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New records of the damsel bug *Alloeorhynchus reinhardi* Kerzhner & Günther, 1999 (Hemiptera, Heteroptera, Nabidae) from Japan

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Abstract

To date, the damsel bug *Alloeorhynchus reinhardi* Kerzhner & Günther, 1999 (Hemiptera, Heteroptera, Nabidae, Prostemmatinae, Prostemmatini) has been reported from China and Korea. We report from Japan for the first time *A. reinhardi*, which represents the second member of the genus in the country. This species inhabits the ground surface of grasslands in Kyushu.

Keywords

East Asia, Kyushu, Palaearctic Region, Prostemmatinae, Prostemmatini

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Introduction

The damsel bug *Alloeorhynchus reinhardi* Kerzhner & Günther, 1999 (Hemiptera, Heteroptera, Nabidae, Prostemmatinae, Prostemmatini), which has macropterous and brachypterous morphs, has been recorded in China and Korea (Kerzhner and Günther 1999; Gapon and Konstantinov 2008; Aukema et al. 2013; Zhao et al. 2019; Lee et al. 2020). However, in Japan, only one species of the genus *Alloeorhynchus* Fieber, 1860, *A. vinulus* Stål, 1864, has been recorded to date (Miyamoto 1964; Ishikawa 2016).

For the past 13 years, two of us (TN and KO), together with other colleagues, have collected an indeterminate species of *Alloeorhynchus* from Kyushu, Japan. After careful morphological examination, we concluded that it corresponds to *A. reinhardi*. Thus, we report here *A. reinhardi* from Japan for the first time as the second member of the genus in the country.

Methods

Dried specimens were used for observing morphological characteristics. For the examination of the genitalia, the male terminalia were removed from the body after softening the specimens in hot water. The removed parts were immersed in hot 15% KOH solution for 5 min and then soaked in 99% ethanol for further observation. The male genitalia were preserved in small polyethylene vials containing 50% glycerin and mounted on a pin with the respective specimens. Morphological characteristics were observed and measured under a stereoscopic

microscope (SZ60; Olympus, Tokyo, Japan) equipped with an ocular grid. The specimens were photographed using a digital microscope (Dino-Lite Premier M, Opto Science, Tokyo, Japan), and image stacks were processed using Adobe Photoshop 2021 v. 22.5.1.

All specimens used in this study were deposited in the Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka, Japan (ELKU) and the Laboratory of Entomology, Faculty of Agriculture, Tokyo University of Agriculture, Kanagawa, Japan (TUA).

Distribution records of species were mapped using SimpleMappr (Shorthouse 2010). Geographical coordinates were obtained using Google Maps. The map was edited using Adobe Photoshop 2021 v. 22.5.1.

Results

Alloeorhynchus reinhardi is herein recorded from Japan for the first time based on 11 macropterous specimens collected from Kyushu, representing the second member of the genus in the country.

***Alloeorhynchus reinhardi* Kerzhner & Günther, 1999**
Figures 1–3

New records. JAPAN – **Kyushu** • Fukuoka-ken, Fukuoka-shi, Nishi-ku, Motooka, Kyushu University, Ito Campus, Biodiversity Zone; 33°35′43.9″N, 130°12′53.1″E; 27.IV.2020; Tsubasa Nozaki leg.; macropterous 1 ♀ ELKU • Fukuoka-ken, Fukuoka-shi, Nishi-ku, Motooka, Kyushu University, Ito Campus; 33°35′50.3″N 130°12′52.4″E; in litter; 8.XI.2021; Naomichi Tsuji leg.; macropterous 1 ♂ ELKU • Nagasaki-ken, Nagasaki-shi; 32°47′40.4″N 129°52′16.9″E; 13.X.2013; Tatsuya Nozaki leg.; macropterous 1 ♂, 1 ♀ TUA • Oita-ken, Nakatsu-shi, Yabakei-machi, Oshima, Yabakei Dam; 33°26′49.4″N 131°07′26.6″E; 16–17.V.2008; Takeshi Miyake leg.; macropterous 1 ♀ TUA • Oita-ken, Hita-shi, Mt. Shakagatake, Tsubakigahana; 33°11′04.6″N 130°54′13.8″E; alt. 900 m; highland grassland; 12.IX.2019; Tatsuya Nozaki & Keiichi Otsui leg.; macropterous 1 ♀ TUA • as above but 19.X.2019; macropterous 1 ♂, 4 ♀ TUA.

