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A NATURAL HYBRID BETWEEN *CALLOPHRYS (CALLOPHRYS) SHERIDANII* AND *C. (INCISALIA) AUGUSTINUS* (LYCAENIDAE)

Additional key words: male genitalia, valvae, *Mitoura*, homology.

Scudder (1872) described *Incisalia* and noted its similarity to *Callophrys* Hübner. Since then, *Incisalia* and *Callophrys* have been treated as subgenera (Ziegler 1960, Clench 1961) or closely related genera (Miller & Brown 1981). The presumed hybrid that we report here is remarkable, whether it is considered intergeneric or intersubgeneric, and further highlights the genetic similarity of *Incisalia* and *Callophrys*.

An apparent male hybrid (Fig. 1) between *C. sheridanii* (Edwards) and *C. augustinus* (Westwood) was captured by the senior author on a dry slope (2950 m) below Cottonwood Point, 6.5 southwest of Hot Sulphur Springs, Grand Co., Colorado, USA, on 28 May 1990. It was flying among individuals of *C. augustinus* in an area with low evergreen shrubs and *Arctostaphylos uva-ursi* L. (Ericaceae), which is the local larval foodplant for *C. augustinus*. Individuals of *C. sheridanii* were common about 100 m away in an area

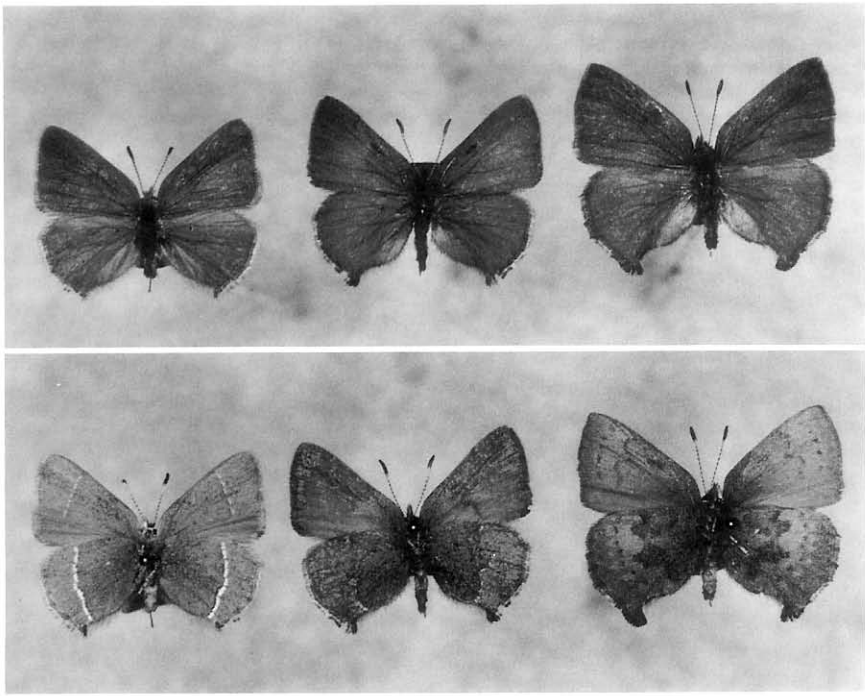

FIG. 1. Dorsal (top row) and ventral aspect of butterflies from Cottonwood Point, Colorado. From left to right, *C. sheridanii*, the presumed hybrid, and *C. augustinus*. Photograph by James Scott.

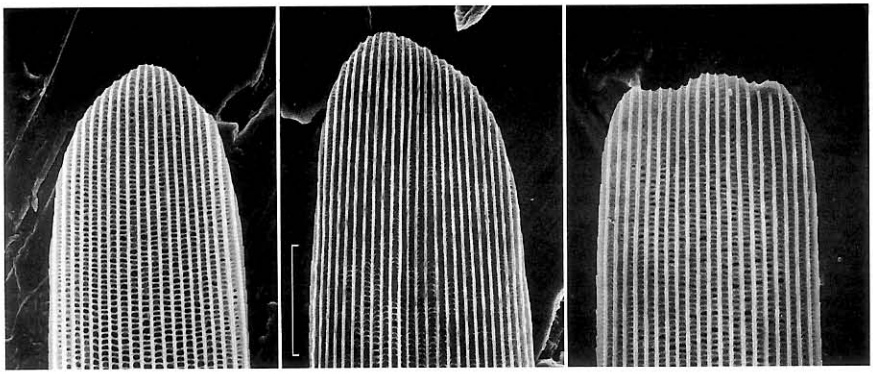

FIG. 2. Distal end of dorsal forewing androconia. From left to right, *C. sheridanii*, the presumed hybrid, and *C. augustinus*. Scale 15 μm.

dominated by *Artemisia tridentata* Nuttall (Asteraceae) and with occasional stands of *Eriogonum umbellatum* Nuttall (Polygonaceae), which is the local larval foodplant for *C. sheridanii*. Thus, adults of the presumed "parent" species of the hybrid are common in the same general vicinity at the same time of year.

