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Geocoris margaretarum: description of a new species from the Oriental region with remarks on allied taxa (Heteroptera: Lygaeoidea: Geocoridae)

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Abstract. *Geocoris margaretarum*, new species (Hemiptera: Heteroptera: Geocoridae) is now described along with the discussion of its placement within the Oriental species and lectotype designations for *G. ochropterus* (Fieber, 1844). Key to discussed species and separating characters from other related taxa are provided.

Key words. Heteroptera, Geocoridae, new species, key, lectotype designation, distribution

INTRODUCTION

The genus *Geocoris* Fallén, 1814 with its 147 valid species is the largest and most diverse taxon of subfamily Geocorinae (Hemiptera: Heteroptera: Lygaeoidea). Representatives of the genus are distributed in most of the biogeographic regions with warm and moderate climates. The Oriental region presents 32 valid species and one of the most widely distributed Oriental species is *G. ochropterus* (Fieber, 1844) (for distribution see Péricart,1999; Dellapé & Henry, 2018), which has a potential economic importance as a predator of thrips species harmful to peanut (Kumar & Ananthakrishnan, 1985; Sweet, 2000). *Cimex tricolor* Fabricius, 1798 (preoccupied, see Dellapé & Henry, 2018); *Geocoris marginicollis* Dohrn, 1860; and *Ophthalmicus cinarescens* Walker, 1872, were synonymised with *G. ochropterus* by Distant (1901, 1904), and *Geocoris rufipennis* Distant, 1918 was synonymised with *G. ochropterus* by Kondorosy (2006). *Geocoris varius* (Uhler, 1860) and *G. chinensis* Jakovlev, 1904, are morphologically highly similar to *G. ochropterus*. *Geocoris chinensis* Jakovlev, 1904 was originally described as a species of the subgenus *Piocoris* Stål, 1872, and later synonymised with *G. ochropterus* by Kerzhner (1979), but it was revived from the synonymy and transferred to the subgenus *Geocoris* Fallén, 1814 by Zheng & Zou (1981). The change was accepted in the addendum of the Lygaeidae World Catalogue (Slater & O'Donnell, 1995).

During the study of *Geocoris* specimens from the Oriental region deposited in European natural history museums, a new species closely related to *G. ochropterus* was found, and described in the present paper, together with comparison to the above mentioned species and discussion of their relationships.

MATERIAL AND METHODS

Abbreviations of depositories:

HNHM – Hungarian Natural History Museum, Budapest
MZMB – Moravian Museum, Brno
BMNH – Natural History Museum, London
NHMW – Naturhistorisches Museum, Vienna
NHRS – Swedish Museum of Natural History, Stockholm
ZMHB – Natural History Museum, Berlin

Labels are cited verbatim, lines on labels are separated by '/', different labels are separated by '//'. Bibliography of the studied species was referred from Lygaeoidea Species File (Dellapé & Henry, 2018) using their Life Science Identifier (LSID). References unrecorded in Species File are cited.

Exoskeletal and genital structures of specimens were studied and imaged using a Keyence VX5000 digital microscope. Genitalia were examined by removal of the whole abdomen and soaking it overnight in lactic acid solution at room temperature. When soaking in lactic acid, structures remain more flexible than by KOH maceration according to author's experiences. This method also prevents "over-clearing" of structures (Blahnik et al., 2007), thus additional dye staining is not necessary before further dissection, observation or photographic documentation.

Measurements were made using an ocular micrometer, measurements are given in millimetres. The morphological terminology used in this article was adapted partly from Tsai et al. (2011) and Malipatil & Blacket (2013).

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The distribution data was processed and maps were generated with the use of QGIS 2.18.7-1 'Las Palmas' software using GlobCover 2009 altitude raster (Arino et al., 2010).

