



Fig. 3. Lateral view of mature egg.

The dark honey-colored eggs were generally oval in shape, about 630μ long and 430μ wide, with a collar (Fig. 3). The surface was covered with a series of oval indentations. One female mated and laid 209 eggs. The two mature female nymphs that died at emergence contained 492 and 284 eggs.

Although all the above individuals were from the Yuba River, nymphs of *Oroperla barbara* also have been collected from Miller Creek (Jewett, 1966), a tributary of the American River, from the American River itself, and from Indian Creek, Plumas County, California (T25N:R11E:S8) by the authors.

Literature Cited

- Jewett, S. G. 1966. Notes on *Arcynopteryx (Oroperla) barbara* Needham (Plecoptera). Pan. Pac. Ento. 42:175-177.
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Scarab folder

Revision of the Scarabaeidae: Anomalinae 3. A Key to the Species of *Anomala* of America North of Mexico

(Coleoptera)

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Because of a generally close relationship, combined with a remarkable variability, *Anomala* species offer few morphological characters so stable as to furnish easy differentiation between species. Many of the key characters used in the past proved questionable when we examined hundreds of specimens. A species that, in the main, has only one broad elytral interval may have two or three in variant specimens. Species with tridentate protibiae not uncommonly produce individuals with no sign of a third tooth. Or, as in the case of a basal tooth on the tarsal claw joint, while the difference does separate the species, the character is impossible to see in most specimens without microscopic dissection. Variation between translucent thinly sclerotized and opaque heavily sclerotized specimens of a species is more common than in most coleoptera, the two superficially appearing as distinct species. Indeed, in one case of partially opaqued sclerotization, the resultant false pattern was the principal character cited for a proposed new species. Nonetheless, species exist and are identifiable, but not often on single, simple characters.

Nor are the genitalia helpful. In the Anomalinae many species share a generalized type whose only differences are in size and proportion, and these are as variable as the external characters. Even in those species where differentiation is possible there is a sufficient variation for a drawing of a single specimen to be quite misleading, and difficult to match.

Working with large numbers of specimens of such variable populations literally forced a number of compromises in working out the key characters. However, it is believed that while the key may not be altogether conventional, that that is not a drawback.

Distribution is sometimes the most positive distinction, as between species of the Southeastern, and the Southwestern States, and it also may be positive in the case of relictual species confined to a sharply limited habitat. Size is sometimes a close second as a distinguishing feature, but sometimes holds only for average specimens, so it is normally used only in combination with one or more additional characters. However, size is noted for all species, but more as an easy check against error in the use of the key. In a number of species the color pattern is most distinctive. Description of pattern is not always simple, and this may appear confusing at first, but if compared character against character with actual specimens, it is usually clearly evident and positive. Finally, in one case, the time of year the two species occur is the simplest and best differentiation.

The key has been as carefully written and tested as possible, with considerable effort being made to describe characters so they may be checked negatively as well as positively, refusing to fit specimens where they do not belong, but, in the aggregate, fitting well enough where they do. However, a certain number of variants will refuse to key at all except, perhaps, on an intuitive basis, or by association with more normal specimens collected at the same time.

