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# Taxonomic and Faunistic Results on the *Spilomelinae* Guenée, 1854 (Lepidoptera: Crambidae) from the Southern Arabian Peninsula with Descriptions of Three New Species

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**Abstract:** The *Spilomelinae* Guenée, 1854 (Lepidoptera: Crambidae) is known as the largest subfamily of the Pyraloidea with a wide distribution in the tropical and temperate zones. In the present study, new taxonomic and faunistic results on this subfamily are presented on the basis of material sampled in the south-western province Dhofar of Oman. In Dhofar three zoogeographical zones intersect, namely the Palearctic, Oriental and Afrotropical zones, with the Afrotropical fauna elements in the majority. The specimens of the sample are attributed to three species of three different genera, namely *Herpetogramma*, Lederer, 1883 (n=2), *Notarcha*, Meyrick, 1884 (n=2) and *Glyphodes*, Meyrick, 1884 (n=2) on the basis of external and genital-morphological characters. The specimens attributed to the genus *Herpetogramma*, Lederer, 1883 are assigned to a species group known as LBJ (Little Brown Jobs), the species of which are distinguishable by genital-morphological features exclusively. The specimens attributed to the genus *Notarcha*, Meyrick, 1884 revealed to be very close in wing pattern features to the *Notarcha quaternalis* Zeller, 1832 species complex. Comparison of the male genitalia of each of the sub-samples with the species of the respective sub-groups revealed significant differences, which result in the descriptions of the new species *Herpetogramma debilis* Seizmair, sp. nov. and *Notarcha viridialis* Seizmair, sp. nov. The presence of the genus *Notarcha*, Meyrick, 1884 is reported as new to the entomofauna of the Arabian Peninsula. The specimens attributed to the genus *Glyphodes*, Meyrick, 1884 differ significantly in external characters from a sample of seven species with similar forewing longitudinal line patterns. Among the species of this cluster *Glyphodes onychinalis* Guenée, 1854 is genital-morphologically very close to the specimens of the sample collected. The latter species and the specimens of the sample share the shape of the uncus and the structure of the corpus bursae wall, yet differ significantly in the structure of the valva. These differences result in the description of the new species *Glyphodes leucomesalis* Seizmair, sp. nov.

**Keywords:** Pyraloidea, *Herpetogramma*, *Notarcha*, *Glyphodes*, Taxonomy, Morphology

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## 1. Introduction

The subfamily *Spilomelinae* Guenée, 1854 is known to be the subfamily with the highest diversity of the Pyraloidea, comprising 4097 described species in 338 genera and accounting for 26% of the species of the Pyraloidea [1, 2].

A recent comprehensive revision of the *Spilomelinae* Guenée, 1854 on tribus level has been done in Mally et al. [1]. Recent faunistic and morphological studies on species level have been done for the Indo-Australian, the Neotropical and the Afrotropical zones [3-6].

In the present study three new species attributed to three different genera, namely *Herpetogramma*, Lederer, 1883, *Notarcha* Meyrick, 1884, *Glyphodes* Guenée, 1854 are described on the basis of a sample (n=6) collected by the author in Dhofar, the south-western province of Oman.

### 1.1. Genus *Herpetogramma*, Lederer, 1883

The genus comprises two species complexes. The members in each of these two species groups are primarily distinguished by genital-morphological characters. The two complexes are referenced as “group A” and “group B” by

Guillermet [7, 8].

These two species groups are distinguished by the basic scaling of the fore- and hindwings – light-brown in the species of group A, darkish-brown in the species of group B. Group A is also referred to by the acronym LBJ (Little Brown Jobs) [9].

The species group B is widely distributed in the Palearctic, Afrotropical and the Indo-Australian zones [2, 10]. On the contrary, the known species of group A are restricted in distribution to the Afrotropical zone, with records from islands of the Indian Ocean (La Reunion, the Comoros Islands, the Malagasy Region, the Seychelles Islands), from South Africa and from Namibia [7, 9, 11].

On the Arabian Peninsula, group B is represented by *Herpetogramma licarsisalis* Walker, 1859, whereas group A has not been recorded for the Arabian Peninsula up to now [12, 13]. In this study the presence of group A is reported as new to the entomofauna of the Arabian Peninsula on the basis of a sample of two specimens. The specimens are assigned to a new species *Herpetogramma debilis* Seizmair sp.nov.

### 1.2. Genus *Notarcha*, Meyrick, 1884

This genus encompasses 18 known species and is distributed in the Afrotropical and Indo-Australian zones [1, 2, 13]. The genus is still little explored in the Afrotropical zone, with seven species known up to now and numerous unknown species conjectured [11, 13].

The distribution of the genus in the Afrotropical zone ranges over the Seychelles Islands, the Comoros Islands, the Malagasy Region, South Africa, Central and Eastern Africa to Ethiopia [13, 14].

The genus has not been recorded so far from the Arabian Peninsula [13]. In this study the presence of the genus on the Arabian Peninsula is reported for the first time on the basis of a sample of two specimens. The specimens are assigned to a new species *Notarcha viridalis* Seizmair, sp.nov.

### 1.3. Genus *Glyphodes*, Meyrick, 1884

This genus comprises 156 known species and is distributed in the Afrotropical, Neotropical and Indo-Australian zones [1, 2].

The genus is polyphyletic [1, 15]. Sutrisno hypothesizes a subdivision of the genus into three monophyletic clades on the basis of morphological and molecular-genetic markers [15-18]. The phylogenetic results in Sutrisno are based on a sample of 14 species thus covering 9% of the total species of the genus. The subdivision of the genus proposed by Sutrisno should thus be regarded as preliminary. Further investigations into the phylogenetic relations between the species of the genus as a whole are needed.

Further recent studies on the morphology of the genus based on small species samples have been done in Park et al., in Ratikannu and Chitra, in Nagaharish et al. and in Reddy and Murthy [19-22].

