HABITAT DISTRIBUTION AND BIOGEOGRAPHICAL FEATURES OF THE ODONATA IN THE DURMITOR RANGE, MONTENEGRO*

Ž.R. ADAMOVIĆ[1], Lj. ANDJUS[2] and Lj. MIHAJLOVIĆ[3]
[1] Institute for Medical Research, P.O. Box 721, YU-11001 Beograd, Serbia
[2] Natural History Museum, Njegoševa 51, YU-11000 Beograd, Serbia
[3] Faculty of Forestry, Kneza Višeslava 1, YU-11030 Beograd, Serbia

Abstract – 27 spp. are at present known from the Durmitor range. 23 of these are here recorded from a sphagnum peat bog, 2 lakes and 2 streams (alt. 750-1495 m), and commented upon in terms of the "Representative Spectrum of Odonata Species" (RSO) of E. SCHMIDT (1985, *Odonatologica* 14: 127-133). The bulk (44.5%) of the Durmitor fauna consists of 12 Euro-Siberian spp. that are common, or moderately common in the sites examined.

Introduction

The Durmitor range is a National Park of Montenegro. The systematic field research of its fauna commenced in 1980 (NONVEILLER, 1984). As far as Odonata are concerned, 2 ♂ of *Somatochlora metallica* have been previously recorded in the area of Durmitor by ADAMOVIĆ (1948), and 14 more species have been listed by ANDJUS & ADAMOVIĆ (1985).

This paper comments on the "Representative

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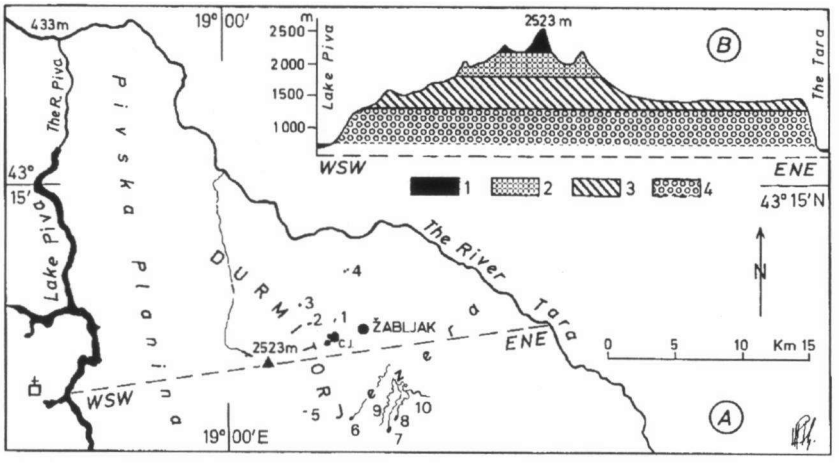


Fig. 1. [A] A sketch map showing the area of Durmitor, with some of the sites examined, namely: C.J.: Crno Jezero; – 1: Barno Jezero; – 2: Zminje Jezero; – 3: Malo Jezero; – 4: Govedja Jezera; – 5: Valovito Jezero; – 6: Pošćensko Jezero; – 7 Vražje Jezero; – 8: Riblje Jezero; – 9: the Bijeli Potok; – 10: Žugića Bare. – [B] The altitudinal zonation of vegetation, from WSW (Pivski Manastir) over the highest peak Bobotov Kuk (2523 m) to ENE (Djurdjevića Tara), namely: 1: alpine turf vegetation and high mountain heathland vegetation; – 2: alpine low pine forest of *Pinus mughus*; – 3: boreal coniferous forests, and – 4: various deciduous forests. – (After LAKUŠIĆ, 1984; very simplified).

Spectra of Odonata Species" (RSO; SCHMIDT, 1985) of some distinctive habitats, and on the biogeographical patterns of the species recorded.

Study area

The Durmitor range is situated between the Piva and Tara rivers (18°50'-19°28'E; 42°57'-43°22'N), in NW Montenegro. The lowest point is at the confluence of these rivers (alt. 433 m). The steep slopes of the river canyons rise sharply to two plateaux, Pivska Planina to the W, and Jezera to the E, at an average altitude of 1450 m. The central massif of Durmitor rises between these two plateaux. It is a group of high and dense ridges, divided by deep hollows and dales, which were glacial cirques and troughs, respectively, during the Pleistocene glaciations (CVIJIĆ, 1899). The massif is broken up into 48 peaks higher than 2000 m; the highest of these is Bobotov Kuk (alt. 2523 m). The Durmitor area is mostly made of the Mesozoic limestones and of the Late Cretaceous and Early Tertiary flysh, but some other (clastic and eruptive) rocks are also represented (BEŠIĆ, 1969).

