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## Revision of Palearctic and Oriental *Necrophila* Kirby et Spence, part 3: subgenus *Calosilpha* Portevin (Coleoptera: Silphidae: Silphinae)

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### Abstract

A taxonomic revision of the subgenus *Calosilpha* Portevin, 1920 (of the genus *Necrophila* Kirby & Spence, 1828) through Asia is presented. Four valid species are recognized: (1) *Necrophila* (*C.*) *brunnicolis* (Kraatz, 1877), widely distributed from Bhutan and China: Yunnan province to Far East of Russia and Japan (including Ryukyu Islands); (2) *N.* (*C.*) *cyaneocephala* (Portevin, 1914), endemic to Taiwan; (3) *N.* (*C.*) *cyaniventris* (Motschulsky, 1870), widely distributed from northern India to Vietnam and southern China (east to Hainan Island); and (4) *N.* (*C.*) *ioptera* (Kollar & Redtenbacher, 1844), comb. nov. (ex *Calosilpha*), widely distributed in Pakistan, India (Himachal Pradesh to Assam) and Nepal. *Eusilpha* (*Calosilpha*) *bicolor imasakai* Nishikawa, 1986 and *Eusilpha* (*Calosilpha*) *kurosawai* Nishikawa, 1986 are confirmed as junior subjective synonyms (*sensu* Cho & Lee 1995, Ji 2012) of *Silpha brunnicolis* Kraatz, 1877. Description of important adult taxonomic characters (including male genitalia) and a key to species is included. Georeferenced records for all four species are mapped. First reliable records of *Necrophila* (*Calosilpha*) *brunnicolis* from China: Hong Kong and Anhui, Fujian, Gansu, Hubei, Jiangxi, Jilin, Qinghai and Zhejiang provinces and Guangxi autonomous region; *N.* (*C.*) *cyaniventris* from India: Himachal Pradesh, Uttarakhand, Meghalaya, Arunachal Pradesh, Nagaland and Manipur; and *N.* (*C.*) *ioptera* from Pakistan, India: Uttarakhand, Uttar Pradesh, Bihar, Sikkim, West Bengal and Assam are given (only imprecise records from “Himalaya” had been published for the last two species). First records of *N.* (*C.*) *brunnicolis* from Bhutan, and of *N.* (*C.*) *cyaniventris* from China: Hainan and Yunnan provinces, Myanmar, Laos and Cambodia are given. Parsimony analysis supports the monophyly of *Calosilpha*, with two clades, one formed by *N.* (*C.*) *brunnicolis* and *N.* (*C.*) *cyaneocephala* and the other by *N.* (*C.*) *cyaniventris* and *N.* (*C.*) *ioptera*. Geometric morphometrics discriminated four taxa of *Necrophila* (*Calosilpha*). Results indicated a sexual dimorphism between sexes in all species. Shape variability was concluded between the taxa. Populations of *N.* (*C.*) *brunnicolis* from continental Asia and three regions of Japan (Honshu + Shikoku, Kyushu and Ryukyus) also were examined. MANOVA was significant and supported shape differences in male and female populations. When testing each pair of groups by discriminant analysis, only differences between male populations from Japan (Kyushu) and those from Japan (Honshu + Shikoku) showed insignificance.

**Key words:** taxonomy, new synonymy, new combination, phylogeny, geometric morphometrics, distribution, Palearctic region, Oriental region

### Introduction

Portevin (1920b) erected *Calosilpha* as a subgenus of *Eusilpha* Semenov, 1890, originally to accommodate seven species: *E.* (*C.*) *ioptera* (Kollar & Redtenbacher, 1844), *E.* (*C.*) *bicolor* (Fairmaire, 1899), *E.* (*C.*) *cyaniventris* (Motschulsky, 1870), *E.* (*C.*) *gilleti* Portevin, 1920, *E.* (*C.*) *formosa* (Laporte, 1832), *E.* (*C.*) *viridis* (Motschulsky, 1861) (Motschulsky 1861a), and *E.* (*C.*) *coelestis* (Dohrn, 1875). Later the same year, Portevin (1920a) described *E.* (*C.*) *renatae*. The next year, Portevin (1921) combined the four later names into his newly constituted genus *Chrysosilpha* and removed them from *Calosilpha* (see Růžička *et al.* (2012) for further nomenclature details on *Chrysosilpha*). Portevin (1926) treated *Calosilpha* as a separate genus with seven species, further accommodating *C.* *brunnicolis* (Kraatz, 1877) (misspelled as *brunneicollis*), *C.* *cyaneocephala* (Portevin, 1920) (described originally in *Eusilpha*) and *C.* *obscuriventris* (Motschulsky, 1870) (treated as species *incertae sedis*). Hatch (1928:

113) cataloged *Calosilpha* as a subgenus of *Silpha* Linnaeus, 1758 with the same seven species as Portevin (1926) and designated *Silpha ioptera* Kollar & Redtenbacher, 1844 as its type species (by subsequent designation).

More recently, Schawaller (1982) keyed all species of *Calosilpha* and treated *Oiceoptoma obscuriventris* Motschulsky, 1870 and *Eusilpha* (*Calosilpha*) *gilleti* Portevin, 1920 as junior subjective synonyms of *Calosilpha ioptera* (Kollar & Redtenbacher, 1844). Nishikawa (1986) described *Eusilpha* (*Calosilpha*) *bicolor imasakai* and *Eusilpha* (*Calosilpha*) *kurosawai* from Kyushu and Amami-Oshima Island (Ryukyus), respectively. Cho & Lee (1995) compared *Calosilpha* from Korea and Japan and treated *Calosilpha bicolor* (Fairmaire, 1899) as a junior subjective synonym of *C. brunnicollis* (Kraatz, 1877). Only recently, Peck (2001) and Sikes (2008) listed *Calosilpha* along with *Chrysosilpha*, *Deutosilpha* Portevin, 1920 and *Eusilpha* as subgenera of *Necrophila* Kirby & Spence, 1828 while following an unpublished taxonomic revision by A.F. Newton, Jr. This classification was also followed by Růžička & Schneider (2011) and Růžička *et al.* (2012), and it is followed here. Detailed phylogenetic relationships of all subgenera will be treated in a separate study (J. Růžička, unpublished). Ji (2012) treated *Eusilpha* (*Calosilpha*) *bicolor imasakai* Nishikawa, 1986 and *Eusilpha* (*Calosilpha*) *kurosawai* Nishikawa, 1986 as junior subjective synonyms of *Necrophila* (*Calosilpha*) *brunnicollis* (Kraatz, 1877).

Recently, Ikeda *et al.* (2008, 2012) published a phylogenetic reconstruction of the Silphinae based on sequences of one mitochondrial gene (16S) and three nuclear genes (28S, wingless (Wg), and phosphoenolpyruvate carboxykinase (PepCK)). Both Bayesian analysis and maximum parsimony produced the following tree topology: *Necrophila* + (*Eusilpha* + (*Calosilpha* + *Chrysosilpha*)) (Ikeda *et al.* 2008: 2072, Fig. 1; Ikeda *et al.* 2012: 5, Fig. 3a).

The aim of this paper is to redescribe the subgenus *Necrophila* (*Calosilpha*), which is distributed in eastern Palearctic and in Oriental regions. Only four species and no subspecies are herein considered valid. Based on the examination of 2,489 specimens from 49 museum or private collections, the detailed distribution of the species is summarized and mapped.

We also employed geometric morphometrics, a frequently used technique to find variation in shape within and among species (Bookstein 1991; Zelditch *et al.* 2012). It is valuable for taxonomic studies as it assists in the delimitation of taxa and in determining new species and subspecies (for applications in taxonomy of beetles, see Pretorius & Scholtz 2001; Roggero 2004; Hájek & Fikáček 2010; Růžička *et al.* 2012; Qubaiová *et al.* 2015).

Here, we apply this technique to distinguish and demonstrate the shape differences of the elytral apex among the taxa of *Calosilpha* and their sexes in order to further test our taxonomic and phylogenetic findings.

## Material and methods

**Museum abbreviations.** Specimens examined in this study are deposited in the following museums and private collections (acronyms according to Arnett *et al.* 1993):

ASMC	collection of Aleš Smetana, Ottawa, Canada;
BMNH	Natural History Museum, London, United Kingdom (R. Booth, M.V.L. Barclay);
EUM	Ehime University Museum, Matsuyama, Japan (H. Yoshitomi);
FMNH	Field Museum of Natural History, Chicago, U.S.A. (A.F. Newton, J.H. Boone);
HNHM	Magyar Természettudományi Múzeum, Budapest, Hungary (O. Merkl);
HUM	Hokkaido University Museum, Sapporo, Japan (M. Ôhara);
IRSNB	Institut royal des Sciences naturelles de Belgique, Belgium, Brussels (Martina Peeters);
JCOC	collection of Jonathan Cooter, Hereford, United Kingdom (will be deposited in OUMNH);
JDAC	collection of Jaroslav Dalihod, Kladno, Czech Republic;
JHAC	collection of Jiří Háva, Únětice u Prahy, Czech Republic;
JMAC	collection of Josef Mašek, Žlutice, Czech Republic;
JRUC	collection of Jan Růžička, Prague, Czech Republic;
JSCC	collection of Jan Schneider, Prague, Czech Republic;
JTUC	collection of Jaroslav Turna, Kostelec na Hané, Czech Republic;
MHNG	Muséum d'Histoire Naturelle, Genève, Switzerland (G. Cuccodoro);

MNHN	Muséum national d'Histoire naturelle, Paris, France (T. Deuve, Azadeh Taghavian);
MNIC	collection of Masaaki Nishikawa, Ebina, Japan;
MSCC	collection of Michael Schülke, Berlin, Germany;
MSNC	collection of Miroslav Snížek, České Budějovice, Czech Republic;
MTRC	collection of Miloš Trýzna, Děčín, Czech Republic;
MZMB	collection of E. Jagemann in Moravské zemské muzeum, Brno, Czech Republic (P. Baňaf, I. Malenovský);
NHMB	Naturhistorisches Museum, Basel, Switzerland (Eva Sprecher-Uebersax, M. Borer);
NHMW	Naturhistorisches Museum, Vienna, Austria (H. Schillhammer);
NMPC	Národní museum, Prague, Czech Republic (J. Hájek);
NHRS	Naturhistoriska riksmuseet, Stockholm, Sweden (B. Viklund);
NMNH	National Museum of Natural History, Smithsonian Institution, Washington, U.S.A. (D. Furth, G.F. Hevel);
NSMT	National Museum of Nature and Science, Tsukuba, Japan (S. Nomura);
OUMNH	Oxford University Museum of Natural History, Oxford, United Kingdom (D.J. Mann);
RMNH	National Museum of Natural History Naturalis, Leiden, Netherlands (Eulalia Gasso Miracle, A. von Assen);
SDEI	Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany (L. Zerche, L. Behne);
SHNU	Department of Biology, Shanghai Normal University, Shanghai, China (L. Tang);
SMFD	Forschungsinstitut Senckenberg, Frankfurt am Main, Germany (Andrea Vesmanis, D. Kovac);
SMUL	Severočeské muzeum, Liberec, Czech Republic (P. Vonička);
SMNS	Staatliches Museum für Naturkunde, Stuttgart, Germany (W. Schawaller);
SMTD	Staatliches Museum für Tierkunde, Dresden, Germany (O. Jäger);
SNMB	Slovenské národné múzeum, Bratislava, Slovakia;
SVAC	collection of Stéphane Vassel, Saint Agnant de Versillat, France;
SYSU	Institute of Entomology, Sun Yat-sen University, Guangzhou, China (F.L. Jia);
TMNH	Toyohashi Museum of Natural History, Toyohashi, Japan (M. Hasegawa);
WBAC	collection of W. Barries, Vienna, Austria;
WMNH	Wakayama Prefectural Museum of Natural History, Wakayama, Japan (I. Matoba);
ZFMK	Zoologische Forschungsinstitut und Museum "Alexander Koenig", Bonn, Germany (D. Ahrens);
ZMAN	Zoölogisch Museum Amsterdam, Amsterdam, the Netherlands (S.A. Ulenberg, W. Hogenes);
ZMHB	Museum für Naturkunde – Leibniz-Institut für Evolutions- und Biodiversitätsforschung an der Humboldt-Universität zu Berlin, Berlin, Germany (J. Frisch);
ZMAS	Zoological Museum, Academy of Sciences, St. Petersburg, Russia (M.G. Volkovich);
ZMUC	Zoological Museum, University of Copenhagen, Copenhagen, Denmark (A.Yu. Solodovnikov);
ZMUH	Biozentrum Grindel und Zoologisches Museum, Hamburg, Germany (Kai Schütte, F. Wieland);
ZMUM	Zoological Museum of Moscow Lomonosov State University, Moscow, Russia (N. Nikitsky);
ZSM	Zoologische Staatssammlung, Munich, Germany (M. Balke).

Types of 7 of the 9 species-group names were located and examined. Lectotypes for three taxa are designated below to fix the concept of the taxon in question and to ensure the universal and consistent interpretation of the same.

**Morphological analyses.** Photographs of habitus and morphological details were taken using a Canon macro photo lens MP-E 65mm or EF-S 60mm on a Canon 550D and multiple layers of focus combined in the Zerene Stacker 1.04 software (Zerene Systems 2013; <http://www.zerene.com/cms/stacker>).

Male and female terminalia were studied after short clearing in hot 10% solution of KOH, mounted in temporary glycerine mounts for line drawings. General morphological terms used follow Lawrence & Ślipiński (2013), while terminology for male genital segment follows mostly Blackburn (1936). Body length is measured

from labrum of head in prognathous position to apex of elytra (omitting abdomen). Maximum body width is measured across elytra.

Exact label data are cited only for the type material. Separate lines on labels are indicated (only for primary types) by “/”, separate labels by “//”. Author’s remarks and comments are enclosed in square brackets: [p] – preceding data are printed; [hw] – preceding data are handwritten.

Microsoft Encarta Premium 2008 (Microsoft Corporation 2007), NGA GEONet Names Server (National Geospatial-Intelligence Agency 2011; <http://earth-info.nga.mil/gns/html/index.html>), Google Earth (Google 2011; <http://earth.google.com>) and Fuzzy Gazetteer (Ch. Kohlschütter 2011; <http://isodp.fh-hof.de/fuzzyg/query/>) were used to find coordinates for most of the localities. Some old geographic names from China were interpreted using gazetteer provided by Schultze & Kleinfeld (1997). The distribution map was produced and edited in ESRI ArcMap 10.2 of ArcGIS Desktop 10.2 suite. For map layers, free level 0 and level 1 data from Global Administrative Areas (<http://www.gadm.org/world>) and World Shaded Relief (with 60% transparency) (<http://www.arcgis.com/home/item.html?id=9c5370d0b54f4de1b48a3792d7377ff2>) over Etopo1 Global Relief Model (<http://www.ngdc.noaa.gov/mgg/global/global.html>) were used.

Throughout the text, the first state or province distributional records are differentiated from the first reliable records—the latter term is applied to precisely located material available in cases when only old, imprecise records from only roughly delimited territory were published (e.g., “Himalaya”, “China”, “northern China”).

**Phylogenetic analysis.** Phylogenetic analysis was performed using a matrix (Table 1) comprising four terminal taxa of the ingroup and 20 characters (15 of which are parsimony informative characters) for external adult morphology. The matrix was compiled in Winclada version 1.00.08 (Nixon 2002) and analyzed by exhaustive search (“implicit enumeration” option) using TNT ver. 1.1 (Goloboff *et al.* 2008). All characters were equally weighted and multistate characters were treated as unordered. Standard bootstrap analysis (with 1,000 replicates) was executed in TNT. Tree visualization and character mapping were done in Winclada.

*Necrophila (Eusilpha) japonica* (Motschulsky, 1861) (Motschulsky 1861b), a type species of *Eusilpha*, and *N. (Necrophila) americana* (Linnaeus, 1758), a type species of *Necrophila*, were selected as outgroups, because these subgenera were hypothesized to be sister groups to *Calosilpha* and *Chrysosilpha* in the recent phylogenetic reconstructions of Ikeda *et al.* (2008, 2012). The character scoring was based on the following material: *N. (N.) americana*: Canada, Ontario, Point Pelee, vi.1995, D. Čatloš leg., 2 ♂♂ (JRUC); U.S.A., Minnesota, Sherburne Co., Sherburne Wildlife Refuge, 28.vi.1990, 1 ♀ (JRUC); Canada, Quebec, Wakefield, 11.vi.1989, Hutchinson leg., 1 ♀ (JRUC); *N. (E.) japonica*: Japan, Kyushu, Fukuoka prefecture, Motooka, 7.–10.vii.1994, S. Nomura leg., pitfall traps, 1 ♂, 1 ♀ (JRUC).

## Character list

1. Frons in dorsal view, fovea development: (0) without fovea or with weakly indicated fovea between the eyes (Blackburn 1936: Fig. 1; Růžička *et al.* 2012: Fig. 29); (1) with distinctly indicated fovea (Fig. 56).
2. Frons in dorsal view, crest development: (0) weak (Blackburn 1936: Fig. 1; Růžička *et al.* 2012: Fig. 29); (1) distinctly developed (Fig. 56).
3. Punctuation of pronotum in dorsal view: (0) uniform; (1) very superficial discally, arranged in four parallel patches (Figs. 54–55).
4. Shape of pronotal punctures in dorsal view: (0) simple, round to oval (Figs. 54–55); (1) modified, horseshoe-shaped (Růžička *et al.* 2012: Fig. 32).
5. Color of pronotum in dorsal view: (0) yellow with matt, black disc (Blackburn 1936: Fig. 1); (1) black; (2) orange (Figs. 1–8); (3) orange with metallic black medial spot on disc (Figs. 9–10).
6. Hypomeron, coloration medially in ventral view: (0) black; (1) uniformly dark blue; (2) dark blue with orange anterior margin; (3) orange, dark blue only along posterior margin.
7. Punctuation of scutellar shield: (0) large; (1) fine to very fine.
8. Surface of elytron: (0) unmodified (Figs. 1–10); (1) with reticulate sculpturing (Blackburn 1936: Fig. 1).
9. Color of elytra in dorsal view: (0) dark brown to black (Figs. 1–6); (1) metallic blue or green (Figs. 7–10).
10. Elytral epipleural ridge, setation dorsally in females: (0) bare; (1) with dense setation.
11. Elytra, costae development in male: (0) fine, less elevated (Blackburn 1936: Fig. 1; Figs. 1, 3, 5, 7); (1) robust, distinctly elevated (Fig. 9).
12. Apex of elytron, male: (0) regularly rounded (Blackburn 1936: Fig. 1); (1) widely truncate (Figs. 1, 3, 5, 7, 9).
13. Metaventricle, surface microsculpture: (0) medially with distinct microsculpture; (1) with two narrow, longitudinal lineages along medial part without microsculpture; (2) medially glabrous, without distinct microsculpture.
14. Metatibia shape in male, ventral view: (0) straight (Blackburn 1936: Fig. 33); (1) slightly bent (Fig. 57); distinctly bent (Fig. 58).

15. Male genital segment, spiculum gastrale, length in ventral view: (0) short (Blackburn 1936: Fig. 39; Fig. 47); (1) elongate (Figs. 24–29, 43, 51).
16. Male genital segment, shape of ventrite 9: (0) short, constricted anteriorly (Blackburn 1936: Fig. 39); (1) elongate, constricted anteriorly; (2) elongate, oval (Figs. 24–29, 43, 47, 51).
17. Male aedeagus, median lobe in ventral view: (0) very slender (Blackburn 1936: Fig. 39); (1) robust (Figs. 18–23, 42, 46, 50); (2) very wide.
18. Male aedeagus, paramere length in ventral view: (0) elongate, distinctly longer than media lobe (Figs. 18–23, 42); (1) short, slightly longer than median lobe (Figs. 46, 50).
19. Male aedeagus, paramere width in ventral view: (0) slender (Figs. 18–23, 42, 50); (1) wide (Fig. 46).
20. Female genitalia, tergum 10 in dorsal view: (0) small, hexagonal in size (Blackburn 1936: Fig. 44; Fig. 52); (1) large, pentagonal in shape, posteriorly narrowly elongate; (2) large, pentagonal in shape, posteriorly regularly rounded (Figs. 30–35, 44, 48).

**TABLE 1.** Data matrix of adult morphological characters for phylogenetic analysis of the Asian species of *Necrophila* (*Calosilpha*).

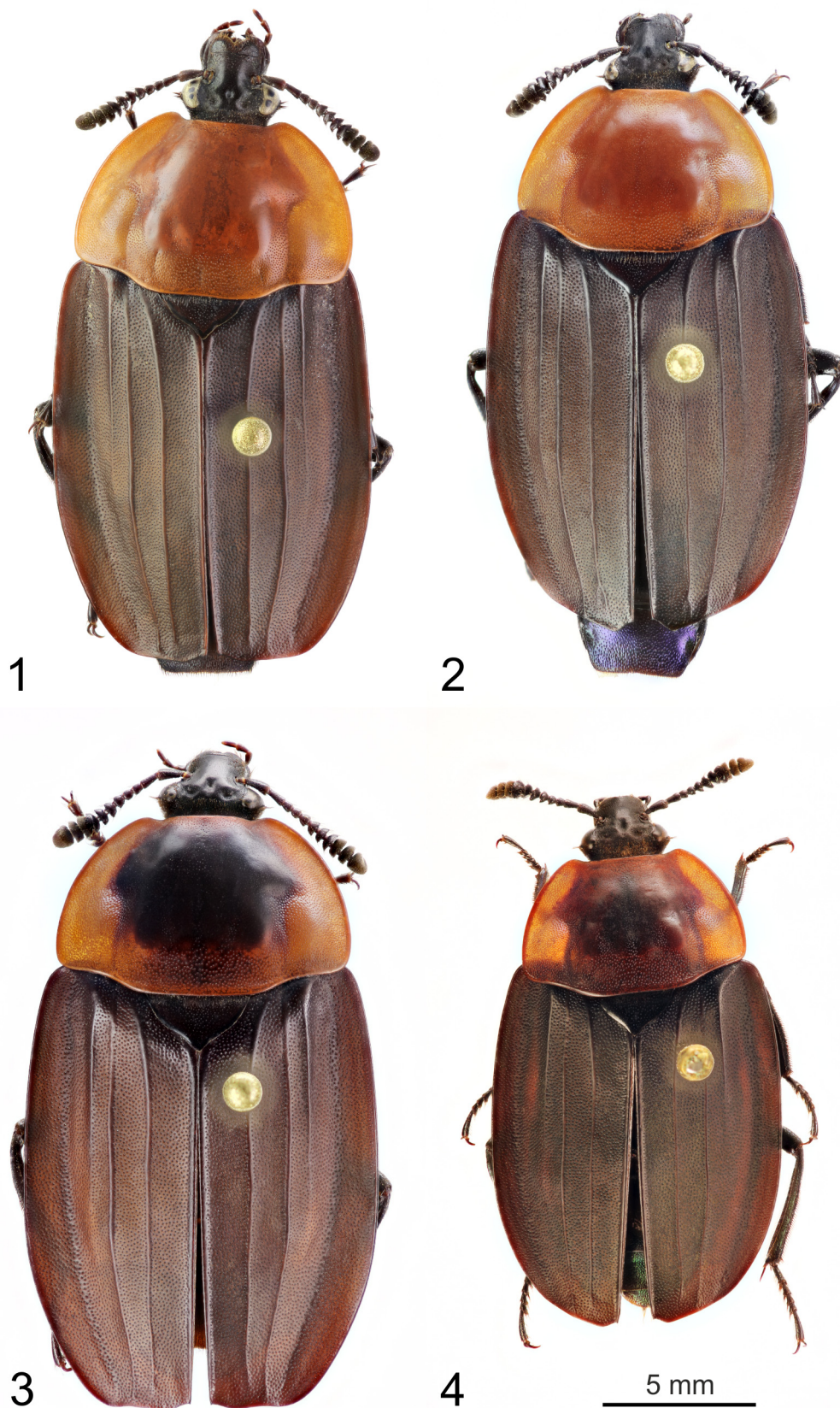
Species/character	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
<i>N. (N.) americana</i> (outgroup)	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
<i>N. (E.) japonica</i> (outgroup)	0	1	1	0	1	0	0	0	0	1	0	0	1	1	1	1	2	0	0	1
<i>N. (C.) brunnicollis</i>	1	1	1	0	2	3	1	0	0	0	0	1	1	1	1	2	1	0	0	2
<i>N. (C.) cyaneocephala</i>	1	1	1	0	2	3	1	0	0	0	0	1	1	1	1	2	1	0	0	2
<i>N. (C.) cyaniventris</i>	1	1	1	0	2	2	1	0	1	0	0	1	1	1	0	2	1	1	1	2
<i>N. (C.) ioptera</i>	1	1	1	0	3	1	1	0	1	0	1	1	2	2	1	2	1	1	0	0

**Geometric morphometrics.** Images of adults in dorsal view were captured by Olympus digital reflex camera (model E-330) connected to an Olympus stereoscopic microscope (model SZX10). Four taxa were examined: *N. (C.) brunnicollis* (171 ♂♂, 196 ♀♀), *N. (C.) cyaniventris* (39 ♂♂, 44 ♀♀), *N. (C.) cyaneocephala* (56 ♂♂, 48 ♀♀), and *N. (C.) ioptera* (37 ♂♂, 37 ♀♀). Moreover, populations of *N. (C.) brunnicollis* from different localities were separated into four groups: from continental Asia (68 ♂♂, 87 ♀♀), Japan (Kyushu) (*Eusilpha (Calosilpha) bicolor imasakai*) (15 ♂♂, 18 ♀♀), Japan (Ryukyus) (*Eusilpha (Calosilpha) kurosawai*) (31 ♂♂, 31 ♀♀), and Japan (Honshu + Shikoku) (57 ♂♂, 60 ♀♀).

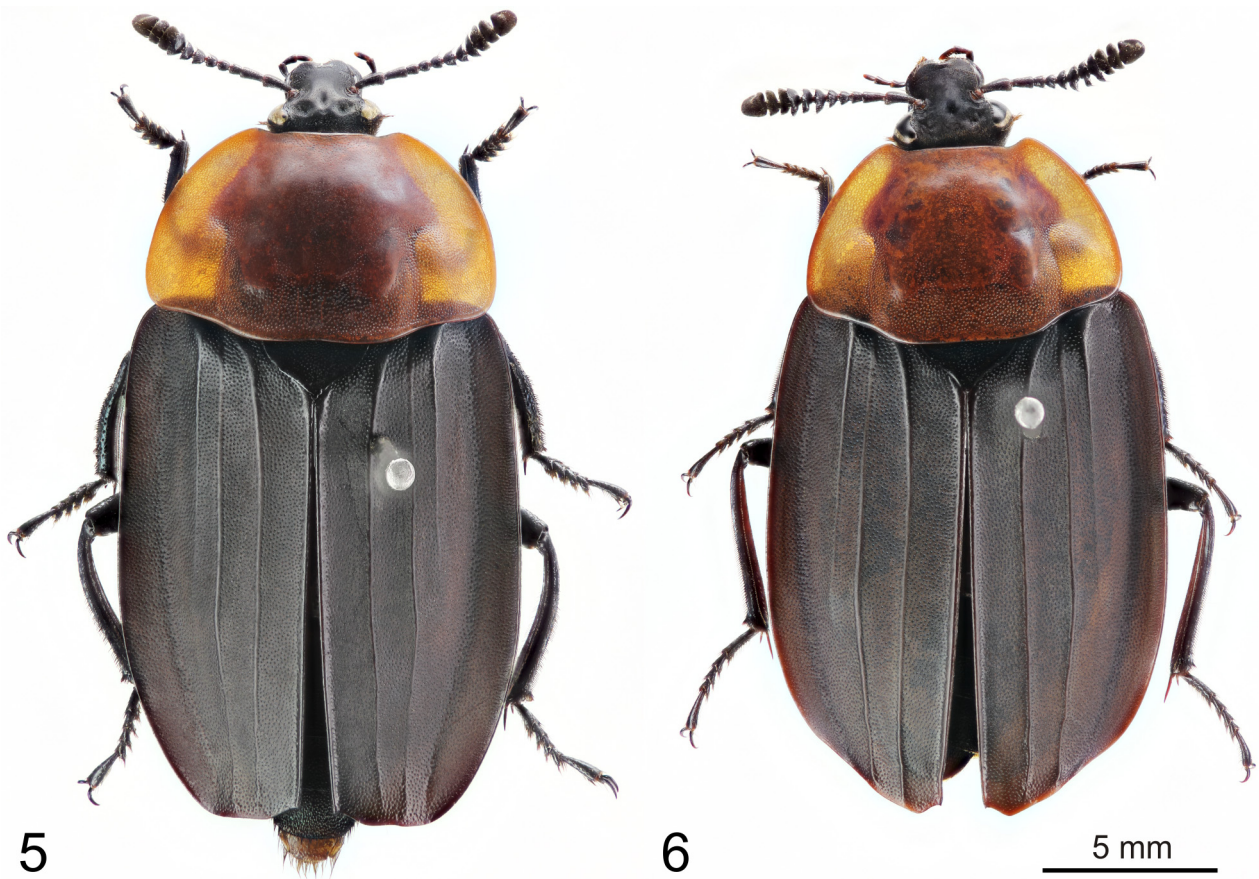
A geometric morphometrics analysis similar to one used in our previous article (Růžička *et al.* 2012) was also employed here. This technique relies on data collected from Cartesian geometric coordinates instead of the linear measurements applied here in 2D space (Bookstein 1982, 1986). All thin-plate spline (TPS) programs are freely available at <http://life.bio.sunysb.edu/morph/index.html> (Rohlf 2014).

Curves are applied if there are no distinct and biologically strong points defined (Bookstein 1997). Hence, here a curve of 50 homologous points that outlined the apex of the left elytron was created in TpsDig 2.10 (Rohlf 2006). Subsequently, the curve points were transformed into landmarks using TpsUtil 1.44 (Rohlf 2009). The method of superimposition (translation, scaling and rotation of the landmark configurations) in generalized Procrustes analysis insured alignment of the landmarks, each on its corresponding position in all specimens, and thus conducting further calculations that identify shape variability between the studied groups (Rohlf 1990; Rohlf & Slice 1990; Rohlf & Marcus 1993; Zelditch *et al.* 2004, 2012). The thin-plate spline method allowed visualization of shape dissimilarities using D'Arcy Thompson's transformation grids, where deformations in these grids represent this disparity (Bookstein 1989; Rohlf 1993; Richtsmeier *et al.* 2002; Adams *et al.* 2004; Mitteroecker & Gunz 2009; Zelditch *et al.* 2012). All these calculations were made in TpsRelw 1.53 (Rohlf 2013).

The significance of the variation between taxa and sexes were examined by multivariate analysis of variance (MANOVA) and discriminant analysis. Canonical variate analysis (CVA) was applied on the relative warp scores matrix to illustrate these differences (Zelditch *et al.* 2004, 2012). Graphical visualization of the CVA results was also made. All of the preceding analyses were executed in PAST ver. 2.11, a freeware available for download at <http://folk.uio.no/ohammer/past/> (Hammer *et al.* 2001). Moreover, TpsRegr 1.38 (Rohlf 2011) was used to compute the multiple regression of the allometric relationship between shape and size (represented by centroid size) to further disclose the effects that size has on the variation between the groups (Bookstein 1991; Mitteroecker *et al.* 2013).



**FIGURES 1–4.** Habitus dorsally of *Necrophila (Calosilpha) brunnicollis* (Kraatz) (1, ♂, JRUC; 2, ♀, JRUC, both Unzen near Shimabara, Kyushu, Japan; 3, ♂, NMPC, Kagoshima, Kyushu, Japan; 4, ♀, JRUC, Mt. Yuwandake, Amami-Oshima Island, Japan).



**FIGURES 5–6.** Habitus dorsally of *Necrophila (Calosilpha) cyaneocephala* (Kraatz) (5, ♂, JRUC; 6, ♀, JRUC, both Guandaoshan, Taiwan).

