

The genus *Zizyphia* Chrétien, 1908, with notes on its systematic position and the first record of *Z. cleodorella* Chrétien, 1908 from Europe (Lepidoptera, Depressariidae, Cacothroinae)

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Abstract. *Zizyphia cleodorella* Chrétien, 1908 is reported as new to Spain and Europe. The genus *Zizyphia* and the species *Z. cleodorella* is diagnosed and its separation from the closely related *Z. zizyphella* Amsel, 1935 is elaborated. The adult habitus and genital structure, and the species' habitat are illustrated. The systematic position of the genus is discussed. Because Orophiniinae Lvoovsky, 1974 is a secondary homonym of Orophini Thomson, 1863 (Coleoptera: Ciidae), and Cryptolechiinae is considered here as being unrelated to it, the name Cacothroini Leraut, 1993 is reinstated as a valid family-group name as Cacothroinae within Depressariidae (Gelechioidea), with Eutornini Lvoovsky, 2019, **syn. nov.** as a subjective junior synonym of Cacothroini.

Introduction

The genus *Zizyphia* Chrétien, 1908 was established based on its type species *Z. cleodorella* Chrétien, 1908 from Algeria. So far only one additional species *Z. zizyphella* Amsel, 1935 has been added to the genus. Since their description both species have only been mentioned a few times in the lepidopterological literature (Gerghiou 1977; Lvoovsky 2009; Lvoovsky et al. 2016; Christophides 2017).

During field work in October 2022 in southern Spain (province of Almería) Txema Revilla and Peder Skou independently collected specimens of a rather small, brownish gelechiid-looking moth, which turned out to be *Z. cleodorella*. The specimens represent the first record of this species, and its genus, from both Spain and Europe. It is a little-known species, with a rather confused history regarding its systematic position. We therefore find it justified to discuss and illustrate it, in order to make it better known.

Materials and methods

Specimens

The studied material of *Z. cleodorella* was collected in the El Toyo/Retamar area and on the slopes of the Sierra Alhamilla in the province of Almería, Andalucía, Spain. It was attracted to ultra-violet light (8W/12V tubes and 125W mercury vapour bulbs), installed in portable light traps (Olsen *et al.* 1984) or attached to a vertical frame covered in a white sheet. We also studied dry, pinned museum specimens deposited in the institutional collections listed below. Genitalia were dissected using standard methods and mounted on permanent slides, with Euparal as the mounting medium.

Abbreviations of collections

MZH Finnish Museum of Natural History, Helsinki, Finland

SMNK Staatliches Museum für Naturkunde, Karlsruhe, Germany

TxR Research collection of Txema Revilla, Berango (Vizcaya), Spain

ZMUC Zoological Museum, Natural History Museum of Denmark, Copenhagen, Denmark

Results

Diagnosis of Cacothroinae

We consider the genus *Zizyphia* to belong to Cacothroinae (Depressariidae) (see Discussion on systematics and nomenclature below). Members of Cacothroinae share the usual characteristics of Gelechioidea, i.e. the basally-scaled haustellum and long, upcurved labial palpi, the second segment of which is particularly long. They are relatively small and slender winged compared to most Depressariidae. The forewing pattern usually contains longitudinal and/or oblique stripes or bands, sometimes with raised scales or scale tufts. The scape of the antenna lacks pecten. The tergal segments of the abdomen lack areas covered by spines. The male genitalia either lack the uncus or it is vestigial, but they have a well-developed tuba analis. They usually have a gnathos that is mesially divided into a paired spinose knob, with *Cacochroa* and *Rosetea* Corley & Ferreira, 2019 being exceptions that lack the gnathos. The shape of the valva varies, but it often contains a curved lobe at the apex of the costa and/or the sacculus is distally separated. The lateral lobes of the juxta are prominent and sometimes very long. The phallus is pistol-shaped with a curved caecum, and is attached to the anellus, that can be membranous or sclerotized. The female genitalia of Cacothroinae have a telescopic ovipositor, but otherwise they vary considerably between genera, and seem not to have any particular shared features amongst all genera. The larvae of only few species are known, but at least some are leaf miners to begin with and then tie or roll leaves.

