



**Full Length Article**

# Re-description of Existing and Description of New Record of Tick [*Hyalomma (Euhyalomma) schulzei*] from Pakistan

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## ABSTRACT

*Hyalomma (Euhyalomma) schulzei* Olenov, 1931 is recorded and re-described for the first time from Balochistan, Pakistan in detail with special reference to its capitulum, basis capituli, hypostome, palpi, scutum, genital aperture, adanal and plates subanal plates, anus and festoons. Taxonomic structures, which has been not discussed and illustrated before are depicted in this paper as an additional information to facilitate zoologists and veterinarians for the correct identification of female and male of this tick species. A key has been erected to Acari families and included genera highlighting their relationships. © 2011 Friends Science Publishers

**Kew Words:** Re-description; *Hyalomma schulzei*; Ixodidae; Balochistan; Pakistan

## INTRODUCTION

Ticks are important to human and livestock. They are vectors of bacterial, protozoal, rickettsial, spirochaetal and viral organisms causing diseases to humans and domestic stock. Hard ticks family Ixodidae consists of 694 species (Anderson *et al.*, 2004; Akhtar *et al.*, 2011). The genus *Hyalomma* is a small group but well adapted to living in arid biotopes and therefore equipped with a high degree of adaptation to hot and dry open habitats. This feature is apparent in its morphology *i.e.*, possession of well developed spherical eyes and high legs. Adult ticks attack livestock preferring camels. In Pakistan ticks systematic has not received much attention. Most of the Pakistani researchers have focused their studies on the prevalence of ticks in Khyber Pakhtoonkhuwah (Siddiqi & Jan, 1986; Zaman, 1997; Manan *et al.*, 2007), Punjab (Abdussalam, 1959; Rasul & Akhtar, 1975; Ahmad, 1991; Hayat *et al.*, 1993; Khan *et al.*, 1993; Khan, 2001; Durrani & Kamal, 2008; Sajid *et al.*, 2008; Wahid-ur-Rahman *et al.*, 2008; Irshad *et al.*, 2010), Sindh (Hussain, 1980; Hussain & Gyanchandani, 1972, 1983, 1985, 1986, 1991; Gyanchandani *et al.*, 1992; Gyanchandani & Hussain, 1993) and also Balochistan (Kakar & Kakarsulemankhel, 2007, 2008). A very little taxonomic work has so far been conducted in the country (Kaiser & Hoogstraal, 1964; McCarthy, 1967; Kosar, 1965, 1968, Chaudhry *et al.*, 1969; Sheikh, 1991; Durrani, 1992; Khan, 1993).

It is important to note that no taxonomical study on tick species infesting poultry and livestock in Balochistan Province has been conducted except of Iqbal and Nawaz

(2007), Kakar and Kakarsulemankhel (2007, 2008). This motivated the interest in the taxonomic study on tick fauna. While conducting ecto-parasitic surveys during May to October, 2009, in central, eastern, western, northern, and southern Balochistan Province, some 381 ticks were collected from domestic animals including camels. Since there is incomplete and insufficient literature on taxonomy of Pakistani ticks, therefore to facilitate zoologists and veterinarians in correct identification of ticks, *Hyalomma schulzei* Olenov, 1931 is re-described here in detail for the first time from Balochistan, Pakistan.

Taxonomic characters studied here are perhaps never been studied or figured by Pakistani workers before, because of the tendency in most publications on ticks to study only the prevalence of ticks. The present report is an attempt to encourage further investigation in this country. It is hoped that this attempt will not only serve as base line study of the taxonomy of Ixodid ticks of livestock but also guide researchers in correct identification of these ticks.

## MATERIALS AND METHODS

During routine ecto-parasitic survey in May to October 2009 of domestic animals including camels in central, eastern and southern Balochistan Province, 381 specimens of ticks were collected following the collection techniques of Kakar and Kakarsulemankhel (2008). Animals were observed at random from houses, meat markets and Animal-Sell-Purchase Market. The head, ears, eyelids, neck, back, ventral side, tail area, legs and other external surfaces of the animal were thoroughly examined. Ticks were also collected from cracks and crevices in the

walls of animal's sheds.

