

Geographic Distribution and other Population Parameters of *Ixodes (Exopalgiger) trianguliceps* (Birula, 1895) in Yugoslavia

Geografska distribucija in drugi populacijski parametri klopa *Ixodes (Exopalgiger) trianguliceps* (Birula, 1895) v Jugoslaviji

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Descriptors: *Ixodes trianguliceps* / Yugoslavia

Abstract. *Ixodes trianguliceps* (Birula) is described as a rather frequently occurring tick species in Yugoslavia, especially in localities between 500 — 2000 metres above sea-level, in the Alps, the Dinaric region including mountains running down the Adriatic coast, and also in the hilly parts of Pannonia and other districts of the country. *Clethrionomys glareolus* and *Apodemus flavicollis* have been ascertained as preferred hosts, followed by *Sorex alpinus*, *Apodemus sylvaticus*, *Sorex araneus* and others. *Ixodes trianguliceps* was mostly found alone on small mammals, although frequently associated with *Ixodes ricinus*. In some places only, and much less frequently, *Ixodes trianguliceps* was found in the same habitats as immature *Dermacentor marginatus* (SR Croatia and SR Montenegro) and *Haemaphysalis erinacei erinacei* (SR Macedonia).

Deskriptorji: *Ixodes trianguliceps* / Jugoslavija

Izvleček. *Ixodes trianguliceps* (Birula) je opisan kot sorazmerno pogost klop v Jugoslaviji, posebej v območjih med 500 — 2000 metri nadmorske višine, tako v Alpah, v Dinarskem gorstvu vključno s hribovjem, potekajočim vzdolž Jadranske obale, kot tudi v gričevnatem svetu Panonije in drugih predelov države. Kot preferenčna gostitelja sta ugotovljena *Clethrionomys glareolus* in *Apodemus flavicollis*, ki jima sledi *Sorex alpinus*, *Apodemus sylvaticus*, *Sorex araneus* in drugi. Na malih sesalcih je bil ugotovljen *Ixodes trianguliceps* največkrat sam, vendar dosti pogosto tudi v združbi z *Ixodes ricinus*. Le ponekod, in mnogo redkeje, je bil *Ixodes trianguliceps* najden v istih habitatih kot nedorasli *Dermacentor marginatus* (SR Hrvatska in Črna gora) in *Haemaphysalis erinacei erinacei* (SR Makedonija).

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Introduction

OSWALD (1940) first supposed that Yugoslavia, too, should be included — regarding all the ecological rules valid for *Ixodes trianguliceps* — in the distribution area of this tick species, but he himself did not have an example in his collection.

We first met *Ixodes trianguliceps* in the early sixties in the valley of Kamniška Bistrica, when analysing the infestation of small mammals from the bottom of the valley to the highest surrounding peaks (ROSICKÝ et al. 1961). Later on, *Ixodes trianguliceps* was found elsewhere in Yugoslavia (TOVORNIK 1970, 1982).

The list of areas established as places where examples of *Ixodes trianguliceps* which we have in our collection were found, was composed in the present study. Hosts of *Ixodes trianguliceps* were defined with regard to the height above sea-level of their perspective catch sites and dates, along with other tick species which were found as parasites of natural hosts of *Ixodes trianguliceps* in mutual habitats.

We tried to expose and evaluate those bio-ecologic parameters which might be useful as a guide to the presence of the *Ixodes trianguliceps* population in the extremely heterogenous zoogeographic conditions of the Yugoslav Pannonic, Alpine, Dinaric and Mediterranean regions, (i.g. throughout Yugoslavia), where the treated species was found.

Methods of work and material

Each example of *Ixodes trianguliceps* was determined by stereomicroscopy. Some, specially larvae, were included in permanent preparations in Canada balsam. Dr. Harry Hoogstraal and Dr. Hilda Y. Wassef (NAMRU-3, Cairo, Egypt) confirmed our determination in 1983, and our specimens were revised by Dr. Carleton Clifford (Rocky Mountain Laboratories, Hamilton, Montana, U.S.A.).

Our ticks are stored in 70 % alcohol, with a minimum addition of glycerine, and represent a permanent collection now owned by the University Institute of Public Health and Social Welfare in Ljubljana, Department of Human and Sanitary Virology.

Savo Breljih, executive curator, handed over to our institute the majority of the ticks treated in this article, these having been collected during many years of field investigation of mammals in Yugoslavia (1957—1981).

Results

1. The geographic distribution of *Ixodes trianguliceps*

The majority of the sites where *Ixodes trianguliceps* were found are located in higher mountainous regions where *Ixodes trianguliceps* inhabits some places in rather large numbers, depending closely on the collecting season: we usually found small mammals infested

with a greater number of uniform population of *Ixodes trianguliceps* higher in the mountains, and especially later in autumn, on the Gorjanci hills in Slovenia in October for example.

Localities in Yugoslavia where *Ixodes trianguliceps* originates, belong to different climatic and zoogeographic areas, which, of course, also have specific species of *Ixodid* ticks.

Of all the areas in Yugoslavia, the continental part of Slovenia is remarkable for the monotony of its *Ixodid* fauna, where except for the ubiquitous *Ixodes ricinus* and some strictly host specific species, no southern tick species habitually live. A single exception to this is found in Slovenia, where the Mediterranean climatic influence is noticeable. Here there are some southern tick species which are otherwise significant for the remaining territory of Yugoslavia, where the tick fauna is usually rather variegated. The phenomenon of geographic distribution of *Ixodid* species is emphasized because *Ixodes trianguliceps* does not fit in with the above cited zoo-geographical laws of differentiation of tick species, but on the contrary is found everywhere. Just as in the Slovene mountains, it has been found in Croatia, Bosnia and Herzegovina, Montenegro, Macedonia, in parts of western Serbia, Kosovo and also in Vojvodina, mainly in the rather higher mountainous areas.

It is understandable that *Ixodes trianguliceps* does not occur on the Adriatic littoral. But it is present here as well, in the higher mountain regions, of course, which extend close to the coast from Rijeka to Split, — Učka, Risnjak, Velebit, Kozjak —. On mount Kozjak, above Split, a representative number of *Ixodes trianguliceps* were found on mice (*Apodemus mystacinus*) at heights as low as 470 metres. However, these were habitats with a decidedly mountainous character and a completely different climate from lower sites in the foothills of the mountains or close to sea level. Collection data concerning the material gathered are presented in a tabulated list where, with each find site or host-animal, the collectors are also indicated by their initials. (Tab. 1). The full names of the collectors, who in the majority of cases also identified small mammals, are written in the heading of the table. All the ascertained sites are arranged according to the UTM system (Universal Transverse Mercator /Grid/) and are additionally incorporated into the map of Yugoslavia. (Fig. 1).

2. Occurrence of *Ixodes trianguliceps* with respect to heights above sea-level

On the basis of 165 small mammals infested with *Ixodes trianguliceps*, 60 % of which originated in Slovenia and 40 % in localities outside Slovenia, we can undoubtedly ascertain that *Ixodes trianguliceps* in Yugoslavia belongs to the *Ixodid* fauna of areas of high elevation. We found *Ixodes trianguliceps* on small mammals trapped in lowland areas, as well, but not as often and not at all regularly. Small mammals infested with *Ixodes trianguliceps* are presented according to elevation of catch sites in figure 2. It was discovered that 81.8 % of all the infested animals came from localities lying between 500 and 2,000 metres, and 1.2 % from localities above 2,000 metres.

