

THE AESCULUS-FEEDING SPECIES OF *EXARTEMA* WITH DESCRIPTION OF A NEW SPECIES

(LEPIDOPTERA, EUCOSMIDAE)

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In most groups of Lepidoptera, the genitalia, both male and female, furnish constant and reliable characters for species differentiation. In many instances, they will separate species otherwise indistinguishable. This is in general as true for the Eucosmidae and for the genus *Exartema* as for any group. Here, while differences may be slight and related species not easily separated by genitalic characters (compare the harpes in several closely related species, and the similarity in female genitalia of species easily separated by other characters, such as *Exartema ochrosuffusanum* Heinrich and *E. hippocastanum* Kearfoot, figs. 4, 7), these structures are apparently constant for the species. It was therefore a considerable surprise to discover a species in which the variation in certain characters of the female genitalia within the species was greater than the differences between species in which these characters are constant for the species.

This new species, herein described as *Exartema appalachianum*, and three previously described species of *Exartema*, *E. sciotanum* Heinrich, *E. hippocastanum* Kearfoot, and *E. ochrosuffusanum* Heinrich are leaf-rollers of various species of *Aesculus* (buckeye). In larval habits, they exhibit a characteristic common to many species of the genus, viz., that of cutting the petiole of a leaf causing it to droop and wilt. In the *Aesculus*-feeding species, the larva feeds at first within a folded young wilted leaflet, later cutting the petiole of a second leaflet, which is then folded within a third leaflet; sometimes the entire compound leaf may be involved in the feeding process.

Larvae collected on *Aesculus octandra* Marsh. in Carter County, Kentucky, in April, 1938, under rearing record B.1611, produced a series of moths, very variable in wing markings (figs. 9, 10), but obviously different from either *E. sciotanum* or *ochrosuffusanum*, both of which were known to be feeders on *Aesculus*. The possibility that these specimens might be *E. hippocastanum*, in spite of apparent disagreement with the description of that species, led to the sending of several specimens to Mr. Carl Heinrich of the United States National Museum, who wrote in reply:

"They are close to both *hippocastanum* and *sciotanum*. Their male genitalia could pass for those of either species. Their female genitalia, however, differ in the shape of the projecting lobes on the sides of the genital opening from those of either *sciotanum* or *hippocastanum*. The dark markings on fore wing are considerably darker and more sharply defined in your unnamed species than those of *sciotanum*; and the paler areas of fore wing are darker than those of *hippocastanum*. I think your specimens represent a new species."

In a second series of moths (B. 1700 and B. 1704) reared on *Aesculus octandra* from Pulaski and Whitley counties in southern Kentucky, and agreeing with the Carter County series in wing markings, the female genitalia are essentially as in the Carter County series (fig. 1). A third series (B. 1875) on *Aesculus octandra* from Paintsville, Kentucky (southeast of Carter County), although in wing markings indistinguishable from the first two series, is strikingly different in female genitalia (fig. 2). In two series from the Tennessee side of the Great Smoky Mountains (B. 1714, B. 2135), there is a further variation in the shape of the

projecting lobes of the female genitalia (fig. 3); all specimens under B.2135 are darker in wing color than any of the Kentucky specimens, and although the wing markings are variable, there is less tendency for the median band to break up.

In this instance, genitalic characters, if used, would divide into several species series which are inseparable on the basis of wing markings. It is suggested that we are here dealing with a case of introgressive hybridization resulting in increased variability, although it is not now possible to determine the original parentage.

