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Subgenera of *Dacne* Latreille, 1797 (Erotylidae: Erotylinae: Dacnini) given full generic rank

Paul E. Skelley

Florida State Collection of Arthropods
Florida Department of Agriculture – DPI
P. O. Box 147100
Gainesville, FL 32614-7100, USA

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Subgenera of *Dacne* Latreille, 1797 (Erotylidae: Erotylinae: Dacnini) given full generic rank

Paul E. Skelley

Florida State Collection of Arthropods
Florida Department of Agriculture – DPI
P. O. Box 147100
Gainesville, FL 32614-7100, USA
Paul.Skelley@FDACS.gov
https://orcid.org/0000-0003-2687-6740

Abstract. Previously described subgenera of *Dacne* Latreille, 1797 (Coleoptera: Erotylidae) show character states and combinations implying closer relationships with genera other than with *Dacne*, suggesting "*Dacne*" is not monophyletic. These characters are briefly discussed along with the genera sharing the characters. To improve the current classification, the subgenera of *Dacne* are **raised to generic status** as: *Afrodacne* Delkeskamp, 1954, *Ameridacne* Skelley, 2009, and *Xenodacne* Boyle, 1956. A checklist of all species included in these genera is presented, updating generic combinations as needed.

Key words. *Afrodacne*, *Ameridacne*, *Xenodacne*.

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Introduction

The tribe Dacnini (Erotylidae: Erotylinae) is a diverse group of small beetles with over 20 genera scattered across the globe (Boyle 1956; Delkeskamp 1981; Chûjô and Chûjô 1988; Alvarenga 1994; Węgrzynowicz 2007; Skelley et al. 2021). Recent phylogenetic analyses included few exemplars of dacnine genera (Węgrzynowicz 2002; Leschen 2003; Robertson et al. 2004; Leschen and Buckley 2007; Powell 2021 and pers. comm.); therefore, none were robust enough to clarify relationships within the tribe Dacnini. The molecular analysis of Powell (2021 and pers. comm.) includes several genera of the Dacnini that were found to be widely separated by other tribes. These findings, along with observations of the striking anatomical diversity within Dacnini, raise concerns about the monophyly of the tribe and some of its included genera, especially some genera that were not represented in previous phylogenetic studies.

Anatomical studies of Dacnini including worldwide representatives, revealed new characters and suggested that *Thallis* Erichson and *Dacne* Latreille may not be monophyletic. The subgenera of *Dacne* appear more distantly related than previously suspected (see discussion for the tribal placement of *Echinothallis* Skelley et al. in Skelley et al. 2021). Raising the subgenera of *Dacne* to genus-level prepares their nomenclature for upcoming taxonomic, phylogenetic and regional faunal works. The primary purpose of this paper is to discuss character incongruities supporting these proposed taxonomic rank changes. A secondary purpose is to present some phylogenetic problems that remain unresolved for the Dacnini.

Materials and Methods

Taxa studied. A broad sampling of Dacnini was examined for this preliminary study. Representatives of the following genera were available in the Florida State Collection of Arthropods (Gainesville, FL, USA): *Cardiodacne* Philipp, *Cnecosa* Pascoe, *Combocerus* Bedel, *Cryptodacne* Sharp, *Dacne* Latreille (along with the subgenera: *Ameridacne* Skelley, *Afrodacne* Delkeskamp, *Dacne* (*sensu stricto*), and *Xenodacne* Boyle), *Kuschelengis* Skelley and Leschen, *Madadacne* Philipp, *Microdacne* Skelley et al., *Microsternus* Crotch, *Neosternus* Dai and Zhao, *Neothallis* Fauvel, and *Thallis* Erichson. In addition, the existing literature provided descriptions and illustrations of many Dacnini and their characters, including: *Dacne* (*Ameridacne*) Skelley in Skelley (2009), *Dacne* Latreille,

Dacne (*Xenodacne*) Boyle and *Microsternus* Crotch in Boyle (1956), *Echinothallis* Skelley et al. and *Microdacne* Skelley et al. in Skelley et al. (2021), *Kuschelengis* Skelley and Leschen and *Cryptodacne* Sharp in Skelley and Leschen (2007), *Masahiria* Węgrzynowicz in Węgrzynowicz (2005), *Neosternus* Dai and Zhao and *Microsternus* in Dai and Zhao (2013b), and *Dacne* (*Xenodacne*) of China in Dai and Zhao (2013a).

