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TAXONOMIC AND DISTRIBUTIONAL STUDIES ON THE WESTERN COMPONENTS OF THE *APODEMIA MORMO* COMPLEX (RIODINIDÆ)

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Apodemia mormo (Felder & Felder) is a widely distributed butterfly species occurring throughout the arid regions of the western United States and northern Mexico. Due to pronounced geographic variation in wing pattern and color, various segregates of the species were considered separately by the early workers. Thus by the turn of the century nine names had been variously applied, and the complex was generally considered to consist of five allopatric species: *mormo* in Utah, Nevada and northern California; *virgulti* Behr in southern California; *cythera* Edwards in Arizona; *mejicanus* Behr in New Mexico and Sonora; and *maxima* Weeks in the cape district of Baja California. However, since the time of the treatment by STICHEL (1911) most writers have considered the complex to consist of a single species. Further collecting gradually developed a more complete picture of the geographic ranges of the various components and resulted in the recognition of two additional restricted races in California, *deserti* Barnes & McDunnough (1918) and *langei* Comstock (1938).

In bringing together a large number of records during the past few years, further illustration of the distribution patterns has been possible through defining areas of blend zones between subspecies, sampling geographic areas where gaps in the known distribution existed, and accumulating more complete samples of the variation within populations. We hope in the present paper to clarify some of the problems and errors extant in the literature through a presentation of the overall distribution

pattern. A great number of records are available from California, resulting in a relatively complete picture, and we have much information on Baja California Norte and Arizona. However, less material from the eastern and northern portions of the range of the complex has been available for study, and these areas are not discussed in detail now.

Apparently all the races of *A. mormo* are associated with *Eriogonum,* the foodplant in all known cases. BROWN (1955) has given the habitat of the populations in Colorado as "moist canyon bottoms and valleys". However our observations, and those of GRUNDEL (1905) and COMSTOCK (1927) in California, indicate that populations of this butterfly typically occur in close association with the foodplant on exposed, well drained, dry slopes, such as on beach or desert sand dunes areas, young alluvial fans, rocky ridges and peaks, and chaparral slopes. A similar habitat is reported by BROWNING (1901) in the vicinity of Salt Lake City, Utah. Little has been reported on the early stages of the species. Life history studies are cited under the subspecies concerned. Additional data concerning flight periods and foodplants has been compiled by WRIGHT (1906), COMSTOCK (1927, 1938), MARTIN and TRUXAL (1955), and BROWN (1955). In general the populations have two or three overlapping generations in areas characterized by a long dry season but are limited to a single annual flight in most areas of the northern portion of the range.

Due to the localized nature of the flight habits of the adults, together, at least in part, with the disjunct nature of the distribution of areas to which the species and foodplants are adapted, populations of *A. mormo* tend to be restricted. Thus the species occurs across a broad range, but to a large extent in scattered colonies with little interbreeding. Therefore, within the more widely ranging among the recognized subspecies, divergence within populations has occurred, resulting in a mosaic of segregates, expressed by both locally distinctive populations and more widely distributed forms.

The separation and naming of the various entities has been based entirely on the phenotypic expression of wing color and pattern. However, this expression appears to be constant within geographic areas, the color pattern being a qualitative difference between subspecies, except within the relatively narrow blend zones between the major races. Although there is a more or less uniform combination of weather conditions during the period of time when the adults fly, the dry and hot season of *Eriogonum* bloom, the early stages of the various populations are adapted to a wide range of variation in ecological factors, particularly the temperature and moisture extremes. Thus a high degree of correlation between the wing pattern and genotypic variation is suggested in this case.

It was hoped that a study of the male genitalia would offer further characters for the definition of subspecies. Specimens from the various major populations were studied by dissection and clearings of the abdomen in caustic solution. Individuals showed some remarkable differences, especially in the shape of the gnathos arms and the form of the distal margin of the uncus. The latter structure was selected as an index since it offers a character which can be studied on the whole insect by merely denuding the terminalia with a fine brush, thus facilitating the study of numbers of individuals. There appear to be tendencies within each subspecies towards a general type of form of the uncus margin. However, after studying a number of specimens from each of several different populations, it was decided that the individual variation is too great to enable the use of this character in subspecies definition. Presumably the other genital structures which have less conspicuous differences will also show individual variation.

In that the entities have already been named, we feel that the subspecies concept has served greatly to clarify the relationships within the complex. Further subdivision of more wide-ranging subspecies seems unwarranted in view of the present status of knowledge of the group. However, relatively restricted races and even a local population in the case of *A. mormo langei* have received names when these were not referable to any of the existing subspecies. During the course of our investigations, two additional montane populations have been found which seem so distinct that including them in previously named races is not possible.

Discussion and locality records of the distribution for each race is given under the subspecies heading. We have examined all of the specimens for which localities are given. Localities are listed, in general, by state and county in a north to south sequence.

Certain of the data are listed below under putative "blend-zones". It is our opinion that these represent populations exhibiting unstable characteristics due to an influence of gene flow from the more stable populations of the named races which adjoin them. These areas are restricted to relatively narrow bands, and it seems likely that this is due to the occurence of narrow geographical features which act as isolating barriers to the subspecies and define the areas of ecological conditions to which the populations have responded through phenotypic and presumably genotypic variation.

In addition to the California Insect Survey, University of California Berkeley, and our personal collections, material has been studied from a number of other sources. We wish to acknowledge the helpful cooperation of the following in making available specimens of the private

and institutional collections in their care: JOHN M. BURNS, Berkeley; CHARLES F. HARBISON, San Diego Natural History Museum; R. L. LANGSTON, Berkeley; MILFORD LUNDGREN, Oakland; M. J. MCKENNEY, San Diego; R. A. MACKIE, San Diego; C. DON MACNEILL, California Academy of Sciences; LLOYD M. MARTIN, Los Angeles County Museum; JOHN C. MONTGOMERY, Menlo Park; DON and BILL PATTERSON, Atherton; Dr. F. H. RINDGE, American Museum of Natural History; and Dr. J. W. TILDEN, San Jose. Additional thanks are due to F. MARTIN BROWN, Colorado Springs, Colorado for advice and assistance on the problem, and to JOHN M. BURNS and Dr. E. G. LINSLEY, University of California, Berkeley for reading the manucript and offering helpful suggestions.

Apodemia mormo mormo (Felder & Felder)

Lemonias mormo Felder & Felder, 1859, *Wiener ent. Monat.* 3: 271; Bates, 1868, *Journ. Linn. soc. London, zool.* 9: 448; Wright, 1906, *Butterflies West Coast*: 201, pl.27, fig.294b.

Apodemia mormo, Felder & Felder, 1865, *Reise Freg. Novara, Zool.* 2: 302; Holland, 1931, *Butterfly book*, rev. ed.: 212, pl.28, fig.7; Leighton, 1946, *Univ. Washington publ. biol.* 9: 59.

Apodemia mormo mormo, Stichel, 1911, *Genera insectorum*, fasc.112: 287; Barnes & McDunnough, 1918, *Contr. nat. hist. Lepid. North America* 4: pl.12; Seitz, 1924, *Macrolep. world* 5: 700, fig.141e; Comstock, 1927, *Butterflies California*: 149, pl.47, fig.4; Stichel, 1930, *Lepid. catalogus* 41: 586; McDunnough, 1938, *Mem. so. California acad. sci.* 1: 23; Comstock, 1938, *Bull. so. California acad. sci.* 37: 129, fig.4; Hoffmann, 1940, *An. inst. biol. Mexico* 12: 700; Brown, 1955, *Proc. Denver mus. nat. hist.* 5: 118, fig.

Chrysobia mormo, Scudder, 1876, *Bull. Buffalo soc. nat. sci.* 3: 103.

Lemonias virgulti, Grundel, 1905 (not Behr, 1865), *Ent. news* 17: 86 (biology).

Chrysobia mormonia Boisduval, 1868, *Ann. soc. ent. Belgique* 12: 52; Scudder, 1876, *Bull. Buffalo soc. nat. sci.* 3: 103 (synonymy).

Nemeobius dumeti Behr, 1865, *Proc. California acad. sci.* 3: 178; Bates, 1868, *Journ. Linn. soc. London, zool.* 9: 448 (synonymy).

Male. – Length of forewing 12.5 to 15.0 mm. *Head*: labial palpus exceeding head by length of head as seen from above, tapering from broad base to narrow third segment; second segment white exteriorly, brownish at apex, third segment brownish; antenna about three-fifths wing length, shaft black, segment bases annulate with white, entirely whitish apically below, club red-brown interiorly and below, tip orange; head scaling erect, greyish, whitish marginal to eye. *Thorax*: black with brownish scaling above; collar tinged with orange, scales erect; underside white, densely covered with scaling and hair tufts; legs white, meso- and metathoracic tibiæ and tarsi with two rows of conspicuous black spines ventrally. *Forewing*: conspicuously marked by two pairs of white spots in basal half, and two transverse rows of white spots in apical half; ground color blackish, infused with orange-brown through central portion to submarginal spot row, costal and anal margins blackish, the latter sometimes broadly; basal pair of white spots just before one-third the distance from base to apex, above and below median vein, second pair before middle, upper at end of discal cell, largest of the four; basal pair and discal margined inwardly and outwardly with a darker black than ground color, lower median spot and subterminal row margined inwardly only; subterminal row at apical one-third of wing, consisting of seven subtriangular spots between the veins, the fourth from

costa smallest, the final three nearer to base, fifth nearest; orange-brown suffusion sometimes extending slightly beyond fifth and sixth; terminal row parallel to margin, the spots round, of subequal size and shape, smaller than smallest of subterminal row, faintly margined outwardly darker; fringe of ground color, marked with white. Underside pattern as above, in general paler, orange more extensive, extending along veins between spots of submarginal band, apical area pale brownish to whitish, terminal white spots at times extended to margin. *Hindwing*: spot pattern essentially as on forewing, ground color blackish with a greyish tinge in central area, sometimes with a tinge of orange before second pair of spots or outside submarginal band; first and fourth spots of submarginal band reduced to white specks, third elongate; underside, spots of above reproduced conspicuously and nearly completely outlined with black, two additional large spots on costa, first at base, second at about middle; second and third spots of submarginal band fused into the largest spot of the pattern; ground color pale greyish to brownish, a white suffusion from base to apex through the area of the large spot; area below this whitish before submarginal band; terminal area greyish to whitish; terminal band of spots usually not evident. *Abdomen*: blackish above, some whitish scaling at segmental bases; whitish below, pleural areas rough scaled.

