

AMERICAN MUSEUM NOVITATES

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY
CITY OF NEW YORK OCTOBER 20, 1950 NUMBER 1469

A REVISION OF THE NORTH AMERICAN SPECIES OF THE GENUS *SYRRHODIA* (LEPIDOPTERA, GEOMETRIDAE)

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This small group of moths is much better known under the generic name of *Catopyrrha* Hübner. A careful study of the respective genotypes indicates that they are congeneric, so a change in the generic name becomes necessary. This was suggested by Forbes (1948) but was not used at that time.

There has been but little trouble with identifications on the specific level since Grossbeck's paper (1912), in which he clearly differentiated the two species that occur in the eastern and southern United States. Much more collecting is needed to determine accurately the limits of distribution of the species concerned, the extent of the flight periods, and intraspecific variations. Life history work is badly needed, not only to supply food plant records, but to furnish a basis for comparison of the eggs, larvae, and pupae on both specific and generic levels.

MATERIALS STUDIED: Over 350 specimens have been studied, including all the types in this country. This material has been made available to the author through the kindness of the authorities in some of the major eastern and western museums, and the cooperation of several private collectors; these are referred to specifically in the following paragraph. A large number of genitalic slides have been prepared by the author, mainly from specimens in the collection of the American Museum of Natural History and his personal collection, and additional slides have been examined at the United States National Museum and

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Museum of Comparative Zoölogy, Harvard University; these have served as the basis for the genitalic descriptions and drawings.

ACKNOWLEDGMENTS: The author wishes to acknowledge with thanks the cooperation and aid of the following men who have allowed him to study the types and specimens in their charge: Mr. John G. Franclemont of the United States National Museum; Dr. J. Bequaert of the Museum of Comparative Zoölogy, Harvard University; Dr. J. B. Schmitt of Rutgers University; and Dr. Edward S. Ross of the California Academy of Sciences. A similar word of thanks goes to Mr. John L. Sperry of Riverside, California, for the privilege of studying specimens from his private collection, and to Mr. Laurence R. Rupert of Horseheads, New York, for the privilege of studying his larval material in this genus. The author is grateful for the help of Miss Alice Gray of the American Museum of Natural History who prepared the distribution maps and arranged the genitalic drawings in preparation for publication.

GENUS **SYRRHODIA** HÜBNER

Syrrhodia HÜBNER, 1823, *Zuträge zur Sammlung exotischer Schmettlinge*, vol. 2, p. 29; "1816" [1823], *Verzeichniss bekannter Schmetterlinge*, p. 300. DRUCE, 1892, *Biologia Centrali-Americana*, Insecta, Lepidoptera-Heterocera, vol. 2, p. 44. HEMMING, 1937, *Hübner*, vol. 2, p. 259. SCHAUS, 1940, *Scientific survey of Porto Rico and the Virgin Islands*, New York Acad. Sci., vol. 12, pt. 3, p. 312.

Catopyrrha HÜBNER, "1816" [1823], *Verzeichniss bekannter Schmetterlinge*, p. 300. WALKER, 1862, *List of the specimens of lepidopterous insects in the collection of the British Museum*, pt. 24, p. 1064. HULST, 1896, *Trans. Amer. Ent. Soc.*, vol. 23, p. 340. FORBES, 1948, *Cornell Univ. Agr. Exp. Sta.*, mem. 274, p. 70.

Head, front flat, with strong projecting triangular tuft; eyes large, round; antennae of male bipectinate nearly to apex, pectinations arising in central region of segments, of female simple; tongue present; labial palpi strongly developed, middle segment heavily scaled extending well beyond front, terminal segment slightly shorter than length of eye. Thorax without tufts; legs without hair pencils, fore tibiae with fairly strong process, hind tibiae not dilated, with two pairs of spurs. Abdomen without tufts. Forewings broad, costa arched near apex, outer margin curved, 12 veins, no areoles; R_1 from top of cell approximated to, or shortly anastomosing with, Sc, R_2 to R_5 stalked, from top near upper angle, R_2 from stalk before R_5 ; M_1 from upper angle; M_2 from just above middle of DC; M_3

and Cu_1 from just before lower angle of cell; Cu_2 from well before outer angle; fovea absent. Hind wings broad; frenulum strong in both sexes; outer margin slightly concave between veins; fovea in Sc large, slender; Sc approximate to R near base for one-half length of cell; R and M_1 approximate, from just before upper angle of cell; DC oblique; M_3 from lower angle, approximate with Cu_1 at base; Cu_2 from well before outer angle. Forewings and hind wings concolorous, rarely not so, brown, yellow, or green; forewings above with t. a., median, and t. p. lines present or obsolescent, s. t. line absent, discal dot weak or absent; hind wings with one or two cross lines, discal dot weak or absent. Beneath similar to upper surface, often broadly suffused with pink, red, or brown, usually more strongly marked, discal dots usually present on all wings.

MALE GENITALIA: Uncus long, simple, strongly curved dorsally, sparsely haired, apex with strong spine; socius fairly strong, with from nine to 32 hairs; gnathos rudimentary to obsolescent; valves sclerotized basally, costal region with prominent sclerotized arm, symmetrical or asymmetrical, apex pointed or swollen, small tubercle or swelling with elongate hairs near base of arm; valve distad of arm sclerotized part way to apex; arms of transtilla sclerotized, enlarged medially; cristae absent; juxta broad; furca absent; saccus projecting short distance beyond base of valves, bluntly pointed or rounded; subequal to, or slightly longer than, uncus; aedeagus elongate, in length slightly shorter to longer than combined length of tegumen and saccus, slender, bluntly rounded or tapering to point posteriorly on ventral surface, vesica unarmed or with sclerotized or scobinate patch. Ventral surface of eighth abdominal segment without plate.

FEMALE GENITALIA: Ostium simple; operculum absent; ductus bursae sclerotized, very short, subequal in length to length of ovipositor lobes; ductus seminalis from ventral surface of ductus bursae; bursa copulatrix membranous, ranging in length from one and one-half to five times length of apophyses of ovipositor, with one or two spermatophores enlarged distally, signum absent.

EARLY STAGES: Partially described by Guenée, after Abbott. The following larval description was made from material reared by Mr. Laurence R. Rupert and is based on *cruentaria* only.

EGGS: Undescribed.

LARVAE, FIFTH INSTAR: Head, first adfrontal seta (Adf_1) above

middle of clypeus, second adfrontal (Adf_2) above branching of epicranial suture; first posterior seta (P_1) below level of Adf_2 , second posterior seta (P_2) vertically above P_1 , these three setae forming an acute angle; lateral seta (L_1) well below P_1 , but these two forming an almost straight line with Adf_2 ; first anterior seta (A_1) on level with ocellus three, second anterior seta (A_2) above ocelli and forming an almost straight line with A_1 and Adf_1 , third anterior seta (A_3) below Adf_1 in horizontal plane but level with L_1 , the three anterior setae forming slightly less than a right angle; all six ocelli well developed, located on lateral surface of head with lowest ocelli partially on anteroventral surface of head capsule; second ocellar seta (O_2) on level with bottom of ocellus one, third ocellar seta (O_3) posterior to ocellus five, the three ocellar setae forming a right angle; subocellar seta (SO_2) posterior to lowest ocellus. Thorax, prothorax with shield, with setae 1a, 1b, and 2a, 2b well separated; seta 3 double, higher than spiracle; seta 4 on level with lower rim of spiracle; seta 5 approximate; setae 6 and 7 approximate. Mesothorax, seta 2a located ventrally below 1b, seta 2b the most anterior of the four; seta 3 slightly posterior to or ventrally below 1a; seta 4 lower than 3; seta 5 ventral and approximate to 4; seta 6 ventral to 2a, 2b. Metathorax similar to mesothorax except seta 1b ventral to 1a. Abdomen, segment I, seta 1 above anterior rim of spiracle; seta 2 posterior; seta 3 above and slightly anterior to spiracle; seta 4 on level with and posterior to middle of spiracle; seta 5 well anterior of 3, below spiracle; seta 6 slightly anterior to 3; seta 7 above 6, posterior to 2. Segments II to V, seta 1 anterior to spiracle; seta 2 posterior; seta 3 below 1, higher than spiracle; seta 4 on level with middle of spiracle, anterior to 2; seta 5 very slightly posterior to 3, lower than 4; seta 6 ventrally posterior to 5, anterior to spiracle; seta 7 between levels of 5 and 6, posterior to 2. Segment VI similar, except setae 3 and 5 closer in vertical plane to spiracle, the latter below spiracle; seta 6 anterior to 5. Segment VII similar to VI, except seta 1 closer in ventral plane to spiracle; seta 4 opposite center of spiracle; seta 6 below 4. Segment VIII similar to VII, except setae 1 and 3 above spiracle.

