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The Taxonomic Report

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A TAXONOMIC EXAMINATION OF *HARKENCLENUS TITUS* (LYCAENIDAE: THECLINAE) IN THE EASTERN UNITED STATES

RECOGNITION AND RESOLUTION OF TAXONOMIC PROBLEMS BY THE DELINEATION OF OLD NAMES, NAMING OF A LONG RECOGNIZED (BUT HERETOFORE UNDESCRIBED) SUBSPECIES, AND DESCRIPTION OF A WIDE RANGING NEW SUBSPECIES.

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ABSTRACT. *Harkenclenus* is retained per dos Passos 1970 as a genus distinct from *Satyrium.* The names *titus* and *mopsus* have long been considered to apply to two subspecies. These are demonstrated to be synonymous as both names are based on southeastern US populations. The holotype of *titus* (NHM London) is examined and its type locality established as Screven County, Georgia. A neotype is established for the synonymic name *mopsus*, type locality, Screven County, GA. This leaves the long recognized northern subspecies without a name; it is described as new subspecies *Harkenclenus titus winteri*, type locality Sherborn, Massachusetts. *Harkenclenus titus campus*, type locality Shelby Co., Iowa, is described as a new subspecies. Subspecies *campus* has long been recognized as distinct from northern *titus winteri*, but wrongly assumed to be subspecies *mopsus (=titus).* *Harkenclenus titus watsoni* is assessed and considered valid. Four subspecies of *titus* are thus known from eastern North America: *H. titus titus, H. titus winteri, H. titus campus, H. titus watsoni*. Each subspecies is phenotypically defined and their ranges delineated. *H . t. titus* ranges from north central Florida up the coastal plain possibly to Maryland. *H. t. watsoni* ranges west of a line from south central Texas north to at least western Oklahoma; its western boundary in New Mexico is uncertain. *H. t. winteri* ranges from the Atlantic across the northern US and southern Canada to subspecies *immaculosus*; not in southern Appalachians. The range of *H. t. campus* extends from the Black Belt prairies of Alabama to eastern Texas and north and northeast to the ranges of *H. t. immaculosus & H. t. winteri*.

Additional key words: Evolutionary relationships *H. titus occidentalis*, Floridian relict.

HISTORY AND PROGRESSION OF THIS PROJECT

The North American butterfly commonly known as the Coral Hairstreak was described in 1793 by Fabricius as *Hesperia titus*. It is a distinct part of the North American fauna and easy to identify. The only modern taxonomic debates have been over what genus it is best placed in – *Satyrium* Scudder, 1876, or *Harkenclenus* dosPassos, 1970, and the periodic questioning of "in Anglia" =Newfoundland as the type locality (Miller & Brown 1981). Because Newfoundland has been given in the literature as the *titus* type locality, the nominate subspecies has long been accepted as the ventrally moderately marked and rather un-contrasting populations from southeastern Canada into Manitoba, and the northeastern US south to Virginia and west to the east slope of the Colorado Rockies (Ferris & Brown 1980, Layberry et al. 1998).

Hübner described *Chrysophanus mopsus* in 1818 with "Georgia in Florida" as the type locality. The name *mopsus* has long been applied to all *titus* from Georgia to Texas, and north to Virginia and Colorado (e.g. Klots 1951, Ferris & Brown 1980). There are some exceptions, as Scott (1986), pg. 360, who attributes all eastern population to *H. t. titus* and all western populations to *H. t. immaculosus* (W.P.

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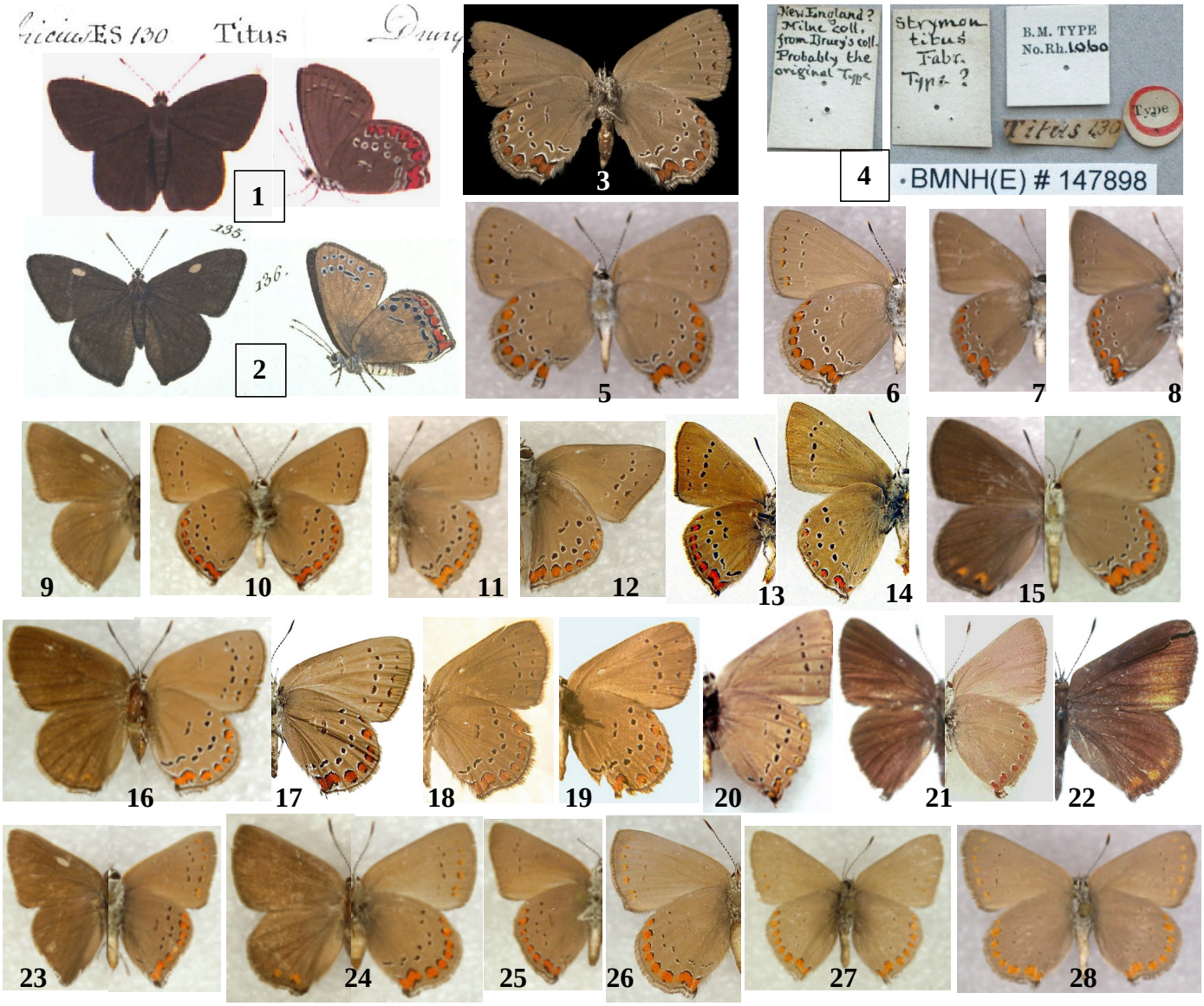


