Review Article

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Emerging of *Hyalomma Species* Infestations on Animal in Different Region of Iraq: A Review

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Abstract

This review article aims to cover the some published research of the ticks of the genus *Hyalomma* that is endemic in Iraq, and known of its direct and indirect impact on both human and animals. About 13 species of the ixodid tick of two genera *Rhipicephalus*, *Hyalomma* are recorded in Iraq that transmits a wide range of etiological agent. Being a multi-host species, ticks considered the major challenge for enhancing livestock health and productivity especially around in development countries. The *Hyalomma* spp. assign of their veterinary significance as the high ability for transmit haemoprotozoan parasite of *Babesia* and *thieleria* species. The manuscript cover some regional and local medical studies of tick borne diseases (TBD) caused by either viruses or bacteria, that impact human which receintilly gained additional attention. Various confirmed cases of Crimean-Congo hemorrhagic fever (CCHF) in 2022 over governorates in the southern of Iraq mainly, Dhi Qar and Maysan, which considered the largest outbreak recorded since the disease was first reported forty years ago. The diagnosis and identification of tick usually, depend on the morphological characterizations however, Polymerase chain reactions (PCR) found to be more accurate for identifying a variety of ticks genus and species. The use of the chemical acaricides are the fundamental strategy of ticks control, however these traditional method start to be ineffective, and switched to alternative tick control after the successful development of vaccines against cattle tick.

Keywards: Ticks , Ticks borne diseases , *Hyalomma* ,*Rhipicephalus*

الأصابة بفصائل من قراد جنس *Hyalomma* في مناطق مختلفة من العراق : مقالة مراجعة

مقالة المراجعة هذه تغطية لبعض الأبحاث المنشورة عن القراد من جنس *Hyalomma* المتوطن في العراق ، والمعروف بتأثيره المباشر وغير المباشر على كل من الإنسان والحيوان. تم تسجيل أكثر من 13 نوعا من القراد ixodid في العراق من الجنسين *Rhipicephalus* و*Hyalomma* التي تنقل مجموعة واسعة من المسببات المرضية. نظرا لكون هذا الجنس هو متعدد المضائف لذا يعتبر تحدي مهم في صحة الحيوانات وإنتاجيتها خاصة في البلدان النامية . تعرف *Hyalomma* spp. باهميتها البيطرية كالقدرة العالية على نقل طفيليات الدم (الأوالي) من أنواع *Babesia* و*Thieleria* . لقد غطت المقالة بعض الدراسات الطبية الإقليمية والمحلية للأمراض المنقولة بواسطة القراد و التي تسببها الفيروسات أو البكتيريا المؤثرة على الإنسان والحيوان والتي اكتسبت مؤخرا اهتماما إضافيا. تم تسجيل حالات مؤكدة مختلفة من حمى القرم والكونغو النزفية (CCHF) في عام 2022 في جميع أنحاء البلاد والتي شكلت أكبر ثورة مرضية مسجلة في العراق منذ ظهور المرض لأول مرة قبل أربعين عاما. يعتمد تشخيص القراد وتحديده نوعه اعتمادا على الخصائص الشكلية ، ومع ذلك ، وجد أن تفاعلات البلمرة المتسلسلة (PCR) الأدق لتحديد جنس وأنواع القراد. تعد السيطرة على القراد بالمكافحة بالمبيدات الحشرية الكيميائية طريقة اساسية للسيطرة على انتشار القراد، ولكن هذه الطرق التقليدية بدأت تكون غير فعالة، والتحول إلى مكافحة بديلة للقراد اضافة الى تطور الناجح للبعض للقاحات ضد القراد.

Introduction

Globally, Ticks (Acari: Ixodidae) known as the vector of a wide range of pathogen that causing multiple diseases which can be serious or fatal. Tick borne diseases (TBD) casing by bacteria, viruses, protozoa, and are the major challenge for enhancing livestock productivity especially around developed countries. (1,2). In Iraq infestation of more than 13 species of tick reported Table 1. (3,4). Word economic losses from tick and tick borne disease reach up to 30 billion US dollars, accumulated from direct effect of infestation and disease impact carried by ticks (5). One of the direct influence from infestation of tick on the animals is the anemia once, it caused by sucking blood and hemorrhage during ticks feed meal (2). Around 900 classified species of the ixodid tick are recorded worldwide and tick of the genera *Hyalomma* and *Rhipicephalus*, assign of their medical and veterinary significance as the high ability for transmit haemoprotozoan parasite of *Babesia* and *thieleria* species (6). Chemical acaricides are the crucial backbone of tick management; however, limited efficacy and drawbacks of their practice; mainly, resistant ticks appear recently, due to the repetition of application (7). A resistance monitoring system of acaricides and biological control in addition to the vaccination, were the strategic adopted alternative approaches (8). Recently, the anti-*Hyalomma* vaccine is considered a viable and sustainable management control (9).

