On some Geometridae (Lepidoptera) collected in Madagascar and the Mascarene islands.

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Abstract: Recent records of some selected species of Geometridae from Madagascar, Réunion and Mauritius as well as new hostplant records for 6 species are reported. One species is recorded for the first time from Réunion island and four species from Mauritius. Semiothisa troni Guillermet, 2011 is found being a syn. nov. of Chiasmia crassilembaria (Mabille, 1880). The genitalia of 15 species are imaged: Epigynopteryx modesta (Butler, 1880), Psilocerea monochroma Herbulot, 1954, Psilocerea swinhoei Herbulot, 1959, as well as the male of Chloroclystis latifasciata de Joannis, 1932 for the first time. The caterpillars of 4 species are illustrated.

Keywords: Lepidoptera, Geometridae, Madagascar, Mascarene islands

Many species of African Lepidoptera have hardly ever been illustrated in the past and no, or few, hostplant records are available for most species. I would therefore like to share some of my observations from the Mascarene islands of Mauritius and Réunion as well as in Madagascar. It appears that the diversity of the lepidopterous fauna is underestimated, in particular for the island of Mauritius which has not been systematically prospected for 60 years.

Ennominiae:

Cleora acaciaria (Boisduval, 1833) - Figs. 1-4

Wingspan: 35mm

1 specimen (Fig.1-2) was raised on *Dodonaea viscosa* Jacq. (Sapindaceae), 09-xii-2015, male, dissected, slide RE-2293 (Fig.3) found in Reunion, La Montagne, alt.900m and another male specimen was bred on *Syzygium cumini* (L.) Skeels. (Myrtaceae) in La Possession, alt.550m, 07-xi-2016.

The mature larvae reached a length of 36mm (Fig.4).

Hostplants: polyphagous. This species was reported feeding on *Agauria salicifolia* (Ericaceae), *Stachytarpheta urticifolia* (Verbenaceae), *Toddalia asiatica* (Rutaceae), *Crassocephalum rubens* (Asteraceae), *Syzygium jambos* (Martiré & Rochat, 2008), *Syzygium cumini* (Myrtaceae) and *Dodonaea viscosa* (Sapindaceae) (new records).

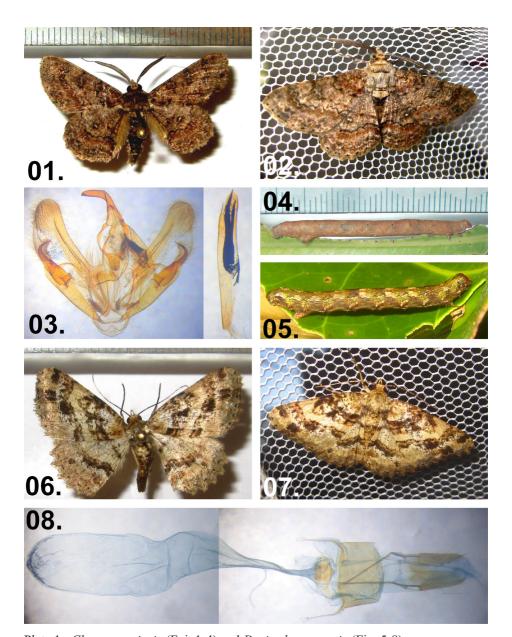


Plate 1: Cleora acaciaria (Fgi. 1-4) and Darisodes orygaria (Fig. 5-8)

Cleora acaciaria: 1 - male, e.l. Dodonaea viscosa, 2 - Cleora acaciaria - male, e.l. Dodonaea viscosa, 3 - male genitalia (same specimen, slide RE-2293), 4 - larvae on Syzygium cumini

Davisodes orygania: 5 darwa 6 morph tamboura formula 7 morph tamboura

Darisodes orygaria: 5 - larva, 6 - morph *tamboura*, female, 7 - morph *tamboura*, female, 8 - female genitalia, RE-2355

Darisodes orygaria (Guenée, 1862) – morphe tamboura Pl.01 - Figs. 5-8

Wingspan: 35mm

Distribution: Mayotte, Grand Comores, Madagascar, Mauritius, Réunion

One female (Fig.6-7), dissected, slide RE-2355 (Fig.8), 11-i-2016, was raised from larvae collected in Réunion, La Montagne, alt. 950m, feeding on *Tambourissa elliptica* (Tul.) A. DC. subsp. *elliptica* (Monimiaceae). Pupal stade: 13 days.