Female. — Length of forewing 15.0 to 16.5 mm. Wings appearing broader, marked as in male, ground color more extensive, the white spots and orange suffusion reduced; orange lacking from hindwing except at extreme base. Underside more heavily suffused with white; hind wing nearly entirely whitish except an indistinct band exterior to submarginal spots.

The above description is made from specimens from Beaver and Juab Counties, Utah.

The original specimens of *mormo* came from the area of the Great Salt Lake, Utah. As presently conceived, the subspecies is the most wide ranging of the complex, occurring from central and eastern Washington south into California, in the Coast Ranges as far as San Luis Obispo County and in the Sierra Nevada as far as Mono Basin; east in the Great Basin, through Utah, to western Colorado; south through most of Arizona and west in the Mojave Desert to the foothills of the transverse ranges of southern California. Although records are lacking for Oregon and Nevada, scattered colonies of *mormo* are to be expected throughout the Great Basin portions of both states.

Information on the life history of the nominate subspecies is lacking except for the report by GRUNDEL (1905) on a colony in the Santa Cruz Mountains of coastal California. COOLIDGE (1924) has reported several *Eriogonum* species and forms as the native food plants of *A. mormo virgulti* in a restricted area, so that it seems logical to assume that *mormo mormo* utilizes a variety of *Eriogonum* species across its wide geographic distribution.

Within this broad range, there are populations which have diverged in wing color and pattern. Several segregates seem worthy of mention, although at present they are not well defined, at least in part due to insufficient sampling.

1) Specimens from Washington and northern California are larger in size than those from central Utah (forewing length 14.6 to 18.2 mm.) and have the ground color of the underside of the hind wings darker, with the white spots well defined.

2) Consistently in several series of 15 or more specimens from populations of coastal central California, the greyish overscaling of the upper sides is lacking, and the ground color is darker, so that the wings appear nearly coal black. A similar effect is produced on the undersides by a reduction of the white and the presence of a blackish area between the submarginal and marginal white spot bands, especially on the forewing. In the Vallejo population the marginal white spots are elongated into thin dashes, giving an especially distinctive appearance.

3) A series of 13 specimens from Mono Lake shows consistently larger white spots than is typical of Utah specimens. The underside tends to show a greater white overscaling in the ground color, but this is somewhat variable, as it is to some extent throughout the subspecies.

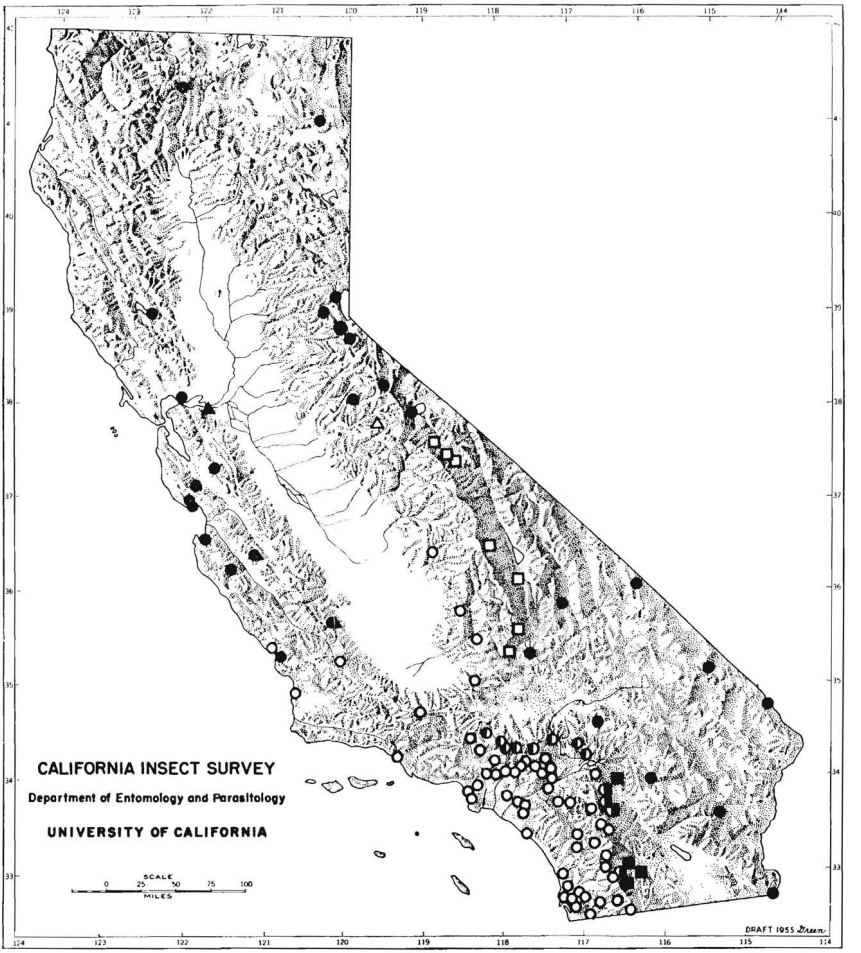
4) Numerous specimens from eastern Mojave and Sonoran Desert areas (New York Mts., Hualapai Mts., Ajo, Covered Wells, Sells) are larger in size (forewing length 17.1 to 19.2 mm.), have a tendency toward larger white spots and a more conspicuous grey upperside ground color, and, at times, have somewhat more extensive or subdued, almost infuscated areas of orange on the forewings.

5) Populations of the western Mojave Desert (Argus Mts., Ord Mtn., Twentynine Palms) usually show an extensive, often pale orange, and have a tendency towards enlarged terminal band spots, relating them to *mormo deserti* of the Colorado Desert, but the latter consistently show a pale aspect due to more conspicuous pale grey scaling in the hind wing ground color and more extensive white scaling on the underside.

6) A limited amount of material from central and eastern Arizona indicates that populations in these areas (Sunflower, White Mts.) have the orange of the forewings very restricted, nearly lacking in some individuals. In addition, the white spots are restricted as in Utah specimens, so that there is a great extent of blackish ground color.

The most striking of the previously mentioned "blend-zones" is the area along the northeastern slope of the San Gabriel Mountains, adjoining the Mojave Desert, from Palmdale, Los Angeles County, eastward to the north side of the San Bernardino Mountains. Here the colonies are extremely heterogeneous; some individuals phenotypically resemble *A. mormo mormo* of the Mojave; others very nearly approach *m. virgulti;* and all degrees of intermediate variation are present. Thus single or

few specimen samples from these areas frequently appear to indicate a population of one or the other subspecies and in some instances may actually represent a relatively constant local population, but we have considered all records from this area as representing the blend zone in treating the data. The best examples studied illustrating the situation are 24 specimens comprising three collections from Littlerock and a single day collection of 30 specimens from Desert Springs.



Distribution of *Apodemia mormo* in California. Symbols indicate localities as follows: closed circles = *A. mormo mormo;* open circles = *A. m. virgulti;* open squares = *A. m· cythera;* closed squares = *A. m. deserti;* closed triangle = *A. m. langei;* open triangle = *A. m. tuolumnensis.* Divided symbols indicate putative blend zone localities.

A second possible blend zone exists along the inner side of the Coast Range of California, south of the San Francisco Bay area. Occasional examples are taken (Paraiso Springs, Pinnacles, Cholame) along with typical appearing *m. mormo* phenotypes which suggest a relationship with *A. m. langei* by the distinctive orange suffusion of the discal white spot of the forewing, a characteristic which does not occur elsewhere in the complex.

Another possible blend zone, that with *A. m. mejicanus* to the south, is exhibited in our material by a few intermediate appearing specimens from the Santa Catalina Mountains, Arizona, and from Catron County, New Mexico. However, a general lack of material from this whole area limits our conclusions.

Data from material examined:—WASHINGTON.—Okanogan Co.: Brewster, VIII-19-35 (Hovanitz Collection), VIII-11-35 (P. S. REMINGTON), IX-1-40 (J. C. HOPFINGER). Yakima Co.: Yakima, VIII-23-57 (J. LONGWORTH); Mill Creek, 1800′, VIII-19-58 (NEWCOMER); Tampico, VIII-30-58 (NEWCOMER). MONTANA.—Valley Co.: 1½ mi. S. Saco, VIII-11, 20-51 (W. WHEATON). IDAHO.—Bear Co.: Montpelier, VIII-10-31 (W. J. GERTSCH). UTAH.—Juab Co.: Eureka, VIII-1, 3-20 (T. SPALDING). Beaver Co.: Wildcat Vy., "VIII" (DODGE). CALIFORNIA.—Siskiyou Co.: Mt. Shasta City, VIII-20-58 (POWELL); "Siskiyou Co.", VIII-3-14 (W. WHOLEY). Lassen Co.: 8 mi. N. Madeline, IX-7-57 (B. J. ADELSON). Placer Co.: Chipmunk Ridge, El Dorado Nat'l. For., VIII-17, IX-1-47 (LANGSTON); Deerpark, 7900′, VIII-20-10 (NEWCOMER). El Dorado Co.: Horsetail Falls, 7000′, VIII-23-47 (MACNEILL); Grass Lake, 8000′, VIII-27-47 (H. P. CHANDLER). Tuolumne Co.: Strawberry Lake, IX-1-30, V-2-31 (R. G. WIND). Mono Co.: Mono Lake, VIII-20-52, VII-28-54 (POWELL); Pickle Mdw., 6800′, VII-28-39 (RINDGE). Inyo Co.: Argus Mts., IV-'91 (KOEBELE); Argus Mts., 14 mi. N. Trona, IV-8-60 (LANGSTON); 9 mi. E. Shoshone, IV-12-60 (OPLER); E. branch Last Chance Cnyn., IV-10-60 (K. TOSCHI). San Bernardino Co.: Ivanpah Mts., IX-22-39 (RINDGE); New York Mts., VIII-4,5-36 (COMSTOCK); Barnwell, N. Y. Mts., IX-3-45 (C.I. SMITH); Needles, IV-10-38 (TILDEN), IV-25-49 (MACNEILL); nr. Needles, IV-7-39 (COMSTOCK); 6 mi. S. Twentynine Palms, 3000′, III-23-48 (SMITH); Mojave R. bed nr. Daggett, "VIII-30" (no collector); Ord Mtn., 4000′, IV-19-60 (J. LAWRENCE, POWELL, J. R. POWERS), IV-20-60 (BURNS). Riverside Co.: Desert Center, VI-30-52 (TILDEN). Lake Co.: nr. Clearlake Highlands, IX-27-37 (HOVANITZ). Solano Co.: Hunter's Hill, 2 mi. NE. Vallejo, VIII-21-56 (OPLER). Santa Clara Co.: Alum Rock Park, VIII-6-51 (TILDEN), VIII-28-54, VIII-12-55, VIII-26-57 (PATTERSON); Arroyo Bayo, Mt. Hamilton, IX-8-53, VIII-7-54, IX-11-55 (TILDEN);

