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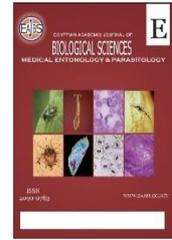
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Identification and Morphological Key of Pakistani Ticks

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ABSTRACT

Ticks are obligate blood-sucking ectoparasites of wild and domestic animals as well as poultry birds. These are the major threat to the livestock industry across the globe. They are the most significant ectoparasites in tropical and subtropical countries, causing considerable economic losses both directly by blood-sucking and indirectly as infection vectors. In endemic locations across the world, tick-borne diseases have become a public health issue. Ticks, as possible vectors for helminth parasites and haemoprotozoa, cause blood loss. The weight reduces due to blood-sucking and causes anaemia in domestic animals, while tick bites impair the quality of hides and skin. The milk and meat production of animals reduces during high tick infestation. Ticks badly effect host health even mortality and morbidity occur. The present study was, therefore, conducted to know the ticks associated with animals in Pakistan and prepare the morphological key for the identification of ticks. During the study eight genus (*Amblyomma*, *Boophilus*, *Dermacentor*, *Hyalomma*, *Haemophysalis*, *Ixodes*, *Margaropus* and *Rhipicephalous*) were identified found in domestic animals of Pakistan. This key will be helpful for the acarologists especially in Pakistan.

INTRODUCTION

Ticks are blood-feeding necessitate ectoparasites belonging to the order Arachnida, having three main families, Argasidae (soft ticks), Nuttalleillidae (Guglielmone *et al.*, 2010), and Ixodidae (hard ticks) have been reported worldwide with greater than 900 species. Ixodidae, Argasidae and Nutteliellaide have approximately 700, 200 and 1 species, respectively. Ticks are widely distributed or spread in tropical and sub-tropical areas of the globe including Pakistan (Kadir *et al.* 2012). Approximately 53 tick species of Ixodidae and Agrasidae have been reported (Batool *et al.*, 2019; Ghaffar *et al.*,2020a) in Pakistan.

During feeding, ticks transmit toxic chemicals in animals (Alim *et al.*, 2011; Shemshad *et al.*, 2012) that become the cause of various diseases (Iqbal *et al.*, 2014; Naz *et al.*, 2012) such as theileriosis, anaplasmosis, ehrlichiosis and babesiosis (Rajput *et al.*, 2006). Ticks can reduce the quality and quantity (Abbasi *et al.*, 2017; Irshad *et al.*, 2010) of various animal products like weight loss, wool and milk production directly or indirectly (Ejima and Ayegba, 2011). Different microorganisms have been isolated and identified from ticks that act as a vector of various diseases (Ghaffar *et al.*, 2020b).

Many researchers have conducted studies on various parameters of ticks in Pakistan but still no morphological identification key of Pakistani ticks has been reported. Pakistani researchers had used foreign morphological keys which could not represent the correct characteristics of Pakistani ticks so, there is a need for the morphological key of Pakistani ticks present on domesticated animals. Keeping in view, the importance of the study, the current study was conducted.

MATERIALS AND METHODS

Collection and Identification:

Ticks were collected randomly from different farms of Tehsil Dera Ismail Khan. A total of 50 specimens were removed from 50 animals including 11 cows, 20 buffaloes, 12 goats and 7 sheep and brought to PARC Arid Zone Research Centre. The collected ticks were preserved in 70% Ethyl Alcohol and identified to genus level under the microscope by using different morphological keys (Walker *et al.*, 2014). The method of tick collection and preservation was followed as adopted by early Researchers (Ica *et al.*, 2007; Jamil *et al.*, 2021, 2022; Ullah *et al.*, 2022).

RESULTS AND DISCUSSION

Ticks are ectoparasites of all types of animals *i.e* wild, domestic and aquatic creatures. They drink the blood of animals and transmit the various rickettsial, bacterial and viral diseases during sucking

the host blood (Sultana *et al.*, 2015; Ramzan *et al.*, 2021; Rahman *et al.*, 2022). The current research was planned to identify the ticks and eight genera identified from the study nearby using already published morphological keys. Various researchers have performed various studies on ticks with respect to distribution, prevalence, biology, diversity, and epidemiology in Pakistan. The morphological characters of Ixodidae and Argasidae have given below in key.

The Morphological Characters of Ixodidae and Argasidae:

Argasidae:

Scutum and festoons absent, capitulum concealed at above, legs have no coxal spur, palpal segment 4 of larvae not in reduce form and similar in shape

Ixodidae:

Scutum and festoons present, capitulum not concealed at above, legs with the coxal spur, palpal segment 4 of larvae reduce and not similar in shape.

The Morphological Characters of Male and Female:

Male:

The prose area is not present on basis of the capitulum and the scutum is completely sheltered on the dorsal side of the tick.

Female:

The prose areas are present on the basis of the capitulum and dorsum/ back of the body partially shielded by a hard shield-like structure called a scutum. The genital pore is present in females. Tick genera found in Pakistan is shown in figure 1.

