Micropterix of Cyprus and the Middle East (Micropterigidae)

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Abstract. All known species of the genus *Micropterix* Hübner, 1825 (Micropterigidae) from Cyprus (*Micropterix cypriensis* Heath, 1985) and the Middle East (Israel, Lebanon: *Micropterix berytella* de Joannis, 1886, *Micropterix elegans* Stainton, 1867 and *Micropterix islamella* Amsel, 1935) are treated. The male genitalia of *Micropterix islamella* Amsel, 1935 are illustrated for the first time. The association of two *Micropterix* species with *Cyclamen persicum* Mill. (Myrsinaceae) is detailed. Adults and male genitalia of all species are illustrated, showing the habitus of all species in their natural environment.

Introduction

Here we treat the four species of the Palaearctic genus *Micropterix* of Cyprus and the Middle East: *Micropterix berytella* de Joannis, 1886, *Micropterix cypriensis* Heath, 1985, *Micropterix elegans* Stainton, 1867 and *Micropterix islamella* Amsel, 1935. All species are figured in colour (also in their natural environment), and their male genitalia are illustrated. Our focus in this paper is on the aspects of the species most useful for identification, namely wing colour patterns and male genital morphology. Besides this, we also provide details of the pollination of *Cyclamen* (Myrsinaceae) by *Micropterix* species, demonstrated in a previous experiment by Schwartz-Tzachor (1998).

In this paper we build on the previous important identification treatments by Heath (1987), Kozlov (1989, 1990a, b) and Zeller et al. (2007). Two of the species (*M. octopunctella* Amsel 1935, considered by Heath and here to be a synonym of *M. elegans*, and *M. islamella*) were redescribed by Kozlov (1988), who reexamined some of Amsel's types. We update all these treatments here.

Material and methods

The examined material was mainly collected by the authors, provided by others and investigated in different museums. For more information about collecting sites, preparation techniques and data archive see Zeller et al. (2007). For generating maps we used DIVA-GIS, a free computer program for mapping and geographic data analysis. We also inspected the unpublished manuscripts of John Heath at BMNH to extract relevant data, particularly for forewing length and to augment the distributional data.

Abbreviations

BMNH British Museum of Natural History, London
MNHN Muséum national d'Histoire naturelle, Paris
NHRS Naturhistoriska Riksmuseet, Stockholm
UMB Übersee-Museum, Bremen, Germany
SMNK Staatliches Museum für Naturkunde, Karlsruhe

Ecology

We observed frequent visits of the moths *M. berytella* and *M. elegans* to the underneath of *Cyclamen* flowers. In closeup observations, we found that the moths appeared to eat pollen grains from the flowers, to mate on them, and to take shelter inside the flowers from rain and on cold nights. Schwartz-Tzachor (1998) tested the pollination efficiency of both *Micropterix* species on *Cyclamen persicum* and found that the moths successfully pollinated the flowers and significantly raised the percentage of fruit set. In addition, the moths appeared approximately three weeks after the beginning of flowering in the synanthous *C. persicum* population, and accompanied the flowering throughout the season (Schwartz-Tzachor et al. 2006).

