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GEOGRAPHIC VARIATION AND NEW TAXA OF WESTERN NORTH AMERICAN BUTTERFLIES, ESPECIALLY FROM COLORADO

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Introduction and Abstract

Michael Fisher is currently updating the 1957 book Colorado Butterflies, by F. Martin Brown, J. Donald Eff, and Bernard Rotger (Fisher 2005a, 2005b, 2006). This project has emphasized the necessity of naming certain butterflies in Colorado and vicinity that are distinctive, but currently have no name, as part of our goal of applying correct species/ subspecies names to all Colorado butterflies. Eleven of those distinctive butterflies are named here, in the genera *Anthocharis*, *Neominois*, *Asterocampa*, *Argynnis (Speyeria)*, *Euphydryas*, *Lycaena*, and *Hesperia*. New life histories are reported for species or subspecies of *Neominois* & *Oeneis* & *Euphydryas* & *Lycaena* that were recently described or recently elevated in status. *Lycaena florus* differs in hostplant, egg morphology, and somewhat in a seta on 1st-stage larvae. We also report the results of research elsewhere in North America that was needed to determine which of the current subspecies names should be applied to other butterflies in Colorado, in the genera *Anthocharis*, *Neominois*, *Apodemia*, *Callophrys*, *Atlides*, *Euphilotes*, *Plebejus*, *Polites*, & *Hylephila*. This research has added additional species to the total of Colorado butterflies. Nomenclatural problems in Colorado *Lycaena* & *Callophrys* are settled with lectotypes and designations of type localities and two pending petitions to suppress toxotaxa. Difficulties with the ICZN Code in properly applying names to clines are explored, and new terminology is given to some necessary biological solutions.

Anthocharis "*sara*" group, Especially in Colorado and Vicinity, by J. Scott & M. Fisher (with New Research from Todd Stout) (one Ssp. Coauthored by Norbert G. Kondla)

(Todd Stout will publish a regular paper on *Anthocharis "sara"* in The Taxonomic Report eventually, but has contributed some research here, in pursuit of our goal of determining the proper name for Colorado butterflies.)

Colorado *Anthocharis* were previously considered to be *A. sara*, but actually there are two species in the state, *A. sara* near *thoosa*/*inghami*, and *A. julia julia*. This section discusses why there are two species, characterizes the known ssp., names three new ssp., and discusses their intergradation and problems with their taxonomic placement. We examined specimens from Colorado and other states in our collections and in Colorado museums, to determine proper names.

Clearly there are two species (not just one)--*A. sara* and *A. julia*--because the two are sympatric or nearly so at many sites. H. Geiger & A. Shapiro (1986, J. Res. Lepid. 25:15-24) found *A. sara sara* very near the higher-altitude *A. julia stella* at several sites on the top and W side of Sierra Nevada (*stella* occurs at Donner Pass 2100m where *A. sara* has been found as a stray 3 times; *stella* is a resident at Castle Peak 2750m where *sara* was found as a stray twice; and both were found as strays at Lang Crossing in Nevada Co. 4-5 times), and they found both near each other on the E side of the Sierras (*stella* at Truckee 1800m and *sara* 40 km N at Sierra Valley [Sierraville?] 5000'=1500m, Sierra Co. Calif., April 10, 1988; *stella* at Yuba Pass in Sierra Co. 14 km from Sierra Valley [Sierraville?] *sara*), and both were found in the Trinity Alps and Ball Mtn. in N Calif., where *stella* was at higher altitude than *sara*; but they found no strict sympatry of resident populations. They also claimed to find electrophoretic differences between *sara* & *stella*, though these claims have not been repeated/verified. And Dennis Sorg caught *sara* and *stella* on Sierra Buttes Rd. above Packer Lake (in Yuba River drainage NNW of Sierra City), 7100', Sierra Co., June 22, 2002 (2002 Season Summary of Lepid. Soc.). And Ken Davenport and Jim Brock found both *sara* and *stella* in close proximity E of Bass Lake and in Fresno Dome region in Madera Co. in the SW Sierra Nevada (*stella* occurs at Beasore Rd., Madera Co. L May-M July, 500 feet higher in altitude and 1-3 road miles farther up than *sara* which flies Apr.-E June near Bass Lake)(cited by Ken Davenport 2004, Taxonomic

Report of Int. Lep. Survey 5:17, and Davenport, pers. comm.). Brock found *stella* near Fresno Dome (June 6, 2002), and *sara* at lower levels of the Fresno Dome Road area (Scenic Road 10). Davenport (pers. comm.) found both sympatric at Big Sandy Cgd. (a small stream & meadow running into Bear Creek, Madera Co. Calif., May 29-30, 2007), where 6m1f *stella* and 3m large 2nd-generation *sara* were found; only *stella* was found below Fresno Dome Camp. Thus *A. sara sara* and *A. julia stella* are barely sympatric on the W side of the Sierra Nevada. Also, *A. sara pseudothoosa* and *A. julia stella* are actually sympatric at several sites on the E side of the Sierra Nevada in Mono Co. (from Green Can. N to the Walker area N of Sonora Jct., June-M July, Bruce & Bret Boyd, also cited by Davenport in Tax. Rept. 5:17). Also, Todd Stout has found *A. sara thoosa* and *A. julia browningi* sympatric at 3 sites in Utah. And our new records show that *A. julia julia* and *A. sara* ssp. interdigitate ranges in SW Colorado and N New Mexico, and will surely be found to be strictly sympatric there as well at least at the overlapping altitudinal limits of their ranges (they are known ~2 miles apart in La Plata Co. and 9 miles from each other in Garfield Co., and not far apart in Delta Co., and will probably be found to be completely sympatric in those counties plus Montrose & Archuleta Cos.).

Todd Stout also found differences between larvae of *sara* (from Siskiyou Mts.)-*thoosa-inghami* compared to *stella-browningi-julia-flora*. Larvae of the former have the white lateral band more-or-less abruptly contrasting with the subdorsal and dorsal ground color, whereas the latter have the white lateral band gradually blended dorsally into the dorsal ground color. Larvae and pupae have a fairly simple color pattern, so all are somewhat similar (other than the blending), as shown by color photos of larvae of *A. sara sara* (Monroe & Monroe 2004, from Anza Borrego Desert State Park in S Calif.; Allen et al. 2005), the mature larva and pupa paintings by Charles Dammers of S Calif. *A. sara sara* (b/w drawing in Emmel & Emmel 1973 Butt. So. Calif.), the color photo of larvae of *A. sara thoosa* and *A. julia browningi* reared by Todd Stout (on utahlepsociety.org website), the color photos of larva (from BC) and pupa (from NW Ore.) of *A. julia flora* (in Guppy & Shepard 2001 Butt. BC), and color photos of larva and pupa of *A. julia julia* (from Lyons, Boulder Co. Colo., reared from egg/1st stage larva found on *Arabis fendleri* by Lynn & Gene Monroe). Larvae of all are fairly-dark green, with a whitish lateral band (extending onto the head) edged below by a darker green line, the uns darker green. The lateral band is mostly white, but may be yellowish-white (Emmel & Emmel 1973, from C. Dammers) due to a narrow band of yellow along the top of the band (as in the photos of *sara* in Allen et al. 2005 and *flora* in Guppy & Shepard 2001). The pupa is green or light-brown, and has the same white lateral band that extends from cone tip to cremaster, although it is edged dorsally (not ventrally) by a thick darker line. The ssp. *sara* pupa was described as light-brown, but pupae of ssp. *sara* do vary in color, as one from Strawberry Can. near Berkeley Calif. (photo from Paul Opler) is light-brown, while one from Alpine Lake Marin Co. Calif. (photo Opler) is green. The *julia* pupa is green, and *flora* varies from light-brown to dark-green. Thus, pupae seem to be individually variable in color. The *thoosa* larva looks dark-green, while the *browningi* larva is medium-green. The ssp. *julia* larva and pupa look more bluish-green dorsally than ventrally, and both are a lighter shade of green than the medium-green in the *flora* photos. And the white band is narrower on the head of *julia* than *flora* (the ssp. *sara* band is wide in Allen et al. 2005 [photo by T. J. Allen, but location not stated] but narrow in Monroe & Monroe 2004, and narrow on some photos by Todd Stout), while the white band is narrow on head and A10 of *thoosa* but wider on *browningi*. A larva of ssp. *sara* from Lagunitas Creek Calif. (slide from Paul Opler, reared by John Emmel) is dark-green, with the white band fairly wide on the head (the uns darker green). The species *A. sara* in general may have darker ground color. Todd Stout notes that the lateral white stripe is narrower on *thoosa* and *inghami* than on *browningi* & *julia*.

However, the main difference between *A. sara* ssp. larvae and *A. julia* ssp. (including *flora*) larvae seems to be that above the lateral white band on the body, the ground color is whiter on *A. julia* as the band blends dorsally for 1-2 mm into the green ground color on top of larva, whereas in *A. sara* the larva is dark greenish above the white lateral band which is not blended into the green color. This blending occurs on all the *julia* and *browningi* and *flora* larva photos mentioned above, is evidently on a larva sent to Stout by the Monroes in 2006 from Boulder Co., and is lacking on the drawing and on all the photos of *A. s. sara* and the photo of *thoosa*. Stout's larvae of *sara* (from Siskiyou Mts.) & *thoosa* & *inghami* demonstrate this difference from his larvae of *julia* & *browningi* & *stella* & *flora*. The photo of evident ssp. *sara* from Anza-Borrego shows a weak whitish dorsolateral band of little white vertical short dashes above the lateral white band, but that is nothing like the dorsal blending found in those four *A. julia* ssp.

Based on wing pattern of specimens in Scott's and Fisher's collections and two Colorado museums (CU=Univ. of Colo., and CSU=Colorado State Univ.), it is apparent that *Anthocharis "sara"* of yore should be divided into two species, *A. sara* and *A. julia*. ***Anthocharis sara*** has the black bar (esp. of males) more continuous and thicker at base of orangish upf patch, the black bar is thicker incl. at end of discal cell, the patch averages slightly redder (from orangish to reddish), the black spots on uph margin are stronger, & unh mottling averages stronger/blacker, and females are mostly whiter; *A sara* includes about seven or eight ssp. ***Anthocharis julia*** has the black bar offset (more distal beyond discal cell end) and weaker in the middle just beyond discal cell, the orangish patch is oranger on average, the black uph marginal spots tend to be weaker (the ssp. vary in this trait), the unh mottling is weaker, & females are mostly yellower; it contains about five ssp. These ssp. are fully characterized below.

The main point of controversy in this group is whether *flora* (& the similar *alaskensis*) belongs to *A. sara* or to *A. julia*. Based on the 47 specimens in CU and Scott collections plus book photos, *flora* adults are obviously more similar to ssp. *sara*, because the black bar edging the orangish patch is more similar to *sara*, as the bar is not offset much and is sometimes even basal to the discal-cell-end bar, and is not weak in the middle, and the orangish patch is sometimes redder in tone, the mottling is rather strong, and the uph marginal dots are rather strong. However, the larva (Cris Guppy's fig. in Butt. BC book from Metchosin on SE end of Vancouver I.) has a dorsally blended lateral band like *julia*, and Todd Stout has found that larvae of *julia* (from Grand & Garfield Co. Colo. also) and *browningi* are the same, and *stella* and *flora* (the *flora* he reared from Polk Co. Ore., and BC book photo) are very similar, in contrast to larvae of Siskiyou Mts. *sara*, *thoosa*, & *inghami* and Garfield Co. Colo. near-*thoosa* which are alike in having a non-blended white lateral band. Stout has found and reared the *sara*-type larva from Josephine and Jackson Cos. Ore. Warren (2005) mentions great adult variation from *sara* to near-*stella* in the Klamath River Canyon Ore., as if both taxa might be present. And Guppy & Shepard (2001) separate *A. sara flora* and "*stella*" into separate species because they occur almost sympatrically on Mt. Cheam in BC (W of Hope on W side of Cascade Mts.), where "*stella*" flies in alpine area near the summit, while *flora* flies at the bottom of the mtn. in coastal forest (but Scott notes that near-sympatry does not qualify as real sympatry, for instance *Callophrys affinis perplexa* flies very near to *C. affinis washingtonia* near Satus Pass Wash., yet Scott believes that they are conspecific rather than separate species as treated by some workers). But adults of *sara* and near-*stella* are rather similar in Klamath R. Can., and Warren (2005) writes that NE Ore. has a clinal set of populations he labels "near-*stella*", and Warren and also R. Pyle (2002, Butt. Cascadia) insist that in the Cascades north of S Ore. the butterflies on the W slope (*flora*) are clearly conspecific with the butterflies on the E slope ("near-*stella*"). The ssp. of bookkeeping species *A. sara* evidently range northward only to the Siskiyou Mts. of S Ore., while *A. julia flora* and *A. julia* near-*stella* occur northward. Stout found only near-*stella* larvae & adults at Chiloquin in Klamath Co. Ssp. *stella* has the black bar a little straighter and less offset than *browningi* and ssp. *julia* (not too different from the bar of *flora*), and Warren (2005) wrote that E Ore. populations represent near-*stella*, as they gradually intergrade from S-C to NE Ore. toward *browningi*. Thus, the adult characters seem to show a lot of intergradation/introgression and suggest that there are only 1½ species, while the larvae thus far suggest there are two species.

But the possibility that *flora* belongs to *A. sara* still needs to be studied. Warren (2005) used characters of orangish vs. reddish patch color and unh mottling and size and amount of yellow on females to try to determine the ssp. found in Oregon, but he failed to mention the black bar character and uph marginal dot character, which seem very important to Scott, so his conclusion that *flora* and "near-*stella*" are conspecific can be questioned (and Warren designated NE Ore. material "near *stella*", yet only 33% of Boise/Pocatello Ida. males are slightly yellowish, and true *stella* from Sierra Nevada has all the males distinctly yellowish in tint, so Scott doubts that the name *stella* properly applies to NE Ore-Wash.-Ida. populations); maybe those important characters could help separate *flora* and near-*stella* along the Cascadian crest.

And N. Kondla notes that he has not seen conclusive evidence that *flora* and the SE BC "*stella*" intergrade, though both are somewhat variable in BC. At Chilliwack in SW BC, most *flora* have a strong thicker bar and strong dots, but some look more like "*stella*" with thinner bar and weak dots, as if they fly together. And at Meziadin Jct. in NW BC, there are some thicker-bar/ strongly-mottled "*alaskensis*" along with specimens with weaker mottling and thinner bar that could pass for "*stella*". And C. Guppy notes that some of the Coast Range BC "*stella*" may have been misidentified as *flora*, as identifications may have been based on range rather than wing characters. So this variation should be studied, and larvae reared from the different-appearing wing phenotypes in BC.

Thus it appears that this group is yet another stenchospecies, as *A. sara* and *A. julia* are bookkeeping species within the larger *A. sara*-group stenchospecies, and the two species are more similar in Oregon, and in the Ore.-BC part of the combined range the wing characters aren't as distinctive as they are in the S and central parts, as adults are more like one species and larvae are like the other species. Evidently the current hypothesis is that the presumed genes causing reproductive isolation are correlated with the larval-band-blending genes, and recently spread through the ancestral progenitor *A. sara* range, and for unknown reasons (continuity of montane habitat?) the *julia*-type reproductive isolation/larval blending genes spread through *flora* also, leaving *flora* in the "wrong" species based on wing pattern. That ancestral *A. sara*-group evidently had a cline in width of black band edging the orange patch (darkest in the SW & C part of its range, narrowest in the N & E), and that cline continues through the combined ranges of the two bookkeeping species, so the two descendant bookkeeping species are now most distinct in Utah (*browningi* vs. *thoosa*), and are not as distinctive northwestward and eastward, where the *A. sara* ssp. aren't quite as different from the *A. julia* ssp. Thus there are 1½ to 2 distinct species, and not just one or 3 or 4 species.

Anyway, the bookkeeping species names in Colorado seem clear, so authors of Colorado butterfly books can happily ignore the mess in Oregon-B.C. and the contradictory adult-vs.-larva placement of *flora*. The correct species name is *A. julia*, as ssp. *julia* and *browningi* clearly seem to belong to the same species, and *stella* seems to belong also. And it is clear that *thoosa* is the same species as *A. sara*. The *A. sara* ssp. in SW Colo. is really an unnamed ssp. related to *thoosa*, which is named below. And a similar narrower-banded ssp. occurs in northern New Mexico-S.C. Colo., also described below.

In Colorado, *A. julia julia* occurs in the higher mountains, in montane habitats. It is uncommon on the east slope of the Front Range, where it occurs in Boulder and Gilpin and Larimer Cos. south to extreme NW Jefferson Co. (but is absent southward in the Front Range and Wet Mts.), and extends westward in the mts. at the N end of South Park, then extends southward in the Sawatch Range and the Sangre de Cristo Mts. and San Juan Mts. On the wetter W slope of the continental divide it is commoner and widespread (in Routt, Grand, Summit, Moffat, Garfield, Gunnison, Delta, Montrose, La Plata, Archuleta Cos. etc.). It occurs from 5600-11500' (most often 8000-9500', but as low as 5600' near Gregory Can., and as high as 11,500' on Cottonwood Pass Rd.).

In Colo., *A. sara colorado* (named below) occurs in lowland more arid habitats in W Colo., from Garfield & Mesa & Delta & Montrose Cos. in the lower Colorado River system, and in SW Colorado it flies in Montezuma and probably La Plata Cos. at least. It occurs from 5850-8000' (usually 6000-7000'). *A. sara coriande* (named below) barely enters the San Juan Mts. in Archuleta & LaPlata Cos. Colo. from New Mex., and flies at 6000-7400'.

Now we describe three new ssp., two in *A. sara* and one in *A. julia*, and list characteristics (and data for specimens examined) of all ssp., giving special attention to those found in & near Colo.

***Anthocharis sara sara* Lucas=*reakirtii* W. Edwards.** **Definition:** Patch reddish-orange. Black bar of males rather straight, and fairly wide averaging about 1 mm at constriction, rarely a 2-mm gap in males. Unh mottling fairly strong. Uph dots usually rather strong. Females white in many, to 2/3 yellow in many; females vary a lot and the average female has a little yellow. Males white (but close examination shows they are usually a tiny bit yellow-tinted rather than pure white). The first generation ("*reakirtii*") looks quite different from the 2nd ("*sara*" is larger with less-dense unh mottling) and their generations sometimes overlap, but several people have reared the 2nd from the 1st gen. **Seasonal form.** Form "*reakirti*" is more heavily marked with black esp. on unh, whereas the 2nd gen. "sara" has much less unh mottling. John Emmel (pers. comm.; Arthur Shapiro has also reared these forms) has reared *sara* from *reakirti*, and states that the 2nd generation comes from non-diapausing pupae exposed to longer day length and warmer temperatures. In contrast, the desert near-*thoosa* populations rarely produce a lightly-marked-unh 2nd gen.; those also average slightly larger than the 1st gen. **Range:** lowland Calif. N to SW Ore.; on E side of Sierra Nevada extends north to Nine Mile Can. in Inyo Co. (according to Ken Davenport). Davenport notes an atypically-marked often-large pop. on E Sierra Nevada bordering Kelso Valley. **Specimens examined:** Diamond Lake, Ore., I [Jan.]-1, 1930, ex. Coll. Robert G. Wind, 1m (CU)(giant, ssp. *sara*). 4 mi. SE Copper, Siskiyou Co. Calif., 4m, J. Scott. 5 mi. SE Douglas City, Trinity Co. Calif., 1m, J.Scott. Blue Lake, Humboldt County Calif., 1m (CU). Anderson, Shasta Co. Calif., D. V. Brown, 2m (CU). 1.1 mi. N Hobergs, Lake Co. Calif., 1m, J. Scott. 3 mi. N Loch Loman, Lake Co. Calif., 1f, J. Scott. Mt. Cobb, Lake Co. Calif., William N. Burdick, 1f (& 2 papered)(CU). Sonoma, Sonoma Co. Calif., 1m1f (CU). Cazadero, Sonoma Co. Calif., 21m7f (CU). 1 mi. S Robert L. Stevenson Mon., Napa Co. Calif., 1m3f, J. Scott. Mt. St. Helena, Napa Co. Calif., William N. Burdick, 1m (&3 papered)(CU). Monticello Dam, Yolo Co. Calif., 3m8f, J. Scott. Inverness, Marin Co. Calif., 1f. Marin Co. Calif., 7m (CU). Mt. Diablo, Contra Costa Co. Calif., 1m2f, J. Scott. Berkeley, Contra Costa Co., Calif., 118m15f (CU)(all have a fairly-straight bar averaging 1.0 mm at constriction, uph dots weak to very strong averaging strong in 1st gen. and fairly weak in 2nd gen.). Oakland, Contra Costa Co., Calif., 11m1f (CU). Oakland Hills, Contra Costa Co., Calif., 3m (CU). Redwood Can., Contra Costa Co., Calif., 8m (CU). Redwood Park, C. C. Co., 1f, J. Scott. Bear Creek Rd., Contra Costa Co. Calif., 1m (CU). Mitchell's Can., Contra Costa Co. Calif., 3m (CU). Mt. Diablo, Contra Costa Co. Calif., 4m3f (CU). Fair Oaks, Sacramento Co. Calif., Noel LaDue, 4m2f (CU). Pleasanton, Alameda Co. Calif., 2m2f (CU). Palo Alto Mts., San Mateo Co. Calif., 1m (CU). Los Gatos, Santa Clara Co. Calif., 3m2f (CU). Mt. Hamilton, Santa Clara Co. Calif., 2f (CU). Arroyo Bayou, 6.5 mi. E. Mt. Hamilton, March 7, 1971, 1m, J. Scott. Santa Cruz Mts., Santa Cruz Co. Calif., 1m1f (CU). Del Puerto Can., Stanislaus Co. Calif., 2m (CU), 1f. Pinnacles Nat. Mon., San Benito Co., Calif., 2m (CU). 5 mi. SE Somerset, El Dorado Co. Calif., 1m, J. Scott. N fork Cosumnes R., El Dorado Co. Calif., 1m1f, J. Scott. Sonora, Tuolumne Co. Calif., T. B. Blevins, Apr. 25, 1945, 1m1f (CU)(f white). Sequoia Nat For., Fresno Co. Calif., 1f (CU). Santa Barbara, Calif., 2m, T. Preston Webster III (in Scott coll.). Atascadero, San Luis Obispo. Co., Calif. 1f (CU). Cambria Pines, San Luis Obispo Co. Calif., 1f (CU). Ventura, Ventura Co. Calif., 1f (CU). Ojai, Ventura Co. Calif., 1f (CU). Topanga Can., Santa Monica Mts., Los Angeles Co. Calif., 2m &many papered (CU). Malibu Lake, Los Angeles Co. Calif., 1m1f papered (CU). Redondo Beach, Los Angeles Co. Calif., Apr. 24, 1938, William T. Meyer, 1f in Riker Mount in W. Burdick Coll. (CU)(3/4 yellow, dots medium). Whitewater Can. L.A. Co. 2m1f (CU). Griffith Park, Los Angeles, LA Co., Calif., 3m1f (+6m2f [+12 from AN Griffith Park] papered)(CU). Griffith Park, Los Angeles Co. Calif., Feb.-March 1943 (spring form), William T. Meyer, 16m16f in Riker Mounts in W. Burdick Coll. (CU)(bar average ~1.0 mm at constriction [four 0.7, three 1.5], one male has tiny gap, uph dots strong except weak in 7f, 3f white, a tint of yellowish in most f, 2f somewhat yellowish on uph, 3f 60% yellow, patch red-orange in males & oranger in females, all males a bit yellow-tinted). Griffith Park, Los Angeles, May 13, 1941 ~5m, May 12, 1938 2f, (2nd gen.), W. T. Meyer, in Riker Mount in W. Burdick Coll. (CU)(bar 0.5 at constriction, 1.0, 1.5 mm, dots medium, 1f dots very weak & other f dots very strong wider, 1f whitish & other f uph a bit yellow). Arroyo Seco [just NE Glendale], Los Angeles Co. Calif., many papered (CU). San Gabriel [Can.], Los Angeles Co. Calif., many papered (CU). Azusa, San Gabriel Can., Los Angeles Co. Calif., 1f (+1m papered)(CU). Glendora (E of Azusa), Los Angeles Co. Calif., 1m4f (CU). Balboa Park Los Angeles 1m (CU). Higgins Can., Los Angeles Co. Calif., 9m papered (CU). Los Angeles, Calif., some papered (CU). Beverly Glen Canyon, Los Angeles 1f (CU). Sherman Woods, Los Angeles Co. Calif.,1f (CU). The Gavilan, Los Angeles Co. Calif.,1f (CU). Little Rock, Los Angeles Co. Calif., 2m1f (CU). Devil's Canyon, San Bernardino Mts. LA Co. Calif., 1m1f (CU). El Modena, Orange Co., Calif., 1m (CU). Dana Point, Orange Co. Calif., 1f (CU). Trabuco Can., Orange Co., Calif., Feb. 28, 1933, William N. Burdick, 8m in riker mount (CU)(bar 1.5 mm in 5m & 1.0 in 1m & .5 in 2m, dots extremely strong in 1m & strong 6m & medium 1m, mottling very strong 1m & strong 2m & weaker yellower in 5m). Mt. Vilas, county?, Cal. 1f (CU). Twin Lakes, Mono Co. Calif., June 15, 1932, William N. Burdick, 1 to 7f in riker mount (locality poorly labeled with "female" & confused with others in riker mount that may be from Trabuco Can., 7f are in riker mount that collectively look like ssp. *sara*)(CU). Many papered specimens in Scott coll.

Anthocharis sara* near *sara (a bit toward near-*stella* in bar width as bar width is sl. narrower than *sara*). Rush Creek [Ash Creek runs through Adin on map], Adin, [4201'], Modoc Co. Calif., June 30, 1941, William N. Burdick, 7m1f (CU)(bar 0.9 mm at constriction in bar in four males & .5 in two & tiny gap in one, females have little black & have a 4 mm gap in bar, mottling strong, dots strong in 2m & weak in 5m1f, males white but 6m have the usual trace of yellowish tinge, female half yellow).

Anthocharis sara "pseudothoosa"* Austin** (C Nevada, E-C Calif.). **Definition:** Similar to *thoosa* in white ups and orange apex, but the black bar is thinner and a little offset and thin in the middle gap, & the unh mottling is a little greener, the orange patch was described as paler, and the male fw usually has 5 radial veins vs. 4 in *thoosa*. However, it appears to be rather similar to ssp. *sara*, as its described traits and O.D. photos are similar, and the few specimens Scott has examined could not be distinguished from *sara*. (Also, note how Ken Davenport's photos of *sara* and *pseudothoosa* in his Yosemite paper [Taxonomic Report of TILS 5{2}, 2007] cannot be distinguished/do not fit description of amount of black, though the *pseudothoosa* tips are a little oranger.) Davenport compared his 22m1f *pseudothoosa* to *sara*, and states (pers. comm.) that they are smaller than ssp. *sara*, the orange tip is smaller and more reddish-orange [Scott thinks this seems to contradict the claim that the patch is oranger than *thoosa*], and there is more black around the orange patch, and the unh is much darker olive or greenish below than in *sara*; he notes that *thoosa* has a consistently dark-olive unh and blacker marking around the patch than *pseudothoosa*. Also, Austin's O.D. described how it apparently intergrades into *thoosa* in C Nevada. Thus, though *pseudothoosa* does seem to be different from *sara* & *thoosa*, its traits overall seem to be intermediate, so it seems to be just an intergrade between *sara* and *thoosa*, and is therefore invalid and should be placed as a syn. of *sara*, as Scott does not accept ssp. that are just intergrades. But *pseudothoosa* is usable by persons with different definitions of ssp., and the final determination should be made by someone who has seen hundreds of specimens. **Range:** O.D. states Calif. in White and Inyo Mts. and E slope of Sierra Nevada from Mammoth northward, & W Nevada. Ken Davenport found the southernmost limit on the E slope of Sierra Nevada at Lower Rock Creek Gorge, Mono Co., May 14, 2006. **Specimens examined:** 1 mi. S Fredericksburg, Alpine Co. Cal. Apr. 21, 1974 J. A. Scott, 5m (the orange tips same color as ssp. *sara*). Rush Creek, 4300', Washoe Co. Nev. May 25, 1974 J. A. Scott, 1m. 3 mi. W Genoa, Kingsbury Grade, Douglas Co., May 20, 1970, Paul A. Opler, 1m (Colorado State Univ.=CSU). ***Pseudothoosa?: Additionally, a pair from Baker, Baker Co. Ore., April 20, 1941, James H. Baker, 1m1f (CU) may be *pseudothoosa*, as the male is whitish, female yellow uph, bar wide 1.5 mm & fairly straight, female yellow uph & ½ yellow upf, strong dots in male & female, mottling strong but yellow. A pair from Durkee, Baker Co. Ore., May 19, 1941, L. W. Motley, 1m1f (CU) may be *pseudothoosa*, or could be near-*stella*/*columbia*, as the male is a bit tinged with yellow, dots strong.

***Anthocharis sara gunderi* Ingham 1933.** **Definition:** Like ssp. *sara*, but black bar thicker (~ 1.5 mm, though some are less .9), and females have black nearly surrounding the orange patch except usually for a tiny gap. Mottling is usually strong but sometimes moderate. Dots are strong. Females are usually white (2f white, 3f a tinge of yellow, 1f slightly yellow on uph). Ssp. *gunderi* is very similar to *thoosa*, so needs to be compared more (and perhaps synonymized, as a disjunct distribution alone does not make *gunderi* a valid ssp.). **Range:** S Calif. on Santa Catalina (TL) & Santa Cruz Islands. **Specimens examined:** Santa Catalina Island, Calif., April 12, 1932, D. Parker, 3f (CU). Santa Catalina I., just S & W of Avalon, Los Angeles Co. Calif., Joseph Zeligs, Mar. 29, 1989 1m1f, March 30, 1989 4m2f (in Scott coll.).

***Anthocharis sara sara* X *thoosa* or New Ssp.?** 2m5f from the desert near Scissors Crossing in San Diego Co. (1 mi. W, 2 mi. N, 3 mile hill, Allan Oakley Shields, Feb.-Mar. 1960, 1962, in Scott coll.) have dark upf markings like those on Santa Catalina Is. *gunderi* and like *thoosa*, and Fisher's from San Diego Co. are also blacker. However, the unh mottling is weak on these, so these may be *sara*X*thoosa* or a weak new ssp., and further investigation is needed. The male and female from northern Baja California fig. in. Butt. Baja Cal. (J. Brown, H. Real, D. Faulkner, 1992) also have dark black upf markings, and are evidently also this taxon. (The name *mollis* W. G. Wright 1905 TL Riche Canyon, Calif. [internet search indicates that only a current motocross site near San Bernardino & Indio has the name Riche Can., but the Reche Canyon on current maps between San Bernardino and Moreno Valley may be the same as Riche Can.] probably is just a syn. of *sara* based on the male & female from Anza-Borrego Desert SP fig. by Monroe & Monroe 2004, rather than the Scissors Crossing bug, but Riche Can. should be sampled.)

***Anthocharis sara thoosa* (Scudder).** **Definition:** This ssp. has the black bar very thick, and the mostly-whitish females usually have an extensive black "cage" around the orange patch, unh mottling is thick, and the uph marginal dots are usually strong. Utah specimens may have the unh mottling rather blotchy. Ssp. *thoosa* has been considered a separate species, but it is clearly a ssp. of *A. sara* similar to ssp. *gunderi*, which in turn is related to ssp. *sara*. **Range:** evidently the deserts of W Utah-E Nevada-NW Ariz. **Specimens examined:** 0.5 mi. WNW Rodeo Grounds, 6000', Oquirrh Mts., Cedar Ft., Utah Co. Utah, ex ova April 29, 1995, emgd. Jan. 10, 1997, Todd L. Stout, 1f (white ups, black bar continuous but narrow near end cell, mottling black and fairly dense but not blotchy, uph dots conspicuous, uph with a weak yellowish tinge). Cedar Mts., 9 mi. S Low, 5600', Tooele Co. Utah, Kenneth B. Tidwell, April 16, 1971 3m, April 24, 1962 1m, April 25 1962 1m, April 28, 1969 2m, April 29, 1971 1m, May 1, 1970 1f, May 16, 1970 1m (CU)(very wide bar 2, 1.5, 1.5, 1.5, 1.5, 1.4, 1.3, 1.0, 1.0 mm, f has bar gap 2 mm, dots very strong in 1m & strong in 2m & moderate in other males, mottling strong in all except weak in 1m)(1f with black cage Cedar Mts. Apr. 16, 1971 fig. Butt. Rocky Mtn. States). Cora [there is a Cora Lake in/near Jarbidge Mts., maybe this is that, or some now-ungazeteered ghost town of Cora], [Elko Co.] Nev., May 5, 1932, D. Parker, 2m4f (CU)(black bar very wide in one m & 1mm in other m, bar wide in 1f & medium in 3f, dots weak to strong, mottling very strong). Wasatch Mts. Utah (bad data), June 3, 1932, 1m (CU)(giant dots, redder patch, black bar 1.5 mm, mottling weaker). Oak Creek Forest Camp, Millard Co. Utah, June 18, 1965, J. A. Scott, 1f (a bit of yellow on uph). Leeds Can., Washington Co. Utah, L21, Mar. 22, 1967, K. B. Tidwell, 1f (CU)(strong black cage around patch). 2.1 rd. mi. East Central Pine Valley Mts., 5500', Washington Co. Utah, immatures coll. May 1, 1995, Todd Stout, emgd. 1995 (Feb. 11 1m, Feb. 12 1m, Feb. 13 1f [these 2m1f wide black bar & big uph dots & thick black blotchy mottling & white ups], Feb. 18 1f [uph light yellow, a 2 mm gap distal to cell-end dash, unh black mottling thick but less dense & not blotchy, uph dots conspicuous]). We have also seen photos of this ssp. from Utah from Todd Stout.

***Anthocharis sara* near *thoosa*.** This is like *thoosa*, but the black markings are a little smaller. Dots are strong, mottling is strong & blackish. It is like *sara* but the black bar is even thicker, and females have strong black markings around the orange patch. **Range:** the E part of the Mojave Desert in SE Calif. (Emmel & Emmel 1973), and evidently C Nev. **Specimens examined:** Bonanza King Mine, 4500', Providence Mts., San Bernardino Co. Calif., March 28, 1969, John F. Emmel & Allan Oakley Shields, 3m (CU)(bar 1.5 mm in 1m, a tiny gap in 2m). Bonanza King Can., Providence Mts., San Bernardino Co. Calif., Mar. 28, 1968, 1m M. Fisher. Providence Mts., San Bernardino Co. Calif., April 1950 1m (CU)(bar 1 mm)(four Prov. Mts. males have dots medium strong, strong mottling). Providence Mts., San Bernardino Co. Calif., Apr. 16, 1935 4m, Apr. 6, 1935 4m, Wm. T. Meyer, riker mount in W. N. Burdick coll. (CU)(bar wide in all but constricted to .8 mm in 1m & 0.5 mm in 2m & 0 in 2m, dots fairly strong 2m & medium 2m & weaker 4m, mottling fairly strong in 5m & weak 3m, patch orangish). Cima Summit, just N Providence Mts., San Bernardino Co. Calif., Apr. 2, 1935, 1f, Wm. T. Meyer, riker mount in W. N. Burdick coll. (CU)(orange patch, dots strong, mottling strong, ups sl. yellow, no black bar for 2 mm but strong black markings otherwise). Near Copper King Mine, 2950', NE end Old Woman Mts., San Bernardino Co. Calif., J. F. Emmel & A. O. Shields, Mar. 27, 1969, 3m (CU)(bar 1.5, 1, 1 mm). Canyon SE of Horse Thief Spring, Kingston Range, San Bernardino Co. Calif., J. F. Emmel & A. O. Shields, May 29, 1969, 2m (CU)(bar 1.5, 0.5 mm). Chino Can. [just N of Palm Springs, Riverside Co.] Calif., Mar. 20, 1935, 1f (CU)(female whitish a bit tinged with yellow, dots very large, black bar large nearly a black cage around orange patch, mottling strong). Toiyabe Mts., Lander Co. Nev., June 6, 1935, Wm. T. Meyer, riker mount in W. N. Burdick coll. (CU), 1m (bar wide 1.5 mm but 0.5 mm at constriction, dots fairly strong, very strong dense unh mottling).

***Anthocharis sara inghami* Gunder.** **Definition:** This ssp. has the black bar rather wide but averaging not as wide as *thoosa*. The uph dots are weak, unlike *thoosa*. Unh mottling is rather strong (though weaker in many in Sabino Can. near the TL of Tucson). Females usually have the uph somewhat yellowish, the upf usually whitish but often yellow-tinged. (Photos of 1m1f *inghami* in Bailowitz & Brock's Butt SE Ariz. from Tucson Mts. have heavier black bar esp. on the f than Scott's 4m5f from Sabino Can., evidently due to individual variation, and look more like ssp. *thoosa*.) Todd Stout notes that many males from "A" Mtn. near Tucson are yellowish on ups, which is rather strange and needs investigation (introgression with *Anthocharis cethura pima* is doubtful as a source of the yellow). **Range:** C and S Ariz., & SW New Mex. **Specimens examined:** Oak Creek Can., Coconino Co. Ariz., April 13, 1963, Scott L. Ellis, 3m1f (CU)(black bar narrow & weak in one male & 0.5 mm in 2nd & 1 mm in 3rd m, female white with a bit of black bar below orange, mottling fairly strong). Oak Creek Can., Coconino Co. Ariz., March 21, 1950, David L. Bauer, 5m (CU)(black bar averages ~1 mm, mottling strong and very yellow at site). Oak Creek Can., Coconino Co. Ariz., March 28, 1959, Kilian Roever,2m (CU). South Mtn. Park, Gila Valley Overlook, Phoenix, Maricopa Co. Ariz., Feb. 22, 1997, 2330', 1m M. Fisher. Roosevelt Lake, 3000', Superstition Mts., Maricopa Co. Ariz., March 19-30,1933, D. K. Duncan, 21m10f (CU)(black bar solid 1.5 mm to gone 0 mm, usually narrow in middle 1.0 mm, usually narrow in middle 1.0 mm, females not much black, females white but 3f have some yellow uph and 2 or 3f weak yellow uph). Globe, 3300', Gila Co. Ariz., D. K. Duncan, Feb. 28-Mar. 26, 1933 & 1935, 23m1f (CU)(males strong to weak black bar, bar 0.2 to 1.7 mm but usually ~1 mm, female yellow uph & weak yellow upf, little black on female upf). 20 mi. S Globe, 6500', Gila Co. Ariz., April 12, 1933, 3m (CU), evidently D. K. Duncan. Payson, Gila Co., Ariz., May 26, 1935, 1m (CU) evidently D. K. Duncan (bar 0.5 mm). Jones Water Cgd., N of Globe, Gila Co. Ariz., April 3, 2002, K. L. Prudic, J. C. Oliver, 1m (CU). Pinal Mtn., 4000', [Pinal Co.?], Ariz., D. K. Duncan, Mar. 2, 1933 1m, Mar. 8, 1933 1m (CU). Cottonwood, Yavapai Co. Ariz., D. L. Bauer, March 19, 1950, 1f (CU)(yellowish uph). Mingus Mts., near Jerome, Yavapai Co. Ariz., D. L. Bauer, March 23, 1950, 1m (CU). AZ, 4500', March 22, 1933, L. E. C., 1f (CU)(yellow uph & white upf, upf weak black marks). Mt. "A", 2800', Tucson, Pima Co. Ariz., D. K. Duncan, March 15, 1933 1m, March 16, 1933 2m2f (CU)(black bar same as Roosevelt Lake, bar .7, .8, 1.0 mm wide, females have a 2mm gap in bar, mottling medium on 2m1f, weak on 1m1f, both f have half-yellow uph, slightly yellow upf). "A" Mtn., Tucson, Pima Co. Ariz., Feb. 27, 1968, Kilian Roever, 1m (bar 1.3 mm, uph of male is ½ yellow on anterior 2/3 of wing!, dots medium)(CU)(all 3f from Tucson-Sabino Can.-Peppersauce Can. have yellowish uph, weak yellow upf). Sabino Can., Santa Catalina Mts., Pima Co. Ariz., Kilian Roever, Feb. 11, 1961 1m, Feb. 25, 1959 4m, Mar. 18, 1968 1m (CU)(bar 1.5, 1.5, 1.2, 1.2, 1, 1 mm, dots strong in 1m but weaker in 5m, mottling yellowish and strong in 3m but fairly weak in 3m). Sabino Can. nature trail, Santa Cat. Mts., Pima Co., J. A. Scott, March 20, 1969 1f, March 21, 1969 4m3f, April 4, 1969 1f (bar 1.5, 1.2, 1.1, females have 4 mm gap in bar except one f narrow bar, all 5f slightly yellow uph, 2f sl. yellow upf tinge, mottling strong in many, moderate in many, dots weak except 1f). Peppersauce Can., Santa Catalina Mts., Pinal Co. Ariz., May 22, 1961, Kilian Roever, 1m1f (CU)(male bar interrupted a little but 1.5 wide beyond tiny gap, female with some black but no bar for 4 mm, weak yellow mottling in both, female yellow uph & half-yellow upf). Box Canyon, Forest Road 62, Coronado NF, Santa Rita Mts., Pima Co. Ariz., Mar. 9, 2002, K. L. Prudic & J. C. Oliver, 1m (CU)(bar 1.3 mm, weaker yellow mottling). Clifton, Greenlee Co. Ariz., Lowell Hulbirt, March 13, 1938, 1m (CU). Stewart Cgd., Chiricahua Mts., Cochise Co. Ariz., April 6, 1966, J. A. Scott, 4m1f. Cherry Creek Cgd., 10 mi. N Silver City, Grant Co. NM, 7500', Apr. 20, 1968, in forest, M. Fisher 1m. Silver City, Grant Co. NM, Apr. 3, 1969, 1m with albinic fw patch, J. Scott. Glenwood, Catron Co. NM, Mar. 26, 1964, 1m J. Scott. Pinos Altos, Grant Co., New Mex., May 3, 1940, William N. Burdick, 2m (CU)(fairly-wide bar 1.7 & 1.2 mm, mottling strong in one & medium in one, mottling rather yellowish in Grant Co. males except when strong). San Lorenzo, Grant Co. New Mex., May 1, 1940, W. N. Burdick, 6m (CU)(weak bar in two 0 mm, 0.5 mm, fairly-wide bar in four 1, 1, 1, 1.5, dots medium in 2m & weak in 4m, mottling strong in 2m and medium in 3m & weak in 1m). Spring Canyon, Florida Mts., 5200-6200', Luna Co. New Mex., Mar. 27, 1986 2m1f (very yellowish f), R. E. Stanford (CSU). Rockhound State Park, Little Florida Mts., 4600-5634', Luna Co. New Mex., P. A. Opler, Mar. 27, 1986 1f, Feb. 19, 2003 1m2f (one f very yellow)(CSU). 3 Rivers Campground, Sacramento Mts., Lincoln Co. New Mex., April 28, 1990, P. A. Opler, 1m (like Ariz. specimens), (CSU). 4.4 rd. mi. E Emory Pass, Black Range, Sierra Co. New Mex., Mar. 28, 1986 1m R. E. Stanford (*inghami* evidently as it is similar to Phoenix *inghami*)(CSU). Water Can. Picnic Ground, Magdalena Mts., Socorro Co. NM, Apr. 4, 1966, 1m J. Scott.

Anthocharis sara colorado **M. Fisher & J. Scott, NEW SUBSPECIES (plate II)**

Definition: Ssp. *colorado* has been called and is related to *inghami*, but dots are larger than *inghami* [dots very strong in some, strong in many, weaker in many, very weak in some], and mottling is darker [strong], the female bar is closed below orange patch in a little more than half of females, females are whiter than *inghami* [females are usually white but some have tinge of uph yellow], the bar is fairly thick 0.6, .6, .6, .9, 1, 1, 1, 1, 1, 1, 1, 1.2 1.5, 1.5, 1.5, 1.5 mm at narrowest point in those mounted on ups at CU and Scott's). It resembles *thoosa*, but the black bar edging the orange patch is thinner on average. Only a little more than 50% of females have fairly strong black markings all around the orange patch (these black markings are strong in *thoosa*). The uph marginal dots are fairly strong like *thoosa*. The unh mottling is strong but may not be quite as blotchy as many *thoosa*. The uph is whitish on most females, but is slightly yellowish on some females; the upf is whitish. Ssp. *pseudothoosa* from W Nev.-E-C Calif. is similar but has the uph marginal dots a little stronger and the unh mottling yellower than ssp. *colorado*. **Name:** The name is from the COLORADO Plateau, which entirely encloses its range (and much of the range is in the state of Colorado). The Colorado Plateau is an extensive ancient mesa covering most of SW Colorado and SE Utah and NW New Mexico and NE Arizona, and the butterfly occupies the canyons etc. eroded from this plateau. **Range:** Colorado Plateau country in SW Colo., SE Utah, and NW New Mex., and surely NE Ariz. **Type locality and types:** Holotype male (plate II) & allotype female (plate II) from McElmo Creek, 6000', Montezuma Co. Colo., April 11, 1971, coll. M. Fisher (CSU). Paratype specimens examined from Colorado and Utah and New Mexico: Coal Mine Point, Black Ridge Breaks, ~6800', Mesa Co. Colo., May 4, 1974, 1m1f, Michael S. Fisher; Coal Mine Point, Black Ridge, Mesa Co. Colo., Apr. 27, 1981 3m1f Ray E. Stanford (CSU). Black Ridge, Mesa Co. Colo., May 13, 1960, J. Donald Eff, "*inghami*", J. Lepid. Soc. 22:159-171 (not seen). Monument Can., Colo. Nat. Mon., Mesa Co. Colo., March 19, 1996, P. A. Opler, 2f (CSU). Colorado Nat. Mon., Mesa Co. Colo., May 13, 1960, D. Eff, 1m (CU) typical. West Creek, W Unaweep Can., 6000', Mesa Co. Colo., May 3, 1974 1m1f, Apr. 15, 2008 4m1f, M. Fisher. W Unaweep Can., Mesa Co. Colo., R. E. Stanford, Apr. 25, 1987 1m, Apr. 29, 1982 1f, (CSU). Unaweep Divide, Unaweep Can., 7046', Mesa Co. Colo., April 12, 1986, Richard L. Klopshinske, 1m1f, in Steve Spomer coll. Sewemup Gulches S of Gateway, ~5100', Mesa Co. Colo., May 3, 1974 1f R. E. Stanford (CSU). Glenwood Can., Garfield Co. Colo., R. E. Stanford (recorded as *thoosa*, not seen by us, evidently *colorado*). Grizzly Creek, on N side I-70 ~4 mi. E. Glenwood Springs, 6100', Garfield Co. Colo., May 29-30, 2007, Floyd W. Preston, 1m1f (female whitish)(examined by Todd Stout). Anthracite Crk., 8000', Gunnison Co. Colo., May 21, 1961, S. L. Ellis, 1m (CU)(strong dots, strong bar 0.5 mm in middle, strong mottling). Surface Creek, 7950', 7.6 mi. NNE Cedaredge, Delta Co. Colo., May 22, 1984, 1m fresh, J. A. Scott. Along Leroux Creek, ~7000'?, common in pinyon-juniper belt, Delta Co. Colo., M April-L May, 1961-1962, Scott L. Ellis, "*inghami*", J. Lepid. Soc. 22:159-171. Smith Fork Canyon, 7000'?, Delta Co. Colo., Scott L. Ellis, "*inghami*", J. Lepid. Soc. 22:159-171. SLE location #1011 or 1101, Delta Co. Colo., S. L. Ellis, 1m1f (CSU). Rogers Mesa, 5800', Delta Co. Colo., Apr. 29, 1965, S. L. Ellis, 1f (CSU). #4 Ditch, Rogers Mesa, 5900', Delta Co. Colo., April 19, 1962, S. L. Ellis, 1m (CU)(black bar 1 mm but wide gap, mottling very strong, giant dots). 3 mi. N Lazear, Rogers Mesa, 5850', Delta Co. Colo., April 23, 1972, S. L. Ellis, 1f (CU). Stingley Gulch, N of Rogers Mesa, Delta Co. Colo., S. L. Ellis, April 19, 1962 2m, April 19 1962 6000' 1m, April 19 1962 6300' 1m1f, April 20, 1962 1m, April 20, 1962 6300' 1m, April – 1962 6300' 2m1f, April 20, 1962 6300' 4m1f, April 28, 1962 1f (CU). Stingley Gulch, Delta Co. Colo., May 1, 1972, S. L. Ellis, 1f (CSU). W rim Black Canyon of the Gunnison, 6900', Montrose Co. Colo., March 30, 1986, R. Klopshinske, 3m1f, in S. Spomer coll. Dolores River Overlook, 7800', Dolores Co. Colo., April 20, 2005, R. E. Stanford & Kit Stanford, 1m (CSU). Aztec and Trail Canyons, SSW Cortez, 6000', Montezuma Co. Colo., April 10-11, 1971, 5m2f, M. Fisher. Mesa Verde Nat. Park, Montezuma Co. Colo., May 7, 1999, P. A. Opler & Evi Buckner, 1f (CSU). Mesa Verde Headquarters Can., 6800'?, Montezuma Co. Colo., May 12, 1953, Bernard Rotger, in Colo. Butt. 1957 (not seen, probably *colorado*). Towaoc, 5800', Montezuma Co. Colo., April 21, 1955, "near *inghami*", B. Rotger, in Colo. Butt. 1957 (not seen, surely *colorado*). McElmo Creek, 6000', Montezuma Co. Colo., April 11, 1971, 5m2f (1m holotype, 4m2f paratypes), April 13, 2008 1m paratype, M. Fisher. McElmo Canyon, Montezuma Co. Colo., April 28, 1954, "near *inghami*", B. Rotger, in Colo. Butt. 1957 (not seen, but certainly *colorado*). Sleeping Ute Mtn., Montezuma Co. Colo., April 15, 1968, B. Rotger C.R. [Catholic Reverend?], 3m1f (CU)(band a bit offset on all 3m, strong dots, strong mottling). Blanding, 6100', San Juan Co. Utah, April 15, 1960, 1m, J. Scott. Canyons at Toadlena, Chuska Mts., 6800-7200', San Juan Co., New Mex., April 30, 1974, 1m, M. Fisher. near Toadlena, San Juan Co. New Mex., May 1, 1980 1f, May 4, 1974 1m, R. E. Stanford (CSU).

Anthocharis sara coriande J. Scott & M. Fisher, NEW SUBSPECIES (plate II)

Definition: This ssp. resembles *thoosa* and *colorado*, but the black bar edging the reddish patch is fairly wide to narrow (usually 0.5 mm at the narrowest point but one is 1.0 & one is 1.5 & one 0.8)(the bar is not offset as it is in *julia*), much thinner than *thoosa* and averaging somewhat thinner than *colorado*, on females the black bar is only present at the end of the discal cell and is absent distally posterior to the orange patch, the uph marginal dots are weak (dots weak and fairly small on most but strong on occasional males and females)(these dots are strong on ssp. *gunderi* and *sara* and *pseudothoosa* and *thoosa* and *colorado*, and are weak in ssp. *inghami* and *coriande*). The unh mottling is rather strong (strong on nearly all males but moderate on some, mottling strong & clumped in females). It is similar to *inghami* but the black bar averages narrower, and females average whiter (females are whitish on upf and are usually slightly yellow on uph but a few are whitish). **Name and Range:** The name is from the small part of the range that is in SW COlorado (in La Plata & Archuleta Cos. in the San Juan River part of the Colorado River System) and the main range in northern New Mexico (in the RIo GrANDE river system on both sides of the Sangre de Cristo Mts. and the Sandia and Manzano Mts.). It flies from 6000-7600'. **Type locality and types:** holotype male (plate II) 1 mi. SE Glorieta, 7300', pinyon-juniper woodland, Santa Fe Co. New Mex., April 19, 1962, J. Scott (BMNH). It occurs in pinyon/juniper woodland in Taos Co. Paratypes examined from New Mexico and Colorado (specimens not seen are not paratypes): John Dunn Bridge, Rio Grande Gorge, 7000', Taos Co. New Mex., April 16, 2001, Richard Holland, 3m1f (CSU). ½ mi. ESE Valdez, Rio Hondo, 7600', Taos Co. New Mex., May 24, 1985, 1m worn, J. Scott. Santa Fe, Santa Fe Co. New Mex., 1f (examined by Todd Stout). Embudo, E side Rio Grande, 6000', Rio Arriba Co. New Mex., April 21, 1962, 1f fresh, J. Scott. 1 mi. SE Glorieta, 7300', Santa Fe Co. New Mex., April 19, 1962, 3m4f (1m holotype, 2m4f paratypes), J. Scott. Gallinas Creek, NW of Las Vegas, 7000', Sangre de Cristo Mts., San Miguel Co. New Mex., May 9, 1973, 6m2f Ray E. Stanford (CSU), 1m1f M. Fisher. Los Frios Canyon, Bandelier Nat. Mon., Sandoval Co. New Mex., Boris Kondratieff, 1m1f (CSU). S of Placitas, (N end Sandia Mts.), 6800', Sandoval Co. New Mex., May 2, 1970, Ray E. Stanford, 4m2f (CSU). Dry Camp Picnic Ground, Sandia Mts., [Sandoval or Bernalillo Co.], New Mex., May 1, 1977, Reed A. Watkins, 2m (CU)(weaker linear bar, dots weak, mottling weaker). Juan Tabo Canyon, Sandia Mts., Sandoval Co., New Mex., R. A. Watkins, May 4, 1996, 1f (CU)(black bar very weak, some dots, mottling strong, uph about 1/3 yellow). Juan Tabo Can., (N of Albuquerque), 5821', Bernalillo Co. New Mex., April 9, 2001, Charles Harp, 1m1f (CSU). Embudo Can., 6000', Sandia Mts., Bernalillo Co., New Mex., April 22, 1993, R. A. Watkins, 1f (CU)(ups whitish with sl. yellow uph tint, some uph dots, no outer bar, mottling moderate). Priest Can. (a rather dry habitat), Manzano Mts., 7100', Torrance Co. New Mex., May 8, 1973 4m2f Ray E. Stanford (CSU), May 7, 1973 1m1f M. Fisher (best called *coriande* at Priest Can., but they are variable, one male has a thick black bar on upf like *colorado* but most are thinner and less dark and not offset as much as *julia*, and uph spots are small/weak; Fisher's male has a weaker upf bar of which the outer element is nearly missing and the unh mottling is greenish rather than blacker; color and spotting on females are typical of *coriande*). Trego Canyon, 6600', E side Manzano Mts., Torrance Co. New Mex., May 8, 1973, Ray E. Stanford, 2f (CSU)(the black around the orange patch is a little heavier than typical for *coriande*, otherwise the color & spots fit *coriande*)(the Manzano Mts. adults from Priest Can. & Trego Can. have greener unh mottling than usual, so differ somewhat). Belen, near Manzano Mts., Valencia Co. New Mex., Todd Stout, last-instar larvae were like *thoosa-inghami* (these may be ssp. *coriande*). 5.8 mi. SSW Manzano Peak, Valencia Co. N.M., Mar. 26, 2007 female ovip. *Descurainia pinnata* & a few adults reared by Todd Stout (mother & offspring had fairly strong black bars, females had yellowish uph, uph dots moderate, unh mottling strong, thus are like *coriande* but uph dots are a bit stronger & female uph a bit yellower than usual)(Todd Stout thinks that Manzano Mts. bugs are not like *inghami*, they are evidently near *coriande* but may be an intergrade with some *inghami* influence; a large series is needed). Between Pagosa Junction & Arboles, ~6300’, Archuleta Co. Colo., April 24, 1970, B. Rotger, 2m (CU). near Old Arboles, ~6100’, Archuleta Co. Colo., April 9, 1970, B. Rotger, 1m1f (CU)(weak bars, mottling weaker, female white). S Arboles, ~6000’, Archuleta Co. Colo., April 17, 1961, B. Rotger, 2m (CU). N Arboles, ~6100’, Archuleta Co. Colo., April 17, 1961, B. Rotger, 5m1f (CU). Arboles, ~6100’, Archuleta Co. Colo., April 9, 1968, B. Rotger, 1m (CU). W Sandoval Mesa N of Arboles, ~6050’[<8000’], Archuleta Co. Colo., April 29, 1974, 1m, 1f (Plate II), M. Fisher. Sandoval Creek N of [Southern Ute, not Navajo] Indian Res., Archuleta Co. Colo., April 29, 1974, Ray E. Stanford, 3m2f (CSU)(less mottled unh than *colorado*). Archuleta Co.Colo., “many localities, April 26-June 11” (not seen, *coriande* and ?*julia*). 2 mi. SE Yellow Jacket Pass, ~7400’, Archuleta Co. Colo., May 7, 1977 1m Glenn R. Scott (traded away, not seen, *coriande* or *julia*?). Durango, 6590’, La Plata Co. Colo., [presumably Bernard Rotger], April 1, 1937 1m, April 18, 1937 1m (CU). Durango, April 20-May 31, La Plata Co. Colo., B. Rotger, in Colo. Butt. 1957 (not seen, probably *coriande*). Animas Valley, La Plata Co. Colo., May 3, 1940, B. Rotger, in Colo. Butt. 1957 (not seen, probably *coriande*). Junction Creek [NW of Durango], +/-7000’, La Plata Co. Colo., May 30-June 4, B. Rotger, in Colo. Butt. 1957 (not seen, *coriande* or *julia*?). Marvel, ~6750’, La Plata Co. Colo., May 9, 1941, B. Rotger, in Colo. Butt. 1957 (not seen, *coriande* or *julia*?).

***Anthocharis julia browningi* Skinner**. **Definition:** This is the ssp. of *A. julia* that is most different from *A. sara* (though Todd Stout has found two evident hybrids with *A. sara thoosa*, which are presumably sterile). It has the black bar very offset, and absent or nearly absent in the middle, and black upf markings are weak on females. Females are all yellow, males are off-white to slightly yellow-tinged. The uph marginal dots are weak. Unh mottling is weak. (Todd Stout notes that some males from Providence Can., Bear River Range, Cache Co. Utah, coll. Apr. 19, 1994, exhibit slightly more yellowish tint as compared to typical off-white males collected from other *browningi* populations.) **Range:** The Wasatch and Uinta Mts. of Utah, and the Rocky Mts. of W Wyo., and evidently E Idaho, but variants like it occur in Ore. & Wash. & BC. **Specimens examined:** Brooks Lake (E of Togwotee Pass), 9100’, Fremont Co. Wyo., 2m1f (CU). Teton Mtns., Wyo., July 18, 1937, 10m7f (CU). “Station 82”, Teton Co. Wyo., date?, 1f yellow (CSU). The Potholes (just S Jackson Lake, 6900’), Teton Co. Wyo., June 18-19, 1962, 4m5f, J. Scott & Glenn R. Scott & Kathleen A. Scott & Juanita M. Scott (females yellow, all like *browningi* but 1 of 3 males has black band thick & straight like *flora*/*sara* etc., but unh has weak mottling on all). Togwotee Pass, 9658’, Teton Co. Wyo., J. H. & F. Martin Brown, 2m1f (CU). Mill Hollow, Uinta Mts., Wasatch Co. Utah, June 23, 1965, 1m Kenneth B. Tidwell, in Scott coll. Mill Creek Can., Wasatch Mts., Salt Lake Co. Utah, May 18, 1965, 2m K. B. Tidwell, in Scott coll. Mill Creek Can., Utah, Robert M. Pyle, June 28, 1965 1m (CU). Mill Creek Can., 5330’, Utah, May 4, 1962, K. B. Tidwell, 2m (CU). Big Water Fork of Mill Creek, Salt Lake Co., Utah, June 24, 1961, 1m, K. B. Tidwell, in Scott coll. Soapstone Mtn., Dry Hollow, Wasatch Co. Utah, June 23, 1961, 1m, K. B. Tidwell, in Scott coll. Mueller Park, Wasatch Mts., Davis Co. Utah, May 19, 1965, 2f K. B. Tidwell, in Scott coll. Mueller Park 5400’, Wasatch Mts., Davis Co. Utah, K. B. Tidwell, 4m1f (CU). Shingle Creek, Uinta Mts., Summit Co. Utah, June 30, 1965 1f, July 12, 1965 1f, K. B. Tidwell, in Scott coll. Single [Shingle] Creek, Summit Co. Utah, R. M. Pyle, June 30, 1965, 1m (CU). Big Cottonwood Can., Wasatch Range, Salt Lake City, Utah, Don Eff, 1m (CU). Heber [City], Wasatch Co. Utah, A. L. Lauck, June 20, 1949, 1m1f (CU). Big Canyon, Salt Lake Co., Utah, June 19, 1932, 1m1f (CU). Brush Creek, 5600’, Uintah Co. Utah, May 9, 1961, Kenneth B. Tidwell, 1m (CU). Dry Fork at Ashley Creek, Uintah Co. Utah, K. B. Tidwell, May 29, 1961, 1m (CU). Daniel, Sublette Co. Wyo., July 10, 1947, Clye Glasgow, 1m (CU)(no bar beyond discal cell, strong yellowish mottling, almost no dots). South Beaver, near Daniel, Sublette Co. Wyo., C. Glasgow, June 20, 1946, 1f (CU)(very yellow, little black, no dots, yellow moderate mottling). Green River Lakes, Sublette Co. Wyo., Don Eff, July 17, 1953, 1f (CU)(3/4 yellow ups, little upf black, yellow mottlng, no dots). (Scott has specimens with tendencies toward *browningi* also from Baker Co. Ore. and C. Wash. incl. Chelan, Columbia, Okanogan Cos. [though Pyle calls those *flora* and Warren calls E Ore. pops. near-*stella*]. R. Pyle’s Butt. Cascadia photos from Chelan & Yakima Cos. Wash. look like they could be *browningi* also, though his male ups from Kittitas Co. Wash. looks like *A. sara flora*. And N. Kondla has a few variants from Pend d’Oreille Valley BC that are similar to *browningi*).

