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CLASSIFICATION OF THE OVIPENNIS AND
TRIFARIA GROUPS OF *NEBRIA* LATREILLE
(COLEOPTERA: CARABIDAE: NEBRIINI)

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This study of western high altitude *Nebria* began with our discovery of a new form on Circleville Mountain in southern Utah. This new form is related to *Nebria trifaria* LeConte, and because we are opposed in principle to publication of isolated descriptions of new taxa (Ball and Erwin, 1969), we surveyed the trifaria group of species in seeking more information about the relationships of this new form. In turn, this led us to re-examine Lindroth's (1961) study of North American *Nebria*, which further led us to examine other *Nebria* species groups occurring in the mountains of western United States. Our data on two of these groups are presented here.

On the basis of more extensive material than was available to Lindroth, we have slightly rearranged his groups; revised part of his key to accommodate our new forms; and we have provided illustrations of diagnostic characteristics not illustrated by him.

MATERIAL

We examined 719 adult specimens of the ovipennis and trifaria groups. The number of specimens of each taxon is given with the respective descriptions. We have also seen numerous additional specimens of *Nebria* representing species not reported on here, which helped in our understanding of the genus in North America.

The following letter code denotes museums or private collections whose material we examined: CAS—California Academy of Sciences,

San Francisco, California 94118; DHKa—David H. Kavanaugh, GRNo—Gerald R. Noonan, and UASM—Strickland Museum, Department of Entomology, University of Alberta, Edmonton 7, Alberta, Canada; MCZ—Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts 02138; USNM—National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560; OUCO—Ohio State University, Columbus, Ohio 43210; SJSC—San Jose State College, San Jose, California 95114; TLEr—personal collection of senior author; UCD—University of California, Davis, California 95616; UCR—University of California, Riverside, California 92502.

METHODS

These have been described in detail previously (Ball and Erwin, 1969; Erwin, 1970).

We define subspecies as geographically (or temporally) isolated populations within a species that differ taxonomically from other such populations (but which are potentially capable of interbreeding with these other subspecies). The evidence for meeting the criteria is derived from morphological and distributional data, only.

An exclamation point (!) is used here to indicate type-specimens seen by us.

The only measurement presented is total length. This was made with an ocular micrometer in a Wild binocular microscope. At the magnification used, one unit equalled 0.07 mm.

NOTES ABOUT THE STRUCTURE OF THE FEMALE REPRODUCTIVE SYSTEM

Females for study should be killed and preserved in a histological fixative, such as Bouin's solution. Our observations, however, were of museum specimens known to have been killed in cyanide or ethyl acetate fumes. Thus, the observations are tentative and must be confirmed with material especially prepared for study of lightly sclerotized tissue.

The bursa copulatrix of a nebrine female (Fig. 36) is a large, saclike structure diverted anterodorsally from the common oviduct. This sac has a characteristic shape which differs from species group to species group.

Among females of the trifaria and ovipennis groups and *N. paradisi* Darlington, the spermathecal duct arises from the dorsal surface of the bursa (Fig. 36), and extends to the lanceolate-shaped spermathecal reservoir. Near the origin of the duct, the membrane of the bursa is various, differing among groups of species, interspecifically and intraspecifically. In females of *N. hudsonica*, the bursal sclerite and spermatheca are located ventrally.

Females of *N. purpurata* and *N. trifaria* exhibit a sclerite on the dorsal surface of the bursa, near the point of origin of the spermatheca. This sclerite varies in form both among and within population samples

of *N. trifaria*, but the intrapopulation variation is slight compared to the amount of interpopulation difference.

TAXONOMY

Nebria Latreille

Nebria Latreille, 1802: 89. Type-species.—*Carabus brevicollis* Fabricius, 1792: 150. (See Lindroth, 1961: 60 for nomenclatorial remarks about the type species.)

