

WEEVILS FAUNA (COLEOPTERA: CURCULIONOIDEA) OF GRUŽA RESERVOIR (CENTRAL SERBIA)

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ABSTRACT. The first data of weevil fauna analysis of Gruža Reservoir are given.

The analysis of 160 findings (466 adult specimens), showed the presence of 69 species, from five families: Rhynchitidae (one species), Apionidae (22), Nanophyidae (four), Eriirhinidae (one), and Curculionidae (41). Interesting blind species had been collected earlier, *Ubychia holdhausi*, from Raymondionymidae.

From aquatic weevils category eight species were registered: *Notaris scirpi*, *Bagous bagdatensis*, *B. collignensis*, *Phytobius* (= *Litodactylus*) *leucogaster*, *Rhinoncus castor*, *Rh. inconspicuous*, *Rh. pericarpus* and *Rh. perpendicularis*). Two of them, *Notaris scirpi* and *Rhinoncus castor* are registered in the vicinity of Kragujevac for the first time.

The eutrophication caused the lake to become overgrown with aquatic and semi aquatic plants. It is the reason for mass presence of *Rhinoncus perpendicularis* (94 specimens), *Rh. castor* (33) and *Bagous bagdatensis* (25).

INTRODUCTION

Description of investigated locality

Geographically, the Basin of Gruža River (318km²) belongs to Central Serbia. It reclines between 43°42' and 44°07' of north latitude and 20°31' and 20°53' of east longitude, in the valley surrounded by the Rudnik, Gledičke planine and Kotlenik mountains. The Gruža River is the left tributary of Zapadna Morava River. This, 60km long river, originates on the Rudnik Mountain. (MILOVANOVIĆ *et al.* 1995)

As far as climate is concerned, the Gruža basin belongs to the moderate continental type. The average air temperature is 10.8°C, and the sum of precipitations during the year is 742.2 l/m² (MILOVANOVIĆ *et al.* 1995).

Increasing number of inhabitants in the town of Kragujevac and the grooving industry in the middle of the past century required a new solution for water supply problem. On the other side the Gruža often flooded (old Serbian word "gruž" means which floods, drowns

(MILOVANOVIĆ *et al.* 1995)). For that reason, it was decided in 1974 that a dam on middle flow of the Gruža River should be built, 10km upstream of the Pajsijevići village. The 51.5m high and 288m long dam started being built in 1979. In 1985 the accumulation was definitely formed 20km southwest of Kragujevac, 238-269m a.s.l. (ČOMIĆ, 1989). (Fig. 1)

