Arthropodology

THE CLASSIFICATION TERMS OF ARTHROPODS

Phylum	Spesific name.
Subphylum	Spesific name.
Class:	“ea”
Order:	“ida”
Suborder	“ina”
Upper-family	“dea”
Family	“idae”
Sup-family	“inae”
Genus	Spesific name. *Hylomma*
Species	Spesific name. *Hylomma marginatum*

Animalia Kingdom
Metazoa Subkingdom
Arthropoda Phylum

Chelicerata (Amandibulata) Subphylum

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Arachnida Class

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I) Araneae Subclass (Spiders)
II) Scorpionea Subclass (Scorpions)
III) Acarina Subclass (Mites and Ticks)

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1- Astigmata Order (*Sarcoptes* spp) (*Psoroptes* spp) (*Chorioptes* spp) (*Otodectes* spp) (*Cnemidocoptes* spp)

2- Prostigmata Order (*Demodex* spp) (*Cheyletiella* spp)

3- Mesostigmata Order (*Dermanyssus gallinae*) (*Varroa destructor*)

4- Metastigmata Order (Ticks)

Tracheata (Mandibulata; Antennata) Subphylum

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Insecta Class

1- Diptera Order (Flies)
2- Phthiraptera Order (Lice)
3- Siphonoptera Order (Fleas)
4- Heteroptera Order (Bed bags)
5- Blattaria Order (Cockroaches)
6- Lepidoptera Order (Butterflies)
7- Hymenoptera Order (Membranous wings)
8- Coleoptera Order (Beetles)
9- Odonata Order (Dragonflies)

Morhological differentations in Arthropods

- Subphylum: Antennata
- Class: Insecta
  - Caput
    - Eyes
    - Antenna
    - Palp
    - Mouth parts
  - Thorax (pro, mezo and metathorax)
    - Wings
    - 6 legs
    - Stigma
  - Abdomen
    - Stigmates
    - Genital opening

Morhological differentations in Arthropods

- Subphylum: Chelicerata
- Subclass: Acarina
  - The body consists of one piece (idiosoma)
  - The front of body contains the mouth organelles (capitulum)
  - Larvae have 6 legs,
  - Nymphs and adults have 8 legs

Antennata: Insecta (*Bovicola sp.*)

I- Caput
II- Thorax
III- Abdomen
1- Antenna

2-
3-
4-
} legs (6)

5-Nail
6- Stigma

Chelicerata: Acar (*Ornithonyssus* sp.)

1-Chelicerler
2- Hypostom
3-Palps
} Capitulum
4- Sternal plate
5- Genal plate
6- Anal plate
7- Trachea
8- Stigma
9- Coxa
10- Pretarsus
11- Tarsus
12- Nail
13-Idiosoma

Arachnida Class

- Subclass: Araneae (Spider)
- Subclass: Scorpionea (Scorpions)
- Subclass: Acarina (Acars and Ticks)
  - No wings and antennas
  - Body parts are different from other arthropods
    - Caput + thorax: Cephalothorax — Spiders, Scorpions
    - Abdomen
    - Caput +Thorax+ Abdomen — Ticks, Scabies etc.

Subclass: Araneae (Spiders)

- The spiders are 1-2 cm long
- The body consist of cephalotoraks (caput+thorax) and abdomen
- No segmentations in Abdomen
- Has web glands
- There are venom glands on the front of his body and they give their poisons through palps
- The poisons are neurotoxic and some species may cause death in susceptible animals and humans
- They usually live in secluded places.
- They generally feed insects
- Black widow is a famous species, but this species is not in Turkey.

