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The macromoth fauna of a humid biotope in the Novara district (Piedmont, Northern Italy)

(Lepidoptera)

Riassunto: *I 'Macroeteroceri' di un biotopo umido relitto della pianura novarese (Piemonte, Italia settentrionale) (Lepidoptera).*

Nel lavoro si forniscono i risultati di censimenti periodici di 'macrolepidotteri eteroceri' svolti tra il 2015 e il 2020 nei pressi di Torrion Quartara, in provincia di Novara. La zona esaminata presenta ancora elevati livelli di naturalità della vegetazione, circostanza che ha permesso la sopravvivenza di una ricca fauna lepidotterologica propria delle zone umide e subumide planiziali, oramai in fortissima contrazione in tutta la pianura padano-veneta. Tra gli innumerevoli elementi caratteristici di ambienti palustri, boschi igrofili e prati umidi, degni di particolare nota sono *Diachrysia nadeja* e *D. zosimi*, che a causa della loro estrema rarità e frammentazione sul territorio richiamano, unitamente a tutta la ricchissima componente di specie igrofile o mesoigrofile presenti, la necessità dell'adozione di rigorose forme di tutela della zona onde salvaguardare una comunità lepidotterologica altrimenti fortmente minacciata da pratiche agricole, sviluppo urbano ed altresì esposta a forme di alterazione dovute ai cambiamenti climatici.

Abstract: The authors detail a survey of macromoths carried out from 2015 to 2020 in the area of Torrion Quartara of the municipality of Novara (Piedmont, NW Italy). The site still retains many of the original vegetation characteristics of Po Valley, a factor which enabled the survival of numerous species linked to humid and subhumid environments that are greatly threatened nowadays by extensive farming, urban developments, and global warming, thus highlighting the need to carefully preserve the environmental integrity of such rare lowland remnant of primeval habitats once widespread in the area.

Key words: Lepidoptera, Heterocera, wetlands, Po Valley.

Introduction

Data on the original assemblages of Lepidoptera in the Padan-Venetic Plain (also known as Po Valley or Padan Plain in a broad-sense) would be of primary interest for assessing the faunal relationships between continental and peninsular Italy. However, this information is hard to be obtained because few areas of this vast flatland escaped from being turned into cultivation, a process started in historical times that however dramatically accelerated with extensive deforestation during the second half of the 19th century. Mounting interest in tracing remnants of primeval communities of Lepidoptera from the region led to numerous surveys being carried out in the few surviving fragments of the original Padan environments, above all patches of mixed deciduous woodland and humid areas. However, data on the Lepidoptera of wetlands and other humid areas from the western Po Valley (*e.g.*, Baldizzone *et al.*, 2022) are not comparable at all to that gained from the eastern sector of the plain (cf. Deutsch, 2006; Huemer, 1997; Huemer & Morandini, 2006; Marini & Trentini, 1982, 1984; Triberti, 1989, 2002, 2005; Triberti *et al.*, 2017). This is likely because, more to the west, exploitation of land with the establishment of monocultures over large extensions has discouraged lepidopterists from undertaking any surveys. As a matter of fact, the abundance of water supply via a complex network of rivers, streams, and canals was taken as an opportunity to turn a great extent of eastern Piedmont and the adjoining province of Pavia (Lombardy) into paddy fields of rice. Accordingly, the change in land use towards intensive farming, not to forget the urban developments, led to the progressive disappearance of the original wooded areas of Po Valley together with their autochthonous plants. It is a rare occurrence to spot nowadays an iconic plant of the Padan flora such as *Prunus padus* L. (Bird cherry tree) along the banks of local rivers, whilst invasive species such as *Robinia pseudoacacia* L. (Black locust) and *Prunus serotina* Ehrh. (Black cherry) and *Reynoutria japonica* Houtt.

