



Mauritius butterflies revisited: short faunal survey reveals a new record for the Mascarene fauna – *Leptotes jeanneli* (Stempffer)

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Abstract: Results of a short survey on the island of Mauritius are presented. A total of 30 species are listed and commented upon, with special reference to the recently published similar study by Lawrence (2016). *Hypolimnas anthedon drucei* (Butler), considered previously as migratory on Mauritius, is reported as forming a well-established population in the SW of the island. *Cyclyrius mandersi* (Druce), considered as possibly extinct, is found on the eastern coast. Furthermore, a new record for the island is reported, *Leptotes jeanneli* (Stempffer). Adults and male genitalia are illustrated and compared to *L. pirithous* (Linnaeus) showing that the two species are rather easily identified by their external morphology.

Key words: Lepidoptera, Lycaenidae, Afrotropical Region, endemic species, extinction, *Leptotes jeanneli*, *Cyclyrius mandersi*, male genitalia

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INTRODUCTION

Volcanic islands are fascinating natural biological laboratories offering a number of scientific problems to be solved and a wealth of ideas for naturalists of all specialties, ecologists, taxonomists and biogeographers, among others. This is where the theory of evolution was forged. Volcanic islands are also, sadly, the theatre of a ferocious struggle for survival, where human destructive involvement is expressed in its extreme form. An impressive number of animal species vanished from volcanic islands throughout the world before modern science was granted the privilege of studying them; others were described just to perish shortly afterwards. The Dodo bird (*Raphus cucullatus*) is arguably one of the most emblematic of these victims of humanity. Unfortunately, it is by no means the only inhabitant of the island of Mauritius to be exterminated as a consequence of anthropogenic activity. Several species of butterfly have shared its fate. This is not surprising, since at least 90% of the natural vegetation (rain forest) of Mauritius has disappeared since human colonisation. This is far more than on the sister island of La Réunion, which has retained a fair portion of its natural vegetation cover. Therefore, endemic species such as *Antanartia borbonica borbonica* (Oberthür)

and *Salamis augustina augustina* Boisduval still survive on Réunion, even though it would be an overstatement to say they flourish, whereas on Mauritius subspecies of these two taxa are most probably long gone.

However, it would be unrealistic to say that volcanic island faunas undergo a one way process of gradual impoverishment. Island biotas are constantly evolving entities and, according to island biogeography theory (MacArthur & Wilson, 1967), two major processes shaping their faunas are extinction on the one hand, and immigration on the other. While several species are lost, others immigrate by their own means or with human help, and some of them are able to colonise the islands. Human activity does not only lead to the elimination of natural habitats but also stimulates the creation of others, occasionally contributing to the heterogeneity of environments and providing niche opportunities for incoming species. This process is being documented on the island of Mauritius, whose butterfly fauna has been studied and monitored for nearly two centuries (Boisduval, 1833). Over the years, 40 species of butterflies have been recorded on Mauritius, with three endemic taxa presumably extinct, and some three to five others listed as occasional strays and not established on the island. On the other hand, at least five or six species have been more recently recorded on Mauritius, have established viable populations, and with larvae mostly feeding on introduced garden plants.

Lawrence (2016), in the introductory note to the report of his short (5 days) survey, stated that: "... the butterfly fauna of Mauritius can be considered fairly well known". In fact, the butterflies of Mauritius have

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been catalogued repeatedly in the 20th century by Manders (1907), Vinson (1938), and more recently, rather intensively, by Davies & Barnes (1991), Florens & Probst (1995), Williams (1989, 2006, 2007), and De Freina (2011). Finally, the checklist of butterflies of Mauritius was critically revised and updated by Lawrence (2016), who observed or collected 30 species. During a short trip in December 2016 a survey was carried out by the author, resulting in 30 observed or collected species, including three reported previously from Mauritius, but not during Lawrence's survey, and one additional new record for the island.

