

Original scientific article
Received: 2015-02-12

UDK 595.74(497)

TWO SIBLING GREEN LACEWING SPECIES, *CHRYSOPA PALLENS* AND *CHRYSOPA GIBEAUXI* (INSECTA: NEUROPTERA: CHRYSOPIDAE) IN SLOVENIA AND WESTERN BALKAN COUNTRIES¹

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ABSTRACT

Green lacewing species, *Chrysopa gibeauxi* (Leraut, 1989), was recently reinstated as a valid species, and closely related to *Chrysopa pallens* (Rambur, 1838). Evaluation of morphological diagnostic characters of the two sibling species justified the separation of the two species. After re-examination the available insect material from Slovenia and western Balkan countries it was revealed that *Chrysopa pallens* is widely distributed in the area, whilst *Chrysopa gibeauxi* is a rare green lacewing, recorded in Slovenia, Croatia and Serbia (Kosovo). The distribution of the latter species is for sure larger than appearing. Some details concerning morphology and habitat of the species are provided. The erroneous citations given for Slovenia, assigned now to *Chrysopa gibeauxi*, are corrected.

Key words: Neuroptera, *Chrysopa gibeauxi*, *Chrysopa pallens*, sibling species, new records, Slovenia, Balkan

DUE SPECIE GEMELLE DI CRISOPIDI, *CHRYSOPA PALLENS* E *CHRYSOPA GIBEAUXI* (INSECTA: NEUROPTERA: CHRYSOPIDAE) IN SLOVENIA E NEI PAESI DEI BALCANI OCCIDENTALI

SINTESI

Il crisopide *Chrysopa gibeauxi* (Leraut, 1989) è stato recentemente ripristinato come specie valida, strettamente correlata a *Chrysopa pallens* (Rambur, 1838). La valutazione dei caratteri diagnostici morfologici delle specie gemelle ha giustificato la separazione delle due specie. Dopo un nuovo esame del materiale entomologico proveniente dalla Slovenia e dai paesi dei Balcani occidentali è stato concluso che *Chrysopa pallens* è una specie ampiamente diffusa nell'area in questione, mentre *Chrysopa gibeauxi* è un crisopide raro, trovato in Slovenia, Croazia e Serbia (Kosovo). La distribuzione della seconda specie è sicuramente più ampia di quanto al momento appaia. L'articolo fornisce alcuni dettagli riguardanti la morfologia e l'habitat delle specie considerate. Le citazioni erranee fornite per la Slovenia sono state corrette e ora assegnate a *Chrysopa gibeauxi*.

Parole chiave: Neuroptera, *Chrysopa gibeauxi*, *Chrysopa pallens*, specie gemelle, nuove segnalazioni, Slovenia, Balcani

¹ Dedicated to the memory of Jan Cernelutti (1920-2012)

INTRODUCTION

Green lacewings (Chrysopidae) are neuropteran insects used as biological pest control agents of insect and mite pests in agriculture and gardens (e.g., McEwen & Senior, 1998; Senior & McEwen, 2001; for reviews see Stelzl & Devetak, 1999; Canard, 2001; McEwen *et al.*, 2001). The family Chrysopidae comprises more than 1,200 described species in approximately 80 valid genera world-wide (Brooks & Barnard, 1990). Green lacewing genus *Chrysopa* Leach in Brewster, 1815 is distributed in Holarctic, with 11 valid species occurring in North America and approx. 50 in Europe, North Africa and Asia. Among them, 17 are recorded from Europe (Brooks & Barnard, 1990; Aspöck *et al.*, 2001).

From specimens captured in the French Alps, Leraut (1989) described a new green lacewing subspecies, *Metachrysopa pallens* ssp. *gibeauxi* Leraut, 1989. It was later raised as *bona species* (Leraut, 1992), but in 2001 it was synonymized with *Chrysopa pallens* (Rambur, 1838) by Aspöck *et al.* (2001). A decade and a half later, the species *Chrysopa gibeauxi* (Leraut, 1989) was con-

firmed and its valid status reinstated in a comprehensive study by Tillier *et al.* (2014).