PUPA: Undescribed.

GENOTYPE: *Syrrhodia decrepitaria* Hübner (monobasic).

This genus shows relationships to both *Sericosema* Warren (Rindge, 1950, Amer. Mus. Novitates, no. 1468, pp. 1-30) and to the *Drepanulatrix* complex (Rindge, 1949, Bull. Amer. Mus.

Nat. Hist., vol. 94, pp. 231–298). *Syrrhodia* can be distinguished from all these genera by the branching of the radial vein in the forewings, as R_2 comes off the stalk before R_5 . The male genitalia appear to be a more complex development from the simpler *Drepanulatrix* type, showing, among other features, a stronger uncus, a more complicated valve with prominent costal arms, and a more intricate transtilla and juxta. The female genitalia, on the other hand, are less complicated, with the bursa copulatrix tending to be a more or less simple sac, showing only the rudiments of longitudinal rows of teeth, and with a short and rather uniform ductus bursae. The mature larvae of *Syrrhodia*, as far as is known, will key out to *Drepanulatrix* (1949, *ibid.*, p. 243). There are, however, a number of differences between them. Among other characters, *Syrrhodia* can be separated by having setae L_1 and A_3 of the larval head in a horizontal plane, setae A_1 , A_2 , and Adf_1 in a straight line, seta O_2 on a level with the lower edge of ocellus 1, and seta P_1 lower than seta Adf_2 ; there are also differences in the setae of the thoracic segments. Unfortunately, nothing can be said at this time about the comparative morphology of the pupae, owing to lack of material.

The species included in the genus *Syrrhodia*, as here defined, can be separated into two groups, by both maculation and genitalia. One of these groups includes *esperanza* and *viridirufaria* (*Syrrhodia*, *sensu stricto*); the other, *cruentaria* and *sphaeromacharia* (*Catopyrrha*; genotype: *Erastria immista dissimilaria* Hübner, monobasic). The first of these shows a tendency for sexual dimorphism in the maculation of the adults within the species, with the possibility of seasonal dimorphism; the second group displays seasonal dimorphism in the maculation of the adults to a greater or lesser degree. In the genitalia, the two groups can be separated, in the male, by the shape of the aedeagus and the outline of the costal arms of the valves and, in the female, by the origin of the ductus seminalis. (Refer to couplet 1 of the keys to the genitalia for details.) The differences, if any, present in the early stages are unknown, as there is insufficient material at the present time for comparative purposes. In the light of our present knowledge it is believed that the above differences are not of generic value but might possibly be used in a subgeneric sense if desired.

The genus *Syrrhodia* is found from northern South America through Central America and the Antilles as far north as southern Canada but is lacking in the Pacific coast states in this country.

KEY TO ADULTS

1. Forewings above unicolorous dull pea green or deep flesh color, without maculation except for two red brown spots in distal half of wing completely or partially connected by band of same color extending from middle of wing to inner margin; expanse, 34 to 43 mm. *viridirufaria*
- Forewings above dark gray, olive green, light reddish brown, or yellow, maculation consisting of one to three cross lines beginning at costa and extending completely or partially across wing; expanse, 26 to 39 mm. 2
2. T. p. line of forewings above sharply defined or diffuse, arising on costa two-thirds to three-fourths distance from base, curving subparallel with outer margin. 3
- T. p. line of forewings sharply defined, arising on costa five-sixths distance from base, extending across wing in straight line, usually with two black spots distad of this but these sometimes reduced or absent. *sphaeromacharia*
3. T. p. line of forewings above diffuse, sometimes faintly represented, evenly curved in both sexes; t. a. line usually absent or only vaguely indicated. *cruentaria*
- T. p. line of forewings usually sharply defined and prominent, curved in male, waved in female; t. a. line present, distinct. *esperanza*

KEY TO MALE GENITALIA

1. Costal arms of valves not enlarged terminally, apex either pointed or hook-like; both ends of aedeagus tapered. 2
- Valves with costal arms enlarged terminally; aedeagus truncate anteriorly, posterior end produced into long sclerotized point. 3
2. Valves with costal region distad of costal arm heavily spined for one-half distance to apex; aedeagus not longer than combined length of tegumen and saccus, posterior end rounded. *esperanza*
- Valves without heavy spining distad of costal arms; aedeagus one and one-fourth times as long as length of tegumen and saccus, posterior end pointed. *viridirufaria*
3. Valves with costal arms symmetrical, terminal swelling projecting medio-posteriorly. *cruentaria*
- Valves with costal arms asymmetrical, left arm larger than right, terminal swelling projecting laterally. *sphaeromacharia*

KEY TO FEMALE GENITALIA

1. Ductus bursae ventrally with membranous band; ductus seminalis arising at junction of ductus bursae and bursa copulatrix. 2
- Ductus bursae ventrally with sclerotized median band; ductus seminalis arising from this sclerotized ring. 3
2. Bursa copulatrix short, subovoid, less than twice as long as wide; ductus bursae with sclerotized dorsal margin extending beyond ventral margin a distance equal to length of ventral surface of ductus bursae. *esperanza*
- Bursa copulatrix elongate, approximately three times as long as wide; ductus bursae with sclerotized ventral margin apparently extending farther posteriorly than dorsal margin. *viridirufaria*

3. Bursa copulatrix not extending anterior to segments IV or V. *cruentaria*
 — Bursa copulatrix extending almost entire length of abdomen, much longer
 than wide. *sphaeromacharia*

Syrrhodia decrepitaria Hübner

Syrrhodia decrepitaria HÜBNER, 1823, *Zuträge zur Sammlung exotischer Schmettlinge*, vol. 2, p. 29, figs. 371, 372; "1816" [1823], *Verzeichniss bekannter Schmetterlinge*, p. 300.

Unfortunately there is insufficient material at this time to undertake a complete study of the subspeciation of *decrepitaria*, although preliminary investigations suggest that some intraspecific variations do occur. A number of names have been placed in the synonymy of this species by various authors; however, until the types can be carefully checked, their status must remain more or less uncertain. The species apparently is distributed across the northern portion of South America, from Brazil, Ecuador, and Peru, through Central America and Mexico to southern Texas, and in the Antilles from Trinidad to Cuba. The specimens occurring in Texas are herein treated as the northern subspecies.

Syrrhodia decrepitaria esperanza (Barnes and McDunnough), new status

Figures 4A, 6A

Catopyrrha esperanza BARNES AND MCDUNNOUGH, 1917, *Contributions to the natural history of the Lepidoptera of North America*, vol. 3, p. 239, pl. 22, figs. 5, 6. FORBES, 1948, *Cornell Univ. Agr. Exp. Sta., mem.* 274, p. 71.

MALE: Head, vertex and front purplish pink, yellowish bordering eyes; palpi yellow, with increasing number of purplish pink scales terminally. Thorax above olive green, concolorous with forewings, ventrally yellow; legs, coxae yellow, remaining segments suffused with olive and pink scales, shading into olive gray terminally. Abdomen concolorous with thorax, olive green above, yellow below.