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(Japanese knotweed) have taken over. Unfortunately, even in some nature parks, there is the attitude of allowing uncontrolled growth by any plant species without care for the original vegetation, provided that the sites are just attractive to bikers or hundreds of people enjoying their own picnics.

Current farming practices of paddy fields generally consist of the removal of turf and soil with scrapers and bulldozers to reach the alluvial gravel. After sowing rice, aerial spray of chemical fertilizers, weedkillers, and pesticides usually follow, this being accomplished by means of massive tractors equipped with long sprayers and narrow iron wheels to get through the wetland rice fields with low damage to the seedlings. As these procedures are hampered by riparian wooded vegetation, this is made essentially by poplars, willows, and alders, these plants have usually been removed from the edges of fields and canals.

In such a monotonous landscape, the resilience of populations of *Lycaena dispar* (Haworth, 1802) (Lycaenidae) is remarkable, this species still occurs in three generations along weeded embankments where its hostplant survives, namely *Rumex hydrolapathum* Huds. (Great water dock), together with the main nectar source for the adults, that is *Rorippa palustris* (L.) Besser (Marsh yellow cress). A few other butterfly species can be found in these environments, these being mostly common ones, with possibly the sole exception of *Plebejus argyrognomon* (Bergsträsser, 1779).

With the intent of tracing the original Lepidoptera fauna of the Novara district that would also include moths, we started searching for an accessible site that still maintained some acceptable features of wilderness. Eventually, south of the city of Novara and its fraction named Torrion Quartara, we spotted a suitable biotope to the left and not far from Agogna, a stream that originates at 700 m a.s.l. from Mt. Mottarone between lakes Maggiore and Orta. The area is part of "Parco della Battaglia di Novara", a park founded for ecological protection and historical reasons to commemorate the Battle of Novara (1849), actually a defeat for the Piedmont Sabaudian forces (the would-be "Italian" ones), during the First Italian War of Independence.

Study area

Our study site consists of a long and narrow belt of mostly humid meadows settled on alluvial deposits and extended over a surface of some 30,000 m^2 that have exceptionally remained unaffected by conversion into rice paddy fields (Fig. 1). Stretching from the north to the south for some 500 m and with a width

Fig. 1. View of the study site in the "Parco della Battaglia di Novara", surroundings of Torrion Quartara (Novara, Piedmont).

between 40 and 70 m, the elevation of this strip of land ranges from 120 to 140 m. The terrain thus shows a steep inclination from the east to the west that by preventing persistent flooding allowed the belt to escape its conversion into paddy fields, making also easier at the same time the regular spillage of water that from the uphill rice fields flows towards stream Agogna. This watercourse periodically floods the lowermost parts of the meadows. A narrow artificial canal runs alongside the western edge of the meadows. It is embedded between some moderately high ridges of compacted terrain that support a flourishing arboreal vegetation mainly consisting of *Quercus* spp. (oaks), *Fraxinus* spp. (ashes), *Salix caprea* L. (Goat willow) and *Robinia pseudoacacia*, together with shrubs of *Sambucus nigra* L. (Black elder), *Corylus avellana* L. (Common hazel), *Euonymus europaeus* L. (Common spindle), *Crataegus* spp. (hawthorns), *Cornus sanguinea* L. (Common dogwood), and impenetrable hedges of *Rubus* spp. (brambles). In the herb layer, *Rumex* spp. (docks), *Aristolochia* spp. (pipevines) and *Iris pseudacorus* L. (Yellow flag) can be found. The long belt of meadows between the stream and the canal is home to luxuriant spontaneous herbs that are mowed only once a year at the end of summer. Grasses do prevail here, including rushes (*Juncus* spp.), but also Apiaceae, Lamiaceae (*e.g.*, *Lamium purpureum* L., Red dead-nettle), and Fabaceae are present, *e.g.*, *Lotus* (bird's-foot trefoils), *Trifolium pratense* L. (Red clover), *Vicia sepium* L. (Bush vetch), together with weeds or low demanding species bordering crops, above all *Rumex* spp. (docks), *Cirsium vulgare* (Savi) Ten. (Spear thistle), *Senecio viscosus* L. (Sticky ragwort), *Tanacetum* spp. (tansies), *Leucanthemum vulgare* L. (Ox-eye daisy), *Galium verum* L. (Lady's bedstraw), *Alliaria petiolata* (M. Bieb.) Cavara & Grande (Garlic mustard), *Capsella bursa-pastoris* (L.) Medik. (Shepherd's purse), *Bryonia* spp. (bryonies), *Urtica dioica* L. (Common nettle), *Ranunculus arvensis* L. (Corn buttercup), *Geranium molle* L. (Dove's-foot Crane's-bill), *Potentilla reptans* L. (Creeping cinquefoil), and *Equisetum arvense* L. (Field horsetail). Unfortunately, these rich meadows have been planted over their whole extent with the most varied trees, *e.g.*, maple, ashes, black Italian poplar, hornbeam, cherry, walnut, and mulberries, that will evidently convert the open natural vegetation into a completely artificial woodland. In the SE part of the site, a surface of some 50×40 m is covered with *Phragmites australis* (Cav.) Trin. ex Steud. (Common reed) mixed with brambles, that is bordered by a stand of *Populus x canadensis*.