Fig. 1. Jones' 1785 Icones ♀ *titus*. **Fig. 2.** Hübner's 1818 ♂ *Chrysophanus mopsus.* **Fig. 3.** Fabricius' 1793 ♀ *Hesperia titus* holotype (NHM, London). **Fig. 4.** *H. titus* holotype labels. **Fig. 5.** ♀ *C. mopsus* neotype (data in text). **Fig. 6.** ♀ *H. titus*, 6 June 1992, nr. Jct. 3 & 394, Orangeburg Co., SC. **Fig. 7.** ♂ *H. titus*, 4 May 1975, nr. Torreya, Liberty Co., FL. **Fig. 8.** ♂ *H. titus*, 13 May 2002, Axon Rd., Orangeburg Co., SC. **Figs. 9-10.** ♂ holotype. *H. titus campus* (data in text). **Fig. 11.** ♂ paratype. *H. t. campus*, 5-10 June, visc. Clinton Lk., Douglas Co., KS (leg. Adams). **Fig. 12.** ♂ Paratype. *H. t. campus*. 2 June 1975, Athens, TX. (leg. Bordelon). **Fig. 13.** ♂ *H. t. campus*. 24 June 1991, 8 mi. n. Walker, Ellis Co. KS (leg. Kuhn). **Fig. 14.** ♂ *H. t. watsoni*. 11 May 2003, nr. Mendard, Menard Co., TX. (FW 17 mm. leg. Kuhn). **Fig. 15.** ♀ *H. titus*. ex. pupa 8 April 1993, Wakulla Springs, Wakulla Co., FL (leg. Slotten). **Fig. 16.** ♀ Allotype. *H. t. campus* (same data as 11). **Fig. 17.** ♀ Paratype. *H. t. campus*, 1 June 1945, Faulkner Co., AK (no. leg). **Fig. 18.** ♀ *H. t. campus*, 8 July 1980, 10 mi. east Nobel, Cleveland, Co., OK. (leg. Davenport). **Fig. 19.** ♀ *H. t.* nr. *watsoni* (same data as 18). **Fig. 20.** ♂ Paratype. *H. t. watsoni*, Kerrville, TX (AMNH). **Fig. 21** ♂ holotype. *H. t. immaculosus*, July, Provo, UT (AMNH). **Fig 22** allotype. *H. t. immaculosus* (same data as 21). **Fig. 23** D/V ♂ holotype. *H. t. winteri* (data in text). **Fig. 24** D/V ♀ Allotype, *H. t. winteri* (data in text). **Fig. 25** ♂ paratype. *H. t. winteri* (data in text). **Fig. 26** ♀ Paratype. *H. t. winteri* (data in text). **Fig. 27** ♂ *H. t. immaculosus*, 2 August 1952, 6,400', Warm Springs Rd., nr. Sun Valley, UT (no leg). **Fig. 28** ♀ *H. t. immaculosus* (same data as 27). All leg. Gatrelle except as noted. 13-14 same photo/lighting: by Kuhn. AMHN *watsoni* and *immaculosus* photos, D. Wright. Photo of *titus* holotype, NHM staff. 18-19 photos, D. Walker. All other photos by Joseph Mueller. Not to scale.

Comstock, 1913). The only other described subspecies in the eastern area is *watsoni* Barnes & Benjamin, 1926. Throughout the literature, subspecies *watsoni* (when recognized as valid) has been attributed to the area of south central & west Texas, north to southwest Oklahoma, possibly extreme southeast Colorado and west into New Mexico. All of this appears to render all the subspecific eastern taxa of *titus* as well understood entities with stable nomenclature. However, the examination of this taxon has shown that it is both a nomenclatural and taxonomic quagmire.

My field experience with the Coral Hairstreak is in Iowa, Florida, Georgia and South Carolina. The significance of this, is that these populations are in taxonomically unique and rarely sampled regions. In Iowa, two phenotypes were found; one was what has been conventionally known as *titus titus* in northeastern Iowa (Howard County, 1975); the other was in central Iowa (Johnson County, 1975), west Iowa (Shelby County, 1967), and southwest Iowa (Guthrie County, 1975) which fell within the literature concept of subspecies *mopsus* in the western prairie region. True *mopsus* was collected in Liberty County, FL in 1975, in south coastal South Carolina (Aiken & Orangeburg counties: 1976, 77, 88, 90, 91, 92, 98, 2002), and most importantly, in 1994 at its type locality in both Screven and Burke counties, Georgia.

These specimens from the Midwest and southeast indicated that the conventional application in the literature of the name *mopsus* to western and Midwestern populations was incorrect. Thus, about 1977, a taxonomic assessment of *titus* east of the Rocky Mountains was undertaken and by 1980 series from the above locations demonstrated that these prairie "mopsus" populations were either: 1) an undescribed subspecies or 2) perhaps an expression of *H. titus watsoni* as described from south central Texas – because they were not *mopsus*.

A search began for specimens of *watsoni* for comparison. This took many years as I was not able to travel to those museums which housed type material, was unable to obtain the loan of these specimens, and was not able to find any in private collections until 2002. However, this potential *watsoni* specimen was from Oklahoma, and Texas topotypes were needed for unequivocal determination. This resulted in periods of years of little activity re *titus*. With the inability to determine just what *watsoni* was, the effort to reach a taxonomic conclusion on the western and Midwestern prairie populations became a dead end.

However, from 1980 to 2001 some significant information was obtained. 1) A visit in 1994 to Mississippi State University, and an examination of its collection, revealed that Mississippi *titus* were of the same phenotype collected in southwestern Iowa, and thus, what the literature incorrectly called "mopsus" in the prairie states. During that visit, knowledge of the Black Belt Prairies of Mississippi and Alabama was acquired and why the Mississippi *titus* are of western prairie affinity and evolutionally disassociated with the *titus* of the southeastern coastal plain. 2) Specimens of *titus* in the FSCA collection Gainesville were examined and 3) specimens borrowed from private collectors. The examination of these specimens showed 1) that *mopsus* is restricted to the Southeast from north Florida up the eastern seaboard into Virginia and 2) that all the prairie populations from Mississippi to Texas, Colorado, and central Iowa were the same taxon and lacked a name – unless they were broadly referable to *watsoni*.

In 2001, this project changed dramatically. To that point, the research was only seeking to determine the taxonomic placement of prairie *titus* – was it an undescribed taxon or did it belong within *watsoni*. While acquiring copies of original descriptions in general, the original descriptions of *titus* and *mopsus* were obtained. It was immediately evident that a big problem existed. The figure on which the name ***titus*** was based (fig. 1) was clearly the southeastern phenotype – traditional ***mopsus***. Further, the OD illustration of "mopsus" (fig. 2) was intermediate to the northern phenotype associated with the name *titus*. This problem was confirmed in 2002 through correspondence with Harish Gaonkar (page 4) who stated that the actual type locality of *titus* was not "Newfoundland" but Georgia! Hübner had restricted the type locality of the name *mopsus* to "Georgia in Florida" in his original description of that taxon. All of this renders the name *mopsus* a junior synonym of *titus* with both names applying to the subspecies of the southeast and eastern seaboard with ventrally dark grayish brown wings, small black spots, reduced black spotting on the VFW (esp. of males), and with bright white halos.

TITUS TAXONOMY

No type or syntypes exist for *mopsus* as all American Hübner types are lost or destroyed [2]. The holotype of *titus* exists in the British Museum of Natural History (fig. 3). Because the names *titus* and *mopsus* are based on the same southeastern subspecies, this leaves the northern and northeastern subspecies (traditionally assumed to be *titus titus*) without a name – having never been described.

In 2003, photographs of a fresh nearly topotypical male *watsoni* were obtained (fig. 14). This confirmed that the wide ranging prairie populations are not related to *watsoni* and that *watsoni* is indeed a unique and rare southwestern taxon.

The background research has unveiled two matters that need to be addressed and resolved. One is the matter of the wide ranging prairie populations that have long incorrectly passed as subspecies *mopsus*. This situation (the original area of investigation) is easily taken care of by the description and delineation of this prairie entity as a new subspecies, which is accomplished herein. The second, and paramount matter, is having found that *titus* and *mopsus* were actually proposed for the same zoological taxon, which negates the long standing nomenclatural application of these names by synonymizing the name *mopsus* and leaving the northern subspecies without a name. Regarding the *mopsus*/*titus* synonymy, there is no easy solution. The two courses of action relative to the names *titus* and *mopsus* are these:

1. Ignore the type specimen of *titus*, both ODs, the historical facts about the type localities and leave the names *titus* and *mopsus* in application (**usage**) as they have been. Not simple. To do this, an appeal would have to be made to the *International Commission of Zoological Nomenclature* to set aside a valid holotype and ignore all historical data and erect a neotype and type locality for *titus* that would be historically and scientifically fiction. Not only is *titus* not known from Newfoundland, it does not range anywhere near there (Butterflies of Canada, 1998, page 132 map). What would be the advantage of this? Maintain popular usage? North American butterfly hobbyists seldom utilize scientific names and overwhelmingly choose to just call all *titus* subspecies the "Coral Hairstreak". Further, most hobbyists Guides use only binomials. Thus, maintaining current usage would sacrifice science for a trinomial nomenclature seldom even utilized by recreational lepidopterists.
2. Maintain the historical and ICZN Code compliant synonymy and erect a new name for the heretofore undescribed northern subspecies. What would the disadvantage of this be? Professionals and taxonomists would need to adapt to using a different set of trinomials for this group of subspecies.

The advise of the taxonomists who reviewed this paper was to implement solution two.

Harish Gaonkar is generally accepted as the expert on Fabricius and his work. Here is his email of November 12, 2002. (I have put some key words in bold.)