This study aimed to cover the some published research of the ticks of the genus *Hyalomma* which is endemic in Iraq. The present review are focused on the impact *Hyaloma* ticks, and we used data collected from google schooler, Direct Science and PubMed, also, we include some reports and local academic journals.

Table 1. The tick species, host and the site of collection of Ixodid tics in Shubber et. al., 2014 study (3).

Tick species	Hosts *	Collection sites**
Hyalomma anatolicum	1,2,3,4,5,6,7	1,2,3,4,5,6,7,8,9,10
Hyalomma dromedarii	1,2,7	1,2,3,5,6,7
Hyalomma excavatum	2,3,7	2,4,5,6,7,8,9,10
Hyalomma impeltatum	1,3,7	3,5,6
Hyalomma scupense	1,2,7	1,5,8
Hyalomma schulzei	7	5,6,7
Hyalomma turanicum	1,2,3,7	1,5,8,10
Hyalomma sp.	1,2,3,4,14,16,17,19,20,21	1,2,3,4,5,6,7,8,9,10
icephalus (Boophilus) annulatus	1,2,3,5,6	1,2,5,6,7,8,10
Rhipicephalus leporis	10,11,12,13,17	1,4,9
Rhipicephalus sanguineus	8,11	9
Rhipicephalus turanicus	1,2,3,4,8,9,10,12,14,15,17	1,2,3,4,5,6,7,8,9,10
Rhipicephalus sp.	13	1
Haemaphysalis adleri	11,12,13	1
Haemaphysalis sulcata	2	8

5=Horse, 6=Donkey, 7=Camel, 8=Dog, 9=Domestic cat, 10=Hare, 11=Red fox, 12=Asiatic jackal,13=Wild jungle cat, 14=Wild :ared hedgehog, 18=Common otter, 19=Black bird, 20=Crested lark, 21=Grey hypocolius.
Vasit, 5=Diwaniya, 6=Najaf, 7=Muthana, 8=Missan, 9= Thi Qar, 10=Basra.

Classification:

Tick of the genus: *Hyalomma* are classified according to (10)

Kingdom: Animalia

Phylum: Arthropoda

Class: Archnida

Order: Ixodida

Family: Ixodidae

Genus: *Hyalomma*

3. Morphology

Ticks are common member of the chelicerate arthropods group, and it is vary according to genus species by shapes and sizes. A typical acarine body adopted for ectoparasitic life, scutum, is the main morphological feature, covering all dorsal surface of the male and partially of the female (11). A movable head, which called capitulum or gnathosoma, and the idiosoma

(makes up the rest of the body).

The capitulum includes palps, the chelicerae, and the hypostome. The ganathosoma is connected with the idiosoma by cavity (used for hard tick species identification), legs extended outer the body region and the organ that is essential in the feeding process. Hypostome is a single, central structure with tooth on the ventral surface arranged in columns (used for taxonomic value) used to penetrate the host skin surface (12). *Hyalomma* genus ticks is a large size ticks with long mouth-part, the species have convex eye, and festoons (less clear in the engorged female) and male has anal plates. *Hyalomma* legs usually have pale ring and slender. Pulvilli are always present, Coxae IV are of normal size, and Coxae 1 has large and equal paired suprs. The opisthosoma has respiratory tract opening and the anus Figure 1. (13).

Figure 1 . The *Hyalomma* spp. male (A-dorsal view, B- ventral view (4X), (13).

Life Cycle

The life cycle of some species as *Haylomma anatolicum and Hy. droedarii* belonging to the genus are known to be either one or two host tick, while other species (*Hy. excavatum*) may introduce two or even three host (including, small mammals and birds) depending on the host biology Figure 2. (14).

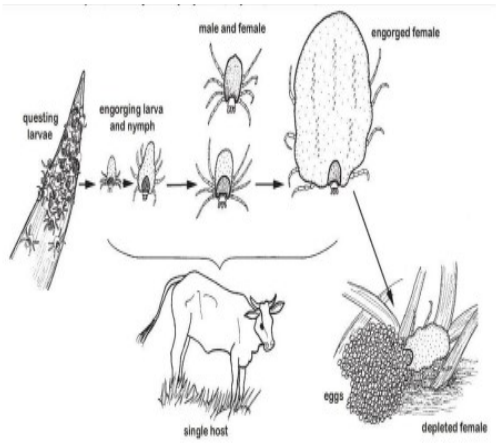

Figure 2. Life cycle of the *Hyalomma* spp. (14).