Tillier *et al.* (2014) provided diagnostic characters separating the two species. In *Ch. gibeauxi* the pronotum covered with numerous thick black hairs, whilst in *Ch. pallens* there are slender blond and blackish brown hairs (Figs. 1, 2). In forewings of *Ch. gibeauxi* is first costal cross-veinlet black, and other costal cross-veinlets are fully black except in pterostigma, whilst in *Ch. pallens* is first costal cross-veinlet green, and other costal cross-veinlets are partly blackened, i.e. in the very distal part the veinlets are bright (Figs. 3, 4). On the head of *Ch. gibeauxi* seven black spots are larger and more intensively marked than in *Ch. pallens*. (Figs. 1, 2) (Tillier *et al.*, 2014). Furthermore, examination of the male genitalia of *Ch. pallens* from France and Romania, and of *Ch. gibeauxi* from France showed differences justifying the separation of the two species (Tillier *et al.*, 2014).

In the past, when the existence of *Ch. gibeauxi* has not yet been confirmed, *Chrysopa pallens sensu lato* was considered a common species in Slovenia and western



Figs. 1, 2: Dorsal view of the head and the prothorax: 1 – *Chrysopa pallens* (Rambur) (Hrastovlje, Slovenia), 2 – *Chrysopa gibeauxi* (Leraut) (Šempeter pri Gorici, Slovenia). (Photo: D. Devetak)

Sl. 1, 2: Glava in predprsje dorzalno: 1 – *Chrysopa pallens* (Rambur) (Hrastovlje, Slovenija), 2 – *Chrysopa gibeauxi* (Leraut) (Šempeter pri Gorici, Slovenija) (Foto: D. Devetak)

Balkan countries (reviews in Aspöck *et al.*, 1980, 2001; Devetak, 1992a).

As we now know, two closely related species occur in Europe (Tillier *et al.*, 2014), consequently it was necessary to re-examine material in the first author's collection to reinstate the knowledge of the occurrence of the both species in the area.

MATERIAL AND METHODS

Green lacewings were collected using a sweep net. Pinned individuals and lacewings preserved in alcohol are deposited in the first author's collection. Insects were photographed under a stereoscopic zoom microscope Nikon SMZ800 with a mounted digital camera Nikon DS-Fi1, and processed with NIS-Elements F 3.0 software. Digital images captured at different focal planes were assembled using the application Helicon Focus 4.62 Lite. A map of the studied area was created using ArcGIS 9.3 software (ESRI, 2010) and the free available DIVA-GIS database (<http://www.diva-gis.org/gdata>, accessed on 9.2.2015).

RESULTS

Distribution of *Chrysopa pallens* (Rambur) and *Ch. gibeauxi* (Leraut) in the studied area

Chrysopa pallens (Rambur, 1838)

In older literature (e.g., Klapálek, 1898, 1899, 1900; Živojinović, 1950; Zelený, 1964; Devetak, 1984, 1991, 1992b), the species is cited as *Chrysopa septempunctata* Wesm., 1841. After re-inspection the first author's collection the presence of the species was confirmed for Slovenia, Croatia, Montenegro, Serbia, Bosnia and Herzegovina, Živojinović (1950) in Serbia, Zelený (1964) in Albania, and a series of papers in Croatia (for a review see Devetak, 1992b), but due to the lack of preserved individuals it was impossible to verify the identity of species cited in the papers for these countries.

Slovenia

Literature records

Verified citations: Devetak (1984): Bohinj; Črni Kal; Ljubljana; Maribor; Maribor: Meljski hrib; Sečovelje; Šempeter pri Gorici; Škocjan pri Divači. Erroneous citations – *Ch. gibeauxi* mistaken for *Ch. pallens* in the following collecting places: Devetak (1984): Dravograd; Maribor: Starše; Kidričevo; Devetak (2011): Predoslje; grad Brdo.