***Anthocharis julia julia* W. Edwards (plate II)**. **Definition:** Ssp. *julia* has the black bar strongly offset (the discal cell-end part is not connected to the distal remainder of the bar). The marginal uph dots are comparatively weak (moderate). Unh mottling is weak. Females are half yellow (half-yellow on uph, slightly yellow on upf) though rare females are whitish. *A. j. julia* is the same as *browningi* but the male black bar is a bit thicker toward margin and the bar is not quite as offset, males are whitish, and females are half yellow (uph moderately yellowish [varying from white to strongly yellow], upf less-yellow usually whitish-yellow). **Range:** throughout the Colorado mts. (except absent from the mts. bordering the plains from Denver southward), north through C Wyo. to S-C Mont. (though we have not studied the northern populations enough), and the boreal San Juan Mts. in Rio Arriba Co. in N New Mex. In boreal habitats, usually 7000-10,000’ in Colo., but 5600-11,500’ sometimes. **Specimens examined:** Halfmoon Park (Cgd.), 6400’, Crazy Mts., Sweet Grass Co. Mont., June 27, 1966 1m1f J. A. Scott. ½ mi. W Halfmoon Park, 6900’, Crazy Mts., Sweet Grass Co. Mont., July 4, 1966 1m J. A. Scott (in Crazy Mts. the female is yellower more like *browningi*, but black bar on males is less offset more like *julia*). E Rosebud Lake, ~6500’, in SW Carbon Co. Mont., June 21, 1962, B. Vogel, 1f (CU). Wilson Ranch, 5000’, 4 mi. SE Pryor, Bighorn Co. Mont., June 17, 1953, [labels suggest coll. F. M. Brown], 5m2f (CU). Antelope Butte Ski Area, 8366’, Bighorn Mts., Big Horn Co. Wyo., Aug. 3, 1995, J. A. Scott, 1m (shape of black bar more like *browningi*). Mosier Gulch Picnic Area 6 mi. W Buffalo, ~5600’, Bighorn Mts., Johnson Co. Wyo., May 30, 1995, Ray E. Stanford, 1m (CSU). Little Mtn., ~8200’, Sweetwater Co., Wyo., May 29, 1978 1m, J. Scott. Arlington, 7900’, near I-80, tip of Medicine Bow Mts., Carbon Co. Wyo., May 31, 1972, Url N. Lanham, 1m (CU). Battle Crk. Campground, 13 mi. ENE Slater, 7600’, Carbon Co. Wyo., June 21, 1973 (CSU). near Woods Landing, Albany Co. Wyo., June 1, 1971, U. N. Lanham, 1m (CU). Pole Mtn., SE of Laramie, ~8800’, Albany Co. Wyo., June 2, 2007, 7m3f and five ova found on *Arabis* spp., Todd Stout. Pole Mtn., SE of Laramie, ~8800’, May 17, 1969 1m, May 23, 1969 1f, Clifford D. Ferris, fig. in Rocky Mtn. Butt. Foxpark, 9100’, Medicine Bow Mts., in SW Albany Co. Wyo., June 19, 1955, Gene DeFoliart, 1m (CU). 3 mi. S Red Feather Lakes, on Poudre River Rd., 8500’, Larimer Co. Colo., May 27, 1974, Scott L. Ellis, 1m (CU). County road 162, Manhatten Crk. W of Goodell Corner, 8500’, Larimer Co. Colo., May 31, 1997, May 21, 2000, 5m7f, Michael S. Fisher. Same site County road 162, Manhatten Crk., 11 ova found on *Arabis* spp. (*glabra?*), June 2, 2007, Todd Stout. Red Feather Lakes, 8500’, Larimer Co. Colo., June 19, 1929, Alexander Barrett Klots, in Colo. Butt. 1957 (not seen, but *julia*). Glacier View Meadow near Red Feather Lakes, 2300m, Larimer Co. Colo., May 17, 1988, Howard Evans, 2m1f (CSU). Fort Collins, Larimer Co. Colo., June 10, 1962, coll. Hoseir, 1m (CSU). Boulder Co. Colo., many localities, 6000-9500’, May 8-July 18, J. Donald Eff=D. Eff, Raymond J. “Jae”=Jablonski, Charles L. Remington, P.S. Remington, Walfred J. Reinthal, in Colo. Butt. 1957 (not seen, but all *julia*). Near Boulder, 1700-2100m, Boulder Co. Colo., D. Eff, 14 June 1984 1m2f, 26 June 1983 1f, in S. Spomer coll. Long Canyon, ~7200’, Flagstaff Mtn., nr. Boulder, Boulder Co. Colo., 17 May 1979, D. Eff, 1m, in Steve Spomer coll. Chicken Ranch Gulch, 7200’, Gregory Can., Boulder Co. Colo., May 30, 1965, D. Eff, 1m (CU). Chicken Ranch Gulch (a N-S gulch just N Green Mtn., which is the big peak just S Gregory Can.) and trail to Green Mtn., in gulch just above Green Mtn. Lodge, Boulder Co. Colo., May 30, 1965 3m fresh, May 28, 1966 1f fresh, J. Scott. Green Mtn. Cabin above Gregory Can., ~7300’, Boulder Co. Colo., April 26, 1966, 1m fresh J. Scott. Green Mtn. trail above Gregory Can., 8000’, Boulder Co. Colo., June 9, 1973, June 16, 1984, 1m1f, M. Fisher. A little E of Kossler Ranch, above Gregory Can., ~7600’, Boulder Co. Colo., May 25, 1966, 1m worn, J. Scott. Gregory Can., ~6000’, Boulder Co. Colo., April 14, 1966 1m fresh at bottom of big slope, April 26, 1966 1m fresh, May 1, 1966 1m fresh, May 5, 1966 1m fresh, May 29, 1966 1f fresh, April 18, 1967 1m fresh in lower part of canyon, April 19, 1967 2m fresh, April 28, 1967, 2m fresh (total 6 seen), May 8, 1967 10m2f fresh, May 15, 1967 1m fresh, all J. Scott. Gregory Can., ~6000’, Boulder Co. Colo., many specimens, dates and numbers and collectors not recorded (CSU). Magnolia Road, ~7500’, Boulder Co. Colo., D. Eff, 30 May 1980 1m, 26 May 1989 1f, 30 May 1980 1f, 5 June 1979 1f, in Steve Spomer coll. Caribou bog (where a Bucyrus dragline once used to build the Panama Canal was brought in to harvest peat until WWII, then was abandoned and remained mired in the muck, until recently moved to a museum), 9800’, Boulder Co. Colo., July 3, 1988 1m worn (on July 2, 1989 1 orange egg (of *sara*?) found 2/3 way up *Arabis drummondii* plant), J. Scott. Caribou townsite, 4 mi. NW Nederland, 9300’, Boulder Co. Colo., June 30, 1990, 1f, M. Fisher. Packers Gulch, in 4 Mile Canyon (NW of Boulder), Boulder Co. Colo., May 29, 1965, J. Scott (with D. Eff), 2m1f fresh in gully along road through Ponderosa Pines. Packers Gulch, near Crismon, ~6300’, Boulder Co. Colo., May 6, 1962, D. Eff, 2m (CU). Packers Gulch, Boulder Co. Colo., May 21, 1961, D. Eff, 1m (CU). The Anne U. White Trail, Lee Hill Road, in 4-Mile Can., Boulder Co. Colo., about early May 2007-2008, many seen, Jan Chu. Bear Creek, Old RR grade W of Sunset, ~8400’, Boulder Co. Colo., June 20, 1965, 1m, no doubt D. Eff (CU). Boulder Co. Colo., Apr. 1925, C. P. Custer, 1m (CU). Near Sugarloaf, ~7500’, Boulder Co. Colo., May 26, 1956, Vaughan Aandahl, 1m (CU). Boulder, Boulder Co. Colo., 5600’, April 19, 1971, Url N. Lanham, 1m (CU). Shanahan Mesa (SW Boulder), ~6000’, Boulder, Boulder Co. Colo., May 22, 1971, U. N. Lanham, 1f (CU). Flagstaff Mtn., ~7000’, Boulder Co. Colo., D. Eff, May 15, 1948 1m, May 20, 1948 1m (CU). Boulder Can., Boulder Co. Colo., June 28, 1947, D. Eff, 1f (CU). Dream Can., Boulder Co. Colo., May 25, 1949, D. Eff, 1m (CU). Rainbow Lakes, 10200’, Boulder Co. Colo., Helen E. Rodeck, June 20, 1937 1m, June 25, 1936 1m (CU). Bluebell Can., 6700’, Boulder Co. Colo., May 13, 1965, D. Eff, 1m (CU). Lump Gulch (S of Rollinsville, ~8900’), Gilpin Co. Colo., July 4, 1957, Hugo G. Rodeck, 1m (CU). East Portal Moffat Tunnel, 9000’, Gilpin Co., Colo., July 3, 1980, 1m, M. Fisher. Golden Gate State Park, Blackman Equestrian Trail (Frazier Meadow Trail), 8400’, Gilpin Co. Colo., June 16, 1990, 1m, M. Fisher. Hughesville (NE Blackhawk), ~8500’, Gilpin Co. Colo., July 24, 1980, Charles Slater, 1m (worn) (CSU). Macey Gulch, off Smith Hill Road (on the Green Ranch side), Golden Gate Can. State Park, Gilpin Co. Colo., 1st week of June ~2005-8, some seen, Barbara Bartell. Golden Gate State Park, Jefferson Co. Colo., June 1998, m photo Rick Cech (in J. Glassberg’s Butt. through Binoc. The West). Coal Creek, Jefferson Co. Colo., May 1938, Bernard Rotger, in Colo. Butt. 1957 (not seen, but *julia*). Beaver Creek near Fairplay, 10,000’, Park Co. Colo., July 7-14, 1871, Theodore L. Mead (not seen, TL). Hall Valley, 10,000’, Park Co. Colo., Aug. 3, 1935, F. Martin Brown, in Colo. Butt. 1957 (not seen, but *julia*). Sacramento Gulch (W Fairplay), ~10,500’, Park Co. Colo., June-July, FOX=Richard M. Fox?, in Colo. Butt. 1957 (not seen, but *julia*). Tabernash Camp, Grand Co. Colo., June 29, 1963 2m3f common most males worn, J. Scott. Near Tabernash, 9000’, Grand Co. Colo., June 20, 1974, 2f (Plate II), M. Fisher. Tabernash, ~8300’, Grand Co. Colo, R. E.

Stanford, 1f (CSU). Big Park Creek (evidently near Madlin Creek, 8700’), Grand Co. Colo., June 30, 1963, 1m worn, J. Scott. St. Louis Creek W of Fraser, ~9000’?, Grand Co. Colo., colony found, Tom Kral (pers. comm. to Todd Stout, not seen). N of Fraser, ~8500’, Grand Co. Colo., 21 June 1984, leg. N.Rank, 2m, in S. Spomer coll. Hideaway Park, S of Fraser, 9000’, Grand Co. Colo., June 20, 1974 1m (Plate II), June 18, 1988 1m2f, M. Fisher. Hot Sulphur Springs, ~7700’, Grand Co. Colo., R. E. Stanford, 3m2f (CSU). Beaver Creek, 3 mi. SSW Hot Sulfur Springs (actually 2.3 or 2.4 road mi. WSW then 2.1 or 2.2 mi. SSE up Beaver Creek), 8300’, Grand Co. Colo., June 24, 1989 1m, June 28 & 30, 1989 none seen, on June 24 1 egg found halfway up *Descurainia* sp. probably *richardsoni* (hairs stellate) may be *sara* or *ausonides,* J. Scott. Beaver Creek, forest road 133, 8200’, Grand Co. Colo., June 26, 1998, 1m, M. Fisher. Bronco Creek, state road 125, 8800’, Grand Co. Colo., June 26, 1998, 1f, M. Fisher. Monarch Lake [Res.], 8340’, Grand Co. Colo., late July, John J. Renk, in Colo. Butt. 1957 (not seen, but *julia*). W of Fraser, ~8800’?, Grand Co. Colo., June 4, 1966, D. Eff, 3m1f (CU). Green Mtn. Res., ~8000’, Summit Co. Colo., June 25, 1963, 1m2f worn, William A. Cobban Jr., in J. Scott coll. Base Peak 9, Breckenridge Ski Area, 10000’, Summit Co. Colo., July 2, 1993, 2m, M. Fisher. Dillon, 8600’, Summit Co. Colo., June 27, 1953, Hans Epstein, in Colo. Butt. 1957 (not seen, but *julia*). Snake River, 9500’, Summit Co. Colo., June 22, 1955, H. Epstein, in Colo. Butt. 1957 (not seen, but *julia*). Climax, 10800’, Lake Co. Colo., June 27, 1953 H. Epstein, in Colo. Butt. 1957 (not seen, but *julia*). Twin Lakes, 8000’, Lake Co. Colo., June 27, 1953, H. Epstein, in Colo. Butt. 1957 (not seen, but *julia*). Turnoff to O’Haver Lake, ~8400’, Sawatch Range, Chaffee Co Colo., May 27, 1972, 1m fresh, J. Scott. Indian Flats, ~9000’, 7.1 mi. W Buena Vista, Sawatch Range, Chaffee Co Colo., June 8, 1970, 1m fresh, J. Scott. Morrison Creek, ~8 mi. NW Buena Vista, 10000’, Chaffee Co. Colo., June 17, 1974, 1m, Glenn R. Scott. Silver Plume Crk., 9600’, Chaffee Co. Colo., June 20, 1974, 1f, Glenn R. Scott. Clear Creek, Buena Vista, Chaffee Co. Colo., June 10, 1952 1m, June 11, 1952 8m, June 13, 1952 1m1f (CU). Clear Creek, 8000’, Sawatch Range, Chaffee Co. Colo., June 12-14, 1953 in Colo. Butt. 1957 (not seen, but *julia*), June 10 1952, June 11-13 1952 in CU museum, F. Martin Brown. St. Elmo, 9950’, Sawatch Range, Chaffee Co Colo., June 24, 1966 Maurice L. Howard, examined by Scott long ago. N. Cottonwood Crk., 9850’, Chaffee Co. Colo., June 12, 1974, 2m, Glenn R. Scott. Cottonwood Pass road, 10500’, Sawatch Range, Chaffee Co Colo., June 28, 1953 H. Epstein in Colo. Butt. 1957 (not seen, but *julia*). Cottonwood Pass road, 11500’, Sawatch Range, Chaffee Co Colo., July 9, 1953 F. M. Brown in Colo. Butt. 1957 (not seen, but *julia*). Blank Cabin 9 mi. NW Poncha Springs, Chaffee Co.Colo., 10000’, Chaffee Co. Colo., June 18, 1974, adult seen, Glenn R. Scott. Hayden Creek Cgd., 7800’, E side Sangre de Cristo Mts., Fremont Co. Colo., May 25, 1971, 1m1f Glenn R. Scott, in J. Scott coll. Hayden Pass road, 9500’, W side Sangre de Cristo Mts., Saguache Co. Colo., June 24, 1971 M. Howard, specimen(s) examined by Scott long ago. Luders Creek Cgd., ~10000’, Cochetopa Hills (NW edge San Luis Valley), Saguache Co. Colo., June 6, 1971 1m2f Glenn R. Scott, June 23, 1971 9m1f common (also 1m in S. Spomer coll.) J. Scott, May 28, 1972 2m J. Scott. Hamilton, 7000’, Moffat Co. Colo., May 29, 1938, (in Denver Nat. History museum? seen by Scott decades ago). Rabbit Ears Pass, Routt Co. Colo., June 29, 1951, Charles L. Remington, in Colo. Butt. 1957 (not seen, but *julia*). Rabbit Ears Pass, Ferndale Picnic Ground, ~8000’, July 7, 1993, Stephen M. Spomer 1m in S. Spomer coll. Gulch 13 mi. NE Glenwood Springs, ~7300’, Garfield Co. Colo., May 12, 1984, 3m, J. Scott. Glenwood Springs, ~6000’, Garfield Co. Colo., May 1954, NM [Norman Marston?], in Colo. Butt. 1957 (not seen, may be *julia*). 2 mi. NW Carbondale, 6000’, Garfield Co. Colo., Scott L. Ellis, May 1, 1966, 1m (CU)(offset bar, weak dots, mottling weaker). Roaring Fork River, 2 mi. NW Carbondale, 6000’, Garfield Co. Colo., April 24, 1966, S. L. Ellis, 1m (CU)(typical weak offset band). Edgarton Creek, 2 mi. WSW Carbondale, Garfield Co. Colo., 2008, larva found & reared by Todd Stout. Coal Creek, 8000’, Gunnison Co. Colo., May 20, 1961, S. L. Ellis, 1m (CU)(offset bar, weak dots). Anthracite Creek, 8000’, Gunnison Co. Colo., May 20, 1961, S. L. Ellis, 1m (CU)(very offset bar, weaker dots, mottling weaker). Dark Canyon Trail, Erickson Springs [38º57’10’’N, 107º16’25’’W], 6900’, Gunnison Co. Colo., May 27, 2002 (no collector) 2m (CSU). Gothic, 10000’, Gunnison Co. Colo., June 20, 1949, Walfred J. Reinthal, in Colo. Butt. 1957 (not seen, but *julia*). Crystal Creek, 8000’, Montrose Co. Colo., S. L. Ellis, May 5, 1963 1m, May 8, 1962 1m (CU)(offset bar, medium uph dots, mottling weaker). Diamond Joe Gulch, Black Ridge, T51N, R8W, S11, 6480’, Delta Co. Colo., April 24, 1972, S. L. Ellis, 1m (CU)(very offset bar, medium dots). Hatcher [not “Hatchet” which is not on maps] Lake, 10,500’, near San Juan R., Mineral Co. Colo., May 28, 1954, Bernard Rotger, in Colo. Butt. 1957 (not seen, but *julia*). Turkey Creek, ~8700’, Mineral Co. Colo., May 5, 1954, B. Rotger, in Colo. Butt. 1957 (not seen, but probably *julia*). 2 mi. SSE Durango, 7000’, shrubby habitat, La Plata Co. Colo., May 4, 1972 1m, M. Fisher (has *julia* characters). Archuleta Co. Colo., many localities, April 26-June 11, B. Rotger, in Colo. Butt. 1957 (not seen, some may be *julia* but *A. sara coriande* occurs in county also). 1.6 mi. S of Dulce Lake, 7400’, Rio Arriba Co. New Mex., May 10, 1983, Ray E. Stanford, 4m (CSU)(JAS caught 5m2f mostly in gulch ½ mi. NE of the lake on same date but traded them away).

***Anthocharis julia stella* W. Edwards.** **Definition:** Males almost always light yellow on ups unlike any other taxon, females all yellow like *browningi*, black bar somewhat more linear and less offset than ssp. *julia* & *browningi*, though more offset than *flora*. Uph dots mostly weak. Unh mottling weak and yellowish. **Range:** Calif. Sierras only. In the Sierra Nevada nearly all the males are slightly yellowish. Some are similar in E Ore. as Warren (2005) says, and based on his writeup Klamath & Lake Cos. Ore. bugs should be called near-*stella*. Todd Stout found an occasional yellowish male even in Idaho, where some Boise Co. males are off-white and some are white, and long series from Boise and

Pocatello area in CU have ~33% of males a little yellowish, but those Idaho pops. are near ssp. *columbia* named below. **Specimens examined:** 10m1f at CU (all males yellowish, f yellow, bar fairly narrow & fairly straight & slightly offset): Tuolumne Meadow, Tuolumne Co. Calif., 3m (CU). Truckee, Nevada Co. Calif. 1m1f (CU). Dorrington, Calaveras Co. Calif., 1m (CU). Fallen Leaf Lake, El Dorado Co. Calif. 5m (CU). Glen Alpine Falls, El Dorado Co. Calif. J. Scott 2m. E Glenbrook, Douglas Co. Nevada. J. Scott 4m1f. Gold Lake Lodge, Sierra Co. Calif. J. Scott 2m. Fiddle Creek Cgd., Sierra Co. Calif. J. Scott 1f. E Floriston, Nevada Co. Calif. J. Scott 1m1f (the male white). Many papered in Scott coll.

***Anthocharis julia sempervirens* J. Emmel, T. Emmel, S. Mattoon.** **Definition:** This newly described bug (Emmel Emmel & Mattoon 2008) is distinguished from *flora* by having light-yellow females usually lacking the orange upf patch. Described as a ssp. of *sara*, but placed in *A. julia* here because it is univoltine, has light-yellow females, a tinge of yellow on uph of male, greener less-mottled unh than *sara*, black bar a bit more offset on male & more offset on female than *sara*, uph dots a little less (medium), and it occurs ~10 mi. from ssp. *sara* without noticeable intergradation. Thus it appears similar to *flora*, though the orange patch is rare on females. It has been reared, but the larva should have been figured. **Range**: so far known only from TL area Bald Hills, Redwood NP, Humboldt Co. Calif.

Anthocharis julia columbia J. Scott & Norbert G. Kondla, NEW SUBSPECIES (plate II)

Definition: This ssp. is the "near *stella*" of various authors. In its black bar and yellow females, the bug resembles *stella* of the Sierra Nevada Calif., where all males are slightly yellow on ups, but males of *columbia* are mostly white, and at the northern end of the range in SE BC males are nearly always white. The black bar is narrower and more offset than *flora*, and less offset than *browningi*. Females are yellow like *stella* & *browningi*. There is considerable variation in Kondla's specimens from the western Kootenay (Brilliant, and Charbonneau Crk.) and the Pend D"Oreille Valley in BC, where some specimens resemble Calif. *stella* and some resemble *browningi*, and most males are white but some are very slightly tinged with yellowish esp. on uph, the uph dots are moderate to absent, the unh mottling is weak to strong but usually yellowish-green, the black bar is usually a little offset but sometimes straight, the bar is usually medium width, and females are usually yellow but some are half- yellow and a few are whitish (but less than 1% of interior BC females are white, in contrast to BC "*flora*" and *alaskensis* in which white females are abundant). (Kondla notes that specimens from the dry-belt north Okanagan area of BC are near ssp. *columbia* but many males have some bright yellow on uph esp. outwardly, and these pops. have more uph black dots and greener unh mottling, so may be a nameable ssp.)(There is considerable variation in nearly every ssp. and population of *A julia* and *A. sara*) **Name** comes from the main **range**, which is the Columbia River Basin in BC, E Wash., Idaho, and NE Oregon, which includes the TL in British Columbia. **Type locality** of holotype male (plate II) and allotype female (plate II) is Brilliant, BC, in the West Kootenay area of BC near Castlegar on the Columbia River, April 30, 1999, N. Kondla (deposited CNC)(holotype black bar fairly thick but slightly interrupted at the small jog, uph dots moderate; allotype light yellow on ups, upf blackish fairly weak, uph dots weak; mottling of both types greenish & moderate but weak on outer 1/3). Evidence to date suggests that there may be an incomplete clinal type of variation from Calif. where all males are yellowish, to BC where yellowish males are rare, so specimens from Idaho and NE Ore. that have some yellow-tinged males can now be called "near *columbia*" rather than "near *stella*". Idaho specimens have a fairly straight weak bar, and only 33% of males are yellowish, so they are near *columbia*, not near *stella*. **Specimens examined by Scott:** Robson [NW of Castlegar on Columbia R.], BC, Canada, May 5-10-16-19-26-30-30-31, 1936, H. R. Foxlee, 4m4f (CU)(females all yellow, all males white except 1m a bit tinged with yellow, bar weak & offset a little). 44½ mi. N Coleman, Alberta, July 8, 1968, no collector [surely Don Eff], 1f (CU)(very yellow with weak black markings). Harts Pass, Methow Valley Rd., Okanogan Co. Wash., July 23, 1968 no collector 1m1f (CU)(male white, f yellow with very little upf black, unh moderate mottling), July 9, 1961 Robert E. Woodley 1f in Scott coll. (yellow, dots moderate). Brewster, Okanogan Co. Wash., April 20 to May 15, 1947-49, J. C. Hopfinger, 5m3f (CU)(females very yellow, bar straight on 2m & offset 3m, I didn't write that males were yellow so they must be rather whitish). Antilon Lake, Chelan Co. Wash., April 23, 1961, R. E. Woodley, 2m in Scott coll. (white, black bar a bit staighter than *browningi*, & dots stronger [moderate]). Chinook Pass, 5430', Yakima Co. Wash., July 17, William N. Burdick, 1f (CU)(mostly yellow, little black, dots weak, mottling strong but yellow). Gilbreth Springs, 5000', Blue Mts., Columbia Co. Wash., June 17, 1960, R. E. Woodley, 1f in Scott coll. (yellow, very little black, dots weak). Cougar Res., Deschutes Co. Ore., June 7, 1970, K. T. H. leg., 1f (3/4 yellow)(CU). N Pine Creek, near Halfway, Baker Co. Ore., April 24, 1961, Stanley G. Jewett Jr., 1m in Scott coll. (white, bar straighter than *browningi*, but dots weak). Corral Creek, near Ketchum, Blaine Co. Ida., June 18, 1944, D. Eff, 1m (CU)(slightly yellow). Trail Creek Summit, Challis NF, near Ketchum, Blaine Co. Ida., Ida., July 2, 1944, D. Eff, 1m (CU)(sl. yellow). Proctor Mtn., Sun Valley, Blaine Co. Ida., Ida., June 24, 1944, D. Eff, 1m (CU)(sl. yellow). Oregon Gulch near Ketchum, Blaine Co. Ida., June 4, 1944, D. Eff, 1f (CU). Alturas Lake, Blaine Co. Ida., July 8, 1945, D. Eff, 1f (CU)(very yellow, orange patch nearly absent)(very yellow, orange nearly absent). Pocatello, Bannock Co. Ida., 4500', Idaho, J. H. Manning, May 10, 1944, 32m10f (CU)(males mostly slightly yellowish, females like *browningi*). near Boise, 4000', Ada? Co., Idaho, J. H. Manning, May 2, 1948, 18m17f (CU)(f all yellow). Horseshoe B. near Boise, Ada? Co. Ida., J. H. Manning, 3m (CU). Starkey Hot Springs, Boise Co. Ida., J. H. Manning, 3f (CU). Deer

Park, Boise, Ida., J. H. Manning, 1f (CU). {Jct. Menton Rd., state?, July 8, 1969 1m (CU)(no other data, state and ssp. unknown)}

Synonym sulfuris Pelham 2008 (Catalogue of Butt. U.S. & Canada, J. Res. Lepid. 40:167-8). Pelham attempted to name this as a new ssp. of *A. sara* by raising the aberration "*Anthocharis sara race julia* tr. f. sulfuris" Gunder 1931 status to subspecies status. Unfortunately it is a nomen nudum. ICZN Code Art. 13 says "To be available, every name published after 1930 must satisfy the provisions of Article 11 and must/ 13.1.1. be accompanied by a description or definition that states in words characters that are purported to differentiate the taxon, or/ 13.1.2. be accompanied by a bibliographic reference to such a published statement…, or/ 13.1.3. be proposed expressly as a new replacement name (nomen novum) for an available name, whether required by any provision of the Code or not." Pelham did not publish a description or definition of sulfuris, so it does not satisfy 13.1.1. Note that the words "the taxon" in 13.1.1. mean the taxon being named, namely the subspecies in this case; and the glossary defines "taxon" as a "population, or group of populations" (a taxon is not an individual such as an aberration—the glossary does define "intrasubspecific taxon", but that means a taxon such as a subspecies that is a whole population or group of populations that someone wrongly gave an unavailable "form" or "variety" name). The original description of an aberration does not qualify as the description or definition of the taxon such as a subspecies, because by definition aberrations are abnormal and are thus different from the population and thus the subspecies from which they came, and aberrations are not populations or groups of populations. And the Code requires a description or definition of the taxon being named: the subspecies. Thus the original description of an aberration cannot be used to satisfy the description or definition of a taxon required by 13.1.1., or the bibliographic reference to the description or definition required by 13.1.2. Aberrations are unavailable names, thus cannot fulfill 13.1.3 either. So, raising an aberration to ssp. status mandates satisfying 13.1.1 or referencing 13.1.2, by requiring Pelham to write a "description or definition that states in words characters that are purported to differentiate the taxon", the taxon being the subspecies being named, not a freak individual within the population. Unfortunately, Pelham failed to provide it, and failed to provide a reference to such a published statement. Pelham does not provide a description or definition, and only states that it is from SE BC, E Wash., NE Ore., N Ida. and W Montana, and references A. Warren (2005). But Warren (2005) did not say that this is a separate ssp. or new taxon, he described it as near already-named taxa, he just wrote that NE Ore. has individuals resembling ssp. *browningi* flying with ssp. *stella*, and wrote that many in Baker & Wallowa Cos. of NE Ore. approach the phenotype of ssp. *browningi*, and wrote that adults in the Warner Mts. of SE Ore. are phenotypically similar to ssp. *stella*, and wrote that ssp. *stella* phenotypes also occur in the Klamath River Can. in S-C Ore., and wrote that high-elevation Cascades populations cannot be assigned to either ssp. near *stella* or ssp. *flora*. Warren did not mention BC or Wash. or Ida. or Montana at all. So we do not know what bug Pelham was proposing, so sulfuris does not satisfy 13.1.2. or 13.1.1 (or 13.1.3.), thus is an unavailable nomen nudum. It is unavailable, so will not be discussed further.

***Anthocharis julia flora* Wright.** *Flora* belongs to *A. sara* based on the black bar [which is not offset] and strong uph marginal dots and sometimes redder patch and rather strong unh mottling; however the larva is like *A. julia* according to the larva photo in Butt. BC (Guppy & Shepard 2001) and Todd Stout's larvae. The BC book has a good treatment of these two *Anthocharis* (which they call *A. sara flora* [our *A. julia flora*] and *A. stella stella* [our *A. julia columbia*]), at least for adult traits (except *flora* larval traits contradict the adult traits, as noted above). **Definition:** Black smudge at base of ups wings larger than all other *Anthocharis* (except some spring form *A. sara sara*). Black bar straight and fairly wide, patch reddish-orange, dots usually strong but weak on several, unh mottling usually strong but many moderate, males usually whitish but a few slightly yellow, females vary completely from white to slightly-yellow to very yellow (6f white, 3f sl. yellow, 1f yellowish uph, 4f half-yellow, 4f all yellow). Adults evidently seem to intergrade into ssp. *columbia* at least in Ore. according to Pyle & Warren. The TL of *flora* is Tenino, Wash., and N. Kondla and Cris Guppy note that Vancouver Is. BC may have a somewhat different bug, as white females are more abundant there (specimens below show >50% white), but there is variation between populations. Guppy notes that the proportion of white females increases northward from Victoria to Nanaimo. **Specimens examined:** Wellington, Vancouver Island, BC, Richard Guppy, April 29-May 12-17-20-26, 1951-1950, 27m16f (all CU)(males all white but 2m have a very slight yellowish tinge & 2m slight yellowish tinge)(5f white, 2f nearly white [a bit of uph yellow], 1f very-slightly-yellowish ups, 1f half yellow on uph only, 4f half-yellow all over, 3f all yellow), April 28, 1958 1m (sl. yellowish), May 7, 1958 1m white, May 14, 1958 1f white ups (all in Scott coll.). Malahat, 1200', BC, Apr. 25, 1967, R. Guppy, 1f mostly yellow(CU).

***Anthocharis julia alaskensis* Gunder.** This appears the same as *flora* based on specimens at CU, except females are whiter: the patch is bright red-orange, the bar is straight & solid black and fairly wide (0.9, 1.2, 1.5, 2 mm at narrowest point), female has not much black, dots medium, females mostly whitish. Guppy & Shepard (2001) also state that females are mostly white, the only evident difference. A complete study of its status would need a long series from the *flora* TL Tenino Wash.; if half the females are white there, then *alaskensis* isn't very distinct. N. Kondla thinks that a complete examination of *alaskensis* should include numerous other existing specimens from Skagway (Tom Kral coll.) and Haines road Alaska. It is evidently disjunct from *flora*, as Cris Guppy notes that *Anthocharis* have not been collected at Bella

Coola BC. (And the TL of *flora* is Tenino, Thurston Co. Wash., which is south of the Belfair pop. detailed in next section, which has the black bar narrower than Vancouver I.-Alaska specimens, so IF Tenino specimens are like Belfair ones then the name *alaskensis* would be better for Vancouver I. pops. [Scott has not seen *flora* topotypes or the O.D., though the male & female in Holland's 1931 Butt. Book pl. XXXIV figs. 4-5 are claimed to be "types" on p. 287, and that fig. 4 male "type" has a thick black bar like Vancouver I.-Alaska pops., while the female is light-yellow]) **Specimens examined:** Skagway, Alaska, May 22, 1923, [no collector noted, from Don Eff collection], 4m3f (CU)(2f white, 1f has slight tinge of yellowish on basal half of uph).

Anthocharis julia* near *flora (these are closest to *flora*, but have some *columbia* influence). **Specimens examined:** Tulalip, Snohomish Co., Wash., May 12, 1953, David L. Bauer, 1m (CU)(bar straight). Blue Mtn., Olympic Mts., Wash., Lowell H. Hulbirt, July 15, 1950, 1m (CU)(straight black bar 1.0 mm wide). Belfair, Mason Co. Wash., May 8, 1949, 14m2f in riker mount in William N. Burdick coll. (CU)(patch orange-red, black bar weak & narrow 0.3 mm in 4m & .41m & .5 in 3m & 1 mm in 1m, dots all strong to very strong in males & strong in females, strong unh mottling, 1f yellow & 1f pale-yellow, 3m white & 4m near-white & 3m yellow-tinged, resemble male from Tulalip Wash., these are *flora* X *columbia*, as black bar is narrower than *flora* and males are yellower than *flora*). McDonald Forest, Corvallis, Benton Co. Ore., May 2, 1958, in Don Eff coll., 1m (CU)(bar straight 1 mm, dots very strong, mottling strong but yellowish, a bit yellow-tinted). McDonald Forest, Benton Co. Ore., Stanley G. Jewett Jr. (in Scott coll.), April 10, 1960 1m & May 3, 1960 1f, April 13, 1968 1m from J. Bolling Sullivan (bar straight ~1.3, .9, .9 mm, dots very strong). Barton, Clackamas Co. Ore., S. G. Jewett Jr. (in Scott coll.), June 4, 1961 1f, May 8, 1960 1f (yellow, dots strong). Marmot, Clackamas Co. Ore., S. G. Jewett Jr. (in Scott coll.), April 29, 1950 1m (black bar straight .9 mm, dots very strong).

Neominois ridingsii in Colorado--Overview, by Michael S. Fisher & James A. Scott

Neominois ridingsii (Ridings Satyr, or Grasshopper Satyr after Scott 1986) is distributed widely in Colorado on both sides of the Continental Divide, at altitudes of approx. 5000-10,000', rarely straying above timberline. Populations typically occupy shortgrass prairie habitats on the plains, short grasslands in sparsely-forested areas of the eastern mountains, and usually occupy sagebrush areas with grasses in western Colorado. The habitats are mostly moderately dry, the annual rainfall ranging between 10 inches in the San Luis Valley to 15 on the eastern plains, 20 at middle elevations in the Front Range, nearly 30 at Cripple Creek, up to 30 in some sagebrush areas of the western slope, and below 20 on some drier areas of the western slope. Most populations in eastern Colorado occupy sites with gently rolling hills, where males often fly on a ridgeline or hilltop, or may occur on a flat bench above a drainage creek bed where Fisher has found them in Douglas and Elbert Cos. Fisher has also found them on the flats of South Park (Park Co.) but they also occur there on slopes with a southerly exposure in somewhat upland terrain at the bases of higher hills, and at similar sites in the San Luis Valley (Saguache and Conejos Cos.). In westem Colorado, populations in the Colorado and Gunnison Rivers drainages mostly occur in sagebrush habitat, in intermountain valleys and upland flats or gentle hillside slopes. Populations are found on relatively flat or hilly terrain in northwestern Colorado, but males don't tend to fly on ridges or hill summits often there.

Austin (1986) reviewed the genus *Neominois* and named three new subspecies. He examined 329 male and 132 female ssp. *ridingsii* from 22 Colorado counties, including Archuleta, Gunnison and La Plata Cos. west of the Continental Divide, with dates from 3 June to August 18. He examined 102 males and 24 females of *N. r. stretchii*, most from the four west-central counties (Eagle, Garfield, Mesa and Montrose) but also from Moffat Co., though none were illustrated from Colo. He studied characters of overall wing color, depth of the serrations of the distal edge of the postmedian hw spot band, and somewhat arbitrary traits such as definition of the band, its contrast to the ground and also color in the discal and basal area. Our treatments below continue the study of Colorado area taxa, based on many specimens from Colorado of all the local taxa, and specimens of *wyomingo* from Wyoming, that have been newly mounted and examined. We name new subspecies, redefine the other ssp., and discuss whether there is more than one species in this complex.

The markings of these butterflies are quite variable, and no two specimens are exactly alike. But the sinuous distal edge of the postmedian band (called "submarginal" by Austin as it extends into that area) is useful to distinguish subspecies. The dorsal hindwing and ventral hindwing have this postmedian band, and the outer edge is a sinuous or zigzag line, which line is blacker in color on the underside. The ventral hindwing has a mesial band similar to that of *Oeneis*, and then this postmedian band.

There is considerable variation in populations throughout the state. The eastern slope—plus the western slope in southwestern and central and northern Colorado--has *N. ridingsii ndingsii* (plate I shows one from the high plains). The ups has medium to dark gray-brown areas with lighter whitish or creamy ground color, the same as that of the submarginal area on both wings. The postmedian spots on the hindwings are usually smallish or concise in size, not particularly elongated; many spots exhibit a closed appearance, with the spot in each cell closed by darker veins, the spots connected in series, while others have the postmedian spots fused into an open band. With the postmedian band spots smaller, there is a noticeably wider submarginal area between the bottom edge of these spots and the wing edge. Some populations produce individuals with more striations over the wings, and if striations occur within the postmedian band, it gives the overall wing surface a rather granular look. This seems to be more frequent from places higher in elevation but may occur lower also.

Populations fly mostly during June-early July in Colorado, except for *wyomingo*.

Late-summer-flying populations, flying mid August to mid September, occur along the northern portion of the eastern Front Range and eastward onto the high prairie along the Colorado-Wyoming border, in Larimer and Weld Cos. These are *N. ridingsii wyomingo,* named by J. Scott (1998) from Natrona Co., Wyo. *Wyomingo* varies (see below), but tends to have the coloration of *ridingsii*, the spot patterns of *stretchii*, although not all of the Colorado specimens in the collection of M. Fisher exactly match "typical" *wyomingo*. Some look closer to ssp. *ridingsii* in the opinion of Fisher but the distal edge of the postmedian band tends toward that typical of *wyomingo* (see below). An example of *wyomingo* collected by Fisher in Boulder Co is provided (plate I). The ground color and spots above are a little more whitish than typical *ridingsii*, the markings above look a little darker as well due to the lighter ground. The most noticeable difference of *wyomingo* is in the pattern of the hindwing postmedian spot bands. The spots are larger, more elongated in shape overall than typical *ridingsii*. The spots of the band are not always as closed or connected as ssp. *ridingsii* but are open throughout the series giving the band a wider appearance and the bottom outline of these spots have deeper serrations giving the band a more zig-zag outline, and the spots being enlarged or elongated leaves a narrower submarginal space between them and the wing edge.

These traits are like the basic pattern of *N. ridingsii stretchii* in western-central Colorado, including the lower Colorado River & lower Gunnison River drainages, a considerable distance south, except the ground color of the latter is typically darker brown and the postmedian band is yellowish in tone, the ups ground appears to have this yellowish tint distributed over the entire surface. *N. ridingsii stretchii* is illustrated (plate I). *N. ndingsii stretchii* was applied by Austin (1986) to populations with yellowish-tan coloring from Nevada (TL Nye Co.) across the Great Basin into western Colorado, and the range of variation among different populations of *stretchii* (and also *ridingsii*) was considerable as shown by Austin's black and white photos (general coloration varied from light to dark and the hindwing band was variable in both ssp.). From southwestern Utah, Fisher has specimens from Siever Co. and Scott has a series from Iron Co., which are similar to *stretchii* but are small in size, and Scott's are whiter. Ssp. *ridingsii* east of the continental divide rarely exhibits a very slight yellowish tint characteristic of *stretchii*.

Scott's naming of *wyomingo* added a considerable amount of uncertainty to the *ndingsii* complex (which we clear up several sections below), as one field guide even considered it a distinct species. Fisher (2004) tentatively suggested it to be a separate species, as they fly in some of the same localies where *ridingsii* flies earlier in the year, although Scott named it a subspecies because they do not fly together at the same time. Typical *ridingsii* does not occur at all *wyomingo* locations earlier in June, but both do occur at one location in Larimer Co. (Cherokee State Wildlife Area--although Fisher does not have specimens from June at that locality, another collector Teruo Utsumi took Fisher to this site where he had found *ridingsii* in June the same year 2004). The *wyomingo* phenotype sometimes occurs in June-July in these variable bugs, sometimes in odd places such as one specimen Fisher found in westem Colorado, as just a single individual on the north rim of the Black Canyon, Montrose Co. on July 31; darker-brown and yellowish-colored populations occur in that region (including one new subspecies named in this paper). *Wyomingo* occurs in lowland Moffat Co. in NW Colo. in L Aug.-E Sept., but in the June populations, the *wyomingo* phenotype does not seem to be common anywhere west of the Divide, except it is fairly common on the high northwestern plateau in Colorado at Diamond Peak ~8700' in Moffat Co. Here, Fisher and Scott have collected a population of basically *stretchii* during different years from June to July 17; some of these are yellowish like regular *stretchii*, but some are creamier like ssp. *ridingsii* or *wyomingo*, and some are even whiter and have some resemblance to the new ssp. named below from the Roan Plateau. We haven't been to Diamond Peak in Aug.-Sept., but Scott found ordinary *wyomingo* on the sagebrush flats in eastern Moffat Co. then.

The new subspecies named below from around the Roan Plateau in westem Colorado, shares some of the characteristics of *wyomingo* and *stretchii*, except its ground color is very light (with white postmedian band), while the band is wider than on most ssp. *ridingsii* but the bottom border has a shallow serration outline. This is the palest population known in the species.

A second new subspecies named below, is the opposite extreme, being the darkest, from a very cold higher-altitude valley in Gunnison Co. on the western slope.

Neominois ridingsii coloalbiterra Matthew C. Garhart and Michael S. Fisher, NEW SUBSPECIES, Common Name Roan Cliffs Satyr (plate I)

Definition: Distinguished by its bright white postmedian spot band on both wings and the same whitish color mixed throughout the ground color among the light brown to tan. Light brown to tan is heaviest toward the margins and apicies and in the median and basal areas of the wings. The postmedian band is moderate in width, wider than most ssp. *ridingsii* but has a similar rather shallow- to moderately-serrated distal outline as compared to ssp. *ridingsii*, not as zig-zag as *stretchii*. Ventrally, the color is largely white with brownish-tan maculation highlighting the ground in areas like the dorsal. The postmedian bands on the forewings are well defined but much less so on the hindwings being washed heavily with bright white scaling and forming a continuous band. The mesial band is more clearly expressed than the postmedian band. The only area on the wings below with any notable striation is in the forewing cell. Adults are often very large: the fw length of the holotype male is 25.5 mm; fw is characteristically larger than all other races except some *stretchii* from Glenwood Springs (well east of the type locality) but some are even larger than those. **Types & type locality:** Holotype male (plate I) Colorado: Garfield Co., CR 215, Parachute Creek, approx. 8 miles north of Parachute, Roan Cliffs, 6000 ft., 25 June 2003, M. C. and K. S. Garhart. Allotype female (plate I) same data except 6 miles north of Parachute, 20 June 2004, M. S. Fisher (MSF). Both types deposited in the Gillette Museum of Arthropod Diversity, Colorado State University, Ft. Collins, Colorado. Paratypes collected between 2002 and 2005 reside in the collection of M.C. Garhart, and between 2004 and 2008 reside in the M. S. Fisher collection. **Range:** This race is presently known only from the type locality (but the same geological rock layers occur all around the Roan Plateau--which is a flat pancakelike sequence of rock layers--so the bug may have a larger range around this plateau). Much of the area is currently under exploration for natural gas resources and a manned gate blocks the road just north of the TL. In 2008 a small layer of rock in the Green River Formation (evidently the Mahogany layer containing much oil shale?) was mined, and the waste rock simply dumped down the slope all along the cut, which has covered and trashed the entire slope extending 1000+ feet down to the road along about a mile of the E side of the valley, covering the most whitish-soil area of the type locality. This mining activity will not completely destroy the butterfly, which occurs to the S and N of the wasted area, and also probably occurs on the W side of the valley which now cannot be accessed because of signs posted by natural gas producers. But trashing an entire mountain slope to mine just a few meters-thick layer of rock is incredibly wasteful in our opinion, and we wonder why it could have been allowed. And now that the whitest-soil area of the range has been destroyed, will be butterflies evolve to be darker before the soil turns whiter again in a few hundred or thousand years? The surrounding cliffs make up the southeastern escarpment of the Roan Plateau, holding large deposits of natural gas, and one of the largest deposits of oil shale in the world. The area also has large deposits of nahcolite, from which soda ash and sodium bicarbonate are processed locally in the area by the American Soda company. **Name:** The name means Colorado white land. The soil at the type locality contains tiny crystals of the the mineral albite (coincidentally part of its scientific name), which is white in color and is a major contnbutor to the whitish soil surface of the area and evidently has caused the very light, bright white color of the butterfly. **Variation and Discussion:** This remarkable race of *N. ridingsii* is the whitest and lightest of all the named races. The lighter (white) and darker (light brown or tan) colors above are lighter than seen on any of the other named races. There is considerable variation in contrast between the light and darker regions on the wings above in series. Darker areas vary darker to a grayish tone rather than to the brown. The extremes of maculation and color are presented (plate I). Fisher has one paratype with a faint yellow tint above. **Hostplant and Behavior.** There are several grasses occupying the type area that may be used as hosts. *Bouteloua gracilis* is also present, however Fisher has never observed any individuals at a site with this grass. The population occupies the lower western side slope of the cliff hillside where they rest in the gullies and benches and saddles there to locate females. Early in the day, males will land up on shrubs or cactus to bask. In early afternoon, the west slope exposure of the habitat takes direct sunshine, heating significantly and generally, when butterfly activity ceases and the *ridingsii* seek shade, retreating under bushes or next to grass clumps, re-landing in or on the shady sides of them or next to rocks if disturbed, otherwise, they do not fly once the ground temperature rises significantly from AM to PM. Fisher witnessed one mating about 11AM. The reflective value of their wing color is certainly genetic and may allow them to tolerate the high temperatures of the site location than would otherwise be the case with darker-colored *stretchii* populations found well east of this site in Garfield Co., while the whitish wing color evidently provides better camouflage to reduce predation. **Soil Samples.** The ventral surface compares perfectly to the surface soil color. In order to verify what mineral in the soil was responsible for its light color, Fisher took a surface soil sample at two sites. One site was at the type locality (this sample was much lighter), the second site was at a location 2 to 3 miles south at about the limit of where this butterfly is first seen in the area. Garhart had the samples analyzed as follows: 1 gram of dried bulk sample was crushed in a mortar and pestle, transferred to a sample holder, and placed into an x-ray diffractor. The same was scanned using SCINTAGDMSNT software at a range of 5 to 70 degrees. Identification of albite in the sample was made using the ICDD catalog (Intemational Centre for Diffraction Data). The samples were analyzed as bulk mass samples, not cleaned samples meaning they were not sorted to extract only albite grains under a petrographic scope. The signatures of both samples and albite as graphs are provided (fig. 1). The samples contain other signatures, especially high quartz content typical of the Green River Formation (peak at 27). Albite is shown to be present in both samples (peaks 15, 21 and 29) but not isolated from the samples. The large quartz peak is indicative of alternate minerals and possibly an extensive primary weathering pattern among the soils.

Neominois ridingsii coloalbiterra Natural History and Early Stages, by James Scott (Plate V)

MATE-LOCATING BEHAVIOR. The known population occupies the lower western side slopes of the hillside below the cliff. J. Scott (and M. Fisher) found that to await females for mating, males rait (=rest "perch" to await females) in depressions, specifically sagebrush swales lower down and narrow eroded gulch bottoms farther up each little drainage, sometimes even on the roadside at the base of the slope, in the morning. When disturbed they soon return or land nearby. Raiting behavior including pursuits was seen by Scott from ~8:50-11:45 (military standard time); and by 11:50 few chases were seen, including a few from ~12:10-12:30, and one male pursued a female at 12:52. (In ssp. *ridingsii* in Chaffee Co. Colo., Scott [1973] found that males rait on little ridgetops and hilltops from 07:50 to 10:40, rarely 11:00, with maximum

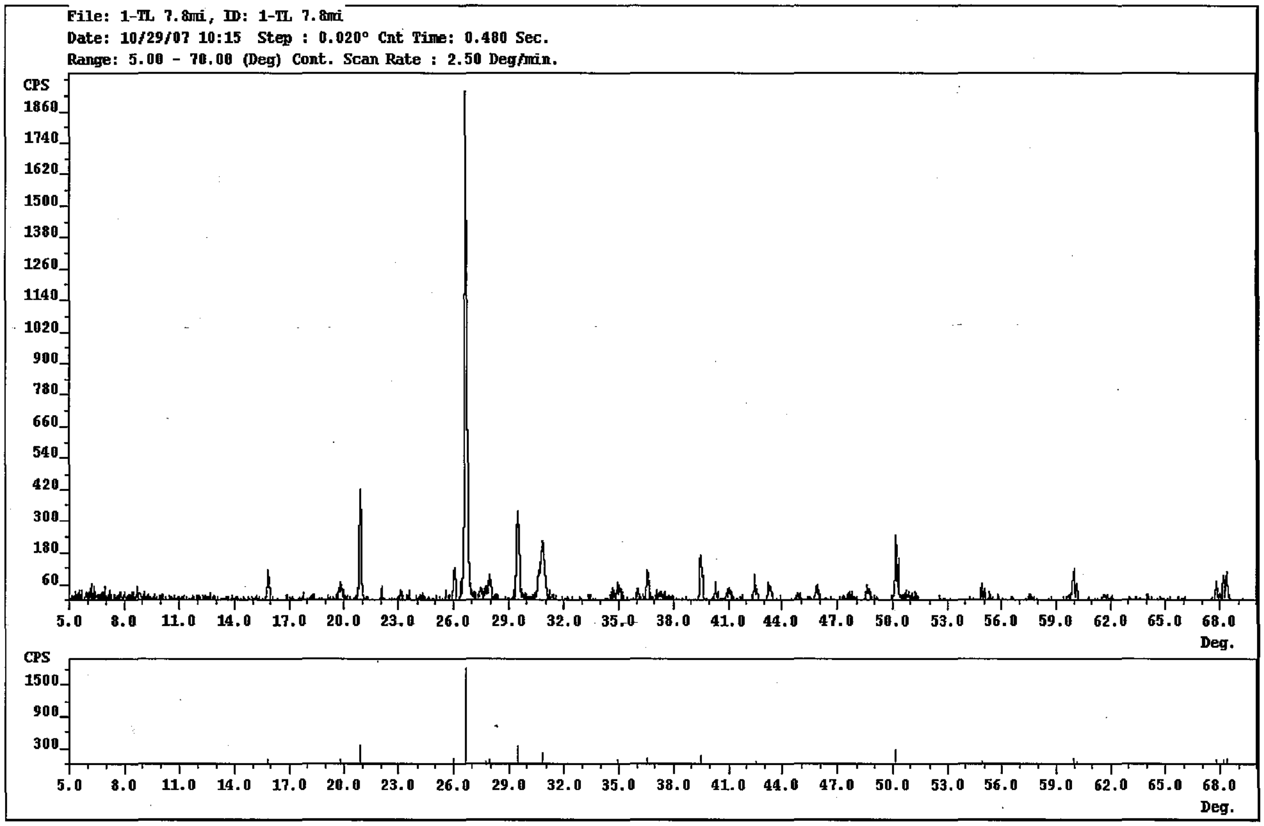
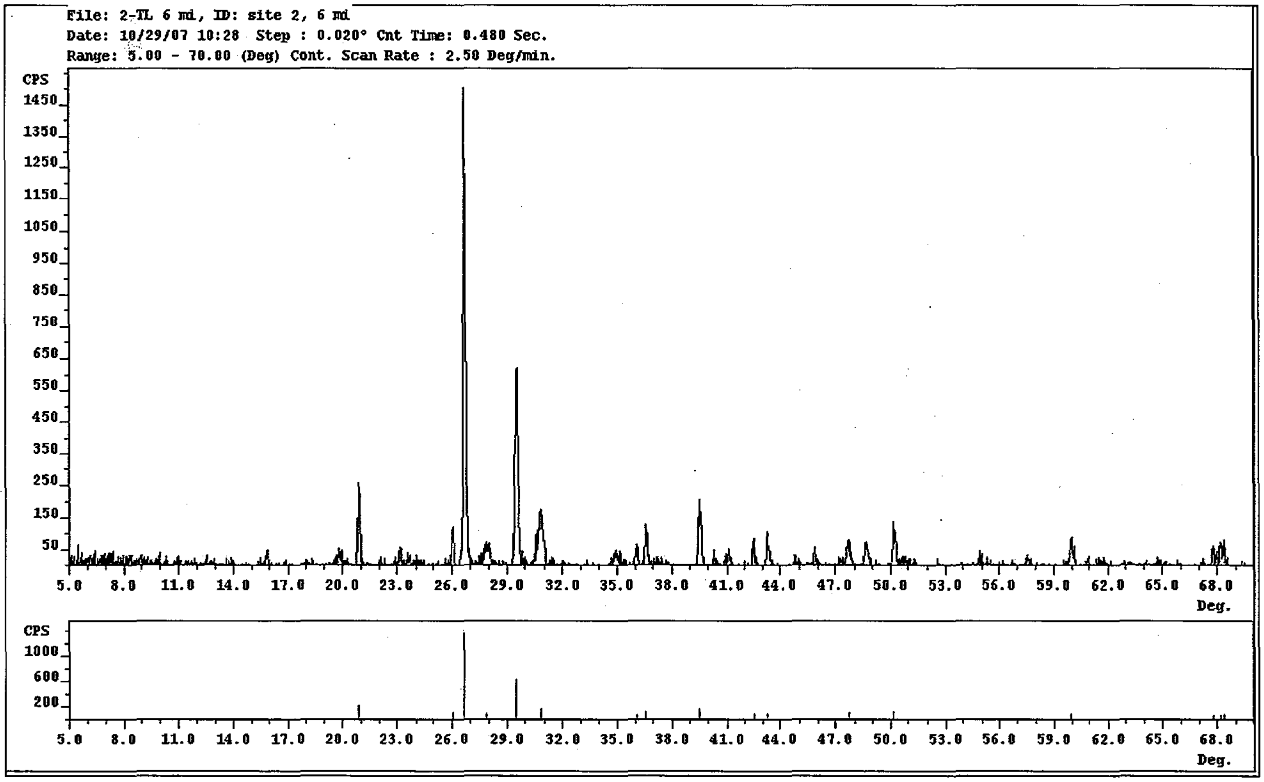


Fig. 1. Soil analysis at two sites from the habitat of *Neominois ridingsii coloalbiterra*, n. ssp. The one above is from CR 215, 7-8 miles north of Parachute, the Holotype location; below, from the approximate limit *coloalbiterra* is found, approximately 2 miles to the south.



raiting from 08:30-10:00, and observed six copulations and nine courtships.) Very early in the day in cool temperatures, Fisher noted that males land up on shrubs or cactus to bask (they spread the wings widely to expose the uppersides to the sun). Mate-locating males mostly rest on the ground, sometimes low on bushes such as sagebrush. Fisher witnessed one mating at about 11AM, and Scott saw a mated pair in a gully at 12:54 (the female flew toting the male). In early afternoon, the west-facing slope at the site becomes hot, when *ridingsii* seeks shade under bushes or next to grass clumps and does not fly unless disturbed. By 11:10 Scott noticed little raiting behavior as males would land on bushes (*Artemisia tridentata*, sometimes *Atriplex confertifolia*) 20-40 cm above ground in the hot temperature. The male reared in my basement was whitish and the female was tan, so the pale color seems to be genetic, and might reflect sunlight to help them stay cool in hot afternoons. **HOSTPLANT.** The main hostplants at the type locality area seem to be two species of rather dry-looking bunch grasses (~50 cm tall inflorescences, the clumps ~20-25 cm wide and ~25 cm tall) that have gray-green leaves that are mostly rolled into a narrow tube (involute), that grow on the dry slopes. The most common host grass is *Agropyron* (*Pseudoroegnerium* for some recent splitters) *spicatum* var. *inerme* (I saw an oviposition on this at 12:52, June 28, 2008, the egg laid on an inflorescence stalk 15 cm above ground), which seems to be about 90% of the bunch-grasses present, and has an inflorescence like beardless wheat but much thinner (var. *inerme* lacks awns, and is considered to be perhaps a species by some botanists). The other presumed host is *Oryzopsis* (in recent decades sometimes placed in *Stipa*, and recently in *Achnatherium* by splitters) *hymenoides*, which is uncommon at the southern part of the sampled TL but was about 20% or more of the clumps at the northern part; no ovipositions have been seen on this yet but its clumps of dry-looking narrow inrolled leaves look the same (though the large frilly lacy inflorescence is totally different) and the rather careless oviposition of *Neominois* females makes Scott think this is a host too (females land on a clump and lay eggs mostly on dead grass blades or dead grass stems about 10-15 cm above ground level, so that searching plants for the conspicuous large whitish eggs after the main female flight would not be difficult)(I would have done the search but it costs $50 in gas to drive there, and in trying to catch a male I grabbed an *Artemisia* to get past a steep spot of a gulch and it crumbled into bits in my hand and I fell head-first into the gulch, and my arm suffered a nondisplaced fracture so I had to baby it for 6 weeks [which was good; the inactivity cured my rotator cuff]. Ahh, the joys of lepidoptery, reminds me of the time I was driving in New Mexico enjoying the grassland scenery, and I smelled a brush fire but couldn't see it out the windows, then a mile farther on the brush fire smelled stronger, so I turned around to look and was horrified to see my sleeping bag on fire in the back of my pickup [ignited by sunlight focused by a clear jug of water], so I screeched to a stop and dragged my sleeping bag out the back and tried to put out the fire with some water, then I just stood beside the freeway in futility watching the entire bag hotly burn to a crisp on the side of the road. That was a cold trip.). (In ssp. *ridingsii* in Chaffee Co. Colo., Scott [1973] found that females have no special oviposition flight, and oviposit rather haphazardly, as he saw 6 eggs laid on *Bouteloua gracilis*, one on *Koeleria macrantha*, one on *Sitanion hystrix*, one on *Stipa comata* [all grasses], and one each on the shrubs *Helianthus pumilus*, *Gutierrezia sarothrae*, *Artemisia frigida*, and once on a dead twig while resting on *A. frigida*.) A clump of *Elymus* (now *Leymus* for splitters) *salina* was found near the road, which might be an occasional host for *coloalbiterra* also (it resembles a clump of the *Agropyron* but mostly has two spikelets at each node rather than one and the glumes are narrow & tapering ("subulate"), and the inflorescence is more dense than *A. spicatum*). Dried-out *Bromus tectorum* inflorescences are abundant, but that is not a host. *Bouteloua gracilis* is also present in the vicinity of the TL, but I saw none at the *coloalbiterra* sites. In lab, the very young 1st-stage larvae seemed to greatly prefer the more tender turfgrass *Poa pratensis* to the tougher haygrass *Agropyron repens*, but later they ate both readily with no apparent preference. There may be considerable mortality in nature when drought makes the hostplants too tough to eat when the tiny larvae hatch (the hosts have rather tough-looking involute leaves to begin with, though perhaps there are more tender leaf bases in the base of the clump). I always gave them both grasses to eat, which seemed to work well (a previous attempt to rear ssp. *ridingsii* on only *Poa pratensis* failed to get any past 4th stage, maybe because they are not adapted to tender moist turfgrasses). (In general, hay grasses—tall wide-leaved grasses including *Agropyron*—should be used to rear grass feeders in lab, because they evidently have fewer secondary chemicals to deter herbivores, as all the hay-feeding butterflies can eat many hay-grass species, while butterflies eating other grasses seem more restricted in host preference at least partly because of biochemical peculiarities of their grass hosts; see Papilio [New Series] #6.) Occasionally a little *Digitaria sanguinalis* was placed in the bottles, which they also ate. **EGG** dull white, with ridgey bumps on top of egg (smaller near micropyle), with about 19 vertical ribs on side (18, 18, 18, 19, 20 on 5 eggs); the valleys between ribs have little elliptical aeropyles and a small bumpy vertical ridge running down the middle of each valley; egg barrel-shaped, tapered near top and near bottom (size ~1.7X1.2 mm), longer than ssp. *ridingsii* egg. To emerge, the larva chews around the top of the side of the egg, until the top is hinged onto the side by a small flap and the larva can push out and emerge (this behavior is like *Oeneis*). Duration ~15 days in lab. **LARVAE.** The larvae are patterned like *Oeneis*, with similar stripes on the body, and a similar striped head on 2nd-stage to mature larvae. Scott (1986) standardized the terminology of the main bands on the body by numbering them from 1 to 6 (in his description of *Oeneis chryxus* larvae, which actually applied mostly to *O. calais altacordillera* rather than *chryxus*). Each of those six bands are fairly wide, and are dark or colored, and are separated from adjacent bands by a pale line (every band or line tends to be edged by a line or band of contrasting darkness). The longitudinally-striped pattern of alternating dark and paler bands and lines serves to camouflage the larva as it rests on grass blades. Those *Oeneis* bands also occur on *Neominois*, noted below by #1 to #6. Larvae take ~70-80 days to mature in lab if they don't die or diapause. **NUMBER OF LARVAL STAGES.** There are five stages, based on approximate width (compared to mm ruler) of pickled head capsules: 1st stage 0.9 mm (n=8), 2nd 1.3 mm (n=9), 3rd 1.7 mm (n=7), 4th 2.3-2.4 mm (n=4), 5th 3.3 mm (n=3). **HIBERNATION STAGE IS 4TH-STAGE LARVA.** I got about 12 eggs from one female by netting her over an *Elymus salina* grass clump (half were laid on dead inflorescence stalks in the clump [commonly about 10-15 cm above ground], half on the net). One was eaten by ants and 10 hatched, then a 1st-stage died Aug. 11, 2nd-stage larvae died Aug. 15 & 26, a 3rd-stage larva died early Sept., then 3 larvae went on to pupate in lab, while three 4th-stage larvae stopped growing (while still feeding some) in early Sept. and shrank in bottles of fresh grass from 12 mm to 9 mm long by late Sept. when I put them in the refrigerator to overwinter. Thus *coloalbiterra* evidently hibernates as 4th-stage larvae in nature. (The mortality in 1st-3rd- and especially 2nd-stage larvae might suggest that ssp. *wyomingo* hibernates as young larvae). By August, larvae from this site were only 3-4 mm long in lab, a tiny fraction of the ~27 mm size they would have to attain by pupation (reaffirming the total impossibility of any *N. ridingsii* population being able to produce a second generation flying at the same time as ssp. *wyomingo*). Even in lab, the duration from oviposition to emergence of adult was 93 days for a male pupa that died Oct. 2 when about to emerge (its pupa was tiny, evidently too small to survive), 103 days for a male that emerged Oct. 12, and 114 days for a female that emerged Oct. 23, so obviously the *coloalbiterra* developmental rate is not fast enough to produce a second generation in nature. **YOUNG 1ST-STAGE LARVA** grayish-tan, with heart-band (band #1) light-brown, edged by a brown line, then a grayish band (#2), a brown line, a grayish band (#3), a brown line, a wide brown band (#4) that is paler ventrally, a grayish narrower band (#5), then a weak line of brown dashes along the row of spiracles, a creamy narrower band (#6) along lateral ridge, then a weaker brown wider line, underside pale-tan; A10 has two fairly-long tan tails; legs & prolegs pale-brown; head grayish-tan with red-brown short setae, the coronal sulcus and adfrontal sulcus brownish. **OLDER 1ST-STAGE LARVA** has gray heart-band (#1) edged by a cream line, a creamy-gray band (#2), a gray line, a cream band (#3) that consists of a creamy wide line and then a russet wide line near the center of the band and then a wider cream line at the bottom, a wide gray band (#4) that is darker at the edge, a cream line then a very narrow russet line, a creamy-tan narrower band (#5) containing spiracles, a russet line, a cream lateral ridge band (#6), a wider russet line, underside grayish-tan; legs & prolegs tan. Duration ~23 days in lab. Young larvae seem to grasp the leaf fairly strongly. **2ND STAGE LARVA** tan, with pattern similar to older larva, with heart-band (#1) grayish-black, a cream line, a narrow russet line, a creamy-gray band (#2), a gray line, a cream wide band (#3) that has a mottled-light-russet center (this band extends onto top of tail as a cream band), a wide blackish-gray band (blackish at the edges)(#4) that tapers to a point on tail, a cream line, a tan band (#5) containing black spiracles that is creamier on side of tail, a cream lateral ridge band (#6) that is slightly orangish in the middle of each segment, underside tanish-gray, legs & prolegs tan-gray; two long tails; head has a slight reddish-tan look because of grayish or grayish-tan ground color with fairly-weak brown stripes (one near midline, one farther to the side, one curving from eyes to the wide blackish-gray body band #4), the largest eye brown. **OLDER (4th stage on Pl. V) TO MATURE LARVA** striped longitudinally, heart-band (#1) grayish-black (blacker at the edge)(overall look on live larva blackish-brown), a cream line, a narrow russet line, a tan band (#2) full of tiny russety wiggly anterposterior dashes (making the overall band look russety-tan), a blackish line, a wide cream band (#3) consisting of a cream line on top then most of the interior filled with tiny russety squiggly dashes (making the overall band look light-russety-tan) then a wider cream line at bottom (band #3 is brighter than band #2), a blackish line edging top of a wide grayish-tan band (#4) (segments A3-8 have blackish infusing this band from the blackish upper edge downward which happens toward the front & rear of each segment) that has a brown edge of bottom of band (#4 overall looks light-brown & very-dark-brown in a scalloped pattern), a cream line, a russety narrow line, a grayish-tan band (#5) that contains russety squiggles and black spiracles (this band a bit greenish on T1-2)(#5 overall looks light-brown), a slightly-russety line at lower edge of #5, a cream lateral ridge (#6) (slightly reddish below spiracles), underside grayish-tan (light-translucent brown with dark splotches just below cream lateral band, these splotches directly below the scalloped dark patches noted in band #4); two tails are brown middorsally, then band #3 becomes cream on top edge of each tail, bands #4-5 run into a dark-tan wedge on tail, then the cream lateral ridge (#6) becomes tan-cream on side of tail; legs reddish-tan, prolegs slightly-reddish-tan; head tan with brown stripes (due to tiny blackish dots) including a stripe beside the coronal-adfrontal cleavage line, a stripe toward the side, a weak brown stripe curves from eyes toward body band #4, frontoclypeus slightly-browner tan with two blacker dots near top and several in lower corner, eyes are reddish-brown circles, edge of head capsule lateral to labrum dark-brown, mandible tips blacker. About 27 mm long when mature. **GREENER & MATURE LARVA.** Two % of the three older larvae were brownish, as noted above. The third larva—the last one to mature rather than diapause--was greener &. The details of the body pattern were the same as the brownish larvae above, but the heart-band (#1) was blackish, bands #2 & #3 were greenish-tan, #4 was gray-green and rather mottled, #5 was tan with large gray-green patches, & the lateral ridge #6 was grayish-green. **PREPUPA AND PUPATION.** In my little lab bottle, the larva chewed up frass to make a bed to lay on (in nature the larva presumably pupates in a chamber in the base of the grass clump on loose detritus at the clump base, using a little silk and bits to lay on (the ssp. *ridingsii* prepupa worms itself into the soil like *Parnassius phoebus* prepupa and pupates ½" underground [W. Edwards 1997, Butt. N.A.]; Clyde Gillette [pers. comm., & photos of pupal shell] found that Utah *stretchii* pupate in a loosely-silked nest in soil, like the closely-related *Oeneis* & *Hipparchia*). About 3 days before pupation, it lays down on its side or back in the bottle and curls up in a shallow-bowed shape (convex ventrally), and rests in that shape until finally pupating (this long period also occurs in *Oeneis*). **PUPA.** Stout, ellipsoidal but abdomen more conical toward the short blunt cremaster; T1 spiracle giant, semicircular, red-brown, the convex rear edge whitish; cremaster red-b rown, appearing U-shaped ventrally, with <u>no crochets</u> (crochets seem to be absent in all the related butterflies *Neominois*-*Oeneis* etc. that pupate in a chamber in loose soil-detritus). Duration 18 or perhaps 19 days for pupa that died due to being a runt, 19 & 23 for pupae that emerged male & female. **NEW (3 HOURS OLD) PUPA.** Head tan, T1 yellow-tan, T2 & wings pale-yellow, top of thorax & abdomen cream-tan, heart-band on abdomen dark-yellow and a stripe on head (weak T1 & front of T2)-T3 but irregular like a chain of spots on A1-7 (narrow at front & wide on middle & rear of each segment), a weak brown dorsolateral line on A1-7, band #4 of larva is represented by a narrow brown laterodorsal line & then a wide band of slight brown mottling then a second narrow brown line. **OLDER (18 HOURS OLD) PUPA** orangish-brown, wings light yellow-brown, with the same abdominal pattern (the heart band & two dorsolateral brown lines) becomes weak, one pupa had a weak brown subdorsal line on T2 & A1-2. **Older pupa** reddish-brown, wings slightly yellower-brown, then nearly same color as rest of pupa, with same abdominal pattern that is very weak (nearly absent), base of mouthparts reddish-brown, legs & antenna dingy yellowish-tan. **PUPA NEAR EMERGENCE.** The A3-4 joint becomes narrowly black, the A7-8 joint very narrowly black, and the other abdominal joints become a bit black also (the A2 & A4-7 segments become blacker at the rear); wing pattern of adult becomes visible and the head & thorax become blacker; antenna shaft reddish-brown, but the club is ochre over most of its length and dark-brown at the distal 1/3. **NEW & PUPA FROM GREENER LARVA.** Head & T1 & T3 greenish-creamy, T2 & wings pale-green, A1-8 cream, heart-band on A1-7 is like on larva (narrow on front of each segment then wide on middle & rear of each segment), larval band #4 is visible on A1-10 by having two weak brown lines (strongest on A4-7 and weak at the ends) with a trace of brownish mottling between them, two weak supraventral lines of translucent dashes & spots on A4-6, T1 spiracle a red-brown semicircle, cremaster red-brown. **OLDER & PUPA FROM GREENER LARVA** orangish-brown on head thorax & abdomen, wings and most of appendages dingy greenish-yellowish-tan, antennae tan, heart-band brown on abdomen (with the usual chainlike shape), two extremely faint dorsolateral darker lines on abdomen, T1 spiracle & cremaster red-brown. **COMPARISON OF EARLY STAGES TO SSP. *RIDINGSII*, "*DIONYSUS*", & WYOMINGO.** The egg has about the same number of vertical ribs, but *ridingsii* eggs are greener (greenish-white), and are nearly oval in side view versus barrel-shaped in *coloalbiterra* (which looks like it has been elongated 20% in the middle). The older *ridingsii* larvae were much greener on head and body (for instance the heart-band is green and band #2 [except the top] and all of band #3 are light-green and band #4 is mostly dark-green and the head ground color is light-green), and *ridingsii* has the upper part of band #2 a little rosy-brown and has a bright <u>rosy</u> stripe below the spiracles at lower part of band #5, and the tails are upturned a little (versus just slightly in *coloalbiterra*). Todd Stout's Emery Co. Utah whitish-adult "*dionysus*" are more like *coloalbiterra* but are variable in overall color, tan to dark brown, and lack green and lack rosy bands. Wasatch Mts. Utah *wyomingo* (Todd Stout, Dale Nielson) looks like *coloalbiterra* but has more reddish, thus the upper edge of band #2 is more reddish and an odd reddish-orange-tan 3-toed pawlike blotch covers band #5 and extends into the creamy narrow lines beside it. Both these ssp. have the largest head stripe wider than *coloalbiterra*. These differences seem rather large (although one *coloalbiterra* larva was somewhat greener), making me wonder if there are several species. Is *ridingsii* a different species (with *minimus* and *neomexicanus*), that also occurs in the Sierra Nevada as *pallidus*, while *stretchii* & *coloalbiterra* and *wyomingo* is a second species? But *wyomingo* seems to be similar to *coloalbiterra* (& presumably *stretchi*) yet shows more rosy coloration maybe tending toward ssp. *ridingsii*.

