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## Taxonomic changes in the genus *Diabrotica* Chevrolat (Coleoptera: Chrysomelidae: Galerucinae): results of a synopsis of North and Central America *Diabrotica* species

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## Taxonomic changes in the genus *Diabrotica* Chevrolat (Coleoptera: Chrysomelidae: Galerucinae): results of a synopsis of North and Central America *Diabrotica* species

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### Abstract

The following new synonyms in *Diabrotica* Chevrolat 1836 are proposed: *D. flaviventris* Jacoby 1887 and *D. tibialis* Jacoby 1887 are synonyms of *D. adelpha* Harold 1875; *D. peckii* Bowditch 1911 is a synonym of *D. bioculata* Bowditch 1911; *D. nummularis* Harold 1877 is a synonym of *D. circulata* Harold 1875; *D. linensis* Bechyné 1956 is a synonym of *D. trifurcata* Jacoby 1887; *D. brunneosignata* Jacoby 1887 is a synonym of *D. sinuata* Olivier 1790; *D. duplicata* Jacoby 1887 is a synonym of *D. viridifasciata* Jacoby 1887. *Diabrotica cyaneomaculata* Jacoby 1887 does not share the synapomorphies of *Diabrotica* and is treated as *incertae sedis*. *Diabrotica tripunctata* (Fabricius) is removed from synonymy with *D. sinuata* Olivier and is considered to be a valid species. The original combination is restored for *Diabrotica fasciata* Kirsch, the species being transferred from *Paranapiacaba* Bechyné back to *Diabrotica*. It was found that the type series of *D. godmani* Jacoby contains seven different taxa: one is *D. godmani* itself; one is *D. championi* Jacoby; one is *D. quadricollis* Jacoby; three are unidentified *Diabrotica* species, each different from the others; and one is not a *Diabrotica*. The type series of *D. viridicollis* Jacoby contains four different taxa, *D. viridicollis* Jacoby itself and three different unidentified *Diabrotica* species.

**Key words:** *Diabrotica*, new synonyms, lectotypes

### Introduction

*Diabrotica* Chevrolat, 1836 [type species *Diabrotica fucata* (Fabricius 1787) designated by Barber (1947)] with over 400 described species is one of the most speciose leaf beetle genera in the New World. Many *Diabrotica* species feed on flowers, leaves and roots of a wide variety of herbaceous plants, including agricultural crops, vegetables, fruits and ornamentals, and they are vectors of viral and other lethal plant diseases. For example, a single species, *D. virgifera* LeConte, costs approximately one billion dollars to the US economy annually (Burchett 2001). This makes *Diabrotica* one of the most economically important genera of leaf beetles. However, species identification in *Diabrotica* remains a problem because of a lack of modern treatments and keys (excluding a key for the *virgifera* species group [Krysan and Smith 1987]). Therefore, a project was launched to provide a synopsis of North and Central American *Diabrotica* and prepare a richly illustrated, morphologically based, interactive key to species.

The study focused on documenting the type specimens of all 123 *Diabrotica* species and subspecies known from North and Central America (Smith and Lawrence 1967). As a result, we found several new synonyms, new combinations, a need to restore an original combination, revised species status, discrepancies in the type specimen gender attribution, and identifications that are the subject of this paper.

Study of the type specimens also revealed some extreme cases of misidentification in the type series. For example, the type series of *D. godmani* Jacoby contains seven different taxa: one is *D. godmani* itself, one is *D. championi* Jacoby; one is *D. quadricollis* Jacoby; one is not a *Diabrotica*; and three different unidentified *Diabrotica* species. The type series of *D. viridicollis* Jacoby contained four different taxa, *D. viridicollis* Jacoby itself and three different unidentified *Diabrotica* species.

Altogether, considering new synonyms proposed in this paper and new species that will be published separately, we recognized 112 valid *Diabrotica* species in the region under consideration.

## Material and methods

Specimen observations and preparation follow Konstantinov (1998). Specimens were examined from the following collections:

ANSP	Academy of Natural Sciences, Philadelphia, USA
BMNH	Natural History Museum, London, United Kingdom (M. V. L. Barclay)
ESUH	Entomologischen Sammlungen des Institutes für Biologie/Zoologie der Martin-Luther-Universität Halle-Wittenberg, Halle, Germany (K. Schneider)
FMNH-UH	Finnish Museum of Natural History, University of Helsinki, Helsinki, Finland (H. Viljanen)
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, MA, USA (P. D. Perkins)
MfN	Museum für Naturkunde, Berlin, Germany (J. Frisch)
MNHN	Muséum national d'Histoire naturelle, Paris, France (A. Mantilleri)
MTD	Museum für Tierkunde, Senckenberg Naturhistorische Sammlungen, Dresden, Germany (O. Jäger)
NMB	Naturhistorisches Museum Basel, Sammlung Frey, Basel, Switzerland (E. Sprecher-Uebersax)
SDEI	Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany (L. Zerche, L. Behne)
USNM	National Museum of Natural History, Smithsonian Institution, Washington DC, USA (A. Konstantinov)
ZMUC	Zoological Museum, Natural History Museum of Denmark, University of Copenhagen, Denmark (A. Solodovnikov)

This study is based on investigation of all available type specimens of all 123 *Diabrotica* species and subspecies known from North and Central America (Smith and Lawrence 1967). The type specimens were documented and illustrated, their aedeagi were extracted, and internal sacs of the aedeagi were examined, except for a few instances where the only available type specimens were females. Label data are cited as verbatim, each label is numbered, and the format of citation follows Smith and Lawrence (1967). Many of the type series in *Diabrotica* were established by the authors of the species names, who did not designate holotypes and did not specify the number of studied specimens (e.g. Jacoby 1887). Smith and Lawrence (1967) interpreted the original descriptions, compared them to available syntypic series and designated lectotypes and paralectotypes. In our study, particularly for species in question, discussed in this paper, we checked all the original descriptions and lectotype designations to make sure they were done properly.

## New synonyms

### *Diabrotica adelpha* Harold 1875

(Figs 1–15)

*adelpha* Harold 1875: 92 (type locality: Guatemala; type depository: MNHN, lectotype, female, designated by Smith and Lawrence 1967: 30).

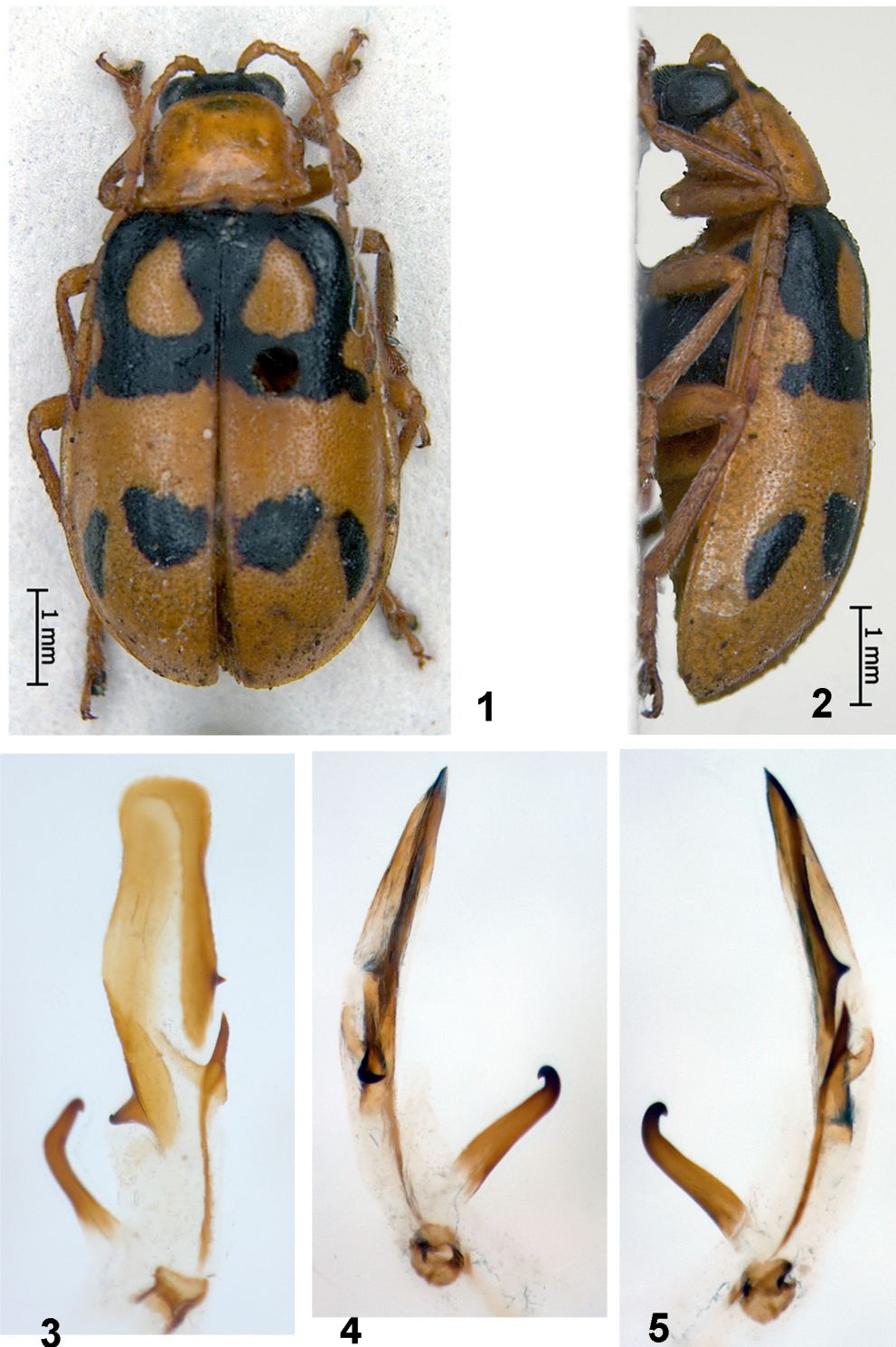
*flaviventris* Jacoby 1887: 517 (type locality: Mexico, San Juan Bautista; type depository: BMNH, lectotype, female, designated by Smith and Lawrence 1967: 67). **New synonym**

*picticornis* Horn 1893: 90 (type locality: Texas, USA; type depository: ANSP, holotype, female), synonym of *Diabrotica tibialis* Jacoby (Smith 1966).

*tibialis* Jacoby 1887: 512 (type locality: Mexico, Jalapa; type depository: BMNH, lectotype, female, designated by Smith and Lawrence 1967: 132). **New synonym**

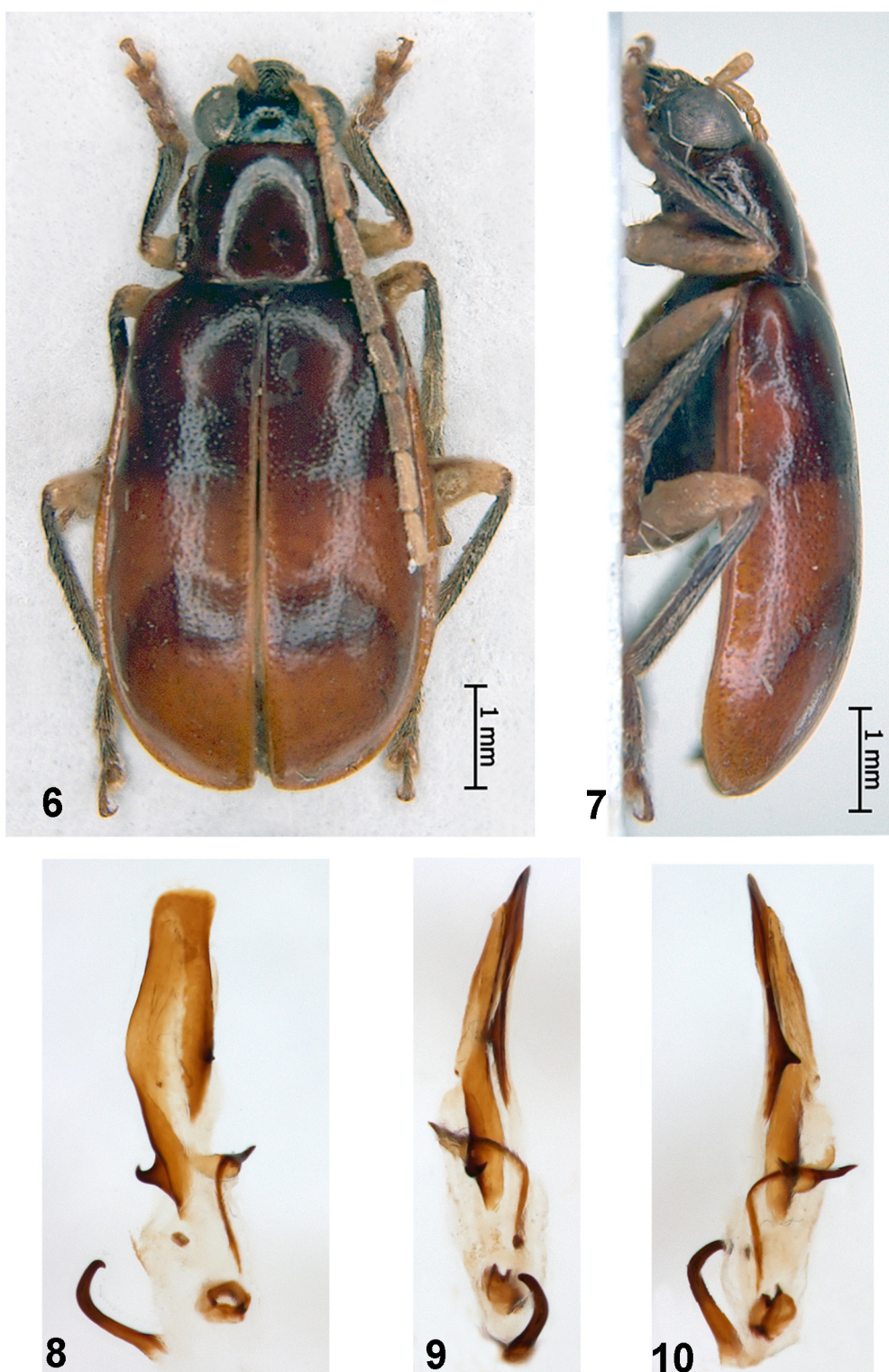
**Material examined.** *Diabrotica adelpha*: Lectotype female (MNHN): 1) [Guatemala]; 2) [*adelpha* m. typ.]; 3) [Ex Musaeo E. Harold]; 4) [Lectotype *Diabrotica adelpha* Harold]. 1 male (MNHN): 1) [*Diabrotica adelpha* Harold]; 2) [Ex Musaeo Quedenfeldt]. 1 male (USNM): [on Cucurbits Antigua Guat. 16-VI-50 I E Melhus]. 1 male

(USNM): [on corn Antigua Guat. 16-VI-50 I E Melhus]. 1 female (USNM): [on corn Antigua Guat. 15-VI-50 I E Melhus]. 1 male (USNM): 1) [on cucumber Antigua Guat. I E Melhus 19-VI-50-8547]; 2) [USNM]. 1 male and 1 female (USNM): 1) [Honduras: EAP, 30 km E Tegucigalpa 7-III-1979 Coll. Jamie Inashima]; 2) [ex frijoles]; 3) [madurez fisiologico]; 4) [*Diabrotica adelpha* Harold Det. J. Krysan 1995]. 3 females (USNM): 1) [Sig. Hond 10-5-79 № 19536 Coll. M. Paz Z.]; 2) [*Diabrotica adelpha* Harold Det. J. Krysan 1995].