The markings of this specimen are rather uncommon for this species I believe that this morph might be restricted to this hostplant.

Hostplant: *Tambourissa elliptica* (Tul.) A. DC. (Monimiaceae).

Tambourissa elliptica is an endemic tree reaching a height of approximately 12 meters in low altitudes (ssp. *micrantha*) and approximately 6 meters for the nominal subspecies that is found in higher altitudes only and has larger leaves. In Africa trees of this genus are often used for the manufacture of drums.

Epigynopteryx modesta (Butler, 1880) - Figs. 9-11

Wingspan: 27mm

No photograph or genitalia illustrations of this species seem to exist, only a drawing of the imago published by Saalmüller & von Heyden (1891), Pl.XiV, fig. 277 - without description, as *Gynopteryx sipariata* Saalm.; a good reason to illustrate this species at least once.

The illustrated male (Figs.9-11) was found in Andasibe, Madagascar, 30-xi-2016 where this species seems to be rather common.

Distribution: Madagascar

Chiasmia crassilembaria (Mabille, 1880) - Figs. 15-22

Synonym: Semiothisa troni Guillermet, 2011 syn.nov.

Description:

Adult: Figs.15-16.

Forewing length: 12-13mm, ground colour of wings ochreous-brownish, striated with grey, postmedian darker olive-brownish, a brownish preapical spot.

Male genitalia: Figs.17-20.

Uncus horns present and well developped, gnathos present.

Costa of valvae massive, not dilated apically, distal margin widened without process.

Sacculus broadend. Aedeagus stout; vesica with single, drop-shaped median cornutus.

The eighth sternite shows to be a little variable in shape (Figs. 20a+b).

Female genitalia: Figs.21-22.

Slender apophyses, anteriores shorter than posteriores. Ductus bursae ribbed, elongated bursae copulatrix with oval signum, irregularly spined, length approx. 45-50/100mm (Fig.22).

Chiasmia crassilembaria (Mabille, 1880) was redescribed and illustrated by Kruger (2001; Figs. 356, 678, 899) in his excellent revision on African, Malagasy and Arabian Macariini. Krüger illustrated images of adults, male and female genitalia. This shows that this species is identical with the later described *Semiothisa troni* Guillermet, 2011 syn. nov. described from a unique male, wingspan 22mm, collected in Reunion, Grande

Chaloupe, alt. 10m on 03-vii-2010. *S. troni* was illustrated in the original description by the holotype imago and a drawing of the male genitalia and aedeagus. The author probably did not know of the revision of African, Malagasy and Arabian Macariini by Kruger (2001) as it was not cited. The later had transferred all African species formerly placed in *Semiothisa* to other genera, except those whose position could not been cleared. The genus *Semiothisa* is restricted to the Neotropics.

The *S. troni* holotype illustrated by Guillermet and additional material collected in Réunion and Madagascar correspond to the description and images of *Chiasmia crassilembaria* (Mabille, 1880) in Kruger (2001). These illustrations and the female genitalia from specimens collected in La Réunion (fig.21-22) confirm that *S. troni* Guillermet, 2011 is a junior synonym of *C. crassilembaria* (Mabille, 1880). In addition to the specimens collected in Réunion, I examined specimens from Madagascar from my own collection and that of the Madagascar Biodiversity Center / Parque Zoologique & Botanique de Tsimbazaza, Antananarivo.

The type locality for *S. troni* is situated in an approximate «butterfly»-flight distance of only 5-7 kms from my collection site at Ravine à Malheur, La Possession, Réunion and has similar climatic conditions. Both belong to Réunion's semi-deciduous dry forest. Material examined:

35 specimens of both sex, collected in Réunion, La Possession, Ravine à Malheur, alt.400m on: 10-v-2013, 31-v-2013, 13-vi-2013, 16-vi-2013, 20-vi-2013, 07-vii-2013, 17-vii-2013, 26-ix-2013, 27-ix-2013, 02-x-2013, 09-ii-2014, 09-iii-2014, 25-iv-2014, 19-vi-2014, 22-vi-2014, 14-viii-2014, 20-viii-2014, 27-ix-2014, 09-x-2014, 14-iii-2015, 30-iv-2015, 26-v-2015, 19-vi-2015, 25-vi-2015, 27-vi-2015, 30-vi-2015, 12-viii-2015, 13-ix-2015, 10-x-2015, 01-xi-2015, 27-xi-2015, 29-xii-2015, 17-vi-2016, 22-vi-2016 and 18-i-2017.

