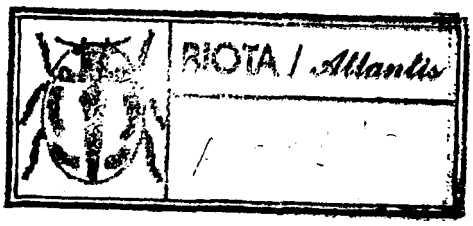


A taxonomic revision of the Scopariinae from the Macaronesian Region (Lepidoptera: Pyraloidea: Crambidae)

MATTHIAS NUSS. OLE KARSHOLT and **MARC MEYER**

Ent. scand.

Nuss, hl.. Karsholt, O. & Meyer. hl.: A taxonomic revision of the Scopariinae from the Macaronesian Region (Lepidoptera: Pyraloidea: Crambidae). *Ent. scand.* 28: 509-551. Copenhagen, Denniark. January 1998. ISSN 0013-8711.

Sixteen scopariine species and two subspecies, of which five are undescribed, occur on the archipriagos of the Azores, Madeira, the Canary Is., and the Cape Verde Is. Four new species, *Scoparia carvalhoi* sp. n., ***Eirdotiin shafferi*** sp. n., ***E. parviangusta*** sp. n., ***E. geminoflexuosa*** sp. n.. and one new subspecies ***Eudonia litieoln 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) comh. n., ***E. stenota*** (Wollaston. 1858) comb. n., ***E. scorielln*** (Wollaston, 1858) cornb. n., ***E. lindbergalis*** (Viette, 1958) conib. n.. and ***E. decorella*** (Stainton, 1859) coiiib. n. The status of ***Eudonia litieoln*** *tafirella* (Chrétien. 1908) stat. n. is changed from species to subspecies. ***Eiidonin decorella*** (Stainton. 1859) comb. n.. sp. rev., forinerly 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 ***Eiidotiin*** *lineola tafirella*, ***Scopnrin*** *wollastoni* Bethune-Baker, 1894 syn. n. of ***Eiidotiin scorielln,*** *Scoparia maderensis* Rebel, 1939 syn. n. of ***Eudonia decorella***, *Scoparia imparilis* Dyar. 1929 syn. n. of ***Eudonia angustea***, and ***Scopnrin*** *virescens* Rebel, 1896 syn. n. of ***Eudonia lineola***. Eight lectotypes are designated. The taxonoiiiic 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 iiicreases in proportion to growing distance froni 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.* ***scorielln*** 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*** froni the Canary Is. The successful colonisation of oceanic islands by Scopariinae seems to be correiated with the prerequisites: dispersai ability, adaptation to a humid climate, and mosses and lichens as larval food.

M. Nuss. Institut für Systematische Zoologie, Museum **für** Naturkunde. Invaiidenstr. 43, D-**1**0115 Berlin, Germany.

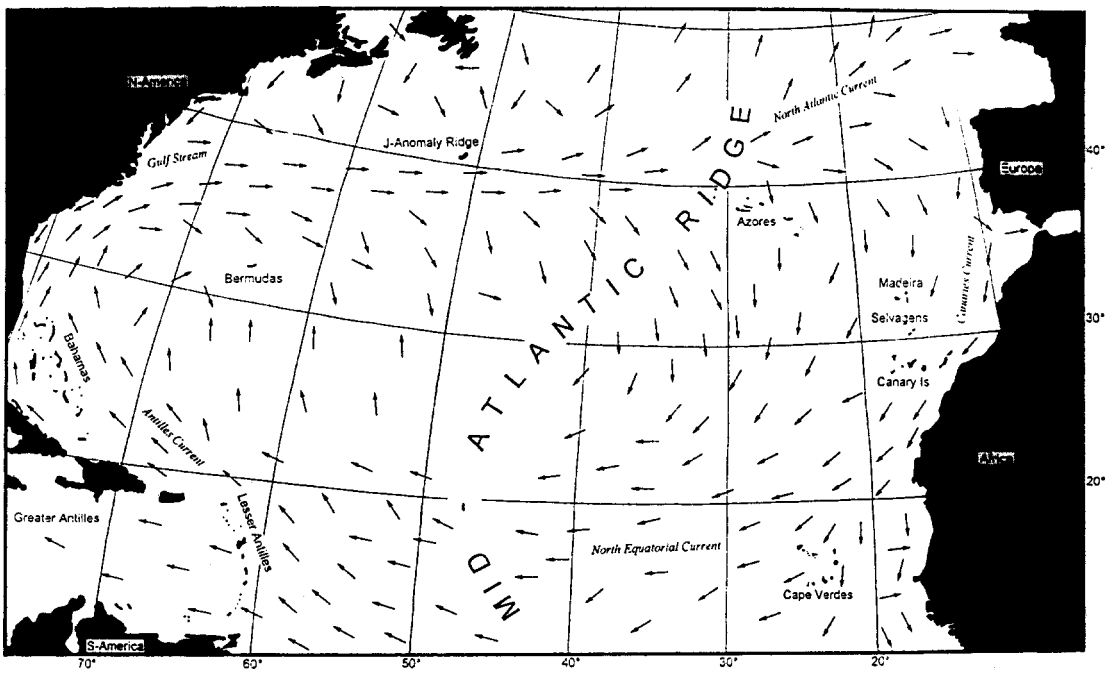
O. Karsholt. Zoological Museum. University of Copenhagen. Universitetsparken 15, DK-3100 Copeiihagen. Denmark.

M. Meyer. Orscholzer Str. 15. D-66706 Perl-Kesslingen. Germany.

Introduction

Tlie biogeographical region 'Macaronesia' comprises the archipelagos of the Azores. Madeira. Canary Is., and Cape Verde Is. The first records of Microlepidoptera froni this region date to the middle of the last century. The earliest publications are those of Wollaston (1858). Stainton (1859). Morelet (1860). Droiiet (1861). Felder (1862), and Godman (1870). Only the first two authors mentioned Scopariinae describing three endeiriic species of this subfamily from these archipelagos. **At** the turn of the century Bethune-Baker (1894), Warren (1905), Hanipson (1907). and Chrétien (1908) described a number of scopariine species fioiii this region. **Rebel** (1917) summarised these results and concluded that the overal number of lepidopteran species decreases proportionally with growing distance from the continents, whereas the niiniber of Scopariinae increases. He stated that an 'oceanic character' of an

© Entomologica scandinavica (Grp 3)



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

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

Fi-oni 1892 until 1940, Rebel published a numbei 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 **tasa.** taxonomic and nomenclatural changes. The revised classification allows to draw conclusions about reiationships within the Macaronesian region and to taxa froni adjacent regions. The origin of the Macaronesian scopariine fauna is discussed with respect to the geological history of the Macaronesian Islands and to tlie currents and winds of the Atlantic Ocean.

Geographical and ecological aspects of the study area

The four archipelagos are situated iii tlie lower latitudes of the northeastern Atlantic Ocean and forni the biogeographical region „Macaronesia". Recently, botanists put into question the view of a biogeographical homogenity of this region (Lüpnitz 1995: Beyhl, hlies & Ohiii 1996). The archipelagos are scattered over 2.700 hiii 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*		

1.800km 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 Eiirope 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 fornier 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 tlie 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 hlacaronesian region. showing a slightly cooler climate. The coldest nionth is February with an average temperature of 14.3°C. the hottest is August with 22,3°C. The rainfall decreases frorn west to east. varying from 57 (dri-eit 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 nionth. The prevailing winds in the western and central islands come fruiii north. northwest and southwest. In the eastern group the North-East Trade Winds are regular, escept 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 coinposed of the main island hladeira. the island Porto Santo situated 40 km NE, and the three Desertas (Chão, Deserta Grande, Bugio) that are situated 20 km SE of hladeira. 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 honiogenous 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 (Liipnitz 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 doniinants and represent eleinents of the mediterranean flora (Lüpnitz 1995).Thermophilous laurel forests dominated by *Juniperus phoenica* 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 niany small rocks. banks, and reefs; some are subnierged 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 hliocene epoch (Mitchell-Thomé 1976). The flora consists of xerophytes aiid halophytes (Lüpnitz 1995).

The Canary Is. are tlie 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. aiid Graciosa; all situated north of Lanzarote I.. and Lobos northeast of Fuerteventura I. The Canary Is. are the largest archipelago of the region and the Pico **de** Teide on Teiierife 1. is the highest mountain of all

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

	average geographical coordinates	area (km²)	maximal high (m)	age (My)	av. annual temperatur (°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 1'W	143	914		17.4	1430
Graciosa	39°03';": 28°02'W	61	402	?	17,2	991
Sáo 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"12W	401	1021	<1	17,2	1130
Siio 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	323 1'N 16°30'W	ca. 14,8	478		?	?
CANARY IS.		total 7600				
Hierro	27'45;": 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	350	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	165 1'N 24°59'W	227	774		23,6	175
Santa Luzia	16°46'N 24°45'W	35	395		?	3
Branco	16°39'N 24°41'W	3	321		?	?
Raso	16°37'N 24°36'W	7	164		?	?
São Nicolau	16°36'N 24°15'W	343	1304		23,9	300
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 (Schniincke 1982; Rothe 1986). The climate is infliienced 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 cliniate. The mean monthly teniperature depends on altitiide: 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 nionths, January and December, frost and snow is common above 2000m altitude (Fernandopullé 1976). The potential occurrence of the evergreen forests is lirnited 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, Schrnincke (1967) pointed out that forest occurred on Gran Canaria in the Mid-Pliocene epoch. Srnall 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 srnall 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-Thorné 1976). There is the possibility of forrner inter-island connections by the common shallow shelf of Santo Antáo and Sáo 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 srnall annual fluctiiations. At higher altitudes, temperatures are coolor and there is more precipitation: the mountains of Santo Antão have an annual rainfall of 4000 mrn. whereas 20 km away, on the low, leeward coastal nrea annual rainfall may be only 200 rnm. The North-East Trade Winds bring relative humidity of about 70%. During the summer, the hot and dry Harniattan winds blow froni the Sahara (Mitchell-Thomé 1976). Most of the islands are barren and dry except above 450m where xerophytic vegetation (primarily *Euphorbia tuckeyana* Steudel) occurs (Liipnitz 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 tlie Macaronesian Repioii. but have to be discussed in a biogeographical context. The preseiit 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 tlie 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 rnain currents and winds of the oceans (Ferguson et al. 1991, Guilmette et al. 1970, Peck 1994 a, b). The current pattem of the North Atlantic (Map 1) is dorninated 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 Ainerican coast and leaves the coast as the North Atlantic Current carrying warm waters towards north-westem 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 becornes the North Equatorial Current across the Atlantic. East of the Caribbean, the Antilles Current closing the circle. The speed of the niain circulatory currents is usually about 10 km a day, but the Gulf Strearn may travel more than 130 km per day (Brarnwell 1977). The prevailing winds show seasonal oscillations, especially when anticyclones develop over the Sahara. Then, the dry, and hot '-Harniattan' blows out from the desert for a few days (Mitchell-Thonié 1976). Tho Harmattan have its greatest influence on the Cape Verde Is., where he amount to 6 % of the annual winds (-Osang 1991). It ~{ a sobserved that Noctuoidea were carried uith this wind froni northern Africa to Madeira (Classey 1966). and a swarm of the pyraloid species *Nomophila noctuella* [Denis & Schiffermüller] and *Udea ferrugalis* (Hübner) to tlie 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			CANXRY ISLANDS							CAPE VERDES	
	Co	Fl	Gr	Jo	Fa	Pi	Te	Mi	Ma	Ma	PS	De	Hi	Pa	Go	Tf	GC	Fu	La	Santo	Antão
Scoparia aequipennalis		x	x	x	x	x	x	x	x												
S. carvalhai					x	x	x		x												
S. semiamplalis		x		x	x	x	x	x	x												
S. coecimaculalis			x	x	x	x	x	x	x	*											
Eudonia interlinealis		x	x	x	x	x	x	x	x												
E. luteusalis				x		x	x		x												
E. melanographa				x		x	x	x													
E. scoriella										x											
E. decorella										x				x	x	x					
E. stenota										x											
E. shafferi										x											
E. lineola tafirella													x	x	x	x	x				
E. lineola dorada																		x	x		
E. angustea										x	x	x	x	x	x	x	x				
E. parviangusta																	x				
E. geminoflexuosa														x		x					
E. lindbergalis																				x	

ente 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 surroiinded 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 northerii slopes (Santoi 1990).

Material and niethods

Although niost 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 centiiry (Wollaston 1858; Stainton 1859) and since them relatively little additional material has became available. The speciniens for this study were collected by Niels Wolff and his assistants between 1970-1977 (ZMUC). by Ole Karsholt in February 1979, June-July 1993. Octoher 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 froni differeiit islands; nevertheless, we consider the scopariine fauna of the Canary Is. less well investipated 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). aiid 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 flipht periods are only recorded from material examined in this study; published records are not inciuded. **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 – Hiirbusch & Meyer, Germany.
JPC – José Passos de Carvalho, Oeiras, Portugal.
MINGA – Muzeul de Istorie Naturala 'Grigore Antipa', Bucuresti, Roniania.
MSHS – 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. Stockholiii. Sweden.
SMN – Staatliches Museum fiir Naturkunde, Karlsruhe, Germany.
USNM – United States National Museum of Natural History, Washington, USA.
ZMUC – Zoologisk Museum, Copenhagen, Deninark.
ZM – Institut fiir Systematische Zoologie, Museum **für** Naturkunde, Berlin, Germany.
ZMU – Zoological Museuni, 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 lutcusalis (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) rungsi* 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. *napolitalis* Millière, 1870
    Scoparia imparilis Dyar, 1929 **syn. n.**
Eudonia parviangusta **sp. n.**
Eudonia geminoflexuosa **sp. n.**
Eudonia lindbergalis (Viette, 1958) **comb. n.**