**FIGURES 1–5.** *Diabrotica adelpha* Harold. 1—dorsal view, lectotype, 2—lateral view, lectotype, 3—internal sac of the aedeagus, ventral view, 4—lateral view, left, 5—lateral view, right.

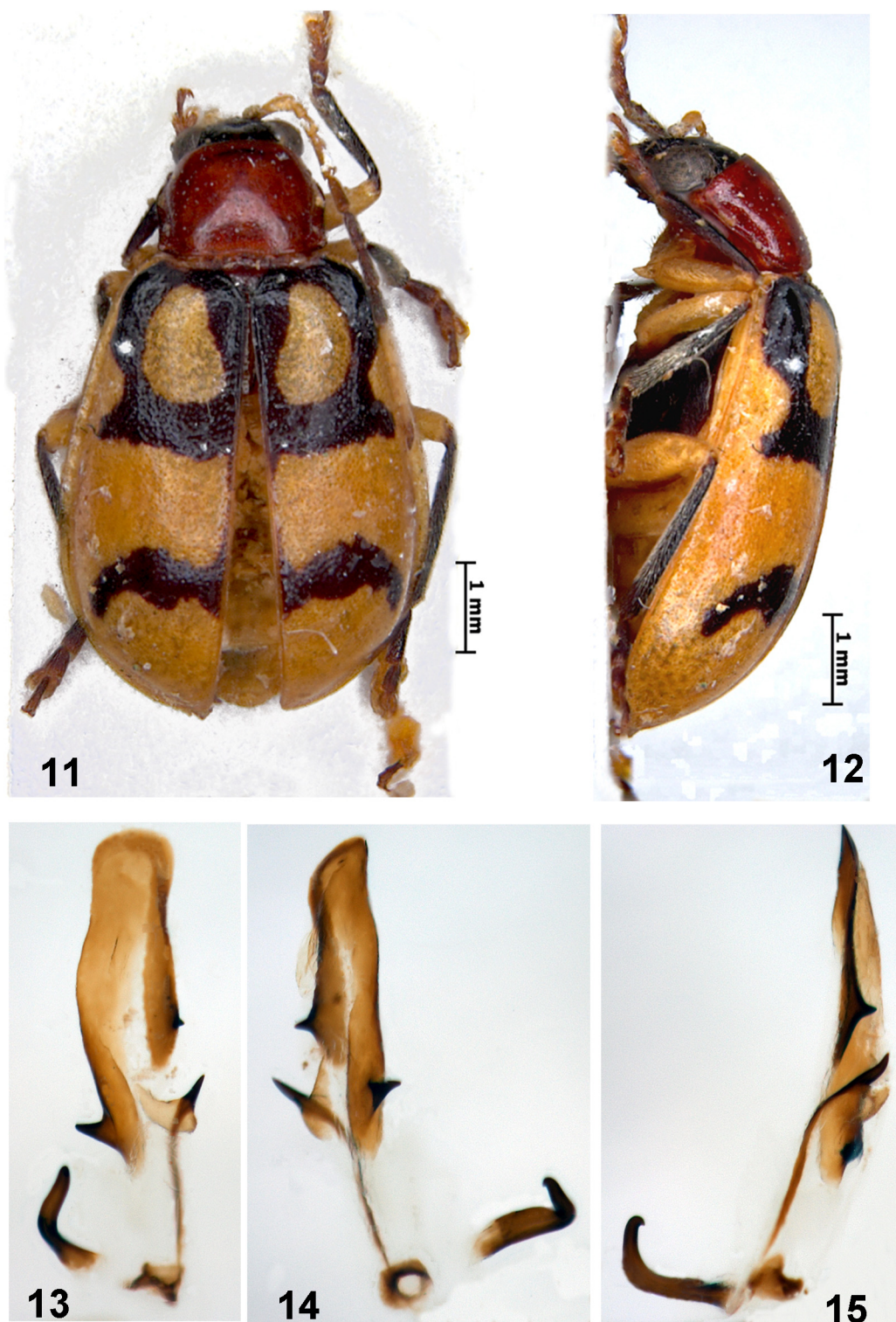




**FIGURES 6–10.** *Diabrotica flaviventris* Jacoby. 6—dorsal view, lectotype, 7—lateral view, lectotype, 8—internal sac of the aedeagus, ventral view, 9—lateral view, left, 10—lateral view, right.

*Diabrotica flaviventris*: Lectotype female (BMNH): 1) [type]; 2) [San Juan Bautista, Tabasco. Höge]; 3) [Godman-Salvin Coll., Biol. Centr.-Amer.]; 4) [Lectotype *Diabrotica flaviventris* Jac RFS]. Seven paralectotypes with same labels as lectotype (BMNH), 4 males (genitalia dissected), 3 females. Twelve specimens (MCZ): 5 paralectotypes: [Teleman, Vera Paz, Champion] (1 male, 1 female), [Panzos, Vera Paz, Champion] (1 male), [Tlalcotalpam, Mex. Salle coll.] (1 female), [Tlalcotalpam, Vera Cruz, Höge] (1 female); 4 males and 3 females.

One male (USNM): 1) [177]; 2) [Tuxiepec Oax. Mex. Oct. 1933 Moises Fraire]; 3) [Lectotype Homoparatype *Diabrotica flaviventris* Jac MCZ Det. J. Krysan'95]. One female (USNM): 1) [241]; 2) [241.] 3) [Tuxiepec Oax. Mex. Oct. 1933 Moises Fraire]; 3) [Homoparalectotype *Diabrotica flaviventris* Jac MCZ Det. J. Krysan'95].



**FIGURES 11–15.** *Diabrotica tibialis* Jacoby. 11—dorsal view, lectotype, 12—lateral view, lectotype, 13—internal sac of the aedeagus, ventral view, 14—lateral view, left, 15—lateral view, right.

*Diabrotica tibialis*: Lectotype female (BMNH): 1) [lectotype]; 2) [Jalapa, Mexico. Hoege.]; 3) [Godman-Salvin Coll., Biol. Centr.-Amer.]; 4) [Type. Sp. figured.]; [*D. tibialis*, Jac.]; 5) [Lectotype *Diabrotica tibialis* Jac. R.F.S.]. Paralectotypes 2 males, 1 female (BMNH): 1) [paralectotype]; 2) [Jalapa, Mexico. Hoege.]; 3) [Godman-



Salvin Coll., Biol. Centr.-Amer.]; 4) [Lectoparatype *Diabrotica tibialis* Jac RFS]. Paralectotype male (MCZ): 1) [Type 17624]; 2) [Jalapa, Mexico. Hoege.]; 3) [*tibialis* Jac]; 4) [1st Jacoby Coll.]; 5) [Lectoparatype *Diabrotica tibialis* Jac]. Paralectotypes 1 male, 3 females (MCZ): 1) [Jalapa, Mexico. Hoege.]; 2) [1st Jacoby Coll.]; 3) [Lectoparatype *Diabrotica tibialis* Jac]. Paralectotypes 2 females (MCZ): 1) [Colima city. Mexico. Höge.]; 2) [1st Jacoby Coll.]; 3) [Lectoparatype *Diabrotica tibialis* Jac].

Smith and Lawrence (1967) recognized the only specimen (female) of *D. adelpha* in the Allard collection in the MNHN as a part of Harold's original series. They designated it as the lectotype. The male in the Allard collection (MNHN), bearing labels (1) [*Diabrotica adelpha* Harold] handwritten and (2) [Ex Musaeo Quedenfeldt] white, printed, is morphologically identical with the lectotype, except for gender-specific characters. We treat it as the male of *D. adelpha* and examined its genitalia (Figs 3–5). Male genitalia have been examined in six paralectotype males of *D. flaviventris* and 4 paralectotype males of *D. tibialis* (BMNH and MCZ). Male genitalia of additional specimens of all three taxa in the USNM collection have been examined as well. The armament of the internal sac of the aedeagus is identical in all three taxa. In addition, they are very similar in the coloration patterns. Jacoby (1887: 511) wrote: “This [*D. adelpha*] and several of the following species [*D. tibialis*, *D. brunneosignata*, etc.] are extremely closely allied, their characters of distinction being slight and variable”. The only two substantial differences in coloration between the lectotype females of *D. adelpha* and *D. tibialis* are as follow: in *D. adelpha*, the pronotum and tibiae are yellow or yellow ocher (Fig. 2); in *D. tibialis*, the pronotum is testaceous, while the tibiae are black or chestnut (Fig. 11). After studying large series of these two taxa, we recognized a few transitional coloration patterns of the tibiae from uniformly yellow through bicolored (yellow, outer edge with piceous or testaceous line, sometimes extensively darkened) to uniformly black or chestnut. The outlines of the elytral bands of all three taxa are very similar as well. *Diabrotica flaviventris* with almost entirely testaceous elytra, is probably a melanistic color morph of *D. adelpha*. No substantial differences exist in the body size or shape of all three species. Therefore, we treat *D. tibialis* and *D. flaviventris* as synonyms of *D. adelpha*.

### ***Diabrotica bioculata* Bowditch 1911**

(Figs 16–25)

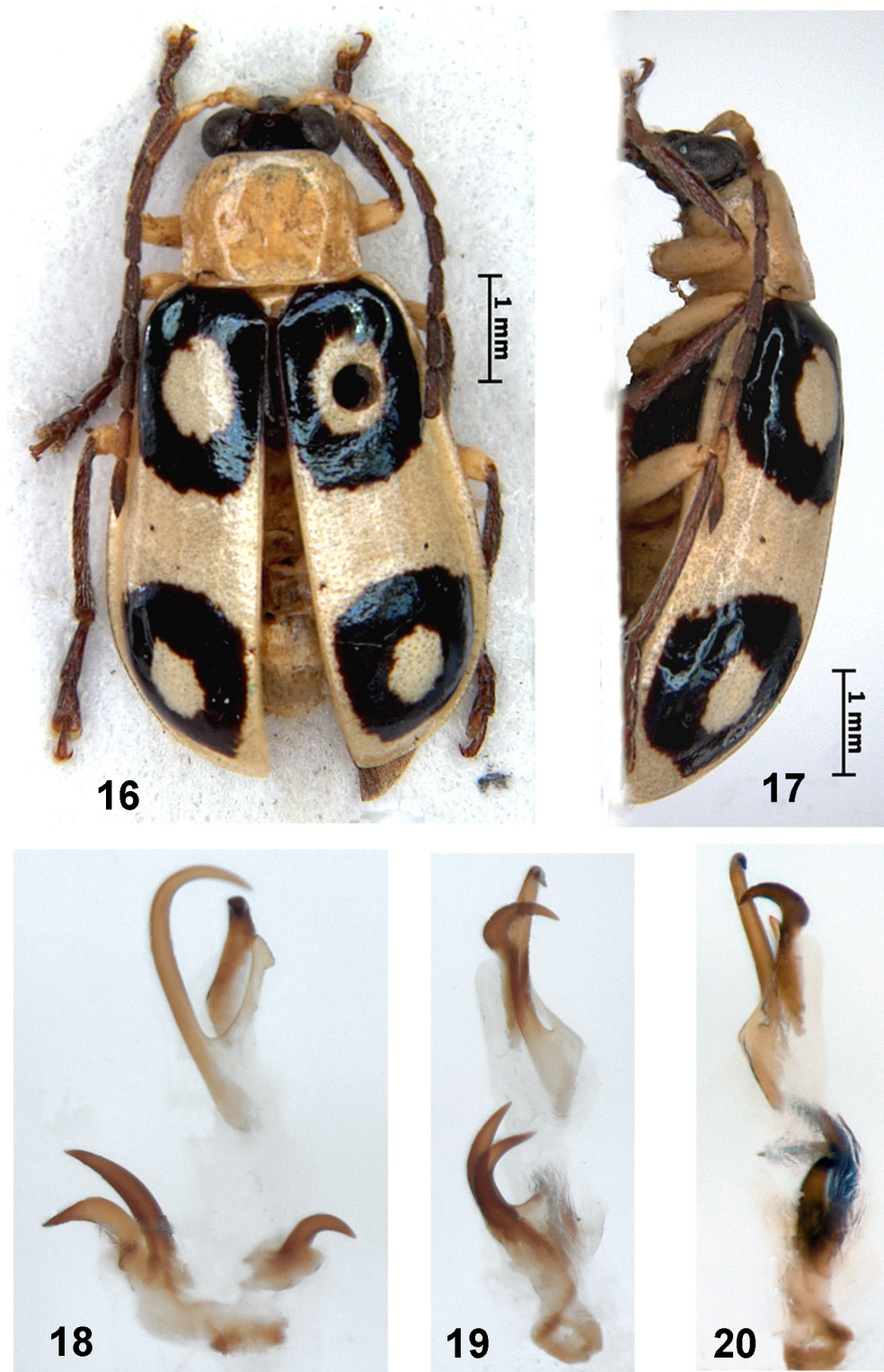
*bioculata* Bowditch 1911: 16 (type locality: Jalapa, Mexico; type depository: MCZ, lectotype, male, designated by Smith and Lawrence 1967: 41).