Re-examined individuals:

Bohinj, jezero, 9. VIII. 1975 1 ♂ 1 ♀, 1. VIII. 1976 1 ♂, D. Devetak leg.; Črni Kal, Predloka, 24. VI. 1990 1 ♀; Haloze: Belski vrh, 14. VII. 1986 1 ♂, F. Janžekovič leg.; Ljubljana, VI. 1968 1 ♀, VI. 1971 1 ♂ 1 ♀, 1.-23. IX. 1971

1 ♀, I. Sivec leg., 8. VIII. 1976 7 ♂ 1 ♀, D. Devetak leg.; Makole: Šega, 13. VII. 1984 1 ♂, C. Krušnik leg.; Maribor, 24. VII. 1975 1 ♂, 28. VIII. 1976 3 ♂ 1 ♀, 10. IX. 1986 1 ♀, 14. IX. 1986 1 ♂, D. Devetak leg.; Maribor: Kalvarija, 16. VIII. 1991 1 ♂ 1 ♀, D. Devetak & Barbara Senegačnik leg.; Maribor: Kamnica, Kamniška Graba-Medič, 12. IX. 1992 1 ♂, Nataša Kočev leg.; Maribor, Meljski hrib, 22. VII. 1978 1 ♂, D. Devetak leg.; Nazarje, 23. VIII. 1986 1 ♀, D. Devetak leg.; Nova Gorica: Šempeter pri Gorici, 6. VII. 1973 1 ♀, 14. IX. 1973 1 ♂ 1 ♀, I. Sivec leg.; Obalno-kraška regija: Hrastovlje, 13. IX. 1980 1 ♀; 13. IX. 1990 1 ♂ 1 ♀, D. Devetak leg.; Ptuj: Gorišnica, 26. VIII. 1988 1 ♂, F. Janžekovič leg.; Rižana, izvir, 24. VII. 1990 1 ♀, C. Krušnik leg.; Sečovelje, VIII. 1973, 1 ♀, 19. VIII. 1983 1 ♂, D. Devetak leg.; Škocjan pri Divači, Škocjanske jame, 22. V. 1976 1 ♂, D. Devetak leg.

Croatia

Literature records

Verified citations: Devetak (1992b): Biograd na Moru; Istra, Premantura; O. Brač, Bol; O. Brač, Vidova gora; O. Rab, Lopar.

Re-examined individuals:

Biograd na Moru, 19. VIII. 1973 1 ♂, D. Devetak leg.; Istra, Premantura, 20. VII. 1984 1 ♀, D. Devetak leg.; O. Brač, Bol, 12. VII. 1987 1 ♂, 25.-30. VII. 1997 1 ♀, all D. Devetak leg.; O. Brač, Vidova gora, 9. VII. 1990 1 ♂, D. Devetak leg.; O. Rab, Lopar, 21. VI. 1976 2 ♀, D. Devetak leg.

Montenegro

Literature records

Verified citations: Devetak (1991): National Park Durmitor: Crno jezero: Čeline, Drenova gora, Komarnica – Nevidio, Mlinski potok, Tara – Tepca.

Re-examined individuals:

Budva, 25. VIII. 1988 1 ♀, F. Janžekovič leg.; National Park Durmitor, Crno jezero: Čeline, 11. VIII. 1988 1 ♂, P. Jakšić leg.; Durmitor, Drenova gora, 20. VIII. 1987 4 ♂ 3 ♀, F. Janžekovič leg.; Durmitor, Komarnica, Nevidio, 1100 m, 6. VII. 1986 1 ♂, P. Jakšić leg.; Durmitor, Mlinski potok, 17. VIII. 1987 1 ♂, F. Janžekovič leg.; Durmitor, Tara – Tepca, 4. VIII. 1984 1 ♀, 13. VIII. 1988 1 ♀, both P. Jakšić leg.; Tuzi, 5.-17. IX. 1982, 2 ♀, F. Janžekovič leg.