Diagnostic characteristics: Head with one supraorbital seta over each eye; scrobe of mandible unisetose; stipes and mentum without spiniform setae; mentum with tooth broadly truncate or bifid; anterior coxae uniperforate-separate, open behind; anterior tibia anisochaetous-sulcate; middle coxae disjunct-confluent; hind coxae conjunct-confluent, lateral margin or "wing" vertical; elytra each with short scutellar stria and nine complete striae; male genitalia with unarmed internal sac (sac shape various) and glabrous unequal parameres; styli of ovipositor each with bisetigerous ventral puncture; bursa copulatrix various (Figs. 36-41); proventriculus internally with four large, coarse teeth (Fig. 22), each with two external projections alternated with four rows of dense brushes; (Figs. 21, 22); proventricular teeth of two types, one with broad smooth concavity, three more linearly convex, without smooth areas. Size medium to large (length 7.5-17.0 mm, from Lindroth, 1961).

REVISED PORTION OF LINDROTH'S KEY TO THE NORTH AMERICAN SPECIES OF *NEBRIA* (1961).

(to be inserted at couplet number 19, replacing 19-27:
page numbers given below refer to this paper)

19. Pronotum without posterior lateral seta; with deep furrow inside hind angle (Fig. 9) *N. kincaidi* Schwarz, p. 85.
Pronotum with lateral setigerous puncture just in front of hind angle 20.
20. Hind coxa at base (except in *hudsonica* and, individually in *paradisi*) and sterna III-V plurisetose (not all three sterna in some specimens of *paradisi*) 21.
Hind coxa and sterna III-V (except for asymmetrical anomalies) unisetose Couplet 36 in Lindroth
21. Humeri narrow, sloped; elytra broadest in apical half, basal setigerous puncture (between striae one and two) absent in most specimens; wings reduced, with or without bare suggestion of reflexed apex 22a.
Humeri prominent; elytra rather parallel-sided; basal setigerous puncture present; wings with complete reflexed apex
..... Couplet 28 in Lindroth
- 22a. Abdominal sternum II with setae between hind coxae 23a.
Abdominal sternum II without setae between hind coxae 24a.

- 23a. Tarsal articles short and robust (Fig. 4); scape of antenna swollen, widest about middle *N. ovipennis* LeConte, p. 81.
Tarsal articles long and narrow (Fig. 5); scape of antenna narrower, widest apically *N. spatulata* Van Dyke, p. 83.
- 24a. Metasternum subequal to or longer than diameter of middle coxa (Fig. 7). Elytra ellipsiform, widened only slightly from humeri to basal third. Wing rudiment with suggestion of reflexed apex 25a.
Metasternum shorter than diameter of middle coxa (Fig. 6). Elytra oviform. Wing rudiment without trace of reflexed apex 30a.
- 25a. Pronotum with sides widely reflexed (Fig. 8); lateral bead effaced at anterior angle. Scape of antenna swollen apically. Head, pronotum and elytra broad 26a.
Sides of pronotum not or barely reflexed (Fig. 2); lateral bead clearly engraved at anterior angle (Fig. 2). Antennal scape almost cylindrical. Head, pronotum and elytra narrow
..... *N. purpurata* LeConte, p. 89.
- 26a. Elytron with intervals 3, 5 and 7 strongly catenate. Dorsal surface piceous, not metallic. Median lobe with apical portion as in Figures 26, 28, 29 27a.
Elytral intervals 3, 5 and 7 with few catenations, interval 5 of some males not catenate. Dorsal surface shiny, elytra violaceous metallic. Median lobe with apical portion as in Figure 27; known only from Circleville Mt. of southern Utah
..... *N. trifaria piute* new subspecies, p. 95.
- 27a. Male median lobe with apical portion as in Figure 26; locality, mountains of central Utah, southern Wyoming or eastern Nevada (Fig. 42) *N. trifaria trifaria* LeConte, p. 93.
Apex of median lobe and range not as above 28a.
- 28a. Median lobe with apical portion as in Figure 29; locality, Rocky Mountains of southern Colorado and eastern Utah (Fig. 42) *N. trifaria catenata* Casey, p. 97.
Apex of median lobe and range not as above 29a.
- 29a. Median lobe with apical portion as in Figure 28; locality, Rocky Mountains of southern Wyoming, northern and central Colorado (Fig. 42)
..... *N. trifaria coloradensis* Van Dyke, p. 96.
Median lobe with apical portion as in Figure 25; locality, Grand Teton Mountains, Wyoming (Fig. 42)
..... *N. trifaria tetonensis* new subspecies, p. 95.
- 30a. Mentum with tooth broadly truncate. Tarsus with articles short and robust (Fig. 4), especially in male; (median lobe of *ingens* Horn as in Fig. 33) "ingens Group."
Mental tooth bifid. Tarsus with articles long and narrow (Fig. 5) 31a.