Dissected: 3 males and 3 females.

Recorded at the same locality but not collected also on 23-viii-2012, 07-viii-2017, 20-viii-2017 and 04-x-2017.

Supplentary material from Madagascar examined: 6 females and 1 male collected in Mahamasina (Diana) between 24 and 26-iv-2013. Dissected: 2 females, 1 male (Fig.18).

Recorded flight period (months): i, iii, iv, v, vi, vii, viii, ix, x, xi, xii

Biology: unknown

Distribution: Madagascar, Comoros and La Réunion.

Some of the specimens collected in Réunion were donated to the collections of the Madagascar Biodiversity Center/Parque Zoologique & Botanique de Tsimbazaza, Antananarivo and Musée d' Histoire Naturelle, Saint-Denis, Réunion.

Erastria madecassaria (Boisduval, 1833) - Figs. 12-14

Forewing length: 16-17mm. Wingspan 35-36mm.

One male (Figs.12-13) was collected in Mauritius, Flic-en-Flac, 10-13-vi-2016, dissected, slide Mru-054 (Fig.12).

In Réunion this species is rather scarce, I only remember having found 3 specimens on 15-ii-2016, 25-iv-2014 and 23-xi-2014 in La Possession, alt.400m.

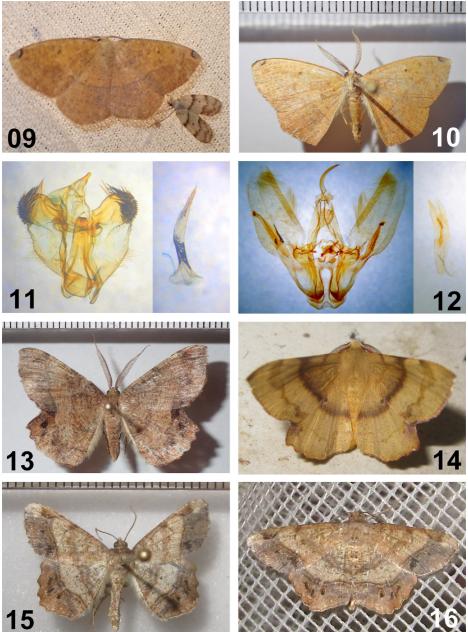
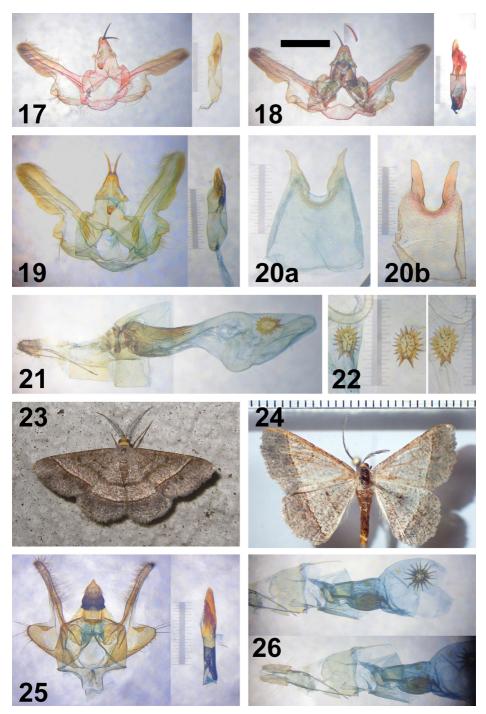


Plate 2: *Epigynopteryx modesta* (Fig. 9-11), *Erastria madecassaria* (Fig. 12-14) and *Chiasmia crassilembaria* (Fig. 15-16)

Epigynopteryx modesta: 9 - Andasibe, below: Exilisia placida (Butler, 1882), 10 - male, Andasibe, 11 - male genitalia, slide Mad-023. Erastria madecassaria: 12 - male genitalia, slide Mru-054, 13 - Flic-en-Flac, male, 14 - Réunion. Chiasmia crassilembaria: 15&16 - Réunion, slide RE-1911



Isturgia deeraria (Walker, 1860) – Figs. 23-26

Wingspan: 23mm (female).