MATERIALS AND METHODS

Butterflies were collected using standard entomological nets for the purpose of identification. Sight observations were carried out in all visited localities, and species unequivocally identified are specified in the report.

Taxonomically difficult species were preserved and examined later in the Zoological Division of the

Nature Education Centre (formerly Zoological Museum) of the Jagiellonian University. Male genitalia were removed from abdomens and soaked in 10% KOH solution for 5–10 minutes. Subsequently, abdomens were preliminarily cleaned of soft tissue in water in order to expose genital parts. Dissected genitalia were then cleaned in ethanol (90–95%). A Nikon digital camera DS-Fi1 and Olympus SZX9 stereomicroscope were used for taking pictures of the dissections, which were then processed in Combine ZP and Corel PHOTO-PAINT X3 programs to enhance focus and improve quality. Genital dissections were kept in glycerol vials pinned under corresponding specimens.

Overall, seven sampling days were carried out by two people in 11 localities throughout the island (excluding NW) in the period 20–26.12.2016. One locality (Le Surcouf) was visited four times (16 person/hours), one locality (Curepipe) thrice (10 p/h), two localities (Trou d'Eau Douce and Grande Rivière Noire) twice (6 p/h), and the remaining seven localities were sampled once (approx. 2–3 p/h each).

Table 1 – List of surveyed localities (all elevations metres above mean sea level) shown on Fig. 1

Locality number	Locality name	Dates visited	GPS co-ordinates	Elevation (m)
1	Palmar, 0.5 km W of Hotel Le Surcouf	20, 21, 23, 26.xii.2016	20°12'57" S 57°47'36" W	5–10
2	1 km S of Trou d'Eau Douce	21, 24.xii.2016	20°14'38" S 57°46'57" W	35–40
3	Beau Champ, Le Pont	21.xii.2016	20°16'40" S 57°46'16" W	35–40
4	2 km NE of Curepipe	21, 22, 23.xii.2016	20°17'49" S 57°32'33" W	500–510
5	Curepipe, Mare aux Vacoas	22.xii.2016	20°24'07" S 57°28'33" W	590–600
6	Bassin Blanc, 2 km N of Chamouny	22.xii.2016	20°27'3" S 57°28'41" W	360–370
7	2 km E of Chamarel	22.xii.2016	20°27'23" S 57°24'15" W	320–330
8	Moka, Base of Le Pouce	23.xii.2016	20°14'15" S 57°31'43" W	400–450
9	1km E of Grande Rivière Noire	25, 26.xii.2016	20°21'49" S 57°23'06" W	10–15
10	2 km E of Case Noyale	25.xii.2016	20°25'01" S 57°22'55" W	130–140
11	Hill 2 km S of Queen Victoria	24.xii.2016	20°14'27" S 57°42'55" W	250–280

RESULTS

Hesperiidae: Out of six species listed for Mauritius (Lawrence, 2016) four were observed during this survey (not observed: *Erionota torus* Evans, and *Parnara naso naso* (Fabricius)). This is the lowest ratio of reported/observed species for any family. All the Skipper species were observed as single individuals, except for *Eagris sabadius* (Gray) which was seen more frequently in one locality (Queen Victoria). Note: The numbers in parentheses refer to

the locality/localities in which each species was observed.

Coeliades forestan forestan (Stoll) (1, 2)
Pyrrhiades pansa (Hewitson) (1)
Eagris sabadius sabadius (Gray) (11)
Borbo borbonica borbonica (Boisduval) (11)

Papilionidae: Both species known from Mauritius were seen, usually as single individuals, flying actively and patrolling. No hill-topping behaviour was observed. Most observations of *P. manlius* Fabricius



Figure 1 – Map of Mauritius with surveyed localities (www.eu.wikipedia.org)

took place in or around Curepipe, including gardens and other urbanised areas.