Serbia

Re-examined individuals:

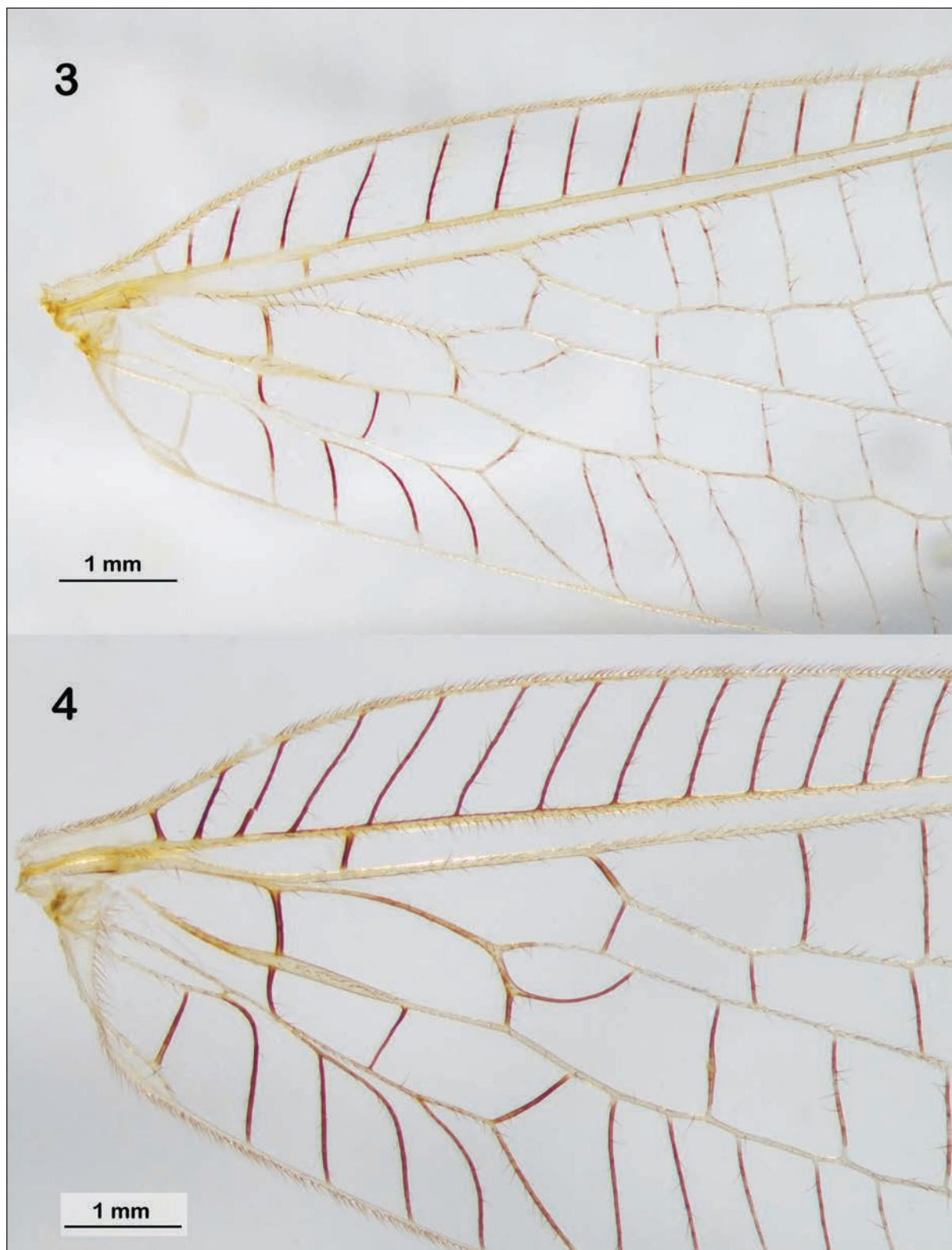
Kopaonik: Jošanička Banja, 6. VIII. 1986 5 ♂, P. Jakšić leg.; Raška: Raška, Razdolje, 500 m, 29. VII. 1987 1 ♀, P. Jakšić leg.