UPPER SURFACE OF WINGS: Forewings, ground color olive green, sparsely marked with olive brown scales; costa pink at base, concolorous with wing distally, crossed by numerous deep olive strigations in basal half, these fewer to obsolescent in distal half; t. a. line narrow, distinct, sometimes obsolescent, olive brown, often becoming orange brown posteriorly, arising on costa one-fourth distance from base, running obliquely outward into cell, sharply angled posteriorly with slight basal bend on vein

Cu, meeting inner angle with basal bend about three-tenths distance from base; median line broader, diffuse, often fading out before reaching inner margin, arising on costa one-half distance from base, forming diffuse patch in cell, turning posteriorly, and running subparallel with t. a. line; t. p. line narrow, distinct, olive brown, becoming purple brown or orange brown posteriorly, arising on costa at right angle two-thirds distance from base, going straight to vein M_1 , angled posteriorly, sometimes with slight basal bend to vein Cu_1 , turning subparallel with outer margin, meeting inner angle with outward bend four-fifths distance from base; subterminal area next to t. p. line deep olive green, darker than remainder of wing, becoming lighter again terminally, with a small blackish or red brown spot, often with few white scales above vein 2A near t. p. line, below this above inner margin a diffuse dark area; fringe concolorous with wing. Hind wings concolorous with forewings; antemedian line diffuse, olive brown to orange brown, going straight or being slightly convex across wing approximately one-half distance from base at costal and inner margins; t. p. line similar to that on primaries, curving with slight basal bend on vein Cu_2 , meeting inner margin at four-fifths distance from base; subterminal area as on forewings but without spots; fringe concolorous with wing.

UNDER SURFACE OF WINGS: Forewings, ground color yellow, lightly strigate with olive brown or purple brown scales; costa pink at base, crossed by numerous olive strigations; t. a. line absent; discal dot present, sometimes faint; median line absent in anterior half of wing, vaguely indicated in posterior half by diffuse groupings of darker scales; t. p. line prominent, as above; subterminal area concolorous with remainder of wing or broadly suffused with olive brown or red brown, becoming smoky brown posteriorly, with apex and margin relatively unsuffused; outer margin narrowly darkened; fringe concolorous with wing. Hind wings concolorous with forewings; antemedian line diffuse, faint, obsolescent in anterior half of wing; discal dot present, dark brown; t. p. line as on forewings; subterminal area as on forewings, when suffused with olive brown scales, terminal area largely yellow; outer margin and fringe as on primaries. Expanse: 26 to 33 mm.

FEMALE: Like male, except all wings above with cross lines fainter, t. p. line waved instead of being straight; spots above inner margin on forewing larger. Under surface usually more

contrastingly marked, all maculation being with red or orange brown scales; t. p. line waved as above. Expanse: 31 to 35 mm.

MALE GENITALIA: Uncus slightly tapering to apex; socius with from 12 to 16 hairs; gnathos rudimentary; valves elongate, narrow, costal region with elongate arm near base, in length approximately one-half that of tegumen, arms of two valves asymmetrical, arm of right valve narrowed medially, terminally bluntly pointed to sharply hooked, arm of left valve shorter and wider than right arm, terminally pointed or hook shaped; area basad of costal arm in form of small tubercle with from five to eight hairs; middle one-third of both valves in costa and valvula convex with large number of short heavy hairs, terminal portion curved posteriorly; transtilla with anterior projection rounded; saccus extending beyond base of valves a distance equal to width of aedeagus; aedeagus as long as combined length of tegumen and saccus, of greatest width medially, both ends tapering to rounded apices, vesica unarmed.

FEMALE GENITALIA: Ductus bursae slightly longer than length of ovipositor lobes, sclerotized dorsal surface approximately twice length of ventral surface, posterodorsal margin shallowly cleft medially, median band membranous; ductus seminalis from junction of ductus bursae and bursa copulatrix; bursa copulatrix slightly longer than dorsum of segment VII, obtusely pear-shaped, sometimes anterolaterally extended on right side, surface of posterior one-third with irregular longitudinal striations, remainder of surface smooth, internally with spermatophore somewhat transversely coiled, anteriorly swollen, terminally into irregularly shaped sac.

EARLY STAGES: Unknown.

TYPES: In United States National Museum. Described from one male and one female; these specimens illustrated with original description.

TYPE LOCALITY: Brownsville, Texas.

RANGE: Southern portion of Texas. It has been reported from Florida but this should be verified. (See fig. 1.) Very little data are available on the season of flight. The allotype is dated "7-11"; the only other definite date is October.

FOOD PLANT: Unknown.

REMARKS: Nineteen specimens examined. The species is easily distinguished from the others occurring in the United States by the fact that the t. p. line of the forewings is subparallel

with the outer margin of the wing and is curved in the male and waved in the female. This subspecies apparently tends to be more olivaceous and of a more uniform color than Mexican examples, although this character may not hold true when large series of both are obtained. All the Mexican examples studied have been from central Vera Cruz and Chiapas. This gap of approxi-

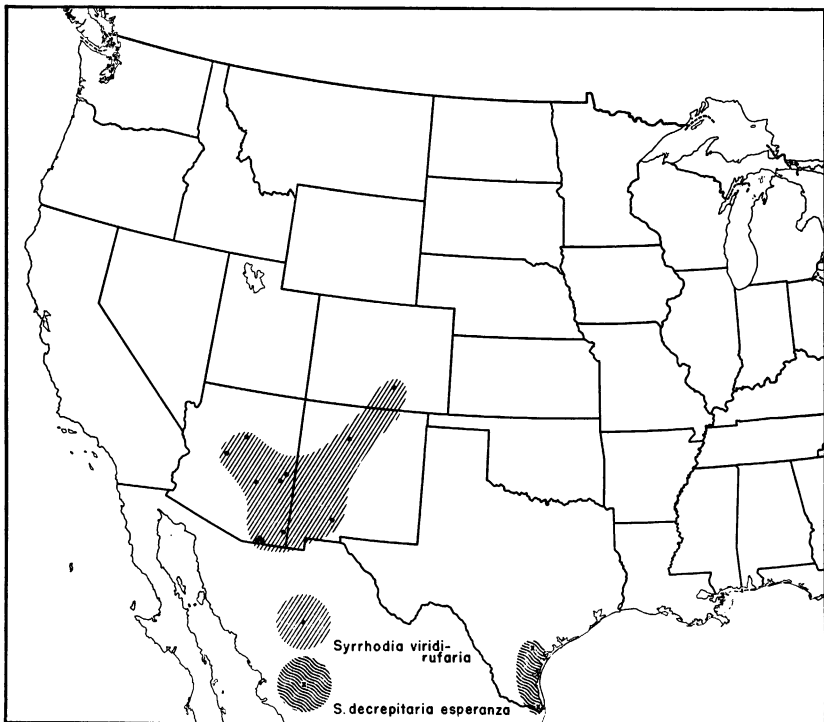


FIG. 1. Distribution of *Syrrhodia decrepitaria esperanza* (Barnes and McDunnough) and *S. viridirufaria* (Neumoegen).

mately 450 miles is probably due more to a lack of collecting in the intervening areas than to an actual discontinuity in the distribution of the species.

The genitalia of *esperanza* are quite distinctive when compared with the other species of this genus occurring in this country. The male can be recognized by the heavily spined area on the valves distad to the costal arms, and the female by the fact that the ductus seminalis arises at the junction of the ductus bursae

and bursa copulatrix, the bursa being relatively short and sub-ovoid, and by the shape of the ductus bursae.

Syrrhodia viridirufaria (Neumoegen), new combination

Figures 4B, 6B

Aspilates viridirufaria NEUMOEGEN, 1881, Papilio, vol. 1, p. 145.

Enemera (sic!) viridirufaria, DYAR, 1902, Bull. U. S. Natl. Mus., vol. 52, p. 318.

Sericosema viridirufaria, BARNES AND McDUNNOUGH, 1917, Check list, p. 115. CASSINO AND SWETT, 1922, Lepidopterist, vol. 3, p. 151.

Sericosema viridirufaria form ♀ *incarnata* BARNES AND McDUNNOUGH, 1917, Contributions to the natural history of the Lepidoptera of North America, vol. 3, p. 240.

MALE: Head, vertex and front pink, cream colored bordering eyes; palpi rose, with scattered whitish scales. Thorax above light green, concolorous with forewings, ventrally paler; legs with rose and pink scales, becoming cream gray on tarsi. Abdomen concolorous with thorax.

