

Three new *Opogona* species with wing reduction from St Helena Island, South Atlantic Ocean (Lepidoptera: Tineidae: Hieroxestinae)

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Abstract: Three new species of *Opogona* Zeller, 1853 from St Helena Island with wing reduction are described; *Opogona ashmolei* Karisch & Fowler, sp. nov., *Opogona squamata* Karisch & Stevens, sp. nov. and *Opogona exiguata* Karisch & Dutton, sp. nov. All these species were found in the semi-desert areas in the Eastern Part of the island, where the larva of *O. ashmolei* Karisch & Fowler, sp. nov. feeds on *Suaeda fruticosa*.

Key words: Taxonomy, Tineidae, *Opogona ashmolei*, *Opogona squamata*, *Opogona exiguata*, brachyptery, St Helena Island.

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INTRODUCTION

Most Lepidoptera have two pairs of membranous wings, which are covered by characteristic scales and which enable them to fly. Only occasionally are the wings reduced (brachyptery) and dispersal ability is limited. Well known examples of this are the females of several European Geometridae which emerge in early spring or late autumn. Heppner (1991) and Sattler (1991) published reviews of wing reduction in Lepidoptera. Among other things, they show that wing reduction is rarely seen in males.

Flight is an effective method to search for a mate. Strong winds on islands could explain the reduction of wings in the males of some species, because winged males could be blown beyond their habitat and unable to return, compounded by the rapid loss of the attractive pheromones of the females in such conditions. In this case, it would be advantageous for males to remain on the ground and among vegetation where the females reside. However, many moth species inhabiting such habitats still retain fully developed wings, even if the area of occurrence is very small, e.g. *Erechthias darwini* G. S. Robinson, 1963 occurs within 15 000 m² at St Pauls Rocks some hundreds of miles from the Brazilian coast.

The presence of moth species with reduced wings is well known from the subantarctic South Atlantic islands, but they also occur on islands in the tropics. According to Sattler (1991) and other authors (mentioned below) the following brachypterous species have been recorded from the islands in the South Atlantic Ocean:

Falkland Islands

Acrolepiopsis madeleinae Wakeham-Dawson & Gaedike, 2014 (Wakeham-Dawson, 2014)

Borkhausenia falklandensis Bradley, 1965 (Oecophoridae)

Elachista holdgatei (Bradley, 1965) (Elachistinae)

Scrobipalpula saltans Wakeham-Dawson, 2012 (Wakeham-Dawson, 2011)

Gough Island

Dimorphinoctua goughensis Fletcher, 1963 (Noctuidae)

Peridroma goughi Fletcher, 1963 (Noctuidae)

Tristan da Cuna Islands

Udea hageni Viette, 1952 (Crambidae)

Dimorphinoctua pilifera (Walker, 1857) (Noctuidae)

Dimorphinoctua cunhaensis Viette, 1952 (Noctuidae)

Faronta exoul (Walker, 1856) (Noctuidae; slight reduction in female only)

Ascension Island

Erechthias grayi Davis & Mendel, 2013 (Tineidae) (Davis & Mendel, 2013)

Brachypterous Tineidae species appear to be very rare. In September – December 2003 Philip and Myrtle Ashmole undertook field work for invertebrates to assess the influence of the intended construction of an airport on the endemic fauna of St Helena Island in the South Atlantic. Surprisingly, they discovered adult specimens of a short-winged *Opogona* species on Prosperous Bay Plain. The scuttling individuals were quite common in *Carpobrotus edulis* (Aizoaceae) wasteland (Ashmole & Ashmole, 2004).

Robinson (2009) referred to the observations of the Ashmoles in his book but did not describe the new species. Due to the increased awareness, *Opogona* specimens with vestigial wings were subsequently located, but very little material was collected and pinned, and so far there have been no reliable descriptions.

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Due to fieldwork in 2017 and 2018 and the access to supplementary material (see next section) it is possible now to describe three new members of the *Opogona* radiation on St Helena Island. So far, 30 species of *Opogona* are known from this remote and small (only 122 km²) island (Ashmole & Ashmole, 2000), but the true number is likely to be significantly higher.