A key to the species related to *Geocoris Ochropterus*

1. Pronotum almost entirely black or at most with irregular ochraceous spots at humeral angles. Connexiva entirely black.....2
– Pronotum with more extended, irregular ochraceous spots at lateral and posterior margins. Connexiva with ochraceous markings on lateral margin.....3

2. Base of head with blackish marking of various extent (fig.2). Antennal segments I and IV entirely ochraceous, segments II-III partly fuscous. Humeral angles without ochraceous spots. Corium with sparse, irregular, coarse punctation; punctures and surrounding brownish..... .....*Geocoris margaretarum* new species
– Only extreme base of head black, never exceeding the level of ocelli. Antennal segment I ochraceous, segments II-IV brownish, segment II-III with apex ochraceous. Humeral angles with irregular ochraceous spot of various extent. Punctuation of hemelytra fine, dense in M-R region. Punctures fuscous without surroundings of the same colour..... ..... *Geocoris varius* (Uhler, 1860)

3. Antennal segments entirely black or dark fuscous. Hemelytra always translucent; apex of corium undecorated, punctuation with brownish surrounding. Lateral margin of connexiva with smaller, irregular ochraceous spots..... .....*Geocoris chinensis* Jakovlev, 1904
– Antennal segment I mostly with base ochraceous and apex fuscous or blackish; II-III entirely darker, colouration varies from fuscous to blackish; segment IV ochraceous. Hemelytra sometimes opaline with fine brownish punctuation without surroundings of the same colour; apex of corium with irregular fuscous spot. Connexiva margined with ochraceous ....*Geocoris ochropterus* (Fieber, 1844)

TAXONOMY

Geocoris (*Geocoris*) *margaretarum*, new species (Figs. 1–4)

Material examined. Holotype: male (NHMW), CHINA, Yunnan 1993 / 100 km W Baoshan / 14.-21. 6. / Gaoligongshan Nat. Res. / leg. E. Jendek & O. Sausa.

Paratypes: 3 males, 3 females (MZMB) NE INDIA, ARUNACHAL PR. / ETALIN vicinity, 700m / 28°36′56″N 95°53′21″E, / L. Dembický leg. 12-25.v.2012 / AP 3/2012 MZM Expedition; 1 male, 1 female (HNHM), NE INDIA, ARUNACHAL PR. / ETALIN vicinity, 700m / 28°36′56″N 95°53′21″E, / L. Dembický leg. 12-25.v.2012 / AP 3/2012 MZM Expedition; 2 males, 4 females (NHMW), CHINA, Yunnan 1993 / 100 km W Baoshan / 14.-21. 6. / Gaoligongshan Nat. Res. / leg. E. Jendek & O. Sausa; 1 male (BMNH), ASSAM: Mishmi Hills, / Dalai Valley, / Taphlogam. / 10. xi. 1936 // Alt. ft. / M. Steele. / B.M. 1937-324.; 3 males (NHRS), N. E. BURMA / Kambaiti 7000ft / 2-3/5 1937 / R. MALAISE // NHRS-GULI / 000006386.

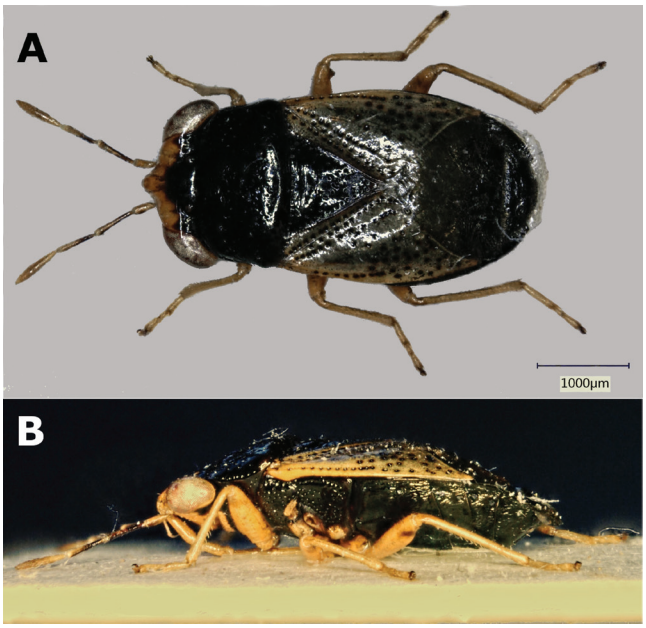

Fig. 1. Habitus of *Geocoris margaretarum* new species (holotype, NHMW). A, dorsal view; B, lateral view.

