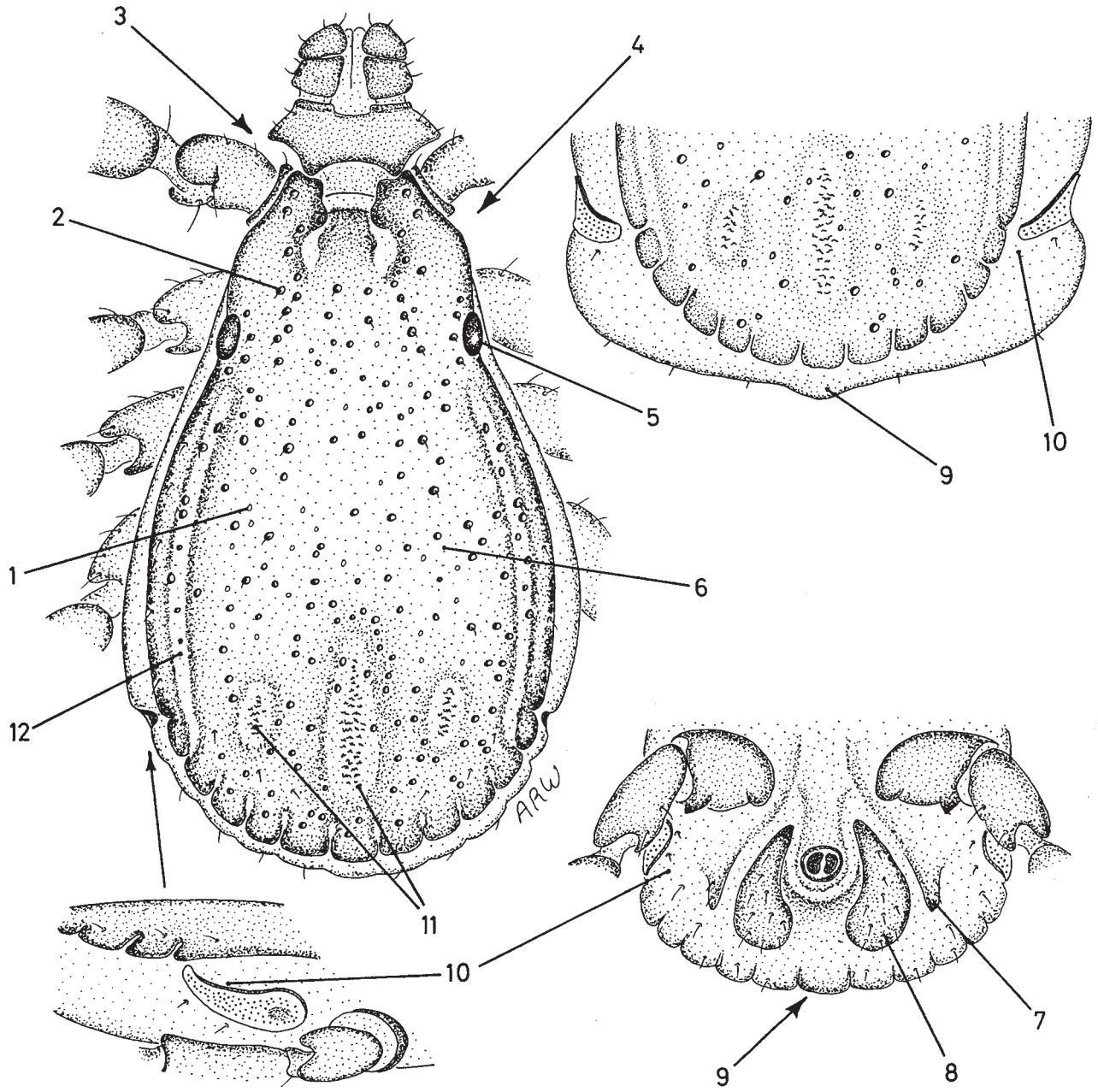
1 Basis capituli lateral angles are sharp.
2 Porose areas separation is broad.
3 Palp pedicels are short.
4 Cervical fields shape is large and straight.
5 Spiracle areas have sparse setae. (Spiracle plates have narrow tails, half the width of adjacent festoon.)
6 Scutum posterior margin is distinctly sinuous (with a distinctly concave curve posterior to the eyes).
7 Scutum colour is pale (in some populations it is dark).

Rhipicephalus sanguineus **female**, **dorsal scutum at top left**, **genital aperture at bottom right**.



1 Interstitial punctation size is small to medium. Interstitial punctation distribution is sparse (density of these punctations is highly variable).
2 Setiferous punctations are indistinct.
3 Scapular grooves profile is steep.
4 Cervical fields texture has wrinkled areas.
5 Eyes are slightly convex.
6 Genital aperture posterior lips have a broad **U** shape (but may have a broad **V** shape).

***Rhipicephalus sanguineus* male**, **dorsal at top left and caudal appendage at top right**, **ventral plates at bottom right**, **spiracle at bottom left**.



1 Interstitial punctation size is small to medium. Interstitial puncation distribution is sparse (density of these punctations is highly variable).
2 Setiferous punctations are indistinct.
3 Coxae 1 anterior spurs are not visible dorsally.
4 Cervical fields depression is not apparent. Cervical fields texture has no wrinkles.
5 Eyes are slightly convex (as shown for the female).
6 Conscutum colour is pale (but may be dark in some populations).
7 Accessory adanal plates are large.
8 Adanal plates shape is narrow and trapezoid (but tend towards a broad and curved appearance).
9 Caudal appendage is broad in fed males (it protrudes as a slight bulge, as shown in the fed male at top right).
10 Spiracle areas have sparse setae. (Spiracle plate tails are narrow, half the width of adjacent festoon.)
11 Posterior grooves are distinct (deep and wide with wrinkled texture).
12 Lateral grooves type is a distinct groove. Lateral grooves texture is smooth.

Rhipicephalus senegalensis Koch, 1844.

General.
Rhipicephalus senegalensis is a conspicuous *Rhipicephalus* species of cattle in West Africa. The naming of this species has been confused in the past and thus information on its biology may be unclear.

Differential diagnosis.
This tick species is large, robust and dark brown. It is similar to ticks of the *simus* group of ticks, but does not belong to this group. The species of the *simus* group are *Rhipicephalus simus*, *Rhipicephalus muhsamae* and *Rhipicephalus praetextatus*. Other similar species, not included in this guide are *Rhipicephalus longus* and *Rhipicephalus pseudolongus*. *Rhipicephalus senegalensis* females have genital apertures with a simple narrow **V** shape formed by the posterior lips compared to a truncated **V** shape formed by the hyaline borders at the posterior lips in females of the *simus* group. *Rhipicephalus senegalensis* males have a conscutum with distinct posterior grooves compared to absent or indistinct posterior grooves in *simus* group males. The males of *Rh. senegalensis* also have conspicuously large crescent shaped adanal plates and fed males reveal an unusual caudal appendage consisting of three expanded festoons.

Hosts.
Cattle, dogs, warthogs and African buffaloes are the preferred hosts of adult *Rh. senegalensis.* The adults may also be found on sheep, goats, horses and pigs. The ears are the preferred site of attachment of adults on cattle, but when large numbers are present they may attach anywhere on the head as well as on the shoulders, flanks, tail and around the feet. The immatures stages prefer to feed on rodents.