San Antonio Vy., Mt. Hamilton, VIII-25-56 (TILDEN); Saratoga, VIII-31-44 (T. B. BLEVINS). Santa Cruz Co.: Alma, IX-30-05 (GUNDER); Santa Cruz Mts., no date (GUEDET); Mt. Hermon, VIII-12-51 (MACNEILL); Santa Cruz, "VIII-15" (KLOTS), VII-20-31, VII-27-39, VIII-28-39 IX-8-39 (TILDEN). Monterey Co.: Seaside, X-14-29 (G. HEID), VII-4-59 (POWELL); Monterey, VII-15-28 (no collector); Paraiso Spr., IX-26, 29-34 (L. S. SLEVIN); San Luis Obispo Co.: Morro Bay, VIII-30-45 (MELANDER). ARIZONA.—Navajo Co.: 15 mi. NW. Kayenta, 6560′, VII-19-33 (S. BEE., H. N. HULTGREN). Coconino Co.: Todd's Lodge, Oak Cr. Cnyn., IX-29, X-3-48 (SPERRYS); Mohave Co.: Hualapai Mts., X-1-55 (MARTIN). Yavapai Co.: Congress, IV-14-57 (PATTERSON); Yarnell, VI-21-51 (MCKENNEY). Maricopa Co.: nr. Sunflower, X-25-59 (MARTIN & TRUXAL). Greenlee Co.: Coronado Trail, 5 mi. S. Rose Peak, 7000′, VI-6-59 (BURNS). Pinal Co.: Apache Jct., V-10-33 (SPERRYS); Oracle, 4000′, V-29-37 (no collector). Pima Co.: Bear Cnyn., Santa Catalina Mts., IX-14-49 (L. I. HEWES); Tucson, IX-12-31 (no collector); Covered Wells, IV-30-50, IV-12-54 (MARTIN); Ajo, VIII-26-55 (TILDEN); 20 mi. SE. Ajo, IX-2-59 (BURNS); Sells, VIII-26-55 (TILDEN); SE. Growler Vy., Organ Pipe Cactus Nat'l Mon., XII-10-39 (HARBISON); La Abra Vy., Organ Pipe Cactus Nat'l Mon., XI-30-39 (HARBISON). Santa Cruz Co.: Nogales, "VI" (OSLAR). Yuma Co.: Yuma, XI-27-08 (C. PLATT). NEW MEXICO.—McKinley Co.: Ft. Wingate, VII-22, VIII-17-07, IX-29-09, VII-22- to VIII-8-10 (W. P. COMSTOCK).

Blend zones. — With *langei*: CALIFORNIA. — San Benito Co.: Pinnacles Nat'l Mon., IX-7-28, IX-26-26 (no collector). Kern Co.: 5 mi. E. Cholame, San Luis Obispo Co., IX-18-57 (W. E. FERGUSON). With *mejicanus*: ARIZONA.—Pima Co.: Molino Basin, Santa Catalina Mts., VI-7-58 (PATTERSON); Madera Cnyn., VIII-25-55 (PATTERSON), XI-11-51 (MARTIN). NEW MEXICO.—Catron Co.: Whitewater Cnyn., 4 mi. NE. Glenwood, VIII-20-52 (H. B. LEECH & J. W. GREEN). With *virgulti*: CALIFORNIA.—Los Angeles Co.: 6 mi. W. Palmdale, IV-20-32 (E. P. VAN DUZEE); Palmdale, V-8-41 (no collector); Littlerock, IV-2-32, VII-1-32 (G. & R. BOHART), IV-21-35 (G. HEID), III-16-48 (LANGSTON), IV-9-51 (MACNEILL), III-28 to IV-6-53, IV-11-54 (OPLER), IV-8-55 (PATTERSON); Pearblossom, IV-1-59 (J. R. POWERS); nr. Llano, III-27-32 (COMSTOCK); S. of Llano, IV-6-46 (C. I. SMITH); Valyermo, IV-28-35 (G. HEID), IV-13-48 (STERNITSKY); Pallett Cr., IV-22-50 (MACNEILL); Desert Spr., V-5-56 (POWELL). San Bernardino Co.: Phelan, V-3-32, (C. M. DAMMERS), IV-18-50 (SPERRY); Adelanto, IV-28-49 (SPERRY), IV-15-57 (TILDEN); Victorville, V-8-31 (L. I. HEWES), IV-23-55 (R. O. SCHUSTER); 15 mi. SE. Victorville, IV-11-60; 22 mi. SE. Victorville, IV-10-60 (MONTGOMERY); Sheep Cr., IV-27-24 (no collector), V-25-30 (DAMMERS).

Apodemia mormo cythera (Edwards), NEW STATUS

Lemonias cythera Edwards, 1873, *Trans. Amer. ent. soc.* 4: 345; Mead, 1875, *in*: Wheeler, *Rept. geogr. expl.* 5: 786, pl.36, Figs.3, 4; Cockerell, 1893, *Trans. Amer. ent. soc.* 20: 354; Brown, 1957, *Journ. N. Y. ent. soc.* 65: 231.

Chrysobia cythera, Scudder, 1876, *Bull. Buffalo soc. nat. sci.* 3: 103.

Apodemia mormo virgulti (part, not *virgulti* Behr, 1865), Stichel, 1911, *Genera insectorum,* fasc.112: 288 (synonymy); Barnes & McDunnough, 1916, *Contr. nat. hist. Lepid. North America* 3: 103 (synonymy); Stichel, 1930, *Lepid. catalogus* 41: 588 (form); McDunnough, 1938, *Mem. So. California acad. sci.* 1: 23; Hoffmann, 1940, *An. inst. biol. Mexico* 12: 700; Martin & Truxal, 1955, *Los Angeles Co. mus., sci. ser.* 18, *zool.* 8: 20 (form).

Apodemia cythera, Holland (part), 1931, *Butterfly book,* rev. ed.: 212, pl.28, fig.5.

Apodemia mormo cythera is characterized by a greater extent of orange on both the upper and lower surfaces of the forewing, the orange subterminal band of the hindwing, and the pale, whitish underside of the hindwing.

Length of forewing, male 12.5 to 15.5 mm; female 15.0 to 16.5 mm. *Forewing*: white spots large; the orange area extending beyond the submarginal band, reaching the terminal spots in lower half of wing, partially replacing the subterminal band spots, and at times entirely replacing the third and fourth spots; the orange usually lacking the reddish quality of *mormo* and *virgulti,* of an ochreous-orange shade and rather pale; blackish ground color greatly reduced to the apical area and a narrow terminal and anal margin. Underside at times nearly entirely ochreous-orange, the spots sometimes flushed with yellowish; termen whitish. *Hindwing*: above similar to *virgulti,* the subterminal band spots more or less replaced by orange; underside ground color pale greyish ochreous, the spots not well defined; a broad white diffuse streak from base to apex through center and along anal margin.

The name *cythera* was first applied to three males taken by the 1871 Wheeler Expedition which traveled in eastern California, southern Nevada and Utah, and northern Arizona. The locality was recorded by EDWARDS as "in Arizona", and this same statement is given in the MEAD report (1875) of the expedition. However, BROWN (1957b) has stated that all material from the expedition was labeled from Arizona in spite of evidence that much of it came from elsewhere. The citation "Arizona" misled most subsequent writers to apply the name *cythera* to the *mejicanus* populations of the mountains of southern Arizona, an area not reached by the Wheeler Expedition. The latter apparently represents the only orange hindwing form in Arizona. The situation was somewhat clarified by COMSTOCK (1927) who first listed *mejicanus* for southern Arizona, and most authors since have therefore followed STICHEL (1911) in treating *cythera* as a synonym of *virgulti* because of the similar upper wing surface pattern and because the true source of *cythera* remained unknown.

BROWN (1957a) has given an itinerary of the activities of FERDINAND BISCHOFF, naturalist with the Wheeler 1871 Expedition, together with a discussion of the butterfly species taken. BROWN proposes a locality near Truxton Springs in northern Arizona as a probable type locality for *cythera,* based on literature reports of the flight periods (the 1871

expedition did not arrive in Arizona until early October) and an assumption that there are probably scattered colonies of *mormo* throughout northwestern Arizona. However, our records for northern Arizona and the adjoining area of California (see map), together with the reports of GARTH (1950) and HASKIN (1914) indicate that this area is occupied by relatively uniform populations of *A. mormo mormo.* In view of the general uniformity of *m. mormo* over its entire range, with respect to hindwing color, it seems highly unlikely that a population of individuals fitting the description of *cythera* exists in northern Arizona.