Key to the Species of *Anomala* of America North of Mexico

1. Larger protarsal claws simple or very obscurely cleft, with minor ramus extremely fine, closely appressed; mesotarsal claws simple or sometimes finely cleft. . . . 2
 - Larger pro- and mesotarsal claws obviously cleft, minor ramus sometimes quite small but always distinct; uncommonly the mesotarsal claws simple. . . . 11
- 2(1). Clypeus subquadrate, sides parallel, subparallel or convergent basally, less than twice as wide as long. . . . 3
 - Clypeus subsemicircular or trapezoidal, sides subparallel to divergent basally, more than twice as wide as long. . . . 5
- 3(2). Pale straw-colored to medium brown, unicolorous or pronotum with dark central macula, elytra narrowly margined darker brown. . . . 4
 - Dark brown; subsutural interval rugose, with few punctures; 11.5 mm; Arizona, Dragoon Mtns. . . . *bulleri* (Howden)
- 4(3). Clypeal suture more or less carinate; subsutural interval irregularly uniseriately punctate or impunctate, rarely weakly biseriately punctate; 8-13mm, moderately slender; Colorado and Kansas to Texas and Arizona. . . . *cavifrons* LeConte
 - Clypeal suture flat or depressed in ♂, but distinct angle between planes of frons and clypeus may give cariniform appearance, carinate in ♀; subsutural interval confusedly multipunctate, rarely strongly biseriately; 13-21mm, heavy-bodied; western Texas to southern Arizona. . . . *carinifrons* Bates
- 5(2). Entirely dark brown to black above, sometimes paler beneath; pronotum may become gradually paler toward lateral margins, but never with distinct light brown band laterally. . . . 6
 - Pale straw to largely brown-black; pronotum with at least lateral margins light brown, in a distinct band. . . . 7
- 6(5). North Carolina to Florida; 6-8mm; entirely shining black or rarely brown-black; elytral punctation coarse with striae moderately grooved. . . . *mendica* Casey
 - New Mexico and Arizona; 9-14mm; brown-black; elytra often partly pruinose, especially lateroposteriorly; elytral striae shallow, finely punctate; a narrow band of close-set short setae along carinate edges of abdomen and across propygidium, but this hidden by margins of elytra when properly positioned. . . . *castaniceps* Bates
- 7(5). Pronotum with single central macula or pair of maculae. . . . 8
 - Pronotum immaculate; elytra often with moderately broad dark margins but varying to nearly immaculate; 8.5-11.5mm; lower Colorado River basin, California, Arizona. . . . *imperialae* Potts
- 8(7). North Carolina to Florida, Alabama. . . . 9
 - Texas, middle Rio Grande basin, near Del Rio and Eagle Pass; about 9 mm. . . . *diabla* Potts
- 9(8). Pronotum with single macula, sometimes only margins pale. . . . 10
 - Pronotum with pair of small central maculae; 7-8mm (cf. couplet 36). . . . *parvula* Burmeister

- 10(9). Elytra straw to pale brown, rarely 3rd and 5th intervals streaked darker brown; pronotal macula variable in size, but if complete to base, enclosing pale area mediobasally; clypeus deeply concave; body pilose beneath; 5-7mm. . . . *semivida* LeConte
 - Elytra with dark brown margins to entirely brown-black; pronotal macula incomplete or complete to basal margin but never enclosing pale area; clypeus broadly flat, strongly but narrowly reflexed to margins; not more than sparsely or inconspicuously pilose beneath; 5-7mm (cf. couplet 37). . . . *minuta* Burmeister
- 11(1). Mesosternum between mesocoxae concave or flat anteriorly, never rising posteriorly to more than a low umbo. . . . 12
 - Mesocoxae separated by a distinctly convex to prominent raised mesosternal process, sometimes porrect. . . . 13
- 12(11). Mesocoxae moderately separated, the mesosternal plate between about as broad or broader than a tarsal segment; pronotum often entirely red-brown to black; pygidium sometimes short pilose. . . . 16
 - Mesocoxae narrowly separated, mesosternum between depressed, often concave; pronotum pale brown or with central maculation, very rarely entirely dark; pygidium with only few long hairs. . . . 24
- 13(11). Elytra subcostate or strongly striate but if with more than 10 or 11 apparent striae, then 2 or 3 formed by large, rather than by small punctures; usually smaller, 6-12mm. . . . 14
 - Elytra with 13 to 15 subequal finely punctate grooved striae; often larger, 11-16mm; pronotum with large dark macula and flaccate margins, rarely entirely dark; Great Lakes to southern New England, south to Texas and Florida *marginata* (Fabricius)
- 14(13). Medium brown, varying to uncommonly entirely dull black; labrum visible before clypeus. . . . 15
 - Entirely black, often with greenish metallic luster; labrum not visible before clypeus; elytra laterally with 4 distinctly prominent subequal costate intervals; Florida. . . . *robinsoni* Potts
- 15(14). Labrum moderately emarginate, extending only slightly beyond nearly vertical anterior face of clypeus; elytra commonly with 7th and 9th intervals only moderately convex and with a distinct 8th interval between, often for more than half the length of intervals; Great Lakes to New England, south to Kansas and Florida. . . . *lucicola* (Fabricius)
 - Labrum deeply emarginate, porrect well beyond strongly oblique anterior face of clypeus; elytra commonly with two strongly swollen costate intervals laterally, but 8th interval between often obsolescent, or if distinct, then uncommonly extending for more than a short distance; Great Lakes to New England, south to Tennessee and Florida. . . . *oblivia* Horn
- 16(12). Pygidium largely glabrous; elytra with rather finely punctate or impunctate grooved striae; antennal club of ♂ often notably longer than stem. . . . 17
 - Pygidium pilose; elytra with striae series formed by brown or black colored punctures, these sometimes coalesced into short foveae, most or all striae plane or very slightly grooved; club of ♂ subequal to stem. . . . 19
- 17(16). Brown, or bicolorous pale and dark brown to black, if rarely slightly metallic, with luster confined to head and pronotum. . . . 18
 - Black, pronotum with green or coppery, elytra with green or bluish-green metallic luster, rarely elytra dull; 11-13mm; southern Texas. . . . *insitiva* Robinson
- 18(17). Head and pronotum pale straw or head a little darker; clypeus about twice as wide as long; labrum projecting shelf-like beneath broadly rounded-under anterior face of clypeus; 10-13mm; Arizona, Coconino Co. . . . *adscita* (Robinson)
 - Head and pronotum red-brown, dark brown, greenish- or brownish-black or black; clypeus more than twice as wide as long; labrum appressed to anterior face of clypeus, not porrect; 8-13mm; Great Lakes and New England south to eastern New Mexico and Florida. . . . *flavipennis* Burmeister

