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Taxonomic and faunistic notes on four species of the Spilomelinae (Lepidoptera, Crambidae) in Saudi-Arabia with description of a new species of *Cirrhochrista* Lederer, 1863

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Abstract
Taxonomic and faunistic results on the Spilomelinae Guenée, 1854 are presented on the basis of material collected in Saudi-Arabia. A new species *Cirrhochrista biangularis* sp.nov. is described. It is placed close to the *Cirrhochrista brizoalis* (Walker, 1859) species group and *Cirrhochrista metisalis* Viette, 1961. The adult and the female genitalia are described and figured. The differential character states in wing maculation and female genitalia are listed. The male is unknown. A determination key to the Arabian species of *Cirrhochrista* Lederer, 1863 and their closest relatives is provided. Distributional updates are presented on three further known species: *Orphanostigma abruptalis* (Walker, 1859) is reported as new to the entomofauna of Saudi-Arabia. *Herpetogramma mutualis* (Zeller, 1852) is reported as new to the entomofauna of the Arabian Peninsula. The adults and the male genitalia of these two species are re-described and figured. The presence of *Diaphania indica* (Saunders, 1851) in Saudi-Arabia, known exclusively from historical records, is re-confirmed.

Keywords: pyraloidea**,** cirrhochrista, diaphania, herpetogramma, orphanostigma, morphology, fauna, distribution, arabian peninsula

Introduction

The subfamily Spilomelinae Guenée, 1854 has a world-wide distribution. It comprises 4100 described species distributed over 338 genera and 12 tribes (Mally *et al*., 2019; Nuss *et al*., 2022; Matsui *et al*., 2022 [1, 2, 3]) and is thus the most diverse subfamily among the Pyraloidea. From the Arabian Peninsula, 47 species have been known till date, which were compiled into a preliminary checklist in Seizmair (2022) [4]. The spectrum of species on the Arabian Peninsula spans three zoogeographical zones, namely the Palearctic, the Oriental and the Afrotropical zones, with Afrotropical species predominant in the south-western parts of the Arabian Peninsula (Dhofar, Yemen, SW- Saudi-Arabia).

As shown in Hacker (2016) [5] for the Noctuoidea, several mountain chains of the Arabian Peninsula, in particular the Jebel Akhdar in Northern Oman, the coastal mountain chains along the Indian ocean ranging over Dhofar and Southern Yemen, and the Saravat mountain ranges in Yemen and SW- Saudi-Arabia have a high endemic potential. For the Pyraloidea however, endemism on the Arabian Peninsula has been little explored till date. The species records for the southwestern parts of the Arabian Peninsula have been based predominantly on historical reports exclusively. A comprehensive survey on literature and research status is given in Seizmair (2022) [4]. This paper is a continuation of Seizmair (2022) [4] adding further results to the study of Arabian Spilomelinae Guenée, 1854 on the basis of material collected in Saudi-Arabia in autumn 2022: A new species *Cirrhochrista biangularis* sp. nov, is described. The new species is placed near the *Cirrhochrista brizoalis* (Walker, 1859) species group sensu Chen, Song & Wu (2006) [6] and *Cirrhochrista metisalis* Viette, 1961. The genus is distributed in the Oriental, Australasian and Afrotropical zones. Its presence on the Arabian Peninsula has been reported in Seizmair (2021) [7] for the first time with the description of *Cirrhochrista seminivea* Seizmair, 2021. A determination key to the Arabian species of *Cirrhochrista* Lederer, 1863 and their closest relatives is provided in this paper. Two further known species are reported as new to Saudi-Arabia and the Arabian Peninsula respectively, namely *Orphanostigma abruptalis* (Walker, 1859) and *Herpetogramma mutualis* (Zeller, 1852). The presence of *Diaphania indica* (Saunders, 1851) in Saudi-Arabia, known from historical records exclusively till date, is reconfirmed.

