Linzer biol. Beitr.	52/1	141-149	31.7.2020

Description of a new species of *Chrysoperla* STEINMANN, 1964 of the *Ch. mediterranea* HÖLZEL, 1972 group from Europe (Neuropterida, Neuroptera, Chrysopidae)

Michel CANARD & Dominique THIERRY

A b s t r a c t : The complex of the Mediterranean green lacewing *Chrysoperla mediterranea* sensu lato largely distributed in West-Palaearctics may be separated into different morphs occurring in various countries of Europe. Some specimens were recognized as new taxon, here named as *Chrysoperla europaea* nov.sp.

K e y w o r d s : *Chrysoperla mediterranea*, nomenclature, pretarsal claw, *Chrysoperla europaea* nov.sp.

Introduction

Chrysoperla STEINMANN, 1964 are Chrysopinae whose fore wing has the first cross veinlet between the radial sector (Rs) and the pseudomedia (Psm) reaching this vein beyond (or just at) the apex of a short ovalo-triangular intramedian cell (Cim) (Fig. 1). The genus contains about 36 valid species distributed worldwide but with most species Holarctic (BROOKS 1994). Seven species occur in Europe: *Ch. carnea* STEPHENS, 1836*, *Ch. affinis* STEPHENS, 1836*, *Ch. mutata* MCLACHLAN, 1898, *Ch. lucasina* LACROIX, 1912*, *Ch. renoni* LACROIX, 1933*, *Ch. mediterranea* HÖLZEL, 1972*, *Ch. ankylopteryformis* MONSERRAT & DÍAZ-ARANDA, 1989. The five asterisked taxons are all present in countries of Central Europe (ASPÖCK et al. 2001).

Chrysoperla mediterranea is a small sized species, clearly delimited by four external morphological features:

- intense green ground coloration,
- red markings on the head,
- relatively narrow wings,
- small basal dilation of the claw giving it a sub-triangular shape,
- to which one may add three bio-ecological traits:
- a strong association with conifers (mainly *Pinus*) most often in dry biotopes,
- no color change during adult winter diapause,
- possible reproduction with other *Chrysoperla* when sympatric.

A study based on specimens of *Ch. mediterranea* coming from various places in Europe (HENRY et al. 1999) ascertained that differences were present between populations coming from different areas. Nevertheless, they emit similar courtship song; so, if we agree with the tenet upheld by the above-mentioned authors – one courtship song

designating automatically a single species – there would be only a single taxon distributed on a large range of about 2800 km. This perspective is not fully satisfactory. Here, in continuation with this previous work, we attempt to assess the true status of these morphs more convincingly.

The more traditional concept of definition based on genital structures must be revisited in order to determine if the observed arrangement complex of the male genitalia defines a single species divided in sub-species or into several different species.

Material and methods

The specimens used in this study were collected as follows:

