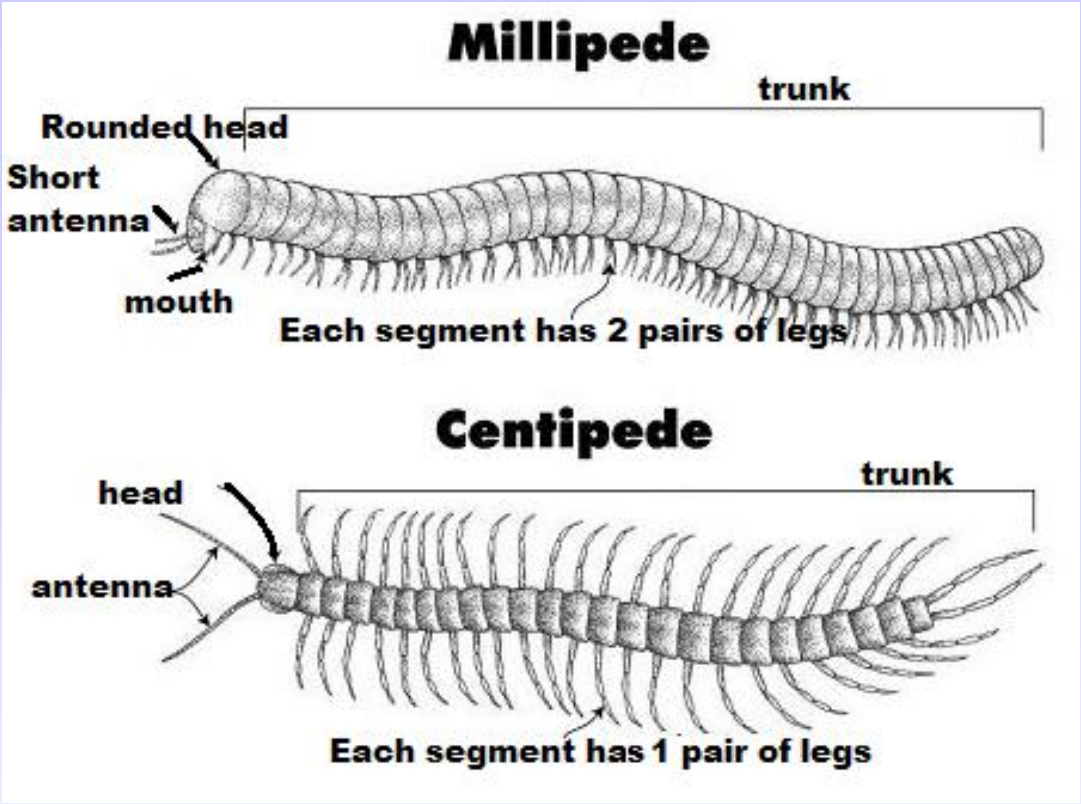
# Veterinary Medical Entomology

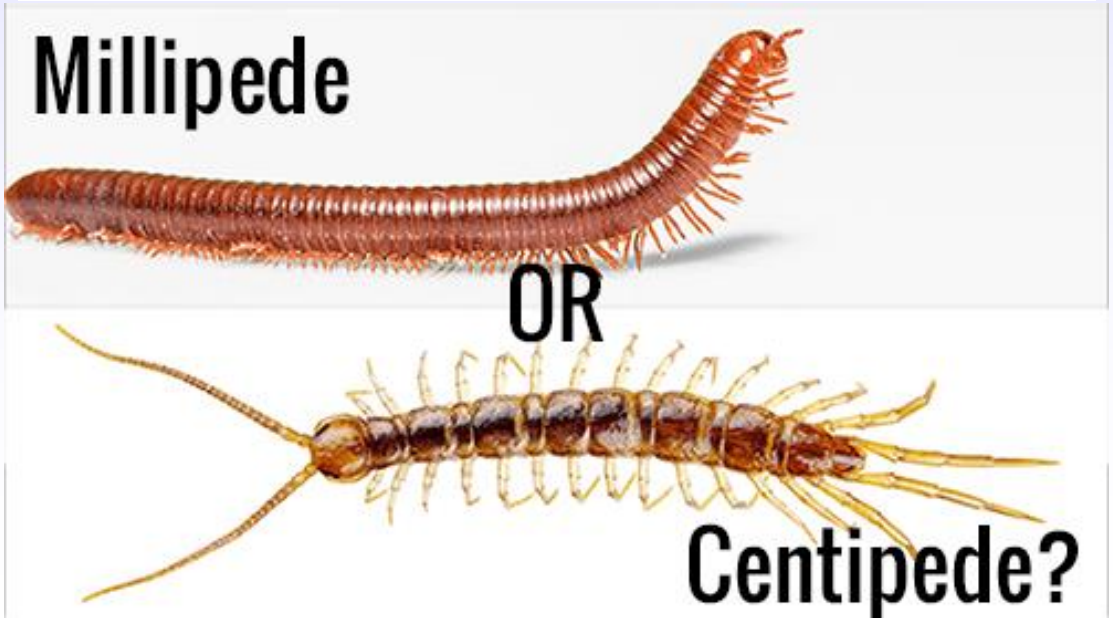
## Phylum: Arthropoda

***Phylum Arthropoda Can be classified into several classes:**

- **I- Myripoda**
- **II- Crustacea**
- **III- Insecta**
- **IV- Arachnida**

| I- Myripoda | II- Crustacea |
| --- | --- |
| - They are breathing air.<br>- They are live on the ground.<br>-They have apair of antennae.<br>- Each segment has apair legs as in case of Centipedes or, tow pairs of leg as in case of Millipedes.<br>*** Medical importance:**<br>- They cause painful bites to man and small mammals.<br>- They are poisonous in case of large ones.<br>- Centipedes secrete some secretions on the face and eye of man & cause pain. | - Most of them are aquatic and live either in sea or fresh water.<br>-They breathe through gills.<br>-The body consists of abdomen, the abdomen is segmented and each one provided by appendages adapted for feeding walking and swimming.<br>* It contains the following genera:<br>**i- Daphnia**<br>**ii- Cyclops**<br>**iii- Diaptomus** |


Millipede
trunk
Rounded head
Short antenna
mouth
Each segment has 2 pairs of legs
Centipede
trunk
head
antenna
Each segment has 1 pair of legs


Millipede
OR
Centipede?

