

***Aphidius geranii* sp. n. (Hymenoptera: Braconidae) from Southeast Europe – a new member of the *Aphidius urticae* s. str. group**

Andjeljko Petrović, Željko Tomanović*, Nickolas G. Kavallieratos, Petr Starý
& Vladimir Žikić

Petrović, A., Tomanović, Ž., Kavallieratos, N. G., Starý, P. & Žikić, V. 2009: *Aphidius geranii* sp. n. (Hymenoptera: Braconidae) from Southeast Europe – a new member of the *Aphidius urticae* s. str. group. — Entomol. Fennica 20: 233–238.

Aphidius geranii Tomanović and Kavallieratos, sp. n., is described as an additional member of the *Aphidius urticae* s. str. group from high-mountain habitats of Southeast Europe. The new species was reared from *Amphorophora* sp./*Geranium coeruleatum* associations. Parasitoid guilds associated with *G. coeruleatum* are discussed. Key for identification of *Aphidius* spp. on *Geranium* plants in Europe is given.

A. Petrović, Department of Plant Pests, Institute for Plant Protection and Environment, Banatska 33, 11080 Zemun, Serbia; E-mail: andjeljko@gmail.com
Ž. Tomanović (*corresponding author), Institute of Zoology, Faculty of Biology, University of Belgrade, Studentski trg 16, 11000 Belgrade, Serbia; E-mail: ztoman@bio.bg.ac.rs

N. G. Kavallieratos, Laboratory of Agricultural Entomology, Department of Entomology & Agricultural Zoology, Benaki Phytopathological Institute, 8 Stefanou Delta str, 14561 Kifissia, Attica, Greece; E-mail: nick_kaval@hotmail.com

P. Starý, Institute of Entomology, Biology Centre, Academy of Sciences of the Czech Republic, Branišovská 31, 37005 České Budějovice, Czech Republic; E-mail: stary@entu.cas.cz

V. Žikić, Faculty of Sciences, University of Niš, Višegradska 33, 18000 Niš, Serbia; E-mail: vzikic@yahoo.com

Received 18 February 2008, accepted 3 September 2008

1. Introduction

Aphidius Nees is the most diverse genus within the subfamily Aphidiinae (Hymenoptera: Braconidae) (Starý 1973, Achterberg 2004). It is also the most taxonomically problematical aphidiine genus, with over 100 species and at least 10 species groups having unresolved taxonomic status

(Eady 1969, Pungler 1986, Tomanović *et al.* 2003, 2007, Rakhshani *et al.* 2008). *Aphidius* species were characterized by a very limited number of reliable morphological characters relevant for species separation (Starý 1973, Pungler 1986, Kambhampati & Mackauer 1988).

Tomanović *et al.* (2003, 2007) pointed out taxonomical importance of the number of palpo-

meres in the maxillary and labial palps within genus *Aphidius*.

The *Aphidius urticae* s. str. group parasitizes aphid hosts belonging to *Amphorophora*, *Macrosiphum*, and *Acyrtosiphon* lineages (Homoptera: Aphididae), mainly in forest and semi-forest habitats (Starý 1973, Kavallieratos *et al.* 2004). Within the *A. urticae* s. str. group there are several taxa of unresolved status (Starý 1962, 1973).

Here we present the description and diagnosis of an additional member of the *A. urticae* s. str. group from high-mountain habitats of Southeast Europe. The new member was collected from *Amphorophora* sp./*Geranium coeruleatum* Schur associations. Additionally, a key for the identification of *Aphidius* species that attack aphids on *Geranium* plants in Europe is provided.

2. Materials and methods

G. coeruleatum bearing both live and mummified aphids were collected from 2002–2005 near the Škrka lakes on Mt. Durmitor (43°10'31.48"; 19°01'14.67"E; 1,700 m elevation) in Montenegro. Live aphids were preserved in 90% ethanol and 75% lactic acid in a ratio 2:1 (Eastop & van Emden 1972) for later identification. The remaining aphids were maintained in the laboratory until parasitoid emergence. Mummies, each attached to a small leaf piece, were placed separately in small plastic boxes with a circular opening covered with muslin on the lid and put inside a growth cabinet (22.5°C, relative humidity 65%, 16L:8D) (Kavallieratos *et al.* 2001). Since the host plants fed upon by at least two aphid species, *Acyrtosiphon malvae* (Mosley) and *Amphorophora* sp., with different parasitoid complexes, separation of mummies was necessary in order to confirm the host range of emerged parasitoids. The external structure of emerged parasitoids was studied using an Olympus SZX9 stereomicroscope. One female paratype specimen was gold-coated with a sputter coater and examined using a Jeol JSM – 6460LV scanning electron microscope.

