Recent records of Noctuidae from Malta, with five species new to the European fauna, and a new subspecies

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Abstract. Recent records of Noctuoidea from Malta are given. Five noctuid species are recorded from Europe for the first time: *Eublemma conistrota* Hampson, 1910, *Eublemma deserti* Rothschild, 1909, *Anumeta hilgerti* (Rothschild 1909), *Hadula deserticula* (Hampson 1905), and *Euxoa canariensis* Rebel, 1902. New synonyms are stated: *Leptosia velocissima* f. *tarda* Turati, 1926, **syn. n.** and *Leptosia griseimargo* Warren, 1912, **syn. n.**, both synonyms of *Metachrostis velox* (Hübner, 1813); and *Pseudohadena* (*Eremohadena*) *roseonitens espugnensis* Lajonquiere, 1964, **syn. n.**, a synonym of *P.* (*E.*) *roseonitens roseonitens* (Oberthür, 1887). A new subspecies of *Xylena exsoleta* (Linneaus, 1758), *Xylena exsoleta maltensis* ssp. n., is established. The literature on Maltese Noctuoidea is reviewed and erronuously reported species are indicated. The revised number of Noctuidae (s.l.) recorded from the Maltese archipelago is 158. To date no Notodontidae have been recorded. For some species, some additional iformation is given on their life history and distribution. *Araeopteron ecphaea* (Hampson, 1914) is recorded for the first time from France (Corsica).

K e y w o r d s . Lepidoptera, Noctuoidea, Malta, faunistics, systematics, new subspecies, new synonyms, ecology.

Introduction

The Maltese Islands are a group of small, low-lying islands situated almost at the centre of the Mediterranean, from 35°48'28" to 36°0'0" N and 14°11'04" to 14°34'37" E. They are 92 km south of Sicily and 252 km north of the Libyan coast. The Maltese archipelago is composed of three inhabited islands, Malta (246 km^2), Gozo (61 km^2) and Comino (3 km^2) and a number of smaller, uninhabited islets and rocks. From the ecological point of view, the most important of these are Cominotto, Filfa, St. Paul's Island and Hagra tal-General.

Malta is the main island. The highest point is at Dingli, on the west side of Malta and is 253m above sea level. The island is tilted towards the southeast, with numerous harbours and creeks on the east side. Lakes and rivers are lacking and only a few permanent freshwater springs are to be found.

Geologically the Maltese Islands form part of the European plate. The rock which now is the Maltese archipelago was deposited under the sea during the Eocene, Oligocene and Miocene periods of the Tertiary epoch, some 35 million years ago. The Maltese Islands emerged from the sea about 7 to 5 million years ago, when the African plate pushed against the European plate. The islands are composed of sedimentary rocks, which except for the blue clay layer, are wholly limestone. (Pedley et al. 2002)

The Maltese climate is typically of the Mediterranean type, with mild, wet winters and hot dry summers. Annual rainfall is variable and the average for the last forty years is about 500 mm. Most of the rain (c. 85%) falls between October and March.

The period between April and September make up the dry season. The mean temperature for the last 45 years was 18.7 °C. The average for February, the coldest month is 12.36 °C, while that for August, the hottest month is 26.39 °C. The lowest temperature ever recorded was 1.4°C in January 1981 while the highest, 43.8 °C was recorded in August of 1999. Snow never falls. Relative humidity is generally high (65–80%) all the year round. Windy conditions are the norm. About 92% of the days of the year have a minimum of 1.85km per hour of wind. The prevailing wind is the the northwesterly wind or *mistral*.

The islands have been settled since Neolithic times. According to the National Statistics Office, the population in 2004 was 402,668 and the population density reached approximately 1274 inhabitants per km^2. These figures do not take into account the number of tourists who visit the islands every year. In the same year the estimated number of tourists who visited Malta was 1,127,407.

The natural vegetation of the Maltese Islands is dominated by the Mediterranean scrub communities of which the best representatives are the various types of garigue typical of rocky ground and characterized by such species as *Coridothymus capitatus, Anthyllis hermanniae, Teucrium fruticans, Erica multiflora* and the endemic *Euphorbia melitensis* (Lanfranco 1995). Garigue ecosystems, such as at Ras il-Pellegrin, Il-Kortin tal-Mellieha in Malta, and Ta' Cenc in Gozo, make up to about 10% of the natural environment. (Lanfranco 2002). In favoured situations, such as under cliff faces, scrub community occurs as maquis, with *Ceratonia siliqua, Olea europaea, Pistacia lentiscus, Rhamnus oleoides, Teucrium flavum, Prasium majus, Lonicera impexa, Smilax aspera, Acanthus mollis, Capparis orientalis* and others (Lanfranco 1995). Less than 3% of the natural environment is of this type (Lanfranco 2002).

No natural woods occur, although remnants of a few *Quercus ilex* woods, such as at Buskett, near Dingli, at Wardija and Mellieha still remain or are reduced to maquis. The semi-artificial woodland at Buskett is fairly characteristic of a Mediterranean evergreen wood (Lanfranco 1995). Wooded areas account to only 1.4% of the natural environment. (Lanfranco 2002).

Freshwater habitats are scarce in Malta, especially during the summer months. Permanent streams, such as at Wied il-Luq in Buskett, Wied tal-Bahrija in Bahrija and Wied il-Lunzjata in Gozo are dominated by plant communities comprising *Arundo donax, Cyperus longus, Holoschoenus vulgaris, Populus albus, Salix pedicellata, Ulmus canescens*, sometimes accompanied by *Laurus nobilis*.

Dune communities are even rarer and are largely degraded. These are characterized by species belonging to *Salicornia, Suaeda, Crithmum, Limonium, Phrgamites australis, Juncus acutus, Pancratium maritimum, Euphorbia, Salsola, Medicaga,* and others (Lanfranco 1995). Dune areas still exist at Ghadira Bay and Rdum il-Hmar in Mellieha, at Armier Bay in Malta and at Ramla in Gozo.

Agricultural land accounts for 46.8% while built up areas and roads account for 30.6% of the land area. Only about 20% is still in its natural state. (Schembri et al. 1998).

The fauna of the Maltese Islands, like its flora is numerous, varied and very interesting. Considering the insects alone, no less than 4200 species have been recorded so far from the Maltese Islands (Schembri 1996), of which about 600 species belong to

the Lepidoptera. There exists a large literature on Lepidoptera. The first mention of lepidoptera from the Maltese Islands is by De Reville (1750) of a larva feeding on the vine, later named by Stainton as *Antispila rivillei* in 1855. Notable summaries which contain references to Noctuidae include the contributions of Valletta (1950a, 1950b, 1951, 1955, 1973), DeLucca (1949, 1956, 1969), Sammut (1984, 1985, 2000) and Sammut et al. (2003). Other important contributions are those of Caruana Gatto (1905), Borg (1932), Boursin (1952) Berio (1976), DeLaever (1980) and Karsholt and Razowski (1996). Passim references on Noctuidae from Malta are also found in nearly all the volumes of Noctuidae Europaeae. So far 158 species of Noctuidae have been recorded from the Maltese Islands.

Being in close proximity both to Italy and Africa, Malta has also biologically served as a stepping stone for distribution of butterflies and moths from either south or north, and because Malta is among the southernmost islands of Europe (actually Crete is a little further to the south) it has drawn special attention for faunistists searching to find out the diversity and number of the total European fauna.

A short visit during early October of 2004 of the senior author and Mrs. Fibiger to Malta, gave us the opportunity to re-evalutate the noctuid material in the collections of the co-authors. These are the three major lepidoptera collections on the island, with approximately 9000 noctuid specimens between them (coll. Catania 2240 specimens, coll. Sammut 3900 specimens and coll. Seguna 3296 specimens). Three other sizeable collections, those of Jonathan Agius, Denis Magro and Michael Zerafa were also studied and findings are included also here.

It became evident from the start that some material represented new records for Malta and Europe. It was also evident that some species reported in literature were incorrectly determined or that a particular series contained two species. This was particularly so with some of the *Eublemma* species and the Caradrinini. These corrections are also included here. It was decided that species which needed determination by genitalia were to be further studied by the senior author at home in Søro. The object of this work is to describe the findings.

Material and Methods

This publication refers to Sammut (2000) and the more recently published records of Noctuoidea from Malta by Sammut et al. (2003).

The present paper will compile all records made by the authors and include the most remarkable here. Also records made by Bjarne Skule, Denmark in the spring of 2004, and Åke Selling, Sweden in late December 2003 are included.

For a correct identification of the material, genitalia preparations if necessary have been performed and material deposited at various museums has been studied.

Following, the species are listed systematically, according to Fibiger & Hacker (2005) and Lafontaine & Fibiger (in print). Unless otherwise indicated, all cited material has been collected at light, either in moth traps with 15W actinic lights or at 160W M.V. light.