<u>Note on white minerals, white soil, & global warming</u> (written by J. Scott in consultation with Bob Cobban, 1st author of the recent-revision of the book Minerals of Colorado [originally authored by Ed Eckel], pers. comm.). This butterfly evidently evolved its whitish coloration for camouflage on the whitish soil (though the whitest area is now buried under waste mining rock dumped down the slope). White minerals not only affected the butterfly, but also tell us the fate of the earth affected by global warming. Albite is $NaAlSi_3O_8$, called Soda Spar (for soda feldspar) when relatively pure, a white mineral common in certain oil-shale layers of the Eocene-age Green River Formation (this formation is mostly dolomite & ankerite which are brown), esp. the Parachute Creek member, which forms cliffs around the Roan Plateau (including the TL) and elsewhere in NW Colo. & NE Utah-SW Wyo. The albite originally came from volcanic ash (tuffs) landing in the ancient lake bed, then algae made the water alkaline, and the albite was formed and deposited in the lake. Zeolites (including analcime $NaAlSi_2O_6$-H_2O which is common in Green River Formation oil shale) form in those alkaline lakes too. Albite is the more-acidic end of a continuous series of six replacement minerals in Plagioclase Feldspar (the more-basic end being anorthite, $CaAl_2Si_2O_8$); weathered feldspar forms clay. The pH of the original lake affects the minerals deposited because volcanic ash is more soluble in more-alkaline water, so albite tends to be more common in the center of alkaline lake basins, and zeolites more common at the margin. Albite has been found in all oil-shale samples, and is common in the Parachute Creek Member within the Green River Formation (the best reference is "X ray mineralogy of the Parachute Creek Member, Green River Formation, in northern Piceance Basin, Colorado. Geological Survey Professional Paper 803, 1973; quartz is common in all samples). The Parachute Creek Member forms a vertical cliff higher on the side of the Roan Mesa than the butterfly locality, which occurs below the Green River Formation on the Wasatch Formation. The Wasatch Formation consists of claystone, shale, & sandstone according to the Geologic Map of Colorado compiled by Ogden Tweto 1979. Thus from the map and Bob Cobban, the butterfly localities occur where bedrock under the surface consists of the multicolored Wasatch Formation (the Green River-Wasatch contact is at the top of the uppermost reddish shale), and the whiter color of the soil surface is thus evidently due to slopewash/dirtslides of albite-containing dirt and rock from the Parachute Creek Member cliff higher up, the albite sliding down the Green River Fm. slope at base of the cliff, to the Wasatch Fm. badlands below; a geologist would have to survey the site to determine the details of this process and the depth of the albite-rich surface layer. The whitest area of the TL was where the cliff and steep slope was very close to the road, but in 2008 at that stretch of about 1 mile, a mining company mined rock from a narrow layer on the Parachute Creek Member about halfway up the cliff (probably the Mahogany layer of rich oil shale), and instead of disposing it in a few piles or gulches by sliding it down a few chutes as they should have, they just dumped the waste rock all along the slope, covering the entire slope and ruining it. Scott is not against mining, but ruining 1500 vertical feet of slope to mine 10 feet of rock is incredibly disgusting. Bob Cobban notes that in dry climates, a whitish color on the soil surface is usually due to sodium sulfate (called mirabolite, which dehydrates to glauberite) rather than sodium carbonate; but the white color at this butterfly locale is evidently due to tiny insoluble albite grains and not to sodium sulfate or the above sodium carbonates which are soluble and would be washed away on the slopes. The water-soluble sodium carbonates (nahcolite & trona) are not the cause of the white soil color as they are much more common farther north near Meeker, and they would dissolve and be washed away. Nahcolite, $Na(HCO_3)$, is basically baking soda (so is white when pure), and is common in rocks near Meeker and Rifle in the Piceance Creek Basin. Trona is a natural vitreous gray or white mineral, $Na_3(CO_3)(HCO_3)$-$2H_20$, which is sort of half carbonate and half bicarbonate, and is common in some closed-basin dry lakes of the San Luis Valley (the only place in Colorado where it has been proven to exist) and Green River Wyo. and African rift lakes, but any kind of drainage in groundwater or on the surface washes it away, thus it is doubtfully present in significant concentrations in Garfield Co. When baking soda and water evaporate in drying desert lakes, trona can form. Natron is Na_2CO_3-$10H_20$ (the flamingos breed in Lake Natron in the East Africa rift valley). All of these have <u>na</u> in the name, because na is the chemical abbreviation for sodium. Dawsonite is $NaAl(OH)_2CO_3$, a nahcolite-like mineral that is common in the N end of the Piceance Basin, forming up to ¼ by weight of oil shale, associated with albite. These minerals form at different levels of CO_2 in the atmosphere: at 1200 ppm (many million years ago) nahcolite formed, at 380 ppm (about the concentration now--it was 280 ppm 1850 at the start of the industrial revolution) trona would form, and at 500 ppm which we will suffer from later in this century (550 is predicted for the year 2100), natron forms. These minerals are interesting because of the current global warming crisis. R. Demmico (Science Mag., Sept. 29 2006, 313:1928) has a chart showing how nahcolite, trona, & natron precipitate at varying CO_2 concentration and temperature (at current CO_2 concentration of 380 ppm, trona crystallizes above 25^0C in a dozen saline lakes worldwide, while natron forms at lower temp.; nahcolite precipitates only at higher CO_2). The CO_2 was >1125 ppm in the early Eocene, which caused a greenhouse effect making temperatures high worldwide and forming nahcolite up to ~300 m thick in the Piceance Creek Basin/Roan Plateau of Colo. CO_2 was even higher in the Pennsylvanian Period when most of the world's coal deposits were laid down (and higher 30% oxygen concentration allowed 1 m-wingspan dragonflies to exist—O_2 varied from 10-23% from the end of the Triassic to the present), and at the start of the Triassic CO_2 was 5X that of today or 380X5=1900 ppm (note that the Permian-Triassic boundary marks the time of the greatest extinction known on earth, at least since the PreCambrian, as ~80% of the world's species went extinct because of enormous volcanic eruptions in the Siberian Traps and the associated emission of CO_2 and especially sulfur which produced sulfuric acid that acidified the oceans). This means that some life on earth will evidently survive global warming even if the CO_2 gets that high, though the cold-adapted species will retreat, the polar bears will drown, and species with small ranges will mostly become extinct.

Neominois ridingsii curicata Michael S. Fisher, James A Scott, and Matthew C. Garhart, NEW SUBSPECIES, Common Name Curecanti Satyr (plate I)

Definition: This is the darkest of the known races, much darker than *stretchii* and *wyomingo*. Similar in maculation to *N. ridingsii ridingsii*, but darker. The postmedian spots on the ups hw are concise, not elongated, and the distal edge has a shallow or normal *ridingsii* serration pattern (the uph postmedian band is not very zigzag, just scalloped distally, thus is like *ridingsii*, and is less zigzag than *stretchii*). The ground color in the median portion of the wings is very dark brown, not lighter brown or gray-brown as is ssp. *ridingsii*. The postmedian spot bands on both wings are yellowish cream rather than off-white or whitish cream as they are in *ridingsii*. The entire ups surface is overlaid with this color making adults look rather chestnut brown; the lighter areas on the ups are also yellowish cream. The ground color of the ventral surface is the same dark brown color and overall with a very striated appearance, perhaps not more than seen on ssp. *ridingsii* but more striking because it has hints of the upper yellowish tone overall and is mixed with contrasting white scaling. The mesial band on ventral hw is well defined and bordered outwardly heavily with white in the postmedian band. White scaling is less concentrated elsewhere, scattered except in the fw cell and costa but to a lesser degree. The fw length of the holotype male is 22mm. It has one generation, mostly in M June-July. **Comparison to other subspecies in Austin (1986).** *N. m. pallidus* (TL in Mineral Co.. Nevada) is gray brown dorsally with white postmedian bands and gray ventral color. *N. m. minimus* (TL in Saskatchewan, Canada) is dark gray brown dorsally with cream postmedian bands noted to be heavily overscaled with dark brown (but the maculation pattern above is not obscured), brown ventral color (and the ventral pattern is very well defined also not obscured). *N. m. neomexicanus* (TL in New Mexico), pale brown dorsally with cream colored postmedian, ventral color pale creamy moderately overscaled with dark brown (maculation pattern weaker to very well defined but weakness not due to overscaling noted). Ssp. *neomexicanus* is described as darker than *ridingsii* but nowhere near as dark as this new subspecies. The postmedian hw bands of *neomexicanus* exhibit a wide degree of variation and appear to be wider than most (but not all) ssp. *ridingsii* based on the type and paratypes Austin illustrated, somewhat approaching those of *wyomingo* except the bottom serration border is shallower. **Types & type locality:** Holotype male (plate I) Colorado: Gunnison Co., Big Mesa, 1 mi. S. Hwy 50 off CR31 and SR 149, 7800 ft, 14 June 2003, M. S. Fisher (MSF). Allotype female (plate I) Colorado: Gunnison Co., [old] Iola Township, Blue Mesa Reservoir, off SR 149, 7600 Ft., 26 June 2006, M. S. Fisher. Both types deposited in the Gillette Museum of Arthropod Diversity, Colorado State University, Ft. Collins, Colorado. Paratype specimens collected between 2002 and 2007 from Gunnison and Hinsdale Cos. reside in the Fisher collection. Additional paratypes reside in the collections of J Scott and M. Garhart (see below). **Range:** This subspecies occupies the Gunnison River Valley, in typical form near Blue Mesa Reservoir area south into Hinsdale Co via the Lake Fork of the Gunnison River to just west of Lake San Cristobal (9000'), eastward to near Gunnison; at the east end of the valley (near Sargents) the populations are somewhat intermediate to ssp. *ridingsii*, as noted below. **Name:** Curicata was a chief of a band of Tabeguache Ute Indians (his twin brother Kaniache was involved in the massacre at Guadeloupe, and he had a famous daughter Towa for which Towaoc, the Ute Mountain Agency Village south of Cortez, Colorado, is named). The word Curecanti is a corruption [modernization] of Curicata's name. Curecanti Creek and Curecanti National Recreation Area are near the type locality. **Previous figure.** Austin (1986, fig. 1) pictured a specimen of *curicata* from Gunnison Co. collected by J.P. Savage, 28 July 1984, the locality given as "cut of road. Lake City..." and noted "Many of these are very dark brown with no hint of gray, the submarginal bands are heavily clouded with brown and the ventrum is very heavily overscaled with the same brown It is unknown if this is usual or following a poor growing season." The locality given is incorrect, & should read "Lake City cutoff road." There are two Lake City cutoff roads joining to US Hwy. 50. One, County Road 26 is about mid-way along the south shoreline of Blue Mesa Reservoir west of the junction with State Hwy. 149. It crosses Sapinero Mesa. The other, County Road 25, is nearer the west end of the lake and crosses Pine Creek and Willow Creek Mesa. Both separately join into State Hwy. 149, about 25 miles south which is the main highway leading into Lake City (Hinsdale Co., ~8500'). It seems most likely the collection site is at either one of these points, a short distance off highway 50. The upland sagebrush community habitat and elevation is fairly uniform throughout this area and is just west of the type locality of this new subspecies. **Variation and Discussion:** Central western Colorado populations of *N. ridingsii stretchii* (noted above and below) have less-dark brown ups with yellowish color in the lighter areas of the wings. *Curicata* also has yellower color, which is completely unlike those populations of *ridingsii* east of the Continental Divide in eastern Colorado. *Curicata* is darker than most *stretchii* found in the Colorado River drainage some 50 or more miles north. The type specimen represents an average among the type series. Some are even darker over the entire ups and uns, to the point of nearly obscuring the spot bands dorsally. Some possess moderate to heavy striations over the ups wings, which are especially noticeable when they mark through the lighter areas and spot bands; striations tend to be more pronounced at higher elevation. The majority of specimens from three separate locations in the Gunnison Valley, from the town of Gunnison west through the Blue Mesa Reservoir area, are distinct and consistent. Additional variation is noted, as follows: An individual or two is seen with lighter wings, both lighter brown and yellow but never the typical color of ssp. *ridingsii*. Eastward in the Gunnison Valley, from 0.2 mi. E Dawson Creek, US50, 3.7 mi. E Sargents, Gunnison Co., July 21,1981 (J Scott)(M. Garhart caught specimens near here), 9 males are intergrades toward *curicata*, as many are dark like the types from the west, but some are somewhat lighter resembling ssp. *ridingsii*. A male from 10 mi SW Monarch Pass (near Sargents) July 29,1967, J. Scott, also seems to be somewhat intermediate to ssp. *ridingsii*, which occurs just southeastward in the San Luis Valley over the Continental Divide. Some of Fisher's paratypes from 9000 ft in Hinsdale Co. (locality noted above) are also lighter, though some are typically marked and colored but smaller in size. One paratype male (from the TL) has a more deeply serrated distal edge of the hw postmedian band, similar to that of *stretchii*. This should be expected on occasion because this is the common condition found in most western Colorado populations (in ssp. *stretchi*) including those somewhat proximate to but west of Gunnison Co. and at lower elevations in Montrose and Ouray Cos. **Hostplant and Behavior:** The hostplant is unknown. There are several bunch-type grasses which may serve as hosts and occasional patches of *Bouteloua* may be found in the area occupied by a population. The best population locations seem to be at the bases of hills where the drainage features merge and the slope flattens out. Males tend to fly back and forth through gullies or the ravine features in search of females. Males usually sit or rest in low spots, on bare ground or rocks, not actively flying unless disturbed or engaging other passing males. Males at the locations sampled by Fisher do not appear to move up toward summits but the population located at the type locality is found just below the summit which is a lower bench, flat with little slope at the base of the adjoining high mesa to the south where it does occur but not on the higher mesa top. It does not exhibit any tendency to hilltop. Females are very sedentary and difficult to locate.

Neominois ridingsii ridingsii Distribution, by J. Scott & M. Fisher (plate I)

Because we are naming several new ssp. of *N. ridingsii*, we also carefully redefine most other ssp. (*ridingsii*, "*neomexicanus*", *stretchi*, *wyomingo*, *pallidus*) in order to properly compare all the ssp.

Definition: This ssp. is normal in size (not large like Glenwood Springs *N. r. stretchii*), the ground color is brown, the pale ups patches are creamy in color (not especially yellowish as are most *stretchii*), the pale ups patches are not especially large (they tend to be larger in *stretchii*), and the basal edge of the uph postmedian band seems less zigzag (straighter) than *stretchii*, while the distal edge of the uph postmedian band is less zigzag also (merely scalloped). Ssp. *ridingsii* has one generation mostly in June (into July at higher altitude in the mts.), and is widespread. Where it overlaps the range of *N. r. wyomingo*, Scott has specimens from Chugwater in Platte Co. Wyo., south to Terry Road just N of Colorado in Laramie Co. Wyo., and 8 km NE of Nunn and Round Butte in Larimer Co. Ordinary ssp. *ridingsii* occurs southward to the plains SE of Denver (and occurred in the Denver suburb of Lakewood before houses exterminated it), the Front Range foothills (Guy Hill, Lookout Mtn., Mother Cabrini Shrine, and Green Mtn.), barely into Gilpin Co. (North Clear Creek), in South Park, on the plains N of Pueblo in Pueblo Co., south to Union and Colfax Cos. in NE New Mex., in the Wet Mts. and Wet Mtn. Valley, all around the San Luis Valley south to San Antonio Mtn. barely into Rio Arriba Co. New Mex., along the Arkansas Canyon from Royal Gorge to Salida and Buena Vista and Maysville as far upstream as N of Granite in Lake Co., and on the W slope of the continental divide in Grand Co. Scott has two specimens from the low grassy ridge just NW of Cripple Creek (Aug. 10, 1969, Aug. 10, 1972), which is a Teller Co. record on recent USGS county record butterfly maps that lack Teller Co., but actually the original 1957 Colorado Butterflies book clearly wrote that it occurs in Teller County. Adults look very similar throughout this range, though individual variation is great, and some specimens are rather dark (even at low altitude such as Green Mtn. in Jefferson Co.) and others are paler, and there is a lot of individual variation in the pattern of markings on the wings. But *ridingsii* is clearly a smaller brown bug with creamy patches and more modest patch size and markings, the distal edge of postmedian band merely scalloped.

Ssp. *ridingsii* ranges northward to Canada (as *minimus*), and occurs in the Black Hills of S.D. (Marrone 2002).

To find females, males rait (="perch to await females") on low ridgetops and hilltops, early in the morning. (Raiting is contrasted with fleeking "patrolling to find females" in the new terminology for mate-locating behavior proposed and discussed at the end of Papilio #14 by Scott).

The usual hostplant of ssp. *ridingsii* is the wide-bunch turfgrass *Bouteloua gracilis* (Scott [1973] found 6 ovip. on *B. gracilis* and 2 on *Artemisia frigida* near *B. gracilis*, 1 on *Koeleria macrantha*, 1 on *Agropyron [Elymus] longifolius*, 1 on *Stipa comata*, 1 on *Helianthus pumilus*, 1 on *Gutierrezia sarothrae*, all reported in Papilio [New Series] #6, 1992; and Fisher recorded *B. gracilis* as a host in Lepid. News 1971#3).

Neominois ridingsii "neomexicanus" Austin Comparison, by J. Scott

Definition: This ssp. resembles ssp. *ridingsii* in color and pattern and small size, except it is a little paler on average. It is a rather weak ssp., and could be treated as a synonym of *ridingsii*. It has one generation, mostly in June. Scott has a series from the Zuni Mts. in New Mex. near the TL, and has several from Rio Arriba Co. in northern New Mex. that look similar (1 male Encino Lookout, 9957', June 19, 1978; 1 female Rio Gallina at edge of San Pedro Parks Wilderness, June 15, 1978). Being a little whiter, it thus tends a bit toward the new ssp. *coloalbiterra* named in this paper, but is not much different from ssp. *ridingsii* and matches the paler individual variants of *ridingsii*. *Neomexicanus* is different from both the new ssp. named in this paper.

Neominois ridingsii minimus Austin Comparison, by J. Scott

Definition: This ssp. resembles ssp. *ridingsii* but is smaller, and thus could be considered a syn. of *ridingsii*.

Neominois ridingsii pallidus Austin Comparison, by J. Scott

Definition: This resembles ssp. *ridingsii* in wing pattern and lack of yellow color and in fairly-small size, except it is whiter. It thus is an oddly-disjunct relative of ssp. *ridingsii*. It occurs in the higher Sierra Nevada of Calif., the adjacent White Mts. of Calif.-Nev., and the Wassuk Range, Pine Grove Hills, and Sweetwater Mts. in W Nev. It is quite unlike the two new ssp. named herein.

Neominois ridingsii stretchii Comparison, by M. Fisher & J. Scott (plate I)

Definition: The ssp. *stretchii* differs from ssp. *ridingsii* by having a yellower shade to the lighter ups spots, the paler areas of the ups tend to be larger on average, and the distal edge of the uph postmedian band tends to be more zigzag (less straight, with longer V-shaped indentations (*ridingsii* is evenly scalloped). It has one generation, mostly in June. This ssp. is also rather variable individually, as some are dark and others are pale, and there is a lot of variation in the wing markings. A series from Robinson Summit, White Pine Co. Nev. (June 16, 1972, J. Scott), is probably typical, medium in size with yellowish ups. Some populations differ also. The Glenwood Springs (Garfield Co.) populations (on little sage-covered hills near town) tend to be much larger in size, almost giant. The population on Diamond Peak in Moffat Co. tends to be paler (a little creamier on the paler patches, and the brown areas often paler, though many are yellowish), and Scott has several males from there that are much creamier and the brown areas have a lot of cream also, and these look similar to the new ssp. *coloalbiterra*. Thus the Diamond Peak population evidently shows a bit of intergradation toward *coloalbiterra*. A population from S Utah (½ mi. S Hatch, Garfield Co. Utah, July 18, 1972, J. Scott) is also a bit whiter than most *stretchii* (although most adults esp. females are somewhat yellowish), and several males are paler near *coloalbiterra* also.

Hibernation evidently occurs as **4th-stage larvae**, because Todd Stout (pers. comm.) obtained 50 eggs of the Rilda Can. (up Huntington Can., in Emery Co., Utah) population (whose adults resemble Robinson Summit Nev. *stretchii*) and reared them to 4th-stage on Sept. 29, 2004.

Neominois ridingsii wyomingo Redefinition, by J. Scott & M. Fisher (plate I)

Definition: We are now able to characterize the appearance of adults of this ssp. in a satisfying way (Scott's original description was based on biology and did not distinguish its wing pattern differences very well). This ssp. has wing pattern (the size of the pale areas and the extent of zigzaging on the basal and distal edge of the uph postmedian band) mostly like *stretchii*, but differs by having the ups pale areas creamy in color (less yellowish), like *ridingsii*. The ups pale spots tend to be longer/less neat than *ridingsii*, mostly like *stretchii*. The uph postmedian band has the basal edge more irregular than *ridingsii*, thus the V-shaped indentations tend to be longer; and the distal edge of this band is more zigzag than *ridingsii* (fewer are evenly scalloped as are most *ridingsii*) and mostly like *stretchii*. Some *wyomingo* populations vary a little in appearance, namely the population in Sinks Can. SW of Lander in Wyo., which looks paler light-brown (but still creamy-spotted) on the ups. But all the other *wyomingo* populations in Wyo. and in Boulder and Larimer Cos. Colo. look similar (of course, there is considerable individual variation, as in *stretchii* and ssp. *ridingsii*). It has one generation like all the other *N. ridingsii* ssp., but it flies in late Aug. and early Sept., evidently because it diapauses as very young larvae (see below), rather than nearly-mature (evidently 4th-stage) larvae as the other ssp. do. And mate-location occurs in swales, unlike ssp. *ridingsii* which mate-locates mostly on low ridgetops and hilltops, although ssp. *coloalbiterra* and evidently ssp. *curicata* rait in swales also (mate-locating behavior of ssp. *stretchi* was not studied well by us, though the populations we studied did not occur on ridgetops/hilltops, so *stretchi* presumably raits in swales/gulches).

Wyomingo overlaps the range of ssp. *stretchii* by hundreds of miles, as it has been found in the Wasatch Mts. of N Utah, and both occur in SW Wyo.

Wyomingo overlaps the range of ssp. *ridingsii* by 500 miles from N Colo. through Wyo. to C Montana (the overlap is more than 100 miles just in our specimens). Fisher found typical *wyomingo* in Boulder Co. (Hwy. 36, 5 mi. N Boulder, 5800', Sept. 6, 1975, 1m fig. by Fisher 2005a [p. 6]), and collected a series in Larimer Co. (Cherokee State Wildlife Area, 7000', Rd. 80C along Meadow Crk., Aug. 17, 2003, 6m). (Fisher caught a female from Red Feather Lakes Rd in Larimer Co. [11.5 mi. W hwy 285, 7200', Aug. 22, 2003] which resembles ssp. *ridingsii*, but is dark, and may be ssp. *wyomingo* based on its flight time.) F. M. Brown (1957, Colo. Butt.) noted it in Larimer Co. (as a "2nd gen." of *ridingsii*). Cliff Ferris found it in Laramie Co. Wyo. (30 mi. N of Cheyenne) on Aug. 30, and found ssp. *ridingsii* at the same site on June 28 (2000 Lepid. News 42 suppl. S1, p. 27). In the *wyomingo* OD, Scott reported it in Moffat Co. Colo. and all over C and S and N-C Wyoming, including Cheyenne, in and around Casper, and Goshen Co. in E Wyo., and SE of Gillette in N-C Wyo. It evidently occurs over approx. the southern half of Montana, as Steve Kohler & Chuck Harp & John Christenson have reported it in the Season Summary of Lepid. Soc. all across S Montana (Silver Bow, Madison, Gallatin, Park, Carbon, Big Horn Cos.) and northward in S-C & SE Mont. (Yellowstone, Custer Co.) and near the mts. into NW Mont. (Lewis & Clark Co.). In C Wyo., Scott found *ridingsii* 1 mi. S Chugwater in Platte Co. Wyo. June 25, 1966, and ssp. *ridingsii* evidently occurs continuously northward to Saskatchewan (where it flies in late June), as county records show it ranging continuously from N. New Mex. to Canada (ssp. "*minimus*" northward resembles ssp. *ridingsii* except that it is a little smaller, so Scott treats it as a synonym). Thus *wyomingo* and ssp. *ridingsii* evidently overlap all the way from N Colo. to S Montana & Canada. *Wyomingo* evidently flies in the Pine Ridge of NW **NEBRASKA** also (**new state record**), as R. Leussler wrote (in Ent. News, 1938) that in 1911 he found two broods near Harrison Neb., on June 16-30, and on Aug. 17; he noted that adults were variable, and some specimens esp. of the later brood resembled *dionysus* [a syn. of *stretchii*] with eyespots larger and ground color at base lighter, and sharper dentation of postmedian band of secondaries; of course Leussler's second "brood" is really ssp. *wyomingo*, as the flight time and all of those wing pattern traits (pattern of *stretchii* and paler color of *ridingsii*) describe *wyomingo* very well!

A. G. Lauck found *wyomingo* common in the Colo. Front Range mountains at the [E] entrance to Rocky Mtn. Nat. Park in Aug. 1950 (Lepid. News 4:95). And Ritterbush (1972) found it common in Rocky Mtn. NP on Sept. 2, 1956 ("the meadows of Moraine Park from Eagle Cliff to Moraine Museum were simply alive with the things"). Recently, Lynn and Gene Munroe and Richard Bray (pers. comm.) found that population of *wyomingo* on a S-facing slope at the E side of Rocky Mtn. Nat. Park (below Eagle Cliff, 8250', on upper edge of sloping bench above Bear Lake Road to E of Bear Lake Rd.), where adults were found in areas with several dominant grasses (*Bouteloua gracilis*, *Agropyron [Elymus] spicatum*, *Muhlenbergia montana*). They found that this population flies only L Aug.-E Sept. (Aug. 22, 29, Sept. 4, 12) as does other *wyomingo*, and no other *Neominois* flies there earlier in the year (despite search in June/July), so it is clear at this location that the late flight is NOT a second generation, and diapause must occur in an early larval stage in Rocky Mtn. Nat. Park.

The Munroes sent us six photos of wild adults at this site (2m1f ups, and 2m1f uns evidently of the same specimens), which in wing colors and pattern seem assignable to ssp. *wyomingo*, though there is considerable variation (great variation occurs in ssp. *ridingsii* and *stretchii* and other *wyomingo* pops. also): 1) a male seen Aug. 22, 2000 has ups pale spots yellowish-tan more like *stretchii*, but the ups pale patches are long, and the uph band is very zigzag on its inner and outer edge like *stretchii* and most *wyomingo*; 2) the male seen Aug. 28, 2001 has ups pale spots cream like *wyomingo* and *ridingsii*, and the uph band has a long V-indentation on the inside and a fairly zigzag outside, like *wyomingo*; 3) the female seen Aug. 22, 2000 also has the ups pale spots creamy, but the overall color is paler than most *ridingsii* and more like *stretchii* & *wyomingo* (and quite like the Sinks Can. Lander Co. Wyo. *wyomingo* pop.), while the uph band is merely scalloped and not very zigzag and thus resembles most ssp. *ridingsii* (and resembles the merely scalloped band of other ssp., *pallidus*, "*minimus*", & "*neomexicanus*"), yet this uph band is very wide (wider than nearly all specimens of all the ssp.), but other than the very wide uph band, this female looks like several females from the Wyo. *wyomingo* TL (*wyomingo* individuals vary from zigzag to sometimes not very zigzag). Overall, Scott thinks that *wyomingo* is the best name for this population based on adult appearance (though it is very variable and only 3 specimens have been photographed), and has no qualms about calling it that, and of course its genes producing its diapause stage are those of *wyomingo*.

At the L Aug.-E Sep. populations in the Wasatch Mts. Utah (Partings Can. E of Salt Lake City, and above Provo, at 7000-8000'), Wayne Whaley (pers. comm.) saw several ovipositions in nature on *Agropyron spicatum* (the same grass used by ssp. *coloalbiterra*). He also found it flying L Aug.-Sept. in Lambs Can. 4500' east on I-80 in the Wasatch Mts. Clyde Gillette notes (pers. comm.) that in Utah eggs are laid only on dead or dried tan/brown grass parts, never on green parts, and **larvae HIBERNATE as unfed 1st-stage larvae** in nature but eat lawn grass without diapause in lab. Todd Stout (pers. comm.) found an empty eggshell on *Agropyron spicatum* on a S-facing slope at Hobble Creek Golf Course (behind Springville, in Wasatch Mts. of Utah Co. Utah), and suggests that they must hibernate as **unfed 1st-stage larvae** [probably] or maybe 2nd-stage, as that's as big as they could possibly grow before the grass dries up completely there.

It is obvious that *wyomingo* and ssp. *ridingsii* have just one yearly generation, and *wyomingo* is NOT the second generation of *ridingsii*, because lab rearing studies have proven that the growth rate of *Neominois* larvae is too slow for them to have two generations per year, and over huge areas only *ridingsii* occurs and not *wyomingo*, and at some places such as Rocky Mtn. Nat. Park only *wyomingo* occurs and no other ssp. of *N. ridingsii* occurs, and the Aug.-Sept. butterflies differ in wing color and pattern from the June ones, and as noted above *wyomingo* seems to hibernate as unfed 1st-stage larvae, while ssp. *ridingsii* hibernates as 4th-stage larvae. At Sonora Pass in the Sierra Nevada of Calif., ssp. *pallidus* is mostly biennial, and there it evidently hibernates in both stages, 1st stage during the first winter, then 4th-stage the second winter; at that location it has mostly one generation every TWO years, a much slower developmental rate than the impossible two generations within one year. William Henry Edwards (1897, in Butt. N.A.) reared all the larval stages and the pupa of ssp. *ridingsii* at various times during numerous attempts, and by adding up his recorded times for each stage, the egg-larva-pupa immatures lasted about 156 days overall in lab; this is more than 5 months, far too long to produce two generations per year in nature. Edwards figured a "late season" female that was larger and paler, but its source is unknown, and looks like ssp. *ridingsii*, so it may just have been a late-emerging early-Aug. *ridingsii* and not *wyomingo*. Ssp. *coloalbiterra* requires 103-114 days in lab from oviposition to adult emergence (the impossible 2nd generation would emerge in mid to late Oct. at that rate), and its pupa alone lasts nearly three weeks!

Because *wyomingo* overlaps the range of ssp. *ridingsii* and *stretchii* so much, and they look different (*wyomingo* looks most like a creamy-colored [less-yellow] *stretchii*), some people want to treat it as a separate species. But Scott still considers it a ssp., because adults fly two months after other ssp. of *N. ridingsii*, thus they never meet in nature, and so the extensive sympatry is not a natural test of reproductive isolation, and there may not be any barriers to courtship and mating and physiological hybridization. And the characters of *wyomingo* link it to both *stretchii* (in wing pattern) and *ridingsii* (in ups color).

Based on *wyomingo*'s range and phenotype, we can guess at its origin. It may have originated from some population at the meeting ground of ssp. *ridingsii* and *stretchii* (thus having the pattern of markings of *stretchii* and the color of ssp. *ridingsii*) that somehow mutated some gene regulating its hibernal diapause stage, making adults fly in L Aug.-E Sept., and then, facing no other populations at that time of year that could dilute its genes through interbreeding, it spread into the range of both *stretchii* and ssp. *ridingsii*, and evidently evolved mate-location in swales because swales are so common in its lowland sagebrush/brush habitat.

To find females, *wyomingo* males rait ("perch to await females") in swales, early in the morning. Later in the day, males of all *N. ridingsii* ssp. mostly just rest on the ground, and fly when disturbed, and their appearance during those escape flights resembles the short erratic escape flights of the group of grasshoppers like the Carolina Grasshopper (Oedipodinae), as was noticed and written about even in the 1800s, which is why Scott called *N. ridingsii* the "Grasshopper Satyr" in his 1986 book "Butterflies of North America…".

Early Stages of *Oeneis calais altacordillera* Scott, by J. Scott (plate V)

This butterfly was named in 2006, a butterfly new to the entire Rocky Mtn. chain, which was formerly confused with *Oeneis chryxus*. Its life history was unknown, so it is presented here for comparison with *O. chryxus*. Four females were collected near the E end of Eisenhower Tunnel, Clr.Crk. Co., Colo., ~11600-11800', July 2, 13 (2f), & 21, 2007. Adults fly every year at this locality with no discernable biennialism, though individuals are evidently biennial. Several eggs were obtained from a female from this site in 2008 also, and one male was reared after 103 days. Wild females are aggravating to watch, because they seem to have no desire to oviposit, and just rest & occasionally fly about open areas with grasses, and sometimes feed on flowers & wet soil, but were not seen to oviposit. **OVIPOSITION IN LAB.** The female caught July 13 laid eggs in lab, which were reared. No eggs were laid in a jar indoors, but eggs were obtained by potting some *Poa pratensis* grass and covering the pot with two wires supporting a cheesecloth net secured to the pot rim with rubber bands, and placed in outdoor sun. 15 eggs were laid July 14 (1 egg was found on the dirt, 1 on wire near top, 14 on cheesecloth near top), 4 on July 15 (1 in clump, 1 on wire at top, 2 on net at top), 4 eggs July 15 or 16 (1 on net at top, 3 on dead *Poa pratensis* leaves in clump 2" above ground), 3 on July 17 (3 on net near pot rim). The female died July 17. 10 mature eggs were dissected from two of the dead females coll. July 13, and one of them from the female that died July 15 hatched July 28. For those eggs laid on a plant, obviously females prefer to lay on dead blades of grass and refuse to lay on green leaves (most Satyrinae seem to prefer to lay on dead blades/stems). Most eggs were laid on the cheesecloth at top of net, evidently because that is where the females spent most of their time, trying to escape. (A female in 2008 also laid several eggs on the net.) **EGG** rather elliptical in vertical cross section (thus rounded on bottom and top, but a little wider near bottom than near top), with vertical ribs around side (very roughly 16, 17, 18, 18, 19, 19, 20, 21 ribs, the # difficult to count with my bad microscope, as the 16 count I thought was accurate, but eggs in alcohol had counts of 20, 21, 21, 22), and little white bumps on top 1/3 of egg & on rounded base, color white when laid, due to white ribs & light-brown vallies & light-brown micropyle. Duration 10 days in four eggs, ~11 in one, and ~12 days in 14. **NUMBER OF LARVAL STAGES.** There are five larval stages, with head widths 0.7 mm, 1.1, 1.6, 2.2 (some 2.3), and 3.2 (3.1-3.3) mm based on ~100 head capsules preserved in alcohol (stages 1-4) and based on 7 pickled mature 5th-stage larvae. **1ST-STAGE LARVA** tan, with brown lines & bands (heart-band brown, a brown line below that, a wide brown band, a weaker brownish narrow band above creamy lateral band, a slightly-darker brown narrow band below that; rear of A10 a sclerotized chitin-yellow-brown base containing two tails jutting rearward; head tan, setae brown, ommatidia & mandibles blackish. Later larva reddish-brown with alternate dark (brown or red-brown) bands & cream lines: heart-band brown, edged by narrow cream line, a wide brown band with a weak (soon strengthening) white line through middle, a narrow white then narrow brown then narrow white line, a fairly wide dorsolateral rather dark-brown band, a narrow white line, a moderately-wide brown band, a lateral wide white band, a wide brown band, then a narrow white line just above prolegs (there are 7 white lines, of which 1 is wide, 1 weak); head same as above. Similar when molting to 2nd stage (the 2nd-stage head bulging behind head) but becoming more like later stages, the brown heart-band wide, a narrow white line, narrow brown line, narrow white line, wider narrow brown line, narrow white line, narrow brown line, fairly wide white band, a wide brown band with white mottling in the middle but not on dark edges, a white line, a sl. narrower brown band with white mottling except on dark edges, a wide lateral white band, a weaker wide brown band with whiter mottling in the middle but not on the dark edges, a weak wide white band above prolegs. Duration ~9 days. **2ND-STAGE LARVA** has bands on the body similar to later stages; collar an elliptical light-brown ridge on each side of top; head has brown stripes like later stages; duration ~9 days, or more as some try to diapause. **3RD-STAGE LARVA** (now quite similar to mature larva) has brown middorsal heart-band, a white line, a broad light-reddish-brown band formed microscopically of 3 red-brown lines (a narrow brownish-red line, a whitish wiggly-margin "cloud" band, and two adjacent brownish-red lines), then a broad creamy band with a diffuse red-brown band down the middle, a wide brown dorsolateral band (paler ventrally and the interior tan toward front of body except on the dark edges) that narrows as it runs on top of tail, a narrow white line, a brownish-red line above a cloud-white band containing the spiracles, a brownish-red line, a fairly-wide white lateral band, a fairly-wide red-brown band that narrows on side of tail, a weak creamy tan narrow band above prolegs, uns tan, legs & prolegs tan; two tails on A10, light-brown on A10 dorsum between the tails; collar like 2nd stage, but tan and not conspicuous; head tan, frontoclypeus slightly darker (brownish-tan), three vertical stripes start near rear of head and run forward (one toward midline runs forward and down then angles toward mandibles as it narrows to a point near frontoclypeus, the second runs forward on side of top down to near largest ommatidia, the 3rd runs from side and curves down to near rear of ommatidia); duration ~9 days. **4TH-STAGE LARVA** similar to mature larva except as noted below, and I noticed in two 2008 larvae that the heart-band was darker (less dashed) and then became mostly dashed when mature. **5TH-STAGE MATURE LARVA**. Some older larvae take on a slightly pinker-tan overall color (on Sept. 5 these were smaller than the others and were ~4th-stage), while most are just shades of tan and brown in color. A few larvae become paler toward the rear, where the bands are paler (except for the darkest-brown bands which stay dark all along body). The narrow brown lines on most larvae are rather reddish-brown, but on the darkest few larvae the lines are just brown. Older larvae have a dark heart-band (band #1) which is dark-brown or blackish except in the middle of each segment which contains a tan elliptical area, which is small on the darkest larvae which have the heart-band appearing mostly solid blackish, but the tan area is larger on many larvae and quite large (just as large as or much larger than the black areas on the body joints in this heart-band) on the larvae that have the very-conspicuously dashed heart-band (which consists of black and tan series of dashes along top of body)(the most dashed heart-bands have blacker color at the joints, then tan in nearly 80% of the band until the next joint [though a few have the tan and blacker colors arranged into a neat row of equal-sized tan and dark-brown rectangles along the heart-band], while the blackest heart-bands are dark-brown near the joint also so only the middle of the segment is light-brown). The heart-band variation is continuous, from very dashed (see below Fig. 7) to mostly solid (color Pl. V) , with most larvae showing more or less conspicuous dashes, but all of them have a narrow brown line edging the heart-band lateral to the tan ellipses. The darkest larvae are somewhat darker brown all over and have a mostly-solid heart-band, while the paler larvae are paler all over and have a dashed heart-band. The heart-band on thorax mostly has a paler center all along (often reduced to a pale whitish line down center), though the border is thicker brown between T2-3. Below heart-band is a tan line, then a broad tan (in the paler larvae) or light-brown (in the darker larvae) band (#2) which is composed of short red-brown (brown in the darkest larvae) striations (a line of striations at the top and then sinuous lines of striations nearer the bottom and a line of striations at the very bottom—one larva Sept. 5 had the lower part of this band darker due to dark-brown striations, in the two 2008 larvae it was tan above light-brown) and extends on top of tail, then a broad pale band (#3; this band is tan but has numerous tiny red-brown longitudinal striations in the middle that roughly are arranged into 2 or 3 rows down the middle)(this band becomes whitish where it extends onto top of tail), then a wide dark-brown band (#4; a bit darker at top; the ground color brown caused by lots of dark-brown short striations) that has a narrow darker-brown line forming the upper and the lower edge (this band extends onto side of tail), then a narrow tan band above spiracles, then a wide tan or light-brown band (#5) contains the spiracles (spiracles positioned nearer top than bottom of the band)(this band is formed of numerous dark-brown striations and these form dark-brown lines at the upper and lower edge of band while the interior is lighter-brown, though in a few larvae the whole band appears to be rather uniform brown)(this band pinches out to almost nothing on tail), a tan band along lateral ridge of larva (#6) goes under lateral side of tail, then a fairly-wide band is brown (not dark), and the uns including legs & prolegs is tan. The brown colors all over larva are caused by numerous tiny dark striations. Head tan with brown stripes that run from near rear onto front where they narrow into points, frontoclypeus contains two long triangles or streaks of brown (side by side) with tips pointed upward, head is tan along coronal sulcus, the first brown stripe runs from rear forward near coronal sulcus and then angles near adfrontal sulcus and narrows to a point near bottom of adfrontal sulcus, the second dorsolateral brown stripe runs from rear and narrows to a point dorsomedial to eyes, the third runs from rear of side of head forward and then down to a point above eyes. Larval mandibles are shears without teeth, like other grass feeders (Satyrinae & Hesperiinae), the cutting edge of mandible blackish. Eyes blackish. Duration ~9 days for 4th-stage, and ~18-25+ days for 5th-stage as they mostly try to diapause, larval stages lasted ~64 days average in lab for the eight pupae reared (77 for the 2008 male); in nature these would last nearly two years. Mature larva differs from 3rd- & 4th-stage larva on bands #3 & #5: the 3rd & 4th-stages have band #3 (above dark-brown band) with an oranger center, whereas mature larvae have band #3 more uniform with scattered red-brown striae in it except at the edges. 3rd & 4th-stages have band #5 (spiracular band) creamy between two red-brown lines, whereas mature larvae have gray suffusion over band #5 except at the dark edges (even on the darkest larvae the band has grayish over the brown tiny striations). **PREPUPA** lasts 3+ days, and was a bit paler. **DIAPAUSE STAGES**. Larvae evidently diapause in the 2nd & 3rd stages, and in the 5th (mature fed) stage, based on unexplained mortality in the lab (evidently due to failure to eat and grow due to diapause), as one 2nd-stage larva and two 3rd-stage larvae died for no reason, and seven+ 5th-stage larvae died (the only other cause of mortality was that some older larvae died evidently because of a black fungus due to overly-moist rearing conditions). The last larva was a mature larva pickled on Oct. 26 because it was evidently in diapause and was not feeding and was growing smaller and smaller. In 2008 one mature larva pupated, while the other diapaused in late Oct. fully-fed. These diapause stages are consistent with the presumed biennial life cycle of this species and most other *Oeneis*. **PUPA** stout, elliptical in shape with the tip of the abdomen somewhat pointed but still rounded at tip; abdomen tan (though some pupae are darker and have a brownish-tan abdomen, and some pupae are slightly more pinkish-tan) with numerous little oval dark-brown dots (the dots a little larger in some, and some dots weak in some pupae), top of thorax light-brown, but dark-brown with tan lines on wings and head and mouthparts (the tan lines delimit the wing veins and the edges of the brown mouthparts and legs and antennae and head). The antenna is brown with tan edge and the club has tan delimiting the joints although the club is brown along middle. T1 is brown with tan edges. T2 is light-brown with a brown oval dot near top of rear (and some pupae have the whole rear of top of T2 lighter brown behind this dot) and a dot anterior to it about in middle of segment, and up to 6 little brown dots, with a tan wedge above front of wing, a tan dot and streak at base of wing, the wing veins tan including a vein surrounding the other veins that runs along distal and anal margin (this surrounding vein is typical of the tracheae/venation in the developing wings of insects). T3 is tan with a brown oval dot near top, light-brown laterally with 4 oval dots, hw light-brown. Abdomen has 7 rows of numerous tiny blackish short vertical oval dots (near top are 2 dots [the rear one higher] on A1-8 [these are missing on A4-8 on one pupa]; subdorsal are 1 oval on A1, 2 on A2-7 [the front one higher on A3-7], 1 on A8-9 [these and the ventral rows of dots are weak on abdomen on one pupa]; supralateral are 0 on A1, 3 on A2-3 [the middle lower], 2 on A4-7 [the anterior one higher]; a brown crescent posteroventrad of spiracle on A4-7; 1 sublateral oval dot on A5-8 [A8 has a brown flush running from this oval to top][some pupae have a tiny dot posterodorsal to the main dot]; lateroventral are 1 dot on A5-8; on/beside midventral bottom is an oblique dash or long dash broken in middle and a midventral X on A5-6, and one vertical dash on A7 [sometimes there is a brownish flush in middle of each of A5-7][a few pupae have just a midventral dash on A5 and one above it {both are side-to-side dashes} & one dash near midventral line on A6-7]), A9 has a black sinuous line running from near top to near side, cremaster is rounded with no crochets, though ~30% of pupae have a tiny shiny brown or black bump on each side where the crochets are missing. The A8 spiracle is a long narrow slit, which looks rather nonfunctional compared to the wider functional spiracles on A2-7. The head is tan at its anterior point between the dorsal antenna bases, and brown behind that, with a tan triangle on frontoclypeus that extends onto the visible labrum and the small triangular labial sclerite, and a brown patch is laterally on head and extends to orbit. Orbit is blackish-brown, the eye tan. A tiny brown spot is where the anterior tentorial pit would be if there were one. The foreleg is small with one segment visible, the middle leg long with tibia and all 5 tarsal segments visible. Some pupae are darker, and have a brownish-tan abdomen (rather than tan), and head is more brown. Just before emergence pupa & abdomen becomes blackish-brown (tan at abd. joints). Pupa duration 10-14 days in lab for eight pupae (mean 11-12 males, 12 days females). **PUPAL NEST.** The rounded shape and absence of crochets evidently indicates that the pupa is formed in a cavity in a grass/sedge clump or in loose soil, as is known to occur in related species: *O. melissa* pupates under moss and stones or partly in the soil, *Neominois ridingsii* worms itself into the soil and pupates ½” underground (W. Edwards 1997, Butt. N.A.), and *Hipparchia semele* pupa is formed (without an attachment) in a chamber just below the soil surface (M. Brooks & C. Knight, A complete pocket guide to British Butt., 1982, Jonathan Cape, London, 159 p.)(*Hipparchia* pupal shape & egg & larval stripes & colors are quite like *Oeneis*). Evidently all *Oeneis* & *Hipparchia* & *Neominois* (closely related to *Hipparchia*) pupate in a chamber in grass clump/litter or in soil.

Comparison of *O. calais altacordillera* to *Oeneis calais valerata* & *O. calais strigulosa* & *Oeneis chryxus*: The photo of *O. calais valerata* larva (R. Pyle, p. 356 in Butt. Cascadia, from Olympic Mts. Wash.) is of a 3rd- or 4th-stage larva, as it has orangish along middle of stripe #3 (the orangish is mostly lost on mature larvae) & has cream over most of the interior of stripe #5 (containing spiracles)(this interior turns gray on mature larvae). That *valerata* larva is very similar to paler larvae of *altacordillera* in every way (note the fairly-equal width of the 1st & 2nd head stripes & the tawnier (not pinkish) ground color and the stongly dashed [brown & tan dashes] heart-band). Photos of *O. calais strigulosa* from Ont. reared by Jim Troubridge show the heart-band very dashed also, and the larva is similar to *altacordillera* & *valerata*, though my bad copies of the photos are too pale to detect proper colors. *Oeneis chryxus* has similar eggs (maybe a little more bumpy?), and larvae have the same bands etc., but there are some differences (color of 1st-stage bands, overall color of older larvae, amount of dashing on the heart-band, and width of head stripes). The younger 1st-stage *chryxus* larva looks much redder on my slides, as the bands are brownish-RED, versus brown or reddish-brown in *altacordillera*, which would seem to be a difference, though my *chryxus* notes say that these lines were usually red-brown (one light-orange-brown), so the difference may not be great, however Kodachrome etc. color slides have more accurate colors than any other type of photographic film so this would seem to be a slight difference; more samples would be useful here. Most older larvae of *chryxus* seem to have an overall pinker color (except for the dark-brown larvae), whereas in *altacordillera* a few 3rd-4th-stage larvae looked a little pinker but nearly all older larvae are of a yellower-tawnier shade with no pinkish tint (*altacordillera* also has some darker-brown larvae). The heart-band on *chryxus* larvae is never obviously dashed (never a series of tan & blackish dashes) and is solid blackish on most larvae, though many have a tan line down center of heart on T1-3 as in *altacordillera*; only the palest larvae have slight paler centers of heart-band within each segment, but only on front half of abdomen, as the rear half of abd. always has a solid heart-band. In *altacordillera*, the heart-band usually has at least a little dashing, and some have striking alternate tan & brown rectangular dashes like Pyle’s *valerata* larva (most larvae have strong to weak dashes, and only some have the band solid-blackish except for a tan middorsal line through heart-band on T1-3). The head of older larvae of *chryxus* has the 1st stripe (near midline) relatively wider than 2nd stripe (dorsolateral) on average, it varies from ~1.3X as wide to 2X as wide as 2nd, but nearly half the larvae have the stripe 2X as wide; in *altacordillera* the 1st stripe varies from only 1.0X as wide to 2X as wide as 2nd, but most are 1.5X as wide. Pupae are quite similar, though some *chryxus* pupae may be a bit more pinkish in overall color. The little brown dots may average a bit paler (less pronounced) on *chryxus* pupae, though some *altacordillera* have these spots weak esp. near top and bottom of abdomen (and some have the spots bigger and more conspicuous), so this isn’t much of a difference.

Comparison to other *Oeneis:* Here are some brief comparisons of *Oeneis* immatures, and some speculations about the evolution of *Oeneis*. The eggs of *O. alberta-calais-chryxus* & *O. uhleri* & *O. jutta* have roughly 20 vertical ribs, whereas *O. bore taygete* & *O. polixenes* & *O. melissa* have many more ~30+ ribs. 1st-stage larvae generally have reddish-brown stripes. The mature larva heart-band is quite dashed in most *Oeneis* (*alberta, calais* ssp., *jutta, bore taygete, polixenes, melissa*), except it is solid in *O. uhleri*, and is mostly solid in *O. chryxus* & *O. nevadensis* (photo in Allen, Brock, & Glassberg’s 2005 Caterpillars in the Field & Garden). Older larvae are pale (top greenish) in *O. jutta*, they are less-striking brown & cream striped overall in *O. alberta*/*calais* ssp./*chryxus*/*uhleri*, and look rather pretty due to bold contrasting dark & pale stripes in *O. bore taygete*/*polixenes*/*melissa* (although the *melissa* photo in Butt. Canada is mostly green with whitish & green stripes). Conclusions? It’s obvious that *alberta-calais-chryxus* form a natural grouping (see Papilio [New Series] #12), and *nevadensis* evidently is closely related as adults & larvae look like *chryxus* (and *macouni* seems to be just a stigmaless allopatric ssp. of *nevadensis*). According to the immatures, *uhleri* belongs near *chryxus*, and the arctic/alpine *bore taygete-polixenes-melissa* seem to belong together. However, the male valva has a dorsal tooth near base in most *Oeneis*, except it is missing in *uhleri* and *polixenes* & *melissa* & *jutta*, so the question is, why is the classification based on valva different than the similarities shown by other characters (for one thing, *bore* seems to be similar to *melissa-polixenes* despite the tooth difference)?, did *uhleri* lose the tooth independently of a similar loss in *polixenes-melissa-jutta*? Maybe valva shape isn't a very robust character. Probably "*Protoeneis*" isn't a very valid subgenus containing mostly *uhleri*. The stigma isn't a very robust character, as it has been almost entirely lost in *macounii* independently of shrinking in *O. alberta*-*O. calais*. *Oeneis* species have a lot of variation, in nearly every character (the *polixenes* and *melissa* valvae vary a lot and some are similar), and relationships are unclear in some groups (*norna* vs. *polixenes*, *luteus*-*yukonensis*-*philipi*, etc.).

Oeneis chryxus Geographic Variation, J. Scott & Norbert G. Kondla

Kondla has examined about 3 dozen low-altitude Colorado *O. chryxus* sent by Scott, and found that they are similar to low-altitude Alberta *chryxus*, such as the photos in the Butt. Alta. book. However, high-altitude Alta. *chryxus* (they range into the alpine zone in Alta.) seem to be a little darker: they have a darker/duller less-orange unf and ups, and the unh is darker/duller with less development of the strigulose markings, than low-altitude Alta. *chryxus*. In Colo., *chryxus* does not fly in the alpine or subalpine zone, and the upper Montane Zone is about the highest they get. In Colo., the highest-altitude adults from the Montane Zone are not much different from low-altitude ones (they are a little smaller), although 2m from 1 mi. SE Yankee Doodle Lake on Rollins Pass 10500' in Gilpin Co. and 2m from 2 mi. N of Victor 10500' in Teller Co. are darker. As noted in Papilio (New Series) #12, some *O. chryxus* in Alberta have the hw relatively larger, and the fw margin averages a bit straighter. In Alberta, various *Carex* species are common in the predominantly open (or at least less dense) lodgepole pine forest habitat that Alta. *chryxus* usually occupies, so eggs could be laid on twigs above the *Carex* there, although *chryxus* occurs in glades/forest openings of the upper subalpine forest including the open krumholz tension zone at timberline. Colo. & Montana pops. are biennial, whereas Canadian populations evidently fly every year (evidently because there are two cohorts on even-numbered years and odd-numbered years that fly together). Overall, the differences between Colo. and Alta. (the TL) *chryxus* are variable and still do not seem to be quite enough to name a new subspecies. Kondla notes that there are several different-looking *chryxus* varieties in B.C. that warrant further study.