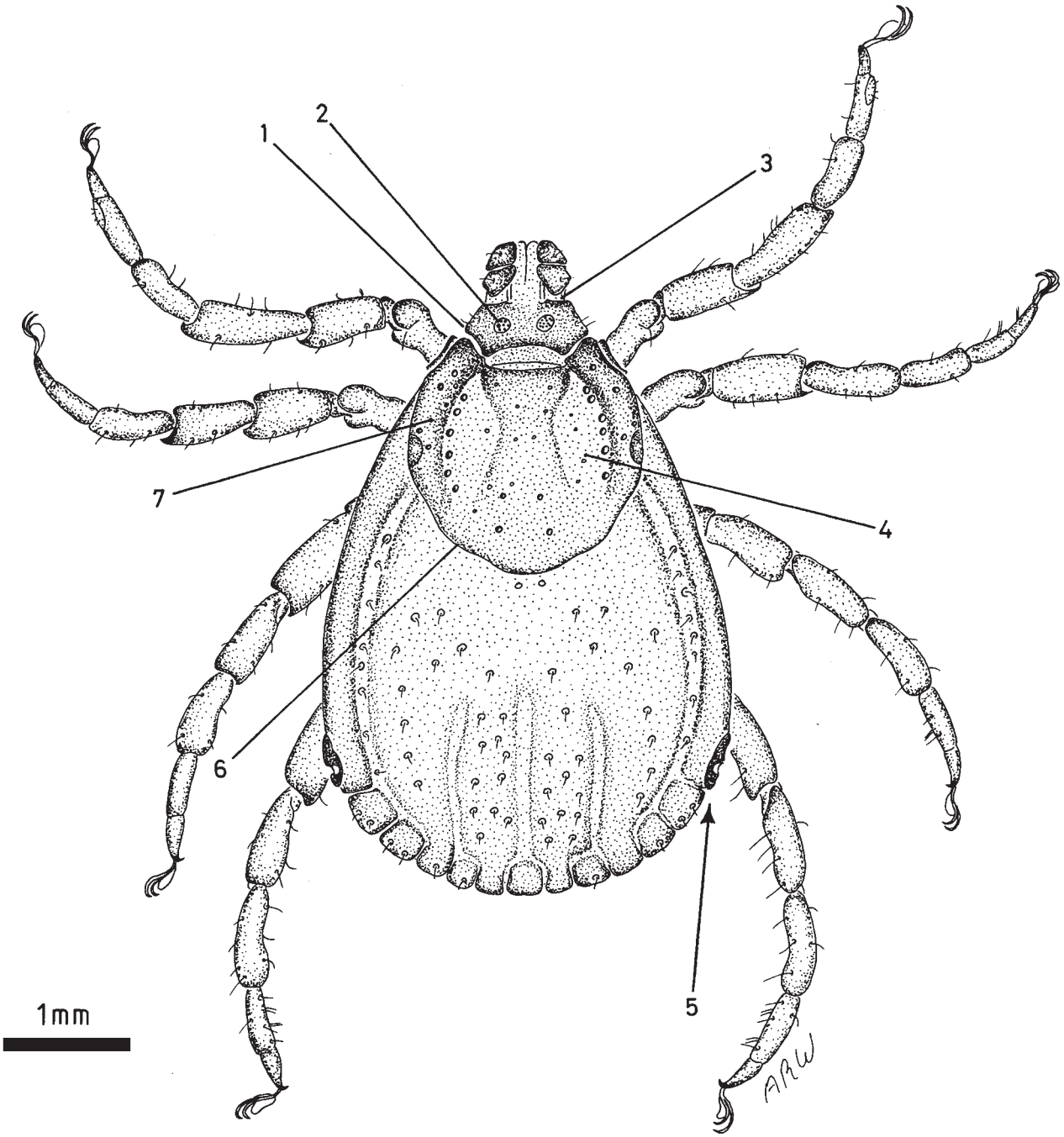
Life cycle and seasonal occurrence.
Rhipicephalus senegalensis is a three-host species, with adults present chiefly during the rainy season.

Disease.
This tick species is not known to be a vector of important pathogens of domestic animals.

Habitat and distribution.
Rhipicephalus senegalensis occurs in regions with savanna and rain forest climates. It is confined to a broad band roughly between 0° and 12°N across Africa from Senegal in the west to Sudan and Uganda in the east. The distribution of *Rh. senegalensis* does not overlap with the distribution of *Rh. simus,* which occurs entirely further south.

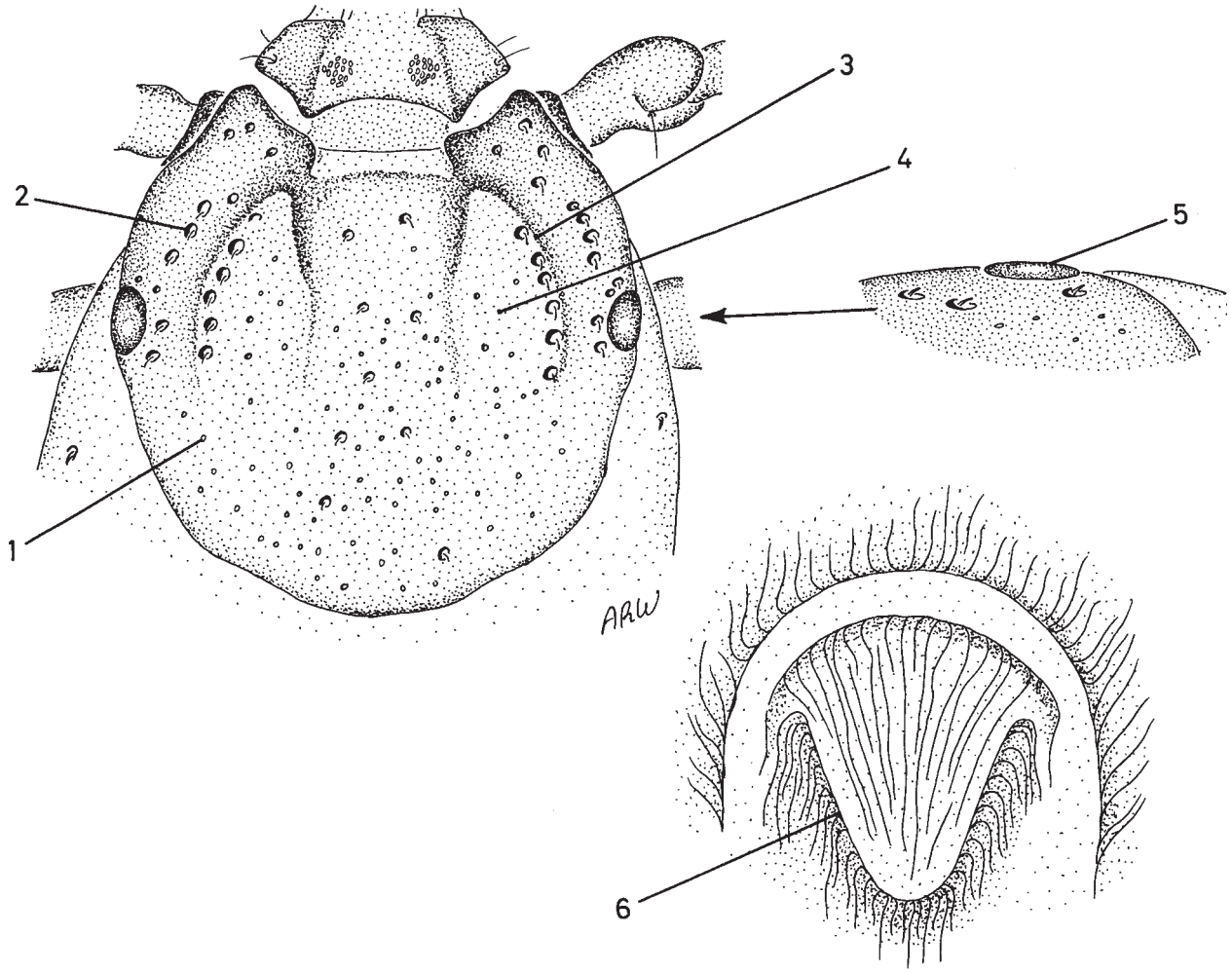
Distribution of *Rhipicephalus senegalensis*.

***Rhipicephalus senegalensis* female, dorsal.**



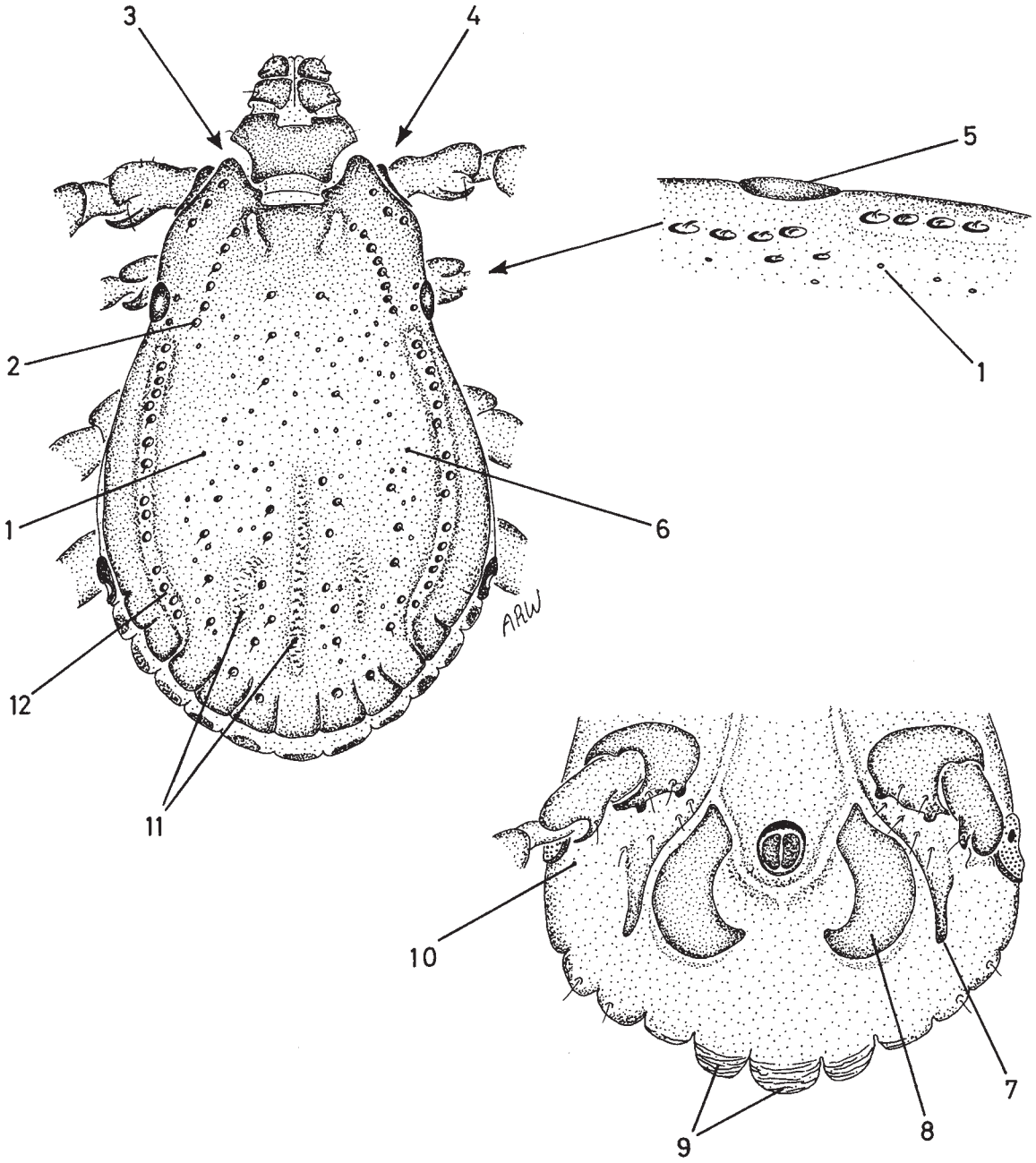
1 Basis capituli lateral angles are blunt.
2 Porose areas separation is narrow.
3 Palp pedicels are short.
4 Cervical fields shape is large and curved.
5 Spiracle plate areas have sparse setae (not shown).
6 Scutum posterior margin is slightly sinuous.
7 Scutum colour is dark.