The male genitalia of *Cacochroa permixtella* (Herrich-Schäffer, 1854) are anomalous, compared to virtually all other species of Gelechioidea, in having an enormous-sized vinculum (cf. Corley and Ferreira 2019). The female genitalia are rather similar to that of *Zizyphia*, but the signum is more similar to that of *Rosetea*. Along with *Rosetea*, it also differs from others in not having a gnathos. It should be noted that the structure called the uncus by Corley and Ferreira (2019) for *C. permixtella* is actually the anellus that surrounds the phallus. The true uncus is vestigial and weakly sclerotized, situated dorsad of the more distinctive tuba analis. Even though *C. permixtella* has such distinctive features, it also shares characters with *Rosetea*, including the vestigial uncus and well-developed tuba analis, and divided valva, in addition to a markedly similar outer appearance.

It also has broadly separated valvae that are typical of other genera. Therefore, we consider *C. permixtella* a close relative of other genera treated here. However, discussion of the status or species composition of the established cacochoirine genera is beyond the scope of this publication.

Zizyphia Chrétien, 1908

Zizyphia Chrétien, 1908: 166. Type species: *Zizyphia cleodorella* Chrétien, 1908, by monotypy. Type Locality: Algeria; Meyrick, 1925: 36.

Diagnosis. *Zizyphia* adults externally most closely resemble those of some species of *Orophia* and the predominantly East-Asian – Australasian genus *Eutorna* in having a similar wing shape, with the forewings being relatively narrow. The wing pattern is also similar to that of several *Eutorna* species and *Orophia zernyi* (Szent-Ivány, 1942). The male genitalia of *Zizyphia* share with other cacochoirines the vestigial or entirely lacking uncus, the well-developed tuba analis, divided mesial knob of the gnathos, the bilobed valva and the broad vinculum. Note that in the genera *Cacochroa* and *Rosetea* the gnathos is absent. The knobs of the gnathos are significantly larger in *Zizyphia* than in other genera. This seems to be the only male genitalia character that separates *Zizyphia* from *Orophia*. Externally, the species in these genera are also fairly similar, with the apex of the forewing being somewhat more acute in *Orophia* than in *Zizyphia*. In their male genitalia, unlike in *Rosetea*, the costa of the valva is weakly sclerotized, and the sacculus is extended into a prolonged hook. The vinculum is broad, but not as long as in *Cacochroa*. In the *Eutorna* species examined (*E. leonidi* Lvovsky, one unidentified species from Australia, and another from New Zealand) the valvae are undivided. The females of *Zizyphia* differ from those of *Orophia* as follows: in *Orophia* the ductus bursae and the colliculum are narrow and elongate, being longer than the corpus bursae. The ductus bursae is otherwise not sclerotized. In *Zizyphia* the ductus bursae is broad and there is a separate, elongate sclerotization on its ventral side.

Remarks. Chrétien (1908) did not compare *Zizyphia* with other genera, but placed it next to *Holcophora* Staudinger, 1871, *Sophronia* Hübner, 1825) (both Gelechiidae) and *Holcopogon* Staudinger, 1879 (now Autostichidae: Holcopogoninae). Meyrick (1925) stated that he had not seen material of *Zizyphia*, but based upon its original description, he doubted that it was related to *Sophronia*.

Zizyphia cleodorella Chrétien, 1908

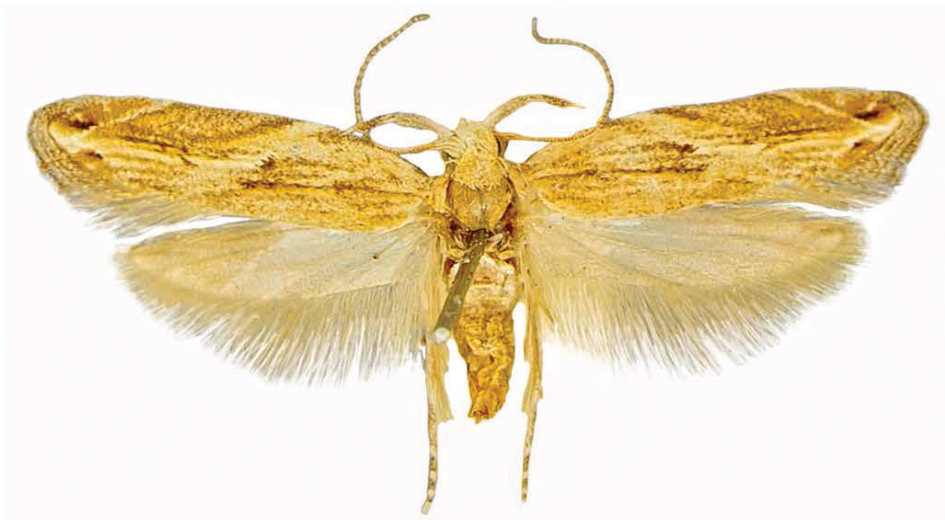
Zizyphia cleodorella Chrétien, 1908: 167; Meyrick 1925: 36; Mück 1985: 20, 163; Báez and García 2005: 87.

