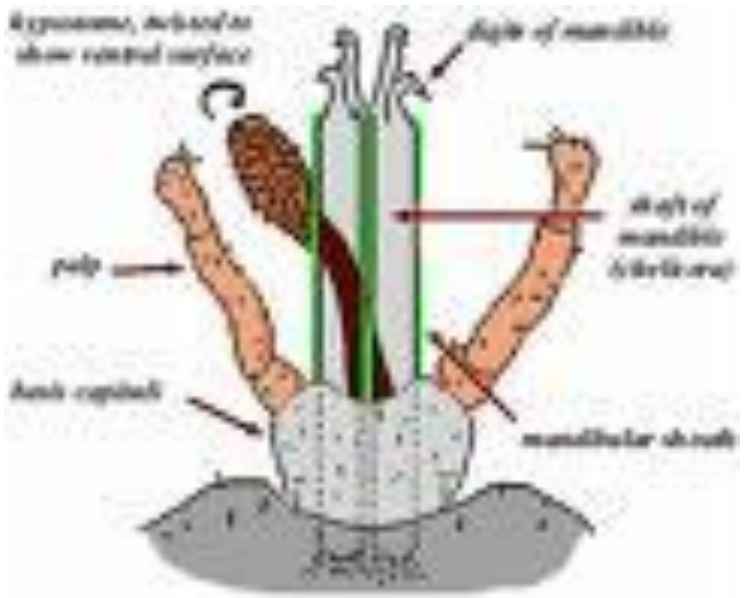
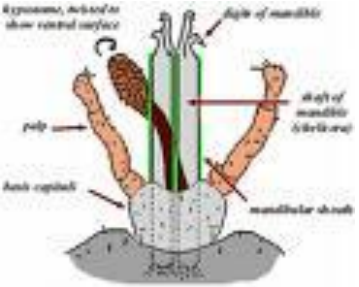
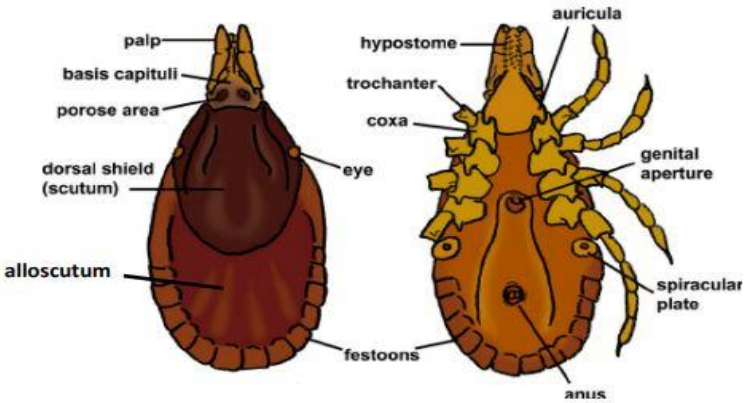
# Family: IXODIDAE



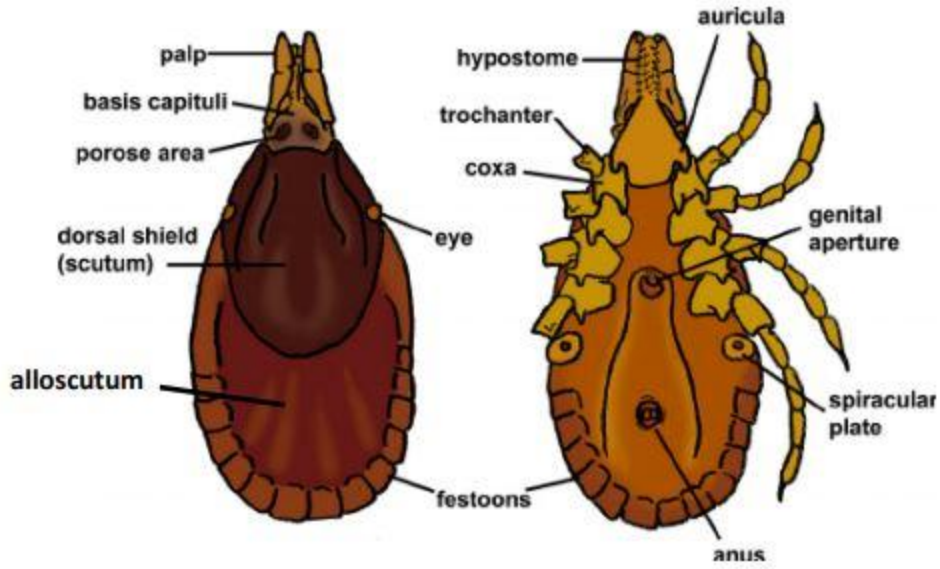
Ticks of this family possess

1. A hard chitinous shield or **scutum**, which extends over the whole dorsal surface of the male and covers only a small portion behind the head in the larvae, nymph and adult female.
2. The **mouthparts** are anterior and well visible from the dorsal aspect.
3. **Eyes are present** (one pair) situated on the lateral margin of the scutum.
4. Imago has one pair of **spiracles** situated postero-laterally to the fourth coxae.
5. The *basis capituli or* ***capitulum*** carries the mouthparts and palps shows two dorsal porose areas in the female.



