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Hard ticks (Acari: Ixodida) in Sakar Mountains, SE Bulgaria

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Abstract. Eight species of hard ticks (Acari: Ixodida: Ixodidae) are reported in Bulgarian part of Sakar Mountains. Of the species found, *Ixodes ricinus* Linnaeus, 1756, *Haemaphysalis punctata* Canestrini & Fanzago, 1878**,** *Dermacentor marginatus* (Sulzer, 1776) and *Hyalomma marginatum* Koch, 1844 are widespread species in Bulgaria, while *Haemaphysalis inermis* Birula, 1895, *Hae. parva* (Neumann, 1897), *R. turanicus* Pomerantsev, 1936 and *Hyalomma aegyptium* Linnaeus, 1758 are less common and distributed mainly in the southern or southeastern regions of the country. It appears that *R. turanicus* substitutes the widespread tick species *R. bursa* Canestrini & Fanzago, 1878 in the studied habitats of Sakar Mountains.

Key words: hard ticks, Ixodidae, Bulgaria, Sakar Mountains.

Introduction

Hard ticks (Acari: Ixodida: Ixodidae) are relatively well studied in Bulgaria. Georgieva & Gecheva (2013) listed 32 species belonging to 5 genera (*Ixodes* Latreille, 1795*, Hyalomma* Koch, 1844*, Dermacentor* Koch, 1844*, Rhipicephalus* Koch, 1844 and *Haemaphysalis* Koch, 1844) for the territory of the country. In comparison, lists of ixodid species in the neighbouring countries include 21 species for Serbia (Kapo *et al.* 2024), 26 species for Greece (Efstratiou *et al.* 2021), 25 species for Romania (Mihalca *et al.* 2012), 15 species for North Macedonia (Kapo *et al.* 2024) and 47 species for Türkiye (Keskin *et. al.* 2017). *Amblyomma* species were also reported from different countries in Europe including Bulgaria, but these tick species were imported on exotic reptiles or wild birds and are not considered part of the European fauna (Georgieva & Gecheva 2013, Mihalca 2015, Estrada-Peña *et al.* 2017). In the last decade, data on the distribution of the ixodid ticks in Bulgaria were expanded (Arnaudov *et al.* 2014, Arnaudov & Arnaudov 2017, Aleksandrova *et al.* 2021, Arnaudov & Georgiev 2022).

Still, the available data on the hard ticks from Sakar Mountains are scarce. Mincheva *et al.* (1965) noted the wide distribution of the tick species *Hyalomma scupense* Schulze 1919 (as *H. detritum*), *Rhipicephalus bursa* Canestrini & Fanzago, 1878 and *Hyalomma marginatum* Koch, 1844 (as *H. plumbeum*) in the western part of the mountain (surroundings of the villages Balgarin, Shishmanovo, Ovcharovo, Rogozinovo and Dositeevo). Christov (1966) reported the species *R. sanguineus* (Latreille, 1806) and *R. turanicus* Pomerantsev, 1936 on small mammals with locality "Svilengrad". However, the affiliation of this locality to the territory of the mountain is questionable. Meshkov & Zapryanov (1985) reported finding the species *R. annulatus* (Say, 1821) (as *Boophilus calcaratus*) and *R. bursa* on ruminants in the Strandzha-Sakar region, but without specified localities.

In the present work, we report original data on the distribution of several ixodid species in Sakar Mountains.

Material and Methods

The ticks examined for the present study were collected accidentally during entomological research in the Sakar Mountain region in the period 2016 – 2024. Most of the collected specimens were found on clothing or on the ground. A few specimens were collected by net sweeping. In the field the ticks were preserved in 70% ethanol with a small amount of glycerol added.

The pictures of the habitats are taken with digital camera Canon PowerShot SX420 IS (Fig. 4) and Canon EOS 250D (Figs 3; 8 – 9; 13 – 14), the tick specimens are photographed with combination of Canon EOS 2000D digital camera, PRO-CA Camera Adapter, and a microscope Olympus SZ61 (Figs 1, 2; 5 – 7; 10 – 12).

