

Review of the *Catocala delilah* species complex (Lepidoptera, Erebidae)

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Abstract

The members of the Nearctic *Catocala delilah* species complex are reviewed. One new species (*C. caesia*) and four new subspecies are described, one subspecies is reinstated to specific rank (*C. desdemona*), and one species and three subspecies are placed into synonymy. A neotype is designated for *C. calphurnia* and a lectotype is designated for *C. desdemona*.

Keywords

Lepidoptera, Erebidae, *Catocala*, southwestern USA, California, Arizona, *Quercus*, oaks

Introduction

In their monograph of the North American *Catocala*, Barnes and McDunnough (1918) subdivided the genus into 20 “Groups” based on morphological characteristics. They included four species with primarily southwestern geographical distributions in their Group XII (the *Catocala delilah* species complex), acknowledging that little information was known of the species and that the placement was provisional. Four additional species in the *delilah* complex were described subsequent to Barnes and McDunnough’s time, and the monophyly of the complex, species’ boundaries, relationships, and life histories of these taxa were examined by Hawks (1986).

This paper summarizes recent taxonomic work on the *delilah* complex, with descriptions of one new species and four new subspecies: *Catocala caesia* Hawks sp. n., *C. benjamini jumpi* Hawks ssp. n., *C. benjamini maybewi* Hawks ssp. n., *C. chelidonia occidentalis* Hawks ssp. n., and *C. chelidonia uniforma* Hawks ssp. n. Also, *Catocala desdemona* is reinstated to species status, *C. delilah utahensis* and *C. ixion* are placed in synonymy with *C. desdemona*, *C. andromache wellsi* is placed in synonymy with *C. andromache*, and *C. mcdunnoughi browerorum* is placed in synonymy with *C. mcdunnoughi*.

Institutional acronyms follow Arnett et al. (1993): AMNH = American Museum of Natural History, New York; BMNH = The Natural History Museum, London; CMNH = Carnegie Museum of Natural History, Pittsburgh; CNC = Canadian National Collection of Insects, Ottawa; FMNH = Field Museum of Natural History, Chicago; MCZ = Museum of Comparative Zoology, Cambridge (USA); PMNH = Peabody Museum of Natural History, New Haven; USNM = United States National Collection, Smithsonian Institution, Washington; ZMHU = Museum fur Naturkunde, Humboldt University, Berlin.

Checklist of the *Catocala delilah* species complex

- C. delilah*** Strecker, 1874
adoptiva Grote, 1874
calphurnia H. Edwards, 1880
umbrella Barnes & Benjamin, 1927
- C. desdemona*** H. Edwards, 1882, **stat. rev.**
ixion Druce, 1890, **syn. n.**
utahensis Cassino, 1918, **syn. n.**
swetti Barnes & Benjamin, 1927
umbra Barnes & Benjamin, 1927
- C. caesia*** Hawks, 2010, **sp. n.**
- C. frederici*** Grote, 1872
- C. benjamini*** Brower, 1937
 a. *benjamini* Brower, 1937
 b. *ute* Peacock & Wagner, 2009
 c. *jumpi* Hawks, 2010, **ssp. n.**
 d. *maybewi* Hawks, 2010, **ssp. n.**
- C. andromache*** H. Edwards, 1885
wellsi Johnson, 1983, **syn. n.**
- C. californiensis*** Brower, 1976
- C. johnsoniana*** Brower, 1976
- C. mcdunnoughi*** Brower, 1937
browerorum Johnson, 1983, **syn. n.**
- C. chelidonia*** Grote, 1881
 a. *chelidonia* Grote, 1881

b. *occidentalis* Hawks, 2010, **ssp. n.**

c. *uniforma* Hawks, 2010, **ssp. n.**

Key to adults of the *Catocala delilah* species complex

1. Forewing with conspicuous basal dash; subreniform open..... *johnsoniana*
- Basal dash absent, or small and inconspicuous; subreniform usually closed **2**
2. Dorsal hindwing with thin black line along margin between M1 and ScR1 dividing apical spot; ventral hindwing apical area invaded by black..... **3**
- Apical areas not as above **4**
3. Dorsal forewing even charcoal or ashy gray *chelidonia*
- Dorsal forewing mostly brown, mottled with dark patches..... *mcdunnoughi*
4. Two teeth of PM line pointing outward near M1 and M2, third tooth pointing inward near 2A at least twice as long as other teeth; generally large species, forewing costal margin length circa 28–31 mm..... **5**
- All teeth of PM line similar in size, none conspicuously longer than others; smaller species, forewing costal margin circa 19–26 mm **6**
5. AM line thick at costa, gradually becoming thin toward inner margin, or appearing “beaded” due to alternating thick and thin areas; dorsal forewing surface usually evenly brown; dorsal hindwing with bands brownish orange; edges of apical spot on ventral hindwing usually not well defined *delilah*
- AM line thick at costa, abruptly becoming thin near radial vein and near inner margin, not conspicuously “beaded;” dorsal forewing highly variable, usually mottled grayish brown; bands of dorsal hindwing yellowish orange; edges of apical spot on ventral hindwing usually well defined..... *desdemona*
6. Undersides of forewings and hindwings boldly marked with yellow and black; apex and fringe of ventral forewing yellowish gray with few dark scales; apical hindwing spot yellow, sharply defined; fringes mostly yellow **7**
- Yellow areas of ventral wings often smeared with dark scales; apex of ventral forewing infused with dark scales; apical hindwing spot not sharply defined, ventral fringes conspicuously checkered **8**
7. Dorsal forewing even green to blue gray, black scales nearly absent *frederici*
- Dorsal forewing mottled blue, gray, brown, and black..... *caesia*
8. Dorsal forewing even ashy gray with black lines; AM line thick; dark patch between reniform, subreniform, and PM line usually conspicuous..... *californiensis*
- Dorsal forewing mottled with brown, lines indistinct; AM line usually thin, indistinct; dark patch usually not conspicuous **9**
9. Dorsal forewing varies from mottled to even brown or gray brown, not speckled with green or bluish-gray scales; ventral hindwing yellowish tan with narrow (1–2 mm) black inner band; few dark scales at hindwing base *benjamini*
- Dorsal forewing often blackish-gray, variably speckled with green or bluish-gray scales; ventral hindwing yellow to yellow orange with wide (2–4 mm) black inner band; dark scales usually present at hindwing base.... *andromache*

Taxonomic accounts

Catocala delilah Strecker

Figs 1, 3

Catocala delilah Strecker, 1874: 96, fig. 7, pl. XI.