3. Seasonal distribution of small mammals infested with *Ixodes trianguliceps*

Small mammals infested with *Ixodes trianguliceps* were arranged according to both the intervals of heights above sea-level and months of catch. Thus the seasonal fluctuation of the entire determined mass of *Ixodes trianguliceps* depending on height above sea-level,

Table 1. *The list of collected small mammals and ticks*
 Tabela 1. *Seznam zbranih malih sesalcev in klosov*

SLOVENIJA — SLOVENIA

UTM klasifikacija; UTM classification	Kraj Locality	Nadmorska višina (*) Sea-level (*)	Gostitelj Host	Število živali; Number of animals	Datum Date	Legit	Klopi — Ticks					
							<i>I. ricinus</i>		<i>I. trianguliceps</i>			
							La	Ny	La	Ny	Ad	
1	2	3	4	5	6	7	8	9	10	11	12	
UM94	Julijske Alpe: Mangrt	2000 m	<i>Chionomys nivalis</i>		29. 7. 73	BrS GrJ				2		
UM94	Julijske Alpe: Mangrtska planina	1350 m	<i>Cl. glareolus</i>		3. 7. 73	PeB KrB						2 ♀
VL08	Trnovski gozd: Čaven		<i>Sorex alpinus</i>	5	3. 10. 68	BrS JeR				28		
			<i>Cl. glareolus</i>		3. 10. 68	BrS JeR				1		1 ♀
		(1351 m)	<i>Ap. sylvaticus</i>		3. 10. 68	BrS JeR				4		
		ca 1100 m	<i>Crocidura suaveolens</i>		3. 10. 68	BrS JeR				3		
			<i>Glis glis</i>		3. 10. 68	BrS JeR				5		
			<i>Ap. sylvaticus</i>		10. 7. 69	PeB BrS	9	2	3		1	
			<i>Ap. sylvaticus</i>		11. 9. 69	PeB BrS			1			
			<i>Ap. flavicollis</i>		11. 7. 69	PeB BrS			2			
		ca 1250 m	<i>Cl. glareolus</i>		10. 7. 69	PeB BrS			2			
			<i>Talpa europaea</i>		10. 7. 69	PeB BrS			1			
			<i>Arvicola terrestris</i>		23. 9. 71	BrS						1 ♀
			<i>Cl. glareolus</i>		23. 9. 71	BrS					1	
			<i>Sorex alpinus</i>		24. 9. 71	BrS			1			
VL27	Nanos: Pleša	(1313 m)	<i>Ap. flavicollis</i>	2	5. 7. 59	BrS				5		
		1200 m	<i>Ap. flavicollis</i>		10. 7. 74	BrS GrJ	1			5		
			<i>Ap. sylvaticus</i>	2	16. 7. 77	BrS	2			2		2 ♀
VL28	Hrušica: Javornik	(1240 m)	<i>Chionomys nivalis</i>		3. 9. 71	BrS JeR						
		1100—1150 m										
VL38	Hrušica: Travnj vrh	800 m	<i>Cl. glareolus</i>		22. 8. 71	BrS JeR	8					2 ♀

(*) Številka v oklepaju pomeni najvišji vrh pogorja oz. hriba
 The number in parenthesis means the highest peak of the mountain chain resp. hill

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1	2	3	4	5	6	7	8	9	10	11	12
VL38	Hotedršica: Ravnik	550—650 m	<i>Ap. flavicollis</i>		21. 10. 67	BrS			10	1	1 ♀
			<i>Ap. sylvaticus</i>		21. 10. 67	BrS			4		
			<i>Cl. glareolus</i>		21. 10. 67	BrS			1		
			<i>Crocidura suaveolens</i>	2	1. 10. 67	BrS			4		
			<i>Cl. glareolus</i>		1. 10. 67	BrS	4	1	11	1	
			<i>Ap. sylvaticus</i>		1. 10. 67	BrS	3		10		
			<i>Ap. flavicollis</i>		1. 10. 67	BrS			15		
			<i>Sorex araneus</i>		1. 10. 67	BrS			1		
			<i>Talpa europaea</i>		29. 9. 68	BrS JeR			2		
			<i>Glis glis</i>		22. 9. 68	BrS JeR	14	22	1		
			<i>Ap. flavicollis</i>		5. 8. 67	PeB BrS	3				1 ♀
			<i>Cl. glareolus</i>		4. 8. 67	PeB BrS	45		1		
VL48	Borovnica: Pokojišče	650 m	<i>Ap. flavicollis</i>	2	25. 10. 67	BrS LeF	3		4		2 ♀
			<i>Cl. glareolus</i>	2	25. 10. 67	BrS LeF			3	1	1 ♀
VL54	Snežnik: med Sviščaki in vrhom between Sviščaki and the peak	(1796 m) 1370 m	<i>Chionomys nivalis</i>		7. 7. 67	PeB BrS			1		
			<i>Cl. glareolus</i>		20. 7. 72	BrS			1		
VL56	Cerknica: Otok	550 m	<i>Sorex alpinus</i>		7. 8. 67	PeB BrS	1			1	
VL58	Borovnica: Pako	ca 320 m	<i>Glis glis</i>		21. 9. 68	LeF		2		1	
VL68	Ig, Kremenica	300—320 m	<i>Sorex minutus</i>		8. 2. 79	KrB BrS			7		
			<i>Cl. glareolus</i>		21. 4. 79	KrB BrS					1 ♀
			<i>Sorex minutus</i>		13. 7. 79	KrB BrS			3		
VM03	Julijske Alpe: Zadnjica		<i>Ap. sylvaticus</i>		13. 9. 68	BrS DoJ					1
VM03	Julijske Alpe: Trenta, Na Logu	600 m	<i>Sorex araneus</i>		12. 9. 68	BrS DoJ		2			1
			<i>Cl. glareolus</i>		12. 9. 68	BrS DoJ				8	
VM04	Julijske Alpe: Trenta: Botanični vrt "Julijana" garden	800 m	<i>Glis glis</i>		13. 9. 68	BrS DoJ				1	
VM05	Podkoren: Zelenci	860 m	<i>Ap. flavicollis</i>		14. 7. 74	BrS DoJ	2			1	
VM14	Julijske Alpe: Krma	(2863 m) 1100 m	<i>Cl. glareolus</i>		18. 8. 67	PeB BrS	1			1	
VM15	Karavanke: Za Lepim vrhom	(2143 m) 1300 m	<i>Cl. glareolus</i>		14. 8. 71	BrS GrJ	1			1	
			<i>Ap. flavicollis</i>		14. 8. 71	BrS GrJ	1			1	
VM15	Karavanke: Srednji vrh	960 m	<i>Sorex araneus</i>		27. 7. 73	PeB KrB					2
			<i>Talpa europaea</i>		25. 9. 71	GrJ				3	
VM42	Kranj: Zgornja Besnica	450—470 m	<i>Neomys fodiens</i>		20. 8. 67	PeB BrS				1	