## Results

### Taxonomic section

#### *Necrophila (Calosilpha) Portevin, 1920*

*Calosilpha* Portevin, 1920b: 396 (as subgenus of *Eusilpha*; type species *Silpha ioptera* Kollar & Redtenbacher, 1844, subsequent designation by Hatch 1928: 113)

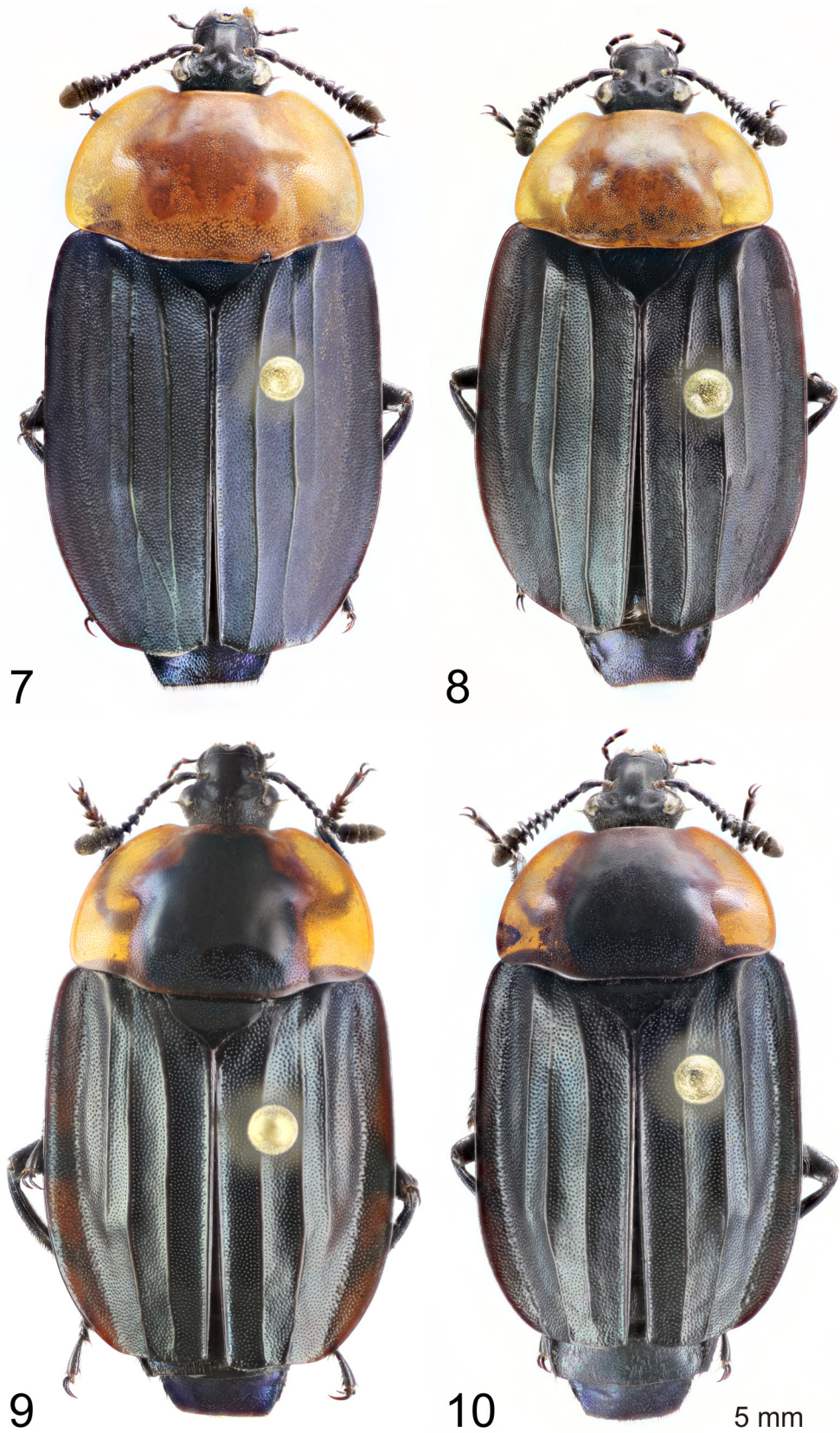
*Calosilpha*: Portevin 1926: 111, 151 (as genus, key, catalog)

*Silpha (Calosilpha)*: Hatch 1928: 113 (as subgenus of *Silpha*, catalog)

*Necrophila (Calosilpha)*: Peck 2001: 270 (as subgenus of *Necrophila*, catalog)

**Diagnostic description.** Body flattened, length 11.9–23.1 mm, maximum body width 8.5–12.5 mm. Head and antennae black or black with metallic luster. Pronotum orange in dorsal view, sometimes with darker (brown to dark brown), poorly delimited medial spot on disc (Figs. 1–8); or pronotum orange with large, well-delimited, metallic black medial spot on disc (Figs. 9–10). Ventrally, hypomeron is orange; prosternum is orange, its posterior part with blue metallic luster of varying extent. Scutellum and elytra brown to dark brown (Figs. 1–6), or with blue or green metallic luster (Figs. 7–10). Meso- and metathorax ventrally, abdomen and legs dark with blue or green metallic luster.

*Head* flattened, with row of long, erect, yellow setae behind the eyes (Fig. 56). Frons with distinctly indicated fovea between the eyes, deep dorsal tentorial pits and a weak transverse crest posteriorly (Fig. 56) (less prominent than in *Chrysosilpha*, see Růžička et al. 2012: 46, Figs. 30–31). Surface with fine punctation. Eyes small, not prominently protruding, reniform (Fig. 56). Antennae with distinctly formed antennal club, consisting of 6–7 antennomeres; in females antennomeres are 5–8 in number, shorter and broader than in males (Figs. 59–62).



**FIGURES 7–10.** Habitus dorsally of *Necrophila (Calosilpha) cyaniventris* (Motschulsky) (7, ♂, JRUC; 8, ♀, JRUC, both Phongsaly, Laos) and *N. (C.) ioptera* (Kollar & Redtenbacher) (9, ♂, JRUC; 10, ♀, JRUC, both Nainital, Uttarakhand, India).



*Pronotum* broadly oval to hexagonal in shape (Figs. 1–10), with anterior margin only weakly emarginate, posterior margin straight medially, with broadly rounded posterolateral corners (Figs. 1–10). Surface with dense punctures, larger in size laterally and posteriorly, only very superficial to indistinct on pronotal disc, without setation (Figs. 54–55). Disc with three longitudinal, continuous, anteriorly divergent patches of more distinct, larger punctures (one medial and two more lateral), dividing very superficial punctation on disc into four areas, corresponding with dorsally more elevated areas. Interstices between the punctures glossy, with fine isodiametric microsculpture, very superficial or without microsculpture discally. Anterior and posterior margin of pronotum with dense row of stout, short, yellow, ventrally oriented setae.

*Scutellar shield* small, cordiform, with sinuous lateral margins. Sparsely covered by very fine punctures, densely setose in anterior part, covered by posterior margin of pronotum.

*Elytra* flattened, each elytron with three distinctly developed costae in both males and females, outer (third) costa shorter, not crossing bulges (Figs. 1–10). The third interval on elytron is distinctly narrower than the first and second ones (Figs. 1–10). Elytral epipleural ridge not elevated, laterally flattened, reaching subapical part of elytra in both males and females. Apex of elytron in males subtruncate to truncate with sinuous margin (Figs. 1, 3, 5, 7, 9); in females subtruncate or elongated slightly or distinctly (Figs. 2, 4, 6, 8, 10). Sutural edge apically elongate into small but distinct denticle in both males and females. Dorsal surface with uniformly dispersed, fine and dense punctation, similar in size to that on pronotum; surface matt, with fine to very fine, isodiametric microsculpture; without reticulate sculpture (which is present in *Necrophila* s. str.). Ventrally, elytral epipleura covered by fine, densely arranged punctures.

*Hind wings* fully developed, functional.

Ventral side of body and legs very glossy, with distinct punctation and long setation; with fine, transverse microsculpture. Metaventrite glossy, without microsculpture on entire median part (*N. ioptera*), or without microsculpture only in two narrow, longitudinal lineages along medial part (other species).

*Legs* with tibia armed with several longitudinal rows of short, strong setae. Pro- and mesofemur only slightly expanded distally in males and simple in females, without distinct expansion. Metatibia slightly bent in males (distinctly bent in *N. ioptera*), almost straight in females. Pro- and mesotarsomere 1–4 moderately expanded in males (simple, unmodified in females). Meso- and metatarsal claws symmetrical in both males and females (asymmetrical in males of *Deutosilpha* and *Chrysosilpha*).

*Abdomen* distinctly sclerotized, with ventrites 2–5 unmodified (weakly sclerotized in *Deutosilpha* and *Chrysosilpha*, with ventrites 2–5 very short in *Chrysosilpha*).

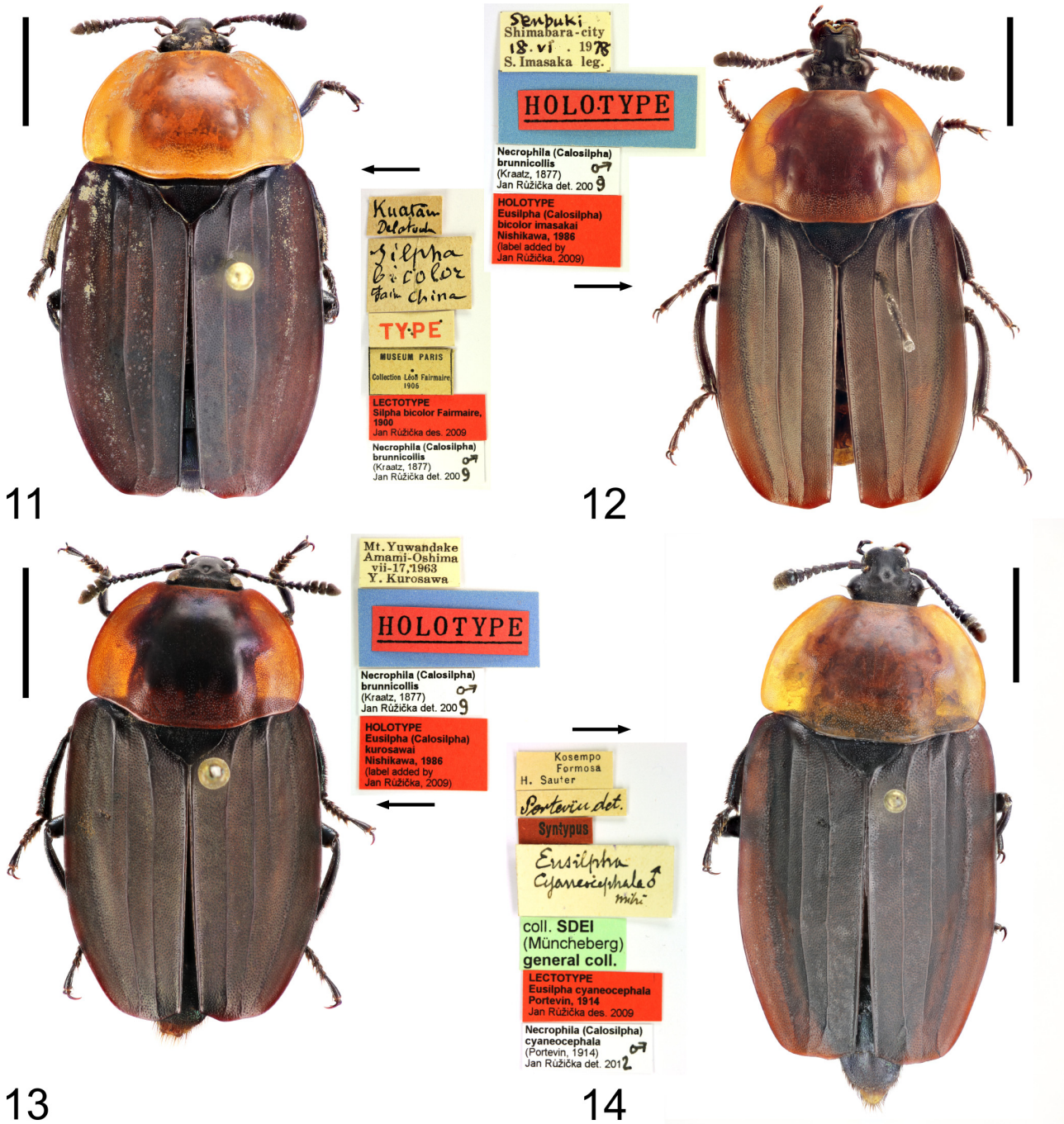
*Male*. Genital segment with robust, oblong ventrite 9, truncate apically, extending anterior margin of tergum 9 (Figs. 26–29, 43, 47, 51); spiculum gastrale large, robust, slightly asymmetrical (Figs. 26–29, 43, 47, 51). Aedeagus large; parameres robust; median lobe slightly to distinctly shorter than parameres, regularly tapering to a triangular tip (Figs. 18–23, 42, 46, 50).

*Female*. Genital segment with tergum 10 large, pentagonal in shape, regularly rounded posteriorly in dorsal view (Figs. 30–35, 44, 48) (but small, hexagonal in *N. ioptera*, Fig. 52); with stylus inserted laterally, slightly to distinctly longer than apex of coxite in ventral view (Figs. 36–41, 45, 49, 53).

### A key to species of *Necrophila* (*Calosilpha*)

- 1 Pronotum orange in dorsal view, with large, well-delimited, metallic black medial spot on disc (Figs. 9–10, 55). Elytra with green metallic luster; costae very robust and distinctly elevated (Figs. 9–10). Hypomeron medially dark metallic blue in ventral view. Metatibia in male distinctly bent. Genital segment with tergum 10 small, hexagonal in shape in dorsal view (Fig. 52). Pakistan, northern India, Nepal. . . . . *N. (C.) ioptera*
- Pronotum orange in dorsal view, sometimes with darker (brown to dark brown), usually poorly delimited medial spot on disc (Figs. 1–8, 55). Elytra with blue metallic luster (Figs. 7–8) or brown to dark brown, without metallic luster (Figs. 1–6); costae finer, less elevated (Figs. 1–8). Hypomeron medially at least in anterior part orange in ventral view. Metatibia in male only slightly bent. Genital segment with tergum 10 large, pentagonal in shape, rounded posteriorly in dorsal view (Figs. 30–35, 44, 48). . . . . 2
- 2 Elytra with blue metallic luster (Figs. 7–8). Male genital segment with short spiculum gastrale in ventral view (Fig. 47). Aedeagus with median lobe only slightly shorter than short, robust parameres (Fig. 46). Northern India to Vietnam and southern China (Hainan Island, rarely Yunnan). . . . . *N. (C.) cyaniventris*
- Elytra brown to dark brown, without metallic luster (Figs. 1–6). Male genital segment with longer spiculum gastrale in ventral view (Figs. 24–29, 43). Aedeagus with median lobe distinctly shorter than slender, elongate parameres in ventral view (Figs. 18–23, 42). China and Bhutan to Japan. . . . . 3

- 3 In male, elytra slightly more rounded and wide than in *N. cyaneocephala* (Figs. 1, 3). In female, apex of elytron shorter and more rounded (Figs. 2, 4, 66, 69). Continental China and Bhutan to Far East of Russia and Japan (including Ryukyus) . . . . . *N. (C.) brunnicollis*
- In male, elytra laterally parallel and more narrow than in *N. brunnicollis* (Fig. 5). In female, apex of elytron more elongated (Figs. 6, 66). Taiwan. . . . . *N. (C.) cyaneocephala*



FIGURES 11–14. Habitus dorsally and labels of lectotype ♂ of *Silpha bicolor* Fairmaire (11, MNHN), holotype ♂ of *Eusilpha bicolor imasakai* Nishikawa (12, NSMT), holotype ♂ of *Eusilpha kurosawai* Nishikawa (13, NSMT) and lectotype ♂ of *Eusilpha cyaneocephala* Portevin (14, SDEI). All scale bars 5 mm.

***Necrophila (Calosilpha) brunnicollis* (Kraatz, 1877)**

(Figs. 1–4, 11–13, 18–41)

*Silpha brunnicollis* Kraatz, 1877: 106 (description, type locality “Japan”) [number of syntypes not specified]

*Silpha brunnicollis*: Harold 1877: 347 (supplementary description; partially misidentification with *N. cyaniventris*, cf. Schawaller 1982: 250)

*Silpha brunnicollis*: Lewis 1879: 9 (catalog)

*Silpha brunnicollis*: Fairmaire 1888: 114 (redescription)

*Eusilpha brunneicollis*: Portevin 1914a: 8 (new combination, incorrect subsequent spelling)

*Eusilpha brunnicollis*: Portevin 1914b: 220 (key)

*Calosilpha brunneicollis*: Portevin 1926: 115, 151 (new combination, incorrect subsequent spelling, key, catalog)

*Silpha (Calosilpha) brunneicollis*: Hatch 1928: 113 (new combination, incorrect subsequent spelling, catalog)

*Silpha brunneicollis*: Kurosa 1959: 426 (description of larva, incorrect subsequent spelling)

*Calosilpha brunneicollis*: Cho & Lee 1995: 7 (redescription, incorrect subsequent spelling, catalog, synonymy)

*Necrophila brunnicollis*: Nishikawa 2007a: 94 (new combination, diagnostic description, distribution)

*Calosilpha brunnicollis*: Ikeda *et al.* 2008: 2067, 2072 (phylogenetic position)

*Necrophila brunnicollis*: Ikeda *et al.* 2012: 2–5 (molecular variance)

*Necrophila (Calosilpha) brunnicollis*: Ji 2012: 35, 81 (redescription, key, catalog, synonymy)

*Silpha bicolor* Fairmaire, 1900: 616 (description, type locality “Koua Toun, dans le Szé-Tchouen [= Sichuan province]”)

*Eusilpha (Calosilpha) bicolor*: Portevin 1920a: 397 (new combination, catalog)

*Calosilpha bicolor*: Portevin 1926: 116–117, 151 (new combination, key, catalog)

*Silpha (Calosilpha) bicolor*: Hatch 1928: 113 (new combination, catalog)

*Calosilpha bicolor*: Cho & Lee 1992: 12 (redescription, catalog)

*Calosilpha bicolor*: Cho & Lee 1995: 7 (redescription, catalog, junior subjective synonym of *Silpha brunnicollis*)

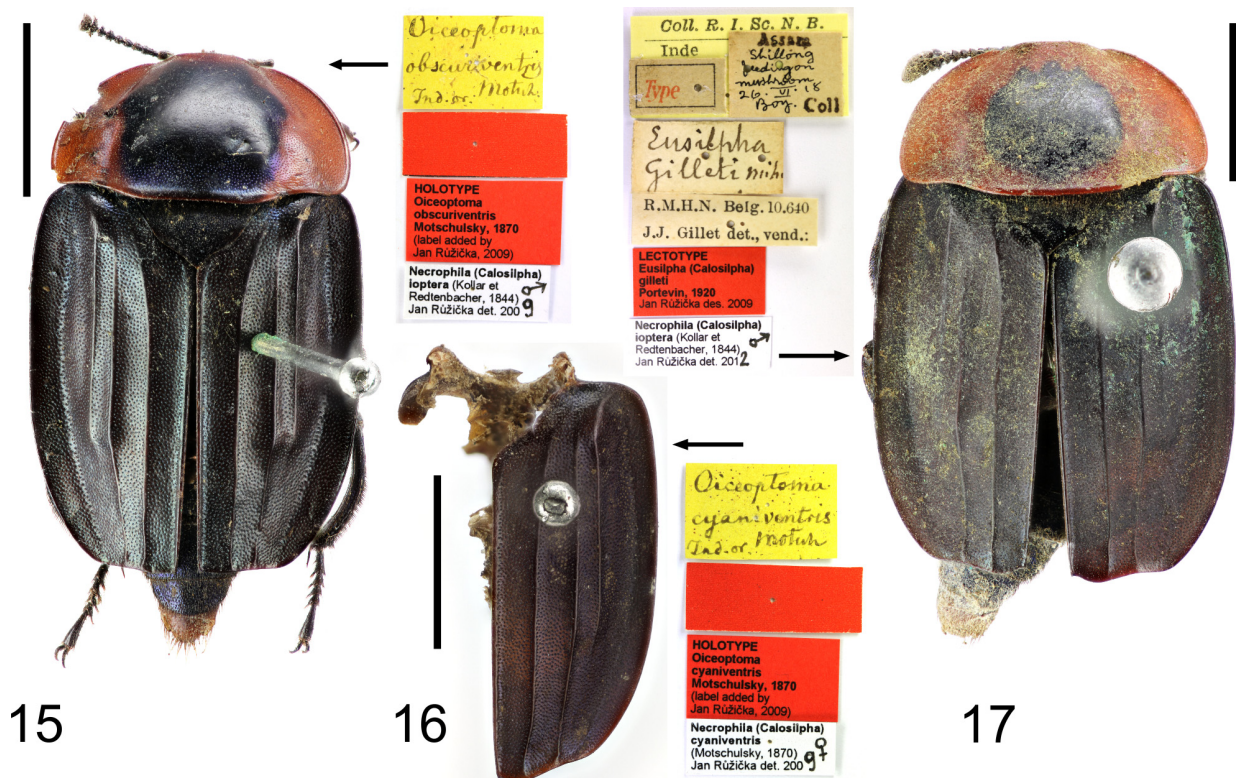
*Eusilpha (Calosilpha) bicolor imasakai* Nishikawa, 1986: 154 (description, type locality “Senbuki, Shimabara City, Kyushu”)

*Necrophila (Calosilpha) bicolor imasakai*: Ji 2012: 81 (junior subjective synonym of *Silpha brunnicollis*)

*Eusilpha (Calosilpha) kurosawai* Nishikawa, 1986: 156 (description, type locality “Mt. Yuwandake, Amami-Oshima Is., Ryukyus”)

*Calosilpha kurosawai*: Ikeda *et al.* 2008: 2067, 2072 (new combination, phylogenetic position)

*Necrophila (Calosilpha) kurosawai*: Ji 2012: 81 (junior subjective synonym of *Silpha brunnicollis*)



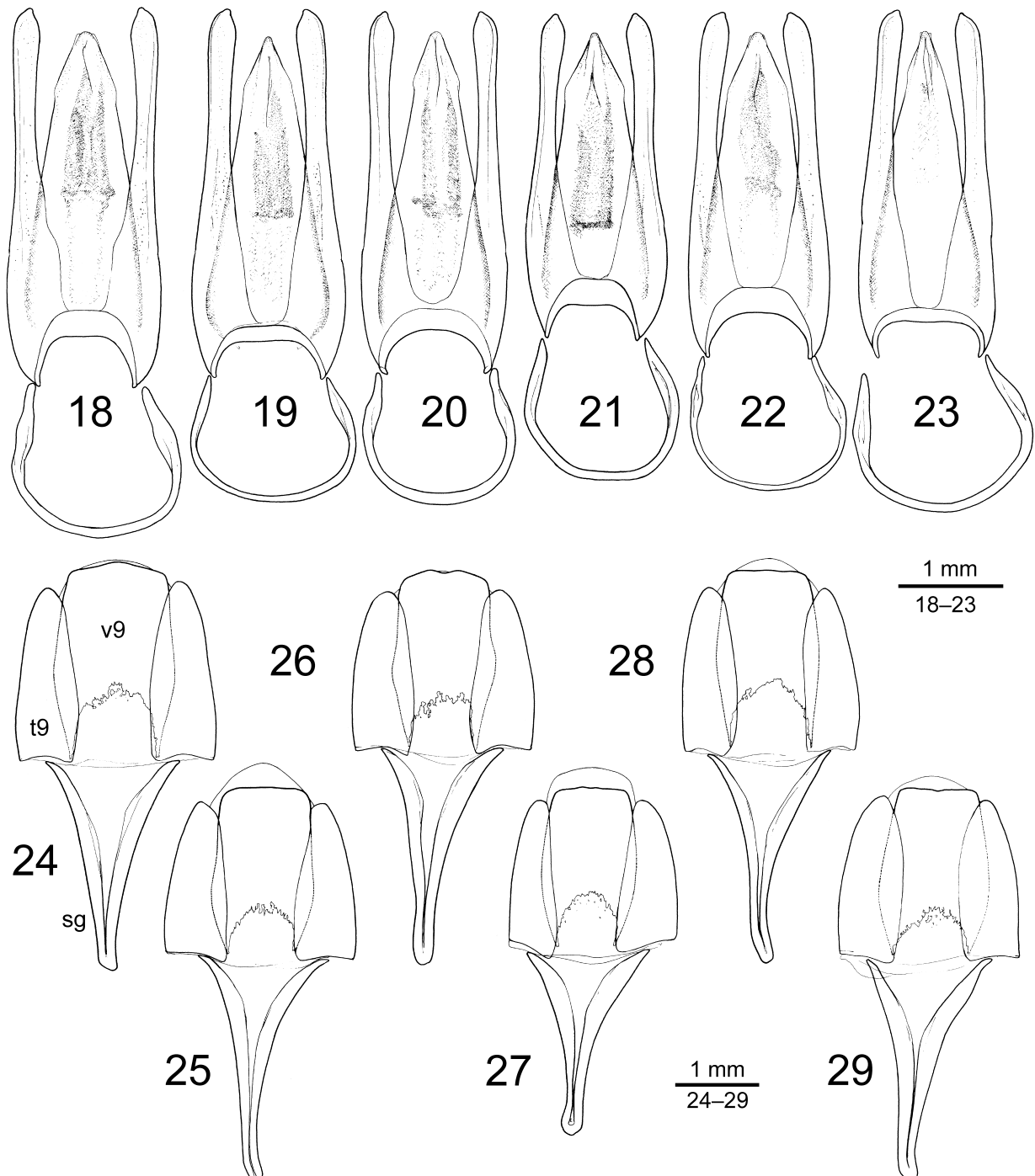
**FIGURES 15–17.** Habitus dorsally and labels of holotype ♂ of *Oiceoptoma obscuriventris* Motschulsky (15, ZMUM), holotype of *Oiceoptoma cyaniventris* Motschulsky (16, ZMUM) and lectotype of *Eusilpha gilleti* Portevin (17, IRSNB). All scale bars 5 mm.

**Type material examined:** Lectotype ♂ of *Silpha bicolor* Fairmaire, 1900 (here designated, MNHN), labelled (Fig. 11): “Kuatun / Delatouche [leg.] [hw] // Silpha / bicolor / Fairm. China [hw, Fairmaire’s handwriting] // TYPE [p, red characters] // MUSEUM PARIS / Collection Léon Fairmaire / 1906 [p] // LECTOTYPE / Silpha bicolor / Fairmaire, 1900 / Jan Růžička des. 2009 [p, red label] // Necrophila (Calosilpha) / brunnicollis / (Kraatz, 1877) [p] ♂ [hw] / Jan Růžička det. 200 [p] 9 [hw]”. Paralectotypes (2 ♂♂, 7 ♀♀): paralectotype ♂ (MNHN), labelled: “Kuatun [hw] // Silpha / bicolor / Fairm. / China [hw] // TYPE [p, red characters] // MUSEUM PARIS / Collection Léon Fairmaire / 1906 [p] // PARALECTOTYPE / Silpha bicolor / Fairmaire, 1900 / Jan Růžička des. 2009 [p, red label] // Necrophila (Calosilpha) / brunnicollis / (Kraatz, 1877) [p] ♂ [hw] / Jan Růžička det. 200 [p] 9 [hw]”; paralectotype ♀ (MNHN), labelled: “Kuatun [hw] / COTYPE [p, red characters] // MUSEUM PARIS / Collection Léon Fairmaire / 1906 [p] // PARALECTOTYPE / Silpha bicolor / Fairmaire, 1900 / Jan Růžička des. 2009 [p, red label] // Necrophila (Calosilpha) / brunnicollis / (Kraatz, 1877) [p] ♀ [hw] / Jan Růžička det. 200 [p] 9 [hw]”; paralectotype ♀ (MNHN), labelled: “Koua-Toun / Delatouche [leg.] [hw] // COTYPE [p, red characters] // MUSEUM PARIS / Collection Léon Fairmaire / 1906 [p] // PARALECTOTYPE / Silpha bicolor / Fairmaire, 1900 / Jan Růžička des. 2009 [p, red label] // Necrophila (Calosilpha) / brunnicollis / (Kraatz, 1877) [p] ♀ [hw] / Jan Růžička det. 200 [p] 9 [hw]”; paralectotype ♀ (MNHN), labelled: “Kouang-Toung / (de Latouche) [leg.] [hw] // CHINE / H: DONCKIER 1900 [p] // TYPE [p, red characters] // Fairmaire det. / cf. Ann. Fr. 1899 [hw] // Silpha / bicolor / Fairm. n.sp. [hw] // PARALECTOTYPE / Silpha bicolor / Fairmaire, 1900 / Jan Růžička des. 2009 [p, red label] // Necrophila (Calosilpha) / brunnicollis / (Kraatz, 1877) [p] ♀ [hw] / Jan Růžička det. 200 [p] 9 [hw]”; paralectotype ♂ (MNHN), labelled: “Kouang-Toung / (de Latouche) [leg.] [hw] // CHINE / H: DONCKIER 1900 [p] // TYPE [p, red characters] // PARALECTOTYPE / Silpha bicolor / Fairmaire, 1900 / Jan Růžička des. 2009 [p, red label] // Necrophila (Calosilpha) / brunnicollis / (Kraatz, 1877) [p] ♀ [hw] / Jan Růžička det. 200 [p] 9 [hw]”; paralectotype ♀ (coll. M. Pic, MNHN), labelled: “Kuatun [hw] // TYPE [p, red characters] // Silpha / bicolor / type Fokien [hw, Pic’s handwriting] // PARALECTOTYPE / Silpha bicolor / Fairmaire, 1900 / Jan Růžička des. 2009 [p, red label] // Necrophila (Calosilpha) / brunnicollis / (Kraatz, 1877) [p] ♀ [hw] / Jan Růžička det. 200 [p] 9 [hw]”; paralectotype ♀ (coll. M. Pic, MNHN), labelled: “Kuatun [hw] // TYPE [p, red characters] // PARALECTOTYPE / Silpha bicolor / Fairmaire, 1900 / Jan Růžička des. 2009 [p, red label] // Necrophila (Calosilpha) / brunnicollis / (Kraatz, 1877) [p] ♀ [hw] / Jan Růžička det. 200 [p] 9 [hw]”; paralectotype ♀ (BMNH), labelled: “70686 [hw, yellow label] // FOKIEN [p] // CO- [hw] / TYPE [p] // China [hw] // bicolor Frm. [hw] // Fry Coll. / 1905-100. [p] // PARALECTOTYPE / Silpha bicolor / Fairmaire, 1900 / Jan Růžička des. 2009 [p, red label] // Necrophila (Calosilpha) / brunnicollis / (Kraatz, 1877) [p] ♀ [hw] / Jan Růžička det. 200 [p] 9 [hw]”; paralectotype ♀ (BMNH), labelled “FOKIEN [p] // CO- [hw] TYPE [p] // China [hw] // Fry Coll. / 1905-100. [p] // PARALECTOTYPE / Silpha bicolor / Fairmaire, 1900 / Jan Růžička des. 2009 [p, red label] // Necrophila (Calosilpha) / brunnicollis / (Kraatz, 1877) [p] ♀ [hw] / Jan Růžička det. 200 [p] 9 [hw]”.

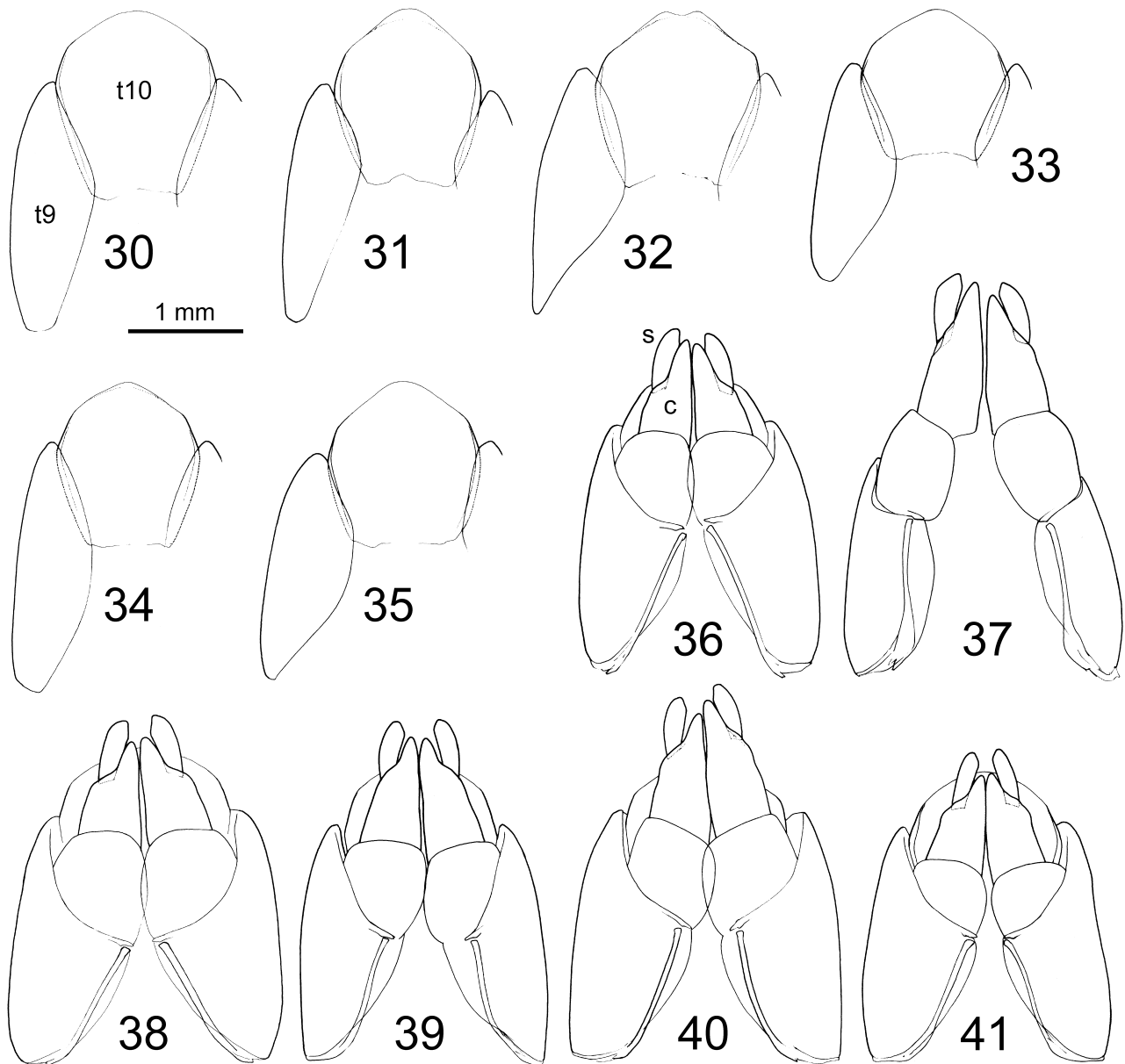
Holotype ♂ of *Eusilpha bicolor imasakai* Nishikawa, 1986 (NSMT), labelled (Fig. 12): “Senbuki [hw] / Shimabara-city [p] / 18. VI. [hw] 19 [p] 78 [hw] / S. Imasaka leg. [p] // HOLOTYPE [p, red label] // [blue label = sign for holotype] // HOLOTYPE / Eusilpha (Calosilpha) / bicolor imasakai / Nishikawa, 1986 / (label added by / Jan Růžička, 2009) [p, red label] // Necrophila (Calosilpha) / brunnicollis / (Kraatz, 1877) [p] ♂ [hw] / Jan Růžička det. 200 [p] 9 [hw]”. Paratypes (1 ♂, 5 ♀♀): paratype ♀ (NSMT), with identical locality label and “PARATYPE [p, red label] // PARATYPE / Eusilpha (Calosilpha) / bicolor imasakai / Nishikawa, 1986 / (label added by / Jan Růžička, 2009) [p, red label] // Necrophila (Calosilpha) / brunnicollis / (Kraatz, 1877) [p] ♀ [hw] / Jan Růžička det. 200 [p] 9 [hw]”; paratypes 1 ♂, 4 ♀♀ (MNIC), labelled: “Senbuki [hw] / Shimabara-city [Nagasaki prefecture, Kyushu, Japan] [p] / 18.VI. [hw] 19 [p] 78 [hw] / S. Imasaka leg. [p] // PARATYPE / Eusilpha (Calosilpha) / bicolor imasakai / M. NISHIKAWA, 1986 [p, light blue label]”.