Examined material. Spain, prov. Almería, Sierra Alhamilla, 400 m, 1 ♀ 3/4.x.2022, leg. Tx. Revilla (TxR); prov. Almería, Retamar, 25 m, 1 ♀ 3/4.x.2022, leg. Tx. Revilla (TxR); same locality but 15 m, 3 ♂, 4/5.x.2022, 4 ♂, 2 ♀, 16.x.2022, P. Skou leg. (MZH, ZMUC).

Description (Fig. 1). Forewing brown, costal side broadly grey. Along basal 1/3 of wing length at centre, grey spot varying from small, dark grey and distinctive to indistinctly delineated grey area blended with the costal grey area. Along fold white, longitudinal stripes, irregular in number and strength. Near apex from costa to apex, oblique, white stripe; before apex black spot. In the male genitalia (Fig. 3) sacculus of valva separated from the rest, and terminating in a curved, sclerotized hook. Phallus short



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Figures 1, 2. *Zizyphia* adults. 1. *Z. cleodorella* Chrétien; 2. *Z. zizyphella* Amsel, holotype.

and broad, pistol-shaped with broad and bent caecum, with one long and another shorter cornutus, and near base comb-like dense group of spines. Female genitalia (Fig. 4) characterized by broad ductus bursae, with short and broad, sclerotized antrum, ductus bursae otherwise membranous; on ventral side of ductus bursae a conspicuous sclerotization, three times as long as broad. Ductus seminalis basally bulbous and situated in posterior end of corpus bursae; corpus bursae with one small, star-shaped signum.

Biology. The larva and pupa were described in detail in the original description (Chrétien, 1908), but the life history was only briefly summarized. The larva feeds during May on *Ziziphus* (probably *Z. mauritiana* Lam. or *Z. lotus* Lam.) (Rhamnaceae), afterwards descending to the ground to pupate. The adults emerge in June (Chrétien 1908) and October. Mück (1985: 20, 163) lists *Z. cleodorella* from *Ziziphus mauritiana* in the Cape Verde Islands, without a detailed locality, but it is unclear if this was based on personal observation.

The biotope where this species occurs in Spain is a sandy area with narrow, mobile dunes (Fig. 7), within the semi-arid thermo-Mediterranean climatic zone with high atmospheric humidity, where



Figures 3–6. *Zizyphia* genitalia. 3. *Z. cleodorella* Chrétien, ♂; 4. *Z. cleodorella* Chrétien, ♀; 5. *Z. zizyphella* Amsel ♂; 6. ♀. In the male genitalia images the anellus has been severed from the rest of the genitalia and is surrounding the phallus.

extensive formations of *Ziziphus lotus* (“azufaifo” in Spanish) occur, together with patches of annual grassland. *Tamarix* sp., *Ephedra* sp., *Ononis* sp., *Thymelaea* sp. etc. complete the markedly African botanical character of this landscape, distinctive of the Retamar area where *Z. cleodorella* occurs.

Distribution (Fig. 8). Algeria, Cape Verde Islands and Spain.

Remarks. *Zizyphia cleodorella* was described from an unstated number of specimens bred from larvae found in Biskra, Algeria.

Zizyphia zizyphella Amsel, 1935

Zizyphia zizyphella Amsel, 1933: 127 (nomen nudum); Amsel 1935a: 298, pl. 11, fig. 101; 1935b: 210; 1935c: 266; Gerghiou 1977: 198; Lvovsky 2009: 149–152, figs 1–2; Gozmány 2012: 348–349; Lvovsky *et al.* 2016: 108.

Examined material. Image of the holotype ♀ with labels: Jericho (Pal), 30.4.1930 H. Amsel (Lichtfang); Typus leg. H. Amsel; ex coll. H.G. Amsel (SMNK).

Examined paratypes: 1 ♂ with same collecting data as in holotype, but the collecting date 28.iv.1930; with labels *Zizyphia zizyphella* Amsel teste A.L. Lvovsky; L. Kaila prep. 6358 (SMNK); 1 ♀: Jericho Z.312 *Zyzyphus spina-christi* 4.5.; Palästina expedition 18.2.–14.6.1930 H.G. Amsel, L. Kaila prep 6359 (SMNK).