# * II- Class: Crustacea:
## 1- Cyclops:

- Cyclops individuals may range from ½–5 mm long and are clearly divided into two sections.
- The broadly oval front section comprises the head and the first five thoracic segments and called Cephalothorax there only one single median eye.
- The hind part is considerably slimmer and is made up of the sixth thoracic segments.
- Two caudal appendages project from the rear. (Bifid limbs). Although they may be difficult to observe, Cyclops has 5 pairs of legs.
- Two pairs of antenna, the long first antennae are used by the males for gripping the females during mating. Afterwards,
- **The female** carries the eggs in two small sacs on her body.
- The larvae, or nauplii, are free-swimming and unsegmented.
- Elongated well segmented body enclosed in a shell or carapace

* **Med Importance:** **Act as Intermediate host for:**

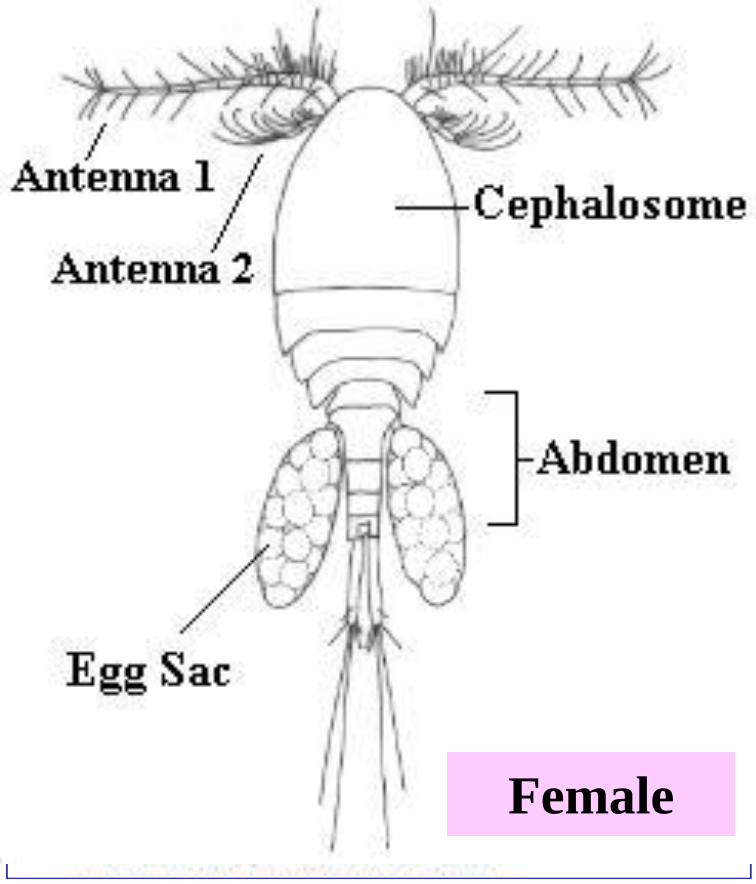
**1-***Diphylobothrium latum*

**2-***Dracunculus medinensis* (Medina worm).

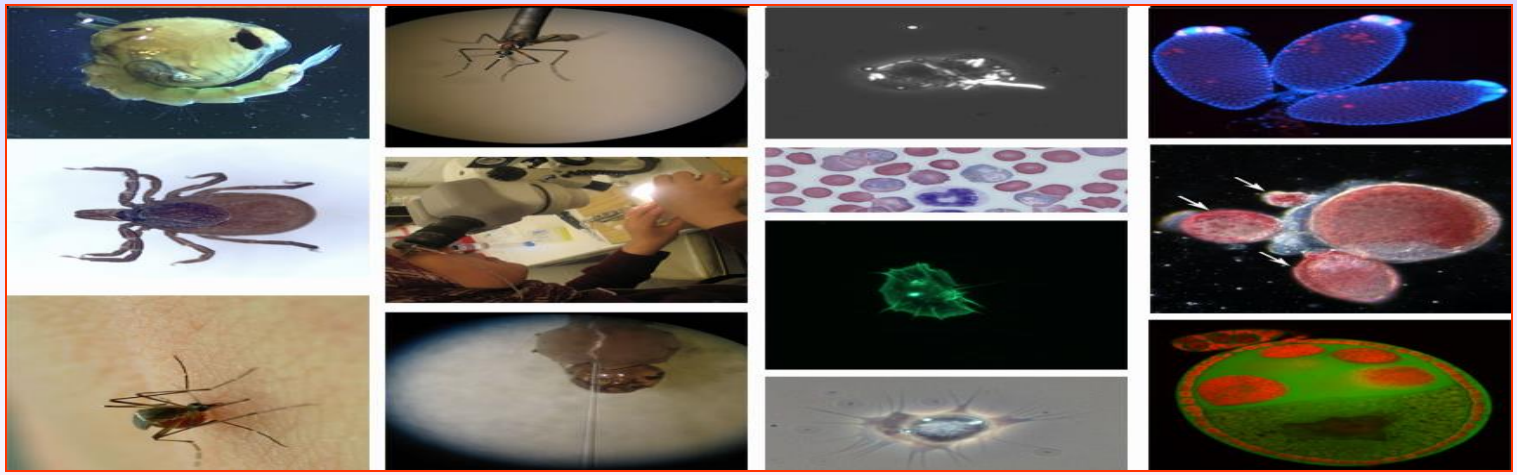
**3-***Hynemolepis lanceolata*

# * II- Class: Crustacea:

## 1- Cyclops:




# Phylum: **Arthropoda**
## Class: **Arachnida**



# IV - Class: Arachnida

- Chelicerae arthropods which have no antennae.
- The body consists of an anterior part called Cephalothorax and a posterior part called abdomen or in some cases they may be fused.
- They have one pair of chelicerae and a pair of pedipalps (mouthparts) that used in feeding
- Respiration is by tracheae (Stigmae).
- Incomplete metamorphosis.
- Class Arachnida can be classified to:

