A Checklist and New Species of *Eleodes* Eschscholtz (Coleoptera: Tenebrionidae) Pertaining to the Subgenus *Promus* Leconte, with a Key to United States Species

Author(s): M. Andrew Johnston
Published By: The Coleopterists Society
DOI: http://dx.doi.org/10.1649/0010-065X-69.1.11
A CHECKLIST AND NEW SPECIES OF Eleodes Eschscholtz (Coleoptera: Tenebrionidae) Pertaining to the Subgenus Promus LeConte, with a Key to United States Species

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ABSTRACT

The tenebrionid genus Eleodes Eschscholtz, 1829 was monographed by Blaisdell in 1909. Blaisdell’s monograph did not cover most of the continental Mexican species, and most of the Eleodes subgenera have not been revised since the time of that publication. The subgenus Promus LeConte, 1862 is herein reviewed. Eleodes compositus Casey, 1891, revised status, is removed from synonymy with Eleodes hispilabris (Say, 1824) and placed in the subgenus Promus. Moreover, Eleodes hepbumni Champion, 1892 is moved from Promus to the subgenus Steneleodes Blaisdell, 1909. Eleodes subnitiens simuata Blaisdell, 1909 is placed as a junior synonym of Eleodes subnitiens LeConte, 1851, new synonymy. Eleodes madrensis Johnston, new species, is described from Arizona and northern Sonora, Mexico. A checklist is given for all species currently assigned to Promus, and a key is presented for the eight species known to occur in the United States.

Key Words: taxonomy, darkling beetles, sky islands, Arizona, synonymy

The genus Eleodes Eschscholtz, 1829 is among the most conspicuous and often observed groups of tenebrionids (Coleoptera: Tenebrionidae sensu Bouchard et al. 2011) in North America. Many researchers have worked to produce a large body of literature on the genus, yet there still remain many systematic challenges within Eleodes, especially with regards to the species-level taxonomy (Triplehorn and Thomas 2011) and nomenclature (Thomas 2005). The most current and comprehensive revision of Eleodes was undertaken in Blaisdell’s (1909) monograph, which treated species from the United States and Baja California, and most of the currently recognized 15 subgenera have not been treated since then. One such subgenus is Promus LeConte, 1862. Initially erected by LeConte (1862) as a monotypic genus to accommodate the species described by Thomas Say as Blaps opaca Say, 1823, Promus was subsequently classified as a subgenus of Eleodes by Horn (1870) and remained relatively unchanged through Blaisdell’s (1909) revision.

Promus can be readily separated from the other subgenera of Eleodes by several gender-specific characters. In particular, the males can be recognized by having the plantar groove of at least the first protarsomere interrupted by a patch of yellow, tomentose setae. The males of most species also have a single profemoral spine. Eleodes opacus (Say, 1823) and Eleodes fusiformis LeConte, 1858 lack profemoral spines but can be recognized by their strongly fusiform and dorsally flattened body. Females of all species lack profemoral spines and lack tarsal pads, having an uninterrupted plantar groove on all tarsal segments. The female genitalia are distinct, being quadrate in form with the inner posterior angle of the coxite produced, acute, and pointing mesally; and the gonostyle is rounded and flattened, positioned on the posterior facing edge of the coxite, often clothed in long setae.

The Eleodes fauna of Mexico represents a largely unrevised group of species. In the most recent checklist of the Tenebrionidae, Papp (1961) largely followed Gebien’s (1938) placement of the Mexican species into the standing subgenera of the time. Many of these placements remain to be critically re-examined, and it is likely that many changes will need to be made. Although a revision of the Mexican species of Promus is beyond the scope of this paper, the herein provided checklist includes all species presently assigned to the subgenus. The Promus species found in the United States have remained fairly stable, though several changes are presented here, including the description of a new species based on material acquired from museums and through recent collecting.

MATERIAL AND METHODS

Specimens were examined with a Leica M205 dissecting microscope and measured with an attached Leica DFC450 camera. Images were taken...
with the Visionary Digital Passport camera system equipped with a Cannon 6D and 65 mm lens; stacked images were obtained with Zerene Stacker and processed in Adobe Photoshop 6.

