LIVING WORLD

Journal of The Trinidad and Tobago Field Naturalists' Club

2020

THE TRINIDAD AND TOBAGO FIELD NATURALISTS' CLUB

The Trinidad and Tobago Field Naturalists' Club was founded on 10 July, 1891. Its name was incorporated by an Act of Parliament (Act 17 of 1991). The objects of the Club are to bring together persons interested in the study of natural history, the diffusion of knowledge thereof and the conservation of nature.
Monthly meetings are held at St. Mary's College on the second Thursday of every month except December.
Membership is open to all persons of at least fifteen years of age who subscribe to the objects of the Club.

Mission Statement
To foster education and knowledge of natural history and to encourage and promote activities that lead to the appreciation, preservation and conservation of our natural heritage.

Enquiries

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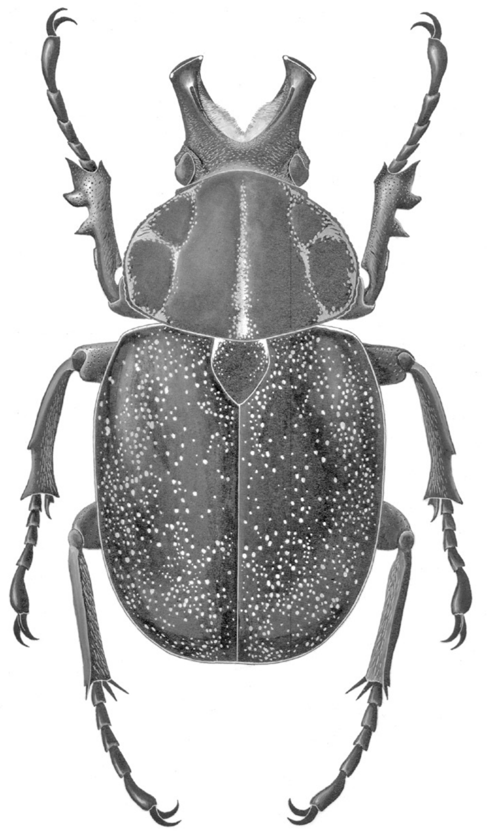

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Editorial

In 2020 our transition of Living World to an online journal with continuous publication was finally accomplished. This process has been made possible by a strengthening of the editorial team to include joint editors, four associate editors and three assistant editors in addition to our online editor. Bios of the editorial team will be available on the journal's website. Continuous publication is facilitated by our Early View of each article or Nature Note published before November of the current year.

The 2020 issue includes six Research Papers, eight Nature Notes and one Report. The LW team is greatly saddened by the passing of Jo-Anne Sewlal, one of our regular contributors and friend of the TTFNC. A survey of the spiders of Dominica is published here posthumously along with a tribute in her memory.

This issue is somewhat dominated by papers or nature notes on Lepidoptera which are written or supported by observations made by non-specialists. Indeed the TTFNC has a long tradition of bringing together and benefiting from the association of specialists and amateur enthusiasts. This is reflected in the current issue of Living World. Among the research papers we have an account of the Witch Moths of Trinidad & Tobago, new records of moths which were attracted to lights in Tobago and additional moths observed during night walks in Trinidad. The Nature Notes include records of a new Skipper butterfly, the life cycle of the Pierid butterfly *Ascia monuste* and records of the Brassolid genus Dynastor. These papers all highlight the value of citizen science and the on-line opportunities to share observations and contribute to our knowledge of our biota (more on this below). Two additional Nature Notes on methods for field identification of Bark Butterflies and species of Postmen Butterflies enable non-specialists to identify and record their observations without having to capture the butterfly.

In addition to those papers supported by citizen science we have an account of ticks infesting Cane Toads in northern Trinidad, a preliminary list of Spiders from Dominica and a case-study of two sea turtles successfully treated and released after exhibiting 'floating syndrome'- a buoyancy disorder often associated with the presence of excess gas in the body. Nature Notes also include a description of colour morphs of Streak Lizards in Northeastern Trinidad and observations of Moriche Palms at Erin Savannah. The final Nature Note describes the first sighting of a Stygian Owl in Trinidad.

Our regular report of the Trinidad and Tobago Birds Status and Distribution Committee describes 95 records submitted to the Committee including six new species for the country and one new species for Tobago.

Citizen science is scientific research conducted by volunteer amateur scientists. It is an aspect of research that has expanded greatly in recent years as online portals, such as Zooniverse.org or Scistarter.org, allow scientists to share their projects and recruit volunteers. It can take many forms, such as recording the weather, identifying types of stars, deciphering handwritten labels on old museum specimens and more, but as far as Living World/TTFNC is concerned it is the observations of wildlife that are of most interest.

It has never been easier to share wildlife sightings with a wider audience than at the present time. A host of websites have been developed that allow users to upload photographs, sound clips, and/or data concerning species they have encountered. Two of the biggest, in terms of numbers of users and numbers of records submitted, are eBird and iNaturalist.

eBird has long been a favoured platform for birdwatchers in Trinidad & Tobago with both local users and many visitors uploading checklists after a day's birding. At the time of writing 440 species from over 30,000 checklists made by 1961 birders have been recorded on the website. Although the hotspots of the Asa Wright Nature Centre, Caroni Bird Sanctuary and Nariva Swamp account for many of the records there are observations from all over the islands. Preceding this has been one of the longest running citizen scientists projects in the world, the Audubon Society's Christmas Bird Count, which started in 1900. People have been undertaking this annual event on these islands since 1969 with the results being published in Living World.

iNaturalist is a social networking service that allows users to record and identify all types of wildlife. It is accessed via its website or on mobile apps and has more than one million registered users worldwide. It has been growing in popularity in Trinidad & Tobago over the last few years with more than 27,000 observations of wildlife from over 1,000 observers. Around 6,700 of these records were made in just one weekend as part of the 2020 Trinidad & Tobago Backyard Bioblitz. This was an almost entirely citizen science based project, relying on members of the public to make and submit records through iNaturalist. Although many of the regular bioblitz experts, some of whom are professionals in their fields, did their own backyard surveys their main job over the weekend of the event was to identify the observations online. By all measures this bioblitz was a great success, with more recorded observations, more species, more observers and more international participation (through the identifiers) than any previous Trinidad & Tobago bioblitz. Many of the observers were first time users of iNaturalist, but despite a few teething troubles they documented a wonderful array of species with over 1,370 identified to some level. More detailed analysis is still underway and there are already possibilities of new species records for the islands, including two types of terrestrial flatworms, a moth that hasn't been recorded from Tobago in over 80 years and a possible second record of a twig anole.

Current plans for monitoring of diversity within protected areas of Trinidad & Tobago are to a large extent dependent on citizen science. The Trinidad and Tobago Biodiversity Information System (TTBIS), an output of a FAO project on Improving Forest and Protected Area Management in Trinidad and Tobago, identifies as its goal, to provide access to GIS information and datasets collected on the Protected Areas from Trinidad and Tobago. We encourage readers to visit the site at https://ttbis.planning.gov.tt/ttbis/about

2020 was also a year in which we grappled with the challenges and sorrows of COVID-19. Sharing of experiences or catching up on eBird, iNaturalist and other platforms no doubt helped some cope with the isolation brought on by restrictions.

Amy Deacon,
Mike G. Rutherford and
Graham White

Cover Photograph

This year's cover shows a female *Acontista multicolor* mantid photographed by Rossi Nicholi Dookie in Preysal on 21 November during the 2020 Backyard Bioblitz. This image won a competition held by the organisers of the event and was selected from a range of observations submitted to iNaturalist. See www.inaturalist.org/observations/65352155.

An Evaluation of the Hard Ticks (Ixodidae) Infesting Cane Toads *Rhinella marina* (Bufonidae) in Northeastern Trinidad, W.I.

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ABSTRACT

The cane toad *Rhinella marina* provides a unique opportunity to investigate Neotropical ectoparasite communities, because individuals travel long distances and traverse multiple habitat types, each inhabited by different species of ectoparasite including ticks (Ixodidae). To evaluate the ticks parasitising *Rhinella marina* within northeastern Trinidad, individual toads were obtained from four agrarian sites with different environmental characteristics and proximity to urban or sylvan areas. Individuals were collected by hand and inspected for ticks within 5-10 minutes of capture. Parasitism by ticks occurred in 12 of the 39 toads collected. *R. marina* specimens were hosts to 12 species of ticks represented by five genera (*Amblyomma* spp., *Hamaphysalis* spp., *Hyalomma* spp., *Ixodes* spp., and *Rhipicephalis* spp.). Individuals sampled from sylvan environments exhibited the highest incidence of infestation with a low to moderate density of toads while individuals collected from urban environments showed lower incidences of infestation despite the greatest density of toads. 84% of all ticks collected were female and 43% of all ticks collected were immature. Individuals representing all instars were obtained for all five genera excluding *Amblyomma* spp., for which only adult specimens were observed. The data resulting from this study provides evidence that *R. marina* is infested by a moderate diversity of tick species in northeastern Trinidad which reinforces the utility of this species as a means to study ectoparasites within Neotropical environments.

Key words: Anura, Ixodidae, ectoparasite, host preference, instar

INTRODUCTION:

The cane toad *Rhinella marina* is a well-studied species in non-native areas due to their potential as an amplifying host for pathogens (Kelehear 2016). However, in Trinidad and Tobago, where they are native (Murphy *et al.* 2018), these toads are largely overlooked with the exception of a study by Burgon *et al.* (2012) and a few papers examining internal parasites (e.g. Ragoo and Omah-Maharaj 2003). Individual cane toads have been recorded travelling up to 55km per year (CABI 2018) making them a species of interest when it comes to the potential spread of disease agents over large areas. Previous studies describe adult cane toad habitats as lowland disturbed/urban areas, but eggs must be laid in shallow bodies of water existing further from preferred adult habitats, contributing to the need for locomotion across large distances (Zug and Zug 1979). This potential for dispersal across large areas may result in a higher probability of exposure to a greater diversity of ectoparasites (Clifford *et al.* 2014). Though several species of ticks are known to inhabit northern Trinidad (Basu and Charles 2017) a previous study reported only two species of ticks, *A. dissimili* and *A. rotundatum*, as ectoparasites of *R. marina* in Trinidad (Burgon *et al.* 2012).

Some of the species of ticks that are reported to inhabit northern Trinidad, including *Amblyomma ovale* and *Rhipicephalus microplus* can act as vectors for the spread of *Rickettsia* and *Ehrlichia* bacteria (Guerrero *et al.* 2010, Barbieri *et al.* 2015). Adults of the aforementioned species of ticks are typically associated with non-anuran preferred hosts (Basu and Charles 2017) and have yet to be reported as ectoparasites of cane toads in Trinidad. Host preference can be described as the host specialisation of a species of tick at a population dynamics level (McCoy *et al.* 2013). The concept of host preference is debated for adult ticks and is even more polarised in the conversations on the efficacy of host preference-based predictability in the younger stages of development (McCoy *et al.* 2013). Given a host-generalist based approach, the high probability of exposure to a variety of pathogens and interactions with various environments suggests that *R. marina* could serve as an appropriate indicator of which species of ticks (and associated disease agents) may be present within a particular environment (Kelehear 2016). The aims of this study are (1) to determine the burden of tick infestation on cane toads collected in four different areas in northeastern Trinidad to assess which species of ticks infest this common species of anuran; and (2) to assess whether additional species of tick are parasitising *R. marina* in northeastern Trinidad than have been reported previously.

MATERIALS AND METHODS:

<u>Sample sites</u>

Specimens of *Rhinella marina* were collected from one of four areas in the vicinity of Toco in northeastern Trinidad. All four sites were considered agrarian based on a proximity to human dwellings, but differed slightly in terms of habitat and the level of human activity. The perimeters of all sample areas were positioned at least 500 metres apart (Table 1).

Toad Collection and Ectoparasite Inspection

Each of the four sites were surveyed for individuals of *R. marina* on two separate occasions with each survey separated by four days to decrease the probability of recapture. Handling of toads and collection of ticks was permitted via a special game license granted through the Trinidad Wildlife Section of the Forestry Division. Samples were collected from 5 May to 1 June 2019 during the dry season. Toads were collected by baiting a collapsible hexagon trap with cat food as well as through capture by hand from 2000-2100h using flashlights. Captured toads were placed into plastic collection tubs and brought back to the field laboratory for measurements, photographs, and tick inspections. The snout to vent length of each individual was recorded using a caliper and photographs of each individual were taken using a Canon 80D camera, to minimize the risk of recapture. Tick inspections were performed visually. All ticks were removed from toads by hand using fine-tip tweezers and placed directly into a vial containing 70% ethanol. All toads were released after the removal of ticks at their site of capture. Ticks were examined under an Opti-TekScope (electrical microscope) to identify instars, sex, and species. Species identifications were performed through the use of published keys (Krantz and Walter 2009, Basu and Charles 2017, Keirans and Durden 1998) and verified by the Texas A&M Insect Collection (Voucher #744). The first two instars (larva and nymph) were referred to as immatures for comparison purposes with adult specimens within this paper.

Table 1. Sample site descriptions and GPS coordinates for nearest points between transect perimeters.

Site	Collection Area	Position of the Area	Characterisation of Area
Site 1	Grounds of Jammev Beach Resort	10.8264°N, -60.9291°W	Concrete paved areas, maintained gardens, and a nearby drainage ditch where toads were found spawning.
Site 2	Roadside to the northeast of Site 1	10.8314°N, -60.9291°W	More human-populated area, featuring homes interspersed between unmanaged lands.
Site 3	Roadside to the southeast of Site 1	10.8233°N, -60.9350°W	Bordered by dense vegetation on one side and a drop off into a valley with a creek bed on the other side. Mostly sylvan environment, determined by the observation of the greatest variety of species of amphibians, reptiles, and mammals were observed.
Site 4	Toco Beach	10.8346°N, -60.9219°W	Adjacent to a drainage ditch located between small restaurants directly south of Toco Beach-front.

RESULTS

In total, 39 individuals of *R. marina* were collected, 13 specimens from Jammev grounds, 11 specimens from Roadside SE, ten specimens from Roadside NE, and five specimens from Toco Beach. Of the 39 toads collected, 12 were infested with ticks. A total of 61 ticks were collected, representing five genera, 12 species, and all life stages except eggs (Figure 1). The genera collected include *Amblyomma* spp., *Haemaphysalis* spp., *Hyalloma* spp., *Ixodes* spp., and *Rhipicephalus* spp., all within the family Ixodidae. (Figure 2).

The mean density of ticks per cane toads examined as well as intensity of infestation (IOI) of toads carrying ticks were calculated per NIH guidelines (Agustin 2013). The mean density of ticks, calculated as number of ticks per cane toad, across all examined individuals of *R. marina* collected was 1.47. Mean density of individual sites ranges between 0.38 and 4.09. The intensity of tick infestation on cane toads, calculated as the number of ticks per infested individuals of *R. marina* collected, was 4.38 (Table 2). IOI of individual sites range between 1.5 and 9. Roadside SE yielded the highest number of ticks, while Roadside NE yielded the second highest number. followed by Jammev and Toco Beach (Table 2). The average ticks per host across all sites is 5.08 ticks per toad. This drops to 2.4 ticks per toad with the exclusion of the two outlying highly infested toads. These highly infested individuals were both collected from Roadside SE. Individually their infestations were comprised of 55% immature for the first specimen and 84.6% immature for the second specimen. 83% of the immature ticks on specimen one were *Ixodes* spp. and 37% of the immature for the second specimen were also *Ixodes* spp.. Across all infested toads, there were varied proportions of immature ticks relative to adults between each genus of tick (Figure 1). There were high proportions of females, especially amongst genera containing high levels of immature ticks (Figure 3).

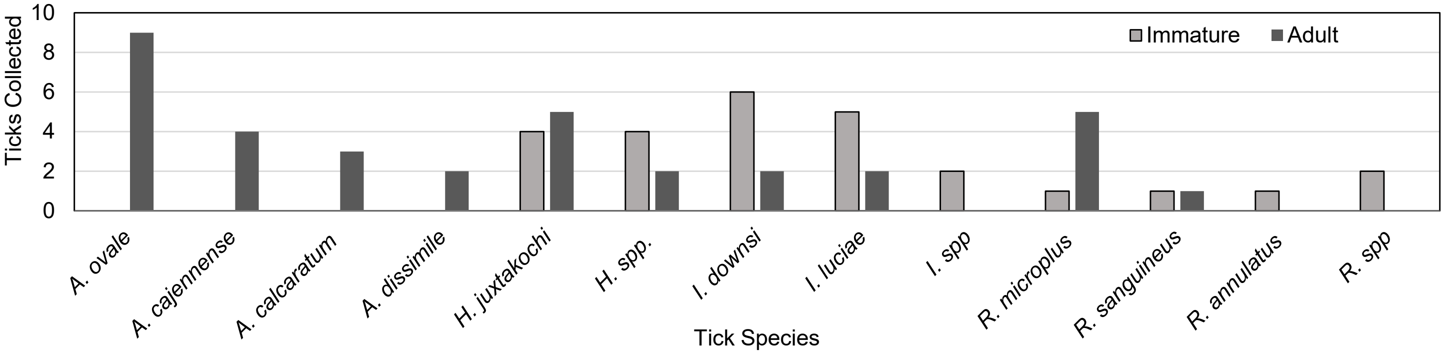

Fig. 1. Number of immature and adult individuals of each species of tick collected during the course of this study. Total number of ticks collected=61.

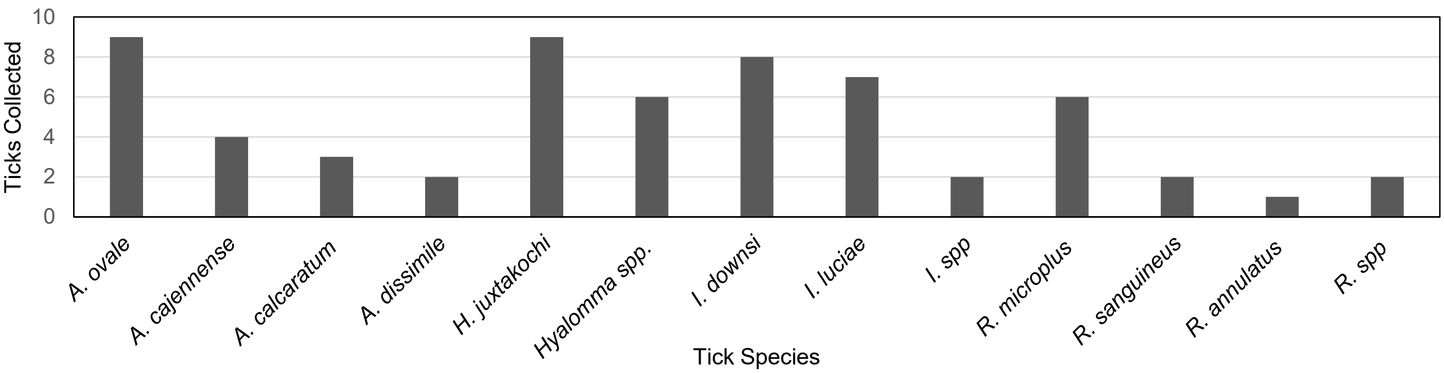

Fig. 2. Number of each species of tick collected from 12 cane toads during the course of this study. Total number of ticks collected=61.

Table 2. Summary descriptive statistics for the four collection sites.

Site	Number of Toads Sampled	Number of Toads Infested	Total Number of Ticks Found	Proportion of Ticks Collected per Site	Density of Infestation (+/- SE)	Mean Number of Ticks per Toad Infested (IOI) (+/- SE)
Jammev	13	1	5	8.20%	0.38 +/- 0.75	5 +/- 0
Roadside NE	10	4	6	9.84%	0.6 +/- 0.52	1.5 +/- 0.46
Roadside SE	11	5	46	75.41%	4.09 +/- 5.05	9.2 +/- 9.79
Beach	5	2	4	6.56%	0.8 +/- 1.14	2 +/- 1.96

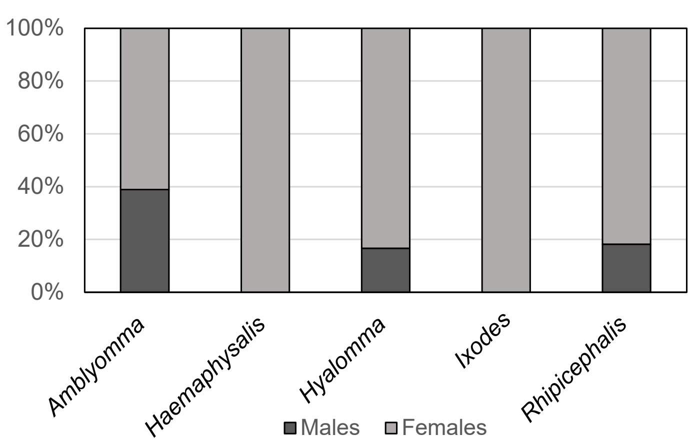

Fig. 3. Percentage of male and female individuals for each of the five genera of ticks collected during the study.

DISCUSSION

This study supports the idea that a large variety of tick species exist, parasitise cane toads, and reproduce perennially in northeastern Trinidad. Twelve species spanning five genera from the family Ixodidae were found parasitising cane toads, while previously only *A. dissimile* and *A. rotundatum* were reported as ectoparasites of this species in Trinidad (Burgon *et al.* 2012).

Effect of Site Variation on Ectoparasitic Burden

Roadside SE site contributed 75.41% of the ticks encountered in this study. This site represents the least disturbed of the four areas sampled, based upon visual observations made during collection times. Within the more urban areas sampled (Toco Beach and Jammev) the incidence of toads was higher than the less urban sites, while the incidence of ticks on those toads was lower. This provides support for the hypothesis that more ticks of a greater diversity exist in areas with a greater abundance of hosts (Meeüs *et al.* 2007). These areas are characterised by dense vegetation and access to water even though these are not requirements for either the tick or are associated with cane toad habitats (Page *et al.* 2008, Agustin 2013). Therefore, the question of why both ticks and toads are encountered in more sylvan areas, such as Roadside SE, exists.

These data may represent the higher infestation rate speculated to exist when travelling across a variety of environments (Clifford 2014). Roadside SE was along a path that toads cross between breeding grounds and preferred habitats, not where the toads would regularly come into contact with people, which would favour the spread of diseases to animals and not humans. If the incidence of infestation becomes great enough, however, a spillover event could affect human populations (Harrus and Beneth 2005); thus, continued monitoring of tick densities even in sylvatic populations of wildlife is recommended.

The variety of tick species collected on cane toads at a single time in the year, represents the potential for a variety of associated disease agents to exist within cane toad populations at any given time. It is unknown, however, if cane toads in northern Trinidad are competent intermediaries for tick to tick serial infections for the diseases associated with the ticks found in this study. If *R. marina* is capable of amplifying disease agents such as *Rickettsia* from *Haemaphysalis* spp. and *Amblyomma* spp.*;* Ehrlichiosis, Babesiosis, and Anaplasmosis bacteria from *Rhipicephalus* spp*.; Bartonellae* bacteria from *Ixodes* spp., or even Crimean-Congo Hemorrhagic Fever Virus from *Hyalomma* spp., then cane toads may represent a greater public health risk than they are currently considered (Hornak and Horváth 2012, Constable *et al.* 2017, Bayer 2019, Guerrero *et al.* 2010, Scott *et al.* 2017, Souza *et al.* 2018, Reis *et al.* 2011). Cane toads have been found to amplify Myxosporean parasites, *Myxidium* spp. in non-native areas (Hartigan *et al.* 2011), but investigations into their ability to amplify *Rickettsia, Ehrlichia*, or other bacteria are lacking. An essential step in considering the public health risk of any species is assessing their ability to be an amplifying host. Beyond that, is the presence of the disease agents in the environment (Rodricks 1994). Due to the increasingly globalised world, even in the case where the pathogens are not currently in the area of concern, continued monitoring is recommended.

Relative Abundance of Immature and Mature Ticks

Individuals of *Hyalomma* spp*.*, *Ixodes* spp., and *Rhipicephalis* spp. collected in this study comprised >50% immatures while 100% of the individuals of *Amblyomma* spp collected were adult. All larval ticks were collected from toads in the Roadside SE site. This sample area was characterised by an abundance of potential amphibian and mammalian host dwellings, and thus, adult ticks are more likely to exist in the vicinity, leading to a greater probability of female ticks laying their eggs in this area (Aeschlimann *et al.* 1976). These eggs would then hatch, and larval ticks would be seeking their first blood meal. Since larvae cannot travel more than a few feet on their own (Meeüs 2007), it is probable that a ground dwelling animal such as a toad would be the optimal host whether the toad is the preferred host of the adult tick or not. Since immature ticks have been found in significantly greater densities in low lying vegetation, when sampled in other studies, it is logical to presume this is where their first blood meal will be derived (Aeschlimann *et al.* 1976, Mejlon and Jaenson 1997).

Due to high humidity and temperatures year-round in Trinidad, the probability of finding varying life stages of ticks was high (Bale *et al.* 2002). In multi-season areas, tick life cycles can be predicted and tracked throughout the year due to the rise and fall of temperatures dictating when life stages can progress (Krasnov and Matthee 2010, Cradock and Needham 2010). In more tropical areas such as Trinidad, it is likely that ticks collected throughout the year will vary in instar and thus vary in predictability of host-preferences for any given species of tick. In this study there were several genera represented at different life stages, thus no definitive conclusions on a single tick species causing the most significant burden for cane toads could be made.

Sex Distribution

Female ticks accounted for 83.6% of specimens (across all genera and life stage) and 100% of *Haemaphysalis* spp. and *Ixodes* spp. collected were female. The reason for this is unknown, but this phenomenon has been observed previously (Meeüs *et al.* 2007, Krasnov and Matthee 2010). Aeshlimann *et al.* (1976) hypothesized that male ticks may prefer hosts that have larger zones of existence thus causing lesser densities of males across regions through being passively carried by the host to locations away from where the tick emerged initially (Aeschlimann *et al.* 1976). Thirty one years later, Meeüs *et al.* reinforced this hypothesis in finding that fewer males have been repeatedly collected in small defined regions and suggesting that this may be due to their larger distribution patterns (Meeüs *et al.* 2007). However, these hypotheses have not been fully supported by empirical data and should be further researched. Another explanation suggested was based upon the observation that lab-bred ticks commonly yield more females than males in each clutch (Pinter *et al.* 2002). Furthermore, male lab-bred ticks have shown longer feeding durations than females, correlating with a longer interval of time between emerging or molting and host seeking (Pinter *et al.* 2002).

Recommendations

Due to proportions of immatures as well as the number of species found, it is likely that cane toads and potentially various other ground dwelling vertebrates such as rodents and lizards play a vital role in the life cycle of various tick species. However, because the majority of genera encountered were represented by different life stages, no definitive conclusion on a single tick species causing the greatest burden for cane toads can be made. The tick species collected are capable of vectoring several disease agents (Hornak and Horváth 2012, Constable *et al.* 2017, Bayer 2019, Guerrero *et al.* 2010, Scott *et al.* 2017, Souza *et al.* 2018, Reis *et al.* 2011), while the competence of the cane toad at amplifying these agents is unknown at this time. For this reason, research on cane toad amplification competence should be continued, alongside the monitoring of tick species and their associated agents.

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Witch moths (Lepidoptera, Erebidae, Erebinae, Thermesiini) of Trinidad & Tobago

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ABSTRACT
An illustrated and annotated catalogue is presented of 17 species of the tribe Thermesiini (Lepidoptera, Erebidae, Erebinae) confirmed to occur in Trinidad, of which *Hemeroblemma dolon* (Cramer), *H. helima* (Stoll), *H. malitiosa* (Guenée) *H. ochrolinea* (Guenée), *Feigeria mycerina* (Cramer) and '*Letis*' *arcana* Feige are new records for the island. Seven species are recorded from Tobago, two for the first time. Images of 14 species of living adults are included. Almost nothing has recorded regarding food plants and early stages of Thermesiini in Trinidad, but known food plants from elsewhere in the Neotropics are tabulated.

Key words: *Ascalapha*, *Feigeria*, *Hemeroblemma*, *Letis*, *Thysania*, DNA barcodes, cacao

INTRODUCTION

The tribe Thermesiini is found predominantly in South America, with just a few species found in or straying into North America. It forms part of the subfamily Erebinae in the family Erebidae, one of the most species rich Lepidoptera families. Until about ten years ago, Erebidae were subsumed within the huge family Noctuidae. Thermesiini includes some of the largest moths in South America, such as *Thysania agrippina* (Linnaeus) which is credited with the greatest wingspan of any moth: up to 30cm or more. *Thysania agrippina* and another large Thermesiini moth, *Ascalapha odorata* (Linnaeus), are known in parts of their range as the white witch and the black witch respectively. In his website on Bolivian Lepidoptera, Andersen (2020) refers to this group as witches. It therefore seems appropriate to refer to the moths of this tribe collectively as witches or witch moths, as I cannot trace any other common names for this tribe.

The taxonomy of Thermesiini requires further work. The recent development and use of DNA barcodes has shed much new light on many groups of Lepidoptera (e.g. Janzen *et al.* 2009), showing that some apparent species are synonyms, but that other apparently good species encompass additional previously unrecognised cryptic species. This has been most convincing when evidence from DNA barcodes, adult morphology including genitalia, and biology studies are combined in an integrative taxonomy (e.g. Burns *et al.* 2008). In the case of Thermesiini, it seems certain that such studies across the Neotropical fauna will show that the Trinidad and Tobago fauna includes some species that are actually members of species complexes currently treated as a single species. Furthermore, bearing in mind that apparent relatedness based on DNA barcodes alone is not robust, there are areas amongst Thermesiini where this is not in concordance with current use of genera, so that changes to genera can be expected. Some areas where future changes are likely are indicated in the text below, but the current well-known names are retained.

The following account sets out the species recorded from Trinidad and Tobago with illustrations, and summarises what is known about them in the country. All published records are listed, of which Kaye and Lamont (1927) for Trinidad and Cock (2017) for Tobago are the most important. Four species are recorded from Trinidad for the first time, and two for Tobago. For general background on collecting and the methods used to compile this work, see Cock (2018). In preparing this work, I consulted the following collections, either in person or from images shared by their staff (see acknowledgements):

MJWC the private research collection of M.J.W. Cock, UK (records from all specimens and unpublished notes compiled and collated);

NHMUK Natural History Museum, London, UK, which contains much historical material collected by F. Birch, S.M. Klages and others (only selected records confirmed and included);

NMS National Museum of Scotland, Edinburgh, UK, which includes part of the collection of Sir N. Lamont (all records compiled and collated);

OUNHM Oxford University Natural History Museum, which includes material collected by R.M. Farmborough and others (records from many, but perhaps not all, specimens compiled and collated).

UWIZM University of the West Indies Zoology Museum, St. Augustine, Trinidad and Tobago, which includes part of the collections of Sir N. Lamont and D.J. Stradling as well as the former CABI collection containing material collected by the author, F.D. Bennett, R.E. Cruttwell (now McFadyen), R. Brown and T. Cassie, M. Morais and others (records from all specimens compiled and collated).

I have also examined images of live material from various contacts (see specimen listings and acknowledgements) as well as reviewing the records on iNaturalist (https://www.inaturalist.org/) and selected other websites.

Family Erebidae Leach, [1815]
Subfamily Erebinae Leach, [1815]
Tribe Thermesiini Guenée, 1852

The classification of Noctuoidea and the use and nomenclature of family and infrafamily names within it have changed greatly over time. I do not attempt to trace all developments relating to the group now known as Thermesiini (see Forbes 1952, Berio 1992, Zilli 2003, Kühne and Speidel 2004, Homziak *et al.* 2016, etc. for more detail), but only mention key points in the following. Guenée (1852) first used the suprageneric name Thermesidae within Noctuélites (his sixth division of moths) for a large group of genera now placed within the family Erebidae. The name was based on *Thermesia* Hübner, 1823, a junior subjective synonym of *Hemeroblemma* Hübner, 1818 (Poole 1989).

Subsequently Grote (1895) established the tribe Thysaniini: for *Thysania*, *Letis* (i.e. *Letis sensu lato*), and *Erebus* (i.e. *Ascalapha*), and referred to *Thysania agrippina* as the type species. He characterised the tribe thus: 'the extreme limits in size within the Order is reached; the fore wings are greatly elongated, the body vestiture lies close, the eyes are large, head and palpi well developed, while the large lateral expansion of the wings fit the moths for extended flights.' In his study of the noctuoid tympanum, Richards (1933) grouped *Hemeroblemma*, *Latebraria*, *Letis* (as *Blosyris*), *Ascalapha* (as *Erebus*) and *Thysania*, i.e. a slightly expanded version of Grote's Thysaniini.

In their checklist of the Noctuoidea of North America, Lafontaine and Schmidt (2010) include the genera *Hemeroblemma*, *Latebraria*, *Letis*, *Thysania* and *Ascalapha* in their treatment of the tribe Thermesiini. Because *Hemeroblemma* is now included in the tribe, Guenée's Thermesiini has priority over Grote's Thysaniini. These five genera, plus the genera split off from *Letis* (see under *Letis* below), are the same ones included in the classification of Thermesiini in the Barcode Of Life Database (BOLD 2020c).

Apart from Kirkpatrick's (1953) observations of *Hemeroblemma leontia* (Stoll) on cacao, almost nothing has been recorded regarding the food plants and early stages of this tribe in Trinidad. Food plants records from elsewhere are predominantly Fabaceae (Table 1).

Ascalapha Hübner, 1809
Type species: *Phalaena odorata* Linnaeus.
Synonym: *Otosema* Hübner 1823, type species *Phalaena odorata* Linnaeus.

This is a monotypic genus containing a single, large, sexually dimorphic species, which is widespread in the Americas.

***Ascalapha odorata* (Linnaeus, 1758)**
Linnaeus (1758): *Phalaena Bombyx odorata*, TL "America".
Erebus odora [sic] (Linnaeus): Druce (1881-1900), Wilson (1894)
Erebus odoratum [sic] (Linnaeus): Kaye (1901)
Otosema odora [sic] (Linnaeus): Kaye and Lamont (1927)
Ascalapha odorata (Linnaeus): Cock (2017)

Historical notes. Apart from the use of different genera and different spellings of *odorata*, this species has been unambiguously recognised in Trinidad since Wilson's (1894) list, and has been reported from Tobago (Cock 2017).

Identification. This is a sexually dimorphic species, which because of its size, wing shape and markings, is unlikely to mistaken in either sex. In case of doubt, the ε-shape at the hindwing tornus is a good diagnostic feature. Males are darker, and females have a white postdiscal band.

Biology in Trinidad. I have found no information on the biology in Trinidad, except that Kaye and Lamont (1927) mention a caterpillar from Trinidad in the NHMUK, which I have not seen. It is known to be highly vagile or migratory, spreading from the tropics north to Canada in some years (Holland 1903). The adults will feed on fruit, but Zenker *et al.* (2010) showed that the proboscis of *A. odorata* is not suitable for piercing fruit, although it is suitable for lacerating the pulp once there is an opening, as reported by Angeles and Requena (1966) in Venezuela.

Status in Trinidad and Tobago. An occasional species which could turn up anywhere, attracted to light or disturbed by day. Also found on Chacachacare Island.

Arima Valley, Asa Wright Nature Centre: ♀ 20.iv.2016 (D. Wendelken photo) [iNaturalist observation 20533225]
D'Abadie, 10.620 -61.308, at light: ♀ 30.xi.2019 (R. Deo photo) [iNaturalist observation 36216429]
Manzanilla: ♂ 22.xii.2018 (F. Mohammed photo) [iNaturalist observation 19180718]
Morne Bleu, Textel Installation, at light: ♂♀ 26.vii.1978 (M.J.W. Cock) [MJWC] (Figs. 1-2)

Table 1. Summary of available information on food plants of the Thermesiini found in Trinidad &Tobago, based on records from other countries.

Thermesiini species	Summary of food plants	References
Ascalapha odorata	Fabaceae trees such as *Acacia*, *Albizia, Cassia, Inga, Piptadenia*, *Prosopis,* etc.	Lima (1936), Comstock (1936)*, Bourquin (1945)*, Wolcott (1951), Zimmermann (1958)*, Quinn (2008)*, Janzen and Hallwachs (2019)*
Hemeroblemma dolon	Apparently unknown	
Hemeroblemma helima	Apparently unknown	
Hemeroblemma leontia	*Guettarda* (Rubiaceae) and *Machaerium* (Fabaceae)	Janzen and Hallwachs (2019)*
Hemeroblemma malitiosa	Fabaceae, especially *Inga* spp.	Janzen and Hallwachs (2019)*
Hemeroblemma ochrolinea	*Stryphnodendron* (Fabaceae)	Janzen and Hallwachs (2019)*
Hemeroblemma opigena pandrosa	Apparently unknown	
Feigeria buteo	*Caesalpinia*, *Senna* spp. (Fabaceae)	Robinson *et al.* (2020), Arlo (2012)*, Janzen and Hallwachs (2019)*
Feigeria herilia	*Inga* spp. such as *I. oerstediana* (Fabaceae)	Janzen and Hallwachs (2019)*
Feigeria magna	*Inga* spp. (Fabaceae)	Janzen and Hallwachs (2019)*
Feigeria mycerina	*Inga* spp. especially *I. oerstediana* and *I. vera* (Fabaceae); also recorded from coffee (*Coffea*, Rubiaceae) and mango (*Mangifera*, Anacardiaceae) but some of these could refer to adult feeding.	Wolcott (1951), Miller *et al.* (2007)*, Robinson *et al.* (2020), Janzen and Hallwachs (2019)*
Feigeria scops	Apparently unknown	
'Letis' arcana	Apparently unknown	
'Letis' doliaris	Apparently unknown	
'Letis' iphianasse	Apparently unknown	
Thysania agrippina[1]	*Senna spectabilis* and *Pterogyne nitens* (Fabaceae)	Pastrana (2004)
Thysania zenobia	*Cassia* spp., *Senna spp.* and *Pterogyne nitens* (Fabaceae)	Hillermann (2009)*, Pastrana (2004), Robinson *et al.* (2020), Janzen and Hallwachs (2019)*

¹ The caterpillar associated with the adult of *T. agrippina* in Merian (1705, plate 20) is that of a sphingid.

* These references also include images of early stages.

Palmiste: ♂ vii.1915 [N. Lamont] [NMS]; ♂ 24.v.1916 [N. Lamont] [NMS]; ♂ 25.v.1916 [N. Lamont] [UWIZM.2013.13.1537]; ♀ 1.ix.1916 [N. Lamont] [NMS];♂3.ix.1916[N.Lamont][UWIZM.2013.13.1536]; ♀ x.1916 [N. Lamont] [UWIZM.2013.13.1535]; ♀ 16.xii.1921 [N. Lamont] [NMS]; ♀ 29.iv.1934 [N. Lamont] [UWIZM.2013.13.1534]

Parrylands, al light: ♀ ii.1980 (J.O. Boos) [MJWC]

Trinidad: ♂ iv-v.1902 (E. Bourke) [OUNHM]

CHACACHACARE ISLAND, by day: ♂ 24.i.2015 (K. Sookdeo photo, moths58) (Fig. 3)

TOBAGO, Englishman's Bay, at light: ♀ (J. Ingraham) [M. Kelly photo]

TOBAGO, Mount Pleasant, 11.166-60.799: ♀ 10.vii.2020 (R. Williams-Littzen photo) [iNaturalist observation 52668676]

Fig. 1. Male *Ascalapha odorata,* Morne Bleu, Textel Installation, at light, 26.vii.1978 (M.J.W. Cock). The left hindwing is slightly greasy, obscuring the markings.