In California, along the eastern foothills of the southern portion of the Sierra Nevada, occurs a population which has not previously been explained. Most of the individuals appear much like *virgulti* dorsally, but differ in having a heavy suffusion of whitish ventrally, much as was originally described for *cythera.* In addition, some specimens show suffusion of orange on the forewing to a greater extent than is found in *m. virgulti,* and in fact, extreme examples in this regard are indistinguishable from the original description of *cythera.*

The itinerary of BISCHOFF's activities includes a stay at Independence, Inyo County, from July 18 to August 10, and as suggested by BROWN (1957a), he doubtless collected in a fairly broad area from this camp, including the foothills to the west. In that our records for the above described population include localities both to the north and south of Independence, and the seasonal dates are also coincident, it is our suggestion that the original collection of *cythera* actually took place within the area of this population.

In at least one instance (*i.e., Ochlodes yuma* Edwards), a type locality for a species "from Arizona" has actually been set in the area of Independence, California, in view of the present knowledge on the distribution (Brown, 1957b). We do not propose to set a type locality for *cythera;* however, it seems quite realistic to apply the name to this eastern California population.

As indicated above, individuals within populations of *cythera* are variable, and most have a greater development of white spots than that described by EDWARDS. In addition, of 18 specimens from several collections at Rock Creek (near Tom's Place) three lack all but a trace of the orange on the hindwings, thus phenotypically resembling *A. m. mormo.* The proximity of the nominate subspecies to the east is unknown, but it does not seem likely that *cythera* ranges far eastward. A single specimen from Haiwee Summit closely resembles *virgulti* on the upper surface, and a series of 27 specimens from Walker Pass includes three or four individuals which are nearly indistinguishable from *virgulti,* suggesting the possibility of a relationship with *m. virgulti* populations

across the southern end of the Sierra. The exact nature of this relationship is at present obscure, due in part to the lack of records from the area, and in part to the lack of knowledge of the flight periods. To the south, *virgulti* has a long flight season including at least two generations; to the north *cythera* is restricted to a single summer flight. The Walker Pass series was taken in September, and a single specimen from nearby Dove Springs was taken in April, indicating that there are two flights in this area, and there may be two generations at any given locality. The Dove Springs specimen is of a darker, brick red and has an extreme amount of whitish overscaling on the underside. Thus, in addition to the possibility of this area being an intergrade zone, there is also a possibility of some seasonal variation, although the latter does not seem to be the case in other areas of the complex.

BROWN (1955) has applied the name *cythera* to a form occurring in north and south central Colorado, specimens of which we have not seen. This designation, however, creates a situation which is not tenable, since that area is isolated from any region visited by the Wheeler 1871 expedition by intervening areas with populations of *mormo mormo*. It seems possible that the Colorado race has a relationship with *A. mormo mejicanus* to the south, the nearest geographic race having the orange hindwing phenotype.

Data from material examined.—CALIFORNIA.—Mono Co.: Casa Diablo, VII-4-47 (MACNEILL); Rock Cr., 1 mi. S. Tom's Place, 7200′, VIII-20-56 (BURNS, MACNEILL); Rock Cr., VIII-8-26 (T. CRAIG), VIII-10-58 (LUNDGREN); Sherwin Summit, VII-31-59 (OPLER). Inyo Co.: Bishop Cr., VII-22-34 (C. RUDKIN); Bishop Cr., 15 mi. SW. Bishop, VII-28-52 (POWELL); 5 mi. E. Lake Sabrina, VII-30-59 (OPLER); Whitney Portal, 7000′, VII-24-39 (RINDGE); nr. Haiwee Summit, VI-1-47 (C. I. SMITH). Kern Co.: Walker Pass, IX-23-56 (TILDEN); Dove Springs, IV-15-60 (K. TOSCHI); "Tehachapi Mts.", VII-24-34 (MARTIN).

Apodemia mormo mejicanus (Behr)

Nemeobius mejicanus Behr, 1865, *Proc. California acad. sci.* 3:179.

Lemonias mejicanus, Bates, 1868, *Journ. Linn. soc. London, zool.* 9: 448; Edwards, 1884, *Trans. Amer. ent. soc.* 11:294.

Apodemia mejicanus, Godman & Salvin, 1886, *Biol. Cent. Americana, Lepid. Rhop.* 1: 467; Barnes & McDunnough, 1917, *Checklist Lepid. Boreal America*: 13 (treated as synonym of *duryi*); Tilden, 1953, *Lepid. news* 7: 72.

Apodemia mormo mejicanus, Seitz, 1924, *Macrolep. world* 5: 700; Comstock, 1927, *Butterflies California*: 151, pl.47, figs.13, 14; Stichel, 1930, *Lepid. catalogus*, 41: 589; McDunnough, 1938, *Mem. so. California acad. sci.* 1: 23; Comstock, 1938, *Bull. so. California acad. sci.* 37: 129; Hoffmann, 1940, *An. inst. biol. Mexico* 12: 700.

Apodemia sonorensis Felder & Felder, 1865, *Reise Freg. Novara, Zool.* 2: 303 (NEW SYNONYMY).

Lemonias virgulti (part, not Behr, 1865), Bates, 1868, *Journ. Linn. soc. London, zool.* 9: 448; Godman & Salvin, 1886, *Biol. Cent. Americana, Lepid. Rhop.* 1: 467; McDunnough, 1938, *Mem. so. California acad. sci.* 1: 23 (treated *sonorensis* as synonym of *virgulti*).

Apodemia mormo virgulti, (part, not Behr, 1865) Seitz, 1924, *Macrolep. world,* 5: 700; Hoffmann, 1940, *An. inst. biol. Mexico,* 12: 700.

Lemonias duryi Edwards, 1882, *Papilio* 2: 47; Cockerell, 1899, *Can. ent.* 31: 65.

Apodemia duryi, Barnes & Benjamin, 1926, *Bull. so. California acad. sci.* 25: 16 (synonymy); Holland, 1931, *Butterfly book,* rev. ed.: 213, pl.28, fig.10 (as valid species); McDunnough, 1938, *Mem. so. California acad. sci.* 1: 23 (synonymy).

Apodemia mormo druryi (error), Stichel, 1911, *Genera insectorum,* fasc. 112: 288; Seitz, 1924, *Macrolep. world,* 5: 700, fig.14le.

Lemonias cythera, (not Edwards, 1873) Edwards, 1883, *Papilio* 3: 9; Wright, 1906, *Butterflies West Coast*: 201, pl.27, fig.295; Stone, 1921, *Ent. news* 32: 114.

Apodemia cythera (not Edwards, 1873), Godman & Salvin, 1886, *Biol. Cent. Americana, Lepid. Rhop.* 1: 467; Holland, 1931, *Butterfly book,* rev. ed. : pl.28, fig.4.

Apodemia mormo cythera (not Edwards, 1873), Seitz, 1924, *Macrolep. world* 5: 700, fig.14le; Stichel, 1930, *Lepid. catalogus* 41: 589 (in part); Brown, 1955, *Proc. Denver mus. nat. hist.* 5: 118, fig.

Apodemia mormo mejicanus is characterized by the yellow-orange color of the upper surface which replaces the black ground color from the base of the wings almost to the terminal row of white spots, including, at least in part, the basal half of the hind wing.

Length of forewing, male 13.0 to 17.0 mm., female 16.0 to 18.0 mm. *Forewing*: orange ground color from base to terminal row of spots having a yellowish quality; inner costal spot in basal area tending to be infused with ground color; terminal row of white spots bordered by small patches of black scales inwardly and outwardly, contrasting with the remainder of the terminal area which has scattered white scales. *Hindwing*: basal half of wing having ground color varyingly infused with yellowish orange, not often invading the white spots. Subterminal band with yellowish ground color tending to obscure white spots. Underside of hindwing greatly variable. Some specimens exhibit a very whitish appearance underneath with large spots similar to *mormo deserti,* others show an orange scaling in varying amounts, and others have reduction of black scaling, the ground color being a mixture of grey and white scaling with white along the terminal margin, giving a uniform appearance.

HOLLAND (1930, pl.28) referred to his figure 4 as the female type of *cythera,* an error since *cythera* was described from three males. This figure apparently is of a specimen of *mejicanus.*

The race was described by BEHR from the Sierra Madre Occidental near Mazatlan, Sinaloa, Mexio. From the type locality, the race apparently ranges northward into southern Arizona and New Mexico. We have not seen material from localities south of Mazatlan. In the United States *mejicanus* is found from the Baboquivari Mountains of southern Arizona eastward to the Davis Mountains in Texas, and northward in New Mexico. It is likely that derivative populations which exhibit phenotypic expressions similar to *mejicanus* range into Colorado.

Although we have seen relatively few specimens from scattered localities, it is evident that *mejicanus* is highly variable. Specimens from

the mountain ranges in southern Arizona indicate that variation both within populations and between populations is pronounced. This is especially notable in the amount of orange scaling and in the development of the pattern of the underside of the hindwing. Much of the variation in certain populations (*e.g.*, Santa Rita Mountains) may be due to influence from *mormo mormo* populations of lower elevations at the northern margin of the *mejicanus* range in Arizona. However, we have not had material in series from these areas for study.

Data from material examined.—ARIZONA.—Pima Co.: Baboquivari Mts., VI-(1-15)-24, IX-7-23 (O. C. POLING); Brown Cnyn., Baboquivari Mts., III-20-38 (TILDEN); Box Cnyn., Santa Rita Mt., VIII-2-59 (TILDEN). Santa Cruz Co.: Patagonia, III-23-38, III-24-38 (TILDEN); Canelo, VIII-24-53 (TILDEN). Cochise Co.: Huachuca Mts., "V-1" (W. G. WRIGHT); Ramsey Cnyn., IX-3-52, IX-1-53 (MARTIN), IX-9-49, VIII-31-52, VIII-24-53 (TILDEN). NEW MEXICO.— Colfax Co.: Raton, VII-26-52 (J. R. MERRITT). Bernalillo Co.: Juan Tabo, Sandia Mts., 7000', VIII-1-44 (GRIESEL). Grant Co.: 2 mi. NE. San Lorenzo, Black Range, 6200', V-28-59 (BURNS). Dona Ana Co.: San Agustin Pass, 5600', Organ Mts., IV-27-59 (BURNS). Eddy Co.: White's City, VII-8-54 (CAZIER & GERTSCH). TEXAS. —Jeff Davis Co.: Davis Mts., nr. Fort Davis, 5000', V-(1-10)-28, VI-(1-15)-28, VII-(15-30)-28 (O. C. POLING). MEXICO.—Sonora: Monument Bay, Tiburon Is., IV-1-39 (RINDGE); 20 mi. N. Guaymas, X-29-58 (PATTERSON).

