Life cycle and ethological notes on *Memphis verticodia echemus* (Nymphalidae: Charaxinae: Anaeini).

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Estado actual: Inicio.

Dificultades: Es una especie rara y se requiere trabajo de campo para concluirlo.

Abstract: On this study, we describe for the first time the immature stages of *Memphis verticodia echemus*: eggs, larval instars, prepupa, and pupa. Morfometrics means of each stage are given. We also report notes on feeding patterns and oviposition.

Keywords: *Memphis*, *Croton*, Charaxinae, Anaeini, larval shelters, immature stages.

Introducción.

Memphis verticodia echemus (Nymphalidae: Charaxinae: Anaeini) está distribuida en Cuba, Las Bahamas (Islas New Providence y Andros) e Islas Caimán (Smith *et al*., 1994). Utiliza como planta hospedera a *Croton lucidus* (Gundlach, 1881) de la misma forma que *Burca b. braco*. Sin embargo, aún se desconocen los estadios inmaduros de esta especie (Smith *et al*., 1994).

Con este estudio se pretende describir por primera vez los estadios inmaduros para la especie y proveer notas conductuales referentes a los refugios larvales y oviposición.

Materiales y Métodos

Se seguirá una metodología similar a la empleada en el estudio de *Aguna asander haitiensis*, salvo que las localidades de estudio serán Piedra Alta ($23^0$10’ N, -$81^0$59’ O) y Boca de Canasí ($23^0$09’ N, -$81^0$46’ O), previamente descritas en el estudio de *Burca b. braco*.

Resultados preliminares.

Preliminarmente se cuentan con datos morfométricos de seis larvas: ancho de la cápsula cefálica (**HW**), longitud del cuerpo (**L**) y fotografías de refugios. Todos los estadios inmaduros y los refugios larvales (Figura 1.) están pendientes de descripción formal.

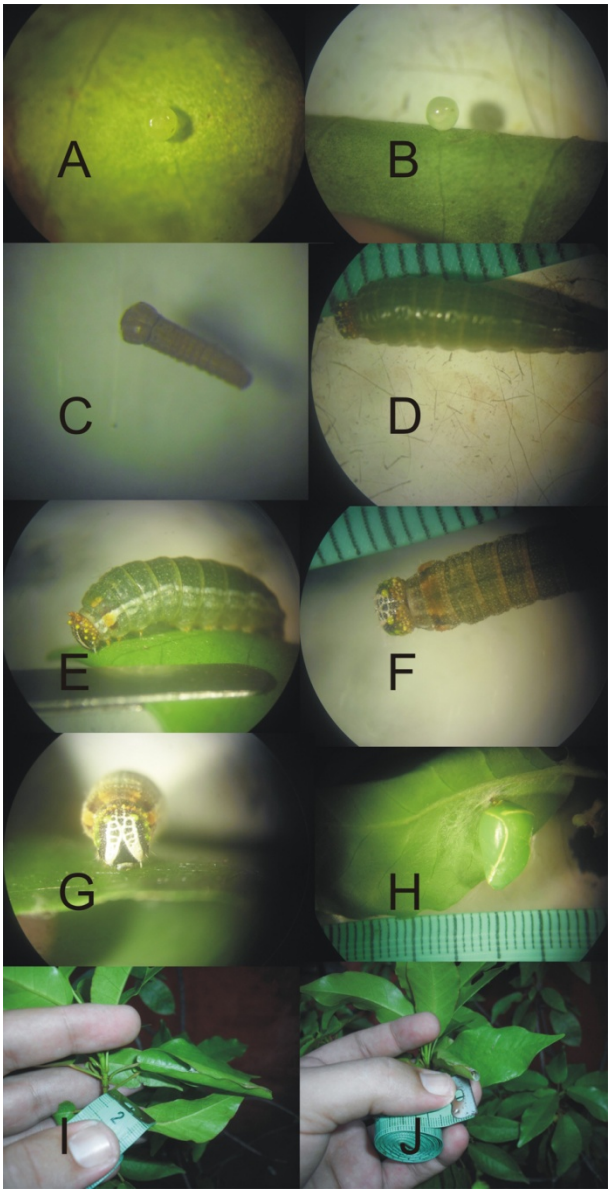

Figure 1. Immature stages of *Memphis verticodia echemus.* Egg A-B), first instar at born C), undetermined late instars D-G), pupa H), larval shelter of late instar I-J).

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Resultado no comprometido (extra):

d-Checklist of butterflies on the expedition Cuba Explore 21 to Parque Nacional Alejandro de Humboldt, Eastern Cuba, October-November 2015.

