

Recent Distribution and Ecological Notes on the Dryopid Beetle *Pomatinus substriatus* Müller, 1806 (Dryopidae: Coleoptera) in Serbia

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Abstract

The aim of this paper is to present recent distribution and to provide some ecological notes on the dryopid beetle *Pomatinus substriatus* (Müller, 1806) in Serbia on the basis of field research in the period from 2010 to 2013. During the research, *P. substriatus* was recorded at 36 localities situated at 27 streams and rivers in total and one reservoir in Serbia (the Bojnik Reservoir). The species was found to be the dominant water beetle species at 12 localities/watercourses: The Mosna/Porečka River, Gornjak/Mlava, Neresnica/Pek, Kusići/Pek, Ušće/ Studenica, Lepenac/Rasina, Svođe/Lužica, Vlasotince/Vlasina, Krivi Do/ Visočica, Trnski Odorovci/Jerma, Lučani (upstream Stenjevac Brook confluence)/Bjelica and the Gugaljski Most/Zapadna Morava River. According to the national watercourse classification (Official Gazette of the Republic of Serbia, 74/2011), most of the watercourses where the species was recorded belong to Type 3 (small to medium streams, altitude to 500 m, with domination of large fractions of substrate). The highest abundance of adults was detected in August and September of 2013 at 3 localities (Mosna/Porečka River, Lepenac/Rasina and Svođe/Lužica). Larvae were very rare in samples and found only at two localities (Ušće/Studenica, June 16 2011 and Leskovac/Veternica, May 29 2012). Considering the species' habitat preference, it was found that larvae and adults of *P. substriatus* predominantly inhabit stretches of streams with domination of medium or large-sized stones, while occasionally it can be found in small stagnant water puddles. Additionally, some individuals were found in fragments of tree trunks and rotting branches submerged in water. The population trend of *P. substriatus* could not be assessed based on the collected data. The objective of the study is to contribute to the general knowledge of the species autecological characteristics and distribution in Serbia.

Keywords: *Pomatinus substriatus*, distribution, ecological notes, Serbia, field research

Introduction

Dryopidae (Coleoptera) or long-toed water beetles are small beetles (size range 3.0 to 5.5 mm), usually found on the edges or in the emergent vegetation of shallow stagnant waters, yet some species also occur in rivers and brooks. The adults crawl under the surface clinging to water plants, where they feed on decaying plant matter. Long-toed water beetles are incapable of swimming; their locomotion is aided by their strong, clawed legs (Kriska, 2014). Adults of nominotypic *Dryops* are typically riparian and can take flight directly from water surface when disturbed; those of *Pomatinus* are truly aquatic, which like elmids (riffle beetles, Coleoptera: Elmidae) use a plastron for breathing (LeSage, 1991). Pupation takes place in the moist soil near

the water line. The elongate, strongly sclerotised larvae develop among the waterside debris, where they feed on plant remnants (Kriska, 2014).

Pomatinus is a name reclaimed for *Helichus substriatus* (Müller, 1806). *Pomatinus substriatus* is a southern and central European species, known north to Lithuania and Sweden, south to Algeria and Morocco, and east to Turkey, Israel, the Lebanon, and Syria (Foster, 2010). *Pomatinus* wireworm-like larvae, which feed on wet, rotting wood, and may occur in damp soil, have been described by Olmi (Olmi, 1976). Olmi also described the eggs, which are inserted into rotting tree branches under water (Ibidem).

Pomatinus larva (Fig. 1a) has a single hook on the 8th urotergit, medially positioned, pointing to the caudal edge; on the 9th urotergit there are 2 hooks, directed to the oral edge. On the oral edge of the

tergites, from the mesothorax to the 9th urit, there are deep grooves separated by small dark sclerotised cerci. *Dryops* larvae are differentiated from *Pomatinus* larvae by the lack of hooks and grooves on the oral edge of tergites (Ibidem). The *Pomatinus* adult (Fig. 1b) is easily distinguished from *Dryops* by the general form and the recumbent covering of hair (Foster, 2010), has a pronotum without furrows (although a narrow rim is present), short hair and a size of 4.5-5.5 mm (Friday, 1988).



Figure 1: *Pomatinus substriatus* (Müller, 1806):
a-larva, b-adult

Adults are often associated with side streams and larvae with temporarily flooded banks. This species is capable of flight (Foster, 2010).