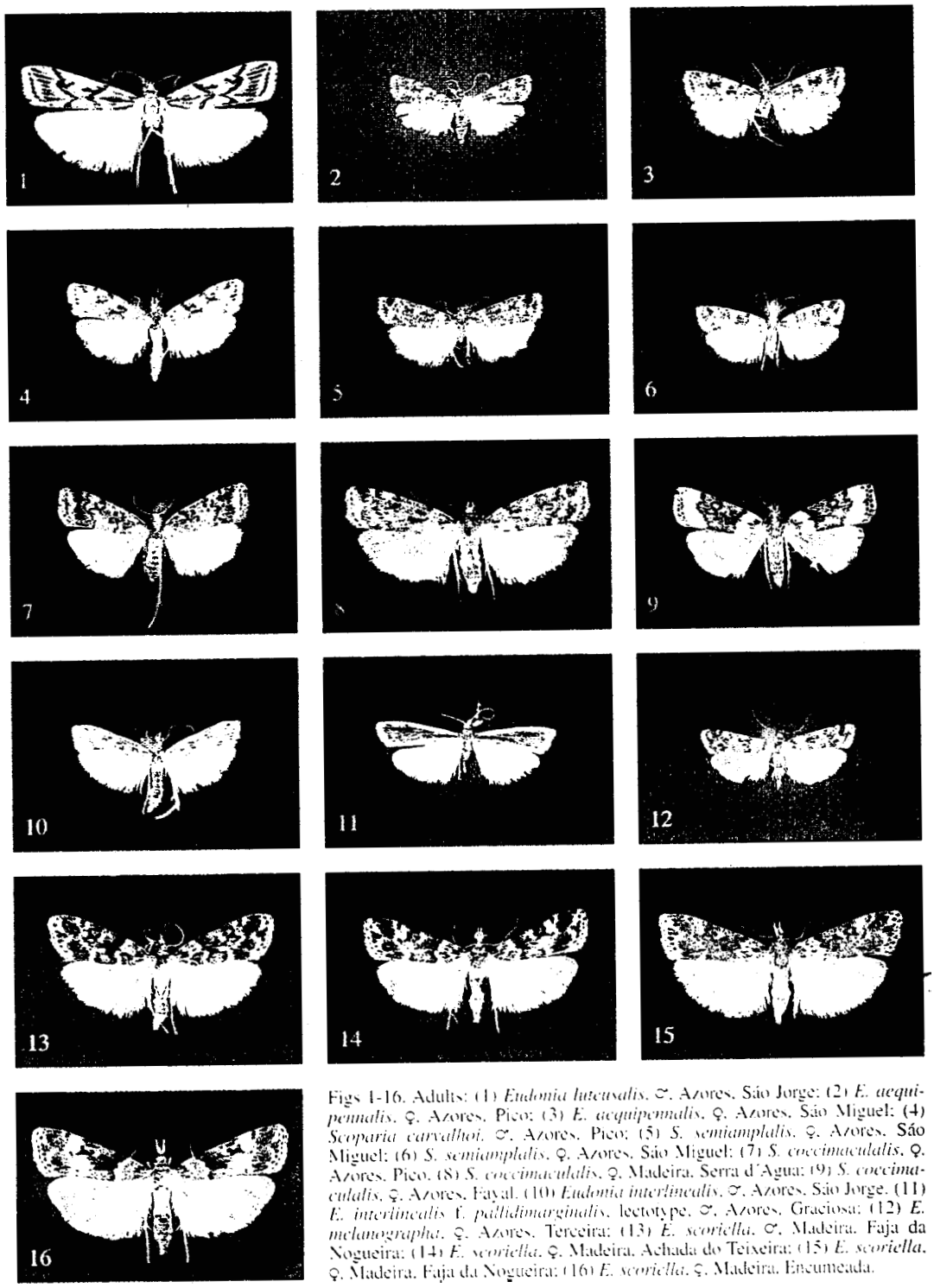
Review of species

Genus *Scoparia* Haworth

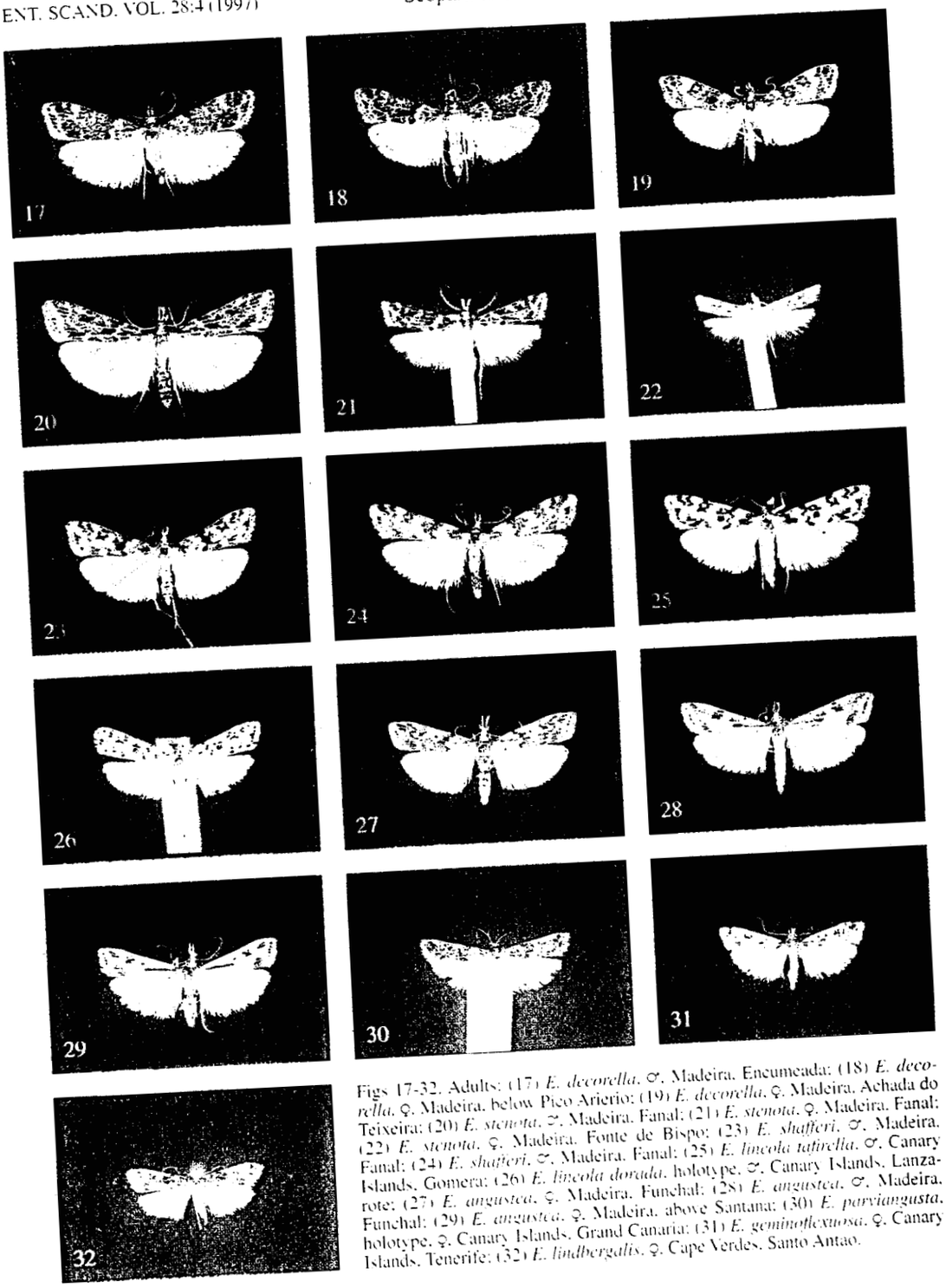
Scoparia Haworth, 1811: 498; Chapinan 1912: 507; Leraut 1984: 160. Type species: *Tinea pyralella* [Denis & Schiffermüller], 1773: 135, by subsequent designation by Curtis 1827: pl. 170.

Diagnosis. – Male genitalia with a long and distally pointed uncus, a free distal extension of the sacciilus, aiid corniiti in the aedeagus: females with a streak **like** signum on the corpiis 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 (Fip. 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 iost the cornuti in the aedeagus; the other two species, *S. aequipennalis* and *S. carvalhoi*, have corniiti. The Azoreaii species of *Scoparia* are closely related to two species froiii the Nearctic Region: *Scoparia biplagialis* Walker (Munroe 1973: 40; Munroe 1974: pl. 2 figs 16-39. pl. B fig. 8, pl. G fig. 7) froni northern America, and *Scoparia jonesalis* Dyar (Ferguson et al. 1991: 10. 37. 73. figs 60, 6i. 202a-e) from the Bermudas Is. *S. jonesalis* and *S. biplagialis* do not posses a hamus in the male retinaculum, nor do they have coriiiiti in the aedeagus. These two Neartic and the foiir Azorean species are a monophyletic proup, the *Scoparia biplagialis*-species proup. 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 lutcusalis*, ♂, 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. coccimaculalis*, ♀, Azores, Pico; (8) *S. coccimaculalis*, ♀, Madeira, Serra d'Agua; (9) *S. coccimaculalis*, ♀, Azores, Fayal; (10) *Eudonia interlinealis*, ♂, Azores, São Jorge; (11) *E. interlinealis* f. *pallidimarginalis*, lectotype, ♂, Azores, Graciosa; (12) *E. melanographa*, ♀, Azores, Tereceira; (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 & Schiffermüller] 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', 'Pyralidae 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. **51.** 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 ercepi. 400m. 5.v.1903. Grant (BMNH); 1 ♂ same ercspt. 9.v.1903. Grant (CNC); 1 ♀ Pico das Caldeirinhas. 700m. 16.viii.1990. Meyer (Nuss); 3 ♂, 3 ♀ Ssrra do Topo. 800m. 18.vii.1994. Meyer (H/M); 1 ♀ Ilmagreira. 29.ii.1903. Grant (BMNH). FAIAL: 1 ♂ above Horta. 333m. 26.v.1903. Grnnt (BMNH); 1 ♀ central. 633m. 25.v.1903. Grant (BMNH); 1 ♀ Norte Pequeno. 300m. 11.viii.1990. hleyer (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 hlatias. 900m. 15.vii.1994. hleyer (H/M); 1 ♂ hlisterio Prainha, 200m. 15.vii.1994. Meyer (H/M); 3 ♀ Cabeco da Rocha. 800m. 13.viii.1990, hleyer (H/M. ZMUC); 2 ♂, 5 ♀ Cabecinhos. 480m. 14.viii.1990. hleyer (H/M. Nuss); 2 ♀ Norte Pequeno, 500m. 17.vii.1994. Meyer (H/M); 3 ♂. 2 ♀ Pico Caveiro, 900m. 14.vii.1994. Meyer (H/M); 3 ♂. 3 ♀ Sao Roque do Pico, 150m. 13.vii.1994, hleyer (H/M); 3 ♀ Silveira. hlisterio, 400m. 14.vii.1994. hleyer (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. Graiit (BMNH); 6 ♂. 2 ♀ Furnas. v.1969. Pinker (SMN); 17♂, 13 ♀same escept, 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 escept. 600m. 29.vii.1990. Meyer (H/M); 3 ♂, 4 ♀ Sete Citades. Pico Carvao. 500m. 9.vii.1994. hleyer (H/M). SANTA MARIA: 1 ♂ Sao Pedro. 3.iii.1903. Grant (BMNH); 1 ♀ Sao Pedro. 3.v.1903. Grant (BMNH); 2 ♂ same eucept. 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. 34.33.71)

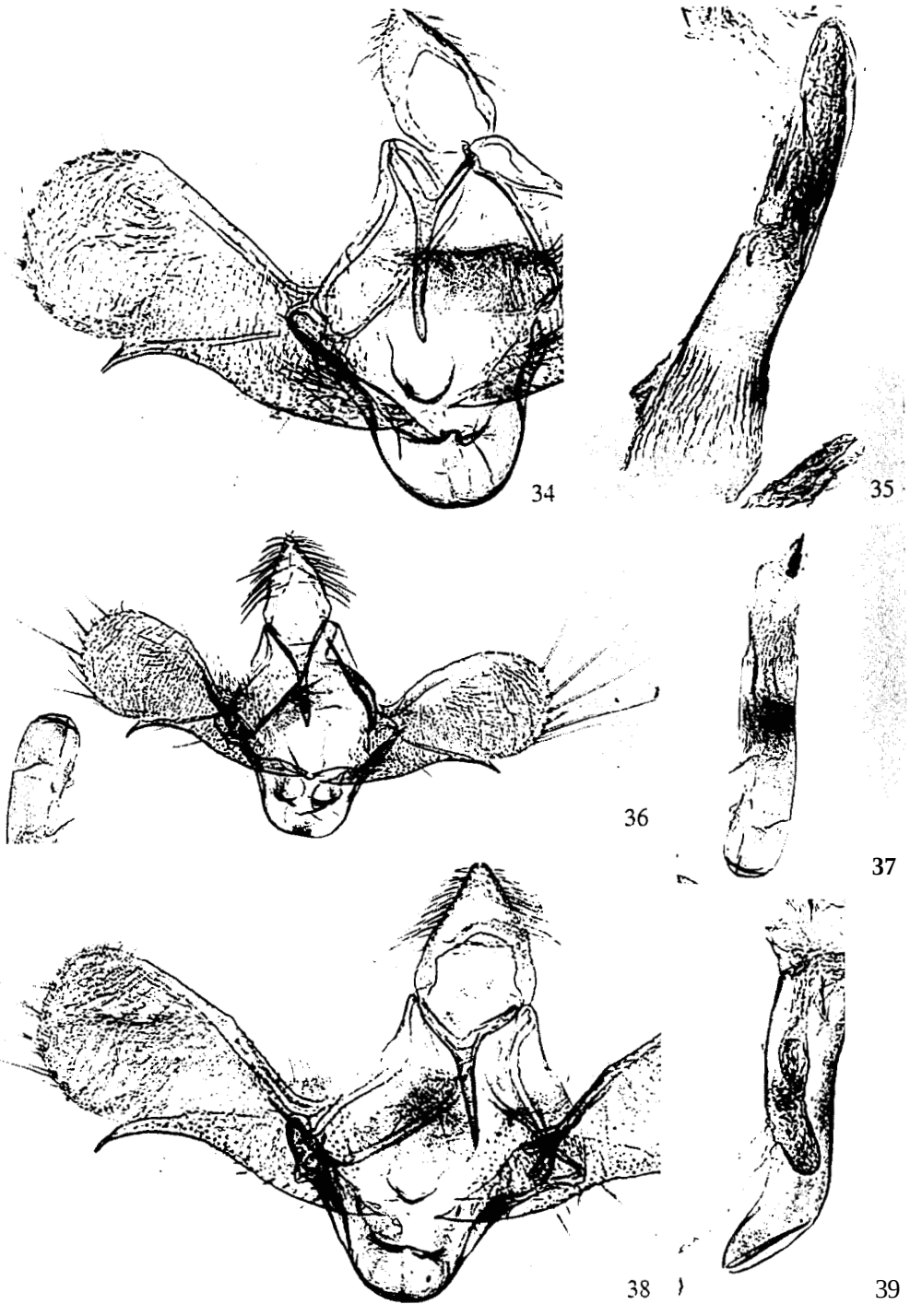
Diagnosis. – Male-aedeagus with a sickle-shaped corniittis: fsrnale-ducttis bursae not looped, but with a bow anterior to dticttis seminalis.

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, niixed 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 octire 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 bronn; hindwings light grey and transparent. terminal area dark with a light postmedial fascia: fringe as in forewings.

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

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

Material examined. – Holotype ♂ 'Holotypus', '30.7.1990 P-Acores/ Santa Maria 2 km NE Châ de Sâo Tomé 350m leg. M. Meyer', 'Holotype Scopnria carvalhoi Nuss. Karsholt. Meyer drt. 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. Al. hleyer' (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 Los. Bicas 11/7/1981 col. Passos Carvalho António Contente' (Nuss). 1 ♂ **'Azores:** Fayal Caldeira 4.vii. Storâ', 'Sc. semiamplalis Warr.' [det. Rebel] (NHM) (compare Rebel. 1940c: 35). (All paratypes wirli **a** red label 'Paratypus' aiid 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. acquipennalis*, G
Nuss 703; (38, 39) *S. semiamplalis*, GU Nuss 620, Azores, São Miguel.

Derivcirio nominis. – Thc species is named after the Portuguese entomologist, J. Passos de Carvalho.

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

Biology. – Known flight period: 36 June to 30 July.

Remarks. – The species is similar to specimens of *S. aequipennalis* froni 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 & Pinttireau 1993: 110.

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

Description. – Wingspan 13-16 nim (n=102). Upperside of head and thoras black and shining yellow; labial palpi upright with short scales. Forewings with the typical pattern of *Scoparia* but shiiiing yellow with black admixture, in some specimens a predominance of black; antemedial and postmedial fascia broad and yellow; subterniinal fascia approximated to postinedial fascia in the niiddle, thin towards costa. posteriorly broad: with two black antemedial stigmata, of indistinct shape caused by surrounding black scales; discocellular stigma black aiid)<-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*, biit aedeagus without cornuti.

Female genitalia: Ductus biirsae without loops.

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

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

Distribution. – Endeniic to the Azores: recorded from all larger islands except Corvo and Graciosa.

Biology. – Known flight psriod: 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.

Scopnrin coecimaculalis Warren

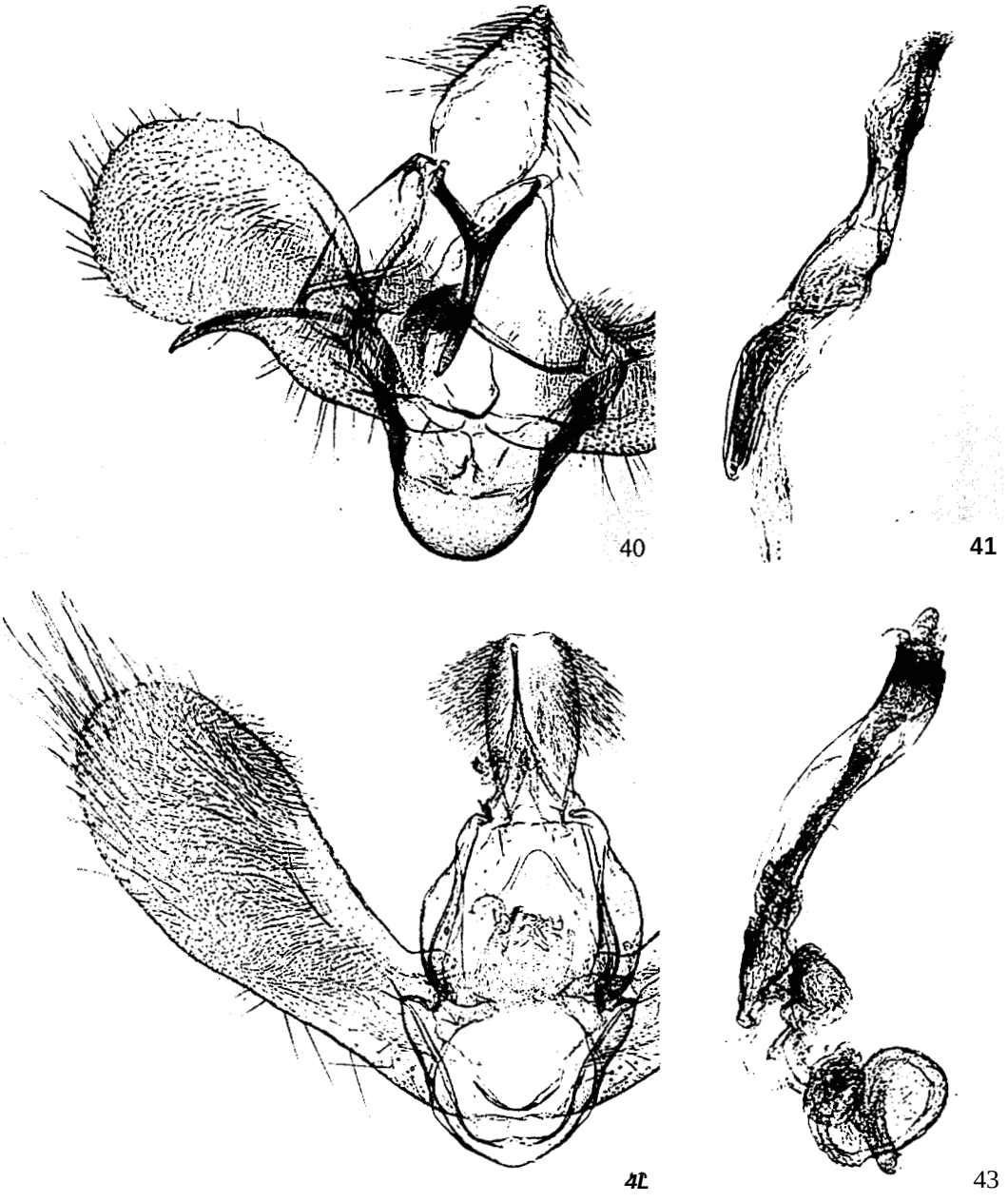
(Figs 7, **8.** 9, 40, 41, 70)

Scoparia coecimaculalis Warren. 1905: 4-15; Carvalho 1982: 181; Rebel 1917: 18; Vieira & Pinttireau 1991: 33: Vieira & Pintiireau 1993: 110.