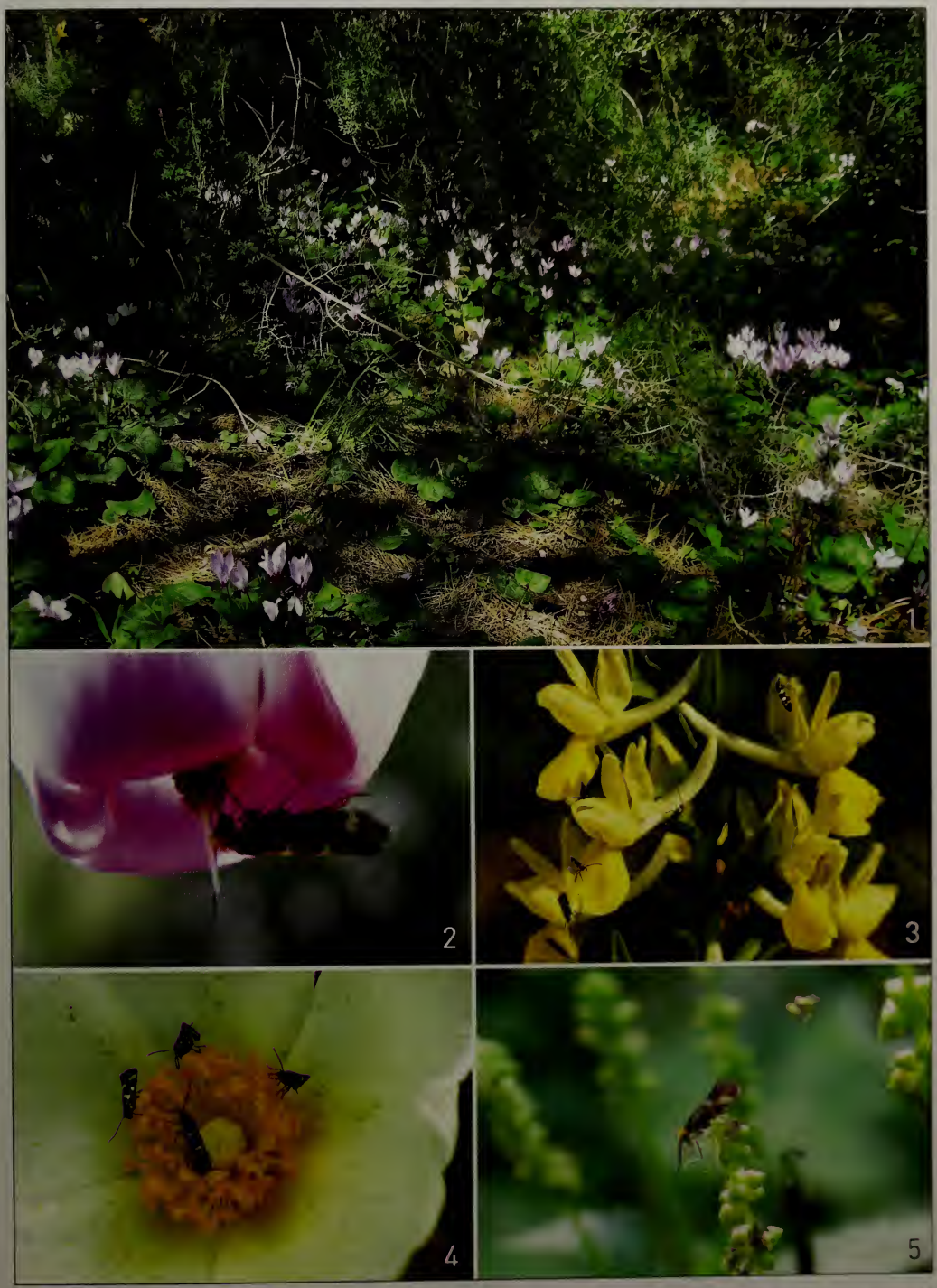
Taxonomic treatment

Micropterix berytella de Joannis, 1886

Micropteryx berytella de Joannis, 1886: 183, pl. 6 fig. 5. Type locality: Beirut, Lebanon. Syntype: in coll. MNHN.

Material. 5♂, 1♀, **Israel**, Haifa, Montfort, 180–300 m, 28.2.2006, leg. Hausenblas/Zeller; 7♂, 2♀, **Israel**, Zichron Yaacov, Ramat Hanadiv, 125 m, 24.–25.2.2006, leg. Hausenblas/Zeller; 2♂, **Israel**, Haifa, Abu Sennan, Asherat, 80 m, 28.2.2006, leg. Hausenblas/Zeller; 2♀, **Israel**, En Hemed, 100 m, 1.5.1998, leg. Hausenblas; 2♂, 1♀, **Lebanon**, Beirut, 10.3.1961, leg. Vartian.

