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International Lepidoptera Survey

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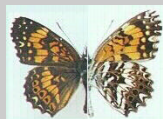


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The Taxonomic Report

OF THE INTERNATIONAL LEPIDOPTERA SURVEY



THE REDISCOVERY, TAXONOMY, AND BIOLOGY OF *CHLOSYNE GORGONE GORGONE* AND *CHLOSYNE ISMERIA* (NYMPHALIDAE) IN BURKE COUNTY, GEORGIA.

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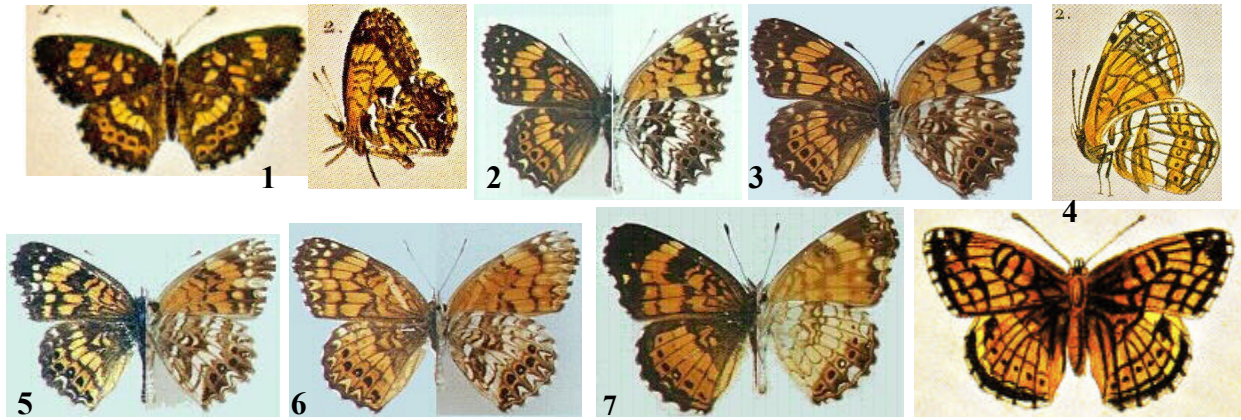
ABSTRACT. On 24 April 1993 a colony of *Chlosyne gorgone gorgone* was found in Orangeburg County, South Carolina. This led to the rediscovery on 27 April 1993 of *C. g. gorgone* at its type locality in Burke County, Georgia. This species had not been seen or collected anywhere in east coastal Georgia or coastal South Carolina since its description in 1810. The type locality is xeric, scrub oak sandhill. This habitat is generally unsuitable for the survival of later broods. The larvae of nominate *gorgone* have only been found on *Helianthus divaricatus*. Topotypical *gorgone* differ slightly, but consistently, in phenotype from *C. gorgone carlota*. In biology, *gorgone gorgone* is strongly univoltine and thus markedly distinct from the multibrooded subspecies *carlota*. The range of nominate *gorgone* is restricted to these univoltine coastal populations. Upland/inland multivoltine populations in Georgia and South Carolina are best referred to subspecies *carlota*. A neotype of *Dryas reticulata gorgone* is designated and placed in the Allyn Museum of Entomology where the neotype of *C. g. carlota* is also located. On 20 August 1989, *Chlosyne nycteis* was also found to occur in Burke County along the Savannah River. The presence, both today and in John Abbot's day, of two *Chlosyne* species in Burke County necessitates the reopening of the *Melitaea ismeria* mystery. Enough evidence now exists to resurrect *ismeria* and define it correctly as the insect long known as *C. nycteis*. A neotype of *Melitaea ismeria* is designated and deposited in the Allyn Museum of Entomology. *Ismeria* (1833) becomes the binomial species name under *Chlosyne*. Due to lack of preserved specimens, *ismeria* is tentatively applied to only the coastal/sandhill populations in eastern Georgia and adjacent South Carolina having broader light areas above and ventral orange borders. *Chlosyne ismeria nycteis* [new combination] retained as the trinomial name through the remainder of *nycteis*' traditional range.