MATERIAL AND METHODS

During the fieldwork for the Darwin Plus funded project “Securing the future for St Helena’s endemic invertebrates” (DPLUS040) more material of short-winged *Opogona* was collected in the dry Eastern Areas of St Helena Island [Fig. 1 in Fowler & Karisch (2020)].

Samples of the *Opogona* moths collected in 2017 and 2018 were barcoded by the Canadian Center for DNA Barcoding in Guelph. The methods of sequencing are described in Ivanova & Grainger (2007). Analyses from barcoding follow the approach defined in Ratnasingham & Hebert (2007). To create the neighbour joining tree (Fig. 1) the BOLD-tool (www.boldsystems.org) was used. The specimens of *O. exiguata* sp. nov. were not available for barcoding.

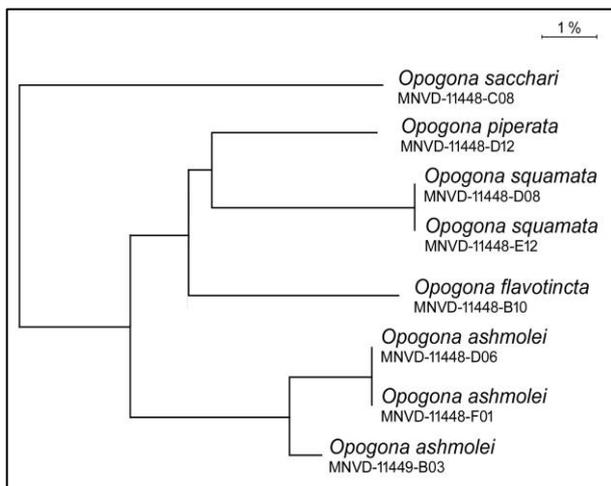


Figure 1 – Neighbour joining tree of *Opogona ashmolei*, *O. squamata*, *O. piperata* and *O. flavotincta* (BOLD; COI-5P Marker, Kimura 2 Parameter Distance Model; outlying species *Opogona sacchari*).

To give precise descriptions, the specimens were examined under the stereomicroscope. The genitalia were dissected following the procedures published by Robinson (1976). Colouration was done with chlorazol black and for the slides Euparal was used.

Abbreviations and conventions

MNVD = Museum für Naturkunde und Vorgeschichte Dessau

BMNH = British Museum of Natural History

Altitudes are given in meters above mean sea level.

Scale bar in figures of imagines = 1 mm.

DESCRIPTION OF NEW SPECIES

Genus *Opogona* Zeller, 1853

Zeller, P.C. 1853. Drei Javanische Nachtfalter. *Bulletin de la Société Impériale des Naturalistes de Moscou*. **26**(4):

507–508, pl. 4, Figs. 13–16.

Type species: *Opogona dimidiatella* Zeller, by monotypy.

Opogona ashmolei Karisch & Fowler, sp. nov.

urn:lsid:zoobank.org:act:1B04C334-D9AA-46CB-A008-95912578E915

Type material:

Holotype ♂: St Helena Island, near Gregory’s Battery, lichen covered stones, 15°56’00”S, 5°39’42”W, 285 m; 12.iii.2017; diurnal (beneath stones), legit T. Karisch; Barcoding CCDB-11448, Sample MNVD-11448-D06; Genit.-Prep. 3731 Karisch 2019. In coll. MNVD.

Paratype ♀: same data as holotype, but Barcoding CCDB-11448, Sample MNVD-11448-F01. Genit.-Prep. 3733 Karisch 2019. In coll. MNVD.

Description:

Sexually dimorphic.

Male (Figs 2, 3a, 3b):

Head Frons light beige; epicranial hairs umber; palpi light beige, about 3 x diameter of eye; antenna about 1.25 length of forewing, with beige and fuscous scales forming alternating dark and pale bands, conical near base. Conus light beige, fuscous at base.

Body Thorax beige with some blackish scales.

Wings Wingspan 6 mm. Forewing: comparatively short; broadened at middle, with acute apex (Fig. 3a); mixed dun and pale brown, with some fuscous scales; fringes pale near apex, pale brown at dorsum. Hindwing: Glume-shaped, greyish yellow; fringes pale.