Fig. 2. Female *Ascalapha odorata,* Morne Bleu, Textel Installation, at light, 26.vii.1978 (M.J.W. Cock).

Fig. 3. Living male *Ascalapha odorata,* Chacachacare Island, 24.i.2015, K. Sookdeo photo, © K. Sookdeo with permission.

***Hemeroblemma* Hübner, 1818**

The type species is *Hemeroblemma amethystina* Hübner, 1818, which is a junior subjective synonym of *Phalaena Noctua dolon* Cramer, 1777. The following genera are currently considered synonyms (Poole 1989):

- *Blosyris* Hübner, [1822]; type species *Phalaena opigena* Drury, misidentified by Hübner; actually *Brujas malitiosa* Guenée
- *Thermesia* Guenée, 1852; type species *Thermesia abadirina* Hübner (a junior subjective synonym of *Phalaena Noctua pandrosa* Cramer) designated by Berio (1966)
- *Brujas* Guenée, 1852; type species *Brujas malitiosa* Guenée
- *Peosina* Guenée, 1852; type species *Phalaena leontia* Stoll
- *Obucola* Walker, 1858; type species *Obucola expandens* Walker

Poole (1989) lists 32 species for this genus, which is found throughout tropical America. Barbut and Lalanne-Cassou (2005) describe three new species and synonymise others so that they too list 32 species. Several species, in addition to *H. leontia* below, have been reported as occasional pests of cacao (Costa 1977, Feliz 1977, Gerónimo Cruz *et al.* 2015).

Taxonomic issues. There are public barcodes for ten named species of *Hemeroblemma* in BOLD (2020b), but not for the type species, *H. dolon*. The apparent relatedness based on these barcodes suggests that either *Hemeroblemma* will need to be divided into several genera, or it will necessary to include species currently placed in *Latebraria*, *Letis* / *Feigeria*, and perhaps *Ascalapha odorata* to create a monophyletic clade. Either way, there will need to be some reclassification of or within this genus in the future. As indicated above there are several synonyms available to define new genera or subgenera, but for the moment, it is appropriate to retain the existing nomenclature pending a definitive study.

***Hemeroblemma dolon* (Cramer, 1777)**

Cramer (1777): *Phalaena Noctua dolon*, TL Surinam.

Historical notes. This species has not previously been recorded from Trinidad, and is not known from Tobago (Cock 2017). My identification is based on a comparison with the type of *amethystina* Guenée (♂ French Guiana, NHMUK, a synonym) and NHMUK series.

Identification. There is modest sexual dimorphism, but I have not seen females from Trinidad. Figures of the female from mainland South America can be found in Barbut and Lalanne-Cassou (2005), and on the internet (Cahurel 2020). The dorsal discal bands of the female are arranged similarly to those of the male, but the ground colour is uniform with a purple-blue sheen, and a small yellow-white apical costal patch may be conspicuous.

Status in Trinidad. A rare species in Trinidad, known only from two males from lowland forest.

Bush Bush Reserve: ♂ 23.i.2016 (M.G. Rutherford photo) [iNaturalist observation 3901922] (Fig. 5)

Hollis Reservoir, at light: ♂ 2.xi.1978 (M.J.W. Cock) [MJWC] (Fig. 4)

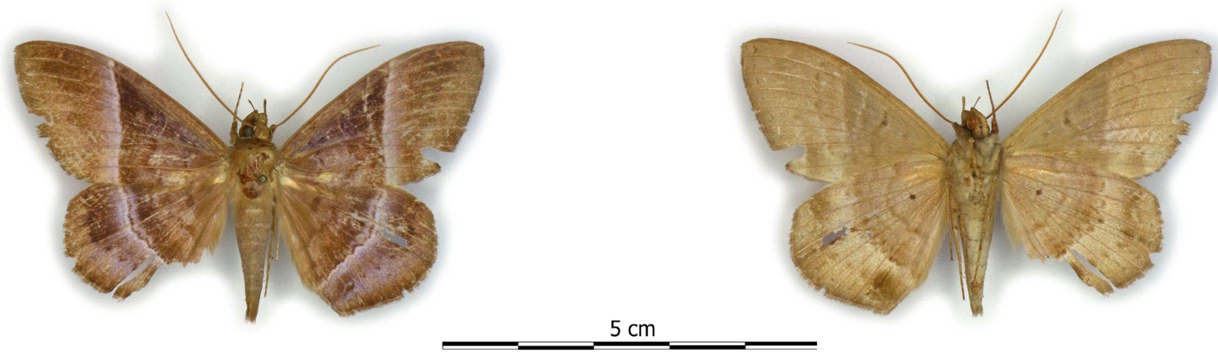

Fig. 4. Male *Hemeroblemma dolon*, Hollis Reservoir, at light, 2.xi.1978 (M.J.W. Cock).

Fig. 5. Living male *Hemeroblemma dolon*, Bush Bush Reserve: 23.i.2016, M.G. Rutherford photo, iNaturalist observation 3901922, © M.G. Rutherford, Creative Commons license CC-BY-NC.

Hemeroblemma helima (Stoll, 1782)
Stoll (1782): *Phalaena Noctua helima*, TL Sierra Leone in error [Tropical America].
Historical notes. This species has not previously been recorded from Trinidad, and is not known from Tobago (Cock 2017). My identification is based on a comparison with the NHMUK series. Stoll's original plate shows the sexually dimorphic female (reproduced here as Fig. 7). It seems a fair match to the male shown here from Trinidad (Figs. 6, 8), but there are several similar species in South America, so confirmation of the female from Trinidad would be desirable.
Identification. I have only seen males from Trinidad; the sharply defined predominantly white costal half of the dorsal forewing is distinctive. Stoll's original plate of the female (Fig. 7) shows that the costal half of the dorsal forewing is pale brown rather than white, and there are contrasting markings on the remainder of the dorsal surface.
Status in Trinidad. An uncommon species with scattered records from forested parts of the lower areas of the Northern Range.
Arima Valley, Simla, MVL: 2♂ 6.viii.1982 (M.J.W. Cock) [MJWC; UWIZM CABI.3808]
Cumaca Road, 4.6 miles, MVL: ♂ 21.x.1982 (M.J.W. Cock) [MJWC]
Grand Tacaribe: ♂ 30.viii.2014 (K. Sookdeo, moths 47) (Fig. 8)
Hollis Reservoir, at light: ♂ 2.xi.1978 (M.J.W. Cock) [MJWC] (Fig. 6)

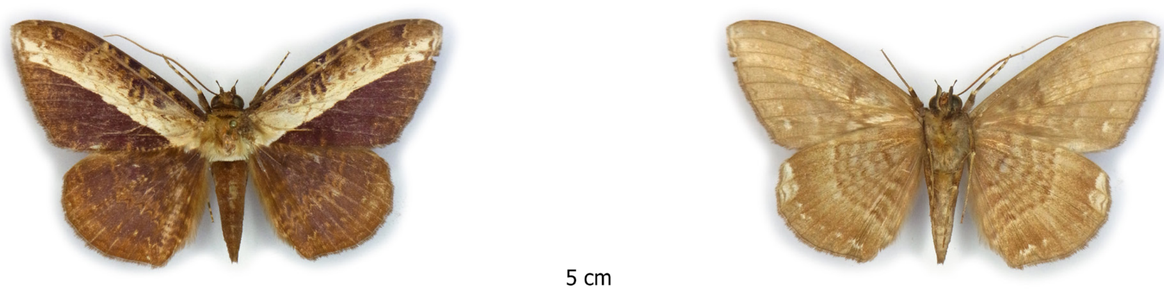

Fig. 6. Male *Hemeroblemma helima*, Hollis Reservoir, at light, 2.xi.1978 (M.J.W. Cock).

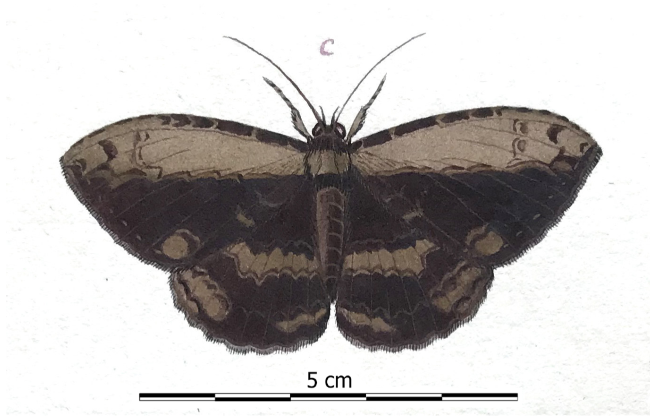

Fig. 7. The original figure for Stoll's (1782, pl. 309, Fig. D) plate of *Hemeroblemma helima* (female). From an image taken by Alberto Zilli, courtesy of Library and Archives of the Natural History Museum, © Trustees of the Natural History Museum, released under Creative Commons license CC BY 4.0 http://creativecommons.org/licenses/by/4.0/.

Fig. 8. Living male *Hemeroblemma helima*, Grand Tacaribe, 30.viii.2014 (K. Sookdeo photo), © K. Sookdeo with permission.

***Hemeroblemma leontia* (Stoll, 1790)**

Stoll (1790): *Phal[aena] Noct[ua] helima*, TL Brazil, Rio de Janeiro

Hemeroblemma helima var. *rengus* (Poey): Kaye (1901) [misidentification / synonym]

Pessina [sic] *leontia* (Stoll): Wilson (1894)

Peosina leontia (Stoll): Kaye (1901), Druce (1881-1900)

Melanchroia leontia (Stoll)*:* Kaye and Lamont (1927), Kirkpatrick (1953)

Hemeroblemma rengus (Poey): Kaye and Lamont (1927), Kirkpatrick (1953) [synonym]

Hemeroblemma leontia (Stoll): Cock (2017)

Historical notes. The marked sexual dimorphism in this species led early workers to believe that the male and female represented separate species (Kaye 1901, Kaye and Lamont 1927, Kirkpatrick 1953). In 1981, I was fortunate enough to encounter a mating pair (Fig. 9), which drew my attention to the association of the two sexes. It is also found in Tobago (Cock 2017).

Taxonomic issues. The name *leontia* Stoll was not included in Poole's (1989) catalogue of the world Noctuidae, perhaps because it had been placed in the geometrid genus *Melanchroia*. My identification was by comparison with the all-male NHMUK series. The *H. leontia* phenotype is male. The female has been treated as the Cuban *H. rengus* (Poey, 1832), which in turn has been treated a synonym of the male *H. numeria* (Drury, 1773) from Jamaica (Núñez Aguila and Barro Cañamero 2012). As Cock (2017) wrote, the female of *H. leontia* certainly resembles the female of *H. rengus*, and they were treated as the same species in the NHMUK. I have not investigated possible synonymy for this publication as *H. leontia*, described from Rio de Janeiro (given as Surinam in error in Cock (2017)), is the older name and satisfactory for use for the species that occurs in Trinidad and Tobago.

Identification. The male (Fig. 9 above) with its large, bright white apical areas of the dorsal and ventral hindwing contrasting with the dark brown-purple remainder of the wings cannot be mistaken for any other Trinidad species. The female (Fig. 9 below) is much less distinctive, and superficially resembles *H. malitiosa* (Fig. 11), but note the different wing shape and the pale brown markings near the tornus of the dorsal forewing.

Biology in Trinidad. In his study on Lepidoptera pests of cacao, Kirkpatrick (1953) treated the female as *H. rengus* and the male as *M. leontia.* He found the caterpillars not uncommon on flush cacao. Larvae of both 'species' were very similar except for the larger female (his *H. rengus*), and more slowly developing male (his *M. leontia*). Regarding the female he wrote 'Larva about 65 mm. long, reddish brown, finely reticulated with yellowish green, indistinct paler oval marks on the dorsal line; 8th abdominal segment with a pair of small conical protuberances, yellow at the apex and bearing a long dark hair; 9th segment with two pairs of long hairs; a minute yellow dorsal spot on the anterior margin of 2nd abdominal segment and on the outer sides of the protuberances. Abdominal feet only on the 4th, 5th, 6th and 10th segments. The early instars are black with sparse long hairs and without prolegs on the 4th segment. Duration of larval stages about 17 days, of pupa 12-14 days. Generally distributed and not uncommon throughout the year.' While of the male he wrote: 'Larva about 50 mm. long, very similar to that of *H. rengus* [i.e. the female]; the pale reticulations rather brighter yellow, and no yellow spot at the base of the tubercles on the 8th abdominal segment. Duration of the larval stage considerably longer than that of [the female], about 28 days; the pupal stage lasts 11-14 days. Throughout the year, not uncommon.'

Status in Trinidad and Tobago. Generally quite common and widespread in Trinidad and Tobago, in disturbed forest and suburban areas.

Arima Valley, Simla, MVL: 2♀ 30.vii.1981 (M.J.W. Cock) [MJWC; UWIZM CABI.3809]
Near Brasso Seco, 10.739N 61.257W: ♂ 1.x.2016 (M.G. Rutherford photo) [iNaturalist observation 12466988]
Nr Centeno: ♂♀ in cop. 24.viii.1981 (M.J.W. Cock) [MJWC] (Fig. 9)
Curepe: ♂ 5.x.1978 (M.J.W. Cock) [MJWC]
Monte Video: ♀ 7.i.2014 (J. Morrall) [MJWC]
Morne Bleu, Textel Installation, at light: ♀ 20.xi.1978 (M.J.W. Cock) [MJWC]
Palmiste: ♂ undated [N. Lamont] [UWIZM.2013.13.1523, as *Melanchroia leontia*]; ♂ vii.1915 [N. Lamont] [UWIZM.2013.13.1520, as *Melanchroia leontia*]; ♀ x.1915 [N. Lamont] [NMS, as *Hemeroblemma rengus*]; ♀ 9.x.1917 [N. Lamont] [NMS, as *Hemeroblemma rengus*]; ♀ 14.ii.1926 [N. Lamont] [NMS, as *Hemeroblemma rengus*]; ♂ 13.iii.1932 [N. Lamont] [NMS]; ♀ 9.iii.1934 [UWIZM.2013.13.1510, as *Hemeroblemma rengus*]; ♀ 21.xii.1936 [N. Lamont] [UWIZM.2013.13.1512, as *Hemeroblemma rengus*]; ♀ 12.ii.1938 [N. Lamont] [NMS, as *Hemeroblemma rengus*]; ♀ 4.iv.1947 [N. Lamont] [UWIZM.2013.13.1513, as *Hemeroblemma rengus*]; ♀ 24.x.1947 [N. Lamont] [UWIZM.2013.13.2395, as *Hemeroblemma rengus*]
< 15 mi from Port of Spain, < 1,000 ft.: ♂ xii.1913-iv.1914 (F.W. Jackson) [OUNHM]
San Fernando: ♂ 1922 (R.W. Farmborough) [OUNHM]
Santa Cruz, on cacao: ♂ v.1951 (T.W. Kirkpatrick) [UWIZM.2014.9.371 (ICTA 15578) as *Melanchroia leontia*]; ♂, 2♀ vi.1951 (T.W. Kirkpatrick) [♂ UWIZM.2014.9.374 (ICTA 15580) as *Melanchroia leontia*; 2♀ UWIZM.2014.9.322-323 (ICTA15573, 15574), as *Hemeroblemma rengus*]; ♂ i.1952 (T.W. Kirkpatrick) [UWIZM.2014.9.372 (ICTA 15581) as *Melanchroia leontia*]
S. of S[an] Fernando, Palmiste, cult'd estate: ♂ 1922 (R.W. Farmborough) [OUNHM]
South Oropouche, Mondesir: ♂ 19.xi.2009 (T.P. Maharaj photo 1670658) (Fig. 10)
St. Augustine, on cacao: ♂ undated (T.W. Kirkpatrick) [UWIZM.2014.9.373 (ICTA 15579) as *Melanchroia leontia*]; ♂ v.1951 (T.W. Kirkpatrick) [UWIZM.2014.9.370 (ICTA 15577) as *Melanchroia leontia*]; ♀ vi.1951 (T.W. Kirkpatrick) [UWIZM.2014.9.324 (ICTA 15576) as *Hemeroblemma rengus*]; ♀ viii.1951 (T.W. Kirkpatrick) [UWIZM.2014.9.325 (ICTA15575) as *Hemeroblemma rengus*]
Trinidad: 6♂,4♀ (1 ♀ no abdomen) undated [N. Lamont] [4♂,3♀ NMS, ♂♂ as *Melanchroia leontia*, ♀♀ as *Hemeroblemma rengus*; 2♂ UWIZM.2013.13.1521-22, as *Melanchroia leontia,* ♀ UWIZM.2013.13.1511, as *Hemeroblemma rengus*]
[Trinidad]: ♀ [UWIZM.214.9.1440, ex ICTA]
TOBAGO, Englishman's Bay, at light: ♂ vi-xii. 2009, J. Ingraham [UWIZM.2015.15.156]
TOBAGO, near Parlatuvier, at light: ♂, ♀ i.2009 (A. Zheludev) [https://www.neutron.phys.ethz.ch/Lepidoptera/index.html AZ12-248, AZ12-0251]

Fig. 9. Male and female *Hemeroblemma leontia* captured *in copulo,* Nr Centeno, 24.viii.1981 (M.J.W. Cock).

Fig. 10. Living male *Hemeroblemma leontia,* South Oropouche, Mondesir, 19.xi.2009, T.P. Maharaj photo, © T.P. Maharaj with permission.

Hemeroblemma malitiosa **(Guenée, 1852)**
Guenée (1852): *Brujas malitiosa*, TL Brazil.

Historical notes. This represents a new record for both Trinidad and Tobago. It was identified by comparison with the NHMUK series.

Taxonomic issues. Janzen and Hallwachs (2019) indicate at least two species are mixed under this name in Costa Rica, but there is no information about this possibility from South America.

Identification. In the specimens available to me, the male is a darker brown than the female but they are otherwise similar. A rather undistinguished species, but note the distinctive shape of the submarginal line of the dorsal forewing. The wings are squarer and shorter than those of female *H. leontia* and the pale brown markings near the tornus of the dorsal forewing of that species are absent in *H. malitiosa*.

Status in Trinidad and Tobago. A rare species recorded from lowland forest in southern Trinidad and north eastern Tobago.

Parrylands Oilfield, MVL: ♂ 7.xi.1980 (M.J.W. Cock) [MJWC] (Fig. 11 above); ♀ 25.vii.1981 (M.J.W. Cock) [MJWC] (Fig. 11 below)

TOBAGO, near Parlatuvier, at light: ♀ i.2009 (A. Zheludev) [https://www.neutron.phys.ethz.ch/Lepidoptera/index.html AZ12-0252]

Hemeroblemma ochrolinea (Guenée, 1852)
Guenée (1852): *Peosina ochrolinea*, TL Brazil.

Historical notes. This species has not previously been recorded from Trinidad, and is not known from Tobago (Cock 2017). It was identified by comparison with NHMUK series.

Identification. There is strong sexual dimorphism in this species. The male is superficially similar to *H. opigena pandrosa* below, but note that the ventral wing markings are completely different, the line from base to apex of the dorsal forewing is yellow-brown (as implied in the specific name) rather than white, and the tornal area distal to this line is relatively uniform rather than sharply divided. The female lacks the yellow-brown line of the dorsal forewing, although there is a yellow-brown suffusion, particularly at

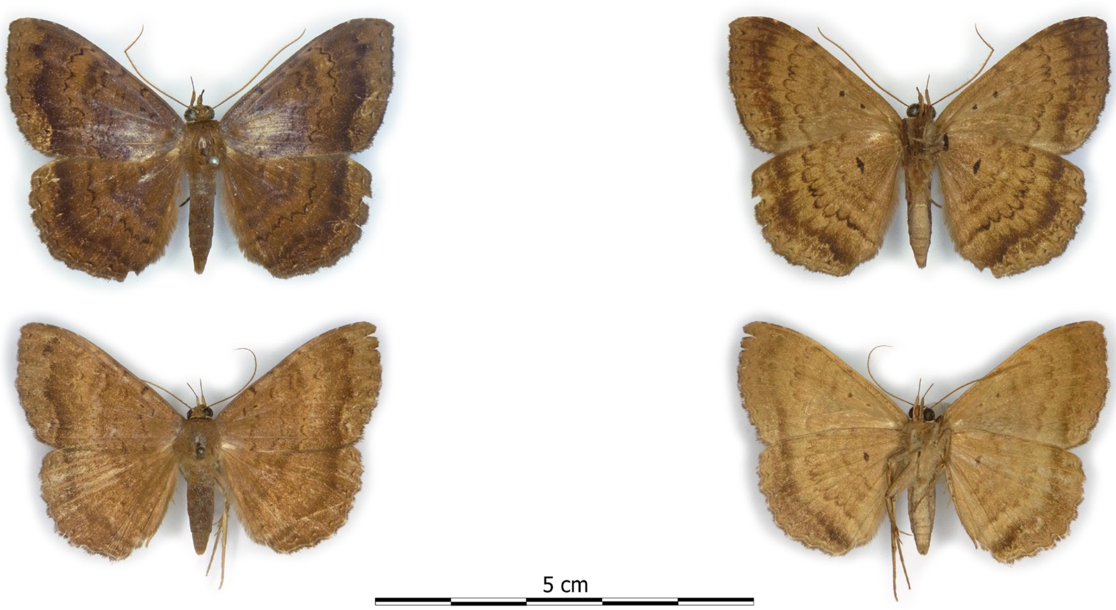

Fig. 11. Male (above) *Hemeroblemma malitiosa*, Parrylands Oilfield, MVL, 7.xi.1980 (M.J.W. Cock); female (below), Parrylands Oilfield, MVL, 25.vii.1981 (M.J.W. Cock).

the base of the forewing dorsum; ventrally it is similar to the male.

Status in Trinidad. A rare species in Trinidad, known from two specimens collected at light in lowland forested areas, and one photographic record from Brasso Seco in the Northern Range.

Brasso Seco: ♀ 12.iv.2020 (R. Deo photo) [iNaturalist observation 42283669] (Fig. 13)

Cumaca Road, 4.6 miles, MVL: ♂ 21.x.1982 (M.J.W. Cock) [MJWC] (Fig. 12)

Rio Claro-Guayaguayare Road, milestone 6.5, MVL: ♂ 30.ix.1978 (M.J.W. Cock) [MJWC]

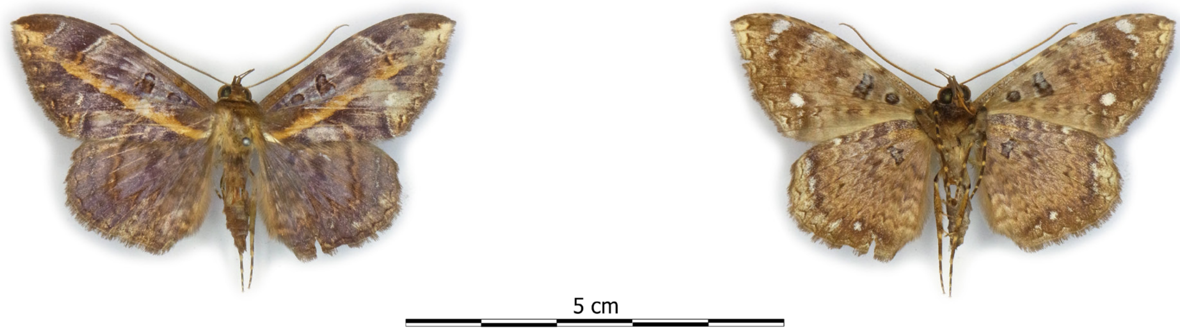

Fig. 12. Male *Hemeroblemma ochrolinea*, Cumaca Road, 4.6 miles, MVL, 21.x.1982 (M.J.W. Cock).

Fig. 13. Female *Hemeroblemma ochrolinea*, Brasso Seco: ♀ 12.iv.2020, R. Deo photo, iNaturalist observation 42283669, © R. Deo with permission.

***Hemeroblemma opigena* (Drury, 1773) *pandrosa* (Cramer, 1776)**

Drury (1773): *Phalaena Noctua opigena*, TL Jamaica.

Cramer (1776): *Phalaena Bombyx pandrosa*, TL Surinam, a subspecies (Barbut and Lalanne-Cassou 2005)

Peosina pandrosa (Cramer): Druce (1881-1990)

Hemeroblemma pandrosa (Cramer): Kaye and Lamont (1927)

Historical notes. Identified by comparison with NHMUK series. It is reported here from Tobago for the first time, based on a specimen collected by Andrey Zheludev.

Taxonomic notes. Almost identical DNA barcodes are available in BOLD (2020a) for this species from USA, Central America, Venezuela, French Guiana and Brazil, so that there is little doubt that a single widespread species is present on the mainland. There are no barcodes available for this species from Jamaica, so the treatment of the mainland *pandrosa* as a subspecies of the Jamaican *opigena* cannot yet be assessed based on barcodes.

Identification. This species shows strong sexual dimorphism in the dorsal view, although the ventral view is similar in both sexes. In dorsal view, the males are superficially similar to those of the last species, although the pale diagonal line is white rather than yellow, etc. However, the ventral view is very different, being rather plain in this species, and strongly mottled in *H. ochrolinea.* The size, wing shape, smooth margins and relatively uniform colour of the dorsal view of the female make it a distinctive species in Trinidad. In particular, the smooth wing margins compared to the crenulate margins of the last species are distinctive.

Status in Trinidad and Tobago. An occasional species in Trinidad found in forested areas to at least 700 m. Just one record from the north east of Tobago.

Arima Valley, 10.704 -61.283, at fallen fruit: ♂ 29.xi.2019 (R. Deo photo) [iNaturalist observation 36195538]

Arima Valley, Simla, MVL: ♂ 22.vii.1981 (M.J.W. Cock) [MJWC] (Fig. 14)

Fyzabad, oilfield, forest surrounded: ♂ 16.x.1917 (R.M. Farmborough) [OUNHM]

Upper Guanapo Valley, 10.710 -61.273: ♂ 29.xi.2019 (S. Manchouk photo) [iNaturalist observation 38096706]

Upper Guanapo Valley, at fallen fruit, 10.709 -61.274: ♂ 29.xi.2019 (S. Manchouk photo) [iNaturalist observation 38096707] (Fig. 16)

Upper Guanapo Valley, on ground, 10.710 -61.270: ♀ 29.xi.2019 (S. Manchouk photo) [iNaturalist observation 38096708] (Fig. 17)

Inniss Field, 10.171 -61.268: ♂ 3.viii.2019 (R. Deo photo) [iNaturalist observation 30270377] (Fig. 17)

Morne Bleu, Textel Installation, at light: ♀ 13.ix.1978

(M.J.W. Cock) [MJWC] (Fig. 15)
Palmiste: ♂ 31.i.1917 [N. Lamont] [UWIZM.2013.13.1514, as *Hemeroblemma pandrosa*]
Valencia Forest, MVL: ♀ 5.viii.1981 (M.J.W. Cock) [MJWC]
Trinidad: ♂ undated [N. Lamont] [NMS, as *Hemeroblemma pandrosa*]; ♂ [N. Lamont] [UWIZM.2013.13.1515, as *Hemeroblemma pandrosa*]
TOBAGO, Englishman's Bay, at light: ♀ (J. Ingraham) [UWIZM.2015.15.161]
TOBAGO, near Parlatuvier, at light: ♂ i.2009 (A. Zheludev) [https://www.neutron.phys.ethz.ch/Lepidoptera/index.html AZ12-0253]

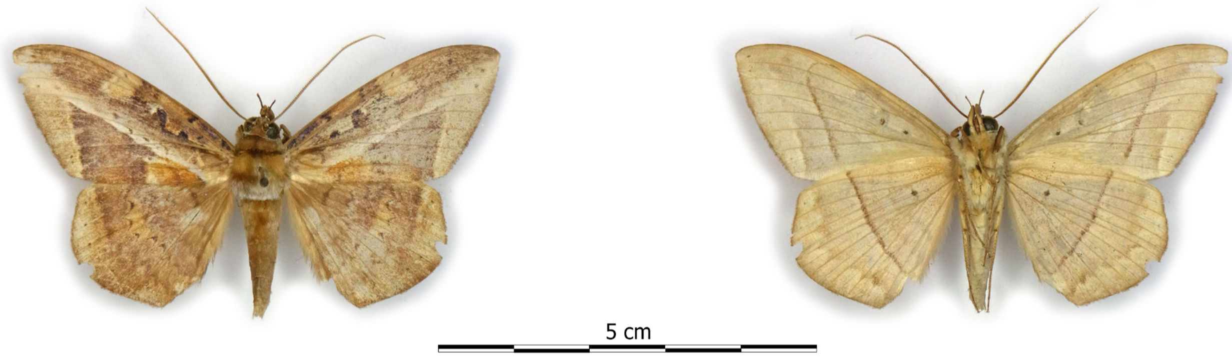

Fig. 14. Male *Hemeroblemma opigena,* Arima Valley, Simla, MVL, 22.vii.1981 (M.J.W. Cock).

Fig. 15. Female *Hemeroblemma opigena,* Morne Bleu, Textel Installation, at light, 13.ix.1978 (M.J.W. Cock).

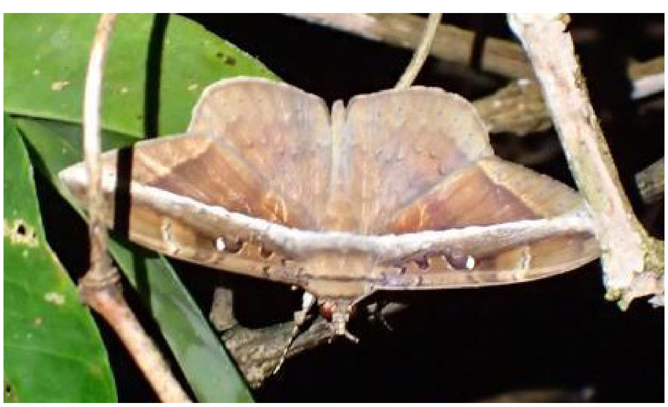

Fig. 16. Living adult male *Hemeroblemma opigena,* Upper Guanapo Valley, 29.xi.2019, S. Manchouk photo, iNaturalist observation 38096706, © S. Manchouk with permission.

Fig. 17. Living adult female *Hemeroblemma opigena,* Upper Guanapo Valley, 29.xi.2019, S. Manchouk photo, iNaturalist observation 38096708, © S. Manchouk with permission.

Letis Hübner, 1821
Type species: *Letis specularis* Hübner 1821.
In the past, some species of this genus (in the broad sense) have been placed in *Blosyris* Hübner but that is a synonym of *Hemeroblemma*. The genus *Syrnia* Hübner, [1821] also appears in the Trinidad literature. It has been considered a synonym of *Letis*, but is now recognised as a valid genus. Thus, Berio (1991) revised the genus *Letis* and divided it into five genera based on the male genitalia, the distance between the eyes, and other characters of the head:

- *Letis* Hübner, [1821], type species *specularis* Hübner, [1821]
- *Syrnia* Hübner, [1821], type species *hypnois* Hübner, [1821]
- *Feigeria* Berio, 1991, type species *herilia* (Stoll, 1780)
- *Ronania* Berio, 1991, type species *marmorides* (Cramer, 1775)
- *Latebraria* Guenée, 1852, type species *amphipyroides* Guenée, 1852

Collectively the five genera have been referred to as *Letis sensu lato*, as not all workers adopted the new genera. Zilli (2003) raised concerns about the morphological characters that Berio used, but acknowledged that Berio's changes also relied heavily on the male genitalia illustrated posthumously by Feige [1991]. Barbut *et al.* (2012) studied the 17 *Letis* (*sensu lato*) spp. from French Guiana (which includes all the species recognised here from Trinidad) and based on male and female genitalia dissections concluded that Berio's genera were valid, but there were two more genera represented within *Letis* (*sensu lato*). However, they concluded that until molecular studies could be used to clarify and confirm the relationships, it would be premature to describe additional genera. Certainly, based on the public DNA barcodes available in BOLD (2020c), the genera within Thermesiini will need further work to create monophyletic groups. Here, I follow Zilli (2003) as modified by Barbut *et al.* (2012) with the reservations just alluded to, and recognise the following genera groups in Trinidad that were previously treated as *Letis* spp.:

- *Feigeria* Berio, with five species: *F. buteo* (Guenée), *F. herilia* (Stoll), *F. magna* (Gmelin), *F. mycerina* (Cramer), and *F. scops* (Guenée)
- *'Letis' incertae sedis* genus group 1, with one species, '*L*'. *doliaris* (Guenée)
- *'Letis' incertae sedis* genus group 2, with two species, '*L.*' *arcana* Feige, '*L*'. *iphianasse* (Cramer)

Feigeria **Berio, 1991**
See the discussion above under *Letis*. The type species of the genus is *F. herilia*, which occurs in Trinidad. Four of the five Trinidad species are quite common, and are amongst the most photographed moth species in Trinidad, e.g. https://www.inaturalist.org/. All are large, and show slight to moderate sexual dimorphism, and some are quite variable in colour and contrast of their markings.

Feigeria buteo **(Guenée, 1852)**
Guenée (1852): *Letis buteo*, TL Brazil.
Letis hercyna (Drury): Wilson (1894), Kaye (1901) [misidentification]
Blosyris buteo (Guenée): Kaye and Lamont (1927)
Feigeria buteo (Guenée): Cock (2017)
Historical notes. Identified by comparison with the NHMUK series. This species also occurs in Tobago (Cock 2017).
Taxonomic issues. Janzen and Hallwachs (2019) indicate there may be as many as four species under this name in Costa Rica but this possibility has not been evaluated for South America.
Identification. The size and more or less pale area from near the base of the dorsum to the apex should distinguish this species from others of the genus. It is quite variable with regard to the tone and contrast of the dorsal wings (compare Figs. 18-21), but the ventral wings are much more consistent. Females are larger than males, the forewings less pointed, and the pale area of the forewing is less white and contrasting, although usually sufficiently differentiated to distinguish female *F. buteo* from other *Feigeria* spp.
Status in Trinidad and Tobago. A common species, mainly found in forested areas to at least 700m in the Northern Range.
Arima: ♂ 7.ii.1938 [N. Lamont] [UWIZM.2013.13.1594]; ♀ 5.iii.1938 [N. Lamont] [NMS]
Arima Valley, 10.685N 61.290W: ♀ 7.ix.2015 (M.G. Rutherford photo) [iNaturalist observation 11332106]
Arima Valley, 10.701 -61.283: ♂ 29.xi.2019 (R. Deo photo) [iNaturalist observation 36195492]
Arima Valley, Asa Wright: ♀ 10.v.2007 (I. Woiwod) [photo]; ♂ 29.i.2009 (gavin_miller photo) [iNaturalist observation 49576413]; ♀ 22.viii.2009 (K. Zyskowski photo) [iNaturalist observation 7548928]; ♀ 8 or 11.xii.2013 (P. Prior) [iNaturalist observations 1788429 and 5429999]; ♀ 7.xii.2019 (jaredclarkenl photo) [iNaturalist observation 36535011]; ♀ 18.xii.2019 (N. Norman photo) [iNaturalist observation 36762278]
Arima Valley, Scott's Quarry: ♀ 25.xii.2018 (R. Deo photo) [iNaturalist observation 19268473]
Arima Valley, Simla, at light: ♂ 28.vi.2004 (M.G. Rutherford photo) [iNaturalist observation 52035947]; ♀ 28.viii.2016 (M.G. Rutherford photo) [iNaturalist

observation 12413927]
Caroni-Arima Road, 10.565 -61.292: ♀ 27.x.2019 (miriam_amy photo) [iNaturalist observation 47118711]
Curepe: ♂ undated (F.D. Bennett) [UWIZM CABI.4735]
Curepe, MVL: ♂ x.1979 (M.J.W. Cock) [MJWC]; ♂ 8-13.ix.1981 (M.J.W. Cock) [MJWC] (Fig. 18)
Curucaye, 10.683 -61.451: ♀ 1.viii.2019 (stefairy photo) [iNaturalist observation 29989291]
Cushe Village, Cunapo Southern Main Road, approximately mid-way between Biche and Rio Claro, +10.38, -61.18: ♀ 26.ix.2017 20.35h (Kamal Mahabir photo 20170926_203548-1.jpg)
Upper Guanapo Valley, 10.711 -61.275: ♀ 29.xi.2019 (S. Manchouk photo) [iNaturalist observation 38096714] (Fig. 24)
Maracas Valley, Avondale Gardens / Riverview Gardens, 10.677 -61.412: ♀ 21.ii.2020 (R. Williams-Littzen photo) [iNaturalist observation 39029778]
Morne Bleu, Textel Installation, at light: ♂ 26.vi.1978 (M.J.W. Cock) [UWIZM CABI.4738, TL-148]; ♀ 3.vii.1978 (M.J.W. Cock) [MJWC] (Fig. 21); ♂ 21.vii.1989 (R.G. Brown & T. Cassie) [UWIZM CABI.4737]
Nr. Moruga, off Edwards Trace, 10.129 -61.259: ♂ 30.viii.2019 (S. Manchouk photo) [iNaturalist observation 33717141]
Palmiste: ♀ x.1915 [N. Lamont] [NMS]; ♂ 30.x.1946 [N. Lamont] [UWIZM.2013.13.1597]; ♂ 1.xi.1946 [N. Lamont] [UWIZM.2013.13.1595]; ♂ 11.iv.1948 [N. Lamont] [UWIZM.2013.13.1596]
Penal, at light: ♂ 8.i.2010 (K. Sookdeo photo, moths 22) (Fig. 22)
Port of Spain, Lady Chancellor Road, 10.687 -61.512: ♂ 7.ii.2020 (M. Gibson photo) [iNaturalist observation 38385892]
Santa Cruz: ♂ 9.vii.2020 (stefairy photo) [iNaturalist observation 52568013]
South Oropouche, Mondesir: ♂ 9.iii.2010 (T.P. Maharaj photo DSCN1554)
St Ann's, Fondes Amandes Road, 10.687 -61.502: ♀ 2.ix.2019 (sarah-lee photo) [iNaturalist observation 31980342]
Nr. St. Augustine: ♂ 24.ix.1924 (W.C. Lester-Smith) [OUNHM]
Tucker Valley, 10.730 -61.616: ? 29.xi.2019 (S. Manchouk photo) [iNaturalist observation 38096702]
Trinidad: ♂ iv-v.1902 (E. Bourke) [OUNHM]; ♂ undated [UWIZM CABI.4736]; ♀ undated [N. Lamont] [NMS]
TOBAGO, Cuffie River Nature Resort: ♂ 23.xi.2009 (C. Sexton photo) [iNaturalist observation 2510438]
TOBAGO, Englishman's Bay, at light: ♂ 20.iii.2019 (M. Kelly photo 4654) (Fig. 23)
TOBAGO, Runnemede Local Road [Cuffie River Nature Resort], 11.24N 60.70W: ♀ 14.x.2017 (tlaloc27 photo) [iNaturalist observation 8434698]
TOBAGO, Scarborough, Marden House, MVL: ♂ 9.i.1982 (M.J.W. Cock) [MJWC] (Fig. 20)
TOBAGO, Nr. Speyside, fruit trap: ♂ 17.v.1982 (M.J.W. Cock) [MJWC] (Fig. 19)

Fig. 18. *Feigeria buteo* ♂ Curepe, MVL, 8-13.ix.1981 (M.J.W. Cock).