Materials and Methods

1. Sampling

The material presented in this study is part of a sample collected by the author in Saudi-Arabia (province Jizan) in September 2022. The specimens were captured by night by means of two light traps, each equipped with four UV-Power-LEDs covering a wave spectrum of 365 nm – 385 nm (LepiLED, Nichia, Tokushima, Japan; EntoLED, Starlight, Weissenburg, Germany). The trapping technique applied is described in Brehm (2017) [8].

2. Preparation, Dissection, Digital Image Processing

The adults were photographed after relaxation and subsequent preparation with a CANON EOS M6 Mark II under a MP-E-65mm zoom. For examining the genitalia, dissection, preparation and slide-mounting techniques were applied on the specimens on the basis of the protocol described in Robinson (1976) [9]. The preparation of the genitalia was done under a Motic stereomicroscope (SMZ-171). The slides were photographed with a ToupCam c-mount camera (ToupTek Inc., Zhejiang, China) under a resolution of 18 megapixels. Image stacking and background normalization were applied on the images by means of Adobe Photoshop PS, Version 24.0.0.

3. Morphological Analyses

Analyses of wing pattern characters and morphological structures in the specimens were done on the images. Structural ratios were calculated on the images by means of the imaging software ToupView, Version 1.0 (ToupTek Inc., Zhejiang, China).

4. Terminology and Abbreviations

The descriptions of external and internal character states follow the terminology and systematics in Maes (1994) [10] and in Mally *et al*. (2019) [1]. Abbreviations: ZSM = Zoological State Collection Munich, Germany.

Results and Discussion

1. Tribe Margaroniini

1.1 *Cirrhochrista biangularis* sp. nov.

Zoobank ID: 78411E80-EB16-4BD5-A2C1-01E22F365D26

Material

Holotype**:** ♀**,** Saudi-Arabia, Province Jizan, Wadi Lajab, 1200 m, 27-IX-2022, slide no. 22GP0073, leg. et prep. M. Seizmair, coll. ZSM.

External characters (Fig 1A - D)

Wingspan of the holotype**:** 20.5 mm. Forewing length: 10.8 mm. Head: Frons and vertex white scaled. Antenna filiform ciliate, flagellum and ciliae yellowish. Proboscis concolorous with the antenna. Labial palpus acuminate, elongate, length relative to the diameter of the eye 2.5, dorsally white scaled, ventrally white in segments 1 and 4, fulvous in segments 2, 3. Shape and scaling of the maxillary palpus as for the labial palpus, length relative to the labial palpus 0.3. Thorax: White scaled dorso-laterally, medial dorsum with fulvous-ochreous stripes forming a sub-triangular shape. Dorsal metathorax with a transversal fulvous-ochreous stripe. Ventral scaling white interspersed with yellowish scales. Tegula white scaled. Legs white scaled at the femur and the tibial spurs, with fulvous scaling at the tibia. Mid-legs interspersed with darkish brown scales at the epiphyses. Abdomen: Dorsum white scaled with a brownish ochreous spot at A1 and a brownish-ochrous longitudinal line from A3 to A8. Venter white scaled interspersed with brownish-ochreous spots at A4, A5, A6 laterally. Forewing: Apex up-turned, rounded. Tornus edged. Termen slightly curved at M3. Costal and anal borders straight. Upper side: Ground white. Costal stripe fulvous-ochreous, ranging from the basis to the apex. Presence of basal, antemedial, medial and postmedial lines each concolorous with the costal stripe and differing in shape: Basal line slender, straight, ranging over 35 % of the basal area. Antemedial line equal in width with the basal line, medially interrupted. Medial line strongly broadened, of trapezoid shape bifurcated at M2 into two lines reduced to a series of minute spots. Each of these lines range to the anal border, forming an asymmetrical structure, the posterior one s-shaped, the anterior one strongly angled towards the basis. Postmedial line basally broad, triangular shaped, strongly tapered from R5 onwards and reduced to a s-shaped series of points terminating at M3. Termen and fringe concolorous with the costa, with small sub-triangular shaped spots at the veins. Underside: Ground concolorous with the ground of the upper side. Scaling of costa, termen and fringe as for the upper side. Basal and antemedial lines evanescent. Medial and postmedial lines light ochreous. Hindwing: Apex and tornus rounded. Costal and anal borders straight. Upper side: Ground concolorous with the forewing ground. Terminal line with a fulvous-ochreous area ranging from M2 to CuA2. Fringe fulvous-ochreous. No further maculation present. Underside like upper side.