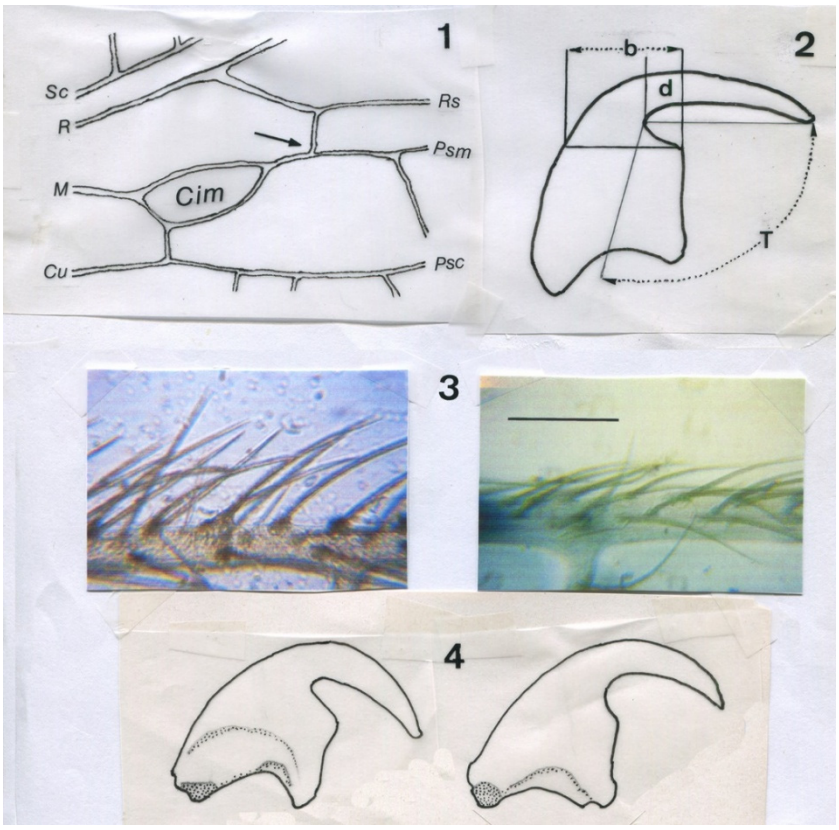
Material examined: *Ch. mediterranea* (typica), Morocco, Meknes, 33°53'N-05°33'W, light trap, 25.10.1975 (Y. Miermont / M. Canard); 2♀♀, southeastern France, Var, Le-Luc-en-Provence (83073), 43°24'N-06°19'E, McPhail traps baited with diammonium phosphate, 17.07.1981 (R. Pralavorio / M. Canard); several specimens from Spain, conifer woods near the sea shore: Castellón, Peniscola, 40°21'N-0°02'E, sea level, suburban, light traps, 5♂♂, 3♀♀, 23-29.07.1987; Sierra de Espedan, 39°05'N-0°17'W, 550 m, light traps, suburban, 2♂♂, 29.07.1987; Valencia, Puçol, 39°4'N-0°2'W, 1♀, 25.07.1987 (D. Thierry); southern France, several specimens, Gard, Peyremale (30194), 44°18'N-04°03'E, on Pinus, 28.06.2019 (D. Thierry).

Ch. europaea, Hungary, Vas, Tanakajd, 47°11'N-16°44'E, light traps, 1♂, 1♀, 06.07.2013 (F. Szentkirályi / D. Thierry); Italy, Piedmont, Bardonecchia, 45°05'N-06°42'E, eastern slope of the Frejus pass, 1250 m, 1♂, 2♀♀, 01.08.1989 (D. Thierry); France, Gard, Sénéchas (30316), 44°19'N-04°01' E, 1♂, 26.06.2019 (D. Thierry); Maine-et-Loire, Brain-sur-Allonnes (49041), 47°18'N-0° 51' W, 1♂, 02.08.2017, 1♀, 29.08.2018 (Y. Guenescheau / D. Thierry).

In examining numerous morphological characters of *Chrysoperla mediterranea* sensu lato, several categories can be distinguished. As the original description of the species is founded on individuals originating from Bizerta, Tunisia (holotype) and from Morocco, Spain and southern France (paratypes) (HÖLZEL 1972), we consider the morph originating both from Maghreb, south- and western Europe as the nominate species.

All the regional samples were roughly consistent within the range of morphological character states previously given in the original description. They have quasi-similar – if not identical – courtship song carefully described by HENRY et al. (1999). The geographical populations were poorly separated by their morphology. The main difference consists mainly of their distribution areas and some subtle morphological details.

The shape of the pretarsal claw, considered one of the best discriminating traits by several authors, points out the proportional size of the basal dilation. In the above-mentioned study, HENRY et al. (1999) gave a ratio R as the total breadth of the claw b following a perpendicular cut across on the basal dilation d (Fig. 2); but as the dilation d may be zero in some *Chrysoperla* such as in *Ch. furcifera* (OKAMOTO, 1914), the ratio may then tend to infinity, a value objectively absurd. An alternative expression is used here, namely the inverse relation d/b., so giving higher numerical value with larger basal dilation. Another feature is the opening of the hook (tilting) namely the angle T (Fig. 2).