Serbia: Kosovo

Literature records

Verified citations: Devetak & Jakšić (2003):

Ibarska klisura: Košutovac, Košutovački potok; Mt. Grmija; Mt. Goleš; Mt. Šar planina, Prizrenska Bistrica; Priština; Prizren; Slatina.



Figs. 3, 4: The forewing of both species: 3 – *Ch. pallens* (Hrastovlje, Slovenia), 4 – *Ch. gibeauxi* (Šempeter pri Gorici, Slovenia). (Photo: D. Devetak)

Sl. 3, 4: Sprednje krilo: 3 – *Ch. pallens* (Hrastovlje, Slovenija), 4 – *Ch. gibeauxi* (Šempeter pri Gorici, Slovenija). (Foto: D. Devetak)

Re-examined individuals:

Ibar (Ibër): Ibarska klisura: Košutovac, Košutovački potok, 510 m, 24. VII. 1987 1 ♂ 5 ♀, P. Jakšić leg.; Kosovska Mitrovica (Mitrovicë) /former: Titova Mitrovica/, Ribariče, 1. VII. 1987 1 ♀, P. Jakšić leg.; Mt. Goleš (Golesh), 5. VI. 1979 1 ♂, D. Devetak leg.; Mt. Grmija (Gërmia), 21. VII. 1979 1 ♂, D. Devetak leg.; Mt. Šar planina (Malet e Sharrit), Prizrenska Bistrica, 530 m, 22. VII. 1986 1 ♂, P. Jakšić leg.; Priština (Prishtinë), from V. to IX. 1979 41 ♂ 11 ♀, D. Devetak leg.; 21. VIII. 1980 5 ♂ 2 ♀, P. Jakšić leg.; Prizren (Prizren), 22. VII. 1986 1 ♀, P. Jakšić leg.; Slatina (Sllatinë), 25. VII. 1979 1 ♀, D. Devetak leg.

Macedonia (=FYROM)

Re-examined individuals:

Demir Kapija, 21. V. 1988 1 ♂, P. Jakšić leg.; Dojran-sko Ezero, N part, 7. VIII. 1978 6 ♂ 2 ♀, F. Janžekovič leg.; Sv. Naum, Ohridsko Ezero, 5. VIII. 1988 1 ♂, F. Janžekovič leg.; Zrnovci, Kochani, 8. VI. 1985 1 ♂, I. Sivec & M. Štangelj leg.

Chrysopa gibeauxi (Leraut, 1989)

Distribution of re-examined individuals (Fig. 5):

Slovenia

Črni Kal, Predloka, 2. VII. 1990 1 ♀; Dravograd, 1. VII. – 6. VIII. 1975 38 ind.; Ig, Kremenica, 3. VIII. 1980 2 ♀, S. Brelih leg.; Kidričevo, 26. VI. 1983 1 ♀, D. Devetak leg.; Maribor, 4. VII. 1975 1 ♂, 16.–23. VII. 1975 5 ♂ 1 ♀, D. Devetak leg.; Mt. Pohorje, Pameče: Jesenkov vrh, 25. VII. 1985 1 ♀, M. Jež leg.; Nova Gorica: Šempeter pri Gorici, 6. VII. 1973 1 ♂, I. Sivec leg.; Predoslje: grad Brdo, 31. V. 2007 1 ♂, D. Devetak leg.; Starše, VIII. 1974, 2 ♀.

Croatia

Baranja: Ilok, 26. VIII. 2013 1 ♂, T. Koren leg.

