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***Reptalus quinquecostatus* (DUFOUR, 1833) (Hemiptera: Fulgoromorpha) – new species of cixiid in Poland**ARTUR TASZAKOWSKI¹, MARCIN WALCZAK², BARTOSZ BARAN³^{1,2}Department of Zoology, Faculty of Biology and Environmental Protection, University of Silesia, Bankowa 9, 40-007 Katowice, Poland³Department of Animal Physiology and Ecotoxicology, Faculty of Biology and Environmental Protection, University of Silesia, Bankowa 9, 40-007 Katowice, Poland; Students' Scientific Association of Zoologists "Faunatyzy"e-mail: ¹ atszakowski@us.edu.pl, ² cerambyx@wp.pl**ABSTRACT. *Reptalus quinquecostatus* (DUFOUR, 1833) (Hemiptera: Fulgoromorpha) – new species of cixiid in Poland.**

The paper presents the information on *Reptalus quinquecostatus* (DUFOUR, 1833) – a species of cixiid found in Poland for the first time. It is widespread in South Palearctic. *R. quinquecostatus* is strongly polyphagous species of cixiid, which may be a vector of pathogens, such as stolbur phytoplasma. The paper presents additional data on its biology and diagnostic features.

KEY WORDS: planthopper, fauna of Poland, Eastern Beskidy Mountains, pest, migration, climate changes.

INTRODUCTION

The cixiids are mostly phloem-feeders, and their sap-sucking habit makes them potential vectors of phloem-inhabiting plant pathogens. In Europe, several crops (beet, maize, strawberry, solanaceous and grapevine) are affected by different diseases vectored by cixiids. Several species are known as vectors of viruses, bacterium-like organisms and phytoplasmas (BERTIN *et al.* 2010). *Reptalus quinquecostatus* is a vector of *Candidatus Phytoplasma solani* [Stolbur - 16SrXII-A] (Bacteria, Mollicutes, Acholeplasmatales, Acholeplasmataceae) (PINZAUTI *et al.* 2008, CVRKOVIĆ *et al.* 2011, 2014).

The genus *Reptalus* EMELJANOV, 1971 belongs to the subtribe Pentastirina EMELJANOV, 1971, tribe Pentastirini EMELJANOV, 1971, subfamily Cixiinae SPINOLA, 1839, and family Cixiidae SPINOLA, 1839 (EMELJANOV 1971). The genus includes 29 species (BOURGOIN 2015). Most of its species are distributed in southern and central Europe, in North Africa, the Caucasus and Central Asia (LOGVINENKO 1975). *R. iguchii* (MATSUMURA, 1914) and *R. quadricinctus* (MATSUMURA, 1914) do occur in Japan (MATSUMURA 1914) and South Korea (RAHMAN *et al.* 2012). Some species do occur in China e.g. *R. quinquecostatus* (DUFOUR, 1833), *R. basiprocessus* GUO *et al.* WANG, 2007; *R. beirnei* EMELJANOV, 1978 occurs in Canada [= *Oliarus artemisiae* BEIRNE, 1950 *nomen praeoccupatum* replaced by *R. beirnei* EMELJANOV, 1978 *nomen novum*, according to EMELJANOV (1978) (BEIRNE 1950, BOURGOIN 2015)]. In Europe the genus *Reptalus* includes 11 species distributed in the temperate areas of central and southern Europe and also the Mediterranean Sea basin (HOCH 2013). In Poland so far only one species of this genus was reported – *Reptalus panzeri* (LÖW, 1883) (GĘBICKI *et al.* 2013).

Reptalus quinquecostatus (DUFOUR, 1833) occurs in the following European countries: Austria, Belgium, Bulgaria, Czech Republic, European Turkey (incl. Imroz Island - Gökçeada, but not those in the Sea of Marmara) mainland France, Germany, mainland Greece (incl. Andikithira Is., Evvia Is., Ionian Islands, Samothraki Is., Northern Sporades Islands, Thasos Is.) Hungary, mainland Italy, Kosovo, Macedonia, Moldova, Montenegro, Portugal, Romania, south of European Russia, Serbia, Slovakia, mainland Spain (incl. Alboran Is.), Ukraine. In Asia this species occurs in Asian Turkey, Caucasian republics of Russia, China, Georgia, Armenia, Azerbaijan, Kazakhstan, Lebanon, Israel, Jordan, Iran, Iraq, Syria, Tajikistan, Sinai Peninsula (Egypt), Arabian Peninsula (HOCH 2013, BOURGOIN 2015). Recently WEBB *et al.* (2013) reported, that the specimens from the United Kingdom regarded to be *R. panzeri* (LÖW, 1883) are in fact *R. quinquecostatus* (DUFOUR, 1833).