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Abstract: The Expedition Cuba Explore 21 was organized by the American Museum of Natural History (AMNH), the Museo Nacional de Historia Natural de Cuba (MNHNC), Delegación del CITMA de Guantánamo and the authorities of "Parque Nacional Alejandro de Humboldt", Eastern Cuba: one of the main areas of biodiversity of Cuba and the Caribbean. The Goal is to make a contribution to knowledge of biodiversity richness of the area. Also, it is a step for new and better Cuban-US relationships. On Current work, 67 species of butterflies were collected and/or observed, 12 of them are new reports for the area, increased the total butterflies' species richness to 126. Each observation is related with localities and vegetation type. As a result, 187 specimens were collected and deposited on MNHNC Lepidoptera's Collection, including the fifth specimen of *Oarisma bruneri* (Hesperiidae: Hesperiinae) was found, collected and deposited on collection.

Keywords: Parque Nacional Alejandro de Humboldt, Eastern Cuba, butterflies, collections, American Museum of Natural History, Museo Nacional de Historia Natural de Cuba, *Oarisma bruneri*, Cuban-US scientific collaboration.

Introduction.

The "Parque Nacional Alejandro de Humboldt" is the main center of biodiversity of "Cuchillas del Toa" Biosphere Reserve. It is located on Eastern región of Cuba on the provinces Holguín and Guantánamo with 70 680 ha, of them 68 430 ha terrestrial. Altitudes vary from O to 1,175 m. It is one of locations with highest biodiversity and vegetal endemism index of Cuban Archipelago and whole Caribbean islands. Here, are represented 16 of the 28 vegetal formations of Cuba (Zabala *et al*., 2013).

Despite the importance of the area in terms of biodiversity, only it has made a list of butterflies (Alayón & Solana, 1989). Since then, there is no available information, even on the Rapid Biological Inventory (Fong *et al*., 2005).

On this paper, I list the butterfly's species observed and/or collected during Expedition Cuba Explore 21. This expedition was organized by American Museum of Natural History (AMNH), Museo Nacional de Historia Natural de Cuba (MNHNC), Delegation of CITMA from Guantánamo province, and the authorities of the area. This effort is a good example of scientific collaboration between Cuba and United States of America, two countries with

a complex historical political relationship but with a common biogeographic and human history.

Materials and Methods.

The expedition was done between October 18th and November 4th, 2015. Were visited 18 localities and 8 vegetal formations (Table 1). Were collected enough individuals in order to have the best representativity in each locality. The sampling effort was irregular between localities and highly dependent of climatic and logistic conditions. The individuals collected were conserved on entomological envelopes, transported to MNHNC and deposited on its collection. Some species were just observed, but I only report those which identification to species level is secure. For classification of vegetal formations I follow the criteria of Capote & Berazaín (1984) y Zabala *et al*. (2013).

Table 1. Schedule and sampling conditions of expedition Cuba Explore 21 to Parque Nacional Alejandro de Humboldt. Acronyms of localities: **Sector Cupeyal del Norte**, LMs-CNBS (Road from Las Municiones to Cupeyal del Norte Biological Station), HM (Hoyo de Mola), AE (Alto de Eugenio), M (Mucaral), BS-RC (Road from Cupeyal del Norte Biological Station to Río Castro), BS-OA (Road from Cupeyal del Norte Biological Station to Ojito de Agua), LMs (Las Municiones community); **Sector La Melba**, LN (La Naza community), AB (Arroyo Bueno), LMb (La Melba community), LMb-SLC (Road from La Melba community to Salto Las Comadres), BS (Boca Seca), AR (Alto del Rayo), LC (Las Comadres); **Sector Baracoa**, BT (Bahía de Taco Biological Station), NM (Nuevo Mundo), Y (Yamanigüey), RP (Desembocadura del Río Potosí).