> "The following notes may be useful on Fabricius's sources in Britain and in Denmark. I am afraid the problems with Fabrician types are not as neat as they some times appear to be...
>
> 1) *Hesperia titus* Fabricius, 1793.
>
> F described the species from the Collection of Dru Drury and stated that it was, "in Anglia Dom. Drury..." Fabricius would have studied this material either in 1787 or in 1790. The locality given by Fab was **obviously wrong**, because Drury often did not know from where many insects came from, although

[2] Dr. Gerhard Tarmann of Innsbruck, Austria, relayed the following information in 1998: "There is some Hübner material there although most of Hübner's material was destroyed by a fire. There was a man called Mazzola who bought some of Hübner's original material. As this man has taken away all of Hübner's labels and replaced them with his own printed labels, it took years to find out that some of the material in Mazzola's collection is in fact original Hübner material. However, although the Mazzola collection is in Vienna, there is only European material involved. There are no possible Hübner types of American butterflies existing. I got this information from Dr. Sabina Gaal, Naturhis-torissches Museum Wien (NHMW)."

we do know sources of many (mostly from west Africa and southern India). I am **positive** that Fabrician taxon was illustrated in William **Jones's "Icones**", although I can not look it up in Copenhagen. Fab also took away often specimens from these collections. So we do have in Fabricius's own collection "syntypic" material from Drury, Banks, Hunter etc. However, I will have to see if there are any specimens of "*H. titus*" here (next week).

Now, I know fairly well those butterflies from the Americas in Sir Joseph Banks Collection, which Fab described. If one puts a little time in the NHM Libraries, you might even come up with the exact localities. According to Butler (1870), the "specimen" of *titus* that you hint at was **NOT** in the Banks Collection, but in the National Collection, i. e. the General Collection. If it was subsequently moved in to Banks, I can't say from here. However, it is very probable that the specimen which Butler saw came from the Milne's Collection. When the Drury Collection was sold in 1804 (or 1805) many type material described by Fabricius from the Drury Collection was "bought" by Sir J. E. Smith (the founder of the Linnean Society), Sir Joseph Banks, Edward Donovan, Milne and many others. And practically ALL the "types" of butterflies described by Fabricius from British Collections were "depicted" by William Jones.

Taken all in all - with the external evidence etc. that I know - I think "*Hesperia titus*" came from the **southern parts of USA.**..and NOT Canada. The Canadian butterflies collected by Banks during his famous travels to Newfoundland etc were described by Fabricius earlier in 1775, 1781 etc. Insects collected during Cook's second voyage from north America also came from other places (west coast). The prevailing usage was apparently based on the **misunderstanding** that Fab described *H. titus* from Banks Collection (possibly collected by Banks himself, which Fab **did not**). Perhaps... this may go back to other errors committed by Holland...too...?)

Fabricius also knew and met **John Abbot** by the way in London. Abbot did send material to J. E. Smith, Dru Drury etc...

Conclusion: The specimen in BM general collection has a long history – it was identified by Doubleday before 1840s and he knew north American butterflies very well indeed. The "red" or "yellow" BM-Type labels in the Banks Collection inserted by subsequent authorities must be taken with very critical eyes...some of them **are not** consistent with the original descriptions. Anyway if there is a specimen either in Banks or in BM, I think it is very likely the type (or one of them). Much of the Drury material is now in Australia too...!

There was some reason as to why **Butler (1870) synonymized** Huebner's name... "***mopsus*" with "*titus***"...anyway do as you think is fitting."

Next, is a follow-up message from Harish Gaonkar November 13, 2002 as follows.

"Fabricius described about 650 butterflies, out of which about 230 were from the Indo-Australian Region. So, it is only with these that I have gone deeper in to the history. However, I have done some work on his material from all over the world.

Following information may be useful to you:

1) *Hesperia titus* 1793: p. 297, no. 130. According to Butler (Fig.) that specimen in BM has the label "*titus*, 130", which may be the one written by Drury himself.

I confirm that there are NO specimens of this [*titus*] in Fabricius's own collection here in ZMUC!

2) Jones illustration, although stylized, was most certainly based on the TYPE then in the Drury Collection. This illustration was completed before 1787 by Jones. That is, when Fabricius studied all the six volumes of the Icones for the first time in London. So, I suggest that you choose the Jones's illustration as the LECTOTYPE. As I said, adding two and two together, I think that the specimen in the BM did come from the Drury Collection. The Banks Collection of Lepidoptera is kept separately in the BM, which I am supposed to curate. So the actual specimen of "*titus*" must be in the Lycaenidae drawers on the First floor. On reflection, I think the specimen was one seen by Fabricius..., because I have identified specimens of Oriental butterflies there with similar histories...

It is known that Hübner received material from Abbot. Hubner's types, which should have been in Vienna, were destroyed by fire in 1848! So forget about that.

Hübner's name **was synonymized by Butler** (Catalogue of the Diurnal Lepidoptera described by Fabricius in the Collection of the British Museum, [1870]: 191)

3) John Abbot.

Most of John Abbot's drawings and paintings of North American Insects (also butterflies) are held by the Entomology Library in the BM.

Although I have not done careful research, I have a "feeling" (not subjective though) that his specimens are in the Linnean Society Collection, London. And why do I think that? Some years back, I helped two of my colleagues Martin Honey and Malcolm Scoble on Linnean Butterflies. It appeared to me then (and now) that some of the specimens in LS Collections were added later by Sir James E. Smith to the Linnaean Collection, particularly from North America. We know that Smith received a lot of material from your area (first from **Virginia and later from Georgia**) sent by Abbot. William Jones also got some specimens, and so did Dru Drury. So, I think (in many cases know) that specimens sent by Abbot to these three are to be searched in the Linnaean Collection (LS) AND Hope Dept. of Entomology, University of Oxford.

The LS now houses many specimens that were used by Jones for his Icones and described by Fabricius directly from the illustrations themselves. Oxford contains many specimens of William Jones himself which came there through many others, among others through the John Francillon Collection.
Harish"

The pertinent facts from the above are these. 1) The published type locality of "in Anglia Dom. Drury" is "obviously wrong" in Harish's expert opinion. 2) It is his view that the specimen the name *titus* was based on came from the "southern parts of the USA" and likely from John Abbot ex "Virginia and later from Georgia". (Abbot moved from Virginia to Georgia in 1775). 3) The type was illustrated by Jones in his Icones and exists in the main collection of the British Museum.

Contacting the NHM, London confirmed that the type is there and in the Lycaenidae drawer as Harish stated (fig. 3). This specimen is here determined to be the holotype by monotypy. A comparison of this female specimen with the Jones Icones' female illustration shows they have the same markings and spot positions. The *titus* holotype is typical of southeastern females traditionally known as subspecies *mopsus* of Hübner (TL Georgia in Florida). No other specimens were figured or mentioned, thus there are no syntypes. A holotype label has been sent to Kim Goodger, NHM, for placement on this specimen.

Butler (1870) synonymized the names *titus* and *mopsus* as below. While correctly recognizing that the taxa represented by these two names were synonyms, he was incorrect in assuming New England as the habitat. Specifically, because Hübner had stated that Georgia was the habitat of *mopsus* – and because the *titus* holotype is clearly the southeastern phenotype. Thus, this paper is not the first to state that the names are synonymous. It is the first to determine and that the region inhabited by both these taxa, based on the proceeding data, is coastal Georgia.

Butler 1870

3. **Strymon Titus.**

Hesperia (R.) Titus, *Fabricius*, "alis integerrimis, fuscis immaculatis; posticis subtus ocellatis strigaque postica maculari fulva: habitat in Anglia." S. Mopsus, *Hübner, Exot. Schmett. Zuträge*, figs. 135, 136 (1806).

Fabricius, Ent. Syst. iii. p. 297. n. 130 (1793).

North America. (Probably from Mr. Milne's collection) B.M.

The specimen of *P. Titus* in the National Collection bears an old label, on which is written "*Titus*, 130," evidently a reference to the description by Fabricius. It is quite possible that this is the type from Drury's collection, received through Mr. Milne, as it answers in every particular to the description, and has altogether the appearance of a very old specimen; its true habitat appears to be New England.

TYPE LOCALITIES

(TITUS)

The phenotype of the *titus* holotype is Southeastern. Harish Gaonkar states that he considers it likely this type specimen originated from John Abbot from either Virginia or Georgia. It is considered unlikely that the specimen originated from Virginia because 1) Abbot only resided in Virginia from 1773 to 1775 when he relocated to Georgia due to the impending American Revolution (Harris, 1972), 2) Fabricius likely saw the specimen "…either in 1787 or in 1790" and published the name in 1793 – 18 years after Abbot left Virginia, and 3) Abbot did not figure *titus* for the 1797 book on the Lepidoptera of Georgia by J.E. Smith which makes it possible he did not even discover *titus* in Georgia until after 1797 – after Fabricius' description of *titus* (which would mean this is not an Abbot specimen). However, we know Abbot found *titus* in coastal Georgia as his painting of it was published in Boisduval and Le Conte, 1833 (http://www.sc.edu/library/spcoll/abbot/part_ 1.html Image 11, and historical notes. *University of South Carolina* (USC) *Thomas Cooper Library* web site). This painting depicts a typical male and female of the Georgian phenotype. The issue of Virginia as the potential TL is important as some populations there are likely not nominate *titus*, but intermediates.