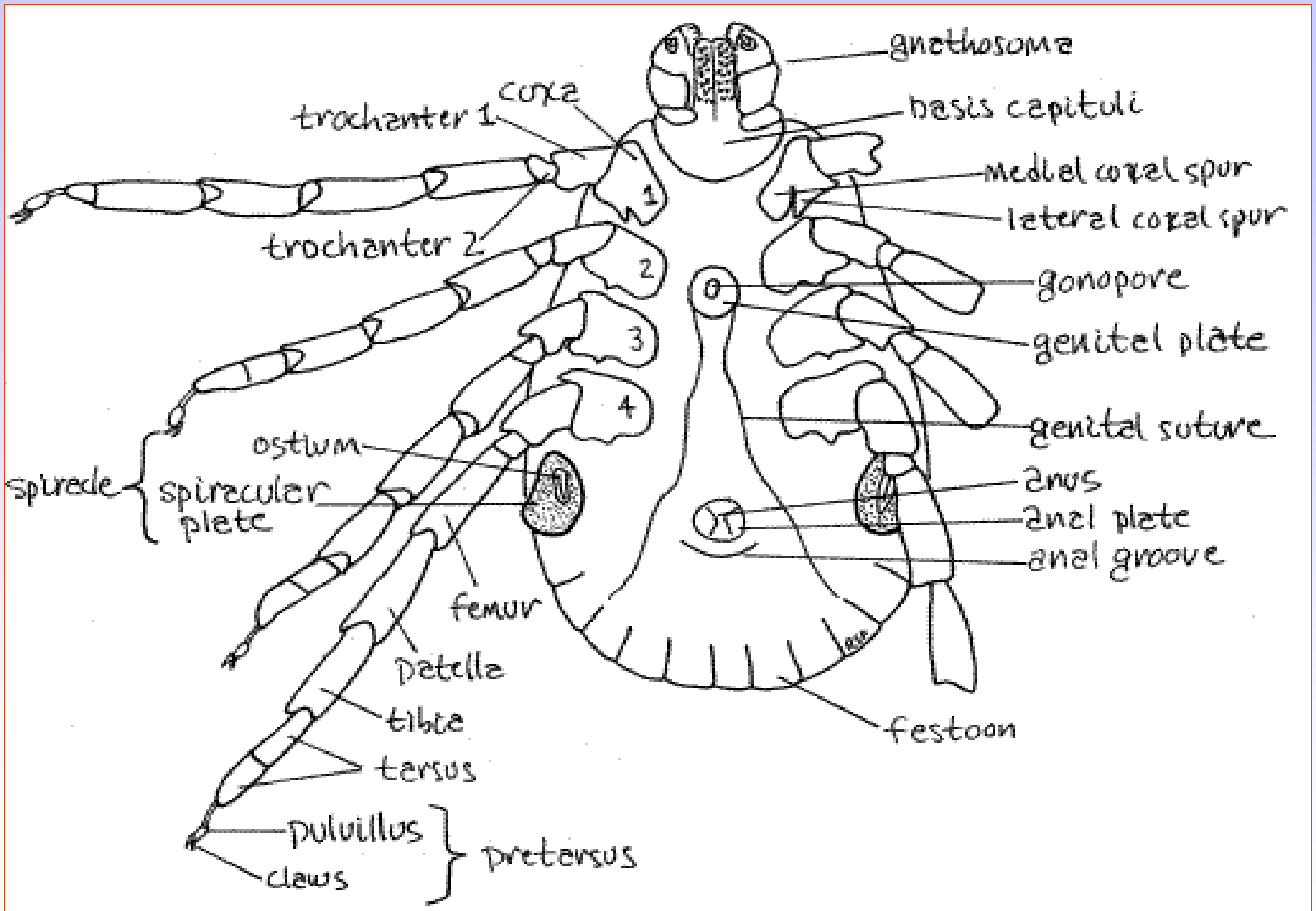
**1-Order: Acarina (ticks and mites)**

**2-Order: Scorpionida (scorpions)**

**3-Order: Aranida (spiders)**

# 1-Order: Acarina *(Ticks & mite)*

- The are about 30,000 species of Acarina, belonging to more that 2,000 genera has been described.
- Acarina is arachnids with medium to minute in size.
- The body is composed of an anterior capitulum and a posterior body
- The body is compressed dorsoventrally.
- The body may be covered either completely or partially by a hard chitinous shield called **scutum** or this may be absent.
- Mouth parts are composed of a pair of **chelicerae**, a pair of **pedipalps** and between them is a medium toothed structure called the **hypostome**, these mouth parts are borne on a plate called capitulum or **basis capituli;** the **pedipalps** of 4 segments.
- The body is unsegmented except in the suborder Astigmata (mites) where transverse superficial lines could be traced.
- The Acarina are provided with four pairs of six segmented legs located on the anterior half of the body, the tarsus ends in a pair of sharp claws between which there is a pulvillus which as claw-like in ticks and a hair- like or pad-like or suck -like in mite .
- Respiration may be through tracheal tubes that open to the exterior by one pair of spiracles in Ticks, or it may be Cutaneous without the presence of respiratory openings as in Mites.
- The genital opening is located in the median aspect of the ventral surface at the level of the 1 st pair of legs.
- The anus is located medially in the posterior third of the body on the ventral surface.
- Acarina are permanent or temporary Ectoparasites of animals & birds and also man.
- Metamorphosis is simple (incomplete, Hemimetabolate.)


gnathosoma
basis capituli
coxa
trochanter 1
trochanter 2
1
2
3
4
medial coxal spur
lateral coxal spur
gonopore
genital plate
genital suture
anus
anal plate
anal groove
ostium
spiracle
spiracular plate
femur
patella
tibia
tarsus
pulvillus
claws
pretarsus
festoon

# 1- Sub-order Ixodidea (Hard & Soft ticks)
# A) Family: Ixodidae (Hard ticks)

- hard ticks are flattened dorsoventrally in the unfed state and oval in shape, measuring about 3-23mm in length and the females are bigger than the males.
- The **capitulum** (false head) projects forwards and it is clearly visible from above.
- When eyes are present, they are found on the lateral margins of the scutum
- In the adult stage, a sclerotized dorsal plate called the **scutum** .
- In adult males, the scutum covers the entire dorsal surface behind the capitulum.
- In larvae, nymphs and adult females the scutum is restricted to the dorsal area behind the capitulum.
- No coxal organs.
- The coxae of ixodids are armed with spurs.
- Festoons present in some species.
- They are permanent Ectoparasites.

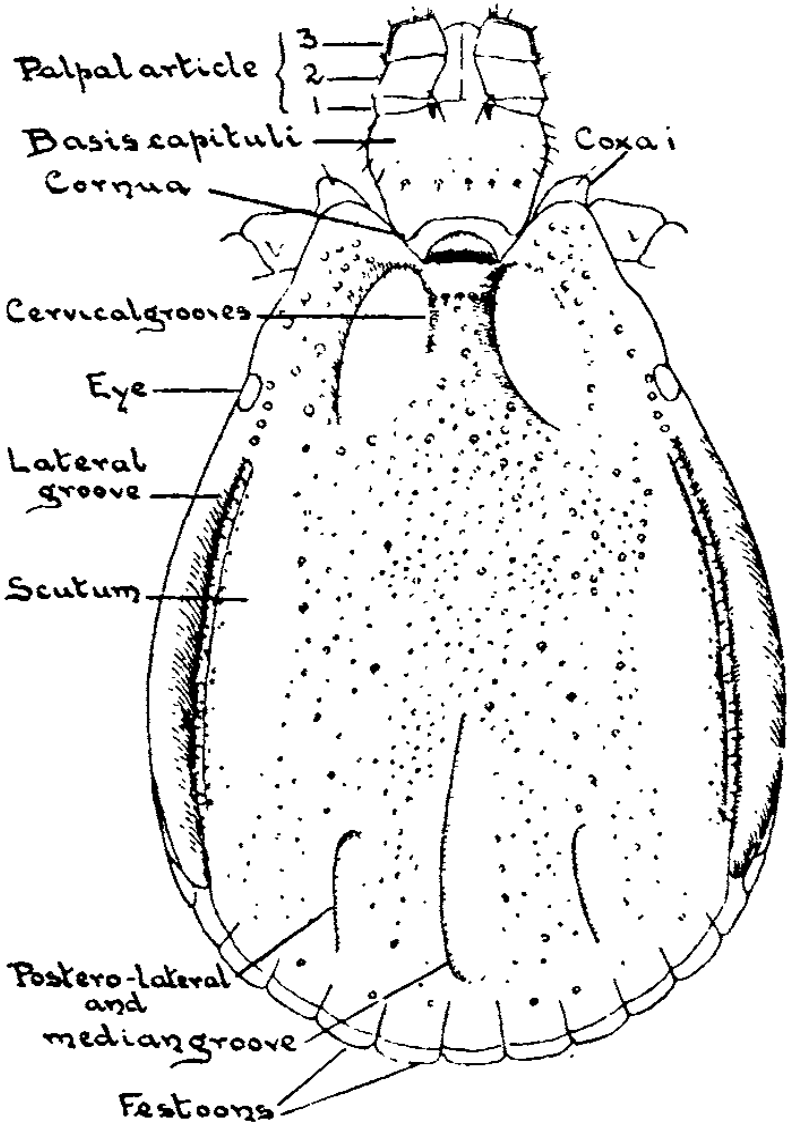



FIG. 258.—*Rhipicephalus appendiculatus*, DORSAL VIEW OF MALE. (AFTER BEDFORD.)