Abbreviations

AC	coll. A. Catania
AS	coll. A. Seguna
AV	coll. A. Valletta
BMNH	The Natural History Museum London
BS	coll. B. Skule
coll.	Collection
DM	coll. D. Magro
EAS	coll. E. Åke Selling
e.o	bred ex-ova
JA	coll. J. Agius
MF	coll. M. Fibiger
M.V.	mercury vapour light source
NMNH	National Museum of Natural History, Malta
prep.	Genitalia preparation
PS	coll. P. Sammut
TMB	Termeszettudomanyi Musuem, Budapest
ZMUC	Zoological Museum, University of Copenhagen

Results

Noctuidae Latreille, 1809 s. l. (Lafontaine & Fibiger, in print)

Araeopteroninae Fibiger, 2005

***Araeopteron ecphaea* (Hampson, 1914)** **Fig. 1**

M a t e r i a l . Several specimens **Malta**, Bahrija, Wied tal-Bahrija, 8.vii.2000, 15.viii.2001, 6.vii., 5., 23.viii.2003, leg. Catania (AC); several specimens, Buskett, Wied il-Luq, 6.vii.2001, 10., 17.vii.2003, 6.vii., 2., 15.viii.2004, leg. Agius (JA), Catania (AC), Seguna (MF), Sammut (PS, EAS); Dingli, Dingli Cliffs, 13.vii.2001, leg. Sammut (PS); Rabat, Wied ta' l-Isqof, 11.vii.1999, 28.vi., 16.vii.2002, 28.vi.2002, 9.vii.2003, 8.ix.2004, leg. Agius (JA), Catania (AC), Sammut (PS), Seguna (AS).

This mainly afrotropical species appears to be quite common in Malta, especially in wet biota. It readily comes to light. It is known from Yemen, Nigeria, Congo, Malawi, Kenya, Tanzania, Namibia (Fibiger & Hacker 2001), Turkey, Egypt, Morocco, Greece (incl. Crete), southern Italy, mainland Spain and Mallorca (Fibiger & Agassiz 2001; Requena 2002), as well as Corsica (D. Nilsson & P. Skou, pers. comm.). The latter is the first record of this species from France.

Remarks. The recent discovery of *A. ecphaea* in Europe (Fibiger & Agassiz 2001) still raises some questions. Has the species had a surprisingly rapid spread to most of the Mediterranean area just recently or has it been generally overlooked by lepidopterists formerly? In general, there are not many records of species of the genus *Araeopteron* available yet, which might be due to the small size of these animals, which may have contributed that these species have often been overlooked.

Eublemminae Forbes, 1954

***Eublemma deserti* (Rothschild, 1909)** **Fig. 2**

M a t e r i a l . 1♂, **Malta** Pembroke, 13.xi.2003, leg. Seguna (AS), prep. Fibiger 5202.

To date only one specimen has been recorded from the Maltese Islands. Pembroke Ranges are very close to the sea and with a typical garigue vegetation. The specimen was collected at an actinic moth trap.
The type species, a male, labelled, Algeria, Mraier, 105 km south of Biskra, 17.iv.09 (W. R. & E. H.), is in the BMNH collection. This taxon resembles *Eublemma debilis* Christoph, 1884, which is described from the Achal-Tekke region in southern Turkmenistan. A colour photo of a possible *E. debilis* from Syria, 20 km NE of Damascus, is illustrated by Hacker (2001). The name of the Maltese specimen becomes even more dubious as Staudinger (1901) established the taxon *Thalpochares* (today a synonym of *Eublemma*) *debilis* var. (= subspecies) *deleta* Staudinger, 1901, which has as the type locality Algeria, Biskra. However, if *E. debilis* is not conspecific with *E. deserti*, the correct name for the Maltese specimen could very well be *E deleta*. Two more names need to be considered: *E. purulenta* (Turati, 1926), described from Libya, Oasi de Augila, and *E. purinula* (Turati, 1926) from Libya, Oasi dei Carcura. Judging from the relatively good black and white photos by Turati (1926) they are probably both synonyms of *E. deserti*; however, the types are not included by Berio (2002), and could also not be traced elsewhere. If these five taxa are identical, this report does only concern a very interesting record, not a new species to Europe, because two male specimens of *E. debilis* are reported from Crimea in the Ukraine, and from Sarepta in Russia respectively (Fibiger & Hacker 1998). But because the *E. siticulosa* species-group, to which *E. deserti* and *E. debilis* belong, is so difficult to determine, and because the species therein are so many and variable, the true identity cannot be stated before all the species have been revised. In the European list (Fibiger & Hacker 2005) it should be placed after *E. debilis* (Christoph, 1884).
New record to the fauna of Europe.

Eublemma conistrota Hampson, 1910 **Fig. 3**

M a t e r i a l . 1♀, **Malta**, Pembroke, 22.iv.1990, leg. Catania (AC), prep. Fibiger 5201.

The only specimen recorded so far from the Maltese Islands has been collected at M.V. light. The type specimen, a male, is recorded together with a female from Pakistan, Belochistan, Quetta (BMNH). These two specimens have been studied, and resembles well the Maltese specimen.
However, this species belongs to a complex of *Eublemma* species, which are very similar to each other and still need taxonomic revision. These species are *E. subvenata* (Staudinger, 1892) from Tunisia; *E. albivestalis* Hampson, 1910 from Israel, Chor el Sueme; *E. albidior* Rothschild, 1915 from Algeria; *E. cremorna* (Hampson, 1918) from Tunisia, Tozeur; *E. deserta* (Staudinger, 1900) from Algeria, Biskra; *E. ernesti* Rothschild, 1915 from Algeria, Qued Vaa; *E. lacteola* Rothschild, 1914 from Algeria, Guelt-Es-Stel; *E. nucha* Strand, 1917 from Iran, Schahrud; *E. pernivea* Rothschild, 1920 from Algeria, Ain Sefra and *E. uniformis* (Staudinger, 1878) from Iran, Schahrud. Here, we are attributing the Maltese specimen to *E. conistrota*. In the European list (Fibiger & Hacker 2005) it should be placed after *E. pallidula* (Herrich-Schäffer, 1856).
New record to the fauna of Europe.

Metachrostis velox (Hübner, 1813) Figs 4–5

= *Leptosia velocissima* Turati, 1926
= *Leptosia velocissima* f. *tarda* Turati, 1926, **syn. n.**
= *Leptosia griseimargo* Warren, 1912, **syn . n.**

M a t e r i a l . 3 exp. **Gozo**, Xaghra, 14.ix.2005, leg. Catania (AC); **Malta**, Attard, Wied Qirda, 30.vi.1989, leg. Catania (AC); Buskett, 6.vii.2001, leg. Sammut (PS); Mellieha, Il-Kortin, 10.x.2004, leg. Borg-Barthet (PS); Pembroke, 26.x.1989, 25.iv.1990, 29.ix.2004, leg. Catania (AC); Rabat, 29.x.1973, viii., ix., x., xi.1981, 26.x.1983, 10.x.1990, 13., 25.x.2001, 10.vi., 21.x.2003, 17 viii.2004, 28.x.2005, leg. Agius (JA), Catania (AC), Sammut (PS); Rabat, Wied il-Qlejja, 09.vii.2003, leg. J. Agius (JA); Zurrieq, 4.ix.2003, leg. J. Agius (JA).

Poole (1989) has erroneously placed the taxon *Leptosia velocissima* in the genus *Eublemma* Hübner, 1821. *M. velox*, is sexually dimorphic: the male is lighter, greyish-beige, and the female is darker, even reddish brown. Through the help of M. Honey (BMNH) syntypes of *M. velocissima* were found in the museum. The abdomen of two of the specimens were dissected (male: prep. Fibiger 5227; female 5228), and they showed a clear match with *M. velox*, and with the drawings of the right valve of the male genitalia of the lectotype designated by Berio (2002). Further, investigation of the type specimen of *Metachrostis griseimargo* (Warren, 1912), **syn. n.** (BMNH) revealed synonymy of this taxon, as it is only a colour form of *M. velox*.
Among the Maltese specimens was a single peculiar male, recorded 19.ix.2000, smaller than *M. velocior*, but larger than *M. velox*, and with a wing pattern more like *M. velocior* than of *M. velox*. As its genitalia (Fig. 5) is almost intermediate between *M. velocior* and *M. velox*, it could presumably be a hybrid specimen.

Metachrostis velocior (Staudinger, 1892) Figs 5–6

M a t e r i a l . **Gozo**, Xaghra, 14 ix 2005, leg. Catania (AC); **Malta,** Bahrija, 2.vii.1991, 3.viii.2001, leg. Catania (AC), Seguna (JA); Bahrija, Fomm ir-Rih, 4.ix.2001, leg. Sammut (JA); Bahrija, Wied tal-Bahrija, 5.viii.2003, leg. Sammut (PS); Delimara, 22.vi.2001, leg. Sammut (PS); Dingli, Dingli Cliffs, 22.vi.1989, 30.v., 27.vi.1995, 10.v.1997, 13.vii.2001, 10.vi.2003, ix., 16.x.2004, leg. Agius (JA), Catania (AC), Sammut (PS), Seguna (AS); Gharghur, 28.vi.1995, leg. Seguna (AS); Marfa, 25.vi.1994, 28.x.2004, leg. Seguna (AS); Mosta, Targa Gap, 10.vi.1986, leg. Sammut (PS); Mtarfa, 9.vi.1991, leg. Sammut (PS); Naxxar, 5.vi.1995, 19.iii.1997, 20.ix.2004,leg. Seguna (AS); Paradise Bay, 18.v.1997, 15.v.1999, leg. Sammut (PS), Seguna (AS); Pembroke, 22.v.1989, leg. Catania (AC); Rabat, 11.vii.1999, 16.vii.2001, 10.vi.2003, 29.vii 2004, leg. Sammut (PS); Rabat, Dwejra, 2.vi.1994, 25.vi.1999, 21.vii.2003, leg. Sammut (PS), Seguna (AS); Siggiewi, Ghar Lapsi, 16.vii.1999, leg. Sammut (PS); Zurrieq, 28.xi.2003, leg. Agius (JA); Qrendi, 14.x.2004, leg. Agius (JA).