Catocala adoptiva Grote, 1874: 96.

Catocala calphurnia H. Edwards, 1880: 59.

Catocala delilah form *umbella* Barnes & Benjamin, 1927: 7

Type material. *Catocala delilah*: lectotype ♂ [FMNH, examined], designated by Gall and Hawks (1990: 8). Type locality: [Dallas], Texas, [USA]. *Catocala adoptiva*: lectotype ♂ [MCZ, examined], designated by Gall (1990: 121). Type locality: Dallas Co[unty], Texas, [USA]. *Catocala calphurnia*: **neotype** ♂ [PMNH specimen #ENT 718629, examined], hereby designated to promote taxonomic stability (Fig. 3). Type locality: Burnet Co[unty], Texas, [USA]. The neotype bears the labels “Burnett [sic] Co. / Texas”, “Presented by / HERMAN PAUL WILHELM / October 1970”, “*Catocala / delilah / Stkr. / det. / D.C.Hawks 1986.*” *Catocala delilah* form *umbella*: holotype ♂ [USNM, examined], unavailable infra-specific name proposed as a color form. Type locality: Kerrville, Texas, [USA].

Taxonomic remarks. The original description of *Catocala calphurnia* states “the primaries are of a wholly greenish tinge, and not bright brown... secondaries are wholly black, with the exception of a small central cloud... Exp. wings, 2.10 inch. Kansas. Type, coll. Dr. James S. Bailey.” Beutenmüller stated (1907: 149): “The type of this form [*calphurnia*] is a female in the collection of the late Dr. James Bailey, Albany, New York, and was examined by me. The specimen looks suspiciously like an exotic species allied to the European *nymphaea* Esper or it is an undersized aberration of *Catocala delilah*. The fore wings are almost completely uniform dark brown...” Barnes and McDunnough (1918: 33) stated: “We know nothing regarding *calphurnia* Hy. Edwards, described from a single specimen in the Bailey Collection ostensibly from Kansas; according to Beutenmüller, the species may be either European or an aberration of *delilah*; we leave it as the latter for the present.” The type of *calphurnia* has not been located, and the Bailey collection has apparently been lost. The potential confusion with Palearctic *Catocala* threatens nomenclatorial stability, hence the neotype designation. The neotype is one of three dwarfed and perhaps reared *Catocala delilah* specimens from the Wilhelm collection, with uniformly dark forewings and the yellowish basal area of the hindwing suffused with dark brown. The neotype thus agrees closely with Henry Edwards’ original description as well as with Beutenmüller’s assessment. The type locality is hereby amended from the original Kanss, [USA] on the basis of the neotype labels.

Diagnosis. One of the two largest species in the complex, with mean forewing costal margin length 27.1 mm (♂), 30.5 mm (♀). The only species similar to *C. delilah* is *C. desdemona*. Both are similar in size, with a brown thorax, but *C. desdemona* has a paler and more yellowish abdomen that contrasts with the thorax. The forewing antemedial line is wide (ca. 2 mm) at the costa in both species, but in *C.*



Figures 1–8. Adults of *Catocala*. **1** *C. delilah* Strecker **2** *C. desdemona* H. Edwards **3** neotype, *C. calphurnia* H. Edwards **4** lectotype, *C. desdemona* H. Edwards **5** holotype, *C. caesia* Hawks **6** allotype, *C. caesia* Hawks **7, 8** *C. frederici* Grote.

desdemona it abruptly becomes thin just past the radial vein; in *delilah* the line becomes thinner gradually. The brown line just basal to the antemedial line is usually less conspicuous in *C. delilah*. In contrast to *C. delilah*, the forewings of almost all specimens of *C. desdemona* are speckled with white or yellow scales, which gives the wings a distinctly gray cast.

Distribution and biology. Southern USA from south-central Texas to Kansas, and eastward (mostly coastally) to Florida. County records for USA are as follows. ARKANSAS: Washington; KANSAS: Douglas, Leavenworth; OKLAHOMA: Comanche, Carter, Creek, Mays, Oklahoma, Pittsburg, Pottawattamie, Payne; NEBRASKA: Gage; TEXAS: Anderson, Bastrop, Bee, Bexar, Blanco, Brazos, Burnet, Comal, Dallas, Erath, Harris, Hays, Kerr, Kimble, Medina, Montague, Robertson, San Patricio, Washington; MISSOURI: Greene, Organ; ILLINOIS: Adams, Jackson, Union; TENNESSEE: Morgan; MISSISSIPPI: Oktibbeha; GEORGIA: Macintosh; FLORIDA: Citrus, Dixie, Hernando, Hillsborough, Jackson, Lake, Lane, Levy, Orange, Putnam, Seminole; KENTUCKY: (no county). Adults fly from May to July, with most records from May and June. Larvae of *C. delilah* have been collected from *Quercus virginiana* Mill. (in Texas and Florida), *Q. fusiformis* Small (Texas), and *Q. laurifolia* Michx. (Texas).

***Catocala desdemona* H. Edwards, stat. rev.**

Figs 2, 4

Catocala desdemona H. Edwards, 1882: 15.

Catocala ixion Druce, 1890: 360, **syn. n.**

Catocala delilah form *utahensis* Cassino, 1918: 14, **syn. n.**

Catocala delilah utahensis form *swetti* Barnes and Benjamin, 1927: 8

Catocala delilah desdemona form *umbra* Barnes and Benjamin, 1927: 8

Type material. *Catocala desdemona*: **lectotype** ♂ [USNM, examined], hereby designated to promote taxonomic stability (Fig. 4). Type locality: Prescott, Arizona, [USA]. The original description states “Four examples. Prescott, Arizona. I. Doll. Type. Coll. B. Neumoegen.” The lectotype bears the labels “Prescott. / Ariz.”, “Col. / B. Neumoegen.”, “Type / No. / 33991 / U.S.N.M.”, “*Catocala / desdemona / Type Hy. Edw.*” *Catocala ixion*: holotype ♂ [BMNH, examined]. Type locality: Xucumanatlan, Guerrero, Mexico. *Catocala delilah* form *utahensis*: holotype ♂ [USNM, examined]. Type locality: Provo, Utah, [USA]. *Catocala delilah desdemona* form *umbra*: holotype ♂ [USNM, examined], unavailable infrasubspecific name proposed as a color form. Type locality: Hereford, Arizona, [USA]. *Catocala delilah utahensis* form *swetti*: holotype ♀ [USNM, examined], unavailable infrasubspecific name proposed as a color form. Type locality: Vineyard, Utah, [USA].