Key to Developmental Stages (Larvae, Nymphs and Adults):

1. Six legs are present.....**Larvae**
 Eight legs are present.....**2**
 2. Scutum present but porose areas absent on basis capitulum, genital pore absent.....**Nymph**
 Scutum presents both in male and female, basis capitulum has porose areas, genital pore present**Adult**

Key to Genera of Adult Ticks:

- 1. Eyes and festoons are either present or absent, anal groove present posterior to anus, legs have no pale rings.....**2**
- Eyes and festoons are absent, never have pale rings, anal groove present anterior to anus.....***Ixodes***
- 2. Scutum ornate or in ornate and eyes present and palps article 2 spreading alongside....**3**
- Scutum inornate and eyes absent.....***Haemophysalis***
- 3. Basis capitulum are rectangular, palps articles 2 are larger than 1 and 2.....**6**
- Basis capitulum are hexagonal in shape and palps are short.....**4**
- 4. Spur of coxa 1 is large, prominently present.....***Rhipicephalous***

- Spur of coxa 1 reduce form or absent.....**5**
- 5. palps are very short, dorsally grooved, festoons absent, normal legs.....***Boophilus***
- Palps are short, no ridged but with bright legs.....***Margaropus***
- 6. The length of basis capitulum is the same as long as palps, seven number of festoons present, enamel absent.....***Dermacentor***
- The length of basis capitulum is larger than palps, enamel present or absent, eleven festoons.....**7**
- 7. Adanal and accessory shields are present, scutum typically ornate with enamel and eyes, festoons well established.....***Amblyomma***
- Adanal and accessory shields are absent, scutum usually inornate without enamel, and festoons are not well developed.....***Hyalomma***

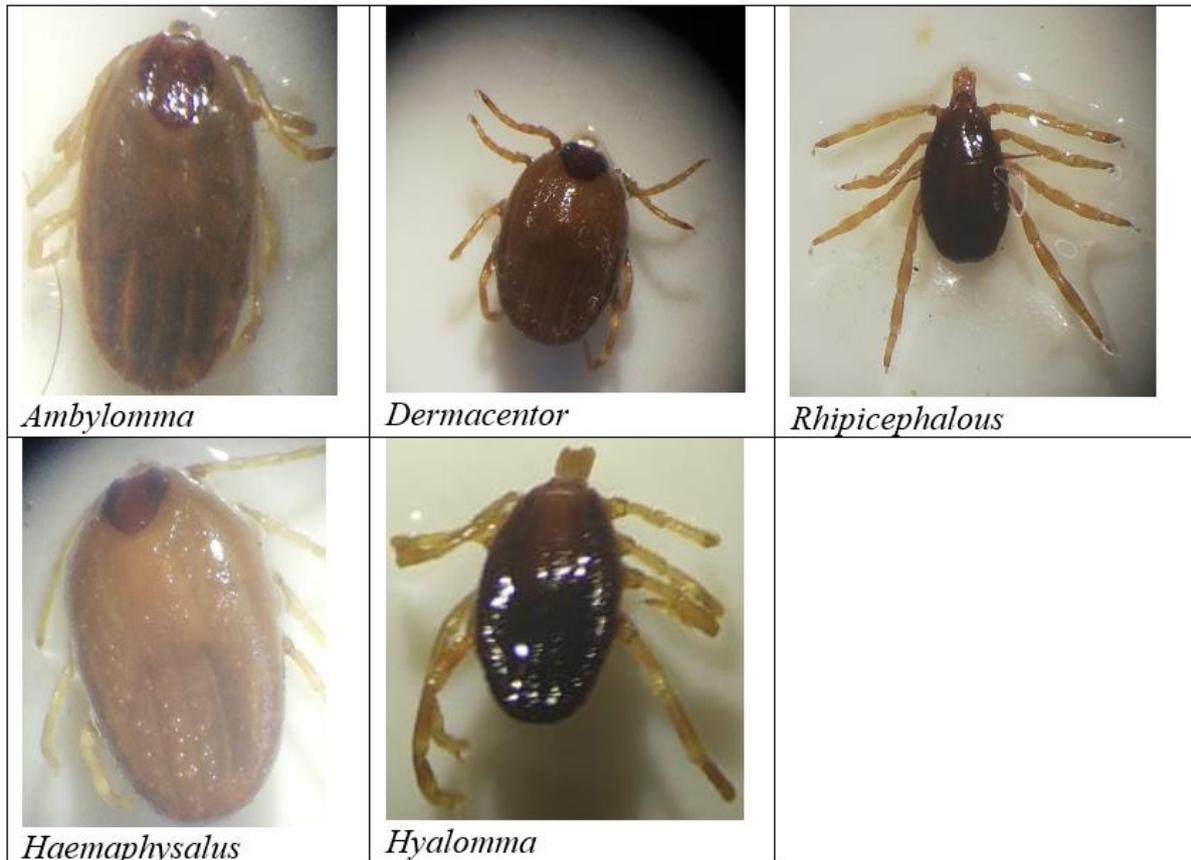


Fig. 1: Tick genera found in Pakistan

Conclusion

Ticks are blood-sucking ectoparasitic arthropods. These parasites feed on blood and spread diseases like Lyme and Crimean-Congo Haemorrhagic Fever (CCHF). These have an impact on humans and animals, both wild and domestic. Tick species have an effect on animal growth and reproduction. Researchers will benefit from the current morphological key in identifying ticks on livestock such as cattle, buffaloes, goats, and sheep, particularly in the district of Dera Ismail Khan, Multan, KPK, Pakistan. These pests must be controlled in the animal industry. Such creatures should be subjected to proper control measures. The current study's findings emphasise the importance of proper arthropod control measures.

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