The species has been illustrated by Sammut (2000: fig. 343) as *M. velox*. *M. velocior* is considerably larger than *M. velox*: 20–24 mm against 18–20 mm. It can not be excluded that the records of Anthony Valletta and Carmelo DeLucca for *M. velox* refer to this species. *Metachrostis velocior* has not been recorded by either Valletta or DeLucca. It flies in one generation from June to July, whereas *M. velox* has two generations, one in late spring and one in autumn. New record to the Maltese fauna.

Catocalinae Boisduval, 1828

Dysgonia torrida (Guenée, 1852)

Both a common migrant on Malta and resident, feeding on *Ricinus communis*. The inner crossline is smoothly bent in *D. torrida*, that of the sister-species *D. algira* (Linneaus,

1967) which is more common on Malta, has the inner line slightly angled midially, and the whitish band on the hindwing is narrower than that of *D. torrida*. Larvae of this latter species have been bred on *Rubus fruticosus* and *Punica granata*.

***Anumeta hilgerti* (Rothschild, 1909)** **Figs 7–9**

M a t e r i a l . **Malta,** ♂ Pembroke 10.vi.1991, leg. Catania. (AC), prep. Fibiger 5175; 1♀ same data (AC).

A. hilgerti is illustrated by Sammut (2000: fig. 316) as *Anumeta cestis* (Ménétriés, 1848). However, *A. cestis* occurs neither in Europe nor on Malta. It occurs in South East European Russia, e.g. the dunes by the northern Caspian Sea (Goater et al. 2003). *A. hilgerti* is described from Algeria, southern Sahara, Bdj. Ferdjan, where it occurs sympatrically with *A. cestis*. It is a Saharo-Arabian species, distributed throughout the desert zone of North Africa from Morocco to Egypt and all of the Arabian Peninsula (Rungs 1981; Wiltshire 1990). In the European list (Fibiger & Hacker, 2005) it should be placed after *Anumeta cestis* (Ménétriés, 1848). New record to the fauna of Malta and Europe.

***Autophila maura* (Staudinger, 1888)**

M a t e r i a l . **Malta**, 1♀ Mriehel, 17.iii.1949, leg. Valletta (AV); 1♂ Valletta, 15.iv.2004, leg. Agius (JA).

This North African species is known from Europe only from these two Maltese specimens. Its larva is known to feed on *Genista* sp. and *Ulex europeus* (Valletta 1973). These two species are not indeginous in the Maltese Islands and if they exist, they do so in very small numbers in public or private gardens. The specimen recorded by Valletta was taken from under a lamp-post while that recorded by Agius was found on a door step, also attracted to street light. These two specimens are the only *A. maura* observed from Europe.

***Autophila rosea* (Staudinger, 1888)**

M a t e r i a l . **Malta**, Hamrun, 25.ii.1981, leg. Seguna (AS); Mellieha, Mellieha ridge, Red Tower area, 80 m., 9.iv.2004, Skule leg (BS); Pembroke, 29.xi., 24.xii.1991, leg. Catania (AC); Rabat, 15.ii.2002, 15.xii.2003, leg Sammut (PS); Ta' l-Ibragg, 6.xi.2004, leg. Catania (AC); Zebbug, 4., 8., 13.xi.2004, leg. Catania (AC).

This south Mediterranean species has been recorded from Sicily and Malta (Goater et al. 2003: 138). Outside Europe it is common in the Canary Islands and North Africa. Some specimens of *A. dilucida* (Hübner, 1808) are difficult to distinguish from specimens of *A. rosea*, so a genitalia preparation is often needed (see Goater et al. 2003). Because it has not been possible to find more specimens the occurrence of this species in the Maltese Islands is believed to be a result of migration from North Africa.

***Pandesma robusta* (Walker, 1858).**

The species is now common everywhere in Crete, Greece, Malta, Sicily, southern Italy, and on the southern Iberian peninsula. The records from Malta are numerous and the species is widely distributed on the island.

Plusiinae Boisduval, 1829

***Thysanoplusia circumscripta* (Freyer, 1831)**

M a t e r i a l . No material available.

This species has been recorded from Malta by Goater et al. (2003), but it was so far impossible to trace any voucher specimens from Malta.

Cuculliinae Herrich-Schäffer, 1850

***Cucullia syrtana* (Mabille, 1888)**

M a t e r i a l . **Malta**, 1♂ Mriehel, 3.xi.1948, leg. Valletta (AV); 1♂ Naxxar, 8.iii.2002, leg. Sammut (PS).

The record by Sammut from Naxxar is the second specimen of this North African species for the Maltese Islands. Boths specimens have been taken at light. Beside these two records, one more European specimen is recorded from Greece (Ronkay & Ronkay, 1995). *Cucullia* species are most often not attracted to light, but much easier to observe while they visit flowers in the dusk and dawn, flying like a humming-bird when they are nectaring. They are good and fast flyers.

***Cucullia biskrana* (Oberthür, 1918)**

M a t e r i a l . **Malta**, 1♂ Mriehel, 6.xii.1950, leg. Valletta (AV); 1♂ Rabat, 18.xi.1983, leg. Sammut (PS).

No further specimens of this species have been recorded. It is still unrecorded from elsewhere in Europe.

Heliothinae Boisduval, 1828

***Schinia scutosa* ([Denis & Schiffermüller], 1775)**

This species is known from Malta from only four specimens. It has been recorded from two specimens collected from Mriehel in July and August 1953 (leg. A. Valletta); further from Naxxar in October 1981 (leg. Alfred Zerafa); and from Pembroke in May 1990 (leg. A. Catania). It has been illustrated by Valletta (1973: pl. 11) and Sammut (2000: fig. 356). The record from Naxxar is a new record.

Bryophilinae Guenée, 1852

***Cryphia (Bryophila) domestica* (Hufnagel, 1766)**

The specimen figured by Sammut (2000) was borrowed from a European museum as *C. domestica*. However, it is a specimen of *Nycteola degenerana* (Hübner, 1799). *C. domestica* is reported by a few specimens from Birkirkara and Naxxar (Valletta 1973). The presence of this species from the Maltese Islands is considered doubtful.

Xyleninae Guenée, 1837

Caradriniini Boisduval, 1840

***Caradrina* (*Eremodrina*) *vicina castrensis* Berio, 1981** **Fig. 10**

M a t e r i a l . **Malta**, 1♀ Bahrija, Wied tal-Bahrija, 15.viii.2001, leg. Seguna (AS), prep. Fibiger 5194.

This species was erroneously reported from Malta by Valletta (1973), but it was actually due to a misidentification of a specimen of *Cryphia raptricula* ([Denis & Schiffermüller], 1775) (Sammut 2000). Now it can be stated that one female specimen was recorded on Malta. The identification was possible through the large, excellent *Caradrina* revision by Hacker (2004). *C. vicina* occurs as four subspecies: subsp. *vicina* Staudinger, 1870 (also illustrated in fig. 10) from SE Russia, Kazakhstan, Turkey, Armenia, Kirghizstan, Turkestan, and Iran; the more greyish, suffused with blackish scales, subsp. *castrensis* Berio, 1981 from northern and central Italy, and now also Malta; subsp. *rosea* (Boursin, 1936) from Lebanon and Israel; and subsp. *hunza* (Hacker, 1992) from Pakistan, Tadjikistan, and Afghanistan. It is new to the Maltese fauna.

***Caradrina* (*Platyperigea*) *proxima* (Rambur, 1837)** **Fig. 11**

M a t e r i a l . **Malta**, Dingli, Dingli Cliffs 10.v.1997, leg. Seguna (AS).

A single specimen has been recorded from Malta; it seems to be a migrant. *C. proxima* is known from S France, just north of the eastern Pyrenean range, Iberian Peninsula and the Baleares, Morocco, Algeria, Tunis, Sardinia and Sicily. Its eastern vicariant species *C. kadenii* (Freyer, 1836) is spreading rapidly towards the north-west, and occurs in south-eastern France, England, south-west Germany, Switzerland, Austria, the north-east Iberian Peninsula, Corsica, Italy incl. Sardinia, all Balkan countries, Romania, Ukraine, Caucasus, Transcaucasus, Tyrkey, Cyprus, Iran, and the middle East. It occurs on Sardinia and Sicily sympatrically with *C. proxima*. New for Malta.