Apodemia mormo langei Comstock

Apodemia mormo langei Comstock, 1938, *Bull. so. California acad. sci.* 37: 129, fig.1, 2.

Apodemia mormo langei is characterized by invasion of orange scaling into the discal spot of the forewing and onto the basal half of the hindwing.

Length of forewing, male 12.0 to 14.5 mm., female 14.0 to 15.5 mm. *Forewing*: the four spots in basal half invaded by orange scaling, particularly in discal spot, less on inner anal spot. *Hindwing*: basal half infused with orange scaling except on veins, nearly covering spots in this area, extending to subterminal row of white spots. Underside characterized by reduction of black scaling, the ground color being of brown and white scaling; margins whitish, spots not greatly contrasting.

A. m. langei is the most recently described of the previously recognized subspecies, and, so far as is known, is endemic to the Antioch sand dunes. The species feeds there on *Eriogonum latifolium* Sm. (*sens. lat.*), larvæ having been taken by OPLER in June 1957. These dune areas adjoin the San Joaquin River, thus offering an ideal site for industrial expansion, which, during the past decade has reduced the once extensive dunes to a few isolated portions. Most of the sampling of the *langei* population during the past few years has place at one small colony. Upwards of 200

specimens must have been taken on September 5, 1954, when members of the Pacific Slope Branch of the Lepidopterists' Society collected in the area, so that the locality, although restricted, was capable at least as recently as six years ago, of supporting quite a large colony.

As mentioned under the discussion of *A. m. mormo*, specimens showing phenotypic affinities with *langei* occur along the inner coast range to the south. The collection listed from near Cholame consists of three males which are discernible from the typical *langei* phenotype only by the darker ground color and reduction of the basal orange of the hind wings, and a similar female which has the discal spot white. The colony thus shows a definite relationship with the coastal *m. mormo* populations to the north. Therefore it appears possible that the *langei* phenotype will be found in isolated populations along the western foothills of the San Joaquin Valley.

Data from material examined.—CALIFORNIA.—Contra Costa Co.: Antioch, VIII-18-33, VIII-14-38 (W. H. LANGE) (type series), VIII-30-36, VIII-15-37, VIII-21-38, VIII-10-41, VIII-16-42 (E. C. VAN DYKE), IX-25-37 (HOVANITZ), VIII-27-38 (no collector), VII-17-47 (T. W. DAVIES), IX-8-48 (P. D. HURD), VIII-14-54 (TILDEN), VIII-21-54 (LANGSTON), IX-5-54 (MARTIN, OPLER, PATTERSON, POWELL, TILDEN), IX-7-54 (MACNEILL), IX-18-55 (BURNS), VIII-23-56, VIII-20-57 (PATTERSON); Oakley, IX-5-37 (VAN DYKE).

APODEMIA MORMO TUOLUMNENSIS Opler & Powell,
NEW SUBSPECIES

A Sierran population characterized by a great extent of orange on the upperside together with reduction of white spots, and dark underside.

Male.—As described above for the nominate subspecies, differing by the following characteristics. Length of forewing 13.3 to 14.0 mm. Antennal club orange to dull brown below. *Forewing*: white spots greatly reduced; orange infusion of an ochreous-orange color, greatly expanded, replacing the black on entire wing surface from base to terminal spot band and leaving only a narrow black band on anal margin below lower white spots, at times surrounding subterminal spots in lower half of wing, nearly replacing white spots of subterminal band, the latter usually reduced to a trace in first, second and fifth spot loci, rarely these larger and traces present at all seven loci; spots of terminal band small, at times nearly lacking. Underside similarly marked, the extensive ochreous-orange paler; terminal area brownish-grey. *Hindwing*: white spots reduced; orange infusion varying from a replacement of the subterminal band, as in *virgulti,* to a nearly complete replacement of the basal, median and subterminal interspaces, similar to *mejicanus;* subterminal white spots entirely replaced or reduced to traces; terminal spots small. Underside dark brownish grey, the spots rather distinctly contrasted as in *virgulti;* some whitish infusion along anal and terminal margins.

Female.—Length of forewing 14.5 to 16.0 mm. Essentially as described for male, the white spots tend to be not so reduced, the orange paler and consistently more extensive on the basal half of the hindwing.

HOLOTYPE male and ALLOTYPE female: Grand Canyon of the Tuolumne, Yosemite National Park, Tuolumne County, California, August 1, 1959 (P. A. OPLER). Fifteen PARATYPES: nine male and two female same data as holotype; two male and two female same data except August 20, 1954. Holotype, allotype, and series of eight paratypes deposited in the California Academy of Sciences, single specimens deposited at American Museum of Natural History and Los Angeles County Museum, remainder in authors' collections.

So far as is known the subspecies is restricted to a population along a four mile area of the Pate Valley trail from about 4500′ to 7000′. It seems likely that *tuolumnensis* is a segregate from *virgulti,* its nearest geographic relative, which probably occurs in scattered colonies through the lower foothills to the west.

Due to the forewing pattern, the subspecies appears superficially much like *A. m. cythera,* from which it differs by the reduced white spots above and the dark underside of the hindwings. The hindwings of some individuals appear much like those of *virgulti;* however, the great extension of orange on the forewings will at once distinguish it from any specimen of *virgulti* we have seen.

Apodemia mormo virgulti (Behr)

Nemeobius virgulti Behr, 1865, *Proc. California acad. sci.* 3:178.

Lemonias virgulti, Bates, 1868, *Journ. Linn. soc. London, zool.* 9: 448; Wright, 1906, *Butterflies West Coast* :201, pl.27, fig.296.

Apodemia mormo virgulti, Stichel, 1911, *Genera insectorum,* fasc.112: 288; Barnes & McDunnough, 1916, *Contr. nat. hist. Lepid. North America* 3: 103; Seitz, 1924, *Macrolep. world* 5: 700, fig.14le; Coolidge, 1924, *Trans. Amer. ent. soc.* 50: 324 (biology); Comstock, 1927, *Butterflies California*: 149, pl.47, fig.6; Wright, 1930, *Trans. San Diego soc. nat. hist.* 6: 21; Stichel, 1930, *Lepid. catalogus* 41: 587; McDunnough, 1938, *Mem. so. California acad. sci.* 1: 23; Comstock, 1938, *Bull. so. California acad. sci.* 37: 129, fig.3; Hoffmann, 1940, *An. inst. biol. Mexico* 12: 700; Rindge, 1948, *Proc. California acad. sci.,* 4th ser. 24: 299; Powell, 1958, *Lepid. news* 12: 29.

Apodemia vergulti (error), Anonymous, 1927, *Journ. zool. ent.* (Pomona Coll.) 9: 136.

Apodemia virgulti, Holland, 1931, *Butterfly book,* rev. ed.: 212, pl.28, fig.6.

Apodemia mormo virgulti is characterized by the distinct orange submarginal band of the hindwing, the reduced terminal band spots, and the more uniform lack of white scaling in the black ground color of the underside of the hindwing with the accompanying sharply contrasted white spots.

Length of forewing, male 10.0 to 13.5 mm., female 14.5 to 17.0 mm. *Thorax*: dorsal scaling grey and blackish, often with mixed orange scales. *Forewing*: white spots of terminal bands reduced, those of subterminal mostly replaced by orange, those of terminal nearly replaced by surrounding ground color, especially in male; black scaling of anal margin often extends to lower edge of cell, especially in male. *Hindwing*: subterminal spot band usually nearly entirely replaced by orange;

terminal band spots very reduced. Underside, white scaling mostly lacking from ground color except along margins; spots thus very contrasting, bordered by darker black lines.

The name *virgulti* was proposed when BEHR described specimens from near Los Angeles. BATES erroneously synonymized *sonorensis* under *virgulti,* listing the distribution as Los Angeles and Sonora, and this form of synonomy has been followed by all subsequent writers. We have not seen the original specimens of *sonorensis,* but on the basis of distribution patterns we believe that it certainly must be a synonym of *mejicanus.*

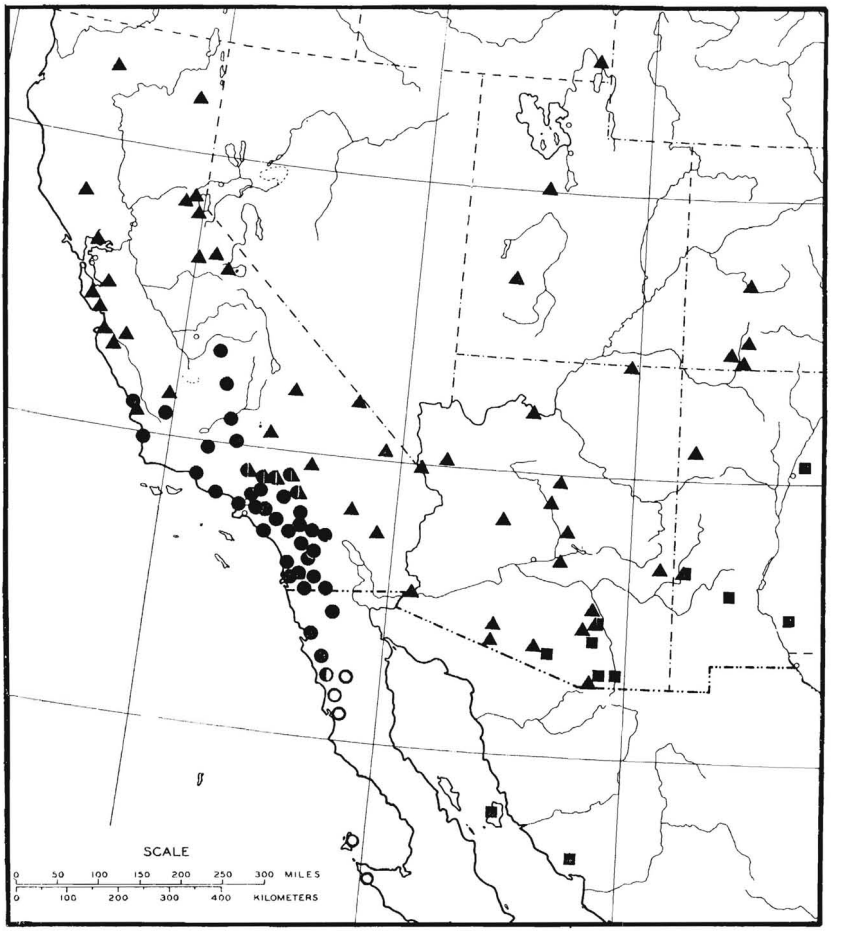
The distribution of *virgulti* is confined to coastal southern California and Baja California Norte, and along the foothills on the west slope of the Sierra Nevada at least as far north as Mariposa County. COMSTOCK (1928) states that *virgulti* is found north to the Sacramento Valley, but we have not seen specimens from this area. Three specimens of the *virgulti* phenotype, labeled San Antonio Valley, Mt. Hamilton, Santa Clara County, were apparently collected along with *mormo mormo* in an area remote from any of the known *virgulti* populations. The relationships and variation of populations in this area are in need of further clarification.