Additional key words: *Chlosyne harrisii*, Asters, convergent evolution, *Falcapica midea*.

TYPE LOCALITIES AND HISTORICAL INFORMATION

Chlosyne gorgone gorgone (Hübner) was described in 1810 from a John Abbot painting (Fig. 1) without any text. In the absence of a text, and because the figures of the type were produced by Abbot, it has traditionally been presumed that the Burke County area of Georgia is the type locality of *C. gorgone*. *Chlosyne ismeria* (Boisduval and LeConte) was described in 1833 from a poor copy of an Abbot painting (Fig. 4) and was accompanied by a brief textual annotation. The annotation established the range of *ismeria* as "Carolina and Georgia." The traditional assumption is that "coastal" Georgia and South Carolina is meant. The range of *ismeria* may actually be wider once its status in nature is better understood. Further, Burke County, Georgia has been established throughout the historical literature as the type locality of *ismeria*. I agree that this is the correct position.

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FIGS. 1-7. 1, Hübner's ♂ *Dryas reticulata Gorgone*, dorsal and ventral surfaces from his plate 41. 2, **Neotype** ♂ *Dryas reticulata Gorgone*, 27 April 1993 Burke Co., GA, River Rd., dorsal and ventral surfaces. 3, Topotype ♀ *Chlosyne gorgone gorgone*, 21 April 1994 Burke Co., GA, River Road, dorsal and ventral surfaces. 4, Boisduval and LeConte's ♀ *Melitaea ismeria*, dorsal and ventral surfaces from their plate 46. 5, ♂ *C. g. carlota*, 22 April 1989 Oconee Co., SC, Brasstown Creek Rd., dorsal and ventral surfaces (leg. Watson). 6, ♀ *C. g. carlota*, 25 June 1988 Oconee Co., SC, Rt. 107 S. of Oconee St. Park, dorsal and ventral surfaces (leg. Watson). 7, **Neotype** ♂ *Melitaea ismeria*, 20 August 1989, Burke County, GA, at Savannah River, dorsal and ventral surfaces. All specimens collected by R. Gatrell unless otherwise noted.

I have not found any valid historical records for either of these species from or near their type locality since their discovery – a period of about 180 years. Harris (1972) lists several records of *C. gorgone* from various inland and upland Georgia counties. Burke County is 180 km from Harris' nearest record.

Forbes (1960) under *gorgone*, sites personal knowledge of “a few males in the British Museum [NH] from Abbot”. His text structure is unclear, but the statement seems to refer to *ismeria*. Dr. Ian James Kitching of the British Museum (NH) kindly searched their holdings and found no Georgia specimens of *C. gorgone*, *C. ismeria* or *Chlosyne nycteis* (Doubleday and Hewitson). Nor did they find any Abbot specimens in the BMNH. Thus, Forbes statement is in error.

Opler (1984) has a dot on his range map for *C. gorgone* along the coast of South Carolina. After communicating with Dr. Opler on this matter, I contacted the individual from whom he received this record. This individual informed me that the record was in error, and he had not taken nor observed *C. gorgone* at any South Carolina location. Dr. Opler's record is also in error.

F. Martin Brown (1974) in number 16 of the *Bulletin of the Allyn Museum*, provides the singular most extensive historical and thorough taxonomic treatment of *C. gorgone*, *C. gorgone carlota* (Reakirt), and *C. ismeria*. He too found no existent coastal Georgia specimens of either *C. gorgone* or *C. ismeria*.