Fabricius' OD citation of "in Anglia" (Newfoundland in the literature) is false. This is confirmed by the fact that *H. titus* has never been recorded anywhere near Newfoundland (Butterflies of Canada, 1998). Butler's rendering of "in Anglia" as "New England" is literal but, as Harish noted, an error. Recommendation 76A.2 of the ICZN Code says: "A statement of a type locality that is found to be erroneous should be corrected." The type locality of *Hesperia titus* Fabricius, 1793 is here corrected to: Millhaven Plantation, Screven County, Georgia. This is because Abbot collected on this Plantation (Harris, 1972) and I have found it still there today. Abbot lived in adjacent Burke County (1776-1806) until he was 55 and moved to Savannah (see above web site), found many of his taxa in these counties, and *Harkenclenus titus* still occurs in both counties today.

(MOPSUS)

Hübner established "Georgia in Florida" as the TL of *mopsus*. At that time, "Georgia in Florida" meant Spanish (coastal) Georgia. At one time this region extended from Beaufort, SC south into Florida. In the early 1800's, this was a commonly used phrase to denote coastal Georgia. The specimen from which Hübner described *mopsus* was obtained from a Dr. Andersch (see *mopsus* OD below). Martin Spies provided the following from a German web resource (http://www.zalf.de/deid/index.htm) and suspects this may be Hübner's Andersch: "Johann David (or Daniel) Andersch (1768-1847), died in Tilsit (now Sovetsk in the Russian enclave between Poland and Lithuania that also contains Kaliningrad". Spies states, "There's no indication in the above that he lived in the U.S." He considers it likely that Andersch was a wealthy Dr. and "…private collector who acquired material from all over the world." Andersch is frequently mentioned by Hübner, 1818, and it is reasonable to conclude Andersch was a customer of the European agents who sold Abbot's specimens. It is also possible Andersch also bought Abbot art – perhaps the very painting for Hubner's *mopsus* plate because the Hübner figures of *mopsus* are identical to an Abbot painting at the USC Thomas Cooper Library (image 13). This Abbot figure even has the name "mopsus" (1818) penciled beneath it. This male painting has heavier spots than the # 11 image that was the Boisduval and Le Conte plate original. The Hübner painting is quite atypical.

It is wise to delimit the type locality of *mopsus* by designating a neotype to eliminate all ambiguity and possible future instability relative to the names *titus* and *mopsus* in accordance with the ICZN provisions laid out in Article 75.3 and subsections. All provisions of 75.3.1, 3.2, 3.3, 3.4, 3.5, 3.6 and 3.7 are here considered quoted by this reference and specifically addressed and met within the applicable sections of this paper. The type locality of *Chrysophanus mopsus* Hübner, 1818 is here clarified by neotypification (fig. 5) to Millhaven Plantation, Screven County, Georgia. Neotype deposited in the NHM (London) and bears the following labels. A red label, hand lettered "NEOTYPE: *Chrysophanus mopsus*, Hübner 1818"; small white label, hand lettered "♀ *H. t. mopsus*" and type set print "Ronald R. Gatrelle, COLLECTOR"; a medium size white label hand lettered, "June 9, 1994, Screven Co., GA, Millhaven Plantation, Brier Creek". All words in black ink.

GENERIC PLACEMENT

The taxon *titus* was originally described in the genus *Hesperia* (now restricted to skipper butterflies). The next oldest name is *mopsus* described in *Chrysophanus,* which was suppressed by the ICZN in 1959. C.F. dosPassos (1970) proposed *Harkenclenus* as the replacement name for *Chrysophanus* with *mopsus* as type species = subspecies *titus.* DosPassos treatment was very brief and is as follows.

On page 28.

HARKENCLENUS nom. nov.
pro *Chrysophanus* Hübner, 1818 (opinion 541, name 1235)
Type: *Chrysophanus mopsus* Hübner, 1818 (opinion 541, name 1235)
(= *Papilio titus* Fabricius, 1793) (opinion 541, name 1605)

On page 36.

The International Commission on Zoological Nomenclature by opinion 541 suppressed among other names *Chrysophanus* Hübner, 1818, and placed it on the Official Index of Rejected and Invalid Names in Zoology for the purpose of the Law of Priority but not for those of the Law of Homonymy. Consequently, a replacement name is in order. For that purpose *Harkenclenus* has been chosen, being an arbitrary combination of the first syllables of the name of my friend and colleague, Harry Kendon Clench. The new name is masculine.

Clench in Ehrlich & Ehrlich (1961) was the first to begin combining other genera into *Satyrium* Scudder, 1876. In his 1961 assessment, Clench not only determined *Chrysophanus titus* was not a *Satyrium,* but that it was monotypic (page 191). In 1978, Clench again assessed various world genera and synonymized many genera (and thus species) into *Satyrium* – but not genus *Harkenclenus* (1970) nor species *titus.* His analysis continued his 1961 position that *titus* was not a *Satryium* (delimited species on page 281). Lafontaine (Butterflies of Canada, 1998, page 25) proposes the inclusion of *titus* in *Satyrium* and presents data in support of this. In the last 7 years, most lists and books have placed the taxon *titus* in the genus *Satyrium*. The assertion of this paper is that there is insufficient criteria to place *titus* into *Satyrium*. Until more genus level in-depth research is presented specific to *titus*, it is deemed best to leave the species *titus* in *Harkenclenus* per dos Passos 1970 – and several other publications between 1970 and today. The perspective here is that this also serves to keep synonymization to a minimum. Retaining *titus* in *Harkenclenus* is the most conservative position.

(In review, this section was discussed and various versions considered. Because the primary objectives of this paper are to 1) properly define the names *titus* and *mopsus* according to the type specimens and historical record and 2) assess the other regional populations from that base, the consensus was that the paper is best served by limiting this section to basic information and author's opinion because the generic placement issues are outside the paper's primary purposes.)

TAXONOMIC DESCRIPTIONS

Harkenclenus titus titus (Fabricius, 1793)

Original Description

Latin (Transcribed as in original.)

130. H. R. alis integerrimus fuscis immaculatis: Titus. posticis subtus ocellatis strigaque postica maculari fulva.
Papilio Titus. Jon. fig. pict. 6 tab. 44. fig. 2
Habitat in Anglia Dom. Drury.
Statura omnino praecedentium. Alae omnes supra fuscae, immaculatae. Subtus itidem fuscae, anticae striga postica e lineolis albis nigrisque, posticae lineola media strigaque e punctis nigris, albo cinctis. Versus marginem maculae rufae, puncto nigro notatae.

English Translation (By: Dr. Rienk de Jong, NMHN, The Netherlands.)

130. H[esperia] R[urales] entire wings dark and without spots: Titus underside of hindwings with eye spots and a discal series of tawny spots.
Papilio Titus. Jon[Jones] fig. pict. 6 tab. 44. fig. 2
Lives in Anglia Dom. [N. American English territory] Drury.
With general build of foregoing species [artaxerxes]. All wings dark on upperside, without spots. Underside **equally** dark, forewings with a distal series of **white and black** short lines, hindwings with a central short line and a series of black, **white-ringed specks**. Toward the margin reddish-brown spots, marked with a black speck

Diagnosis. Key words in **bold**. This description alone applies only to the southeastern subspecies as it is the only *titus* subspecies to have the ventral surface a dark grayish black or blackish brown equal to the darkness of the dorsal surface in many specimens. This is significant because the specimen described is the female holotype (and many females are lighter than males). As seen in the figures, the ventral markings on *titus titus* are quite small, and on male VFWs, often nearly absent. However, though small, they are prominent due to the white halos. The red "coral" spots along the VHW margin are reddish orange with these spots sometimes also found on the VFW of females. This is especially so at the southern terminus of the range of *titus titus* in the Florida panhandle where some females have extensive red spotting on the outer margin of the VFW (fig. 15). This character is clinal and, as such, holds no subspecific significance – it is merely a form.