Colouration. Head variably dark ochraceous or orange with extended, irregular black marking of various extent basally (Fig. 2). Clypeus sometimes with dark brown marking basally. Antennal segments I and IV ochraceous, segment I sometimes infused with fuscous ventrally; segments II and III dark brownish with apex ochraceous. Labial segments uniformly ochraceous. Thorax: Pronotum and scutellum dark brownish, pronotal callosities and humeral angles slightly paler in hue. Clavus and corium of hemelytron pale ochraceous with fuscous punctures. Membrane hyaline. Thoracic pleura and sterna dark brownish; prothorax with ochraceous collar ventrolaterally, irregular ochraceous spots above coxae (Fig. 1B). Orifice of metathoracic scent gland ochraceous. Legs ochraceous with an irregular fuscous band on apices of femora dorsally. Abdomen: Segments uniformly dark brownish with silvery setae ventrally.

Structure. Head surface impunctate, shiny. Ocular sulcus reduced, only visible near ocelli. Ocelli situated almost equidistantly from the compound eyes and each other; ratio of ocellar distance to eye-ocellus distance: 1: 1.22. Clypeus rounded, exceeding mandibular plates. Antennal segment I shortest, II and III subequal, segment IV longest; ratio of antennal segments: 1: 1.86: 1.71: 2.14 (1: 1.83: 1.8: 2.33–1: 1.86: 1.71: 2.14). Labial segment I not reaching prothorax; segment II shorter than III, segments III longest IV subequal to segment II; ratio of labial segments: 1: 0.69: 1.07: 0.77 (1: 0.72: 1.09: 0.81–1: 0.69: 1.07: 0.77). Thorax: Pronotum widened, slightly trapezoidal; surface shiny with dense, strong punctuation. Pronotum ratio: 1:1.75. Pronotal calli, humeral angles and posterior margin impunctate; calli slightly elevated. Lateral margin of pronotum with a blunt but well-defined carina, disc with slight impression medially above carina. Scutellum nearly equilateral with sharp apex; ratio of length and basal width: 1: 1.07; surface with dense, strong punctuation except slightly elevated triradiate carina. Clavus of hemelytron narrowing gradually towards apex