Available keys. There is no current key to easily identify genera of the Dacnini on a world level. Various regional keys exist that allow identification of subgenera and species of "*Dacne*" (Delkeskamp 1954 (Africa); Boyle 1956 (North America); Chûjô 1969 (Japan); Iablokoff-Khnzorian 1975 (Palearctic); Skelley 1997, 2004 (World); Dai and Zhao 2013a (China)). These works cover "*Dacne*" species, but not necessarily any closely related genera on a world basis.

Structural characters. Recent research brought attention to new characters and states that will be important for future research in the Erotylinae (Pecci-Maddalena et al. 2021; Pecci-Maddalena and Skelley 2021). Preliminary observations on world Dacnini found more potentially significant characters (Skelley et al. 2021). Many other characters need detailed examination and analysis across genera. A few of these characters include: antenna club development, occipital stridulatory file development, pronotum with anterior margin swollen and hood-like, pronotal puncture patterns, pronotal lateral margin development, pronotal and elytral marginal beads, maxillary and labial palpomere development and sensory areas, maxillary orientation at rest and buccal cavity development, proventrite and coxal line development, mesoventrite surface structure, meso-metaventrite junction width and internal knob development, tarsal structures, sexual dimorphisms (Delkeskamp 1959), male and female genital structures, etc.

Some of these features are relevant for diagnosing the previous subgenera of *Dacne*. The following discussions do not exhaust all characters that may be significant for a phylogenetic analysis. Only a few are highlighted to justify the subgenera becoming genera. Future work on the Dacnini will surely include further discussion of these character systems.

In the following generic diagnoses, an asterisk (*) indicates characters whose combinations are synapomorphic for the newly raised genera, not for *Dacne* in the broad sense.

Taxonomic Discussion

Dacne Latreille, 1797

Figures 2, 4, 6–9, 12, 19

Dacne Latreille 1797: 12. Type: *Dermestes bipustulatus* Thunberg 1781: 6, subsequent designation by Latreille 1810: 427.

Engis Paykull 1800: 349. Type: *Ips humeralis* Fabricius 1787: 45, subsequent designation by Chûjô and Chûjô 1988: 141. Synonym of *Dacne* Latreille 1797: 12 by Lacordaire 1842: 63.

Cnesophages Reitter 1875: 42. Type *Cnesophages jekeli* Reitter 1875: 43, by monotypy. Synonym of *Dacne* Latreille 1797: 12 by Ganglbauer 1899: 645.

Diagnosis. Some characters that help distinguish *Dacne* (*sensu stricto*) include: *Antennal club strongly capitate to subcircular, antennomeres asymmetrical in many (Fig. 6–7). *Pronotal anterior margin convex and swollen, covering base of head (hood-like) (Fig. 2, 8–9). Pronotal punctures evenly distributed. Proventrite with lines generally short, central plate not prominent. Lateral pronotal marginal bead thin entire length (Fig. 2, 4, 8–9). Mesocoxae broadly separated, meso-metaventrite juncture straight (Fig. 19). Female genitalia with gonostyli absent, gonocoxite sclerotized and chisel-like. Female genitalia with segment 9 bearing rows of teeth-like lamellae (Fig. 12).

Included species. Seventeen species (Boyle 1956; Węgrzynowicz 2007):