Rhipicephalus senegalensis **female**, **scutum at top left**, **genital aperture at bottom right**.



1 Interstitial punctation size is minute. Interstitial punctation distribution is dense (but these punctations are so indistinct that the scutum has a smooth shiny appearance).
2 Setiferous punctations are distinct.
3 Scapular grooves profile is shallow.
4 Cervical fields texture has no wrinkles.
5 Eyes are flat.
6 Genital aperture posterior lips have a narrow **V** shape.

***Rhipicephalus senegalensis* male, dorsal at left, ventral plates at bottom right.**



1 Interstitial punctation size is minute to small. Interstitial punctation distribution is dense (these punctations are so indistinct that the conscutum has a smooth shiny appearance).
2 Setiferous punctations are distinct.
3 Coxae 1 anterior spurs are not visible dorsally.
4 Cervical fields depression is not apparent. Cervical fields texture has no wrinkles.
5 Eyes are flat to slightly convex.
6 Conscutum colour is dark.
7 Accessory adanal plates are large.
8 Adanal plates shape is broad and curved (distinctly so).
9 Caudal appendage is broad in fed males (consisting of three expanded festoons).
10 Spiracle area has sparse setae.
11 Posterior grooves are distinct (shallow, narrow and with wrinkled texture, may be indistinct in some specimens).
12 Lateral grooves type is a distinct groove (they also enclose two festoons on each side). Lateral grooves texture is distinctly punctate.

Rhipicephalus simus Koch, 1844.

General.
Rhipicephalus simus is also known as The glossy tick. It is a conspicuous tick with a large, dark and shiny scutum or conscutum. As it has in the past been confused with *Rhipicephalus praetextatus* and *Rhipicephalus senegalensis*, information on its biology is likely to be unclear.

Differential diagnosis.
This tick species is typical of the *simus* group and needs to be distinguished from the other members, *Rh. praetextatus* and *Rhipicephalus muhsamae*. Another similar species is *Rhipicephalus senegalensis*. Females of the *simus* group have the two outermost festoons enclosed by each lateral groove (this is clear only in unfed females). Compared to other *simus* group females *Rh. simus* is a larger tick and has a denser distribution of small interstitial punctations. These punctations give the scutum a less smooth or shiny appearance than that of *Rh. praetextatus*. Females of the *simus* group have genital apertures with hyaline borders forming, with the posterior lips, a truncated **V** shape. In contrast *Rh. senegalensis* has a narrow **V** shape here. Male *Rh. simus* also have a denser distribution of small interstitial punctations than males of *Rh. muhsamae* and *Rh. praetextatus*. Both male and female ticks of all members of the *simus* group have distinctive setiferous punctations and the term *simus* pattern is derived from this tick, with four irregular columns down the centre of the scutum or conscutum.

Hosts.
Cattle are the main host of adult *Rh. simus*, also sheep, goats and horses are infested. This tick also feeds on dogs, large wild carnivores, zebras, warthogs and rhinoceroses. The adults attach in the tail-brush and around the feet of cattle and on the tails of horses and zebras, and on the heads and shoulders of dogs and warthogs. On sheep they attach around the feet. The immature stages prefer murid rodents.

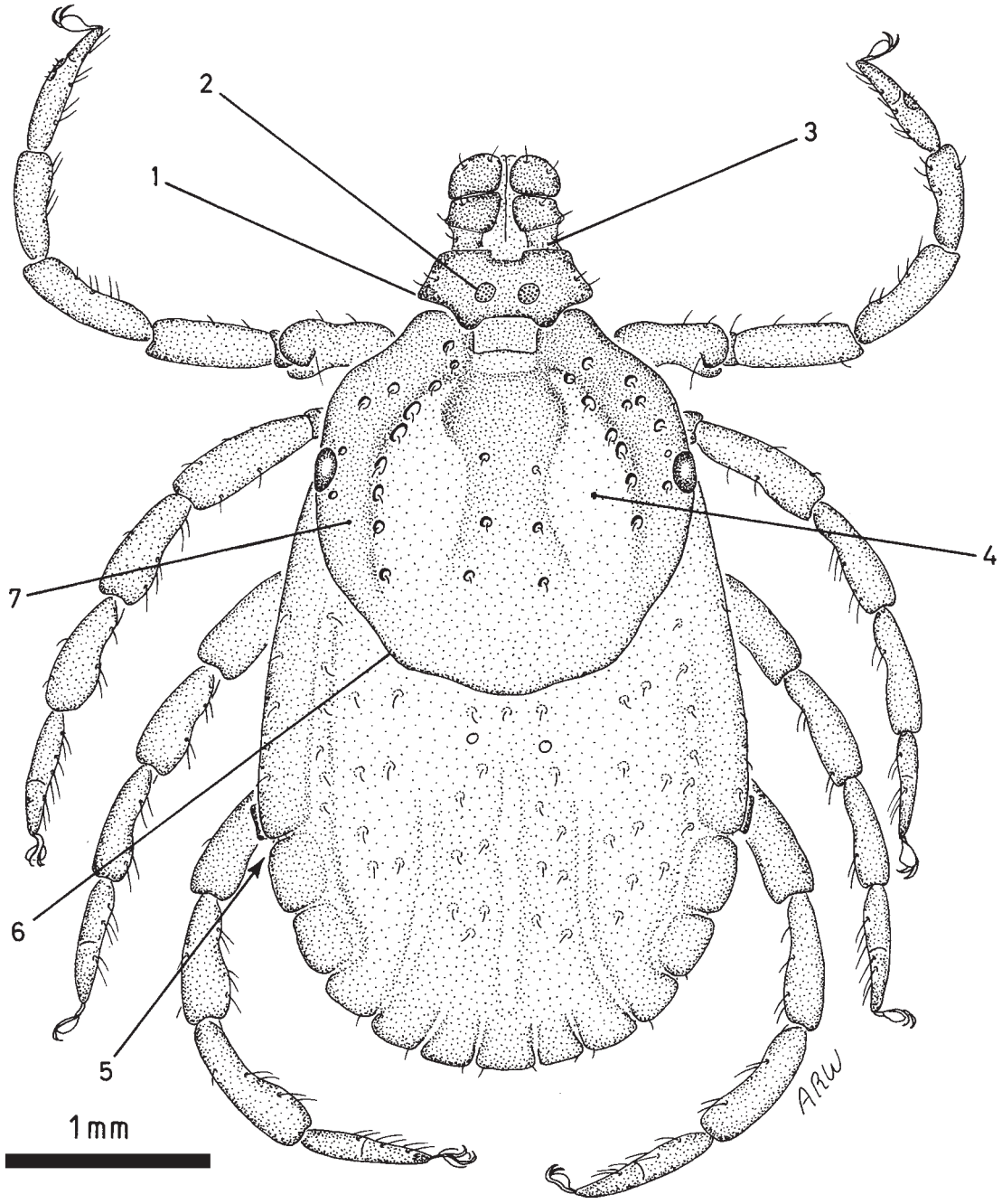
Life cycle and seasonal occurrence.
This species is a three-host tick. Adults are present on large hosts during summer, larvae on rodents in autumn and winter, and nymphs on rodents in winter and spring.