Figure 2 – *Opogona ashmolei* Karisch & Fowler, sp. nov., imago ♂ (holotype).

Male genitalia (Fig. 4): Two large lobes arising beneath tegumen, with stout and strong cornuti in ventro-discal half; tegumen relatively broad; vinculum leading to long, tapered saccus; valva with elongate cucullus, broadened towards tip; sacculus rather broad, with slender process close to ventral side of cucullus; some patches of hair-like setae on sacculus and in angle between sacculus and cucullus. Aedeagus slender, straight, without cornuti.

Female (Figs 3c, 5): Frons light beige; epicranial hairs brown; palpi light beige, with a few fuscous scales; about 2.5 x diameter of eye; antenna about 1.2 x length of forewing, slightly paler than in males; thorax light beige suffused with dun; tibia of 3rd pair of legs dorsal with comb formed by long scales.

Wings Wingspan 8 mm. Forewing: very broad, stout, broadened at the middle, apex acute (Fig. 3c); mixed pale dun and beige; very few fuscous scales; fringes pale. Hindwing: spelt-shaped; pale beige; fringes pale.

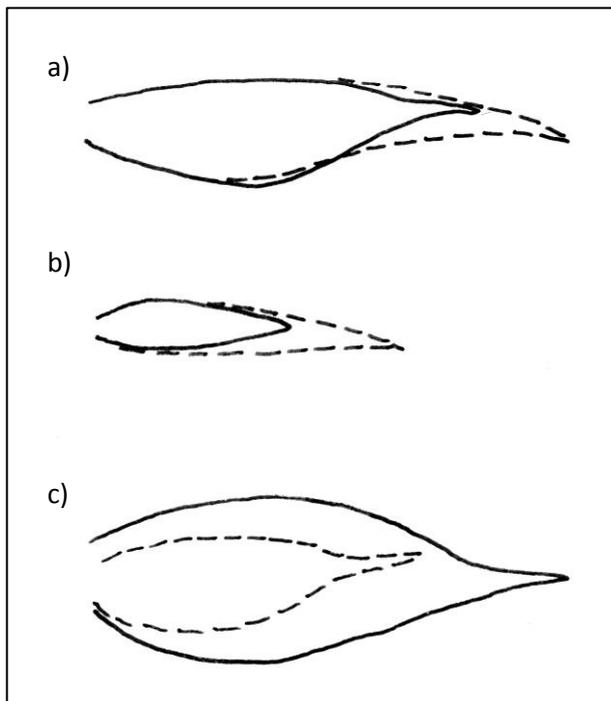


Figure 3 – Wing shapes of *O. ashmolei* (continuous line) and *O. squamata* (dashed line): a) ♂ forewing, b) ♂ hindwing and c) ♀ forewing.

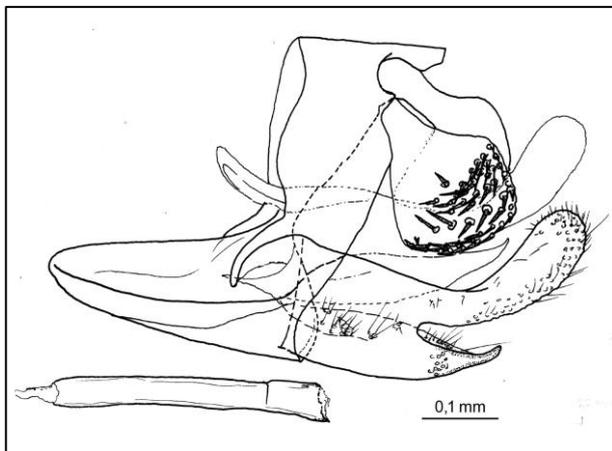


Figure 4 – *Opogona ashmolei* Karisch & Fowler, sp. nov., ♂ genitalia (holotype).

Female genitalia (Fig. 6a): Apophyses very long; corpus bursae well sclerotized, signum elongated, with strong lateral flanks and with short tip anteriorly; on slight crest in the middle a few broad teeth.