Holotype ♂ of *Eusilpha kurosawai* Nishikawa, 1986 (NSMT), labelled (Fig. 13): “Mt. Yuwandake / Amami – Oshima / vii-17, 1963 / Y. Kurosawa [leg.] [p] // HOLOTYPE [p, red label] // [blue label = sign for holotype] // HOLOTYPE / Eusilpha (Calosilpha) / kurosawai / Nishikawa, 1986 / (label added by / Jan Růžička, 2009) // Necrophila (Calosilpha) / brunnicollis / (Kraatz, 1877) [p] ♂ [hw] / Jan Růžička det. 200 [p] 9 [hw]”. Paratypes (5 ♂♂, 4 ♀♀): paratypes 3 ♂♂, 2 ♀♀ (one ♀ paratype with dissected genitalia, glued on a paper card on the same pin with the specimen) (NSMT), with identical locality label and “PARATYPE [p, red label] // PARATYPE / Eusilpha (Calosilpha) / kurosawai / Nishikawa, 1986 / (label added by / Jan Růžička, 2009) // Necrophila (Calosilpha) / brunnicollis / (Kraatz, 1877) [p] ♂ [or ♀] [hw] / Jan Růžička det. 200 [p] 9 [hw]”; paratype ♂ (aedeagus dissected, glued together with two apical abdominal segments on a paper card on the same pin with the specimen) (NSMT), labelled: “Mt. Yuwan / Amami–Oshima I. / 22. VI. 1980 / S. Imasaka leg. [p] // trap [p] // Fig. 1 [hw] //

PARATYPE [p, red label] // PARATYPE / *Eusilpha* (*Calosilpha*) / kurosawai / Nishikawa, 1986 / (label added by / Jan Růžička, 2009) // *Necrophila* (*Calosilpha*) / *brunnicollis* / (Kraatz, 1877) [p] ♂ [hw] / Jan Růžička det. 200 [p] 9 [hw]"; paratypes 1 ♂, 1 ♀ (MNIC), labelled: "(Mt. Yuwan) / Amami-Oshima I. [Ryukyu Islands, Kagoshima prefecture, Japan] / 22.VI.1980 / S. Imasaka leg. [p] // trap [p] // PARATYPE / *Eusilpha* (*Calosilpha*) / kurosawai / M. NISHIKAWA, 1986 [p, light blue label]; paratype 1 ♀ (MNIC), labelled: "Nishinakama / Amami-Oshima Is. / 5.IV. [hw] 19 [p] 72 [hw] / leg. [p] M. Nishikawa [hw] // PARATYPE / *Eusilpha* (*Calosilpha*) / kurosawai / M. NISHIKAWA, 1986 [p, light blue label]"



**FIGURES 18–29.** ♂ genitalia of *Necrophila* (*Calosilpha*) *brunnicollis* (Kraatz) (18, 24, Wuyi Shan, Fujian, China; 19, 25, Kaesong, North Korea; 20, 26, Kaymanovka, Russia; 21, 27, Yona, Okinawa Island, Japan; 22, 28, Unzen, Kyushu, Japan; 23, 29, Omogo valley, Shikoku, Japan, all JRUC), setae omitted. Aedeagus ventrally (18–23), ♂ genital segment ventrally (24–29). Abbreviations: sg—spiculum gastrale, t9—tergum 9, v9—ventrite 9.



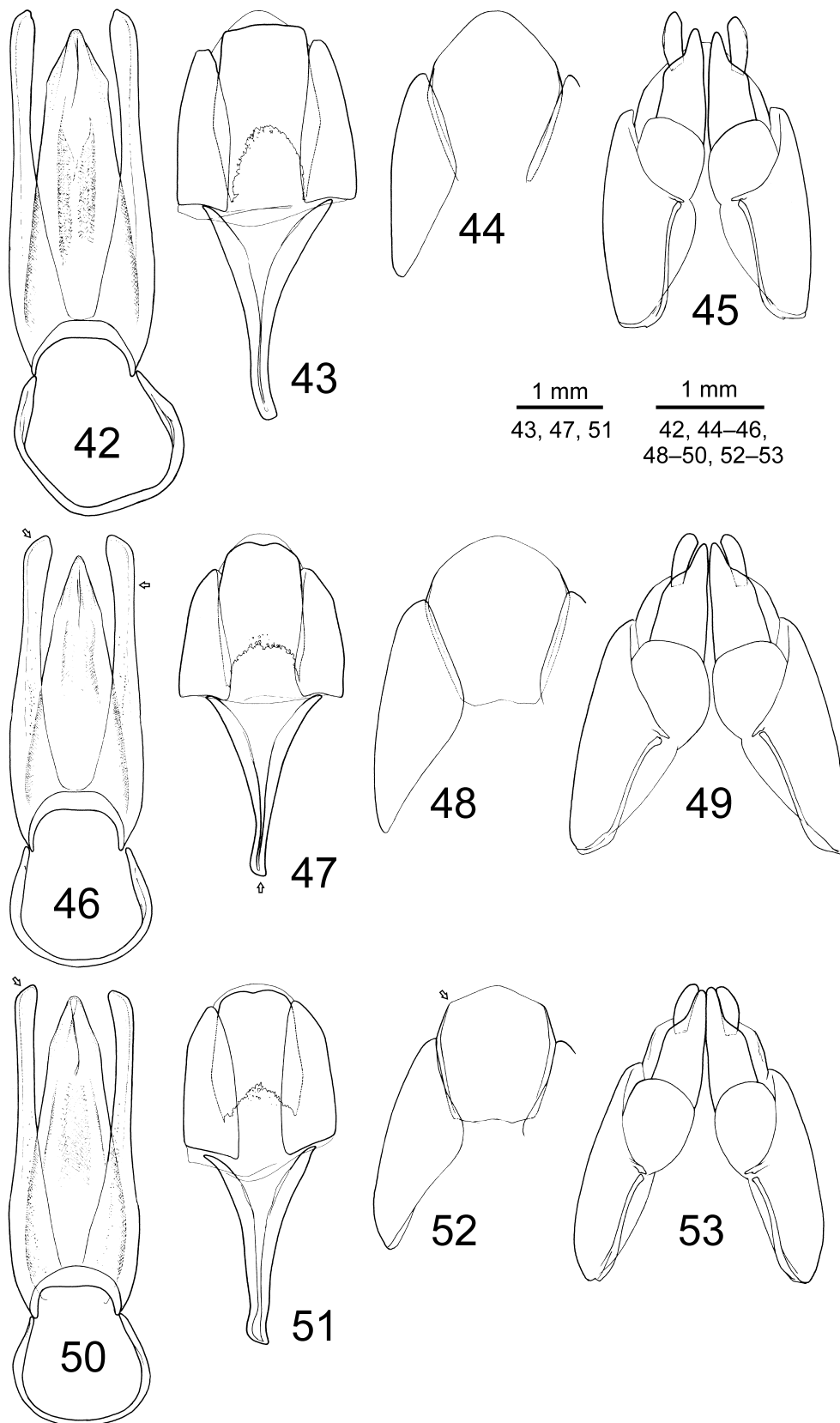
**FIGURES 30–41.** ♀ genitalia of *Necrophila (Calosilpha) brunnicollis* (Kraatz) (30, 38, Wuyi Shan, Fujian, China; 31, 39, Kaesong, North Korea; 32, 40, Kaymanovka, Russia; 33, 41, Yona, Okinawa Island, Japan; 34, 36, Unzen, Kyushu, Japan; 35, 37, Omogo valley, Shikoku, Japan, all JRUC), setae omitted. Genital segment dorsally (30–35) and ventrally (36–41). Abbreviations: c—coxite, s—stylus, t9—tergum 9, t10—tergum 10.

**Additional material examined.** See Appendix 1.

**Diagnostic description.** Body length 17.0–22.8 mm (22.0 mm in the lectotype of *Silpha bicolor*), maximum body width 9.6–12.5 mm (12.1 mm in the lectotype). Pronotum orange in dorsal view (Figs. 1–2, 4); sometimes with darker (brown to dark brown), usually poorly delimited medial spot on disc (populations from Japan, including Ryukyus) (Fig. 3). Hypomeron medially orange in ventral view, dark metallic blue only along its posterior margin. Elytra brown to dark brown, without metallic luster; outline subrectangular; costae finer, less elevated (Figs. 1–4).

*Male.* Elytra slightly more rounded and wide than in *N. cyaneocephala* (Figs. 1, 3). Metatibia only slightly bent. Male genital segment with longer spiculum gastrale in ventral view (Figs. 24–29). Aedeagus with median lobe distinctly shorter than slender, elongate parameres in ventral view (Figs. 18–23).

*Female.* Apex of elytron shorter than in *N. cyaneocephala* (Figs. 2, 4, 66, 69). Genital segment with tergum 10 large, pentagonal in shape, narrowly or widely rounded in dorsal view (Figs. 30–35).



**FIGURES 42–53.** Genitalia of *Necrophila (Calosilpha) cyanocephala* (Kraatz) (42–43, ♂, and 44–45, ♀, both SDEI, paralectotypes, Kosempo, Taiwan), *N. (C.) cyaniventris* (Motschulsky) (46–47, ♂, JRUC, Phongsaly, Laos, and 48–49, ♀, JRUC, near Mt. Everest, Nepal) and *N. (C.) ioptera* (Kollar & Redtenbacher) (50–51, ♂, and 52–53, ♀, both JRUC, Nainital, Uttarakhand, India). Aedeagus ventrally (42, 46, 50), ♂ genital segment ventrally (43, 47, 51), ♀ genital segment dorsally (44, 48, 52) and ventrally (45, 49, 53).

**Notes on type specimens and synonymy.** We were not able to locate syntypes of *Silpha brunnicollis*. They are not found in the collection of SDEI (where most of Kraatz's type material of beetles is deposited), nor in ZMHB, where is deposited the collection of Palearctic beetles of Friedrich Otto Gustav Quedenfeldt (1817–1891), who collected in Japan the pair of syntypes of *S. brunnicollis* mentioned by Kraatz (1877).

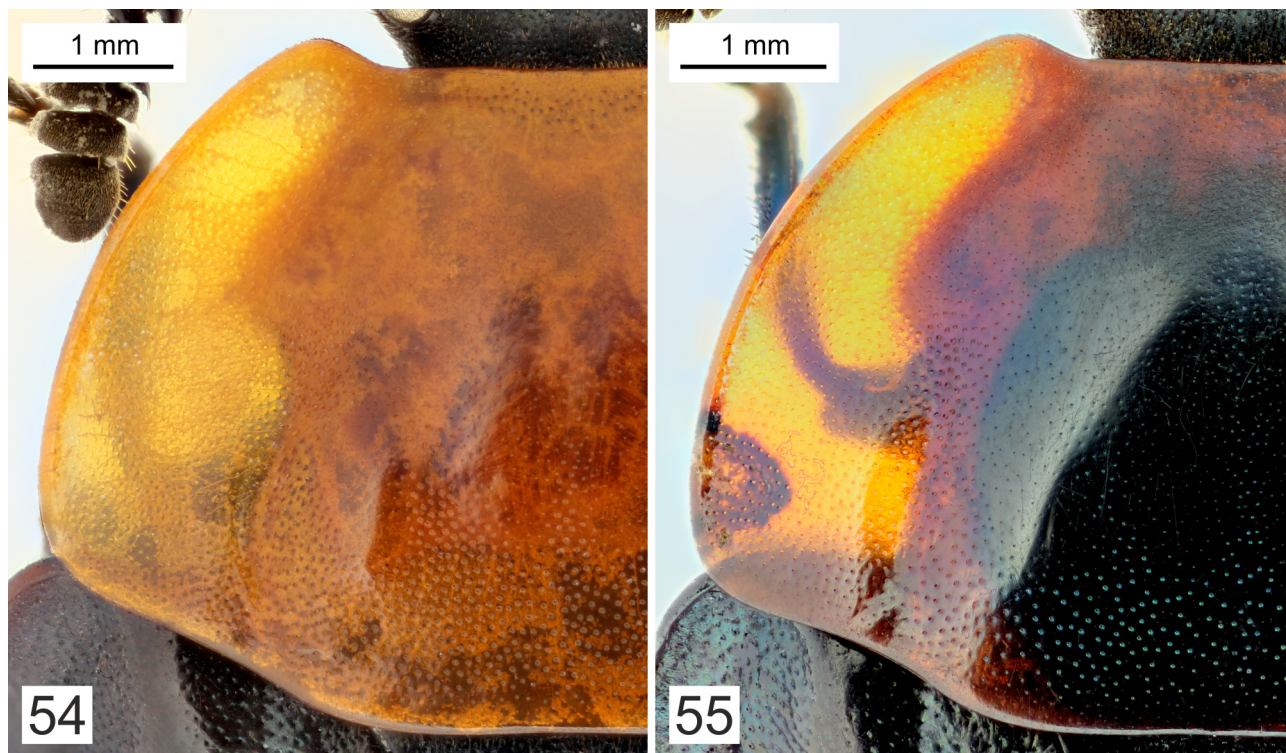
A lectotype of *Silpha bicolor* is designated here, selected from a series of syntype specimens from MNHN and BMNH. We confirm the opinion of Cho & Lee (1995), who considered both *S. brunnicollis* from Japan and *S. bicolor* from continental Asia as conspecific, and we are treating *S. bicolor* as a junior subjective synonym of *S. brunnicollis*.

Type material of *Eusilpha (Calosilpha) bicolor imasakai* and *Eusilpha (Calosilpha) kurosawai* was examined, including both holotypes deposited in NSMT. We confirm the opinion of Ji (2012), who considers both taxa as junior subjective synonyms of *S. brunnicollis*. See the section on geometric morphometrics below for more details.

**Ecology.** Specimen data (based on material from Fujian Province, Kuatun [=Huaqiao, 27°40'N 117°40'E], 1938, J. Klapperich leg., mostly deposited in ZFMK) indicate that adults are most active in the spring and early summer (summarized by months: April—173 spec. (85 ♂♂, 88 ♀♀), May—48 spec. (22 ♂♂, 26 ♀♀), June—45 spec. (19 ♂♂, 26 ♀♀), July—119 spec. (58 ♂♂, 61 ♀♀), August—18 spec. (8 ♂♂, 10 ♀♀)).

This species is usually collected on larger carcasses of endothermic vertebrates or using baited pitfall traps. Several records from Japan also document its occurrence on snake carrion and on smelling stinkhorn mushrooms (*Phallus*, Agaricomycetes: Phallales) (see Appendices 1, 2).

**Distribution** (Fig. 63). Known from Far East of Russia, Korea and Japan (Lafer 1989; Cho & Lee 1995; Nishikawa 1986, 1994, 2007a–b, 2013, 2014), and reported in China from Beijing and Chongqing municipalities as well as Guizhou, Heilongjiang, Hunan, Shaanxi, Sichuan and Yunnan provinces (Fairmaire 1888; Zhang 1992, 1993, 1997; Růžička & Schneider 1996; Ji 2012; Nishikawa 2014). Old records from Taiwan (Fairmaire 1888: without precise locality; Portevin 1914a: Kosempo) are probable misidentifications with *N. cyaneocephala* or are based on erroneously labelled specimens of *C. brunnicollis* (see Appendix 1). First reliable records from China: Hong Kong, and Anhui, Fujian, Gansu, Guangxi, Hubei, Jiangxi, Jilin, Qinghai and Zhejiang provinces. First record from Bhutan.



**FIGURES 54–55.** Pronotum dorsally of *Necrophila (Calosilpha) cyaniventris* (Motschulsky) (54, ♀, JRUC, Phongsaly env., Laos) and *N. (C.) ioptera* (Kollar & Redtenbacher) (55, ♀, JRUC, Nainital, Uttarakhand, India).



***Necrophila (Calosilpha) cyaneocephala* (Portevin, 1914)**

(Figs 5–6, 14, 42–45, 57, 59, 60)

*Eusilpha cyaneocephala* Portevin, 1914a: 6 (description, type locality “Kosempo, Hoozan”)

*Calosilpha cyaneocephala*: Portevin 1926: 116, 151 (new combination, key, catalog)

*Silpha (Calosilpha) cyaneocephala*: Hatch 1928: 113 (new combination, catalog)

*Calosilpha cyaneocephala*: Schawaller 1982: 251 (new combination, key, variability)

*Necrophila (Calosilpha) cyaneocephala*: Ji 2012: 36, 84 (new combination, redescription, key, catalog)

**Type material examined:** Lectotype ♂ (SDEI), labelled (Fig. 14): “Kosempo / Formosa / Sauter [leg.] [p] // Portevin det. [hw] // Syntypus [p, red label] // *Eusilpha / cyaneocephala* ♂ / mihi [hw, Portevin’s handwriting] // coll. SDEI / (Müncheberg) / general coll. [p, light green modern label] // LECTOTYPE / *Eusilpha cyaneocephala* / Portevin, 1914 / Jan Růžička des. 2009 [p, red label] // *Necrophila (Calosilpha) / cyaneocephala* / (Portevin, 1914) [p] ♂ [hw] / Jan Růžička det. 201 [p] 2 [hw]”; paralectotypes (8 ♂♂, 14 ♀♀): 7 ♂♂, 5 ♀♀ (SDEI), labelled: “Kosempo / Formosa / H. Sauter [leg.] [p] VII. [19]11 [hw] // Portevin det. [hw] // Syntypus [p, red label] // PARALECTOTYPE / *Eusilpha cyaneocephala* / Portevin, 1914 / Jan Růžička des. 2009 [p, red label] // *Necrophila (Calosilpha) / cyaneocephala* / (Portevin, 1914) [p] ♂ [or ♀] [hw] / Jan Růžička det. 201 [p] 2 [hw]”; paralectotype 1 ♀ (SDEI), labelled: “Kosempo / Formosa / H. Sauter [leg.] [p] [without date] // Portevin det. [hw] // Syntypus [p, red label] // PARALECTOTYPE / *Eusilpha cyaneocephala* / Portevin, 1914 / Jan Růžička des. 2009 [p, red label] // *Necrophila (Calosilpha) / cyaneocephala* / (Portevin, 1914) [p] ♂ [or ♀] [hw] / Jan Růžička det. 201 [p] 2 [hw]”; 1 ♂ (SDEI), labelled: “Kosempo [p] / 8 [hw] Formosa [p] 08 [hw] / H. Sauter [leg.], \* [hw] 19 [p] † [hw] // Syntypus [p, red label] // PARALECTOTYPE / *Eusilpha cyaneocephala* / Portevin, 1914 / Jan Růžička des. 2009 [p, red label] // *Necrophila (Calosilpha) / cyaneocephala* / (Portevin, 1914) [p] ♂ [hw] / Jan Růžička det. 201 [p] 2 [hw]”; 2 ♀♀ (SDEI), labelled: “Formosa / Hoozan 08-10 / Sauter [leg.] [p] // 7.iv. [p] // Portevin det. [hw] // Syntypus [p, red label] // PARALECTOTYPE / *Eusilpha cyaneocephala* / Portevin, 1914 / Jan Růžička des. 2009 [p, red label] // *Necrophila (Calosilpha) / cyaneocephala* / (Portevin, 1914) [p] ♀ [hw] / Jan Růžička det. 201 [p] 2 [hw]”; 1 ♀ (SDEI), labelled: “Formosa / Hoozan 08-10 / Sauter [leg.] [p] // 7.iv. [p] // Portevin det. [hw] // *Eusilpha / cyaneocephala* / m. [hw, Portevin’s handwriting] // PARALECTOTYPE / *Eusilpha cyaneocephala* / Portevin, 1914 / Jan Růžička des. 2009 [p, red label] // *Necrophila (Calosilpha) / cyaneocephala* / (Portevin, 1914) [p] ♀ [hw] / Jan Růžička det. 201 [p] 2 [hw]”; 1 ♀ (coll. M. Pic, MNHN), labelled: “Formosa / Hoozan 08-10 / Sauter [leg.] [p] // 7. IV. [p] // MUSÉUM PARIS [p] / collection / Pic. Portevin [hw] // *C. cyaneocephala* / Port. [hw, Portevin’s handwriting] // TYPE [p, violet paper] // Muséum Paris / Coll. M. Pic [p] // PARALECTOTYPE / *Eusilpha cyaneocephala* / Portevin, 1914 / Jan Růžička des. 2009 [p, red label] // *Necrophila (Calosilpha) / cyaneocephala* / (Portevin, 1914) [p] ♀ [hw] / Jan Růžička det. 201 [p] 2 [hw]”; 1 ♀ (NHRS), labelled: “Kosempo / Formosa / H. Sauter [leg.] [p] VII. [19]11 [hw] // PARATYP [p, red label] // *Eusilpha cy- / aneocephala* / Port. [hw, Portevin’s handwriting] // Portevin det. [hw] // PARALECTOTYPE / *Eusilpha cyaneocephala* / Portevin, 1914 / Jan Růžička des. 2009 [p, red label] // *Necrophila (Calosilpha) / cyaneocephala* / (Portevin, 1914) [p] ♀ [hw] / Jan Růžička det. 200 [p] 9 [hw]”; 1 ♀ (BMNH), labelled: “Co- / type [hw, round label with yellow margin] // PARATYPUS [p, red label] // Formosa. / H. Sauter. / Brit. Mus. / 1923-61. [p] // Kosempo / Formosa / H. Sauter [leg.] [p] VII. [19]11 [hw] // *Eusilpha cyaneo- / cephal*a Port. [hw] // PARALECTOTYPE / *Eusilpha cyaneocephala* / Portevin, 1914 / Jan Růžička des. 2009 [p, red label] // *Necrophila (Calosilpha) / cyaneocephala* / (Portevin, 1914) [p] ♀ [hw] / Jan Růžička det. 200 [p] 9 [hw]”; 1 ♀ (NMNH), labelled: “COTYPUS [p, red label] // CarlFBaker / Collection [p] // *Eusilpha cya- / neocephala* / Port. [hw] // *Eusilpha / cyanocephala* / Port. [hw, red label with black frame] // PARALECTOTYPE / *Eusilpha cyaneocephala* / Portevin, 1914 / Jan Růžička des. 2009 [p, red label] // *Necrophila (Calosilpha) / cyaneocephala* / (Portevin, 1914) [p] ♀ [hw] / Jan Růžička det. 201 [p] 2 [hw]”; 1 ♀ (NMNH), labelled: “Kosempo / Formosa / H. Sauter [leg.] [p] VII. [19]11 [hw] // COTYPUS [p, red label] // CarlFBaker / Collection [p] // PARALECTOTYPE / *Eusilpha cyaneocephala* / Portevin, 1914 / Jan Růžička des. 2009 [p, red label] // *Necrophila (Calosilpha) / cyaneocephala* / (Portevin, 1914) [p] ♀ [hw] / Jan Růžička det. 201 [p] 2 [hw]”.

**Additional material examined.** See Appendix 1.

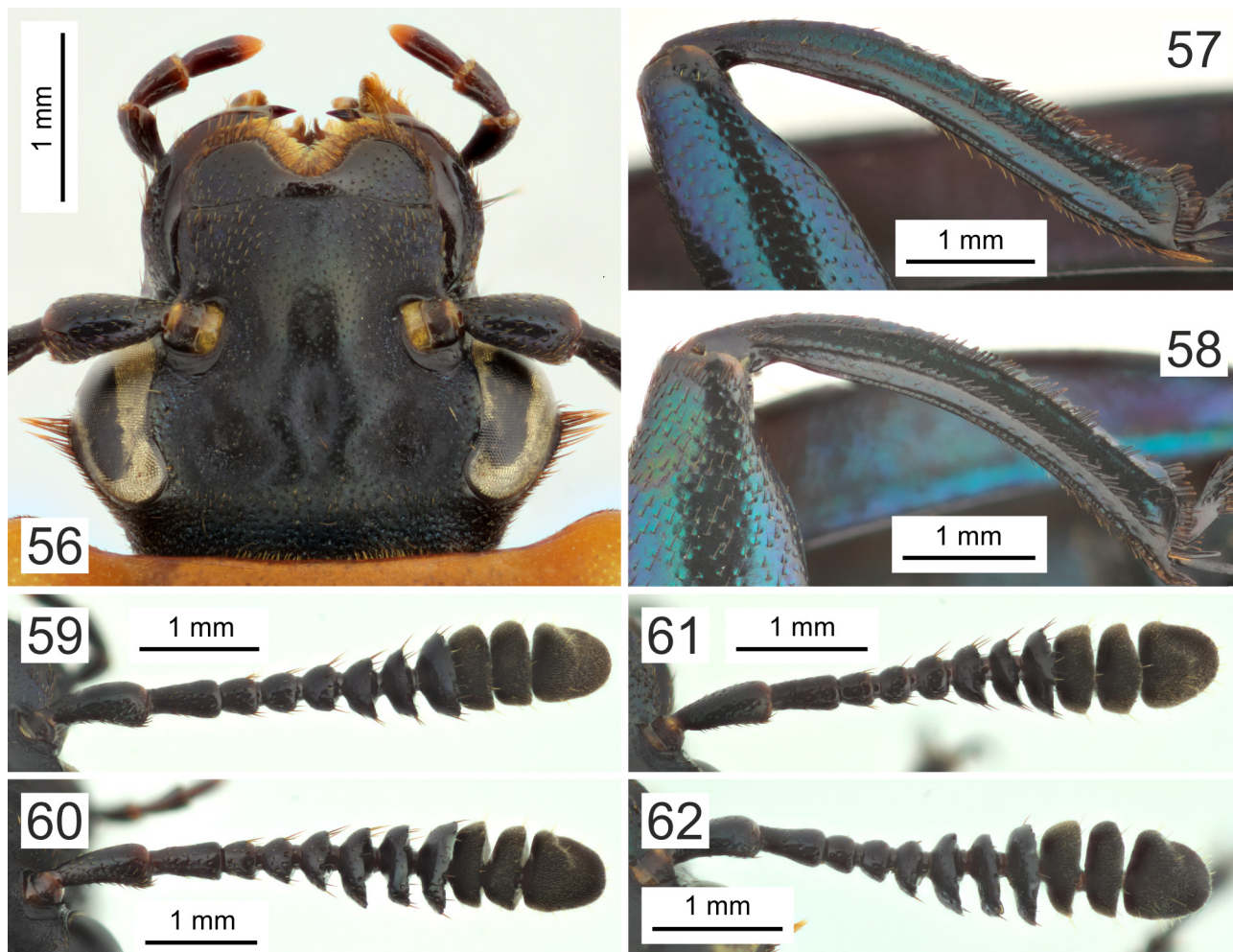
**Diagnostic description.** Body length 11.9–23.1 mm (21.9 mm in the lectotype), maximum body width 8.5–11.9 mm (11.2 mm in the lectotype). Pronotum orange in dorsal view (Figs. 5–6). Hypomeron medially orange in ventral view, dark metallic blue only along its posterior margin. Elytra brown to dark brown, without metallic luster; outline subrectangular; costae finer, less elevated (Figs. 5–6).

*Male.* Elytra laterally parallel and more narrow than in *N. brunnicollis* (Fig. 5). Metatibia only slightly bent. Male genital segment with longer spiculum gastrale in ventral view (Fig. 43). Aedeagus with median lobe distinctly shorter than slender, elongate parameres in ventral view (Figs. 42).

*Female.* Apex of elytron more elongated than in *N. brunnicollis* (Figs. 6, 66). Genital segment with tergum 10 large, pentagonal in shape, narrowly rounded posteriorly in dorsal view (Fig. 44).

**Notes on type specimens.** Lectotype of *Eusilpha cyaneocephala* is designated here as a male from SDEI, selected from series of syntype specimens from SDEI, MNHN and NMNH.

**Distribution** (Fig. 63). Endemic Taiwanese species (Portevin 1914, Nishikawa 2014).



**FIGURES 56–62.** Morphological details of *Necrophila (Calosilpha) cyaniventris* (Motschulsky) (56, ♀, JRUC, Phongsaly env., Laos), *N. (C.) cyaneocephala* (Kraatz) (57, ♂, JRUC, Fushan, Taiwan), same species (59, ♂, 60, ♀, both JRUC, Guandaoshan, Taiwan), *N. (C.) ioptera* (Kollar & Redtenbacher) (58, 61, ♂, 62, ♀, both JRUC, Nainital, Uttarakhand, India). Head dorsally (56), ♂ metatibia ventrally (57–58), antenna dorsally in ♂ (59, 61) and ♀ (60, 62).

***Necrophila (Calosilpha) cyaniventris* (Motschulsky, 1870)**

(Figs. 7–8, 16, 46–49, 54, 56)

*Oiceoptoma cyaniventris* Motschulsky, 1870: 348 (description, type locality “Indes orientales”) [single ♀]

*Silpha cyanipennis* Hope: Fairmaire 1900: 616 (sic, nomen nudum, probably misspelling of *O. cyaniventris* Motschulsky or unpublished manuscript name)

*Eusilpha (Calosilpha) cyaniventris*: Portevin 1920b: 397 (new combination, redescription)

*Calosilpha cyaniventris*: Portevin 1926: 115–116, 151 (new combination, key, catalog)

*Silpha (Calosilpha) cyaniventris*: Hatch 1928: 113 (new combination, catalog)

*Calosilpha cyaniventris*: Schawaller 1982: 250 (redescription, synonymy)

*Necrophila (Calosilpha) cyaniventris*: Ji 2012: 36, 86 (new combination, redescription, key, catalog)

**Type material examined:** Holotype ♀ of *Oiceoptoma cyaniventris* (only right elytron, right wing and remnants of metaventricle) (ZMUM), labelled (Fig. 16): “[minute yellow quadrate label = sign for Oriental region] // *Oiceoptoma* / *cyaniventris* / Motsch / Ind. or. [hw, Motschulsky’s handwriting, yellow label] // [red rectangular label] // HOLOTYPE / *Oiceoptoma* / *cyaniventris* / Motschulsky, 1870 / (label added by / Jan Růžička, 2009) [p, red label] // *Necrophila* (*Calosilpha*) / *cyaniventris* / (Motschulsky, 1870) [p] ♀ [hw] / Jan Růžička det. 200 [p] 9 [hw]”.

**Additional material examined.** See Appendix 1.

**Diagnostic description.** Body length 12.1–20.9 mm, maximum body width 9.6–12.5 mm. Pronotum orange in dorsal view (Figs. 7–8). Hypomeron medially dark metallic blue in ventral view, orange only along its anterior margin. Elytra with blue metallic luster; outline oval; costae finer, less elevated (Figs. 7–8).

*Male.* Metatibia only slightly bent. Male genital segment with short spiculum gastrale in ventral view (Fig. 47). Aedeagus with median lobe only slightly shorter than short, robust parameres (Fig. 46).

*Female.* Genital segment with tergum 10 large, pentagonal in shape, widely rounded posteriorly in dorsal view (Fig. 48).

**Notes on type specimen.** We have located the female holotype of *Oiceoptoma cyaniventris* in collections of ZMUM. The specimen is badly damaged, with only fragments preserved (Fig. 16); right elytron with blue metallic luster and only fine and less elevated costae on elytra well correspond with the current concept of this species.

**Ecology.** Predation on dipterous maggots during the decay stage and necrophagy on carrion during the dry stage was observed in Punjab, India by Bharti & Singh (2003).

**Distribution** (Fig. 63). Known from Nepal, northeastern India (Punjab, West Bengal (Darjeeling) and Sikkim), Myanmar, Thailand and northern Vietnam (Portevin 1926; Schawaller 1982; Růžička *et al.* 2000; Bharti & Singh 2003). Schawaller (1982) also reported an imprecise record from “Himalaya”. The first reliable records from India: Himachal Pradesh, Uttarakhand, Meghalaya, Arunachal Pradesh, Nagaland and Manipur. First records from China (Hainan and Yunnan provinces), Myanmar, Laos and Cambodia.

### ***Necrophila* (*Calosilpha*) *ioptera* (Kollar & Redtenbacher, 1844), comb. nov.**

(Figs. 9–10, 15, 17, 50–53, 55, 58, 61, 62)

*Silpha ioptera* Kollar & Redtenbacher, 1844: 512 (description, type locality “Caschmir”)

*Silpha ioptera*: Gemminger & Harold 1868: 722 (catalog)

*Eusilpha* (*Calosilpha*) *ioptera*: Portevin 1920b: 397 (new combination, catalog)

*Calosilpha ioptera*: Portevin 1926: 113, 151 (new combination, key, catalog)

*Silpha* (*Calosilpha*) *ioptera*: Hatch 1928: 113 (new combination, catalog)

*Calosilpha ioptera*: Schawaller 1982: 249 (redescription, synonymy)

*Oiceoptoma obscuriventris* Motschulsky, 1870: 349 (description, type locality “Indes orientales”) [single ♀]

*Oiceoptoma obscuriventris*: Schawaller 1982: 249 (redescription, junior subjective synonym of *Silpha ioptera*)

*Eusilpha* (*Calosilpha*) *Gilleti* Portevin, 1920b: 397 (description, type locality “Assam, Shillong”)

*Calosilpha Gilleti*: Portevin 1926: 115, 151 (new combination, key, catalog)

*Silpha* (*Calosilpha*) *Gilleti*: Hatch 1928: 113 (new combination, catalog)

*Calosilpha gilleti*: Schawaller 1982: 249 (redescription, junior subjective synonym of *Silpha ioptera*)

**Type material examined:** Holotype ♂ of *Oiceoptoma obscuriventris* (ZMUM), labelled (Fig. 15) “[minute yellow quadrate label = sign for Oriental region] // *Oiceoptoma* / *obscuriventris* / Motsch / Ind. or. [hw, Motschulsky’s handwriting, yellow label] // [red rectangular label] // HOLOTYPE / *Oiceoptoma* / *obscuriventris* / Motschulsky, 1870 / (label added by / Jan Růžička, 2009) [p, red label] // *Necrophila* (*Calosilpha*) / *ioptera* (Kollar et / Redtenbacher, 1844) [p] ♂ [hw] / Jan Růžička det. 200 [p] 9 [hw]”.