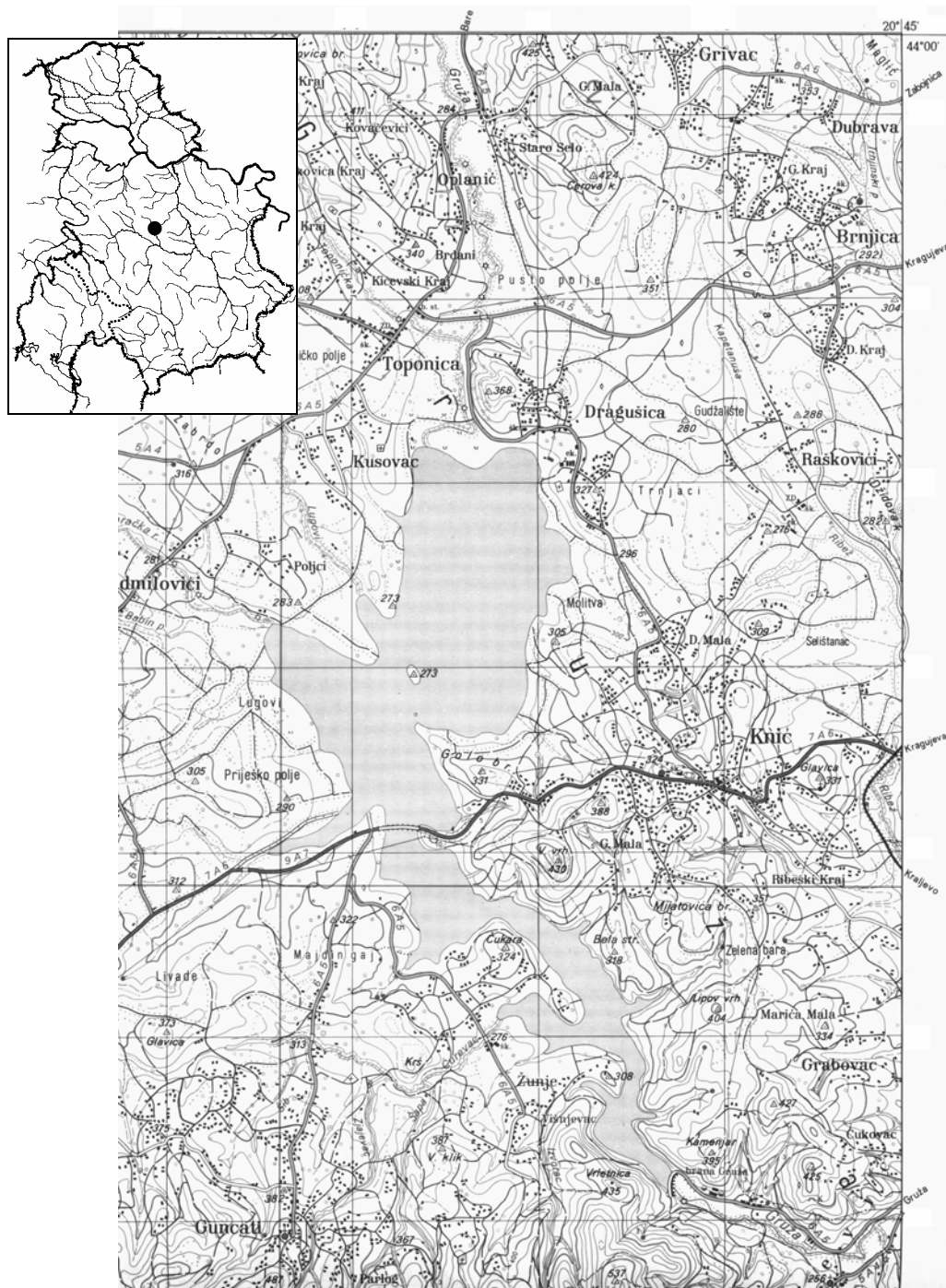


Fig. 1 – Geographical position of Gruža Reservoir

Under the highest water level conditions, the artificial lake is 10km long, and 0.2-1.5km wide. The accumulation has got 934ha surface and protection zone around it occupies 1450ha (there are 93 households). When accumulation is full up to the maximum level (270m above the sea) it contains 64.6 millions of m³ of water. The water stays in the accumulation 1.8 year, on average. Maximum depth is near the dam (31m), but the average is 6.3m. During the year, water level oscillates 3-5m, depending on the season. Only one third of accumulation, placed in the gorge, is deeper (15-30m) and surrounded by forests and pastures. The bigger part (two thirds) is shallow (2-9m), placed in the depression of Kničko field, and surrounded by plowed agricultural terrains. Accumulation is fed by water from the atmospheric precipitations. (MILOJEVIĆ, M. *et al.*, 1995)

The artificial lake Gruža is dimictical. According to the oxygen regime and total phosphorus quantity it is a eutrophic lake. The water quality varies from clean to the polluted and lake has low to satisfying level of autopurification. All physiological bacterial groups (proteolytic, amylolytic, cellulolytic, fixators of nitrogen and phosphoromineralytic) have got the largest presence at the end of summer and at the beginning of autumn due to decomposing of dead plankton (ĆURČIĆ, 2003)

The Gruža Reservoir accepts five tributaries: Boračka River (it is 8.7km long), Toponička River, Ćurevac, Đurđevac and Izvorac. The last four cited are short (3 – 7km), and during the summer they are dried up (ČOMIĆ, 1989).