Diagnosis

Externally very similar to *O. squamata*, but differing in the following respects: the females are larger, the colour of the antenna is lighter, the forewing of the male is shorter with a less extended tip, that of the female much broader; the hindwing of the male is shorter (Figs 3a–c), in male genitalia the number of cornuti on the lobes is greater, the sacculus has only one projection; the signum in female genitalia is elongated instead of rounded.



Figure 5 – *Opogona ashmolei* Karisch & Fowler, sp. nov. imago ♀ (paratype).

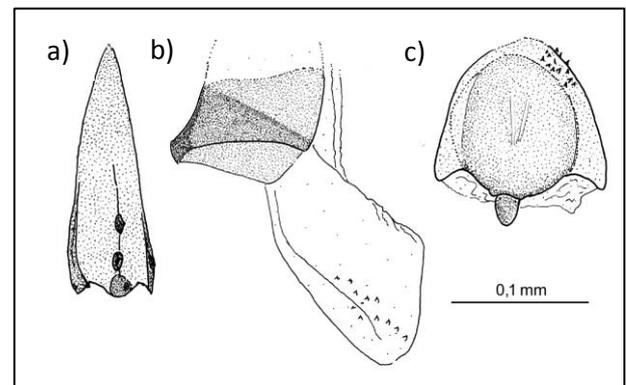


Figure 6 – a) *Opogona ashmolei* Karisch & Fowler, sp. nov., ♀ genitalia (paratype), signum, b) *Opogona squamata* Karisch & Stevens, sp. nov., ♀ genitalia (paratype), signum, and c) *Opogona exiguata* Karisch & Dutton, sp. nov., ♀ genitalia (paratype), signum.

DNA

Barcoding analyses (Fig. 1) shows that *O. ashmolei* sp. nov. (BIN ADR 5633) clusters separately from *O. squamata* sp. nov., *O. piperata* (E. Wollaston, 1879) and *O. flavotincta* (E. Wollaston, 1879). It seems that brachyptery was developed in several *Opogona* lines on St Helena Island.

Remarks

A female from Mole Spider Hill, 12.iv.2018, collected at night by M. Paajanen, shows a slight difference in the barcode (Fig. 1 – MNVD 11449 B03). Until there is more material available it is not clear whether this indicates slight genetic differences between populations from different sites on the island.

Biology

The type specimens were found beneath stones. The second author often saw specimens resting under Shrubby Seablite (*Samphire*), *Suaeda fruticosa* (L.) Forssk. (Amaranthaceae), but some were also possibly hidden in holes or cracks in the twigs of this plant, because they were obtained by beating. When the imagines are

disturbed they scuttle between the grasses and blend in because of a striking similarity with dead grass blossoms.

Etymology

Named in honour of Philip and Myrtle Ashmole, the discoverers of the short winged *Opogona* moths on St Helena Island.

Opogona squamata Karisch & Stevens, sp. nov.

urn:lsid:zoobank.org:act:836C044F-DFD3-4C5F-803C-A0D1004F40B9

Type material:

Holotype ♂: St Helena Island, near Gregory's Battery, lichens covered stones, 15°56'00"S 5°39'42"W, 285 m, diurnal (beneath stones); 12.iii.2017; legit T. Karisch; Barcoding CCDB-11448, Sample MNVD-11448-D08; Genit.-Prep. 3738, Karisch 2019. In coll. MNVD.

Paratypes: 1 ♀ same data as holotype, but Barcoding CCDB-11448, Sample MNVD-11448-E12; Genit.-Prep. 3739 Karisch 2019. In coll. MNVD.

2 ♂♂ same data as the holotype, but no barcoding label. In coll. St Helena National Trust, BMNH.

Description:

Sexually dimorphic.

Male (Figs 3a, 3b, 7, 8):

Head Frons greyish-beige; epicranial hairs dark brown; palpi light beige, with brown tip, about 3 x diameter of eye; antenna about 1.1 x length of forewing, beige and fuscous spotted, but darker than in *O. ashmolei* sp. nov., conical near base (Fig. 8). Conus fuscous with beige part at tip.

Body Thorax brown, scapulae blackish.