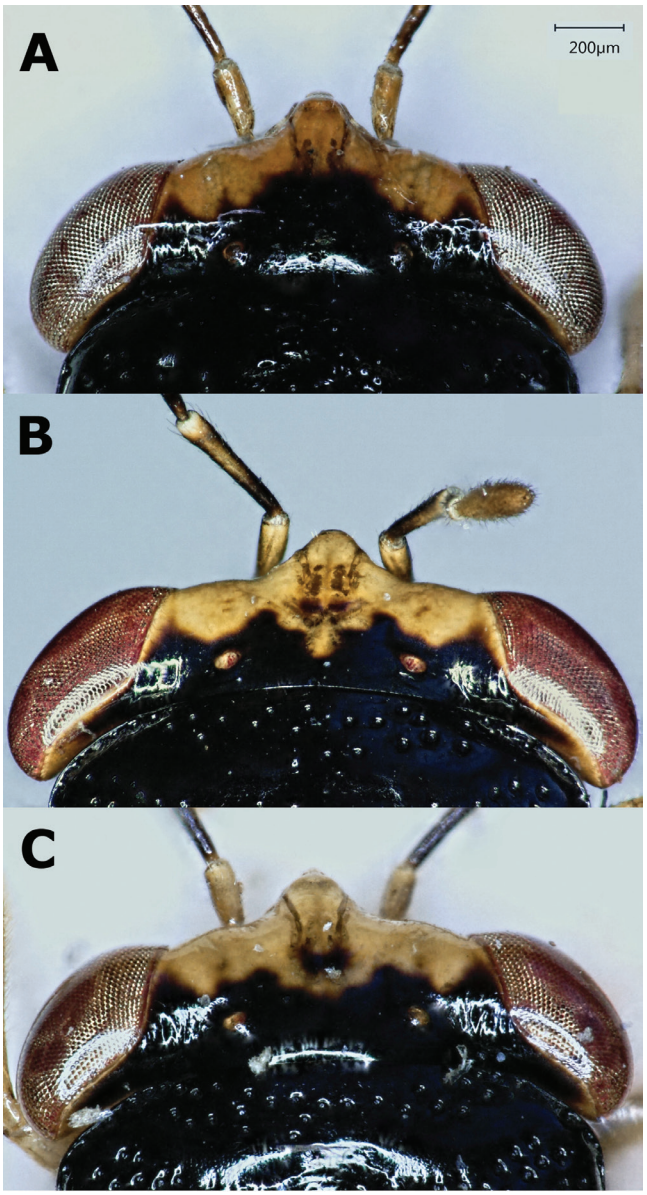

Fig. 2. Variability of head pattern in *Geocoris margaretarum* sp. n. A, holotype from Yunnan, China (NHMW); B, paratype from Arunachal province, India (MMB); C, paratype from Kambaiti Pass, Mianmar (NHRS).

of scutellum, claval commissure absent; clavus with one complete row of punctures at corial margin. R-M region with sparse, deep, irregular punctuation. Apical margin of corium S-shape with deep concavity. Membrane without visible veins. Pronotal pleuron with dense, deep but fine punctation except supracoxal lobes and orifice of metathoracic scent gland. Opening of metathoracic scent gland situated ventrolaterally close to anterior margin of metathorax; peritreme ear-shaped, somewhat protruding, evaporative area small. Abdomen: Abdominal dorsum with fine, dense punctuation and pubescence medially. Genitalia: Female spermatheca as in Fig. 3E. Male pygophore as in Fig. 3A.; paramere as in Fig. 3B, C; gonoporal process of aedeagus with ~17 coils.

Measurements. (Holotype [minimum–maximum]): total body length: 4.98 (4.93–4.98); head length: 0.79 (0.65–0.79);

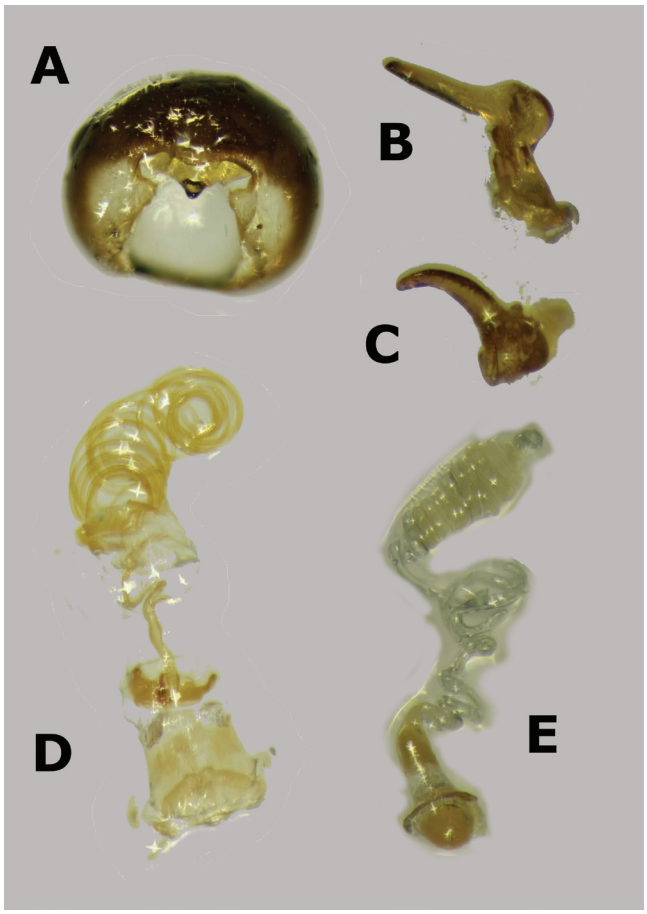

Fig. 3. Genitalia of *Geocoris margaretarum* sp. n. A, male pygophore; B, male paramere from posterior view; C, male paramere from dorsal view; D, male aedeagus; E, female spemartheca.

head width: 2.23 (2.14–2.23); antennal segments (I-II-III-IV): 0.33-0.60-0.56-0.70 (0.28-0.51-0.51-0.65 – 0.33-0.60-0.56-0.70); labial segments (I-II-III-IV): 0.60-0.42-0.65-0.47 (0.51-0.37-0.56-0.42 – 0.60-0.42-0.65-0.47); pronotum length: 1.30 (1.16–1.30); pronotum width: 2.28 (2.09–2.28); scutellum length: 1.21 (1.07–1.21); scutellum width: 1.3 (1.21–1.3).