The climate is of continental type, with hot summers (sometimes exceeding 30°C) and quite cold winters, often down to well below 0°C at night. A recurrent feature of the site is its being warm-humid from spring to midsummer, when paddy fields are flooded, followed by a hot climate with dried out and hardened soil at the end of summer and autumn, when rice fields are drained.

Materials and methods

Besides a few occasional early records here reported the increasing comprehensiveness of the local species inventory, precisely after 4 visits spent on 3.IV.2002, 15.V.2002, 25.VI.2013, and 1.VI.2014, surveys of macromoths were more regularly run in the site from 4.III.2015 to 20.VIII.2020, for a whole of 4+228 visits. Depending on weather conditions, visits took place at least once or twice in a week in the period March-October/November, from dusk to around midnight. The cumulative numbers of visits per month have therefore been as follows (months in Roman numerals): III-14, IV-41, V-68, VI-43, VII-11, VIII-18, IX-16, X-17, and XI-4.

Sampling was performed after three basic procedures, precisely:

i) Light luring with a mixed light 250W/220V lamp placed at 70-100 cm above the ground illuminating a horizontally positioned white sheet of approximately 3×3 m. Two spots separated by more than 100 m were sampled, the power supply being provided in one case by a portable generator, and in the other by an electrical inverter connected to a car battery. Both stations were monitored by one of us.
ii) Contemporary examination by one of us (DFP) of the vegetation with a high-power LED torch and netting of flying moths or direct collection in a jar if they were resting on plants.
iii) Contemporary "sugaring" after painting tree trunks with a mixture containing ethanol and sucrose before dusk, periodic examination of the stations by one of us (DFP) with a torch and collecting with a jar.

In order to minimize the impact of the sampling, after that a voucher specimen was taken for newly recorded species (available in the collections of the first three authors), with the exception of protected ones, ad-

ditional specimens of easily identifiable species were just recorded at sight on the field, whilst more difficult ones were temporarily narcotized in a jar with some drops of ethyl acetate in a sponge and only killed whenever necessary in a jar with a stronger charge of the chemical.

Identifications were achieved after detailed comparisons of samples with literature sources and collection specimens. Dissections of random individuals from genera known to include species that are closely resembling in external habitus such as *Mesapamea* Heinicke, 1959 and *Oligia* Hübner, [1821] were performed. However, as it was unpracticable to dissect all members of such genera seen in the field, the reader should consider that under the relative entries in the faunistic list, only individuals marked with an asterisk have been determined after examination of the genitalia. For essentially similar reasons, it was unfeasible to assess the sexes of all individuals observed in the field. Sexing was therefore done only on a subset of the sample in case of strikingly dimorphic species or physically collected voucher specimens.