Species identification was performed by the first author according to Estrada-Peña *et al.* (2017). The examined specimens are preserved in the Zoological Collection of Sofia University "St. Kliment Ohridski", Faculty of Biology (BFUS).

Results and Discussion

As a result of the study, a total of eight ixodid tick species, belonging to five genera, were identified. Of these, the species *Ixodes ricinus* Linnaeus, 1756, *Haemaphysalis punctata* Canestrini & Fanzago, 1878, *Dermacentor marginatus* (Sulzer, 1776) and *H. marginatum,* are widespread in Bulgaria (Georgieva & Gecheva 2013). The rest of the reported species – *Haemaphysalis inermis* Birula, 1895*, Hae. parva* (Neumann, 1897), *R. turanicus* and *H. aegyptium* Linnaeus, 1758 are mainly known from Southern Bulgaria (Georgieva & Gecheva 2013).

Species list

Family Ixodidae Koch, 1844

Genus *Ixodes* Latreille, 1795

***Ixodes ricinus* Linnaeus, 1756** (Fig. 1)

Material examined: Sakar Mts, NE of Balgarska Polyana Vill., edge of mixed forest, roadside vegetation (Fig. 3), 42°02'23.4"N 26°12'34.8"E, 415 m. a.s.l., 12.v.2024, 1 ♀ (BFUS-ACR000014), net sweeping, D. Gradinarov leg.

Notes: In Bulgaria *I. ricinus* is one of the most widespread tick species, as it prevails in mountainous and semi-mountainous areas with sufficient humidity (Georgieva & Gecheva 2013). This species is dependent on a humid microclimate and is less tolerant of excessive heat and desiccation (Estrada-Peña *et al.* 2017). It seems that the arid conditions in the Sakar Mountains are the reason for this single finding in the present study.

Genus *Haemaphysalis* Koch, 1844

***Haemaphysalis inermis* Birula, 1895** (Fig. 2)

Material examined: Sakar Mts, NE of Planinovo Vill., 41°58'32.5"N 26°23'11.8"E, 333 m a.s.l., 02.v.2021, edge of oak forest, 1 ♀ (BFUS-ACR000015), on clothing, Y. Petrova leg.; Sakar Mts, the road between Ustrem and Radovets Villages, 41°58.388'N 26°28.983'E, 216 m a.s.l., edge of mixed forest, roadside vegetation, 14.iv.2023, 1 ♂ (BFUS-ACR000016), on clothing, D. Gradinarov & Y. Petrova leg.

Notes: According to Georgieva & Gecheva (2013), *Hae. inermis* is rare species, distributed in Southern Bulgaria. In previous studies it was reported from Sofia, Petrich, Rila Mts, Kardzhali region and localities along the Black Sea coast (Trifonov 1975, Georgieva & Gecheva 2013). Recently this species has been found in Sarnena Sredna Gora Mts (Arnaudov & Georgiev 2022). Typical habitats of *Hae. inermis* are deciduous and mixed

forests (Guglielmone *et al.* 2014a, Estrada-Peña *et al.* 2017), which is also confirmed by our findings of this species.

