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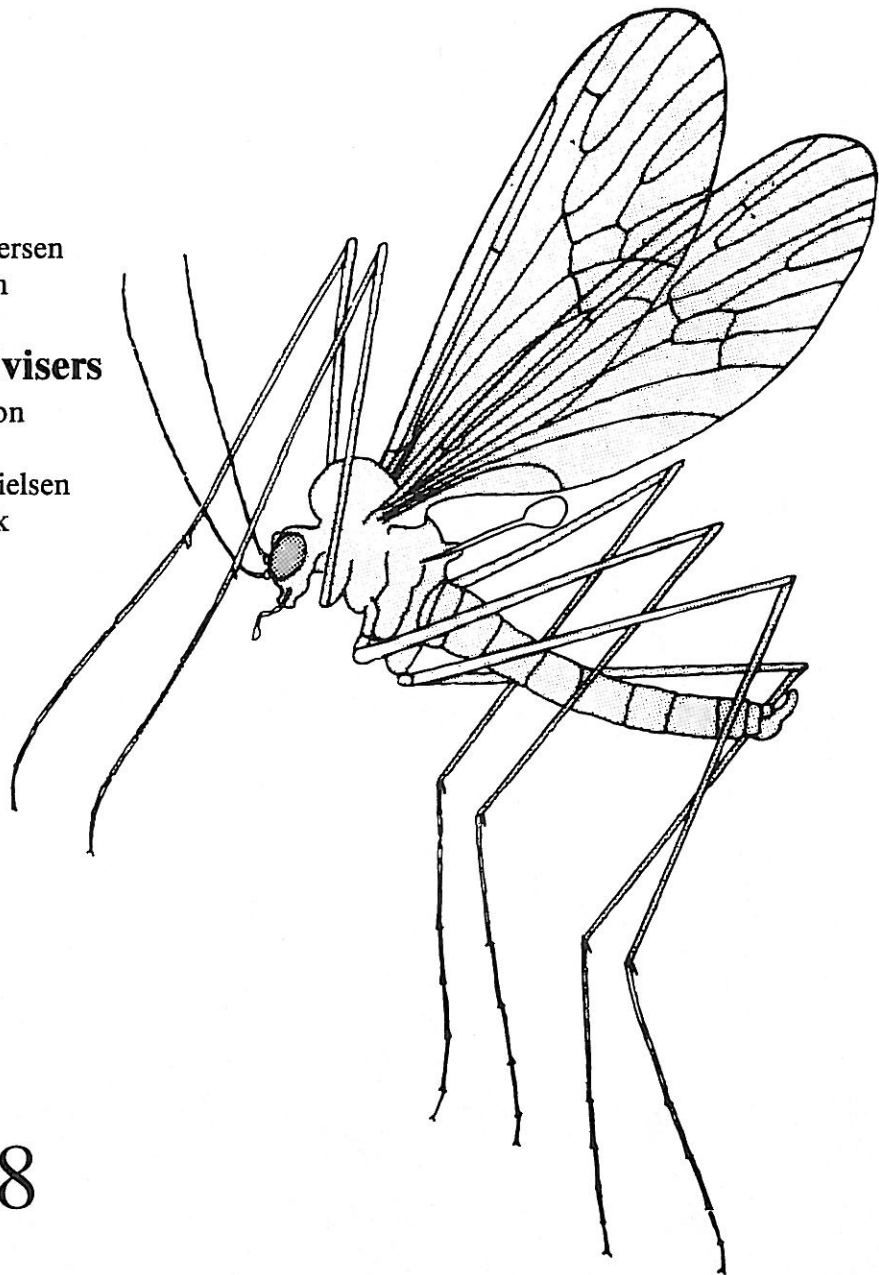
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A taxonomic revision of the Scopariinae from the Macaronesian Region (Lepidoptera: Pyraloidea: Crambidae)

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Sixteen scopariine species and two subspecies, of which five are undescribed, occur on the archipelagos of the Azores, Madeira, the Canary Is., and the Cape Verde Is. Four new species, *Scoparia carvalhoi* sp. n., *Eudonia shafferi* sp. n., *E. parviangusta* sp. n., *E. geminoflexuosa* sp. n., and one new subspecies *Eudonia lineola dorada* ssp. n., are described. Seven species are transferred to the genus *Eudonia* Billberg: *E. interlinealis* (Warren, 1905) comb. n., *E. luteusalis* (Hampson, 1907) comb. n., *E. melanographa* (Hampson, 1907) comb. n., *E. stenota* (Wollaston, 1858) comb. n., *E. scoriella* (Wollaston, 1858) comb. n., *E. lindbergalis* (Viette, 1958) comb. n., and *E. decorella* (Stainton, 1859) comb. n. The status of *Eudonia lineola tafirella* (Chrétien, 1908) stat. n. is changed from species to subspecies. *Eudonia decorella* (Stainton, 1859) comb. n., sp. rev., formerly regarded as synonym of *E. stenota*, is confirmed as a valid species. Five new junior synonyms of *Eudonia* species are given: *Scoparia coeruleotincta* Hampson, 1917 syn. n. of *Eudonia lineola tafirella*, *Scoparia wollastoni* Bethune-Baker, 1894 syn. n. of *Eudonia scoriella*, *Scoparia maderensis* Rebel, 1939 syn. n. of *Eudonia decorella*, *Scoparia imparilis* Dyar, 1929 syn. n. of *Eudonia angustea*, and *Scoparia virescens* Rebel, 1896 syn. n. of *Eudonia lineola*. Eight lectotypes are designated. The taxonomic and chorological results indicate that the colonisation of the archipelagos took place by passive dispersal on the ocean surface currents and winds. Each archipelago has endemic scopariine species and the number of endemic species increases in proportion to growing distance from the continents. The ancestors of the Azorean *Scoparia* species were of nearctic origin, while the species of Madeira and the Canary Is. show affinities to Europe and northern Africa, except that *E. scoriella* from Madeira Is. seems to be of nearctic origin. *E. lindbergalis* from the Cape Verde Archipelago show similarities to *E. lineola*, *E. parviangusta* and *E. geminoflexuosa* from the Canary Is. The successful colonisation of oceanic islands by Scopariinae seems to be correlated with the prerequisites: dispersal ability, adaptation to a humid climate, and mosses and lichens as larval food.

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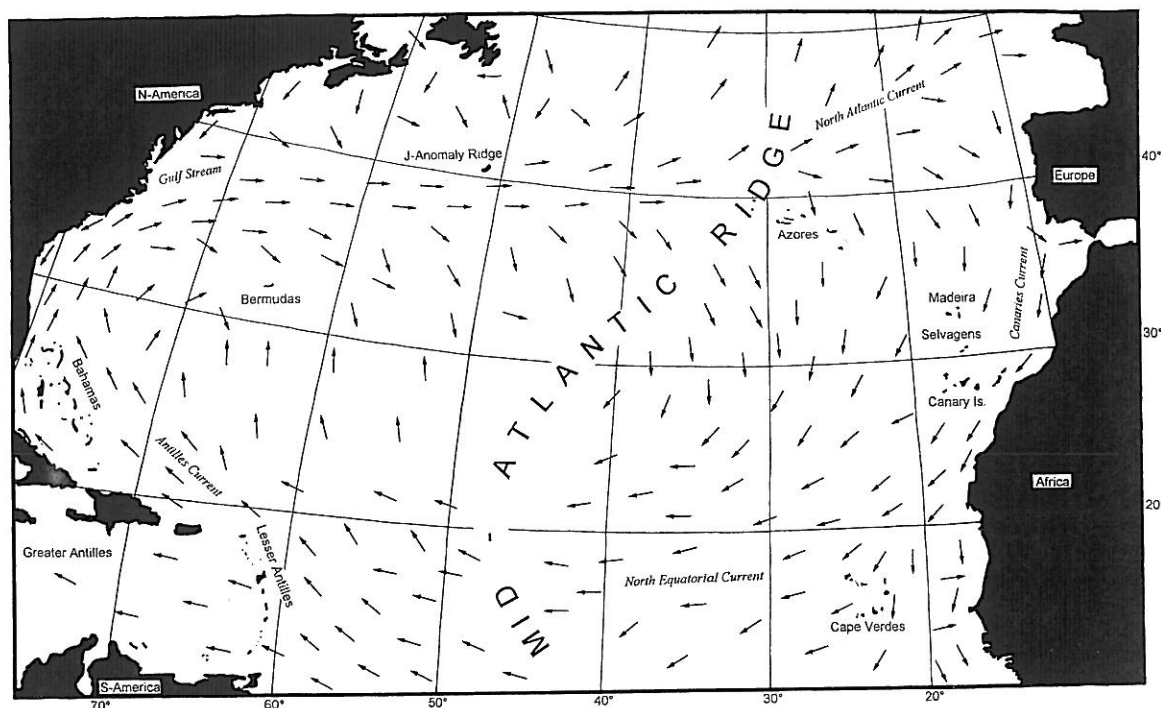
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Introduction

The biogeographical region 'Macaronesia' comprises the archipelagos of the Azores, Madeira, Canary Is., and Cape Verde Is. The first records of Microlepidoptera from this region date to the middle of the last century. The earliest publications are those of Wollaston (1858), Stainton (1859), Morelet (1860), Drouet (1861), Felder (1862), and Godman (1870). Only the first two authors mentioned Scopariinae describing three

endemic species of this subfamily from these archipelagos. At the turn of the century Bethune-Baker (1894), Warren (1905), Hampson (1907), and Chrétien (1908) described a number of scopariine species from this region. Rebel (1917) summarised these results and concluded that the overall number of lepidopteran species decreases proportionally with growing distance from the continents, whereas the number of Scopariinae increases. He stated that an 'oceanic character' of an



Map 1. Northern Mid-Atlantic Ocean. Arrows show the surface currents (after Schuleikin 1953).

island is determined by the number of endemic species. Thus, the Scopariinae could indicate the degree of oceanity.

From 1892 until 1940, Rebel published a number of papers about the lepidopteran fauna of the Atlantic Islands that are still valid in many respects. After the middle of our century, publications about the Macaronesian region were mainly restricted to faunistic lists (Carthy 1957; Bradley 1958; Gardner & Classey 1960; Carvalho 1982, 1992, 1996; Vieira & Pintureau 1991, 1993). Up to now, the taxonomy of the Macaronesian Scopariinae was unsatisfactory, due to misidentifications. The present revision of 1,934 specimens, including type specimens, resulted in the discovery of new taxa, taxonomic and nomenclatural changes. The revised classification allows to draw

conclusions about relationships within the Macaronesian region and to taxa from adjacent regions. The origin of the Macaronesian scoparine fauna is discussed with respect to the geological history of the Macaronesian Islands and to the currents and winds of the Atlantic Ocean.

Geographical and ecological aspects of the study area

The four archipelagos are situated in the lower latitudes of the northeastern Atlantic Ocean and form the biogeographical region 'Macaronesia'. Recently, botanists put into question the view of a biogeographical homogeneity of this region (Lüpnitz 1995; Beyhl, Mies & Ohm 1996). The archipelagos are scattered over 2,700 km in latitude,

Table 1. Distances between present and former land masses in the Mid-Atlantic Ocean area, along the currents

	America	Europe	Africa	Azores	Selvagens	Canary Is.
Bermudas	1040			3600		
Azores	4000	1400		/		
Madeira		800	700	800	250	400
Canary Islands			100		160	/
Cape Verdes			460			1300
J-Anomaly Ridge	900			1800		

1.800 km in longitude, having a total area of nearly 15.000 km². An overview of the region is given in Tables 1 & 2, and Map 1.

Since the Jurassic period, when northern America, Greenland, and Europe were still joined, volcanic activity has persisted in the Atlantic Ocean (Stets & Wurster 1982). The first volcanic islands of the Atlantic Ocean have long vanished, e. g. the eastern end of the J-Anomaly Ridge is the foundation of an Early Cretaceous reef (Emery & Uchupi 1984, see Map 1). These former islands could have functioned as stepping stones, reducing considerably the distances for dispersal between land areas (compare Table 1, Map 1). The development of the present islands of Macaronesia began in the Cretaceous period or later (Robertson & Bernoulli 1982; Rothe 1986). All Macaronesian Islands are of submarine, and later subaerial volcanic origin. Vertical movements are indicated by limestone sediments in terrestrial rocks on all Macaronesian archipelagos (Mitchell-Thomé 1976; Schmincke 1982). As to the age of the islands, permanent appearance above sea level is relevant for biogeographical interpretations concerning terrestrial elements. The earliest possible time for colonization by terrestrial animals and plants is called 'age of subaerial shield phase'.

The Azores are situated on the eastern slope of the Mid-Atlantic ridge, rising from depths of 2000 m. They are composed of nine inhabited islands (Table 2) and the Rocas Formigas, a group of reefs approximately 35 km northeast of Santa Maria I. The Azores are the northwesternmost islands in the Macaronesian region, showing a slightly cooler climate. The coldest month is February with an average temperature of 14,3°C, the hottest is August with 22,3°C. The rainfall decreases from west to east, varying from 57 (driest month)-200 (wettest month) mm on Flores to 18-83 mm on Santa Maria (Mitchell-Thomé, 1976). October to January is the period of highest rainfalls and July is invariably the driest month. The prevailing winds in the western and central islands come from north, northwest and southwest. In the eastern group the North-East Trade Winds are regular, except when south west winds show a dominance in winter (Mitchell-Thomé 1976). The natural vegetation of all islands was a special type of evergreen forest, reaching from the coast up to the top of the mountains (Lüpnitz 1995). Today, there are only a few relict forests

left, mainly on Corvo, Flores, São Jorge, Faial, and São Miguel (Santos 1990).

The Madeiran archipelago is composed of the main island Madeira, the island Porto Santo situated 40 km NE, and the three Desertas (Chão, Deserta Grande, Bugio) that are situated 20 km SE of Madeira. Porto Santo is surrounded by tiny islets. The archipelago lies within the North-East Trade Wind belt in summer. In winter the winds from west and southwest cause abundant rains. Dry and hot east winds from Africa, which are short-lived, are no regular events. The climate is quite homogenous with a daily temperature amplitude of 5°C and the annual variation reaching 6°C. The northern coast is considerably wetter and cooler than the southern coast. Annual precipitation is 3000 mm at higher altitudes on Madeira (Santos 1990). The laurel forests are reduced to the island of Madeira to altitudes between 700 and 1300m (Lüpnitz 1995; Santos 1990). The extreme eastern part of Madeira (Ponta de São Lourenço), Porto Santo, and the Desertas are semi-arid as they lie in the rain shadow of Madeira. *Euphorbia piscatoria* Ait. and *Echium nervosum* Dryand. are xerophytic dominants and represent elements of the mediterranean flora (Lüpnitz 1995). Thermophilous laurel forests dominated by *Juniperus phoenicea* Linnaeus were the natural vegetation of Porto Santo, they have been totally destroyed (Lüpnitz 1995; Santos 1990). The Desertas are all heavily grassed, without any tree and on the top of Deserta Grande there is a plateau covered with lichens (Karsholt).

The Selvagens Archipelago lies 160 km north of Tenerife at 30°06'N 15°58'W. It comprises nine islets plus many small rocks, banks, and reefs; some are submerged at high tide. Selvagem Grande is the biggest islet with an area of about 3,5 km² and a maximum elevation of 153 m. The oldest subaerial volcanic rocks and sediments are of Miocene epoch (Mitchell-Thomé 1976). The flora consists of xerophytes and halophytes (Lüpnitz 1995).

The Canary Is. are the best investigated Macaronesian archipelago (Rothe 1986). In addition to the seven islands listed in Table 2 five islets have to be added: Alegranza, Roque del Oeste, Montaña Clara, Roque del Este, and Graciosa; all situated north of Lanzarote I., and Lobos north-east of Fuerteventura I. The Canary Is. are the largest archipelago of the region and the Pico de Teide on Tenerife I. is the highest mountain of all

Table 2. General features of the archipelagos (Fernandopullé 1976, Mitchell-Thomé 1976, Schmincke 1982, Rothe 1982). The islands are arranged in northwest to southeast direction.

	average geographical coordinates	area (km ²)	maximal high (m)	age (My)	av. annual temperature (°C)	av. annual rainfall (mm)
AZORES		total: 2344				
Corvo	39°42'N 31°06'W	17	718		17,6	1047
Flores	39°27'N 31°11'W	143	914		17,4	1430
Graciosa	39°03'N 28°02'W	61	402	?	17,2	991
São Jorge	38°38'N 28°01'W	246	1053	<1 ?	17,4	1045
Faial	38°35'N 28°43'W	173	1043	<1 ?	17,3	1240
Pico	38°29'N 28°17'W	446	2351	<1 ?	17,3	1195
Terceira	38°43'N 27°12'W	401	1021	<1	17,2	1130
São Miguel	37°47'N 25°29'W	757	1103	4	17,3	968
Santa Maria	36°58'N 25°07'W	97	587	4-5	17,3	652
MADEIRA IS.		total: 812				
Madeira	32°44'N 16°58'W	728	1862	2-3	18,8	602
Porto Santo	33°04'N 16°20'W	69	517	12-13	19,0	355
Desertas	32°31'N 16°30'W	ca. 14,8	478		?	?
CANARY IS.		total 7600				
Hierro	27°45'N 18°00'W	278	1501	2-3	?	426
La Palma	28°38'N 17°52'W	730	2423	2-3	19,0	586
Gomera	28°06'N 17°12'W	380	1482	12	19,3	410
Tenerife	28°30'N 16°30'W	2058	3718	5	21,1	420
Gran Canaria	27°56'N 15°32'W	1532	1950	13,5-14	19,6	325
Fuerteventura	28°28'N 14°45'W	1725	807	17	21,0	147
Lanzarote	29°08'N 13°39'W	796	671	15-17	20,5	135
CAPE VERDES		total: 4033		>5		
Santo Antão	17°04'N 25°10'W	779	1979		22,6	475
São Vicente	16°51'N 24°59'W	227	774		23,6	175
Santa Luzia	16°46'N 24°45'W	35	395		?	?
Branco	16°39'N 24°41'W	3	327		?	?
Raso	16°37'N 24°36'W	7	164		?	?
São Nicolau	16°36'N 24°15'W	343	1304		23,9	200
Sal	16°43'N 22°56'W	216	406		23,5	95
Boa Vista	16°05'N 22°50'W	620	390		24,0	275
Maio	15°13'N 23°10'W	269	436		?	373
San Tiago	15°05'N 23°29'W	991	1392		21,6	455
Fogo	14°56'N 24°24'W	476	2829		22,1	665
Brava	14°51'N 24°43'W	64	976		21,5	400

Atlantic Islands with an altitude of 3718 m. The discovery of fossil ostrich eggs on Lanzarote I. was the main argument for the existence of a former land bridge between the eastern Canary Is. and Africa (Rothe 1964). However, geological studies have as yet not provided evidence for such a land bridge (Schmincke 1982; Rothe 1986). The climate is influenced by the rain bearing North-East Trade Winds and the Westerlies. Lanzarote I. and Fuerteventura I. do not benefit to the same extent from the wet North-East Trade Winds because of lower elevations and the hot and dry 'Harmattan' wind from the Sahara cause a semi-

arid climate. The western islands of higher elevation, Hierro, La Palma, Gomera, Tenerife, and Gran Canaria, have a cooler, more humid climate. The mean monthly temperature depends on altitude; it varies from over 20 °C in the subtropical zone at sea level to below 10°C in the subalpine zone above 2000m altitude. In the winter months, January and December, frost and snow is common above 2000m altitude (Fernandopullé 1976). The potential occurrence of the evergreen forests is limited to the western and central islands at altitudes between 500-1000m (Santos 1990), at higher altitudes replaced by a subalpine flora and

Pinus canariensis Smith forests (Lüpnitz 1995). Xerophytes dominate the lower elevations of the western and central Canary Is., as well as the eastern islands. An overview of the Canary Is. plants is given by Kunkel (1993). Based on the discovery of fossil wood, Schmincke (1967) pointed out that forest occurred on Gran Canaria in the Mid-Pliocene epoch. Small fossil tree trunks indicate the occurrence of a plant cover on Fuerteventura during the Pleistocene epoch (Rothe 1986). Today, no forests occur on the semi-arid islands Fuerteventura and Lanzarote.

The Cape Verde Is. have been studied least of all Macaronesian archipelagos. In addition to the 12 islands listed in Table 2 there is the group of small islands Ilheus Secos, comprising 7 islets, north of Brava. The largest islet (14°58'N 24°42'W) has an area of 2 km² with the highest altitude 96m (Mitchell-Thomé 1976). There is the possibility of former inter-island connections by the common shallow shelf of Santo Antão and São Nicolau, but connections to the African continent are improbable (Rothe 1982). The islands lie in the western part of the Sahel Zone with a hot, desert-like climate. Temperatures are of an equatorial type, with small annual fluctuations. At higher altitudes, temperatures are cooler and there is more precipitation: the mountains of Santo Antão have an annual rainfall of 4000 mm, whereas 20 km away, on the low, leeward coastal area annual rainfall may be only 200 mm. The North-East Trade Winds bring relative humidity of about 70%. During the summer, the hot and dry Harmattan winds blow from the Sahara (Mitchell-Thomé 1976). Most of the islands are barren and dry except above 450m where xerophytic vegetation (primarily *Euphorbia tuckeyana* Steudel) occurs (Lüpnitz 1995). In the highlands of San Tiago and Santo Antão still exist some of the originally forests of the cool tropical type (Mitchell-Thomé 1976).

The Bermuda Is. do not belong to the Macaronesian Region, but have to be discussed in a biogeographical context. The present islands emerged 500.000 years ago as coral reefs and were 650 km² above sea level in the Pleistocene epoch. Today, there are only about 54 km² above sea level and is the second subaerial shield phase of the Bermudas. The coral reefs were built upon the top of a submerged volcano that erupted about 30 million years ago (Ferguson et al. 1991).

Ocean currents and winds

Dispersal and migration of lepidopterous adults follow the main currents and winds of the oceans (Ferguson et al. 1991, Guilmette et al. 1970, Peck 1994 a, b). The current pattern of the North Atlantic (Map 1) is dominated by the great North Atlantic Gyre, a roughly circular system in clockwise direction. It is stimulated by the North-East Trade Winds between 10° and 30° North in the eastern Atlantic and by the Westerlies between 40° and 60° North in the western Atlantic. The Gulf Stream flows north along the American coast and leaves the coast as the North Atlantic Current carrying warm waters towards north-western Europe. The current swings in a southern direction through the influence of the North-East Trade Winds and transporting cool waters southwards to the equator. This slow moving current is the Canaries Current which becomes the North Equatorial Current across the Atlantic. East of the Caribbean, the Antilles Current closing the circle. The speed of the main circulatory currents is usually about 10 km a day, but the Gulf Stream may travel more than 130 km per day (Bramwell 1977). The prevailing winds show seasonal oscillations, especially when anticyclones develop over the Sahara. Then, the dry, and hot 'Harmattan' blows out from the desert for a few days (Mitchell-Thomé 1976). The Harmattan have its greatest influence on the Cape Verde Is., where he amount to 6 % of the annual winds (-Osang 1991). It was observed that Noctuoidea were carried with this wind from northern Africa to Madeira (Classey 1966), and a swarm of the pyraloid species *Nomophila noctuella* [Denis & Schiffermüller] and *Udea ferrugalis* (Hübner) to the Azores (Wolff 1971).

The evergreen forests of Macaronesia

The term 'evergreen forest', called 'laurisilva' or 'laurel forest', means any type of multilayered hardwood forest of non-deciduous trees and shrubs having laurifolius leaves. In the Macaronesian region, dominant species are members of the family Lauraceae (Santos 1990). In addition, epiphytes and lianas give the forest a tropical look. Relative humidity is about 70% and precipitation is between 400 to 3000 mm, and is essential for the sustenance of the forests. Frost is probably one of the most important constraints to the altitudinal distribution of laurisilva. Without the influ-

Table 3. Distribution of the scopariine species on the Macaronesian Islands. * Only one specimen is known. Abbreviations: AZORES: Co =Corvo, Fl =Flores, Gr =Graciosa, Jo =São Jorge, Fa =Faial, Pi =Pico, Te =Terceira, Mi =São Miguel, Ma =Sta. Maria. MADEIRA: Ma =Madeira, PS =Porto Santo, De =Desertas. CANARY ISLANDS: Hi =Hierro, Pa =La Palma, Go =Gomera, Tf =Tenerife, GC =Gran Canaria, Fu =Fuerteventura, La =Lanzarote.

	AZORES									MADEIRA			CANARY ISLANDS						CAPE VERDES	
	Co	Fl	Gr	Jo	Fa	Pi	Te	Mi	Ma	Ma	PS	De	Hi	Pa	Go	Tf	GC	Fu	La	Santo Antão
<i>Scoparia aequipennalis</i>		x	x	x	x	x	x	x	x											
<i>S. carvalhoi</i>					x	x	x		x											
<i>S. semiamplalis</i>		x		x	x	x	x	x	x											
<i>S. coecimaculalis</i>			x	x	x	x	x	x	x	*										
<i>Eudonia interlinealis</i>		x	x	x	x	x	x	x	x											
<i>E. luteusalis</i>				x		x	x	x	x											
<i>E. melanographa</i>				x		x	x	x												
<i>E. scoriella</i>										x										
<i>E. decorella</i>										x				x	x	x				
<i>E. stenota</i>										x										
<i>E. shafferi</i>										x										
<i>E. lineola tafirella</i>													x	x	x	x	x			
<i>E. lineola dorada</i>																		x	x	
<i>E. angustea</i>										x	x	x		x	x	x	x			
<i>E. parviangusta</i>																	x			
<i>E. geminoflexuosa</i>														x		x				
<i>E. lindbergalis</i>																				x

ence of human, this type of forest would cover a greater part of the island's surface: 30% on the Canary Is. (but absent from Lanzarote and Fuerteventura), 60% on Madeira, and 80% on the Azores. It is absent from the Selvagens, and from the Cape Verde Is. (Kunkel 1993, Lüpnitz 1995). Its origin can be traced back to the existence of tropical forests covering the Mediterranean area during the Miocene and Pliocene epochs (Santos 1990). These forests were generally destroyed and replaced with human settlements surrounded by agricultural land. For example, less than 1% of the original laurel forests are left on Gran Canaria (Kunkel 1993). Relicts (often secondary vegetation after cutting and burning) are limited to inaccessible, steep valleys, mainly on the northwestern and northern slopes (Santos 1990).

Material and methods

Although most scopariine species occurring in the Azores were already described during the beginning of this century (Warren 1905; Hampson 1907), most of the material available for this study was collected recently, mainly by Marc Meyer in July-August 1990 and July 1994 (H/M). No material was available from the northwesternmost island of Corvo.

On Madeira, the first microlepidoptera were collected in the middle of the last century (Wol-

laston 1858; Stainton 1859) and since them relatively little additional material has become available. The specimens for this study were collected by Niels Wolff and his assistants between 1970-1977 (ZMUC), by Ole Karsholt in February 1979, June-July 1993, October 1994, and April 1996 (ZMUC), and by Marc Meyer in May 1989 and July 1991 (H/M). Only a few specimens were available from the smaller islands of this archipelago.

Only 15 species of Lepidoptera are known from the Selvagens archipelago (Carvalho 1981; Carvalho 1996). No Scopariinae were found on the islets.

The lepidopteran fauna of the Canary Is. has received the most attention, between 1892 and 1938 it was reviewed eight times by Rebel (see Rebel 1938 for references). During recent years material has been collected from different islands; nevertheless, we consider the scopariine fauna of the Canary Is. less well investigated than that of the Azores and Madeira.

The only material available from the Cape Verde Is. was that collected on S. Antão by H.Lindberg (30.xii.1953), and by Panelius (1.i.1954), all belonging to the same species.

Smaller collections of Macaronesian material were available from various museums and private lepidopterists (see Acknowledgements). In all, 1,934 specimens were investigated. Data about

distribution and flight periods are only recorded from material examined in this study; published records are not included. An overview of the distribution is given in Table 3.

The preparation of the genitalia followed Robinson (1976).