The morphological terminology for Hymenoptera follows Sharkey and Wharton (1997) and Kavallieratos *et al.* (2001). Subdivisions of the flagellum are referred to as segments in order to

remain consistent with other taxonomic works on Aphidiinae.

3. Parasitoid guild associated with aphid hosts, *Amphorophora* sp. and *A. malvae*, on *Geranium coeruleatum*

Here we present trophic relationships from two aphid hosts, *Amphorophora* sp. and *A. malvae*, on *G. coeruleatum* which is a high-mountain plant species endemic to Southeast Europe (Aedo *et al.* 1998) with an insular type of distribution. It inhabits mountain pastures and dry meadows. We reared *Aphidius geranii* sp. n. from aphid host *Amphorophora* sp. (probably an undescribed species) feeding on *G. coeruleatum*.

An additional aphid-parasitoid association occurring on *G. coeruleatum* involved *A. malvae*, which was parasitized by *Aphidius* cf. *pelargonii* Starý & Carver, *Aphidius avenae* Haliday, *Ephedrus lacertosus* (Haliday), and *Monoctonus* sp. (probably also undescribed species).

Here we demonstrated importance of endemic plants for maintaining these specific trophic associations. The newly described species as well as the other members of the parasitoid guild on *G. coeruleatum* could be regarded as important for conservation aspects.

4. Description of *Aphidius geranii* Tomanović and Kavallieratos, sp. n. (Figs 1 and 2)

Type individuals. Holotype female. Montenegro, Mt. Durmitor-Škrčka lakes, Skakala, 03.VII.2002, reared from *Amphorophora* sp. on *Geranium coeruleatum*, coll. Ž. Tomanović & N. G. Kavallieratos. Holotype slide mounted and deposited in the collection of Institute of Zoology, Faculty of Biology, University of Belgrade.

Paratypes. 2♂♂, Montenegro, Mt. Durmitor – Škrčka lakes, Skakala, 03.VII.2002; 3♀♀ 2♂♂, Montenegro, Mt. Durmitor – Škrčka lakes, 22.VII.2004; 2♀♀ 1♂, Montenegro, Mt. Durmitor – Škrčka lakes, 06.VIII.2005, reared from *Amphorophora* sp. on *Geranium coeruleatum*, coll. Ž. Tomanović. Paratype slide mounted and