REDISCOVERY OF BURKE COUNTY *CHLOSYNE*

On 24 April 1993 I stopped to fix a flat tire on an Orangeburg County, South Carolina road. (Localities will remain vague due to the rarity of species concerned.) While fixing the tire, a non-lepidopterist friend, Scott Massey, who occasionally accompanies me and helps with collecting, caught a butterfly by the car and asked what it was. It was a *Chlosyne gorgone*! By chance we had stopped in the middle of a flourishing colony of *C. gorgone*. I had been actively collecting in South Carolina for 23 years, and this was my first encounter with this long sought after species.

Both sexes were numerous and fresh. A small series was collected. Adults were nectaring at the diminutive *Coreopsis auriculata* L. The habitat at the Orangeburg locality reminded me of an area I had collected a few years earlier in Burke County, Georgia.

On 27 April 1993, I made a trip to this location in Burke County, and upon finding a patch of *C. auriculata*, parked the car. Within a minute of exiting the vehicle, I had rediscovered this rare butterfly at its type locality. 200 years had passed since John Abbot had found this butterfly in this same general area and it was still there! While *C. gorgone* was not as numerous here as in Orangeburg County, the suitable habitat was more extensive and continuous. Consequently, *C. gorgone* was more dispersed at the Burke County site.

The rediscovery of the insect named *Melitaea ismeria* by Boisduval and LeConte was much less dramatic but more significant.

On 20 August 1989 at about 1800 h, while observing several species of butterflies gathered at mud along the banks of the Savannah River, I noted that among them were some fresh males of *Chlosyne nycteis*. Having found *nycteis* in many states over the years, I initially gave it no thought. In fact, earlier that day I had been collecting in the mountains of Georgia where *nycteis* had been a virtual pest. Remembering I was in Burke County, it occurred to me that this species may be unusual for that part of the state. So I netted three as vouchers. These *nycteis* were not only a new record for Burke County, but for southeastern Georgia, and over 140 km from the nearest record for this species in Harris (1972).

These sat unexamined (I only mounted one) in my collection from 1989 until 1997. By then I had rediscovered *gorgone* and was putting together a paper on it. One day while working on *gorgone*, I was struck by the obvious – Abbot had found two species of what we now call *Chlosyne* in Burke County. I had also found two. Could these two be Abbot's *gorgone* and *ismeria*? I herein propose that they are.

TAXONOMY OF THESE SPECIES

Brown's aforementioned paper is a detailed and definitive work on the literary history and taxonomy of the species which we are examining. While Brown's work is foundational to this present paper, I will only mention herein a few key quotations and points, and leave it to the reader to search out the full record.

Melitaea ismeria Boisduval and LeConte

Brown demonstrated that the modern misuse of *ismeria* being synonymous with *gorgone* was the result of an identification error by Scudder and A. G. Butler subsequently communicated to W. H. Edwards and others. On page 2 Brown states, "Scudder's concept [of *ismeria* = *gorgone*] is untenable." On page 3 he says, "Careful study of the use of the name *ismeria* indicates that its acceptance as the equivalent of *gorgone* male hinges on Scudder's statement about the [faulty] manuscript plate of Abbot in the British Museum (N. H.)." Then in Brown's concluding statements on page 10 he unequivocally states, "In conclusion, I believe that the name *ismeria* Blv. & LeC. cannot be used in association with *gorgone* Huebner."

Brown's determination was that while in much of the literature *ismeria* and *gorgone* have been associated as the same species, in nature they are not.

Brown's quandary was not in determining what *ismeria* wasn't, that is, not *gorgone*, but in what it was. To Brown, *ismeria* was most likely either *Chlosyne harrisii* (Scudder) or *C. nycteis*. His personal leaning was toward *harrisii*, chiefly because of his preoccupation with one feature, the orange margin of the ventral wings. Consider the following quotes from Brown in reference to the original painting of *ismeria*. On page 2, "On the underside the most striking feature is broad orange brown margins on both wings, much as on *harrisii* Scudder." On page 3, "It cannot be considered even a crude representation of either of the insects called *gorgone* by Huebner. It can be considered a crude representation of the butterfly called *harrisii* by Scudder, but this insect is not now found in Georgia. The larvae figured... does

not conform to the mature larva of *carlota* (*gorgone* male Huebner). It does suggest the mature larvae of *harrisii*... [or] early-stage larvae of... *nycteis*." On page 10, "Again the evidence, poor as it is, points toward *harrisii* (or *nycteis*) rather than *carlota* [= *gorgone*] being the closest known taxon to *ismeria*."