Abbreviations

- BMNH – British Museum (Natural History), London, U.K.
 CNC – Canadian National Collection, Ottawa, Canada.
 H/M – Harbusch & Meyer, Germany.
 JPC – José Passos de Carvalho, Oeiras, Portugal.
 MINGA – Muzeul de Istorie Naturala 'Grigore Antipa', Bucuresti, Romania.
 MNHN – Musée national d'Histoire naturelle, Paris, France.
 MRSN – Museo Regionale di Scienze Naturali, Torino, Italy.
 NHM – Naturhistorisches Museum, Vienna, Austria.
 NMV – National Museum of Victoria, Melbourne, Australia.
 NHRS – Naturhistoriska Riksmuseet, Stockholm, Sweden.
 SMN – Staatliches Museum für Naturkunde, Karlsruhe, Germany.
 USNM – United States National Museum of Natural History, Washington, USA.
 ZMUC – Zoologisk Museum, Copenhagen, Denmark.
 ZM – Institut für Systematische Zoologie, Museum für Naturkunde, Berlin, Germany.
 ZMU – Zoological Museum, University of Helsinki, Finland.
 ZSB – Zoologische Sammlung des Bayerischen Staates, Munich, Germany.

Checklist of Macaronesian Scopariinae

- Scoparia aequipennalis* Warren, 1905
Scoparia carvalhoi **sp. n.**
Scoparia semiamplalis Warren, 1905
Scoparia coecimaculalis Warren, 1905
Scoparia caecimaculalis; misspelling
Eudonia interlinealis (Warren, 1905) **comb. n.**
Scoparia interlinealis ab. *pallidimarginalis* Warren, 1905
Eudonia luteusalis (Hampson, 1907) **comb. n.**
Scoparia lutensis; misspelling
Bradyrrhoa versicolorella Rebel, 1940
Eudonia melanographa (Hampson, 1907) **comb. n.**
Eudonia scoriella (Wollaston, 1858) **comb. n.**
Scoparia wollastoni Bethune-Baker, 1894 **syn. n.**
Eudonia decorella (Stainton, 1859) **comb. n., sp. rev.**
Scoparia maderensis Rebel, 1940 **syn. n.**
Eudonia stenota (Wollaston, 1858) **comb. n.**
Eudonia shafferi **sp. n.**
Eudonia lineola lineola (Curtis, 1827)
Scoparia virescens Rebel, 1896 **syn. n.**
Eudoria [sic] (*Scoparia*) *rungsii* Amsel, 1952
Eudonia lineola tafirella (Chrétien, 1908) **comb. n., stat. n.**

- Scoparia coeruleotincta* Hampson, 1917 **syn. n.**
Eudonia lineola dorada **ssp. n.**
Eudonia angustea (Curtis, 1827)
Eudorea coarctata Zeller, 1846
Eudorea hesperella Heydenreich, 1851
Eudorea acuminatella Stainton, 1859
Scoparia coarctalis var. *napolitana* Millière, 1870
Scoparia imparilis Dyar, 1929 **syn. n.**
Eudonia parviangusta **sp. n.**
Eudonia geminoflexuosa **sp. n.**
Eudonia lindbergalis (Viette, 1958) **comb. n.**

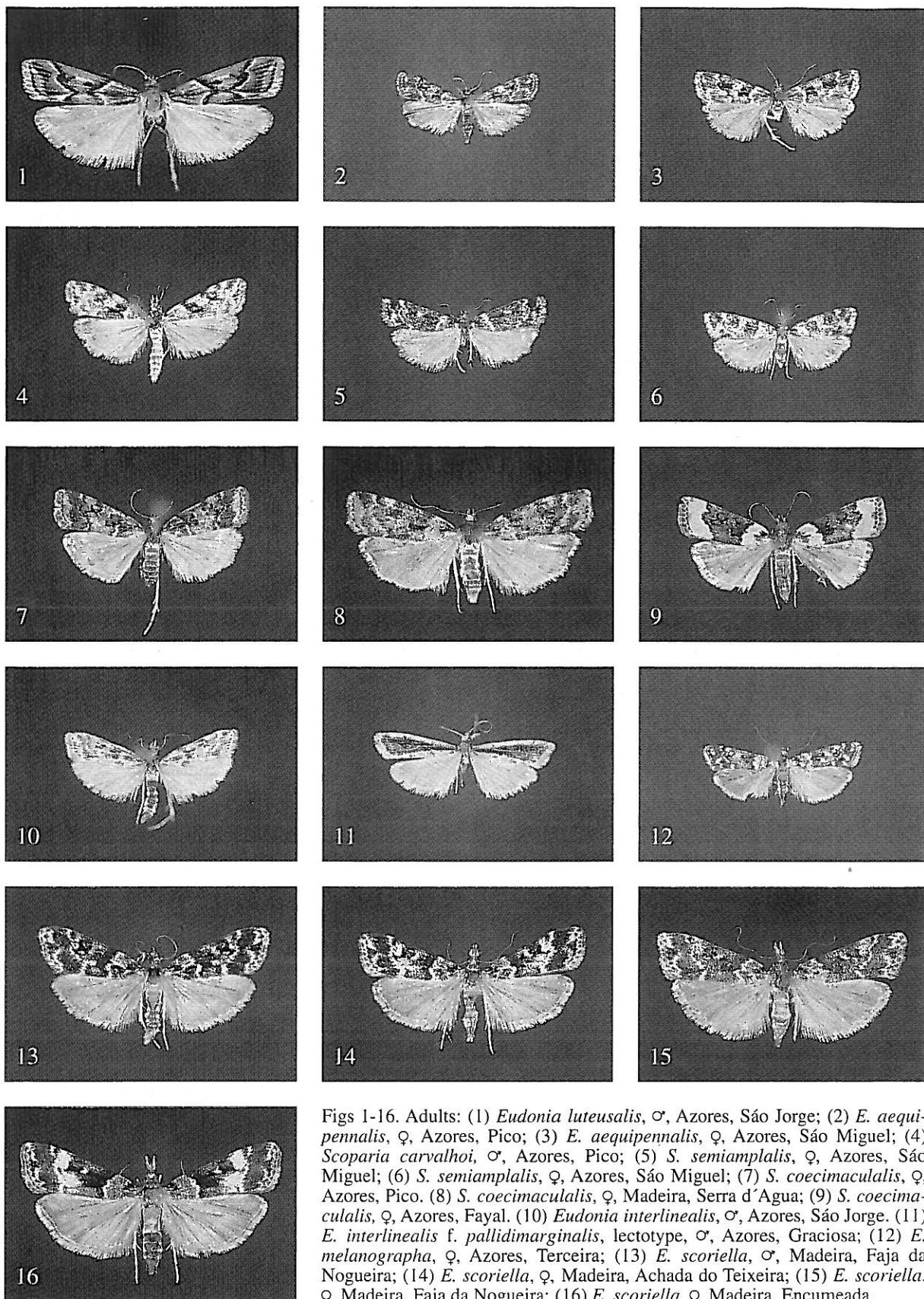
Review of species

Genus *Scoparia* Haworth

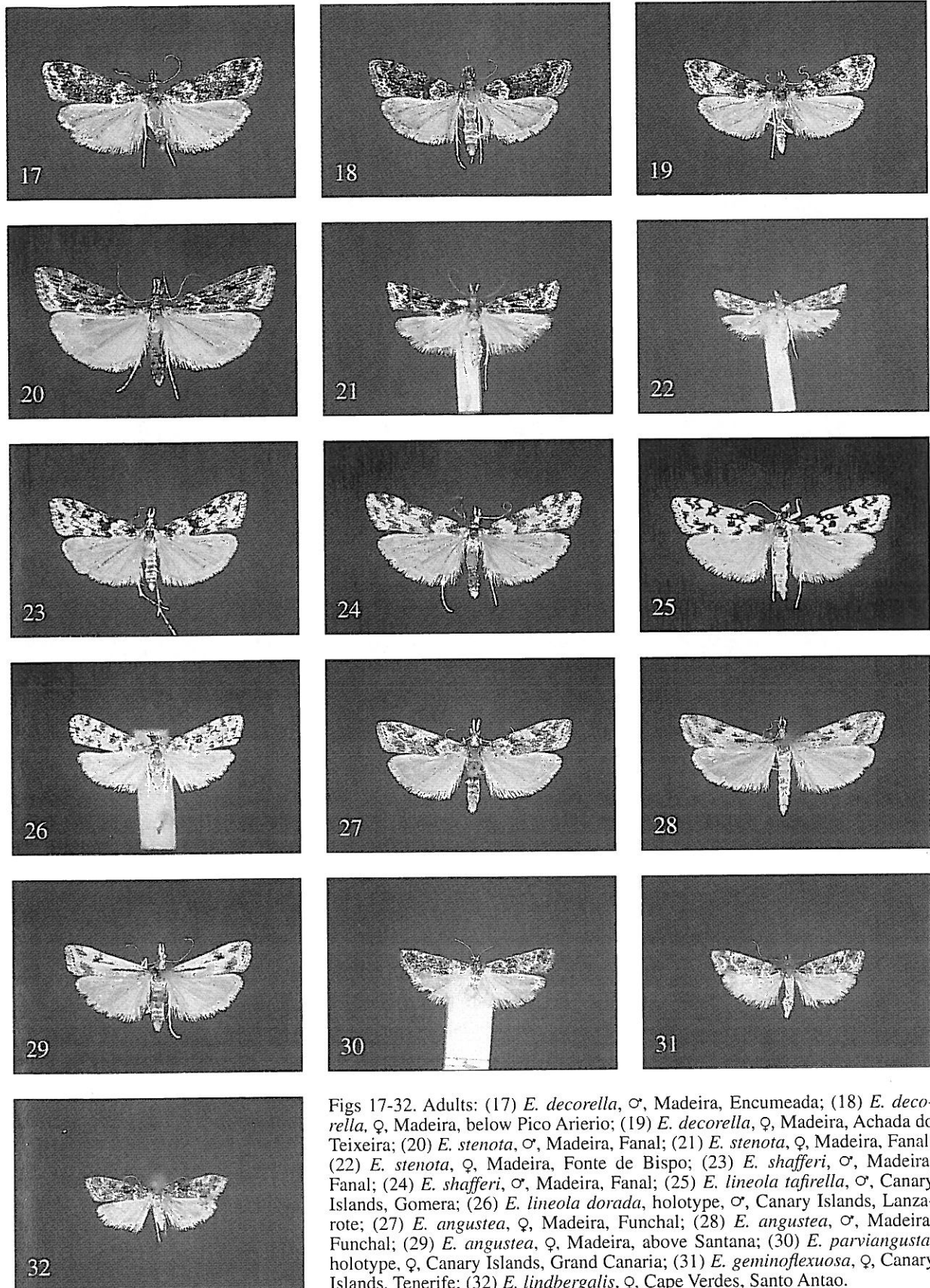
Scoparia Haworth, 1811: 498; Chapman 1912: 507; Leraut 1984: 160. Type species: *Tinea pyralella* [Denis & Schiffermüller], 1775: 135, by subsequent designation by Curtis 1827: pl. 170.

Diagnosis. – Male genitalia with a long and distally pointed uncus, a free distal extension of the sacculus, and cornuti in the aedeagus; females with a streak like signum on the corpus bursae.

Remarks. – Within Macaronesia *Scoparia* is represented only on the Azores Is. The four species have the following characters in common: male – a slightly stocky uncus, a thickened saccus, which is bent upwards, and a hamus in the retinaculum (Fig. 33); female – corpus bursae with area adjacent to signum with reticulate pattern, opposite side with extensive field of inwardly directed tiny spines, ductus bursae with a short sclerotised collar posterior to ductus seminalis. *S. semiamplalis* and *S. coecimaculalis* secondarily lost the cornuti in the aedeagus; the other two species, *S. aequipennalis* and *S. carvalhoi*, have cornuti. The Azorean species of *Scoparia* are closely related to two species from the Nearctic Region: *Scoparia biplagiata* Walker (Munroe 1972: 40; Munroe 1974: pl. 2 figs 16-29, pl. B fig. 8, pl. G fig. 7) from northern America, and *Scoparia jonesalis* Dyar (Ferguson et al. 1991: 10, 32, 73, figs 60, 61, 202a-c) from the Bermudas Is. *S. jonesalis* and *S. biplagiata* do not possess a hamus in the male retinaculum, nor do they have cornuti in the aedeagus. These two Nearctic and the four Azorean species are a monophyletic group, the *Scoparia biplagiata*-species group. Their synapomorphy is the narrow and short sclerotisation of the ductus bursae caudal to the insertion of the ductus seminalis.



Figs 1-16. Adults: (1) *Eudonia luteusalis*, ♂, Azores, São Jorge; (2) *E. aequipennalis*, ♀, Azores, Pico; (3) *E. aequipennalis*, ♀, Azores, São Miguel; (4) *Scoparia carvalhoi*, ♂, Azores, Pico; (5) *S. semiamplalis*, ♀, Azores, São Miguel; (6) *S. semiamplalis*, ♀, Azores, São Miguel; (7) *S. coecimaculalis*, ♀, Azores, Pico; (8) *S. coecimaculalis*, ♀, Madeira, Serra d'Água; (9) *S. coecimaculalis*, ♀, Azores, Fayal. (10) *Eudonia interlinealis*, ♂, Azores, São Jorge. (11) *E. interlinealis* f. *pallidimarginalis*, lectotype, ♂, Azores, Graciosa; (12) *E. melanographa*, ♀, Azores, Terceira; (13) *E. scoriella*, ♂, Madeira, Faja da Nogueira; (14) *E. scoriella*, ♀, Madeira, Achada do Teixeira; (15) *E. scoriella*, ♀, Madeira, Faja da Nogueira; (16) *E. scoriella*, ♀, Madeira, Encumeada.



Figs 17-32. Adults: (17) *E. decorella*, ♂, Madeira, Encumeada; (18) *E. decorella*, ♀, Madeira, below Pico Arierio; (19) *E. decorella*, ♀, Madeira, Achada do Teixeira; (20) *E. stenota*, ♂, Madeira, Fanal; (21) *E. stenota*, ♀, Madeira, Fanal; (22) *E. stenota*, ♀, Madeira, Fonte de Bispo; (23) *E. shafferi*, ♂, Madeira, Fanal; (24) *E. shafferi*, ♂, Madeira, Fanal; (25) *E. lineola tafirella*, ♂, Canary Islands, Gomera; (26) *E. lineola dorada*, holotype, ♂, Canary Islands, Lanzarote; (27) *E. angustea*, ♀, Madeira, Funchal; (28) *E. angustea*, ♂, Madeira, Funchal; (29) *E. angustea*, ♀, Madeira, above Santana; (30) *E. parviangusta*, holotype, ♀, Canary Islands, Grand Canaria; (31) *E. geminoflexuosa*, ♀, Canary Islands, Tenerife; (32) *E. lindbergalis*, ♀, Cape Verdes, Santo Antao.

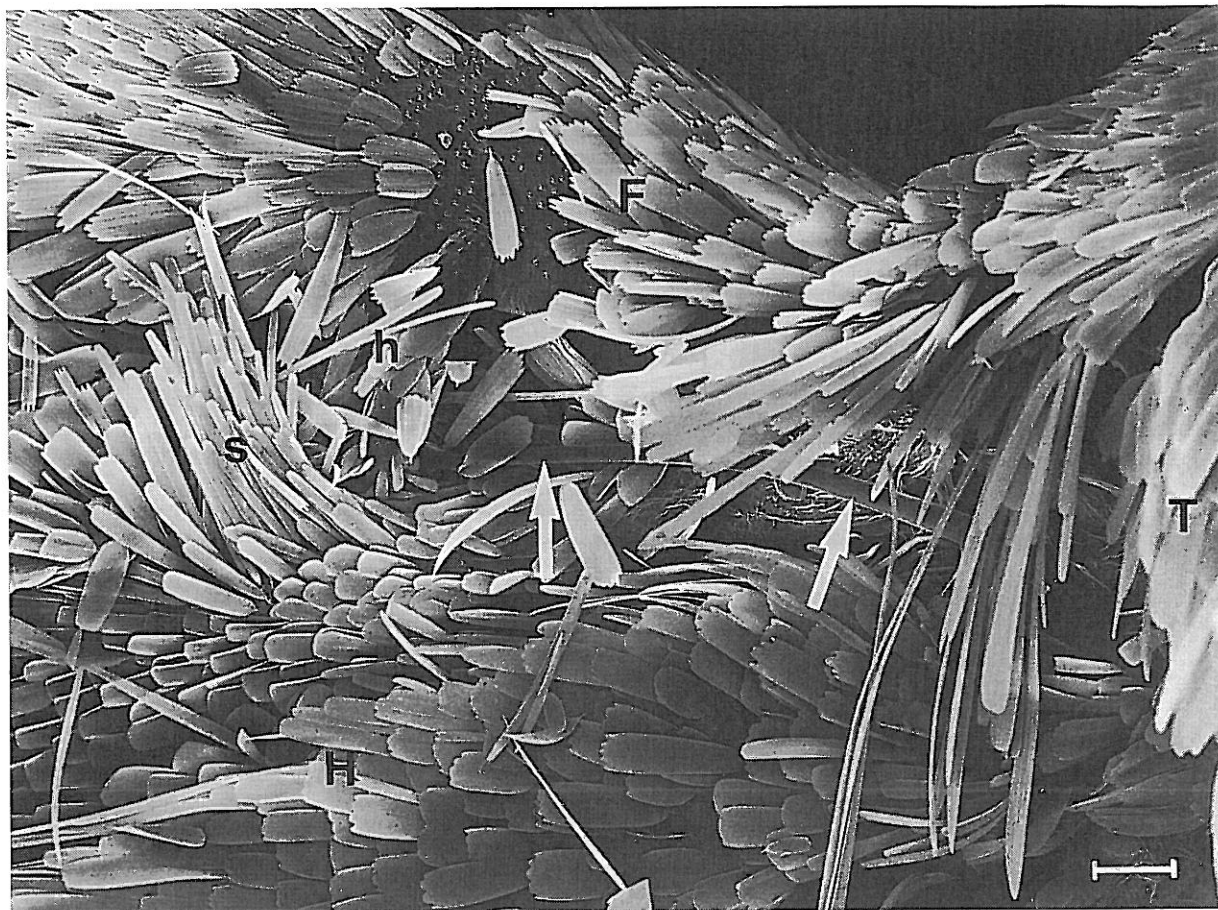


Fig. 33. Wing coupling in a male of *Scoparia pyralella* [Denis & Schifferrmüller] showing frenulum (white arrows) and retinaculum with hamus (h) and long and stiff scales (s). F: forewing, H: hindwing, T: thorax. Scale 100 µm.

Scoparia aequipennalis Warren

(Figs 2, 3, 36, 37, 68)

Scoparia aequipennalis Warren, 1905: 444; Carthy 1957: 213; Carvalho 1982: 180; Carvalho 1992: 268; Rebel 1917: 18; Rebel 1940c: 8, 32 (key), 33, pl. 2 fig. 5; Vieira & Pintureau 1991: 33; Vieira & Pintureau 1993: 110.

Diagnosis. – Male-aedeagus with a small group of four cornuti; female-ductus bursae beyond corpus bursae thickened and with one loop.

Description. – Wingspan 10-15 mm (n=137). Forewings dark brown, colour a mixture of black and white scales with ochreous scales especially around stigmata; fasciae white, stigmata black; basal area with a black streak, above streak a black dot; antemedial stigmata claviform; discocellular stigma reniform, with blackish, X-shaped mark; postmedial fascia evenly sinuate; subterminal fascia interrupted in the middle, termen with a

white wavy line; fringe grey with dark subbasal band; hindwings grey brown, opaque and without fasciae, fringe as in the forewings. Specimens from São Miguel larger and somewhat paler with a predominance of white scales in forewings; subbasal band of fringe in forewing white and grey striped; hindwings whitish with indistinct grey brown border.

Male genitalia: A small group of cornuti (total length 130 mm) in the aedeagus, composed of four longish, slightly bent cornuti which are connected at their bases.

Female genitalia: Corpus bursae globular; ductus bursae anteriorly thickened and looped, then membranous to ductus seminalis.

Material examined. – Holotype ♂, 'Holotype', 'Crater above Reguinho, 2000ft. (O Grant.)', '*Scoparia aequipennalis*, Type ♀ Warr', 'Pylalidae Brit. Mus. Slide No. 2546' [GU Nuss 369 – the abdomen, which was in a capsule on the pin of the type, was strongly damaged],

'Holotype *Scoparia aequipennalis* Warren det. M. Nuss' (BMNH).

AZORES. FLORES: 2 ♂ Santa Cruz, 19.iv.1903, Grant (BMNH). 1 ♂, 1 ♀ same except, 100m, 3.viii.1990, Meyer (H/M); 1 ♂ same except, Pedra Alta, 375m, 7.viii.1990, Meyer (H/M); 1 ♂ Caldeira Comprida, 580m, 8.viii.1990, Meyer (H/M). **GRACIOSA:** 1 ♂, 1 ♀ Caldeira, 400m, 27.iv.1903, Grant (BMNH). **SAO JORGE:** 1 ♂ above Calheta, 2.v.1903, Grant (BMNH); 1 ♀ same except, 400m, 5.v.1903, Grant (BMNH); 1 ♂ same except, 9.v.1903, Grant (CNC); 1 ♀ Pico das Caldeirinhas, 700m, 16.viii.1990, Meyer (Nuss); 3 ♂, 3 ♀ Serra do Topo, 800m, 18.vii.1994, Meyer (H/M); 1 ♀ Ilmagreira, 29.ii.1903, Grant (BMNH). **FAIAL:** 1 ♂ above Horta, 333m, 26.v.1903, Grant (BMNH); 1 ♀ central, 633m, 25.v.1903, Grant (BMNH); 1 ♀ Norte Pequeno, 300m, 11.viii.1990, Meyer (H/M); 1 ♂, 1 ♀ Serra da Feteira, Cabeco Redondo, 850m, 12.viii.1990, Meyer (H/M). **PICO:** 2 ♂, 1 ♀ below Pico, 333m, 15.v.1903, Grant (BMNH); 2 ♂, 1 ♀ Cima da Silveira, 3.vii.1981, Carvalho (JPC); 3 ♂, 3 ♀ Furna Frei Matias, 900m, 15.vii.1994, Meyer (H/M); 1 ♂ Misterio Prainha, 200m, 15.vii.1994, Meyer (H/M); 3 ♀ Cabeco da Rocha, 800m, 13.viii.1990, Meyer (H/M, ZMUC); 2 ♂, 5 ♀ Cabecinhos, 480m, 14.viii.1990, Meyer (H/M, Nuss); 2 ♀ Norte Pequeno, 500m, 17.vii.1994, Meyer (H/M); 3 ♂, 2 ♀ Pico Caveiro, 900m, 14.vii.1994, Meyer (H/M); 2 ♂, 3 ♀ Sao Roque do Pico, 150m, 13.vii.1994, Meyer (H/M); 3 ♀ Silveira, Misterio, 400m, 14.vii.1994, Meyer (H/M, Nuss). **TERCEIRA:** 1 ♂ 24.x.1978, Carvalho (BMNH); 2 ♂ Crater above Reguinho, 666m, Grant (BMNH); 1 ♀ Pau Velho, 28.x.1978, Carvalho (BMNH); 1 ♂ Pta. Serreta, 26.iii.1979, Carvalho (JPC); 1 ♂ Santa Barbara, 600m, 19.vii.1994, Meyer (H/M); 2 ♂, 4 ♀ Serra da Labacal, 800m, 20.vii.1994, Meyer (H/M). **SAO MIGUEL:** 1 ♂ 270m, 26.iii.1903, Grant (BMNH); 6 ♂, 2 ♀ Furnas, v.1969, Pinker (SMN); 17 ♂, 13 ♀ same except, 11.v.-3.vi.1969, Pinker (SMN); 1 ♀ Monte Escuro, Lombadas, 600m, 12.vii.1994, Meyer (H/M); 3 ♂, 1 ♀ Planalto dos Graminhais, 700m, 12.vii.1994, Meyer (H/M, Nuss); 2 ♂ Caldeira Velha, 300m, 9.vii.1994, Meyer (H/M); 1 ♂ Serra da Tronqueira, 800m, 2.vii.1994, Meyer (Nuss); 2 ♂, 2 ♀ same except, 800m, 12.vii.1994, Meyer (H/M); 1 ♂ same except, 600m, 29.vii.1990, Meyer (H/M); 3 ♂, 4 ♀ Sete Cidades, Pico Carvao, 500m, 9.vii.1994, Meyer (H/M). **SANTA MARIA:** 1 ♂ Sao Pedro, 3.iii.1903, Grant (BMNH); 1 ♀ Sao Pedro, 3.v.1903, Grant (BMNH); 2 ♂ same except, 2.v.1903, Grant (BMNH).

Distribution. – Endemic to the Azores.

Biology. – Known flight period: 29 February to 28 October.

Remarks. – Rebel (1940c pl. 2 figs 5, 10 & 15) misidentified three specimens of *E. melanographa* as *S. aequipennalis*.

Scoparia carvalhoi sp. n.

(Figs 4, 34, 35, 71)

Diagnosis. – Male-aedeagus with a sickle-shaped

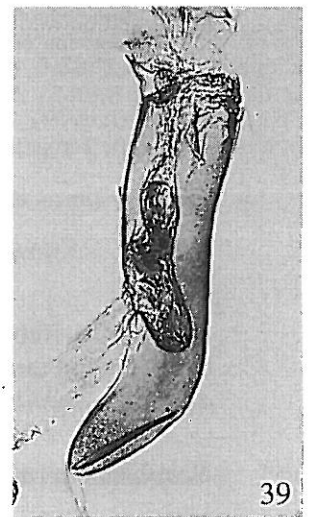
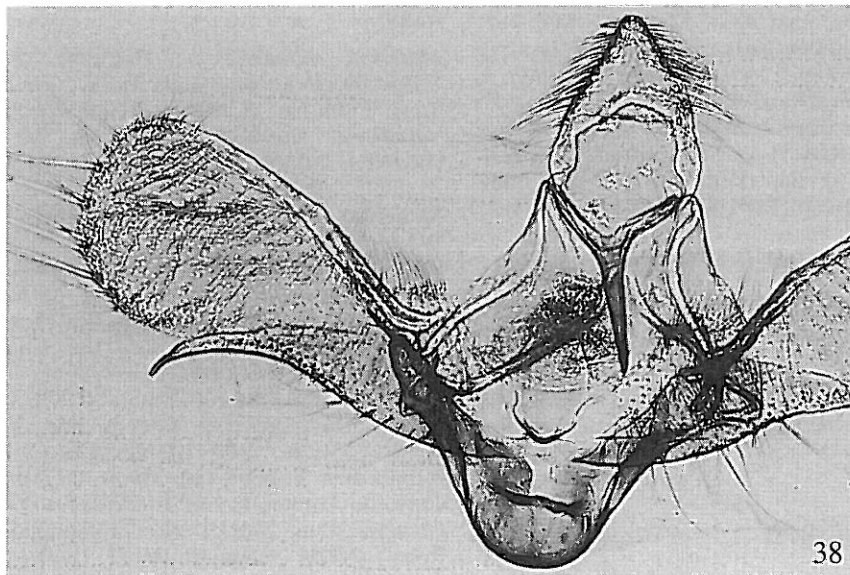
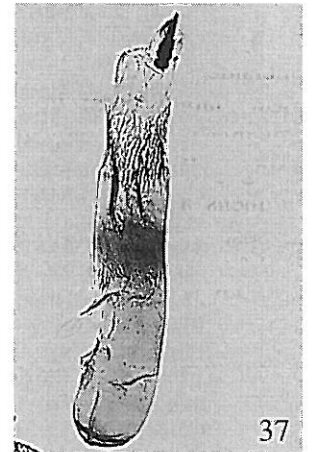
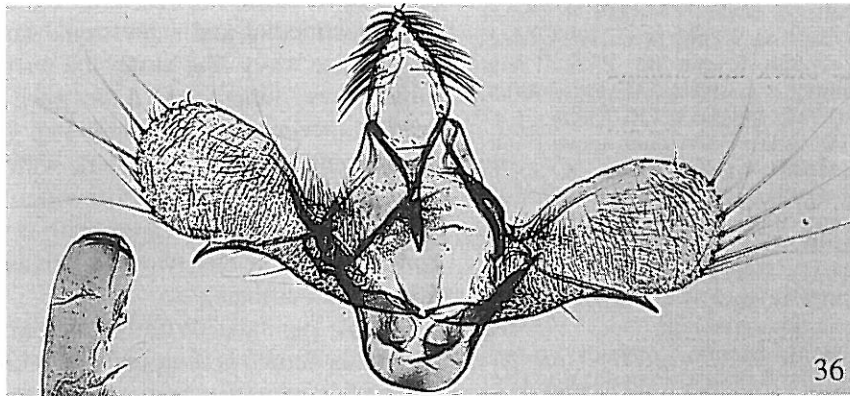
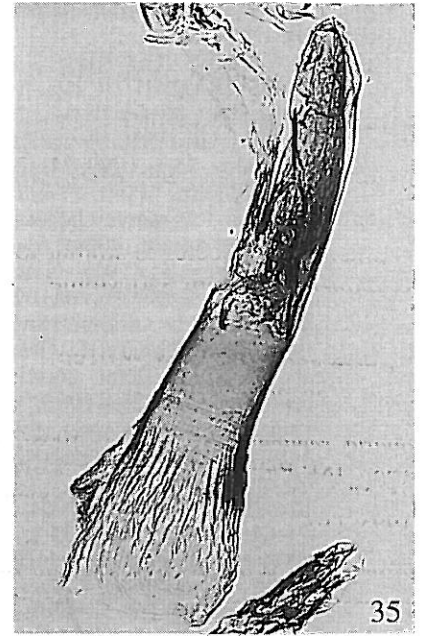
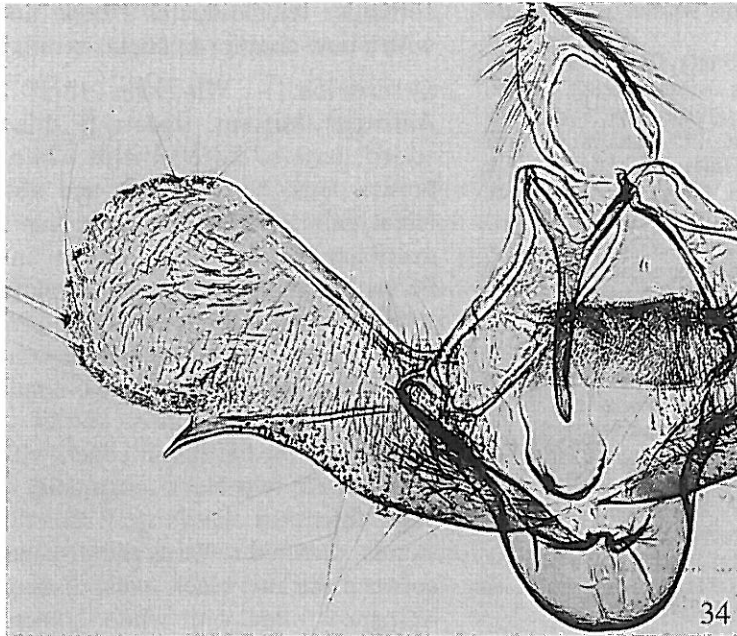
cornutus; female-ductus bursae not looped, but with a bow anterior to ductus seminalis.

