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TAXONOMY OF *STRYMON TOUSSAINTI*, *S. ANDREWI*, *S. AMONENSIS*, AND *S. RHAPTOS* (LYCAENIDAE: THECLINAE)

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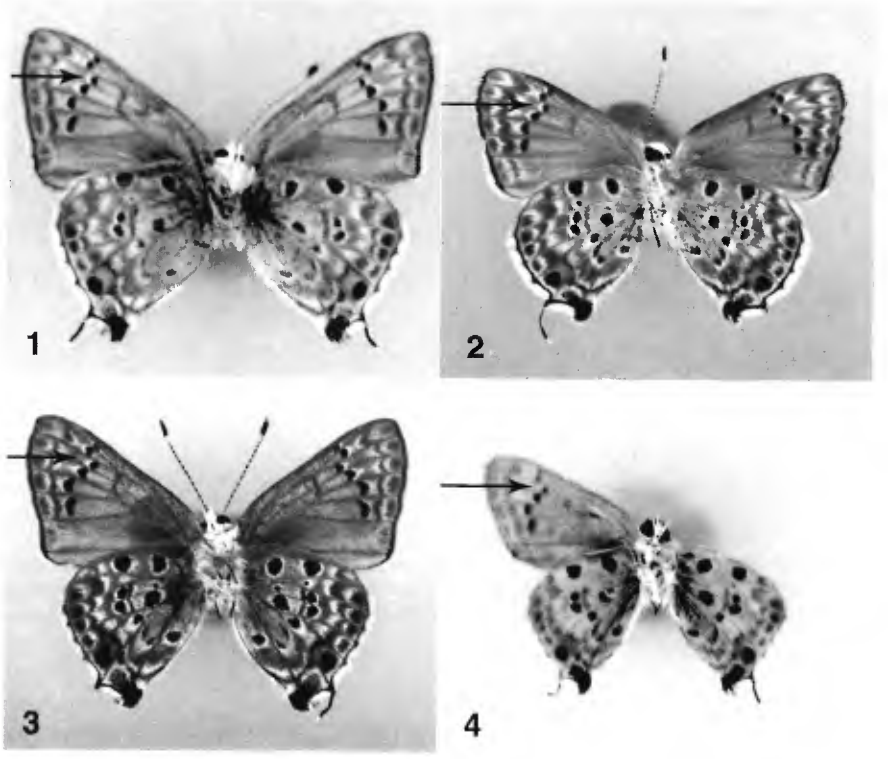
ABSTRACT. *Strymon toussainti*, *S. andrewi*, and *S. amonensis* have been considered closely related Antillean species, but their genitalia and wing pattern vary continuously without clearly distinct states. The genitalia of the holotype and allotype of *S. andrewi* do not match those of its paratypes collected in the same series, but are quite similar to those of *S. eurytulus*. Since the male holotype of *S. andrewi* is actually a female, it appears that the genitalia and adults of the holotype and allotype were improperly associated. The Argentine *S. rhaptos* is known from one male and one female whose genitalia and wing pattern are indistinguishable from those of *S. toussainti*. It appears that they were mislabeled. The following names are junior synonyms of *S. toussainti* (Comstock & Huntington 1943): *Strymon andrewi* Johnson & Matusik, 1988; *S. rhaptos* Johnson, Eisele & MacPherson, 1990; and *S. amonensis* Smith, Johnson, Miller & McKenzie, 1991.

Additional key words: Eumaeini, Antilles, genitalia, brush organs.

The Antillean species *Strymon toussainti* (Comstock & Huntington), *S. andrewi* Johnson & Matusik, and *S. amonensis* Smith et al. differ from other members of the *S. columella* complex. The ventral forewing spot in cell M1–M2, and to a lesser extent in cell M2–M3, is displaced basally more than 0.35 mm (Figs. 1–3). This shared trait suggests a close, perhaps monophyletic, relationship among these three species. However, Johnson and Matusik (1988) mentioned that *S. andrewi* may be as closely related to *S. istapa* (Reakirt) (*S. columella cybira* [Hew.] in their paper) as to *S. toussainti*, and Smith et al. (1994) raised the possibility that *S. andrewi* might be most closely related to *S. christophei* (Comstock & Huntington). To complicate matters, *S. rhaptos* Johnson, Eisele & MacPherson from the mountains of Patagonia in Argentina also shares this forewing trait (Fig. 4), making for a confused taxonomic and biogeographical situation. The purpose of this paper is to 1) determine if *S. toussainti*, *S. andrewi*, *S. amonensis*, and *S. rhaptos*—the four species with the basally displaced forewing spot—are closely related to each other; 2) examine the evidence for the distinctness of these taxa; and 3) discuss possible explanations for the unusual Antillean-Patagonian distribution of these butterflies.