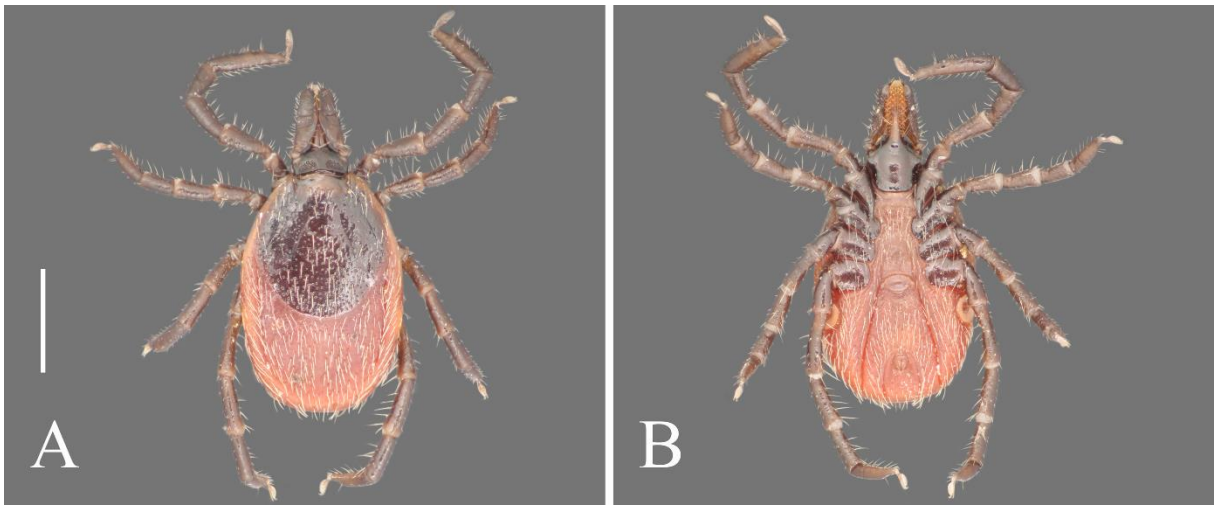

Fig. 1. Female of *Ixodes ricinus*, NE of Balgarska Polyana Village, 12.v.2024. A – dorsal view; B – ventral view. Scale bar: 1 mm.

Fig. 2. Male of *Haemaphysalis inermis*, Sakar Mts, the road between Ustrem and Radovets Villages, 14.iv.2023. A – dorsal view; B – ventral view. Scale bar: 1 mm.

***Haemaphysalis parva* (Neumann, 1897)** (Fig. 5)

Material examined: Sakar Mts, S of Ustrem Vill., the road to Radovets Vill., 42°00'51.0"N 26°27'51.6"E, 146 m a.s.l., hillside, xerothermic vegetation with *Paliurus spina-christi* Mill., grazing area (Fig. 4), 05.v.2021, 1 ♀ (BFUS-ACR000017), on the ground, Y. Petrova leg.

Notes: Rare species in Bulgaria, being recorded mainly from the southern and south-eastern regions of the country (e.g. Petrich, Haskovo, Burgas, Malko Tarnovo, Tsarevo) Georgieva & Gecheva (2013). It was also collected from the Shumen and Balchik regions (Georgieva & Gecheva 2013). *Haemaphysalis parva* prefers mountain steppes and lower mountain forests (Estrada-Peña *et al.* 2017) and our finding is consistent with these preferences.

Fig. 3. Sakar Mts, NE of Balgarska Polyana Village, 12.v.2024. Habitats of *Ixodes ricinus*, *Rhipicephalus turanicus* and *Hyalomma marginatum*.

Fig. 4. Sakar Mts, S of Ustrem Village, 05.v.2021. Habitat of *Haemaphysalis parva*.

***Haemaphysalis punctata* Canestrini & Fanzago, 1878** (Fig. 6)

Material examined: Sakar Mts, SW of Izvorovo Vill., 41°57'11.9"N 26°07'56.2"E, 289 m a.s.l., roadside grasslands with burrows of *Spermophilus citellus* (Linnaeus, 1766) (Fig. 8), 08.v.2024, 1 ♀ (BFUS-ACR000018), on clothing, D. Gradinarov & Y. Petrova leg.

Notes: Widely distributed species in Bulgaria, most common in the Southern Black Sea coast and the Upper Thracian plain regions (Georgieva & Gecheva 2013). The species exhibits high ecological plasticity and is found in a variety of habitats (Georgieva & Gecheva 2013, Estrada-Peña *et al.* 2017).

Fig. 5. Female of *Haemaphysalis parva*, Sakar Mts, S of Ustrem Village, 05.v.2021. A – dorsal view; B – ventral view. Scale bar: 1 mm.