***Caradrina* (*Platyperigea*) *germainii* (Duponchel, 1835)**

This species has always been recorded from the Maltese Islands as a rare or even very rare species. It was first recorded by Anthony Valletta (1950a) from a specimen taken at light from Birkirkara on October 23, 1943. He adds that it was commom during October of 1948 and that he took another specimen on September 27, 1950. In his other paper, (1950b) he writes that he took 3 specimens during October 1949. It has now been recorded on numerous occasions, always in October, from various localities around Malta mostly from garigue habitat.

***Caradrina (Paradrina) seleni djebli* Rungs, 1973** **Fig. 12**

M a t e r i a l . **Malta**, 2♂, 2♀, Mellieha, Ghadira Bay, at the Red Tower, Marfa Ridge, 80 m, 5.–11.iv. 2004, leg. Skule (BS); Mellieha, Mellieha Bay Holiday Centre, 25 m, 5.–11.iv.2004, leg Skule (BS); 5♂, 3♀, Hamrun, 25.ii.1981, leg. Seguna (AS); Rabat, 2.iv.2004, leg. Sammut (PS), prep. Fibiger 5229.

Several specimens of *C. seleni* are recorded in subspecies *djebli* Rungs, 1973, which is previously unknown from Europe. Its main occurrence is in north-west Africa. The nominotypical subspecies is known from almost all of Europe, also from Sicily. In north-east Africa another subspecies of *C. seleni* occurs: *mairei* Draudt, 1909 (Hacker, 2004). New to the Maltese fauna.

***Hoplodrina blanda* (Denis & Schiffermüller, 1775)**

The illustration in Sammut (2000, fig.364) of this species is actually only a dark, weakly marked specimen of *Xestia xanthographa* ([Denis & Schiffermüller], 1775). *Hoplodrina blanda* is therefore to be removed from the list of Maltese Noctuidae.

***Chilodes maritima* (Tauscher, 1806)**

This species was listed as new to Malta by Sammut et al. (2003); a closer examination has shown that the figured specimen is a somewhat aberrant specimen of *Proxenus hospes* (Freyer, 1831). *Chilodes maritima* is therefore to be removed from the list of Maltese Noctuidae.

Apameini Guenée, 1841

***Denticucullus pygmina* (Haworth, 1809)**

Material. **Malta**, 1♂ Bahrija, Wied tal-Bahrija, 10.x.2003, leg. Agius (JA); 1♂ Gnejna, 28.x.2004, leg. Sammut (PS).

This Euroasiatic species has a wide distribution in Europe. Outside Europe, it is known from western Siberia, Turkey, north Iran and the Caucasus region. (Zilli et al. 2005) The species is associated with wet biotas where *Carex* sp, and Juncaceae species occur, on Malta e.g. the marshy and boggy area near Bahrija and Gnejna, from where the only two Maltese specimens have been recorded. New to the fauna of Malta.

Xylenini Guenée, 1837

***Xylena exsoleta maltensis* subsp. n.** **Figs 13–14**

Material. Holotype: ♂, **Malta**, Rabat, 27.i.2006, leg. Sammut, coll. NMNH. – Paratypes: 1♀, **Gozo**, Nadur, 29.xii.2005, leg. Agius; 1♀, **Malta**, Attard, 24.i.1988, leg. Catania; 1♂, Benghisa, 10.i.1972, leg. Valletta; 5♂, Birkirkara, 27.i., 25.xi.1972, 10.xii.1973, 9.ii.1975, leg. Berry; 1♀, Birzebbugia, 5.i.1970, leg. Sammut; 1♂, Buskett, i.1982, leg. Sammut, prep. Fibiger 5178; 1♂, 1♀, Gzira, 9., 18.i.1989, leg. Catania; 1♂, Hamrun, 1.v.1985, leg. Seguna; 1♂, Kirkop, 14. xii. 2004, leg. Magro; 1♂, Mriehel, 4.i.1957, leg. Vallatta; 10♂, 8♀ Naxxar, 6.i.1984, xii.1987, 5., 13., 19.i.1988, 15., 26.i.1989, 3.i.1990 (e.l.), 25.xii.1993, 4.ii., 4.xii.1997, 19.ii., 20., 23.xii.2000, 13., 16., 17., 18.i.2001, 9.vii.2004, leg. Sammut, Seguna, A. & M. Zerafa; 5♂, 1♀, Pembroke 23.ii., vi.1989, 13., 15., 22.i.1991, leg. Catania, Sammut; ♂, Qormi. Wied il-Kbir, 12.i.1988, leg. Seguna; 1♂, Qrendi, Il-Maqluba, 3.i.2003, leg. Magro; 13♂, 6♀, Qrendi, San Niklaw, 1., 6., 7., 15.xii.2000, 5., 8., 22., 27.xii.i.2001, 10.xii.2003, 28.i.2004, leg. Magro; 5♂, 15♀, Rabat, 20.i.1970, 12.xii.1975, 16.xi., 16.xii.1981, ix.1988, 12.i., 6.ii.1992, 12.i.1993, 15.ii.2002, 23.iv.2003, 12.ii., 3.xii.2004, 12., 27.i.2006, leg. Sammut; 1♂, Safi, 28.xi.2003m leg. Agius; 1♀, Valletta, 4.xii.1988, leg. Catania; 2♂, 2♀, Zabbar, 23.xi.2000, 24., 26.xi.2002, leg. Agius; 1♀, Zebbug 29.xi.2003, 20.x.2005, 1.i.2006, leg. Agius, Catania; colls BMNH, A. Catania, M. Fibiger, NMNH, G. Ronkay, TMB, P. Sammut, A. Seguna, Å. Selling, and B. Skule.

Xylena exsoleta (Linneaus, 1758) is widely distributed throughout Europe, even from localities at sea-level in both North and South Europe. However, the populations from Malta and North Africa are different, both superficially and by the male genitalia. The everted vesica and female genitalia show no differences between these two subspecies.
Xylena exoleta maltensis ssp. n. differs from the nominotypical subspecies by both fore and hindwings being conspicuously narrower and more pointed at the apex, and with lighter brownish colouration. In the genitalia the uncus is narrower; the sacculus more triangular; the two costal processes are longer; the ampulla is longer; and the juxta, in which the outer sides are parallel, is ventrally broader.
The larva of *Xylena exoleta maltensis* subsp. n. is polyphagous on the flowers of a variety of plants. In the wild it has been found on the flowers of *Hedysarum coronarium* L., (Fabaceae), a widely cultivated fodder crop, *Chrysanthemum coronarium* L., (Asteraceae) and *Gladiolus italicus* Mill., (Iridaceae). The latter two species are very common and widely distributed in the Maltese Islands. Valletta (1973) reports the Maltese subspecies feeding on broad-beans (*Vicia faba*) and kolh-rabi (*Brassica oleracea*).
The larvae usually hatch in January, feed rapidly, and by the end of March are fully grown. Mature larvae bury themselves underground and aestivate all summer, for half a year. With the first autumn rain, they pupate. Adults are usually on wing from early December till early February. According to our studies adults recorded during other times of the year result from pupae which received out-of-season rain.
The species is widely distributed in Malta and Gozo, and is frequently attracted to both artificial light and sugar baits.

***Aporophila nigra cinerea* Staudinger, 1901** **Fig. 15**

M a t e r i a l . **Malta**, 1♂, Zebbug, 2.xi.2000, leg. Catania (AC) prep. Fibiger 5222.

This male specimen was published and illustrated as *Aporophila australis* Boisduval, 1829 (Sammut et al. 2003) as new to the Maltese fauna. However, genitalia preparation has confirmed that it is actually the first European record of subsp. *cinerea* of *A. nigra*, which is widely distributed in Tunisia and Libya. Both *A. nigra* and *A. australis* are geographically widely known from Europe, the latter often in a large diversity of different colour forms (see the ten different forms illustrated in Noctuidae Europaeae, pl. 14 (Ronkay et al. 2001). However, *A. nigra cinerea* can always be seperated from *A. australis* by the presence of a black basal streak of the latter. This information is not expressively stated in Ronkay et al. (2003) and could well lead to reports of more *A. nigra cinerea*, especially from southern Italy and Greece. A genitalia preparation will easily confirm a correct determination; even brushing off the scales from the male abdomen, will show the different shape of cucullus. This subspecies has not previously been recorded from Europe.

***Pseudohadena* (*Eremohadena*) *roseonitens* (Oberthür, 1887)** **Figs 16–18**

M a t e r i a l . **Malta**, 1♂ Dingli, Dingli Cliffs, 10.v.1997, leg. A. Seguna leg. (AS) genit. Prep. 5174 M. Fibiger.

This single male specimen from the Maltese Islands represents the ninth specimen from Europe, all the other eight European specimens are recorded from two localities in southern Spain: three specimens from Sierra Espuna, Alhama in the province of Murcia, and five specimens from Mini Hollywood near Tabernas in the province of Almeria. The first specimens resulted in the description of subsp. *espugnensis* Lajonquiere, 1964. An examination of specimens from Spain, North Africa, and Malta shows no structural or superficial differences which could support a distinct subspecies and the taxon is therefore synonymised, **syn. n.** The species is not a rarity in Morocco, Algeria, and Tunisia, so whether the Maltese specimen is from a local population or it is an occasional migrant from North Africa only the future can show. The moth over-winters, and occurs from late October to May.