**Collection and identification of ticks:** Sampling was conducted in central, eastern and southern Balochistan Province. Collected samples were preserved in 70% ethanol in glass vials (labeled with the date, locality, host-information), which were brought to the laboratory of Department of Zoology for processing and identification. For making permanent slides, ticks were cleared for few hours in cold KOH solution and were then dehydrated with ascending grades of ethanol till absolute grade, thereafter washed by Xylene. Each tick was picked up with the help of fine brush and placed on glass slide and slowly pressed by an insect pin to remove all internal content through anal opening. Each tick was studied under light compound microscope (CH2, Olympus, Japan). All the measurements were taken under 4×10 and 10×10 magnifications. Taxonomic structures have been drawn with the help of camera lucida mounted on microscope. The data of specimens critically examined for the description and measurements are designated under "examined". Specimens were identified according to the criteria presented by Kaiser and Hoogstraal (1963, 1964), McCarthy (1967) and Lloyd (2004). Measurements are given in micrometers unless otherwise indicated. Specimens placed in the vials and permanent slides are deposited with the author's collection of ticks.

## RESULTS

***Hyalomma (Euhyalomma) schulzei*:** Olenov, 1931. (Figs. A-1, A-18; B-1, B-8). The genus *Hyalomma* Koch, 1844 characterizes with in-ornate scutum, ♂ with adanal and subanal plates. Palpal segment-II longer than III, festoons may or may not be present, or they may be partially concealed. Ticks of this genus have been arranged in two sub genera. Subgenus *Hyalomma* Koch, 1844 consists of *H. aegyptium* (Linnaeus). Its adults parasitize tortoises (Robbins *et al.*, 1998; Siroky *et al.*, 2006; Tavassoli *et al.*, 2007) with characteristics (Apanaskevich, 2003): ♂: any grooves in scutum absent, except short and pit-like cervical ones, punctuation sparse and impressive, adanal shields short and wide, without inner branch, posterior part widened, antero-median margin straight, spurs of coxae-I widely separated, triangular wide, sub-equal in size. ♀: genital orifice as wide arch with straight posterior margin, vestibular part of vagina funnel like, greatly swollen, setae of alloscutum stick-like, tapering in apical one, II-segment of palps with proximal narrowing, spurs of coxae-I widely separated, triangular, wide, sub-equal in size.

Immature stages retain the primary wide diapason of hosts, which are various mammals, birds and reptiles. The life cycle of this tick is the three-host type that is considered as a primary type in Ixodid ticks. The species of Subgenus *Euhyalomma* Filippova (1984), have been arranged in two groups. In the first group, the immature stages infest only small mammals and birds and the adults parasitize large

mammals. This sub group includes: *H. albiparmatum* Schulzei (1919) (three-host tick), *H. asiaticum* Schulzei and Schlottke (three-host tick), *H. excavatum* Koch, 1844 (two- or three-host tick), *H. franchinii* Tonelli-Rondelli, 1932, *H. impeltatum* Schulzei and Schlottke (1930) (three-host tick), *H. impressum* Koch (1844) (three-host tick), *H. lusitanicum* Koch (1844) (three-host tick), *H. marginatum* Koch (1844) (two-host tick), *H. nitidum* Schulzei (1919) (three-host tick), *H. schulzei* (two-host species) and *H. truncatum* Koch (1844) (three host tick). The second group includes: *H. dromedarii* Koch (1844) (two or three host tick); *H. anatolicum* Koch (1844) and *H. scupense* Schulze (1918). The immature as well as the adult stage parasitize large mammals.

**Key to the sub orders, families and genera:** 1 With dentate faces of cheliceral digits directed externally (laterally), presence of a well developed hypostome provided ventrally with re-curved teeth; with lateral stigmatal openings behind coxae-IV or laterally above coxae II-III; prosoma completely fused; no trace of segmentation to the abdominal section; behind the legs size large, possession of true Haller's organ on the I pair of legs..... sub order Ixodida.

• External and internal parasitic mites of a wide variety of vertebrate hosts ..... sub order Gamsida (Mesostigmata).

2 Capitulum situated anteriorly, not concealed from above, dorsal scutum present, Spiracles posterior to coxae IV, well developed sexual dimorphism.....Family.....Ixodidae Koch (1844)..... 3.

• Capitulum ventral, partially or completely concealed from above, dorsal scutum absent, spiracles usually anterior to coxae-IV, sexual dimorphism slight ..... Family Argasidae Koch (1844) Family Ixodidae.

3 Anal groove distinct or indistinct but never surrounding the anus anteriorly, festoons often present ..... 4.

5. • Anal grooves distinct, surrounding the anus in front/anteriorly and usually uniting in a pointed arch, festoons absent. .... *Ixodes* Latreille (1795).