*peckii* Bowditch 1911: 53 (type locality: Brit. Honduras, Manatee Dist.; type depository: MCZ, holotype, male). **New synonym**

**Material examined.** *Diabrotica bioculata*: Lectotype male (MCZ): 1) [Jalapa Mex]; 2) [*D. bioculata* Type Bow]; 3) [MCZ Type 17639]; 4) [lectoholotype *Diabrotica bioculata* Bowd.]; 5) [Jan.–Jul. 2004, MCZ image database]. Paralectotype male (MCZ): 1) [Jalapa Mex]; 2) [Type]; 3) [Type 17639]; 4) [lectoholotype *Diabrotica bioculata* Bowd.]. Paralectotypes 2 males (MCZ): 1) [Jalapa, Mexico. Hoege.]; 2) [1st Jacoby Coll.]; 3) [biannularis Jac. coll.]; 4) [Lectoparatype ?? *Diabrotica bioculata* Bowd.]. Paralectotype male (MCZ): 1) [Mexique]; 2) [*Diabrotica ocellata biannularis* Har Mexique]; 3) [Lectoparatype *Diabrotica bioculata* Bowd.]. Paralectotype male (MCZ): 1) [Mexique]; 2) [Lectoparatype *Diabrotica bioculata* Bowd.]. Male (MCZ): [Sn. Rafael Jicaltepec V. CruzMex 6/22 96]. Male (MCZ): [Sn. Rafael Jicaltepec V. CruzMex 3/9 96].

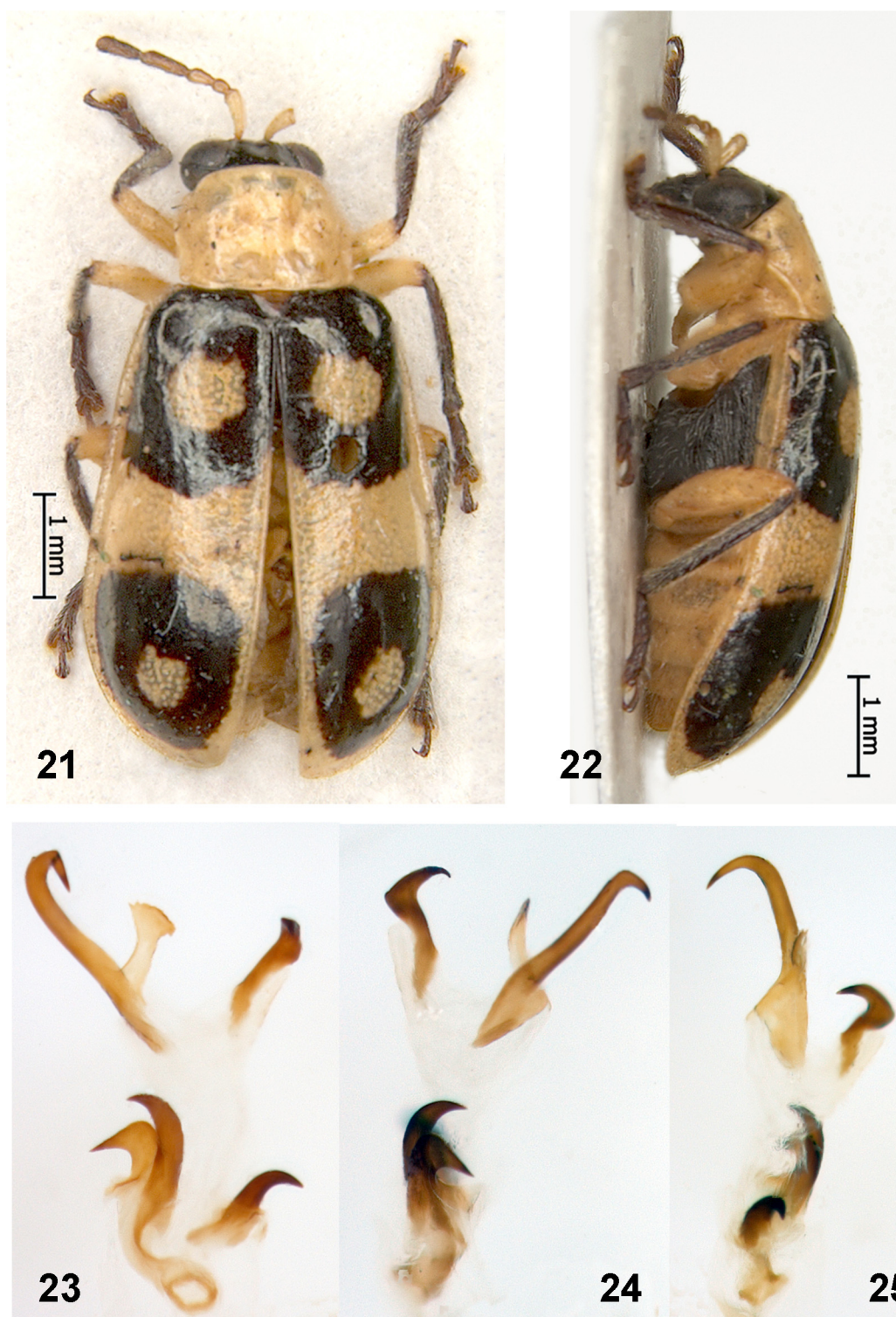
*Diabrotica peckii*: Lectotype male (MCZ): 1) [M-tee Dist. Brit. Hond. 6/12'06 Peck]; 2) [*D. Peckii* Bow Type]; 3) [Type 17640]; 4) [Holotype *Diabrotica peckii* Bowd.]; 5) [Jan.–Jul. 2004, MCZ image database].

Bowditch (1911) indicated the differences between *D. bioculata* and *D. peckii* as slightly different coloration of the antennae and elytra, details of pronotal foveation and elytral punctation. All these features are subject to intraspecific variation. We studied the internal sac of the aedeagus of the lectotypes of both species (Figs 18–20, 23–25) and found no substantial differences in the internal sac armament. Both lectotypes are very similar in their external features. Therefore, we treat *D. peckii* as a synonym of *D. bioculata*. In the type series of *D. bioculata*, one paralectotype from Jalapa, Mexico, at the MCZ is a different unidentified species.



**FIGURES 16–20.** *Diabrotica bioculata* Bowditch. 16—dorsal view, lectotype, 17—lateral view, lectotype, 18—internal sac of the aedeagus, ventral view, 19—lateral view, left, 20—lateral view, right.





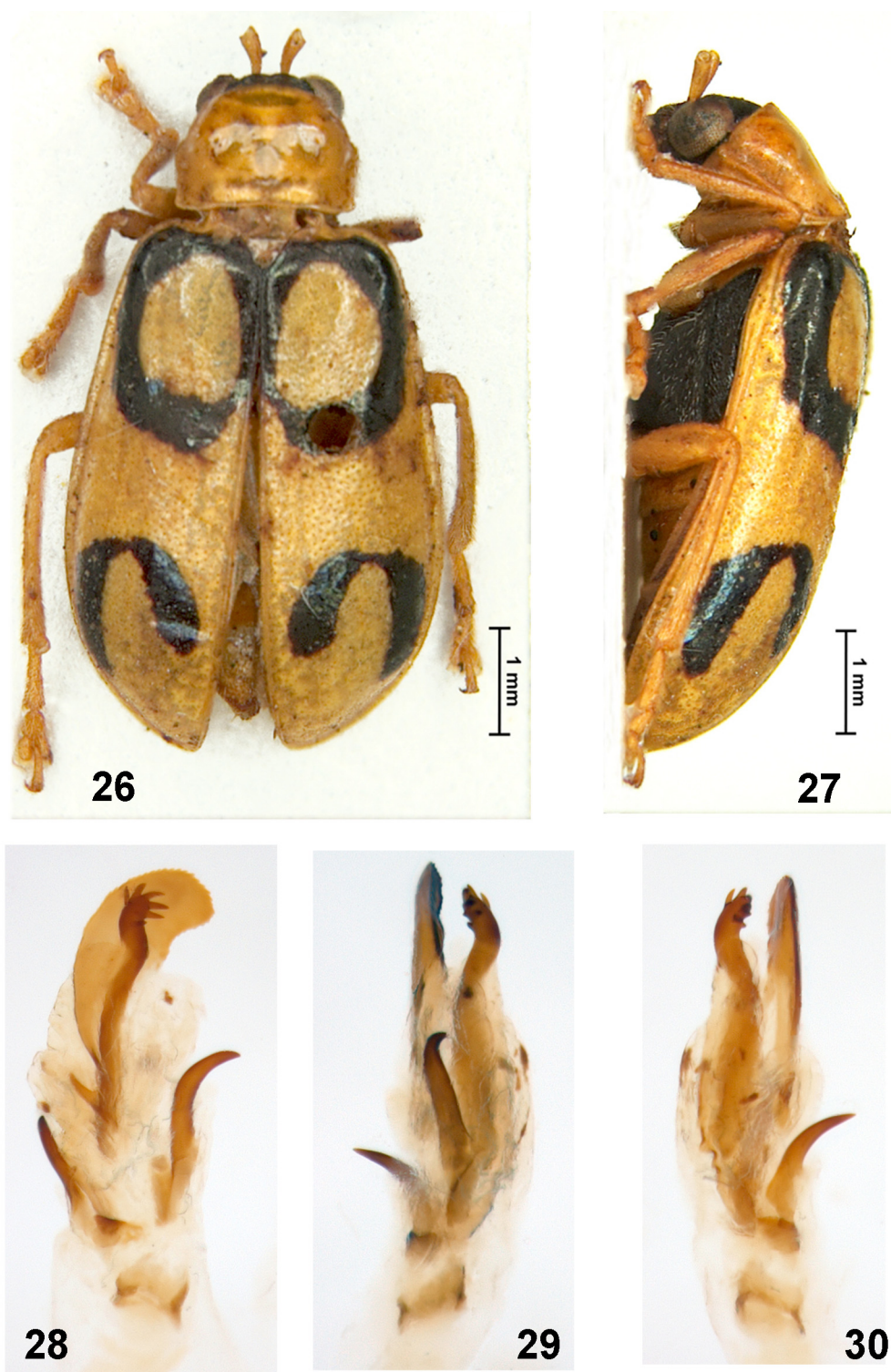
**FIGURES 21–25.** *Diabrotica peckii* Bowditch. 21—dorsal view, holotype, 22—lateral view, holotype, 23—internal sac of the aedeagus, ventral view, 24—lateral view, left, 25—lateral view, right.

***Diabrotica circulata* Harold 1875**  
(Figs 26–35)

*circulata* Harold 1875: 91 (type locality: Guatemala; type depository: MNHN, lectotype, female, designated by Smith and Lawrence 1967: 49).

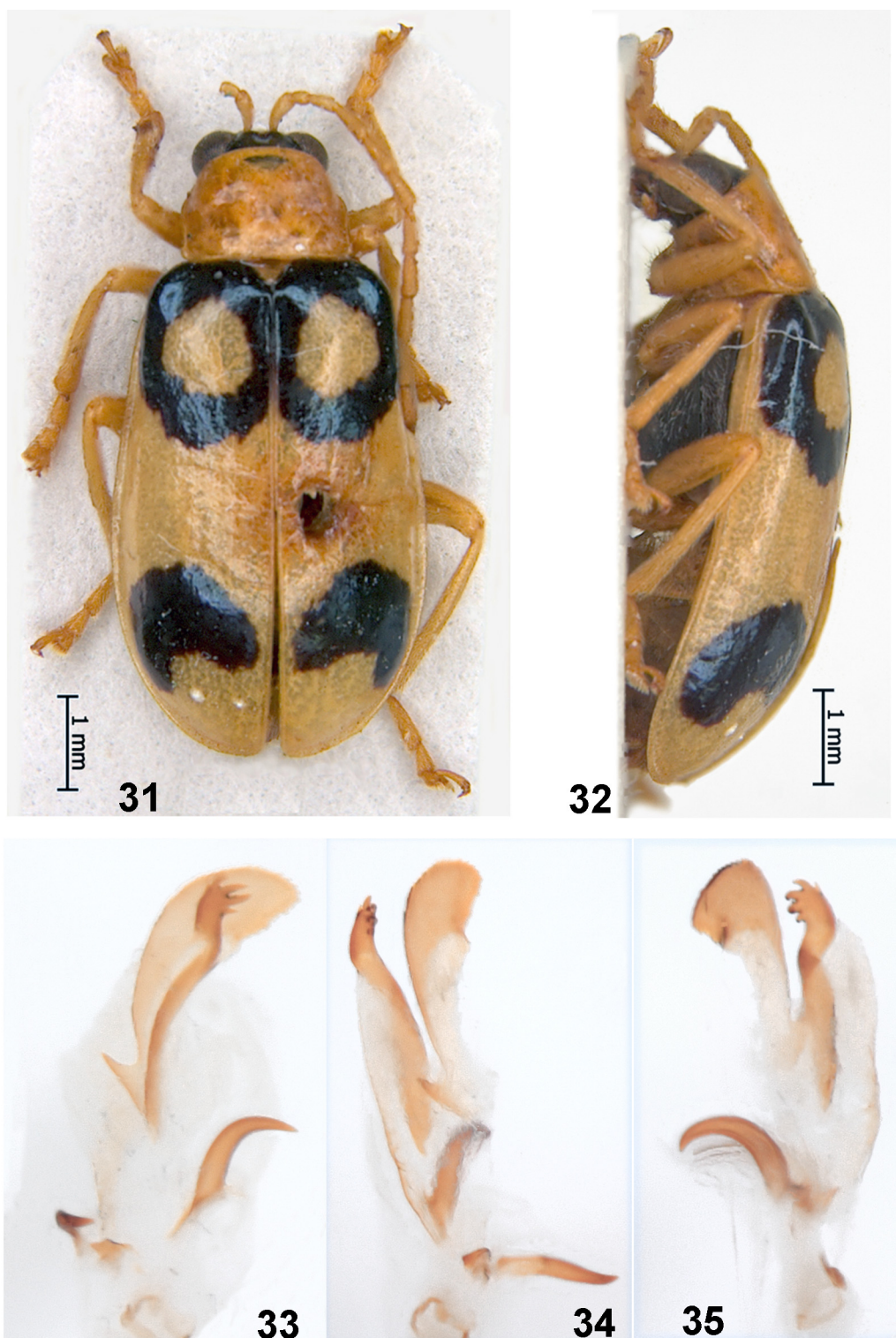
*nummularis* Harold 1877: 110 (type locality: Mexico; type depository: MfN, lectotype, male, designated by Smith and Lawrence 1967: 99). **New synonym**