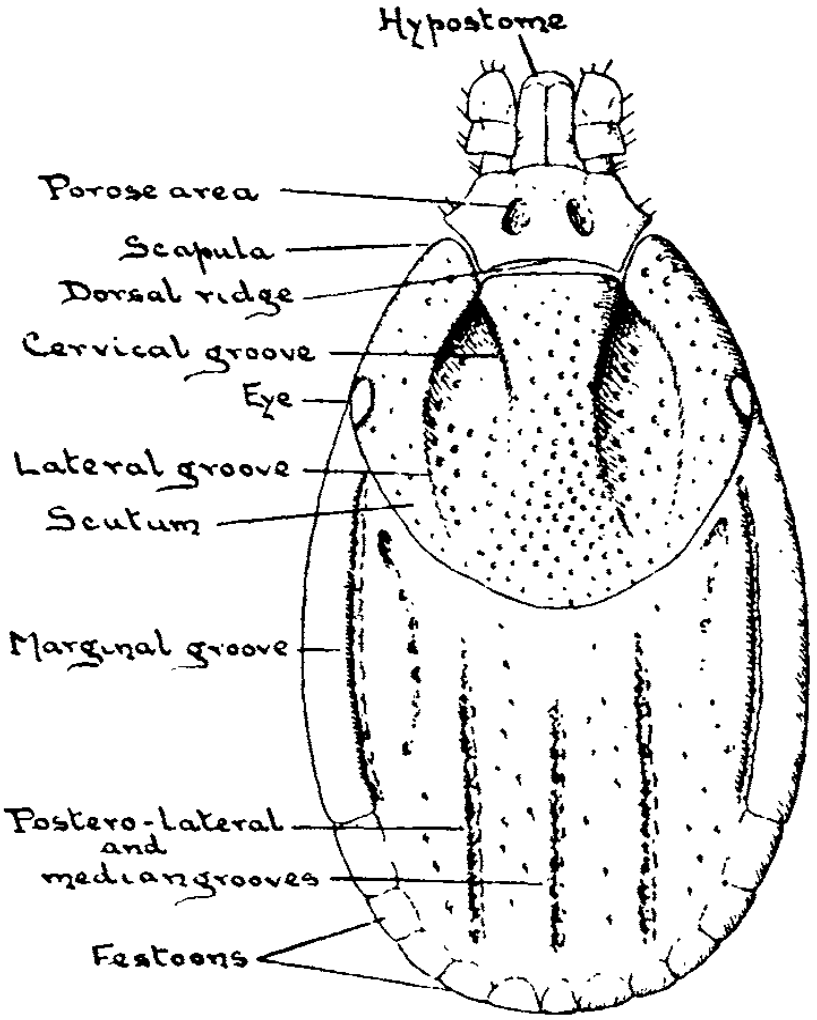
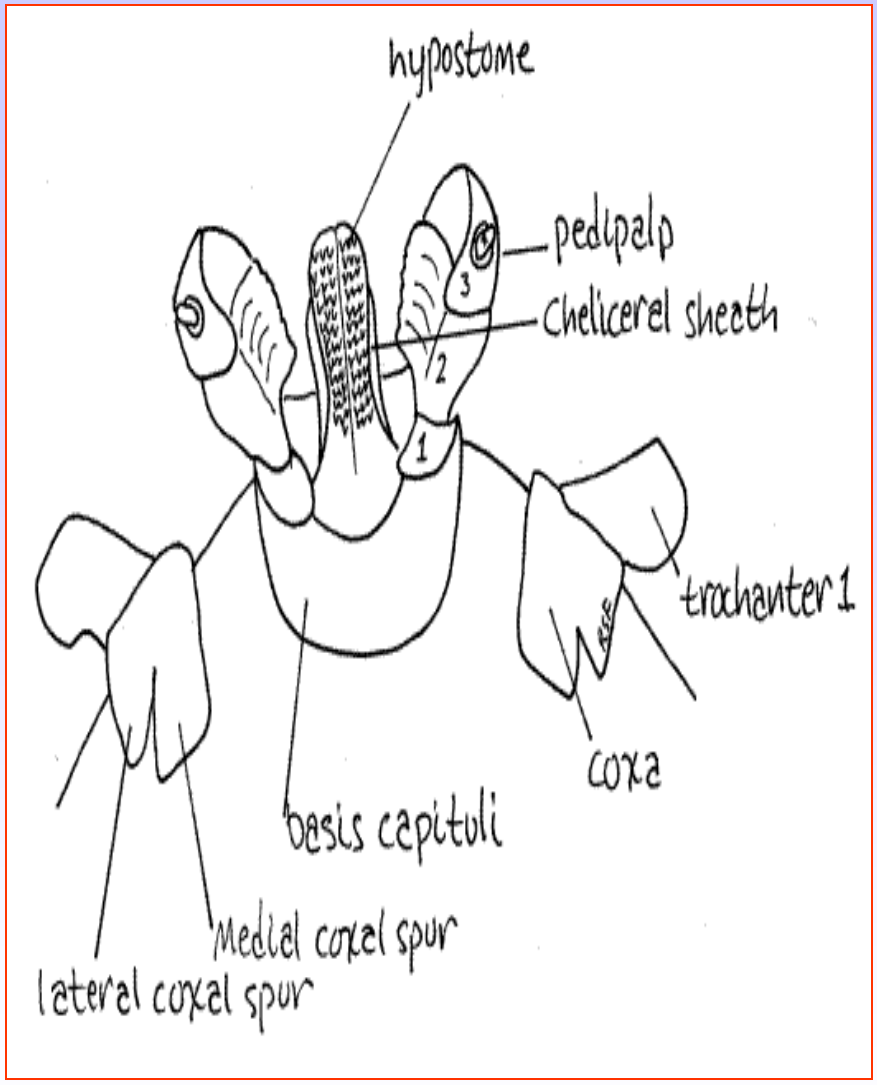