Diagnosis. This new species differs in colouration patterns and punctation from other closely related representatives in the region: Head with variably extended blackish markings always exceeding the level of ocelli. Femora with fuscous annulation apically. Punctuation finer and sparser than *G. chinensis*, *G. ochropterus*, and *G. varius* contrastingly punctation of hemelytra deeper, Cu-M region with sparse, irregular punctures. Apical margin of corium S-shaped, unlikely to relatives where it is simply concave (Fig. 1.)

Etymology. The name of the species comes from the feminine first name Margaret (Margit in Hungarian) as a tribute to the birthday of Margit Kiss (mother of the author) and also commemorates the life of Margit Kiss (1932–2017, grandmother of the author) expressing the gratefulness towards them for the love and support received throughout the years.

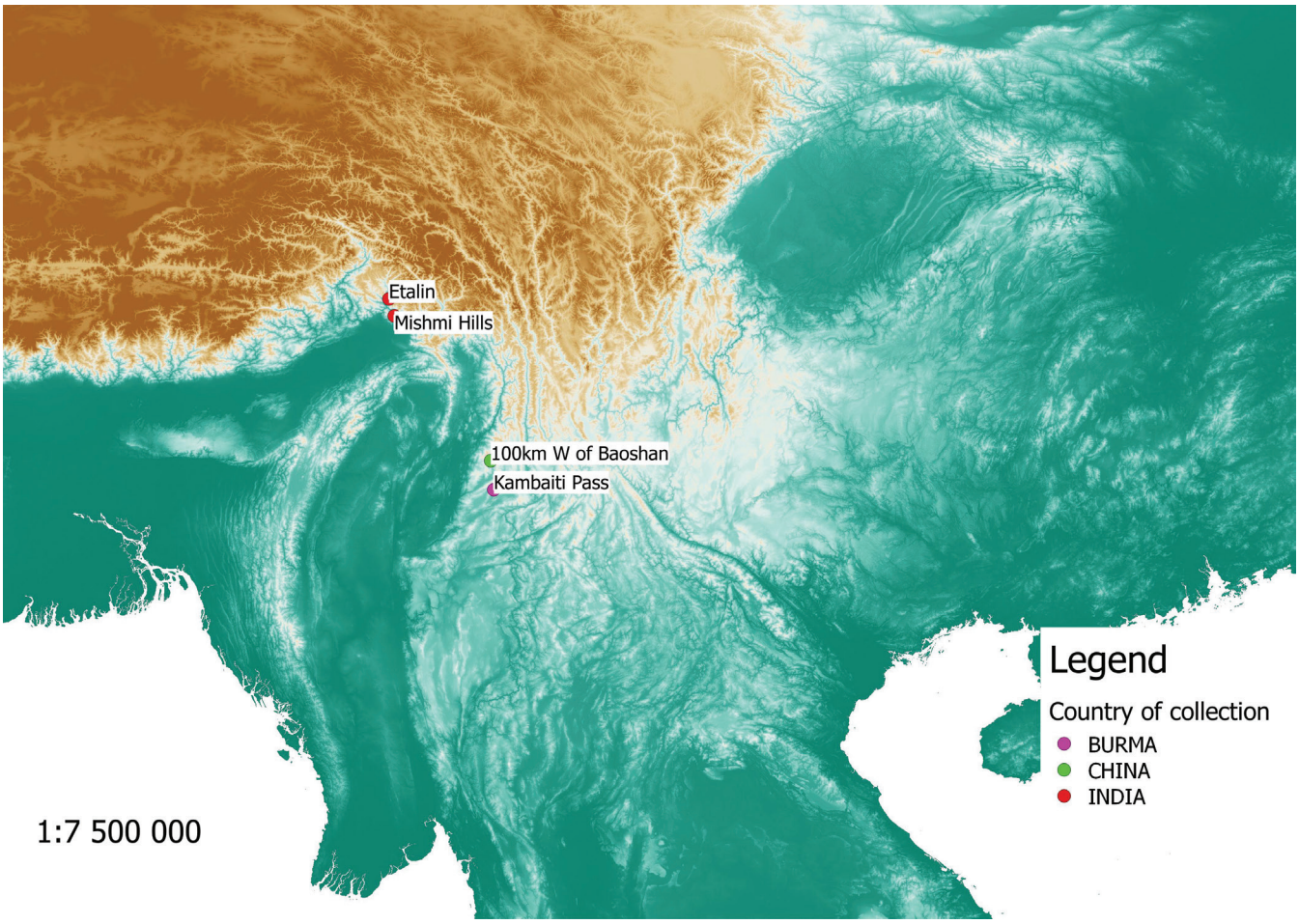

Fig. 4. Distribution of *Geocoris margaretarum* new species.

Distribution. According to the available data this new species is distributed in North-East India (Assam state, Arunachal Pradesh) and South-East China (Yunnan province). The distributional area of the species is in the Burma monsoon forest (Indomalayan realm) biogeographical province according to Udvardy's (1975) classification.

Geocoris (*Geocoris*) *ochropterus* (Fieber, 1844) (Figs. 5, 6)

http://lsid.speciesfile.org/urn:lsid:Lygaeoidea.speciesfile.org:TaxonName:488588

Material studied. Lectotype of *Ophthalmicus cinerascens* (designated here): 1 male (BMNH), Circular blue 'SYNTYPE' label // circular green 'TYPE' label // 31. OPHTHALMICUS CINERASCENS. // [rectangular bluish label with unreadable handwriting] // Saunders / 65.13.