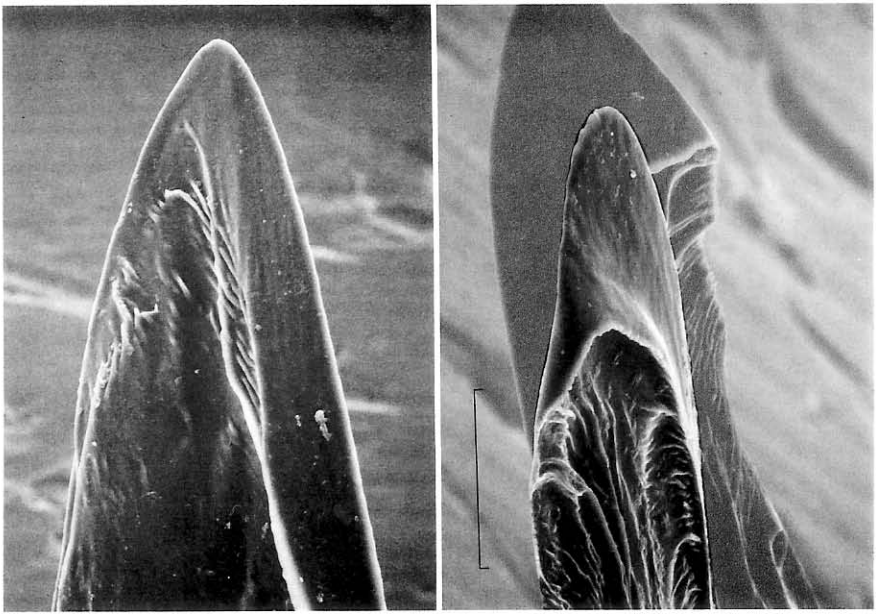

FIG. 3. Thickened tips of the left valva in the male genitalia (ventral aspect). From left to right, *C. sheridanii* and *C. augustinus*. Scale 38 μm.

TABLE 1. Characters in *C. sheridanii*, the presumed hybrid, and *C. augustinus* from Cottonwood Point, Colorado. Genitalic measurements are ± one standard deviation with sample size of 9. Abbreviations: V, ventral; D, dorsal; Pm, postmedian; HW, hindwing; FW, forewing.

Character	*C. sheridanii*	Hybrid	*C. augustinus*
	Wing and head characters		
1. V coloration	green & gray	green & brown	red-brown
2. Hindwing shape	rounded	intermediate	angular
3. Anal lobe	short	intermediate	long
4. V Pm line shape	nearly straight	slightly jagged	jagged
5. V Pm line position	submarginal	postmedian	postbasal
6. VHW Pm line color	white	white & brown	brown
7. Wing fringe color	white, some gray	gray, some white	gray
8. Androconia	rounded	rounded	dentate
9. Scales around eye	white	brown, some white	brown, some white
	Genitalic characters		
1. Valva thickening	tips & inner margin	tips & part (?) of inner margin	tips
2. Penis length (mm)	3.62 ± 0.196	3.44	3.04 ± 0.117
3. Valvae length (mm)	1.31 ± 0.052	1.33	1.20 ± 0.062
4. Saccus length (mm)	0.64 ± 0.050	0.52	0.47 ± 0.049

Clench (1961) noted three differences between *Incisalia* and *Callophrys*. The ventral ground color of *Callophrys* is green and that of *Incisalia* brown; the hybrid has a mixture of brown and green (Table 1). Androconia of *Callophrys* are rounded whereas those of *I. augustinus* are "dentate" (Fig. 2). Androconia of the hybrid are rounded like those in *Callophrys* (Fig. 2). Tips of the valvae in the male genitalia are thickened in *Incisalia* but not in *Callophrys* (Clench 1961). However, we found that the tips are thickened in both taxa (Fig. 3), although less prominently in *C. sheridanii*, where the thickening continues along the inner margin of the valves, as it does in *Mitoura* (Robbins unpubl. data). We did not photograph the valvae of the hybrid because preparation for the scanning electron microscope would have destroyed the genitalia. However, the thickened tips of the valvae, viewed with a light microscope, appeared to be intermediate, but more similar to *C. sheridanii*.

