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## The North American Moths of the Genus *Earophila* Gumpenberg (Lepidoptera, Geometridae)

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During the past few years, collectors in southern California have caught considerable numbers of a large species of moth belonging to the subfamily Larentiinae. Examples submitted to me for identification proved to belong to an undescribed species, the generic placement of which was uncertain. The present paper is the outgrowth of my studies of this moth. The new species, belonging to *Earophila*, is described, and two additional taxa are placed in this genus for the first time.

The author wishes to express his thanks to Mr. L. M. Martin, of the Los Angeles County Museum of Natural History; Mr. R. H. Leuschner, of Gardena, California; and Mr. C. W. Kirkwood, of Summerland, California; all of whom lent specimens that were used in this study.

The genitalic drawings were done by Mr. J. C. Berberis, and the photographs by Mr. R. E. Logan, of the American Museum of Natural History.

The following abbreviations have been used:

A.M.N.H., the American Museum of Natural History

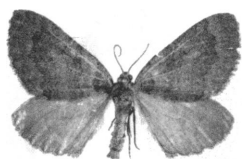
L.A.M., the Los Angeles County Museum of Natural History

### GENUS *EAROPHILA* GUMPPENBERG

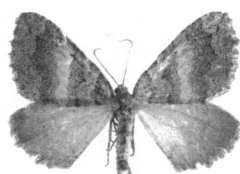
*Earophila* GUMPPENBERG, 1887, pp. 327, 339; 1890b, p. 457. FORBES, 1948, p. 146.

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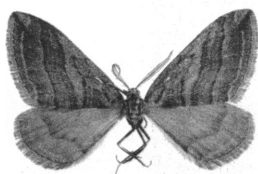
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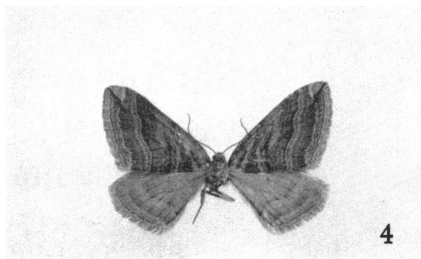
1



2



3



4

FIGS. 1, 2. *Earophila switzeraria* (Wright), paratypes, males, San Diego, California, March 12, 1912 (Geo. H. Field; A.M.N.H.).

FIGS. 3, 4. *Earophila pectinata*, new species. 3. Holotype, male, Pinyon Crest, Riverside County, California, January 23, 1965 (R. H. Leuschner; L.A.M.). 4. Allotype, female, same data.

All figures natural size.