Description of adults. (Figs 6, 7). Forewing length: ♂ 2,7–3,5 mm; ♀ 2,9–3,6 mm. Head black-brown, vestiture of hair-like scales on the head dirty white to yellow; antennae dark brown, bronze golden shining, 3/4 (♂), slightly more than 1/2 (♀) respectively of forewing length; thorax bronze golden, posteriorly with single purple scales; tegulae whitish golden to golden, posteriorly with purple scales; forewings bronzy golden to coppery, reddish golden along costa and outer margin, with silvery white markings; a narrow fascia across the whole wing width at 1/5; a narrow, outwardly bent, sometimes interrupted fascia across the whole wing width at nearly 1/2; sometimes a small costal spot at 2/3; at 3/4 a narrow fascia across the whole wing width, broadening from costa onwards, interrupted beyond the middle; a very narrow, slightly inwardly oblique fascia reaching from costa to the outer margin (this fourth fascia sometimes missing); fringe bronzy golden, whitish outwards; hindwings bronzy golden with purplish tinge and bronzy golden, outwards brighter fringe; legs and abdomen dark brown, bright golden shining.



Figs 1–5. Habitat and *Micropterix* species in their natural environment. **1.** Habitat of *M. berytella* and *M. elegans* with *Cyclamen persicum* (photo by Zeller 2006). **2.** *M. berytella* feeding on pollen of *C. persicum* (photo by Schwartz-Tzachor 2006). **3.** *M. cypriensis* feeding on pollen of *Dactylorhiza romana* (photo by Thoma 2004). **4.** *M. elegans* feeding on pollen of *Cistus salviifolius* (photo by Schwartz-Tzachor 2009). **5.** *M. islamella* feeding on pollen of *Mercurialis annua* (photo by Schwartz-Tzachor 2006).

♂ Genitalia. (Fig. 11). Uncus moderately long and slender, with a spatulate tip; accessory claspers sledge-shaped and relatively large, weakly sclerotized with about ten moderately long and straight, stout and thickened setae at the ventral margin; additionally, beyond the accessory claspers two club-shaped lobes, with only one fairly long, stout and thickened seta; valve moderately long, slender, distinctly constricted beyond the middle; its distal third spoon-like enlarged and distinctly bent upwards; valve postbasally with three fairly long and stout setae at the inner surface, distal third with one or two rows of shorter, stout and thickened setae, as well as some longer setae.

Diagnosis. *M. cypriensis* has similar wing patterns, but it is distributed allopatrically, endemic to Cyprus. In Israel, the fourth fascia at the outer forewing margin of *M. berytella* is often missing. *M. berytella* specimens with interrupted fascia at 1/2 can be confused with *M. elegans*: *M. berytella* usually exhibits a fine, elongated fascia at 1/2, and therefore the vestiges of this fascia are more elongated and finer than those of *M. elegans*, which has more rounded spots at 1/2. For reliable identification, genitalic examination is needed.

Life history. *M. berytella* was found mainly on *Cyclamen persicum* (Figs 1, 2) and also on *Cistus salviifolius* L. (Cistaceae), feeding on pollen. This species inhabits the Mediterranean forest types "garrigue" and "batha", occurring sometimes syntopically with *M. elegans*. According to de Joannis (1888), the specimens investigated by him were found on bushes. The adults appear between January and April.

Distribution. Lebanon (Ghazir, Aley and near Beirut), Israel (northern Israel and Mount Carmel) (de Joannis 1886, 1888; Kurz et al. 2000–2009; Heath, unpublished manuscript) (Fig. 15).

Micropterix cypriensis Heath, 1985

Micropterix cypriensis Heath, 1985: 338–340. Type locality: Cyprus, Limassol, Yermasoyle. Holotype ♂: in coll. NHRS.

Material. 5♂, 28♀, **Cyprus**, near Paphos, 26.3.–2.4.1995, leg. Wimmer; 1♂, 3♀, **Cyprus**, Trodos mountains, Platres, 1200m, 8.5.1994, leg. Wimmer; 7 specimens, **Cyprus**, Akamas, Smigies, March 2004, observed by Thoma (see Fig. 3).