The subspecies is abundant throughout the chaparral zones of cismontane southern California in association with *Eriogonum fasciculatum* Benth. COOLIDGE (1924) has described the early stages from Mt. Wilson, Los Angeles County, where it is double brooded. COOLIDGE found them on *E. fasciculatum* var. *foliolosum* Stokes and var. *porifolium* P. as well as *E. elongatum* Benth.

At least in many areas *virgulti* does not seem to be confined to restricted local populations as is *A. mormo mormo* to the north, and throughout coastal California and northern Baja California populations of *virgulti* are very similar in phenotypic expression. However, as one observes the subspecies proceeding southward along the west coast of Baja California populations gradually lose the orange of the hindwing, and the individuals take on a very dark aspect. At Arroyo Seco a sample of six specimens indicates the population is about half composed of individuals with little or no hindwing orange. Further south, in the areas of Colonia Guerrero and San Quintin, only occasional individuals show even a faint trace of orange; most have entirely black ground color. In addition, the underside is darker, with the spots strongly contrasting. Worn specimens from Cedros Island and San Bartolime Bay, some distance to the south, appear to have similar characteristics. As mentioned previously (Powell, 1958), these dark populations may warrant subspecific recognition when more information becomes available on their relationships to the south and east. However, at present it does not seem likely that the black hindwing is due to influence from *mormo mormo* popula-

tions to the east, as postulated previously, but it is more likely that the dark form is a southern derivative of *A. mormo virgulti.*

As has been discussed under *mormo*, *virgulti* forms a blend zone with *mormo* on the lower desert slopes to the east and north of the San Gabriel Mountains. In these areas *virgulti*-like individuals invariably exhibit a pronounced replacement of the orange submarginal band by white, and the underside ground color tends to be suffused with white.



Distribution of the major subspecies of *Apodemia mormo* in the southwestern Nearctic region. Triangles indicate localities for *A. mormo mormo*, squares for *A. mormo mejicanus*, and circles for *A. mormo virgulti*; open circles indicate the dark southern segregate of *virgulti.*

Due to the abrupt topographical change from the mountain to the desert areas of Riverside and San Diego Counties, there is a sharp demarcation between ecological areas inhabited by *A. mormo virgulti* and *A. m. deserti.* Thus one expects a possible blend zone between these to be geographically restricted. Evidence of this population is shown by specimens labeled "Palm Springs". Most of these collections are typical *deserti,* but some separately collected specimens resemble *virgulti* in some respects. These probably have been collected at somewhat differing localities in the canyons west of Palm Springs. It seems likely that an intergrade population exists in varying expressions throughout the canyons of the eastern foothills of the San Jacinto Mountains (*i.e.,* Snow. Cr., Chino Canyon, Tahquitz Canyon, Palm Canyon, south to Pinon Flat), as well as in scattered colonies on the east side of the Santa Rosa Mountains and the mountains of San Diego County.

Data from material examined.—CALIFORNIA.—Mariposa Co.: Yosemite Vy., no date (Hy. EDWARDS). Tulare Co.: "Sheep Cr., Calif." [prob. nr. Kaweah, Tulare Co.], IV-12-50 (PATTERSON); California Hot Spr., V-16-37 (E. C. VAN DYKE). Kern Co.: Havilah, no date (HY. EDWARDS); Tehachapi, VII-7-18 (COMSTOCK). San Luis Obispo Co.: Cayucos, V-23-28 (L. S. SLEVIN); Oso Flaco Lake, VII-13-59 (C. A. CAMPBELL); 7 mi. W. Simmler, VIII-7-55 (POWELL). Ventura Co.: Ventura, VIII-2-26 (G. HEID), VII-6-27 (T. CRAIG); 5 mi. W. Frazier Park, VII-21-56 (TILDEN). Los Angeles Co.: Bouquet Cnyn., V-20-59 (POWELL); Mint Cnyn, IV-20-32 (VAN DUZEE), IV-14 to 30-23, V-3-45 (COMSTOCK); Soledad Cnyn., IV-24-46 (MARTIN); Pacoima Wash, 1060′, VI-23-13 (GRINNELL); Nichol's Cnyn., IV-21-43 (LANGSTON); Cloudburst Cnyn., VII-12-41 (LANGSTON); Switzer's Trail, San Gabriel Mts., VIII-'07 (GRINNELL); Switzer's, VII-17-37 (W. A. EVANS); Arroyo Seco, VIII-20-07; (GRINNELL); Mt. Lowe, VIII-21-16 (no collector); Mt. Wilson, VIII-2-04 (GRINNELL); Santa Anita Cnyn., VII-20-30 (no collector); Sierra Madre nr. Los Angeles, VIII-23-16 (no collector); Azusa, IX-17-40, IV-3-45 (C. I. SMITH); Glendora, V-5-31, IV-2-32, IV-2-33 (L. HULBIRT), III-29-31, IV-22-30, V-27-30,VI-6-30, X-19-30 (no collector); Glendora Mtn., VIII-2,11-56 (TILDEN); Tanbark Flat, V-13-57 (TILDEN); Padua Hills, IX-12-49 (TILDEN); San Antonio Cnyn., 3000′, VII-6 to 16-25, IX-1-25, IX-9-27 (T. CRAIG); San Antonio Wash, VII-2-52 (TILDEN); Claremont, III-17 to IV-28-26 (T. CRAIG); Pasadena, V-21-04, V-22-07, IV-6-09 (GRINNELL); Griffith Park, III-12,24-35, V-5-35 (G. HEID); Los Angeles, VII-30-48 (VAURIE); Venice, IX-5-26 (COMSTOCK); El Segundo, VII-25-21 (COMSTOCK); Manhattan Beach, VII-25-21 (COMSTOCK). Orange Co.: La Habra, IX-28-20 (T. CRAIG); Laguna Beach, VIII-24-30 (no collector); Orange County Park,

III-31-28 (T. CRAIG); Santa Ana Cnyn., IX-17-32 (L. HULBIRT); Silverado Cnyn., III-30-47 (LANGSTON); Gypsum Cnyn., III-16-28 (C. M. DAMMERS). San Bernardino Co.: W. fork Cucamonga Cnyn., VII-13-23, VII-6-25 (T. CRAIG); Baldy Mesa, IX-19-39 (RINDGE); Oak Glen, V-4-39 (RINDGE); Rialto, IX-17-38 (P. D. HURD); Etiwanda, IV-14-27 (T. CRAIG); Verdemont, Cajon Pass, VI-27-35 (E. P. VAN DUZEE); Forest Home, VI-19-28 (VAN DYKE); "San Bernardino Mts.", IX-1-20 (COMSTOCK). Riverside Co.: Riverside, IX-16-32 (DAMMERS); Perris, V-26-52, VIII-2, 21-52, III-15,22-53 (no collector), Rancho La Sierra, V-12-38, IV-23-39 (RINDGE); Gavilan Hills, IV-18-37 (ANDREWS & MARTIN), IV-19-57 (TILDEN); Hemet, IV-28-49 (MACNEILL); Idyllwild, VI-'36 (E. S. ROSS), VI-18-52 (CAZIER); 10 mi. SW. Coahuila, V-21-27 (T. CRAIG); Keen Camp, VI-9-17 (VAN DUZEE); San Jacinto Cr., IV-7-31 (L. I. HEWES); Nightingale, IV-28-49 (MACNEILL); Pinon Flat, IV-27-55 (D. J. BURDICK); "San Jacinto Mts.", IX-1-20 (COMSTOCK); Anza, IX-17-40 (C. I. SMITH); Santa Rosa Mts., 6000′, "VI-25" (GRINNELL); Temecula, IV-11-50 (HURD). San Diego Co.: 10 mi. S. Temecula, Riverside Co., no date (J. W. MACSWAIN); Mt. Palomar, 5400′, I-26-36 [?] (RINDGE), VII-10-52 (MCKENNEY); Nellie, [Mt. Palomar], IV-1-17 (G. HALL); Mt. Palomar, 3700′, V-20-39 (RINDGE); Warner Spr., 3000′, IV-15-51, VI-22-51 (POWELL); San Felipe turnoff, VIII-4-55 (TILDEN); Santa Ysabel, "IV-20" (W. G. WRIGHT); Julian, (no further data); Pine Vy., (no further data); Rancho Santa Fe, III-30-30 (no collector), III-13-33 (L. I. HEWES); hiway 395, 15 mi. N. San Diego, IV-13-55 (PATTERSON); Mission Gorge, II-28-52, IV-15-52; "S" [COWLES] Mt., V-3-52; Lakeside, IX-14-51, VI-9-52, IX-4-52, X-12-52; Flinn Spr., VII-21-51 (all POWELL); 2 mi. SE. El Cajon, V-18-52 (F. T. THORNE);La Mesa, III-28-43 (E. W. CLARK), VII-22-54 (F. X. WILLIAMS); Fairmount Cnyn., IV-25-48 (G. A. MARSH); San Diego, VII-27-07, III-21 to IV-24-08, VII-11, 27-08, IX-19-08, V-13-13, IV-18-14 (no collector), IV-7, 11-18 (COMSTOCK), VII-21-24 (PATTERSON), IX-19-26 (THORNE), IV-14-39 (W. P. MEDLAR); Sweetwater Lake, X-28-50 (LANGSTON); Camp Minnewawa [Dulzura Cr.], X-28-50 (LANGSTON); Dulzura IV-17-08 (no collector); Jacumba, IV-26-29 (MORAND), IV-25-51 (MACNEILL), III-31-53 (MCKENNEY). MEXICO.—Baja California Norte: Sierra Juarez, mesa W. of Canyon del Tajo, X-9-53 (HARBISON); Ensenada, VII-2,5-05 (F. X. WILLIAMS); 7 mi. SE. Santo Tomas, V-25-58 (PATTERSON); nr. Arroyo Seco, IV-5-55 (PATTERSON); Socorro, Sierra San Pedro Martir, 4000′, V-26-58 (PATTERSON, POWELL); trail nr. Las Encinas, Sierra San Pedro Martir, 5000′, V-27-58 (PATTERSON); Santo Domingo, VIII-14-54 (POWELL); Colonia Guerrero, IV-5-55 (PATTERSON); Santa Maria Vy., VIII-11-54 (POWELL); San Simon, IX -6 to 10 -55 (MCKENNEY); Cedros Is., VII-14-38,