Asterocampa celtis jeffermont J. Scott & M. Fisher, NEW SUBSPECIES (plate III)

Definition: The ups ground color of adults resembles ssp. *antonia*, but the two upf eyespots resemble Ariz. ssp. *montis*. Real Ariz. *A. c. montis* has a tawnier-oranger ups color than *antonia* and *jeffermont*, and has a very weak uph median yellower band unlike both ssp., thus the *montis* ups is distinctively different from *jeffermont*.

To study this variation, the frequency of upf eyespot types was noted in specimens mounted in Scott's collection, as follows. The numbers refer to four types of upper eyespot, and two types of lower eyespot. Each line below gives six numbers for each sex, which are the number of individuals with these eyespot types:

Upper Eyespot (white patch--white patch with black lunule near bottom--black ring with large white center--black with small white center dot). Lower Eyespot (black spot--black spot with white center dot)

A. celtis jeffermont eyespot frequency:

gulches along Front Range mtn. front, Jefferson Co. Colorado, host *Celtis reticulata*:

male Upper 2-4-10-24, male Lower 32-7 female Upper 5-17-7-9, female Lower 26-11

A. celtis near-*jeffermont* eyespot frequency:

western Denver suburbs of Lakewood and Wheatridge, Jefferson Co. Colorado, host *Celtis occidentalis*:

male Upper 2-1-1-2, male Lower 6-0 female Upper 3-3-2-4, female Lower 6-6

north Denver, nursery at 64th & Washington Streets, in northern Colorado, host *Celtis occidentalis*:

male Upper 6-6-5-2, male Lower 10-10 female Upper 1-1-1-0, female Lower 1-1

A. celtis antonia eyespot frequency:

Fremont-Custer-Pueblo Cos. in southern Colorado, host *Celtis reticulata*:

male Upper 0-1-2-17, male Lower 4-16 female Upper 0-0-0-5, female Lower 1-4

Baca Co. Colorado, & 1 W Oklahoma:

male Upper 0-0-0-4, male Lower 1-2 (+ one male with little black dot in large tan spot)

female Upper 0-0-2-5, female Lower 3-4

A. c. antonia (Texas; Baca Co. Colorado; Fremont-Custer-Pueblo Cos. Colorado) generally has the upper eyespot black with a small white spot, while the lower is black with a tiny white dot. The native Jefferson Co. *A. c. jeffermont* pops. along the foothills of the Front Range (& on mts. barely E of the mtn front, specifically North Table Mtn. & rarely on Green Mtn.) are the same color, but have the *A. c. montis* pattern of upper eyespot black with fairly large to small white center (females frequently white with lower black lunule), and lower eyespot usually a solid black spot but sometimes a small white dot in center. Adults in the suburbs of Lakewood and Wheat Ridge (host the eastern hackberry *Celtis occidentalis* as all the *Celtis* trees Scott has found in the suburb of Lakewood are *C. occidentalis*, and Scott doubts that anyone would plant the shorter more-scraggly native tree *C. reticulata*) are similar and are the same color, but have interbred with ssp. *celtis* a bit, so the upper eyespot is either black with white center or solid white, and lower eyespot is mostly a black patch but in females often with white dot. The north Denver nursery pop. on *Celtis occidentalis* (at the Northern Nursery at 64th & Washington St. in northern Denver, June 29 & July 11, 1973; nursery now gone) is a bit more interbred with ssp. *celtis*, as the upper eyespot is even more frequently a white patch, and in these the color seems to average just a teeny bit darker on ups also. Thus the Denver metro populations are still *jeffermont*, but seem interbred a small amount with ssp. *celtis*. Of course true ssp. *celtis* from E U.S. is dark brown on males (females are lighter brown), and the upper eyespot is always a white patch, the lower a black spot.

Jefferson Co. *A. c. jeffermont* is a good ssp., as the eyespot pattern is like *montis*, but Ariz. *montis* are tawnier (more orangish) in color on ups, and the uph yellowish median band is weak in *montis*, giving the *montis* uph a much different appearance. Holland (1931 Butt. Book) figs. the *montis* lectotype on pl. XXIII fig. 11 (misident. as *A. leilia*), and it is a bit oranger, but has atypical *antonia*-type eyespots both black with white dot (compare to ssp. *celtis* on this plate figs. 3-4—figs. 7-8 are dark like ssp. *celtis* but have the *montis* eyespot pattern, and are supposed to be reared from Colo. eggs according to F. Martin Brown [explained in a section in Papilio [New Series] #19 identifying every fig. in Holland's 1931 plates, and correcting Brown's series on Edwards' types], but the female especially is darker than Jeff. Co. ones so these maybe were from NE corner of Colo.)(Holland's fig. 12 is the *antonia* lectotype, and that color is typical of Colo. *antonia* and Colo. *jeffermont*). Scott's two *A. c. montis* females from S Ariz. (near Patagonia) are tawny with upper eyespot black with small white dot and lower solid black. Friedlander's male & female *montis* from Ariz. (J. Res. Lepid 25:333, pl. 20 figs. J & K) are also both tawnier-oranger with upper eyespot a black ring with white center dot and lower solid black. The text in Butt. Rocky Mtn. States says that Ariz. *montis* are more orange than *antonia*, and the figured specimen from Gila Co. AZ has atypical *antonia*-type eyespots (both black with white dot). William Howe's Butt. N.A. Arizona *montis* male (pl. 13 fig. 6 from Sabino Can. in Santa Catalina Mts. [NOT Baboquivari Mts.] is tawny maybe a bit oranger, while the female fig. 7 from TL Mt. Graham is the color of Jeff. Co. specimens, and note that both have the *montis*-type eyespot pattern in which the upper eyespot is a black ring with white dot, the lower is solid black. The book Butt. SE Ariz. by Bailowitz & Brock figs. a male that looks a bit tawnier, and it has a *montis*-like eyespot pattern of upper a black spot with small white dot, the lower black with very tiny white speck.

All of the Ariz. *montis* just discussed (lectotype male in Holland, male female in Howe, Scott's two females, male in Butt SE Ariz., Friedlander's male female) have a very uniform uph and the upf basal half, whereas the other *A. celtis* ssp. have yellower spot-mottling on uph (notably a yellowish median band). The only exception is the male fig. in Butt. Rocky Mtn. States, which is from far E Ariz. (Gila Co.) near New Mex. and may represent a population that is intergrading to ssp. *antonia* in New Mex. Ssp. *jeffermont* has the *montis*-type eyespots, but its color is like *antonia* (not tawny like *montis*), and its uph is mottled with yellow, not uniform as in *montis*. Thus, *jeffermont* represents a new ssp. *A. c. jeffermont* is not just an intergrade population, because an intergrade would have each character intermediate between two ssp., and in *jeffermont* each character shows a different pattern, as the ups is unlike *celtis* in color, it's unlike *montis* in mottling, it's unlike *antonia* in eyespots; and *montis* is 400-600 miles away. Each of its traits is like that of another ssp., but the other traits differ, which seems to justify its naming as a new ssp., even with Scott's belief that an intergrade population with no distinctive traits of its own is not a valid ssp. Friedlander included *montis* within *antonia*, but *montis* seems to be a good ssp. (as C. Ferris noted in the book Rocky Mtn. Butt.) with different eyespots, different ups color, and different uph median band.

Type locality and types: Indian Gulch, 1 mi. W Golden, Clear Creek Can., Jefferson Co. Colo., male holotype (plate III) July 2, 1997, coll. J. Scott (BMNH). Numerous paratypes from TL and other Jefferson Co. locales (Deer Creek Can. vic. Deer Crk. Park [this colony may be small, but *C. reticulata* trees are on S-facing hogback cut beside hwy.]; base of Falcon Co. Park; Red Rocks; Cherry Gulch [small pop.]; Dakota hogback E of Red Rocks [small pop.]; Green Mtn. [stray]; E end of S. Table Mtn. [stray]; gulch SE corner N. Table Mtn.; Apex Gulch; Chimney Gulch; Mt. Zion [stray]; Tucker Gulch [weak pop.]; Halfmile Gulch in Tucker Gulch [weak]; Lakewood [Scott's back yard etc., on *Celtis occidentalis*]; Wheatridge [on a *Celtis reticulata* tree on a bluff S of Clear Crk.]) are in J. Scott coll., and others from some of these same sites are in M. Fisher coll. **Name** is from JEFFERson county bug with *MONTis* eyespots and *antonia* wing color.

Range and intergrades. N Colo. to W South Dakota. A pale phenotype of *A. celtis* from Larimer Co. Colo. mentioned by C. Ferris (in Rocky Mtn. Butt.), is surely near *jeffermont*. In Neb. near the NE corner of Colorado (Ash Hollow State Park, Garden Co., July 17, 1986, on *Celtis occidentalis*, J. Scott) 2 males are like *jeffermont*, as they are paler in ups color (not dark like *celtis*), and one has a black crescent in the upper eyespot while the other has it white (both have the lower eyespot solid black). A male from S-C Neb. (5 mi. S Gothenburg, Dawson Co., June 15, 1991, J. Scott) is similar to *jeffermont* also (upper eyespot a black ring with white dot). The Pine Ridge in NW Nebraska and Lone Tree Can. in Goshen Co. in SE Wyo. were stated to have ssp. "*antonia*" by Kurt Johnson (J. Res. Lepid. 11:21, 1973), which are near-*jeffermont*. Steve Spomer's (pers. comm.) specimens from Pine Ridge Neb. have spot frequencies of males 0-3-3-0 upper, 2-4 lower, of females 2-3-2-0 upper, 6-1 lower, closer to *jeffermont* than to regular *antonia*. The hostplant in Pine Ridge is *C. occidentalis* as in E Neb. according to Spomer. Ordinary ssp. *celtis* (dark-brown ups of males, upper eyespot solid white) occurs in E Neb. (Camp Luther in Colfax Co.; Lincoln; Yankton) and SE S.D. (Volin, Clay Co.) and S Minn. (Freeborn Co.; Minneapolis), based on Scott's specimens. W South Dakota has near-*jeffermont*, based on Marrone (2002), who called it "*antonia*", but the eyespots and wing color of his figured 1m1f are like *jeffermont* (the wing color of the 1m1f ssp. *celtis* figures are tawnier than true *celtis* so E SD may have near-*celtis* if those are typical colors).

Argynnis (Speyeria) mormonia kimimela Gary M. Marrone, Stephen M. Spomer, & J. Scott, NEW SUBSPECIES (Lakota Fritillary)

Definition: This ssp. resembles *eurynome*, but has a brown unh disc. It was noted as an undetermined ssp. by Marrone (2002), and other persons including Paul Hammond and Ricky Patterson have noted that it is distinctive. The unh disc is light-brown (one very pale male has a tan disc barely darker than the submarginal color) to medium- (sometimes dark-) brown in males, and medium-brown to dark-brown (sometimes pale-brown but usually rather dark) in females. Both sexes usually have some greenish along the anal margin of unh (behind vein CuA_2), but the disc is mostly brownish, whereas ssp. *eurynome* mostly has a greenish unh disc (Spomer has found 2m *eurynome* from Carbon Co. Wyo. that are similar to *kimimela*, but found none in Routt Co. Colo.). Marrone found a few adults (<10%) with sage-green scaling throughout the basal half of the unh disc. For instance, the male with greenest unh has the disc tan in the base of cells Rs-M1-2, and has green over half of unh base and near anal margin, and has little green dashes basad and distad of postmedian silver spots, but unh has only brown in cell Sc+R1 (to its base) and only brown between the postmedian spots and along wing margin, so this male is not completely green. Scott has seen a male with the disc green behind vein CuA_2 and green in the discal cell. But Spomer & Scott have not seen adults with the disc all green. A few adults (<10%) lack silvered unh spots, and have an overall yellowish (tawny) cast to the undersides; Scott has one male and Marrone has two males that are unsilvered. Butt. Rocky Mtn. States states that the Black Hills pop. is extremely variable from greenish to dark brown, but actually it does not vary much and the extremes are uncommon. It seems to average a mm or slightly more larger in fw length than *eurynome*; this difference is not very noticeable, though some specimens are much larger, and Spomer has one female the size of *S. aphrodite manitoba*. **Range**: Resident in the Black Hills of S.D. (Custer, Fall River, Pennington, Meade, and Lawrence Cos.) and Wyo. (Crook & Weston Cos.), and a rare stray to Slim Buttes of Harding Co. S.D. and Shannon Co. SD, and a rare stray to the Pine Ridge of Neb. **Type locality and types:** Male holotype Terry Peak, Lawrence Co. SD, June 22, 1991, Gary M. Marrone (fig. in color in Marrone 2002 p. 232). Allotype Deerfield Res., Pennington Co. SD, July 4, 1985 G. Marrone (also fig. p. 232). Holotype and allotype to be deposited in South Dakota State Univ. coll. in Brookings, SD. Paratypes: O'Neil Pass, Lawrence Co. SD, June 26, 1987, G. Marrone, 1m1f "in copula" in Marrone coll.; Heely Creek, 3 mi. S Deerfield Res., T1S,R2E,S12,NE¼, Pennington Co. SD, July 21, 2006, G. Marrone 1m2f in Scott coll.; Ditch Creek, S of Deerfield Res., Pennington Co. SD, July 19, 1970 1m John S. Nordin in Scott coll.; CR309/FR301 ~3 mi. S Deerfield Res., Pennington Co. SD, July 13, 2005, Drew Hildebrandt, 4f in Scott coll.; CR 309/FR 301, ~3 mi. S Deerfield Res., Penn. Co. SD, July 13, 2005, Ricky Patterson, 2f in Scott coll., 3m12f in R. Patterson coll.; Deerfield Res., Pennington Co. July 5, 1985 4m1f G. Marrone in Scott coll.; Deerfield Res., Pennington Co., S. Spomer (June 30 1984 1m1f, June 28 1989 1f, July 28 1989 1f, July 15 1994 1m1f [coll. D. T. Spomer], June 21 1988 1m, July 23 1988 3m; Deerfield Res., Penn. Co. SD, July 12, 2005, Ricky Patterson, 1m in Scott coll., 5m in Patterson coll.; Castle Creek SW of Deerfield Res., Pennington Co., S. Spomer, July 15, 1994, 1f; FR 297, 6 mi. SE Deerfield Res., Penn. Co. SD, July 13, 2005, Ricky Patterson #6632, 1m in Scott coll.; S of Deerfield Res., FR297 near Medicine Mtn., Pennington Co. SD, June 23, 2007, Ricky Patterson, 2m in Patterson coll.; 4 mi. NW Custer, Pennington Co. SD, July 16, 1986, 3m J. Scott in Scott coll.; Beaver Creek, T1NR1E, sect. 16, Pennington Co. SD., July 18, 1970, 1f John S. Nordin in Scott coll.; Twp. 1S, Rge 3E, Sec. 23, Pennington Co. SD, June 25, 1991, G. Marrone, 1m in Scott coll.; 3 mi. NE Crows Nest Peak, Pennington Co. SD, June 23, 1991, G. Marrone, 1f in Scott coll.; near Dumont, Lawrence Co. SD, July 24, 2005, G. Marrone, 1m in Scott coll.; Tillson Creek, Lawrence Co. SD, June 24, 1991, G. Marrone, 1m in Scott coll.; Tin Mtn. Mine, Custer Co. SD, June 26, 1976, G. Marrone, 2m in R. Patterson coll.; Sowbelly Can., G. H. Coffee Park, Sioux Co. Neb., Aug. 10, 1985, S. Spomer, 1f. (Several people [Cary in 1901, Leussler in 1911] listed *mormonia* from Sioux Co. Neb., but later authors did not list it from Neb.) Spomer has a photo of 1 pair from SE of Crawford, Dawes Co. Neb., Aug. 6, 1984, evidently in the Chadron State College coll. **Habitat:** Flies in meadows and canyon bottoms in the Black Hills, usually above 5000 feet altitude. **Name:** is the Lakota Sioux word for butterfly (pronounced key-me-me-la), according to Francis Whitebird, a Lakota friend of Marrone. (Note: Morphology & DNA suggest that *Speyeria* is a subgenus of *Argynnis*, Simonsen et al. 2006.)

Note on parallel variation in *Argynnis* (*Speyeria*). *Speyeria* species have great geographic variation, and adults of different species often show uncanny resemblance in certain places, while they look much different elsewhere. Scott (1986) thought that parallel variation in *Speyeria* could be explained by virus transmission of genes between species. Of interest here is a paper by J. Dunning Hotopp & 19 other authors (2007, Science 317:1753-6, "Widespread lateral gene transfer from intracellular bacteria to multicellular eukaryotes") which writes that a bacteria *Wolbachia pipientis* is an intracellular symbiont that affects more than 20% of insect species and even nematodes, and is present in gametes, and transfers genes between species; they demonstrated genes from various species that had moved into the *Wolbachia* genome. Scott thinks that various microbes such as this bacteria and other viruses etc. that infest *Speyeria* larvae transfer DNA to larvae of other *Speyeria* eating in the same violet patch (the larva dies and liquifies and the juices drip and spread around), and thereby transfer wing pattern genes between species. It has become apparent that lateral tranfer of genes between species has been enormously important in the history of life on earth (especially among and between bacteria, archaea, and viruses, which all have very complex origins prominently involving lateral transfer of genes and organelles). It seems difficult to explain the precise parallel variation in *Speyeria* any other way.

Euphydryas bernadetta rorina J. Scott & M. Fisher, NEW SUBSPECIES (plate III)

Definition: This ssp. resembles *bernadetta*, but some adults in all known populations are more reddish in color, and the unh submarginal area of reddish spots has less of a blackish ring surrounding the area. In *E. b. bernadetta* from the TL Pine Ridge of Nebraska, this submarginal area is surrounded by a thick black line, and the same is true of *E. b. veazieae* (*E. b. macyi* has a thin line like *rorina*, but its ups is redder). *E. bernadetta* has recently been separated from *E. anicia* as a distinct species (by Steve Kohler & Norbert Kondla, in Scott et. al. 2006). Scott (in same paper) suggested that Colorado "*bernadetta*" is probably a distinct species from *anicia* also, but there is some evidence that the Colorado population intergrades with *E. anicia eurytion*, as several collectors have collected series in NW Larimer Co. Colo. that they think represent *eurytion* and *bernadetta* intergrading, and Steve Spomer's series from Veedauwoo Cgd. (next to Pole Mtn. SE of Laramie Wyo.), assoc. with the *bernadetta* host *Besseya wyomingensis*, are mostly like *bernadetta* but a number of adults (all or nearly all males) appear to get oranger and oranger and look like they blend into *eurytion* there (although the oranger ones look most like the "*carolae*" variants that are yellower than typical *eurytion*), which may mean that the two species have introgressed at that locality to form a "hybrid swarm" near *bernadetta*. But Spomer's *rorina* larvae from Veedauwoo are dark resembling *bernadetta*, quite unlike the very white *eurytion* & *capella* (see below), suggesting that oranger variants are just introgression. In the rest of the range in Colorado, occasional reddish adults appear that look like *eurytion* (a few even look like *capella*), but evidently these are just individual *rorina* variants. In the Sierra Madre Range of Carbon Co. in southern Wyo., *rorina* flies at low altitude in hills near Encampment, though a few adults there are reddish like *eurytion*, while at Summit 10000' in the Sierra Madre Range *eurytion* flies, all based on specimens coll. by William N. Burdick July 10-14, 1950 (in Univ. Colo. museum). (Speculations: If *rorina* were proven to be a ssp. of *E. anicia*, or part of a stenchospecies as *E. anicia* transitions into *E. bernadetta* through *rorina*, it still would be a valid ssp., because it is quite different from any *E. anicia* ssp. If *eurytion* & *capella*/*cloudcrofti* & *chuskae* were proven to belong to *E. bernadetta*, they would belong to *E. eurytion* the older name.) **Type locality and types:** holotype (plate III) & allotype (plate III) Beaver Creek, 3 air mi. SSW Hot Sulfur Springs, Grand Co. Colo., holotype male June (photo of holotype ups and uns also on p. 14 top of Fisher 2006) deposited in Gillette Mus. at Colo. State Univ., many paratypes from TL and throughout western Colo. in collections of Scott & Fisher. **Name:** is from ROcky mts. bug with RIng NArrow around unh submarginal area. **Behavior:** at the TL, males rait (perch to await females for mating) by resting with wings spread flat on 20-cm tall shrubs etc. on low hilltops, all day surely (Scott's observations were 12:30, 12:34, 13:25, 13:30, 13:52, 14:45 in the afternoon), and two males were observed there in a vertical encounter 30 m into the air.

Euphydryas chalcedona sinecat J. Scott, NEW SUBSPECIES (plate III)

Definition: Adults are mostly black with cream spots on ups, like Coast Range ssp. *chalcedona* (Doubleday), but the upf has slightly more postmedian orange, in this respect tending a little toward the very different N Calif. ssp. *dwinellei* (Hy. Edwards); and the outer part of uph averages a bit darker than *chalcedona*. The larva is vastly different, as A. Shapiro (2007) wrote that Coast Range larvae are black & orange, with only a bit of white pattern, whereas Sierra Nevada larvae (& on E edge of Sacramento Valley) are conspicuously striped with white. Allen et al. (2005) illustrate the larva of *E. c.* near-*olancha* (W. Wright), that looks like *sinecat* (from Kern Can., Kern Co. Calif. p. 91 fig. 5), which has a solid wide white middorsal band enclosing orange BD1 scoli & orange bases, (with NO black heart line), then a wide black subdorsal band enclosing BD2 scoli, a wide white stripe enclosing black BSD scoli that have orange around bases, mostly black along row of black BL1 scoli, the BSV scoli orangish on a narrow whitish stripe; head black. My *sinecat* larvae from *Penstemon antirrhinoides* at Jerseydale, Mariposa Co. Cal. looked the same. *E. c. macglashanii* (Rivers) from the E side of the Sierra Nevada N to S-C Ore. has a larva with similar longitudinally black and white striped pattern, but its adults are whiter on ups. The valva prong is like *chalcedona*. Overall, adults look similar to ssp. *chalcedona* from the Calif. Coast Range (but have a little more upf postmedian red), but the larva is vastly different in appearance. The ssp. is named here, because it is very distinct when you consider all life stages, and larval coloration will perhaps help improve the classification of stenchospecies *E. chalcedona* (which includes *chalcedona*, *anicia* [Doubleday], & *bernadetta* [Leussler]), which is a mess. **Range:** the western foothills of the Sierra Nevada range. Ken Davenport (pers. comm.) notes that the phenotype only goes as far south as the Tule River drainage SE of Springville, Tulare Co. Calif. (S of Johnsonville the bugs are much more yellow on ups, near-*olancha*). **Types:** Pine Hill, El Dorado Co. Calif., May 26, 1975, J. Scott, holotype (plate III)(BMNH) & 2m1f paratypes. Paratypes: in Scott coll: City of Folsom, Sacramento Co. Calif. (bike trail on S shore of Lake Natoma [American River] at Iron Point Road, 63m), June 3, 2008, Arthur M. Shapiro, 7m2f, larvae boldly-striped as usual, host *Keckiella breviflora* (Shapiro notes that the same host is used downstream at Sailor Bar Park, Fair Oaks, Sacramento Co.). American River gorge, Auburn, Placer Co. Calif., June 13, 2003, Ken Davenport, 4m2f. Forest Hill, Placer Co. Calif., June 13, 2003, K. Davenport, 1m. Jerseydale, Mariposa Co. Calif., Allan Oakley Shields, June 9, 1962 1m, June 13, 1962 1m3f. El Portal, Mariposa Co. Calif., 2100', May 14, 1961, James Wilson Tilden, 1f. Ridge NE of Auberry Rd., San Joaquin

River Crossing, Madera Co. Calif., Apr. 10, 2004, K. Davenport, 1m. 2 mi. S Jack Flat, Tulare Co. Calif., Apr. 28, 1989, K. Davenport, 1m. Mineral King Rd., milepoint 3-5, Tulare Co. Calif., May 8, 2002, K. Davenport, 1m; same but milepoint 3-4, 1m; same but milepost 3, May 7, 2002, 1f. Davenport notes that series from the these sites (American River and from Mineral King Road) look the same despite being >200 miles apart, and have more orange red on upf than Coast Range ssp. *chalcedona*. **Name:** is from SIerra NEvada Mts. bug with strikingly-banded CATerpillar.

Other nearby ssp.: The TL of *chalcedona* is here considered to be San Francisco, Calif., the TL accepted by J. Emmel, T. Emmel, & S. Mattoon (1998, Syst. W N.A. Butt. chapter 6:101) and earlier by W. Barnes & J. McDunnough (1916, vol. 3 #2), based on wing pattern and history.

Bauer (1975) used the name *macglashanii* for low-altitude bugs from both sides of the Sierra Nevada, all united by the striped larval pattern. However the adults are different on W and E side of the Sierra. Austin & Murphy (1998) discuss the variation of these butterflies, and illustrate numerous *macglashanii* adults on their fig. 4. They found that it occurs on E slope of the Sierra from Alpine Co. and adjacent Douglas Co. Nev., to just N of Reno, Washoe Co., & Sierra Valley, Sierra Co. Calif., plus the adjacent mts. of W Nevada. *Macglashanii* also occurs in the Warner Mts., and in S-C Oregon, and intergrades southward into N Calif. a little (Scott et al. 2006). *Macglashanii* is more whitish on ups than *sinecat* and *chalcedona* (not as much as *olancha*)because it has a lot of yellow-cream ups spots, and a little to much reddish on the outer part of the ups. *Sinecat* has less ups cream, as in *chalcedona*. *Sinecat* is not just an invalid intermediate between *chalcedona* and *macglashanii*, because its ups pattern is like *chalcedona* but tends a bit toward *dwinellei*, while the larva is like *macglashanii*; thus it has a combination of traits that are found individually in several other ssp., but is not just an intergrade or intermediate with any other ssp. Between the ranges of *macglashanii* and *sinecat*, are high-elevation *sierra* populations, which Austin & Murphy map from 1500m+ from Tulare Co. N to Plumas Co. in Calif. (*Sinecat* is also isolated from ssp. chalcedona to the west, as noted below.)

The name *olancha* appears to have nothing to do with *sinecat*. It was named by W.Wright 1905 in his Butt. West Coast p. 150, from Olancha Peak, Tulare/Inyo Cos. Calif. Not many specimens are known from there as the peak requires a long hike on a well-maintained trail from the Monache Meadows trailhead, but J. Comstock's 1927 Butt. Calif. figured a male from Olancha Peak in his pl. 33 fig. 3, and it is mostly cream on ups with numerous enlarged cream spots. Ssp. *olancha* has always been characterized by the creamier ups. Bauer (1975) writes that the *olancha* types were coll. about 11000' on Olancha Peak, and there are numerous other high elevation colonies along the Sierra Nevada Crest including Bishop Creek (although he states that it occurs on Sonora Pass, which actually is a very variable intergrade population). (I have examined 8m7f of these creamy *olancha* from Bishop Creek in the Univ. Colo. museum.) *Olancha* is yellower on ups than *macglashanii* which also has somewhat-(but-less)-enlarged cream spots, but Bauer noted that the larva is very similar to that of *macglashanii*. Comstock illustrated a creamy female *olancha* from Casa Diablo Hot Springs in Mono Co. Cal., and that site was the source of Jean Gunder's male and perhaps also the female he illustrated on pl. 4 in his classic *Euphydryas* paper (Pan-Pac. Ent. 6:1-6+pls.), and was also his type locality of *georgei* (Gunder), which is a redder infrasubspecific form of *olancha* at the north end of its range with lots of cream but more red. Ken Davenport (2003, and pers. comm. based on recent collections by himself and John Pasko) lists *olancha* from Big Pine Creek, Bishop Creek, & Swall Meadow in Inyo & Mono Cos., and notes that pops. from Pine Mtn., Kennedy Meadows region, Lamont Peak and Sageland, & Kelso Valley are near *olancha* but differ, and are often redder. Davenport notes Tehachapis mts. bugs have larger yellow spot development (bugs from near Cummings Creek drainages in the Tehachapi Mts. have well-developed yellow spots on ups, & there are some yellower phenotypes at Caliente Creek also), which would seem to be intergradation with *olancha*. But *sinecat* over the W foothills of the Sierra Nevada northward doesn't have the creamy ups of *olancha* or *macglashanii*. *Sinecat* is not intermediate between *chalcedona* and *olancha* either.

Davenport (pers. comm.) collected many more samples in 2007, and notes that the near-*olancha* phenotype is more widespread than previously thought. He collected near-*olancha* on Bald Mtn. & vicinity in May-June 2007, and to the west at Alder Creek. Material along the upper Kern River at Ant Canyon also appears similar but is a bit more blackish. A mix of blackish and more-yellow phenotypes occur in the Kern Can. localities of Miracle Hot Springs, Democrat Hot Springs, and Richbar. All these populations are close in appearance to the *olancha* series from the TL Olancha Peak that Ken has examined at LACM, so Ken thinks all these populations including the Kern Canyon pops. are best called near-*olancha*. (The populations to the north, west of Sequoia Nat. Park along the Mineral King Road and in the San Joaquin River Drainage, are much blacker on ups and resemble *sinecat*.). (Even ssp. *chalcedona* from Frazier Park at the S end of the San Joaquin Valley, in a large series coll. June 5 & 12, 2007, are more yellow on ups than the more blackish Coast Range populations, showing some apparent gene flow with *olancha* to the east.)

(I have examined samples of near-olancha coll. by K. Davenport from near Lamont Peak in Kern/Tulare Cos., from Ant. Can. & Kennedy Meadows in Tulare Co., from Upper Richbar & Kernville & Canebrake & Piute Mts. & Havilah in Kern. Co.)

Davenport notes that *olancha* from the E side of the Sierra (Whitney Portal, Bishop Creek, Pine Creek, Swall Meadow, Tom's Hill) is a very different phenotype than those from Olancha Peak, Pine Mtn., and the Kennedy Meadows areas. Many individuals from Whitney Portal and occasional individuals from Kennedy Meadows are reddish like *sierra*, and evidently represent the redder "*georgei*" form. He found 4 *georgei* among 31 *olancha* from the east side of the Sierra, and

5 *georgei* out of 42 from the Kern River drainage to the west, thus the % seems to be about 10%, lessening westward. Thus there is a lot of intergrading going on, and there may not be any completely "pure" orange-less populations of *olancha*, and the TL Olancha Peak is probably a blend of bugs from the west and east slopes of the Sierra, but the concept of *olancha* should still be kept for the very-yellow ups bugs, understanding that they intergrade into surrounding phenotypes and may never occur anywhere in pure-yellow form.

At any rate, *sinecat* is the darker-ups critter in the Sierra Nevada western-slope lowlands, defined mostly by its much-different larva, whose range seems to be isolated from the similar-ups Coast Range *chalcedona* by *E. c.* near-*olancha* in the south, and *E. c. dwinellei* in the north.

Larval Variation in Stenchospecies *Euphydryas chalcedona* (Including Bookkeeping Species *E. chalcedona, E. colon, E. anicia, E. bernadetta*), by J. Scott

There are many different phenotypes of larvae in these butterflies, though the heart line is always black, there is little to much white beside the heart-line, there is little to much white on the side of the larva, there is always a black line next to the spiracles, the BD1 (middorsal) & BSD & BSV scoli are always orangish at least at the base (the other BD1 & BL scoli--and often most of the prior scoli also--are black), and the head is always black. The three bookkeeping species names (*E. chalcedona*, *E. anicia*, *E. bernadetta*) are used below (*E. colon* is sometimes considered a bookkeeping species also. Notably, John Emmel etc. found *E. chalcedona macglashanii* & *E. colon* near *wallacensis* sympatric [*macglashanii* prediapause larvae on *Castilleja applegatei*, and near-*wallacensis* eggs on *Symphoricarpos rotundifolius*] in the Warner Mts. [Pine Crk. Can., 1.7-2.8 mi. E Hwy 395, Modoc Co. Calif., June 25, 2007, in News Lepid. Soc. 50:12, 2008]. Thus *E. colon* may be a bookkeeping species also, if this proves correct.). Published descriptions are often rather imprecise.

E. chalcedona chalcedona larvae (Monticello Dam, Yolo Co. Calif., J. Scott) were similar to *Chlosyne leanira leanira* (which is black with some orange and a little white), but had yellow BD1 scoli with two lines passing through (whereas *leanira* has black BD1 scoli with a single line through). Barnes & McDunnough (1916) & Shapiro (2007) describe San Francisco area larvae (on *Scrophularia* etc.) as black with BD1 & BSD scoli orange at base, without pale dorsal & lateral whitish stripes.

E. c. chalcedona larva (So. Calif., paintings by Charles Dammers, in Emmel & Emmel 1973, Butt. So. Calif.) is black with some white near heart-band and some lateral white, and orangish BD1 & BSD scoli.

E. c. chalcedona (W. H. Edwards' larvae on *Penstemon* from San Bernardino in S Calif., Papilio 4:63, 1884) were black (brown-black on lower side), a double whitish stripe on middorsum containing orange BD1 scoli, BD2 scoli black, a macular whitish stripe in line with BSD scoli which are black with orange around base except on dorsal side, BL1 scoli orange [?](those on abdomen with a little patch of orange at base on dorsal side), BSV scoli orange, numerous whitish small setae over body.

E. chalcedona sinecat (Jerseydale, Mariposa Co. Cal., J. Scott, on *Penstemon antirrhinoides*; and Sierra Nevada foothills E of Sacramento, Shapiro [2007], host *Keckiella breviflora* etc.) boldly banded with white & black similar to fig. 5 in Allen et al. (2005).

E. chalcedona near-*olancha* (Kern Can., Kern Co. Calif., Allen et al. [2005] p. 91 fig. 5) larva looks like *sinecat* larva, has a solid wide white middorsal band enclosing orange BD1 scoli & orange bases, (with NO black heart line), then a wide black subdorsal band enclosing BD2 scoli, a wide white stripe enclosing black BSD scoli that have orange around bases, mostly black along row of black BL1 scoli, the BSV scoli orangish on a narrow whitish stripe; head black.

E. chalcedona olancha (Bauer 1975) larva similar to *macglashanii* [which was described as having a longitudinally black and white striped pattern] with slightly wider white stripes).

E. chalcedona near-*olancha* (adults redder than the "typical" creamy *olancha*, Whitney Portal Calif., host a red *Penstemon*, Steve Spomer photo) larva black, heart-line black with a white band beside it, BD1 scoli orange at base, lateral band a series of white patches.

E. chalcedona macglashanii has a longitudinally black and white striped pattern like *sinecat* (Bauer 1975). Rivers (Proc. Cal. Acad. Sci. 2nd Ser. I p. 103, 1888) described *macglashanii* larva on *Penstemon* from Truckee Calif. as having white stripes like the larva from San Bernardino.

E. chalcedona near-*dwinellei.* J. McDunnough (Barnes & McDunnough 1916) described the larva he found on *Penstemon* at Dunsmuir, Siskiyou Co. Calif. as having white stripes like larvae from San Bernardino & Truckee, Calif.

E. chalcedona sierra (Bauer 1975) similar to Bauer's *macglashanii* & *olancha,* with very wide white & narrow black longitudinal stripe with almost no white specks in the black stripes.

E. chalcedona hennei is similar to ssp. *chalcedona* (Emmel & Emmel1973, Butt. So. Calif.).

E. chalcedona near *corralensis* (Christmas Tree Pass, Newberry Mts., Clark Co. Nev., Steve Spomer photo; adults look closer to *corralensis* than *kingstonensis*) larva mostly black, a narrow whitish line beside black heartband, BD1 scoli ochre, BD2 scoli black in a wide black area, BSD scoli black with orange around base and a creamy band connecting them, blackish below that except BSV scoli orangish with black tips; head black. Pupa white, the black markings less wide than *bernadetta* pupa, the cones on top of thorax & abdomen orange. *E. chalcedona corralensis* larvae are identical to ssp. *chalcedona* (C. Dammers, Bull. So. Cal. Acad. Sci. 39:124).

E. chalcedona kingstonensis larvae are identical to ssp. *chalcedona* (C. Dammers, Bull. So. Cal. Acad. Sci. 39:124).

E. chalcedona colon & related ssp. including *E. c. paradoxa* have "relatively abundant, fairly long, white body hairs and the white bristles on the lower half of the tubercles, giving the body a fuzzy white appearance. The head is black but covered with long black & short white hairs." (Bauer 1975). Scoli color like *chalcedona*. Bauer noted that ssp. *colon* has a little less white on the body than some of the other populations similar to *colon*, and noted that ssp. *paradoxa* is like *colon* but usually has more white hairs and more extensive white markings; the white areas are often tinged with yellow & orange on thorax.

E. chalcedona (*colon*) *nevadensis* is identical to *E. "anicia" maria* according to Todd Stout, thus is like Stout's photo of *maria* from Taylor Can., Weber Co. Utah in Allen et al. (2005, p. 91 fig. 1, as "*anicia*"), thus the larva is mostly black but has numerous whitish hairs (the *maria* photo is described below).

E. anicia "*variicolor*" (Steve Spomer photo) larva black with the usual tiny white dots, heart-band a black line edged by white band, BD1 scoli (middorsal on abdomen) orange at base and darker orangish on scolus, a white lateral band of white patches above BL1 scoli, BL1 scoli black with slightly-tawny tips, BD2 & BSD scoli black, SV1 scoli tawny orange; head black. Obviously more similar to *E. anicia wheeleri* than *E. chalcedona macglashanii/olancha*.

E. anicia anicia=*howlandi* (Wash. Cascades, Bauer 1975) larva mostly black with bristly tubercles, except BD1 & BSD scoli orange basally.

E. anicia anicia=*howlandi*? (photo S Mammoth Hot Springs, Yellowstone Nat. Park, Allen et al. 2005, p. 91 fig.4) larva black with some white next to black heart-line, side of larva mostly white divided by a black line below spiracles, BD1 scoli orange on basal part & around base, a little orange at base of BSD scoli, & orangish BSV scoli; head black.

E. anicia hopfingeri (Bauer, 1975) black, with whitish stipe of specks beside the black heart-line, and a double whitish lateral band, BD1 scoli orange, a spot of orange at base of BSD scoli, BSV scoli orange.

E. anicia "*hopfingeri*" ([*paradoxa*?], photo Williams Lake in C BC, Guppy & Shepard 2001, Butt. BC) nearly all white, heart-line black, bases of BD1 & BSD scoli orange, BSV scoli orange, proleg plates orangish-brown, a black band through BD2 scoli, a wavy black narrower band between BL1 & BSV scoli.

E. anicia maria (Todd Stout photo from Taylor Can., Weber Co. Utah, Allen et al. 2005, p. 91 fig. 1, as "*anicia*"; and 2nd photo by Todd Stout from Salt Lake Co. Utah 6800' sent by S. Spomer) is mostly black but has numerous whitish hairs on scoli, BD1 scoli black with darkish-orange bases, heart-line black edged by white band, BD2 scoli black, BSD scoli black with darkish-orange bases (all these orange bases are larger in second photo) in a band of white, a weak band of sinuous cream crescents above BL1 scoli, BL1 scoli black with a field of white dots between them, BSV scoli orangish; head black. Adults are rather blackish according to Todd Stout, tending toward *nevadensis* (and Bauer [1975] mentions that adults are blackish, some reddish), and its larva has a lot of whitish hairs, as is reported to occur on *colon*, so evidently there has been a lot of hybridization and introgression of genes between *E. colon nevadensis* and NE Nevada-N Utah *anicia*.

E. anicia maria=*effi*. Bauer (1975) described the larva of *effi* as black with considerable white in bands of spots & specks, which is rather similar to the larva of *maria*, and Bauer stated that the hostplants of both are a blue *Penstemon* and adults are the same (maybe slightly smaller in Idaho), so *effi* is evidently a synonym of *E. anicia maria*.

E. anicia wheeleri (photo Dugway Mts., Tooele Co. Utah, Allen et al. 2005, p. 91 fig.3) larva mostly black with just a little whitish next to black heart-line, a band of white narrow dashes between the BSD scoli, a lot of orange at base of BD1 scoli, a bit of orange at base of BSD scoli, & orangish BSV scoli; head black.

E. anicia "*alena*" (RC Loop, Uintah Co. 9000' Utah, photo by Todd Stout sent by S. Spomer) 5th stage larva black, BD1 scoli black with dark-orange bases, BD2 scoli black, BSD scoli black with dark-orange bases and a white band between them, BL1 scoli black with lots of white dots in area, BSV scoli dark-orangish in a whitish band; head black.

E. anicia wecoeut (SE Cortez, Montezuma Co. Colo., Scott) is mostly black, BD1 & BSD & BSV scoli orangish, with small orange spots next to heart-line.

E. anicia wecoeut (Coral Pink Sand Dunes Area, SE Utah, S. Spomer) normal larva odd-looking, overall appearance black with large orange spots: heart-line black, some small tawny dots beside it, BD1 scoli all ochre, body then black below that area including the black BD2 scoli, BSD scoli ochre with wide yellow-ochre bases, a white band between BSD scoli that is about as wide as those scoli, some small tawny crescents below that just above the black BL1 scoli (BL1 scoli ochre on thorax), BSV scoli ochre. Light larva (same site) the same as normal larva but with much greater extension of white, the white band beside heart-line wider, the black band below that is only half white because of extensive white splattering, the wide white bands above spiracles much wider & the white band below spiracles much wider also (these bands are joined into a completely white lateral area except for a narrow black line that runs just below spiracles), the BD1 & BSD scoli are orange-ochre with black tips as in the normal larva (thoracic BSD scoli black with orangish ring around base) but BD2 scoli are also orange ochre on basal half, BL1 & BSV scoli are orange-ochre.

E. anicia hermosa larva (Oak Creek Can. Ariz., Bauer 1975) is similar to *sinecat* with a black & white striped color pattern.

E. anicia magdalena (J. Comstock, Bull. So. Calif. Acad. Sci. 34:145-6) is black & white striped, a narrow black heart-line runs through an ivory middorsal band which contains the BD1 scoli arising from orange-yellow bases, a black mottled subdorsal band contains BD2 scoli, BSD scoli have narrow orange-yellow bases in a white band, a mottled black area between spiracles forms a spiracular line, scoli black except BSV scoli orange-yellow, legs black, prolegs stray; head black.

E. anicia brucei (Summit & Hinsdale Cos. Colo., Scott) is black, with some white near heart-line, a bit of lateral whitish, bases of BD1 & BSD & BSV scoli orangish.

E. anicia eurytion (T. Mead 1875 [Wheeler Survey Report] wrote that larvae found on "*Plantago*" were probably "*nubigena*"; these may be *eurytion* as *eurytion* was named by Mead in this Wheeler Report and its types had "*nubigena*" labels), larva white slightly marbled with black, scoli black with bases of BD1 & BSD & BSV yellowish, collar black; head black, hairy, bilobed. Pupa whitish-gray, marked with black &yellow dots, much as in *phaeton*.

E. anicia eurytion. (T. Emmel, Bull. So. Cal. Acad. Sci. 62:19; & T. Emmel et al., Butt. Florissant pl. I legend photo, text rather confused), larva white, several black transverse lines on dorsum of each seg., narrowly black at segment joints, heart-line black, weak black line along spiracles, black scoli [no doubt with orangish bases of at least BD1 & BSD].

E. anicia capella (Jefferson Co. Colo., Scott) is mostly white all over except for black heart-line & some black transverse lines, & orangish bases of the black BD1 &BSD scoli.

E. bernadetta bernadetta (topotype, near Harrison, Sioux Co. Neb., Steve Spomer photos) larva black with tiny white dots & transverse streaks, making the body look frosted, scoli mostly black, heart-line black containing the BD1 scoli, which are black with large light-orange bases, the heart-line edged by a white band <1.5 mm wide, BD2 scoli black in the frosted area, BSD scoli black with narrow light-orange bases in a wide white band, below that a narrow sinuous black line near spiracles, below that a white sinuous narrow band runs between black BL1 scoli, BSV scoli orange-brown; head black. Pupa white with rather wide black stripes & spots, many orange spots on abd.

E. bernadetta rorina (Veedauwoo Picnic Ground, Laramie Mts., W of Cheyenne, Wyo., Steve Spomer photos; so far only 2 adults have been rearedfrom the diapausing larvae, including 1 female like *bernadetta*, and 1 male like *bernadetta* but a bit redder; placed in ssp. *rorina* now but I have not seen adults from locality [some males here become reddish—S. Spomer]) similar to Neb. *bernadetta* (which has no reddish adults) with black & white bands, body black with tiny white dots & white transverse streaks, heart-line black containing middorsal BD1 scoli, scoli black, but BD1 scoli on abdomen are tan-orange around base, a band of white spots beside heart-line & BD1 scoli, BSD scoli on abdomen have a small brownish-orange ring around base, a band of white spots between BSD scoli; head black.

E. bernadetta veazieae (Bauer, 1975) is black with a row of small white spots beside black heart line, BD1 scoli orange at base (description incomplete).

What can we conclude about this larval variation? Nothing major, other than they vary a lot geographically, in the amount of white on the body, in the amount of orange on the body (even changing the color of BD1 & BSD scoli to orange), and in the apparent numbers and color of the "hair". Striped larvae like *sinecat* also show up in Ariz. ssp. *hermosa*, and very white larvae show up in BC and C Colo. and as variants in SE Utah. Also, larvae evidently show parallel variation with *E. editha*: the *editha* photo in Allen et al. 2005 is similar to their near-*olancha* photo from Kern Co., Todd Stout notes that Utah *E. anicia wheeleri* larvae look like *E. editha lehmani*, and S. Spomer notes that *E. bernadetta rorina* larvae from Veedauwoo in S Wyo. look like *E. editha hutchinsi=alebarki*. These convergences suggest that genes have been transmitted between species by viruses etc. The variation does not seem to parallel obvious trends in the adults. David Bauer (1975) described larvae of many ssp., but couldn't make any robust conclusions either, although he thought that the white-furred larva of *colon/wallacensis/nevadensis* along with their preferred *Symphoricarpus* host meant that they were a separate species *E. colon* (now Todd Stout has found that the *E. anicia maria* larva in Utah has a similar white-haired larva, even though *maria* has *anicia* valvae, suggesting a lot of introgression in this imperfect trait). Nobody has followed up Bauer's work with a detailed study. *Euphydryas* workers at Stanford Univ. have reared many populations, but have not done a comparative study of immatures. By now there are surely hundreds of good photos and pickled larvae that could support a good study. The larvae of *bernadetta* and *bernadetta rorina* are comparatively dark, with black & white longitudinal bands, while *capella* (& *eurytion*) larva are mostly white, which should help document any purported intergradation between them in N-C Colo. & S-C Wyo.

Apodemia "mormo" Species, and the Taxa in and Near Colo., by J. Scott

There seem to be three or four definite species of "*mormo*" now instead of one, calling into question the proper name for Colo. bugs.

Here is my current treatment of *Apodemia* "*mormo*" ssp., based on my modest but comprehensive coll. of specimens and what little info I have been able to gather on egg size, flight time, hosts, appearance, etc. (see Pratt & Ballmer 1991; Emmel & Emmel 1998; and Emmel, Emmel, & Pratt 1998; Austin, 1998; Davenport 2003; for the most recent papers)(= denotes synonyms/weak ssp.). This section was aided by specimens & information from Ken Davenport, who is now naming the Kern Co. ssp. with John F. Emmel. Recent research on *A. "mormo"* is mostly unpublished, so this treatment could surely be improved. Note that there is considerable confusion and uncertainty in this group, as egg size and diapause stage etc. are unknown for most of the varieties, hosts are unknown for many, and the group is a confusing mess of local forms and perhaps some "hostplant races", though hostplant specificity seems rather wide on *Eriogonum* species (compared to *Euphilotes*), and the variations of wing pattern appear to happen independently rather often. Of course the *A. "mormo"* group is a stenchospecies, which will take decades to understand more fully. The 1998 papers cited above apparently abandoned the biological treatment used in the 1991 paper, leaving the group in chaos; however the "1998" papers were written in 1988 and took 10 years to publish (as were the major *Euphilotes* papers in Syst. W N.A. Butt.), so maybe the 1991 paper is still useful. Rumor has it that there are nine different varieties of these bugs in the San Bernardino Mts. alone, as this stenchospecies is basically a complex mess of local varieties. But it is clear that there are several bookkeeping species instead of one, as there are some little zones of sympatry here and there among the varieties. Ssp. *deserti*, *davenporti* and *cythera* are found in close proximity in the desert part of the Tehachapi Mts., Jawbone Can., E of Walker Pass and Nine Mile Can., where they overlap slightly and can occasionally be found on the same days. Ken Davenport has collected *davenporti* and *deserti* together and the new *virgulti* ssp. with *cythera* around Lake Isabella.

APODEMIA VIRGULTI (multivoltine, diapause stage evidently young larva, larva aestivates in summer, larval duration short, egg small at least in ssp. *deserti*) includes ssp. ***virgulti***=*arenaria*=*nigrescens* (reddish uph & upf postmedian band), ssp. ***deserti*** (no postmedian-submarginal reddish on upf & uph, the upf more orange), new ssp. along Kern River, new ssp. in central Baja Calif., ssp. ***maxima*** (large, ups reddish all over, host maybe *Krameria*), ssp. ***duryi*** (ups extensively reddish-orange, browner unh than *mejicanus*; eats *Krameria* and *Eriog. wrightii* [ssp. *deserti* larvae survive on *Krameria* also]), ssp. ***mejicanus*** (ups extensively reddish-orange, orangish areas in center of unh, and unh veins M1, M3, CuA1, & CuA2 are orangish in center of the wing, whereas these veins are gray in W Texas-SE N.M.-Albuquerque *duryi*). Ken Davenport and John Emmel (pers comm.) consider *deserti* a separate species from *virgulti*. Ssp. *duryi* and *mejicanus* are certainly conspecific, and probably belong in *A. virgulti*. Scott places *deserti* in *A. virgulti* now because of similarities of voltinism and life histories and wing pattern, as some variant adults of the new ssp. resemble *virgulti* and some resemble *deserti* (frequently in Tehachapi Mts.). Brown et al. (1992) note some *virgulti*-like populations in Baja Calif. on E slopes of the Sierra Juarez & at the W edge of the Colorado Desert near Cantillas Can. in which the fw orange is greatly expanded and lighter in color, approaching *deserti*. And Davenport notes that Gordon Pratt (pers. comm. to Davenport) reared a family from S-C Ariz. from Douglas Mullins, that produced variants ranging from typical *deserti* to typical *mejicanus*, and *deserti* occurs west of there while *mejicanus* occurs east, suggesting that *deserti* and *mejicanus* are conspecific. Ssp. *deserti* and *duryi* can eat *Krameria*, and *A. virgulti maxima* from S Baja Calif. may use *Krameria* as its host (Brown et al. 1992), and both ssp. have widespread redder color on ups, which is another indication they could be conspecific. San Diego Co. butterflies from El Cajon & Dictionary Hill are like *virgulti*, but the unh is rather darker outwardly. Then *virgulti* loses its orange uph band (like *deserti*) as it ranges S to the middle of Baja Calif. (unnamed there).

John Emmel (pers. comm.) notes that *arenaria* belongs in *A. virgulti* because it is double-brooded. Gordon Pratt found that *arenaria* allozymes differ from Riverside *virgulti* (though *nigrescens* was similar to *virgulti*), but Scott notes that isozymes are rather subjective in interpretation, electrostatic motility can be similar in different isozymes, starch-gel electrophoresis is a poor technique compared to acrylamide gel electrophoresis, and allozyme studies are never reproduced by other workers (other workers never repeat the work, so errors are never discovered, and thus conclusions based on electrophoresis are reduced to a matter of faith concerning poor techniques of the study of obscure mostly-neutral-allele isozymes that have no relevance to the ecology/morphology of the bugs).

{The new ssp. along the Kern River in Calif. mts. has recently been discovered and studied by Ken Davenport [Scott has numerous specimens], and perhaps will be named by Davenport [pers. comm.] and John F. Emmel. It is related to ssp. *virgulti* and *deserti*. The ups orangish color is darker than *deserti*, more like *virgulti*. The upf orangish is distributed like *deserti* but often spills beyond the postmedian white spots a little, while the uph usually lacks orange like *deserti* [unlike *virgulti* which usually has uph submarginal orange], but sometimes has orange in outer part of the postmedian white spots. Adults show some variation, as there are orange and black phenotypes. It was discussed by Davenport [2003] as "Undescribed Kernville-Greenhorn Mts. segregate" [and Scott thinks that Davenport's 131c, d, e varieties are probably also the new ssp.]. The new ssp. occurs along the Kern River in Kern Co., Calif., where it has two generations [L May-M June, and L Sept.-E Nov.], and is assoc. with *Eriogonum wrightii* along the upper Kern River, although the host is *Eriogonum nudum* along the lower Kern River [possibly *E. fasciculatum* as well]. It also occurs in the Greenhorn Mts. John Emmel has reared the new ssp. from material supplied by Davenport. The new ssp. occurs very near the Kern River near Kernville, and occurs along Lucas Creek which is just off the lower Kern River. The only known locality not on the Kern River is 3 mi. W of the Kern River up the Sawmill Road on the E side of the Greenhorn Mts. [a good locale for both *A. dialeuca davenporti* in Aug.-E Sept., and the new ssp. in June and L Sept.-Oct.][both *davenporti* and the new ssp. occur near Kernville L Sept.-E Oct.]. The population in the Tehachapi Mts. is similar to it, but looks like it may be closer to ssp. *deserti*, and needs more study; *E. fasciculatum* is the likely host on the E side of the Tehachapi Mts. Davenport [pers. comm.] has found some black forms of *A. virgulti* in Tulare Co. [Corral Crk.], and a few such black forms are also known from the Piute Mts. [on Hooper hill, 2 air mi. S of Kern River] and in Greenhorn Mts. [on Old State Road ~5 air mi. from Lake Isabella on the Kern River]. [The *Apodemia* become rather complex in Kern Co., as Davenport notes that there is an orange *cythera*-looking bug on *Eriog. umbellatum* that may not be the same as the *tuolumnensis* on *E. fasciculatum* at lower altitude, as the bug has less black on the wings and is a deeper orange-red on most specimens.]}

APODEMIA DIALEUCA (mostly univoltine flying in spring, larva diapauses young or half-grown, egg small, adults mostly have larger white ups spots, very little orange which is limited to middle of upf) includes ssp. ***davenporti***=*pratti* (1st-reviser synonymy—John Emmel considers *pratti* to be a distinct ssp. biologically closer to *dialeucoides* and notes that *pratti* has page priority, but Scott notes that "page priority" does not matter as it not mentioned in the ICZN Code so Scott gives *davenporti* priority in synonymy because of its similar appearance and much larger range)(looks rather like *virgulti*, submarginal ups white spots larger, M Apr.-L May, *E. fasciculatum*), ssp. ***dialeuca***=*dialeucoides* (ups has lots of white spots and little or no reddish)(L May-L June in San Bernardino Mts., *E. wrightii*, M May-M July in Sierra San Pedro Martir)(Scott's specimens from Wildhorse Meadow & Barton Flats & Seven Oaks coll. by Bill Gendron show an Aug.-Sept. gen. or pop. also [these were claimed to be fall *A. mormo mormo*, but they are identical in whitish wing pattern to spring *dialeucoides*, so Scott finds it impossible to believe that they are ssp. *mormo*, and note also the Aug.-Sept. flights of *davenporti* mentioned above])(ssp. *dialeuca* from Sierra San Pedro Martin in N Baja Calif. has a range far from *dialeucoides*, leading some to suspect that they differ, but they do look quite similar, and distance alone is not grounds for separate ssp.); ssp. ***mojavelimbus*** (ups similar to ssp. *mormo* but uph submarginal white spots larger, & flies E Apr.-M May, *E. fasciculatum*; this intergrades with *davenporti* on E side San Gabriel Mts. southward), ssp. ***peninsularis*** (similar to *virgulti* but sl. more orange and less white dots, M May-L June, *E. wrightii*). Davenport believes also that this *A. dialeuca* species (*davenporti*, *pratti*, *dialeucoides*, *mojavelimbus*, *peninsularis*) seems to be a natural grouping. J. Emmel notes that *peninsularis* could be a separate entity from the other ssp. *in A. dialeuca*, & its appearance is different also. (The single-gen. *peninsularis* is claimed to fly on E. *wrightii* less than 1 km from the several-gen. *virgulti* on *E. fasciculatum*, so it evidently does not belong to *A. virgulti*; *peninsularis* is claimed to fly in San Jacinto Mts., Palomar Mts., & Laguna Mts., while *A. cythera tuolumnensis* occurs S to San Bernardino Mts. & San Jacinto Mts., so *peninsularis* cannot belong to *A. cythera* if it is sympatric with it in San Jacinto Mts.) Brown et al. (1992) note that some specimens from middle altitudes (1600-1800m) in Sierra San Pedro Martir in N Baja Calif. look intermediate between *dialeuca* & *virgulti*; Baja Calif. bugs have not been examined with multiple species in mind.

APODEMIA CYTHERA (univoltine adults fly in late summer, eggs or young larvae diapause, egg larger in size) seems to be a separate sp. because Davenport (2003) has found it flying with *A. mormo* ssp. The orangish-red color is very extensive esp. on upf. It includes ssp. ***cythera*** (E side Sierra Nevada, white dots [submarginal etc.] a bit larger) and ssp. ***tuolumnensis*** (a weak ssp. with white dots a bit smaller, W side Sierra and S Calif., though Davenport notes a pop. like *cythera* in Bates Can. Santa Barbara Co.). Emmel notes that the S Calif. "*tuolumnensis*" is also distinctive. Interestingly, Ken Davenport has found two phenotypes of *cythera* on different hosts and *davenporti* and the new *virgulti* ssp. all on the E side of the Greenhorn Mts. on a 3 mile stretch of Old State Road. According to Davenport, *Eriogonum umbellatum*-associated pops. more closely resemble Inyo Co. pops. at Whitney Portal (which may use *E. fasciculatum* and *umbellatum*), while desert pops. of *cythera* on *E. fasciculatum* appear very light, often yellow-orange with a brown aspect, and pops. on the Old Ridge Route seem to be very bright-orange-red with black rather than brown on uph. Recent information suggests that maybe *cythera* does belong to *A. mormo*. I recently identified 3m2f from McGee Can. in Mono Co., July 28-Aug. 1, Ricky Patterson, which look quite like the new *A. virgulti* Kern River ssp., 2m lack uph submarginal orange, 1m has some orange, 2f have much orange there, the upf has more orangish than *mormo* and it extends a bit beyond pm white spots in males and much beyond in females; this pop. does not look like ssp. *mormo* or *cythera*, but may be *mormo*X*cythera*. Davenport notes that a *cythera*-looking bug (a variety of *A. mormo*?) extends to coastal Santa Barbara Co., and recent findings in San Luis Obispo Co. may alter the species status (maybe it will be re-lumped with *A mormo*?).

APODEMIA MORMO (univoltine, flies late summer, eggs or young larvae diapause [According to A. Shapiro, *langei* eggs evidently hatch in winter but the larva does not begin feeding until the host sprouts new growth in late winter or early spring], egg larger in size) includes ssp. ***langei*** (upf central spot reddish instead of white, a little reddish on uph base) ssp. ***mormo***=*autumnalis*=*parva*=*mormonia* (no uph reddish, & less reddish on upf) (the Trinity Co. Cal. pop. is a little darker), ssp. ***pueblo*** (E Colo., has submarginal ups orange). Some *pueblo* adults have orangish veins on unh as in *mejicanus* (and most have the usual 3 little orange streaks posteriorly edging vein Rs on unh as in most "*mormo*"), but most adults have these veins gray-brown. Scott's series of ssp. *mormo* from the Santa Catalina Mts. (Molino Basin) Ariz. has a few adults with orangish submarginal uph spots, but all these lack orange on the unh veins unlike the lowland *mejicanus*.

<u>Colorado ssp.</u> *A. virgulti duryi* ranges northward only to the Albuquerque area in New Mex. (Juan Tabo Can. Sandoval Co.; La Cueva Cgd. & Embudo Can. & Piedra Lisa Can. in Bernalillo Co.; April 22-May 26 & evidently later gen.), so Colo. has a rather simple fauna of two true *A. mormo* ssp., consisting of *A. mormo mormo* on the W slope (widespread in SW and W Colo., where hosts are a number of mostly white-flowered bushy *Eriogonum*), and *A. mormo pueblo* on the E slope in S-C Colo. Ssp. *pueblo* was once considered to be *cythera* of Calif., but the latter is much oranger on ups etc., and the addition of reddish on the postmedian band of the ups seems to be a frequent occurrence among the "*mormo*" varieties, as if it is a simple genetic switch. Ssp. *pueblo* is present but is incredibly scarce in the N-C Colo. foothills. There is one female in Univ. Colo. museum from North St. Vrain Can., 6500', on what was state hwy. 66, SE of Estes Park, Boulder Co. Colo., Aug. 1, 1952 June Preston, caught on goldenrod near hwy. in a steep wooded mtn. canyon; this specimen was given to Don Eff then, and appears to be a totally correct record documented in the Preston's notebook (Floyd & June Preston, pers. comm.), and Don Eff recognized its rarity at the time and asked to keep the specimen. Also, Brown, Eff, & Rotger's Colo. Butterflies 1957 lists *pueblo* (as "*cythera*") from Larimer Co. (2f Poudre Can. July 31, 1952 Don Eff [1953 Lepid. News 7:89], and Buckhorn Valley 6000', July 16, 1954 Arthur H. Moeck). The host in N-C Colo. is probably *Eriogonum umbellatum*, maybe *E. flavum*; in S. Colo. *pueblo* eats *Eriog. jamesii*. S.D., N.D., and SE Mont. have ssp. *mormo*, not *pueblo* as an internet checklist of N.A.-C.Amer. butterflies wrongly claims (I examined 5m1f ssp.*mormo* from 10-12 mi. W Terry, Mont., Aug. 15-22 1972 Jack L. Harry, in CU coll.). On the plains near Colorado Springs and Pueblo, ssp. *pueblo* often has slightly more white and less red in the postmedian ups spots, whereas in the mts. and San Luis valley most have more red in these spots, thus look a little redder; thus the plains pops. average slightly whiter, but there is variation and some redder ones fly with them, so they are not different enough to be named a separate ssp., and in a drawer full of these bugs the plains bugs aren't very noticeable. In the San Luis Valley Colo., ssp. *pueblo* occurs at the N end [SW & W of Villa Grove, W side of Hayden Pass, etc.] and the E edge [W edge of Sangre de Cristo Mts. such as Medona Crk. & Mosca Crk., side of Mt. Blanca, W La Veta Pass, etc.], and intergrades a little with *mormo* southward in the Rio Grande Can. W of Questa in Taos Co. New Mex. (where Scott has 2m1f, of which 1m resembles *pueblo* but 1m1f are similar to *pueblo* but have a little less postmedian uph reddish thus tend toward *mormo*), all on *Eriog. jamesi*, while ssp. *mormo* occurs at the center of the S end of the San Luis Valley floor on *Eriog. microthecum* and at the SW and W side of the valley (M. Fisher collected 2m2f A. *mormo* from D Mtn. at Del Norte [Rio Grande Co., July 28, 1982], and 2m1f resemble *mormo* while 1f looks like *pueblo*; and Scott has a male from 7 mi. W La Garita in Saguache Co. Aug. 14, 1970 that resembles ssp. *mormo*).