4 Capitulum short in relation to width, II palpal segment not especially longer than wider ..... 5.

• Capitulum long in relation to width, II palpal segment longer than wide..... 11.

5 II palpal segment not acutely laterally produced at base, eyes present ..... 6.

• Short conical palpi, II palpal segment projects laterally extending beyond the basis capituli, about twice as broad as long, eyes absent ..... *Hymophysalis* Koch (1844).

6 Festoons absent, anal grooves faint or absent ..... 7.

• Festoons present, anal grooves very distinct to indistinct ..... 8.

7 Palpi compressed with acute transverse ridges dorsally and laterally, ♂ with normal legs, adanal and accessory plates but without preanal plate ..... *Boophilus* Curtice (1891).

• Palpi not ridged and somewhat more elongate ♂ with massive beady leg segments, without adanal or accessory plates but with preanal plate, which is continued backward on either side of anus as two prongs ..... *Margaropus* Karsch (1879).

8 Basis capituli rectangular dorsally, ventral plates absent in ♀, ♂ both, ornate or inornate ..... 9.

• Basis capituli hexagonal dorsally, ventral plates present or absent, usually inornate ..... 10.

9 Usually ornate, dentition of hypostome 3/3 ..... *Dermacentor* Say (1821).

• Inornate, dentition of hypostome 4/4 ..... *Anocentor* Schulzei (1937).

10 Coxae-IV much larger than other coxae, without anterior plates or shield ..... *Rhipicentor* Koch (1844).

• Coxae-IV normal, ♂ with ventral plates and possibly showing a caudal protrusion ..... *Rhipicephalus* Koch (1844).

11 Palpi long, with II segment about twice as long as broad, ♂ without adanal or sub anal shields ..... 12.

• Palpi long, with joints sub equal, ♂ with adanal and sub anal shields ..... *Hyalomma* Koch (1844).

12 Without eyes, ..... *Aponomma* Neumann (1899).

• With eyes, ..... *Amblyomma* Koch (1844).

**Male (11 specimens examined):** Body: ♂ very large 7. 8–10. 0 long, 5.6–7. 3 broad, ovoid, dark red-brown to black, narrow in front, broadly rounded behind, maximum breadth at spiracular level.

**Capitulum (Fig. A-1):** Highly sclerotized structure consisting of basis capituli, median ventral hypostome, a pair of long cylindrical shafts, the chelicerae and flanked on each side by a pair of palpi with visible three segments, capitulum shorter than that of ♀, dorsal ridge strongly developed, and both it and lateral margins straight and heavily sclerotized, slightly converging posteriorly, hind margin also straight and transverse.

**Basis capituli (Fig. A-2):** Height 0.80, breadth 0.85, without lateral projections, dorsal posterior margin a little angular and deeply concave, cornua apparent but short.

**Palpi:** Short and robust, borne on the antero-lateral angles of the capitulum, one on either side of the median hypostome, 0.6 long, in argasid ticks three segments of palpi approximately of equal length but in the genera *Ixodes* and *Hyalomma* the I is considerably smaller than the II and III and has few setae, whereas the IV is reduced lying in a membranous cup-like hollow structure, segment-I visible dorsally, not concave on its inner surface and with 5 ventro-median setae (Fig. A-3), internal faces of II and III concave, segment-II relatively long with undulate lateral margins bearing 6-8 setae concentrated along the margins of the

mesial concavity or inner margin of the II segment (Fig. A-4), III also long, maximum width at base, where it adjoins the II-segment apically the former narrows to the apex, which is bluntly rounded (Fig. A-5), body with 3-4 median and lateral setae.

**Hypostome:** Club-shaped, total length 1.10, width 0.3, outer visible portion 0.7 long, denticulate portion a little longer than free portion, dentition 3/3 files of 15-18 strong teeth per file (Fig. A-6), the pointed lateral denticles protrude over the lateral edges, the medians rounded and then 2/2 files of 3-4 crenulations basally, apex of hypostome flattened, sides gently curved (Fig. A-7).

**Chelicerae:** A pair of long shafts running through the capitulum dorsally, proximally expanded to form a bulbous base, lying partly within the cavity of the capitulum, a rigid prolongation of a shaft with outwardly directed teeth of triangular pattern (Fig. A-8) originates from the base of the segment, the other relatively broader shaft terminates in a bifid-type teeth (Fig. A-9).