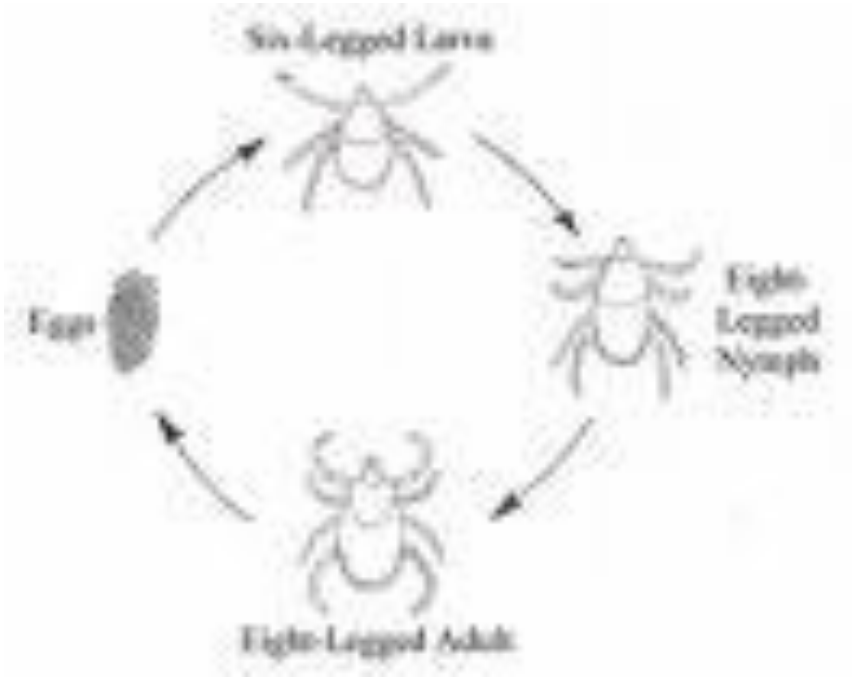


6. The posterior border of the body may be notched, forming the **festoons**, which are generally 11 in number.
7. The genital opening is a ventral transverse slit in front of the middle and the anus being posterior.
8. Males may have ventral plates.
9. Ornate ticks have coloured, enamel like areas on the body in-ornate ticks have not.




## Bionomics:

The engorged adult females lay their **eggs** in sheltered spots *i.e*. under stones and clods of soil or in crevices of walls and cracks of wood near the ground. The eggs are small spherical yellowish brown to dark brown in colour and are laid in large masses.

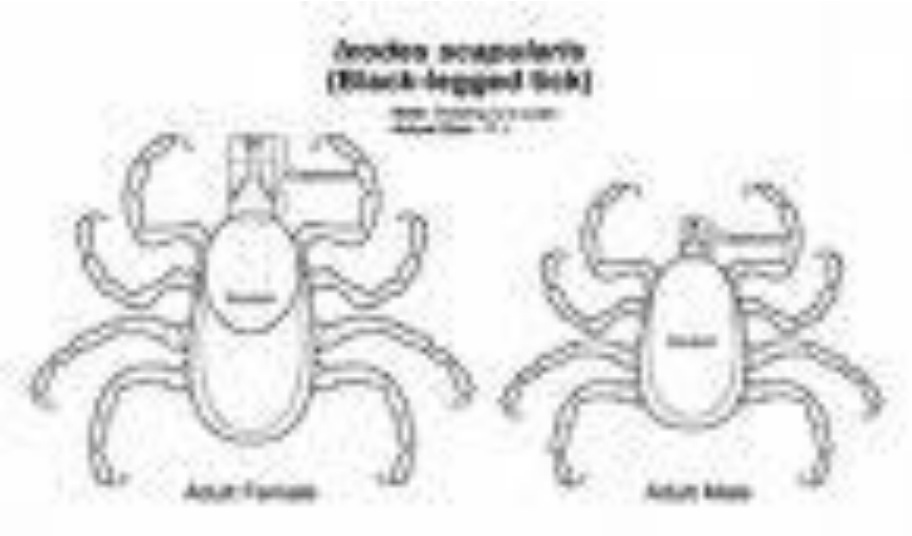



The female lays all her eggs in one batch up to 18,000 in some species and then die. The hatching of the eggs to **larvae** depends on environmental condition *i.e.* temperature and humidity.

The newly hatched larvae (**seed ticks**) climb on to grass and shrubs and wait there till a suitable host passes to which they attach themselves with their claws.

After having engorged, the larvae moult and become **nymphs**. The integument of the latter requires a few days to harden and then the nymph engorges and moults to become an imago. After hardening of the integument and often also after copulation the female engorges, drops off and seeks a sheltered spot to lay her eggs.

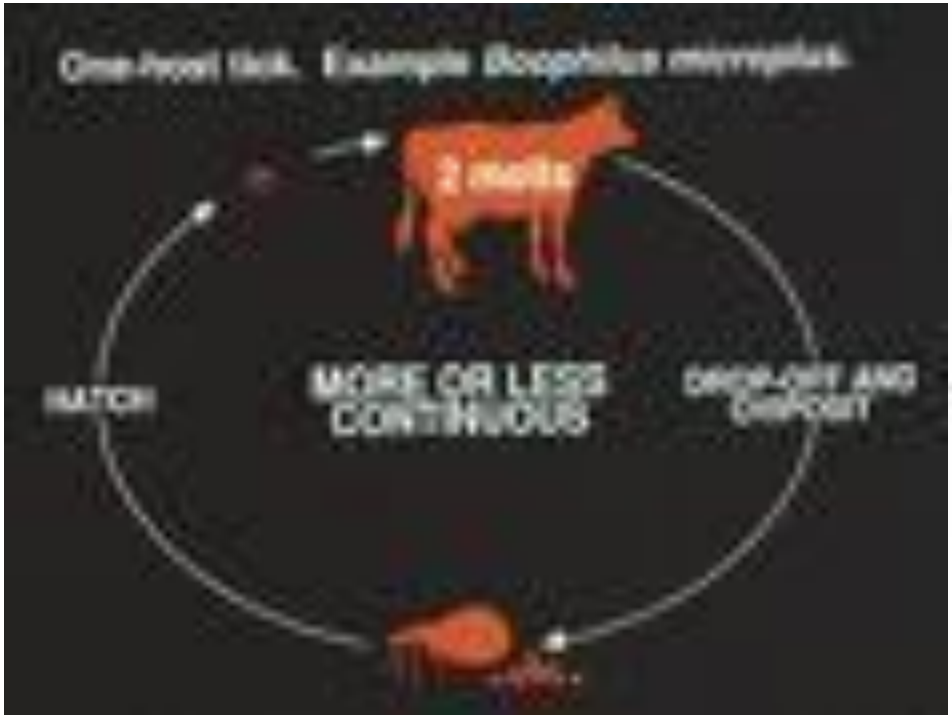
The males remain much longer on the host than the females in some cases four months or even longer.