UPPER SURFACE OF WINGS: Forewings, ground color unicolorous dull pea green, very sparsely speckled with red brown and orange brown scales; costa rose or pink, sometimes shading into yellow distally; entire wing without maculation except for two red brown spots usually connected by band of same color in distal half of wing, uppermost spot located below vein M_3 about two-thirds distance from base, lower spot on vein 2A about three-fifths distance from base, extending from anal margin to middle of cell above, line connecting these slightly reduced medially with inner margin sharply defined, outer margin less sharply so; fringe, basal half concolorous with wing, terminal half pink. Hind wings green, heavily dusted with brown scales, or orange brown dusted with orange, pink, and brown scales; without maculation except for broad, indistinct, brownish postmedian line usually extending across wing approximately one-half distance from base, sometimes reduced or absent; fringe green or pink.

UNDER SURFACE OF WINGS: Ground color yellow, both wings usually heavily and evenly dusted with pink scales; primaries, costa chiefly without pink scales, wing without maculation except for faint, often obsolescent, discal dot and indistinct postmedian band two-thirds distance from base, extending subparallel with outer margin across wing, formed by concentration of pink scales, inner margin pale, fringe pink; secondaries concolorous with primaries, without maculation except for small pink discal

dot, rarely very faint postmedian line indicated; fringe as on primaries. Expanse: 34 to 40 mm.

FEMALE: Like male; ground color of wings above either green as in male or deep flesh color; line connecting spots on forewings incomplete or absent; hind wings less heavily dusted with dark scales, without indistinct postmedian line. Under surface less heavily dusted with pink scales, maculation obsolescent. Expanse: 40 to 43 mm.

MALE GENITALIA: Uncus tapering to apex; socius with from 12 to 16 hairs; gnathos rudimentary; valves, costal region with elongate pointed arm near base, in length approximately one-half that of tegumen, inner margin of arm at right angle to valve rarely with slight projection medially, outer margin at angle to valve with broad medial swelling between apex of arm and costal margin, this slightly more pronounced on left side; area basad of costal arm in form of slight swelling with from five to nine hairs; distal portion of valve without any heavy concentration of hairs; transtilla with anterior projection curved mediad; saccus projecting well beyond anterior margin of valves, anterior margin of valves halfway between junction of tegumen and anterior margin of saccus which is rounded; aedeagus very long, one and one-fourth times as long as combined length of tegumen and saccus, posterior end sclerotized, tapering to long sharp point, slightly constricted medially, vesica with sclerotized or scobinate patch.

FEMALE GENITALIA: Ductus bursae slightly shorter than length of ovipositor lobes, sclerotized area extending laterally to ostium, deeply cleft dorsally, median band membranous; ductus seminalis from junction of ductus bursae and bursa copulatrix; bursa copulatrix approximately one and one-half times length of dorsum of segment VII, elongate, widest medially, surface of posterior one-third irregularly wrinkled, finely punctate, remainder of surface smooth, internally with coiled and recoiled spermatophore.

EARLY STAGES: Unknown.

TYPES: *Viridirufaria*, United States National Museum type no. 34240; described from one female and one male. The male is in rather poor condition, while the female is in much better shape; the original description was apparently based primarily on this latter specimen, and it (the female) is hereby designated as lectotype. *Incarnata*, in United States National Museum.

TYPE LOCALITIES: Greenhorn Mountains, Colorado (*viridi-*

rufaria, type labeled "Col." only); Palmerlee, Cochise County, Arizona (*incarnata*).

RANGE: Colorado, New Mexico, and Arizona. (See fig. 1.) On the wing from May through August.

FOOD PLANT: Unknown.

REMARKS: Forty-four specimens examined. This species would be difficult to confuse with any of the others, owing to its larger size and coloration. Within the species, the maculation shows but slight differences, while the coloration is apt to be more variable. This latter is more apt to be expressed in the female, which appears in two color phases throughout the range of the species, as far as is known. One of these is green as in the male (typical *viridirufaria*), the other being a deep flesh color (form *incarnata* Barnes and McDunnough). Much more material is needed to determine the ratio of green forms to flesh-colored forms; apparently it is not seasonal dimorphism, as both forms occur in the same population at the same time.

The genitalia are also distinctive. The male can be separated by the pointed costal arms and the elongate nature of the aedeagus, and the female genitalia by the fact that the ductus seminalis arises from the junction of the ductus bursae and bursa copulatrix, together with the elongate shape of the bursa.

***Syrrhodia cruentaria* (Hübner), new combination**

Figures 5A, 6C

Geometra cruentaria HÜBNER, "1796" [1796-1799], Sammlung Europäischer Schmetterlinge, Horde 5, pl. 10, fig. 48.

Aspilates cruentaria, TREITSCHKE, 1827, Schmetterlinge von Europa, vol. 6, p. 136. DUPONCHEL, 1830, Histoire naturelle des lépidoptères ou papillons de France, vol. 8, p. 128, pl. 179, fig. 8. GUENÉE, 1857, Histoire naturelle des insectes, vol. 10, p. 183.

Catopyrrha cruentaria, DYAR, 1902, Bull. U. S. Natl. Mus., vol. 52, p. 318.

Phalaena coloraria FABRICIUS, 1798, Supplementum, entomologiae systematicae, p. 452.

Aspilates coloraria, GUENÉE, 1857, Histoire naturelle des insectes, vol. 10, p. 183. PACKARD, 1876, A monograph of the geometrid moths... of the United States, vol. 206, 564, pl. 9, fig. 36. HULST, 1887, Ent. Amer., vol. 3, p. 10; 1895, Ent. News, vol. 6, p. 15.

Catopyrrha coloraria, WALKER, 1862, List of the specimens of lepidopterous insects in the collection of the British Museum, pt. 24, p. 1064. HOLLAND, 1903, Moth book, p. 343, pl. 43, fig. 54. GROSSBECK, 1912, Jour. New York Ent. Soc., vol. 20, p. 288, fig. 1 (male genitalia); 1917, Bull. Amer. Mus. Nat. Hist., vol. 37, p. 95. BRITTON, 1920, Check-list of the insects of Connecticut, State Geol. and Nat. Hist. Surv., bull. no. 31, p. 118. FORBES, 1928, in Leonard,

Cornell Univ. Agr. Exp. Sta., mem. 101, p. 610; 1948, Cornell Univ. Agr. Exp. Sta., mem. 274, p. 70.

Perconia coloraria, GUMPPENBERG, 1892, Nova Acta Deutschen Akad. Naturf., Halle, vol. 58, p. 279.

Erastria immista dissimilaria HÜBNER, "1806" [1813], Sammlung exotischer Schmetterlinge, vol. 1, [pl. 203].

Catopyrrha dissimilaria, HÜBNER, "1816" [1823], Verzeichniss bekannter Schmetterlinge, p. 301. WALKER, 1862, List of the specimens of lepidopterous insects in the collection of the British Museum, pt. 24, p. 1064.

Aspilates dissimilaria, GUENÉE, 1857, Histoire naturelle des insectes, vol. 10, p. 182. PACKARD, 1876, A monograph of the geometrid moths... of the United States, p. 208. HENRY EDWARDS, 1883, Papilio, vol. 3, p. 25. HULST, 1887, Ent. Amer., vol. 3, p. 10.

Perconia dissimilaria, GUMPPENBERG, 1892, Nova Acta Deutschen Akad. Naturf., Halle, vol. 58, p. 279.

Catopyrrha coloraria dissimilaria, DYAR, 1902, Bull. U. S. Natl. Mus., vol. 52, p. 318. HOLLAND, 1903, Moth book, p. 342, pl. 43, fig. 53. GROSSBECK, 1912, Jour. New York Ent. Soc., vol. 20, p. 288; 1917, Bull. Amer. Mus. Nat. Hist., vol. 37, p. 95. BRITTON, 1920, Check-list of the insects of Connecticut, State Geol. and Nat. Hist. Surv., bull. no. 31, p. 118. FORBES, 1948, Cornell Univ. Agr. Exp. Sta., mem. 274, p. 70.

Crociphora accessaria HÜBNER, "1825" [1827-1831], Zuträge zur Sammlung exotischer Schmetterlinge, vol. 3, p. 26, figs. 503, 504.

Aspilates accessaria, GUENÉE, 1857, Histoire naturelle des insectes, vol. 10, p. 183.