**Conscutum (Fig. A-10):** 5.9–6.8 long, 5.3–6.5 broad, marbling of pale color absent, sclerotized plate covering most of the dorsal surface, dark brown to black in color, oval in shape, widest near mid-length, a little narrowing in region of spiracular plate, cervical and lateral grooves very deep and extend up to 2/3 length of conscutum, short marginal grooves, postero-median groove a little away from parma and separated, paramedian grooves obvious, caudal field ill-developed, transverse ridges commonly present on caudal area, punctuation size large, distribution sparse, small punctuations also present but dense.

**Eyes:** Very convex, bulging, on the edge of conscutum (Fig. A-11), at the level of coxae-II.

**Genital structure:** Almost rounded, at the level of coxae-II, in the center of the body, just below the capitulum.

**Adanal plates:** Trapezoidal in shape, body comparatively broader and lateral margins curving towards each other or slightly convex (Fig. A-12), median projections quite obvious (Fig. A-13), postero-median margin concave but hind margin convex, maximum breadth at median projections (0.35), 0.65 long, basal breadth 0.28, antero-median margins of plates concave and cover more than 2/3 of the length of plates, hind margin convex, base of plates a little rounded (Fig. A-14), in engorged specimens adanal plates may become separated.

**Sub anal plates:** Usually longer than wider, situated laterally (Fig. A-15) in relation to the axis of the adanal plates.

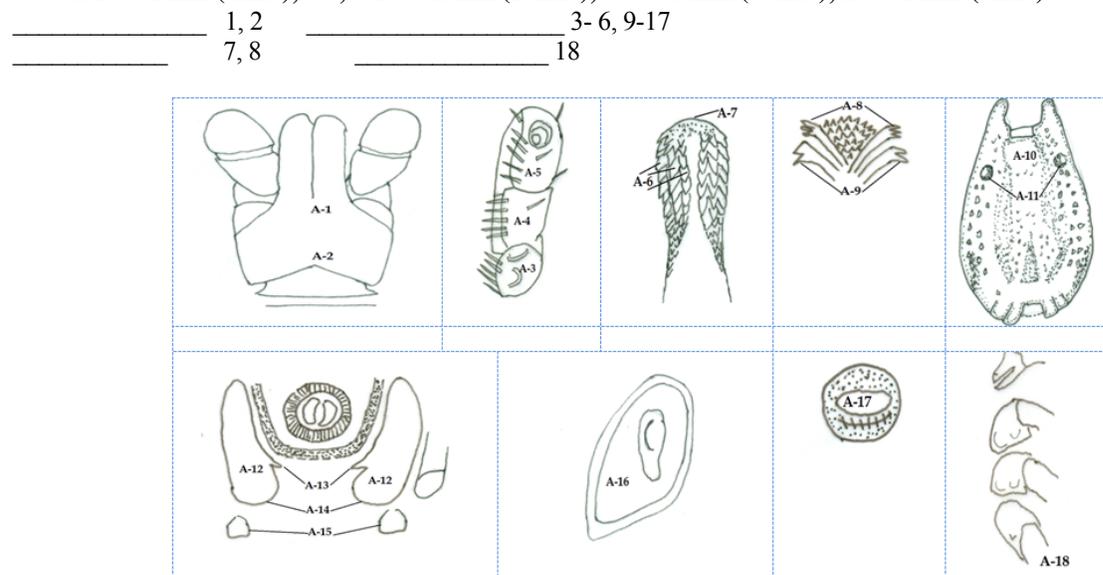
**Spiracular plates (Fig. A-16):** As illustrated, irregularly oval, dorsal prolongation or tail short and blunt, macula anteriorly placed, perforated portion of prolongation straight, triangular, circumspiraculat setae sparse.

**Anus:** As illustrated (Fig. A-17), almost rounded, borne at 1.0 mm away from the hind end of the body, a thick integumentary wall encircles the anal opening.