Chorotype analysis was based on the categories outlined by Parenzan (1994) and recalled for the Piedmont Lepidoptera by Hellmann & Parenzan (2010), with slight modifications.

Results

A total of 1032 individuals of 214 species belonging to 12 'traditional' macrolepidopteran families have overall been surveyed, as detailed in the following list. Nomenclature essentially follows Lepiforum e.V. (2023), with some modifications accounting for systematic information missing in such source.

List of species

HEPIALIDAE
Triodia sylvina (Linnaeus, 1761)
Records. 1.IX.2016 (1 ex.).

PSYCHIDAE
Rebelia plumella (Ochsenheimer, 1810)
Records. 19.V.2015 (2 exx.), 24.IV.2016 (2 exx.), 24.V.2017 (2 exx.), 23.IV.2018 (1 ex.), 9.V.2018 (1 ex.), 20.V.2018 (1 ex.), 19.V.2020 (1 ex.).

COSSIDAE
Cossus cossus (Linnaeus, 1758)
Records. 25.V.2015 (2 exx.), 20.V.2016 (1 ex.), 25.V.2016 (2 exx.), 18.VI.2016 (1 ex.), 20.VI.2016 (1 ex.), 30.VI.2016 (1 ex.), 27.V.2017 (1 ex.), 18.VI.2018 (1 ex.), 23.V.2019 (2 exx.).

Phragmataecia castaneae (Hübner, 1790) (Fig. 2)
Records. 21.V.2017 (2 exx.), 29.V.2017 (8 exx.), 20.V.2018 (2 exx.), 26.V.2018 (1 ex.), 2.VII.2018 (3 exx.), 19.V.2020 (6 exx.).

Zeuzera pyrina (Linnaeus, 1761)
Records. 20.VI.2015 (1 ex.), 10.VI.2016 (1 ex.).

DREPANIDAE
Habrosyne pyritoides (Hufnagel, 1766)
Records. 8.V.2015 (1 ex.), 10.V.2015 (2 exx.), 25.V.2015 (1 ex.), 24.IV.2016 (1 ex.), 24.V.2016 (1 ex.), 30.V.2016 (3 exx.), 22.VIII.2016 (1 ex.), 26.VIII.2016 (1 ex.), 7.V.2017 (1 ex.), 10.VI.2017 (3 exx.), 5.VI.2018 (2 exx.), 10.IX.2019 (2 exx.).

Tethea ocularis (Linnaeus, 1767)
Records. 16.V.2016 (1 ex.), 25.V.2017 (2 exx.), 10.VI.2017 (1 ex.).

Tethea or ([Denis & Schiffermüller], 1775)
Records. 5.V.2016 (1 ex.), 25.V.2016 (1 ex.), 28.V.2018 (1 ex.).

Thyatira batis (Linnaeus, 1758)
Records. 30.V.2016 (2 exx.), 26.VIII.2016 (1 ex.), 1.VI.2017 (3 exx.), 2.VI.2018 (3 exx.), 10.IX.2019 (2 exx.).

Watsonalla binaria (Hufnagel, 1767)
Records. 30.IV.2019 (1 ex.).

SATURNIIDAE
Samia cynthia (Drury, 1773)
Records. 20.VIII.2020 (1 ex.).

Saturnia pavoniella (Scopoli, 1763)
Records. 3.IV.2016 (1 ex.), 10.IV.2016 (1 ex.), 14.IV.2017 (1 ex.).

SPHINGIDAE
Agrius convolvuli (Linnaeus, 1758)
Records. 2.X.2016 (1 ex.).

Deilephila elpenor (Linnaeus, 1758)
Records. 10.V.2015 (1 ex.), 17.V.2015 (1 ex.), 20.V.2016 (3 exx.), 22.VIII.2016 (1 ex.), 24.V.2017 (1 ex.), 1.VI.2018 (2 exx.), 10.VI.2019 (3 exx.), 12.VI.2019 (1 ex.).