Serbia: Kosovo

Priština (Prishtinë), 9. VIII. 1979 1 ♀, D. Devetak leg.

Diagnostic differences between the two species

Both sibling species observed in this study are - like Polish green lacewings studied by Tillier *et al.* (2014) - unambiguously separated. The key characters separating the two species are colouration of hairs on the pronotum (*Ch. pallens*: slender blond and blackish brown hairs, *Ch. gibeauxi*: thick black hairs) (Figs. 1, 2) and colouration of first costal cross-veinlet in forewings (*Ch. pallens*: green cross-veinlet, *Ch. gibeauxi*: black cross-veinlet) (Figs. 3, 4). Colouration of second antennal segment is not clearly visible in individuals preserved in alcohol, because, after a few years, it loses its colour. Most of the abdomen and the legs of *Ch. pallens* are covered only with blond (light) hairs, whilst in *Ch. gibeauxi* there are black hairs. Black spots on the head are in most individuals (but not in all) of *Ch. gibeauxi* larger than in *Ch. pallens*. In male genitalia, the gonocristae (central group) are smaller and more numerous in *Ch. pallens* than in *Ch. gibeauxi*.

Plant substrate specificity

The two sibling species differ according to their preference for plant substrate. Whilst *Ch. gibeauxi* was found on conifers (*Picea*, *Pinus*) or in coniferous forests, *Ch. pallens* occurred on a variety of deciduous trees. Twelve tree species were noted in Slovenia and western Balkan countries as plant substrates for *Ch. pallens* (Tab. 1).

Tab. 1: Plant substrate species for *Chrysopa pallens* in Slovenia and western Balkan countries.

Tab. 1: Rastlinske vrste, na katerih je bila najdena *Chrysopa pallens* v Sloveniji in deželah zahodnega Balkana

Plant substrate species	Country			
	Slovenia	Croatia	Serbia: Kosovo	Montenegro
<i>Pinus nigra</i> J.F. Arnold			X	
<i>Acer monspessulanum</i> L.		X		
<i>Acer campestre</i> L.	X			
<i>Acer negundo</i> L.			X	
<i>Acer platanooides</i> L.			X	
<i>Acer pseudoplatanus</i> L.			X	
<i>Fagus sylvatica</i> L.	X			X
<i>Prunus avium</i> L.	X			
<i>Quercus pubescens</i> Willd.	X			
<i>Quercus virgiliana</i> (Ten.) Ten.	X			
<i>Robinia pseudacacia</i> L.			X	
<i>Tilia cordata</i> Mill.	X			

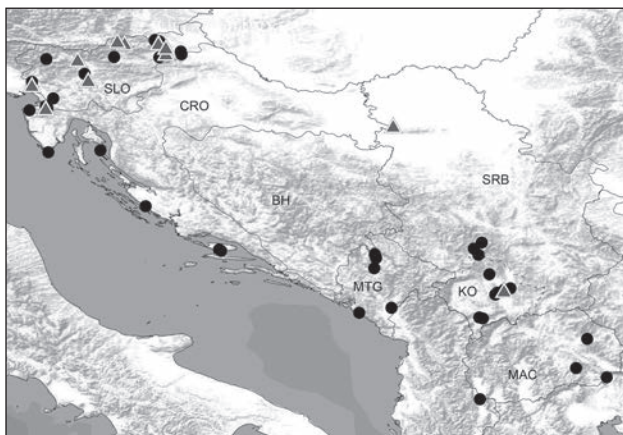


Fig. 5: Known distribution of *Ch. pallens* (circles) and *Ch. gibeauxi* (triangles) in Slovenia and western Balkan countries. BH – Bosnia and Herzegovina, CRO – Croatia, KO – Serbia: Kosovo, MAC – Macedonia, MTG – Montenegro, SLO – Slovenia, SRB – Serbia. (Author of the map: D. Ivajnsič)