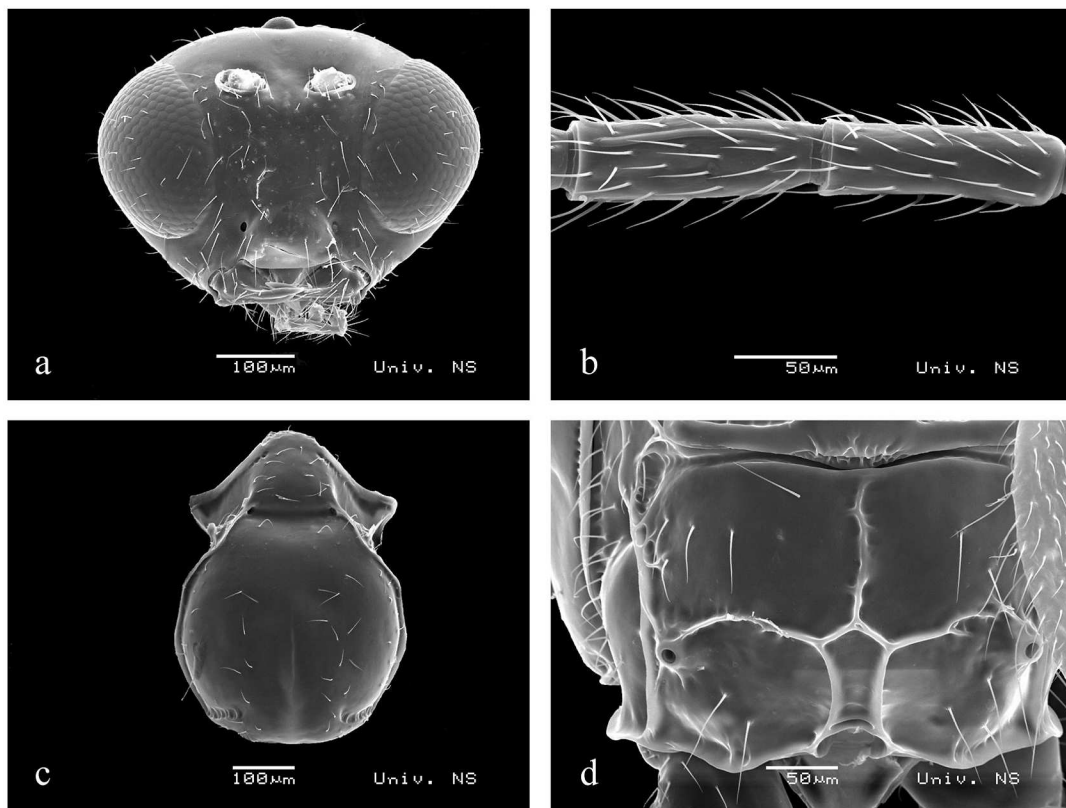


Fig. 1. *Aphidius geranii* sp. n. – a. Head. – b. Flagellomeres F_1 and F_2 . – c. Mesoscutum. – d. Propodeum, dorsal aspect.

deposited in the collection of Institute of Zoology, Faculty of Biology, University of Belgrade.

Description. Female. Head. Eyes oval, sparsely setose (Fig. 1a). Malar space equal to 0.37–0.42 times the longitudinal eye diameter. Clypeus oval, with about 12 long setae. Tentorial index (tentoriocular line/intertentorial line) 0.44–0.50. Antennae 16-segmented, filiform, moderately thickened at apex with semierect and adpressed setae shorter than the diameter of the segments. Flagellomere (F) 1 (Fig. 1b) 3.67–3.71 times as long as median width, without longitudinal placodes. F2 (Fig. 1b) is 3.11–3.29 times as long as median width, with 2–3 longitudinal placodes. F8 is 2.22–2.30 times as long as median width, with 4 longitudinal placodes. F1 little shorter than F2 ($F_1/F_2=0.93\text{--}0.96$) (Fig. 1b). Maxillary palp with four palpomeres, labial palp with two palpomeres.

Mesosoma. Mesonotum with notaulices distinct in the fore part, slightly crenulated, with two

rows of setae. Notauli effaced on the disc (Fig. 1c). Propodeum areolated with narrow central pentagonal areola (Fig. 1d). Upper lateral areola with five setae and lower lateral areola with four setae.

Fore wing. Stigma elongate, 5.05–5.14 times as long as wide and 1.20–1.29 times as long as distal abscissa of R1 (=metacarpus); R1 vein 4.00–4.21 times longer than stigma width (Fig. 2a).

Metasoma. Petiole elongate, 3.88–4.00 times as long as wide at spiracles (Fig. 2b), with 8–10 costulae on its anterolateral area (Fig. 2c) and with moderately prominent mediadorsal carina. Ovipositor sheath slightly concave in its dorsal margin (Fig. 2d).

Colour. Head dark brown to black. Mouthparts light brown. Scape and pedicel light brown. F_1 with narrow yellow ring at the base, remaining part of antennae brown. Petiole light brown, remaining part of metasoma black. Legs brownish