Range. *H. titus titus* ranges from the Pine & Oak upland (hilly) dry forests in the Florida Panhandle and up the Sandhills region of Georgia and South Carolina. It probably ranges through the Sandhills of North Carolina and the Piedmont and coastal plain of Virginia perhaps to Maryland. The blend (or tension) zone between *titus winteri* (below) and *titus titus* needs to be researched. There are no known records of *titus* in the lower coastal plain south of Virginia. The type locality in Screven County is literally at the junction of the upper and lower coastal plain but within the upper coastal plain ecosystem. (See under Additional Comments under *campus* for more range information.)

Additional Comments. Few specimens of Southeastern nominotypical *titus* are known in either private or public collections. The only topotypes I am aware of are the one female I collected (the neotype of Hübner's *mopsus*) and seven specimens collected by Otto Buchholz in 1967 housed in the Smithsonian National Museum collection. The longest series I know of typical southeastern *titus titus* are the 25 I have collected over several years from Aiken and Orangeburg counties South Carolina. (Aiken County is adjacent to Burke County and Orangeburg adjacent to Aiken.)

Chrysophanus mopsus Hübner, 1818 (= *titus* Fabricius, 1793)

Original Description

German (Transcribed as in original)

Aus Georgien in Florida. Durch Herrn Dr. Andersch erlangt. Ein *Papilio gentilis* und *Agrodiaetus villicans*. Dem *C. Circe* * am aehnlichsten, aber die Schwingen oben mit einem Glaetzgen gezeichnet und sammt den Senken im innern Raume zeichenlos. Die Fuerbildung 135. 136. giebt das maennliche Geschlecht zu erkennen.

* Schiff. Verz. Pap. M. 7. Circe.

English Translation (By Martin Spies, Munich, Germany.)

From Georgia in Florida. Obtained through Dr. Andersch. A butterfly related to *Agrodiaetus villicans*. Most similar to *C. Circe* *, but the dorsum with a small bald spot located at the top [the forewings] and, like the hindwings, unmarked in the inner area. The figures 135 & 136 show how to recognize the male

*Schiff. Verz. Pap. M. 7. *Circe.*

OD Notes.

David Wright: "*Chrysophanus circe* Denis & Schiffermüller (1775) is a synonym of *Heodes tityrus* (Poda, 1761). The sentence linking *mopsus* to *Agrodiaetus villicans* is difficult to translate. First, *villicans* is not a known species. Second, Hübner's genus *Agrodiaetus* was erected four years later in 1822. Whether Hübner slipped and introduced *Agrodiaetus* before it was officially published in unclear. The genus (or subgenus in some checklists) is a Eurasian polyommatine (blue) genus with brown females and mostly blue males. Some species also have brown males. *Villicans* perhaps was a MS name that was abandoned, or it is a synonym no longer carried in checklists."

Martin Spies: " 'Glaetzgen' and 'Fuerbildung' are old words that I hadn't seen. The former has no equivalent in modern German, I take it to mean a 'kleine Glatze', i.e. a small bald spot ('Glatze' = bald head or the bald area on a head). The latter would be 'Abbildung' today. I'm also not familiar with the terms 'Schwingen' and 'Senken', but from looking at Huebner's figures assume that your [Wright's] translation (forewing and hindwing) is correct."

Gatrelle: Pictures of *Heodes tityrus* (Sooty Copper) are in: *A Field Guide to the Butterflies of Britain and Europe*, Higgins & Riley, 1970, Plate 52. The OD *mopsus* figures and the comparison with *C. circe* (=*H. tityrus*) provides a poor diagnosis of this taxon. It is curious that the OD ventral figure does not look like male *mopsus* in the type locality region at all. Further, this painting is identical to one supposedly by John Abbot as stated on page 7 under *mopsus*.

Range. The OD range is "Georgia in Florida". This indicates coastal Georgia.

Diagnosis & Additional Comments. The problems in the OD diagnosis, curious art, its misconception as **heavily** spotted, wide ranging taxon (from the long history in the lit of inaccurate delineation), and now synonymy with *titus*, all relate to the above cited Code criteria calling for neotypification. The least confusion (most stability) is obtained by keeping the name "mopsus" associated with its historical application, which is the **thinly** spotted taxon with strong white halos inhabiting the southeastern region of the United States in north Florida and coastal Georgia and South Carolina.

Harkenclenus titus winteri Gatrelle: new subspecies

Diagnosis. The photos of *Harkenclenus titus winteri* (figs. 23-26) illustrate this subspecies well. *H. titus winteri* is a familiar taxon having been incorrectly assumed for decades to be the nominate subspecies. It is therefore not necessary to establish a long type series nor provide a discourse for the purpose of persuasion. Likewise, the southeastern subspecies now known to be true nominate *titus* is familiar to lepidopterists (as *mopsus*), although it is in need of better delineation. The region of transition from northern to southeastern subspecies has been, and is, in need of more detailed study. Southeastern *titus* males are ventrally dark gray brown to gray black with tiny to medium black spots (often very restricted to absent on the forewings) and with bright white halos. Female southeastern *titus* also have the ventral spots reduced, but not as much as males, and boldly circled in white; their ventral ground is like the males but lighter. In *winteri,* the ventral ground is dark brown and the spots usually moderately developed, but they may also be very reduced (figs. 25-26). In both sexes, these spots appear drab because they are not highlighted with white as in *titus titus*. In this subspecies the males and females are usually about the same size. The photos illustrate the normal phenotypes of each subspecies and serve to help the observer recognize each subspecies and populations that are intermediate.

Description. **Dorsally:** Males: solid medium to dark grayish brown. Females: medium grayish brown and frequently having two to four red spots on the posterior area of hind wing outer margin, occasionally some red suffusion on the margins of the forewings. **Ventrally:** Ground a warm medium to dark brown with both sexes marked alike, females being slightly more boldly marked and brightly colored; black spots medium to small in size (absent in some individuals) but not standing out contrastingly due to lack of, or weak, white halos in most specimens, some individuals have subdued (not bright) whitish halos – esp. in females; band of "coral" spots on the outer margin orange to orange red, more vivid in females. **Overall**: *winteri* is rather drab except for the ventral orange red marginal spot band.

Types. All MASSACHUSETTS. *Holotype* ♂ (fig. 23): Sherborn, 8 July 1973. *Allotype* ♀ (fig. 24): Sherborn, 10 July 1973. *Paratypes*: 1♂, 1♀: Sherborn: 1♂, 9 July; 1♀ 15 July 1973 (all leg. D. Winter). Types in MOTH collection.

Etymology. *H titus winteri* is named in honor of the late Dr. William D. Winter Jr. (1923-1998) of Massachusetts who contributed much to our knowledge of butterflies in that region. He is the author of Memoir No. 5 of the Lepidopterists' Society: *Basic Techniques fro Observing and Studying Moths and Butterflies.*

Range. As established throughout the literature from the New England states west across southern Canada to the Canadian prairies where it meets (or blends) to subspecies *immaculosus* W.P. Comstock, 1913 (TL Provo, Utah); and across the extreme northern US to the northeast prairies to North Dakota (what has passed as this in northeastern Colorado may actually be an intermediate between *campus* and *immaculosus*). Pictures of *winteri* can be found in the following popular publications, usually under the name *titus*; *A Field Guide to the Butterflies* (Klots, 1951), *Michigan Butterflies & Skippers* (Nielsen, 1999), *Butterflies of Wisconsin* (Ebner, 1970), *The Butterflies of Canada* (Layberry, Hall & Lafontaine, 1998) and *The Butterflies of Manitoba* (Klassen, Westwood, Preston & McKillop, 1989). The *Butterflies of North Dakota* (Royer, 1988) figures three specimens – one is a *winteri* from Wisconsin. The other two look intermediate to subspecies *immaculosus*. *H. t. winteri's* Appalachians range is undetermined. In *Butterflies of West Virginia and Their Caterpillars*, Allen calls the WV populations *mopsus* (now = *titus*), but the one venter figure (a male) is not the southeastern phenotype. It also does not appear to be the northeastern *winteri* phenotype (although closer to that subspecies). It is logical that the populations there would be intermediate between *winteri* and *campus* as *campus* occurs in Ohio. In *Butterflies of Virginia* (Clark & Clark, 1951), *winteri* ("titus") was only recorded from Highlands County which is adjacent to West Virginia. Clark & Clark recorded *mopsus* (nominate *titus*) only from the Piedmont and Shenandoah Valley and their figure is certainly of the southeastern phenotype. However, populations there may actually be intermediate between *winteri* and *titus* when examined more closely and in long series. *Winteri* occupies the eastern glaciated areas, with subspecies *campus* (see below) in the mid and southern plains. The best source in the popular literature for accurate pictures of *H. titus titus* and *H. titus winteri* is Howe, 1975. On Howe's Plate 50, figures 23 and 24 are typical *titus titus* (captioned as *mopsus*. These are near topotypes from South Carolina.) On plate 52, figures 23 and 24 are typical specimens of *titus winteri* (captioned as *titus*).