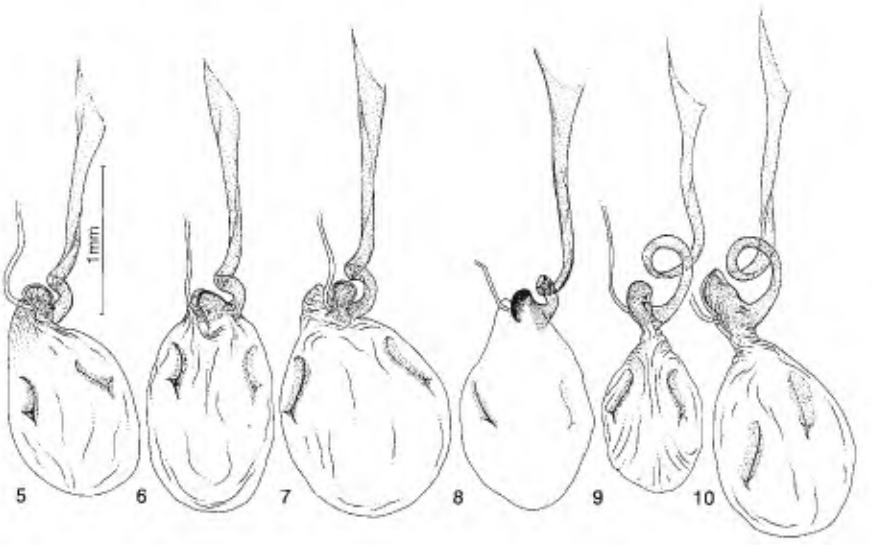


FIGS. 1–4. Ventral wings. **1,** male holotype of *S. toussainti*; **2,** "male" (=female) holotype of *S. andrewi*; **3,** male paratype of *S. amonensis*; and **4,** male holotype of *S. rhaptos*. Arrows refer to characters discussed in the text.

MATERIAL EXAMINED

This study was based on 11 males and 12 females of *S. toussainti, S. andrewi, S. amonensis,* and *S. rhaptos.* Included were the holotype and 10 paratypes of *S. toussainti,* the holotype and 5 paratypes of *S. andrewi,* 4 paratypes of *S. amonensis,* and the holotype and allotype of *S. rhaptos.* Although 24 paratypes of *S. amonensis* were reported to be deposited in the museums above (Smith et al. 1991), only four were found, and none had abdomens or associated genitalia. Thus, we reproduced the genitalic figures in the original description of *S. amonensis.*

Although most specimens used in this study belong to the National Museum of Natural History, Washington, DC, USA (USNM), specimens were also borrowed from the following museums (with their abbreviation and the curator who made the loan): American Museum of Natural History, New York, USA (AMNH, J. S. Miller); Allyn Museum



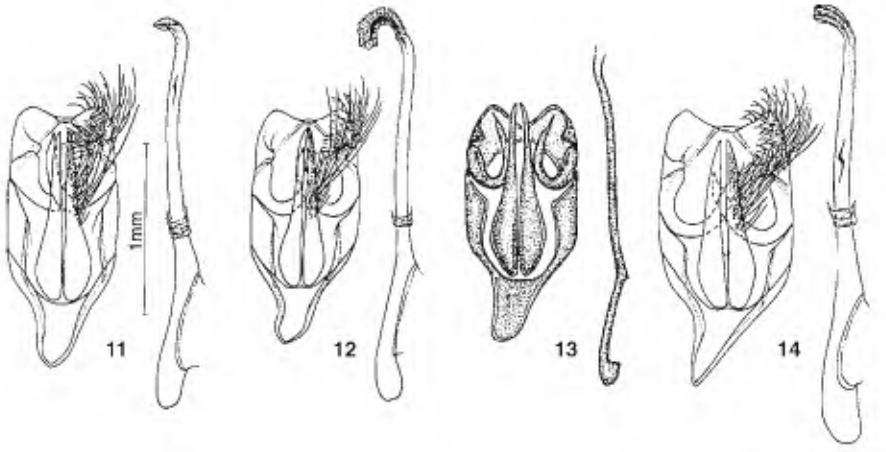
FIGS. 5–10. Bursa copulatrix in lateral aspect. **5,** allotype of *S. toussainti*; **6,** allotype of *S. rhaptos*; **7,** paratype of *S. andrewi*; **8,** reproduction of allotype of *S. amonensis* (scale approximated); **9,** allotype of *S. andrewi*; and **10,** *S. eurytulus* from Argentina.

of Entomology, Florida Museum of Natural History, Sarasota, Florida, USA (AME, J. Y. Miller and L. D. Miller); and Carnegie Museum of Natural History, Pittsburgh, Pennsylvania, USA (CMNH, J. E. Rawlins).