Specimens were examined from the following institutions:

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<thead>
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<th>Institution</th>
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<td>ADSC</td>
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<td>ASUHIC</td>
<td>Hashbrouck Insect Collection, Arizona State University, Tempe, AZ</td>
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<td>CASC</td>
<td>California Academy of Sciences, San Francisco, CA</td>
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<td>MAJC</td>
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<td>OSUC</td>
<td>C. A. Triplehorn Collection, Ohio State University, Columbus, OH</td>
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<td>RLAC</td>
<td>Rolf L. Aalbu Collection, Sacramento, CA</td>
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<td>TAMU</td>
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<td>USNM</td>
<td>United States National Museum, Smithsonian Institution, Washington, DC</td>
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<tr>
<td>WBWC</td>
<td>William B. Warner Collection, Phoenix, AZ</td>
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**SYSTEMATICS**

*Eleodes (Steneleodes) hepburni* Champion, 1892, *new placement*

_Eleodes compressitarsis_ Blaisdell, 1935
_Eleodes beameri_ Blaisdell, 1937
_Eleodes bryanti_ Blaisdell, 1937
_Eleodes palmerleensis_ Blaisdell, 1937

_Eleodes hepburni_ is the valid name for a group of synonymized species names with a tangled nomenclatural legacy. Blaisdell (1937) described the subgenus _Holeleodes_ Blaisdell as containing three then newly described species from Arizona, therein named _E. beameri_ Blaisdell (the type species), _E. bryanti_ Blaisdell, and _E. palmerleensis_ Blaisdell. These three purported species were later found to be conspecific with each other and were thus synonymized, remaining assigned to the subgenus _Holeleodes_ (Triplehorn and Doyen 1972). Triplehorn (2010) further synonymized these three species names with two priority-carrying names, *i.e.*, _E. compressitarsis_ Blaisdell and _E. hepburni_, which had both been placed by Papp (1961) in the subgenus _Ardeleodes_ Blaisdell.

In his act of assigning synonymy, Triplehorn (2010) erroneously placed _E. hepburni_ in _Steneleodes_ and not _Promus_. This interpretation is further and unambiguously supported by the presence of heavily sclerotized female genitalia characteristic of the subgenus _Steneleodes_ and phylogenetic placement based on molecular data (A. D. Smith and M. A. Johnston, unpublished data). _Eleodes hepburni_ is hereby placed in the subgenus _Steneleodes_.

Although Triplehorn (2010) did not make any mention of the subgenus _Holeleodes_, it is in accordance with current species-level synonyms that this subgenus follows the placement of _E. hepburni_ and thereby becomes a junior subjective synonym of _Steneleodes_.

_Eleodes (Promus) compositus_ Casey 1891, revised status

(Fig. 1)

The well-known coleopterist Thomas L. Casey described 15 species of _Eleodes_, of which four are currently considered valid. _Eleodes compositus_ was described in 1891 and subsequently synonymized by Blaisdell (1909) with _Eleodes hispilabris_ (Say), albeit without reexamining the type or any specimens that could be ascribed to this newly designated infrasubspecific _forma composita_ (Blaisdell 1909). Blaisdell assessed that the aberrant form of the pronotum which Casey described “is no proof that it is specifically distinct. Analogous aberrations are observed in _dentipes_ in particular, and _hispilabris_ is fully as variable as that species” (Blaisdell 1909). Indeed, the pronotum of _E. compositus_ (Fig. 1) is

![Fig. 1. Eleodes compositus. A) Holotype male, lateral habitus, scale bar = 1 cm, B) Dorsal habitus.](image-url)
subquadrate, evenly arcuate laterally, and only slightly constricted posteriorly unlike the pronotum of *E. hispilabris*, which is distinctly constricted posteriorly, widest anterior of midline, and with very prominent anterior projections. The name *Eleodes compositus* has since been listed as a synonym of *E. hispilabris* in several publications and its status has not been reconsidered in the literature (Papp 1961; Tanner 1961).

As part of an ongoing effort to reassess every type specimen within the genus *Eleodes*, the type of *Eleodes compositus*, residing at the USNM, was examined. In doing so, it became apparent that this specimen did not represent *E. hispilabris*, nor was it even a member of the subgenus *Eleodes* where *E. hispilabris* is placed. In fact, this specimen belongs to the subgenus *Promus* as clearly evidenced by the holotype male having the combined characters of spined profemora and the first two segments of the protarsi with pads of tomentose setae, a combination found in no other subgenus. The heavily sulcate elytral striae clearly distinguish this species from all other described *Promus* species. The holotype, with the locality given as “Texas”, remains as the only known specimen of this enigmatic species. *Eleodes compositus* Casey is hereby returned to valid, species-level standing and placed in the subgenus *Promus*.