Brown's conclusion on *ismeria* was that he considered it a *nomen incognitum*.

However, now that it is **known** that two *Chlosyne* **species** are living today in Burke County, Georgia, two of Brown's statements stand out. On page 8, "Taxonomically there are two, possibly three, **species** involved." On page 3, "There is no way today to judge the accuracy of Abbot's representations in Boisduval and LeConte's book, except by comparison with **known** butterflies from [Georgian] America." (Emphasis mine.) The comparison can now be made.

The consideration of the following facts and comparison of species characters clearly reveals just what *ismeria* was and is.

1) Brown established *ismeria* as a valid (but unidentified) species separate from *gorgone* and postulated that it could well be *C. nycteis*.

2) Abbot found two species of *Chlosyne* in Burke County, Georgia. 200 years later there are still two (and only two) species of *Chlosyne* in Burke County.

3) One of these species has always been readily identifiable as *C. gorgone*. The logical probability is that the remaining species is the poorly depicted, but valid, *ismeria*.

4) The range of *C. harrisii* is hundreds of miles to the north of Burke County.

5) *C. nycteis*, as the only other *Chlosyne* in the eastern United States, is the only other species available for consideration as *ismeria*.

6) Abbot stated that his *ismeria* fed on sunflower, and depicted it on *Helianthus strumosus* L. (= *trachelifolius* Miller). This plant occurs in Burke county, and is a known host for *nycteis*.

7) The only known host (Opler 1984) of *harrisii*, *Aster umbellatus* Miller, is not known in eastern Georgia. *Aster umbellatus* is known from South Carolina only as variation *brevisquamus* Fernald and in only a few extreme northeast counties adjacent to North Carolina (Radford 1968). Thus, *harrisii* should be eliminated from consideration.

8) Abbot stated that his *ismeria* pupated on May 16 and eclosed on May 26. This coincides with the first brood records of *nycteis* in Georgia.

9) Burke County *gorgone* emerge from mid to late April, a full month before *ismeria*.

10) Lastly, Burke County specimens of *nycteis* possess all the major phenotypic characters of the original painting of *ismeria* and twice as many of these characters than does *harrisii*. They differ from northern specimens of *nycteis* and *C. harrisii* as detailed in Table I.

While characters F and G on the original *ismeria* painting match in size *harrisii* better than Burke County *nycteis* (= *ismeria*), it must be remembered that the painting is a copy and a very poor rendition. Which means we should first be looking for the presence of a character and secondarily at the accuracy of the size and shape of the character. What is important is that in nature, Burke County *nycteis* (= *ismeria*) do possess all characters A - G.

There is one other character on the Boisduval and LeConte plate of *ismeria* which is of interest. That is the complete row of silver spots along the margin of the hind wing. This picture is of a female. As yet we have no topotypical females for comparison. However, I do have a female *nycteis* from Spartanburg County, South Carolina with silver spots all along its hind wing margin. It is very probable that as we go further south and to the coast this character becomes more pronounced and more frequent, especially for females.