Disease.
Rhipicephalus simus can transmit the bacterium *Anaplasma marginale* to cattle both transstadially and also within the single adult stage. Although transstadial transmission of *An. marginale* is possible it seems unlikely to occur in the field as the immature stages feed virtually exclusively on rodents which do not become infected with the bacterium. Intrastadial transmission by infected adult ticks, and more particularly males, wandering from one host to another seems a more likely route of infection. This tick transmits the bacterium *Rickettsia africae* to humans causing African tick typhus. When feeding, *Rh. simus* produces a toxin causing paralysis in calves and lambs.

Habitat and distribution.
This is a tick of regions with a savanna climate. It is widely distributed in the moderate to high rainfall regions of Angola, Zambia, Malawi and Mozambique, Zimbabwe in the north to South Africa in the south. This tick is never encountered in very large numbers. Its distribution is distinct from *Rh. senegalensis* and *Rh. muhsamae* which both occur in an overlapping band from West Africa to East Africa. *Rhipicephalus simus* occurs entirely to the south of this band. There may be some overlap between the most southerly distribution of *Rh. praetextatus* and the most northerly distribution of *Rh. simus*, between the latitudes 7º and 10º south.

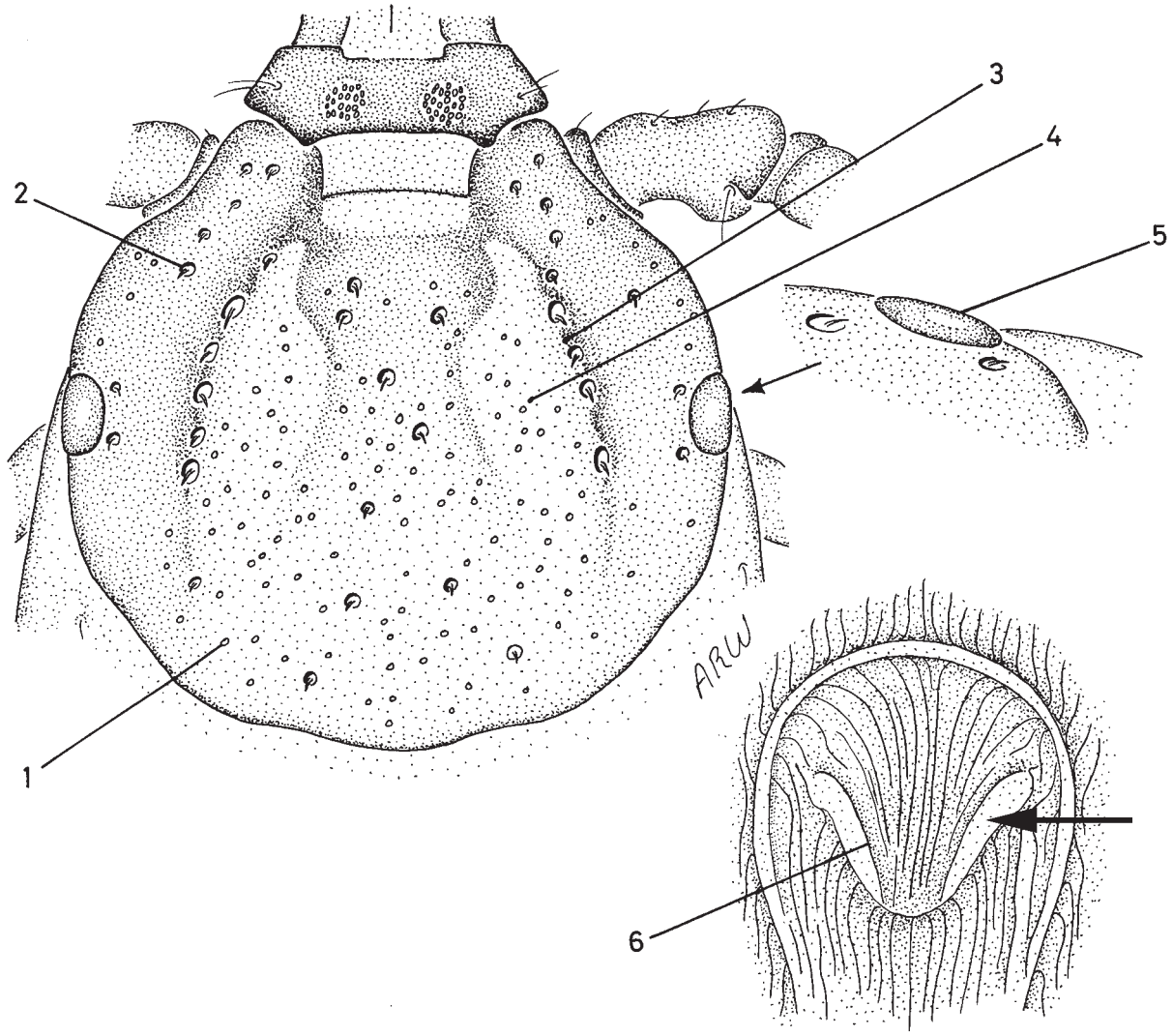
Distribution of *Rhipicephalus simus*.

***Rhipicephalus simus* female, dorsal.**



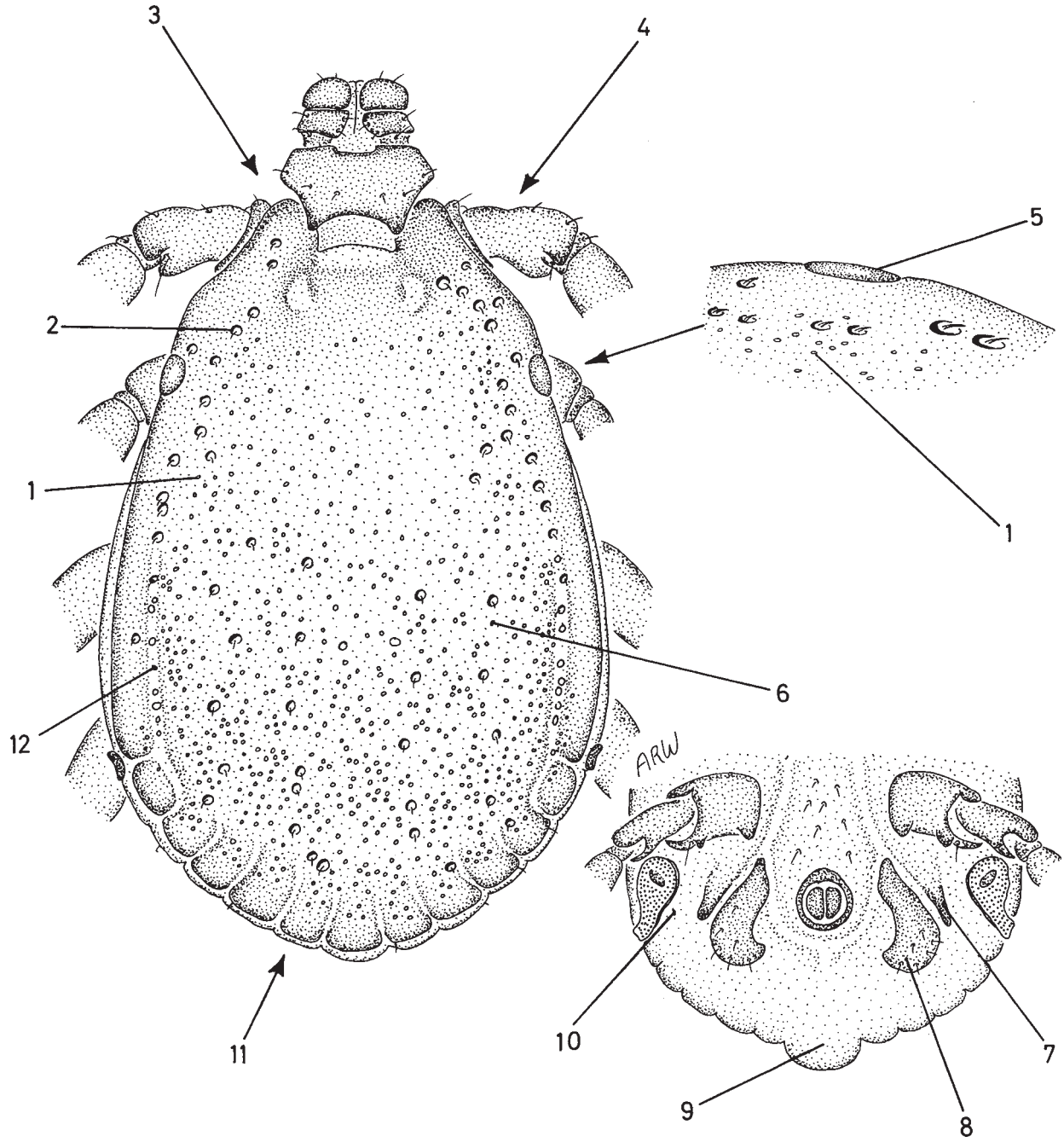
1 Basis capituli lateral angles are blunt.
2 Porose areas separation is narrow.
3 Palp pedicels are long.
4 Cervical fields shape is large and curved.
5 Spiracle areas have sparse setae (not shown).
6 Scutum posterior margin is slightly sinuous (populations of this species in South Africa tend to have a more smoothly rounded posterior margin).
7 Scutum colour is dark.