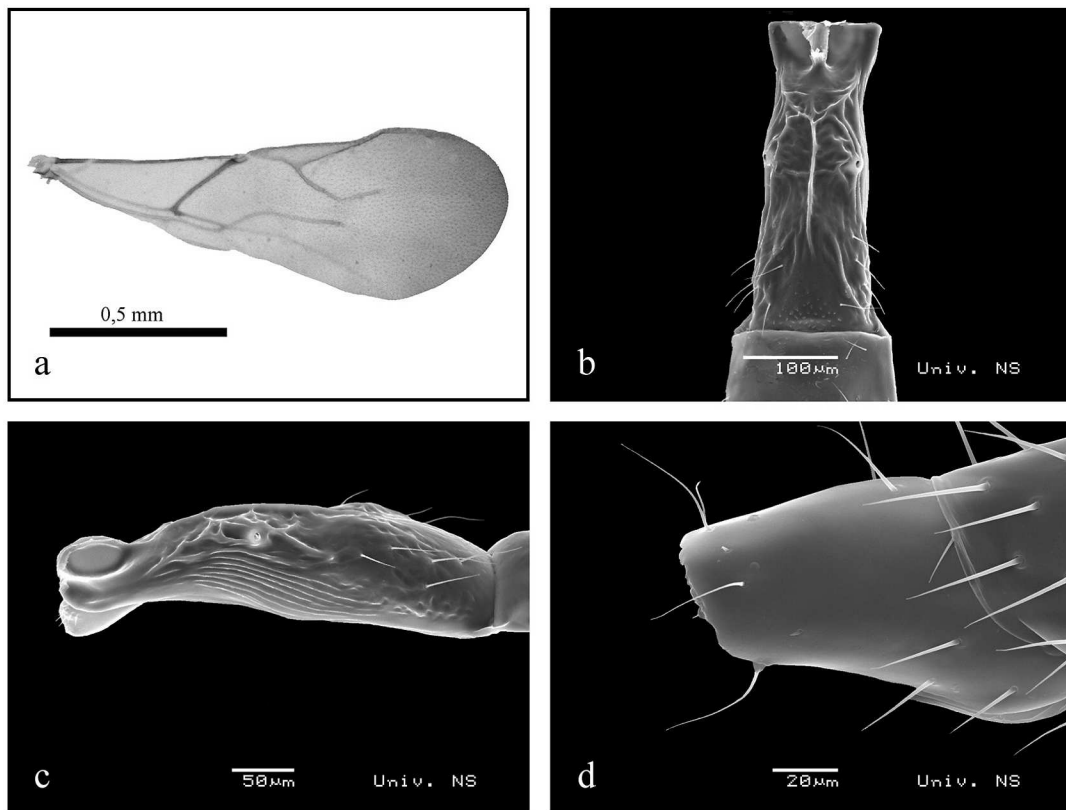


Fig. 2. *Aphidius geranii* sp. n. – a. Fore wing. – b. Petiole, dorsal aspect. – c. Petiole, lateral aspect. – d. Ovipositor sheath, lateral aspect.

with dark apices. Rest of body black.

Body length. 2.0–2.3 mm.

Male. Antennae 18 segmented. Flagellomere 1 with 5–6 longitudinal placodes. Petiole about 3 times as long as wide at spiracles level. Body generally darker than female, with brown legs and mouthparts.

Diagnosis. The host range pattern and long R1 vein put *A. geranii* sp. n. in the *A. urticae* s. str. group, but it differs from other species within the *A. urticae* group in labial palps with two palpomeres (all other species within the *A. urticae* group have labial palps with three palpomeres) and an elongate stigma (*A. geranii* sp. n. has a stigma length/width ratio of 5.0–5.2 vs. 3.2–4.0 in all other species of the *A. urticae* group).

The new species is distinguished from all other *Aphidius* species by the synopsis of the following characters: 16-segmented antennae, labial palps with two palpomeres, and a very elongate stigma. *Aphidius geranii* sp. n. resembles *Aphi-*

dius sonchi Marshall in the number of antennal segments and partially in wing venation, but it differs from *A. sonchi* in the stigma length/width ratio (5.0–5.2 in *Aphidius geranii* sp. n. vs. 3.5–4.0 in *A. sonchi*), the petiole length/width ratio (3.9–4.0 in *Aphidius geranii* sp. n. vs. 2.8–3.5 in *A. sonchi*), and the host range pattern (*A. sonchi* is a widely distributed parasitoid of *Hyperomyzus* aphid hosts throughout the Palaearctic).

Etymology. The new species takes its name from the host plant.

5. Key to *Aphidius* spp. reared from *Geranium* plants in Europe

Numbers in parentheses in the key indicate uncommon conditions.

1. Stigma length/width ratio of 5.05–5.14 (Fig. 2a); petiole length/width ratio 3.88–4.00 (Fig.

2b); labial palpus with two palpomeres

Aphidius geranii sp.n.

- Stigma length/ width ratio of 3.2–3.9; petiole length/width ratio 2.8–3.4; labial palpus with three palpomeres 2
- 2. Anterolateral area of petiole rugose (Fig. 3a). Antennae (17)18–19(20)-segmented

Aphidius ervi

- Anterolateral area of petiole costate or costulate. Antennae 16–17(18)-segmented 3

- 3. Anterolateral area of petiole costate (Fig. 3b). Body dark brown to black *Aphidius avenae*

- Anterolateral area of petiole costulate (Fig. 3c). Body brown to light brown

Aphidius cf. *pelargonii*

6. Discussion

6.1. Taxonomy

On the basis of its elongate R1 and host range pattern, *Aphidius geranii* sp.n. belongs to the *Aphidius urticae* s. str. group (Starý 1973). The *Aphidius urticae* s. str. group consists of several Palearctic species (*A. urticae* Haliday, *A. galii* Tomanović & Kavallieratos, *A. cf. pelargonii*, while *A. rubi* Starý and *A. silvaticus* Starý are with unclear taxonomic status) (Starý 1962, 1973, Tomanović & Kavallieratos 2002). Its labial palps with two palpomeres, elongate stigma, and petiole represent apomorphic characters in *A. geranii* sp. n., while the long distal abscissa of R1 and short first flagellomere are plesiomorphic characters.