Material and Methods

Aquatic macroinvertebrates were sampled using a hand net (25x25 cm, 500 µm mesh size) or collected manually using tweezers during the period from 2010 to 2013 throughout Serbia. Sampling was performed twice per year, in the period summer/autumn within the Regular Annual Water Quality Monitoring Program (conducted by the Hydrometeorological Service of Serbia and the Serbian Environmental Protection Agency) and investigations were carried out by the Institute for Biological Research "Siniša Stanković", University of Belgrade. The multi-habitat sampling procedure (Hering et al, 2004) and AQEM protocol (AQEM, 2002) were applied. All the samples were preserved using 70% ethanol and further analyzed in the laboratory. Identification of the species was done by using appropriate keys (Olmi, 1976; Friday, 1988).

Adults were observed using a binocular magnifier Leica MS 5 and larvae using a binocular magnifier Carl Zeiss, Stemi 2000-C. The specimens of larvae were photographed with a digital camera AxioCamERc 5s, Zeiss and appropriate software was used (ZEN, 2011).

For species relative abundance estimation, the following scale was used: 1 - present individually, 2 - low abundance (2-5 ex.) and 3 - moderate abundance (6-30 ex.)

Results and Discussion

During the research, *P. substriatus* was recorded at 36 localities in Serbia situated at 27 streams and rivers and one reservoir (the Bojnik Reservoir) (Fig. 2).

The species is present mainly in smaller streams in the Central, Eastern, Western and Southern part of country, while it was not recorded in the Pannonian lowland (Vojvodina Province) and large rivers (the Danube and Sava). According to the national watercourse classification (Official Gazette of the Republic of Serbia, 74/2011), most of these watercourses (where the species was found) belong to Type 3 (small to medium streams, altitude to 500 m, with domination of large fractions of substrate).

P. substriatus was found to be the dominant water beetle species at 12 localities/watercourses: the Mosna/Porečka River, Gornjak/Mlava, Neresnica/Pek, Kusići/Pek, Ušće/ Studenica, Lepenac/Rasina, Svođe/Lužnica, Vlasotince/Vlasina, Krivi Do/ Visočica, Trnski Odorovci/Jerma, Lučani (upstream Stenjevac Brook confluence)/Bjelica and Gugaljski Most/Zapadna Morava River.

Average annual relative abundances (of larvae and adults) of the species are given in Fig. 4.

Considering species habitat preference, it was found that larvae and adults of *P. substriatus* predominantly inhabit stretches of streams with domination of medium or large-sized stones, while it can occasionally be found in small stagnant water puddles. Additionally, some individuals were found in fragments of tree trunks and rotting branches submerged in water. This is consistent with literature data that Dryopidae live primarily on the edges or in the emergent vegetation of shallow stagnant waters (Kriska, 2014).

The highest abundance of adults in 2013 was recorded in August and September at 3 sampling sites (Mosna/Porečka River, Lepenac/Rasina and Svođe/Lužnica). Larvae were very rare in samples in comparison with adults and found only at two localities (Ušće/Studenica, June 16 2011 and Leskovac/Veternica, May 29 2012). This confirms that emerging of *P. substriatus* in the area of the Eastern and Western Balkans (Illies, 1978; Paunović et al, 2012) occurs in late August-mid September.

Pomatinus larvae were found at a water temperature of 16.8 °C (Ušće/Studenica) and 12.6 °C (Leskovac/Veternica). Measured concentrations of oxygen dissolved in water at these sampling sites were 9.50 and 9.68 mg/L respectively, indicating high ecological status (class I), according to the national regulation (Official Gazette of the Republic of Serbia, 74/2011) and based on the class boundaries of watercourses Type 3. Obtained values of other physico-chemical