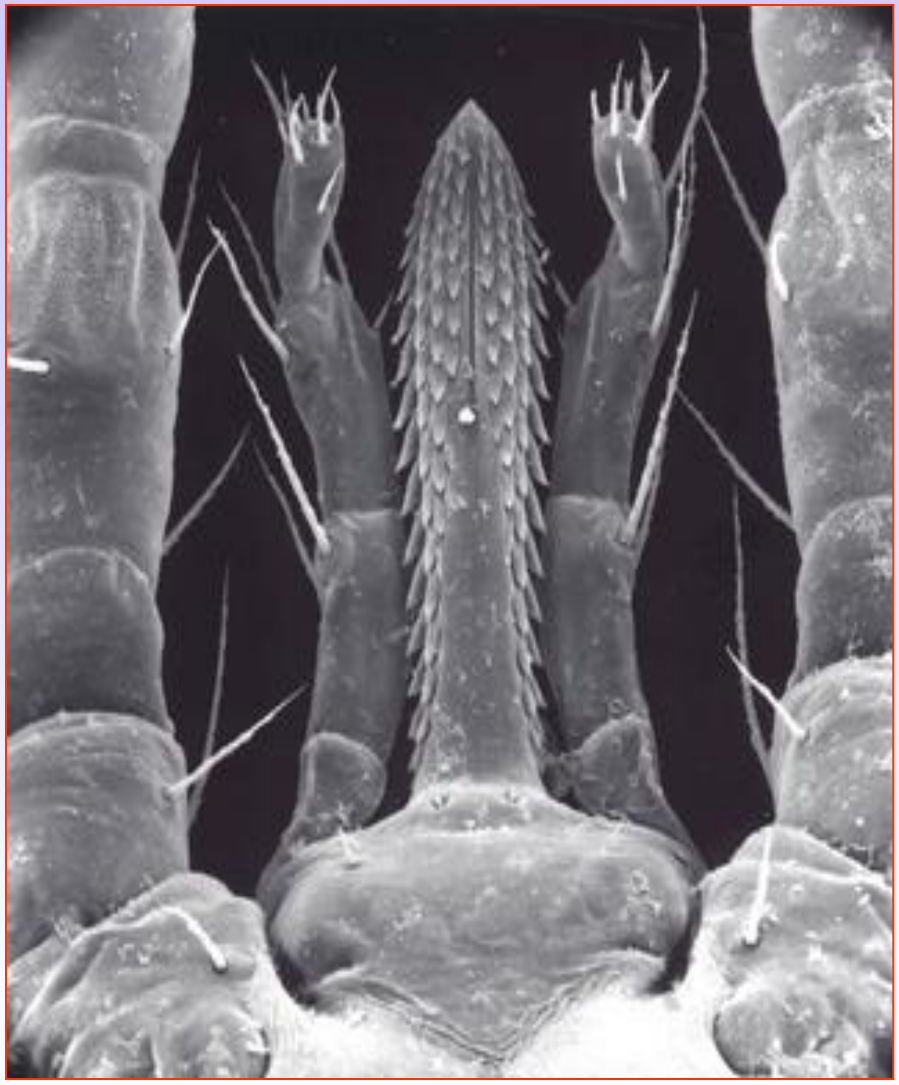
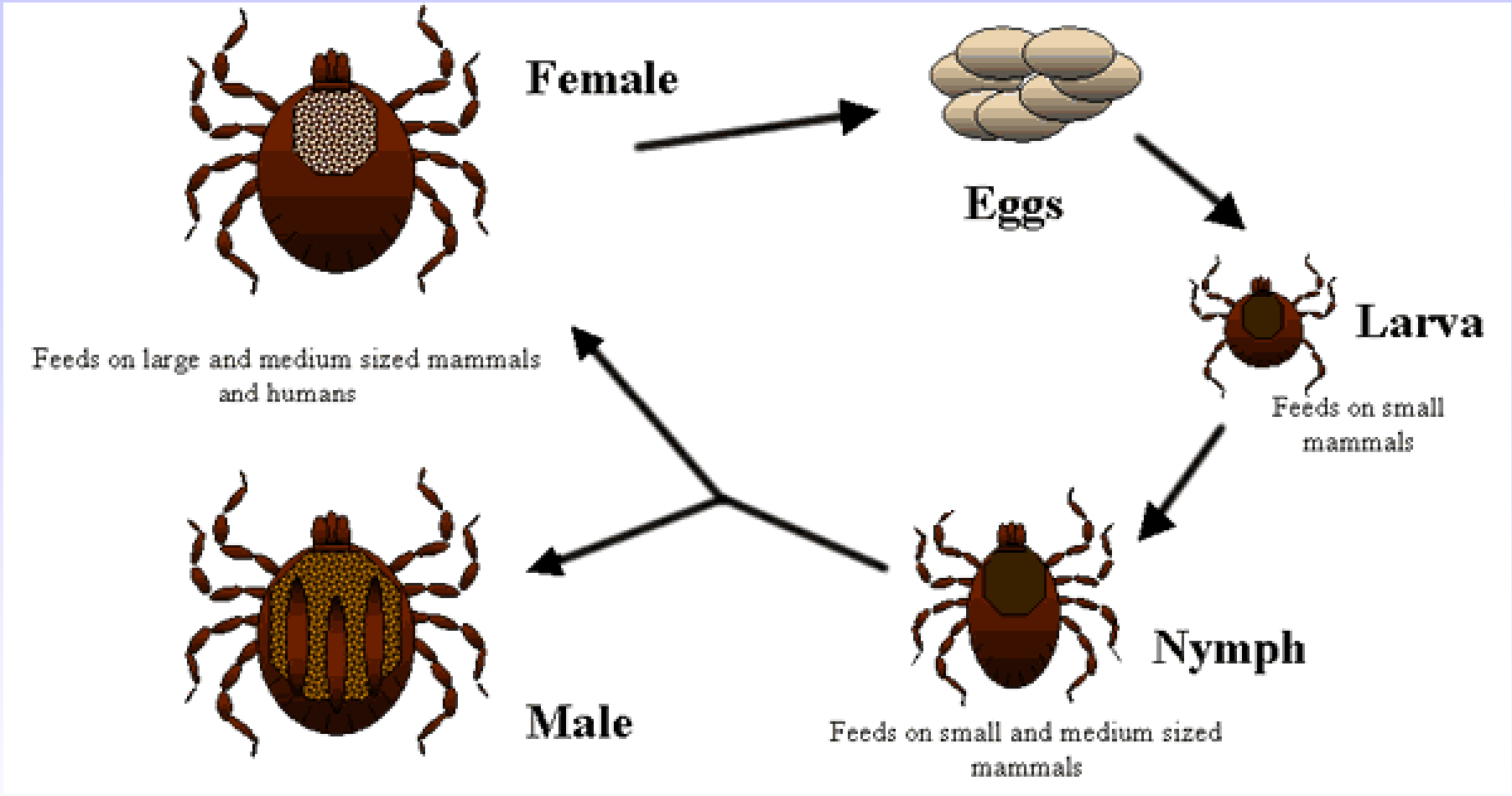