Rhipicephalus simus **female**, **scutum at top left**, **genital aperture at bottom right**.



1 Interstitial punctation size is minute to small. Interstitial punctation distribution is dense.
2 Setiferous punctations are distinct.
3 Scapular grooves profile is shallow.
4 Cervical fields texture has no wrinkles.
5 Eyes are flat.
6 Genital aperture posterior lips have a truncated **V** shape (the hyaline border is relatively narrow in this species, see the arrow).

***Rhipicephalus simus* male, conscutum at left, ventral plates at bottom right.**



1 Interstitial punctation size is minute to small. Interstitial punctation distribution is dense.
2 Setiferous punctations are distinct (the *simus* pattern of punctations is formed by the four irregular columns of setiferous punctations down the conscutum between the lateral grooves, there is also a column of setiferous punctations at each outer margin of the conscutum).
3 Coxae 1 anterior spurs are not visible dorsally.
4 Cervical fields depression is not apparent. Cervical fields texture has no wrinkles.
5 Eyes are flat.
6 Conscutum colour is dark.
7 Accessory adanal plates are large.
8 Adanal plates shape is broad and curved.
9 Caudal appendage is broad in fed males.
10 Spiracle plate areas have sparse setae.
11 Posterior grooves are absent.
12 Lateral grooves type is a distinct groove (they usually enclose one festoon on each side). Lateral grooves texture is distinctly punctate.

Rhipicephalus turanicus Pomerantsev, 1936.

General.
Rhipicephalus turanicus is a typical *Rhipicephalus* of livestock except that it has a distribution much wider than Africa. Like *Haemaphysalis leachi*, it is found in the Palaearctic and Afrotropical regions. Its specific name refers to Turkestan, near the Caspian Sea.

Differential diagnosis.
This is a *Rhipicephalus* species of mid brown colour. It is a member of the *sanguineus* group, and is closely similar to *Rhipicephalus camicasi*, *Rhipicephalus guilhoni* and *Rhipicephalus sanguineus*. The females of *Rh. turanicus* have the genital aperture with posterior lips forming a distinctly narrow **U** shape. In *Rh. sanguineus* these posterior lips form a broad **U** shape. The males of *Rh. turanicus* have small shallow cervical fields, and in fed males a distinctive broad and protruding caudal appendage. Both sexes of *Rh. turanicus* have spiracle plates with tails that are as broad as the adjacent festoon. In *Rh. sanguineus* and also *Rh. camicasi* of both sexes these tails are narrower than the adjacent festoon. The illustrations here are from Tunisian ticks. This species occurs in widely distributed and isolated populations and there is more than the usual level of variation in some characters. In South Africa this species has a denser distribution of punctations and the adanal plates are more narrow and angular than shown here.

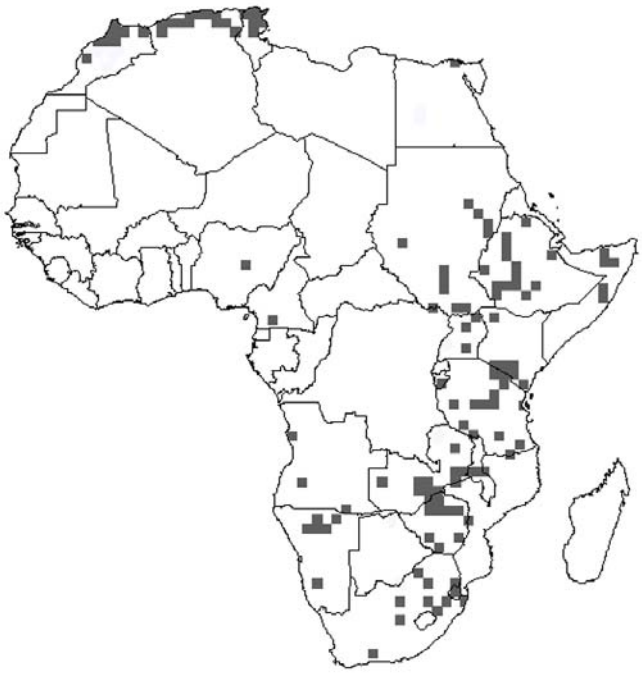
Hosts.
Cattle, sheep and dogs are the domestic animals from which adult *Rh. turanicus* have most frequently been collected in sub-Saharan Africa. This tick species often heavily infests sheep. It is sometimes found on horses. In North Africa and the northern Sahel it is in addition found on camels, water buffalo and goats. Its favoured wild hosts are the larger carnivores and some of the larger ground-feeding birds, with some collections from zebras and warthogs. The hosts of the immature stages include hedgehogs, shrews, gerbils, murid rodents and hares.

Life cycle and seasonal occurrence.
Rhipicephalus turanicus is a three-host tick. The adults generally are most numerous during the late rainy to early dry seasons.

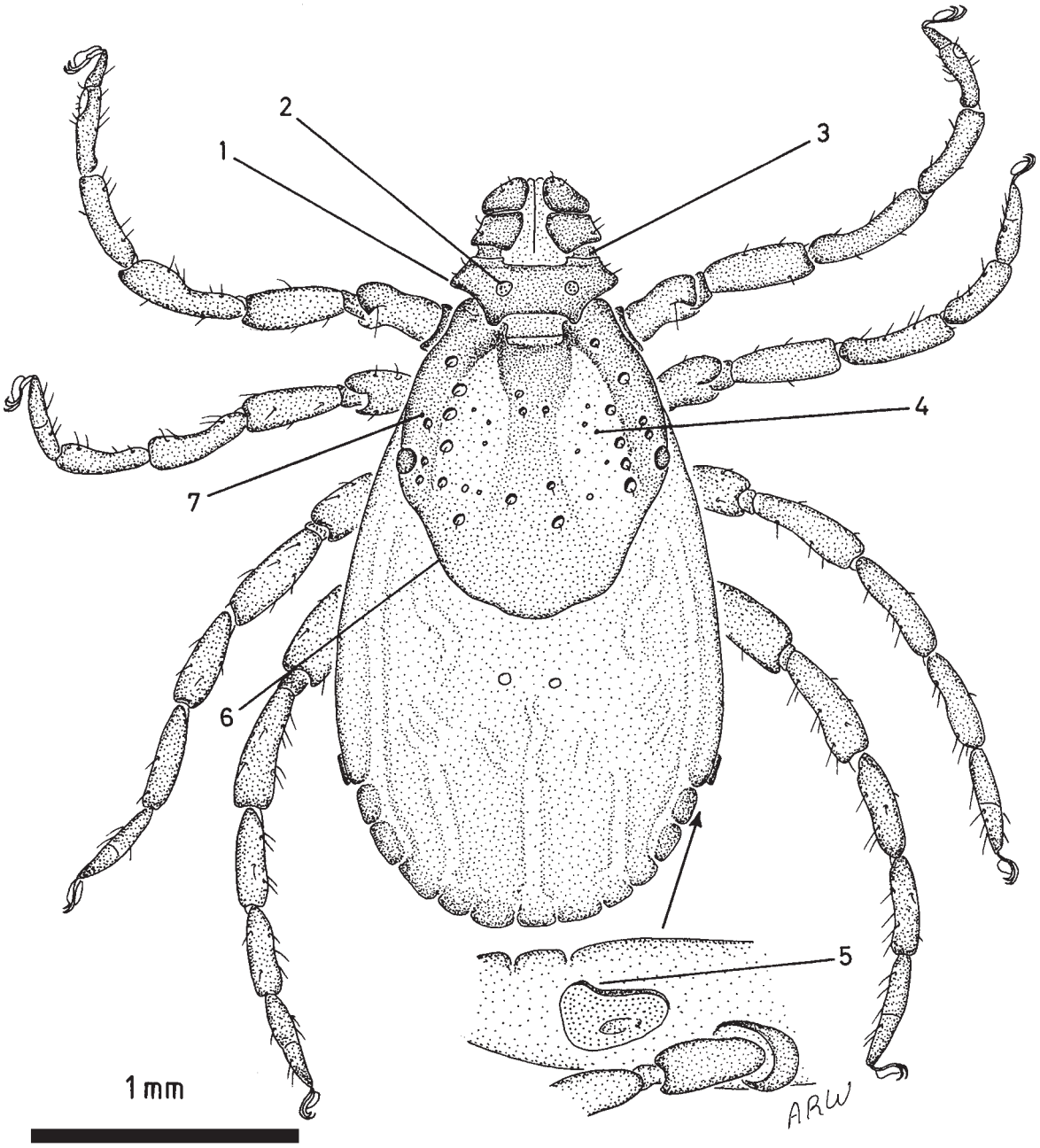
Disease.
This tick species is not known as the main vector of any pathogen in Africa. Its effect on sheep when in heavy infestations is probably significant.