RESULTS

Female genitalia. The female genitalia of *S. toussainti*, *S. andrewi*, *S. amonensis*, and *S. rhaptos* do not differ from each other in any substantive way. We illustrate the female genitalia of paratypes for all four (Figs. 5–8). Smith et al. (1991) noted that the posterior tip of the corpus bursae of *S. amonensis* is heavily sclerotized and that this structure is unique among Antillean *Strymon*. However, *S. toussainti*, *S. andrewi*, and *S. rhaptos* share this structure, as do *S. limenia* and *S. bubastus*. Johnson et al. (1990) described the "u" shaped anterior ductus bursae of *S. rhaptos* (Fig. 6) as unique in *Strymon*, but it also occurs in *S. toussainti* (Fig. 5), *S. andrewi* (Fig. 7), *S. amonensis* (Fig. 8), and *S. bubastus*.

The female genitalia of three paratypes of *S. andrewi* that we dissected (Fig. 7) differ from those of the allotype of *S. andrewi* (Fig. 9, also illustrated in Johnson & Matusik 1988), even though two of the paratypes and the allotype were collected at the same locality one day apart. The genitalia of the allotype are similar to those of *S. eurytulus* (Fig. 10), a common species from the southern part of South America.



FIGS. 11–14. Male genitalia in ventral aspect with aedeagus in lateral aspect. **11,** holotype of *S. toussainti*; **12,** holotype of *S. rhaptos*; **13,** reproduction of holotype of *S. amonensis* (scale approximated); and **14,** "holotype" of *S. andrewi*.

Either the genitalia of the allotype were incorrectly associated or its female genitalia are highly aberrant. In either case, female genitalia do not provide definitive evidence for the specific distinctness of *S. andrewi*.

Male genitalia. The male genitalia of *S. toussainti*, *S. amonensis*, and *S. rhaptos* do not differ in any substantive way. We illustrate the genitalia of the holotype for each species (Figs. 11–13). We could not confirm the differences noted by Smith et al. (1991). These reported differences, particularly in the shape of the valves, are small compared with the intraspecific genitalic variation reported in other eumaeines (e.g., Brown 1983, Robbins 1990, 1991), and we doubt that they are likely to be a reliable distinction between species. In fact, we find few, if any, structural differences between the male genitalia of these species and those of *S. limenia* and *S. istapa* from the southern part of its range (Robbins & Nicolay 1999).

Johnson and Matusik (1988) illustrated the male holotype of *S. andrewi* and its genitalia, but these genitalia present two problems. First, the illustrated adult (Fig. 2), which we have examined, is a female. It lacks dorsal forewing androconia and its right foretarsus (the left one is broken) is five segmented with a clawed pretarsus, and its forewings have the rounded female *Strymon* shape (Fig. 2) in contrast to the more angular male forewing shape (Figs. 1, 3, 4). Thus, the holotype "male genitalia" belong to some other specimen. The second problem with the "male genitalia" of the holotype is analogous to the situation described for the female genitalia of the allotype. The male genitalia associated with the holotype (Fig. 14) are the same as those of *S. eurytulus* except for the cornutus, which is larger than

those in other males belonging to the Antillean members of the *S. columella* complex. The genitalia of the one male paratype of *S. andrewi* that were available to us were missing the distal parts of one valve and the aedeagus, but were otherwise not different from the male genitalia of *S. toussainti*. And again, the "male holotype" and paratype were part of the same collecting series. Since the "male genitalia" of the holotype that Johnson and Matusik (1988) illustrated do not belong to the holotype, they do not provide evidence for the specific distinctness of *S. andrewi*.

Wing pattern. The *S. toussainti* species complex is distinguished by a ventral forewing spot in cell M1–M2 (arrows in Figs. 1–4), and to a lesser extent in cell M2–M3, displaced basally more than 0.35 mm. All specimens of *S. toussainti, S. andrewi, S. amonensis,* and *S. rhaptos* that we have examined possess this trait, but the three smallest females had this segment displaced the least. Two paratypes of *S. toussainti* (AMNH) lack this trait, but they are actually *S. istapa*. Since Comstock and Huntington (1943) distingnished *S. toussainti* from *S. istapa* by the basally displaced forewing spot, we doubt that these specimens are original paratypes.

Other wing pattern characters suggested to distinguish species in the *S. toussainti* species complex are the amount of blue on the dorsal wings (Johnson & Matusik 1988), the amount of red comprising the anterior four spots of the ventral hindwing line (Smith et al. 1991), and the "boldness" of the ventral hindwing spots, particularly the one near the hindwing anal margin (Smith et al. 1994).