GEOGRAPHIC DISTRIBUTION ... OF IXODES TRIANGULICEPS IN YUGOSLAVIA

1	2	3	4	5	6	7	8	9	10	11	12
VM63	Kamniška Bistrica	600—640 m	<i>Sorex alpinus</i>		5. 12. 57		1		3		
			<i>Sorex araneus</i>		3. 4. 60	BrS	3		8	1	
			<i>Sorex alpinus</i>	4	4. 4. 60	BrS	5		22	1	2 ♂
			<i>Cl. glareolus</i>		29. 6. 69	PeB BrS				1	
			<i>Pitymys lichtensteini</i>		29. 6. 69	PeB BrS			4		
VM63	Kamniške Alpe: slap Rinka waterfall	1300 m	<i>Ap. flavicollis</i>		15. 8. 67	PeB BrS		1			1 ♀
VM53	Kamniške Alpe: Kokrško sedlo — Cojzova koča	(2558 m) 1822 m	<i>Sorex alpinus</i>	3	22. 6. 57	BrS			12		
WL26	Gorjanci: Gospodična	(1181 m) 700—800 m	<i>Neomys fodiens</i>		10. 10. 81	TvN BrS			3		
			<i>Neomys anomalus</i>		11. 10. 81	TvN BrS	1		10		
			<i>Pitymys lichtensteini</i>		11. 10. 81	TvN BrS			3		
			<i>Cl. glareolus</i>	2	10. 10. 81	TvN BrS			20	2	1 ♀
			<i>Sorex araneus</i>		10. 10. 81	TvN BrS			10		
			<i>Ap. flavicollis</i>		10. 10. 81	TvN BrS			3		
			<i>Talpa europaea</i>		10. 10. 81	TvN BrS			5		
			<i>Sorex alpinus</i>		10. 10. 81	TvN BrS			3		
			<i>Sorex minutus</i>		11. 10. 81	TvN BrS			1		
WL27	Gorjanci: Miklavž	(1181 m) 965 m	<i>Cl. glareolus</i>	4	28. 10. 81	BrS			21		
			<i>Ap. sylvaticus</i>		28. 10. 81	BrS			1		
WM35	Pohorje: Lobnica	ca 1000 m	<i>Ap. flavicollis</i>		18. 7. 69	PeB BrS			1		
			<i>Neomys fodiens</i>		18. 7. 69	PeB BrS				1	
			<i>Cl. glareolus</i>		18. 7. 69	PeB BrS	2	1			1
WM78	Prekmurje: Gerlovci		<i>Ap. sylvaticus</i>		10. 10. 59	BrS	3		2		
WM94	Prekmurje: Miklavž pri Ormožu	300 m	<i>Ap. flavicollis</i>		13. 8. 67	PeB BrS			5		
			<i>Cl. glareolus</i>		12. 8. 67	PeB BrS	8		1		
WM97	Prekmurje: Puconci		<i>Ap. flavicollis</i>		10. 10. 67				4		
WM98	Prekmurje: Moščanci	200 m	<i>Sorex araneus</i>		17. 7. 69	PeB BrS					2
			<i>Ap. flavicollis</i>		17. 7. 69	PeB BrS	4				2
XM07	Prekmurje: Filovci		<i>Ap. flavicollis</i>		9. 10. 59	BrS			2		
XM15	Prekmurje: Lendava, Črni Log	156 m	<i>Cl. glareolus</i>		2. 4. 81	KrB GrJ		1			3 ♀

1	2	3	4	5	6	7	8	9	10	11	12
HRVATSKA — CROATIA											
VK96	Velebit: Veliki Zavižan	(1667 m) 1600 m	<i>Sorex araneus</i>		28. 9. 75	TvN			1		
VL31	Istra: Učka	(1396 m) 1100 m	<i>Ap. flavicollis</i>	2	12. 7. 69	PeB BrS			2		
VL63	Gorski Kotar: Risnjak	(1528 m) 1450—1500 m	<i>Sorex alpinus</i>		9. 8. 67	PeB BrS			1		
			<i>Cl. glareolus</i>	2	1. 9. 78	BrS			1		1 ♀
WK04	Velebit: Crni padež	(1468 m) 1060 m	<i>Cl. glareolus</i>		1. 8. 75	TvN					1 ♀
WK12	Velebit: Baške Oštarije	900 m	<i>Ap. sylvaticus</i>		11. 8. 68	PeB BrS			1		
WK19	Vel. Kapela: Razvala	850 m	<i>Cl. glareolus</i>		16. 8. 68	PeB BrS	1				1 ♀
WK46	Lika: Plitvice, Crna rijeka	750 m	<i>Ap. sylvaticus</i>		12. 8. 68	PeB BrS	3	1	3		
			<i>Ap. flavicollis</i>		12. 8. 68	PeB BrS	4	1	3		
WK56	Lika: Plitvice, Mukinje	600 m	<i>Cl. glareolus</i>		29. 5. 77	TvN				1	
			<i>Sorex araneus</i>		29. 5. 75	TvN					1 ♀
WK60	Velebit: Predzid (pod Čelavcem)	700 m	<i>Ap. sylvaticus</i>		1. 8. 75	TvN KrB			1		
WL78	Medvednica: Slijeme	(1035 m)	<i>Ap. flavicollis</i>		25. 6. 75	TvN			1	1	1 ♀
WL84	Vukomeričke gorice: Prkovec	200 m	<i>Ap. flavicollis</i>		19. 7. 74	TvN		1		1	
			<i>Ap. agrarius</i>		19. 7. 74	TvN				1	
WL95	Turopolje: Peščenica	100 m	<i>Ap. flavicollis</i>	2	5. 10. 77	TvN					5 ♀
			<i>Sorex araneus</i>		28. 10. 76				7	1	
XJ02	Kozjak: Malačka	(780 m) 470 m	<i>Ap. mystacinus</i>	7	29. 4. 74	BrS GrJ	1		23	2	
XL39	Križevci: Stara vas	ca 200 m	<i>Ap. sylvaticus</i>		20. 4. 63	ToD					1 ♀
BOSNA IN HERCEGOVINA BOSNIA AND HERZEGOVINA											
CP39	Vlasenica, Vrela Tišće	650 m	<i>Ap. flavicollis</i>		24. 7. 70	PeB	3		5		

ČRNA GORA — MONTENEGRO

1	2	3	4	5	6	7	8	9	10	11	12
CN47	Durmitor: Valovito jezero, ok.	(2522 m) 1715 m	<i>Chionomys nivalis</i>		23. 9. 81	PeB			2	1	
CN85	Kolašin: Biogradsko jezero	1100 m	<i>Sorex araneus</i>		4. 8. 67	PeB	1		1		
			<i>Cl. glareolus</i>	2	5. 5. 67					2	1 ♀
			<i>Ap. flavicollis</i>	2	5. 5. 67				2		
			<i>Ap. sylvaticus</i>		5. 5. 67				1		

VOJVODINA — VOJVODINA

EQ49	Banat: Vršacke planine, Široko Bilo	(641 m) 400 m	<i>Ap. agrarius</i>		18. 5. 76				1		
DR00	Srem: Fruška gora: Zmajevac	(539 m) 450 m	<i>Cl. glareolus</i>		21. 4. 66	PeB					1 ♀ 1 ♂
			<i>Ap. agrarius</i>		23. 7. 66	PeB			1		1 ♀
			<i>Sorex minutus</i>		21. 4. 66					1	
			<i>Ap. flavicollis</i>		23. 7. 66		2		2		

SRBIJA — SERBIA

CP66	Tara: Predov krst	(1673 m) 950 — 1000 m	<i>Cl. glareolus</i>		26. 10. 68	PeB					1
			<i>Neomys fodiens</i>		26. 10. 68	PeB	2		1		
CP66	Tara: Predov krst, Kameno brdo	1000 m	<i>Pitymys sp.</i>		29. 10. 68	PeB					1 ♀
CP76	Tara: Mitrovac	1100 m	<i>Cl. glareolus</i>		17. 8. 69	PeB				1	
			<i>Talpa europaea</i>		31. 10. 68	PeB			2		
			<i>Ap. flavicollis</i>		17. 8. 69	PeB					1 ♀
CP76	Tara: Mitrovac, Beli Rzav	850—900 m	<i>Microtus arvalis</i>		7. 5. 74	PeB				1	1 ♀
CQ61	Krupanj: Kržava	400 m	<i>Ap. agrarius</i>		20. 11. 65	RuA			1		
DP22	Javor: Mučanj	(1520 m) 1300 m	<i>Cl. glareolus</i>		24. 10. 69	PeB				1	
DN59	Golja: Crni vrh	(1833 m) 1400 m	<i>Cl. glareolus</i>		8. 6. 70	PeB					2

1	2	3	4	5	6	7	8	9	10	11	12
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KOSOVO

DN22	Rugovo, Bjeluha (na robu Prokletij) (on the edge of Prokletije)	(1849 m) 1400 m	<i>Cl. glareolus</i>		28. 9. 66	PeB					1
			<i>Neomys sp.</i>		28. 9. 66	PeB					1
DN33	Žljeb	(2382 m)	<i>Sorex alpinus</i>		13. 7. 78	KrB PeB BrS			3		
EM07	Šar planina: Brezovica	1300	<i>Ap. flavicollis</i>		8. 6. 71	PeB				1	2 ♀