Harkenclenus titus campus Gatrelle: new subspecies

Diagnosis. The photos of *Harkenclenus titus campus* (figs. 9-13 & 16-18) illustrate this subspecies well. *H. titus campus* is a familiar taxon having been incorrectly assumed for decades to be a southern and prairie extension of what was formerly known as subspecies *mopsus*. It is therefore not necessary to establish a long type series nor provide a discourse for the purpose of persuasion. The single character trait that has led to this false taxonomic association is the rather prominent white halos frequently present around the prominent large black spots on the underside of this subspecies. It has been assumed that this is what "mopsus" looked like. However, the false presentation in much of the literature, and virtual absence of specimens of southeastern *titus titus* (= *mopsus*) in museums, has resulted in an incorrect concept of what the southeastern phenotype is. As can be seen from the photos of nominate *titus*, it is a taxon that frequently lacks or has reduced black spots

on the ventral forewing of males and present, but reduced, ventral spots on most females (with some females also having very restricted VFW spots). In *campus*, the black ventral spots have the highest degree of development of any *titus* subspecies, including the frequent presence of a cell end bar on both the fore and hind wings (especially the hind wings). In this subspecies the males are frequently noticeably larger than females.

Description. **Dorsally:** Males: solid medium grayish brown. Females: medium grayish brown and frequently having a few small red spots on the posterior area of hind wing outer margin, red suffusion on the disc of the forewings is not yet documented. **Ventrally:** Ground: from light brown to medium gray brown, both sexes are marked alike with females being more boldly marked and brightly colored; all black spots well developed and standing out contrastingly due to either 1) black spot contrast with the light brown ground and/or 2) moderately white halos in males and moderate to strong white halos in females; males usually with fully developed marginal and median spot bands and a cell end spot on both wings; red band of spots on the outer margin more vivid in females and orange red. **Overall**: *campus* is a ventrally boldly marked taxon, especially in its females.

Types. *Holotype* ♂ (figs. 9-10): **IOWA:** Shelby County, visc. of Defiance, 8 July 1967 (leg. R. Gatrelle). *Allotype* ♀ (figs 16): **KANSAS:** Douglas County, Lawrence, Clinton LK area, 17 May 1989 (leg. James Adams). *Paratypes*: 12♂♂, 5♀♀: **IOWA:** Shelby County: visc. of Defiance, 1♂, 8 July 1967; Guthrie County: visc. Sheader Prairie, 4♂♂, 1♀, 28 July 1975; Johnson County: Williams Prairie, 1♂, 28 June, 2♂♂, 1♀, 2 July, 1♀, 3 July 1975 (all leg. R. Gatrelle). **KANSAS:** Douglas County: Lawrence, Clinton LK area, 1♂ 17 May, 2♂♂, 1♀, ? June 1989 (leg. J. Adams). **ARKANSAS:** Faulkner County: no location, 1♀, 1 June 1945 (leg. unknown). **TEXAS:** Henderson County: Athens, 1♂, 2 June 1975 (leg. C. Bordelon). The holotype is deposited in the Museum of the Hemispheres (MOTH), Goose Creek, South Carolina. The allotype and 11 paratypes deposited in the MOTH collection, Goose Creek, SC. Other paratypes deposited as follows: 3♂ & 1♀, James Adams coll., Calhoun, GA; 1♂,Charles Bordelon coll., Houston, TX; 1♀, FSCA collection, Gainesville, FL.

Etymology. *H. t. campus* is named for the central and southern plains region that comprises much of it range.

Range. As throughout the literature as that which was formerly considered "mopsus" from Mississippi to central Texas to southeast Colorado, South Dakota, and east into at least Ohio. Photos of *campus* can be found in the following popular publications and usually under the name *mopsus* but occasionally as *titus* or *titus* ssp.: *Butterflies and Skippers of Ohio* (Iftner, Shuey & Calhoun, 1992), *Colorado Butterflies* (Brown et al, 1957), *Butterflies of the Rocky Mountain States* (Ferris & Brown, 1981), *Butterflies and Moths of Missouri* (Heitzman & Heitzman, 1987), *The Butterflies of Indiana* (Shull, 1987). *Field Guide to the Butterflies of South Dakota* (Marrone, 2003). *H. titus campus* has the largest range of the eastern *titus* subspecies. It is not known if, or to what degree, *campus* blends with *winteri* across the northern part of its range and east of Ohio. One Alabama specimen examined appears intermediate to southeastern *titus titus*. The specimens figured in *Butterflies of Georgia* (Harris, 1972) from the Atlanta area are so small one can not make a definitive statement about them. However, they appear too brown for *titus titus* and look to be near *campus* – if not that taxon.

There are very few records of *titus* from the southern Appalachians (USGS web site) and I have not personally found any specimens from above 1000 ft. in this region. Thus, the taxonomic status of those populations in the true mountains (above 2000 ft.) of north Georgia, eastern Tennessee (Watson & Hyatt, 1988) and Kentucky, southern West Virginia, and southwestern Virginia is unknown to me. (See under Concluding Remarks for updated information re Appalachians). There does not appear to be a blend zone in Texas from *campus* to *watsoni*. If this is so, it indicates that *watsoni* is descended from a more western or Mexican taxon that has moved north and east to abut the range of *campus*.

Additional Comments. Although specimens throughout the range of *campus* are quite variable in ventral ground coloration (grays & browns), the basic phenotype of prominent large black ventral spots with some to much white haloing manifests the evolutional connectivity of this taxon throughout its wide range. The following statement in *Butterflies of the Rocky Mountain States* (1981) summarizes well the main characters of *campus*. "This subspecies is **larger** and somewhat **lighter** with the VHW discal spots conspicuously **large** and ringed with **white**." Bold added to the key words. This was stated in description of what was then thought to be "mopsus" in Colorado – and as compared to what is now subspecies *winteri* of the northern US and southeast Canada. But in true *mopsus* (now *titus*) the black spots are very **small** (often **absent** on the VFW, especially in males) and the ground is **darker** (often dark grayish brown which looks blackish in very fresh individuals). Male *campus* are often large while male *titus* are medium in comparison.

Evolutionally, my view is that the northern subspecies *winteri* evolved **from** *immaculosus*. Two things lead me to this hypothesis. 1) The range of *winteri* is almost entirely in formerly glaciated areas and, as such, is thus indicated to be the most recently evolved taxon in this eastern complex and 2) it tends to most resemble *immaculosus* (figs. 25-28). I consider *campus* more closely related to *watsoni* with each having evolved in near, but different, refugia (Mexico and/or Texas). I consider *titus* ascended from a very different Florida refugia. In their subsequent dispersal, *titus* became restricted between the barriers of the Appalachian Mountains and the Atlantic coastal swampy Maritime Forest which has resulted in its modern range from the open Pine & Oak forests of the Panhandle of Florida and up the Sandhills region of Georgia, South Carolina and North Carolina, and dry Piedmont and coastal plain possibly to Maryland. *Campus* had no such restrictions and probably easily and quickly dispersed north, east and northeast into its present range – and is likely still expanding.

Harkenclenus titus watsoni (Barnes and Benjamin, 1926)

Original Description

363 add *b* watsoni *B. & Benj.*

Strymon titus race *watsoni* nov.

Similar to typical **titus**, larger, the underside much paler.

Expanse: ♂ 31-34 mm.; ♀ 34-40 mm.

Type localities and number and sexes of types: Holotype ♂, Allotype ♀, 1 ♂ 1 ♀ Paratypes, Kerrville, Texas, no dates; 1 ♂ Paratype, Shovel Mt., Texas, 8-15 May.

Notes: presumably collected by Mr. Lacey and Dr. Barnes.

Diagnosis. (Figs. 14 & 20.) This taxon remains elusive to taxonomic assessment. I retain it as a valid subspecies based on the apparent consistent character traits of light venters, bold ventral spotting from prominent white halos, and small brassy yellow-orange VHW marginal spots. Its size would not indicate subspeciation alone, but in conjunction with the other characters adds to its uniqueness. Because museum specimens fade with age, any phenotypic assessment should be done with fresh wild caught individuals. Herein lies an excellent opportunity for photographic documentation for scientific analysis rather than collection of specimens which may put added pressure on struggling weak micro populations.