TABLE I

Character	<i>C. i. ismeria</i>	<i>C. i. nycteis</i>	<i>C. h. harrisii</i>
(A) Dorsal hindwing black postmedian line	Narrow across the entire area	Often wide to very wide	Usually only partial, but very variable
(B) Dorsal forewing submarginal spots	Well developed to ½ size of postmedian spots	Often just dots, usually less than ¼ size of postmedian spots	Variable, dots to well developed
(C) Eyespots on apex of ventral forewing	3 - 4 well defined pupiled eyespots on light to medium brown background	3 - 4 eyespots less defined on dark background.	Usually no eyespots, if so, only one or two and weak
(D) Inner three fourths of ventral forewing	Nearly solid light orange, light striations	Medium orange striated with brown lines.	Orange-red, well striated with black-brown lines
(E) Inner two thirds of ventral hindwing	Light buff dominant, somewhat silvered, usually with medium to dark brown striations near base	Same as <i>ismeria</i> , but tending to less silvered and brown striations lighter.	Dark, contrasting, orange-brown and white checkered
(F) Ventral hindwing submarginal black spots	Surrounded by some narrow orange in dark field.	Nearly always in dark field only.	In broad orange band in dark field
(G) Ventral margins	Orange, narrow, clearly defined	Mainly cream or buff, may have some orange.	Orange, wide, well defined

It should also be remembered that my Burke County specimens are from the fall brood. The spring brood (which we know Abbot reared and perhaps his figures were made from) should be expected to differ in appearance and may more fully fit the form painted.

Based on the above, *C. nycteis* is synonymous with *C. ismeria* in Burke County, Georgia. Accordingly, I have designated a male (Fig. 7) taken 20 August 1989 along the Savannah River, Burke County, Georgia as neotype of *Melitaea ismeria* Boisduval and LeConte (1833). This specimen is deposited in the Allyn Museum of Entomology, Sarasota Florida and is labeled: NEOTYPE, *Melitaea ismeria* Boisduval and LeConte, Det. R. R. Gatrell. One male topotype is also deposited in the Allyn Museum. The remaining male is in the authors collection.

The new nomenclature is:

Chlosyne ismeria (Boisduval and LeConte) *MELITAEA* . (1833)

- a. *i. ismeria* (Boisduval and LeConte) *MELITAEA*. (1833)
- b. ***i. nycteis*** (Doubleday and Hewitson) *MELITAEA*. (1847) [NEW COMBINATION]
- c. ***i. drusius*** (W. H. Edwards) *PHYCIODES*. (1884) [NEW COMBINATION]
- d. ***i. reversa*** (F. and R. Chermock) *MELITAEA*. (1940) [NEW COMBINATION]

Having made only one attempt to collect this insect, I am sure this subspecies, while virtually uncollected, is not that rare in nature. It should be looked for along watercourses in southern Georgia and South Carolina. Harris' record of *nycteis* from Laurens County, Georgia, is likely *C. ismeria* also. The *nycteis* I have from Spartanburg County tend to have well defined narrow orange borders also. So the final decision as to the range of *Chlosyne ismeria ismeria* and *C. ismeria nycteis* remains to be worked out. For now, I think it best to limit the range of *C. ismeria ismeria* to the coastal plain of Georgia and southeastern South Carolina.

Chlosyne gorgone (Hübner)

John Abbot's painting of *C. gorgone* published by Hübner is excellent. In it we see a dark, boldly marked *gorgone* phenotype. Its two most distinguishing characters are the lack of a white pupil in the dark submarginal spot in cell M₃, both dorsally and ventrally, and the restricted white chevrons on the margin of

the ventral hind wing. We now know that this is in fact exactly what typical *gorgone gorgone* looks like in nature (Figs. 2, 3). I have designated a male (Fig. 2) taken 27 April 1993 Burke County, Georgia as neotype. It is labeled: NEOTYPE, *Dryas reticulata gorgone* Hübner, Det. R. R. Gatrell. It has been deposited in the Allyn Museum of Entomology, Sarasota, Florida.

C. gorgone carlota is a valid subspecies. Ventrally, *carlota* is generally lighter, nearly always has a white pupil in the submarginal black spot in cell M₃, both dorsally and ventrally (especially in females), and bolder marginal chevrons. Its range is primarily Midwestern, northern and western. A number of *gorgone* have been collected in upland Georgia and South Carolina and most workers who have seen them have rightly concluded that in appearance they are so close to Midwestern *carlota* as to be the same subspecies (Figs. 5, 6). Thus the range of subspecies *carlota* extends into at least the upper piedmont of Georgia and South Carolina.