- 31a. Elytra piceous to black, each with intervals 3, 5 and 7 catenate. Abdominal sterna III-V with group of setigerous punctures laterally at base *N. vandykei* Bänninger, p. 87.
 Elytra violaceous, metallic, without catenate intervals. Abdominal sterna without lateral setae; male median lobe as in Figure 35 *N. paradisi* Darlington, p. 81.

THE OVIPENNIS GROUP

The diagnostic characteristics of this group are as follows. Elytra with narrow humeri, elytral intervals not or weakly catenate; hind wings extremely reduced; sterna III-V with apical setae only; median lobe of male genitalia with pouch in right side; bursa copulatrix without sclerites.

Originally included in this group by Lindroth (1961) were the three species described below plus *Nebria paradisi* Darlington. The latter species is removed on the grounds that males lack the pouch of the median lobe, and hence there is no evidence that *N. paradisi* is related to the other three species. Its true relationships must await further studies.

Nebria ovipennis LeConte

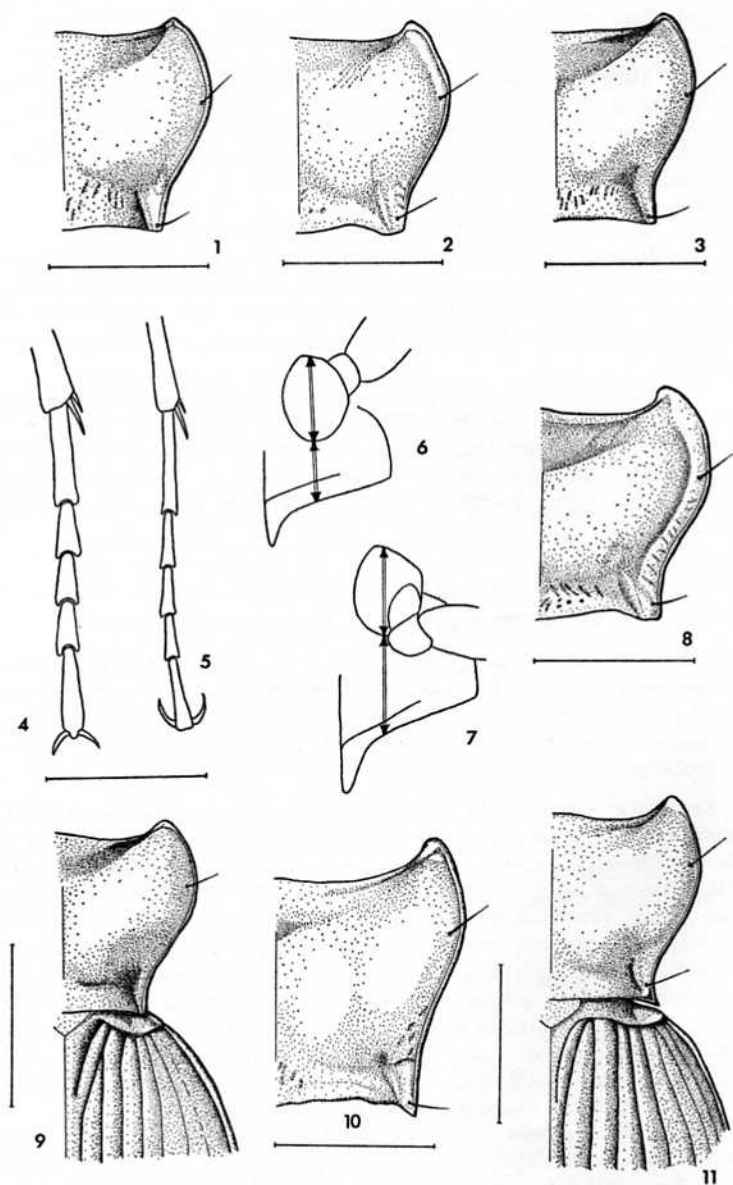
Figures 1, 4, 12, 15, 18, 42

Nebria ovipennis LeConte, 1878: 477. Type-locality.—Sierra Nevada, California, as originally given by LeConte, but here restricted to Chipmunk Flat, Tuolumne County, California, on the basis that the range is restricted to the southern Sierra Nevada. Type a male!, MCZ No. 648.

Diagnostic characteristics: Body dark rufous to piceous, without metallic luster, appendages rufous. Microsculpture of entire dorsal surface isodiametric. Antenna with scape short, robust, widest about middle. Tooth of mentum broadly truncate or bifid. Head and pronotum very broad, pronotum wider than one elytron, sides narrowly reflexed, anterior and posterior angles produced, posterior angles acute. Elytra oviform, interval 7 partially catenate or not. Middle coxa with longitudinal diameter much greater than length of metasternum behind middle coxa. Tarsus with articles short and robust, especially in male (Fig. 4). Male median lobe with long broad pouch on right side (Figs. 15 and 18). Stylus of female ovipositor as in Figure 36. Total length 10.9–12.1 mm. Material dissected: three males, one female.

