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SYSTEMATICS AND LIFE HISTORY STUDIES OF ROCKY MOUNTAINS BUTTERFLIES

by

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Norbert G. Kondla and Richard E. Gray)

Contents. This issue of Papilio (New Series) contains miscellaneous studies of Rocky Mts. (mostly-Colorado) butterflies: *Papilio multicaudata* adult forms and geographic variation; *Coenonympha tullia brenda* types and geographic variation; *Neominois ridingsii wyomingo* early stages and subspecies status; *Oeneis chryxus* and *O. calais altacordillera* types and life histories; *Chlosyne acastus arkanyon* life history; *C. whitneyi damoetas* type locality and types; *Euphydryas anicia anicia* types and phenotype; *Nymphalis californica* forms, geographic variation, and a new subspecies *timidar*; *Polygonia* geographic variation; and *Lycaena florus* life history. A list of Rocky Mountains butterfly specimens donated to BMNH by the Earl of Derby is analyzed. Detailed suggestions are made to improve the ICZN Code of Zoological Nomenclature, inspired by problems found while dealing with scientific names of these and other butterflies.

PAPILIO MULTICAUDATA: ADULT FORMS AND THEIR ECOLOGICAL CAUSES (PAPILIONIDAE)

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Abstract. This note discusses previously-unrecognized adult wing pattern forms of *Papilio multicaudata* Kirby, a discussion of ecological causes of these forms, and the reasons that the name *pusillus* Austin & J. Emmel is an early seasonal form and not a subspecies. Form *minimulticaudata* is tiny in size, and is caused by starvation of second-generation larvae in the lower mountains the previous late summer.

This research was started when Michael S. Fisher was studying the forms he was observing. As a result, the tiny form *minimulticaudata* was named by Fisher & Scott in Fisher (2012), who summarized the distribution and flight periods of the forms.

The adult forms differ in wing size, in the width of the submarginal black unh band containing the blue spots, and in the width of the other unh black markings (and the black markings elsewhere on the wings), and differ sometimes in concavity of forewing outer margin. All these forms seem to be continuous in variation, grading from tiny to giant and narrow to wide black markings, and are not discrete and separated by wide gaps. Sexual dimorphism is considerable. Females have wider black markings especially in the central areas of the wings. To sort specimens into the various forms I used the width of the black submarginal unh band (which contains the large blended blue spots) because this band is visible on papered as well as mounted specimens.

There are three mostly-seasonal forms: form *minimulticaudata*, form *pusillus*, and form *multicaudata*.

The list of specimens examined follows. 336 specimens (70 mounted and 266 papered) are listed below from most western U.S. states, mostly from Colorado. All were collected by J. Scott, unless noted; all are in J. Scott collection.

A. Form *minimulticaudata*. Definition: very small (fw length only 42-49 mm). Unh submarginal black band very narrow. Forewing outer margin only slightly concave. Generally found only in lower mountains, early in the season. Does not occur on the plains.

MOUNTED form *minimulticaudata* (21 specimens). Specimen data:

Red Rocks, Front Range foothills, Jefferson Co. Colo., May 2 1965 male 2nd stream N of geologic marker, June 15, 1987 male
Cherry Gulch, just N Red Rocks, Front Range foothills, Jefferson Co. Colo., July 1, 1997 male
Indian Gulch, just W Golden, Front Range foothills, Jefferson Co. Colo.: June 15, 1994 male, July 6, 1992 male
Apex Gulch, Front Range foothills, Jefferson Co. Colo.: June 8, 1992 male, June 11, 1999 2 males
ridge NE of top of Crawford Gulch, Front Range foothills, Jefferson Co. Colo., May 24, 1988 male
Tinytown, Front Range foothills, Jefferson Co. Colo.: July 4, 1991 male, July 4, 1997 male
5 mi SE Blackhawk, near North Fork Clear Creek, Gilpin Co. Colo., June 30, 1980 male
Lefthand Can. Front Range foothills, Boulder Co. Colo., June 3, 2008 male E of Ward, June 8, 1994 male
Gregory Can., upstream from Baird Park, Front Range foothills, Boulder Co. Colo., May 5, 1965 male May 17, 1967 female 5,900 ft. Ponderosa Pine zone
Flagstaff Mtn., Front Range foothills, Boulder Co. CO, April 27, 1962 male
Phantom Can., 7,000', SW of Colorado Springs, Fremont Co. Colo., April 13, 1968 male
5 mi. NW Cañon City, foothill slopes E of Royal Gorge, Fremont Co. Colo., May 12, 1972 male
Wolf Park, gulch in rugged flats SW of Cañon City, Fremont Co. Colo., May 6, 1994 male
McCloud Bridge, Gilman Road, 1,300 ft., Shasta Co. Calif., May 22, 1983 Marc L. Grinnell male

PAPERED form *minimulticaudata*. Specimen data: none.

B. Form *pusillus* larger (fw length 51-62 mm) with narrow black unh submarginal band. Forewing outer margin only slightly concave.

MOUNTED narrow form *pusillus* (12 specimens). Specimen data:

Lakewood (W suburb of Denver), Jefferson Co. Colo.: June 26, 1996 female; July 14, 1960 female; July 15, 1997 male

Indian Gulch, just W Golden, Front Range foothills, Jefferson Co. Colo., June 26, 1996 male

Deer Creek, Front Range foothills, Jefferson Co. Colo., June 4, 1961 male

Gregory Canyon, Front Range foothills, Boulder Co. Colo., May 5, 1966 male

Fall River, Clear Creek Co. Colo., June 18, 1960 male

Pattee Canyon, Missoula Co. Montana, 3,500 ft., June 23, 1962 male

Mack Canyon, Stansbury Mts., Tooele Co. Utah July 5, 1964 male

McCloud Bridge, Gilman Road, 1,300 ft., Shasta Co. Calif., May 19, 1983 Marc L. Grinnell 2 males

McKelligan Canyon, Franklin Mts., near El Paso, Texas April 25, 1973 female

PAPERED narrow form *pusillus* (120 specimens). Specimen data:

Lakewood (W suburb of Denver), Jefferson Co. Colo.: May 7, 2011 male; May 28, 2009 male; June 7, 2011 male; June 20, 2011 male; June 23, 2011 male; June 24, 2011 male; June 27, 1990 male; June 27, 2011 male; June 27, 2011 male; June 28, 2011 male; June 29, 1997 male; June 29, 2001 male; June 29, 2011 3 male; June 30, 1994 male; June 30, 2011 2 male; July 2, 2010 male; July 5, 2004 2 male; July 5, 2011 male; July 7, 2005 male; July 9, 2005 male; July 9, 2010 male; July 9, 2011 male; July 11, 2011 2; July 12, 2011 male; July 14, 2010 male; July 15, 2011 male female; Aug. 11, 1995 male

Wheatridge, Clear Creek greenbelt, Jefferson Co. Colo.: June 16, 1998 male; July 6, 2008 male; July 18, 1993 female

Tinytown, Front Range foothills, Jefferson Co. Colo.,: May 15, 1988 male; June 1, 1988 female; June 17, 1994 female; June 16, 1992 male; July 5, 1995 male; July 13, 1995 2 male; July 17, 1997 female; July 22, 1995 male; July 26, 1995 male

Indian Gulch, just W Golden, Front Range foothills, Jefferson Co. Colo.: June 15, 1994 3 male; June 30, 1993 male; July 1, 1980 male female; July 2, 1997 male; July 7, 1985 male; July 7, 1996 male; July 12, 1981 male; July 17, 1998 male; July 31, 1998 2 male

Apex Gulch, Front Range foothills, Jefferson Co. Colo.: May 19, 1994 male; May 29, 1991 male; June 11, 1999 2 male; June 12, 1998 2 male; June 20, 1995 male

Red Rocks, Front Range foothills, Jefferson Co. Colo.: June 14, 1994 male; June 15, 1987 male; June 16, 1981 2 male; June 19, 1984 male; June 19, 1990 male; June 21, 1973 male; June 25, 1989 5m; July 2, 1986 male

Cherry Gulch, just N of Red Rocks, Front Range foothills, Jefferson Co. Colo.: July 1, 1997 2 males , ?July 1, 1997 male; July 10, 1984 male

Mt. Zion, Front Range foothills, Lookout Mtn., Jefferson Co. Colo.: May 13, 1996 female; May 29, 1988 male; June 11, 1980 male; July 11, 1977 female

Falcon County Park, Front Range foothills, Jefferson Co. Colo., May 28, 1984 male

SW of Morrison, Front Range foothills, Jefferson Co. Colo., July 14, 1984 male

Tucker Gulch, E of Guy Hill, Front Range foothills, Jefferson Co. Colo.: June 29, 1998 male; July 15, 1995 male

W of White Ranch Park, Front Range foothills, Jefferson Co. Colo., July 3, 1988 male

Green Mtn., a hill just E of mtn. front, Jefferson Co. Colo.: May 9, 1989 male; May 31, 1994 2 male; June 24, 1972 male

Leyden Gulch, w of hog back N of Golden, Jefferson Co. Colo., July 9, 1980 female

Ralston Butte, at mtn. front above railroad switchback, Jefferson Co. Colo., June 10, 1994 male

Coal Creek, Front Range foothills, Jefferson Co. Colo., July 3, 1996 male

2 mi. NNW Bergen Park, Jefferson Co. Colo., June 22, 1989 female
Gregory Canyon, Front Range foothills, Boulder Co. Colo., May 29, 1966 male
North Fork Clear Creek, Gilpin Co. Colo., July 1, 1981 male
5 mi. SE Blackhawk, Gilpin Co. Colo., June 30, 1980 male
2 mi. W Elizabeth, Elbert Co. Colo., July 4, 1995 male
Timnath, near Cache la Poudre River, Larimer Co. Colo., July 12, 1978 female
Oak Creek Campground, lower Wet Mts., Fremont Co. Colo., July 7, 1970 male
4 mi. NW Cañon City, foothill slopes E of Royal Gorge, Fremont Co. Colo., June 16, 1970 male
Phantom Can., 7,000 ft., foothills of Front Range, Fremont Co. Colo., April 13, 1968 female
Greenwood, S of Wetmore, base of Wet Mts., Custer Co. Colo., July 16, 1993 male
0.5 mi. E Smith Creek Cgd., Wet Mts., Custer Co. Colo., June 26, 1971 male
Bull Domingo Mine, NE of Westcliffe, Wet Mtn. Valley, Custer Co. Colo., July 2, 1969 male
Stove Mtn., E slope of Pikes Peak, El Paso Co. Colo., June 23, 1990 male
Diamond Peak, Moffat Co. Colo., July 8, 1972 male
Señorito Can., 7,700 ft., Sandoval Co. New Mex., June 17, 1978 male
Tongue Can., Bighorn Mts., Sheridan Co. Wyo., Aug. 1, 1995 3 male
Mosier Gulch, E side Bighorn Mts., Johnson Co. Wyo., Aug. 4, 1995 male
Five Springs Can., W side Bighorn Mts., Bighorn Co. Wyo. Aug. 1, 1996 male
Five Springs Falls Cgd., W side Bighorn Mts., Bighorn Co. Wyo., Aug. 17, 1993 male

C. Form _pusillus_ larger (fw length ~55-63, rarely 49 mm) with _wider_ black unh submarginal band. Forewing outer margin only slightly concave.

MOUNTED wider form _pusillus_ (7 specimens). Specimen data:

Lakewood (W suburb of Denver), Jefferson Co. Colo.: July 10, 1961 2 males; July 21, 2011 female
Green Mtn., a hill just E of hogback at mtn. front, Jefferson Co. Colo., July 13, 1960 male
Magic Mountain [later renamed Heritage Square], just S Golden, Jefferson Co. Colo., July 12, 1960 male
Molino Basin Campground, oak woodland, Santa Catalina Mts., Pima Co. Ariz., April 8, 1966 male
north of Alpine, Texas Sept. 20, 1963 male (49 mm fw the size of minimulticaudata, but has a wider unh band)

PAPERED wider form _pusillus_ (120 specimens). Specimen data:

Lakewood (W suburb of Denver), Jefferson Co. Colo.: May 4, 2011 male; June 6, 2011 male female; June 12, 2011 female; June 18, 2011 female; June 22, 2011 female; June 25, 2007 male; June 25, 2011 2 female; June 26, 2010 male; June 28, 2011 female; June 29, 2010 male; June 29, 2011 male female; June 30, 2009 male; June 30, 2010 male; July 2, 2010 male 2 female; July 3, 2010 male; July 4, 2004 male; July 4, 2005 male; July 4, 2011 5m 2 female; July 5, 2011 2 male; July 6, 2011 male female; July 7, 2011 3 male female; July 8, 1996 female; July 8, 2011 2 male; July 9, 2010 3 male 3 female; July 9, 2011 4 male; July 10, 2011 male female; July 11, 2000 male; July 11, 2010 male female; July 11, 2011 female; July 12, 2008 female; July 12, 2009 2 male; July 12, 2010 female; July 12, 2011 male 2 female; July 13, 2010 2 female; July 13, 2011 2 female; July 14, 2010 male; July 14, 2011 male; July 15, 2011 3 male 2 female; July 16, 2007 female; July 16, 2010 male; July 16, 2011 female; July 18, 2011 female; July 19, 2009 female; July 19, 2010 male female; July 19, 2011 female; July 20, 2011 male; July 22, 2011 male; July 23, 1979 female; July 25, 2010 female; July 29, 2011 female; July 2011 male; Aug. 5, 2011 male

North Table Mtn., NE of Golden, Jefferson Co. Colo., July 24, 1984 male
Wheatridge, Clear Creek greenbelt, Jefferson Co. Colo., July 6, 2008 female
Green Mtn., hill at mtn. front, Jefferson Co. Colo., July 6, 1997 female
Red Rocks, Front Range foothills, Jefferson Co. Colo., June 25, 1989 male
SW Morrison, Front Range foothills, Jefferson Co. Colo., July 14, 1984 2 male
Cherry Gulch, Front Range foothills, just N Red Rocks, Jefferson Co. Colo., July 1, 1997 2 male
Tucker Gulch, Front Range foothills, Jefferson Co. Colo., June 29, 1998 male
Apex Gulch, Front Range foothills, Jefferson Co. Colo., July 27, 1987 male
Indian Gulch, just W Golden, Front Range foothills, Jefferson Co. Colo.: June 15, 1994 male; July 2, 1997 2 males; July 13, 1994 male; Aug. 5, 1998 male
Crawford Hill, Front Range foothills, Jefferson Co. Colo., July 7, 1991 male
Ralston Butte, above railroad switchback at base of Front Range, Jefferson Co. Colo., June 28, 1993 male
Coal Creek, Front Range foothills, Jefferson Co. Colo.: July 7, 1993 male; July 17, 1991 male; July 19, 1994 male
1 mi. SW Greenwood, base of Wet Mts., Custer Co. Colo., July 11, 1967 male
1 mi. W Rye, Wet Mts., Pueblo Co. Colo., June 17, 1967 male
Oak Creek Cgd., lower Wet Mts., Fremont Co. Colo., July 7, 1970 female
1.5 mi. E of East Cañon City, plains, Fremont Co. Colo., July 9, 1971 female
foothills W of Stinking Spring, base of Wet Mts., Pueblo Co. Colo., June 30, 1967 male
Pants Butte, Pine Ridge, Sioux Co. Nebraska June 24, 1994 male
Tongue Can., Bighorn Mts., Sheridan Co. Wyo., Aug. 1, 1995 2 female
Black Mesa, at NW tip of Okla., Cimarron Co. Okla., May 20, 1973 male
Big Arsenic Spring, Rio Grande Gorge, Taos Co. New Mex., Aug. 10, 1986 male
Rio Grande Gorge, Taos Co. New Mex., Aug. 13, 1996 male

D. Form _pusillus_ larger (fw length ~55-63) with even wider black unh submarginal band. Forewing outer margin only slightly concave.

MOUNTED even wider form *pusillus* (6 specimens). Specimen data:
Lakewood (W suburb of Denver), Jefferson Co. Colo.: June 29, 2001 female; June 29, 1997
Tinytown, Front Range foothills, Jefferson Co. Colo., Aug. 26, 1998 female
Sand Gulch near Wetmore, base of Wet Mts., Custer Co. Colo., ~6,100 ft., Aug. 8, 1994 male (fig. Mike Fisher Colorado Butterflies book)
Blue Bird Mesa, 6 mi. E Cuba, Sandoval Co. New Mex. 8,200 ft., June 18, 1977 female
Big Arsenic Spring, Rio Grande gorge, Taos Co. New Mex., Aug. 17, 1986 female

PAPERED even wider form *pusillus* (13 specimens). Specimen data:
Lakewood (W suburb of Denver), Jefferson Co. Colo.: June 23, 2006 male; July 2, 2010 male; July 5, 2006 female; July 5, 2011 female; July 10, 2010 male; July 14, 2011 male; July 15, 2011 male; July 17, 2009 female; July 28, 2011 male
Wheatridge, Clear Creek greenbelt, Jefferson Co. Colo., July 6, 2008 female
Indian Gulch, Front Range foothills, Jefferson Co. Colo.: Aug. 5, 1998 male
Tinytown, Front Range foothills, Jefferson Co. Colo., Aug. 24, 1995 male
Rio Grande Gorge, Taos Co. New Mex., Aug. 13, 1996 male

E. Form _multicaudata_ larger (often very large, fw length mostly 56-68, rarely 48 mm) with widest black unh submarginal band. Some specimens (about a third) have a more concave outer margin of forewing than is found in other specimens and the other forms.

MOUNTED widest form *multicaudata* (24 specimens). Specimen data:

Lakewood, suburb of Denver, 6,400', Jefferson Co. Colo., Aug. 18, 2011 male
Red Rocks, Front Range foothills, Jefferson Co. Colo., June 29, 1993 female
Chimney Gulch, SW edge Golden, Front Range foothills, Jefferson Co. Colo., June 9, 1994 female
Tinytown, Front Range foothills, Jefferson Co. Colo.: July 25, 1994 female; Aug. 26, 1998 male
Indian Gulch, just W Golden, Front Range foothills, Jefferson Co. Colo., June 26, 1996 female
Shingle Creek, E of Genesee Mtn., Front Range foothills, Jefferson Co. Colo., Jul 27, 1988 female
Chatfield Reservoir, South Platte River, plains SW of Denver, Jefferson Co. Colo., Aug. 14, 1991 female
Sand Gulch, Wet Mts. foothills SW Wetmore, Custer Co. Colo., Aug. 8, 1994 2 males 3 females (one female fig. Fisher 2012)
Greenhorn, eastern base of Wet Mts., Pueblo Co. Colo., Aug. 12, 1961 female
Torrington, Goshen Co. Wyo., Aug. 23, 1994 female
Oak Creek Can., Mogollon Rim S of Flagstaff, Coconino Co. Ariz., June 12, 1965 male (48 mm fw length the size of minimulticaudata but has a quite wide black band) & female
Molino Basin Cgd., Santa Catalina Mts., Pima Co. Ariz., April 8, 1966 male
East Turkey Creek near Onion Saddle, Chiricahua Mts., Cochise Co. Ariz., Aug. 8, 1986 male
Stewart Cgd., Chiricahua Mts., Cochise Co. Ariz., June 21, 1968 male
Pena Blanca Lake, Atascosa Mts., Santa Cruz Co. Ariz., July 30, 1986 male
Guadaloupe Can., Peloncillo Mts., Cochise Co. Ariz., Aug. 4, 1986, male & female

PAPERED widest form <u>*multicaudata*</u> (13 specimens). Specimen data:

Lakewood (W suburb of Denver), Jefferson Co. Colo.: July 3, 2010 female; July 5, 2011 female; July 7, 2007 female; July 31, 2011 male; Aug. 1, 2010 female; Aug. 12, 2010 male; Aug. 13, 2011 female
Big Arsenic Spring, Rio Grande Gorge, Taos Co. New Mex.: Aug. 10, 1986 male; Aug. 17, 1986 female
Rio Grande Gorge, Taos Co. New Mex., Aug. 13, 1996 male
Yank's Spring, Atascosa Mts., Santa Cruz Co. Ariz. Oct. 1, 1971 male extremely wide band
Molino Basin, Santa Catalina Mts., Pima Co. Ariz., July 29, 1986 male
Stewart Cgd., Chiricahua Mts., Cochise Co. Ariz., Sept. 28, 1968 male very wide band
North of Alpine, Texas, Sept. 20, 1963 male

Ecological-physiological possible causes of these adult forms. Form *minimulticaudata* is tiny, and occurs only comparatively early in the season (April 13, 27, May 2, 5, 6, 12, 17, 22, 24, June 3, 8, 8, 11, 11, 15, 15, 30, July 1, 4, 4, 6) and only in the mountains (my records are mostly from the lower foothills, several from upper foothills), where the larval hostplant evidently is mostly *Prunus*, esp. *Prunus virginiana*, because the usual hostplant on the plains in Denver (*Fraxinus pensylvanica lanceolata*) is absent in the mountains. Pupae hibernate in this species, and the size of adult is determined by the size of the pupa, thus the pupae of *minimulticaudata* were tiny when the larvae pupated the previous summer. Therefore, it is logical to deduce that <u>the larvae pupated at small size because the larvae did not have sufficient quantities of quality succulent *Prunus* leaves to eat</u>, probably because the larvae were finishing eating in late August or September when the *P. virginiana* berries are getting ripe and the leaves are getting old and tough and nutritionally poor. These larvae may be late because they are offspring of late adults that laid eggs in late July-August, and the season is shortened in the mountains where there is not enough time to produce several generations as there is on the plains.

In some butterflies, small spring forms are caused by photoperiod, or by low temperature. But the flight period on the plains is longer than in the mountains in Colorado yet there are no tiny adults there, which seemingly rules out photoperiod as a cause, and the pupal diapause would seem to rule out the influence of cold fall-winter-spring temperatures as causing the tiny adult size, because the tiny size was already determined (presumably in Aug.-Sept.) by the pupation of the larva at a small size.

Form *pusillus* is the usual form in Colorado, representing the usual main generation from early to mid June to mid July, flying in mountains and plains. In the mountains and even on the plains at Lakewood, there is just one main generation, which flies mid June-July but some have two generations represented by adults in April-mid June and Aug.-early Sept. In south-central Colorado, there is just one generation M June-E Aug. in the Arkansas Canyon and Wet Mountain Valley and San Luis Valley, but two apparently mostly-complete generations L April-E June and M June-M Aug. in the Wet Mtns. foothills and the plains around Pueblo. Fisher (2012) notes that there are apparently two generations also in lowland far western Colorado (Mesa, Montrose, and Delta Cos.) and southwestern Colorado.

Form *multicaudata* is the large wide-black-markings form that occurs late in the season in Colorado (end of June-late August, except one specimen June 9) but flies April-Oct. in southern Arizona (records from the entire range are April 8, June 9, 12, 12, 21, 26, 29, July 3, 5, 7, 27, 29, 30, 31, Aug. 1, 4, 4, 8, 8, 8, 8, 8, 10, 12, 13, 13, 14, 17, 23, 26, Sept. 20, 28, Oct. 1). In Colorado it occurs on the plains and sometimes in the lower foothills, often during the main flight from mid June-July but more often flies in the second generation as the offspring of the occasional adults that fly in late May (rarely April) & June. The parents of some of these could even be form *minimulticaudata*, though the parents are mostly form *pusillus*, especially on the plains where form *minimulticaudata* does not occur.

Is *pusillus* a form or a subspecies? The original description of *pusillus* (Austin & J. Emmel 1998) named it from the mountains in NE Nevada, and described and illustrated it as having relatively narrow black borders and markings, and straight forewing margins. The holotype male has quite narrow black markings, while the markings of the allotype female are wider. Their illustrated specimens of ssp. *multicaudata* from Arizona and ssp. *grandiosa* from Mexico had concave forewing margins. In my specimens from Colorado and Arizona-Texas-New Mexico-Utah-Montana-Wyoming-California, the concave forewing is found only on a minority of the form *multicaudata* adults in Colorado and Arizona, and never on forms *pusillus* or *minimulticaudata*, thus this trait does not seem to be a good subspecies character. Adults resembling the types of *pusillus* match adults of the usual main mid June-July flight in Colorado, while adults matching their figures of *multicaudata* match the often-second generation form in Colorado. Thus it appears that the name *pusillus* merely represents a partly-seasonal form, and is not a real subspecies. Colorado has both forms *pusillus* and *multicaudata*, and also has another form, form *minimulticaudata*.

In northern Mexico, the presumed type locality of *multicaudata* (Austin & J. Emmel should have restricted the TL), form *multicaudata* would seem to be the main form, based on the prevalence of this form among my specimens from southern Arizona, and based on Austin & J. Emmel (1998).

Literature Cited

Austin, G. T. & J. F. Emmel. 1998. A review of Papilio *multicaudatus* Kirby (Lepidoptera: Papilionidae). Chapter 54 pp. 691-700 in: Systematics of Western North American Butterflies, ed. T. C. Emmel, Mariposa Press, Gainesville, Fla., 878 p.

Fisher, M. S. 2012. The butterflies of Colorado. Pieridae and Papilionidae-Part 5. The whites, sulphurs, and swallowtails. Lepidoptera of North America 7.5. Contributions of the C. P. Gillette Museum of Arthropod Diversity, Colorado State University, Fort Collins, Colorado.

THE IDENTITY OF *COENONYMPHA BRENDA* W. EDWARDS 1870 (NYMPHALIDAE)

by

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Abstract. The identity of *Coenonympha brenda* is in dispute because the types and the original description differ greatly. The original description mostly describes a California butterfly. The male and female syntypes are labeled “Los Angeles” [California], but are orangish in color and match Utah-Colorado butterflies. In 1998 the orangish Nevada-Utah butterfly with many ocelli was named *Coenonympha tullia pseudobrenda*, under the assumption that the *brenda* types are not the same taxon as the *brenda* original description therefore are not valid syntypes. However, the original description is ambiguous and well-describes some traits of those types, and analysis of mistakes made by W. H. Edwards suggests that the lectotype (a lectotype was designated in 1931, and the same specimen unnecessarily redesignated in 1964) could have been the taxon that he meant to describe and the original publication may have mistakenly described the wrong taxon. And the *brenda* lectotype is valid under ICZN nomenclatural rules, regardless of the original description. But the valid lectotype has an erroneous locality, so the name of the Utah-Nevada butterfly is in dispute—is it *brenda* or *pseudobrenda*? Here we show that the *brenda* types match butterflies from western Colorado, which are near ssp. *ochracea*, so we restrict the TL to Colorado (northwestern Colo.), thus *brenda* is a subjective synonym of *ochracea*, and *pseudobrenda* is the valid name for the Nevada-Utah ssp.

Keywords. Nomenclature; taxonomy; Insecta; Lepidoptera; Nymphalidae; *Coenonympha*; *Coenonympha brenda*; *Coenonympha tullia pseudobrenda*; *Coenonympha tullia california*; California; Nevada; Utah; Colorado.

The name *Caenonympha Brenda* W. H. Edwards, 1869 (pp. 375-376) was established for a butterfly “From Los Angeles, Cala., 2 m, 1 f.” [California] (the genus is properly spelled *Coenonympha* Hubner, [1819]). The Tryon Reakirt collection in the Herman Strecker collection (in Field Museum of Natural History, Chicago, Illinois, USA) now contains only two specimens, male and female syntypes, labeled “C. Brenda/W. H. Edw./Los Angeles,/orig. Type/Coll. Reak.”, and the third specimen (male) is lost.

Holland (1931) validly designated a lectotype male *brenda* and figured it on pl. LXXIV figs. 11 & 12 (our figs. 1-2). Holland called it the “type” on p. 185 and also called it the “type” on the plate, and stated that it was from the Field Museum Nat. Hist. Brown (1964a) later showed that this specimen was a syntype, so Holland validly designated this specimen as lectotype. Scott (2008) showed that Holland validly designated 75 lectotypes in his books, because Holland made a concerted effort to borrow and figure the types of as many species as possible and he singled out those individual specimens and called them the "type" in his books, satisfying ICZN rules for the designation of lectotypes. Scott (2008) should have listed this specimen as a 76th lectotype designated by Holland (he failed to do so because at that time he mistakenly followed the suggestion of Austin & Gray 1998 that this male was not a syntype).

Brown (1964a) wrongly dismissed all but three of Holland's 76 valid lectotype designations, and Brown redesignated Holland's male lectotype as a lectotype of *brenda* (his Fig. 7). This male is labeled "Type" and has many ventral ocelli (more than the female syntype). Brown assumed that the "Los Angeles" locality in Edwards' (1869) original publication (and the "Los Angeles" locality on the labels) was a mistake (as Barnes & McDunnough 1916 wrote), because authentic *C. tullia* from southern California (including Los Angeles) are cream in color with very small spots & ocelli than are the types of *brenda* and also have more pointed forewings. Brown stated that "Nothing like *brenda* has ever been collected in the vicinity of Los Angeles, California…", and wrote that the male and female must have come from the Great Basin area or the western foothills of the Rocky Mountains, and are larger and lighter than typical Rocky Mountain *C. tullia ochracea* W. H. Edwards, 1861. Brown stated in particular "On the whole, these butterflies suggest to me the material I have seen from the vicinity of Salt Lake City, Utah, and from Mount Charleston, Nevada.", where adults are tawny and have many ocelli on ventral hindwing. Davenport (1941, p. 266) placed *brenda* as a synonym of *C. t. ochracea*, a treatment first used by Dyar (1902). But following Brown, most authors used the name *brenda* for Utah-Nevada orangish butterflies with many ocelli as Brown (1964a) suggested (Brown 1963, Austin & Austin 1980, Miller in Ferris & Brown 1981, Scott 1986, Tilden & Smith 1986). The only exceptions were dos Passos (1964), Austin (1985), and Austin & Gray (1998) and subsequent authors (Pelham 2008), who treated *brenda* as synonymous with *C. t. california* Westwood, 1851.