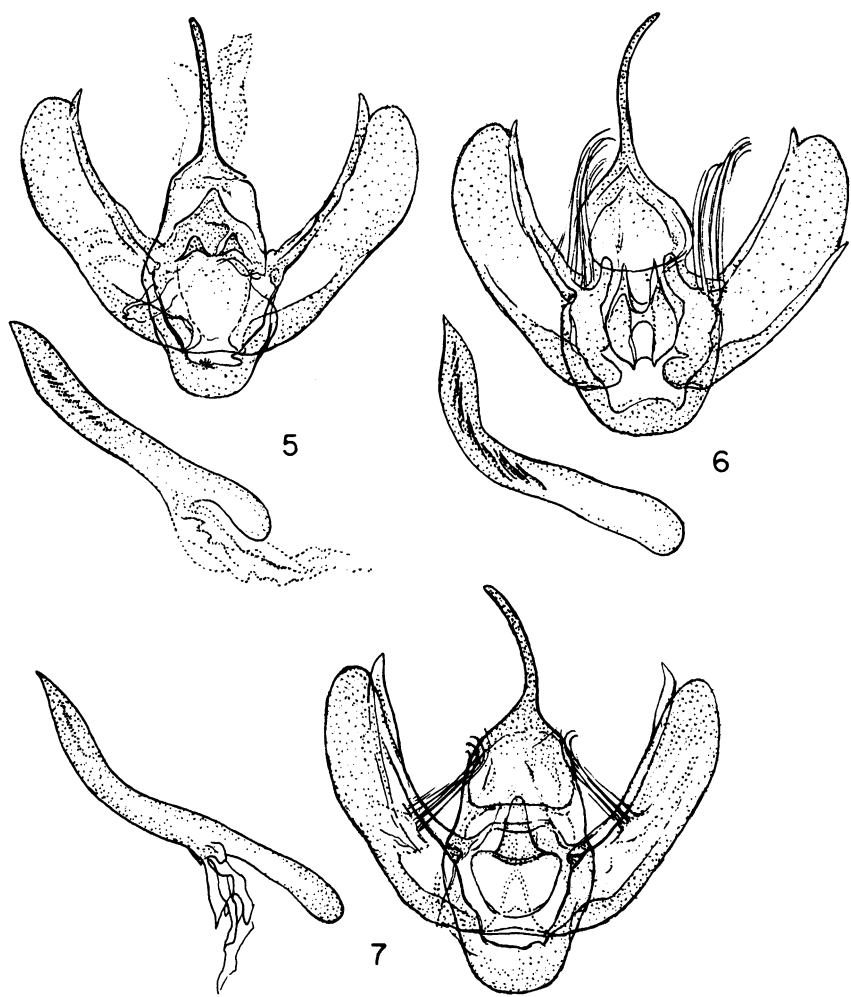
The type species of *Earophila*, by monotypy, is *badiata* Schiffermüller of Europe.

Heretofore, *vasiliata* has been the only North American species placed in *Earophila*. Three additional species are now being included. One has simple male antennae and is transcontinental in distribution (*multiferata* Walker). The others occur in southern California; one has dentate antennae (*switzeraria* Wright), the other pectinate (a new species, described below).

## KEY TO THE NORTH AMERICAN SPECIES

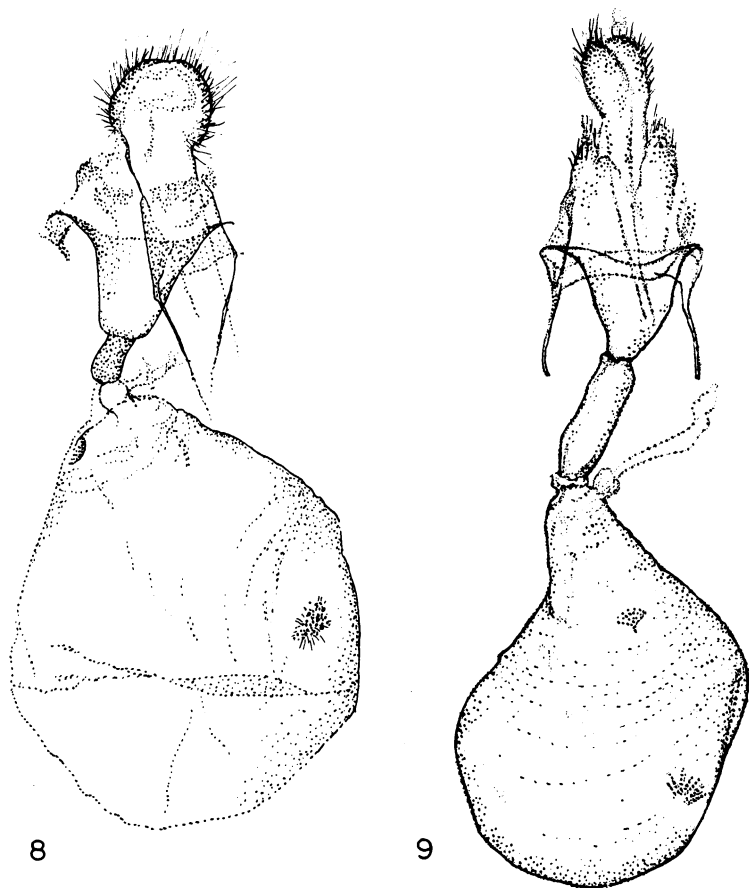
### BASED ON MACULATION AND ANTENNAE

1. Male antennae simple; forewings above dull brown; transcontinental in distribution . . . . . 2
- Male antennae dentate or pectinate; forewings above brownish gray or grayish brown; from southern California . . . . . 3
2. Upper surface of forewings with as many as 20 narrow, dark brown and either white or pale brown lines extending width of wing at right angles