Wings Wingspan 5.5–6.5 mm. Forewing: long, broadened in about first 1/3, with long acute apex (Fig. 3a); pale beige, irrorate with fuscous, with irregular dark brown and black patches; fringes beige, some scales with fuscous tip. Hindwing: spelt-shaped, elongated; grey; fringes greyish yellow (Fig. 3b).



Figure 7 – *Opogona squamata* Karisch & Stevens, sp. nov. imago ♂ (paratype).

Male genitalia (Fig. 9): Two very large lobes arising beneath tegumen, with stout cornuti ventrally and less strong ones caudally; tegumen relatively broad; vinculum leading to long and fairly broad saccus; valva with elongate cucullus, broadened towards tip; sacculus broad, with slender, slightly sinuous process close to ventral side

of cucullus and projecting tip beneath this process, here and near base of valva groups of short hairs. Aedeagus slender, straight, slightly broadened towards end, without cornuti.

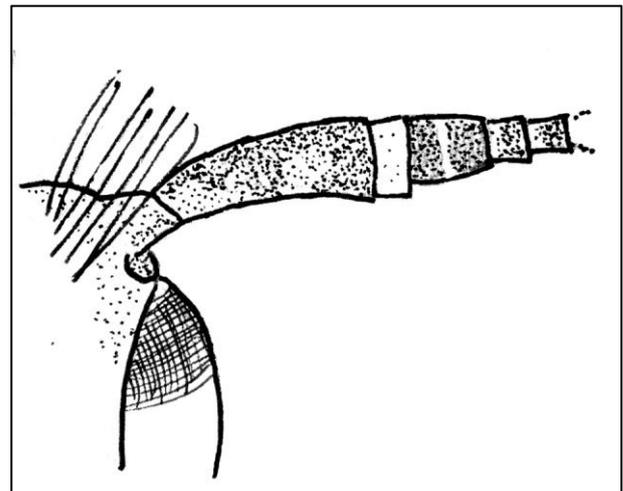


Figure 8 – *Opogona squamata* Karisch & Stevens, sp. nov. – base of antenna.

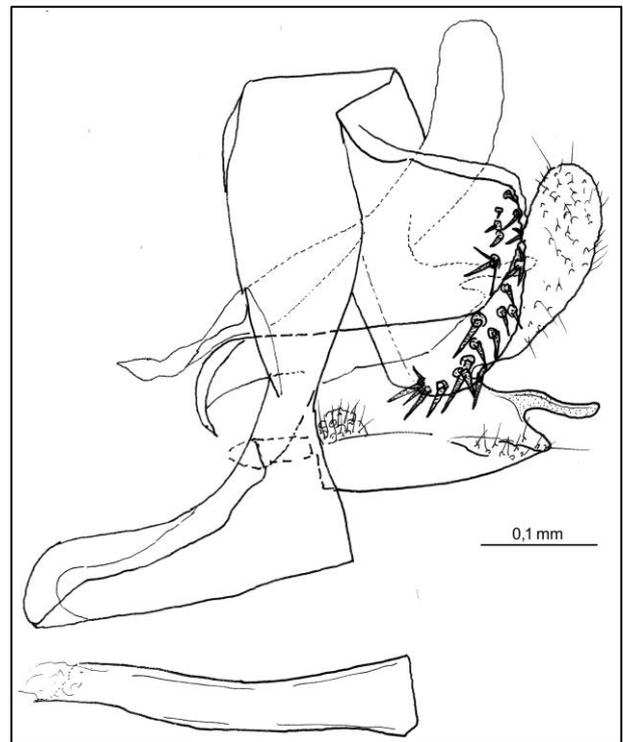


Figure 9 – *Opogona squamata* Karisch & Stevens, sp. nov., ♂-genitalia (holotype).

Female (Figs 3c, 10):

Head Frons beige; epicranial hairs fuscous; palpi beige, about 2.5 x diameter of eye; antenna 1.25 x length of forewing, beige and fuscous spotted, conical near base.

Body Scales at conus lost in the examined specimen; thorax beige.

Wings Wingspan 5 mm. Forewing: broadened at the middle, with long acute apex (Fig. 3c); examined specimen with many scales lost, light beige, spotted with brown and fuscous. Hindwing: short glume-shaped, light beige; fringes light pale.