The flora and vegetation of the River Gruža basin had been studied in detail far before Reservoir origin (OSTOJIC, 2000). In the River Gruža basin the plowed fields (cultivated and orchards) dominated (56.1% of total surface) before the dam was built. Different types of forests covered 26.2%. Dry and moderately wet valley meadows and pastures covered 17.1%. The swampy meadows were present only in two places: 10km upstream of accumulation, and where the Gruža entered the Zapadna Morava River. The barren soils occupied 0.6%. (VELJOVIĆ & MARKOVIĆ, (1984)

At the beginning of 80s even more intense botanical researches were organized because of the monitoring of the newly found artificial lake and they continue till present days (TOPUZOVIĆ & PAVLOVIĆ, 2003).

Although the Insecta is the most numerous class of living creatures on Earth, it has only partially and unsystematically been studied in Serbia, particularly in Central Serbia, as less interesting part.

Earlier Insecta studies on the territory of Gruža

The first data has origin in period before and during the damming of the Gruža River (1980-1985). The focus was on Protura, Diplura, Orthopteroida and Pselaphidae (Coleoptera) faunistical and ecological study. Along the Gruža River there were five sampling places. The fifth one was near the dam. (KARAMAN, 1983a, 1983b)

Three Protura species, from two families (Acerentomidae and Eosentomidae) were registered: *Eosentomon transitorium* (the most frequent and numerous), *Acerentomon balcanicum* (Balkans endemic species) and *Acerentulus trægardhi*. (KARAMAN, 1985)

From Diplura, family Campodeidae, the six species have been established: *Campodea frenata*, *C. campestre*, *C. spelea*, *C. wallacei*, *C. suenisoni* and *Podocampa serbica*. (BLESIĆ, 1983, 1991).

Orthopteroida (crickets, grasshoppers, cockroaches and earwigs) are represented with 30 species. Particularly interesting are two very rare cricket species, *Isophia obtusa* and *Pholidopte-*

ra littoralis. Once again, the orthopterous insects' populations confirmed themselves to be good indicators of anthropogenous influences on ecosystems (KARAMAN, 1981).

From Coleoptera, family Pselaphidae the presence of 19 species was established. The four of them have been found in Serbia for the first time: *Amauronix maerkli*, *Bryaxis femoratus*, *Trimium lichtekneri* and *Brachygluta trigonoprocta*. From family Leiodidae, subfamily Cholevinae only Carpathian endemic species *Ptomaphagus (Merodiscus) validus* was registered. (MILOJEVIĆ, R., 1984)

Except for listed Apterygota and Pselaphidae, qualitative study of soil samples showed presence of 12 more families of Coleoptera (Carabidae, Catopidae, Leiodidae, Scydmanidae, Staphylinidae, Elateridae, Byrrhidae, Colydiidae, Coccinellidae, Scarabaeidae, Curculionidae i Scolytidae), but without species identification. (KARAMAN, 1985)

Later a karpatian endem (*Ptomaphagus (Merodiscus) validus* (Kraatz)) from beetle family Leiodidae, subfamily Cholevinae was mentioned (NONVEILLER *et al.*, 1999).

Actual entomological studies

Earlier studies merely registered that weevils (only a part of them exactly, fam. Curculionidae), were present in vicinity of Gruža. In the recent times (from 2001), weevils have been for the first time studied in detail, faunistically and ecologically.

Although the weevils are wide spread (practically in all places with vascular plants), they do not like freshwater habitats (CALDARA & O'BRIEN, 1995). Except this, aquatic weevil species are endangered (WINKELMANN, 1991), as the other inhabitants of these very vulnerable ecosystems.

The life of aquatic and semi aquatic weevil species is particularly interesting, because it is mostly hidden. Their activity is going on during the night. This creates difficulties in their collecting. Since the earlier weevil researches on the territory of Kragujevac vicinity (PEŠIĆ, 1997, 1998) did not include aquatic ecosystems, a parallel study of four Kragujevac Reservoirs (Gruža, Grošnica, Šumarice and Bubanj) started in 2001. This work shows results of what was found in the Gruža Reservoir.

MATERIAL AND METHODS

In the spring of 2001 and 2002 (respectively May 15th, and June 20th) adult weevils were collected in the early morning hours (6.00-10:00 h) on the localities Molitva and Trnjaci between Knić and Dragušica (left bank of the lake) and Priješko Polje (right bank) of the Gruža Reservoir. All representative habitats, from the lake shoal to 50-100m from the water were covered: swampy meadows, moist meadows, valley meadows, neglected land, ruderal vegetation, boundaries and tilled grounds.