Description of adults. (Fig. 8). Forewing length: ♂ 2,5–3,6 mm; ♀ 2,8–4,0 mm. Head dark brown, vestiture of hair-like scales on the head dirty to rusty yellow; antennae dark brown, bronzy golden shining, 4/5 (♂), slightly more than 1/2 (♀) respectively of forewing length. thorax and tegulae bronzy golden, reddish to purple distad, proximad sometimes also silvery; forewings bronzy golden to reddish bronzy golden, purple to purple-violet at the apex and along the costal and outer margin (along the costa often only distad): forewings with silvery markings; near 1/4, a slender and straight fascia; a slender fascia at 1/2, slightly bent outwards; an elongated spot at 3/4 at the costal margin extending across the half wing width; near the apex, two small spots at the costal margin and at the outer margin, the posterior spot often larger and sometimes fused with the anterior spot, thus forming a fourth fascia (rarely one of these or both spots are missing); rarely an additional small costal spot near 3/5 may be present; fringe

Figs 6–10. Adults. **6**. *M. berytella* ♂. **7**. *M. berytella* ♀. **8**. *M. cypriensis* ♀. **9**. *M. elegans* ♂. **10**. *M. islamella* ♂.

golden, purple at its basis, whitish outwards; hindwings bronzy golden, especially apically with a strong purple tinge; fringe bronzy golden, lighter outwards; legs and abdomen brown, bronzy golden shining.

♂ Genitalia (Fig. 12). Uncus moderately long, flattened, broadened at its tip; tegumen slender; accessory claspers tennis racket-like shaped with a posterior row and an irregular group of short, stout and thickened setae at the inner surface; additionally, beyond the accessory claspers two large, irregular, weakly sclerotized and folded lobes with sharp edged tips and some irregular, stout and thickened setae; valves moderately long, distinctly constricted in the middle, spatulate at the tips; postbasally a small group of short setae at the inner surface, the spatulate end with an irregular row of moderately long, stout and thickened setae at the inner surface.

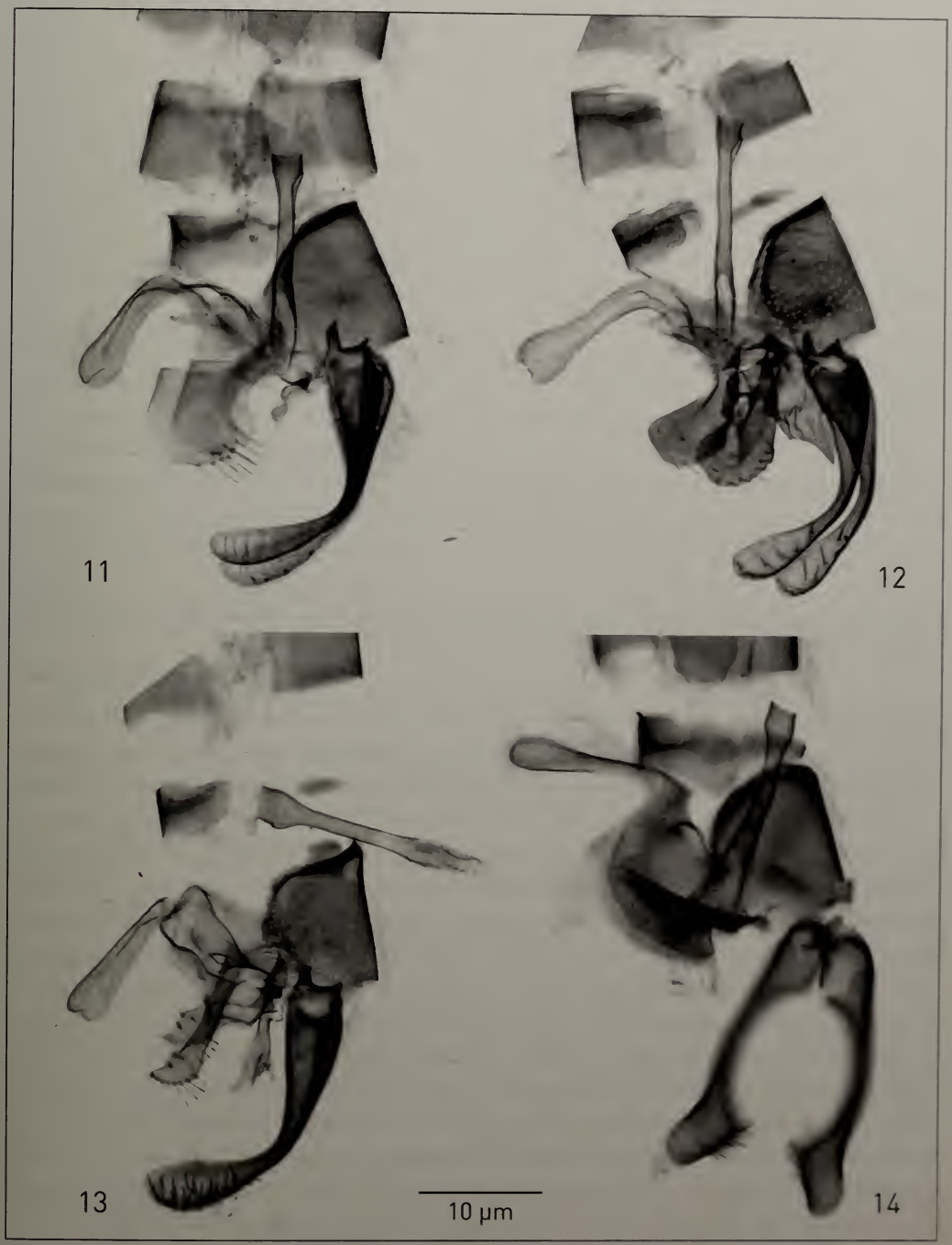
Diagnosis. *M. cypriensis* is the only species of this genus known from Cyprus.
Life history. *M. cypriensis* was found on *Dactylorhiza romana* (Seb.) (Orchidaceae) (Fig. 3). This species has been found in the margins of sparse pine forest with broom, *Cistus* and *Pistacia lentiscus* L. (Anacardiaceae) (Richard Thoma, pers. comm). The adults were found in March.
Distribution. Southern and western Cyprus (Troodos Mountains) (Heath 1996; Karsholt et al. 2004; Kurz et al. 2000–2009) (Fig. 16).