The mistaken locality "Los Angeles" probably originated from Tryon Reakirt. The original publication listed the source of the specimens as "Collection of Tryon Reakirt, Esq." The label on the lectotype (and the identical label on the paralectotype [syntype] female) stating "C. Brenda/W. H. Edw./Los Angeles,/orig. Type Coll. Reak." are not in W. H. Edwards' distinctive handwriting, and they were clearly written after Edwards had decided to name *brenda*. They were obviously written by Tryon Reakirt, because the label is identical to Reakirt's label of *Polyommatus castro* Reakirt, 1866 (LYCAENIDAE) figured by Ferris (1977, p. 26 fig. 68) by having four thick lines outside four thin lines placed around the periphery of the label plus two dotted lines across the label, and the handwriting is the same and they have identical "Orig." above "Type" on lower left and identical "Coll." above "Reak." on lower right of each label. Therefore, it would seem that Edwards borrowed these specimens from Reakirt, decided to name them (perhaps because they were distinctive orangish butterflies from California where the previously-known butterflies were all cream in color) and then returned them to Reakirt with the statement that he [Edwards] was planning on naming them *brenda*, and then Reakirt wrote the label containing that information. Presumably Reakirt made the mistake of thinking they were from Los Angeles when he sent the specimens to Edwards, because Reakirt reasonably would not have sent specimens with no known locality to Edwards and then received them back with a Los Angeles locality without questioning how the locality became determined. Reakirt never collected butterflies in California, but he received specimens from there collected by Pierre Lorquin. On Nov. 22 1866, Reakirt wrote a letter to Herman Strecker stating that he had purchased 1,000 specimens "of Philippines, Moluccan and Californian" butterflies, apparently from Lorquin (Brown 1964b). Lorquin had collected butterflies from Los Angeles in 1859 (Emmel, Emmel, & Mattoon 1998, p. 6 fig. 1). Perhaps the *brenda* types became mixed in with Lorquin's California butterflies somehow, leading Reakirt to think they came from Los Angeles. Reakirt assumed the wrong "California" locality for other specimens Lorquin had collected: W. H. Edwards named the butterfly *Polygonia marsyas* (W. H. Edwards 1870) from "California", then later (Edwards 1874-1884, vol. 2 p. 192) misstated that "They were taken some years ago by the late M. [Pierre Joseph Michel] Lorquin, and assigned to Mr. Reakirt, with no other locality than "Rocky Mountains.", but Lorquin never collected in the Rocky Mountains (Brown 1967 p. 332), and *marsyas* later proved to be synonymous with the European *Polygonia c-album* Linnaeus, 1758 and were probably collected in France by Lorquin (Brown 1967 p. 332-335).

Austin & Gray (1998) reported that the original description of *brenda* clearly described the pale cream-colored California butterfly with a reddish ventral forewing line, which had been previously named *Coenonympha tullia california* Westwood, 1851. Article 74.2 states that if a lectotype is found to be not a syntype, it loses its status of lectotype; so Austin & Gray (1998) thought the lectotype was invalid as it was not a syntype. They stated that somewhere in the journey of the *brenda* types from W. H. Edwards to Tryon Reakirt to Herman Strecker and the Field Museum of Natural History in Chicago, Illinois, USA, the wrong labels must have been applied to the specimens. So they treated *brenda* as a synonym of *C. t. california*, and named the orangish butterflies with many ventral ocelli from east-central Nevada *Coenonympha tullia pseudobrenda* Austin & Gray, 1998.

However, a comparison of the original description of *brenda* with the extant male and female *brenda* types, and with the California taxon *C. tullia california* and the Colorado taxon *C. t. ochracea*, suggests that Edwards' description might have applied to those *brenda* types after all. The original description (O.D.) describes the upperside as "light buff" (evidently meaning light-orange-yellow or light-yellow, as "buff" can mean "moderate orange-yellow" or can mean "light to moderate yellow"), which fits neither ssp. well, but fits the cream-colored *california* better than the brownish-orange *ochracea*. O.D. states ventral forewing is a shade more yellow, which fits *california* better as *ochracea* has most of the wing orangish. O.D. states ventral forewing has a faint reddish line, and actually both ssp. have a brownish-orange (not reddish) inner edge of the postmedian band, however only in *california* does this orangish edging form just an isolated orangish line. O.D. states that ventral forewing has a large subapical round black spot, which fits *ochracea* well, as *california* usually has just a tiny black spot. O.D. states there is a point in lower median interspace on ventral forewing, which fits neither ssp. (and is absent on the lectotype as well). O.D. states that secondaries have a more or less complete submarginal row of spots or points, which fits some butterflies from Colorado (*C. t. ochracea*) to Nevada that have a submarginal series of creamy spots around a black point, and fits the lectotype of *brenda*, whereas *california* has just one or two tiny black spots although there may be multiple spots in the spring generation. O.D. states antenna is buff, the club pale ferruginous, which fits *california* better as *california* has a pale antenna shaft and an orangish club, whereas *ochracea* has a checkered antenna shaft and an orange-brown to orangish club. O.D. states that the female has the apex of ventral forewing and the discal areas of the wings obscured by gray, which fits *ochracea* better as those areas look somewhat grayish in *ochracea* but are just browner-cream in *california*. O.D. states that the spots on ventral hindwing are partly absent on the female, which is true of that female paralectotype. O.D. states that the other now-missing male syntype ("Var. a, Male") has no ventral spots except a faint subapical spot (on forewing presumably), which fits *california* better. Overall, the O.D. fits *california* better in four traits (dorsal color, ventral forewing color, orangish ventral forewing line, and antenna) and fits *ochracea* much better in two traits (large ventral forewing spot, gray on ventral forewing apex), plus the number of submarginal ventral hindwing spots described in the O.D. fits the two extant types. This ambiguity suggests that the two extant types might actually be syntypes.

The following plausible (perhaps even probable) scenario also suggests that the extant types of *brenda* might have been valid original syntypes. Under this scenario, Edwards intended to describe *brenda* from the orangish specimens he borrowed from Tryon Reakirt, and mistakenly thought they were from Los Angeles (probably because Reakirt thought they were some of the butterflies Pierre Lorquin had collected in Los Angeles), and then Edwards mistakenly sent them back to Reakirt before writing the description. Some time later when he forgot what the types looked like, Edwards found that he lacked a description for publication, but he had access to true Los Angeles area specimen(s) of the pale taxon later described as *C. tullia california* that flies in southern California, so he described *brenda* from that specimen(s) and his memory. Under this likely scenario, the orangish male and female are valid syntypes after all, and the original description is the mistake, making the name *brenda* validly apply to the Nevada-Utah-Colorado butterflies, and possibly even making the name *pseudobrenda* a synonym of *brenda*. There is plenty of evidence to suggest the possibility of this scenario. Brown (1964a, p. 325) wrote that "[William Henry] Edwards usually returned to the original owner the specimens he used when a particular novelty was not found in his own collection." Brown provided numerous examples of these returned specimens in his studies of Edwards' types (Brown 1964-1987). And forgetting what he had named would not be rare for Edwards. "On several occasions he wrote to correspondents begging them to send him examples of butterflies that he had named from their collections since he had little memory for what he had named." (Brown 1970, p. 34). For instance, Edwards described *Melitaea minuta* W. H. Edwards, 1861 (Nymphalidae), then returned the type to the collector Weidemeyer who then moved to Europe, then Edwards described *Melitaea arachne* W. H. Edwards, 1869, but then forgot the differences between those taxa and reversed the two names in 1881 (Brown 1966, p. 414 & 411). Also, Edwards returned the type of *Thecla tetra* W. H. Edwards, 1870 to Herman Behr in 1870, then forgot what he had named and thereafter used the name *tetra* for another species that had been named *Thecla auretorum* Boisduval, 1852, and then when he received true examples of *tetra* he labeled them *Thecla adenostomatis* H. Edwards, 1877 (Brown 1970, p. 34). Edwards forgot the reddish-brown underside butterfly that he had named *Argynnis nokomis* W. H. Edwards, 1862, and later redescribed and illustrated *A. nokomis* as having a yellow underside (the yellow butterflies are actually a different butterfly *A. nokomis apacheana* Skinner, 1918)(Brown 1965, p. 247-249). Edwards was very sloppy, and did not label each specimen in his collection, he merely placed a label at the head of a series. And he failed to place "type" labels on specimens, so William J. Holland (who purchased Edwards' collection) would pick out "typical" specimens from Edwards' collection and send their labels to Edwards to have the word "type" written on them in red ink, and Edwards would then send those labels back to Holland. Numerous specimens were thereby labeled as "type" which were actually not syntypes (Brown 1964-1987).

The lectotype of Holland's (1931) was named when the Re'gles applied, and Brown (1964a) redesignated that specimen lectotype when the 2nd edition of the Code applied. (Only the 2000 4th edition ICZN Code applies now as those earlier rules no longer apply.) Brown (1964a) searched for the type specimens and found the male and female labeled “C. Brenda/W. H. Edw./Los Angeles/orig. Type Coll. Reak.”, which matches the “From Los Angeles, Cala, 2m, 1f” information in the original publication, so he considered them syntypes and designated one of them as lectotype, even though he stated that they do not fit the concept of *brenda* written in the original publication. Articles 61.1 and 72.10 state that the type specimen is the bearer of the scientific name and provides the objective standard of reference for the application of the name it bears, so evidently the type defines the taxon rather than the description, if they differ, so if there is a type that is reasonably valid, the description does not matter.

We can explore whether the lectotype is valid under the recent 2000 4th edition of the Code, which we must follow. Article 72.4.1 of the 2000 Code states that the type series in this case consists of all the specimens directly included by the author in the new taxon, the 2m1f. Article 72.4.1.1 of the 2000 Code allows that “For a nominal species or subspecies established before 2000, any evidence, published or unpublished, may be taken into account to determine what specimens constitute the type series.” However, 72.4.1.1 is indented and numbered as subservient to 72.4.1, therefore 72.4.1.1 allows one to add specimens to the type series, only if those specimens belong to the taxon defined by the original publication. So, by 72.4.1 the original publication directly included only pale red-lined butterflies in *brenda*, so 72.4.1.1 permits a search for syntypes to be made outside the original publication only to find only pale red-lined specimens. Brown found none, so the current *brenda* “types” are not part of the type series, thus Brown’s lectotype is invalid because it is not a syntype. Under this interpretation of 72.4.1.1, the name *brenda* becomes a synonym of *C. t. california*, and *C. t. pseudobrenda* confidently applies to Utah-Nevada butterflies. (This restrictive interpretation of 72.4.1.1 is beneficial because it will generally prevent the worst-case scenario that could befall a lectotype, which is to belong to a different taxon than the taxon clearly defined by the original publication.) However, the description in the original publication is somewhat ambiguous as noted above and mostly fits the California butterfly but almost as strongly fits the Colorado-Nevada butterflies, so the complete description (not just the red-lined part) is a bad chimera of both taxa so 72.4.1.1 permits the other types of butterflies to be considered syntypes also, and the two current types are somewhat described by the original publication, and their labels definitely fit the original description.

Several courses of action are available to rectify this problem, in which the name *brenda* can be considered a senior synonym of *pseudobrenda*, causing uncertainty in the name of the well-spotted Utah-Nevada butterfly. One course of action would be to petition the ICZN to designate a neotype of *brenda* using a specimen of Los Angeles area *C. t. california*. This neotype would make *brenda* a synonym of *C. t. california*, and would preserve the current usage (since Austin & Gray 1998) of *C. t. pseudobrenda* for the Nevada-Utah butterflies. That course of action is suggested by the slight majority of characters described in the original publication. However, most recent authors have used the name *brenda* for Utah-Nevada butterflies and the lectotype does match a minority of Utah butterflies. So one could petition the ICZN to designate a neotype of *brenda* using a Utah specimen of *pseudobrenda*. This solution would work, and would happily replace the name *pseudobrenda* by the simpler name *brenda*; however such petitions are time-consuming and might not succeed, and if successful this solution would create more nomenclatural confusion due to the change of names.

Another course of action would be to simply accept the valid lectotype and show that the name *brenda* applies to a specific named geographic taxon based on the characteristics of the lectotype and the other types. But a problem is that the three *brenda* types (the male lectotype, the female paralectotype/syntype, and the lost male syntype with no ocelli described in the O.D.) have erroneous locality labels, so they could have come from three different localities. Adults are variable in number of ocelli in Colorado (Fig. 3), and the frequency of ocelli increases westward from central Colorado to Nevada. Utah butterflies resemble Nevada *pseudobrenda* in having more ocelli (Fig. 4). The male *brenda* lectotype has many ocelli and looks like many butterflies from Nevada or Utah (if it were from Utah *pseudobrenda* would be a synonym of *brenda*), although half the Utah butterflies have even bigger ocelli and markings than the lectotype, and the lectotype looks like some specimens from Colorado and northern New Mexico and southwestern/central Wyoming. The female paralectotype with fewer ocelli (and the missing male in the original publication with no ocelli) resemble typical butterflies from Colorado (where they would belong to *C. t. ochracea*). Western Colorado butterflies are near ssp. *ochracea* because they average fewer ocelli than westward, though they average slightly more than topotypical *ochracea* from the eastern slope of the continental divide in Colorado which average few ocelli (although some have many). Brown (1964a) noted that the *brenda* types are larger and lighter than *C. t. ochracea*, which suggests that *brenda* is not a strict synonym of *ochracea*. But Austin & Gray (1998) did not describe *pseudobrenda* as lighter than *ochracea*, and all of these *Coenonympha* are about the same size in Scott's series.

The best **solution** is to assume that the three syntypes came from one region, as Edwards considered them to be one taxon, and to assign the name *brenda* to the region that best matches those three specimens and might have produced those specimens. As Fig. 3 shows, western Colorado has specimens with many ocelli like the fig. 1 lectotype (such as the male from Grand Co. and the male from Moffat Co.), and has specimens with few or no ocelli (the majority of them) like the female paralectotype/syntype and the missing male in the O.D. with no ocelli. Thus the types match northwestern Colorado butterflies. In contrast, Utah butterflies have numerous ocelli (fig. 4) that are most often larger than those on the lectotype, and seem identical to Nevada *pseudobrenda*. Confirming this assessment, Austin & Gray thought the extant male and female types could have come from western Colorado, so they thought that even if the *brenda* lectotype were valid the name *brenda* would be a synonym of *ochracea* Edwards. Therefore, to settle the identity of the name *brenda*, **we hereby designate the type locality of *brenda* as NW Colorado**. Reakirt collected specimens in Colorado, especially from the eastern slope of the continental divide where *ochracea* flies (Reakirt 1866) and where occasional individuals have many ocelli. As the butterflies in northwestern and southwestern Colorado are near-*ochracea* and those on the eastern slope of Colorado and south-central Colorado are *ochracea*, we therefore assign the name *brenda* as a subjective synonym of *ochracea*, and not a synonym of *california*.

(Interestingly, butterflies from the Wind River Mts. in west-central Wyoming also have many ocelli, owing to some influence from *pseudobrenda*. And northern New Mexico populations in Rio Arriba Co. have a greater frequency of unh ocelli than *ochracea*, and farther south in Sandoval Co. there are even more ocelli, showing considerable influence of *pseudobrenda* or *subfusca* Barnes & Benjamin 1926 there. The unh of *subfusca* has many ocelli but has small yellow markings, whereas the New Mexico butterflies have larger yellow markings more like *pseudobrenda*, suggesting that they could be intergrades between *ochracea* and *pseudobrenda*, or they intergraded between *ochracea* and *subfusca* in the past and then *subfusca* later developed smaller yellow markings.)

(Note: Taxonomists should not name anything *pseudo-*. Nearly every one of those named recently [also in *Callophrys* & *Colias*] has become embroiled in disputes.)

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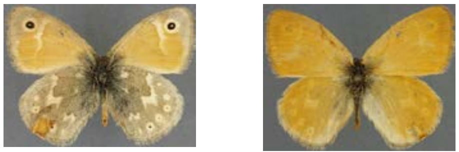

Figs. 1-2. Lectotype of *brenda*.

Fig. 3 (left). *C. tullia* near-*ochracea* from NW Colorado (coll. J. Scott unless noted). Left column: Willow Creek Reservoir, Grand Co., June 2, 1963 (coll. William A. Cobban Jr.) 1m; 7.4 road mi. N of Parachute, Garfield Co., 5,800-6,000', June 25, 2008 1m; 1/3 mi. up Deer Park Gulch, Roan Creek drainage, Garfield Co., 5,900-6,000', June 25, 2008 1f; 2 mi. S Glenwood Springs, Garfield Co., June 22, 1971, 1f. Middle column: same data 2 mi. S Glenwood Springs 1f; 11 air mi. W Sunbeam, Moffat Co., May 27, 1978 1m; 10 mi. W Craig, Moffat Co. June 13, 1965 2m. Right column: same data 10 mi. W Craig 1f; Lay Peak, Moffat Co., June 18, 1965 3m1f.

Fig. 4 (right). *C. tullia pseudobrenda* from Utah (coll. J. Scott). Left column: Sheep Marina, Daggett Co., May 30, 1978 2m; 1 mi. N Red Springs Campground, Daggett Co., June 7, 1962 1m; 8 mi. N Heber, Wasatch Co., June 14, 1965 2m. Middle column: 3 mi. W Long Valley Junction, Kane Co., June 19, 1965 5m (1st male has unh like ssp. *furcae*; last male fig. James Scott book). Right column: same data 3 mi. W Long V. 1f; 0.5 mi. W Hatch, Garfield Co., June 18, 1972 1m; Vermilion Castle Forest Camp, Iron Co. Utah, June 19, 1965 2m; Oak Creek Forest Camp, Millard Co., June 18, 1965 1m.

NEOMINOIS RIDINGSII WYOMINGO EARLY STAGES AND NATURAL HISTORY (NYMPHALIDAE)

by James A. Scott

Abstract. 1st–stage larvae overwinter. Eggs are intermediate in height to other ssp. Larvae and pupae are similar to other ssp., and some variation occurs in coloration. Each of its traits of early stages and mate-locating behavior and adult wing pattern shows some similarity to the same trait in some other ssp.

Ssp. *wyomingo* (Scott) is especially interesting because it overlaps the range of other *ridingsii* (W. Edwards) ssp. by about 500 miles, without any possibility of interbreeding because it flies in late August-early September while other ssp. fly mostly in June (it can be retained it in *N. ridingsii* because reproductive isolation has not been demonstrated to occur—allochrony is NOT reproductive isolation). Its life history and early stages were poorly known, so are reported here.

Three females were found in shortgrass prairie mesa/gulch terrain N of Lodgepole Creek, 6,200', Laramie Co. Wyoming, Sept. 5, 2013. One female had shrunken abdomen and non-joined proboscis halves and could not feed and died Sept. 6. The other two did not lay eggs Sept. 6 in a clear plastic jar with *Agropyron repens* grass and moist towel under table lamp, so Sept. 7 they were placed in outdoor sun on potted *A. repens* enclosed in netting, and they laid 39 eggs Sept. 7, & nine Sept. 8 (48 total), most on the U-shaped wire holding the net open and some on the net nearby, nearly all at the top of the net (this outdoor system works well with *Oeneis* also). In nature all Satyrinae generally place their eggs on DEAD (not green) stems/leaves of the host, so *wyomingo* [and *Oeneis*] eggs are placed the same way—high up on the plant where predators are fewer and heat is less, and on dead parts less subject to shrinkage than green parts (dented eggs die)(Clyde Gillette found this also in Utah *wyomingo*, Scott & Fisher 2008).

Egg (fig. 1) placed on dead parts at top of grass clump, dull whitish (a bit greener-white when laid but quickly becoming white, remaining white until emergence), barrel-shaped with flattened base and top, ~50 whitish bumps on the somewhat-flattened area on top (the bumps smaller medially), micropyle darker. Sides average 17 vertical ribs (extremely variable, 14-19). Egg duration in lab averages 16 days (13-18); 3 dented eggs never hatched.

First-stage larva (fig. 2 newly-emerged, fig. 3 after feeding) tan, heart-band brown (paler on T1-2), a wide tan band, a narrow dark line, a wide tan band, a less-wide brown subdorsal band then an equally-wide tan band, a slightly darker narrow band along spiracles, a creamy narrower lateral band, a slightly-darker line, then tan beneath; legs & prolegs light brown (all the brown colors on larva are fairly light, not dark-brown); the two wide tan bands narrow to a point on the two short tails that stick up, while the brown heart-band ends between the tails; head tan with the usual primary setae, setae whitish-tan with black bases, short with spatulate tips, largest ommatidium medium-brown. After feeding the larvae become greener: heart-band dark-green, a narrow cream band, a dark-green line, two cream lines, a wide not-dark mottled greenish-cream band, a cream line edged below with darker-green, a wide greenish-tan band has spiracles at bottom, a cream lateral band, a brown line, underside tan; head tan as before.

Second-stage larva (fig. 4) heart-band green, a wide band and a narrower band have creamier centers (larva is greenish in all those areas), a narrower dark band, a wide dark band then a narrower one with spiracles at lower edge (each of these dark bands has cream lines edging it), a cream lateral band, underside tan; head tan with three light-brown vertical bands that narrow and curve laterally as they extend downward to points near lower part of head)(one band near midline, a second lateral to that, the third curled mostly on side above ommatidia, frontoclypeus light-brown.

Older larvae vary a little in coloration. Some are a bit redder-tinted in subdorsal areas giving them a more tawny appearance, while most have a little reddish tint, but some have none and are a bit greener in appearance.

4th-stage larva tan with brown bands, heart-band brown edged wih darker-brown-dotted line, a cream narrow band, a tan mottled band, a brown line, a cream wide band with weak tan line in center, two dark-brown lines with fine-brown-dotted area between them, a cream narrow band, a redder-brown line, a tan band encloses dark spiracles, a light interrupted brownish line, lateral ridge cream, a gray area below lateral ridge, underside and prologs and legs grayish-tan, with tips of prologs & legs chitin-colored.

Mature larva (figs 5-7; fig. 6 a greener larva, fig. 7 a redder larva) has dark-gray-brown heart-band (band #1 of *Oeneis chryxus* [Dbldy.] in Scott 1986) edged by dark-brown line, a cream narrow band, a wide tan band (#2) with some brown tiny dashes near segment-joints, a narrow brown line, a wide cream band (#3) with reddish weak area in middle (these two wide bands are slightly redder in some larvae giving them a more tawny appearance--most larvae have a little reddish, some have none, and some of those with none have a slightly greener appearance), a dark-brown line, a dark-gray wide band (#4) with tiny brown wiggly dashes in it, a dark-brown line, a cream narrow band, a reddish-brown weak line just above black tiny oval spiracles which are near top of a fairly wide gray band (#5), a cream lateral ridge, underside (band #6) greenish-gray (tips of prologs and legs chitin-colored); head tan with 3 brown-dot vertical stripes on each side that curve laterally as they narrow to a point (the median band near coronal sulcus, 2nd stripe positioned halfway to 3rd, 3rd stripe curved forward from rear then curved down ending just above ommatidia), an inverted brown V on frontoclypeus, two brown anterior tentorial pits, head brown on lower rim above mouthparts (the brown extending upward to lower part of frontoclypeus, labrum brown, the straight-edged-shear mandible brown with black cutting edge and an anterolateral black ridge, 6 ommatidia (the 3rd from top nearly 2x wider.

Larval duration averages 83 days, but two later female larvae lasted 127 & 130 days.

Larval behavior. Larvae are very sluggish. They rarely move, and when moving do so slowly. And they make no nest. In nature they must spend nearly all of their time merely resting hidden in the base of a grass clump, and venture up occasionally to feed (probably mostly at night), so it would seem that their hosts in nature must be fairly-large bunch grasses such as *Agropyron spicatum*, because sluggish larvae could never survive on tall hay grasses or any other grass/sedge host on which they are exposed to wind etc.

Pupa (fig. 8) medium orange-brown the first few days, turning darker-orange-brown, minutely rugose, a brown heart-band on A1-9 (strong on rear of A2 & rear of A3, uniformly brown A4-8), a weak brown subdorsal line on rear of T3 to A9, a weak wide subdorsal band T3-A8 (this band mostly suggested by darker dots along both edges), a very weak redder line through spiracles A2-8, slightly darker supraventral ovals on rear of A4-8, cremaster has no crochets just a round dark-brown area; T1 spiracle roughly circular, rising from surface posteriorly and the rear part overhanging surface, appearing black but the posterior part above and at and below the overhang reflects bright yellow at most angles evidently due to minute air tubes; head a little darker orange-brown, bottom of eye has large flaplike setae (wide with narrowed tips) that are a little paler orange-brown, orbit of eye smooth and paler.

Pupal duration. Larva + pupa duration averages 114 days for males, 120 days for females, and pupae average 34 days. Male pupae lasted an average of 31 days and females 37 days based on male+female pupation dates, but new pupae were not sexed, so most of the 6 day emergence lag (females minus males) probably occurred as larvae, so male pupae are interpolated to average a little less than 33 days and females a little more than 35 days.

Diapause stage. This was deduced from lab mortality and flight period. Eggs always hatched, except for 3 eggs that I accidentally dented that never hatched. 14 1st-stage larvae died, and another died molting to 2nd-stage, one 2nd-stage died, three 3rd-stage died, two large larvae turned purple and died of ?fungus, one large larva died of white fungus, two large larvae turned limp or moribund and died of ?disease, and a pupa died of a puncture wound. Half a dozen older larvae lagged behind the others and most died as just noted but two females emerged more than a month behind the other emerged adults (which could be interpreted as a genetic remnant of an older-larva diapause experienced by biennial *N. ridingsii pallidus* Austin in Calif., although such diapause is not known to occur in *wyomingo* in nature). The **diapause stage in nature is obviously 1st-stage larva**. Clyde Gillette and Todd Stout also found 1st-stage diapause in Wasatch Mts. Utah *wyomingo* (Scott & Fisher 1998).

Lab developmental period. Duration from oviposition to adult emergence is 130 days for males, 136 for females. This is the longest lab duration of any butterfly I have ever reared, and obviously *wyomingo* has just one generation per year and is not the second generation of ssp. *ridingsii*.

Lab food. Larvae ate *Agropyron repens* and *Poa pratensis* well in lab. I have found that a mixture of these tough and tender grasses works adequately for *Neominois* and *Oeneis*, which are difficult to rear but some adults emerge despite much mortality (potted native-hostplants near the constant light would probably reduce mortality).

Hostplants. Natural hosts are evidently tough dry grasses growing in clumps, notably *Agropyron* (*Pseudoregneria*) *spicatum*, that frequently have dry even involute (rolled) leaves. The larvae seldom move so need grass clumps in which to rest immobile most of the time.

In the Wasatch Mts. Utah, Wayne Whaley found several ovipositions on *Agrypyron spicatum*, and Todd Stout found an egg on it there.

At the TL of *wyomingo* (WNW Midwest, Natrona Co. Wyoming) I found *Stipa comata* common, a few *Agropyron (Psathyrostachys) juncea*, both tough clumplike grasses which are probable hosts, and *Bouteloua gracilis* common nearby, the usual host of ssp. *ridingsii*.

In Rocky Mountain National Park, adults were assoc. with *Agropyron spicatum*, *Muhlenbergia montana*, and *Bouteloua gracilis* on a S-facing slope (details in Scott & Fisher 2008); this population was extremely common in the 1950s, but is now extinct, perhaps due to global warming as there was no recent collecting or other apparent cause. (Ssp. *ridingsii* is now evidently extinct E of Denver, as I could not find it there in 2014 at former localities.)

Probable hosts at the site of the mothers used in this study can be surmised. Colorado was dry then and butterflies were not common, but just a few miles away Wyoming was much greener because of recent rain. Grasses present were *Agropyron* "*Pseudoroegneria*" *spicatum* (most have awn on glume) common, *Oryzopsis "Achnatherum" hymenoides* common, and *Stipa*

"Hesperostipa" comata very common; *A. spicatum* is a known host and the other two are surely occasional hosts as well. Other grasses less likely to be hosts were *Bouteloua "Chondrosum" gracilis* very common (a host of ssp. *ridingsii*), *Andropogon "Schizachyrium" scoparius* common especially on high slopes, *Bouteloua curtipendula* few, *Aristida purpurea* some, *Koeleria macrantha* few, the sedge *Carex inops "pensylvanica" heliophila* very common. (Botanist taxonomists love to split genera so no one else can recognize the names [their latest names in quotes in this paragraph], which gives one a very low opinion of them. Sarcastically, their goal would seem to be to change the name of every single plant.)