**Material examined.** *Diabrotica circulata*: Lectotype female (MNHN): 1) [Guatemala *Diabrotica circulata* Harold typ.]; 2) [Ex Musaeo E. Harold]; 3) [Lectotype *Diabrotica circulata* Harold]. Paralectotypes 1 male and 1 female (MNHN): 1) [Ex Musaeo E. Harold]; 2) [Lectoparatype ? *Diabrotica circulata* Har.]. Male (MNHN): 1) [Costa Rica]; 2) [Ex Musaeo E. Allard 1899]. Female (MNHN): 1) [Costa Rica]; 2) [*circulata*]; 3) [Ex Musaeo E. Allard 1899]. Female (MNHN): 1) [Ex Musaeo E. Allard 1899]. Female (MNHN): 1) [M.-W.]; 2) [Ex Musaeo E. Harold].



**FIGURES 26–30.** *Diabrotica circulata* Harold. 26—dorsal view, lectotype, 27—lateral view, lectotype, 28—internal sac of the aedeagus, ventral view, 29—lateral view, left, 30—lateral view, right.





**FIGURES 31–35.** *Diabrotica nummularis* Harold. 31—dorsal view, lectotype, 32—lateral view, lectotype, 33—internal sac of the aedeagus, ventral view, 34—lateral view, left, 35—lateral view, right.

*Diabrotica nummularis*: Lectotype male (MfN): 1) [*nummularis* Harold.]; 2) [Hist.-Coll. (Coleoptera) Nr. 30961 *Diabrotica ornata* N. Mexico, Deppe. Zool Mus. Berlin]; 3) [Lecto-type Smith 6]. Paralectotype female (MfN): 1) [Hist.-Coll. (Coleoptera) Nr. 30961 *Diabrotica ornata* N. Mexico, Deppe. Zool Mus. Berlin]; 2) [Allolecto-type Smith 64].

Smith and Lawrence (1967) designated the lectotype of *D. circulata* and two paralectotypes (the paralectotype labels with question-marks) in the Allard collection in the MNHN. One of the paralectotype males is

morphologically identical with the lectotype, except for gender-specific characters. We treat this male as the male of *D. circulata*. Genitalia of this male were examined (Figs 28–30). No substantial differences were found between the internal sacs of this specimen and those of the lectotype male of *D. nummularis* (Figs 33–35). The currently known geographic range of both taxa is about the same. Except for the very variable shape of elytral maculae, no substantial morphological differences were observed between these two taxa. Thus, we place *D. nummularis* as a synonym of *D. circulata*.

### ***Diabrotica sinuata* Olivier 1790**

(Figs 36–47)

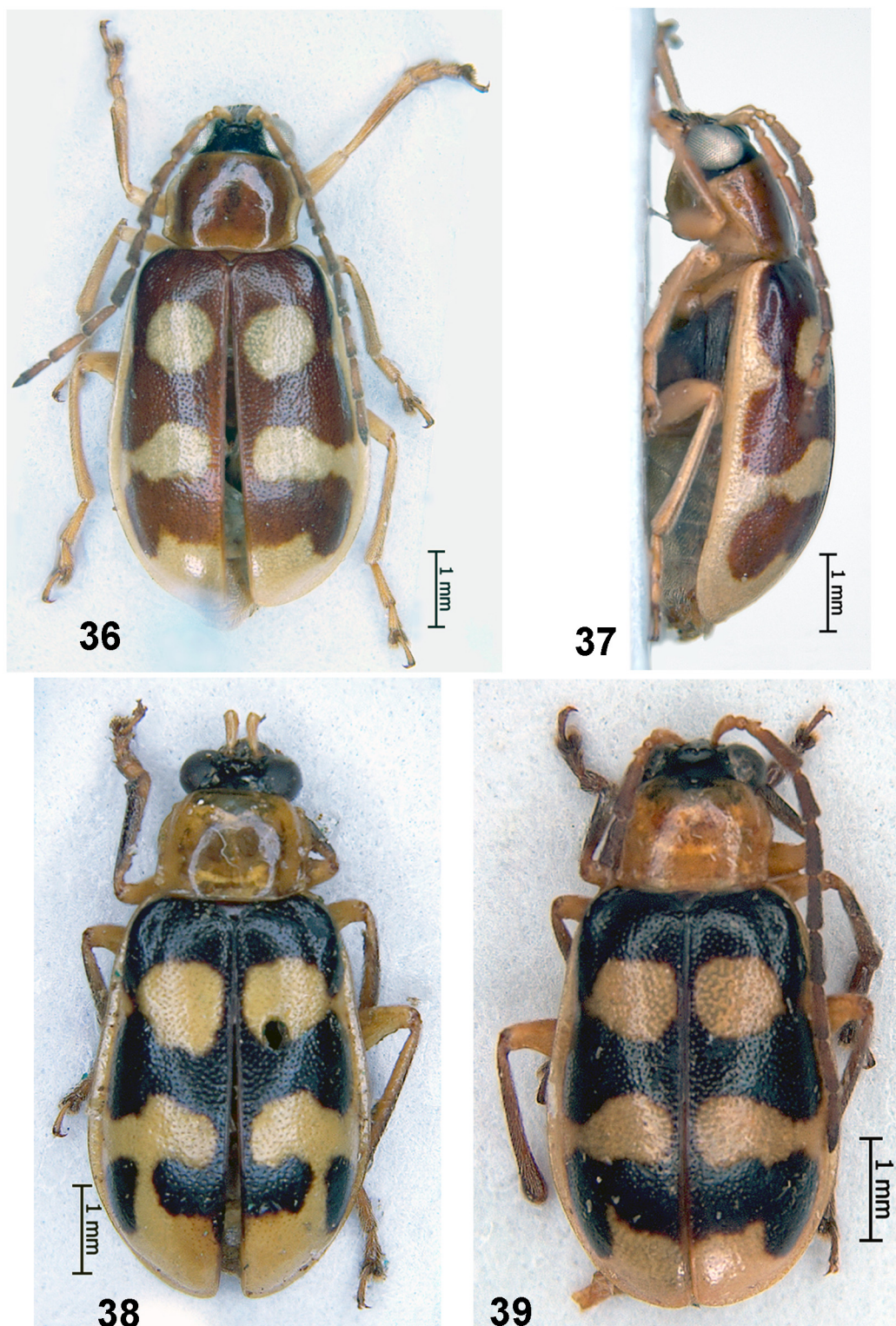
- sinuata* Olivier 1790: 106 [type locality: Cayenne; type depository: unknown (type specimens assumed missing)] as *Altica*.  
*abrupta* Fabricius 1801: 453 (type locality: America meridionalis; type depository: ZMUC, lectotype, female, designated by Smith and Lawrence 1967: 30, examined). Bechyné 1956: 254 (synonymy) as *Crioceris*.  
*bivittula* Klug 1829: 8 (type locality: Süd-Brasilien; type depository: unknown). Bechyné 1957: 135 (synonymy) as *Galleruca*.  
*brunneosignata* Jacoby 1887: 512; (type locality: Panama, Volcan de Chiriqui; type depository: BMNH, holotype, male, examined). **New synonym**  
*capitata* Fabricius 1801: 452 (replacement name for *Galleruca melanocephala* Fabricius 1798: 95). Baly 1890: 13 (synonymy) as *Crioceris*.  
*fulvomaculata* Christensen 1943 (1944): 479, 483, 497 (type locality: Misiones, Pindapoy, Argentina; type depository: holotype, Catedra de Zoología Agrícola, Facultad de Ciencias Agrarias, Universidad Nacional de Cuyo, Mendoza, not examined). Bechyné 1955a: 141 (synonymy).  
*melanocephala* Fabricius 1798: 95 (type locality: Cajennae; type depository: unknown). Smith and Lawrence 1967: 91 (synonymy) as *Galleruca*.  
*melanoptera* Christensen 1944: 479, 481, 495 (type locality: La Pampa, Gral. Pico, Argentina; type depository: holotype, Catedra de Zoología Agrícola, Facultad de Ciencias Agrarias, Universidad Nacional de Cuyo, Mendoza, not examined). Bechyné 1955a: 141 (synonymy).  
*misionensis* Christensen 1944: 479, 482, 496 (type locality: Misiones, Pindapoy, Argentina; type depository: holotype, Catedra de Zoología Agrícola, Facultad de Ciencias Agrarias, Universidad Nacional de Cuyo, Mendoza, not examined). Bechyné 1955a: 141 (synonymy).  
*moseri* Christensen 1944: 482, 498 (type locality: Argentina; type depository: Catedra de Zoología Agrícola, Facultad de Ciencias Agrarias, Universidad Nacional de Cuyo, Mendoza, not examined). Bechyné 1955a: 141 (synonymy).  
*ogloblini* Christensen 1944: 479, 482, 496 (type locality: Misiones-Loreto, Argentina; type depository: holotype, Catedra de Zoología Agrícola, Facultad de Ciencias Agrarias, Universidad Nacional de Cuyo, Mendoza, not examined). Bechyné 1955a: 141 (synonymy).  
*pindapoyensis* Christensen 1944: 479, 485, 501 (type locality: Misiones, Pindapoy, Argentina; type depository: holotype, Catedra de Zoología Agrícola, Facultad de Ciencias Agrarias, Universidad Nacional de Cuyo, Mendoza, not examined). Bechyné 1955a: 141 (synonymy).  
*quinquelitirata* Christensen 1944: 484, 502 (type locality: Misiones, El Dorado, Argentina; type depository: holotype, Catedra de Zoología Agrícola, Facultad de Ciencias Agrarias, Universidad Nacional de Cuyo, Mendoza, not examined). Bechyné 1955a: 141 (synonymy).  
*speronii* Christensen 1944: 485, 500 (type locality: Misiones, Pindapoy, Argentina; type depository: holotype, Catedra de Zoología Agrícola, Facultad de Ciencias Agrarias, Universidad Nacional de Cuyo, Mendoza, not examined). Bechyné 1955a: 141 (synonymy).

**Material examined.** *Crioceris abrupta*: Lectotype female (ZMUC): 1) [TYPE]; 2) [C: *abrupta* ex Am: mer: Schmidt]; 3) [LECTOTYPE *Crioceris abrupta* Fabr. Smith 1965]. Female (ZMUC): [*abrupta*].

*Diabrotica sinuata*: Male (USNM): 1) [Mulford BioExpl 1921-22]; 2) [Cavinas. Rio Beni. Bolivia. WmMMann Feb. 1922]. Male (USNM): 1) [Mulford BioExpl 1921-22]; 2) [Cavinas. Rio Beni. Boliv Jan. W.M. Mann]. Male and female (USNM): 1) [La Esmeralda TFA June 51]; 2) [ExpFcoVen AltoOrinoco]; 3) [*Diabrotica* “*melanocephala* (= *sinuata*) Det. J. Krysan 198 [stricken out]]. Male (USNM): 1) [Trinidad BWI Piarco 8–10 Dec 1950 E.J. Gerberg]. Two males and a female (USNM): 1) [Mèrida (Vénezuela)]; 2) [Gift of F.C. Bowditch]. Male (USNM): 1) [Sapucay, Paraguay]; [WTFoster Collector]. Male (USNM): [Harold E Box Collection 1963]. One male and five females (USNM): 1) [St. Augustine, Trin. 27-VIII-53(?) F.J. Simmons]; 2) [Appar. does not cause scarring of Jute 53-13625].

*Diabrotica brunneosignata*: Holotype (BMNH): 1) [Type]; 2) [V. de Chiriqui, 25–4000 ft. Champion.]; 3) [Godman-Salvin Coll., Biol. Centr.-Amer.]; 4) [*Diabrotica brunneosignata* Jac. Type.].