Ixodid ticks transmit all *Babesia* parasites to their vertebrate hosts. The transovarial transmission (The transmission of protozoa through eggs from adult female ticks) and transstadial transmission (The transmission of protozoa from egg to larvae to nymph to adult on the same animal or different one) occurs within ticks. However, *Babesia* spp. are naturally transmitted from animal to animal through tick bites Figure 3. (15).

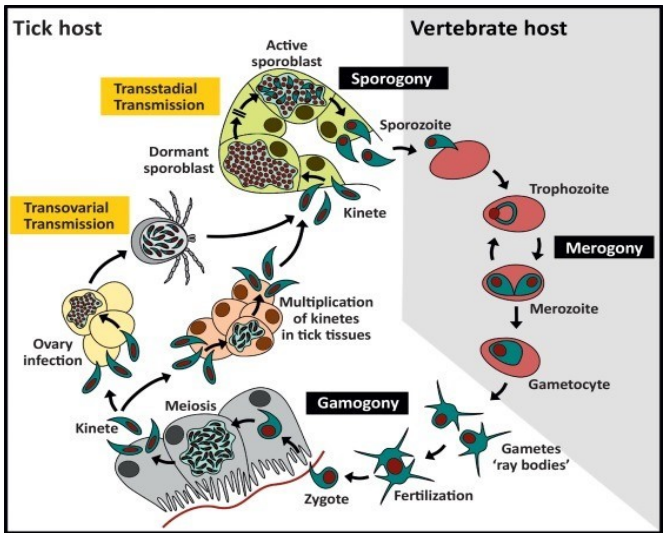

Figure 4 . Life Cycle of *Babesia* spp. in the intermediate hosts and tick vectors (15)

Diagnosis and identification

Primary, microscopically examination based on morphological taxonomic keys was used for tick's diagnosis and species identification (16). These traditional techniques may disconfirmed results. Therefore, DNA-based methods and the follow up sequencing and phylogeny analysis would deliver more information about tick's genetic data, and reached an accurate diagnosis (17). In addition, species identification by morphological characterization can be difficult, when the physical characters of specimens are damaged during collection, and when the specimens are engorged with blood, or due to similarity in morphologies across different species (18). Polymerase chain reactions (PCR) are now found the useful molecular tool for identifying a variety of ticks. Multiple DNA markers are routinely used for ticks identifications and other evolutionary studies (19). Cytochrome oxidase subunit 1 (*Cox1*) gene was used as a common molecular marker in the many ticks' identification studies. This provide a higher rates of molecular evolution that allows differentiation between closely allied *Ixodes* species (20) and have tested *Cox1* gene to identify *I. ricinus* on cattle (21).

Impact of *Hyalomma* spp. on man

Generally, the main indirect impacts, primarily the viruses transmitted to human from ticks and livestock animals. Human-to-human transmission can occur due to the close contact with the blood, secretions, meat, or body fluids and also through infected people (22). In Iraq, the one health approach and zoonotic diseases start newly to gaind attention. Even recent study had very limited data recorded the impact of tick (mainly *Hyalomma* spp.) on human in Iraq. However, there was study in 2022 that recorded 219 confirmed cases of Crimean-congo hemorrhagic fever (CCHF) by surveillance officers in 20 surveillance departments (Control of Disease Center-CDC) all over the governorates of southern Iraq in Dhi Qar, Maysan, Muthanna, Diwaniya and Basra were highlighted and included (23). It is assigned as the largest outbreak in Iraq since the disease was first reported forty years ago (23). The majority of cases occurred in southern parts, especially in governorates bordering country of Iran, The median age of the cases was 34 years and with fatality rate 16.4%. Figure 4. (23)

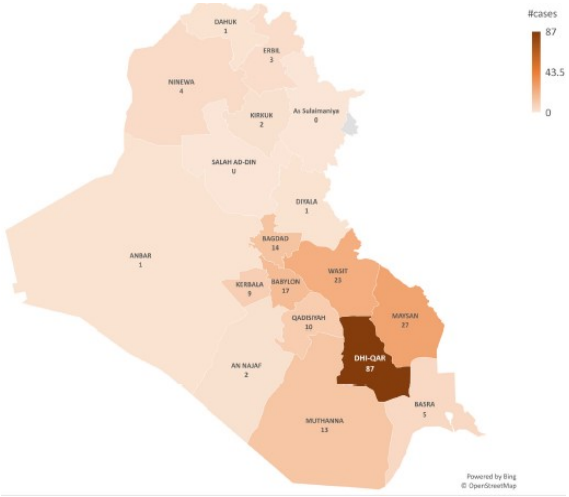

Figure 5. Iraqi map showing the distribution of the human CCHF cases in the recent outbreak (23).