Dacne akitai Narukawa, 1992

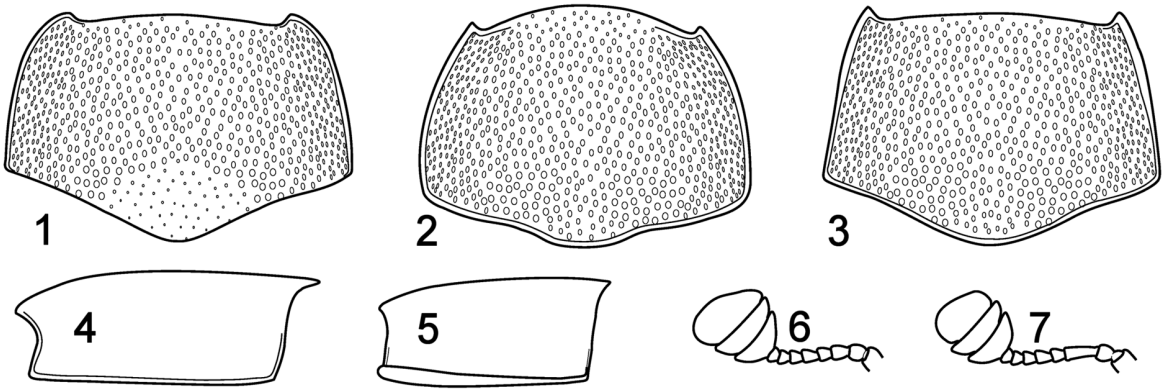
Dacne bipustulata (Thunberg, 1781)

Dacne californica (Horn, 1870)