The existence of *carlota* in north Georgia has caused most modern workers to wrongly sink *carlota* into synonymy. Why is this the case?

In spite of the accuracy of the original depiction of *gorgone*, subsequent writers of popular butterfly literature have consistently transposed the *ismeria* phenotype (large pale washed out below more well marked above) onto the name *gorgone*. In other words, their **term** was “gorgone” but their **concept** was “ismeria.” This false concept of *gorgone* has also affected the concept and taxonomic validity of *carlota*.

Two conceptual errors have become orthodoxy. 1) The name *gorgone* is used but the concept is *ismeria* and 2) the name *carlota* is no longer used because the concept is *gorgone*.

As pointed out by Brown, this conceptual confusion all began with the misidentification and misassociation of *C. ismeria* with the totally dissimilar species *C. gorgone* by Scudder and A. G. Butler who in turn relayed this error to W. H. Edwards, and he to others. Since Edwards, many have seemed to just “take the word” of the previous worker and perpetuated the error. The treatment of *C. gorgone* by Opler (1984) and Scott (1986) are examples of this continuing “hearsay” taxonomy. (It appears that neither Scott nor Opler were aware of Brown’s 1974 paper.) Howe (1975) is one modern writer to have the taxonomy correct.

Opler defined *ismeria* as a large pale (dominant in coastal Georgia?) form of *gorgone*. Then, by not mentioning *carlota*, demonstrated that he considered *carlota* and *gorgone* to be phenotypically the same. He held both conceptual errors.

Scott took Scudder’s error to its logical conclusion. He only mentioned *gorgone*, demonstrating that his concept of *carlota* was *gorgone* and his concept of *ismeria* was as a form of *gorgone*. He held both conceptual errors.

Howe correctly treated *C. gorgone* as a valid subspecies limited to the coast of Georgia and *C. g. carlota* as the inland and westward subspecies. He did this correctly, but probably for the wrong reason. Howe seemed under the impression that *ismeria* and *gorgone* were synonymous and did not mention *ismeria* for that reason. If this is correct, he also associated the painting of *ismeria* as being what coastal Georgia *gorgone* looked like. In other words, conceptually, his *gorgone* was still phenotype *ismeria*. He held only one of the conceptual errors. So he had the right taxonomy, but part of the old concept.

There may or may not be some avoidable errors here. But by far, the primary, most unavoidable and problematic factor has been that up until now there were no actual topotypes in existence of either *C. gorgone* or *C. ismeria*.

As mentioned above, *gorgone gorgone* varies slightly, but consistently, from *gorgone carlota* in phenotype. These differences alone are enough to validate subspecific status of both entities. However, my attempts to rear nominate *gorgone* revealed that it is strongly univoltine. I have attempted to rear approximately 800 larvae and have only kept two out of diapause. (Larvae were subjected to the usually very effective long photoperiod (continuous light) method of breaking diapause. Roughly 600 were from the Orangeburg sight. The two kept out of diapause were also from the Orangeburg site.) I also sent a few larvae to Dr. Tom Allen of the West Virginia DNR (in connection with his book on W.Va. butterflies) and

he too was unable to keep larvae out of diapause or break it. (All diapausing larvae were returned to their place of origin and securely released back into the population.)

Adults were found at both locations in April of 1993 and 1994. No adults were ever seen in repeated visits to these areas in those years at the appropriate time for subsequent flights of adults. And perhaps more importantly (since larvae are easier to find than adults) no other immatures were ever found later in those years.

C. g. carlota is multiple brooded throughout its range, including Canada (Catling and Layberry 1998), upstate Georgia (Harris) and Pickens County, South Carolina (Dr. Charles Watson, personal communication). Thus, one would expect the populations of *gorgone* at its southern extreme to be multibrooded – especially if we were dealing with clinal subspeciation. But it is only single brooded. I consider this difference in genetic biology to be the strongest reason to consider *gorgone* as a distinct subspecies.