Taxonomic remarks. The name *ixion* has apparently not been previously tabulated in the Nearctic *Catocala* literature. Druce’s illustration is a good representation of the BMNH holotype, which is a typical specimen of *Catocala desdemona* H. Edwards. Regarding the name *utahensis*, Cassino used the term “race” in the body of the original description, and offered a restricted geographic distribution (Utah), and hence the name has been treated as subspecific (McDunnough 1938; Franclemont and Todd 1983). However, the name *utahensis* refers to a lighter infrapopulational variant of *C. desdemona* with no definable geographic basis.

Diagnosis. *Catocala desdemona* has been treated as a subspecies of *C. delilah* since early in the twentieth century. However, *C. delilah* and *C. desdemona* breed true ex ovis, and remain morphologically distinct in a broad area of sympatry in central Texas and Oklahoma. Besides *C. delilah*, no other species is similar to *C. desdemona*. Mean forewing costal margin length 27.2 mm (♂), 29.5 mm (♂); see the species account for *C. delilah* above for points of separation. *C. desdemona* is much more variable in maculation than *C. delilah*, especially in the southern part of its range. The variation is continuous, with the form “umbra” (dark brown patch nearly filling the area between the antemedial and postmedial lines) being just one extreme example.

Distribution and biology. *Catocala desdemona* occurs from central Oklahoma and central Texas westward to central Utah, and southward through Mexico to Guatemala and Honduras. It is sympatric with *C. delilah* in central Texas and central Oklahoma. County records for the USA are as follows: OKLAHOMA: Comanche, Carter, Oklahoma, Pittsburg, Pottawattamie, Woods; TEXAS: Bexar, Blanco, Brewster, Brown, Burnet, Coleman, Culberson, El Paso, Hays, Hudspeth, Jeff Davis, Kaufman, Kerr, Kimble, Montague, Real, San Patricio, Taylor, Uvalde, Val Verde, Wise; NEW MEXICO: Bernalillo, Colfax, Dona Ana, Grant, Hidalgo, Lincoln, Sandoval, San Miguel, Sierra, Torrance, Union; UTAH: Davis, Garfield, Grand, Kane, Utah, Washington; COLORADO: Montezuma; ARIZONA: Cochise, Greenlee, Maricopa, Pima, Pinal, Santa Cruz, Yavapai. Records for MEXICO are as follows: SONORA: 3 km S of Mina Trinidad, 9 km W of Yecora, Rancho Tres Rios, km 60 Colonia Mesa Tres Rios to Huachinera; CHIHUAHUA: 4 km S of Temoresi-Cuicateco, Creel; NUEVO LEON: 22 km W. Linares, 6 km W of Iturbide; SINALOA: 11 km W of El Palmito; BAJA CALIFORNIA SUR: 25 km SE of San Antonio, Sierra de La Laguna, Rancho San Antonio de La Sierra; SAN LUIS POTOSI; GUERRERO: Xucumanatlan; MEXICO DF: Zacualpan. Records for GUATEMALA are as follows: Guatemala City. Records for HONDURAS are as follows: CORTÉS, YORO, and OLANCHO departments. Adults emerge from May to November, with peaks of abundance in June and September, at least in the southwestern United States and northern Mexico). This long flight period, especially evident in southeastern Arizona, is apparently due to some eggs hatching in response to the spring growth period of the oaks, while other eggs wait until the summer growth period to hatch. There is no evidence that *C. desdemona* is ever double brooded. Larvae of *C. desdemona* undoubtedly feed on several species of oaks in nature, but so far have only been recorded on *Quercus oblongifolia* Torr. (Huachuca Mountains, Arizona).

***Catocala caesia* Hawks, sp. n.**

urn:lsid:zoobank.org:act:1A145102-8285-440D-991A-46F5D37B3F4F

Figs 5, 6

Type material. **Holotype** ♂ (Fig. 5, PMNH specimen #ENT 721045): South Fork of Cave Creek, Chiricahua Mountains, Cochise County, Arizona, 28 May 1985, leg. D.

C. Hawks (FW length 23 mm). **Allotype** ♀ (Fig. 6, PMNH specimen #ENT 721046): same locality as holotype, 21 May 1962, leg. L. M. Martin (FW length 25 mm). **Paratypes** (35 ♂ 34 ♀): 6 ♂ 15 ♀ from same locality as holotype late May to mid June, various years and collectors; other localities: ARIZONA: Cochise County: Chiricahua Mountains, 7 km W of Portal (6 ♂ 4 ♀; early to mid-June); Chiricahua Mountains, Southwestern Research Station, 8 km W of Portal (3 ♂ 2 ♀; mid-June and early Sept.); Cochise County: Chiricahua Mountains, Sunny Flat Campground, 11–12 June 2007, M.L. Raschko (2 ♂); Dragoon Mountains, Cochise Stronghold (1 ♂; 8 June 1967); Huachuca Mountains, Ash Canyon (2 ♂; 13 Aug. 1967, 7 Oct. 1968); Huachuca Mountains, Carr Canyon (1 ♂; 27 Sept. 1967); Huachuca Mountains, Miller Canyon (1 ♂; 13 Oct. 1967); Huachuca Mountains, Ramsey Canyon (3 ♂; 15 July 1968, 25 July 1967, 13 Oct. 1967); Peloncillo Mountains, Cottonwood Canyon (2 ♂ 2 ♀; 31 May 1979; leg. P. M. Jump); Pima County: Santa Rita Mountains (1 ♂; June). NEW MEXICO: Hidalgo County: Peloncillo Mountains, Clanton Draw (1 ♀; 6 June 1979, leg. P. M. Jump). MEXICO: CHIHUAHUA: Creel (7 ♂ 6 ♀; mid-July to late-August); Sierra del Nido, Arroyo del Mesteno (1 ♀; 21 July 1959); Madera, Cerro de la Concha, 29 July 2009, D.L. Wikle (3 ♀). Holotype and allotype deposited at PMNH, paratypes deposited at LACM and other USA museums as well as in private collections.