Hyperitis ? accessaria, WALKER, 1862, List of the specimens of lepidopterous insects in the collection of the British Museum, pt. 26, p. 1501.

Catopyrrha accessaria, DYAR, 1902, Bull. U. S. Natl. Mus., vol. 52, p. 318.

Aspilates olenusaria WALKER, 1862, List of the specimens of lepidopterous insects in the collection of the British Museum, pt. 26, p. 1675. PACKARD, 1876, A monograph of the geometrid moths... of the United States, p. 211. HULST, 1887, Ent. Amer., vol. 3, p. 10; 1895, Ent. News, vol. 6, p. 15.

Catopyrrha coloraria olenusaria, DYAR, 1902, Bull. U. S. Natl. Mus., vol. 52, p. 318.

MALE: Head, vertex and front dark gray brown, the scales light gray distally, narrowly red brown bordering eyes; palpi brown with scattered black scales, gray dorsally. Thorax above concolorous with forewings, ventrally red brown to rust; legs, coxae concolorous with thorax, remaining segments with red brown, black, and gray scales. Abdomen concolorous with thorax.

UPPER SURFACE OF WINGS: Forewings, ground color dark gray to gray brown, often with very faint rosy suffusion, sparsely dotted with black brown scales; costa often narrowly pink crossed by numerous dark striae; t. a. line absent or obsolescent; when present, arising on costa one-fourth distance from base, running

obliquely outward into cell, curving posteriorly and hence to inner margin; median line obsolescent or absent; when present, represented by diffuse patch on costa one-half distance from base, extending into cell, then disappearing; t. p. line usually prominent, sometimes faint, diffuse black brown, arising on costa three-fourths distance from base, curving evenly subparallel with outer margin across wing to inner margin at two-thirds to four-fifths distance from base; subterminal area concolorous with remainder of wing, sometimes with diffuse blackish spot between veins M_3 and Cu_1 just distad of or adjoining t. p. line and with smaller spot adjoining t. p. line above inner margin, both spots very often absent; fringe concolorous or with distal half pink. Hind wings concolorous with forewings; antemedian line absent or obsolescent; postmedian line diffuse, faint, or obsolescent, going almost straight or slightly curved across wing, meeting inner margin three-fourths distance from base; subterminal area and fringe as on primaries.

UNDER SURFACE OF WINGS: Forewings, ground color red brown or orange brown, heavily strigate with black brown scales; t. a. and median lines absent, rarely the latter faintly suggested by clumps of dark scales; discal dot black brown, rounded; t. p. line broad, diffuse, prominent, as above but fading out above inner margin; subterminal area concolorous with remainder of wing, without spots of upper surface; fringe light gray or pinkish gray. Hind wings concolorous with forewings; antemedian line faint, diffuse, often obsolescent; discal dot prominent, black brown; postmedian line broad, diffuse, prominent, black brown, somewhat waved, subparallel with outer margin; subterminal area and fringe as on primaries. Expanse: 27 to 32 mm.

FEMALE: Like male, but tending to be slightly less heavily marked. Expanse: 26 to 32 mm.

The typical form, described above, is dark gray and flies during the spring months. Specimens from the northern part of the range are a fairly dark gray with darker maculation, while specimens from Florida tend to be more suffused with pink and with the maculation of the upper surface tending to be of this color. Hübner's figure of *cruentaria* is somewhat intermediate between these two extremes, the ground color of the wings being dark gray with a pink t. p. line. There is some variation in the presence or absence of the dark spots adjacent to the t. p. line; these appear in approximately one-half of the specimens studied.

The summer form, described as *dissimilaria* Hübner (*olenusaria* Walker), is similar to the above, but the gray ground color of the wings above is replaced by yellow, and varies from bright yellow to a dull yellow olivaceous. The maculation is similar, the cross lines being pink or reddish brown; the spots adjacent to the t. p. line in the subterminal area are nearly always absent. The under surface of both wings is also yellow and is heavily strigate and suffused with pink or red scales, being much more heavily suffused than in the spring form. The females are similar to the males. Expanse: males 27 to 36 mm., females 26 to 36 mm.

MALE GENITALIA: Uncus slightly tapering; socius with from nine to 18 hairs; gnathos obsolescent; valves, costal region near base with prominent arm, terminally projecting medio-posteriorly, both arms symmetrical, in length approximately two-thirds that of tegumen, arising from broad base, inner margin concave, outer margin with median ventral projection, concave between this and bluntly pointed apex, in thickness one-half to two-thirds width of aedeagus; area basad of costal arm scarcely swollen or slightly so, with from eight to 14 hairs; transtilla rounded medially; juxta broad, only slightly increasing in width posteriorly, anterior end narrowly cleft, posterior end broadly shallowly cleft; tegumen constricted in anterior third, anterior end narrower than width of aedeagus; saccus projecting beyond base of valves a distance less than width of aedeagus, anterior margin rounded; aedeagus approximately three-quarters combined length of tegumen and saccus, anterior end truncate, posterior end tapering to elongate sclerotized spine, vesica unarmed.

FEMALE GENITALIA: Ductus bursae slightly shorter than length of ovipositor lobes, sclerotized area extending laterally to ostium, dorsally with deep cleft, sclerotized ring extending laterally and ventrally from base of cleft, from whence ductus seminalis arises; bursa copulatrix approximately twice length of dorsum of segment VII, obtusely pear shaped, quite broad anteriorly, surface of posterior one-third with fine longitudinal striations and very small, inwardly pointing teeth, remainder of surface smooth or with occasional wrinkles, internally with one or two spermatophores somewhat transversely coiled anteriorly, enlarged terminally into elongate subovoid sac.

EARLY STAGES: The larvae have been briefly noted by Guenée and Forbes. As the latter author suggests, the earlier descriptions should be verified, as they may apply to either this species or

sphaeromacharia. Mr. Laurence R. Rupert has succeeded in rearing *cruentaria*; he has been kind enough to furnish the following notes:

LARVAE, UP TO FINAL INSTAR: "Greenish with many fine darker longitudinal lines. Between the two subdorsal dark lines the space is filled with darker color at the anterior end of each of

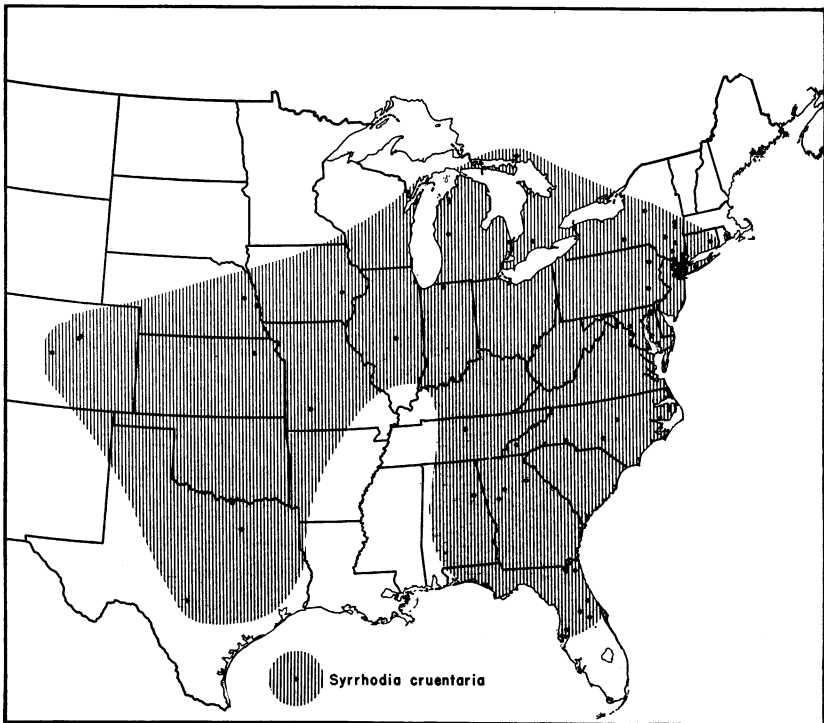


FIG. 2. Distribution of *Syrrhodia cruentaria* (Hübner).

the first five abdominal segments, giving the appearance of five dark dashes down the middle of the back."