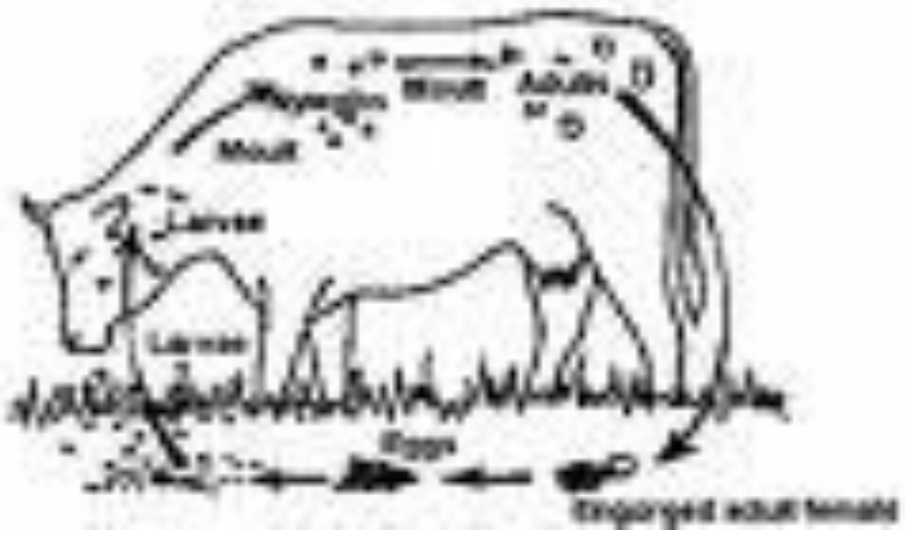



According to the number of hosts they require during their life cycle ticks can be classified into three groups -

**One host ticks:**

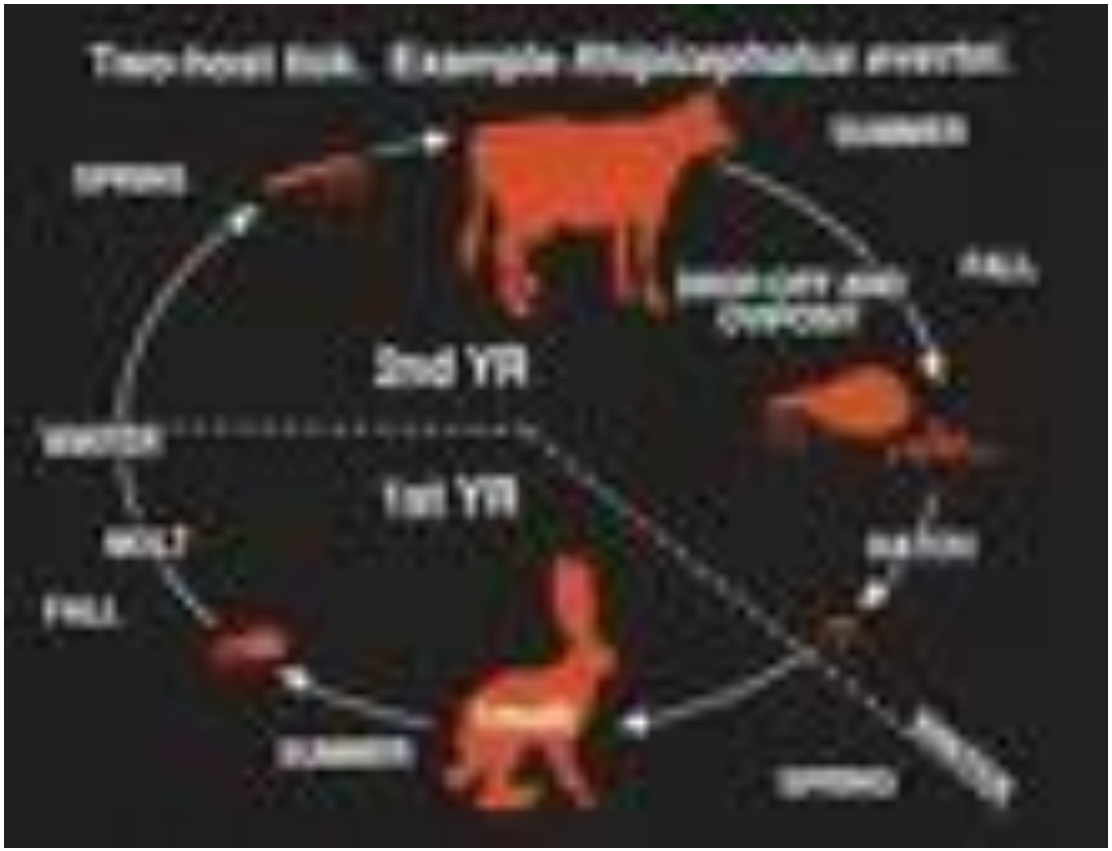
All three instars engorge on the same animal, the two ecdyses also taking place on the host. *e.g*. *Boophilus microplus, B. annulatus, Margaropus*.