On the Arabian Peninsula, the genus is represented by *Glyphodes onychinalis* Guenée, 1854. The species has been recorded from SE-Saudi-Arabia, Yemen and Dhofar [23-25]. Further two specimens similar to *G. onychinalis* in wing

pattern and genital-morphological characters were collected by the author in 2019 near the Yemen border. There are significant external and genital-morphological differences between the specimens of the sample, *G. onychinalis* and six further species similar in wing pattern, which result in the description of the new species *Glyphodes leucomesalis* Seizmair, sp.nov.

## 2. Material and Methods

### 2.1. Sampling

The material presented in this paper was sampled by the author in two research expeditions to Dhofar, the south-western province of Oman in November 2018 and in February 2019. The collecting sites are situated on the southern slopes of the western parts of Jabal Al Qamar, a coastal mountain system ranging from the western surroundings of the province capital Salalah to the Yemen border (Figure 1). The specimens were captured at night by means of a light-trap equipped with a 20W tube of infra-blue light.

### 2.2. Macro-Preparation and Dissection

The adults were photographed with a SONY HX400V camera after relaxation and subsequent preparation.

For examining the genitalia, dissection, preparation and slide-mounting techniques were applied on the specimens on the basis of the protocol described in Robinson [26]. The slides were photographed with a SONY DSC100V camera under a 40x zoom.

The images were optimized by means of the software Ps Adobe Photoshop, Version 21.0.2.

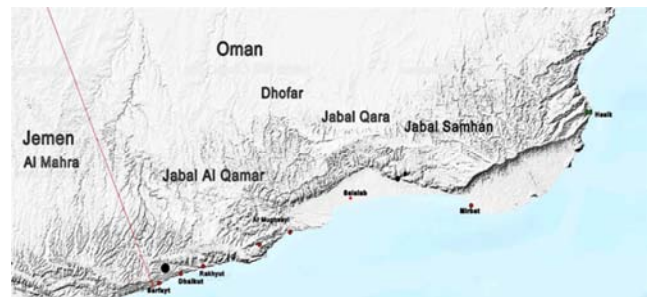


Figure 1. Collection site in Oman, Dhofar; Jabal Al Qamar, near the Yemen border (black point).

### 2.3. Morphological Analyses

Morphometric analyses of wing patterns and genital-morphological structures were done on the images. Structural ratios were measured and calculated by means of the imaging software ZEISS AxioVision, Version 4.8.

### 2.4. Terminology and Abbreviations

The descriptions of the genitalia and of wing pattern elements are based on the terminology in Maes [27]. The nomenclature of the venation follows Shaffer & Munroe [11]. The feature states referred to in the descriptions and diagnoses

are based on the feature space given in Mally et al. [1].

Abbreviations:

ZSM Zoological State Collection Munich, Germany

### 3. Results

*Herpetogramma debilis* Seizmair, sp.nov. (Figures 2-3)

Material: Holotype: ♂, Oman, Dhofar, 20 km E Sarfait, Road 47, Jebel Al Qamar, 960 m, 07-XI-2018, leg. M. Seizmair, coll. ZSM, slide no. GPPYR1519.

Paratype: same collection data as holotype, leg. et coll. M. Seizmair, 1 ♂, slide no. GPPYR1619.

External features (Figure 2): Wing span of the holotype 18,5 mm, wing span of the paratype 22,6 mm.

Head: Frons and vertex whitish-grey. Labial palpus greyish, dorsally interspersed with darkish-brown to blackish scales, rounded distally, porrect, 2,4 times as long as the diameter of the eye, 2,3 times as long as wide. Maxillary palpus with darkish-grey sales in the segment 1, scaling in all the other segments constantly black, half as long as the labial palpus, distally rounded. Antennae filiform ciliate, flagellum hyaline, ciliae whitish-grey.

Thorax: Scaling of the prothorax whitish-grey, meso- and metathorax with whitish-grey scales laterally and with ochre scales dorsally and ventrally. Scaling of the legs whitish-grey, interspersed with ochre scales at the segments. Forelegs with two tibial spurs of different lengths, the longer one being 1,8 times as long as the shorter one. Tegula scaled black.

Forewing upper side: Ground greyish-brown. Costal border, apical area and external area interspersed with yellowish-brown scales. Basal area interspersed with darkish-brown to blackish scales immediately below the costal border, with two orbiform stigmata, strongly differing in size, located on the sub-costa (Sc) and on the anal border respectively. Antemedial, postmedial and anteterminal lines present, yet strongly interrupted, black. Antemedial line developing from the discoidal cell and terminating at the anal border. Postmedial line developing from the sub-costa (Sc),

with two 90° curvatures at M1 and CuA2, running straight from the Sc up to the first curvature, slanted between the two curvatures, with another slight angle between the second 90° curvature at CuA2 and the anal border. Anteterminal line strongly interrupted, consisting of a row of fuscous points. Discocellular spot black, reniform. Forewing underside like forewing upper side.

Hindwing upper side: Ground like forewing. Medial and external areas sporadically interspersed with yellowish scales. Antemedial line black, strongly interrupted, running between CuA2 and A1+2, paired with a small black stigma between M1 and M2. Postmedial line black, developing immediately below M1, terminating at A3, strongly tapering from M2 onwards. Anteterminal line black and strongly interrupted. Terminal line yellowish-fuscous and strongly interrupted.

Male genitalia (Figure 2): Uncus with a deep lateral concave curvature and a strong dorsal convexity at its base, transition between the basal uncus and the tegumen with a lateral triangular-shaped offset, ratio width of the base / total length of the uncus 1/1,65=0,6. Apical uncus acute, with lateral fields of elongate chaetae forming a triangular shape and ranging over 44% of the length of the uncus proximad, ratio maximum length of the chaetae / total length of the uncus 1/3. Ratio length of the uncus / length of the tuba analis 1/1,3. Tuba analis with a fine, stroke-like sclerite ranging over half of its total length.

Valva elongate, apex evenly rounded, basal costa inflated and convex with pencil-shaped projections directed anteriorly, post-basal and distal costa straight. Sacculus triangular-shaped basally, strongly tapering dorso-distally. Coremata pencil-shaped, rounded proximally.