Comparison with other ssp. The *wyomingo* egg is longer than ssp. *ridingsii* egg (which is oval in lateral view) but about 20% shorter than the *coloalbiterra* Garhart & Fisher egg (Scott 2008) which is longer barrel-conical shaped. Wasatch Mts. Utah *wyomingo* older larvae (internet photos by Todd Stout, Dale Nielson) are similar to mine, but look redder (with bands #2, 3, and 5 redder) although my *wyomingo* vary to slightly reddish. My *wyomingo* mature larvae are similar to ssp. *stretchii* (W. Edwards) =*dionysus* Scudder (Garfield Co. Utah, Allen et al 2005 p. 110 photo; and Emery Co. internet photos by Todd Stout), but those larvae have a darker band #5. My *wyomingo* have narrower stripes on top of head than Utah *stretchii* and *wyomingo*, and resemble *coloalbiterra* in width. *Wyomingo* is similar to the ssp. *ridingsii* description in Scott (1986) based on W. Edwards' (Butt. N.A.) description of S Colo. *ridingsii* larvae, though the *ridingsii* #5 band was described as brownish-green; my *ridingsii* 4th-stage larva from Jefferson Co. Colo. (fig. 10) is very pale-green with band #5 oddly pink, but most of my older larvae from Weld Co. Colo. (fig. 11) were browner with dashed heart-band. Overall, the early stages vary some (especially egg shape), but so far do not suggest that any taxon is a distinct species.

Taxonomic status. Adult *wyomingo* are mostly grayish-white in coloration like ssp. *ridingsii*, but the pattern of lines and spots on the wings (fig. 9) is like the tawny-colored ssp. *stretchii* (Scott & Fisher 2008). Its diapause stage differs from other ssp., though the high-altitude biennial Sierra Nevada/White Mts. Calif. ssp. *pallidus* Austin surely has TWO diapause stages that serve as connecting links: one older-larval stage used by most ssp. such as *ridingsii* and *coloalbiterra* (4th stage larva) etc., and the other 1st-stage larval stage used by *wyomingo*. Mate-locating behavior of *wyomingo* involves raiting ("perch to await females") in swales in morning (~7:50-11:00 seldom to 11:30), whereas ssp. *ridingsii* raits on hilltops at that time in N & C & S Colo. However, ssp. *coloalbiterra* and *curicata* Fisher, Scott & Garhart (evidently also *stretchi*) also rait in swales/gulches at that time like *wyomingo*, so raiting location cannot be used to declare *wyomingo* a distinct species. Eggs are intermediate. All of these traits of *wyomingo* thus show links to some other *N. ridingsii* ssp., and there may be no reproductive isolation, so I still treat *wyomingo* as a ssp. of *N. ridingsii*. The early stages of *Neominois* are obviously very similar to *Oeneis*, so they may be closely related.


Fig. 1 egg (top view, side view)


Fig. 2 new 1st stage larva


Fig. 3 later 1st-stage larva


Fig. 4 2nd-stage larva


Fig. 5 mature larva


Fig. 6 greener mature larva


Fig. 7 redder mature larva


Fig. 8 pupa


Fig. 9 emerged female


Fig. 10 ssp. *ridingsii* 4th-stage larva, Guy Hill, Jefferson Co. Colo.


Fig. 11 ssp. *ridingsii* 4th-stage larva, Terry Bison Ranch, Weld Co. Colo.

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OENEIS CHRYXUS AND *OENEIS CALAIS ALTACORDILLERA*: TYPES AND LIFE HISTORIES (NYMPHALIDAE)

by James A. Scott

Abstract. The species identity of the name *chryxus* is uncertain, so a neotype of *Oeneis chryxus* is designated from the Front Range of Colorado, belonging to the species which oviposits on twigs under conifer trees above sedge mats, raits on hilltops, has a larger male stigma, and is the only lower-altitude biennial butterfly. The other species *O. calais altacordillera* occurs mostly at higher altitude, oviposits on meadow grasses/sedges, raits in swales, has a smaller stigma, averages a greater protrusion of brown and postmedian marks etc. on the male upf, and has a more beadlike larval heart band. New hostplants are presented for *O. calais altacordillera*. The *O. chryxus* 1st-stage larva has redder stripes. *O. calais socorro* (new combination) is discussed from the San Mateo Mts. of New Mex.

Neotype for *Oeneis chryxus*. The name *Oeneis chryxus* Doubleday has been embroiled in controversy recently due to problems with the types and original publication. This causes confusion because it has become apparent that there are two species involved, not one. In Colorado, *Oeneis chryxus* occupies foothills to middle altitudes barely up to the subalpine zone, males rait ("perch to await females") on hilltops to await females for mate-location, females oviposit on twigs or narrow branches on or near the ground beneath conifer trees that have a mat of turflike sedges (*Carex rossii* and relatives) (occasionally grasses) growing under the tree, the 1st-stage larva has redder stripes, the mature larva has a solid heart band, and males have a wide stigma and have less brown and a less-angled postmedian band on upf (Scott 2006a,b); Colorado *O. chryxus* is biennial and flies only in alternate years. In Colorado, *Oeneis calais altacordillera* Scott flies every year in high altitudes from the Montane Zone up to Alpine Zone tundra, males rait in swales to await females for mate-location, females oviposit on various grasses and sedges in open meadows and open tundra, the mature larva usually has a more dashed heart band, and males average a smaller stigma (put a light bulb behind the wing to check this trait) and have more brown and more angled postmedian line and darker veins on the upf etc. (Scott 2006a).

The original description of the name *O. chryxus* was just a color painting of the upperside of a male (Doubleday 1849, plate 64, fig. 1) showing the wide stigma and mostly-orange upf (traits matching the twig-ovipositing species in the paragraph above), with "1. CHIONOBAS CHRYXUS Doubleday" printed at the bottom of the plate. There was nothing else, and vol. 2 of the same-title series (Westwood 1851) mentioned only this one specimen. Article 73.1 of the current 4th edition of the ICZN Code states "A holotype is the single specimen upon which a new nominal species group taxon is based in the original publication", therefore the male in the painting & in vol. 2 is the holotype (Article 86.3 states that the wording of this rule must be followed only as herein expressed, not the wording expressed in any earlier version of the Code, so we must interpret Art. 73.1 and all the other articles in the Code as written, not how we might like them to be used based on our preferences or prior Codes). The male was considered to be the holotype by Kondla, Scott, & Guppy (2006). That holotype male specimen is now lost, but is still valid according to Art. 73.1.4. Shepard (1984) designated a lectotype female that he thought was collected at Rock Lake, Alberta, but that lectotype designation is invalid because that female and another similar female are just paratypes if they are types at all (syntypes are all the members of a type series in which there is no holotype, and a lectotype can only be designated from syntypes, not from paratypes). Both dubious paratype females are difficult to identify, because females lack the stigma and other traits that are most useful for identification. Art. 75.1 states: "Definition. A neotype is the name-bearing type of a nominal species-group taxon designated under conditions specified in this Article when no name-bearing type specimen (i.e., holotype, lectotype, syntype or prior neotype) is believed to be extant and an author considers that a name-bearing type is necessary to define the nominal taxon objectively. The continued existence of paratypes or paralectotypes does not in itself preclude the designation of a neotype." A neotype is necessary here, because the holotype has been missing since 1849, the lectotype is invalid and unidentifiable, and there are no syntypes (just two dubious paratypes that do not show enough diagnostic characters to assign them to a species and have the inadequate locality of "Rocky Mountains"), so another specimen is needed to serve as neotype to define the species.

A neotype male is hereby chosen from a ridgetop NE of Crawford Gulch, 7,760', Jefferson Co., Colorado, June 6, 1996, collected by J. Scott (Figs. 1-2) (BMNH). This specimen resembles the figure of the holotype. I saw ovipositions and found many eggs on twigs above sedge mats beneath the *Pinus ponderosa* trees at this site, where the butterflies are biennial. Only this species *O. chryxus* occurs in Jefferson Co. This neotype means that the name *Oeneis chryxus* refers to the biennial twig-ovipositing species which occurs widely in the Rocky Mountains (Scott 2006b). The other species *Oeneis calais* occurs in the Rocky Mountains also, as ssp. *altacordillera* mostly at higher altitude from New Mex. to Nev. & B.C. & Alberta, and other *O. calais* ssp. occur in the Sierra Nevada & Olympic Mts. & across Canada from Yukon to Ontario (Scott 2006c) and the Gaspe' Peninsula in Quebec.

Figs. 1-2. Neotype of Oeneis chryxus.

The nomenclatural history of the name *chryxus* should be discussed. This case attracted vehement disagreement among lepidopterists, and Nick V. Grishin even set up a large website about it. Scott (2010) petitioned the ICZN to designate a different specimen--a male from Rock Lake Alberta recently collected by Norbert Kondla that resembled the original painting--as neotype of *chryxus,* because Shepard (1984) thought the original locality of *chryxus* was Rock Lake, Alberta, though Shepard (1984) and Scott (2010) noted the possibility that it was caught in Idaho or Wyoming by J. Burke or T. Nuttall. Three lepidopterists (Pelham et al. 2011) submitted comments critical of the petition because they had not yet learned to distinguish the two species and still believed that only one species was present, so they thought Shepard's lectotype was adequate to represent the species (Warren thought only one taxon occurs in Alberta, but actually Scott and Norbert Kondla have found both apparent species there including obvious examples of *altacordillera,* and the book Alberta Butterflies [Bird et al. 1995] illustrated a male resembling the Colorado biennial species and the *chryxus* holotype). Scott (2011) responded to those comments and explained again the differences between the two species and repeated evidence that both occur in Alberta, but he agreed with those critics that the Alberta location for the neotype is bad because the biology of this species has not been studied in Alberta, and since the two species are so different in oviposition and mate-locating behavior and were first recognized as distinct as a result of those differences in biology, the optimal neotype should be selected from a place where their biology has been well studied and such differences have been demonstrated. Therefore I have selected the present neotype from Colorado. The ICZN commissioners considered that petition, but never published an opinion because one or more commissioners thought that the holotype might still be found in the bowels of the BMNH (even though no one has definitely seen it since 1849 and many people have looked for it), and because some commissioners probably thought the Shepard lectotype was adequate (they probably thought that the original male and the two females are all syntypes thus one could be validly designated lectotype by Shepard) while others thought it was not adequate and a neotype was useful, and some commissioners surely did not wish to render an opinion on a petition involving disagreements.

There are squabbles among taxonomists concerning how one should decide whether to include specimens in the type series when those are not mentioned in the original publication. Art. 73.1 clearly states that the figured male is the holotype, and Art. 86.3 says we must accept that wording as written, not the wording in previous Codes, which means that the two females are no more than paratypes if they are types at all; they cannot be syntypes. Despite this wording, some people remember older versions of the Code and treat the male and the two females as syntypes so they think the Shepard lectotype is valid. So let's carefully consider the rules governing how to find syntypes that are not mentioned in the original publication. Article 72.4.1 states "The type series consists of all the specimens included by the author (whether directly or by bibliographic reference) except any that the author expressly excludes from the type series", thus only the figured male is in the type series because the original publication provided no reference and no mention of excluded specimens, and Westwood (1851) (in the second volume of the same-title series) mentioned only the one specimen shown in the painting. Article 72.4.1.1 states "For a species or subspecies established before 2000, any evidence, published or unpublished, may be taken into account to determine what specimens constitute the type series." Some people could use this rule 72.4.1.1 to find specimens and include them in the type series even if they belong to a different species (the two females including the lectotype are not identifiable and may belong to the other species *Oeneis calais altacordillera*), but as written ("as herein expressed", as Art. 86.3 states), Article 72.4.1.1. is numbered and indented as subservient to 72.4.1; therefore 72.4.1.1 allows one to add specimens not mentioned in the original publication to the type series, only if those specimens belong to the taxon defined by the original publication. This restrictive interpretation of 72.4.1.1 prevents the worst calamity that can befall a lectotype, namely a lectotype that proves to belong to a taxon different from that defined by the original publication (obviously you should not designate any lectotype that is a different species from the one described in the original publication). Good taxonomists use this restrictive interpretation (for instance Emmel Emmel & Mattoon [1998] rejected the lectotype of *Hesperia ruricola* Boisduval designated by Brown & Miller & Clench {designated in an obscure non-indexed place in Brown & Miller 1980} because the original description was of a yellow butterfly and the *ruricola* lectotype was brown). When the petition (Scott 2010) was reviewed by four ICZN commissioners prior to publication, two Commissioners agreed with this restrictive interpretation of Articles 72.4.1 and 72.4.1.1 (which invalidates the lectotype because those females do not resemble the painting and might belong to another species), and wrote that I could just designate a neotype without petitioning the Commission (another commissioner thought the lectotype was valid). I designate that neotype now. So the absence of an ICZN opinion on that Scott (2010) petition prevented the Rock Creek Alberta neotype proposed in 2010 from being designated, and thus satisfies the doubters who criticized that Alberta neotype, and allows the designation of the present neotype from the well-studied location of Colorado. Colorado is in the "Rocky Mountains", the only certain locality of the original holotype. Article 73.1.2 states that "If the species-group taxon is based on a single specimen [as *chryxus* was in the original publication], either so stated or implied in the original publication [nothing in the original 2-volume same-title series published from 1846-1852 by first Doubleday and then Westwood suggested that the name was based on more than the one specimen], that specimen is the holotype fixed by monotypy. If the taxon was established before 2000 evidence derived from outside the work itself may be taken into account [Art. 72.4.1.1] to help identify the specimen." Such evidence was found in Westwood (1851) which listed only the male holotype and its locality "Rocky Mountains"; that evidence assigned the type locality of "Rocky Mountains" to *chryxus*. Doubleday's 1848 list of BMNH specimens also listed "Rocky Mountains" for three "Chionabas ?" specimens, which probably included the *chryxus* holotype plus the two dubious-paratype females including the invalid lectotype female (because 1+2=3), thus probably also assigns the "Rocky Mountains" TL to *chryxus*; but I deal only with facts here, and do not wish to conduct a farcical séance to determine what Doubleday was thinking when he wrote the words "Chionabas ?" (And 1+2 might not equal 3 *Chionabas*?, because Doubleday couldn't find and count specimens very well--my compilation below in this Papilio (New Series) issue titled "Rocky Mountains Butterfly specimens Donated by the Earl of Derby to the BMNH…" shows that there is very frequent disagreement between the number of those donated specimens published in Doubleday's 1848 list and the actual number of specimens present in BMNH; Doubleday missed most of them.)

A lot of time—surely more than a thousand hours--was wasted by many persons arguing and writing about the nomenclatural details surrounding the name *chryxus*, so this neotype should be welcome as it settles the identity of the two species involved. People who believe that there is just one species can happily continue to use the name *chryxus* and ignore these nomenclatural matters. I believe those people will gradually accept the existence of two species as they gradually learn how to identify them and we learn more details about their distribution etc. The differences in male stigma size and color pattern are real and need to be examined on the 20,000+ specimens that exist in collections. The populations with primarily odd-year and even-year biennial flight periods need to be fully discovered and mapped. Mate-locating and oviposition behavior need to be studied much more widely (it is easy to find the big white eggs on low or fallen tree branches above sedge mats, so people must search for them). If someone objects to the current neotype they could submit a petition to ICZN to attempt to invalidate it, but considering the controversy and disagreements and squabbling involved in about every aspect of this case, there is zero chance that the ICZN will either publish another petition involving *chryxus*, or publish an opinion on any such petition. The proper interpretation of the relevant 4th edition of the Code makes the new neotype the valid objective standard for the definition of the name *chryxus*.

There is one lesson to be learned in this matter. Lectotypes should not be designated as a matter of curatorial routine, as Shepard (1984) did. For neotypes, Art. 75.2 states "A neotype is not to be designated as an end in itself, or as a matter of curatorial routine, and any such neotype designation is invalid.", but this is only a recommendation (74G) for lectotypes. Shepard (1984) designated another invalid lectotype: the valid *Euphydryas anicia* lectotype was another specimen, designated lectotype by Jean Gunder, as I demonstrate elsewhere in this Papilio (New Series) issue.

Hostplants of *Oeneis chryxus* and *O. calais altacordillera*. Scott (2008) detailed the early stages of *O. calais altacordillera*, and illustrated the egg, larva, and pupa. But hostplants of it were inadequately known, so newly-discovered hostplants of *altacordillera* and the well-known hosts of *Oeneis chryxus* are presented here.

Hostplants of *Oeneis chryxus* (most from Scott 1992, 2006d). *O. chryxus* occurs only in or beside forests because its hosts grow under trees. These forests are mostly *Pinus* trees and occasionally *Pseudotsuga*, but never *Picea* because *Picea* tree branches grow down to the ground and thus shade and kill all macroscopic living things underneath (even King Bolete mushrooms). (And most *Pinus contorta* forest is also dog-hair thick which shades and kills all other life.) Scott (1992, 2006d) observed oviposition and found 61 eggs on twigs and branches above mostly-sedge (occasionally grass) mats under the trees, and two more were found in 2014. The twigs were mostly dead and still attached to the trunk, or broken off the tree and fallen to the ground (one twig was a dead *Cercocarpus* branch). 41 eggs were found above *Carex rossii*, 7 above *Carex geyeri*, 6 above *Carex inops "pensylvanica" heliophila* (another above that and *Poa pratensis agassizensis*, and another above that and *Elymus lanceolatus*, *Stipa comata*, and *Bromopsis lanatipes* grasses), 1 above *Carex foenea*, 1 above *Carex pityophila=geophila* & *C. rossii*, 2 above *Poa pratensis agassizensis* (and 4 more above that and *C. inops heliophila*). All these *Carex* are short turflike plants that grow in mats so look like lawn grass, and *Poa pratensis* IS lawn grass. And another locality had only *Carex brevipes* so that is the host there. In the lab, larvae eat grasses well, and in nature many trees had various amounts of grasses growing underneath also, so the conclusion is that the hostplants are mostly turflike mats of sedges (*Carex* esp. *C. rossii*) and sometimes grasses that grow in the shade of conifers (mostly *Pinus*). Obviously temperatures in the shade under the trees are lower than out in the open meadow, and the early stages of *Oeneis* (and closely-related *Neominois*) take 2-5 months even in lab with constant light and warmth, so the early stages in nature are much longer than that, which explains the fact that *O. chryxus* is the only butterfly in the lower mountains of Colorado that is biennial. *O. chryxus* flies mostly in even years in Colorado and southern Wyoming and central Idaho and Montana and NE Nevada, mostly in odd years in northern Wyoming (Wind River Mts., Bighorn Mts., Teton Mts.), and 5 of 6 from "Brewster" in Okanogan Co. Wash that I have seen were from odd years.

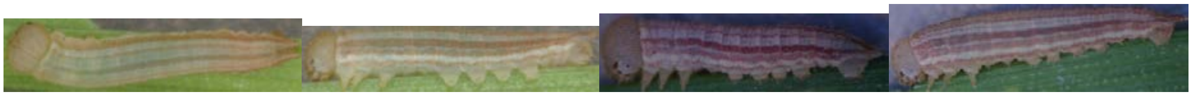
What is the origin of this twig-ovipositing behavior? Krzysztofiak et al. (2009) evidently reported that Poland *Oeneis jutta* (Hübner) oviposits on *Pinus* trunks or twigs ("In all observed egg-laying cases, a butterfly sat on a tree trunk or branch, at a height not greater than 1 m above a peat bog."), and hostplants were cited as cottonsedge *Eriophorum vaginatum* in Poland and elsewhere, and elsewhere as the sedge *Carex concinna*, the rush *Juncus*, and grasses *Molinia caerulea & Glyceria*. I wonder whether *Oeneis nevadensis* oviposits on twigs, as it is a forest species also. James & Nunnallee (2011) wrote that "Neill (2007) reported that *O. nevadensis* females stick eggs to blades of grass or nearby structures close to the ground.", so I wonder what that means (were those "structures" twigs?; and Satyrinae including *Oeneis* do not oviposit on green blades of grass). Those species evidently are slightly basal to the phylogenetic tree branch producing *O. chryxus/O. calais/O. alberta*, so one wonders if twig-oviposition was primitive in the group, rather than convergently evolved (*chryxus* may be similar to the progenitor as its wing pattern is similar to *nevadensis*, then presumably *calais* evolved to live on grasslands and *alberta* evolved to fly early on drier grasslands as their stigma shrank).

Hostplants of *Oeneis calais altacordillera.* In 2013 I observed five ovipositions in the subalpine zone of Clear Creek Co. Colorado by two females that flew slowly over grasses in an open unforested area. All Satyrinae lay eggs on dead grass/sedge blades or twigs etc. among the live grass or sedge hosts (except *Cercyonis pegala* and *Lethe eurydice* oviposit on green hostplants sometimes, in my experience), and these females are no exception as they oviposited on three dead leaf blades of grasses and a dead leaf blade of *Carex deflexa boottii* and a small dead *Vaccinium myrtillus oreophilum* stem, among bunches of the following grasses and sedges which are thus proven hostplants: *Bromopsis inermis pumpelliana* (2 eggs), *Festuca calligera* and *Bromopsis inermis inermis/pumpelliana* (1 egg), *Poa fendleriana fendleriana* (1), and *Carex deflexa* var. *boottii* (1). *Bromopsis ciliata* is surely also a host at this locality based on its abundance in the area. Daily et al. (1991) also found that females in a meadow oviposited on grass, aspen saplings, sagebrush, *Potentilla gracilis*, dead twigs & leaves, and one larva was found on *Poa nemoralis interior* a hostplant that was common and widely distributed there. In the lab, larvae eat grasses well (*Agropyron repens* and *Poa pratensis* etc.), and presumably can eat sedges well also. *O. calais altacordillera* is certainly biennial also (because all Alpine Zone/arctic butterflies are either biennial or multiannual [*Chlosyne whitneyi damoetas, Boloria improba acrocnema,* plus most northern Alaska *Colias* studied by Jack Harry, are now even known to be able to overwinter for two or three years or just one sometimes, so those multiannual species can even be absent for two years in a row for instance and yet be common the next year]), but the difference from *O. chryxus* is that *altacordillera* occurs in colder higher-altitude places where the open meadow-grassy habitats are cold too. It would be impossible for *altacordillera* or any other butterfly immatures to develop in the full shade under a *Picea* tree in the Subalpine Zone of Colorado.

In lab, *O. calais ivallda* larvae ate sedges well (2 *Carex* sp., *Cyperus*), and *Imperata* grass well, and *O. calais stanislaus* larvae also ate sedges well (*Carex stricta*, *C. spissa*, *Scirpus atrovirens*) (James & Nunnallee 2011).

O. calais altacordillera flies every year in all Colorado localities as far as known, even though it is biennial or multiannual. *Oeneis calais* is a cold-adapted species that extends to the alpine Sierra Nevada and Yukon and the colder areas of Canada. Adults fly mostly in odd years in Calif. ssp. *ivallda*, often odd years in Manitoba ssp. *calais,* odd and even in Mich. & Ontario ssp. *strigulosa*. Larvae of *O. calais ivallda/stanislaus, O. c. valerata,* and *O.* sp. [*calais altacordillera* or *chryxus*, from Mt. Hull Okanogan Co. Wash., species identity undetermined] diapause as late-1st-stage larvae and 4th/5th-stage larvae (James & Nunnallee 2011 & references therein). The mature larva of *O. c. ivallda* fig. by James & Nunnallee 2011 has a solid blackish heart-band like a minority of *altacordillera* (most *altacordillera* and *O. calais strigulosa* and *O. calais valerata* and *O. alberta* have this heart band a series of dark dashes), but *ivallda* should still be placed in *O. calais* because the majority of traits fit that assignment (notably wing pattern and high altitude and lack of twig oviposition in its usual tundra habitat), and despite the mate-locating behavior of *ivallda* of raiting on hilltops.

1st-Stage Larva Coloration of *O. calais altacordillera* and *O. chryxus*. *O. chryxus* 1st-stage larvae seem to have redder stripes, as suggested by Scott (2008), and the new photos below confirm this.



Figs. 3-4 (left) *O. calais altacordillera* Loveland Ski Area, Clear Creek Co. Colo. Figs. 5-6 (right) *O. chryxus* from TL NE Crawford Gulch, Jefferson Co. Colo., 2014.

***Oeneis calais socorro*, new combination.** Holland (2010) named this from the N half of the San Mateo Mts. in Socorro Co. New Mexico (discovered by Kilian Roever), and figured 2m1f. Holland distributed types to four museums, but his collection (now in Gillette Museum at Colorado State University) still has 18m4f, which I examined courtesy of Dr. Paul Opler. *O. calais socorro* is actually a valid ssp. of *O. calais* similar to *altacordillera*, as its stigma and browner male ups (including brown median & veins on upf) suggest, its unh is more often finely-strigulated like many N New Mex. *altacordillera*, it flies in even and odd years like *altacordillera,* and a paratype male is dark melanic brown, a variant occasional in *altacordillera* but not in *O. chryxus*. Additionally, my collections across northern New Mex. produced only *altacordillera*, and Holland's collection has only that from the Jemez Mts. & Rio Arriba & San Miguel Counties. In the Sangre de Cristo Mts. of NE New Mex., Holland found *altacordillera* sympatric with *O. chryxus* N of Mt. Wheeler in Taos Co. (*altacordillera* mostly at higher altitude, *chryxus* mostly lower) and those plus 2m1f in his coll. from ~Cerro Vista NW Chacon in Taos Co. (coll. Steven J. Cary) are the first true *O. chryxus* I have seen from New Mexico. Ssp. *socorro* is a valid ssp. distinguished by a weaker unh median band, which is weak in half the males, strong in only ~10% (the band is weak in Holland's figs. 5m & 7f and Table 1 indicates it is weak on average, while it looks strong through the uph of his fig. 3m), whereas in

N New Mex. *altacordillera* it is weak in only ~20% and the band averages even stronger in Colorado northward (the unh band is always weaker in females than males). *Socorro* also averages more orange in the median area of male upf cell CuA_2 though many have this area brown. Ocellus size and upf vein darkness do not differ. (Holland did not give localities of his Figs. 1-2 males, which look like *altacordillera*; those are not in Gillette Museum.) Holland did not study whether males mate-locate by raiting in swales or on hilltops, and did not look for eggs on twigs/branches under pine trees; those traits need to be studied by biologists. Inbreeding and even introgression may have occurred in the history of *socorro*.

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TYPE LOCALITY AND LECTOTYPE OF *CHLOSYNE WHITNEYI DAMOETAS* (NYMPHALIDAE)

by James A. Scott

Abstract. The TL of *damoetas* is the alpine or near-timberline talus on the Flat Tops, Garfield Co. Colorado, based on new information about the travels of its collector. Miller & Brown (1981) designated the lectotype in CMNH when they wrote and labeled it as "holotype."

Skinner (1902) named *Melitaea damoetas* from Colorado from three locations: "Described from four specimens from Colorado as follows: One from South Park, viii. 15.02 [1902] John [John A. Comstock] and Hurd Comstock; two from Prof. A. J. Snyder, Williams River Range, viii. 9.02 and Hall Valley, vii. 21.02; one from E. [Ernest] J. Oslar." Thus the type series was four syntypes from three localities, and no holotype was mentioned. Fig. 1 is a photo of two specimens in CMNH taken by John V. Calhoun. The left specimen was fig. by Holland (1931) as a "paratype" based on the positions of its antennae, while the right specimen has a label "seems to be holotype". Calhoun notes that the right specimen may be the syntype that Pelham (2008) listed as syntype (#7,021) in ANSP. The right specimen's "holotype" label is consistent with the handwriting of F. M. Brown, which evidently accounts for this listing of TL in Miller &

Brown (1981): “Williams River Range (=Williams Fork Range), Summit/Grand Cos. Colorado. HT in CM”. This listing means that the holotype specimen is the rightmost specimen in Fig. 1 and is one of the specimens listed by Skinner (1902) as collected by Snyder on 9 August 1902 at Williams River Range. Miller & Brown’s statement “HT in CM” is a clear designation of a lectotype, because a holotype was not designated in the original description by Skinner (1902) so the four types are syntypes from which a lectotype can be designated but not a holotype (a holotype must be designated in the original description). The specimen figured by Holland in 1931 was presumably in CMNH at that time, while the other was probably transferred to CMNH from ANSP in 1963, according to Calhoun.

Fig. 1. Photos of 2 male *damoetas* in CMNH (taken by John Calhoun). The label on right evidently says “seems to be …holotype”

However, the TL is evidently the Flat Tops in Garfield Co. Colo.

Ewan & Ewan (1981) and Ewan (1950, which has extra words bracketed in [ ] below) present this biography of one of the collectors: “COMSTOCK, JOHN ADAMS, 1883-1970. Entomologist, specialist in the Lepidoptera, b. Evanston, Ill.; DO Osteopathy, Los Angeles 1914; MA Occidental 1924; active member of the Chicago Entomological Society; chief curator of the natural sciences, Los Angeles County Museum, 1928-1948, and well-known author of Butterflies of California (1927). He collected diurnal Lepidoptera in Colo. during the summer of 1902 with his brother, Hurd, and [Prof.] A. J. Snyder, q.v. The party outfitted at Denver with covered wagon, pair of mules and saddle horse, and traveled up Turkey Creek Canyon to Hall Valley, the famous locality of David Bruce, q.v. Circling northwestward, they entered the White River Forest Reserve. In Flat Tops region, they collected the type of Melitaea damoetas Skinner. “In 1902 the back country of Colorado was still very primitive and the roads were difficult. We furnished most of the meat for the party with our rifles.” (J.A.C. in letter to J. Ewan). The only publication emanating from this 1902 trip was a humorous note on the ‘Rocky Mountain Humming-bird,’ Entomological News (13 (1902): 258. They visited E. J. Oslar, q.v., [the well-known professional collector], at his home in Denver. AMSCI; C. Stock in *Los Angeles Mus. Quart.* 7 (1948): 11-12, portr.; L. M. Martin in *Jour. Lepidop. Soc.* 25 (1971): 215, portr., which refers for complete biog. and bibl. to *25 *Ann. Lepidop. Soc.* (1972).”