Papilio manlius Fabricius (4, 5, 7, 9)

Papilio demodocus demodocus Esper (1, 3, 4, 9)

Pieridae: All four species of Pieridae listed for Mauritius by previous authors were observed. As pointed out by Williams (2007) and Lawrence (2016) *Eurema floricola ceres* (Butler) is common in different kinds of disturbed habitats, and widespread, whereas *E. brigitta pulchella* (Boisduval) is highly localised. However, in the localities where this species was seen its populations were abundant. Mirroring the situation of *Eurema*, *Catopsilla florella* (Fabricius) was widespread and rather common, whereas *C. thauruma* (Reakirt) was found to be very localised. However, in Grande Rivière Noire *C. thauruma* was observed rather commonly, contrary to Lawrence (2016), and as many as 10 individuals of both were seen flying along the road, and in one spot as many as five aggregated on mud-puddles.

Eurema brigitta pulchella (Boisduval) (5, 6, 11)

Eurema floricola ceres (Butler) (1, 2, 7, 10, 11)

Catopsilla thauruma (Reakirt) (9)

Catopsilla florella (Fabricius) (1, 2, 4, 9)

Nymphalidae: The two endemic species of Danainae were found to be localised and uncommon, and mostly confined to the SW of the island where *Euploea euphon* (Fabricius) was seen only in riverine forests of Grande Rivière Noire, which confirms previous reports (Lawrence, 2016). *Amauris phoedon* (Fabricius) seems to be more widespread and was also noted at higher elevations in Curepipe. It is possible that both species are seasonal. *Danaus chrysippus orientis* (Aurivillius) was found to be rather

widespread and not uncommon. *Heteropsis narcissus narcissus* (Fabricius) was found to be widespread on the island and found in all kinds of woody habitats in shaded areas with abundant grasses. It was however never really abundant as noted by Lawrence (2016). *Neptis frobenia* (Fabricius) was found in more or less similar habitats with a predilection for denser and higher forest cover, and generally in the SW woody, more humid part of the island, invariably at higher elevations. In each locality single individuals were observed. *Phalanta phalantha aethiopica* (Rothschild & Jordan) was common, whereas *Melanitis leda* (Linnaeus) and *Hypolimnas misippus* (Linnaeus) were observed only once. Taxa not seen were: *Hypolimnas bolina jacintha* (Drury), *Vanessa cardui* (Linnaeus), *Danaus plexippus* (Linnaeus) (all three are vagrant species occasionally observed on Mauritius), *Junonia goudoti* (Boisduval) (doubtful single record from 1938), *Libythea cinyras* Trimen, *Salamis augustina vinsoni* Le Cerf, and *Antanartia borbonica mauritiana* Manders (all three presumed extinct).

It is interesting to note that *Hypolimnas anthedon drucei* (Butler) reported by Williams (1989, 2007) from four historical specimens, and subsequently by Lawrence (2016) who mentioned another, single individual collected by Dobson in Black River Gorges in 2007 is considered as possibly migratory and/or exceedingly rare in Mauritius. It was rediscovered during this survey in Grande Rivière Noire. Over two days as many as 12 individuals were seen flying actively along the river margins, usually well inside the riverine forest in shaded places, but occasionally overflying open areas and roads. Both males and females were seen. It appears therefore that there is a strong population of this species in extreme SW Mauritius.

Euploea euphon (Fabricius) (7, 9)

Amauris phoedon (Fabricius) (4, 6, 9)

Danaus chrysippus orientis (Aurivillius) (2, 3, 9, 10, 11)

Heteropsis narcissus narcissus (Fabricius) (1, 2, 3, 4, 5, 8, 11)

Melanitis leda (Linnaeus) (4)

Neptis frobenia (Fabricius) (4, 5, 8, 10)

Phalanta phalantha aethiopica (Rothschild & Jordan) (1, 2, 7, 10, 11)

Junonia rhadama (Boisduval) (1, 2)

Hypolimnas misippus (Linnaeus) (2)

Hypolimnas anthedon drucei (Butler) (9)