***Exartema appalachianum* n. sp.**

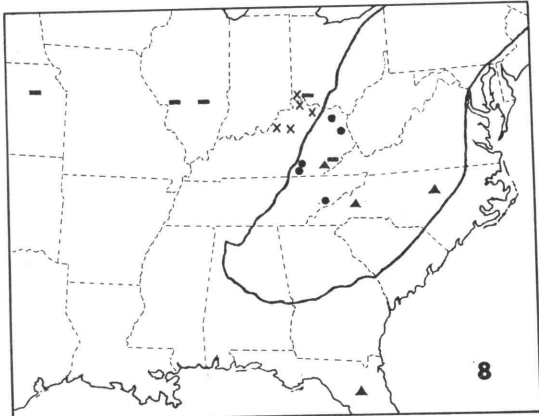
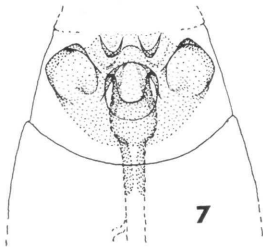
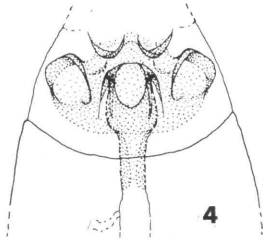
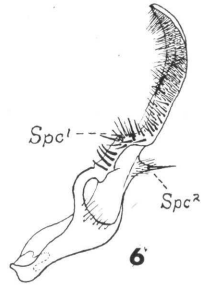
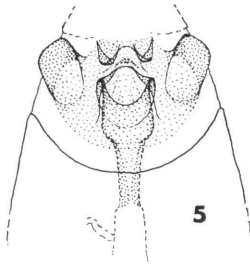
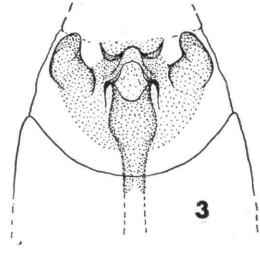
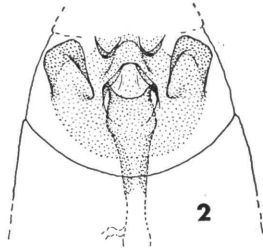
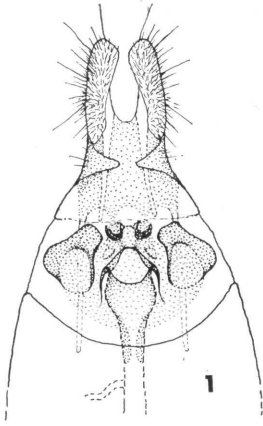
Antennae ochreous to ochreous-fuscous, darker above; first segment with a dark brown or fuscous spot above, second segment blackish fuscous with the dark shade spreading along the stalk in the darker specimens. Palpi whitish ochreous; second segment with brownish or fuscous shading toward apex, and two brown or blackish fuscous spots on outer side; third segment blackish fuscous, with extreme tip whitish. Head ochreous-tawny or ferruginous-brown, with more or less fuscous shading; on each side of front a blackish fuscous patch. Thorax ferruginous-ochreous to brownish fuscous, with transverse darker bars; tips of tegulae pale.

Fore wing (figs. 9, 10) with the basal area, median band, pretornal patch, outer costal spots and subapical bar dark brown in most specimens, black in the series B.2135, more or less overlaid with dull ochreous, reddish ochreous, or ferruginous brown. The basal area is more or less broken with transverse leaden metallic lines, interlined with fine fuscous lines, especially toward costa, but its outer margin, although irregular and sometimes indistinct near costa, is always complete, i.e., the basal area is not longitudinally divided. Antemedian and postmedian pale areas leaden metallic with a faint rosy tinge in the ferruginous-tinted specimens; with blackish or reddish fuscous interlines. The antemedian pale area sometimes broadens and forks toward dorsum thus cutting off from the basal area a triangular patch, which may be reduced to a mere dorsal dash (fig. 9). Median band with both teeth short and widely separated, the upper narrower, the lower, broader and bluntly rounded; at the base of the sinus between them a circular more or less clearly defined patch, separated by a narrow line from the band itself. Below the teeth the median band is deeply indented or even separated from the costal half of the band by an intrusion of the pale postmedian area; dorsal portion of the band variously shaped and sometimes abruptly contracted near dorsum to a mere stalk. The median band may be broken up by intrusions of the pale areas, and is then represented by the separated costal part with the upper tooth, the detached lower tooth, and a dorsal patch (fig. 9). This variation is irrespective of sex, but occurs more commonly in the female. Pretornal patch and subapical bar variable in shape. Cilia tawny to ferruginous-fuscous, with a dark basal line and blackish fuscous bars, the broadest at apex and opposite the end of the subapical bar.

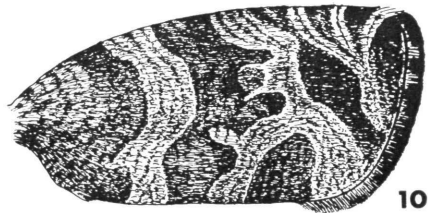
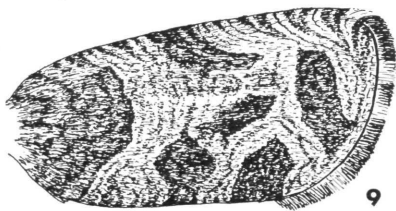
Hind wing pale brownish fuscous, blackish fuscous in series B.2135, becoming paler toward costa and base; cilia whitish ochreous, with more or less fuscous shading, especially at apex and tornus, and a dark basal band. Underside of hind wing whitish ochreous, more or less shaded with fuscous, especially toward costa and apex, the fuscous scales arranged in transverse bars between the veins. Only in the darkest specimens are the bars obscured by fuscous shading. In male, a notch at vein 1b, and slight notches at veins 1c and 5.