The sampling techniques included sweeping and shaking of plants, rinsing of aquatic plants, beating of the tree branches and bushes, mowing of the ground floor of vegetation, as well as hand collecting. In the previous researches (1981 and 1983) of soil-fauna around the accumulation, the separation of insects from the soil with the aid of Tullgren-Berlesse apparatuses was employed.

The following keys were used for the species identification: ALONSO-ZARAZAGA, 1990; ANGELOV 1976, 1978, 1979, 1980, 1981; DIECKMANN, 1972, 1980, 1983; FREUDE *et al.* 1981, 1983; SMRECZYŃSKI, 1974.

The nomenclature is that used by ALONSO-ZARAZAGA & LYAL (1999).

Each specimen was determined by sex.

Material is in authoress's collection on Faculty of Sciences in Kragujevac.

RESULTS AND DISSCUSION

The analysis of 160 findings that contained 466 adult specimens (219 males and 247 females), showed presence of 69 species, from five families: Rhynchitidae (one species, one specimens), Apionidae (22 species, 106 specimens), Nanophyidae (four species, 20 specimens), Eirihinidae (one species, one specimen), and Curculionidae (41 species, 338 specimens) (Tab. 1). Earlier, not far from the dam, interesting blind species were collected, *Ubychia holdhausi*, from Raymondionymidae.

In comparison with the first results from other Reservoirs in Kragujevac (PEŠIĆ, 2000), weevil settlement in Gruža is quantitatively and qualitatively richer.

Table 1. represents taxonomical list of registered species with findings data: date, biotope, plant, number of specimens (males, females, and total). That mixture fully corresponds to the floristic situation, described in work of TOPUZOVIĆ & PAVLOVIĆ (2003).

Special attention was focused on swampy and moist meadows, because of aquatic and semiaquatic weevils. From aquatic weevils category eight species were collected: *Notaris scirpi*, *Bagous bagdatensis*, *B. collignensis*, *Phytobius* (= *Litodactylus*) *leucogaster*, *Rhinoncus castor*, *Rh. inconspetus*, *Rh. pericarpus* and *Rh. perpendicularis*. Two of them, *Notaris scirpi* and *Rhinoncus castor* are registered in vicinity of Kragujevac for the first time.

Following details of biology of some species are mostly taken over from already cited "keys".

Notaris scirpi is biologically connected with plants from genera *Typha*, *Scirpus* and *Carex* (CALDARA & O'BRIEN, 1995). Earlier it was registered for the lake in Sumarice Mamorial Park (PEŠIĆ, 1997, 1998). It is a pretty wide distributed species – in Europe, Siberia, Japan. HOFFMANN (1954) collected larvae in the root collar of *Carex acutiformis* (= *C. paludosa*), where the puppation happens. This plant species was not registered for Gruža, but three other species from the same genus were (TOPUZOVIĆ & PAVLOVIĆ, 2003). Adult is present from March to November. In spite of that, and the fact that this is a quite big beetle (6-7.5mm) and that its feeding plants are present on the banks of the Gruža Reservoir (TOPUZOVIĆ & PAVLOVIĆ, 2003), it is not easy to hunt it (only one specimen was collected).

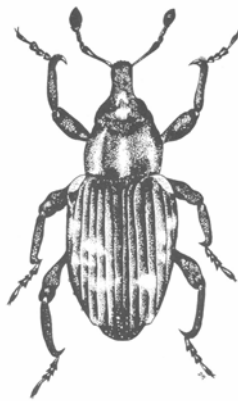


Fig. 2 – *Bagous bagdatensis* (from HOLECOVA, 1993)