We scored other differences between Cottonwood Point individuals of *C. augustinus* and *C. sheridanii* to test further the hypothesis that this individual is an interspecific hybrid. We noted 6 other differences in wing pattern (Table 1), and in each case the hybrid was intermediate. Many of these characters can be seen in Fig. 1. Color of scales surrounding the hybrid's eye was the same as that in *C. augustinus* (Table 1). We also compared lengths of structures in the male genitalia (Table 1) using *t*-tests. The penis of the hybrid was significantly longer than that of *C. augustinus* ($t_s = 3.243$, df = 8, $P < 0.05$), but statistically indistinguishable from that of *C. sheridanii* ($t_s = -0.871$, df = 8, $P > 0.4$). The valvae of the hybrid were marginally longer than those of *C. augustinus* ($t_s = -1.989$, df = 8, $0.1 > P > 0.05$), but indistinguishable from those of *C. sheridanii* ($t_s = 0.365$, df = 8, $P > 0.5$). The saccus of the hybrid was marginally longer than that of *C. sheridanii* ($t_s = -2.277$, df = 8, $0.1 > P > 0.05$) and indistinguishable from that of *C. augustinus* ($t_s = 0.0968$, df = 8, $0.4 > P > 0.2$). The presumed hybrid specimen is deposited in the National Museum of Natural History, Smithsonian Institution.

Interspecific hybridization is prevented in nature by pre-mating isolating mechanisms and by differences in genetic regulation that cause abnormal development (Remington 1958, Oliver 1979). For these reasons, interspecific hybrids are uncommon in nature. Hand-mating techniques (Platt 1969 and included references) and hormonal treatments (Clarke & Willig 1977) are often necessary to produce such hybrids in the laboratory. Although interspecific hybrids occur consistently in some groups, such as *Limenitis* F., only one hypothesized New World hairstreak (Eumaeini) hybrid has been reported previously (Robbins & Venables 1991). The hybrid described above is thus remarkable.

The biological significance of the presumed hybrid between *C. augustinus* and *C. sheridanii* is that it provides information on homology. For example, position of the hybrid's ventral hindwing postmedian line is intermediate between those in *Callophrys* and *Incisalia*, indicating that this line is homologous in the two species. If the postmedian lines were not homologous, then both lines would be expected to be expressed in the hybrid. While the presumed hybrid provides no information on phylogeny within *Callophrys* (genetic similarity is a shared primitive trait derived from the last common ancestor), it indicates that *Incisalia* and *Callophrys* are genetically very similar, whether they are considered subgenera or genera.

LITERATURE CITED

CLARKE, C. A. & A. WILLIG. 1977. The use of α-ecdysone to break permanent diapause of female hybrids between *Papilio glaucus* L. female and *Papilio rutulus* Lucas male. J. Res. Lepid. 16:245–248.

CLENCH, H. K. 1961. Tribe Theclini, pp. 177–220. *In* Ehrlich, P. R. & A. H. Ehrlich, How to know the butterflies. Brown Company, Dubuque, Iowa.

MILLER, L. D. & F. M. BROWN. 1981. A catalogue/checklist of the butterflies of America north of Mexico. Lepid. Soc. Mem. No. 2. 280 pp.

OLIVER, C. G. 1979. Genetic differentiation and hybrid viability between some Lepidoptera species. Amer. Nat. 114:681–694.

PLATT, A. P. 1969. A simple technique for hand-pairing *Limenitis* butterflies (Nymphalidae). J. Lepid. Soc. 23:109–112.

REMINGTON, C. A. 1958. Genetics of populations of Lepidoptera. Proc. X Int. Cong. Entomol. 787–805.

ROBBINS, R. K. & B. A. B. VENABLES. 1991. Synopsis of a new neotropical hairstreak genus, *Janthecla*, and description of a new species (Lycaenidae). J. Lepid. Soc. 45: 11–33.

SCUDDER, S. H. 1872. A systematic revision of some of the American buterflies, with brief notes on those known to occur in Essex County, Mass. Salem, Massachusetts. 62 pp.

ZIEGLER, J. B. 1960. Preliminary contribution to a redefinition of the genera of North American hairstreaks (Lycaenidae) north of Mexico. J. Lepid. Soc. 14:19–23.

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