The Williams Fork Mountains are SE of Craig and are too low in altitude to have *damoetas*. However, the Williams Fork River is just south of the Williams Fork Mountains and extends upstream in the East Fork of Williams Creek to its source at Flat Tops in northern Garfield Co. Colorado, so that spot must be what was called “Williams River Range”. That locality does not come anywhere near “Summit/Grand Cos.” which was an error by Miller & Brown (1981), who also erred in assuming that “Williams River Range” meant “Williams Fork Range”. The Flat Tops include alpine tundra and talus slopes above and below timberline (the habitat of *damoetas*), and a later collector Don Eff reported *damoetas* from the Flat Tops, along with *Erebia theano*, so the species does occur there. Therefore the locality on the lectotype of

"Williams River Range" and the locality of Flat Tops in John Comstock's letter to Joseph Ewan agree that the TL is the Flat Tops in Garfield (nearly all the Flat Tops mesa is in Garfield Co.)/Rio Blanco/Eagle Cos. Colo. There are only two roads into the Flat Tops now, but maybe the Trappers Lake road would be passable in 1902.

So the correct type data for *damoetas* is this: the lectotype was designated by Miller & Brown (1981) (the right specimen on Fig. 1 in CMNH mislabeled "holotype") because their calling it the holotype is a clear designation of "the type" therefore is in this case a valid designation of lectotype, and the TL is the alpine or near-timberline talus on the Flat Tops in Garfield Co. Colorado. (I have learned that there are hundreds of squabblers. If any squabbling person claims that Miller & Brown did not validly designate the lectotype, I hereby state that the specimen is the lectotype. So those squabblers can write that I designated it.)

Acknowledgments

I thank John V. Calhoun for information and the photo.

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EARLY STAGES OF *CHLOSYNE ACASTUS ARKANYON* (NYMPHALIDAE)

by James A. Scott

Abstract. The hostplant, eggs, older larvae, and pupae are described.

Chlosyne acastus arkanyon Fisher & Scott occurs in the upper Arkansas River Valley in Colorado, and is distinguished by a blacker upperside. Some 3rd-, 4th-, and mature larvae were found near Poncha Springs, Chaffee Co. Colo. May 7, 2014, and reared.

Hostplant. Most larvae were found on about 6 *Chrysothamnus viscidiflorus* bushes growing on soft ochre rock (finely pulverized out of hard Precambrian rock by a major fault along the Rio Grande Trench that allowed the W side of the Sangre de Cristo Mts. to rise in a block) on a slope, and two 4th- and 5th- stage larvae were found on *Chrysothamnus nauseosus* bushes in the gulch bottom, where they possibly wandered. Most larvae were found on upper branches with green leaves in cool weather late in the day, while several were found resting in litter under the bushes. Lab larvae ate *C. viscidflorus* well, and also ate numerous leaves (leaving the bases) of *C. nauseosus*, so *C. nauseosus* is evidently an additional occasional host of *arkanyon*.

Diapause Stage is obviously 3rd-stage larva, because that was the smallest stage found (several) and several 3rds continued to diapause and died in lab and one 3rd-stage was still diapausing in June 2014 (so would diapause until 2015), though 4th-stage could possibly also diapause (most larvae found); 5 near-mature larvae were also found. So this bug is annual & often multiannual.

Egg. Pale greenish, laid in large clusters on host.

3rd-stage larva (fig. 2) similar to mature larva; head width 1.1-1.2 mm.

4th-stage larva (fig. 3) similar to mature larva; head width ~1.7 mm.

Mature larva (figs. 4-6) all black, covered with hundreds of tiny yellowish dots (all yellowish markings on larva are actually yellowish-cream), some tiny yellow-cream dots beside BD1 scoli on A2-8 form a paler band edging the middorsal black heart band that occurs on T1-A8, two lateral rows of larger pale-yellow spots (the upper row just above spiracles includes brownish-orange clasping the underside of BSD scoli on A2-8 [very weakly on A2 and A8]) (the lower row [on T2 rear to T3-A8] just below BL scoli includes a brownish-orange ring around BL scoli on A2-8 [very weakly on A2 & A8]), spiracles surrounded by a yellowish oval ring (L1 surrounded by gray ring), scoli long, black; head solid black, width ~2.1-2.2 mm.

Pupa from afar looks uniform ugly brownish-black. In closeup (figs. 7-8), dull black with fine tan mottling (some pupae have fine paler whitish-tan mottling), 3 rows of orange-brown cream-tipped small cones (middorsal A1-8, subdorsal T2-A8, supralateral A2-4), some small yellowish-cream patches (above spiracles, on A3-8 especially the 3 movable intersegmental areas, sublateral A4-8, some supraventral black circular spots A4-8, spiracles surrounded by tan ovals, most of proboscis and midventral abdominal area and ventral cremaster area black, a sunken ventral area just anterior to cremaster and a round rodlike bump on front of A10 near midventral axis, shoulder on each side of cremaster, orbits of eye black, some yellowish-cream between the orbits on front of head, various yellowish-cream marks (on top point of thorax, one across hind leg), yellowish-cream marks on wing (several on higher points of wing base, one at discal cell end, and many postmedian and marginal dots [one at each wing vein], one on each antenna segment).

Comparison with other *C. acastus* ssp.: Ssp. *acastus* (W. Edwards) from Bighorn Mts. Wyo. (host *Aster* [*Eucephalus*] *glaucodes* there and in Eagle Co. Colo., Scott 2006) is similar and also has some brownish-orange crescents below BSD scoli, and pupae varied in color, one pupa blackish like *arkanyon*, but brownish in several pupae. Internet photos: Ssp. *acastus* (Gallatin Co. Mont., host *C. viscidiflorus*) mature larvae are similar to *arkanyon*, but no orangish or reddish is visible above spiracles. Ssp. *acastus* mature larva (Carbon Co. Mont., S. Kohler, host *C. viscidiflorus*) is also similar, and has a slight amount of orange-brown below the SD scoli on A2-8 esp. A2-7, and has a slight amount of orange-brown around BL scoli on A2-8. Ssp. *sabina* (W. Wright) (Ariz., host *Dieteria asteroides*, Ken Kertell) mature larva is similar, with row of orange-tan crescents below BSD scoli on A1-9 esp. A4-7. Ssp. *neumoegeni* (Skinner) (St. George Utah, Todd Stout & Jacque Wolfe, host *Machaeranthera* [*Xyloriza*] *tortifolia*) is similar but mature larva has dark-red-tan crescents below SD scoli, and pupa has red-orange above spiracles on A3-7 and has tiny orange-tipped cones over abdomen.

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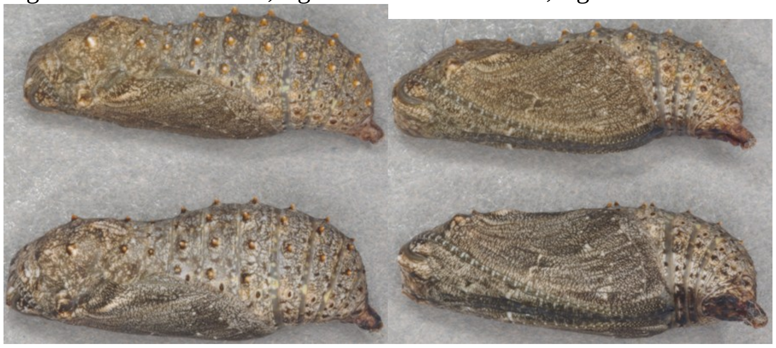
Fig. 1 Eggs.


Fig. 2. 3rd-stage larva.


Fig. 3. 4th-stage larva.


Figs. 4-6. Mature larvae, fig. 4 on litter under host, figs. 5-6 on host branches.


Figs. 7-8. Pupae, two slight variations.

THE TYPES AND IDENTITY OF *EUPHYDRYAS ANICIA ANICIA* (DOUBLEDAY), 1847 (NYMPHALIDAE)

by James A. Scott

Abstract. This paper corrects the type series and lectotype of *Euphydryas anicia anicia*. There were three syntypes, and Gunder (1929) validly designated the lectotype, a different male than the male that was invalidly designated lectotype by Shepard (1984). The name applies to a reddish-black ssp. of limited range in W-C Alberta.

Study of the specimens donated to the BMNH (now Natural History Museum London) by the Earl of Derby and the specimens in that museum listed by Doubleday (1848) (see my compilation of those donations and specimens below in this Papilio [New Series] issue), has revealed some mistakes in types designated from those specimens, including the lectotype of *Euphydryas anicia* designated by Shepard (1984). Photos of the original *anicia* engraving by

William Hewitson (in Doubleday 1847), photos of both *anicia* types now in BMNH and their labels (taken by Joseph Belicek), and the photos of two female *anicia* in Gunder (1929), show that there are actually three candidate type specimens, not two as Shepard (1984) thought, and the lectotype was actually designated by Gunder, not Shepard (1984), and the lectotype is actually the male accessioned in 1847, not the male accessioned in 1845.

The type series. There were THREE original specimens that are syntypes, although the female syntype illustrated by Gunder was lost sometime between 1929 and 1984. The existence of three specimens is clear from the text of Doubleday (1848), from the three different "Rocky Mts." labels (paper size, number and position of pinholes, and handwriting), and from morphology of the three different specimens (number of antennae, wing shape and markings, flaws on the wings, body shape).

Doubleday (1848, Appendix p. 20), an inventory of butterflies in the British Museum, cited THREE specimens in this entry: "Melitaea anicia, Doubleday & Hewitson, Genera of Diurnal Lepidoptera, t 23, f. 2. a—c. Rocky Mountains. Presented by the Earl of Derby." The a—c in the listing means that three specimens of *anicia* a, b, and c were present in the museum then.

There are THREE different labels which show different details on the letters, different pinholes, and different sizes. Two of the labels say "Rocky Mts. Pres by Earl of Derby 45-136", and the third label says "Rocky Mts. Pres. by Earl of Derby 47-74" (These numbers are entries written in the Accessions Books of the museum, and mean that the first two specimens were received in 1845 as part of accession number 136, while the third specimen was received in 1847 as part of accession number 74). The Gunder paralectotype female label—one of the two labeled 45-136--is much shorter than the other two, so it is obvious that the label could not grow and double in height between 1929 to the 1990s when Joseph Belicek photographed the other two labels. Labels can be cut down with scissors, but they cannot grow larger. All three labels have similar handwriting (the same v-like r in "Pres", the same squatty y's in "by" and in "Derby") so all three clearly are original labels.

And there are THREE individual specimens with different morphologies, as noted below.

Following are crucial details of each specimen and illustrations of the specimens and their labels. To simplify the discussion, each of the six specimens/illustrations of importance in this matter is numbered from A to F below, and shown as figs. A to F. The original *anicia* engraving is numbered #A, the four photographed specimens (three types and one non-syntype) are numbered #B, #C, #D, and #E, and Gunder's valva drawing is numbered #F.

A)(fig. A). The original *anicia* engraving by William Hewitson (in Doubleday, 1847) depicted a rather blackish-red male like both male types #B & #C below. Based on a comparison of this engraving to all four specimens (#B-#E below), the engraving best resembles male #B below, but resembles #C in some traits. It is a partial chimera, as noted below. The engraving resembles the blackish-red specimens collected by Kondla at Rock Lake, Alberta.

B)(figs. B1 ups, B2 uns, B3 labels). Male (not female) paralectotype specimen, still present in BMNH, designated as lectotype by Shepard (1984). This specimen has Shepard's large red lectotype label. This specimen is obviously a male (not a female as Shepard thought), based on obvious differences of more pointed forewings and smaller size and narrower abdomens of males compared to females. The four wings are intact although the ups of right wings is quite scratched. It has one antenna. The abdomen tip on the underside shows both valvae and shows the sternum descaled by a brush anterior to the valva, where someone in the past brushed off the scales in order to examine the valvae. The "Rocky Mts. Pres. by Earl of Derby 45-136" label is about 12mm wide, and about 20 mm long top-to-bottom. The capital R and the capital P on that label have the top horizontal part extended considerably to the left. On the unlettered bottom half of that label are 4 big pinholes, and a whiter area where the circular "45-136" label resided for decades and reduced the oxidation of the larger label beneath. The little r in the word "Pres" is rather strangely v-shaped (like the lower case of the greek letter gamma), and the y's in the words "by" and "Derby" are squashed dorsoventrally in an odd way; these peculiarities are the same in the Rocky Mts. label on the other two specimens, proving that these three labels are original labels written by the same person. The circular 45-136 label has 5 big pinholes and a chunk out of the side. This specimen also has three other labels: a yellow-rimmed "Co type" label, a blue-rimmed "LECTO- TYPE" label, and a rectangular "anicia paratype" label. Shepard (1984) mistakenly thought this specimen was a female, and mistakenly thought that Gunder's rightmost female (fig. E) was this specimen (they do not resemble each other at all, contrary to Shepard), and mistakenly thought that Gunder's figured label was from this specimen; the wings antennae and labels clearly show Shepard was mistaken. (Shepard claimed that his lectotype #B best resembles the Hewitson engraving, but his statement is flawed because he mistakenly thought his lectotype was a female, and he thought it resembled the rightmost female in Gunder, which is grossly different.)

C)(figs. C1 ups, C2 uns, C3 underside of abdomen tip, C4 labels). Male lectotype specimen, the lectotype designated by Gunder (1929, who did NOT illustrate its wings), which is still present in BMNH. It has the front part of the tip of left forewing a bit deformed and anteroposteriorly shortened a tiny bit but not folded over. This specimen is obviously a male, based on its wing shape etc. The body is angled (yawed) clockwise 15 degrees compared to the wings, and the abdomen is curved counterclockwise to compensate. It has one antenna. The ventral abdomen tip (fig. C3) does not look like Shepard's lectotype male #B, as the tip shows a tan-colored chitinous curved thing, which represents the ventral edge of the right valva—the lateral side still covered with some white scales--as it curls medially while it extends distally; to the right of that valva on the photo in ventral view (left on the specimen) there is a space, where the left valva is ABSENT (Gunder's illustration of valva showed the right valva). The label "Rocky Mts. Pres. by Earl of Derby 47-74" is long, about 12X20 mm in size like that on male #B. The top line of the R in Rocky does not extend to the left as it does on the label on male #B. The r in "Pres" and the two y's in "Rocky" and "Derby" are oddly shaped, just as they are in the "Rocky Mts." label on the other two types. The P has the top line extended leftward much less than on the specimen #B label. There are 5 pinholes from top to bottom on this label, one of them grazing the bottom of the o in the word "of", and the pinhole below that much smaller. The bottom unlettered part of the label has a whiter area where the circular label "74 47" resided and protected it from oxidation for decades. That circular label has the vertical element in the two "4" numbers very short, and has 8! pinholes, two of them smaller. This specimen also has three more labels: a red-rimmed "type" label, an old rectangular "anicia Dbld. type male" label, and a rectangular label "B.M. TYPE No. Rh.8422 Melitaea anicia male D. & H.". Shepard (1984) mistakenly thought that Gunder's leftmost female (fig. D) was this specimen, and mistakenly thought Gunder's leftmost female was from 1847; it obviously is neither (this specimen would have to transform its wings and body and grow an antenna to resemble the 1847 male). Shepard mistakenly wrote that this specimen was not even a paralectotype.

D)(fig. D). Female paralectotype specimen. It was figured by Gunder (1929) plate 5 as the leftmost whole female, the underside of left wings of same female, and the label. It was [mis]labeled "type male <u>anicia</u>" by Gunder. This paralectotype was lost sometime after Gunder figured it, so Shepard 1984 and Joseph Belicek did not find it (or at least did not mention it). It is obviously a female, with large rounded forewings, fat abdomen, etc. It has NO antennae. The left forewing tip costa is folded back/compressed, which evidently happened when the wing was folded back either in the envelope when collected or during later mounting. The left hindwing underside has a blackish streak across it roughly behind the discal cell then along vein CuA_1. The wing pattern of this female, notably on the apical area of ventral hindwing, is different from that of the other specimens. The label “Rocky Mts. Pres. by Earl of Derby 45-136” is about 12 mm wide, but only 8 mm long, much shorter than the equivalent label on the other two types (this label would have to double in length between 1929 and the 1990s to match the labels on the existing two male types, so this label is obviously different). The R in “Rocky” has a little black spot on upper left but the upper element doesn’t extend leftward much. The r in “Pres” and the two y’s in “by” and “Derby” are oddly-shaped just as they are on the other two equivalent labels on the other two type specimens. This label has only one pinhole, just below the t in “Mts.”. Gunder (1929) made a bad mistake on the upper left of his pl. 5: he attempted to illustrate the adult of his male lectotype (specimen #C), and Gunder’s pl. 5 labeled the upper left specimen “type male anicia”, clearly indicating Gunder’s intention to actually depict his male type, but someone mistakenly substituted photos of the wings and label of this female paralectotype (#D), perhaps because it is a better specimen than the scratched males. This mistake probably happened when someone at BMNH sent the wrong photo, because this female specimen (#D) and its label obviously differ from the two males (#B and #C) and their labels now in BMNH. Gunder should have caught this bad mistake.

E)(fig. E). Female non-syntype specimen, figured by Gunder (1929) on plate 5 as the right-most whole female and the underside of left wings of the same female. It is merely labeled “female” by Gunder. The ventral hindwing reddish areas are dark on this female. This is obviously a female as it has broad rounded forewings and fat abdomen etc. The wing margins are perfect on this female, the forewings are mounted insufficiently forward, and it has both antennae. I consider this female as a non-syntype because it is not labeled “type”, and the label to its left I assume belongs to the leftmost female that has the words “type male anicia” beneath, and not to this non-syntype female.

F)(fig. F). Valva drawing: the inner face of right valva is drawn on Gunder’s (1929) plate 5. This drawing is labeled “anicia” and “TYPE”, and below it “ROCKY MTS. N.A.” and “(RE-DRAWN)”. “ROCKY MTS. N.A.” is the locality of the type in the original publication.

Which male was used for the genitalia drawing in Gunder (1929)? Gunder’s (1929) text on p. 4 says “*Anicia* Dbldy. and Hew. Mr. N. D. Riley of the British Museum made the drawing of the genitalia of the type specimen from which my illustration was made.” Clearly, Gunder asked Riley to find the type and draw its valva. So, Norman D. Riley looked in the museum for the type, and he picked out the male #C donated in 1847, because it has three old labels designating it as the type, including an old handwritten rectangular label “anicia Dbld. type male”, and a square label “B.M. TYPE No. Rh.8422 Melitaea anicia male D. & H.”, and a red-rimmed label “type”. Those labels are old, and were evidently placed there by Riley & Gabriel (1924) while they compiled their catalogue of type specimens in the museum. So it makes perfect logic that Riley picked out that #C “type” specimen and drew its valva for Gunder (1929). The other male—the 1845 male #B--looks like it has been examined genitalically by someone, because the sternum on the abdomen tip of that lectotype seems to show the scales brushed off. However, both valvae of #B are still present and in place, thus neither provides the full view of the inside of the valva depicted in Gunder’s drawing of the right valva. In contrast, the abdomen of the 1847 male #C, has the the right valva exposed for viewing because the left valva is missing (Fig. C3). The most likely reason that Gunder re-drew the valva was that Riley broke off the LEFT valva of #C and drew it and sent the drawing to Gunder, and then Gunder had to re-draw it in mirror image so that he could illustrate the inner face of the RIGHT valva, to match the right-valva view displayed on all of his 42 genitalia drawings.

FIGURES A-F below are *Euphydryas anicia anicia* types (except Fig. E) and their labels:


Fig. A, original Hewitson male figure (Doubleday 1847)


Fig. B1, paralectotype male upperside, BMNH, (photo J. Belicek)


Fig. B2, paralectotype male underside, BMNH, (photos J. Belicek)


anicia
Paratype

Rocky mts.
Pres. by
Earl of Derby
45-136.

Co-type

LECTO TYPE

Lectotype of
Melitea anicia
Doubleday, designated
by Jon H. Shepard 1983

Fig. B3, paralectotype male labels, BMNH (photo J. Belicek)


Fig. C1, lectotype male upperside BMNH (photo J. Belicek)


Fig. C2, lectotype male underside BMNH (photo J. Belicek)


Fig. C3, lectotype male abdomen tip underside


anicia, Dbld
type ♂

Rocky mts.
Pres. by
Earl of Derby
47·74.

Type

74
47.

B.M. TYPE
No. Rh8422.
Melitaea
anicia.
♂ D.&H.

Fig. C4, lectotype male labels BMNH (photo J. Belicek)

Fig. D, paralectotype female (lost) fig. Gunder (1929) plate 5 (left side)

Fig. E, female non-syntype fig. Gunder (1929) plate 5 (middle of plate)

Fig. F, lectotype valva fig. by Gunder (1929) plate 5

The type series: is there a holotype or a holotype by monotypy? Only one apparent specimen (the engraving of a male, #A) was depicted in the original publication, so that male specimen must be the holotype by monotypy, as suggested by these articles: Article 73.1 states "A holotype is the single specimen upon which a new nominal species-group taxon is based in the original publication…", which as written ("as herein expressed" in Art. 86.3) suggests that because the *anicia* original publication had only one specimen illustrated and had no text except the name "*anicia*", that specimen is therefore holotype. And the official Glossary defines holotype as "The single specimen designated or otherwise fixed as the name-bearing type of a nominal species or subspecies when the nominal taxon is established.", so the figure must be the holotype (even though that specimen was not "designated" as type, because biologists did not think in those terms back then). Article 72.4.1 states that "The type series of a nominal species-group taxon consists of all the specimens included by the author in the new nominal taxon (whether directly or by bibliographic reference).., and the original publication only showed one apparent specimen, which suggests that specimen must be the entire type series and thus must be the holotype, as there was no bibliographic reference. Also, Art. 73.1.2 states "If the nominal species-group taxon is based on a single specimen, either so stated or implied in the original publication, that specimen is the holotype fixed by monotypy…", so the male depicted in the painting must be the holotype as no others were mentioned or depicted.

However, Art. 73.1.2 continues with the statement "If the taxon was established before 2000 evidence derived from outside the work itself may be taken into account [Art. 72.4.1.1] to help identify the specimen.", and it cites Recommendation 73F that also suggests that we should look for other specimens that might be type specimens. So we must consult Art. 72.4.1.1, which states "For a nominal species or subspecies established before 2000, any evidence, published or unpublished, may be taken into account to determine what specimens constitute the type series." 72.4.1.1 is indented and numbered as subservient to 72.4.1, so the proper restrictive interpretation of it permits one to go outside the original publication to find additional syntypes only if they fit the concept of the taxon as defined in 72.4.1. Making that search, we see that Doubleday (1848)--a year after the original description--listed three specimens of "Melitaea anicia". Also, the labels on three BMNH museum specimens state "Rocky Mts. Pres. by Earl of Derby" suggesting all three are one type series. And those three specimens resemble the engraving, so appear to be the *anicia* taxon. So, clearly, based on the proper restrictive interpretation of Art. 72.4.1.1, there was no holotype and the type series is those three syntype specimens, specifically male #C, male #B, and female #D.

An additional reason there is no holotype, is that the illustration seems to be partly a chimera rather than a single specimen, as specimen #B resembles the engraving in roughly half of the traits, #C resembles it in about 1/3 of the traits, and neither is like it in about 1/6 of the traits. W. Hewitson evidently used #B to paint many traits on the engraving, used #C for fewer traits, and used a fanciful imagination for some traits, so it seems unwise to confidently consider #B to be the specimen illustrated in the original publication, and unwise to consider #B to be a holotype by monotypy. Here are the details: On the engraving, the upf submarginal spots are cones on the right wing, but not on the left, while on specimen #B they are weak cones on both wings, and on #C they are regular cones on both wings. The upf median spot in cell CuA_2 is pink on the right wing and yellow on the left on the engraving, but is cream on #B and #C. The upf discal cell spots are like the engraving on #B, unlike it on #C. The upf postmedian row of spots are yellow on the engraving, orange on #B, and yellowish-cream on #C. The uph postmedian spot in cell CuA_2 is a yellow crescent on right wing and a pink oval on left wing of the engraving, but is a cream crescent on #B, a pair of small cream spots on #C. The uph submarginal spots are pink crescents in cells M_3 and CuA_1 and are orange in more-anterior cells on the engraving, while all are pale-orange crescents on #B, and all are orange crescents with cream centers on #C. The spots on the basal 2/3 of uph are more like the engraving on #B, unlike it on #C. The forewings sag backward on the engraving, but not on #B, while the left forewing sags backward on #C. Female #D is quite unlike the engraving.

When an illustration represents a chimera of multiple specimens, none of the specimens can be considered to be the holotype (Gerardo Lamas pers. comm.), for the simple reason that a holotype by definition has to be a single specimen, not parts of several. A series of syntypes matches the engraving better, the two male and one female syntypes, as there is much variation in *Euphydryas*, and the three syntypes reasonably fit the concept of the taxon as indicated by the engraving in the original publication.

When Gunder (1929) designated his lectotype, the Re'gles were in effect, and his lectotype was perfectly valid under the Re'gles. Likewise, Shepard's (1984) lectotype was perfectly valid under the 1964 2nd edition of the Code in force in 1984, except it was the second designation.

To conclude, there is no holotype because Art. 72.4.1.1 leads us to three syntypes that clearly represent the taxon and analysis of these prove that the painting is a chimera, so any one of the three syntypes #B, #C, & #D, could have been designated lectotype, thus in this case Gunder's lectotype #C is valid simply because it was designated prior to Shepard's invalid lectotype #B.

Did Gunder (1929) validly designate a lectotype? Before 2000, if an author singles out a single syntype specimen and declares that that specimen is "the type", he is considered to have designated it a lectotype (Articles 74.5 and 74.6.1.1). Gunder (1929) singled out one male *anicia* syntype that N. Riley had labeled as "type" and illustrated its valva and called it "the type" in a publication, thus by those Articles he validly designated that valva specimen (which is #C based on the evidence of genitalic manipulation noted above) as lectotype, even though he did not use the word "lectotype" (which only appeared in the ICZN Code in 1958/1960 even though it had been in popular use since 1905). It should be noted here that specimen #C has three "type" labels, evidently placed there by Riley & Gabriel (1924), but Riley & Gabriel did not designate this specimen as lectotype, because Code Art. 72.4.7 states that mere "type" labels on specimens do not constitute a valid lectotype designation. A valid lectotype designation requires that one designated specimen must be singled out and called "the type" or the "lectotype" in a publication (as Gunder did), and a mere published list of types such as Riley & Gabriel (1924) does not constitute valid lectotype designation (Art. 74.3).

Is Gunder's lectotype invalid because he labeled two specimens as "type?" Gunder (1929, pl. 5) labeled his valva drawing (fig. E) as "TYPE" and also on pl. 5 labeled his left-most female (fig. D) as "type male *anicia*". Ordinarily, if any publication labels two different specimens as type of a name, neither can be considered a valid lectotype, because the lectotype must be a single specified specimen. However, Gunder labeled the female a male, which is clearly a mistake as Gunder was an expert on *Euphydryas* and obviously knew how to distinguish males from females (he drew the genitalia of dozens of them, and he was very meticulous as over a period of several decades he named a hundred "transition form" aberrations based on details of wing pattern of various butterflies that he found to be aberrant), so I assume that he had meant to illustrate the same male used for the genitalic drawing—male #C that had been considered a type by N. Riley--in the left-most position on his plate, but failed to do so as another specimen was somehow mistakenly substituted. So I consider both "type" words on that plate to refer to the same specimen, the valid Gunder lectotype, which is specimen #C.

The valid lectotype. To conclude, Gunder (1929) validly designated as lectotype the male whose valva was drawn by Norman D. Riley, which is the male that Riley chose in the museum, the same male that Riley had previously labeled as “type”, namely specimen #C. Pelham (2008) also stated that Gunder designated the lectotype, though Pelham repeated Shepard’s mistake in stating that Gunder illustrated the lectotype dorsal and ventral, which Gunder did not do (Gunder illustrated only its valva, plus paralectotype female #D and non-syntype female #E). Also, the lectotype in BMNH is labeled type No. Rh. 8422 and #74-47, not #45-136 as Pelham stated.

The **type locality** of Rock Lake, Alberta, needs to be discussed. Shepard (1984) determined from historical records that the specimens donated in 1845 to the BMNH came from Rock Lake in Alberta. That location seems reasonable for all three *anicia* syntypes, because all three look like the blackish-red-upperside specimens N. Kondla has collected at Rock Lake. However, Shepard (1984) noted that historical records suggest that specimens donated by the Earl of Derby and accessioned in 1847 to the BMNH—as was Gunder’s lectotype--could have been collected from Fort Hall Idaho to Platte River Wyoming. There are fairly dark *anicia*-like butterflies at high altitude on W side of Wind River Mts. in Wyo. (ssp. *windi* Gunder), suggesting that Gunder’s lectotype remotely might have been collected there, but *windi* is redder than *anicia*. But an 1847-accessioned *Erebia mancinus* could have only been collected in Alberta, so the 1847 *anicia* lectotype could have come from Alberta also. So Rock Lake Alberta still seems to be a reasonable choice for the TL of *anicia*.

Definition of ssp. *anicia*. The syntypes resemble adults collected at and near Rock Lake in Alberta by Norbert Kondla. Ssp. *anicia* from there and the rest of its range in the mountains of west-central Alberta is quite dark (reddish-black) on the upperside, whereas in southwestern Alberta north to at least Livingston Falls in the Livingston Range a different ssp. occurs that has less black and is mostly reddish-blackish with some yellow spots (N. Kondla pers. comm. and photos; S. Spomer photos) that appears identical to *E. a. howlandi* D. Stallings & Turner 1947 from Polaris, Beaverhead Co. Montana, which in turn is similar to and could be considered a syn. of the slightly-redder Washington *E. a. hopfingeri* Gunder 1934.