Female genitalia (Fig. 6b): Apophyses very long; corpus bursae with nearly round and alate signum, wings

translucent, with short projection anteriorly; convex central part well sclerotized, with conical process anteriorly.



Figure 10 – *Opogona squamata* Karisch & Stevens, sp. nov., imago ♀ (paratype).

Diagnosis

Externally very similar to *O. ashmolei*, but differing as follows: the females are smaller, the colour of the antenna is darker, the forewing of the male is much longer with an extended end and a darker pattern, that of the female is shorter, and less broad; the hindwing of the male is longer (Figs 3a–c). In male genitalia the lobes have smaller cornuti dorsally, and the sacculus has a slightly sinuous process and a projecting tip. In female genitalia the signum is round and alate instead of long and triangular.

DNA

O. squamata sp. nov. (BIN ADR 7534) is well separated from *O. ashmolei* sp. nov. by COI-Barcode (Fig. 1). Nearest COI barcode neighbours are *O. piperata* and *O. flavotincta*.

Biology

The adults were collected beneath stones in a rocky area with Shrubby Seablite, *S. fruticosa*, and Hottentot-fig (locally known as Creeper), *C. edulis* (L.) N.E. Br (Fig. 11) but few other vascular plants. They also sit within the litter of Creeper.



Figure 11 – Habitat near Gregory's Battery (photo: T. Karisch).

Etymology

squamosus = flaked; because of the shape of the wings.

Opogona exiguata Karisch & Dutton, sp. nov.

urn:lsid:zoobank.org:act:67E821CD-CC61-4DBD-93A1-AC664C773966

Type material:

Holotype ♂: St Helena Island (HPP10), Horse Point, E of Longwood, Creeper waste, 8–10.x.2003, legit Ph. & M. Ashmole, Genit.-Prep. 3736 Karisch 2019. In coll. Ashmole.

Paratype ♀: same data as the holotype, but Genit.-Prep. 3737 Karisch 2019. In coll. Ashmole.

Description:

A minute species, sexually dimorphic. Type specimens in poor condition, and external description needs to be checked when more material becomes available.

Male (Fig. 12):

Head Epicranial hairs fuscous; palpi pale, about 3 x diameter of eye; antenna 1.25 x length of forewing, brindled, without conical extension near base, but with broad scales at base.

Wings Wingspan 3 mm. Forewing: long, narrow, with long acute apex; with only a few beige scales and some dark ones in centre. Hindwing: short, very narrow.

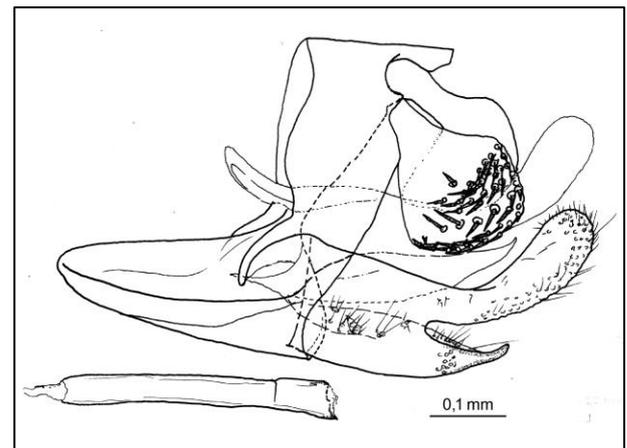


Figure 12 – *Opogona exiguata* Karisch & Dutton, sp. nov., imago ♂ (holotype).

Male genitalia (Fig. 13): Two large lobes arising beneath tegumen, with row of stout cornuti laterally and a few weaker ones behind main row; tegumen relatively broad; vinculum leading to rather short saccus; valva with elongate but comparatively short cucullus, broadened towards tip; sacculus broad, with slender, slightly curved process; some soft hair-like setae between this process and cucullus. Aedeagus slender, straight, slightly broadened towards end, without cornuti.

Female (Fig. 14):

Head Palpi pale beige, about 2.5 x diameter of eye; antenna at least as long as forewing, brindled; without conical extension.