Differential diagnosis. *Alloeorhynchus reinhardi* is easily distinguished from the other Japanese species of the

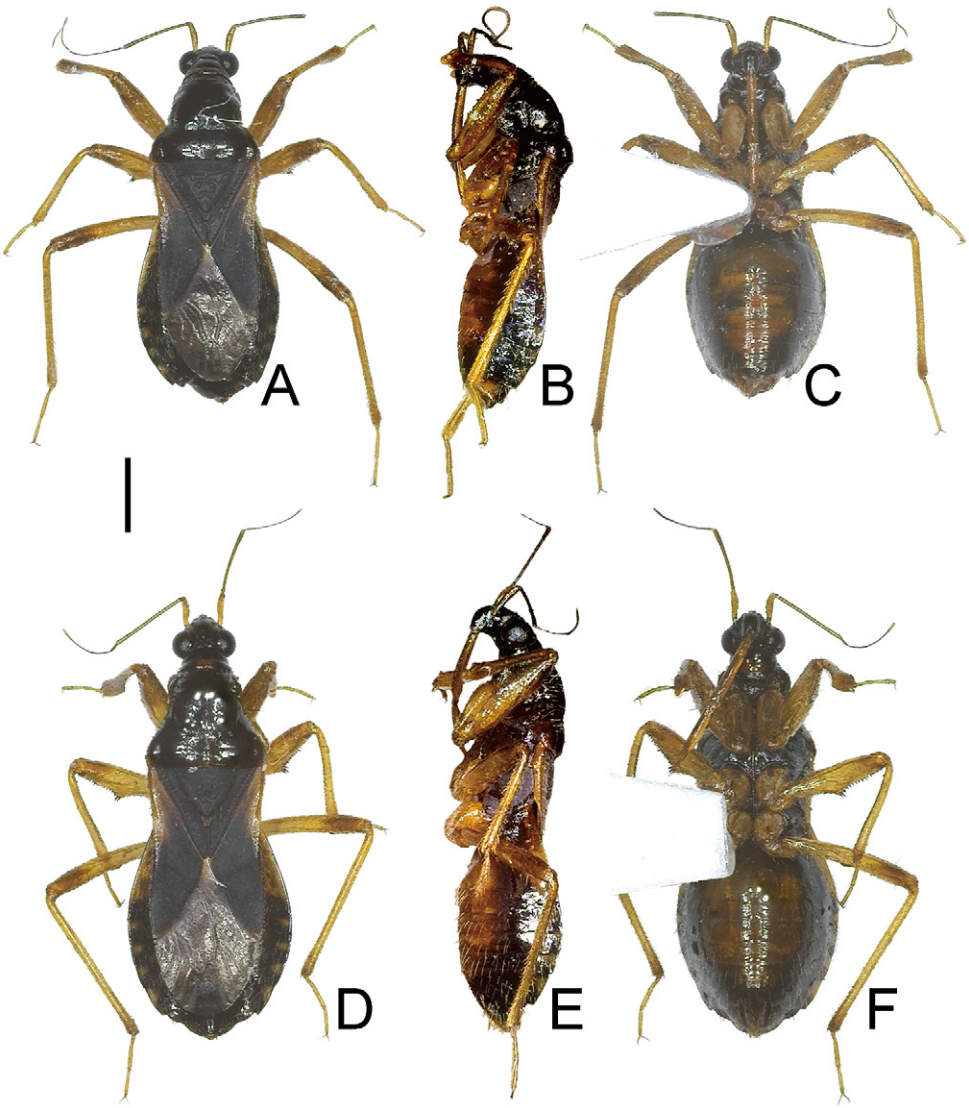

Figure 1. Dried specimens of *Alloeorhynchus reinhardi* from Fukuoka, Kyushu, Japan. **A.** Male, dorsal view. **B.** Male, lateral view. **C.** Male, ventral view. **D.** Female, dorsal view. **E.** Female, lateral view. **F.** Female, ventral view. Scale bar: 1.0 mm.