Paralectotype of *Ophthalmicus cinerascens*: 1 female (BMNH), Circular blue 'SYNTYPE' label // [rectangular bluish label with unreadable handwriting] // Saunders / 65.13.

Lectotype of *Geocoris rufipennis* (designated here): 1 specimen (BMNH), Circular blue 'SYNTYPE' label // circular red 'TYPE' label // Calcutta / 31-X-07' [label handwritten] // Distant Coll. / 1911–383. // Geocoris / rufipennis / type Dist. [label handwritten by W. L. Distant] / BMNH(E) / 1340502 / NHMUK 010591786.

Other material: 1 female (HNHM), INDIA, W. Bengal, / Nalbani, / N. Salt Lake / leg. Gy. Topál // No. 36. / netting in grasses / 7. XII. 1966; 1 male, 1 female (HNHM), INDIA, Nadhya Pradesh, / Sahpura, near River, / Narmada / leg. Gy. Topál // No. 234 / trodden from mud / 18. III. 1967.; 2 males, 1 female (HNHM), India, Waterfalls, Est. / Anaimalai Hills, / Tamil Nadu // No. 318. netted / 31. III. 1980. / leg. Gy. Topál; 2 females (HNHM), INDIA Sukna, / Darjeeling District, W. Bengal, 180 m // No. 388. netted / 22. V. 1980. / leg. Topál; 1 male, 1 female (HNHM), LAOS, Vientiane / shore of Mekong r. / singled from / buffalo dung, No. 4 // 19-20. III. 1998. / leg. O. Merkl & / G. Csorba // Geocoris / ochropterus (Fieb.) / det. Kondorosy; 1 female (HNHM), MALAYSIA, Selangor / Batu Caves, / secondary vegetation, // swept & singled, / No. 1. 5. III. 1995, / O. Merkl // Gecocoris / ochropterus (Fieb.) / det. Kondorosy; 1 female (HNHM), THAILAND / Prov Prachuap Khiri / Khan, Wana Kon / Beach, 25 km S of // Noghin, No. 3. / 19. XI. 2003. / leg. A. Orosz et Gy. Sziráki; 1 female (HNHM), THAILAND / prov. Chumphon / N of Thung Tako // 3. XII. 2003. / leg. A. Orosz et Gy. Sziráki // Geocoris / ochropterus (Fieb.) / det. Kondorosy; 2 females (HNHM), THAILAND, Ban Yong / Sata, pasture, 16. XI. 2004. / leg. A. Orosz, Gy. Sziráki & M. Földvári // Geocoris / ochropterus (Fieb.) /