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

Diagnosis. – Male-valvae downcurved, aedeagus without corniiti: femiile-base of ductus biirsae thickened, one loop before ductiis seminalis.

Description. – Wingspan 16-30 mm (n=177). Forewings light ochreous with black pattern; fasciae whitish, edged with black adjacent to medial area; stigmata black, suffiised by ochreous; basal area light ochre. at base iii niiddle some black spots: antemedial stigmata black, roughly oval, sometimes suffiised by ochreous scales: discocellular stigma X-shaped, distiint froiii 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 coccimaculalis*, 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; saeculus 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 Q Warr', 'Pyralidae Brit. hlus. Slide No. 3776', 'Lectotype. Scoparia coecimaculalis Warren, det. M. Nuss' (BMNH). Paralectotype: Q same, except 'Paralectotype'. 8. May 03, 'Paralectotype Scoparia coecimaculalis Warren det. hl. Nuss' (BMNH) (Abdomen in capsule on pin).

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

MADEIRA: 1 Q Serra de Agua. 660m. 7.ix.1973. Loniholdt & Wolff (ZMUC).

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

Biology. – Known flight period: 18 January to 38 Octobsr. no records froni 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 driftet froiii the Azores or prrhaps had been transportsd by ship. Silberglied (1978). for example. showed thnt 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 signuni on the corpus bursae and a long sclerotised portion between ductus seminalis and antrum. In the hlacaronesian Region, the males of all species have a hamus in the retinaculum, except ***E. lineola.***

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

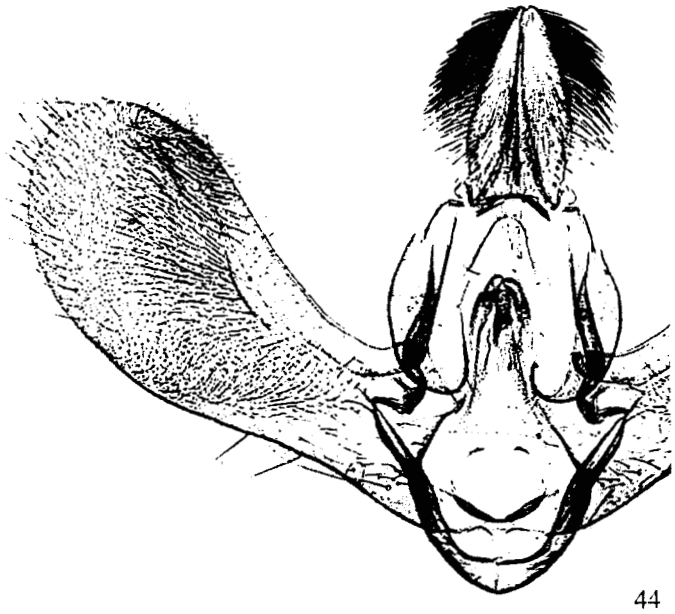
(Figs 10.11, 42.43.73)

*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.

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

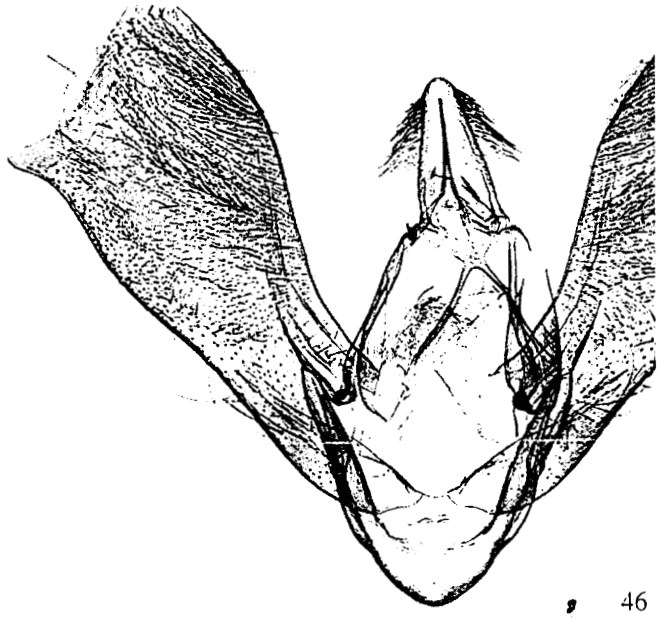
Diagnosis. – Forewings long and narrow, dirty-white, antemedial and postmedial fascia triangular. directed towards the medial area.

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: subterniinal 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 treiid towards a reduction of black scales which are replaced by ochre scales. The wing pattern of such speciniens is less contrasted. The aberatio *pallidimarginalis* has a



44

45



46

47

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 froni 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: giiathos aboiit 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 nb. 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 escept. 150m, 5.viii.1990. Meyer (H/M). GRACIOSA: 1 ♀ Caldeira, 15.i. 1979. Carvalho (JPC): 5 ♂ same except. 400m, 26.iv.1903, Grant (BXISH): 1 ♂ same except, 27.iv.1903, Grnnt (BMNH). SAO JORGE: 1 ♂, 1 ♀ above Calheta. 400m. 5.v. 1903. Grant (BMNH, CNC); 13 ♂, 2 ♀ Serra do Topo. 800m, 18.vii.1994. hleyer (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. hleyer (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. Cnrvalho (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. 1991. Meyer (H/M). TERCEIR.4: 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 di. 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. Xleyer (H/M); 1 ♀ Serra da Tronqueira. 800m. 12.vii.1994. Xleyer (H/M); 1 ♂ Sete Ciades. 500m. 23.iii.1903. Grant (BMNH): 3 ♂, 1 ♀ Sete Citades. Pico Cnrvao. 500m, 9.vii. 1991. hleyer (H/M). SANTA MARIA: 2 ♀ Cha de Sao Tome. 350m, 30.vii.1990. Xleyer (H/M).

Distribution. – Endemic to the Azores.

Biology. – Known flight period: January, hlarch 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 Haiiipson. 1907: 23: Carvalho 1992: 265; Rebel 1917: 18; Rebel 1940c: 32 (key), 32, pl. 1. figs 13, 14 [as *Bradyrrhoa versicolorella*]: Roesler 1988: 71: Roesler 1993: 2-19: 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 & Pintiireau 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 easy confiised with *E. interlinealis*.

Description. – Wingspan 17-33 mm (n=39). Large; upperside of body aiid forewings dominantly yellow ochre: forewings with obvious wing pattern: basal area with a large black streak: antemedial and postmedial fascine white, conspicuously black edged towards medial area: antemedial fascia esteiiding triangulary 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 indentaion, directed towards medial area. in costal half straight, sometimes with an indentation opposite thc 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 ochrs 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 boa; ovipositor long.

Material examined. – *Scoparia luteusalis*: Holotype Q 'Holotype', 'Azores. 84.72.', 'Scoparia luteusalis type Q Hmpsn.', 'Holotype Scoparia luteusalis Harnpson det. M. Nuss' (BMNH). *Bradyrrhoa versicolorella*: Lectotyps Q 'Azores: Fayal Caldeira 4.vii. Storå', 'Bradyrrhoa versicolorella Rbl. Type Q', 'U. Roesler Q 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 ♂ sarne except, 800m, 17.viii.1990, Meyer **(Nuss).** PICO: 3 ♂, 1 Q Gorda, 9.vii.1929, Balfour Browne (BMNH); 2 ♂, 20 ♀ Lajes do Pico, Cabeco da Rocha. 800m, 13.viii.1990, Meyer (H/M, ZMUC); 2 Q Sao Joao, Cabecinhos, 480m, 14.viii.1990, Meyer (H/M); 1 Q 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 Q Cha de Sao Tome, 350m, 30.vii.1990, Meyer (H/M, Nuss).

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

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

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

Eudonia melanographa (Hampson). **conib. n.**

(Figs 12. 46. 47. 71)

Scoparia melanographa Hanipson. 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 claviforrn 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: Unciis long and narrow, distally roiind: 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 nielanographa type O Hrnpsn.', 'Pyralidae Brit. Mus. Slide No. 3778', 'Holotype Scoparia melanographa Hainpson det. M. Nuss' (BMNH).

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

Distribution. – Endciiiic **to** the Azores. known froni São Jorge. Pico. Terceira nnd São Miguel. Ths moths were observed flying in a quarry on the western slope of the volcano Pico.

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

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

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

(Figs 13.14, 15, 16. JS. 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 1919: 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 bodp 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, anteriorlp 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 oiie whitish brown; hindwings grey, fringe mostly paler, with a grey line.

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

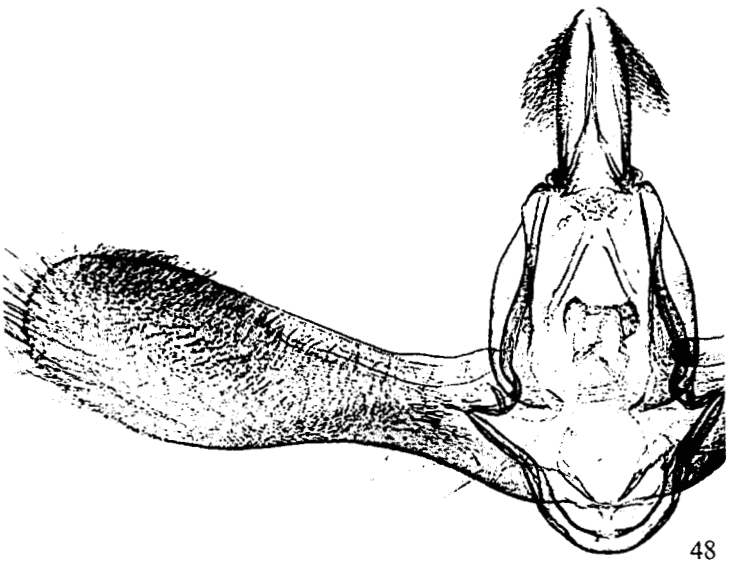
Female genitalia: Corpus bursae globular, signum ovate; ducttis btirsae very long, a large loop between corptis bursae and ducttis seminalis, sclerotisation between ducttis seminalis and antrum forming **a** wide curve anteriorly, followed by a straight section.

Material examined. – *Eudorea scoriella*: Lectotype, hereby designated, ♂ 'Lectotype', 'Maderia, Wollaston Coll. 55-7', 'Eudorea Scoriella Z.', 'Pyralidae Brit. Mus. Slide **So.** 3687', 'Lectotype Eudorea scoriella Wollaston, 1858 det. M. Nuss' (BMNH). Paralectotype ♀ 'Paralectotype', 'Maderia, Woolaston 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).

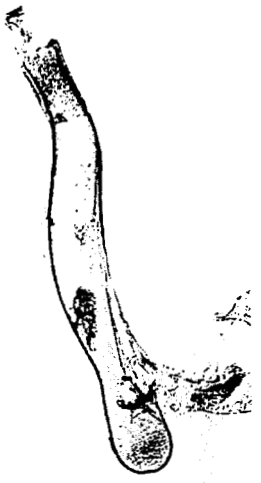
MADEIRA: 5 ♂, 3 ♀ Archada do Teixeira, 4.vi.1980, Carvalho & Contente (JPC); 28 U, 35 ♀ same escept, 1300-1600m, 22.vi.1993, Karsholt (ZMUC); 1 ♂ Chao da Ribeira, 20.i.1980, Carvalho (JPC); 2 O, 3 ♀ same escept, 430m, 14.vii.1991, hleyer (H/M); 2 ♀ same escept, 20.vii.1982, Carvalho & Camoes (JPC); 1 ♂ sanie escept, 30.viii.1982, Carvalho & Contente (JPC); 1 ♂ Curral das Freiras, 11.vi.1980, Carvalho (JPC); 2 ♀ same escept, 21.vi.1982, Carvalho & Camoes (JPC); 1 ♀ same except, 29.vii.1982, Carvalho & L. Canioes (JPC); 1 ♀ **Faja** da Nogueira, 28.v.1980, Carvalho (JPC); 2 ♂, 4 ♀ sanie except, 600m, 20.vi.1993, Karsholt (ZMUC); 1 O, 3 ♀ same escept, 1000m, 23.viii.1974, Traugott-Olsen (ZMUC); 1 U, 5 ♀ same escept, 1000m, 23.-24.viii.1974, Traugott-Olsen (ZMUC); 1 ♂ same except, 2.ix.1980, Carvalho & Camoes (JPC); 2 ♀ same escept, 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 (ZXIUC); 2 ♂ same excrpt, 1050m, 7.vii.1993, Karsholt (ZMUC); 1 U, 4 ♀ Pico Arieiro, 1500m, 6.vii.1991, hleyer (H/M); 2 ♂ sanie escept, 1600m, 9.vii.1993, Karsholt (ZMUC); 3 U, 17 ♀ Pto. Encumeada, Lamaceiros, 900m, 11.vii.1991, hleyer (H/M, Kuss); 1 ♂ Queimadas, 3.vi.1980, Carvalho & Contente (JPC); 4 U, 10 ♀ same except, 950m, 19.vi.1993, Karsholt (ZMUC); 3 O, 3 ♀ same except, 18.vii.1980, Rodrigues (JPC); 1 ♂ same escept, 22.vii.1982, Carvalho (JPC); 1 ♂ sanie escept, 5.viii.19880, Carvalho (JPC); 1 ♀ sanie except, 28.viii.1982, Carvalho (JPC); 2 O, 2 ♀ Quinta Grande, 850m, 6.vii.1991, hleyer (H/M); 2 ♂ Rabacal, 7.vi.1903, Grant (BMNH, CNC); 2 ♂ saiiie escept, 1050m, 14.vi.1993, Karsholt (ZMUC); 12 ♂, 19 ♀ same eicept, 1000m, 10.vii.1991, Meyer (H/M); 2 O, 1 ♀ sanie escept, 12.vii.1991, Meyer (Nuss); 1 U, 3 ♀ sanie except, 17.vii.-4.viii.1935, Lundblad (NHM); 2 ♀ same escept, 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 U, 26 ♀ Ribeiro Frio, 900m, 3.vii.1991, hleyer (H/M, Nuss); 7 U, 5 ♀ Redondo, Pico das Pedras, 8.vii.1991, Meyer (H/M, Nuss); 7 O, 3 ♀ Encumeada, 1000m, 13.vi.1993, Karsholt (ZMUC); 1 ♂, 2 ♀ same escept, 16.vi.1993, Karsholt (ZMUC); 1 ♂ same eicrpt, 17.vi.1993, Karsholt (ZMUC); 2 ♂, 5 ♀ same escept, 18.vi.1993, Karsholt (ZMUC); 1 ♂ same except, 29.vi.1993, Karsholt (ZMUC); 5 U, 14 ♀ same except, 3.vii.1993, Karsholt (ZMUC); 1 U, 1 ♀ Scrra de Agua, 580m, 1.vii.1993, Karsholt (ZMUC); 5 ♂, 8 ♀ sanie escept, Lapa do Galho 1000m, 13.vii.1991, hleyer (H/M); 5 O, 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, hleyer (ZMUC).