**Eleodes subnitens sinuata** Blaisdell, 1909

(Fig. 2)

Thomas (2005) reviewed and illuminated the many nomenclatural problems created by Papp’s (1961) checklist, which validated many of Blaisdell’s infrasubspecific ‘formae’ as available species-level names. Blaisdell himself never intended to formalize these designations, rather they were meant to aid entomologists in discussing natural variation within a single species. One such case is *E. subnitens sinuata*.

Blaisdell’s (1909) original description references two male specimens from Prescott, Arizona as having “the pronotum widest at the middle, and the sides are feebly sinuate before the basal angles, the base appearing narrower than normal”. He also noted that some females tend to show similar variation, as opposed to the *forma typica*, which has the pronotum appearing to be widest at the base. Unfortunately, the specimens referred to by Blaisdell are not identifiable as present in the California Academy of Sciences insect collection, where his vouchers have been deposited. However, the California Academy does have a single specimen with Blaisdell’s determination label of “*Eleodes (Promus) sinuata* Blaisdell”, with a collection date of 17 July 1921, 12 years after the publication of his monograph. This specimen is from Texas and belongs to what is now known as *Eeleodes knullorum* Triplehorn, 1971. Therefore it is most plausible that Blaisdell recognized the California Academy specimen as a member of a then-undescribed species and presumably applied a manuscript name to it, which was never published.

It is possible that the specimens and habitus that Blaisdell referred to as ‘forma sinuata’ are con-specific with a herein newly named and described species (see below), in that this newly recognized and validated entity has been long confused with *Eleodes subnitens* LeConte and shares with it the presence of a posteriorly sinuate pronotum. The two species are often found in sympatry, generally in mid-elevation oak-juniper forests; indeed, the two species are found together both in the vicinity of Prescott, Arizona and throughout southeastern Arizona. However, the male tarsal setation of the new entity is distinctive and is not a feature that Blaisdell was likely to miss. Blaisdell (1909) concludes his *E. subnitens* diagnosis with: “the males have only the basal joint of the anterior tarsi pubescent beneath, which distinguishes it from all other members of the subgenus, except insularis”. This sentence immediately precedes his *forma* descriptions. It should also be noted that, while the sinuate shape of the pronotum is the most superficially striking feature to diagnose *E. subnitens* as separate from the new species, it is not always reliable. Some specimens of *E. subnitens* are known to have remarkably sinuate pronota.

In light of the above, I conclude that *E. subnitens sinuata* Blaisdell as specified in Blaisdell (1909) does not refer to the herein newly described species, but rather to a form within *E. subnitens*,

![Fig. 2. Eleodes subnitens sinuata. A) Neotype female, lateral habitus, scale bar = 1 cm, B) Dorsal habitus.](image-url)
which is often easily recognizable by its parallel-sided pronotum, though there is variation in its lateral curvature. Based on an examination of large series of specimens, I conclude that the sinuate form discussed by Blaisdell falls well within the natural variation of the species and does not represent a diagnosable subspecies. *Eleodes subnitens sinuata* Blaisdell, 1909 is hereby placed as a junior subjective synonym of *Eleodes subnitens* LeConte, 1851.

**Type Material.** A neotype female (Fig. 2), deposited in CASC, is hereby designated for *E. subnitens sinuata*. Two labels, first “USA:AZ, Yavapai Co 12km/SW Prescott, headlamping/34.4576° -112.5199° 5700ft/23-VIII-2014 M.A. Johnston”, second red paper “Neotype/Eleodes subnitens sinuata/ Blaisdell, 1909”.

*Eleodes* (*Promus*) *madrensis* Johnston, new species (Fig. 3)

**Diagnosis.** This species can be readily distinguished from other members of *Eleodes*, subgenus *Promus*, by the presence of tomentose pads interrupting the plantar surface on the first and second protarsal segments in males, the shape of the pronotum being widest anterior to midline, attenuate posteriorly, and by having a strongly declivous prosternum with a small recurved process at the tip. It most closely resembles *E. knullorum* and *Eleodes subnitens*, as discussed above.