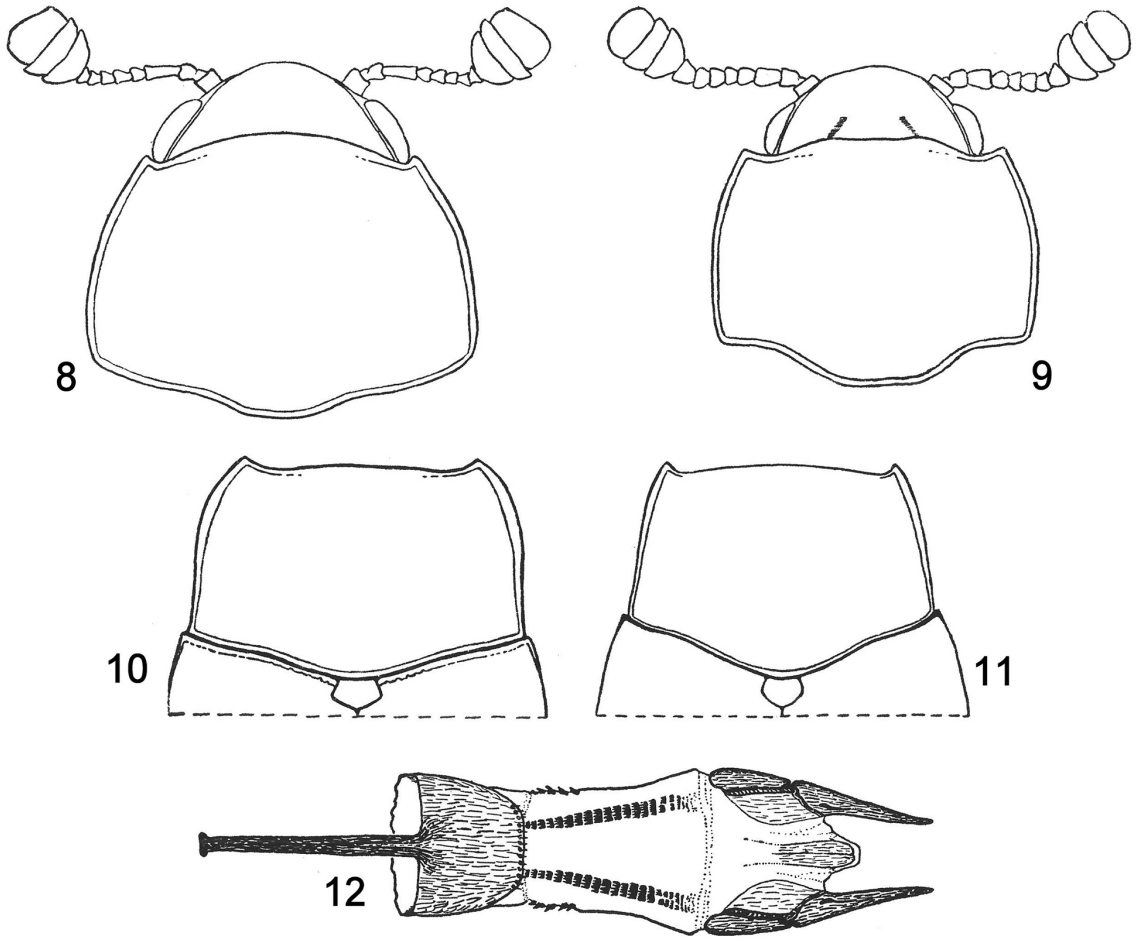
Dacne fungorum fungorum Lewis, 1887

Dacne fungorum nigrocephala Chûjô, Chûjô and Lee, 1993

Dacne indica Crotch, 1876



Figures 1–7. Pronota and antennae of *Afrodacne*, *Dacne* and *Xenodacne*. **1)** Pronotum of *Afrodacne aequinoctialis*, dorsal view, basal width = 1.75 mm. **2)** Pronotum of *Dacne quadrimaculata*, dorsal view, basal width = 1.42 mm. **3)** Pronotum of *Xenodacne pubescens*, dorsal view, basal width = 1.06 mm. **4)** Pronotum of *Dacne quadrimaculata*, left lateral view, margin length = 0.70 mm. **5)** Pronotum of *Xenodacne pubescens*, left lateral view, margin length = 0.51 mm. **6)** Antenna of *Dacne quadrimaculata*, antennomere X width = 0.24 mm. **7)** Antenna of *Dacne picta*, antennomere X width = 0.30 mm. (Reproduced from Skelley 1997).



Figures 8–12. *Dacne* and *Xenodacne* spp. **8–11)** Dorsal pronotum. **8)** *Dacne quadrimaculata*. **9)** *Dacne californica*. **10)** *Xenodacne picea*. **11)** *Xenodacne pubescens*. **12)** Female genitalia *Dacne quadrimaculata*. (Reproduced from Boyle 1956).

Dacne japonica Crotch, 1873
Dacne kidoi Nakane, 1981
Dacne minima Nikitsky and Kompantzev, 1995
Dacne notata (Gmelin, 1790)
Dacne optabilis Gorham, 1896
Dacne osawai Ashida and Kim, 1999
Dacne picta Crotch, 1873
Dacne pontica (Bedel, 1868)
Dacne pulchella Arrow, 1925
Dacne quadrimaculata (Say, 1835)
Dacne rufifrons (Fabricius, 1775)
Dacne semirufula (Reitter, 1897)

Distribution. Naturally, *Dacne* generally occur in more temperate areas throughout the Holarctic. One species, *Dacne picta*, native to eastern Asia, has been intercepted as a stored product pest in dried mushrooms in various countries worldwide (pers. comm. with museum curators and agricultural officials). However, it is established in Hawaii (Boyle 1963), Australia (Lawrence 1988), eastern Europe (Schmidl 1995; Jelínek and Štourač 1997; Lundberg 2006; Ruta et al. 2017), and the eastern United States (Skelley 2018).

Remarks. The diagnostic characters above are provided simply to show differences between former subgenera and more narrowly define the included members of this genus. With the other former subgenera removed, *Dacne* is a more homogeneous group. A new description should be written when the world genera of Dacnini are revised.

Afrodacne Delkeskamp, 1954, full generic status

Figures 1, 13–14

Dacne (*Afrodacne*) Delkeskamp 1954: 64. Type species *Engis aequinoctialis* Thomson 1858: 235, by original designation.