6.2. Parasitoid guild

Aphid hosts belonging to the cosmopolite genus *Amphorophora* are parasitized by *A. urticae*, *E. lacertosus*, *Praon longicorne* Marshall, and *P. volucre* (Haliday) (Starý 1962, 2006; Kavallieratos *et al.* 2004). Parasitoid guilds of species belonging to this aphid genus are relatively well known because some species, e.g., *A. rubi* (Kaltenbach 1843), are pests on *Rubus* spp. (Rosaceae) that are distributed almost worldwide. Although *Geranium* plants are not commonly fed upon by *Amphorophora* aphids, there is an evidence of this behaviour in the literature: *Ampho-*

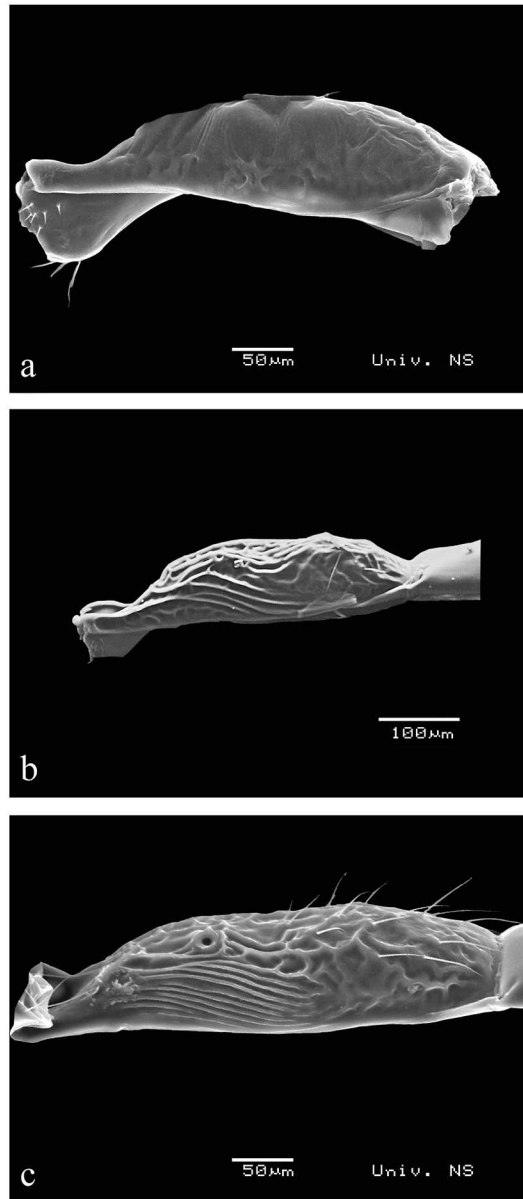


Fig. 3.— a. *Aphidius ervi*, petiole, lateral aspect. — b. *Aphidius avenae*, petiole, lateral aspect. — c. *Aphidius* cf. *pelargonii*, petiole, lateral aspect.

rophora tuberculata Brown & Blackman is known from *Geranium macrorrhizum* L. in England and Bulgaria; *Amphorophora coloutensis* Smith & Knowlton is known from *Geranium* spp. and *Amphorophora geranii* Gillette & Palmer from *Geranium richardsonii* Fisch. & Trautv in the USA (Blackman & Eastop 2006).

Acknowledgments. We wish to thank Dr. Olivera Petrović-Obradović (Faculty of Agriculture, University of Belgrade) for the identification and information about aphids. This study was partially supported by the Ministry of Science and Technological Development of the Republic of Serbia (143006B) and by the Entomology Institute Project Z50070508 (Academy of Sciences of the Czech Republic).