Diagnosis. Most closely related to *C. frederici*. The ventral surface of the forewing and both surfaces of the hindwing are nearly identical in *C. caesia* and *C. frederici*, although *C. frederici* tends to have paler yellow-orange scales and slightly narrower black bands. However, the upper surface of the forewing of *C. frederici* is an even grayish to nearly off-white color, and there are almost no black scales present; all lines are less distinct in *C. frederici* than in *C. caesia*. The forewings are usually browner in *C. benjamini* than in *C. caesia*, although the former also may have a bluish cast; the antemedial and postmedial lines are also more distinct in *C. benjamini*, and the subreniform is sometimes open. The hindwing upperside of *C. benjamini* is a duller orange and more brown scales are present at the base. On the wing undersides, *C. benjamini* always has substantial dusky suffusion, especially on the forewing, and the apex of the forewing is brown. The general appearance of *C. caesia* is also like *C. desdemona*, although *C. caesia* is smaller and can always be separated from *C. desdemona* by the uniform size of the teeth of the postmedial band, and by the pure pale yellowish-tan color of the ventral surfaces (*C. desdemona* has a whitish shade along the costa of the forewing, and usually more dusky suffusion at the apex of the forewing underside).

Description. *Head:* eye dark brown; vertex and palpi covered with dark-brown and white scales; antenna 26–28 mm, brown dorsally, reddish brown ventrally. *Thorax:* patagia and tegulae mottled with white, tan, and dark-brown scales, patagia slightly darker; remainder of thorax covered dorsally by tan scales, especially posteriorly; ventrally covered by long thin off-white scales; tibiae clothed mainly with short, pale-tan scales, speckled with brown scales; mid-section of tibiae with brush of medium to long, straight, off-white and tan scales; tarsi pale tan, banded with dark brown. *Abdomen:* mostly orange, clothed with sparse, long, pale-tan scales, especially anteriorly; ventrally, pale, yellowish tan. *Forewing:* mean FW length 22.4 mm (males), 25.0 mm (females).

Dorsal surface: patterns composed of black, dark brown, tan, and white scales, some scales iridescent bluish gray; basal line black, ending before meeting 2A; no basal dash; antemedial line and line basal to antemedial line black, blurred; reniform bluish gray and tan outlined indistinctly with black; subreniform closed, whitish or tan, to indistinct, narrowly outlined with black; postmedial line black, indistinct, all teeth between M1 and inner margin subequal in length; area between postmedial and subterminal lines more brownish especially between M2 and inner margin; subterminal line black, blurred, often only teeth near M1 and M2 obvious; terminal line inconspicuous, usually present only as a series of black dots mid-way between ends of veins; fringe brown. Overall appearance of the dorsal forewing is mottled bluish gray and black. Ventral surface: base of wing pale yellowish tan, blending with indistinct postbasal band of yellow and brown scales; antemedial band pale yellowish tan, edges indistinct; medial band black, widest between M2 and Cul, narrowing markedly between Cu and inner margin, occasionally disappearing before reaching inner margin; postmedial band pale yellowish tan; outer band black, often interrupted by pale yellowish tan along a fold between Cu and 2A. Apex pale yellowish tan, blending smoothly with pale yellowish-tan marginal band; fringe pale yellowish tan with a few black scales at end of each vein. *Hindwing*: dorsal surface: basal area, postmedial band, apical spot, and fringe yellow orange; basal area with a few brown scales; inner band black, usually thin (3–4 mm at widest point); short hook usually apparent just anterior to anal spot; outer band black; anal spot nearly always separated from outer band by 2–3 mm; apical spot large, squared; fringe varyingly checkered with black scales originating from near ends of M1 to 2A. Ventral surface: basal area, postmedial band, apical spot, and fringe pale yellowish tan, a little brighter than ventral forewing; inner band black, distinctly narrower than on dorsal surface; outer band black, often connected with anal spot by thin array of black scales; apical spot sharply defined, squared, although occasionally blending with pale yellowish-tan marginal band when band wider than just width of fringe; fringe usually pure pale yellowish tan. Overall, there is no pronounced sexual dimorphism in *C. caesia*.

Etymology. The adjectival name *caesia* is based on the Latin root *caesi*, referring to the bluish-gray color of the forewing. The “Bluish-gray Underwing” is suggested as a vernacular name.

Distribution and biology. The range of *C. caesia* is limited to the mountains of southeastern Arizona and southwestern New Mexico, and southward through the Sierra Madre Occidental in Chihuahua. *Catocala caesia* is sympatric with its closest relative, *C. frederici*, in the Chiricahua and Huachuca Mountains of Cochise County, Arizona. In collections, *C. caesia* has usually been identified as *C. benjamini*, and these two species have likely also been conflated in the literature. Some paratypes of *C. benjamini* may actually be *C. caesia* because Brower’s (1937) original description of *C. benjamini* lists paratypes from the Huachuca Mountains (the author has seen more specimens of *C. caesia* than *C. benjamini* in the Huachuca Mountains). Fortunately, the type locality of *C. benjamini* is Mojave County, Arizona, which is not within the range of *C. caesia*. Adults fly from late May to October, although late emerging individuals are much less common than are those from May to July. Several species of oaks are present at each of the known collecting localities.

***Catocala frederici* Grote**

Figs 7, 8

Catocala frederici Grote, 1872: 14.

Type material. *Catocala frederici*: lectotype ♀ [ZMHU, examined], designated by Gall and Hawks (2002: 246). Type locality: Texas, [USA].

Diagnosis. The ventral surface of the forewing and both surfaces of the hindwing are similar in both *C. frederici* and *C. caesia*, although the patterning is less distinct in *C. frederici* compared to *C. caesia*. However, the even, generally pale-gray appearance of the forewing upperside in *C. frederici* is distinctive. The black hindwing bands tend to be narrower in *C. frederici* than in *C. caesia*.

Distribution and biology. Southwestern USA, from east-central Kansas and western Texas, westward to southeastern Arizona. County records for USA are as follows. ARIZONA: Cochise; KANSAS: Douglas, Riley; NEW MEXICO: Bernalillo, Dona Ana, Eddy, Lincoln, Otero, Sandoval, San Miguel; COLORADO: Baca; OKLAHOMA: Cimarron, Kiowa; TEXAS: Blanco, Bosque, Brewster, Burnet, Coke, Coleman, Culberson, Dallas, Dickens, El Paso, Hudspeth, Jeff Davis, Kerr, Kimble, Lubbock, Randall, Uvalde, Vale Verde.