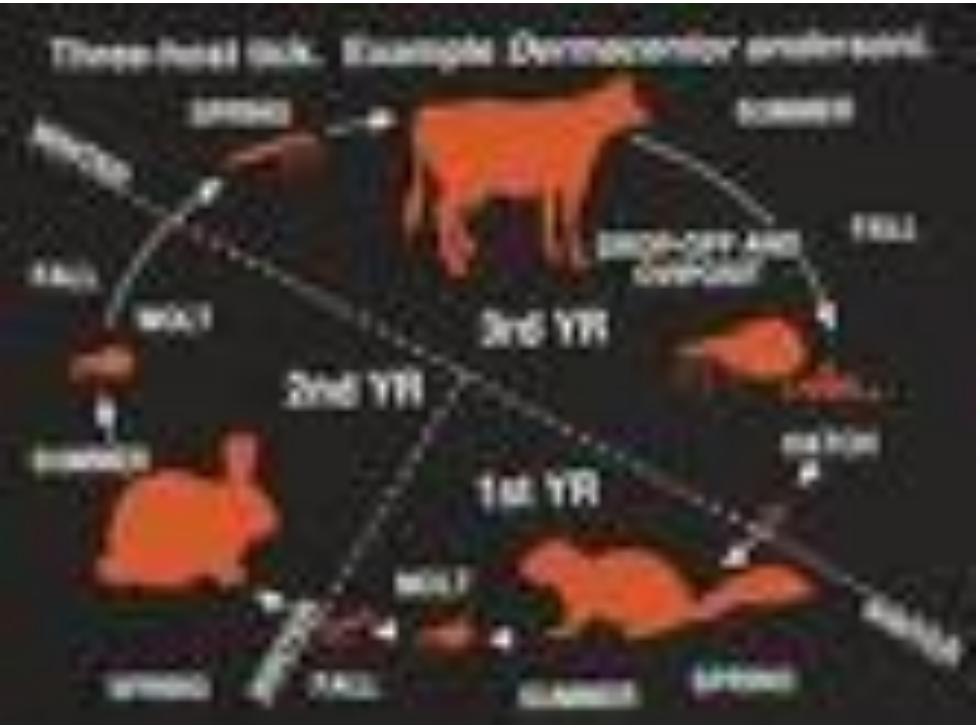
**Two host ticks:**

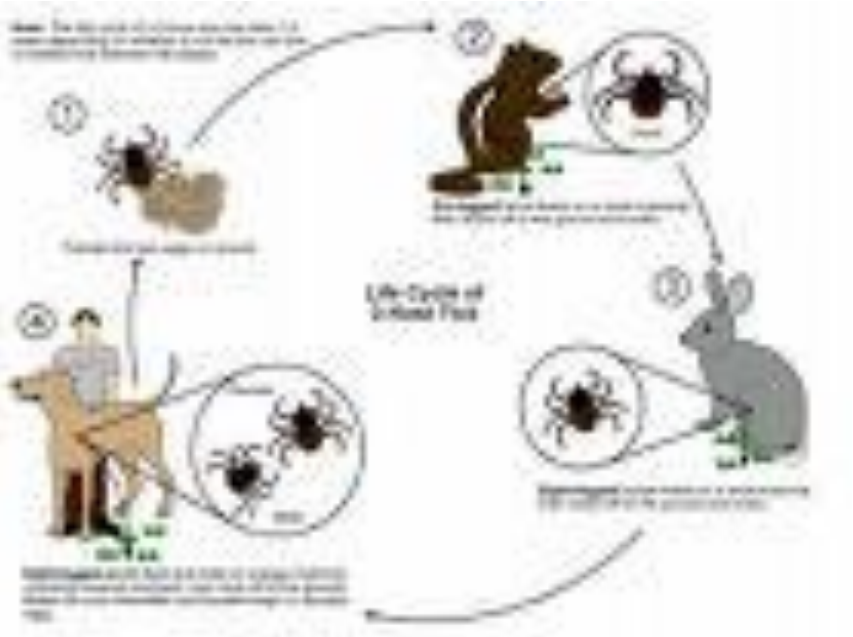
The larvae engorge and moult on the host and the nymphs drop of after having engorged. It moult on the ground and the imago seeks a new host. *e.g . Rhipicephalus evertsi, R. bursa*



**Three host tick:**

These require a different host for every instar. They drop off each time after having engorged and moult on the ground. *e.g Ixodes ricinus, Rhipicephalus appendiculatus, Hyalomma anatolicum anatolicum.*



**Stages in the life cycle of ticks:**

Preoviposition period **:** From day of last engorgement to the day of laying start

| | | |
|---|---|---|
| Oviposition period | **:** | Day of laying start to end |
| Egg hatch | **:** | Hatching period |
| Larvae engorge | **:** | Days of feeding |
| Larvae moult | **:** | Days from larvae drop off the body of the host after engorgement to development of nymph |
| Nymph engorge | **:** | Days of feeding |
| Nymph moult | **:** | Days from nymph drop off the body of the host after engorgement to development of adult |

**Stages in the life cycle of ticks:**

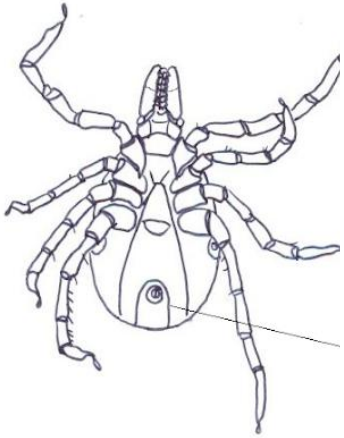
| | | |
|---|---|---|
| Nymph moult | **:** | Days from nymph drop off the body of the host after engorgement to development of adult |
| Adult female engorge | **:** | Days of feeding |
| Unfed larvae survive | **:** | Period (days) the larvae survive without feeding |
| Unfed nymph survive | **:** | Period (days) the nymph survive without feeding |
| Unfed adults survive | **:** | Period (days) the adult survive without feeding |

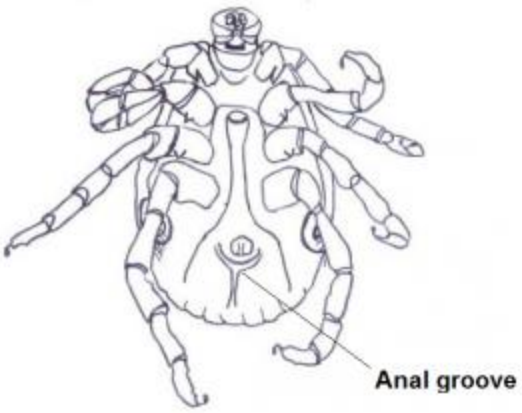
# KEY

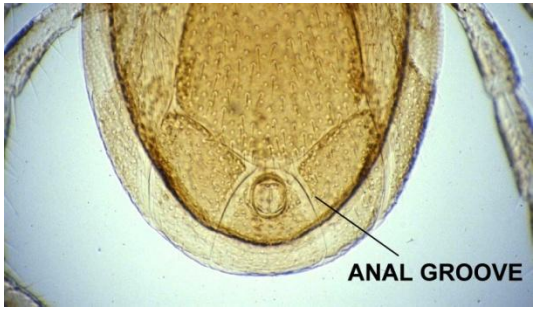
1. Anal groves surrounding the anus anteriorly - ***Ixodes***
   Anal groves surrounding the anus posteriorly - ***2***

(In *Boophilus* and *Margaropus* anal grove is faint or obsolete)