Description. – Wingspan 15-17 mm (n=24). Antennae filiform, underside ciliate, upperside scaled: base of flagellomeres white, distally pale brown; legs, head, thorax and abdomen white; labial palpi porrect, but not much longer as the maxillary palpi, white, brown in the middle. Forewings broad, grey ground colour is a mixture of black and white scales, with a predominance of white scales; stigmata black, mixed with ochreous; base near costa with two small black spots; fasciae white, with little contrast to the ground colour; antemedial fascia edged with black to the medial area; two black antemedial stigmata, with ochre filled and claviform, with a third, claviform stigma, directed towards the discocellular stigma, between the two black ones; discocellular stigma X-shaped, filled with white, sometimes more or less edged with brown; towards costa a black spot; postmedial and subterminal fasciae form an X; a white wavy line along the termen; fringe of three rows, inner row dark grey, second row white, outer row brown; hindwings light grey and transparent, terminal area dark with a light post-medial fascia; fringe as in forewings.

Male genitalia: Aedeagus with a sickle-shaped cornutus, which has two smaller and some very thin cornuti at the base.

Female genitalia: With the typical characters of the genus *Scoparia*, corpus bursae large, globular; ductus bursae with a bow anterior to ductus seminalis.

Material examined. – Holotype ♂ 'Holotypus', '30.7.1990 P-Acores/ Santa Maria 2 km NE Chã de São Tomé 350m leg. M. Meyer', 'Holotype *Scoparia carvalhoi* Nuss, Karsholt, Meyer det. M. Nuss, 1995' (BMNH). Paratypes: 7 ♂, 4 ♀ same (H/M, Nuss, ZM, ZMUC). 1 ♂ '14.7.1994 P-Acores Pico Silveira / L.F. Mistério / 400m leg. M. Meyer' (H/M), 1 ♀ '15.7.1994 P-Acores Pico L.F. Furna Frei Matias Mistério 900m leg. M. Meyer' (BMNH). 1 ♀ '19.7.1994 P-Acores Terceira Santa Barbara L.F./ 600m leg. M. Meyer' (H/M). 1 ♂, 1 ♀ 'Arquipélago dos Açores Ilha Pico Loc. E. longitudinal 4/7/1981 col. Passos Carvalho' (JPC). 1 ♀ 'Arquipélago dos Açores Ilha Terceira Loc. Pau Velho 11/7/1981, col. Passos Carvalho' (JPC). 3 ♂, 1 ♀ 'Arquipélago dos Açores Ilha Terceira Loc. Bicas 26/6/1982 Passos Carvalho' (JPC, M. Nuss). 1 ♀ 'Arquipélago dos Açores Ilha Terceira Loc. Bicas 11/7/1981 col. Passos Carvalho António Contente' (Nuss). 1 ♂ 'Azores: Fayal Caldeira 4.vii. Storå', 'Sc. semiampalis Warr.' [det. Rebel] (NHM) (compare Rebel, 1940c: 35). (All paratypes with a red label 'Paratypus' and a label 'Paratype *Scoparia carvalhoi* Nuss, Karsholt, Meyer det. M. Nuss, 1995'.)



Figs 34-39. ♂ genitalia: (34, 35) *Scoparia carvalhoi*, GU Nuss 622, Azores, Fayal; (36, 37) *S. aequipennalis*, GU Nuss 704; (38, 39) *S. semiamplalis*, GU Nuss 620, Azores, Sao Miguel.

Derivatio nominis. – The species is named after the Portuguese entomologist, J. Passos de Carvalho.

Distribution. – Endemic to the Azores. Known from Faial, Pico, Terceira and Santa Maria.

Biology. – Known flight period: 26 June to 30 July.

Remarks. – The species is similar to specimens of *S. aequipennalis* from São Miguel.

Scoparia semiamplalis Warren

(Figs 5, 6, 38, 39, 69)

Scoparia semiamplalis Warren, 1905: 446; Carvalho 1982: 181; Rebel 1917: 18; Rebel 1940c: 8, 32 (key), 35; Vieira & Pintureau 1991: 33; Vieira & Pintureau 1993: 110.

Diagnosis. – Wing pattern shining black and yellow; male-aedeagus without cornuti; female-ductus bursae without loops.

Description. – Wingspan 13–16 mm (n=102). Upperside of head and thorax black and shining yellow; labial palpi upright with short scales. Forewings with the typical pattern of *Scoparia* but shining yellow with black admixture, in some specimens a predominance of black; antemedial and postmedial fascia broad and yellow; subterminal fascia approximated to postmedial fascia in the middle, thin towards costa, posteriorly broad; with two black antemedial stigmata, of indistinct shape caused by surrounding black scales; discocellular stigma black and X-shaped; termen shining yellow; hindwings white or pale grey, darker grey towards termen, underside with a discocellular stigma and a postmedial fascia; fringe of the forewings grey, that of the hindwings white.

Male genitalia: Like that of *S. aequipennalis*, but aedeagus without cornuti.

Female genitalia: Ductus bursae without loops.

Material examined. – Holotype ♂ 'Holotype', 'Reguinho, Terceira, 2200 ft., 6 April 03. (O. Grant).', 'Scoparia semiamplalis Type ♀ Warr.', 'Pyralidae Brit. Mus. Slide No. 3777', 'Holotype Scoparia semiamplalis Warren det. M. Nuss' (BMNH).

AZORES. FLORES: 1 ♀ Mosteiro, 300m, 9.viii.1990, Meyer (H/M); 1 ♂ Santa Cruz das Flores, 19.iv.1903, Grant (BMNH). SAO JORGE: 1 ♂, 2 ♀ Pico das Caldeirinhas, 700m, 16.viii.1990, Meyer (H/M); 1 ♂, 1 ♀ Serra do Topo, 800m, 18.vii.1994, Meyer (H/M, Nuss). FAIAL: 1 ♂, 1 ♀ Serra da Feteira, Cabeco Redondo, 850m, 12.viii.1990, Meyer (H/M, Nuss). PICO: 1 ♂ Cima da Silveira, 5.vii.1981, Carvalho (JPC); 2 ♂, 15 ♀ Cabeco da Rocha, 800m, 13.viii.1990, Meyer (H/M, Nuss, ZMUC); TERCEIRA: 1 ♀ Serra da

Labacal, 800m, 20.vii.1994, Meyer (Nuss); 1 ♂ Bicas, 26.vi.1981, Carvalho & Contente (JPC); 1 ♀ Pau Velho, 19.v.1983, Carvalho (JPC); 1 ♂, 5 ♀ Veredas, 24.x.1978, Carvalho (BMNH, JPC). SAO MIGUEL: 6 ♂, 2 ♀ Furnas, v.1969, Pinker (SMN); 24 ♂, 11 ♀ Furnas, 11.v.-3.vi.1969, Pinker (SMN); 7 ♂, 1 ♀ Monte Escuro, Lombadas, 600m, 12.vii.1994, Meyer (H/M, Nuss); 2 ♀ Caldeira Velha, 300m, 9.vii.1994, Meyer (H/M, Nuss); 2 ♂ Serra da Tronqueira, 800m, 12.vii.1994, Meyer (H/M); 5 ♂, 4 ♀ same except, 600m, 29.vii.1990, Meyer (H/M). SANTA MARIA: 1 ♀ Cha de Sao Tome, 350m, 30.vii.1990, Meyer (H/M).

Distribution. – Endemic to the Azores; recorded from all larger islands except Corvo and Graciosa.

Biology. – Known flight period: 6 April to 24 October.

Remarks. – Holotype with a dark medial area of the forewings. Rebel (1940c: 35) recorded this species on the basis of one misidentified specimen from Faial. This is preserved in the collection of the NHM and selected as paratype of *S. carvalhoi* sp. n.

Scoparia coecimaculalis Warren

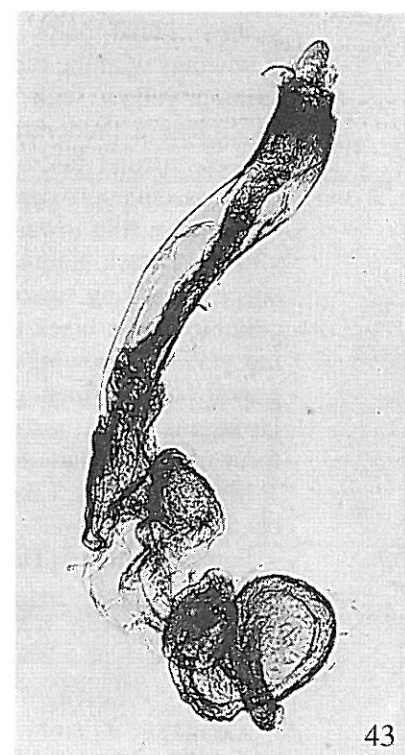
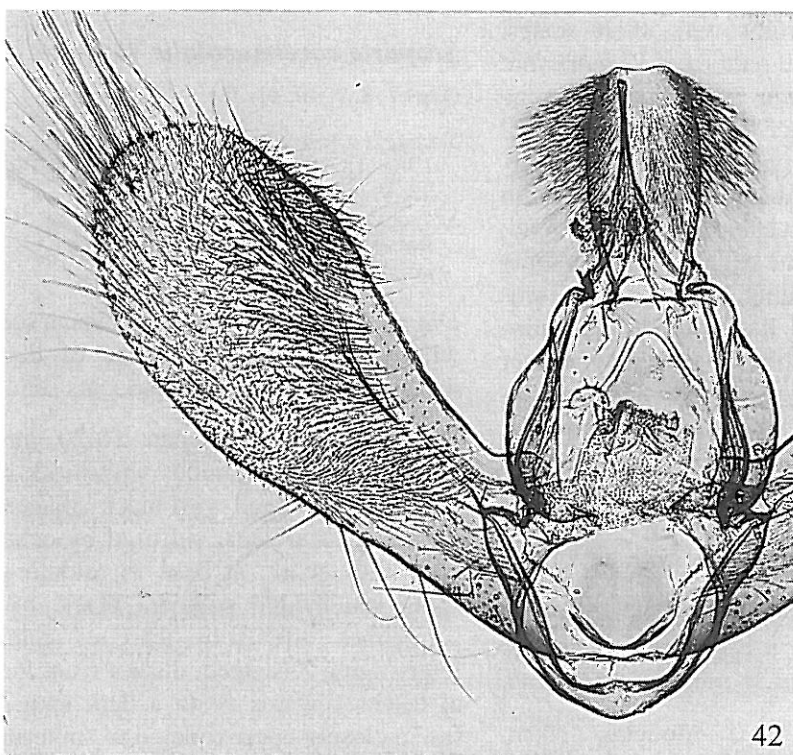
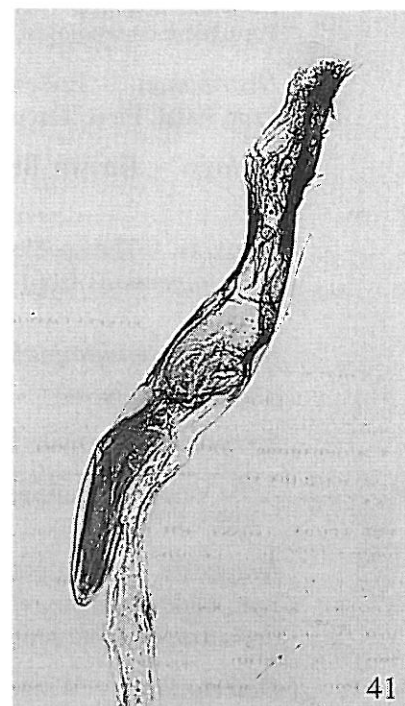
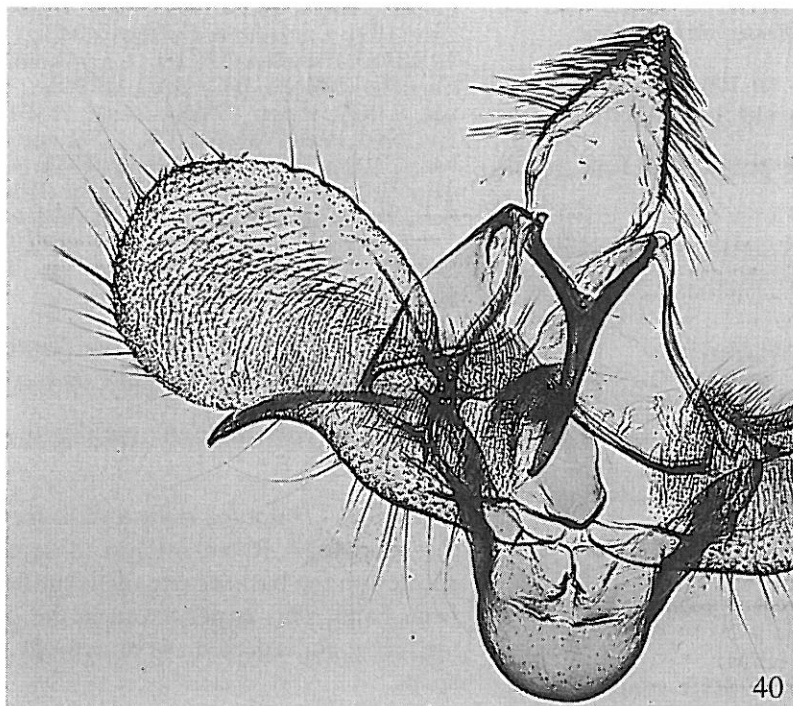
(Figs 7, 8, 9, 40, 41, 70)

Scoparia coecimaculalis Warren, 1905: 445; Carvalho 1982: 181; Rebel 1917: 18; Vieira & Pintureau 1991: 33; Vieira & Pintureau 1993: 110.

Scoparia caecimaculalis; misspelling, Carthy 1957, Rebel 1940c: 8, 32 (key), pl. 1 figs 13, 14 (as *Scoparia luteusalis*).

Diagnosis. – Male-valvae downcurved, aedeagus without cornuti; female-base of ductus bursae thickened, one loop before ductus seminalis.

Description. – Wingspan 16–20 mm (n=177). Forewings light ochreous with black pattern; fasciae whitish, edged with black adjacent to medial area; stigmata black, suffused by ochreous; basal area light ochre, at base in middle some black spots; antemedial stigmata black, roughly oval, sometimes suffused by ochreous scales; discocellular stigma X-shaped, distant from the postmedial fascia, towards costa a dark spot; postmedial fascia closely approximated to subterminal fascia, forming an X-shape; a black wavy line along termen, bordered with white to the margin of the wing; fringe grey, indistinctly striped; hindwings white, somewhat transparent, dark at apex and with an interrupted grey postmedial fascia, fringe whitish brown. About three percent of all specimens have in the forewings a predominantly black



Figs 40-43, ♂ genitalia: (40, 41) *Scoparia coecimaculalis*, GU Nuss 624, Azores, Pico; (42-43). *E. interlinealis*, GU Nuss 719, Azores, Sao Jorge.

scaled medial area; the stigmata are black, suffused ochreous; basal and postmedial area pale ochreous, subterminal fascia obsolete.

Male genitalia: Valvae downcurved; sacculus with a well developed spiny process; no cornuti in the aedeagus.

Female genitalia: Corpus bursae ovoid; anterior portion of ductus bursae thickened, a fold anterior to ductus seminalis.

Material examined. – Lectotype, hereby designated, ♂ 'Lectotype', 'Above Calheta S. Jorge. 1200 ft., 7. May 03. (O. Grant)', 'Scoparia coecimaculalis, Type ♀ Warr', 'Pyralidae Brit. Mus. Slide No. 3776', 'Lectotype, Scoparia coecimaculalis Warren, det. M. Nuss' (BMNH). Paralectotype: ♀ same, except 'Paralectotype', 8. May 03, 'Paralectotype Scoparia coecimaculalis Warren det. M. Nuss' (BMNH) (Abdomen in capsule on pin).

AZORES. GRACIOSA: 1 ♀ Caldeira, 400m, 26.iv.1903, Grant (BMNH). SAO JORGE: 2 ♂, 1 ♀ Manadas, 600m, 16.vii.1994, Meyer (H/M); 2 ♀ Pico das Caldeirinhas, 700m, 16.viii.1990, Meyer (H/M); 1 ♂, 2 ♀ Serra do Topo, 800m, 18.vii.1994, Meyer (H/M). FAIAL: 3 ♂, 16 ♀ Norte Pequeno, 300m, 11.viii.1990, Meyer (H/M, Nuss); PICO: 1 ♀ Silveira, 3.viii.1981, Carvalho (JPC); 1 ♀ Calhau, 250m, 16.vii.1994, Meyer (H/M); 1 ♀ Furna Frei Matias, 900m, 15.vii.1994, Meyer (H/M); 8 ♂, 83 ♀ Cabeco da Rocha, 800m, 13.viii.1990, Meyer (H/M, Nuss, ZMUC); 5 ♂, 12 ♀ Cabecinhos, 480m, 14.viii.1990, Meyer (H/M); 1 ♀ Norte Pequeno, 500m, 17.vii.1994, Meyer (H/M); 5 ♀ Sao Roque do Pico, 150m, 13.vii.1994, Meyer (H/M). TERCEIRA: Pau Velho: 3 ♀ 19.v.1983, Carvalho (JPC); 3 ♀ same except, 18.i.1979, Carvalho (BMNH, JPC); 1 ♂ same except, 18.i.1971, Carvalho (BMNH); 1 ♂ same except, 13.vii.1981, Carvalho (JPC); 1 ♂ same except, 1 ♀ 18.i.1971, Contente (BMNH); 2 ♀ same except, 11.vii.1981, Carvalho & Contente (JPC); 1 ♀ same except, 20.viii.1982, Carvalho (JPC); 2 ♀ same except, 13.vii.1981, Carvalho (JPC); 4 ♀ same except, 28.x.1978, Carvalho & Contente (JPC); 1 ♂ same except, 13.vii.1981, Carvalho & Contente (JPC); 1 ♂ same except, 5.vii.1981, Carvalho (JPC); 2 ♂ same except, 12.vii.1981, Carvalho (JPC); 1 ♀ Serra de Santa Barbara, 1000m, 18.viii.1990, Meyer (H/M); SAO MIGUEL: 1 ♀ Furnas, 22.-24.v., Storå (NHM); 1 ♀ Monte Escuro, Lombadas, 600m, 12.vii.1994, Meyer (H/M). SANTA MARIA: 1 ♂, 2 ♀ Cha de Sao Tome, 350m, 30.vii.1990, Meyer (H/M).

MADEIRA: 1 ♀ Serra de Agua, 660m, 7.ix.1973, Lomholdt & Wolff (ZMUC).

Distribution. – Endemic to the Azores, abundant, but no records from the northwestern islands Corvo and Flores. There is one female from 'Madeira Serra d'Agua 660m 7.ix.1973 Lomholdt & Wolff leg.' (ZMUC) (see below).

Biology. – Known flight period: 18 January to 28 October, no records from June.

Remarks. – Rebel (1940c) figured the species on pl. 1, fig. 13 & 14 as *Scoparia luteusalis*.

The single female of *S. coecimaculalis* found on Madeira had probably drifted from the Azores or perhaps had been transported by ship. Silberglied (1978), for example, showed that insects

that are attracted to shipboard lights are regularly transported between Galápagos Is. Compare chapter on 'Doubtful records and species' below.

Genus *Eudonia* Billberg

Eudonia Billberg, 1820: 93; Chapman 1912: 507 [*Eudoria*]; Leraut 1984: 161. Type species: *Phalaena Tinea mercurella* Linnaeus, 1758: 538, by monotypy.

Diagnosis. – The genus is distinguished from *Scoparia* by morphological characters of the genitalia: the males have no cornuti in the aedeagus, no free distal extension of the sacculus and the uncus is dorsally rounded or bilobed. The females have a well sclerotised, more or less rounded signum on the corpus bursae and a long sclerotised portion between ductus seminalis and antrum. In the Macaronesian Region, the males of all species have a hamus in the retinaculum, except *E. lineola*.

Eudonia interlinealis (Warren), **comb. n.**

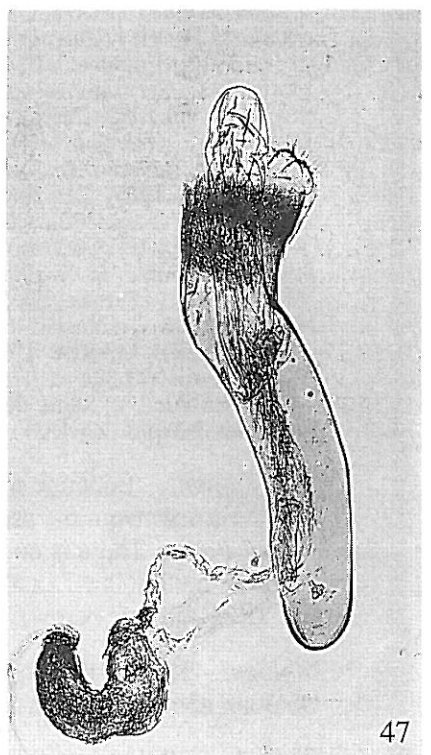
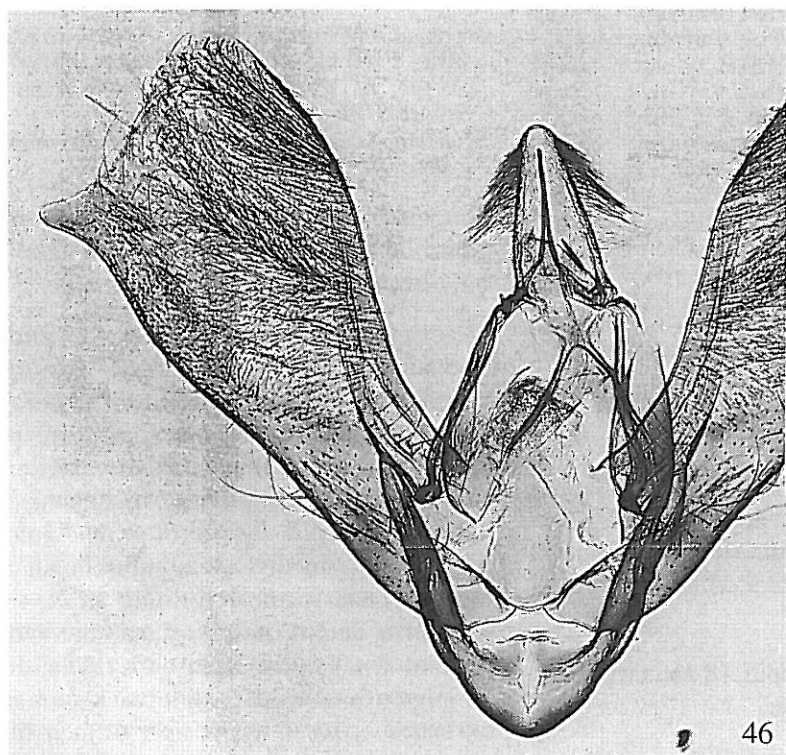
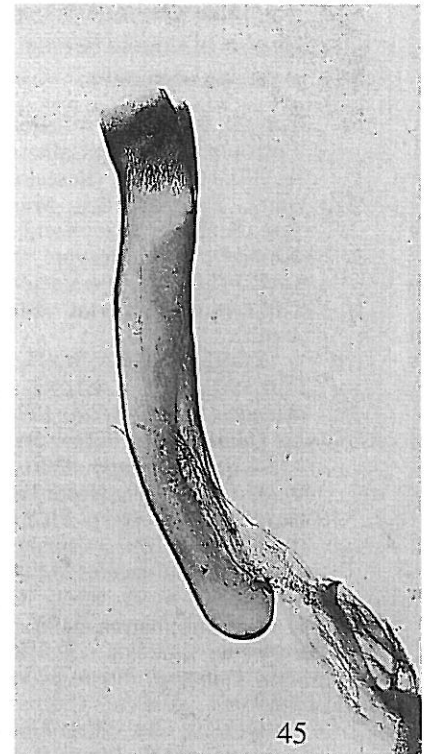
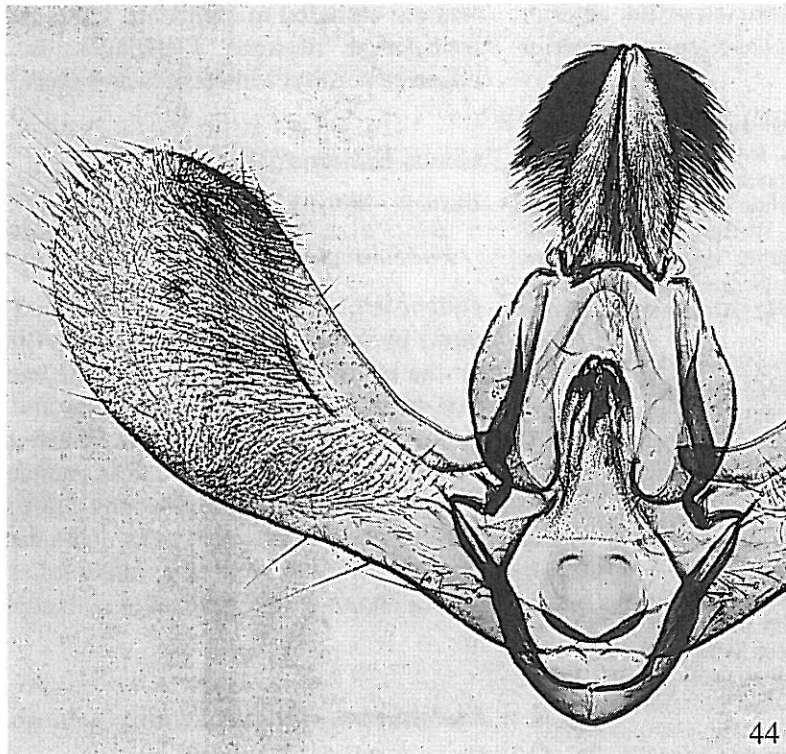
(Figs 10, 11, 42, 43, 73)

Scoparia interlinealis Warren, 1905: 446; Carthy 1957: 212; Carvalho 1982: 181; Rebel 1917: 18; Rebel 1940c: 8, 32 (key); Vieira & Pintureau 1991: 33; Vieira & Pintureau 1993: 110.