FINAL INSTAR: "Head small and flat. Brownish, variable in color and pattern, but all with a dark mid-dorsal line or stripe, with many fine darker lines on each side of it. A pale lateral stripe extends uninterrupted from the last pair of prolegs to the mouth. Each abdominal segment has three small black tubercles on each side and two pairs of subdorsal ones; these show up better on the pale larvae. Beneath with many fine longitudinal lines. One

individual lacked the lateral stripe; some had dark brown patches and mottling in various patterns."

TYPES: Of *cruentaria*, *coloraria*, *dissimilaria*, *accessaria*, location unknown if still in existence; *olenusaria* in British Museum (Natural History).

TYPE LOCALITIES: None given (*cruentaria*, *dissimilaria*); North America (*accessaria*); Virginia (*coloraria*); east Florida, Georgia (*olenusaria*).

RANGE: Eastern and central United States and southern Canada, from the Atlantic Ocean to Colorado, and from Ontario and the Great Lakes region to Texas and Florida; no specimens or records have been seen from the lower Mississippi River Valley. (See fig. 2.) The spring form is on the wing from March through April or May (rarely as early as January in Florida); the summer form, from April or May through September; these dates vary with the latitude and season.

FOOD PLANTS: *Ceanothus americanus* Linnaeus. Reported (Guenée) on *Trifolium* and *Rubus* in the southern states; these records should be verified as they might conceivably be referable to *sphaeromacharia*, as it also occurs in this region.

REMARKS: Two hundred and eighteen specimens examined. Very little needs to be added to Grossbeck's separation (1912) of this species and *sphaeromacharia* Harvey. This species can be recognized by the marked seasonal dimorphism, and by the fact that the t. p. line of the forewings is diffuse and evenly curved subparallel with the outer margin.

The genitalia are also easy to recognize. Unfortunately, Grossbeck's preparations were rather crushed, and hence his drawings are somewhat distorted, although they suffice to separate *cruentaria* and *sphaeromacharia*. The male genitalia of this species differ from the others in the genus in that the costal arms of the valves are enlarged terminally and project medio-posteriorly, and in that the aedeagus is truncate anteriorly, with the posterior end produced into a long sclerotized point. The female genitalia can be recognized by the ventral median sclerotized band of the ductus bursae, with the ductus seminalis arising therefrom, and the short rounded bursa copulatrix. There are some indications that there may be some seasonal dimorphism in the female genitalia; much more material and further study are needed, however, before this can be definitely stated. In the gray-colored spring form, two out of the four genitalic prepara-

tions show two spermatophores; in all six preparations from the yellow-colored summer generation only a single spermatophore is present. Except for this character, the genitalia appear to be identical. There apparently are no obvious differences in the male genitalia between the spring and summer generations, although a fair amount of individual variation does occur.

The name *cruentaria* is used in preference to the better known *coloraria*, since Hemming (1937, Hübner, vol. 1, pp. 204, 268) has shown that plates 1 to 60 of Hübner's work were published sometime between the years 1796 and 1799. If these plates were issued consecutively, it seems probable that plate 10, on which *cruentaria* appeared, would have been published in the earlier part of this period, undoubtedly before the year 1798 when Fabricius published *coloraria*. It is unfortunate that a more definite date cannot be established for these plates, as there is always the possibility that *coloraria* was validated first; however, until this can be proved it seems advisable to accept the name *cruentaria*.

Syrrhodia sphaeromacharia (Harvey), new combination

Figures 5B, 6D

Crochiphora coloraria var. *sphaeromacharia* HARVEY, 1875, Bull. Buffalo Soc. Nat. Hist., vol. 2, p. 284.

Aspilates coloraria var. *sphaeromacharia*, PACKARD, 1876, A monograph of the geometrid moths . . . of the United States, p. 207, pl. 9, fig. 35 (as *coloraria* var.).

Catopyrrha coloraria sphaeromacharia, DYAR, 1902, Bull. U. S. Natl. Mus., vol. 52, p. 318.

Catopyrrha sphaeromacharia, GROSSBECK, 1912, Jour. New York Ent. Soc., vol. 20, p. 288, fig. 2 (male genitalia); 1917, Bull. Amer. Mus. Nat. Hist., vol. 37, p. 95. FORBES, 1948, Cornell Univ. Agr. Exp. Sta., mem. 274, p. 71.

Catopyrrha coloraria var. *perolivata* HULST, 1896, Trans. Amer. Ent. Soc., vol. 23, p. 340.

Catopyrrha coloraria var. *perolivaria*, PEARSALL, 1906, Sci. Bull. Brooklyn Inst. Arts and Sci., vol. 1, p. 207.

Catopyrrha sphaeromacharia var. *perolivata*, GROSSBECK, 1912, Jour. New York Ent. Soc., vol. 20, p. 288; 1917, Bull. Amer. Mus. Nat. Hist., vol. 37, p. 95. FORBES, 1948, Cornell Univ. Agr. Exp. Sta., mem. 274, p. 71.

MALE: Head, vertex and front reddish purple, the scales light gray distally, yellowish bordering eyes; palpi yellow at base, becoming increasingly suffused with reddish purple and black scales terminally. Thorax above concolorous with forewings, ventrally yellow with pink scales; legs, coxae concolorous with thorax, remaining segments reddish purple with black scales, tarsi lighter. Abdomen concolorous with thorax.

UPPER SURFACE OF WINGS: Forewings, ground color varying from yellow through dull olive to light reddish brown, sparsely dotted with black brown scales; costa usually narrowly pink crossed by small dark striae; t. a. line narrow, distinct to occasionally obsolescent, olive brown to orange brown, arising on costa one-fourth distance from base, running obliquely outward into cell, turning sharply posteriorly, going straight to inner margin at one-third distance from base with slight basal bend below vein 2A; median line incomplete, represented by diffuse patch on costa, extending to vein M_1 , very rarely showing posteriad of this by scattered orange brown or dark brown scales; t. p. line narrow, distinct, black brown to orange brown, arising on costa five-sixths distance from base, going straight across wing to inner margin at three-fourths distance from base, sometimes with very slight outward curve below vein R_5 and with very slight basal bend below vein Cu_2 ; subterminal area next to t. p. line reddish purple to orange brown for about 1 mm., then fading back to ground color or appearing somewhat darker than remainder of wing, usually with round black spot between veins M_3 and Cu_1 just distad of t. p. line, often with second black spot adjoining t. p. line above inner margin, both spots may be reduced or absent; small dash at apex; fringe concolorous or red brown. Hind wings concolorous with forewings; t. a. line diffuse, reddish purple to orange brown, obsolescent near costa, curving to inner margin before one-half distance from base; median line prominent, similar to t. p. line of primaries with same distal shading, going straight across wing to inner margin two-thirds distance from base, sometimes with slight basal bends on veins R and Cu_2 ; t. p. line faint or absent, waved, subparalleling median line; outer half of wing slightly darker than basal half, rarely concolorous; fringe concolorous with wing.

UNDER SURFACE OF WINGS: Forewings, ground color yellow or orange brown, strigate with reddish purple scales; costa pink crossed by numerous olive strigations; antemedian line broad, diffuse, reddish purple, basad of discal dot, obsolescent near costal and inner margins; discal dot black brown, elongate; t. p. line prominent, as above, but sometimes slightly more curved, fading out above inner margin; subterminal area concolorous with remainder of wing, reddish purple shading along t. p. line or broadly suffused with reddish purple, sometimes completely shading costal half of area, posterior portion showing ground color in outer

half, black spots of upper surface faintly indicated or absent; fringe pink, becoming yellow posteriorly. Hind wings concolorous with forewings; t. a. line broad, diffuse, reddish purple, one-third distance from base on both costal and inner margins, strongly curved, confluent with black brown discal dot; median line narrow, faint, sometimes obsolescent, going straight across wing; t. p. line narrow, waved, reddish purple, arising on costa four-fifths distance from base, curving subparallel to outer margin, meeting inner margin five-sixths distance from base; subterminal area as on forewings; fringe pink, yellow along inner margin. Expanse: 27 to 37 mm.

