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Yılmaz Burak

Department of Veterinary
Parasitology, Aegean College of
Veterinary Parasitology, İzmir,
Turkey

Demir Sena

Department of Veterinary
Parasitology, Aegean College of
Veterinary Parasitology, İzmir,
Turkey

Çelik Kaan

Department of Veterinary
Parasitology, Aegean College of
Veterinary Parasitology, İzmir,
Turkey

Corresponding Author:

Yılmaz Burak

Department of Veterinary
Parasitology, Aegean College of
Veterinary Parasitology, İzmir,
Turkey

Prevalence and seasonal dynamics of ectoparasites in stray dogs of urban municipal areas

Yılmaz Burak, Demir Sena and Çelik Kaan

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Abstract

While owned companion dogs benefit from regular ectoparasite prophylaxis, stray dog populations in urban municipalities remain largely untreated and serve as persistent reservoirs for flea, tick, and mite infestations with zoonotic potential. This research determined the prevalence, species composition, and seasonal dynamics of ectoparasites in 384 stray dogs sampled across 12 urban zones in four districts of İzmir, Turkey, over 12 consecutive months (January through December 2023). Dogs were captured through municipal animal control operations, physically examined, and sampled for ectoparasites using standardised visual inspection, coat combing, and skin scraping protocols. Overall ectoparasite prevalence was 68.5% (263/384). Six species were identified: *Ctenocephalides canis* (34.2%), *Rhipicephalus sanguineus* (28.7%), *Sarcoptes scabiei* (14.3%), *Demodex canis* (8.6%), *Otodectes cynotis* (5.1%), and mixed infestations (9.1%). Seasonal prevalence peaked in summer (71.9% for fleas, 54.6% for ticks) and was lowest in winter (22.4% for fleas, 11.2% for ticks), while mite prevalence showed less seasonal fluctuation (15.8-23.7%). Dogs with poor body condition scores were 2.8 times more likely to harbour ectoparasites than those in fair condition (OR = 2.81; 95% CI 1.74-4.53; $p < 0.001$). These findings document a high year-round ectoparasite burden in the urban stray dog population, underscore the seasonal window of peak transmission risk to humans and owned pets, and support the case for targeted municipal acaricide treatment programmes timed to the spring-summer vector surge.

Keywords: Ectoparasites, stray dogs, prevalence, seasonal dynamics, *Ctenocephalides*, *Rhipicephalus*, *sarcoptes*, urban, zoonosis, Turkey

Introduction

In contrast to the steady decline of ectoparasite burdens in owned companion animals brought about by monthly topical and oral preventatives, stray dog populations occupying urban fringe habitats abandoned buildings, waste disposal sites, and park peripheries remain perpetual hosts for fleas, ticks, and mites^[1, 2]. These untreated animals create a transmission interface between wildlife reservoirs and human communities, contributing to the epidemiology of zoonotic pathogens including *Rickettsia conorii* (Mediterranean spotted fever), *Bartonella henselae*, and *Leishmania infantum* vectored by *Phlebotomus* spp. that co-feed alongside *Rhipicephalus* ticks^[3, 4].

Turkey's stray dog population is estimated at 10 to 15 million, one of the highest densities in Europe and western Asia, owing to cultural attitudes favouring tolerance over culling and to incomplete enforcement of spay-neuter mandates^[5]. İzmir, the third-largest metropolitan municipality, has a Mediterranean climate with hot dry summers and mild wet winters conditions highly favourable to the year-round survival of arthropod ectoparasites^[6]. Although several prevalence surveys have been conducted in Ankara and Istanbul, comprehensive seasonal data covering all four quarters in a single systematic sampling design are lacking for the Aegean coastal region^[7, 8].

This research addressed that gap by conducting a 12-month prospective cross-sectional survey of ectoparasite prevalence, species composition, and seasonal fluctuation in stray dogs across 12 urban zones of İzmir, with the secondary objective of identifying host-level risk factors (age, sex, body condition score, coat type) associated with infestation.

