NEW ICHNEUMONID PARASITOIDS (HYMENOPTERA: ICHNEUMONIDAE) OF THE EAST ASIAN INVASIVE SPECIES OF SAWFLY, *APROCEROS LEUCOPODA* (HYMENOPTERA: ARGIDAE), DEFOLIATOR OF THE FIELD ELM, *ULMUS MINOR* IN SOME DECIDUOUS FORESTS IN MOLDOVA (ROMANIA)

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In this paper we present some aspects about attack and biology of *Aproceros leucopoda* and two parasitoid species for this defoliator pest, native in the East Asia (Japan, China and the Eastern part of Russia). In Romania this defoliator pest was observed for the first time in 2005 on *Ulmus minor* Mill., but its presence was published later, in 2010 (Blank *et al*.). We obtain by rearings two new ichneumonid parasitoids species: *Itoplectis maculator* (Fabricius) and *Pimpla turionellae* (L.), (Hymenoptera: Ichneumonidae: Pimplinae) for *Aproceros leucopoda*. Both ichneumonid species *Itoplectis maculator* (F.) and *Pimpla turionellae* (L.) are larval parasitoids of *Aproceros leucopoda*, but its adults emerged from the pupae of the host.

Keywords: *Aproceros leucopoda*, *Ulmus*, new larvar parasitoid species, new host.

INTRODUCTION

Aproceros leucopoda Takeuchi, 1939 (Hymenoptera: Argidae) is an invasive defoliator pest of the *Ulmus* genus, introduced passively in Europe. It is native from Eastern Asia: Japan (Takeuchi, 1939), Russian Far East (Zhelochovtsev, Zinoviev, 1995), China (Wen & Wei, 1998). *Aproceros leucopoda* is a monophagous or oligophagous species of the *Ulmus* genus. In Europe, this defoliator was collected for the first time in Hungary and Poland (2003), then from Romania (Dulceşti, Neamţ county, 2005) and Ukraine (Luhansk, 2005).

The spreading of *Aproceros leucopoda* extended in its new areal, Europe, which had enlarged. Thus, *Aproceros leucopoda* was recorded from the Republic of Moldova (Timuş *et al*., 2008, misidentified as *Arge* sp.), Austria (Altenhofer, 2009, in Blank *et al*., 2010), Slovakia (Blank *et al*., 2010), Serbia (Hirka, 2010), Italy (Zandigiacomo *et al*., 2012), Germany (Kraus *et al*., 2012), Croatia (Matošević, 2012), European Russia (Lengesova, 2012), Slovenia (de Groot *et al*., 2012), Czech Republic (Roques *et al*., 2013), Serbia (Glavendekić *et al*., 2013), Belgium (Boevé, 2014), Netherlands (Mol & Vonk, 2015), Letonia (Mihailova, 2015), Bulgaria (Doychev, 2015), Switzerland (Roques *et al*., 2016).

The first studies on the biology and control of *Aproceros leucopoda* were made in the Eastern Asia, in China, by Wu & Xin (2006). In Europe, the new area of this invasive sawfly, the studies on the biology and ecology were made by Lengesova & Mishchenko (2013) in the Middle Volga region, Russia.

However, *Aproceros leucopoda* was recorded for the first time in Europe and in all Western Palaearctic subregions by Stephan Blank, Raoul Constantineanu, Csóka György and Hideho Hara, published in a part of the project: "Identification of the wasp pest species of plants" (2004–2010) of the German Institute of Entomology, Leibniz Center for the Agricultural Research.