The extent of dorsal blue coloration is similar in all males that we examined. Viewed under a dissecting microscope, the dorsal wings of males tend to have a few light blue scales, which are relatively inconspicuous to the naked eye, scattered among a majority of brown scales. The extensive area of dorsal blue scales illustrated for the "male" holotype of *S. andrewi* (Johnson & Matusik 1988) describes the female dorsal pattern, which is logical because the holotype is a female.

The extent of dorsal blue coloration varies considerably among females. They may have blue scales on the forewing base posterior of the cubital vein, on the hindwing base posterior of the radial vein, and on the distal hindwing posterior of the cubital vein (illustrated in Johnson & Matusik 1988). In these areas, the blue scales vary from scattered to extensive. Indeed, the entire range of variation occurs in females of the type series of *S. andrewi* that we examined. Virtually identical variation also occurs in Antillean females of *S. istapa* and some other *Strymon* species. In sum, extent of dorsal blue coloration does not seem to be a reliable distinguishing trait for Antillean *Strymon*.

As a measure of the red in the postmedian line spots, we counted the number of orange and red scales in the spot in hindwing cell SC+R1–RS for types of all the species. Among types of *S. toussainti,* it ranged from

3 to 30 scales in 6 males, and from 2 to 14 scales in 4 females. Among types of *S. andrewi,* the number of orange and red scales was 34 in the one male without rubbed wings, and ranged from 0 to 25 scales in 4 females. Among types of *S. amonensis,* it ranged from 2 to 9 in 2 males, and from 1 to 18 in 2 females. The amount of red in this spot appears to be too variable to be a distinguishing trait for these species.

The ventral hindwing postmedian spot at the anal margin is well-developed in the four paratypes of *S. amonensis* that we examined, but was also well-developed in four of six types of *S. andrewi* and in 2 of 11 types of *S. toussainti.* Since "boldness" is a subjective and variable criterion, it does not seem to distinguish these species.

DISCUSSION

Taxonomy. There is no definitive evidence supporting the hypothesis that *S. andrewi, S. amonensis,* and *S. rhaptos* are distinct from *S. toussainti.* Variation of male genitalia, female genitalia, and wing pattern appears to be continuous without distinct states. The troubling complication is that the genitalia of the type series of *S. andrewi* represent two phenotypes. The genitalia of the two types previously dissected, presumably by Johnson and Matusik, resemble those of *S. eurytulus,* whereas the genitalia of the four types that we dissected resemble *S. toussainti.* Further, we know that the "male" holotype genitalia were incorrectly associated because the holotype is a female. For these reasons, the hypothesis that Johnson and Matusik improperly associated the genitalia of the holotype and allotype with those of another *Strymon* species, probably *S. eurytulus,* is better supported than the idea that two species are represented in the type series of *S. andrewi.*

Biogeography and *S. rhaptos*. *Strymon toussainti* and its synonyms *S. andrewi* and *S. amonensis* refer to butterflies on the neighboring Antillean islands of Mona and Hispaniola, but the male and female types of *S. rhaptos* are from the mountains of Patagonia, Argentina. There appear to be two possible explanations for this unusual situation. First, *S. toussainti* has a widely disjunct distribution in the Antilles and in the mountains of Patagonia. Second, the types of *S. rhaptos* were of Antillean origin, but were mislabeled.

There is evidence for both these explanations. In support of the first explanation (a widely disjunct distribution), according to the data labels on the types of *S. rhaptos,* Herrera collected the male type, and Shapiro caught the female. Both Herrera and Shapiro are well-known collectors of Argentine Lepidoptera, and Shapiro has not been to Hispaniola (Shapiro, pers. comm). (No other specimens of *S. rhaptos* are known.) However, the male holotype was not labeled by Herrera, who is now deceased, but rather has a label printed by Johnson when he spread the

specimen (Johnson, pers. comm.). Similarly, the female type was spread and labeled by Johnson (Shapiro, pers. comm.). Further, Johnson has collected in Hispaniola (Johnson & Matusik 1988), increasing the likelihood that the types were mislabeled. Lastly, we know of no other butterfly with a disjunct distribution in the Antilles and the mountains of Patagonia. Although we cannot resolve this situation definitively at present, the second explanation seems more likely.

Nomenclature. The following synonymic list summarizes our taxonomic results. All citations are listed in the Literature Cited.

Strymon toussainti (Comstock & Huntington, 1943)

= *Strymon andrewi* Johnson & Matusik, 1988 **NEW SYNONYM**

= *Strymon rhaptos* Johnson, Eisele & MacPherson, 1990 **NEW SYNONYM**

= *Strymon amonensis* Smith, Johnson, Miller & McKenzie, 1991 **NEW SYNONYM**

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Note Added In Proof: The USNM received the four paratypes of *S. amonensis* mentioned in Smith et al. (1991) too late (October 1998) to be incorporated into the study, but the morphology of these specimens is consistent with our results.