Hadeninae Guenée, 1837

Hadenini Guenée, 1837

***Hadena capsincola* ([Denis & Schiffermüller], 1775)**

M a t e r i a l . Several specimens. **Malta**, Birzebbuga, Wied Dalam, 14.iv.1992, leg. Seguna (AS); Gharghur, 10.v.1985, 17.iv.1986, 7.iv.1987, 24.iv.1992, 31.v.1997, leg. A. Seguna (AS); Naxxar, 11.v.1997, 27.iv., 11.v., 5.vi., 13.x.1998, 20.iii., 28.iv.1999, 20.iv., 27.x.2000, 2., 20., 23.iv.2001, 30.v.2002, leg. Seguna (AS); Pembroke, 6.vi.1990, 14.iv., 16.v.1991, 24.iv.1992, leg. Catania, Fibiger (AC); Rabat, 10., 15.v.1984, 29.vi.1992, 2.vi.1994, 31.iii.2002, 3.iii.2004, leg. Sammut (PS), Seguna (AS); San Pawl tat-Targa, 10.v.1086, leg. Sammut (PS), prep. Fibiger 5199; Zebbug, 1.x.2004, leg. Catania (AC); Zebbug, Wied il-Kbir, 6.iv.1986, leg. Seguna (AS).

This species has erroneously been listed by DeLucca (1969), Valletta (1973), Karsholt & Razowski (1996) and Sammut (2000) as *Hadena bicruris* (Hufnagel, 1766). This species is also illustrated in Valletta (1973) and Sammut (2000). *Hadena capsincola* is a new record for the Maltese Islands. *Hadena bicruris* (Hufnagel, 1766) is hereby cancelled from the Maltese list.

***Anarta* (*Aglossestra*) *deserticola* (Hampson, 1905)** **Fig. 19**

M a t e r i a l . **Malta**, 1♂ Kirkop, 16.xi.2004, leg. Magro (DM).

Anarta Ochsenheimer, 1816 is recently stated as a senior synonym to *Hadula* Staudinger, 1889 (Fibiger & Lafontaine 2005), and *Aglossestra* Hampson, 1905 was regarded as a subgenus by Hacker (1998). Following Draudt (1937) and Boursin (1963) Hacker listed *mariaeludovicae* D. Lucas, 1914, and *affinis* Rothschild, 1914 as synonyms of *A. deserticola*. The male specimen is easily separated from other similar Hadeninae species by its heavily bipectinated antennae; both sexes are special by their whitish-beige orbicular and reniform stigmata, and the ante- and postmedian cross-lines. The genitalia of both sexes are illustrated by Hacker (1998). The species is distributed along the North African Mediterranean coast from Egypt to Morocco, so it has for a long time been expected to be found from Europe. It is an autumn flyer occurring in October and November, and the moths are attracted to light. In the European list (Fibiger & Hacker 2005) it should be placed after *Anarta (Hadula) sabulorum* (Alphéraky, 1882). *Anarta* (*Aglossestra*) *deserticola* is new to the fauna of Europe.

***Mythimna* (*Morphopoliana*) *languida* (Walker, 1858)**

The first specimen in Europe of this fast spreading species was recorded in 1990. Now it is a well-established and rather common species on Malta, and it visits both light and sugar. At the moment it is known from most of Africa, Arabia, Cyprus, Turkey, Greece incl. Crete, Malta, Italy, France, and Spain, incl. the Baleares. Two migrant specimens were surprisingly taken simultaneously in mid September of 2005 on sugar in northern Europe, one from north-eastern Denmark, and one from south-eastern Sweden (Madsen 2005).

***Leucania* (*Leucania*) *zeae* (Duponchel, 1827)**

M a t e r i a l . Several specimens. **Malta**, Bahrija, Wied tal-Bahrija, 6.viii.2003, leg. Seguna (AS); Bidnija, 21.v.1991, 2.v.1997, leg. Catania (AC), Seguna (AS); Ghajn Tuffieha, 14.iv.1999, leg. Seguna (AS); Naxxar, 18.v.1993, 16.iv., 2., 4.v.1997, 17., 26., 30.iv., 6.v., 24.vi.1999, 19., 25.iii.2001, leg. Seguna (AS); Pembroke, 22.ii.1989, leg. Catania (AC); Rabat, 15.v.1990, 22.iv.1993, 14.iv.1999, 3.v.2003, leg. Sammut (PS); Wied Qannotta, 3.v.1995, leg. Catania (AC).

During his visit to Malta, Bjarne Skule suggested that material in the collections of the Maltese authors determined as *L. obsoleta* could refer to *L. zeae*. This was confirmed by the senior author when he reviewed this material. *Leucania zeae* is a Holo-Mediterranean-Turkestanian species distributed from Morocco and Algeria through the south-western parts of the Palaearctic region (Asia Minor, Iran and Turkmenistan) to Mongolia and NW China. In Europe it is found in Spain and Portugal, in countries bordering the Mediterranean, including the larger islands and in the xerothermic ranges of SE. Russia (Hacker et al. 2002). *Leucania obsoleta* (Hubner, 1803) is a Euro-Siberian species and occurs in Europe, mostly the mid and northern part. This latter species is not known from North Africa. The illustration in Sammut (2000 fig. 398) of *Mythimna obsoleta* (Hübner, 1803) represents this species. *Leucania* (*Leucania*) *zeae* (Duponchel, 1827) is new to the lepidoptera fauna of Malta.

Noctuinae Latreille, 1809

Agrotini Rambur, 1848

***Euxoa* (*Euxoa*) *canariensis diamondi* Boursin, 1940** **Fig. 20**

M a t e r i a l . **Malta**, 1♀ Pembroke, 28.iv.1990, leg. Catania (AC), prep. Fibiger 5173.

The first report of this species from Europe has been most awaited. The nominotypical subspecies occurs in many forms only on the Canary Islands and Madeira. The subspecies *diamondi* is also very variable, and a much more widespread taxon, probably the subspecies of any *Euxoa* with the largest area of distribution. It is a desert and semi-desert species recorded from western Morocco along North Africa, down to Yemen, including all the Arabian peninsula, and further eastwards through all of the Middle Eastern countries to Afghanistan, Pakistan and India. It is taxonomically linked to the little group of African *Euxoa* species that occur in Somalia, Ethiopia, Tanzania, and Uganda. The species is expected to occur – at least as a migrant – in southern Spain. The peak of the flying period is April. In the European list (Fibiger & Hacker 2005) it should be placed after *Euxoa (Pleonectopoda) nevadensis* (Corti, 1928).

***Agrotis haifae* Staudinger, 1897** **Fig. 21**

Material. **Malta**, 1♂ Mosta, 31.x.2003, leg. Seguna leg. (AS); ♀ Naxxar, 10.xi.1983, leg. Sammut (PS); 1 ♀ Qrendi, San Niklaw, 27.x.2003, leg. Magro (PS).

The specimen illustrated in Sammut (2000) as *Agrotis herzogi* Rebel, 1911 collected from Naxxar in November 1983, belongs to this species. This is a rare species in Europe, so far known only from the three Maltese specimens and a single specimen collected from southern Greece (Fibiger 1993). Outside Europe, it is distributed from Israel through northern Africa to the Canary Islands, here as subsp. *pigmaea* Pinker, 1974 (Fibiger, 1990). New to the Maltese Islands.

***Agrotis herzogi* Rebel, 1911** **Fig. 22**

Material. Several specimens. **Gozo**, Dwejra, 5.xi.2004, leg. Catania (AC); **Malta**, Attard, Wied is-Sewda, 3.xi.1985, leg. Seguna (AS); Naxxar, 10.xi.1983, 29.x.1987, 5., 8.xi.1996, 13.xi.2000, 23.iii.2001, 2.xi.2003, leg. Sammut (PS), Seguna (AS), M. Zerafa (MZ); Pembroke, 21.xi.1989, leg. Catania (AC); Qrendi, San Niklaw, 21.iii.2001, 29.iii., 27.x., 4.xi.2003, leg. Magro (DM); Rabat, xi.1992, 8.xi.2000, 15.xi.2001, 4., 15.xi.2003, 3.xii.2004, leg. Sammut (PS); Zabbar, 20.x.2004, leg. J. & S. Agius (JA).

This North African-Iranian species reaches the Maltese Islands by migration from North Africa: So far 20 specimens have been recorded from the Maltese islands. Its breeding range does not include Europe but extends from the Canary Islands in the west, through the Sahara and the Arabian countries, Turkey, Iraq and Iran to western India (Fibiger 1990). In Europe it is known only from southern Greece, Crete and Malta, where it is an irregular early spring and autumn migrant, e.g. on one night, 1.iii.1984, 62 specimens were recorded close to Monemvasia in southern Greece.