Saccus v-shaped with a protruding keel at its ventral tip. Phallus apodeme of the aedeagus with a longitudinal sclerotized strip, which is acute proximally. Posterior phallus apodeme with additional stroke-shaped sclerotizations on the lateral borders, bare from any sclerotizations in the interior. Cornuti absent.

**Table 1.** Differential diagnosis of *Herpetogramma debilis* Seizmair; sp.nov. based on the male genitalia.

Characters and character states	<i>H. debilis</i> <i>Seizmair sp.nov</i>	<i>H.</i> <i>juba</i>	<i>H.</i> <i>continualis</i>	<i>H.</i> <i>mutualis</i>	<i>H.</i> <i>admensalis</i>
Basal uncus: presence of a significant convex curvatures on the lateral border: (0) absent; (1) present	1	0	0	0	0
Basal uncus: shape of the dorsal border: (0): straight; (1) convex; (2) concave	1	1	0	0	2
Transition basal uncus – tegumen: (0): smooth; (1) with a strong lateral triangular-shaped offset, (2) with slight convex angles laterally	1	2	0	2	0
Ratio maximum width of the basal uncus/total length of the uncus: (0): ≤ 0, 5; (1) > 0, 5	1	0	0	0	0
Sacculus: presence of a stroke-like projection in the dorso-distal area directed costad: (0) absent; (1) present	0	1	0	1	0
Sacculus: shape of the basal area: (0) rounded; (1) triangular-shaped	1	0	0	0	0
Shape of the saccus: (0) U-shaped; (1) V-shaped	1	1	0	1	1
Saccus: Presence of a protruding keel at the anterior end: (0) absent; (1) present	1	1	0	1	1
Aedeagus: Sclerotizations in the posterior portion of the phallus: (0): absent, (1) lateral borders sclerotized, no sclerites in the interior (1) several small, orbicular sclerites in the interior; (2) one rectangular-shaped sclerite extending over > 80% of the posterior portion of the phallus	0	1	2	2	0

Female genitalia: The female genitalia are unknown.

Differential diagnosis: The closest species are *Herpetogramma juba* Shaffer & Munroe, 2007, *Herpetogramma continualis* Shaffer & Munroe, 2007, *Herpetogramma mutualis* Zeller, 1852, *Herpetogramma admensalis* Walker, 1859. The new species is externally distinguished from these species in the strongly interrupted antemedial and postmedial lines in the fore- and hindwings. The key differences are in the male genitalia (Table 1). The male genitalia of the comparative species are described and figured in [7, 11, 28]. Bionomics: The type material was collected in an escarpment in the montane zone of the Jabal Al Qamar. The life cycle is unknown.

Distribution: Known only from the type locality.

Etymology: The epitheton refers to one of the characteristic external features, the strongly interrupted lines in the fore- and hindwings (lat. debilis=broken, weak).



Figure 2. *Herpetogramma debilis* Seizmair, sp.nov., holotype, adult, ♂, Oman, Dhofar, 20 km E Sarfait, Road 47, Jebel Al Qamar, 960 m.

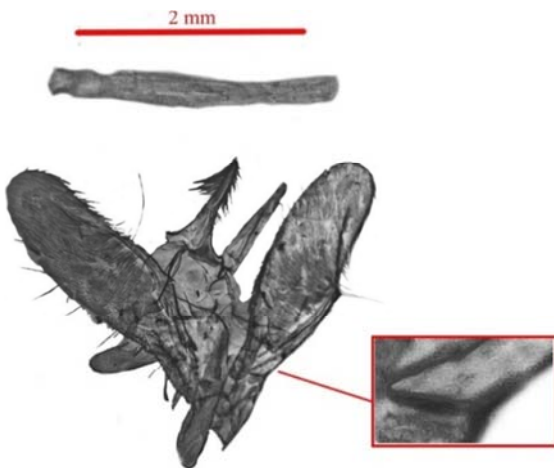


Figure 3. *Herpetogramma debilis* Seizmair, sp.nov. holotype, male genitalia, slide no. GPPYR1519, saccus of the right valva zoomed (red box).

*Notarcha viridialis* Seizmair, sp.nov. (Figures 4-5)

Material: Holotype: ♂, Oman, Dhofar, 20 km E Sarfait, Jebel Al Qamar, 960 m, 07-XI-2018, leg. M. Seizmair, coll. ZSM, slide no. GPPYR2319. Paratype: same collection data as holotype, leg. et coll. M. Seizmair, 1 ♂, slide no. GPPYR2219.

External features (Figure 4): Wingspan of the holotype: 21,3 mm, wingspan of the paratype: 23,5 mm. Head: Frons and vertex

whitish-grey. Labial palpus porrect, distal end acute, segment 1 proximally tapered, with darkish-brown scales, segment 2 broadened, scaling from the segment 2 onwards light-brown, sporadically interspersed with black scales, with whitish-grey chaetae supero-laterally, ratio length/diameter of the eye 1/2,5. Maxillary palpus broad, rounded distally, scaling constantly darkish-brown, ratio width/length 1/2, ratio length of the maxillary palpus/length of the labial palpus 1/2. Antennae filiform ciliate, flagellum darkish-brown, ciliae whitish-grey. Thorax: scaling whitish-grey, interspersed with darkish-brown to black scales dorsally. Fore- and hindlegs with whitish-grey ground scaling, tibia interspersed with darkish-brown scales, tibial spurs equal in length. Abdomen: Ventral and lateral scaling whitish-grey, dorsal scaling inter-segmentally greenish-yellow, on the segments whitish-grey.

Forewing upper side: ground whitish-grey. Basal area with two black stigmata of irregular shape on the anal and costal border. Costal border with two further black stigmata ante-medially and postmedially. Discal spot well developed, claviform, black with a white kernel. Costal border with greenish-yellowish scales. Antemedial, postmedial and ante-terminal lines greenish-yellow, developing from the costal border. Antemedial line straight, strongly interrupted. Medial line at M1 with a convex curvature, interrupted at CuA1, then running straight to the anal border. Postmedial line developing from the postmedial subcostal spot, with angles at M1 and M3, connected with the medial line at CuA1. The postmedial and medial lines thus form a structure of ellipsoid shape. Ante-terminal line strongly tapering from M1 onwards, terminating at the anal border, with a strong 90° angle at CuA2 opened proximad. Terminal line black, straight. Fringe greenish-yellow. Forewing underside like forewing upper side.