- 19(16). Protibiae with external tooth 20
Protibiae without external tooth; 6.5-7.5mm; Florida, Highlands Co.
..... *eximia* Potts
- 20(19). South central Texas to North Dakota, east to New England and Florida 21
Western New Mexico and Arizona; front of head punctorugulose, almost always
with scattered larger punctures as well; elytra immaculate, with fine binotate
spots or rarely with a little fine streaking, striae punctures discrete or uncom-
monly somewhat foveate; 9-12mm *ellipsis* Casey
- 21(20). Elytra with striae series 2 and 3, 4 and 5 geminate, formed in part by short foveae,
sutural, 6 and sometimes 7 similarly formed; binotate spots rarely developed. 22
Elytra with striae not clearly geminate, colored striae punctures almost always
discrete; binotate spots rarely wanting 23
- 22(21). Lateral margins of elytra with only short dark brown or blackish band from humeral
angle, extending only briefly beyond umbone; 8.5-13mm; southern Texas
..... *foraminosa* Bates
Lateral margins of elytra more or less broadly dark brown or blackish from
humeral almost to suture; 6-9mm; North Dakota to Indiana, south to Texas and
Louisiana *ludoviciana* Schaeffer
- 23(21). Elytra dark red-brown to blackish, concolorous with pronotum or nearly, but often
with pale basal area; colored striae punctures and binotate spots more or less
hidden by dark coloring; 8-10mm; New Jersey to Florida *umbra* Casey
Elytral disc often lighter than pronotum but suture and outer margin brown to
black, sometimes very broadly so; colored striae punctures sometimes large
and dark, almost always with a strong central dark spot on each elytron; 8-12mm;
Atlantic States to Great Plains and central Texas. *binotata* (Gyllenhal)
- 24(12). Protibiae with external tooth 25
Protibiae lacking external tooth; extremely small, 3.9-4.5mm; Florida, Lake
Altapopka. *exigua* (Schwarz)
- 25(24). Basal bead of pronotum formed by distinct groove along line proximal to basal
margin, entire or briefly interrupted medially. 26
Basal bead entirely wanting; labrum porrect before clypeus, deeply emarginate;
11-15mm; New Jersey *dubia* (Scopoli)
- 26(25). Elytra with 5 or 6 slightly grooved striae before humeral umbone, intervals not
all nearly equal, with at least subsutural interval much broader and multipunc-
tate at least in part. 27
Elytra with 6 well grooved striae before umbone, intervals subequal, costate, sub-
sutural never much broader, never multipunctate; pronotum immaculate to
black but often with paired maculae; elytra variable but often with dark fasciate
spots or bands; 7-11mm; New Jersey to Connecticut *orientalis* (Waterhouse)
- 27(26). Protibiae tridentate or with some angulate indication of 3rd tooth along outer
marginal line; elytra often broadly dark margined to almost entirely dark, less
commonly varying to immaculate; New Mexico to southern California 28
Protibiae bidentate, outer margin smoothly curved or straight before external
tooth; elytra usually narrowly margined, but sometimes spotted or entirely
black, Southwestern, Midwestern and Eastern species. 30
- 28(27). Pronotum with single central macula to entirely dark. 29
Pronotum commonly with pair of small to large maculae, sometimes immaculate,
rarely as a single macula but then often a pale median line partway through;
elytra broadly margined, both laterally and at suture, but varying to rarely nar-
rowly dark at suture only; 6.5-10mm, slender, not much broader behind middle;
lower Colorado River basin, California, Arizona. *flavilla* Bates
- 29(28). Elytra with only sutural margin narrowly dark brown; 9-12mm, slender to moderat-
ly robust, subparallel to somewhat cuneate; southern Arizona *digressa* Casey
Elytra largely dark brown or brown-black with pale streakings on narrow intervals,
rarely with only humeral and umbonal areas dark; 9-13mm, broadest behind
middle, robust; southern Arizona and southwestern New Mexico
..... *nimbosa* Casey