Figs 1-4: (**1**) Fore wing of *Chrysoperla* sp., central part showing the contact point (arrow) of the first transverse veinlet between the Radial sector (Rs) and the Pseudomedian vein (Psm). Cim = intramedian cell; Cu = cubital vein; M = median vein; Psc = post cubital vein; Psm = post median vein; R = radial vein; Rs = radial sector; Sc = sub costal vein; (**2**) *Chrysoperla* sp. claw outline of showing the basal dilation (d), the breadth (b) and the tilting angle (T); (**3**) Costal setae on the median part of the forewing of *Chrysoperla europaea* (left) and *Ch. mediterranea* (right); (**4**) Claws of *Chrysoperla europaea* (left), *Ch. mediterranea* (right).

Results

Tab. 1: Comparative description of morphological characters of *Chrysoperla europaea* nov.sp. Facing the features mentioned below (left), the kind of each relevant character of the closely related species *Chrysoperla mediterranea* sensu stricto. is noted in the right column in italic types.

	Chrysoperla europaea	*Chrysoperla mediterranea*
General body coloration	yellow green	intense green
Head		
- frons	yellow light	prominent orange-red markings
- markings on stipites	——————broad black stripe all along——————	

	Chrysoperla europaea	*Chrysoperla mediterranea*
- palps	Yellowish, black brown laterally	entirely black
- clypeus	reddish	narrow lateral black band
- genae	——————broad black squared stripe——————	
Scape and pedicel	yellowish light	yellowish
Flagellum	yellowish, fuscous on lateral side	brownish
Pronotum	Unicolorous, yellowish green	pale green, medio-dorsal yellow fascies (vitta)
Wing		
- outline (L/W)	3.0-3.6	3.3
- length of fore wing	10.3-12.5 mm	9-9.7 mm, always < 12 mm
- length of hind wing	9.3-9.9 mm	8.-9.0 mm
- costal setae (Fig. 3)	——————Thin, tight, inclined towards wing apex————	
Leg		
- femur	numerous black thorns	blond setae
- tarsus	green	greyish brown
- outline of claw	sub-quadrangular	sub-triangular
- basal dilation of claw (fig. 4)	dilation medium, R about 0.26	dilation minute, R about 0.18
- tilting of the tooth	T about 120 °	T about 100 °
Longitudinal veins	——————————green——————————	
Cross veins	——————————green——————————	
Gradates	——————————green——————————	
Abdomen		green, yellow dorsal fascies
- abdominal setae		black

Male internal genitalia (Fig. 5)

The genital male complex of the two species is similar in general pattern: arcessus almost straight, striated dorsally, two small lobes with long antero-lateral thorns, small crescentic entoprocesses. But the apex of the arcessus is blunt in *Ch. europaea* and acute in *Ch. mediteranea*, the tignum has regularly curved arms in *Ch. europaea* and almost quadrangular in *Ch. mediterranea*; acumen long and rounded apically. These features are sufficiently distinct to allow us to consider two separate species, although they may mate and reproduce in the lab (THIERRY et al. 1992) a character common in (? all) Chrysoperla spp. The outline of the male terminalia of the two sibling green lacewings does not give any significant difference, both in size and proportions of the sternites 7 and (8 + 9) (Fig. 6).