Fig. 19. *Feigeria buteo* ♂*,* Tobago, Nr. Speyside, fruit trap, 17.v.1982 (M.J.W. Cock).

Fig. 20. Male *Feigeria buteo* ♂*,* Tobago, Scarborough, Marden House, MVL, 9.i.1982 (M.J.W. Cock).

Fig. 21. Female *Feigeria buteo,* Morne Bleu, Textel Installation, at light, 3.vii.1978 (M.J.W. Cock).

Fig. 22. Living adult male *Feigeria buteo*, Penal, 8.i.2010, K. Sookdeo photo, © K. Sookdeo with permission.

Fig. 23. Living adult male *Feigeria buteo*, Tobago, Englishman's Bay, at light, 20.iii.2019, M. Kelly photo, © M. Kelly with permission.

Fig. 24 Living adult female *Feigeria buteo*, Upper Guanapo Valley, 29.xi.2019, S. Manchouk photo, iNaturalist observation 38096714, © S. Manchouk with permission.

Feigeria herilia (Stoll, 1780)

Stoll (1780): *Phalaena Noctua herilia*, TL Surinam.

Blosyris herilia (Stoll): Kaye and Lamont (1927)

Historical notes. My identification is based on a comparison with the NHMUK series. There may be confusion in some of the old records as three *F. herilia* in Sir Norman Lamont's collection in UWIZM were identified as *L. alauda*. Not known from Tobago (Cock 2017).

Identification. This is a large distinctive species, by virtue of the pale brown or white patches on the dorsal forewing costa and termen and hindwing apex (Figs. 25-27).

Status in Trinidad. An occasional species in forested areas.

Arima Valley, Asa Wright Nature Centre, at light: ♀ 29.i.2009 (gavin_miller photo) [iNaturalist observation 50324081]; ♂ 21.ix.2013 (K. Sookdeo photo, moths 15) (Fig. 25); ♀ 11.ii.2017 (J. Muddeman, photo 0497); ?♂ 23.xii.2019 (M. McFarlane photo) [iNaturalist observation 36900418]; ?♀ 25.xii.2019 (M. McFarlane photo) [iNaturalist observation 36953344]

Arima Valley, near Temple Village, 10.674 -61.290, at light: ?♂ 22.iii.2020 (plups photo) [iNaturalist observation 40560870]

Clearwater Village, 1.5km from Rio Claro on Naparima-Mayaro Rd: ♀ 10.x.2017 (Savetree Dhanpat photo, img-20171010-wa0000.jpg)

Curepe: ♀ 22.v.1989 (T. Cassie) [UWIZM CABI.4729]

Cushe Village, Cunapo Southern Main Road, approximately mid-way between Biche and Rio Claro, +10.38, -61.18: ♀ ix.2017 (Kamal Mahabir, image P)

Morne Bleu, Textel Installation, at light: ♀ 28.viii.1978 (M. Dookie) [MJWC] (Fig. 27); ♀ 6.xii.1980 (M.J.W. Cock) [MJWC]; ♀ 3.iii.1981 (M.J.W. Cock) [MJWC]; ♀ 5.v.1989 (R.G. Brown & T. Cassie) [UWIZM CABI.4730]; ♂ 21.vii.1989 (R.G. Brown & T. Cassie) [UWIZM CABI.4739]; ♂ 25.iii.2016 (R. Heathcote photo) [iNaturalist observation 52071432]

Palmiste: ♂ 20.i.1917 [N. Lamont] [UWIZM.2013.13.1599, as *Blosyris alauda*]; ♂ 8.iii.1917 [N. Lamont] [UWIZM.2013.13.1598, as *Blosyris alauda*]

Above St Benedict's, 10.665N 61.400W: ? 4.xii.2010 (M.G. Rutherford photo) [iNaturalist observation 9861725]

Trinidad: ♂ undated [N. Lamont] [UWIZM.2013.13.1600, as *Blosyris alauda*] (Fig. 26)

Fig. 25. Living adult male *Feigeria herilia,* Arima Valley, Asa Wright Nature Centre, at light, 21.ix.2013, K. Sookdeo photo, © K. Sookdeo with permission.

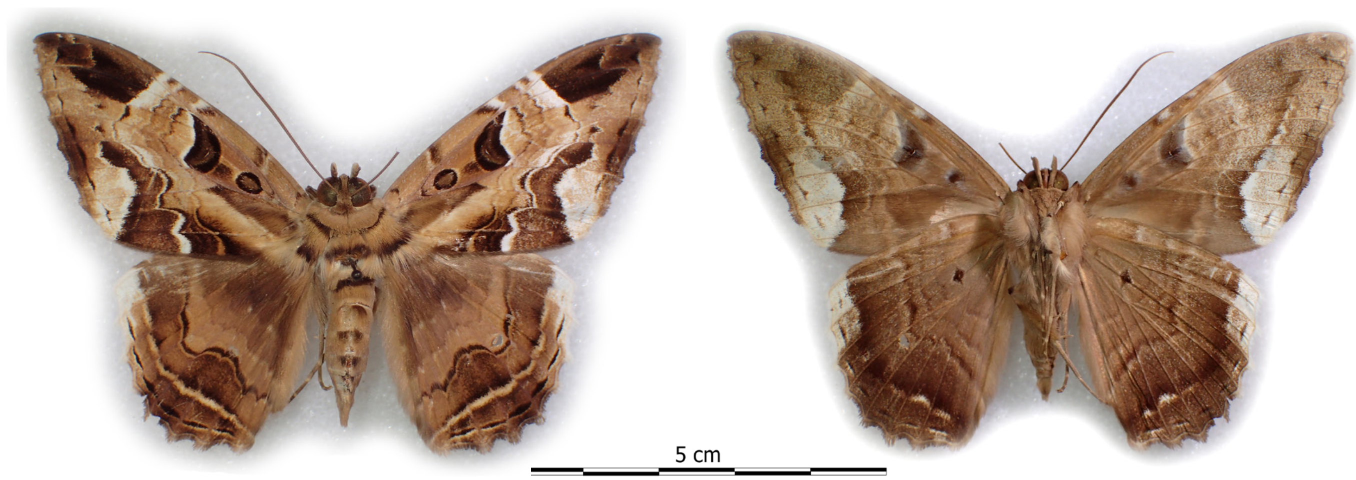

Fig. 26. Male *Feigeria herilia,* Trinidad, undated [N. Lamont] [UWIZM.2013.13.1600]. © UWIZM.

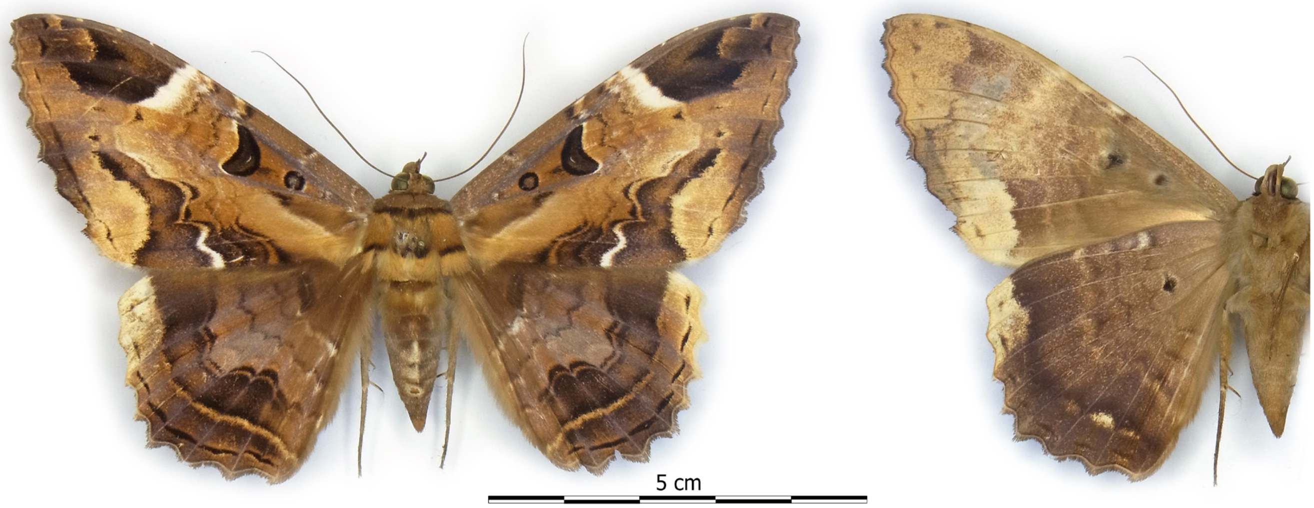

Fig. 27. Female *Feigeria herilia,* Morne Bleu, Textel Installation, at light, 28.viii.1978 (M. Dookie).

Feigeria magna **(Gmelin, 1790)**

Gmelin [1790]: *Phalaena Noctua magna*, TL "Extra European".

Letis magna (Gmelin): Kaye (1901)

Blosyris magna (Gmelin): Kaye and Lamont (1927)

Feigeria magna (Gmelin): Cock (2017)

Historical notes. My identification is based on a comparison with the NHMUK series. There may be confusion in the old records as I note that the four specimens in Sir Norman Lamont's collection [UWIZM] curated as this species are a male and three female *L. scops*. Also found in Tobago (Cock 2017).

Identification. Sexual dimorphism is strong with regard to wing shape and markings. The male is rather uniformly dark apart from the two forewing cell spots. The male of *F. mycerina* is also dark, but usually darker with the marginal areas clearly demarcated and paler. The female is dorsally quite variable with regard to the tone and contrast although the markings are fairly constant (Figs. 29-30, 32); ventrally they are more constant.

Status in Trinidad and Tobago. An occasional or common species mostly found in forested areas to at least 700m.

Arima Valley, Asa Wright Nature Centre: ♂ 8.xii.2018 (C.D. Jones photo) [iNaturalist observation 19047676]

Arima Valley, Simla, at light: ♂ i.2012 (D.J. Stradling photo, SAM_3785); ♂ 8.vii.2017 (N. Block photo) [iNaturalist observation 7152373]

Brigand Hill, lighthouse security MVL lights: Brigand Hill, lighthouse security MVL lights: ♂ 14.v.1989 (R.G. Brown & T. Cassie) [UWIZM CABI.4733]; ♂ 17.i.2004 (M.J.W. Cock) [MJWC] (Fig. 28)

Cushe Village, Cunapo Southern Main Road, approximately mid-way between Biche and Rio Claro, +10.38, -61.18: ♀ 14.ix.2017, 01.08h (Kamal Mahabir, image A)

Fonrose (south of), 10.267 -61.217: ♀ 31.xii.2018 (B. Hjelle photo) [iNaturalist observation 19383408] (Fig. 32)

Inniss Field, 10.173 -61.270: ♂ 30.viii.2019 (R. Deo photo) [iNaturalist observation 31788340]

Morne Bleu, Textel Installation, at light: ♂ 3.vii.1978

(M.J.W. Cock) [UWIZM CABI.4732]; ♀ 26.vii.1978 (M.J.W. Cock) [MJWC] (Fig. 29)
Parrylands Oilfield, MVL: ♂ 13.xi.1980 (M.J.W. Cock) [UWIZM CABI.4734]
South Oropouche, Mondesir: ♂ 23.i.2010 (T.P. Maharaj photo 1780185)
St Augustine, UWI: ♂ 7.ii.2018 (M.G. Rutherford photo) [iNaturalist observation 9761756]
Trinidad: ♂ undated [N. Lamont] [NMS, as *Blosyris abrupta*]
TOBAGO, Englishman's Bay, at light: 2♀ vi-xii. 2009, J. Ingraham (UWIZM.2015.15.159-160)
TOBAGO, Flagstaff Hill: ♂ 22.vi.2015 (M.G. Rutherford photo) [iNaturalist observation 11331365] (Fig. 31)
TOBAGO, near Parlatuvier, at light: 2♂, ♀ i.2009 (A. Zheludev) [https://www.neutron.phys.ethz.ch/Lepidoptera/index.html AZ12-0249, AZ12-02545, AZ12-0247] (Fig. 30)
TOBAGO, Parlatuvier, Pine Hill Trace 11.293 -60.651: ♀ 30.xii.2019 (M. McFarlane photo) [iNaturalist observation 37116915]

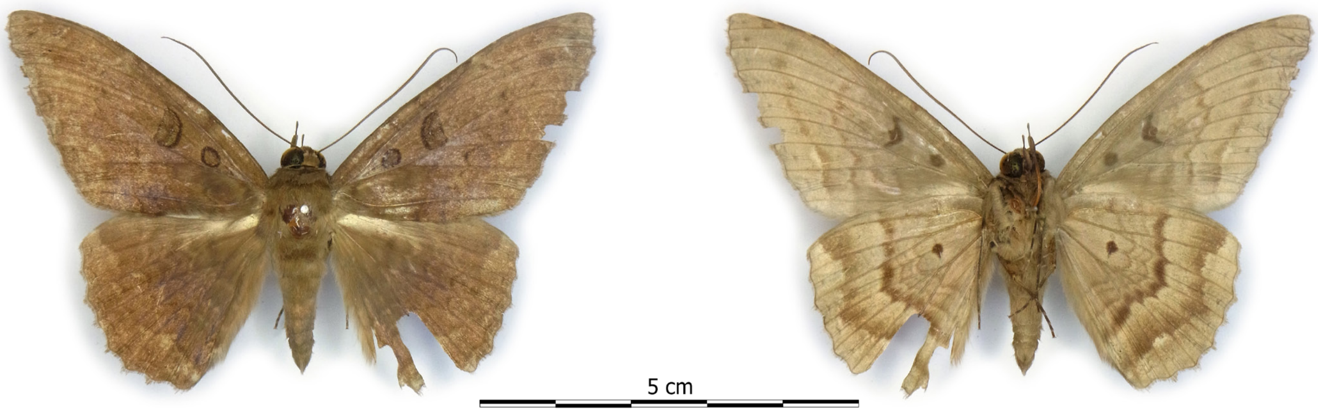

Fig. 28. Male *Feigeria magna* ♂, Brigand Hill, lighthouse security MVL lights, 17.i.2004 (M.J.W. Cock).

Fig. 29. Female *Feigeria magna,* Morne Bleu, Textel Installation, at light, 26.vii.1978 (M.J.W. Cock).

Fig. 30. Female *Feigeria magna,* Tobago, near Parlatuvier, at light, i.2009 (A. Zheludev) [coll. A. Zheludev] © A. Zheludev.

Fig. 31. Living adult male *Feigeria magna*, Tobago, Flagstaff Hill, 22.vi.2015, M.G. Rutherford photo, cropped from iNaturalist observation 11331365, Creative Commons licence CC-BY-NC.

Fig. 32. Living adult female *Feigeria magna*, south of Fonrose, 31.xii.2018, B. Hjelle photo, iNaturalist observation 19383408, Creative Commons license CC-BY-NC-ND.

***Feigeria mycerina* (Cramer, 1777)**

Cramer (1777): *Phalaena attacus mycerina*, TL Surinam

Letis mycerina (Cramer): Kaye (1901)

Feigeria mycerina (Cramer): Bhukal and Rutherford (2017)

Historical notes. Kaye (1901) recorded this species from Trinidad based on a male from Verdant Vale (i.e. Simla) which his brother, Steven Kaye, captured in the late 19th century. Kaye and Lamont (1927) did not mention this species. It is likely that the original identification was a misidentification since Kaye and Lamont (1927) listed a specimen of *F. buteo* which S. Kaye collected at Verdant Vale, which was not mentioned in Kaye (1901). I have checked the NHMUK collection and confirmed that there are no specimens of *F. mycerina* from Trinidad in the main collection, and there is one specimen of *F. buteo* of the right vintage, but without locality, which may well be S. Kaye's specimen. There were no subsequent records *F. mycerina* until M.G. Rutherford photographed a male on Soldado Rock, 10 km off Icacos Point, in November 2017 during the TTFNC Icacos Bioblitz (Bhukal and Rutherford 2017). There are no records from Tobago (Cock 2017). I identified the moth in Rutherford's photograph (Fig. 33) from Barbut *et al.* (2012).

Identification. This species shows strong sexual dimorphism. The dark male is most likely to be confused with *L. magna*, under which species differences are highlighted. The female is not known from Trinidad, but it is illustrated in Barbut *et al.* (2012) and an image from Brazil is included here to facilitate identification (Fig. 34). It is similar to the female of *F. buteo*, but a dark submarginal band, weakly interrupted beyond the cell on both wings should help to distinguish this species.

Status in Trinidad. Just the single confirmed record from Soldado Rock suggests this species may not be resident in Trinidad, rather a stray from the mainland.

SOLDADO ROCK: ♂ 4.xi.2017 (M. Rutherford photo, TTFNC Bioblitz) (Fig. 33)

Fig. 33. Living adult male *Feigeria mycerina*, Soldado Rock, 4.xi.2017, M. Rutherford photo, © M. Rutherford with permission.

Fig. 34. Living adult female *Feigeria mycerina*, Rio de Janeiro, Brazil, claudiomartins photo, © claudiomartins (iNaturalist name). Edited from https://www.inaturalist.org/observations/41011032, Creative Commons License CC-BY-NC.

***Feigeria scops* (Guenée, 1852)**

Guenée (1852): *Letis scops*, TL Uruguay.

Letis scops Guenée: Druce (1881-1900)

Letis alauda (Guenée): Kaye (1901) [misidentification]

Blosyris alauda (Guenée): Kaye and Lamont (1927) [misidentification]

Historical notes. I identified this species by comparison with the NHMUK series. Earlier records by Kaye (1901) and Kaye and Lamont (1927) were misidentified as *F. alauda*. Their records are based on specimens from Tabaquite (W.J. Kaye) and Palmiste, 22.xi.1915, 20.i.1917, 8.iii.1917, 22.x.1918, 21.i.1922 (N.L.). Two of the specimens from Palmiste are in the series of six in Sir Norman Lamont's collection in NMS; they had been identified as *Blosyris alauda* by Sir Norman Lamont, but are female *F. scops*. This species is not reported from Tobago (Cock 2017).

Identification. *Feigeria scops* and *F. alauda* are very similar in colour and markings, but *F. alauda* is fairly constant (comparable to Figs. 35 and 38 of *F. scops*) and significantly smaller (wingspan ♂ 65-75 mm, ♀ 80-90 mm) whereas *F. scops* is variable in the intensity and contrast of its markings and is larger (wingspan ♂ 85-95 mm, ♀ 65-105 mm) (Barbut *et al.* 2012). Furthermore, as Barbut *et al.* (2012) point out, the male of *F. scops* has an area of yellow-orange scent hairs in the basal half of space 1B of the ventral forewing and a purple sheen to the ventral hind wing, both of which are absent in *F. alauda*.

Status in Trinidad. This is one of the common *Feigeria* spp. in Trinidad, found in forested and suburban areas to at least 700m.

Arima Valley, Asa Wright Nature Centre, at light: ♀ 7.xii.2010 (P. Prior photo) [iNaturalist observation 29826641]; ♂ 21.ix.2013 (K. Sookdeo photo, moths 22) (Fig. 41)

Bayshore, Cedar Avenue: ♀ 6.x.2018 (Barbara_st_ photo)

Fig. 35. *Feigeria scops* ♂, Curepe, MVL, 8-13.ix.1981 (M.J.W. Cock).

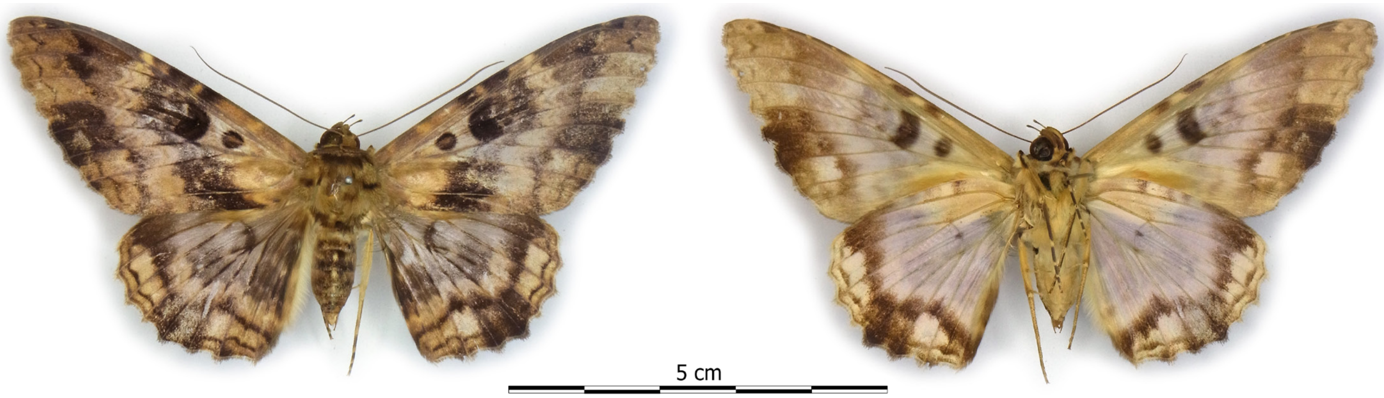

Fig. 36. *Feigeria scops* ♂, Cumaca Road, 4.6 miles, MVL, 21.x.1982 (M.J.W. Cock).

[iNaturalist observation 35935921] (Fig. 43)
Brigand Hill, lighthouse security MVL lights: ♀ 17.i.2004 (M.J.W. Cock) [MJWC]
Carapo, 10.599 -61.298: ♂ 13.xii.2019 (stefairy photo) [iNaturalist observation 36633407]
Cumaca Road, 4.6 miles, MVL: ♂ 21.x.1982 (M.J.W. Cock) [MJWC] (Fig. 36)
Curepe, MVL: ♀ 1-7.ix.1981 (M.J.W. Cock) [MJWC]; ♂ 8-13.ix.1981 (M.J.W. Cock) [MJWC] (Fig. 35); ♀ 13-20.ix.1981 (M.J.W. Cock) [MJWC] (Fig. 38)
Cumaca Road, 4.6 miles, MVL: ♂ 21.x.1982 (M.J.W. Cock) [MJWC]
Macqueripe Bay, 10.738 -61.611: ?♀ (S. Manchouk photo) [iNaturalist observation 26822810]

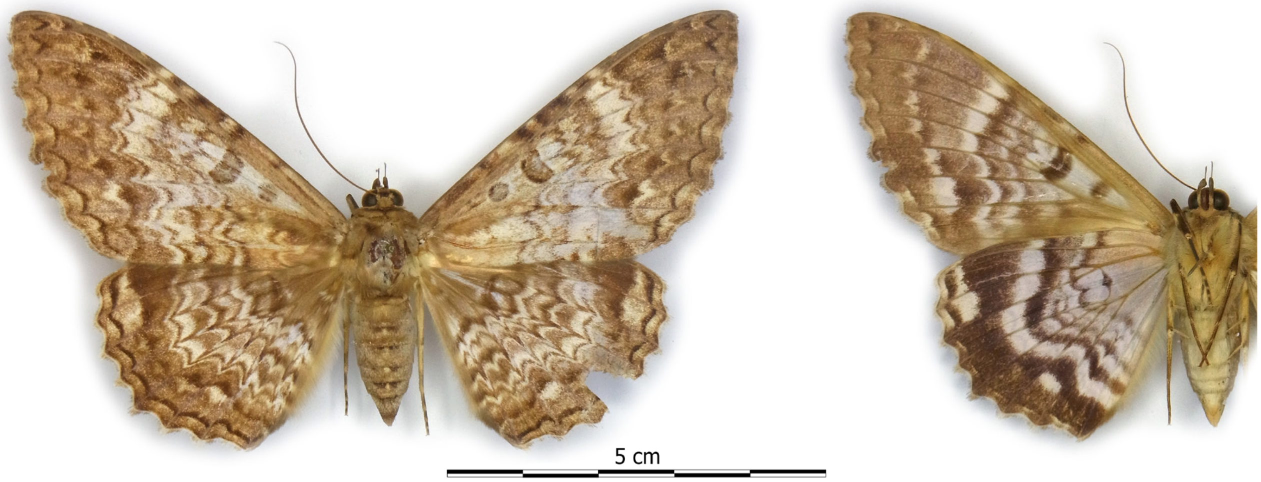

Fig. 37. *Feigeria scops* ♀, Morne Bleu, Textel Installation, at light, 30.viii.1978 (M.J.W. Cock).

Fig. 38. *Feigeria scops* ♀, Curepe, MVL, 13-20.ix.1981 (M.J.W. Cock).

Fig. 39. *Feigeria scops* ♀, Palmiste, 22.x.1918, [N. Lamont] [NMS], photos A. Whiffen, © NMS.

Fig. 40. *Feigeria scops* ♀, Palmiste, 22.x.1918, [N. Lamont] [NMS], photos A. Whiffen, © NMS.

Fig. 41. Living adult male *Feigeria scops*, Arima Valley, Asa Wright Nature Centre, at light, 21.ix.2013, K. Sookdeo photo, © K. Sookdeo with permission.

Fig. 42. Living adult female *Feigeria scops*, San Rafael, 18.vii.2010, T.P. Maharaj photo, © T.P. Maharaj with permission.

Fig. 43. Living adult female *Feigeria scops*, Trinidad, Bayshore, 6.x.2018, barbara_st_ photo, iNaturalist observation 35935921, Creative Commons license CC-BY-NC.

Morne Bleu, Textel Installation, at light: ♀ 30.viii.1978 (M.J.W. Cock) [MJWC] (Fig. 37)

Palmiste: 3♀ undated [N. Lamont] [UWIZM.2013.13.1591-93, as *Blosyris magna*]; ♀ 22.xi.1915 [N. Lamont] [NMS, as *Blosyris alauda*]; 2♀ 22.x.1918 [N. Lamont] [NMS, as *Blosyris alauda*] (Figs. 39,40); ♀ 15.ix.1947 [N. Lamont] [UWIZM.2013.13.2392]; ♂ 11.x.1947 [N. Lamont] [UWIZM.2013.13.1590, as *Blosyris magna*]

San Rafael: ♀ 18.vii.2010 (T.P. Maharaj photo P1860337) (Fig. 42)

South Oropouche, Mondesir: ♀ 4.i.2009 (T.P. Maharaj photo P1560911)

Trinidad: 2♂,♀ (♀ no abdomen) undated [N. Lamont] [NMS, as *Blosyris alauda*]

'Letis' doliaris (Guenée, 1852)

Guenée (1852): *Syrnia doliaris*, TL unknown.

Blosyris doliaris (Guenée): Kaye and Lamont (1927)

Historical notes. I identified this species by comparison with the NHMUK series. Cock (2017) does not record it from Tobago.

Identification. This is the smallest of the Trinidad species formerly placed in *Letis*, and this alone should distinguish it. Where the size is not known, e.g. photos of living moths (Fig. 46), it might be confused with female *F. buteo*, *F. scops* or female *F. mycerina*. The less pointed wings will help to distinguish it, as will the pale submarginal lines on both wings of *F. buteo* (Figs. 18-24), the paler and more translucent wings of *F. scops* (Figs. 35-43), and the more contrasting markings and stronger cell spots in the female of *F. mycerina* (Fig. 34).

Biology in Trinidad. I captured two males in a fruit trap set for butterflies, indicating that this genera group will also feed at fruit.

Status in Trinidad. An uncommon species, with records mostly from forested areas of the Northern Range to 700 m.

Arima Valley, Asa Wright Nature Centre: ♂ 22.iii.2015 (S. Nanz, photo 3436) (Fig. 46); ?♀ 26.vii.2017 (E. Rooks photo) [iNaturalist observation 9104198]

Arima Valley, Simla, fruit trap: 2♂ 12.vi.1982 (M.J.W. Cock) [MJWC] (Fig. 44)

Nr. Moruga, off Edwards Trace, 10.129 -61.259: ♂ 30.viii.2019 (S. Manchouk photo) [iNaturalist observation 33717136]

Morne Bleu, Textel Installation, at light: ♀ 20.xi.1978 (M.J.W. Cock) [MJWC] (Fig. 45)

Palmiste: ♂ 5.vi.1917 [N. Lamont] [UWIZM.2013.13.1586]

Trinidad: ♀ iv-v.1902 (E. Bourke) [OUNHM]; ♂ undated [N. Lamont] [NMS]

Fig. 44. Male *'Letis' doliaris,* Arima Valley, Simla, fruit trap, 12.vi.1982 (M.J.W. Cock).

Fig. 45. Female *'Letis' doliaris,* Morne Bleu, Textel Installation, at light, 20.xi.1978 (M.J.W. Cock).

Fig. 46. Living adult male *'Letis' doliaris* Arima Valley, Asa Wright Nature Centre, 22.iii.2015, S. Nanz photo, © S. Nanz with permission.

'Letis' arcana Feige, 1974

Feige (1974) *Letis arcana*, TL French Guiana.

Historical notes. My identification of the male in Fig. 47 is based on a comparison with the female illustrated by Barbut *et al.* (2012). Not known from Tobago (Cock 2017).

Identification. This is a moderately large species, about the same size as *F. magna* (Fig. 28) with a wingspan of 75 mm in the male and 80 mm in the female (Barbut *et al.* 2012). On the dorsal forewing, the pale bar from where the post discal line meets the dorsum at about two-thirds, to just short of the narrow cell spot, together with the cell spot which is at a slight angle, forms a pale bar across the wing. This combined with the dark areas each side of this line, interrupted by a broad brown streak from the base of the wing to the termen, and the dark area on the costa before the apex, should help to recognise this species. There is modest sexual dimorphism in wing shape and based on the single images I have seen of each sex, in the male the more contrasting dark areas on both dorsal wings are much more obvious, while the colouring of the female apart from the pale band across the wing is much more homogenous.

Status in Trinidad. The only Trinidad record is a photograph taken by R. Deo by night in the forest of the Northern Range. This species is very rarely collected in its known range in French Guiana and northern Brazil (Feige 1974, Barbut *et al.* 2012).

Brasso Seco, 10.756 -61.260: ♂ 18.iv.2020 (R. Deo photo) [iNaturalist observation 42649233]

Fig. 47. Living male *'Letis' arcana*, Brasso Seco, 8.i.2020, R. Deo photo, iNaturalist observation 42649233, © R. Deo with permission.

'Letis' iphianasse (Cramer, 1777)

Cramer (1777) *Phalaena Attacus iphianasse*, TL Surinam.
Syrnia iphianasse (Cramer): Wilson (1894), Kaye (1901)
Blosyris iphianasse (Cramer): Kaye and Lamont (1927)

Historical notes. My identification is based on a comparison with the NHMUK series, and Barbut *et al.* (2012). Not known from Tobago (Cock 2017).

Identification. This large, dark species with red and blue bands dorsally, should not be mistaken for any other in Trinidad. The purple-blue colouring is at least partly refractive, which means that images of living moths, particularly taken with a flash, readily distort these colours (compare Figs. 50 and 51). There is slight sexual dimorphism in wing shape and the female has a heavier purple-blue sheen dorsally.

Status in Trinidad. An occasional species in forested and suburban areas.

Arima: ♀ 9.i.1938 [N. Lamont] [NMS]

Arima Valley, Asa Wright Nature Centre: ♀ 29.i.2009 (gavin_miller photo) [iNaturalist observation 49576221]; ♀ 24.x.2010 (J. Ryan photo) [iNaturalist observation 40127276]; ♂ 25.xii.2010 (D.L. Schulman photo) [https://www.flickr.com/photos/queensgirl/8308998934/]; ?♂ 22.iii.2013 (R. Sargent photo) [https://www.flickr.com/photos/onemoreshotrog/8692630375]; ♀ 11.i.2014 (J. Schefski photo) [https://www.flickr.com/photos/125114464@N04/16181310777/]; ♀ 9.iii.2016 (J. Perry photo, iGoTerra) [https://igoterra.com/#!/taxon/view/125377/Letis-iphianasse]; ♂ 24.xii.2019 (M. McFarlane photo) [iNaturalist observation 36953341] Arima Valley, St. Patrick's Estate: ♀ 24.ii.1932 [N. Lamont] [UWIZM.2013.13.1587]; ♀ 1.iv.1934 [N. Lamont] [UWIZM.2013.13.1588]

Chaguanas, 10.517 -61.411: ♀ 8.i.2020 (D. Gunn photo) [iNaturalist observation 37409411] (Fig. 50)

Chatham, at light: ♀ undated (M. Alkins) [UWIZM CABI.4728]

Fig. 48. Male *'Letis' iphianasse*, Morne Bleu, Textel Installation, at light, 29.iii.1979 (M.J.W. Cock) [UWIZM CABI.4725], © UWIZM.

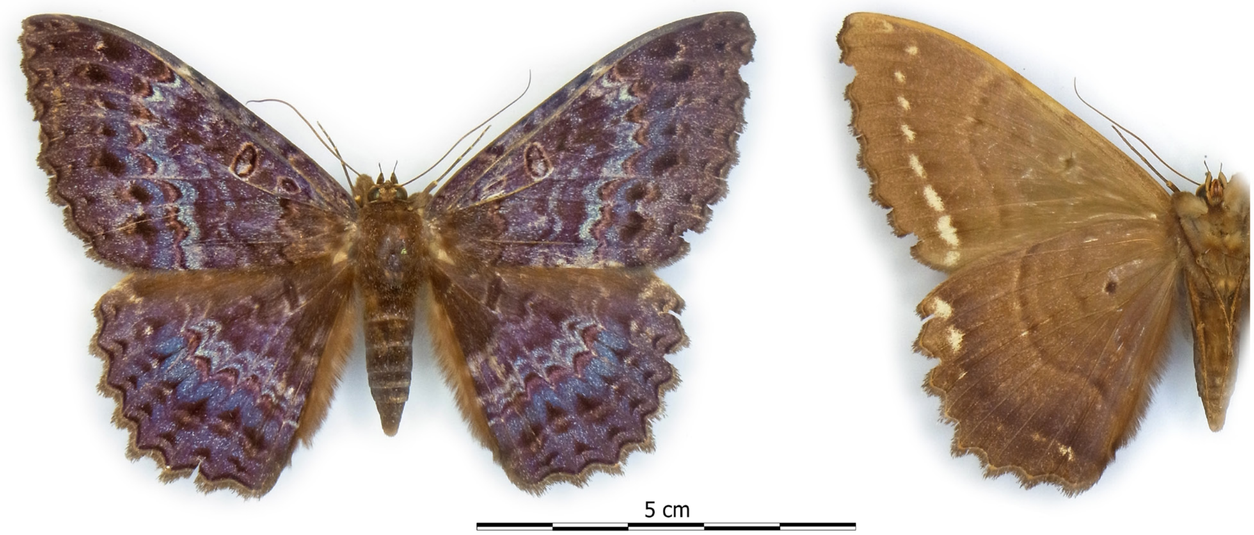

Fig. 49. Female *'Letis' iphianasse*, Curepe, MVL, 17.viii.1978 (M.J.W. Cock).

Fig. 50. Living female *'Letis' iphianasse*, Chaguanas, 8.i.2020, D. Gunn photo, iNaturalist observation 37409411, © D. Gunn, Creative Commons license CC-BY-NC.

Fig. 51. Living female *'Letis' iphianasse*, Inniss Field, 9.v.2020, R. Deo photo, iNaturalist observation 45921369, © R. Deo, with permission.

Curepe, MVL: ♂ undated (F.D. Bennett) [UWIZM CABI.4723]; ♀ 17.viii.1978 (M.J.W. Cock) [MJWC] (Fig. 49); ♀ 24.iv.1981 (M.J.W. Cock) [UWIZM CABI.4726]

Fishing Pond: ♂ 1.iv.2020 (R. Boyce) [based on photo]

Inniss Field: ♀ 9.v.2020 (R. Deo photo) [iNaturalist observation 45921369] (Fig. 51)

Lalaja Ridge, 10.706 -61.280: ♂ 18.x.2019 (S. Manchouk photo) [iNaturalist observation 34543455]

Morne Bleu, Textel Installation, at light: ♂ 29.iii.1979 (M.J.W. Cock) [UWIZM CABI.4725] (Fig. 48); ♂ 6.xii.1980 (M.J.W. Cock) [UWIZM CABI.4724]; ♀ 14.vii.1989 (R.G. Brown & T. Cassie) [UWIZM CABI.4727]

Palmiste: ♀ 1915 [N. Lamont] [UWIZM.2013.13.1589]; ♀ vii.1915 [N. Lamont] [NMS]; ♀ 24.viii.1917 [N. Lamont] [NMS]; ♀ 13.xii.1917 [N. Lamont] [NMS]; ♀ 27.v.1921 [N. Lamont] [NMS]

St. Patrick's: ♀ (no abdomen) 14.iv.1928 [N. Lamont] [NMS]

Trinidad: ♀ iv-v.1902 (E. Bourke) [OUNHM]

Thysania Dalman, 1824

Type species: *Thysania agrippina* Cramer

Two species are reported from Trinidad: *Thysania agrippina* and *T. zenobia*. Although DNA barcodes cannot be used to generate phylogenies, the neighbour-joining functions in BOLD suggests that *T. agrippina* and *T. zenobia* are not as closely related to each other as to some *Letis* / *Feigeria* spp. and some different generic groupings may be needed. I do not attempt to resolve these issues here, but flag them for future attention.

***Thysania agrippina* (Cramer, 1776)**

Cramer (1776): *Phalaena Noctua agrippina*, TL Surinam.
Noctua strix Linnaeus: Kaye (1901) [misinterpretation, see below]
Thysania agrippina (Cramer): Kaye and Lamont (1927), Plester (1994)

Historical notes. Linnaeus (1758, p. 508) described *Phalaena Noctua strix* from South America (*America meridionali*), referring to MLU (i.e. a specimen in 'Museum Ludovicae Ulricae', the Museum of Queen Louisa Ulrika of Sweden) and plate 20 of Merian (1705), based on which he included a note on the caterpillar. Subsequently, Linnaeus (1767, p. 833) refined this by citing Clerck's (1759) plate 51, figure 1, of the MLU specimen. Clerck's figure shows an Asian cossid, now referred to as *Xyleutes strix* (Linnaeus), whereas Merian's plate 20, shows the adult of *Thysania agrippina* and the caterpillar of a sphingid. The first citation (MLU) is taken as defining the species, so this name should not be applied to the species which Merian illustrated and Cramer subsequently described as *Thysania agrippina*. Hence, Kaye's (1901) inclusion of *Noctua strix* is taken to refer to *T. agrippina*. Later, Kaye and Lamont (1927) included *T. agrippina*, but did not mention *N. strix*. Plester's (1994) record of this species from Tobago is considered to be a misidentification (Cock 2017).

Identification. Adults typically rest with the long wing axis vertical (e.g. http://www.arthurgrosset.com/mammals/photos/thyagr10784.jpg). The male shown here (Fig. 52) is darker than the female (Fig. 53), but I have not examined enough material to be confident whether this represents sexual dimorphism or individual variation.

Status in Trinidad. This is an uncommon species in Trinidad that could turn up anywhere, but is more usually found in forested areas.