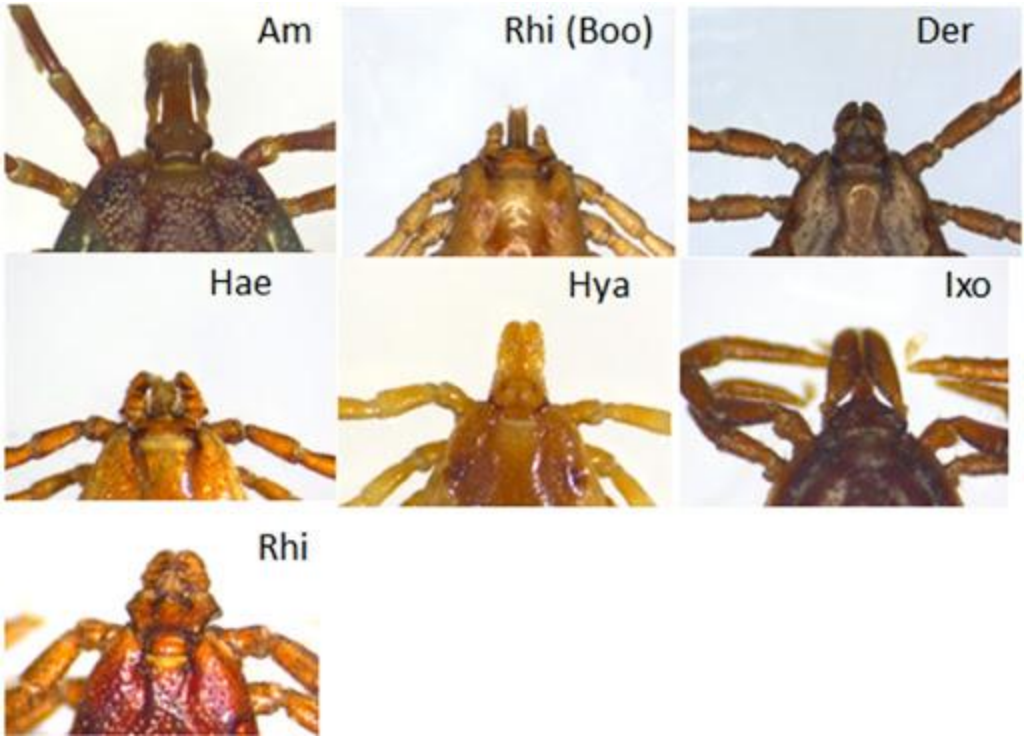
| Ixodes | Not Ixodes |
| --- | --- |
|   Anal groove is anterior (just below red line) |   Anal groove is posterior (just above red line) |

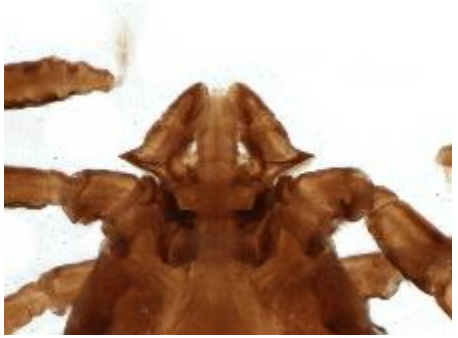


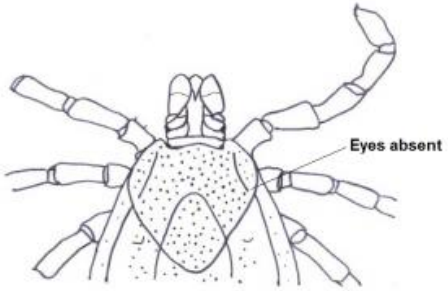


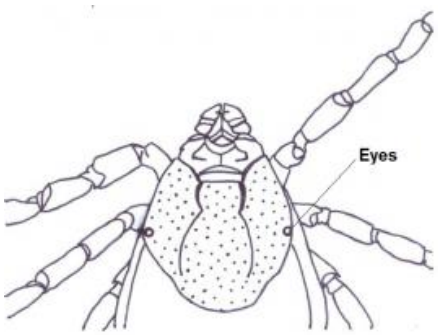



2. Hypostome and palpi short - **3**
   Hypostome and palpi long - **8**



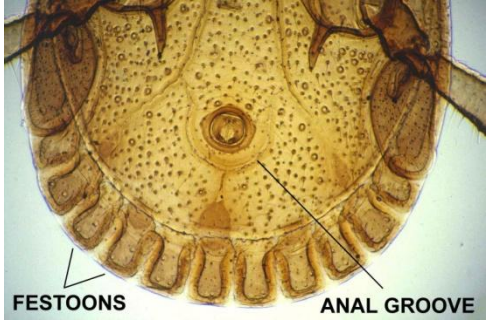


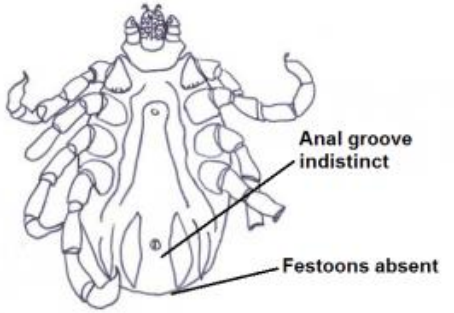

3. Eye absent - *Haemaphysalis*
   (2nd article of palp having tooth like projection)

   Eye present - **4**

4. Festoons present - **5**
   Festoons absent - **7**




5. Males with coxae IV much large than coxae I to III, no plates or shields on ventral surface of male. - **6**




Males with coxae IV not larger than coxae 1 to III, - ***Rhipicephalus***
a pair of adanal shields on ventral surface of male.
Inornate, basis capituli generally hexagonal dorsally.

6. Species ornate, basis capituli rectangular dorsally - ***Dermacentor***

   Species inornate, basis capituli hexagonal dorsally with prominent lateral angle, coxae IV of male with two long spine. - ***Rhipicentor***

7. Inornate, coxae I bifid, male with a pair of adanal and accessory shields and a caudal protrusion, fourth pair of legs normal - ***Boophilus***

   Inornate, coxae I with a small spine, fourth pair of legs of male dilated. - ***Margaropus***

8. Eye present. - **9**

   Eye absent or rudimentary, occurs on reptiles - ***Aponomma***

9. Festoons absent or present, males with a pair of adanal shields and two posterior abdominal protrusions. Aceessory adanal shields absent or present. - ***Hyalomma***

   Ornate, festoons present, males without adanal shields but small plaques may be present on ventral surface near festoons. - ***Amblyomma***

http://www.bristoluniversitytickid.uk/page/Key+to+Genera/6/

**Genus:** ***Ixodes***

**Character:**

1. The anal groove surrounds the anus anteriorly
2. Palpi long
3. Inornate
4. Eyes and festoons absent.


**Species -*Ixodes ricinus***

**Castor bean tick or sheep tick**

Occurs in Europe, Tunisia, Algeria and limited area in Asia. Hosts are dog, domestic and wild mammals, attach to the face, ears, axillae and inguinal region where the hairs are short or skin base.
It takes 3 years to complete the life cycle *i.e.* each instar one year.

