*Zootaxa* 2917: 48–58 (2011)
www.mapress.com/zootaxa/


**Article**

ISSN 1175-5326 (print edition)
**ZOOTAXA**
ISSN 1175-5334 (online edition)

# Species of the genus *Eurydema* (Hemiptera: Heteroptera: Pentatomidae) in Far East Asia: An integrated approach using morphological, molecular, and data crossing analyses for taxonomy

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## Abstract

In a revision of four previously described species of the genus *Eurydema* in Far East Asia, we confirm only two species, one of which consists of two subspecies: ***E. dominulus* (Scopoli 1763)** [= *E. pulchra* (Westwood 1837), **syn. nov.**], ***E. gebleri gebleri* Kolenati 1846**, and ***E. gebleri rugosa* Motschulsky 1861** [**stat. nov.**]. In order to prove the above taxonomic changes, we focused on three major analyses; (1) morphological study (color patterns), (2) molecular identification (DNA barcording) and (3) cross–breeding (inter–specific copulation, fertilization). The results of these analyses were sufficient to confirm the new taxonomic changes. According to the cross–breeding analysis, interspecific copulation between males of *E. dominulus* (= *E. pulchra*) and females of *E. g. gebleri* or *E. g. rugosa* occurs in nature, but the eggs laid by the interspecific copulation were unfertilized. Two subspecies, *E. g. rugosa* and *E. g. gebleri*, preserve their own unique coloration patterns; this was confirmed by the results of intra–subspecific copulation and breeding. However, the 1st progeny from the inter–subspecific copulation of *E. g. rugosa*♂ X *E. g. gebleri*♀ (or *E. g. gebleri*♂ X *E. g. rugosa*♀) were confirmed to have the coloration patterns inherited from *E. g. gebleri*.

**Key words:** *Eurydema*, taxonomy, cross–breeding, DNA barcoding, Far East Asia

## Introduction

Species of the genus *Eurydema* Laporte, 1833 (commonly called cabbage bugs) are associated with cruciferous plants and are well known pests of cabbage and other related crops (cf. Kwon *et al*. 2001). They have an attractive color pattern combining black and pale areas, with the latter varying from white to orange–yellow to red in most species; this variation is associated with the age of the specimen or the degree of sexual maturity (Dupuis 1951).

Four species of this genus were reported in Far East Asia (Korea, Japan, NE China, and SE Russia; Rider 2006): *E. dominulus* (Scopoli, 1763), *E. pulchra* (Westwood, 1837), *E. gebleri* Kolenati, 1846, and *E. rugosa* Motschulsky, 1861. The characteristics commonly used to distinguish these species (from Kanyukova 1988, with addition of *E. pulchra*) are summarized in the following key (Fig. 1A–E):

1. Apex of corium pale with a black spot. Exocorium (external part of corium) entirely pale or with a black spot near its middle . . . . . 2
- Apex of corium black. Exocorium in hind half almost entirely black or black along inner margin . . . . . 3
2. Exocorium entirely pale . . . . . ***E. dominulus***
- Exocorium with a black spot near its middle . . . . . ***E. pulchra***
3. Legs partly pale (femora pale with black apices; tibiae pale at middle). Hind half of exocorium narrowly black along inner margin. Abdominal sterna with 2 medial rows of black spots. Pronotum with 4–6 dark spots . . . . . ***E. gebleri***
- Legs entirely black. Hind half of exocorium almost entirely black. Abdominal sterna with a single medial row of transverse black spots. Pronotum with 2 dark spots . . . . . ***E. rugosa***

 *Accepted by D. Rider: 6 Apr. 2011; published: 14 Jun. 2011*