

ANOPHELINES (DIPTERA, CULICIDAE) IN GRUŽA, LEVAČ AND TEMNIĆ, SERBIA

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A total of five anopheline species were found in dwellings and domestic animal shelters in three neighbouring hilly areas of Serbia, namely: Gruža, Levač and Temnić. *Anopheles plumbeus* and *A. atroparvus* were extremely rare species. *A. messeae* was a predominant species at only one site. *A. claviger* was a moderately common species while *A. maculipennis* was by far the most abundant and predominant species in Gruža, Levač and Temnić.

INTRODUCTION

The hilly and mountainous areas of Serbia are free of malaria (Guelmino, 1950). Probably therefore the anopheline vectors of malaria were not examined before in Gruža, Levač and Temnić, which are three neighbouring hilly areas in central Serbia. Malaria was eradicated in Yugoslavia after World War II (Popović, 1963). However, there is another good reason for examining anophelines in this country. An unidentified virus was recently recovered out of anopheline mosquitoes of the *maculipennis* complex, collected in Serbia (Gligić and Adamović, 1976).

AREA EXAMINED

The field examinations were carried out in an area consisting of three neighbouring parts, namely: Gruža, Levač and Temnić, in Serbia. This is a hilly area lying between latitudes 43° 35' and 44° 00' north, and between longitudes 20° 35' and 21° 25' east of Greenwich. The area is bordered by the valley of the river Velika Morava on the east and the valley of the river Zapadna Morava on the south. These lowlands give place to an area of hills and low mountains towards the north-west. Three mountains rise above the surrounding hilly plateau of this area, namely: Kotlenik (748 m), Gledičke Planine (922 m), and Juhor (773 m). The valleys of the rivers Gruža, Lugomir, Dulenska and Kalenićska with many narrow tributary valleys are situated in this area. The plains of the rivers Velika

Morava, Zapadna Morava, Gruža and Lugomir consist of recent alluvial deposits. Brown forest soils and smonitza soils are found in the hilly area while acid, brown and podzolic soils are found in the mentioned mountains (Nejgebauer et al., 1961). Gruža, Levač and Temnić experience a modified continental climate, which is moderately warm and humid. The lowest average temperature is in January, ranging from -0.8°C (Kruševac) to -0.2°C (Kragujevac). The highest average temperature is in July, ranging from 22.1°C (Kruševac) to 22.4°C (Kragujevac). The mean annual rainfall ranges from 639 mm (Kruševac) and 660 mm (Rekovac) to 1500 mm (mount Gledičke Planine). The main maximum of rainfall is in May and the main minimum in February (Milosavljević, 1948).

MATERIAL AND METHODS

Anopheline mosquitoes were collected at eight sites situated in Gruža, Levač and Temnić, during 1983 and 1984. A total of 2419 anopheline females was taken in dwelling houses and domestic animal shelters, using the technique described in detail in a previous paper (Adamović, 1980). The number of females taken per site ranged from 265 (Belušić) to 329 (Trnava), with an average of 302 collected females. The samples appear to be large enough for valid comparison.

RESULTS

Five anopheline species were identified among the examined insects and batches of eggs, namely: *Anopheles plumbeus* Stephens 1829, *Anopheles claviger* Meigen 1804, *Anopheles maculipennis* Meigen 1818, *Anopheles messeae* Falleroni 1926, and *Anopheles atroparvus* Van Thiel 1927.

Anopheline females of the species *A. plumbeus* were recorded at the following two sites: Belušić (3 females or 1.4%) and Planinica (3 females or 1.3%). The species *A. claviger* was found at 5 sites or 62.5% of the eight examined sites. A total of 194 females of this species was collected. The relative abundance of this species ranged from 8.0% (Selište) to 24.7% (Belušić), with an average of 9.8%.