MAKEDONIJA — MACEDONIA

DM95	Šar planina: Popova Šapka	(2584 m) 1750 m	<i>Sorex araneus</i>		11. 8. 65	PeB					1
			<i>Chionomys nivalis</i>	2	26. 8. 76	PeB DžG					1 ♀
EL13	Pelister: Golemo jezero	(2600 m) 2200 m	<i>Sorex araneus</i>		19. 7. 71	PeB					1
EL58	Babuna: Derven	1100—1300 m	<i>Ap. sylvaticus</i>		23. 4. 69	PeB		1		1	
EL96	Kožufo: Veliki Čardak	(2173 m) 1300 m	<i>Apodemus sp.</i>		15. 7. 75	KrB				1	
FL46	Dojran		<i>Ap. agrarius</i>	2	22. 7. 78	PeB				2	
FM22	Plačkovica	(1754 m) ca 1200 m	<i>Ap. flavicollis</i>		28. 5. 70	PeB				2	2
FM44	Golak: Čavka	(1538 m) 1300 m	<i>Ap. flavicollis</i>		28. 5. 70	PeB					1 ♀ 1 ♂

Collectors of the material:

Zbiralci materiala:

BrS = Savo Breljih (Ljubljana), DoJ = Janez Dovič (Ljubljana), DžG = MSc. Georg Džukić (Beograd), GrJ = Janez Gregori (Ljubljana), JeR = Rado Jelinčič (Ljubljana), KrB = Dr. Boris Kryštufek (Ljubljana), LeF = France Leben (Ljubljana), PeB = Dr. Boris Petrov (Beograd), RuA = Dr. Anka Ružić (Beograd), ToD = Dr. Danica Tovornik (Ljubljana), TvN = MSc. Nikola Tvrtković (Zagreb)

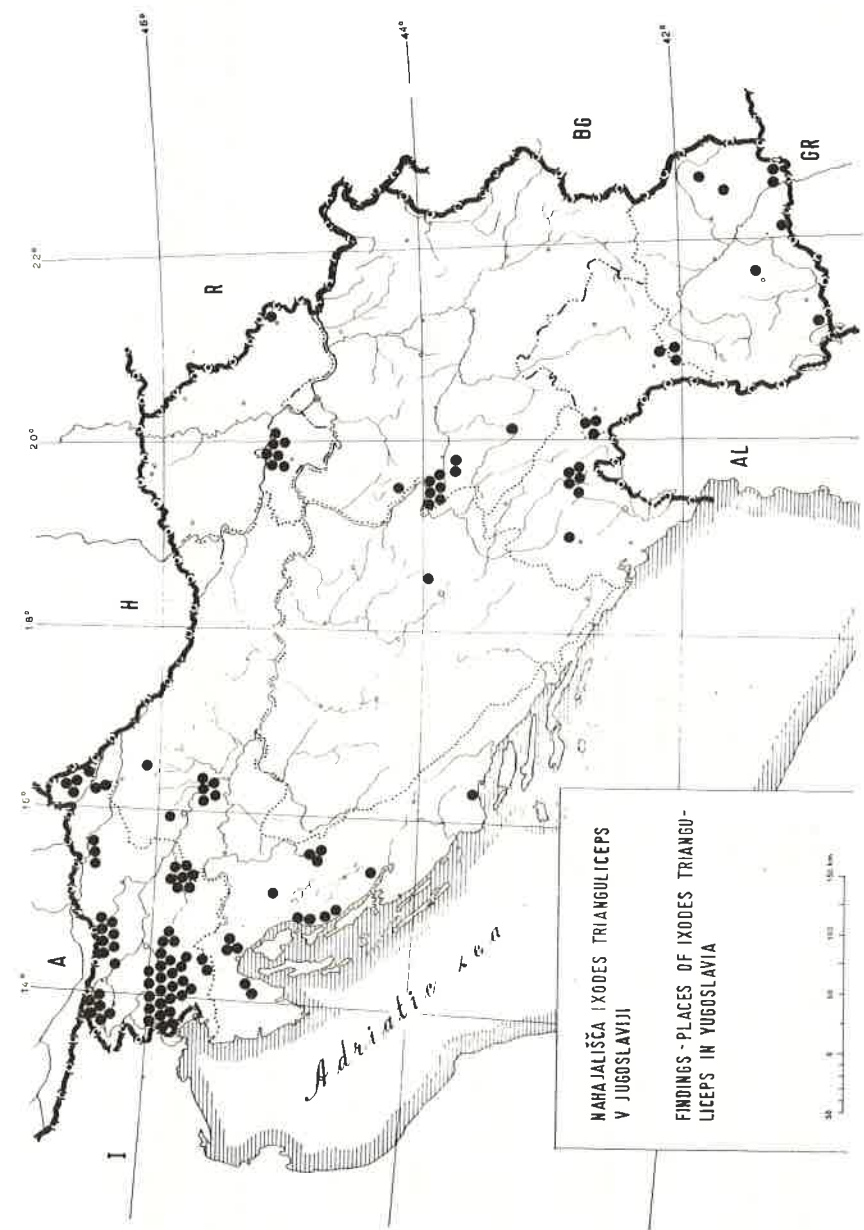


Figure 1. Horizontal distribution of *Ixodes trianguliceps* in Yugoslavia
Slika 1. Horizontalna razporeditev *Ixodes trianguliceps* v Jugoslaviji

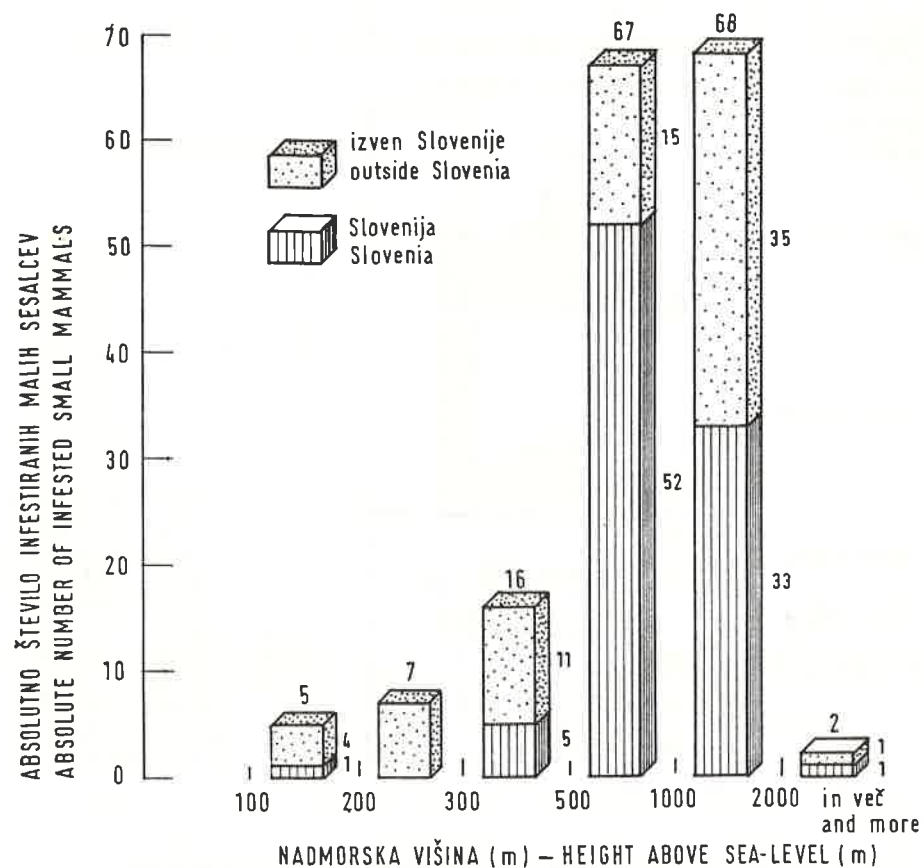


Figure 2. Graphic presentation of vertical distribution of small mammals infested by *Ixodes trianguliceps*
Slika 2. Grafični prikaz vertikalne razporeditve malih sesalcev infestiranih z *Ixodes trianguliceps*

which we consider as the principal determinant of the presence of *Ixodes trianguliceps*, is indirectly presented. (Fig. 3).