Arima Valley, Asa Wright Nature Centre: ?♀ 24.vi.2011 (G. Watkins-Colwell photo) [iNaturalist observation 45253501]; ? 7.vii.2011 (C. McNamee photo) [iNaturalist observation 4993002]; ?♀ 10.vii.2011 (Harald from Heidelberg photo) [https://www.whatsthatbug.com/2011/07/10/white-witch-from-trinidad-2/]

Arima Valley, Simla: ? 28.vi.2004 (M.G. Rutherford photo) [iNaturalist observation 52035932]

Curepe, MVL: ♂ viii.1970 (F.D. Bennett) [UWIZM CABI.7217]; ♀ 10.viii.1974 (F.D. Bennett) [UWIZM CABI.7221]; ♀ 27.ix.1978 (M.J.W. Cock) [UWIZM CABI.7220]

Diego Martin: ♀ xii.1970 [UWIZM CABI.7216]

Morne Bleu, Textel Installation, at light: ♀ 17.xi.1978 [MJWC] (Fig. 53); ♂ 5.vii.1989 (R.G. Brown & T. Cassie) [UWIZM CABI.7218]; ♀ 21.vii.1989 (R.G. Brown & T. Cassie) [UWIZM CABI.7219]

Santa Cruz, 10.720 -61.481: at light: ♀ (A. Ganasa photo) [iNaturalist observation 44675492]

[St. Augustine], Santa Margarita, in house: ♀ 31.i.1954 (F. Bennett) [UWIZM.2014.9.391]

Valsayn Park, at light: ♂ 22.ix.1979 (M.J.W. Cock) [MJWC] (Fig. 52)

Trinidad: ♀ undated [UWIZM.2013.13.1743]; ♂,♀ 1978-1982 [MJWC papered]

Thysania zenobia (Cramer, 1777)

Cramer (1777): *Phalaena Attacus zenobia*, TL Surinam.
Thysania zenobia (Cramer): Druce (1881-1900), Wilson (1894), Kaye and Lamont (1927), Cock (2017)

Historical notes. There has been no ambiguity about the records of this moth going back to the first list of Trinidad moths (Wilson 1894). It also occurs in Tobago (Cock 2017).

Identification. The large size, grey dorsal colouring and salmon-pink ventral colouring make this species easily recognisable in Trinidad and Tobago. There is some sexual dimorphism, the males having darker, more strongly contrasting diagonal lines dorsally on both forewings and hindwings.

Status in Trinidad and Tobago. An occasional species in both Trinidad and Tobago, that is more often found in forested situations, but can be found in suburban areas too.

Curepe, BLT: ♀ 21-28.ii.1982 (F.D. Bennett) [MJWC] (Fig. 55)

Curepe, MVL: ♀ 10.ii.1970 (F.D. Bennett) [UWIZM CABI.7222]; ♂ 22.v.1981 (M.J.W. Cock) [MJWC]

Fyzabad: ♂ ix.1917-vi.1918 (R.W. Farmborough) [OUNHM]

Morne Bleu, Textel Installation, at light: ♀ 31.vii.1979 (M. Dookie) [UWIZM CABI.7223]; ♂ 28.viii.1978 (M. Dookie) [MJWC] (Fig. 54)

TOBAGO, Black Rock, 11.197 -60.789, at light: ♀ 22.xi.2019 (figtree photo) [iNaturalist observation 36219406]

TOBAGO, Englishman's Bay, at light: ♀ (J. Ingraham) [M. Kelly photos 10880, 10881]

TOBAGO, near Parlatuvier, at light: ♂ i.2009 (A. Zheludev) [https://www.neutron.phys.ethz.ch/Lepidoptera/index.html AZ12-0259]

Fig. 52. Male *Thysania Agrippina*, Valsayn Park, at light, 22.ix.1979 (M.J.W. Cock).

Fig. 53. Female *Thysania agrippina,* Morne Bleu, Textel Installation, at light, 17.xi.1978.

Fig. 54. Male *Thysania zenobia,* Morne Bleu, Textel Installation, at light, 28.viii.1978 (M. Dookie).

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Fig. 55. Female *Thysania zenobia,* Curepe, black light trap, 21-28.ii.1982 (F.D. Bennett).

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A Preliminary Survey for Spiders on Dominica, W.I.

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ABSTRACT
A survey of spiders was conducted on Dominica, West Indies, over a five-week period from July-August 2014. Thirteen habitats from 17 localities were surveyed, including five man-made habitats. Nineteen families representing 90 species were collected. Members of the families Araneidae, Salticidae and Theridiidae comprised over half of the species found.

Keywords: Araneidae, Lesser Antilles, Salticidae, Theridiidae

INTRODUCTION

Arthropods comprise the most diverse organisms in any terrestrial environment. Sampling arthropods is particularly challenging due to their size, short generation time, diversity, limited distribution and strict environmental requirements (microhabitats). However, these traits make it theoretically possible to use arthropods for more fine-scale studies, such as mapping environmental diversity or tracking environmental changes; thus, they are preferred for certain studies over longer-lived and more habitat-flexible organisms like vertebrates and plants for such studies.

Spiders have a worldwide distribution, occupying all terrestrial environments except the polar extremes. Currently 48,299 species of spiders are described worldwide (World Spider Catalog 2019), representing what is believed to be roughly one-fifth of the true total. The spider fauna of the Neotropics remains relatively unknown. Within the Lesser Antilles of the Caribbean, the spider fauna has been preliminarily documented at the species level for Barbados (G. Alayón and J. Horrocks 2004), St. Vincent & the Grenadines (Simon 1894; de Silva *et al.* 2006), Anguilla (Sewlal and Starr 2010), Antigua (Sewlal 2009a), Nevis (Sewlal and Starr 2007), St. Kitts (Sewlal 2008), Grenada (Sewlal 2009b), Montserrat (Sewlal 2010a), St Lucia (Sewlal 2011), Great Inagua, Bahamas (Sewlal and Starr 2011) and St. Eustatius (Mopeth *et al.* 2016) .

The overall goal of the survey was to collect and document a substantial part the species present in a broad range of habitats, both natural and those influenced by human activities. This paper forms part of a series of papers documenting the spider fauna of islands in the Caribbean.

METHODS

I spent five weeks (14 June to 21 July 2014) of the early rainy season on the island of Dominica as an entomologist for Operation Wallacea (Opwall), a conservation research organization. Part of my assignment was to conduct a survey of the island's spider fauna with the aim of collecting a substantial part of the fauna in a broad variety of habitats. Dominica is one of the southern Lesser Antilles at (15°25′N 61°20′W) with an area of 751km^2. It is volcanic in origin with its highest elevation being approximately 1,447m. There are a range of habitats found on the island, including fumarole vegetation, elfin woodland, montane forest, deciduous forest and lowland rainforest. The selection of habitats and localities were based on consultations and habitat descriptions from the staff at the Archbold Research Centre, Springfield Estate and the Forestry Division of the Ministry of Environment, Climate Resilience, Disaster Management and Urban Renewal, Dominica.

Three collecting methods were employed during this survey; sweep-netting and visual searches were conducted at all sites and pit-fall traps were used at one site. Sweep-netting consisted of sweeping understory vegetation and low-hanging branches with a heavy canvas insect net, 30.5 cm in diameter. Any individuals resting or hiding in the vegetation are dislodged into the net. After 15 to 20 sweeps, the net was examined and any spiders transferred to vials containing 95% alcohol within the confines of the net to prevent escape of specimens. Visual search involved walking around and collecting spiders by hand. The surface of plants, tree stems and logs were searched, as well as finding webs and subsequently the spiders' retreat.

Pitfall traps were only used at the Beehouse Trail near the Archbold Research Centre, Springfield Estate. Each pitfall trap consisted of a plastic cup approximately 11cm deep placed in the soil so that the lip of the cup was level with the ground. It was two-thirds filled with a super-saturated salt solution and a few drops of dish washing liquid to break the surface tension of the water so the spiders sank to the bottom. This method targeted ground-dwelling spiders.

Table 1 Spiders collected for each habitat sampled in Dominica, W.I. during the period 14 June to 21 July 2014.

Family and Species	Habitat	Secondary vegetation	Garden	Riparian Vegetation	Coastal vegetation	Fumarole vegetation	Elfin woodland	Roadside	Ruins	Montane	Deciduous forest	In & around buildings	Lowland rainforest	Rainforest
Araneidae	14 spp. not ID	abcdefgil	achjm										k	
	Acacesia sp.		✓											
	Cf *Alpaida* sp.	✓	✓						✓					
	Argiope argentata	✓	✓	✓	✓	✓							✓	
	Cyclosa caroli	✓	✓							✓		✓	✓	
	Eustala anastera	✓	✓							✓				
	Eustala fuscovittata		✓											
	cancriformis	✓								✓				
	Cf *Hypognatha* sp.	✓								✓				
	Larinia sp.		✓											
	Metepeira compsa	✓	✓											
	Micrathena sp.	✓	✓	✓										
	Neoscona sp.	✓												
	Spilasma sp.	✓								✓				✓
	Cf. *Wagneriana* sp.	✓												
	Cf *Xylethrus* sp.	✓												
Agelenidae	1 sp. not ID	✓												
Coriniidae	2 spp. not ID	a	b											
Linyphiidae	1 sp. not ID		✓			✓								
Lycosidae	1 sp. not ID	✓	✓	✓										
Mimetidae	1 sp. not ID		✓											
Miturgidae	2 spp. not ID	ab	a		a			a			a	a		a
	Cheircanthium sp.	✓												
Oecobidae	1 sp. not ID								✓					
Oxyopidae	1 sp. not ID	✓												
Pholcidae	4 spp. not ID	abc	a	a		d	c	a		ac			ac	d
	Physocyclus globosus											✓		
Salticidae	9 spp. Not-ID	abcdefg	afhl			h		a		c		d	a	
	Hentzia sp.	✓												
	Lyssomanes sp.	✓												
Scytodidae	*Scytodes fusca*					✓						✓		
	Scytodes longipes		✓									✓		
Sicariidae	1sp. not ID													
Sparassidae	"*Olios*" sp.	✓	✓		✓									✓
Tetragnathidae	1 sp. not-ID	✓	✓											
	Aleimosphenus licinus	✓	✓											
	Leucauge argyra	✓	✓	✓	✓	✓	✓				✓		✓	✓
	Leucauge regyni	✓	✓							✓		✓		
	Leucauge 2 spp.								b	a				
	Cf *Opas* sp.												✓	
	Tetragnatha s p.	✓	✓	✓										
Theridiidae	9 spp. not-ID	abcefhi	cf			f						d	c	
	Argyrodes elevatus	✓			✓									
	Latrodectus geometricus		✓									✓		
	Theridon 2 spp.	a	a			a						b		
	1 sp. not ID	✓	✓							✓		✓		
Thomisidae	6 spp. not ID	abcdef	b			f				d				
	Misumenops sp.		✓											
Uloboridae	1 sp. not ID	✓								✓				
TOTAL		65	38	6	5	10	3	3	3	15	4	11	10	6

After collection, specimens were identified to species level under a microscope using identification keys. All specimens are stored in 95% ethanol with their identification and locality labels, and a selection of specimens were deposited in the Archbold Research Centre, Springfield Estate, Dominica, to assist researchers of future general ecological surveys.

RESULTS AND DISCUSSION

Seventeen localities covering 13 habitats were sampled, including five habitats that were man-made or heavily influenced by human activities. The sampling produced a total of 90 species from 19 families. Secondary vegetation and garden habitats were the most species-rich, producing the highest and second highest number of different species (Table 1), while one natural habitat (elfin woodland) and two human-made habitats (roadside and ruins) showed the lowest species richness, yielding only three species each. The families Araneidae, Theridiidae and Salticidae were the best-represented, yielding 29, 11 and 13 species respectively. Araneidae and Tetragnathidae were the two most ecologically diverse families containing species collected from 11 and 12 habitats, respectively. Forty-six species from 14 families were found in a single habitat only. It must be noted that the sampling effort was not standardised so any comparisons of species richness between habitats/ locations must be made with caution.

Dominica has earned the nickname, "the nature isle of the Caribbean". This is because Dominica has capitalized on its biodiversity in terms of ecotourism, thereby preserving the habitats present including both natural habitats and those influenced by human activities, like secondary forest and gardens. This preservation, along with the extended sampling period, may account for the greater number of spider species documented in Dominica compared to other islands in the Eastern Caribbean that have been sampled.

Of islands surveyed for spiders in the Eastern Caribbean, the ones with greater species richness in natural habitats are: Grenada (Sewlal 2009b), Monserrat (Sewlal 2010a) and Antigua (Sewlal 2009a), while the islands that showed greater species richness in human-made habitats are: Nevis (Sewlal & Starr 2007), St Kitts (Sewlal 2008) and St Lucia (Sewlal 2011)The results here are congruent with the former scenario.

In habitats with higher species richness, secondary vegetation contained the highest number of species, with 65 species from 15 families (Table 1). This is expected as the disturbance may create conditions ideal for both generalist and specialist species, thus increasing species richness. Some habitats also provide a natural path or gap in the vegetation where prey, in particular flying insects, can be more easily caught in the webs. Another feature of most altered habitats is the presence of artificial lighting during the night which attracts flying insects, so that nocturnal species have a more or less steady food supply. This could account for the second highest species richness of the garden habitat.

The three habitats yielding the fewest species (three each) were ruins, roadside vegetation and elfin woodland. The presence of the family Oecobiidae in the ruins habitat is expected, as this family is commonly found on ruins on other islands (personal observation). A low species richness was also expected for elfin woodland due to the extreme conditions present in this habitat type in terms of microclimate. However, a low species richness for roadside vegetation was unusual because no members of the family Araneidae were collected from this habitat type. Ward (2007) reported *Argiope argentata* from roadside vegetation, which is consistent with observations from other islands in the Eastern Caribbean (Sewlal and Starr 2007; 2010, Sewlal 2008; 2009a; 2009b; 2010a; 2011). However, since little time was devoted to collecting in this habitat, a low species richness was expected.

It was notable that no specimens of the Mygalomorphae group were collected during this survey. I had expected to find at least occasional small tarantulas under logs or rocks. The only species of known medical importance for humans was *Latrodectus geometricus* (Theridiidae), commonly called the Brown Widow.

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Forty-five New Records of Moths (Lepidoptera) from Tobago, W.I., Increase the Total Species Known to 400

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ABSTRACT
Details of 45 new moth records from Tobago are presented, including species of Cossidae (1), Crambidae (14), Dalceridae (1), Erebidae (7), Geometridae (9), Limacodidae (3), Megalopygidae (1), Noctuidae (1), Nolidae (1), Notodontidae (1), Oecophoridae (1), Pyralidae (2), Sphingidae (2), and Uraniidae (1). All records are based solely on photographs, and representative images are included as vouchers. Forty-two species were identified as adults and three as caterpillars. The total number of moth species known from Tobago is now 400. All reported species are also known from Trinidad (although some records represent the first notification for Trinidad), apart from *Trocodima lenistriata* (Dognin) (Erebidae, Arctiinae, Phaegopterini) and *Eulepidotis* sp. (Erebidae, Eulepidotinae), which are not so far known from Trinidad.

Key words: biology, citizen science, Trinidad, Bombycoidea, Gelechioidea, Noctuoidea, Pyraloidea, Zygaenoidea.

INTRODUCTION

The two main islands of Trinidad & Tobago provide a zoogeographical contrast in terms of size and distance from the mainland (Starr 2009, Wikipedia 2020). Trinidad has an area of 4,768 km^2; the south-west peninsula is 11km from Venezuela and while the north-west peninsula is 20km from the mainland, the widest gap is 11.5 km, thanks to the intervening Bocas Islands. Tobago, on the other hand, has an area of about 300km^2, and is separated from Trinidad by 36km, and from the mainland by about 125km. They are both continental islands and Trinidad's Northern Range and Tobago's Main Ridge are extensions of Venezuela's coastal range. Trinidad was probably last joined to the mainland 10,000 years ago, and Tobago 14,000 years ago. This combination of land area, distance from the mainland, and time since the land masses were last joined, means that Trinidad's biodiversity is a subset of that of the mainland, and in turn, Tobago biodiversity is almost entirely a subset of Trinidad's. Very few species from Tobago are either known from the Lesser Antilles, but not Trinidad or the mainland, or known from Venezuela but not (as yet) from Trinidad.

The moths of Tobago are not well known and only in 2017 was the first checklist of 355 species published (Cock 2017). This is a small total compared to the more than 742 species extrapolated by Cock (2003), and many more species are expected to occur in Tobago, particular those of smaller size. With no active collectors or entomologists currently involved in surveying the Tobago moth fauna, progress is limited to observations and images shared by resident and visiting naturalists and observers. Fortunately, the identification of photos of most species of Tobago moths is relatively straightforward given that (1) digital cameras or phones make taking identifiable images increasingly straightforward; (2) the Lepidoptera fauna of Tobago is, with very few exceptions, a subset of the fauna of Trinidad (Cock 2017); (3) the moth fauna of Trinidad is now reasonably well known to the first author, based on extensive collecting and museum work (Cock 2003). Furthermore, digital images are easily shared, facilitating rapid identification and feedback. Using this approach, we report here on 45 additions to the moth fauna of Tobago based solely on images, including a voucher image for each record.

METHODS

The great majority of these records are based on photographs taken by the second author at his house at about 130m altitude above Englishman's Bay, on the north coast of Tobago in a mixed habitat of former cocoa estate, disturbed scrub including bamboo, and forest. Moths were attracted to the house lights during the evening and photographed in situ. In the following account, records are based on the second author's photographs from Englishman's Bay unless indicated otherwise.

We refer to material examined in the following collections:

MJWC	Matthew J.W. Cock, private research collection, Dolgellau, UK
NHMUK	The Natural History Museum, London, UK
NMS	National Museums of Scotland, Edinburgh, UK
OUNHM	Oxford University Natural History Museum, Oxford, UK
USNM	United States National Museum, Washington, D.C., USA
UWIZM	University of the West Indies Zoology Museum, St. Augustine, Trinidad & Tobago

As discussed in Cock (2017) identifications were made by comparison with the first author's collection of Trinidad moths (MJWC), which have been named primarily in the context of the collections of NHMUK and USNM. Species are arranged by family alphabetically, and alphabetically within families; subfamilies are included in parentheses after each. The figures show photographs taken in Tobago, except as indicated. Comments on the status of each species in Trinidad are based on the first author's unpublished records; these give an indication of what the status of these species may be in Tobago. As the Tobago moths were photographed without any indication of scale, the forewing length (F: base of forewing – wing tip) is provided in the figure legends based on Trinidad material in MJWC, except as indicated.

RESULTS

COSSIDAE

Inguromorpha polybia **(Schaus, 1892) (Hypoptinae) (Fig. 1)**

This is the species recorded from Trinidad as *Zeuzera inguromorpha* (Schaus) by Kaye and Lamont (1927). The first author compared Trinidad material with the labelled types of *I. polybia* (USNM, ♂ Brazil) and of *I. inguromorpha* (USNM, ♂ French Guiana), which is a synonym. In Trinidad this is a widespread occasional species, found in forested and suburban areas.

Fig. 1. Male *Inguromorpha polybia* (Schaus), at light, Englishman's Bay, 11 March 2020. F 14mm.

CRAMBIDAE

Asturodes bioalfae **Solis, 2020 (Spilomelinae) (Fig. 2)**

Trinidad specimens of this distinctive appearance were initially identified as *Spilomela fimbriauralis* by comparison with the NHMUK series (as they were by Kaye and Lamont 1927). They were reidentified, alongside the second author's image (Fig. 2) using Solis *et al.* (2020) in which *A. bioalfae* was described, and recorded from Trinidad. The identification of the Tobago image (Fig. 2) was confirmed by M.A. Solis (pers. comm.). This is an occasional species in Trinidad, widespread in forested areas.

Fig. 2. Male *Asturodes bioalfae*, at light, Englishman's Bay, 13 December 2019. F 9mm.

Asturodes junkoshimurae **Solis, 2020 (Spilomelinae) (Fig. 3)**

See comments under the previous species. Trinidad specimens, along with the second author's image (Fig. 3) were identified as this species from Solis *et al.* (2020), and the Tobago identification confirmed by M.A. Solis (pers. comm.). In Trinidad, this species is recorded from Morne Bleu and Point Gourde, where it co-occurs with *A. bioalfae*, as is also the case at Englishman's Bay.

Fig. 3. Female *Asturodes junkoshimurae*, at light, Englishman's Bay, 13 December 2019. F 9mm.

***Blepharomastix lacertalis* (Guenée, 1854) (Spilomelinae) (Fig. 4)**

The second author photographed a male of this species at light above Englishman's Bay on 23 November 2019 and a female 19 March 2020. They match Trinidad specimens identified by comparison with the specimen labelled as type in NHMUK. It has been recorded from Trinidad as *Lamprosema lacertalis* (Kaye and Lamont 1927), and seems to be quite common in forested areas of Trinidad.

Fig. 4. Male *Blepharomastix lacertalis*, at light, Englishman's Bay, 23 November 2019. F 9mm.

***Ceratocilia damonalis* (Walker, 1859) (Spilomelinae) (Fig. 5)**

This species is included on the basis of a dead specimen in poor condition which the second author found in his house at Englishman's Bay (Fig. 5). Trinidad material was identified by comparison with a syntype in NHMUK. In Trinidad this is an uncommon species associated with forest habitat. In the limited material to hand, the pale markings of the forewing are stronger in the female as here, than in the male.

Fig. 5. Female(?) *Ceratocilia damonalis*, dead in house, Englishman's Bay, 28 February 2019. F 18mm.

***Gonocausta zephyralis* (Lederer, 1863) (Spilomelinae) (Fig. 6)**

Trinidad material was identified by comparison with the lectotype (NHMUK ♀), NHMUK series and USNM series. This is an uncommon species in Trinidad, apparently associated with forested areas.

Fig. 6. Female *Gonocausta zephyralis*, at light, Englishman's Bay, 20 March 2020. F 8mm.

***Hileithia approprialis* (Dyar, 1914) (Spilomelinae) (Fig. 7)**

The second author photographed this species at Englishman's Bay on 13 December 2019 (Fig. 7) and 29 January 2020. Trinidad material has been identified by comparison with a cotype (USNM ♀ Panama), originally described as *Bocchoris approprialis*. *Samea delicata* Kaye was described from Trinidad (Kaye 1923); the first author has examined the holotype collected by Sir Norman Lamont (NMS, ♂ Trinidad), and the two species appear identical. Although *Samea delicata* Kaye, 1923 is anticipated to be a synonym of *Bocchoris approprialis* Dyar, 1914, no formal action is taken at this time. This species is widespread in diverse habitats in Trinidad, and commonly found in suburban areas.

Fig. 7. Male *Hileithia approprialis*, at light, Englishman's Bay, 13 December 2019. F 7mm.

***Hyalorista taeniolalis* (Guenée, 1854) (Pyraustinae) (Fig. 8)**

A Trinidad specimen of this species was identified by M. Shaffer in 1980, and the first author subsequently compared it with the NHMUK series. Longstaff (1912) recorded this species from Tobago in the combination *Pionea taeniolalis*, but his specimen was a misidentification of *H. exuvialis* (Guenée) as noted by Cock (2017). *Hyalorista taeniolalis* is an occasional species in Trinidad found in disturbed areas.

Fig. 8. *Hyalorista taeniolalis*, at light, Englishman's Bay, 17 March 2020. F 6mm.

***Lamprosema canacealis* (Walker, 1859) (Spilomelinae) (Fig. 9)**

Trinidad material was identified by comparison with the specimen labelled as type (Brazil, Pernambuco) in NHMUK and the NHMUK series. This species seems uncommon in Trinidad, but recorded from diverse habitats.

Fig. 9. Female(?) *Lamprosema canacealis*, at light, Englishman's Bay, 22 January 2020. F 8mm.

***Massepha lupa* (Druce, 1899) (Spilomelinae) (Fig. 10)**

This species was described from Trinidad as *Pilocrocis plumbilinea* Kaye in 1901, but this is now considered to be a synonym of *M. lupa* described from Guatemala (Kaye and Lamont 1927). Trinidad material was identified by comparison with the specimens labelled as type for both taxa in NHMUK. It is a common and widespread species in Trinidad, primarily associated with forested areas

Fig. 10. *Massepha lupa*, Englishman's Bay, 17 March 2020. F 11mm.

***Palpita flegia* (Cramer, 1777) (Spilomelinae) (Fig. 11)**

Identified by comparison of specimens collected by Sir Norman Lamont in Trinidad (Lamont and Callan 1950) with the USNM series. A further Tobago specimen was photographed near Black Rock, 9 August 2020 by figtree (https://www.inaturalist.org/observations/60005769). Lamont's two specimens from Palmiste are the only Trinidad records known to us.

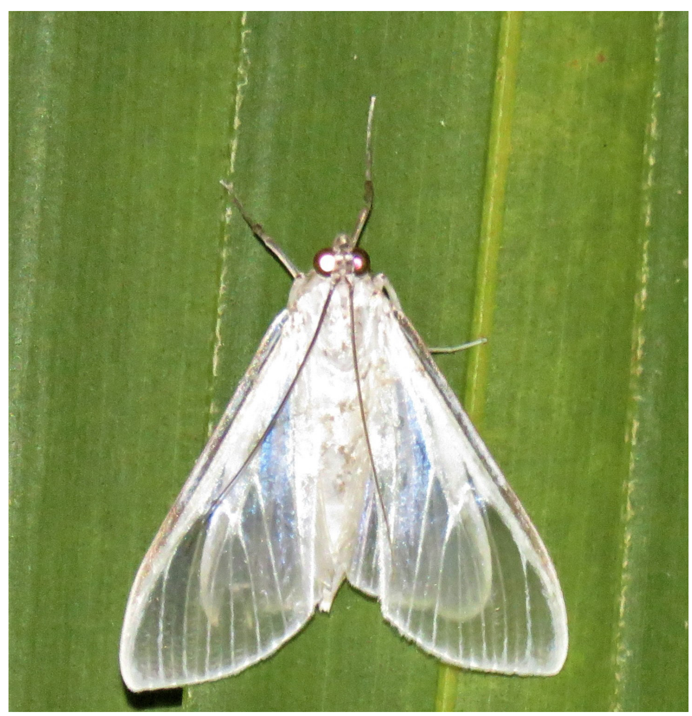

Fig. 11. Female *Palpita flegia*, Englishman's Bay, 14 February 2020. F 23mm (from Lamont's specimens).

***Palpusia ptyonota* (Hampson, 1912) (Spilomelinae) (Fig. 12)**

Trinidad material was identified by comparison with the specimen from Peru labelled as type in NHMUK. Although this species has not been reported from Trinidad before, it appeared in Kaye and Lamont's (1927) catalogue as *P. glaucusalis* (Walker) (in the combination *Pilocrocis glaucusalis*). This record was based on a misidentification of a specimen collected by Sir Norman Lamont at Palmiste, 18 December 1921, which is now in RSM, where the first author examined it. In Trinidad this species is occasionally encountered in forested areas, with records from the Arima Valley, Cumaca Road, and St. Benedict's.

Fig. 12. Female *Palpusia ptyonota*, at light, Englishman's Bay, 13 January 2020. F 11mm.

***Palpusia terminalis* (Dognin, 1910) male (Spilomelinae) (Fig. 13)**

Trinidad material was identified by comparison with the USNM series. The wing margins of specimens from Trinidad are comparable with those of the Tobago specimen shown here (Fig. 13) but darker than most of the USNM series, matching a Guyana specimen in this regard. This is an occasional species in forested areas of Trinidad, and is also a new record for Trinidad, with records from the top of Arima Valley, Cumaca Road, Morne Bleu Textel, Point Gourde and Valencia Forest (off the Long Stretch).

Fig. 13. Male *Palpusia terminalis*, at light, Englishman's Bay, 31 January 2020. F 10mm.

***Salbia pachyceralis* (Hampson, 1917) (Spilomelinae) (Fig. 14)**

Trinidad specimens were identified by comparison with the specimen labelled as type (a male from Panama) and the NHMUK series. This species has not previously been recorded from Tobago, but the first author has records from Arima Valley (Simla, 15 February 1980), Parrylands (13 November 1980) and Penal (K. Sookdeo photo 9 April 2011).

Fig. 14. Female *Salbia pachyceralis*, at light, Englishman's Bay, 29 January 2020. F 10mm.

DALCERIDAE

***Acraga infusa* complex (Dalceridae) (Fig. 15)**

This record is based on an image taken by the second author of a plain orange dalcerid attracted to light above Englishman's Bay (Fig. 15). The Dalceridae of Trinidad were treated by Miller (1994) in his account of the systematics of the Dalceridae, for which he examined material of all known Trinidad species from the collections of MJWC, USNM, UWIZM, etc. Miller treated the only plain orange species from Trinidad as '*Acraga infusa* complex' -a single variable species or a complex of similar species.

Fig. 15. Female *Acraga infusa* complex, at light, Englishman's Bay, 23 November 2019. F male 10mm, female 13mm.

EREBIDAE

Epeiromulona hamata hamata Field, 1952 (Arctiinae, Lithosiini) (Fig. 16)

The second author's image from Englishman's Bay (Fig. 16) is the first time this species has been identified from Tobago. However, having established that this species is present on Tobago, the first author was able to confirm a previously unreported provisional identification of a specimen in poor condition collected at light by Roger Hammond at Charlotteville in June 1999. This species was described from French Guiana and Trinidad (Field 1952), and Trinidad material in MJWC was identified by comparison with paratype material in NHMUK. The hindwings, which are not visible in Fig. 16, are pale orange. In Trinidad, records are mostly from forested areas of the Northern Range and Caparo.

Fig. 16. *Epeiromulona hamata hamata*, at light, Englishman's Bay, 30.xii.2019. F 8mm.

Eulepidotis sp. (Eulepidotinae) (Figs. 17-18)

This species was photographed by the second author at light above Englishman's Bay on five occasions: 18 November 2019, 5 December 2019, 6 January 2020, 12 February 2020 and 24 February 2020 (Figs. 17-18). It has not been identified to species as yet. There are three other bright green species of *Eulepidotis* known from Trinidad: *E. viridissima* (Bar), *E. schedoglauca* Dyar and *E. croceipars* Dyar (Fig. 19). Although the dorsal forewing is similar in all four species, there are obvious differences in size (the Tobago species is comparable to *E. viridissima*) and the markings of the dorsal hindwing and ventral surface.

Fig. 17. *Eulepidotis* sp. at light, Englishman's Bay, 18 November 2019. F 12mm.

Fig. 18. *Eulepidotis* sp. at light, Englishman's Bay, 17 March 2020. F 12mm.

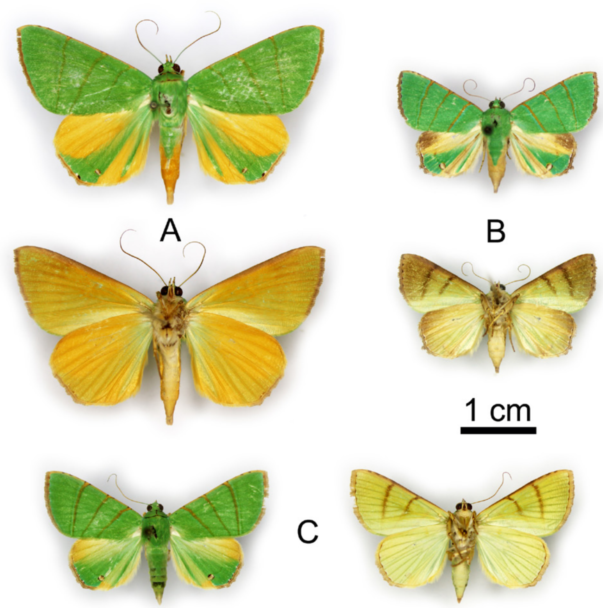

Fig. 19. Green *Eulepidotis* spp. of Trinidad [MJWC]. A, *E. croceipars*, Morne Bleu Textel Installation, at light, 4 February 1979. B, *E. viridissima*, Cumberland Hill, 7 August 1982. C, *E. schedoglauca*, Curepe, MV light trap, June 1979.

***Ilsea* sp. (Calpinae) (Fig. 20)**

The second author's photograph (Fig. 20) matches one of the three species of *Ilsea* found in Trinidad (Fig. 21). Poole (1989) lists five species of *Ilsea* in total, but the species considered here does not match any of these and is probably undescribed.

Fig. 20. Female *Ilsea* sp. at light, Englishman's Bay, 7 January 2020. F 12mm.

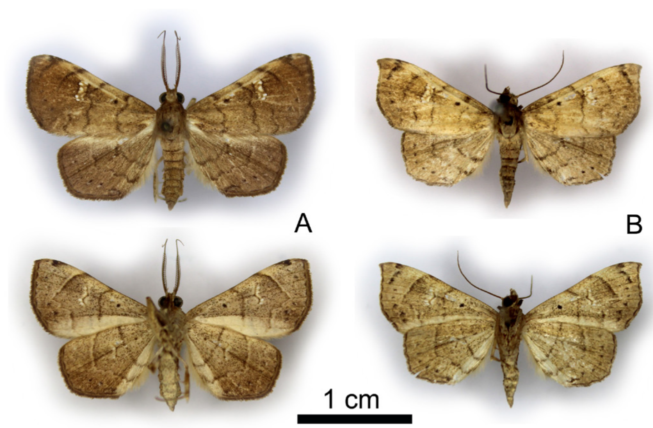

Fig. 21. Trinidad specimens of *Ilsea* sp., dorsal view above, ventral view below; M.J.W. Cock [MJWC]. A, male, Hollis Reservoir, at pump house lights, 17 October 1978. B, female, Parrylands Oilfield, at UV light, 13 November 1980.

***Metalectra praecisalis* Hübner, 1823 (Erebidae, Boletobinae) (Fig. 22)**

The second author photographed this species twice at Englishman's Bay: 13 January 2020 (Fig. 22) and 7 March 2020. Trinidad material in MJWC was identified by comparison with the NHMUK series. This is a common and widespread species in Trinidad in both forested and suburban habitats. *Metalectra carneomacula* (Guenée, 1852) (Fig. 23) is a similar but larger species with some pale markings, which is also found in Tobago (Cock 2017).

Fig. 22. Male *Metalectra praecisalis*, at light, Englishman's Bay, 13 January 2020. F 13mm.

Fig. 23. Male(?) *Metalectra carneomacula*, at light, Englishman's Bay, 3 January 2020. F 16mm.

***Renodes croceiceps* (Walker, 1865) (Eulepidotinae) (Fig. 24)**

Trinidad material was identified by comparison with the NHMUK series. While a good match to material from Colombia, Trinidad specimens are not an exact match to the specimen labelled as type from Guatemala, so it may be that South American material represents a different, closely related species. *Renodes liturata* (Walker, 1865) has also been recorded from Tobago (Cock 2017); it can be distinguished most easily by the dark brown, rather than yellow brown, head (Fig. 25).

Fig. 24. *Renodes croceiceps* at light, Englishman's Bay, 15.xii.2019. F 11mm.

Fig. 25. *Renodes liturata* at light, Englishman's Bay, 2.xii.2019. F 11mm.

***Trocodima lenistriata* (Dognin, 1906) (Arctiinae, Phaegopterini) (Fig. 26)**

Identified with the assistance of Michel Laguerre by comparison with an image of the lectotype of *T. pellucida* (Rothschild) from Venezuela (NHMUK). *Trocodima pellucida* is currently considered a synonym of *T. lenistriata* (Vincent and Laguerre 2014), but may prove to be a valid species in its own right, in which case *T. pellucida* would be the better name to use for this record. No *Trocodima* spp. from Trinidad or Tobago have been recorded or are known to the authors, so this is a new country record, which would be expected to occur in Trinidad.

Fig. 26. Male *Trocodima lenistriata* at light, Englishman's Bay, 24 January 2020.

***Zale strigimacula* (Guenée, 1852) (Erebinae) (Fig. 27)**

This species was found in Plymouth, 12 July 2015 by Aaron Wheeler and an image posted on iNaturalist (Fig. 27). Zagatti *et al*. (1995-2006) was used to identify Trinidad material. In Trinidad, this species was recorded as *Z. lunata* (Drury) by Kaye and Lamont (1927), but this is a misidentification of a North American species. *Zale strigimacula* occurs in Brazil, the Guianas and north into the Lesser Antilles (Zagatti *et al.* 1995-2006), so its presence in Tobago is to be expected. In Trinidad, it is an occasional species in suburban areas. *Zale fictilis* (Guenée, 1852) is also known from Tobago (Cock 2017). It is a slightly smaller, greyer, more uniformly marked species (Fig. 28), whereas *Z. strigimacula* although varied, is larger, usually more colourful, and more contrasting and more granular in its markings (Fig. 27).

Fig. 27. *Zale strigimacula*, Plymouth, 12.vii.2015. © figtree, edited from https://www.inaturalist.org/observations/36635554, under Creative Commons License CC-BY-NC. F 28mm.

Fig. 28. *Zale fictilis*, Trinidad, Arima Valley, Simla, at light, January 2012, D.J. Stradling. F 24mm.

GEOMETRIDAE

Chloropteryx opalaria (Guenée, [1858]) (Geometrinae) (Fig. 29)

The second author photographed this species coming to light at Englishman's Bay on 22 January and 17 March 2020. Material from Trinidad was identified by comparison with the specimen labelled as type (NHMUK, Brazil) and NHMUK series. Although not recorded from Trinidad by Kaye and Lamont (1927), it was recorded (with a ?) from the island by Pitkin (1996). This is an occasional species in Trinidad, mainly found in forested areas.

Fig. 29. Female *Chloropteryx opalaria*, at light, Englishman's Bay, 17 March 2020. F 10mm.

Dithecodes deaurata (Warren, 1904) (Sterrhinae) (Fig. 30)

Material from Trinidad was identified by comparison with the specimen from Ecuador labelled as type and the NHMUK series. It was recorded from Trinidad by Kaye and Lamont (1927) as *Mnesithetis olivaria* Snellen (which is actually a synonym of a similar species, *D. distracta* Walker), based on a specimen collected at San Hilario in August 1917 by Agnes Lickfold. The first author has reidentified this specimen (in OUNHM), as *D. deaurata*. This is a common and widespread species in Trinidad.

Fig. 30. *Dithecodes deaurata* (Warren), at light, Englishman's Bay, 18.xi.2019. F 10mm.

Parilexia nicetaria (Guenée, [1858]) (Ennominae) (Fig. 31)

This species was recorded from Trinidad as *Casbia nicetaria* by Kaye and Lamont (1927), and is a variable, fairly common, widespread species in forested areas of Trinidad, readily attracted to light.

Fig. 31. Male *Parilexia nicetaria*, at light, Englishman's Bay, 28 November 2019. F 14mm.

Pero amanda (Druce, 1898) (Ennominae) (Fig. 32)

Trinidad material was identified by comparison with the holotype (NHMUK, ♂, Mexico) and Poole (1987). This is an occasional species restricted to forested areas in Trinidad.

Fig. 32. Female *Pero amanda*, at light, Englishman's Bay, 26 February 2020. F 20mm.

Semiothisa arenisca (Dognin, 1898) (Ennominae) (Fig. 33)

Trinidad material was identified by comparison with the NHMUK series. Public DNA barcodes in BOLD indicate that more than one species is probably grouped under this name, but until this is clarified and published, this name will be used for Trinidad and Tobago material. Kaye and Lamont (1927) record this species from Trinidad, where it is widespread and quite common, but more frequent in forested areas.

Fig. 33. Male *Semiothisa arenisca*, at light, Englishman's Bay, 2 December 2019. F 14mm.

***Synchlora expulsata expulsata* (Walker, 1861) (Geometrinae) (Fig. 34)**

Trinidad material was identified by comparison with the specimen from Tefé, Amazonas, Brazil labelled as type (NHMUK) and the NHMUK series. It is a widespread and occasional species of forested areas in Trinidad.