Egg Morphology of *Lycaena florus*, by David M. Wright

The life history of *Lycaena florus* was mostly undescribed, so all the life stages are described in this and later sections.

The *Lycaena florus* egg (Fig. 2) is upright, dome-shaped, and echinoid. The *florus* egg is typical of the Nearctic *Lycaena* subgenus *Epidemia* (see Wright 1983). Eggs of closely-related congeners, *L. helloides* (Fig. 3) and *L. dorcas* (Fig. 4), are figured for comparison. The outer chorion is highly reticulated giving the egg surface a honeycombed or pitted appearance. The depressed pits, properly called cells, are formed within a network of intersecting chorionic ridges. The ridges form the walls of each individual cell and bear small rounded prominences at points of intersection (Fig. 2). Small aeropyles on the ridges and porosity at the bottom of each cell communicate with an extensive airspace beneath the outer chorion (Fig. 5). The intrachorionic airspace is continuous and covers the entire surface of the egg except for the flattened bottom. This constant gas film around the ovum is predicted to serve as a plastron or physical gill allowing gas exchange to occur when the ovum is submerged in water.

The micropylar region of the *florus* egg (Fig. 6) is depressed and located in the central axis on top of the egg. On low power magnification, it appears as a typical cell on the upper surface of the egg and does not influence egg profile. The micropyle proper (Fig. 7) is a very small centrally-located, five-sided depression (pentagon) found at the bottom of the micropylar region. Five tiny holes are located at the apices of the pentagon just beneath the lip margin. These holes allow spermatozoa access to the unfertilized oocyte. Encircling the micropyle depression is a rosette of petal-shaped cells (Fig. 6), which may vary in size and shape. *Florus* eggs generally have five to six cells in the rosette.

Measurements: Ten ova provided an average width of 0.84 mm and height of 0.53 mm. The individual chorionic cells are cup-shaped and nearly circular when viewed from above. They average 0.04 mm wide at the cell mouth and 0.03 mm wide at the base; average depth is 0.06 mm. The micropylar area measures 0.09 mm in diameter. The pentagonal depression measures 5 microns in greatest diameter. The individual micropyle holes vary from 0.4-0.8 microns in diameter. Material examined: *L. florus:* Colorado: Clear Creek Co., Fall River (10 Aug 1977) (1); Gilpin Co., Rollins Pass (4 Aug 1977) (3); Grand Co., Winter Park (9 Aug 1977) (1); Summit Co., Keystone Gulch (8-9 Aug 1977) (5), all coll. J. A. Scott. *L. helloides:* Colorado: Jefferson Co. Lakewood (Aug. 17, 1978), ovip. *Rumex maritimus* var. *fueginus* (2), coll. J. A. Scott; California: Inyo Co., Round Valley (no date) (2), coll. Rudi Mattoni. *L. dorcas:* Canada: Newfoundland: St. John's (8-9 Aug 1984) (7), coll. Bernard Jackson.

Discussion: The geometric pattern of the *florus* egg is very similar to eggs of other Nearctic *Lycaena*, particularly congeners of the same subgenus *Epidemia* (Ferris 1977; Downey & Allyn 1981; Wright 1983). Among the *Epidemia* there are no appreciable differences in ova size, despite differences in size of adult butterflies. The dimensions of *florus* eggs are nearly identical to those published for *dorcas* (Newcomb, 1911), *helloides* (Coolidge, 1924), *nivalis* (Newcomer, 1911), and *epixanthe* (Wright 1983). The micropylar region of the *florus* egg is also similar to other Nearctic *Lycaena* (Downey & Allyn 1981; Wright 1983). Some intraspecific variability exists in the number of petal-shaped cells of the micropylar region, but this is common within *Epidemia* (Wright, pers. obs). *Epixanthe* has four to five cells in the rosette, while *florus, helloides* and *dorcas* usually have five to six. The micropyle itself is a small pentagonal depression with five tiny holes at the apices. It is suspected that all *Lycaena* share this pattern.

Ferris (1977) claimed there were no significant differences between *helloides* and *dorcas* eggs. Miller and Brown (1979) presented an SEM of the *helloides* micropyle as proof that *helloides* is taxonomically different from *dorcas*. However, their ovum is excessively coated with gold/palladium and the micropyle itself is obscured to such an extent that it cannot be evaluated.

A comparative look at SEM egg morphology of the *Epidemia* shows a noticeable trend in chorionic differentiation within the subgenus. Two egg subgroups emerge, specifically the *helloides* type (Fig. 2) and the *dorcas* type (Fig. 3). The egg of *L. helloides* has numerous small cells with less prominent ridges, whereas the *L. dorcas* egg has fewer but larger cells with prominent points on ridge intersections. The cell mouth of the *helloides* cell (0.04 mm) is little more than half the size of the *dorcas* cell (0.075 mm). Additional SEMs of *Epidemia* eggs can be found in Downey & Allyn (1981) and Wright (1983). Eggs of *helloides*, *florus*, *nivalis*, and *mariposa* match the *helloides* type. Eggs of *dorcas*, *epixanthe*, and *hyllus* match the *dorcas* type. These two separate egg clusters align with a branching pattern dividing the *Epidemia* in an allozyme phylogeny of Lycaeninae (Pratt & Wright 2002).

Detailed study of members of a given egg type may uncover minor differences that are useful for differentiating species. For instance, within the *helloides* type, the diameter of the micropylar region is not constant. The micropylar pit of the *florus* egg (Fig. 1) is narrow (0.09 mm), while that of *helloides* (Fig. 2) is considerably wider (0.13 mm). The wide micropylar region of *helloides* eggs is found both in Colorado and in California, implying it is consistent across a large part its range. Because of bottlenecks in oviduct capability, egg configurations are usually confined to their respective taxonomic subdivisions. In this context any character divergence, no matter how small, is significant.

First Instar Chaetotaxy of *Lycaena florus, b*y David M. Wright & James A. Scott

In describing details of *Lycaena florus* first instar chaetotaxy, we follow in general the nomenclature employed by Hinton (1946), Stehr (1987), and Hasenfuss & Kristensen (2003). For certain setae unique to *Lycaena* we follow Wright (1983) and Pratt *et al.* (1993). Recently, Ballmer & Wright (2008) attempted to standardize the specialized first instar lycaenid chaetotaxy based on patterns observed among lycaenid taxa representing several lycaenid subfamilies and tribes (Curetinae; Miletinae; Lycaeninae: Aphnaeini, Lycaenini, Theclini, Polyommatini). Principles described there are adopted here.

Material examined (n = 12): CO: Clear Creek Co., Fall River (10 Aug 1977) (1), Eisenhower Tunnel (29 Jul 2007) (1); Gilpin Co., Toll Ranch (28 Jul 1977) (1), Rollins Pass (4 Aug 1977) (3); Grand Co., Winter Park (9 Aug 1977) (1); Summit Co., Keystone Gulch (8-9 Aug 1977) (5); all coll. J. Scott.

General Appearance. 1.4-2.5 mm. Cylindrical at emergence, becoming onisciform. Similar to *L. epixanthe* neonate (see Wright 1983; Scott 1986). Pale green. Head, prothoracic shield, and anal shield brown. Dorsal and lateral setae brown, mostly long and spiculate, arising from brown chalazae. Subdorsal setae short and inconspicuous. Setae and cuticular structures (e.g. lenticles, pores) mapped using dissecting microscope and/or microscopic slides of cuticle mounts cleared with 5% KOH.

Detailed Appearance. Cranium (Fig. 9). 13 pairs of cranial setae (all short, non-spiculate) as follows: A1, A2, F1, AF1, AF2, P1, MD1, MD2, S1, SS1, SS2, SS3, and MG1. 11 pairs of cranial pores as follows: Aa, Fa, AFa, Pa, Pb, MDa, La, Sa, Sb, SSa (additional SS punctures on ventral cranium), and Ga. Clypeus (below frons) with C1, C2, and Ca. **Body** (Fig. 8) **T1.** Prothoracic shield (Fig. 10) brown, flask-shaped with slight central constriction, with six pairs of setae and one pair of lenticles: XD1 mesal-most at anterior margin, spiculate, tapered; XD2 at anterolateral margin, spiculate, tapered; dorsal lenticle DL at anterior margin between XD1 and XD2; D1 posterior to DL, at level of central constriction, long, spiculate, tapered; SD1 (“sensory seta”, tonosensilla) near mid-lateral margin, slender, tapered; D2 short, near clavate, with few minute spicules, posteromesal to SD1; SD2 minute, clavate, near lateral margin of posterior portion of shield. Three pores present, two posterior to D1 and anteromesal to SD1, a third slightly anterolateral to D1. Four anterior fringe setae (F1-4) in echelon anterolateral to the shield. Two lateral setae (L1, L2) anteroventral to spiracle. Two subventral setae (SV2, SV1) in horizontal line above base of coxa, with small lenticle (SVL) slightly dorsal to SV setae. V1 seta mesal to the coxa. Two microscopic proprioceptor setae: MV2 and MV3 anterior to the SV group. MXD1 absent. **T2–3.** Two pairs of long, stout, spiculate setae in dorsal group, each arising from a relatively large chalaza; D1 nearest dorsal midline; D2 posterolateral to D1, equal in size to D1 on T2, but half size of D1 on T3. A prominent lenticle (SDL) slightly lateral to D1. SD1 near anterior segmental line, posterodorsal to T1 spiracle; SD2 more dorsal and posterior on segment; both SD setae very short, nearly clavate, similar in length. Four long speculate lateral setae (L4, L2, L1, L3, respectively) below the level of the T1 spiracle. Two simple subventral setae (SV1, SV2), above the base of the coxa; small subventral lenticle (SVL) posterior to SV setae on T2. V1 seta mesal to the coxa. Six microscopic proprioceptor setae near the anterior segmental boundary: MD1 anterior to SDL, MSD1 and MSD2 slightly inferior to SD1, MV1 and MV2 below the L group, MV3 more ventral. **A1–A2.** Similar to T3 with the following differences: SD2 shifted slightly laterally; supraspiracular lenticle (SSL) situated between SD1 and SD2; additional small SD seta (SD4) situated immediately posterior to spiracle; lateral group with three setae (L2, L1, L3 respectively); single subventral seta (SV1); seta inferior to SV1 interpreted as P1, persistent vestige of P-group, rather than SV2. Three microscopic proprioceptor setae: MD1, MSD1 near anterior edge of spiracle, and MV3 near segmental margin anterior to P1. **A3–A6.** Similar to A1 & A2 with following differences: additional small SD seta (SD3) situated near segmental margin, mesal to SDL and slightly lateral to D1 (mostly on A4-6); SD2 shifted even more laterally near level of SSL; small lenticle (SVL) slightly dorsal to SV1; P1 and P2 present on lateral prolegs. Each proleg with 14 crochets, in near-continuous row around the proleg, consisting of uniordinal lateroseries (8 small) blending with uniordinal mesoseries (6 large) interrupted medially by fleshy spatulate lobe. Occasional extra or missing crochet. **A7** similar to A6 with following differences: D2 absent and replaced by dorsal lenticle (DL); SD3 absent; SSL absent; SD2 shifted further laterally, converging to level of SD1. **A8.** Dorsal and dorsolateral ornamentation reduced. D2, DL, SD1 and SD2 absent. Spiracle shifted slightly dorsally. Lateral setae, SV1, and V1 as in A7. No SVL. **A9.** Greatly reduced, narrow segment, less than half the length of previous segments, yet not fused with A8 or A10 as in many polyommatines and theclines. Only D1, MD1, L1, SV1, MV3, and V1 present. No SD setae found in specimens examined. **A10.** Prominent indentation marks the boundary with A9. Homologies for A10 setae have not been satisfactorily determined. Hinton (1946) declined to homologize them; Stehr (1987) and Hasenfuss & Kristensen (2003) placed the D and SD group setae on the anal plate and the L group setae below the lateral line. In *Lycaena* and all lycaenids, we believe the A10 lateral setae (L group) are on or slightly above the lateral line in continuity with L setae of previous segments. A sclerotized split anal plate is situated on the dorsum of A10. Two lenticles on anteromesal edge and small pore in posterolateral area of each plate half. Three pairs of prominent speculate fringe setae on or just above the lateral fold interpreted as L2, L1, and D1 (anterior to posterior). Two additional setae, supraproct SP1 and SP2, prominently spiculate in distal third, located just below the posterolateral fold but above the anus. Nine small setae encircle anal proleg; 2 laterally have thorny tips; all other proleg setae short and simple. Mesal-most believed to be V1. Small pore present laterally and small lenticle mesally. Anal proleg has 8 crochets, interrupted into groups of 6 and 2. Six lateral crochets in arc increasing in length from posterolateral to anteromesal; two large posteromesal crochets, posterior to spatulate lobe. Occasional extra crochet in lateral group.

Discussion. The cranial setal pattern of *L. florus* fits the standard pattern for members of the North American subgenera *Epidemia* and *Hyllolycaena* (F1, AF1 & 2 present; S2 absent). All New World coppers lack S2, a key feature distinguishing them from Palaearctic coppers (except for *L. phlaeas* & *L. cupreus*, which are Old World Coppers living in America). Miller & Brown (1979) believed monotypic *Hyllolycaena* is derived from an old lineage shared with subgenus *Gaeides*. However, Pratt & Wright (2002) demonstrated a close relationship between *Epidemia* and *Hyllolycaena* with the latter potentially included in the *Epidemia*.

The body setal pattern of *L. florus* fits the standard pattern for members of the *Epidemia*, in particular the *dorcas-helloides* species complex. In fact, there is very little to separate members of this complex by larval chaetotaxy. Individual variability at some loci further can complicate attempts to guarantee a singular setal pattern for a given species. It appears that chaetotaxy has its best utility when separating higher taxa.

One locus of interest was the SD group on the narrow A9 segment. We did not find any SD setae on this segment in the *florus* material examined. First instars of *L. dorcas* from Newfoundland (n = 7, coll. Bernard Jackson) routinely had SD1 on A9. Our first instars of *L. helloides* from Colorado (n = 11) and those from California (n = 2, coll. Rudi Mattoni) were highly variable at this locus. Some lacked SD1, others had SD1, and one individual had both SD1 & SD2. Because *florus* appears to lack SD1 on A9, *florus* may tentatively be thought of as apomorphic to *helloides*--in this one trait.

Hostplants & Early Stages of *Lycaena florus*, by J. Scott (plate V)

This section presents an overall description of hostplants, egg appearance, larval stages, and pupa of Colorado *Lycaena florus* (=”*castro*”), and compares it to *L. dorcas* & *L. helloides*.

Hostplants. Scott (1978) found 5 hostplant records in Colo. for *L. florus* on Polygonaceae (*Polygonum aviculare*, *P. douglasii*, *Rumex acetosella*, *R. densiflorus, R. triangulivalvis*), and suggested that Polygonaceae were the hostplants, not *Potentilla fruticosa*. However, the hostplants must be reassessed. At that time, Scott was watching in meadows for ovipositions on *Potentilla fruticosa* (and found none) and Polygonaceae, because he disagreed with Ferris’ placement of *florus* into the *Potentilla*-feeding *Lycaena dorcas*, and at that time *L. dorcas* was thought to eat only *Potentilla fruticosa*, and so Scott did not give other plant possibilities equal viewing time (in particular, *Vaccinium* grows in the nearby forest). Later, Clyde Gillette found that *Vaccinium* is the main host in Utah and NW Wyo.-Idaho (records cited in Scott et al. 2006). My observations in 2007 in Colorado confirmed Gillette’s finding that *Vaccinium* is the main host. I observed two ovipositions of eggs on small twigs of *Vaccinium scoparium* near Eisenhower Tunnel, Clear Creek Co. Colorado, July 29, 2007 (& in 2008 a female from here ovip 7 eggs on *V. scoparium* stems in lab), and then saw an oviposition on *V. myrtillus oreophilum* twig N of Fall River Res., Clear Creek Co., Aug. 9, 2007. The former locality has *L. florus* fairly common, and *V. scoparium* is extremely common, but few Polygonaceae were seen (one *Rumex occidentalis* plant growing in gravel at the edge of the highway, one *Rumex salicifolius triangulivalvis* growing there plus another plant in the middle of a ski slope, and two small patches of *Rumex acetosella* growing on a ski slope where adults were not common). And no Polygonaceae were seen at the 2nd site. Thus *Vaccinium* is the host at those sites, and Polygonaceae is not. Then I surmised that the main host must be *Vaccinium*, but surely Polygonaceae must be used at the lowest-altitude sites. But a visit to the lowest site in the Front Range (Critchell, 7700’, Jefferson Co. Colo.) revealed that *Vaccinium myrtillus oreophilum* is very abundant on N slope and Polygonaceae is scarce. So, I think that at all *L. florus* sites in Colorado and New Mexico *Vaccinium* is very common and must be the main host, while *Rumex* and *Polygonum* are generally uncommon or scarce so must be just occasional hosts. Both *Vaccinium* and *florus* are forest/forest edge inhabitants (except the dog-hair-thick Engelmann Spruce/Lodgepole Pine forest supports little life so should be burned or killed by bark beetles), so *Vaccinium* makes sense as the main host. *Vaccinium* is enormously common, carpeting the open forest floor and some open areas nearby, usually growing in populations of thousands or millions of plants. The butterfly is evidently somewhat polyphagous on both families (though *Vaccinium* is usually eaten), and I think that the Utah-Wyo.-Ida. butterflies would also oviposit on Polygonaceae if given the chance. Thus the Colo. butterflies would seem to be the same species as the butterflies in Utah-Wyo.-Ida., as there isn't a big difference in host preference. *Vaccinium* is probably the main host of *L. florus* throughout its range, and is the only host of its relative *L. mariposa*. (The host of *Lycaena dorcas* is *Potentilla fruticosa* E of Manitoba, & *Potentilla palustris* from Man. to BC {see Papilio [N.S.] #12}, though late in the season Q. Hess & A. Hanks found females ovipositing on *Vaccinium oxycoccos* {Occas. Pub. Toronto Ent. Assoc. #9-78 p. 28}.)

The 3 eggs ovip. on *Vaccinium* in Clear Creek Co. Colo. (as noted above) were reared. I gathered dried seeds of *Rumex crispus* from plant tops in Sept. and covered them with soil in a pot, and surprisingly every one sprouted, so those seedlings (which resemble *Polygonum viviparum* leaves) were used for food (those leaves stayed small--blades little more than 1 cm—for several months in the pot, then doubled to about 10 cm long by March, and grew to 15 cm by June, then senesced and turned brownish-green by Aug.). The diapausing eggs were refrigerated for 2 months, then larvae hatched within 1-3 days of removal to room temperature. The Fall River Res. egg hatched Nov. 22, 2007 & was reared to larva & pupa & adult on the *Rumex*. The Eisenhower Tunnel eggs hatched into 1st-stage larvae Nov. 24 & 26, but the latter died 3 days later after eating little, and the former died Dec. 7 at 2 mm length while molting to 2nd stage; maybe these from slightly higher altitude were unable to tolerate *Rumex*? and would have survived on *Vaccinium*?, while the one from slightly lower altitude at Fall River was better able to tolerate *Rumex* (though even it seemed to eat a large number ~20 of the seedling leaves as if it wasn't getting much nourishment out of them).

EARLY STAGES: EGG slightly yellowish-greenish-white when laid, soon becoming white; it looks similar to *helloides* eggs, with wide ridges and deep pits (David Wright's SEM photos of *dorcas* & *helloides* eggs show an aeropyle at the intersection of ridges, and many aeropyles on the bottom of the pits). **1ST-STAGE LARVA** chews a little hole centered at micropyle just enough to squeeze out, then does not eat eggshell; newly-emerged larva solid grass-green (not pale-green, more bluegrass-green) with numerous long setae; head chitin color; eats tiny pits into surface of leaf. Late 1st-stage larva light-grass-green with numerous creamy chevrons, setae red-brown, the topmost setae very long and curved backward, heart band darker, on front of thorax the middorsal area is a little darker partly due to many setae, heart-band area darker-green on T2-3, on abdomen heart-band area darker due to the long setae and a brownish middorsal area around/near the long setae, on rear a greenish-tan middorsal area is partly darker because of many setae, beside the long top setae on each segment is a creamy dash that is curved downward posteriorly, and below that a second creamy dash bent a little in the middle and curved downward beyond the bend, this second dash edged below by dark-green, below that a third weaker creamy chevron (like a squashed V), below that the body is creamier above/on the lateral edge, front of T1 darker due to many setae. David M. Wright (see above) prepared setal maps of 1st-stage larvae of my specimens from high-mountain sites in the Colorado Front Range. Wright found that cranial setae are typical of subgenus *Epidemia*. Body setae were like *Lycaena helloides* and *L. dorcas michuron* (Mem. Univ. Nfld. Bot. Garden, St. Johns, Newfoundland, Canada, N=7 incl. 6 ovip. *Myrica gale* & 1 ovip. *Potentilla fruticosa*), except that all the Colorado *L. florus* near-*florus* lacked the SD1 seta on A9, while most *L. helloides* have it but some lack it, and the few *L. dorcas michuron* examined have it; an interesting finding that may support the status of *florus* as a distinct bookkeeping species within the overall stenchospecies. **2nd-STAGE LARVA** solid grass green; head chitin color; eats the surface of leaf. **3rd-STAGE LARVA** solid grass-green; eats whole leaf from the edge. **4th-STAGE-MATURE LARVA** green, heart-band a little darker green & edged by a slightly creamier-green band, a weak cream subdorsal zigzag line (the curved line on each segment dives downward a bit toward rear of segment), two faint slightly-creamier-green bands (the lower containing the faint spiracles which are white with chitin-colored ring around edge), then a fairly-conspicuous sublateral light-yellow line; (I think that the light from flash photography brings out the pale band beside heart-band and the supraspiracular & spiracular pale bands, as my notes and the *helloides* description of Coolidge noted below does not mention these, and not all are mentioned in the *dorcas* description of Newcomb noted below—thus the darker heart-line and the zigzag subdorsal line and the yellower sublateral line are the ones that are definitely visible on living larvae with human eyes);there are hundreds of minute white protrusions all over integument (the mushroom-setae of Wright 1983 which really look like pine cones on stalks), and hundreds of setae from tiny chitin-colored bases; head chitin-colored. Larva started pupating Dec. 18, pupating larva spun silk all over area of leaf, then pupated Dec. 20 morning, pupa was attached to the silk by a 1.3-mm wide patch of crochets caught in silk mat and by silk girdle over body between A1 & A2. Duration of larval stages 28 days in lab. **PUPA** green at first, but developed pattern by Dec. 20 night. Pupa green, head-thorax-A1-wings pale-creamy-green, heart-band darker-green with darker pattern (blackish on head-T1, a brown line T2, strong blackish band T3-A1, darker-green with a tiny blackish dot on A2-3-4-5-6 [anteroposteriorly-compressed on A1-2], one dot on combined A9-10), there is a slightly paler creamier band beside heart-band and another near-dorsal creamier band a little ways away on T2-abdomen (just above dorsolateral dots), a dorsolateral blackish dot on T1, 3 small blackish spots in a row on T2 above wing base, tiny blackish mottling & a blackish blotch on T3 above wing base (four marks like filled in ^{O}O:O), tiny blackish mottling on A1 above wing base, the supralateral area has a blackish dot on each segment A1-7 (plus some minute mottling on A8) & a tiny blackish oval venteroposterior to that dot on A2-7, wing base has a brown longitudinal dash, a similar postbasal dash near rear (dorsal edge) of wing, some weak tan mottling between the paler wing veins on all but basal area of wing, spiracles whitish (T1 spiracle long & white, spiracles on A2-7, A7 spiracle bigger)), a tiny brown dot posterior to and a bit above spiracle on A2-6, a larger tiny brown lateral dot on abdomen posteroventrad of spiracle on A4-7 & another in same place on A8, a weak wide mottled brown sublateral band on abdomen, A8 & rear have tiny brown mottling over most of area, a blackish rectangular brushlike spot near midventral line on A5-6, a brown midventral spot at front of cremaster crochets ring, the ecdysial flap on underside has light-brown to tan markings including brownish antennae (the distal half of antennae tan & clubs slightly tan), proboscis tan, a brown rim around eye & brown beside (medial to) orbit, legs mottled tan esp. in middle of each leg, some brown on side of head, a U-shaped brownish mark (pointed posteriorly) on underside of head; A8 not visible ventrally and A9-10 appear combined; the usual middorsal cleavage line on head-T1-2. 2 days before emergence the ecdysial flap becomes dark-brown, wings light-brown; 1 day before emergence pupa all blackish except side & ventral areas of abdomen are still green; male emerged Dec. 30 morning; duration of pupa 10 days. (The pupa has the same spots and many more than the *Lycaena epixanthe* pupa color photo in Wright 1983.)

Comparison of *florus* Early Stages to *Lycaena helloides, L. florus dospassosi,* & *L. dorcas*. Allen et al. (2005) has photos of older larvae of *helloides* (p. 49#5) & *L. florus dospassosi* (p. 49#4 from Bathurst NB, as "*dorcas*"). They both look like *florus* and have the same paler bands/lines, though the *dospassosi* looks a little more similar to *florus* in the crisper-narrower lines of the pattern. The *helloides* seems to have longer setae on rear and sides, and some tan ones are even visible against the dark-green background, while the *dospassosi* seems to have just short setae; the *florus* has some long setae all over, thus would be more like the *helloides* in seta length, unless the longer setae on the *dospassosi* are just not visible due to lighting conditions (look at the *dospassosi* photo under microscope and you see just very crude blotches of green & red and you don't see any hairs at all, while if you look at my *florus* slides with magnifying glass you see just shorter setae like *dospassosi* but if you look at the slides with a microscope you see longer setae).

Newcomb (1911) reared *L. dorcas michuron*, and did not mention "brownish mottling" on larva. He found hundreds of eggs on the uns of *Potentilla fruticosa* leaflets and overwintered some in little vials with added drops of water, and raised them in little vials with host sprigs inserted into wet sand. He found average durations of 17, 12, 8, 11, 14 days for five larval stages, & 10 for pupa. Larvae prefer to eat tender opening leaflets in spring. Egg white. 1st-stage larva clay-yellow or pale-brown but changing to pale green after feeding, with a pale-brown triangular prothoracic shield, & long setae; head dark-brown. 2nd-stage blue-green with 4 faint lines between white sublateral line & darker heart-line. 3rd-stage similar, but becomes pale-green, and some minute white mushroom-setae. 4th-stage similar, with dark-green heart-band, and faint white lines as before though upper two were fused into one, thoracic shield a shallow diamond-shaped pit. 5th-stage-mature larva pale-green, described as having 4 variably-expressed white lines, evidently meaning that there was a darker heart-band, then a whiter band, a faint wavy whiter line, a whiter band, then the white sublateral band; numerous mushroom-setae on older larvae; thoracic shield a diamond-shaped pit with curved crease-like extension on each side; longest setae on T1 & rear; head tan. Pupa variable in color (green, or slightly-mottled with tiny blackish spots,, or green thoroughly-mottled with brown, or entirely brown or black, or in one ccase a "purple-madder"); sublateral & two wavy white dorsolateral bands of larva are sometimes present on pupa; spiracles white; larval setae replaced by tiny wine-glass-shaped processes whose rims have fingerlike projections (the trumpet setae of Wright 1983, which actually look like a trumpet-shaped sea urchin).

Coolidge (1924) reared *Lycaena helloides* in L.A. Calif. The older larva was grass-green, with a weak yellowish line beside darker heart-line, a weak dorsolateral line of yellow oblique dashes, & weak sublateral yellow stripe, & setae 0.2-0.6 mm long. Pupa yellow-green on abdomen, grass-green on thorax, wings pale cream, with a pattern of brown on ecdysial flap & blacker spots evidently similar to many of those of *florus*; with minute trumpet-setae.

I found many *L. helloides* larvae & eggs on *Polygonum coccineum* at Salida, Chaffee Co. Colo., & reared many to pupae. Mature larvae were yellow-green, with the same bands as *florus* (heart-band darker-green, edged by a creamy-green band, then the row of curved creamy-green zigzags that dive posteriorly on each segment, two weak creamier-green bands, then a cream sublateral line); setae are about as long as *florus*; many more white mushroom-setae than *florus*; head chitin-brown. Pupae variable in color from tan to brown to brownish-red with pattern of mottling similar to *florus* but brown not black, the mottling very strong on the darker pupae (the wings and uns dark-brown on the brownest pupae); spiracles very conspicuous white (more conspicuous than *florus*).

Overall, the *L. florus* older larvae and pupae are too similar to *L. helloides* & *L. dorcas* to draw any big conclusions about taxonomic relationships. The *florus* older larva looks similar to *L. florus dospassosi*, and neither is pale green with "brownish mottling" as *L. dorcas* is described in Layberry et al.'s Butt. Canada (but their description of mottling is almost certainly in error as Newcomb describes no brown mottling, so evidently they mistakenly used the pupa description for the larva). Pupae are polymorphic pale to brown in *L. helloides* & *L. dorcas*, so *L. florus* may be polymorphic also (I reared only one pupa).

Systematics and Taxonomy of *Lycaena florus (L. "castro")* in Colorado and Western North America, by J. Scott

Because *L. florus* has recently been raised to species status from *L. helloides* (Scott & Kondla & Guppy 2006, in Scott et al. 2006, Papilio [New Series] #12, as "*castro*"), and I have since collected it at many more sites in Colo. and Wyo. than reported by Scott (1978), its status is reviewed here. I mounted hundreds more for study, and studied the amount of orange maculation on these specimens (I have 2,549 specimens of *L. florus* & *L. helloides* in my coll., and studied hundreds more at Univ. of Colorado=CU) to study geographic variation within *L. florus* and its relationship with *L. helloides*.

Here I delve into taxonomic problems in this group, discuss a toxotaxon, restrict a TL, name a new ssp., and discuss its relationship with *L. helloides*.

Interesting results were obtained, that require changing the range of ssp. *florus (castro)*, and restricting the TL of *castro*. Colorado does not have one uniform ssp. as was thought. The amount of orange increases greatly from N to S, forming a definite clinal gradient of increasing extent of orange from N Wyo. southward through Colo. to New Mex. Ssp. *florus* (averaging only 1 orange lunule on male uph) occurs in Alta. and BC and Montana, and I have similar bugs from the east side of the Wind River Mts. and from the Salt River Range in Wyo. Populations from northern Colorado (TL of "*castro*") are actually near *florus*, as the males average only 1.9 orange uph lunules and females average less than ½ orange on ups. In contrast, populations from S Colo. (San Juan, Sangre de Cristo, Wet Mts.) average 2.4-2.6 lunules and more than ½ orange, and pops. from the Sangre de Cristo Mts. in New Mex. are rather uniformly well-orange-spotted averaging 3.1 lunules on males and 56% orange upf on females, and are named as a new ssp. below, because "*castro*" from N Colo. is closer to *florus* than is the new ssp.

Thus we have two ssp. of *L. florus* in Colorado, not just one ssp. formerly called "*castro*", which requires more of the nomenclatural juggling that is needed to conform to the ICZN code, especially if one accepts the name "*castro*" as valid.

The complete life history of *florus* was reported for the first time above. The egg of *florus* from N Colo. (reported by Wright above) is somewhat different from *L. helloides* and quite different from *L. dorcas*, and the 1st-stage larva of *L. florus* from N Colo. is missing a seta that is present but sometimes absent on *L. helloides* and present in *L. dorcas*, which may support the separate bookkeeping species status of *florus*.

Eggs of *L. florus* are more similar to eggs of *helloides*, *nivalis*, & *mariposa*, whereas eggs of *L. dorcas* are more similar to *epixanthe* & *thoe*. Allozymes (Pratt & Wright 2002) also show that *L. florus* is related to *L. helloides* (& *nivalis* & *mariposa*) and not to *L. dorcas* (& *epixanthe* & *thoe*). Thus *L. florus* is definitely not conspecific with *L. dorcas*, and evidently the *L. helloides/florus* "stenchospecies" (superspecies) does not include *L. dorcas*.

Toxotaxon castro. The name *"castro"* is another gruesome toxotaxon, which has two species identities (the syntypes contain two species), two "lectotypes", its TL is near the middle of a cline causing confusion and threatening to eliminate a long-accepted name (*florus*), the second lectotype might be a different species, that lectotype contradicted the recommendations of Art. 74A and the "50-year rule", and the name is spelled like a foreign dictator. Accordingly, I have submitted a petition to ICZN to suppress the name *castro* for purposes of synonymy under ICZN 81.2.3. plenary powers.

Here is the original description of *castro,* by Tryon Reakirt (1866), Proc. Ent. Soc. Philadelphia 6:148-149:+++++
Polyommatus Castro, nov. sp.

Hab. Rocky Mountains, Colorado Territory (Coll Tryon Reakirt.)

Male. Upper surface brown, with a broad blackish-brown border, on the outer margins of both wings; a brilliant violet reflection glosses the entire surface, rarely absent. Eleven black spots on the primaries arranged thus: one at the end of the cell, and two others within the cells at equal distances between the first and the base; a transverse row of seven, between the cell and the outer margin of which the last is duplex; the eleventh spot is found directly under the origin of the first, median veinlet. Secondaries, with a long black discal bar, and an intermediate row of seven black spots, between this and the margin, of which the third, fourth and sixth are the largest: a marginal series of fulvous lunules ranging from one to four in number.

Under side; primaries, yellowish ochreous, becoming grayish at the apex; the black spots of above, reproduced much larger, to which are added three or four semi-lunes, forming a sub-marginal row, running up from the inner angle and a small spot between the eleventh of the upper surface and the base. Secondaries, gray, brownish-gray, and reddish-gray; two transverse black macular bands, of which the first near the base is composed of three spots, one near the costa, another within the cell, and the last in the medio-inferior interspace; the band is formed of eight small elongate black spots, running from the costa to the inner margin, midway between the cell and the outer margin; an indistinct sub-marginal row of fulvous lunules, sometimes rising to the outer angle. Fringe, light brown; expanse 1.12-1.30 inches.

Body, above black, below gray, grayish-brown.

Antennae black, with incomplete white annulations, interrupted above; tip of club, fuscous.

Female, markings disposed as in the *male*, but of much greater size; terminal band much broader; color of the disc, lightened on both wings, and between the border, and the transverse macular bands, there is an almost continuous fulvous band, cut by darker veins, from the costa of the primaries to the abdominal margin, indistinct only upon the costal and anal borders of the secondaries; these last also present an additional black spot within the cell, otherwise the upper surface is the same as in the *male*.

Below, primaries orange brown, secondaries grayish-brown diluted with red; the markings larger, but placed as in the other sex. Expanse 1.25 inches.

Var. Female.—The disc of the primaries, and all the light spots of the secondaries, are pale ochraceous.

Below, yellowish-ochreous, the secondaries sprinkled with brown atoms; the rest as in the preceding.

Closely allied to both *Epixanthe*, and *Helloides*, but constantly distinct from either.*
+++++(end of original description)(*refers to Reakirt's original description of a separate species, *Lycaena mariposa*)

The type series of *castro* was in the Herman Strecker collection in the Field Museum of Natural History, which is now on extended loan to the McGuire Center, Gainesville, Florida. The type series consists of three male and two female syntypes, illustrated by Cliff Ferris (1977, figs. 68-72) that belong to two species. The male in fig. 70 looks conspecific with *L. florus*. The male in fig. 68 is probably *florus* but could be considered a nomen dubium because it has two orange uph lunules and is brighter than fig. 70, so there is a small possibility that it is *helloides* (I have seen nearly a dozen definite *helloides* males with 2 or fewer lunules). The male in figs. 69 and the females in figs. 71 and 72 have a much greater extent of orange markings and have a paler underside, and are *L. helloides*. All five syntypes are labeled just "P. Castro Reak. Col. [for Colorado] orig. type Coll. Reak.", though the male in fig. 68 also has a label "Polyommatus castro Reakirt Rocky Mts.".

Historical records suggest more precise localities for these five syntypes. Reakirt's (1866) O.D. paper stated that James Ridings was the source of most of his Rocky Mts. specimens, and pages 131 and 136 discussed specimens of various butterflies that Ridings collected at Empire City. F. Martin Brown wrote (p. xii of C. Ferris & F. M. Brown, eds., Butterflies of the Rocky Mtn. States, Univ. Okla. Press, 1981) that James Ridings collected in 1864 in Nebraska, and in Colorado around Denver and as far north as Longmont and in the mts. around Empire City [now Clear Creek Co.] and made a fine collection of butterflies, and Tryon Reakirt—a well-to-do Philadelphian--purchased Ridings' material and wrote his 1866 publication on the basis of Ridings' collection. According to that history, and my knowledge of the distribution of *L. florus* and *L. helloides* from Denver to Clear Creek Co., the *L. florus* adults [Ferris' 1977 figs. 70 & probably 68] were evidently collected near Empire, while the others [69, 71, 72] were 1m2f *helloides* evidently collected in or near Denver. So, the *castro* syntypes that are conspecific with *florus* (Ferris' 1977 fig. 70 and probably his lectotype fig. 68) are evidently from **Empire, 8600 feet, Clear Creek Co., Colorado** (the butterfly probably occurs there on N-facing slopes and is known to occur in the mts. a short distance to the W, N, and S)(thus Empire is the **TL of *castro*** as defined by Ferris if you believe that it is conspecific with *florus*). Ferris' figs. 69, 71, & 72 I identify as *L. helloides* from Denver, Colo., where *L. helloides* flies and where they were probably collected by James Ridings in 1864 (thus Denver would be the TL of the *castro* Reakirt taxon as defined by the specimen Barnes & Benjamin labeled as lectotype).

The male of *L. helloides* in fig. 69 was given a lectotype label of *castro* by Barnes & Benjamin sometime between 1922-1927 (Foster Hendrickson Benjamin was William Barnes' curator from 1922-1927). Their label reads "Heodes castro Reak. Lectotype male Br. Benj.". However Ferris (1977) stated that Barnes & Benjamin never published their lectotype designation, so he considered it invalid (it is invalid under ICZN rules from 1960 to the present that require publication of each such action). Ferris designated another specimen, the male in fig. 68, as lectotype of *castro*, and attached a label that reads "LECTOTYPE Polyommatus castro Reakirt, 1866 Designated by: C. D. Ferris 1976". That specimen has the margin worn near tornus, however it apparently has just two orange lunules and the uns is a little darker than figs. 69/71/72 but is not quite as dark as 70, so Ferris' lectotype is probably conspecific with *Lycaena florus*, but could be conspecific with *L. helloides* as noted above. (If Ferris had wanted to assign the name *castro* to *L. florus*, he should have chosen fig. 70 as lectotype as that specimen is undoubtedly *L. florus* because it has the least orange and is most different from *L. helloides*.)

The original description of *castro* described variation ranging from *L. florus* to *L. helloides*. It described the number of lunules on the dorsal hindwing margin of males as varying from 1-4 (adults with one or two lunules are probably *L. florus*, while N Colo. adults with 4-5 lunules are most likely to be *L. helloides*), and described some females as having a fulvous upf band and described a variety of the female as having the dorsal forewing disc pale ochraceous (*L. florus* females ranges from dark brown to orangish on dorsal forewing, while most *L. helloides* are orangish, thus the variety with pale ochraceous disc best describes *L. helloides*). Ferris wrote that he chose a lectotype from the the fig. 68 male (belonging to *L. florus*) because the O.D. best fit that specimen among the five syntypes. However, my comparison of the five syntypes with the O.D. indicates otherwise, because the fig. 68 Ferris lectotype best matches Reakirt's O.D. description of males only by having dark upf black spots, but fig. 68 has these spots the same size on unf whereas he O.D. said they are much larger on unf which fits the other males better. And the original description mentioned specimens with from one to four orange dorsal hindwing lunules, which fit both lectotypes and both species. And both *helloides* female syntypes match Reakirt's "Var. Female" with yellowish-ochraceous unf that best describes *helloides*, and neither of the female syntypes match the other females Reakirt described. Thus the two *helloides* female syntypes best match Reakirt's description of *castro* females.

For 101 years prior to Ferris (1977), the name *castro* was considered a synonym of *L. helloides*. Throughout history—as Ferris cites—Kirby (1871), Barnes & Benjamin (1926), McDunnough (1938), and dos Passos (1964) all treated *castro* as a syn. of *helloides* in their catalogues & checklists, as did all later authors until Ferris (1977). Ferris did not follow Recommendation 74A of the ICZN codes, which recommended that the lectotype should belong to the species to which prior authors assigned it (thus Ferris did not follow the "50-year rule" that informally tried to get rid of names that hadn't been used for 50 years, but that rule was never formally written into the code and is now ignored). The 1960-2000 ICZN Codes say that Barnes & Benjamin's lectotype can be ignored because they did not publish it, but there was no such rule when Barnes & Benjamin labeled their lectotype, and they did publish that *castro* is a syn. of *helloides* in their 1926 checklist. Their publishing that *castro* is *helloides* implies that they were publishing that the name *castro* should be applied to a syntype that is clearly *helloides*, and they did label the fig. 69 *helloides* male as castro lectotype, but they failed to publish the specific lectotype designation.

The rules of 1926 were not as stringent as they are today. The ICZN was founded in 1895, and the Régles applied from 1905-1947, and the 1958 ICZN rule 20 section 3(a)(iii) "The selection of a lectotype shall not be effective until published." (this rule later dropped in subsequent codes and evidently replaced by usage of the word "author") was not present in early times, though in 1953 a rule was modified to say "on publication of that lectotype selection the specimen so selected becomes the lectotype" (Copenhagen Decisions on Zool Nomenclature, p. 74). These 1953 and 1958 rules were passed evidently because many authors had thought that a mere labeling of a specimen as lectotype was sufficient, and publication was not required. The 1905 Régles did not even mention the word lectotype. The reprinted Régles of 1926 (Proc. Biol. Soc. Wash. 39:75-104, 1926) were little changed and still did not even mention lectotype. The word lectotype apparently never appeared in the ICZN Code until the 1958 draft of the code which wasn't official until 1960!, even though the word was in popular usage. The Oxford English Dictionary (2nd ed., vol. VIII p. 785, Clarendon Press, Oxford, 1989) is a compilation of the history of english words, and cites Schuchert & Buckman in 1905 (Ann. & Mag. Nat. Hist. 7th Ser. XVI, 103) as using the word lectotype to mean "a syntype chosen, subsequently to the original description, to take the place which in other cases a holotype occupies.", and lists another usage in 1951. (The 20-vol. Oxford English Dictionary gives the history of other types as follows: neotype: 1905 C. Schuchert in Bull. USNM #53, 13 [used as defined by Cossman in 1905]; paratype: 1893 O. Thomas, Proc. Zool. Soc. 242; holotype: 1897 C. Schuchert in Science 23 Apr. 637/2; paralectotype: not in dictionary; topotype: not in dictionary.) Strangely, these various type names were used for some **50 YEARS** by taxonomists before they found their way into the ICZN rules! Thus we have the surprising finding that the lectotype and those other kinds of types were in popular usage during that time despite never being sanctioned in the code! Barnes & Benjamin evidently thought that labeling a lectotype and specifying *castro's* identity in their 1926 checklist satisfied the rules in effect at the time they worked (when there were NO rules regarding lectotype)(obviously they do not have to satisfy future rules because they do not have futuristic ESP/time machines). Ferris' fig. 68 lectotype *castro* probably belongs to a different species (*Lycaena florus*) from the *castro* of prior authors (*Lycaena helloides*). The current code states that the new code supercedes all previous codes, suggesting that we should ignore that history, when making taxonomic decisions today. But the definition of a species as defined by its O.D. and type etc. is a legacy that is defined by history, and carries forward in time through all codes, for instance the original definition of *helloides* was ancient but is still valid today, so when a species becomes satisfactorily defined, that definition must stand through history. And present in the current code is Art. 74.1.3 that states that the first valid designation of a lectotype permanently prevents any of the former syntypes (which are now called paralectotypes) from being later designated as lectotype; thus a valid lectotype designation by Barnes & Benjamin would make Ferris' later lectotype designation invalid under the current rules. Ernst Mayr (1969, Principles of Systematic Zoology, McGraw Hill, p. 373) notes that "Many classical authors clearly designated one specimen as the type in their collections without specifically citing such a specimen as "the type" in the published description…..Such specimens have traditionally been accepted as holotypes". Therefore, the same acceptance should occur for lectotypes. Thus one can make a case that Barnes & Benjamin's lectotype should be considered to be valid, and *castro* should still be considered a syn. of *helloides*. The only sentence in the 1926 reprint of the Régles that has any bearing on whether publication is needed for a valid taxonomic act, is opinion summary 87, which reads "Printer's proof sheets do not constitute publication and, therefore, have no status under the International Rules of Zoological Nomenclature", which might suggest that any taxonomic decision—such as a lectotype—has to be published to be valid, which again suggests that a mere label on a specimen is meaningless unless the taxonomic decision is published; but it is quite a stretch to apply opinion 87 to lectotypes. Actually, even if Barnes & Benjamin had published the selection of their lectotype as *helloides* in the 1920s, why would it have mattered, because the Régles had absolutely zero mention then of lectotype (or neotype or holotype or paratype or anything else other than "type") until the 1950s! Why should they have published their selection of lectotype, when the Régles did not require them to publish it or even designate it? My opinion is that if the lectotype had no validity in the ICZN code until 1960, then 106 years of usage should be considered to be a valid species designation, regardless of a lectotype; and the 1922-1927 lectotype was valid for that time anyway because the Code at that time did not require publication of those type designations.

Obviously, taxonomists are expected to obey the ICZN code at the time they publish, and they cannot be expected to have future-divining ESP time machines that can look forward in time to obey rules that will be passed decades in the future. That is ridiculous. It is just as ridiculous to expect a future ICZN rule to reach back in time and overturn taxonomic decisions that were properly made long ago using the rules of that earlier time. Thus, *castro* is a synonym of *helloides*, and is not validly applied to *L. florus*.

So, there is controversy here, but we may be stuck with toxotaxon *castro*, as my opinion does not matter to the ICZN, which evidently thinks that it can propose retroactive rules that overrule prior practice. Of course Barnes & Benjamin's lectotype is invalid under the current code, but it was valid back when they labeled it (when the ICZN had no rules concerning lectotypes). But the name *castro* has so many problems that I have petitioned the ICZN, in the proper formal way using the current Code, to attempt to preserve *florus* and suppress *castro* through their plenary powers under Art. 81.2.3. Because *castro* is arguably a nomen dubium and may be suppressed, in the following sections I use *L. florus* and append the dubious *castro* names in the section headings. If my petition to the ICZN to suppress it does not succeed, some people will want to use the toxotaxon *castro*. But in that case, I may consider *castro* Reakirt 1866 a nomen dubium because the 1977 lectotype has a small chance of being *L. helloides*, and I may consider that *castro* 1866 with its perfectly-valid-for-the-time lectotype is conspecific and synonymous with *helloides*, while *castro* Ferris 1977 with its separate holotype (Ferris' different "lectotype") is a new 1977 taxon which is both a junior homonym of *castro* 1866, and is either conspecific with but younger than *florus* 1884 and thus unable to replace *florus* in synonymy, or a synonym of *helloides*.

The name *castro* is also confusing because it falls near the middle of a cline. The butterflies in the Southern Rockies (southern Wyoming through Colorado to northern New Mexico) are not one uniform subspecies *castro* as Ferris (1977) wrote. I found that northern Colorado populations—the type locality of *castro*--have fewer orange markings, and the extent of orange increases southward in clinal fashion through southern Colorado to New Mexico. The *L. florus* butterflies with the most orange markings—from New Mexico and southern Colorado--lack a name so are named *L. florus sangremar* below. Compared to those, the N Colo. butterflies (*castro*) most closely resemble Canada *L. florus florus*, making Ferris' concept of *castro* and *florus* synonymous, and by priority *castro* must be used for Canadian butterflies that have long been called *florus*, which greatly upsets stability.

Since the ICZN Code is not biologist-friendly, being a set of legalistic rules--mostly about the dead latin language—that have no foundation in biology, applying names to a cline is difficult when the TL of one or more of the names—such as *castro*--is near the middle of the cline. I accept at most two names for a cline, one for each end (some people might accept three [irrationally I think], so they could accept all three names *florus* and *castro* and the new ssp.), so if the name *castro* is accepted, then I am forced to define and use a "**pretend type locality**" here, and pretend that *castro* refers to the N Wyo. pops. that are the least-spotted end of the cline, thus making *florus* a syn. of *castro*, and the new ssp. *sangremar* is the other end of the cline. And I am forced to use "**jumping subspecies**", in which an older subspecies named near the middle of the cline suddenly jumps a younger ssp. nearer an end of the cline and—like checkers--is crowned king of that end of the cline and takes the name for that end, thus *castro* jumps *florus* and is crowned king of the northern Rockies. (Other clines have the same situation, for instance, *hilda* was the end of the orange-female-ups cline from the other end *Plebejus saepiolus aehaja*, until *aureolus* was found to be more extreme, thus to apply only two names for that cline *hilda* jumps *aureolus* and the pretend TL for *hilda* thus becomes the TL of *aureolus*. And *Cercyonis oetus pallescens* was the palest until the even paler *C. p. alkalorum* was named nearby, so *pallescens* jumps *alkalorum* and the pretend TL of *pallescens* is now the TL of *alkalorum*. And in *Chlosyne palla, altasierra-palla-eremita* form a cline of increasingly black females but *palla* is the older name, so *palla* jumps *eremita* and the pretend TL of *palla* is the TL of *eremita*.). Yes, pretend type localities and jumping subspecies are ludicrous and pathetic, but don't blame me; blame the ICZN for its stupid rules that do not apply well to real biological organisms. The ICZN Code is mired in grammatical details of a dead language (latin), and cares little about biology as names are judged only by priority regardless of correctness or inappropriateness. One of these decades biologists will demand a revision of the ICZN Code that incorporates biology, and expunges inappropriate names.

Adult variation and taxonomy. The following parts define & discuss the taxa of *Lycaena florus* & *L. helloides* found in Colo., and briefly in the rest of North America north to Alberta, and list specimens examined, describing the amount of orange maculation, plus misc. notes (pap=papered in Scott coll.). A new ssp. is described, as follows.

***Lycaena florus* [*castro*] *sangremar* J. Scott, NEW SUBSPECIES (plate II)**. **Definition**: The frequency of orange marks is greater in *sangremar*, as males average about 3.1 orange uph lunules (2-3 in S Colo.), and females average more than ½ orange on upf. New Mex. pops. from the Sangre de Cristo Mts. (and those from the San Juan Mts. in Rio Arriba Co. in N-C New Mex. have a lot of orange markings so are included here now) have the most orange spots averaging 3.1 lunules in males (and 56% upf orange in the few females), while northward in Colorado there are slightly fewer orange markings in Sangre de Cristo Mts. and vicinity (mean 2.6 male lunules and females 60% orange)(& females 3.2 >D orange in Scott's 1978 tables), and slightly less in the San Juan Mts. of Colo. (mean 2.4 male lunules, and female upf 51% orange). It ranges north evidently through 2/3 of the Sawatch Range although I don't have many specimens from there to judge spot frequency well. In contrast, *L. florus near florus "castro"* in the Front Range and N end of the Sawatch Range have less orange (mean 1.9 male lunules & 2.0=C [which is roughly 1/3 orange] female orange in those tables). This increase in number of orange spots from N. Colo. to New Mex. is also apparent in Scott's 1978 tables, and in Ferris' 1977 figs. (66-67 vs. 75). Maybe the extra orange spots originated from past meeting/introgression with *L. helloides*, because *helloides* & *florus* are just bookkeeping species within a stenchospecies and *dorcas* is very similar, so at the N end of the *L. florus* range near and in Canada they are most influenced by *dorcas*, while at the south end they are most influenced by *helloides*. One generation, at higher altitude. Host probably mostly *Vaccinium*. **Type locality and types:** holotype male (plate II) NE Taos Ski Basin, 10400', Sangre de Cristo Mts., Taos Co. New Mex., Aug. 25, 1979, J. Scott (BMNH); many paratypes (all listed below). **Name:** is from the multiple orange spots (SANGRE=blood in spanish, similar to the color of the spots) and the range in New Mex. and S Colo. which mostly includes the SANGRE de cristo mts. and the SAN juan mts. and the SAwatch range, plus MARiposa=butterfly in spanish, & MAR can be thought of as bloodlike MARkings. **Range:** N New Mex. and S Colorado. **Specimens examined:** TL is NE Taos Ski Basin, 10400', Sangre de Cristo Mts., Taos Co. New Mex., Aug. 25, 1979, J. Scott, 2m (incl. holotype)(3, 3 lunules) 1f (1/3 orange). Taos Valley Ski Basin, 9350', valley bottom, Sangre de Cristo Mts., Taos Co. New Mex., Aug. 22, 1979, J. Scott, 4m (all 3 lunules) 1f ½ orange. Hondo Can., ~9000', Taos Co. New Mex., July 30, 1999, Reed A. Watkins, 1f ¾ orange (brown unh)(CU). Santa Fe Ski Area, ~10000', Sangre de Cristo Mts., Santa Fe Co. New Mex., J. Scott; Aug. 14, 1974, 5m (2, 4, 4, 3, 4 lunules); July 27, 1986, 2m (3.5, 4 lunules). Spring Creek Picnic Ground, S side Cuchara, 8600', Sangre de Cristo Mts., Huerfano Co. Colo., Aug. 21, 1980, J. Scott, 2m 3 lunules. South Crestone Creek, 11000', Sangre de Cristo Mts., Saguache Co. Colo., July 31, 1967, J. Scott, 4m (3, 2, 2, 2 lunules). North Crestone Cgd., ~8900', Sangre de Cristo Mts., Saguache Co. Colo., July15, 1970, J. Scott, 1m 1 lunule. Hayden Pass, 10600', Sangre de Cristo Mts., Saguache Co. Colo., July 22, 1971, J. Scott, 1f 1/3 orange. Wild Cherry Creek, ~9000', Sangre de Cristo Mts., Saguache Co. Colo., July15, 1970, J. Scott, 2m (2, 3 lunules). Ferguson Crk., Canadian Zone, ~10000', Sangre de Cristo Mts., Saguache Co. Colo., Aug. 4, 1965, J. Scott, 11m (males 3, 3, 2, 3, 2, 2, 2, 3, 4, 3, 3 lunules, 2f (all, ½ orange)(Scott 1978 gives frequency of orange). Rock Creek, 9600', 1.5 mi. N Simmons Peak, (S of Salida), Sangre de Cristo Mts., Fremont Co. Colo., July 29, 1969, J. Scott, 1f all orange. Bear Creek tributary, 1.5 mi. NE Simmons Peak, ~8600'?, Sangre de Cristo Mts., Fremont Co. Colo., July 31, 1969, J. Scott, 1m 4 lunules. West Creek Lake to Red Mountain, 11000-11600', Sangre de Cristo Mts., Fremont Co. Colo., Aug. 11, 1970, J. Scott, 8m (3, 3, 1, 2, 2+, 3, 2, 4.5 lunules), 5f (1/3, ½, ½, 2/3, 2/3 orange)(Scott 1978 gives frequency of orange). Hayden Creek Cgd., 7800', Sangre de Cristo Mts., Fremont Co. Colo., Aug. 12, 1965, J. Scott, 1m <4 lunules. Spruce Creek, near Rita Alta Mine, 9200-9600', Sangre de Cristo Mts., Custer Co. Colo., July 30, 1968, Glenn R. Scott, 6m(3, 3, 2, 3.5, 2, 3 lunules), 6f (1/2, 2/3, 2/3, 4/5, 4/5, all orange). North Brush Creek, ~10000', Sangre de Cristo Mts., Custer Co. Colo., July 30, 1968, Glenn R. Scott, 1m 2 lunules, 1f all orange. North Taylor Creek, 10800', Sangre de Cristo Mts., Custer Co. Colo., July 17, 1968, Glenn R. Scott, 1m 3 lunules, 1f 2/3 orange. Middle Taylor Crk., 10200', Sangre de Cristo Mts., Custer Co. Colo., Aug. 23, 1965, J. Scott, 4m (4, 2, 4, 3 lunules). Alvarado Cgd., ~9400', Sangre de Cristo Mts., Custer Co. Colo., July 21, 1967, J. Scott, 2m (2, 3 lunules). Hermit Pass (Horseshoe Lake and ridge east), 11000'+, Sangre de Cristo Mts., Custer Co. Colo., Aug. 1, 1971, J. Scott, 1m 2+ lunules. Venable Trail, 9500', Sangre de Cristo Mts., Custer Co. Colo., July 30, 1984, Reed A. Watkins, 1m 2+ lunules, 2f (3/4, all orange)(CU). Apishapa (now Cordova) Pass, 11300', Huerfano Co. Colo., July 29, 1972, M. S. Fisher, 1m 4 lunules. 0.5 mi. E Smith Creek Cgd., 7400', Wet Mts., Custer Co. Colo., Aug. 3, 1971, J. Scott, 1m 2 lunules. 4 mi. W Beulah, 8500, Wet Mts., Custer Co. Colo., Aug. 12, 1961, J. Scott, 1m 2 lunules. Ophir Creek, 10300', Wet Mts., Custer Co. Colo., J. Scott, July 30, 1971, 1m 3 lunules. Ophir Creek, 9800', Wet Mts., Custer Co. Colo., J. Scott, Aug. 25, 1970, 1m 3 lunules. 10 mi. N Greenhorn Peak, 10,800', Wet Mts., Custer Co. Colo., willow carr, Aug. 25, 1970, J. Scott, 1m 2 lunules. Cañones Creek, 5.5 mi. NE Brazos, ~8000-9000', Rio Arriba Co. New Mex., July 19, 1979, Glenn R. Scott, 1m1f (m 3 lunules, f 2/3 orange). Little Willow Creek, 4 mi. E Chama, ~8400', Rio Arriba Co. New Mex., July 16, 1979, Glenn R. Scott, 1m 3 lunules. headwaters of Willow Creek about 8 mi. NW Chama, ~8400', Rio Arriba Co. New Mex., July 14, 1979, Glenn R. Scott, 3f (½, ½, 2/3 orange). Los Alamos Creek, 3 mi. E Chama, ~8500'. Rio Arriba Co. New Mex., July 19, 1979, Glenn R. Scott, 1m 3 lunules. Nabor Creek, 8700', NW of Chama, Rio Arriba Co. New Mex., July 6, 1979, Glenn R. Scott, 1m1f (m 2 lunules, f all orange).

***Lycaena florus* [*castro*] near-*sangremar*.** **Definition**: San Juan Mts. in Colo. & most of Sawatch Range; males average 2.4 orange lunules in San Juan Mts., where females average slightly more than ½ orange on upf. One generation, at higher altitudes, host probably mainly *Vaccinium*. **Specimens examined:** Aspen Glade Cgd., 8600', San Juan Mts., Conejos R., Conejos Co. Colo., Aug. 21, 1965, J. Scott, 4m (3, 2.5, 2, 4 lunules). 2 mi. N Handies Peak, Lake Fork Gunnison River, 11400', Hinsdale Co. Colo., Aug. 20, 1979, J. Scott, 2m (4, 2.5 lunules) 1f ¼ orange. American Basin, 11200', Hinsdale Co. Colo., July 19, 1981, J. Scott, 4m (1/5, <3, 2/5, 2.5 lunules). Silver Creek NW of Redcloud Peak, 12000', Hinsdale Co. Colo., Aug. 2, 1983, J. Scott, 1m (2.5 lunules). Silver Creek, ~12000', Hinsdale Co. Colo., July 18, 1988, J. Scott, 2m (2.5, 4 lunules). Nellie Creek, 11000-11800', FR877, Hinsdale Co. Colo., July 29, 1998, M. S. Fisher, 1f ½ orange. Weminuche Pass, 10600', Hinsdale Co. Colo., July 31, 1972, J. Scott, 4m (2, 1, 1, 3 lunules) 1f 1/5 orange. Weminuche Creek, 10400-11500', Hinsdale Co. Colo., July 28, 1971, J. Scott, 2m (1.5, 1.5 lunules) 8f (1/3-7, ½-3, 2/3-5, ¾-2)(Scott 1978 gives frequency of orange). Cinnamon Pass, 12600', Hinsdale Co. Colo., July 18, 1988, J. Scott, 2m (1, 2.5 lunules). Spring Creek Pass, 11000', Hinsdale Co. Colo., July 24, 1971, J. Scott, 11m (0.5, 3, 3.5, 4, 2, 2.5, 2.5, 3, 2, <1, 3.5 lunules) 2f (¾, ¾ orange)(Scott 1978 gives frequency of orange). Animas River headwaters, 3300m, San Juan Co. Colo., K. L. Prudic & J. C. Oliver (CU): July 13, 2001, 1m 2.5 lunules, 1f 1/3 orange; July 15, 2001 4m (3.5, 2.5, 1, 3+ lunules). Little Molas Lake Rd., 3325 m, San Juan Co. Colo., Aug. 15, 2001, K. L. Prudic & J. C. Oliver, 1f ½ orange (CU). Old Lime Crk. Rd., 2675 m, San Juan Co. Colo., July 13, 2001, K. Prudic & J. Oliver, 1f 1/3 orange (CU). Scout Lake, 2650 m, San Juan Co. Colo., K. Prudic & J. Oliver (CU): July 1, 2001, 1m 2.5 lunules; July 13, 2001, 1m 1.5 lunule. Poughkeepsie Gulch, 10500', Ouray Co. Colo., Aug. 21, 1964, Scott L. Ellis, 1f all orange (CU). Red Mtn. Pass, 11000', Ouray Co. Colo., July 31, 1971, M. S. Fisher, 1m 3.5 lunules, 1f ¼ orange. Barlow Creek, 9600', Rico area, Dolores Co. Colo., July 9, 1974, M. S. Fisher, 1m 3 lunules, 1f ½ orange. Monarch Pass, old pass road, ~11200-11500', Gunnison Co. Colo., July 29, 1967, J. Scott, 2m with 3 lunules. Cumberland Pass, ~11000'?, "Pitkin" [Gunnison] Co. Colo., Aug. 8, 1961, Scott L. Ellis, 1m 2 lunules, 1f ¾ orange (CU). Pikes Peak, 11000', El Paso Co. Colo., Aug. 17, 1972, J. Scott, 1m 4 lunules (ssp. assignment uncertain). 4 mi. E. Cottonwood Pass, 10500', Sawatch Range, Chaffee Co. Colo., Aug. 14, 1973,

J. Scott, 1m 3 thin lunules. Black Mesa Rd., off Hwy. 92, ~9000’, Montrose Co. Colo., M. S. Fisher, July 11, 1974, 3m (4, 2.5, 2 lunules) 2f (2/3, 60% orange).