Lycaenidae: Two species recorded from Mauritius by previous authors (Williams, 2007; Lawrence, 2016) were not found during this survey: *Chilades pandava* (Horsfield) and *Leptomyrina phidias* (Fabricius). The former is an introduced species whose larvae feed on ornamental *Cycas*, therefore it is unsurprising not to find it in semi-natural areas or secondary forests. The latter species is considered by Williams (2007) to be fairly common but Lawrence (2016) observed only one individual. All other species of Lycaenidae were found, including *Zizina otis antanossa* (Mabille), not reported by Lawrence (2016). Contrary to this author,

Deudorix antalus (Hopffer) was found to be locally very common in Grande Rivière Noire. *Cacyreus darius* (Mabille) was observed only in one site, as was *Pseudonacaduba sichela reticulum* (Mabille), considered common by Williams (2007), but certainly very restricted geographically. Contrary to Williams (2007) and Lawrence (2016), the endemic *Cyclus mandersi* (Druce) was also observed, despite the fact that it was considered by the latter author as possibly extinct or confined to the islet of Aigrettes (Florens & Probst, 1995; Libert, 2011).

Additionally, a new record for the island of Mauritius was found, *Leptotes jeanneli* (Stempffer, 1935). Three males were dissected and their genitalia confirmed the identity of this species (Larsen, 1991b; Libert, 2011). This is probably due to identification problems and confusion with *L. pirithous pirithous* (Linnaeus) this species has been overlooked and is actually present in some Mauritian butterfly collections. Nevertheless, *L. jeanneli* (Stempffer) was found to be much less frequent than its common congeneric.

Lampides boeticus (Linnaeus) (1, 9)
Cacyreus darius (Mabille) (4)
Pseudonacaduma sichela reticulum (Mabille) (1, 11)
Deudorix antalus (Hopffer) (9, 11)
Zizeeria knysna (Trimen) (6)
Zizina otis antanossa (Mabille) (2, 10)
Zizula hylax (Fabricius) (1)
Leptotes pirithous pirithous (Linnaeus) (1, 2, 7, 8, 9)
Cyclus mandersi (Druce) (1)
Leptotes jeanneli (Stempffer) (7, 9, 11)

DISCUSSION

Mauritius is a prime tourist destination, and recently collected information on the butterflies of this island is generally an outcome of short surveys, by-products of leisure trips, rather than an outcome of specialized entomological expeditions. This certainly influences their scope and sampling methodology, selection of localities (depending on hotel residence), and strongly limits their timeframe. There is no ongoing long-term research project in Mauritius, in contrast to what was carried out on the sister-island of La Réunion (Martire & Rochat, 2008). The only active lepidopterist based in Mauritius is, to my knowledge, Jacques Siedlecki, whose collection is exhibited in the museum of the La Vanille Reserve in Rivière des Anguilles. Time constraints, coupled with the fact that butterfly abundance in Mauritius is low or very low, means that many species are reported from single localities or single individuals with no comprehensive data on their phenology, spatial distribution and abundance.

The fact that some species are considered to be migrants and are not firmly established on the island, may be, in some cases, biased by random and short sampling. This is certainly the case for *Hypolimnas anthedon drucei* where two individuals were collected first in the early 20th century, a further two in 1953 (Williams, 2007), and eventually one in 2007 (Lawrence, 2016). During this survey *H. anthedon* was found, to be relatively common with well-established