Distribution. – Endemic to Madeira

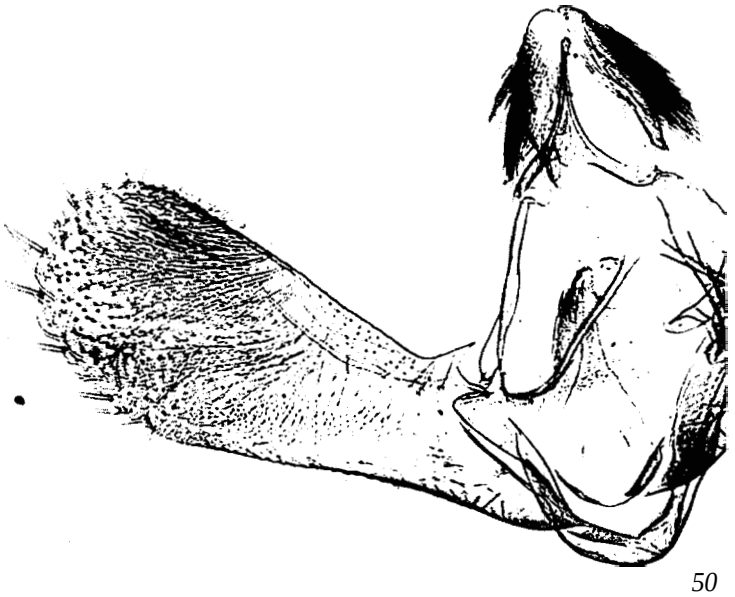
Biology. – Known flight period January, May to October. *E. scoriella* is cniiiiiinn in the highlands above 600m, but only occasionally found iii lower altitudes. It occurs in **a** nuiiiber of different habitats, often together with *E. decorella*



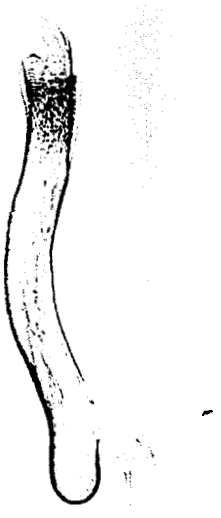
48



49



50



51

Figs 48-51. ♂ genitalia: (48, 49) *Eudonia scoriella*, GU Nuss 713, Madeira; (50, 51) *E. steniota*, 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 tlie 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 foriii '*wollastoni*' occurs mainly in laurel-forests. while the forrn '*scoriella*' is distributed also in open land. Possibly the different colour forrns can be regarded as somatolytic adaptations to the different habitats. The synonymy of *S. wollastoni* is proved by completely similar genitalia of specirnens corresponding in wing pattern with the types of €. *scoriella* or *S. wollastoni* respectively.

Records of this species from the Azores by Carvalho (1952) and Vieira & Pintureau (1991) are probably erroneous. Aniong the material frorn Carvalho which was examined no *E. scoriella* was fotind froni the Azores.

Considering tlie 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., conib. n.**

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

Eudorea decorella Stainton. 1859: 2 10; Bethune-Baker 1894: 581; Cockerell 1919: 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 heavyly 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. stiffused 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 arid brown stripped: hindwings whitish. grey towards termen and apes. fringe white. with grey line medially.

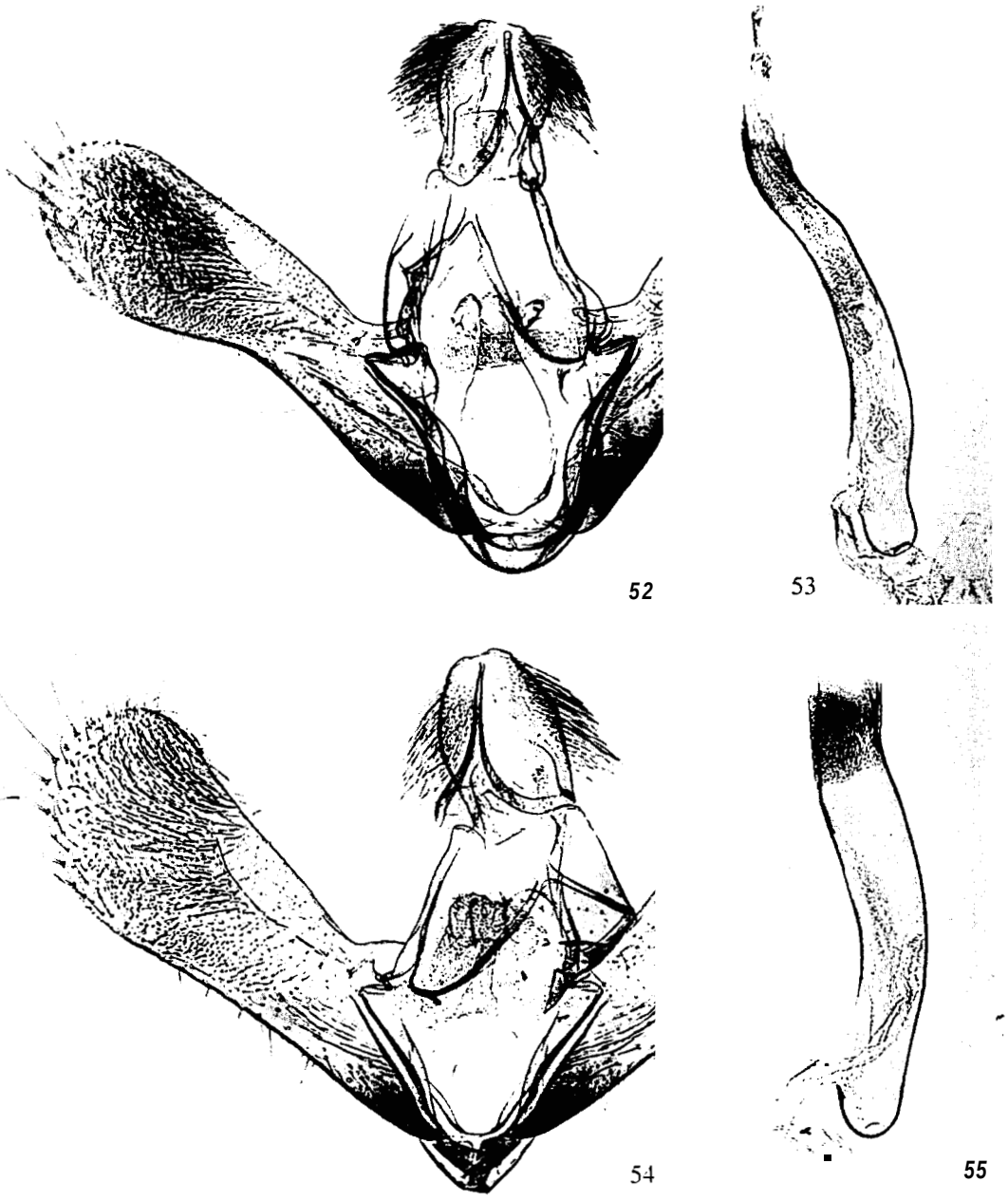
Male genitalia: Uncus strongly bilobed: valvae in middle characteristically narrow and distally broad.

Female genitalia: Corpus bursae with ovate signum: ductus bursne beyond corptis bursae with two loops: proportioiis of corpus bursae and ductus bursae variable.

Material examined. – *Eudorea decorella*: Lectotype. hereby designated, ♂ 'Lectotype', 'Madeira. Wollaston. 58-21'., 'Pyralidae Brit. Mus. Slide Ko. 3686', 'Eudorea decorella Sttn. Type I.4.1958', 'Lectotype Eudorea decorella Stainton det. M. Nuss' (BMNH). *Scoparia maderensis*: Lectotype. hereby designated, ♂ 'Madeira, 1080 ni. 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. 4031 Niels L. Wolff', respectively. 2 ♀ with same data, but GU Nuss 340 & 341 (NHM).

MADEIRA: 3 ♂, 1 ♀ T.V.Wollaston (BMNH); 1 ♀ Archada do Teixeira. 4.vi.1980. Carvalho & Camoes (JPC): 11 ♂. 15 ♀ sanie 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 (ZXIUC); 3 ♂ same except. 20.vi. 1993, Karsholt (ZMUC); 1 ♀ same except. 700m. 5.vii.1991, Meyer (H/M); 1 ♂ sanie except, 800m. 6.x.1993. Meyer (H/M): 6 ♂. 3 ♀ sanie 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 eucept. 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 ♂ sanie rxcrpt. 1080m. 17.vii.-4.viii.1935. Liindblad (NHM); 1 ♂ Encumeada. 1000m. 13.vi.1993. Knrsholt (ZMUC); 1 ♀ same except. 16.vi.1993. Karsholt (ZMUC); 3 ♂. 1 ♀ same eucept. 18.vi.1993. Karsholt (ZMUC); 4 ♀ same except. 3.vii.1993. Karsholt (ZMUC); 2 ♀ same eucept. 18.x.1994. Knrsholt (ZMUC); 1 ♂ Seixal. Fanal. 1200m. 12.x.1994. Karsholt (ZMUC); 1 ♂. 1 ♀ Serra de Agua. 650m. S.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). TESERIFE: 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.



Figs 52-55. ♂ genitalia: (52, 53) *Eudonia decorella*, GU Nuss 697, Madeira; (54-55) *E. shafferi*, GU Nuss 65

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 prefered 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. Speciniens from the Canary Is. sometimes lacking the ochre and broun scales completely and vary more in size thaii the specimens from Madeira. The larger moths (19-21mm) and the smallest one (15mm) were from the Canary Is.

E. decorella was fornierly regarded as a synonym of *E. stenota* (Rebel 1940a). Rungs (1979) recorded the species from Morocco (as *E. maderensis*) 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.

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

Eudorea stenota Wollaston, 1858: 119; Bethune-Baker 1894: 582; Bradley 3958: 193; Carvalho 1981: 180; Cockerell 1929: 113; Gardner & Classey 1960: 203; Rebel 1892: 248; Rebel & Ropenhofer 1894: 96 (index): Rebel 1896a: 113, 1-16; 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: 417.

Diagnosis. – Forewings long and narrow, females often slightly brachypterous, with an olive shine and an ochrrous admixture. Male: valvae broad in the midclle. 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 ofteii slightly brachypteroiis with shorter wings and apes of forewings clearly pointed: forewings with a faint olive shine and varying in coloiiration from a predoiiiinance of black and grey to ochreous, admised with white; fasciae white, dark edged towards medial area; antemedial fascia pointing as a triangle into the medial area, with two claviforiii stigmata; discocellular stigma X-shaped, not coniiected 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 broacl. 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; vinculuni slender.

Fernale genitalia: Corpus bursae small, ovoid, at right angle to ductus bursae, with a large ovate signum; ductus bursae long and thin, whithout 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 drt. 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 Ferreiro, 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 ♀ sanie except, 700m, 10.x.1994, Karsholt (ZMUC): 3 ♂ Queirnadas, 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.1991, Karsholt (ZMUC); 1 ♂ Redondo. Pico das Pedras, 8.vii.1991, Meyer (H/M); 9 ♂ Santo da Serra, 700m, 26.x.1991. Karsholt (ZMUC); 1 ♀ same escept, 650m, 19.xi.1972. Lundqvist & Wolff (ZMUC).

Distribution. – Endeinic 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 froiii ths Azores, hut 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, 51, 55, 79)

Diagnosis. – Forewings contrastingly black and

white coloured. with an ochreous admixttire. 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 tipright, white at apex. Forewings with white ground colotir with a contrasting black pattern. admixtured uith 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 uith 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 bronn line iii 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 saccus slender.

Female genitalia: Corpus bursae globular. signum small, round to ovate: ductus bursae slender. u-ith one or two loops beyond corpiis 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 Rabaçal 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 ♀ 'Arquipélayo 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. – Endeniic to Madeira.

Biology. – Known flight period 5 September to 26 October, with fotir 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 ochreotis 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*. Furtherniore. the males of *E. shafferi* posses 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 shadou in *E. lineola tafirella*.

Eudonia lineola lineola (Curtis)

Eudorea lineola Curtis. 1827: pl. 170: Goater 1956: 53. pl. 3. fig. 17: Leraut 1984: ISO: 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 Grotindcolour of forewings olive-fuscous.

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' (MNHN).

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 1.. 30.vi.1973

(ZMUC): 1 ♂ Oostkapelle. 6.-18.vii.1969 (ZMUC). FRASCE: 1 ♂ Boliches dii Rhoiie. 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 Lagoo da Nava. 25.iii: 1989. Goater (Goater).SPAIN: 2 ♂ Chiclana. iv.-v.1858. Staudinger (ZSB): 3 ♀ 2 km west of Ontinena. Huesca. 24.-25.v1991. Goater (Goater): 7 ♀ Huesca. Penalba, 31.v-2.1988. Goater. Hall (Coater. Hall). XIOROCCO: 1 ♀ Fès. 1.iv.1988. Pasubl (ZMUC): 1 ♀ Inezgane, 17.-18.iii.1974. R. & E. Brander (SMN): 1 ♂ Larache. 23.-24.iv.1989. Zool. hlus. Copenh. Esp. (ZMUC): 1 specimen: Mazagan (=El-Jadida). ? (BMNH): 1 ♀ Mehdiya. 15.iii.1939. Rungs (SMN): 1 spscimen: Tangier. 6.vii.1934. ? (BMNH). ALGERIA: 1 specimen: Alper, ? (BMNH). Tunisia: 1 ♀ Hammamet 13.-20.v. 1979, Arenberger (Arenberger): 1 ♀ same data. except 13.-30.v. 1979.

Distribution. – *E.* ***lirieola*** *lirieola* ranges along the Atlantic Coast froni 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* Achariiis (Goater 1986). Rungs stated on the label of the type of *Eudoria rungsi* from Morocco thnt the moth was reared froni a larva feeding on lichens growing on *P. [runus] persica.*

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

E. lineola occurs on the Canary Is. in two subspecies. These are closely relatives with the extremely similar wing patterii. the morphology of thc genitalia is identical aiid tlie male retinaculum lacks tlie hamus. Ttie subspecies are allopatric. They are different in the colouration of the upperside of body aiid 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 aii ochreoiis admixture.

Description. – Wingspan 13-19 mm (n=65). Wing pattern (but not colouring) identical to *E. lineola lineola*: Forewing basally with sonie black spots, then white towards the antemedial fascia: antemedial fascia with two strong notches and black edged towards thz 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 thc terminal shade; forewing colouring contrasted black and white instead of a grey colouring as in *E. lineola lineola.*

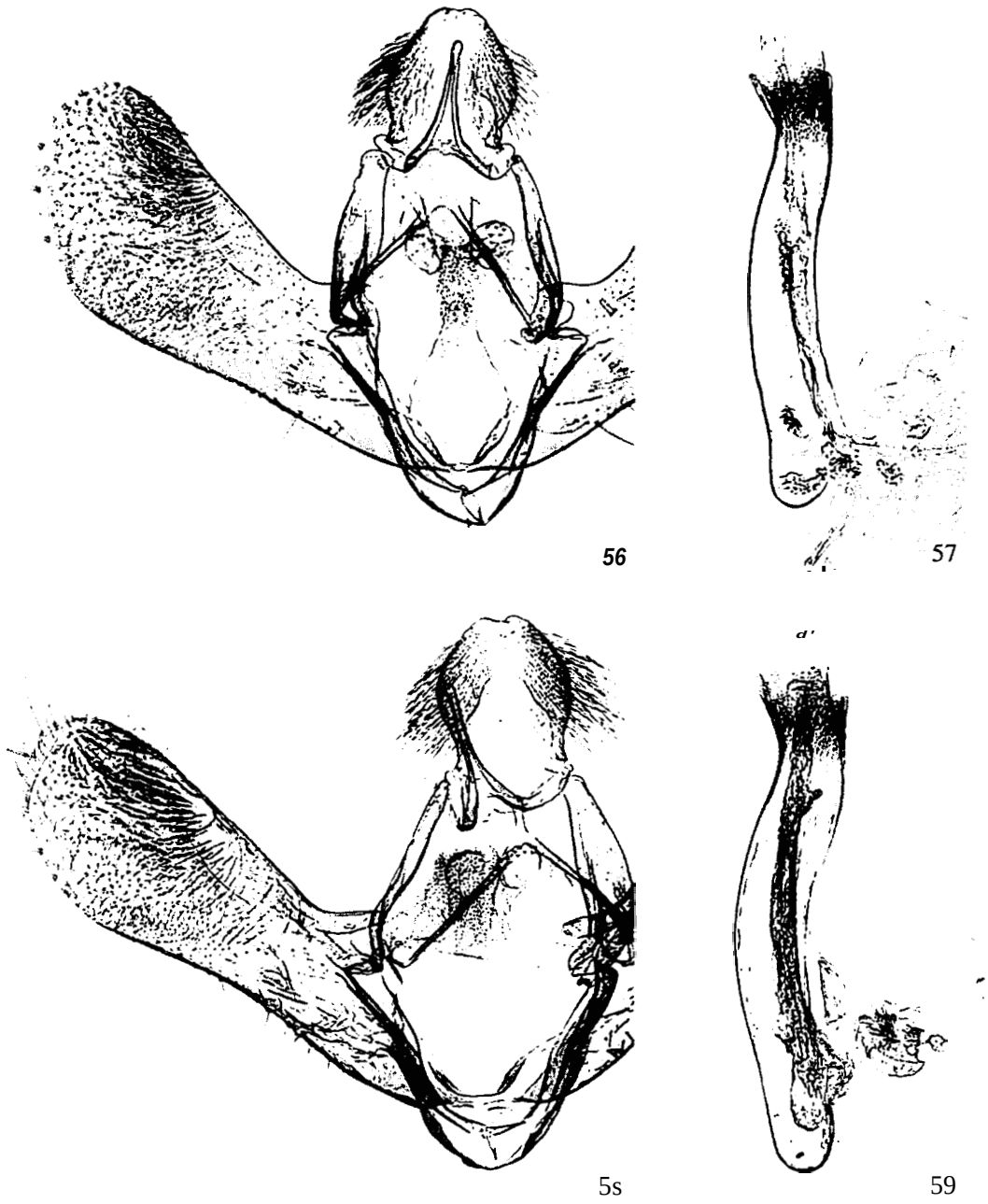
Male genitalia: Uncus laterally convex, distally bilobed; valvae narrow, dorsal niargin straight, ventral niargin concave. distal margin convex; justa long, pear-shaped.