***Agrotis syricola* Corti & Draudt, 1933**

Material. **Malta**, 1$ Dingli, 5.x.2004, leg. Sammut (AC); 1$ Naxxar, 19.vi.1998, leg. Seguna (AS); 2♂♂ Rabat, 17.x.2003, 2.iv.2004, leg. Sammut (PS); 2♂♂,1♀ Rabat, Dwejra, 28.x.2003, 1., 18.x.2004, leg. Seguna (AS); 2♂♂ Zebbug, 20, 29.x.2004, leg. Catania (AC)

A very recent addition to the lepidopterofauna of the Maltese Islands. The species is probably resident on the Maltese Islands. There appears to be two broods, from April to June and again during October. The species has a Holo-Mediterranean distribution.

***Powellinia lasserrei* (Oberthür, 1881)**

Material. **Malta**, 1♂ Naxxar, 15.x.1996, leg. Seguna leg. (AS).

The specimen recorded by A. Seguna from Naxxar is the third for the Maltese Islands. Previously this eremic species, known in Europe as a resident species only from southern Spain, was recorded by A. Valletta from Mriehel in October 1950 and 1953 (Valletta 1951 and 1973).

Noctuini Latreille, 1809

***Cerastis faceta* (Treitschke, 1835)** **Fig. 23**

Material. 1♂, 1♀, **Gozo**, Nadur, 29.xii.2005, leg. J. & S. Agius (JA); 1♂, same data (PS).

These three specimens, the first for the Maltese archipelago, were taken at light (MV.125W). The night was very clear with no wind and moonlight (J. Agius, pers. comm). In Fibiger (1993), the species is reported as flying in (February) March and again in April (May). At present it cannot be stated if the specimens are of local origin or due to a migration. Neither can it be stated whether this is an unusually early emergence nor that the flight period begins earlier. Larvae are known to accept *Taraxacum* in captivity, feeding by night and resting subterraneanly by day (Fibiger 1993). In Europe the species is known from the Iberian Peninsula, parts of France bordering the Mediterranean, Corsica, Italy, incl. Sardinia and Sicily. Outside Europe it has been reported from North Africa in Morocco, Algeria and Tunisia (Fibiger 1993). New to the fauna of the Maltese Islands.

Noctua tirrenica Biebinger, Speidel & Hanigk, 1983

M a t e r i a l . **Malta**, 1 ♂ Dingli, Dingli Cliffs, 24.vii.1992, at light, leg. Catania (AC); Naxxar, 26., 30.i., 3., 8.ii.1988 (e.o.), leg. M. Zerafa (PS, MZ); 2♂♂ Rabat 24.ix., 15.x.2004, at light, leg. Sammut (AS).

The figured specimen of *Noctua fimbriata* (Schreber, 1759) in Sammut (2000), represents this species. Whether references to *Noctua fimbria* Linnaeus (Borg 1932; Saliba 1963) are also misidentifications for *N. tirrenica* is impossible to tell. The references by Valletta (1973) and Sammut (1984) are only bibliographical. The material in Alfred and Michael Zerafa collection was only discovered during the compilation of this work. A large number of specimens were bred from a single female, most of these moths were released (M. Zerafa, pers. comm.)

Acknowledgements

The authors are sincerely thankful for help and information in different ways from Bjarne Skule, Denmark; Åke Selling, Sweden, Martin Honey (BMNH), Laszlo Ronkay (TMB), and to our colleagues on Malta: Jonathan and Suzanna Agius, Denis Magro, Alfred and Michael Zerafa, and Mariann Fibiger. For editorial corrections and suggestions we especially thank Matthias Nuss, Dresden.

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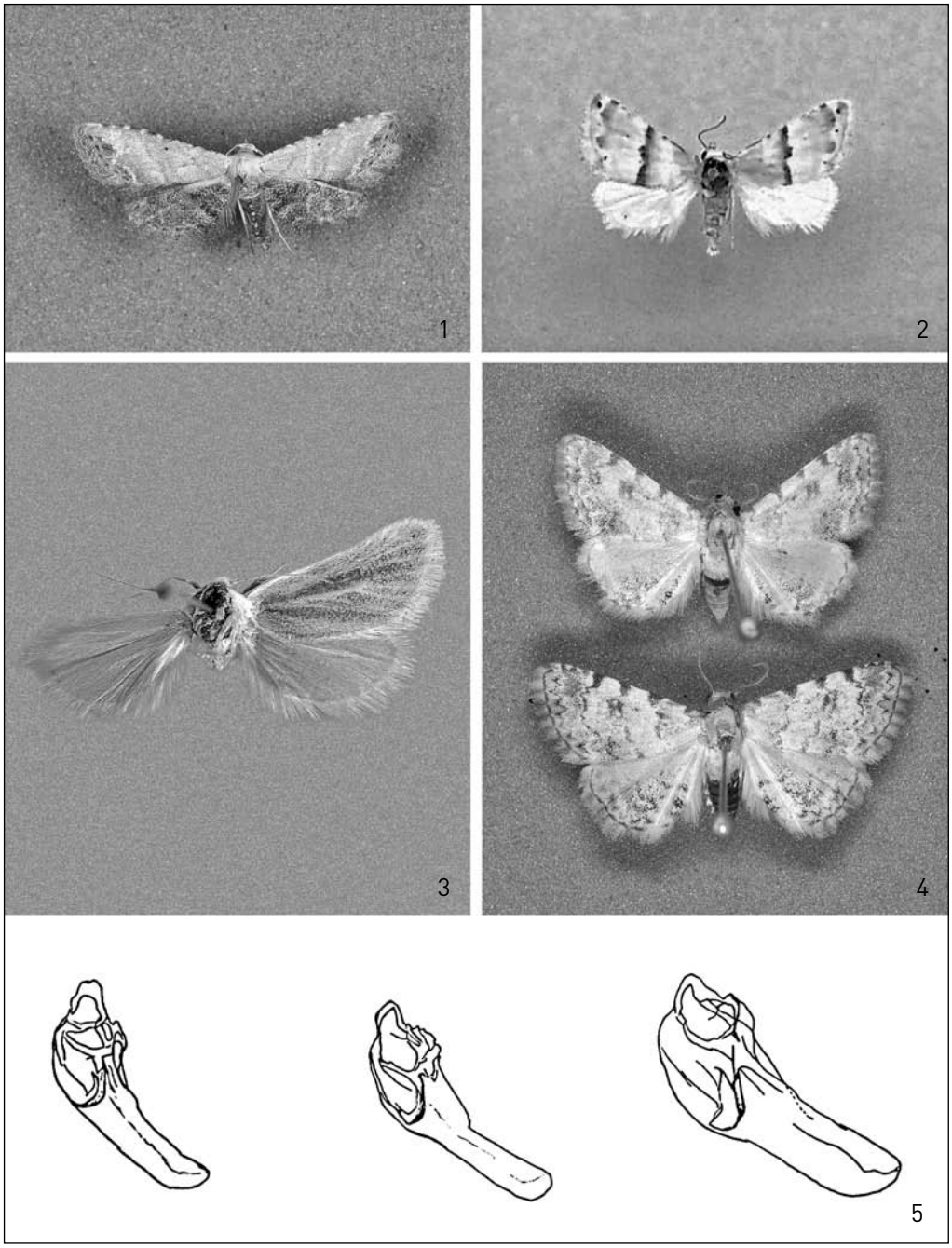

Figs 1–5. 1. *Araeopteron ecphaea* (Hampson, 1914) from Malta; wingspan 12 mm. **2.** *Eublemma deserti* (Rothschild, 1909) from Malta; wingspan 33 mm. **3.** *Eublemma conistrota* Hampson, 1910 from Malta. Wingspan 21 mm. **4.** *Metachrostis velox* (Hübner, 1813), male and female, Malta. wingspan ♂ 16 mm, ♀ 20 mm. **5.** Right valve of male genitalia of *M. velocior* (right), *M. velox* (left), and a presumably hybrid (middle)