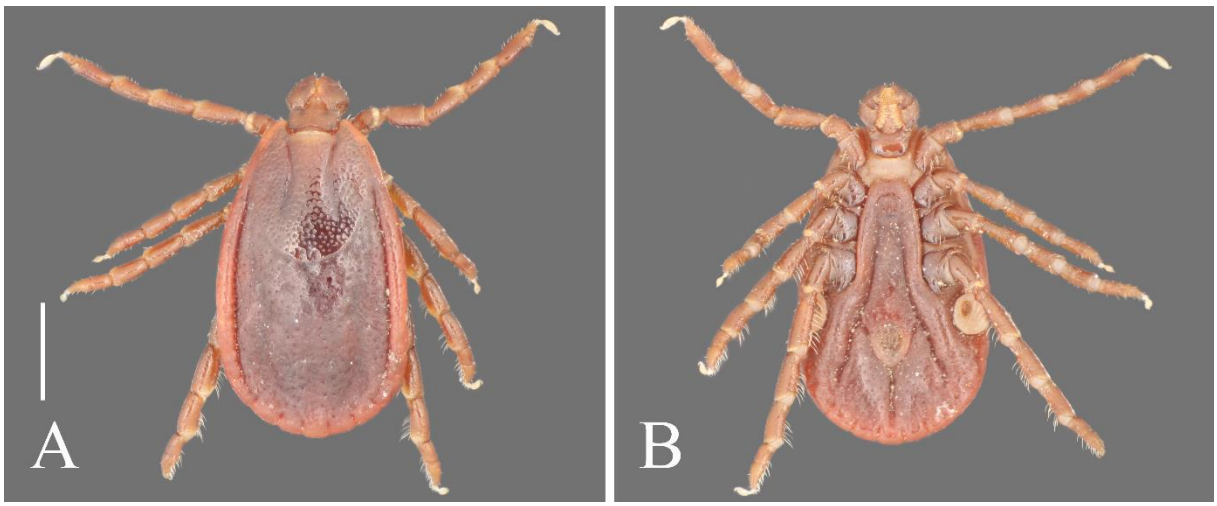

Fig. 6. Female of *Haemaphysalis punctata*, Sakar Mts, SW of Izvorovo Village, 08.v.2024. A – dorsal view; B – ventral view. Scale bar: 1 mm.

Genus *Dermacentor* Koch, 1844

***Dermacentor marginatus* (Sulzer, 1776)** (Fig. 7)

Material examined: Sakar Mts, the road between Ustrem and Radovets Villages, 41°58.388'N 26°28.983'E, 216 m a.s.l., edge of mixed forest, roadside vegetation, 14.iv.2023, 1 ♂ (BFUS-ACR000019), on clothing, D. Gradinarov & Y. Petrova leg.

Notes: Widespread species in Bulgaria, found up to 2000 m a.s.l. (Georgieva & Gecheva 2013). The species prefers open habitats (meadows and pastures, including xerophilic plant communities) (Georgieva & Gecheva 2013, Estrada-Peña *et al.* 2017).

Fig. 7. Male of *Dermacentor marginatus*, Sakar Mts, the road between Ustrem and Radovets Villages, 14.iv.2023. A – dorsal view; B – ventral view. Scale bar: 1 mm.