Fig. 34. Male *Synchlora expulsata expulsata*, at light, Englishman's Bay, 8 December 2019. F 7mm.

***Tachyphyle allineata* (Warren, 1900) (Geometrinae) (Fig. 35)**

Trinidad material was identified by comparison with the specimen labelled as type (NHMUK, ♂ Venezuela) and NHMUK series. This species is widespread in lowland areas of Trinidad, in both forested and suburban areas.

Fig. 35. Female *Tachyphyle allineata*, at light, Englishman's Bay, 26 February 2020. F 12mm.

***Tricentrogyna colligata* (Warren, 1906) (Sterrhinae) (Fig. 36)**

This tiny species (wingspan 11 mm) was photographed by the second author at light above Englishman's Bay. It has not previously been recorded from Trinidad or Tobago, but there are several specimens from Trinidad in MJWC and UWIZM, which were identified by comparison with the male type (USNM, French Guiana) and NHMUK series. In Trinidad, it is an occasional species, primarily associated with forested habitats.

Fig. 36. *Tricentrogyna colligata*, at light, Englishman's Bay, 19 November 2019. F 5mm.

***Zanclopteryx subsimilis* Warren, 1897 (Desmobathrinae) (Fig. 37)**

Identified by comparison with the specimen labelled as type (NHMUK, Venezuela) and NHMUK series, which includes Trinidad material. The diagnostic very faint forewing subdiscal line is visible in the figure. Prout (1910) records this species from Trinidad, although it does not appear in Kaye and Lamont's (1927) catalogue. An uncommon species in lowland forested areas of Trinidad.

Fig. 37. *Zanclopteryx subsimilis*, at light, Englishman's Bay, 27 January 2020. F 10mm.

LIMACODIDAE

Miresa clarissa **(Stoll, 1790) (Fig. 38)**

This species was identified by the comparison of Trinidad material with the NHMUK series. This is an occasional species in Trinidad, widespread in forested areas to 700m.

Fig. 38. Male *Miresa clarissa*, at light, Englishman's Bay, 20 February 2020. F 15mm.

Semyra coarctata **Walker, 1855 (Fig. 39)**

The second author photographed males of this species at light at Englishman's Bay on 12 February and 19 March 2020. This name is based on a visual comparison of Trinidad material with the NHMUK series. However, this is part of a species complex needing revision (M.E. Epstein pers. com.) and so this name should be considered provisional at this time. In Trinidad, most records of this species have been from a suburban area (Curepe).

Fig. 39. Male *Semyra coarctata*, at light, Englishman's Bay, 12 February 2020. F 11mm.

Tanadema mas **Dyar, 1905 (Fig. 40)**

The second author photographed this species twice at light at Englishman's Bay: 29 January and 26 March 2020. *Tanadema mas* was described from French Guiana, Suriname and Guyana; Trinidad material was identified by comparison with a paratype from Guyana in NHMUK and the NHMUK series. Compared to Trinidad specimens, the male photographed by the second author at Englishman's Bay (Fig. 40) appears to have darker forewing markings and the thorax is more orange, but this is a variable species (M.E. Epstein pers. comm.) and so we use this name for Tobago – at least pending availability of specimens for a more detailed study. In Trinidad, *T. mas* is not uncommon and widespread in forested habitats.

Fig. 40. Male *Tanadema mas*, at light, Englishman's Bay, 29 January 2020. F 10mm.

MEGALOPYGIDAE

Thoscera brugea **Schaus, 1904 (Trosiinae) (Fig. 41)**

This record is based on a photograph taken by Chris Harrison at the Cuffie River Nature Retreat in January 2019. It has not previously been recorded from Trinidad, but there are specimens from Arima Valley (Simla), Curepe and Morne Bleu in MJWC and UWIZM. Trinidad specimens were compared with the male specimen from Venezuela labelled as type in USNM. This is a rare species in Trinidad with no obvious habitat association.

Fig. 41. Male *Thoscera brugea*, Cuffie Nature Resort, 1 January 2019, C. Harrison. © C. Harrison, edited from https://www.inaturalist.org/observations/19364420 under Creative Commons License CC-BY-NC. F 20mm.

NOCTUIDAE

Callopistria floridensis **(Guenée, 1852) (Eriopinae) (Fig. 42)**

This record is based on an image of a caterpillar (Fig. 42) found feeding on a fern in the Mount Pleasant – Golden Grove area of Tobago by Aaron Wheeler, and posted on iNaturalist (https://www.inaturalist.org/observations/31320559). Following a suggestion by Oswaldo Hernández, identification was based on Valerie G. Bugh's image in MPG (2019). *Callopistria floridensis* is known from Trinidad (Kaye and Lamont 1927), where it is a common and widespread species. It also occurs in the Lesser Antilles (Zagatti *et al.* 1995-2006), so would be expected in Tobago. *Callopistria* spp., including *C. floridensis*, are known to feed on ferns, which are unusual food plants for most Lepidoptera groups (Hendrix 1980). Recorded food plants of *C. floridensis* in North America include species of the fern genera *Adiantum*, *Blechnum*, *Cyrtomium*, *Nephrolepis*, *Polypodium* and *Pteris* (Tietz 1972). The fern species shown here was subsequently identified from additional images as an exotic garden ornamental, *Nephrolepis exaltata* (L.) Schott., by Yasmin Baksh-Comeau of the National Herbarium.

Fig. 42. Final instar caterpillar of *Callopistria floridensis*, on *Nephrolepis exaltata*, Mount Pleasant–Golden Grove, 26 November 2018, A. Wheeler. © figtree, edited from https://www.inaturalist.org/observations/31320559 under Creative Commons License, CC-BY-NC.

NOLIDAE

Nola pernitens **(Schaus, 1911) (Nolinae) (Fig. 43)**

This species has not previously been reported from Trinidad or Tobago. Material in MJWC was identified by comparison with the specimen labelled as type in USNM, a male from Costa Rica. Trinidad specimens in MJWC and UWIZM are from Arima Valley (Simla 3♂) and Morne Bleu Textel (1♂).

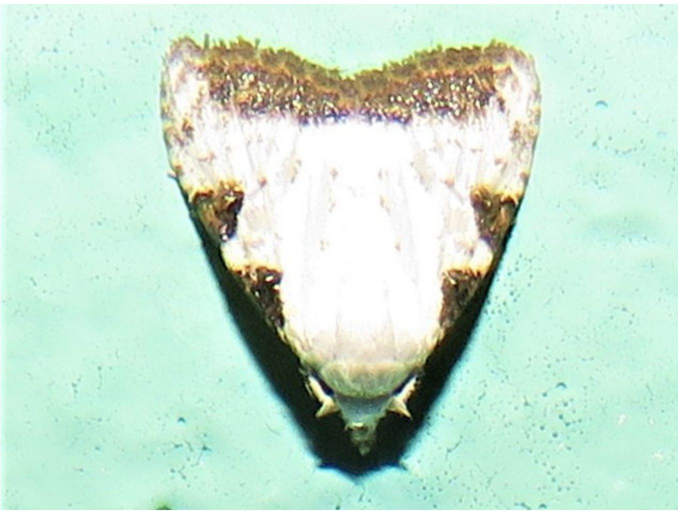

Fig. 43. *Nola pernitens* at light, Englishman's Bay, 7 January 2020. F 6mm.

NOTODONTIDAE

Tachuda discreta **Schaus, 1905 (Nystaleinae) (Fig. 44)**

Trinidad material was included in the type series (Schaus 1905), although more recent captures are consistently darker than the lectotype (USNM, French Guiana, ♂) and NHMUK series, raising the possibility that it may represent a different taxon. This is an uncommon species in Trinidad, found in forested areas.

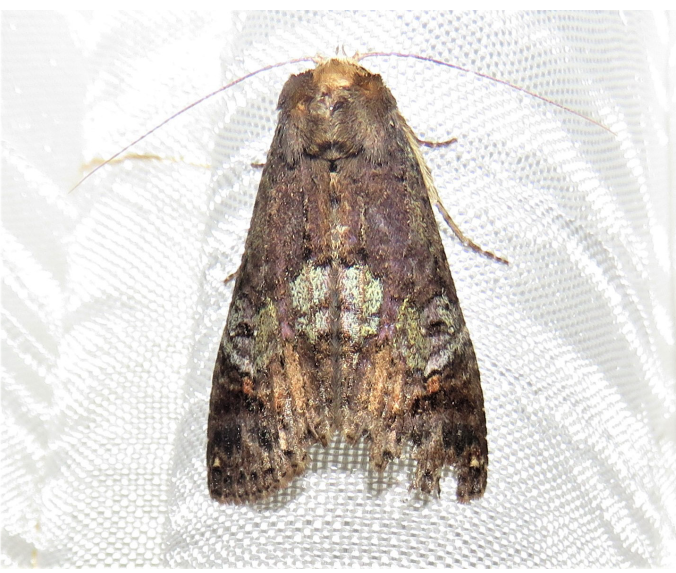

Fig. 44. *Tachuda discreta* at light, Englishman's Bay, 18 February 2020. F 18mm.

OECOPHORIDAE

Stenoma leucaniella **(Walker, 1864) (Stenomatinae) (Fig. 45)**

Trinidad material was identified by comparison with the USNM series, which includes specimens from the Arima Valley. In Trinidad, this is an occasional species, mostly recorded from forested areas.

Fig. 45. Male *Stenoma leucaniella*, at light, Englishman's Bay, 29 March 2020. M 11mm, F 12mm.

PYRALIDAE

Cacozelia elegans **(Schaus, 1912) (Epipaschiinae) (Fig. 46)**

There is a single female Trinidad specimen known from Palmiste, 30 December 1931, collected by Sir Norman Lamont (Lamont and Callan 1950), which the first author has examined in RSM and confirmed the identification by comparison with the USNM series. Apparently rare in both Trinidad and Tobago.

Fig. 46. *Cacozelia elegans*, at light, Englishman's Bay, 15 December 2019. F 11mm (estimated).

***Dasycnemia naparimalis* (Kaye, 1924) (Chrysauginae) (Fig. 47)**

The second author photographed this species at Englishman's Bay on 5 December 2019, 24 February, 14 and 17 March 2020 (all males). Trinidad material in MJWC was identified by comparison with the type material from Trinidad (Palmiste and Port of Spain) in Sir Norman Lamont's collection in NMS. It is possible that *D. naparimalis* is a synonym of *D. obliqualis* Hampson described from Brazil, but this has not been critically evaluated. This species is widespread in diverse habitats in Trinidad, but most commonly found in forested areas.

Fig. 47. Male *Dasycnemia naparimalis*, at light, Englishman's Bay, 24 February 2020. F male 8mm, F 12mm.

***Hypocosmia floralis* (Stoll, 1782) (Chrysauginae) (Fig. 48)**

Trinidad material was identified by comparison with the USNM series. An occasional species in Trinidad, mostly encountered in forested areas.

Fig. 48. *Hypocosmia floralis*, at light, Englishman's Bay, 27 January 2020. F 9mm.

SPHINGIDAE

***Eumorpha labruscae labruscae* (Linnaeus, 1758) (Macroglossinae)**

Anushka Ramsden photographed a caterpillar in her yard in Scarborough, and posted it on iNaturalist (https://www.inaturalist.org/observations/40688145) on 25 March 2020. It was identified by comparison with the images in Hossie *et al.* (2013). This species used to be common in suburban areas of Trinidad, but seems less so in recent decades (Cock 2018). It is widespread throughout tropical America, including the Caribbean, so its presence in Tobago is expected.

***Xylophanes chiron nechus* (Cramer, 1777) (Macroglossinae) (Fig. 49)**

Mike G. Rutherford photographed a *Xylophanes* sp. caterpillar near Hermitage, eastern Tobago in July 2016. Three species of *Xylophanes* are recorded from Tobago: *X. pluto* (Fabricius), *X. tersa* (Linnaeus) and *X. tyndarus* (Boisduval) (Cock 2017). The caterpillars of all three are known and they do not match this species; *X. pluto* and *X. tyndarus* have a single pair of eye spots on the thorax, and *X. tersa* has a row of eye spots extending almost the length of the body. Of the nine other species of *Xylophanes* known from Trinidad (Cock 2018), only *X. chiron* has two pairs of eye spots on the thorax (e.g. Janzen and Hallwachs 2020, Oelkhe 2020), although I have not located images of two of the Trinidad species, *X. neoptolemus* (Cramer) and *X. thyelia* (Linnaeus). However, while *X. chiron nechus* also occurs in the Lesser Antilles and so should be expected to occur in Tobago, these other two species do not extend that far north (Zagatti *et al.* 1995-2006), and are less likely to occur in Tobago. Nevertheless, confirmation that this is a Tobago species is desirable.

Fig. 49. Full grown caterpillar deduced to be *Xylophanes chiron nechus*, Hermitage, 8 July 2016, M.G. Rutherford. © Mike G. Rutherford https://www.inaturalist.org/observations/12144889, Creative Commons Licence, CC-BY-NC.

URANIIDAE

Syngria druidaria **Guenée, 1857 (Epipleminae) (Fig. 50)**

This species was described from Guyana, Tefé (Brazil), and Venezuela. It was identified by comparison with the specimen labelled as type in NHMUK and the NHMUK series. It is a variable species, and may represent a species complex. In Trinidad it is widespread and common in forested areas, often encountered by day as well as being attracted to light at night.

Fig. 50. Female *Syngria druidaria*, at light, Englishman's Bay, 16 December 2019. F 25mm.

DISCUSSION

Cock (2017) considered his checklist of 355 species of Tobago moths to be provisional, as the island has only been casually and locally surveyed by visiting collectors and naturalists. This is especially true for the smaller species that are less likely to be collected or observed by many short-term visitors, and this is reflected in the new records reported here. However, the increase in the number of species of moths known from Tobago, although more than 12%, still leaves the total far short of that expected. The new records reported here are based entirely on images taken by interested observers in Tobago, particularly the second author, and are a clear demonstration of how such images taken by citizen scientists can be used to add to our knowledge of the biodiversity of under-recorded areas. The fact that the first author is already familiar with the Lepidoptera fauna of Trinidad, of which the Tobago Lepidoptera make up a subset, has made their identification practical and reasonably reliable. Two species, *Trocodima lenistriata* (Erebidae, Arctiinae, Phaegopterini) and *Eulepidotis* sp. (Erebidae, Eulepidotinae) are not so far known from Trinidad. Although the former is known from the mainland, e.g. Venezuela, the distribution of the latter cannot be assessed until it is identified. Several other species had not previously been recorded from Trinidad, although the first author was aware that they occurred there. Most of the species reported here are not uncommon in Trinidad and their occurrence in Tobago is not unexpected.

Photographs taken by the second author of about 20 other species of mainly Crambidae, Pyralidae and Geometridae could not be fully identified at this time and are not reported here. Bearing in mind that the second author's photographic record was primarily during the dry season when moths are less common, it seems clear that there are many more species still to be recorded from Tobago. As shown here, citizen scientists can play a significant role in filling this gap.

ACKNOWLEDGEMENTS

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Sea Turtle Conservation: Tackling 'Floating Syndrome' A Caribbean Perspective

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ABSTRACT

In July 2013, a severely debilitated, critically endangered juvenile hawksbill sea turtle *(Eretmochelys imbricata)* washed ashore on Campbleton Beach, in northeast Tobago, West Indies. Four years later, in June 2017, a similarly debilitated, vulnerable sub-adult loggerhead sea turtle (*Caretta caretta*) stranded on Manzanilla Beach, on the east coast of Trinidad, West Indies. Floating Syndrome was diagnosed in both cases. Based on local resource availability, several modifications were effectively made to previously documented sea turtle management techniques, particularly pertaining to selection of gelatin diet ingredients for nutritional support and equipment used for handling and restraint. Despite the very limited resources and the absence of a well-equipped facility on the islands for long-term management of larger aquatic vertebrates, each animal was successfully rehabilitated after 10 weeks of therapy which included correction of serum biochemical abnormalities, fluid therapy, dietary modification, assist-feeding and freshwater therapy. Once fully recovered, the turtles were returned to their respective stranding sites and were successfully released. Rescue, rehabilitation and release of these animals were made possible through the collaborative efforts of a multitude of local and international wildlife conservation organisations and volunteers. These represent the first documented cases of successful rehabilitation and release of a hawksbill sea turtle and a loggerhead sea turtle with Floating Syndrome in Trinidad and Tobago. Furthermore, it is the first known and first documented loggerhead sea turtle stranding case for Trinidad and Tobago.

Key words: Sea Turtles, Hawksbill, *Eretmochelys imbricata*, Loggerhead, *Caretta caretta*, Threatened species, Rehabilitation, Caribbean.

INTRODUCTION

Of the seven species of sea turtles, six are present in the wider Caribbean, and five have been recorded for Trinidad and Tobago; the leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*), green (*Chelonia mydas*), loggerhead (*Caretta caretta*) and olive ridley (*Lepidochelys olivacea*) (Dow *et al.* 2007; Eckert and Eckert 2019; Forestry Division (GORTT) *et al.* 2010;). All five are long-lived, migratory species that are considered Threatened by the IUCN, are listed on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and have been designated as Environmentally Sensitive Species under local law in 2014, following the closure of the seasonal sea turtle fishery in 2011.

Leatherbacks visit only to breed and they are the dominant species nesting in Trinidad and Tobago, which is recognised as one of the largest rookeries of this species in the world (Eckert *et al.* 2012). Significant but scattered nesting of hawksbills takes place on beaches throughout Trinidad and Tobago (Dow *et al.* 2007; Eckert and Eckert 2019; Forestry Division (GORTT) *et al.* 2010; Walker *et al.* 2015), while nesting by greens is more limited, and nesting by olive ridleys and loggerheads is described as infrequent (Dow *et al.* 2007; Eckert and Eckert 2019).

A handful of loggerhead nesting records for the north coast of Trinidad and Great Courland Bay in Tobago have been reported by Forestry Division (GORTT) *et al.* (2010), and more recently, two live hatchlings were encountered at Turtle Beach (Great Courland Bay), Tobago in 2010 (Cazabon-Mannette, personal comment). Eckert and Eckert (2019) have identified two beaches in Trinidad and three in Tobago where loggerhead nesting has been reported.

In addition to nesting activity, hawksbills and greens are commonly encountered foraging around both islands year round, and comprise the bulk of sea turtles harvested at sea by fisherfolk (Cazabon-Mannette 2016; Forestry Division (GORTT) *et al.* 2010). Extensive information on the offshore activities of these species is lacking, however, due to a paucity of offshore studies. Forestry Division (GORTT) *et al.* (2010) report that loggerheads are rare locally, but have been observed foraging offshore both islands, and a single record of at-sea harvest in Toco, Trinidad was documented in a survey conducted in 1982-83 (Chu Cheong 1995). More recent evidence of foraging loggerheads comes from a local conservationist's video of an individual harvested at sea at a fishing depot in Guayaguayare, Trinidad in 2010, and divers' underwater photos of an individual at Charlotteville, Tobago in 2012

(Cazabon-Mannette, personal comment). A live loggerhead entangled in rope and fishing line was also encountered in April 2020 in Chaguaramas, and a dead loggerhead was recorded at Icacos in September 2019 (Cazabon-Mannette, personal comment).

Following early development in the oceanic epipelagic zone, juvenile hawksbills and loggerheads exhibit an ontogenetic shift, recruiting to benthic, neritic developmental habitat, where they largely remain resident until moving on to their adult foraging range, as they approach sexual maturity (Meylan *et al.* 2011; Musick and Limpus 1997). The benthic developmental stage appears to alternate with a pelagic foraging mode in some Atlantic loggerheads (Meylan *et al.* 2011). Developmental foraging aggregations represent "mixed stocks" of individuals drawn from a variety of genetically distinct rookeries distributed widely around the region (Bolker *et al.* 2007; Bowen *et al.* 2004; Bowen *et al.* 1996; Cazabon-Mannette *et al.* 2016; Reece *et al.* 2006). Adult hawksbills and loggerheads make extensive migrations between foraging areas and nesting beaches (Blumenthal *et al.* 2006; Horrocks *et al.* 2001) and females exhibit natal homing; returning to the rookery of their birth to breed (Bass *et al.* 1996; Bowen *et al.* 1994; Diaz-Fernandez *et al.* 1999; Troeng *et al.* 2005).

Periodically, sea turtles wash ashore due to illness. Of the reported cases documented at the University of the West Indies, School of Veterinary Medicine (UWI-SVM), Aquatic Animal Health (AAH) Unit, fibropapillomatosis in green sea turtles is the most commonly seen pathologic condition in stranded sea turtles on the islands. Two such cases were admitted to the UWI-SVM AAH Unit, but were severely emaciated and ultimately died during treatment (Cazabon-Mannette and Phillips 2017). At least six other cases of live or dead animals with characteristic lesions have been reported and/or documented on social media in Trinidad and Tobago, while many others have likely gone unreported. For the period September 2010 to May 2020, the UWI-SVM AAH Unit also documented other conditions affecting sea turtles on these islands, including boat strike, drowning following entanglement in fishing nets, lacerations, poaching and Floating Syndrome. Floating Syndrome is a collective term for positive buoyancy disorders in sea turtles. It is most often associated with the presence of excess gas in the body, but may alternatively be a behavioural response to other pathological conditions, or be the result of neurological deficits, or it may be multifactorial in aetiology (Wyneken *et al.* 2006).

While successful sea turtle rehabilitation is routine at specialised, well-equipped, well-funded facilities in developed countries, it is an uncommon occurrence for many Caribbean territories, including Trinidad and Tobago, as rehabilitation poses a significant challenge where equally outfitted facilities are lacking. Challenges are further exacerbated when extended case management is required. Herein we report on collaborative conservation efforts that resulted in the successful rehabilitation and release of two cases of Floating Syndrome, in a hawksbill and a loggerhead, despite the absence of sophisticated aquatic animal rehabilitation facilities and resources in the country. The paper demonstrates that locally available resources, even if limited, can be effectively utilised to manage and rehabilitate stranded sea turtles. This report also constitutes the first known and documented loggerhead sea turtle stranding case for Trinidad and Tobago.

BACKGROUND

The hawksbill stranded on the Leeward/Caribbean coast of northeast Tobago, while the loggerhead stranded on the Atlantic (eastern) coast of Trinidad (Figure 1). The 8.3kg juvenile hawksbill (46.3cm curved carapace length (CCL)) was discovered debilitated and minimally responsive on July 3, 2013 on Campbleton Beach, Tobago (Figure 2a). The animal was rescued by a team of visiting zoology students from the University of Glasgow, Scotland, and members of a local sea turtle conservation group, North East Sea Turtles (NEST). The animal was kept indoors in shallow (5cm depth) freshwater for 5 days after which it was transferred to shallow natural seawater.

A veterinarian on the island visited on the day after the animal was rescued and administered an unknown antibiotic and a multivitamin, and advised that the care takers syringe-feed the animal 590ml of a popular commercially available electrolyte drink daily. Two days later, the veterinarian administered another dose of the antibiotic and a steroid, the identities and doses of which are unknown. As the animal became more alert and responsive to stimuli, the veterinarian advised that the animal be hand fed canned sardines daily. Care takers force fed the animal half a can of sardines (62.5g) twice daily. The animal began passing faeces two days after being rescued and did so periodically for ten days.

Two weeks after being rescued, attempts were made to release the animal in a shallow area of the bay, however, it became immediately apparent that the animal had a buoyancy disturbance and was unable to submerge when it attempted to dive. Persistent caudal positive buoyancy was evident. After multiple dive attempts, the animal quickly became exhausted and the release attempt was aborted. On the following day, another release attempt was made. The animal could submerge and swim with only slight caudal positive buoyancy for a few minutes, but on surfacing to breathe, it could not re-submerge. No further release attempts were made. Daily hand feeding of 125-

Fig.1. Stranding sites of two sea turtles diagnosed with Floating Syndrome in Trinidad and Tobago, West Indies. A severely debilitated, critically endangered juvenile hawksbill sea turtle *Eretmochelys imbricata* washed ashore on Campbleton Beach in northeast Tobago in July 2013 **(S1)**. A similarly debilitated, vulnerable sub-adult loggerhead sea turtle *Caretta caretta* stranded on Manzanilla Beach on the east coast of Trinidad in June 2017 **(S2)**.

200g of sardines or fresh bait fish was continued, however, the animal experienced multiple episodes of diarrhoea followed by the absence of faeces. After six weeks of care in Tobago by its rescuers, the animal was transferred to the UWI-SVM, AAH Unit at the University of the West Indies, School of Veterinary Medicine, St. Augustine Campus, in Trinidad, for physical examination, diagnostics and rehabilitation following ongoing gastrointestinal upsets and continued problems with buoyancy regulation.

The loggerhead was discovered in a very similar condition on June 30, 2017 on Manzanilla Beach, Trinidad. The 63.0kg, 82.75cm CCL sub-adult was also severely debilitated on stranding (Figure 2b). It too was minimally responsive. It was rescued and immediately transported from its stranding site to the El Socorro Centre for Wildlife Conservation, a non-profit, non-governmental wildlife conservation centre in Trinidad, the only site on the island at which an adequately sized (approximately 3785L) marine holding tank was readily available for immediate use at the time of the stranding. The animal was managed as a patient of the UWI-SVM, AAH Unit.

MATERIALS AND METHODS

Physical Examination and Diagnostics

The physical condition of each animal was quickly assessed upon discovery of the animals at the stranding sites. Detailed physical examinations were carried out upon arrival at the rehabilitation facilities. Prognostic indicators were determined based on animal behaviour and physiological parameters. The animals were assessed for an estimation of sexual maturity, weight, determination of morphometric measurements, presence of lesions, general body condition, presence of reflexes, function of cranial nerves, and the level of activity and coordination of

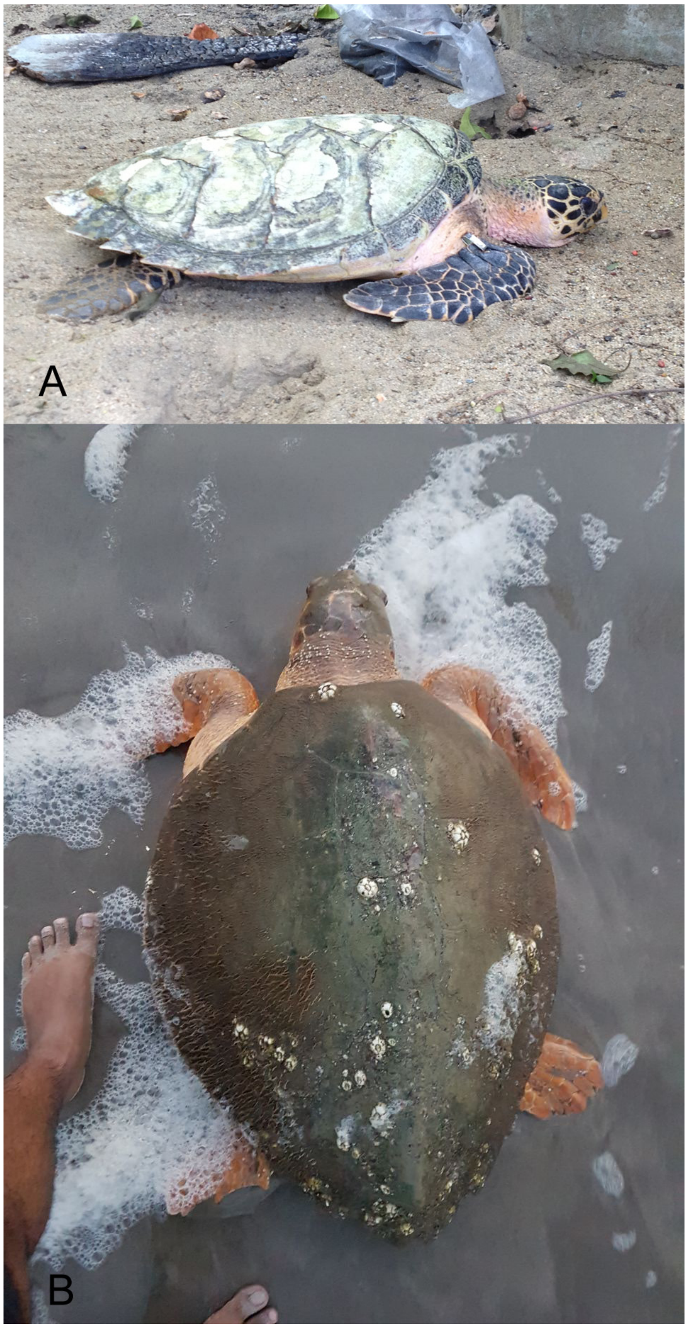

Fig. 2. Two stranded sea turtles diagnosed with Floating Syndrome in Trinidad and Tobago, West Indies. **(A)** A severely debilitated, critically endangered juvenile hawksbill sea turtle (*Eretmochelys imbricata*) washed ashore on Campbleton Beach in northeast Tobago on July 3, 2013. **(B)** A similarly debilitated, vulnerable sub-adult loggerhead sea turtle (*Caretta caretta*) stranded on Manzanilla Beach on the east coast of Trinidad on June 30, 2017.

movement in and out of water. Blood samples and whole body radiographs were taken. Small quantities of faecal material and rectal mucus, collected per rectum, were submitted for bacterial culture and sensitivity and were also examined for gastrointestinal parasites.

Medical Management

Immediate measures included addressing dehydration and hypoglycaemia via intracoelomic (IC) administration of 5% dextrose/0.9% sodium chloride sterile solution at a rate of 10-18ml/kg/day. An additional 20ml single bolus of 50% dextrose solution was administered orally via feeding tube. Nutritional and haematological deficits were initially targeted via the intramuscular administration of a multivitamin containing Vitamins B, E and A twice weekly, along with a single dose of Vitamin K1 at 0.25mg/kg to address clotting insufficiency sometimes seen in debilitated sea turtles. Iron dextran was administered intramuscularly at 6mg/kg once weekly. Once blood parameters improved, Becoplex oral Vitamin B and Vitamin C supplement (Carlisle Laboratories Ltd., St. Thomas, Barbados) was administered daily at 15-20ml in the feed. Broad spectrum antibiotic coverage was instituted for the duration of the rehabilitation process, since severely debilitated sea turtles often succumb to bacterial infections secondary to being severely immunocompromised. On admission, long acting oxytetracycline was administered at 40mg/kg every 72 hours, pending the results of faecal culture and sensitivity. Based on the results of faecal culture and sensitivity, the antibiotic regimen for the hawksbill was modified to enrofloxacin at 5mg/kg administered orally every 48 hours for 6 treatments, while the regimen for the loggerhead was modified to four-quadrant antibiotic coverage using a combination of metronidazole at 20mg/kg once daily for 5 days and procaine benzylpenicillin at 20,000IU/kg every other day until the animal had fully recovered. Deworming was achieved using fenbendazole at 25mg/kg orally and praziquantel at 8mg/kg orally. Both drugs were repeated two weeks later. Additional therapeutic agents included oral simethicone as needed to stimulate the elimination of gas from the digestive tract, mineral oil gavages, KY Jelly enemas and oral Lactulose Sandoz Solution (Sandoz Inc. New Jersey, USA) administration for catharsis.

Dietary Management

On presentation, neither animal ate on its own. Gel diets were therefore prepared as shown in Table 1. The animals were tube fed daily at a rate of 0.5 – 3.0% body weight, split over three feedings daily in the case of the hawksbill, and as one feeding in the case of the loggerhead. Animals were maintained in an upright position at a 60° to 90° angle for 30 minutes post-feeding to minimise regurgitation. Body weight was re-assessed every two weeks. In the case of the loggerhead, after approximately seven weeks the animal had gained strength and began eating small quantities on its own. Tube feeding was therefore reduced to once every other day.

Hydrotherapy

Animals were housed in marine tanks of either natural or artificial seawater. The hawksbill tank contained

Table 1. Hawksbill *Eretmochelys imbricata* and Loggerhead *Caretta caretta* Sea Turtle Gelatin Diet Recipes used in the rehabilitation of two stranded sea turtles in Trinidad and Tobago.

Ingredients	Amount	*E. imbricata* gelatin diet	*C. caretta* gelatin diet
Tilapia Grower Pellets (National Flour Mills Limited, Feed Mill, Port-of-Spain, Trinidad and Tobago)	212.5g	√	√
Dasheen/Taro Leaves (*Colocasia esculenta*)	142.0g	√	
Malabar spinach (*Basella alba* and/or *Basella rubra* L.)	142.0g		√
Canned sardines	282.5g	√	√
Shrimp (peeled)	141.0g	√	
Squid (viscera removed)	141.0g	√	
Frozen Seafood mix (thawed):			
(Squid, Shrimp, Octopus, Mussels (shells removed), Clams (shells removed), Conch (shell removed).	282.0g		√
Ginger (*Zingiber officinale*) root or powder	5.0g	√	√
Oyster shell calcium (Nature's Blend, National Vitamin Company, Casa Grande, AZ, USA) or Coral calcium (GNC Holdings Inc, Pittsburgh, PA, USA)	1.3g	√	√
Gelatin	225g	√	√
Water	1600ml	√	√

approximately 568L (150 US gallons) of artificial seawater (Instant Ocean® Sea Salt, Aquarium Systems USA and France) prepared according to manufacturer's instructions to a concentration of approximately 32ppt. The average daily water temperature was 27°C. The water was continuously mechanically filtered and was changed every 1-2 weeks. The loggerhead tank contained approximately 3785L (1000 US gallons) of natural seawater at a salinity of approximately 27ppt (brackish water) and an average daily temperature of 28°C. The seawater was collected from Trinidad's west coast, trucked to the conservation centre and was UV sterilised.

Freshwater therapy was performed in the latter weeks of the rehabilitation period when animals had clearly regained strength and were showing improvement in gastrointestinal function. To facilitate ease of return to diving, each turtle was placed in a freshwater tank for 6-8 hours daily. Freshwater (dechlorinated) tanks were appropriately sized to allow the turtles to dive to at least approximately 1.5m (5ft). Animals were monitored to prevent accidental drowning through exhaustion. After 6-8 hours, animals were returned to their marine tanks.

Handling and Restraint

Manual restraint was readily accomplished with the hawksbill due to its relatively small size. Restraint during feeding was accomplished by placing the animal in an upright position in a small tub (Figure 3a). Towel rolls were placed beneath the animal to provide adequate padding for the caudal carapacial margin as the animal stood on end, and a foam block was placed behind the animal to secure the animal in position. Only light manual restraint was applied thereafter to minimise animal movement. The animal was readily manually lifted into and out of its treatment tanks.

Daily handling and restraint of the loggerhead presented a significant challenge, especially when moving the animal between the marine and freshwater hydrotherapy tanks. In the absence of appropriate equipment, the animal's size and weight posed a threat to the safety of both the animal and handlers. As such, volunteers constructed equipment components that were used in conjunction with other basic hardware items to achieve the desired handling and restraint goals. A marine mammal stretcher acquired from the Trinidad and Tobago Marine Mammal Stranding Network (TTMMSN) was used to carry the animal and to help restrain the flippers during feeding and medical management. A wooden bench was modified with hinges to allow the benchtop to be elevated to a 60° angle for feeding. The angle was maintained using a stack of concrete bricks. Bungee cords and ropes were used to secure the animal to the elevated benchtop throughout feeding (Figure 3b). This apparatus was used successfully for approximately 4 weeks, after which a local veterinary clinic donated an adjustable, mobile stainless steel examination table (Figure 3c). The animal was kept calm during feeding by covering its eyes with self-adhering bandages. This bandage also

Fig.3. Restraint and handling techniques used during the rehabilitation of two stranded sea turtles diagnosed with Floating Syndrome in Trinidad and Tobago, West Indies. **(A)** Manual restraint was adequate for the juvenile hawksbill sea turtle (*Eretmochelys imbricata*). During feeding, the animal was placed in an upright positon in a small tub, with towels and foam blocks used for padding. **(B)** The sub-adult loggerhead sea turtle (*Caretta caretta*) was lifted using a marine mammal stretcher and placed on a wooden bench that was modified with hinges to allow the benchtop to be elevated to a 60° angle for feeding. The angle was maintained using a stack of concrete bricks. Bungee cords and ropes were used to secure the animal to the elevated benchtop throughout feeding. **(C)** The modified wooden bench in (B) was eventually replaced by an adjustable, mobile, stainless steel examination table that was donated by a local veterinary clinic. **(D)** The loggerhead was kept calm during feeding by covering its eyes with self-adhering bandages. This bandage also served to keep a mouth speculum, derived from a circular 7.5cm diameter PVC fitting, in position during feeding. **(E and F)** Volunteers purchased materials and constructed a wooden crane which allowed the loggerhead to be safely and more readily hoisted from the freshwater hydrotherapy tank.

served to keep a mouth speculum, derived from a circular 7.5cm diameter PVC fitting, in position during feeding (Figure 3d). Safely hoisting the animal out of its freshwater tank was particularly difficult. Volunteers again purchased materials and constructed a wooden crane which allowed the animal to be more readily retrieved from the tank using less effort and reduced the risk of handler injury (Figures 3e and 3f).

RESULTS

Physical Examination

Select morphometric data and clinical findings are presented in Table 2. Although size at sexual maturity reported in the literature is highly variable among and within populations, and size is therefore not considered as a reliable indicator of maturity (Meylan *et al.* 2011), minimum size at sexual maturity can be used to confirm immaturity. Minimum size at sexual maturity for hawksbills in the west Atlantic is straight carapace length (SCL) 67cm i.e. notch to notch (Meylan *et al*. 2011) which is the equivalent of approximately 70cm CCL (van Dam and Diez 1998). For loggerheads in the northwest Atlantic, the minimum size at sexual maturity is CCL 87.9 cm (Ehrhart and Witherington 1987). Therefore the morphometric data suggests that the hawksbill was a juvenile animal, while the loggerhead was a sub-adult (Table 2). Sexual dimorphism is only apparent in sea turtles after sexual maturity, at which point males develop a large and muscular prehensile tail which extends beyond the caudal margin of the carapace (Wibbels 1999). In the absence of additional ultrasound or endoscopic evaluation, sex could not be assumed for either animal.

Both animals were deemed to be in fair body condition at the time of clinical evaluation. Increased prominence of the biventer cervical and transverse cervical muscles and moderate to severely sunken eyes especially when angled head up/tail down, were consistent with sub-optimal body condition in both animals. The hawksbill was reportedly minimally responsive at the time of stranding, however, at the time of transfer to the UWI-SVM AAH Unit, the animal was alert and responsive. The loggerhead was minimally responsive at the time of clinical examination.

Table 2. Stranding location, select morphometric data and clinical findings for a hawksbill sea turtle *Eretmochelys imbricata* and a loggerhead sea turtle *Caretta caretta* that stranded in Trinidad and Tobago, West Indies.