As already mentioned, the majority of infested animals come from heights of between 500 and 2,000 metres above sea-level, where we found the most intensive infestation to be during the period from April to October, when the small mammals infested with *Ixodes trianguliceps* were most numerous.

In heights above 2000 metres above sea-level we found small mammals infested with *Ixodes trianguliceps* in the month of July only, in lower areas from 100 — 500 metres the infestation of small mammals occurs practically throughout the year, and in winter, although in minimal numbers.

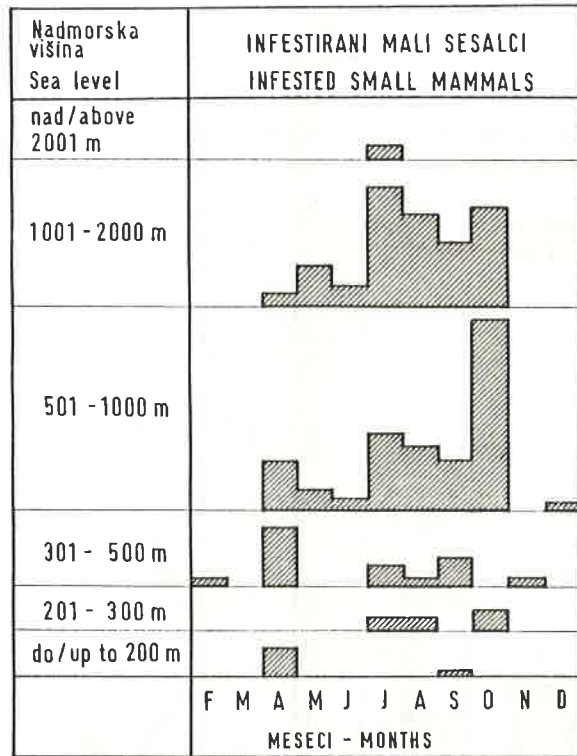


Figure 3. Seasonal distribution of small mammals infested by *Ixodes trianguliceps* regarding heights above sea-level of catch localities

Slika 3. Sezonska razporeditev malih sesalcev infestiranih z *Ixodes trianguliceps* glede na nadmorske višine krajev ulova

nus (1), *Apodemus flavicollis* (1) and *Clethrionomys glareolus* (2), in find sites at heights from 500 to 1200 metres, in April, May, and October.

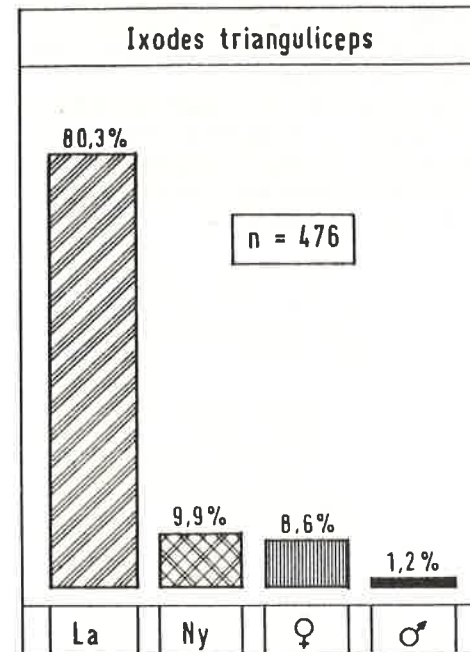


Figure 4. Growth structure of *Ixodes trianguliceps*
Slika 4. Vrstna struktura *Ixodes trianguliceps*

4. Growth structure of *Ixodes trianguliceps* and seasonal distribution of stages

The growth structure of *Ixodes trianguliceps* is presented in fig. 4., and in fig. 5 it is further analysed with a simplified scheme of seasonal tick distribution regarding the ascertained developmental stages.

- Larvae represent the majority of our identified material, and were continuously found on small mammals from February to December. The population peak of larvae quite evidently culminates in October.
- Nymphs occur from the period April—October.
- Adults are constantly present on small mammals from April to October.
- The majority of females was found as parasites in August and October on nine of the infested species of small mammals: *Sorex araneus* (1), *Apodemus agrarius* (1), *Apodemus sylvaticus* (3), *Apodemus flavicollis* (18), *Clethrionomys glareolus* (14), *Chionomys nivalis* (1), *Arvicola terrestris* (1), *Microtus arvalis* (1), *Pitymys lichtensteini* (1).
- The percentage of males in our material is relatively high, which, for the treated tick species, is on the whole not a regular phenomenon. Males were found on *Sorex alpi-*

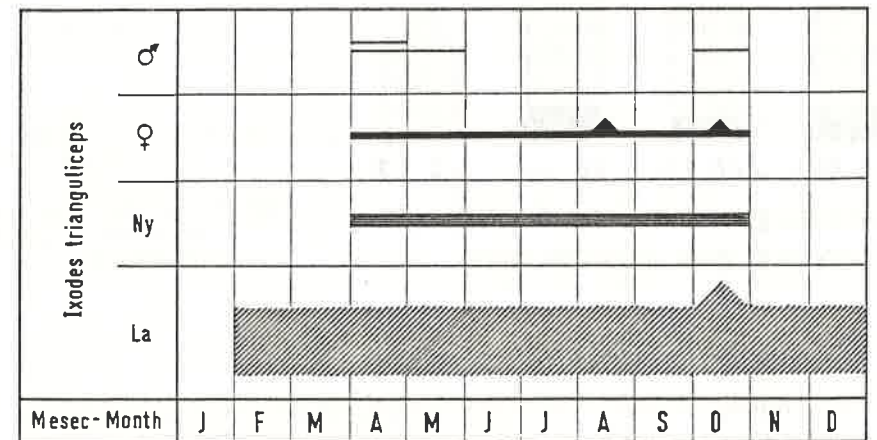


Figure 5. Scheme of seasonal distribution of *Ixodes trianguliceps* stages
Slika 5. Shema sezonske razporeditve stadijev *Ixodes trianguliceps*

5. The infestation intensity of small mammals by *Ixodes trianguliceps*

Ixodes trianguliceps was not established as a numerous parasite of small mammals; a single infested animal was usually a host to 1 — 5 larvae. The most highly infested were *Sorex alpinus*, with 16 ticks, and *Clethrionomys glareolus*, with 21 ticks, both trapped in October. Moreover all the remaining animals, if infested with a greater number of *Ixodes trianguliceps*, were found only during the period of mass tick occurrence.

Small infested mammals were arranged according to the intensity of their infestation at intervals of average values from 1,0 — 4,9 ticks per animal, according to the number of collected individuals and the number of corresponding species. The highest category of infestation with an average of 4,0—4,9 ticks, is occupied by only one species, *Sorex alpinus*. Most infested small mammals were found with 3,0 — 3,9 ticks per animal (Fig. 6).