XI-10-48 (no collector); San Bartolime Bay, VI-1-25 (H. H. KEIFER).

Blend zone with *deserti*: CALIFORNIA.—Riverside Co.: Palm Springs, XI-1-20 (COMSTOCK), IV-20-32 (GUEDET); Coachella Vy. nr. Indian Well, X-15-20 (COMSTOCK). San Diego Co.: San Felipe Vy., IX-29-49 (STERNITSKY).

Apodemia mormo deserti Barnes & McDunnough

Apodemia mormo deserti Barnes & McDunnough, 1918, *Contr. nat. hist. Lepid. North America* 4: 75, pl.12, figs.1,2; Comstock, 1927, *Butterflies California*: 151, pl.47, figs.8, 12; Stichel, 1930, *Lepid. catalogus* 41: 589; McDunnough, 1938, *Mem. so. California acad. sci.* 1: 23; Comstock, 1938, *Bull. so. California acad. sci.* 37: 129.

Lemonias mormo, Wright, 1906 (in part, fig.294a) (not Felder & Felder, 1859), *Butterflies West Coast*: 201.

Apodemia mormo mormo, (not Felder & Felder, 1859), Comstock, 1927 (in part), *Butterflies California*: pl.47, fig.5: Wright, 1930, *Trans. San Diego soc. nat. hist.* 6: 21; Rindge, 1948, *Proc. California acad. sci.* 24: 299 (in part?).

Apodemia mormo var. *deserti*, Holland, 1931, *Butterfly book*, rev. ed.: 212 (synonymy); Hoffmann, 1940, *An. inst. biol. Mexico* 12: 700.

Apodemia mormo deserti is characterized by a general pale aspect due to paler ground color, enlarged white spots, particularly those of the terminal band, and extensive white scaling on the hindwing underside. Worn or greasy specimens, or those discolored by over-relaxing, lose some of the whitish appearance.

Length of forewing, male 11.0 to 13.5 mm.; female 13.5 to 15.5 mm. *Thorax*: white with mixed orange scales. *Forewing*: upperside, white spots large, those of terminal row nearly equal in size to those of subterminal row; black scaling of costal and anal margins reduced; orange area pale. *Hindwing*: white spots large, especially notable in terminal band; ground color greyish, a pale grey in central area. Underside characterized by extensive white scaling on ground color areas, especially in median area. *Abdomen*: dorsal scaling a mixture of white and orange or black and white with a few orange scales; underside white.

This race was described from three specimens collected in La Puerta Valley on the western edge of the Colorado Desert in San Diego County. BARNES and MCDUNNOUGH mentioned additional specimens from Palm Springs, but, unfortunately, referred to this as the "borders of the Mohave Desert". Palm Springs is situated in the Coachella Valley at the northern end of the Colorado Desert and is separated from the Mojave Desert plateau by the Little San Bernardino Mountains. A general conception about the race developed, collectors referring any specimens from desert areas, including the Mojave, to *deserti*, and the distinctness of the race has become obscured in the literature because pale (especially faded or worn) specimens from *m. mormo* populations of various areas of the Mojave Desert have been used as a basis for reference to *deserti*.

Although COMSTOCK (1927) accurately represented the race in his figures and probably understood the distribution, he did not give a clear picture of it by "the southern arid regions" of California. HOLLAND

(1930) apparently did not consider *deserti* as a geographic race and erroneously gave the locality as "southwestern California". These two reports doubtless resulted in much of the uncertainty which has existed through subsequent years concerning the occurrence of the subspecies over desert regions in general.

We do not believe that the name *deserti* is applicable to any of the several desert populations discussed above under *mormo mormo*. Each of these, as well as the northern segregates of *m. mormo* are separable on a comparable level. Populations of the western Mojave Desert are distinguishable from *m. deserti* of the western Colorado Desert foothills only in being darker, since the spot size of the terminal band is not consistently smaller. The populations from Pima County, Arizona, are pale with greyish ground color, but are distinguishable by larger size of the butterflies and by smaller spots of the terminal band, yet are as different from the western Mojave populations as from *deserti*. Therefore it would seem that use of the name *deserti* is of little value, but if used, its application should be restricted to populations along a narrow band of the foothills on the western edge of the Colorado Desert. Specimens of the dark *mormo mormo* phenotype from the southern Mojave Desert (Ord Mtn., Twentynine Palms) and the Colorado River basin (Needles, Yuma) support this concept.

BROWN (1955) indicates that specimens resembling *deserti* will probably be found in Colorado. If populations with the *deserti* phenotype occur in eastern portions of the range of the species, it would appear that they should not be referred to the *deserti* of Barnes & McDunnough of the western Colorado Desert foothills.

The foodplant of *deserti* is listed as *Eriogonum inflatum* by COMSTOCK and DAMMERS (1934), who collected larvæ in the desert foothills of Riverside County, and they state that the larva and pupa are indistinguishible from those of *virgulti*. Apparently there is usually at least a partial spring and fall emergence in most localities. However, the time of flight and number of generations per year probably vary greatly with the seasonal conditions, particularly the rainfall, in any given locality.

Data from material examined.—CALIFORNIA.—San Bernardino Co.: Morongo Vy., V-1-29 (C. M. DAMMERS); III-17-40, IV-28-40 (RINDGE). Riverside Co.: Tahquitz Cnyn., IV-4-55 (OPLER); Palm Springs, III-11-33, III-11-35, XI-6-32 (C. M. DAMMERS), VIII-10-33, X-15-33 (L. HULBIRT), III-27-37, IV-20-38 (no collector), IV-3-35 (COMSTOCK); Palm Springs Canyon, IV-4-25 (VAN DYKE). San Diego Co.: Borrego Vy., X-10-39, IV-8-39 (RINDGE); "Borrego", [10 mi. SE. Borrego Springs], III-21-51 (POWELL); 3 mi. W. Yaqui Well, Anza Desert, IX-16-51, X-14-51 (LANGSTON); XI-12-45 (MELANDER); "Borrego", IV-11-41, IV-27-46, III-

17-40, XI-7-45, XI-11-45, XII-16-45, I-19-46, (SPERRYS), III-14-53 (POWELL); "Borrego", [nr. Sentenac Cnyn.], IX-5-51, IX-10-51, X-12-51, VI-6-52 (POWELL); Sentenac Cnyn., IV-14-51, X-14-51, VIII-25-55 (LANGSTON), VIII-16-35, IX-4 to X-17-35 (C. M. DAMMERS); 1 mi. E. Sentenac Cnyn., IX-12-59 (MACKIE); Scissor's Crossing, VIII-4-55 (TILDEN); IX-4-55 (LANGSTON); San Felipe Wash, X-28-36, X-24-36, X-30-36 (COMSTOCK); "Box Cnyn." [7 airline mi. SE. Banner], VIII-25-55 (LANGSTON), III-30-52 (MCKENNEY), IV-8-52, VII-11-52 (POWELL), IX-12-59 (MACKIE); Mason Vy., VIII-27-52 (MACKIE); LaPuerta Vy., VII-1911 (G H. FIELD); Vallecito, XI-12-45 (COMSTOCK); County unknown: "Colorado Desert", X-28-33 (no further data).

APODEMIA MORMO DIALEUCA Opler & Powell,

NEW SUBSPECIES

Apodemia mormo complex, "population", Patterson & Powell, 1960, *Journ. lepid. soc.* 13: 233.

A Baja California montane race characterized by greatly enlarged white spots and an accompanying reduction of orange.

Male.—As described above for the nominate subspecies, differing by the following characteristics. Length of forewing 12.3 to 15.0 mm. *Forewing*: inner three white spots greatly enlarged, subequal in size to discal spot; subterminal band spots large, all well developed; terminal band spots small or large; black ground color little replaced by orange suffusion, varying from an obscure tinge between discal spots and outside fifth subterminal spot to reduced but bright orange interspaces between the veins and the broad black spot margins above the median vein. Underside, orange similarly restricted; termen and anal margin broadly bordered with pale grey. *Hindwing*: spots large; ground color dark grey; orange infusion varying from a trace to a well defined submarginal band partially replacing the white subterminal spots. Underside pale appearing due to the large white spots and a general whitish infusion centering between veins; ground color grey, the spots distinct, at times partly margined with black.

Female.—Length of forewing 15.0 mm. Essentially as described for male; the orange of forewing varying to slightly more extensive, appearing outside the fourth, fifth and sixth subterminal spots.