Hindwing upper side: ground like forewing. Basal, medial, postmedial and anteterminal lines greenish-yellow. Basal line ranging from Rs to A1+2. Medial line angled at M2, ending at A1+2. Postmedial line sinusoid with angles at M2 and CuP and ending at the anal border. Anteterminal line developing from Sc+R1, running parallel to the termen and ending at the anal border. Hindwing underside like hindwing upper side.

Male genitalia (Figure 5): Uncus elongate, basis trapezoid, distal fourth with an enlarged offset of slightly bulbous shape with several fine stroke-like sclerites in the interior and several short chaetae supero-laterally.

Valva 2,2 times as long as wide, costa and ventral border running straight in the basal and post-basal areas, distally with rounded convexities at the transitions to the apex. Apex medially rounded. Rounding of the costal border strongly sclerotized and covered with a tuft of long chaetae. Basal costa inflated and with broad triangular-shaped projections directed towards the tegumen. Fibula developing in the proximal third of the valva, with a convex curvature anterio-laterally, directed ventrad, not exceeding the ventral border of the valva. Basal saccus rounded.

Tegumen rectangular-shaped with a pair of elongate rod-shaped sclerites running slant and forming a trapezoid structure. Saccus v-shaped. Coremata pads present, rounded proximally, elongate, ratio width/length 1/2,5.

Phallus apodeme of the aedeagus with three cornuti developing from the distal portion to the middle of the phallus, two of them of equal strength, the third one more slender and partially occluded by the two stronger developed cornuti.

Differential diagnosis: The new species is attributed to the *Notarcha quaternalis* Zeller, 1832 species complex sensu Shaffer and Munroe [11, 29]. In this species group, the species closest to the new species are *Notarcha quaternalis* Zeller, 1832 and *Notarcha digitalis* Shaffer & Munroe, 2007. The three species are externally distinguished from the other species of this complex – *Notarcha casualis* Walker, 1859, *Notarcha temeratalis* Zeller, 1852 and *Notarcha muscerdalis* Zeller, 1852

– by the three black stigmata on the forewing costa, the connectedness of the medial and postmedial lines forming an ellipsoid shape and the dark scaling of the labial palpus.

The new species is externally distinguished from *N. quaternalis* and *N. digitalis* by the greenish-yellow scaling of the longitudinal lines of the fore- and hindwings. In each of the comparative species the longitudinal lines are scaled darkish-yellow. The whitish-grey setae on the labial palpus in the new species are absent in each of the comparative species.

The main key differences are in the male genitalia (Table 2). The male genitalia of *N. quaternalis* and *N. digitalis* are figured in Guillermet and in Shaffer and Munroe [7, 11].

**Table 2.** Differential diagnosis of *Notarcha viridalis* Seizmair sp. nov. based on the male genitalia.

Characters and character states	<i>N. viridalis</i> Seizmair sp. nov	<i>N.</i> <i>quaternalis</i>	<i>N.</i> <i>digitalis</i>
Length of the uncus: (0) shortened with the distal end not exceeding sub-apical area of the valva; (1) elongate, exceeding the apex of the valva	1	0	1
Shape of distal uncus: (0) finger-shaped, rounded; (1) with a slightly bulbous-shaped distal offset	1	0	0
Presence of a pair of elongate sclerites in the tegumen: (0) absent; (1) running slant forming a quasi triangular-shaped structure; (2) with convex curvatures medially and concave angles proximally, forming an omega-shaped structure	1	0	2
Presence of projections at the basal costa of the valva directed towards/into the tegumen: (0) absent; (1) distally stout, of trapezoid shape; (2) rectangular-shaped	2	0	1
Shape of the post-basal costa: (0) straight, (1) convex	0	0	1
Shape of the distal costa: (0) straight, (1) convex	1	0	0
Presence of a chaetose sclerotization on the distal costa: (0) absent; (1) present	1	0	1
Length of the fibula: (0) not exceeding the ventral border; (1) exceeding the ventral border	0	1	0
Shape of the fibula: (0) with a convex curvature antero-laterally, forming a 45° angle with the ventral border; (1) straight, bared from any curvatures, running quasi parallel to the ventral border	0	0	1
Presence of a diverticulum on the posterior border of the fibula: (0) absent; (1) present	0	0	1
Shape of the saccus: (0) U-shaped; (1) V-shaped	1	0	0
Presence of a protruding keel at the anterior end of the saccus: (0) absent; (1) present	0	1	1
Presence of coremata pads: (0) absent; (1) proximally rounded (2) quasi triangular-shaped, acute proximally	1	0	2
Aedeagus: number of cornuto in the phallus apodeme: (0) one; (1) two; (2) three	2	0	1

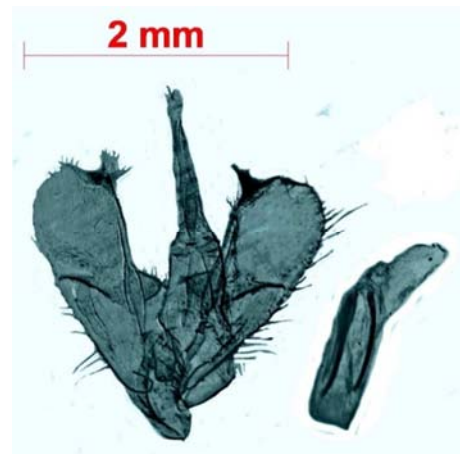
Bionomics: The type material was collected in an escarpment in the montane zone of the Jabal Al Qamar. The life cycle is unknown.

Distribution: Known only from the type locality.

Etymology: The epitheton refers to one of the characteristic external features, the greenish-yellow line pattern (lat. *viridus*=green).