Male genitalia

The male genitalia are unknown.

Female genitalia (Fig 3A, 4A)

Corpus bursae ovate, elongate, 2.5 times as long as wide with rod-shaped sclerites and slightly granulate areas, bare from signa. Ductus bursae short, length relative to the length of the corpus bursae 45%, width relative to length 22%, colliculum present, which ranges over 50% of the total ductus bursae. Transition from the ductus bursae to the corpus bursae distinct, from an anteriorly narrowed ductus bursae to a posteriorly widened corpus bursae. Antrum with a sub-triangular sclerite dorso-laterally. Ostium strongly sclerotised laterally. Posterior apophyses constant in width, length relative to the anterior apophyses 43%. Anterior apophyses strongly tapered from a basal dilatation onwards. Papilla analis ovate, chaetose, width relative to length 25%, dorsal and ventral ends equal in width.

Diagnosis

The new species is closely related to the Afrotropical *Cirrhochrista metisalis* Viette, 1961 known till date as endemic to Madagascar (De Prins & De Prins, 2022) [11] and to the Oriental *Cirrhochrista spinuella* Chen, Song & Wu, 2006 and *Cirrhochrista brizoalis* (Walker, 1859). The latter two species are resumed under the *C. brizoalis*- species group in Chen, Song & Wu (2006) [6]. With these species the new species shares the following external character states: Presence of an interrupted antemedial line, presence of a medial band ranging from the costa to M2, medial lines following the medial band either reduced to series of minute spots or completely absent, presence of a postmedial line strongly tapered from R5 onwards in the forewing, presence of hindwing terminal markings.

The new species is differentiated from its closest relatives by the following external character states: Shape of the forewing apex: up-turned and rounded in the new species, down-turned and pointed in each of the comparative species. Shape of the termen: angled in the new species and in *C. metisalis*, straight in *C. brizoalis* and in *C. spinuella*. Presence of a forewing basal line clearly detached from the costal border: present in the new species, in *C. brizoalis* and in *C. spinuella*, absent or reduced to a slight dilatation of the costa in *C. metisalis*. Presence and shape of the medial series of spots following the medial band from the M2 onwards: present in the new species with each of the lines strongly angled, present in *C. metisalis* with the posterior line angled and the anterior line quasi straight, absent in *C. spinuella* and *C. brizoalis*. Presence of a ring near the tornus in the medial forewing area: absent in the new species, in *C. metisalis* and in *C. spinuella*, present in *C. brizoalis*. Shape of the forewing postmedial line: s-shaped (with two angles) in the new species, arch-shaped, concave (with one angle) in each of the comparative species. Presence of a comma-shaped stroke in the hindwing terminal line near CuP: absent in the new species, in *C. brizoalis* and in *C. spinuella*, present in *C. metisalis*.

Furthermore, the new species is differentiated from the members of the *C. brizoalis*- species group in the female genitalia as follows: Presence of signa in the corpus bursae: absent in the new species, present in *C. brizoalis* and in *C. spinuella*. Presence of a colliculum: present in the new species, absent in *C. brizoalis* and in *C. spinuella*. Presence of an elongate, sub-triangular shaped sclerite in the antrum: present in the new species, absent in in *C. brizoalis* and in *C. spinuella*. The female genitalia of *C. brizoalis* and *C. spinuella* are described and figured in Chen, Song & Wu (2006) [6] and in Ko *et al*. (2020) [12]. The female genitalia of *C. metisalis* are unknown.