- 30(27). Clypeus subrectangular, sides parallel or subparallel, less than twice as wide as
long; metatibiae shorter than or subequal to femora, no longer than first 4 tarsal
segments 31
Clypeus trapezoidal or subsemicircular, sides divergent basally, rarely subparallel,
more than twice as wide as long; metatibiae longer than femora, longer than
first 4 tarsal segments 35
- 31(30). Metatibiae not notably obconical, obviously more than twice as long as wide at
apex 32
Metatibiae strongly obconical, not more than twice as long as wide at apex; 10mm;
Texas *tibialis* Schaeffer
- 32(31). Pronotum immaculate, or with one or two maculae, but these small, never reaching
to base 33
Maculation dark brown, strongly contrasting to ground color; single large pronotal
macula complete to base; elytra with dark margins strong and complete; ante-
rior pronotal angles obtuse but distinctly angulate; 7mm; western Texas
..... *suavis* Potts
- 33(32). Minor protibial claw subequal to larger, divided claw in length; pronotum usually
with central macula or pair of maculae 34
Minor protibial claw approximately half as long as larger claw; pronotum immacu-
late; 5.0-8.5mm; California, Imperial Co., Glamis Sand Dunes *carlsoni* Hardy
- 34(33). Northwestern Arizona and southwestern Utah; pronotum with pair of well-sepa-
rated small anteromedial maculae, or immaculate; 6.5-9mm. *kanei* Potts
Southeastern New Mexico and western Texas; pronotum usually with single tri-
angulate anteromedial macula; 6-9mm *antennata* Schaeffer
- 35(30). Atlantic Coast to Great Plains and south-central Texas; pronotum with dark central
macula, pair of maculae, or entirely brown or black; elytra broadly margined,
immaculate, or with fasciate spots or bands to entirely black 36
Western Texas to southern California; pronotum never entirely dark; elytra never
with fasciate spots or bands or entirely black 39
- 36(35). Pronotum never with paired maculae 37
Pronotum with pair of central maculae, sometimes reduced or faint; 7-8mm; North
Carolina to Florida *parvula* Burmeister
- 37(36). Elytra narrowly margined, usually with blackish fasciate spots or bands but varying
from immaculate to entirely black; Minnesota to southern New England, to
southcentral Texas and Florida. 38
Elytra medium brown with broad darker brown margins, particularly outside
humeral umbone, sometimes posterolaterally as well, more uncommonly broad
margined to almost entirely dark brown; 5-7mm; Georgia, Florida, and Alabama
(cf. couplet 10) *minuta* Burmeister
- 38(37). Generally a summer species, June and July; elytra immaculate to spotted, banded
or black, nearly always with dark area over apical umbone; head often bicolorous
pale brown and blackish; pronotal macula triangulate with waist-like constrict-
ion near anterior margin, uncommonly varying to entirely black; scutellum pale
or narrowly dark margined, rarely entirely dark except in black form; 6-9mm.
..... *innuba* (Fabricius)
Generally a spring species, March to May; elytral maculation similar but never
entirely black, and rarely with apical umbonal area dark; head often entirely
red-brown, gradually darkening to vertex but not distinctly bicolorous; pronotal
macula commonly complete to basal margin, but if not, then broadly rectangu-
lar, not especially constricted anteriorly nor pointed posteriorly; scutellum
nearly always dark or broadly dark margined, with pale median area; 7.5-10.5mm
..... *undulata* Melsheimer
- 39(35). Pronotum with central maculation 40
Pronotum immaculate 45