References

- van Achterberg, C. 2004: Fauna Europaea: Braconidae. — In: van Achterberg (ed.), Fauna Europaea: Hymenoptera: Symphyta + Ichneumonoidea. Version 1.1. [www document]. URL <http://www.faunaeur.org/>. (Site visited on 22 July, 2008)
- Aedo, C., Munoz, F. & Pando, G. 1998: World checklist of *Geranium* L. (Geraniaceae). — *Anales Jardín Botánico de Madrid* 56: 211–252.
- Blackman, R.L. & Eastop, V.F. 2006: Aphids on the World's Herbaceous Plants and Shrubs. — John Wiley & Sons, Natural History Museum. 1439 pp.
- Eady, R.D. 1969: A new diagnostic character in *Aphidius* (Hymenoptera: Braconidae) of special significance in species on pea aphid. — *Proceedings of the Royal Entomological Society of London B* 38: 165–173.
- Eastop, V. F. & van Emden, H. F. 1972: Aphid technology. — In: van Emden, H. F. (ed.), *The insect material*. Academic Press, London. 45pp.
- Kambhampati, S. & Mackauer, M. 1988: Intra- and inter-specific morphological variation in some *Aphidius* species (Hymenoptera: Aphidiidae) parasitic on the pea aphid in North America. — *Annals of the Entomological Society of America* 81: 1010–1016.
- Kavallieratos, N.G., Lykouressis, D.P., Sarlis, G.P., Stathas, G.J., Sanchis Segovia, A. & Athanassiou, C.G. 2001: The Aphidiinae (Hymenoptera: Ichneumonoidea: Braconidae) of Greece. — *Phytoparasitica* 29: 306–340.
- Kavallieratos, N.G., Tomanović, Ž., Starý, P., Athanassiou, C.G., Sarlis, G.P., Petrović, O., Niketić, M. & Veroniki, M.A. 2004: A survey of aphid parasitoids (Hymenoptera: Braconidae: Aphidiinae) of South-eastern Europe and their aphid – plant associations. — *Applied Entomology & Zoology* 39: 527–563.
- Pungerl, N.B. 1986: Morphometric and electrophoretic study of *Aphidius* species (Hymenoptera: Aphidiidae) reared from a variety of aphid hosts. — *Systematic Entomology* 11: 327–354.
- Rakhshani, E., Talebi, A. A., Starý, P., Tomanović, Ž., Kavallieratos, N.G. & Manzari, S. 2008: A review of *Aphidius* Nees (Hymenoptera: Braconidae: Aphidiinae) in Iran: host associations, distribution, and taxonomic notes. — *Zootaxa* 1767: 37–54.
- Sharkey, M. J. & Wharton, R. A. 1997: Morphology and Terminology. — In: Wharton, R. A. Marsh & Sharkey, M. J. (eds), *Manual of the New World genera of the family Braconidae* (Hymenoptera): 19–37. International Society of Hymenopterists, Special Publication 1, Washington, 439pp.
- Starý, P. 1962: New aphid parasites of the genus *Aphidius* Nees from Europe (Hymenoptera: Aphidiidae). — *Bulletin Entomologique de Pologne* 32: 109–122.
- Starý, P. 1973: A review of the *Aphidius* species (Hymenoptera: Aphidiidae) of Europe. — *Annotationes Zoologicae et Botanicae Bratislava* 84: 1–85.
- Starý, P. 2006: Aphid parasitoids of the Czech Republic (Hymenoptera: Braconidae: Aphidiinae). — *Academia, Praha*. 430 pp.
- Tomanović, Ž. & Kavallieratos, N.G. 2002: Two new aphidiine wasps (Insecta: Hymenoptera: Braconidae: Aphidiinae) from the southeastern Europe. — *Reichenbachia* 34: 341–345.
- Tomanović, Ž., Kavallieratos, N. G., Starý, P., Athanassiou, C.G., Žikić, V., Petrović-Obradović, O. & Sarlis, G.P. 2003: *Aphidius* Nees aphid parasitoids (Hymenoptera: Braconidae: Aphidiinae) in Serbia and Montenegro: Tritrophic associations and key. — *Acta Entomologica Serbica* 8: 15–39.
- Tomanović, Ž., Rakhshani, E., Starý, P., Kavallieratos, N.G., Stanisavljević, Lj. & Žikić, V. 2007: Phylogenetic relationships between the genera *Aphidius* and *Lysaphidius* (Hymenoptera: Braconidae: Aphidiinae) with description of *Aphidius iranicus* sp. nov. — *The Canadian Entomologist* 139: 297–307.