Biological notes. Adults have been collected from May to September. Several species of oaks are present at most of the known collecting localities. *C. frederici* tends to inhabit hotter and drier desert mountain ranges than do *C. delilah*, *C. desdemona* and *C. caesia*.

***Catocala benjamini* Brower**

Figs 9–14

Catocala andromache race *benjamini* Brower, 1937: 185*Catocala benjamini ute* Peacock & Wagner, 2009: 89*Catocala benjamini jumpi* Hawks, **ssp. n.***Catocala benjamini mayhewi* Hawks, **ssp. n.*****Catocala benjamini benjamini* Brower**

Fig. 9

Type material. *Catocala andromache* race *benjamini*: holotype ♂ [USNM, examined]. Type locality: Mohave County, Arizona, [USA].

Diagnosis. *Catocala b. benjamini* is similar to *C. caesia* on the upperside, but the undersides differ (see account for *C. caesia* above for points of distinction). Nominate *C. benjamini* is also similar to *C. andromache* and the only fairly reliable difference in color pattern is that the dorsal forewing of *C. andromache* tends to have a distinctly greenish cast due to iridescent scales. Most populations of *C. benjamini* and *C. an-*



Figures 9–16. Adults of *Catocala*. **9** *C. benjamini benjamini* Brower **10** *C. benjamini ute* Peacock & Wagner **11** holotype, *C. benjamini jumpi* Hawks **12** allotype, *C. benjamini jumpi* Hawks **13** holotype, *C. benjamini maybewi* Hawks **14** allotype, *C. benjamini maybewi* Hawks.

dromache are allopatric, although *C. benjamini maybewi* and *C. andromache* occur in sympatry in southern California. Differences between the larvae of *C. benjamini* and *C. andromache* were reported by Johnson (1985).

Distribution and biology. Southeastern California, Arizona, southern Nevada, and southwestern Utah. County records for USA are as follows. ARIZONA: Apache, Cochise, Coconino, Gila, Graham, Mohave, Maricopa, Navajo, Pima, Yavapai; CALIFORNIA: San Bernardino; NEVADA: Clark, Lincoln; UTAH: Washington. Adults have been collected from May to September with most from June and July. The immature stages of the nominate subspecies are unknown. However, at several of the known collecting localities (e.g., Hualapai and Pinal Mountains) *Quercus turbinella* Greene is the only species of oak. Additionally, the known distribution of *C. b. benjamini* closely coincides with the distribution of *Q. turbinella*. Like *C. frederici*, *C. b. benjamini* primarily inhabits dry desert mountain ranges.

***Catocala benjamini ute* Peacock & Wagner**

Fig. 10

Type material. *Catocala benjamini ute*: holotype ♂ [PMNH, examined]. Type locality: USA, Utah, Grand Co[unty], Arches National Park, Balanced Rock Area, 1610 m.

Diagnosis. Similar to other subspecies, although slightly larger in size and with an orange-brown ground color, and yellow orange usually infusing other aspects of the maculation; underside with reduced black scaling in both basal and adterminal areas; adterminal not as checkered as in other subspecies.

Distribution and biology. Known only from Grand and San Juan counties in southeastern Utah, in the most northeastern part of the species' overall range. Adults have been taken in early June. The immature stages are unknown. Peacock and Wagner (2009) indicate *Quercus* × *pauciloba* Rydb. (= *Q. undulata* Torr.; a hybrid from *Q. gambelii* Nutt. and *Q. turbinella*) is the most prevalent and sometimes only oak species at the known collecting localities; they report the absence of *C. benjamini ute* from nearby stands of *Q. gambelii*.

***Catocala benjamini jumpi* Hawks, ssp. n.**

urn:lsid:zoobank.org:act:EA01B04C-27EE-4604-83C5-7AF5696A3A6F

Figs 11, 12

Type material. Holotype ♂ (Fig. 11, PMNH specimen #ENT 721047; FW length 21 mm), **allotype** ♀ (Fig. 12, PMNH specimen #ENT 721048; FW length 23 mm): Kofa Queen Canyon, 900 m, Kofa Mountains, Yuma County, Arizona, 27 May 1989, leg. D. C. Hawks. **Paratypes** (14 ♂ 16 ♀): 1 ♂ 6 ♀ from type locality, 29 May 1981, P.M. Jump; 13 ♂ 10 ♀ from type locality, 27 May 1989, D.C. Hawks. The remainder are from Palm Canyon, Kofa Mountains (6 ♂ 1 ♀, leg. G. Butler & D. Tuttle, 29 May 1955; 1 ♂ 1 ♀, leg. D. C. Hawks, 3 June 1985). Holotype and allotype deposited at PMNH, paratypes deposited at LACM and other USA museums as well as in private collections.

Diagnosis. *C. benjamini jumpi* differs from other *C. benjamini* subspecies in having pale dusky-yellow hindwing bands; forewings distinctly narrower and more pointed; lines less distinct; ventral surface yellow areas paler; black hindwing bands tend to be wider; inner band, outer band, and anal spot sometimes fused.

Description. *Forewing*: narrow and pointed; dorsal surface with black, dark-brown, tan, and beige scales, few scales iridescent bluish or purplish; antemedial line black, edges indistinct; reniform black, subreniform usually beige, variable in size; apical yellowish area suffused with black; fringes gray, checkered with black. *Hindwing*: dorsal surface with pale-brown scales suffusing much of basal area; medial band dull pale yellowish; fringe yellowish tan with black checkering; bands black; ventral surface pale dusky yellow; fringe pale yellowish beige checkered with black; inner band usually only slightly narrower than on dorsal surface.

Etymology. The subspecies is named in honor of Peter M. Jump, who introduced the author to this unique population of *C. benjamini*, and who collected seven of the type specimens.

Distribution and biology. *Catocala benjamini jumpi* is known only from the Kofa Mountains of southwestern Arizona. The Kofa Mountains and the nearby Castle Dome Mountains are separated from the nearest known suitable locality for *C. benjamini* by about 140 km. The oaks (*Q. turbinella*) occurring in these two mountain ranges are notably disjunct in the overall range of this oak. Adults have been collected only in late May and early June. Larvae likely feed exclusively on *Quercus turbinella* since this is the only oak occurring in the area.