Identification of *Reptalus* species is based on morphological characteristics and restricted to a small number of specialist entomologists with broad experience of this insect family. Even for experts, the morphological distinction of closely related species remains difficult. Furthermore, the main taxonomic characteristics concerns the male genitalia, thus hampering the identification of juveniles and adult females. Recent research presented system for determining the three common species of the genus *Reptalus* using molecular techniques (BERTIN *et al.* 2010). Hence, some additional data on the morphology of the male genitalia are provided.

MATERIAL AND METHODS

Collection data

Łysa Góra (near Nowy Żmigród), UTM: EV49, geographical coordinates: N: 49°34'5", E: 21°35'20" (Fig. 1.), herbaceous meadow, 12.08.2013, 1♂, leg. A. Taszakowski.

Study area

Zoogeographic area (according to “*Katalog Fauny Polski*”: BURAKOWSKI *et al.* 1973): the Eastern Beskidy Mountains, in respect of physico-geographical division of Poland by KONDRACKI (2013) this site is situated in the Low Beskidy Mts.

The Low Beskidy Mts. is a mountain range situated on the south border of Poland from west to east, that as a result of the geological structure is traversed by numerous passes extending longitudinally. Mountain flora is impoverished - the thermophilous plants of the Pannonian Basin appear. Forests belong to the foothill and montane zones of vegetation, but in reserves the relics of the other phases of climate changes are preserved (KONDRACKI 2013). In the Low Beskidy Mts. there are trans-Carpathian mountain passes arranged along the lines of longitude. There is a suggestion that some species can penetrate this way into our country, but the functioning of this migratory route (Ondavian migratory route) is not yet well documented (MAZUR 2001). However, there are facts suggesting the greater importance of this route (TASZAKOWSKI 2012a).

So far 107 species of planthoppers and leafhoppers (Hemiptera: Fulgoromorpha and Cicadomorpha) has been recorded in the Eastern Beskidy Mts. (TASZAKOWSKI *et al.* 2015)



Fig. 1. Location of collection site of *R. quinquecostatus*.

Ryc. 1. Lokalizacja miejsca odłowu *R. quinquecostatus*.

Methods

Specimen was identified with a stereomicroscope and the external morphological features were used to determine family and genus. For species identification, male terminalia: phallic complex, genital styles (Fig. 2 A, C, D) and anal tube (Fig. 2 F) were applied, based on key of LOGVINENKO (1975) and BIEDERMANN & NIEDRINGHAUS (2004). Genitalia were carefully dissected and etched in a 10% potassium hydroxide solution (according to the procedure used in this group) in order to remove soft tissues. This procedure also turns the male genitalia semi-diaphanous, which allows better visualization of all the shape details (KNIGHT 1965). Specimens imaging was performed with Carl Zeiss SteREO Lumar.V12 stereomicroscope equipped with AxioCam 503 mono digital camera operating on Carl Zeiss AxioVision software. Acquired images were subsequently processed using G'MIC open source image processing framework.

TAXONOMIC COMMENTS ON THE COLLECTED SPECIMEN

European representatives of the family Cixiidae are quite easily distinguishable from the other Fulgoromorpha by the large and transparent forewings, surpassing the tip of the abdomen, with distinct venations, often with tubercles. These forewings are held roof-like in the rest position and sometimes overlap slightly apically. The frons is wide, with three keels giving a distinctive aspect to the species belonging to this family. Three ocelli are normally present (in European species), two laterally and one in the middle on the

frons. The pronotum is short and collar-like. The mesonotum is quite large, subtriangular and bears three or five longitudinal carinae. The hind tibiae have a row of apical spines and no movable spurs (BERTIN *et al.* 2010).