Lectotype ♂ of *Eusilpha gilleti* (here designated, IRSNB), labelled (Fig. 17) “Coll. R. I. Sc. N. B. / Inde [p, large yellow label with glued additional labels] // Assam [p] / Shillong / feeding on / mushroom / 26. VI. [19]18 / Boy. [hw] Coll [p] // Type [p, red characters in black frame] // *Eusilpha* / *Gilleti* mihi [hw, Portevin’s handwriting] / / R.M.H.N. Belg. 10.640 / J.J. Gillet det., vend.: [p] // LECTOTYPE / *Eusilpha* (*Calosilpha*) / *gilleti* / Portevin, 1920 / Jan Růžička des. 2009 [p, red label] // *Necrophila* (*Calosilpha*) / *ioptera* (Kollar et / Redtenbacher, 1844) [p] ♂ [hw] / Jan Růžička det. 201 [p] 2 [hw]”. Paralectotype ♀ (IRSNB), with identical labels except for “*Eusilpha* /

Gilleti / Portev [hw, Portevin's handwriting] // PARALECTOTYPE / *Eusilpha* (*Calosilpha*) / gilleti / Portevin, 1920 / Jan Růžička des. 2009 [p, red label] // *Necrophila* (*Calosilpha*) / *ioptera* (Kollar et / Redtenbacher, 1844) [p] ♀ [hw] / Jan Růžička det. 201 [p] 2 [hw]"

**Additional material examined.** See Appendix 1.

**Diagnostic description.** Body length 15.9–19.0 mm (19.0 mm in the lectotype of *Eusilpha gilleti*), maximum body width 8.9–11.0 mm (11.0 mm in the lectotype). Pronotum orange in dorsal view, with large, well-delimited, metallic black medial spot on disc (Figs. 9–10). Hypomeron medially dark metallic blue in ventral view. Elytra with green metallic luster; outline widely subrectangular; costae very robust and distinctly elevated (Figs. 9–10).

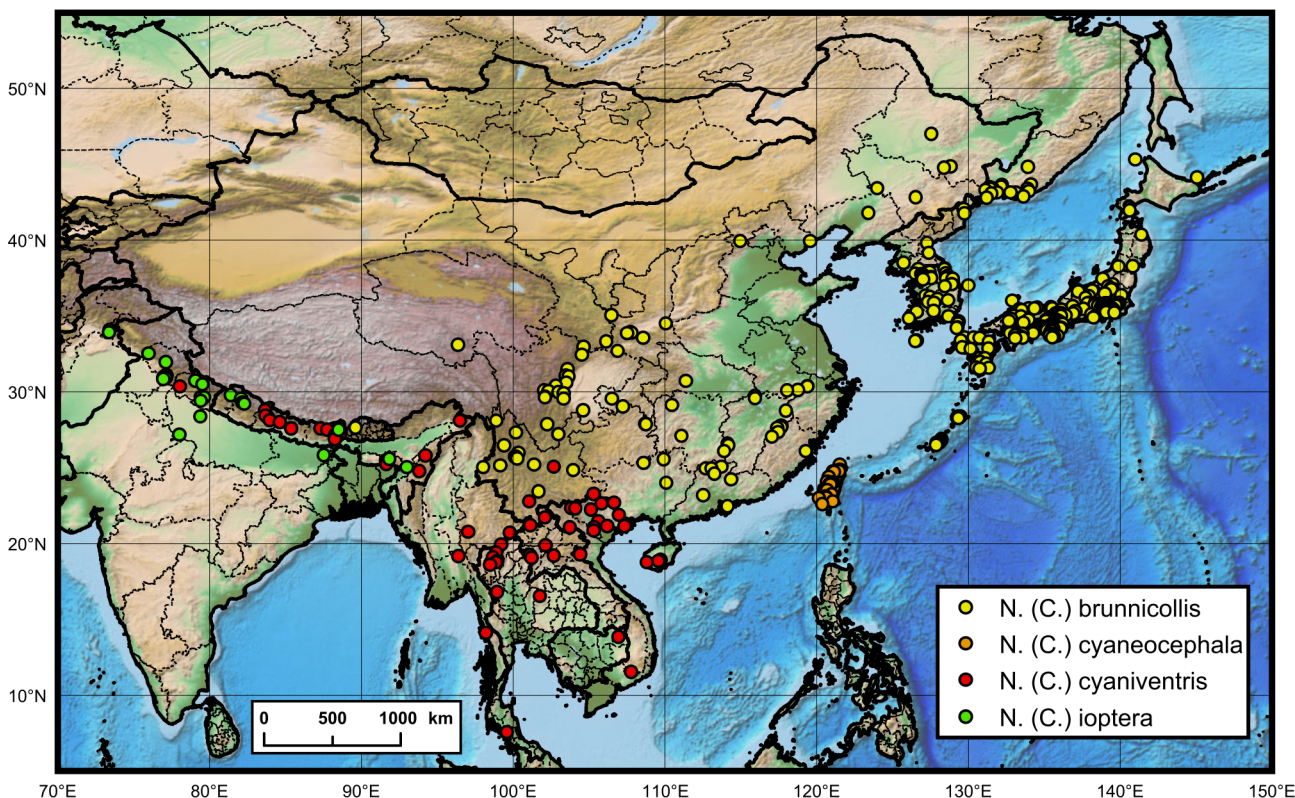
**Male.** Metatibia distinctly bent. Male genital segment with longer spiculum gastrale in ventral view (Fig. 51). Aedeagus with median lobe only slightly shorter than short, slender parameres (Fig. 50).

**Female.** Genital segment with tergum 10 small, hexagonal in shape in dorsal view (Fig. 52).

**Notes on type specimens and synonymy.** We were not able to locate syntypes of *Silpha ioptera* in the collections of NHMW, where most of the insect material of Carl von Hügel from “Cashmir” expedition is deposited, including type material of taxa described by Kollar & Redtenbacher (1844). We only have located here four specimens (three males and a single female) of *N. (C.) ioptera* from “Kashmir”, labels are clearly subsequent, written by typewriter, no additional information about collector(s) or original collection are available; it is not clear if these specimens can be syntypes of Kollar & Redtenbacher (H. Schillhammer, pers. comm.).

We were able to locate the holotype of *Oiceoptoma obscuriventris* in the collection of ZMUM. We confirm the opinion of Schawaller (1982), who considers *O. obscuriventris* (described from “Ind. or.”) as a junior subjective synonym of *S. ioptera*. We consider both taxa as conspecific, as examined material from Pakistan, India and Nepal shares several diagnostic characters (large, metallic black medial spot on disc; elytra with green metallic luster; costae very robust and distinctly elevated), without any considerable variation.

Lectotype of *Eusilpha (Calosilpha) gilleti* is designated here as a male from a series of two syntypes from IRSNB. We confirm the opinion of Schawaller (1982), who considers *E. (C.) gilleti* as a junior subjective synonym of *S. ioptera*. The lectotype of *E. (C.) gilleti* well agrees in most characters with *N. (C.) ioptera*, only the medial spot on pronotum is slightly smaller (Fig. 17). We did not dissect the specimen, as it is heavily covered by fungal mycelia and we were afraid of damage.



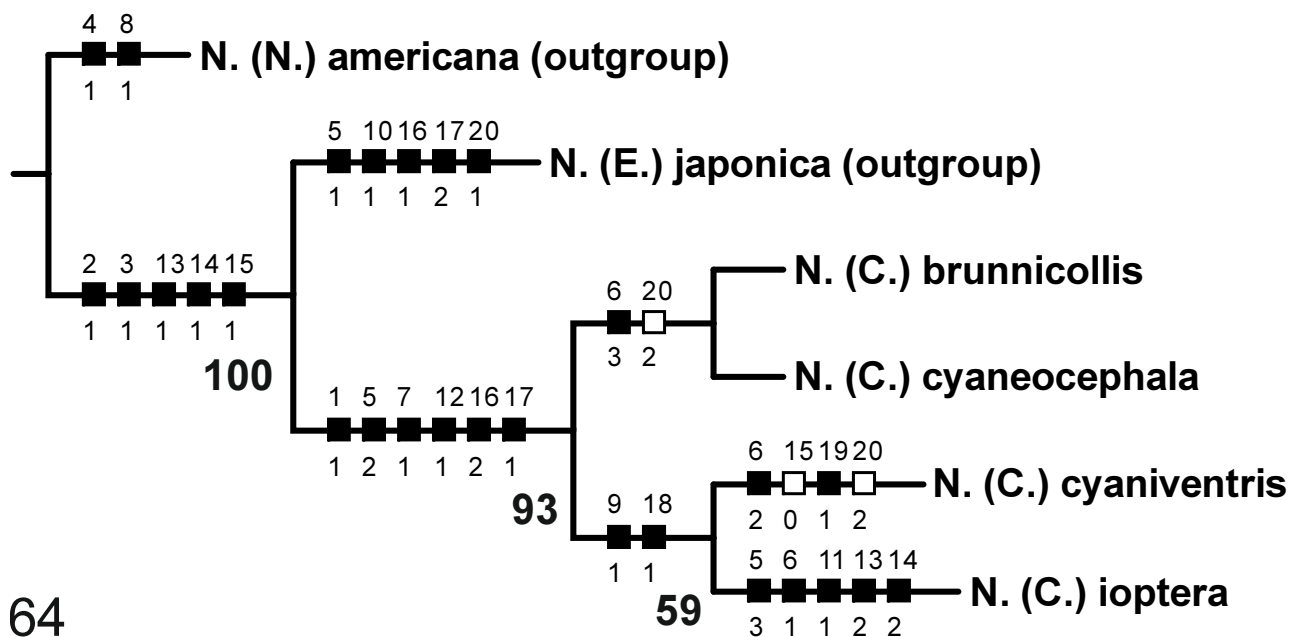
**FIGURE 63.** Known distribution of *Necrophila (Calosilpha)* species in Asia.

**Distribution** (Fig. 63). Known from India: Himachal Pradesh, Uttar Pradesh, Meghalaya and “Assam” (without more detailed locality) (Schawaller 1982), and also reported from “Kashmir” and “Himalaya” (both without more detailed localities; see Schawaller (1982) for discussion about the distribution of this species). From Nepal, reported from two localities by Schawaller (2003). First reliable records from Pakistan and India: Uttarakhand, Uttar Pradesh, Bihar, Sikkim, West Bengal and Assam. Old specimen from “Thibet” (see Appendix 1) is the only record documenting its possible occurrence in China.

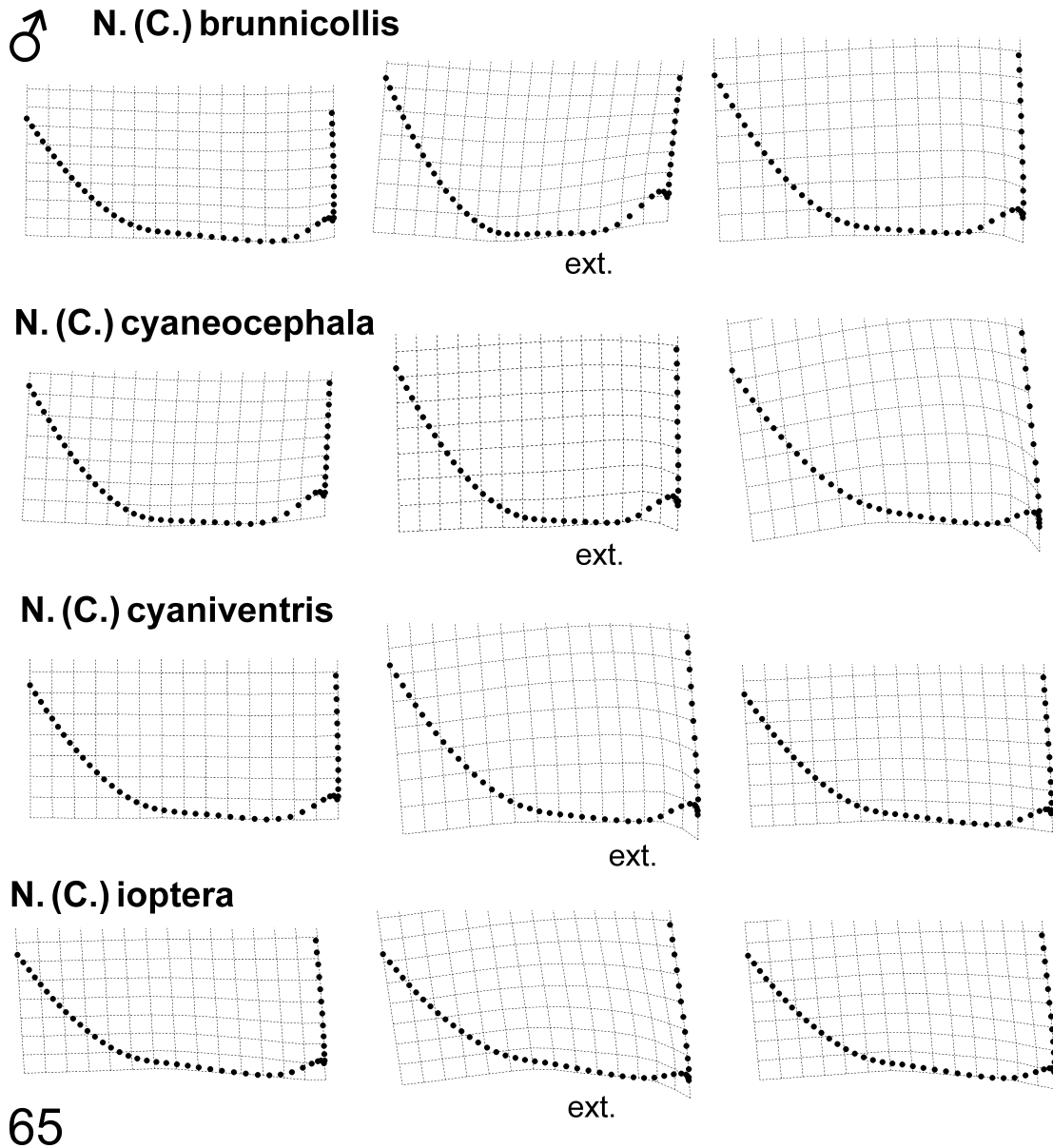
## Phylogeny

The implicit enumeration run of TNT resulted in a single most parsimonious tree with a length of 31 steps (consistency index = 0.93, retention index = 0.75) (Fig. 64). The analysis supports the subgenus *Calosilpha* as monophyletic (with bootstrap of 93), based on derived states of 6 characters, unique for this clade (**1-1**: frons in dorsal view with distinctly indicated fovea; **5-2**: pronotum orange in color [with metallic black spot in *N. ioptera*]; **7-1**: punctuation of scutellar shield fine to very fine; **12-1**: apex of elytron in male widely truncate; **16-2**: male genital segment with ventrite 9 elongate, oval; **17-1**: median lobe of aedeagus robust in ventral view).

Within *Calosilpha*, *N. (C.) brunnicollis* and *N. (C.) cyaneocephala* were recovered as a clade (without significant support) sister to a clade of *N. (C.) cyaniventris* and *N. (C.) ioptera* (with weak bootstrap of 59) (Fig. 64). The clade of *N. (C.) brunnicollis* and *N. (C.) cyaneocephala* is characterized as a distinct lineage, based on derived states of 2 characters (**6-3**: hypomeron in ventral view medially orange, dark blue only along posterior margin; **20-2**: female tergum 10 in dorsal view large, pentagonal in shape, posteriorly regularly rounded [this is probably a homoplasious character, shared also with *N. (C.) cyaniventris*]). *N. (C.) cyaniventris* and *N. (C.) ioptera* are characterized as constituting another distinct lineage within *Calosilpha* based on derived states of 2 unique characters (**9-1**: elytra metallic blue or green in dorsal view; **18-1**: paramere of aedeagus short, only slightly longer than median lobe). Similar phylogenetic relationships had been postulated already by Schawaller (1982: 252), albeit at that time without any formal cladistic analysis.



**FIGURE 64.** Single most parsimonious tree (length = 31; consistency index = 0.93; retention index = 0.75) obtained from implicit enumeration analysis. Ambiguous characters are optimized with ACCTRAN (slow optimization in Winclada). Character numbers are given above, character states below. Solid rectangles indicate unique character transformations, open rectangles indicate homoplastic character state transformations. Numbers below branches indicate standard bootstrap (1,000 replicates).

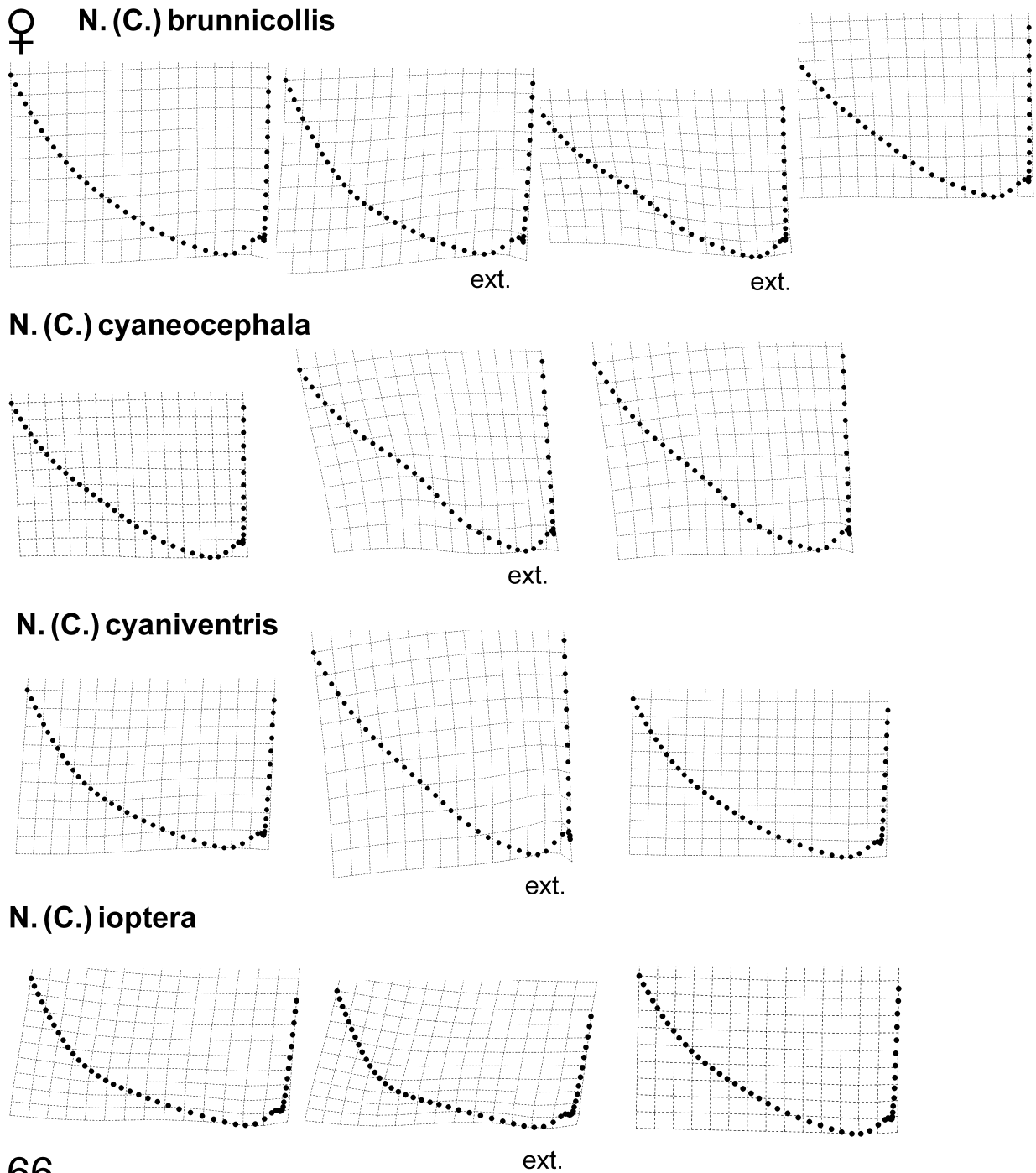


**FIGURE 65.** Thin-plate spline (TPS) transformation grids representing the shape variation of the elytral apex in males of *Necrophila* (*Calosilpha*) species along the first two relative warp axes. Grids marked as “ext.” belong to specimens from extreme positions on the relative warps scatter plot.

## Geometric morphometrics

### 1) *Necrophila* (*Calosilpha*) spp.

The relative warps (RWs) of both male and female elytral apex of the four *Necrophila* (*Calosilpha*) taxa were calculated and plotted on an axis system (not shown here). The first RW axis represented 72.58% of shape variability and the second axis was 11.51%, thus indicating a significantly high sexual dimorphism. Due to these results, male and female taxa were further tested independently. Among the male groups, the first RW axis accounted for 49.69% of the total shape difference between the taxa, whereas the second axis accounted for 29.85%. Meanwhile, 58.98% of variability between the females was explained by the first RW axis and 14.11% by the second axis.

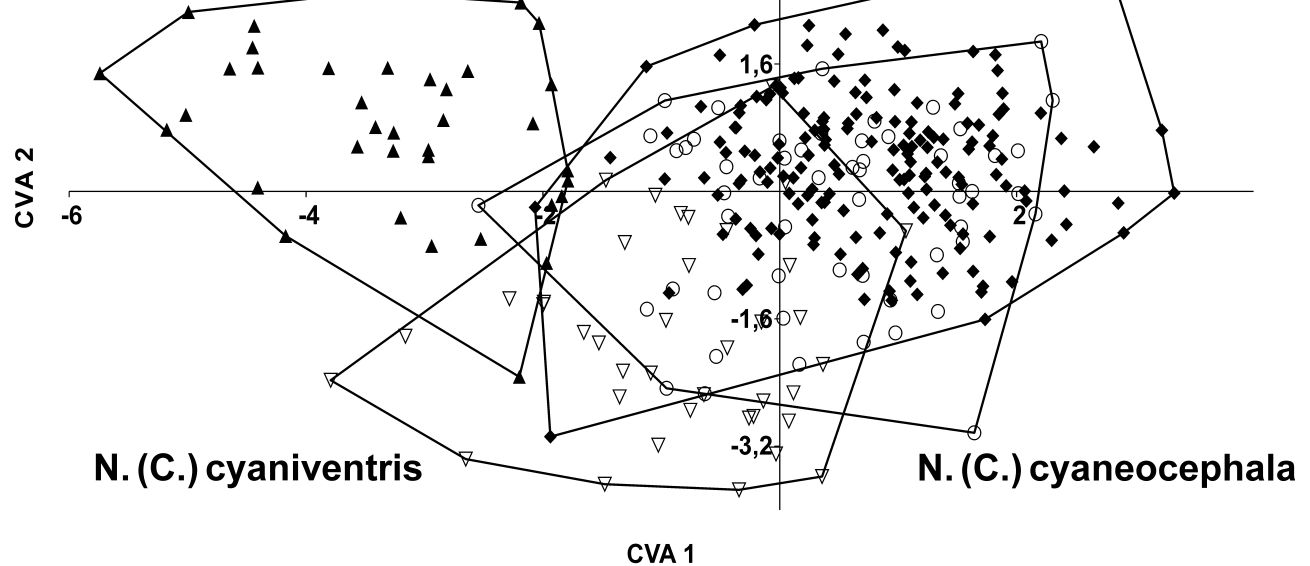


**FIGURE 66.** Thin-plate spline (TPS) transformation grids representing the shape variation of the elytral apex in females of *Necrophila* (*Calosilpha*) species along the first two relative warp axes. Grids marked as “ext.” belong to specimens from extreme positions on the relative warps scatter plot.

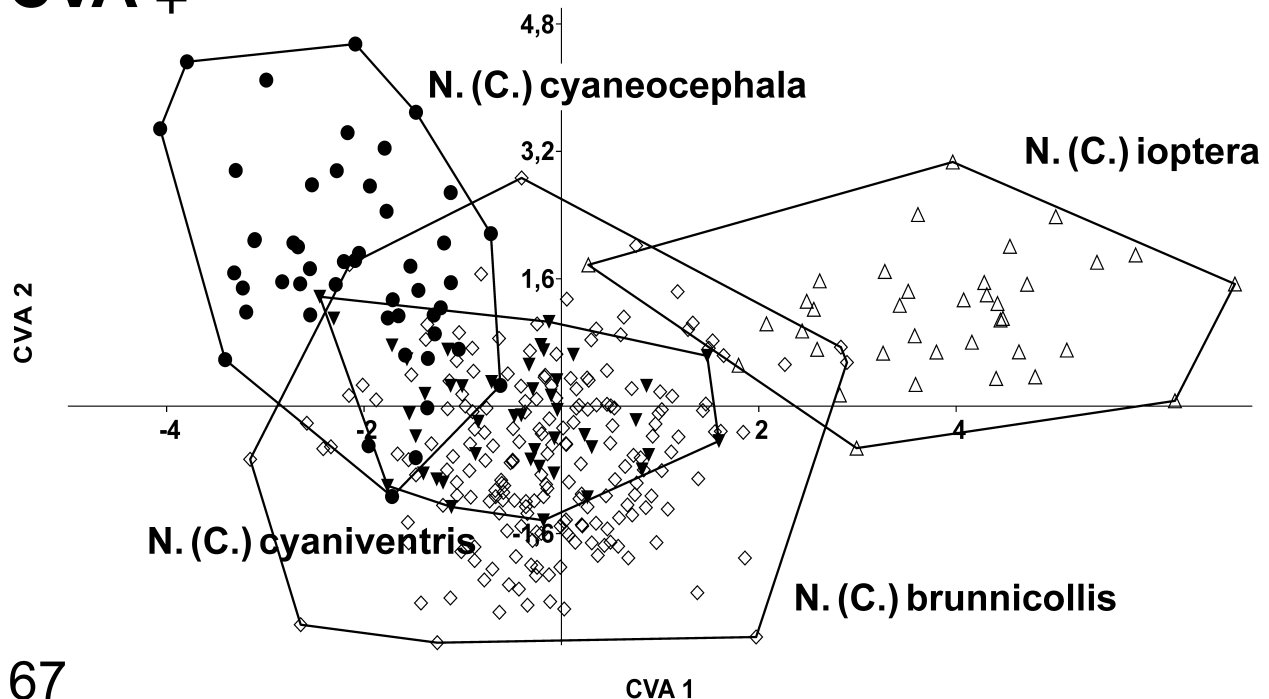
The scatter plot of the two first RWs for male *Calosilpha* displayed a greater overlap between the groups of the various taxa than in the females. The thin-plate spline (TPS) transformation grids indicated shape changes of the elytral apex on the first two RW axes, and in males it appeared more rectangular in all groups than in females (apart from in *N. (C.) ioptera*). *N. (C.) brunnicollis* was slightly more truncate. In females, the shape of *N. (C.) brunnicollis* elytral apex was more robust. In *N. (C.) cyaniventris* and *N. (C.) cyaneocephala*, it was more prolonged and even pear-shaped (*N. (C.) cyaneocephala*). *N. (C.) ioptera* appeared subrectangular, more rounded and with more prominent tip than in the males (Figs. 65–66).

## CVA ♂

*N. (C.) ioptera*



## CVA ♀



67

**FIGURE 67.** Canonical variate analysis (CVA) of male (above) and female (below) elytral apex of *Necrophila (Calosilpha)* species.

Shape variety of the elytra between the studied taxa was indicated, as MANOVA for male groups revealed significant shape differences ( $F = 13.24$ ; Wilk's lambda = 0.1599; d.f. = 54/841;  $p < 0.0001$ ). Female groups demonstrated greater elytral shape variability ( $F = 19.56$ ; Wilk's lambda = 0.1001; d.f. = 54/907;  $p < 0.0001$ ).

To obtain separation of the studied groups, two individual canonical variate analyses (CVA) were performed, for male and female elytron apex, on the first 18 axes of the RW scores matrix that covered 99.76% of the shape variation between the males and 99.79% between the females. In both cases, the canonical axes indicated some separation of the taxa—especially of *N. (C.) ioptera* in both sexes—but generally there was an overlap between the groups (Fig. 67).



The jackknifed values of the confusion matrix (Table 2) indicated that most (134 from 171) specimens of *N. (C.) brunnicollis* were assigned correctly; 8 had mean closer to *N. (C.) cyaniventris*, 27 to *N. (C.) cyaneocephala*, and only 2 specimens to *N. (C.) ioptera*. The majority of both *N. (C.) cyaniventris* and *N. (C.) ioptera* were assigned correctly. *N. (C.) cyaniventris* had 8 specimens closer in mean to *N. (C.) brunnicollis* and 3 specimens to *N. (C.) ioptera* of a total 39 specimens. *N. (C.) ioptera* had only 2 taxa closer to *N. (C.) cyaniventris* of a total of 37. Also, 33 *N. (C.) cyaneocephala* were assigned correctly of 56 while 14 were closer to *N. (C.) brunnicollis*, 7 to *N. (C.) cyaniventris*, and 2 to *N. (C.) ioptera*. This indicated *N. (C.) brunnicollis* and *N. (C.) cyaneocephala* are closer in their mean shape than are any of the other groups.

Females likewise showed an overlap between the groups. *N. (C.) brunnicollis* had a correct assignment in 148 specimens of 196 while 26 taxa had a mean closer to *N. (C.) cyaniventris*, 17 to *N. (C.) cyaneocephala*, and 5 to *N. (C.) ioptera*. While *N. (C.) cyaniventris* had 32 out of 44 correct assignments, 8 specimens were closer to *N. (C.) brunnicollis* and 4 to *N. (C.) cyaneocephala*. Further, 6 *N. (C.) cyaneocephala* were closer to *N. (C.) brunnicollis* and only 2 to *N. (C.) cyaniventris*, thus making 40 of 48 correctly assigned. Only 2 specimens of *N. (C.) ioptera* had mean closer to *N. (C.) cyaniventris* while 35 of 37 were correctly assigned. In general, *N. (C.) cyaniventris* and *N. (C.) brunnicollis* seem to be closer in elytral shape. The high misclassification in both sexes could be caused by the much larger number of *N. (C.) brunnicollis* samples used. *N. (C.) ioptera* demonstrated great separation from all other taxa.

**TABLE 2.** Canonical variate analysis (CVA) confusion matrix results in both sexes of *Necrophila (Calosilpha)*.

Taxa	Males			Females		
	Correctly classified	Misclassified	Total	Correctly classified	Misclassified	Total
<i>N. (C.) brunnicollis</i>	134	37	171	148	48	196
<i>N. (C.) cyaniventris</i>	28	11	39	32	12	44
<i>N. (C.) cyaneocephala</i>	33	23	56	40	8	48
<i>N. (C.) ioptera</i>	35	2	37	35	2	37

When testing the effect size had on body shape, the natural logarithm of centroid size was used as an independent variable in the regression analysis. The results indicated significance in males ( $F = 21.621$ ,  $p < 0.0001$ ), where size explained 22.47% of the shape dissimilarity. The permutation tests for 1,000 random permutations gave  $p < 0.0259$ . In females, size explained a much higher percentage of 40.36% ( $F = 54.302$ ,  $p < 0.0001$ ) and the permutation tests for 1,000 random permutations gave  $p < 0.0147$ . Accordingly, it can be concluded that size has an irrefutable effect on shape variability among the studied taxa. Even though size explained a great deal of the difference between the groups, shape variability among them cannot be denied.

## 2) *Necrophila (Calosilpha) brunnicollis sensu lato*

When analyzing the different *N. (C.) brunnicollis* populations, the first RW axis in the male groups accounted for 62.34% of the elytral shape differences and the second RW axis had a value of 17.61%. Alternatively, the female groups showed 52.91% shape variation in the first RW axis and 15.54% in the second. The RWs scatter plots in both sexes were greatly overlapped (not shown here), and the TPS transformation grids showed little shape variability in the elytra. Males appeared to be generally truncate, and particularly specimens from Continental Asia (Fig. 68). The female elytral apex conversely seemed more protracted and rounded compared to that of the males (Fig. 69).

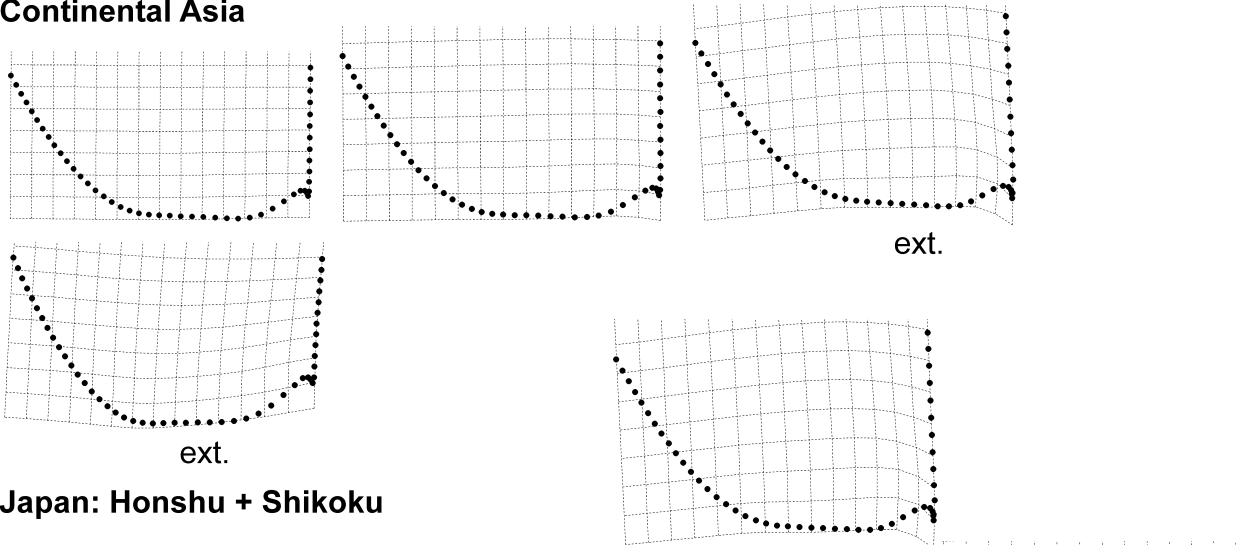
MANOVA appeared significant for both sexes. In the male population groups:  $F = 3.291$ , Wilk's lambda = 0.6343, d.f. = 24/465, and  $p < 0.0001$ . For the female groups:  $F = 7.817$ , Wilk's lambda = 0.4194, d.f. = 24/537, and  $p < 0.0001$ . CVA was performed on the first 8 axes of the RW scores matrix, representing 98.33% of shape variability in males and 98.07% in females. The plot displayed great overlap between all male and female groups (Fig. 70). The jackknifed values of the CVA confusion matrix indicated a large number of incorrectly classified specimens in both males and females (Table 3).