Materials and methods

Materials

Three hundred and eighty-four stray dogs were sampled between January and December 2023 through collaboration with the İzmir Metropolitan Municipality Department of Animal Services. Each month, 32 dogs were captured during routine animal control operations and transported to the municipal veterinary clinic for examination. Dogs were distributed across 12 urban zones spanning four administrative districts to ensure geographic representativeness. Approximate age was categorised as juvenile (less than 1 year, $n = 74$), adult (1-7 years, $n = 218$), and senior (greater than 7 years, $n = 92$) based on dental examination. Body condition was scored on a 1-5 scale. Coat type was classified as short ($n = 201$), medium ($n = 118$), or long ($n = 65$). The research protocol was approved by the Local Ethics Committee for Animal Experiments at the Aegean College of Veterinary Parasitology (Protocol No. ACVP-ECAE-2022-038, approved 14 November 2022).

Methods

Each dog underwent a standardised three-stage ectoparasite examination. First, a whole-body visual inspection was performed under adequate lighting to detect attached ticks,

flea dirt, and crusted skin lesions suggestive of mange. Second, a fine-toothed flea comb was drawn through the coat at five body sites (dorsal midline, ventral abdomen, inguinal region, base of tail, and behind ears), with dislodged material collected onto white paper for identification. Third, deep skin scrapings were taken from at least three sites exhibiting alopecia, erythema, or papules using a No. 10 scalpel blade moistened with mineral oil until capillary oozing was observed. Scrapings were examined under light microscopy at 40x and 100x magnification.

Collected arthropods were preserved in 70% ethanol, cleared in 10% KOH when necessary, and identified to species level using morphological keys under a stereomicroscope at 20-40x magnification [9, 10]. Ticks were identified based on scutum shape, palp configuration, and festoon pattern. Fleas were identified by genal and pronotal comb morphology.

Statistical analysis was performed in R v4.3.1. Prevalence was expressed as the proportion of infested animals with 95% Clopper-Pearson exact confidence intervals. Associations between ectoparasite presence and host-level categorical variables were assessed by logistic regression, with odds ratios (OR) and 95% confidence intervals reported. Seasonal differences in prevalence were tested using the chi-square test for trend. Significance was set at $p < 0.05$ [11, 12].

Results

Table 1: Overall prevalence and species distribution of ectoparasites ($n = 384$)

Ectoparasite Species	n Positive	Prevalence (%)	95% CI
<i>Ctenocephalides canis</i>	131	34.2	29.5-39.1
<i>Rhipicephalus sanguineus</i>	110	28.7	24.3-33.4
<i>Sarcoptes scabiei</i>	55	14.3	11.0-18.3
<i>Demodex canis</i>	33	8.6	6.0-11.9
<i>Otodectes cynotis</i>	20	5.1	3.2-7.9
Mixed infestations	35	9.1	6.5-12.5
Total infested	263	68.5	63.6-73.1

Overall ectoparasite prevalence was 68.5% (263/384; 95% CI 63.6-73.1%). The most common ectoparasite was *Ctenocephalides canis* (34.2%), followed by *Rhipicephalus sanguineus* (28.7%) and *Sarcoptes scabiei* (14.3%). Mixed

infestations defined as simultaneous carriage of two or more ectoparasite genera accounted for 9.1% of cases, most commonly involving concurrent flea and tick infestation.

Table 2: Host-level risk factors associated with ectoparasite infestation (logistic regression)

Risk Factor	n Infested/Total	Prevalence (%)	OR (95% CI)	p-value
Poor BCS (1-2)	112/138	81.2	2.81 (1.74-4.53)	<0.001
Fair BCS (3-5)	151/246	61.4	Reference	
Long coat	52/65	80.0	1.68 (1.12-2.51)	0.012
Medium coat	83/118	70.3	1.21 (0.84-1.74)	0.306
Short coat	128/201	63.7	Reference	
Juvenile (<1 yr)	54/74	73.0	1.34 (0.76-2.38)	0.312
Adult (1-7 yr)	147/218	67.4	Reference	
Senior (>7 yr)	62/92	67.4	1.00 (0.61-1.64)	0.994

Logistic regression identified body condition score as the strongest predictor of ectoparasite carriage. Dogs scored 1 or 2 out of 5 (poor condition) had 2.81 times greater odds of infestation than those scored 3 or above (OR = 2.81; 95% CI 1.74-4.53; $p < 0.001$). Long-coated dogs were 1.68 times more likely to harbour fleas than short-coated dogs (OR = 1.68; 95% CI 1.12-2.51; $p = 0.012$). Age category and sex were not significantly associated with overall prevalence. Seasonal dynamics were pronounced for fleas and ticks. Flea

prevalence rose from 22.4% in winter to a peak of 61.3% in summer, falling back to 38.7% in autumn. Tick prevalence followed a similar but even more sharply seasonal curve: 11.2% in winter, rising to 54.6% in summer. In contrast, mite-associated conditions (sarcoptic and demodectic mange) varied less across seasons, with prevalence ranging from 15.8% in winter to 23.7% in summer, likely reflecting the non-arthropod-vector, contact-dependent transmission mode of mites.