Scoparia interlinealis ab. *pallidimarginalis* Warren, 1905: 446; Rebel 1917: 18.

Diagnosis. – Forewings long and narrow, dirty-white, antemedial and postmedial fascia triangular, directed towards the medial area.

Description. – Wingspan 14-18 mm (n=94). Forewings with some sexual dimorphism in shape, with costa more convex and being slightly broader in males, and the apex more pointed in the female; dirty white, pattern weak; antemedial fascia concave in basal area, basal area sometimes with a black spot; fasciae of ground colour, black edged to the medial area; subterminal and postmedial fascia together forming an X; two black, claviform antemedial stigmata, the more costal one not always connected with fascia; discocellular stigma X-shaped, with a black spot at the costa; space between veins near termen black; first row of fringe grey, second row white; hindwings white, brown towards termen, fringe white. There is variation with a trend towards a reduction of black scales which are replaced by ochre scales. The wing pattern of such specimens is less contrasted. The aberratio *pallidimarginalis* has a



Figs 44-47. ♂ genitalia: (44, 45) *Eudonia luteusalis*, GU Nuss 522, Azores, Pico; (46, 47) *E. melanographa*, GU Nuss 720, Azores, Pico.

brown, triangular suffusion from the basal area to the termen of the forewings, with costa, dorsum and fringe white.

Male genitalia: Uncus long and narrow, distally straight, laterally slightly convex, with long hairs; gnathos about as long as uncus; valvae long, distally broader and round, ventral and dorsal margins slightly concave; juxta long cone-shaped; vinculum narrow.

Female genitalia: Corpus bursae globular, small, signum ovate; ductus bursae with two loops; ovipositor long.

Material examined. – *Scoparia interlinealis*: Holotype ♀ 'Holotype', 'Caldeira, Graciosa, 1200 ft. 26. April 03. (O. Grant)', 'Scoparia interlinealis ♀ Warr.', '♀ Pyralidae Brit. Mus. Slide No. 19380' [GU Nuss 370], 'Holotype Scoparia interlinealis Warren det. M. Nuss' (BMNH). *Scoparia interlinealis* ab. *pallidimarginalis*: Lectotype, hereby designated, ♂ 'Lectotype', 'Sta. Cruz, Graciosa, 22. April 03. (O. Grant)', 'Scoparia interlinealis ab. pallidimarginalis Type ♀ Warr.', '♂ Pyralidae Brit. Mus. Slide No. 20185', 'Lectotype, Scoparia interlinealis ab. pallidimarginalis, det. M. Nuss' (BMNH).

AZORES. FLORES: 1 ♂ Caldeira Seca, 9.-21.vi., Storå (NHM); 1 ♂ Santa Cruz, 100m, 3.viii.1990, Meyer (H/M); 1 ♂ same except, 150m, 5.viii.1990, Meyer (H/M). GRACIOSA: 1 ♂ Caldeira, 15.i.1979, Carvalho (JPC); 5 ♂ same except, 400m, 26.iv.1903, Grant (BMNH); 1 ♂ same except, 27.iv.1903, Grant (BMNH). SAO JORGE: 1 ♂, 1 ♀ above Calheta, 400m, 5.v.1903, Grant (BMNH, CNC); 13 ♂, 2 ♀ Serra do Topo, 800m, 18.vii.1994, Meyer (H/M, Nuss). FAIAL: 1 ♂ 29.viii.1952, Carthy (BMNH); 1 ♂ 30.viii.1952, Carthy (BMNH); 1 ♀ above Horta, 333m, 24.v.1903, Grant (BMNH); 1 ♀ Areeiro, 8.vii.1981, Carvalho (JPC); 2 ♂, 2 ♀ Norte Pequeno, 300m, 11.viii.1990, Meyer (H/M, Nuss). PICO: 1 ♂ 17.viii.1952, Carthy (BMNH); 1 ♂, 1 ♀ 3.xi.1952, Carthy (BMNH); 1 ♂ Cerrado de Sonicas, 850m, 13.vii.1994, Meyer (H/M); 1 ♀ Estrada longitudinal, 4.vii.1981, Carvalho (JPC); 1 ♀ same except, 5.vii.1981, Carvalho (JPC); 1 ♂, 1 ♀ Norte Pequeno, 500m, 17.vii.1994, Meyer (H/M); 3 ♂ Pico Caveiro, 900m, 14.vii.1994, Meyer (H/M, Nuss); 2 ♂ Sao Roque do Pico, 150m, 13.vii.1994, Meyer (H/M); 1 ♂ Silveira, Misterio, 400m, 14.vii.1994, Meyer (H/M). TERCEIRA: 2 ♂ Bicas, 11.vii.1981, Carvalho & Contente (JPC); 2 ♂ Crater above Reguinho, 666m, Grant (BMNH); 1 ♂ Pau Velho, 18.i.1979, Contente (JPC); 1 ♀ same except, 11.vii.1981, Carvalho (JPC); 1 ♂, 2 ♀ same except, 24.x.1978, Contente (JPC); 2 ♂, 1 ♀ Pta. Serreta, 27.iii.1979, Carvalho (BMNH, JPC); 1 ♂ Reguinho, 733m, 6.iv.1903, Grant (BMNH); 1 ♂, 2 ♀ Serra da Labacal, 800m, 20.vii.1994, Meyer (H/M); 1 ♀ Serra de Santa Barbara, 1000m, 18.viii.1990, Meyer (Nuss); 1 ♀ Veredas, Contente (JPC). SAO MIGUEL: 1 ♂ Barossa, Serra de Agua de Pau, 900m, 26.vii.1990, Meyer (H/M); 5 ♂, 4 ♀ Furnas, 11.v.-3.vi.1969, Pinker (SMN); 1 ♂, 1 ♀ same except, Pedras de Galego, 350m, 26.vii.1990, Meyer (H/M); 2 ♂ Monte Escuro, Lombadas, 600m, 12.vii.1994, Meyer (H/M); 3 ♀ Planalto dos Graminhais, 700m, 12.vii.1994, Meyer (H/M); 1 ♂, 1 ♀

Povoacao, 300m, 10.vii.1994, Meyer (H/M); 1 ♂ Serra da Tronqueira, 800m, 12.vii.1994, Meyer (H/M); 1 ♂ Sete Ciades, 500m, 23.iii.1903, Grant (BMNH); 3 ♂, 1 ♀ Sete Ciades, Pico Carvao, 500m, 9.vii.1994, Meyer (H/M). SANTA MARIA: 2 ♀ Cha de Sao Tome, 350m, 30.vii.1990, Meyer (H/M).

Distribution. – Endemic to the Azores.

Biology. – Known flight period: January, March to August, October to November.

Remarks. – *E. interlinealis* was often confused with *E. angustea* (Carvalho 1982; Rebel 1940c; Vieira & Pintureau 1991), a species which does not occur in the Azores.

Eudonia luteusalis (Hampson), **comb. n.**

(Figs 1, 44, 45, 72)

Scoparia luteusalis Hampson, 1907: 23; Carvalho 1992: 268; Rebel 1917: 18; Rebel 1940c: 32 (key), 32, pl. 1, figs 13, 14 [as *Bradyrrhoa versicolorella*]; Roesler 1988: 71; Roesler 1993: 249; Vieira & Pintureau 1991: 33; Vieira & Pintureau 1993: 110.

Scoparia lutensis; Rebel 1940c: 8, misspelling.

Bradyrrhoa versicolorella Rebel, 1940c: 30, pl. 1, figs 11, 12; Carvalho 1982: 180; Roesler 1988: 71; Roesler 1993: 249; Vieira & Pintureau 1991: 33; Vieira & Pintureau 1993: 110.

Diagnosis. – This large species is distinct from the very similar *E. interlinealis* by the contrastful and attractive wing pattern of predominantly yellow ochre. Worn specimens of *E. luteusalis* can be easily confused with *E. interlinealis*.

Description. – Wingspan 17-23 mm (n=39). Large; upperside of body and forewings dominantly yellow ochre; forewings with obvious wing pattern; basal area with a large black streak; antemedial and postmedial fasciae white, conspicuously black edged towards medial area; antemedial fascia extending triangularly into medial area; with one antemedial black stigma, varying from a little spot to a long streak across entire medial area; postmedial fascia in posterior half with triangular indentation, directed towards medial area, in costal half straight, sometimes with an indentation opposite the discocellular stigma; discocellular stigma varying from a small spot to a X, always connected with the postmedial fascia; subterminal fascia white, suffused by ochre scales, edged with black along the inner margin, concave towards termen and not connected with postmedial fascia; a black line at termen; fringe light ochre; hindwings white with a light ochre termi-

nal shade, interrupted by a white ribbon; fringe white, towards apex ochre.

Male genitalia: Similar to *E. interlinealis* but uncus distally slightly pointed and medially notched; valvae slightly shorter and distally broader.

Female genitalia: Corpus bursae globular to ovoid, signum ovate; ductus bursae with one great loop, posteriorly followed by a bow; ovipositor long.

Material examined. – *Scoparia luteusalis*: Holotype ♀ 'Holotype', 'Azores, 84.72.', 'Scoparia luteusalis type ♀ Hmps.', 'Holotype Scoparia luteusalis Hampson det. M. Nuss' (BMNH). *Bradyrrhoa versicolorella*: Lectotype ♀ 'Azores: Fayal Caldeira 4.vii. Storå', 'Bradyrrhoa versicolorella Rbl. Type ♀', 'U. Roesler ♀ GU: 9457', 'U. Roesler/ Lectotype', designation by Roesler 1988 (NHM).

AZORES. SAO JORGE: 1 ♂ Serra do Topo, 800m, 18.vii.1994, Meyer (H/M); 1 ♂ same except, 800m, 17.viii.1990, Meyer (Nuss). PICO: 3 ♂, 1 ♀ Gorda, 9.vii.1929, Balfour Browne (BMNH); 2 ♂, 20 ♀ Lajes do Pico, Cabeco da Rocha, 800m, 13.viii.1990, Meyer (H/M, ZMUC); 2 ♀ Sao Joao, Cabecinhos, 480m, 14.viii.1990, Meyer (H/M); 1 ♀ Cha do Pelado, 800m, 15.viii.1990, Meyer (H/M). TERCEIRA: 1 ♂ Pta. Serreta, 27.viii.1982, Carvalho (JPC); 1 ♂ Pau Velho, 28.viii.1982, Carvalho (JPC); 1 ♂ same except, 28.x.1978, Carvalho (BMNH). SANTA MARIA: 3 ♀ Cha de Sao Tome, 350m, 30.vii.1990, Meyer (H/M, Nuss).

Distribution. – Endemic on the Azores, known from São Jorge, Pico, Terceira and Sta. Maria.

Biology. – Known flight period: July, August, October.

Remarks. – Rebel (1940c) misinterpreted *Scoparia luteusalis*. He figured this species as *B. versicolorella* and used the name *S. luteusalis* for *S. coecimaculalis*.

2 *Eudonia melanographa* (Hampson), **comb. n.**
(Figs 12, 46, 47, 74)

Scoparia melanographa Hampson, 1907: 24; Carvalho 1982: 180; Rebel 1917: 18; Rebel 1940c: 8, 32 (key), 34, pl. 2 figs 5, 10, 15 (as *Scoparia aequipennalis*); Vieira & Pintureau 1991: 33; Vieira & Pintureau 1993: 110.

Diagnosis. – Forewings long and narrow, predominantly black, sprinkled with white. Male-valvae ventro-distally with a pointed process; female-corpus bursae large, ovoid; signum nearly as long as corpus bursae.

Description. – Wingspan 11-15 mm (n=43). A small species with narrow forewings; forewings

dark with chiefly black scales, with sprinkling of white scales; fasciae white; basal area black, white towards the antemedial fascia; antemedial fascia with two black claviform stigmata, which are obscure because of dark surrounding area; two white patches in the medial area, one in the middle and the other between the discocellular stigma and the postmedial fascia, near the costa; discocellular stigma X-shaped, black, towards costa characteristically filled with white; postmedial and subterminal fasciae form a X, they are interrupted by black scales, especially middle part of subterminal fascia; fringe with first row black, second one grey; hindwings grey, darker towards termen and apex; fringe as in forewings.

Male genitalia: Uncus long and narrow, distally round; valvae ventro-distally with a pointed process, saccus thickened.

Female genitalia: Corpus bursae large, ovoid; signum nearly as long as corpus bursae; ductus bursae short, thick, without loops; ovipositor long.

Material examined. – Holotype ♂ 'Holotype', 'Reguinho, Terceira, 2200 ft., 6. April 03, (O. Grant)', '1905-300', 'Scoparia melanographa type ♂ Hmps.', 'Pyralidae Brit. Mus. Slide No. 3778', 'Holotype Scoparia melanographa Hampson det. M. Nuss' (BMNH).

AZORES. SAO JORGE: 1 ♂ above Calheta, 400m, 2.v.1903, Carvalho (BMNH); 1 ♂ Urzelinha, 16.vi.1984, Carvalho (JPC); 1 ♀ 8.ix.1965, Marsden (BMNH). PICO: 11 ♂, 2 ♀ Cabeco das Cabras, 1100m, 14.vii.1994, Meyer (H/M, Nuss). TERCEIRA: 1 ♂ Angra do Heroismo, 22.iii.1974, Carvalho (BMNH); 1 ♂, 1 ♀ same except, 4.iv.1979, Carvalho (JPC); 1 ♂, 1 ♀ Caldeira, 26.vi.1981, Carvalho (JPC); 1 ♂ same except, 29.vi.1981, Carvalho (JPC); 2 ♂, 3 ♀ Pau Velho, 22.vi.1981, Carvalho (JPC); 1 ♀ same except, 29.vi.1981, Carvalho (JPC); 1 ♀ same except, 4.vii.1981, Carvalho (JPC); 1 ♂, 1 ♀ same except, 11.vii.1981, Carvalho (JPC); 1 ♀ same except, 28.viii.1982, Carvalho (JPC); 1 ♂, 1 ♀ same except, 24.x.1978, Carvalho (BMNH); 3 ♂ Santa Barbara, 600m, 19.vii.1994, Meyer (H/M, Nuss). SAO MIGUEL: 1 ♂ Furnas, 11.v.-3.vi.1969, Pinker (SMN); 1 ♀ same except, 19.-24.v., Storå (ZMU); 1 ♂, 1 ♀ same except, 22.-24.v., Storå (NHM); 1 ♀ Ponta Delgada, 4.x.1979, Carvalho (BMNH).

Distribution. – Endemic to the Azores, known from São Jorge, Pico, Terceira and São Miguel. The moths were observed flying in a quarry on the western slope of the volcano Pico.

Biology. – Known flight period: March to October. Moths rest and fly around rupicolous lichens.

Remarks. – Rebel (1940c) figured this species under the name *S. aequipennalis*.

***Eudonia scoriella* (Wollaston), comb. n.**

(Figs 13, 14, 15, 16, 48, 49, 76)

Eudorea scoriella Wollaston, 1858: 119; Bethune-Baker 1894: 582; Carvalho 1982: 180; Cockerell 1929: 113; Rebel 1917: 11, 13; Rebel 1940a: 4 (key), 5, pl. 1 figs 1-4; Rebel 1940b: 6; Vieira & Pintureau 1991: 33; Warren 1905: 446.

Scoparia wollastoni Bethune-Baker, 1894: 583. Cockerell 1929: 113; Rebel 1917: 11, 13; Rebel 1940a: 4 (key), 7; Rebel 1940b: 6. **Syn. n.**

Diagnosis. – Forewings broad, postmedial and subterminal fascia not approximated, subterminal fascia interrupted. Female-sclerotised portion of ductus bursae forming a wide curve.

Description. – Wingspan 17-23 mm (n=364). Labial palpi long, porrect, with long and white scales below; black above and laterally; underside of body white; legs black, articulations white; forewings and upperside of body predominantly black with white and ochreous sprinkling; fasciae thin and white, edged with black to the medial area, with two black and claviform antemedial stigmata; discocellular stigma X-shaped, anteriorly filled with black and ochre, posteriorly white or black and white; postmedial fascia indented; subterminal fascia interrupted in middle, not connected with postmedial fascia; subterminal area with a predominance of black scales and an ochreous admixture; basal row of fringe grey, second one whitish brown; hindwings grey, fringe mostly paler, with a grey line.

Male genitalia: Uncus longish, distally round; gnathos as long as uncus; valvae long and narrow, margins of anterior half are concave at base.

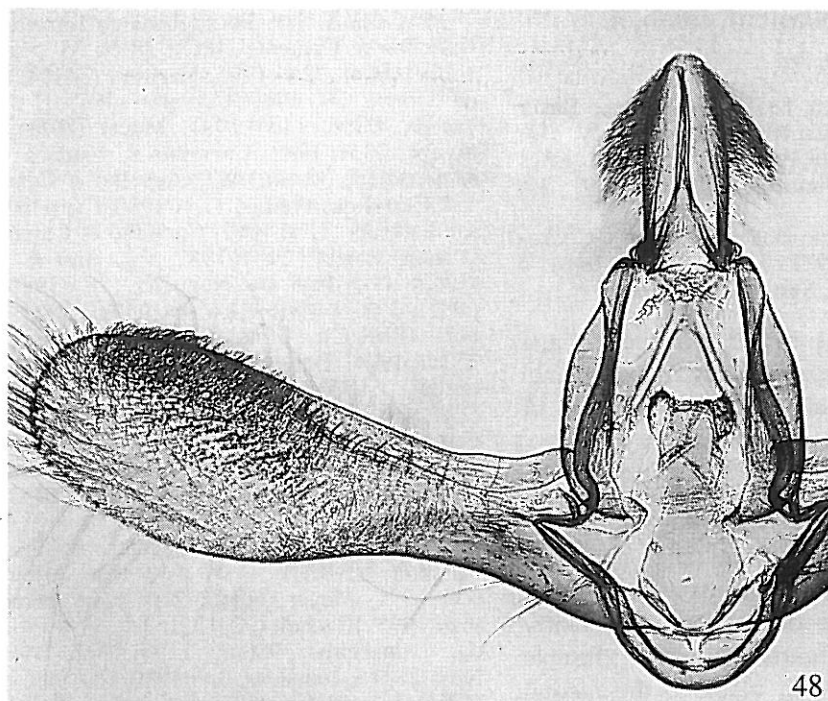
Female genitalia: Corpus bursae globular, signum ovate; ductus bursae very long, a large loop between corpus bursae and ductus seminalis, sclerotisation between ductus seminalis and antrum forming a wide curve anteriorly, followed by a straight section.

Material examined. – *Eudorea scoriella*: Lectotype, hereby designated, ♂ 'Lectotype', 'Maderia. Wollaston Coll. 55-7', 'Eudorea Scoriella Z.', 'Pyralidae Brit. Mus. Slide No. 3687', 'Lectotype Eudorea scoriella Wollaston, 1858 det. M. Nuss' (BMNH). Paralectotype ♀ 'Paralectotype', 'Maderia. Wollaston Coll. 55-7', '♀ Genit. 4054 Niels L. Wolff', '♀ Pyralidae Brit. Mus. Slide No. 14568', 'Scoparia scoriella Wollaston det. M. Shaffer, 1973', 'Paralectotype Eudorea scoriella Wollaston, 1858 det. M. Nuss' (BMNH). *Scoparia wollastoni*: Holotype ♂ (?) 'Holotype, 'Madeira. T.V. Wollaston.', 'G.T.B.-Baker Coll. Brit. Mus. 1927-360.', 'Wollastoni B.-Bak.', '6.', 'Abdomen missing', 'Holotype Scoparia wollastoni Bethune-Baker det. M. Nuss' (BMNH).

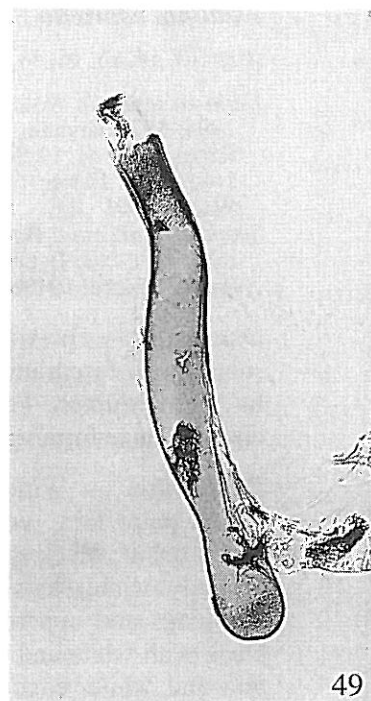
MADEIRA: 5 ♂, 3 ♀ Archada do Teixeira, 4.vi.1980, Carvalho & Contente (JPC); 28 ♂, 35 ♀ same except, 1300-1600m, 22.vi.1993, Karsholt (ZMUC); 1 ♂ Chao da Ribeira, 20.i.1980, Carvalho (JPC); 2 ♂, 3 ♀ same except, 430m, 14.vii.1991, Meyer (H/M); 2 ♀ same except, 20.vii.1982, Carvalho & Camoes (JPC); 1 ♂ same except, 30.viii.1982, Carvalho & Contente (JPC); 1 ♂ Curral das Freiras, 11.vi.1980, Carvalho (JPC); 2 ♀ same except, 21.vi.1982, Carvalho & Camoes (JPC); 1 ♀ same except, 29.vii.1982, Carvalho & L. Camoes (JPC); 1 ♀ Faja da Nogueira, 28.v.1980, Carvalho (JPC); 2 ♂, 4 ♀ same except, 600m, 20.vi.1993, Karsholt (ZMUC); 1 ♂, 3 ♀ same except, 1000m, 23.viii.1974, Traugott-Olsen (ZMUC); 1 ♂, 8 ♀ same except, 1000m, 23.-24.viii.1974, Traugott-Olsen (ZMUC); 1 ♂ same except, 2.ix.1980, Carvalho & Camoes (JPC); 2 ♀ same except, 800m, 6.x.1993, Meyer (H/M); 1 ♂ Machico, 27.vi.1993, Karsholt (ZMUC); 1 ♂ Paul da Serra, 1500m, 16.vi.1993, Karsholt (ZMUC); 3 ♂ Fonte de Bispo, 1150m, 6.vii.1993, Karsholt (ZMUC); 2 ♂ same except, 1050m, 7.vii.1993, Karsholt (ZMUC); 1 ♂, 4 ♀ Pico Arieiro, 1500m, 6.vii.1991, Meyer (H/M); 2 ♂ same except, 1600m, 9.vii.1993, Karsholt (ZMUC); 3 ♂, 17 ♀ Pto. Encumeada, Lamaceiros, 900m, 11.vii.1991, Meyer (H/M, Nuss); 1 ♂ Queimadas, 3.vi.1980, Carvalho & Contente (JPC); 4 ♂, 10 ♀ same except, 950m, 19.vi.1993, Karsholt (ZMUC); 3 ♂, 3 ♀ same except, 18.vii.1980, Rodrigues (JPC); 1 ♂ same except, 22.vii.1982, Carvalho (JPC); 1 ♂ same except, 5.viii.1988, Carvalho (JPC); 1 ♀ same except, 28.viii.1982, Carvalho (JPC); 2 ♂, 2 ♀ Quinta Grande, 850m, 6.vii.1991, Meyer (H/M); 2 ♂ Rabacal, 7.vi.1903, Grant (BMNH, CNC); 2 ♂ same except, 1050m, 14.vi.1993, Karsholt (ZMUC); 12 ♂, 19 ♀ same except, 1000m, 10.vii.1991, Meyer (H/M); 2 ♂, 1 ♀ same except, 12.vii.1991, Meyer (Nuss); 1 ♂, 3 ♀ same except, 17.vii.-4.viii.1935, Lundblad (NHM); 2 ♀ same except, 23.vii.1982, Carvalho & Camoes (JPC); 1 ♂ same except, 12.ix.1980, Carvalho & Camoes (JPC); 2 ♂ Ribeira Brava, 13.vii.1991, Meyer (H/M); 9 ♂, 26 ♀ Ribeiro Frio, 900m, 3.vii.1991, Meyer (H/M, Nuss); 7 ♂, 5 ♀ Redondo, Pico das Pedras, 8.vii.1991, Meyer (H/M, Nuss); 7 ♂, 3 ♀ Encumeada, 1000m, 13.vi.1993, Karsholt (ZMUC); 1 ♂, 2 ♀ same except, 16.vi.1993, Karsholt (ZMUC); 1 ♂ same except, 17.vi.1993, Karsholt (ZMUC); 2 ♂, 5 ♀ same except, 18.vi.1993, Karsholt (ZMUC); 1 ♂ same except, 29.vi.1993, Karsholt (ZMUC); 5 ♂, 14 ♀ same except, 3.vii.1993, Karsholt (ZMUC); 1 ♂, 1 ♀ Serra de Agua, 580m, 1.vii.1993, Karsholt (ZMUC); 5 ♂, 8 ♀ same except, Lapa do Galho 1000m, 13.vii.1991, Meyer (H/M); 5 ♂, 35 ♀ same except, 600m, 15.viii.-23.viii.1974, Wolff & Traugott-Olsen (ZMUC); 1 ♀ Paul do Mar, 1100m, 12.vii.1991, Meyer (ZMUC); 1 ♂ Santa Madalena, Pico Alto, 600m, 9.vii.1991, Meyer (ZMUC).

Distribution. – Endemic to Madeira.

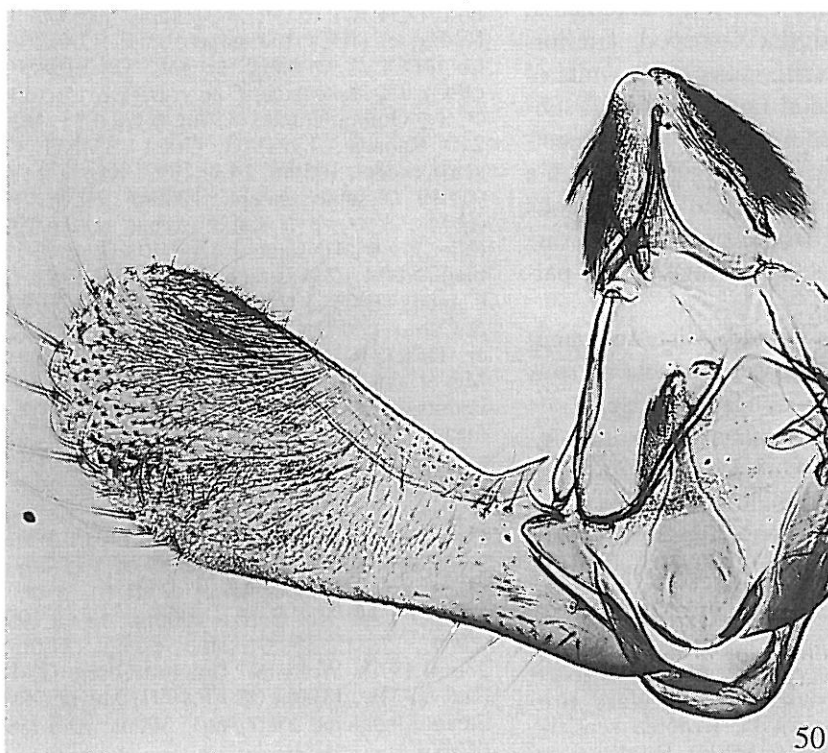
Biology. – Known flight period January, May to October. *E. scoriella* is common in the highlands above 600m, but only occasionally found in lower altitudes. It occurs in a number of different habitats, often together with *E. decorella*.