It is also significant that in rearing Canadian *gorgone carlota*, Catling and Layberry found that *H. divaricatus* L. was rejected as a host. At both sites where *gorgone gorgone* was found, intensive searching located larvae and ova on *H. divaricatus* only.

***Gorgone* biogeographical evolution**

The habitat of *C. gorgone* in Burke County is xeric, turkey oak, rolling sandhill in the vicinity of the Georgia Power Nuclear Facility. These areas in Burke County change very little from year to year, and slowly decade to decade. Thus, species in this type of habitat have less of a need to continually be colonizing new areas. Multiple broods are obviously advantageous in species relocation dynamics. (Fire is a medium factor here in species survival strategy.)

The habitat at the Orangeburg County site is open mixed hardwood and some pine in hilly sandhill dispersed amid wetter areas and agricultural fields. This habitat may vary greatly decade to decade. Lepidoptera in these areas need to be more flexible for relocation purposes. (Fire is a major survival factor here.) However, larvae of *gorgone* from both sites were virtually impossible to keep out of diapause.

Thus, both colonies are genetically linked by a common ancestor. An ancestor which evolved into a univoltine subspecies to insure its survival due to hostile environmental conditions (lack of surface water?). Both of these locations are usually very hot and dry in June and July. While the larval host, *H. divaricatus*, is leafed out at that time, conditions are nearly always such that acceptable nectar sources for adults are virtually nonexistent.

I believe *C. gorgone gorgone* is a remnant of a biogeological relic whose univoltine reproductive cycle developed under the climatic pressure of an annual dry season in Florida when it was an island. It is pertinent to note that *Falcapica midea midea* (Hübner) which is endemic to the Georgia and South Carolina coastal islands, has gone as long as three years as pupae when kept inside in dry conditions and then emerged when exposed to high spring humidity (Gatrelle 1985). This genetic trait, though currently unnecessary in *midea*'s present ecology, is still retained by *midea* from its Florida ancestor.

This theory would indicate that the multivoltine *carlota* populations in Georgia and South Carolina are descendent from ancestors from the west. Dr. Richard L. Brown has documented the eastward movement, and subsequent influence, of western species on the Lepidoptera of the Black Belt region (remnant prairies) of Mississippi and Alabama (personal communication). If the above is so, convergent evolution is taking place as these two formerly isolated taxa move toward each other. Something which is surely enhanced by human environmental alteration through deforestation and agriculture.

We see this same type of convergent evolution occurring between *F. m. midea* and *F. m. annickae* (dos Passos and Klots) in this same region (Gatrelle, 1998). *Midea midea* is from a Florida ancestor. *Annickae* is from a Mexican/Texas ancestor which moved eastward along the then coast into Georgia and then northeastward, while *midea midea* was still isolated in Island Florida. After Florida was rejoined to the mainland, those *midea* which moved northwestward (unhindered by habitat barriers) met the *annickae* phenotype and gave rise to the mixed phenotypes north and northwest of the Florida panhandle. Those *midea* which moved northeastward became isolated on the coastal islands. Before colonial times, these two subspecies were kept apart in that region by thick maritime forest swamps.

Today, *annickae* ranges from the upper coastal plain and Sandhills of east central Georgia into New England. *Midea* was once limited to the Islands of Georgia, South Carolina, and south coastal North Carolina. However, they may now be found within 60 km of each other in Chatham (*midea*) and Burke (*annickae*) counties, Georgia, and within 50 km in adjacent Jasper and Hampton counties of South Carolina. Three centuries of environmental alteration and destruction is allowing *midea* and *annickae* to move toward each other, and eventually genetically absorb each other in the region. Perhaps, this is also occurring with *gorgone* and *carlota*.

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