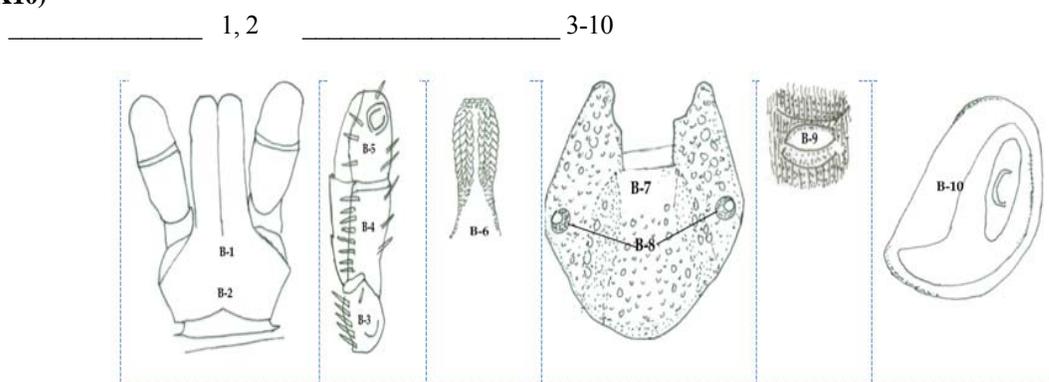
**Festoons:** Parma sub-rectangular and white to pale in color, 4-5 visible festoons present, intact and not widely separated.

**Legs:** Of moderate length and thickness, relatively shorter

**Fig. 1: Male *Hyalomma (Euhyalomma) schulzei* Olenev, 1931: A-1, Capitulum; A-2, Basis capituli; A-3, Segment-I of Palpi; A-4, Segment-II of Palpi; A-5, Apex of segment-III of palpi bluntly rounded; A-6, Hypostome dentition 3/3 per file; A-7, apex of Hypostome flattened; A-8, Triangular pattern of cheleceral teeth; A-9, Bifid type of cheleceral teeth; A-10, Conscutum; A-11, Eyes; A-12, Adanal plates; A-13, Median projections directing each other; A-14, Hind basal margin almost rounded; A-15, Subanal plates; A-16, Spiracular plate; A-17, Anus; A-18, Coxae. Scale bars: 1-2= 0.1 mm (4X10); 3-6, 9-17=0.1 mm (10X10); 7-8=0.5 mm (40X10); 18=0.1 mm (4X10).**



**Fig. 2: Female *Hyalomma (Euhyalomma) schulzei* Olenev, 1931: B-1, Capitulum; B-2, Basis capituli; B-3, Segment-I of Palpi; B-4, Segment-II of Palpi; B-5, Apex of segment-III of palpi bluntly rounded; B-6, Hypostome; B-7, Scutum; B-8, Eyes; B-9, Genital structure; B-10, Spiracular plate. Scale bars: 1-2= 0.1 mm (4X10); 3-10=0.1 mm (10X10)**



and broader than those of ♀. *Coxae* (Fig. A-18) as illustrated, coxa-I with postero-median and postero-lateral long spurs, sub-equal in length, coxae II-IV each with obvious, a little broad postero-lateral spur, coxae-II-III each with postero-median spur, coxa-IV also apparent postero-median spur. *Tarsus*-I with almost parallel sides but tapering sub-apically, apex rounded, tarsi II-IV sharply humped with apical and subapical spurs *Claws* mildly curved and relatively longer than pulvillae.

**Female (5 specimen examined):** ♀ are also very large.

**Capitulum (Fig. B-1):** relatively longer than that of ♂.

**Basis capituli (Fig. B-2):** Dorsally lateral projections appear relatively short, but ventrally lacking, dorsal

posterior margin comparatively concave, or straight, dorsal cornua ill-developed.

**Palpi (Fig. B-3-5):** Relatively short but broad, shape much as in ♂.

**Hypostome (Fig. B-6):** Club-shaped, less bluntly rounded distally, denticulate portion relatively longer than denticle free part.

**Scutum (Fig. B-7):** Heart-shaped, slightly more elongate, covers only a portion of the dorsal surface at the anterior end, maximum width in front of eyes, with slightly developed scapular grooves reaching the hind end of the scutum, posterior margin slightly sinous, punctuation size large and distribution sparse.

**Eyes (Fig. B-8):** Prominent, round, convex and peripheral.

**Female genital structures (Fig. B-9):** Operculum sub-rectangular, relatively convex anterior and posterior margins, rounded, borne between coxae-II and III, genital aperture broad but deep, apparently U-shaped having flat base, vestibular part of vagina obviously bulging.

**Spiracular plates (Fig. B-10):** Irregularly oval with short and blunt tail, perforated part of dorsal projection slightly curved, narrow but short.