FIGS. 5-7. Male genitalia. 5. *Earophila vasilata* (Guenée), 2 miles east of Elsie, Clatsop County, Oregon, April 2-4, 1965 (S. G. Jewett, Jr.; A.M.N.H.). 6. *E. switzeraria* (Wright), paratype, San Diego, California, March 12, 1912 (G. H. Field; A.M.N.H.). 7. *E. pectinata*, new species, paratype, Pinyon Crest, Riverside County, California, January 23, 1965 (R. H. Leuschner; A.M.N.H.).

- to inner margin; length of forewing varying from about 11 to 14 mm. .... *multiferata*  
Upper surface of forewings not as above; length of forewing varying from about 13 to 17 mm. .... *vasiliata*  
3. Male antennae dentate ..... *switzeraria*  
Male antennae pectinate ..... *pectinata*



FIGS. 8, 9. Female genitalia. 8. *Earophila vasiliata* (Guenée), Orcas Island, Washington, April 14, 1949 (E. Henrikson; A.M.N.H.). 9. *E. pectinata*, new species, Pinyon Crest, Riverside County, California, January 23, 1965 (R. H. Leuschner; A.M.N.H.).

#### BASED ON MALE GENITALIA

1. Valves with costa sclerotized, extending beyond end of valve as curving point ..... 2  
Costa simple, not protruding apically ..... *multiferata*
2. Valves with group of elongate setae near base ..... 3  
Valves without elongate setae ..... *vasiliata*
3. Juxta with two widely separated, posteriorly projecting points ... *switzeraria*  
Juxta with single, median, apically rounded projection ..... *pectinata*

BASED ON FEMALE GENITALIA<sup>1</sup>

1. Ductus bursae 0.2 mm. in length; posterior signum flat ..... 2  
    Ductus bursae 0.4 mm. in length; posterior signum thornlike, extending  
    into corpus bursae ..... *pectinata*
2. Sclerotized portion of sterigma shorter than length of ductus bursae .....  
    ..... *multiferata*  
    Sclerotized portion of sterigma one and one-half to two times longer than  
    ductus bursae ..... *vasiliata*

*Earophila vasiliata* (Guenée)

## Figures 5, 8

*Anticlea vasiliata* GUENÉE, 1857, p. 407. PACKARD, 1876, p. 167, pl. 9, fig. 12.  
 GUMPPENBERG, 1890a, p. 409. HULST, 1895, p. 103.

*Anticlea vasaliata* (*sic!*): GROTE, 1882, p. 50. BEUTENMÜLLER, 1890, p. 223.  
 SMITH, 1891, p. 74.

*Anticlea vasillata* (*sic!*): BRUCE, 1887, p. 49.

*Cidaria vasiliata*: ANON, 1882, p. 22.

*Mesoleuca vasaliata* (*sic!*): DYAR, "1902" [1903], p. 282; 1904, p. 898. SMITH,  
 1903, p. 68; 1910, p. 497.

*Mesoleuca vasiliata*: DYAR, 1905, p. 25 (life history). BLACKMORE, 1915, p. 118.

*Earophila vasiliata*: BARNES AND McDUNNOUGH, 1917, p. 108. BLACKMORE,  
 1927, p. 38. FORBES, 1928, p. 596; 1948, p. 146. McDUNNOUGH, 1938, p. 155.  
 PROCTER, 1938, p. 236; 1946, p. 274. FERGUSON, 1954, p. 306. HARDY, 1957, p.  
 D64. MCGUFFIN, 1958, p. 34, figs. 33, 107, 150 (larval characters).