**Description.** *Male.* Length 18–23 mm; width 7–9 mm (*n = 21*). Body elongate oval, widest near middle of abdomen, glabrous. **Head:** Antennae clavate, moderately long, extending beyond pronotum by approximately 3 segments, segments 3–7 longer than wide, segments 8–11 at least as wide as long. Mentum transversely hexagonal; anterior margin blunt, half as wide as posterior margin; lateral angles lined with long, dark setae. Maxillae heavily punctate, clothed with scattered golden setae; stipes bearing long, dark setae; palpifer rounded, produced ventrally, with long, dark setae; terminal palp segment triangular, distal margin as wide as segment is long; galea and lacinia covered with dense, yellow setae anteriorly. Ligula with 2 dense brushes of yellow setae dorsally. Mandibles heavily punctate laterally; punctures obsolete anteriorly. Head subparallel, narrowing anteriorly before antennal insertion and posteriorly behind temples, moderately punctured evenly throughout; labrum transverse, deeply sinuate anteromesally, densely covered with large punctures, clothed with yellow setae densest along anterior margin; clypeus completely fused, frontoclypeal suture entirely visible; postgenae clothed with sparse, yellow setae and punctate, punctures becoming confused mesally and forming transverse stria that do not extend to submentum; eyes elongate, slightly constricted by

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**Fig. 3.** *Eleodes madrensis.* A) Holotype male, dorsal habitus, scale bar = 1 cm, B) Lateral habitus, C) Paratype female, dorsal habitus, D) Paratype female, terminalia, dorsal view, scale bar = 1 mm, E) Paratype male, fore tarsus, ventral view.
epistomal canthus, ventral lobe positioned slightly anterior to dorsal. **Thorax:** Pronotum quadrate, rounded laterally, slightly wider than long; widest slightly anterior to midline; anterior angles acute, distinct, projecting antero-laterally; lateral margin inflexed immediately after anterior angles, then laterally inflated, becoming wider than elytral base, posterior half sinuate; posterior margin slightly narrower than elytral base; posterior margin slightly and evenly rounded; disc evenly convex, with small, scattered, moderately dense punctures. Prosternum narrow between coxae, about half the width of coxal opening, with a shallow median furrow; strongly declivous immediately anterior of coxae, with a short, rounded, recurved process strongly appressed to anterior margin of mesosternum; clothed with scattered, short, golden setae. Scutellum moderately large, about twice as wide as long; adorned with several large, shallow punctures. Elytra glabrous, fused medially; moderately densely punctate; punctures arranged in linear striae; striae very inconspicuously and slightly depressed; elytral intervals bare and impunctate. Epipleura moderately wide, same width as pseudepipleura, traceable to posterior margin of thorax, epipleura and pseudepipleura contiguous and indiscernible thereafter; pseudepipleura ending near midline of 5th visible sternite. Hind wings absent. **Legs:** Relatively long. Profemora clavate, moderately punctate throughout; each puncture bearing a single golden brown seta; armed with a single, acute tooth on anterior face; tooth positioned about 1/4 the femoral length from apex, angled antero-laterally. Protibiae similar to prothoracic legs, but bluntly sinuate distally. Protarsal segments 1–2 without tomentose pad; all tarsal segments with golden brown setae along antero-lateral margins of plantar groove. **Terminalia:** Coxites trapezoidal, elongate, twice as long as wide, dorso-laterally concave; mesally appressed, produced apical angle acutely produced, triangular; lateral and distal margins clothed with long, yellow setae. Gonostyles as wide as long, rounded, crowned with long, yellow setae.

**Variation.** The morphology of this species is fairly consistent, though the tarsi are sometimes abraded, likely due to specimen age, which can obscure the male setal pads.

**Distribution.** Northern Sonora, Mexico; southwestern New Mexico, southeastern to central Arizona, United States.

**Etymology.** The specific epithet *madrensis* is derived from the Madrean archipelago, where this species is found.

**Remarks.** Specimens of *Eleodes madrensis* are frequently found in natural history collections, but tend to be interspersed with material identified as *E. subnitens* and *E. knallorum*. See Diagnosis and Key for means to separate these taxa. K. W. Brown was the first tenebriorid worker to diagnose the difference between *E. madrensis* and *E. subnitens*, indicated in his collection by the determination label of ‘Promus possibly new species.’ The type specimen has therefore been selected from his original series of specimens from Ramsey Canyon.