**Adanal and sub-anal plates:** Absent.

**Legs:** lighter than body in color, long and moderately thick with moderate to long hairs, coloration of legs similar to that of ♂.

**Coxae:** Coxa-I relatively long, sub-equal in length with postero-median and postero-lateral spurs spur, coxae II-IV each with obvious postero-lateral spur, with round tip, coxae II-IV each with postero-median spur.

**Hosts and distribution:** Camels are common hosts of adults, however, rarely, cattle, sheep and goats are the hosts of adults. New Record: For the first time present specimens were collected from sheep and goats from Chaman, Dalbandin, Kuchlugh, Quetta and Turbat. Afghanistan (Kaiser & Hoogstraal, 1963), Iran (Nabian *et al.*, 2009).

**Comparative note:** This species shares some of its characters with *dromedarii* Koch (1844), such as ♀ and ♂ both larger in size, from ♂ characters it appears to be a giant relative of *dromedarii*, pale marbling of conscutum/scutum absent, adanal plates long and broad, not straight but slightly curving towards each other, slightly convex, base of adanal plates a little rounded, sub-anal plates longer than wider, sub-anal plates alignment outside the adanal plates, eyes rounded, convex and peripheral, coloration of legs similar to that of ♂. Its ♂ is distinct, however with its closest relative (*dromedarii*) in having without lateral projections of basis capituli, dorsal posterior margin angular and deeply concave, conscutum with deep and long cervical grooves but very short marginal grooves, postero-median groove does not reach the parma, and remain separated, paramedian festoons parma generally rectangular and broad, large punctuations on caudal and lateral fields but sparse, however small punctuations always dense, transverse ridges present in caudal area, broad, angle of paraparmal festoons eject, sub-anal plates smaller in size and a very short dorsal prolongation of the spiracular plates and not clear from the body of the plate. Its ♀ can be differentiated on the basis of dorsal lateral projections of basis capituli short but ventrally absent, denticulate part of club-shaped hypostome slightly longer than that of dentition free part, scutum slightly more elongate than that of *dromedarii*, pale marbling absent, posterolateral angles quite obvious, cervical and lateral grooves deep and extending up to hind margin of scutum, spiracular plate with comparatively short dorsal perforated part, which is slightly broad but curved, denticulate part of club-shaped hypostome slightly longer than that of dentition free part, festoons not clearly separated from each other. ♀ genital operculum sub-rectangular with slightly convex

anterior and posterior margins, U-shaped genital aperture very wide, vagina slightly bulging, and so differs from that of *dromedarii* (narrow and V-shaped vaginal aperture).

## DISCUSSION

*Hyalomma schulzei* is also known as the Iranian Camel *Hyalomma* or the Near Eastern Camel *Hyalomma*. This species has a restricted geographical range and extends from Iran (Abbassian-Lintzen, 1961; Al-Asgah, 1992) and Afghanistan (Anastos, 1954) through Egypt (Hoogstraal *et al.*, 1981; Kolonin, 1983), Iraq and Palestine (Adler & Feldman-Musham, 1948), Jordan, Syria, Kuwait and Saudi Arabia It is absent in Russia (Pomerantzev, 1950). Since, there is no published taxonomic data of this tick from Pakistan therefore, present data could not be compared with it. However, the present work is in conformity with the findings of Kaiser and Hoogstraal (1963). They reported this tick from eastern Afghanistan and Mazlum (1971) and Nabian *et al.* (2009) reported from north east Iran and suspected its presence in and near Pakistani border areas.

Peoples crossing these borders usually bring with them herds of sheep, goats and camels from Iran and Afghanistan to Pakistani border areas. The collection sites of present specimen are situated with border areas with Afghanistan and Iran. The present findings of this tick in sheep and goats of Pakistani border areas conforms this fact. *Hyalomma* species can transmit the protozoan *Theileria annulata* to cattle and camels. The vectorial role of *H. schulzei* has not been investigated. This fact is yet to be explored in the country by initiating research in this direction.

## CONCLUSION

The farmers and owners of the domesticated animals of the study area should be educated about the prevalence of tick fauna. The precise data on the distribution of tick fauna in Pakistan especially in Balochistan Province and morphologic taxonomical characters of prevalent ticks facilitating researchers in species identification are still unknown and deserve to be investigated. Findings of this study would provide the basis for further taxonomic work on ticks in the Province, which is essential for control of ticks and disease abatement.

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(Received 24 December 2010; Accepted 11 February 2011)