FEMALE: Like male; t. p. line of hind wings above tending to be somewhat more prominent in some specimens. Expanse: 31 to 41 mm.

MALE GENITALIA: Uncus very slightly tapering; socius with from 18 to 32 hairs; gnathos obsolescent; valves, costal region near base with prominent arm enlarged distally, arm on left valve thicker and with larger terminal swelling than arm on right valve, both arms in length approximately one-half that of tegumen, arising from broad base, constricted medially with apex enlarged laterally, long axis of swelling parallel to long axis of valve, with pointed dorsal protuberance, arm of right valve with minimum thickness equal to one-third to one-half width of aedeagus, length of terminal swelling slightly shorter than, to subequal to, width of aedeagus, arm of left valve with minimum thickness and length of terminal swelling approximately one and one-half to twice that of right valve; area basad of costal arm in form of slight swelling with from five to 11 hairs; transtilla with anterior projection curving mediad; juxta broad, increasing in width posteriorly, posterior end broadly shallowly cleft; saccus projecting beyond base of valves a distance slightly less than width of aedeagus, anterior margin rounded; aedeagus slightly shorter than, or subequal to, combined length of tegumen and saccus, anterior end truncate, posterior end extending in form of elongate sclerotized blade, vesica armed with narrow, lightly sclerotized band extending approximately one-half circumference of aedeagus.

FEMALE GENITALIA: Ductus bursae slightly shorter than length of ovipositor lobes, ventral surface with median sclerotized lip produced posteriorly, from whence ductus seminalis arises; bursa copulatrix elongate, extending almost entire length of abdomen, surface finely wrinkled, usually arranged more or less

longitudinally, with very small, inwardly pointing teeth, internally with one or two elongate spermatophores somewhat coiled at posterior end with bursa correspondingly enlarged, running length of bursa, doubling back at anterior end for one-third length, terminating in large rounded sac.

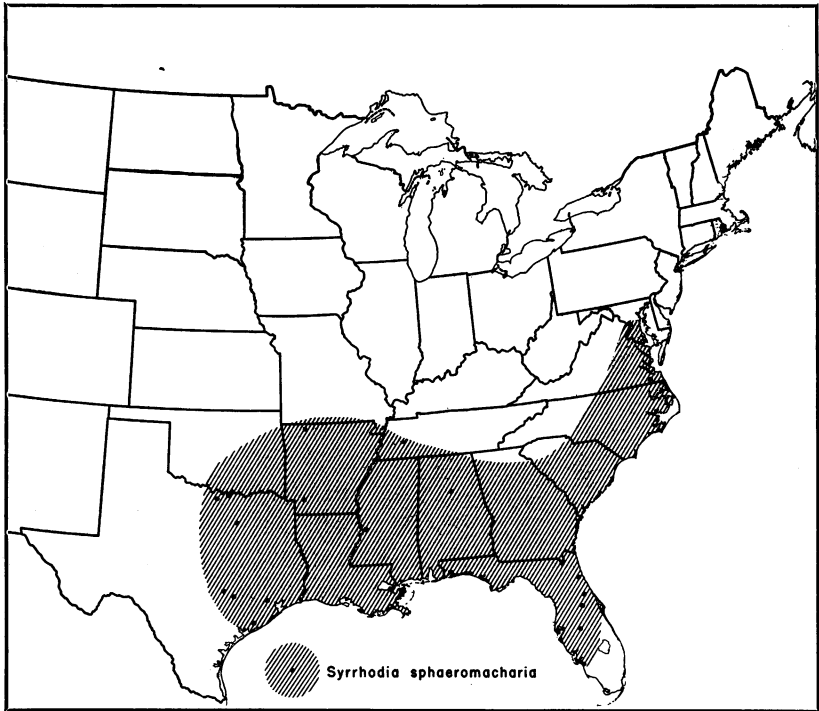


FIG. 3. Distribution of *Syrrhodia sphaeromacharia* (Harvey).

EARLY STAGES: Unknown.

TYPES: Of *sphaeromacharia*, location unknown; of *perolivata*, in Rutgers University.

TYPE LOCALITY: Alabama (*sphaeromacharia*); Texas (*perolivata*).

RANGE: Southeastern United States, from the District of Columbia to Florida and eastern Texas. (See fig. 3.) On the wing from April through September; probably at least two generations per year.

FOOD PLANT: Unknown.

REMARKS: Seventy-six specimens examined. This species can be recognized by the fact that the sharply defined t. p. line of the forewings arises on the costa about five-sixths the distance from the base and extends across the wing in an almost straight line, and by the continuation of this line across the hind wings. A considerable range of color is present in this species, and seasonal dimorphism may be indicated. However, if present, it is not nearly so marked as in *cruentaria*; much more accurately dated material is needed to settle this point. Forbes reports that the ground color varies from yellow to dull olive for most of the summer generation, and is reddish fuscous, more or less overlain with rosy, for most of the spring generation. There is also some variation in the size of the two black spots distad of the t. p. line on the forewings above; these may vary from large and prominent (typical *sphaeromacharia*) to partially reduced or completely absent (*perolivata*) in any population. Consequently, this latter name is not retained.

The specimen of *perolivata* bearing Hulst's type label in the Rutgers University collection has been examined. It is a male and is in good condition; it has no locality label. It agrees fairly well with the one sentence that constituted the original description; however, this specimen has a single, relatively small, black dot in cell M_3 distad to the t. p. line that is not mentioned in the description. The abdomen on this specimen has been glued on; a genitalic preparation has been made and it proves that this abdomen is definitely wrongly associated.

The genitalia are distinctive and easy to separate from the other species. Grossbeck's figure of the male genitalia was based on a crushed preparation, but the structures are nevertheless recognizable. The male can be distinguished by the asymmetrical costal arms of the valves, with the left arm being larger than the right one, and with the terminal swelling projecting laterally. The female genitalia are very distinct in having the very elongate bursa copulatrix. Some female preparations show one spermatophore while others have two; this might suggest a parallel variation with *cruentaria*, where the same phenomenon also occurs. Before this question can be answered, however, much more accurately dated material and study are needed.