Authorship of the name *anicia*. Authorship has frequently been cited as Doubleday & Hewitson (even by Doubleday 1846-1849 and Westwood 1850-1852 sometimes), and sometimes as just Doubleday. Doubleday wrote the entire volume 1 containing the plate showing *anicia*, and Hewitson just prepared the illustrations, so Doubleday was the author according to Hemming (1941), as Pelham (2008) also wrote.

Acknowledgments

Joseph Belicek took photos of specimens #B & #C in the BMNH and provided them to Norbert G. Kondla. Norbert Kondla discussed nomenclatural issues and provided photos of Alberta *anicia*. Steve Spomer provided photos of Alta. *anicia*. John V. Calhoun sent a photo of the original Doubleday engraving (fig. A). Nick Grishin, Cris Guppy, Jonathan P. Pelham, and Gerardo Lamas discussed nomenclatural decisions on Doubleday’s names.

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NYMPHALIS CALIFORNICA: COMPLEX VARIATION OF FORMS, MIGRANTS, AND A NEW TIMID SUBSPECIES (NYMPHALIDAE)

by

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Abstract. *N. californica* has complex variation in two intergrading forms: one form has a strong ventral postmedian grayish-to-whitish band and is usually paler on the outer part of ups, and the other form mostly lacks this band and is darker on ups. These forms do not seem to depend on season or photoperiod or temperature, but vary individually, sexually, and geographically. In California (ssp. *californica*) most males but only slightly more than half of females are striped/pale, and that striping continues northward to Canada but the frequency of striped adults may lessen northward then remains lessened southeastward in the Northern Rocky Mts. to Utah, while in Wyoming-Colorado-New Mexico-Arizona there are no striped/pale males or females. The striped/pale form does not automatically force migration, but that form prevails or is common in populations that have a greater genetic propensity to migrate. The ssp. *herri* TL is restricted to Buckhorn Mtn. (W of Brewster and SE of Methow, Okanogan Co. Wash.); it

evidently has fewer striped adults than ssp. *californica* and averages a darker ups, so can be considered a valid ssp. Ssp. *timidar* is named from the Southern Rockies and Arizona, which timidly refuses to migrate and refuses to display gaudy striped/pale wings, as its unh is dark and the unf is less pale-striped than *californica* or *herri*.

Introduction. *Nymphalis californica* (Boisduval) is a familiar butterfly native to western North America. It has been poorly studied except for numerous reports of occasional flying swarms that splatter on cars and attract attention. Some strays have been reported as far as Pennsylvania and Vermont. Published references to *californica* have always been brief and superficial (the worst treatment being the Rocky Mountains Butterflies book which even reversed the descriptions of *californica* and *herri* Field and listed *herri* as having a tiny range around the TL), and no one has investigated the forms in any way, and people have missed the presence of the striped form in females, and the two forms have rarely even been mentioned before or since Field gave the unstriped/dark form the name *herri*. We attempt here to make sense of the variation within this species.

It is fairly closely related to *N. xanthomelas* (Schiffermueller), *N. antiopa* (Linnaeus), and *N. polychloros* (Linnaeus) but is distinct from them (Wahlberg et al. 2005). Kondla constructed a genetic distance tree from 'barcoding' dna sequence data on the BOLD workbench (www.boldsystems.org). It included sequences of *N. polychloros* (15 specimens), *N. xanthomelas* (6 specimens) and *N. californica* (11 specimens). Results are consistent with the taxonomic hypothesis that *polychloros*, *xanthomelas* and *californica* are different species. Genetic divergence was ~3.5% between *xanthomelas* and *californica*, ~5% between *xanthomelas* and *polychloros*, ~5% between *californica* and *polychloros*. *N. californica* specimens were from California, British Columbia and Utah, and there was no genetic distance separating them using the Kimura 2 parameter distance model. This is consistent with the hypothesis that that *herri* and *californica* are conspecific.

The forms of *N. californica*. The complex variation in this species is individual, sexual, and geographic. There are two forms which intergrade with each other, and the frequency of those forms varies geographically (Figs. 1-3). The pale form has a grayish (dark-gray to gray to grayish-white) postmedian stripe on unh & unf, and the unf tornus is more tan and less brown. The dark form has little or no postmedian stripe on unh (there is usually just a small anterior area of grayish-dark-brown) and unf, and the unf tornus is darker (it is tan and brown-streaked in both forms). The pale form tends to have extensive postmedian fulvous areas on upperside, while these areas are small on the dark form, so the pale form has more ochre areas and the dark form is more orange-brown. The dorsal wing bases are dark orange-brown on both forms, while the postmedian paler areas occur distal to the black spots (where the grayish areas occur on the underside) but blend outward more. The differences on the upperside are much less different between the forms than the striping on the underside, and underside and upperside variation is not perfectly correlated, so many striped-unh adults have darker ups, and some darker-unh adults have paler ups.

Sexual difference in frequency of forms. Females are very similar to males in *Nymphalis-Aglais-Inachis-Vanessa*, so a third or more of the sex guesses of *N. californica* specimens in photos and reports are wrong and no one has made a good estimate of the prevalence of the forms in each sex. Females can often be identified by their more-square wings (especially the hindwing) and usually fatter abdomens (though newly-emerged males and females tend to have fat greasy abdomens which after collection frequently grease the wings), and the abdomen tip can be brushed to confidently determine the sex (see below). One can determine sex in the field by squeezing the abdomen. Shapiro (2007) merely noted that males are usually contrastingly paler on outer half of underside, while females are uniformly dark on underside, thus he mistakenly assumed that all females are dark. Scott's Calif. series has 22 striped males, three weaker-striped males, and 2 weakly-striped mostly-dark males, and 6 striped and 5 dark females. Thus most males are striped on underside and paler on upperside, while not much more than half of females belong to the striped/paler form, and nearly half of females are the unstriped/dark form.

Many *Polygonia* are striped on uns in males, but unstriped in females, especially *P. satyrus* (W. Edwards) & *P. comma* (Harris), while in *P. faunus* (W. Edwards) males and many females are patterned on uns but many females (form *silvius=orpheus*) are not. This suggests that the genetic mechanism causing many females to lack stripes is ancient among all these butterflies, so the mechanism in *N. californica* may be similar (*Nymphalis* and *Polygonia* could be combined into one genus *Nymphalis* based on DNA study by Wahlberg & Nylin [2003], but Wahlberg et al. [2005] separated them).

Genitalia. Genitalia (fig. by Miller & Miller 1990) were examined in order to determine whether these forms are different species. When the abdomen tip is brushed to remove long scales, the male resembles the head of a Phillips-Head Screw recessed into a tube, with the dorsal slot pinched together a bit, while the female displays the two parallel papillae analis that are pressed together like pancakes then flared apart ventrally, and females have a wide orangish sternum below that. The male has a narrow uncus. What appears to be a large dorsal process of the male valva (the tip of the process resembling the terminal segment of a scorpion stinger) forming the upper parts of the Phillips Head screw actually seems to be the gnathos, yet both gnathos and the rectangular valva open wide together during mating. And there is a long awl-like process (usually called "harpe"), keeled medially along its length, extending from the inner lower base of the valva nearly to the valva tip, whose function during mating may be to fit into the groove between her lamella and the rear of the preceding sternum, while the valvae tips grab the lateral edges of the lamella? (a copulating pair would have to be killed and slowly pulled apart under a microscope to clarify its function); this process also occurs in *Polygonia* but arises more dorsally on valva base. Scott dissected male genitalia of 3 California and 3 Colorado males with KOH, and carefully compared them but did not find significant differences, and many others were examined from brushing. Female genitalia is comparatively simple with an orangish-tawny muffin-shaped lamella (narrower distally and indented at the papilla analis) with a small ostium bursa about halfway to its rear, and is rather variable individually in shape and especially variable in 3D expression of the folding between front and rear and the height of a slight ridge around rear of ostium that extends to the rear indentation; no consistent differences were seen on brushed females within or between forms or subspecies. So there are apparently no differences in genitalia between the forms or between geographic subspecies.

Are striped butterflies mimics of stones, rather than leaves? One could guess that the striped form looks more like a fallen leaf than the dark form, because old dried leaves are presumably paler than newer leaves. But fallen leaves tend to not have a stripe, and this explanation does not work on the unstriped form. The striped form might resemble a stone, as the stripe would mimic a lighter sunlit face of a stone while the darker wing bases would mimic a shaded face of the stone, for camouflage as the butterflies—mostly males—rest on the stony bank of a stream sipping mud, as the butterflies do by the thousands. This explanation fits the greater prevalence of the striped form in mud-sipping males, and also fits the distribution of the striped form which coincides with the geographical distribution of the migrants and the massive swarms, which produce vast clusters of mud suckers. California has a dry climate after March, so the adults may be more likely to sip moisture on stony creek banks there, and California has a larger preponderance of the striped form. Maybe the swarms of butterflies on a stream bank attract birds etc. who eat fewer of the butterflies that resemble stones. But what about the unstriped form, do they resemble dark rocks? While speculating, we can examine wing shape and patterns of related species. *Nymphalis californica* and *Aglais milberti* (Godart) have wing shape that is less leaflike than ragged-wing-margin *Polygonia* and *Nymphalis l-album* (Esper) that are said to resemble leaves, perhaps because the former have hostplants that are low bushes and herbs while the latter eat trees (but some *Polygonia* eat bushes and herbs). The striped *N. californica* do resemble similar-striped *l-album* and *Polygonia gracilis* (Grote & Robinson), and the *Polygonia* (especially males) noted above. *Aglais milberti* has a strong uns stripe, but it feeds on yellow/white flowers often and visits mud much less often than *N. californica* which visits mud as often as flowers. *Nymphalis antiopa* (Linnaeus) has wing shape that is less leaf-shaped, and it has a yellowish border on wing margins that makes it look like a protruding broken-off branch/twig? The upperside of all these butterflies evidently shocks a predator when the wings are opened. To conclude, these wing shapes/patterns evidently serve as camouflage to match rocks and leaves and disruption of edible-to-birds visual patterns; and there is some randomness.

<u>Are the forms caused by photoperiod?</u> In California there does not seem to be any association of the forms with months of the year. Scott collected unstriped/dark forms most often in March (when he often collected butterflies), a few in February, and some in late June-early July when he collected butterflies there less often. Striped forms were mostly collected in March or June, with some in February, May, or July. Internet photos show numerous striped adults and a few unstriped ones in June and some striped ones in July. Shapiro (2007) notes that there is just one generation at any given location, and adults overwinter, so early spring adults obviously resemble the adults of the previous late summer and fall that hibernated. To conclude, the frequency of forms does not seem to differ during the year, so it would seem that photoperiod has little effect on producing these forms.

Is the striped/pale form the migratory form, the unstriped/dark form the sedentary form? To determine this we need to understand migration in this species. Shapiro (2007) wrote that overwintering adults in the Coast Range north of San Francisco lay eggs on *Ceanothus* (often in March) that produce the first generation of adults that emerge in L May-E June, and those butterflies emigrate to higher altitude (to the north Coast Range or across the central Valley to the Sierra Nevada) (by mid June no butterflies are left S of Colusa/Mendocino Cos.) and lay eggs on *Ceanothus* that produce a second generation of adults in L July at higher altitude, and those butterflies migrate to even higher altitude mostly above treeline (the Sierra Nevada butterflies fly to the high southern Sierra Nevada) to aestivate, then in L September they migrate back to low altitude in the Sierra Nevada foothills or across the Central Valley to the Coast Range to hibernate. Adults in the Central Valley are mostly migrants (eastward in E May-June, westward in L Sept.-E Oct.). Shapiro also notes that some adults hibernate at higher altitude in the mountains and become active in June, coinciding with the masses of upslope migrants in June.

In Washington-Oregon, James & Nunnallee (2011) wrote that spring adults move higher to seek fresh growth of *Ceanothus*, then adults emerge in July and fly north, then S-SW from M Aug. to L Sept., which is similar to the California migrations (though migrating swarms seem to travel other directions at times). Pyle (2002) wrote that it “routinely masses around the Cascade volcanoes” during population explosions, and wrote of a late Sept. migration of 11 butterflies per minute flying south along the coast from the Columbia River to the Yaquina Head lighthouse (40% down the Ore. Coast) which fits Shapiro's scenario.

The earlier-than-midsummer butterflies (overwintering adults if there is just one generation, the first new generation if there are two generations) migrate to higher altitude north and east, in order to find young *Ceanothus* plants for their young larvae (most often *C. velutinus* in Calif. & Wash., often *C. cordulatus* in Calif., *C. velutinus* & *C. integerrimus* in Ore., *C velutinus* & *sanguineus* in BC, plus numerous other *Ceanothus* everywhere), because (as Shapiro 2007 notes) mature plants have leathery leaves full of tannins that young larvae can't eat (James & Nunnallee 2011 also note that 1st-3rd-stage larvae feed only on young foliage). These butterflies can produce the enormous swarms of butterflies that lead to the mass migrations that appear irregularly (documented by Powell [1972], Garth & Tilden [1963], and numerous references in Warren [2005]). Shapiro's (2007) summary allows for the possibility that first generation migrants might even travel from California to BC, but no mark-recapture studies have been done and there is no proof of this. However, those and other papers report that adults overwinter in California and Oregon and Wash. (incl. Pyle 1974, 2002) and BC (Guppy & Shepard 2001), and most of the mass-movements that have been observed have been local mass-movements of random direction apparently coming from population explosions and defoliation of *Ceanothus*. So *N. californica* is not like *Vanessa cardui* which migrates hundreds and thousands of miles in an organized yearly system. *N. californica* does have a yearly system, but the vast migrations of *N. californica* swarms frequently or usually appear disorganized (for instance a swarm can fly W on the top of the Sierra Nevada Mts. on July 21 despite the theory), yet those anecdotal reports suggest that massive swarms can spread adults over much of a state such as Oregon and can send butterflies from the Cascades of Washington into SW BC. Dornfeld (1980) wrote that the massive swarms in Oregon occur mostly in the Cascades. Pyle (2002) wrote that they often swarm around the Cascades volcanoes (of Ore. & Wash.), and sometimes in the Blue Mts. in the NE part of Ore. Massive swarms sometimes occur at various places in S BC except near the coast where *Ceanothus* is absent (Guppy & Shepard 2001), and Leech (1946) noted migrating swarms in Waterton Lakes NP in SW Alberta and near Golden and Kelowna (sites widespread all over SE BC).

What does this prove about the genetic integrity of ssp. *californica*? The anecdotal reports suggest that all the butterflies from California to the Cascades of Ore.-Wash.-S BC should be similar genetically because of considerable gene flow throughout this range, over a period of decades at least, from the directed regular migration and from the random swarms, even if such gene flow does not happen every year.

However, when we get to the Rocky Mountains of Colorado and Wyoming (and presumably S Montana) southward, a different situation occurs, as there is no evidence of migration in this area, and just one generation occurs per year. The butterflies are uncommon in this area also. In Colorado overwintering adults in the Front Range foothills lay eggs on *Ceanothus fendleri* (no doubt occasionally on *C. velutinus* also which is less common east of the continental divide) mostly in late April, then adults appear in early July then aestivate and hibernate locally, as I have found no butterflies in the higher Front Range mountains, and there are no county records of *N. californica* from the mountains just west of the continental divide. Michael Fisher has found some adults in Golden Gate Canyon State Park in Gilpin Co., but this is merely in the montane zone halfway up the mountains and not at high altitude. In the Wet Mts. of southern Colorado there are several dozen records for all altitudes including 6 records at higher altitudes including one at or just above timberline on Greenhorn Peak. So some butterflies may fly to higher altitudes, but the number must be few. In comparison, Colorado *Aglais milberti* is common on alpine zone flowers in late July-Aug., where I have never seen a *N. californica*. *Ceanothus velutinus* is obviously the favorite host of *N. californica*, so perhaps the lack of migration in Wyoming-Colorado-New Mexico-Arizona populations is because *C. velutinus* is uncommon is this area and the main host *C. fendleri* only occurs in the lower mountains.

At any rate, the two forms do not seem to be seasonal forms functionally connected with migration, because Shapiro's scenario suggests that all the generations migrate. The forms or the propensity to produce the forms would seem to be mostly genetic, because the absence of the striped/pale form in the Southern Rockies is hard to explain any other way, as the photoperiod is the same and temperature/moisture regimes are not much different there than westward, while moisture regimes vary greatly within the range of the striped form.

Overall, the idea that the striped/pale form is migratory and the unstriped/dark form is sedentary has little support, although the striped/pale form evidently does occur in populations that seem to have a greater genetic propensity to migrate. It seems safe to conclude that during the migrations in California, some of the butterflies (roughly 9% of males and slightly less than half of females) migrating are the unstriped/dark form. Those unstriped/dark butterflies do not remain behind as their striped brethren migrate away, so migration is not caused directly by whatever physiological mechanism/genes is responsible for producing the striped/pale form. However the striped form seems to occur wherever there are migratory swarms, though the frequency of striping may lessen in the north, so the presence of striped/paler adults in a population is correlated with a greater propensity to migrate. This relationship is correlation without direct causation. Evidently, the genes that produce the striped form and other genes that promote migration are common from California to BC. Ssp. *californica* is usually striped and paler, and that ssp. also has the genes for migration. Colorado butterflies are unstriped and darker, and lack those migration genes. Perhaps a DNA study comparing adults from Calif., Ore., Wash., SW BC, and Montana, Wyoming, Colorado, New Mexico, and Arizona would prove genetic differentiation.

Guppy & Shepard (2001) wrote that adults migrate into BC in spring, and coastal BC adults are larger and paler than those in the interior, and wrote that coastal adults are migrants because hostplants are scarce on the coast so they cannot successfully breed there, while in interior BC one generation is produced per year which is smaller and darker (the phenotype of *herri*). They wrote that the unstriped form is a "variation resulting from maturation in the mountain environment rather than being due to genetic differences" because migration would mix populations and prevent genetic differentiation. Those statements pose difficulties, one being that if coastal adults are striped/pale and interior ones are not and there is just one generation (there seems to be just one generation everywhere except in Calif. and probably SW Ore.), there can be no migration between coastal areas and the interior or the difference in frequency of forms would evaporate, yet we know that they are migratory, so the only way that system would work would be if striped coastal butterflies migrated north from Washington to the Coast Range of BC and then died out without going inland. Reports southward indicate that migrants do spread east in years of population explosions. Yet they cited four papers that claimed the adults do hibernate in BC and several papers wrote that they emerge in spring in BC, and the book's histogram suggests that there is a spring generation of overwintering April-May adults that breeds and produces a fourfold-larger generation mostly in July-September, which is a different pattern than the pattern produced if most BC adults were just migrants. And Kondla lived in the west Kootenay area of southern BC from 1997-2007 and spent a lot of field time there, and did not see any migratory movements and did not see any massive population explosions. In most years *N. californica* was common and Kondla saw flight-worn hibernated adults often in April and some even in March, which suggests the population is resident there rather than replenished yearly by migration. So it would seem that most inland BC butterflies are natives, and the difference between coastal and inland butterflies is in large part genetic. Shapiro claimed that mountain butterflies migrate also, and wrote that the high-mountain butterflies migrate down to low altitude in the fall including to the Coast Range, where most are striped/pale so those must have been born in the "mountain environment" of the high Sierra Nevada as striped/pale adults. So in California the high mountains breed plenty of striped/pale adults. Four internet photos by John Lane show ~60 to ~500 adults sipping mud (thousands along Soda Creek, Feather River Canyon, Hwy. 70, ~3,000 feet, Plumas Co. California), and nearly all of the adults on mud have visible whitish uns stripes (these adults would probably produce a migrating swarm there are so many of them (young adults tend to sip mud etc., and then migrate). So the "mountain environment" alone does not seem to produce the dark form. The forms or the ability to produce the forms seem to be mostly genetic, as this ability is absent from the Southern Rockies to Arizona. Colorado butterflies are unstriped yet most occur mostly in the foothills at ~5,500-7,500' rather than the higher mountains, although there are some to 9,000 feet and some records in higher mountains in the Wet Mts. and Wet Mtn. Valley in S-C Colo.

Genetic/Physiological Causes of the forms. The idea that the cold high-mountain environment produces the unstriped/dark form, while the hot lowland environment produces the striped/pale form, is tempting but seems easily debunked. The primary logic is that adults migrate to place their offspring in the SAME environment: overwintering adults move to higher altitude to lay their eggs, then later in the year when that area gets warm California adults move higher still to find an area that is just as cool as they grew up in and they lay eggs and produce a second generation, and then they migrate lower. In most of the range there is just one generation, and they fly to where it is cool, to where the *Ceanothus* has young leaves, so <u>adults everywhere grow up in similar temperature conditions</u>, where it is cool enough that the *Ceanothus* leaves are young. Colorado warms later than lowland California, so the life cycle in Colo. is later than the 1st Calif. generation but is the same as the 2nd higher-altitude Calif. generation, so the temperatures during larval/pupal development are similar. If warmer weather produced the striped form, then females should be more striped than males, because females emerge days later than males (the male-female emergence lag that occurs in all univoltine insects that is important for mate-location by allowing virgin females to emerge when the abundance of males is greatest, see Scott 1977) so females experience warmer temperatures and should be more striped, yet actually females are less striped than males.

To conclude, striped/paler and unstriped/darker forms are evidently genetic, or the ability for slight environmental/sexual differences to produce them is genetic, because environmental causes seem to have been discredited. Maybe the genetic system is similar to that shown by some *Polygonia*, in which males are more often striped than females and some females are striped but some are quite uniform.

Phenotype in California (ssp. *californica*) (fig. 1). Emmel Emmel & Mattoon (1998) designated a lectotype and TL of *californica* from Plumas Co. Calif. (Queen Lily Campground, near Belden, North Fork Feather River Canyon, 2,400'), and figured the lectotype, which is the striped/pale form with whitish-gray postmedian stripe on underside and extensive ochre postmedian areas on upperside. Most California butterflies are of this pale form, somewhat to very pale on ups, and most have considerable degree of the gray uns stripe, which is whitish in the palest adults. Scott's Calif. adults from the Coast Range N of San Francisco and the central Sierra Nevada has nearly all males strongly striped and a slight majority of females striped, as noted above. A photo from Cecilville in Siskiyou Co. in June has a strong stripe but another from there has a fairly dark ups. There are four photos on the internet taken by John Lane of ~60 to ~500 adults from a swarm of thousands feeding on riverbank mud in Plumas Co. (Feather River Canyon, Soda Creek, Hwy. 70, ~3,000 ft., June 1, 2009), and nearly all have the pale stripe, so only about 9% of those butterflies lack a visible uns gray stripe; the closeup photo shows 34 specimens well on underside, and 29 have a strong stripe, 2 have ½ a stripe, and 3 have almost none (just the usual slightly-paler anterior patch); so that photo can be taken as a rough 91% estimate of the frequency of the striped form in males at the TL, since most of the butterflies at the mud are probably males, as females tend to visit mud much less often than males.

The whitish uns stripe is often strong in southern California, where most adults are the striped/paler form, but many are dark. In Kern Co. all the ~dozen adults we saw early in this study had a strong whitish stripe and are pale on ups, and Comstock's Butterflies of California (1927) figured a strongly-striped adult (with dark ups) from Mt. Wilson, June 25, 1919. But Emmel & Emmel (1973) figure a fresh dark-ups form from Laguna Mts., San Diego Co. Calif. June 17, 1960 O. Shields (they did not illustrate uns), and Monroe & Monroe (2004) figure an adult with only about 1/3 of a stripe from Cuyamaca Rancho SP in eastern San Diego Co. Calif. June 1, 2003. And in various counties around Bakersfield California (nearly all in the mountains), Ken Davenport (pers. comm.) found 10 males 5 females with strong uns stripe, 2 males 2 females intermediate in striping, and 5 males and 8 females with little or no uns stripe; on the upperside of those he found 11 males 9 females were pale, 1 male 2 females were intermediate, and 5 males 4 females were dark; and some of those specimens had a striped uns but dark ups or an unstriped uns and paler ups, so there was not total correlation between the coloration of underside and underside; some of those specimens may have been sexed wrong as it is difficult to determine sex of adults without brushing the abdomen, but it is clear that California has both striped and unstriped plus pale and dark forms.

Adults are usually rare in S California and reside only in the higher mts., and only occasionally are common and dispersive, when adults can stray to the desert floor in San Diego Co., and several were found in 1960 at Clark Mtn. in the eastern Mojave Desert (Emmel & Emmel 1973). *N. californica* is rarely found in northern Baja California Mexico.

Phenotype in Oregon. The striped/paler form is common in Oregon, where Dornfeld (1980) wrote that adults vary greatly in darkness or lightness of the underside. A photo from Mt. Hood Clackamas Co. has a dark unh, but the unf has a stripe. Pyle (2002) wrote that the uns in Ore.-Wash. is mostly striped with "variable white marbling, more or less two-toned with dark inner half, light outer." An internet photo of an almost-unstriped adult is from Rogue River, Josephine Co. Ore., Feb. 22, 2005 A. Warren.

Phenotype in Washington (and see NE Wash. next). Two males from Stevens Pass 4,100' King Co. Aug. 5, 2007 Michael S. Fisher are both dark on ups and have 1/5 and 1/3 of a stripe on unh. Jonathan Pelham (pers. comm.) has a series reared from mature larvae at Mills Can., Chelan Co. on the E slope of the N Cascades just W Entiat, and 20 of 25 males (~80%) and 6 of 10 females (60%) are striped, and all specimens contrast with dark Colorado adults. A photo showing ~15% stripe is from Derby Can. Chelan Co. Wash. July 10, 2010 (Bob Hardwick). A few darker-uns adults have been seen around Wenatchee and Leavenworth in Chelan Co. (Peter Smytheman pers. comm.) A photo from Puyallup near Tacoma Nov. 16, 2008 has about ¾ of a full stripe. A photo from Lion Gulch Kittitas Co. Aug. 14, 2001 Markku Sarela has a very strong stripe like the most-striped California adults. A sample of 106 adults from the northern Cascade Mts. of Okanogan Co. Wash. (on the Cascade Mts. divide ~20 mi. S of BC, at Cache Creek 4,160' on Harts Pass road NW of Mazama Aug. 9-10 2007 coll. David Threatful, probably on mud, in Kondla and Scott collections, fig. 2) ranged from solid dark-brown with no grayer area to about 95% of a whitish-gray unh stripe (none of them have a strong whitish stripe like some Calif. etc. adults that have a ~20% whiter stripe). 20 of those 99 were mounted (proving to be 19 males and only 1 female) and compared to Colorado specimens, and 9 of them had a stripe stronger than ANY Colorado adult, while nearly ALL were paler on unf with larger and lighter tan areas on the tornus and on the postmedian area of the stripe beyond the discal cell and in the pale bar in the discal cell. In comparison, California adults average more of a full stripe in males on average and less in females, while in Colorado males typically have just a weak ghost of a stripe on unh and few females have the ghost, and the unf mostly lacks the stripe beyond the discal cell and lacks the pale bar in the discal cell.

Phenotype in NE Washington. 1 male 2 females from 2 mi. W Kettle Falls, Stevens Co. Wash. July 5, 1962 J. Scott are unstriped/dark with just a little gray-brown area on front of unh (~40 others from there were mostly dark also but were traded away so cannot be examined), they were mostly lying dead beside the highway killed by cars as most had squashed abdomens. Weather was cloudy and no migration was seen as "live specimens there, when chased from the brush, invariably flew to the roadsides"; the swarm was local as none were seen on W side of Sherman Pass and 4 mi. S of Republic (both in Ferry Co.) to the west.

Phenotype in SW BC. Guppy & Shepard (2001) wrote that coastal BC adults tend to be larger and paler than those in the interior [so many presumably have the uns stripe], and coastal adults tend to be migrants from Wash. because *Ceanothus* is scarce near the coast. But they illustrated an unstriped/dark adult from Shawnigan District at the SE end of Vancouver I. The adult in Layberry et. al (1998) from Hope Mts., in SW BC has a moderate unh stripe.

Phenotype in SE BC, Alberta, Idaho, and NW Montana. *N. californica* is rare in Alberta, where Kondla found larvae on *Ceanothus velutinus* in Waterton Lakes Nat. Park, and photographed a male there with a strong uns stripe which is flight worn thus might have been a migrant, and an Alberta photo (Bird et al. 1995) has a strong uns stripe and pale ups. Ted Pike has an unstriped/dark Alberta specimen. Pohl et al. (1998) confirms breeding in Alberta. N. Kondla found numerous adults in S-C BC (Pend d'Oreille Valley, Rossland, Rock Creek), and some are uniform dark-brown on unh, some have just the usual small grayer-brown anterior patch, while the majority have a moderate to strong grayish-white unh band (very strong in several), so that sample looks nearest ssp. *californica* (they were when collected anyway). But another Kondla collection of 68 puddling adults (mostly males) from the Pend-d'Oreille River valley just N of the NE corner of Washington has only 2 with a strong stripe and only 5 with a partial light-gray stripe. An internet photo from a specimen from Seeley Lake, Missoula Co. Montana Aug. 20, 1975 S. Kohler has a strong 4/5-complete gray band on uns like ssp. *californica*, but the majority of Montana butterflies are presumed to be the unstriped/dark form. A photo from Park Crk., Custer Co. in southern Idaho July 17 1972 has almost ½ of an unh band.