Discussion

From the Arabian Peninsula two species of the genus *Cirrhochrista* Lederer, 1863 have been known till date, namely the new species and *Cirrhochrista seminivea* Seizmair, 2021. *C. seminivea* is seen as closely related to *Cirrhochrista nivea* (Joannis, 1932) and *Cirrhochrista etiennei* Viette, 1976, however sharing character states in the forewing maculation, namely the presence of medial and postmedial lines with *C. metisalis* and the *C. brizoalis* species group. Tab 1 gives a determination key to the Arabian species of the genus and their closest relatives based on external character states.

Tab 1: Key to the Arabian species of the genus *Cirrhochrista* Lederer, 1863 and their closest relatives

1	Anteterminal line present in the hindwing	2
-	Anteterminal line absent in the hindwing	5
2	Two medial lines reduced to a series of minute spots present in the forewing immediately following the medial band	3
-	Medial series of spots / lines absent below the medial band	4
3	Posterior medial line angled, anterior medial line quasi straight. Hindwing anteterminal line with a comma-shaped costad-directed stroke	*C. metisalis*
-	Both posterior and antemedial line angled. Hindwing bare from maculation beyond the anteterminal line	*C. biangularis* sp. nov.
4	Medial fulvous ring present in the forewing near the tornus	*C. brizoalis*
-	Medial fulvous ring absent in the forewing	*C. spinuella*
5	Black antemedial stigma present in the forewing near the cubitus	6
-	Antemedial stigma absent in the forewing	*C. etiennei*
6	Medial and postmedial lines present in the forewing	*C. seminivea*
-	Forewing bare from further maculation	*C. nivea*

Bionomics (Fig 5)

The holotype was captured at night in an escarpment with high disturbance, interspersed with patches of grass, shrubs and trees. The premature stages and host plant usage are unknown.

Distribution

Only known from the type locality in south-western Saudi-Arabia.

Etymology

The epitheton refers to one of the external differential character states, the two angulated medial lines (lat: bi- = two (-fold), angula = angle).

1. 2. *Diaphania indica* (Saunders, 1851)

Material

Saudi-Arabia, Province Jizan, Wadi Lajab, 1200 m, 27-IX-2022, 1 ♂, leg. et coll. M. Seizmair.

Diagnosis (Fig 2A- B)

Wingspan 22.0 mm. Forewing and hindwing ground white. Forewing costa, forewing and hindwing termen with broad black margins. Presence of a brownish-yellowish anal tuft in the male.

Distribution

Neotropical: Central America. Australasian. Oriental: India, Indonesia, New Guinea, Sri Lanka. Palearctic: Canary Islands, Madeira, China, Japan, Korea. Nearctic: USA (Florida). Afrotropical: Eastern Africa from Ethiopia to South Africa, Kongo, Cameroon, Malagasy and Mascarene Islands (De Prins & De Prins, 2022; Slamka, 2013; Shaffer & Munroe, 2007; Guillermet, 2009) [11, 13, 14, 15]. For the Arabian Peninsula, the species has recently been recorded from the UAE (Asselbergs, 2008) [16] and Northern Oman (Pelham-Clinton, 1977) [17]. For Yemen and Saudi-Arabia there have been exclusively historical records (De Prins & De Prins, 2022; Ghesquière, 1942; Butler, 1884; Rebel, 1907) [11, 18, 19, 20]. The presence of the species in Saudi-Arabia is re-confirmed.

2. Tribe Spilomelini

2.1 *Orphanostigma abruptalis* (Walker, 1859)

Material

Saudi-Arabia, Province Jizan, Fayfa, 600 m, 23-IX-2022, 1♂, slide no. 22GP076, leg., prep. et coll. M. Seizmair.

