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Seasonal prevalence and species diversity of ixodid ticks parasitizing cattle in tropical lowland agropastoral zones of Mombasa

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Abstract

Ixodid ticks remain a major constraint to cattle productivity in tropical agropastoral systems across sub-Saharan Africa. This research determined the seasonal prevalence, species diversity, and risk factors of ixodid ticks in cattle within Mombasa County, Kenya. A cross-sectional investigation was conducted from January to December 2023 on 480 cattle from 24 herds. A total of 4,826 ticks belonging to five genera and twelve species were recovered. *Rhipicephalus decoloratus* was the most prevalent species (28.8%), followed by *R. appendiculatus* (24.2%) and *Amblyomma variegatum* (19.8%). Tick prevalence was significantly higher during the long rainy season (78.4%) compared to the dry season (42.6%) ($p < 0.001$). Age, body condition, breed, and management system were significant risk factors. These findings support season-specific integrated tick management strategies in lowland agropastoral zones.

Keywords: Ixodid ticks, seasonal prevalence, species diversity, *Rhipicephalus decoloratus*, *Amblyomma variegatum*, cattle, agropastoral zones, risk factors, Mombasa County, tick-borne diseases

Introduction

What proportion of economic losses in tropical livestock systems can be attributed to tick infestations? This question has driven considerable research across sub-Saharan Africa, where ixodid ticks represent the most economically significant ectoparasites affecting cattle ^[1]. Ticks belonging to the family Ixodidae are obligate blood-feeding arthropods parasitizing a wide range of vertebrate hosts, with cattle serving as primary hosts for numerous pathogenic species ^[2]. Direct effects include blood loss, hide damage, reduced weight gain, and decreased milk production, collectively resulting in substantial economic losses estimated at billions of dollars annually ^[3]. Beyond direct pathological effects, ixodid ticks serve as vectors for protozoan, rickettsial, and viral pathogens responsible for East Coast fever, babesiosis, anaplasmosis, and heartwater ^[4]. In Kenya, tick-borne diseases represent the largest cause of livestock mortality in pastoral systems, accounting for approximately 70% of cattle deaths in some endemic regions ^[5]. Seasonal dynamics of tick populations are influenced by temperature, humidity, rainfall, and vegetation cover ^[6]. Yusuf AY, Aliyi MB reported significant associations between seasonal variations and tick prevalence in eastern Ethiopia ^[7]. Mombasa County presents a unique epidemiological context due to its tropical lowland climate with distinct wet and dry seasons ^[8]. Previous investigations documented diverse tick assemblages, with *Rhipicephalus* species predominating in highlands and *Amblyomma* and *Hyalomma* species more prevalent in lowland zones ^[9]. However, specific relationships between seasonal conditions and tick species diversity in coastal lowland agropastoral systems remain inadequately characterized ^[10]. This research was conducted to determine the seasonal prevalence, species diversity, and risk factors associated with ixodid tick infestations in cattle within Mombasa County, Kenya.

Material and Methods

Material

This research was conducted in Mombasa County, Kenya, located along the southeastern coast between latitudes 3.5°S and 4.5°S. The county has a tropical monsoon climate with temperatures ranging from 24°C to 30°C and annual rainfall between 900 mm and 1,200 mm. Ethical clearance was obtained from the Mombasa Institute of Veterinary Sciences Animal Ethics Committee (Approval No. MIVS/AEC/2023/014). Materials included fine-point forceps, 70% ethanol collection vials, a Leica EZ4 stereomicroscope, standard taxonomic keys, and a Davis Vantage Pro2 weather station.

Methods

A repeated cross-sectional design was employed with sampling during four seasons: dry (January-March), short rains (April-June), long rains (July-September), and cool dry (October-December).

Twenty-four herds were randomly selected from four agro-ecological zones, with 20 cattle per herd examined using the half-body count method. Ticks were identified to species level using established morphological keys. For each animal, age, sex, breed, body condition score, and management system were recorded. Data were analyzed using SPSS version 26.0 with chi-square tests and logistic regression analysis. Shannon-Wiener diversity indices were computed across seasons. Statistical significance was set at $p < 0.05$.

Results

A total of 4,826 ixodid ticks were collected from 1,920 examinations. Overall tick prevalence was 62.8%, with the highest during the long rainy season (78.4%) and lowest during the dry season (42.6%) ($p < 0.001$). Five genera comprising twelve species were identified, with *Rhipicephalus* being the most frequently encountered genus.