**TABLE 3.** Canonical variate analysis (CVA) confusion matrix results of male and female *N. (C.) brunnicollis* populations.

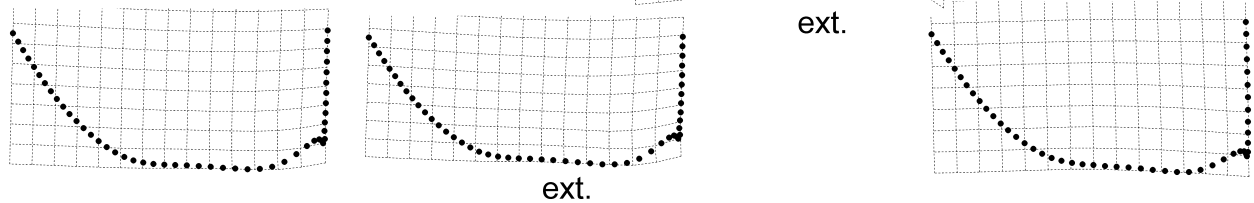
Regions	Males			Females		
	Correctly classified	Misclassified	Total	Correctly classified	Misclassified	Total
Continental Asia	27	41	68	51	36	87
Japan (Kyushu)	6	9	15	14	4	18
Japan (Ryukus)	14	17	31	22	9	31
Japan (Honshu + Shikoku)	23	34	57	20	40	60

♂ ***N. (C.) brunnicollis sensu lato***

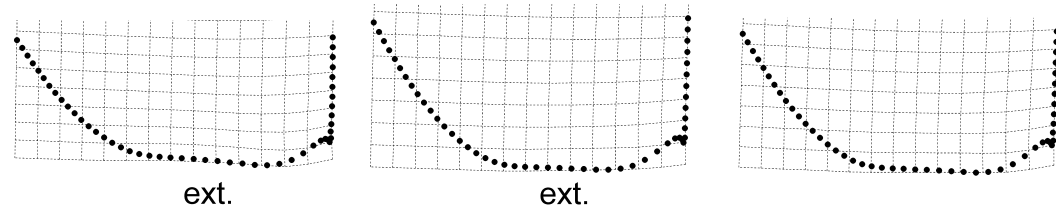
**Continental Asia**



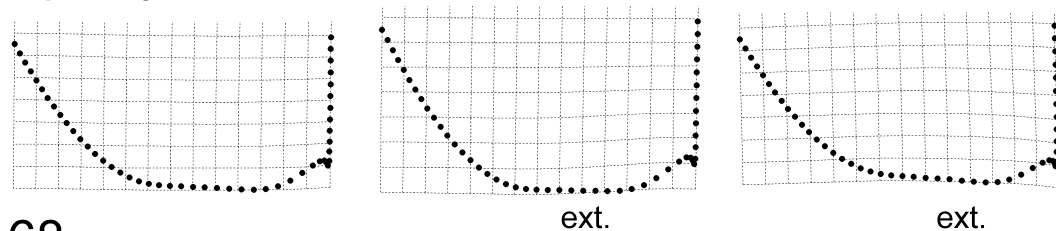
**Japan: Honshu + Shikoku**



**Japan: Kyushu**



**Japan: Ryukus**

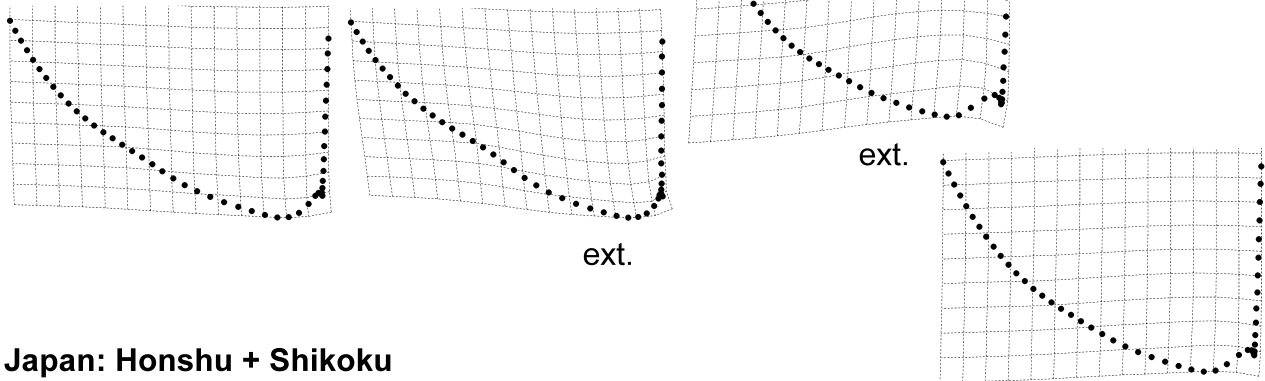


68

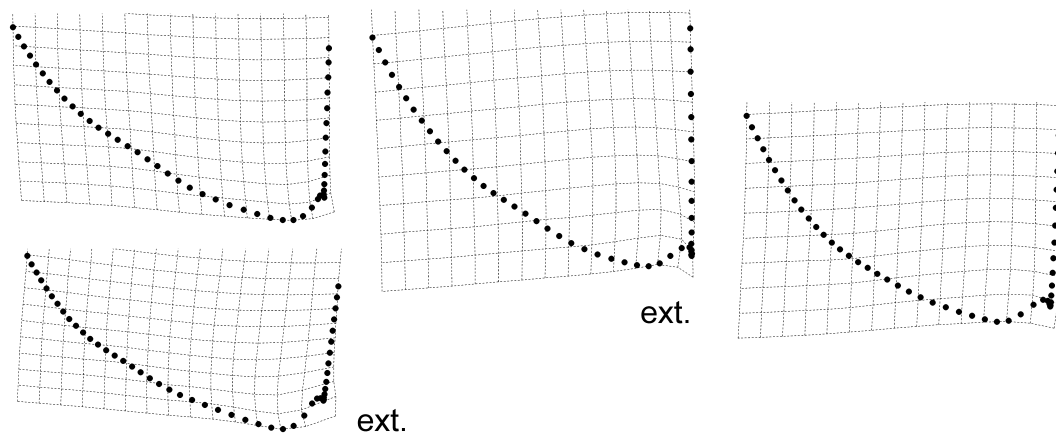
**FIGURE 68.** Thin-plate spline (TPS) transformation grids representing the shape variation of the elytral apex in males of *Necrophila (Calosilpha) brunnicollis* populations along the relative warp axes (RW1 and RW2). Grids marked as “ext.” belong to specimens from extreme positions on the relative warps scatter plot.

♀ **N. (C.) brunnicollis sensu lato**

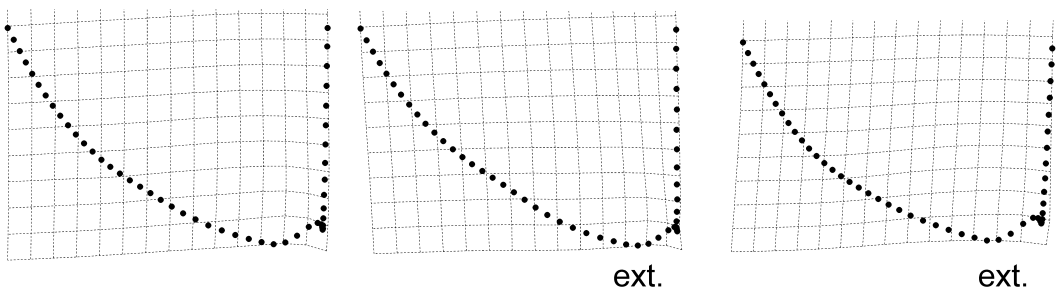
**Continental Asia**



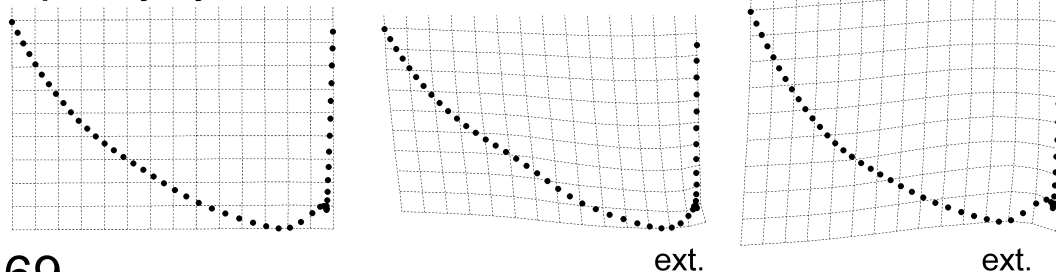
**Japan: Honshu + Shikoku**



**Japan: Kyushu**



**Japan: Ryukyus**

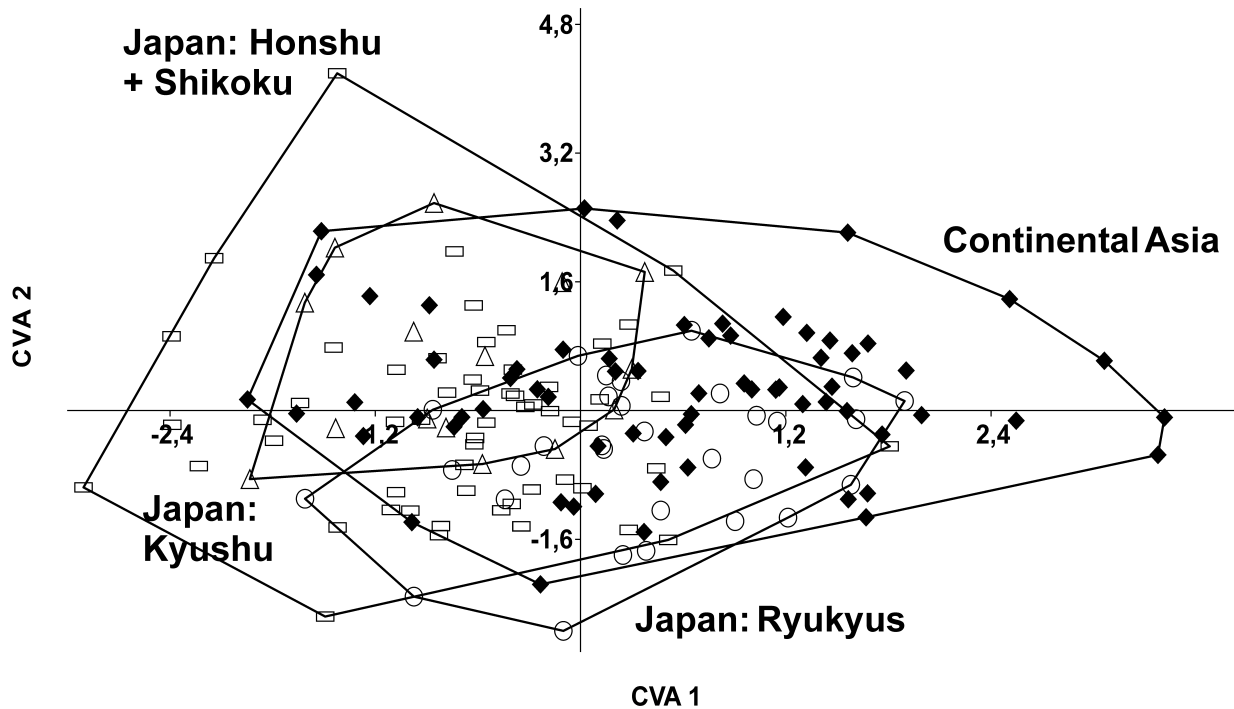


69

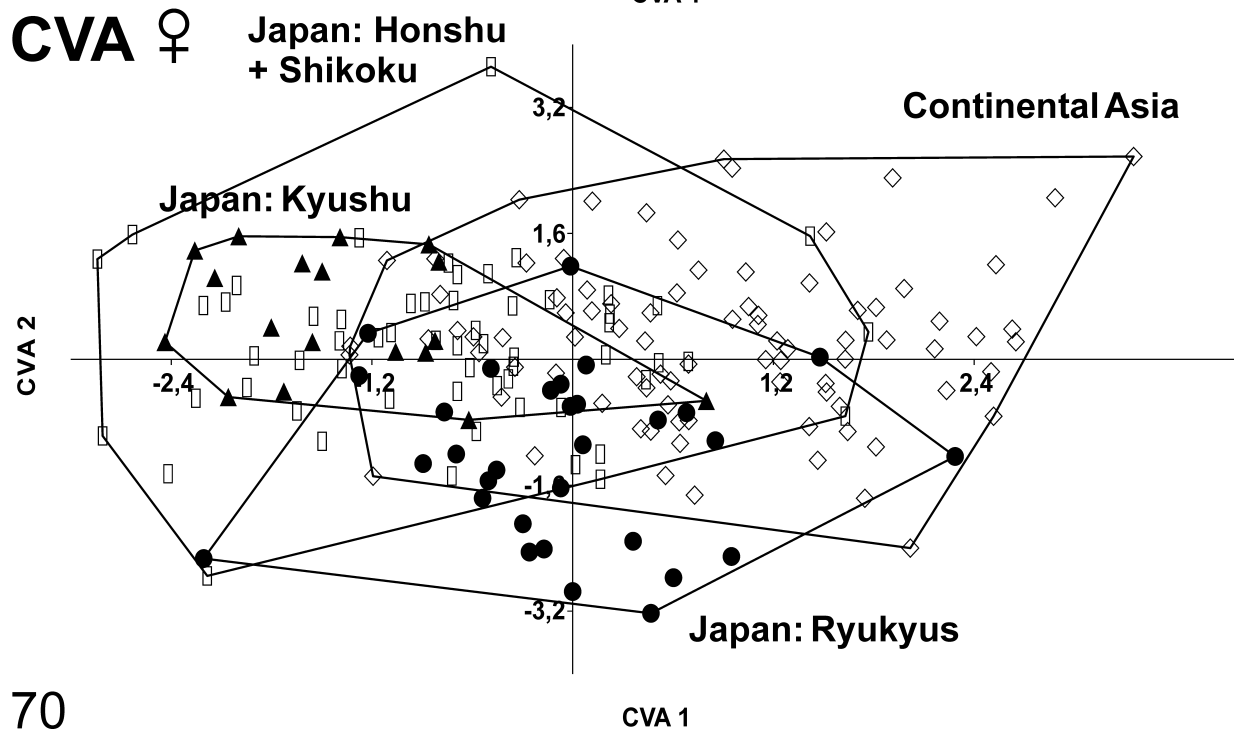
**FIGURE 69.** Thin-plate spline (TPS) transformation grids representing the shape variation of the elytral apex in females of *Necrophila (Calosilpha) brunnicollis* populations along the relative warp axes (RW1 and RW2). Grids marked as “ext.” belong to specimens from extreme positions on the relative warps scatter plot.

# CVA ♂

## N. (C.) brunnicollis sensu lato



# CVA ♀



70

**FIGURE 70.** Canonical variate analysis (CVA) of male (above) and female (below) elytral apex of *Necrophila (Calosilpha) brunnicollis* populations.

Inasmuch as there were many misclassifications, discriminant analysis between each pair of groups was performed on the first 8 RW scores of the matrix for further support of significance (Table 4). Results between the majority of tested groups were significant, thus indicating shape variability. The exception was in comparing males of the Japan (Kyushu) and Japan (Honshu + Shikoku) groups.

**TABLE 4.** Discriminant analysis for each pair of groups of the male/female *N. (C.) brunnicollis* populations (number in bold indicates insignificance).

Tested groups	Males/Females			
	Hotelling's $t^2$	<i>F</i> value	<i>p</i> value ( <i>p</i> <)	% Misclassified
Continental Asia / Japan (Kyushu)	22.74/ 77.24	2.60/ 8.99	0.05/ 0.001	26.51/ 14.24
Continental Asia / Japan (Ryukus)	21.27/ 55.74	2.47/ 6.55	0.05/ 0.001	35.35/ 23.73
Continental Asia / Japan (Honshu + Shikoku)	46.12/ 87.21	5.44/ 10.38	0.001/ 0.001	24.8/ 23.13
Japan (Honshu + Shikoku) / Japan (Kyushu)	9.43/ 29.34	1.06/ 3.33	<b>0.4017</b> / 0.01	31.94/ 23.08
Japan (Honshu + Shikoku) / Japan (Ryukus)	45.82/ 52.60	5.26/ 6.06	0.001/ 0.001	19.32/ 18.68
Japan (Kyushu) / Japan (Ryukus)	55.86/ 76.49	5.87/ 8.46	0.001/ 0.001	15.22/ 10.20

To exclude the effect of allometry, regression analysis was conducted in both male and female groups separately. Size explained 20.78% of the shape variability in males and its effect was significant ( $F = 10.909$ ,  $p < 0.001$ ). In females it explained 34.79% and results also showed significance ( $F = 25.51$ ,  $p < 0.001$ ). Permutation tests with 1,000 random permutations indicated significance;  $p < 0.0091$  in males and  $p < 0.0087$  in females. As indicated, size played a great role in the shape variation between the groups.

## Discussion

**Taxonomy.** The concept presented here, recognizing four valid species within *Calosilpha*, should be considered as preliminary. In the cladistic analysis based on characters of external morphology, both *N. (C.) cyaniventris* and *N. (C.) ioptera* are well characterized by several autapomorphies, including several sexual dimorphic characters (Fig. 64). On the other hand, we failed to find any strict morphological character to separate *N. (C.) brunnicollis* from *N. (C.) cyaneocephala*. We did find some differences in shape of male and female elytra, but these are highly variable. The results obtained by geometric morphometrics indicated significance of shape variability between the species of *Calosilpha*. Although there was overlap among all groups, *N. (C.) ioptera* evidently occupies the most isolated position and it showed the most autonomy in CVA. Regardless of the high misclassification rate seen in the males of *N. (C.) cyaneocephala*, we prefer, for now, to treat that taxon as a valid species. However, further studies employing molecular techniques and phylogeographic analysis should focus on this lineage (*N. (C.) brunnicollis* and *N. (C.) cyaneocephala*). Ikeda *et al.* (2013) recently published a similar study on *Necrophila (Eusilpha)* species from Korea and Japan and estimated that *N. (E.) jakowlewi* (Semenov, 1890) diverged in the Japanese Archipelago during the last glacial period, whereas the related *N. (E.) japonica* and *N. (C.) brunnicollis* diverged later, during the interglacial of the last glacial period.

The populations of *N. (C.) brunnicollis* from different regions of Japan had previously been considered as separate taxa (*N. (C.) bicolor imasakai* from Kyushu, *N. (C.) kurosawai* from Ryukyus) (Nishikawa 1986, 1994; Ikeda *et al.* 2008). These considerations before 1995 had been caused chiefly by the overestimation of character states of their pronotal coloration. The results of this study revealed that the poorly delimited medial spot appeared on disc is variable, present only in part of populations on the Japanese Archipelago. Although the results obtained by geometric morphometrics demonstrated mostly significant differences, both a lack of separation and a great number of misclassified specimens were observed. Moreover, the differences in body size (with the population from Ryukyus being smaller) significantly affect the shape variability. This has led us to treat these taxa as junior subjective synonyms of *N. (C.) brunnicollis*, which is in agreement with a review recently published by Ji (2012).

**Ecology.** The seasonal activity of *N. (C.) brunnicollis* in lowland areas was investigated in southern Kantô District, Japan (45°39'N 139°17'E & 35°20'N 139°35'E), where adults of this species were collected from April to October with a single peak in July or from May to October with a single peak in July (Nagano & Suzuki 2003). These activities differ to those of Huaqiao, China, based on specimen data examined; this can probably be linked with different geographic positions and sampling purposes. Further differences in the spatio-temporal distribution and foraging strategies between *N. (C.) brunnicollis* and *N. (E.) japonica* had been studied by Nagano & Suzuki (2003).

**Biogeography.** Based on the extensive material examined, we broadened and made more precise the known distribution of all four species of *Calosilpha*.

All three records of *N. (C.) brunnicollis* from Hokkaido, Japan, are most probably each based on single adventive specimen, because their localities are included in famous tourism areas and other records have not been reported from Hokkaido to date (see Appendices 1, 2; all available specimens were examined).

Syntopic occurrence of *N. (C.) cyaniventris* and *N. (C.) ioptera* in India, with its generally broadly overlapping species ranges of both taxa, had been excluded by Schawaller (1982: 252, Map 2). We have evidence for two localities with occurrence of both species. One is recent record (2003) from Naintal (India: Uttarakhand; 5 specimens of *N. (C.) cyaniventris* and 43 specimens of *N. (C.) ioptera* in the same sample). Another is documented by old museum specimens from Shimla (India: Himachal Pradesh). Several records of *N. (C.) ioptera* from Shimla were located in various collections, but only a single specimen belongs to *N. (C.) cyaniventris*, and that is from coll. Oberthür at ZFMK and there is a possibility that it was mislabeled.

We confirm only one recent record of *N. (C.) cyaniventris* from Puer prefecture (China: Yunnan, deposited in MNIC) and another very old record from Kunming (China: Yunnan; collected in 1917, deposited in MNHN, male genitalia examined). All other Chinese material in the collections identified as *N. (C.) cyaniventris* and coming from China north of Hainan were found to be misidentified and to belong to *N. (C.) brunnicollis*. Additional recent material is needed to clarify the precise distribution of both species in southwestern China.

Similarly, only a single old specimen of *N. (C.) ioptera* (imprecisely labelled “Thibet”) was located in NHRS. Additional material is needed to confirm this species’ occurrence in China.

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**APPENDIX 1.** List of additional (non-type) *Necrophila (Calosilpha)* material examined.

*Necrophila (Calosilpha) brunnicollis* (Kraatz, 1877) (1558 specimens)

**China: Anhui province:** Jixi, Mt. Qiyun Shan [ca. 30°05'N 118°05'E], 1200 m, vi.2005, Jin et al. leg., 67 spec. (MNIC);

**Chongqing municipality:** mts near Chungking [= Chongqing, ca. 29°32'N 106°31'E], without date and collector's name, 1 ♂ (ZMHB); same data, 2 ♂♂, 2 ♀♀ (NHMW); same data, 1 ♂ (ZSM); same data, 1 ♂, 2 ♀♀ (coll. G. Frey, NHMB); same data, without date and collector's name, ex coll. J. Roubal, 2 spec. (SNMB); same data, without date and collector's name, ex coll. Kouřil, 1 ♂ (NMPC); same data, without date and collector's name, ex coll. P. van der Wiel, 1 ♂ (ZMAN);

Giufu Shan mts [= Jinfo Shan mts], 1500–2000 m, without date and collector's name, ex coll. Em. Reitter, 13 spec. (NMPC); Giufu Shan mts [= Jinfo Shan mts], without date and collector's name, ex coll. Em. Reitter, 2 ♀♀ (SMNS); same data, 1 ♂, 1 ♀ (JRUC); same data, 1 ♀ (MZMB); same data, ex coll. J. Roubal, 1 spec. (SNMB); same data, ex coll. J.B. Jöger, 1 ♂ (NHMB); Kinfu Shan mts [= Jinfo Shan mts], 2000 m, without date and collector's name, 3 ♂♂, 2 ♀♀ (JSCC, NHMW, NMPC); Jinfo Shan mts, 29°01'N 107°14'E, 1700–1950 m, 24.–29.vi.1998, J. Schneider leg., 3 ♂♂, 3 ♀♀ (JSCC);

**Fujian province:** “Fokien”, without date, coll. Kraatz, 1 ♀ (SDEI); “Fukien”, 2.v.1938, without more detailed locality, Klapperich leg., 1 ♀ (ZFMK); same data, 12.v.1938, 4 ♂♂, 3 ♀♀ (ZFMK); same data, 10.v.1938, 1 ♂, 3 ♀♀ (ZFMK);

Futschau [= Fuzhou, ca. 26°04'N 119°18'E], without date, ex coll. J.N. Ertl, 1 ♀ (ZSM);

Yun-ling-shan [= Shan Ling, ca. 27°36'N 117°24'E], without date and collector's name, 1 ♂, 2 ♀♀ (ZMHB); Yunling mts [= Shan Ling], without date and collector's name, 4 ♂♂ (SMFD); Yun-ling-shan [=Shan Ling], Koateng [= Huaqiao], without date and collector's name, 2 ♂♂, 2 ♀♀ (ZMHB); Koateng [= Huaqiao], without date and collector's name, 1 ♂ (ZMHB); Kuatun [= Huaqiao], without date, ex coll. M. Pic, 1 ♀ (MNHN); Kuatun [= Huaqiao], 27°40'N 117°40'E, various dates between 1.iv.1938 and 4.viii.1938, J. Klapperich leg., 194 ♂♂, 212 ♀♀ (ZFMK); Kuatun [= Huaqiao], 27°40'N 117°40'E, 2300 m, various dates between 3.iv.1938 and 17.vi.1938, J. Klapperich leg., 3 ♂♂, 2 ♀♀ (NMPC); Kuatun [= Huaqiao], 3.vi.1938, T.H. Cheng leg., 1 ♂ (NMNH); Kuatun [= Huaqiao], various dates between 20.iii.1946 and 14.vii.1946, Tschung Sen leg., 6 ♂♂, 2 ♀♀ (SMNS);

Shaowu env. [ca. 27°20'N 117°28'E], 13.–16.vi.1991, without collector's name, 1 ♀ (JSCC);

Wuyi Shan mts, Qiliqiao – Guadun road, ca. 27.75°N 117.64°E, 1150 m, 1.vi.2001, J. Cooter leg., at dead snake, 1 ♂ (JRUC);

Wuyi Shan mts, 2 km NE Tongmu, 27.75°N 117.68°E, 800 m, 4.vi.2001, J. Cooter leg., pitfall trap (fish bait), 2 ♂♂ (BMNH); same locality, but 3 km NE Tongmu, 780 m, 7.vi.2001, J. Cooter leg., mixed forest and bamboo, pitfall trap (fish bait), 1 ♂, 2 ♀♀ (BMNH);

Wuyishan city, W env., 28.75°N 118.00°00'E, 1300 m, 2.–5.vi.2004, J. Turna leg., 1 ♂ (JTUC);

Emei Feng, 27°01'N 117°04'E, 1200–1500 m, 1.–2.vii.2007, J. Turna leg., 1 ♂, 1 ♀ (JTUC); same locality, 1300 m, 1.vii.2007, without collector's name, 1 ♂ (SVAC);

**Gansu province:** Wenxian env. [ca. 32°58'N 104°39'E], 18.–26.vi.1995, V. Beneš leg., 2 ♂♂, 2 ♀♀ (JSCC, NMPC); same locality, 26.vi.1995, V. Beneš leg., 2 ♂♂, 1 ♀ (WBAC); same data, 3 ♂♂, 3 ♀♀ (FMNH);

Liupan mts, 10 km W Shangguan, 35°03'N 106°29'E, vi.2005, team of V. Siniaev leg., 1 ♂, 1 ♀ (JRUC);

**Guandong province:** Tsha-jiu-san [= Jiuwan Dashan mts, ca. 25°18'N 108°36'E], vii.–ix.1910, Mell leg., 1 ♀ (ZMHB); mts N Kuangtung [= Guandong province], Tscha-Jui-San [= Jiuwan Dashan mts], v.–vi.1912, Mell leg., *Bambus* forest, 1 ♀ (SMNS);

Shaoguan, Nauling [= Nanling National Forest Park, ca. 24°55'N 113°05'E], 1100 m, 8.–13.vii.2003, Y. Kishida leg., 1 ♂, 2 ♀♀ (NSMT);

Dadongshan, 5.vii.1997, Zhixiong Liu leg., 1 ♂, 1 ♀ (SYSU); same locality, 6.vii.1997, Zhixiong Liu leg., 2 ♂♂ (SYSU); same locality, 1.vii.1998, Zhenyao Chen leg., 1 ♂ (SYSU); same locality, 13.vii.1998, Cuiping Chen leg., 1 ♂ (SYSU); Nanling National Nature Reserve, Dadongshan, 24°56.0'N, 112°42.9'E, 690–700 m, 18.–19.iv.2013,

J. Hájek & J. Růžička leg., baited pitfall traps (fish meat) J, secondary vegetation with shrubs and trees on steep slope along path to waterfall in small valley behind headquarters, cold and rainy weather, 1 ♀ (DNA voucher, JRUC);

Danxia Shan mts [ca. 25°02'N 113°44'E], 30.v.–8.vi.2008, Yun Wang leg., 1 ♀ (SYSU);

Dinghu Shan mt. [ca. 23°10'N 112°33'E], 19.v.2002, Bisheng Zhang leg., 1 ♂ (SYSU);

Lien-Ping distr. [= Lianping], Kau-lin San [= Jiulian Shan mts, ca. 24°12'N 114°23'E], 700–900 m, 19.iv.1940, J.L. Gressitt & F.K. To leg., 1 ♀ (SYSU);

Tianjing Shan mt. [ca. 24°35'N 113°18'E], 6.vi.1974, Liu leg., 1 ♂ (SYSU);

Guangxi autonomous region: Miaoershan mt. [ca. 35°48'N 110°22'E], S slope, 800–1300 m, 20.–27.i.1997, Bolm leg., 1 ♀ (NHMB);

Lingui county, Pingshan mts, 25°33'–36'N 109°56'–110°01'E, 700–1300 m, 19.–23.viii.1998, L. et R. Businský leg., 1 ♀ (JSCC);

Jinxiu County, Mt. Shengtangshan, 23°59'26.82"N 110°05'56.20"E, 1230–1450 m, 25.vii.2011, Peng & Zhu leg., 51 spec. (SHNU);

Guizhou province: Kouy-Tchéou [= Guizhou province], without date, Largeteau leg., 1 ♂ (MNHN);

20 km NW Jiangkou, Fanjing Shan, Kuaichang [ca. 27°51'N 108°46'E], 27.v.–3.vi.1995, E. Jendek & O. Šauša leg., 2 ♂♂ (JHAC); same data, 3 ♂♂, 2 ♀♀ (WBAC);

Mt. Fanjing, 27°53'36.07"N 108°43'21.44"E, 10.vii.2003, Hu & Tang leg., 1 ♀ (SHNU);

Hebei province: Chinwangtao [= Qinhuangdao, ca. 39°55'N 119°35'E], without date (but before 1922), Delatouche leg., 1 ♂ (MNHN);

Weixian County, Mt. Xiao-Wu-Tai-Sha [= Taihang Shan mts, Mt. Xiao Wutaishan, ca. 39°56'N 114°59'E], vii.2005, without collector's name, 1 spec. (MNIC);

Heilongjiang province: “Mandzhuria”, Gaolintszy [= Gaolingzi, ca. 44°52'N 128°50'E], 15.vii.1940, M. Volkov leg., ex coll. Mazokhin-Porshnyakov, 1 ♀ (ZMUM); same data, 16.vii.1940, 1 ♀ (ZMUM); same data, 19.vii.1940, 1 ♀ (ZMUM);

“Manshu, Hôten” [= Shenyang, ca. 41°47'N 123°26'E], vi.1937, without collector's name, 1 ♀ (HUM);

“Manchuria, Yablonia” [= Yabuli, ca. 44°46'N 128°26'E, Shangzhi-shi], vi.1940, A.E. Loukasakin leg., 1 ♂, 1 ♀ (HUM);

Hong Kong: Tai Po [ca. 22°26'N 114°09'E], 1996, G. de Rougemont leg., 1 ♂ (BMNH);

Hubei province: Wu Shan mts, without date and collector's name, 1 ♂, 2 ♀♀ (NHMW, SMFD);

forest park 15 km SE of Yichang, 30.7°N 111.4°E, 1.–9.ix.2004, J. Turna leg., pitfall traps, 1 ♂, 1 ♀ (JTUC); same locality, 11.v.–4.vi.2005, J. Turna leg., 1 spec. (JTUC);

Hunan province: Guidong env., 26°04'N 113°56'E, without date, O. Šauša leg., 2 ♂♂, 1 ♀ (JHAC); same locality, 26.–31.v.1994, E. Jendek & O. Šauša leg., 1 ♂, 2 ♀♀ (MTRC); same data, 1 ♂, 1 ♀ (JSCC);

Xin'hua, Mt. Tianlong Shan [ca. 27°05'N 111°07'E], 1500 m, vii.2005, Yi et al. leg., 45 spec. (MNIC);

Zhangjiajie [ca. 29°07'N 110°29'E], 7.viii.2007, Haidong Chen leg., 1 ♀ (SYSU);

Jiangxi province: Kiukiang [= Jiujiang, ca. 29°43'N 115°58'E], v.1887, A. E. Pratt leg., ex coll. R. Oberthür, 3 ♂♂ (MNHN); same locality, vi.1887, A. E. Pratt leg., 2 ♂♂, 1 ♀ (MNHN); Kiu-Kiang, without date, coll. Kraatz, 1 ♀ (SDEI);

Lu Shan mts [ca. 29°34'N 115°58'E], 2.–6.ix.1959, Székessy et Yang leg., 3 ♂♂, 7 ♀♀ (HNHM, SMNS);

Jinggang Shan mts, Ciping env. [= Jinggangshan, ca. 26°34'N 114°09'E], 2.–14.vi.1994, without collector's name, 3 ♂♂, 1 ♀ (JRUC, NHMW);