Geographical distribution: The members of this species are in the Sierra Nevada of California, ranging from Tulare County in the south to at least Placer County in the north (Fig. 42). We have studied 19 specimens from the following localities.

CALIFORNIA: ALPINE COUNTY: Ebbetts Pass 8,730' 25 June (MCZ); Gin, July (NMNH). PLACER COUNTY: (NMNH). TULARE COUNTY:



FIGS. 1-3, 8 and 10. Pronotum, right dorsal aspect. 1. *Nebria ovipennis* LeC., female, Lake Elizabeth, California. 2. *Nebria purpurata* LeC., female, Canyon of the Big Blue, Colorado. 3. *Nebria spatulata*

Franklin Lake, 8 September (MCZ); Mount Silliman, 10,000', September (CAS). TUOLUMNE COUNTY: Chipmunk Flat, 9 August (UCR); Lake Elizabeth 11,000', 6 August (CAS); above Lundy, 9,000–11,000', 9 July (USNM); Sonora Pass, 9,626', 27 July (GRNo); Tuolumne Meadows, 27 July (CAS, MCZ).

One specimen is labelled Eugene, Oregon (MCZ). We doubt the authenticity of this record.

Nebria spatulata Van Dyke

Figures 3, 5, 13, 16, 19, 42

Nebria spatulata Van Dyke, 1925: 119. Type-locality.—Franklin Lake, California. Type a female!, No. 1625 (CAS).

Diagnostic characteristics: Color of body rufous to dark piceous, appendages rufous. Microsculpture of dorsum well developed, meshes slightly transverse. Dorsal surface shiny. Antenna with scape elongate, narrow, widened apically. Pronotum narrow, as wide as single elytron; sides narrowly reflexed; anterior and posterior angles produced, latter acute. Elytra ellipsiform, humeri more pronounced than in *ovipennis* specimens. Middle coxa with longitudinal diameter subequal to or slightly greater than length of metasternum behind middle coxa (Fig. 6). Median lobe of male as in Figures 16 and 19, pouch narrower than in *ovipennis* males. Ovipositor of female with stylus as in Figure 36. Total length 11.0–12.4 mm. Material dissected: three males, one female.

Geographical distribution: Members of this species are known from the southern part of the Sierra Nevada of California, from Tulare County to Tuolumne County (Fig. 42). We have seen 14 specimens from the following localities.