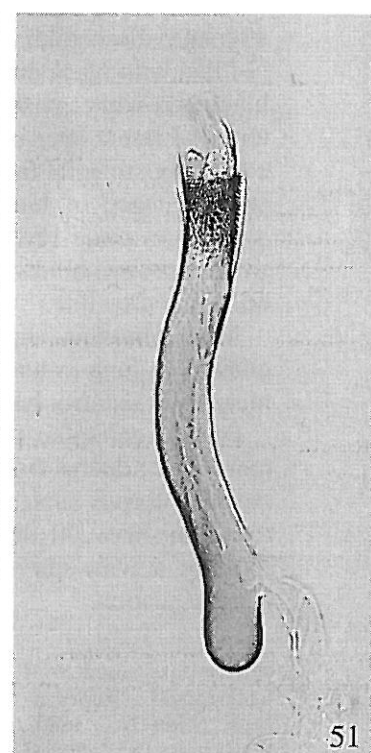
48



49



50



51

Figs 48-51. ♂ genitalia: (48, 49) *Eudonia scoriella*, GU Nuss 713, Madeira; (50, 51) *E. stenota*, GU Nuss 631, Madeira.

Remarks. – A second form, described as *S. wollastoni*, has a contrasting wing pattern with marked reduction of black scales. The pattern is

almost identical, except the fasciae are more straight. The forewings show a conspicuous predominance of ochreous scales. There is a black

area near the antemedial fascia and the two stigmata. The outer half of the medial area towards the postmedial fascia is white. There are intermediate forms between these two variations. No differences exist in the genitalia. The variation may be caused by ecological factors. The form '*wollastoni*' occurs mainly in laurel-forests, while the form '*scoriella*' is distributed also in open land. Possibly the different colour forms can be regarded as somatolytic adaptations to the different habitats. The synonymy of *S. wollastoni* is proved by completely similar genitalia of specimens corresponding in wing pattern with the types of *E. scoriella* or *S. wollastoni* respectively.

Records of this species from the Azores by Carvalho (1982) and Vieira & Pintureau (1991) are probably erroneous. Among the material from Carvalho which was examined no *E. scoriella* was found from the Azores.

Considering the wing pattern, the nearest relative seems to be the nearctic *Eudonia rectilinea* (Zeller) (Munroe 1972: 50; 1974: pl. 3, figs 1, 2).

***Eudonia decorella* (Stainton), sp. rev., comb. n.**

(Figs 17, 18, 19, 52, 53, 75)

Eudorea decorella Stainton, 1859: 210; Bethune-Baker 1894: 581; Cockerell 1929: 113; Rebel 1917: 11 (as synonym of *Scoparia stenota*); Rebel 1940a: 6 (as synonym of *Scoparia stenota*).

Scoparia maderensis Rebel, 1940a: 4 (key), 5, pl. 2, figs 15-18. Rebel 1940b: 6. **Syn. n.**

Diagnosis. – Forewings black and white scaled with a conspicuous admixture of ochreous scales in the discocellular stigma. Male-uncus strongly bilobed, valvae narrow in middle and distally broad; female-ductus bursae with two loops.

Description. – Wingspan 15-21 mm (n=128). Labial palpi very long and heavily scaled, predominantly black; upperside of head and body black, underside white; forewings basally dirty-white with a black ribbon; antemedial fascia white, black edged towards medial area; with two black, claviform antemedial stigmata, medial area more or less white, suffused with black scales; postmedial fascia white, black edged to medial area, indented; discocellular stigma X-shaped, always with characteristic yellow ochre admixture; postmedial and subterminal fasciae form a white 'X' on dark ground; termen black, sometimes with white admixture; fringe white and brown striped; hindwings whitish, grey towards

termen and apex, fringe white, with grey line medially.

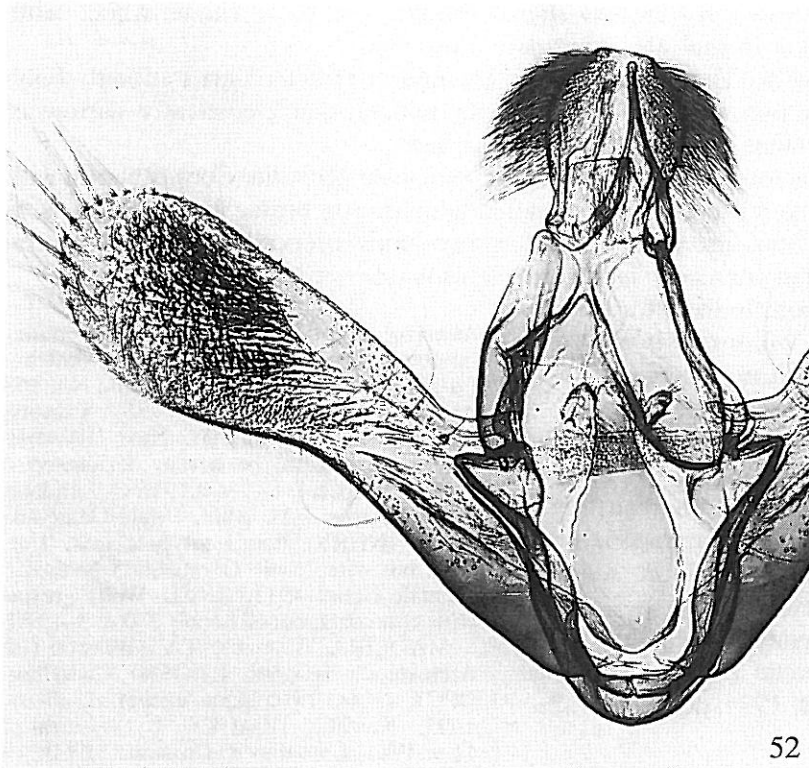
Male genitalia: Uncus strongly bilobed; valvae in middle characteristically narrow and distally broad.

Female genitalia: Corpus bursae with ovate signum; ductus bursae beyond corpus bursae with two loops; proportions of corpus bursae and ductus bursae variable.

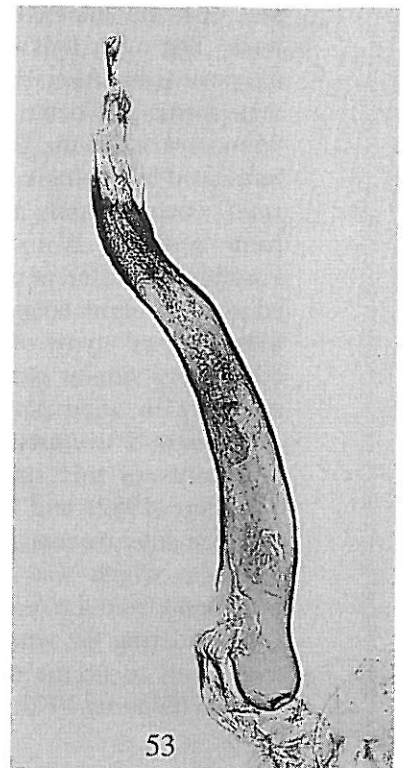
Material examined. – *Eudorea decorella*: Lectotype, hereby designated, ♂ 'Lectotype', 'Madeira. Wollaston. 58-21.', 'Pyralidae Brit. Mus. Slide No. 3686', 'Eudorea decorella Sttn. Type I.4.1958', 'Lectotype Eudorea decorella Stainton det. M. Nuss' (BMNH). *Scoparia maderensis*: Lectotype, hereby designated, ♂ 'Madeira, 1080 m. Rabaçal, 17.7-4.8.1935 O. Lundblad', 'Scoparia maderensis Type Rbl.', 'Male-Genit 4031 Niels L. Wolff' (NHRS). Paralectotypes: 1 ♂, 1 ♀ with same data, but with 'Male Genit. 4045 Niels L. Wolff' and 'Female Genit. 4032 Niels L. Wolff', respectively. 2 ♀ with same data, but GU Nuss 340 & 341 (NHM).

MADEIRA: 2 ♂, 1 ♀ T.V. Wollaston (BMNH); 1 ♀ Archada do Teixeira, 4.vi.1980, Carvalho & Camoes (JPC); 11 ♂, 15 ♀ same except, 1300-1600m. 22.vi.1993, Karsholt (ZMUC); 1 ♀ Curral de Freiras, 11.vi.1981, Carvalho & Contente (JPC); 1 ♂ Chao da Ribeira, 430m, 14.vii.1991 Meyer (H/M); 1 ♂, 7 ♀ Faja da Nogueira, 600m, 6.-9.v.1975, Wolff (ZMUC); 5 ♀ same except, 9.-10.vi.1976, Wolff (ZMUC); 2 ♂ same except, 20.vi.1993, Karsholt (ZMUC); 1 ♀ same except, 700m, 5.vii.1991, Meyer (H/M); 1 ♂ same except, 800m, 6.x.1993, Meyer (H/M); 6 ♂, 3 ♀ same except, 8.x.1994, Karsholt (ZMUC); 1 ♂ Fonte de Bispo, 1150m, 6.vii.1993, Karsholt (ZMUC); 1 ♀ Pico Arieiro to Pico Ruivo, 1500m, 6.vii.1991, Meyer (H/M); 2 ♂, 9 ♀ same except, 1600m, 9.vii.1993, Karsholt (ZMUC); 1 ♂ Rabacal, 1200m, 6.vi.1903, O. Grant (BMNH); 2 ♀ same except, 1200m, 7.vi.1903, Grant (BMNH); 1 ♂ same except 1050m, 14.vi.1993, Karsholt (ZMUC); 1 ♂ same except, 1080m, 17.vii.-4.viii.1935, Lundblad (NHM); 1 ♂ Encumeada, 1000m, 13.vi.1993, Karsholt (ZMUC); 1 ♀ same except, 16.vi.1993, Karsholt (ZMUC); 3 ♂, 1 ♀ same except, 18.vi.1993, Karsholt (ZMUC); 4 ♀ same except, 3.vii.1993, Karsholt (ZMUC); 2 ♀ same except, 18.x.1994, Karsholt (ZMUC); 1 ♂ Seixal, Fanal, 1200m, 12.x.1994, Karsholt (ZMUC); 1 ♂, 1 ♀ Serra de Agua, 650m, 8.vi.1976, Wolff (ZMUC); 1 ♂, 2 ♀ same except, 1000m, 13.vii.1991, Meyer (H/M).

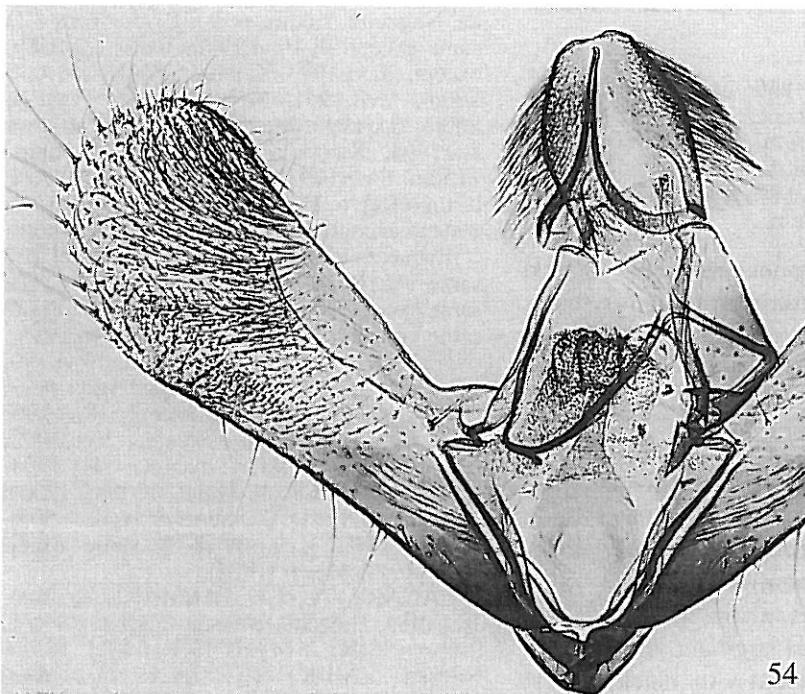
CANARY Is. LA PALMA: 1 ♀ Bco. Nogales, 15.i.1981, P. Stadel Nielsen (ZMUC); 1 ♀ Los Sauxes, Pinker (SMN); 1 ♂ Los Tilos, 400m, 16.i.1981, Stadel Nielsen (ZMUC). GOMERA: 1 ♀ Agulo, Pinker (SMN); 1 ♀ El Cedro, 1000m, 25.vii.1984, Olsen, Skule, Stadel (ZMUC). TENERIFE: 1 ♂ Cabezo del Tejo, 10.ii.1994, Báez (Báez); 1 ♂ La Laguna, 23.v.1907, Walsingham (BMNH); 1 ♂, 1 ♀ Mercedes forest, x.1972, Pinker (Arenberger); 1 ♂, 1 ♀ same except, 15.x.1993, Arenberger (Arenberger); 1 ♀ same except, 18.v.1979, Klimesch (Klimesch); 1 ♀ same except, 14.iii.1988, Scaramozzino (MRSN); 1 ♂ same except, 15.-16.iii.1967, Kasy (NHM); 6 ♀ same except,



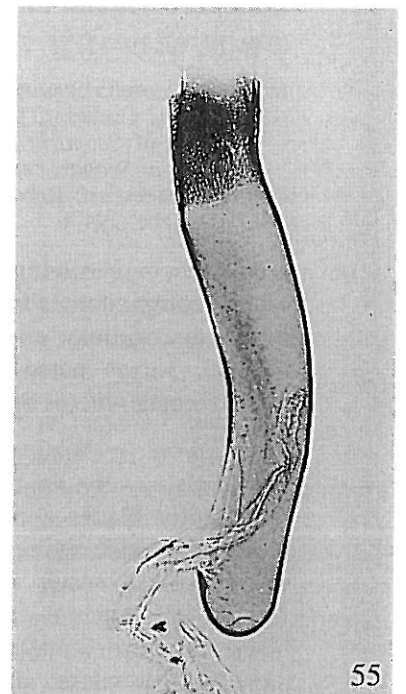
52



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54



55

Figs 52-55. ♂ genitalia: (52, 53) *Eudonia decorella*, GU Nuss 697, Madeira; (54-55) *E. shafferi*, GU Nuss 651, Madeira.

1000m, 19.v.1974, Schmitz (Speidel); 1 ♂, 1 ♀ Mte. del Agua, 16.i.1994, Báez (Báez); 1 ♂ Pto. Orotava, 17.v.1907, Walsingham (BMNH); 5 ♂ Puerto de la Cruz, 22.ii.1994, Goergens (Schmitz).

Distribution. – Madeira; Canary Archipelago, known from La Palma, Gomera and Tenerife.

Biology. – Known flight period May to August,

October. *E. decorella* occurs on Madeira in the highlands between 600-1600m (occasionally at lower altitudes). The preferred habitats are open forests.

Remarks. – Forewing colouration vary in some specimens towards a predominance of black and brown scales. The stigmata filled with pure ochre in such specimens strongly contrast this dark colouration. Specimens from the Canary Is. sometimes lacking the ochre and brown scales completely and vary more in size than the specimens from Madeira. The larger moths (19-21mm) and the smallest one (15mm) were from the Canary Is.

E. decorella was formerly regarded as a synonym of *E. stenota* (Rebel 1940a). Rungs (1979) recorded the species from Morocco (as *E. madeirensis*) but we have never seen this species from there and assume that Rungs record was a misidentification of *E. lineola*.

***Eudonia stenota* (Wollaston), sp. rev., comb. n.**

(Figs 20, 21, 22, 50, 51, 78)

Eudorea stenota Wollaston, 1858: 119; Bethune-Baker 1894: 582; Bradley 1958: 193; Carvalho 1982: 180; Cockerell 1929: 113; Gardner & Classey 1960: 203; Rebel 1892: 248; Rebel & Rogenhofer 1894: 96 (index); Rebel 1896a: 113, 146; Rebel 1898: 380 (index); Rebel 1906: 43; Rebel 1911: 370 (index); Rebel 1917: 11, 13; Rebel 1940a: 4 (key), 6; Rebel 1940b: 6; Warren 1905: 447.

Diagnosis. – Forewings long and narrow, females often slightly brachypterous, with an olive shine and an ochreous admixture. Male: valvae broad in the middle. Female: ductus bursae without loops.

Description. – Wingspan 11 (♀) -20 (♂) mm (n=105). Labial palpi porrect, long; forewings long and narrow, especially in the males; females often slightly brachypterous with shorter wings and apex of forewings clearly pointed; forewings with a faint olive shine and varying in colouration from a predominance of black and grey to ochreous, admixed with white; fasciae white, dark edged towards medial area; antemedial fascia pointing as a triangle into the medial area, with two clavi-form stigmata; discocellular stigma X-shaped, not connected with postmedial fascia; stigmata filled with ochreous in the ochre coloured specimens; postmedial fascia indented, not touching subterminal fascia; fringe grey, white striped; hindwings white with a broad, grey terminal shade, interrupted by a white postmedial fascia, fringe white.

Male genitalia: Uncus broad, distally slightly bilobed; valvae broad with dorsal margin straight, ventral margin slightly concave; vinculum slender.

Female genitalia: Corpus bursae small, ovoid, at right angle to ductus bursae, with a large ovate signum; ductus bursae long and thin, without loops.

Material examined. – Lectotype, hereby designated, ♂ 'Lectotype', 'Maderia. Woolaston [sic] Coll. 55-7', 'Eudorea stenota Z.', 'Pyralidae Brit. Mus. Slide No. 3685', 'Lectotype Eudorea stenota Wollaston det. M. Nuss' (BMNH).

MADEIRA: 1 ♂ Encumeada, 1200m, 13.x.1993, Meyer (H/M); 3 ♂, 1 ♀ Fanal, 1000m, 18.v.1989, Meyer (H/M, Nuss); 4 ♂, 14 ♀ same except, 1200m, 12.x.1994, Karsholt (Nuss, ZMUC); 1 ♂ Fanal de Baixo, 13.iv.1980, M. Scucno (JPC); 1 ♂ Paul da Serra, 1400m, 15.x.1994, Karsholt (ZMUC); 1 ♂ Palheiro Ferreira, 16.xii.1957, Classey & Gardner (BMNH); 4 ♂, 1 ♀ Fonte de Bispo, 1050m, 7.vii.1993, Karsholt (ZMUC); 9 ♂, 1 ♀ same except, 1050m, 6.vii.1993, Karsholt (ZMUC); 1 ♂ Rabacal, 1000m, 28.xi.1972, Lundqvist & Wolff (ZMUC); 1 ♂ Poiso, 1400m, 13.v.1989, Hellers (Hellers); 1 ♂ Ribeiro Frio, 950m, 15.vi.1993, Karsholt (ZMUC); 1 ♀ Faja da Nogueira, 800m, 8.x.1994, Karsholt (ZMUC); 1 ♂ Achadas da Cruz, 725m, 8.vii.1993, Karsholt (ZMUC); 16 ♂, 8 ♀ same except, 700m, 10.x.1994, Karsholt (ZMUC); 3 ♂ Queimadas, 900m, 14.-15.vi.1976, Wolff (ZMUC); 1 ♀ same except, 29.viii.1980, Rodrigues (JPC); 1 ♂ same except, 9.ix.1980, Carvalho (JPC); 3 ♂ Ribeira dos Cales, 2.xii.1957, Classey & Gardner (BMNH); 15 ♂ above Santana, 1050m, 6.x.1994, Karsholt (ZMUC); 1 ♂ Redondo, Pico das Pedras, 8.vii.1991, Meyer (H/M); 9 ♂ Santo da Serra, 700m, 26.x.1994, Karsholt (ZMUC); 1 ♂ same except, 650m, 19.xi.1972, Lundqvist & Wolff (ZMUC).

Distribution. – Endemic to Madeira.

Biology. – Known flight period April to December. This is a species of the open land and occurs in the highlands above 600m altitude. The adults can be disturbed from *Erica* L. bushes, and other vegetation during the day.

Remarks. – Warren (1905) recorded the species from the Azores, but this is here considered to be a misinterpretation. Rebel (1940a) described and figured a specimen of *E. angutea* with a black basal streak as *S. stenota*. Carvalho (1982) wrongly regarded *E. stenota* as a junior synonym of *E. melanographa*, even though the former would have had priority.

***Eudonia shafferi* sp. n.**

(Figs 23, 24, 54, 55, 79)

Diagnosis. – Forewings contrastingly black and

white coloured, with an ochreous admixture, white between fasciae on dorsum; males with hamus in retinaculum.

Description. – Wingspan 14–18 mm (n=63). Upper- and underside of body white; legs black, white near articulations; labial palpi grey, porrect; maxillary palpi upright, white at apex. Forewings with white ground colour with a contrasting black pattern, admixed with ochreous; white at the base, followed by a black band, then white, admixed with grey scales towards white antemedial fascia; antemedial fascia black edged towards medial area, antemedial stigmata fused with this black border; medial area white; discocellular stigma X-shaped, close to a black spot at costa and far from the postmedial fascia; postmedial fascia indented and forming a white X on a black ground with the subterminal fascia; fringe black and white striped; hindwings white, suffused brown at termen and apex, with a pale brown line in the white fringe.

Male genitalia: Uncus broad, laterally convex, distally straight; valvae slightly convex at dorsum, conspicuously concave at ventral margin, but distally convex, sclerotised along dorsum and ventro-basally; juxta club-shaped; vinculum and sacculus slender.

Female genitalia: Corpus bursae globular, signum small, round to ovate; ductus bursae slender, with one or two loops beyond corpus bursae.

Material examined. – Holotype ♂ 'Holotypus', 'Madeira, 600–1000m Faja da Nogueira 8.x.1994 O. Karsholt', 'Zool. Museum Copenhagen', 'Holotype Eudonia shafferi det. Nuss, Karsholt, Meyer, 1995' (ZMUC). Paratypes: 12 ♂, 13 ♀ same data as holotype (BMNH, Nuss, ZM, ZMUC). 1 ♂, 3 ♀ 'Madeira, 700m, Achadas da Cruz, 11.x.1994, O. Karsholt' (ZMUC). 1 ♂ 'Madeira 1000m Encumeada 18.x.1994 O. Karsholt' (ZMUC). 6 ♂, 4 ♀ 'Madeira 1200m Fanal 12.x.1994 O. Karsholt' (ZMUC). 2 ♀ 'Madeira above Santana 1050m 6.x.1994 O. Karsholt' (ZMUC). 1 ♀ 'Madeira Santo de Serra 700m 26.x.1994 O. Karsholt' (ZMUC). 1 ♀ 'Madeira Faja da Nogueira 600m 20.x.1994 J.S. da Silva' (ZMUC). 1 ♂, 3 ♀ 'Madeira Rabacal 1000m 28.xi.1972 Lundqvist & Wolff' (ZMUC). 1 ♂ 'Madeira Serra d'Agua 669m 7.ix.1973 Lomholdt & Wolff' (ZMUC). 1 ♀ '6.10.1993 P-Madeira Faja da Nogueira L.F. 800m leg. M. Meyer' (H/M). 1 ♀ '11.10.1993 P-Madeira Boca de Encumeada leg. M. Meyer' (H/M). 1 ♀ '13.10.1993 P-Madeira Encumeada -> Paul da Serra L.F. / 1.200m leg. M. Meyer' (H/M). 1 ♂ '13.10.1993 P-Madeira Rabacal 900m, leg. M. Meyer' (H/M). 1 ♂, 1 ♀ 'Isola Di Madeira, dint. Encumeada. 3.x.1993. LUX. Leg. G. Bassi' (MRSN). 2 ♀ 'Arquipélago da Madeira Ilha da Madeira Loc. – Chao de Louros, 5/9/1980 col. Passos Carvalho, Luis de Camoes' (JPC, Nuss). 1 ♀ 'Arquipél-

ago da Madeira Ilha da Madeira Loc. – Queimadas, 10/9/1980 col. P. Carvalho' (JPC). 2 ♂, 1 ♀ 'Arquipélago da Madeira Ilha da Madeira Loc. Ribeiro Frio 24/9/1981 col. Passos Carvalho, Luis de Camoes' (JPC). 1 ♂ 'Arquipélago da Madeira Ilha da Madeira Loc. – Faja de Nogueira, 25/9/1981, col. M. Eduardo Rodrigues' (JPC). (All paratypes with a red label 'Paratypus' and a label 'Paratype Eudonia shafferi det. Nuss, Karsholt, Meyer, 1995').

Derivatio nominis. – This species is named in honour of Mr Michael Shaffer.

Distribution. – Endemic to Madeira.

Biology. – Known flight period 5 September to 26 October, with four on 28 November. *E. shafferi* inhabits laurel forests in altitudes between 660 and 1200m. The adults come to light and can be disturbed during the day.

Remarks. – *E. shafferi* is very similar to *E. lineola tafirella* from the Canary Is. *E. shafferi* shows a less contrasting wing pattern than *E. tafirella* because the black markings are suffused with ochreous and in some specimens ochreous scaling predominates. The black and white scaling of palpi and legs is also not as contrasting as in *E. lineola tafirella*. Furthermore, the males of *E. shafferi* possess a hamus in the retinaculum. Costa and termen are slightly concave in the forewings, while in *E. lineola tafirella* the costa is convex and the termen less concave. Also, the forewings of *E. shafferi* are white on the dorsum between the fasciae, whereas there is a grey shadow in *E. lineola tafirella*.

Eudonia lineola lineola (Curtis)

Eudorea lineola Curtis, 1827: pl. 170; Goater 1986: 53, pl. 3, fig. 17; Leraut 1984: 180; Whalley & Tweedie 1963: 94, pl. 10, figs 50–52.

Scoparia virescens Rebel, 1896b: 174. Leraut 1984: 180; Rebel 1938: (55); Rungs 1979: 160. **Syn. n.**

Eudoria (Scoparia) rungsi Amsel, 1952: 65; Leraut 1984: 180.

Diagnosis. – Male without hamus in retinaculum. Groundcolour of forewings olive-fusca.

Material examined (n=33). – *Eudoria (Scoparia) rungsi*: Holotype ♂ 'Type', 'Typus leg. H. Amsel', 'Rabat ex l. 17.III.47 Maroc lichens sur P. persica 3122 Ch. Rungs', 'Eudoria (Scoparia) rungsi Amsel Bull. Soc. Sc. nat. Maroc, 1951, vol. 31 p. 65, fig. 1 et 2' (MNH).

UNITED KINGDOM: 1 ♂ Cornwall, Kynance, 24.-25.viii.1984, Hall (Hall); 1 ♂ Dorset Portland, E-Cliff 18.vii.1982, Hall (Hall); 1 ♂ Channel Is., Jersey, Goater (Goater). NETHERLANDS: 1 ♂ Goeree I., 30.vi.1973

(ZMUC); 1 ♂ Oostkapelle, 6.-18.vii.1969 (ZMUC). FRANCE: 1 ♂ Bouches du Rhone, Camargue, Environs d'Arles, 18.vi.1932 (SMN); 2 ♀ Bretagne, Vannes (ZMUC); 1 ♂ Evreux (ZSB); 1 specimen: Pyrénées, Le Lac Saint Jean de Luz (BMNH); PORTUGAL: 1 ♂ Algarve, above Lagoa da Nava, 25.iii.1989, Goater (Goater). SPAIN: 2 ♂ Chiclana, iv.-v.1858, Staudinger (ZSB); 3 ♀ 2 km west of Ontinena, Huesca, 24.-25.v.1991, Goater (Goater); 7 ♀ Huesca, Penalba, 31.v.2.1988, Goater, Hall (Goater, Hall). MOROCCO: 1 ♀ Fès, 1.iv.1988, Pasubl (ZMUC); 1 ♀ Inezgane, 17.-18.iii.1974, R. & E. Brander (SMN); 1 ♂ Larache, 23.-24.iv.1989, Zool. Mus. Copenh. Exp. (ZMUC); 1 specimen: Mazagan (=El-Jadida), ? (BMNH); 1 ♀ Mehdiya, 15.iii.1939, Rungs (SMN); 1 specimen: Tangier, 6.vii.1934, ? (BMNH). ALGERIA: 1 specimen: Alger, ? (BMNH). Tunisia: 1 ♀ Hammamet 13.-20.v.1979, Arenberger (Arenberger); 1 ♀ same data, except 13.-30.v.1979.

Distribution. – *E. lineola lineola* ranges along the Atlantic Coast from the British Isles to Morocco and along the southern coast of the Mediterranean to Tunisia.

Biology. – The larvae feed on lichens of species of the genus *Parmelia* Acharius (Goater 1986). Rungs stated on the label of the type of *Eudoria rungsi* from Morocco that the moth was reared from a larva feeding on lichens growing on *P. [runus] persica*.

Remarks. – Leraut (1984) listed *S. virescens* Rebel from Morocco as subspecies of *E. lineola*. However, the holotype of *E. rungsi* (synonymised with *S. virescens* by Leraut (1984)) and further 6 specimens from the western coast of Morocco (SMN) show no differences in size, colour and wing pattern to European specimens. Therefore, both names are here regarded as synonyms of *E. lineola lineola*.