Range. The range given in the literature seems accurate – central Texas north into southwestern Oklahoma and west into New Mexico. This area is faunally western, and as such, is disassociated from east Texas and the Midwestern Great Plains fauna. *Deciduphagus henrici solatus* (Cook and Watson, 1909) and *D. henrici turneri* (Clench, 1943) are another pair of Lycaenidae taxa that have the same basic distributional relationship as *H. t. watsoni* and *H. t. campus* have.

Additional Comments. Some may consider *watsoni* and *campus* to be conspecific, in which concept, *campus* becomes a synonym. However the range of *watsoni* would then extend from New Mexico into Ohio and Alabama and include phenotypes quite dissimilar from typical *watsoni*. To this researcher, no such affinity is evident. It is most probable that *watsoni* once ranged much farther west and southwest of it current range. It would seem most probable for it to have evolved into its unique state of being westwardly disjunct from any of the eastern populations. It is apparently very rare but to what is this attributable? Habitat destruction, natural evolutionary pressure, or something else. This taxon should be evaluated and its conservation status assessed. Upon submission of this manuscript, only two specimens, one from Wheeler, Texas and one from Norman, Oklahoma (which looks nr. *campus*) had been seen, and one photo. During review, David Wright has sent additional photos of AMNH specimens. (See page 17 discussion for late information on Oklahoma specimens.) *Watsoni* is similar to *campus* and it can be seen why some would lump these together. This paper just doesn't agree with that concept.

Harkenclenus titus immaculosus (W. P. Comstock, 1913)

Original Description. The OD of this taxon is refreshingly thorough and provides much needed information on the taxon *titus* as a whole. This is a hard to find paper, and like a lot of these older papers, they should be more accessable to the general lepidopterological public. Thus, most of this scientific paper is reproduced herewith. Some key words and phrases have been highlighted in **bold**. (Types are illustrated on page 2. Holotype, fig. 21; allotype, fig. 22.)

"♂ and ♀. This variety is slightly smaller in size than the normal form of S[trymon]. titus Fabr. (expanse of ♂ from 28-30 mm., ♀ from 30-34 mm., as compared with ♂ 30-35 mm., ♀ 33-38 mm. in normal specimens*)

The head, thorax, abdomen and appendages do not differ from the normal form.

The upper surface may be as in the normal form of ♂ and ♀, a satiny seal brown with slight greenish reflections (Figs. C and D), or in a series of specimens, the surface many become gradually suffused with fulvous, until an extreme form is reached in which the outer half of the disk of the primaries in both ♂ and ♀ is completely covered with fulvous scales and there appears a complete row of marginal red-orange or fulvous spots on both primaries and secondaries in ♂ and ♀, although on the primaries these spots become lost in the ground color in extreme specimens such as shown on the plate, Figs. A and B.

On the underside the ground color varies, some specimens being like the normal form, and others of a paler shade. All black markings are obsolete to absent (Figs. E, F, G, and H), showing as mere pin points even where best defined. In these specimens a trace of the white markings occurs as a few scattered scales about the black markings. The red marginal spots of the secondaries are retained for the most part in reduced size, but in those specimens where the row of red spots is repeated the full marginal length of the primaries, the secondary row is of fully normal size and appears more prominently because of the obsolence of other markings on all four wings.

I did not examine the genitalia and androconia. The name given is the Latin adjective meaning unspotted or unspeckled.

[*Bottom of page 33 with the footnote: Measurements made from tip of wing to center of thorax and doubled.]

"Described from nine ♂ and twelve ♀ cotypes. 12 from Provo, Utah, variously dated in July, collected by Tom Spalding. 8 from Utah (general label), no date. 1 from Miniota, Manitoba, in July.

Means were selected as types, 1♂ and 1♀; the remaining specimens are considered paratypes. The types are retained in my own collection. [text with deposition of others text omitted]

I have checked all literature relating to *S. titus* as recorded in the bibliography below, and I can find no reference to any such variation as here described. Elrod in his "Butterflies of Montana" finds that specimens in Montana occur "with or without an outer marginal row of orange spots or a distinct orange band" on the upperside.

French in "The Butterflies of the Eastern United States" also refers to orange spots on the upper surface of the hind wings in some specimens. It is quite usual to find specimens with red-orange spots repeated upon the termen of the primaries beneath; also in females there are often one or more spots of red-orange near the anal angle of the secondaries above and sometimes a fulvous suffusion above at the anal angle of the primaries.

For the most part, eastern specimens from the southern part of Canada, New England, the Middle States and the Southwestern States have **well defined discal bands of black** on the underside of **both** wings, which are **more or less** edged with white [accurate for lumped *watsoni, campus* and *winteri* – not southeastern *titus titus*]. I have two male specimens from Catskills, taken at an altitude of from 1,500 to 2,000 feet, aberrant in that the discal rows of black spots are very poorly defined and there are practically no white markings on the under side [actually, not unusual for *winteri*]. The black spots, however, cover about the normal area and are indistinct because of suffusion and appear to be blurred. They are not like the spots in variety *immaculosus* which are, where present, reduced to **fine points**.

By far the most complete description of *S[trymon]. titus* is to be found in "The Butterflies of the Eastern United States" by S. H. Scudder. However, he makes no references to such variation as I have described, but calls attention to the fact that "male specimens from Idaho and Minnesota differ from all others that I have seen in having the spots of the inner row of both wings much larger, being nearly as large as the marginal spots of the hind wings."

Mr. Scudder also gives us information concerning the distribution, and his faunal map shows the species extending from northern New England to central Georgia on the Atlantic coast, and then n a broad belt westward along the line of the Lakes on the north and through central Texas to Arizona on the south. It also extends westward to the coast through the states of Montana and Washington. Mr. Scudder's map excludes southern Texas and the larger part of Utah from which I have specimens, and shows but one Canadian locality, in the Province of Ontario, though specimens are now recorded from Manitoba.

So far as I know *S. titus* is not recorded from California, but the type locality of the synonym [sp.] *mopsus* is given as Georgia and Florida, although I know of no actual Florida records.

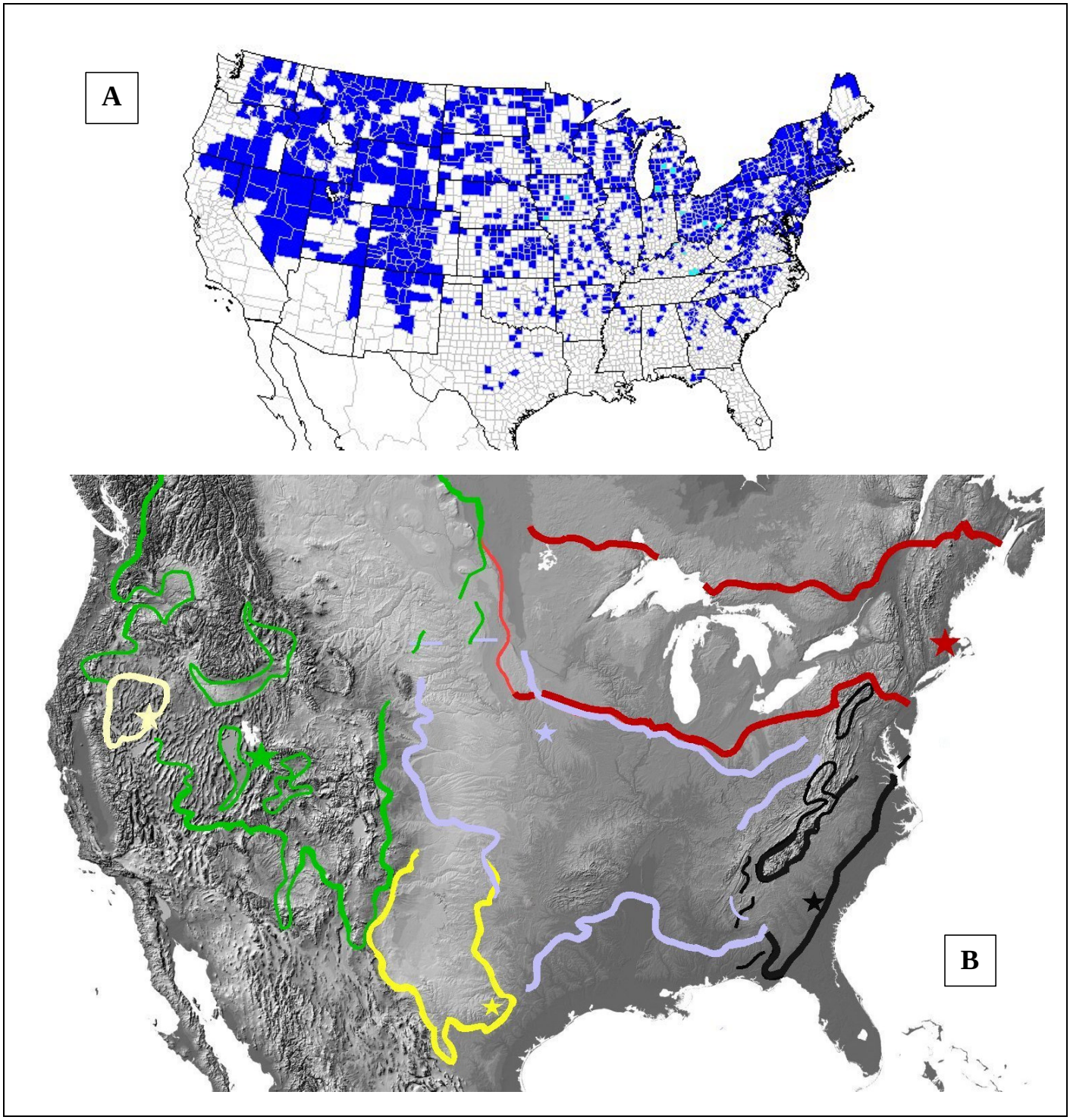
I record one other specimen, a male from Texas, which is interesting because the marginal row of spots on the secondaries beneath are **pale buff** and the specimen is of **large size** [this sounds like a faded *watsoni*], being about 37 mm. in expanse. Otherwise it is typical. More material might prove this to be a member of a local race, presumably a desert form." [Bibliography follows and ends the paper.]