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' (MNHN). *Scoparia coeruleotincta*: Holotype ♀ 'Holotype', 'Las Mercedes Tenerife 19.V.1907 Wlsm.', '1907 299.', 'Scoparia coeruleotincta type ♀ Hmpsn.', 'Pyralidae Brit. Mus. Slide No. 3779'. 'Holotype Scoparia coeruleotincta Hampson det. hl. Nuss' (BMNH).

CANARY Is. HIERRO: 2 ♂, 4 ♀ Valverde. 16.-23.xi. 1970. Pinker (SMN). LA PALMA: 1 ♀ Los Sauces. 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). TESERIFE: 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. 71.-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.



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 froni April.

Remarks. – *E. lineola tafirella* is superficially similar to *E. shafferi* from hladeira. *E. lineola tafirella* lacks the admixture of brown scales in the foreninps and a grey shade between the anteniedial and postinedial 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 rnm (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 nnd 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 niargin upturned; vinculum slender.

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

Material examined. – Holotype ♂ 'Holotypus'. 'Canar. Ins. Fuerteventiira 13.-33.3.26 Hering S.', 'GU 1534', 'Holotype Eudonia dorada Nuss, Karsholt. Meyer det. M. Nuss. 1995' (ZM). Paratypes: 9 ♂, 2 ♀ 'Costa Teguise. Lanzarote, Spain 18.-24.xii.1984 K. Larsen' (Larsen, Nuss, ZMUC). 1 ♂ '3.-5.3.1967 Lanzarote Hava F. Kasy' (NHM). 1 ♂ 'Fuerteventiira 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 whitr label 'Paratype Eudonia lineola dorada Nuss, Karsholt. hlryer det. M. Nuss. 1995').

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

Distribution. – Endemic to Fuerteventura and Lanzarote.

Biology. – Known flight periocl 1S Deceniber to S May. but no records froiii January and April.

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

Eudonia angustea (Curtis)

(Figs 27. 28. 39. 60. 61. 82)

Eudorea angustea Curtis, 1827: pl. 170: Bradiey 1958: 193: Chrétien. 1908: 359; Carvalho 1982: 181; Cockerell 1929: 113; Gardner & Classey 1960: 203; Goater 1986: 54. pl.3. fig.18; Leraut 1981: 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); Rebei 1917: 11, 13, 18; Rebel 1940a: 4 (key). 7, [as *Scoparia stenota*] pl.2, fig. 19; Rebel 1940b: 6: Rebel 1910: 8, 32 (Ley), 35; Stainton 1859: 311; 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. *napolitalis* Millière, 1870: 90, 127, pl. 109, fig. 17: Leraut 1984: 178; Whalley & Tweedie 1963: 95.

Scoparia vafra Meyrick, 1913: 158; Leraut 1981: 178; Whalley & Tweedie 1963: 91.

Scoparia imparilis Dyar, 1939: 8. Cockerell 1929: 113; Rebel 1940a: 7; Rebel 1938: [47]. Syn. n.

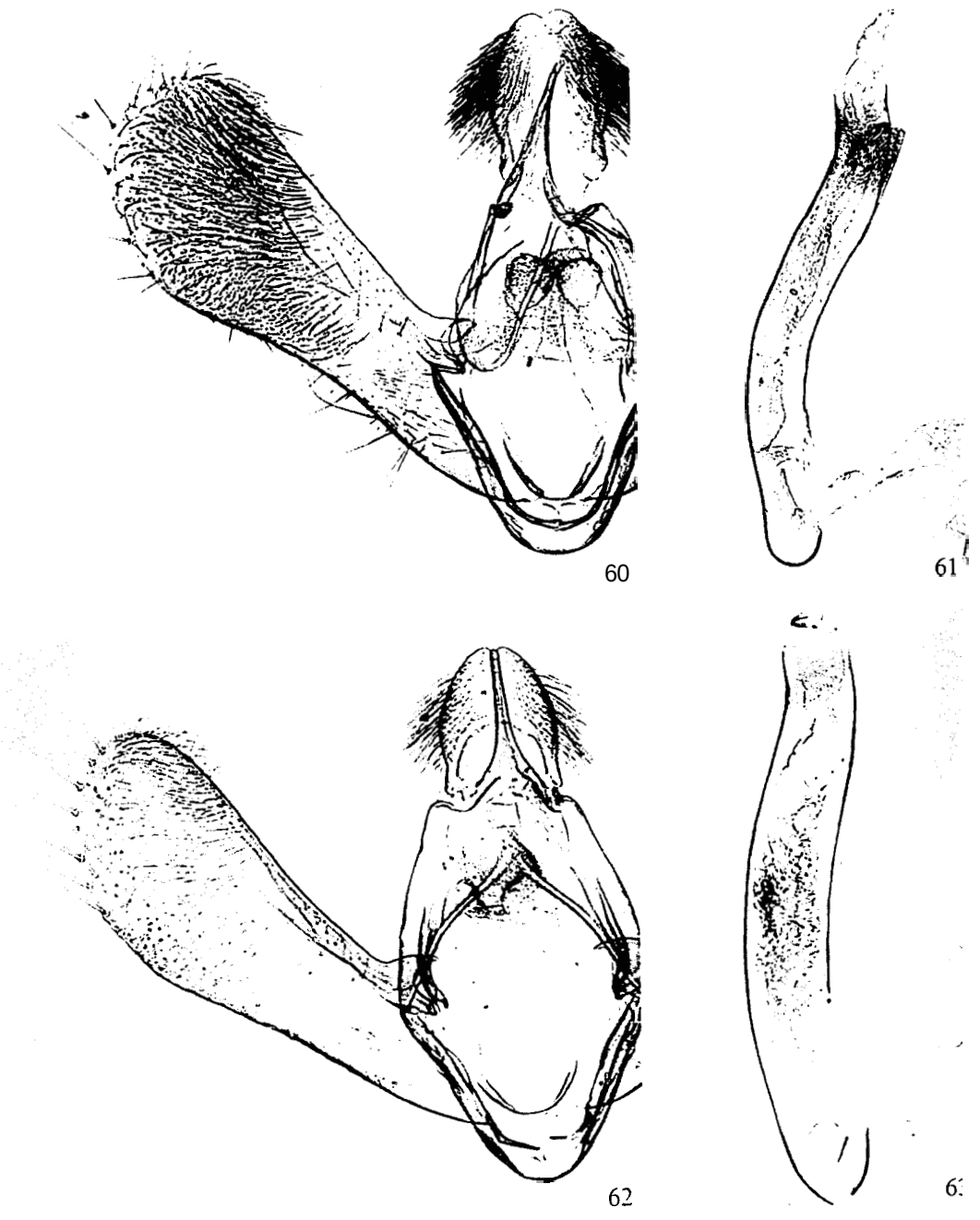
Diagnosis. – Forewings long and narrow, grey. Female: ductiis bursae with onr loop.

Description. – Wingspan 13-21 nim (n=474). Labial palpi long. porrect, laterally brown, ventrally white; forewings long and narrow, apex pointed: colouration white admixed with pale-brown. black markings; anteniedial fascia extends as triangle into medial area, antemedial stigmata obscure or only one apparent, black and claviforni: discocellular stigma X-shaped, sometimes connected with costa by a pale brown spot; postmedial 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. 11. Nuss' (BMNH). Paralectotypes: 1 specimen 'Paralectotype', 'Messina 6/3 44', 'Zell. Coll. 1884.', 'Abdo-

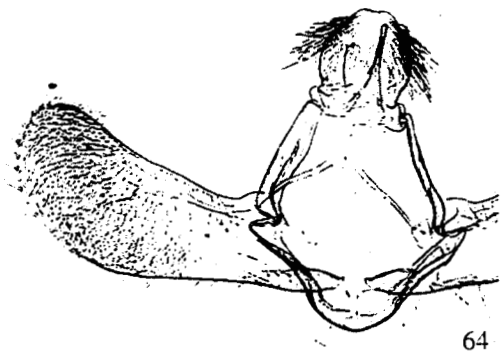


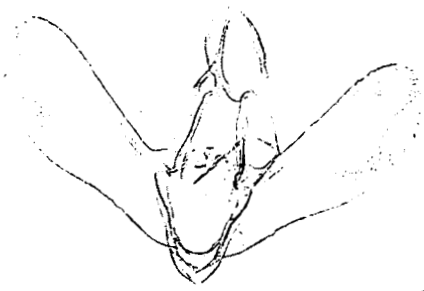
Figs 60-63. ♂ genitalia: (60, 61) *Eudonia angustea*, GU Nuss 711, Madeira; (62, 63) *E. geminoflexuosa*, GU Nu 611, Canary Islands, Tenerife.

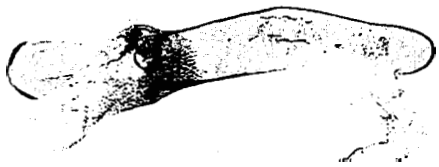
men missing', 'Paratype Eudorea coarctata Z. det. M. **h'uss'** (BMNH). 1 specimen: same label data but 6/4 44 (BMNH). *Eudorea acuminatella*: Lectotype, hereby designated. Q 'Lectotype'. 'Madeira. Woolaston [sic] Coll. 55-7.', 'Eudorea acuminatella type. Stt.', 'Q Pyralidae Brit. Mus. Slide No. 19376', 'Lectotype Eudorea acuminatella Stt. det. **hl.** Nuss, 1991' (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. hl. Nuss' (USNM).

ALGERÍA: 1 ♂ Batna. Mts. de Belezma, 1200m, 10.iv.1982, Thomas (Speidel); 1 Q Biskra, 1978, Krauss (ZSB); 1 Q Guelt es Stel, 21.iv.1912, Rothschild & Jordan (BMNH); MOROCCO: 3 O, 4 ♀Anti-Atlas, Tirhmi, 450m, 31.i.1990, de Freina (Speidel); 1 Q Rabat, 21.iii.1940, Rungs (CNC); 1 O, 3 Q Tanger, iii.1885, Leech (BMNH, CNC). TUNISIA: 1♂, 2 Q Hammamet, **1.-5.i.**1979, Arenberger (Arenberger); 1♀ Tabarka. 10.-17.xii.1993, Schmitz (Schmitz); 1 ♂ Sfax. 3.iv.1957, Bédé (BMNH); 1♂, 1 Q Tabarka, **7.-18.v.1988**, Zool. Mus. Copenh. Exp. (ZMUC); 1 ♀ Tunis, 23.iii.1913, Buxton (BMNH). FRANCE: 1♂, IQ Collioure, 24.-28.v.1936, Osthelder (ZSB): 1 ♀ Bouches du Rhonc. Camargue, Environs d'Arles 21.xi.1933, Henriot (SMN);1 O. Cannes, Staudinger (ZM); 1♀ Corse. Ajaccio. Frey 1890 (BMNH): 1 ♂ Lot Douelle, 29.x.1931, Lhoinme (ZSB): 1 Q Morbihan Lorient, 11.-26.vi.1942, Hasslinger (ZSB); GREECE: 1 ♂ Crete, Rethimnon, 50 20.iv.1971, Malicky (SMN): 1 O. Hellas, Lakonia **5** km south of Monemvasia, 28.i.1984, Christensen (ZMUC); IRELAND: 1 U, IQ Cork City, 16.viii.1980, Hall (Hall); ITALY 2 ♂ Liguria, Ventimiglia, 500m, **6.-7.iv.1988**, Fibiger (ZMUC); 4 Q Lazio, Tivoli, 6.iv.-31.v.1910, Dannehl (ZSB): 1 O Sardinia. Aritzo, 14.vi.1933, Amsel (BMNH); 1 Q Sizily, Madonie mountains, 6.viii., Dannehl (ZSB). PORTUGAL: 1 ♂, 1 QAlgarve, 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 Mirandor, 100m, 11.iii.1980, Traugott-Olsen (ZMUC); 1 Q Andalusia, Chiclana, 31.iii.1858, Staudinger (ZM); 1 Q Asturias, Amieva, Precendi. 300m, 20.vi.1987, Hellers (Hellers); 2 ♂ Badajos Olivenza, 9.iv.1992, Goater (Goater). 1 ♂ Cantabria. Picos de Europa. Lebena, 200m, 20.v.1988, Meyer (H/M): 3 ♂, 6 ♀ Gerona, Port Boii, 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 O. 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 QArchada do Teixeira. 4.vi.1980, Carvalho & Camoes (JPC): 1 ♂ same except. 1600m, 22.vi.1993, Karsholt (ZMUC): 1 Q Bica da Cana. 1.vi.1980, P. Carvalho **6** Contente (JPC): 1 O. 2 Q Camara de Lobos, 600m, 13.v.1989, hleyer (H/M): 1 ♂ Chao da Ribeira. 22.vi.1982, Carvalho & Cainoes (JPC): 1 O. 1 Q Chao da Ribeira. 27.ix.1982, Carvalho & Contente (JPC): 1 ♂ Ribeira Brava, 19.iii.1997, Müller (Nuss): 1 Q Curral das Freiras, 650m, 13.v.1989, hleyer (H/M): 1 Q same except. 600m, 22.v.1989, Hellers (Hellers): 1 Q same except, 26.v.1982, Carvalho & Camoes (JPC): 1 U, 1 Q same except, 1.ix.1980, Carvalho & Camoes (JPC): 1 ♂ Encunieada. **950m, 15.iii.1997**, Müller (Nuss): 1 ♂ same except, 950m, 26.iii.1997, Müller (Nuss): 1 Q same except. **950m, 25.iii.1997**, Müller (Nuss): 1 Q same except, 29.v.1980, Carvalho & Contente (JPC): 1 ♂ same except 1000m, 16.vi.1993, Karsholt (ZMUC); 1 Q sarne except **1000m**, 9.vii.1991, Meyer (H/M); 2 U, 2 Q same except. Lamaceiros 900m, 11.vii.1991, hleyer (H/M): 1 ♂, 1 Q same except, 1200m, 13.x.1993, Meyer (H/M, Nuss); 1 ♀ Estreito, Camara de Lobos, 30.v.1980, Carvalho & Contente (JPC): 1 Q 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 escept. 6.viii.1980, Carvalho (JPC); 1 O., 1 Q same except, 9.viii.1982, Carvalho (JPC); 1 O. same escept, **16.viii.1980**, Carvalho (JPC): 2 O., **4** Q same except, **25.ix.1981**, Carvalho (JPC): 1 ♀ same except. 13.ix.1980, Carvalho & Camoes (JPC); 1 O. same except, **1.x.1981**, Carvalho & Cainoes (JPC); **3** ♂, 7 Q same except, **5.vi.1980**, Carvalho & Contente (JPC): 1 Q same except, 15.v.1989, Hellers (Hellers); 1 O., **5** Q **same** except. 8.x.1994, Karsholt (ZMUC); 1 Q same except, 5.vii.1991, hleyer (H/M); 2 O., 4 Q same except. 800m, 6.s.1993. Meyer (H/M, Nuss): 1 Q same except, 600m, 20.x.1974, Silva (ZMUC); 4 ♀ sarne except. 23.viii.1974. Traugott-Olsen (ZMUC); 2 ♂ sanie except, 24.viii. 1974, Traugott-Olsen (ZhlUC); **3** Q sanie except, **9.-10.vi.1976**, Wolff (ZMUC): 1 O., 1 Q same except, 600m, 14.-15.ix.1977, Loniholdt & Wolff (ZMUC); 2 U, 3 Q Faja do Penedo, 1.x.1981, Carvalho & Camoes (JPC): 1 O, 2 Q Funchal. IS.ii.1979. Karsholt (ZMUC): 1 ♂, 1 Q sanie escept. 19.ii.1979, Karsholt (ZMUC): 3 ♂ sanie escept. 21.ii.1979, Karsholt (ZMUC): 1 ♀ sarne except. 2.iii.1902, Eaton (BMNH); 1 Q same escept. 14.iv.1902, Eaton (BMNH); 1 Q 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 Q Poiso, 1400m, 13.v.1989, hleyer (H/M): 3 ♂, 5 ♀ Poiso, 1400m, 13.v.1989, Hellers (Hellers): 1 Q Pico Arieiro, 1600m, 15.vi.1993, Karsholt (ZMUC); 2 Q Porto do Moniz, Santa Madalena, 600m, 9.vii.1991, Meyer (H/M); 2 O. 1 Q Queimadas, 2.vi.1980, Carvalho (JPC): 2 O. 2 Q same eucept. 3.vi.1980, Carvalho (JPC): 2 ♂ same escept. 4.vi.1982, Carvalho (JPC): 1 Q same excrpt. 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 eucept. 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 ♂ sarne except, 1000m, 28.xi.1972, Lundqvist & Wolff (ZMUC); 5 ♂, 7 Q above Santana, 1050m, 6.x.1994, Karsholt (ZMUC); 1 ♂ Santana, Ilha, 900m,