Sınıf altı: Scorpionea (Akrep)

- The length of scorpions varies between 1-20 cm.
- The body consist of cephalotoraks (caput+thorax) and abdomen
  - Two chelicer on the front, on both sides of their mouth
  - Two pedipal
- Has 8 legs
- Preabdomen has 7 segments
- Postabdomen has 6 segmens (like a tail and curled up)
- There is venom gland and sting (telson) in last segment of post abdomen
- They are active at night
- They are hidden in the day.
- They feed with insects
- Ovipar and mostly ovovivipar
- There is a paralyzing effect of the poison.
- Scorpions belonging to Buthidae family are widespread in Turkey

Subclass: Acarina (Mites and Ticks)

- There are ticks and scabies in this subclass.
- The body is composed of two parts.
  - Capitulum (gnathosoma) and idiosoma.
  - Generally no segmentations.
- Mouth parts
  - 2 pedipals
  - 2 cheliser
  - 1 hypostom
- There is sexual dimorphisms between males and females.
- Most of them are ovipar.
- Biology egg, larvae, nymphs and adults
- Larvae has 6 legs
- Nymphs and adults have 8 legs.

Subclass: Acarina (Mites and Ticks)

- Mites generally breathe in two ways
  - Stigma (tracheal)
  - Breath with body surfaces.
  - Akarlar stigmaların durumuna göre dizilere ayrılır.
- Mites are sorted according to status of their stigma
  - Metastigmata (stigmates are behind the 4. coxae)
  - Mesostigmata (stigmates are between 2 and 3 coxae)
  - Prostigmata (stigmates are on the gnathsoma)
  - Astigmata (no stigma)

Acarina

- 1- Astigmata Order (Sarcoptes spp)
  (Psoroptes spp)
- (Chorioptes spp)
- (Otodectes spp)
- (Cnemidocoptes spp)
- 2- Prostigmata Order (Demodex spp)
  (Cheyletiella spp)
- 3- Mesostigmata Order (Dermanyssus gallinae)
- (Varroa destructor)
- 4- Metastigmata Order (Ticks)

Metastigmata (Ticks)

Metastigmata (Ticks)

- Ticks that are ectoparasites of vertebrates are found in all terrestrial regions of the world.
- Approximately 900 species exist in the world
  - Three family;
    - Ixodidae,
    - Argasidae
    - Nuttalliellidae
- Approximately 40 species exist in Turkey
- Sakırga, yavsı etc.

Metastigmata (Ticks)

- The life cycle includes four stages: the egg, larva, nymph, and adult.
- Ixodid ticks have only one nymphal instar, whereas argasid ticks have two or more nymphal instars.
- All ticks feed on blood during some or all stages in their life cycle; that is, they obligate ectoparasites.
- Larvae attack hosts, feed, detach, and develop in sheltered microenvironments where they molt to nymphs.
- Nymphs seek hosts ,feed, drop and molt to adults.
- Adult ticks seek hosts, feed, and in the case of engorged ixodid females, drop off to lay their eggs.
- In contrast to most other hematophagous arthropods, ticks can be remarkably long-lived.
- Many can survive for one ore more years without feeding

Metastigmata (Ticks)

- Ticks transmit a greater variety of infectious organisms than any other group of blood-sucking arthropods.
- Ticks transmit numerous protozoan, viral, bacterial (including rickettsia) and fungal pathogens.
- In addition, the bites of ticks can cause toxic reactions, allergic responses, and fatal paralysis, and the wounds that they produce can create sites for secondary infections

Order: Metastigmata (ticks)

Ixodidae and Argasidae family

- Ixodidae (Hard ticks)
  - *Ixodes*
  - *Rhipicephalus*
  - *Dermacentor*
  - *Haemaphysalis*
  - *Hyalomma*
  - *Ambylomma*
- Argasidae (Soft ticks)
  - *Argas*
  - *Ornithodoros*
  - *Otobius*

Their hosts are mammalians, reptiles and birds
They are vectors of many pathogens

Protozoa (Theileria, Babesia, Hepatozoon)
Bacteria (Borrelia , Francisella species)
Vırus (CCHF, Encephalitis virus)
Rickettsiales (Rickettsia species, Coxiella, Anaplasma)

Ixodidae family

- Hard ticks
- Immature and adult ticks each take a blood meal.
- Following contact with the host, a tick uses its chelicerate to puncture the skin and its hypostome to securely anchor itself.
- Females feed only once
- Following mating, females suck blood for several days and swell enormously during the last 24-48 hours of attachment.
- Replete, mated females drop from their hosts, find a sheltered locations and subsequently oviposit hundreds to thousands of eggs.
- The female dies upon completion of egg laying