Localities	Vegetation	Weather conditions	Hours	Date
LMs-CNBS	*Pinus* forest (1)	Sunny	12:00-14:00	Oct 17th
HM	Mesophyllous Evergreen Forest (2)	Sunny	09:00-14:00	Oct 18th
AE	Serpentine xeromorphic shrub (3)	Sunny	09:00-09:30	Oct 19th
M	Mogotes Complex and Mesophyllous Evergreen Forest patches(4)	Sunny then rainy	10:00-16:00	Oct 20th
BS-RC	Transition from *Pinus* forest to Submontane Rainforest (5)	Sunny	09:00-14:00	Oct 20th
BS-RC	Transition from *Pinus* forest to Submontane Rainforest (5)	Sunny	09:00-14:00	Oct 22th
BS-OA	Transition from *Pinus* forest to Submontane Rainforest (5)	Sunny then rainy	09:00-14:00	Oct 23th
BS-OA	Transition from *Pinus* forest to Submontane Rainforest (5)	Rainy then cloudy	11:00-15:00	Oct 24th
LMs	Cultural vegetation (6)	Sunny	11:00-11:30	Oct 25th
LN	Low Rainforest plus Cultural Vegetation patches (7)	Sunny	09:00-14:00	Oct 26th
LN	Low Rainforest plus Cultural Vegetation patches (7)	Sunny	09:00-14:00	Oct 27th
AB	Galley forest plus Low Rainforest (8)	Sunny	09:00-11:00	Oct 28th

LMb	Low Rainforest plus Cultural Vegetation patches (7)	Sunny	13:00-16:00	Oct 28th
LMb-SLC	Submontane Rainforests and Serpentine xeromorphic shrub patches (9)	Sunny	09:00-14:00	Oct 29th
AB	Galley forest plus Low Rainforest (8)	Sunny then rainy	09:00-13:00	Oct 29th
BS	Galley forest plus Low Rainforest (8)	Sunny	09:00-09:30	Oct 30th
AR	Submontane Rainforest (10)	Sunny then rainy	09:30-14:00	Oct 30th
LMb	Low Rainforest plus Cultural Vegetation patches (7)	Cloudy	14:00-16:00	Oct 30th
LMb	Low Rainforest plus Cultural Vegetation patches (7)	Sunny	10:00-13:00	Oct 31th
LC	Young Submnontane Rainforest (11)	Sunny	14:00-15:00	Oct 31th
BT	Cultural vegetation (6)	Cloudy	14:00-15:00	Nov 1st
NM	Cultural Vegetation and Secondary Mesophyllous Evergreen forest (12)	Sunny then rainy	10:00-15:00	Nov 2nd
Y	Serpentine xeromorphic shrub (3)	Cloudy then rainy	10:00-12:00	Nov 4th
RP	Galley Forest Patch surrounded by Serpentine xeromorphic shrub (13)	Cloudy	13:00-14:00	Nov 4th

Results and Discussion.

I list 67 butterfly's species, 56 of them were collected (Table 2) and deposited on MNHNC's collection: 187 specimens (16.148-16.158, 16.160-16.186, 16.188-16.198, 16.200-16.285, 16.287-16.325, and 16.327-16.339). This represents 34 % of the total species richness of Cuban butterflies and includes 21 endemics, 9 of them to species level (30 % and 24 % respectively for total endemics of Cuba) (see Núñez, 2015; Núñez & Barro, 2012; Núñez, *et al*.2013). Alayón & Solana (1989) reported 113 species on the area, more than the present paper. They had more sampling effort and spend more days in the area (Alayón pers. com.). However, here I list 12 species which were not listed by Alayón & Solana (1989), increasing the butterflies list of the area to 125: *Papilio demoleus* (Papilionidae), *Anteos clorinde*, *Eurema daira*, *Phoebis sennae*, *Pyrisitia nise* (Pieridae), *Leptotes cassius* (Lycaenidae), *Lucinia sida* (Nymphalidae), *Oarisma bruneri*, *Cymaenes tripunctus*, *Parachoranthus magdalia*, *Synapte malitiosa* and *Perichares philetes* (Hesperiidae). The two individuals collected of *Oarisma bruneri* (16.203 collected at Río Potosí, and 16.301 collected at Hoyo de Mola) are the fifth and sixth historical reports of this taxon (Alayo & Hernández, 1987; Smith *et al*., 1994). The invasive *P. demoleus* is a recent addition to the Cuban butterfly's fauna (Lauranzón *et al*., 2011; Fernández & Minno, 2015). Fourteen species were reported for all localities, each one well distributed on Cuba such in natural or antropic areas: *Ascia monuste*, *Phoebis sennae*, *Pyrisitia dina*, *P. larae* (Nymphalidae), *Leptotes cassius* (Lycaenidae), *Agraulis vanillae*, *Dryas iulia*, *Heliconius charinthonia*, *Junonia evarete*, *Anartia jatrophae* (Nymphalidae), *Synapte*

malitiosa, *Urbanus dorantes*, *U. proteus* and *Pyrgus oileus* (Hesperiidae). It is possibly that *Calisto herophile* (Nymphalidae) is distributed on all localities because I could not assure specific identification of observed ones on localities where it was not collected. The well adaptable *C. herophile* has a great resemblance with locals' *C. dissimulatum* and *Calisto bruneri* (see Núñez *et al.*, 2012, 2013). This results would be consider as underestimated for butterfly´s richness of the area, considering the adaptative conditions of sampling, the low percent of area sampled, and the fact that was only recorded collected species, rarely observed ones. However, this work added 12 new species for the area and it is an important tool for its management.