EXPLANATION OF FIGURES

1. Female genitalia of *Exartema appalachianum* n. sp., paratype, series B.1611.
2. Female genitalia of *Exartema appalachianum* n. sp., paratype, series B.1875.
3. Female genitalia of *Exartema appalachianum* n. sp., paratype, series B.2135.
4. Female genitalia of *Exartema hippocastanum* Kearfott, paratype, Black Mountains, North Carolina.
5. Female genitalia of *Exartema sciotanum* Heinrich, Cincinnati, Ohio (type locality).
6. Harpe of *Exartema appalachianum* n. sp., paratype, series B.1611.
7. Female genitalia of *Exartema ochrosuffusanum* Heinrich, Cincinnati, Ohio (type locality).
8. Map showing geographic distribution of the Aesculus-feeding species of *Exartema*.
9. Fore wing of *Exartema appalachianum* n. sp., allotype, female.
10. Fore wing of *Exartema appalachianum* n. sp., type, male.



• appalachianum ▲ hippocastanum
 X sciotanum ■ ochrosuffusum
 ——— Boundary of Appalachian Highlands



Expanse: 21 to 22 mm.

Male genitalia: harpe (fig. 6) with spine cluster (Sp^c) close to cucullus; spine cluster (Sp^c) almost identical with that of *E. hippocastanum*.

Female genitalia (figs. 1, 2, 3): variable in the shape of the projecting lobes on either side of the ostium. In series B.1611 (fig. 1) and in series B. 1704, these lobes with a lateral bulge and a more or less truncate produced apical lobe; in series B.2135 (fig. 3), lateral bulge absent, and apical lobes rounded; in series B. 1875 (fig. 2) the entire projecting lobe is rectangular in outline, but rises to a broadly rounded apex. Compare this with figure 5 (*sciotanum*) which it closely resembles but in which the projecting lobe tapers to a sharp ridge along the apex.

Type.—♂, Carter City, Carter County, Kentucky, under rearing record B.1611, imago May 28, 1938; in Coll. A. F. Braun. (Wing pattern, fig. 10.)

Allotype.—♀, Carter City, Carter County, Kentucky, under rearing record B. 1611, imago May 27, 1938; in Coll. A. F. Braun. (Wing pattern, fig. 9.)

Paratypes.—16♂, 20♀. Under rearing record B.1611, Carter City, Carter County, Kentucky, 4♂, 6♀, imagoes May 24 to June 2, 1938 (3♂, 4♀ in Coll. A. F. B.; 1♂, 2♀, in the United States National Museum); under B.1700, Cumberland National Forest, Pulaski County, Kentucky, 1♀, imago May 24, 1939; under B.1704, Buck Branch of Jellico Creek, Whitley County, Kentucky, 2♂, 2♀, imagoes May 27 to June 1, 1939; under B.1875, Paintsville, Johnson County, Kentucky, 7♂, 4♀, imagoes May 22 to May 25, 1941; under B.1714 and B.2135, in the valley of Le Conte Creek, Great Smoky Mountains, Tennessee, 3♂, 7♀, imagoes May 30, 1939, and May 29, 30, 1950. Paratypes will be deposited in the United States National Museum, the American Museum of Natural History, and the Academy of Natural Sciences of Philadelphia.

All of the specimens were reared on *Aesculus octandra* Marsh., the larva at first feeding within a folded and wilted leaflet, later cutting the petiole of a second leaflet, which together with the first leaflet is rolled within a third leaflet; on smaller leaves, the entire compound leaf is involved in the feeding, but the rolled leaves are only partially consumed. Larvae may be found in the latter half of April and in early May, depending on latitude and altitude, with the emergence of the imagoes in May and early June.

It will be noticed from the distribution map (fig. 8) that all of the localities are within the boundary of the Appalachian Highlands.

In spite of the extreme variability in wing markings, there is a general aspect by which individuals of the species can be associated together. In this species, characters of the female genitalia offer little assistance, because of the variation from series to series; male genitalia of related species are closely similar.