E. lineola occurs on the Canary Is. in two subspecies. These are closely relatives with the extremely similar wing pattern, the morphology of the genitalia is identical and the male retinaculum lacks the hamus. The subspecies are allopatric. They are different in the colouration of the upperside of body and forewings. No intermediate forms exist.

***Eudonia lineola tafirella* (Chrétien), stat. n., comb. n.**

(Figs 25, 58, 59, 80)

Scoparia tafirella Chrétien, 1908: 358; Rebel 1917: 50; Rebel 1938: [54].

Scoparia coeruleotincta Hampson, 1917: 281. Rebel 1938: [54]. **Syn. n.**

Diagnosis. – Wing pattern contrasted black and white without an ochreous admixture.

Description. – Wingspan 13-19 mm (n=65). Wing pattern (but not colouring) identical to *E. lineola lineola*: Forewing basally with some black spots, then white towards the antemedial fascia; antemedial fascia with two strong notches and black edged towards the medial area; antemedial stigmata round; discocellular stigma X-shaped with a black spot at the costa; postmedial fascia strongly indented, forming a white X together with the subterminal fascia; hindwings with discal spot and a white line in the terminal shade; forewing colouring contrasted black and white instead of a grey colouring as in *E. lineola lineola*.

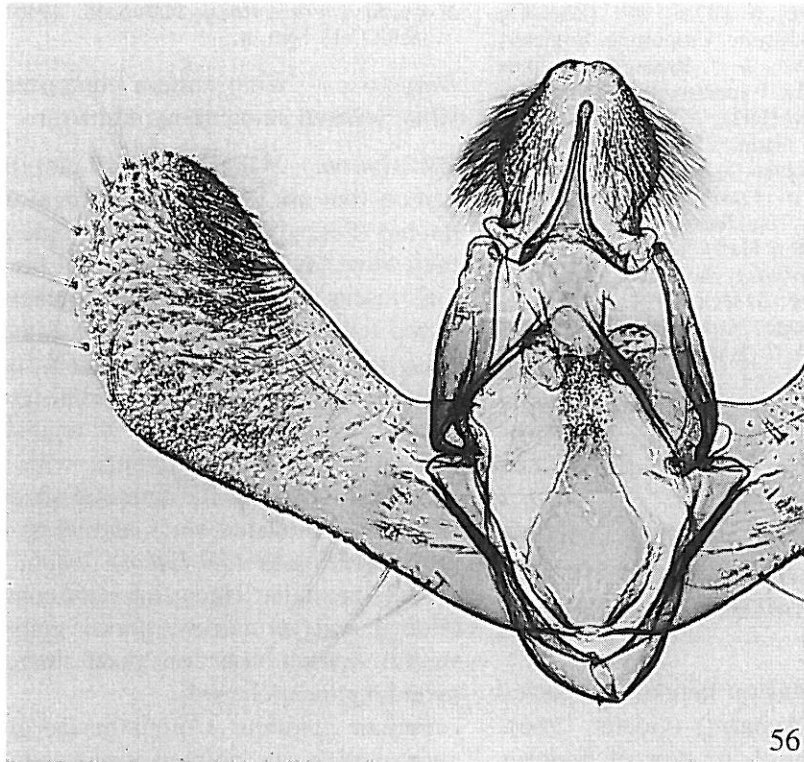
Male genitalia: Uncus laterally convex, distally bilobed; valvae narrow, dorsal margin straight, ventral margin concave, distal margin convex; juxta long, pear-shaped.

Female genitalia: Corpus bursae globular, signum small, ovate, pointed at one end; ductus bursae thin, one or two loops beyond corpus bursae.

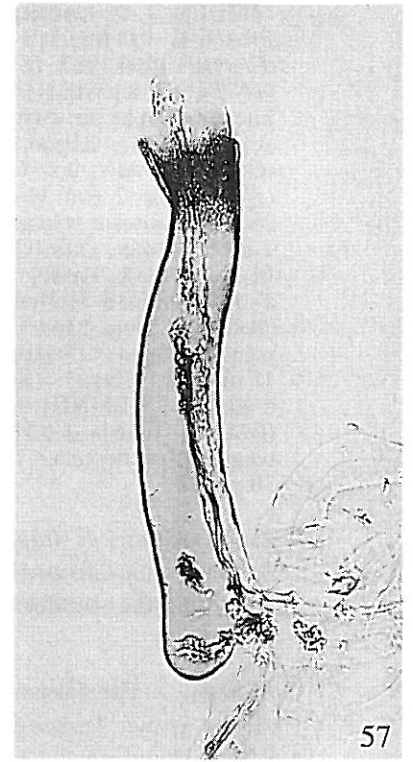
Material examined. – *Scoparia tafirella*: Holotype ♂ 'Holotypus', 'Type', 'Tafira, Chrys. 23.2.03 en l'écorce, d'un Troène, adulli a. 24.', 'Scoparia tafirella', 'Scoparia tafirella Chrét. Bull. Museum 1908, p. 358 P. Viette V.1956', 'Museum Paris Grande Canarie Tafira P Lesne 1903', [exuvia glued to additional label], 'Holotype Eudonia tafirella (Chr.) det. M. Nuss, 1995' (MNH). *Scoparia coeruleotincta*: Holotype ♀ 'Holotype', 'Las Mercedes Tenerife 19.V.1907 Wlsm.', '1907 299.', 'Scoparia coeruleotincta type ♀ Hmps. n.', 'Pyralidae Brit. Mus. Slide No. 3779', 'Holotype Scoparia coeruleotincta Hampson det. M. Nuss' (BMNH).

CANARY Is. HIERRO: 2 ♂, 4 ♀ Valverde, 16.-23.xi.1970, Pinker (SMN). LA PALMA: 1 ♀ Los Saucos, Pinker (SMN); 1 ♂ same except, i.1962, Pinker (MRSN); 1 ♀ same except, ii.1962, Pinker (NHM); 1 ♀ Los Tilos, 400m, 16.i.1981, Stadel Nielsen (ZMUC). GOMERA: 1 ♂ Meriga, 900m, 12.i.1981, Stadel Nielsen (ZMUC). TENERIFE: 1 ♂ Laguna, 11.ii.1921, Cabrera (NHM); 4 ♀ same except, 26.v.1974 (Speidel); 3 ♂, 2 ♀ Mercedes forest, 700m, 15.-16.iii.1967, Kasy (NHM); 1 ♀ same except, 15.x.1993, Arenberger (Arenberger); 9 ♂, 14 ♀ same except, 1.-13.xi.1970, Pinker (SMN); 1 ♀ Mt. Anaga, 23.ix.1992, Bailandero (MRSN); 1 ♂ Monte del Agua, 20.x.1993, Báez (Báez); 1 ♂ same except, Erjos, 20.x.1993, Arenberger (Arenberger); 1 ♂ Azur, 4.xii.1993, Báez (Báez). GRAN CANARIA 1 ♀ Bandama, 21.-23.ii.1967, Kasy (NHM); 8 ♂, 4 ♀ Valleseco, 9.-28.x.1967, Pinker (SMN); 1 ♀ St. Bartholomeo, xii.1958, Pinker (NHM); 1 ♂ Valdesegno, xii.1958, Pinker (NHM).

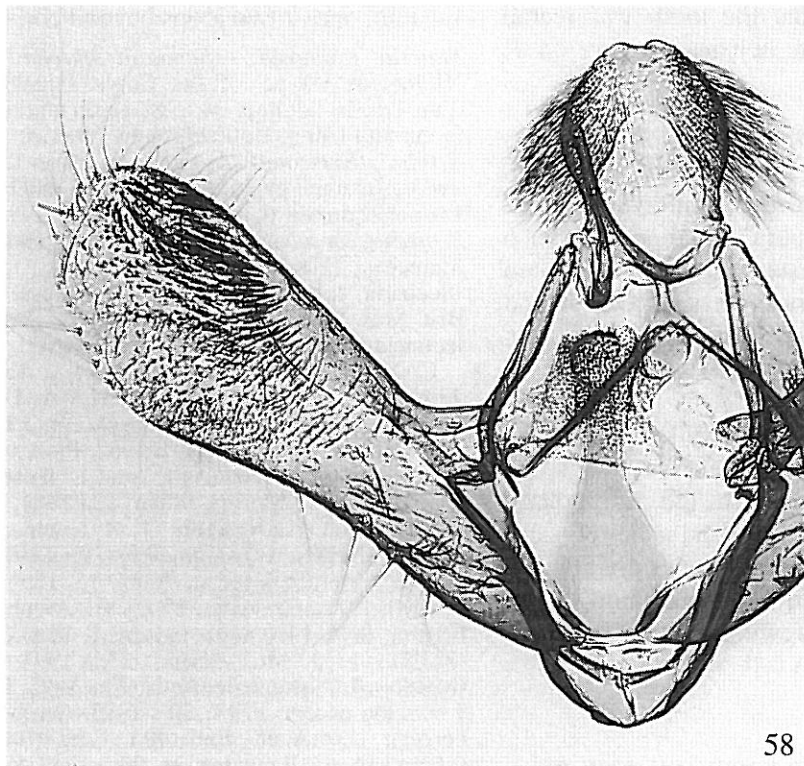
Distribution. – Endemic to Hierro, La Palma, Gomera, Tenerife and Gran Canaria.



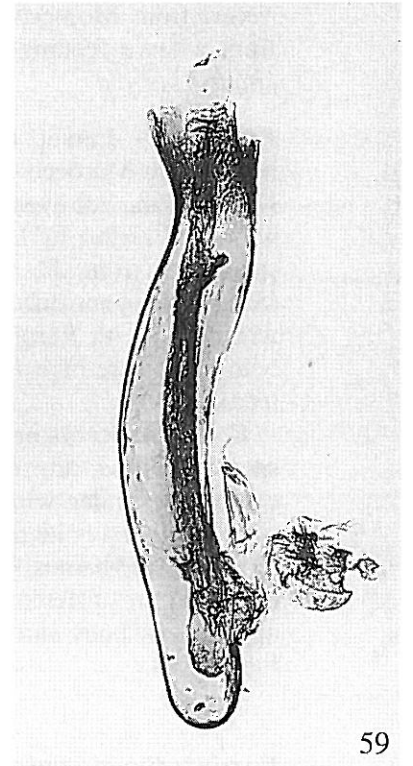
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58



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Figs 56-59. ♂ genitalia: (56, 57) *E. lineola dorada*, GU Nuss 699, Canary Islands, Lanzarote; (58, 59) *Eudonia lineola tafirella*, GU Nuss 700, Canary Islands, La Palma.

Biology. – Known flight period: October to May, but no records from April.

Remarks. – *E. lineola tafirella* is superficially similar to *E. shafferi* from Madeira. *E. lineola tafirella* lacks the admixture of brown scales in the forewings and a grey shade between the antemedial and postmedial fasciae on the dorsum of the forewings is present in *E. lineola tafirella*, but absent in *E. shafferi*.

***Eudonia lineola dorada* ssp. n.**

(Figs 26, 56, 57, 81)

Diagnosis. – Upperside of body and forewings with a conspicuous golden shine.

Description. – Wingspan 12–15 mm (n=16). Small, forewings narrow, wing pattern as in *E. lineola lineola* and *E. lineola tafirella* (compare description of *E. l. tafirella*) but upperside of forewings and body with a conspicuous golden shine.

Male genitalia: Uncus distally slightly bilobed, laterally convex; juxta stocky, pear-shaped; ventral and dorsal margin of valvae concave, distal margin upturned; vinculum slender.

Female genitalia: Corpus bursae globular, with a round signum; ductus bursae with one or two loops.

Material examined. – Holotype ♂ 'Holotypus', 'Canar. Ins. Fuerteventura 13.-23.3.26 Hering S.', 'GU 1534', 'Holotype Eudonia dorada Nuss, Karsholt, Meyer det. M. Nuss, 1995' (ZM). Paratypes: 9 ♂, 2 ♀ 'Costa Teguisse, Lanzarote, Spain 18.-24.xii.1984 K. Larsen' (Larsen, Nuss, ZMUC). 1 ♂ '3.-5.3.1967 Lanzarote Haria F. Kasy' (NHM). 1 ♂ 'Fuerteventura Vega de Rio Palmas 8.5.87 W. Schmitz' (Schmitz). 1 ♀ 'Fuerteventura Cofete ca. 250m 11.3.88 W. Schmitz' (Speidel). 1 ♂ 'Fuertevent. Vega Rio Palmas 27.ii.90 M. Báez' (Báez). (All paratypes with a red label 'Paratypus' and a white label 'Paratype Eudonia lineola dorada Nuss, Karsholt, Meyer det. M. Nuss, 1995').

Derivatio nominis. – Named after the Spanish word *dorado* (golden), relating to the golden shine of the upperside of the body and the forewings.

Distribution. – Endemic to Fuerteventura and Lanzarote.

Biology. – Known flight period 18 December to 8 May, but no records from January and April.

Remarks. – Rebel (1938: (55)) recorded one male from Fuerteventura collected by Hering from 13.-23.iii.1926 as *Scoparia virescens*. This specimen is selected as the holotype of *E. dorada*.

***Eudonia angustea* (Curtis)**

(Figs 27, 28, 29, 60, 61, 82)

Eudorea angustea Curtis, 1827: pl. 170; Bradley 1958: 193; Chrétien, 1908: 359; Carvalho 1982: 181; Cockerell 1929: 113; Gardner & Classey 1960: 203; Goater 1986: 54, pl.3, fig.18; Leraut 1984: 175; Rebel 1892: 248, 281; Rebel & Rogenhofer 1894: 94 (index); Rebel 1896a: 113, 146; Rebel 1898: 374, 380 (index); Rebel 1906: 43; Rebel 1911: 370 (index); Rebel 1917: 11, 13, 18; Rebel 1940a: 4 (key), 7, [as *Scoparia stenota*] pl.2, fig. 19; Rebel 1940b: 6; Rebel 1940: 8, 32 (key), 35; Stainton 1859: 211; Vieira & Pintureau 1991: 33; Warren 1905: 445; Whalley & Tweedie 1963: 94, pls 10-11, figs 53-56. *Eudorea coarctata* Zeller, 1846: 308, pl. 2 fig. 14; Leraut 1984: 175.

Eudorea hesperella Heydenreich, 1851: 75; Leraut 1984: 175. (Unjustified replacement name.)

Eudorea acuminatella Stainton, 1859: 210; Bradley 1958: 193; Carvalho 1982: 180; Cockerell 1929: 113; Leraut 1984: 175; Rebel 1917: 11, 13; Rebel 1940a: 4 (key), 7; Vieira & Pintureau 1991: 33.

Scoparia coarctalis var. *napolitana* Millière, 1870: 90, 127, pl. 109, fig. 17; Leraut 1984: 178; Whalley & Tweedie 1963: 95.

Scoparia vafra Meyrick, 1913: 158; Leraut 1984: 178; Whalley & Tweedie 1963: 94.

Scoparia imparilis Dyar, 1929: 8. Cockerell 1929: 113; Rebel 1940a: 7; Rebel 1938: [47]. **Syn. n.**

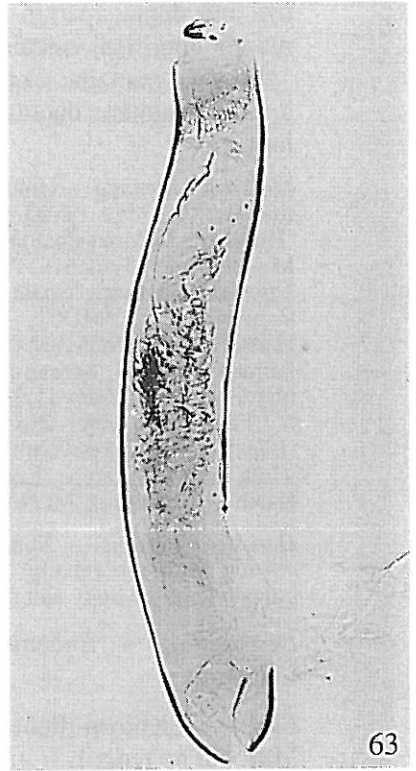
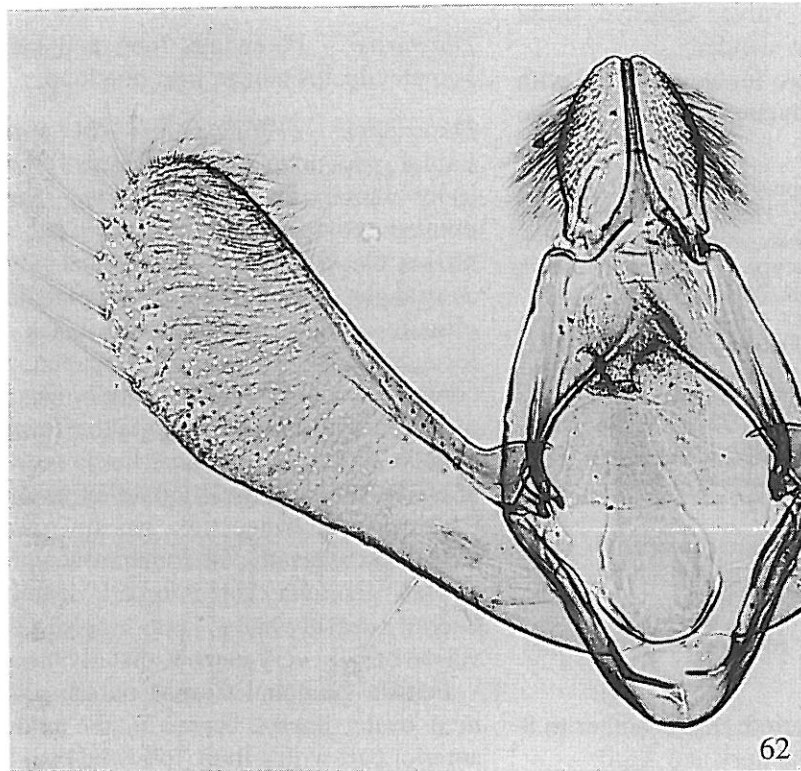
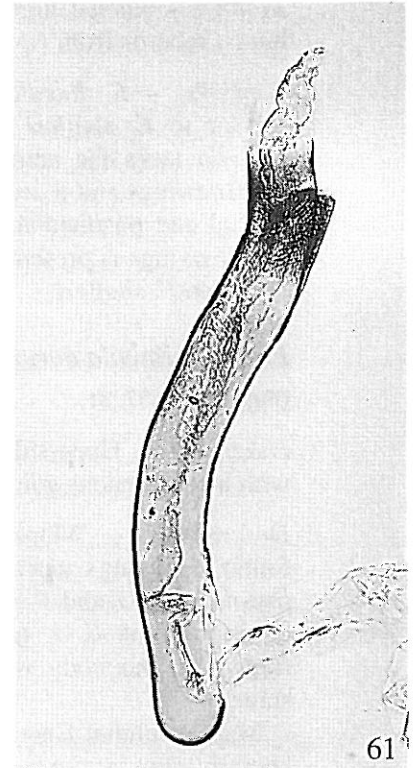
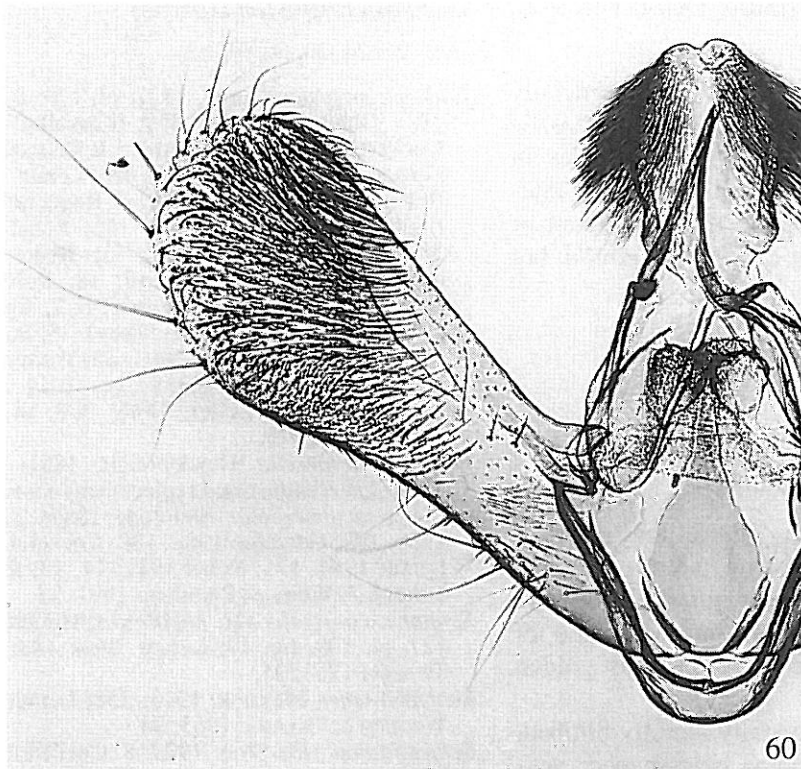
Diagnosis. – Forewings long and narrow, grey. Female: ductus bursae with one loop.

Description. – Wingspan 13–21 mm (n=474). Labial palpi long, porrect, laterally brown, ventrally white; forewings long and narrow, apex pointed; colouration white admixed with pale-brown, black markings; antemedial fascia extends as triangle into medial area, antemedial stigmata obscure or only one apparent, black and clavi-form; discocellular stigma X-shaped, sometimes connected with costa by a pale brown spot; post-medial fascia with an indentation towards discocellular stigma; subterminal fascia near postmedial fascia, the latter nearly parallel to termen; with three rows of fringe, two basally rows white at base, brown distally, outermost row white.

Male genitalia: Uncus broad, distally bilobed, laterally densely hairy; juxta longish pear-shaped; valvae basally very narrow, distally broad.

Female genitalia: Corpus bursae globular, signum ovate; ductus bursae in the middle of the anterior part with a loop, followed by a fold.

Material examined. – *Eudorea coarctata*: Lectotype, hereby designated, ♀ 'Lectotype', 'Messina 4/2 44.', 'Zell. Coll. 1884.', 'Lectotype Eudorea coarctata Z. det. M. Nuss' (BMNH). Paralectotypes: 1 specimen 'Paralectotype', 'Messina 6/3 44.', 'Zell. Coll. 1884.', 'Abdo-



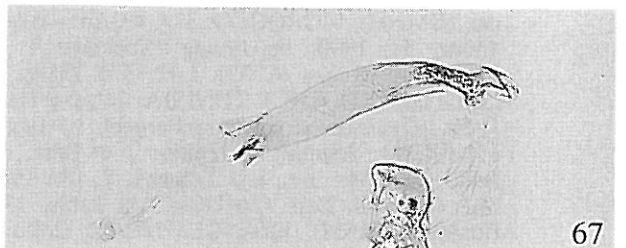
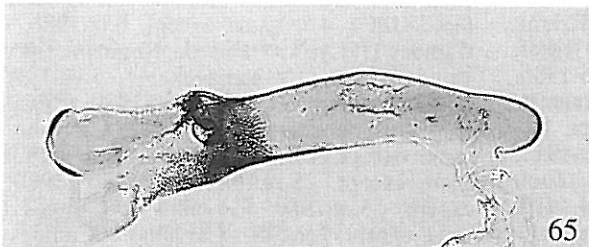
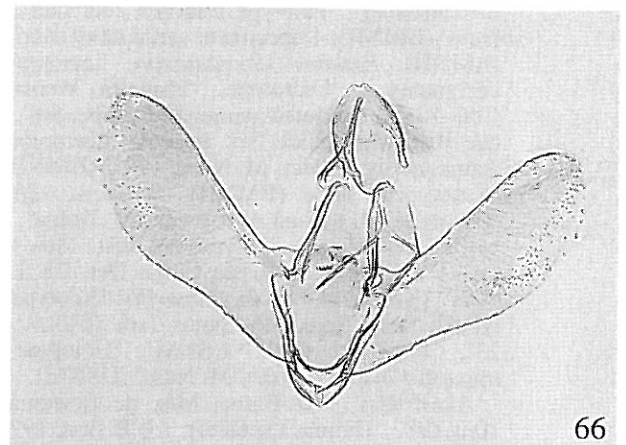
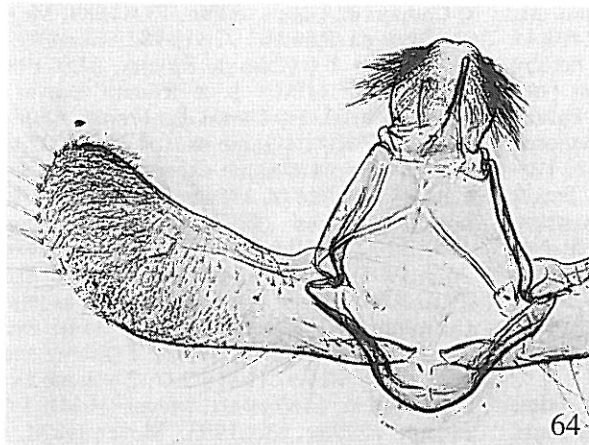
Figs 60-63. ♂ genitalia: (60, 61) *Eudonia angustea*, GU Nuss 711, Madeira; (62, 63) *E. geminoflexuosa*, GU Nuss 644, Canary Islands, Tenerife.

men missing', 'Paratype *Eudorea coarctata* Z. det. M. Nuss' (BMNH). 1 specimen: same label data but 6/4 44 (BMNH). *Eudorea acuminatella*: Lectotype, hereby designated, ♀ 'Lectotype', 'Madeira. Woolaston [sic] Coll. 55-7.', 'Eudorea acuminatella type. Stt.', '♀ Pyralidae Brit. Mus. Slide No. 19376', 'Lectotype *Eudorea acuminatella* Stt. det. M. Nuss, 1994' (BMNH). 10 Paralectotypes: same (BMNH). *Scoparia vafra*: [sex?] 'Holotype', 'England nr. Chester H. Dobie', 'Scoparia vafra Meyr. Type', '? Pyralidae Brit. Mus. Slide No. 19378', 'Eudorea angustea Curtis Det. P.E.S. Whalley. 1961.' (BMNH). *Scoparia imparilis*: Holotype ♂ 'Holotypus', 'Villa Baleda Pt. Santo, Jam. (Ckll)', 'V.13 Jan. 23', 'Type No. 41380 USNM', 'Holotype *Scoparia imparilis* Dyar, 1929 det. M. Nuss' (USNM).