Jinggang Shan mts, Xiaoxidong [ca. 26°28'N, 114°13'E], 30.v.2011, Jinwei Li leg., 1 ♂ (SYSU);

Jilin province: Sungari River [= Songhua River], 60–70 miles [ca. 96–113 km] S Kirin [= Jilin, ca. 42°50'N 126°34'E], 23.vi.–16.vii.[19]13, A. de C. Sowerby leg., 1 ♂ (NMNH);

Gongzhuling city, Mt. Dahei Shan [ca. 43°24'N 124°01'E], 500 m, 5.–13.vii.2008, 8 spec. (MNIC);

Qinghai province: Baila, Yushu [ca. 33°06'N 096°23'E], 1.–14.viii.2005, S.C. Tan leg., 2 spec. (MNIC);

Shaanxi province: Hua Shan Mt. [ca. 34°29'N 110°05'E], 27.vii.1990, R. Dunda leg., 1 ♀ (JRUC);

Qinling Shan mts, Foping Nature Reserve, 33°51'N 107°57'E, 1600 m, 8.iv.1999, V. Siniaev et A. Plutenko leg., 1 ♂ (JMAC); Qinling Shan mts, Taibaishan range, Houzhenzi env., 33°53'N 107°49'E, 1900 m, 1.–11.viii.1999, V. Siniaev et A. Plutenko leg., 1 ♀ (JSCC); Taibai Shan mts, Houzhenzi vill. [ca. 33°56'N 107°45'E], 1500–2000 m, vi.–vii.2000, A. Plutenko leg., 3 spec. (MNIC);

Qinling Shan mts, 6 km E Xunyangba [ca. 33°33'N 108°35'E], 1000–1300 m, 23.v.–13.vi.2000, C. Holzschuh, I. H. Marshal leg., 12 spec. (JSCC); same data, V. Kubáň leg., 2 ♂♂ (NMPC);

Qinling Shan, Taibaishan Nature Reserve, 33°53'N 107°49'E, 2000 m, 5.–15.viii.2005, without collector's name, 1 ♂, 3 ♀♀ (BMNH);

Lueyang [ca. 33°19'N 106°09'E], 26.vi.–6.vii.2009, E. Kučera leg., 4 spec. (MNIC);

Sichuan province: “Prov. Sze-tschwan” [no more precise locality], without date, ex coll. P. van der Wiel, 2 ♀♀ (ZMAN);

Micang Shan mts, Daba, 1385 m, 32°40'N 106°55'E, 5.vi.–9.vii.2007, J. Turna leg., 1 ♀ (JTUC);

mts near Kwanshien [= Guan Xian, ca. 31°01'N 103°40'E], without date and collector's name, 2 ♂♂, 2 ♀♀ (SMFD);

near Pingwu [ca. 32°25'N 104°32'E], 1.vii.2005, A. Gorodinski leg., 3 spec. (MNIC);

Nitou, Tatsienlu [= Kangding, ca. 30°05'N 102°04'E], without date and collector's name, ex coll. Em. Reitter, 4 spec. (NMPC); same locality, without date, ex coll. J. Hlisnikovský, 1 ♀ (MHNG); Tatsienlu-Kiulung, without date and collector's name, ex coll. Em. Reitter, coll. J. Roubal, 1 spec. (SNMB);

Mou-pin [= Baoxing, ca. 30°24'N 102°50'E], 1870, A. David leg., 1 ♀ (MNHN); Baoxing, Panda Park, 30°22'15"N 102°48'48"E, 1020 m, 14.vi.2014, J. Hájek, J. Růžička & M. Tkoč leg., on excrement, at evening, 1 ♂ (JRUC);

Hongya Xian [ca. 29°54'N 103°21'E], NE slope of Mt. Wawu Shan, Jinhuaqiao, 1100–1200 m, 24.v.–3.vi.2004, Y. Imura & Y. Nagahata leg., 1 ♂, 1 ♀ (MNIC);

Mt. Omei & vic. [= Emei Shan mts, ca. 29°31'N 103°20'E], vii.–viii.1922, D.C. Graham leg., 1 ♂ (NMNH);

Mt. Omei [= Emei Shan mts], ShinKaiSi near Kiating [= Leshan], 4400 ft [ca. 1340 m], 1921, D.C. Graham leg., 1 ♂, 4 ♀♀ (NMNH);

Siào Lou [= Xiaolou, the ancient pass from Lianghekou Village (Tianquan County, ca. 30°01'N 102°27'E) to Angzhou village [Luding County, ca. 30°02'N 102°13'E], 1897, without collector's name, 1 ♂ (MNHN);

Suiufu [= Yibin, ca. 28°46'N 104°37'E], iv.1923, D.C. Graham leg., 2 ♀♀ (NMNH);

Ya-Tchéou [= Yazhou (ancient name), = Ya'an, ca. 29°59'N 103°01'E], 1897, without collector's name, 4 ♂♂, 1 ♀ (MNHN); same data, 1 ♀ (BMNH);

Ta-Tsien-Lou [= Kangding, ca. 30°05'N 102°04'E], 1901, ex coll. R. P. Déjean, 3 ♂♂, 2 ♀♀ (MNHN);

Wenchuan env. [ca. 31°29'N 103°35'E], 4000–6000 ft [ca. 1220–1830 m], v.–viii.1933, D.C. Graham leg., 1 ♂ (NMNH); same locality, vii.–viii.1933, D.C. Graham leg., 1 ♂ (NMNH);

70 km W Chengdu, Jiulonggou env. near Dayi [ca. 30°35'N 103°31'E], 23.–27.vi.1993, M. Trýzna leg., 1 ♂ (JHAC); same data, 4 ♀♀ (FMNH);

Yingxiuvan [= Yingxiuwan, ca. 31°04'N 103°29'E], 26.vi.1996, Beneš leg., 1 ♂, 1 ♀ (NMPC); same data, 2 ♀♀ (WBAC);

Mô-Sy-Mien [= Moxi], 1897, without collector's name, 1 ♀ (MNHN); Gongga Shan Mts., Moxi, 21.vii.–24.vii.1992, J. Schneider leg., 1 ♀ (JSCC); Luding county, Moxi env., v.1993, V. Beneš leg., 1 ♂, 2 ♀♀ (JHAC);

Gongga Shan mts, Moxi, 29°13'[40']N 102°10'E, 1300 m, 10.–11.vii.1996, J. Farkač, P. Kabátek and A. Smetana leg., 1 ♂ (NHMB); Luding Xian, Moxi [ca. 29°39'N 102°06'E], 9.–14.vii.1999, V. Beneš leg., 1 ♀ (JSCC); Moxi env., 29°40'N 102°07'E, 1597 m, 15.vi.2006, R. Sehnal & M. Trýzna leg., 4 ♀♀ (SMNS);

Gongga Shan Mts., Moxi env., Hailuogou valley, Mulinsen, 29°36'42"N 102°06'51"E, 1680 m, 19.vi.2014, J. Hájek, J. Růžička & M. Tkoč leg., pig carrion in advanced decay stage, close valley near brook, 1 ♀ (JRUC);

Xichang env. [ca. 27°52'N 102°15'E], 1600 m, 1.vii.2002, Gorodinski leg., 1 ♂, 2 ♀♀ (MNIC);

Yunnan province: Baoshan env. [ca. 25°07'N 099°09'E], 5.–8.vi.1993, E. Jendek & O. Šauša leg., 1 ♀ (WBAC);

Mojiang, Mt. Dajian Shan [ca. 23°25'N 101°41'E], 2700 m, vi.2005, Wen et al. leg., 1 spec. (MNIC);

Old Dali city [ca. 25°36'N 100°16'E], 2300 m, 8.vi.1998, Gorodinski leg., 1 ♂, 1 ♀ (MNIC);

Dali Bai Nat. Aut. Pref., 1 km W Dali old town, creek valley at foothill of Diancang Shan, 25°41.9'N 100°08.4'E, 2170 m, 23.vi.2005, D.W. Wrase leg., on dead pig, [as *C. cyaniventris*, W. Schawaller det. 2005], 1 ♀ (MSCC); same data, 1 ♂ (JCOC);

Dali env., bank of Erhai Hu lake, 25°42.4'N 100°12.1'E, 1970 m, 31.v.2007, J. Hájek & J. Růžička leg., on pig carrion, margin of a groove and fields close to lake bank, 2 ♀♀ (DNA sample, JRUC);

Tengchong county, Mt. Gaoligong Shan [ca. 25°00'N 098°02'E], 20.–29.vii.2006, without collector's name, 2 spec. (MNIC);

Nu Shan mts, Lampin city env. [=Lanping, 26°27'N 099°24'E], 2500 m, 11.vi.2007, A. Gorodinski leg., 4 spec. (MNIC);

Jinsha river valley, 27°18'N 100°12'E, 2150 m, 8.vii.1995, Bolm leg., 1 ♂, 1 ♀ (NHMB);

Jizu Shan mts. [ca. 25°58'N 100°21'E], 2800 m, 30.v.–3.vi.1993, Bolm leg., 2 ♂, 2 ♀♀ (JSCC);

Sse-Tsong [= Shizong, ca. 24°49'N 103°59'E], 2000 m, without date and collector's name, 1 ♂ (IRSNB);

Tsekou [=Yanmen, ca. 28°04'N 098°54'E], 1896, without collector's name, 1 ♂ (MNHN); Tsékou [=Yanmen], 1900, P. P. J. Dubernard leg., 1 ♀ (MNHN);

Weibao Shan mts, W slope, 25°11'N 101°24'E, 2000–2800 m, 25.–28.vi.1992, V. Kubáň leg., 1 ♂ (JSCC);

Qiajia Co., Yao Shan mts, 27°11–16'N 103°01–03'E, 2400–3900 m, 19.–30.vii.1998, L. & R. Businský leg., 1 ♂ (JSCC);

Zhejiang province: Tianmu Shan mts [between ca. 30°06'N 118°47'E and 30°26'N 119°39'E], without date and collector's name, 2 ♂♂, 1 ♀ (NHMW);

Lin'an county, Mt. Tianmu Shan [ca. 30°20'N 119°25'E], 1300 m, viii.2005, Li et al. leg., 5 spec. (MNIC);

Lin'an county, West Tianmu Shan, ca. 1100 m, 2.vii.2009, under stone, J. Cooter leg., 1 ♂, 2 ♀♀ (JCOC);

Lin'an City, West Tianmushan, 30°20'38.49"N 119°26'23.31"E, 1000–1200 m, 21.viii.2011, L. Tang leg., 2 ♀♀ (SHNU);

“Chi-Kiang” [= Zhejiang province; without more details], without date, ex. coll. Le Moul, 1 ♂ (ZMUH);

Not or imprecisely located:

“Manchuria, Lat. 42 N.”, 1500–2000 ft. [ca. 450–600 m], 20.–30.vi.1898, R.T. Turley leg., in or near forest, 4 ♀♀ (OUMNH);

**Bhutan**: Timphu distr., Taba [ca. 27°38'N 089°38'E], 2600 m, 4.–17.vii.1988, C. Holzschuh leg., 1 ♂ (JSCC);

**North Korea**: Gensan [= Wonsan, ca. 39°09'N 127°25'E], without date [but before 1915], ex coll. A. Grouvelle, 2 ♀♀ (MNHN);

Puryong [ca. 42°03'N 129°42'E], without date, ex coll. M. Pic, 1 ♀ (MNHN);

Seishin [= Chongjin, ca. 41°46'N 129°46'E], without date, ex coll. C. Bosch, 3 ♂♂, 1 ♀ (SMFD); same locality, without date, ex coll. E. Grundmann, 2 ♂♂, 3 ♀♀ (NHMW); same locality, without date, ex coll. W.H. Muche, 1 ♀ (SMTD); same locality, without date, ex coll. Leonhard, 2 ♀♀ (SDEI); Seishin Olto, without date and collector's name, 2 ♂♂, 1 ♀ (coll. G. Frey, NHMB);

Sarivon [= Sariwon, ca. 38°30'N 125°45'E], 20.–28.viii.1956, M. Magyar leg., 1 ♂ (HNHM);

Tshon-Ban-San, 11.ix.1956, M. Magyar leg., 7 ♂♂, 10 ♀♀ (HNHM);

Kaesong, Pakyon mts, 20 km NE Kaesong [ca. 38°05'N 126°43'E], 10.ix.1971, S. Horvatovich et J. Papp leg., 2 ♂♂, 1 ♀ (HNHM); same data, 1 ♂, 1 ♀ (JRUC);

South Hamgyong province, Omdonri hill [ca. 39°48'N 127°18'E], 18.vii.1990, Murzin leg., 1 ♀ (JSCC);

“Nordkorea”, Ompo [not located], 10.–27.vii.1929, Jankowsky leg., ex coll. G. Reineck, 1 ♂, 1 ♀ (SMFD); same locality, vii.1926, Jankowsky leg., ex coll. Korschefsky, 2 ♂♂, 2 ♀♀ (SDEI);

Pyonganbuk-do province, Mt. Myohyan-san [ca. 40°00'N 126°04'E], 19.–29.vi.2006, without collector's name, 13 spec. (MNIC);

**South Korea**: Gangwon-do province: Mt. Taebaek [ca. 37°05'N 128°55'E], 31.vii.1986, Y. B. Cho leg., 1 ♂, 1 ♀ (SMNS); same locality, 31.vii.1986, without collector's name, 1 ♂, 1 ♀ (NSMT);

Pyeongchang-gun, Mt. Dutasan [ca. 37°33'N 128°34'E], 14.viii.1995, Y.B. Cho leg., 5 ♂♂, 7 ♀♀ (MNIC);

Pyeongchang-gun, Mt. Odaesan [ca. 37°47'N 126°32'E], 5.viii.1985, Y.B. Cho leg., 2 ♂♂, 1 ♀ (MNIC);

Yangyang-gun, Seo-myeon, Osaek-ri, Osekyaksu [ca. 38°05'N 128°27'E], 2.v.1990, ex coll. A. Tanaka, 4 spec. (HUM);  
 Sorak city, Mt. Sorak National Park [= Seorak-san, ca. 38°07'N 128°28'E], 6.viii.1979, G. Minet leg., 1 ♂, 1 ♀ (NHMB); Sorak San Mt., 24.vii.1992, G. Minet leg., 1 ♂, 2 ♀♀ (NHMB);  
 Odae San, Yong Pyeong [= Yong Pyong, ca. 37°39'N 128°41'E], 29.vii.1992, G. Minet leg., 1 ♂, 1 ♀ (NHMB);  
Jeju-do province: Jeju-do Island: Yونسil, Mt. Halla-san [ca. 33°21'N 126°31'E], 27.vii.1990, S. Nomura leg., 1 ♀ (JHAC);  
Seoul: Seoul [ca. 37°33'N 126°59'E], without date and collector's name, 1 ♂ (NSMT); Keijō-fu [= Seoul], 15.viii.1938, ex coll. Tani, 1 ♀ (NSMT);  
Gyeonggi-do province: Kyonggi-dō, Mt. Shōyōsan [not located] [near Seoul], 4.viii.2603 [= 1943], ex coll. K. Tsuneki, 2 ♂♂ (NSMT);  
 Gwacheon-si, Makgye-dong, Mt. Cheonggyesan [ca. 37°24'N 127°02'E], 19.vi.1990, ex coll. A. Tanaka, 6 spec. (HUM);  
 Yangpyong-gun, 37°29'N 127°35'E, Mt. Yongmunsan, 300–350 m, carrion traps, 18.–19.viii.1998, M. Nishikawa leg., 3 ♂♂, 6 ♀♀ (MNIC);  
 Chow-san [= Chaoxian, = Korean Peninsula], without date [but before 1863], ex coll. Bowring, 1 ♂ (BMNH);  
**Russia**: Amurskaya oblast: “Amur” [without more details], without date, ex coll. Haglund, 1 ♂ (NHRS);  
Primorskaya oblast: Sutschanski Rudnik [= Partizansk, ca. 43°08'N 133°08'E], without date and collector's name, 2 ♀♀ (MNHN);  
 Vladivostok [ca. 43°07'N 131°54'E], without date, I. Bryner [leg.], 8 spec. (NHMW);  
 Nadezhdinsky district, Elduga river [= Ananyevka river, ca. 43°25'N 131°37'E], 50–150 m, 12.vi.1975, on dung, A.V. Plutenko leg., 1 ♂ (JRUC); Black Mountains mts, Elduga river, vii.1992, without collector's name, 1 ♂, 2 ♀♀ (WBAC);  
 Khasanskiy district, Ryazanovka env., Fudnyak, 16.vii.1979, in flight, A.V. Plutenko leg., 1 ♀ (JRUC); Slavyanka env., Ryazanovka [ca. 42°48'N 131°14'E], 17.–23.vii.1992, D. Boukal leg., 1 ♀ (JRUC);  
 40 km SE Ussuriysk [ca. 43°31'N 132°11'E], 7.vii.1984, A. Ozerov leg., on decaying meat, 1 ♀ (ZMUM); same data, 15.vii.1984, 1 ♀ (ZMUM);  
 Kedrovaya Pad' State Reserve [ca. 43°30'N 131°25'E], 26.viii.1984, S. Tchurkin leg., 1 ♀ (SMNS);  
 40 km SW Ussuriysk, Krounovka, Medveditsa river, 43.3°N 131.15°E, 250 m, 2.–6.viii.1993, E. Groll & C. Kutscher leg., 1 ♂, 2 ♀♀ (SDEI);  
 Lazovskiy Reserve, 20 km SE Lazo [ca. 43°13'N 134°00'E], 20.vii.1986, without collector's name, 1 ♂ (ZMUM);  
 Melkovodnoe, 2 km SE mouth of Kievka river [ca. 42°52'N 133°40'E], 5.ix.1987, A. L. Ozerov leg., 1 ♀ (ZMUM);  
 Black Mountains mts, Gryaznaya river [ca. 43°22'N 131°30'E], vi.1990, A. Plutenko leg., 1 ♀ (FMNH);  
 Oblachnaya mts [ca. 43°40'N 134°08'E], viii.1990, A. Plutenko leg., 1 ♂ (WBAC);  
 Chernye Gory mts [=Black Mountains mts], Nadezhdenskiy distr., Gornoe vill. env. [ca. 44°50'N 133°57'E], Anan'evka river, 100–200 m, vii.–viii.1991, A. Plutenko leg., 4 spec. (MNIC);  
 Smolnyy river, Mt. Krinichnaya [ca. 43°07'N 132°48'E], 390 m, 22.viii.1991, S. Uéno leg., 1 ♂ (NSMT);  
 Kaymanovka [ca. 43°38'N 132°14'E], 2.–9.viii.1992, M. Snížek leg., 1 ♀ (MSNC); same locality, 10.–22.vii.1993, Z. Kletečka leg., 5 ♂♂, 5 ♀♀ (JHAC);  
 Primorskiy Kray, Lazovsky Distr., Lazo env. [ca. 43°22'N 133°54'E], 3.–10.vii.2002, without collector's name, 3 ♀♀ (MNIC);  
**Taiwan**: “Formose” [probably mislabeled], without date, ex coll. Laporte, 2 ♀♀ (MNHN);  
**Japan**: Hokkaido: Oshima-shichō, [Nanae-chō], Ohnuma [ca. 41°58'N 140°40'E], 18.vii.1954, T. Nakane leg., 1 ♂ (HUM);  
Honshu: Aichi prefecture, Nagoya city, Higashi-ku, Kenchūji [ca. 35°10'N 136°55'E], 9.viii.1941, T. Hozumi leg., decayed meat, 1 ♂ (TMNH); same locality, 14.viii.1941, without collector's name, 2 ♀♀ (HUM);  
 Aichi prefecture, Kasugai city, Sotonohara-chō [ca. 35°17'N 137°04'E], 6.vii.2008, T. Yoshida leg., 1 ♀ (TMNH);  
 Aichi prefecture, Kasugai city, Hosono-chō [ca. 35°18'N 137°03'E], 30.vii.2009, T. Yoshida leg., 1 ♀ (TMNH);

Chiba prefecture, Kashiwa [ca. 35°51'N, 139°58'E], 5.vii.1924, without collector's name, on leaves of "Nanten" [evergreen tree *Nandina domestica*, Berberidaceae], 1 ♂ (NSMT);

Fukui prefecture, Takahama-chô, Taka-shima Is. in Wakasa Bay [ca. 35°30'N 135°33'E], 11.viii.1986, T. Ueno leg., 1 spec. (MNIC); same locality, 15.ix.1986, T. Ueno leg., 1 spec. (MNIC);

Fukushima prefecture, Minami-aizu, Shindenhara [ca. 37°05'N 139°33'E], 7.–8.vi.1979, A. Izumi leg., 2 spec. (MNIC);

Gifu prefecture, Hirugano [ca. 36°00'N 132°54'E], 900 m, vii.1949, without collector's name, 1 ♂ (IRSNB);

Gifu prefecture, Mino city, Kataji [ca. 35°37'N 136°53'E], 1.–2.viii.1990, A. Miyano leg., 2 ♂♂ (TMNH);

Gifu prefecture, Mino city, Kataji-keikoku [ca. 35°37'N 136°53'E], 2.viii.1990, A. Miyano leg., 1 ♂ (TMNH);

Gunma prefecture, Oze [ca. 36°56'N 139°15'E], 1.viii.1947, K. Nagayama leg., 1 ♂, 1 ♀ (HUM);

Gunma prefecture, Shibukawa-shi, Arima [ca. 36°28'N 139°00'E], 17.vi.2002, T. Horiguchi leg., 3 ♂♂ (MNIC);

Hiroshima prefecture, Myoshi [= Miyoshi, ca. 34°48'N 132°50'E], 26.vi.1943, ex coll. A. Veldhuyzen, 1 ♀ (RMNH);

Hiroshima prefecture, Midoridani [= Akitakata, ca. 34°40'N 132°42'E], vii.1976, P. Kuijten leg., 2 ♀♀ (RMNH);

Hiroshima prefecture, Takano [ca. 35°02'N 132°54'E], 24.viii.1994, S. Nakamura leg., 2 ♂♂, 2 ♀♀ (HUM);

Hiroshima prefecture, Hiwa-chô [ca. 34°59'N 132°59'E], 27.vii.1995, S. Nakamura leg., 2 ♂♂, 1 ♀ (HUM);

Hyogo prefecture, Settsu, Suma [ca. 34°39'N 135°08'E], Ichiotani, 9.vii.1932, without collector's name, 1 ♀ (coll. G. Frey, NHMB);

Hyogo prefecture, Awaji-shima Island, Mt. Kashiharayama [ca. 34°17'N 134°54'E], vii.1923, without collector's name, 1 ♀ (NSMT);

Hyogo prefecture, Motoyama-mura [ca. 34°44'N 135°17'E], 28.v.1937, K. Sakaguchi leg., 1 ♀ (HUM);

Hyogo prefecture, "Hiogo" [without more details], 1880, Th. Lenz leg., 1 ♀ (NHMB); same locality, without date [but before 1915], G. Lewis leg., 1 ♂ (BMNH); same locality, without date, ex coll. P. de Borre, 1 ♂, 1 ♀ (MHNG); same locality, without date, ex coll. J.C. Stevens, 2 ♂♂ (IRSNB);

Ibaraki prefecture, Sakuragawa-shi, Inuda [ca. 36°21'N 140°06'E], v.–vi.2006, T. Senba leg., 2 spec. (MNIC);

Kanagawa prefecture, Yokohama [ca. 35°27'N 137°37'E], without date (but before 1917), ex coll. A. Grouvelle, 1 ♂ (MNHN); same locality, without date (but before 1917), H. Fruhstorfer leg., ex coll. A. Grouvelle, 1 ♂, 1 ♀ (MNHN); same locality, without date (but before 1922), Mellottée leg., ex coll. L. Bedel, 1 ♂ (MNHN); same locality, without date, H. Fruhstorfer leg., ex coll. C. & O. Vogt, 5 ♂♂, 2 ♀♀ (ZMAN); same locality, without date, H. Fruhstorfer leg., 2 ♂♂, 4 ♀♀ (RMNH); same locality, without date, H. Fruhstorfer leg., ex coll. Madon, 1 ♂ (IRSNB); same locality, without date, H. Fruhstorfer leg., ex coll. Otterstedt, 1 ♂, 2 ♀♀ (SMTD); same locality, without date, ex coll. W.H. Muche, 1 ♀ (SMTD); same locality, without date, H. Fruhstorfer leg., ex coll. A. Koller, 2 ♀♀ (IRSNB); same locality, without date, H. Fruhstorfer leg., ex coll. P. de Borre, 1 ♂, 2 ♀♀ (MHNG); same locality, without date, H. Fruhstorfer leg., ex coll. Kraatz, 1 ♂, 2 ♀♀ (SDEI); same locality, without date, ex coll. Ch. Maerky, 1 ♀ (MHNG); same locality, without date and collector's name, 1 ♂ (NHRS); same locality, without date and collector's name, 1 ♂ (FMNH); same locality, without date and collector's name, 1 ♀ (JHAC); same locality, without date, ex coll. E. Grundmann, 1 ♀ (NHMW); same locality, without date, Haberer leg., 1 ♀ (ZSM); same locality, 3.–18.xi.1880, G. Lewis leg., 1 ♀ (BMNH); same locality, without date (but before 1929), H. Fruhstorfer leg., ex coll. B. Hamfeld, ex Brooklyn Museum, 2 ♂♂ (NMNH); same locality, without date, H. Loomis leg., 1 ♂ (NMNH);

Kanagawa prefecture, Mt. Ôyama [ca. 35°26'N 139°14'E], 13.ix.1936, H. Uchida leg., 1 ♂, 1 ♀ (NSMT);

Kanagawa prefecture, Yokohama-shi, Kamigô [ca. 35°21'N 139°35'E], 19.viii.1973, K. Masumoto leg., 2 spec. (MNIC); same locality, 8.viii.1974, ex coll. K. Masumoto, 2 spec. (MNIC);

Kanagawa prefecture, Mt. Sagamiôyama, Nanohanadai, 35°25'N 139°13'E, 7.vii.1979, M. Nishikawa leg., ex cat carcass, 1 spec. (MNIC);

Kanagawa prefecture, Tanzawa mts, Kiyokawa-mura, Fudakake, 35°28'N 139°13'E, 11.v.1980, carrion trap, M. Nishikawa leg., 1 spec. (MNIC);

Kanagawa prefecture, Sagamihara-shi, Katsusaka, 35°31'N 139°24'E, 24.vii.1981, carrion trap, M. Nishikawa leg., 6 spec. (MNIC);

Kanagawa prefecture, Tanzawa mts, Fujino-machi, Shinobara, 35°35'N 139°11'E, 14.v.1983, carrion trap, M. Nishikawa leg., 4 spec. (MNIC);

Kanagawa prefecture, Tanzawa mts, Mt. Tanzawa-san, Dôdaira, 35°29'N 139°11'E, 5.viii.1983, carrion trap, M. Nishikawa leg., 1 spec. (MNIC);

Kanagawa prefecture, Tanzawa mts, Mt. Setozawa-no-atama, 35°29'N 139°10'E, 5.viii.1983, carrion trap, M. Nishikawa leg., 6 spec. (MNIC);

Kanagawa prefecture, Tanzawa mts, Ashigarakami-gun, Yûshin, 35°27'N 139°07'E, 16.x., 30.x.1983, M. Nishikawa leg., 2 spec. (MNIC);

Kanagawa prefecture, Akuwa-chô [ca. 35°26'N 139°30'E], 25.v.1984, K. Wada leg., 1 spec. (MNIC); same locality, 27.v.1984, K. Wada leg., 1 spec. (MNIC); same locality, 9.vi.1984, K. Wada leg., 1 spec. (MNIC);

Kanagawa prefecture, Matsuda-machi, Yadoriki-sawa [ca. 35°26'N 139°08'E], 14.vi.1987, A. Izumi leg., baited trap, 1 spec. (MNIC);

Kanagawa prefecture, Hakone [ca. 35°14'N 139°06'E], without date, Harrington leg., 1 spec. (ASMC); same locality, without date and collector's name, 1 ♀ (ZSM);

Kanagawa prefecture, Hakone Volcanos, Sengoku [ca. 35°16'N 139°00'E], 10.x.1988, A. Izumi leg., 1 spec. (MNIC);

Kanagawa prefecture, Miura Peninsula, Mt. Miurafuji [ca. 35°13'N 139°40'E], 8.vii.1989, S. Tsuyuki leg., baited trap, 1 spec. (MNIC);

Kanagawa prefecture, Yokohama-shi, Isogo-ku, Kuraki-nômaidai [ca. 35°24'N 139°36'E], 16.viii.2005, H. Akiyama leg., 2 spec. (MNIC);

Kyoto prefecture, Kyoto [= Kyoto, ca. 35°00'N 135°46'E], without date, v. Schönfeldt leg., 2 ♀♀ (IRSNB);

Kyoto prefecture, Mt. Hiei [ca. 35°03'N 135°49'E], 4.–6.vii.1923, KT leg., 1 ♂ (HUM);

Kyoto prefecture, Hanase [ca. 35°09'N 135°47'E], 3.vii.1960, M. Nagai leg., 1 ♂, 1 ♀ (HUM);

Mie prefecture, Misugi-mura, Hirakura [ca. 34°28'N 136°14'E], 14.viii.1955, T. Hozumi leg., 1 ♂ (TMNH); same locality, 15.viii.1955, T. Hozumi leg., 2 ♂♂ (TMNH);

Mie prefecture, Ogino-chô, Yunoyama [ca. 35°01'N 136°27'E], 14.viii.1994, T. Hozumi leg., 1 ♀ (TMNH);

Mie prefecture, Akame [ca. 34°35'N 136°05'E], Nabari-shi, 25.viii.2006, without collector's name, 1 spec. (MNIC);

Miyagi prefecture, Sendai [ca. 38°16'N 140°52'E], without date [but before 1910], G. Lewis leg., 1 ♂ (BMNH);

Nagano prefecture, Nagano [ca. 36°39'N 138°11'E], 19.vi.1924, without collector's name, 2 ♂♂, 1 ♀ (NSMT);

Nagano prefecture, Kamikochi [ca. 36°18'N 137°58'E], 2.viii.1938, K. Sakaguchi leg., 1 ♂ (HUM);

Nagano prefecture, Shinano, Shimashima [ca. 36°11'N 137°46'E], 10.viii.1943, S. Osawa leg., 1 ♀ (HUM);

Nara prefecture, Mt. Ohdai [= Mt. Ohdaigahara, ca. 34°11'N 136°06'E], 27.–9.vii.1952, O. Sato leg., 1 ♀ (HUM); same locality, 21.vii.1953, T. Nakane leg., 1 ♀ (HUM);

Nara prefecture, Nara [ca. 34°41'N 135°48'E], 11.viii.1980, A. Smetana leg., 1 spec. (ASMC); same locality, 19.vii.1999, V. Puthz leg., 1 ♂ (SDEI);

Niigata prefecture, Nagaoka-shi, Yûkyûyama-kôen [ca. 37°26'N 138°53'E], 2.viii.1997, K. Seya leg., 2 spec. (MNIC);

Niigata prefecture, Nagaoka, Yûkyuzan Park [ca. 37°26'N 138°53'E], 17.vii.1998, M. Maruyama leg., ex coll. F. Malsbender, 1 ♀ (ZFMK);

Okayama prefecture, Kurashiki, Tomi-tôge [ca. 34°32'N 133°40'E], 26.x.1975, T. Aono leg., 2 ♂♂ (HUM);

Okayama prefecture, Niimi-shi, Karamatsu [ca. 34°57'N 133°29'E], 1.vii.2001, Y. Fajitani leg., 1 ♀ (MNIC);

Okayama prefecture, Okayama-shi, Musa [ca. 34°44'N 133°58'E], 12.vi.2004, K. Nakano leg., ex Kinugasa-take (long net stinkhorn: *Phallus* sp., Phallales), 1 spec. (MNIC);

Osaka prefecture, Myôken, Shin-taki [ca. 34°25'N 135°40'E], 23.viii.1943, K. Sawada leg., 1 ♂ (HUM);

Osaka prefecture, Kaizuka-cho, SW of Sobura [ca. 34°22'N 135°24'E], 12.viii.1988, A. Hiramine leg., 1 ♂ (JHAC);

Osaka prefecture, Sakai [ca. 35°34'N 135°29'E], without date and collector's name, 1 ♂ (ZSM);