**Disease transmitted:**

a. *Babesia divergens* - Cause red water fever in cattle

b. Babesia bovis - passes through the eggs of the ticks.

c. *Anaplasma marginale*

d. Viruses of louping ill

e. Rickettsial tick borne fever of sheep

f. Tick pyaemia caused by *Staphylococcus aureous* in lamb 2-6 weeks old.

g. Causes tick paralysis

h. Vector of Czechoslovakian encephalitis

*i. Coxiella burnetii*

j. Bukhovinian haemorrhagic fever.

**Species -*Ixodes persulcatus***

***Ixodes hexagonus*** - Hedgehog tick

***Ixodes canisuga*** - British dog tick

***Ixodes pilosus*** - Bush tick

***Ixodes rubicundus*** - paralysis tick of southern Africa.

Host**:** Sheep, goat and cattle

***Ixodes holocyclus*** - paralysis tick of Australia

***Ixodes scapularis*** - shoulder tick or black-legged tick.

Cattle, Sheep, Horses and dogs and Cat in North America and transmit Anaplasmosis

**Genus:** ***Boophilus***

**Characters:**

1. Anal groove absent in female & faint in male and surrounding the anus posteriorly.
2. Inornate, eyes present.
3. Festoons absent
4. Palps and hypostome short
5. Coxa I bifid

**Species -** ***Boophilus annulatus***

**North American tick** – USA

One host tick

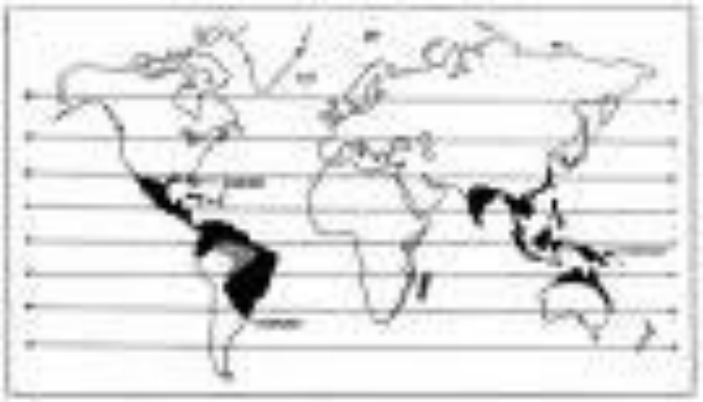
Domestic and wild angulates and man.

Transmit -

*Babesia bigemina* - bovine piroplasmosis or Texas fever.

Spirochaete, *Borrelia* theileri

Anaplasmosis



***Boophilus decoloratus***
**Blue tick** of cattle and equines

One host tick.
It transmits *B. bigemina, Anaplasma marginale, B. trautmani* of pigs and spirochaetes.

**Boophilus *microplus***
**Tropical cattle tick**

Australia, West Indies, Mexico, Central America, South America, Asia, South Africa and India.
Transmit *Babesia bigemina, B. argentina, Anaplasma marginale, Coxiella burnetti* and *Borrelia theileri*.





**Genus:** ***Margaropus***

1. Males are large, their 4th pair of legs is markedly thickened.
2. Coxa I has a small posterior spine.

**Species:**

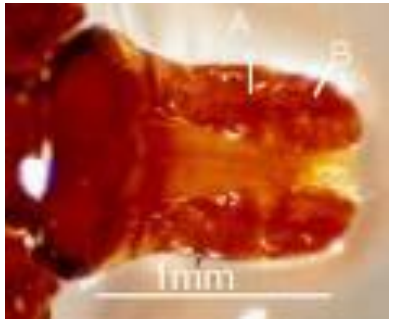
***Margaropus winthemi*** - Argentine tick, one host tick of horse and cattle

***Margaropus reidi*** - beads- legged tick

**Genus:** ***Hyalomma***

**Characters:**

Inornate sometime ornate
Eyes present
Festoons present or absent
Hypostome and palps long
Males with a pair of adanal shields, frequently a pair of chitenous protrusions behind the adanal shields.
Spiracles comma-shaped in male, triangular in female.
They are two host occasionally 3 host ticks.
Disease transmitted by the tick are *Theileria annulata, Babesia caballi, B. equi, Coxiella burnetti, Theileria perva, Theileria dispar, Rickettsia bovis,* and *R. conori*



**Species:**

***Hyalomma marginatum***
***Hyalomma anatolicum anatolicum***
***Hyalomma detritum***
***Hyalomma dromedarii***
***Hyalomma anatolicum isaci***




**Genus:** ***Rhipicephalus***

1. Inornate (usually)
2. Eyes and festoons present
3. Hypostome and palps short
4. Basis capituli hexagonal dorsally
5. Coxae I with two strong spur
6. Males with adanal and usually also accessory adanal shields.
7. Spiracle coma shaped short in fesmale and long in male


**Species:** ***Rhipicephalus appendiculatus***

Brown ear tick in Africa in cattle, equines, sheep, goats and wild antelopes.

3 host tick.

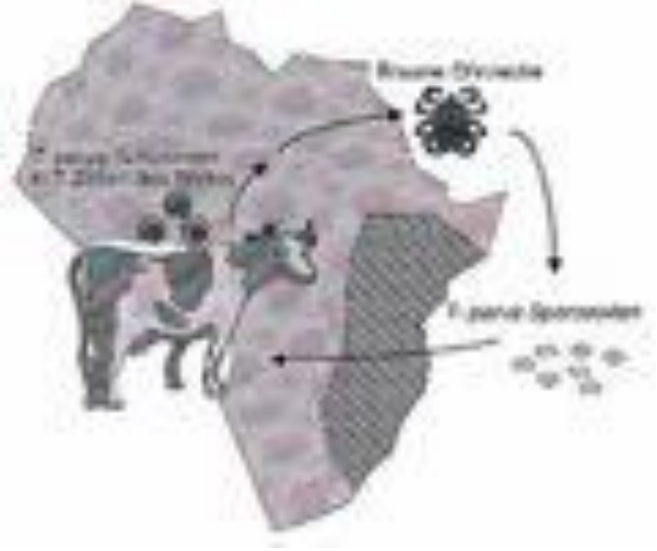
Remain attached under the tail and in the ear but in other part also

Vector of east coast fever (***Theileria perva***) of cattle.