Micropterix elegans Stainton, 1867

Micropteryx elegans Stainton, 1867: 42. Type locality: "Hunen, Palestine" [?Wadi Hunayn, near Jerusalem, Israel]. Holotype ♂: in coll. BMNH.
Micropteryx octopunctella Amsel, 1935: 276. Type locality: "Tabgha, See Genezareth" [Lake Tiberias, Israel]. Junior subjective synonym.

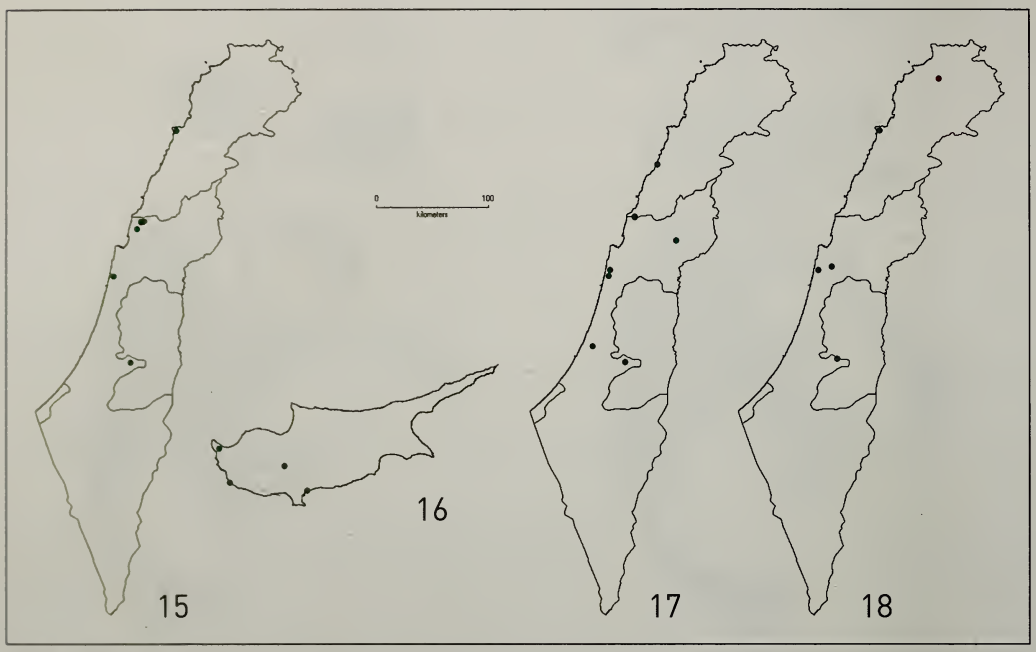
Material. 9♂, 5♀, **Israel**, Zichron Yaacov, Ramat Hanadiv, 125m, 24.–25.2.2006, leg. Hausenblas/Zeller; 1♂, 1♀ **Israel**, Zichron Yaacov, Fureidis, 30 m, 2.3.2006, leg. Hausenblas/Zeller; 4♂, 1♀ **Israel**, En Hemed, 100m, 1.5.1998, leg. Hausenblas; 7♀ **Israel**, Adamit, 200 m, 29.4.1998, leg. Hausenblas.