Diagnosis (Fig. 2). Similar to *Z. cleodorella*, but forewings paler ochreous brown with only a little grey along costa; near apex usually two inconspicuous dark spots (forewing in *Z. zizyphella* dark brown, costal side broadly grey, near apex one more prominent spot). Male genitalia (Fig. 5) similar to those of *Z. cleodorella*. The sclerotization in the female ostium+antrum is shorter and broader, and likewise, the ductus bursae is with shorter and broader sclerotization in *Z. cleodorella* (Fig. 6) than in *Z. zizyphella*. In *Z. cleodorella* the sclerotization is three times as long as broad, whereas in *Z. zizyphella* it is four times as long as broad.

Biology. According to the original description the type series was collected as larvae in late April and early May on *Ziziphus spina-christi* (L.) Willd., but according to a label on the holotype it was apparently collected at light. In the original description Amsel (1935a: 298) gave no details on the life history, but stated that the larvae were common. In another paper from the same year (Amsel, 1935c) he described the larva in some detail, stating that it lives in a boat-shaped leaf, which it skeletonizes. When disturbed it becomes very lively. Gerghiou (1977: 198) reported larvae being a leaf tier on leaves on *Paliurus* sp. (Rhamnaceae) in January and July–August, mentioning that these specimens had been identified by H. G. Amsel, the author of the species. According to Christophides (2017: 282), records of *Paliurus* from Cyprus refer to *Zizyphus lotus*.

Distribution (Fig. 8). Known only from the type locality Jericho (Palestine/Israel) and the southern shore of the Dead Sea (Amsel, 1935b: 210), and from Cyprus, but without an exact locality (Gerghiou 1977). *Z. zizyphella* was not included in Fauna Europaea (Karsholt and Nieukerken 2004–2023) although this website treats Cyprus as a part of Europe.

Remarks. The name *Zizyphia zizyphella* was first listed by Amsel (1933: 127) in a checklist of Palestinian Lepidoptera, but without a description. It was subsequently described by Amsel two years later (Amsel 1935a). In that publication the species was illustrated from a black/white photograph of low quality, making it look much darker than the holotype, which may in turn be bleached.

Although *Z. zizyphella* is similar to the other species of the genus, *Z. cleodorella*, Amsel (1935a: 298) wrote: “Mit keiner Art näher verwant” (Not related to any species).

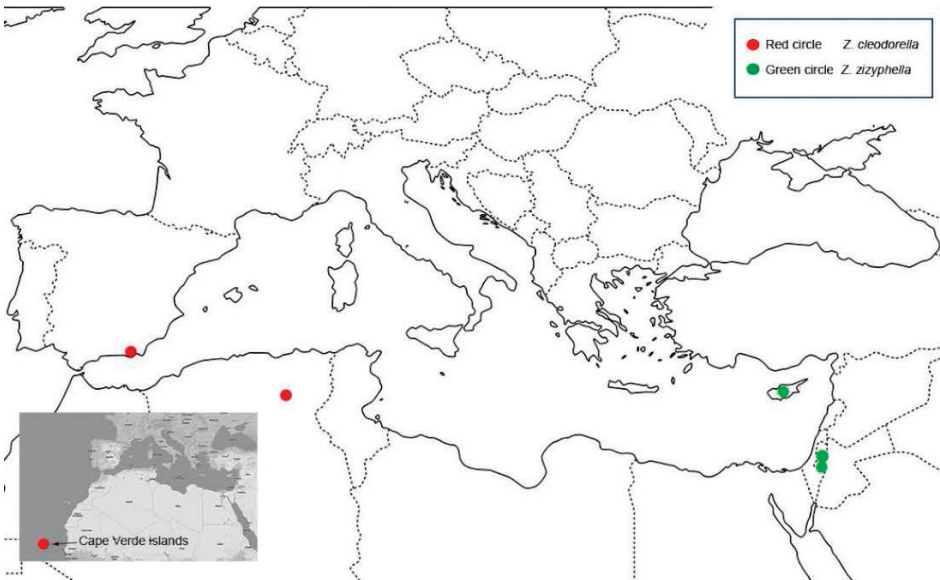
Zizyphia zizyphella was described within the Gelechiidae, and stayed there until Lvovsky (2009) transferred it into the Depressariidae (tribe Orophini). During a recent survey of the Gelechiidae of Israel (Bidzilya *et al.* 2019) no additional specimens were examined.