FIG. 259. — *Rhipicephalus appendiculatus*, DORSAL VIEW OF FEMALE. (AFTER BEDFORD.)


hypostome
pedipalp
Chelicerel sheath
3
2
1
trochanter 1
coxa
basis capituli
Medial coxal spur
lateral coxal spur




Female
Eggs
Larva
Feeds on small mammals
Nymph
Feeds on small and medium sized mammals
Male
Feeds on large and medium sized mammals and humans

TickEncounter Resource Center

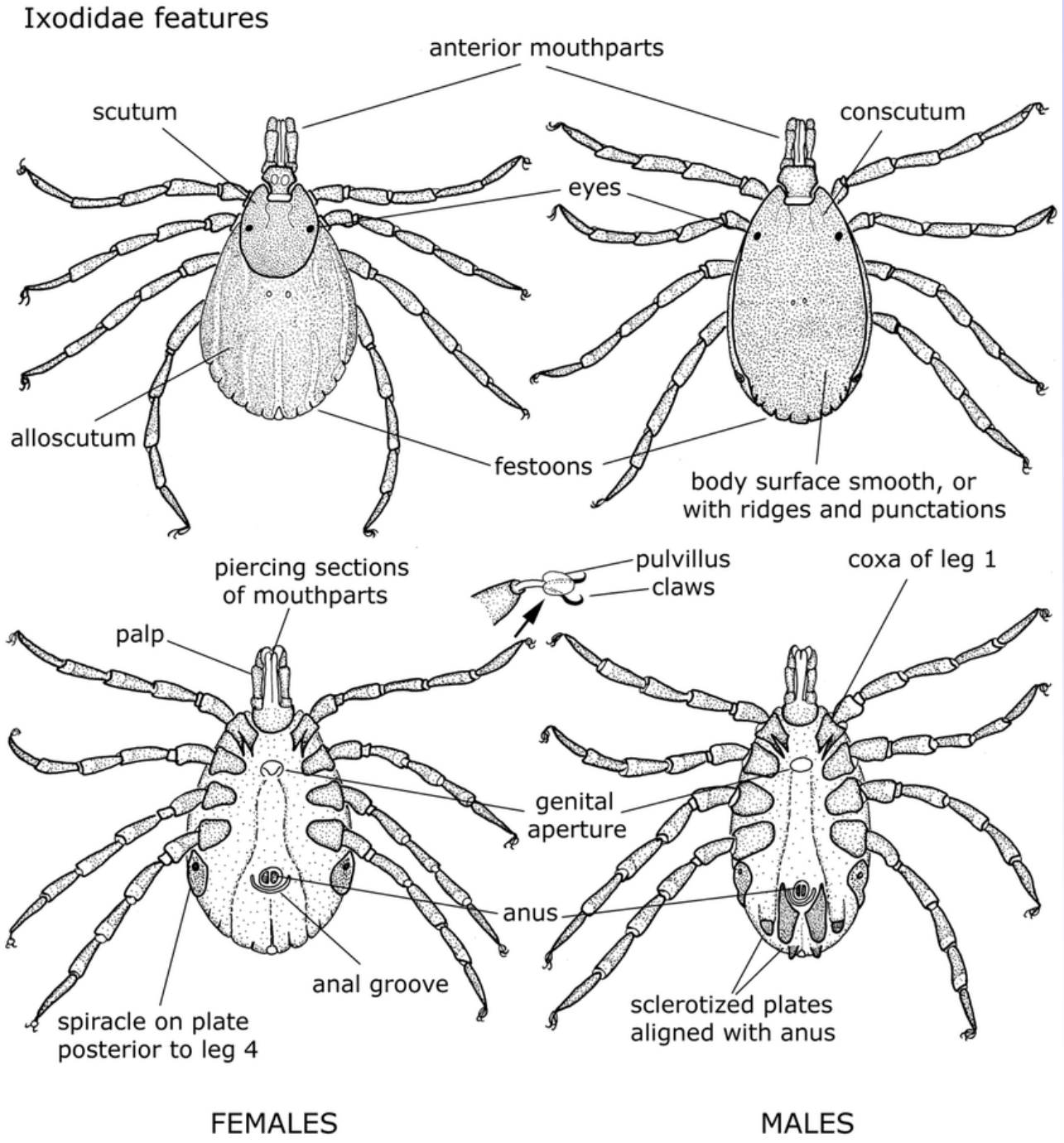
# Ixodes pacifcus (Western-Blacklegged Tick)

Larva

Nymph

Adult Male

Adult Female


Ixodidae features
anterior mouthparts
scutum
conscutum
eyes
alloscutum
festoons
body surface smooth, or
with ridges and punctations
piercing sections
of mouthparts
pulvillus
claws
coxa of leg 1
palp
genital
aperture
anus
anal groove
spiracle on plate
posterior to leg 4
sclerotized plates
aligned with anus
FEMALES
MALES

## ***Life cycle:-**

- The engorged females lay their eggs under the stones, in crevices of walls and cracks of wood near the ground.
- The female lay all the egg in one batch (18,000 eggs )and die.
- The newly hatched larvae climb on grasses to attach themselves to a suitable passing host to suck blood (the larva has 6 legs) for 2-15 days to engorge..
- After engorgement, larva molts to nymphs (this may occurs on the animal or on the ground).
- The newly molted nymphs (unfed) fed on the animal blood (if molted on the ground they attach to the animal, the same or other to engorgement).
- The nymphs molts to adults (this may occurs on the animal or on the ground)
- The unfed adults fed on the animal blood (if molted on the ground they attach to the animal, the same or other) till engorgement
- The engorged adults (females) drop off to the ground to lay the eggs and die.

* ***According to the number of hosts ticks need during their* life *cycle, the ticks can be classified into:***

*1) One- host ticks:* In which, all the three instars engorgement and the two molts take place on the same animal(L__N__A) e.g.***Boophilus species***

*2) Two- host ticks:* In which, the larvae engorge and molt to nymphs on the host and feed to engorged nymphs, then leave the host for molting to adults on the ground and seeks for another host to feed and engorgement (The same animal or another from the same species or other species), Then drop off on the ground for egg laying.

- e.g.***Hyalomma*** *spp. &* ***Rhipicephalus*** spp.

*3) Three - host ticks:* In which, each stage need a host for engorgement and the molting (2 molts) occur usually on the ground.

- (The three host needed may the same animal or different from the same species or other one}
- E.g. ***Ixodes*** *and* Some species ***Dermacentor*** and ***Amblyomma.***

***Medical importance:***

- They suck the host blood_____ cause severe Anemia.
- They cause irritation for the host _____ decrease production
- They cause tick paralysis (ticks born disease) in man & animals
  -due to toxins in the saliva of the ticks.
  -manifestation: fever, rabid ascending flaccid paralysis.
- Mechanical injury at the site of bite:

Local inflammation , odema and haemorrhage. The wound may be infected and ulcerated especially if the capitulum is torn off by forcible traction.