Ixodidae family

- They show seasonal activation
  - *Hyalomma marginatum*
  - *Dermacentor marginatus*
- The life cycle may take two or more years.
- Life cycles
  - One-host life cycle (*Rh. annulatus*)
  - Two-host life cycle (*H. marginatum*)
  - Three-host life cycle (*I. ricinus*)

Ixodidae family

- Females have a hard cuticular plate or scutum on the anterior half of the dorsal body surface.
- In males, the scutum occupies virtually the entire dorsal surface
- The body of the female posterior to the scutum expands enormously during feeding during feeding as new cuticule is synthesized to accommodate the blood meal.
- In males, however, the larger scutum limits expansion.
- When present, a simple eye occurs along each postero-lateral margin of the scutum.
- The entire body is covered by numerous setae and the pore-like sensilla auriformia.
- Larvae posses few setae, although their number and relative placement provide valuable taxonomic characters for generic and subgeneric differentiation.

Ixodidae family

- An odour-detecting sensory apparatus, Haller's organ, is evident on the dorsal surface of the tarsus of leg I in all stages.
- This organ consist of an anterior pit and a posterior capsule.
- Gustatory, thermosensory, and mechanosensory functions also have been associated with this organ.
- Variations in the structure of Haller's organ are useful for distinguishing genera and species

Transmission route of the pathogens

- **Transsitadial transmission**
  - Passage of microbial agents, such as bacteria and protozoa, virus, from one developmental stage to its subsequent stage or stages
- **Transovarial transmission**
  - Passage of microbial agents from the maternal body to eggs within the ovaries.

İxodidae (Hard ticks)

- *Ixodes*
- *Rhipicephalus*
- *Dermacentor*
- *Haemaphysalis*
- *Hyalomma*
- *Ambylomma*

- **Short mouth parts**
  - *Haemaphysalis*
  - *Rhipicephalus*
  - *Dermacentor*

- **Long mouth parts**
- *Hyalomma*
- *Ixodes*
- *Ambylomma*

Ticks of Turkey
Hyalomma genus

- *H. anatolicum*
  - *T. annulata*
- *H. detritum*
  - *T. annulata*
- *H. marginatum*
  - CCHF, *R. aeschlimannii, R. sibirica* subsp *mongolitimonae*
- *H. excavatum*
- *H. eagyptium*
- *H. scupense*
- *H. rufipes*
  - CCHF
- *H. dromedarii*

Ticks of Turkey
Rhipicephalus genus

- *Rh. annulatus*
  - *Babesia bigimina* and *Babesia bovis*
- *Rh. turanicus*
  - *Babesia* species in sheep and goats
- *Rh. sanguineus*
  - *Babasia canis* and *Hepatozoon canis*
- *Rh. bursa*
  - *B. ovis, B. motasi*

Ticks of Turkey
Ixodes genus

- *I. ricinus*
  - Lyme disease, Tick-borne encephalitis and *Babesia divergens*
- *I. hexagonus*
- *I. redikorzevi*
- *I. gibbosus*
- *I. frontalis*
- *I. vespertilionis*
- *I. laguri*

Ticks of Turkey
Dermacentor genus

- *D. marginatus*
  - *Babesia caballi* and *R. slovaca*
- *D. reticulatus*
  - *R. slovaca*

Ticks of Turkey
Haemaphysalis genus

- ***H. punctata***
  - *Theileria ovis*, *Babesia major*
- ***H. sulcata***
  - *Theileria orientalis*
- ***H. parva***
  - *Theileria orientalis*
- ***Ha. inermis***
- ***Ha. erinacei***
- ***Ha. concinna***

Argasidae

- *Argas*
- *Ornithodoros*
- *Otobius*

Argasidae

- Called as soft ticks
- The body margins are rounded in most species
- In Argas, they are flattened and covered by small marginal discs.
- Eyes, when present, occur on folds lateral to the coxae.
- In females, the genital pore appears as a horizontal slit surrounded by a prominent fold.
- In males, the pore is subtriangular or suboval, without a genital apron.