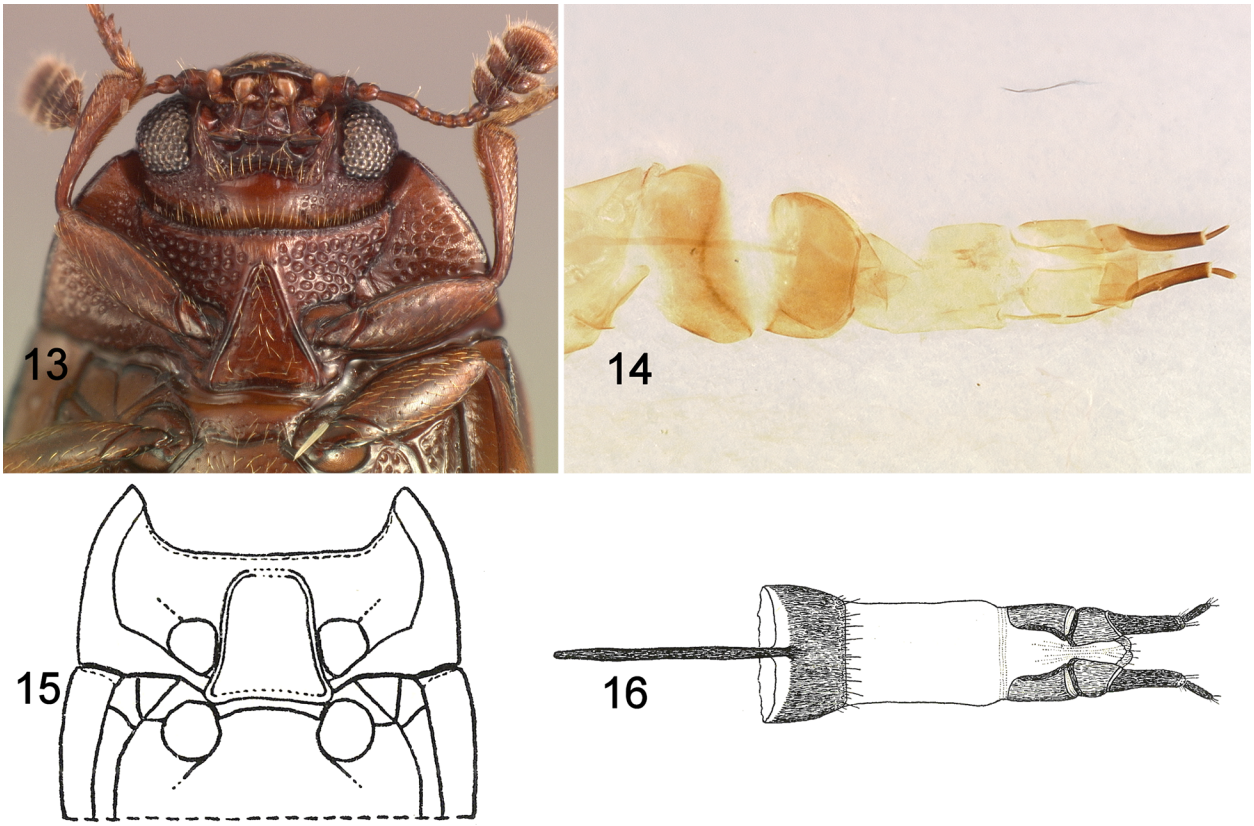
Diagnosis. Some characters that help diagnose *Afrodacne* include: Pronotal margin not anteriorly prominent medially (not hood-like). *Pronotal punctation generally coarse, with a sharp line marking a dramatic change from coarse to fine puncture near the medial base (Fig. 1). *Proventrite with long coxal lines and prominent proventral plate (Fig. 13). *Mesoventrite with visible portion very short and broad. *Female genitalia with apical gonostyli, gonocoxite not heavily sclerotized. *Female genitalia with segment 9 lacking rows of teeth-like lamellae (Fig. 14).

Included species. Four species (Delkeskamp 1981):
Afrodacne aequinoctialis (Thomson, 1858)
Afrodacne clavata (Delkeskamp, 1954)
Afrodacne nigropicta (Delkeskamp, 1954)
Afrodacne rufa (Delkeskamp, 1954)

Distribution. Africa.

Remarks. The diagnostic characters listed above appear to be a set of possibly synapomorphies shared between *Afrodacne*, *Microsternus* (Fig. 15–16), and *Neosternus*, that readily distinguish them from true *Dacne* and other Dacnini. In the analysis of Powell (2021, pers. comm.) *Microsternus* is well separated from typical *Dacne*. Until phylogenetic studies resolve the precise placement of *Afrodacne* and presumed relatives, raising its rank to genus-level improves the classification by clarifying the delimitation of *Dacne*.