Table 1: Seasonal prevalence of ixodid tick species collected from cattle in Mombasa County, Kenya

Tick Species	Dry (%)	Short Rains (%)	Long Rains (%)	Cool Dry (%)	Overall (%)
<i>R. decoloratus</i>	18.4	32.6	41.2	22.8	28.8
<i>R. appendiculatus</i>	14.2	26.8	35.4	19.6	24.2
<i>A. variegatum</i>	12.8	22.4	28.6	15.2	19.8
<i>H. rufipes</i>	8.6	14.2	18.8	10.4	13.0
<i>R. evertsi evertsi</i>	6.4	11.6	15.2	8.8	10.5
Others	2.2	3.6	4.8	2.4	3.7

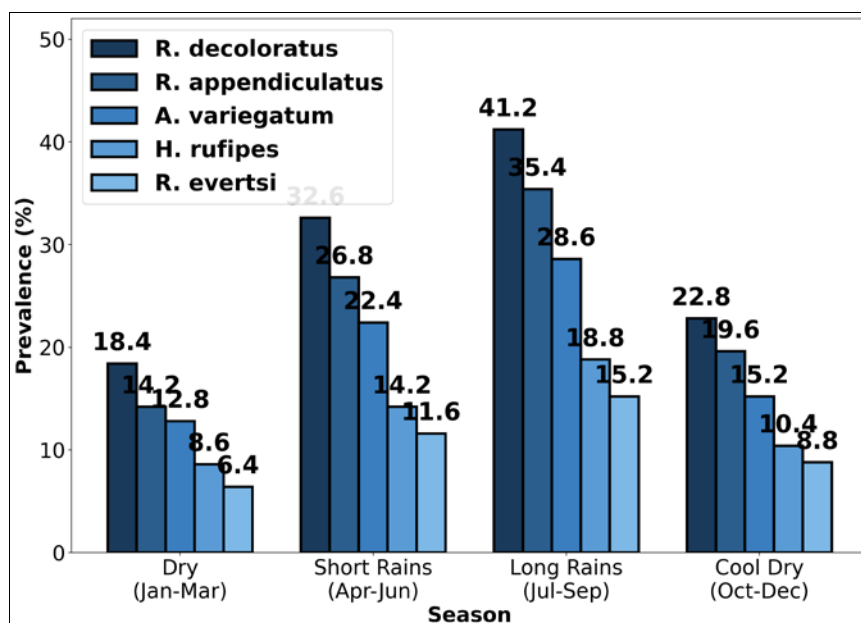


Fig 1: Seasonal distribution of the five most prevalent ixodid tick species in cattle from Mombasa County, Kenya

Table 2: Risk factors associated with tick infestation in cattle (logistic regression)

Risk Factor	Category	Prevalence (%)	OR (95% CI)	p-value
Age	Young (<2 yr)	52.4	Ref	-
	Adult (2-5 yr)	64.8	1.68 (1.32-2.14)	0.001
	Old (>5 yr)	71.2	2.24 (1.74-2.88)	<0.001
BCS	Poor	74.8	2.86 (2.18-3.76)	<0.001
	Moderate	62.4	1.42 (1.14-1.77)	0.002
	Good	48.6	Ref	-
Breed	Local	68.4	1.82 (1.42-2.33)	<0.001
	Crossbred	62.2	1.36 (1.08-1.72)	0.009
	Exotic	54.6	Ref	-
System	Extensive	68.2	1.74 (1.40-2.16)	<0.001
	Semi-intensive	55.8	Ref	-

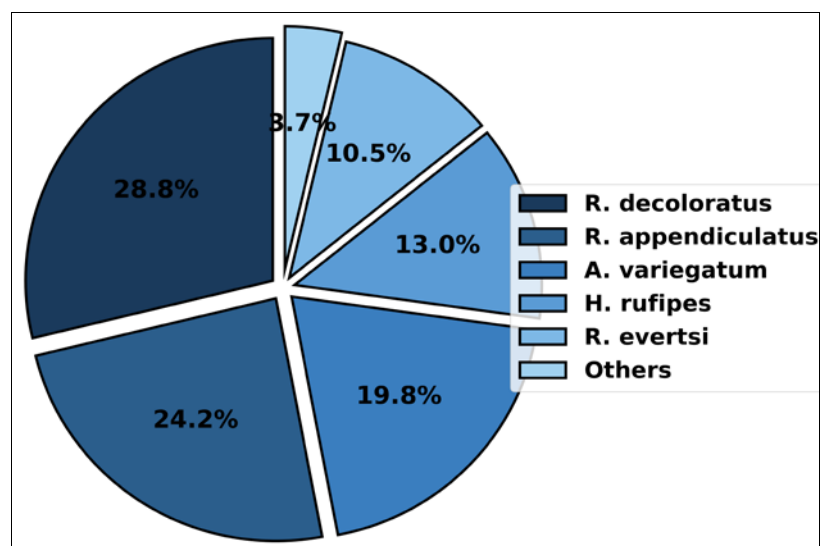


Fig 2: Overall proportional composition of ixodid tick species collected from cattle in Mombasa County

Monthly trends revealed progressive increases from January through August, with peak counts in August (mean = 424), followed by decline through December. The Shannon-Wiener

diversity index ranged from $H' = 1.42$ (dry season) to $H' = 1.86$ (long rains).