Argasidae

- Female and male are similar, but male is slightly smaller.
- The capitium is not seen from the dorsal view in nymphs and adults.
- The palps are cylindrical and consist of 4 joint
- No pulvillum on the feet except for larvae

Argasidae

- In contrast to the ixodids, most argasids have two or more nymphal instrars in their life cycle, each of which must consume a blood meal.
- This pattern is termed the multihost life cycle.
- Molting occurs off the host in craks, crevices, or beneath debris in or near the nest.
- Argasid females take repeated small blood meals and lay small bathes of eggs, typically less than 500 eggs/batch after each feeding.
- These are termed **multiple gonotrophic cycles**.
- The internal between feeding is typically several months.
- As many as six gonotrophic cycles have been reported in some species.

Argasidae

- Mating usually occurs off the host.
- Because of the multiple nymphal instars that may number six or seven in some species, argasid ticks often live for many years.
- These ticks are highly resistant to starvation, which can extend their longevity even further.

Argas genus
A. reflexus
A. persicus

- *Ornithodoros* genus
- *O. lahorensis*

ARGASIDAE

Otobius
O. megnini

ARGASIDAE

Argas

- Argas ticks have a flattened body margin, a lateral sutual line, and a leathery, folded cuticle.
- The many small integumental folds usually have a button-like appearance, each with a pit on its top.
- No eyes.
- Most species parasite bats or birds.
- The genus is worldwide in distribution, mostly in xeric environments or dry caves in otherwise humid environments.
- Examples of important species are the fowl tick (*A. persicus*) and the pigeon tick (*A. reflexus*).

ARGASIDAE

Ornithodoros

- Nymphs and adults have a leathery cuticle with innumerable tiny wrinkles (mammillae) and a rounded body margin; they lack a lateral, sutural line.
- Mammillae are smaller and more numerous than those found in *Argas*.
- Some species have eyes.
- The host range is diverse and includes reptiles, birds, and mammals.
- The genus is worldwide in distribution.
- *O. lahorensis* (*A. lahorensis*)
  - Sheep tick, winter tick
  - Tick toxicities.

Argasidae (Soft ticks)

- They are active mostly in winter months.
- They are found in dwelling.
- They are generally active at nights.
- Female ticks often leave their eggs in stables and dwellings.
- These species have a long life span
- Females lay eggs many times and they do not die after leaving the eggs.

Morphology

Ixodidae (Hard ticks)

- There are intense chitinous plates on the body.
  - Scutum in larvae, nymph and female Conscutum in male
- No mammillae on the body
- The caputilum is seen from dorsal view
- There is pulvillum
- 4. palp joint is embedded in the 3. palp
- Sexual dimorphism is evident
- There is no distinct line at the edge of the body
- There are porose areas in basis capituli.
- Eyes, when present, are located laterally in the scutum.
- Stigmas are large and located behind the 4. coxae
- There are festons

Argasidae (Soft ticks)

- No plate scutum and body cover is soft
- The mammillae exist on the body
- The caputilum is not seen from dorsal view (except for larvae)
- No pulvillum (except for larvae)
- 4 palp joints are evident
- Sexual dimorphism is not evident
- There is distinct line at the edge of the body
- No porose areas
- Eyes, when present, are located on supracoxal fold.
- Stigmas are small and located in front of the 4. coxae
- No festons

Biology and development

Ixodidae (Hard ticks)

- Egg+larvae+nymph+adult
- 1-2-3- host life cycle
- One feeding processes in each life stage
- Females feed and mate in one time. After egg production, females die.
- Males that mate do not live much, and die
- They are generally active at day time and in hot seasons
- They are short-lived.

Argasidae (Soft ticks)

- Egg+larvae+2-8 nymphs+adult
- Multiple hosts
- Multiple feeding processes
- Females feed and mate in many time. After egg production, females do not die.
- Males that mate live for many years.
- They are generally active at night and in cold seasons
- They are long-lived.