The plateau, Jezera (= "lakes"), is particularly interesting for the odonate distribution. In the Durmitor area, BEŠIĆ (1969) mentioned 19 lakes by name, and classified them into groups according to the manner in which glaciers were involved in their origin. The majority of the lakes is situated in the altitudinal zone of the boreal, mainly coniferous forests (LAKUŠIĆ, 1984).

According to MILOJEVIĆ (1951), three climatic types occur in the area, viz. the temperate continental climate in canyons (alt. 450-700 m), the mountain climate on the plateaux (alt. 1300--1500 m), and the alpine climate in the central massif (alt. 2200-2523 m).

Methods

Adult dragonflies were netted in 25 locations, on windless, sunny days, from 9.00 till 15.00 h. In order to gather the RSO data, the relative abundance and reproductive behaviour were regularly recorded at the 5 characteristic habitats in July and August, during 1989-1992.

Habitats examined

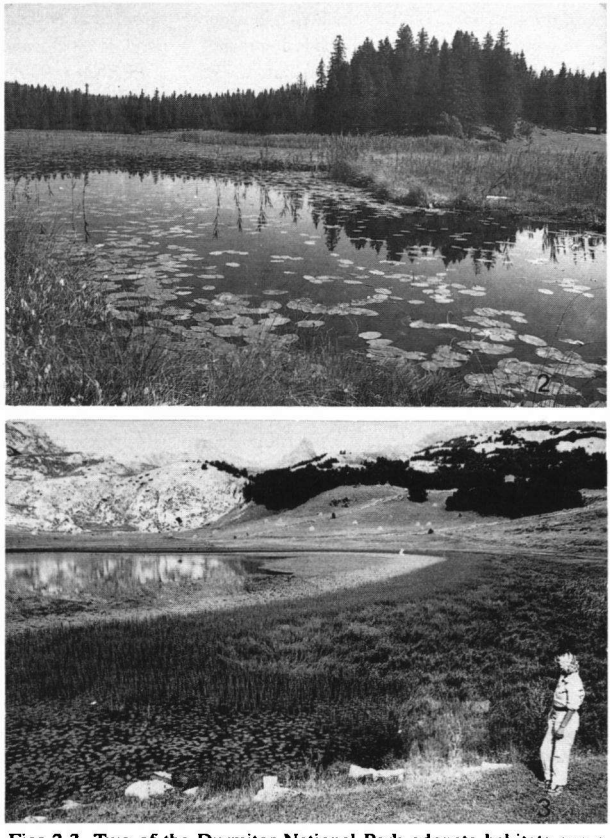
(1) B a r n o J e z e r o – the sphagnum peat bog (18000 m²; 2 m deep; pH 5.0-5.8) in a shallow depression among moraines at 1489 m (Fig. 2). The well-developed littoral raft consists mainly of *Sphagnum contortum* and *Scorpidium scorpioides*. On the edge of the floating raft, *Phragmites australis* is joined by *Carex gracilis*, four other *Carex* spp., *Menyanthes trifoliata* and *Potentilla palustris*. A "carpet" of *Drepanocladus revolvens, Acrocladium trifarium*, several *Carex* spp., *Juncus alpinus, Eriophorum latifolium, Molinia coerulea*, and many other plant species, is found on the organic black, wet substratum (BIRKS & WALTERS, 1973).

(2) P o š ć e n s k o J e z e r o – the lake (15300 m²; 3.6 m deep; pH 7.4) situated in a broad, shallow hollow at the end of a glacial trough at 1495 m. The open water is enclosed by a floating ring of *Potamogeton natans*, and another one of *Nuphar luteum*. The broad, littoral belt of emergent vegetation is dominated by *Typha latifolia, Equisetum palustre* and *Carex rostrata* (Fig. 3).