Description of adults. (Fig. 9). Forewing length: ♂ 2,5–3,1 mm, ♀ 2,7–3,3 mm. Head dark brown, vestiture of hair-like scales on the head dirty to brownish yellow; antennae dark brown, bronzy golden shining, 4/5 (♂), slightly more than 1/2 (♀) respectively of forewing length; thorax bronzy golden, tegulae silvery, bronzy golden distad; forewings bronzy golden, more or less reddish along costa and outer margin with silvery white, sometimes diffuse markings; at 1/5 an irregular diffuse spot in the middle of the wing, sometimes enlarged to a complete narrow fascia across the whole wing width; at 1/2, two spots at costa and inner margin each, not precisely opposite to each other; at 3/4, an inwardly oblique spot from costa to the middle of the wing; fringe bronzy golden, purple at the base, whitish outwards; hindwings bronzy golden, especially at the apex with a purple tinge; fringe bronzy golden, outwards brighter; abdomen and legs brown, golden shining.
♂ Genitalia. (Fig. 13). Uncus moderately long, slender, tip broadly rounded; accessory claspers relatively long and slender; near their tips three strongly modified, stout and thickened setae at the inner surface; about eight moderately long, more or less bent, stout and thickened setae at the anterior margin; additional, strongly irregular lobes beyond the accessory claspers, often folded, bearing a single, bent, stout and thickened seta; valves moderately long, stout, constricted in the middle, the distal third spatulate and somewhat bent upwards; postbasally two or three thickened as well as many normal setae at the inner surface; the distal third at the inner surface with a row of long setae as well as one or two irregular rows of short, straight, stout and thickened setae.
Diagnosis. *M. elegans* is sometimes similar to *M. berytella* (q.v.).
Life history. *M. elegans* was found mainly on *Cyclamen persicum* and also on *Cistus salviifolius*, feeding on pollen (Fig. 4). This species inhabits the Mediterranean forest types "garrigue" and "batha", syntopically with *M. berytella*. The adults appear between January and April.



Figs 11–14. ♂ genitalia. **11.** *M. berytella*. **12.** *M. cypriensis*. **13.** *M. elegans*. **14.** *M. islamella*.

Distribution. ?Syria (Meyrick 1912), Israel (Jordan valley, Lake Tiberias, northern Galilea, Mount Carmel and near Jerusalem), Lebanon (east of Saida) (Stainton 1867; Amsel 1935; Kurz et al. 2000–2009; Heath, unpublished manuscript) (Fig. 17).



Figs 15–18. Distribution maps. **15**. *M. berytella*. **16**. *M. cypriensis*. **17**. *M. elegans*. **18**. *M. islamella*. Red dot indicate supposed occurrence (see text).