Table 2. Species collected (C) and/or observed (O) during Expedition Cuba Explore 21 to Parque Nacional Alejandro de Humboldt. E=Endemic, I=Invasive. For localities and vegetation see Table 1

		Localities	Vegetation
FAMILY PAPILIONIDAE			
1	*Battus devilliers* (Godart, 1823)	O (M, LMs)	4, 6
2	*Battus polydamas cubensis* (Dufrane, 1946)	C (LMb, LN, LMb-SLC); O (M)	4, 7, 9
3	*Heraclides a. andraemon* Hübner, [1823]	C (LMb)	7
4	*Heraclides androgeus epidaurus* (Godman&Salvin, 1890)	C (BS-OA)	5
5	*Heraclides oviedo* (Gundlach, 1866) E	C (LMb, AR)	7, 10
6	*Heraclides pelaus atkinsi* (Bates, 1935) E	O (BS-OA)	5
7	*Papilio demoleus* Linnaeus, 1758 I	C (LMb); O (M)	4, 7
8	*Parides g. gundlachianus* (Felder & Felder, 1864) E	O (BS-RC, LMb-SLC)	5, 9
FAMILY PIERIDAE			
	Subfamily Dismorphiinae		
9	*Dismorphia cubana* (Herrich-Schäffer, 1862) E	C (BS-RC, BS-OA, AR); O (LMs-CNBS)	1, 5, 10
	Subfamily Pierinae		
10	*Glutophrissa drusilla poeyi* Butler, 1872	C (LN)	7
11	*Ascia monuste eubotea* (Godart, 1819)	C (BS-RC, BS); O (All localities)	All
	Subfamily Coliadinae		
12	*Abaeis nicippe* (Cramer, 1779)	C (BS-OA, LN)	5, 7
13	*Anteos clorinde* (Godart, [1824])	C (BS-OA, LMb, LMb-SLC, AR); O (BS-RC, BT, NM)	5, 6, 7, 9, 10, 12
14	*Anteos maerula* (Fabricius, 1775)	C (LMb-SLC); O (AR)	9, 10
15	*Eurema daira daria* (Godart, 1819)	C (BS-RC, LN, LMb-SLC)	5, 7, 9
16	*Eurema elathea* (Cramer, 1777)	C (LMb-SLC)	9
17	*Phoebis avellaneda* (Herrich-Schäffer, 1864)	C (LMb-SLC); O (BS-OA, LN, NM)	5, 7, 9, 12
18	*Phoebis p. philea* (Johansson, 1763)	C (LMb); O (BS-OA, NM)	5, 7, 12
19	*Phoebis s. sennae* (Linnaeus, 1758)	C (M, BS-OA, LN, LMb, LMb-	All