(3) R i b l j e J e z e r o – the lake (42400 m²; 5.5 m deep; pH 7.3) situated in a shallow depression on the plateau Jezera, at 1409 m (ŽUNJIĆ, 1970). Clumps of submergent plants *Potamogeton lucens, P. crispus, P. mucronatus* and *Ranunculus trichophyllus* are found here and there in the water. Emergent vegetation consists of *Phragmites australis, Schoenoplectus lacuster, Juncus glaucus, Galium palustre*, and several *Carex* species.

(4) B i j e l i P o t o k – one of several brooks of clean water meandering through luxuriant hay meadows and, partly, swampy meadows with *Carex rostrata*, on the plateau Jezera, at about 1400 m.

(5) B i s t r i c a – the left-bank tributary stream



Figs 2-3. Two of the Durmitor National Park odonate habitats examined: (2) the sphagnum peat bog, Barno Jezero, situated in a shallow depression among moraines, at 1489 m: *Leucorrhinia dubia* is confined to this locality [Photo: Z. Adamović, August 11, 1989]; – (3) the swampy lake, Pošćensko Jezero, situated in a broad, shallow hollow at the end of the glacial trough Dobri Dol, at 1495 m: *Lestes dryas* and 12 other species occur there [Photo: Z. Adamović, August 15, 1989].

of the river Tara. The Bistrica is rich in water flowing through a forest, which is dominated by *Alnus glutinosa*. It enters the Tara at 750 m.

Results and discussion

The additional 12 species, recorded during the present study, bring the number of dragonflies known to occur in the Durmitor range up to 27 species. The distribution, relative abundance and reproductive behaviour of the 23 species observed in the 5 characteristic habitats, are summarized in Table I. The remaining 4 species have been recorded at Poščenska Bara, a large, clean water pond, at an elevation of 890 m.

PRENN (1930) considered *L. dubia* a stenotopic species, confined in the Alps to sphagnum peat bogs. In the Durmitor National Park, this species, indeed, is restricted to Barno Jezero, a sphagnum peat bog where it regularly breeds in numbers. The other 12 species breed in the same locality and in some other, non-sphagnum lakes. Two of them, *L. dryas* and *S. metallica*, are particularly abundant at other lakes, where they also breed.

The assemblage of species breeding regularly

Table I – Distribution, relative abundance and reproductive behaviour of Odonata examined in five characteristic habitats in the Durmitor NP, Montenegro, from 1989 till 1992. Habitats: (1) Barno Jezero; – (2) Poščensko Jezero; – (3) Riblje Jezero; – (4) Bijeli Potok; – (5) Bistrica. – [A: common species; – M: moderately common; – R: rare; – E: extremely rare; – –: presence of species not established; – c: copulation noticed; – o: oviposition observed; – e: emergence observed and/or exuviae found; – t: teneral specimens collected]

Species	Habitats 1	2	3	4	5
Leucorrhinia dubia	M coet	–	–	–	–
Cordulia aenea	M coe	R co	–	–	–
Libellula quadrimaculata	M coet	R c	–	–	–
Coenagrion hastulatum	E t	M co	–	–	–
Pyrrhosoma nymphula	R	M cot	–	–	–
Coenagrion puella	R co	M c	E	–	–
Aeshna juncea	A coet	A co	R	–	–
Aeshna grandis	M co	M co	R	–	–
Aeshna cyanea	R co	M co	E	–	–
Somatochlora metallica	M c	M co	R	R	–
Lestes sponsa	A cot	A co	M co	R	–
Lestes dryas	M co	A co	A coet	R	–
Enallagma cyathigerum	A cot	A co	M c	R	–
Sympetrum flaveolum	A cot	A co	M co	R	–
Sympetrum striolatum	–	–	E c	–	–
Lestes virens	–	–	E t	–	–
Platycnemis pennipes	–	–	–	E t	–
Calopteryx splendens	–	–	–	E c	–
Calopteryx virgo	–	–	–	R co	–
Onychogomphus forcipatus	–	–	–	A co	–
Tarnetrum fonscolombei	–	–	–	R	M co
Aeshna mixta	–	–	–	–	E
Thecagaster bidentata	–	–	–	–	E

Ischnura elegans, Anax imperator, Platetrum depressum and *Sympetrum sanguineum* have been recorded at an additional habitat, the pond Poščenska Bara, at 890 m.

in the Barno Jezero sphagnum peat bog is similar to the fauna of the sphagnum peat bogs and some other oligotrophic moors in the Central European mountains (cf. SCHMIDT, 1967). Using Schmidt's grouping, *L. sponsa, C. hastulatum, E. cyathigerum, A. juncea, C. aenea, L. quadrimaculata* and *L. dubia* are the characteristic taxa of the Barno Jezero sphagnum peat bog. *C. puella, P. nymphula, A. grandis, A. cyanea* and *S. flaveolum* are sphagnum tolerant species, while *L. dryas* and *S. metallica* are foreign to the sphagnum peat bog habitat of Barno Jezero.