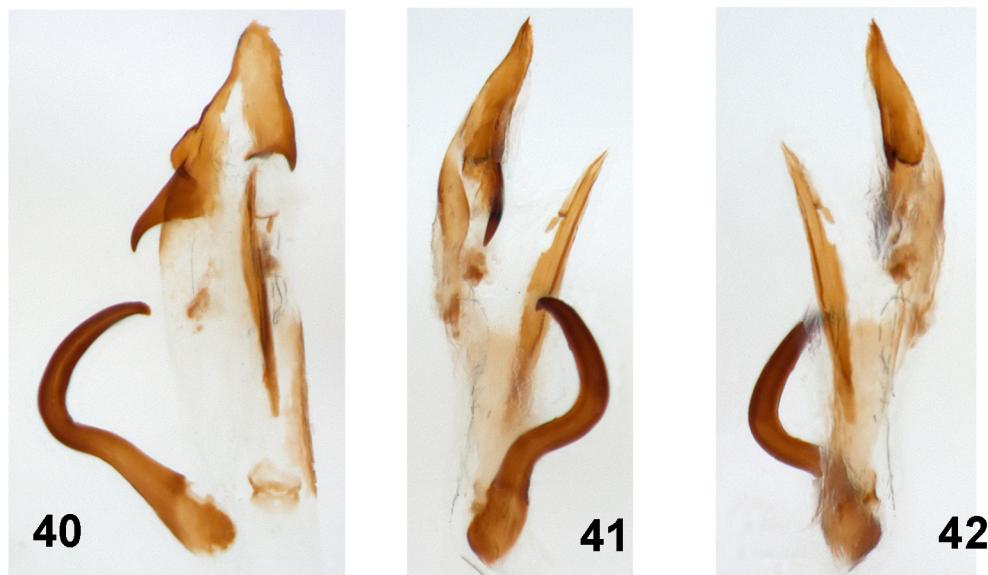


**FIGURES 36–39.** *Diabrotica sinuata* Olivier. 36—dorsal view, 37—lateral view, 38, 39—dorsal view, color variations.

*Diabrotica sinuata* is an extremely variable species (Figs 36–39). The type of *Altica sinuata* Olivier was not located (Smith and Lawrence 1967), nor were the types of *Galleruca melanocephala* Fabricius with which it was synonymized by Smith and Lawrence (1967). Our concept of *D. sinuata* is largely based on various identified specimens in the USNM, descriptions and illustrations provided by Olivier (1808), Barber (1947) and Bechyné (1955a), and type material of *D. abrupta* and *D. brunneosignata*. As suggested by all the synonyms available for this species, elytral color pattern varies greatly in *D. sinuata*, and the color pattern of *D. brunneosignata* falls well

within this diversity. Our study of the internal sac characters (Figs 40–42, 45–47) confirmed that *D. brunneosignata* should be treated as a synonym of *D. sinuata*.

*Diabrotica tripunctata* (Fabricius, 1801) was previously treated as a synonym of *D. sinuata* (Smith and Lawrence 1967). However, our study of the type material showed that it is quite different and should be treated as a separate species. We discuss this in detail under *D. tripunctata*. All taxa proposed by Christensen (1944) originate from Argentina and fall outside of our area of interest.



**FIGURES 40–42.** *Diabrotica sinuata* Olivier internal sac of the aedeagus, 40—ventral view, 41—lateral view, left, 42—lateral view, right.

### ***Diabrotica trifurcata* Jacoby 1887**

(Figs 48–57)

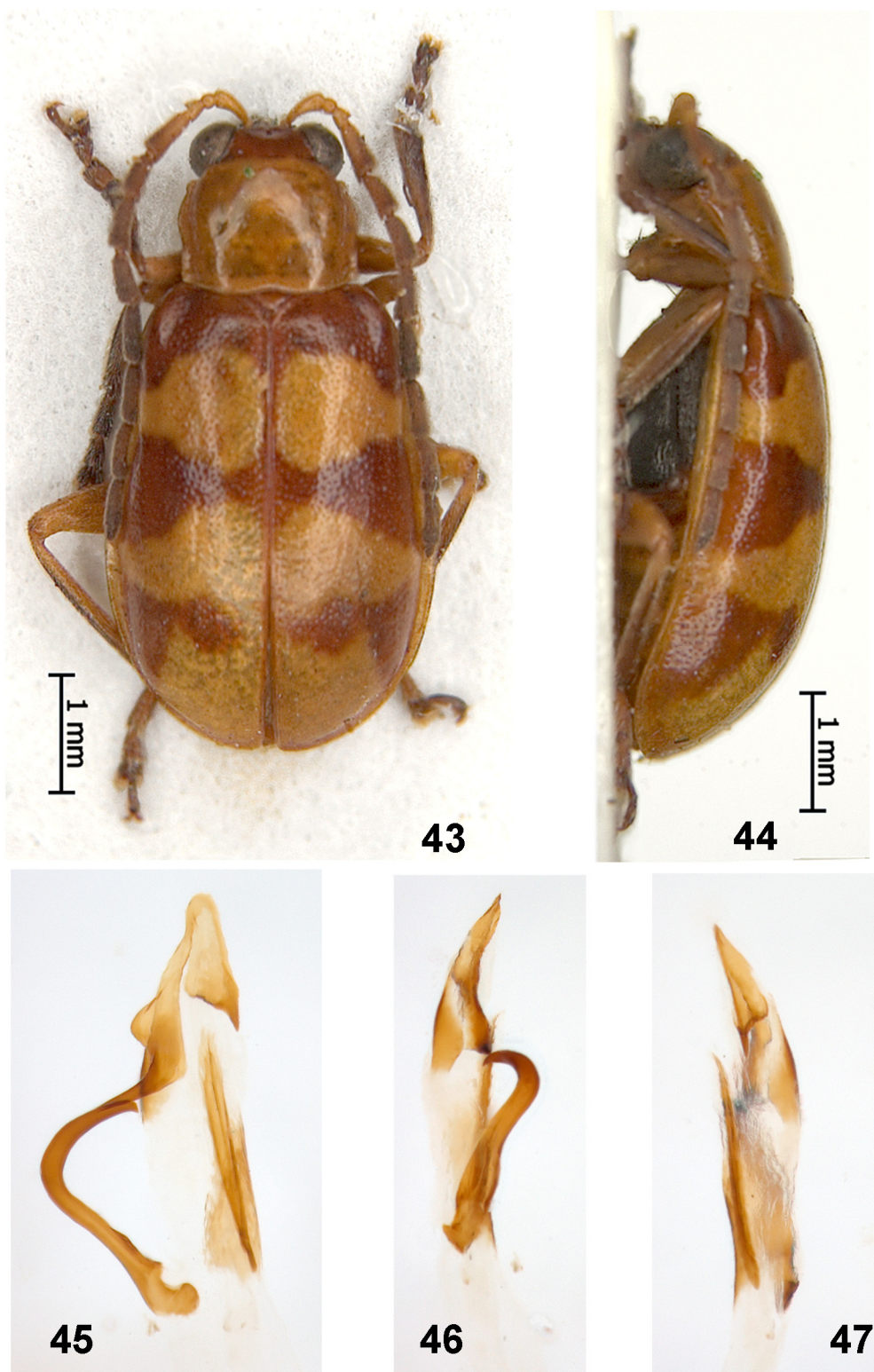
*trifurcata* Jacoby 1887: 522 (type locality: Panama, V. de Chiriqui; type depository: BMNH, lectotype, male, designated by Smith and Lawrence 1967: 134).

*linensis* Bechyné 1956: 260 (type locality: Panama, V. de Chiriqui; type depository: BMNH, lectotype, male, designated by Smith and Lawrence 1967: 85). **New synonym**

**Material examined.** *Diabrotica trifurcata*: Lectotype male (BMNH): 1) [Lectotype]; 2) [V. de Chiriqui, 2–3000 ft. Champion.]; 3) [Type. Sp. figured.]; 4) [*Diabrotica trifurcata* Jac.]; 5) [Godman-Salvin Coll., Biol. Centr.-Amer.]; 6) [Lectotype *Diabrotica trifurcata* Jac. RFS]. Paralectotype male and female (BMNH): 1) [Paralectotype]; 2) [Chontales, Nicaragua. Janson.]; 3) [Godman-Salvin Coll., Biol. Centr.-Amer.]; 4) [paraLectotype *Diabrotica trifurcata* Jac. RFS]. Paralectotype female (BMNH): 1) [Paralectotype]; 2) [Chontales, Nicaragua. T. Belt.]; 3) [Godman-Salvin Coll., Biol. Centr.-Amer.]; 4) [paraLectotype *Diabrotica trifurcata* Jac. RFS]. Paralectotype female (BMNH): 1) [Paralectotype]; 2) [Chontales, Janson]; 3) [*trifurcata* Jac.]; 4) [Baly coll.]; 5) [paraLectotype *Diabrotica trifurcata* Jac. RFS]. Paralectotype male (BMNH): 1) [Paralectotype]; 2) [Irazu, 6–7000 ft. H.Rogers.]; 3) [Godman-Salvin Coll., Biol. Centr.-Amer.]; 4) [paraLectotype *Diabrotica trifurcata* Jac. RFS]. Paralectotype male (MCZ): 1) [V. de Chiriqui, Champion]; 2) [*Diabrotica trifurcata* Jac.]; 3) [1st Jacoby Coll.]; 4) [Type 17686]; 5) [LectoParatype *Diabrotica trifurcata* Jac.]. Paralectotype male (MCZ): 1) [Chontales, Nicaragua. Janson.]; 2) [1st Jacoby Coll.]; 3) [LectoParatype *Diabrotica trifurcata* Jac.]. Paralectotype female (MCZ): 1) [Chontales, Nicaragua. T. Belt.]; 2) [1st Jacoby Coll.]; 3) [LectoParatype *Diabrotica trifurcata* Jac.].

*Diabrotica linensis*: Lectotype male (BMNH): 1) [V. de Chiriqui, 4000–6000 ft. Champion.]; 2) [Lectotype *Diabrotica linensis* Baly (= *elongatula* Jac.). Male (USNM): [Costa Rica: Las Cruces, Nr. San Vito 19–20.III.65. SS&WDDuckworth].

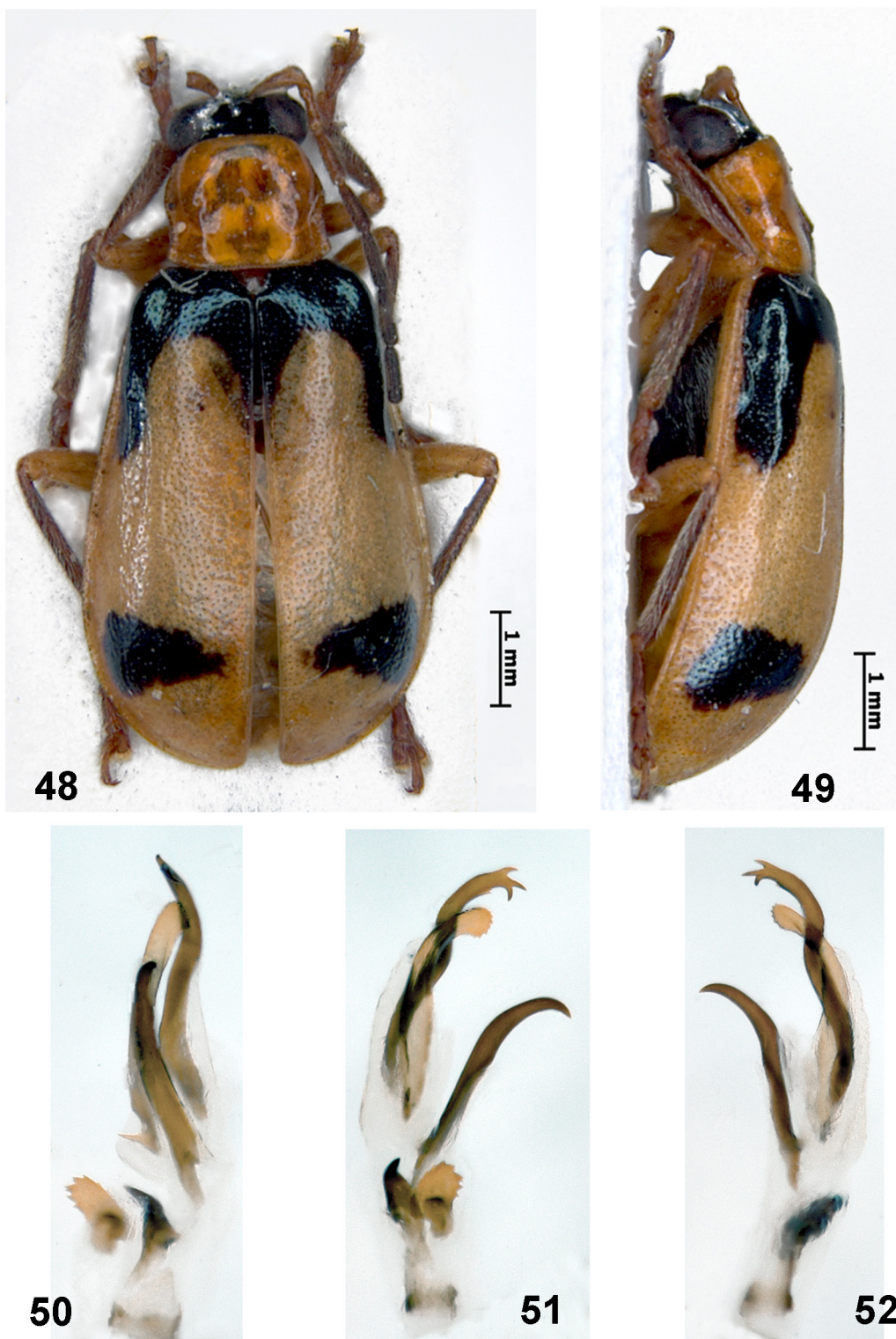




**FIGURES 43–47.** *Diabrotica brunneosignata* Jacoby. 43—dorsal view, holotype, 44—lateral view, holotype, 45—internal sac of the aedeagus, ventral view, 46—lateral view, left, 47—lateral view, right.