Bagous bagdatensis Pic, 1904 (= *B. wagneri* Dieckmann, 1964) (Fig. 2) lives in Central, South and South-eastern Europe, Asia Minor and Caucasus. Recently, it was for the first time registered in Serbia (PEŠIĆ, 2000). Its bionomy and host plant are still unknown. Comparing the plant lists along the dead arm of the Latorica River in Slovakia (HOLECOVA, 1993) and the Gruža Reservoir (TOPUZOVIĆ & PAVLOVIĆ, 2003), the next plants are common: *Alisma plantago – aquatica*, *Butomus umbellatus*, *Ceratophyllum demersum*, *Carex* sp., *Myriophyllum spicatum*, *Lemna minor*, *Lythrum salicaria*, *Glyceria* sp.. Between this plants there could be a host. *B. bagdatensis* has nocturnal habits. «By the nightfall adults ascend from water on the surrounding vegetation» (HOLECOVA, 1993).

By literatural data *Bagous collignensis* develops in *Equisetum limosum*. This plant species has still not been registered for Gruža Reservoir, but two other (*E. telmateia* and *E. palustre*) have (TOPUZOVIĆ & PAVLOVIĆ, 2003). Adults are active in June. Female lays one egg per

host stem. The larva bites stem inside, in places making holes through a wall to the surface. Geographical distribution includes south part of Northern Europe, Central and Southern Europe and Anatolia (FREUDE *et al.*, 1983).



Fig. 3 – *Phytobius leucogaster* (from CALDARA & O'BRIEN, 1995)

Phytobius leucogaster (Fig. 3) lays eggs between unopened buds of *Myriophyllum spicatum* and *M. verticilatum*. Larva develops in the flower cluster, but often goes down the stem, under water, where pupation happens. The cocoon draws the oxygen from the host plant aerenchym. Adults are active from May to December. They eat the leaves of host and can swim between plants. During the reproductive period adults can stay under water 8-24 hours, in the air bubble. (BUCKINGHAM & BENNET, 1981) Through the winter period adults are spread under dead leaves, in moss and the like. After three years long experimental researching, exactly this species was recommended by LEKIĆ & MIHAJLOVIĆ (1970) as the most successful in biological control of aquatic weed *Myriophyllum spicatum*.

Rhinoncus castor adults are active from May to August. In the root or low parts of stem of *Rumex acetosella* it lays eggs. Larva develops while eating the tunnels through the stem and root. This weevil species is distributed in wide area – Holarctic, except North Africa.

Rumex species are hosts even for another holarctic weevil, *Rhinoncus pericarpus*, but it lays eggs into the upper part of stem compared to *R. castor* and its adult is present in nature for a longer period of time (from April until October). In such a way competition between this two weevils is avoided.

Polygonum amphibium is very often plant in numerous inlets of Gruža Reservoir. It is a host to *Rhynoncus inconspetus*, distributed in Europe and West Siberia. The female lays eggs in the basis of stem or into the root (it digs the hole by “snout”, and after eggs are laid closes it with secretion). The larva bites tunnels through the stem and root. Its pupation happens inside the root. The adults are active for a shorter time than other *Rhynoncus* species founded in Gruža.

Noticeable, in greatest numbers on the lakeside vegetation are populations of palaeractic distributed weevil *Rhynoncus perpendicularis*. It also uses *Polygonum* species as the host-plant, but its development begins in the leaf (competition with *R. inconspetus* larvae is avoided in that way); larva later leaves leaf through petiole and goes into the stem, eating the tunnel all the time. Adults are active from April to October, competing with *R. inconspetus* adults (CALDARA & O'BRIEN, 1995).

The Gruža Reservoir is relatively shallow, has got small quantity of water mass, and a big surface. The moving of water is minimal (near the dam only 1m³). The result is long storage of water in the accumulation (about 22 months). Such combination of conditions represents a good basis for eutrophication (MILOJEVIĆ, M., 1994). Intensive usage of agrochemical measures causes enormous presence of phosphorus in the water.

Intensive eutrophication caused the lake to become overgrown with aquatic and semi aquatic plants. That is the reason for massive presence of *Rhynoncus perpendicularis* (94 specimens), *Rh. castor* (33) and *Bagous bagdatensis* (25).

All results and intensive eutrophication, point out to necessity to continue weevil study on Gruža Reservoir, particularly from ecological view, because of the fact that their settlement has got very intensive dynamics, following the intensive changes of this lake ecosystem.

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