Anyway, Blank *et al*. (2010) have published the first paper on the recording of the *Aproceros leucopoda* in Europe. *Aproceros leucopoda* is a parthenogenetic and a multivoltine species, with four generations in Eastern Asia. In Romania it has at least two generations per year. In Eastern Asia, the only known natural enemy of *Aproceros leucopoda* is the parasitoid *Blondelia nigripes* (Fallén, 1810) (Diptera: Tachinidae) (Blank *et al*., 2010). Although, this parasitoid is a widespread Palaearctic species, not being recorded as a parasitoid of *Aproceros leucopoda* in Europe until now. In Romania it was recorded for the first time only the egg parasitoid, *Asecodes erxias* (Walker, 1848) (Hymenoptera: Eulophidae: Entedoninae) (Pricop *et al*., 2012). Milka Glavendekić (2013) had recorded in Serbia the larvae of the the predatory Harlequin ladybeetle, *Harmonia axyridis* (Pallas, 1773) (Coleoptera: Coccinellidae) feeding with larvae of *Aproceros leucopoda*, being the only predator known for this elm defoliator pest. Thus, in a nursery in the western part of Serbia (Šabac) she had observed a larva of *Harmonia axyridis* feeding on larvae of *A. leucopoda*.

MATERIAL AND METHODS

The field observations on the attack of *Aproceros leucopoda* and the collectings of its larvae, were made in the forests: Truşeşti, Botoşani county (Fig. 1), Roşcani and Gorban, Iaşi county. In the laboratory, the larvae of *Aproceros leucopoda* (Fig. 2) were fed with elm leaves, then they weaved a cocoon (Fig. 3), until they became pupae (Fig. 4) and adults (Fig. 5).

Fig. 1. A strong attack of *Aproceros leucopoda* with losing a substantial volume of leaves of *Ulmus minor* (Truşeşti forest, Botoşani county, June 2009).

Fig. 2. Larva of *Aproceros leucopoda.*

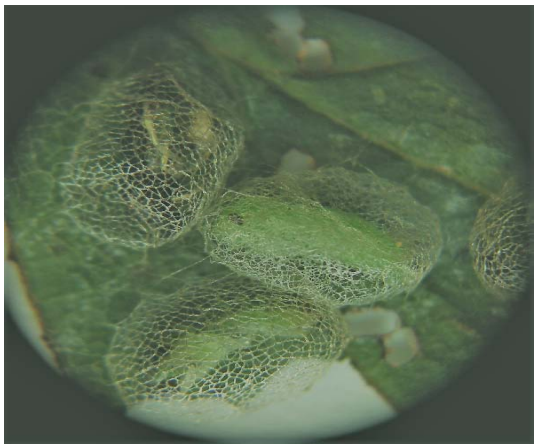

Fig. 3. Cocoons of *Aproceros leucopoda*.

A B

Fig. 4. The pupa of *Aproceros leucopoda*: A – dorsal view; B – ventral view.

A B

Fig. 5. Adult of *Aproceros leucopoda:* A – on elm leaves; B – dorsal view.

RESULTS

On 8.05.2009, 200 larvae of *Aproceros leucopoda* were collected from Truşeşti forest, Botoşani county. On 26.05.2009 one male emerged of the ichneumonid species *Itoplectis maculator* (F.), ♂ (Fig. 6).

Fig. 6. *Itoplectis maculator*, ♂, emerged.

On 3.06.2008, 200 larvae of *Aproceros leucopoda* were collected from Roşcani, near Paşcani town, Iaşi county. In the laboratory they became pupae and from one pupa one male of the ichneumonid species *Itoplectis maculator* (F.), ♂ emerged on 9.06.2008.

On 26.05.2009 200 larvae of *Aproceros leucopoda* were collected from Gorban forest, Iaşi county. In the laboratory they became pupae and from a pupa an ichneumonid species of *Itoplectis maculator* (F.), ♂ emerged on 10.06.2009.

Itoplectis maculator (F.) (Hymenoptera: Ichneumonidae: Pimplinae) (Fig. 6). The basic color of the body is black, with length of 8–10 mm. The female ovipositor is 2–5 mm length. It is a polyphagous species, its larvae parasitize over 75 species of pest insects of agriculture and forestry. It is a Holarctic species, in Romania being widespread, with large populations.

Aproceros leucopoda is a new host in science for *Itoplectis maculator* (F.).