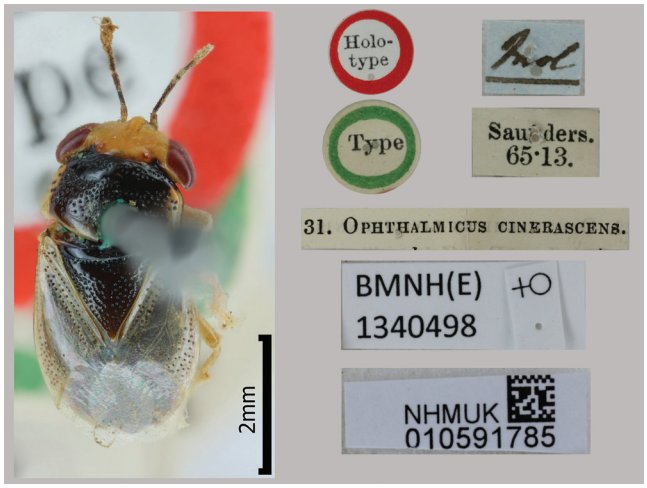

Fig. 5. Type specimen of *Ophthalmicus cinerascens* Walker, 1872 (BMNH).

Fig. 6. Type specimen of *Geocoris rufipennis* Distant, 1918 (BMNH).

det.Kondorosy; 1 female (HNHM), THAILAND, / Thung Kai Bot. Garden, / nyílt füves legelő bokrokkal / 19. XI. 2004. leg. A. Orosz // Geocoris / ochropterus (Fieb.) / det. Kondorosy; 1 female (HNHM) VIETNAM, Prov. Ha-Tinh / forestiére Hüöng-sön / 150 m, forêt trop.pluv. // 19. VIII. 1963.; 2 males (HNHM), VIETNAM, forêt trop. second., 20. IX. 1963 / 2-25 km à Lai-cai / 300 m, T. PÓCS // Geocoris / ochropterus (Fieb.) / det.Kondorosy; 1 female (HNHM), VIETNAM, Da Lat / Thrac Prenn waterfall // 10. XII. 1994., No. 756 / leg. S. Mahunka, / Gy. Sziráki, L. Zombori // Geocoris / ochropterus (Fieb.) / det.Kondorosy.

Notes. Fieber's type on *Ophthalmicus ochropterus* seems to be lost according to the author's recent knowledge. However, types of two synonymous species (*Ophthalmicus cinarescens* Walker, 1872; *Geocoris rufipennis* Distant, 1918) are deposited in the collection of BMNH and they were studied during the author's visit in 2016. All three specimens are clearly identifiable as syntypes, description and collecting data concurrent with the original descriptions. A syntype of *Ophthalmicus cinerascens* was improperly provided with a holotype label. During the study it was concluded that the

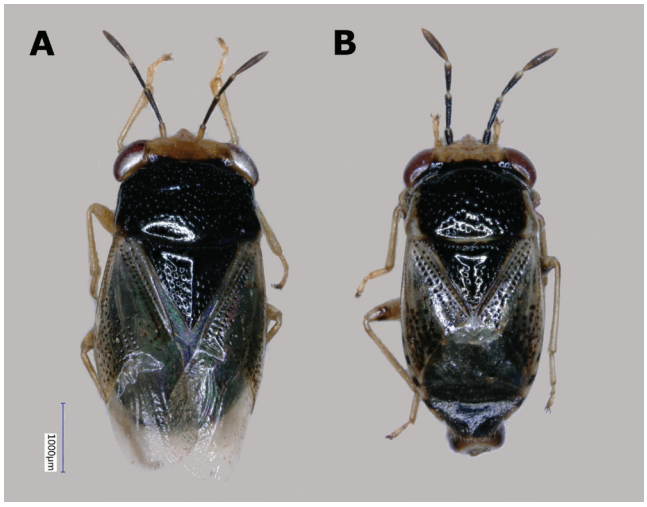

Fig. 7. Habitus of *Geocoris varius* (Uhler, 1860) (A) and *Geocoris chinensis* Jakovlev, 1904 (B).