Discussion

The name of the genus *Zizyphia* refers to the host plant, from which the larvae of the type species, *Z. cleodorella* were found. *Ziziphus* is a genus of evergreen shrubs or medium-sized trees.



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Figures 7, 8. 7. Habitat of *Zizyphia cleodorella* Chrétien, Spain, province Almería, Retamar; 8. Distribution map of *Zizyphia cleodorella* Chrétien and *Z. zizyphella* Amsel.

Some species, e.g. *Z. mauritiana* and *Z. jujuba* (English: Jujube or Chinese Date), originating from South Asia, have been planted in other parts of the world, because they are edible (especially the fruits) and can survive in dry areas. Considering that they are grown for horticultural purpose, it is surprising that we have only been able to find little published information on the life histories and distribution of these two species. Therefore, *Z. cleodorella* may have expanded its distribution northward due to climate change rather than human activity.

With ongoing climate change and the consequent increase in temperatures, the distributions of “exotic species” are expanding to include regions that until recently did not provide suitable climates for them. The Spanish Mediterranean coast, affected by recent climate change, offers clear examples of such range shifts in the Microlepidoptera fauna, with recently recorded appearanc-

es of other species of Gelechoidea, e.g. *Batrachedra amydraula* Meyrick, 1916 (Batrachedridae) in Mojacar (Almería) in 2019 (Revilla and Gastón 2019), *Labdia semicoccinea* (Stainton, 1859) (Cosmopterigidae) in Motril (Granada) in 2022 (Olvera *et al.* 2022), and perhaps also *Xenotorodor stygioxanthus* Sterling, Lees & Grundy, 2023 (Lecithoceridae) near Tarifa (Cádiz).

Notes on systematics and nomenclature on Cacochroinae

Heikkilä *et al.* (2014) and Wang and Li (2020) preliminarily placed Cacochroinae (as Cryptolechiinae) in the family Depressariidae in their summary of the family classification of Gelechioidea. However, Heikkilä *et al.* (2014) discussed the possible distinctiveness of Cryptolechiinae and Cacochroinae, suggesting that *Cryptolechia* might belong to Lypusidae instead (p. 581). The name Orophini Lvovsky 1974, also used as the subfamily name Orophinae, based on *Orophia* Hübner, [1825], has occasionally been understood to include some or all of the genera *Eutorna*, *Orophia*, *Cacochroa* and *Zizyphia* (e.g. Tokár *et al.* 2005; Lvovsky 2009, 2012). Recently Corley and Ferreira (2019) added a new genus, *Rosetea*, to this group of genera. Orophinae was synonymized with Cryptolechiinae by Minet (1990), but because it is a junior homonym of Orophini Thomson, 1863 (Coleoptera: Ciidae) (Bouchard *et al.* 2011), it is unavailable. Lvovsky (2019) proposed Eutornini as a replacement name for Orophini. However, because these names have different type genera, Eutornini is not an objective synonym. The name Cryptolechiinae, (originally Cryptolechidae Meyrick, 1883, with the type species *Cryptolechia straminella* Zeller, 1852), has been widely applied to these genera (Minet 1990; Kaila 2004; Kaila *et al.* 2011; Heikkilä *et al.* 2014; Kim *et al.* 2016; Wang and Li 2020). The application of this name has, however, been inconstant. In addition to the name-bearing genus *Cryptolechia*, and the group here treated, it has also been used for Periacmini Lvovsky 2005, whose author originally considered it as a tribe within Amphisbatinae. Heikkilä and Kaila (2010) narrowed the concept Amphisbatidae, this name though proven to be a junior synonym of Lypusidae after inclusion of *Lypusa* (van Nieukerken *et al.* (2011), and excluded Periacmini. Periacminae is now a subfamily in Autostichidae (Wang and Li 2020). According to Heikkilä *et al.* (2014) *C. straminella* is likely related to Lypusidae, and not to Periacminae or the *Cacochroa* group of genera. We support the view that *C. straminella* (for images of the holotype, see http://www2.nrm.se/en/lep_nrm/s/cryptolechia_straminella.html) is not closely related to the genus group treated here, because of the different wing shape, the presence of a well-developed uncus, unilobed gnathos, and absence of lobes attached either laterad of juxta or the base of the valva. As the name Orophini is unavailable, and Cryptolechiinae is here considered as unrelated, the valid name is Cacochroinae. As we consider *Eutorna* and *Cacochroa* to belong to the same tribe, Eutornini Lvovsky, 2019, syn. nov. becomes a subjective junior synonym of Cacochroini Leraut, 1993.

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