Genus *Rhipicephalus* Koch, 1844

***Rhipicephalus turanicus* Pomerantsev, 1936** (Fig. 10)

Material examined: Sakar Mts, W of Levka Vill., approx. 41°52'16.09"N 26°12'46.46"E, 17.v.2016, roadside xerophilic grasslands, 1 ♂ (BFUS-ACR000020), D. Gradinarov & Y. Petrova leg.; Sakar Mts, NE of Balgarska Polyana Vill., 42°02'25.2"N 26°12'32.2"E, 431 m a.s.l., xerophilic grasslands (Fig. 3), 21.vii.2021, 2 ♀♀ (BFUS-ACR000021, BFUS-ACR000022), on the ground, D. Gradinarov leg.; Sakar Mts, NE of Izvorovo Vill., 41°59'04.6"N 26°09'52.4"E, 490 m a.s.l., meadows near a roadside water fountain (Fig. 9), 08.v.2024, 1 ♀ (BFUS-ACR000023), on clothing, D. Gradinarov leg.; Sakar Mts, SW of Izvorovo Vill., 41°57'11.9"N 26°07'56.2"E, 289 m a.s.l., roadside grasslands with burrows of *S. citellus* (Fig. 8), 08.v.2024, 1 ♀ (BFUS-ACR000024), on clothing, D. Gradinarov & Y. Petrova leg.; Sakar Mts, SE of Kolarovo Vill., 41°56'17.3"N 26°05'45.2"E, 203 m a.s.l., grasslands near an artificial pond (Fig. 13), 11.v.2024, 1 ♂ (BFUS-ACR000025), net sweeping, D. Gradinarov leg.; Sakar Mts, SW of Pomoshtnik Village, 42°02'29.8"N 26°02'15.9"E, 274 m a.s.l., grasslands near wheat field, 11.v.2024, on clothing, 3 ♂♂ (BFUS-ACR000026, BFUS-ACR000027, BFUS-ACR000028), 1 ♀ (BFUS-ACR000029), D. Gradinarov & Y. Petrova leg.; the same data, 1 ♂ (BFUS-ACR000030), net sweeping, D. Gradinarov leg.

Notes: In Bulgaria *R. turanicus* is known from several localities in the southeast part of the country (Mincheva *et al.* 1965, Georgieva & Gecheva 2013, Arnaudov & Georgiev 2022). The widespread up to 1000 m a.s.l. in Bulgaria species *R. bursa* (Georgieva & Gecheva 2013), has not been found during the present study. *Rhipicephalus turanicus* is typical for regions with hot and dry climate (e.g. deserts, semi-deserts, steppes and open

woodlands) (Georgieva & Gecheva 2013, Guglielmone *et al.* 2014b) and thus, its presence in the Sakar Mts is not surprising. It seems that in areas with favourable ecological conditions, *R. turanicus* can substitute *R. bursa*. Such substitution was noticed by Mincheva *et al.* (1965) for the flattest part of the Stara Zagora Plain, and now we observed the same phenomenon in the studied habitats of Sakar Mts.

Fig. 8. Sakar Mts, SW of Izvorovo Village, 08.v.2024. Habitat of *Haemaphysalis punctata* and *Rhipicephalus turanicus*.

Fig. 9. Sakar Mts, NE of Izvorovo Village, 08.v.2024. Habitat of *Rhipicephalus turanicus*.

Fig. 10. Male of *Rhipicephalus turanicus*, Sakar Mts, SW of Pomoshtnik Village, 11.v.2024. A – dorsal view; B – ventral view. Scale bar: 1 mm.

Genus *Hyalomma* Koch, 1844

***Hyalomma aegyptium* Linnaeus, 1758** (Fig. 11)

Material examined: Sakar Mts, N of Yerusalimovo Vill., 41°54'17.8"N 26°06'04.4"E, 167 m a.s.l., roadside verges (Fig. 14), 08.v.2024, 1 ♂ (BFUS-ACR000031), on the ground, D. Gradinarov leg.

Notes: According to Estrada-Peña *et al.* (2017) *H. aegyptium* is the most common tick species on tortoises in the Balkan area and the Middle East. In Bulgaria, *H. aegyptium* is

known from the Black Sea coast and the southern regions of the country (Georgieva & Gecheva, 2013).