*Macaria pilosaria* WALKER, 1860, p. 266; 1862, p. 1641. PACKARD, 1876, p.  
 296. HULST, 1895, p. 105. BARNES AND McDUNNOUGH, 1916, p. 38 (synonym of  
*vasiliata*).

*Cidaria rigida* WALKER, 1862, p. 1727. PACKARD, 1876, p. 133. HULST, 1895,  
 p. 103 (synonym of *vasiliata*).

*Petrophora rigida*: SMITH, 1891, p. 74.

*Mesoleuca niveifasciata* HULST, 1900, p. 216. RINDGE, 1955, p. 150.

*Mesoleuca vasaliata* (*sic!*) *niveifascia* (*sic!*): DYAR, "1902" [1903], p. 282. SMITH,  
 1903, p. 68.

*Mesoleuca vasiliata* var. *niveifasciata*: BLACKMORE, 1915, p. 118.

*Earophila vasiliata* form *niveifasciata*: BARNES AND McDUNNOUGH, 1917, p. 68.  
 McDUNNOUGH, 1938, p. 155.

*Earophila vasiliata* var. *niveifasciata*: FORBES, 1928, p. 596.

This species is similar in size, color, and pattern to the type of the genus, *badiata* Schifferrmüller. Both species have brown forewings, with the median area varying in color from a concolorous brown to pure white. The male antennae of *badiata* are dentate, with tufts of short cilia at the ends of the teeth, whereas those of *vasiliata* are simple, with numerous short setae on the ventral side.

<sup>1</sup> The females of *switzeraria* have not been examined.

*Earophila vasiliata* is transcontinental in distribution, extending from Nova Scotia and Quebec to Alaska and British Columbia, south to New Jersey and Pennsylvania in the east, and to Idaho and Oregon in the west.

*Earophila multiferata* (Walker), new combination

*Campptogramma multiferata* WALKER, 1862, p. 1715.

*Plemmyria multiferata*: PACKARD, 1876, p. 81, pl. 8, fig. 22. GROTE, 1882, p. 51. SMITH, 1891, p. 75.

*Plemmyria (sic!) multiferata*: GUMPPENBERG, 1890a, p. 403.

*Cidaria multiferata*: ANON, 1882, p. 22.

*Hydriomena multiferata*: HULST, 1896, p. 284. DYAR, "1902" [1903], p. 283. SMITH, 1903, p. 68.

*Hydriomene (sic!) multiferata*: DYAR, 1903, p. 193 (life history).

*Euphyia multiferata*: BARNES AND McDUNNOUGH, 1917, p. 107. McDUNNOUGH, 1938, p. 155. MCGUFFIN, 1958, pp. 19, 43.

*Percnoptilota multiferata*: FORBES, 1948, p. 155.

That the generic placement of *multiferata* has long been a source of trouble is evident from the above bibliographical references. The identity of the species itself, however, has caused no difficulties, as there is no other North American geometrid with which it can be confused.

This species is transferred to *Earophila* largely on the basis of a study of the genitalic structures, particularly of the female. The female genitalia have two signa on the opposite sides of the large and membranous corpus bursae; *multiferata* agrees with the other species of the genus in this character. The male genitalia of *multiferata* are atypical for *Earophila* in that they lack the extension of the costa beyond the valve, but they agree in the other characters. The type of pattern, venation, and antennae of *multiferata* agrees quite well with that of the other species of *Earophila*.

On the other hand, a study of the larvae (McGuffin, 1958) indicates that *multiferata* may not be very closely related to *vasiliata*. McGuffin's study resulted in the placing of *Earophila vasiliata* in the tribe Mesoleucini, while *multiferata* was retained in the genus *Euphyia* of the Hydriomenini. As the structural details of the adults of *multiferata* do not agree with those of *Euphyia*, I cannot accept McGuffin's retention of *multiferata* in that genus. The placement of this species in *Percnoptilota* (a synonym of *Nycterosea* Hulst) by Forbes (1948) is equally untenable on the basis of anatomical structures.