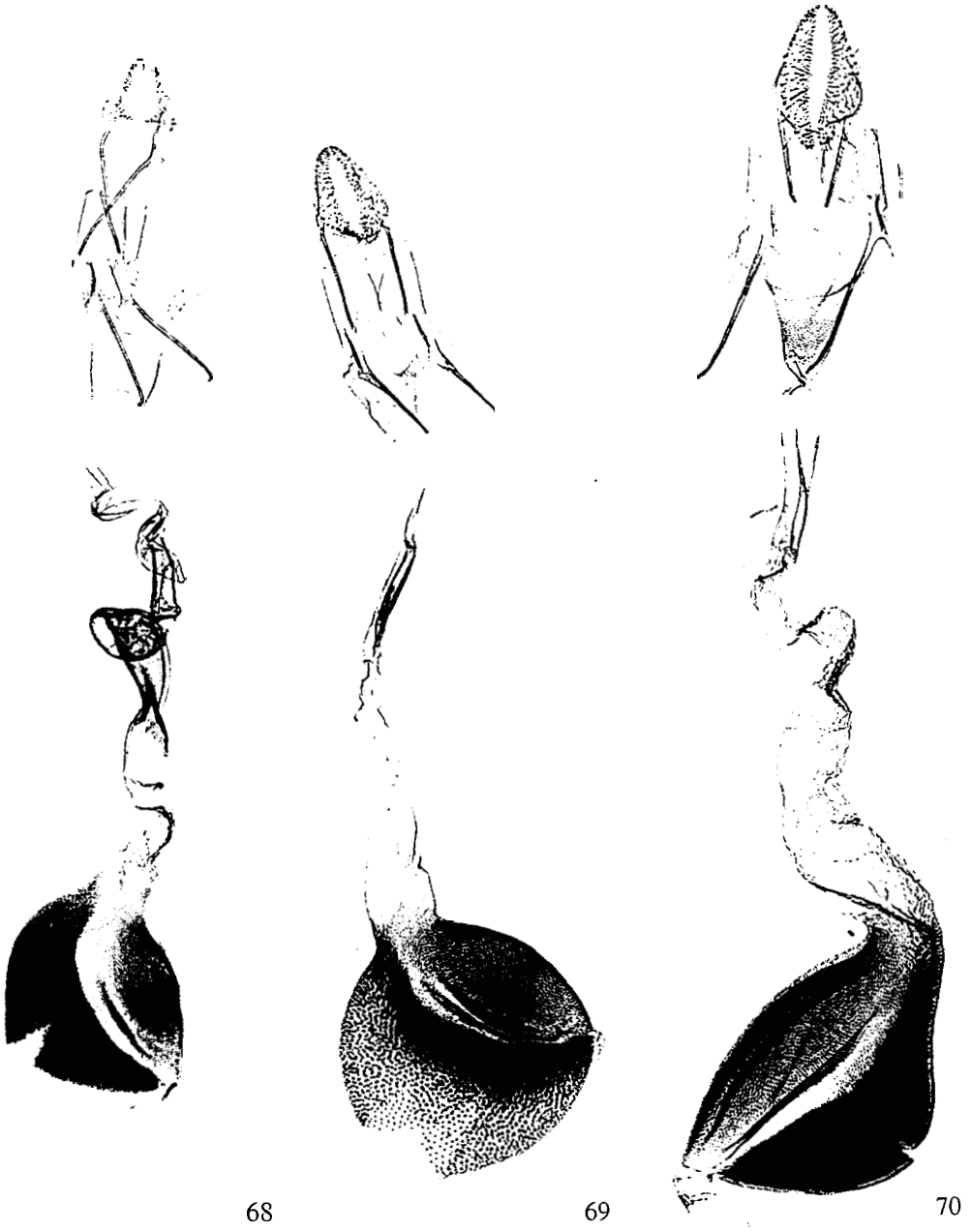
Figs 6-1-67. ♂ genitalia: (64, 65) *Eudonia lindbergalis*, GU Nuss 634, Cape Verde Islands, Santo Antao: (66, 67) *E. parviangusta*, GC; Nuss 714, Canary Islands, Gran Canaria.

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, Klimesch (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.

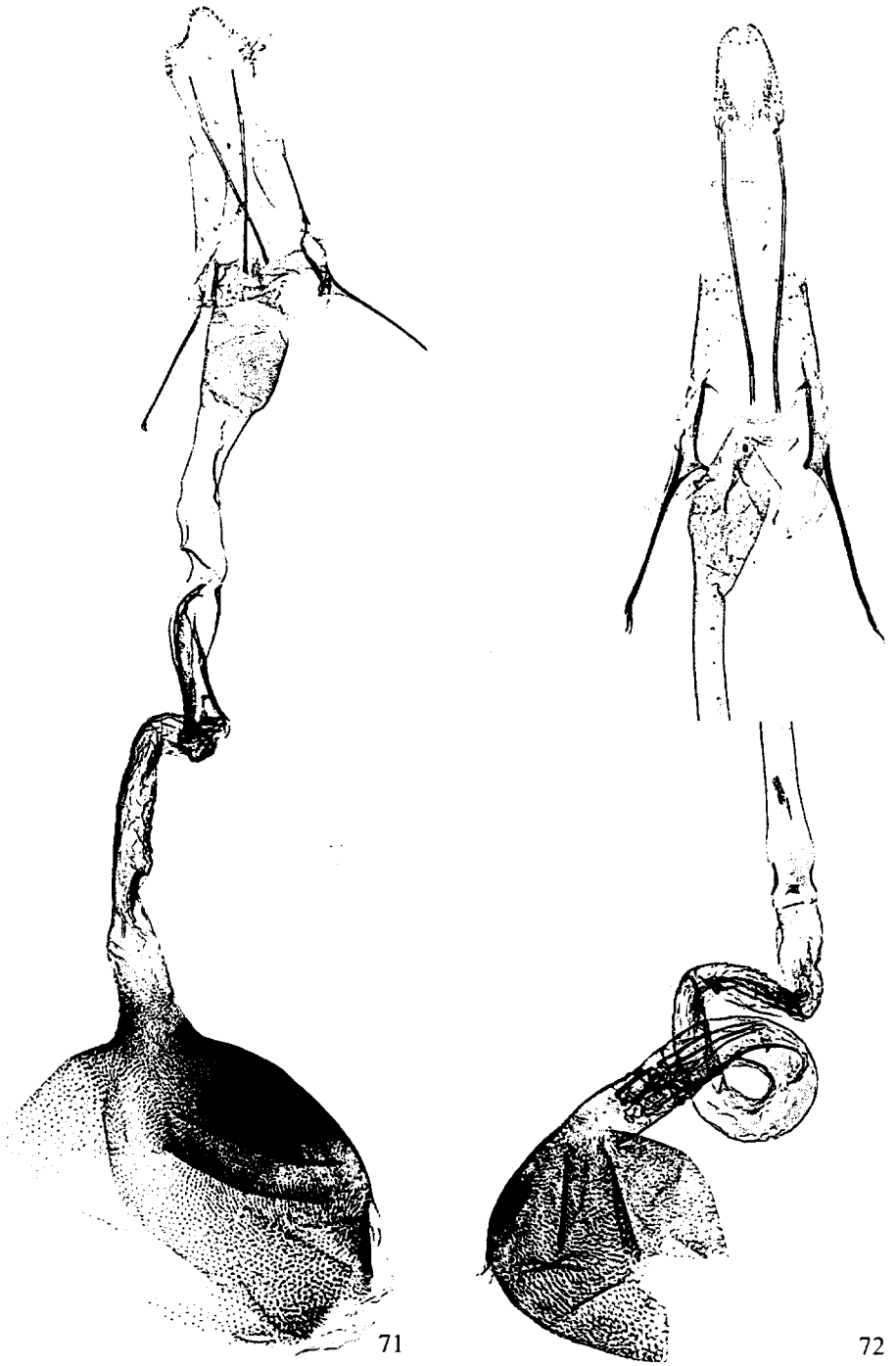
Biology. – *E. angustea* is the most common scopariine in Madeira. It occurs in nearly all habitats



68 69 70

Figs 68-70. ♀ genitalia: (68) *Scoparia acquipennalis*, 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).



71 72

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 tuo 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. steriota*. Superficially. *E. angustea* is very similar to the following two species.

Eudonia parviangusta sp. n.

(Figs 30, 66, 67, 83)

Diagiiosis. – A ***very*** small species; foreuings 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 broun scales; iipperside of foreuings, head and palpi mainly black, irridescent: base of proboscis and underside of head and thorax white; abdomen dorsally light grey; wing pattern inconspiciious: 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, ventrodistally convex, apex slightly pointed: juxta similar to justa of *E. angustea*, but much narrower.

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

Material examined. – Holotype Q 'Holotypus', 'Isole Canarie Sett.-Ott.1992 Sped. G. **Bassi'.** '04.X. 1993 **Lux C.** Gran Canaria Ayacata m.1000', '15482', 'GU Nr. 608 prep. M. Nuss', 'Holotype Eudonin parviangusta Nuss, Karsholt. Meyer det. M. Nuss, 1995', 'coll. *G.* Bassi' (MRSN). Paratypes: 5 ♂, 7 ♀ same label data (MRSN, Nuss, ZM, ZMUC).

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

Distribution. – Knonn 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 speciniens of *E. angustea*.

Eudonia geminoflexuosa sp. n.

(Figs 31, 62, 63, 84)

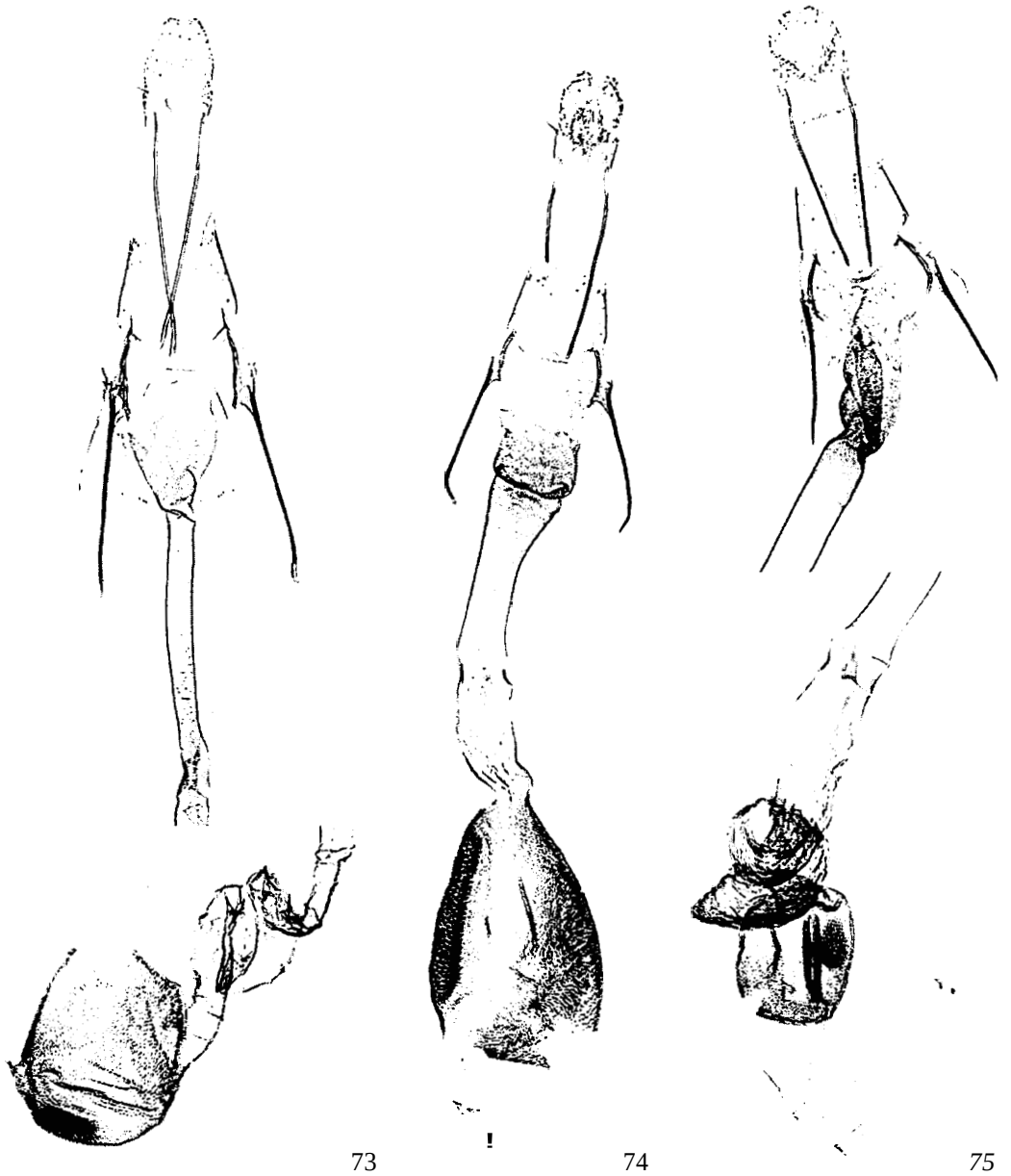
Diagnosis. – Very similar to *E. parviangusta*, but broader forewings and female with ductus bursae with two loops.

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 irridescent scales: antemedial and postmedial fasciae white, bordered with black towards medial aren: with two black, claviform antemedial stigmata; discocellular stigma X-shaped. near postmedial fascia; postmedial fascia nearly straight, sometinies slightly wavy; subterminal fascia not connected with postmedial fascia; black interneural dots along ternien; fringe brown with a white medially line: hindwings white, brown scaled along the veins and at thz ternien. fringe basally brown, then white.

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

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

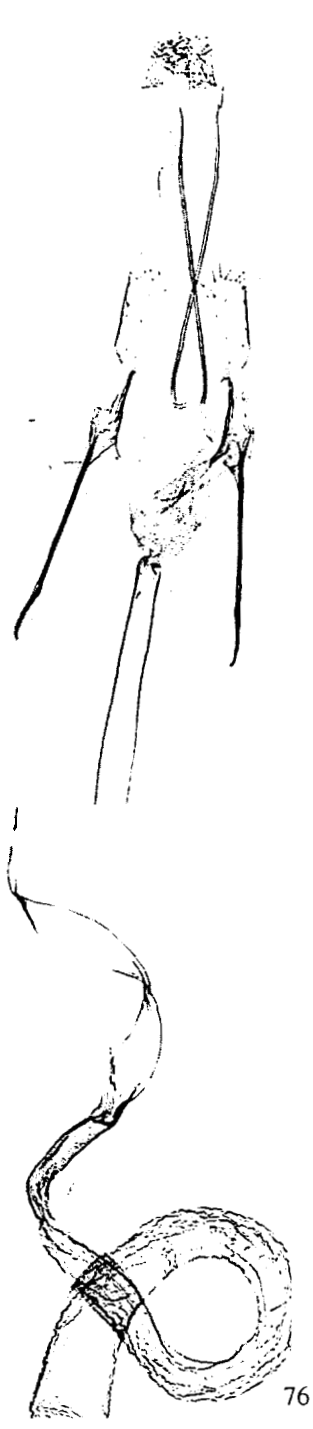
Material examined. – Holotype Q 'Holotypus', 'Ins. Canar. Ten. Gülmar 10-30.X. 1966 J Klimesch', 'Holotype Eudonia geminoflexuosa Nuss, Karsholt. Meyer det. hl. Nuss. 1995' (ZSB). Paratypes: 1 ♂, 2 **Q** same. 1



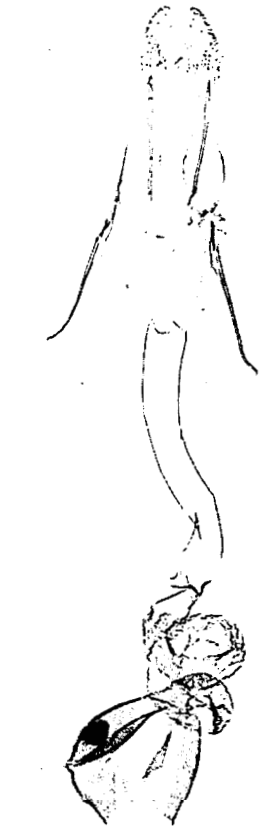
73 74 75

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.