- Ixodes ricinus transmits Lyme disease in Human which caused by Spirochetes.
- The transmit Viral diseases like equine encephalomyelitis and Colorado tick fever.
- Rickettsial diseases: Q- fever of man, Rocky Mountain spotted fever & heart water of sheep,
- Bacterial Diseases: Spirochaetes of cattle, relapsing fever & Tularemia in man & rabbits.
- Protozoal diseases: Texas fever (*Babesia bigemina*) and East coast fever (*Theileria parva*)

* * They transmit all species of Theileria, Babesia and Anaplasma for animals.

# B-Family: Argasidae (Soft ticks)

- Argasids are tough, leathery ticks and mammillated but there is no scutum.
- Difficult differentiation between the sexes.
- In nymphs and adults the capitulum is not visible from the dorsal view, being located ventrally.
- When eyes are present they are lateral in position in folds above the legs.
- The stigmata are small and placed anterior to the coxa of the 4 th pair of legs.
- They are temporary Ectoparasites on birds and mammals unless the larval stage is permanent under the bird's wing.
- The adults and nymphal stages feed during night and hidden under the stones, in cracks, in bedding .....etc. during the day.
- The females feed several times and produce several egg batches. The eggs are large in size and few in number.
- The soft tick larva resembles the hard tick larva but, has no scutum, no pulvili, and no festoons.

* This family contains 2 genera:

# 1-Genus: *Argas*

(Bird ticks or blue bug or fowl ticks)

**Comman_Species**

- *Argas persicus* : ticks of chickens.
- *Argas reflexus*: Ticks of pigeons.

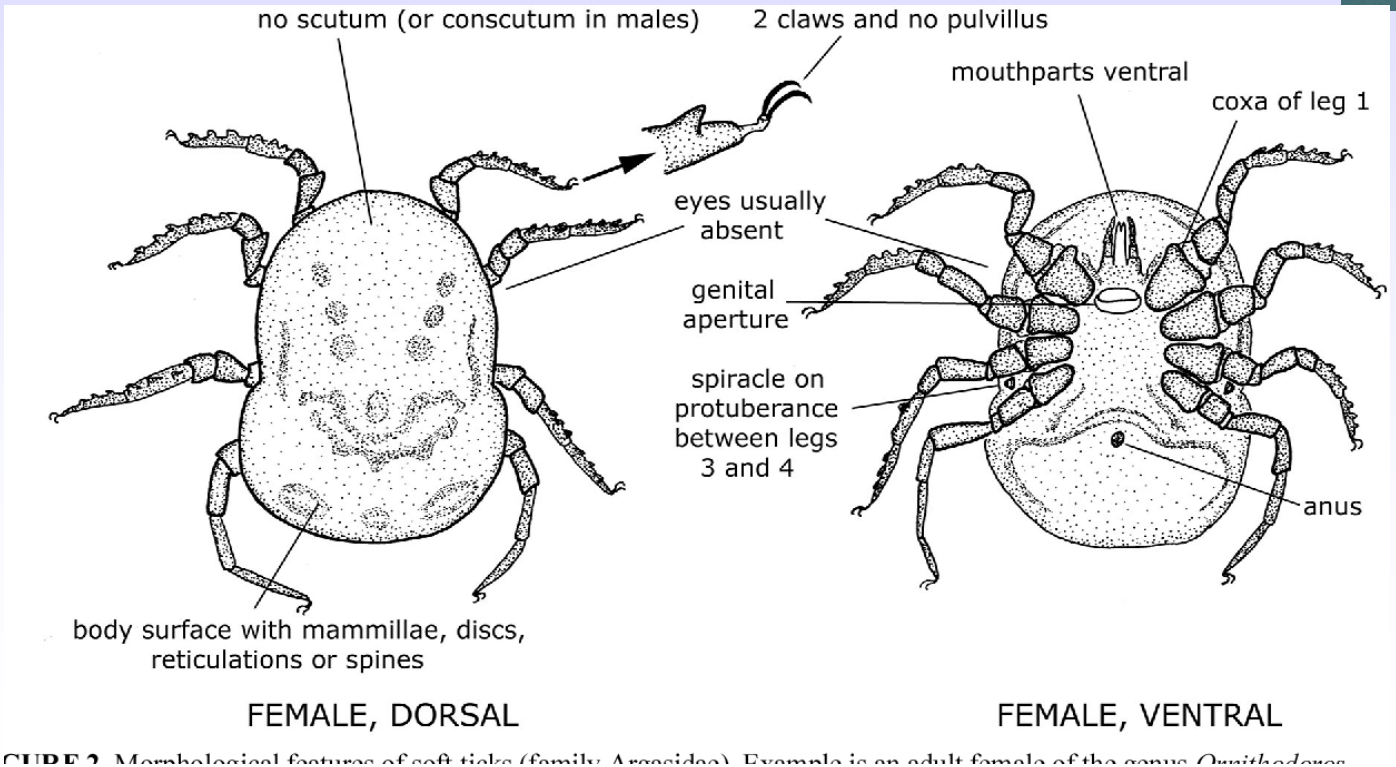
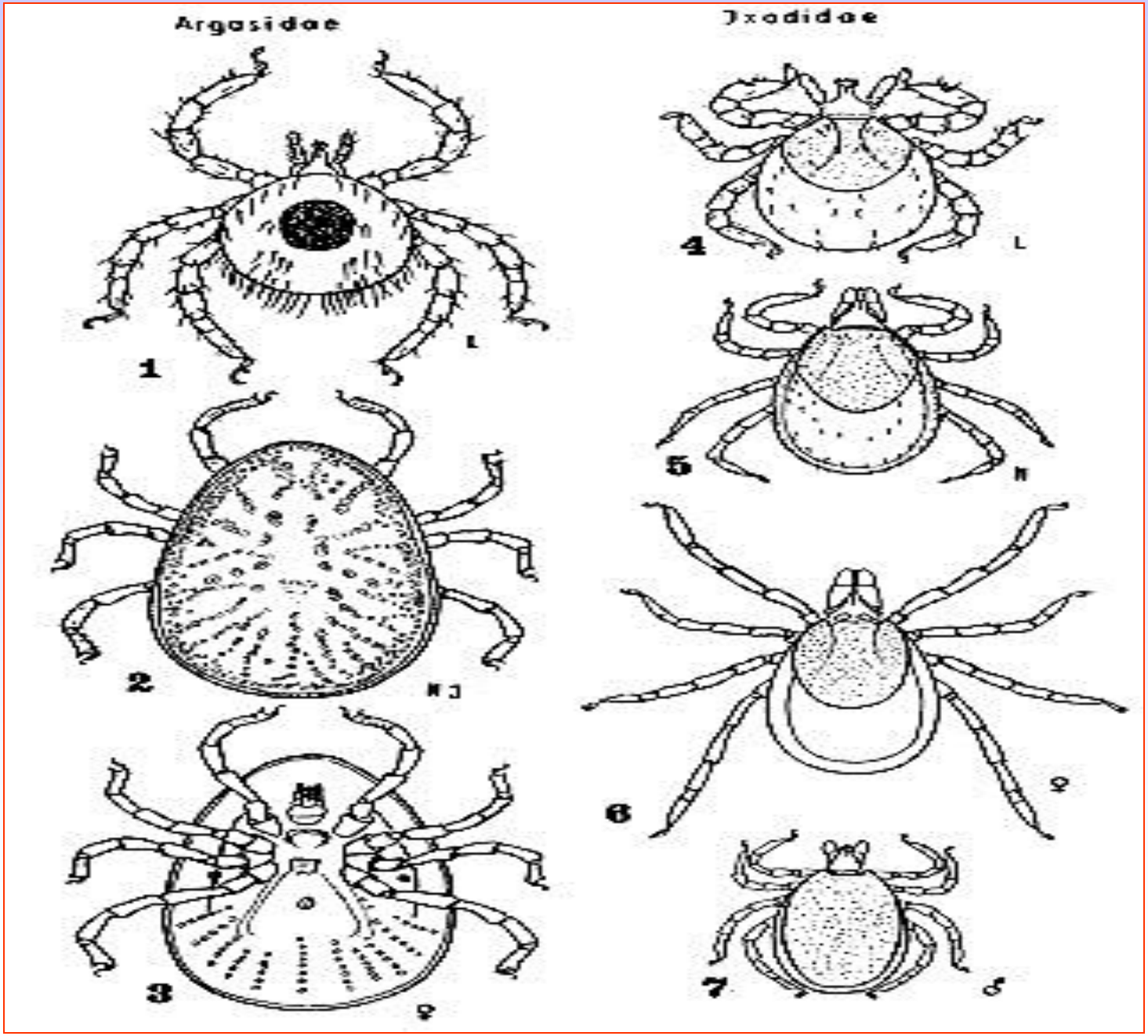