Diagnosis (Fig 2C-D)

Wingspan: 14.0 mm. Frons, vertex, tegula strong orange-yellow. Labial palpus ventrally white, dorsally and laterally yellowish-brown. Maxillary palpus ventrally brown, dorsal and lateral surfaces yellowish to light brown. Forewing ground yellowish orange, costal area and area distal to the postmedial line orange brown. Presence of basal, antemedial, medial and postmedial lines in the forewing. Basal line deep orange ranging from the costa to the anal border. Antemedial line darkish brown and slightly angled outward. Medial line darkish-brown developing from the sub-costa to the closing vein of the cell, slightly concave. Postmedial line darkish-brown, prominent and black near the costa, convex between R5 and M1, concave between M1 and M2, turning between CuA1 and CuA2 towards the lower angle of the cell immediately below the end of the medial line, then continuing to the anal border. Hindwing ground yellowish orange from the basis to the postmedial line, deep orange brown in the area distal to the postmedial line. Presence of darkish-brown antemedial and postmedial lines. Antemedial line slightly concave. Postmedial line angled outward near CuA2.

Male genitalia (Fig 3B, 4B, 4D): Medial valva with a broadened, costad- directed fibula with several edges, apex

rounded towards the costa with a chaetose patch, ventro-distal border with a spine-shaped costad-directed processus and several small, sub-triangular-shaped dilatations. Uncus bi-lobed. Phallus apodeme with a broad sclerotised denticulate strap.

Distribution

Afrotropical, from West Africa (Sierra Leone, Mali, Liberia, Nigeria) to East Africa (Somalia, Kenya, Zimbabwe), Malagasy and Mascarene Islands (De Prins & De Prins, 2022; Shaffer & Munroe, 2007; Guillermet, 2009) [11, 14, 15]. Australasian: Australia, Fiji. Oriental: India, Myanmar, Andamans, Sri Lanka (De Prins & De Prins, 2022) [11]. From the Arabian Peninsula the records known till date are confined on historical records from Socotra (De Prins & de Prins, 2022; Rebel, 1907) [11, 20]. The species is reported as new for Saudi-Arabia, its presence on the Arabian Peninsula is reconfirmed.

3. Tribe Herpetogrammatini

3.1 *Herpetogramma mutualis* (Zeller, 1852)

Material

Saudi-Arabia, Province Jizan, Fayfa, 600 m, 25-IX-2022, 1♂, Wadi Lajab, 1200 m, 27-IX-2022, 1♂, slide no. 22GP075, leg., prep. et coll. M. Seizmair.

Diagnosis (Fig 2E- F)

Wingspan: 18.3 – 19.6 mm. The species belongs to the species group A of the genus sensu Guillermet (2009), the members of which are characterised by a light to yellowish brown ground. Forewing with a darkish-brown antemedial line, a postmedial line of the same colour and two antemedial and medial subcostal spots concolorous with the lines. Antemedial line prominent near the costa, ranging to the inner margin, slightly angled outwards. Postmedial line angled outwards near M2, turning towards the middle of the cell near CuA2, then continuing to the inner margin. Medial spot reniform, antemedial spot orbiform, significantly smaller than the medial one. Hindwing with a darkish brown antemedial line and a postmedial line of the same colour, the antemedial line prominent near the costal border and angled outwards near the CuA2, the postmedial line angled inwards near M1.

Male genitalia (Fig 3C, 4C, 4E)

Uncus narrowly triangular shaped and apically narrowly rounded. Basal costa of the valva with a lobe-shaped, anteriad-directed projection. Transtilla arms elongate, acuminate. Basal sacculus strongly broadened, with the dorsal border projected. Juxta ovate. Medial area of the phallus strongly granulated, vesica with an extensive plate-shaped sclerite. The male genitalia of the lectotype were figured for the first time in Shaffer & Munroe (1989) [21].