Sl. 5: Znana razširjenost vrst *Ch. pallens* (krogi) in *Ch. gibeauxi* (trikotniki) v Sloveniji in deželah zahodnega Balkana. BH – Bosna in Hercegovina, CRO – Hrvatska, KO – Srbija: Kosovo, MAC – Makedonija, MTG – Črna Gora, SLO – Slovenija, SRB – Srbija. (Avtor risbe: D. Ivajnsič)

DISCUSSION

Species of the green lacewing taxon, *Ch. pallens sensu lato*, are known as beneficial predatory insects, feeding on crop pests, mainly small arthropods (e.g., Grimal & Canard, 1990; Canard, 2001). The species play role in vegetables, forests, field, fruit and nut crops (Duelli, 2001;

Szentkirályi, 2001a, b). In this study, the occurrence of *Ch. pallens* is confirmed for Slovenia and western Balkan countries, and the presence of *Ch. gibeauxi* is noted for the first time in Slovenia, Croatia and Serbia: Kosovo.

A series of papers containing data on the Balkan distribution of *Ch. pallens* published before 1989 exists, e.g., for Serbia (Živojinović, 1950), Bosnia and Herzegovina (Klapálek, 1898, 1899, 1900), Albania (Zelený, 1964), and Croatia (Novak, 1891; Mocsáry, 1899; Klapálek, 1906; Esben-Petersen, 1925; Saure, 1989). However, these papers have no value in these particular cases, considering the fact that they were published before 1989, when *Ch. gibeauxi* has not yet been known.

When morphological characters are considered, the both sibling species are unambiguously separated, as was already pointed out by Tillier *et al.* (2014). The association of green lacewings with particular tree species in Europe was reviewed extensively by Monserrat & Marín (2001) and Szentkirályi (2001b). The two species in the studied area differ in their ecological preference – whilst *Ch. gibeauxi* is found mainly on conifers, *Ch. pallens* prefers deciduous trees (Tab. 1).

It may be possible that *Ch. gibeauxi* is in Europe more frequent than it appears until now (Tillier *et al.*, 2014) and is probably relatively common also in Balkan countries.

ACKNOWLEDGEMENTS

We are grateful to field entomologists for collecting the insects. This research was supported partly by the Research Project Biodiversity of the Neuropterida in the Balkan (RP BioDiv Neuropterida Balkan – ALBH 2013) and partly by the Research Project Biodiversity of the green lacewings (Neuroptera: Chrysopidae) in Serbia (RP BioDiv CHRYSER 2015).

VRSTI TENČIČARIC, *CHRYSOPE PALLENS* IN *CHRYSOPE GIBEAUXI*
(INSECTA: NEUROPTERA: CHRYSOPIDAE),
V SLOVENIJI IN DEŽELAH ZAHODNEGA BALKANA

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POVZETEK

Tenčičarico vrste Chrysopa gibeauxi (Leraut, 1989) so v novejšem času ponovno ovrednotili kot veljavno vrsto, ozko sorodno vrsti Chrysopa pallens (Rambur, 1838). Na osnovi ovrednotenja morfoloških diagnostičnih znakov so utemeljili razlikovanje dveh sestrskih vrst. Ob ponovnem pregledu dostopnega materiala iz Slovenije in držav zahodnega Balkana smo ugotovili, da je vrsta Chrysopa pallens na območju splošno razširjena, medtem ko je Chrysopa gibeauxi redka, prvič zabeležena v Sloveniji, na Hrvaškem in Kosovem. Prav gotovo je slednja vrsta bolj razširjena, kot nakazujejo najdbe. Navajamo podatke o morfologiji in habitatu obeh vrst. Popravljeni so napačni citati za Slovenijo, ki se nanašajo na Chrysopa gibeauxi.

Ključne besede: Neuroptera, *Chrysopa gibeauxi*, *Chrysopa pallens*, sestrške vrste, nove najdbe, Slovenija, Balkan

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