synonymies proposed (Distant, 1901, 1904; Kondorosy, 2006) in former publications are correct. I hereby propose the designation of the above cited syntypes as lectotypes.

Geocoris (*Geocoris*) *varius* (Uhler, 1860) (Fig. 7A)

http://lsid.speciesfile.org/urn:lsid:Lygaeoidea.speciesfile.org:TaxonName:488675

Material studied. 1 female (HNHM), KOREA: Prov.S Pyongan / Yonpung-ho, / 10 km SW of Kaechon; 1 female (HNHM), KOREA: Prov.N Hwanghae / Sohung-ho / 20 km SSE of Sariwon.

Notes. According to the distribution data of Lygaeoidea Species File (Dellapé & Henry, 2018) this species occurs in China, Formosa, and Japan. Josifov & Kerzhner (1978) recorded its presence from the Korean Peninsula.

Geocoris (*Geocoris*) *chinensis* Jakovlev, 1904 (Fig. 7B)

http://lsid.speciesfile.org/urn:lsid:Lygaeoidea.speciesfile.org:TaxonName:488465

Material studied. 1 male (ZMHB), CHINA: N-Yunnan: Dali Bai Nat. / Aut. Pref., 1 km W Dali old town, / creek valley at foothill of Dian- / cang Shan, 2170m, 25°41.9′N/ / 100°08.4′E (ruderal place) / 28. viii.-3.ix.2003, leg. Wrase // Zool. Mus. Berlin // *Geocoris* / *chinensis* Jak. / det. Kondorosy.

DISCUSSION

Based on the comparison of colouration patterns and morphological structures it is to be concluded that *Geocoris margaretarum* (new species) can be considered closely related to *G. chinensis*, *G. ochropterus*, and *G. varius*.

In terms of colouration patterns the extended blackish mark on the base of head, colouration of antennal segments, entirely black pronotum and corial punctation with surroundings of the same colour are to be mentioned as discriminative characters. Though all of the four species has blackish markings on base of head it never exceeds level of ocelli nor reaches base of clypeus. Colouration of antennal segments is mostly analogous in *G. margaretarum* and *G. ochropterus*: antennal segments I and IV ochraceous, II and III fuscous or brownish. Among the studied species *G. margaretarum* appeared to be the only species with entirely black pronotum: *G. varius* has ochraceous spots in humeral angles; *G. chinensis* and *G. ochropterus* has extended ochraceous markings laterally and posteriorly. Besides the new species, corial punctures with surrounding of the same colour can only be observed in *G. chinensis*. Intraspecific variance of colouration can be observed in both species where longer series of specimens were studied (*G. margaretarum* and *G. ochropterus*). However, this variance is within certain limits and combination of patterns is characteristic to each of the species as well.

Among morphological characters, punctation of corium is the one easiest to recognise: in *G. margaretarum* it is deeper and coarser than the other three species and irregular punctation out of the M-R region can also be observed. After careful examination two other differences are to be observed: margins of clypeus less reduced in *G. margaretarum* and *G. chinensis* than in *G. ochropterus* and *G. varius*; posterior margin of corium is S-shaped in *G. margaretarum* and simply concave in the other three species.

The high morphological similarity and scarcity of more conspicuous discriminative characters suggest that these four species may form a coherent group of closely related species. However, the proof of this hypothesis should be based on the results of the study of long series of specimens of all included taxa (especially *G. chinensis* and *G. varius*) and thorough comparison with other, similar taxa in the region, e.g., *Geocoris flaviceps* (Burmeister, 1834), preferably with supplementary molecular phylogenies. Such studies are planned by the author depending on the availability of material suitable for DNA extraction.

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