Diagnosis. (Figs. 21-22 & 27-28.) This taxon derives its name from the lack of spots on the underside of the wings. However, it is equally defined and evolutionally unique by the extensive amount of red (fulvous) scaling that is frequently found on both male and female specimens. Howe (1975) on plate 52 figures 27 & 28 depicts beautiful examples or this. None of the eastern subspecies exhibit this trait any where near this extensively.

Range. This subspecies ranges from western Manitoba and North Dakota west to British Columbia and the northwest US. From Utah and Colorado it ranges south into central New Mexico. See western books for more details.

General Comments. Females of *winteri* can have fulvous dusting on the outer third of the forewings (I have never seen females of southeastern *titus titus* with any fulvous on the forewings); they also only have two or three red spots at the anal margin of the dorsal hindwings. Male *titus titus* are always dorsally unmarked. All of the Guthrie Co., IA male paratypes of *campus* have well defined (1.3 mm) single red spots at the dorsal anal area of the hindwings; one has a dusting of red scales at the tornus of the DFW. Specimens of *watsoni* are light brown beneath with the VHW marginal aurora a light coppery color, not red; but with bold and white haloed ventral spots of both wings.

For sake of completeness, *Harkenclenus titus occidentalis* Austin & J. Emmel, 1998 was described from Pershing County, Nevada with a distribution of: "Pershing (Humboldt Range), Humboldt (Santa Rosa Range) and Washoe (Red Rocks area north of Reno and Granite Mountains) counties, Nevada and Modoc (Warner Mountains), Lassen (near Doyle) and Plumas (Lake Almanor) counties, California. It flies in one brood from early July to mid August." It is characterized by a paler dorsum than *immaculosus* but otherwise similar on that surface except a tendency to fewer submarginal fulvous spots on the hind wings of both sexes. The underside of *occidentalis* is: "pale tan with rather bold postmedian spots." It is unfortunate that the OD photos of the types are black & white and of poor quality. The evolutionary affinity of this subspecies seems tied to both *immaculosus* (dorsal characters) and some extinct west-southern ancestor (ventral characters).



Map A. USGS range map. Historical site records by county and state geopolitical boundaries. **Map B.** Geological relief map. Subspecies' ranges overlaid to biogeographical regions. Stars indicate type localities; lines, range limits. **Black:** *H. titus titus*. Encircled Appalachian areas are where *titus* is rare or restricted by high elevations. Southwest and northeast range/blend zones undetermined and indicated by open line. **Red:** *H. titus winteri*. Southern boundary corresponds closely to glacial limits. Western transition to *campus* and *immaculosus* needs determination. **Lavender:** *H. titus campus*. Northwestern, southwestern and northeastern limits/transition areas need verification. **Green:** *H. titus immaculosus*. Eastern area of transition with *campus* and *winteri* needs to be worked out. Absent in many areas within the range of subspecies**. Light yellow:** *H. titus occidentalis.* Northeast California and northwest Nevada. Only in mountain ranges in this region. **Yellow:** *H. titus watsoni*. Northern limit/blend with *campus* undetermined.

CONCLUDING REMARKS

During the review of this paper, David Wright informed the author that he had photos of type material of *watsoni* (fig. 20 paratype male) and *immaculosus* (figs 21-22 holotype and allotype) in the American Museum of Natural History (AMNH). The addition of these adds greatly to the substance of this paper.

Also, just prior to going to press, Ken Davenport emailed photos of three female *titus* he had collected east of Nobel, Cleveland County, Oklahoma, 4-8 July 1980 (figs. 18-19). These are significant specimens as they are from the area where *watsoni* and *campus* meet. Fig. 18 is a typical *campus* while fig. 19 is near *watsoni* with reduced and yellow VHW marginal spots. The Canadian River is a geological feature which seems to be the basic boundary between *campus* and *watsoni* in Oklahoma.

The ranges of the *titus* subspecies differ greatly (Maps pg. 14). *H. t. occidentalis* has the smallest range and is the rarest of the subspecies. The next smallest range is that of *H. t. watsoni*, after that *H. t. titus*, *H. t. winteri*, *H. t. immaculosus* and *H. t. campus*. None of these subspecies are considered "common", although they may be locally not uncommon at the right time and place.

John Hyatt (recent pers. comm.) stated he has "… found none from localities above about 1400-1500', or below 1200" in eastern TN. Together with the USGS range maps and the author's extensive collecting in western NC above 1500', *titus* appears to be absent from the southern Appalachian Mountains. If this is so, an extensive north south barrier exists between those population east and west of these mountains – and apparently as far north as Pennsylvania.

It is possible that nominate *titus* ranges through north GA and around the Appalachian Mountains in a narrow band up into extreme eastern TN. This is because Hyatt has determined the *titus* in east TN as "mopsus" and James Adams (pers. comm.) has stated the *titus* in northwest GA are also the "mopsus" phenotype. However, I have not seen specimens to confirm either of these determinations. Thus, they may be intermediates or subspecies *campus*.

Having lived in Pensacola, Florida, It is probable that *titus titus* may inhabit the sub-Appalachian hill country of Escambia County in the Cantonment area and into southeast Alabama. The taxon in the Black Belt of Alabama should be *campus*.

In the southeastern US, the author's experience is that unless *Asclepias tuberosa* is found, especially subspecies *rolfsii* (Vail) Woodson (Butterfly-weed), the Coral Hairstreak will seldom be located. Thus, not finding this taxon does not mean it is not at a location, just that it is very difficult to find unless the proper nectar source is present. Then again, this taxon may be so selective about nectar sources, that even where the larval host is abundant, *titus* will be absent without these resources. If this is so, conservationists need to support the availability of these "weedy" Milkweeds in areas where *titus* taxa are known to occur.

Unfortunately, it was not noted, nor now remembered, on what flowers *campus* was found at Sheeder Prairie in Guthrie County, Iowa. The following uncommon species were found with *campus* at this location: *Satyrium acadica* (W.H. Edwards, 1862), *Euphyes bimacula illinois* (Dodge, 1872) and *E. dion* ssp. (W.H. Edwards, 1879). In the one visit to this site in 1975, it was a small hillside prairie and rather invaded with weeds and surrounded by agriculture. It is unknown if the site is still extent, and if so, if any of these taxa are still found there. When the *campus* type was taken, the author resided in Defiance, Iowa. A detailed notation was not placed on that specimen as to where it was caught. The recollection is that it was (in 1967) not far north of Defiance along Hwy. 59, east side of road, at the edge of a wooded area going up a hill. *S. calanus falacer* (Godart, 1824) was also found at the type locality.

Norbert Kondla brought two 2003 publications to the author's attention during review. One on the Butterflies of North Dakota (Royer) and one on South Dakota butterflies (Marrone). The photos in these are in stark contrast. The North Dakota individuals are very near *immaculosus*, if not that taxon, while the South Dakota individuals are boldly marked *campus*. The Dakotas need a subspecific range analysis for *titus*. Kondla considers the *titus* in south west Canada also in need of more taxonomic work.

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