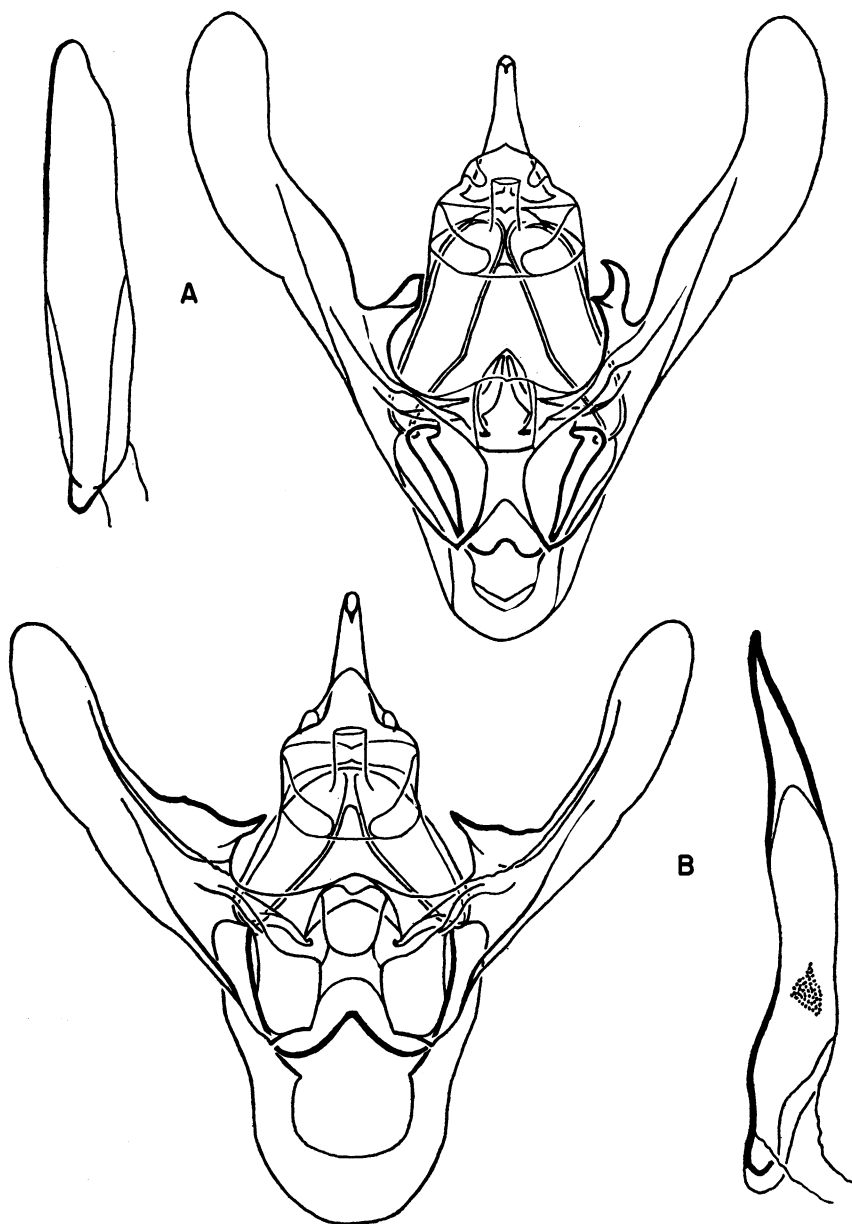


FIG. 4. Male genitalia of *Syrrhodia*. A. *S. decrepitaria esperanza* (Barnes and McDunnough), Texas. B. *S. viridirufaria* (Neumoegen), Palmerlee, Arizona.

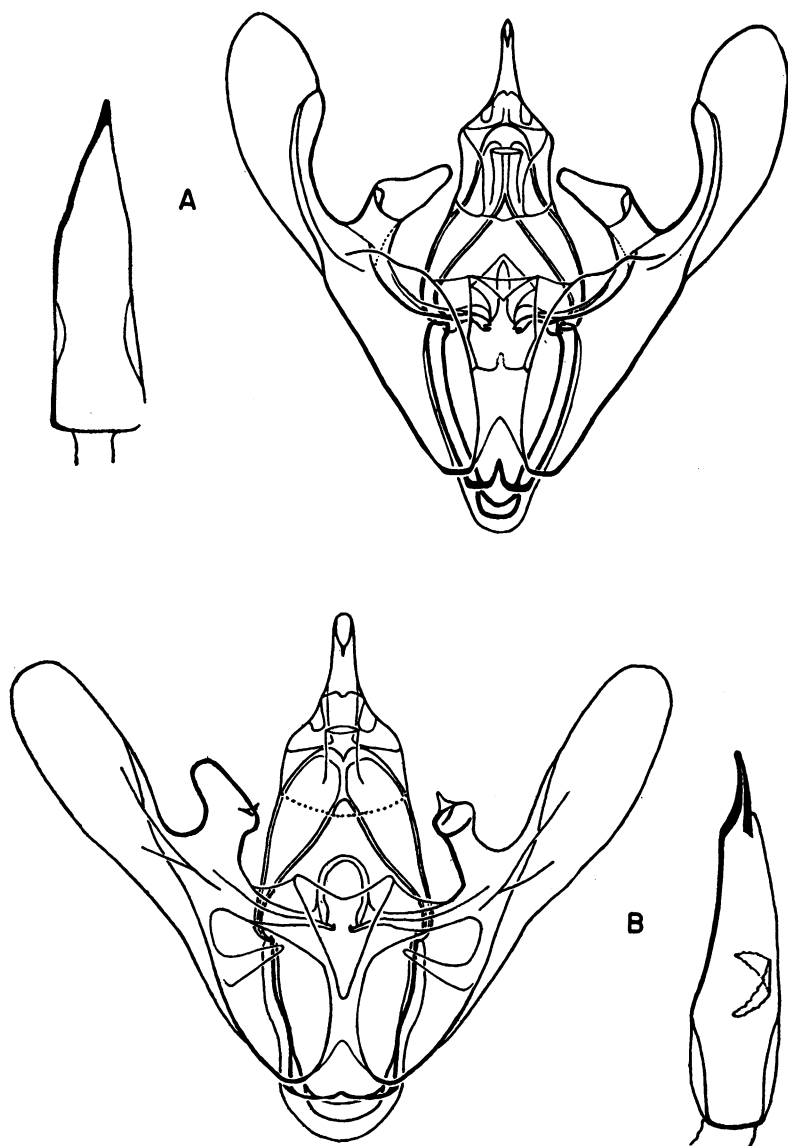


FIG. 5. Male genitalia of *Syrrhodia*. A. *S. cruentaria* (Hübner), Scranton, Pennsylvania, April 26, 1912 (M. Rothke). B. *S. sphaeromacharia* (Harvey), Birmingham, Alabama, August 8-9, 1916.

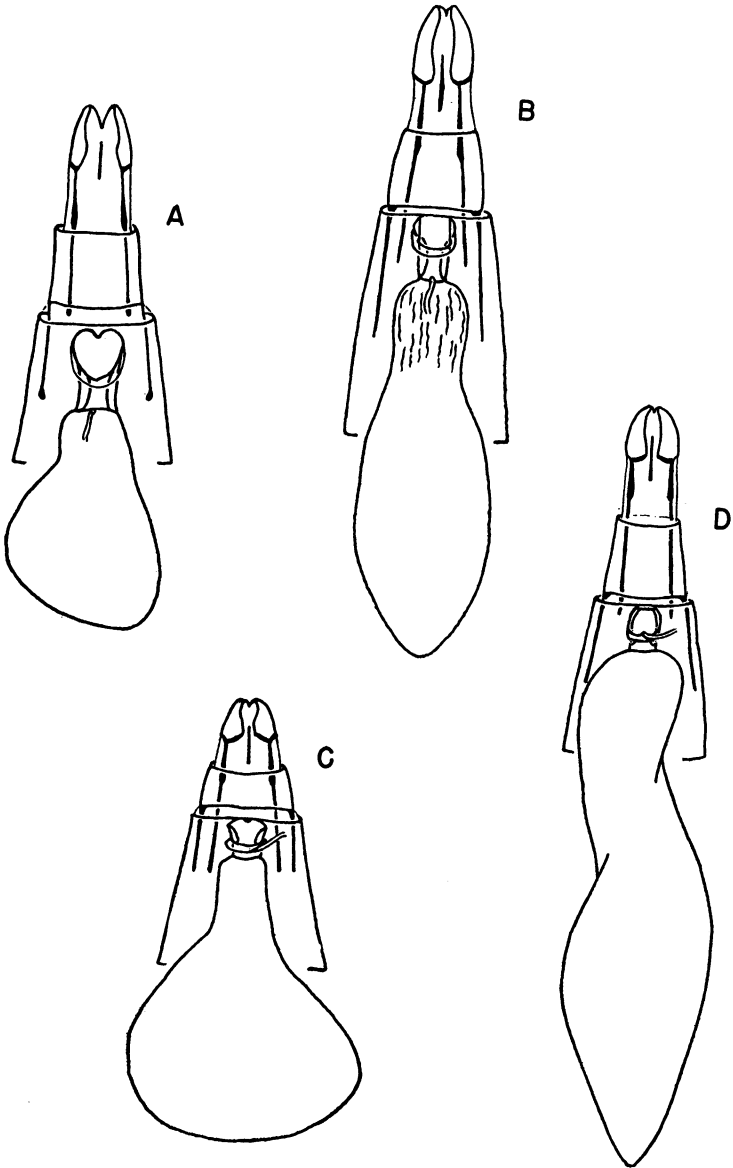


FIG. 6. Female genitalia of *Syrrhodia*. A. *S. decrepitaria esperanza* (Barnes and McDunnough), Brownsville, Texas, October 18, 1939 (collection of G. H. and J. L. Sperry). B. *S. viridirufaria* (Neumoegen), Gila County, Arizona, June 15-30, 1902 (O. C. Poling). C. *S. cruentaria* (Hübner), Plainfield, New Jersey, July 4. D. *S. sphaeromacharia* (Harvey), Florida, ex collection A. T. Slosson.