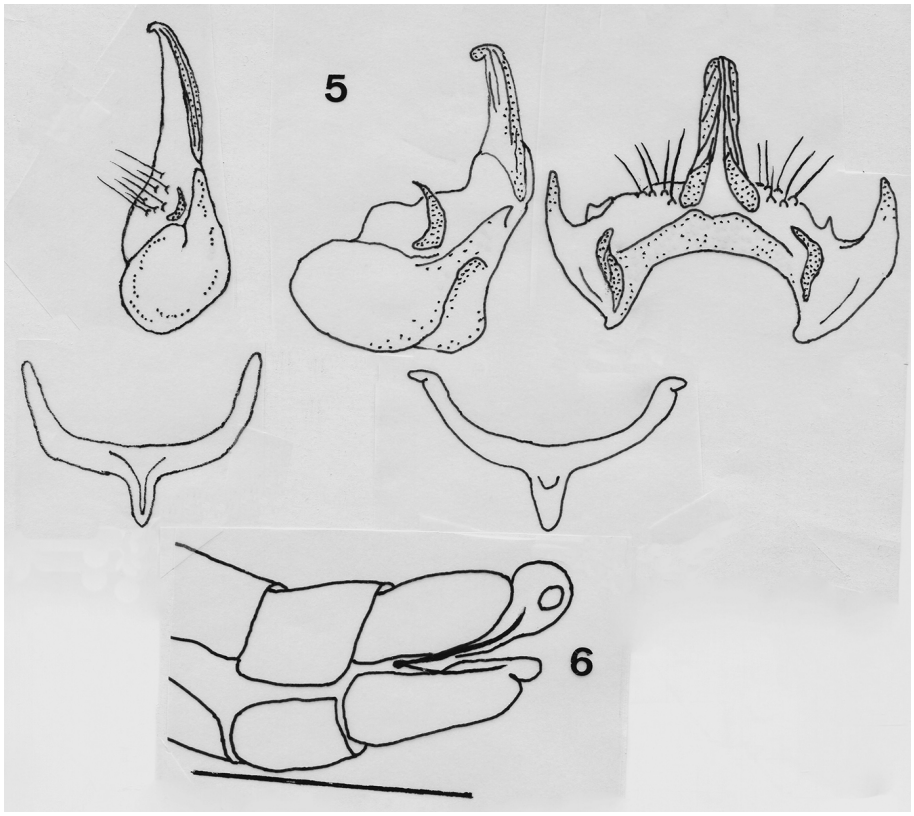


Fig. 5-6: (**5**) Internal genitalia: *Chrysoperla europaea* (right, after BROOKS, 1994 erroneously labelled *Chrysoperla mediterranea*), gonarcus complex lateral view (left), dorsal view (middle), tignum dorsal (down); and of *Ch. mediterranea* (left) (after HÖLZEL, 1972). Scales not appointed; **(6)** male abdominal terminalia of *Chrysoperla europaea* (scale bar = 1 mm).

The holotype is a male collected in France, Gard, Sénéchas (30316), 44°19'N-4°01'E, in hedge of deciduous tree, 26.06.2019. Paratypes are one female and one male, collected respectively in Hungary, Vas, Tanakajd, 47°11'N-16°44'E, light trap, 06.07.2013 and in France, Maine-et-Loire, Brain-sur-Allonnes (49041), 47°18'N-0° 51'E, 1♀ on *Fraxinus excelsior*, 02.08.2017. Holotype and paratypes are deposited and stored in the Musée d'Histoire Naturelle d'Angers, (49000 France).

Distribution

Chrysoperla europaea is little known due to its misidentification with the very close *Ch. mediterranea*. It occurs (Fig. 7) only with certainty in Hungary from where the first specimens come (SZENTKIRALYI in lit.); in southern (Pfynwald) (DUELLI 1987) and central Switzerland (Zürich) (DUELLI in lit.); in central Austria, nature Reserve

Eichkogel (ANDERLE & ASPÖCK 2007); in central-eastern Austria (Eppersdorf), Carinthia (HÖLZEL & WEISSER 1999); in Slovakia (DUELLI in lit.; JEDLIČKA et al. 2004); in Georgia (DUELLI et al. 2015) that is the more eastern known site; in France, Val-de-Loire, near Saumur (Brain-sur-Allonnes 49041) and in the Cévennes, Gard, Sénéchas (30316)); in Italy, on the eastern slope of Frejus pass, 1250 m. (THIERRY unpubl.).