CALIFORNIA: FRESNO COUNTY: Brewer Lake, 22 September (CAS). MADERA COUNTY: Mount Lyell, 11,000', 27 August (CAS). TULARE

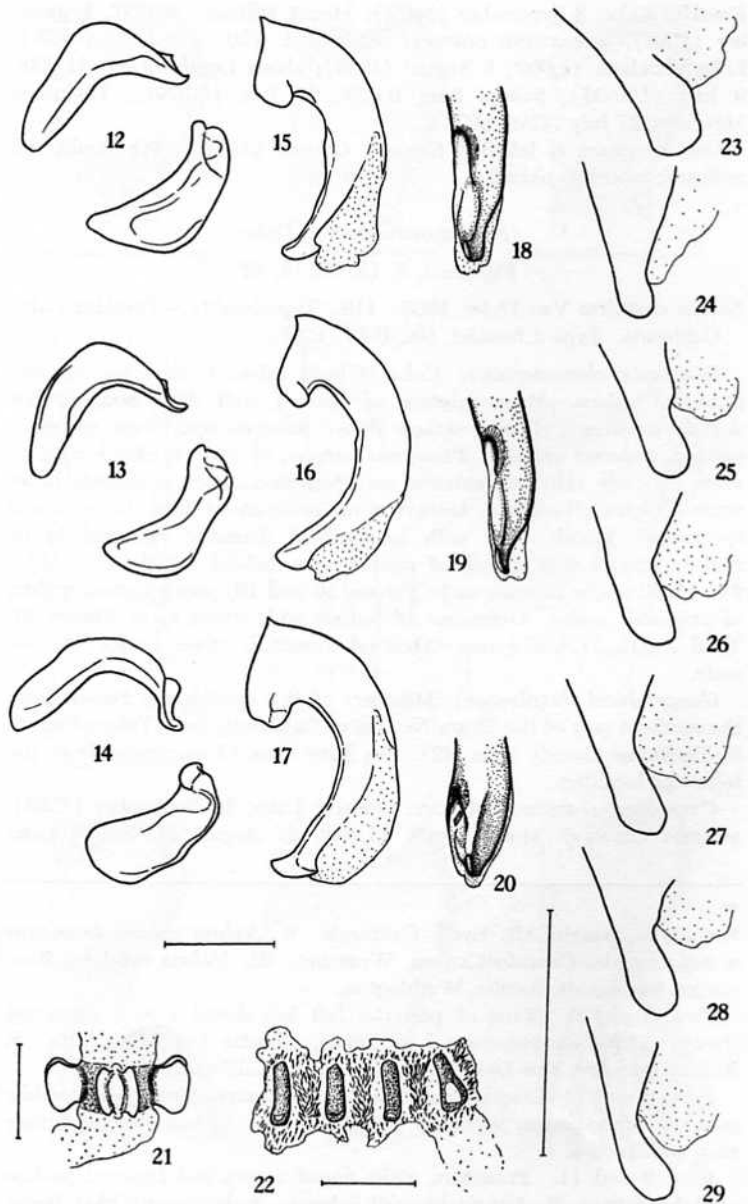
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Van Dyke, female, Mt. Lyell, California. 8. *Nebria trifaria tetonensis* n. ssp., female, Cascade Canyon, Wyoming. 10. *Nebria vandykei* Bänninger, female, Mt. Rainier, Washington.

FIGS. 4 and 5. Tarsi of posterior left leg, dorsal aspect, setae not shown. 4. *Nebria ovipennis* LeC., male, Ebbetts Pass, California. 5. *Nebria spatulata* Van Dyke, male, Mt. Lyell, California.

FIGS. 6 and 7. Diagrammatic illustration of metasternum and middle coxa. 6. Metasternum subequal to middle coxa. 7. Metasternum longer than middle coxa.

FIGS. 9 and 11. Pronotum, right dorsal aspect and humeral portion of right elytron. 9. *Nebria kincaidi* Schwarz, male, Seven Lakes Basin, Washington. 11. *Nebria paradisi* Darlington, female, Mt. Rainier, Washington.



FIGS. 12-14. Right and left parameres of male genitalia, ventral aspect.
 12. *Nebria ovipennis* LeC. 13. *Nebria spatulata* Van Dyke, Mt. Lyell,