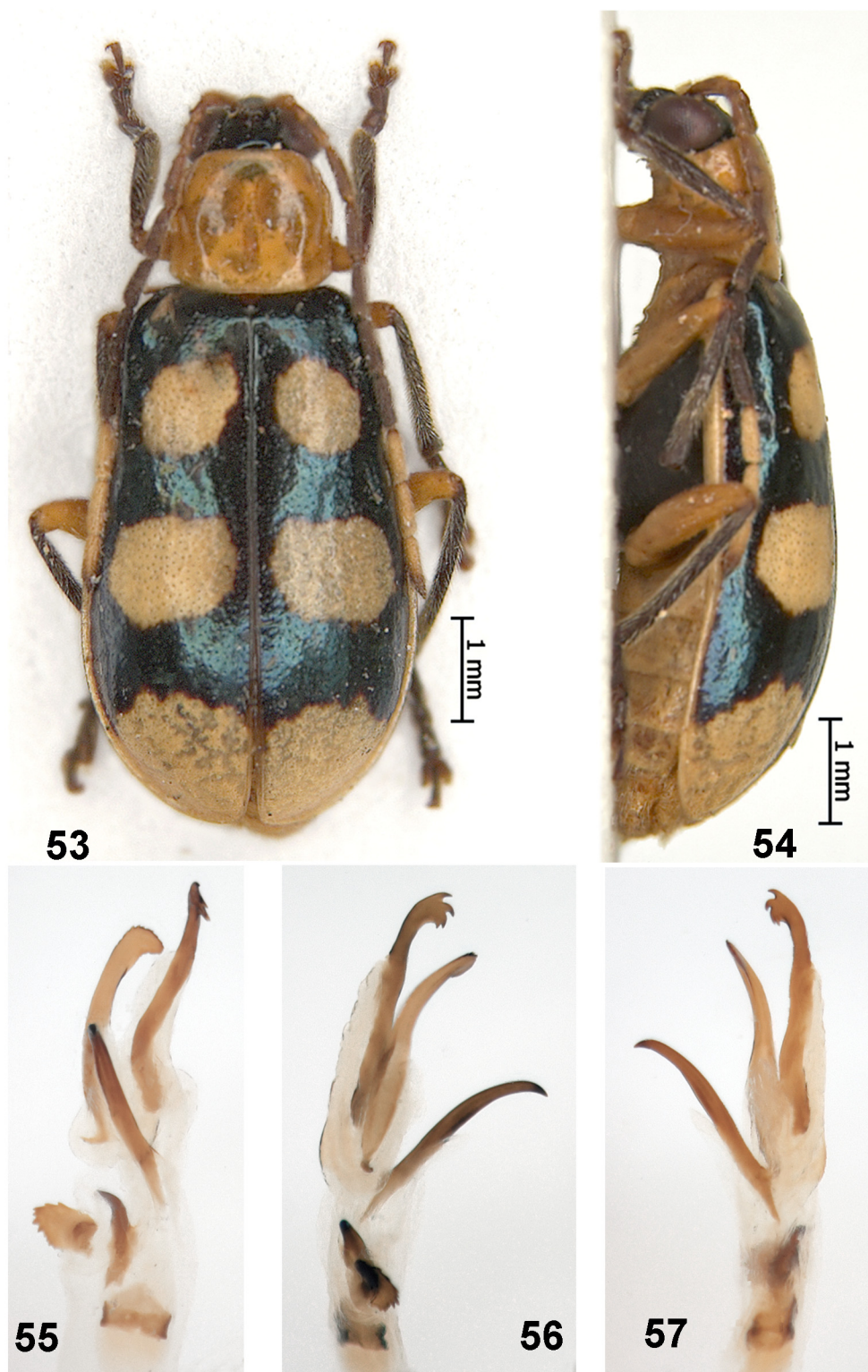
We studied the internal sacs of the aedeagi of the lectotypes of *D. linensis* (Figs 55–57) and *D. trifurcata* (Figs 50–52) and found no significant differences between them. The elytral color patterns of *D. linensis* (Figs 53, 54) and *D. trifurcata* (Figs 48, 49) are different, but that alone is not sufficient to justify the recognition of species status for *D. linensis*. Therefore, we treat *D. linensis* as a synonym of *D. trifurcata*. In the type series of *D. trifurcata* Jacoby at the BMNH, one paralectotype is not a *Diabrotica*: 1) [Paralectotype]; 2) [Chontales,

Nicaragua. Janson.]; 3) [Godman-Salvin Coll., Biol. Centr.-Amer.]; 4) [paraLectotype *Diabrotica trifurcata* Jac. RFS]. We do not know what genus this specimen belongs to.



**FIGURES 48–52.** *Diabrotica trifurcata* Jacoby. 48—dorsal view, lectotype, 49—lateral view, lectotype, 50—internal sac of the aedeagus, ventral view, 51—lateral view, left, 52—lateral view, right.





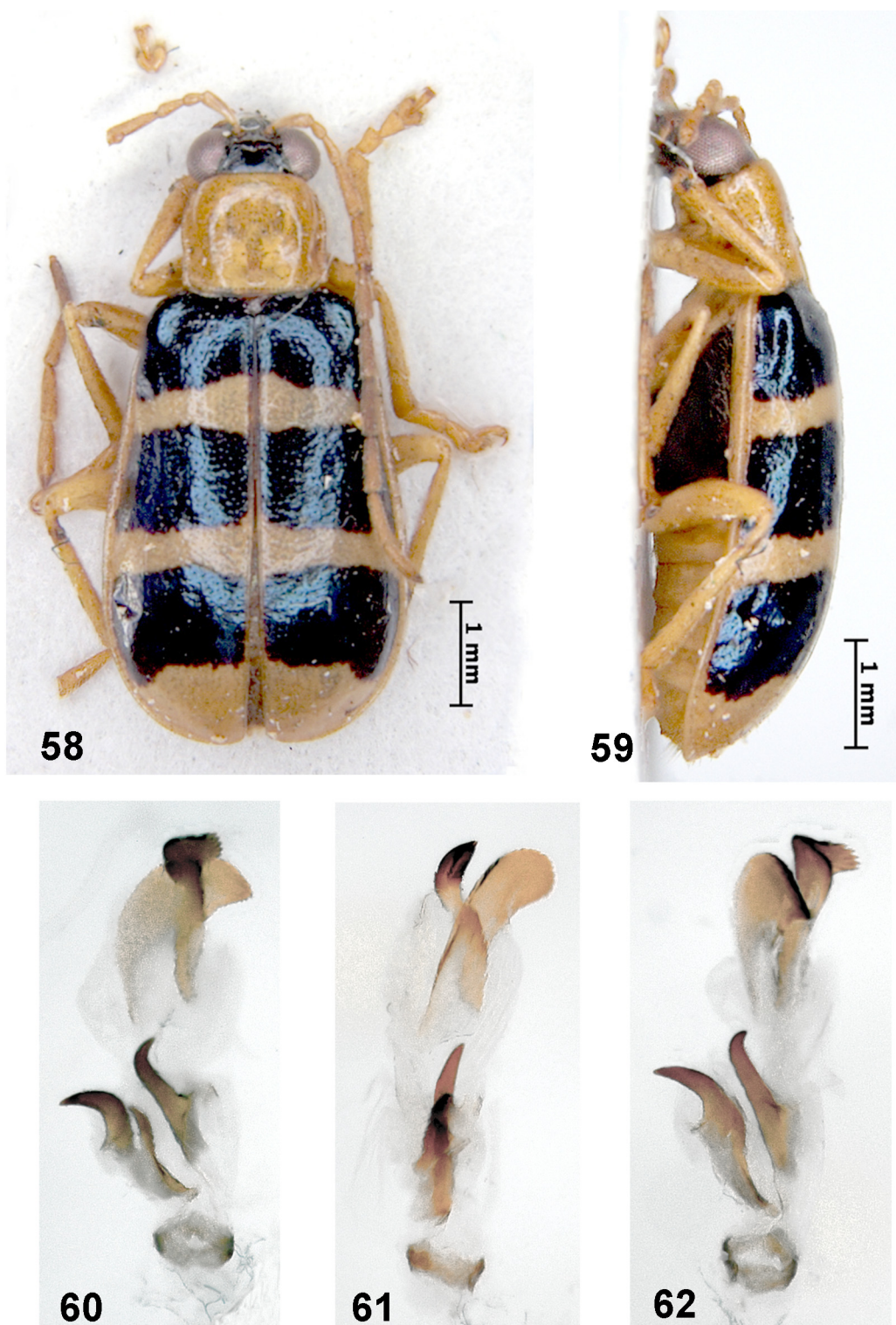
**FIGURES 53–57.** *Diabrotica linensis* Bechyné. 53—dorsal view, lectotype, 54—lateral view, lectotype, 55—internal sac of the aedeagus, ventral view, 56—lateral view, left, 57—lateral view, right.

***Diabrotica viridifasciata* Jacoby 1887**

(Figs 58–67)

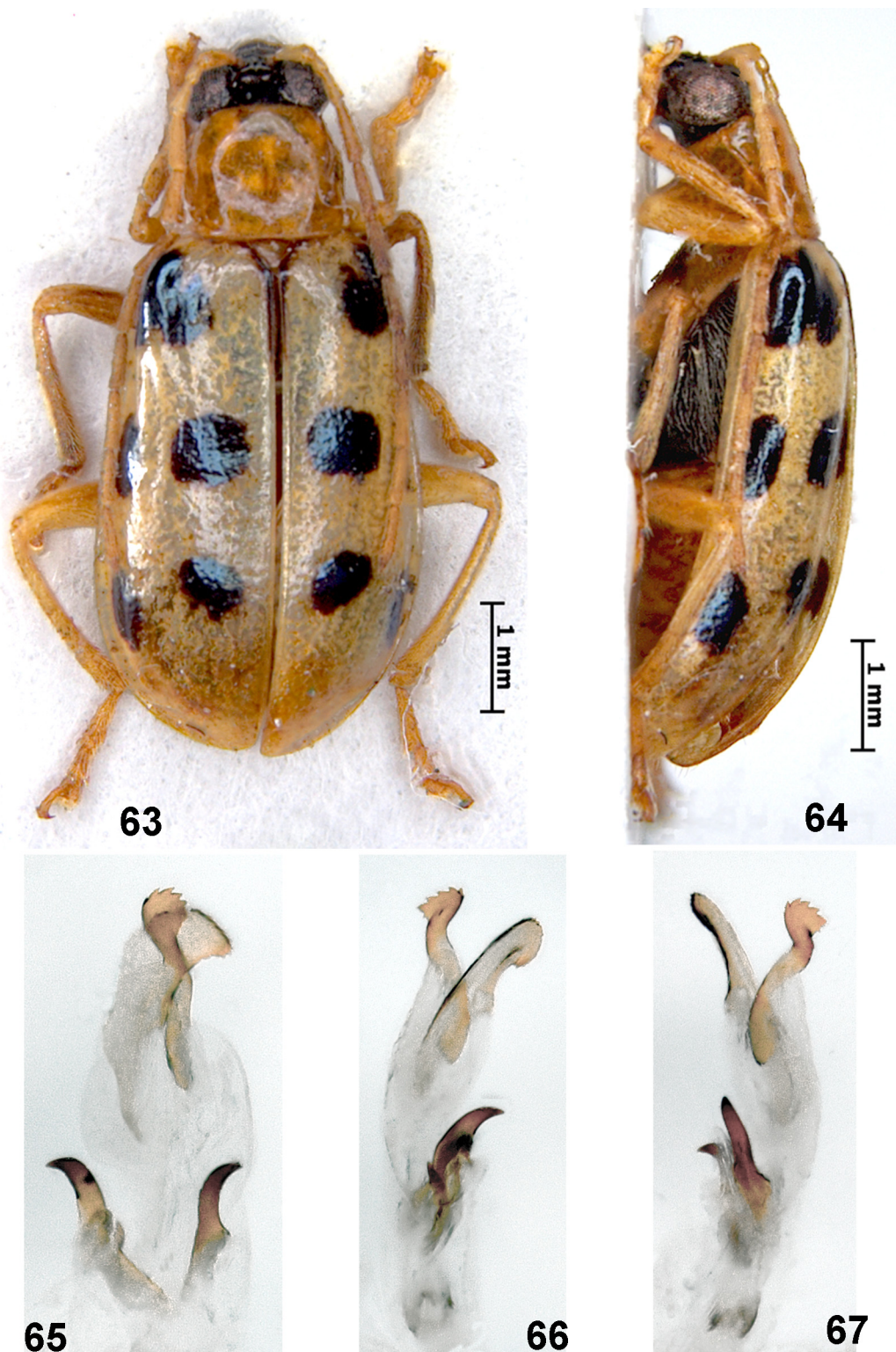
*viridifasciata* Jacoby 1887: 507 (type locality: Panama, Volcan de Chiriqui; type depository: BMNH, lectotype, male, designated by Smith and Lawrence 1967).

*duplicata* Jacoby 1887: 519 (type locality: Panama, Volcan de Chiriqui; type depository: BMNH, lectotype, male, designated by Smith and Lawrence 1967). **New synonym**



**FIGURES 58–62.** *Diabrotica viridifasciata* Jacoby. 58—dorsal view, lectotype, 59—lateral view, lectotype, 60—internal sac of the aedeagus, ventral view, 61—lateral view, left, 62—lateral view, right.





**FIGURES 63–67.** *Diabrotica duplicata* Jacoby. 63—dorsal view, lectotype, 64—lateral view, lectotype, 65—internal sac of the aedeagus, ventral view, 66—lateral view, left, 67—lateral view, right.