***Catocala benjamini mayhewi* Hawks, ssp. n.**

urn:lsid:zoobank.org:act:8E8508F4-153B-4CFC-B015-CDF6374BFC4F

Figs 13, 14

Type material. **Holotype** ♂ (Fig. 13, PMNH specimen #ENT 721049; FW length 19.5 mm), **allotype** ♀ (Fig. 14, PMNH specimen #ENT 721050; FW length 21 mm): Pinyon Flat, 1500 m, Santa Rosa Mountains, Riverside County, California, 22 June 1987 leg. D. C. Hawks. **Paratypes** (70 ♂ 68 ♀): 62 ♂ 59 ♀ from the type locality, collected between 1 June and 2 August over several decades by J. W. Johnson, E. Walter, R. H. Leuschner, and D. C. Hawks. Remaining paratypes: Los Angeles County: San Gabriel Mountains near Valyermo (4 ♀); San Gabriel Mountains, Big Rock Creek (1 ♂); Riverside County: San Jacinto Mountains, Chino Canyon near Palm Springs (4 ♂ 1 ♀); San Bernardino County: Joshua Tree (1 ♂); San Diego County: Anza Borrego State Park, Tub Springs (1 ♀); Jacumba (1 ♂); Sentenac Canyon (3 ♀). Holotype and allotype deposited at PMNH, paratypes deposited at LACM and other USA museums as well as in private collections.

Diagnosis. *Catocala benjamini mayhewi* is similar to *C. b. benjamini*, but differs as follows: dorsal forewing surface slightly paler grayish brown; yellowish areas on hindwing dorsal surface slightly paler; inner band almost always thin, occasionally absent. Mean forewing length of *C. b. mayhewi* (19.0 mm, males; 21.5 mm, females) consistently smaller than all other *C. benjamini* subspecies. *C. b. mayhewi* is sympatric with *C. andromache* throughout most of its range (this fact led Brower (1982) to elevate *C. benjamini* to a full species).

Description. **Forewing:** dorsal surface with black, dark-brown, tan, and beige scales, few scales iridescent bluish or purplish; overall appearance pale grayish brown; antemedial line black, edges indistinct; reniform black, subreniform usually beige, variable in size; apical yellowish area suffused with black; fringes gray, checkered with black; ventral surface pale whitish yellow with relatively narrow black medial band. **Hindwing:** dorsal surface with pale-brown scales suffusing much of basal area; medial band dull pale orange; fringe yellowish tan with black checkering; bands black; ventral surface pale yellow; fringe pale yellowish beige checkered with black; inner band quite thin and narrow on both surfaces.

Etymology. The subspecies is named in honor of W. W. Mayhew, the author's MS thesis advisor. A portion of the type locality (Pinyon Flat) has been protected from encroaching development thanks to Mayhew's foresight and persistence.

Distribution and biology. *Catocala benjamini mayhewi* occurs along the desert-facing slopes of the Laguna, Santa Rosa, San Jacinto, San Bernardino, San Gabriel Mountains, and Little San Bernardino Mountains in southern California. It also occurs in northern Baja California, Mexico. Adults have been collected from early June to early August. The immature stages of *C. b. mayhewi* have been described and the larva figured by Johnson (1985). The larvae feed on *Quercus cornelius-mulleri* Nixon & Steele at the San Bernardino, Riverside, and San Diego County localities.

***Catocala andromache* H. Edwards**

Figs 15, 16

Catocala andromache H. Edwards, 1885: 50

Catocala andromache wellsii Johnson, 1983: 245, **syn. n.**

Type material. *Catocala andromache*: holotype ♂ [AMNH, examined]. Type locality: San Bernardino, Cal[ifornia, USA].

Diagnosis. The only closely similar taxon to *C. andromache* is *C. b. benjamini*. The dorsal forewing of *C. andromache* is usually liberally speckled with greenish scales (in many freshly eclosed specimens the wings are a mottled moss green), whereas the dorsal forewing of *C. b. benjamini* is sparsely speckled with bluish scales. This distinction breaks down for worn specimens, and for many specimens from desert edge mountains in southern California. However, *C. andromache* is not sympatric with *C. b. benjamini*. *Catocala andromache* is sympatric with *C. b. mayhewi* along the desert slopes of the mountains of southern California, and there the two species are consistently separated by the larger size, darker forewings, darker yellowish bands, and wider black bands of *C. andromache*. The name *wellsii* was proposed for specimens with more blackish, unmottled forewings from the central Sierran foothills, but these characteristics break down in larger series and there seems little merit in retaining the name at subspecific rank.

Distribution and biology. *Catocala andromache* occurs in the mountains of San Diego, Riverside, San Bernardino, and Los Angeles counties, and northward through the southern Coast Ranges and the Sierra Nevada of California. County records for USA are as follows. CALIFORNIA: Amador, Butte, Calaveras, Kern, Lake, Los Angeles, Mariposa, Nevada, Riverside, San Bernardino, San Diego, Santa Barbara, Solano, Ventura, Yolo. Larvae of *C. andromache* have been collected from *Quercus chrysolepis* Liebm. They also probably feed on *Quercus cornelius-mulleri*, *Q. dumosa* Nutt., and *Q. wislizenii* A. de Candolle, among others. Adults have been collected from mid-June through August, and fly mostly below 2000 m.



Figures 15–20. Adults of *Catocala*. **15, 16** *C. andromache* H. Edwards **17** *C. californiensis* Brower **18** *C. johnsoniana* Brower **19, 20** *C. mcdunnoughi* Brower.

***Catocala californiensis* Brower**

Fig. 17

Catocala californiensis Brower, 1976: 30

Type material. *Catocala californiensis*: holotype ♂ [USNM, examined]. Type locality: Ranch two and one half miles south-southwest of Valyermo, Los Angeles Co[unty], Calif[ornia, USA].

Diagnosis. *Catocala californiensis* is most similar to *C. johnsoniana* in forewing coloration, and to *C. benjamini mayhewi* in hindwing coloration. However, on the forewing, *C. johnsoniana* has a conspicuous basal dash (lacking or very small in *C. californiensis*), and longer teeth in the postmedial line with a shorter and wider inner hindwing black band than in *C. californiensis*.