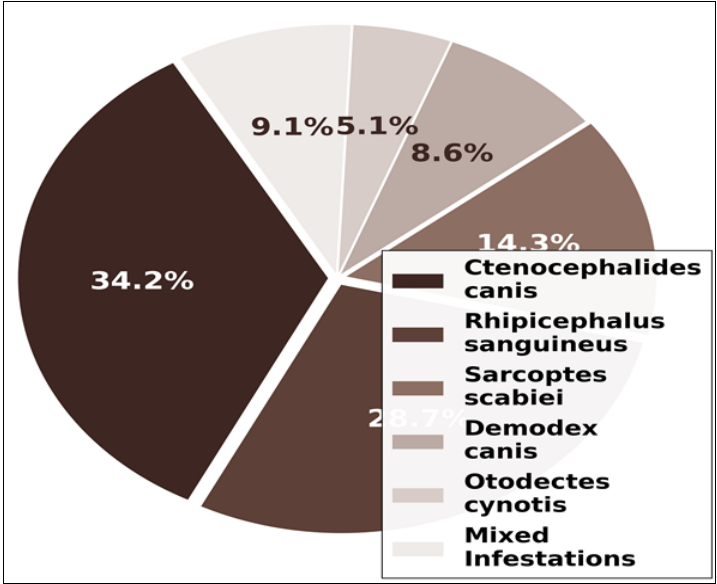


Fig 1: Species composition of ectoparasites identified in 263 infested stray dogs across urban İzmir

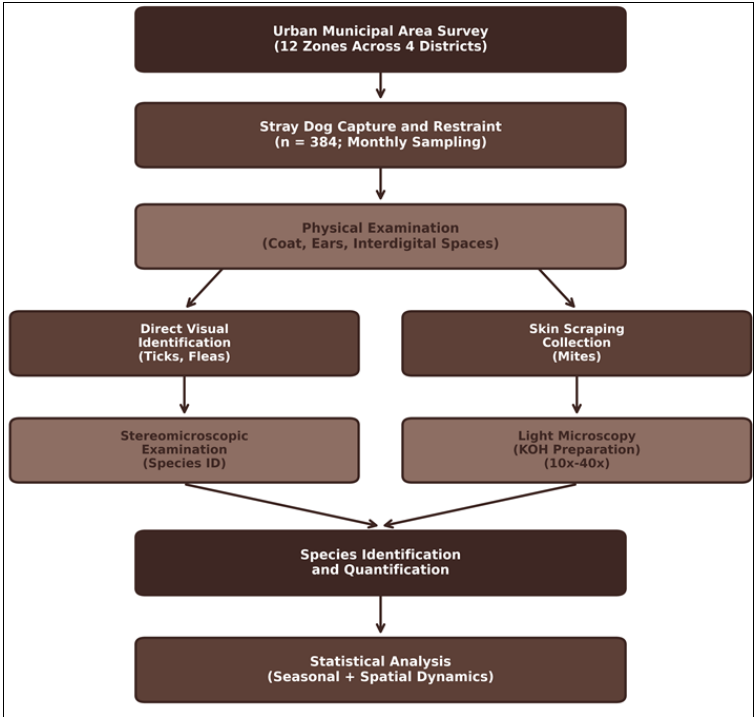


Fig 2: Flowchart of the standardised ectoparasite sampling and diagnostic identification methodology