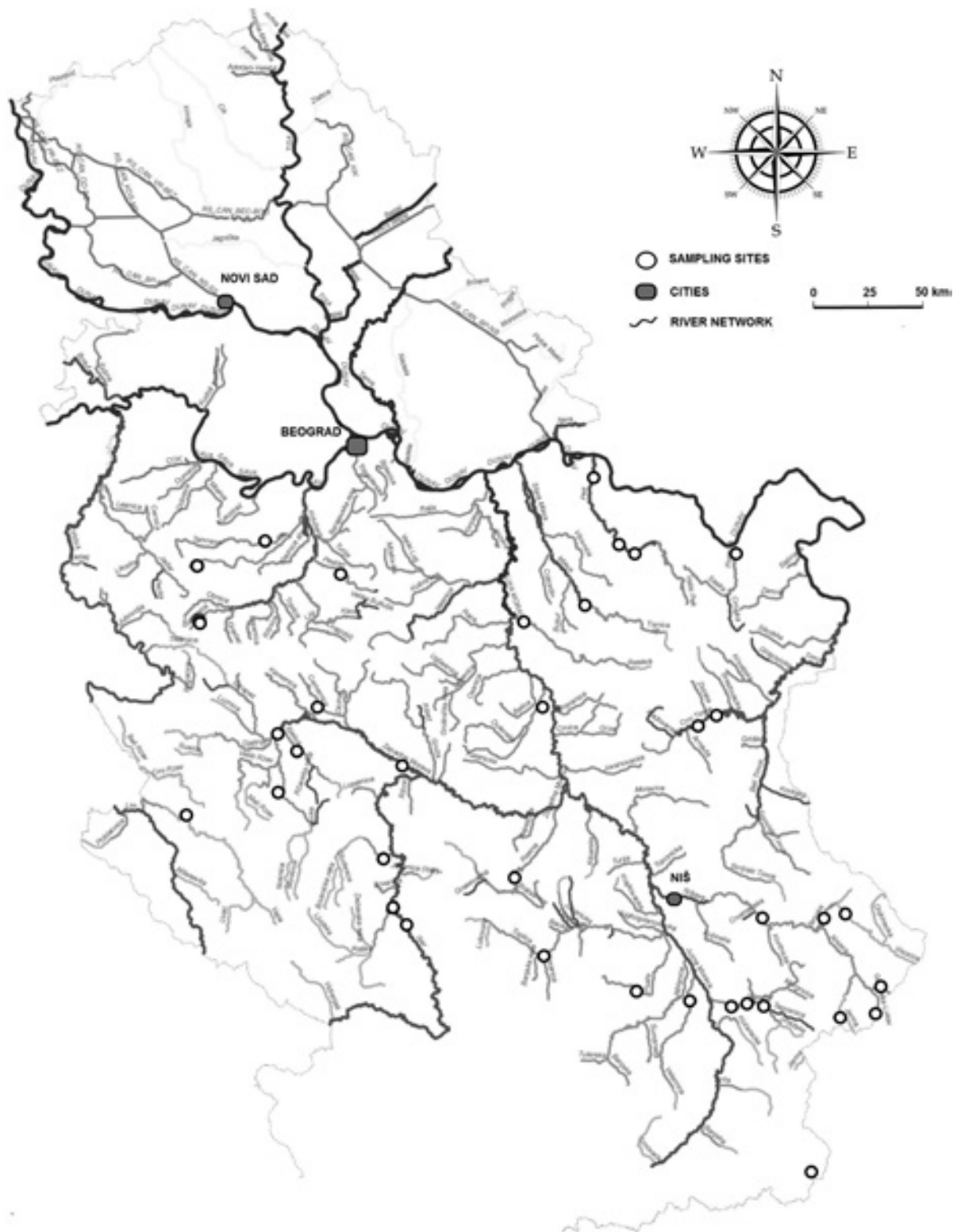


Figure 2: Distribution of *Pomatinus substriatus* (Müller, 1806) in Serbia in the period 2010-2013

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|--|---|---|
| 1. Kolubara Basin (Rebelj/
Jablanica, Gunjevac/Ub, Crvena
Jabuka/Tamnava, Vreoci/Peštan) | 5. Temštica Basin (Krivi Do/Visočica) | 10. Struma Basin-Aegean Sea
(Ribarce/Dragovištica) |
| 2. Lim Basin (Manastir Uvac/Uvac) | 6. Vlasina Basin (Svođe/Lužnica) | 11. Beli Timok Basin (Bogovina/Crni
Timok, Šarbanovac/Crni Timok) |
| 3. Ibar Basin (Ušće/Studenica) | 7. Nišava Basin (Temska/Temštica,
Manastirište/Vlasina, Vlasotince/
Vlasina, Trnski Odorovci/Jerma,
Mrtvine/Gaberska Reka) | 12. Velika Morava Basin (Jagodina/
Lugomir, Svilajnac/Resava,
Gugaljski Most/Zapadna Morava,
Miločaj/Zapadna Morava) |
| 4. Zapadna Morava Basin
(Trbušani/Čemernica, Lučani
(upstream Stenjevac Brook
confluence)/Bjelica, Lepenac/
Rasina, Gradina/Moravica,
Rudnica/Ibar, Raška/Ibar) | 8. Toplica Basin (Kuršumljija/Kosanica) | 13. Danube Basin (Mosna/Porečka
Reka, Neresnica/Pek, Kučevo/
Pek, Kusići/Pek, Gornjak/Mlava) |
| | 9. Južna Morava Basin (Bojnik
Reservoir, Leskovac/Veternica,
Bela Palanka/Nišava,
Dimitrovgrad/Nišava) | |



Figure 3: Locality Ušće at Studenica Stream – a sampling site with typical habitats of *Pomatinus substriatus* (Müller, 1806)

parameters also reflect high or good water status (class I or II). A review of measured physical and physico-chemical parameters at localities where *Pomatinus* larvae were registered are shown in Table 1.