Etymology. I suggest the common name “Ashy-gray Underwing” for *C. californiensis* based on Brower’s description of the forewing ground color. The “California Underwing” is probably best applied to *C. californica* W. H. Edwards (1864).

Distribution and biology. *Catocala californiensis* occurs in southern California along the desert-facing slopes of the Peninsular and Transverse Ranges to the southeastern edge of the Coast Ranges in Santa Barbara County. County records for USA are as follows. CALIFORNIA: Kern, Los Angeles, Riverside, San Bernardino, San Diego, Santa Barbara, Ventura. The immature stages of *C. californiensis* have been described and the larva figured by Johnson (1985). Larvae feed on *Quercus cornelius-mulleri* at the San Bernardino, Riverside, and San Diego County localities, and they probably feed on *Q. turbinella* at the Los Angeles, Kern, Santa Barbara, and Ventura county localities. Adults have been collected from mid-June to late August. The northwestern-most populations represent a distinctive new subspecies (Hawks, in prep.).

Catocala johnsoniana Brower

Fig. 18

Catocala johnsoniana Brower, 1976: 30

Type material. *Catocala johnsoniana*: holotype ♂ [USNM, examined]. Type locality: Kernville, Kern Co[unty], Calif[ornia, USA].

Diagnosis. *Catocala johnsoniana* is most similar to *C. californiensis* but the forewing has a distinct basal dash, the subreniform is always widely open, and the teeth of the postmedial line are longer. Also, the hindwing black inner band is relatively short and thick, while the postmedial yellow band is proportionately wider than in most specimens of all other species in the *C. delilah* complex.

Distribution and biology. *Catocala johnsoniana* occurs mostly in the northern, eastern and southern foothills edging the Central Valley of California, mostly at slightly lower elevations than the other five species found in California. County records for USA are as follows. CALIFORNIA: Butte, Colusa, Kern, Lake, Los Angeles, Madera, Solano, Tuolumne, Yolo. The immature stages of *C. johnsoniana* have been described and the larva figured by Johnson (1985). Moths are always collected in areas dominated by *Quercus douglasii* Hook. & Arn., and this is probably the primary or only host plant. Adults have been collected from late May to early July.

***Catocala mcdunnoughi* Brower**

Figs 19, 20

Catocala mcdunnoughi Brower, 1937: 32*Catocala mcdunnoughi browerorum* Johnson, 1983: 247, **syn. n.**

Type material. *Catocala mcdunnoughi*: holotype ♂ [MCZ, examined]. Type locality: [Mount Wilson], southwestern California, [USA]. *Catocala mcdunnoughi browerorum*: holotype ♀ [USNM, examined]. Type locality: Moore Creek Forest Service Campground, Amador-Calaveras Co[unties], California, [USA].

Taxonomic remarks. *Catocala mcdunnoughi browerorum* Johnson was described from four darker and more greenish specimens from Amador County, California. However, other topotypical *browerorum* material does not differ from nominate material and variation is not consistent geographically (e.g., many Plumas and Butte county specimens are more evenly greenish brown), so there seems little reason to retain the name.

Diagnosis. *Catocala mcdunnoughi* is most similar to *C. chelidonia*, but the more brownish and mottled ground color of *C. mcdunnoughi* will usually separate these species. No other small *Catocala* species in the region has postmedial lines with two large teeth only at M1 and M2.

Distribution and biology. *Catocala mcdunnoughi* occurs from the Laguna Mountains of San Diego County, California, northward to southern Oregon. County records for USA are as follows. CALIFORNIA: Amador, Butte, Calaveras, Inyo, Kern, Los Angeles, Mariposa, Orange, Plumas, Riverside, San Bernardino, San Diego; OREGON: Josephine. The immature stages of *C. mcdunnoughi* have been described and the larva figured by Johnson (1985). Larvae have been collected on *Quercus chrysolepis* Liebm. in the San Gabriel Mountains of Los Angeles County, California, and this is likely the major (or only) host of *C. mcdunnoughi*. In southern California, *C. mcdunnoughi* flies at somewhat higher elevations than the other five species. It also flies later in the year, usually emerging from mid-July to mid-August. At lower elevations in northern California it begins to fly in late June.

***Catocala chelidonia* Grote**

Figs 21–26

Catocala chelidonia Grote, 1881: 159.*Catocala chelidonia occidentalis* Hawks, **ssp. n.***Catocala chelidonia uniforma* Hawks, **ssp. n.*****Catocala chelidonia chelidonia* Grote**

Figs 21, 22

Type material. *Catocala chelidonia*: lectotype ♂ [USNM, examined], designated by Gall and Hawks (2002: 244). Type locality: Prescott, Arizona, [USA].



Figures 21–26. Adults of *Catocala*. **21, 22** *C. chelidonia chelidonia* Grote **23** holotype, *C. chelidonia occidentalis* Hawks **24** allotype, *C. chelidonia occidentalis* Hawks **25** holotype, *C. chelidonia uniforma* Hawks **26** allotype, *C. chelidonia uniforma* Hawks.

Diagnosis. *Catocala chelidonia chelidonia* is similar only to *C. mcdunnoughi*. The more brownish and mottled ground color in *mcdunnoughi* will usually separate these species. Also, in *chelidonia*, the teeth of the postmedial line at M1 and M2 are usually longer than other teeth, but usually not as conspicuous as in *mcdunnoughi*.

Distribution and biology. *Catocala c. chelidonia* occurs from southern Nevada and south-central Utah southward and eastward through Arizona to New Mexico. County records for USA are as follows. ARIZONA: Apache, Coconino, Gila, Maricopa, Mohave, Pinal, Yavapai; CALIFORNIA: San Bernardino; NEVADA: Clark, Lincoln; NEW MEXICO: Bernalillo, Grant, Sandoval, Sierra; UTAH: Garfield, Washington. Crumb (1956) described larvae of *C. c. chelidonia* from Cave Creek, Maricopa County, Arizona. The larvae of this subspecies probably feed mostly, if not exclusively, on *Quercus turbinella*. Adults have been collected from mid-June to late July.