Hyles euphorbiae (Linnaeus, 1758)
Records. 15.V.2018 (1 ex.).

Hyles livornica (Esper, [1780])
Records. 10.V.2015 (1 ex.), 10.V.2016 (1 ex.).

Laothoe populi (Linnaeus, 1758)
Records. 22.V.2016 (1 ex.), 10.V.2017 (1 ex.), 10.VI.2018 (1 ex.).

Macroglossum stellatarum (Linnaeus, 1758)
Records. 10.IX.2017 (1 ex.).

Mimas tiliae (Linnaeus, 1758)
Records. 25.V.2015 (1 ex.), 12.IV.2016 (1 ex.), 10.V.2016 (1 ex.), 25.V.2017 (1 ex.), 10.VI.2017 (1 ex.), 25.IV.2018 (1 ex.).

Proserpinus proserpina (Pallas, 1772)
Records. 10.V.2015 (1 ex.), 27.V.2015 (2 exx.), 25.V.2017 (2 exx.), 24.V.2018 (2 exx.), 27.V.2019 (3 exx.), 19.V.2020 (1 ex.).

Smerinthus ocellata (Linnaeus, 1758)
Records. 25.IV.2016 (1 ex.), 20.IV.2017 (1 ex.).

LASIOCAMPIDAE
Dendrolimus pini (Linnaeus, 1758)
Records. 25.V.2015 (1 ex.), 20.VIII.2017 (1 ex.).

Lasiocampa quercus (Linnaeus, 1758)
Records. 20.VI.2018 (1 ex.).

Phyllodesma tremulifolia (Hübner, [1809-1810])
Records. 6.IV.2018 (3 exx.).

GEOMETRIDAE
Alcis repandata (Linnaeus, 1758)
Records. 29.V.2017 (1 ex.).

Ascotis selenaria ([Denis & Schiffermüller], 1775)
Records. 29.V.2017 (1 ex.).

Campaea margaritaria (Linnaeus, 1761)
Records. 29.V.2017 (1 ex.).

Camptogramma bilineata (Linnaeus, 1758)
Records. 29.V.2017 (1 ex.).

Cleora cinctaria ([Denis & Schiffermüller], 1775)
Records. 17.IV.2016 (1 ex.).

Colotois pennaria (Linnaeus, 1761)
Records. 10.XI.2017 (1 ex.).

Ematurga atomaria (Linnaeus, 1758)
Records. 29.VI.2016 (1 ex.), 26.VIII.2016 (1 ex.), 23.V.2017 (1 ex.), 7.V.2020 (1 ex.).

Epirrhoe rivata (Hübner, [1809-1813])
Records. 7.V.2020 (1 ex.).

Gymnoscelis rufifasciata (Haworth, 1809)
Records. 8.VI.2015 (1 ex.).

Hemithea aestivaria (Hübner, [1796-1799])
Records. 29.V.2017 (3 exx.).

Hydrelia flammeolaria (Hufnagel, 1767)
Records. 6.VII.2016 (1 ex.).

Idaea aversata (Linnaeus, 1758)
Records. 29.V.2017 (1 ex.), 10.VI.2017 (1 ex.).

Idaea ochrata (Scopoli, 1763)
Records. 2.VII.2018 (1 ex.).

Isturgia arenacearia ([Denis & Schiffermüller], 1775)
Records. 25.V.2016 (1 ex.).

Larerannis marginaria (Fabricius, 1777)
Records. 14.III.2017 (1 ex.).

Ligdia adustata ([Denis & Schiffermüller], 1775)
Records. 17.IV.2016 (1 ex.).

Lobophora halterata (Hufnagel, 1767)
Records. 23.IV.2018 (1 ex.).

Lomaspilis marginata (Linnaeus, 1758)
Records. 17.IV.2016 (1 ex.).