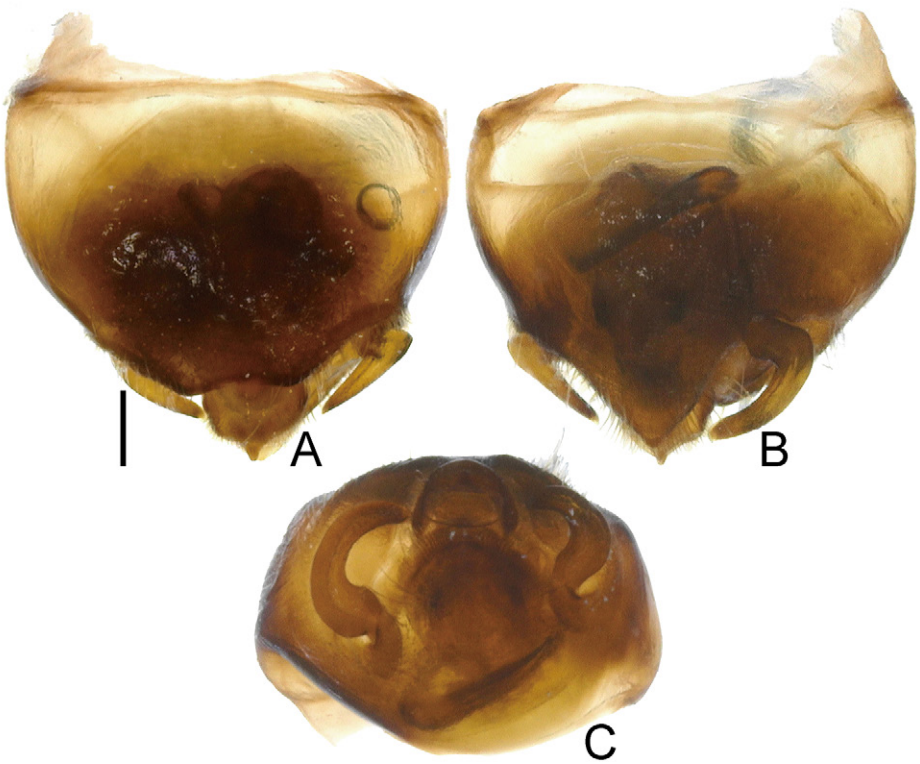

Figure 2. Pygophore of *Alloeorhynchus reinhardi*. **A.** Dorsal view. **B.** Ventral view. **C.** Posterior view. Scale bar: 0.2 mm.

Figure 3. Photograph of a living adult of *Alloeorhynchus reinhardi* from Oita, Kyushu, Japan.

genus, *A. vinulus*, by the black anterior pronotal lobe and the dark brown basal part of the hemelytral corium (Fig. 1).

Identification. All 11 specimens recorded above (Figs. 1–3) match well the descriptions of the macropterous morphs of *A. reinhardi* in terms of morphological characteristics (Zhao et al. 2019; Lee et al. 2020), including the photographs of male genitalia (Lee et al. 2020). Moreover, these specimens can be identified as *A. reinhardi* using the key including all East Asian species of *Alloeorhynchus* (Zhao et al. 2019). Therefore, we identified the above-recorded specimens as *A. reinhardi*.

Distribution. Japan (Kyushu), China (Guizhou Province, Sichuan Province), and Korea (South Chungcheong Province) (Fig. 4).

Biology. *Alloeorhynchus reinhardi* occurs on the ground surface of grasslands in Kyushu, Japan (present study) and in Korea has been found in moist places near streams, particularly on piles or clusters of dead leaves of Cyperaceae spp. under plants (Lee et al. 2020). Adults were collected from March to November (Kerzhner and Günther 1999; Zhao et al. 2019; Lee et al. 2020; present study). The nymph is unknown.

Discussion

Alloeorhynchus reinhardi has only been recorded from two localities in China and one locality in Korea to date (Kerzhner and Günther 1999; Zhao et al. 2019; Lee et al. 2020). Therefore, our report of *A. reinhardi* from Kyushu, Japan, represents the easternmost occurrences of this species (Fig. 4). Moreover, the localities in Japan and the type locality (China; westernmost record) are at least 2,900 km apart, whereas the Korean locality (northernmost record) and another locality in China (southernmost record) are more than 2,200 km apart. Therefore, this damsel bug species seems to be widely distributed in East Asia, and more localities will probably be discovered in future field surveys.