Transmit *Hepatozoon canis* and exanthematic fever of dogs.

*Theileria mutans* and *B. bigemina* of cattle. *Rickettsia conori* and Nairobi sheep disease and louping ill.

*B. bigemina* - transmitted transovarially.



***Rhipicephalus sanguineus***

Brown dog tick

Occurs in dog wide variety of mammals and birds

Cosmopolitan in distribution.

3 host tick.

Transmit canine piroplasmosis caused by *B. canis* and canine ehrlichiosis caused by *Ehrlichia canis* and *B. vogeli* of dog Also transmits *B. equi* and *B. caballi* of equines; *Anaplasma marginale, Hepatozoon canis* of dog; *Coxiella burnetti, Rickettsia conori, R. canis, R. rickettsii, Pasteurella tularensis, Borrelia hispanica;* Viruses of Nairobi sheep disease and vector of *B. bigemina*.


***Rhipicephalus evertsi***
Red-regged tick
Domestic and wild animals
Two host tick
It transmits *Theileria parva, T. mutans* and *B. bigemina* in cattle, *Borrelia theileri* of various animals, *B. equi* (biliary fever) of horse, and *R. conori. B. bigemina* and *R. conori p*ass through the eggs of the ticks.

***Rhipicephalus bursa***

Two host tick

Transmit *B. ovis, B. equi, B. caballi, T. ovis, A. marginale, Rickettsia ovina, Coxiella. burnetti* and nairobi sheep disease.

***Genus:*** ***Haemaphysalis***

1. Inornate tick
2. Eye absent, festoons present
3. Palps usually short and conical
4. The second articles of the palp having conspicuous lateral projections.
5. The spiracles in females' ovoid or comma shaped and in males ovoid.
6. Ventral surface of male without chitinous plates.

***Species: Haemaphysalis leachi leachi***

Yellow dog tick

Occurs in domestic and wild carnivora and rarely on cattle in Africa, Asia, and Australia

3 host tick

Transmit Canine piroplasmosis (*B. canis*), tick bite fever (*Rickettsia conori*) and *Coxiella burnetti.*

***Haemaphysalis longicornis***

New Zealand cattle tick or bush tick

China, Japan, Australia and N.Z.

Man, cattle, sheep, horse, dog, wild mammals and birds

3 host tick

Transmit *Theileria* spp and *Coxiella burnetti* (Q fever)

***Haemaphysalis bispinosa***

1. India, Burma, East Africa, Malaysia and Thailand

***Haemaphysalis punctala***

**Genus:** ***Dermacentor***

1. Usually ornate
2. Eyes and festoons present
3. Hypostome and palps short
4. Coxa I bifid and coxa IV of male much larger than coxae I to III
5. No plates on ventral surface of male

**Spesies** ***Dermacentor reticulatus***

USSR, Central Europe, France, England

Parasitic on many wild and domestic mammals

Three host tick

Transmit *Babesia caballi, B. equi, B, canis* transovarially

***Dermacentor marginatus***

1. Iran, Afganisthan, Algeria, Morocco, Tunisia, Turkey

***Dermacentor andersoni***

Rocky mountain wood tick.

Transmit Rocky Mountain Spotted fever (*Rickettsia rickettsi*), *Tularaemia (Pasteurella tularensis), Equine encephalitis (westen), Anaplasma marginale, B. canis, Coxiella burnetti, Leptospira pomona*

Cause tick paralysis in man and animals.

Three host tick

***Dermacentor variabilis***
American dog tick, occur in dog in USA

Transmit RMSF, St. Louis encephalitis, *A. marginale and* Tularaemia

***Dermacentor nitens***
Tropical horse tick,

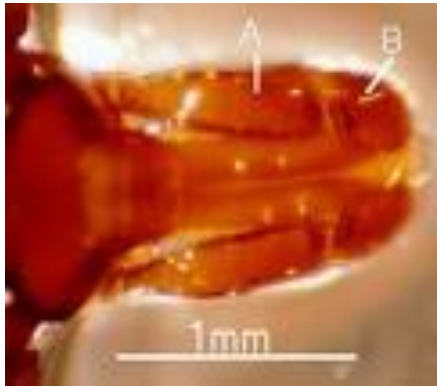
Distribution - Mexico, America, Caribbean and in tropical countries
Host - horse, cattle and deer
One host tick
Transmit equine piroplasmosis.

**Genus:** ***Amblyomma***

1. Usually ornate
2. Eyes and festoons present
3. Hypostome and palpi long
4. Male without ventral plates but small chitinous plaques may be present close to the festoons.
5. The species are usually large and broad.

**Species:** ***Amblyomma hebraeum***
Bont tick

Distribution - South and Central Africa (warmer parts)
Host - all domestic and many wild animals.
3 host ticks
Attack perineal and genital regions of its host and produce wound.
Transmit *Rickettsia runimantium,* causes heart water of cattle, sheep & goat and *Rickettsia conori* causing tick bite fever.





***Amblyomma veriegatum***
Tropical bont tick / varugated tick

Distribution - Africa
Host - many mammals and rarely on birds.
3 host tick
Transmit heart water, Nairobi sheep disease *and Coxiella burnetti.*

***Amblyomma americana***
Lone star tick in USA

Single large white spot on the scutum of the female.
3 host tick.
Wide range of host.
Transmit Q fever, Rocky Mountain spotted fever, Tularaemia *etc.*

***Amblyomma maculatum***
Gulf coast tick in North America

Larvae and nymphs on birds, adults on cattle, sheep, horse, dog and man.
3 host tick
Cause tick paralysis

**Ganus:** ***Rhipicentor*** (resemble *Dermaemtor*)

1. Inornate
2. Basis capituli hexagonal

**Ganus:** ***Aponomma*** (resemble *Amblyomma*)

Eye vestigesl or absent
Occur almost exclusively on reptiles.

**IMPORTANCE OF TICK / PATHOLOGY**

Ticks may harm their host by -

1. **Injuries** done by their bites which may predispose the hosts to attacks by blow flies, screw-worm flies and biting flies.