Saitama prefecture, Okumusashi-kôgen [ca. 35°49'N 139°02'E], 8.viii.1954, M. Ohno leg., 1 ♀ (NSMT);  
 Shiga prefecture, Suzuka mts, Eigenji [ca. 35°05'N 136°19'E], 13.viii.1957, K. Masumoto leg., 1 spec. (MNIC);  
 Shizuoka prefecture, Gotenba [ca. 35°20'N 138°52'E], 16.viii.1934, without collector's name, 1 ♂ (HUM);  
 Shizuoka prefecture, Mt. Ushio [= Fujieda city, Mt. Ushioyama, ca. 34°53'N 138°16'E], 19.viii.1950, F. Takahashi leg., 1 ♀ (HUM);  
 Tochigi prefecture, Nikko env., Yumote [= Yumoto, ca. 36°48'N 139°25'E], 6.viii.1910, E. Gallois leg., 1 ♂ (MNHN);  
 Tochigi prefecture, Chuzenji lake [ca. 36°44'N 139°28'E], 28.viii.1911, E. Gallois leg., 2 ♂♂ (MNHN);  
 Tochigi prefecture, Nikko, Mokokodaira [ca. 36°47'N 139°32'E], 15.–17.viii.1981, H. Tanaka leg., 3 spec. (MNIC);  
 Tokyo metropolitan area, Tokyo env. [ca. 35°40'N 139°46'E], without date, Harmand leg., 5 ♂♂, 1 ♀ (MNHN);  
 same locality, 6.vii.1909, E. Gallois leg., 1 ♀ (MNHN); same locality, 7.vii.1910, E. Gallois leg., 1 ♀ (MNHN);  
 same locality, 5.vii.1911, E. Gallois leg., 1 ♂ (MNHN); same locality, 1925, without collector's name, 1 ♂ (coll. G. Frey, NHMB);  
 Tokyo metropolitan area, Hachioji env., Mt. Takao [ca. 35°37'N 139°15'E], 1.vi.1908, E. Gallois leg., 2 ♀♀ (MNHN); Tokyo metropolitan area, Hachioji-shi, Mt. Takao-san, 1.v.1966, ex coll. K. Masumoto, 1 spec. (MNIC);  
 Tokyo metropolitan area, Mt. Takamizu-san [ca. 35°50'N 139°11'E], 23.vii.1966, T. Sata leg., 1 spec. (MNIC);  
 Tokyo metropolitan area, Tokyo, Ueno-kôen [park, ca. 35°43'N 139°46'E], 1.vii.1934, H. Uchida leg., 1 ♀ (NSMT); same locality, 1.vii.1934, H. Uchida leg., cat carcass, 2 ♂♂, 1 ♀ (NSMT);  
 Tokyo metropolitan area, Okutama [ca. 35°48'N 139°06'E], Mt. Tenso-san, 22.ix.1976, Y. Kurosawa leg., 1 ♂, 1 ♀ (NSMT);  
 Tokyo metropolitan area, Nishitama-gun, Okutama-chô, Nippara [ca. 35°50'N 139°03'E], 3.–7.viii.2007, K. Endo leg., 3 spec. (MNIC);  
 Tottori prefecture, Mt. Hokidaisen [ca. 35°26'N 133°23'E], 11.viii.1986, Masaki leg., ex coll. W. Barries, 1 ♂, 1 ♀ (JRUC);  
 Toyama prefecture, Toyamaga [= Toyama, ca. 36°42'N 137°13'E], 27.iv.1921, without collector's name, 1 ♂ (NSMT);  
 Toyama prefecture, Kaminikawa [=Kaminiikawa], Fukusawa [ca. 36°36'N 137°16'E], 29.vii.1980, A. Smetana leg., 1 spec. (ASMC);  
 Wakayama prefecture, Nati (= Nachi, ca. 33°40'N 135°53'E), Takechi lav, 22 .vii.1937, F. Takahashi leg., 1 ♀ (HUM);  
 Wakayama prefecture, Kii-Arida, Yuasa [ca. 34°02'N 135°11'E], 12–13.vii.1968, ex coll. I. Matoba, 3 spec. (WMNH);  
 Wakayama prefecture, Kii-Hikada, Hattomaki [ca. 34°00'N 135°28'E], 21.vii.1969, I. Matoba leg., 1 spec. (WMNH);  
 Wakayama prefecture, Shirahama-chô, Katada [= Katata, ca. 33°41'N, 135°23'E], 10.viii.1982, S. Tanaka leg., 1 spec. (WMNH);  
 Wakayama prefecture, Tanabe shi, Akizu [ca. 33°50'N 135°24'E], 10.X.1989, S. Goto leg., 1 spec. (WMNH);  
 Wakayama prefecture, Wakayama-shi, Wakaura [ca. 34°11'N 135°10'E], 31.vii.1991, M. Kitabata, 1 spec. (WMNH);  
 Wakayama prefecture, Hikigawa-chô, Kaura-dani [= Kawara-dani, ca. 33°42'N 135°31'E], 26.viii.1995, S. Tanaka leg., 1 spec. (WMNH);  
 Wakayama prefecture, Kozagawa-chô, Hirai [ca. 33°38'N 135°41'E], Shimo-dani, 450 m, 12.–13.vii.1999, M. Munetoshi leg., 5 ♂♂, 11 ♀♀ (NSMT); same data, 1 ♂, 1 ♀ (JRUC);  
 Wakayama prefecture, Ôsugidani–Kurokuradani [ca. 33°46'N 135°41'E], 24.vii.2002, I. Matoba leg., 1 spec. (WMNH);  
 Wakayama prefecture, Susami-chô, Kotono-taki [ca. 33°34'N, 135°33'E], 17.v.2003, I. Matoba leg., 1 spec. (WMNH);  
 Wakayama prefecture, Mt. Gomadan-yama [ca. 34°03'N 135°34'E], 14.vi.2008, S. Kuwahara leg., 3 spec. (MNIC);

Wakayama prefecture, Katsuragi-chô, Hanazonoyanase [ca. 34°09'N 135°30'E], 8.viii.2008, I. Matoba leg., 1 spec. (WMNH);

Yamagata prefecture, Asahi-kôsen [ca. 38°15'N, 139°55'E], 23.vii.1951, K. Nagayama leg., 1 ♀ (NSMT);

Yamanashi prefecture, Kofou [= Kofu, ca. 35°39'N 138°34'E], 1906, L. Drouart de Lezey leg., 1 ♂, 2 ♀♀ (MNHN);

Yamanashi prefecture, Kofu env., Alpes de Sasago [= Sasago pass, ca. 35°36'N 138°48'E], 27.vii.1908, E. Gallois leg., 2 ♂♂, 2 ♀♀ (MNHN);

Yamanashi prefecture, Kawaguchi-ko lake [ca. 35°31'N 138°46'E], vi.1953, without collector's name, 1 ♀ (JHAC);

Yamanashi prefecture, Shinono-mura [ca. 35°28'N 138°51'E], 12.ix.1971, Y. Hirano leg., 1 spec. (MNIC);

Yamanashi prefecture, Kitakoma-gun, Nagasaka-chô [ca. 35°49'N 138°22'E], 22.vii.1985, A. Izumi leg., baited trap, 1 spec. (MNIC);

Yamanashi prefecture, Makioka, Yanagidaira [ca. 35°48'N 138°40'E], 1495 m, 23–25.vii.1987, H. Yamasaki leg., trap, 1 ♀ (MNIC);

Yamanashi prefecture, Enzan-shi, nr. Sakeishi [ca. 35°44'N 138°48'E], 24–29.vii.1987, H. Yamazaki leg., 1 spec. (MNIC);

Shikoku: Ehime prefecture, Omogokei [ca. 33°43'N 133°06'E], 22.viii.1976, S. Hisamatsu leg., 3 ♂♂ (EUM); Ehime prefecture, Ishizuchi Mt. Nat. Park, Omogo valley [ca. 33°43'N, 133°06'E], 700 m, 18.–25.viii.1980, S.B. Peck leg., 24 ♂♂, 26 ♀♀ (FMNH); same data, 3 m♂, 2 ♀♀ (WBAC); same data, 3 ♂♂, 7 ♀♀ (MHNG); same data, large carrion trap, mixed temperate forest, S.B. Peck & J. Peck leg., 2 ♂♂, 2 ♀♀ (FMNH); Ehime prefecture, Matsuyama [ca. 33°50'N, 132°46'E], 2.vii.1955, without collector's name, 1 ♂ (IRSNB); Ehime prefecture, Saijo-shi, Mt. Iwakuroyama [ca. 33°45'N 133°09'E], 29.vii.2002, Y. Fajitani leg., trap, 1 ♀ (MNIC);

Kyushu: Fukuoka prefecture, Fukuoka city, Minami Koen Park [ca. 33°34'N 130°23'E], 23.v.1998, H. Fujimoto leg., 6 ♂♂, 1 ♀ (NSMT); same data, 1 ♂, 1 ♀ (JRUC); Fukuoka prefecture, Fukuoka, vi.1945, R. van Veen leg., 1 ♂, 2 ♀♀ (RMNH); Fukuoka prefecture, Kitakyushu city, Yamada-Ryokuchi [ca. 33°33'N 130°45'E], 23.vi.1990, S. Nomura leg., 1 ♂ (JHAC); Kagoshima prefecture, Cagoshima [= Kagoshima, ca. 31°35'N 130°33'E], 12.ix.1914, ex coll. Hausebild, 2 ♀♀ (ZMUC); Kagoshima prefecture, “Japon” [without more details, but probably on Mt. Nanatsudake of Kagoshima prefecture (Nishikawa 2013), ca. 31°31'N 130°45'E], 5.viii.1898, F. Steenackers leg., ex coll. Maindron, Le Moults via Rainbeck, 1 ♀ (ZMUH); Kagoshima prefecture, Kirishima mts, Mt. Kurino [summit ca. 31°57'N 130°47'E], 26.–27.vii.1968, S. Kinoshita leg., 1 ♂ (EUM); Kagoshima prefecture, Mt. Kurinodake [ca. 31°58'N 130°45'E], 25.vii.1994, T. Nakane leg., 1 ♂ (NSMT); Kumamoto prefecture, Hitoyoshi [ca. 32°12'N 130°46'E], 3.–8.v.1881, G. Lewis leg., 1 ♂ (BMNH); Kumamoto prefecture, “Kumamoto”, 9.vi.1913, T. Yokoyama leg., from decayed fish meat, 1 ♂ (NSMT); Miyazaki prefecture, “Miyazaki, Omata” [= Nishimera-mura, Omata-tôge, ca. 32°12'N 131°06'E], 17.vii.1954, K. Iwata leg., 1 ♂ (HUM); Miyazaki prefecture, Mt. Aoidake [ca. 31°51'N 131°13'E], 26.vii.1974, M. Sakei leg., 2 ♂♂, 1 ♀ (NSMT); Miyazaki prefecture, Nichinan-shi [without more details; ca. 31°34'N 131°23'E], 10.v.2006, T. Kondo leg., 1 spec. (MNIC); Nagasaki prefecture, Unzen near Shimabara [ca. 32°49'N 130°10'E], without date and collector's name, 1 ♂, 2 ♀♀ (MZMB); same data, 4 ♂♂, 3 ♀♀ (coll. G. Frey, NHMB); same data, 3 ♀♀ (NHMW); same data, 1 ♂ (FMNH); Nagasaki prefecture, Hirado city [ca. 33°22'N 129°33'E], 7.–10.viii.1974, A. Oda leg., 1 ♂ (EUM); Nagasaki prefecture, Ôseto-chô, Matsu-shima Is. [ca. 32°56'N 129°37'E], 29.viii.1994, Y. Kusui leg., 1 spec. (MNIC);

Nagasaki prefecture, Tsushima Is., Sago [ca. 34°38'N 129°20'E], 8.vi.1968, Y. Kurosawa leg., 1 ♀ (NSMT);  
 Nagasaki prefecture, Tsushima Is., Mitsushima, Kechi [ca. 34°15'N 129°19'E], 30.vi.1983, A. Urata leg., ex Kinugasa-take (long net stinkhorn: *Phallus* sp., Phallales), 4 ♂♂ (HUM);  
 Nagasaki prefecture, Tsushima Is., Mine-chô, Ôboshi-rindô [ca. 34°29'N 129°21'E], 4.viii.2006, Y. Takeshita leg., 1 spec. (MNIC);  
 Nagasaki prefecture, Tsushima Is., Kamiagata-chô, Mehoro [ca. 34°33'N 129°22'E], 29.–30.vii.2007, T. Horiguchi leg., 4 spec. (MNIC);  
 Nagasaki prefecture, Tsushima Is., Mine-chô, Yamadayama-tunnel Kyûdo [ca. 34°29'N 129°20'E], 13.viii.2008, Y. Nakamura leg., 1 ♀ (MNIC);  
 Nagasaki prefecture, Tsushima Is., Kamiagata, Miyama-rindô [ca. 34°34'N 129°22'E], 18.–23.vii.2009, T. Watanabe leg., 2 spec. (MNIC);  
 Oita prefecture, Mt. Sobo-san [ca. 32°50'N 131°21'E], 26.vii.1970, S. Miyake leg., 1 spec. (MNIC);  
 Oita prefecture, Yubuin-chô, Mt. Yubudake, Tsukahara [ca. 33°18'N 131°23'E], 750 m, 3.vii.2003, trap, T. Iwamoto leg., 1 ♂, 1 ♀ (MNIC);  
 Saga prefecture, Karatsu, Chinzei-chô, Madara-shima Is., Bansho-no-tsuji [ca. 33°34'N 129°45'E], 18.x.2008, E. Sakamoto leg., 6 spec. (MNIC);  
Ryukyus: Kagoshima prefecture, Ryukyu Islands, Amami-Ôshima Is. [without more details], vii.1970, S. Miyake leg., 1 spec. (MNIC);  
 Kagoshima prefecture, Ryukyu Islands, Amami-Ôshima Is., Mt. Yuwandake [ca. 28°18'N 129°18'E], 17.vii.1963, Y. Kurosawa leg., 20 ♂♂, 22 ♀♀ (NSMT); same data, 2 ♂♂, 2 ♀♀ (JRUC); same locality, 22.–28.v.1996, S. Hori leg., 1 ♀ (FMNH); Mt. Yuwan-dake [ca. 28°17'N 129°19'E], 22.vi.1980, trap, S. Imasaka leg., 2 spec. (MNIC);  
 Kagoshima prefecture, Ryukyu Islands, Amami-Ôshima Is., Nishinakama [ca. 28°18'N 129°24'E], 14.iv.1971, M. Sakai leg., 1 ♂ (EUM);  
 Kagoshima prefecture, Ryukyu Islands, Amami-Ôshima Is., Yuwan [ca. 28°16'N 129°17'E], 30.vii.1973, I. Miyagi leg., 1 ♀ (EUM);  
 Kagoshima prefecture, Ryukyu Islands, Amami-Ôshima Is., Hatsuno [ca. 28°14'N 129°22'E], 12.vii.1970, without collector's name, 3 ♂♂, 3 ♀♀ (JSCC); same locality, 22.vi.1971, I. Matoba leg., 1 spec. (WMNH);  
 Kagoshima prefecture, Ryukyu Islands, Amami-Ôshima Is., Uken, Chuô-rindô [ca. 28°22'N 129°29'E], 28.vi.1980, A. Izumi leg., 1 spec. (MNIC);  
 Kagoshima prefecture, Ryukyu Islands, Amami-Ôshima Is., Uken-son, Mt. Akatsuchi-yama [ca. 28°15'N 129°20'E], 6.vii.1997, S. Ueno leg., 1 spec. (MNIC);  
 Kagoshima prefecture, Ryukyu Islands, Amami-Ôshima Is., Sumiyo-mura, Kamiya, 28°17'N 129°24'E, 15.x.2005, S. Fukida leg., 1 spec. (MNIC);  
 Kagoshima prefecture, Ryukyu Islands, Amami-Ôshima Is., Yamato-son, Fukumoto, 28°19'N 129°21'E, 31.vii.2008, S. Fukida leg., 1 spec. (MNIC);  
 Kagoshima prefecture, Ryukyu Islands, Amami-Ôshima Is., Yamato-son, Yuwangama, 28°22'N 129°25'E, 26.vi.2009, S. Fukida leg., 1 spec. (MNIC);  
 Okinawa prefecture, Ryukyu Islands, Okinawa-hontô Is., Hedona [ca. 26°44'N 128°10'E], 16.iii.1980, A. Tanaka leg., 6 spec. (HUM);  
 Okinawa prefecture, Ryukyu Islands, Okinawa Is., Hiji [ca. 26°51'N 128°15'E], 12.v.1983, S. Azuma leg., 4 ♂♂, 2 ♀♀ (NSMT);  
 Okinawa prefecture, Ryukyu Islands, Okinawa Is., Kunigami, Yona [ca. 26°44'N 128°11'E], 19.iv.1986, S. Nomura leg., 4 ♂♂, 3 ♀♀ (NSMT); same data, 1 ♂, 1 ♀ (JRUC); same data, 1 ♀ (JHAC); same locality, 19.iv.1986, M. Yoshida leg., 1 ♀ (NSMT); same data, 2 ♂♂ (JHAC);  
 Okinawa prefecture, Ryukyu Islands, Okinawa-hontô Is., Nago-shi, bank of Haneji-ôkawa River [ca. 26°37'N 128°01'E], 8.–18.iv.1993, R. Yakita leg., 1 spec. (MNIC);  
 Okinawa prefecture, Ryukyu Islands, Okinawa-hontô Is., Ôgimi-son, Takazato [ca. 26°43'N 128°10'E], 16.v.1993, R. Yakita leg., 1 spec. (MNIC);

Okinawa prefecture, Ryukyu Islands, Okinawa Is., Motobu-mura [Peninsula], Yaetake [= Mt. Yae, ca. 26°38'N 127°56'E], 30.ix.1945, F.N. Young leg., 1 ♂ (NMNH); same locality, 8.x.1945, F.N. Young leg., on dead snake, 7 ♀♀ (NMNH);

Okinawa prefecture, Ryukyu Islands, Okinawa-hontô Is., Kunigami-gun, Ôgimi-son, Êgai-rindô [ca. 26°40'N 128°07'E], 5.vii.1996, S. Inada leg., 3 spec. (MNIC);

Not or imprecisely located:

“Japan”, without date and collector’s name, 3 ♂♂ (ZMUC); “Japan”, without date and collector’s name, 1 ♀ (IRSNB); “Japan”, without date and collector’s name, 1 ♂ (JHAC); “Japan”, without date, Bodemeyer leg., 1 ♂, 2 ♀♀ (NHMW); “Japan”, without date, ex coll. Plason, 2 ♀♀ (NHMW); “Japan”, without date [but before 1900] and collector’s name, ex coll. O. Staudinger, 1 ♂, 1 ♀ (NHRS); “Japan”, without date [but before 1910], G. Lewis leg., 1 ♂, 7 ♀♀ (BMNH); “Japan”, 1886, Dormer leg., ex coll. Sharp, 1 ♂, 2 ♀♀ (BMNH); “Japan, hl, 128”, without date and collector’s name, 1 ♀ (BMNH); “Japan”, without date [but before 1880], without collector’s name, 1 ♀ (BMNH); “Japan”, without date and collector’s name, 1 ♀ (SDEI); “Japan”, without date, ex coll. Madon, 1 ♂ (IRSNB); “Japan”, without date, CNHM 1955 Eduard Knirsch Palaeartic Colln., 1 ♂ (FMNH); “Japan”, without date, H. von Schönfeld leg., 2 ♀♀ (RMNH); “Japan”, without date, ex coll. Van Doesburg, 1 ♂ (RMNH); “Japan”, without date [but before 1909], ex coll. W. Müller, 1 ♀ (SMTD); “Japan”, without date, ex coll. W.H. Muehe, 1 ♂ (SMTD); “Japan”, without date, Schönfeldt leg., ex coll. L. v. Heyden, 1 ♂ (SDEI); “Japan” [without more details], ex coll. Le Moults via Rainbeck, 2 ♂♂ (ZMUH); “Mexico” [mislabelled!], without date, ex coll. C. E. Tottenham, 1 ♂, 1 ♀ (BMNH);

***Necrophila (Calosilpha) cyaneocephala (Portevin, 1914)* (145 specimens)**

**Taiwan:**

Chiayi county: Fenchihu [ca. 23°30'N 120°42'E], 1600 m, 12.–13.vii.1964, H. Inoue leg., 1 ♀ (NSMT);

Hsinchu county: Neiwan [ca. 24°42'N 121°11'E], 7.–12.v.2011, J. Dalihod leg., 1 ♀ (JDAC); same data, 1 ♀ (JSCC);

Kaohsiung county: Kosempo [= Chiahhsien, ca. 23°05'N 120°35'E], 1.–15.viii.1908, H. Sauter leg., 5 ♂♂, 4 ♀♀ (ZMHB); ditto, 15.viii.1908, 3 ♂♂, 3 ♀♀ (RMNH); ditto, x.1908, 1 ♀ (ZMHB); same locality, ii.1910, H. Sauter leg., 1 ♂ (ZMHB); same locality, vii.1911, H. Sauter leg., ex coll. M. Pic, 2 ♀♀ (MNHN); same locality, vii.1911, ex coll. Andrewes, 1 ♀ (BMNH); same locality, vii.1911, H. Sauter leg. [det. by G. Portevin as “*brunneicollis*”], 1 ♂ (SDEI); same locality, without date, Sauter leg., 4 ♂♂, 1 ♀ (NHMW); same data, 1 ♂ (JRUC);

Hoozan [=Fengshan, ca. 22°36'N 120°23'E], v.1910, H. Sauter leg., 8 ♂♂, 3 ♀♀ (SMNS, ZMHB);

Liukuei [ca. 23°00'N 120°39'E], v.1978, W. Chen leg., at light, 1 ♂ (MNIC);

Miaoli county: Guandaoshan [ca. 24°22'N 120°49'E], 7.vi.2006, J. Kantoh leg., 7 ♂♂, 3 ♀♀ (JRUC);

Nantou county: Fuhosho [= Wucheng, ca. 23°53'N 120°53'E], iv.1909, H. Sauter leg., 1 ♂, 1 ♀ (ZMHB);

Polisha [= Puli, ca. 23°58'N 120°57'E], iv.1910, Sauter leg., 12 ♂♂, 15 ♀♀ (SMNS, ZMHB); same locality, 28.iv.1910, 1 ♂ (ZMHB); Horisha [= Puli], 10.ii.1931, S. Hirayama leg., 1 ♂ (ZMHB);

Nanzankei (= Nanshanxi, ca. 24°00'N 121°05'E), 17.vi.1965, T. Shirôzu leg., 1 ♀ (HUM); same locality, 9.vi.1972, T. Du leg., 2 ♂♂, 1 ♀ (MNIC); same locality, 6.vi.1972, T. Du leg., 3 ♂♂, 3 ♀♀ (MNIC); same locality, 19.vi.1972, T. Du leg., 1 ♀ (MNIC);

Sun Moon lake [ca. 23°52'N 120°55'E], 2.vii.–13.vii.1994, J. Dalihod leg., 1 ♀ (JSSC); same data, 1 ♀ (MTRC);

Lenai, Mt. Guandaoshan, 24°00'N 121°01'E, 11.vi.2006, J. Kantoh leg., 5 ♂♂, 1 ♀ (MNIC);

New Taipei municipality: Fu Shan [ca. 24°46'N 121°29'E], 28.ii.2002, Wenbe Hwang leg., 1 ♀ (SMNS); ditto, 16.iii.2002, 1 ♂, 1 ♀ (HNHM); Taipei, Fushan Botanical Garden, 14.–20.vii.2006, C.-F. Lee leg., 1 ♂, 1 ♀ (BMNH);

Taichung municipality: Wufeng [ca. 24°04'N 120°42'E], 100–120 m, 14.iv.1990, A. Smetana leg., 1 ♀ (MHNG);

Tainan municipality: Tainan [ca. 22°59'N 120°11'E], without date, ex coll. Missionshaus SVD Steyl, 2 ♂♂, 1 ♀ (ZFMK);

Taipei municipality: Tatunsan [volcano group, ca. 25°10'N 121°33'E], 24.vi. [year not given], without collector's name, 1 ♂, 1 ♀ (JHAC); same data, 4 ♂♂, 2 ♀♀ (WBAC);  
Wulai [ca. 24°51'N 121°33'E], 21.viii.1969, M. Kubota leg., 1 ♀ (MNIC);  
Taitung county: Taitung [ca. 22°45'N 121°06'E], 31.iii.1973, Y. Kiyoyama leg., 1 ♂ (MNIC);  
Haiduan, Liyuan, 23°13'N 121°00'E, 1793 m, 17.viii.2014, H. Akiyama leg., 6 ♂♂, 5 ♀♀ (MNIC);  
Taoyuan county: Kayahara [ca. 24°48'N 121°21'E], 7.v.1938, T. Kaneko leg., 5 ♀♀ (NSMT);  
**Imprecisely located**: “Formosa”, without more detailed locality and date, T. Kano leg., 1 ♂, 1 ♀ (NSMT);  
“Formosa”, without more detailed locality, ii.1909, ex coll. J.N. Ertl, 2 ♂♂, 2 ♀♀ (ZSM); “C Formosa”, without more detailed locality, vi.1959, without collector's name, 1 ♂, 1 ♀ (NSMT).

*Necrophila (Calosilpha) cyaniventris* (Motschulsky, 1870) (405 specimens)

**India: Himachal Pradesh state**: Kussowlie [= Kasauli, ca. 30°54'N 076°57'E], without date, ex coll. R. Oberthür, 1 ♂ (ZFMK);  
Simla [= Shimla, ca. 31°06'N 077°09'E], without date, ex coll. R. Oberthür, 1 ♀ (ZFMK);  
**Uttarakhand state [= Uttaranchal]**: Dehra Dun [ca. 30°20'N 078°02'E], 10.ix.1984, Pokorný leg., 1 ♂ (JSCC);  
Nainital env. [ca. 29°23'N 079°26'E], 1900–2100 m, 19.–21.vi.2003, Z. Kejval & M. Trýzna leg., 2 ♂♂, 3 ♀♀ (JRUC, MTRC);  
**Sikkim state**: “Sikkim”, without more precise data, 2 ♂♂, 2 ♀♀ (MNHN);  
Tumlong [ca. 27°25'N 088°34'E], without date, ex coll. F. Schneider, 1 ♀ (MNHN);  
Tasberg [not located], without date and collector's name, 1 ♀ (JSCC);  
**West Bengal state**: Darjeeling, Katapahar [ridge, ca. 27°02'N 088°15'E], without date, Gebauer leg., 1 ♂ (NHMW);  
Mungphu [= Mangphu, ca. 26°58'N 088°22'E], without date and collector's name, 1 ♀ (NHRS); same locality, without date [but before 1892], ex coll. Atkinson, 1 ♂, 2 ♀♀ (BMNH);  
Rungbong valley [Rung Bong valley], Gopaldhara [ca. 26°57'N 088°11'E] [ca. 1400–1900 m], without date [but before 1916], H. Stevens leg., 2 ♂♂, 3 ♀♀ (BMNH);  
Kurseong env. [= Karsiyang, ca. 26°53'N 088°16'E], without date, R. P. Bretaudeau leg., 1 ♂, 1 ♀ (MNHN);  
Pedong [ca. 27°09'N 088°36'E], without date [but before 1902], A. Desgodilis leg., 1 ♂, 2 ♀♀ (MNHN); Padong [= Pedong], 1914, L. Durel leg., 1 ♂, 1 ♀ (MNHN);  
**Meghalaya state**: Khasis [= Khasi hills, ca. 25°27'N 091°38'E], without date and collector's name, 1 ♂ (MNHN);  
Khasi Hills, 11 km SW Cherrapunjee, Laitkynsew, 25°13'N 091°39'E, 810 m, 21–24.iv.2008, M. Fikáček, H. Podskalská & P. Šípek leg., baited pitfall traps on open area and close to forest, close to Cherrapunjee Holiday Resort, 1 ♂, 1 ♀ (DNA voucher, JRUC);  
**Arunachal Pradesh state**: Mishmi hills, 28°05'N 096°30'E, 18.vii.1928, P. Sladen Expedition, 1 ♀ (BMNH);  
**Nagaland state**: Naga [= Naga hills (see Lin *et al.* 2009: 159), ca. 25°47'N 094°14'E], without date and collector's name, 1 ♂ (MNHN);  
**Manipur state**: Manipur [without more detailed locality, centroid ca. 24°45'N 093°50'E], without date [but before 1905], Doherty leg., ex coll. Fry, 3 ♂♂, 2 ♀♀ (BMNH);  
**Nepal: Gorkha distr.**: Gorkha [ca. 28°00'N 084°38'E], 29.v.–3.vi.1999, A. Kudrna leg., 1 ♂ (SMUL);  
**Kaski distr.**: Dhampus env. [ca. 28°46'N 083°40'E], 2100 m, 8.–10.v.1980, Martens & Ausobsky leg., deciduous forest, 2 ♂♂, 3 ♀♀ (SMFD, SMNS);  
**Kaski distr.**: Fokhara [= Pokhara], Dhampus [ca. 28°18'N 083°50'E], 1650 m, 26.v.1990, G. Sabatinelli leg., 1 ♂ (NHMB);  
**Kathmandu distr.**: Godawari [ca. 27°35'N 085°23'E], 5600 ft. [ca. 1700 m], 24.v.–6.vi.1983, M. J. D. Brendell leg., ex carrion, 6 ♂♂, 6 ♀♀ (BMNH); same data, 2 ♂♂, 1 ♀ (JRUC);  
**Myagdi distr.**: Dhaulagiri, Ghorepani [ca. 28°24'N 083°42'E], 2500 m, 11.vi.1986, Probst leg., 1 ♀ (WBAC);  
**Sankhua Sabha distr.**: Arun valley bottom between Hedangna and Num [ca. 27°34'N 087°18'E], 950–1000 m, 6.–8.vi.1988, J. Martens et W. Schawaller leg., subtropical forest, 6 ♀♀ (SMNS); same data, 2 ♂♂, 1 ♀ (NHMB); same data, 1 ♂, 1 ♀ (FMNH); same data, 3 ♀♀ (MHNG);

Solukhumbu distr.: Himalaya, near Mt. Everest, 2900 m, 1.–20.ix.1999, without collector's name, ex coll. M. Snížek, 1 ♀ (JRUC);

Syangja distr.: Manaslu Mts., Meme Pokhari Lekh, upper Taksar vill. [ca. 28°07'N 083°58'E], 2500–2700 m, 1.ix.1995, J. Schmidt leg., 1 ♂ (BMNH);

Taplejung distr.: Kangchenjunga Himal mts, Chiruwa vill., 27°29'N 087°45'E, 1260 m, 12.–13.vii.2000, J. Schneider leg., 1 ♂, 1 ♀ (JSCC);

**China:** Hainan: Hainan Is. [geographical centre ca. 19°10'N 109°45'E], 10.–25.iii.1909, H. Schoede leg., 1 ♀ (ZMHB); Hainan Is., without date [but before 1899], J. Whitehead leg., 1 ♀ (BMNH); Taiping Shan [waterfall, ca. 18°49'N 109°35'E], 22.v.1986, J. Okuma leg., 1 ♀ (NSMT); Wuzhishan city, Wuzhishan Nature Reserve, 18°54'07.50"N 109°43'15.09"E, 1500–1700 m, 20.iv.2011, Peng & Dai leg., 30 spec. (SHNU, JRUC); Ledong County, Jianfengling Nature Reserve, Mingfenggou, 18°44'N 108°50'E, 950 m, 30.iv.2012, Pan & Li leg., 1 ♀ (SHNU);

Yunnan province: Yunnanfou [= Kunming, ca. 25°03'N 102°42'E], 1917, R. P. J. Souyris leg., ex coll. R. Oberthür, 1 ♂ (MNHN); Puer prefecture, Jinggu Dai and Yi Autonomous county, Mt. Longtan Shan [ca. 22°46'N 101°05'E], 11.–20.vi.2009, without collector's name, 2 ♂♂ (MNIC);

**Laos:** “Laos”, without more precise locality, 1902, Monteil leg., 1 ♂, 1 ♀ (MNHN);

Hua Phan province: Phu Phan Mt., 20°12'N 104°01'E, 1500–1900 m, 17.v.–3.vi.2007, M. Brancucci leg., 2 ♂♂, 1 ♀ (NHMB); Ban Saluei to Phu Phan Mt., 20°12–13.5'N 103°59.5'–104°01'E, 1340–1870 m, 10.v.–16.vi.2009, M. Brancucci & local collectors leg., 20 ♂♂, 16 ♀♀ (NHMB); 4 ♂♂, 4 ♀♀ (JRUC);

Luang Prabang province: Louang Prabang [ca. 19°52'N 102°08'E], 1888, A. Pavie leg., 1 ♂, 1 ♀ (MNHN); Luang Prabang, Nam Khan river, 13.viii.2009, A. Fontraille leg., 1 ♂ (SVAC);

Luang Namtha province: Muang Sing vill. [ca. 21°11'N 101°08'E], 8.–17.iii.2000, P. Kulík leg., 1 ♂ (JSCC); , 10 km E Muang Sing, Bau Ondomsinh, B. Nam Det, B. Nam Mai, 21°09–10'N 101°13–15'E, 750–1400 m, 14.–20.vi.2011, D. Hauck & M. Geiser leg., NHMB Basel Laos 2011 Expedition, 1 ♀ (NHMB);

Phongsaly province: Phongsaly env., 21°41–42'N 102°06–08'E, ca. 1500 m, 28.v.–20.vi.2003, 14 ♂♂, 1 ♀ (NMHB); ditto, 3 ♂♂, 1 ♀ (JRUC);

Sainyabuli province: Ban Houei Sine, 19°01.5'N 101°24.2'E, 580 m, 2.–20.vii.2012, R. Udržal leg., 2 ♂♂, 5 ♀♀ (JRUC);

Xiangkhoang province: Xiangkhoang [ca. 19°12'N 102°42'E], 3.vii.1996, without collector's name, 3 spec. (MNIC);

**Thailand:** Chaiyaphum province: Phu Khieo Wildlife Sanctuary, 16°30'N 101°46'E, 800 m, 2.–4.v.1986, M. G. Allen leg., 2 ♀♀ (BMNH);

Chiang Mai province: Doi Pui [= Doi Suthep-Pui National Park, ca. 18°47'N 098°55'E], 14.v.1985, without collector's name, 1 ♂, 1 ♀ (SMNS); same locality, 7.iv.1986, without collector's name, 1 ♀ (NHMB); same locality, 17.vi.1985, A. M. Cotton leg., 1 ♀ (NHMB); same locality, 7.iv.1986, S. Steinke leg., 3 ♀♀ (SMNS); same locality, 7.iv.1986, A. M. Cotton leg., 1 ♀ (NHMB); same locality, 7.vi.1986, A. M. Cotton leg., 1 ♀ (NHMB); same locality, 1400 m, 2.–3.vi.1995, V. Kubáň leg., 1 ♀ (JSCC); same locality, vii.2006, W. Foster & M. Ellwood leg., 1 ♀ (BMNH); Doi Suthep [= Doi Suthep-Pui National Park, ca. 18°47'N 098°55'E], 24.v.1996, S. Bílý leg., 1 ♀ (JSCC); same locality, 1585 m, 18.x.2002, H. Bänziger leg., 2 ♂♂, 2 ♀♀ (SMNS); Mt. Doi Suthep, 18°48'N 098°54'E, 1100 m, 21.ix.1993, carrion traps, M. Nishikawa leg., 3 ♂♂, 4 ♀♀ (MNIC); Doi Pui–Mt. Doi Suthep, 1300 m, carrion traps, 1.viii.1987, K. Masumoto leg., 5 ♂♂, 4 ♀♀ (MNIC); Doi Pui env., v.1988, without collector's name, 3 ♂♂, 3 ♀♀ (MNIC); Fang [ca. 19°55'N 099°13'E], 10.viii.1985, A.M. Cotton leg., 1 ♀ (NHMB); Chiang Mai [ca. 18°47'N 098°57'E], iv.1988, without collector's name, 1 ♀ (MNIC); Mt. Doi Inthanon [ca. 18°35'N 098°29'E], 2500 m, carrion traps, deciduous forest, ix.1988, Y. Manit leg., 5 ♂♂, 4 ♀♀ (MNIC); same locality, 14.ix.1988, same collector, 1 ♀ (MNIC); same locality, 18°34'N 098°28'E, 31.iii.1989, M. Nishikawa leg., ex walking a tree trunk, streamside, 1 spec. (MNIC);