Distribution

Afrotropical – Central Africa and East Africa: Congo, Angola, Namibia, Somalia, Tanzania, Mozambique, South Africa (De Prins & De Prins, 2022) [11]. The species is reported as new to the entomofauna of the Arabian Peninsula

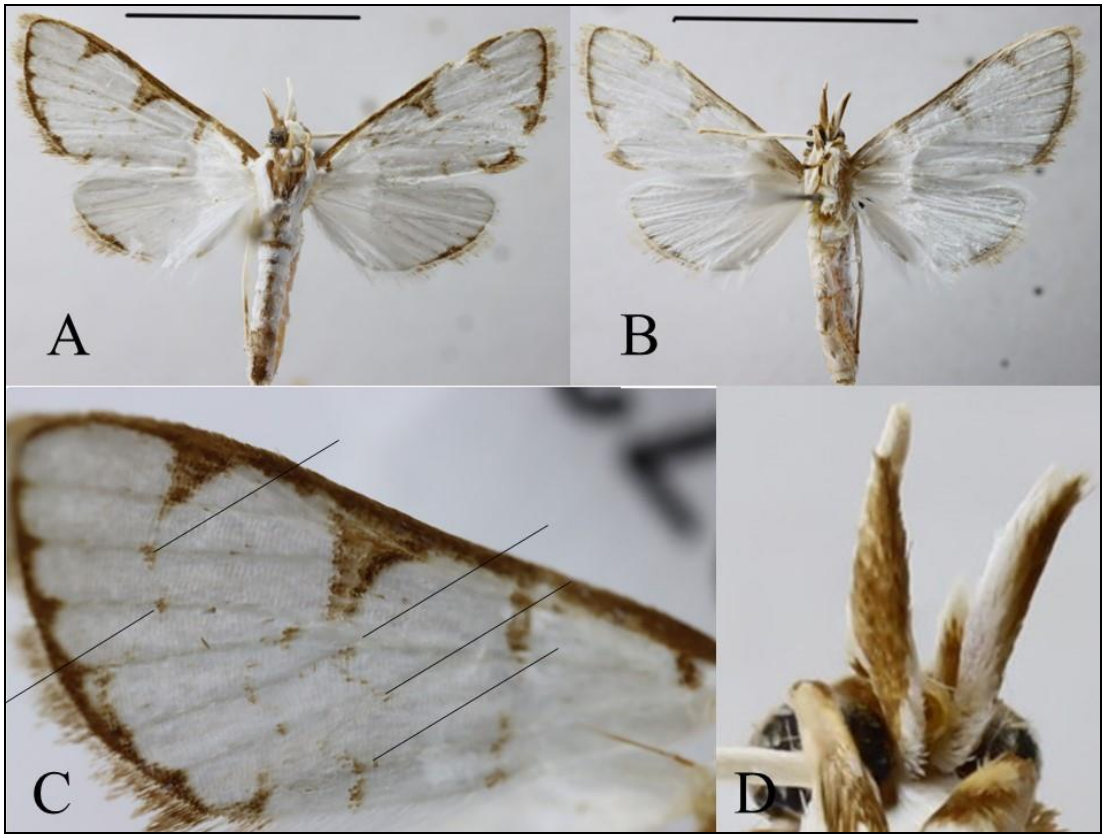

Fig 1: *Cirrhochrista biangularis* **sp.nov**., holotype, adult, ♀, slide no. 22GP073. A: Upper side. B: Underside. C: Close-up, forewing maculation, medial and postmedial lines. D: Head profile. Scale-bar = 10 mm.