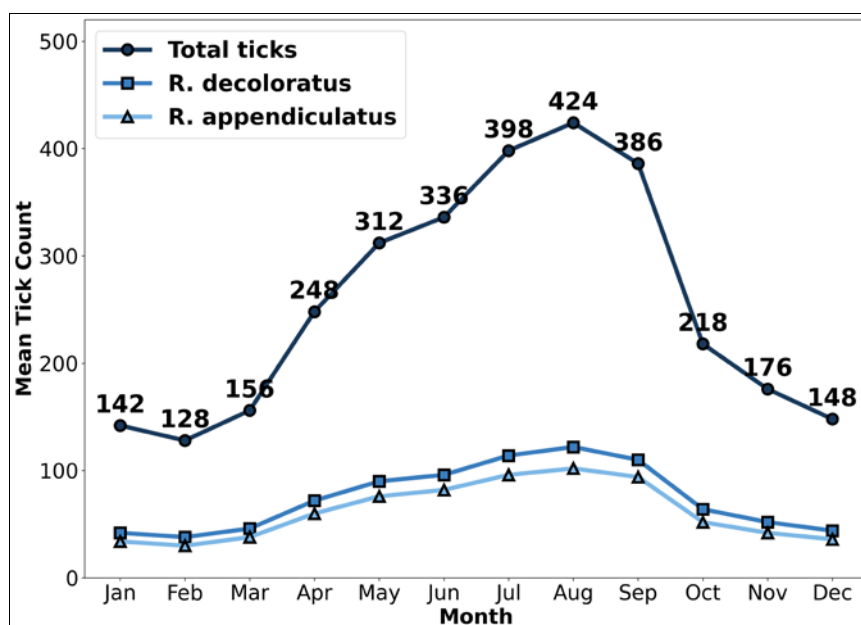


Fig 3: Monthly trends in total tick counts and dominant species abundance in cattle from Mombasa County

Multivariate analysis identified older cattle ($OR=2.24$, $p<0.001$), poor body condition ($OR=2.86$, $p<0.001$), local breeds ($OR=1.82$, $p<0.001$), and extensive management ($OR=1.74$, $p<0.001$) as significant risk factors.

Discussion

The overall tick prevalence of 62.8% is consistent with reports from other tropical lowland regions of East Africa [11]. The finding that *R. decoloratus* was the most prevalent species aligns with observations from similar agro-ecological settings [12]. The significantly higher prevalence during the long rainy season can be attributed to favorable conditions including increased humidity and vegetation growth promoting tick survival [13]. This seasonal pattern supports the established understanding that tick activity is closely linked to moisture availability during off-host life cycle phases [3]. The association between poor body condition and increased tick burden suggests a bidirectional relationship whereby

nutritional stress compromises host immunity while heavy infestations contribute to weight loss [14]. The higher susceptibility of local breeds likely reflects confounding management practices rather than inherent breed susceptibility [15]. The broader implications suggest that strategic acaricide applications timed to the onset of rainy seasons could achieve maximum efficacy [16]. Future investigations should incorporate molecular techniques to assess genetic diversity and pathogen prevalence across seasons.

Tick-borne disease implications

Rhipicephalus appendiculatus, the second most prevalent species, is the primary vector of *Theileria parva*, causing East Coast fever [10]. Similarly, *A. variegatum* transmits *Ehrlichia ruminantium*, and its high rainy-season prevalence suggests elevated disease transmission risk during these periods [6]. The concurrent presence of multiple vector species creates

conditions for co-infections that may exacerbate disease severity.

Environmental considerations

The strong positive correlation between rainfall and tick prevalence suggests that anticipated climate change-driven precipitation shifts could alter tick distribution in the region^[13]. Coastal regions are particularly vulnerable to climate variability, and projected changes may expand tick geographic ranges and intensify tick-borne disease burdens on livestock production.

Conclusion

This research determined the seasonal prevalence, species diversity, and risk factors of ixodid ticks in cattle within Mombasa County, Kenya. The findings revealed a high overall prevalence of 62.8% with pronounced seasonal variation and peak infestation during the long rainy season. *Rhipicephalus decoloratus* was the most predominant species. Age, body condition, breed, and management system were significant determinants. These results support implementing season-specific integrated tick management incorporating strategic acaricide application, nutritional supplementation, and targeted treatment of high-risk categories. Future research should characterize molecular epidemiology of tick-borne pathogens and evaluate integrated management approaches for coastal lowland Kenya.

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