populations, although restricted geographically. Interestingly, *H. anthedon* does not seem to occur on the island of La Réunion, situated closer to Madagascar, the potential source area of its immigration. That such a large and conspicuous butterfly has eluded the attention of many lepidopterists visiting the island, including the very area where it occurs, raises some doubt whether the species that are firmly considered as extinct, are really extinct. *Salamis augustina vinsoni* has always been a scarce butterfly and since its description in 1922 only a few have been collected, the last in 1957 (Williams, 2007). Its disappearance is considered to be related to the presumed extinction of its host plant, *Obetia ficifolia* on Mauritius. On La Réunion this plant grows mainly at low and mid-altitudes (15–800 m), generally on rock-cliffs, on basalt rampart-formations, and in ravines (www.bihrmann.com) - all areas hard to access. It may still exist in some ravines in SW Mauritius which are still covered with patches of primary or secondary forests this plant (there have been no recent botanical surveys on Mauritius). *Salamis augustina* is, as are other similar congenics such as *S. cacta* (Fabricius), a shy, reclusive species, fond of dense forests, and small populations may still exist on Mauritius. Another subspecies considered to be extinct is *Antanartia borbonica mauritiana*. Its survival is more plausible since it is not strictly monophagous as is the preceding species but feeds on several Urticaceae, including an exotic species (Martire & Rochat, 2008). As a fast flying, unpredictable butterfly with a preference for mid-elevations (500–1000 m), it may still occur in places in SW Mauritius which host patches of forest that are hard to access. An individual of the latter species, collected in 1947, was examined in the collection of Jacques Siedlecki, even though Williams (2007) stated that the last specimens were collected in the early 20th century.

Some endemic species are small and inconspicuous and may easily be overlooked, for example *Cyclus mandersi*. This butterfly was not found by Williams (1989, 2007) or by Lawrence (2016) who considered it as “almost extinct”. Interestingly, it was observed on two occasions some twenty years ago on small offshore islands of Aigrettes by Florens & Probst (1995) and on Ile des Cerfs (Haydon Warren-Gash, pers. comm.; Libert, 2011). During this survey it was found in a secondary coastal forest among extremely abundant *Leptotes pirithous*. It appears, therefore, to be tolerant of highly disturbed areas. It seems, however, to be restricted to peripheral areas, which could possibly mean an ongoing process of competitive exclusion by non-endemic *Leptotes*, mirroring the situation of endemic *Leptotes sanctithomae* (Sharpe) and *L. pyrcti* Libert, and *L. pirithous* on the islands of Sao Tomé and Principe (Pyrzcz, 1993), or that of *Pararge xiphia* (Fabricius) and *Pararge aegeria* (Linnaeus) on Madeira (Jones & Lace, 1992). Its similarity to *L. pirithous* means that it is easily overlooked.

Finally, during this study the 41st species of Mauritian butterfly, *Leptotes jeanneli*, was recorded. It is a

widespread Afrotropical species found throughout Sub-Saharan Africa south to Swaziland, and in Yemen (Larsen, 1991b; Libert, 2011; Williams, 2016). It has not been reported, so far, from any island in the Indian Ocean, including Madagascar. There are no data on its host plants, although they are presumably similar to *L. pirithous* (Davis & Barnes, 1991). Its inconspicuous appearance and similarity to the more abundant (and generally neglected by lepidopterists) *L. pirithous*, make it difficult to detect in the field. Contrary to what was expressed by Larsen (1991b) this species, at least in Mauritius, is rather easy to separate from *L. pirithous* based on colour patterns and size, and it is not necessary to resort to genitalia examination (see Fig. 2). *L. jeanneli* is markedly larger (male: 13-14 mm, mean: 13.6 mm n=7) compared to *L. pirithous* (male: 9-12 mm, mean: 10.3 mm, n=29), and with a stronger bluish flush than its violet congeneric. However, in particular, it is different on the hindwing underside. Blackish or dark brown dots, visible in fresh individuals of *L. pirithous*, are not apparent. The submarginal line is wavy and composed of lunular patches, not straight and parallel to the outer margin as in *L. pirithous*.



Figure 2 – Adult facies (left: recto, right: verso): 1 – *Leptotes pirithous* ♂, Palmar; 2 – *Leptotes pirithous* ♀, Palmar; 3 – *Leptotes pirithous* ♂, Trou d'Eau Douce; 4 – *Leptotes pirithous* ♀, Grande Riviere Noire; 5 – *Leptotes jeanneli* ♂, Palmar; 6 – *Cyclyrius mandersi* ♂, Palmar.