Wings Wingspan 3 mm. Forewing: broadly glume-shaped, broadened near base, strongly tapered towards apex; with a few pale scales. Hindwing: short, very narrow.

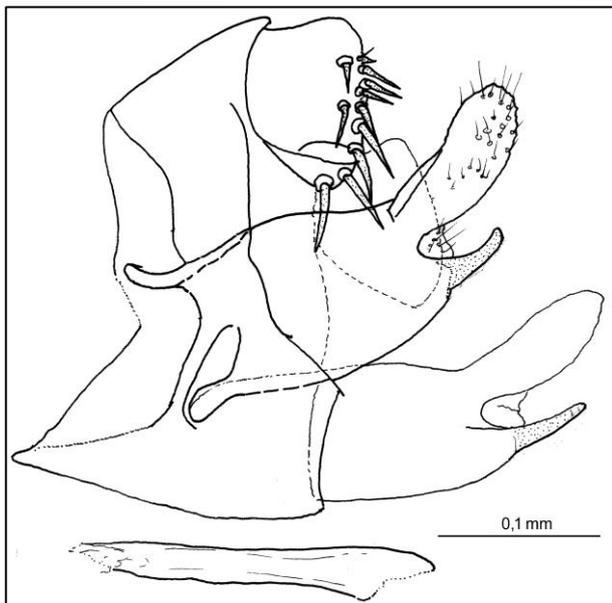


Figure 13 – *Opogona exiguata* Karisch & Dutton, sp. nov., ♂ genitalia (holotype).



Figure 14 – *Opogona exiguata* Karisch & Dutton, sp. nov. – imago ♀ (holotype).

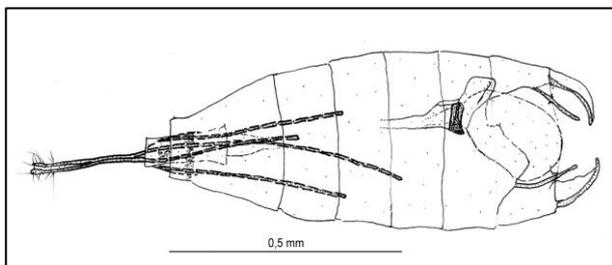


Figure 15 – *Opogona exiguata* Karisch & Dutton, sp. nov., ♀ genitalia (holotype) and abdomen, general view.

Female genitalia (Figs 6c, 15): Apophyses very long; at base of corpus bursae antrum-like sclerotized ring and weak rectangular signum with a few minute teeth.

Diagnosis

Easily distinguished by its smaller size, short cucullus and sacculus, with a simple process in male genitalia; the signum in female genitalia is membranous and at the base of ductus bursae antrum-like sclerotization.

Biology

The species inhabits rocky areas with Sour Fig (Creeper), *C. edulis* (Fig. 16).



Figure 16 – Creeper waste at Horse Point (photo: T. Karisch).

Etymology

exiguus = small; because of the minute size of the moth.

Remarks on the biology of the short-winged *Opogona*

On 14.vi.2018, 16.vi.2018 and 12.ix.2018 the second author found in the Central Basin of Prosperous Bay Plain (Fig. 17) a number of larvae on *S. fruticosa*. The larva is beige with a dark brown pattern (Figs 18, 19). There is a pair of dorso-lateral lines and a weak dorsal line. The dark pattern forms oblique bands of irregular shape on the sides of the larva. The head of the larva is greyish brown with a paler adfrontal area.



Figure 17 – *Opogona* habitat at Central Basin in Prosperous Bay Plain, *Suaeda fruticosa* semi-desert with *Mesembryanthemum crystallinum*, *M. cryptanthum*, *Carpobrotus edulis* and *Eragrostis cilianensis* (photo: A.-J. Dutton).

Pupation is most likely in or at the soil as some exuviae were found under the food plant.

At the moment we cannot assign the larvae to one of the species described above because the hatched adults were not suitably preserved and a DNA barcoding of the larvae is not feasible currently.



Figure 18 – Larva of *Opogona*, last instar, on samphire (photos: L. Fowler).



Figure 19 – Larva of *Opogona*, last instar, on samphire (photos: L. Fowler).

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