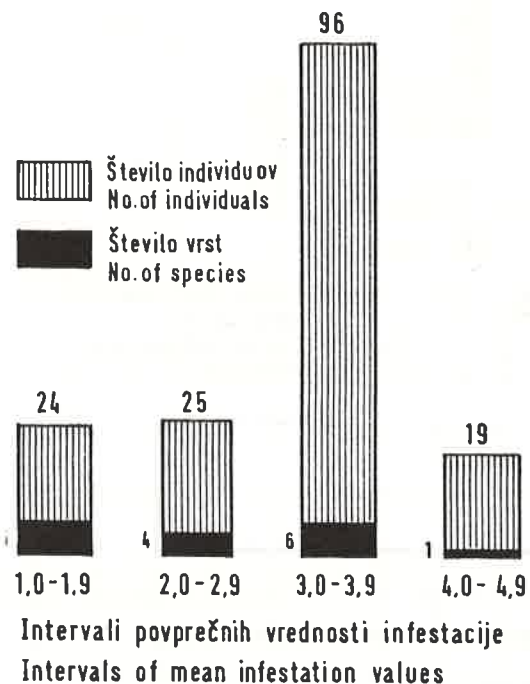


Figure 6. Infestation intensity of small mammals by *Ixodes trianguliceps*

Slika 6. Intenzivnost infestacije malih sesalcev z *Ixodes trianguliceps*

i. Small mammals, the hosts of *Ixodes trianguliceps*

Small mammals belonging to the 18 species which were hosts to *Ixodes trianguliceps*, were arranged in tables 2 and 3.

The species *Clethrionomys glareolus* was found to be infested with *Ixodes trianguliceps* in 23 %, followed by *Apodemus flavicollis* (20 %), *Sorex alpinus* (11,6 %), *Apodemus sylvaticus* (9,9 %), *Sorex araneus* (7,3 %) and others (Tab. 2).

Table 2. Survey of small mammals infested by *Ixodes trianguliceps*

Tabela 2. Pregled malih sesalcev infestiranih z *Ixodes trianguliceps*

Mali sesalci Small mammals Število infestiranih živali Number of infested animals	Slovenija Slovenia		izven Slovenije outside Slovenia		Jugoslavija (Skupno) Yugoslavia (Total)	
	Abs.	Rel. (%)	Abs.	Rel. (%)	Abs.	Rel. (%)
<i>Talpa europaea</i> Linnaeus, 1758	4	4,0	1	1,5	5	3,0
<i>Sorex araneus</i> Linnaeus, 1758	6	6,1	6	9,1	12	7,3
<i>Sorex minutus</i> Linnaeus, 1766	3	3,0	1	1,5	4	2,4
<i>Sorex alpinus</i> Schinz, 1837	17	17,2	2	3,0	19	11,6
<i>Neomys fodiens</i> Pennant, 1771	3	3,0	1	1,5	4	2,4
<i>Neomys anomalus</i> Cabrera, 1907	1	1,0	—	—	1	0,6
<i>Neomys</i> sp.	—	—	1	1,5	1	0,6
<i>Crocidura suaveolens</i> (Pallas, 1811)	3	3,0	—	—	3	1,8
<i>Glis glis</i> (Linnaeus, 1766)	4	4,0	—	—	4	2,4
<i>Apodemus agrarius</i> (Pallas, 1771)	—	—	6	9,1	6	3,6
<i>Apodemus sylvaticus</i> (Linnaeus, 1758)	10	10,1	6	9,1	16	9,9
<i>Apodemus flavicollis</i> (Melchior, 1834)	17	17,2	16	24,3	33	20,0
<i>Apodemus mystacinus</i> (Danford et Alston, 1877)	—	—	7	10,6	7	4,2
<i>Apodemus</i> sp.	—	—	1	1,5	1	0,6
<i>Clethrionomys glareolus</i> (Schreber, 1780)	25	25,3	13	19,8	38	23,0
<i>Chionomys nivalis</i> (Martins, 1842)	3	3,0	3	4,5	6	3,6
<i>Arvicola terrestris</i> (Linnaeus, 1758)	1	1,0	—	—	1	0,6
<i>Microtus arvalis</i> (Pallas, 1779)	—	—	1	1,5	1	0,6
<i>Pitymys lichtensteini</i> Wettstein, 1927	2	2,0	—	—	2	1,2
<i>Pitymys</i> sp. / ? <i>multiplax</i> (Fatio, 1905)	—	—	1	1,5	1	0,6
	99	99,9	66	100,0	165	100,0

The infestation analysis of individual species of small mammals for the whole of Yugoslavia is presented in table 3. Only data denoted in this table under the title "outside Slovenia" are specified in detail in the text which immediately follows.

- In the Adriatic region of Croatia, *Ixodes trianguliceps* was found on *Sorex alpinus*, *Apodemus sylvaticus*, *Apodemus flavicollis*, *Apodemus mystacinus*, *Clethrionomys glareolus* (Učka, Velebit, Kozjak);
- In continental regions of Croatia on *Sorex araneus*, *Apodemus agrarius*, *Apodemus sylvaticus*, *Apodemus flavicollis*, *Clethrionomys glareolus* (Lika, Vukomeričke gorice, the neighbourhood of Križevci);
- In Montenegro, on *Sorex araneus*, *Apodemus sylvaticus*, *Apodemus flavicollis*, *Clethrionomys glareolus*, *Chionomys nivalis* (Biogradsko jezero near Kolašin, Valovito jezero on Durmitor);
- In Vojvodina, on *Sorex minutus*, *Apodemus agrarius*, *Apodemus flavicollis*, *Clethrionomys glareolus* (Vršačke planine, Fruška gora);
- For Serbia we have data for mount Tara, and for *Talpa europaea*, *Neomys fodiens*, *Apodemus agrarius*, *Clethrionomys glareolus*, *Microtus arvalis*, *Pitymys* sp.;
- In Kosovo, *Sorex alpinus*, *Apodemus flavicollis*, *Clethrionomys glareolus*, *Neomys* sp. were found infested with *Ixodes trianguliceps*;
- In Macedonia, *Sorex araneus*, *Apodemus agrarius*, *Apodemus flavicollis* and *Chionomys nivalis* were infested.

All republics and both autonomous provinces are quoted in this paper as geographical and not as political units.

Tabela 3. Analiza infestacije malih sesalcev z Ixodes trianguliceps

GOSTITELJI HOSTS	SLOVENIJA SLOVENIA				IZVNEJ SLOVENIJE OUTSIDE SLOVENIA				SKUPNO V JUGOSLAVIJI TOTAL IN YUGOSLAVIA					
	ŠTEVILU ZBRANIH KLOPOV I. TRIANGULICEPS NUMBER OF COLLECTED TICKS I. TRIANGULICEPS		ŠTEVILU INFESTIRANIH ŽIVALI Z I. TRIANGULICEPS NUMBER OF INFESTED ANIMALS WITH I. TRIANGULICEPS		ŠTEVILU ZBRANIH KLOPOV I. TRIANGULICEPS NUMBER OF COLLECTED TICKS I. TRIANGULICEPS		ŠTEVILU INFESTIRANIH ŽIVALI Z I. TRIANGULICEPS NUMBER OF INFESTED ANIMALS WITH I. TRIANGULICEPS		ŠTEVILU ZBRANIH KLOPOV I. TRIANGULICEPS NUMBER OF COLLECTED TICKS I. TRIANGULICEPS		ŠTEVILU INFESTIRANIH ŽIVALI Z I. TRIANGULICEPS NUMBER OF INFESTED ANIMALS WITH I. TRIANGULICEPS			
	La	My	Ad	ALL TICS	La	My	Ad	ALL TICS	La	My	Ad	ALL TICS		
	SLOVENIJA SLOVENIA				IZVNEJ SLOVENIJE OUTSIDE SLOVENIA				SKUPNO V JUGOSLAVIJI TOTAL IN YUGOSLAVIA					
TALPA EUROPAEA	6	11		11	1	2		2	13			7	13	2.6
SOREX ARANEUS	6	19	6	25	6	9	3	13	12	28	9	1	10	3.2
SOREX MURTUS	3	11		11	1	1		1	1	1	1		7	3.0
SOREX ALPINUS	17	70	2	74	2	4		4	19	74	2	2	16	4.1
NEOMYS FODIENS	3	4	1	5	1	1		1	4	5	1		3	1.5
NEOMYS ANOMALUS	1	10		10					1	10			10	10.0
NEOMYS SP.					1	1		1	1	1	1		1	1.0
CROCIBURA SUAVEOLENS	3	7		7					3	7			3	2.3
GLIS GLIS	4	7		7					4	7			4	1.6
APODEMUS AGRARIUS					6	6	1	8	6	6	1	1	2	1.3
APODEMUS SYLVATICUS	10	26	2	30	6	6		1	16	32	2	3	4	3.7
APODEMUS FLAVICOLLIS	17	53	4	65	16	19	4	34	33	72	8	19	10	9.9
APODEMUS MYSTACINUS					7	23	2	25	7	23	2		7	3.6
APODEMUS SP.					1	1		1	1	1			1	1.0
CLETHRIONOMYS GLAREOLUS	25	80	7	98	13	1	9	16	38	81	16	17	21	14.0
CHIONOMYS MYALIS	3	3	1	4	3	2	2	5	6	5	3	1	2	9
ARYCOLA TERRESTRIS	1			1				1					1	1.0
MICROTUS ARVALIS					1	1	2	2	1	1	1	1	2	2.0
PITYMYS LICHTENSTEINI	2	7		7					2	7			4	3.5
PITYMYS SP.					1	1		1	1	1			1	1.0
SKUPNO - TOTAL	99	308	23	355	66	74	24	121	165	382	47	47	9.9	4.75
ABS %	86.8	6.5	6.7	100	51.2	19.8	19.0	100	80.2	9.9	9.9	100 %		

