



<http://dx.doi.org/10.11646/zootaxa.3918.2.2>

<http://zoobank.org/urn:lsid:zoobank.org:pub:3676B5FD-8C9B-48D8-B31F-1453C1944EB2>

## A new East-Asian species in the *Chrysoperla carnea*-group of cryptic lacewing species (Neuroptera: Chrysopidae) based on distinct larval morphology and a unique courtship song

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### Abstract

Larval morphology and substrate-borne vibrational courtship songs have been hypothesized to distinguish and isolate *Chrysoperla* ‘nipponensis-B’ from true ‘Type A’ *Chrysoperla nipponensis* (Okamoto), both of which occur sympatrically in eastern Asia. Here, we formally describe *C.* ‘nipponensis-B’ as *Chrysoperla nigrocapitata* **sp.n.**, based on populations sampled throughout Japan and at two sites in South Korea. Behavioral playback experiments show that males and females of each species reject the duetting songs of non-conspecifics, supporting the existence in nature of strong premating reproductive isolation between the two species. Detailed morphological analysis substantiates that the adults of the two species are nearly identical. However, the dorsum of the larval head of *C. nigrocapitata* is usually darkly and heavily pigmented, in striking contrast to the condition seen in *C. nipponensis*; if available, it is probably the best trait for distinguishing the two species morphologically. Other aspects of life history, ecology, geographic distribution, and molecular systematics of the new species are briefly considered.

**Key words:** systematics, mating signal, cryptic species, song species, substrate vibration, morphology

### Introduction

The *Chrysoperla carnea*-group of green lacewings is well known for its numerous, morphologically cryptic species, distinguishable largely by their diverse, species-specific, substrate-borne duetting songs (reviewed in Henry *et al.* 2013 and references therein). The *carnea*-group has a global distribution, but exhibits maximum species diversity in mountainous regions such as are found in the Swiss Alps of Europe (Wells & Henry 1998), the Sierra Nevada and Coast Ranges of California (Henry *et al.* 2012), and the Caucasus Mountains of western Asia (Henry *et al.* 2014). However, the group is less well studied across the vast expanse of central and eastern Asia. Clearly, the rugged and heterogeneous terrain characteristic of several parts of Asia could harbor additional hotspots of lacewing diversity.

Over the last century, many species assignable to what we would now call the *carnea*-group of *Chrysoperla* Steinmann were described from China, Mongolia, Korea, and Japan (Okamoto 1914; Okamoto 1919; Navás 1927; Kuwayama 1962; Tsukaguchi 1984; Yang & Yang 1992; Brooks 1994). However, Tsukaguchi (1985) synonymized nearly all of these species with Holarctic *C. carnea* (Stephens), using morphological criteria. Brooks, in his revision of the genus *Chrysoperla* (1994), then reinstated the Japanese species *C. nipponensis* (Okamoto) based in part on its black gradate veins and long costal setae, but left such Asian taxa as *C. sinica* (Tjeder), *C. kurisakiana*

## Acknowledgements

We thank M.-Y. Choi (National Institute of Crop Science RDA, Iksan, Republic of Korea), H. Naka (Tottori University, Tottori, Japan), K. Nakahira (Kyushu University, Fukuoka, Japan), M. Nomura (Chiba University, Matsudo, Japan), S. Tsukaguchi (Nishinomiya, Japan), and M. Wells (University of Connecticut, Storrs, CT, U.S.A.), for their generous help collecting, identifying, and rearing specimens. The authors declare no conflicts of interest.

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