	E. imbricata	***C. caretta***
Stranding location	Latitude: 11°19'01.5 N Longitude: 060°33'38 W	Latitude: 10°29'44.0 N Longitude: 61°02'37.5 W
Straight carapace length notch-tip (SCL) (cm)	Data unavailable	80.0
Curved carapace length notch-tip (CCL) (cm)	46.3	82.75
Straight width (cm)	Data unavailable	68.0
Curved width (cm)	40.0	78.0
Weight on presentation (kg)	8.3	63.0
Thin neck?	Mild	Mild
Tendons of neck stretched and obvious?	Mild	Mild
Shoulder area sunken behind leading edge of carapace?	Mild	No
Radius and humerus thin?	No	No
Plastron and inguinal area sunken?	Mild	Mild
Eyes sunken (especially if stood on rear end)?	Severe	Severe
Overall estimation of body condition	Fair	Fair
Compulsive circling in water?	None	None
Head posture	Level	Level
Head movement	Normal	Normal
Body posture	Caudal positive buoyancy	Tilted right
Limb movement, strength and coordination (in and out of water)	Normal	Normal
Animal picks up its head to breathe when out of water?	Yes	Yes
Reflexes (flexor, crossed extensor, cloacal, nociception) and tail movement	Normal	Normal
Cranial Nerve Assessment	No abnormalities detected	No abnormalities detected

Following fluid and dextrose administration, the animal became increasingly more alert and responsive over the course of approximately 60 to 90 minutes. No ectoparasites or epibiota were noted on the hawksbill, however, there was considerable algal growth along the dorsal midline and left side of the carapace of the loggerhead and numerous surface and burrowing barnacle colonies of varying sizes covered approximately 25% of its carapace, plastron and skin of the perineum, flippers, neck, head and periorbit (Figures 2b and 4a). An approximately 4cm x 2cm superficial, non-penetrating crack was also noted on the carapace, just right of the dorsal midline, in the caudal-most corner of the second central scute (Figure 4a).These findings suggested possible inactivity of the animal, likely close to the water surface, prior to stranding. The majority of the barnacles were removed over the first two weeks of rehabilitation using a combination of fresh water immersion and manual removal. The loggerhead initially presented with a mild cloacal prolapse (Figure 4b), which reduced spontaneously during the physical examination, but recurred two days later as a severe prolapse. The prolapsed cloacal mucosa was bathed in a supersaturated sugar solution followed by veterinary obstetric lubricant and was gently manually reduced. A purse-string suture was placed to prevent re-prolapse, but leaving an adequate orifice for the passage of faeces. Neither animal was observed to be passing faeces and digital examination of the rectum yielded only small amounts of yellow/green to cream gelatinous mucous in both cases (Figure 4b).

When placed in a marine tank, both animals floated high in the water and were asymmetrically buoyant. The hawksbill demonstrated slight caudal positive buoyancy (Figure 5a) and could not stay submerged on attempting to dive, thus demonstrating involuntary positive buoyancy. The loggerhead made strong, coordinated attempts to dive, but was also unable to submerge. A significant, persistent right-sided tilt (right side downward) was noted (Figure 5b). Both animals would quickly become exhausted following multiple dive attempts and would remain floating on the surface with their respective tilts evident, as described. In both cases, the centre of buoyancy was noted to shift periodically over the course of rehabilitation, consistent with what may be seen as gas moves through the gastrointestinal tract. This suggested that the animals may have been 'gastrointestinal floaters'.

Radiographic Evaluation

Radiographic findings were similar for both animals, with there being a presence of gas within the caudal loops of intestine (Figure 6). There was no evidence of gas trapped beneath the carapace or within the body cavity. These findings confirmed the diagnosis of the animals being gastrointestinal floaters, but the underlying cause of the accumulation of gas in the intestine was not discernible based on the radiographic images. No foreign bodies and no skeletal abnormalities were detected.

Medical, Dietary and Hydrotherapeutic Management

Based on clinical assessment and diagnostic findings, the aim in each case was to support a return to normal haematological parameters, provide antimicrobial coverage to prevent the development of systemic infection secondary to environmental stress and an immunocompromised state, to stimulate gut motility and the expulsion of the gas present in the caudal gastrointestinal tract, and to provide nutritional support by gradually reintroducing the animals to food via tube feeding and hand-feeding as tolerated and accepted by the animals. In both cases, animals were gradually re-introduced to larger quantities of food via tube feeding over a period of 10 weeks. The animals were tube fed a liquefied

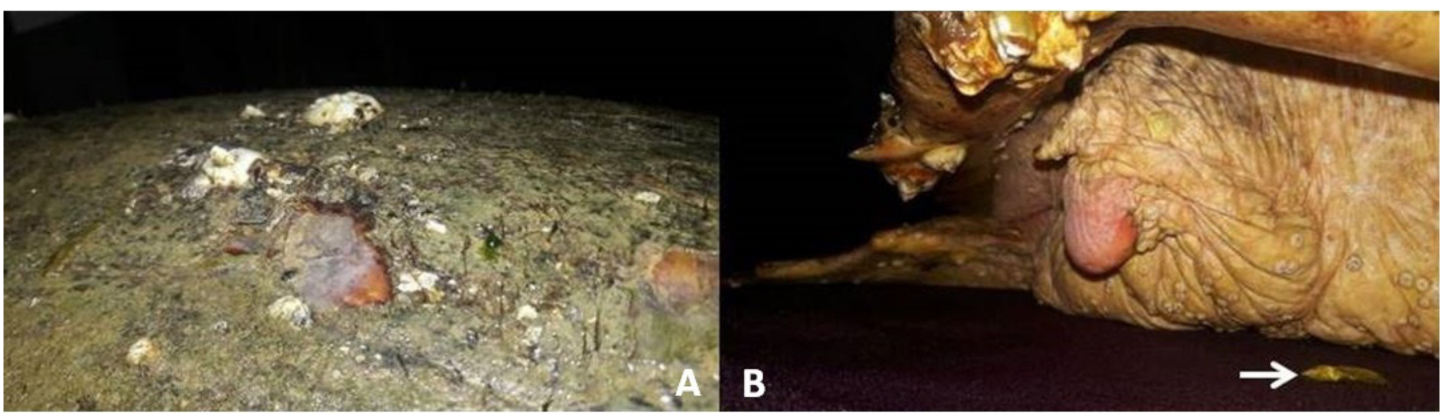

Fig. 4. Lesions observed on a stranded sub-adult loggerhead sea turtle *Caretta caretta* diagnosed with Floating Syndrome on June 30, 2017 in Trinidad and Tobago, West Indies. **(A)** An approximately 4cm x 2cm superficial, non-penetrating crack in the carapace was noted just right of the dorsal midline, in the caudal-most corner of the second central scute. **(B)** Mild cloacal prolapse observed on presentation. Digital examination of the rectum yielded only small amounts of yellow/green to cream gelatinous mucous ***(arrow)***. Similar faecal material was obtained from a hawksbill sea turtle *Eretmochelys imbricata* diagnosed with Floating Syndrome, which stranded on Campbleton Beach in northeast Tobago on July 3, 2013.

gelatin-based diet, modified from Wyneken *et al.* (2006) as shown in Table 1. Locally available ingredients were substituted as necessary and were well tolerated by both animals, ultimately yielding excellent results. Trout chow was replaced with tilapia grower pellets. Malabar spinach (*Basella alba* and/or *Basella rubra* L.) and Dasheen (Taro) (*Colocasia esculenta*) leaves constituted the leafy greens. A variety of canned, fresh, or thawed frozen seafoods were utilised. While an effective (if any) dosing regimen in aquatic species requires study, either fresh or powdered ginger (*Zingiber officinale*) root was included in the gelatin diet for its potential to have prokinetic, anti-inflammatory and antioxidant effects (Ghayur and Gilani 2005). Either oyster shell calcium or coral calcium was incorporated as a supplement for musculoskeletal support.

After 10 days of medical and dietary management, the hawksbill started passing faeces daily. Over the course of two weeks, the faecal material gradually transitioned from small amounts of yellow/green mucoid material to greater quantities of well-formed faeces of a normal consistency. The animal was placed in a freshwater tank daily, as described earlier, to further support correction of the positive buoyancy. Approximately 5 days after faecal elimination had normalised and freshwater therapy was

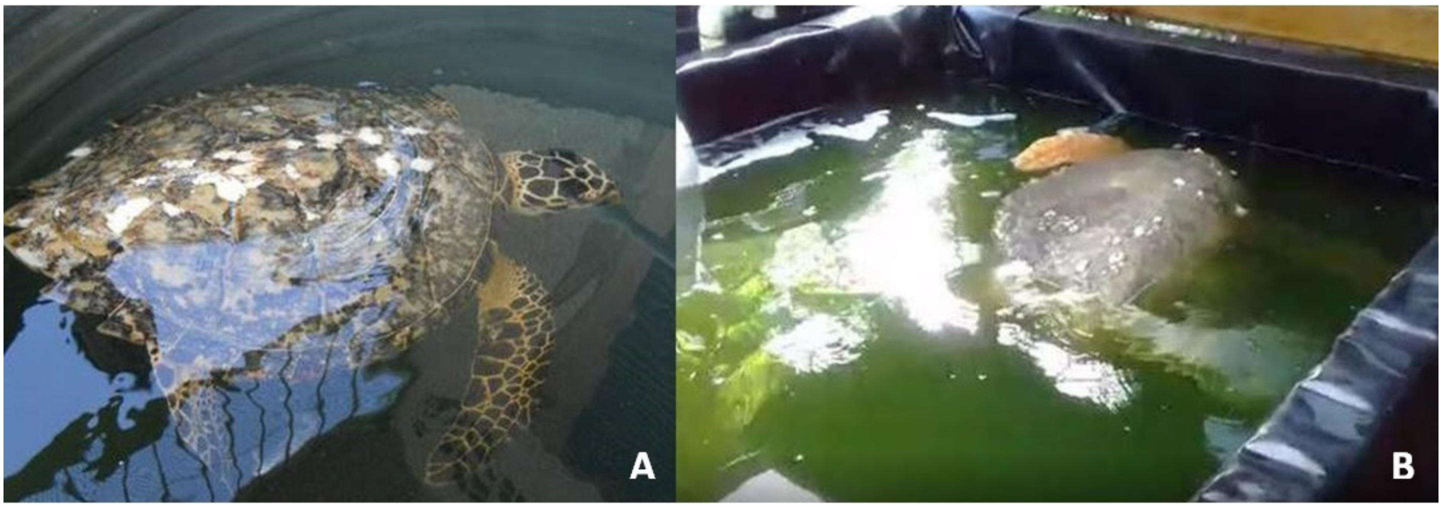

Fig. 5. Two stranded sea turtles diagnosed with Floating Syndrome in Trinidad and Tobago, West Indies. Both animals floated high in marine water and were asymmetrically buoyant. **(A)** The juvenile hawksbill sea turtle *Eretmochelys imbricata* demonstrated a slight upward pelvic tilt. **(B)** The sub-adult loggerhead sea turtle *Caretta caretta* demonstrated a significant, persistent right-sided tilt (right side downward).

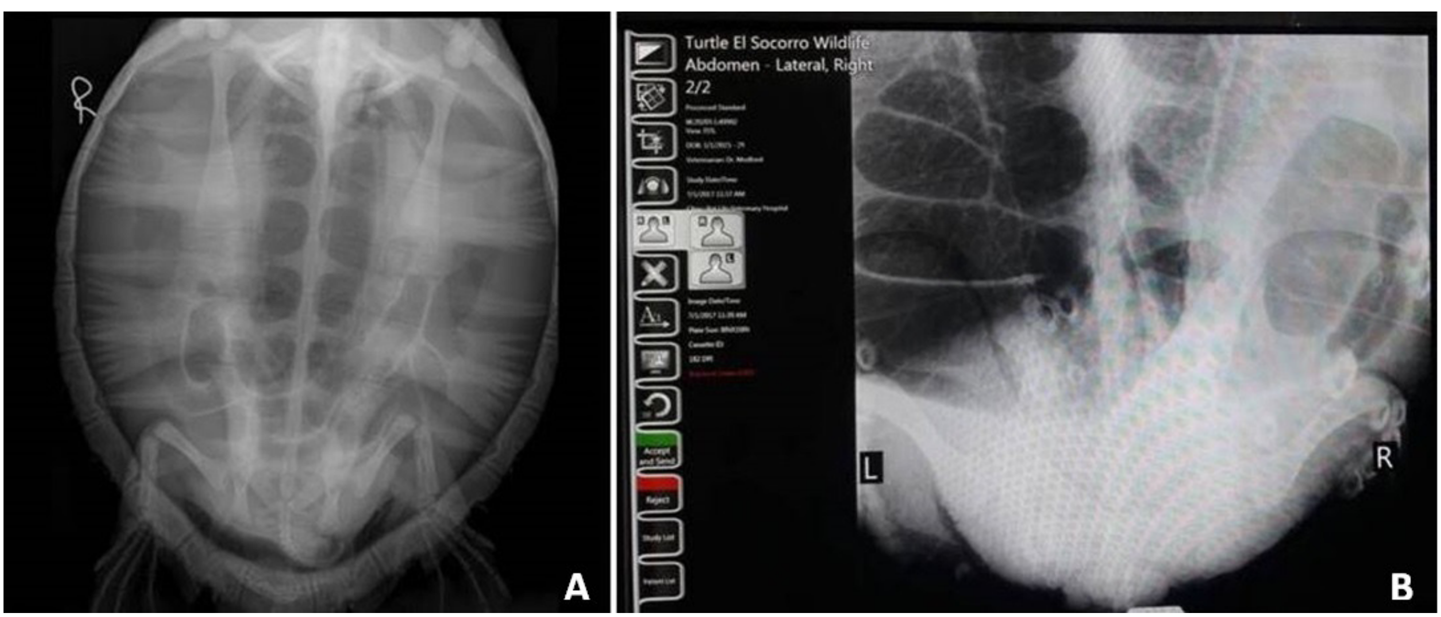

Fig. 6. Dorsoventral radiographs of two stranded sea turtles diagnosed with Floating Syndrome in Trinidad and Tobago, West Indies. Significantly distended, gas-filled caudal loops of intestine were observed in both animals. **(A)** Juvenile hawksbill sea turtle *Eretmochelys imbricata* which demonstrated a caudal positive buoyancy in marine water. **(B)** Sub-adult loggerhead sea turtle *Caretta caretta* which demonstrated a significant, persistent right-sided tilt (right side downward) in marine water.

initiated, the caudal positive buoyancy completely resolved and the animal could quickly submerge and rest comfortably at the bottom of both the freshwater and the marine tanks. The animal consistently showed no interest in shellfish, fish or vegetation offered, perhaps due to the almost exclusively spongivorous nature of the hawksbill diet in this region. After a total of ten weeks (six weeks in Tobago and four weeks in Trinidad), the hawksbill, though it refused to eat on its own, had gained 0.7kg, was consistently diving to full tank depth, was comfortably regulating its buoyancy and was therefore cleared for release.

After five weeks of fluid therapy, nutritional supplementation, and antimicrobial and anthelminthic coverage, the loggerhead had gained 4kg and was also gaining strength, but was only periodically passing small amounts of yellow-tinged mucoid faecal material. There was a general absence of faeces. The animal intermittently showed an interest in hand fed fish and shrimp and ate a maximum of 850g on its own on one occasion, making ongoing tube feeding necessary. Radiographs were repeated, revealing that gas-distended loops of intestine were still prominent. Intestinal obstruction was suspected. A mineral oil gavage was performed along with a KY Jelly enema. Two days later, no faeces had passed. The animal was therefore tube-fed Lactulose Sandoz (3.3g/5ml) oral solution (Sandoz Inc., New Jersey, USA) to promote catharsis. Twenty-four hours later, the cloaca was distended, hyperaemic and a faecal mass was visible at the cloacal orifice. The purse-string suture was removed and a 40g well-formed faecal mass was passed. The mass contained primarily coarse crushed shell material and fish bone fragments. Lactulose administration was continued once daily as part of the daily feeding regimen for a total of 5 days to ensure continued smooth, regular passage of faeces. The animal was also offered whole fish and shrimp daily to encourage self-feeding. Following the passage of the impacted material, faeces were either passed during tube feeding or were observed floating in the animal's tank daily thereafter. Within 10 days, the animal was readily diving to full tank depth, regulating its buoyancy and eating a variety of fish and shrimp on its own. After 10 weeks of rehabilitation, the animal was deemed releasable.

Release

The hawksbill was transported from Trinidad back to its stranding site in Tobago. Inconel tags were applied and the animal was successfully released at nearby Hermitage beach, a short distance from Campbleton Beach where it initially washed ashore (Figure 7a). The loggerhead was prepared for release by first applying Inconel tags, followed by the application of a satellite telemetry tag (ARGOS- CLS

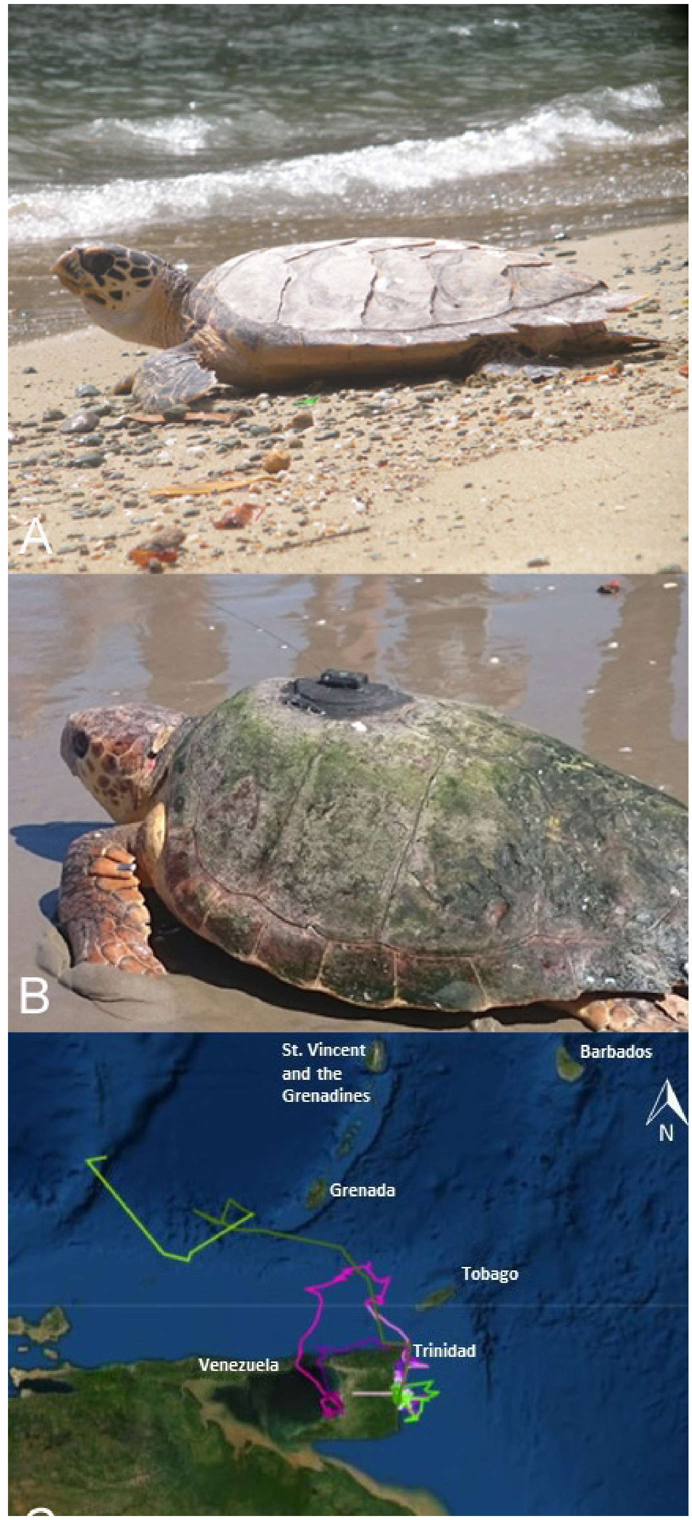

Fig. 7. Release of two stranded sea turtles diagnosed with Floating Syndrome, after successful rehabilitation in Trinidad and Tobago, West Indies. **(A)** Juvenile hawksbill sea turtle *Eretmochelys imbricata* was flipper tagged and released on Hermitage beach, Tobago. **(B)** Sub-adult loggerhead sea turtle *Caretta caretta* was flipper tagged and satellite telemetry tagged and released on Manzanilla Beach, Trinidad. **(C)** Path of the loggerhead sea turtle from the time of release (September 2017) to January 2018, as recorded by the satellite telemetry tag.

America Inc., Maryland, USA). The animal was transported back to its stranding site on Manzanilla Beach and was successfully released (Figure 7b). This is the first loggerhead sea turtle to be satellite tagged in Trinidad and Tobago. The animal’s path from the time of release (September 2017) to January 2018 is shown in Figure 7c. The last recorded signal from the satellite tag was on 23 January, 2018, consistent with the approximate battery life of the tag. At that time, the animal was recorded in the Caribbean Sea, over 120km to the west of the northwestern tip of Grenada, West Indies. The satellite tag data provided a brief glimpse into the possible role of Trinidad and Tobago’s waters as a foraging habitat or a migratory pathway for loggerheads.

DISCUSSION

In the wild, healthy turtles are known to float periodically, perhaps as a behavioural thermoregulatory mechanism, referred to as ‘basking’, or perhaps simply to rest. However, weak sea turtles can also be found floating at the surface, likely as a behavioural response to prevent drowning (Manire *et al*. 2017). Conversely, floating may be involuntary. Possible underlying causes include excess gas in the stomach and/or intestines. Most commonly, this may occur secondary to gastroenterocolitis; ileus secondary to dehydration, foreign bodies including fishing hooks and lines, systemic disease, spinal cord injury, gastroenterocolitis and malnutrition; impactions consisting of vegetation or indigestible ingested materials secondary to gastrointestinal stasis (Manire *et al*. 2017). Floating may also be precipitated by pneumocoelom; a condition where gas is trapped within the coelomic cavity but outside of the gastrointestinal tract and lungs. This is most commonly associated with lung tears secondary to blunt force trauma, but may also be linked to ruptured pulmonary lesions such a bullae, or due to pneumonia, which result in leakage of air into the coelom . Neurological disease (traumatic or non-traumatic) may also result in involuntary positive buoyancy, with traumatic causes such as boat strike being more common (Manire *et al.* 2017). Depending on the nature of the nerve injury sustained due to such trauma, there may be disruption of the animal’s fine buoyancy control, there may be rear flipper paralysis, or it may cause ileus, thus leading to gas accumulation in the gastrointestinal tract, further exacerbating positive buoyancy (Manire *et al.* 2017). Another more recently described cause of positive buoyancy in sea turtles is decompression sickness, in which floating is presumably caused by gas emboli in the cardiovascular system and within viscera (García-Párraga *et al.* 2014; Manire *et al.* 2017). It is therefore important to carry out a full diagnostic evaluation to correctly identify the underlying cause of the animal’s positive buoyancy, although in some cases, the underlying cause is never elucidated.

Floating Syndrome in the cases discussed was ultimately demonstrated to be the result of excess gas in the gastrointestinal tract (‘gastrointestinal floaters’). However, the cause of the accumulation of gastrointestinal gas differed. Gas accumulation in the hawksbill was ultimately presumed to be secondary to gastroenterocolitis. This was suspected based on the animal’s relatively rapid response to medical therapy and dietary management. The condition in the loggerhead, however, was due to ileus following faecal impaction with shell fragments and other indigestible components of the animal’s prey. These cases represent the first two instances of animals with Floating Syndrome reported in Trinidad and Tobago. A third case, a juvenile green sea turtle *Chelonia mydas*, was reported in March 2020, however, despite initial signs of improvement during treatment, this animal died suddenly 1 week after being admitted to the UWI-SVM, AAH Unit. The underlying cause of this animal’s buoyancy disturbance was undetermined. Other presentations of buoyancy abnormalities can be less amenable to treatment, including free gas in the coelomic cavity from tears in the lung, or carapace fractures transecting or compressing the spinal cord leading to expanded caudal lung fields and/or persistent lower gastrointestinal atony (Manire *et al.* 2017)

There are presently no aquatic wildlife rehabilitation facilities in the country, thus making long-term management of such cases, particularly for larger animals, especially challenging. Physical and financial resources were entirely donated by rescuers, care takers and other volunteers. In the absence of sophisticated machinery and a constant availability of adequate manpower, there was an absolute need for ingenuity in devising techniques for the safe handling of these animals throughout the rehabilitative process, especially as the animals showed physiological improvement and as they gained strength. Further, local and international interagency collaborations were imperative to these sea turtle conservation efforts, with governmental and non-governmental organisations in Trinidad and Tobago, Florida, USA and Scotland, UK playing vital supportive roles that collectively influenced the positive outcome of each case. It is anticipated that as further aquatic wildlife health assessments are conducted and continued rehabilitation success is achieved, aquatic wildlife conservation efforts in Trinidad and Tobago will garner even greater support, and ultimately result in the establishment of a designated, well-equipped facility suited for long term housing and rehabilitation of these and other protected aquatic megavertebrates of the Southern Caribbean.

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Night Walks Generate Unexpected New Observations of Moths (Lepidoptera) from Trinidad, West Indies.

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ABSTRACT

During night walks in the forests of Trinidad, West Indies, the authors observed and photographed several moth species (Lepidoptera) not previously reported from the island and documented several interesting behaviours. *Belonoptera patercula* (Pagenstcher), *Siculodes avicula* Guenée (both Thyrididae) and *Sylepte coelivitta* (Walker) (Crambidae) are species not previously known from Trinidad. *Rejectaria niciasalis* (Walker) and *R. rosimonalis* (Walker) (Erebidae) were known from Trinidad, but their presence had not previously been reported in the literature. Feeding was noted at flowers, fallen fruit, bird droppings, diseased grass flowers and water.

Key words: *Belonoptera patercula*, *Siculodes avicula*, *Sylepte coelivitta*, new to Trinidad.

INTRODUCTION

In the course of night walks to observe reptiles and amphibians in the forests of Trinidad, RND and HA observed and photographed a variety of other animals, most prominent amongst which were moths (Lepidoptera). Many of these were posted on iNaturalist (www.inaturalist.org), where MJWC identified them based on his detailed knowledge of the Lepidoptera of Trinidad & Tobago. In the process, it became apparent that hitherto rarely recorded species, including some new to the island, and previously unreported behaviours were being observed.

This paper describes the methods used and document some of the more interesting of our observations.

METHODS

RND and HA undertook night collecting trips to several areas of Trinidad to collect data on reptiles and amphibians. Expeditions to some of the more remote areas lasted up to four nights. Night walks with 2–6 observers were conducted typically at 1900-2200h and again at 24.00–02.00h. Walks followed a planned route and covered 2km or more, depending on the activity of the wildlife on that night.

The foliage of shrubs and trees from ground level to approximately 3m above ground were closely inspected using headlamps. Observations of moths were recorded using a phone camera with flash. If necessary, the brightness of the flash on the camera was reduced to prevent too much white light being reflected off the moths. The white balance of the camera was set between 4000-5000K (fluorescent lamp spectrum) to capture more accurate colours.. The image metadata included the precise time, but not GPS data. The locality data were estimated using Google Maps. Depending on the availability of landmarks and the distance covered during the night walk, accuracy was typically within 100 m.

Based on observations of moths attracted to light, different species of moths are known to be active at different times of night, and sometimes this reveals clear differences between species which are otherwise very difficult to distinguish. We therefore include the time of each observation. MJWC was able to identify the majority of species photographed based on his personal reference collection of Trinidad Lepidoptera (MJWC coll.), identified by reference to the collections of the Natural History Museum, London (NHMUK), and the Smithsonian Institution, Washington (Cock 2003). The collection of the University of the West Indies Zoological Museum (UWIZM) could be used similarly. Species not previously known from Trinidad were identified from original sources, on-line resources or by specialists.

RESULTS

Moths were readily spotted on the night walks because of their reflective eyes and the contrast in their colour with the background foliage. Many seemed to be simply resting on foliage, while others were active. Typically, resting moths were unbothered by the lights or flash, and would only fly off if their resting place was disturbed. A frequently observed resting position was on the underside of a hanging leaf, just above the tip (e.g. Fig. 1), but the significance of this position was not clear. Most moths were perched more than 1.5m above the ground. Moths actively feeding on flowers (especially Sphingidae) were more likely to be disturbed by the lights and flash.

Active caterpillars were frequently observed on the night walks, but rarely could they be identified. It would be an interesting extension to these night walks to identify the food plants and rear caterpillars to adults for identification.

New or noteworthy records for Trinidad

The following were new or noteworthy records and observations of moths from night walks. Additional species yet to be identified are not presented.

***Belonoptera patercula* (Pagenstcher, 1892) (Thyrididae, Siculodinae)**

This species was seen near the last house on the trail from Brasso Seco to Paria (approximately 10.768°, -61.274°) on 25 January 2020 at 21.08h (Fig. 1). It was perched on the underside of a leaf tip hanging over a drop, positioned so that only a photo of the ventral view could be safely obtained.

The image was identified from the dorsal view in Gaede (1936, plate 174g), as fortunately the ventral and dorsal wing markings are similar, and the wing shapes are distinctive. Only 11 species of Thyrididae are known from Trinidad, all of them rare in collections.

Fig. 1. Female *Belonoptera patercula* near Brasso Seco, 25 January 2020.

***Hemeroblemma ochrolinea* (Guenée, 1852) (Erebidae, Erebinae, Thermesiini)**

Cock (2020) recorded this species from Trinidad based on two male specimens and RND's image of a female taken at rest under a leaf, near Brasso Seco during a night walk on 12 April 2020 at 19.46h. This photo (Cock 2020, Fig. 13. This issue, p. 17) remains the only record of the female of this species from Trinidad.

'*Letis*' *arcana* Feige, 1974 (Erebidae, Erebinae, Thermesiini)

Species belonging to the Thermesiini are amongst the more noticeable moths on night walks due to their large size, reflective eyes and in some species iridescent colours. The only Trinidad record of '*Letis*' *arcana*[1] is a photograph taken during a night walk near Brasso Seco on 18 April 2020 at 21.20h. Cock (2020, Fig. 47. This issue p. 30) included it in his account of the Trinidad Thermesiini, where it is noted that this species is very rarely collected in its known range in French Guiana and northern Brazil. Since Thermesiini are amongst the larger and most frequently seen, collected and photographed moths in Trinidad, this record is all the more remarkable.

***Rejectaria niciasalis* (Walker, [1859]) (Erebidae, Herminiinae)**

This species was not previously recorded from Trinidad. MJWC captured a male at the Morne Bleu Textel Installation, 13 September 1978 [MJWC coll.], and identified it by comparison with the type and NHMUK series. K. Sookdeo (pers. comm.) subsequently photographed a female at Brasso Seco, 11 January 2014. RND photographed a mating pair near Brasso Seco at 01.18h on a night walk on 15 February 2020 (Fig. 2). The female is resting on the underside of a leaf, and the male is hanging free beneath her.

Fig. 2. Mating pair of *Rejectaria niciasalis*, Brasso Seco, 15 February 2020, female above.

***Rejectaria rosimonalis* (Walker, [1859]) (Erebidae, Erebinae)**

There are two specimens of this species collected by MJWC at the lights of the Morne Bleu, Textel Installation, 10 July 1987 [NHMUK] and 17 October 1979 [MJWC

[1]The use of inverted commas for *Letis* reflects that this species is not correctly placed in the genus and is expected to be placed in a new genus when the group is next revised (Cock 2020).

coll.]. They were identified by comparison with the NHMUK series. A further specimen was photographed on a night walk near Brasso Seco, 24 December 2019 at 22.25h (Fig. 3). This species was not previously recorded from Trinidad.

Fig. 3. *Rejectaria rosimonalis* near Brasso Seco, 24 December 2019.

***Siculodes avicula* Guenée, 1877 (Thyrididae, Siculodinae)**

The moth in Fig. 4. was photographed at rest on a *Heliconia* sp. leaf on a night walk near Brasso Seco, 27 September 2020 at 00.14h. Hampson (1897, p. 630) lists this species as occurring in Tobago, presumably based on a specimen in NHMUK. Cock (2017) overlooked this record in his checklist of Tobago moths, and it has not previously been recorded from Trinidad. The species was identified by comparison with colour figures in Druce (1881-1900, plate 59.8) of the synonym *S. macropterana* Druce, 1889, and Gaede (1936, plate 175d).

Fig. 4. *Siculodes avicula* near Brasso Seco, 27 September 2020.

***Syllepte coelivitta* (Walker, 1866) (Crambidae, Spilomelinae)**

The brilliant blue reflective markings of this species (Fig. 5) were noticed on the underside of a leaf near a slow-moving stream in rain forest near Brasso Seco at 22.20h, on 12 April 2020.

This species was identified by M. Alma Solis based on Fig. 5. It appears to be a mimic of *Euagra intercisa* Butler (Erebidae, Arctiidae, Ctenuchina), which is rare in Trinidad with just two records (Kaye and Lamont 1927). The wings

Fig. 5. Male *Slept coelivitta* near Brasso Seco, 12 April 2020.

of the two species are a close match, although *E. intercisa* has bipectinate antennae and a shorter, broader abdomen.

Behavioural observations

The following are examples of behaviour observed on the night walks. Most relate to different types of attractants, whereas courtship and oviposition have yet to be recorded, and mating has been rarely observed (e.g. Fig. 2).

Flowers attracting moths: Java plum, *Syzygium cumini* (Myrtaceae)

Moths are known to visit flowers, but because they are mostly nocturnal this is much less observed than with butterflies. Many moths were observed being attracted to a flowering Java plum tree near the Caroni Swamp Visitor Centre between 21.06h and 21.40h on 25 July 2020. The species photographed included *Anticarsia gemmatalis* Hübner, *Epidromia pannosa* Guenée, *Mocis latipes* (Guenée) (Erebidae), *Argyrogramma verruca* (Fabricius), *Condica cupentia* (Cramer), and *Neomilichia caternaultii* (Guenée) (Noctuidae) (Fig. 6). Some were photographed resting on the foliage rather than feeding, but we assume they were attracted by the flowers.These species were all identified by comparison with the NHMUK collection and previously recorded from Trinidad by Kaye and Lamont (1927). They are all fairly common species, apart from *N. caternaultii*, which is rarely collected.

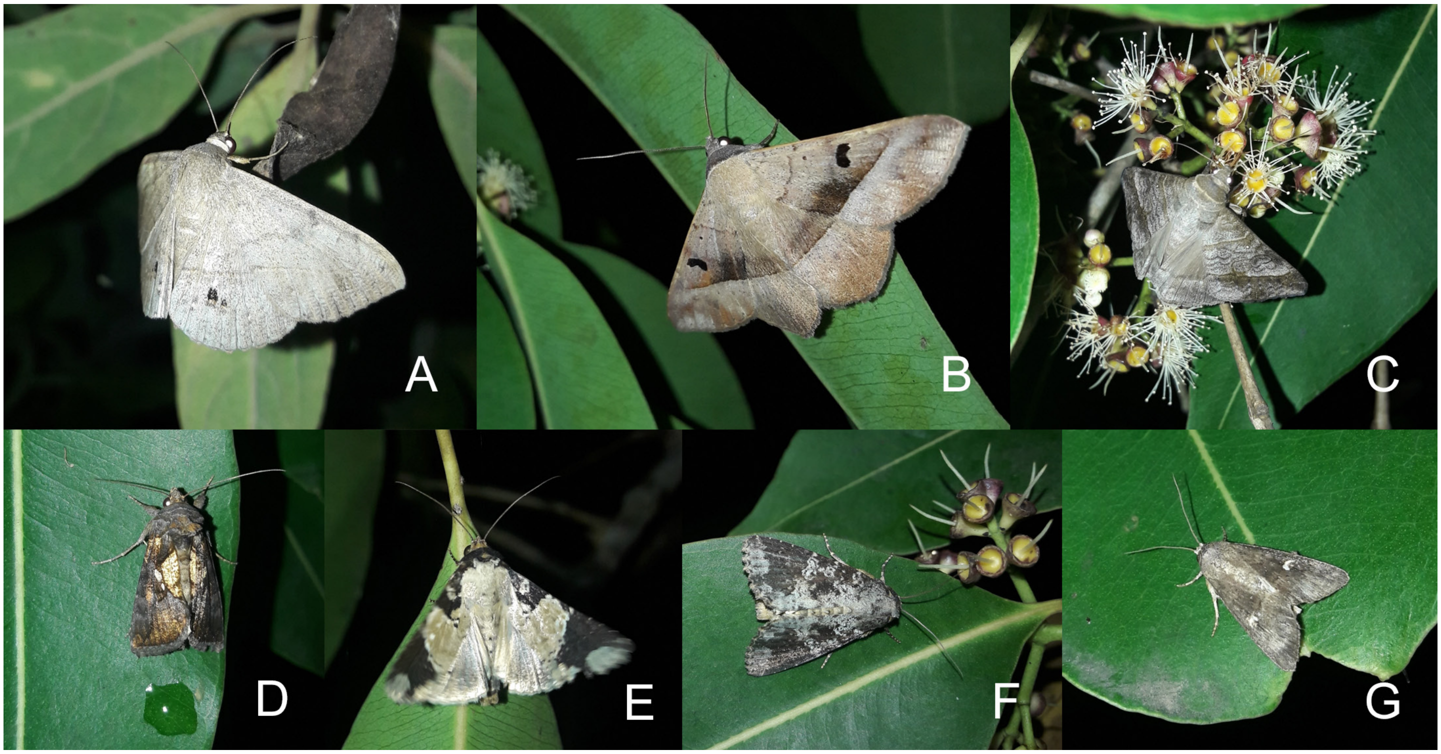

Fig 6. Moths attracted to a flowering Java plum, Caroni Visitor Centre, 25 July 2020. A, *Anticarsia gemmatalis*; B, *Epidromia pannosa*; C, *Mocis latipes* (Erebidae); D, *Argyrogramma verruca*; E, *Condica cupentia* male; F female; G, *Neomilichia caternaultii* (Noctuidae).

Feeding at fallen flowers: *Oxidercia fuscapurpurea* (Kaye, 1927) (Erebidae, Calpinae)

A male of this species was photographed near Brasso Seco on 27 December 2019 at 21.12h feeding on an unidentified fallen purple flower (Fig. 7). Presumably the freshly fallen flower retained attractive scent and nectar.

Kaye (1901) described *Catamelas fusca-purpurea* [sic] from Trinidad, and subsequently transferred it to the genus *Oxidercia* (Kaye and Lamont 1927), which Poole (1989) overlooked in his catalogue of Noctuidae (as then defined). This species was identified by comparison with Kaye's original type in NHMUK and is an occasional species of forested areas of Trinidad.

Fig. 7. Male *Oxidercia fuscapurpurea* feeding at an unidentified fallen flower, near Brasso Seco, 27 December 2019.

Feeding on fallen fruit: *Hemeroblemma opigena pandrosa* (Cramer) (Erebidae, Erebinae)

Several species of witch moths (tribe Thermesiini) have been recorded feeding on fallen fruit (Cock 2020). We include here a record of a male *H. opigena pandrosa* feeding on fallen fruit of *Flacourtia indica* (governor plum or cerise) (Salicaceae), photographed on Lalaja South Road at 24.53h on 29 November 2019 as one example (Fig. 8).

Feeding on fallen fruit is a common behaviour observed in many nymphalid butterflies, so it is likely that many moths will be found to do this.

Fig. 8. Male *Hemeroblemma opigena pandrosa* at fallen fruit of *Flacourtia indica*, Lalaja South Road, 29 November 2019.

Feeding on cacao seed pulp: *Gorgone augusta* (Stoll) (Erebidae, Calpinae) and *Coremagnatha cyanocraspis* Hampson (Erebidae, Herminiinae)

In an abandoned cacao estate near Brasso Seco, two moths were photographed feeding on the pulp around a cacao seed at 20.41h on 27 December 2019 (Fig. 9). They were a male *G. augusta* and a female *C. cyanocraspis*. Both were recorded from Trinidad by Kaye and Lamont (1927) and are occasional species in forested areas.