Description of the genus *Reptalus* EMELJANOV, 1971

Vertex rather broad, its width in the middle usually equal to its length, less frequently its length 1.5 times its width, its lateral margins approximately parallel anteriorly, diverging posteriorly, its anterior margin weakly arcuate. Areolar carinae projecting forward in an angle or in an arc, joined to the anterior margin of the vertex in the middle by two small and frequently indistinct converged longitudinal carinae. Vertex horizontal behind areolar carinae, longitudinally concave in a shallow groove, with a longitudinal carina behind, strongly canted forward and downward in front of the carinae. Frons and postclypeus forming a longitudinal hexagonal figure with rounded lateral angles opposite the antennae, above carinae slightly convex, straight or slightly concave. Median carina of frons and postclypeus sharp. Width of frons opposite antennae approximately twice its width at vertex. Lora without “windows”. Postclypeus forming a rounded-trapeziform projection on the frons up to the level of the antennae. Median ocellus small and distinct. Pronotum with a sharp obtuse-angled notch at rear, postocular carinae sharp, sharper than lateral carinae of pronotum, reaching or practically reaching anterior margin of sides of prosternum beneath eyes. Scutellum with five sharp carinae, the inter-mediate ones not extending to its anterior margin. Veins of elytra with setiferous granules. Tarsi of hind legs with approximately eight teeth on 1st and 2nd segments, subapical setae present either on both or only on 2nd (EMELJANOV 1971).

The genus *Reptalus* EMELJANOV, 1971 is a subject of nomenclatory and taxonomic discussion (WEBB *et al.* 2013), significantly exceeding the outlines of the presented paper.

The studied specimen was identified on the base of the shape of its gonostyli and anal tube. In the case of *R. quinquecostatus* these structures are very characteristic. Outer appendage of gonostyle is strongly elongated (Fig. 2 A, C, D), in contrast to *R. panzeri* (LÖW, 1883) (Fig. 2 B), in which it is short. Moreover, the differences can be easily seen in the structure of anal tube (Fig. 2 E) which has distinct, left directed process in *R. quinquecostatus* in contrast to *R. panzeri* which lacks such process (Fig. 2 F) (EMELJANOV 1971, LOGVINENKO 1975, BIEDERMANN & NIEDRINGHAUS 2004).

BIOLOGY OF *Reptalus quinquecostatus*

The biology and behaviour of the *Reptalus* species remain poorly known because of the peculiar characteristics of this planthopper genus (BERTIN *et al.* 2010, LOGVINENKO 1975). *R. quinquecostatus* is mesophilic species. Adult insects live mostly on grassy, rarely woody plants on steppe and other dry, isolated habitats (LOGVINENKO 1975). The lifecycle of cixiids is related to their host plants, which are exploited for feeding, mating and oviposition and serve as protection against predators (WILSON *et al.* 1994, SFORZA & BOURGOIN 1998). Species of this genus are polyphagous, they feed e.g. on *Chenopodium* sp. (Amaranthaceae), *Crataegus* sp., *Prunus cerasus* L., *Prunus domestica* L., *Prunus persica* (L.), *Pyrus malus* L. (Rosaceae), *Fraxinus* sp. (Oleaceae), *Glycine soja* SIEBOLD & ZUCC., *Medicago sativa* L., *Humulus lupulus* L. (Cannabaceae), *Oryza*

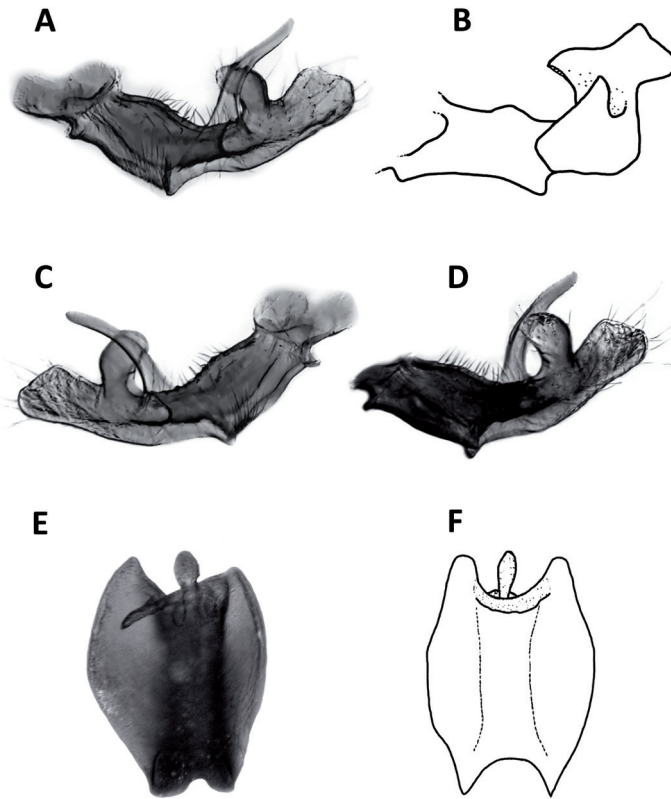


Fig. 2. A – *R. quinquecostatus*, right gonostyle of the studied specimen from inferior view (photo by B. Baran), B – *R. panzeri*, right gonostyle (according to BIEDERMANN & NIEDRINGHAUS 2004, changed), C – *R. quinquecostatus*, left gonostyle of the studied specimen from inferior view (photo by B. Baran), D – *R. quinquecostatus*, left gonostyle of the studied specimen from superior view (photo by B. Baran), E – *R. quinquecostatus*, anal tube of the studied specimen from below (photo by B. Baran), F – *R. panzeri*, anal tube from below (according to BIEDERMANN & NIEDRINGHAUS 2004, changed).