On 28.05.2008, 50 larvae of *Aproceros leucopoda* were collected from Roşcani forest, Iaşi county and reared in the laboratory. In the laboratory they became pupae and 1 ♀ and 1 ♂ of the ichneumonid species *Pimpla turionellae* (L.) (Fig. 7) emerged, each from a pupa of the host, on 8.06.2008.

Fig. 7. *Pimpla turionellae*, ♀ from a cocoon of *Aproceros leucopoda.*

Pimpla turionellae (L.) (Hymenoptera: Ichneumonidae: Pimplinae) (Fig. 7). The basic color of the body is black, with a length of 5–12 mm, the female with an ovipositor not outrun ½ of the abdomen length. It is a polyphagous species, its larvae parasitize over 100 species of pest insects of agriculture and forestry. It is a Holarctic species, in Romania being widespread, with large populations. In the U.S.A., *Pimpla turionellae* (L.) was introduced in 1906 to control the gypsy moth, *Lymantria dispar* (L.). This ichneumonid parasitoid was established there. Also, *Pimpla turionellae* (L.) was introduced in 2009 and established in Central Asia to control gypsy moth, *Lymantria dispar* (L.) (Orozumbekov *et al*., 2009).

Aproceros leucopoda is a new host in science for *Pimpla turionellae* (L.).

CONCLUSIONS

In the present paper we record two larval ichneumonid species, emerged from pupae of *Aproceros leucopoda*: *Itoplectis maculator* (F.) and *Pimpla turionellae* (L.) (Hymenoptera: Ichneumonidae: Pimplinae).

Aproceros leucopoda Takeuchi is a new host in science for parasitoids *Itoplectis maculator* (F.). and *Pimpla turionellae* (L.).

Acknowledgements. We are especially grateful to Dr. Stephan Blank, Senckenberg German Entomological Institute Müncheberg for his correct identification of the defoliator of the field elm, *Aproceros leucopoda*.

REFERENCES

BLANK S.M., CONSTANTINEANU R., CSÓKA G., HARA H., 2008, *Charakterisierung der biotischen Naturraumausstattung Identifikation schädlicher Pflanzenwespenarten* – Teilprojekt: Identification schädlicher Pflanzenwespenarten (2004–2010), Deutsches Entomologisches Institut, Leribniz Zentrum für Agrallandschaftsforschung.

BLANK S.M., HARA H., MIKULÁS J., CSÓKA G., CIORNEI C., CONSTANTINEANU R., CONSTANTINEANU I., ROLLER L., ALTENHOFER E., HUFLEIT T. & VÉTEK G., 2010, *Aproceros leucopoda (Hymenoptera: Argidae): An East Asian pest of elms (Ulmus spp.) invading Europe*. European Journal of Entomology, **107**: 357–367.

BOEVÉ J.-L., 2014, *First record in Belgium of the invasive sawfly Aproceros leucopoda (Hymenoptera: Argidae) and some related ecological data*. Bulletin de la Société Royale Belge d'Entomologie, **149** [2013]: 217–221.

De GROOT, M., HAUPTMAN T., SELJAK, G., 2012, *Prva najdba invazivne brestove grizlice, Aproceros leucopoda (Hymenoptera: Argidae) v Sloveniji. The first record of the invasive »zigzag« sawfly Aproceros leucopoda (Hymenoptera: Argidae) in Slovenia*. Gozdarski vestnik, **70** (1): 3–7. (in Slovenian).

DOYCHEV D., 2015, *First record of the invasive Elm sawfly Aproceros leucopoda Takeuchi (Hymenoptera: Argidae) in Bulgaria*. Silva Balcanica, **16** (1): 108–112.

KRAUS M., LISTON A.D., TAEGER A., 2012*, Die invasive Zick-Zack-Ulmenblattwespe Aproceros leucopoda Takeuchi, 1939 (Hym., Argidae) in Deutschland*. DGaaE Nachrichten, **25** [2011] (**3**): 117–119.