Globally, human being recorded in many cases as host of this tick genus infestation and considered as zooanthrophilic. Table 2. The direct infestation, by the tick bites which cause signs at the site of the bite including inflammation, itching, swelling and painful condition. Systemically, *Hyalomma* spp. is involved in cases of otoacariasis and tick paralysis (24). The indirect effect when tick considered the vector of many pathogens as the Crimean-Congo hemorrhagic fever virus (CCHF) where many species of this tick genus reported the vector of transmission, the disease is distrusted Africa, Asia, Europe and Middle East (25,26).

Impact of *Hyalomma* Tick infestation on animals

The *Hyalomma* genus ticks with it long mouthparts, which cause skin damage and pain on the bite site. Also, the bleeding leading to anemia, effecting animals productivity. Assessment of a direct effect of *Hy*. *asiaticium* on the bovine host through the ability to suck about 9 ml (39). Livestock are of great challenge against ticks infestation and their impact on the animal health population in Iraq (40). Iraq has huge large and small (sheep and goats) domestic animal populations other than the camels (3, 13). *Hyalomma* ticks are the vector of several bacterial, viral, and protozoan pathogens as *Babesia* spp. and *Theileria* spp. Table 3

The human medically important of *Hyalomma* comes from transmit the CCHF, while, it reported as veterinary important hard tick in this country because it is responsible for transmit common parasitic heamoprotozan. Recently, a study, in Baghdad city, recorded a prevalence of theileriosis in sheep 70% by using the conventional PCR relatively to 33% through the microsocial examination (53).

Conclusion

In Iraq, ticks of *Hyalomma* spp. are endemic and involved in an illness cases of both human and animals. The opined bordered and uncontrolled livestock transportation (import and export) and trading from the neighbor's countries with absence of vital control strategies made it of high-risk tick's outbreaks. However, a little efforts have made to reduce or monitoring the important of the infected host in addition to the restricted international rules and regulation, which usually enforced by Communicable Disease Control Centre and WHO.

Confect Of Interest

The authors declared no conflict of interest.

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Table 2. Global Hyalomma tick borne zoonotic pathogenes

Pathogen	*Hyalomma* species	Reference
Crimean-Congo hemorrhagic *(CCHF) virus*	*Hylomma spp.*	(23,24,25)
	Hy. marginatum	(28,27)
	Hy. anatolicum	(25)
	Hy. turanicum	(25)
West Nile virus	*Hy. marginatum*	(29)
Kadam virus	*Hy. dromedarii and H.anatolicum*	(30,31)
Chick Ross virus	*Hy. dromedarii*	(31)
A.phagocytophilum	*Hy. aegyptium*	(33)
Rift Valley Fever virus	*H. truncatum*	(33)
Rickettsia aeschlimannii	*Hy. ditritum,*	(34,35)
	H. impeltatum, H. exavatum	(28,36)
R. rickettsii	*Hy. dromedarii*	(37)
Borrelia turcica	*Hyalomma aegyptium*	(38)

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Table 3. *Hyalomma* ticks are the vector of bacterial, viral, and protozoan pathogens in Iraq.

Pathogen	*Hyalomma species*	Reference (region)
Theileria anulata *T. ovis* *T. lestoquardi*	*Hyalomma sp.*	(3,42,41), (Baghdad ,Kurdistan)
Babesia ovis *B.motasi* *B.tayleri* *B. foliate*	*Hy. anatolicum*	(3,44,43), (Kurdistan, Wasit governorate)
B. bovis *B.bigemina*	*Hy. dromedarii* *Hy. anatolicum* *Hy. excavatum,* *Hy. marginatum,* *Hy. turanicum,* *Hy. scupense,* *Hy. rufipes*	(49, 48, 47,46,45,13,3), (Sulaimani, Baghdad, Al Anbar,, Erbil, Al-Najaf
Anaplasma . marginale	*Hy. excavatum,* *H. anatolicum,* *H. marginatum,* *H. turanicum,* *H. scupense.*	(50,46) Mosul, Erbil
Crimean-Congo hemorrhagic fever virus (CCHFV)	*Hyalomma spp.*	(23,51,52) (Baghdad and Ramadi)

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