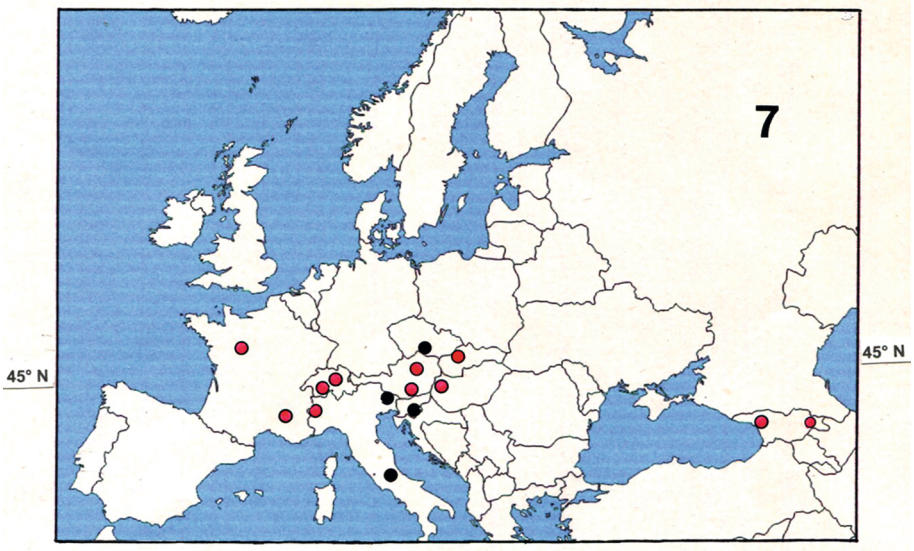


Fig. 7: Distribution of *Chrysoperla europaea* (after d-maps.com). Black spots: data which must be ascertained.

However, many other samples bearing the most used common name *Chrysoperla mediterranea* were registered in several sites, but the doubts on their actual occurrence make their placement uncertain, and in need of confirmation. This is the case for Czech Republic (SEVČIK 2010); Slovenia, Kozjanski Regional Park (KLOKOČOVNIK et al. 2010; LANGERHOLC & DEVETAK 2019); central Italy, Abruzzo, Majella National Park (LETARDI & BISCACCIANTI 2007; POPOV & LETARDI 2010); northern Italy, Friuli-Venezia Giulia (LETARDI et al. 2010).

Comments

The new species *Chrysoperla europaea* displays approximately the traits of the typical form of the Mediterranean green lacewing, including the precopulatory acoustic signals. Nevertheless, some characters show differences and may be used to identify the species. The head of *Ch. europaea* never bears red markings, the size is larger than the sibling species. The claw dilation ratio R is 1.4 times larger than that of *Ch. mediterranea*, so that it looks sub-quadrangular rather than sub-triangular. Biogeographically, it seems confined to the North of the Alps and is associated most often with deciduous trees rather than conifers.

Another morph yet undescribed was previously expected in Greece; after DUELLI (1987), it may be possibly a new east-Mediterranean species occurring in the Greek Peninsula up to Adriatic coast. It was caught later and differentiated from other Common green lacewings by means of claw shape in THIERRY et al. (1998) and then registered as "Greek morph" without any formal description.