Chaing Dao [= Chiang Dao mt., ca. 19°23'N 098°54'E], Pa Kia, 1500 m, 6.v.2002, T. Ishikawa leg., 1 ♂, 1 ♀ (NSMT);

Mae Hong Son province: Ban Pha Mon env. [ca. 19°04'N 098°41'E], 23.vi.2006, D. Kovac leg., on dead pig, 1 ♂, 1 ♀ (JRUC);

Nan province: Doi Phu Kha, 14.iv.1936, Deignan leg., 1 ♀ (NMNH); Doi Phu Kha National Park Headq., 19°13'N 101°07'E, 22.–26.iv.1999, D. Hauck leg., 1 ♂, 1 ♀ (JHAC); same data, 1 ♂, 1 ♀ (JRUC);

Tak province: Lansang National Park, 16°48'N 098°57'E, 500 m, 18.–24.iv.1991, D. Král leg., 1 ♀ (JRUC);

Trang province: “Lower Siam”, Trong [= Trang, ca. 07°33'N 099°36'E], i.–iii.1899, W.L. Abbott leg., 2 ♀♀ (NMNH);

“Lower Siam”, Trong [= Trang], Khow Sai Dow [not located], 1000 ft. [ca. 300 m], i.–ii.1899, W.L. Abbott leg., 1 ♂ (NMNH);

**Myanmar**: S Shan states, Möng Hai [ca. 20°41'N 099°48'E], 4000 ft. [ca. 1220 m], 2.v.1937, F. Kingdom Ward [leg.], 2 ♂♂ (BMNH);

Carin Chebà [=Karen hills, region inhabited by Chebà tribe (see Merkl 2007: 266); E of modern Toungoo (see Lin *et al.* 2009: 159), ca. 19°09'N 096°24'E], 900–1100 m, xii.1888, L. Fea leg., 6 ♂♂, 9 ♀♀ (MNHN, ZMHB);

Tanasserim [= Tanintharyi region], Tavoy env. [ca. 14°05'N 098°12'E], v.1994, without collector's name, 2 ♀♀ (NSMT);

Tenasserim [= Tanintharyi region], 31.v.1994, without collector's name, 1 ♀ (MSCC);

Shan State, Taunggyi [ca. 20°44'N 097°03'E], 5.–23.v.2008, without collector's name, 6 ♂♂, 9 ♀♀ (MNIC);

**Vietnam**:

Bac Ninh province: Annam, Phuc-Son [ca. 21°08'N 106°12'E], xi.–xii. [year not given], H. Fruhstorfer leg., 1 ♂ (ZMHB);

Cao Bang province: Tonkin sept., Ha Lang [district, ca. 22°41'N 106°39'E], without date, Lamey leg., 151-97 [probably 1897], [labelled erroneously as “type” of *Silpha bicolor*], 1 ♂ (MNHN);

Quang Thanh, N Pia Oac [ca. 22°37'N 105°51'E], vii.1998, without collector's name, 1 ♂, 1 ♀ (MNIC);

Ha Giang province: near Dong Van [ca. 23°16'N 105°19'E], vii.2005, without collector's name, 1 spec. (MNIC);

Ha Tai province: Mt. Tan Vien [in Ba Vi National Park, ca. 21°03'N 105°21'E], 14.–16.x.1995, H. Kurahashi leg., 1 ♀ (NSMT);

Hoa Binh province: Tonkin, Hoa-Binh [ca. 20°49'N 105°19'E], without date, ex coll. A. Grouvelle, 2 ♀♀ (MNHN);

Tonkin, Hoa-Binh env., 1919, R.P.A. de Cooman leg., 8 ♂♂, 19 ♀♀ (MNHN); ditto, 1926, 1 ♂ (MNHN); ditto, 1928, 1 ♀ (MNHN); ditto, 1929, 1 ♀ (MNHN);

Truong Yen, Ban Xa Lenh [not located], 890 m, 20.vi.1997, H. Kurahashi leg., 1 ♂ (NSMT);

Lam Dong province: Annam, Haut Donai, Agr. Stat. of Blao [ca. 11°32'N 107°48'E], 800 m, 28.iv.1883, M. Poilane leg., 1 ♂ (NMNH);

Lang Son province: Tonkin, Montes Mauson [or Montes Manson] [= Mount Mau Son, ca. 21°52'N 107°00'E], 2000–3000 ft. [ca. 610–915 m], without date, ex coll. H. Rolle, 1 ♀ (MNHN); same data, ex coll. F.A. Eddy, 1 ♂ (FMNH); Tonkin, Montes Mauson, 2000–3000 ft. [ca. 610–915 m], iv.–v. [without year], H. Fruhstorfer leg., 14 ♂♂, 17 ♀♀ (BMNH, NHMW, RMNH, SMFD, SMNS, ZMHB, ZMUC); same locality, iv.–v. [without year], H. Fruhstorfer leg. [det. by G. Portevin as *Eusilpha bicolor*], 2 ♂♂ (SDEI);

Lao Cai province: Ht-Tonkin, Laokay [= Lao Cai, ca. 22°19'N 104°07'E, without more details], ex coll. Le Moul, 1 ♂, 1 ♀ (ZMUH); Tonkin, Lao Ray [= Lao Cai], without date and collector's name, 1 ♀ (MNHN);

Tonkin, Chapa [= Sa-Pa, ca. 22°20'N 103°50'E], 1917, ex coll. A. Grouvelle, 1 ♀ (MNHN);

Nghe An province: Annam sept. [= Annam highlands], Cuarao [= Cua Rao, ca. 19°17'N 104°26'E], 1920, A. Vuillet leg., 1 ♂ (MNHN);

Quang Ninh province: N Tonkin, Ha-Gang [ca. 21°09'N 107°21'E], 1914, Bonifacy leg., 1 ♂ (MNHN);

Son La province: Songma [in cyrillics; ca. 21°03'N 103°45'E], 5.v.1986, Gorokhov leg., 1 ♀ (ZMAS);

Vinh Phuc province: “Haut Tonkin”, Rivière Claire [= Song Lo, ca. 22°13'N 105°09'E], without date, Madon leg., 1 ♀ (IRSNB);

Tam Dao [ca. 21°27'N 105°37'E], iv.–v.1975, Kubát leg., ex coll. A. Olexa, 2 ♂♂ (JSCC); 3.–11.vi.1985, M. Hradský leg., 1 ♀ (JRUC); same locality, 900 m, 16.–23.v.1991, J. Strnad leg., 2 ♂♂, 3 ♀♀ (JSCC); same locality, 950–1100 m, 21.–27.ix.1995, H. Kurahashi leg., 1 ♀ (NSMT); same locality, 21.–27.ix.1995, S. Nomura leg., 1 ♀ (NSMT);

**Cambodia:** “Cambodia” [without more detailed locality], 1920, A. Vuillet leg., ex coll. Vitalis de Salvaza, 1 ♀ (MNHN);

Khett Rotanah Kiri, Phumi Kalai Thum [ca. 13°50'N 106°57'E], 1.–28.vi.2007, without collector's name, 1 spec. (MNIC);

**Not or imprecisely located:** “Himalaya”, without date, Keitel leg., 1 ♀ (ZMHB); “Himalaya”, without date and collector's name, 1 ♂ (ZMUC); “India”, 1864, ex coll. L. M. Oldfield, 1 ♂ (BMNH); “N India, E.I.C.”, without date [but before 1860], 1 ♂ (BMNH); “Capt. Boys”, without date, 1 ♂, 1 ♀ (OUMNH); “Natal” [mislabelled], Inde! [Portevin's handwriting], ex coll. Kraatz, 1 ♀ (SDEI);

*Necrophila (Calosilpha) ioptera* (Kollar et Redtenbacher, 1844) (328 specimens)

**Pakistan:** North West Frontier prov.: Murree [ca. 33°54'N 073°23'E], without date, ex coll. A. Grouvelle, 1 ♂, 2 ♀♀ (MNHN);

Murree hills, Thobba, without date [but before 1926], H. Reberts leg., 1 ♂ (BMNH);

20 km N Murree, Nathiagali, 34°04'N 073°24'E, 2400 m, 9.–11.viii.2000, J. Kaláb leg., 1 ♂ (JSCC);

**India:** Himachal Pradesh state: Kalka [ca. 30°50'N 076°56'E], without date, ex coll. R. Oberthür, 1 ♂ (MNHN);

Himalaya, Kulu [= Kullu, ca. 31°57'N 077°06'E], without date and collector's name, 1 ♂ (NMPC); same data, without date and collector's name, 1 ♂, 1 ♀ (JSCC); same data, 1 ♂, 1 ♀ (ZMAS); same data, ex coll. J. Hlisnikovský, 1 ♂ (MHNG); same data, ex coll. C. Bosch, 1 ♂, 1 ♀ (SMFD); same data, ex coll. Noesske, 26 spec. (SMTD); Kulu [= Kullu], without date, Rost leg., ex coll. B. Schwarzar, 1 ♂ (SMFD); Kooloo [= Kullu], without date, Carleton leg., 1 ♂ (NMPC); same data, ex coll. A. Newton & M. Thayer, 1 ♀ (FMNH); Kulu env. [= Kullu], Katrain [ca. 32°06'N 77°07'E], without date and collector's name, 3 ♂♂, 1 ♀ (NMPC); same data, 2 ♂♂ (JHAC); same data, 1 ♂ 2 ♀♀ (IRSNB); same data, ex coll. C. Bosch, 2 ♀♀ (SMFD); same data, ex coll. M. Pic, 1 ♀ (MNHN); same data, ex coll. Noesske, 5 spec. (SMTD); same data, ex coll. W.H. Mucbe, 42 spec. (SMTD); Kulu [= Kullu], Salandhar, without date, ex coll. E. Grundmann, 1 ♀ (NHMW);

Sabatoo [= Sabathu, ca. 30°58'N 076°58'E], without date, ex coll. A. Grouvelle, 1 ♀ (MNHN);

Dalhousie [ca. 32°31'N 075°58'E], without date [but before 1969], ex coll. C. G. Tottenham, 1 ♂, 2 ♀♀ (BMNH); same locality, 2000 m, without date, 1 ♀ (MNHN);

Simla env. [= Shimla, ca. 31°06'N 077°09'E], 2000–2500 m, without date [but before 1937], ex coll. J. Berlioz, 1 ♂ (MNHN); Simla, without date, ex coll. R. Oberthür, 5 ♂♂, 1 ♀ (ZFMK); same locality, 1887, Harmand leg., 3 ♀♀ (MNHN); same locality, iv.–vii. 1896, ex coll. R. Oberthür, 1 ♂ (MNHN); same locality, 6.viii.1918, G.D. Allen leg., 1 ♀ (OUMNH); Simlah [= Simla], without date [but before 1905], ex coll. Fry, 1 ♀ (BMNH); W Himalaya, Hindustan-Tibet road, Simla, 2200 m, 22.vii.1926, v. d. Sleen leg., 1 ♂ (SMNS);

Solan [ca. 30°55'N 077°07'E] near Simla, Lakhat, 1896, ex coll. R. Oberthür, 3 ♂♂, 4 ♀♀ (MNHN);

W Himalaya, Hindustan-Thibet road, Kachar [not located], 115 miles [ca. 185 km] from Simla, 2200 m, 22.vii.1926, v. d. Sleen leg., 2 ♀♀ (ZMAN);

Uttarakhand state [= Uttaranchal]: Kumaon distr., W Almora division [ca. 29°36'N 079°39'E], vi.1917, H. G. Champion leg., 13 ♂♂, 8 ♀♀ (BMNH);

W Almora division, Nainital [ca. 29°23'N 079°26'E], without date, H. G. Champion leg., 1 ♂ (BMNH); Nainital, without date [but before 1905], Owen leg., ex coll. Fry, 1 ♀ (BMNH);

Nainital env., 1900–2100 m, 19.–21.vi.2003, Z. Kejval & M. Trýzna leg., 4 ♂♂, 4 ♀♀ (JRUC); same data, 2 ♂♂, 2 ♀♀ (JSCC); same data, 15 ♂♂, 16 ♀♀ (MTRC);

Kumaon distr., Ranikhat division [ca. 29°38'N 079°25'E], viii.1920, H. G. Champion leg., 2 ♀♀ (BMNH);

Himalaya, Molta [ca. 30°29'N 079°32'E], 3000 m, 5.v.1956, D. Indien Exp., 23 ♂♂, 28 ♀♀ (ZMUH); same locality, 12.v.1956, 1 ♂, 2 ♀♀ (ZMUH); same locality, 20.v.1956, 2 ♂♂, 3 ♀♀ (ZMUH);



14 km S Rambara, Kedarnath [ca. 30°43'N 079°03'E], 3300 m, 26.–29.vii.1994, M. Snížek leg., 1 ♂, 1 ♀ (JRUC); same data, 1 ♂ (JHAC);  
Uttar Pradesh state: Agra [ca. 27°10'N 078°00'E], without date and collector's name, 1 ♀ (ZMUC); Bareilly [ca. 28°21'N 079°24'E], without date and collector's name, 1 ♂ (BMNH);  
Bihar state: “U. P.” [United Province?], Kolikola [ca. 25°50'N 087°33'E], 10.vi.1915, ex coll. J.J. Gillet, 1 ♂ (IRSNB);  
Sikkim state: “Sikkim” [centroid ca. 27°30'N 088°30'E] without more precise data, 1 ♀ (NHRS);  
West Bengal state: “Bengal”, without more precise data, 1 ♂ (NHRS);  
Meghalaya state: Shillong env. [ca. 25°34'N 091°52'E], 1912, ex coll. R. Oberthür, 1 ♀ (MNHN);  
Assam state: “Assam”, without more precise data, 2 ♀♀ (MNHN); Cachar [= Cachar district, ca. 25°00'N 093°00'E], without date and collector's name, 1 ♂ (ZMHB);  
**Nepal**: “Nepal” [without more detailed locality], Hardwicke leg., 4 ♂♂, 2 ♀♀ (BMNH);  
Jumla distr.: Garjigoth [close to Jumla, which is ca. 29°16'N 082°09'E], 8000–12000 ft. [ca. 2440–3660 m], 8.viii.1952, 1952 Botanical Expedition to Nepal, 2 ♂♂, 1 ♀ (BMNH);  
Mugu distr.: Karnali Zone, Rara lake [ca. 29°32'N 082°05'E], 3000 m, 27.–29.vi.1995, Ahrens & Pommeranz leg., 3 ♂♂, 5 ♀♀ (SMTD); same data, 2 spec. (SMNS);  
Bahjang distr.: Seti Zone, 34 km NE Chainpur, Ghatganga Khola near Sapdule Dobhan [ca. 29°46'N 081°25'E], way to vic. Shima, 2300–2900 m, 25.vi.2009, E. Sprecher leg., 1 ♂, 1 ♀ (NHMB);  
**China**: Xizang Autonomous Region: “Thibet”, without date, Melly leg., 1 ♂ (NHRS);  
**Not or imprecisely located**: “India”, Dhor [or Dnoon, illegible], without date and collector's name, 1 ♂ (MNHN); “Caschmir” [= Kashmir], without date, Kollar leg., 3 ♂♂, 1 ♀ (ZMHB); “Himalaya”, without date and collector's name, 2 ♂♂, 3 ♀♀ (ZMHB); “Himalayas”, without date [but before 1929], ex coll. Osmaston, 4 ♀♀ (OUMNH); “Himalaya”, without date and collector's name, 2 ♂♂ (SDEI); “India”, without date and collector's name, 1 ♂ (OUMNH); “India or.”, without date and collector's name, 1 ♂ (NHMB); “Cahar., Bowring [leg.], 63.47\*”, 1 ♂ (BMNH); “India, 60.15, E.I.C.”, 1 ♀ (BMNH); “India Orient., 9920”, without date [but before 1905], ex coll. Fry, 1 ♂ (BMNH); “12.977 E. India”, without date [but before 1880], ex coll. J.W. Miers, 1 ♀ (OUMNH); “Capt. Boys”, without date, 3 ♂♂, 2 ♀♀ (OUMNH); “Sahrne”, without date and collector's name, 1 ♂ (OUMNH); “India, Hearsey”, without date, 1 ♂ (OUMNH); “Ostindien”, without date, ex coll. G. Schneider, 1 ♀ (NHMB); “Indes”, without date, Cap. Boys [leg.], 1 ♀ (MHNG); “coll. Melly”, without locality and date, 1 ♀ (MHNG); “Ostindien”, without date, coll. Kraatz, 2 ♀♀ (SDEI); “Natal” [mislabelled], Inde! [Portevin's handwriting], ex coll. Kraatz, 1 ♂ (SDEI); “Natal” [mislabelled], without date, coll. Kraatz, Portevin det., 1 ♀ (SDEI);

**Appendix 2.** List of published precise localities of *Necrophila (Calosilpha)* spp. (used in distribution maps, different from localities in material examined in Appendix 1).

***Necrophila (Calosilpha) brunnicollis (Kraatz, 1877)***

**China**: Heilongjiang, near Harbin, Cheng Ching [= Qingan, ca. 47°00'N 127°35'E] (Nishikawa 2014)

**Japan**: Hokkaido: Rebun-tô Is. [ca. 45°18'N 141°02'E] (Kusakari 1992)

Hokkaido: Abashiri-shichô: Iwaobetsu [ca. 44°07'N 145°05'E] (Nishikawa 2014)

Honshu: Chiba prefecture: Ichikawa [ca. 35°44'N 139°55'E] (Nishikawa 2014)

Honshu: Hyogo prefecture: Hara-chô [35°33'N 134°34'E] (Nishikawa 2014)

Honshu: Hyogo prefecture: Kawanishi city, Sasabe [34°54'N 135°25'E] (Nishikawa 2014)

Honshu: Hyogo prefecture: Kôbe city, Mt. Rokko [summit 34°46'N 135°15'E] (Nishikawa 2014)

Honshu: Hyogo prefecture: Kôbe city, Mt. Mayasan [34°44'N 135°12'E] (Nishikawa 2014)

Honshu: Hyogo prefecture: Kôbe city, Mikage [34°44'N 135°15'E] (Nishikawa 2014)

Honshu: Hyogo prefecture: Kôbe city, Chuô-ku, Shiroyama-tenbô kôen Park [34°42'N 135°11'E] (Nishikawa 2014)

Honshu: Hyogo prefecture: Kôbe city, Karasubara [34°42'N 135°09'E] (Nishikawa 2014)

Honshu: Iwate prefecture: Karumai-gun [ca. 40°20'N 141°27'E] (Nishikawa 2014)  
Honshu: Mie prefecture: Ôdaigahara, Ôsugi [ca. 34°13'N 136°09'E] (Nishikawa 2014)  
Honshu: Nagano prefecture, Minamiminowa [ca. 35°52'N 137°58'E] (Siddiquee & Nakamura 2005)  
Honshu: Nagano prefecture, E of Mt. Kiso-komagatake, Nishikoma station [ca. 35°50'N 137°52'E] (Nakayama *et al.* 2009)  
Honshu: Nara prefecture: Nara-kôen Park [ca. 34°41'N 135°55'E] (Nishikawa 2014)  
Honshu: Nara prefecture: Nara-kôen Park, Mioken [34°41'N 135°52'E] (Nishikawa 2014)  
Honshu: Nara prefecture: Nara-kôen Park, Mt. Akahada, Akahada-machino-oka [34°41'N 135°46'E] (Nishikawa 2014)  
Honshu: Nara prefecture: Nara city, Kasugayama, Jigokudani-Shiniike [34°40'N 135°52'E] (Nishikawa 2014)  
Honshu: Nara prefecture: Ikoma-gun, Heguri-chô, Yoshishin [34°38'N 135°42'E], 70 m (Nishikawa 2014)  
Honshu: Nara prefecture: Gose city, Mt. Kongôzan, Ichinotorii–Mizuhikidani–Koseguchi [summit 34°25'N 135°40'E] (Nishikawa 2014)  
Honshu: Nara prefecture: Yoshino-gun, Tenkawa-mura, Dorogawa [34°16'N 135°53'E] (Nishikawa 2014)  
Honshu: Nara prefecture: Kawai–Dorogawa [34°16'N 135°53'E] (Nishikawa 2014)  
Honshu: Nara prefecture: Dorogawa, Goyomatsujaya [summit 34°16'N 135°54'E] (Nishikawa 2014)  
Honshu: Nara prefecture: Oku-kôya, Mt. Taterikôjin [34°09'N 135°39'E] (Nishikawa 2014)  
Honshu: Nara prefecture: Yoshino-gun, Nosegawa-mura, Riv. Kawarabi-gawa, Shimo-dani [34°06'N 135°37'E], 730 m, ex bird droppings (Nishikawa 2014)  
Honshu: Kanagawa prefecture: W of Yokohama [ca. 35°31'N 139°30'E] (Itoh & Aoki 1983)  
Honshu: Kyoto city, Kibune [35°07'N 135°46'E] (Nishikawa 2014)  
Honshu: Kyoto city, Yuya [34°56'N 135°32'E] (Nishikawa 2014)  
Honshu: Osaka prefecture: Nose-chô, Mt. Myômisán [34°56'N 135°28'E] (Nishikawa 2014)  
Honshu: Osaka prefecture: Minô city, Minô-gawa dam [34°52'N 135°29'E], chicken carcass trap (Nishikawa 2014)  
Honshu: Osaka prefecture: Hirakata city, Son'enji [34°48'N 135°44'E], carrion trap (Nishikawa 2014)  
Honshu: Osaka prefecture: Higashiosaka city, Hiraoka park [34°40'N 135°39'E], near Toyoura, ex. mole carcass (Nishikawa 2014)  
Honshu: Osaka prefecture: Ikoma-gun, Sangô-chô, Tatsuta-jinja [34°36'N 135°41'E], 70 m, grassland in grove, carrion trap (Nishikawa 2014)  
Honshu: Osaka prefecture: Minamikawachi-gun, Taishi-chô, Kôtokuten'nô-ryô [34°31'N 135°39'E], syrup trap (Nishikawa 2014)  
Honshu: Osaka prefecture: Kawachinagano city, Amanosan [34°26'N 135°32'E], 200 m, bait trap (Nishikawa 2014)  
Honshu: Osaka prefecture: Kawachinagano city, Amami, Bôdani, Tori-jigoku, [34°24'N 135°38'E], ex carcass (Nishikawa 2014)  
Honshu: Osaka prefecture: Kawachinagano city, Mt. Iwawakisan [summit 34°22'N 135°33'E] (Nishikawa 2014)  
Honshu: Osaka prefecture: Kaizuka city, SW of Sobura, in Japanese cedar plantation [34°22'N 135°25'E] (Nishikawa 2014)  
Honshu: Osaka prefecture: Izumisano city, Inunaki [34°20'N 135°23'E] (Nishikawa 2014)  
Honshu: Shiga prefecture: Higashiasai-gun, Biwa-chô, Chikubushima Is. on Lake Biwa-ko [35°25'N 136°09'E] (Nishikawa 2014)  
Honshu: Shiga prefecture: Ômihachiman-shi, Miyagahama [35°11'N 136°05'E], 85 m (Nishikawa 2014)  
Honshu: Shiga prefecture: Yôkaichi-shi, Mikabe-jinja, Aichi-gawa River [35°07'N 136°13'E], 134 m, carrion trap (Nishikawa 2014)  
Honshu: Shiga prefecture: Kôka-gun, Kôsei-chô, Mikumo, Yasu-kawa Riv., Yokota Bridge [34°59'N 136°07'E], 150 m, carrion trap, farm (Nishikawa 2014)  
Honshu: Shizuoka prefecture: Shizuoka [34°58'N 138°23'E] (Ikeda *et al.* 2008)  
Honshu: Shizuoka prefecture: Senzu [35°06'N 138°08'E] (Nishikawa 2014)

Honshu: Tokyo metropolitan area, Mitaka [ca. 35°41'N 139°32'E] (Taniwaki *et al.* 2005)

Honshu: Tottori prefecture: Tottori city, Tsuyudani, Ketaka [35°30'N 133°59'E] (Nishikawa 2014)

Honshu: Tottori prefecture: Iwami-gun, Kokufu-chô, Kokufu Amedaki [35°29'N 134°23'E] (Nishikawa 2014)

Honshu: Tottori prefecture: Mt. Daisen [summit 35°22'N 133°33'E] (Nishikawa 2014)

Honshu: Wakayama prefecture: Hashimoto city, Kimi-tôge [34°23'N 135°36'E] (Nishikawa 2014)

Honshu: Wakayama prefecture: Wakayama city, Takurazaki-kaigan, Kada [34°16'N 135°04'E] (Nishikawa 2014)

Honshu: Wakayama prefecture: Kôya-chô, Mt. Kôya [34°13'N 135°35'E] (Nishikawa 2014)

Honshu: Wakayama prefecture: Kinokawa city, Kuratani [34°04'N 135°26'E] (Nishikawa 2014)

Honshu: Wakayama prefecture: Tanabe city, Mt. Gomadan [34°03'N 135°34'E] (Nishikawa 2014)

Honshu: Wakayama prefecture: Higashimuro-gun, Mt. Ohtô-san, Ôsugi-dani [33°46'N 135°41'E], ex carcass of tiger keelback (*Rhabdophis tigrinus*) on road (Nishikawa 2014)

Honshu: Yamanashi prefecture: En'nô-chô, Mt. Hôdzan, Gozaishi-kôsen [35°43'N 138°20'E] (Nishikawa 2014)

Shikoku: Kochi prefecture: Motoyama-chô, Mt. Shiragayama, Namekawa [33°49'N 133°36'E], 850 m (Nishikawa 2014)

Shikoku: Kochi prefecture: Tosayama-mura, Mt. Kushi [33°38'N 133°32'E] (Nishikawa 2014)

Shikoku: Kochi prefecture: Kochi city, Kera [33°33'N 133°36'E] (Nishikawa 2014)

Shikoku: Kochi prefecture: Niyodogawa-chô, Niyodo Val., Cyoza [33°30'N 133°07'E] (Nishikawa 2014)

Shikoku: Tokushima prefecture: Mt. Tsurugi [33°51'N 134°06'E] (Nishikawa 2014)

Shikoku: Tokushima prefecture: Naka-gun, Kisawa-son, Sakashû, Mukae [33°50'N 134°18'E], 300 m (Nishikawa 2014)

Kyushu: Nagasaki prefecture: Tsushima Is., Sasuna [34°38'N 129°24'E] (Nishikawa 2014)

Kyushu: Nagasaki prefecture: Tsushima Is., Shimoagata-gun, Mt. Ariakeyama [summit 34°12'N 129°16'E] (Nishikawa 2014)

Ryukyu Islands: Amami-Oshima Is., Nishinakama [ca. 28°16'N 129°25'E] (Nishikawa 1986, as *C. kurosawai*)

Ryukyu Islands: Amami-Oshima Island (Ikeda *et al.* 2008, as *N. kurosawai*)

Ryukyu Islands: Amami-Oshima Is., Yamato-son [28°21'N 129°24'E] (Nishikawa 2014)

Ryukyu Islands: Amami-Oshima Is., Naze city, E of Asato Pass [28°21'N 129°31'E], 320 m, chicken trap (Nishikawa 2014)

Ryukyu Islands: Amami-Oshima Is., Ôshima-gun, Uken-mura, S slope of Mt. Yuwan [28°17'N 129°19'E], ex snake carcass (*Ophedrya semicarinatus*) (Nishikawa 2014)

Ryukyu Islands: Amami-Oshima Is., Sumiyô-mura, Nishinakama [28°16'N 129°24'E], ex carcass of lance-head snake (*Protobothrops flavoviridis*) (Nishikawa 2014)

Ryukyu Islands: Okinawa Island: On'na-son, Afuso [ca. 26°30'N 127°53'E] (Nishikawa 1994, as *C. kurosawai*)

Ryukyu Islands: Okinawa Is.: Nago-shi [ca. 26°35'N 127°58'E] (Nishikawa 1994, as *C. kurosawai*)

Ryukyu Islands: Okinawa Is., Hedo-misaki [26°52'N 128°16'E] (Nishikawa 2014)

Ryukyu Islands: Okinawa Is., Kunigami-gun, Kunigami-son, Yona, around Ryukyu Univ. Forest [26°46'N 128°12'E], 20 m, chicken carcass trap (Nishikawa 2014)

**Korea: Gyeonggi-do province:** Seoul-shi, Mt. Dobongsan [ca. 37°42'N 127°01'E] (Cho & Ahn 2001)

Yangpyung-gun, Mt. Yongmunsan [ca. 37°34'N 127°33'E] (Cho & Ahn 2001)

Yangju-gun, Bogwangsa temple [ca. 37°45'N 126°55'E] (Cho & Ahn 2001)

Gapyung-gun, Myungjisan [ca. 37°54'N 127°28'E] (Cho & Ahn 2001)

**Gangwon-do province:** Pyeongchang-gun, Mt. Odaesan [ca. 37°48'N 128°32'E] (Cho & Ahn 2001)

Taebaek-shi, Mt. Taebaeksan [ca. 37°05'N 128°55'E] (Cho & Ahn 2001)

Inje-gun, Mt. Seolaksan [= Mt. Seoraksan, ca. 38°07'N 128°27'E] (Cho & Ahn 2001)

Jeongseon-gun, Mt. Gariwangsan [ca. 37°28'N 128°34'E] (Cho & Ahn 2001)

Donghae-shi, Mt. Dutasan [ca. 37°27'N 128°59'E] (Cho & Ahn 2001)

**Chungcheongnam-do province:** Mt. Kyeryongsan [=Gyeryongsan, ca. 36°20'N 127°12'E], Donghaksa temple (Cho & Ahn 2001)

Kumsan-gun, Mt. Seodaesan [ca. 36°14'N 127°31'E] (Cho & Ahn 2001)  
Taejon-shi, Sutonggol [not located] (Cho & Ahn 2001)  
Jeollabuk-do province: Muju-gun, Mt. Deokyusan [ca. 35°51'N 127°45'E] (Cho & Ahn 2001)  
Gochang-gun, Mt. Kyungsusan [not located] (Cho & Ahn 2001)  
Wanju-gun, Mt. Unjangan [ca. 35°55'N 127°21'E] (Cho & Ahn 2001)  
Jeollanam-do province: Gurye-gun, Mt. Jirisan, Piagol [not located] (Cho & Ahn 2001)  
Younggwang-gun, Mt. Taechongsan [not located] (Cho & Ahn 2001)  
Jangseong-gun, Mt. Taechongsan [ca. 35°16'N 126°36'E] (Cho & Ahn 2001)  
Seungju-gun, Mt. Jokyesan [not located] (Cho & Ahn 2001)  
Sinan-gun, Uido Island [ca. 34°50'N 126°06'E] (Cho & Ahn 2001)  
Gyeongsangbuk-do province: Chongsong-gun, Mt. Juwangsang [not located] (Cho & Ahn 2001)  
Youngju-shi, Mt. Sobaeksan [ca. 36°57'N 128°29'E] (Cho & Ahn 2001)  
Andong-shi, Yean-myun [not located] (Cho & Ahn 2001)  
Kimchon-shi, Mt. Hwangaksan [ca. 36°07'N 127°58'E] (Cho & Ahn 2001)  
Youngdeok-gun, Mt. Badaesan [not located] (Cho & Ahn 2001)  
Uisong-gun, Mt. Seonamsan [not located] (Cho & Ahn 2001)  
Kyungsan-shi, Mt. Palgongsan [ca. 36°01'N 128°41'E] (Cho & Ahn 2001)  
Ulleung-do Is., Mt. Seonginbong [ca. 37°00'N 130°00'E], 984 m (Nishikawa, 2007b)  
Gyeongsangnam-do province: Hapchon-gun, Mt. Kayasan [not located] (Cho & Ahn 2001)  
Sanchong-gun, Jungsan-ri, Mt. Jirisan [ca. 35°20'N 127°43'E] (Cho & Ahn 2001)  
Geojedo [Island], Mt. Daegumsan [= Taegumsan, ca. 34°57'N 128°42'E] (Cho & Ahn 2001)  
Jeju-do province: Seongpanak [ca. 33°23'N 126°37'E] (Cho & Ahn 2001)  
Jeju-do Is., Jeju-si, Mt. Hanra [= Mt. Hallasan, 33°21'N 126°31'E] (Nishikawa 2014)  
**Russia**: Primorskaya oblast: Khasan distr., Kedrovaya Pad Nat. Res. [43°05'N 131°33'E], 100 m, forest, bait traps (Nishikawa 2014);

***Necrophila (Calosilpha) cyaneocephala (Portevin, 1914)***

**Taiwan**: Nantou county: Hori [= Puli, ca. 24°00'N 120°57'E] (Nishikawa 2014);  
Nantou county: Musha [= Wushe, 24°01'N 121°07'E] (Nishikawa 2014);  
Xinzhu [=Hsinchu] county: Zhudong [ca. 24°44'N 121°05'E] (Nishikawa 2014);

***Necrophila (Calosilpha) cyaniventris (Motschulsky, 1870)***

**India**: Punjab state: Patiala [ca. 30°19'N 076°23'E] (Bharti & Singh 2003)

***Necrophila (Calosilpha) ioptera (Kollar & Redtenbacher, 1844)***

**Nepal**: Jumla distr., 2 km W Gothichaur [ca. 29°11'N 082°17'E] (Schawaller 2003)  
Jumla distr., Rara lake [ca. 29°30'N 082°05'E] (Schawaller 2003)