**Figure 4.** *Notarcha viridalis* Seizmair, sp. nov., holotype, adult, ♂, Oman, Dhofar; 20 km E Sarfait, Road 47, Jebel Al Qamar, 960 m.



**Figure 5.** *Notarcha viridalis* Seizmair, sp. nov., holotype, male genitalia, slide no. GPPYR2319.

*Glyphodes leucomesalis* Seizmair, sp. nov. (Figures 6 - 8)

Material: Holotype: ♂, Oman, Dhofar, 20 km E Sarfait, Jebel Al Qamar, 960 m, 03-II-2019, leg. M. Seizmair, coll. ZSM, slide no. GPPYR2819. Paratype: Oman, Dhofar, 4km W Dalkuth, 04. II. 2019, leg. et coll. M. Seizmair, 1 ♀, slide no. GPPYR2519.

External features (Figure 6): Wingspan of the holotype 21,5

mm, wingspan of the paratype 17,7 mm.

Head: Frons, vertex and maxillary palpus scaled whitish-grey. Labial palpus with a whitish grey ground scaling interspersed with darkish-brown scales in the segments 2 and 3, equal in length with the diameter of the eye. Antennae filiform ciliate in both sexes, flagellum yellowish-brown up to the distal fifth, distal fifth darkish-brown to black, ciliae whitish-grey.

Thorax: Ventral and lateral scaling constantly whitish-grey, dorsal scaling of the prothorax ochre, of the mesothorax darkish-brown to black, of the metathorax darkish-grey interspersed with yellowish scales. Hindlegs and femur of forelegs constantly whitish-grey, transition from the femur to the tibia of the foreleg with darkish-brown scales, tibia of the foreleg darkish-grey interspersed with yellowish scales. Abdomen: ventral and lateral scaling whitish-grey, dorsal scaling whitish-grey between the segments, yellowish-brown on the segments.

Forewing upper side: Ground whitish-grey. Medial and post-medial areas between the costa and R1 interspersed with yellowish scales. Discal spot split up into a pair of small black stroke-like stigmata. Antemedial and postmedial bands broken into a paired structure of adjacent greenish-fuscous lines, with the band in between concolorous with the ground. Medial band broad, yellowish-fuscous, bifurcating at M3 into two complex lines, which are of the same paired structure as the antemedial and postmedial lines respectively and form together an eye-shaped structure. Postmedial band terminating at CuA1, strongly angled at M2, with the angle opened proximad. Anteterminal line simple, yellowish-fuscous, terminating at M3. Terminal line darkish-fuscous, straight. Fringe yellowish-grey. Forewing underside like forewing upper side with an additional yellowish scaling in the postmedial and anteterminal areas.

Hindwing upper side: Medial, postmedial and anteterminal lines of the same scaling as the lines of the forewing. Medial line of a paired structure like the antemedial and postmedial lines of the forewing. Postmedial and anteterminal lines simple, connected at CuA2. Terminal line and fringe like in the forewing. Hindwing underside like hindwing upper side.



Figure 6. *Glyphodes leucomesalis* Seizmair, sp.nov., holotype, adult, ♂, Oman, Dhofar, 20 km E Sarfait, Road 47, Jebel Al Qamar, 960m.

Male genitalia (Figure 7): Uncus: composed of a neck and a beak forming a 90°- angle, with the neck membranous and the beak with a triangular-shaped sclerite ranging over its entire length, several short chaetae on the ventral border and a knob-like

sclerotization on the apex. Tegumen of sub-triangular shape with several stroke-like sclerites, ratio maximum width/height 1/1,2. Tuba analis present, articulating with the ventro-lateral border of the tegumen, equal in length with the height of the tegumen and with a rod-shaped sclerite in its interior.

Valva: ratio maximum width/maximum length 1/1,4. Costal border straight, post-basal and dorso-distal areas interspersed with short chaetae. Basal ventral border convex, the post-basal and distal area quasi perpendicular with the basal portion with a strong concavity ranging up to the apex. Apex obliquely rounded towards the costa with a tuft of long chaetae on the transition to the costa. Basal ventral border with a process, which is pointed anteriorly, strongly broadened and quasi triangular-shaped in the posterior third, then strongly tapering anteriorly forming a pencil-shaped structure. The interior of the valva is characterized by the presence of an editum sensu Maes and a fibula [27]. The fibula is equal in length with 35% of the maximum width of the valva, running straight and directed costad. Its basis is interspersed with several chaetae dorso-laterally. Saccus strongly tapered and acute in its distal portion, inflated and broadened medially, its distal end with an elongate rod-shaped projection running to the post-basal ventral border.

Saccus: strongly broadened, stout, of trapezoid shape, ratio maximum width/height 1/1, anterior border with a small diverticulum medially and with a strongly broadened falciform projection pointing anteriorly, posterior border with a pencil-shape projection developing into the basal area of the valva, with the anterior half of asymmetrical, semi-ovoid shape.

Aedeagus: Phallus apodeme with an elongate pencil-shaped cornutus extending from the posterior portion to the apex. Posterior portion with several plate-shaped and rod-shaped sclerites.