***Lycaena florus* near-*florus* [*castro*].** **Definition**: In N Colo. (N end of Sawatch range and Elk Mts. & Front Range and N-C Colo.) and S-C Wyo., males usually have 1 or 2 orange lunules and average slightly less than 2 (1.9), while females average <½ orange upf (~1/3). One generation, occurs higher altitude, host usually *Vaccinium*, sometimes *Rumex* or *Polygonum*. The TL of *castro* is in this area. **Specimens examined:** Lake Creek, 10000’, Lake Co. Colo., July 27, 2008, J. Scott, 1m 1.5 lunules. Tennessee Pass, 10424’, Lake Co. Colo., J. Scott, Aug. 15, 1971 4m, Aug. 17, 1974 1m, Aug. 9, 1972 3m1f (& 1f pap), orange less than *sangremar* (males 1, 1, 2, 1, 2, 4, 2, 2 lunules, female 2/3 orange). Gothic, 9500’, Gunnison Co. Colo., Aug. 7, 1961, Scott L. Ellis, 1m ½ lunule (CU). Gothic, 9600’, Gunnison Co. Colo., J. Scott, Aug. 8, 1961 1f 2/3 orange, Aug. 9, 1961 1m 4 lunules. Crested Butte, 8900’, Gunnison Co. Colo., Robert M. Pyle, July 22, 1960 1m 2 lunules, July 18, 1960 1f all orange (in Scott coll.). Emerald Lake, 10500’, Gunnison Co. Colo., Aug. 8, 1961, J. Scott, 1f 1/3 orange. McClure Pass, 8755’, Gunnison Co. Colo., Aug., M. Fisher, 1f ~1/2 orange. Placer Gulch, 11500’, Park Co. Colo., July 30, 1982, J. Scott, 1m 0 lunules. Jefferson Crk., 10000’, Park Co. Colo., July 27, 1985, Reed A. Watkins, 1m 2 lunules (CU). Just W Critchell, wooded E-W valley bottom, 7760’, Jefferson Co.Colo., J. Scott; Aug. 6, 1978 4m1f (& 18m9f pap); Aug. 3, 1985 4m3f; Aug. 4, 1985 7f (& 15m2f pap); Aug. 2, 1987 9m5f (& 2m2f pap); the frequency of male uph lunules is 1/2 (just a dot)-6 males, 1-0, 1.5-2, 2-15, 2.5-5, 3-14, 3.5-4, 4-6, for a mean of 2.5 orange lunules; the frequency of female upf orange is (in the A-F terminology of Scott 1978) A-3, B-4, C-8, D-4, E-12, F-0; and in a simple rough proportion of orange on female upf it is none-3, 1/5-1, ¼-6, 1/3-6, ½-1, 2/3-8, ¾-5, 4/5-1, for a mean of 45% orange; this Critchell pop. has males with a little more orange than most N. Colo. near-*florus*, and is thus nearer *sangremar*, but some males and many females are quite dark, and the extra male lunules are often very thin, whereas *sangremar* has very few mostly-brown females, so I still place this pop. in *L. florus* near-*florus*; *Vaccinium myrtillus oreophilum is* abundant on N-facing slope (surely the main host), and a few *Polygonum douglasii* & *Rumex acetosella* are present in this gulch W Critchell. Tinytown, 7000’, Jefferson Co. Colo., July 26, 1978 J. Scott, 1m 3 weak lunules (very rare stray here, not native). Indian Creek Cgd., 7600’, Rampart Range, Douglas Co. Colo., Aug. 12, 1971, J. Scott, 1f <1/3 orange. Indian Creek Cgd., 7600’, Douglas Co. Colo., Aug. 2, 1973, R. E. Stanford, 1m 2 lunules, 1f 1/3 orange (CSU). Golden Gate Can. State Park, creek N visitor center, 8200-8700’, Gilpin Co. Colo., July 25, 1990, J. Scott, 4m (1, 1, 2, 3 lunules), 4f (1/3, ½, ½, 2/3 orange). 1 mi. SE Golden Gate Can. State Park, 8600’, Gilpin Co. Colo., July 30, 1987, J. Scott, 1f 4/5 orange. 1 mi. NE Mt. Judge, 9100’, Clear Creek Co. Colo., J. Scott, July 31, 1987 1m ½ lunule, Aug. 5, 1987 1f ¾ orange; pap: Aug. 8, 1985 3m, July 24, 1986 1m2f, Aug. 2, 1984 5m8f. Lamartine, 10300’, Clear Creek Co. Colo., Aug. 3, 1963, J. Scott, 1f ½ orange. Hoop Creek, 10800’, Clear Creek Co. Colo., Aug. 9, 1977, J. Scott, 2m pap. Big Bend Picnic Ground, Clear Creek Co. Colo., July 16, 1978, J. Scott, 1m pap. West Fork Clear Creek, 9500’, Clear Creek Co. Colo., Aug. 23, 1961, J. Scott, 1m ½ lunule. Bakerville, 9800’, Clear Creek Co. Colo., Aug. 3, 1980, J. Scott, 3m1f pap. Clearings N of Eisenhower Tunnel, 11500-11700’, Clear Creek Co. Colo., July 21, 23, 29, 2007, J. Scott, 14m (males 3.5, 0, ½, 3, 3, 3, 2.5, 3, 2, 1, 1.5, 2, 3, 2 lunules) 6f (0, 1/6, 1/5, 1/3, all, 1/4 orange, and six females watched for ovip. had ~1/4 to ¾ orange); two ovip. *Vaccinium scoparium*. Same site N Eisenhower Tunnel, Aug. 1, 2008, J. Scott, 27m (½ lunule-2, 1-5, 1.5-1, 2-9, 2.5-4, 3-5, 3.5 lunule-1) 1f (½ orange). Squaw Mtn. Pass, 10900’, Clear Creek Co. Colo., July 31, 1954, 1m 2 lunules. 3.1 mi. SE Fall River Res. (S of Alice), start of rd. 274=Rainbow Rd., 10800’, Clear Creek Co. Colo., J. Scott; Aug. 9, 2007 3m (2, 3, 3 lunules) assoc. *Vaccinium myrtillus oreophilum*; Aug. 10, 1977 (15m pap)(egg found *Rumex triangulivalvis*)(Scott 1978 gives frequency of orange). N of Fall River Res., 11100’, S-facing subalpine slope, Clear Creek Co. Colo., Aug. 9, 2007, J. Scott, 7m(3.5, 2, 1, 2, 0.5, 0.5, 0.5 lunules), 2f (1/4, 1/3 orange), ovip. *Vacc. myrtillus oreophilum*. E Portal Moffat Tunnel/Toll Ranch, 9400’, Gilpin Co. Colo., J. Scott, July 7, 1985 1m 4 lunules (& 7m pap), July 28, 1977 ovip. *Polygonum aviculare*, and ovip. near *P. aviculare*/*Rumex acetosella*, and ovip *R. acetosella* (Scott 1978 gives frequency of orange) & 11m pap, July 27, 1977 9m pap, Aug. 5, 1996 3m pap, July 31, 1973 14m3f [2f ½ orange, 1f very orange] pap. Rollins Pass, 10500’, Gilpin Co. Colo., J. Scott, Aug. 4, 1977, 1f ¾ orange, & pap: Aug. 5, 1978 3m2f. Lump Gulch, 9000’, Gilpin Co. Colo., Helen E. Rodeck, July 28, 1940 1m 1.5 lunules, July 30, 1949 1m 2+ lunules (CU). 3 mi. NW Nederland, 8900’, Boulder Co. Colo., J. Scott, July 16, 1977 2m (2, 2 lunules). Near Nederland, 8200’+, Boulder Co. Colo., Aug. 2, 1972, Url N. Lanham, 1m 2.5 lunules, 1f all orange (CU). Balsam Lake, ~8600’?, Eldora, Boulder Co. Colo., Aug. 22, 1961, Hugo G. Rodeck, 1m 3 lunules (CU). Rainbow Lakes, 10200’, Boulder Co. Colo. (CU): Aug. 13, 1936, K. Wahlstrom 2m (2, 4 lunules); Aug. 20, 1936 Helen E. Rodeck 1m 1+ lunule. CU Science Lodge, W Boulder Co. Colo., July 20, 1942, Hugo G. Rodeck, 1m 1.5 lunules (CU). 4th of July Cgd., 10400’, Boulder Co. Colo., J. Scott, Aug. 4, 1967, 6m (2, 1, 1, 1, 1.5, 2 lunules). 4th of July Can., ~10400’, W Boulder Co. Colo., Aug. 10, 1941, Hugo G. Rodeck, 1m 1.5 lunules (CU). Arapahoe Pass Trail, 11000’, Boulder Co. Colo., Aug. 3, 1977, J. Scott, 7m1f (Scott 1978 gives frequency of orange). Arapahoe Pass Trail, ~11000’, Boulder Co. Colo., Aug. 12, 1980, Charles P. Slater, 1m 1.5 lunules (CU). St. Vrain Glacier trail, “8200” [really 9000’], Boulder Co. Colo., July 31, 1976, C. P. Slater, 1m 4 lunules (CU). Hills Mill, 9800’, W Boulder Co. Colo., Aug. 13, 1941, Hugo G. Rodeck, 1m 3.5 lunules (CU). Lake Isabelle, 10868’, W Boulder Co. Colo., July 25, 1940, Helen E. Rodeck, 1f ¼ orange (CU). Loveland Pass, ~11800’, Summit Co. Colo., Aug. 6, 1994, J. Scott, 1m 1.5 lunules. Keystone Gulch, 9600’, Summit Co. Colo., J. Scott, Aug. 7, 1977 4m9f (& 41m7f pap), Aug. 8, 1977 egg found *Rumex densiflorus* (Scott 1978 gives frequency of orange), Aug. 20, 1983 1f orange pap. Winter

Park, 10000’, Grand Co. Colo., J. Scott, July 29, 1973, 2m (1/2, 2 lunules) 2f (¼, 1/5 orange). W Portal Moffat Tunnel, 10000’, Grand Co. Colo., J. Scott, July 29, 1973, 6m pap. 0.6 mi. N of W Portal Moffat Tunnel, 10000’, Grand Co. Colo., J. Scott, July 16, 1978 1m pap. Hideaway Park, 8750’, Grand Co. Colo., July 14, 1955, 1m 1.5 lunule. Fraser, 8574’, Grand Co. Colo., Aug. 5, 1991, J. Scott, ovip. near *Polygonum douglasii*. Jim Creek Cgd., 9400’, Grand Co. Colo., J. Scott, Aug. 9, 1977 2f (0, 1/6 orange)(Scott 1978 gives frequency of orange); pap 9m1f; ovip. *Polygonum douglasii.* No Name Creek (just NE Glenwood Springs), 10500’, Garfield Co. Colo., Aug. 18, 1961, Charles P. Slater, 2m (½ , 3.5 lunules), 1f < 1/3 orange (CU). Hay Press Lake, 10400’, Garfield Co. Colo., Aug. 18, 1961, C. P. Slater, 1f 1/3 orange (CU). Minturn, 8000’, Eagle Co. Colo., J. Scott, July 19, 1970 2m2f (Scott 1978 gives frequency of orange)(& 17m2f pap), Aug. 15, 1997 (5m2f pap). Stream NW Minturn, 8050’, Eagle Co. Colo., J. Scott, Aug. 22, 1969, 2m pap. Piney Creek, 7000’, Eagle Co. Colo., J. Scott, Aug. 16, 1973 2f (Scott 1978 gives frequency of orange)(& 16m1f pap). Vail, 8400’, Eagle Co. Colo., J. Scott, Aug. 22, 1977 4m1f pap (males 1, 1, 2, 3 lunules, f reddish ups). 2 mi. E Wolcott, 7100’, Eagle Co. Colo., July 29, 1972, J. Scott, 1m 5 lunules (*helloides*? but date fits *L. florus*). Gore Creek Cgd., 9000’?, Eagle Co. Colo., Aug. 17, 1964, J. Scott, 2m (2, 3 lunules) 2f (¼, ¾ orange). Gore Pass Road, 9500’, Grand Co. Colo., July 27, 1964, S. L. Ellis, 2m (1, 1.5 lunules)(CU). 1.2 rd. mi. NNE Radium, 7300’, Grand Co. Colo., July 11, 1996, 1m 2 lunules. Beaver Creek, 3 mi. SSW Hot Sulfur Springs, 8300’, Grand Co. Colo., July 4, 1990, J. Scott, 1f 1/5 orange. West Portal Moffat Tunnel, 9200’, Grand Co. Colo., Aug. 27, 1957, Hugo G. Rodeck, 1m ½ lunule (CU). SE end Green Mtn. Res., 8100’, Summit Co. Colo., J. Scott; July 15 1985, 1m 2+ lunules; July 11 1996, 1f ½ orange. 5.4 rd. mi. NE Hayden, ~7050’, W of Morgan Creek, Routt Co. Colo., July 16, 1985, big hilltop with oak/serviceberry, J. Scott, 1m <2 lunules, 1f ¼ orange. Ridge ~3 mi. NW Hayden near paved hwy., 7100’, Routt Co. Colo., July 15, 1985, J. Scott, 1f 2/3 orange. Rabbit Ears Pass, Routt Co. Colo., July 31, 1955 2m (2, 3 lunules), June 20, 1955 1f 1/3 orange. ~10 rd mi. W Rabbit Ears Pass, near Ferndale Picnic Ground, 7800-8500’, Routt Co. Colo., J. Scott; July 11 1962, 1m 2 lunules; July 16 1985 4m (2, 0, 3, 1 lunule)1f (1/ 6 orange); July 17 1985 18m (0, 1, 1, 2, 2, 2.5, 1.5, 0.5, 1.5, 1 lunule) 3f (1/4, 1/3, 2/3 orange), July 7 1989 4m (3, 1, 2, 1 lunule), July 9 1972 2m (2, 2 lunules). 6.7 mi. E Toponas (W of Gore Pass), hwy. 84, ~9000’, Routt Co. Colo., July 12, 1996, J. Scott, 1m 2.5 lunules. 1 mi. N of Oak Creek, 7500’, in gulch, Routt Co. Colo., July 12, 1996, J. Scott, 2f (2/3, 1/10 orange). 7 mi. NE Clark, Elk River, 7650’, Routt Co. Colo., Url N. Lanham, Aug. 4-5, 1955, 3m (2.5, 3, 1 lunules)(CU). 1 mi. W Steamboat Springs, 6700’, sage ridge N of hwy., Routt Co. Colo., July 15, 1985, J. Scott, 1m 2 lunules. Steamboat Springs, 6700’, Routt Co. Colo., July 12, 1996, J. Scott, 1f ½ orange ups. Steamboat Springs, 6700’, Routt Co. Colo., Helene I. Gibbons, July 19, 1933 1m 0 lunules, July 20, 1933 1m 1.5 lunules (CU). Hahns Peak trail, 9400’, Forest Rds. 490/414, Routt Co. Colo., M. S. Fisher, Aug. 18, 1995, 2f (1/5 orange [postmedian band], the other female solid brown on ups except for a trace of paler on upf postmedian area and 4½ conspicuous uph lunules!). near Mt. Zirkel, 10000’?, Routt Co. Colo., Aug. 6, 1980, C. P. Slater, 1m 2.5 weak lunules (CU). Vermilion Creek X Douglas Draw, 5700’, Moffat Co. Colo., July 8, 1972, J. Scott, 1m ½ lunule. Ninemile Gap, 7476’, Rio Blanco Co. Colo., June 29, 1955, 1m 2 lunules. 5.8 rd. mi. ESE Pagoda, 6820’, Routt Co. Colo., July 19, 1996, hay field, J. Scott, 1f 1/6 orange. 1.2 mi. NW Pagoda, 6500’, Moffat Co. Colo., July 19, 1996, hay valley, J. Scott, 2m (males 2, 3 lunules) 1f (1/3 orange). 7.9 mi. E Hamilton, 6500’, Moffat Co. Colo., July 19, 1996, edge of hay field, J. Scott, 1f 1/3 orange. 14.7 mi. SW Hamilton, ~6700’, Moffat Co. Colo., July 19, 1996, J. Scott, 2f (1/2, 2/3 orange). Grizzly Creek Cgd., 8500’, SW end North Park, Jackson Co. Colo., July 12, 1996, J. Scott, 5m (0, 3, 3, 1, 2 lunules). Below Lake Agnes, ~10500’, Jackson Co. Colo., Aug. 11, 1955, Hugo G. Rodeck & Helen E. Rodeck, 1m 2.5 lunules (CU). Chambers Lake, 9154’, Cameron Pass Rd., Larimer Co., Colo., Sept. 22, 1973, 1m (ups very violet, 2.5 lunules) M. S. Fisher. Chambers Lake, 9154’, Larimer Co. [8 wrongly say Boulder Co.], Colo., Aug. 9, 1955, Hugo G. Rodeck & Helen E. Rodeck, 5m (2, 4, 1, 3.5, 3 lunules) 4f (2/3, ½, ¼, all orange)(CU). Rocky Mtn. Nat. Park, Larimer? Co. Colo., July 17, 1940, Hugo G. Rodeck, 1m 1 lunule, 1f ¾ orange (CU). Poudre Lakes, Rocky Mtn. Nat. Park, 10700’, 1f ¾ orange (dark unh)(CU). Corner Mtn. trailhead, Medicine Bow Mts., State Route 130, Albany Co. Wyo., Aug. 15, 1999, Reed A. Watkins, 1m 1.5 lunules (CU).

***Lycaena florus* [*castro*] evidently near-*sangremar*.** **Definition**: In the Ruby Mts. of NE Nevada, males average many orange lunules (for females, I have seen none, or two). Ferris (1977) notes that “typical *castro* phenotypes occur in S Ida., Cassia Co. in particular”, and he lists *“castro”* from Utah, implying that the range is continuous from Colo. to Nev.-Ida. Clyde Gillette informed me that*”castro”* is absent from Utah (what I call ssp. *florus* is present), which would mean that Nev.-Ida. pops. are disjunct from Colo. ones, in which case one might think that this is independently evolved through introgression from *L. helloides*, but that is speculation, and I have seen a specimen of *florus* from Wasatch Mts., so *L. florus* seems to occur in Wasatch Mts. as well as Uinta Mts., though the range is maybe not as great as Ferris mapped. **Specimens examined:** Thomas Can. Forest Camp, 7600’, Lamoille Can., Ruby Mts., Elko Co. Nevada, J. Scott, Aug. 5, 1974, 5m (1, 3, 4, 4, 3.5 lunules), Aug. 26, 1966 1m 2.5 lunules; same site, Lionel Paul Grey July 8, 1972, 2m (3, 4 lunules)(this pop. has more lunules like *helloides*, but habitat and flight time suggest it is *L. florus*. Ferris [1977] illustrates 2m2f in figs. 57, 58, 73, 74 from “Elko Co. Nev.” which may be from Ruby Mts. or may be from Jarbidge Mts. (see next section); the males in figs. 57 & 73 have 0 & 2.3 uph lunules, while both females in figs. 58, 74 look about ¼ orange). 5 mi. W Powell Ranger Sta., hwy. 9, wild animal exclosure, Idaho Co. Idaho, July 23, 1964, flowery meadow in pines, J. Scott, 1m 5 small lunules (*helloides*?).

***Lycaena florus florus* [*castro* near-*castro*].** **Definition**: In Alta.-BC-W Mont.-Ida.-W Wyo.-N Utah-Jarbidge Mts. of N Nev., males usually have only 0 or 1 or 2 orange lunules (averaging only 1), one generation, in mts., host mostly *Vaccinium.* In Utah, Clyde Gillette states [pers. comm.] it occurs in the Uinta Mts. (he has no records elsewhere, and states in recent communication that it is absent in Wasatch Mts., though he notes that *Vaccinium* occurs in four other mtn. spots in Utah where he has not checked for *florus*). However, the single *L. florus* from Utah that I have seen was from the Wasatch Mts., and Ferris (1977) listed "*castro*" from there, so *florus* evidently occurs in Wasatch Mts. also. Gillette found that Utah *florus* feed mainly on *V. scoparium*, and also eat *V. cespitosum* and *V. membranaceum* (Gillette also states that Utah females oviposit in lab on *Vaccinium* but not on *Rumex*, *Polygonum* & *Potentilla fruticosa*), and he describes Utah males as dark and females usually have some postmedian upf orange, so Utah bugs are placed here. C. Gillette in 1998 (pers. comm.) wrote that *florus* could feed on *Vaccinium* in Cache, Summit, Daggett, Salt Lake, Utah, Wasatch, Duchesne, Uintah, Carbon, Emery, Grand?, and San Juan Cos. in Utah, so *L. florus* may occur in most of these counties. I do not have enough Canadian *florus* for comparison, so I also list frequencies of orange on N. Kondla photos of his specimens. If *castro* is accepted as a valid name, and if one could accept three names for a cline, one could accept *sangremar*, *castro*, and *florus*, but I only accept at most two names for a cline, so I treat *florus* as a syn. of *castro*. **Specimens examined:** Pine Creek Cgd. road near Jarbidge, Elko Co. Nev., July 16, 1972, L. P. Grey, 1m 0 lunules, 1f 1/3 orange. Mill Creek Can., Wasatch Mts., Salt Lake Co. Utah, Aug. 12, 1967, [evidently Kenneth B. Tidwell], 1m ½ lunule (CU). 2 mi. S Allred Flat Campground, 6800', Little White Creek near Salt Creek, hwy. 89, ~18 mi. S Afton, Lincoln Co. Wyo., July 25, 1964, aspen glades & tall grass among sage, J. Scott & G. Scott, 3m (1, 1, 3 thin lunules) 4f (¼, 1/3, 1/3, ½ orange). Mts. in Lincoln Co. Wyo., 1986, N. Kondla, photo of 6f (1/6, 1/5, 1/5, ¼, ¼, 1/3 orange). Canyon Creek "bog" (willow fen), SW of Lander up Sinks Can. Rd. ~20 mi. (0.6 mi. N of N end of Fiddler's Lake, on Louis Lake Road), 9450', Wind River Mts., Fremont Co. Wyo., J. Scott;, Aug. 11, 1980 1m (1+ lunule), 1f (1/3 orange); Aug. 15, 1983 3m (1, 2, 2 lunules), 1f (½ orange). Dickinson Park to ½ mi. W, 9300', Wind River Mts., Fremont Co. Wyo., Aug. 15, 1983, meadow & willow carr, J. Scott, 12m (2, 2, 1, 2, 2, 1, ½, 4, 3 weak, 2 weak, 2 weak lunules) 3f (2/3, ½, ½ orange). Teton Mts., [Wyo.], July 21 [1937], William N. Burdick, 1m 2 weak lunules (CU). 1 mi. S Humphrey, Clark Co. Idaho July 24, 1964, J. Scott, 1m ½ uph lunule. Madison River Can., W of Yellowstone, William N. Burdick, Aug. 2, 1937, 2m (0, 2 lunules) 2f (no orange, a bit of postmedian tawny)(CU). Warm Springs Cgd., ~1.3 mi. SSW of hwy. 93 on Medicine Spgs. Rd., near Warm Springs Crk., ~4800', Ravalli Co., Mont., July 7, 1962, J. Scott, 1m 2 lunules (looks most like *florus*), 1f all orange (looks like it could also be *helloides*). Swamp Creek Rd., 4 mi. E Seeley Lake, Powell Co., Mont., July 14, 1992, Steve Kohler, 3m (2, ½, 0 lunules) 1f no orange; Swamp Creek, 5 mi. E Seeley Lake, June 23, 1992, S. Kohler, 1m ½ lunule. Rocky Boy Ski Hill, ~4500', Bear Paw Mts., Hill Co. Mont., Aug. 7, 1982, N. Kondla, photo of 4m (1/2, 0, 1, 2 lunules). 9 mi. E Morley, Calgary-Banff Hwy., Alta., July 19, 1966, J. Scott, 1m 2 lunules. Bog near Kananaskis Lakes, Alta., Aug. 4, 1966, J. Scott, 2f (4/5, 2/3 orange). W of Banff, Alta., Aug. 8, 1959, J. Donald Eff, 1m ½ lunule (CU). km 3 South Castle Rd., Alta., July 12, 2004, N. Kondla, photo of 1m with ½ lunule. Meinsinger Crk. near Chain Lake, Alta., July 26, 2000, N. Kondla, photo of 1m with 2 lunules. Waterton, Alta. (maybe 1 or 2 specimens from Calgary), N. Kondla, photo of 17 m (1/2, ½, 1.5, 2, 2, 2, 0, ½, 1, ½, ½, ½, ½, 1, 2, 1, ½ lunules). Calgary, Alta., N. Kondla, photo of 3m (2, 2, 2.5 lunules). West Kootenay area, BC, July 7, 2004, N. Kondla, photo of 4m (2, 1, ½, ½ lunules). Record Ridge, near Rossland, BC, July 18, 2004, N. Kondla, photo of 1m with 1 lunule. Km 11 Cascade-Rossland Rd., near Rossland, BC, July 17, 2004, N. Kondla, photo of 1m with 1 lunule.

***Lycaena florus*, More Extreme than *florus* because Very Dark [*castro* farther-from-*castro*].** **Definition**: Beartooth Plateau (in Park Co. Wyo.-Carbon Co. Mont.), evidently extending to Yellowstone NP & Absaroka Mts. to NW Wind River Mts. Wyo. Very dark adults that could be named a new ssp., averaging <1/2 orange lunule, one generation, at higher altitude, host probably mainly *Vaccinium*. **Specimens examined:** Beartooth Plateau, Park Co. Wyo., 1982, N. Kondla, photo of 8m (7 have ½ and 1 has 1/5 lunules). Beartooth Plateau, Carbon Co. Mont., 1982, N. Kondla, photo of 4m all with 0 lunules. Yellowstone Nat. Park, [Wyo.], July 22, 1937, W. Burdick, 5m (0, ½, 3 weak, ½, 1 lunules)(CU). Clear Creek (at Slide Creek to 1 mi. upstream), 8600', Wind River Mts., Sublette Co. Wyo., Aug. 10, 1980, J. Scott, 8m (males ½, 1, ½, ½, ½, 1, 1, ½ lunules) 1f ¼ orange (this pop. is evidently darker than E slope Wind River Mts. pops., and may belong here). Brooks Lake, E of Togwotee Pass, 9100', Fremont Co. Wyo., July 21, 1960, J. Scott, 1f 1/10 orange. Mackenzie Highland Ranch, 8100', 18 mi. W Dubois, Route 283, Wind R. Mts., Fremont Co. Wyo., Aug. 13, 1999, Reed A. Watkins, 2m (1/3, 2 weak lunules), 2f (1/3, 2/3 orange)(CU). ~2 mi. NW Warm Spring Mtn., 8400', Wind R. Mts., Fremont Co. Wyo., Aug. 13, 1999, Reed A. Watkins, 1m 0 lunules, 1f 4/5 cream upf (CU).

Lycaena florus* [*castro*] *megaloceras. **Definition**: Bighorn Mts. Wyo., cream-colored female ups, grayer unh, one generation, at higher altitude, host probably mainly *Vaccinium*. **Specimens examined:** 1.2 mi. S Loaf Mtn. Overlook, Bighorn Mts., Johnson Co. Wyo., Aug. 4, 1995, J. Scott, 1m ½ lunule, 1f ¾ orange. 1 mi. SW Steamboat Point, Bighorn Mts., Sheridan Co. Wyo., Aug. 3, 1995, J. Scott, 1m 1 lunule. Upper Crazy Woman Can. Road, Bighorn Mts., Johnson Co. Wyo., Aug. 4, 1995, J. Scott, 1f 1/5 orange. Bighorn Mts., Wyo., July 25, 1937, William N. Burdick, 2m (2, 2 lunules)(CU)

Lycaena florus* [*castro*] near-*megaloceras. **Definition**: SW & C Montana, cream-colored female ups, normal unh color, one generation, at somewhat high altitude, host probably mainly *Vaccinium*. This could be named a new ssp., though it is like *megaloceras* except on unh. **Specimens examined:** Halfmoon Park, 6400', Crazy Mts., Sweet Grass Co. Mont., Aug. 16, 1966, J. Scott, 1m 2 lunules, 6f (1/3, ¼, 1/3, 2/3, 1/3, 1/10 cream). Big Timber Can., Crazy Mts., Sweet Grass Co. Mont., July 30, 1977, Lionel Paul Grey, 1m 1 lunule, 1f 1/3 cream. (Steve Kohler notes that some from Crazy Mts. have grayer unh like *megaloceras*.) Harley Creek., below Belt Park, Little Belt Mts., Cascade Co., Mont., Aug. 15, 1966, J. Scott, 2m (5 [this actually is *Lycaena helloides*], ½ lunules), 1f ¾ cream. 4-mile Creek, Boulder River Can., Sweet Grass Co. Mont., July 5, 1966, J. Scott, 5m2f (males 0, 3, ½, 1 lunules, females ½, 1/5 cream). Deep Creek, 11 mi. E Townsend, Broadwater Co., Mont., July 17, 1962, William A. Cobban Jr., 2m both ½ lunule. Bozeman Pass, 5712', Gallatin Co. Mont., David L. Bauer, Aug. 1, 1960, 1f 2/3 cream ups (CU).

Lycaena helloides in Colorado & Western North America, by J. Scott

Definition: Males have many (~4) orange uph lunules, female upf mostly orange, larger wingspan, occurs at lower altitude, two or more generations, hosts Polygonaceae. The Wet Mtn. Valley and adjacent grassland on W side of Wet Mts. are rather high altitude (to 9000'), yet they have *helloides* in valley bottoms and wetlands assoc. with *Rumex*. There are two generations in most of Colo., but on the plains there are evidently three in L May-E June, M July-E Aug., Sept. **Specimens examined** (pap=papered)**:** 22 mi. E Gateway, 6900', Unaweep Can., Mesa Co. Colo., Sept. 2, 1966, J. Scott, 6m4f (males 4, 3, 4, 4 lunules, females ½ orange), this pop. is a bit darker than usual. West Unaweep Can., 6500', Mesa Co. Colo., Aug. 21-22, 1998, M. S. Fisher, 1m 3 lunules. White River (town) on the White River [must be near Rangely], 5758', Rio Blanco Co. Colo., Sept. 1, 1966, J. Scott, 1f 2/3 orange. Maybell, Moffat Co. Colo., June 3, 1969, Bernard Rotger, 1m 4 lunules, 1f 2/3 orange (CU). Moab, 3980', Grand Co. Utah, Sept. 5, 1978, J. Scott, 4m (3, 3, 4, 4.5 lunules), all pap. La Sal Creek, 6000', San Juan Co. Utah, Sept. 4, 1978, J. Scott, 1m 4 lunules. Wet meadow N Monticello, <7066', San Juan Co. Utah, Aug. 23, 1974, J. Scott, 4m (3.5, 4, 4, 4.5 lunules), all pap. Just S Steamboat Springs, 6700', Routt Co. Colo., Sept. 2, 1978, J. Scott, 1m 4 lunules, 1f very orange. 5 mi. W Steamboat Springs, 6550', Routt Co. Colo., June 28, 1962, S. Ellis, 1m 4 lunules (CU). ~5 mi. W Steamboat Springs, 6550', Routt Co. Colo., Sept. 2, 1978, J. Scott, 8m, 2nd gen. like helloides, but many males are dark (4, 4, 4, 3, 2, 1.5, 1.5, 1.5 uph orange lunules) so looks maybe hybridized a bit with *florus*. ~7 mi. W Hayden, ~6350', Routt Co. Colo., Sept. 2, 1978, J. Scott, 3m (4, 3+, 3.5 lunules) 2f (2/3, all orange). W of Hayden, 6350', Routt Co. Colo., S edge of horse pasture beside bluff S of RR track, Aug. 18, 1994, J. Scott, 6m (3, 3.5, 3.5, 2, 4.5, 4 lunules) 1f ½ orange. 4 mi. N Hayden, (6800' if NNW, 6400' if NE), Routt Co. Colo., S. Ellis, June 29, 1962 1f all orange, June 30, 1962 9m (4.5, 4.5, 4.5, 4.5, 3.5, 3, 2.5, 2.5, 3 lunules) 2f (½, ¾ orange)(CU). 2 mi. S Glenwood Springs, Garfield Co. Colo., June 22, 1971, J. Scott, 1m 2.3 lunules. (D. Chambers 1963 J. Lepid. Soc. 17:26 found *helloides* in Gunnison, Gunnison Co. Colo., Aug. 25, 1961, on *Rumex* along an irrigation ditch, and reared them on *Rumex*.) Cow Creek, 7000', Owl Creek Pass Rd., 4 mi. S US550, Ouray Co. Colo., Aug. 24, 1970, Scott Ellis, 1m 4 lunules (CU). Redlands Mesa, ~6300', Delta Co. Colo., July 1, 1962, S. Ellis, 1m 4 lunules, 1f ½ orange upf & very orange uph (CU). Stingley Gulch, 6300', Delta Co. Colo., S. Ellis, May 26 1962 1f 2/3 orange, May 31 1964 2m (2.5, 3 lunules), Aug. 18 1961 1m 3 lunules & 1f 60% orange (CU). Leroux Creek, 6500', Delta Co. Colo., S. Ellis, June 2, 1962 2m (4, 3 lunules)(CU). Leroux Creek, 7000', S. Ellis, Aug. 6, 1963 1f all orange (CU). N fork Gunnison River, 5500', Delta Co. Colo., S. Ellis, Aug. 30, 1963, 1f 1/3 orange (CU). #4 ditch, Rogers Mesa, 5900', Delta Co. Colo., S. Ellis, Aug. 5, 1961, 1m 2 lunules (CU). Rio Blanco, 6700', Archuleta Co. Colo., Sept. 7, 1978, J. Scott, 1f all orange. 9 mi. NE Pagosa Springs, Archuleta Co. Colo., June 30, 1965, J. Scott, 1m 2 lunules, 1f mostly orange. Pagosa Springs, 7105', Archuleta Co. Colo., June 30, 1965, J. Scott, 1f ½ orange. Pagosa Springs, 7105', Archuleta Co. Colo., Bernard Rotger; June 12, 1961 1m 3.5 small lunules, 1f ½ orange; July 1960 1f all orange (CU). Spiler Can., ~7600', Archuleta Co. Colo., B. Rotger, June 10, 1976, 5m (4, 3.5, 3.5, 3, 4 lunules) 2f (½, ¼ orange), June 24, 1976 1f all orange (CU). Dolores, 7000', Montezuma Co. Colo., June 3, 1980, J. Scott, 1f all orange. 5 mi. SW Mancos, 6600', near Mancos River, Montezuma Co. Colo., Sept. 6, 1978, J. Scott, 1 pap f ¾ orange. La Posta, ~6150', La Plata Co. Colo., May 17, 1961, Bernard Rotger, 2m (4.5, 3+ lunules)(CU). Meadow 0.9 mi. S Hermosa Crk., E of RR, 6550', Animas R. Valley, W of Animas R., La Plata Co. Colo., Aug. 20, 1980, J. Scott, 2m (& 5m pap) (2 weak, 4, 4.5, 4, 4, 2.5, 3.5 lunules) 2f (3/4, all orange). Ignacio, 6450', La Plata Co. Colo., Aug. 28, 1977, J. Scott, 1m (2.5 lunules) 1f ½ orange. Wet meadow "bog" Animas R. valley, 6300', 7.2 mi. N New Mexico, La Plata Co. Colo., Aug. 27, 1977, J. Scott, 1m ½ lunule (has to be a freak *helloides*, but looks like *L. florus*). La Boca, Los Pinos River, 1.2 mi. N New Mex., hwy. 511, 6300', La Plata Co. Colo., Aug. 28, 1977, J. Scott, 2m (7m pap)(2.5, 4, 4, 3, 2.5, 4, 2, 2, 4 lunules), 2f (7f pap)(½, 2/3, 4/5, 4/5, 4/5, 4/5, these all orange). Cañones Creek, 7600', Rio Arriba Co. New Mex., Aug. 28, 1978, J. Scott, 1m 4 lunules, 2f (all, all orange), all pap. La Puente, 7300', Rio Arriba Co. New Mex., Aug. 28, 1978, J. Scott, 1m 4 lunules. Parkview, 7350', Rio Arriba Co. New Mex., Sept. 8, 1978, J. Scott, 1f all orange. Martinez Can., ~7000', Rio Arriba Co. New Mex., Sept. 8, 1978, J. Scott, 1 pap f all orange. Hatch Lake, 7600', NE corner Sandoval Co., New Mex., June 18, 1978, J. Scott, 2m (& 1m pap) all worn (3, 3, 3.5 lunules). La Jara Creek, 8100-8700', Sandoval Co. New Mex., May 28, 1978, J. Scott, 1f all orange. Rio Pueblo, 7600', Taos Co. New Mex., Aug. 26, 1978, J. Scott, 1m 2.3 lunules. 1 mi. SSW El Prado, 6950', Taos Co. New Mex., Aug. 27, 1978, J. Scott, 1 pap m 3.5 lunules. Peñasco, 7700', Taos Co. New Mex., J. Scott; Aug. 26, 1978, 2f (4/5, all orange); Aug. 22, 1979 1m 4 lunules; Sept. 9, 1998 1m2f pap. Rio Hondo, 7400', ½ mi. E Valdez, Taos Co. New Mex., May 24, 1985, J. Scott, 1m 4 big lunules. Ranchito, 6850', Taos Co. New Mex., J. Scott; Aug. 22, 1979, 2m (3, 3.5 lunules) pap; Aug. 27, 1978 1m (& 1m pap) (4, <3 lunules) 1f (all orange) pap. 1.6 mi. WSW Ranchito, 6750', Taos Co. New Mex., Sept. 9, 1998, J. Scott, 1 pap m 4.5 lunules. Questa, 7500', Taos Co. New Mex., Sept. 10, 1977, J. Scott, 1f very orange. 9.7 mi. NE Raton Mesa, hwy. 72, 7700', Colfax Co. New Mex., dry creek at bridge, Aug. 21, 1980, 1f all orange. 4.9 mi. ESE Costilla, 8050', Taos Co. New Mex., Sept. 10, 1998, J. Scott, 10m1f pap, ordinary. N San Pablo, 8085', Costilla Co. Colo., Sept. 8, 1998, J. Scott, 1m 4 lunules pap. ¼ mi. SE San Luis, 7975', Culebra Crk., Costilla Co. Colo., Sept. 8, 1998, J. Scott, 1m pap dark only 2 lunules (others from Costilla Co. typical). 1 mi. S San Luis, 7980', Costilla Co. Colo., Sept. 10, 1998, J. Scott, 1m1f pap. 3.5 mi. SE San Luis, 8200', Costilla Co. Colo., Sept. 10, 1998, J. Scott, 1f pap. 4 mi. E Moffat, floor of San Luis Valley, 7580', Saguache Co. Colo., Aug. 29, 1977, J. Scott, 6m11f; 6 mi. E Moffat, 7620', 1m1f; all are pale, all males 5 lunules, females very orange except 2f 4/5 orange, egg found *Rumex triangulivalvis*. Antonito, 7900', Conejos Co. Colo., Aug. 31, 1960, Bernard Rotger, 1m 4 lunules (CU). 4-5 mi. N Poncha Pass, 8500-8300', Chaffee Co. Colo., Sept. 7, 1998, 1m1f. Salida, 7000', Arkansas Canyon, Chaffee Co. Colo., J. Scott; Aug. 6, 1969 1m; July 30, 1985 15m 52f (1m1f are tiny), ovips. & eggs & larvae found *Polygonum coccineum*; all pap. ~1 mi. W Salida, 7150', Chaffee Co. Colo., Aug. 29, 1977, J. Scott, 1m pap. 3 mi. WSW Westcliffe, Muddy Road X Willow Lane, 7900', Wet Mtn. Valley, Custer Co. Colo., J. Scott; Aug. 18, 1970 1m 4 lunules & 1f very orange; Aug. 28, 1970 4m1f (& 16 m pap); July 1, 1970 1m worn 5 lunules (males here have ~4-5 lunules). Westcliffe, 7888', Wet Mtn. Valley, Custer Co. Colo., J. Scott; Aug. 28, 1961 4m2f 4/5 orange (& 1m pap), Aug. 23, 1970 1m. 2 mi. NW Westcliffe, 7800', Wet Mtn. Valley, Custer Co. Colo., wet meadow, July 9, 1970, J. Scott, 2m worn pap. Lake Creek N of Hillside School, 7300', Wet Mtn. Valley, Custer Co. Colo., July 28, 1968, Glenn R. Scott, 1m 5 lunules. Reed Gulch, 7600', SE of Hillside, Wet Mtn. Valley, Custer Co. Colo., June 27, 1971, J. Scott, 1m worn 5 lunules. Rosita, 9000', Wet Mts., Custer Co. Colo., June 18, 1973, J. Scott, 1m 5 lunules & 1f all orange. 3 mi. N Beulah, 6400', Wet Mts., Pueblo Co. Colo., May 25, 1972, J. Scott, 1m5 lunules. 1.5 mi. E East Cañon, 5300', Fremont Co. Colo., J. Scott; July 10, 1970, 1m1f; pap July 23, 1970 5m. Florence, 5191', Fremont Co. Colo., Aug. 31, 1996, J. Scott, 1f pap. 1 mi. SW Avondale, ~4600', Pueblo Co. Colo., Sept. 8, 1971, J. Scott, 3m1f pap. 7.7 mi. E jct. 24 & 94, 6400', El Paso Co. Colo., J. Scott, Aug. 11 1973 1m pap., Sept. 6 1971 1m pap. Box Elder Crk., ~5800', Elbert Co. Colo., Aug. 11, 1984, J. Scott, 1m, 1f very pale, all pap. Bijou Creek, 5900', Elbert Co. Colo., Aug. 22, 1984, J. Scott, 3m1f pap. Buffalo Creek, 6700', on North Fork South Platte R., Jefferson Co. Colo., Aug. 27, 1986, J. Scott, hay meadow with *Rumex crispus*, 1m very thick long uph band. 1 mi. E Genesee Park, 7500', Jefferson Co. Colo., June 6, 1966, J. Scott, 1f very orange. Mt. Vernon Historic Site, Matthews Winters Park, 6400', Jefferson Co. Colo., J. Scott, Oct. 7, 1988, 1m pap. Green Mtn., 6300', Jefferson Co. Colo., June 7, 1985, J. Scott, 1m pap. Lakewood, 5510', Jefferson Co. Colo., J. Scott; May 10, 1962 1m, May 13, 1962 1m, May 19, 1962 1m (& 12m2f pap), May 30, 1961 1m, June 4, 1961 2m, June 7, 1963 1m pap, June 7, 1966 2m pap, June 8, 1961 1f (& 5m2f pap), June 10, 1962 1m pap, June 11, 1962 1m pap, June 13, 1960 1m, June 13, 1964 2m pap, July 11, 1961 1m pap, July 11, 1962 4m pap, July 12, 1961 1m pap, July 13, 1961 2m pap, July 14, 1961 4m pap, July 14, 1984 1m pap, July 23, 1961 1f, July 28, 1961 7m pap, Aug. 9, 1984 1m pap, Aug. 30, 1960 1m, Aug. 31, 1965 10m1f pap, Sept. 3, 1960 1f (very dark, 1/6 orange), Sept. 4, 1961 1f, Sept. 9, 1961 1m pap, Sept. 15, 1962 1m pap, Oct. 2, 1965 1m pap.; Aug. 17, 1978, ovip. *Rumex maritimus fueginus*. Wheatridge, near Clear Creek, 5400', Jefferson Co. Colo., J. Scott, June 3 1993 1f, July 10 1996 1f, July 11 1992 1f, July 13 1988 3m, July 26 1990 1m, Aug. 7 1984 3m, Aug. 17 1991 1m, Sept. 7, 1989 1f, all pap., most assoc. *Polygonum coccineum*. Indian Gulch, 5900', 1 mi. W Golden, Jefferson Co. Colo., Sept. 10, 1965, J. Scott, 1m1f. Mother Cabrini Shrine, 7000', Jefferson Co. Colo., June 6, 1966, J. Scott, 1f all orange. NW of Kipling St. X Bear Creek, 5500', Jefferson Co. Colo., Aug. 10, 1984, J. Scott, 1m pap. Chatfield Res., 5500', Jefferson Co. Colo., Sept. 27, 1988, J. Scott, 1m1f pap. 4 mi. N Golden, 6000', Jefferson Co. Colo., May 31, 1993, J. Scott, 1f pap. Leyden Gulch, 6000', Jefferson Co. Colo., J. Scott, July 9, 1980 1f, Sept. 3, 1997 1m, Sept. 13, 1990 1m, all pap. Jct. I-76 & 51 & 120th, 5100', Adams Co. Colo., J. Scott, Sept. 6, 1984, 2m1f, Sept. 8, 1984 1m, Sept. 15, 1992 1m, all pap. 8 mi. NE Strasburg, 5100', Adams Co. Colo., July 25, 1973, J. Scott, 1m pap. Barr Lake, 5096', Adams Co. Colo., J. Scott, Aug. 17 1985 3m pap, Aug. 19 1986 4m2f pap, Aug. 23 1988 4m1f pap, Aug. 23 1989 38m8f pap, Aug. 29 1984 130m9f pap, Aug. 30 1987 52m14f pap, Aug. 30 1991 22m4f pap, Aug. 31 1993 2m pap, Sept. 1 1994 3m4f pap, Sept. 2 1987 2f (& 40m12f pap), Sept. 3 1992 41m8f pap, Sept. 5 1989 3f pap, Sept. 3 1993 114m3f pap, Sept 5 1994 61m100f pap, Sept. 6, 1988 1f pap, Sept. 8, 1984 1f, Sept.8 1987 26m14f, Sept. 8 1990 27m5f pap, Sept. 8 1992 1m2f pap, Sept. 10 1996 3m3f pap, Sept. 16, 1997 1f (& 3m1f pap), Sept. 21 1993 5m21f pap, Sept. 24, 1994 1f (& 3m20f pap), Sept. 25 1989 12f pap, Sept. 28 1987 2m, 1f very pale (&7m11f pap), Sept. 28 1994 3m6f pap, Oct. 1 1997 1m2f pap, Oct. 3 1995 2m5f pap, Oct. 8 1988 9m22f pap, Oct. 11, 1989 1f (& 5f pap), Oct. 21 1989 1m1f pap, Oct. 21 1995 1f pap, Oct. 29 1987 1m pap; this pop. can reach more than a million adults on a ~50m-wide ring of the host *Polygonum coccineum* for about a mile around this irrigation-storage lake that is exposed as the lake level drops during the summer and a huge generation is produced in L Aug.-Sept., then the lake rises in winter as the eggs survive underwater; they also ovip. on *Rumex triangulivalvis* and *R. crispus* at the edge of the lake bed, but the vast million grows on *P. coccineum*. 1 mi. NW Brighton, 4950', Weld Co. Colo., Sept. 2, 1984, J. Scott, 1m pap. NE of Roggen, I-76, 4700', Weld Co. Colo., J. Scott, Sept. 27, 2000 1f very orange pap. Marshall, 5540', Boulder Co. Colo., J. Scott; July 14, 1968 Glenn R.

Scott 2m; July 13, 1969 J. Scott 1m; all pap. Boulder, 5450', Boulder Co. Colo., J. Scott; May 26, 1966, 2m1f; Oct. 9, 1965, 4m4f; all pap. Fort Morgan, 4250', Morgan Co. Colo., J. Scott, July 28, 1995, 1m pap. Timnath, 4850', Larimer Co. Colo., Aug. 28, 1973, J. Scott, 1m pap. Horsetooth Res., 5200', Larimer Co. Colo., May 28, 1990, J. Scott, 1f pap. Fort Collins, 5003', Larimer Co. Colo., J. Scott; June 5, 1966 1m; Sept. 20 1976 1f; all pap. Lusk, Niobrara Co. Wyo., Aug. 23, 1994, J. Scott, 1m2f pap. 12 mi. E Savery, Carbon Co. Wyo., Aug. 18, 1994, J. Scott, 1m2f pap. Green River, 6109', Sweetwater Co. Wyo., Aug. 11, 1980, J. Scott, 1m2f pap. Green River State Park, Emery Co. Utah, Aug. 23, 1974, J. Scott, 1m1f pap. Oak Creek Forest Camp, 5760', Canyon Mts. (E of Delta), Millard Co. Utah, June 18, 1965, J. Scott, 2m (3.5, 3, 2, 4, 4 lunules), 1f all orange. Junction 89 & 62, near Sevier River, Piute Co. Utah, June 21, 1971, 1m 5 lunules. Richmond, 4607', Cache Co. Utah, July 8, 1962, J. Scott, 1f very orange. Reese River crossing, hwy. 2, 5800'?, Lander Co. Nev., Aug. 6, 1974, J. Scott, 2m with 4 lunules. Battle Mtn., 4512', Humboldt River, Lander Co. Nev., Aug. 5, 1974, J. Scott, 4m (5, 5, 4, 4 lunules)3f (1/3, ½, ½, ½ orange)(&12m6f pap), assoc. *Polygonum coccineum*. 1 mi. SE North Fork, Lemhi Co. Idaho, Aug. 22, 1966, J. Scott, 2m 3, 5 lunules. North Fork, Lemhi Co. Idaho, July 7, 1962, J. Scott, 1m 4 lunules. 15 mi. NW Blackfoot, Bingham Co. Idaho, July 8, 1962, J. Scott, 2m 5 lunules. Shoshoni Falls, Twin Falls, Idaho, Aug. 23-24, 1966, J. Scott, 5m6f (males 2, 4, 4, 5, 3.5 lunules, females ½, ½, 2/3, 2/3, 2/3, ¾ orange)(&6m1f pap). Twin Falls, Idaho, J. Scott, Sept. 3, 1973, J. Scott, 1f pap. 6 mi. S Maxville, Granite Co. Mont., June 22, 1962, J. Scott, 3m 4 lunules. Pattee Can., 3500', Missoula Co. Mont., June 23, 1961, J. Scott, 1f mostly orange. 4 mi. S Republic, Ferry Co. Wash., July 5, 1962, J. Scott, 1m 5 lunules. along Yakima R., 10 mi. NW Richland, Wash., R. Woodley, April 3, 1961 1m 3 lunules, May 14, 1961 3m2f (males 3, 4, 5 lunules, 2f very orange). 25 mi. SE Yakima, Snipes Mtn., Wash., Sept. 8, 1973, J. Scott, 1m pap. Bear Can., Tieton R., 7500', Wash., July 11, 1959, A. I. Good, 1m 4.5 lunules (CU). Valley of the Rogue Picnic Area, Josephine Co. Ore., July 15, 1964, J. Scott, 2m 4 lunules. 2 mi. N Carson, Baker Co. Ore., June 4, 1966, Robert E. Woodley, 1f very orange. along Pine Crk., 10 mi. E Halfway, Baker Co. Ore., June 4, 1961, Robert E. Woodley, 1f 1/3 orange. Rush Creek, 4300', Washoe Co. Nev., May 25, 1974, J. Scott, 1m. Lake Almanor, Plumas Co. Calif., Aug. 20, 1966, 1m 3 lunules. 1.5 mi. E Devil's Gate Pass, Mono Co. Calif., Aug. 25, 1974, J. Scott, 1m. Hermit Valley, Alpine Co. Calif., July 14, 1968, J. Scott, 2f little orange ups. Icehouse Store, Eldorado Co. Calif., June 9, 1974, J. Scott, 1f ½ orange ups. Shingle Springs, El Dorado Co. Calif., Oct. 5, 1974, J. Scott, 1f.. Del Puerto Can., 19 mi. W Patterson, Stanislaus Co. Calif., May 22, 1971, J. Scott, 1m2f (& 6m pap). Davis, 50', Yolo Co. Calif., J. Scott; July 22, 1974, 2f; May 31, 1974 1m pap. 3 mi. N Davis, Willow Slough, Yolo Co. Calif., Aug. 31, 1974, J. Scott, 7m pap. Jackson Slough Road, Sacramento Co. Calif., Sept. 6, 1968, J. Scott, 1m1f. Brannan Island State Park, Sacramento Co. Calif., April 2, 1970, J. Scott, 2m. Empire Tract, San Joaquin Co. Calif., Sept. 16, 1973, J. Scott, 6m pap. Bethel Island, Contra Costa Co. Calif., Aug. 31, 1968, J. Scott, 3f (& 16m1f pap). Smith Lake, Sheridan Co. Neb., July 17, 1986, J. Scott, 6m1f pap, assoc. *Polygonum coccineum*. Andrews Crk., 3 mi. W Medora, Billings Co. North Dakota, Aug. 21, 1970, John S. Nordin, 1f pale. Fenton Rd., 2 mi. N hwy. 59, Livingston Co. Mich., July 20, 1971, 4m1f John E. Hafernik, males 4, 4, 5, 5 lunules, f ½ orange. T5SR13W sec. 30, Cass Co. Mich., July 18, 1971, Mogens C. Hielsen, 1f 2/3 orange (CU). T29NR2W sec. 18, Otsego Co. Mich., July 22, 1963, M. C. Nielsen, 1m 5 lunules (CU). Culross, Manitoba, June 4, 1972, Paul Klassen, 1m 5 lunules (CU).

The Relationship Between *Lycaena helloides* & *L. florus* in Colorado, by J. Scott

L. helloides and *L. florus* form a stenchospecies of course, as they are not very distinct yet, and their wing characters vary somewhat esp. in *L. florus*, though *L. helloides* varies somewhat also, and there are rather dark *helloides* females even in Calif. where *L. florus* does not occur. The variation within *L. florus* ranges from very dark to *helloides*-like, making the detection of hybridization difficult because Colo.-New Mex. *florus* already looks like an intergrade. *L. helloides* always has two (three on the plains) generations, and averages oranger, while *L. florus* has one and averages darker and flies at higher altitude in or beside *Vaccinium* woods. In general I do not have evidence that they hybridize in Colo., although there may be some introgression. Both species seem to occur at Steamboat Springs (*helloides* two gen., *florus* one). *L. helloides* and *L. florus* approach each other closely in many places in Colo. In Routt Co., *L. helloides* occurs on the Yampa River valley bottom upstream through Hayden through Steamboat Springs to just S of Steamboat Springs, while *L. florus* occurs in Steamboat Springs also, and west of there *florus* occurs on the bushy ridgetops just N of the valley, although some of the males of *helloides* from the river bottom 5 mi. W of Steamboat Springs have few orange lunules like Colo. *L. florus* so are darker, so perhaps the *helloides* population at this site became introgressed with *L. florus* somewhat (the valley bottom habitat and Sept. flight time place these as the 2nd gen. of *helloides*) at least temporarily. *L. helloides* occurs in the lower foothills of Jefferson County, and *L. florus* gets almost that low into the upper foothills. *L. helloides* occurs on the Wet Mtn. Valley floor 7900' in Custer Co. and on the grassy W side of Wet Mts. at Rosita 9000', while *L. florus* is very near in the Sangre de Cristo Mts. and Wet Mts. *L. helloides* is on the floor of the San Luis Valley, and *L. florus* is very near in the Sangre de Cristo Mts. They come near in SW Colo. as well. I found 2 male *helloides* with few orange lunules along the Animas River in La Plata Co., but those dark adults are few and the habitat and two generations and the appearance of most adults there suggest these are regular *helloides*. Mike Fisher found a few from Unaweep Can. in Mesa Co. that look like *L. florus*, but my series from there looks like regular *helloides*. So, *L. helloides* and *L. florus* represent two bookkeeping species in Colorado, which are sympatric in some places, though their two generations versus one where they meet evidently means that there are few opportunities to interbreed. And their eggs and 1st-stage larvae differ somewhat as noted above, and *florus* clearly prefers *Vaccinium*, which seems consistent with their bookkeeping species status.

Atlides halesus (Cramer) Subspecies, by J. Scott

The ssp. names currently used in *A. halesus* are incorrect. Based on the specimens Scott has examined, ssp. *dolichos* Hübner (TL Georgia)=*juanita* (Scudder)(TL Palatka Fla.) is a valid ssp. in Fla.-S Ga. that has a longer (2 mm) 2nd (anterior) tail on the male hw. Ssp. *halesus* (TL Virginia) =*corcorani* dos Passos (TL Riverside Cal.) = infrasubspecific *estesi* Clench (TL Riverside Cal.) is the widespread ssp. ranging across the continent (including Colorado); the 2nd tail on its males is absent or just a conelike stub (0 mm, sometimes 1 mm) in the west (C and W Tex., Okla., N.M., Ariz., Calif.), while the 2nd tail is a 1 mm stub-rudiment in N.C.-S.C., and appears to be a 0-1 mm rudiment in Md. The orange spots and other traits usually cited as distinguishing traits of ssp. do not seem to show noticeable geographic variation. Thus the 2nd tail of Va. TL *halesus* surely must be rudimentary in males, and thus must be very close to *corcorani*, which is therefore a synonym. Of course a full study of this situation would examine hundreds of specimens, in the McGuire Center in Gainesville etc., and would involve designating neotypes and type localities of *dolichos* and perhaps *juanita*, to see which of these best applies to the valid long-tailed ssp. But it seems clear that Colorado has ssp. *halesus*, NOT *corcorani*. Note that the long tails in Fla. are part of a major unexplained set of convergences, as many hairstreaks have longer tails in Fla. and vicinity (*Atlides halesus dolichos*, *Satyrium favonius favonius*, *S. liparops floridensis*, *S. calanus calanus*, *Callophrys hesseli angulata*, *C. henrici margaretae*, *Strymon acis bartrami*, *S. martialis*).

Callophrys sheridanii paradoxa Scott 1986, Redescription, by J. Scott & M. Fisher, and Lectotype Designation (plate IV) by M. Fisher & J. Scott

Scott (1986) inadvertently named this ssp. *paradoxa* in his book "Butterflies of North America…", by using the name *paradoxa*, describing its distinguishing traits and range, and illustrating it. The butterfly was under study by Ray Stanford and Peter Eades and Mike Fisher at the time, and Eades and Stanford had submitted a mss. to a journal. Scott thought that it would be named by the time the book appeared, but no paper was published (the paper was rejected by the editor of a certain blue journal for a non-valid reason we will not discuss here). So now we augment the technical aspects of the description and designate a lectotype. **Definition**: Ssp. *paradoxa* is small, has a mouse-gray ups, the unf has a considerable extent of grayish on rear (extensive to very extensive, more than ssp. *sheridanii*), the unh is grayish-green, and the median unh white band is rather thin and when complete is often kinked in the middle like ssp. *comstocki*, but this band is variable, and varies from complete to absent. The number of white spots in the median unh band averages 4.1 spots for males (0-0, 1-0, 2-10, 3-7, 4-16, 5-14, 6-6, 7-3, 8-0)(N=56), and 4.9 spots for females (0-1, 1-1, 2-0, 3-0, 4-1, 5-0, 6-0, 7-3, 8-1)(N=7). The unh is a rather dark shade of green, somewhat olive green. The unh has a stronger brown edge on the margin than other ssp. such as *lemberti* or *sheridanii* or the Nev. intergrades between *lembertiXcomstocki* (the synonym *interrupta*). It averages fewer unh spots than *comstocki*, and less-often has a complete unh line. The bug may have originated from ancient hybridization between ssp. *sheridanii* and *comstocki*, or it may represent an offshoot of those Great Basin hybrid populations, though its range is rather far from those hybrid populations in C Nevada. The origin is not very clear, as the *Callophrys* are stenchospecies, which have had complex origins with introgression and hybridization and mutation that appear largely random, that resist simple explanations. **Range:** Scott has specimens he coll. from 1 mi. SW Jct. Dolores & San Miguel Rivers (Paradox Valley), Montrose Co. Colo. Apr. 29-30, 1978 (other collectors found it here May 2-3, 1974, and May 2, 1980); 3.6 mi. SW Jct. Dolores & San Miguel Rivers, Montrose Co., April 29, 1978; 3 air mi. NE Bedrock Jct., Montrose Co. Colo. May 7, 1983 common; Cottonwood Can., Mesa Co. CO, May 7, 1983; 1 mi. S Larsen Can., Mesa Co. CO May 7, 1983; 2 mi. S Larsen Can., Mesa Co. Colo. May 7, 1983; S of Gateway, Mesa Co. CO May 1983, female emerged May 22, 1984; 11 mi. NNW Mexican Hat, San Juan Co. Utah May 8, 1983 common; below Moki Dugway Overlook, ~11 mi. NNW Mexican Hat, San Juan Co. Utah, May 8, 1983. Ray Stanford also found *paradoxa* N of Mexican Hat, San Juan Co. Utah, and SW of Blanding in Utah, in 1981, and in NE Ariz. And Ray and Clifford D. Ferris found it in Grand Co. Utah along Colorado River NE of Moab, ~April 26, 1981, evidently 6-27 road mi. above Hwy 160, 4220-4600'. The Stanford collection has ~58m11f of *paradoxa*, all from Montrose Co., many from Paradox Canyon.

The male illustrated in Scott's 1986 book (pl. 39, 345g) was obviously a syntype, as that specimen was the only one specifically mentioned or figured in that O.D. Based on Scott's notes it evidently was from Paradox Valley, Montrose Co., May 2, 1980 coll. Peter Eades, which is therefore the **type locality**, but it is missing, as we searched for it with its distinctive pattern of chips and regluing and label "fig. James Scott book", and could not find it in the Scott or Fisher or Stanford or CSU collections. The book Butt. Rocky Mtn. States says that Eades & Stanford were naming the bug. Scott returned the specimen to Ray Stanford, so evidently Stanford returned it to Eades, who informed Scott (e-mail, 2007) that his collection was "destroyed in a flood".

So, we now designate a lectotype. Scott had examined all the specimens in his and Stanford's collections collected prior to 1985, so those are syntypes. M. Fisher examined Stanford's collection (now at CSU) to analyze these syntypes. One of these, a male from Paradox Can. (CR Y-11, about 4-5 air mi. & 5-6 road mi. W Uravan), 5100', Dolores River, Montrose

Co. Colo., May 3, 1974, Ray E. Stanford [it also has a label "Paratype Callophrys paradoxa P. Eades & R. Stanford"], is hereby designated the **lectotype** by Fisher & Scott, and has been so labeled; it is in CSU collection, Fort Collins, Colo. (plate IV). Those other *paradoxa* syntypes in Scott's and Stanford's and Fisher's collections now become **paralectotypes**.

Paradoxa occurs in every little gulch bottom, where males rait (Scott's new word to replace perch to await females) all day to await females. Scott found one mating pair in a little gulch.