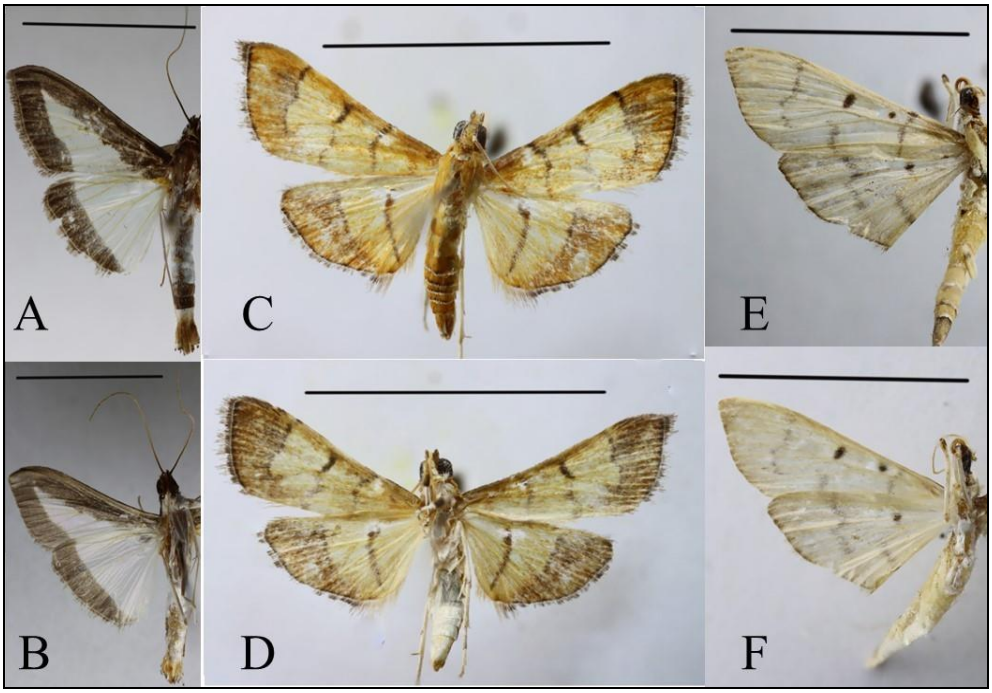

Fig 2: Adults. A, B: *Diaphania indica* (Saunders, 1851), Saudi-Arabia, Province Jizan, Wadi Lajab, 1200 m, 27-IX-2022, ♂, leg. et coll. M. Seizmair, A: Upper side, B: Underside. C, D: *Orphanostigma abruptalis* (Walker, 1859), ♂, slide no. 22GP076, C: Upper side, D: Underside. E, F: *Herpetogramma mutualis* (Zeller, 1852), ♂, slide no. 22GP075, E: Upper side, F: Underside. Scale-bar = 10 mm.

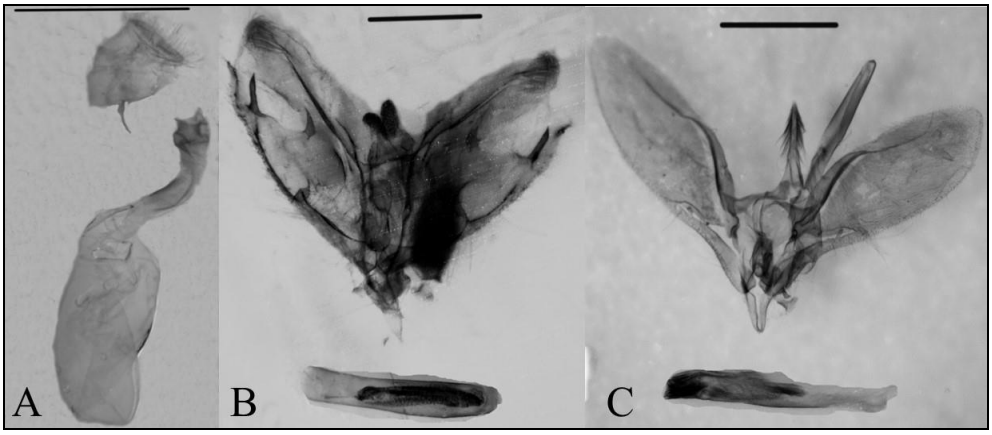

Fig 3: Genitalia. A: *Cirrhochrista biangularis* **sp.nov**., holotype, ♀, slide no. 22GP073. B: *Orphanostigma abruptalis* (Walker, 1859), ♂, slide no. 22GP076. C: *Herpetogramma mutualis* (Zeller, 1852), ♂, slide no. 22GP075. Scale-bar = 1 mm.