These three genera are readily distinguished from each other. *Microsternus* has a gular pit posterior of each postmandibular lobe, has narrow lateral pronotal margins, and is found in eastern Asia and North America. *Neosternus* lacks gular pits, has a deep pronotal sulcus along each side forming a broad lateral margin, and is found in eastern Asia. *Afrodacne* lacking gular pits, has narrow lateral pronotal margins, and is found in Africa. Additional comparative diagnostics and images for *Microsternus* and *Neosternus* can be found in Dai and Zhao (2013b).



Figures 13–16. Ventral view of proventrite and female genitalia. **13–14)** *Afrodacne aequinoctialis*. **15–16)** *Microsternus ulkei* (Crotch) (Reproduced from Boyle 1956).

Ameridacne Skelley, 2009, full generic status

Figures 17–18

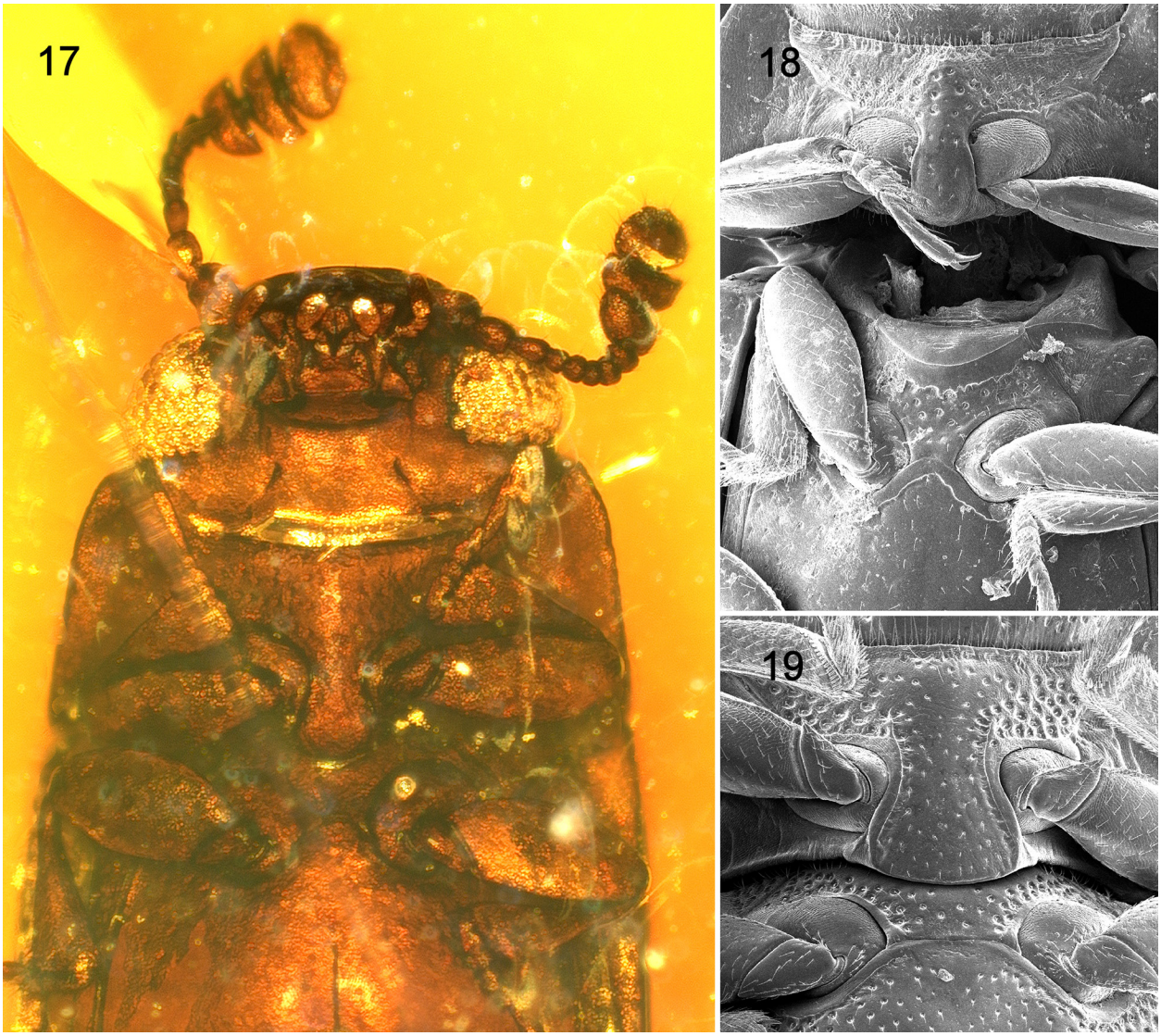
Dacne (*Ameridacne*) Skelley 2009: 12. Type *Dacne brodzinskyi* Skelley 1997: 51, by original designation.