***Catocala chelidonia occidentalis* Hawks, ssp. n.**

urn:lsid:zoobank.org:act:F24788C7-BB3D-40B9-BFC7-6BA5D4370601

Figs 23, 24

Type material. **Holotype** ♂ (Fig. 23, PMNH specimen #ENT 721051; FW length 20 mm), **allotype** ♀ (Fig. 24, PMNH specimen #ENT 721052; FW length 21 mm): Pinyon Flat, Santa Rosa Mountains, Riverside County, California, leg. D. C. Hawks; holotype 15 June 1987, allotype 22 June 1987. **Paratypes** (25 ♂ 53 ♀): 23 ♂ 46 ♀ from the type locality, various dates and collectors. Remaining paratypes: Kern County: 10 km NW of Frazier Park (1 ♀); Los Angeles County: San Gabriel Mountains, 4 km SSW of Valyermo (1 ♂ 4 ♀); Juniper Hills, 3 km S of Pearblossom (1 ♀); San Gabriel Mountains, Ridge Route, Halfway House (1 ♂); San Diego County: 6 km S of Oak Grove (1 ♀). Holotype and allotype deposited at PMNH, paratypes deposited at LACM and other USA museums as well as in private collections.

Diagnosis. The forewings of *C. c. occidentalis* are similar to those of other subspecies. Distinguishing hindwing characters include: dorsal surface has many black scales at the base; wider inner band; narrower postmedial band; yellowish color of the dorsal surface consistently darker. About 5 percent of the specimens of *C. c. occidentalis* examined could be confused with specimens of the nominate subspecies.

Description. *Forewing:* dorsal surface ground color charcoal to brownish gray, mottled with hoary scales; antemedial and postmedial lines black, modestly apparent; subreniform whitish to yellow, usually visible. *Hindwing:* pale areas dull yellow orange; bands black, apical spot dull yellow orange; anal spot separated from outer band; conspicuously narrow postmedial band (usually only 1–2 mm near vein M2); anterior half of outer band wide with conspicuous rounded indentation in inner edge of outer band between M2 and Cu1; many dark scales at base.

Distribution and biology. *Catocala c. occidentalis* occurs along the western desert edge in southern California and northward to at least Trinity County. County records for USA are as follows. CALIFORNIA: Kern, Lake, Los Angeles, Madera, Napa, Riverside, San Bernardino, San Diego, Santa Clara, Solano, Trinity. The immature stages of *C. c. occidentalis* have been described and the larva figured by Johnson (1985). At the San Diego, Riverside, and San Bernardino County localities the larvae feed on *Quercus cornelius-mulleri*. Adults have been collected from early June to late August, with the peak flight period in late June at Pinyon Flat.

***Catocala chelidonia uniforma* Hawks, ssp. n.**

urn:lsid:zoobank.org:act:85959B2B-9561-4B4F-9070-4E7906F0AA72

Figs 25, 26

Type material. **Holotype** ♂ (Fig. 25, PMNH specimen #ENT 721053; FW length 20.0 mm), **allotype** ♀ (Fig. 26, PMNH specimen #ENT 721054; FW length 19.5 mm): Ash Canyon, Huachuca Mountains, Cochise County, Arizona, 1700 m, leg. N.

McFarland; holotype 2 June 1981, allotype 15 June 1983. **Paratypes** (13 ♂ 26 ♀): 8 ♂ 12 ♀ from the type locality, varying dates and collectors; Sierra Vista, Cochise County, Arizona (1 ♀); Miller Canyon, Huachuca Mountains, Cochise County, Arizona (1 ♀); Cochise County: Chiricahua Mountains, Sunny Flat Campground, 11–12 June 2007, M.L. Raschko (1 ♂, 1 ♀); Chiricahua Mountains, South Fork Cave Creek (2 ♀); Chiricahua Mountains, vicinity of Southwestern Research Station (3 ♂, 5 ♀); Chiricahua Mountains (1 ♀); New Mexico: Hidalgo County, Peloncillo Mountains, Clanton Draw (3 ♀); Animas Mountains, Bear Canyon (1 ♂). Holotype and allotype deposited at PMNH, paratypes deposited at LACM and other USA museums as well as in private collections.

Diagnosis. This subspecies has uniform gray forewings with substantially reduced hoary mottling. The antemedial and postmedial forewing lines vary from inconspicuous to very distinct. Hindwing as in the nominate subspecies.

Description. *Forewing*: dorsal surface ground color charcoal gray, concolorous, with few hoary scales; antemedial and postmedial lines black; antemedial line fades away toward the inner margin; subreniform whitish to yellow, usually visible. *Hindwing*: pale areas dull yellow orange; bands black, apical spot dull yellow orange; anal spot separated from outer band; few dark scales at base.

Distribution and biology. *Catocala chelidonia uniforma* is known from mountains of southeastern Arizona and southwestern New Mexico. Nothing is known of the early stages of this subspecies. Adults have been collected from late May to mid-July, with peak abundance in mid-June (N. McFarland, pers. comm.).

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Appendix: Synopsis of actions taken in this paper regarding Nearctic names in the genus *Catocala* Schrank

Name	Author	Year	Assigned to taxon	Typification	Status change
<i>browerarum</i>	Johnson	1983	synonym of <i>C. mcdunnoughi</i> Brower, 1937		new synonymy
<i>caesia</i>	Hawks	2010	full species	holotype	new species
<i>calphurnia</i>	H. Edwards	1880	synonym of <i>C. delilah</i> Strecker, 1874	neotype	
<i>desdemona</i>	H. Edwards	1882	full species	lectotype	revised status
<i>ixion</i>	Druce	1890	synonym of <i>C. desdemona</i> H. Edwards, 1882		new synonymy
<i>jumpi</i>	Hawks	2010	subspecies of <i>C. benjamini</i> Brower, 1937	holotype	new subspecies
<i>mayhewi</i>	Hawks	2010	subspecies of <i>C. benjamini</i> Brower, 1937	holotype	new subspecies
<i>occidentalis</i>	Hawks	2010	subspecies of <i>C. chelidonia</i> Grote, 1881	holotype	new subspecies
<i>uniforma</i>	Hawks	2010	subspecies of <i>C. chelidonia</i> Grote, 1881	holotype	new subspecies
<i>utahensis</i>	Cassino	1918	synonym of <i>C. desdemona</i> H. Edwards, 1882		new synonymy
<i>wellsi</i>	Johnson	1983	synonym of <i>C. andromache</i> H. Edwards, 1885		new synonymy