**Material examined.** *Diabrotica viridifasciata*: Lectotype male (BMNH): 1) [Lectotype]; 2) [V. de Chiriqui, 2–3000 ft. Champion]; 3) [Godman-Salvin Coll., Biol. Centr.-Amer.]; 4) [*Diabrotica viridifasciata* Jac.]; 5) [LECTOTYPE *Diabrotica viridifasciata* Jac. RFS]. Paralectotype female (BMNH): 1) [Paralectotype]; 2) [Cache. Costa Rica. H. Rogers.]; 3) [Type. Sp. figured.]; 4) [*D. viridifasciata* Jac.]; 5) [Godman-Salvin Coll., Biol. Centr.-Amer.]; 6) [Lectoparatype *Diabrotica viridifasciata* Jac. RFS]. Paralectotype (MCZ): 1) [Bugaba, Panama,

Champion]; 2) [Lectoparatype *Diabrotica viridifasciata* Jac. RFS]. 3 ex. (MCZ): [Turrialba, Costa Rica]. 2 ex. (MCZ): [Colombia]. 3 ex. (MCZ): [Trinidad]. Male (USNM): 1) [Sarchi C. R. June 15'33 C.H. Ballou]; 2) C.R. No. 1239]; 3) [Collected at light]; 4) [*viridifasciata* Jac. 87 HSB 33]; 5) [Homoparalectotype *Diabrotica viridifasciata* Jac. MCZ Det. J. Krysan'95]. Male (USNM): 1) [Sarchi C. R. June 15'33 C.H. Ballou]; 2) C.R. No. 1239]; 3) [Collected at light]; 4) [Homoparalectotype *Diabrotica viridifasciata* Jac. MCZ Det. J. Krysan'95]. Male (USNM): 1) [Sarchi C. R. June 15'33 C.H. Ballou]; 2) C.R. No. 1239]; 3) [Collected at light]; 4) [*Diabrotica championi* Jacoby det. R.F. Smith 1963]; 5) [Homoparalectotype *Diabrotica viridifasciata* Jac. MCZ Det. J. Krysan'95]; 6) [*Diabrotica viridifasciata* Jacoby Det. J. Krysan 1995 not *championi* acc. to design. RFS'64 (thorax imp.)]. Female (USNM): 1) [San Jose Costa Rica]; 2) [Coll. Schild & Burgdorf ♀]; 3) [*Diabrotica viridifasciata* Jac.]. Female (USNM): 1) [Costa Rica: Puntarenas Prov., Monte Verde, 1300 m. 11 July 1989. MV lite. leg. David G. Furth]. Male (USNM): 1) [Costa Rica: Puntarenas Prov., Monte Verde, 1300 m. 8 July 1989. MV lite. leg. David G. Furth]. Male (USNM): 1) [Costa Rica: Puntarenas Prov., Monte Verde, 1300 m. 18 July 1989. MV lite. leg. David G. Furth].

*Diabrotica duplicata*: Lectotype male (BMNH): 1) [Lectotype]; 2) [V. de Chiriqui, 2–3000 ft. Champion]; 3) [Godman-Salvin Coll., Biol. Centr.-Amer.]; 4) [Type. Sp. figured.]; 5) [*D. duplicata* Jac.]; 6) [Lectotype *Diabrotica duplicata* Jac. RFS]. Paralectotypes 5 males (BMNH): 1) [Paralectotype]; 2) [Bugaba, Panama. Champion]; 3) [Godman-Salvin Coll., Biol. Centr.-Amer.]; 4) [Lectoparatype *Diabrotica duplicata* Jac. RFS]. Paralectotype male (BMNH) 1) [Paralectotype]; 2) [Bugaba, 800–1500 ft. Champion]; 3) [Godman-Salvin Coll., Biol. Centr.-Amer.]; 4) [Lectoparatype *Diabrotica duplicata* Jac. RFS]. Paralectotype male (BMNH) 1) [Paralectotype]; 2) [David, Panama. Champion]; 3) [Godman-Salvin Coll., Biol. Centr.-Amer.]; 4) [Lectoparatype *Diabrotica duplicata* Jac. RFS]. Paralectotypes 1 male and 3 females (MCZ): 1) [Bugaba, 800–1500 ft. Champion]; 2) [Godman-Salvin Coll., Biol. Centr.-Amer.]; 3) [Lectoparatype *Diabrotica duplicata* Jac. RFS]. Paralectotypes 2 females (MCZ): 1) [V. de Chiriqui, 25–4000 ft. Champion]; 3) [Godman-Salvin Coll., Biol. Centr.-Amer.]; [Lectoparatype *Diabrotica duplicata* Jac. RFS]. Three males (MCZ): 1) [S. Antonio, Agnata]; 2) [Bolívar, Colombia, F.R. Mason, Cartagena, VII.11.20, chaparral]. Two females (MCZ): 1) [Columbia]. Two females (MCZ): 1) [Pichindi, Columbia]. Male (USNM): 1) [July 26.07]; 2) [Tabernilla Canal Zone Panama]; 3) [Collected by August Busck]; 4) [homolectoparatype *Diabrotica duplicata* Jacoby Det. J. Krysan 1995].

The internal sacs in the male types of *D. viridifasciata* and *D. duplicata* show no significant differences in the armament (Figs 60–62, 65–67). The maculae on the *D. duplicata* elytra are homologous to the reduced bands in *D. viridifasciata*. There are no substantial differences in the body shape and other morphological characters between the two taxa. Their ranges overlap considerably. Therefore, we treat *D. duplicata* as a synonym of *D. viridifasciata*.

## New status

### *cyaneomaculata* Jacoby 1887, *incertae sedis*.

(Figs 68–71)

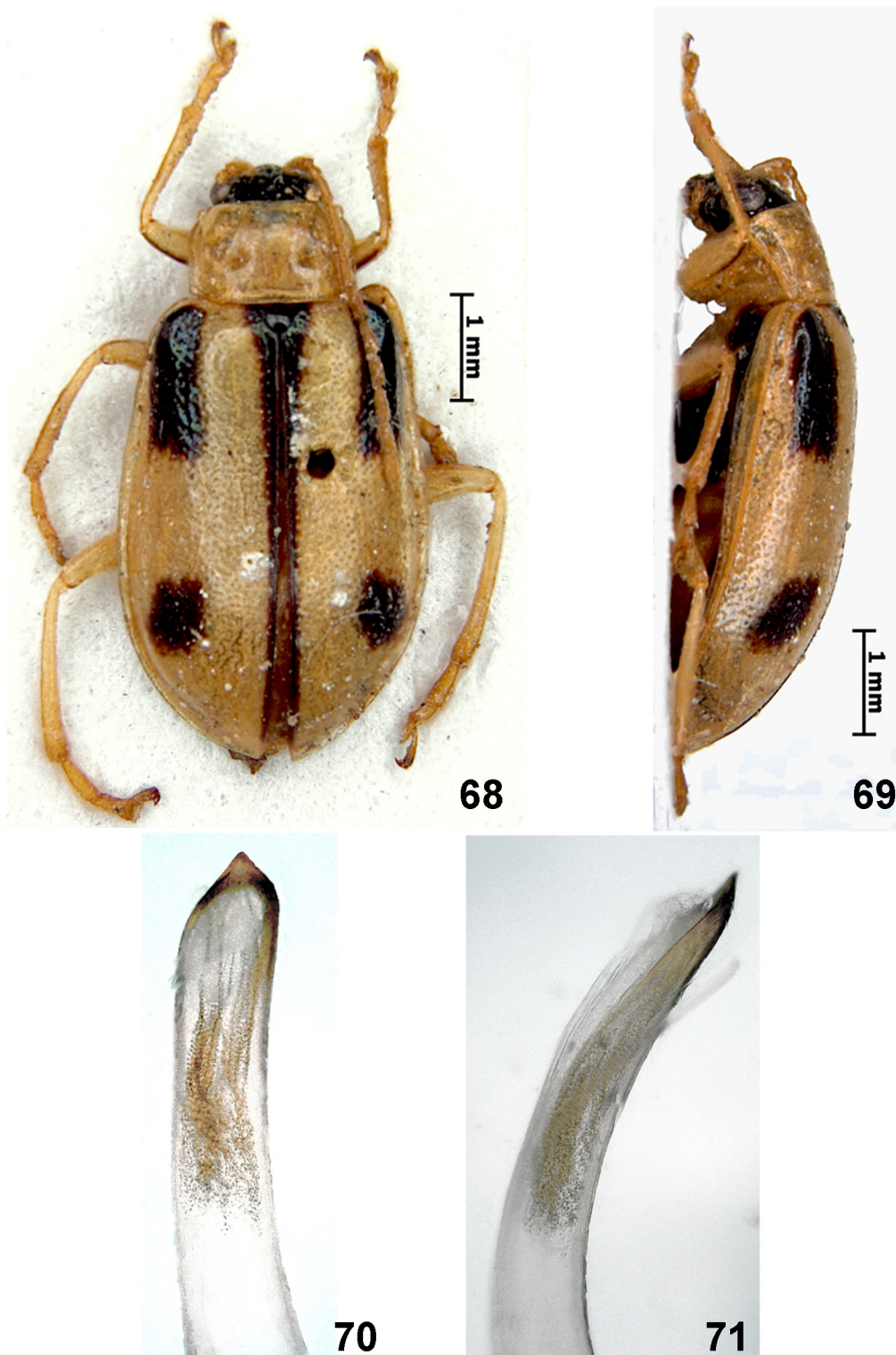
*cyaneomaculata* Jacoby 1887: 523 [Type locality: Volcan de Irazu, Costa Rica; type depository: BMNH, lectotype, female, designated by Smith and Lawrence (1967: 54) examined] as *Diabrotica*.

**Material examined:** Lectotype female (BMNH): 1) [Type]; 2) [Irazu, 6–7000 ft. H. Rogers]; 3) Type. Sp. figured.]; 4) [Godman-Salvin Coll. Biol. Centr.-Amer.]; 5) [*Diabrotica cyaneomaculata* Jac.]; 6) [Lectotype *Diabrotica cyaneomaculata* Jac. RFS]. Paralectotype male (BMNH): 1) [Paralectotype]; 2) [Cache. Costa Rica. H. Rogers]; 3) [Godman-Salvin Coll. Biol. Centr.-Amer.]; 4) [Lectoparatype *Diabrotica cyaneomaculata* Jac. RFS]. Paralectotype female (MCZ): 1) [Costa Rica. V. Patten.]; 2) [*Diabrotica cyaneo-maculata* Jac.]; 3) [1st Jacoby Coll.]; 4) [Type 17689]; 5) [Lectoparatype *Diabrotica cyaneomaculata* Jac.]. Two males and two females (MCZ): [C. Rica]. One male (MCZ): [Costa Rica]. One female (MCZ): [*Diabrotica cyaneomaculata*]. One female (MCZ): 1) [Costa Ri]; 2) [1st Jacoby Coll.].

After studying the type material of *D. cyaneomaculata*, it became clear that this species possesses a set of characters that do not make it congeneric with *Diabrotica* species: aedeagus without orificial plate; internal sac very weakly sclerotized, lacking sclerotized hooks, plates and other armature (Figs 70–71); eyes relatively small,



genal space as wide as one-fourth to one-half of maximum diameter of eye. Extensive generic level studies of the New World Galerucinae are needed to find the proper generic placement for this species.

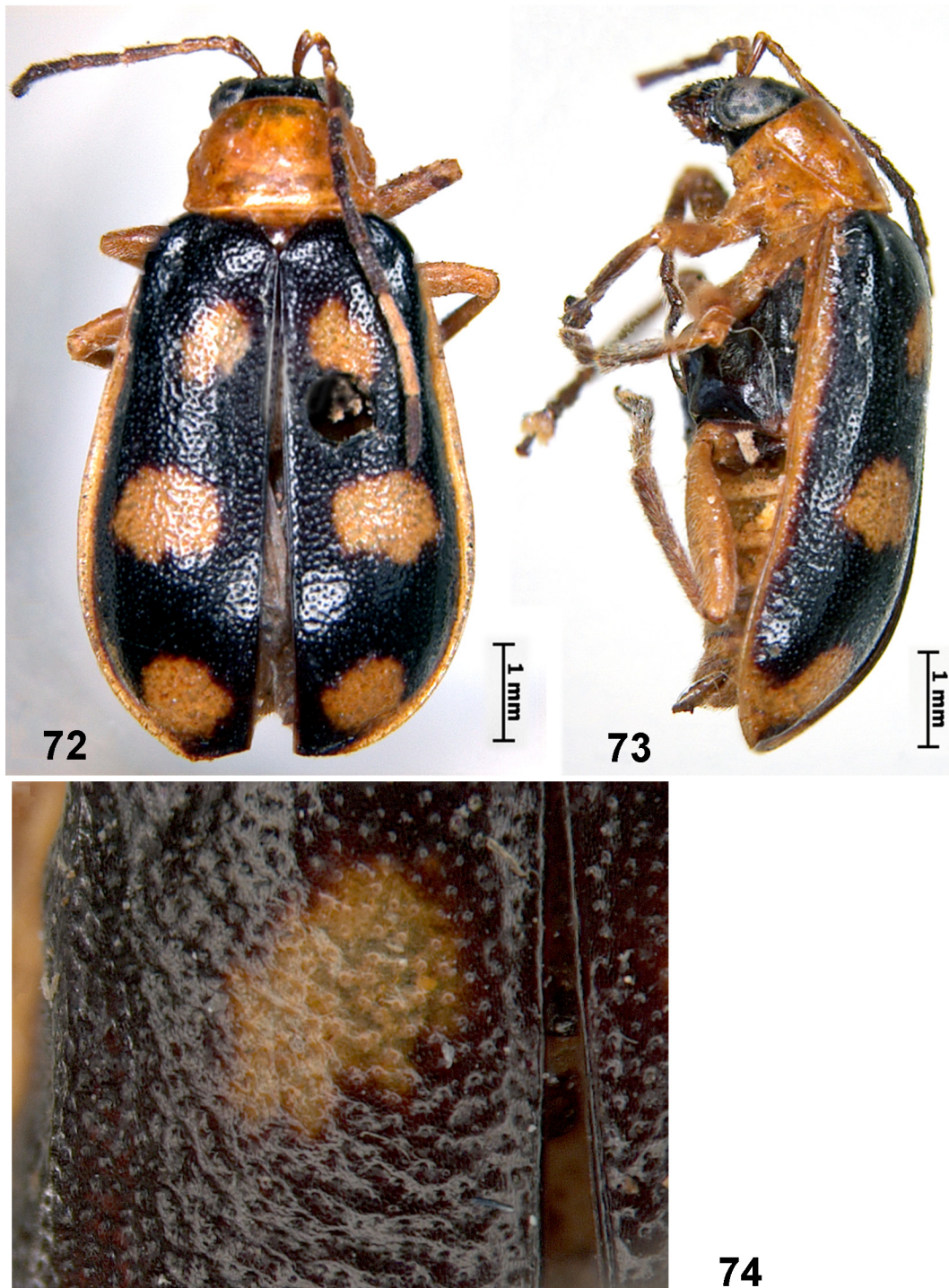


**FIGURES 68–71.** *Diabrotica cyaneomaculata* Jacoby. 68—dorsal view, 69—lateral view, 70—internal sac of the aedeagus, ventral view, 71—lateral view, left.