Distribution: southern palearctic region and throughout Africa, including Madagascar and Comoros (Kruger, 2001), newly recorded for the fauna of Mauritius. This species is the most common Geometridae in Mauritius but is still absent from Réunion. Astonishingly it had never been reported in the past from the Mascarenes and I believe that it might be a recent introduction.

In Mauritius it was collected between 06 to 13-vi-2016 at the following sites: Blackriver, alt.10m ($20^{\circ}22'5$ »S/57°22'47»E) and 55m ($20^{\circ}21'31$ »S/57°24'27»E), Flic-en-Flac, alt.10m ($20^{\circ}16'57$ »S/ 57°22'16»E) and Bambous, alt.230m ($20^{\circ}16'14$ »S/57°25'39» E).

Males (29) were more numberous than females (two).

Dissected: male, slide Mru-023 (Fig.25), Blackriver, alt. 55m, 12-vi-2016; female, slide Mru-117 (Fig.26), Blackriver, alt. 20m, 08-vi-2016.

Hostplants: Fabaceae. Kruger (2001) recorded this species in South Africa on *Acacia karroo* Hayne, *Acacia hirtella* E. Mey, *Acacia nilotica* (L.) Willd. ex Delile, *Acacia mearnsii* De Wild. and *Peltophorum sp*.

In Kenya this species was recorded on *Acacia tortilis* (Forssk.) Hayne by Agassiz & Harper (2009).

Observation: The females differ from the description of Kruger (2001) by having filiform antennae. Two of the specimens were donated to the Musée d'Histoire Naturelle, Saint-Denis, Réunion in ix-2017.

Psilocerea monochroma Herbulot, 1954 – Figs. 28-31

Forewing length: 18.5-20mm. Wingspan: 40-43mm.

Though not rare this species had not previously been identified in Réunion. I had many problems in identifying it because most African and Malagasy species of this genus had no genitalia illustrated and good quality images of the imago are rarely found. My identification is based on the genitalia description of Herbulot (1954) and specimens from the collections of Madagascar Biodiversity Center/Parque Zoologique & Botanique de Tsimbazaza, Antananarivo.

Psilocerea monochroma seems to be on the wing in most seasons of the year but is particularly abundant in the months of xi and xii. A total of 34 specimen were recorded in Réunion in altitudes between 400m and 1750m the months i, ii, iv, vii, viii, ix, x, xi, xii.

Females (80%) are more numberous than males (20%).

Plate 3 (opposite): *Chiasmia crassilembaria* (Fig. 17-22) and *Isturgia deeraria* (Fig. 23-26)

Chiasmia crassilembaria: 17 - male gen., Reunion, 18 - male gen., one uncus horn detached, Mahamasina, 19 - male gen., Reunion, 20 - 8th segment, both Reunion, 21 - female gen., Reunion, 22 - Reunion

Isturgia deeraria: Fig. 23 - Blackriver, 08-vi-2016, 25 - male genitalia, slide Mru-023, 26 - female genitalia