ALGERIA: 1 ♂ Batna, Mts. de Belezma, 1200m, 10.iv.1982, Thomas (Speidel); 1 ♀ Biskra, 1978, Krauss (ZSB); 1 ♀ Gueltes Stel, 21.iv.1912, Rothschild & Jordan (BMNH); MOROCCO: 3 ♂, 4 ♀ Anti-Atlas, Tihmi, 450m, 31.i.1990, de Freina (Speidel); 1 ♀ Rabat, 21.iii.1940, Rungs (CNC); 1 ♂, 3 ♀ Tanger, iii.1885, Leech (BMNH, CNC). TUNISIA: 1 ♂, 2 ♀ Hammamet, 1.-5.i.1979, Arenberger (Arenberger); 1 ♀ Tabarka, 10.-17.xii.1993, Schmitz (Schmitz); 1 ♂ Sfax, 3.iv.1957, Bédé (BMNH); 1 ♂, 1 ♀ Tabarka, 7.-18.v.1988, Zool. Mus. Copenh. Exp. (ZMUC); 1 ♀ Tunis, 23.iii.1913, Buxton (BMNH). FRANCE: 1 ♂, 1 ♀ Collioure, 24.-28.v.1936, Osthelder (ZSB); 1 ♀ Bouches du Rhone, Camargue, Environs d'Arles 21.xi.1933, Henriot (SMN); 1 ♂ Cannes, Staudinger (ZM); 1 ♀ Corse, Ajaccio, Frey 1890 (BMNH); 1 ♂ Lot Douelle, 29.x.1931, Lhomme (ZSB); 1 ♀ Morbihan Lorient, 11.-26.vi.1942, Hasslinger (ZSB); GREECE: 1 ♂ Crete, Rethimnon, 50 20.iv.1971, Malicky (SMN); 1 ♂ Hellas, Lakonia 5 km south of Monemvasia, 28.i.1984, Christensen (ZMUC); IRELAND: 1 ♂, 1 ♀ Cork City, 16.viii.1980, Hall (Hall); ITALY: 2 ♂ Liguria, Ventimiglia, 500m, 6.-7.iv.1988, Fibiger (ZMUC); 4 ♀ Lazio, Tivoli, 6.iv.-31.v.1910, Dannehl (ZSB); 1 ♂ Sardinia, Aritzo, 14.vi.1933, Amsel (BMNH); 1 ♀ Sizily, Madonie mountains, 6.viii., Dannehl (ZSB). PORTUGAL: 1 ♂, 1 ♀ Algarve, Sagres, 31.iii.1991, Mikkola (ZMU). SPAIN: 2 ♂ Bilbao, 12.vi.1902, Seebold (ZSB); 1 ♀ Cadiz, Seebold (ZSB); 1 ♂ Nerja, 1.vi.1988, Herrmann (Speidel); 1 ♂ Andalusia, Sierra de Marbella, El Mirador, 100m, 11.iii.1980, Traugott-Olsen (ZMUC); 1 ♀ Andalusia, Chiclana, 31.iii.1858, Staudinger (ZM); 1 ♀ Asturias, Amieva, Precendi, 300m, 20.vi.1987, Hellers (Hellers); 2 ♂ Badajoz Olivenza, 9.iv.1992, Goater (Goater). 1 ♂ Cantabria, Picos de Europa, Lebeña, 200m, 20.v.1988, Meyer (H/M); 3 ♂, 6 ♀ Gerona, Port Bou, 26.iv.-4.v.1964, Pinker (ZSB); 1 ♂ Sevilla, 10.-12.xii.1900, Walsingham (BMNH); UNITED KINGDOM: 1 ♂ Berkshire, 5.ix.1978, Hall (Hall); 1 ♂ Cornwall, Lizard, 2.ix.1977, Goater (Goater); 1 ♂ Dorset, Portland Bill, 15.-16.vi.1985, Hall (Hall); 1 ♂, 1 ♀ Hampshire New Forest, 14.viii.1960, Goater (Goater); 3 ♂ Orkney Is., Orphir, 16.vi.1978, Goater (Goater); 1 ♂ Shetland, Hellswick, 23.vii.1972, Goater (Goater). MACEDONIA: 1 ♂ Rovinj, 6.-15.ix.1977, Roesler & Küppers (SMN).

MADEIRA IS. MADEIRA: 1 ♀ Archada do Teixeira, 4.vi.1980, Carvalho & Camoes (JPC); 1 ♂ same except, 1600m, 22.vi.1993, Karsholt (ZMUC); 1 ♀ Bica da Cana, 1.vi.1980, P. Carvalho & Contente (JPC); 1 ♂, 2

♀ Camara de Lobos, 600m, 13.v.1989, Meyer (H/M); 1 ♂ Chao da Ribeira, 22.vi.1982, Carvalho & Camoes (JPC); 1 ♂, 1 ♀ Chao da Ribeira, 27.ix.1982, Carvalho & Contente (JPC); 1 ♂ Ribeira Brava, 19.iii.1997, Müller (Nuss); 1 ♀ Curral das Freiras, 650m, 13.v.1989, Meyer (H/M); 1 ♀ same except, 600m, 22.v.1989, Hellers (Hellers); 1 ♀ same except, 26.v.1982, Carvalho & Camoes (JPC); 1 ♂, 1 ♀ same except, 1.ix.1980, Carvalho & Camoes (JPC); 1 ♂ Encumeada, 950m, 15.iii.1997, Müller (Nuss); 1 ♂ same except, 950m, 26.iii.1997, Müller (Nuss); 1 ♀ same except, 950m, 25.iii.1997, Müller (Nuss); 1 ♀ same except, 29.v.1980, Carvalho & Contente (JPC); 1 ♂ same except 1000m, 16.vi.1993, Karsholt (ZMUC); 1 ♀ same except 1000m, 9.vii.1991, Meyer (H/M); 2 ♂, 2 ♀ same except, Lameiros 900m, 11.vii.1991, Meyer (H/M); 1 ♂, 1 ♀ same except, 1200m, 13.x.1993, Meyer (H/M, Nuss); 1 ♀ Estreito, Camara de Lobos, 30.v.1980, Carvalho & Contente (JPC); 1 ♀ same except, 6.ix.1980, Carvalho & Camoes (JPC); 4 ♂ Faja da Nogueira, 28.v.1980, Carvalho (JPC); 1 ♂ same except, 5.vii.1980, Carvalho (JPC); 1 ♂ same except, 6.viii.1980, Carvalho (JPC); 1 ♂, 1 ♀ same except, 9.viii.1982, Carvalho (JPC); 1 ♂ same except, 16.viii.1980, Carvalho (JPC); 2 ♂, 4 ♀ same except, 25.ix.1981, Carvalho (JPC); 1 ♀ same except, 13.ix.1980, Carvalho & Camoes (JPC); 1 ♂ same except, 1.x.1981, Carvalho & Camoes (JPC); 3 ♂, 7 ♀ same except, 5.vi.1980, Carvalho & Contente (JPC); 1 ♀ same except, 15.v.1989, Hellers (Hellers); 1 ♂, 5 ♀ same except, 8.x.1994, Karsholt (ZMUC); 1 ♀ same except, 5.vii.1991, Meyer (H/M); 2 ♂, 4 ♀ same except, 800m, 6.x.1993, Meyer (H/M, Nuss); 1 ♀ same except, 600m, 20.x.1974, Silva (ZMUC); 4 ♀ same except, 23.viii.1974, Traugott-Olsen (ZMUC); 2 ♂ same except, 24.viii.1974, Traugott-Olsen (ZMUC); 3 ♀ same except, 9.-10.vi.1976, Wolff (ZMUC); 1 ♂, 1 ♀ same except, 600m, 14.-15.ix.1977, Lomholdt & Wolff (ZMUC); 2 ♂, 3 ♀ Faja do Penedo, 1.x.1981, Carvalho & Camoes (JPC); 1 ♂, 2 ♀ Funchal, 18.ii.1979, Karsholt (ZMUC); 1 ♂, 1 ♀ same except, 19.ii.1979, Karsholt (ZMUC); 3 ♂ same except, 21.ii.1979, Karsholt (ZMUC); 1 ♀ same except, 2.iii.1902, Eaton (BMNH); 1 ♀ same except, 14.iv.1902, Eaton (BMNH); 1 ♀ same except, 25.iv.1972, Wolff (ZMUC); 1 ♂ Joao Frino, 9.vi.1980, Carvalho & Contente (JPC); 2 ♂ Paul da Serra, Fanal, 1000m, 18.v.1989, Meyer (H/M); 1 ♀ Poiso, 1400m, 13.v.1989, Meyer (H/M); 3 ♂, 5 ♀ Poiso, 1400m, 13.v.1989, Hellers (Hellers); 1 ♀ Pico Arieiro, 1600m, 15.vi.1993, Karsholt (ZMUC); 2 ♀ Porto do Moniz, Santa Madalena, 600m, 9.vii.1991, Meyer (H/M); 2 ♂, 1 ♀ Queimadas, 2.vi.1980, Carvalho (JPC); 2 ♂, 2 ♀ same except, 3.vi.1980, Carvalho (JPC); 2 ♂ same except, 4.vi.1982, Carvalho (JPC); 1 ♀ same except, 18.vii.1980, Rodrigues (JPC); 1 ♀ same except, 9.ix.1980, Carvalho (JPC); 1 ♂ same except, 10.ix.1980, Carvalho & Camoes (JPC); 1 ♂ Fonte de Bispo, 1150m, 6.vii.1993, Karsholt (ZMUC); 1 ♀ same except, 1050m, 7.vii.1993, Karsholt (ZMUC); 1 ♂ Rabacal, 28.v.1982, Carvalho & Contente (JPC); 1 ♂ same except, 31.viii.1982, Carvalho & Camoes (JPC); 1 ♂ same except, 25.ix.1982, Carvalho & Camoes (JPC); 1 ♂ same except, 12.ix.1980, Carvalho & Camoes (JPC); 1 ♂ same except, 1000m, 28.xi.1972, Lundqvist & Wolff (ZMUC); 5 ♂, 7 ♀ above Santana, 1050m, 6.x.1994, Karsholt (ZMUC); 1 ♂ Santana, Ilha, 900m,



Figs 64-67. ♂ genitalia: (64, 65) *Eudonia lindbergalis*, GU Nuss 634, Cape Verde Islands, Santo Antao; (66, 67) *E. parviangusta*, GU Nuss 714, Canary Islands, Gran Canaria.

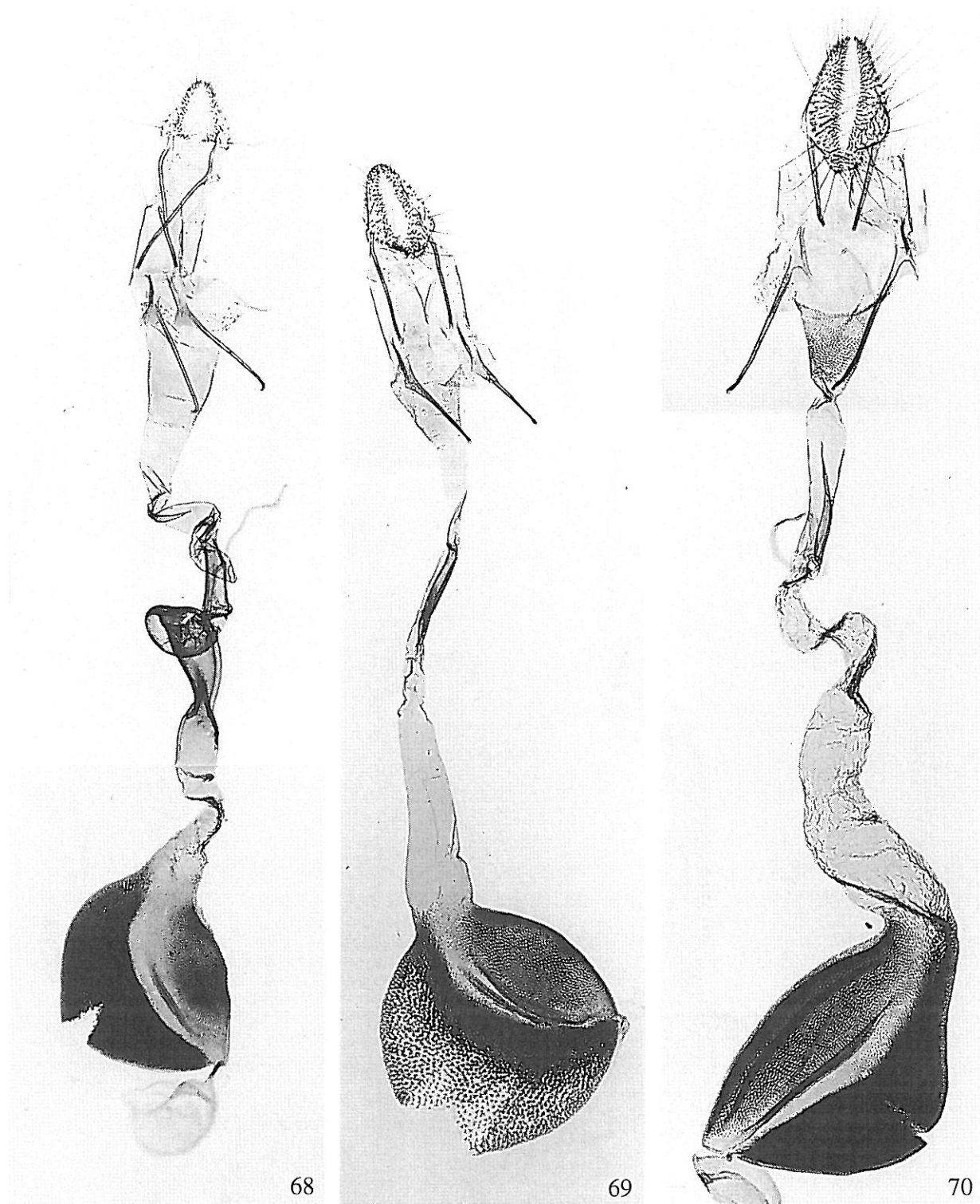
14.x.1993, Meyer (H/M); 2 ♀ Encumeada, 1000m, 13.vi.1993, Karsholt (ZMUC); 3 ♂ same except, 14.vi.1993, Karsholt (ZMUC); 1 ♂, 3 ♀ same except, 16.vi.1993, Karsholt (ZMUC); 3 ♂ same except, 17.vi.1993, Karsholt (ZMUC); 5 ♂ same except, 18.vi.1993, Karsholt (ZMUC); 1 ♂, 1 ♀ Sao Vicente, 50m, 10.x.1993, Meyer (H/M); 2 ♀ Serra de Agua, 640m, 11.vi.1993, Karsholt (ZMUC); PORTO SANTO: 4 ♂, 8 ♀ 300m, 13.-15.iv.1996, Karsholt (ZMUC). DESERTA GRANDE: 1 ♀ Wollaston (BMNH).

CANARY IS. HIERRO: 1 ♂ below Mirador, 1100m, 31.i.1989, Enghoff (ZMUC); 6 ♂, 11 ♀ Valverde, 16.-28.xi.1970, Pinker (SMN). LA PALMA: 1 ♂, 5 ♀ Bco. Nogales, 15.i.1981, Stadel Nielsen (ZMUC); 1 ♀ Los Tilos, 400m, 16.i.1981, Stadel Nielsen (ZMUC); 2 ♀ Brena Alta, 28.ii.1993, Schwan (Schmitz); 3 ♂, 3 ♀ Los Llanos, Pinker (SMN); 1 ♀ Los Sauces, 16.-18.iv.1965, Klimesch (Klimesch); 4 ♂, 16 ♀ same except, 10.-14.iv.1965, Klimesch (Klimesch); 6 ♂, 26 ♀ same except, 12.-17.xi.1966, Klimesch (Klimesch); 4 ♀ same except, 15.xi.1966, Klimesch (Klimesch). GOMERA: 2 ♀ Agulo, Pinker (SMN); 11 ♂, 3 ♀ Meriga, 900m, 12.i.1981, Stadel Nielsen (ZMUC); 2 ♂, 1 ♀ Garajonay, 1400m, 16.ii.1995, Müller (Nuss). TENERIFE: 3 ♂, 11 ♀ Santiago del Teide, 1000m, 9.i.1981, Stadel Nielsen (ZMUC); 1 ♂, 4 ♀ same except, 28.i.1994, Karisch (Karisch); 1 ♂ Realejo Alto, 500m, 14.i.1981, Stadel Nielsen (ZMUC); 2 ♂, 1 ♀ southern coast, ii.1984, Stöckert (Derra); 3 ♀ Puerto de la Cruz, 22.ii.1994, Goergens (Schmitz); 1 ♂, 1 ♀ La Laguna, 8.iii.1904, Eaton (BMNH); 1 ♀ Aguamansa, 23.iii.1972, Klimesch (Klimesch); 1 ♂ Aguamansa, 1000m, 27.iii.1972, Kli-

mesch (Klimesch); 2 ♂, 3 ♀ Aguamansa, 1.-15.ix.1993, Werno (Werno, Nuss); 2 ♂, 2 ♀ Güimar, 9.ii.1970, Klimesch (Klimesch); 1 ♂ Güimar, 23.iii.1907, Walsingham (BMNH); 2 ♀ Güimar, 25.-28.iii.1965, Klimesch (Klimesch); 1 ♀ Güimar, 28.iii.1971, Klimesch (Klimesch); 1 ♀ Güimar, iii.1961, Pinker (Klimesch); 2 ♂, 7 ♀ Güimar, 30.iii.-8.iv.1965, Klimesch (Klimesch); 1 ♀ Güimar, iv.1961, Pinker (Klimesch); 1 ♂, 1 ♀ Mt. Mercedes, 15.xi.1973, Klimesch (Klimesch); 7 ♂, 10 ♀ La Esperanza, 4.xii.1970, Pinker (SMN); 2 ♂ Sta. Cruz, 21.-23.xii.1906, Walsingham (BMNH). GRAN CANARIA: 2 ♀ Berrasalles, ii.1970, Pinker (SMN); 6 ♀ Cald. d. Bandama, ii.1962, Pinker (Klimesch); 1 ♂, 1 ♀ Teror, ii.1988, Stöckert (Derra); 1 ♂ San Bartolomeo, 1100m, iv.1961, Pinker (Klimesch); 1 ♀ same except, 8.-22.v.1965, Klimesch (Klimesch); 1 ♀ same except, xi.1958, Pinker (ZMUC); 4 ♀ Telde, xi.1958, Pinker (Klimesch); 1 ♀ same except, xii.1958, Klimesch (Klimesch); 1 ♂, 1 ♀ Valdesequo, xii.1958, Pinker (NHM).

Distribution. – Madeira, Porto Santo, Deserta Grande; known from all Canary Is., except Lanzarote and Fuerteventura. Entire distribution: Atlantic-Mediterranean. From Orkney and Shetland Is. (Wolff 1971) along the Atlantic coast to Morocco. Along the northern coast of the Mediterranean to Turkey, along the southern coast to Tunisia.

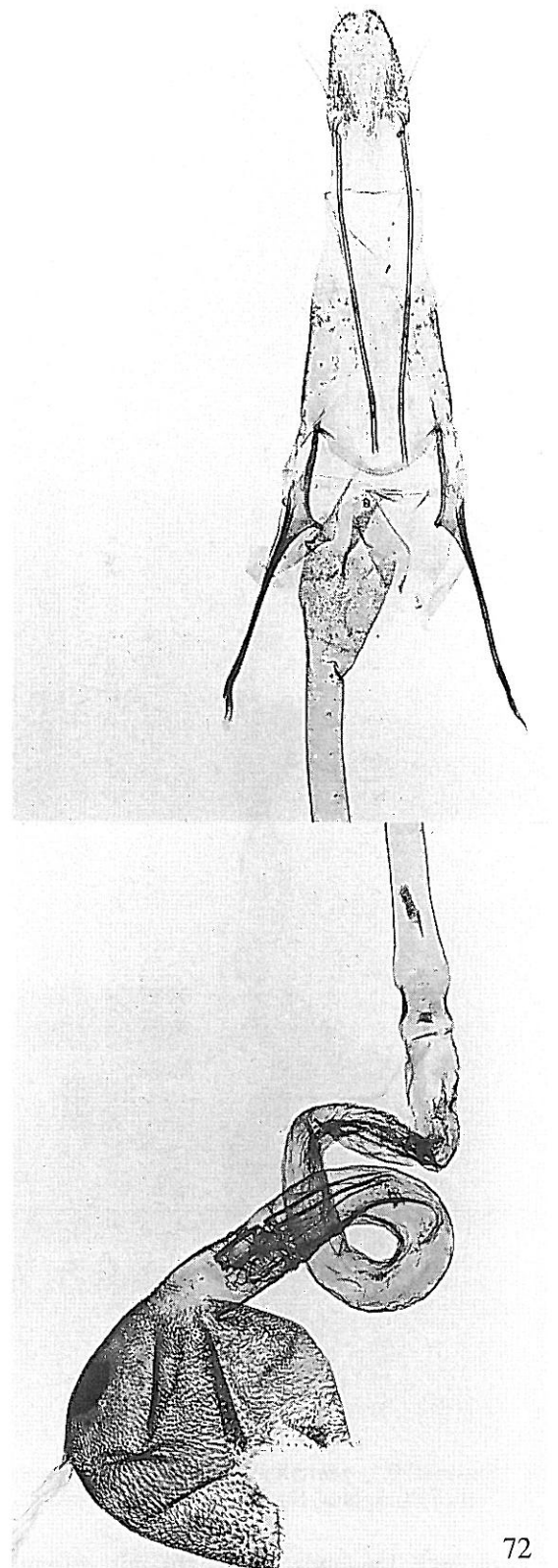
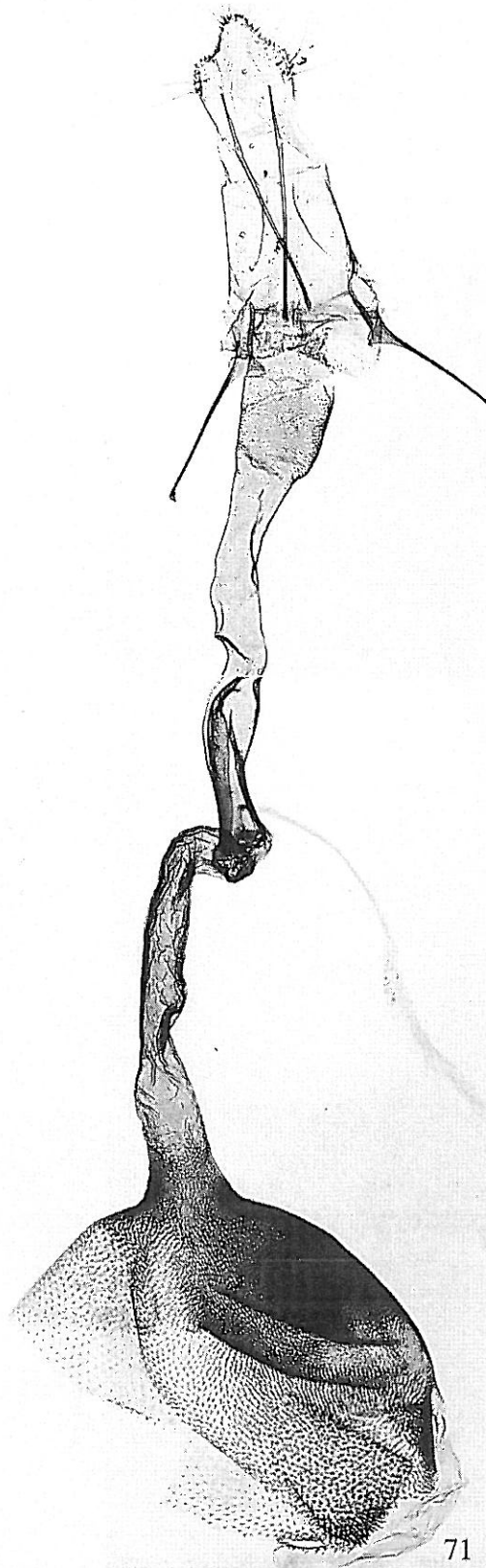
Biology. – *E. angustea* is the most common scopariine in Madeira. It occurs in nearly all habitats



Figs 68-70. ♀ genitalia: (68) *Scoparia aequipennalis*, GU Nuss 705, Azores, Sao Miguel; (69) *S. semiamplalis*, GU Nuss 718, Azores, Sao Miguel; (70) *S. coecimaculalis*. ♀, GU Nuss 706, Azores, Fayal.

in both lowlands and highlands throughout the year. On the British Isles, the larvae feed in cushions of the moss *Tortula ruraliformis* (Besch.)

Ingh. growing on sandhills and in moss on walls (Goater 1986).



Figs 71-72. ♀ genitalia: (71) *Scoparia carvalhoi*, GU Nuss 649, Azores, Terceira; (72) *Eudonia luteusalis*. ♀, GU Nuss 717, Azores, Pico.

Remarks. – The species occurs on Madeira I. in two forms. One is endemic for Madeira and was described as *S. imparilis*. These specimens have a black basal streak, which ends in the lower stigma at the antemedial fascia. We consider this an infraspecific variation as no differences were found in the genitalia.

Dyar (1929) erroneously described *S. imparilis* from Jamaica, but this was corrected by the collector, T. D. A. Cockerell who stated the type locality as 'Villa Baleira, Porto Sante, Madeira Is.' (Cockerell 1929).

E. angustea was recorded from the Azores by Carvalho (1982), Rebel (1917, 1940c), Vieira & Pintureau (1991) and Warren (1905). Material of these authors investigated did not include specimens of *E. angustea* from the Azores. Specimens collected by Carvalho in the Azores and determined as *E. angustea* belong to *E. interlinealis*. We assume that all the above records are based on similar misidentifications and that *E. angustea* does not occur in the Azores. Rebel (1940a) figured *E. angustea* under the name of *S. stenota*. Superficially, *E. angustea* is very similar to the following two species.

Eudonia parviangusta sp. n.

(Figs 30, 66, 67, 83)

Diagnosis. – A very small species; forewings narrow, wing pattern inconspicuous. Female: ductus bursae without any loops.

Description. – Wingspan 10–13 mm (n=13). Small, wings very narrow; with predominantly white and black scaling, with a few brown scales; upperside of forewings, head and palpi mainly black, iridescent; base of proboscis and underside of head and thorax white; abdomen dorsally light grey; wing pattern inconspicuous; basal area with a black streak; antemedial fascia whitish, with one black spot as stigma; discocellular stigma X-shaped, near postmedial fascia; postmedial fascia forming a X with the subterminal fascia; hindwings white, with a brown terminal shade, fringe with first row short and brown, second one long and white.

Male genitalia: Uncus distally slightly bilobed, lateral with fewer hairs than *E. angustea*; valvae distally narrower than in *E. angustea*, dorsal margin straight, ventro-basal margin concave, ventro-distally convex, apex slightly pointed; juxta similar to juxta of *E. angustea*, but much narrower.

Female genitalia: Corpus bursae globular, signum drop-shaped; ductus bursae without loops.

Material examined. – Holotype ♀ 'Holotypus', 'Isole Canarie Sett.-Ott.1992 Sped. G. Bassi', '04.X.1992 Lux C. Gran Canaria Ayacata m.1000', '15482', 'GU Nr. 608 prep. M. Nuss', 'Holotype Eudonia parviangusta Nuss, Karsholt, Meyer det. M. Nuss, 1995', 'coll. G. Bassi' (MRSN). Paratypes: 5 ♂, 7 ♀ same label data (MRSN, Nuss, ZM, ZMUC).

Derivatio nominis. – Named after the Latin *parvus* (small) and *angustus* (narrow), relating to the small and narrow forewings.

Distribution. – Known only from the type locality on Gran Canaria.

Biology. – Known flight period: October.

Remarks. – The smallest scopariine moth from the Macaronesian Region; it is very similar to small specimens of *E. angustea*.

Eudonia geminoflexuosa sp. n.

(Figs 31, 62, 63, 84)

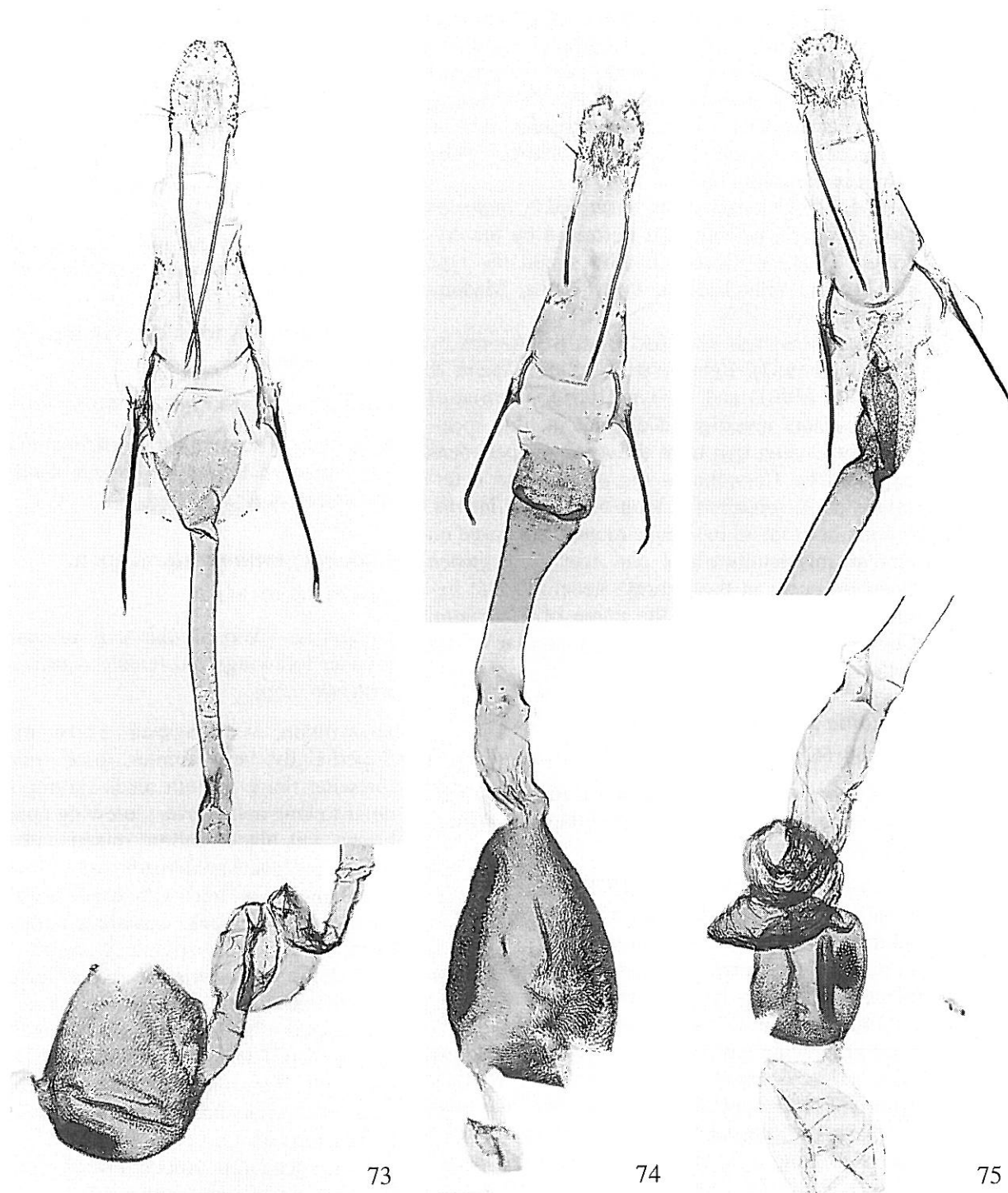
Diagnosis. – Very similar to *E. parviangusta*, but broader forewings and female with ductus bursae with two loops.

