

OLIGOTROPHUS BETHELI FELT (DIPTERA : CECIDOMYIIDAE), A NEW SPECIES IN THE FAUNA OF EUROPE

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Abstract - *Oligotrophus betheli* or the juniper tip midge is a North American species and its presence has been established only in Continental USA, on *Juniperus* spp. (Gagné, 1989). In the period between 2007 and 2009 this species was observed on *Juniperus virginiana* L. in many localities in Serbia, which represents the first record of this species not only in Serbia, but also in Europe.

Key words: Juniper tip midge, *Juniper* spp., morphology, Serbia.

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INTRODUCTION

There are three species of *Oligotrophus* genus which are known in Europe: *O. juniperinus*, *O. panteli* and *O. schmidtii*. They develop on several *Junipers* species (De Jong, 2004). To date, four species of the *Oligotrophus* genus have been discovered in Serbia: *O. juniperinus*, *O. panteli*, *O. schmidtii* and *O. szepligetii*. The first three species were documented on *Juniperus communis* while the fourth was recorded on *Acer tataricum* (Simova-Tošić et al., 2000).

In the period 2007-2009 a large presence of slightly enlarged tip buds with solitary larvae (heretofore unknown in Serbia) was found on young branches of *Junipers virginiana* L. (Cupressaceae). Analysis of the morphological characteristics of each developmental stage identified it as the North American species *Oligotrophus betheli* Felt, unknown both in Serbia (Simova-Tošić et al., 2000) and the rest of Europe (Skuhravá, 1986; Gagné, 2004). This discovery was confirmed by R.J. Gagné, PhD (National Museum of Natural History, Smithsonian Institution, Washington D.C., USA).

MATERIALS AND METHODS

The presence of galls on the young branches of *J. virginiana*, as manifested by tip bud enlargement, was first recorded on July 3, 2007, in Voždovac

(Belgrade). Subsequently, from July 2007 through 2009, regular checks were carried out on junipers that were sampled not only around Belgrade (Bežanija, Novi Beograd, Voždovac, Zemun), but also in other areas in Serbia (Deliblatska peščara, Noćaj, Ruma and Sremska Mitrovica).

Laboratory dissection of the galls was carried out on the collected branches in order to analyze their anatomy, position of larval chambers and the number of larvae per gall. A part of the branches with galls was herbarized, while another part was separated into dishes for rearing in order to propagate adults. The individual developmental stages were fixed in 70% alcohol and then used for temporary and permanent microscopic slides in order to create drawings and identify the species. The analysis of morphological characteristics, important for identification, was carried out by measuring 10 specimens.

The material examined in the present study is kept in the collection of the Chair of Entomology and Agricultural Zoology, Faculty of Agriculture, University of Belgrade.

RESULTS

According to the analysis of the morphological characteristics of larvae, adults and their damage symptoms, i.e. galls on *Juniperus virginiana*, the species was identified as *Oligotrophus betheli*.



Figure 1. Male *O. betheli*

Taxonomic status

Oligotrophus betheli belongs to the subfamily Cecidomyiinae, supertribe Lasiopteridi, tribe Oligotrophini, genus *Oligotrophus* Latreille, 1805. Synonyms according to Gagné (2004) are: *Phytophaga sabinae*, Felt, 1935 and *Oligotrophus apicis* Appleby and Neiswander, 1965.

Morphology

Adults are small gall midges. The male body measures 1.78 mm (1.5 mm–2.0 mm) in length, and its coloring is dirty yellow (Fig. 1). The female is 1.77 mm (1.5–1.88 mm) long, with an orange-colored abdomen and transversal dark stripes on the dorsal side (Fig. 2).

The basic morphological characteristics are shown on Plate 1.

Maxillary palps are three-segmented with thorny bristles on the second and third segments (Plate 1, 7), 93 μ m in length. The first segment is very short, 25 μ m, the second is elongated and the longest, 37.5 μ m (37.3–42.3), and the third is 30.5 μ m (25.5–37.5).



Figure 2. Female *O. betheli*

The antennae consist of 2+12 segments in males, and mainly 2+11 segments in females. The flagellar segments decrease slightly in length and width from base to apex.

In males, the first two flagellomeres are nearly always fused and there is coalescing between the fifth and sixth segments. Also, the two last flagellomeres are frequently fused. A terminal flagellomere goblet with strong short bristles is at the base and long setae are at the apex (Plate 1, 4). The basal node and distal stem of the flagellomeres are marked. Each node bears strong bristles at the base and at the apex, and numerous long thin setae in the middle part. The fifth flagellomere is 78 μ m (75–87.5) long (Plate 1, 5).

In females, the first two flagellomeres are always fused, while the fourth and fifth, seventh and eighth, as well as the last two terminal segments, are frequently fused. The terminal flagellomere goblet with strong short bristles is at the base and short thin setae are at the apex (Plate 1, 2). The basal node of the flagellomeres is marked, while the distal stem is very short. Each node bears strong bristles at the base and short thin setae at the apex. The fifth flagellomere is 44 μ m (37.3–50) long (Plate 1, 3).