**Status restored**

***Diabrotica tripunctata* (Fabricius, 1801) status restored**  
(Figs 72–74)

*tripunctata* Fabricius 1801: 451 (type locality: America meridionalis; type depository: ZMUC, lectotype, female, designated by Smith and Lawrence 1967: 135, examined) as *Crioceris*.



**FIGURES 72–74.** *Diabrotica tripunctata* Fabricius. 72—dorsal view, lectotype, 73—lateral view, lectotype, 74—microsculpture of right elytron.



**Material examined:** Lectotype female (ZMUC): 1) [TYPE]; 2) [C: *tripunctata* ex Am: mer: Schmid]; 3) [Lectotype. *Crioceris 3punctata* Fabr. Smith 1965]. Three females (ZMUC): 1) [TYPE]; 2) [Paratype. *Crioceris 3punctata* Fabr.]. One female from Kiel collection (ZMUC): [*3punctata*].

This species has long been considered part of the *melanocephala* complex (Bechyné 1955b, Smith and Lawrence 1967) and treated as a synonym of *D. sinuata* (Olivier) (Wilcox 1971). We studied the type material of *D. tripunctata* (Fabricius) in ZMUC. The lectotype is a female, but all external characters distinguish it from *D. sinuata*: penultimate joint of maxillary palpi slightly incrassate in *D. tripunctata*, but not incrassate in *D. sinuata*; elytra longer and narrower (the maximal width is posterior to the middle of the elytra) in *D. tripunctata*, but shorter and more roundish (the maximal width is at the middle of the elytra) in *D. sinuata*; pronotum slightly flattened in *D. tripunctata*, but convex in *D. sinuata*; elytral punctation coarse and deep (Fig. 74), punctures around scutellum connected in rough wrinkles in *D. tripunctata*, but surfaces of elytra and pronotum are shiny in *D. sinuata*.

## Original combination restored

### *Diabrotica fasciata* Kirsch 1883 original combination restored

(Figs 75–79)

*fasciata* Kirsch 1883: 200 (type locality: Ecuador; type depository: MTD, lectotype, male, designated by Smith and Lawrence 1967: 66, examined). Smith and Lawrence 1967: 66 (as *Paranapiacaba fasciata*)

**Material examined:** Lectotype male (MTD): 1) [4328]; 2) [Ecuador Stübel]; 3) [Typus]; 4) [Staatl. Museum für Tierkunde, Dresden]; 5) [*Diabrotica fasciata* Kirsch]; 6) [Lectotype *Diabrotica fasciata* Kirsch Smith 1965]; 7) [Museum für Tierkunde, Dresden (MTD)]. Two males (MCZ): [R. Dagua, Colombia W. Rosenberg]. One male (MCZ): [Panama Panama]. Male (USNM): 1) [Costa Rica F.Nevermann 27 7 34]; 2) [Hamburgfarm Reventazon Ebene limon]; 3) [fliegend gefangen]. Female (USNM): 1) [Costa Rica F.Nevermann 4 VII 35]; 2) [Hamburgfarm Reventazon Ebene limon]; 3) [an Gebüsch]. Male (USNM): [Costa Rica: Puntarenas Prov., Monte Verde, 1300 m. 8 July 1989. MV lite. leg. David G. Furth]. Male (USNM): [Costa Rica: Puntarenas Prov., Monte Verde Biol. Res., Camino Penas Blancas, Atlantic side. ca. 1400 m. 20 July 1989. MV lite. leg. David G. Furth]. Male (USNM): [Panama: Chiriqui Prov. Cont'l Divide Trail 3-4-VII-1997 Morris & Wappes]. Female (USNM): 1) [Tucurrique Costa Rica]; 2) [CollSchild & Burgdorf]; 3) [*Diabrotica* near *militaris*].

Smith and Lawrence (1967) placed *D. fasciata* in the genus *Paranapiacaba* Bechyné. The most important external morphological character that distinguishes *Diabrotica* from *Paranapiacaba* is a length of antennomere 3. This antennomere is at least 2 times as long as antennomere 2 in *Paranapiacaba* and subequal (not more than 1.5 times as long as the second) in *Diabrotica* (Bechyné 1958, Smith and Lawrence 1967). Antennomere 3 in the lectotype and in all other studied specimens of *D. fasciata* is 1.5 times as long as antennomere 2. Antennomere 2 in *Paranapiacaba* is without setation, antennomere 3 has the same setation as antennomere 4, but it is denser on antennomere 4. In *Diabrotica*, antennomere 2 has sparse setation, as dense as setation on antennomeres 3 and 4. Antennomeres 2 and 3 in the *D. fasciata* type match the antennomere shape in *Diabrotica*. Smith and Lawrence stated that the lectotype of *D. fasciata* is a female. However, we studied the lectotype at MTD, and it is a male. The internal sac armament of *D. fasciata* (Figs 77–79) is typical for *Diabrotica* species with 5 internal sac sclerites, mostly consisting of strongly sclerotized hooks or spines, similar to those of *D. militaris* Jacoby, *D. circulata* Harold, *D. trifurcata* Jacoby, etc. The armament of the internal sac in *Paranapiacaba* is different. *Diabrotica fasciata* was cited in the *tricincta* group of *Paranapiacaba* in Wilcox's catalogue (Wilcox, 1971). The armament of the internal sac in *Paranapiacaba tricincta* (Say) consists of weakly sclerotized structures that look like wide plates, toothed apically. Based on the internal sac armament and external morphological features, we restore the original combination *Diabrotica fasciata*.



**FIGURES 75–79.** *Diabrotica fasciata* Kirsch. 75—dorsal view, lectotype, 76—lateral view, lectotype, 77—internal sac of the aedeagus, ventral view, 78—lateral view, left, 79—lateral view, right.

### Corrections and changes of gender and attribution of the type specimens of North and Central American *Diabrotica* species

Smith and Lawrence (1967) stated that the lectotypes of the following species are either females, or that it is



impossible to determine the gender of specimens mounted on cards: *D. duvivieri* Baly, *D. fraterna* Baly, *D. nigrocincta* Baly, *D. sedata* Baly, *D. rufomaculata* Jacoby, and *D. championi* Jacoby. We found that the lectotypes of all of these species are males.

In the type series of *D. godmani* Jacoby, one paralectotype from V. de Chiriqui, Panama, at the BMNH is *D. championi* Jacoby; 1 paralectotype from V. de Chiriqui, Panama, at the MNHN is not a *Diabrotica*. One paralectotype female at the MCZ from Bugaba, Panama is *D. quadricollis* Jacoby. One paralectotype male at the MCZ from V. de Chiriqui, Panama is an unidentified *Diabrotica* species. One paralectotype male at the MCZ from Bugaba, Panama is another unidentified *Diabrotica* species. One paralectotype female at the MCZ from Bugaba, Panama, one paralectotype male at the BMNH from Bugaba, Panama, two paralectotype males at the BMNH from V. de Chiriqui, Panama, and one paralectotype male at the USNM from Bugaba, Panama belong to one more different species. The last two species will be described as new.

In the type series of *D. palpalis* Jacoby, the lectotype female matches Jacoby's description of a male of *D. palpalis*. Three paralectotypes, one male and two females, of *D. palpalis* at the BMNH are actually *D. novemmaculata* Jacoby.

In the type series of *D. paradoxa* Jacoby, one paralectotype at the BMNH from Isabal, Guatemala is not *D. paradoxa*, but an unidentified species.

In the type series of *D. viridicollis* Jacoby, three paralectotype males from Tapachula, Chiapas at the MCZ and one paralectotype male from Oaxaca, Mexico at the BMNH belong to a different species. One paralectotype male from Chontales, Nicaragua at the BMNH is a different species. One paralectotype female from Bugaba, Panama, at the BMNH is a different species. All these three species cannot be identified and will be described as new.

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## References

- Baly, J.S. (1890) On the South American species of *Diabrotica*. Part I. *Transactions of the Entomological Society of London* 1890, 1–86.
- Barber, H.S. (1947) *Diabrotica* and two new genera (Coleoptera, Chrysomelidae). *Proceedings of the Entomological Society of Washington*, 49(6), 151–161.
- Bechyné, J. (1955a) Les Chrysomeloidea de Cayenne captures par le Dr. E. Abonnene. *Bulletin Mensuel de la Société Linnéenne de Lyon*, 24, 139–142.
- Bechyné, J. (1955b) Troisième note sur les Chrysomeloidea néotropicaux des collections de l'Institut royal des Sciences naturelles de Belgique (Col. Phytophaga) (1). *Bulletin de l'Institut royal des Sciences naturelles de Belgique*, 31(5), 1–23.
- Bechyné, J. (1956) Reise des Herrn G. Frey in Südamerika: Galerucidae (Col. Phytophaga). *Entomologische Arbeiten aus dem Museum G. Frey*, 7(1), 241–358.
- Bechyné, J. (1957) Voyage de M. le Dr. A. Roman au Brésil (1914–1915). Eumolpides, Galerucides et Alticides (Col. Phytophaga). *Arkiv für Zoologie*, 11(10), 133–152.
- Bechyné, J. (1958) Notizen zu den neotropischen Chrysomeloidea. (Col. Phytophaga). *Entomologische Arbeiten aus dem Museum G. Frey*, 9, 478–706.
- Bowditch, F.C. (1911) Notes on *Diabrotica* and descriptions of new species. *Canadian Entomologist*, 43, 9–16, 53–58, 89–97, 207.  
<http://dx.doi.org/10.4039/Ent439-1>

- Burchett, A. (2001) Operation rootworm: Can biotechnology beat the one-billion dollar bug? *Farm Journal*, 125(11), 16–18.
- Christensen, J.R. (1944) Estudio sobre el género “*Diabrotica*” Chev. en la Argentina. *Revista de la Facultad de Agronomía y Veterinaria de la Universidad de Buenos Aires*, 10(1943), 464–516.
- Fabricius, J.C. (1787) *Mantissa insectorum, sistens eorum species nuper detectas adiectis characteribus genericis, differentiis specificis, emendationibus, observationibus*, Tomus I. Hafniae, C. G. Proft, 348 pp.
- Fabricius, J.C. (1798) *Supplementum entomologiae systematicae*. Hafniae, Prost & Storch. 2+572 pp.
- Fabricius, J.C. (1801) *Systema eleutheratorum*. Vol. 1. Kiliae, Bibliopol. Acad. 24+506 pp.
- Harold, E. von (1875) Diagnosen neuer Arten. *Coleopterologische Hefte*, 13, 88–94.
- Harold, E. von (1877) Coleopterorum species novae. *Mittheilungen des Münchener Entomologischen Vereins*, 1, 97–111.
- Horn, G.H. (1893) The Galerucini of boreal America. *Transactions of the American Entomological Society*, 20, 57–144.
- Jacoby, M. (1887) Galerucidae. *Biologia Centrali-Americana, Insecta, Coleoptera, Galerucidae*. Vol. 6. pt. 1 (1880–1892), 497–584.
- Kirsch, T. (1883) Neue südamerikanische Käfer. *Berliner Entomologische Zeitschrift*, 27, 187–213.  
<http://dx.doi.org/10.1002/mmnd.18830270205>
- Klug, F. (1829) *Preis-Verzeichniss vorräthiger Insectendoubletten des Königl. zoologischen Museums der Universität*. Berlin, 18 pp.
- Konstantinov, A.S. (1998) *Revision of the Palearctic species of Aphthona Chevrolat and cladistic classification of the Aphthonini (Coleoptera: Chrysomelidae: Alticinae)*. *Memoirs on Entomology, International*, “Associated Publishers”, Gainesville, 429 pp.
- Krysan, J.L. & Smith, R.F. (1987) Systematics of the *virgifera* species group of *Diabrotica* (Coleoptera: Chrysomelidae: Galerucinae). *Entomography*, 5, 375–484.
- Olivier, A.G. (1790) Encyclopédie méthodique. Histoire naturelle. Insectes. Encyclopédie méthodique. Histoire naturelle. Insectes. Vol. 4. Panckoucke, Paris & Plomteux, Liege. [A–BOM]. - pp. j–cclxxxvii [= 1–288], j–ccclxxii [= 1–373], 331 (pages 1–44, issued in 1789, 45–331 in 1790).
- Olivier, A.G. (1808) Entomologie, ou histoire naturelle des insectes, avec leurs caractères génériques et spécifiques, leur description, leur synonymie, et leur figure enluminée. *Coléoptères*. Vol. 6. Paris, Desray, 613–1104, pl. 81–100.
- Smith, R.F. (1966) The distribution of Diabroticites in Western North America. *Bulletin, Entomological Society of America*, 12, 108–110.
- Smith, R.F. & Lawrence, J.F. (1967) Clarification of the status of the type specimens of Diabroticites (Coleoptera, Chrysomelidae, Galerucinae). *University of California Publications in Entomology*, 45, 1–174.
- Wilcox, J.A. (1971) Chrysomelidae: Galerucinae (Luperini: Aulacophorina, Diabroticina). *In*: Wilcox, J.A. (Ed.), *Coleopterorum Catalogus Supplementa*. Pars 78(2), Second edition. W. Junk, ‘s-Gravenhage, pp. 431–2211.