The very wide distribution conventionally assigned to the song-species *Ch. mediterranea* sensu lato. from Hungary to Spain makes difficult an easy differentiation of closely related taxa. Using similar precopulatory tremulation pattern (? if not identical as far as the classical method is sufficient to characterize it) is meanwhile not unique in the genus, witnessing so that the behaviourial bareer is not the sole to separate species. Thus, the courtship song of the marsh green lacewing *Ch. renoni* (LACROIX, 1933) could not be differentiated from that of the common green lacewing *Chrysoperla carnea* sensu *stricto* (=*Ch. pallida* HENRY et al., 2002, Cc 2 in the song system) (DUELLI, pers. com., September 2001); but these two species, although have very different ecological requirements. A single precopulatory duet pattern has been also recorded in the pair *Ch. sillemi* (ESBEN-PETERSEN, 1935) and *Ch. zastrowi arabica* HENRY et al., 2006: they conform acoustically one another by displaying the same courtship song; only their allopatric distribution keeps them apart (HENRY et al., 2010).

Ch. europaea is new (the 51st species recorded) to the French green lacewing fauna.

Acknowledgements

Dr Ferenc Szentkiralyi, Hungarian Academy of Sciences, Plant Protection Institute, Budapest, was the first to raise doubts about the actual identity of some green lacewings he collected in the Hungarian light trap network and he classed provisionally then as *Chrysoperla mediterranea* (?). Many thanks for transmitting us his perplexity that gave rise to this study. Warm thanks to Dr Peter Duelli, Birmensdorf, Switzerland for useful information, mainly on distribution, and to Yvon Guenescheau, www.faune-France.org who contributed greatly to the fieldwork and to the examination of samples collected in the Loire Valley. Also Pr Tim New, Bundoora, Australia must be acknowledged for kindly checking a first draft of the MS.

Zusammenfassung

Der mediterrane Florfliegen-Komplex *Chrysoperla mediterranea* sensu lato, welcher großteils in der West-Paläarktis verbreitet ist, zeigt in verschiedenen Ländern Europas unterschiedliche Morphen. Manche Individuen werden einer neuen Art zugeschrieben, welche hier als *Chrysoperla europaea* nov.sp. beschrieben wird.

Literature

ANDERLE F. & U. ASPÖCK (2007): Neuropterida (Insecta, Endopterygota of the Nature Reserve Eichkogel (Lower Austria): arguments for protecting an insular biocoenosis in the South of Vienna. — Annali del Museo Civico di Storia Naturale di Ferrara **8** (2005): 139-144.

ASPÖCK H., HÖLZEL H. & U. ASPÖCK (2001): Kommentierter Katalog der Neuropterida (Insecta: Raphidioptera, Megaloptera, Neuroptera) der Westpaläarktis. — Denisia **2**: 1-606.

BROOKS S.J. (1994): A taxonomic review of the common green lacewing genus *Chrysoperla* (Neuroptera: Chrysopidae). — Bulletin of the British Museum of Natural History (Entomology) **63**: 137-210.

DUELLI P. (1987): Ein isolierte Reliktpopulation von *Chrysoperla mediterranea* (Planipennia: Chrysopidae) in der Schweiz. — Mitteilungen der Schweizerischen Entomologischen Gesellschaft **60**: 301-306.

DUELLI P., BOLT C. & Ch.S. HENRY (2015): Neuroptera of the Caucasian Republic of Georgia. — Entomological News **124** (4): 229-244.

HENRY Ch.S., BROOKS S.J., JOHNSON J.B. & P. DUELLI (1999): Revised concept of *Chrysoperla mediterranea* (HÖLZEL), a green lacewing associated with conifers: courtship song across 2800 kilometres of Europe (Neuroptera: Chrysopidae). — Systematic Entomology **24**: 335-350.

HENRY Ch.S., BROOKS S.J., JOHNSON J.B., VENKATESAN T. & P. DUELLI (2010): The most important lacewing species in Indian agricultural crops, *Chrysoperla sillemi* (ESBEN-PETERSEN), is a subspecies of *Chrysoperla zastrowi* (ESBEN-PETERSEN) (Neuroptera: Chrysopidae. — Journal of Natural History **44** (41-42): 2543-2555.