Fig. 9. Male *Gorgone augusta* feeding on cacao seed pulp, Brasso Seco, 27 December 2019.

Fig. 10. Female *Coremagnatha cyanocraspis* feeding on cacao seed pulp, Brasso Seco, 27 December 2019. A *Gorgone augusta* (Fig. 9) can be seen feeding at the top of the picture.

RND has observed squirrels (*Sciurus granatensis* Humbolt) opening cacao pods and feeding on the seeds, and it is likely that the seed was dropped by a squirrel. We are not aware of other observations of moths feeding in this way, but other species are likely to feed on the pulp around cacao seeds on an opportunistic basis.

Feeding on bird droppings: *Aglaonice deldonalis* (Walker, 1859) (Erebidae, Herminiinae)

A male of this species was photographed feeding at what appears to be a bird dropping containing seeds at Inniss Field on 22 August 2020 at 21.02h (Fig. 11). Butterflies are well known to feed on bird droppings, but very little seems to have been published regarding this habit by nocturnal moths. See Cock (2017) regarding the identification of this species.

Fig. 11. Male *Aglaonice deldonalis* feeding at seed-filled bird dropping, Inniss Field, 22 August 2020.

Feeding on diseased grass flowers: *Lesmone* spp. (Erebidae, Erebinae)

On 26 August 2020, on a night walk in mangrove at the end of Bernhard Road, Caroni Swamp, at 21.36h, numerous moths were observed apparently feeding on flowers of a *Paspalum* sp. grass. Two were photographed (Figs. 12, 13) and identified as *Lesmone formularis* (Geyer) and *L. duplicans* (Möschler), both common species in Trinidad (Kaye and Lamont 1927, M.J.W. Cock unpublished).

Grasses are wind pollinated, so there is no obvious reason why potential pollinators such as moths should be attracted to the flowers. However, closer examination of the images suggests that the inflorescences were diseased and are glistening with moisture, which must be what attracted the moths. There are some suggestions of similar behaviour in the literature. Moths are attracted to a sugary exudate produced by, or due to, an ergot fungus (*Claviceps*

Fig. 12. *Lesmone duplicans* feeding on diseased grass inflorescence, Caroni Swamp, 26 August 2020.

Fig. 13. Female *Lesmone formularis* feeding on diseased grass inflorescence, Caroni Swamp, 26 August 2020.

paspali) infecting inflorescences of *Paspalum* spp. grasses in the USA (Neerwinkle *et al.* 1993, Feldman *et al.* 2008), Japan (Sugiura and Yamazaki 2007) and probably widely elsewhere. Moths are implied as vectors of endophytes and mycoparasitic fungi, which in turn attack the ergot (Feldman *et al.* 2008). Nearly 50 species of moths were observed to visit diseased inflorescences in Japan (Sugiura and Yamazaki 2007); Noctuidae and Crambidae were the most commonly sampled, along with several species of Erebidae and Geometridae. Further species can be expected to show this behaviour in Trinidad.

Claviceps paspali is widespread in North and South America, but does not seem to have been recorded from Trinidad (Baker and Dale 1951, Guzmán *et al*. 1998). Nevertheless, it seems likely that this is the species involved in this observation.

Drinking water: *Ergavia drucei* Schaus (Geometridae, Sterrhinae)

This behaviour is well known in day-flying butterflies, but there have been limited observations of moths showing this behaviour by night, and these were mostly in temperate regions (Adler 1982). When individuals continuously imbibe water through their proboscis, pass it through the gut and discharge it in spurts, this is often termed pumping, and is associated with absorbing sodium ions. Pumping is usually shown by male Lepidoptera, and the sodium is transferred to the female at copulation and used in reproduction (Boggs and Dau 2004, and references therein).

A male *Ergavia drucei* was observed showing this behaviour in the forest at Inniss Field at 19.38h on 6 September 2020 (Fig. 14).

Ergavia drucei was identified by comparison with a specimen in UWIZM and the series in NHMUK and USNM. It is rarely recorded in Trinidad; Kaye and Lamont (1927) record a specimen from Palmiste (19.ix.1947) [UWIZM 2013.13.2043], and there is another from Caparo (F. Birch) in NHMUK. *Ergavia* was transferred from Oenochrominae to Sterrhinae by Murillo-Ramos *et al.* (2019).

Fig. 14. Male *Ergavia drucei* drinking and showing pumping action, Inniss Field, 6 September 2020. Ejected water is visible for at least two body lengths behind this individual.

DISCUSSION

Moths are one of the most species-rich insect groups in Trinidad & Tobago. The moths of Trinidad have been relatively well studied, and Cock (2003) indicated that about 2275 species are known and suggested a true total of about 3500 species. The Tobago fauna is less well known with only 400 species recorded so far (Cock 2017, Cock and Kelly 2020). Understandably, it is therefore not uncommon to come across species that have not previously been recorded from the islands, although many of these are found in collections (Cock 2003). However, records of species that have never previously been collected in Trinidad are likely to be considerably less common. Nevertheless, *Belonoptera patercula*, *Siculodes avicula* and *Sylepte coelivitta* were all new records for Trinidad, and our observation of '*Letis*' *arcana* was a new record reported by Cock (2020).

MJWC has been able to identify almost all photographs of Trinidad moths posted on iNaturalist, but several times images from the night walks represented species new to him and previously unknown from the islands. Identification of these species from photographs, without a voucher specimen, is not ideal, but proved possible in some cases, at least on an interim basis.

Although many species of moths fly by day, the great majority are nocturnal, so that most species recorded from the islands are based on specimens attracted to light by night. Night walks provide a new method to observe (and potentially collect) moths, but the observations recorded here include an unexpectedly large number of new or unusual records, especially considering that moths were not the primary focus of the exercise and were made by observers with scant knowledge of these insects

There are virtually no observations on how moths behave at night in Trinidad and relatively few elsewhere, particularly in the tropics. The only exception is some groups of Arctiini (Erebidae) which can be attracted to drying plants of *Heliotropium* spp. by day and by night (Beebe 1955, M.J.W. Cock unpublished). Although many species photographed on night walks were at rest, showing no obvious behaviour, sometimes individuals were observed feeding and drinking at various attractants. Natural feeding attractants for adult moths include nectar, over-ripe and rotting fruit, juices of sound fruit, exuding plant sap, honeydew, water, animal excreta (Norris 1936) and perhaps pollen and carrion, which are known to be attractive to some groups of butterflies. We include observations from several of these categories.

In conclusion, night walks provide a novel, potentially fruitful way to record moths and their behaviour. Taking photographs provides an explicit voucher for the record and facilitates subsequent identification. As the moth fauna of Trinidad is relatively well known, it is often not necessary to collect specimens.

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Nature Notes

Male Colour Morphs in a Northeastern Trinidad Population of Streak Gecko *Gonatodes vittatus* (Squamata: Gekkota: Sphaerodactylidae)

Gonatodes vittatus (Lichtenstein and von Martens 1856) (Squamata: Gekkota: Sphaerodactylidae) is distributed along the northeastern edge of South America, ranging from northeastern Columbia to Guyana, including the islands of Trinidad and Tobago and smaller islands off the coast of Venezuela (Rivero-Blanco 1980, Demeter and Marcellini 1981). *G. vittatus* occurs in arid climates (Rivero-Blanco 1980) close to forests and is typically found on tree trunks and man-made structures, including stone walls and fences (Demeter and Marcellini 1981; Quesnel *et al*. 2002).

Males of *G. vittatus* are considered to show different colour morphs based on differences in throat, chin and lower lip colour (Quesnel 1957, Fuenmayor *et al.* 2006). Quesnel (1957) reported multiple male colour morphs from Trinidad, including three plain throat colour morphs (white, grey, and golden-yellow) and a patterned morph, with a black and white striped throat. Murphy *et al.* (2018: Plate 90, p. 175) documented two of these colour morphs (solid golden-yellow and black and white striped throat morph) with photographs, but otherwise made no reference to male throat colour variation in this species.

We investigated which of the male colour morphs of *G. vittatus* (as defined by Quesnel 1957) are represented, and in what abundance, in northeastern Trinidad. Our study took place on the property of Jammev Beach Resort, Toco UTM 725990E 1197537N.

Individuals were captured by hand or with the aid of a small hand net from across the property between the hours of 7:00-11:00 and 16:00-18:00 over the course of 12 days from 28 May to 8 June 2018. Upon capture, individuals were immediately transferred to a breathable cloth bag and transported to a field laboratory for examination. During examination, specimens were sexed (based on colour), then placed gently on to a ruler and photographed in dorsal and ventral view using a smartphone (Samsung Galaxy S8+). Close-up images of the throat (ventral view) were also obtained for each male with the aid of a 4x macro lens (Easy-Macro, Manchester, MA) attached to the smartphone. After examination, all specimens were released at the same location from which they were collected. We did not collect at the same location more than once to avoid recapture of the same individual. Snout-vent length (SVL) was obtained for each individual to the nearest tenth of a millimetre from digital images using the program FIJI (Schindelin *et al.* 2012). Male individuals were also assigned to colour morph using digital images. Statistical analyses were performed using Microsoft Excel©. A total of 66 individuals of *G. vittatus* were collected (29 female/37 male). The mean SVL of females was 34.7mm (range 28.6-37.4, SD 1.93). The mean SVL of males was 33.8mm (range 29.5-37.8, SD 1.99). No significant difference was detected in SVL between males and females (two-tailed t-test, p = 0.06895) (Fig. 1). Of the 37 males collected, 21 represented the black and white striped throat morph, seven represented the solid golden-yellow throat morph, and nine represented the solid white throat morph (Fig. 2). Males exhibiting different colour morphs did not differ significantly in SVL (Single Factor ANOVA, p = 0.428) (Fig. 3).

Species of *Gonatodes* are well known for exhibiting multiple male colour morphs (Rivero-Blanco and Schargel 2012, Fuenmayor *et al.* 2006). Of the four different male colour morphs of *G. vittatus* reported from Trinidad by Quesnel (1957), we encountered only three in the population that we studied in northeastern Trinidad (the solid grey throat morph was not encountered). Males representing the black and white striped throat morph were most abundant in our sample (55%), with males representing the solid white throat and the solid golden-yellow throat morphs being less abundant (25% and 20% of males sampled, respectively). Quesnel (1957) reported SVL of 34.0 and 33.5mm for males and females, respectively, of *G. vittatus*

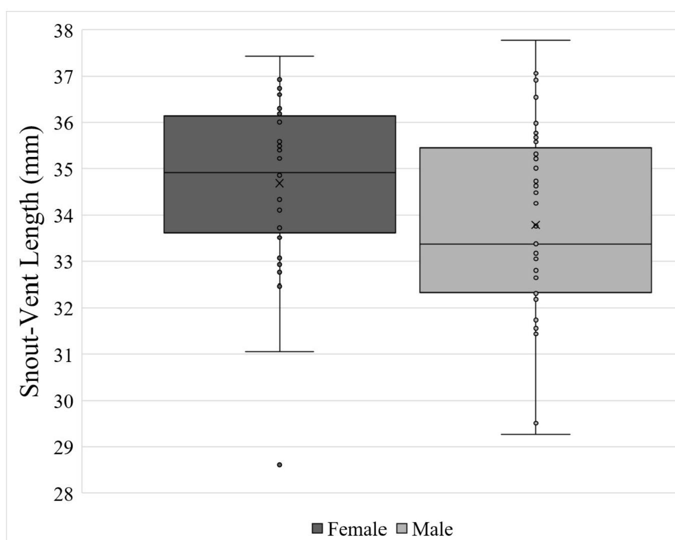

Fig. 1. Snout-vent length of male (n=37, 29.5-37.8mm) and female (n=29, 28.6-37.4) *Gonatodes vittatus* included in this study.

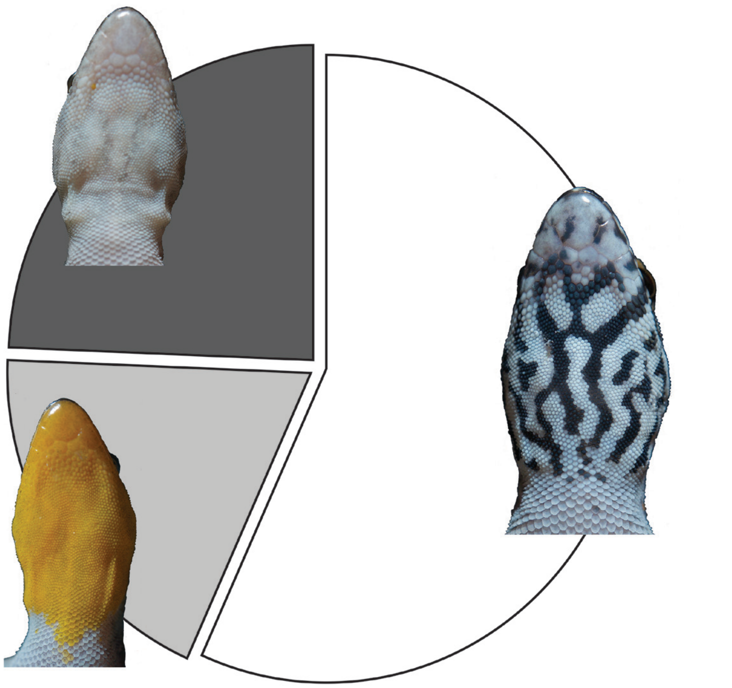

Fig. 2. Piechart showing proportion of three different male colour morphs observed across males of *Gonatodes vittatus* included in this study (n=37).

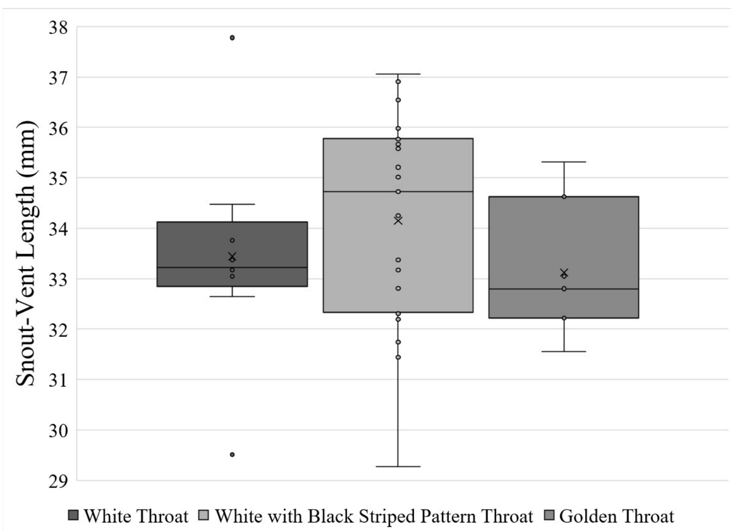

Fig. 3. Snout-vent length of male individuals of *Gonatodes vittatus* (n = 37) representing three different male colour morphs, including solid white throat (n = 9), white with black striped pattern throat (n = 21), and solid golden-yellow throat (n = 7) morphs.

from Trinidad. Murphy *et al*. (2018) reported SVL to be 33–34mm for both sexes. The values that we obtained for SVL based on 66 individuals (29 female/37 male) of *G. vittatus* from northeastern Trinidad (Fig. 1) are similar to those reported by Quesnel (1957) and Murphy *et al*. (2018) but we also encountered larger individuals than reported by either of these authors (the largest individual collected was a male, 37.8mm SVL). We detected no significant difference in SVL between males representing different colour morphs (Fig. 3), supporting Quesnel's (1957) observation that the different male colour morphs of *G. vittatus* are not the product of ontogenetic colour change. *G. vittatus* is widespread across Trinidad (Murphy *et al*. 2018) and it would be interesting to extend this study to other regions of the island, not only to better understand the geographic distribution of the different morphs but also to assess whether the frequency of the different morphs differs between populations.

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Will *Mauritia flexuosa* (Arecaceae) in the Erin Savanna, Trinidad Become Locally Extinct?

Moriche Palm *Mauritia flexuosa* (Arecaceae-Calamoideae) is an arborescent palm species found throughout much of South America. However, it is only found on one Caribbean island, Trinidad, which represents the species' northern geographical extent (EMA 2007). Over the millennia, *M. flexuosa* has survived in both wet and dry conditions (Rodríguez-Zorro *et al.* 2017). In Trinidad, it is found predominantly in the Aripo Savannas [Strict Nature Reserve] Environmentally Sensitive Area (ASESA) on ecotones between savannas and swamp forest (Arneaud *et al.* 2017). Other locations where *M. flexuosa* exist are associated with open areas that are permanently or temporarily inundated during the wet season, such as boundaries of the herbaceous swamps in the Nariva and Los Blanquizales wetlands (Arneaud and Duncan 2019, Comeau *et al.* 2003).

The Erin Savanna (ES) is an assemblage of small areas of grassland situated within the Erin Forest Reserve; directly east of Buenos Ayres village and north of the Erin-Cap de Ville road (Beard 1953). These open areas are hilly, approximately 75m above sea-level (asl) and experience an annual rainfall of less than 165cm (Beard 1953). This is considerably dryer than the ASESA (Comeau 1990) which is flat (≈ 45m asl) with 250cm annual rainfall (T.T.M.S 2016). Most of the open area within the Erin Forest Reserve (in particular the western savannas) were planted with Caribbean Pine *Pinus caribaea* during the 1990s by the Forestry Division of Trinidad and Tobago. Today, many of these pine stands have extended to other open areas and are associated with the palm *Acrocomia aculeata* due to the palm's ability to withstand high-intensity fires.

There are no records of *M. flexuosa* in the Erin Forest Reserve prior to 1990. Beard (1953) did not record any *M. flexuosa* in the ES during his extensive survey of the savanna vegetation of Northern Tropical America. Comeau (1990) reported one sighting of the palm during his studies on the savannas of Trinidad, and Sewlal (2004) reported sighting a patch of *M. flexuosa* during a botanical walk. As a result of this, some ecologists believe that the single stand of *M. flexuosa* in the ES derived from a human origin (Michael Oatham 2020, personal communication).

Observations on *M. flexuosa* stands were made during field visits to the Erin Forest Reserve (Fig. 1) in mid-September 2016 (for forest stands) and early January 2020 (for savanna stands). Upon finding a *M. flexuosa* palm, a circular quadrat of 50m radius centred on the initial palm was searched for additional individuals; this was done until no additional palms could be found. In an attempt to detect any *M. flexuosa* stands not observed during field visits, digital searches were made of high-resolution (approximately 4cm/pixel) aerial photography of the Erin Forest Reserve taken in 2014 (Trinidad and Tobago. M.A.L.F 2014). Aerial photography was interpreted using the QGIS Desktop 3.10.2 version Software (QGIS Development Team 2020). *M. flexuosa* crowns were identified following palm tree identification and classification guidelines from Tagle Casapia *et al.* (2020). Carat palms *Sabal mauritiiformis* are the only other palm species with a similar crown appearance in the Erin Forest Reserve and were differentiated from *M. flexuosa* palm crowns as having fronds with drooping leaflets that do not spread in different planes; the tips of *M. flexuosa* leaflets do not droop and tend to spread in different planes (Comeau *et al.* 2003, Tagle Casapia *et al.* 2020). Environmental observations (canopy coverage, number of stands, habitat, proximity to the nearest housing settlement, and type of human exploitation) were part of a more comprehensive study based on the geographical distribution and threats of *M. flexuosa* populations in Trinidad (Arneaud 2020).

Only four *M. flexuosa* palms were identified in savanna habitat, all in the 'Middle Savanna' of the Erin Forest Reserve (which is in pristine condition) and all of which were adults (Fig. 2). Palms within forest habitat (approximately 2km from the savanna palms mentioned above) accounted for between 100–200 individuals (Fig. 1). The average canopy coverage percent was higher in forested areas. Both *M. flexuosa* stands were associated with a running watercourse (i.e. a stream, river or both). Savanna *M. flexuosa* palms were located approximately 1km from the nearest housing development and 0.5km from the Seegobin Quarry.

The main secondary dispersal agents of *M. flexuosa* are mammals; in particular, those greater than 13kg (Bodmer 1991, Endress *et al.* 2013). Elsewhere in the Neotropics, these include Golden-backed Uakari *Cacajao melanocephalus melanocephalus* (Bodmer 1991), Tapir *Tapirus terrestris* (Gilmore *et al.* 2013), White-lipped Peccary *Tayassu pecari* and the Collared Peccary *Tayassu tajacu* (Bodmer 1991). Of these only the Collared Peccary is found in Trinidad (Boos 1986) but has seldom been seen within Erin Reserve in the past (Wing 1962).

Galetti *et al.* (2010) and Johansson (2009) consider medium-sized mammals to be too small to disperse the large fruit of *M. flexuosa* (51g to 74g according to Arneaud *et al.* 2017). This may not be entirely true for short distance dispersal (as far as 10m), as researchers have occasionally

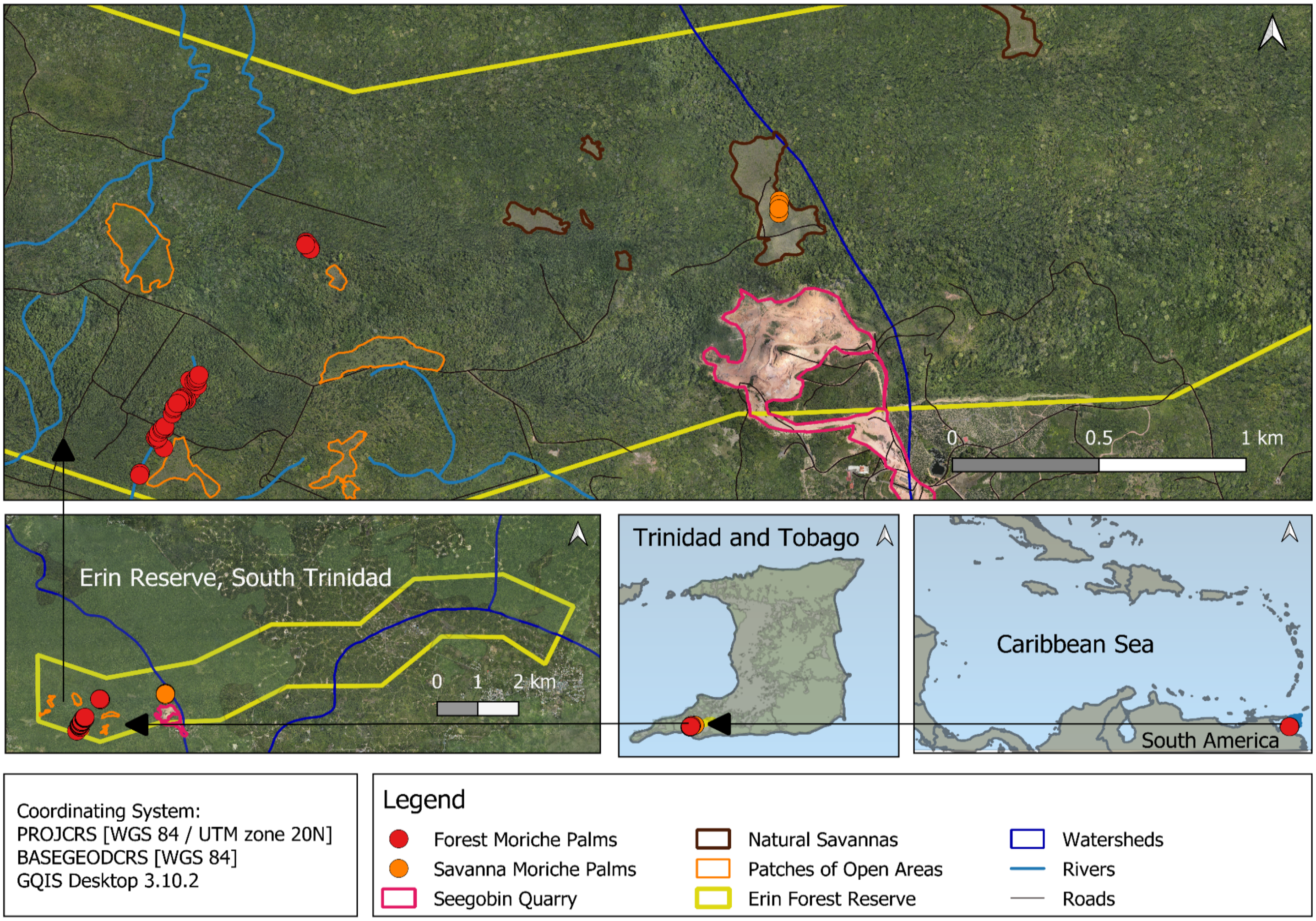

Fig. 1. Location of Moriche Palms *Mauritia flexuosa* population in the Erin Forest Reserve, south Trinidad. Aerial photographs provided by the Trinidad and Tobago Ministry of Agriculture, Land and Fisheries (2014).

observed Red-rumped Agouti *Dasyprocta leporina* (a medium-sized mammal) feeding on *M. flexuosa* fruit in the ASESA (Johnson 2002) and in the southeast region of Guárico State, Venezuela (Calderon 2002), additionally, Arneaud (2020) has recorded *D. leporina* effectively dispersing *M. flexuosa* fruit/seeds over several metres in the ASESA. Long-distance dispersal of *M. flexuosa* over the scale of kilometres has never been observed by medium-sized mammals, but studies on mammaliochory of seeds of other species of trees with similar-sized seeds to *M. flexuosa* such as *Carapa guianensis* have shown that repeated pilfering of caches established by caviomorph rodents such as *D. leporina* can disperse individual seeds over long distances (Wang *et al.* 2014).

Bird species have also been recorded as dispersers of *M. flexuosa* palms by some authors (Bonadie and Bacon 2000, Hosein *et al.* 2017). However, these authors did not document the distance over which fruit were dispersed, but it is likely to have been over relatively short distances (probably less than 2m) (Villalobos and Bagno 2013), and not the 2km between forest and savanna stands (Fig. 1).

Mauritia flexuosa palms in the Middle Savanna are thought to be of human origin, from seeds collected from the adjacent forest (Michael Oatham 2020, personal communication). Amerindians were present within the Erin Bay and environs (Fewkes 1914, Boomert 2009, Lans 2018), they were the last people to use and value the palm (Gilmore *et al.* 2013). This hypothesis is consistent with that of Granville (1992) who proposed that anthropogenic transportation was responsible for the distribution of *M. flexuosa* outside of the Amazon basin, and Rull and Montoya (2014) who suggested that postglacial neotropical expansion of *M. flexuosa* in the Gran Sabana of Southern Venezuela occurred 2,000 years ago as the result of human management of fires.

Savanna palms in the Erin Forest Reserve may go locally extinct because there are only male individuals present. Even though the floral morphology of *M. flexuosa* is intricate, indicating that the species may have hermaphroditic origins (i.e. having both male and female sex organs), this was not observed. There are over 1,000,000 flowers in a single staminate inflorescence and up to 6,000 flowers

Fig. 2. Only one Moriche Palm *Mauritia flexuosa* stand can be found on the margins of the Erin Savanna, south Trinidad. The stand is made up of four male trees (evidence of male inflorescences provided in the inset photos).

in a single pistillate inflorescence. Additionally, insect pollination is considered the original pollination mode in palms (Silberbauer-Gottsberger 1990), and the sweet floral fragrance of *M. flexuosa* nectaries together with the presence of staminodes (an abortive stamen in a pistillate flower) and pistillodes (a sterile under-developed pistil in a staminate flower) suggests that *M. flexuosa* ancestors were once hermaphroditic (Rosa and Koptur 2013). The possibility that palms in the ES practised hermaphroditism is low, as no evidence of seedlings/young juveniles was observed under/near parent palms.

Unfortunately, there is little to no information on the average life expectancy of *M. flexuosa* palms (Melo *et al.* 2018). Dransfield *et al.* (2008) reported that the typical life span for palms is 50–70 years. In the 'Place des Palmistes', Cayenne, French Guiana, there is a population of Royal palms *Roystonea oleracea* (Jacq.) O.F.Cook containing individuals that are over 200 years old (Tomlinson and Huggett 2012). *Mauritia flexuosa*, being a wild arborescent palm, similar to *R. oleracea* is expected to have a comparable life span.

With no female *M. flexuosa* palms in the Middle Savanna or ES, individual palms cannot reproduce. Savanna palms are therefore not expected to survive beyond the next century; providing all environmental conditions remain the same. Furthermore, ecological managers should pay close attention to these palms against encroaching anthropogenic impacts and plant *M. flexuosa* seedlings in streams along the savanna edges.

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First Record of the Stygian Owl *Asio stygius* in Trinidad, W.I.

On 13 December 2018, while conducting a nocturnal faunal survey of the Caroni Swamp, an unidentified owl was observed perched on the bare, extended branches of a hog plum S*pondias mombin* tree, approximately 10m above the ground (UTM 671610E, 1172870N). The time was approximately 23:00h. The owl was observed for about four minutes before it flew off in a northerly direction. The owl was initially thought to be a Short-eared Owl *Asio flammeus pallidicaudus*, a species previously recorded in this area. But from photographs taken, it was subsequently identified as *A. stygius* by Christian Artuso. Dr Artuso pointed out that the size, dark plumage, the evenly dark facial disc with a pale (almost white) border all point to Stygian Owl and rule-out Short-eared Owl. The Stygian Owl *Asio stygius* (Wagler, 1832), is a medium to large-sized "horned" owl (Crozariol 2010) 38-46cm in length (Restall *et al.* 2006) and weighs approximately 675g (Latta 2006). It can be identified by its large size, dark coloration, and conspicuous ear tufts (Latta *et al.* 2006), with a dark facial disc, cream-coloured upperparts with white spots, and streaked underparts.

Dr Artuso further elaborated that the coarse mottling of black and white on warm buff of the underparts, of the owl photographed, points to *A. stygius* and is unlike the streaked underparts of *A. flammeus.* Even the darker races of Short-eared Owl, which are be buff below, do not show white within the plumage. He also noted that the ear tufts appeared too long for *A. flammeus*. Garrido *et al.* 2000 also notes that *A. flammeus* is a smaller species, has barely visible ear tufts and a pale buff facial disc, traits which do not match the species we photographed.

Fig. 1. Stygian Owl *Asio stygius* perched on a Hog Plum tree in the Caroni Swamp. 13 December 2018. Photo Rainer Deo.

This note documents a considerable extension of the known range of *A. stygius* to Trinidad, and brings the total number of owl species observed within Trinidad & Tobago to nine, including the Barn Owl *Tyto alba hellmayri* (Tytonidae). *A. stygius* occurs in the Neotropics between Mexico and southern Brazil, although the available data on its geographic distribution are scant, patchy, and almost certainly incomplete (Crozariol 2010). As to why *A. stygius* was not previously recorded, the general rarity of this owl in the region, the fact it is described as a sedentary (non-migratory) species (Weidensaul 2015), and that it is nocturnal and prefers to perch and roost in the canopy of trees (Restall *et al.* 2006) could all be major contributing factors.

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Field Identification of Caterpillars and Adults of Bark Butterflies *Opsiphanes* spp. (Lepidoptera, Nymphalidae) in Trinidad, W.I.

Two species of *Opsiphanes* (Lepidoptera, Nymphalidae, Satyrinae, Brassolini) are found in Trinidad: *Opsiphanes cassina merianae* Stichel and *O. cassiae cassiae* (Linnaeus) (Kaye 1921, Barcant 1970, Bristow 1991, Cock 2014). Both subspecies are also known from eastern Venezuela and the Guianas (Bristow 1991), but neither is known from Tobago (Cock 2017). Kaye (1921) refers to *O. cassina merianae* by its local name 'bark' butterfly and mentions that *O. cassiae cassiae* is scarcer. Barcant (1970) introduces the name 'rare bark' for *O. cassiae cassiae*, which he considered distinctly rare. Adults are readily attracted to fallen fruit, and are active by day and at dusk. The caterpillars of *O. cassiae* feed on leaves of *Heliconias* spp. (Heliconiaceae) and bananas (*Musa* spp., Musaceae), whereas those of *O. cassina* feed on various palms (Arecaceae) (Bristow 1991). Guppy (1904) illustrated the caterpillar of *O. cassiae cassiae* from Trinidad, but that of *O. cassina merianae* has not been documented from Trinidad, although both species have been reared by local collectors (J.O. Boos pers. comm.; F.C. Urich pers. comm.).

The adults are easily distinguished based on characters of the dorsal surface; in particular, the pale band on the dorsal forewing is split into two at the costa in *O. cassina*, but is single in *O. cassiae* (Barcant 1970, Bristow 1981) (Figs. 1-2). Because the dorsal markings make these species so easy to distinguish, characters of the confusingly similar ventral surfaces of the two species (Figs. 1-2) have not normally been considered. However, living adults always rest with their wings folded above their heads, so that the dorsal surface is not visible (Figs. 3-4). Accordingly, identification of adults in the field and of photographs of living adults requires characters of the ventral surface.

The purpose of this note is to show how adults of these two species can be separated based on a simple character of the ventral surface, provide preliminary documentation of the caterpillar and food plants of *O. cassina merianae* in Trinidad, and indicate how the caterpillars may be identified.

Having examined a series of pinned specimens of the

Fig. 1. *Opsiphanes cassina merianae*, male left, female right, dorsal view above, ventral view below. Male: Brigand Hill summit, at dusk, 28 March 2013; female, Curepe, fruit trap, 25 September 1980.

Fig. 2. *Opsiphanes cassiae cassiae*, male left, female right, dorsal view above, ventral view below. Male: St. Benedict's, fruit trap, 17 May 1982; female, as male 13 May 1982.

Fig. 3. *Opsiphanes cassina merianae*, female. South Oropouche, Mondesir, 2 May 2018, Tarran P. Maharaj.

two species, one character of the ventral surface stands out as providing an unambiguous diagnostic feature. The eye spot at the middle of the hindwing costa is always smoothly rounded in *O. cassina merianae* (Figs. 1, 3), whereas it is at least slightly flattened, even a little concave on the outer margin in *O. cassiae cassiae* (Figs. 2, 4). This feature appears to apply across all subspecies on the mainland judging from the illustrations of Bristow (1991), but as there are also other species of *Opsiphanes* on the mainland, this character cannot be used there in isolation. In Trinidad, with just the two species of *Opsiphanes*, it can be used with confidence.

In October 1981, I reared *O. cassina merianae* from caterpillars (Fig. 5) found on two palms on UWI campus: areca palm *Chrysalidocarpus lutescens* and Manila palm *Adonidia merrillii* (my reference numbers 81/11A and B respectively). As both of these are introduced ornamental palms, it can be anticipated that one or more indigenous palms are also used as food plants, as documented by Bristow (1991) for other subspecies of *O. cassina*. The caterpillar of *O. cassiae cassiae* has recently been

Fig. 4. *Opsiphanes cassiae cassiae*, female. South Oropouche, Mondesir, 5 December 2019, Tarran P. Maharaj.

Fig. 5. Caterpillar of *Opsiphanes cassina merianae*, St. Augustine, on ornamental palm, October 1981, 65mm.

Fig. 6. Caterpillar of *Opsiphanes cassiae cassiae*, Inniss Field, on *Heliconias* sp., 2 August 2019, R. Deo. https://www.inaturalist.org/observations/30270859 with permission.

photographed by Rainer Deo (Fig. 6). The caterpillars of both species have twin caudal spikes, longitudinally striped green bodies and pale grey-brown heads with distinctive backwardly-projecting, black-tipped, orange-brown horns on the heads (Figs. 5-6). *Opsiphanes cassiae cassiae* has three conspicuous pairs of such horns, the subdorsal and dorsolateral pairs being long, but the lateral pair short (Fig. 6), whereas *O. cassina merianae* only has the subdorsal horns long with a black tip (Fig. 5). In addition, *O. cassina merianae* has a double orange line down the centre of the

Fig. 7. Pupa of *Opsiphanes cassina merianae*, St. Augustine, collected as caterpillar on ornamental palm, October 1981, 26mm.

face (Fig. 5), whereas *O. cassiae cassiae* has a double white line, with a black line outside this (Fig. 6). Distinguishing features of the young larvae are not known at this time, although the relative size of the horns may be evident early on. Similarly, I have not been able to compare the pupae of the two species, but illustrate that of *O. cassina merianae* here (Fig. 7)

I thank Tarran P. Maharaj and Rainer Deo for allowing me to use their images.

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Field Identification of the Postmen *Heliconius erato* and *H. melpomene* (Lepidoptera, Nymphalidae, Heliconiinae), in Trinidad &Tobago

Known as postmen in Trinidad & Tobago, *Heliconius erato* (Linnaeus) and *Heliconius melpomene* (Linnaeus) are widely distributed in Central and South America. Both species are common and widespread in open habitats in Trinidad and Tobago, *H. erato* being usually the more common. Both have been recorded from Chacachacare Island (Cock 1981 and Fig. 5), and are anticipated to occur on the other Bocas Islands. The Trinidad forms have been named *H. erato adana* J.R.G. Turner, 1967 and *H. melpomene flagrans* Stichel, 1919 (Cock 2014), while the Tobago forms which are similar but smaller and with narrower red bands on the forewing have been named *H. erato tobagoensis* Barcant, 1982 and *H. melpomene tessa* Barcant, 1982 (Barcant 1982). Although both species are extremely variable across their range on the mainland, in any given locality the colour and markings are constant, and the two species closely resemble each other as Müllerian comimics (Emsley 1964, Flanagan *et al*. 2004). Thus, in Trinidad and Tobago, both species are black with a broad red band across the dorsal forewing, which is paler on the ventral hindwing (all Figs.). The most reliable way to separate the two species is based on the number of small red spots at the base of the ventral hindwing: three in *H. melpomene* and four in *H. erato* (Barcant 1970), the extra one in *H. erato* being at the base of the cell (Figs. 1-4, 6, 11). However, in the field, and especially in photographs, often only the dorsal surface is visible, making species-level identification difficult. This note sets out how the two species may be separated in dorsal view in Trinidad and Tobago.

I examined pinned specimens from my own collection, and images from the Angostura Barcant Collection, Laventille, Trinidad (ABCT), and identified some possible diagnostic characters (Table 1, Figs. 1-4). Next, I successfully tested these criteria on unnamed images of pinned specimens provided by John Morrall from his collection. I then applied these characters to images on iNaturalist (https://www.inaturalist.org/), some of which include ventral views, but most of which don't. I found that the two species could be separated in dorsal view when sharp images were available, showing the wings at close to right angles to the viewer. However, when the images of wings were blurred, moving, or held at an oblique angle, the degree of confidence went down quickly. Figs. 1-4 show pinned adults of both Trinidad subspecies, but see Barcant (1982) for the Tobago subspecies. Figs. 5-11 show a selection of the two species in life.