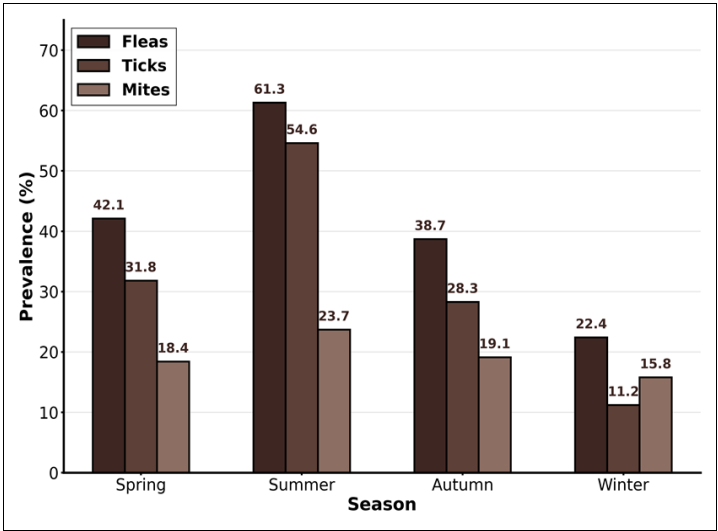


Fig 3: Seasonal prevalence of fleas, ticks, and mites in stray dogs across the four quarters of the sampling year

Comprehensive interpretation

The overall 68.5% ectoparasite prevalence documents a substantial parasite burden across the urban stray dog population, with roughly two in three dogs carrying at least one ectoparasite species at the time of capture. The seasonal surge in fleas and ticks during summer months overlaps precisely with peak human outdoor activity and tourist season in İzmir, amplifying the zoonotic exposure risk. The strong association with poor body condition suggests that nutritionally stressed dogs have weakened immunological and grooming defences, creating a positive feedback loop in which parasite burden further degrades condition and condition further predisposes to infestation.

Discussion

The 68.5% overall prevalence recorded here is higher than the 52.3% reported by Doğan and colleagues for stray dogs in Ankara^[7] but comparable to the 71.8% found in Istanbul by Aktas and co-workers^[8]. The Mediterranean climate of İzmir, with its extended warm season, likely accounts for the elevated year-round tick and flea carriage compared with the continental climate of Ankara, where winter temperatures regularly fall below minus 5 degrees C and suppress arthropod populations more completely^[6].

Ctenocephalides canis as the dominant flea species is consistent with surveys of stray dogs across southern Europe and the Middle East, where *C. canis* predominates in unowned dogs while *Ctenocephalides felis felis* tends to dominate in household environments shared with cats^[1, 13]. The 28.7% prevalence of *Rhipicephalus sanguineus*, the brown dog tick, is particularly noteworthy because this species is the primary vector of *Ehrlichia canis* and *Babesia vogeli*, both of which have been documented in Turkish dogs at seroprevalence rates of 12-20%^[4, 14].

The 14.3% prevalence of *Sarcoptes scabiei* poses a direct zoonotic concern. Human scabies acquired from dog contact so-called pseudo-scabies is self-limiting but intensely pruritic and clinically indistinguishable from human scabies during the acute phase^[15]. Municipal animal control workers and shelter staff are at particular occupational risk, and the data presented here support the recommendation for routine glove use and acaricide treatment at the point of capture rather than after transport.

From a management perspective, the clear seasonal pattern supports a strategy of targeted mass acaricide application using oral isoxazoline compounds or topical fipronil-based formulations timed to late spring (April-May), ahead of the summer prevalence peak. Such an approach, applied during routine trap-neuter-return operations, could substantially reduce the reservoir of ectoparasites that spill over into owned pet populations and human contacts^[16, 17].

Conclusion

This research set out to quantify the ectoparasite burden and seasonal trends in stray dogs across urban İzmir and has delivered several actionable findings. The overall prevalence of 68.5% confirms that urban stray dogs represent a major ectoparasite reservoir. Fleas and ticks show strong summer peaks, reaching 61.3% and 54.6% respectively, while mites remain more constant year-round. Poor body condition is the single strongest host-level risk factor for infestation. These results provide an evidence base for municipal veterinary authorities to design seasonally targeted ectoparasite control programmes integrated into existing animal welfare operations, with priority given to the April-through-

September window when zoonotic transmission risk is highest.

Future work should incorporate molecular identification of vector-borne pathogens carried by the collected arthropods to quantify the actual disease transmission risk, and should evaluate the cost-effectiveness and population-level impact of strategic acaricide treatment within trap-neuter-return programmes.

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Contributions not qualifying for authorship

Dr. Öztürk Ali assisted with tick taxonomic identification. Veterinary students from the parasitology practical rotation contributed to skin scraping collection under supervision.

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