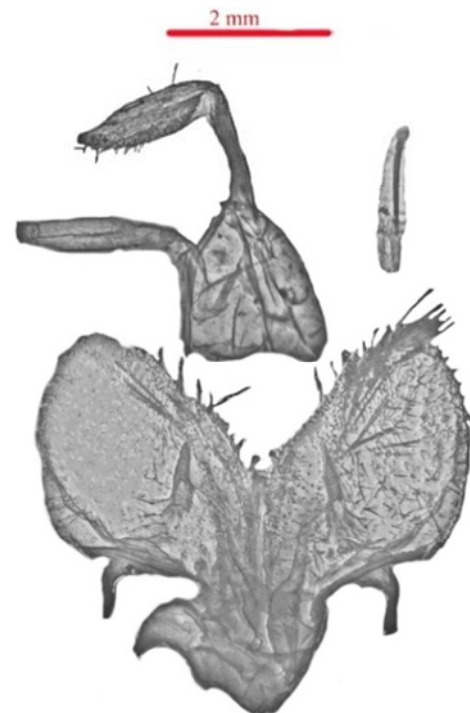
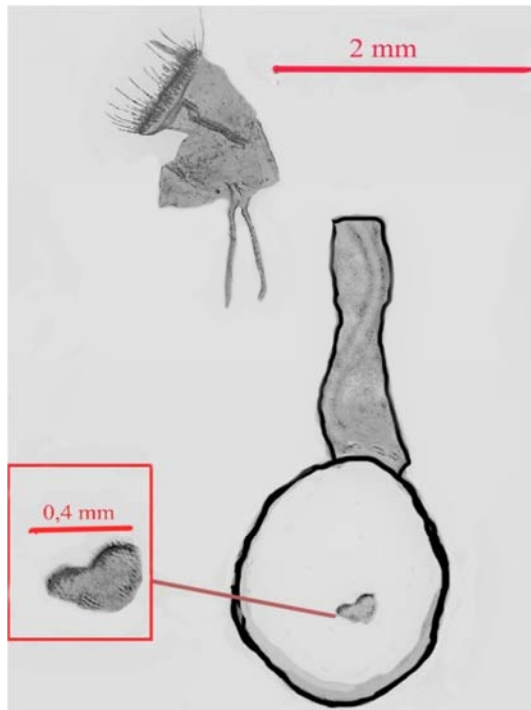


Figure 7. *Glyphodes leucomesalis* Seizmair, sp.nov., holotype, male genitalia, slide no. GPPYR2819.



**Figure 8.** *Glyphodes leucomesalis* Seizmaier, sp.nov., paratype, female genitalia, slide no. GPPYR2519, Oman, Dhofar, 4km W Dalkuth, signum zoomed (red box).

Female genitalia (Figure 8): Corpus bursae with a heart-shaped signum. Ductus bursae membranous, of constant width, equal in length with the corpus bursae. Ostium of trapezoid shape. Papillae anales orbiform, chaetose. Ratio of the lengths of the apophyses posteriores/apophyses anteriores 1/1,8.

Differential diagnosis: The new species shares the basic forewing pattern consisting of narrowed longitudinal lines in the basal, antemedial and anteterminal areas and a broadened medial band bifurcating at M3 with *G. onychinalis*, *Glyphodes caesalis* Walker, 1859, *Glyphodes flavizonalis* Hampson 1898. From all these species the new species differs in the interconnectedness of the forewing longitudinal lines: In each of the latter species, the longitudinal lines are interconnected – the medial line with the postmedial line, the antemedial line with the medial line thus forming ellipsoid, eye-shaped structures, in the new species the forewing longitudinal lines all run separately from each other.

The species differ furthermore in the number of longitudinal lines in the basal-antemedial-postmedial-anteterminal areas: 0-1-1-1 in the new species, 2-1-1-2 in *G. onychinalis*, 1-1-1-0 in *G. caesalis*, 1-2-1-1 in *G. flavizonalis*.

The forewing patterns of longitudinal lines shared by the four species encompass lines split up into a pair of darkish-brown outer lines and a band in between and simple lines. The portions of simple lines and lines split up differ inter-specifically:

The number of lines split up in the basal-antemedial-postmedial-anteterminal areas is 0-1-1-0 in the new species, 2-1-1-0 in *G. onychinalis*, 1-1-1-0 in *G. caesalis*, 0-1-0-0 in *G. flavizonalis*.

In the case of lines split up, the scaling of the band between the bordering lines differs interspecifically: concolorous with the greyish-white ground in the new species, contrasting with the ground and fulvous in each of the other comparative species.

Further species with similar forewing longitudinal line patterns are *Glyphodes xanthostola* Hampson, 1910, *Glyphodes parallelalis* Gaede, 1917, *Glyphodes ochripictalis* Strand, 1912. Each of them differs from the species sample discussed above in the absence of a bifurcation in the medial band. Furthermore, in each of the three species, all the longitudinal lines are split up, with the scaling of the middle band ochreous to darkish-orange.

The new species is very close to *G. onychinalis* in genital-morphological characters. In the male genitalia the two species share the beak-shaped uncus and the triangular-shape of the tegumen. In the female genitalia, the two species share the heart-shaped signum in the corpus bursae. The two species are distinguished in the male and female genitalia as follows. The genitalia of *G. onychinalis* are described in figured in Rathikannu and Chitra [20].

Male genitalia (Figure 7): Valva: Projections on the border: located on the basal ventral border in the new species, on the costa in *G. onychinalis*. Fibula: directed costad, running parallel to the base in the new species, directed dorsad, running orthogonal to the base in *G. onychinalis*. Base of the fibula connected with the distal sacculus in *G. onychinalis*, separated from the sacculus in the new species. Shape of the cucullus: obliquely rounded towards the costal border and narrowed in the new species, strongly broadened and flattened in *G. onychinalis*. Editum: present in the new species, absent in *G. onychinalis*. Sacculus: basal and medial portions strongly broadened and of constant width, distal portion tapered in *G. onychinalis*, medial portion strongly broadened, distal and basal portions strongly tapered in the new species. Furthermore, in the new species an elongate, stroke-shape process develops from the distal portion of the sacculus to the post-basal ventral border, which is absent in *G. onychinalis*.

Saccus: asymmetrical with a projection and a diverticulum dorso-laterally in the new species, symmetrical and bare of any projections in *G. onychinalis*.

Tegumen: Ratio maximum width/length 1/2 in *G. onychinalis*, 1/1,2 in the new species. Tuba analis articulating with the ventro-lateral border of the tegumen present in the new species, absent in *G. onychinalis*.

Uncus: Ratio length neck/maximum length beak < 1 in the new species, > 1 in *G. onychinalis*.

Aedeagus: In *G. onychinalis* there is a stroke-shaped sclerite near the apex, which is absent in the new species. In the new species, there is a plate-shaped sclerite in the posterior portion, which is absent in *G. onychinalis*.