Habitat and distribution.
Rhipicephalus turanicus is a tick of savanna, steppe, desert and Mediterranean climatic regions. It occurs in the northern part of the Afrotropical region, from Senegal and Guinea Conakry in the west to Ethiopia and Somalia in the east. In North Africa *Rh. turanicus* occurs mainly in Morocco, Algeria and Tunisia. *Rhipicephalus turanicus* also occurs in several other Mediterranean countries and in their immediate neighbours, as well as in Russia, India and Pakistan and through to China. This is a recently recognised species and its distribution in the Afrotropical region is currently underestimated and has to be reappraised, particularly in western and central Africa.

Distribution of *Rhipicephalus turanicus*.

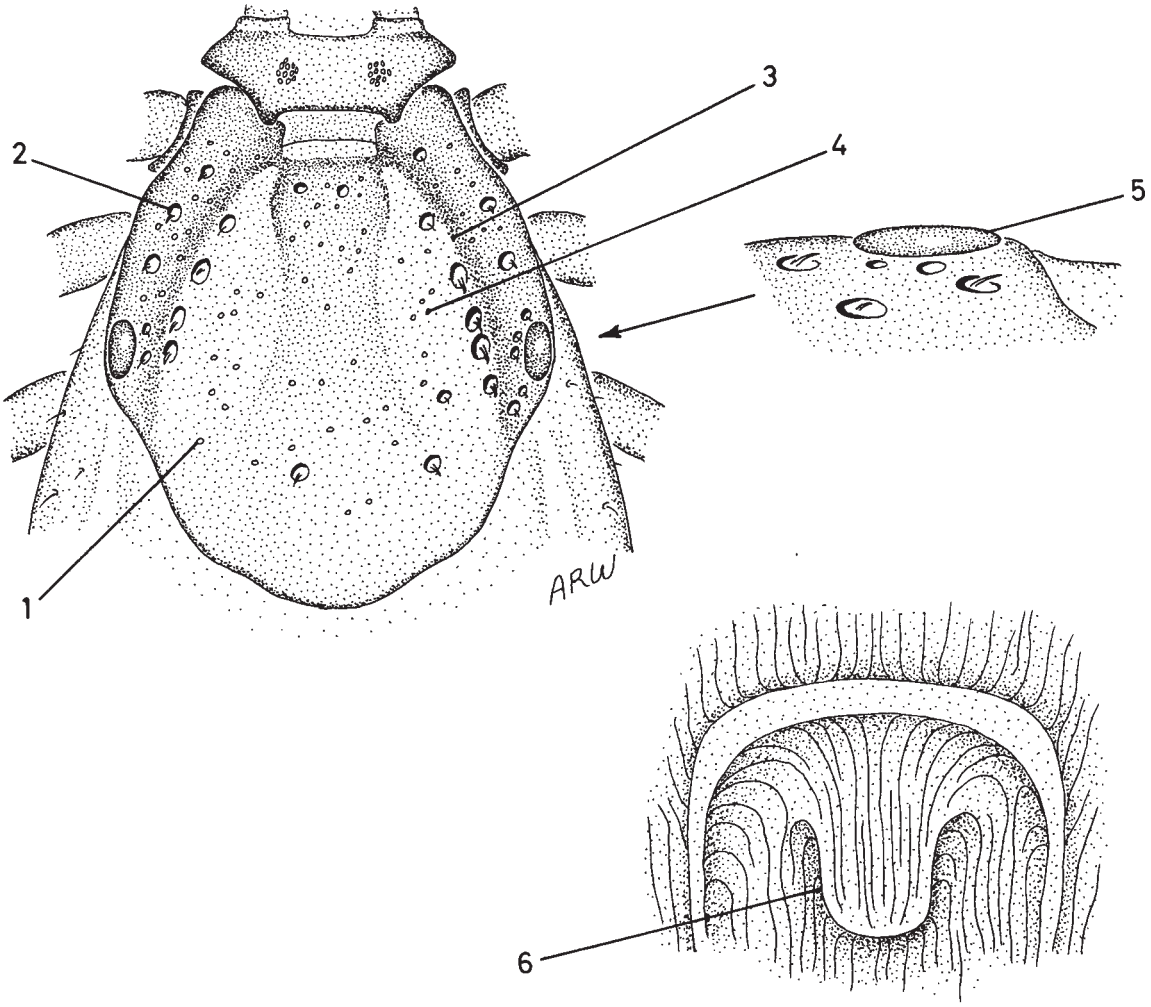


***Rhipicephalus turanicus* female, dorsal, spiracle plate at bottom.**



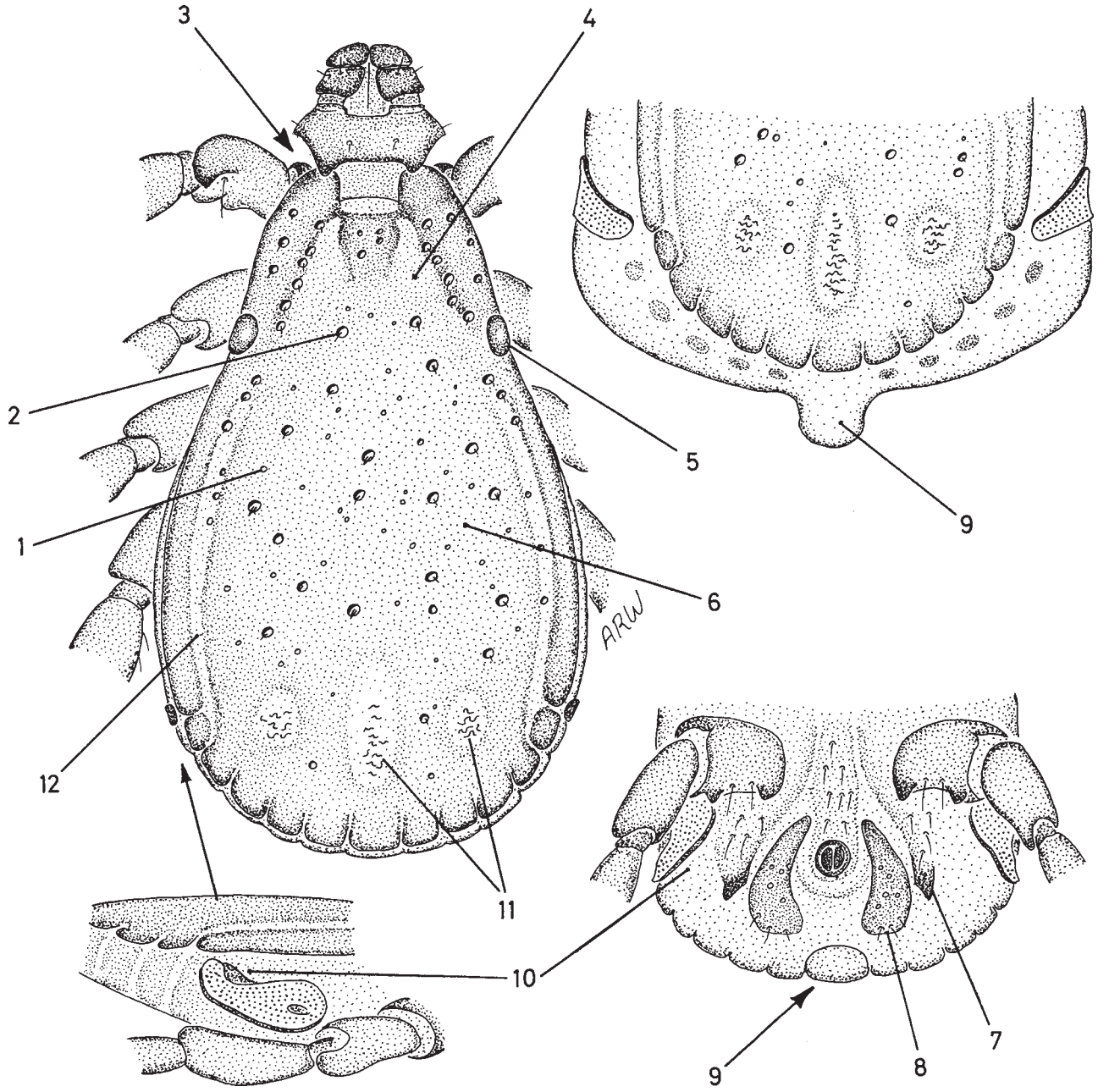
1 Basis capituli lateral angles are blunt.
2 Porose areas separation is broad.
3 Palp pedicels are short.
4 Cervical fields shape is large and curved.
5 Spiracle plate areas have sparse setae. (Spiracle plate tails are broad, same width as the adjacent festoon.)
6 Scutum posterior margin is distinctly sinuous.
7 Scutum colour is dark.