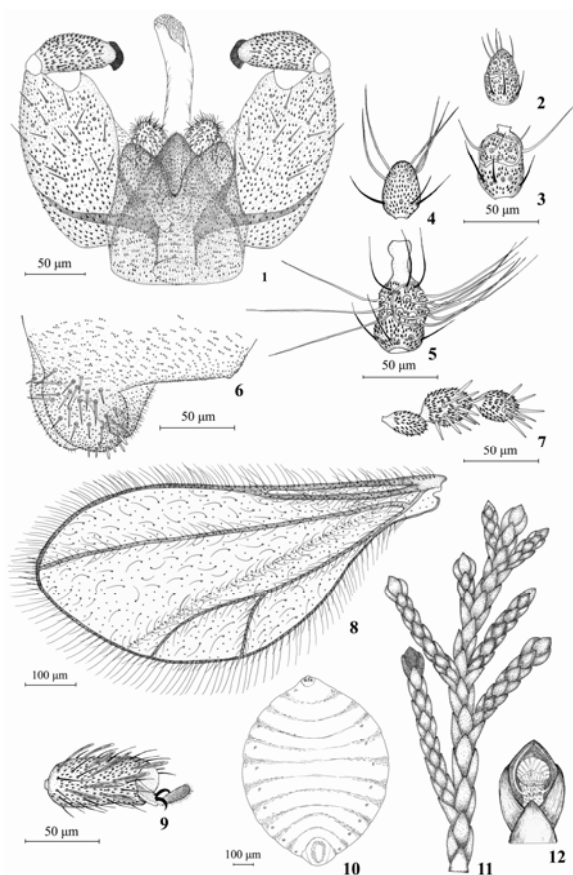


Plate 1, 1-12. 1 - Hypopygium in dorsal view; 2 - female terminal flagellomere; 3 - female fifth flagellomere; 4 - male terminal flagellomere; 5 - male fifth flagellomere; 6 - ovipositor; 7 - maxillary palp; 8 - wing; 9 - terminal tarsomere with claws and empodium; 10 - body of larva in ventral view; 11 - gall; 12 - gall section with a larva inside.

The legs are yellow and covered with short setae; the claws are strong, bent and considerably shorter than the empodium, which is densely covered with microtricha (Plate 1, 9).

The wing length is 1.53 mm (1.33-1.63) in males, and 1.37 mm (1.12-1.53) in females. The whole wing surface is covered with setae, and the posterior margin is fringed with long setae. R_1 joins with the costal nerve in the basal half, while R_5 joins with the costal nerve at the wing tip; Cu is forked (Plate 1, 8).

The basistyles of the male hypopygium are stout, and the dististyles are short, with a convex upper side and stronger sclerotization of the apex.

The aedeagus is curved and significantly longer than the paramere with a characteristically bent tip on its dorsal side (Plate 1, 1).

The female ovipositor is short and stocky. Terminal lobes are not fused and they end at the level of tenth sternite so that the ovipositor looks as if it was cut (Plate 1, 6). The eggs are red, elongated, 0.3 mm long.

The mature larva is orange, roundish and tipped on both ends, without spathula sternalis, 1.39 mm long (1.25-1.68) and 0.7 mm wide (0.6-0.8) (Plate 1, 10).

The pupa is 1.47 mm long (1.33-1.63) and 0.87 mm wide (0.7-1). At first it is red and before imago eclosion it becomes brown with almost black wings, legs and antennal sheaths.

Larvae of *O. betheli* develop in the terminal buds of young branches of *J. virginiana*. The invaded buds, namely galls, are enlarged, conical, 2 mm (1.8-2.2 mm) long, and 1.5 mm (1.3-1.7 mm) wide (Plate 1, 11). The galls are found at the tip of young branches and they consist of 4-8 (most frequently 6) tightly compressed leaflets. The internal bud leaves are concave and they enclose the central larval chamber where only one larva is living (Plate 1, 12). In the beginning of larval development the gall is green but later it becomes more enlarged at the base and yellow-green in color. Finally, after adult emergence, it becomes brown and dry.

DISCUSSION

The species within the *Oligotrophus* genus which develop on *Juniperus* spp. are morphologically very similar, which is typical for many species of the family Cecidomyiidae. Therefore the species identification needs other characteristics besides morphological characteristics, such as: host and organ specificity, shape and anatomy of galls, etc.

To date, three European species from the genus *Oligotrophus* (*O. juniperinus* L., *O. panteli* Kffr. and *O. schmidtii* Rubs), whose larvae develop in tip buds on *Juniperus communis* L., have been discovered in Serbia (Simova-Tošić et al., 2000). The listed species are morphologically very similar. However, differences are clearly visible in the size and anatomy

of the galls. *O. juniperini* galls are about 10 mm long, made of leaves of 3-4 tightened tip nodes slightly expanded at the base, with acuminate tips of exterior leaves externally stooped. The galls of *O. panteli* are about 12 mm long, spindly, with pointed tips and made of leaves of 2 tip nodes. The galls *O. schmidti* are the smallest, about 6 mm long, consisting of leaves of 2 tip nodes (Burh, 1964 – 1965).

Unlike the above-mentioned species, the North American species *O. betheli* develops on different hosts (*J. ashei*, *J. chinensis*, *J. horizontalis*, *J. scopulorum*, *J. utahensis* and *J. virginiana*) (Gagné, 1989). Barnes (1951) finds it important as a pest on *J. utahensis*.

Based on the morphological characteristics of the individual developmental stages, especially the aedeagus of the male copulatory apparatus, type and anatomy of galls, it can be concluded that larvae of the Nearctic species, *O. betheli*, cause the galls that are found on *J. virginiana* in Serbia. This is the first record of this species not only in Serbia, but also in Europe.

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