The genitalia illustrated in figure 2 suggest, by the general shape of the lateral lobes, a relationship to *E. sciotanum*. In this series (B.1875), the duller, more ochreous color of the overscaling of the dark markings approaches that of *E. sciotanum*. The breaking up of the median band with the resulting less sharp definition of its components, and the paler median longitudinal shade (fig. 9)—a variation found in all the series—also suggests a close relationship to *E. sciotanum*. These features, together with the variability of *E. appalachianum* in female genitalic characters, suggested hybrid origin of *E. appalachianum* with the possibility of *E. sciotanum* as one of the original parents, and its later segregation into a distinct species, not yet stabilized.

Exartema sciotanum Heinrich

Exartema sciotanum Heinrich, 1923, Proc. Ent. Soc. Wash. 25: 115; 1926, U. S. N. M. Bull. 132: 147.

This species may be separated from both *E. appalachianum* and *E. hippocastanum* by the less sharply defined dark markings, their dull ochreous shading and paler color, and especially by the fine ochreous line separating the upper and lower teeth of the median band. In female genitalia (fig. 5), the large lateral lobes of the genital plate, with *sharp-ridged* apex distinguish this species.

All of the localities from which *E. sciotanum* is known are west of the Appalachian Plateau (fig. 8) although the eastern-most locality for the species (Bracken County, Kentucky) lies not far to the west of the plateau escarpment. There appears to be no overlapping of ranges of *E. sciotanum* and *E. appalachianum*.

Both *Aesculus octandra* Marsh. and *Aesculus glabra* Willd. are food plants of *E. sciotanum*, the latter most commonly and in most parts of its range the only food plant.

***Exartema hippocastanum* Kearfott**

Exartema hippocastanum Kearfott, 1907, Bull. Amer. Mus. Nat. Hist. 23: 155; Heinrich, 1926, U. S. N. M. Bull. 132: 149.

Originally described from a series reared on *Aesculus* (probably *A. octandra*), Black Mountains, North Carolina, the known range of this species (fig. 8) has been extended to include a locality on the Piedmont (Durham, North Carolina), a locality on the Coastal Plain (Gainesville, Florida), and a locality in the Cumberland Mountains (Gilley, Letcher County, Kentucky, June 13, 1933; A. F. Braun). The Durham, N. C. specimen (a female) was reared on *Aesculus neglecta* Lindl. (Durham, N. C., 26 May, 1942. Wm. Haliburton coll.). This specimen, loaned to the writer for examination through the courtesy of the United States National Museum and Mr. J. F. Gates Clarke, shows the rosy or ferruginous pale areas of the fore wing strongly contrasting with the rich brown or reddish markings, and the longitudinally divided basal area, i.e., the outer boundary of this area broken, its segments separated. In comparison to *E. appalachianum*, it is a somewhat broader-winged species. The hind wings are brown (lacking the strong fuscous admixture of *appalachianum*). The underside of the hind wings in costal and apical areas is mottled with fuscous shading, not conspicuously arranged in transverse bars, as in *appalachianum*. The Cumberland Mountains specimen, a flown female, agrees exactly in genitalic characters with the type series from North Carolina. However, the pale areas of the fore wing are much darker and not strongly contrasting with the dark markings as in typical specimens, although the rosy tint is discernible. Thus it approaches, in color and markings, specimens of *appalachianum* in which the median band is not broken up. The outer margin of the antemedian pale area, although oblique in the cell, lacks the pronounced projection toward the intrusion from the postmedian pale area below the teeth. The outer margin of the basal dark area is broken at the points which define the longitudinal divisions in typical *hippocastanum*. In color and in mottling of the underside of the hind wing, it agrees with typical *hippocastanum*.

In the female genitalia (fig. 4 from a slide of a paratype, Black Mountains, North Carolina, loaned by the American Museum of Natural History) the lobes on either side of the ostium are short, thus differing from *sciotanum* and any of the variations of *appalachianum*, although almost identical with the corresponding structures in *ochrosuffusanum* (fig. 7).

***Exartema ochrosuffusanum* Heinrich**

Exartema ochrosuffusanum Heinrich, 1923, Proc. Ent. Soc. Wash. 25: 117; 1926, U. S. N. M. Bull. 132: 150.

This species is easily recognized by the sienna yellow or pale brown color of the partially obliterated markings, and little contrast between the dark markings and the paler areas, except for the purplish suffusion due to the metallic scaling.

Based upon available records this is the most widely distributed of the Aesculus-feeding species (fig. 8), and the only species to occur both west of the Appalachian Highlands and within that area (note locality in the Cumberland Mountains at the eastern border of Kentucky). In the western parts of its range, the food plant is doubtless *Aesculus glabra*, in the Cumberland Mountains locality, *Aesculus octandra*.