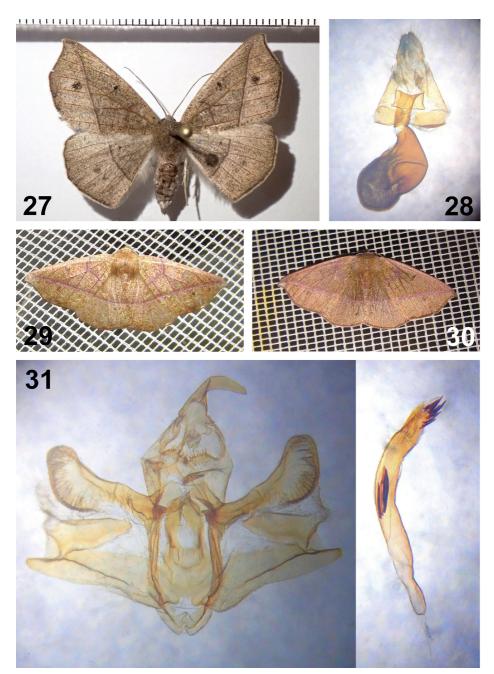


Plate 4: *Psilocerea monochroma*Fig.27 - 10-ix-2016, 28 - female genitalia, 29 - 16-xii-2015, 30 - 21-xi-2015, 31 - male genitalia, Ste.Suzanne, 17-vi-2014

Localities and dates:

La Possession, Ravine à Malheur, alt. 400m on 03/22-xii-2012, 04/09-i-2013, 11-ii-2013, 08-viii-2013 29-x-2013, 07/19/21/23-xi-2013, 01-xii-2013, 20-ix-2014, 17/23/28-xi-2014, 01/03/04-xii-2015, 10-ix-2016, 29-x-2016, 16-xii-2016, 5-i-2017 (3 specimen). Salazie, Helbourg, alt.1100m 20-ix-2014; Sainte-Suzanne, alt.700m: 17-vii-2014, 17-xii-2015, Sainte-Marie, route Piton Fougère, alt.1150m: 3 females on 06-xii-2015; Sainte-Paul, Le Maido, 1750m on 26-iv-2014.

Additional specimens that were not collected had been observed also on 11-xii-2012 in La Montagne (Plaine d'Afffouches), alt.1150m and on 25-ix-2017 in La Possession, alt.400m.

Distribution: Madagascar and Réunion

Four of the specimens collected in Réunion were deposited in the collection of the Madagascar Biodiversity Center, Antananarivo in November 2016 and two specimens in the Musée d'Histoire Naturelle, Saint-Denis, Réunion.

Psilocerea swinhoei Herbulot, 1959 – Fig.32

No genitalia images or illustrations have been published for this species. In the collections of the Madagascar Biodiversity Center, Antananarivo there is a dissection slide of a male (Fig.32), labelled «*Pr.No.4154 C.Herbulot Psilocerea swinhoi Hrblt*», without date and locality, this was possibly dissected by Cl.Herbulot.

Distribution: Madagascar

Larentiinae:

Casuariclystis latifascia (Walker, 1866) – Figs. 33-35

Wingspan 12-13mm.

A nice, small species with a broad distribution from Fiji and Indonesia to Seychelles and Kenya. The forwings are somewhat greyish with darker blackish-grey pattern.

Regional distribution: Kenya, Mauritius, Réunion, Seychelles.

Hostplant: *Casuarina equisetifolia* L. (Casuarinaceae) (Legrand, 1966, in Seychelles) Observations: I did not find this species in Seychelles or Mauritius. The illustrated and examined specimens are from Reunion, La Possession, 400m: 07-viii-2015 and 02-xi-2015 (2x). Recorded also in early September 2017 but not collected.

Chloroclystis latifasciata de Joannis, 1932 – Figs. 36-41

Distribution: Mauritius and Réunion.

Wingspan: 13-14mm.

A small species, recognisable by its greenish head, thorax, abdomen and base of forewings (Fig.37). Unfortunately these parts turn greyish-brown in dead and spread specimens (Fig.36).

Numerous larvae (fig.41) were collected and raised on *Phyllanthus amarus* Schumacher (Phyllanthaceae), collected in La Réunion, La Possession, 400m from which were bred some 25 adults between 15-ii-2015 and 28-iv-2015 and two additional specimens were bred on the same plant on 25/29-viii-2015. It seems to be extremely common on this plant. I actually spotted only the first larvae that I collected in January 2015 and most

of the later emerged specimens must have have been added to my breeding-container with fresh leaves. This plant dries out rather quickly and therefore I added fresh leaves almost every day. Probably most of them had still been eggs or early instar larvae. I did not collect any specimens of this species on my recent travels to Mauritius.

Hostplant: Phyllanthus amarus Schumacher (Phyllanthaceae)

Gymnoscelis rubricata (de Joannis, 1932) Figs.44-46

Wingspan 17-22mm.