Female genitalia: Ductus bursae tapering in its posterior half in *G. onychinalis*, of constant width in the new species, sclerotized at the transition to the ostium in *G. onychinalis*, bare of sclerotizations in the new species.

Remarks: It should be noted that there is no constant correlation between the forewing longitudinal line pattern

shared by the new species, *G. onychinalis* and 6 further species of the genus and the shape of the uncus as shared by the new species and *G. onychinalis*. In *G. caesalis* the beak-shape in the uncus is absent [19]. The new species and *G. onychinalis* share the beak-shape in the uncus with *Glyphodes actorionalis* Walker, 1859 and *Glyphodes vertuminalis* Guenée, 1854 [19, 22]. Yet, a longitudinal line pattern is absent in the forewings of each of these two species. *G. vertuminalis* shows a unicolorous green wing-pattern. *G. actorionalis* is similar in wing pattern to *Glyphodes bivitrealis* Guenée, 1854.

**Bionomics:** Life-cycle and premature stages unknown. The type habitat is situated in an escarpment.

**Distribution:** Known only from the type locality.

**Etymology:** The epitheton refers to one of the differential features in the forewing pattern – the greyish-white scaling in the space between the bordering lines of the composite longitudinal lines (Greek: leucos=white, mesos=middle).

## 4. Discussion

### 4.1. Phylogenetic Placement

The new species *Herpetogramma debilis* Seizmair, sp.nov. and *Notarcha viridalis* Seizmair, sp.nov. belong to sibling species complexes the members of which are primarily distinguished by genital-morphological characters. The identification of each of these species groups – group A of the genus *Herpetogramma* Lederer, 1883 and the *N. quaternalis* complex are based on external similarities in wing-pattern exclusively. The correlation of external characters, morphological and DNA- based markers in these species groups need further investigation.

*Glyphodes leucomesalis* Seizmair, sp. nov. is closely related to *G. onychinalis* externally in the forewing pattern of narrowed longitudinal lines and morphologically. Yet, the two species significantly differ externally in the interconnectedness of the longitudinal lines and in the male genitalia.

The new species is attributed to the preliminary species group 2 of the genus *Glyphodes* Meyrick, 1884 set up in Sutrisno [15-18]. This species cluster encompasses *G. onychinalis* and 6 further species. The new species shares with the species of this clade the triangular-shaped tegumen and sclerotized structures in the tegumen. These characters are identified as apomorphies of this clade in Sutrisno [17].

The phylogenetic placement of the new species in the genus

*Glyphodes* Meyrick, 1884 and the phylogenetic structure of the genus as a whole are still in need of further investigation. The species sample, on which the studies of Sutrisno are based cover less than 10% of the total species of the genus.

### 4.2. Distribution

The distribution of the three species is still unexplored. For *Herpetogramma debilis* Seizmair, sp.nov. and *Notarcha viridalis* Seizmair, sp.nov. both allopatric and parapatric distribution patterns with respect to known species on the African Continent are thinkable. *Glyphodes leucomesalis*

Seizmair, sp.nov. shows parapatric distribution with regard to *G. onychinalis*, yet the potential presence of the new species on the African Mainland is in need of further investigation.

## 5. Conclusion

In this paper three new species belonging to three different genera - *Herpetogramma* Lederer, 1883, *Notarcha*, Meyrick, 1884 and *Glyphodes* Meyrick, 1884 were described on the basis of samples collected in south-western Oman.

Preliminary phylogenetic placements of the new taxa in sibling species complexes in the genera *Herpetogramma* Lederer, 1883 and *Notarcha*, Meyrick, 1884 and in a monophyletic sub-clade of the genus *Glyphodes* Meyrick, 1884 identified in molecular-genetic studies by Sutrisno were discussed [15-18]. The need of revisions of the genera covered by this study by means of integrative approaches, which incorporate external characters, morphological and molecular genetic markers for further corroboration of the species complexes and a thoroughgoing understanding of their phylogenetic and taxonomic status was discussed.

Further distributional data on the new species described in this study as well as further new species in the respective genera are expected from further field research in the coastal mountain system in Dhofar and in Yemen and in the Asir Mountain system in SE- Yemen and SE- Saudi Arabia.

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## References

- [1] R. Mally, J. Hayden, C. Neinhuis, B. H. Jordal, and M. Nuss, "The phylogenetic systematics of Spilomelinae and Pyraustina (Lepidoptera: Pyraloidea: Crambidae) inferred from DNA and morphology," *Arthropod Systematics and Phylogeny*, vol. 77 (1), pp. 141-204, 2019.
- [2] M. Nuss, B. Landry, R. Mally, F. Vegliante, A. Tränkner, F. Bauer, J. Hayden, A. Segerer, R. Schouten, H. Li, T. Trofimova, M. A. Solis, J. De Prins and W. Speidel, "Global Information System on Pyraloidea," World Wide Web electronic publication (<http://www.pyraloidea.org>) [30.09.2020].