The Japanese population of *A. reinhardi* has the black

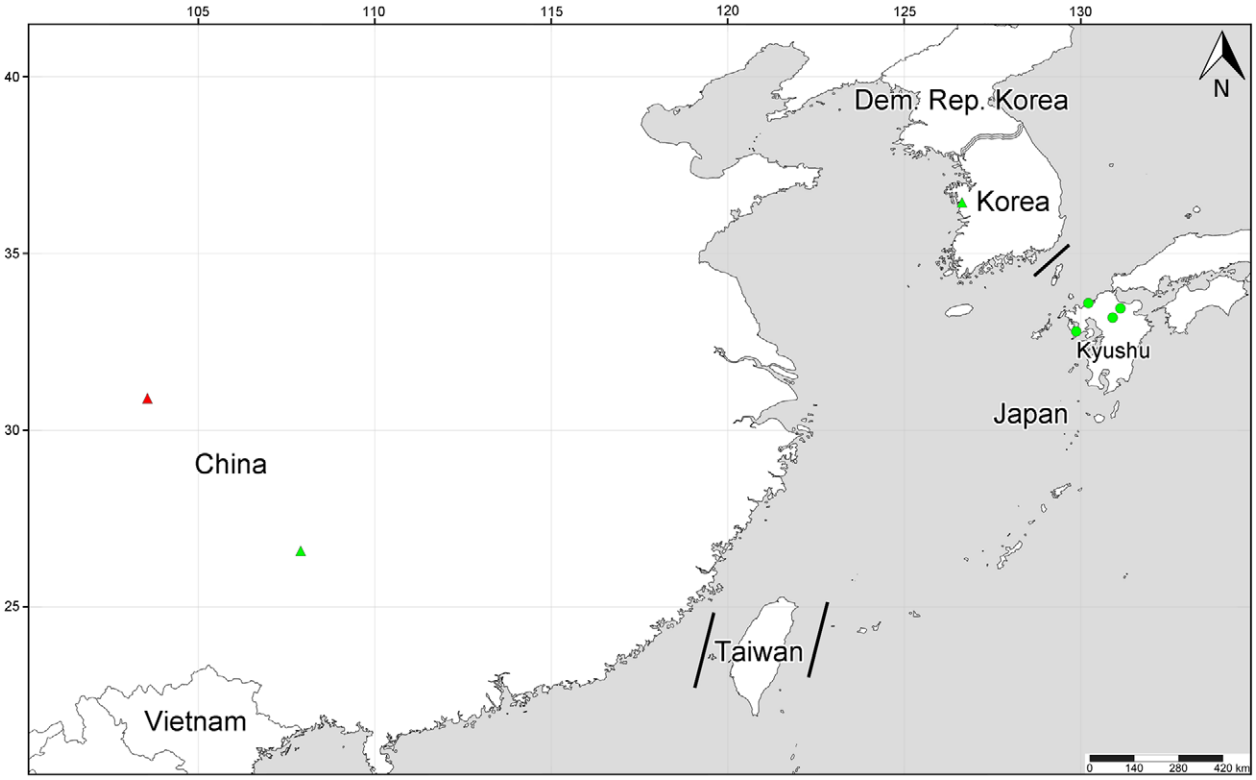

Figure 4. Collection sites of *Alloeorhynchus reinhardi*. Red icon = type locality; green icons = other localities. Circles = new records; triangles = known records.

pronotum and the dark brown basal part of the hemelytral corium (Fig. 3), whereas the Chinese and Korean populations have the dark brown pronotum and the pale brown basal part of the hemelytral corium (Zhao et al. 2019; Lee et al. 2020). These differences in coloration are considered to be geographical variations, suggesting that the genetic interaction between the continental (China and Korea) and island (Kyushu, Japan) populations have not occurred for a long time.

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Author Contributions

Data curation: TN, KO. Funding acquisition: JS. Investigation: TN, KO. Methodology: JS. Project administration: TI, JS. Software: JS. Supervision: TI, JS. Validation: JS. Visualization: JS. Writing – original draft: JS. Writing – review and editing: JS, TI.

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