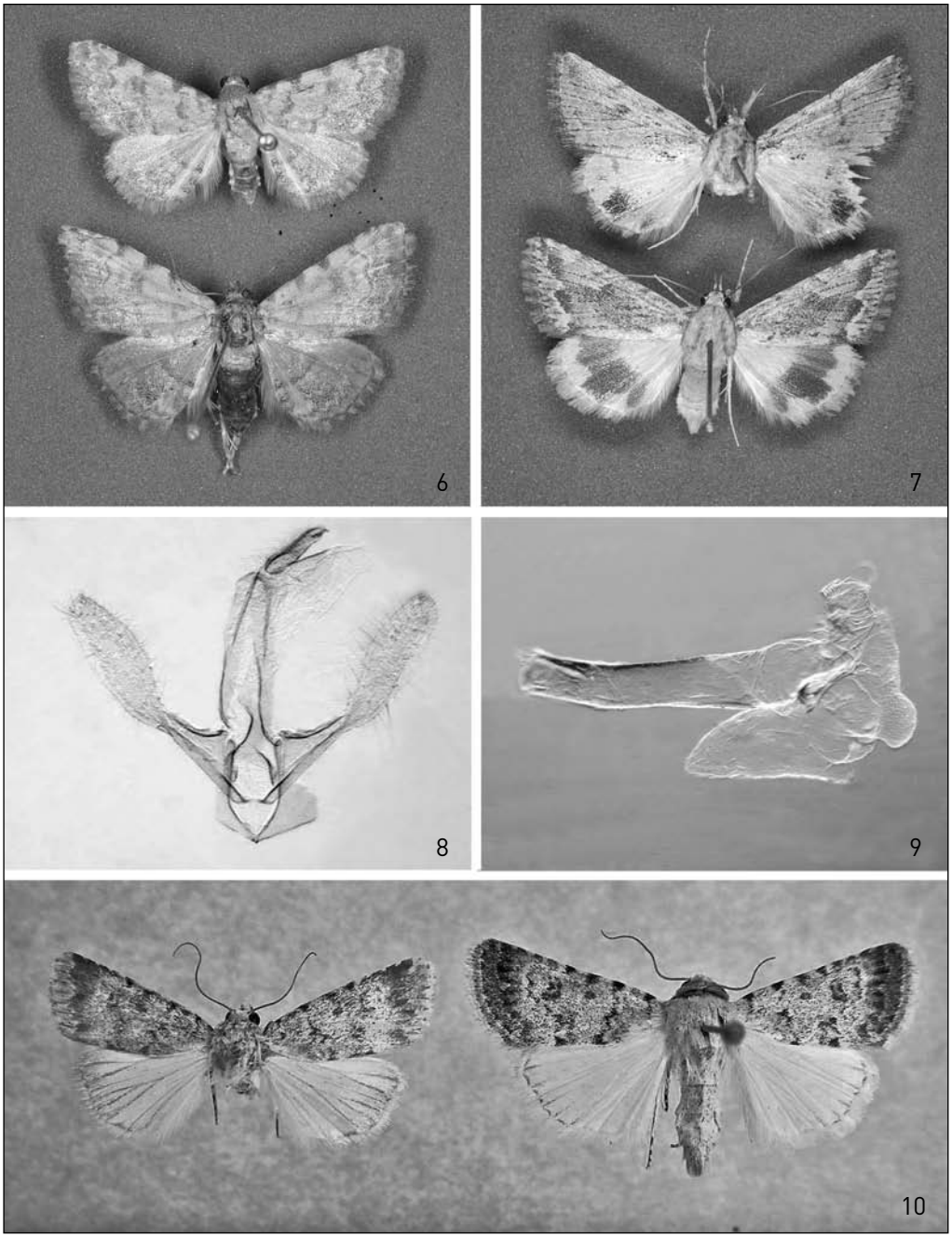

Fig. 6. *Metachrostis velocior* (Staudinger, 1892), male and female, Malta. Wingspan ♂ 22 mm, ♀ 24mm. **Fig. 7.** *Anumeta hilgerti* (Rothschild, 1909), male and female, Malta. Wingspan ♂ 24 mm, ♀ 24 mm. **Fig. 8.** *A. hilgerti* (Rothschild, 1909), male genital armature. **Fig. 9.** *A. hilgerti* (Rothschild, 1909) phallus with everted vesica. **Fig. 10.** *Caradrina (Eremodrina) vicina* Staudinger, 1870. Left subsp. *castrensis* Berio, 1981, Malta. Wingspan 27mm; right subsp. *vicina* Staudinger 1870, Turkey. Wingspan 30mm.

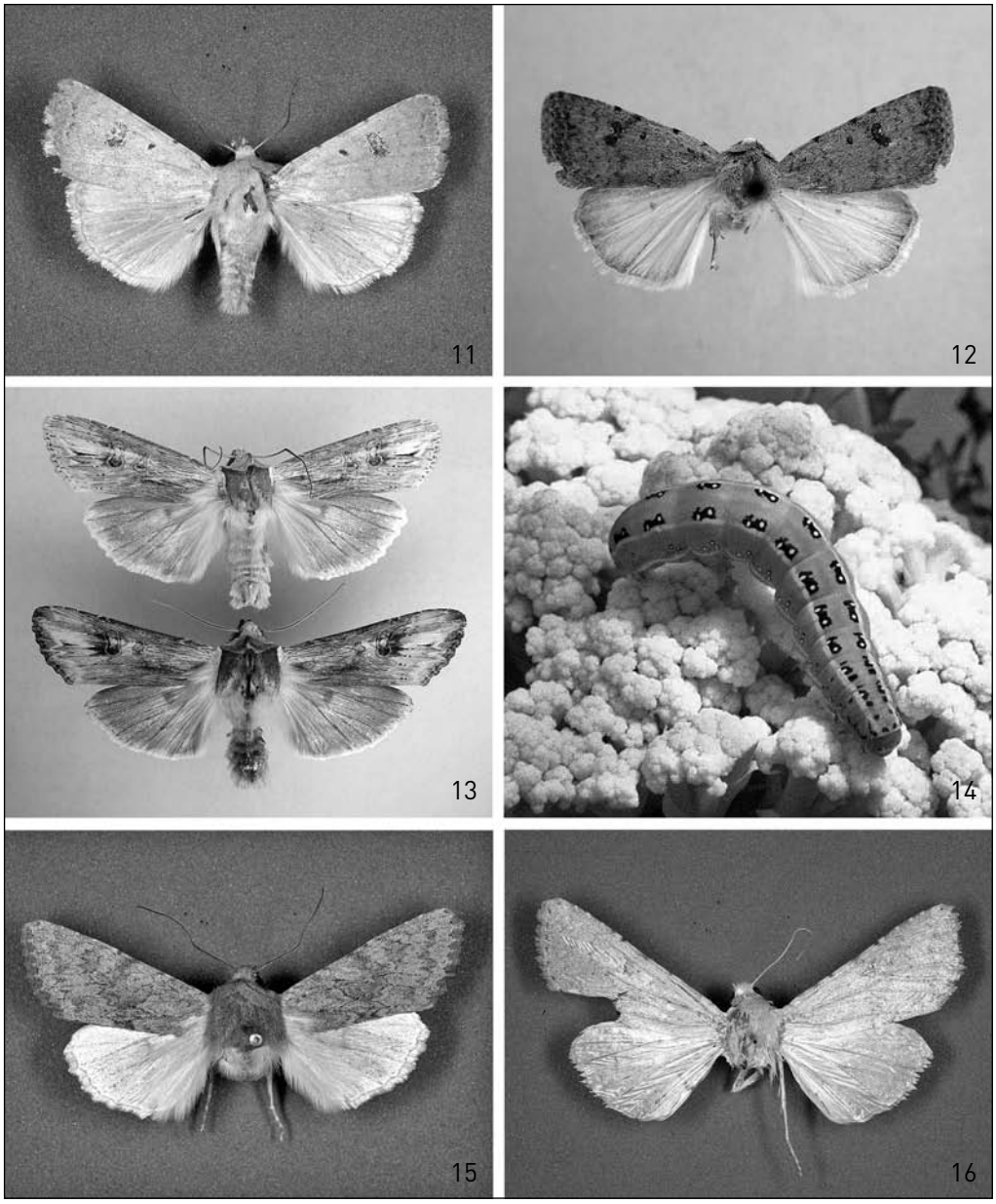

Fig. 11. *Caradrina (Platyperigea) proxima* (Rambur, 1837), Malta. Wingspan 31mm. **Fig. 12.** *Caradrina (Paradrina) seleni djebli* Rings 1973, 1840, Malta. Wingspan 31 mm. **Fig. 13.** *Xylena exsoleta maltensis* Fibiger, Sammut, Seguna & Catania, subsp. n., paratype, Malta. Wingspan 58mm; *X. exsoleta exsoleta* Linnaeus, 1758, Denmark. Wingspan 63 mm. **Fig. 14.** *Xylena exsoleta maltensis* Fibiger, Sammut, Seguna & Catania, subsp. n., larva, Malta. **Fig. 15.** *Aporophila nigra cinerea* Staudinger & Rebel, 1901, Malta. Wingspan 37mm. **Fig. 16.** *Pseudohadena (Eremohadena) roseonitens* (Oberthür, 1887), Malta. Wingspan 47mm.