Distribution: Comoros, Madagascar, Mauritius and Réunion.

Two females (wingspan 17-18mm) of this species were collected in Mauritius, Blackriver, 08-vi-2016 and Bambous, 11-vi-2016, dissected, slide No.Mru-053 and Mru-062 (Fig.46).

The illustrated male (Fig.44-45) was found in Réunion, Sainte Suzanne, alt. 700m, wingspan 22mm, forewing length: 10,5mm.

Mesocolpia nanula (Mabille, 1900) - Figs. 42-43; 47-48

Wingspan: 15-17mm

Distribution: continental Africa, Madagascar, Mauritius and Réunion.

This is probably the most common Larentiinae in the Mascarene islands.

I raised this species from larvae collected on the inflorescence of: *Lantana camara* L. (Verbanaceae) (6 specimens, x/xi/xii-2015, La Possession, alt.400-550m), *Acacia farnesiana* (L.) Willd. (vi/vii-2016, La Possession, alt.90m) and on *Pithecellobium dulce* (Roxb.) Benth (Fabaceae) (9 specimens; x/xi-2016, La Possession, alt.90m).

4 specimens were also collected at light in Mauritius (Blackriver and Flic-en-Flac) in June 2016, and two supplementary specimens in Mahébourg, 24-iv-2017.

Hostplants: *Lantana camara* L. (Verbanaceae), *Acacia farnesiana* (L.) Willd., *Pithecellobium dulce* (Roxb.) Benth (Fabaceae). In Kenya recently recorded on *Acacia drepanolobium* Harms ex Y. Sjöstedt and *Acacia tortilis* (Forssk.) Hayne (Agassiz & Harper, 2009).

1 specimen was placed in the Musée d'Histoire Naturelle, Saint-Denis, Réunion in ix-2017.

Geometrinae:

Comostolopsis complex (not illustrated) in the Islands of the Indian Ocean.

Three species of *Comostolopsis* had been described from the smaller islands of the Indian Ocean:

- Comostolopsis leuconeura Prout, 1930 (Réunion)
- Comostolopsis sladeni Prout, 1915 (Seychelles)
- Comostolopsis viridellaria (Mabille, 1898) (Mauritius).

The specimens collected by the Mission Franco-Mauricienne 1955 in La Réunion, Bébour Forest, 1200 m, 23/26.i.1955 that were mentioned with the same dates and localities in the publication of Herbulot (1957) as *Comostolopsis leuconeura* were found by Willy de Prins (pers.comm.2016) in the Herbulot collection in the ZSM, Munich. Astonishingly they are labelled as *Comostolopsis viridellaria* (Mabille, 1898),

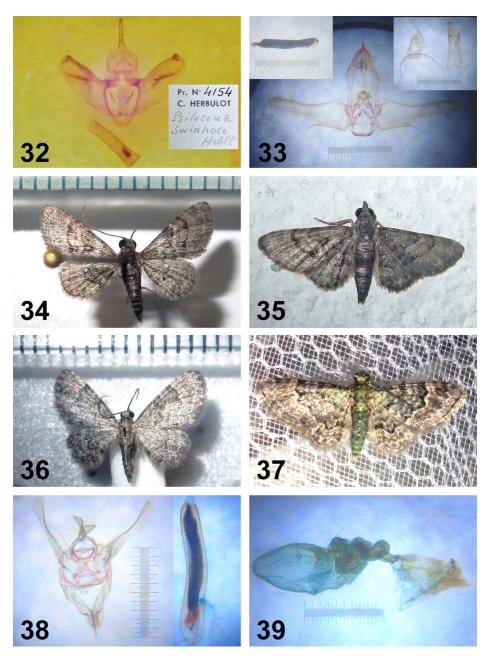
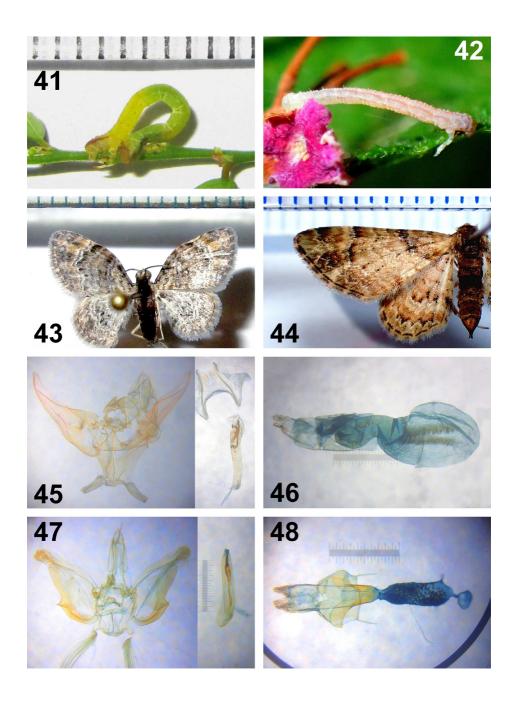