Rhipicephalus turanicus **female**, **dorsal scutum at top left**, **genital aperture at bottom right**.



1 Interstitial punctation size is small to medium. Interstitial punctation distribution is sparse.
2 Setiferous punctations are distinct.
3 Scapular grooves profile is steep.
4 Cervical fields texture has no wrinkles.
5 Eyes are flat.
6 Genital aperture posterior lips have a narrow **U** shape.

***Rhipicephalus turanicus* male, dorsal at left and caudal appendage at top right, ventral plates at bottom right, spiracle at bottom left.**



1 Interstitial punctation size is small to medium. Interstitial punctation distribution is sparse (but in South African populations the conscutum is more densely punctate than shown here).
2 Setiferous punctations are distinct.
3 Coxae 1 anterior spurs are not visible dorsally.
4 Cervical fields depression is apparent. Cervical fields texture has no wrinkles.
5 Eyes are flat (as shown for the female).
6 Conscutum colour is dark.
7 Accessory adanal plates are large.
8 Adanal plates shape is narrow and trapezoid (but in some specimens may be broad and curved).
9 Caudal appendage is broad in fed males (it protrudes as a distinct bulge, as shown in dorsal view at upper right).
10 Spiracle plate areas have sparse setae. (Spiracle plate tails are broad, same width as the adjacent festoon.)
11 Posterior grooves are distinct (deep depressions with wrinkled texture, the posterolateral grooves are nearly circular in outline).
12 Lateral grooves type is a distinct groove. Lateral grooves texture is smooth (but in South African populations they are punctate).

Rhipicephalus zambeziensis Walker, Norval & Corwin, 1981.

General.
Rhipicephalus zambeziensis is of importance for its close similarity to *Rhipicephalus appendiculatus* in the areas where these species overlap and for its potential disease relationships.

Differential diagnosis.
This species of tick must be differentiated from *Rh. appendiculatus* in the areas where they are known to occur together because they may both be involved in the transmission of *Theileria parva* but at different levels of epidemiological importance. Also, in western Angola and Namibia *Rh. zambeziensis* needs to be differentiated from *Rhipicephalus duttoni*. However, this latter species is not of sufficient importance to domestic animals to be included in this guide. *Rhipicephalus zambeziensis* of both sexes is a more robust, darker and heavily punctate tick than *Rh. appendiculatus*. Both the interstitial and setiferous punctations of *Rh. zambeziensis* are larger and denser than in *Rh. appendiculatus*. *Rhipicephalus zambeziensis* has cervical fields which are more conspicuously defined by columns of setiferous punctations along the scapular grooves and by a more extensive wrinkled texture than in *Rh. appendiculatus*. Female *Rh. zambeziensis* have a genital aperture with posterior lips forming an exceptionally broad **U** shape compared to a broad **V** shape in *Rh. appendiculatus*. Male *Rh. zambeziensis* have the outer posterior grooves (posterolateral grooves) forming an almost circular shape compared to a long oval in *Rh. appendiculatus*. However, these differences may not be clear in some populations of these two species in areas where their distributions overlap. Interspecific hybridization is considered to occur between these species. It is important to be able to examine large samples in these circumstances and more studies of their breeding behaviour and nucleic acids are necessary.

Hosts.
Cattle, impala and greater kudus are the main hosts of adult *Rh. zambeziensis*. Adults may also be found in large numbers on lions. Burdens of infestation with *Rh. zambeziensis* on kudu never reach the same magnitude as those of *Rh. appendiculatus* on wild hosts such as buffaloes.The immature stages are common on scrub hares. Adults attach on the head and ears of kudus and on impalas they attach on the muzzles. Immature stages attach on the feet and legs.

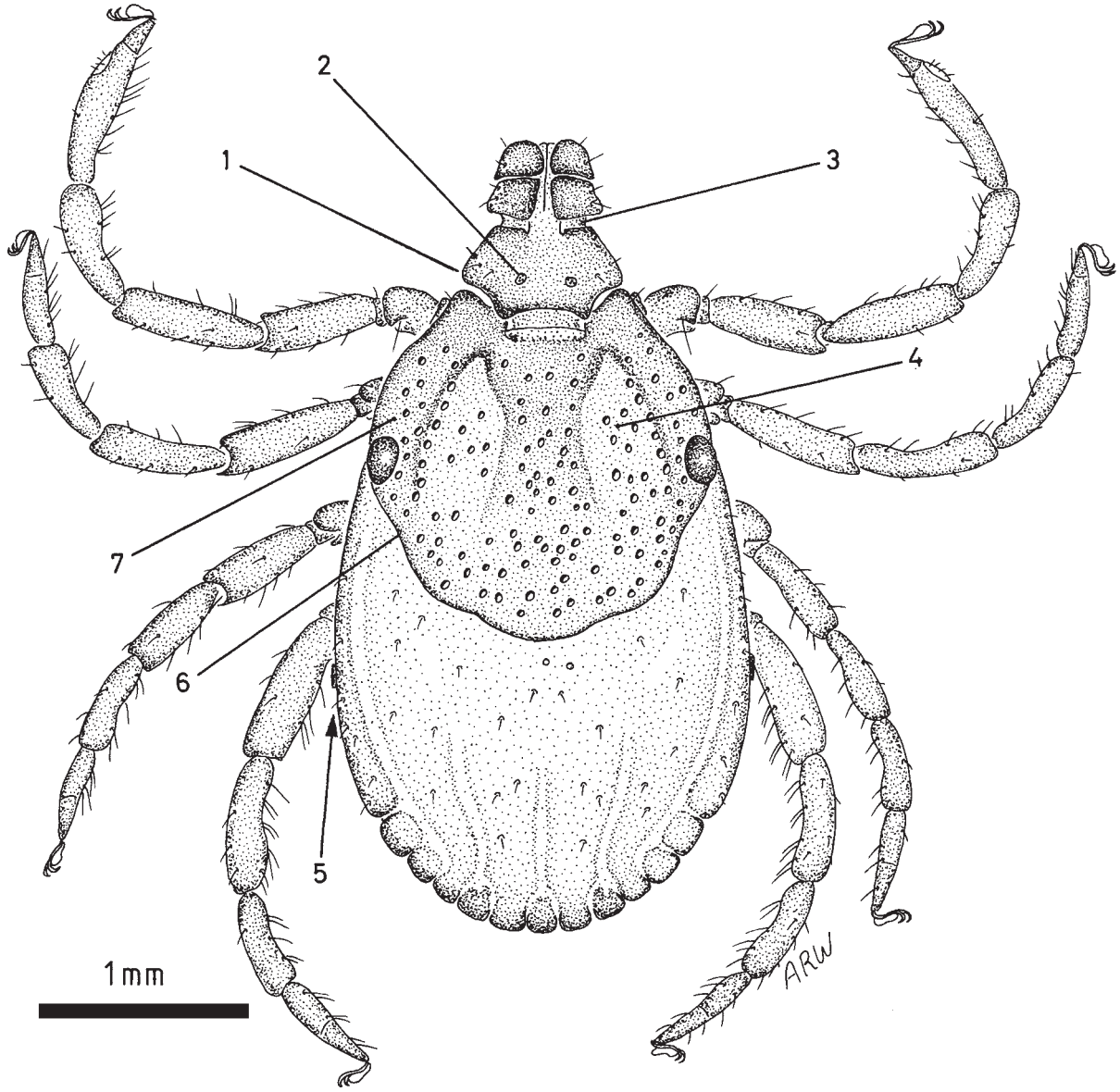
Life cycle and seasonal occurrence.
This is a three-host tick. Adults are most numerous in the late summer, larvae during autumn and winter, and nymphs during winter and spring.

Disease.
Rhipicephalus zambeziensis transmits the protozoan *Theileria parva* to cattle causing, in Zimbabwe, Corridor disease. Although *Rh. zambeziensis* has been shown to transmit *Theileria parva* (of several strains / sub-species) in the laboratory it is not associated with outbreaks of theileriosis in the field. However, it is associated with transmission of *Theileria taurotragi*, which is a protozoan of eland and which may occasionally cause benign bovine theileriosis. The bacterium *Anaplasma bovis* is transmitted to cattle causing tropical bovine anaplasmosis.

Habitat and distribution.
This is a tick species of savanna and steppe climatic regions. It replaces *Rh. appendiculatus* in the hot, dry river valley systems of south eastern Africa (Luangwa, Kafue, Zambezi, Sabi and Limpopo valleys) which 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 *Rh. zambeziensis* and *Rh. 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 the North-West and Mpumalanga Provinces, South Africa. In these situations some interspecific hybridization occurs. *Rhipicephalus zambeziensis* is absent from semi-desert and desert areas.