All other females (2219 or 91.7%) were of indoor resting anopheline three neighbouring parts, namely: Gruža, Levač and Temnić, in Serbia. This 1789 females deposited eggs suitable for identification, or 80.6% of the total of 2219 females. The number of females identified per site ranged from 162 (Belušić) to 287 (Trnava), with an average of 224 identified females. Three sibling species of the *maculipennis* complex, namely: *A. maculipennis*, *A. messeae* and *A. atroparvus*, were identified on the basis of the examined batches of eggs deposited in captivity. The distribution of the anopheline species in Gruža, Levač and Temnić is shown in a sketch map (Figure 1), while the complete data concerning the abundance of these species are summarized in Table 1.

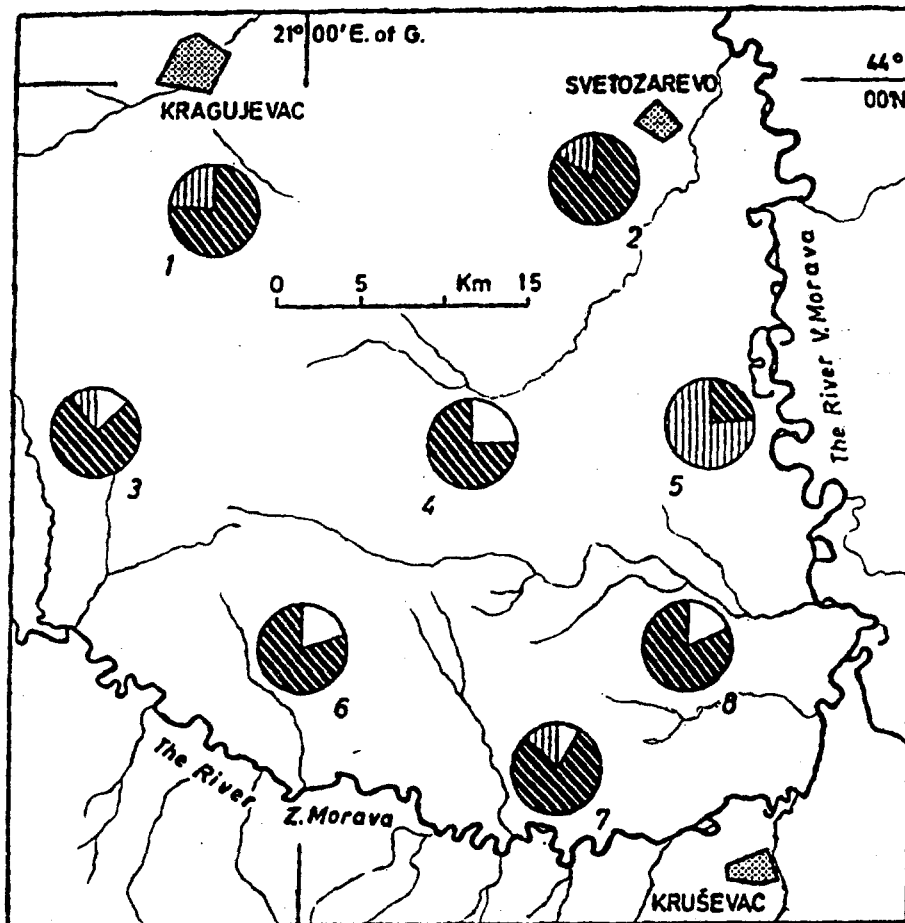


Figure 1. A sketch map showing the distribution and relative abundance of the anopheline species *Anopheles claviger* (white), *Anopheles maculipennis* (black) and *Anopheles messeae* (striped), at the following sites examined in Gruža, Levač and Temnić, Serbia: 1 — Grošnica, 2 — Trnava, 3 — Vitkovac, 4 — Belušić, 5 — Raševica, 6 — Planinica, 7 — Selište, 8 — Bačina (Original).

The species *A. maculipennis* s.str. was found at all the sites examined. It was by far the most abundant and predominant species at seven of the eight sites investigated. The relative abundance of this species ranged from 24.2% (Raševica) to 81.9% (Bačina) and 82.2% (Trnava), with an average of 71.4%. The relative abundance of *A. messeae* ranged from 9.4% (Vitkovac) to 75.8% (Raševica), with an average of 18.4%. Three specimens of the species *A. atroparvus* were recorded at only one site (Trnava) out of eight sites investigated in Gruža, Levač and Temnić.