Phenotype in NE Nevada. (The Carson Range in W Nevada has striped and unstriped forms as that range is part of the Sierra Nevada.) A female from Jett Can., Nye Co. in C Nev. Aug. 6, 1974 J. Scott is unstriped/dark. 1 male 1 female from E Swan Lake, Humboldt Co. Nev. Aug. 4 1974 J. Scott are unstriped/dark (the male with just a small amount of anterior unh gray). A female from Thomas Cgd., Ruby Mts., Elko Co. Nev. Aug. 5 1974 J. Scott is unstriped/dark.

George Austin (Butterflies of Nevada mss. sent to Kondla) wrote that the dark form predominates in E-C Nevada. But a photo of a male from Ruby Valley Elko Co. Aug. 5, 2004 has a strong stripe, so the striped form occurs in E Nevada, and Warren (2005) notes that in years of swarms in Oregon, adults can fly east as far as Steens Mtn., and Emmel & Emmel (1973) note that adults can fly east to Clark Mtn. in the eastern Mojave Desert, so some from the Sierra Nevada may fly to E Nevada also. NE Nevada adults probably average at least as striped as N Okanogan Co. Wash. adults, based on the phenotype in Utah.

Phenotype in Utah. Utah seems to have adults striped at least as much as N Okanogan Co. Wash. adults. A sample of 18 adults (mostly males) from Farmington Can., Davis Co. 1987 reared by Jack Harry, has many with a fairly-strong uns stripe, some with a little stripe, and many with almost none, while nearly all had a whitish postmedian band near unf costa. A photo from Farmington Can. Davis Co. June 20, 2006 by Nicky Davis had a strong uns stripe, and one from Butterfield Can. Salt Lake City Co. May 21, 2006 N. Davis had about ½ of a stripe. Four other photos from N Utah showed a strong unh stripe.

Phenotype in S Montana and Wyoming. We have not seen specimens from S Montana. A photo from Bighorn Mts. Wyo. (vic. Poison Crk. Rd. Johnson Co. July 12, 2009 A. Warren) has almost no stripe.

Phenotype in Colorado. In Colorado, Scott's 86 adults are always rather dark, as the upperside is darker with little ochre in postmedian areas, and the underside is dark-blackish-brown with the postmedian area having little gray-brown (males averaging a little grayer there than females), so only on about 10% of males can the slightly-paler-brown postmedian dark-grayish area be called a slight band (most males just have a slightly paler anterior postmedian area), and females are quite uniformly dark-brown on unh and only 10% have a slightly paler anterior postmedian area. Males and females are similar.

Phenotype in New Mexico and Arizona. A male from Dalton Cgd., Pecos River, San Miguel Co. New Mexico April 9 1962 J. Scott is unstriped/dark. A female from Little Tesuque Can. in Taos Co. New Mexico July 26 1982 M. Fisher has a slight gray unh postmedian stripe, the biggest suggestion of a stripe we have seen in Colo.-New Mex. Two photos from E Turkey Creek, Chiricahua Mts. Ariz. June 10 1981 Jim Brock (one on internet and the other in Bailowitz & Brock [1991] from same site a day later) have a solid black unbanded unh (one has the anterior slightly-paler area). A female from Hualapai Mtn. Park, Mohave Co. Ariz. Aug. 2, 1985 Ken Davenport has little striping. So these adults resemble Colorado ones.

The types of *herri*. The original description of "*Nymphalis californica* new race *herri*" (Field 1936) lists the holotype and allotype of *N. c. herr*i Field from "Buckhorn Mountains, Washington, July 25, 1934". The holotype and allotype are labeled "Buckhorn Mts. Wash. vii-25-34" on yellowing white labels, "HOLOTYPE [or ALLOTYPE] Nymphalis californica Bdv. race herri Field" on red labels, and "Type #54007 [or Allotype No. 54007] U.S.N.M." on orange labels. Both holotype and allotype look like males in their photos, even though the original description states the allotype is female. The holotype has a slight unh postmedian whitish stripe; the allotype lacks it. One paratype in USNM is labeled "Excelsior Wash. vii-20-1934" and "PARATYPE 1 Nymphalis californica Bdv. race herri Field" on blue label; this is mounted sideways, has a fat abdomen, and is probably a female as the original description states, the only female among all the types. It lacks an unh postmedian stripe. Three specimens in USNM are labeled paratypes but were not mentioned in the original description; these are labeled "Pateros, Wash. vii-14-32 C. W. Herr" on yellowing white labels, and PARATYPE 4 [or 5 or 6] Nymphalis californica Bdv. race herri Field" on blue labels; all are probably males, and all three have a slight unh whitish stripe. All the whitish labels have the same handwriting, with the r’s and s’s the same on all labels, and all have most letters slanted to the left evidently because the writer was left-handed. If C. W. Herr wrote them all, then he collected them all; or perhaps W. D. Field wrote all the labels after the specimens were sent in envelopes and mounted in the USNM. The original description also mentions 12 male paratypes from “Priest River, Idaho, various dates in July, 1930, C. W. Herr”.

Three possible type localities of *herri*. Unfortunately, there are three “Buckhorn Mountains” in Washington listed by the USGS Geographic Names Information System:

A. The most prominent of those names today is the Buckhorn Wilderness Area (established 1984) in the east end of the Olympic Mts. in Jefferson Co. (named after Mt. Buckhorn 6,919’ 47^{o}49’36’’N 123^{o}06’58’’W) which has the Tubal Cain Mine at the base. Today there is a road nearby that accesses Mt. Thompson, but in 1934 a visit would have required horse/mule travel from Quilcene (Jonathan Pelham, pers. comm.). A 1938 topographic map of Mt. Constance shows Buckhorn Mtn. 6,985’ and Buckhorn Pass just north and Buckhorn Lake just NE, and trails going up the Quilcene River meeting a N-S trail westward, with several shelters, while the only nearby road is south of Mt. Constance along the Dosewallips River. However the Tubal Cain Mine was at the base of Buckhorn Mtn. in the Olympic Mts. and obviously had enough access to run a mine. The Tubal Cain Mine was started in 1902, when the Tubal Cain Copper & Manganese Mining Co. in Seattle built a trail there and began to mine, then an avalanche in 1912 destroyed the buildings etc. and the mine never earned a profit, but the trails remain, one trail now joining another in T fashion. Two camps were there, Copper City at the bottom of Mt. Buckhorn, and Tull City in Tull Canyon nearby. Certainly people could go in there fairly easily in 1934 because the trails had to be big enough to transport mining equipment and construction equipment to complete buildings at the mine. The current trail to the rocky top of Buckhorn Mtn. 6,988’ is 8.1 one-way miles of strenuous hike with 3,745’ elevation gain, but in 1934 Herr just had to go to Copper City at the mountain base or just near there or even just west of Quilcene to label bugs “Buckhorn Mts.” Considering how sloppy locality data was on butterflies in 1934, and the location of the Buckhorn Mts. on the eastern edge of the Olympic Mts. near Seattle, the specimens could have been caught just at the base of the Olympic Mts. near Seattle.

B. The second Buckhorn Mtn. is 5,587’ at 48^{o}56’46’’N 118^{o}59’08’’W in NE Okanogan Co. Wash., near Canada, which has the operating Buckhorn Mine that produced gold from 1896 to 1950 and after 1988. It is 7 road miles from Chesaw Wash., and in 1934 accessibility to at least the vicinity was probably better than the Olympic Mts., but the location is away from major travel roads.

C. The third Buckhorn Mtn. locality, and the least publicized today, is at 48^{o}08’18’’N 119^{o}55’40’’W, 3,255’ in SW Okanogan Co. Wash., at the eastern edge of the Cascade Mts., about 2 mi E & S of Methow and about 8 mi. W Brewster. Jonathan Pelham told us that some “old timers” told him that the “Buckhorn Mts.” TL most likely represented a placer claim NW of Brewster Washington [Okanogan Co.], which fits this location, and placer claims are along rivers, and several rivers are near Brewster. And the “Pateros Wash.” location of three “paratypes” in USNM is along the Columbia River between Buckhorn Mtn. and Brewster. This location is also near the famous butterfly collector J. C. Hopfinger’s house at Brewster, so Pelham thinks that Herr visited Hopfinger there, which is entirely probable, whereas those other two Buckhorn Mts. locales are more out-of-the-way wilderness spots. That location may be where Hopfinger caught those true *O. chryxus* (Doubleday) and other butterflies that are found in museums labeled Brewster (Eff 1962); however Remington (1962) notes that Hopfinger’s

"Brewster" locality labels are very imprecise and included specimens from all over the region including the alpine Cascade Mts. at 8,275'. This site is on the E slope of the Cascades where *N. californica* is common and often swarms, while *californica* is scarce on the west slope, and the site is next to a major highway, which definitely favors this location as the source of the holotype.

A paratype female was collected 5 days earlier than the holotype, in "Excelsior Washington, July 20, 1934". There are two Excelsior towns in Wash., both near the Olympic Mts. One is the suburb of Excelsior in south Tacoma (which is south of Seattle and about 45 miles from the Olympic Mts.), which was an unnamed stretch of second-growth forest in 1934 (Jonathan Pelham pers. comm.) and did have a good road, so the short distance from the Olympic Mts. suggests that the TL could be the Olympic Mts. The second Excelsior is in NW Wash. near Mt. Baker, specifically on W bank of Wells Crk. near its junction with N fork Nooksack R. in N-C Whatcom Co (nearby is Excelsior Pass and Excelsior Point 5,699'), but this spot might have lacked good access in 1934.

12 paratypes were from "Priest River, Idaho [the northern tip of the state], various dates in July, 1930, C. W. Herr", collected when Herr lived there.

Field stated that the types are in his collection and the Herr collection, so evidently the first three types were in Field coll. and the latter 12 in Herr coll. Pelham (2008) noted the holotype is in USNM (where W. D. Field worked later, though he lived in Lawrence Kansas in 1934-1936), and wrote that the TL is Buckhorn Mts. in Okanogan Co. Wash., though he presented no evidence to support the Okanogan Co. location. Miller & Brown (1981) listed HT USNM, and listed TL merely Buckhorn Mts. Washington.

Clarence Wilson Herr (1864-1938) moved to Priest River, Idaho before his 3rd child was born (perhaps about 1900), and farmed there until 1932 when he and his wife moved to Woodburn Oregon, and he died at Woodburn in 1938, according to his obituary. Woodburn Ore. is just S of Portland in Marion Co. Ore.. The first three specimens including the holotype were collected in 1934 four years after the 12 paratypes, while Herr was living in Woodburn just south of the Olympic Mts., so Herr probably collected those three also. Also, W. Field named *Habrodais grunus herri* and *Plebejus atrapraetextus* and *Coenonympha eunomia* from Herr specimens, so it appears rather certain that all the *herri* types including the holotype were collected by Herr. The Excelsior locality is close to the Olympic Mts., and Herr went to Excelsior, so he might have gone to the Olympic Mts. also and collected the holotype there. Herr may have visited friends back in Priest River Idaho after he moved to Woodburn Ore., and the first and second Buckhorn Mts. locales are far from the road to Priest River, but the third Brewster location is not far out of the way to Priest Rapids, so Herr is likely to have gone to the Brewster spot, in part to visit J. Hopfinger there. So it is possible but unlikely that Herr collected the holotype and allotype in the Olympic Mts. or in NE Okanogan Co, but it is far more likely that he collected them near Brewster. Herr's journals if he made any are not at Oregon State Univ. (Christopher J. Marshall the curator of OSU arthropod coll., pers. comm.), and presumably do not exist.

The TL is the locality of the holotype and the other types do not matter, so the TL is either the E Olympic Mts. Wash. or NE Okanogan Co. Wash. or SW Okanogan Co. Wash.

Let's review the evidence favoring each of the three possibilities for TL. The Excelsior locality is fairly near Olympic Mts., favoring the Buckhorn Mts. site there, but trails to get to the Olympic Mts. Buckhorn Mtns. are rather long and tough for an old man 4 years from death, and *Ceanothus* is reportedly scarce west of the Cascade Mts. summits, so presumably the butterflies would usually be scarce in the Olympic Mts., unless a swarm managed to fly that way. *N.*

californica is much commoner at the two Okanogan Co. locations, and numerous swarms originate on the east slopes of the Cascade Mts. The location in NE Okanogan Co. near Canada is out of the way for Herr and is far from main roads, so there seems little likelihood that the holotype was collected there. The Brewster site is at the base of the east slope of the Cascades where swarms are common, was beside a good road that is not much longer to get to Herr's old home of Priest Rapids Idaho to visit friends, and Brewster was the home of the famous butterfly collector J. Hopfinger who Herr would surely want to visit, and the Pateros Wash. locality of three "paratypes" in USNM is very close to Buckhorn Mtn. and Brewster, so the Brewster site clearly seems to be the TL.

Type locality restriction. We hereby restrict the type locality to the probable collecting site, Buckhorn Mountain, which consists of some hills running SW to NE ~2 miles E and S of Methow and ~6 mi NW Pateros and ~8 miles W Brewster, in Okanogan Co., Washington. Pelham (2008) had previously restricted the TL to Okanogan Co.

The phenotypic identity of *herri*. Field (1936) wrote that *herri* differed from ssp. *californica* by having ups burnt orange rather than fulvous, by having smaller fulvous markings beyond the black ups spots, by having darker undersides especially the postmedian area beyond the dark angular median transverse band, which area is light almost white in ssp. *californica*. However, four of the five types mentioned above from Buckhorn Mts. or nearby Pateros have a slight median unh pale stripe, and the three Pateros paratypes are paler on unf and ups than the holotype and allotype. Most of those differences described in the original description are still valid today—only they actually refer to the FORMS and not just to subspecies, and they intergrade fully. Most California adults are the *californica* form, but some (9% of males, and nearly 50% of females) are the *herri* form, while ~91% of males and >50% of females are the *californica* form with striped uns and often paler ups. Actually all specimens from everywhere including Calif. and Colorado have the basal areas of ups burnt orange, and the main difference on upperside is the color of the area beyond the two large postmedian black spots (the one on rear of upf and that on front of uph). That area is fulvous in the *californica* form, and darker orangish-fulvous in the *herri* form as the orangish encroaches more on the fulvous areas. Some California specimens we have seen (from Kern Co. especially) have those fulvous areas even more enlarged. Those differences on the upperside vary considerably and intergrade fully between the forms, and are much less different between the forms than the striping on the underside, because many striped-unh adults are rather dark on ups.

The question involving *herri* is this: to which subspecies does it apply? Only the locality of the holotype matters, and the phenotype of the holotype does not matter much either (especially in bugs like this that have differing forms); the only thing that matters is the phenotype of the population at the type locality. Only five *herri* types are available from the type locality (Buckhorn Mts. holotype and allotype, three paratypes from Pateros Wash.) to use to deduce the population phenotype, and four of the five have a weak unh whitish postmedian stripe, and the ups is dark to less dark. The pitifully meager evidence of five specimens, and three possible localities! All five specimens are fairly dark; however that information isn't conclusive because the darker form occurs everywhere in the range of *N. californica*, even south to California only 25 miles from Mexico. The dark form similar but even darker than *herri* is 100% of the population in the southern Rocky Mts. and Ariz. So *herri* is a valid ssp. only if the population phenotype at the TL differs greatly from California specimens.

Numerous specimens from sites in all directions away from Okanogan Co. Wash. (in SE BC, SW Alberta, NW Montana, W Wash. and Ore.) are the striped form, so we know that the TL must have a significant number of striped adults. And the sample closest to our restricted TL W of Brewster--Jonathan Pelham's series from adjacent Chelan Co. just down the Columbia River ~30 miles from the TL noted above—has mostly striped adults, suggesting that *herri* is a synonym of *californica*. The sample noted above from Cache Creek on the crest of the north Cascades in Okanogan Co. Wash. is 55 miles away from the TL W of Brewster and is at much higher altitude and is mostly unstriped but has many striped adults. It may be similar to the five *herri* types near the TL. SE BC adults are mostly unstriped dark but many are striped, so if NE Okanogan Co. were the TL then *herri* would evidently be considered a valid ssp. The Olympic Mts. possibility of the TL of *herri* evidently has mostly striped butterflies, so if that were the TL then *herri* would be a syn. of *californica*.

Here's a question: if a TL location has mostly one form, and a big swarm migrates in that mostly contains the other form, should the subspecies assignment change for that name? *N. californica* is much commoner on the E side of the Washington-S BC Cascades because it is drier there, and most swarms originate there, so migration from there can change the phenotype of butterflies, and migratory swarms are frequent in the Cascade Mts. in Okanogan Co., so if a few specimens of one form were found there, a swarm might deliver adults of the other form.

Scott (2015?) submitted a petition to ICZN requesting that an article be installed in the Code that implements the "toxotaxon". A <u>toxotaxon</u> is any taxon whose visualization, based on its types and original description, is unable to be assignable to known valid taxa, and the publication of the declaration of a toxotaxon instantly makes the name a <u>toxoterm</u> to which the Principle of Priority no longer applies. *N. californica* has two obviously valid ssp., the highly striped taxon from Calif. to Wash., and the unstriped taxon from Wyo.-Colo.-Ariz. But the *herri* TL was inadequately described in O.D. and the three possibilities of TL are in the ranges of both subspecies, and there are few type specimens to determine the possible phenotype of the TL population, and migration and individual variation will inevitably confuse the phenotype at these localities, therefore the visualization of the name *herri* encompasses both subspecies thus is a rather worthless toxotaxon, making the name a useless toxoterm. That article is not yet installed in the Code, so the declaration of a toxotaxon here carries no official nomenclatural enforcement, but we include the procedure here to emphasize the necessity for the article.

Is *herri* a good subspecies? Miller & Brown (1981) treated *herri* as a valid ssp. without stating why, and a handful of other authors including Layberry et al. (1998) accepted *herri* as valid, but several recent authors including Pelham (2008) and Pyle (2002) treated *herri* as a synonym, as did Warren (2005) who stated that adults from Washington, Oregon, and the Cascades and Sierra Nevada could not be distinguished (Warren studied the good collection at Oregon State Univ.). However, no one has done a detailed study and unstudied opinions do not matter. Based on the specimens we have seen, adults from the *herri* type locality surely average darker with fewer striped/paler forms than California-TL *californica*. Therefore some people will consider *herri* a valid ssp. (Scott considers it a synonym, Kondla considers it a valid ssp.). This is another unfortunate case of a name that proves to be near the middle of a cline; *Polygonia satyrus neomarsyas* has the same problem. (The Principle of Priority prevents any good solution for this problem.) The end of the cline is the unstriped/darker butterflies from Colorado, which is obviously a good subspecies, named below. Scott uses only two names for clines, one at each end, and he places the name *herri* at the *californica* end of the cline because both those names represent the region where migration is common and numerous adults are striped while some are dark, while the other end of the cline where adults do not migrate and striped adults are unknown is named below.

It is clear that the *herri* TL has enough striped adults to be somewhat similar to ssp. *californica*, so there seems to be almost no likelihood of convincing people to use the name *herri* for the distinctive Colorado butterflies, especially when some random swarm can deliver striped forms to the *herri* TL.

Nymphalis californica timidar Scott & Kondla, NEW SUBSPECIES (figs. 3-4). Adults are always unstriped and have darker unf and little grayish on unh (a little postmedian anterior area is the grayest) on males and very little or none there in females, while the upperside is rather dark. Only one specimen has been seen with a slight unh postmedian stripe, the male from Taos Co. New Mexico listed below. The unf is darker (on tornus and beyond and in discal cell) than all ssp. *californica* and almost all *herri*. It is not *herri*, as noted above (all specimens from Chelan Co. Wash. differed from Colo. adults, and nearly all from N Okanogan Co. Wash. differed on unf and most differed on unh). The name—describing a timid butterfly of dark appearance--comes from the word timid, which describes the lack of desire to migrate or even fly to higher altitudes in Colorado (where it is absent at high altitude and unknown in counties west of the continental divide), and the word dark, which describes the lack of desire to display bright striped patterns on the wings, as if these butterflies were Amish people who wear black and stay at home. Wyoming and New Mexico and Arizona specimens are similar. **TL** N of Apex Gulch near Indian Peak, Jefferson Co. Colorado J. Scott, larva on *Ceanothus fendleri*, emerged June 27, 1980 (holotype male to be deposited in BMNH, London). Numerous paratypes in J. Scott collection and Mike Fisher collection (pap=papered) all coll. J. Scott except as noted: N of Apex Gulch, ridge near Indian Peak, Jefferson Co. Colorado, larvae on *Ceanothus fendleri*, emerged June 26 1m 1980 1m (+1m1f in M. Fisher coll.) & pap 2f, June 27, 1980 1m, June 28, 1980 1m1f & pap 2f, June 29, 1980 2f & pap 1m1f. Apex Gulch, Jefferson Co. Colorado, April 25 1981 pap 3m. Hilltops S of Coal Creek, Jefferson Co. Colo., May 1, 1981 2m pap. Golden Gate Canyon (Tucker Gulch), Front Range foothills, Jefferson Co. Colo. June 29, 1998 1m pap, July 3, 1980 1m1f, July 4 1980 2f, July 6 1980 2m. July 8, 1978 1m. Mt. Zion, near Golden, Jefferson Co. Colo., April 23, 1994 1m, April 25, 1981 1m & 1m1f pap, May 13, 1998 1m pap, May 24 1983 1f pap, May 27 1977 1m pap, July 1 1986 1f. Belcher Hill near Crawford Gulch, Jefferson Co. Colo., May 26, 1980 1f pap. Hilltop 1.5 mi NW Golden, Jefferson Co. Colo., May 26, 1980 1m pap. Hogback at I-70, Jefferson Co. Colo., May 22, 1980 1m pap. Green Mtn., Jefferson Co. Colo. May 21, 1980 1m pap. Red Rocks, Jefferson Co. Colo., July 7, 1978 2f. Mother Cabrini Shrine, Jefferson Co. Colo. May 10, 1980 1m pap. Mt. Falcon, Jefferson Co. Colo., May 29, 1980 1m pap, May 30, 1980 2m pap. Idledale, Jefferson Co. Colo., May 10, 1984 1m1f pap. Cold Spring Gulch, Bear Creek, Jefferson Co. Colo., April 29, 1961 1f. Bear Creek E of Idledale, Jefferson Co. Colo. April 10, 1060 1m. 2 mi W Morrison, Jefferson Co. Colo. May 4, 1968 1m coll. Mike Fisher. Tinytown, Front Range foothills, Jefferson Co. Colo. May 30, 1980 1f pap, June 1, 1995 1m pap, July 2, 1998 2m, July 4, 1997 1m, July 20, 1984 2f pap, July 21, 1984 1m, July 26, 1995 1f. Near jct. SR72 & 119, Gilpin Co. Colo. July 13, 1980 1f Mike Fisher. Russel Ridge, Douglas Co. Colo., Front Range foothills, May 5,1962 1f. Jarre Can., Douglas Co. Colo. April 30, 1981 1f pap. Jarre Can. Douglas Co. Colo. May 2, 1976 1m Mike Fisher. Tributary flowing N into Oak Creek just E of Wet Mts. front, Fremont Co. Colo. 6,000-6,300' April 28, 1971 Glenn R. Scott 1m pap. Oak Creek, 7,000', Wet Mts. foothills, Fremont Co. Colo. May 18 1973 1m pap. 1 mi. SW Greenwood, Custer Co. Colo., July 10, 1967 m. 1 mi. up Sand Gulch, Custer Co. Colo., Wet Mts. foothills, July 10, 196 1f. ½ mi. E Smith Crk. Cgd., Hardscrabble Can., Custer Co. Colo. May 12, 1971 1f pap, July 5, 1973 2m, July 6, 1973 4m, July 7, 1973 1m. Smith Creek Cgd., Custer Co. Colo. May 23, 1985 1f pap.

Hardscrabble Can. near Wetmore, Custer Co. Colo. April 27 1974 1f Mike Fisher. Road to Locke Park, northern Wet Mts., Custer Co. Colo. July 13, 1969 1m. Locke Park, Wet Mts., Fremont Co. Colo. June 29, 1968 m. North Taylor Crk. at Rainbow Trail, Sangre de Cristo Mts., Custer Co. Colo., July 9, 1970 1m. Dalton Cgd., Pecos River, San Miguel Co. New Mex., April 19, 1962 1m. Little Tesuque Can., Taos Co. New Mex. July 26, 1982 1m Mike Fisher. Distribution. This ssp. definitely occurs in Wyoming, Colorado, New Mexico, and in Arizona (at least SE Ariz. & evidently the Hualpai Mts.), and may occur in S-C Montana.

Future research. A good series from the *herri* TL would be useful, although the migration of this species there and the intermediate location of *herri* may continue to deny the name widespread use. A DNA study would be helpful, to determine the limits of gene flow of the migratory populations. The current presumption is that populations from California-Oregon-Washington and southern BC and Northern Idaho and northwestern Montana are frequently migratory and are frequently of the striped/pale form, thus their DNA should be comparatively uniform or at least cohesive, however the intensity of the uns stripe and ups paleness decreases northward so the frequency of some genes should decrease northward, while populations in S Wyoming-Colorado-New Mexico-Arizona-Mexico are non-migratory and are always the unstriped/dark form, so their DNA should be different and may show a cline of growing difference from north to south, although perhaps there are rare migrants that can cross the Great Basin that would make these differences smaller.

A study crossing striped Calif. adults with unstriped Colo. adults would be useful to study inheritance (a problem is getting adults that are sexually receptive, because reared adults that emerge in early summer [in all the single-generation populations] are in diapause/aestivation). The complex system of sex-influenced apparently-genetic forms needs study. The physiology and endocrinology of seasonal forms and diapause & mating is well known in Japanese *Polygonia* (Endo 1972, 1973, Benz 1972 etc.), but none of that seasonal form research seems to apply to the *N. californica* forms. Cold-shocking young pupae merely produces aberrations (Shapiro 2007).

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Warren, A. D. 2005. Butterflies of Oregon. Their taxonomy, distribution, and biology. Contributions of C. P. Gillette Museum of Arthropod Diversity, Colorado State Univ. Lepidoptera of North America 6: 408 p.

Fig. 1. Ssp. *californica* from N Calif., 21m10f (Yolo Co. 9, El Dorado Co. 9, Colusa Co. 4, Glenn Co. 2, Lake, Napa, Stanislaus, Tulare, Plumas, Nevada, Siskiyou Cos. all 1), J. Scott

Fig. 2. *N. californica* Cache Creek, N Okanogan Co. Wash., 19m1f, D. Threatful.

Fig. 3. Ssp. *timidar*, 16m14f Jefferson Co. Colo. (except 2nd ragged female is Douglas Co.)(#4 is holotype), 9m3f Custer Co. Colo. (except top right is Fremont Co.), J. Scott.

Fig. 4. Holotype male *N. californica timidar*. ZooBank registration of this work and taxon Oct. 31, 2014, LSID urn:1sid:zoobank.org:pub:ADCED199-77B6-4618-9AC6-7800B83FF0CD

THE IDENTITY OF *POLYGONIA FAUNUS CENVERAY*, *P. FAUNUS ARCTICUS*, AND *P. SATYRUS TRANSCANADA* (NYMPHALIDAE)

by

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Abstract. Numerous additional specimens and photos of these three *Polygonia* subspecies and nearby subspecies clarifies their taxonomic status.

***Polygonia faunus cenveray* Scott & Kondla and *P. f. arcticus* Leussler**. Ssp. *cenveray* was named by Scott & Kondla (2006) from Halfmoon Park, Crazy Mts., Sweet Grass Co. Montana, and defined by having a gray uns with large green submarginal spots. Pelham (2008) considered it a synonym of *arcticus* (TL base Black Mtn., near Aklavik, NWT). Numerous specimens from near Inuvik and the Richardson Mts. in NWT, the Dempster Highway and N Yukon, and Alaska (many photos can be seen at Mike Leski's site http://proeurasiamedwriter.com/butterflies) show that *P. f. arcticus* is small, the outer part of unh is generally much paler gray than *cenveray*, and the pale-green spots are less conspicuous among the paler gray; some adults have a brownish median area on unf in the nook of the postmedian band, and some females (form *silvius*) have a uniform unmottled paler-gray uns. Bird et al. (1995) wrote that subspecies are poorly defined in Alberta, and improved sampling indicates that most from near Edmonton Alta. extending westward to the W-C Alberta mountains (Prospect Creek, Cadomin, Rock Lake, etc.) and E-C BC to SE Yukon are near ssp. *faunus* (W. Edwards) by having a little orangish-brown on uns (especially unf), while southwestward at Rimbey (NW of Red Deer) variation is great and no ssp. name fits well (most have some brownish on uns, esp. unf). Ssp. *cenveray* is not a synonym of *arcticus* or *faunus* because the uns is darker black-mottled gray in appearance in Montana *cenveray* (and Colorado *hylas* [W. Edwards]) (the unf median area has almost no brownish coloration in *cenveray* and *hylas* because that orangish-brown is mostly replaced by blackish-gray). Ssp. *cenveray* also occurs in SW Alta. (Waterton Lakes NP, Sundre, Etherington Crk., Lineham Creek in K-country, etc.) and S B.C. (a few here have some brown on uns, and a small percentage are smaller and look similar to *arcticus* as a result), Washington, much of Oregon, and Idaho. *P. f. rusticus* (W. Edwards) occurs in California and has a less-mottled underside on which the extensive orangish-brown area even extends outward onto the postmedian areas. *P. faunus rusticus* was stated to occur definitely in coastal Ore. by Warren (2005), and *P. f.* near-*rusticus* does occur west of the Cascades in Oregon where the unf median brown area extends into postmedian area on photos of 3m2f at butterfliesofamerica.com (Jasper & SE Jasper, Lane Co. Feb. 23 2004-5 A. Warren 2m; lower Grave Crk. & Rogue R., Josephine Co. Feb. 22 2005 A. Warren 1m; vic. Pedee Creek Rd. & Bald Mtn. Rd., Polk Co. Aug. 1 2004 A. Warren 1f; 7 mi W Corvallis, Benton Co. April 4 2006 A. Warren 1f), while *P. faunus cenveray* in the rest of Oregon and Washington has the gray underside with large green spots characteristic of *cenveray*; Dornfeld (1980) described Oregon butterflies as "On the underside the wings are gray, contrastingly mottled in the male, and with two submarginal rows of greenish spots; in the female, however, the gray underside tends to be concolorous and washed-out looking." [Actually, brushing the abdomen of adults proves that some females everywhere in the range of *P. faunus* have mottled uns, and the concolorous females should be called form *silvius=orpheus*; these mottled and concolorous forms intergrade completely.] Collectors have gone to Oregon to collect *rusticus* and returned disappointed to find only *cenveray*. Calif. Coast Range *fulvescens* J. Emmel, T. Emmel, & Mattoon is doubtfully distinct from *rusticus* as all were reared and more wild specimens are needed. Finally *smythi* A. Clark is like *faunus* but the uns is very dark and the wing margins are more ragged. In New England many ssp. *faunus* adults have extensive uns reddish-brown. There seems to be considerable variation in all ssp., and the most distinctive are ssp. *rusticus* and *smythi*.