		SLC, AR); O (All localities)	
20	*Pyrisitia d. dina* (Poey, 1832) E	C (M, BS-RC, LMb); O (All localities)	All
21	*Pyrisitia larae* (Herrich-Schäffer, 1864)	C (M, LN); O (All localities)	All
	Pyrisitia cf. larae	C (AB)	8
22	*Pyrisitia lisa euterpe* (Ménétriés, 1832)	C (LN)	7
23	*Pyrisitia messalina* (Fabricius, 1787)	C (M, NM)	4, 12
24	*Pyrisitia n. nise* (Cramer, 1775)	C (M, BS-RC, LN, NM);	4, 5, 7, 12
FAMILY LYCAENIDAE			
	Subfamily Theclinae		
25	*Eumaeus atala* (Poey, 1832)	C (BS-RC)	5
	Subfamily Polyommatinae		
26	*Leptotes cassius theonus* (Lucas, 1857)	C (BS-RC, LN, LMb-SLC, NM); O (Alllocalities)	All
FAMILY NYMPHALIDAE			
	Subfamily Biblidinae		
27	*Lucinia s. sida* Hübner, [1823] E	C (M)	4
	Subfamily Cyrestinae		
28	*Marpesia chiron* (Fabricius, 1775)	C (LN, LMb, LMb-SLC); O (LMb)	7, 9
29	*Marpesia e. eleuchea* (Hübner, 1818) E	O (HM)	2
	Subfamily Charaxinae		
30	*Archaeoprepona demophoon crassina* (Fruhstorfer, 1904). E	C (BS-RC, BS-OA); O (LN, AR)	5, 7, 10
	Subfamily Danainae		
31	*Danaus plexippus plexippus* (Linnaeus, 1758)	O (M)	4
32	*Lycorea cleobaea demeter* Felder & Felder, 1865 E	O (AR)	10
	Subfamily Heliconiinae		
33	*Agraulis vanillae insularis* Maynard, 1869	C (BS-RC, Y); O (All localities)	All
34	*Dryas iulia nudeola* (Bates, 1934) E	C (M, BS-RC); O (All localities)	All
35	*Heliconius charithonia ramsdeni* Comstock & Brown, 1950	C (M, BS-OA, LMb-SLC); O (Alllocalities)	All
36	*Euptoieta h. hegesia* (Cramer, 1779)	C (LC, Y)	3, 11
	Subfamily Nymphalinae		
37	*Historis o. odius* (Fabricius, 1775)	O (AR, NM)	10, 12
38	*Junonia e. evarete* (Stoll, 1782)	C (M, BS-OA, LN); O (All localities)	All
39	*Anthanassa f. frisia* (Poey, 1832)	O (LMs)	6
40	*Atlantea perezi* (Herrich-Schäffer, 1862) E	C (AE, M, LMb-SLC); O (BS-RC, BS-OA, LN, LMb)	3, 4, 5, 7, 9
41	*Colobura dirce wolcott i*(Comstock, 1942)	O (BS-OA)	5
42	*Anartia jatrophae guantanamo* Munroe, 1942	C (LMb); O (All localities)	All
43	*Siproeta stelenes biplagiata* (Fruhstorfer, 1907)	O (BS-OA, AR, NM)	5, 10, 12
	Subfamily Satyrinae		

44	*Calisto h. herophile* Hübner, 1823 E	C (HM, M, BS-RC, LN, LMb-SLC, AR, NM)	2, 4, 5, 7, 9, 10, 12
	Calisto cf. h. herophile	C (M, AB)	4, 8
45	*Calisto cf. occulta* Núñez, 2012 E	C (RP)	13
46	*Calisto disimulatum* Núñez 2013 E	C (M, BS-OA)	4, 5
47	*Calisto brochei* Torre, 1973 E	C (M, BS-RC, AB)	4, 5, 8
48	*Calisto bruneri* Michener, 1949 E	C (BS-RC)	5
FAMILIA HESPERIIDAE			
	Subfamily Hesperiinae		
49	*Oarisma bruneri* Bell, 1959 E	C (RP)	2, 13
50	*Oarisma nanus* (Herrich-Schäffer, 1865) E	C (HM)	2
51	*Cymaenes tripunctus* (Herrich-Schäffer, 1865)	C (M, LN, AB)	4, 7, 8
52	*Asbolis capucinus* (Lucas, 1857)	C (BS-OA, AB, NM)	5, 8, 12
53	*Choranthus radians* (Lucas, 1857)	C (BS-RC, BS-OA)	5
54	*Euphyes c. cornelius* (Latreille, [1824])	C (RP)	13
55	*Parachoranthus magdalia* (Herrich-Schäffer, 1863)	C (BS-OA)	5
56	*Pyrrhocalles antiqua orientis* Skinner, 1920 E	C (AB, AR)	8, 10
57	*Synapte m. malitiosa* (Herrich-Schäffer, 1865)	C (M, BS-OA, AR); O (Alllocalities)	All
58	*Perichares p. philetes* (Gmelin, 1790)	C (BS-RC)	5
	Subfamily Eudaminae		
59	*Astraptes h. habana* (Lucas, 1857) E	C (LN, AR); O (LMb)	7, 10
60	*Astraptes x. xagua* (Lucas, 1857) E	C (M, BS-RC)	4, 5
61	*Urbanus dorantes santiago* (Lucas, 1857)	C (LMb-SLC, NM); O (All localities)	All
62	*Urbanus proteus domingo* (Scudder, 1872)	C (M, LMb-SLC); O (All localities)	All
	Subfamily Pyrginae		
63	*Eantis papiniaunus* (Poey, 1832) E	C (M, LN, AB)	4, 7, 8
64	*Ephyriades arcas philemon* (Fabricius, 1775)	C (BS-RC, AR)	5, 10
65	*Ephyriades b. brunnea* (Herrich-Schäffer, 1865)	C (AR)	10
66	*Erynnis zarucco* (Lucas, 1857)	C (LN)	7
67	*Pyrgus oileus* (Linnaeus, 1767)	C (LN); O (All localities)	All

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