GLAVENDEKIĆ M., PETROVIĆ J., PETAKOVIĆ M., 2013, *Alien invasive species Aproceros leucopoda Takeuchi (Hymenoptera: Argidae) – elm pest in Serbia*. Sumarstvo, **1–2**: 47–56. (in Serbian).

LENGESOVA N. A., 2012, *Elm sawfly (Aproceros leucopoda Takeuchi, 1939) – an elm pest new to the territory of the Ulyanovsk Region*. Priroda Simbirskogo Povolzh'ya, **13**: 136–139 (in Russian).

LENGESOVA N.A., MISHCHENKO A.V., 2013, *Biology, ecology and molecular characterization of Aproceros leucopoda (Takeuchi, 1939) (Hymenoptera: Argidae), pest of elms in the Middle Volga region*. Caucasian Entomological Bulletin, **9** (1): 163–167. (in Russian).

MATOŠEVIĆ D., 2012*, Prvi Nalaz brijestove ose listarice (Aproceros leucopoda), nove invazivne vrste u Hrvatskoj. First record of elm sawfly (Aproceros leucopoda), new invasive species in Croatia*. Šumarski list*,* **136** (1–2): 57–61.

MIHAILOVA J., 2015, *Aproceros leucopoda – jauns gobu kaitēklis Latvijā*. Valsts augu aizsardzības dienests (VAAD).

MOL A., VONK D., 2013, De iepenzigzagbladwesp: een nieuwe exoot in Nederland. natuurbericht.nl (Available at: http://www.natuurbericht.nl/?id=12191)

OROZUMBEKOV A.A, LIEBHOLD A.M., PONOMAREV V.I., TOBIN P.C., 2009, *Gypsy moth in Central Asia*. American Entomologist, **55** (4): 258–264.

PRICOP E., CARDAŞ G., CIORNEI C., ANDRIESCU I., 2012, *On the egg parasitoids of Aproceros leucopoda (Hymenoptera: Argidae), an invasive pest species from Japan*. ABAH Bioflux, **4** (2): 43–46. (Available at: http://www.abah.bioflux.com.ro).

ROQUES A., ROZENBERG M.-A., BLACKBURN T.M., GARNAS J., PYŠEK P., RABITSCH W., RICHARDSON D.M., WINGFIELD M.J., LIEBHOLD A.M., DUNCAN R.P., 2016, *Temporal and interspecific variation in rates of spread for insect species invading Europe during the last 200 years*. Biological Invasions (2016), Springer International Publishing, Switzerland.

TAKEUCHI K., 1939, *A systematic study on the suborder Symphyta (Hymenoptera) of the Japanese Empire (II)*. Tenthredo, **2**: 393–439.

TIMUŞ A., DERJANSCHI V., CROITORU N., 2008, *Viespea neagră a ulmului (Arge sp.) în Republica Moldova şi dezvoltarea acesteia pe ulmul de câmp – Ulmus minor*. Mediul Ambiant, Cercetări Ştiinţifice, **4** (40): 35–37.

WEN J., WEI M., 1998*, Taxonomical study on the genus Aproceros Malaise (Hymenoptera: Argidae) from China with descriptions of two new species*. Journal of Guangxi Agriculture University, **17**: 57–60.

WU X.Y., XIN H., 2006, *A new recorded species of the genus Aproceros Malaise (Hymenoptera: Argidae) from China*. Entomotaxonomia*,* **28**: 279–280. (in Chinese).

ZANDIGIACOMO P., CARGNUS E., VILLANI A., 2011, *First record of the invasive sawfly Aproceros leucopoda infesting elms in Italy*. Bulletin of Insectology, **64** (1): 145–149.

ZHELOCHOVTSEV A.N., ZINOVIEV A.G., 1995, *A list of the sawflies and horntails (Hymenoptera, Symphyta) of the fauna of Russia and adjacent territories*. Entomologicheskoe obozrenie, **74**: 395–415 (English translation: 1996, Entomological Review, **75**: 58–80.

***http://bfw.ac.at/cms_stamm/400/PDF/expertmeeting2013/ Glavendekic_Serbia.pdf

Received October 24, 2018

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