The type locality of *cenveray* was Halfmoon Park, Crazy Mts., Sweet Grass Co. Montana, but the green spots there are slightly smaller there than westward, so the TL should have been 7 mi. W Skalkaho Pass, Ravalli Co. in western Montana where the green spots are a bit larger. However those populations are very similar, and Colorado *P. f. hylas* is much different, being small in size with those green spots very small (almost absent), so the TL difference does not matter, and *cenveray* applies to butterflies from most of Oregon, Washington, S BC, S Alta., Idaho, & Montana.

Kodandaramaiah et al. (2012) studied mtDNA and microsatellite DNA of 11 samples of *P. faunus*, and concluded that the DNA did not match the subspecies well. That is nothing new, as the mtDNA of numerous butterfly species in (*Papilio*, *Phyciodes*, *Speyeria*, etc.) does not match the evolutionary origin deduced from morphology/immatures/genitalia etc. either, and mtDNA has been found to be extremely variable and not necessarily indicative of species vs subspecies rank in many butterflies, and it frequently overlaps the variation in related species. We now know that mtDNA is not suitable for analysis of recently-evolving insects because these have mostly just random variation. Even in *Polygonia*, Wahlberg et al. (2005, fig. 2) found that the DNA of *Polygonia progne* (Cramer) is close to that of *Polygonia interrogationis* (Fabricius)*/P. comma* (T. Harris), but Scott found that nearly everything else about *progne* proves conclusively that it is the sister species of *P. oreas* (W. Edwards) (they share the same male genitalia, the uniform blackish uns, every detail of larval color pattern, hostplants, the slow flight, the rarity everywhere, and their ranges are parapatric and overlap only a few km) (Scott 1984, 1988, 2006) (the cremaster pad is bright pink in *oreas*, evidently yellowish in *progne*). Their sister species status is totally certain, therefore the DNA results are just due to occasional hybridization at some time in the past which resulted in gene frequency changes that perhaps are adaptive in the eastern deciduous woodland (*P. progne* does have the *umbrosa* summer form present in *interrogationis* and *comma* for some mysterious reason, perhaps a mimicry complex with *Asterocampa clyton* [Boisduval & LeConte]). Let's turn this logic around: if species were based on mtDNA, then many butterflies would be split into numerous totally ridiculous "species". This Kodandaramaiah paper analyzed 11 samples, but some of them were misclassified into the wrong subspecies as the map misclassifies the range of some subspecies: Oregon has ssp. *cenveray* and ssp. near-*rusticus* (which does not extend north much farther than W Oregon), ssp. *faunus* extends west into C BC, and *arcticus* is isolated in the far north and is not connected to ssp. *cenveray*. So the British Columbia, Washington, Alberta, and Oregon samples were almost certainly misidentified. The conclusion of the paper, that the California, Arizona-Colorado areas have distinctive DNA, proves that their Oregon sample was not ssp. *rusticus,* and merely represents obvious glacial history, and the only surprise is that *smythi* does not also do so. Those areas are wing pattern endpoints in *Polygonia satyrus* (W. Edwards) and *Nymphalis californica* and numerous other butterflies also. We should study compounds that actually have relevance to the lives of butterflies. For instance we need to use head-space gas chromatography (like that used to determine floral scents) to determine pheromones of individual male and female butterflies, which will finally reveal actual reproductive isolating mechanisms between species, information truly relevant to the evolution of our butterfly species, in contrast to electrophoresis and mtDNA which were studied merely because of laboratory convenience and evolve partly or mostly randomly. To Scott, a butterfly subspecies is a geographical set of populations that can be seen to differ in appearance by an ordinary person—nothing more, nothing less. That is the only practical operational definition of subspecies, and is the one that has historically been applied in butterflies. It is too much to ask that subspecies be genetically distinct in every other trait that someone happens to study, when even the species are not.

***Polygonia satyrus transcanada* Scott & Kondla**. This ssp. was named by Scott & Kondla (2006) from Temiscouata Co. Quebec. Pelham (2008) considered it a synonym of *neomarsyas* dos Passos. Actually, Quebec and Nova Scotia *transcanada* differ by having a darker uns with a russet tone, the uns is slightly more uniform, and both sexes are darker on ups and the black spots are larger and blacker esp. the large black median spots and those in base of cell CuA_1 and near tornus of upf, and the russet-brown inner edging on the uph submarginal pale spots is very wide on females and fairly wide on males. Those butterflies are recognizably different from everything in western North America. But series from most of Alberta and the Rocky Mts. of BC (the upper Fraser River and Mt. Robson and Kootenay Mts. areas) are fairly near this, esp. in NE Alta., and have rather wide russet-brown edging to the submarginal pale spots in females, and fairly wide edging anteriorly on uph of males, and some even have some russet-brown uns color (including a male from Revelstoke & a female from Robson valley in E BC), but most of these are not as dark as Que.-N.S. specimens (though a male from McBride on the upper Fraser River is very dark). Ssp. *neomarsyas* (TL Salmon Meadows, Brewster, Wash.) occurs in southern BC, S Alberta (Bird et al 1995 illustrates a male) including the Cypress Hills, northern Idaho, Montana, Washington, Oregon, and California, and has a brownish uns with no russet tone, some males and females are a little yellower-brown on uns (which never happens in *transcanada*) and males have some brownish inner edging to those uph pale spots (this edging has gaps posteriorly on the holotype uph, and that holotype is not dark), while females have some brown edging but it is not very wide and is narrower than *transcanada*; the black ups spots are a little smaller on *neomarsyas* than *transcanada*. The name *chrysoptera* W. Wright (TL Lake & Mendocino Cos. Calif.) is slightly paler but can be treated as a synonym of *neomarsyas* because it is most similar, and is much darker than Colo. *satyrus*. Ssp. *satyrus* (TL Empire, Clear Creek Co. Colo.) from Colorado and Ariz. (at least some S Idaho specimens are similar) is much paler as Warren (2005) notes, as the underside is paler brown or sometimes yellowish-tan in males and light brown often varying to yellow-tan in females, while males and females have weak or even no brownish edging to the pale uph submarginal spots. *Neomarsyas* is intermediate between *satyrus* and *transcanada*, yet all three names refer to recognizably different butterflies. And E Quebec-N.S. *transcanada* are somewhat darker and have a russet tone to the uns that is less frequent in the west. If only two names are desired in N.A. then one would have to choose between the names *neomarsyas* or *transcanada*, and the choice is difficult because *neomarsyas* is near the intermediate point between E Que. *transcanada* and *satyrus*; Scott uses *transcanada* and places *neomarsyas* in synonymy, in order to have names for the endpoints of the variation, and to recognize the russet-toned uns and uniformly dark appearance of E Quebec-N.S. specimens.

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LYCAENA FLORUS (LYCAENIDAE): A BLACKISH PUPA

by James A. Scott

Abstract. A blackish pupa of *Lycaena florus* has been found; the previous pupa was green.

Lycaena helloides (Boisduval) and *L. dorcas* W. Kirby have pupae that are polymorphic green to brown or even black, but known pupae of *L. florus* (W. Edwards) (Scott 2008) are green. I reared it again to try to find brown pupae, and instead reared a blackish one (figs. 6-7). The eggs and larvae (figs. 1-5) were similar to those illustrated by Scott (2008). (Note that my petition to ICZN [Scott 2009] was successful so *L. florus* is the correct name, and "*castro*" is now a synonym of *L. helloides*.)

Hostplant. More ovipositions were seen, on *Vaccinium scoparium* stems at 10:00, 10:12, 10:25, 11:16, 12:45 (plus three preovipositions) Eisenhower Tunnel, Clear Creek Co. Colo. Aug. 23, 26, 31, 2013. A few tiny *Polygonum douglasii* plants were found at this locality, but *L. florus* mainly chooses *Vaccinium* for oviposition.

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Scott, J. A. 2008. Hostplants and early stages of *Lycaena florus*. Pp. 41-43 in: J. Scott & M. Fisher, Geographic variation and new taxa of western North American butterflies, especially from Colorado. Papilio (New Series) #18:1-72 p.

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(Insecta, Lepidoptera, LYCAENIDAE): specific name conserved by designation of a neotype for *Polyommatus castro* Reakirt, 1866 (currently *Lycaena castro*)", Bulletin of Zoological Nomenclature 67:342-343.}


Fig. 1, egg


Fig. 2, 1st-stage larva


Fig. 3, 1st-stage larva


Fig. 4, 2nd or 3rd stage larva


Fig. 5 mature larva


Fig. 6, pupa upperside


Fig. 7, pupa underside

ROCKY MOUNTAINS BUTTERFLY SPECIMENS DONATED BY THE EARL OF DERBY TO THE BMNH, INCLUDING THOSE LISTED BY DOUBLEDAY (1845, 1947, 1848), AND THOSE NOT LISTED BY DOUBLEDAY BUT PRESENT IN THAT MUSEUM.

James A. Scott

Abstract. Doubleday's list of specimens in the British Museum (Natural History) very badly matched the specimens actually present in the museum.

This information was compiled in 2009 during study of the types of *Oeneis chryxus* (Doubleday) and *Euphydryas anicia* (Doubleday) (those results presented above). It should be useful for lepidopterists interested in taxonomy of Rocky Mts. butterflies. The digital copy of Doubleday (1846-1849) "List of the specimens of Lepidopterous insects in the collection of the British Museum", on Google.com Scholar was searched to find all the butterflies from locality "Rocky Mts.", and those "Presented by the Earl of Derby." I also searched for these words: Rocky Mountains, Earl of Derby, Rocky, Mountains, Derby, Earl, eurynome, Erebia, epipsodea, mancinus, skinneri, christina, astarte, Boloria, Argynnis. When a page with a listing is found, the whole page must be searched, because some pages have up to four entries yet only one is listed in the google search results. The results: he listed 70 specimens "presented by the Earl of Derby", 21 of them from "Rocky Mts.".

The book appeared in three parts: Part 1 1845 (3 title pages, then Introduction p. iii-v, then blank page, then pp. 1-146 treating Papilionidae onward, then Additions on pp. 147-150); Part II 1847 (2 title pages, then pp. 1-57 treating XII. Erycinidae onward); Appendix 1848 (2 pages of titles, pp. 1-37).

These 21 specimens were from “Rocky Mountains. Presented by the Earl of Derby”:

Part II p. 49. Lycaena (n. 2792). a. Rocky Mountains. Presented by the Earl of Derby.

Part II p. 50. Lycaena. (2788). a, b. Rocky Mountains. Presented by the Earl of Derby.

Part II p. 54. Polyommatus (n. 2796). a, b. Rocky Mountains. Presented by the Earl of Derby.

The identity of the above three species was not found by John Calhoun using the species numbers. Their identity might help pinpoint the geographic location of the“Rocky Mountains” specimens. Laborious search of the BMNH collection for likely possible species would be required to find these specimens.

Appendix p. 5. Parnassius Smintheus, E. Doubleday & Hewitson, Genera of Diurnal Lepidoptera, t. 4, f. 1. a---d. Rocky Mountains, N. America. Presented by the Earl of Derby. [A letter from Sir George Hampson said there were 3m1f originally, and Shepard 1984 reported only 2 males remaining, one presented in 1845, one in 1847, so 1m1f were lost.]

Appendix p. 9. Anthocharis Creusa, Doubleday & Hewitson, Genera of Diurnal Lepidoptera, t 7, f. 1. a. Rocky Mountains, N. America. Presented by the Earl of Derby. [Shepard 1984 reported 2 males presented in 1845 in the museum, so Doubleday missed one.]

Appendix p. 10. Colias ---- ? a, b. Rocky Mountains, N. America. Presented by the Earl of Derby. Doubleday (1848) reported two specimens in this Colias ---- ? entry, but he missed one Colias specimen. Ehrlich (1955) reported one pair *Colias christina* presented in 1845, and Ehrlich (1955) reported one female *Colias skinneri* presented in 1845, but Doubleday 1848 only reported two specimens presented, so he missed the third specimen, which might have been *christina* or *skinneri*.

Doubleday missed one specimen of *Colias skinneri* perhaps, as just noted.

Appendix p. 20. Argynnis ---- ? a, b. Rocky Mountains, N. America. Presented by the Earl of Derby. This entry probably refers to *Speyeria mormonia eurynome*, because Ehrlich (1955) reported one *eurynome* female present in the museum which was presented by the Earl of Derby in 1845. The second specimen was probably lost.

Appendix p. 20. Melitaea anicia, Doubleday & Hewitson, Genera of Diurnal Lepidoptera, t 23, f. 2. a—c. Rocky Mountains. Presented by the Earl of Derby. [Shepard 1984 reported only two specimens remaining, 1 male paralectotype (misidentified as female by Shepard) presented in 1845 (later invalidly designated lectotype by Shepard 1984) and a male presented in 1847 (designated lectotype by Gunder 1929), and the third is evidently the leftmost female fig. by Gunder (1929 Pan-Pacific Ent. 6: pl. 5; Gunder figured its shorter label showing it was presented in 1845) which is a paralectotype that was lost between 1929 and 1984.]

Appendix p. 20. Melitaea Proclea, Doubleday & Hewitson, Genera of Diurnal Lepidoptera, t 23, f. 4. a. Rocky Mountains, N. America. Presented by the Earl of Derby. [grossly mislabeled Antillea proclea from the Caribbean]

Appendix p. 31. Chionabas ---- ? a—c. Rocky Mountains, North America. Presented by the Earl of Derby. [Shepard 1984 reported only two females remaining, presented in 1845, so the third specimen was probably the male depicted in the original publication by Doubleday 1851, donated in 1845 or 1847, now lost.]

Doubleday (1845-1848) missed *Boloria astarte* from Rocky Mts. presented in 1845 by the Earl of Derby (Shepard 1984 reported one female in the museum, a syntype which he questionably considered to be holotype merely because that was the only specimen found).

Doubleday (1845-1848) missed *Erebia mancinus* from Rocky Mts. presented by the Earl of Derby (Shepard 1984 reported 2 males present, one donated 1845 the other 1847).

Doubleday (1845-1848) missed *Erebia epipsodea* from Rocky Mts. presented in 1845 by the Earl of Derby (Ehrlich [1955] reported one male present in the museum).

These 49 specimens in Doubleday (1845-1848) were also "Presented by the Earl of Derby", but are from Africa & Australia & Darnley Island (full details and numbers omitted for some listings, at the space   ):

Part I p. 5 Papilio Nireus.   f. Interior of S. Africa. Presented by the Earl of Derby.

Part I p. 34 Pieris Hellica.   d, e. Interior of S. Africa. Presented by the Earl of Derby.

Part I p. 35 Anthocharis Achine. a. Interior of S. Africa. Presented by the Earl of Derby.

Part I p. 38 Callidryas Florella.   e. Interior of S. Africa. Presented by the Earl of Derby.

Part I p. 40 Colias Electra.   g-m. Interior of S. Africa. Presented by the Earl of Derby.

Part I p. 45 Terias Rahel.   d. Interior of S. Africa. Presented by the Earl of Derby.

Part I p. 78 Vanessa Oenone.   r-u. S. Africa. Presented by the Earl of Derby.

Part I p. 79 Vanessa Itea.   d. Australia. Presented by the Earl of Derby.

Part I Additions p. 147 Callidryas ---- ? a. Port Stephen, Australia. Presented by the Earl of Derby.

Part II p. 20 Ogyris damo. a. Hunter River, Australia. Presented by the Earl of Derby. b. Port Stephen, Australia. Presented by the Earl of Derby.

Part II p. 22 Myrina Anterylus.   c. Cape Upstart, Australia. Presented by the Earl of Derby.

Part II p. 24 Amblypodia Centaurus. a. Repulse Bay, Australia. Presented by the Earl of Derby.

Part II p. 44 Lycaena (n. 2770). a, b. Australia. Presented by the Earl of Derby.

Part II p. 50 Lycaena (n. 2759). a, b. S. Africa. Presented by the Earl of Derby.

Part II p. 51 Lycaena thespis.   e, f. S Africa. Presented by the Earl of Derby.

Part II p. 52 Lycaena (n. 2757).   f. S. Africa. Presented by the Earl of Derby.

Part II p. 56 Zeritis thyra.   h-i. South Africa. Presented by the Earl of Derby.

Part II p. 57 Zeritis (n. 2807). a-c. S. Africa. Presented by the Earl of Derby.

Part II p. 57 Zeritis? Lara.   b, c. S. Africa. Presented by the Earl of Derby.

Part II p. 57 Lucia discoidea.   b, c. Australia. Presented by the Earl of Derby.

Appendix p. 1 Ornithoptera Poseidon. a, b. Darnley Island. . Presented by the Earl of Derby.

Appendix p. 2 Papilio Lyaeus. a. Cape of Good Hope. Presented by the Earl of Derby.

Appendix p. 10 Callidryas Gorgophone. a. NW Australia. Presented by the Earl of Derby.

Appendix p. 11 Terias Smilax. a, b. Australia. . Presented by the Earl of Derby.

Appendix p. 12 Euploea ---- ? a. Port Stephen Australia. Presented by the Earl of Derby.

Appendix p. 22 Mynes Geoffroyi. a. N.W. Australia. . Presented by the Earl of Derby.

Appendix p. 32 Coenonympha? Remulia. a, b. Repulse Bay, Australia. Presented by the Earl of Derby.

Two irrelevant listings "Presented by the Earl of Montnorris":

Part I p. 47 Euploea ---- ? a. Australia. Presented by the Earl of Montnorris.

Part I p. 48 Euploea ---- ? a. Australia. Presented by the Earl of Montnorris.

The Futile Search for Boloria Astarte (Doubleday).

Appendix p. 20. Melitaea Astarte, Doubleday & Hewitson, Genera of Diurnal Lepidoptera, t. 23, f. 5. Arg. Pygmaea? Godt. Enc. M. IX 290, n.63. a---d. Jamaica. From Mr. Gosse's collection. [These specimens are evidently the real Jamaican Antillea pygmaea, which is Antillean, and is not Boloria astarte, the butterfly from Alberta.]

Part I p. 91 Catagramma Codomannus. =P. astarte Cram. t756 f.C.D. a. Sta. Lucia. Presented by W. Muter, Esq.). [This is a tropical species.]

All the *Argynnis* entries (which include the current *Euptoieta*, *Argynnis*, *Speyeria*, & *Boloria*) were searched without finding *Boloria astarte*.

The Futile Search for Erebia mancinus Doubleday and E. epipsodea Butler.

All the numerous *Erebia* entries on pages 124-128 were searched for Erebia epipsodea and E. mancinus without success. Only these three possibilities were found: 1) Part I p. 127 Erebia disa. a,b. Lapland. Presented by H. Woodfall, Esq.; 2) Part I p. 127 Erebia discoidalis Kirby, Fauna Bor. Am. t 3, f. 2,3. a, b. Martin's Falls, Albany River, Hudson's Bay, Presented by G. Barnston, Esq.; 3) Part I p. 127 Erebia ---- ? a, b. Martin's Falls, Albany River, Hudson's Bay, Presented by G. Barnston, Esq. This last entry looks like it might be an erroneous repetition of the previous entry. One could think that it represents two specimens of *E. mancinus*, because the bug does occur in NE Ontario around Albany River; however *mancinus* was named by Doubleday 1849 in vol. 1 pl. 64 fig. 2, from "Rocky Mountains", so those specimens were evidently missing from Doubleday (1845-1848). *E. epipsodea* was named from Rocky Mts. also, so it couldn't be that entry either. All the *Erebia* entries were searched without finding *mancinus* or *epipsodea*.

Miscellaneous Irrelevant Errors in Doubleday (1845-1848):

Part I P. 5 lists Papilio cresphontes from Java, Penang, & Moulmein, but this name is followed by P. demolion so these are obviously tropical Asia bugs.

Appendix p. 20 mislabels Melitaea Proclea (Antillea proclea) from Rocky Mts., an Antillean species.

Appendix p. 32 "Erebia? Tamatavae. Stat. Tam. Boisd. Faune, Ent. de Madagascar, 208." lists NO specimens!

Discussion. The listings above include four of the six species Shepard (1984) mentioned (Shepard mentioned *smintheus* [2 specimens], *creusa* [2], *astarte* [1], *anicia* [2], *mancinus* [2], and *chryxus* [2]). I searched for *astarte* and *mancinus* without success, even though they were in the museum in 1845-1848.

Ehrlich (1955, p. 181) mentioned that A. G. Gabriel found five specimens in the museum which had been part of the original 50 specimens donated by the Earl of Derby to the museum in 1845: *Erebia epipsodea* Butler 1868 male, *Colias christina* Edwards 1863 pair, *Colias skinneri* Barnes 1897 female, and *Speyeria eurynome* Edwards 1872 female. Of these, *epipsodea* was not mentioned in Doubleday (1845-1848) even though it was named by Doubleday from TL "Rocky Mts.". *Eurynome* is not in Doubleday (1845-1848) either, but might be one of the two specimens in the p. 20 Appendix entry of Argynnis a, b. from Rocky Mts. Perhaps the pair of *christina* was the p. 10 Appendix entry of "Colias ---- ? a, b." But obviously none of these four species would be listed by the current species' name in Doubleday (1845-1848) because they were all named 15-49 years AFTERWARD. One could think that Ehrlich's species are missing from Doubleday (1845-1848) because the Earl of Derby donated specimens at several different times, and the early ones got into Doubleday (1845-1848), and the later ones didn't and were named much later. However, A. G. Gabriel told Ehrlich that those 5 specimens were part of the 50 specimens presented by Earl of Derby in 1845.

There are numbers in entries: on p. 49. Lycaena (n. 2792). a. Rocky Mountains. Presented by the Earl of Derby.; p. 50. Lycaena. (2788). a, b. Rocky Mountains. Presented by the Earl of Derby.; p. 54. Polyommatus (n. 2796). a, b. Rocky Mountains. Presented by the Earl of Derby. These numbers are evidently some kind of species numbers. Why were those bugs given species numbers and not named to species? Learning the identity of those species could help pinpoint their geographic origin, but John Calhoun has tried to find the identity of those numbered species without success.

Of great interest here is a page in the Accessions Books at the Natural History Museum London. Page 82 (the left and right pages when the book is opened) has an entry "[18]45, #136, 50 Lepidoptera, 10 Coleoptera, 13 Orthoptera, & 14 Hymenoptera, from Rocky Mountains, presented by the Earl of Derby, Rep.'d. 10/1/[18]46, J.C.K." Thus 50 Lepidoptera were donated, whereas I found only 21 in Doubleday's "List of the specimens of Lepidopterous insects…". Thus it would seem that many of the specimens were missed by Doubleday.

Conclusion. Doubleday (1845-1848) missed many specimens. He evidently missed 29 of the 50 specimens from Rocky Mountains donated by the Earl of Derby in 1845, and missed others donated in 1847. He missed a *Boloria astarte* female and two *Erebia mancinus* even though Doubleday named both from "Rocky Mts.". He missed the *epipsodea* male which was labeled "Rocky Mountains" although Butler named it in 1868. He missed *skinneri* which was probably also labeled "Rocky Mountains" because its range is there, although it was named much later by Barnes 1897 from Yellowstone National Park. He might have missed *christina* (which was named much later by Edwards 1863 from portage of the Slave River). There are three *Colias christina/skinneri* specimens in Ehrlich's paper, but Doubleday's (1845-1848) entry listed only two unidentified specimens, so one is missing. Doubleday missed one of the two *Anthocharis creusa* Doubleday specimens present. Evidently there was not a very good agreement between the specimens donated in 1845 and present in the museum and named by Doubleday and later authors, and the specimens listed in Doubleday (1845-1848).

Acknowledgments

Blanca Huertas (curator of Lepidoptera, Natural History Museum London), and Svetlana Nikolaeva (scientific editor, Bull. Zoological Nomenclature, ICZN) searched the Accessions books at the NHM London, and S. Nikolaeva sent photos of records of specimens donated by the Earl of Derby and E. Doubleday to the museum. John Calhoun helped search for some specimens.

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Papilio Bonus

PROBLEMS WITH THE ICZN CODE OF ZOOLOGICAL NOMENCLATURE, AND SOME SOLUTIONS

by James A. Scott

Abstract. Problems with the 2000 4th-edition of the ICZN Code are discussed, and solutions are proposed.

The sections on *Coenonympha* and *Oeneis* and *Euphydryas anicia* (Doubleday) above illustrate some of the difficulties of making nomenclatural decisions, so it seems worthwhile to discuss here the burdens and problems that taxonomists face in dealing with the ICZN Code, and how to fix those problems.

The Code will probably change greatly in the next 20 years, because the internet is rapidly becoming the main method of scientific publication, microbiota characterized mostly by DNA create problems in characterizing and naming taxa, traditional taxonomists are not being hired (for example a decade ago there were four taxonomists working on North American Geometridae, but now there are none) and only DNA workers are being hired, and geneticists take a dim view of traditional taxonomy and insult it as "typological". Younger people will greatly change the Code. So this is the right time to explore improvements in the Code.

The Principle of Priority places a large burden on taxonomists. It requires taxonomists to spend time and money to look at old publications that described the old names, and to view old specimens in museums. Old publications are often hard to obtain (even rare) or expensive, and are often of bad scientific quality, and old specimens including types are often damaged or mislabeled or unidentifiable or lost, causing problems and disagreements. In all other sciences, old bad work is simply forgotten. But in biology, the Principle of Priority requires taxonomists to dive into the Old-Name Sewer to study old texts and old specimens which must remain accessible forever. Museums throughout the world such as the BMNH bear the burden of caring for the type specimens forever, and dollars are becoming fewer for most museums. Until recently the BMNH had three or more Lepidopterists on salary, but now they have just one who is overburdened with requests, so lepidopterists now have to travel to the BMNH to view specimens and locate misplaced types etc.

The current Code requires much time and expense to decipher and implement. Nomenclatural problems sometimes require biologists to submit a petition to the ICZN to fix a nomenclatural problem, and these petitions require much work (100+ hours of time per petition) and require money to publish in Bulletin of Zoological Nomenclature, a journal financed by donations, not page charges. The *Euphydryas anicia* paper took at least 100 hours to finish, which at a cost of $10/hour (butterfly workers make little money as most are amateurs) is a minimum of $1,000. The photos of two syntypes were taken as part of a trip to the BMNH in London that cost perhaps $1,000. in today's dollars, so perhaps those photos cost $100. The *Oeneis chryxus* Doubleday problems surely cost more than 1,000 hours by many people and thousands of dollars of expense including costs of publishing an ICZN petition and running a large website. My *Lycaena florus* (W. Edwards) study and petition to ICZN was also expensive.

The Introduction to the Code states that there is no Case Law in nomenclature, so if arguments arise about some articles or interpretations, those arguments must take place for every similar case, because decisions made on taxonomic petitions by the ICZN in Bull. Zool. Nomenclature do not automatically apply to other similar cases. This requires time and expense to revisit the same procedure for each similar case.

Because of those burdens, a major goal should be to repeal the Principle of Priority. If that principle were eliminated, biologists could just ignore old bad names, and would no longer have to wallow in the Old-Name Sewer to deal with them. If the Principle of Priority were abolished, we could finally get rid of severely problematic names, we could correct inappropriate and misleading scientific names, and we could properly name clines, by simply renaming them. Time and money would be saved. Some chaos would ensue until the names became accepted by most people, but there is also chaos in the current system due to differing interpretation of the Code and bad descriptions and misidentification of specimens and mislabeled or damaged or unidentifiable type specimens or names unfortunately proposed in the middle of a cline, etc. etc.

The most problematic names take up a huge amount of time. So I have submitted a petition to the ICZN to create a new article in the Code that would enable taxonomists to publish that a name represents a **toxotaxon** if the original description/types are so inadequate that the taxon represented cannot be matched to any existing taxon. The declaration of a toxotaxon would instantly cancel any priority that the name possessed, and the taxonomist could then in the same paper properly rename the taxon that the name might have applied to. This would save considerable time and expense by taxonomist and ICZN in dealing with that bad name.