- 40(39). Pronotum with single central macula, or rarely with macula somewhat divided medially, the division narrow or not complete to anterior margin, or maculae weak..... 41
- Pronotum with well-separated pair of usually quadrate strong maculae; elytra with narrow to broad margins, uncommonly only the suture narrowly margined (cf. couplet 28)..... *Havilla* Bates 42
- 41(40). Elytra pale to medium brown, very rarely more than narrowly to moderately margined, but if broadly marked, then only subsutural interval broad and multipunctate..... 41
- Elytra dark brown or brown-black, often with pale streaking on narrow intervals; two or three intervals broad and multipunctate (cf. couplet 29)..... *nimbosa* Casey 42
- 42(41). Arizona, Santa Catalina Mtns., Sabino Canyon; 13-17mm; pronotum with central macula, often extended posteriorly as a short line or point but sometimes complete to basal margin, then enclosing pale area medially; elytral suture narrowly dark margined and sometimes a dark macula over humeral umbone; metatarsi remarkably stout, twice as wide as other tarsi..... *sabinae* Polts Not as described..... 43
- 43(42). Elytra without distinct, or with narrow dark lateral margins, sometimes a dark macula over humeral umbone..... 44
- Elytra laterally with short blackish band below humeral umbone, and often again dark around apical angle to suture, or with dark lateral margins complete but fading or narrowing at middle; central pronotal macula often complete to base, enclosing a pale medio-basal area and sometimes a pale anteromedial area also; 8-11mm; central and southern Arizona..... *arda* Casey 44
- 44(43). Pronotum with red-brown central macula complete to base, only lateral margins pale, but sometimes tonal difference not great; elytra with dark sutural margin extending forward to enclose scutellum to base; sutural interval flattened, almost as broad apically as basally; 9-12mm; southern Arizona (cf. couplet 29)..... *digressa* Casey
- Pronotum with 5-sided dark brown macula, often slightly incised laterally, rarely enlarged and complete to base; elytra with dark sutural margin ending at apex of scutellum or extending only a little around it; sutural interval costate, widest at middle, markedly tapering to apex; metatarsi and maculation quite similar to *sabinae*, except consistently smaller, 8.5-12.5mm; Arizona, Baboquivari Mtns. to Texas, Davis Mtns..... *delicata* Casey
- 45(39). California, Imperial Co., Glamis Sand Dunes; elytra with sutural interval only moderately costate anteriorly, flattened posteriorly, dark margin as a thin line at extreme inner edge of suture; head basally of same pale straw hue as pronotum, gradually becoming light red-brown anteriorly; 7-10mm. *hardyorum* Polts California, Riverside Co., Coachella Valley; elytra with sutural interval distinctly costate, more so posteriorly than anteriorly, dark marginal band occupying at least half of width, head almost unicolorous red-brown, contrasting to straw hue of pronotum; 6.5-10mm (cf. couplet 28)..... *Havilla coachellae* Polts

Descriptions of the First Instar Larvae of Three Species of Epicautine Blister Beetles

(Coleoptera: Meloidae)

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The first instar larvae of *Pleuropompha costata* (LeConte), *Epicaula insignis* Horn, and *E. corvina* (LeConte) are described below. Descriptions of the two *Epicaula* at this time will facilitate their comparisons with members of the *Epicaula maculata* Group in a forthcoming monograph focusing on the latter taxon. Of the two species included in *Pleuropompha*, only the larva of *P. tricornata* Werner has been described (MacSwain, 1956). In addition to the description of the larva of the second species, *P. costata*, a key to species and a discussion of the traits separating *Pleuropompha* from *Epicaula* are included.

To facilitate species comparisons, descriptions closely follow the terminology and format employed by MacSwain (1956) in his extensive study of the first instar larvae of the Meloidae. All quantitative data represent means based on five (slide mounted) specimens that emerged from the same egg mass. Where variation was substantial, the range of measurements is given instead of the mean. Roman numerals refer to segment number of the structure specified unless otherwise stated. Exemplars of the species described here will be deposited in the California Academy of Sciences.

Pleuropompha costata (LeConte)

(Fig. 1)

Color. Head, thorax and abdominal segments I-V yellow brown, abdominal segments VI-IX dark brown. Head 0.92 as long as wide, as long as or only slightly shorter than pronotum and mesothorax combined; lateral margins gradually narrowing behind middle to distinctly emarginate; gula $\frac{1}{2}$ as long as greatest head width, gular setae $\frac{1}{2}$ - $\frac{2}{3}$ as long as greatest gular width. **Antennae.** II twice as long as III, two long and one short seta on apex; sensory organ slightly shorter and wider than III; terminal seta short, only $\frac{1}{3}$ the length of II. **Mandibles** very slender, with 20 very small, poorly delineated teeth; teeth slightly convex apically; apical mandibular seta slightly longer than basal seta. **Maxillary palpi.** III twice as long as wide, lateral margins curved, widest medially, narrowest apically; sensory area of III extending $\frac{3}{5}$ the length of segment; papillae of sensory area short, sparse, ca. $\frac{3}{5}$ in number; two-segmented sensory appendix short, its length slightly less than $\frac{1}{2}$ maximum width of II of labial palpi. **Labial palpi.** I $\frac{1}{2}$ as long as II; II slightly over twice as long as greatest width; only a single seta on II, this seta barely attaining apex of segment. **Thorax.** Prothorax subequal in length to meso- and metathorax combined; line of

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