The species is transcontinental in distribution. In eastern North America it occurs from Nova Scotia and Quebec south to North Carolina and western Florida. It is found in Idaho and Wyoming, and on the

Pacific coast from British Columbia to the Sierra Nevada Range of California. Forbes (1948, p. 155) stated that it goes "north to Yukon," and that on the Pacific coast there is a "larger and rather paler race." Western moths are often larger than specimens of the same species from the rest of the continent. Freshly caught examples of *multiferata* from the Pacific coast region are not necessarily paler than eastern specimens. Consequently, it is not thought that the western "race" of this species should receive a name.

*Earophila switzeraria* (Wright), new combination

Figures 1, 2, 6

*Laurentia switzeraria* WRIGHT, 1916, p. 457.

*Triphosa switzeraria*: McDUNNOUGH, 1938, p. 3.

*Laurentia switzeraria* var. *swettaria* WRIGHT, 1916, p. 458.

*Triphosa switzeraria* form *swettaria*: McDUNNOUGH, 1938, p. 3.

Wright described *switzeraria* from a series of 14 males, and the form with the white median band (*swettaria*) from nine males; the type locality for both is San Diego, San Diego County, California. The holotypes are in the collection of the San Diego Natural History Museum, San Diego, California.

The male antennae are dentate and are similar to the antennae of *badiata*. The forewings have the same type of maculation that is found in *badiata* and *vasiliata*, but the wings are grayer in coloration. The length of the forewing varies from 15 to 19 mm. No females have been examined; this sex was unknown to Wright when he described the species.

The male genitalia are similar to those of *vasiliata*. Both species have the juxta with two posteriorly directed points; those of *switzeraria* are more elongate and have much sharper points than those of *vasiliata*. The distinguishing character of this species is the group of elongate, posteriorly directed setae near the base of the valve. There is also an elongate, curving, finger-like projection on each side at the base of the costa. This structure is also present in both *badiata* and *vasiliata*, but it is not so strongly developed.

The only specimens examined have been 10 males taken in February and March, 1912, at San Diego, California. These include both holotypes, plus four paratypes in the collection of the American Museum of Natural History. Two genitalic dissections have been studied.

*Earophila pectinata*, new species

Figures 3, 4, 7, 9

This is the largest North American species in the genus. The upper

surface of the forewings is predominantly grayish in color, and the males have pectinate antennae. It is known only from southern California.

**MALE:** Head with antennae pectinate, longest pectinations about 0.8 mm., with pectinations arising at base of antennal segments; palpi extending beyond front and rising to just above base of eye. Thorax above pale gray, with scattered black or brownish black scales; patagia well developed, extending length of thorax; posterior portion of thorax with two pairs of black spots; below, and legs, grayish brown, with darker scales tending to be concentrated on legs. Abdomen gray or grayish brown, upper surface with brown and black scales forming paired dorsal spots.

**UPPER SURFACE OF WINGS:** Forewings gray or pale grayish brown, crossed by numerous fine, more or less parallel, black lines; veins tending to be ochraceous; basal line straight, incomplete, extending from middle of cell to anal vein, followed by three narrow black lines; t. a. line sharply and lengthily projecting outward on radial vein, then angled posteriorly and extending in concave arc to inner margin; median area narrow, varying in color from pale grayish brown to whitish gray; t. p. line sinuous, preceded basally by three narrow black lines, in a few examples this area suffused with black and grayish black scales; t. p. line shaded outwardly by narrow white line, with thin subterminal area gradually darkening in color distally; s. t. line white, narrow, complete; apex of wing with narrow black line bisecting apical angle; terminal line black, interrupted by veins; fringe concolorous with wing, outer portion with less whitish scaling than basally. Hind wings gray or pale grayish brown; extradiscal line more or less complete, broad, rather nebulous; subterminal area whitish; terminal line and fringe like those of forewings.