Ryc. 2. A – prawy gonostyl badanego okazu *R. quinquecostatus* w widoku z dołu (fot. B. Baran), B – prawy gonostyl *R. panzeri* (wg BIEDERMANN & NIEDRINGHAUS 2004, zmienione), C – lewy gonostyl badanego okazu *R. quinquecostatus* w widoku z dołu (fot. B. Baran), D – lewy gonostyl badanego okazu *R. quinquecostatus* w widoku z góry (fot. B. Baran), E – rurka analna badanego okazu *R. quinquecostatus* od dołu (fot. B. Baran), F – rurka analna *R. panzeri* od dołu (wg BIEDERMANN & NIEDRINGHAUS 2004, zmienione).

sativa L. (Poaceae), *Pistacia vera* L. (Anacardiaceae), *Platanus* sp. (Platanaceae), *Salix* sp. (Salicaceae), *Sesamum* sp. (Lamiales, Pedaliaceae) (LODOS & KALKANDELEN 1980), *Convolvulus* sp. (Convolvulaceae), *Malus* sp., *Rubus* sp. (Rosaceae), *Sinapis* sp. (Brassicaceae), *Ulmus* sp. (Ulmaceae) (BERTIN *et al.* 2010), *Daucus carota* L. (Apiaceae)

(DROBNJAKOVIĆ *et al.* 2010), *Melilotus albus* MEDIK. (Fabaceae), *Cirsium arvense* (L.) (Asteraceae) (LOGVINENKO 1975), *Vitis vinifera* L. (Vitaceae) (MAZZONI 2005).

Adult females lay eggs in the soil near the base of a host plant, and the five nymphal instars live underground and feed on its roots. Adults fly to leaves where feeding and mating (BERTIN *et al.* 2010, LOGVINENKO 1975). During the year, in temperate latitudes develops one generation (LOGVINENKO 1975).

DISCUSSION

In recent years, in Europe more and more South European species can be observed to expand their ranges to the north. This process may be connected with climate change within our latitude and occurrence of some thermophilic insects in new areas can be regarded as an indicator of this process (WIŚNIEWSKI *et al.* 2013). Occurrence of *R. quinquecostatus* in locality Łysa Góra may be the result the migration of insects from the south by Ondavian migratory route. Łysa Góra is located only 20 kilometers from the lowest pass in this part of Carpathians (Dukielska Pass: 500 m a.s.l.). Last research (TASZAKOWSKI 2012b, 2015) suggest larger than previously thought the importance of trans-Carpathian mountain passes located in the Low Beskids for migration of species from Pannonian Basin. So far recorded such species included to Hemiptera as *Eysarcoris ventralis* (WESTWOOD, 1837) (TASZAKOWSKI 2012b) or *Oxycarenum pallens* (HERRICH-SCHAEFFER, 1850) (TASZAKOWSKI 2015).

R. quinquecostatus is known for being a vector of pathogens (PINZAUTI *et al.* 2008, CVRKOVIC *et al.* 2011, 2014) of common plants of agricultural use. Among Polish species, it may be harmful e.g. for species of the genera *Pyrus*, *Prunus* or *Humulus*, which are of major economic importance and in the area of the Eastern Beskidy Mts., also for *Vitis* sp. Thus, its further dispersion should be monitored, and possible routes and means of dispersal well recognized.

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STRESZCZENIE

***Reptalus quinquecostatus* (DUFOUR, 1833) (Hemiptera: Fulgoromorpha) – nowy gatunek piewika w faunie Polski**

Praca przedstawia informacje o *Reptalus quinquecostatus* (DUFOUR, 1833) – gatunku piewika po raz pierwszy stwierdzonym na terenie Polski. Jest to owad szeroko rozprzestrzeniony w południowej Palearktyce. Piewik ten jest polifagiem (żeruje m.in.

na wielu roślinach użytkowych). *R. quinquecostatus* jest potencjalnym wektorem patogenów roślinnych. Praca zawiera wyczerpującą charakterystykę omawianego gatunku wraz z uwagami taksonomicznymi.

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