HOLOTYPE male, Sierra San Pedro Martir, 5 miles northeast of La Encantada, 9000′, Baja California Norte, Mexico, May 31, 1958 (J. POWELL), and ALLOTYPE female, Sierra San Pedro Martir, La Encantada, 7000′, May 30, 1958 (W. D. PATTERSON), deposited in the California Academy of Sciences. Eighteen PARATYPES, all from the same area, as follows: nine male, same data as holotype; five male and one female same data except PATTERSON collector; two male same data as allotype except J. POWELL collector; one male, trail between La Grulla and La Encantada, 7000′, May 30, 1958 (W. D. PATTERSON). Two additional males apparently also referable to this subspecies but not designated as paratypes, labeled Sierra San Pedro Martir, "La Sanja, May 28, 1958"

(PATTERSON). A representative series of ten males deposited in the California Insect Survey Collection, University of California, Berkeley, single specimens at the American Museum of Natural History and Los Angeles County Museum, and the remainder in the Patterson and authors' collections.

The holotype has about an average amount of orange infusion, most specimens have somewhat more, some have less, but it is unusual in having a relatively greater reduction of orange in the basal area of the forewing, so that the subterminal band of the hindwing is the most conspicuous orange area of the upperside.

The greatly enlarged white spots and reduction of orange give the specimens a striking black and white checkered appearance unlike that of any other known member of the complex. The orange and the rather contrasting spots of the underside of the hindwing together with the geographic proximity suggest a derivation from *virgulti.* However, certain individuals which lack nearly all traces of the orange on both wings recall certain representatives of *mormo mormo* from the mountains of eastern Arizona, and a relationship with the fauna of the mountains of southern Arizona for certain other Lepidoptera of the Sierra San Pedro Martir is known (Patterson & Powell, 1960).

The series was collected on rocky slopes marginal to the southwest side of La Encantada meadow and in a wash southwest of the Tres Palomas peaks in association with a small prostrate *Eriogonum,* presumably *E. hastatum* Wiggins.

Apodemia mormo maxima (Weeks)

Lemonias maxima Weeks, 1891, *Ent. news,* 2:104; Weeks, 1905, *Ill. diurn. Lepid.* 1: 3, pl.1, fig.4.

Apodemia mormo maxima, Seitz, 1924, *Macrolep. world* 5: 700, fig.14le; Stichel, *Lepid. catalogus* 41: 589; Rindge, 1948, *Proc. California acad. sci.,* 4th ser. 24: 300.

Apodemia mormo maxima is characterized by its large size, large white spots, and extensive brownish-orange ground color in both wings.

Length of forewing, male 16.0 to 17.5 mm.; female 19.0 to 21.0 mm. *Forewing*: ground color pale brownish-orange and appearing dull, extending beyond subterminal row of white spots; spots on basal half of wing pure white; spots of subterminal band rounded, not triangulate in appearance. *Hindwing*: ground color from base of wing almost to terminal row of white spots and not much infuscated. White spots on underside narrowly edged with black, white scaling along costal margin adjoining spots of terminal row and at base of costal margin. Remainder of wing with brownish scaling.

This subspecies was described from the southern tip of Baja California. Subsequent records, mostly already given by RINDGE (1948), indicate that the race occurs along the southern half of the peninsula. RINDGE

mentions collections of "the species" under his discussion of *A. mormo maxima,* from the coast of Sonora, Mexico. According to material we have seen from the latter area it seems likely that this record represented populations of *mormo mejicanus.* The two are very close phenotypically.

Data from material examined.—MEXICO.—Baja California, Territorio Sur: 15 mi. N. San Ignacio, IX-29-41 (Ross & Bohart); 10 mi. E. San Ignacio, IX-30-41 (Ross & Bohart); Coyote Cove, Concepcion Bay, X-1-41 (Ross & Bohart); Pulpito Bay, I-2-39 (Rindge); La Paz, XI-9-52 (Harbison), III-25-56 (Patterson); Muertos Bay, III-23-39 (Rindge); Los Frailes Bay, XII-28-38 (Rindge); Cape San Lucas, XII-25-38, XI-13-39 (Rindge); Agua Verde, V-26-21 (E. P. Van Duzee).

Synonymic Checklist of the *Apodemia mormo* Complex

Apodemia

- mormo mormo (Felder & Felder), 1859
  - *dumeti* (Behr), 1865
  - *mormonia* (Boisduval), 1868
- mormo cythera (Edwards), 1873
- mormo mejicanus (Behr), 1865
  - *sonorensis* Felder & Felder, 1865
  - *duryi* (Edwards), 1882
  - *druryi* Stichel, 1911
- mormo langei Comstock, 1938
- mormo tuolumnensis Opler & Powell, 1962
- mormo virgulti (Behr), 1865
  - *vergulti* Anonymous, 1927
- mormo deserti Barnes & McDunnough, 1918
- mormo dialeuca Opler & Powell, 1962
- mormo maxima (Weeks), 1891

Literature Cited

Barnes, W. & J. McDunnough, 1918. Notes and new species. *Contr. nat. hist. Lepid. North America*: 60-208.

Brown, F. M., 1955. The butterflies of Colorado, part III, Libytheidæ, Riodinidæ Lycænidæ. *Proc. Denver mus. nat. hist.* 5: 113-176.

.....1957a. Itineraries of the Wheeler Survey Naturalists 1871 – Ferdinand Bischoff. *Journ. N. Y. ent. soc.* 65: 219-234.

.....1957b. The type locality for *Ochlodes yuma. Lepid. news* 11: 153-154.

Browning, G. W., 1901. Collecting in the vicinity of Salt Lake City with a list of Rhopalocera taken. *Ent. news* 12: 297-304.

Comstock, J. A., 1927. *The butterflies of California.* Los Angeles, Comstock, 334 pp., 63 pls.

.....1938. A new *Apodemia* from California. *Bull. so. California acad. sci.* 37: 129-132.

....& C. M. Dammers, 1934. Additional notes on the early stages of Californian Lepidoptera. *Bull. so. California acad. sci.* 33: 25-34.

Coolidge, K. R., 1924. Life history studies of some Californian Rhopalocera. *Trans. Amer. ent. soc.* 50: 319-335.

Garth, J. S., 1950. Butterflies of Grand Canyon National Park. *Bull. Grand Canyon nat. hist. assoc.* 11: 52 pp.

Grundel, J. G., 1905. Life history of *Lemonias virgulti. Ent. news* 16: 86.

Haskin, J. R., 1914. Butterfly collecting in Mojave County, Arizona. *Ent. news* 25: 300-307.

Holland, W. J., 1931. *The butterfly book,* revised edition. Doubleday & Co., Garden City, N. Y. 424 pp., 77 pls.

Martin, L. M., & F. S. Truxal, 1955. A list of the North American Lepiodoptera in the Los Angeles County Museum, Part I. Butterflies. *Los Angeles Co. mus. sci. ser.* 18, *zool.,* no.8: 35 pp.

Mead, T. L. 1875. Report upon the collections of diurnal Lepidoptera made in portions of Colorado, Utah, New Mexico, and Arizona during the years 1871, 1872, 1873, and 1874, with notes upon all species known to inhabit Colorado. *in*: Wheeler, G. M., *Report upon geographical and geological explorations and surveys west of the one hundredth meridian, zoology* 5: 737-794, pls.35-40. Government Printing Office. Washington, D. C.

Patterson, D., & J. A. Powell, 1960. Lepidoptera collecting in the Sierra San Pedro Martir, Baja California. *Journ. lepid. soc.* 13: 229-235.

Powell, J. A., 1958. Additions to the knowledge of the butterfly fauna of Baja California Norte. *Lepid news* 12: 26-32.

Rindge, F. H., 1948. Contributions toward a knowledge of the insect fauna of Lower California. No.8, Rhopalocera. *Proc. California acad. sci.* 24: 289-312.

Seitz, A., 1923. The American Rhopalocera. *Macrolepidoptera of the world* 5: 1139 pp., 203 pls.

Stichel, H., 1911. Family Riodinidæ, Allgemeines, Subfamily Riodininæ. *Genera insectorum,* fasc.112: 452 pp.

Weeks, A. G., 1905. *Illustrations of diurnal Lepidoptera, with descriptions.* Vol.I. Boston Univ. Press, Cambridge. 117 pp., 45 pls.

Wright, W. G., 1906. *The butterflies of the west coast of the United States,* 2nd ed. San Bernardino, Wright. 257 pp., 32 pls.

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EXPLANATION OF PLATE

Top three rows: uppersides of *Apodemia mormo* subspecies. TOP ROW: (left), *A. m. mormo,* coastal California race, Seaside, Monterey Co., VII-4-59, J. POWELL collector; (middle), *A. m. deserti,* Borrego, San Diego Co., Calif., X-12-51, J. POWELL collector; (right), *A. m. virgulti,* dark southern race, Santa Maria Valley, Baja California Norte, Mexico, VIII-11-54, J. POWELL collector. SECOND ROW: (left), *A. m. dialeuca,* Holotype, Sierra San Pedro Martir, 9000′, 5 mi. NE. La Encantada, Baja California Norte, Mexico, V-31-58, J. POWELL collector; (middle), *A. m. dialeuca,* Allotype, Sierra San Pedro Martir, 7000′, La Encantada, Baja California Norte, Mexico, V-30-58, W. D. PATTERSON collector; (right), *A. m. virgulti,* Mission Gorge, San Diego Co., Calif., II-14-53, J. POWELL collector. THIRD ROW: (left), *A. m. cythera,* Rock Creek, Mono Co., Calif., VIII-10-58, M. LUNDGREN collector; (middle), *A. m. cythera,* 5 mi. E. Lake Sabrina, Inyo Co., Calif., VII-30-59, P. OPLER collector; (right), *A. m. tuolumnensis,* Holotype, Grand Canyon of the Tuolumne, Tuolumne Co., Calif., VIII-1-59, P. OPLER collector.

Bottom three rows: undersides of *Apodemia mormo* subspecies, the same specimens as figured for uppersides, arranged in the same sequence.