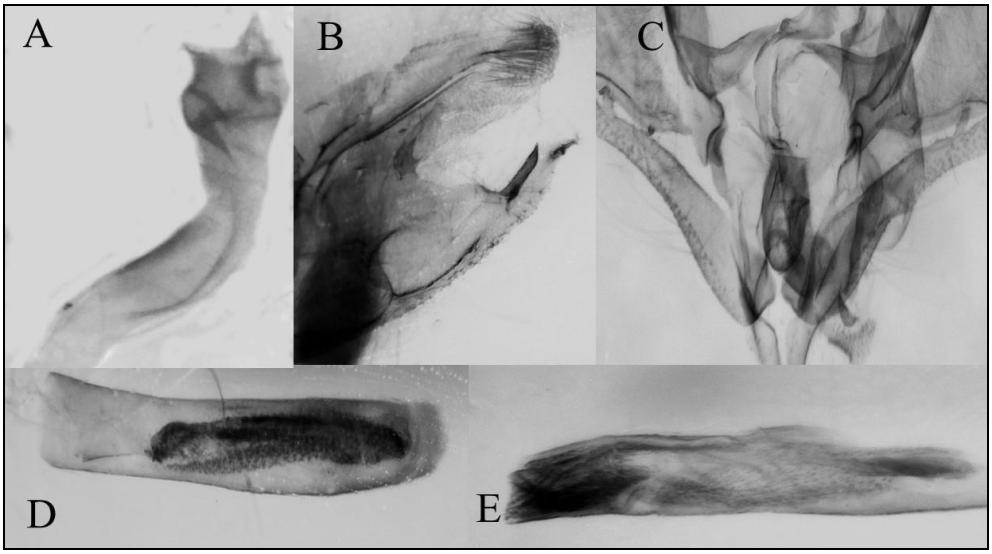

Fig 4: Genitalia, close-ups. A*: Cirrhochrista biangularis* sp.nov., slide no. 22GP073, ♀ - colliculum, antrum, ostium. B, D: *Orphanostigma abruptalis* (Walker, 1859), ♂, slide no. 22GP076, B: Right valva: medial area and ventral border, D: Vesica. C, E: *Herpetogramma mutualis* (Zeller, 1852), ♂, slide no. 22GP075, C: Basal valva, juxta, sacculus, E: Vesica.

Fig 5: Type habitat of *Cirrhochrista biangularis* sp.nov., Saudi-Arabia, Prov. Jizan, Wadi Lajab, 1200m.

Conclusion

Three species were reported as new to the entomofauna of Saudi-Arabia: *Cirrhochrista biangularis* sp. nov. was described as new for science. It is placed near the *C. brizoalis* species group and *C. metisalis* due to shared character states in the wing maculation. From its closest relatives the new species is differentiated in external character states (fore- and hindwing maculation) and in the female genitalia. *Cirrhochrista biangularis* sp. nov. has been the second species of the genus reported from the Arabian Peninsula. A determination key to the Arabian species of the genus and their closest relatives was given. Furthermore, *O. abruptalis* was reported as new to the entomofauna of Saudi-Arabia. *H. mutualis* was reported as new to the entomofauna of the Arabian Peninsula. The presence of *D. indica* in Saudi-Arabia was re-confirmed.

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Conflict of Interest Statement

The author declares that there are no conflicts of interest, neither of personal nor of material kind that could have influenced the results of this work.

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