C. virgo and *O. forcipatus* breed regularly in the Bijeli Potok, and in some other streams on the Jezera plateau, at about 1400 m. Taking into account the ecological features of the Bistrica, *T. bidentata* seems to breed regularly in this stream of clean water, with pebbly and sandy bottom, at 750 m.

The bulk (44.5%) of the Durmitor odonate fauna consists of the following 12 Euro-Siberian species, which, in general, have distributions reaching northwards to the Arctic Circle: *C. virgo, L. sponsa, L. dryas, C. hastulatum, E. cyathigerum, A. juncea, A. grandis, C. aenea, S. metallica, L. quadrimaculata, S. flaveolum* and *L. dubia*. These were almost always assessed as common (abundant) or moderately common in the area examined.

The group of 9 species (33.3%) are European species, reaching the Mediterranean, or Mediterranean species, stretching across Europe. Five of them, *C. splendens, P. pennipes, I. elegans, A. mixta* and *P. depressum*, are rare or extremely rare, while *P. nymphula, C. puella, A. cyanea* and *O. forcipatus* are locally moderately common.

The set of 6 (22.2%) Mediterranean species, viz. *L. virens, A. imperator, T. bidentata, S. striolatum, S. sanguineum* and *T. fonscolombei*, are extremely rare in the Durmitor National Park. Only the wanderer, *T. fonscolombei*, is moderately common at the mouth of the Bistrica brook, at 750 m.

The Durmitor National Park odonate assemblage is similar to that recorded in the Alps and in some other European mountain systems (FUDAKOWSKI, 1930; FREY, 1951; KIAUTA, 1960; SCHMIDT, 1967; DEGRANGE & SEASSAU, 1970; FRANCEZ & BRUNHES, 1983; BOUDOT et al., 1990). However, some conspicuous differences between Durmitor and the Central European mountains are apparent.

HOLDHAUS (1912) gave a rigid definition of the boreoalpine (glacial relict) species. Only *Aeshna caerulea* and *Somatochlora alpestris* fit the definition, having strictly nordic and alpine distributions. Both species have been recorded in the Central European mountains, including the Slovenian Alps (KIAUTA, 1960; KIAUTA & KIAUTA, 1992). However, neither of these has been found in the Durmitor range, nor in any other mountains of Montenegro, Serbia, Macedonia, Albania and Bulgaria.

Five other species, namely *Coenagrion hastulatum, Aeshna juncea, A. subarctica, Somatochlora arctica* and *Leucorrhinia dubia*, are distributed in nordic and alpine areas. These are not as stenotopic as the two boreoalpine species, and have also been recorded at suitable locations in the belt stretching between the nordic and alpine regions. However, a rational explanation of their disjunct occurrence in the South European mountains must also take into account the changes, caused by the Pleistocene glaciations, as well as the movement of species after the Würm glaciation.

Three out of the above 5 species, *C. hastulatum, A. juncea* and *L. dubia*, have been found in the Durmitor National Park, Montenegro, and at the sphagnum peat bog Daićsko Jezero (alt. 1556 m) in Serbia (ADAMOVIĆ, 1990). Three species have been reported from sphagnum peat bogs in the Bulgarian mountains, where *A. subarctica* has been recorded instead of *L. dubia* (BESHOVSKI, 1991). However, none of the 5 mentioned species has so far been evidenced in Albania (PUSCHNIG, 1926; BILEK, 1966; DUMONT et al., 1993) and Macedonia (KARAMAN, 1969).

In addition to the absence of the 2 boreoalpine species, the number of dragonfly species which are regularly to be found at sphagnum peat bogs in the Central European mountains decreases from the Alps towards the mountains of the Balkan Peninsula.

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