In addition, the following four culicine mosquito species were recorded in the domestic animal shelters together with the anopheline mos-

Table 1. The number of identified females of the Anopheles species and the number and percentage (figures in brackets) of the five species examined in Gruža, Levač and Temnić, Serbia, 1983 and 1984.

SITES	Number of identified females					Number and percentage of five Anopheles species				
	plumbeus	claviger	maculipennis	messeae	atroparvus	plumbeus	claviger	maculipennis	messeae	atroparvus
Grošnica	252	0 (0.0)	0 (0.0)	191 (75.8)	61 (24.2)	0 (0.0)				0 (0.0)
Trnava	287	0 (0.0)	0 (0.0)	236 (82.2)	48 (16.9)	3 (1.1)				3 (1.1)
Vitkovac	243	0 (0.0)	31 (12.8)	189 (77.8)	23 (9.4)	0 (0.0)				0 (0.0)
Belušić	219	3 (1.4)	54 (24.7)	162 (73.9)	0 (0.0)	0 (0.0)				0 (0.0)
Raševica	265	0 (0.0)	0 (0.0)	64 (24.2)	201 (75.8)	0 (0.0)				0 (0.0)
Planinica	224	3 (1.3)	45 (20.1)	176 (78.6)	0 (0.0)	0 (0.0)				0 (0.0)
Selište	261	0 (0.0)	21 (8.0)	207 (79.3)	33 (12.7)	0 (0.0)				0 (0.0)
Baćina	238	0 (0.0)	43 (18.1)	195 (81.9)	0 (0.0)	0 (0.0)				0 (0.0)
TOTAL	1989	6 (0.3)	194 (9.8)	1420 (71.4)	366 (18.4)	3 (0.1)				3 (0.1)

quitoes: *Culiseta annulata* Schrank 1776 (Grošnica, Trnava, Selište and Bačina), *Mansonia richiardii* Ficalbi 1889 (Grošnica, Raševica and Selište), *Aedes sticticus* Meigen 1838 (Vitkovac and Raševica), *Aedes vexans* Meigen 1830 (Grošnica, Trnava, Vitkovac and Selište), and *Culex pipiens* Lin-

DISCUSSION

A. plumbeus was an extremely rare anopheline mosquito in the examined sites. According to Pavišić (1949) this species is not a rare anopheline in the forests of Yugoslavia. The main breeding site of this species is the water of the rot-holes in old trees. It was also a rare anopheline in the domestic animal shelters examined previously in the neighbouring hilly areas, Kačer and Takovo (Adamović, 1982). The species *A. claviger* was more widely distributed and more abundant in the domestic animal shelters than the former anopheline species. It was found at five of the eight sites examined, with an average relative abundance of 9.8%. *A. claviger* was a common species at Planinica and Belušić. This species appears to be widely distributed in Yugoslavia. It was found locally as a common species resting indoors in Macedonia (Guelmino, 1928; Adamović, 1981) and Serbia (Adamović, 1984).

The anopheline *A. maculipennis* was by far the most abundant species during the present examination in the area of Gruža, Levač and Temnić. The species was previously recorded as a prevailing anopheline in the area of Jasenica and Lepenica, which are situated north of Gruža and Levač (Adamović, 1983). Anopheline females of the species *A. messeae* were found at five of the eight sites examined in Gruža, Levač and Temnić. It was not recorded at the following three sites: Belušić, Planinica and Bačina, which are situated in the hilly part of the examined area. The species was found at the sites located in the valleys of the rivers Grošnica, Belica, Gruža and Zapadna Morava. *A. messeae* was the predominant species only at the village of Raševica, which is situated in close proximity to some oxbow swamps in the valley of the river Velika Morava (Figure 1). This is in close agreement with the previous finding of *A. messeae* as a prevalent species in the valley of the river Velika Morava (Adamović and Sitar, 1977). The third species of the *maculipennis* complex, *A. atroparvus*, was found at the village of Trnava (Table 1). This village is situated in the valley of the river Belica, which is a tributary of the Velika Morava. *A. atroparvus* is an abundant species in the area with saline and alkaline soils in Serbia (Adamović, 1980). There are no such conditions in the hilly areas of Gruža, Levač and Temnić. The anopheline *A. maculipennis* predominates in these areas because this is an ubiquitous species.