***Hyalomma marginatum* Koch, 1844** (Fig. 12)

Material examined: Sakar Mts, NE of Balgarska Polyana Vill., 42°02'21.8"N 26°12'32.4"E, 410 m a.s.l., roadside xerophilic grasslands (Fig. 3), 25.v.2019, 2 ♂♂ (BFUS-ACR000032, BFUS-ACR000033), on the ground, D. Gradinarov & Y. Petrova leg.; Sakar Mts, SE of Knyazhevo Vill., 42°06'01.0"N 26°30'21.7"E, 102 m a.s.l., dirt road, riverine and xerothermic vegetation, 07.vi.2020, 1 ♀ (BFUS-ACR000034), on the ground, D. Gradinarov leg.; the same locality, 24.v.2023, 1 ♀ (BFUS-ACR000035), on the ground, D. Gradinarov leg.; Sakar, W of Ustrem Vill., right bank of Manastirska Reka Riv., 42°01'25.8"N 26°27'06.8"E, 94 m a.s.l., riverine vegetation, 14.iv.2023, on the ground, 1 ♀ (BFUS-ACR000036), D. Gradinarov leg.

Notes: This species is widespread in Bulgaria up to 1000 m a.s.l., being found in greater numbers in the southern regions of the country (Georgieva & Gecheva 2013). The species exhibits high ecological plasticity in its Palaearctic range (Estrada-Peña *et al.* 2017). In Bulgaria, it is found in hilly areas and in the low mountain belt, often in shrublands and in xerothermic oak forests (Georgieva & Gecheva 2013).

Fig. 11. Male of *Hyalomma aegyptium*, Sakar Mts, N of Yerusalimovo Village, 08.v.2024. A – dorsal view; B – ventral view. Scale bar: 1 mm.

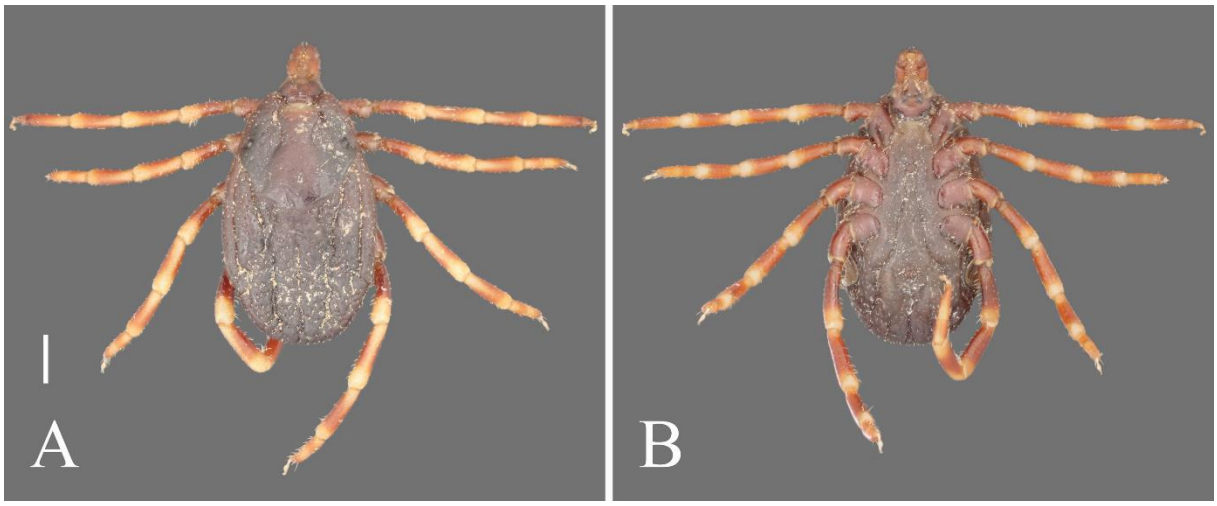

Fig. 12. Female of *Hyalomma marginatum*, Sakar Mts, SE of Knyazhevo Village, 07.vi.2020. A – dorsal view; B – ventral view. Scale bar: 1 mm.

Fig. 13. Sakar Mts, SE of Kolarovo Village, 11.v.2024. Habitat of *Rhipicephalus turanicus*.

Fig. 14. Sakar Mts, N of Yerusalimovo Village, 08.v.2024. Habitat of *Hyalomma aegyptium*.

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