Currently, inappropriate and misleading scientific names cannot be corrected, and must be endured forever. Biologists are burdened with numerous scientific names that are inappropriate because the name wrongly describes the species or its habitat etc. For instance, *Plebejus lupini* Bdv. does not go near lupines as a caterpillar or adult, so the name is a blatant lie. Scott (2008) introduced a universal solution, the "lapsus contrarius", which corrects inappropriate names by adding a- (or anti- if a- produces homonymy) to the front of them to negate their inappropriateness; thus *lupini* becomes *alupini*, meaning "not-*lupini*". But suffixes such as –no or –un or –anti would be better, in order to retain the same index placement of the name, for instance *lupinanti* would appear in an index the same place as *lupini* so people would still be able to find it. I have submitted a petition to the ICZN to create a new article in the Code that formalizes the **lapsus contrarius** to permit the correction of such inappropriate/misleading scientific names.

Naming subspecies involved in clines is very difficult because of the Principle of Priority in the Code. Scientifically, there should be at most two names for a cline. If there are three names for a cline and the oldest names are not nearest the two ends of the cline, in order to reduce the usable names to two (one for each end of the cline) we must invent and apply the concepts of "jumping subspecies" and "pretend type localities" (Scott 2008). For example subspecies *aehaja* (Behr)-*hilda* (J. Grinnell & F. Grinnell)-*aureolus* (J. Emmel, T. Emmel, & Mattoon) form a cline of increasing orange on the wings of female California *Plebejus saepiolus* (Boisduval) blue butterflies, but the name *hilda* is older than *aureolus*, so to reduce three names to two and satisfy the Principle of Priority we must sink the newer name *aureolus* to *hilda*, a process called "jumping subspecies", as the middle name *hilda* jumps the end name *aureolus* and gets crowned queen *hilda* in a game of nomenclatural checkers. Then the "pretend type locality" of *hilda* becomes the TL of the end name *aureolus*. I have submitted a petition to the ICZN to create a new article in the Code that would allow taxonomists to designate a **clinotype**, a type specimen from the end of a cline which would retain the same name as the older name in the middle of the cline but would move the type locality to the end of the cline to enable the cline to be properly named with just two names.

In the past, lectotypes were frequently designated merely for curatorial convenience by persons without expert knowledge of the group, and those lectotypes often prove to be problematic upon further study (often unidentifiable), such as the lectotypes for *Oeneis chryxus* and *Euphydryas anicia* noted above. Currently, neotypes are required to be designated only during a scientific revision, but this is only a recommendation for lectotypes, so lectotypes should also be required to be designated only during a scientific revision.

The Code requires that the gender of latin species/subspecies names must match that of the genus. Unfortunately scientific names are seldom stated to be latin in the original description, so some people change the endings of all names by assuming they are latin even if the author (such as myself) merely concocted them to sound good and had no knowledge of latin. This issue has divided taxonomists (Pelham 2008 used original spellings), and causes instability as the names change because of authors who take opposite sides of this gender issue, and as species are switched frequently to different genera of differing gender. I think we should use original spelling, because fewer and fewer people today know any latin, and rampant splitting frequently moves species to new genera.

The Code continues to encourage the –ii suffix at the end of species/subspecies names, even though nobody can remember which name is –i and which is –ii, so misspellings of these abound in the literature. We need an article that requires all the –ii's to be changed to –i.

Some Code articles have writing that is confusing or incomplete and can be interpreted in different ways, causing disagreement by biologists about names, and adding to the time spent on nomenclatural decisions. That writing should be fixed as noted below.

Articles correcting the spellings of names are confusing. I interpret Art. 32.5 to mean that EVERY lapsus calami must be automatically corrected, because spelling is ALWAYS corrected by consulting an accepted standard of spelling (such as a dictionary or city directory or birth certificate or map), without exception. But some people interpret Art. 32.5's statement "If there is in the original publication itself, without recourse to any external source of information, clear evidence of an inadvertent error, such as a lapsus calami or a copyist's or printer's error, it must be corrected.." to mean that spelling standards such as dictionaries or maps or names of persons in directories etc. are not allowed to be used, thus those people think that if a person's name was misspelled in the name honoring him in the original publication it could never be corrected. I think the words "If" and "such as" in this article mean that its specified case is just a small portion of the total possible types of lapsi calami, and the article does not preclude the correction of lapsi calami based on external sources. So those always must be corrected using standard external sources: every lapsus calami must be automatically corrected. If the Code had wanted to prevent correction of most lapsi calami it would have written "A lapsus calami can be corrected only if there is in the original publication itself, without recourse to any external source of information, clear evidence of a misspelling." (Only if the name is whimsically invented and does not occur in any dictionary or reference, such as the name duwupalu, would the name need to be corrected using only information inside the O.D. paper, and then only if the majority of the usages in the paper were spelled differently such as duwupalu than the usage in the formal O.D. text such as duwupalo.)

"Justified emendation" and "unjustified emendation" are confusingly misnamed in Art. 33.2 governing emendations of names, because these names have nothing to do with whether the correction is justified. They properly should be named "original-publication-warranted emendation" and "non-original-publication-warranted emendation".

Note that Articles 33.2.3.1 and 33.3.1 mean that if a misspelled name comes to prevail in scientific papers (more than 50% of papers I presume), that spelling is now the correct spelling; therefore, we must correct the misspelling of the North American butterflies *Pieris marginalis macdunnoughi* Remington to *mcdunnoughi* (named after James McDunnough) and *Boloria titania ranieri* (Barnes & McDunnough) to *rainieri* (Mt. Rainier) and *Neophasia terlooii* Behr to *terlootii* (Baron Terloot) and *Euphyes dion macguirei* Freeman to *mcguirei* (William McGuire) and *Erebia magdalena mackinleyensis* Gunder to *mckinleyensis* (Mt. McKinley) etc. in scientific names (because the second names are how those people and mountain are named), which many people mistakenly believe we can't do under Art. 32.5. Happily, if anyone misspells any scientific name, other authors should merely use the correct name in their papers, and soon the correct name will prevail and become the Code-correct spelling.

The Code articles on infrasubspecific names later adopted as species/subspecies are confusing, as normally those adopted names take the date and authorship of the adoption as ssp./sp., but sometimes take the date of the original description of the infrasubspecific name. Art. 45.6.4.1 states that IF a name was first published before 1961 as a "variety" or "form" and IF the original publication described it as infrasubspecific and IF the name was adopted as a species/subspecies before 1985, then availability date and authorship are that of the original infrasubspecific name (the Polinski example demonstrates this), NOT the availability date and authorship of the publication that adopted the name for a species/subspecies. Art. 10.2 repeats the information in 45.6.4.1 and Art. 1.3.4 repeats part of it, but the last sentence in 10.2 and the entire Art. 45.5.1 ignore the exception of 45.6.4.1 and state that date and authorship & availability are that of the adoption "elevation". Thus Art. 1.3.4 and 45.6.4.1 and the first part of 10.2 mean that the infrasubspecific name magically became retroactively available between the dates of original naming and subsequent adoption. But 23.3.4 and 50.3.1 don't mention that exception clearly and only cite the above Articles. I suspect that the exception detailed in

45.6.4.1 was implemented in the 2000 4th edition of the Code to cover the mistaken Bequaert example at the end of Art. 45(g) of the 1985 3rd ed. Code which, in its use of authorship & date of the original infrasubspecific name rather than the date of the raising, contradicts articles 23(j) & 50(c)(i) & 10(c) & 45(g)(ii)(1) & 1(b)(5) & the Glossary definition of “establishment” in the 1985 Code. A decision tree would be a superior quick clear way of implementing these rules, which should be more clear. For instance the Examples after 45.6.4.1 use only the words “variety” or “form”, and do not use extra modifying words such as “dimorphic” and “melanic” and “male” that clearly make a name infrasubspecific; I interpret this Article to mean that if modifying words are added such as “dimorphic form” or “recessive form” or “melanic variety” are used, 45.6.4 does not apply to the name, but this is not clearly stated. Another aspect of infrasubspecific names that confuses some people is that a name must be proposed as “variety” or “form” in its first publication to be considered subspecific (Art. 45.6.4), and subsequent publications of the name as a “variety” or “form” have no effect on its infrasubspecific or subspecific status, unless a publication then gives it subspecies/species status (Art. 45.5.1, 10.2, 45.6.4.1).

The writing concerning the word taxon is also confusing. The Glossary writes that a taxon is a population or group of populations, yet below that “infrasubspecific taxon” is defined as “A taxon at lower rank than that of subspecies.” (does this mean a whole population named as a form?).

Authorship of scientific names is often confusing in the Code, as noted above, as people argue whether authorship should go to the person publishing the paper describing the name, or (my opinion) to the person who did the scientific work recognizing the name and at least was mentioned in or coauthored the publication.

The terminology “name-bearing type” is somewhat confusing. Actually it can be one specimen (a holotype or lectotype or neotype or syntype), or it can be a whole set of multiple syntypes. Likewise, “type series” can be a whole series of specimens, or it can be just a single specimen (any of the same four types) as Articles 72.4.2 & 72.4.3 clearly state.

The articles on suppression of synonyms (Art. 81.2.2 & 81.2.3) are a little confusing. 81.2.3 means that if two species are found to be conspecific, and the older name belongs to an obscure species while the younger name applies to a very-often-published species, conditional suppression will make the combined species use the popular name, and the obscure name will be a subspecies of the popular one.

Final thoughts. What should be the future of the Code? If the next edition stays similar to the current one, the above problems should be corrected. Ideally, the principle of priority should be repealed, and then all the problems could be corrected by just proposing a new name the proper way in order to replace the old bad name. The nomenclatural instability that would sometimes ensue would surely be no worse than the instability we now endure.

A better system than the Code might be a registry system like that used for bacteria, which would maintain a system of registered good names, would correct inappropriate names, and would simply ignore old bad names.

A decision tree chart should be constructed to more-clearly implement the process of deciding various issues, including the process of deciding the members of a type series, the date and authorship of an infrasubspecific name later adopted as a ssp./sp., etc.

CORRECTIONS/COMMENTS ON PREVIOUS PAPILIO (NEW SERIES) ISSUES

by James A. Scott

This section contains corrections for all the former issues of Papilio (New Series) #1-20, and includes useful comments on the subjects discussed in those issues.

#6 (=Papilio [New Series] #6). Some corrections were given in #7 p.95. P. 13 the "*Colias*" *Zerene cesonia* oviposition on *Cassia* was actually on *Parosela dalea*. P. 19 *Pontia protodice* the *Schoenocrambe liniarifolia* record for Caprock etc. is actually *Thelypodium integrifolium*. For *Oeneis polixenes*, change *Cerastium vulcatum* to *Cerastium strictum*. For *Vanessa cardui*, add "Larvae *Cirsium ~arvense* Rociada, San Miguel Co., New Mex., Aug. 23, 1978." For *Satyrium californica* oviposition 10:45 there were 3 eggs glued in hole plus another glued beneath them. For *Satyrium acadica*, change *Salix lucida lasiandra* to *Salix ligulifolia*. For *Satyrium auretorum* add "Assoc. *Quercus vaccinifolia* Long Point Lookout, Glenn Co. Calif. June 16, 1974." For *Plebejus idas atrapraetextus*, the *Astragalus alpinus* assoc. record at Slumgullion Pass belongs to *Plebejus melissa pseudosamuelis*. For *Plebejus melissa melissa*, the record of "Mature larva found below *Astragalus flexuosus* from Tinytown…July 3, 1991", belongs to *Glaucopsyche lygdamus*. For *Plebejus shasta pitkinensis*, the oviposition on *Trifolium dasyphyllum* was at 13:01. For *Plebejus shasta pitkinensis* the oviposition 10:37 was on *Potentilla nivea* not *uniflora*. For *Plebejus acmon acmon* the assoc. record was on *Erigonum lobbii* var. *robustum*. For *Hesperia comma* "*assiniboia*"=*ochracea* the record of larva 2 cm long on *Bouteloua curtipendula* found at Apex Gulch, Jefferson Co. Colo. Aug. 24, 1990 should be moved to *H. viridis*. For *Hesperia viridis*, add "Larva (formerly called *H. comma*) on *Bouteloua curtipendula* Apex Gulch, Jefferson Co. Colo. Aug. 24, 1990". Some *H. viridis* larvae do have head stripes. The *Astragalus* "probably *bisulcatus*" record for *Erynnis persius* is actually *Astragalus hallii*.

#7. P. 95, the *Betula* hostplant refers only to Michigan, and *B. frigga* is absent in Utah.

#8. P. 15, ssp. *helena* is actually a syn. of *dennisi*. The larva photos at end have been improved because the originals were bad.

#11. P.8, ignore the section on *oregonia*; it is a valid name from N Calif. for an intergrade mess, thus is a worthless name.

#12. P. 14, *altacordillera* males also have more brown on upf veins. P. 18, Wheeler Park Cgd. evidently should be Wheeler Peak Cgd. P. 5 & 22, there were ~17 to 22 glacial advances, the exact number somewhat uncertain. P. 25 top, Bird's reference to *Oeneis* "*chryxus*" being resident along gullies, paths and edges of meadows may have referred to *altacordillera* raiting in gulches. P. 34, the Veedauwoo population is *rorina*, the adults mostly *bernadetta* (whitish with a few redder adults, though redder adults increase in frequency late in the flight), and Steve Spomer's larvae are striped like Neb. *bernadetta* (ssp. *capella* has a solid white larva in 3 Colo. counties at least, so larvae should be used to determine intermediacy between *rorina* & *capella*). P. 35, ssp. *ehrlichi* is like ssp. *editha* but has more-cream-colored bands. P. 40, ssp. *arcticus* is related to ssp. *faunus* as it is smaller with uns much grayer; some have a little median unf brown. P. 43, *L. florus* and *L. helloides* are also sympatric at Harley Crk., Little Belt Mts., Cascade Co. Mont. P. 47, the specimen misidentified in Scott & Justice (1981) was the female from Fort Simcoe which is not *oregonensis* as only *sheridanii* & *affinis* occur there. P. 51, ssp. *saepiolus* has little blue on ups of females. P. 52, three more *P. icarioides* synonyms (not valid ssp.) should be mentioned: *eosierra* is an intergrade of *fulla*X*icarioides*X*albihalos*, *inyo* is *evius*X*albihalos*, and *argusmontana* is *albihalos*X*fulla*. P. 56 *fridayi* oviposited on *Astragalus whitneyi* not *alpinus*. P. 60 & 68, "bighornimuelis" is actually *P. atrapraetextus* near *longinus*.

#13. P. 2, Boisduval put an X on the label of the *callina* female, so that is the holotype, not a Holland 1931 lectotype designation (see Papilio [New Series] #19 p.37). P. 5, *harperi* belongs in synonymy of ssp. *saskatchewan*. P. 6, *sacramento* TL is Cloudcroft, Otero Co. NM. The *phaon* TL is San Simon=St. Simons I. P. 7, Brown's papers were a full 3" thick. P. 15 & 28, the photo of *phaon* larva in Wagner (2005) is *phaon*. P. 17, *P. diminutor* occurs all across N Ohio (Lucas, Wood, Sandusky, Columbiana Cos.). P. 18, in S Minn. *P. diminutor* evidently has 2 gen. M-L June and Aug.-Sept., *P. tharos* mostly two generations E-L June & L July-Sept. P. 24 top, *P. phaon* has a curved fw costa also. P. 23, Walter Krivda wrote me that *P. batesii saskatchewan* is assoc. with *Aster ciliolatus* in Manitoba. P. 25 bottom, Falco Marsh is in Eureka in Humboldt Co. P. 28, the incised V is on posterior edge of lamella, not tegumen. *P. phaon* frontoclypeus is evidently black in Fla. ssp. *phaon* (H. Gene, J. Nation, & T. Emmel. 2003. Life history & biology of *Phyciodes phaon*. Florida Entomologist 86:445-449), but white? in ssp. *jalapeño* (Comstock & Dammers). P. 28, Gerardo Lamas.

#14. P. 2, add "*Papilio eurymedon* assoc. *Ceanothus velutinus*, W side Rabbit Ears Pass, Routt Co. Colo. July 16, 1985". P. 8 line 8, "another sedge" was evidently *Scirpus microcarpus*. P. 13, *Phleum alpinum=commutatum*. P. 24, Lynn & Gene Monroe later found *C. gorgone* larvae on *Rudbeckia hirta* near Lyons Colo. P. 30, add "Adults common around *Aster ascendens*, Rio Grande River 4 mi. NE Pilar, Taos Co. New Mex., Sept. 10, 1977. Adults assoc. *Aster fendleri*, Questa, Taos Co. New Mex., Sept. 10, 1077." P. 33, *Viola* taxonomy is difficult and *V. canadensis* has been split, so the *S. mormonia* oviposition 11:51 was probably on *Viola rydbergii* because all 8 plants from Tinytown were det. as *rydbergii*, and S. *atlantis sorocko* and *S. hesperis hesperis* are assoc. with *rydbergii* 1 mi. NE Mt. Judge, Clear Creek Co. CO Aug. 8, 1985, and *S. hesperis ratonensis* assoc. *rydbergii* at Sugarite Can., Las Animas Co. CO July 28, 1985, and at ENE Raton, Colfax Co. New Mex. 1978. P. 36, A. Warren also found that *editha* & *xanthoides* intergrade in SW Ore. (2005, Butterflies of Oregon, their taxonomy, distribution, and biology. Gillette Mus. Arthropod Diversity, Colo. State Univ.). P. 36, add "*Lycaena arota* assoc. *Ribes leptanthum*, Spruce Cgd., Tarryall River, Park Co. Colo., Sept. 5, 1959". P. 37, it was *S. sylvinus putnami*. P. 38, add "Dozens of adults on *Atriplex polycarpa* at 6 mi. S Stockton, San Joaquin Co. Calif. Sept. 16-17 1973, & at Kings River S of Kingsburg, Tulare Co. Calif. Sept. 18, 1973, & at Earlimart, Tulare Co. Calif. Sept. 18. 1973, all J. Scott." P. 41, the *P. icarioides* ovip 9:03 was reidentified on *Lupinus argenteus* var. *argenteus* in Sowbelly Can. P. 41-42, the "*lutzi*" on *Eriogonum brevicaule* & *effusum* are actually *P. alupini* ssp. *texanus*. P. 42, the *P. alupini texanus* (not *lutzi*) N Mitchell Neb. was on *Astragalus sericoleucus* (reidentified). P. 59, *E. icelis* also ovip. on *Populus tremula tremuloides* treetops (C. Guppy; also D. James & D. Nunnallee 2011, Life Histories of Cascadia Butterflies). P. 64 line 8, *Sidalcea* [not *Sphaeralcea*] *neomexicana*. P. 64, *Pholisora catullus* no larvae found on one *Atriplex rosea* [not ?*patula*].

#15. A reader suggested the use of a shaper to saw the drawers apart. That would work. However, each professional shaper cutter is very expensive ($300. or more) and has only two or three teeth whereas a good saw blade has 80-100, so the shaper cutter will wear out 27-50 times faster than the saw blade. And a good shaper costs $1,000.-$3,000. (cheap router tables are too small). So using a shaper would be about 1,000 times as expensive as a table saw, or at least 50 times if you buy cheap stuff. Just make a good tall rip fence for your table saw.

#16. None.

#17. None.

#18. P. 8, TL of *coriande* is Santa Fe Co., not Taos Co. P. 12, *A. julia sempervirens* is a <u>new combination</u>. P. 21, nahcolite formed at 1,200 ppm of CO_2, not 200. P. 24 *wyomingo* and *ridingsii* overlap from N Colo. to N Montana. P. 34, the BD2 [not BD1] & BL scoli are black, and BD1 & BSD & BSV are orangish at least at base. P. 37 seven lines from bottom, the 3 mi W Kern R. site has *cythera* not *davenporti* in Aug.-E Sept. P. 39, a series at Colo. State Univ. coll. Scott Ellis from Del Norte has a mixture of black & orange-band uph individuals and some intermediates, suggesting ssp. *mormo* and *pueblo* are conspecific. P. 40, figs. 1-2-3 should be figs. 8-9-10. P. 42 line 7, *oxycoccos* not *ocycoccos*. P. 44 Scott's petition to suppress the name *castro* was successful (opinion 2261 designated a neotype of *castro* using a specimen of *L. helloides*, making *Lycaena florus* the correct name and *castro* a syn. of *helloides*; see Bull. Zool. Nomenclature 67:342-343). P. 52, the male "near *megaloceras*" with 5 lunules from Harley Creek Little Belt Mts. is actually *helloides* sympatric with *L. florus*. P. 56, the male from Chico Crk. 7,000' San Miguel Co. CO is actually *paradoxa*X*sheridanii*. P. 56, Gorelick in vol. 25 supplement only recorded *viridis* in Stanislaus Co., on his p. 14 & map 1. P. 57, the W slope E. *ancilla* on *Eriogonum subalpinum* & *E. umbellatum* was later placed as ssp. *ancilla* [but should be compared to TL Eureka Utah bugs], the Front Range pop. was later named ssp. *barnesi* Opler & Fisher, while Oakley Shields' original small-spotted variety in Delta Co. on *Eriog. ovalifolium* was later named *stanfordorum* Opler & Warren in Michael Fisher's Butterflies of Colorado which is at least a good ssp. resembling *barnesi* but with wider orange band. P. 62, the *texanus* N Mitchell Neb. was on *Astragalus sericoleucus* (reidentified). P. 69, a holotype of *fridayi* was designated in O.D., so Comstock's illustrated specimens are paratypes and no new type is needed because *fridayi* is a perfectly valid name. P. 72 corrections, actually *eurytion* flies at summit 10,000' of Sierra Madre Range.

#19. P. 2, Holland (1931 p. vii) wrote "So far as possible I have employed in making the illustrations, the original types from which the author of the species drew his descriptions.", making it clear that those types that he singled out as "type" are lectotypes. Holland designated 76 lectotypes [not 75], including/adding *brenda* (see Scott & Gray & Kondla paper in this Papilio [New Series] issue). P. 4 & 12 & 31, *floridensis* would be another Holland (1931 pl. LXIV fig. 2) lectotype designation because there is no holotype & no holotype by monotypy, except it is infrasubspecific. P. 15, pl. LV *lehmani* is not holotype as it is a replacement name. P. 19, Holland's O.D. of *albocincta* wrote "Type and holotype in coll. Holland", so Holland designated a holotype. P. 20 top line, figs. 10-11 *lindseyi* are paratypes not syntypes. P. 20, pl. LXXIV figs. 11-12 & p. 185 is a valid Holland (1931) lectotype designation of *brenda* (see Scott & Gray & Kondla paper). P. 21, *pseudobrenda*, see same paper. P. 21, add "*Parnassius phoebus sternitzkyi*, 101:6 "neotype" is actually holotype according to Pelham catalogue." P. 24 & 30, *P. eunus* does occur on Kern River bottoms, so TL is not Victorville. P. 30, Holland (1931) p. 85 & pl. LIII fig. 39 male is evidently *kumskaka* not *bulenta*. P. 31, *aliaska*, Scudder's OD also mentioned a specimen from E coast Hudson Bay. P. 32, P. 185 J. Calhoun actually wrote that Holland gave the name *crameri* to a fig. by Cramer. P. 33, *minyas* is correct. P. 11 & 33, p. 246 *speciosa* was described from one specimen so Holland's figs. can be holotype but not paratypes. P. 33, p. 260, *fridayi* OD designated holotype so the specimens and figures must be paratypes. P.34, p. 301 *lehmanni* was proposed to replace *alaskensis* so fig. can't be holotype. P. 34, p. 305, O.D. of *boisduvalii* gave TL as "far north of Europe". P. 35, p. 306 *rainieri* is the correct prevailing spelling by Art. 33.3.1. P. 35, p. 312 *bremneri* TL was restricted to San Juan Is. by Edwards. P. 35-36, p. 349, ignore this writeup as *c-argenteum* engraving is clearly *progne*. P. 36, p. 365, Pelham validly restricted *colon* TL based on OD etc. P. 40, p. 422, add "*bootes* TL should be considered Cap Nord, as there is no real evidence it is American." P. 40, p. 599-600 James Wilson Tilden. P. 45 bottom, pl. 2 #25 is *N. ridingsii pallidus*. P. 47 2nd parag., spelled George T. Austin. P. 50, 15 lines from bottom, Reed A. Watkins. P. 52, 16th line, Derham Giuliani. P. 55 (chapter 42) & p. 78 & 91 & 93 & 95 & 100, *occidentalis* is older than *titus watsoni* so actually *watsoni* is a syn. of *occidentalis* or a weak ssp. P. 63 & 65 middle, Yukon-W BC "*afranius*" are actually *lucilius* according to Crispin Guppy research. P. 64, *nigrescens* seems to belong to *Cel. lucia*, not to *C. neglecta echo*. P. 75 line 7, *lutea* is evidently a valid ssp. of *O. yuma* with yellower unh. P. 88, 2nd parag: *ariane* & *incana* are syns. of *nephele*. P. 91, Florissant Butt. color pl. viii 93a-c are *O. calais altacordillera*. P. 97, *Pieris virginiensis* does occur in Alabama. P. 102, add "p. 61, *E. vestris* surely has one gen. in N Ohio and two in S Ohio." P. 102, Butt. Ohio book pl. 29 1m1f from Elk Co. Penn. are evidently *Phyciodes diminutor*, not *tharos*. P. 112, caterpillar book p. 110 the blue blotch is *C. sthenele* map 4 not 5. P. 118, in Butt. Binoculars Florida add "Pl. 37 fig. 2 is actually *Hesperia metea metea* female (not *hianna*)".

#20. P. 6, *texana* in W Texas might be considered a syn. of *Hesperopsis alpheus alpheus*, but the series of nice fresh adults from TL S Texas in the J. Richard Heitzman coll. should be examined, which Scott used for the O.D. P. 7 "new sp." near *lucilius* is evidently a ssp. of *lucilius* that Cris Guppy is naming. P. 9 unnamed tribe is evidently Moncini. Nick Grishin has found intermediates *Amblyscirtes celia-belli* in Dallas, so they are evidently ssp. P. 10 *eunus* TL is bottoms of Kern R. near Bakersfield, Calif. P. 10, *Hesperia comma manitoba* is not a lapsus contrarius. P. 11 *basinensis* is a synonym intermediate toward *Polites sabuleti sinemacula*. P. 11 *tenebricosus* seems to be an oranger ssp. of *Atalopedes campestris*. P. 13 place *Parnassius phoebus olympianna* as an indented ssp. below *smintheus* with fewer orange basal unh spots. P. 13, study of dubious Cuban *polyxenes* is needed to determine if *asterias* is a valid ssp. P. 14, *minori* TL is in Colo. not Calif., and *glaucus* is in subgenus *Pterourus*. P. 15 & 46, use *Colias tyche canadensis*. P. 16 *baffinensis* is actually a ssp. of *C. pelidne* as its types prove. P. 16 add *C. scudderii nortepacifica* TL Nimpo Lake in W BC. P. 16, *coriande* TL is in Santa Fe Co. not Taos Co., and *colorado* should be indented under *thoosa*. P. 17 *guaymasensis* interbreeds with *hyantis* so is evidently a ssp. P. 17 add *P. marginalis passosi*=*meckyae*. P. 17 *pseudonapi* is a homonym of Japanese *pseudonapi* so *mcdunnoughi* is valid (and *mcdunnoughi* is the prevailing proper spelling). P. 18 *nordini* TL is in Sioux Co. Neb. not Nev. P. 20 add *Cercyonis sthenele incognita* TL W end of Bald Mtn. ridge, Mendocino Co. Calif. P. 20 add *Cercyonis meadii* form *damei*. P. 20 does *E. dabanensis* really fly with *E. youngi* in Siberia, or is that conclusion just the mistaken interpretation of variable valvae? P. 22 identity of "*polixenes*" *beringiensis* is dubious. P. 23 *A. cybele novascotiae* is valid ssp. with red-brown entering unh submarginal yellowish band, and *pseudocarpenteri* should be indented under *krautwurmi*. P. 25 *S. zerene garrettii* is valid local ssp. with darker disc. P. 26 *raineri* is valid prevailing spelling; *boisduvalii* TL is actually "northern parts of Europe" so delete it from catalogue. P. 27 treat *Roddia* as subgenus of *Nymphalis*. P. 27 *N. antiopa hyperborea* is valid ssp. (smaller & ups redder with duskier borders), while *N. a. lintnerii* is in most of N.A. P. 27 *chrysoptera* is a syn. of *neomarsyas* and is also intermediate *satyrus/transcanada*. P. 27 *arcticus* uns is paler gray and some have unf median brown; move ssp. *rusticus* after ssp. *hylas*. P. 31 *freemani* TL is evidently Chisos Mts. Tex. (it is absent N of Alpine). P. 32 replace homonym *alpestris* by *L. phlaeas shields* Kocak. P. 33 the successful ICZN petition designated a *castro* neotype of a male *L. helloides*, so *castro* is a syn. of *L. helloides*. P. 35 *S. titus occidentalis* is a valid ssp. as it is older than *watsoni*, so indent *watsoni* under it. P. 34 *mopsus* is a syn. of *titus* with same TL. P. 35 *ilavia* TL “Tex.” is mislabeled. P. 35 *Callophrys affinis* ssp. are now *C. dumetorum* ssp., and *perplexa* is a syn. of *dumetorum*. P. 35 indent *newcomeri* under *neoperplexa*. P. 39 *Echinargus* belongs in *genus Hemiargus* (which some say belongs in *Plebejus*). P. 42, for *Panoquina panoquinoides errans* use Pacific Estuary Skipper. P. 42 spell it *Notamblyscirtes*.

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