Diagnosis. Some characters that help diagnose *Ameridacne* include: Antennal club strongly capitate. Pronotal anterior margin convex and swollen, covering base of head (hood-like). Pronotal punctures evenly distributed. Proventrite with lines generally short, central plate not prominent. Lateral pronotal marginal bead thin entire length. *Mesocoxae narrowly separated, meso-metaventrite juncture arched (Fig. 17–18).

Included species. Two species:
Ameridacne brodzinskyi (Skelley, 1997)†
Ameridacne ducke (Skelley, 2004)

Distribution. New World tropics.

Remarks. Although members of *Ameridacne* are similar to *Dacne* in most characters, they have a narrow separation of the mesocoxae and arched meso-metaventrite suture, similar to *Echinothallis* and members of other erotylid subfamilies. This narrowed connection implies a single-knob internal meso-metaventrite connection. A widened junction between the mesocoxae with an internal double-knob connection is an apomorphy defining Erotylinae (Leschen 2003). The narrowed connection may be a plesiomorphy, which presents a major concern with the taxonomic placement of *Ameridacne* and *Echinothallis* in the Dacnini (see discussion in Skelley et al. 2021). Raising *Ameridacne* to generic-level is justified until more detailed analyses can be performed to solidify tribal placement.



Figures 17–19. Ventral sternites. **17)** *Ameridacne brodzinskyi*, amber fossil. **18)** *Ameridacne ducke*. **19)** *Dacne quadrimaculata*. (Reproduced from Skelley 2009).

Xenodacne Boyle, 1956, full generic status

Figures 3, 5, 10–11

Dacne (*Xenodacne*) Boyle 1956: 84. Type: *Dacne picea* LeConte 1875: 170, by original designation.

Diagnosis. Some characters that help diagnose *Ameridacne* include: Antennal club strongly capitate to subcircular, antennomeres symmetrical. *Pronotal anterior margin straight to concave medially (not swollen covering base of head; Fig. 3, 10–11). Pronotal punctures evenly distributed (Fig. 3). Proventrite with lines generally short, central plate not prominent. *Lateral pronotal marginal bead thickened anteriorly (Fig. 5, 10–11). Mesocoxae broadly separated, meso-metaventrite juncture straight. Female genitalia with gonostyli absent, gonocoxite sclerotized and chisel-like. Female genitalia with segment 9 bearing rows of teeth-like lamellae.

Included species. Eight species:
Xenodacne cyclochilus (Boyle, 1954)
Xenodacne hujiayaoi (Dai and Zhao, 2013)
Xenodacne maculata (Chûjô, 1940)

Xenodacne picea (LeConte, 1875)
Xenodacne pubescens (Boyle, 1956)
Xenodacne tangliangi (Dai and Zhao, 2013)
Xenodacne zonaria zonaria (Lewis, 1887)
    Xenodacne zonaria taiwana (Chûjô, 1976)

Distribution. Eastern Asia and western North America.

Remarks. Additional comparative diagnostics and images of Oriental species are presented in Dai and Zhao (2013a). In many ways, *Xenodacne* is more similar to true *Dacne* than other genera. The most notable differences are those stated by Boyle (1956): pronotal anterior margin not swollen and hood-like; pronotal lateral margin swollen anteriorly; and elytral punctation confused, not in distinct rows. These features could group *Xenodacne* with other taxa like some member of *Thallis* (*sensu lato*). Raising *Xenodacne* to generic level, makes *Dacne* more homogeneous and more clearly defined.

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