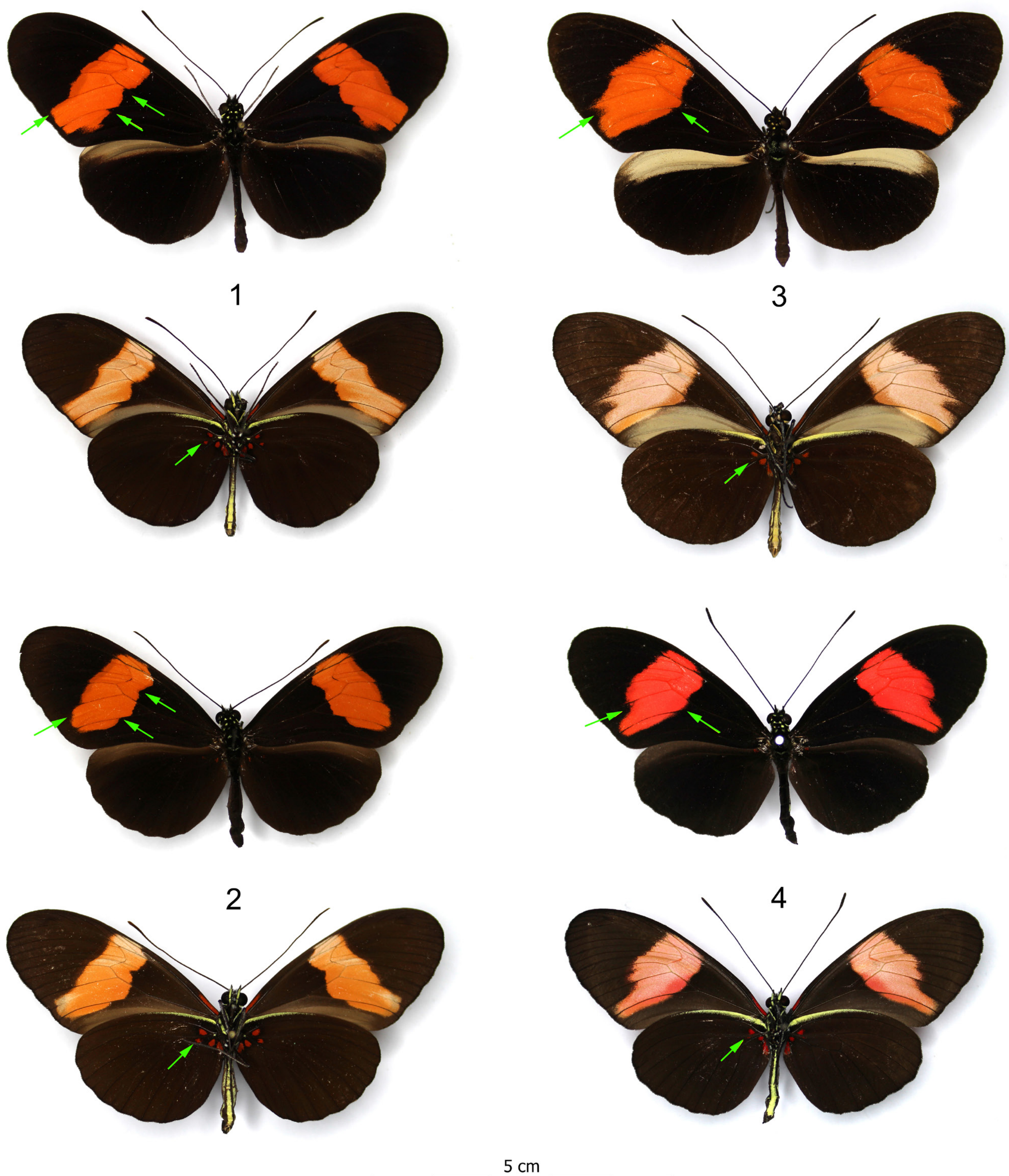
Both species show minor variation in the detail of the outline and width of the red forewing band, which in extreme cases may make identification more difficult. Both species are long lived as adults (Brown 1981), and the intensity of the red and black markings decreases over time, old specimens becoming black-brown rather than black and orange rather than red. It was also noted that about 10% of *H. erato adana* have red spots at the base of the dorsal hindwings, but this has not (so far) been seen in any specimens of *H. melpomene flagrans*. One individual of *H. erato adana* (Fig. 7) had a particularly broad red forewing band, and a nearby red streak close to the dorsum. This resembles the form *vitellina* Stichel, 1919 which is an unavailable infraspecific name and treated as a synonym of *adana* (Cock 2014).

In conclusion, minor characters of the shape of the forewing red band can be used to separate specimens and images of the two species in Trinidad and Tobago, and with familiarity should also suffice to separate living individuals in the field – at least when stationary.

I thank John Morrall for sharing images from his collection, Mike G. Rutherford for sharing images from ABCT, and the photographers of living butterflies who used iNaturalist to make their images available as indicated in the figure legends (Figs. 5-11).

Table 1. Characters that may be used to separate the dorsal view of the two species of postman in Trinidad and Tobago, *Heliconius melpomene* and *H. erato*.

Character	*H. melpomene*	*H. erato*
Inner margin of red band	Relatively evenly rounded	More irregular
Outer margin of red band	A black notch in the upper part of space 1B (Cu_2-2A)	Regular, no indentation in upper part of space 1B (Cu_2-2A)
Red spots at the base of the dorsal hind wing	Not seen	Occasionally (c.10%)



Figs. 1-4. Pinned adult *Heliconius erato adana* (left) and *H. melpomene flagrans* (right)(author's collection); males above, females below; dorsal and ventral view of each specimen. 1, Maracas Valley, 25 July 1978; 2, Toco, 4 June 1978; 3, Mal d'Estomac Bay Trace, 6 September 1982; 4, Point Gourde, 15 October 2011.

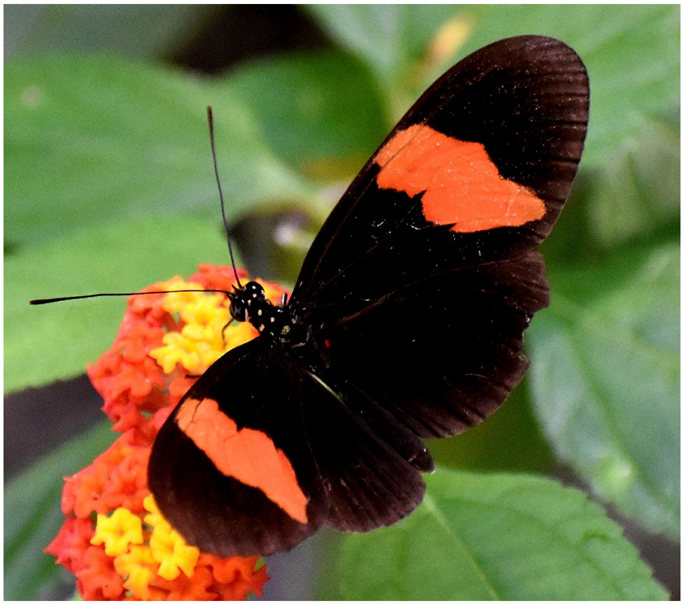


Fig. 5. *Heliconius erato adana*, dorsal view. Chacachacare Island, 10 November 2018, nandani_bridglal. This is a new record for Chacachacare Island (Cock 1981). Cropped from https://www.inaturalist.org/observations/35557049, Creative Commons License CC-BY-NC.

Fig. 6. *Heliconius erato adana*, ventral view. Trinidad, Point-A-Pierre, 27 August 2017, H. Fletcher (hfletchr). Cropped from https://www.inaturalist.org/observations/7682479. © Prof. Horace Fletcher, with permission.

Fig. 7. *Heliconius erato adana* f. *vitellina*, dorsal view. Trinidad, Asa Wright Nature Centre, 25 December 2019, M. McFarlane. Cropped from https://www.inaturalist.org/observations/36950292, Creative Commons License CC-BY-NC.

Fig. 8. *Heliconius erato tobagoensis*, dorsal view. Tobago, Friendship, 12 May 2011, E. Rooks. Cropped from https://www.inaturalist.org/observations/577366, Creative Commons License

Fig. 9. *Heliconius melpomene flagrans*, female, dorsal view. Trinidad, Point Gourde, 15 October 2011, M.J.W. Cock. The red band has an unusual tone to it (compare the same specimen in Fig. 4), perhaps because this female was newly emerged.

Fig. 10. *Heliconius melpomene flagrans*, dorsal view. Trinidad, east of Upper Carapachaima, 14 December 2019, M. Hulme. The colour of the red band has faded to orange-red. Cropped from https://www.inaturalist.org/observations/36688595, Creative Commons License CC-BY-NC.

Fig. 11. *Heliconius melpomene flagrans*, ventral view. Trinidad, Asa Wright Nature Centre, 25 December 2018, C. Harrison. Cropped from https://www.inaturalist.org/observations/19213070, Creative Commons License CC-BY-NC.

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Microceris dulcinea (Plötz) (Lepidoptera, Hesperiidae, Pyrrhopyginae) a New Skipper Butterfly Record from Trinidad, W.I.

iNaturalist is a web-based platform to enable naturalists to share images and identifications, facilitating an important interface between naturalists and researchers. In February 2020, an image of a skipper butterfly posted on iNaturalist by Dempewolf (https://www.inaturalist.org/observations/38797379) was spotted by Cock as a species new to the Trinidad fauna. The picture was taken on Hololo Mountain Road, Cascade, Port of Spain, as the skipper was nectaring at flowers of moringa (*Moringa oleifera*, Moringaceae) at about 15.30-16.00 h on 9 February 2020 (Fig. 1). The image was shared, and rapidly identified as *Microceris dulcinea* (Plötz, 1879) by Olaf H.H. Mielke, and this was confirmed from the Butterflies of America website (Warren *et al.* 2017).

This species has not previously been recorded from Trinidad, although eight other species of the subfamily are known from the island (Cock 2014). It can be recognised as belonging to Pyrrhopyginae by the antennae, which are strongly clubbed, with most of the club in the bent over (reflexed) portion. The white border to the dorsal hindwing, the two pale lines down the thorax and the red dorsal collar between the head and the thorax are distinctive features, any of which would separate this species from other Pyrrhopyginae in Trinidad.

Microceris dulcinea was described from Colombia, and is known from Mexico, Costa Rica, Panama, Colombia, Venezuela, and Ecuador (Evans 1951, Freeman 1966, Mielke 1995, Orellana 2008, Warren *et al.* 2017). In Venezuela, it is reported from the lowlands of the north of the country (Miranda, Aragua, Guárico, Táchira), principally in deciduous forest (Orellana 2008), although there are also records from Trujillo and Bolivar (Mielke 1995).

Microceris dulcinea has been variously treated as a subspecies of *M. scylla* (Ménétriés) (Evans 1951), a valid species (Freeman 1966, Mielke 1995), a synonym of *E. scylla* (Burns and Janzen 2001), and back to a valid species (Mielke 2004, Ortellana 2008, Zhang *et al.* 2019). Until recently it was placed in the genus *Elbella*, but Zhang et al. (2019) synonymised *Elbella* with *Microceris*, and re-established Pyrrhopyginae as a subfamily rather than a tribe of Pyrginae as it had been in recent years (e.g. Cock 2014).

There is one food plant record from Venezuela: the introduced tropical almond, *Terminalia catappa* (Combretaceae) (Orellana 2008). The closely related *M. scylla* feeds on a selection of Malphigiaceae and Combretaceae (Burns and Janzen 2001, Janzen and Hallwachs 2020), and it is likely that *M. dulcinea* will have a similar food plant range. The caterpillar of *M. dulcinea* should resemble that of *P. amyclas amyclas* (Cramer) which also feeds on tropical almond in Trinidad (Cock 2008), so until distinguishing characters can be established, it would be necessary to rear any Pyrrhopyginae caterpillars from

Fig. 1. Adult *Microceris dulcinea*, a new skipper butterfly record for Trinidad.

this plant to establish their identity.

Hololo Mountain Road, where the picture was taken is a well collected area for butterflies, and it seems unlikely that this large distinctive species has hitherto been overlooked in this part of Trinidad. However, Orellana (2008) reports that it is primarily associated with dry broadleaf forest (bosque decíduo) in Venezuela, so *M. dulcinea* might be resident in the far northwest of Trinidad and/or the Bocas Islands. Alternatively, it could be a vagrant individual from Venezuela, or a species that has newly spread to Trinidad and become established. It will be interesting to see if further observations will follow.

We thank Olaf H.H. Mielke, Universidade Federal do Paraná, Brazil, for the initial identification, and the iNaturalist platform for facilitating recognition of this new record.

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The Life Cycle of *Ascia monuste* (L.) (Lepidoptera, Pieridae) in Trinidad, W.I.

Ascia monuste (L.) also known as the great southern white is one of the 29 Pieridae butterflies found in Trinidad & Tobago (Barcant 1970, Cock 2014) and is considered common. However, we did not find any published account of the life cycle of this species in Trinidad.

The host plant species observed in this note were naturally occurring *Cleome* sp., a member of the Cleomaceae, and cultivated *Eruca vesicaria*, commonly known as arugula, a member of the Brassicaceae. The latter family includes cabbages, radish and kale, and *A. monuste* is considered a pest on cabbage crops in the Caribbean (Buckmire 1975). Identification of the plants and butterfly at all stages was facilitated by Matthew Cock.

The life cycle of *A. monuste* was recorded through observations by the authors at different locations over a 10-month period. These observations were submitted to iNaturalist.org.

On 15 August 2019 MCSM observed what was initially thought to be a butterfly trapped in a fence. On closer examination it turned out to be a newly emerging *A. monuste* (Fig. 1) (https://www.inaturalist.org/observations/30870995) from a casing attached to the wire fence (10.6520°; -61.4199°). The empty case reflected the white and brown colouration of the adult.

On 22 August 2019 MCSM notices a caterpillar resting on a PVC structure (10.6520°, -61.4199°) (Fig. 2) (https://www.inaturalist.org/observations/31304607). Two days later a chrysalis (Fig. 3) (https://www.inaturalist.org/observations/31358480) had taken its place. The caterpillar, which was green in colour with yellow-green longitudinal stripes along its sides was identified online as *A. monuste*. The main flowering plants observed in the immediate vicinity were *Cleome* sp. (Fig. 4) and *Bidens* sp. While the emergence of the adult was not observed in this instance, it was noted that the casing was empty six days after initial sighting of the chrysalis.

On 3 January 2020, an adult female was observed by RWL at the Trincity Industrial Estate, Trinidad (10.6376°, -61.3761°), at the end of Suite Drive and adjacent to the Tacarigua River. It was hovering near a plant that was growing from a crack between the sidewalk and parking lot area. When it landed and was seen ovipositing on the underside of the leaves (Fig. 5) (https://www.inaturalist.org/observations/37233450). The forewing and hindwing colouring displayed on the adult female was brown at the marginal and apex point, the remainder of the wing was white and pale yellow. The eggs were of a yellow colour. At the time of this observation the plant was still unknown. The following day another photographic observation was done to confirm it as *Cleome* sp. (Fig. 6).

Fig. 1. Newly emerged *A. monuste* and chrysalis. Photo Margaret Chin Sue Min.

Fig. 2. *A. monuste* caterpillar. Photo Margaret Chin Sue Min.

While on a morning walk to the hillside area along Maracas Royal Road, Maracas Valley (10.6773°, -61.4110°) on 2 May 2020 RWL spotted an *A. monuste* (https://www.inaturalist.org/observations/44592570). It was flying low and near to a small garden bed of arugula *Eruca vesicaria* planted by a family member. While identifying the butterfly on iNaturalist Matthew Cock commented that there were eggs along the edges of the arugula leaf. RWL returned to the site during the afternoon and examined the arugula more closely and observed multiple eggs (https://www.inaturalist.org/observations/44632095). The yellow eggs are torpedo-shaped with a flat bottom that allow them to stand individually but are positioned in a cluster close to the edge of the leaf (Fig. 7).

Whilst *Ascia monuste* is considered a pest by farmers this note records the life cycle on the a native host.

Fig. 3. *A. monuste* chrysalis. Photo Margaret Chin Sue Min.

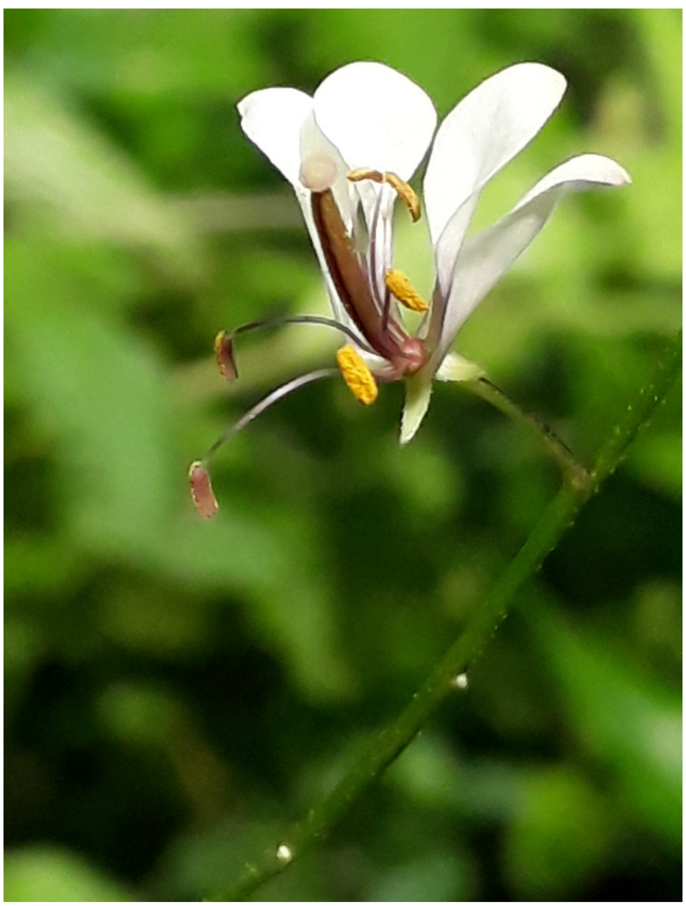

Fig. 4. *Cleome* sp. flower. Photo Margaret Chin Sue Min.

Fig. 5. *A. monuste* ovipositing on *Cleome* sp. Photo Rachael-Ann Williams-Littzen.

Fig. 6. *Cleome* sp. Photo Rachael-Ann Williams-Littzen.

Fig. 7. *A. monuste* eggs on arugula. Photo Rachael-Ann Williams-Littzen.

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Recent Records of the Genus *Dynastor* (Lepidoptera, Nymphalidae, Satyrinae, Brassolini), in Trinidad, W.I.

The genus *Dynastor* is represented by three species. Two species – *Dynastor macrosiris* (Westwood) and *D. darius* (Fabricius) – are found in Trinidad but neither is regularly recorded (Barcant 1970). The adults, which possess vestigial proboscides, are not known to feed and cannot be attracted by fruit baits, which are effective for most Brassolini. Additionally, they typically frequent wooded areas and are inclined to only become active at dusk. Females, however, appear to be attracted to light (Urich 1982) and the majority of records of these species appear to be associated with this tendency. Larvae of both *D. macrosiris* and *D. darius* are known to feed on members of the Bromeliaceae. In particular, Urich (1982) reported that in captivity *D. macrosiris* larvae fed on *Aechmea nudicaulis* which grows throughout the island (Smith and Pittendrigh 1967). This note highlights recent observations of both species in Central and South Trinidad.

On 21 December 2017 Bunty O'Connor and Rory O'Connor found a dead adult female *D. macrosiris* in a room at their home in Chickland, Freeport (Fig. 1a). The room was open to the outdoors and illuminated by a light at night. The surrounding area is lightly wooded with some farmland and residential properties. Several bromeliads grow on the property, including *A. nudicaulis*.

On 21 July 2019, another adult female *D. macrosiris* found by Sandra Downie, Robert Las Heras and Elizabeth Las Heras after it flew into a home located along Talparo Main Road, Talparo (Fig. 1b). The room was also illuminated by a light. On the following day the butterfly exited the room unharmed. The house is located on an agricultural estate with various trees crops and various bromeliads can be found growing on these trees.

On 7 November 2019 at 6:13pm, an adult female *D. darius* was observed by Kris Sookdeo in the parking lot of Anand's Low Price Supermarket in Debe (Fig. 1c). The parking lot was illuminated by bright lights. This site is located along a major road with commercial and residential properties. Adjacent to the supermarket is a watercourse with a few scattered trees but the area cannot be described as wooded.

Given the widespread availability of Bromeliaceae, the distribution of both species is potentially extensive.

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Elizabeth Las Heras, Talparo, Trinidad & Tobago

Bunty O'Connor, Chickland, Freeport, Trinidad & Tobago

Fig 1. *Dynastor macrosiris*, all female, **a.** Chickland, Freeport, 21 December 2017, Bunty O' Connor. **b.** Talparo, 19 July 2019, Robert Las Heras, and **c.** Debe, 7 November 2019, Kris Sookdeo.

Seventeenth Report of the Trinidad and Tobago Birds Status and Distribution Committee Records Submitted During 2019

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The Trinidad and Tobago Rare Birds Committee was established in 1995 to assess, document and archive the occurrence of rare or unusual bird sightings in Trinidad and Tobago and thus provide reliable long-term monitoring of our rarer species. Now renamed the Birds Status and Distribution Committee, we have assessed all records submitted during 2019. In all, 95 records were adjudged, representing 56 different species. During 2019 no less than six new species were recorded for the country and one new species for Tobago. As in previous years, we wish to commend the quality of photographic submissions by so many observers.

Of the submissions assessed, in only two cases were we satisfied that an error in identification had occurred. Additionally in four cases the Committee found the identification inconclusive. One further submission is still under review. Records presented below follow the revised nomenclature and taxonomic order of the South American Classification Committee as at December 2019 (Remsen *et al.* 2019).

The Committee comprises the following members: Martyn Kenefick (Secretary), Faraaz Abdool, Geoffrey Gomes, Nigel Lallsingh, Bill Murphy, Kris Sookdeo and Graham White. There are instances where we have benefited from supporting international expert knowledge to assist us with certain identification issues. We wish to acknowledge the valuable assistance provided by Bob Flood, Keith Hansen, Steve Howell, Tom Johnson, James Smith and Sheri Williamson,

Archived records including photographic submissions number 1,571 at the end of 2019. Reports are published in Living World; the first in 2000, and annually since 2007.

Species considered by the TTBSDC (TTRBC), together with the Official List of the Birds of Trinidad and Tobago and details of all accepted records by the Committee can be accessed, from our website at http://rbc.ttfnc.org. We urge finders to document and report their sightings. All documented sightings summarised below occurred in 2019 unless otherwise stated.

Records accepted

Two **White-faced Whistling-Duck** ***Dendrocygna viduata*** were found along Rahamut Trace on 23 July (DG) and a group of five was photographed at Caroni Rice Project on 20 August (NL) This is a scarce but annual visitor to Trinidad's freshwater swamps with most sightings occurring between the end of May and the end of August.

Initially two **Muscovy Duck** ***Cairina moschata*** were photographed in flooded agricultural fields at Aranguez on 25 January. This increased to seven birds by 9 March (MK, RJ, SR). All appeared to be un-ringed and were exceedingly wary. Whilst their provenance will always remain in doubt, it is likely that these were wild birds wandering from mainland South America.

A female **Northern Pintail** ***Anas acuta*** was found amongst a flock of White-cheeked Pintail at Bon Accord sewage ponds, Tobago on 20 November (MKe) remaining until 30 November at least. This is just the fourth documented sighting of this migrant duck and the first since 2004.

An adult male and two immature/female plumaged **Ring-necked Ducks** ***Aythya collaris*** were photographed at Bon Accord sewage ponds, Tobago on 14 November (NG, *JR et al.*). One remained at least until 16 December. In total, 26 birds have been recorded over the last 24 years, all from south west Tobago and all occurring between 14 November and 3 March.

A flock of 14 **American Flamingos** ***Phoenicopterus ruber*** were photographed over Crown Pt., Tobago on 22 September in the aftermath of a tropical storm (AM). This is the first documented record for Tobago. Elsewhere the large flock within Caroni Swamp were present year round with numbers reaching in excess of 100 birds on many occasions (many observers).

Totally unexpected was a photographed sighting of a **Dwarf Cuckoo** ***Coccycua pumila*** in gardens of a residential area in La Brea on 13 February (TG-M, Fig.1.). Little is known of its distribution within South America, almost all sightings are in northern Columbia and Venezuela and there is one record from Brazil.

Two **Dark-billed Cuckoos** ***Coccyzus melacoryphus*** were well documented from Pt. Gourde on 27 July (ES). Two more were photographed at Carlsen Field on

Fig.1. Dwarf Cuckoo, La Brea, February 2019. Photo Tricia Ganness-Moses.

15 August, remaining in the area until 24 August at least (Bd'A). These sightings fall into the now expected pattern of, what is suspected to be, post-breeding dispersal from the mainland with all ten documented records occurring between 12 July- 31 August.

An **Amethyst Woodstar *Calliphlox amethystina*** was seen briefly and photographed feeding on flowering Vervain at Asa Wright Nature Centre on 12 May (MR). Since the first record in Trinidad in 2015, all 11 documented sightings have been between 28 April-26 July.

For the third year in a row, (presumably the same) **Double-striped Thick-Knee *Burhinus bistriatus*** was found day roosting in the Queens Park Savanna, Port of Spain on 2 September (Bd'A).

An **Upland Sandpiper *Bartramia longicauda*** was found in a rough grassy field at Orange Valley on 7 October, where it as present until at least 15 October (NL, Fig. 2). Of the 14 documented records in the last 24 years, all but one have been southbound migrants occurring between 31 August and 26 October.

An extremely confiding **Paint-billed Crake *Mustelirallus erythrops*** was photographed on the roadside leading to Carli Bay on 29 June (NL, Fig. 3). This is just the eighth documented record, six of which have occurred between 29 June and 9 August .

An adult **Franklin's Gull *Leucophaeus pipixcan,*** beginning to moult into basic plumage was photographed at Orange Valley on 26 July (NL). This is the earliest ever documented date for a southbound migrant and may well represent a 'failed breeder'.

A first-winter plumaged **Great Black-backed Gull *Larus marinus*** was found amongst the gull flock on the mudflats at Orange Valley on 23 January, remaining until 2 February at least (NL). This is just the fourth documented record for Trinidad, all three other birds were from the same location in 2009 (Kenefick 2010).

An adult **Kelp Gull *Larus dominicanus*** was photographed south of Carli Bay on 12 December (EC, JC). This is the fourth documented record of this South American gull, three of which have occurred during December.

A first-winter plumaged **Lesser Black-backed Gull *Larus fuscus*** was well documented from Milford Bay, Tobago on 20 November (MKe). Whilst several birds are present year round on the west coast of Trinidad, this is just the ninth documented sighting for Tobago.

An **Arctic Tern *Sterna paradisaea*** in first-summer plumage was carefully studied on the tidal mudflats at Brickfield amongst a large gathering of Common Terns, *S hirundo* between 26-31 May (NL, Fig. 4). Whilst seen on several occasions in Cuba, Virgin Is, Guadeloupe and once from Barbados, this is the first documented record for Trinidad & Tobago. The complex identification issues surrounding *Sterna* terns may well obscure its true status.

Fig. 2. Upland Sandpiper, Orange Valley, October 2019. Photo Nigel Lallsingh.

Fig. 3. Paint-billed Crake, Carli Bay, June 2019. Photo Nigel Lallsingh.

Fig. 4. Arctic Tern, Orange Valley mudflats, May 2019. Photo Nigel Lallsingh.

A **Cory's Shearwater *Calonectris diomedea*** was photographed sitting on the sea close to Little Tobago island on 3 December (ZF).Whilst occasional tide-line corpses have been found, usually on the east coast of Trinidad, this is just the sixth documented sighting of a live bird in the last 24 years.

A **Cape Verde Shearwater *Calonectris edwardsii*** was found and photographed swimming just offshore Speyside, Tobago on 18 October.(ZF, MH *et al.* Fig. 5). Unsurprisingly, this is the first documented record for Trinidad & Tobago as the breeding range is restricted to the Cape Verde Islands and sightings within the region are usually limited to offshore Brazil.

An adult **Fasciated Tiger-Heron** ***Tigrisoma fasciatum*** was photographed perched beside the river at Grande Riviere on 3 May 2014 (WS, Fig. 6). This is just the second documented sighting of this species, both coming from forested streams in north east Trinidad.

Fig. 5. Cape Verde Shearwater, Speyside, October 2019. Photo Marcia Horman.

A **Squacco Heron** ***Ardeola ralloides*** was photographed close to Bon Accord sewage ponds, Tobago for much of the afternoon on 23 May 2019 (JR, Fig. 7). It could not be relocated on subsequent days. This is the first documented sighting of this Old World heron, whose normal distribution ranges from southern Europe and throughout Africa. Within the region there is a single documented record from Guadeloupe and several sightings from the island of Fernando de Noronha, Brazil.

The **Gray Heron** ***Ardea cinerea***, first found on the west coast tidal mudflats in 2016 remained all year (many observers). The only other documented sighting was of an immature photographed at Kings Bay, Tobago on 2 January and again at Louis d'Or on 17 January (JR).

A **Stygian Owl** ***Asio stygius*** was photographed late at night close to the Caroni Swamp Visitor Centre on 13 December 2018. (RD, Fig. 8). Whilst nowhere common, the species is distributed widely through both Central and South America and this represents the first documented record of the species for Trinidad & Tobago. Further details on this record are provided by Deo *et al.* (2020).

At least two **Snail Kites** ***Rostrhamus sociabilis*** frequented Nariva swamp during the year. A bird in immature/female plumage was found on 26 January (SGr, SG, MR) and an adult male on 18 February (JS). Both were present until mid-April (many observers). A male photographed at the same location on 21 September. (MG, DH) may have been the earlier individual. Elsewhere a male was seen at Aranguez farmland on 16 March (CC).

An adult and an immature **Plumbeous Kite** ***Ictinia plumbea*** were photographed soaring over Cuffie River Nature Retreat on 12 December (LH, SW). This is just the second documented record for Tobago. Whilst a common breeding visitor to Trinidad from mainland South America, present from February to late September, that the two

Fig. 6. Fasciated Tiger-Heron, Grande Riviere, May 2014. Photo William Stephens.

Fig. 7. Squacco Heron, Bon Accord, May 2019. Photo Jason Radix.

Fig. 8. Stygian Owl, Caroni Swamp, December 2018. Photo Rainer Deo.

Tobago records occurred in December and January is most unexpected.

An adult and a sub-adult **Great Black Hawk *Buteogallus urubitinga*** were carefully studied and photographed, flying over Nariva Swamp on 20 February (DL, MRa *et al.*). Whilst still considered a rare resident species in Trinidad, its true status and abundance may be obscured by it visible similarity to the much more widespread Common Black Hawk *B. anthracinus.*

A **Roadside Hawk *Rupornis magnirostris*** was photographed beside Cascadoux Trace, Kernaham settlement on 2 January (SGr, JH *et al.*)(Fig. 9). It remained faithful to the area until 23 April at least. This is the first, and long awaited, documented record of this medium-sized raptor which is commonly found throughout Central and much of South America.

Fig. 9. Roadside Hawk, Cascadoo Trace, Nariva, February 2019. Photo Richard Lakhan.

As in previous years, numbers of **Small-billed Elaenia *Elaenia parvirostris*** were documented during the mid-summer months. Of most significance were at least 12 birds found along the boundary of Caroni Rice Project on 28 July (NL), far and away the largest number ever found in Trinidad. Elsewhere a minimum of two birds were seen in differing areas of Carlsen Field between 24 July and 29 August (JFo,NL) and one was found on the coast at Brickfield on 27 August (NL).

An adult male **Scarlet Tanager *Piranga olivacea*** was photographed close to Brasso Seco village on 4 May (JF, BO'C). Most Scarlet Tanagers overwinter in northern South America, following a western route through Central America. With one exception all previous records of this species are in April and presumably northbound. The sighting on 16 April 2018 was also at Brasso Seco and could be the same individual.

An adult male **Rose-breasted Grosbeak *Pheucticus ludovicianus*** was found feeding in a bay-leaf tree, *Pimenta racemosa* at Morne le Croix on 10 February (MK, HS, GW). This species is a rare winter visitor to Trinidad & Tobago with only 16 documented sightings in the last 24 years.

An adult male **Saffron Finch *Sicalis flaveola*** was photographed in the grass at Crown Pt. Airport, Tobago on 11 October 2015 (SO'R, Fig. 10). This species was introduced into Tobago over 60 years ago (ffrench 2012), however this is the first documented record for many years.

Fig. 10. Saffron Finch, Crown Point, October 2015. Photo Suzanne O'Rourke.

An adult female **Black-and-white Warbler *Mniotilta varia*** was photographed in coastal scrub at Waterloo on 15 September (NL *et al*.). This is an extremely early date, most southbound migrants are found from mid-October to mid-November.

The female **Cerulean Warbler *Setophaga cerulea*** which was first seen on 4 December 2017, returned in 2018, where it remained in the same samaan tree until 14 March at least. Incredibly, it returned on 28 October (NL) and was present until the year end.

Single **Bay-breasted Warblers *Setophaga castanea*** were documented from Gran Couva on 27 December 2018 (NL) and at Las Lapas on 26 December (MK *et al.*). Once considered an extremely rare winter visitor to Trinidad, they have now been found in each of the last seven years, all between 9 December and 30 March.

A **Chestnut-sided Warbler *Setophaga pensylvanica*** was described from Cuffie River Nature Retreat on 1 January (BJ-S). This is just the second documented record from Tobago in the last 24 years. In Trinidad, a winter plumaged individual photographed at Chaguaramas on 24 February remained at the site for at least two days (Bd'A, JFo).

On 30 September a flock of five **Bobolink *Dolichonyx oryzivorus*** were found along Rahamut Trace.(KF, JG). Over the next week or so, this increased to at least 200 birds representing the largest flock ever recorded in Trinidad. Belatedly, one was reported, documented and photographed close to Blue Waters Inn, Tobago on 14 October 2015 (SO'R, LT). October remains the key month to find this southbound migrant.

<u>Escaped cage and aviary species</u>

A Venezuelan Troupial *Icterus icterus* was seen at Pt. Fortin and Village Weavers *Ploceus cucullatus* were inside Caroni Swamp.

The provenance of seedeater and seed-finch species continues to pose a challenge. The Committee has taken a decision that, unless there is supporting evidence to the contrary, all sightings will be considered under this category and that assessment will be based on identification alone.

Additional records

Acceptable records were also received for a further 41 sightings of the following species whose status has been established but whose distribution continues to be monitored by the Committee. Scaled Dove *Columbina squammata*, Blue Ground Dove *Claravis pretiosa*, Rufous-necked Wood-Rail *Aramides axillaris*, Black Skimmer *Rynchops niger* (Tobago only), Rufescent Tiger-Heron *Tigrisoma lineatum*, Little Egret *Egretta garzetta*, Glossy Ibis *Plegadis falcinellus*, Hook-billed Kite *Chondrohierax uncinatus*, Black Hawk-Eagle *Spizaetus tyrannus*, Double-toothed Kite *Harpagus bidentatus*, Crane Hawk *Geranospiza caerulescens*, Rufous Crab Hawk *Buteogallus aequinoctialis*, Crested Caracara *Caracara cheriway*, Aplomado Falcon *Falco femoralis*, White-eyed Parakeet *Psittacara leucophthalmus*, Variegated Flycatcher *Empidonomus varius*, Summer Tanager *Piranga rubra*, Ruddy-breasted Seedeater *Sporophila minuta.*

Inconclusive records

Submissions of the following species were deemed inconclusive: Azure Gallinule *Porphyrio flavirostris*, Lesser Black-backed Gull *Larus fuscus*, Black-collared Hawk *Busarellus nigricollis*, Lesser Elaenia *Elaenia chiriquensis*, Black-whiskered Vireo *Vireo altiloquus*, Summer Tanager *Piranga rubra*.

Nomenclature changes

Part of the mission of the South American Classification Committee is to create a standard classification, with English names, for the birds of South America. This is subject to constant revision by the proposal system to allow incorporation of new data. The following changes were made in 2019 : American Comb-Duck *Sarkidiornis sylvicola* is now deemed a separate species from Comb Duck *Sarkidiornis melanotos* of Africa. Trilling Gnatwren *Ramphocaenus melanurus*, formerly Long-billed Gnatwren, is now renamed and treated as a separate species from Chattering Gnatwren of southern South America.

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Jo-Anne N. Sewlal (1979-2020), Araneologist and Environmentalist

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It was with widespread shock and dismay that the news was received of Jo-Anne Sewlal's untimely death from an acute allergic reaction in January of this year. She has passed from among us with a great deal yet undone, but not before showing what she could do.

Jo-Anne came sharply to the attention of one of us (CKS) as a student in the general entomology course at The University of the West Indies (UWI). Every year I devoted the final lecture to a more in-depth treatment of one selected group of insects or arachnids. One year it was butterflies, another year ants, and the year that Jo-Anne did the course the topic was spiders. I ended by noting that at that time I was the ranking expert on this group in the Eastern Caribbean, not because I was a real araneologist but just because there was nobody better. There was thus a wide-open niche for anyone wishing to devote her/his main attention to this large, diverse and ecologically impactful group. At the end of class Jo-Anne came forward to tell me unequivocally that that was what she wanted to do. At the time I assumed this was due to my eloquence and only later learned that she had had an affinity for spiders since childhood (https://www.youtube.com/watch?reload=9&v=HtM7skvqhs4). She just needed someone to show that there could be a career in it. She did both of her graduate degrees at UWI, completing her PhD in 2013 under the supervision of Professor Adrian Hailey.

As she began graduate studies the following semester, I estimated that in two years Jo-Anne would surpass my moderate knowledge of spiders to become the ranking expert. In fact, it didn't take nearly that long, and I soon routinely re-directed to her the occasional spider-related inquiries that came to me from academic colleagues and students, as well as from the general public. The people soon learned to take their questions directly to her. She was a member of several scientific and environmental societies, including the hemispheric American Arachnological Society (AAS).

Micrathena gracilis female, widespread in woodland and comparable habitat in eastern North America.

One of us (BC) vividly recalls her participation at the 2009 AAS annual meeting in Arkansas, USA. I took special delight during a meeting field trip in being able to show her all three of the eastern North American species of spiny orb-weavers (*Micrathena*). She was keenly interested in this genus and had already collected the nine members found in Trinidad.

As an ongoing project, Jo-Anne aimed to contribute to the (almost non-existent) knowledge of the diversity of spiders in Trinidad and Tobago. After publishing a list of known spider families in 2003, she occasionally discovered new ones, so that the list was gradually augmented over the years. In recording diversity at the species level, her special focus was the orb-weaving spiders.

The West Indies are an entrancing place for a biologist, and Jo-Anne took delight in field work not only in Trinidad & Tobago but throughout the Lesser Antilles (Anguilla, Antigua, Grenada, Montserrat, Nevis, St Eustatius, St Kitts, St Lucia) and on Great Inagua in the Bahamas. In our various collaborations on many of these islands, Jo-Anne took the lead in studies of spiders, while I (CKS) led when the topic was social insects.

Atop a rock wall during a collecting trip to St. Eusatius. The wall was compiled with slave labour during the colonial period.

Jo-Anne's major activities went beyond research. Most notably, she was a prolific contributor to the local popular literature on biological and especially ecological topics. At different times she edited the bulletins of the Trinidad and Tobago Field Naturalists' Club and Environment Tobago, and she had a regular column in the weekly *Tobago News*. At the time of her death she served as secretary of the Trinidad & Tobago Branch of the Caribbean Academy of Sciences.

In addition, she had a large appetite for other intellectual and cultural pursuits. The newspaper reports about her emphasised her role in organising a chess club for elementary-age students, and she practised various forms of dance.

At the time of writing, the two of us are charged with completing her remaining research papers for publication.

Selected publications

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Notes to Contributors

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References should follow the Name and Year system. Some examples:

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   The full title of a journal should be given.
   Larsen, N.J. and **Levesque, A.** 2008. Range expansion of White-winged Dove (*Zenaida asiatica*) in the Lesser Antilles. *Journal of Caribbean Ornithology*, 21: 61-65.
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