In addition, the pattern of dark patches is different; this can be seen in Fig. 2: 5. The male genitalia of *L. jeanneli* are so distinctly different, with wide valves terminated with several long teeth, that they leave no doubt as to the identity of *L. jeanneli* and *L. pirithous* (Larsen, 1996). However, it is worth pointing out the unusual individual variation in the male genitalia of *L. pirithous* on Mauritius, especially in regard to the shape of the valves (Fig. 3). No female of *L. jeanneli* was found during this study.

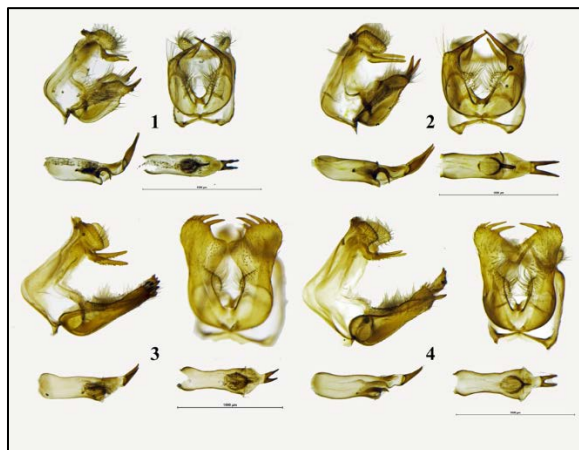


Figure 3 – *Leptotes* male genitalia (lateral and ventral view; aedeagus in lateral and dorsal view): 1 – *Leptotes pirithous*, Palmar; 2 – *Leptotes pirithous*, Grande Riviere Noire; 3 – *Leptotes jeanneli*, Queen Victoria; 4 – *Leptotes jeanneli*, Chamarel.

The Mauritian butterfly fauna is thus an interesting mix of Afrotropical and Oriental elements. The Mascarenes are considered to be part of the Afrotropical Region, and most species found on Mauritius are typically widespread African taxa, or, in a few cases, Madagascan genera (*Heteropsis*), species (*Junonia rhadama*, *Catopsilia thauruma*, *Coeliades pansa*) or subspecies (*Hypolimnas anthedon drucei*). There are however a few typical Oriental genera (*Euploea*) or species (*Catopsilia thauruma* (also considered as a race of a widespread Oriental species *C. pomona* Fabricius) and *Hypolimnas bolina*). Endemic species of Mauritius have rather clear, although not always thoroughly investigated, affinities with their Madagascan congeners (e.g. *Papilio manlius*). The ratio of shared species or shared sister-species with the sister island of La Réunion is very high, and is exemplified by Mauritian endemics such as *Salamis augustina vinsoni*, *Antanartia borbonica mauritiana*, *Neptis frobenia*, *Papilio manlius*, and *Euploea euphon*. Only exceptionally are some species that are exclusively found on Mauritius not found on La Réunion. These include endemics such as *Cyclyrius mandersi* and *Amauris phoedon*) or widespread species such as *Pseudonacaduba sichela* and *Leptotes jeanneli*. However, future surveys may possibly reveal their existence on that island as well. The Mauritius butterfly fauna has a higher species richness (41) compared to La Réunion (32), although three species are probably extinct in Mauritius, compared to none on La Réunion, which clearly exhibits a much better preserved natural environment on the latter island.

More long term lepidopterological surveys are needed in Mauritius with more sampling in less explored areas in the central and south-central parts of the island, which still has patches of primary and secondary forest, as well as in the coastal areas. An emphasis should be placed on Lycaenidae, as it is not impossible that more species, either recently established or overlooked, may be found. In addition, monitoring of endemic species is required, as it seems, based on observations made some 20–30 years ago, and recently, that their populations are decreasing both in extent and numerically. This is especially true for *Papilio manlius*, *Amauris phoedon* and *Euploea euphon*, which were reported as widespread and common by Williams (1989, 2007), but are now restricted and seldom encountered. The status of *Cyclus mandersi* also needs to be evaluated.

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