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REFERENCES

- Adamović, Z. 1980. Über die Verbreitung und Bevölkerungsdichte von *Anopheles atroparvus* Van Thiel (Dipt., Culicidae) in Serbien und Mazedonien, Jugoslawien. *Anzeiger Schädlingskde., Pflanzenschutz, Umweltschutz (Berlin und Hamburg)* 53, 83—86.
- Adamović, Z. 1981. Anopheline populations (Diptera, Culicidae) in east Macedonia, Yugoslavia. *Bulletin T. LXXV de l'Académie Serbe des Sciences et des Arts, Classe*

- Adamović, Z. 1982. Distribution and relative abundance of the anophelines (Diptera, Culicidae) in Kačer and Takovo, Serbia. *Bulletin T. LXXXII de l'Académie Serbe des Sciences et des Arts Classe des Sciences naturelles et mathématiques Sciences naturelles*, 23, 97—104.
- Adamović, Z. 1983. Anopheline species (Diptera, Culicidae) in Jasenica and Lepenica, Serbia. *Glasnik Prirodnjačkog muzeja (Beograd)*, B 38, 81—88.
- Adamović, Z. 1984. The anopheline populations (Diptera, Culicidae) in the Požega depression and the Moravica valley, Serbia. *Ekologija (Beograd)*, in press.
- Adamović, Z. and Sitar, A. 1977. The species of the mosquitoes (Diptera, Culicidae) collected in Pomoravlje, Serbia. *Acta Veterinaria (Beograd)*, 27, 245—255.
- Guelmino, Dj. 1928. Beitrag zum Studium der Biologie der Anophelen in Mazedonien. *Archiv Schiffst- und Tropicen-hygiene (Leipzig)* 32, 87—91.
- Guelmino, Dj. 1950. Problem of Malaria in Serbia. SAN, *Monograph, CLXVIII, Section Medicine (Beograd)* 2, 1—66.
- Gligić, A. and Adamović, Z. 1976. Isolation of Tahyna virus from *Aedes vexans* mosquitoes in Serbia. *Mikrobiologija (Beograd)* 13, 119—129.
- Milosavljević, M. 1948. Relation de température et pluie dans la République Nationale de Serbie. *Godišnjak Poljoprivredno-šumarskog fakulteta (Beograd)* 1, 149—222.
- Nejgebauer, V., Čirić, M. and Živković, M. 1961. Commentary on the Soil map of Yugoslavia, scale 1:1.000.000. *Jugoslovensko društvo za proučavanje zemljišta (Beograd)* 8, 1—107.
- Pavišić, V. 1949. *Anopheles nigripes* Staeg. *Higijena (Beograd)* 1, 253—272.
- Popović, D. 1963. Malaria, its control and implementation of malaria eradication campaigns in Serbia. *Narodno zdravlje (Beograd)* 19, 97—102.

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SADRŽAJ

Gruža, Levač i Temnić, tri susedna brdsko-planinska područja Srbije, bila su uglavnom pošteđena od malarije i pre eradikacije ove bolesti u našoj zemlji. To je verovatno bio razlog što anofeline, vektori uzročnika malarije, nisu od sada bile ispitivane u tri pomenuta područja. U ovom radu su izneseni i komentarisani prvi podatci o rasprostranjenju i relativnoj brojnosti vrsta roda *Anopheles* u ovom delu Šumadije. U stanovima i stajama za domaću stoku nađeno je ukupno pet vrsta ovog roda, koje su potencijalni vektori ljudskog *Plasmodium-a* i arbovirusa. Vrste *A. plumbeus* i *A. atroparvus* bile su krajnje retke. Vrsta *A. messeae* je dominirala samo u selu Raševica u močvarnom delu doline Velike Morave. *A. claviger* je bila umereno česta vrsta dok je vrsta *A. maculipennis* dominirala u sedam