During the sampling, at some of localities where the species was recorded (Mosna/Porečka Reka, Vlasotince/Vlasina and Ušće/Studenica), the oncoming and grouping of adults was observed (up to 12 ex.) and isolation of these adult “aggregates” on different sides of the same medium or large-sized stone. It was also noted that *Pomatinus* adults sometimes coexisted at the same stone with other coleopteran species (primarily *Limnius* sp., *Hydraena* sp. and *Oulimnius tuberculatus*), entering interspecific competition for living space with the mentioned species.

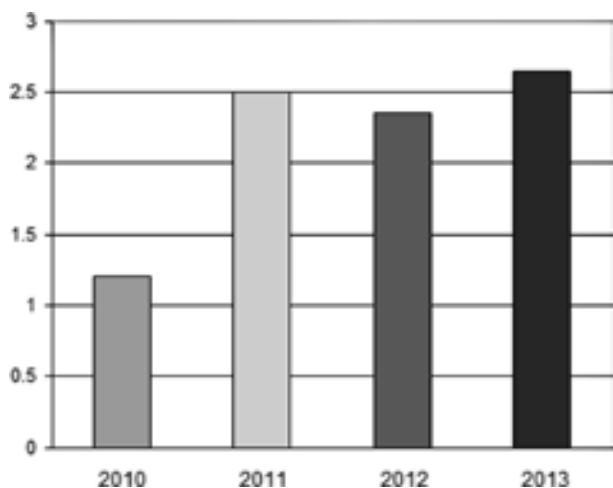


Figure 4: Average annual relative abundances (of larvae and adults) of *P. substriatus* in Serbia

Table 1: A review of some physical and physico-chemical parameters at sampling sites of *P. substriatus* larvae

Parameter	Unit	Ušće/ Studenica	Leskovac/ Veternica
		June 16, 2011	May 29, 2012
pH		8.4	7.9
Water temperature	°C	16.8	12.6
Conductivity	µs/cm	238	157
Dissolved Oxygen	mg/L	9.50	9.68
Oxygen Saturation	%	98	94
Total Suspended Solids	mg/L	11	74
Total Dissolved Solids	mg/L	159	123
Alkalinity	mmol/L	2.30	1.41
Total Hardness (CaCO ₃)	mg/L	134	74
HCO ₃ ⁻	mg/L	131	86
Cl ⁻	mg/L	< 1.0	3.0
NH ₄ ⁺	mg/L	0.06	0.02
NO ₂ ⁻	mg/L	0.004	0.023
NO ₃ ⁻	mg/L	0.6	0.6
Total N	mg/L	0.70	1.0
PO ₄ ³⁻	mg/L	0.040	0.010
Total P	mg/L	0.049	0.303
TOC	mg/L	2.7	3.7
BOD	mg/L	2.10	2.85
COD (Mn)	mg/L	2.3	5.3

Bearing in mind the main stressors occurring in small to medium-sized streams in Serbia (SCG Roof Report, 2004) in ecoregions 5 and 7 (Paunović et al, 2012), habitat degradation, namely hydromorphological degradation (as a consequence of stone, gravel and sand exuviations) is the main potential pressure to populations of *P.substriatus*. Bed material extraction activities change morphology of the bed and banks, which destroy the habitat of this species. Moreover, damming of small to medium-sized watercourses could also contribute to habitat loss and fragmentation, due to the change of water level, hydro-peaking change in the sedimentation regime, etc. There is an increased tendency for the building of small hydropower plants in the Balkan region and the loss of particular habitats should be seriously taken into consideration when designing mitigation measures for such waterworks.

Due to scarce general data of aquatic macroinvertebrates, particularly coleopteran, in this region, this work is a contribution to its knowledge, and should be used as an initial platform for more comprehensive investigation of this order of insects. Further investigation should provide more reliable data for assessing ecological status/potential and for more effective involvement of these groups in order to establish a national list of sensitive macroinvertebrate taxa.

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