HÖLZEL H. (1972): *Anisochrysa* (*Chrysoperla*) *medterranea* n. sp., eine neue europäische Chrysopiden Spezies (Planipennia: Chrysopidae. — Nachrichtenblatt der Bayerischen Entomologen **21** (5): 81-83.

HÖLZEL H. & Ch. WEISSER (1999): Die Netzflüger Kärntens, Eine zusammenfassende Darstellung der Autökologie und Chorologie der Neuropterida (Megaloptera, Raphidioptera, Neuroptera) Kärntens. — Carinthia II **189**/109: 361–429.

JEDLIČKA L., SEVČIK J. & L. VIDLIČKA (2004): Checklist of Neuroptera of Slovakia and the Czech Republic. — Biologia, Bratislava (Zool.) **59** (Suppl. 15): 59-67.

KLOKOČOVNIK V., DEVETAK D. & S. GOMBOC (2010): Neuropterida (Megaloptera, Raphidioptera, Neuroptera) of Kozjanski Regional Park, Slovenia. In: DEVETAK D., LIPOVSEK S. & A.E. ARNETT (eds): Proceedings of the Tenth International Symposium on Neuropterology, Piran, Slovenia, 2008. 171-174. Maribor University 2010.

LANGERHOLC E. & D. DEVETAK (2019). Alderflies and lacewings (Neuropterida, Megaloptera, Neuroptera) of the Natura 2000 protected area in Slovenia: Ličenca near Poljčane-Petelinjek ponds. — Acta Entomologica Slovenica **27** (1): 31-41.

LETARDI A. & A.B. BISCACCIANTI (2007): Neuropterida of the Majella National Park (Italy). — Annali del Museo Civico dii Stora Naturale di Ferrara **8** (2005): 107-110.

LETARDI A., NICOLI ALDINI R. & R. PANTALEONI (2010): The Neuropterida of Triveneto (Northern Italy): an updated faunal checklist with some zoogeographical remarks. — In: DEVETAK D., LIPOVSEK S. & A.E. ARNETT (eds): Proceedings of the Tenth International Symposium on Neuropterology, Piran, Slovenia, 2008. 181-189. Maribor University 2010.

POPOV A. & A. LETARDI (2010): Comparative zoogeographical analysis of Neuropterida of the Apennine and Balkan peninsulas. — In: DEVETAK D., LIPOVSEK S. & A.E. ARNETT (eds): Proceedings of the Tenth International Symposium on Neuropterology, Piran, Slovenia, 2008. 239-256. Maribor University 2010.

SEVČIK J. (2010): Neuroptera, Raphidioptera and Mecoptera of the Podyji National Park (Czech Republic). — Casopis Slezskeho Zemskeho Muzea (A), Opava **59**: 103-112.

THIERRY D., CLOUPEAU R. & M. JARRY (1992): La Chrysope commune *Chrysoperla carnea* (STEPHENS) sensu lato dans le centre de la France: mise en évidence d'un complexe d'espèces (Insecta: Neuroptera: Chrysopidae). — In: CANARD M., ASPÖCK H. & M.W. MANSELL (eds): Current Research in Neuropterology. Proceedings of the Fourth International Symposium on Neuropterology. 379-392. Bagnères-de-Luchon, France, 1991. Imprimerie Sacco, Toulouse, France.

THIERRY D., CLOUPEAU R., JARRY M. & M. CANARD (1998): Discrimination of the West-Palaearctic *Chrysoperla* STEINMANN species of the *carnea* Stephens group by means of claw morphology (Neuroptera, Chrysopidae). — Acta Zoologica Fennica **209**: 255-262.

Authors' addresses: Michel CANARD
47 chemin Flou-de-Rious, F-31400 Toulouse, France
E-mail: michel.canard@wanadoo.fr

Dominique THIERRY
12 rue Martin-Luther-King, F-4900 Angers, France
E-mail: dominique.thierry@wanadoo.fr