- [3] J. S. Irungbam, M. S. Chib, and K. Wangdi, "Taxonomic review of the superfamily Pyraloidea in Bhutan," *Journal of Asia-Pacific Biodiversity*, vol. 9, pp. 355-382, 2016.
- [4] J. Ko, U. Bayarsaikhani, B. Park, T. Lee, Y. Cha, C. Jang, J. K. Lee, and Y. Bae, "Exoasota pursatensis Ko & Bae, new genus and species of the Spilomelinae (Lepidoptera: Pyraloidea: Crambidae) from Indochina," *Zootaxa*, vol. 4838 (1), pp. 119-127, 2020.
- [5] B. Landry, "Taxonomic Revision of the Spilomelinae (Lepidoptera, Pyralidae s. l.) of the Galapagos Islands, Ecuador," *Revue Suisse de Zoologie*, vol. 123 (2), pp. 315-399, 2016.
- [6] M. Bippus, "Pyraloidea of Mauritius and neighbouring islands (Lepidoptera)," *Phelsuma*, vol. 27, pp. 36-57, 2019.
- [7] C. Guillermet, *The Heterocera of La Réunion, Volume 3 – Pyralidae and Crambidae*. Saint-Paul: Nature Discovery, 2009.
- [8] C. Guillermet, "Contribution to the study of the Heterocera of La Réunion: revision of the genera *Herpetogramma* Lederer, 1863 and *Syllepte* Hübner, 1823 and description of six new species (Lepidoptera Crambidae Spilomelinae)," *The Entomologist*, vol. 64 (3), pp. 201-210, 2008.
- [9] K. V. N. Maes, "Crambidae: Noordinae, Odontiinae, Pyraustinae, Spilomelinae (Lepidoptera: Pyraloidea)," *Esperiana Mémoire*, vol. 1, pp. 221-234, 2004.
- [10] F. Slamka, *Pyraloidea of Europe, Volume 3: Pyraustinae & Spilomelinae*. Bratislava: Frantisek Slamka, 2013.
- [11] J. C. Shaffer and E. G. Munroe, "Crambidae of Aldabra Atoll (Lepidoptera: Pyraloidea)," *Tropical Lepidoptera*, vol. 14, pp. 1-110, 2007.
- [12] J. E. F. Asselbergs, "Order Lepidoptera, superfamily Pyraloidea," in *Arthropod fauna of the United Arab Emirates, Volume 1*, Harten, A. van, Ed. Abu Dhabi: Dar Al Ummah Printing, Publishing, Distribution & Advertising, 2008, pp. 469-561.
- [13] J. De Prins and W. De Prins. "Afromoths, online database of Afrotropical moth species (Lepidoptera)," World Wide Web electronic publication (<http://www.afromoths.net>) [30.09.2020].
- [14] A. Poltavsky, V. Kravchenko, M. Traore, S. Traore, P. Gergely, T. Witt, H. Sulak, R. Beck, A. Junnila, E. Revay, S. Doumbia, J. Beier, G. C. Müller, "The Pyraloidea (Lepidoptera) fauna of the woody savannah belt in Mali, West Africa," *Zootaxa*, vol. 4457 (1), pp. 39-69, 2018.
- [15] H. Sutrisno, "Cladistic Analysis of the Australian Glyphodes Guenée and Allied Genera (Lepidoptera: Crambidae)," *Entomological Science*, vol. 5 (4), pp. 457-467, 2002.
- [16] H. Sutrisno, "A Preliminary Study on Relationships among Selected Australian Members of the Tribe Spilomelini (Lepidoptera: Crambidae: Pyraustinae)," *Zoological Science*, vol. 19 (8), pp. 915-929, 2002.
- [17] H. Sutrisno, "Phylogeny of Glyphodes Guenée (Lepidoptera: Crambidae: Spilomelinae) Based on Nucleotide Sequence Variation in a Mitochondrial CO I Gene: Congruence with Morphological Data," *Treubia*, vol. 33 (1), pp. 35-42, 2003.
- [18] H. Sutrisno, N. Azuma, and S. Higashi, "Molecular Phylogeny of the Indo-Australian Glyphodes and its Allied Genera (Insecta: Lepidoptera: Crambidae: Spilomelinae) Inferred from Mitochondrial COI and COII and Nuclear EF-1a Gene Sequences," *Species Diversity*, vol. 11, pp. 57-69, 2006.
- [19] S. Park, J. Ko, S. Na, D. Lee, U. Bayarsaikhani, and Y. Bae, "Taxonomic Study of the Genus *Glyphodes* (Lepidoptera: Crambidae) from Laos," *Korean Journal of Nature Conservation*, vol. 10 (2), pp. 148-154, 2016.
- [20] S. Rathikannu, and N. Chitra, "Genitalia study on the genus *Glyphodes* (Crambidae: Spilomelinae) in Tamil Nadu, India," *Entomon*, vol. 42 (2), pp. 145-152, 2017.
- [21] G. Nagaharish, M. Shankara Murthy, A. Prabhuray, A. S. and S. G. S. Patil, "Faunistic studies on Crambidae: Pyraloidea (Lepidoptera) associated with fruit and flower crops of zone-1 and 2 of Karnataka, India," *Journal of Entomology and Zoology Studies*, vol. (1), pp. 875-880, 2017.
- [22] P. M. Reddy and M. S. Murthy, "Taxonomic studies on the genus *Glyphodes* Guenée (Lepidoptera: Crambidae: Spilomelinae) from Karnataka, India," *Entomon*, vol. 44 (4), pp. 241-248, 2019.
- [23] J. Gesquière, "Lépidoptères Microlépidoptères (deuxième partie)," *Annales du Musée du Congo belge, Zoologie [3, Arthropodes]*, section 2, *Catalogues raisonnés*, vol. 7 (3), pp. 121-240, 1942.
- [24] T. Walsingham and G. Hampson, "On moths collected at Aden and in Somaliland," *Proceedings of the Zoological Society of London*, vol. 1896 (1), pp. 257-283, 1896.
- [25] M. P. T. Gillet, "Brief notes on some species of micro-moths newly reported from Al Ain," *Tribulus*, vol. 7 (1), pp. 19-20, 1997.
- [26] G. Robinson, "The Preparation of Slides of Lepidoptera Genitalia with Special Reference to the Microlepidoptera," *Entomologist's Gazette*, vol. 27, pp. 127-132, 1976.
- [27] K. V. N. Maes, "A comparative morphological study of the adult Crambidae (Lepidoptera, Pyraloidea)," *Proceedings and Annals of the Belgian Entomological Royal Society*, vol. 131, pp. 383-434, 1995.
- [28] J. C. Shaffer and E. Munroe, "Type Material of Two African Species of *Herpetogramma* and One of *Pleuroptya* (Lepidoptera: Crambidae: Pyraustinae)," *Proceedings of the Entomological Society of Washington*, vol. 91 (3), pp. 414-420, 1989.
- [29] J. C. Shaffer and E. Munroe, "Type Material of Four African Species of *Notarcha* Meyrick, with Designation of Lectotypes and Changes in Synonymy," *Proceedings of the Entomological Society of Washington*, vol. 91 (2), pp. 248-256, 1989.