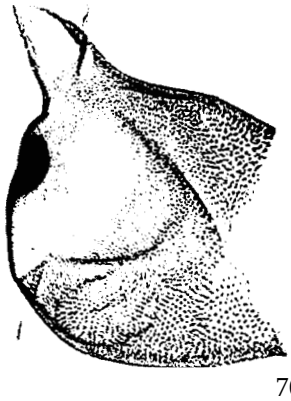
♂ 'Ins. Canar. Ten. Güimar 12.x.1966 J. Klimesch' (Klimesch), 4 ♂, 23 ♀ 'Teneriffe Baranco Ruiz leg. Pinker' (SMN, Nuss, ZM), 1 ♀ '22.IX.1992 Tenerife dint. Kasca', 'Isole Canarie Sett.-Ott. 1992 Sped. G.-Bassi' (MRSN), 1 ♀ '23.IX.1992 Tenerife Mti Anaga dint. Bailandero, Lux Laurisilva', 'Isole Canarie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



76



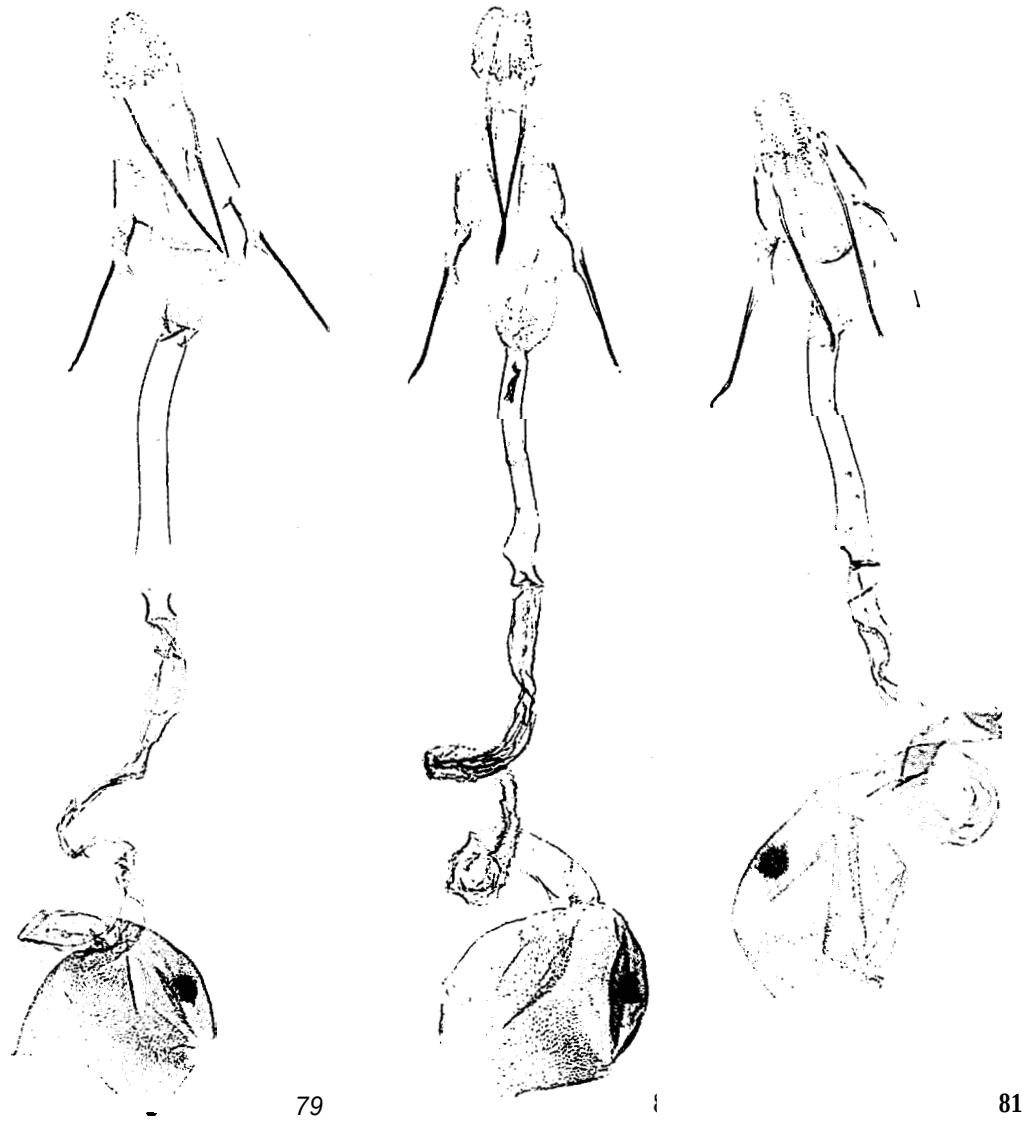
77



76

78

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



Figs 79-81. ♀ genitalia: (79) *Eudonia shafferi*, GU Nuss 698, Madeira; (80) *E. lineola tafirella*, GU Nuss 65 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)

Eudoria 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 beyoiid corpus bursae with two loops, near ductus seminalis with some little spines.

Material examined. – Holotype ♂ 'Type', 'Ins. Cabo Verde S. Antiío Mte. Conceiçao 1.1.1954 Panelius', 'Eudoria ♂ lindbergalis n.sp. Holotype P. Viette', 'Genitalia ♂ P. Viette Prép. No. 3408', 'Eudoria 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 ♀ (MNHN). 1 ♂ (CNC). 26 further speciniens in ZMU (Mikkola, pers. comni. 1995).

CAPE VERDES: 2 ♀ Santo Antiío. Campo de Cño. 30.xii. 1953. Lindberg (CNC).

Distribution. – Known only froni Santo Antão, Cape Verde Is. Ths only known species of Scopariinae frorn 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'.

Doiibtful records and species

Apart froni niisidentifications we have niet with a number of more or less obvious cases of mislabelling 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 hluseiirn, 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, hladeira'. We assume that some of Leechs material became niixed and that the first mentioned label was incorrectly attached to some Madeiran specimens.

The German entomologist Pinker collected in the hlacaronesian 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* froni hladeira could be a mislabelled specimen, though we have not been able to prove that.

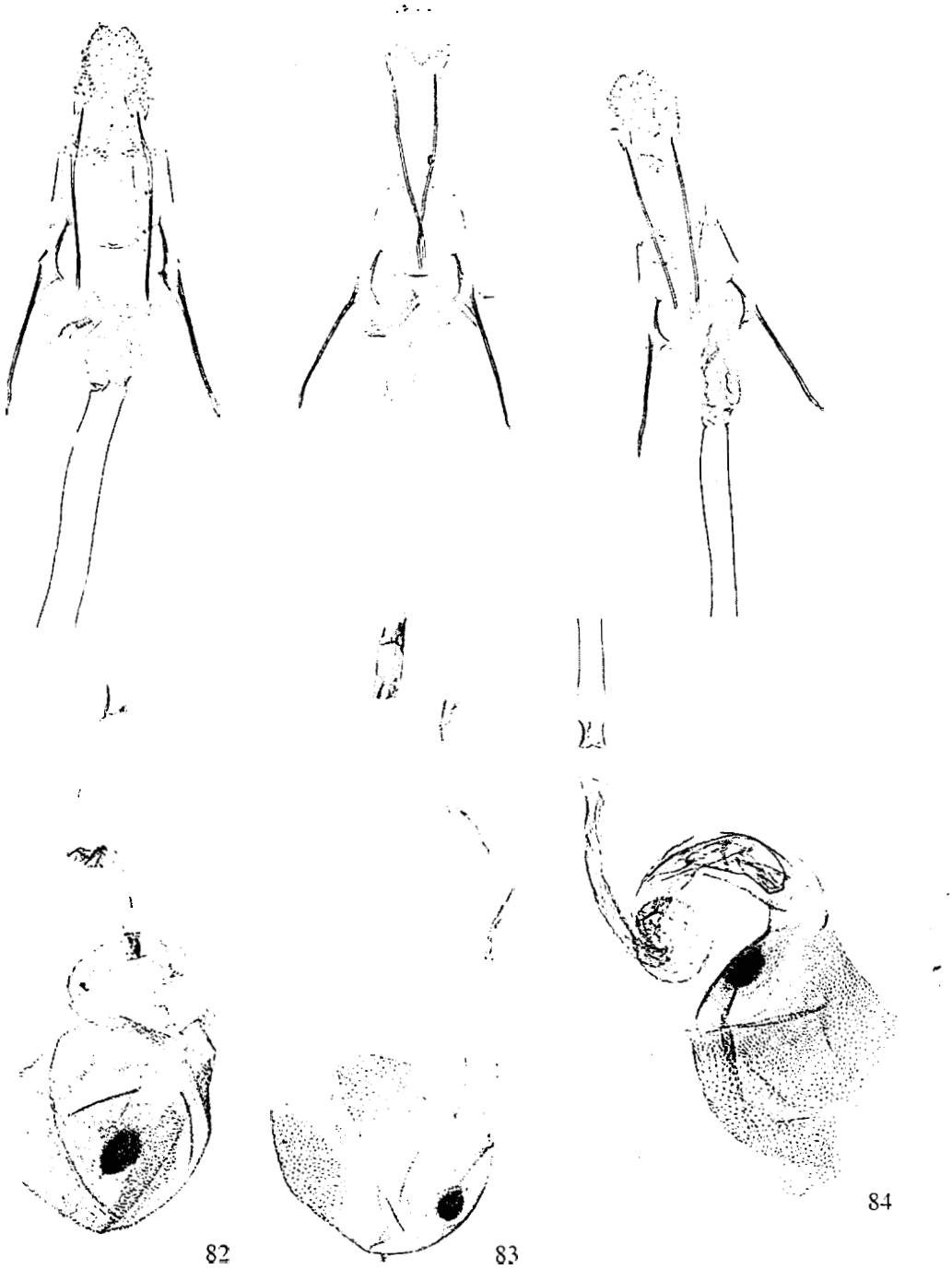
E. mercurella (Linnaeus) had been recorded from Madeira by Bethune-Baker (1894), Cockerell (1929), Rebel (1917) Stainton (1859) and Vieira & Pintureau (1991) and from the Azores by Carvalho (1982), Vieira & Pintureau (1991) and Warren (1905). Rebel (1940a, 1940c) reported that these records were probably a misidentification of *E. decorella* or *S. aequipennalis*. We could not find any specimens of *E. mercurella* from hladeira or the Azores at the BMNH. Some speciniens frorn the Azores collected in 1903 were determined as *E. mercurella* but we identified thein as *S. aequipennalis* and *S. semiamplalis*. We conclude that *E. mercurella* does not occur in the kíacaronesian 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 froin the niainland that potentially serves as the species pool. For example, 96 species of Macrolepidoptera are known froni Madeira and 53 from the more distant Azores (Meyer 1996). In the Pyraloidea. 52 species are recorded from Madeira (Carvalho 1996) and 20 froni the Azores (Meyer, Nuss & Speidel 1997). In slight contrast to the expected result. the Scopariinae has five to six species froni Madeira and five species froni the Canary Islands. btit niore species, seven, froni tlie Azores.

Of the sixteen scopnriine species that occur in the archipelagos of hlacaronesia. 14 are endeinic to these islands. Only *Eudonia angustea* and *E. lineola* are distributed beyond the islands to the neighboring continents. On these mid-Altlantic islands the Scopariinae are richer in endemics than any other group of the Pyraloidea (Rebel 1917). For esaiiiple:, ten eiidemic pyraloids are found on the Azores, and seven are scopariines (see hleyer, Nuss & Speidel 1997). Most Macaronesian scopariine endcmics occtir on niore thaii one island aiid are restricted to a single archipelago (Table 3). except the Madeiran endeinics and *E. decorella* that occtir on both Madeira and the Canary Islands. It is interesting to note that there is an increase in the number of endeniics with increasing distance froiii the niainland: one on Cape Verdes. one on the Canary Islands plus Madeira. two (plus two subspecies) on the Canary Isliinds. three on Madeira. aiid seven on the Azores.

The relatively high number of insular endemic scopariiiies described above is not unique to hlacaronesia. Similar patterns of endemism are found on other oceanic islands. For example, three eiidrinic scopariines are known froin Juan Fernandez Islands (Clarke 1965); three froin Rapa Island (Clarke 1971); 12 from the Marquesas Archipelago (Clarke 1986); more than 100 froiii tlie Hawaiian Islands (Munroe 1989); and 130 froin New Zealand (Dugdale 1988). Leraut (1989) recorded 13 endemic scopariiiies from Madagascar. three froiii the Comores. one froiii Reunion. and one from Mauritius. On the antaretic 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 ocsanic islands is a remarkable phenonieiion. We propose that autecological requirements of larvae and adults are correlated largely with the climatological conditioiis of these oceanic islands, specifically that scopariinss are adapted to temperate and humid climates because the larvae live in niosses and lichens. Pimpl (1988) denionstrated that adults are stimulated to emerge by increased humidity. Based on our knowledge of the bioiogy of Etiropean 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 nuinber of cryptograni species (Mitchell-Thome 1976; Eggers 1952; Purvis. James & Smith 1996) on those archipelagos.

Colonization of oceanic islands by scopariines has not been observed or docuniented. 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 stich records **exist** froni airplane samples at higher elevations (Gressitt. et al. 1961. Yoshiinoto. Gressitt & Mitchel 1962. Yoshiinoto A Gressitt 1963, Holzapfel 1978).

Becniise there is no evidence that the Macaronesian Scopariinae represent a nionophyletic group. it can be assumed that Macaronesia has been siibject 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. aiid they form a nionophyletic group with *S. biplagialis* froni North America and *S. jonesalis* froiii the Bermuda Islands. Because the most closely related species to the Azores group occtir in tlie 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 thr Cretaceous and Tertiary (Emery & Uchupi 1984). and the Bermuda Islands may have served as stepping stones for early colonists (Map 1).

Some scopariines froiii 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 occiirs on hladeira and Canary Islands. *Eudonia lineola* has a similar distribution. but is absent from Madeira and is represented on the Canary islands by two siibspecies, *E. lineola dorada* and *E. lineola tafirella*. *Eudonia shafferi*, endeniic 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 frorn a Madeiran ancestor of *E. shafferi*, or vice versa. However. the short distance to the contiiients, ocean surface currents, and winds do not favor either of these scenarios. A closer relationship seems to exist between *E. lindbergalis* frorn the Cape Verde Islands, and *E. geminoflexuosa*, *E. decorella*, and *E. lirieola* frorn the Canary Islands. These four species appear to be a nionophyletic group based on the two loops of the ductus bursae that is unique to this clade.

Eudonia scoriella from hladeira 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 niale 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 niale genitalia. In contrast. *E. rectilinea* has a short. basally hroad. distally bilobed uncus, and tlie valvae have a straight dorsal margin and a concave ventral margin; we call this the 'continental typr' 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 niainland ancestors: *E. interlinealis* (Fig. 42) and *E. luteusalis* (Fig. 44) from the Azores: *Eudonia* species on the Hawaiian Islands (Zimmerman 1968; Munroe 1989); aiid *Eudonia* species frorii the Marqueses Archipelago (Clarke 1986). Most *Eudonia* species from Europe, Africa. and Australia that we examined have the 'continental type' of niale genitalin. *Eudonia decorella*, *E. stenota*, and *E. shafferi* froni Madeira, and all *Eudonia* species froni the Canary Islands aiid tlie Cape Verde Islands also exhibit the 'continental type' of male genitalia. This can be explained by the relatively close proximity of thsse islands to the continents (Table 1). The 'oceanic type' of niale 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 niale genitalia. it is highly unlikely that all oceanic *Eudonia* form a discrete nionophyletic 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 coiiclusion, 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 miist investigate alternative character systems.

Acknowledgements

The first author wishes to thank Mr Michael Shaffer for his generous help during several weeks of working in the pyraloid collection at the BMNH. He has been one of my most influentical teachers in entomology by his always helpful and critical assessnient of my work, especially in collection curation and genitalia slide preparation. Last but not least, the study of most types for this paper was done with his kind support.

We are greatly indebted to the following for loans of specimens: hlr E. Arenberger (Austria): Mr M. Báez (Tenerife, Spain); Dr G. Bassi, MRSN; Dr J. Passos de Carvalho (Portugal): hlr. G. Derra (Geriiinny): Mr G. Eberi. SMN; hlr B. Goater (U.K.); Mr B. Gustavsson, NHRS; hlr N. Hall (U.K.); Mr M. Hellers (Luxembourg); hlr T. Karisch (Germany); Di. J. Klimesch (Austria); Dr B. Landry, CNC; Mr K. Larsen (Deniiiark); Dr hl. Lödl, NHM; Dr G. C. Luquet, MNHN; Dr K. Mikkola, ZMU; Prof. J. Minet, MNHN; Dr B. Müller (Germany); hlr W. Schrnitz (Germany); Dr A. Solis, USNM; Dr W. Speidel (Germany) and Mr A. Werno (Gerniany). We want to thank Prof. N. P. Kristensen, ZMUC and Dr W. Mey, ZM for helpful discussions; Dr B. Bannert ZM and Dr D. Agassiz (U.K.) for corrections to the English manuscript; Dr B. Neuhaus and hlr P. Czaja for assistance at the Scanning-Electron-Microscope, ZM; hlrs V. Richter, ZM for drawing Map 1; Mrs W. Harre, Zhl for thc development of the photographs; Dr R. Gaedike (Deutsches Entomologisches Institut, Eberswalde, Germany) for his help in bibliographical work; the Carlsberg Foundation (Denmark) for funding the field work of O. Karsholt in Madeira; and the Deutsche Forschungsgemeinschaft (Bonn, Germany) for funding the taxonomic work on Scopariinae for M. h'uss. Oiir special thanks go to Dr Alma Solis (USNM) and Dr Marianne Horak (Australia) who reviewed thr manuscript and gave helpful criticism and comments.

References

Amsel. H. G. 1952. Neue niaroccanische Kleinschmetterlinge. *Bulletin de la Société des Sciences Naturelles du Maroc* 31 (1951): 65-73.

Bethune-Baker. G. T. 1894. Descriptions of the Pyralidae. Crarnbidae, and Phycidae collected by the late T. Vernon Wollaston in Madeira. *Transactions of rlie Entomological Society of London*. 1894: 581-586.

Beyhl. F. E., Mies. B. & Ohm P. 1996. hlacaronesía – a biogeographical puzzle. *Boletim Museu Municipal do Funchal*. suppl. 4 (1995): 107-1 13.

Billberg. G. H. 1820. Eunurneratio insectorum in Museo Gust. Joh. Billberg, [iv] + 138. [Stockholrn.]