Plate 5: Fig.32 - *Psilocerea swinhoei*, male genitalia. Fig.33-36 - *Casuariclystis latifascia*, 33 - male genitalia, 34-36 - adults, Fig.37-39 - *Chloroclystis latisfascia*, 37 - adult, 38 - male genitalia, 39 - female genitalia



a species described and known from the neighboring island of Mauritius that had never been illustrated.

From imago pictures of *Comostolopsis sladeni* Prout, 1915 taken by Paolo Mazzei (de Prins & Mazzei, 2016) in Seychelles I found that this species also conforms to *Comostolopsis leuconeura*, wich I know well from Réunion.

It seems to be that these three species had never been compared to each other by their genitalia and their imagoes suggest that they are likely to be conspecific.

Comostolopsis sladeni was described from a male specimen, while Comostolosis leuconeura was described from a female. This species has a strong sexual dimophism between the sexes: the males are bright green while the females are pale-green. At the same time Prout (1930) also seemed to ignore the previous description of Comostolopsis viridellaria by Mabille when describing Comostolopsis leuconeura in Seitz, Vol.16 (1930).

This complex would be worthwile to study. Unfortunately I did not find any specimens during my travels to Seychelles and Mauritius but I would not mind examining them should any other collector dispose of specimens captured in these countries.

Phaiogramma stibolepida (Butler, 1879) – Figs. 48-50

Wingspan: 23-26mm.

Distribution: southern and eastern continental Africa, Comoros, Madagascar, Réunion, outer islands of the Seychelles. Recorded new for Mauritius.

This beautiful Geometridae appeared first in the Mascarenes in 2008 were it was first stated in La Grande Chaloupe (Réunion) and since it has progressely conquered the entire island up to an altitude of 900 meters (Gasnier et al., 2015).

It has meanwhile become one of the most common species of Geometridae in Réunion where I recorded it on wings in all 12 months of the year. I collected five additional specimens in Mauritius (Blackriver) in June 2016 and I found this species also very frequently in Madagascar (Andasibe) in November 2016.

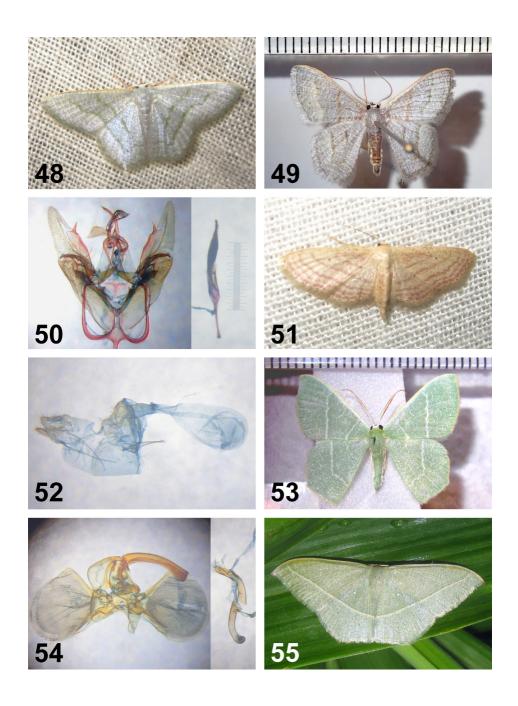
In February 2016 I found its larvae on *Trema orientalis* (L.) Blume (La Possession, Réunion, alt.450m) from which emerged an adult on 12-iii-2016. In most classifications this plant is listed as belonging to the family of Ulmaceae though in some other classifications it is attributed to the hemp family of Cannabaceae. This latter family suggests a possible introduction route: during the first decade of the 21st century there were several interceptions of illegal Cannabaceae (*Cannabis sativa* L.) onboard the mixed cargo-passenger vessel «MS Mauritius Pride» on its monthly sailings between