**Type Material.** Holotype (male) first label “ARIZ., Cochise Co./Huachuca Mts., Miller/Canyon, 5-VIII-1971/ex. R.L. Dunn” second label “Purchased 1971 from/Russell D. Dunn” third label green disc indicating specimens formerly of K. W. Brown Collection, deposited in CASC.

**Paratypes.** 57 marked with blue paratype labels, 9 with same information as holotype, 5 males, 4 females, 1 with additional label “Eleodes (Promus)/Poss. N. SP/det KWB, ’82” ADSC; “Ramsey Canon/Huachuca Mts./Ariz. WH Mann” “WM Mann 1954/Collection” 1 male, 2 females, USNM; “Madera Ch/Pima Co./Arizona” “Dr Lenezy/ X.1982” 2 males, USNM; “Palmerlee/9.18.07..."

Fig. 4. Eleodes knullorum, paratype males, dorsal and lateral habitus, scale bars = 1 cm. A–B) Form 1, C–D) Form 2.
CHECKLIST OF THE SPECIES OF PROMUS LECONTE, 1862

The following is the complete list of species currently placed in the Eleodes subgenus Promus.

Genus Eleodes Eschscholtz 1829: 8
Subgenus Promus LeConte 1862: 226
anachronus Triplehorn 2010: 373
brucei Triplehorn 2007: 638
calcaratus Champion 1884: 86
compositus Casey 1891: 58, new placement
erraticus Champion 1884: 87
fusiformis LeConte 1858: 184
goryi Solier 1848: 251
seriatus LeConte 1858: 185 (synonym)
hogei Champion 1885: 91
insularis Linell 1899: 181

Fig. 5. Eleodes (Promus) species, dorsal and lateral habitus, scale bars = 1 cm. A–B) E. opacus, C–D) E. striolatus, E–F) E. fusiformis G–H) E. goryi.
The subgenus Promus is represented in the United States by eight species. Eleodes knuillorum is highly variable (Triplehorn 1971) and thus keys United States by eight species.

Key to the Species of Eleodes Subgenus Promus of the United States

The subgenus Promus is represented in the United States by eight species. Eleodes knuillorum is highly variable (Triplehorn 1971) and thus keys United States by eight species.

1. Elytral disc strongly flattened, lateral margin distinctly carinate (Fig. 5A–B).............E. opacus (Say)
2. Body strongly fusiform, males without prothoracic spines, anterior angles of pronotum rounded (Fig. 5E–F) .............E. fusiformis LeConte
3. Elytra clothed with minute yellow setae originating from small, evenly spaced punctures ............E. spiculiferous Triplehorn
4. Elytra with deeply impressed, sulcate striae, intervals convex (Fig. 1)............................E. compositus Casey
5. Elytra with >25 conspicuous, neatly arranged, longitudinal striae comprised of small punctures, anterior pronotal angles rounded (Fig. 5C–D) ......................E. striolatus LeConte
6. Elytra with conspicuous strial punctures, often quite large (Fig. 5G–H).........E. goryi Solier
7. Pronotum constricted behind anterior angles, evenly arcuate in posterior half, prosternal process large, forming triangular wedge (Fig. 2) .........................E. subnitens LeConte
8. Pronotum with lateral margins evenly arcuate anteriorly, sinuate posteriorly, prosternal variable, not forming a large triangular wedge (Figs. 3–4).................................E. knullorum Triplehorn (form 1)
9. Prosternum declivous behind procoxae. Males with strong prothoracic spines ..................E. knullorum Triplehorn (form 2)
10. Arizona, southwestern New Mexico. Abdomen attenuate posteriorly, female gonostyle truncate mesally, inserted on posterior face of coxite (Fig. 3).................................E. madrensis Johnston, new species

Acknowledgments

I am gratefully indebted to Aaron Smith who first noticed and pointed out the issues with E. hepburni and E. sinuata as well as the previously undescribed E. madrensis, and who, along with Nico Franz and two anonymous reviewers, provided helpful comments on early versions of this publication. The author’s research was supported by the National Science Foundation (DEB-1258154).

References Cited


(Received 22 October 2014; accepted 11 January 2015. Publication date 18 March 2015.)