7. Associations of Ixodes trianguliceps with other tick species

The ascertained associations of *Ixodes trianguliceps* with other tick species refer to parasitising

- of the same host-animal at the same time,
- of different hosts inhabiting the same narrower or broader habitats, but being natural hosts of *Ixodes trianguliceps*.

Ad 1. On the same host-animal, besides *Ixodes trianguliceps*, only *Ixodes ricinus* Linnaeus was found, but small mammals infested by a uniform population of *Ixodes trianguliceps* without any concomitant *Ixodid* species, prevail in all areas of Yugoslavia. The pure population of *Ixodes trianguliceps* on small mammals was found in Slovenia to be 67,7 %, outside Slovenia, 84,2 %. Small mammals, found to be simultaneously infested with both *Ixodid* species, *Ixodes trianguliceps* and *Ixodes ricinus* are as follows: *Apodemus flavicollis* (12), *Clethrionomys glareolus* (10), *Sorex alpinus* (6), *Sorex araneus* (3), *Glis glis* (2), *Spodermus sylvaticus* (2) *Apodemus mystacinus* (1), *Neomys fodiens* (1), *Neomys anomalus* (1).

Ad 2. Only in territory outside Slovenia did we constantly find *Ixodes trianguliceps* also in localities where on some hosts typical for *Ixodes trianguliceps* some other concomitant species, not exclusively *Ixodes ricinus*, were present, as are *Dermacentor marginatus* in continental and coastal Croatia and in Montenegro, and *Haemaphysalis erinacei erinacei* in Macedonia.

Dermacentor marginatus Sulzer, nymphs found on:

- Microtus arvalis*, Peščenica, Turo polje (lowland-Croatia). 17. 7. 1974, leg. MSc. Nikola Tvrtković;
- Apodemus sylvaticus*, Predzid under Čelavec, Velebit, 800 m, 1. 8. 1975, leg. Savo Brelih and MSc. Nikola Tvrtković;
- Apodemus flavicollis*, Biogradsko jezero, 1100 m (Montenegro), 5. 5. 1967, leg. Dr. Boris Petrov.

Haemaphysalis erinacei erinacei Pavesi, nymphs found on:

- Apodemus mystacinus*, Babuna mountain above Prilep, 1100—1300 m, (Macedonia), 22. 4. 1971, leg. Dr. Boris Petrov.

Discussion

Of all the *Ixodid* ticks *Ixodes trianguliceps* is the most "cold-resistant" species and lives in the USSR even on the hinges of the Arctic Circle (KORENBERG and LEBEDOVA 1969). But it is also distributed in Europe, and in our opinion this tick has not been found only where it has not been looked for in accordance with the tick demands regarding environmental conditions. As this tick prefers a cool climate, it was found in Yugoslavia, as we anticipated, indeed most often high in the mountains where it is colder. On the basis of the collected data we can affirm with certainty that the tick is not a rare species in Yugoslavia, but is a common and rather frequent parasite of small mammals, — *insectivora* and *rodentia* —, of course, in selected habitats.

With the exception of Slovenia, from which we have most data, *Ixodes trianguliceps* was found nearly everywhere in Yugoslavia, including the extreme north-eastern parts, all

along the Adriatic coast and at the extreme southern margin of the country, on the Greek-Yugoslav border. We presume that *Ixodes trianguliceps* is equally present in mountainous southern Macedonia, as at least in the northern parts of Greece which border directly on SR Macedonia.

On the basis of our presented data we can include a large portion of Yugoslavia within the distribution area of *Ixodes trianguliceps*, and thus complete the data concerning the presence of this species in Europe. Because of the known ecological characteristics of *Ixodes trianguliceps*, the opinion of some leading investigators that this species is not present in Yugoslavia probably owing to its warmer climate predominated (KORENBERG and LEBEDOVA 1969), and moreover that the tick should not occur in Greece either. (GILOT et al. 1976).

The majority of small mammals infested with *Ixodes trianguliceps* were found at heights above sea-level from 500 to 2000 metres, while above 2000 metres small mammals are sporadically infested: in the Julian Alps we found the larvae on *Chionomys nivalis* and in Macedonia on *Sorex araneus*, both in July. Also, in the Kamnik Alps, we found *Ixodes trianguliceps* some time ago at the same heights bordering a snow field at the end of June, on *Sorex alpinus* (ROSICKÝ et al. 1961). Equally, small mammals are infested with *Ixodes trianguliceps* more frequently in highlands in the Swiss Alps land, the border being defined precisely from 1200 metres upwards. GRAF et al. (1979) found *Ixodes trianguliceps* at a height of 2400 metres. GILOT et al. (1976) recorded *Ixodes trianguliceps* even higher in the French Alps, between 2600 and 2700 metres. Gilot also cites that *Ixodes trianguliceps* is preserved in Mediterranean regions of France, but in the mountains, where there are suitable climatic conditions. This statement can be also extended to the entire Yugoslav Adriatic coast, where *Ixodes trianguliceps* was found to be present in the mountains only, the lowest place being above Split, not more than 470 metres above sea-level and also here in typical mountainous habitats.

In Switzerland GRAF et al. (1979) found *Ixodes trianguliceps* in association with *Ixodes ricinus* and *Dermacentor marginatus* up to a height of 1200 metres. Our *Ixodes trianguliceps* was found in identical habitats with *Dermacentor marginatus* in lowlands, but also up to 800 -- 1100 metres in Croatia and in Montenegro. In Macedonia we found *Ixodes trianguliceps* together with *Haemaphysalis erinacei erinacei* in identical habitats at heights between 1100 and 1300 metres.

Ixodes trianguliceps is a three-phasic tick species and completes its entire developmental cycle on *insectivora* and *rodentia*. Therefore it is detected with some difficulty, especially if ixodidologists first treat only the parasites of domestic animals, which was the case in Yugoslavia. Principal among the hosts of *Ixodes trianguliceps* are, according to our data, *Clethrionomys glareolus* and *Apodemus flavicollis* followed by *Sorex alpinus*, *Apodemus sylvaticus*, *Sorex araneus* and others. Similarly, in other countries the *Clethrionomys glareolus* is one of the principal hosts of *Ixodes trianguliceps*. Gilot et al. (1976) are of the opinion that this is because it inhabits areas covered with a high layer of grass or other vegetation, which besides nests and galleries for small mammals is the ideal living space for *Ixodes trianguliceps*. *Clethrionomys glareolus* is a known vagrant which constantly circulates on dry leaves and strewing, and gathers a number of parasites which it does not shake off. Authors quote that in France *Clethrionomys glareolus* is most heavily infested with this tick in mountainous regions. Mice, *Apodemus flavicollis*, *Apodemus sylvaticus* and different *Soricidae* are also infested heavily. In small mammals trapped in lowlands, the authors did not observe a significant difference between the infestation intensity of *Clethrionomys glareolus* and *Apodemus sylvaticus*.