2. **Blood loss:**

Suck a substantial amount of blood. The amount of blood removed varies according to the species. A single adult female will remove 0.5 - 2.0 ml of blood and in heavy infection it may lead to anaemia in calf.

3. **Tick worry:**

A combination of several entities including irritation from the tick bites, local skin infection, blood loss and secondary attack by flies.

4. **Tick paralysis:**

This is a disease of man and animals characterized by an acute ascending flaccid motor paralysis. The condition may terminate fatally unless the ticks are removed before respiratory paralysis occurs.

Chiefly the adult females ticks but sometimes the nymphs also are responsible and the ticks of the genus *Ixodes* are particularly associated with the condition.

The degree of paralysis depends on the length of time the tick feed and the number of ticks attached. Removal of the tick is followed by recovery. The toxin injects along with the saliva is responsible for paralysis.

The toxin acts on motor and sensory nerve as well as neuromuscular transmission. The liberation of Acetylcholine is diminished and the receptor site is changed in its sensitivity.

*D. andersoni, D. variabilis* and *R. evertsi* also responsible for tick paralysis.

## 5. Tick toxicosis (sweating sickness):

It is distinct from tick paralysis and is produced by toxin derived from some species of ticks. It affects cattle, sheep, goats and pigs and highest incidence occurs in summer.

Tick concerns are *Hyalomma transiens (truncatum) & H. rufipes*. Adults are responsible for donating the toxin. Profuse moist eczema and hyperaemia of the mucous membranes occurs.

6. **Disease transmission:**

Ticks are mainly important as vectors of animal diseases, transmitting a wide range of pathogenic viruses, Rickettsia, bacteria and protozoa. Some diseases like tick-borne encephalitis, lyme borreliosis, relapsing fevers or RMSF are pathogenic to human. Wild and domesticated animals act as reserver of the diseases and transmit through animal / tick / human cycle of contact.

Ticks are effective vectors because -

1. They attach securely to their hosts allowing them to be transferred to new habitats while on their host.
2. Lengthy feeding period allows large number of pathogens to be ingested.
3. Feeding on a number of different hosts allows the transfer of pathogen from host to host.
4. They are long lived
5. Females lay large number of eggs and have rapid potential for increase.
6. Can survive for lengthy period without feeding.
7. Ingested pathogen may be passed transtadially or transovarially.

**Viral disease**

1. Louping ill (flavi virus) - *Ixodes ricinus* in sheep

2. African swine fever - *Ornithodoros moubata* in pig

**Rickettsial disease**

1 Ehrlichiosis (tick-borne fever) - *Ehrlichia p hagocytophila* in sheep and cattle.

2. Rocky mountain spotted fever (*Rickettsia rickettsii*)– by *Dermacentor andersoni, D. variabilis, A. americanum* and *R. sanguineus* in human and dog.

3. Spotted fever – (*R. coroni*) - *R. sanguineus, Haemaphysalis leachi leach*

4. Tick typhus - *R. australis* and *Ixodes holocyclus.*

**Q fever**

*Coxiella burnetii* - cattle, sheep, and goat - Ixodid ticks.

**Bovine anaplasmosis**

*Anaplasma marginale, A. centrale – Boophilus, Rhipicephalus, Ixodes* and *Dermacentor.*

**Spirochaete**

Lyme borreliosis**:** *Borrelia burgdorferi* by *Ixodes ricinus, I. dammini, I. Pacificus and A. americamun*

**Protozoa**

1. *Theileria* (Transtadial transmission)
   *T. parva* - East coast fever – by *R. appendiculatus*
   *T. annulata* - tropical bovine theileriosis – by *Hyalomma a. anatolicum*.

2. *Babesia* (Transovarian transmission)
   *B. bigemina* - red water fever - by *Boophilus microplus*
   *B. bovis* - by *Rhipicephalus* and *Boophilus*
   *B. divergens* - by *Ixodes ricinus*
   *B. canis* - by *R. sanguineus* and *D. marginatus*

**Bacteria**

1. Tularaemia
2. Anthrax

**Control of ticks:**

Control measures as a rule directed against the diseases of which the ticks are the vector and therefore based on epizootiology of the disease and habits of the ticks.

Treatment with acaricides has to be applied to the whole body and may be carried out by dipping in aqueous solution, suspension or emulsion, howevers pray races, showers *etc*. are replacing them.

Dipping is planned with knowledge of the biology of the ticks to be control, the duration of each of its stages and of its feeding time and duration of the whole life history and whether one, two or three host ticks. It is easy to control one host tick than others.

Control of ticks was achieved by use of chemicals (acaricides) and other means.

A. **Chemical control**

1. Chlorinated hydrocarbon (CO) - Toxaphane, dieldrin, eldrin, lindane *etc.*

   Problems - residual effect (insecticide residue in meat) and development of resistance

2. Organo phosphorus compound (OP) - Diazinon, Bromo cyclen, Cythioate, Dioxathion, Fenthion, Malathion, Chlorphenvinphos, Chlorpyrifos, Dichlorvos and Phosmel.

   Use as dip, spray, spot on, collars, Ear tag, ear-band, neck-band *etc.*

3. Carbomate compound - Carbaryl, Propoxur and Bendiocarb.

4. Pyrethrins-

5. Macro cyclic lactones – Ivermectins, Moxidectin, Doramectin, Milbimycin, Eprinomectin.

6. Synthelic pyrethroids - Flumethrin, Decamethrin, Cypermethrin-150 ppm, Fenvalerate, Deltamethrin.
   - More effective
   - Less liable to the development of resistance

Problems with chemical control: toxicity, environmental pollution, resistance and residues.

B. Burning of pasture

C. Cultivation of land -
   a. Stylosanthes - immobilized by a sticky secretion on the hair of the plant.
   b. Melinis, cynodon and pemisetus act as repellant.

D. Pasture spelling – starvation

E. Repellents - indalone and dimthyl phthalate, pyrethrin

F. Natural enemies - (Biological control)
*Ixodiphagus* and *Hunterellus*, Hymenoptrous parasitesised on ticks specially on nymphs; Certain ants and birds also cat as predators.

*G.* Sterile hybrids - *B. annulatus* and *B. microplus* – Male sterile, hybride female produce sterile male for 3 back cross generation.

H. Immunological
Rhiphicephalus (Boophilus microplus)
TickGARD$_{plus}$ and GAVAC - Bm86

I. Modelling and forecasting
II. Integrated control of Ticks