Scott and Ray Stanford sent eggs to John Emmel, who reared them and sent photos in return, allowing Scott (1986, pl. 4 fig. 345) to illustrate the larva, which is green (or pale-pinkish-green) with a lateral and middorsal line of white dashes, and subdorsal white checks on moderate ridges. Pupa medium brown.

Except for the intermediate Parachute Creek pop. noted in the next section, which appears to represent intergrades between *paradoxa* and *sheridanii*, and a male collected at Diamond Peak in Moffat Co. by Ray Stanford that may be near-*neoperplexa*, the butterflies collected in western Colo. seem to fit primarily into two ssp. Ssp. *paradoxa* occurs in arid lowlands near its host *Eriogonum corymbosum*, whereas ssp. *sheridanii* occurs in W Colorado in montane habitats near *Eriogonum umbellatum*. The population along Parachute Creek in Garfield Co. occupies an intermediate altitude (nearly 6000') but has lowland habitat characteristics and occurs in association with the *paradoxa* lowland host *E. corymbosum* (*paradoxa* occurs up to 6000 Ft., at West Unaweep Canyon in Mesa Co.).

Ssp. *sheridanii* is widespread in montane areas of the W slope of Colorado. Scott has 3 males of *sheridanii* from a S-facing slope at Beaver Creek ~8400' in Eagle Co., which have fairly wide bands on two males, and a slightly narrower band on the other male; they are not significantly different from Front Range *sheridanii*. The 1981 Season Summary listed *sheridanii* from Edwards ~7500' in Eagle Co., which evidently resemble Scott's specimens from Beaver Creek. It has been found on Kebler Pass, 10000' Gunnison Co.; Gothic, Gunnison Co. Colo., June 25, 1962, Jon H. Shepard; Walton Peak, 10200', Routt Co., July 20, 1970; vic. Cathedral Bluffs, 7-8000', Piceance Basin W Meeker, Rio Blanco Co., May, Scott L. Ellis; 2 mi. NW Carbondale, Garfield Co. 6000', April 30, 1966 1 worn male, S. L. Ellis; Crystal Creek, Montrose Co. 7500', May 8, 1962 1f, May 5, 1963 1m, S. L. Ellis; Transfer Road, 8.4 mi. W Public Land Boundary, ~7500', Montrose Co., May 9, 1972, 1f, S. L. Ellis; near Ute, Montrose Co., May 17, 1972 S. L. Ellis; Chico Creek, 7000', 1.9 mi. S Egnar, San Miguel Co. Colo., May 1, 1982, Ray E. Stanford, 1m like ssp. *sheridanii* but uns band very narrow (CSU); Lands End Rd. (end of Grand Mesa), 1 mi. S. Lookout House, Mesa Co. 9600', June 2, 1972 6m11f most worn (1 has thinner band), S. L. Ellis; Diamond Peak, Moffat Co., May 28 1978, 1 female with narrower unh band that may be *neoperplexa*, R. E. Stanford; head of Navaho Can. on Wetherill Mesa Road, Mesa Verde NP, 7800', Montezuma Co., May 26, 1972 1f, S. L. Ellis; and Bernard Rotger found it at three sites in Archuleta Co. (near Coyote Park, May 10, 1951; Pagosa Springs 7200', May 6, 1934; Turkey Creek, May 6, 1954) as reported in Brown's Colo. Butt., which Brown lists as "*neoperplexa*", but they are not that, because Scott caught an ordinary *sheridanii* 1.6 mi. S. Dulce Lake in Rio Arriba Co. New Mex. on May 10, 1983, in the San Juan Mts. just S of Archuleta Co. It was found barely onto the E slope on Mt. Elbert, 12000', Lake Co. July 10, 1965 Samuel Johnson, 1 worn female which was surely a stray at that high altitude.

South of the Colorado River in western Colorado, more collecting is needed. Some populations appear to represent ssp. *sheridanii*, while others such as a population from Chico Creek, San Miguel Co. (noted below) may represent transitional populations perhaps similar to *neoperplexa*. At least some of these adults have a thin postmedian uns hw line which is sometimes fragmentary and not as complete as typical ssp. *sheridanii*. The line yet possesses a black edging, a trait supposedly lacking in ssp. *neoperplexa*. The specimens from Archuleta Co. (ex Rotger) recorded by Brown (1957) have not been examined to my knowledge, but probably were burned when Rev. Rotger's church and collection burned.

Warren (2005) suggested that *C. sheridanii* is the same species as *C. viridis*, because *pseudodumetorum* is evidently a ssp. of *C. sheridanii* and not of *C. perplexa* (which is sympatric with *pseudodumetorum* in Trinity Co.)(and sympatric in Stanislaus Co Calif. [where Gorelick 1971 J. Lepid. Soc. vol. 25 supplement found *viridis* to occur and charted its larvae on his Table 3], as the CU museum has 1 female ordinary *perplexa* and 2 males *pseudodumetorum* from Del Puerto Can. Rd. 2 mi E county line, April 11, 1993, Reed A. Watkins), and SW Ore. pops. of *sheridanii* are similar to *pseudodumetorum*, which is evidently conspecific with *viridis*; that view seems likely to be correct, thus *C. viridis* is evidently the same species as both Colo. *paradoxa* and *sheridanii*. (Note: the name *dumetorum* is the same bug as *viridis* thus evidently applies to the same species as *sheridanii*, and is older, but we refuse to use the name *dumetorum* because it will certainly be suppressed as a result of pending ICZN 81.2.3. plenary powers petition by Scott. Thus I expect the name *dumetorum* will be banished. Scott's petition also protects the name *sheridanii* from being supplanted by the name *viridis*.) But it must be noted here that Warren (2005) characterized *C. sheridanii newcomeri* in a confusing fashion. Scott's coll. has topotype *newcomeri* (Mill Creek, Yakima Co. Wash.) reared by Jonathan Pelham on *Eriog. compositum*, plus other specimens from Yakima Co.; these specimens are fairly small, and have green unh with a narrow thin straight white band; thus *newcomeri* is nothing like the Polk Co. SW Ore. bugs which Warren describes as nearly immaculate and often bluish-green on unh, after writing in error that they are "phenotypically similar" (perhaps Warren has confused/lumped *C. perplexa oregonensis* from Yakima Co. with the real *newcomeri*). Also, *pseudodumetorum* from Del Puerto Can., Stanislaus Co., Calif., is rather similar to coastal *viridis*, and does not resemble even *lemberti* much. *Newcomeri* could be considered a syn. of *neoperplexa* as they are evidently very similar, but is distinctly different from *lemberti* and vastly different from *viridis* and *pseudodumetorum*. (Note also that the unh of *affinis washingtonia* has a variable amount of white unh spots, often many spots, which represents intermediacy of this trait between *affinis* and "*perplexa*" *oregonensis*, and there is no convincing concrete evidence that *perplexa* is a different species from *affinis*, as there is no overlap of ranges between *perplexa* and *washingtonia*, though their ranges approach near each other in km and altitude. [Approaching near is NOT the same as real sympatry.])

Intergradation Between *Callophrys sheridanii paradoxa* and *Callophrys sheridanii sheridanii*, by Michael S. Fisher & J. Scott (plate IV)

Ray Stanford found a population and collected 2 males up gulches 6 miles up Parachute Creek (=Grand Valley) from I-70, in Garfield Co. Colo., nearly 6000' (here males rait [=perch to await females] where the gulch gets steep). The bugs here are near *paradoxa*, but have a blue-green unh with more complete white spots, thus are seemingly intermediate to ssp. *sheridanii*. No *Eriog. corymbosum* was found at this site by Stanford or by Clifford D. Ferris, but Mike Fisher visited the area four times in 2007 and found 20 more specimens, all in association with *E. corymbosum* (four are shown on plate IV). Fisher notes the uns is a rather unique paler green in many cases (perhaps to more-closely match the whitish soil in the area containing the mineral albite?). At least some of these have bluish-green uns (even some ssp. *sheridanii* from the Front Range have bluish-green) but the green isn't like the green of lowland *paradoxa*. The unf has green across the middle of the wing as in ssp. *sheridanii*, which is lighter but not dark gray on the lower area, unlike *paradoxa* which has an unf like *comstocki* with much gray over the central area of the wing. The unh white line varies from complete to almost absent, but does not bend as angularly as it does on *paradoxa*, though some have it somewhat bent/curved; this line is narrower and more broken than ssp. *sheridanii*, and this line is edged with black basally like ssp. *sheridanii*/*paradoxa*/*comstocki* but the black is faint or absent basad of some dashes. Thus, to Fisher and Scott this pop. seems to be rather intermediate between *sheridanii* and *paradoxa*, suggesting to us that these two taxa are conspecific. Some individuals of this pop. would seem to be similar to *neoperplexa*, although *neoperplexa* is characterized as having the unh band complete and thin; however we have not seen many adults of *neoperplexa*, and Scott wonders whether *newcomeri* is basically a synonym of *neoperplexa* (but Warren describes many *newcomeri* as having a tawny ups tinge, and see the comments on *newcomeri* above).

Ray Stanford (pers. comm.) notes that *paradoxa* blends into *comstocki* in NW Arizona and S Nevada, according to George Austin.

Euphilotes ancilla ancilla Small-Spotted W Colo Variety, by J. Scott & M. Fisher

Oakley Shields first noted this smaller-spotted W Colo. critter. Populations in NW Colo. (Pitkin and Grand and Moffat Cos.) seem to have smaller uns black spots on average, and average smaller in wingspan, thus could be named as a distinct subspecies. Scott's few specimens from Summit Co. in Uinta Mts. of NE Utah have fairly small spots also, but his specimens from Jefferson Co. Colo. average larger spots than NW Colo. However, a major problem with naming a new ssp. is that individual variation in spotting is great, so at 1 mi. NE Aspen in Pitkin Co. many have small spots but some have large spots, and in Jefferson Co. there are small spotted and very-large spotted individuals. We think there is too much individual variation for this smaller-spotted variety to be given ssp. status. But studying variation in *ancilla* is difficult. Ssp. *gilvatunica* Austin from Nev. has fairly large spots. But ssp. *ancilla* was named from Eureka, Juab Co. Utah, where the uns spots are supposed to be "fairly large" according to Austin. Thus based on that limited information, *gilvatunica* could even be considered a syn. of *ancilla*. So, perhaps Front Range populations could be called near ssp. *ancilla*. But variation in spot size is great, and *Euphilotes* in general are difficult bugs in which wing pattern is much the same over numerous named "subspecies" and even between genitalic "species", so one should study a large series from the *ancilla* TL to compare. The series from the Uinta Mts. Utah (Summit Co.) looks a bit different also on uns.

Plebejus alupini lutzi and *Plebejus alupini texanus* Distribution in Colorado and Adjacent States, by J. Scott

There has been some uncertainty about the ssp. of these blues that occupy Colorado, and about their voltinism and hostplants. So, numerous specimens from Colo. and vicinity were compared, and their hosts studied, resulting in the following conclusions. Ssp. *lutzi* occurs at higher altitude (the higher foothills to upper Montane Zone), has short hosts with larger flowers that bloom in early summer, has just one generation, is nearly always larger, averages perhaps a bit more silvery blue on male ups, has the uns apparently averaging a bit whiter, and seldom has a very wide male upf border (typically ~1 mm wide). Ssp. near-*texanus* occurs at lower altitude, including the lower foothills and plains (though it gets higher in the Arkansas Canyon [to N of Buena Vista] and all over the Wet Mtn. Valley and all over the San Luis Valley), *texanus* has usually-taller hosts with smaller flowers that bloom later in summer, has two+ generations, is nearly always small, has the uns a bit more grayish-tan it seems, averages a bit darker blue on ups (perhaps mostly an artifact of the wider male border), and most often has a rather wide male upf border (~2 mm wide). In southern Colorado (the middle-altitude Wet Mts., and the hills on SW side of San Luis Valley) ssp. near-*lutzi* is large in size but has a greater frequency of rather wide male upf border, apparently due to intergradation; these have host and size (and habitat?) like *lutzi*, but the borders are more like *texanus*, so the predominance of characters leads Scott to call them near-*lutzi*. There is no evidence that these taxa are two species in Colorado, as every single locality seems to be dominated by just one ssp., evidently because intergradation and gene flow transforms each local population to whatever type is best adapted to that habitat and its climate and *Eriogonum*. (Scott had thought that both species occur at Tucker Gulch in Jefferson Co., but *lutzi* seems to occur higher in the gulch and ssp. *texanus* low in the gulch, though you will note below that Scott lists one *texanus* from 3 mi. up Tucker Gulch, where the vast majority of specimens look like *lutzi*, but Scott refuses to raise *texanus* to species rank based on one specimen, because these bugs do vary, and size is the only mostly-reliable morphological character, as the border width character is weaker, thus variation makes identifying individual specimens somewhat uncertain).

(Note: the name *lupini* is so grossly misleading and inappropriate—implying that the bug has something to do with *Lupinus*, which it does not—that I have invoked the *lapsus contrarius* principle of the Biological Catalogue [see Papilio {New Series} #20], which adds the prefix a- or an- [meaning not-] to the front of such misleading names, in order to negate their inappropriateness, meaning in this case "not-*lupini*".)

The following is a detailed study and full listing of specimens of these taxa in Scott's collection. The specimens are mounted unless labeled as pap in parentheses in the listing below, so Scott now has a total of 592 mounted and 228 papered specimens of the three ssp. of *P. alupini* found in Colo. (the only good thing about these bugs is that one can fit 400 into one drawer). To obtain recorded data on ovipositions and associated *Eriogonum* species, Scott consulted his notebooks for each locality for these specimens, and for localities listed in his records for southern Colorado butterflies (which were used to prepare the paper on that fauna, J. Scott & G. Scott 1980, J. Res. Lepid. 17:73-128), and for other records of "*acmon*" that Scott had found in his notebooks. Some records list specimens recorded as collected in his notes, which are not now present in his collection, which means that Scott had already traded or sold them to someone else (a few of these may be at the Univ. Calif. at Davis collection, because Carll Goodpasture did not return some of the specimens or slides that he borrowed from Scott to do his original studies on these *Plebejus* at Davis, in 1973, Pan-Pacific Ent. 49:149-159 and J. Kans. Ent. Soc. 46:468-485).

Size is the most consistent character, though runts and giants appear sometimes in most or all pops., as ssp. *lutzi* is large, and ssp. *texanus* is small. The **male upf border width** is a not a great character as it is variable, and it differs only in average frequency. However, most (roughly two-thirds) Colorado *texanus* seem to have a fairly-wide male upf border (some have the border narrow like *lutzi*), so the average is different from *lutzi*, though southward in Ariz.-W Texas nearly all *texanus* males have a fairly-wide border (maybe 90%+), so we should evidently call Colorado *texanus* by the name "near-*texanus*", because in S Colo. the near-*texanus* usually has a fairly-wide male upf border, while in C-N Colo. the border is also usually fairly wide, but slightly less often wide, thus those northern ones are evidently a bit more intergraded with *lutzi*; but still, these bugs in N Colo., and even in C Wyo. and Neb. and S.D., are still close to *texanus* (they have wide border too and are identical in size and host and several generations). Thus the near-*texanus* bugs seem to occur northward on the Great Plains to C Wyoming and Nebraska and South Dakota (Marrone 2002 figures a male with wide border like *texanus* and lists two gen.)(Ron Royer's 2003 Butt. ND figs. a male with a rather narrow border, but says there are two gen. there in June and Aug., so maybe they are turning into ssp. *lutzi* there)(Ron Hooper's Butt. Sask. figs. a male with little border and says there is one gen. there, so *texanus* evidently doesn't extend that far north and those are *lutzi*). The **color of the ups blue** varies between individuals also (and changes a little after decades—notoriously, the old *xerces* and *pheres* blues from San Francisco change color in museum drawers after 50 years and mislead taxonomists who compare them to fresh specimens). Ssp. *lutzi* may seem to have a slightly more silvery tint of the blue, however this may be mostly just an illusion due to its larger size and narrower borders producing a greater area of blue. Ssp. *texanus* has wider borders and smaller size which may cause the illusion of a slightly darker blue, though Goodpasture wrote that they are darker blue. Scott's specimens of ssp. near-*texanus* from N Colo. maybe average a teensy bit more silvery tint to the blue than those from S Colo., but they also average a decade or two older in age, so Scott can't conclude that they are much different in color when fresh (his *lutzi* average newer also). The **orange hw band** varies in width. The **uns black spots** vary considerably, and large-spotted specimens often occur along with the usual smaller-spotted ones (one frequently sees many with small spots, then suddenly a female with large spots will appear from the same site).

Carll Goodpasture examined the **genitalia** of a number of Scott's specimens (Scott has slides of these), and he found a lot of intergradation in genitalia, such as in the near-*lutzi* on hills SW of San Luis Valley, and he found some *texanus*-like genitalia on the Colorado plains/foothills, where Scott mapped ssp. *texanus* below. He mapped (Pan-Pac. Ent. 49:152) *lutzi* from higher elev. Gunnison and Clear Creek and Grand and Boulder and Routt Cos. Colo., and mapped *texanus* from lowland Montrose and Montezuma Cos. in W Colo. and the San Luis Valley and Huerfano & Fremont Cos. in S Colo. and the plains in Pueblo and Jefferson and Larimer Cos. Colo. (his *lutzi* location from Custer Co. is a specimen of *cotundra*, not *lutzi*). Because Goodpasture showed significant intergradation between ssp. *alupini* and *lutzi* in Nevada etc., and *texanus* and *lutzi* seem to be conspecific, and *texanus* shows a lot of similarities in wing pattern and genitalia with ssp. *alupini* (and especially with ssp. *alupini* "*alpicola*"), Scott thinks we still have to call them all ssp. of *Plebejus alupini*, as Scott has not seen any evidence that our Colorado bugs are a different species from Calif. *P. alupini*.

Clearly ssp. near-*texanus* has two or more **generations** everywhere (as the following records show), as there are lots of spring records everywhere it occurs (the theory that the late summer bugs are a different species than the spring bugs is clearly wrong). The data for southern Colorado (from the 1980 paper mentioned above) show two generations in the

Arkansas Canyon and Wet Mtn. Valley and San Luis Valley (about June 12-July 12, then about July 16-Sept. 2). Those data seem to show three generations on the S Colo. plains (May 4-June 8, June 26-July 31 [a gap between July 13 & 31], Aug. 19-Sept. 14)(though there are only 7, 10, and 7 sample dates for each gen., and looking at those records again Scott doesn't know where some of those samples came from); data in the current paper show S plains records of May 4, 12, June 8, 24, July 31, Aug. 11, 26, Sept. 6, 9, 9, 14, which could fit into those same three generations. The records on N Colo. plains in the current paper are April 27, May 6, 14, 28, 28, June 4, 12, 25, 28, 29, 30, July 26, 28, Aug. 2, 2, 4, 5, 7, 10, 10, 11, 12, 18, 23, 23, 30, 31, Sept. 3, 3, 5, 6, 9, 9, 9, 12, 13, 18, 21, 22, 24, 25, Oct. 4, 9, 10, 11, 12, 13, 15, which can be interpreted as only two generations April 27-June 30, July 26-Oct. 15, although there is a gap in mid June and most of July so this can be interpreted as April 27-June 12, June 25-30 (& Mike Fisher found it in Kit Carson Co. July 16 probably of this 2nd gen.), and July 26-Oct. 15. Scott's paper (with Marc Epstein, Amer. Midl. Nat. 117:103-118, 1987) on phenology of Red Rocks butterflies listed 3 generations there, though there were only 4 records for Red Rocks at that time so the 3 generations evidently came from the S Colo. study. If there are 3 generations on the E plains as seems likely (specifically May-E June, L June-M July, L July-Sept. or even to M Oct.), there must be nearly 2 months between generations, which seems reasonable because the same time occurs between 1st and 2nd generations in the Arkansas Canyon, Wet Mtn. Valley, and San Luis Valley. So, Scott will conclude that there are more-or-less three generations on the Colo. plains, with the understanding that there is most likely some variation (there is as much as a one-month difference in butterfly flight time between early and late years) and overlap between them and maybe some individuals may have just two and maybe some years the season is truncated in mid Sept. by freezing weather so the bugs would not fly into mid Oct. as they do in some years, jumbling the picture some. Scott should gather up more plains records and chart their phenology, but he is sure the chart will clearly show several generations. If Scott had the time and $, Scott could computerize all his records and get a much better picture of the number of broods in N Colorado, as there are surely more records in his notebooks that are not listed below, involving specimens that Scott traded or sold and thus are no longer in his collection.

Wyo.-Neb.-N.D. records here are May 16, June 26, July 15, Aug. 18, Aug. 23, Aug. 25, for evidently two generations (May 16-June 26, July 15-Aug. 25). That fits the situation in N.D., where Ronald Royer wrote that there are two gen. in E June and L July (and where *Eriogonum pauciflorum* is evidently the host based on *Eriog.* distributions in the Great Plains Flora). In S.D., Marrone (2002) also describes two gen., with peak flights in L May and L July.

As **hostplants**, ssp. *lutzi* eats the closely-related *Eriogonum* species *E. umbellatum* and *subalpinum* and the yellow-colored *E. flavum* (formerly called *jamesii* var. *flavescens*), which are small plants but have large flowers/inflorescences and are closely related; it rarely eats *E. racemosum*. The near-*lutzi* in S Colorado evidently eats mostly the real cream-colored *Eriog. jamesii*, which has the same size and shape and is closely related. Ssp. near-*texanus* generally eats *Eriog. effusum*, which forms larger plants but has small flowers (and it ate the similar *E. lonchophyllum*, which is also tall with small white flowers like *effusum*, at one site before the *lonchophyllum* was exterminated), and eats the yellow-flowered *E. brevicaule* (short plants with small flowers) on the dark shale outcrops northward in Wyo. (and perhaps somewhere in Boulder-Larimer-Weld Cos. in N Colo.); *texanus* occasionally eats other *Eriogonum* such as *E. umbellatum* (and F. M. Brown reported ovip. on *umbellatum* in Elbert Co., and ovip. on *E. effusum* in El Paso Co., 1976 Lepid. News #2 p. 6), and maybe occasionally (no real records of ovip. or larvae as yet) could eat *E. cernuum* and possibly even *E. annuum*. The host of near-*texanus* in S.D. is *Eriogonum pauciflorum*. In most of Ariz.-New Mex.-W Tex. *texanus* eats *Eriog. wrightii*, which is a taller small-flowered plant like *E. effusum* (*Euphilotes rita* also eats these same two *Eriogonum* in the same regions).

Plebejus alupini lutzi (large, male upf border 1 mm [seldom wide], one gen., host mostly *Eriogonum umbellatum/subalpinum/flavum*[="*jamesi* var. *flavescens*"]). **Specimens examined:** Canyon Creek, E side Wind River Mts., Fremont Co. Wyo., Aug. 15, 1983 1m. Clear Creek near Slide Falls, E Green River Lake, Wind River Mts., Sublette Co. Wyo., Aug. 10, 1980 1m. SW Steamboat Point, Bighorn Mts., Sheridan Co. Wyo., Aug. 1, 1995, 1f on *Eriog. subalpinum*. Diamond Peak, Moffat Co. Colo., July 8, 1972 on *E. subalpinum* (not *heracleoides*, no ring of bracts around stem) 6m3f. ~9.5 mi. S Baggs, Moffat Co. Colo., Aug. 18, 1994 1m small. Madlin Creek, 8670', Routt Co. Colo., July 31, 1960 1m. 6 mi. E Crawford, Delta Co., Colo., July 30, 1972 1m. Taylor River, Gunnison Co. Colo., July 10, 1961 John Jeffers 1m. Jack's Cabin Rd., Gunnison Co. Colo., July-Aug. 1976, Robert Price, reared from *Eriog. racemosum* emgd. Aug. 1976 (1f papered). E end Cottonwood Lake, 9600', Sawatch Range, Chaffee Co. Colo., June 21, 1969 1m (not ssp. *cotundra*). Grizzly Creek Cgd., SW edge North Park, Jackson Co. Colo., July 12, 1996, assoc. *E. subalpinum* 1f. Blue River Cgd., Summit Co. Colo., July 11, 1996, assoc. *E. subalpinum* 1m2f. 3.7 rd. mi. N Dillon Res. dam, Summit Co. Colo., July 3, 1989, host *E. subalpinum* 2m. 1 mi. N Dillon, Summit Co. Colo., July 15, 1985 (1f papered). Green Mtn. Res., Summit Co. Colo., July 11, 1996, assoc. *E. subalpinum* 1m. Willow Creek Res., Grand Co. Colo., July 2, 1963, William A. Cobban Jr., 1m1f. 3 mi. SSW Hot Sulfur Springs, 8300', Grand Co. Colo., on *E. subalpinum*, June 30, 1989 2m3f. 3 mi. SSW Hot Sulfur Springs, 8300', Grand Co. Colo., on *Eriog. umbellatum*, July 4, 1990 10m2f. 1/3 mi. NW Tabernash, Grand Co. Colo., June 24, 1989, assoc. *E. subalpinum* 2m. Beaver Creek Cgd., Grand Co. Colo., July 3, 1963 William A. Cobban Jr. (traded away). Fall River, Clear Creek Co. Colo., July 28, 1973, probably assoc. *E. umbellatum* 1f (&1m1f papered). Clearings N Eisenhower Tunnel, 11,600-11,700', Clear Creek Co. Colo., July 13, 2007 1m, July 21, 2007 1m1f, July 23 1m (2m have upf like *lutzi* with no border, 1m1f have wide border and darker blue like *texanus*), assoc. *E. subalpinum*. Dory Hill, 5 mi. NW Central City, Gilpin Co. Colo., July 7, 2001, 2m1f assoc. *E. umbellatum*. Dory Hill, 5 mi. NW Central City, Gilpin Co. Colo., July 8, 1990, 1f assoc. *E. umbellatum*. 1 mi. up North Fork Clear Creek, Gilpin Co. Colo., probably assoc. *E. umbellatum*, July 2, 1978 1m, July 7, 1977 2m. east portal Moffat Tunnel, Gilpin Co. Colo., July 2, 1989 1m assoc. *E. subalpinum*, June 19, 1977 1m. Toll Ranch, east portal Moffat Tunnel, Gilpin Co. Colo., July 27, 1977 1m (&1m papered), July 31, 1973 1f. 3 mi. NW Nederland, Boulder Co. Colo., July 9, 1973, *E. umbellatum* present, 1m. 1 mi. NW Nederland, Boulder Co. Colo., July 2, 1989, 2m assoc. *E. umbellatum*. Lefthand Can., Boulder Co. Colo., June 8, 1994, 3m at mud. junction of York Gulch and Fall River, ~8000', Clear Creek Co. Colo., June 27, 1964 2m (traded away). Beaver Brook, US hwy. 40, ~7500', Jefferson Co. Colo., June 18, 1989 collector unknown 1m. Eldorado Mtn., near Bull Gulch, Jefferson Co. Colo., June 11, 1994 2m (1 small 1 large). 1 mi. SW of Mt. Tom, Jefferson Co. Colo., July 12, 1981, 1m, probably assoc. *E. umbellatum*. Coal Creek Can., Jefferson Co. Colo., July 10, 1991 assoc. E. flavum 1m, July 10, 1995 1m, July 15, 1991 assoc. *E. flavum* 1m1f, July 16, 1991 host *Eriog. flavum* 1m, July 17, 1991 assoc. *E. flavum* 1m1f. hilltop NE Crawford Gulch, Jefferson Co. Colo., June 10, 1989, assoc. *E. umbellatum* 1m. ridge NE of upper end of Crawford Gulch, Jefferson Co. Colo., June 6, 1996 assoc. *E. umbellatum* 2m, July 1, 1993 on *E. umbellatum* 1m1f, June 23, 1997 assoc. *E. umbellatum* 1m. Crawford Hill, WNW Golden, Jefferson Co. Colo., July 7, 1991 1m. Golden Gate Can. (NW of Guy Hill?), Jefferson Co. Colo., June 27, 1986 1m. Golden Gate Can. (Tucker Gulch probably), Jefferson Co. Colo., July 3, 1980 1f. Tucker Gulch (~6 mi. up) "Golden Gate Can.", NE of Guy Hill, ~7500', Jefferson Co. Colo., June 19, 1977 2m. 3 mi. up Tucker Gulch, Jefferson Co. Colo., June 27, 1986 (1m traded away), June 29, 1998 2m, July 3, 1980 (2f traded away), July 5, 1992 1m, July 5, 1996 in gulch 1m, July 7, 1994 near *E. umbellatum* 1m, July 9, 1995 6m, July 15, 1995 *E. umbellatum* present 1m1f, Aug. 7, 1978 (1m traded away). 1 mi. W Idledale, Bear Creek, Jefferson Co. Colo., June 16, 2002, assoc. *E. umbellatum* 1m. North Cheyenne Can., ~8700', El Paso Co. Colo., June 30, 1984 1m. Stove Mtn., 8000', El Paso Co. Colo., June 23, 1990, *host Eriogonum* flavum 3m3f (most fairly small).

Plebejus alupini **near-*lutzi***, upper Wet Mts. (large, but upf male border nearly-always wide, one gen., host evidently the real *Eriogonum jamesii*). **Specimens examined:** 0.5 mi. E Smith Creek Cgd., Wet Mts., Custer Co. Colo., probably assoc. *Eriog. jamesii* [*Euphilotes glaucon centralis* also present], June 26, 1971 7m3f, June 28, 1971 1f, July 2, 1970 1f, July 5, 1973 3m6f, July 6, 1973 6m2f. road to Locke Park, 8400', Wet Mts., Custer Co. Colo., June 20, 1971 2m.

Plebejus alupini **near-*lutzi***, mts. SW side San Luis Valley (large, but upf male border nearly-always wide, one gen., host probably *Eriog. jamesii* (*Eriog. racemosum* also present). **Specimens examined:** ½ mi. SE Shilling's Spring, Conejos Co. Colo., July 9, 1967, assoc. *E. jamesii* & *E. racemosum* 12m5f. W end Alamosa (now Terrace) Res., Conejos Co. Colo., July 9, 1967 7m. ½ mi. N of E end of Alamosa Res., Conejos Co. Colo., July 8, 1967 5m2f. San Antonio Mtn. (a lone volcanic cone), 9000', Rio Arriba Co. New Mex., June 21, 1978, *E. racemosum* common 2m. 5 mi. SW Del Norte, San Luis Valley, Rio Grande Co. Colo., July 17, 1971 (*texanus*?) 3f (&1f papered).

Plebejus alupini **near-*texanus*** (small, upf male border usually wide, uns a bit more grayish-tan than lutzi, two gen., host *Eriogonum corymbosum*). **Specimens examined:** John Brown Can., Mesa Co. Colo., July 29, 1993, probably assoc. *E. corymbosum*, 1m. ridge ~3 mi. S Cortez, Montezuma Co. Colo., Sept. 6, 1978, on *E. corymbosum* var. *velutinum* 1m2f.

Plebejus alupini **near-*texanus*** (small, upf male border usually wide, uns a bit more grayish-tan than lutzi, two gen., host mostly *Eriog. effusum*, *Eriog. corymbosum* in SW Colo., occasionally *Eriog. lonchophyllum* & *Eriog. umbellatum*, and in SD *Eriog. pauciflorum*). **Specimens examined:** Black Mesa, Cimarron Co. Okla, May 20, 1973 1f . 7 mi. N Laughlin Peak, 7200', Colfax Co., New Mex., Sept. 12, 1980, *E. effusum* & *Eriog. jamesii* present 1f. San Luis, Costilla Co. Colo., Sept. 8, 1998 1m1f. Great Sand Dunes, 8000', Alamosa Co. Colo., July 12, 1952 Arthur Moeck (not seen). Great Sand Dunes, Mosca Pass trail, 8500', Sangre de Cristo Mts., Saguache Co. Colo., July 16, 1970 6m3f. Medano Creek to Medano Pass, Sangre de Cristo Mts., Saguache Co. Colo., Aug. 1, 1970 around *E. jamesii* (1m1f traded away, maybe ssp. *lutzi*?). Middle Zapata Creek, Sangre de Cristo Mts., Alamosa Co. Colo., July 23, 1966 Glenn R. Scott 1m. Crestone, Sangre de Cristo Mts., Saguache Co. Colo., Sept. 2, 1967 Maurice Howard (not seen lately). Cotton Creek, 9000', Sangre de Cristo Mts., Saguache Co. Colo., Aug. 1, 1967 1m. Raspberry Creek, 8200', Sangre de Cristo Mts., Saguache Co. Colo., Aug. 22, 1967 1m. Ferguson Creek, 8200', Sangre de Cristo Mts., Saguache Co. Colo., Aug. 22, 1965 (1m traded away). Rito Alto Creek, Sangre de Cristo Mts., Saguache Co. Colo., June 19, 1971 1f coll. Glenn R. Scott, Aug. 9, 1970 1m. Villa Grove (town), San Luis Valley, Saguache Co. Colo., June 14, 1968 (Maurice Howard, not seen lately), Aug. 22, 1965, on *E. effusum* 2m6f. Hills 2 mi. SW Villa Grove, W side San Luis Valley, Saguache Co. Colo., June 17, 1966 1m J. Scott, July 18 1966 2m1f Glenn R. Scott, July 19, 1966 1m3f Glenn R. Scott. 4 mi. SW Villa Grove, hills on W side San Luis Valley, Saguache Co. Colo., July 22, 1969 assoc. *E. effusum* 1m. 6 mi. W Villa Grove, hills on W side San Luis Valley, Saguache Co. Colo., July 21, 1969 1f. Mosca Pass, 7 mi. W Malachite, Sangre de Cristo Mts., Huerfano Co. Colo., July 4, 1970 1m. Nathrop, Chaffee Co. Colo., Aug. 20, 1973 3f (& 2m4f papered). Sugarloaf Mtn., Chaffee Co. Colo., Aug. 11, 1973, on *E. effusum* 4f. 5 mi. SW Buena Vista, Chaffee Co. Colo., Aug. 18, 1973, assoc. *E. effusum* 4f (& 1f papered). 3 mi. W Buena Vista, Chaffee Co. Colo., Aug. 17, 1973, dense stand of *E. effusum* & *Eriog. cernuum* 4f (& 2m1f papered). 2 mi. E Buena Vista, Chaffee Co. Colo., Aug. 17, 1971, on *E. effusum* 1m4f. 4 mi. N Buena Vista, Chaffee Co. Colo., Aug. 17, 1973, patrolling near *E. effusum*, some near *E. cernuum* 1m. 1.5 mi. SW Mt. Princeton Hot Springs, 8800', Chaffee Co. Colo., June 24, 1974, near *E. effusum* 2f. Bald Mtn., S of Cottonwood Creek, 8800', W of Buena Vista, Chaffee Co. Colo., June 11, 1974 1f. Bald Mtn. Gulch, Chaffee Co. Colo., Aug. 20, 1973 (1f traded away). Trout Creek, 5.6 mi. SW jct. hwys. 285 & 24, 8500’, Chaffee Co. Colo., Aug. 29, 1977, roadside near *E. cernuum*. Site of now-absent sawmill 1 mi. SE Salida, Chaffee Co. Colo., on *E. effusum* growing on pure sawdust, July 24, 1974 1m, July 29, 1969 1f, Aug. 1, 1965 1m, Aug. 3, 1969 1m1f, Aug. 6, 1965 (2m papered), Aug. 8, 1969 on *E. effusum* (1m traded away). 1 mi. up Bear Creek, Fremont Co. Colo., June 12, 1969 (1m traded away), June 16, 1969 (1m traded away), June 22, 1970 1f, June 23, 1969 1m, June 26, 1970 (1m traded away). Kerr Gulch, Arkansas Canyon, Fremont Co. Colo., Aug. 15, 1973, flying near *E. cernuum* (*E. jamesii* also at locale) 2m1f. Coaldale, Arkansas Canyon, Fremont Co. Colo., Aug. 2, 1973, *E. effusum* there 1m, Aug. 3 1973 1f, Aug. 13 1973 1m. gulch just W Cotopaxi (probably Kuntz Gulch), Arkansas Canyon, Fremont Co. Colo., July 29, 1967, *E. effusum* there, 2m2f. Kuntz Gulch, 1 mi. W of Cotopaxi, 6500’, Fremont Co. Colo., on *E. effusum*, July 21, 1968 1m2f, July 28, 1968 (6600’, Glenn R. Scott, 1f traded away), July 30, 1970 (1f traded away), Aug. 2, 1973 (1m1f papered), Aug. 8, 1969 (4m papered), Aug. 14, 1965 1m2f (& 1m1f papered), Aug. 15, 1965 (1m1f papered), Aug. 25, 1965 (1m traded away). ½ mi. NW Democratic Mtn., (N end Wet Mtn. Valley), Fremont Co. Colo., Aug. 20, 1965, on *E. effusum* 1f. 1 mi. W Democratic Mtn., (N end Wet Mtn. Valley), Fremont Co. Colo., Aug. 20, 1965, on *E. effusum* (*E. jamesii* also present) 2m4f. Hillside cemetery (2.3 mi. N Hillside), 7500’, NW end Wet Mtn. Valley, Fremont Co. Colo., Aug. 17, 1965, assoc. *E. effusum* 1f (&5m1f papered). 2 mi. E Hillside, ~7800?’, NW end Wet Mtn. Valley, Fremont Co. Colo., Aug. 17, 1965 1m. Hillside School (1.2 mi. N Hillside), 7360’, NW end Wet Mtn. Valley, Fremont Co. Colo., Aug. 16, 1968 Glenn R. Scott 3m2f, Aug. 23, 1965 1m2f (&3m4f papered). hill W of Hillside School, 7400’, NW end Wet Mtn. Valley, Fremont Co. Colo., July 21, 1966 Glenn R. Scott (1m papered). 2 mi. NE Hillside, ~7500’, NW end Wet Mtn. Valley, Fremont Co. Colo., Aug. 18, 1965 1f. 2 mi. N Hillside, 7280’, NW end Wet Mtn. Valley, Fremont Co. Colo., Aug. 24, 1968 Glenn R. Scott 1f, Aug. 25, 1968 Glenn R. Scott 1f (& 1f papered). Bull Domingo Hills, Wet Mtn. Valley, Custer Co. Colo., *E. effusum* present, Aug. 16, 1970, 2m4f (&1m1f papered). Johnson Gulch, 7700’, NE end Wet Mtn. Valley, Custer Co. Colo., July 11, 1965 near road (*E. effusum* present) 1f, July 25, 1967 (1f traded away). Ben West Hill, Wet Mtn. Valley, Custer Co. Colo., *E. effusum* present., June 17, 1973 1m, June 18, 1973 1m1f, July 25, 1965 (20 m papered), July 31, 1971 (seen), Aug. 22, 1970 2m. ¼ mi. NW Ben West Hill, Wet Mtn. Valley, Custer Co. Colo., July 25, 1965, assoc. *E. effusum* (*E. jamesii* also present) 3m1f. 2 mi. N Silver Cliff, Wet Mtn. Valley, Custer Co. Colo., July 18, 1965, 1m. 1 mi. S Silver Cliff, Wet Mtn. Valley, Custer Co. Colo., Aug. 7, 1965, assoc. *E. effusum* 2m1f (& 15m papered). ½ mi. S Silver Cliff, Wet Mtn. Valley, Custer Co. Colo., Aug. 8, 1965, , assoc. *E. effusum*, mating pair 1m1f (& 2f papered). 1.5 mi. NW Westcliffe, Wet Mtn. Valley, Custer Co. Colo., July 25, 1965, assoc. *E. effusum* 11m9f (& 8m papered). ½ mi. N Westcliffe, Wet Mtn. Valley, Custer Co. Colo., July 25, 1965 (3m3f papered). 1 mi. N Westcliffe, Wet Mtn. Valley, Custer Co. Colo., Aug. 8, 1965 assoc. *E. effusum* 2m3f (& 2m papered). 2 mi. N Westcliffe, Wet Mtn. Valley, Custer Co. Colo., June 12, 1970 assoc. *E. effusum* 3m, July 28, 1967 (1m traded away). Westcliffe, Wet Mtn. Valley, Custer Co. Colo., July 28, 1967 assoc. *E. effusum* 1m. 1 mi. S Westcliffe, Wet Mtn. Valley, Custer Co. Colo., June 18, 1966 (4m papered). Hermit Pass Road, Custer Co. Colo., July 22, 1968 Glenn R. Scott 1f. Froze Creek, near SE end Wet Mtn. Valley, Custer Co. Colo., Aug. 28, 1968 Glenn R. Scott (1f traded away). 3 mi. N Promontory Divide, Wet Mtn. Valley, Custer Co. Colo., June 17, 1973, *E. umbellatum* common near hwy. 2m. 1 mi. up Sand Gulch, 2 mi. SW Greenwood, Wet Mts. foothills, Custer Co. Colo., July 10, 1969 3m. Sand Gulch, 2 mi. SW Greenwood, Wet Mtn. foothills, Custer Co. Colo., July 13, 1967 (1m traded away). Welsh Pony Ranch W of Hardscrabble Crk., Wet Mtn. foothills, Custer Co. Colo., July 10, 1967 (1f traded away). Rye, Wet Mtn. foothills, Pueblo Co. Colo., June 29, 1967 (1m traded away). S part of Wolf Park, water tower hill, SW Canon City, Fremont Co. Colo., June 24, 1993 1m fairly large. Wolf Park, 3 mi. S Canon City, Fremont Co. Colo., June 8,1971, coll. Glenn R. Scott 1m fairly large. 2 mi. NE Crow, on plains, Pueblo Co. Colo., May 4, 1972 (1f traded away). SW of Pueblo, on plains, Pueblo Co. Colo., July 31, 1962 1f. Pikes Peak Turf Club, S of Fountain, El Paso Co. Colo., Sept. 14, 1971 1m. Fountain Creek, 6 mi. S Buttes, El Paso Co. Colo., May 12, 1968 (1m1f traded away). Little Fountain Creek, 7000’, foothills Rampart Range, El Paso Co. Colo., Aug. 9, 1971 1m, Aug. 18, 1971 2m. Phantom Canyon, S end Rampart Range, Fremont Co. Colo., May 27, 1972, Aug. 19, 1973, Maurice Howard (not seen lately). prairie 7.7 mi. E jct. hwys 24 & 94, El Paso Co. Colo., assoc. *E. effusum*, Aug. 11, 1973 1m, Sept. 6, 1971 1m, Sept. 9, 1971 1m. 5 mi. N Colorado Springs, El Paso Co. Colo., Aug. 26, 1973 (3m3f papered). 10 mi. N Colorado Springs, El Paso Co. Colo., Sept. 9, 1971 (1f papered). Hwy. 71, North Rush Creek, Lincoln Co. Colo., Oct. 9, 1983, on rabbitbrush 1m. Nighthawk, South Platte River Canyon, Douglas Co. Colo., July 30, 1984, assoc. blooming *E. effusum* 1m1f. Box Elder Creek, Quincy Ave., Arapahoe Co. Colo., June 4, 1988 assoc. *E. effusum* 2m, Aug. 5, 1973 (9m5f papered). just E Box Elder Creek, Arapahoe Co. Colo., May 28, 1991 3m. 1 mi. E Box Elder Creek, Arapahoe Co. Colo., May 6, 1990 1f. 1.8 mi. E Box Elder Creek, Arapahoe Co. Colo., May 28, 1991 1m, Sept. 9, 1988 (1f papered). 3 mi. E Box Elder Creek, Arapahoe Co. Colo., Aug. 11, 1984, on *E. effusum* 2m1f. Cherry Creek Res., Arapahoe Co. Colo., Sept. 21, 1988, one *Eriog. annuum* seen, 3m. 2.4 mi. N River Bend, Elbert Co. Colo., Aug. 7, 1989 at mud & valley bottom (2m papered). 4 mi. NW Sedalia, Douglas Co. Colo., Aug. 2, 1977, on *E. effusum* (2m2f papered). 3 mi. NW Castle Rock, Douglas Co. Colo., Aug. 2, 1977, on *E. effusum* (5m papered). Deer Creek, Front Range foothills, Jefferson Co. Colo., July 23, 1960 1m. Phillipsburg, Deer Creek Can., Front Range foothills, Jefferson Co. Colo., Sept. 4, 1960 near stream 1m. Tinytown, Jefferson Co. Colo., May 13, 1996, clearing N of gulch assoc. *E. umbellatum* 1f, June 28, 1990 1m, July 15, 1990, mud 1m, July 31, 1996, mud, probably assoc. *E. umbellatum* 1m, Sept. 4, 1991, on saddle assoc. *E.*

umbellatum 1m. mtn. front at Falcon Co. Park, Jefferson Co. Colo., June 15, 1989 1f, July 18, 1990 1m. Bandimere Speedway, ENE Morrison, E side hogback, Jefferson Co. Colo., host *E. lonchophyllum* (construction of W-470 and expansion of speedway wiped out almost all the *lonchophyllum*), Aug. 10, 1984 10m4f (& 3m papered), Aug. 31, 1987 2m, Sept. 18. 1987 2m, Sept. 22. 1987 1m. 1 mi. E Morrison, Jefferson Co. Colo., Sept. 6, 1993 (1m papered), Sept. 25, 1997 assoc. *E. effusum* 1m1f, Oct. 4, 1990 *E. effusum* present 1m, Oct. 10, 1995 mud in canal 1m. N of Bear Creek Res., Jefferson Co. Colo., Sept. 9, 1991 1m mud, Sept. 24, 1990 (1m papered). Bear Creek Res. Park, Jefferson Co. Colo., Oct. 12, 1988 (1m papered). Red Rocks, Jefferson Co. Colo., assoc. *E. effusum* on flat S of parking lot, May 17 (earliest date in phenology paper on Red Rocks butterflies, J. Scott & M. Epstein 1987, Amer. Midl. Nat. 117:103-118), June 11, 1966 (1m traded away), Aug. 17, 1992 1f, Sept. 21, 1987 1m, Sept. 22, 1987 2f, Sept. 29, 1977 1f. Green Mtn., lower foothills of Front Range, Jefferson Co. Colo., *E. effusum* & *umbellatum* present, April 27, 1988 1m, June 12, 1980 (1m on *E. umbellatum* traded away), June 30, 1978 1f, Aug. 4, 1978 (1m1f papered), Aug. 10, 1984 (2m2f mud and near *E. effusum* traded away), Aug. 12, 1977 (5m papered), Aug. 18, 1977 (6m1f papered), Aug. 30, 1983 (1m on *E. effusum* traded away), Sept. 3, 1984 (1m papered), Sept. 9, 1983 (seen), Sept. 12, 1987 on *E. effusum* 1f, 1990s (1f papered). Rooney Road, W of Green Mtn., Jefferson Co. Colo., Oct. 14, 1961 (no numbers recorded, traded away), Oct. 15, 1961 William A. Cobban Jr. 1f. Lakewood (near Scott's house, now developed), Jefferson Co. Colo., no doubt assoc. *E. effusum* (which is still present at Addenbrook Park 1 mi. NW), May 10, 1962 (numbers not recorded, traded away), July 26, 1960 1m, July 28, 1961 1f, Oct. 13, 2005 1m. Apex Gulch, Jefferson Co. Colo., May 26, 1998 1m, June 4, 1990 mud 1m, June 11, 1999 1m, June 21, 1984 1m, Aug. 21, 1998 mud 4m, Aug. 24, 1990 near *E. effusum* 1m, Aug. 27, 1990 ovip. *E. umbellatum* 1m1f. Chimney Gulch, Jefferson Co. Colo., assoc. *E. effusum* on hillside NE of gulch, July 1, 1986 1m, July 2, 1986 2m2f. Mt. Zion, Jefferson Co. Colo., June 13, 1994 ovip. *E. umbellatum* 1f, July 2, 1978 *E. umbellatum* present 1f, Aug. 5, 1993 *Eriog. flavum* present 1f, Aug. 14, 1990 *E. flavum* present 1m, hilltop Aug. 20, 1977 1f. Indian Gulch, Clear Creek Can., 1 mi. W. Golden, Jefferson Co. Colo., June 18, 1994 near *E. umbellatum* 2m, July 6, 1992 *E. umbellatum* & *effusum* present 1m, July 17, 1998 1m, Sept. 7, 1966 on *E. effusum* 1m, July 27, 1998 (1m papered), July 29, 1998 (1m1f papered), July 31, 1998 (1m papered), Aug. 8, 1973 (1m papered), Aug. 10, 1995 (2m papered), Sept. 7, 1966 (seen on *E. effusum*), Sept. 10, 1965 2m. 3 mi. up Tucker Gulch "Golden Gate Can.", Jefferson Co. Colo., Aug. 7, 1978 1m small. Tucker Gulch, Jefferson Co. Colo., Sept. 9, 1994 1m tiny. Van Bibber Creek, mtn. front, Jefferson Co. Colo., Sept. 10, 1990, mud 1m. Leyden Gulch, prairie between hogback and foothills, Jefferson Co. Colo., *E. effusum* present, Sept. 3, 1997 1m, Sept. 5, 1997 (3m1f papered), Sept. 13, 1990 (1m papered). Gregory Can., Boulder Co. Colo., May 13, 1966 (1m traded away), May 30, 1966 1m, May 23, 1966 (1m traded away). Lefthand Can., Boulder Co. Colo., June 8, 1994, at mud. 0.6 mi. W Tower Road X 120th, Barr Lake, Adams Co. Colo., flying over *E. effusum*, Aug. 23, 1989 (7m1f papered). Barr Lake, Adams Co. Colo., Aug. 23, 1989 stray below dam no *Eriog.* (1f papered), Oct. 11, 1989 at canal no *Eriog.* (1m papered). Sand Creek, at Round Butte, 5850', Larimer Co. Colo., June 29, 1964 dry wash 1m1f. I-76 rest stop E of Crook, Logan Co. Colo., June 25, 1991 1m. 8 mi. N Brush, Morgan Co. Colo., May 14, 1976, coll. Glenn Robert Scott 1f. 8 km NNE Nunn, Weld Co. Colo., June 28, 1976 1m, *E. effusum* present at site. 6 mi. S Wheatland, Platte Co. Wyo., Aug. 18, 1993, assoc. *E. effusum* 2m2f. 13 mi. N Wheatland, Platte Co. Wyo., Aug. 23, 1994, assoc. *E. effusum* 1m. 2 mi. W Glenrock, Converse Co. Wyo., Aug. 25, 1993, assoc. *E. effusum* 1m. 12 mi. N Mitchell, Sioux Co. Nebraska, May 16, 1994, female on cushion plant *Astragalus* sp. 1f. Just NE of Pants Butte, Pine Ridge, Sioux Co. Neb., June 26, 1994 1m. Hill 6.2 mi. SE Wall, Pennington Co. South Dakota, July 15, 1986 1m, assoc. *Eriog. pauciflorum* var. *pauciflorum.*

Plebejus alupini **near-*texanus***, host *Eriogonum brevicaule* in C Wyo. on dark-gray Pierre Shale (a geologic rock formation), resembles Colo. near-*texanus.* **Specimens examined:** Pierre Shale bluff (N-facing slope) due S Casper, Wyoming Road, ½ mi. E hwy 251=McKinley St., Natrona Co. Wyo., Aug. 24, 1994, assoc. *Eriog. brevicaule* 1m (interestingly, I also found a Cretaceous ammonite [squid] fossil of *Baculites scotti*, named after my father). S edge Casper, near Allendale, Natrona Co. Wyo., Aug. 25, 1993, assoc. *E. brevicaule* on dark-gray Pierre Shale 1m1f.

Plebejus alupini texanus, host *Eriogonum wrightii* mostly, small, male upf border nearly-always fairly wide; resembles Colo. near-*texanus* except nearly all males have fairly-wide male upf border (but even from W Texas Scott has a male with almost no border). **Specimens examined:** Scott has hundreds of these from W Texas, New Mexico, & Arizona, which are not listed here. Notable are: 20.6-22 mi S Alpine, Texas, Sept. 20, 1967, assoc. *Eriog. wrightii*; 3 mi. W Alma, Catron Co. New Mex., Aug. 9, 1986, *assoc. E. wrightii*; and S & W Ariz., many specimens assoc. *E. wrightii*. The host at the following sites is mostly unknown: Big Saddle, jct. rds 425 & 232, N Rim Kaibab Plateau, Coconino Co., Ariz., Aug. 18, 1980, mudhole. North Rim Kaibab Plateau, Coconino Co. Ariz., June 24, 1965. Crazy Jug Point, N Rim Kaibab Plateau, Coconino Co., Ariz., Aug. 17, 1980. Hannagan Meadow, White Mts., Greenlee Co. Ariz., Aug. 9, 1986. Palo Duro Can., 18.6 mi. S Claude, Texas, May 1, 1972 1m. Terrero, Pecos River Can., San Miguel Co., New Mex., Sept. 10, 1978 1m. just N Pecos, San Miguel Co., New Mex., Aug. 14, 1974 1m. 11 rd. mi. N Espanola, hwy. 285, Rio Arriba Co. New Mex., Sept. 9, 1977 2f on *Eriog. annuum.*

Plebejus alupini cotundra. Small, male upf border very narrow, orange hw band narrow to obsolete, uns darker grayish, females mostly blue on ups (versus mostly brown on *lutzi* & *texanus*), one generation, host the short but large-flowered *Eriogonum flavum chloranthum*, occurs only above or at timberline on climax dry (not wet) tundra. Looks like an environmental form (spring form) of *lutzi*, but is surely genetically different. Occurs in Front Range, Mosquito Range, Sawatch Range, and Sangre de Cristo Range; thus far absent in San Juan Mts. Records of this ssp. were published elsewhere (in Papilio [New Series] #12) but are listed again here because of a few minor corrections (and the male from E end Cottonwood Lake in Chaffee Co. that Scott formerly called *cotundra* has been moved to the ssp. *lutzi* section above). **Specimens examined:** Hall Valley, 12000', Front Range, Park Co. Colo., July 29, 1968 Michael S. Fisher 3m, July 29 1969 M. Fisher 1f, Aug. 3, 1975 M. Fisher 4m; 12000' Aug. 3, 1935 F. Martin Brown (in Colo. Butt.). Theodore Mead surely caught specimens in Hall Valley in the 1800s that would now be in Carnegie Museum.. McClellan Mtn., 12800-13000', Front Range, Clear Creek Co. Colo., July 15, 1980 2m, July 16, 1990 1m2f, July 30, 1991 2m3f, July 10, 1992 3m2f, climax tundra assoc. *Eriog. flavum chloranthum*, J. Scott. Mt. Bross, 13,500', Mosquito Range, Park Co. Colo., July 31, 1982 3m2f, July 17, 1990 1m, assoc. *E. flavum chloranthum*, J. Scott. Horseshoe Mtn., Mosquito Range, Park Co. Colo., tundra near E end of low ridge, SE of Mt. Sherman, A. Warren. Mt. Massive, 12,500', Sawatch Range, Lake Co. Colo., Aug. 1, 1982, 1m2f, assoc. *E. flavum chloranthum*, J. Scott. Cottonwood Pass, 12,126', Sawatch Range, Gunnison Co. Colo., July 29, 2004 coll. by "SAF" (News Lepid. Soc. 48: suppl. S1 p. 23, a bit dubious as SAF and source of record are unclear). Baldy Peak, above Silver Lake, 12,500', Sangre de Cristo Mts., Custer Co. Colo., July 29, 1970, 2f assoc. *E. flavum chloranthum* on tundra, J. Scott. Dry Lakes, 11,800', Sangre de Cristo Mts., Custer Co. Colo., July 16, 1968, 1m assoc. *E. flavum chloranthum* on tundra, Glenn R. Scott. Hermit Pass Road, near Hermit Pass, (caught with other true alpine species so ~12000' on alpine tundra, but one labeled 11,000'), Sangre de Cristo Mts., Custer Co. Colo., July 22, 1968, 1m1f, Glenn R. Scott.

Plebejus saepiolus (Bdv.) Subspecies in Colorado, and the Range of ssp. *saepiolus*, by J. Scott

Scott (in Scott et al. 2006) summarized the ssp. in this species, but was uncertain about the name *maculosus* Austin 1998. Ssp. *maculosus* was named from Nevada (TL Snake Range; O.D. Syst. W.N.A. chap. 71) and was stated to occur from Snake Range W to the Monitor, Toquima, & Toiyabe Mts. I thought *maculosus* might be a good ssp. with larger spots as described, as 3 of 4 of Austin's figs. have sl. larger spots, but the holotype has ordinary spots. However, I recently found & photographed in Univ. Colo. museum, 9m2f from Lehman [Caves Nat. Mon., Snake Range, Nev., June 15-16-18, 1935, William N. Burdick], which have ordinary-sized spots and 3m even have sl. smaller spots; and 22m10f from Monitor July 12 [evidently Monitor Pass 7009', Monitor Range, Nye Co., Nev.][1935, W. Burdick] which average slightly larger spots than Lehman but are still not large. Based on these specimens, *maculosus* is identical to the bugs in NW Colo. Also, it appears to be the same as ssp. *saepiolus* (TL Marin Co. Calif.)(my males of Mendocino Co. *saepiolus* are the same); ssp. *saepiolus* was claimed by Emmel Emmel & Mattoon (Syst. W.N.A. Butt . ch. 2 p. 14 & 65) to have blue on the ups of females, whereas *maculosus* & NW Colo. butterflies mostly lack blue. But they described *saepiolous* as having only "various degrees of dorsal blue basal scaling on the dark-brown females", so ssp. *saepiolus* doesn't have much blue if it's limited to the base of some individuals (their fig. 63 on p. 65 has the ups half-blue, but this specimen has no locality). Also, A. Shapiro's book "Field Guide to San Francisco Bay & Sacramento Valley Regions" wrote about the north Bay counties *P. saepiolus*, stating "Sexual dimorphism is extreme in our [Marin/Sonoma/Napa Cos.] populations, but on the far north coast some females have a fair bit of blue above", and illustrated a female with no blue, which suggests that Calif. ssp. *saepiolus* has little blue and also occurs in NW Colo. I conclude that ssp. *saepiolus* extends across most of the western U.S. to NW Colo. (as previous authors wrote for decades), where females have little blue. Southern Colorado (Lake, Gunnison, Delta Cos., San Juan Mts., Sangre de Cristo Mts., Wet Mts.) has ssp. *gertschi* dos Passos which has females mostly blue. The Front Range of Colo. has females with some blue, and these were named *whitmeri* Brown, but I treat *whitmeri* as intermediates *gertschiXsaepiolus*, thus *whitmeri* is intermediate between named ssp. thus is an invalid synonym. Mike Fisher treats *whitmeri* as near-*gertschi*.

The Identity of *Plebejus melissa pseudosamuelis* and *P. atrapraetextus longinus* "bighornimuelis", by J. Scott

P. melissa pseudosamuelis Nabokov has been a mystery taxon, in part because the original description placed its type locality in the wrong county (Scott, in Scott et al. 2006). Thanks to a Historic Trail Map of the Leadville area compiled by Glenn R. Scott, which describes and shows the actual location of Red Mtn. Inn (which is different from Red Mtn. City), I visited the real TL on July 27, 2008, the site of the Red Mtn. Inn in Lake Co. Colo. Ruins of the Inn were not found, although a large house now exists there which probably occupies the site of the Inn (the land is all? privately owned with the usual "no trespassing" signs and a homemade "nature reserve" sign). The bug was rediscovered, after an absence of more than 60 years, and a series was collected which has small orange lunules (some females have larger orange lunules on uns but not ups), and the gnathos was examined on 7 males and is long like *melissa*. I conclude that *pseudosamuelis* seems to be a real taxon, which occurs in several of the cold valleys of the northern Sawatch Range. It is defined as a *melissa*-gnathos bug with predominantly-small orange lunules. The hostplant by association has to be mats of *Astragalus alpinus*, which is common there in the few meadowy spots that still exist (as usual in high-altitude Colorado, a giant fire is needed to counter the infestation of Engelmann Spruce that overruns the area and has choked out most living things).

Of course during each glaciation the *pseudosamuelis* TL was wiped out. The Lake Creek Glacier covered the TL and went more than 30 km east and forced the Arkansas River to the E side of the Arkansas Valley, while southward the Clear Creek and Pine Creek Glaciers dammed the Arkansas Valley, forming a Three Glaciers Lake >500 feet deep, then when the lake water rose to 90% of the glacier top the glacier floated off the ground and instantly broke up and the flood roared down-valley. This flood happened in every glaciation (as many as 24 of them, every 100000 years), the last two times at 20000 and 120000 years ago (info from Glenn R. Scott 1984 Amer. Quaternary Assoc. 8th meeting field trip guidebook; and from Keenan Lee mss. & website, Colo. School of Mines). The floods did not affect the downstream habitat of the endemic Chlosyne sterope (acastus) arkanyon much, but of course both butterflies occurred at much lower altitude during the glaciations than they do today.

Scott (in Scott et al. 2006) was also uncertain about the status of a critter that occurs in the upper Bighorn Mts. in Wyoming, which he called "bighornimuelis" (not a valid scientific name) because it looks similar to *samuelis* & *pseudosamuelis* and has gnathos nearest *melissa* and thus is another "–muelis". Luckily, I found more papered specimens in my boxes. After mounting and examining a good series of this bug, it has become apparent that the taxon should be called *P. atrapraetextus* near-*longinus*. It has fairly small orange lunules like *longinus*, and the gnathos is variable and is intermediate between "*idas*" and *melissa* as is *longinus*, averaging a little closer to *melissa*.

Polites sabuleti (Bdv.) Subspecies, by J. Scott

There has not been a review of the ssp. of this species since G. Austin named many Nevada ssp. I have good series of nearly all the named ssp., so a review is useful here as the ssp. identity of Colo. bugs has been misdetermined lately. Most of Colorado has *P. s. sabuleti*, which is similar to the lowland Calif. ssp. *sabuleti*. The ssp. names should be arranged as follows: *P. s. sabuleti* occurs over most of the range, and has strong unh pattern, with the usual tawny ups. Nevada *alkaliensis* Austin is a synonym of ssp. *sabuleti*. *Basinensis* Austin is also basically a syn. of *sabuleti*; it is a bit paler and looks like it is 40% intermediate from *sabuleti* to *sinemaculata*, so is intermediate between named ssp. thus is invalid. *Nigrescens* Austin is basically also similar to *sabuleti*, as it is the same except many females are darker on ups, so they can be called female form *nigrescens* or it can be accepted as a weak ssp. *P. s. sinemaculata* Austin is a distinctive ssp. with ups yellowish with almost no upf brown border. *P. s. ministigma* Scott occurs in the closed basin in San Luis Valley of Colo. (no stream drainage as the water evaporates from San Luis Lakes) & has upf stigma and adjacent brown patch small, ups a little paler. *P. s. chusca* (W. Edwards) has unh markings nearly absent, ups oranger tawny with less brown border. *P. s. tecumseh* (Grinnell) is a darker univoltine high mts. ssp. =*aestivalis* Emmel Emmel & Mattoon =*albamontana* Austin (this is intermediate *tecumseh*X*sabuleti* thus is invalid). The Sonora Mexico *norae* MacNeill would seem to be a ssp. of *P. sabuleti* also, as it differs only in lacking a stigma, and MacNeill did not bother to consider the small-stigma ssp. *ministigma* when he named *norae*.