Bradley. D. 1958. Pyrales and Microlepidoptera collected by Mr. E. W. Classey in Madeira. 1957. *The Entomologist* 91: 193-197.

Bramwell. M (Ed.) 1977. The Mitchell Beazley Atlas of the Oceans. 208 pp. London.

Carthy. J. D. 1957. Aspects of the fauna and flora of the Azores. **XI.** Lepidoptera. *Annals aiid Magazine of Natural History* (12) 10:209-214.

Carvalho. J. P. 1981. hlacrolepidopteros nocturnos (Heteroceros) dos Arquipélagos da Madeira e das Selvages (Insecta, Lepidoptera). *Boletim do Socieda de Portuguesa de Entomologia* 19: 1-22.

– 1982. Acerca da inventariação dos Lepidópteros dos Açores. Comunicações Apresentadas ao 1.º Congresso Internacional da SPEN, Ponta Delgada, S. Miguel, Açores, 1 a 5 Outubro de 1979. *Ibidem* Suppl. A: 169-198.

– 1992. Notas sobre os Microlepidópteros dos Açores. Actas do V Congresso Ibérico de Entoniologia. *Ibidem*. Suppl. 3 (1): 261-270.

– 1996. Microlepidoptera of the Madeira and Selvagem Archipelagos (Insecta. Lepidoptera). *Boletim Museu Municipal do Funchal*. Suppl. 4 (1995): 559-588.

Chapnian. T. A. 1912. On the British (and a few Continental) species of *Scoparia*. *Transactions of the Entomological Society of London*. 1911: 501-51S, pls 35-44.

Chrétien. hi. P. 1908. Faune entomologique des Iles Canaries. Séjour de M.P. Lesne dans la Grande Canarie (1902-1903). I. Microlépidoptères. *Bulletin du Muséum National d'Histoire Naturelle* 14: 358-364.

Clarke. J. F. G. 1965. Microlepidoptera of Juan Fernandez Islands. *Proceedings of rlie United States National Museum* 117: 1-105.

– 1971. The Lepidoptera of Rapa Island. *Smithsonian Contributions to Zoology* 56: i-iv. 1-28?.

– 1986. Pyralidae aiid Microlepidoptera of the Marquesas Archipelago. *Smithsonian Contributions to Zoology* 416: iv + 485 pp.

Classev. E. W. 1966. The 'Leste' and migration. *Boletim Museu Municipal do Funchal 20:* 38.

Cockerell. T. D. A. 1929. *Scoparia* in the Madeira Islands. *The Entomologist* 62: 113.

Common. I. F. B. 1962. Insects of Macquarie Island. Lepidoptera: Pyralidae: Scopariinae. *Pacific Insects* 4: 975-978.

Curtis. J. 1827. British entomology. Pt. 4: pls. 147-194. London.

[Denis. M. & Schiffermüller. I.] 1775. Ankündung eines systematischen Werkes von den Schmetterlingen der Wienergegend: frontispice. 322 pp.. 2 pls. Wien.

Drouet. H. 1861. Éléments de la faune açoréene. *Mémoires de la Société d'Agriculture, des Sciences, Arts et Belles Lettres du Département de l'Aube, Troyes* 12: 1-287.

Dugdale. J. S. 1988. Lepidoptera – annotated catalogue, aiid keys to family-group taxa. *Fauna of New Zealand* 14. 262 pp.

Dyar. H. G. 1915. Pyralidae of Bermuda. *Insecutor Inscitiae Menstruus* 3: 86-89.

– 1929. Notes and new species of American rnoths of the genus *Scoparia* Hnworth. *Proceedings of rlie United States National Museum* 71 (24), 9 pp.

Eggers. J. 1982. Artenliste der Moose hlakaronesiens. *Cryptogamie, Bryologie & Lichénologie* 3: 283-335.

Emery. K. O. & Uchupi. E. 1981. The geology of the Atlantic Ocean. xx + 1050 pp. Berlin, Heidelberg & New York.

Felder, C. 1862. Verzeichniss der von den Naturforschern der k.k. Fregatte 'Novara' gesainrnelten Macrolepidopteren. *Verhandlungen der zoologisch-botanischen Gesellschaft Wien* 12:473-496.

Ferguson, D. C., Hilburn, D. J. & Wright, B. 1991. The Lepidoptera of Bermuda: their food plants, biogeography, and means of dispersal. *Memoirs of the Entomological Society of Canada* 158, 105 pp.

Fernandopullé, D. 1976. Climatic characteristics of the Canary Islands. Pp. 185-206 *in* Kunkel (Ed.): Biogeography and ecology in the Canary Islands. The Hague.

Gardner. A. E. & Classey. E. W. 1960. Report on the iiisects collected by the E. U: Classey and A. E. Gardner Expedition to Madeira in December 1957 [Part I]. *Proceedings & Transactions of rlie South London Entomological & Natural History Society*, 1959: 184-206.

Goater, B. 1956. British pyralid rnoths. A guide to their identification. 175 pp., 8 pls. Colchester.

Godman. F. C. 1870. Natural history of the Azores or Western Islands. 358 pp. London.

Gressitt. J. L., Sedlacek. J., Wise. K. A. J. & Yoshimoto, C. XI. 1961. A high speed airplane trap for air-borne organisms. *Pacific Insects* 3: 549-555.

Guilmette, J. E.. Holzapfel, E. P. & Tsuda, D. M. 1970. Trapping of air-borne insects on ships in the Pacific. Part 8. *Ibidem* 12: 303-325.

Hampson, G. F. 1907. Descriptions of new Pyralidae of the subfamilies Hydrocariipinae and Scoparianae. *Annals and Magazine of Natural History* (7) 19: 1-24.

– 1917. Descriptions of new Pyralidae of the subfamilies Hydrocampinae, Scoparianae. *Ibidem* (8) 20: 265-282.

Haworth. A. H. 1811. Lepidoptera Britannica 3: 377-512.

Heydenreich. [G. H.] 1851. Lepidopterorum Europaeorum Catalogus Methodicus. 130 pp. Leipzig.

Holzapfel. E. P. 1978. Transoceanic airplane sampling for organisms aiid particles. *Pacific Insects* 1S: 169-189.

Holzapfel. E. P. & Harrell, J. C. 1968. Transoceanic dispersal studies of insects. *Ibidem* 10: 115-153.

Holzapfel. E. P. & Perkins. B. D. 1969. Trapping of airborne insects on ships in the Pacific. part 7. *Ibidem* 11: 455-476.

Kunkel. G. 1993. Die Kanarischen Inseln uiid ihre Pflanzenwelt. 3rd ed. xii + 339 pp. Stuttgart, Jena & New York.

Leraut. P. 1984. Contribution à l'étude des Scopariinae. 4. Révision des types décrits de la région paléarctique occidentüle. description de dix nouveaux tasa et ébauche d'une liste des espèces de cette région. *Alexanor* 13(1983): 157-192.
- 1989. Insectes Lépidoptères Crambidae Scopariinae. *Faune de Madagascar* 72. *35* pp.
Linnaeus. C. 1758. Svstema Naturae (10th ed.), vol. 1, 824 pp. Holmiae.
Lüpnitz, D. 1995. Beitrag ziir phytogeographischen Stellung der Kanarischen Inseln. *Mainzer naturwissenschaftliches Archiv* 33: 83-98.
Meyer, hl. 1996. The Lepidoptera of the Macaronesian Region. VI Biogeographical aspects of Macrolepidoptera in northern Macaronesia (Madeira, Azores). *Boletim Museu Municipal do Funchal*, Suppl. 4(1995): 441-453.
hleyer. M., Nuss, hl. & Speidel, W. 1997. Kommentierte Checkliste der Pyraloidea von den Azoren, mit der Beschreibung von drei neuen Arten (Lepidoptera: Pyraloidea). *Beiträge zur Entomologie* 17: 13-34.
Millière, P. 1870. Iconographie de description de chenilles et lépidoptères inédits, 3: [81]-130, pls 109-112. Paris.
Mitchell-Thomé, R. C. 1976. Geology of the hliddle Atlantic Islands. *Beiträge zur Regionalen Geologie der Erde* 17. x + 382 pp. Berlin & Stuttgart.
hlorelet. A. 1S60. Notice sur l'histoire naturelle des Açores. Paris.
Munroe, E. 1977. Pyraloidea, Pyralidae, Scopariinae, Nymphulinae. *In* Dominick et al. (Eds): *The Moths of America North of Mexico* 13.1A: 1-134.
- 1974. Pyraloidea, Pyralidae, Evergestinae. *Ibidem* 13.1C (1973): 251-304, pls 1-13, pls A-K.
- 1989. Changes in classification and names of Hawaiian Pyraloidea since the publication of Insects of Hawaii, volume 8, by E.C. Zimmerman 11958)(Lepidoptera). *Bishop Museum Occasional Papers* 29: 199-2l2.
Osang, R. 1991. Kapverdische Inseln. 250 pp. Köln.
Peck, S. B. 1994a. Aerial dispersal of insects between arid to islands in ths Galápagos Archipelago, Ecuador. *Annals of the Entomological Society of America* s7: 218-224.
- 1994b. Sea-surface (pleuston) transport of insects between islands in ths Galápagos Archipelago, Ecuador. *Ibidem* 57: 576-582.
Piiiipl. F. 1988. Beiträge ztir Kenntnis der Scopariinae (Pyraustidae). Die Entwicklungsbiologie von *Scoparia ancipitella* (La Harpe, 1855). *Entomologische Nachrichten und Berichte* 32: 249-252.
Purvis, O. W., James, P. W. & Smith, C. W. 1996. Studies on the lichens of the Azores. Part 3. Macrolichens of relict cloud forests. *Boletim Museu Municipal do Funchal*, Suppl. 4(1995): 599-619.
Rebel, H. 1892. Beitrag zur Microlepidopterenfauna de.; canarischen Archipels. *Annalen des Naturhistorischen Museums in Wien* 7: 241-284, pl 17.
- 1896a. Dritter Beitrag zur Lepidopterenfauna der Canaren. *Ibidem* 11: 102-148, pl. 3.
- 1896b. Zwei neue Microlepidopteren aus Marocco. *Verhandlungen der zoologisch-botanischen Gesellschaft in Wien* 46: 174-176.
- 1898. Vierter Beitrag zur Lepidopterenfauna der Canaren. *Annalen des Naturhistorischen Museums in Wien* 13: 361-381.
- 1906. Fünfter Beitrag ztir Lepidopterenfauna der Kanaren. *Ibidem* 21: 22-44.
- 1911. Sechster Beitrag zur Lepidopterenfauna der Kanaren. *Ibidem* 24: 327-374, pl. 12.
- 1917. Siebenter Beitrag ziir Lepidopterenfauna der Kanaren. *Ibidem* 31: 1-62.
- 1938. Achter Beitrag ztir Lepidopterenfauna der Kaniiren. *Ibidem* 49: 43-68.
- 1940a. Die Arthropodenfauna von Madeira nach den Ergebnissen der Reise von Prof. Dr. O. Lundblad. Juli-August 1935. XXI. Lepidoptera: Microlepidoptera. *Arkiv för Zoologi* 32A (2) (1939), 26 pp., 3 pls.
- 1940b. Die Arthropodenfaiina von Madeira nach den Ergebnissen der Reise von Prof. Dr. O. Lundblad, Juli-August 1935. XXIII. Übersicht der Lepidopterenfauna Madeiras. *Ibidem* 32A (5) (1939): 13pp.
- 1940c. Die Lepidopterenfauna des Azorischen Archipels. Mit 1. Anhang: Eine Lepidopteren-Ausbeute von Madeira. *Commentationes Biologicae* 8 (1). 59 pp., 2 pls.
Rebel, H. & Rogeiihofer, A. 1894. Zur Lepidopterenfauna der Canaren. *Annalen des Naturhistorischen Museums in Wien* 9: 1-96, pl. 1.
Robertson, A. H. F. & Bernoulli, D. 1982. Stratigraphy, facies, and significünce of Late hlesozoic and Early Tertiary sedimentary rocks of Fuerteventura (Canary Islands) and Maio (Cape Verde Islands). Pp. 498-525 *in* Rad et al. (Eds): Geology of the Northwest African continent margin. Berlin, Heidelberg & New York.
Robinson, G. S. 1976. The preparation of slides of Lepidoptera genitalia uith special reference to the Microlepidoptera. *Entomologist's Gazette* 27: 127-132.
Roesler, U. 1973. Trifine Acrobasiina. *In* Aiiisel et al. (Eds): *Microlepidoptera Palaearctica* 4 (1). xvi + 752 pp.
- 1988. Untersuchungen zur Tasonornie paläarktischer Phycitinae (Lepidoptera, Pyraloidea). *Beiträge zur Entomologie* 38: 65-73.
- 1993. Phycitinae. *In* Amsel et al. (Eds): *Microlepidoptera Palaearctica* 8 (1). xxii + 305 pp.
Rothe, P. 1964. Fossile Strausseneier auf Lanzarote. *Natur und Museum, Frankfurt/M.* 94: 175-187.
- 1982. Zur Geologie der Kapverdischen Inseln. *Courier Forschungsinstitut Senckenberg, Frankfurt/M.* 52: 1-9.
- 1986. Kanarische Inseln. Lanzarote, Fuerteventura, Gran Canaria, Tenerife, Gomera, La Palma, Hierro. *Sammlung geologischer Führer* 81, s + 226 pp. Berlin & Stuttgart.
Rungs, C. E. E. 1979 Catalogue raisonné des Lépidoptères du Maroc. Inventaire Faunistique et observations écologiques 1. *Travaux de l'Institut Scientifique*, Sér. Zool. no. 39, 231 pp., 2 maps.
Santos, A. 1990. Evergreen forests in the Macaronesian region. *Nature and Environment Series*, no. 49, 78 pp. Strasbourg.
Schmincke, H.-U. 1967. Mid-Pliocene fossil wood from Gran Canaria. Preliminary Note. *Cuadernos de Botanica Canaria* 2: 19-20.
- 1982. Volcanic and chemical evolution of the Canary Islands. Pp. 273-306 *in* Rad et al. (Eds): Geology of the Northwest African continent margin. Berlin, Heidelberg & New York.
Schuleikin, V. V. 1953. Physical-Geographical. *In* Isakov et al. (Eds): Ocean atlas. Vol. 2: xxii + 5 pp., 76 maps. Moscow. (In Russian.)

Silberglied, R. E. 1978. Inter-island transport of insects aboard ships in the Galápagos Islands. *Biological Conservation* 13: 273-278.
Stainton, H. T. 18-19. An attempt at a systematic catalogue of the British Tineidae ¿? Pterophoridae. iv + *32* pp. London.
– 1859. Notes on Lepidoptera collected in hladeira by T. V. Wollaston, Esq.: with descriptions of some new species. *Annals and Magazine of Natural History* (3) 3: 209-214.
Stets. J. & Wurster, P. 1982. Atlas and Atlantic-structurol relations. Pp. 69-85 *in* Radet al. (Eds): Geology of the Northwest African continent margin. Berlin, Heidelberg ¿? New York.
Viette. P. 1958. Resultats de l'expédition zoologique du Professeur Dr. Hakan Lindberg aux îles du Cap Vert durant l'hiver 1953-54. N:o 18. Lépidoptkres Tinéides (s.l.) et Pyrales. *Commentationes Biologicae* 17 *(8)*. 12 pp.
Vieira. V. & Pintureau, B. 1991. Diversité comparée des Lépidoptères (Insecta) dans les îles des Açores, Arquipélago. *Life and Earth Sciences* 9: 25-35.
– 1993. Diversité comparée des Lépidoptkres (Insecta) dans les Îles des Açores: Revision avec de nouvelles données. *Arquipélago* 11: 107-112.
Walker. F. 1865. List of the specimens of lepidopterous insects in the Collection of the British Museum. no. 34: 1121-1533.
Warren. W. 1905. Lepidoptera collected by W. R. Ogilvie-Grant on the Azores and hladeira in 1903. *Novitates Zoologicae* 12: 439-447.
Whalley. P. E. S. & Tweedie. hí. W. F. 1963. A revision of the British Scoparias (Lepidoptera: Pyralidae). *Entomologist's Gazette* 14: *8* 1-98. pls 2-12.
Wolff. N. L. 1971. Lepidoptera. *The Zoology of Iceland* 3 (45). 193 pp., 15 pls.
Wollaston, T. V. 1858. Brief diagnostic characters of undescribed Madeiran insects. *Annals and Magazine of Natural History* (3) 1: 113-125, pl. *5.*
Yoshirnoto. C. M. & Gressitt, J. L. 1963. Trapping of air-borne insects in the Pacific-Antarctica area. *Pacific Insects* 5: 873-883.
Yoshirnoto, C. hí., Gressitt. J. L. & Mitchell, C. J. 1962. Trapping of air-borne insects in the Pacific-Antarctica area. *Ibidem* 4: 847-858.
Zeller, P. C. 1846. Die Arten der Gattung *Eudorea. Linnaea Entomologica* 1: 262-31S, pl. 2.
Ziinmerrnann, E. C. 1958. Lepidoptera: Pyraloidea. *Iiisecrs of Hawaii 8.* xii + 456 pp.

Revised manuscript accepted November 1997.