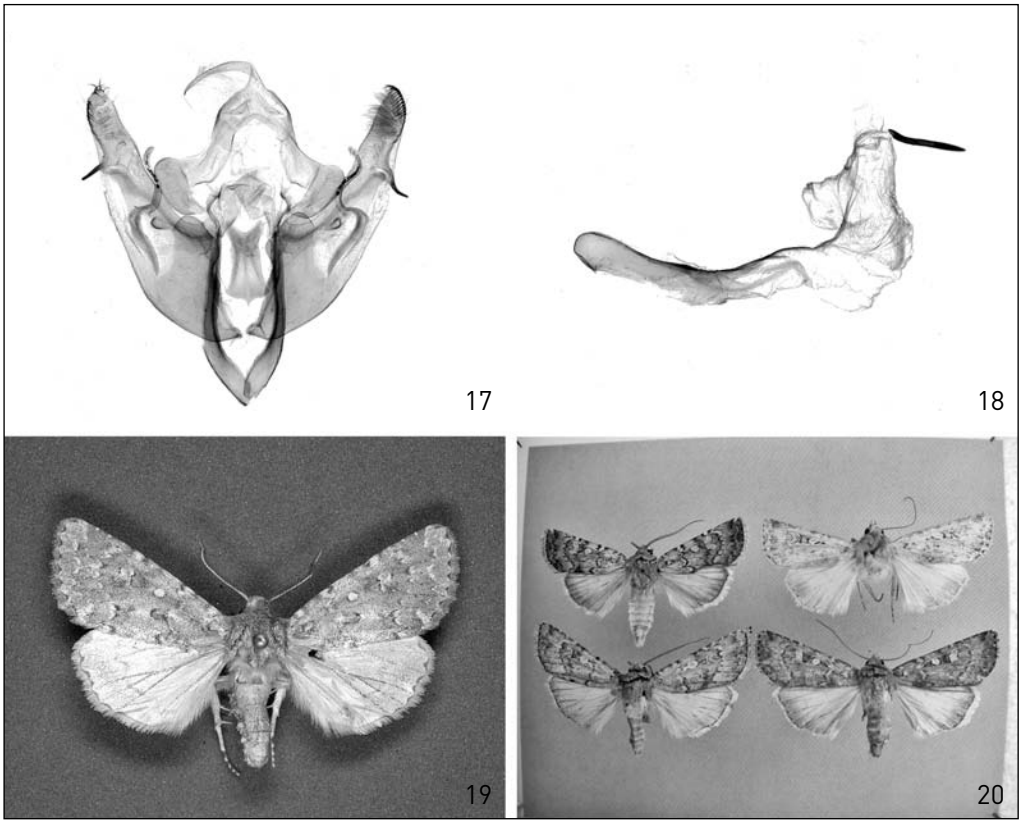

Fig. 17. *Pseudohadena (Eremohadena) roseonitens* (Oberthür, 1887) male genital armature. **Fig. 18.** *Pseudohadena (Eremohadena) roseonitens* (Oberthür, 1887) phallus with everted vesica. **Fig. 19.** *Anarta (Aglossestra) deserticola* (Hampson, 1905), Malta. Wingspan 33 mm. **Fig. 20.** *Euxoa (Euxoa) canariensis diamondi* Boursin, 1940, Top left, Jordan, wingspan 40 mm; Top right, Malta, wingspan 38 mm. Botton left, Israel, wingspan 37 mm. and botton right Israel, wingspan 39 mm.

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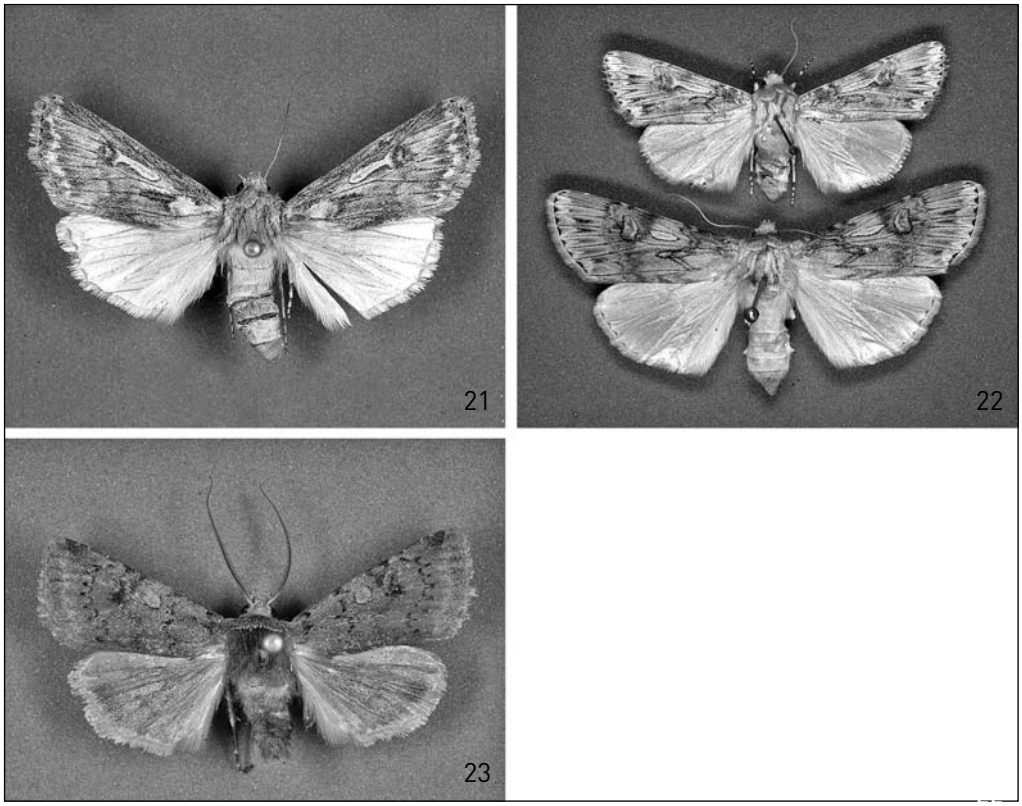

Fig. 21. *Agrotis haifae* Staudinger, 1897, Malta. Wingspan 35 mm. **Fig. 22.** *Agrotis herzogi* Rebel, 1911. male and female, Malta. Wingspan ♂ 34 mm, ♀ 44 mm. **Fig. 23.** *Cerastis faceta* (Treitschke, 1835), Malta. Wingspan 30 mm.

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Tremewan W. G. 2006. Ecology, Phenotypes and the Mendelian Genetics of Burnet Moths (*Zygaena* Fabricius, 1775). – Gem Publishing Company, Wallingford, U.K. – xvi + 390 pp, 194 figs (163 in colour). Size 235 × 156 mm. Hardcover (ISBN 0 906802 11 3). £ 79.00 (+ postage UK £ 6.00, Europe £ 10.00, outside Europe £ 12.00).

Many books on burnet moths (Zygaenidae: Zygaeninae: *Zygaena* Fabricius, 1775) have been written during the past few years. This group of Lepidoptera has been shown to represent a perfect model for a wide field of studies in entomology and zoology, especially with reference to morphology, biochemistry, defensive biology, mimicry patterns, pheromone studies, molecular biology, phylogeny, ecology, and zoogeography.

This book is the result of a lifetime's work by W. G. Tremewan, the world's 'senior specialist' of burnet moths. His impressive knowledge that has been accrued over a period of more than 50 years' fieldwork and rearing experiments, and studies of collections and literature on the genetics of burnet moths, is summarized and presented.

The work begins with a comprehensive introduction into the extraordinary geographical and individual variation of *Zygaena* species. The toxic properties of burnet moths and their relationship with predators are described and attempts to explain the reasons for such variation are summarized. Many of the genotypes responsible for the colour morphs (orange, yellow, and black) have been determined and we now know that they are recessive to the wild type red morph. It has also been discovered that in many cases they form part of a multiple allelomorphic series.

The first chapter of the book deals with chemical defence and predator/prey relationships, predation, wing patterns and associated terminology, warning coloration, mimicry and mimicry rings, and geographical and individual variation and the ecological significance of both. Chapter 2 explains the aims of the book and describes breeding techniques and the unique diapause strategy of burnet moth larvae, which is a challenge for every entomologist who has ever tried to rear *Zygaena* species from the egg stage. In chapter 3 we learn about the basic principles of Mendelian genetics in relation to burnet moths, karyotypes, autosomal and sex chromosomes, genes, alleles, gynandromorphism, somatic mosaics, and teratologies. Chapter 4 provides an overview of wing pattern and colour variation and discusses, in detail, dominance, recessiveness, multiple allelomorphs, and multifactorial inheritance. In chapter 5 the author presents short biographical accounts of scientists who have contributed to our knowledge of the genetics of burnet moths, the most important of whom are figured on black and white photographs. In chapter 6 the results of breeding experiments are given in detail, the species being listed in phylogenetic order. Each case is discussed in detail, often richly illustrated, and, where possible, conclusions are given. It is almost unbelievable how much time the author has put into his studies and the resulting documentation. At the end of this chapter a table summarizes all the results in an impressive overview that includes the genotypes for the different colour and pattern morphs. Chapter 7 deals with hybridisation in general and in burnet moths in particular. Not only hybrids between individuals but also hybridisation between parapatric populations of different species are discussed. It also includes a comprehensive review of the published literature on the subject.

Moreover, the author presents in detail the results of his own rearing experiments. A bibliography of more than 500 references, a glossary, and an index conclude the book.

The publication is dedicated to the memory of Paul Bovey (1905–1990), who studied the genetics of *Zygaena ephialtes* (Linnaeus, 1767), the most polymorphic of all burnet moths, and to Miriam Rothschild (1908–2005), who worked on chemical defence and mimicry of *Zygaena* species. Both of these workers inspired the author to continue through the years with his own breeding experiments and studies.

The book is a unique work. Comprehensive data on genetics are made available and should be of interest even to those who have hesitated to investigate this branch of biology. Moreover, it is an example of how the 'secrets' of nature can be elucidated by the discipline of slow and dedicated scientific work. The presentation of the book is of high quality, as are the printing and the attractive cover and binding.

For anyone who is interested in geographical and individual variation, genetics, biochemical defence, rearing and hybridisation, in burnet moths in particular, this book is an invaluable source of information.

G. M. Tarmann