Elsewhere and also in our material, the majority of *Ixodes trianguliceps* are larvae, an obvious consequence of the high mortality rate of the treated species. Most investigators did not find males of *Ixodes trianguliceps* on small mammals; we have six of them (1.2 %). GILOT et al. (1976) found as much as 22.3 % of males, which is most probably the consequence of the intensive investigation of ideal habitats.

Investigators in Europe connect *Ixodes trianguliceps* with the maintenance of Looping-ill virus and of tick-borne encephalitis (TBE) virus in the population of small mammals, (THOMPSON 1967, AESHLIMANN et al. 1970, SIXL et al. 1971, ČERNÝ 1975, KONOVALOV 1977), and also with the transmission of haemorrhagic fever with renal syndrome and tularemia (KORENBERG and LEBEDOVA 1969). *Ixodes trianguliceps* plays a role in the epidemiology of *Babesia microti* and perhaps also of Q fever (GRAF et al. 1979), but it never attacks people.

In our opinion *Ixodes trianguliceps* participates in the phenomenon of the spread of TBE endemic foci on hills and mountains in the Alpine regions of Slovenia, where the population morbidity owing to TBE in higher geographical positions was found to be even higher when compared with the lowland country. (TOVORNIK 1987). *Ixodes trianguliceps* spreads TBE virus among small mammals and it inhabits higher lying areas, therefore the ecological investigation of this tick presents one of the components of studying the cited epidemiologic phenomena, which is unique in the entire endemic region of TBE in Central Europe.

Conclusions

The investigation treats the bionomy of *Ixodes trianguliceps*, and contributes to the knowledge of *Ixodid* fauna in Slovenia and Yugoslavia.

1. This tick is a rather frequent species, especially in the mountainous regions of Yugoslavia, where it lives as a parasite on small mammals, — *insectivora* and *rodentia* —. Among 165 small mammals infested with *Ixodes trianguliceps*, 81.8 % of animals came from places lying between 500 and 2000 metres above sea-level, 1.2 % coming from above 2000 metres. Only 17 % of the infested animals came from below 500 m, although from this height range we collected the greatest number of small mammals, which all, however, are not discussed in this article.
2. 18 species of small mammals were found to be infested with *Ixodes trianguliceps*, among them *Clethrionomys glareolus* in 23 %, *Apodemus flavicollis* in 20 %, *Sorex alpinus* in 11.6 %, *Apodemus sylvaticus* in 9.9 %, *Sorex araneus* in 7.3 %.
3. 60 % of the infested mammals are from Slovenia and 40 % from other Yugoslav republics and provinces, primarily from mountainous and hilly regions.
4. As we found this tick species in Macedonia close to the border with Greece, we are of the opinion that the mountainous regions of this Mediterranean country are also included in the distribution area of *Ixodes trianguliceps*. Thus, all the mountainous regions of the Balkan Peninsula can be attached to the vast Eurasian distribution area of *Ixodes trianguliceps*.
5. That the Balkan Mediterranean countries are included in the distribution area of *Ixodes trianguliceps* can also be concluded from the fact that the tick lives all along the Yugos-

lav Adriatic coast, where it avoids the unsuitable Mediterranean climate by ascending to the higher regions of the littoral mountains.

6. Small mammals are infested with larvae of *Ixodes trianguliceps* throughout the year, with nymphs and adults only in warmer months.
7. The growth structure of 476 identified *Ixodes trianguliceps* shows 382 (80.2 %) larvae, 47 (9.9 %) nymphs, 41 (8.6 %) females and 6 (1.2 %) males.
8. Small mammals were parasitized in 67.7 % (Slovenia), in 84.2 % (outside Slovenia) by a uniform population of *Ixodes trianguliceps*; the remaining animals were parasitized by *Ixodes trianguliceps* in coexistence with *Ixodes ricinus*.
9. Only in continental and littoral Croatia and Montenegro *Ixodes trianguliceps* was found in some habitats together with immature forms of *Dermacentor marginatus*, and in Macedonia together with *Haemaphysalis erinacei erinacei*.
10. TBE foci spread in Slovenia from the lowlands towards mountain peaks. *Ixodes trianguliceps*, which is the proven vector of TBE virus, is also a frequent inhabitant of higher lying geographic areas in the TBE endemic areas of Slovenia. We are therefore of the opinion that *Ixodes trianguliceps* also maintains, and above all increases the circulation of TBE virus in the cited areas among small mammals, on which it regularly lives as a parasite.
11. It is established that people occupying the higher regions of Slovenia fall ill, owing to the contact with TBE virus. We believe that, besides *Ixodes ricinus*, *Ixodes trianguliceps* is one of the factors which contribute to this specific epidemiologic phenomenon in the Alpine regions of Slovenia, although it does not directly attack people.

Acknowledgement

The majority of *Ixodes trianguliceps* ticks were collected by terriologists during their field work on micromammalia, and all are cited by name in the publication issued. The supply of all the collected ectoparasites belonging to different arthropod groups was organized and coordinated by Savo Brelih, executive curator. I take this opportunity to thank them all most sincerely.

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Povzetek

Med množico pregledanih malih sesalcev, zbranih največ v Sloveniji, vendar tudi drugod v Jugoslaviji, smo na 165 žužkojedih (*Insectivora*) in glodavcih (*Rodentia*) ugotovili klopa *Ixodes trianguliceps* (Birula). Mali sesalci, ki jih je ta klop zajedal, so bili najštevilnejši v višje ležečih geografskih predelih, od 500 — 2000 metrov nadmorske višine, posamični so bili najdeni celo višje od 2000 metrov nadmorske višine. Klop namreč živi do tistih nadmorskih višin, kjer planine še naseljujejo mali sesalci.

Zbrali smo 476 klopov *Ixodes trianguliceps*, med katerimi prevladujejo ličinke — 382 (80,2 %), slede jim nimfe — 47 (9,9 %), samice — 41 (8,6 %) in samci — 6 (1,2 %).

Ugotavljamo razporeditev klopa *Ixodes trianguliceps* v Jugoslaviji glede na njegovo prostorsko in višinsko prisotnost z upoštevanjem nadmorske višine krajev ulova. Proučujemo sezonsko distribucijo klopa v posameznih intervalih nadmorskih višin, naravne gostitelje klopa, med katerimi sta na prvem mestu *Clethrionomys glareolus* in *Apodemus flavicollis*, intenzivnost infestacije malih sesalcev s tem klopom in asociacije klopa z drugimi vrstami *Ixodid* v raznih geografskih področjih Jugoslavije.

Nahajališča klopa *Ixodes trianguliceps*, ugotovljena v Sloveniji, v severovzhodni Srbiji, v južni Makedoniji v mejnem pogorju z Grčijo, ter v pogorju, ki poteka vzdolž jugoslovanske jadranske obale, podajamo kot ključna, ker naj bi bile to naše ekstremne zaznamovalne točke oziroma črte, ki uokvirjajo ozemlje Jugoslavije, ki ga lahko v celoti vključimo v areal distribucije za klopa *Ixodes trianguliceps*. To ugotovitev poudarjamo zato, ker klop doslej tu še ni bil registriran, predvsem ne v južnih in obmorskih predelih Jugoslavije, pa tudi zato, ker je vrsta naravno povezana z dosti hladnejšimi pokrajinskimi predeli. Vendar menimo, da moremo na osnovi naših zbranih in navedenih podatkov priključiti ogromnemu evroazijskemu arealu razširjenosti vrste *Ixodes trianguliceps* tudi še dodatne, predvsem višje gorske predele južnega Balkana.

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