Hylephila phyleus (Drury) Subspecies, by J. Scott

There has been some confusion about the ssp., especially the range of ssp. *muertovalle* Scott 1981 (named in Papilio [New Series] #1). Specifically, does *muertovalle* occur in C Calif. and Ariz., or in all of W N.A.? The confusion is partly because *H. phyleus* in most of the range shows great individual variation. I have examined series of *H. phyleus* from C and W California, Eureka in NW California, Nev., Ariz., Mexico, Colombia, Texas, Minn., and Fla., plus miscellaneous specimens from Mo., Ala., the Caribbean, etc. Ssp. *muertovalle* differs by having the male ups and unh a little paler orangish with a little less of the brown ups border; it has fewer/lighter unh spots (I have seen none with large-spots on unh), and some males are nearly immaculate on unh; *muertovalle* females are a little paler too, the ups orangish areas a little larger, the postbasal-median areas of ups are a bit oranger-flushed, and the unh dark spots are paler-brown and in some females the unh spots are nearly absent (I have seen no *muertovalle* females that have the dark pattern of unh spots that occurs in some ssp. *phyleus*). It averages paler, and has none of the darker variants. Ssp. *muertovalle* seems limited to Death Valley Calif. and nearby Beatty Nev., and nearby Las Vegas and Mesquite in Clark Co. Nev., and *muertovalle* goes S along the Colorado River to Needles, where Ken Davenport found 2 males Sept. 20, 1990 (very pallid and washed-out below), 1m May 29, 1990 (less pale but still lightly marked with small spots), and 17 in a sump there on Aug. 11, 2007 (also pale [8m1f now in Scott's coll. have all the males with very pale unh and only 2m have moderate unh spots]), and he found 1f *muertovalle* July 8, 2007at Lake Shores Ariz. (across river from Needles). Davenport notes that *muertovalle* also seems to occur at Cinco and Cantil in the W Mojave Desert in Kern Co. He notes that Bakersfield Calif. adults of ssp. *phyleus* seem slightly paler than elsewhere also, evidently influenced by *muertovalle* a little. A little farther S on the Colorado R., 4 males 1 female Scott caught near Earp Calif. & Parker Ariz. seem to be near ssp. *phyleus*. Davenport notes 1m *phyleus* from Kingman Ariz. July 8, 2007. The rest of the range from Berkeley and Sacramento Calif. to Ariz. to Tex. to Mexico to Fla. to Minn. etc. all seems to have ssp. *phyleus*, as specimens from there average darker, and very few are as pale as *muertovalle*, even though there is a lot of individual variation (some males have the unh spots very reduced, while they are larger in most and large and blackish in some males; and some females [from Berkeley, Ariz., Tex., Mex., Ala.] have the ups dark brown with a narrow spot band, whereas most have these bands larger and more orange, and the female unh pattern varies from lighter to quite dark and well-spotted). The name *eureka* Austin & J. Emmel 1998 (Syst. W N.A. Butt., chap. 42 p. 502 & figs. 3-6) from Eureka, Humboldt Co. Calif., looks like a syn. of *phyleus* to Scott, as his series is essentially the same as *phyleus,* and his 9 females are the usual oranger-banded type, not the dark ones claimed in the O.D. The males in Colombia look like ssp. *phyleus*, but Scott's 2 females from there have the uph fulvous band uniformly straight-margined, which could indicate a geographic difference, but 2 females are not enough to be sure. Colorado has ssp. *phyleus*.

Hesperia uncas tomichi Michael S. Fisher, NEW SUBSPECIES, Common Name Gunnison Valley Skipper (plate IV)

Definition: Darker above than ssp. *uncas* (TL Denver, Colorado as restricted by Miller & Brown 1977, Trans Amer. Ent. Soc. 103:298-9), lacking the fulvous overscaling on the outer portions of the forewings typical of ssp. *uncas* (Colo. ssp. *uncas* & ssp. *lasus* are also fig. on plate IV for comparison). The fulvous coloration distad of the fw stigma and covering most of the hw disc is darker and reduced in extent. The forewing and hindwing exhibit darker borders in the absence of overscaling noted and have reduction of the extent of fulvous along the upper portion of the hindwing. The subapical and subterminal spots in a majority of the type series are paler than the fulvous color on the wings, often cream to white or whitish, whereas and perhaps augmented somewhat by the wing overscaling, these are uniformly the same color in *uncas* matching the fulvous color on the wings. Male stigma on average is broader (thinner in *uncas*) and is blacker in appearance with noticeable lighter scale approximately in its middle. The underside is darker because there is less yellow tone overall, especially in the hindwing vein interspaces (cells) and apical area of the forewing giving the uns a gray-very pale ochre color overall with mild green tone. The extent of black or dark scaling is more extensive distad of the macular band spots on the hindwing on average than seen on *uncas*. Two features on the uns forewing are noteworthy. The cell spaces outward to the margin of the wing and below the subterminal spots are extensively blackish-gray and the light area distad of the stigma line is pale-whitish-tan without any of the yellow tone typical of *uncas*. The forewing length of the type is 13.5mm. **Type locality and types:** Holotype male (plate IV): Colorado: Gunnison Co., Big Mesa, 1 mi. S. Hwy. 50 off CR31 and SR 149, 7800 Ft., 14 June 2003, M. S. Fisher Allotype female (plate IV): same data except W/NW slope [Big Mesa], 7900 Ft., 31 May-1 June 2002, M. S. Fisher. Both types deposited in Gillette Museum of Arthropod Diversity, Colorado State University, Ft. Collins, Colorado. Paratype specimens collected between 2002 and 2007 reside in the collection of the author and three other paratypes from TL collected by the author (2006) reside in the collection of James Scott. Paratypes from other sites: Ridgeline Open Space, N of Western State Univ. campus, 7700', June 8, 2006, M. Fisher, 1m in Scott coll.; Blue Mesa, Iola, off SR149, 7600', June 9, 2006, M. Fisher, 1m in Scott coll.; 4 mi. W Sargents, July 30, 1993 1m J. Scott in Scott coll. (a quite dark specimen). MacNeill (1964) noted that 1m1f from 3 mi. S Parlin, Gunnison Co., July 30, 1933 (coll. L. Chadwick & D. Davenport, in J. W. Tilden coll.) are quite small and exceptionally dark; they are *tomichi*. **Range:** This subspecies occupies the cold Gunnison Valley at approx. 8000 Ft. It is found west from Gunnison through the Blue Mesa Reservoir area and east in the valley at Parlin, and may extend (as strays?) farther east up to the base of Monarch Pass. **Name:** Tomichi is the name of the drainage into the Gunnison Valley off the Continental Divide joining into the Gunnison River near the town of Gunnison. This is a corruption [modernization] of the Ute Indian word tumu'chichi which the Indians used for a "dome-shaped-rock" (now called Tomichi Dome, 11,400') and the adjacent creek (now called Tomichi Creek), in the Gunnison Valley home of the butterfly. (James Scott researched the origins of the word *tomichi*). The soil type in this region according to information available on the web is also referred to as "Tomichi Series" with a type location of "Gunnison Co., Colorado" and typically located "…on terraces, glacial outwash plains, and on kames and eskers in glaciated country. Slope gradients typically from 2 to 15 percent.….formed in alluvial parent material, glacial outwash, or coarse textured glacial deposits." **Variation and Discussion:** This subspecies averages smaller than *uncas*, which may be related to its occurrence at higher elevation. The wings of males are a bit stubbier, the hindwing a little disproportionate in size (smaller) to the forewings. Some males have a slightly rounder forewing tip than *uncas* which is sometimes very sharply pointed and the outer wing edge from top to bottom is rarely as straight as that of *uncas* having a more rounded contour. The macular band on the hindwing below is about equal in development and variation as ssp. *uncas*. The black scaling distad of the spots in the lower element of the macular band is sometimes more extensive in the related wing cells, extending longer toward the wing margin which is not typically seen on *uncas* and those scales are blacker in tone than on *uncas*. Females are darker in appearance, they have especially darker dorsal forewings, with any fulvous color (usually present on fresh individuals) strongly confined to the basal area. As typically seen, the color is more broadly distributed over the dorsal hindwings but more confined within the macular spots on the disc than seen on *uncas* females I have examined. Among males, the tone of the fulvous color on the wings above varies, all darker than on *uncas*; it varies among individuals from lighter to darker and this trait is also noted for females. The type in this respect is what I see as most frequent within the series. *Uncas* from the San Luis Valley in southem Colorado east of the Continental Divide and southward from there into Taos Co., New Mexico, has some intermediate tendencies toward *tomichi* in that they possess the paler uns forewing noted in the description and the apical spots on the ups forewing of males are sometimes paler to whitish in color and not concolorous. **Hostplant and Behavior:** Several different bunch grasses exist more commonly at the type locality than does *Bouteloua*, a known host for *uncas*, but *Bouteloua* is present at all the sites I have found it. Males of this skipper most likely exhibit hilltopping behavior as does ssp. *uncas* but most of my experience suggests, at least early in the day, that they like sunny side slopes or ridges off of high points where males (occasionally and briefly) and females visit available flowers and the males perch on bare ground, rocks or low vegetation to engage rival males and await females. **Voltinism.** I have not confirmed the occurrence of an additional brood in this area. A second generation is normal for *uncas* east of the Continental Divide in Colorado and throughout its prairie range elsewhere. But see the next paragraph added by James Scott:

H. uncas evidently has two generations on the plains, about L May-L June, and L July-L Sept., whereas at higher altitude it seems to have just one generation M June-E Aug. There are some M and L Aug. records at higher altitude, and it might be thought that the records in M June (or even a little earlier) and around Aug. must be two generations, but there is difficulty accepting this hypothesis, because Scott's lab rearing (Scott 1975, J. Lepid. Soc. 29:166) indicated that in lab most *Hesperia* larvae including *uncas* took about 94 days males and 108 females, and the pupa takes 25 days for both sexes, and Scott (1992, Papilio #6 p. 102) found an *uncas* egg June 8 that produced a female emerging Aug. 29 in lab, which indicates that the developmental rate is not fast enough for there to be two generations anywhere except on warm plains (two generations would require a faster developmental time than shown in the lab). The records in MacNeill (1964) also show ambiguity in number of generations, as there are some July records in Kansas and S New Mexico, where one might expect there to be just two gen. in May and Aug.-Sept.; maybe even on the plains the first generation is more abundant but some early season adults produce a less-common 2nd generation, or the July records are 2nd gen.? (Also, Scott notes that *H. pahaska* and *H. viridis* also show a very long flight period in the Arkansas Canyon etc. even though the lengthy developmental period seems to make it certain that there is just one generation there.)

DISCUSSION

The studies reported herein represent progress in the systematics of western N.A. butterflies. Progress is slow in some groups, but this paper and Papilio (New Series) #12 show that the attempt to delineate local taxa can draw attention to identifying characteristics that in turn can help to better define the species that exist in the rest of North America. It is now clear that *Anthocharis sara/A. julia* and *Lycaena helloides/L. florus* and *Oeneis chryxus/O. calais altacordillera* are two species, and not one or three or four.

Neominois in contrast may be just one species, and its ssp. *wyomingo* seems to be conspecific with other *Neominois* even though it is sympatric with them over a vast area. Ssp. *wyomingo* flies two months later than those others, yet sympatry with allochrony is not a test of reproductive isolation, and based on patterns of variation in adult traits Scott surmises that *wyomingo* would interbreed with at least some other taxa such as ssp. *stretchi* if the allochrony did not exist. But the egg shape and larval pattern are different enough between *ridingsii* and *coloalbiterra* that we must study further whether they belong to different species.

Sometimes, authors have considered that if two closely-related taxa approach within a few miles of each other, but do not meet (most reported cases are at different altitudes), then that near-sympatry is just as good as actual sympatry, and they therefore raise those two taxa to separate species. But that near-sympatry argument may often be wrong, as it appears to be with *Neominois ridingsii wyomingo*. For example, in *Anthocharis*, ssp. *flora* and *columbia* are nearly sympatric but altitudinally separated on Mt. Cheam in BC, yet one can argue based on larvae and intergradation elsewhere that they are the same species. And *Callophrys* "*perplexa*" *oregonensis* and *C. affinis washingtonia* are nearly sympatric at Satus Pass Wash., yet the intergradation of the *perplexa* clone *homoperplexa* with *affinis* in S Wyo.-Neb., plus the similarity of *perplexa* and *homoperplexa* in wing pattern and hostplant polyphagy, and the close interdigitation of *affinis* and *homoperplexa* in S Utah, argues that they all could just be one species *C. affinis*. And in *Poladryas*, *arachne* and *P. minuta* near-*minuta* are nearly sympatric in N New Mexico {see Papilio (New Series) #12} yet Scott thinks they are one species due to clinal intergradation and the absence of behavioral &physiological barriers to courtship and hybridization. We can cite further examples here, including examples in *Euphydryas*, etc., and Scott believes that *Parnassius phoebus* and *P. p. smintheus* are one species also despite nearby ranges in Yukon (a hand lens used on published photos shows that their micropyle are very similar). Near sympatry is not sympatry. "Close but no cigar", as they say. We must study each case in detail before making a judgment.

Some respected museum scientists, even including one at a publicly-supported national museum, have now totally deviated to the species concept that raises all distinctive ssp. to species status, and rejects all subspecies. Yet now we see that the study and use of subspecies helps fully describe those difficult cases that look like species to some people but aren't quite species. Nature is complex, and trying to pigeonhole all the variation into only one category (species) is ridiculous. Adding more categories makes more sense, categories such as infrasubspecies and tetrasubspecies, because the variation observed in nature is continuous, it is not divided into convenient species pigeonholes, so that any species/subspecies etc. concept that creates the most categories, is most similar to the continuous gradient of differences that exists between real natural creatures. It would appear that many of these museum scientists adopt the split species concept not because they actually believe in it, but because naming species has greater status than naming subspecies (which is considered to be one of the lowest forms of biological endeavor), so by naming a subspecies as a species instead, they hope to gain more of the glory that comes from naming species, and less of the derision that comes from naming subspecies.

There are many difficult cases, including some discussed in this paper and in Papilio (New Series) #12, in which evolution has proceeded differently or at different rates in different parts of the range of a lineage, so the bugs may look like species in some areas and look like subspecies in others. In some areas the *Anthocharis* are clearly two very different species, while in other locations they are similar and we are somewhat confused. *Euphydryas bernadetta* is very distinct, but in one area it may interbreed with *E. anicia*. For these cases we need the stenchospecies (superspecies) concept, and its included bookkeeping species (semispecies), as they are interlinked associates, just as plus requires minus, good requires bad, and heaven requires hell. Using only the bookkeeping species, while ignoring the stenchospecies, is deception, because it ignores much of the variation of nature's creatures. *Anthocharis sara* and *Euphydryas chalcedona* (includes bookkeeping species *E. bernadetta* and *E. anicia*) are stenchospecies, with complex overlapping arms like a pretzel.

Recently, many people have seized upon DNA as a panacea for all taxonomic problems. Historically, mtDNA was the easiest to sequence, and so most of the studies were done on the COI mtDNA gene. Unfortunately, mtDNA has mostly failed to be very useful for phylogenetic study, because just a little hybridization evidently is enough to introduce a new mtDNA variant into the other population and allow it to spread through the whole other population, while the rest of the genome remains mostly the same. Thus mtDNA was mostly useless and variable and convergent within *Phyciodes* (though it showed that *tharos* was mostly different from *cocyta*), Appalachian *Papilio glaucus appalachiensis* has the mtDNA of adjacent ssp. *glaucus* rather than the more similar *P. g. canadensis*, Appalachian *Phyciodes diminutor incognitus* has the mtDNA of adjacent *Phyc. tharos* rather than its real relatives *P. cocyta/P. diminutor*, *Polygonia progne* has the mtDNA of sympatric *P. interrogationis/P. comma* (whereas every adult/larva/hostplant/behavioral trait shows *progne* is actually the sister species of *P. oreas*), *Coenonympha tullia nipisiquit* has distinctive relictual mtDNA despite being almost indistinguishable from *C. t. inornata* in other characters except for its allochronic flight period, and mtDNA evolution within Nymphalinae was entirely different from nuclear-gene evolution, etc. Therefore, DNA users will have to work harder and sequence nuclear DNA, and they will have to expend some real effort to also study morphological and biological traits.

More problems with ICZN rules have become apparent: many type localities that were originally designated through historical accidents of sampling often later prove to be inappropriate for the optimal definition of taxa involved in clines, thus forcing practicing biologists to use "pretend type localities" and "jumping subspecies" (even when they don't use those specific words). Dealing with very old names (toxotaxa) is time-consuming and difficult. These problems suggest that changes in the ICZN Code are needed to make the Code better apply to real biological creatures.

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PAPILIO BONUS: The Identity of *Plebejus* (*Lycaeides*) *atrapraetextus fridayi*, and the Old-Name Sewer, by J. Scott

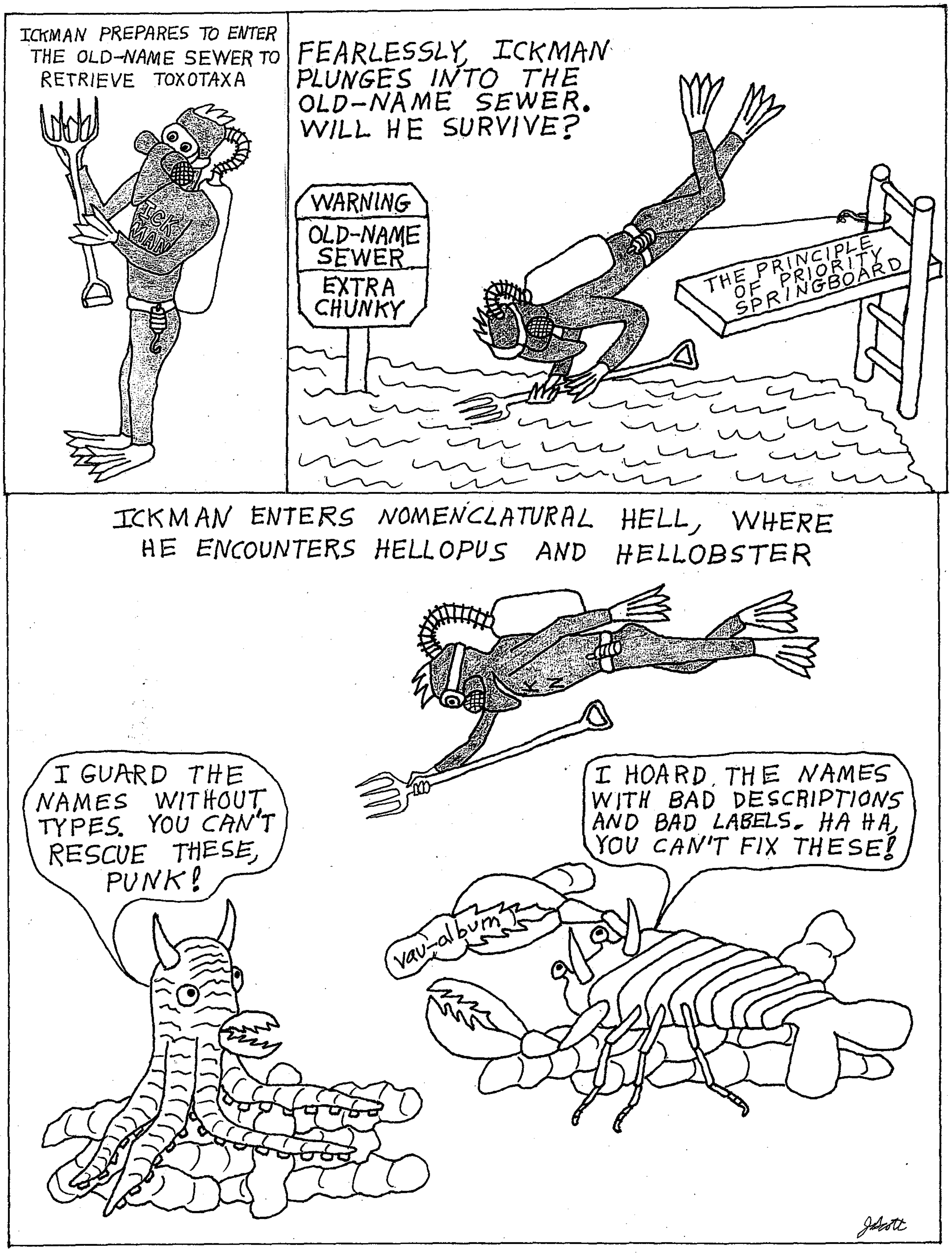
In Papilio (New Series) #12, Scott used the name *P. atrapraetextus fridayi* for the taxon in the higher & alpine Sierra Nevada Mts., which oviposits on *Astragalus whitneyi*, has weak egg glue, and has adults with large unh blue spots (as do some adults in other ssp. of the Hybrid Blue *P. atrapraetextus*, such as *longinus* and *benwarner*) and gnathos closer to *melissa*. Then a later paper in Science Magazine (2006, 314:19233-1925) claimed that this taxon was an "autoploid" and a hybrid "new species". The "autoploid"—meaning no change of chromosome numbers from presumed ancestral species--represents the usual Science Magazine attempt to make their tiny papers sound important by replacing simple words with a blizzard of obscure pompous terminology, while the "new species" unfortunately just represents the usual hype by university researchers who publish a torrent of small papers in vanity-press scientific journals in the forelorn hope of gaining employment/advancement in a poor scientific job market. It is not a new species as they claimed in order to hype their paper, as it belongs to *P. atrapraetextus* as I noted in Papilio #12 (where I named *atrapraetextus* the Hybrid Blue), and was already named *fridayi*: Miller/Brown noted that the *fridayi* type is in CNC, where N. Kondla has taken photos of topotypes that match the description, and Paul Opler has found *fridayi* near Mammoth. Comstock's Butt. Calif. pl. 53 illustrated "*melissa*" from Mammoth Camp with conspicuous blue unh spots on fig. 21 male and bluish ups on fig. 22 female that are this taxon *fridayi*—evidently syntypes--according to Chermock's *fridayi* O.D. Other high-altitude species such as *malcolmi* have the same Mammoth locality. Only a lectotype is needed. This situation is still another case in which the gruesome details of the ICZN code will have to waste some taxonomist's or biologist's time, in order to fix the details of some type. It's sad that we have to go through endless nomenclatural gyrations so often, to the extent that many taxonomists seldom do real biology. Isn't it a shame that whenever we try to do useful biological work, that the ICZN principle of priority gets in the way and causes endless trouble and waste of time. In this case, someone will eventually designate a lectotype of *fridayi* to make its identity clearer. So I have to repeat this yet again: in all other fields of science, old bad work is simply happily ignored, but in taxonomy old bad work hangs around forever, because the backward rules in the ICZN Code of Nomenclature force taxonomists to dive into the old-name sewer and swim around in the murky sludge to find horrid things and then attempt to sanitize them. Instability of nomenclature results as current names are replaced by old ones, and the endings of names are changed frequently because of generic splitting combined with grammatical sex-change rules that inexplicably favor a language—latin--that nearly everyone abandoned thousands of years ago. The principle of priority is the diving board into the old-name sewer. It's time to bring the ICZN into the modern age, and winch our taxonomists out of the old-name sewer, and redirect them toward useful biological work!

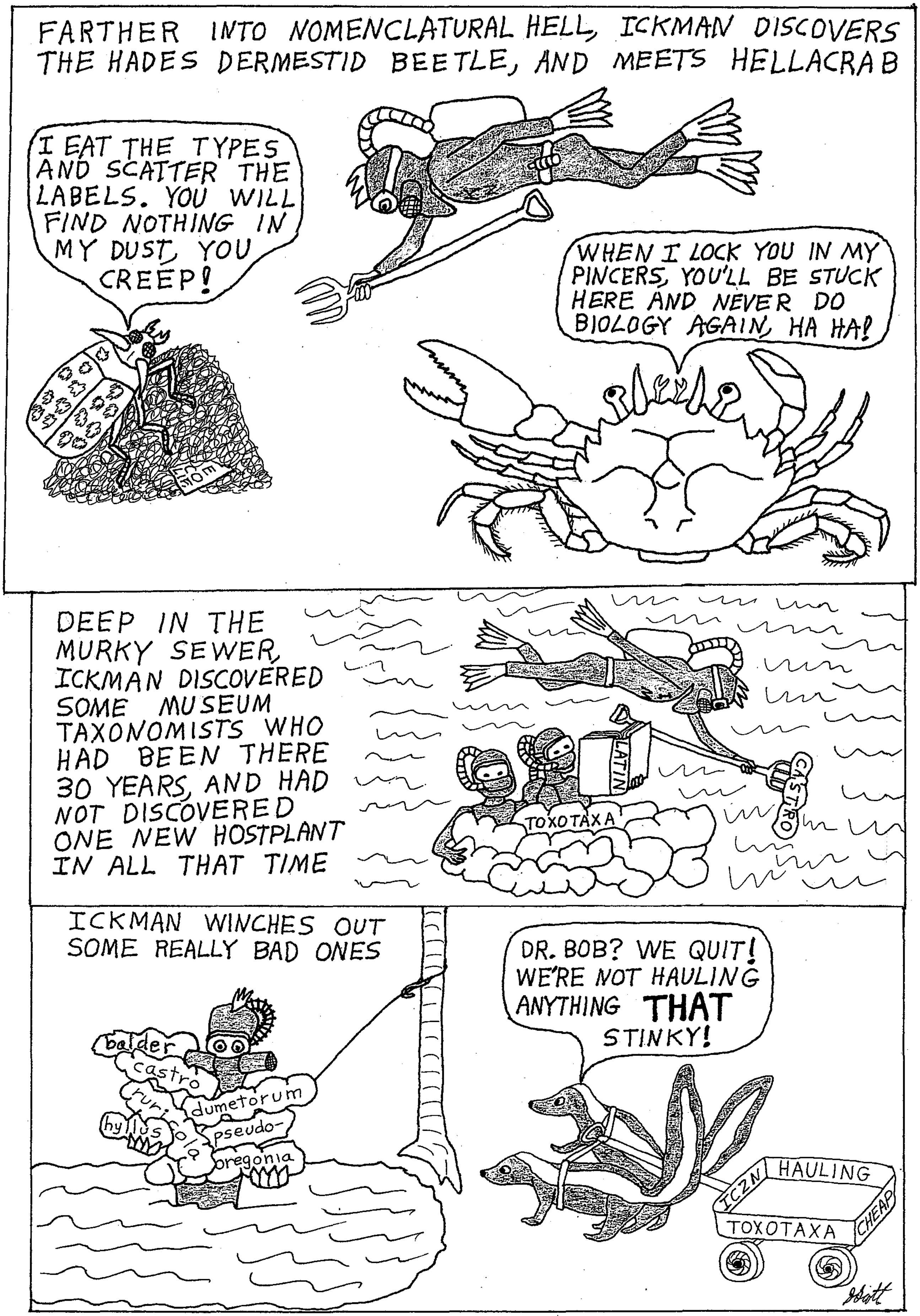
Now, we need an ICZN Nomenclature Recovery Specialist, a superhero who will do the dirty work of diving into the old-name sewer to fix smelly old names such as *fridayi* and *castro*. We could call him ICZN-man, but that name is too long, it should be shorter. Hmm, ICzn-man, ICman---got it, ICKman! Now we know what must be done. Ickman must enter the old-name sewer and retrieve the toxotaxon so that it can be sanitized with the proper lectotype/neotype/TL etc.

Never fear, Ickman is here, filled with cheer, and loaded with gear. With studious looks, he searches the nooks, of scholarly books. With determined grins, he searches the bins, of bugs stuck on pins. But now he knows he must enter, the gruesome old-name sewer center, to grub and probe through its venter. Its depths he must plumb, to find the right crumb, though the task seems dumb. To keep out the smell, of that putrescent hell, he dons a face shell. Ickman looks like a geek, a rubber-clad freak, his mask like a beak, with a filter that lasts a whole week. He needs good luck, to search the muck, as the ancient guck, is nasty…yuck! But he dives right in, to that smelly old bin, while forcing a grin. He swims like a penguin bird, until he spots an old turd--some disgusting old word. Some names are hard, some soft like lard, and others are tarred, but all are marred. Some are sticky, and all are icky, but Ickman is picky. He swims with flippers, that pop out of zippers, and nabs toxotaxa with nippers and grippers. Ickman nabs his prize, a name full of lies, and attempts to rise. But the goo is too thick, it's double-dense ick, that almost makes him sick, so he can't move quick. As he grows weak, things look bleak, and he tries to speak, but can only squeak. So he feels for the winch, gives its ON switch a pinch, and is saved inch by inch, as he yells "Lynch the ICZN grinch!" Now out of the goo, all sticky like glue, he smells like poo, yet feels oddly new. Back on dry land, he finally can stand, the toxotaxa in hand, so we start up the band. He brings us the prize, and we measure its size; will the ick surprise? But the old name is ripe, like maggot-filled tripe, all covered with hype, so we all gripe: "We need an ickotype!" So he picks the right one, with his ICkyZiN gun. Devoid of fun, the project is done.

Now, who's going to be Ickman?

(Turn the page.)


ICKMAN PREPARES TO ENTER THE OLD-NAME SEWER TO RETRIEVE TOXOTAXA
ICK MAN
FEARLESSLY, ICKMAN PLUNGES INTO THE OLD-NAME SEWER. WILL HE SURVIVE?
WARNING
OLD-NAME SEWER
EXTRA CHUNKY
THE PRINCIPLE OF PRIORITY SPRINGBOARD
ICKMAN ENTERS NOMENCLATURAL HELL, WHERE HE ENCOUNTERS HELLOPUS AND HELLOBSTER
I GUARD THE NAMES WITHOUT TYPES. YOU CAN'T RESCUE THESE, PUNK!
I HOARD THE NAMES WITH BAD DESCRIPTIONS AND BAD LABELS. HA HA, YOU CAN'T FIX THESE!
vau-album


FARTHER INTO NOMENCLATURAL HELL, ICKMAN DISCOVERS THE HADES DERMESTID BEETLE, AND MEETS HELLACRAB
I EAT THE TYPES AND SCATTER THE LABELS. YOU WILL FIND NOTHING IN MY DUST, YOU CREEP!
WHEN I LOCK YOU IN MY PINCERS, YOU'LL BE STUCK HERE AND NEVER DO BIOLOGY AGAIN, HA HA!
DEEP IN THE MURKY SEWER, ICKMAN DISCOVERED SOME MUSEUM TAXONOMISTS WHO HAD BEEN THERE 30 YEARS, AND HAD NOT DISCOVERED ONE NEW HOSTPLANT IN ALL THAT TIME
LATIN
TOXOTAXA
CASTRO
ICKMAN WINCHES OUT SOME REALLY BAD ONES
balder
castro
ruricola
dumetorum
hyllus
pseudo-
oregonia
DR. BOB? WE QUIT! WE'RE NOT HAULING ANYTHING **THAT** STINKY!
ICZN
HAULING
CHEAP
TOXOTAXA
JScott

ISSUES OF PAPILIO (NEW SERIES)

1. New Papilionoidea and Hesperioidea from North America. James A. Scott, 1981, 1-12, $2.00
2. The life history and ecology of an alpine relict, *Boloria improba acrocnema* (Lepidoptera: Nymphalidae), illustrating a new mathematical population census method. James A. Scott, 1982, 1-12, $2.00
3. Distribution of Caribbean Butterflies. James A. Scott, 1986, 1-26, $2.50
4. Larval hostplant records for butterflies and skippers (mainly from western U.S.), with notes on their natural history. James A. Scott, 1986, 1-37, $3.00
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6. Hostplant records for butterflies and skippers (mostly from Colorado) 1959-1992, with new life histories and notes on oviposition, immatures, and ecology. James A. Scott, 1992, 1-185, $14.00
7. Biology and systematics of *Phyciodes* (*Phyciodes*). James A. Scott, 1994, 1-120, $9.00
8. *Speyeria hesperis* and *Speyeria atlantis* are separate species. James A. Scott, Norbert G. Kondla, and Stephen M. Spomer, 1998, 1-31, $3.00
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12 .Taxonomic Studies and New Taxa of North American butterflies. James A. Scott, Michael S. Fisher, Norbert G. Kondla, Steve Kohler, Crispin S. Guppy, Stephen M. Spomer, and B. Chris Schmidt, 2006. 74 p. & 6 color plates, $14.00
13. *Phyciodes* (*Phyciodes*): More Progress. James A. Scott, 2006, 38 p., $7.00
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19. Corrections/reviews of 58 North American butterfly books. James A. Scott, 2008, 129 p., $8.00
20. Biological Catalogue of North American butterflies. James A. Scott, 2008, 51 p., $5.00

CORRECTIONS/ADDITIONS TO PREVIOUS PAPILIO ISSUES

#12 p. 34, *bernadetta* flies in lower Sierra Madre Mts. Carbon Co. Wyo. where a few resemble *eurytion*, & flies at summit 10000' of that range. #12 p. 51, 9m2f *maculosus* from Snake Range & 22m10f from Monitor Range in Univ. Colo. museum show that *maculosus* has ordinary-sized dots & is the same as NW Colo. bugs, and is a syn. of *saepiolus*, as Shapiro's Field Guide to San Fran. & Sacramento V. indicates that *saepiolus* TL females have little blue. #12 p. 60 & 68 "bighornimuelis" from Bighorn Mts. is actually *P. atrapraetextus longinus* based on new specimens examined, which have intermediate gnathos (averaging a little closer to *melissa* than "*idas*"). #12 p. 56, *fridayi* S of Sonora Pass. ovip. on *Astragalus whitneyi*, not *A. alpina*. #13 p. 5, *harperi* is a syn. of *Phyciodes batesii saskatchewan*, not *P. b. batesii*. #13 p. 15, 28, the larva photo of *Phyciodes phaon* in Wagner (2005) is actually *P. phaon*.

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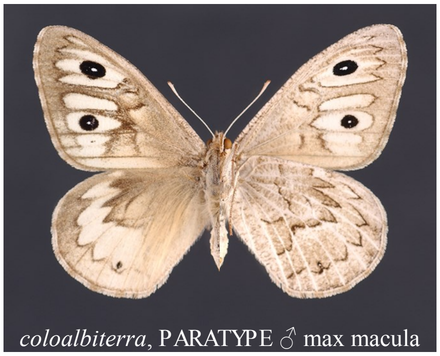
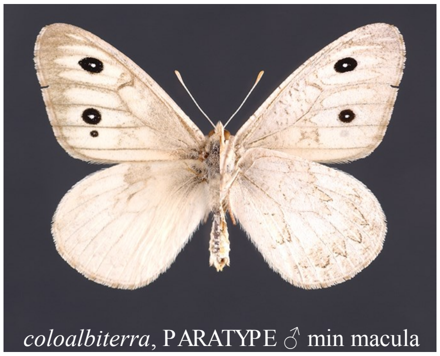
N. ridingsii coloalbiterra, HOLOTYPE ups

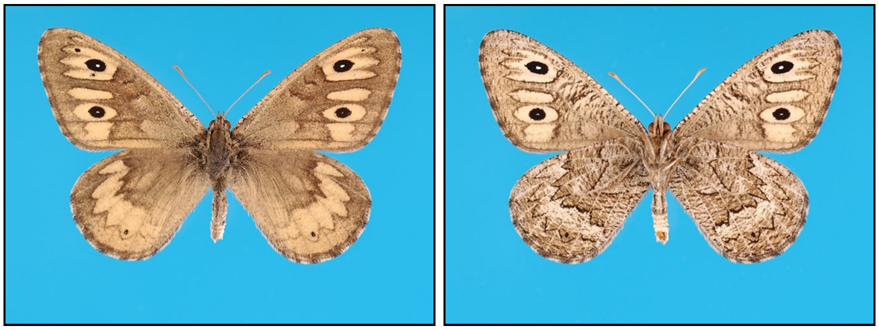

N. ridingsii coloalbiterra, HOLOTYPE uns


N. ridingsii coloalbiterra, ALLOTYPE ups


coloalbiterra, PARATYPE ♂ max macula

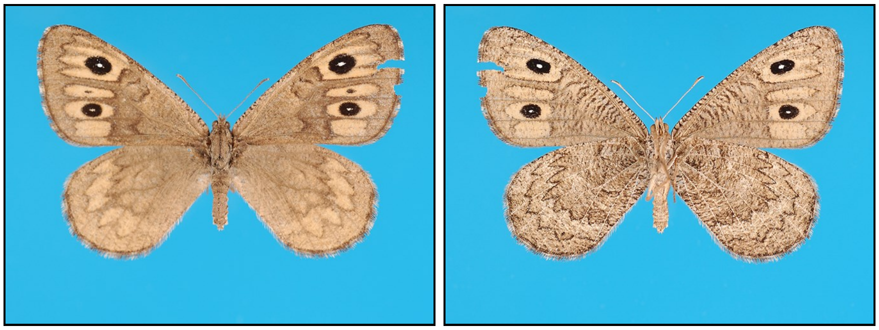

coloalbiterra, PARATYPE ♂ min macula


N. ridingsii coloalbiterra, ALLOTYPE uns




N. ridingsii curicata, n. ssp., ups and uns, HOLOTYPE above ALLOTYPE below

N. r. ridingsii ♂, ups and uns, ♀ ups below left



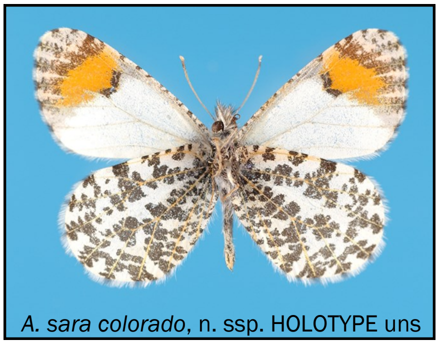

N. r. wyomingo ♂ ups

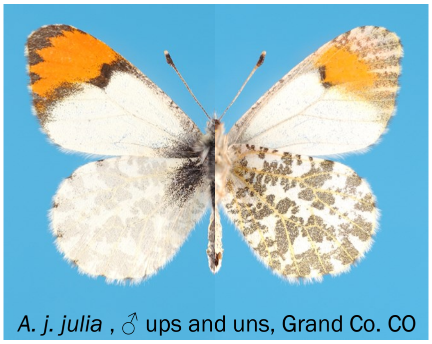

N. ridingsii stretchii ♂, ups and uns (l-r)

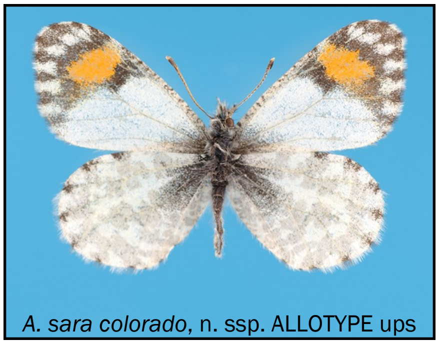
PAPILIO #18 - PLATE I
NEW SUBSPECIES OF *NEOMINOIS RIDINGSII* (W.H. EDWARDS)
and Comparisons of Proximate Named Races.
All images are larger than 1x.

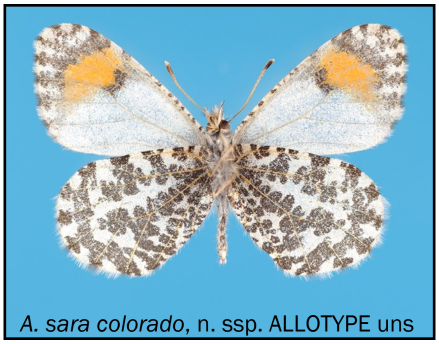
Photographs of *N. ridingsii ridingsii*, *stretchii* and *wyomingo* reproduced from The Butterflies of Colorado, Part 1 (Fisher, 2005).


A. sara colorado, n. ssp. HOLOTYPE ups

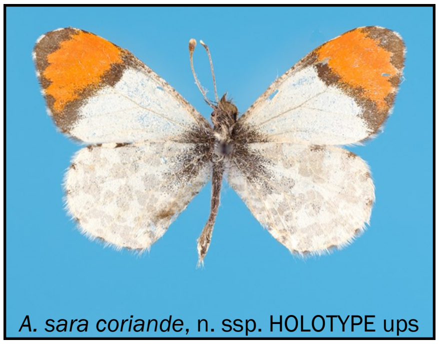

A. sara colorado, n. ssp. HOLOTYPE uns


A. j. julia , ♂ ups and uns, Grand Co. CO

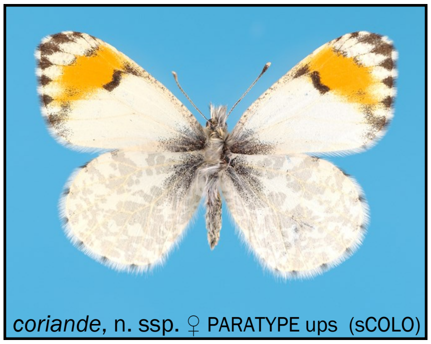

A. sara colorado, n. ssp. ALLOTYPE ups

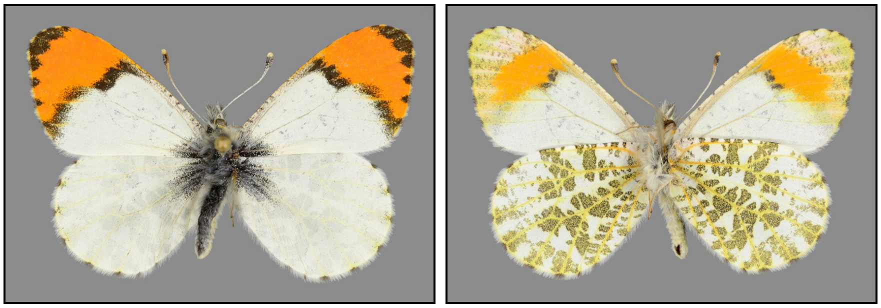

A. sara colorado, n. ssp. ALLOTYPE uns

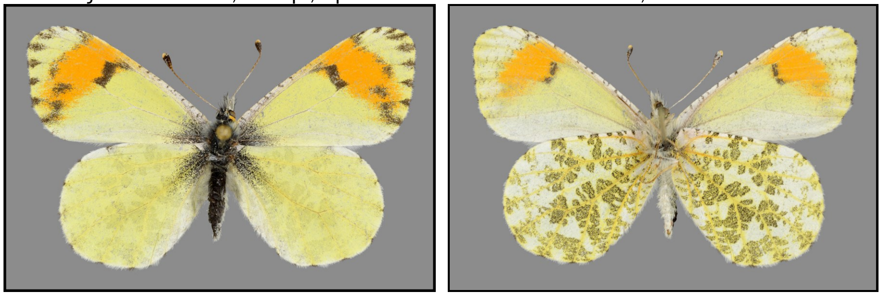

A. j. julia , ♀ ups and uns, Grand Co. CO

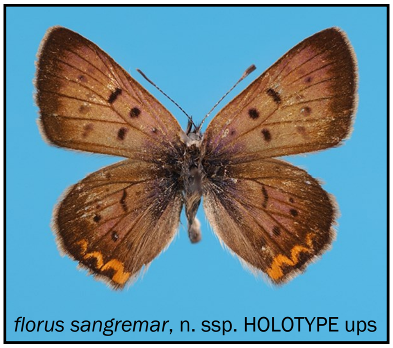

A. sara coriande, n. ssp. HOLOTYPE ups

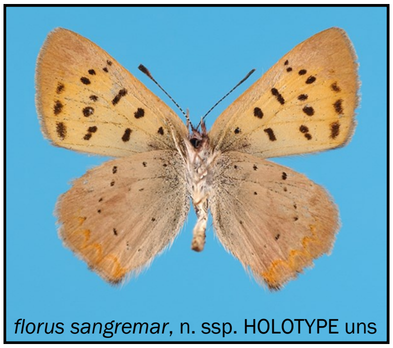

A. sara coriande, n. ssp. HOLOTYPE uns


coriande, n. ssp. ♀ PARATYPE ups (sCOLO)

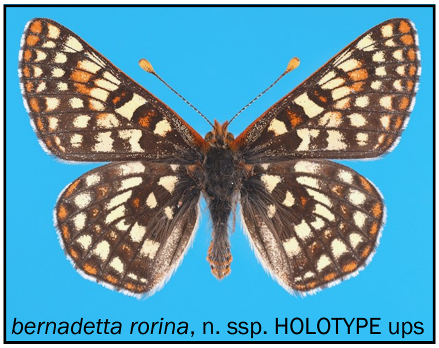

A. julia columbia, n. ssp., ups and uns - HOLOTYPE above, ALLOTYPE below

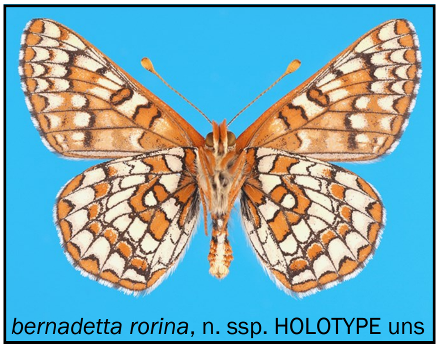


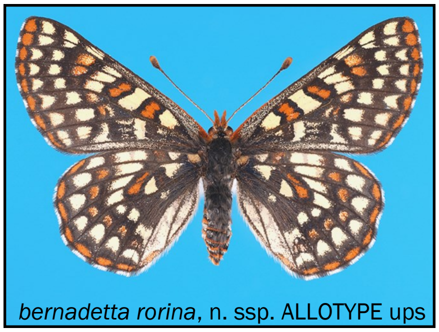

florus sangremar, n. ssp. HOLOTYPE ups

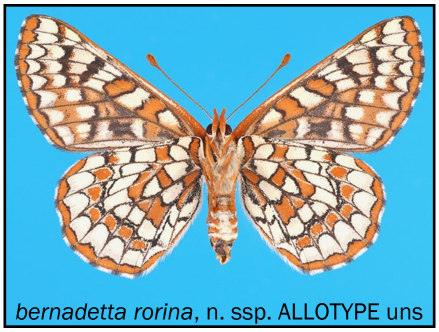

florus sangremar, n. ssp. HOLOTYPE uns

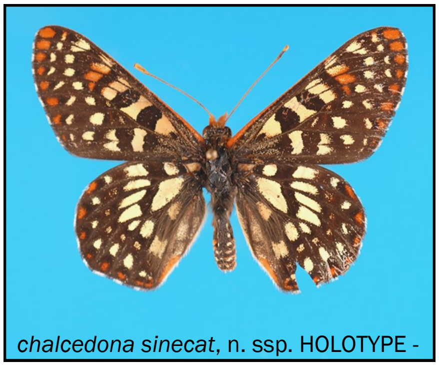
PAPILIO #18 - PLATE II - TYPES OF NEW SUBSPECIES OF ANTHOCARIS AND LYCAENA FLORUS (W.H. EDWARDS) All images are larger than 1x.

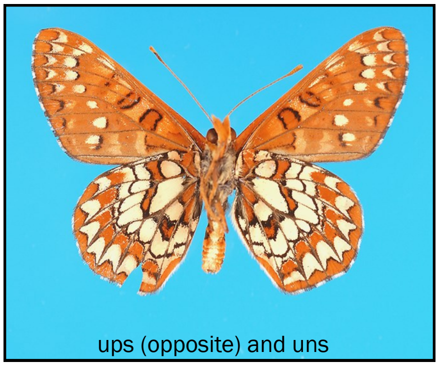

bernadetta rorina, n. ssp. HOLOTYPE ups

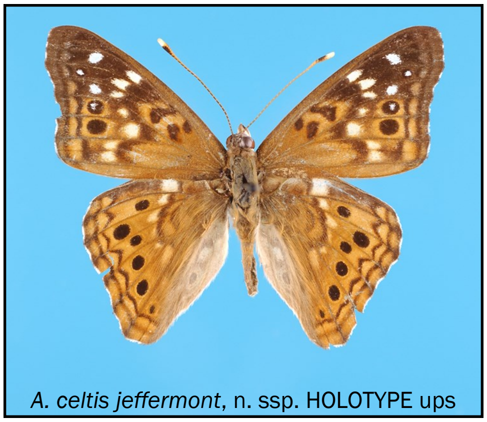

bernadetta rorina, n. ssp. HOLOTYPE uns

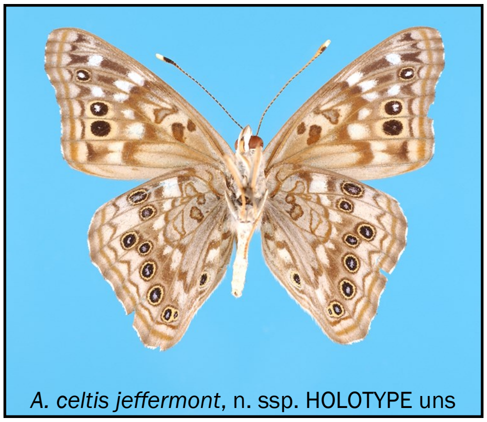

bernadetta rorina, n. ssp. ALLOTYPE ups


bernadetta rorina, n. ssp. ALLOTYPE uns


chalcedona sinecat, n. ssp. HOLOTYPE -

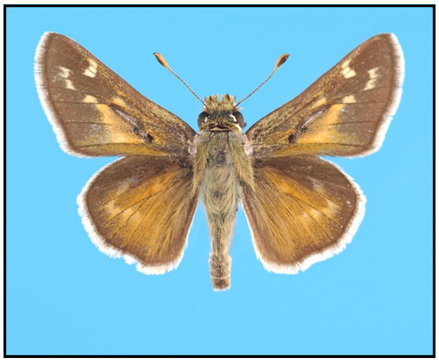

ups (opposite) and uns

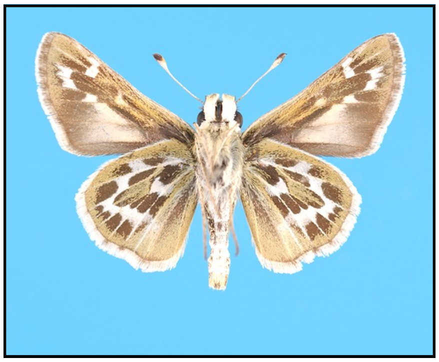

A. celtis jeffermont, n. ssp. HOLOTYPE ups

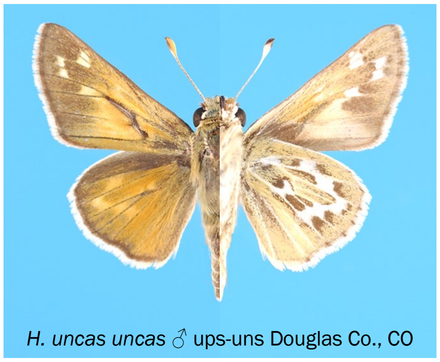

A. celtis jeffermont, n. ssp. HOLOTYPE uns

PAPILIO #18 - PLATE III - TYPES OF NEW SUBSPECIES OF EUPHYDRYAS AND ASTEROCAMPA CELTIS (BOISDUVAL AND LECONTE)

All images are larger than 1x.

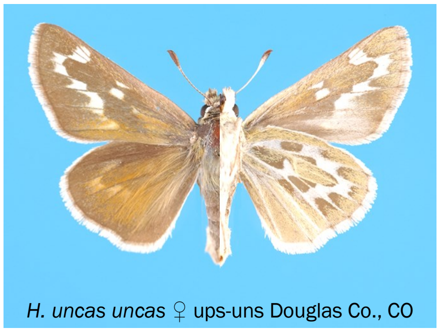




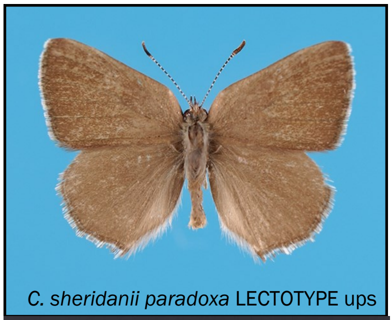


H. uncas uncas ♂ ups-uns Douglas Co., CO

H. uncas tomichi, n. ssp., ups and uns HOLOTYPE above, ALLOTYPE below

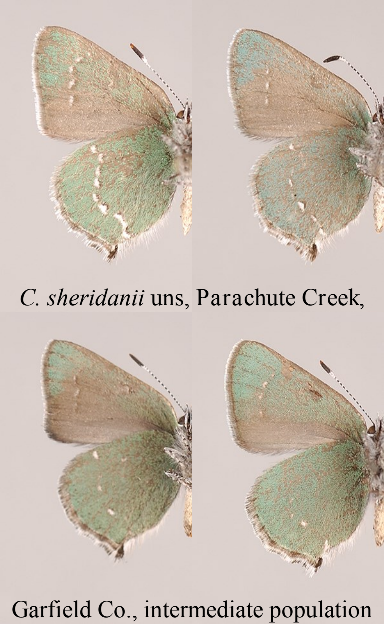


H. uncas uncas ♀ ups-uns Douglas Co., CO

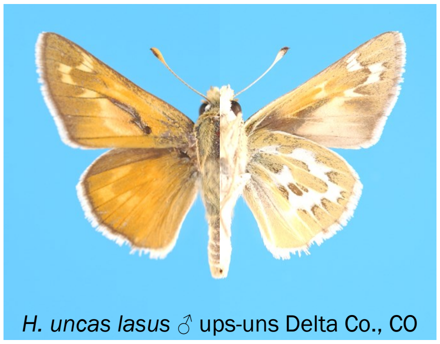


C. sheridanii paradoxa LECTOTYPE ups

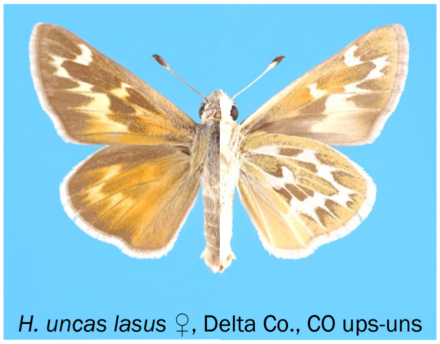
C. sheridanii paradoxa LECTOTYPE uns



C. sheridanii uns, Parachute Creek, Garfield Co., intermediate population



H. uncas lasus ♂ ups-uns Delta Co., CO

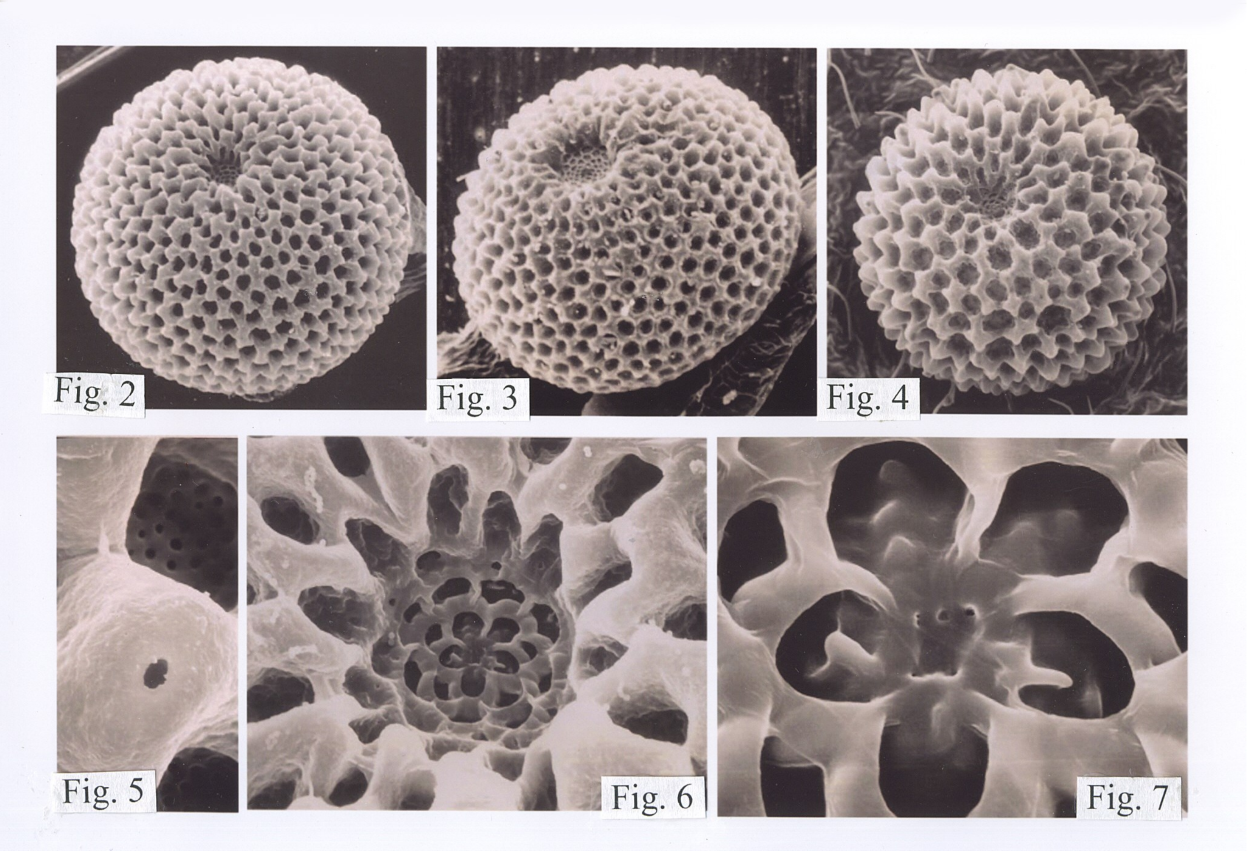


H. uncas lasus ♀, Delta Co., CO ups-uns

PAPILIO #18 - PLATE IV -
A NEW SUBSPECIES OF HESPERIA UNCAS (W.H. EDWARDS) AND
COMPARISON WITH OTHER COLORADO SUBSPECIES;
LECTOTYPE OF CALLOPHRYS SHERIDANII PARADOXA SCOTT (1986)
AND A SERIES OF INTERMEDIATE VARIATION WITHIN A LITTLE KNOW
POPULATION OF C. SHERIDANII IN CENTRAL WESTERN COLORADO

All images are larger than 1x.

PAPILIO #18 - PLATE V - LIFE STAGES OF THREE COLORADO BUTTERFLIES - *Lycaena florus nr. florus* (column left), *Neominois ridingsii coloalbiterra, n.ssp.* (column center) and *Oeneis calais altacordillera* (column right).
Egg, 1st-instar larva, mature larva, pupa and eclosed adult, top to bottom in each column



Figs. 2-7. EGGS OF THREE CLOSELY RELATED *LYCAENA* SPECIES:

Fig. 2, egg of Lycaena florus (80X). Fig. 3, egg of L. helloides (80X). Fig. 4, egg of L. dorcas (80X). Fig. 5, magnified view of cells, ridges and aeropyle of egg of L. florus (1250X). Fig. 6, micropylar region of egg of L. florus (640X). Fig. 7, magnified view of previous figure showing micropyle holes and surrounding rosette of L. florus egg (2500X).

Plate V continued: *O. calais altacordillera* mature larva. Most older larvae have the heart band a series of dashes, as does this pale larva. (Actual size approximately 1cm)

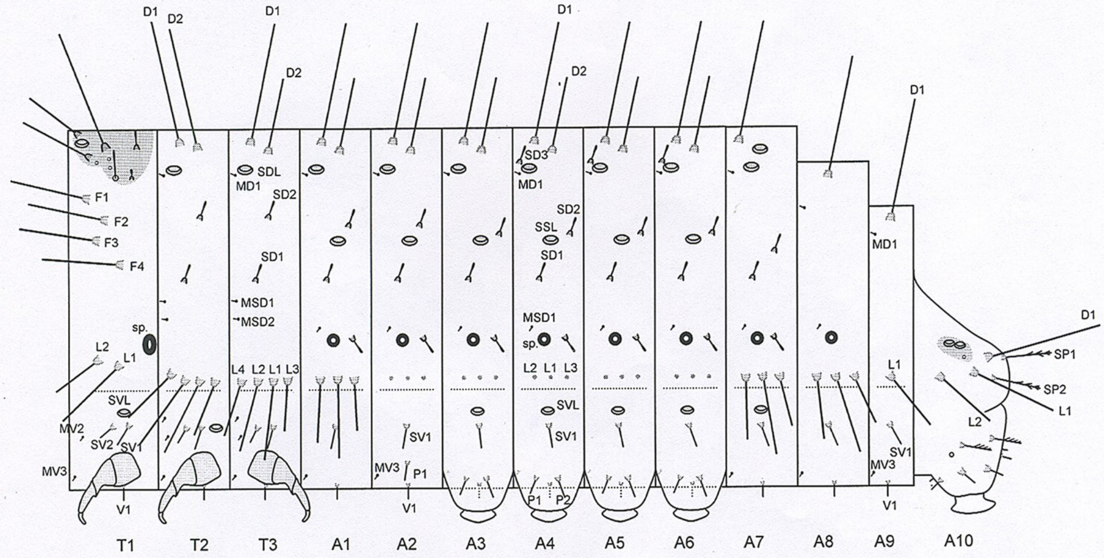


Fig. 8

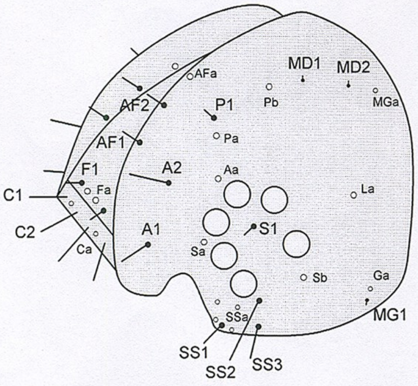


Fig. 9

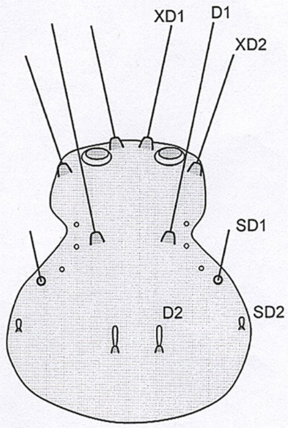


Fig. 10

Figures 8-10. Chaetotaxy of Lycaena florus 1st-instar larva, showing positions, lengths and names of setae ("hairs"), sclerites (shaded), legs (shaded), prolegs, spiracles (dark oval and circles), lenticles (such as SDL & SSL) and sensory pores (tiny circles).

Fig. 8. Setal map of body, lateral view.

Fig. 9. Cranial setae, left anterolateral view (circles are the six ommatidia).

Fig. 10. Prothoracic shield with setae, dorsal view.