**UNDER SURFACE OF WINGS:** All wings gray, with variable amount of dark scaling; without maculation except for small, elongate, discal dots, t. p. and extradiscal lines, and small black dash at apex of forewing; terminal line black, present on all wings.

**LENGTH OF FOREWING:** 17 to 21 mm.; holotype, 19 mm.

**FEMALE:** Similar to male but with simple antennae; maculation tending to be more heavily represented.

**LENGTH OF FOREWING:** 15 to 19 mm.; allotype, 17 mm.

**MALE GENITALIA:** Uncus very long and slender; valves with sclerotized costa extending beyond end of valve as outwardly curving point; inner face of valve with raised ridge, from which extend from two to four very long and slender, apically curved setae, the latter extending to just beyond base of uncus; juxta broad, sclerotized, anterior margin broadly rounded, posterior margin concave, and with single median pro-



jection arising posteromedially from juxta, length of projection slightly longer than median length of juxta; aedeagus very long and slender, apical portion curved and with small group of spines in vesica.

**FEMALE GENITALIA:** Sterigma large, sclerotized, posterior margin weakly concave, lateral margins tapering anteriorly; ductus bursae slightly longer than sterigma, sclerotized, its sides more or less subparallel; ductus seminalis arising dorsally on right side of corpus bursae near junction of ductus bursae, in form of small sac, with tube extending therefrom; corpus bursae large, swollen, membranous, with left side concave; anteroventral signum a series of narrow, posteriorly and laterally directed rays; posterodorsal signum heavily sclerotized, inwardly directed, thornlike.

**TYPES:** Holotype, male, and allotype, female, Pinyon Crest, Riverside County, California, elevation 4000 feet, January 23, 1965 (R. H. Leuschner). The genitalia of the holotype is on slide F.H.R. No. 13913, and that of the allotype on slide F.H.R. No. 13852. Paratypes, all from California, and listed by counties: *Riverside County:* Pinyon Crest, elevation 4000–4200 feet, January 16–29, 1965, January 15, 23, 1966, 14 males and 11 females. *Los Angeles County:* Cruther's Creek, southwest of Valyermo, San Gabriel Mountains, elevation 4500 feet, January 5, 1965 (C. Henne), six males and one female; Juniper Hills, Mojave Desert, elevation 3500–3600 feet, December 31, 1961, December 21, 1962, January 3 to March 12, 1962, January 25 to February 25, 1963 (C. Henne), 29 males and six females; Big Rock Creek, near Valyermo, March 2, 1935 (L. M. Martin), one male; near Llano, Mojave Desert, March 27, 1932 (J. A. Comstock), two males and two females; southwest of Valyermo, north slope of San Gabriel Mountains, elevation 4800 feet, March 11, 1961 (C. Henne), one female; southwest of Valyermo, emerged February 13, 1965 (N. McFarland), one female; near Palmdale, Mint Canyon, elevation 3000 feet, January 26, 1961 (R. H. Leuschner), three males and one female; Pearblossom, Mojave Desert, elevation 3000 feet, February 16, 1960 (R. H. Leuschner), one female; 2½ miles south southwest of Valyermo, elevation 4800 feet, March 4, 1956 (N. McFarland), one male.

The holotype and the allotype are in the collection of the Los Angeles County Museum of Natural History. Paratypes are in the collections of that institution, of the American Museum of Natural History, of R. H. Leuschner, and of C. W. Kirkwood.

**DISTRIBUTION:** Los Angeles and Riverside counties of southern California, at elevations of between 3000 and 4800 feet. This species may be confined to the Southern Cordilleran Biotic Province.

The adults are on the wing from late December through March.

REMARKS: The genitalia offer good diagnostic characters. The male structures can be recognized by the elongate setae near the base of the valves and by the single median projection of the juxta. The female genitalia are characterized by the elongate ductus bursae and by the nature of the two signa.

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