Micropterix islamella Amsel, 1935

Micropteryx islamella Amsel, 1935: 276–277. Type locality: "Kirjat [Kiriath] Anavim" [near Jerusalem, Israel]. Type ♂: probably lost or destroyed in coll. SMNK (Kaltenbach in litt.). 1 Paratype ♂: "Kirjat [Kiriath] Anavim". Examined by J. Heath. In coll. UMB. (Heath, unpublished manuscript).

Material. 1♂, 1♀, **Israel**, Zichron Yaacov, Fureidis, 30m, 2.3.2006, leg. Hausenblas/Zeller; 7♂, 1♀, **Israel**, Yogne'am 'Illit, 180 m, 2.3.2006, leg. Hausenblas/Zeller.

Description of adults. (Fig. 10). Forewing length: ♂ 2,8–3,5 mm; ♀ 3,2–3,6 mm. Head black-brown, vestiture of hair-like scales on the head rusty yellow; antennae dark brown, bronze golden shining, 5/6 (♂), 4/7 (♀) of forewing length; thorax golden; tegulae bluish to violet; forewings violet to reddish violet, with coppery golden and golden markings: a bronzy golden fascia across the whole wing width at 1/5, from the tegulae to this fascia two small bronzy golden lines, one along the inner margin, the other directly in the middle of the wing; a golden fascia across the whole wing width in the middle slightly bent outwards and bronzy golden bordered, sometimes interrupted in the middle; at 3/4 a trapezoid golden spot inwardly directed and reaching the middle of the wing, also bronzy golden bordered; from this spot following the costa to the apex a narrow bronzy golden band recurrent along the tergal margin and broadening towards the spot; fringe bronzy golden; hindwings bronzy golden with purplish tinge and bronzy golden fringe; legs and abdomen dark brown, bright golden shining.

♂Genitalia. (Fig. 14). Uncus very long, slender, distally somewhat broadened with some hair-like setae, forming a separate, clearly distinguishable unit with accessory

claspers; between the uncus and the accessory claspers additional triangular-shaped lobes, more weakly sclerotized and only the distal tip visible; accessory claspers moderately developed and distally trapezoid shaped, distally with long, thickened setae, which have sickle-shaped ends, pointing caudal; valvae moderately long, stout, distally constricted at medial part, the distal ends golf club-like, enlarged and bent upwardly; distal fourth at the inner surface bearing 10 to 15 thickened straight, spinoid setae, clustered at the outer margin of the bend of the valvae.

Diagnosis. *M. islamella* can be easily distinguished from all other species in this region by the purple ground coloration of the forewings and more golden and diffuse spots and fasciae.

Life history. *M. islamella* was found in a forest of *Pinus brutia* Ten. (Pinaceae), feeding on pollen of *Mercurialis annua* L. (Euphorbiaceae) (Fig. 5), and at one locality occurring syntopically with *M. elegans*. A.S. Talhouk found this species abundantly on "peach" (Heath, unpublished manuscript).

Distribution. Israel (near Jerusalem and Mount Carmel), Lebanon (near Beirut and Aïn Jouaik [?Nabaa Jouaik, 70 km northeast of Beirut, indicated by a red dot on Fig. 18]) (Amsel 1933, 1935; Kurz et al. 2000–2009; Heath, unpublished manuscript).

Discussion

Compared to other genera in the family Micropterigidae, the genus *Micropterix* exhibits remarkably uniform male genitalic structures (Zeller et al. 2007: figs 2, 3 and p. 244). However, closely related species can easily be separated and even grouped using this character system.

For example, the similar male genitalic claspers and accessory lobes of *M. berytella*, *M. cypriensis* and *M. elegans* and also *M. sicanella* Zeller, 1847 (from Sicily) suggest a close relationship although *M. elegans* has the most distinctive accessory structures. The geographical proximity and restricted ranges of the first three species in particular (Cyprus, Lebanon and Israel) seems also consistent with them being part of a locally radiated clade. These three species exhibit distinctly divided male genitalia (dorsal part with uncus, tegumen and accessory claspers; ventral part with valvae and vinculum), accessory claspers with spinoid setae, which are not T- or Y-shaped, as well as stout valvae (Zeller et al. 2007).

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