FIGURE 2. Morphological features of soft ticks (family Argasidae). Example is an adult female of the genus *Ornithodoros*


Argasidae
Ixodidae
1
L
2
♀
3
♀
4
L
5
♀
6
♀
7
♂

- ***Life cycle :***
- The females lay their eggs (10-100 each) in the intervals between visiting hosts in crakes, crevices, under the stones, between the wall and the door, or in bedding of poultry houses or under the bark of trees
- The females feed several times during egg laying.
- These eggs hatch to produce larvae (circular outline, sub terminal mouth parts visible from above and no stigmata).
- The larvae attach themselves to the host, particularly under the wing, where they feed for about a week.
- The larvae fall off the host and have a period of relative inactivity before molting to become nymphs. There are two to four nymphal stages before the adult. The unfed adult tick is pale yellow in colour becoming darker when fed. In outline the body is oval to pear shaped being broadest behind the legs at about the level of the anus.
- The adults and nymphal stages feed during night (nocturnal)and hidden under the stones, in cracks, in bedding .....etc. during the day.

- ***<u>Medical importance:</u>***
- They suck the blood of birds. They irritate the birds, sleeplessness, decreased productivity, the egg laying is decreased.
- They produce tick paralysis in birds.
- They transmit fowl spirochetes, Rickettsia and ***Aegyptianella pullorum.***

## 2- Genus: Ornithodoros
## spp: *O.mubata*

- This species has become associated with man and / or his domestic animals (mammals).
- They live in cracks in wells and in the earth floors
- During the day they hide away in dark locations, it is nocturnal blood feeder.
- Only the nymph and adult are parasitic
- The integument bears mammillae, more quadrate in shape.

- ***Life cycle:***
- Female lay several batches.
- Larva moult into nymph stage before hatching and the emerging nymphs feed on blood tacking 20-25 min. to a full meal.
- After an interval the first nymphal stage molts into the second stage which feeds and repeats the process.
- The number of nymphal stages is variable with adult males being produced after 4 nymphal stages and females after five.

- **Medical importance:**
- They are vectors of endemic relapsing fever (African type) caused by *Borrelia duttoni*
- They transmit *Trypanosoma cruzi.*
- Very painful bite with very painful bite which cause severe swelling and itching which lasts for long time.
- Considerable irritation to man and animals, heavy infestation(blood loss) cause death.

## Morphological and Biological differences between hard and soft tick:

| A- Adult: | Ixodidae (Hard ticks) | Argasidae (Soft ticks) |
|---|---|---|
| Scutum | Present | Absent |
| Sexual dimorphism | Marked, the scutum covers the whole dorsum of male while only covers the anterior dorsum of females | Difficult due to absence of the scutum |
| Capitulum | Terminal and visible from the dorsal surface | Hidden ventrally and cannot be seen from the dorsal surface |
| Spiracles | Behind the 4$^{th}$ Coxa | In front the 4$^{th}$ Coxa |
| Festoons | Found one the posterior margin of the body | Absent, and the cuticle is mammillated or ornamented with circular discs |
| Eyes | When present found on the side of the scutum folds | Lateral on the supra-coxal folds |
| Coxa | Armed with spurs | Not armed |
| Pulvili | Present | Absent |
| B- Larva: | With dorsal scutum<br>With Festoons<br>With Pulvili | without |
| C- Nymph: | Only 1 Nymphal stage | Several Nymphal stages |
| Egg Deposition: | Lay eggs in 1 batch then die | Lay eggs in several batches after blood meals |
| Relation to host | Permanent Ectoparasites<br>1 blood meal<br>1-3 host | Temporary Ectoparasites<br>5-12 or more blood meal<br>More than 10 host |
| Life span | 2months - 3years | Long (may to 16 years) |
| Species | Ixodes, Hyalomma, Boophilus, Rhipicephalus | Argas and Ornithodoros |
| Control | Difficult | Easy |

## *Control of ticks:

### A) Acaricides:

-In permanent ectoparasites, acaricides should be applied directly to domestic animals.

- For killing the ticks on animals it must be by

(1) Dipping of animals in a suitable tank containing the acaricides in an aqueous solution, suspension or emulsion.

(2) Spray or showers

(3) Hand spraying.

(4) Ivermectin given by parenteral route is effective against one-host tick and Ornithodoros.

* Before application, the ticks' species must be identified to know the life cycle durations and the type of ticks

* All animals must be watery and free from any wounds.

* Also a proper care for the man who applied because the acaricides are very toxic.

- The proper concentration as indicated for each acaricides takes place and must be freshly diluted before use.

- Soft ticks being intermittent feeders, acaricides should be applied to hiding places as spraying walls and floors.

**B) Gentle removal of ticks by hand.**

**C) Destruction of rodents that serve as hosts for the early stages.**

**D) Avoid tick bites by using repellents and proof clothing.**

***Acaricides used & concentrations**

- Gammatox super fluid (1: 800 for cattle and l: 3200 for sheep}
- Boopertox fluid (Toxophene) (1: 40)
- Malathion compound (1: 100) - Diazinon. (1: 1000)
- Asuntol (1: 700)
- Neguvon 0.15% sol (1, 5: 1000) - Ivomec 1 ml /50 kg. b.w, injection