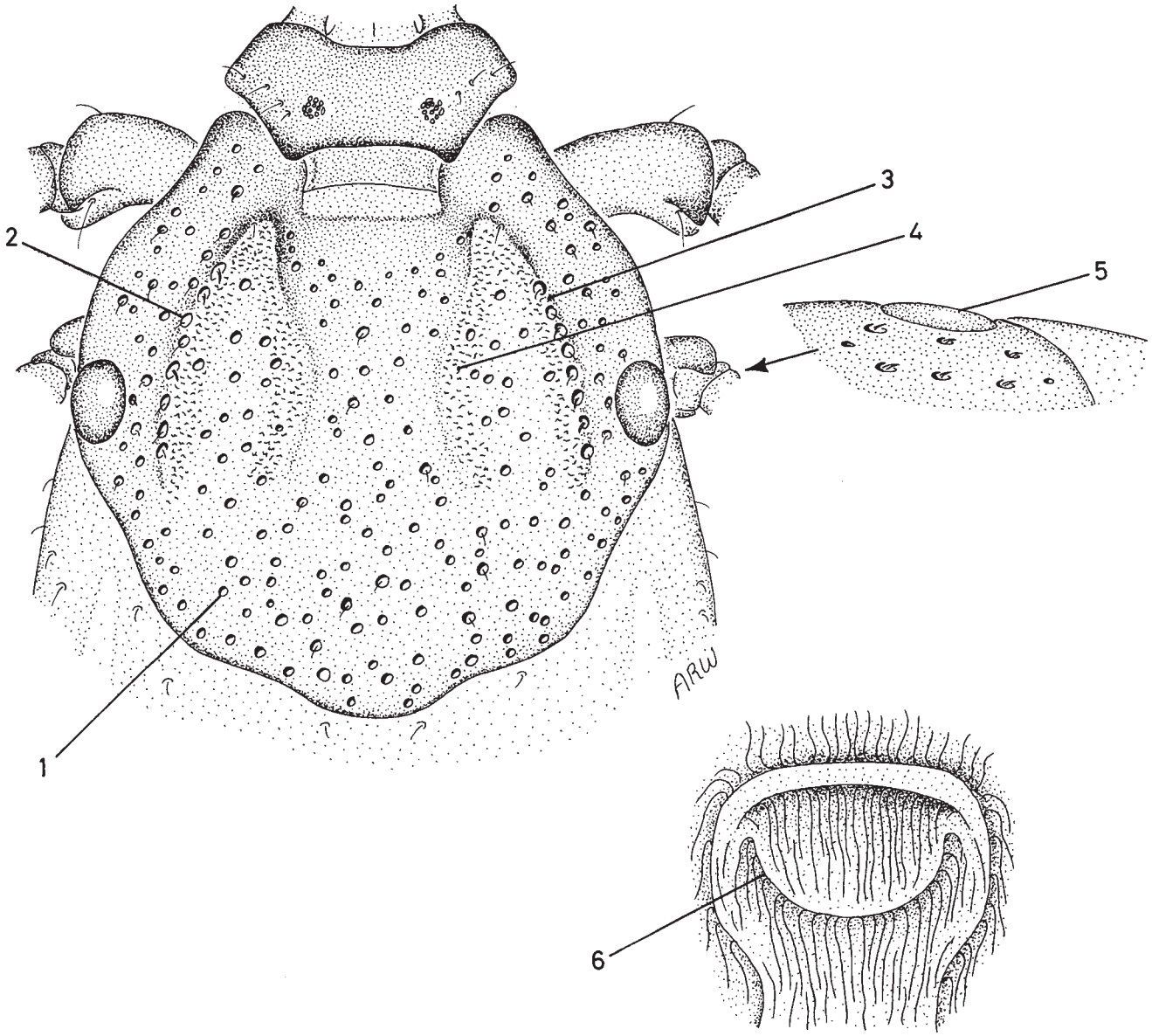
Distribution of *Rhipicephalus zambeziensis*.

***Rhipicephalus zambeziensis* female, dorsal.**



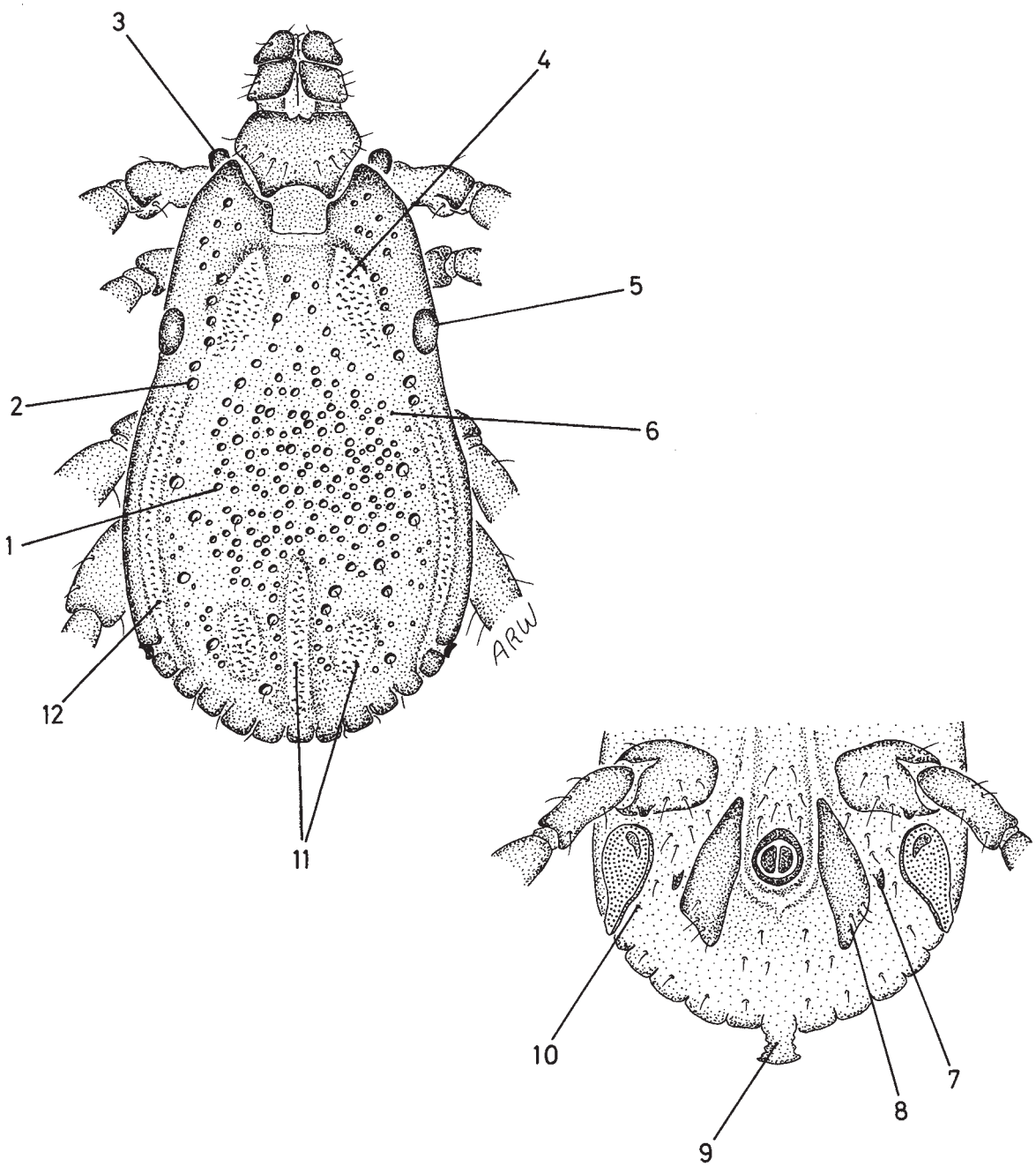
1 Basis capituli lateral angles are blunt.
2 Porose areas separation is broad.
3 Palp pedicels are short.
4 Cervical fields are large and curved.
5 Spiracle areas have sparse setae (not shown).
6 Scutum posterior margin is distinctly sinuous.
7 Scutum colour is dark.

Rhipicephalus zambeziensis **female**, **scutum at top left**, **genital aperture at bottom right**.



1 Interstitial punctation size is medium to large. Interstitial punctation distribution is dense.
2 Setiferous punctations are distinct.
3 Scapular grooves profile is shallow.
4 Cervical fields texture has wrinkled areas.
5 Eyes are flat.
6 Genital aperture posterior lips have a broad **U** shape (exceptionally broad).

***Rhipicephalus zambeziensis* male, conscutum at top left, ventral plates at bottom right.**



1 Interstitial punctation size is medium to large. Interstitial punctation distribution is dense.
2 Setiferous punctations are distinct.
3 Coxae 1 anterior spurs are visible dorsally.
4 Cervical fields depression is apparent. Cervical fields texture has wrinkled areas.
5 Eyes are flat (as shown for the female).
6 Conscutum colour is dark.
7 Accessory adanal plates are small.
8 Adanal plates shape is narrow and trapezoid.
9 Caudal appendage is narrow in fed males.
10 Spiracle plate areas have sparse setae.
11 Posterior grooves are distinct (shallow with wrinkled texture).
12 Lateral grooves type is a distinct groove. Lateral grooves texture is wrinkled.