Plate 6 (opposite): Larentiinae: *Chloroclystis latifasciata* (Fig. 40), *Mesocolpia nanula* (Fig. 41, 43, 46-47), *Gymnoscelis rubricata* (Fig. 42, 44-45)

Chloroclystis latifasciata: 40 - larva.

Mesocolpia nanula: 41 - early instar larva, 43 - adult, male, e.l. *Lantana camara*, 46 - male genitalia, 47 - female genitalia, e.l. *Acacia farnesiana*, 16-vi-2016.

Gymnoscelis rubricata: 42 - adult, male, WS: 22mm, 44 - male genitalia, Reunion, Ste.Suzanne, 45 - female genitalia, Mauritius, slide Mru-062,



Madagascar and Mauritius. Arriving from Toamasina, Madagascar this liner called at Port Réunion on its way to Port Louis, Mauritius and several interceptions of *Cannabis sativa* L. were made by the customs authorities during its calls in Réunion (Anonymous, 2007). This vessel followed the coastline also near La Grande Chaloupe for a distance of some 200-300 meters where this moth was first recorded, only a short flight distance for a lepidopteran. May it have been introduced to the Mascarenes in this way?

Hostplant: Trema orientalis (L.) Blume (Ulmaceae or Cannabaceae)

Thalassodes quadraria Guenée, 1857 - Figs. 52-53

Forewing length: 12,5mm. Wingspan: 27mm.

Distribution: tropical Africa, including Comoros, Madagascar, Mauritius, Réunion, Rodrigues and Seychelles.

In Réunion I raised this species on *Tamarindus indica L*. (Fabaceae), La Possession, alt.200m, 01-vii-2015 and *Rhus longipes* Engl. (Anacardiaceae) collected in La Possession, alt. 400m.

In Mauritius one female collected at light in Flic-en-Flac on 10-vi-2016 (Fig.52 - slide Mru-121),

Hostplants: polyphagous: *Ricinus communis* L. (Euphorbiaceae), *Mangifera indica* L. (Anacardiaceae), *Rosa sp.* (Rosaceae), *Crotalaria verrucosa* L. (Martiré & Rochat, 2008), *Tamarindus indica* L. (Fabaceae), *Rhus longipes* Engl. (Anacardiaceae) (this publication).

Sterrhinae:

Scopula serena Prout L. B., 1920 - Fig. 51

Distribution: throughout continental Africa

Regional distribution. Mauritius (new record), Madagascar, Seychelles, Réunion, Rodrigues.

1 specimen was collected in Mauritius, Flic-en-Flac, alt.10m on 11-vi-2016 and a second specimen in Bambou, 12-vi-2016.

Traminda obversata (Walker, 1861) – Figs. 54-55

Forewing length: 13,5mm. Wingspan 30mm.

Distribution: Continental Africa, Comoros, Madagascar, Reunion, Seychelles, recorded new for Mauritius..

Plate 7 (opposite): Geometrinae. *Phaiogramma stibolepida* (Fig. 48-50), *Scopula serena* (Fig. 51), *Thalassodes quadraria* (Figs. 52-53), *Traminda obversata* (Figs. 54-55)

Phaiogramma stibolepida: 48 - Mauritius, Blackriver, 12-vi-2016, 50 - male genitalia, Blackriver, slide Mru-033,

Scopula serena: 51 - Flic-en-Flac, 11-vi-2016

Thalassodes quadraria: 52 - Flic-en-Flac, male genitalia

Traminda obversata: 54 - male genitalia, slide Mru-119, 55 - Blackriver, 08-vi-2016

3 specimens were collected in Blackriver, Mauritius on 07. and 08.vi.2016, an additional specimen was observed at daytime at the same locality on 08.vi.2016. Examined: male, slide Mru-119 (Fig.54).

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