Description. – Wingspan 12–16 mm (n=44). Superficially very similar to *E. parviangusta*; forewing shape in both sexes varying from triangular to long and narrow; forewing upperside with brown and black scaling, mixed with white and iridescent scales; antemedial and postmedial fasciae white, bordered with black towards medial area; with two black, claviform antemedial stigmata; discocellular stigma X-shaped, near postmedial fascia; postmedial fascia nearly straight, sometimes slightly wavy; subterminal fascia not connected with postmedial fascia; black interneural dots along termen; fringe brown with a white medially line; hindwings white, brown scaled along the veins and at the termen, fringe basally brown, then white.

Male genitalia: Uncus broad, distal slightly bilobed; dorsal and ventral margin of valvae slightly concave, distally slightly upcurved.

Female genitalia: Corpus bursae globular, signum drop-shaped; ductus bursae beyond corpus bursae thickened and with two loops.

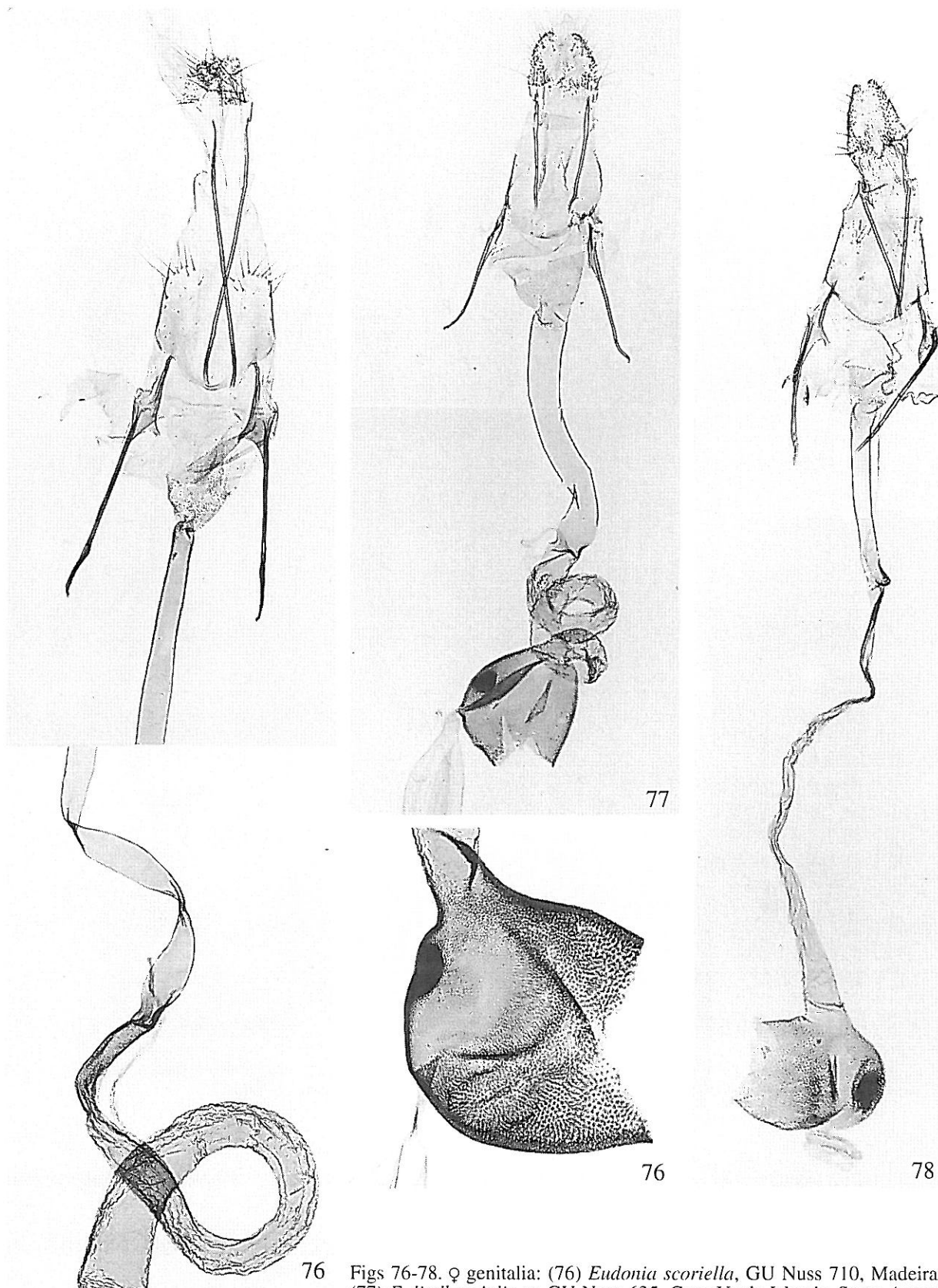
Material examined. – Holotype ♀ 'Holotypus', 'Ins. Canar. Ten. Gülmar 10-30.X.1966 J Klimesch', 'Holotype Eudonia geminoflexuosa Nuss, Karsholt, Meyer det. M. Nuss, 1995' (ZSB). Paratypes: 1 ♂, 2 ♀ same. 1



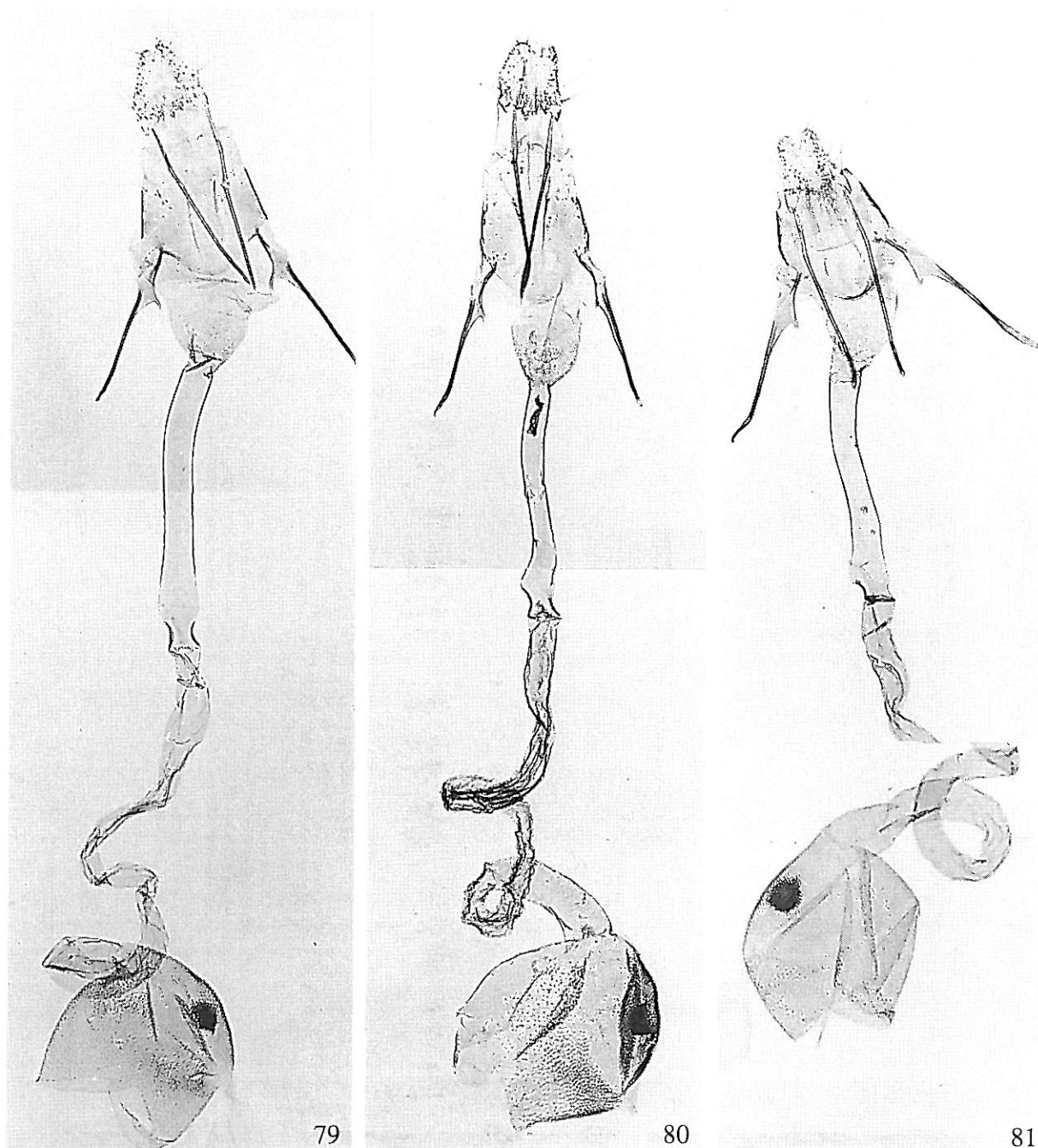
Figs 73-75. ♀ genitalia: (73) *Eudonia interlinealis*, GU Nuss 702, Azores, Sao Jorge; (74) *E. melanographa*, GU Nuss 709, Azores, Terceira; (75) *E. decorella*, GU Nuss 696, Canary Islands, Tenerife.

♂ 'Ins. Canar. Ten. Güimar 12.x.1966 J. Klimesch' (Klimesch). 4 ♂, 23 ♀ 'Teneriffe Baranco Ruiz leg. Pinker' (SMN, Nuss, ZM). 1 ♀ '22.IX.1992 Tenerife dint. Kasca', 'Isole Canarie Sett.-Ott. 1992 Sped. G.-Bassi' (MRSN). 1 ♀ '23.IX.1992 Tenerife Mti Anaga

dint. Bailandero, Lux Laurisilva', 'Isole Canarie Sett.-Ott. 1992 Sped. G.Bassi' (MRSN). 1 ♂, 1 ♀ '24.IX.1992 Tenerife dint. Erjos Laurisilva', 'Isole Canarie Sett.-Ott. 1992 Sped. G.Bassi' (MRSN, ZMUC). 1 ♂, 2 ♀ 'Teneriffe La Esperanza leg. Pinker' (SMN). 1 ♂,



Figs 76-78. ♀ genitalia: (76) *Eudonia scoriella*, GU Nuss 710, Madeira; (77) *E. lindbergialis*, ♀, GU Nuss 635, Cape Verde Islands, Santo Antao; (78) *E. stenota*, GU Nuss 630, Madeira.



Figs 79-81. ♀ genitalia: (79) *Eudonia shafferi*, GU Nuss 698, Madeira; (80) *E. lineola tafirella*, GU Nuss 652, Canary Islands, Tenerife; (81) *E. lineola dorada*, GU Nuss 701, Canary Islands.

1 ♀ 'Tenerife Aguamansa 1.9.-15.9.1993 LF. leg A. Werno' (Nuss). 2 ♀ 'Ins. Canar., Tenerife Mercedeswald La Laguna, 15.10.1993 M. u. E. Arenberger' (Arenberger). 1 ♂ 'Simony 89 Palma' (NHM).

Derivatio nominis. – Named after the Latin *gemino* (double) and *flexuosus* (rich in curves), referring to the two loops of the ductus bursae.

Distribution. – Known from Tenerife and La Palma.

Biology. – Known flight period: September to October.

***Eudonia lindbergalis* (Viette) comb. n.**

(Figs 32, 64, 65, 77)

Eudonia lindbergalis Viette, 1958: 6, fig. 3.

Diagnosis. – In wing pattern and male genitalia very similar to *E. lineola lineola*; but male retinaculum with hamus.

Description. – Wingspan 14–15 mm (n=13). Small; apex of forewings pointed, termen oblique; forewings predominantly brown, in basal area some black dots; antemedial fascia white, in middle with an indentation on inner margin; antemedial stigmata black, ovate and not connected with fascia; discocellular stigma black, X-shaped; postmedial and subterminal fascia together forming a X, both fasciae are interrupted by brown scales; subterminal area with a sprinkling of black scales; fringe basally black, then brown; hindwings white, with a brown terminal shade; fringes basally brown, then white.

Male genitalia: Uncus bilobed; ventro-basal margin of valvae concave, then convex, distally upcurved; juxta pear-shaped.

Female genitalia: Bursa copulatrix globular, structure of surface reticulate, signum round; ductus bursae beyond corpus bursae with two loops, near ductus seminalis with some little spines.

Material examined. – Holotype ♂ 'Type', 'Ins. Cabo Verde S. Antão Mte. Conceição 1.1.1954 Panelius', 'Eudonia ♂ lindbergalis n.sp. Holotype P. Viette', 'Genitalia ♂ P. Viette Prép. No. 3408', 'Eudonia lindbergalis Viette Holotype det. M.Nuss' (ZMU) (slide missing). Paratypes: 'très nombreux exemplaires de la même localité' (Viette 1958). The following have been seen: 1 ♂, 3 ♀ (ZMU). 5 ♀ (MNH). 1 ♂ (CNC). 26 further specimens in ZMU (Mikkola, pers. comm. 1995).

CAPE VERDES: 2 ♀ Santo Antão, Campo de Cão, 30.xii.1953, Lindberg (CNC).

Distribution. – Known only from Santo Antão, Cape Verde Is. The only known species of Scopariinae from this archipelago.

Remarks. – *E. lindbergalis* is closely related to *E. lineola*, they have similar wing pattern and genitalia. It is possible that fresh specimens are of more greyish colour than indicated in the 'Description'.

Doubtful records and species

Apart from misidentifications we have met with a number of more or less obvious cases of mislabeling of specimens of Macaronesian Scopariinae

and other Lepidoptera. Also, all the Macaronesian Islands were sometimes combined under the term 'Canaries' or 'Kanaren'.

In the Natural History Museum, London (BMNH) are three males of *E. stenota* and one male of *E. scoriella* labelled as follows: 'Canary, iv.1885, coll. Leech, 1900-64'. Also, one specimen of *E. angustea* of the typical Madeiran form with the black basal streak present, has this same label and a second is labelled: 'Leech coll. 1900-64, Madeira'. We assume that some of Leech's material became mixed and that the first mentioned label was incorrectly attached to some Madeiran specimens.

The German entomologist Pinker collected in the Macaronesian Islands. In his material some specimens from Azorean islands are labelled 'Kanaren', e.g. four specimens of *Scoparia semiamplalis*: 'Kanaren St. Miguel v.69 leg. Pinker'.

We have also considered the possibility that the single specimen of *Scoparia coecimaculalis* from Madeira could be a mislabelled specimen, though we have not been able to prove that.

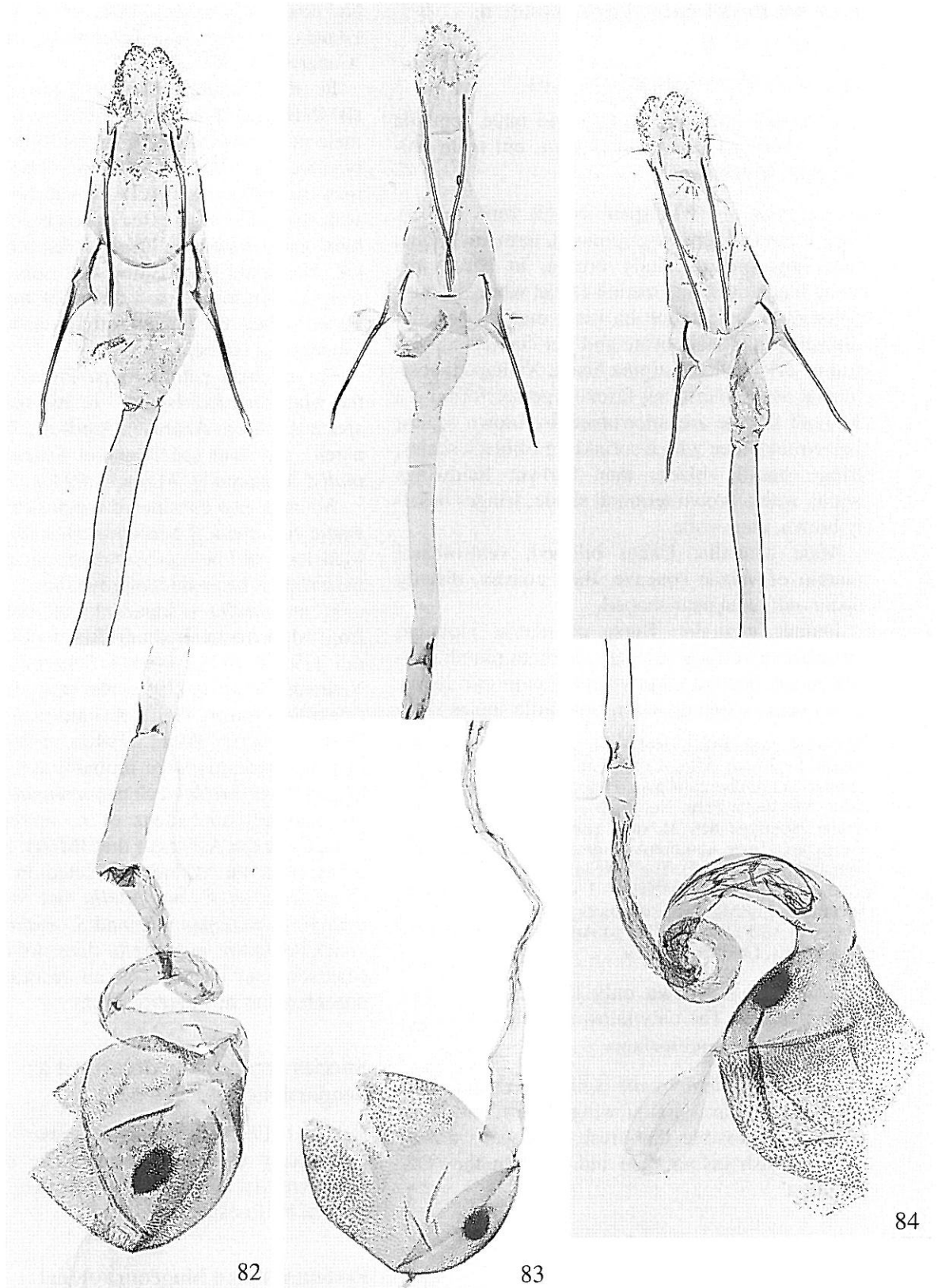
E. mercurella (Linnaeus) had been recorded from Madeira by Bethune-Baker (1894), Cockrell (1929), Rebel (1917) Stainton (1859) and Vieira & Pintureau (1991) and from the Azores by Carvalho (1982), Vieira & Pintureau (1991) and Warren (1905). Rebel (1940a, 1940c) reported that these records were probably a misidentification of *E. decorella* or *S. aequipennalis*. We could not find any specimens of *E. mercurella* from Madeira or the Azores at the BMNH. Some specimens from the Azores collected in 1903 were determined as *E. mercurella* but we identified them as *S. aequipennalis* and *S. semiamplalis*. We conclude that *E. mercurella* does not occur in the Macaronesian Region and all records are to be considered as misidentifications.

Species erroneously described as Scopariinae

Rebel (1917: 49) described *Scoparia gilvescens* erroneously as a Scopariinae. The species was transferred to *Hansreisseria* Roesler, 1973 (Phycitinae) by Roesler (1973: 282).

Systematic and biogeographical considerations

In general, the Lepidoptera fauna of Macaronesia



Figs 82-84. ♀ genitalia: (82) *Eudonia angustea*, GU Nuss 712, Madeira; (83) *E. parviangusta*, GU Nuss 608, Canary Islands, Gran Canaria; (84) *E. geminoflexuosa*, GU Nuss 721, Canary Islands, Tenerife.

conforms well to the expected pattern of decreasing species richness with increasing distance from the mainland that potentially serves as the species pool. For example, 96 species of Macrolepidoptera are known from Madeira and 53 from the more distant Azores (Meyer 1996). In the Pyraloidea, 52 species are recorded from Madeira (Carvalho 1996) and 20 from the Azores (Meyer, Nuss & Speidel 1997). In slight contrast to the expected result, the Scopariinae has five to six species from Madeira and five species from the Canary Islands, but more species, seven, from the Azores.

Of the sixteen scopariine species that occur in the archipelagos of Macaronesia, 14 are endemic to these islands. Only *Eudonia angustea* and *E. lineola* are distributed beyond the islands to the neighboring continents. On these mid-Atlantic islands the Scopariinae are richer in endemics than any other group of the Pyraloidea (Rebel 1917). For example, ten endemic pyraloids are found on the Azores, and seven are scopariines (see Meyer, Nuss & Speidel 1997). Most Macaronesian scopariine endemics occur on more than one island and are restricted to a single archipelago (Table 3), except the Madeiran endemics and *E. decorella* that occur on both Madeira and the Canary Islands. It is interesting to note that there is an increase in the number of endemics with increasing distance from the mainland: one on Cape Verdes, one on the Canary Islands plus Madeira, two (plus two subspecies) on the Canary Islands, three on Madeira, and seven on the Azores.

The relatively high number of insular endemic scopariines described above is not unique to Macaronesia. Similar patterns of endemism are found on other oceanic islands. For example, three endemic scopariines are known from Juan Fernandez Islands (Clarke 1965); three from Rapa Island (Clarke 1971); 12 from the Marquesas Archipelago (Clarke 1986); more than 100 from the Hawaiian Islands (Munroe 1989); and 130 from New Zealand (Dugdale 1988). Leraut (1989) recorded 13 endemic scopariines from Madagascar, three from the Comores, one from Reunion, and one from Mauritius. On the antarctic Macquarie Island, a scopariine species is the only moth breeding on that island (Common 1962). These figures suggest that Scopariinae can be considered a characteristic element of oceanic islands.

The success of Scopariinae in colonizing

oceanic islands is a remarkable phenomenon. We propose that autecological requirements of larvae and adults are correlated largely with the climatological conditions of these oceanic islands, specifically that scopariines are adapted to temperate and humid climates because the larvae live in mosses and lichens. Pimpl (1988) demonstrated that adults are stimulated to emerge by increased humidity. Based on our knowledge of the biology of European species (Goater 1986; Pimpl 1988), it is assumed that Scopariinae of oceanic islands also feed on mosses and lichens. It is also therefore not surprising that the number of scopariine species present on remote islands correlates with a high number of cryptogram species (Mitchell-Thome 1976; Eggers 1982; Purvis, James & Smith 1996) on those archipelagos.

Colonization of oceanic islands by scopariines has not been observed or documented. Possible mechanisms of dispersal facilitated by ocean surface currents and winds include drifting as 'aerial plankton,' rafting on debris, and floating (Peck 1994a, b). Considerable data regarding aerial dispersal of Pyraloidea in general across the sea has accumulated through the collection of air-borne specimens from ships (Holzapfel & Harrell 1968, Holzapfel & Perkins 1969, Guilmette, Holzapfel & Tsuda 1970, Peck 1994a); no such records exist from airplane samples at higher elevations (Gressitt, et al. 1961, Yoshimoto, Gressitt & Mitchel 1962, Yoshimoto & Gressitt 1963, Holzapfel 1978).

Because there is no evidence that the Macaronesian Scopariinae represent a monophyletic group, it can be assumed that Macaronesia has been subject to successive colonization events. The fauna seems to be a mixture of New World and Old World elements. For example, within Macaronesia four species of *Scoparia* occur only in the Azores, and they form a monophyletic group with *S. biplagiata* from North America and *S. jonesalis* from the Bermuda Islands. Because the most closely related species to the Azores group occur in the Nearctic, this indicates that ancestors of the Azorean species were dispersed via the Gulf Stream from the New World. The J-Anomaly Ridge, a dry land bridge during the Cretaceous and Tertiary (Emery & Uchupi 1984), and the Bermuda Islands may have served as stepping stones for early colonists (Map 1).

Some scopariines from Madeira, Canary Islands, and Cape Verde Islands are related to

European species. For example, *Eudonia angustea* is distributed along the coasts of northern Africa and western Europe and also occurs on Madeira and Canary Islands. *Eudonia lineola* has a similar distribution, but is absent from Madeira and is represented on the Canary Islands by two subspecies, *E. lineola dorada* and *E. lineola tafirella*. *Eudonia shafferi*, endemic to Madeira, is identical to *E. lineola* in wing pattern and is most likely a close relative. It is unknown whether *E. lineola* is derived from a Madeiran ancestor of *E. shafferi*, or vice versa. However, the short distance to the continents, ocean surface currents, and winds do not favor either of these scenarios. A closer relationship seems to exist between *E. lindbergalis* from the Cape Verde Islands, and *E. geminoflexuosa*, *E. decorella*, and *E. lineola* from the Canary Islands. These four species appear to be a monophyletic group based on the two loops of the ductus bursae that is unique to this clade.

Eudonia scoriella from Madeira may be another species of Nearctic origin. Its nearest relative appears to be *E. rectilinea* (Zeller), that occurs in British Columbia and California. Although nearly identical in wing pattern, the two species differ in structures of the male genitalia. The genitalia of *E. scoriella* (Fig. 48) has a moderately long, slightly narrow uncus, and the dorsal and ventral margins of the valvae are nearly symmetrical; we call this the 'oceanic type' of male genitalia. In contrast, *E. rectilinea* has a short, basally broad, distally bilobed uncus, and the valvae have a straight dorsal margin and a concave ventral margin; we call this the 'continental type' of male genitalia. On the basis of the genitalia, these two species appear not to be closely related. However, many species of *Eudonia* on oceanic islands express a similar genitalic divergence from their putative mainland ancestors: *E. interlinealis* (Fig. 42) and *E. luteusalis* (Fig. 44) from the Azores; *Eudonia* species on the Hawaiian Islands (Zimmerman 1968; Munroe 1989); and *Eudonia* species from the Marqueses Archipelago (Clarke 1986). Most *Eudonia* species from Europe, Africa, and Australia that we examined have the 'continental type' of male genitalia. *Eudonia decorella*, *E. stenota*, and *E. shafferi* from Madeira, and all *Eudonia* species from the Canary Islands and the Cape Verde Islands also exhibit the 'continental type' of male genitalia. This can be explained by the relatively close proximity of these islands to the continents (Table

1). The 'oceanic type' of male genitalia in *Eudonia* is most well developed in those species whose ancestors dispersed over large oceanic distances. Although we do not have a convincing hypothesis to account for the expression of the 'oceanic type' and 'continental type' of male genitalia, it is highly unlikely that all oceanic *Eudonia* form a discrete monophyletic group and that all continental species a separate monophyletic group. We propose that the genitalic morphology may reflect adaptation to similar ecological conditions on remote islands and the result of parallel evolution.

In conclusion, classic taxonomic characters such as wing pattern and morphology of the external genitalia are not particularly informative for elucidating phylogenetic relationships among the species of *Eudonia*. Future taxonomic studies must investigate alternative character systems.

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