Macaria alternata ([Denis & Schiffermüller], 1775)
Records. 23.IV.2018 (1 ex.), 13.VI.2019 (1 ex.).

Macaria liturata (Clerck, 1759)
Records. 16.V.2016 (1 ex.).

Parectropis similaria (Hufnagel, 1767)
Records. 6.VII.2016 (6 exx.).

Peribatodes rhomboidaria ([Denis & Schiffermüller], 1775)
Records. 1.VI.2016 (1 ex.), 7.V.2017 (1 ex.), 19.V.2017 (3 exx.).

Scopula immutata (Linnaeus, 1758)
Records. 19.V.2015 (1 ex.).

Scopula subpunctaria (Herrich-Schäffer, 1847)
Records. 6.VII.2016 (1 ex.).

Stegania trimaculata (de Villers, 1789)
Records. 23.IV.2018 (1 ex.).

Timandra comae (Schmidt, 1931)
Records. 26.VIII.2016 (1 ex.).

NOTODONTIDAE
Cerura erminea (Esper, [1783]) (Fig. 3)
Records. 15.V.2017 (1 ex.).

Clostera anastomosis (Linnaeus, 1758)
Records. 16.V.2016 (1 ex.), 15.V.2017 (3 exx.), 10.V.2018 (3 exx.), 19.V.2020 (1 ex.).

Clostera curtula (Linnaeus, 1758)
Records. 1.IV.2016 (2 exx.), 17.IV.2016 (1 ex.), 10.IV.2017 (3 exx.), 15.IV.2018 (4 exx.).

Clostera pigra (Hufnagel, 1766)
Records. 20.VIII.2017 (1 ex.).

Drymonia dodonaea ([Denis & Schiffermüller], 1775)
Records. 5.V.2016 (1 ex.).

Furcula furcula (Clerck, 1759)
Records. 25.V.2016 (1 ex.).

Gluphisia crenata (Esper, [1785])
Records. 23.IV.2015 (1 ex.), 28.VII.2015 (1 ex.), 15.V.2017 (2 exx.), 23.IV.2018 (1 ex.), 2.VII.2018 (1 ex.).

Notodonta tritophus ([Denis & Schiffermüller], 1775)
Records. 10.IV.2017 (1 ex.).

Phalera bucephala (Linnaeus, 1758)
Records. 20.V.2016 (1 ex.), 25.IV.2017 (1 ex.), 25.V.2017 (2 exx.).

Pheosia tremula (Clerck, 1759)
Records. 10.V.2017 (1 ex.).

Pterostoma palpina (Clerck, 1759)
Records. 24.IV.2016 (1 ex.), 5.VI.2017 (2 exx.), 10.VI.2018 (1 ex.).

Stauropus fagi (Linnaeus, 1758)
Records. 29.V.2017 (1 ex.).

EREBIDAE
Arctornis l-nigrum (Müller, 1764)
Records. 5.IX.2017 (2 exx.), 9.IX.2018 (4 exx.), 8.IX.2019 (3 exx.).

Calliteara pudibunda (Linnaeus, 1758)
Records. 3.IV.2002 (1 ex.).

Catephia alchymista ([Denis & Schiffermüller], 1775)
Records. 8.V.2018 (1 ex.).

Catocala nupta (Linnaeus, 1767)
Records. 10.VI.2015 (5 exx.), 20.VI.2015 (5 exx.), 10.VI.2017 (1 ex.), 20.VI.2018 (1 ex.), 16.VI.2019 (1 ex.).

Catocala promissa ([Denis & Schiffermüller], 1775)
Records. 10.VI.2015 (4 exx.), 10.VI.2017 (1 ex.).

Colobochyla salicalis ([Denis & Schiffermüller], 1775)
Records. 22.V.2016 (1 ex.), 29.VI.2016 (1 ex.).

Coscinia cribraria (Linnaeus, 1758)
Records. 25.VI.2016 (1 ex.).

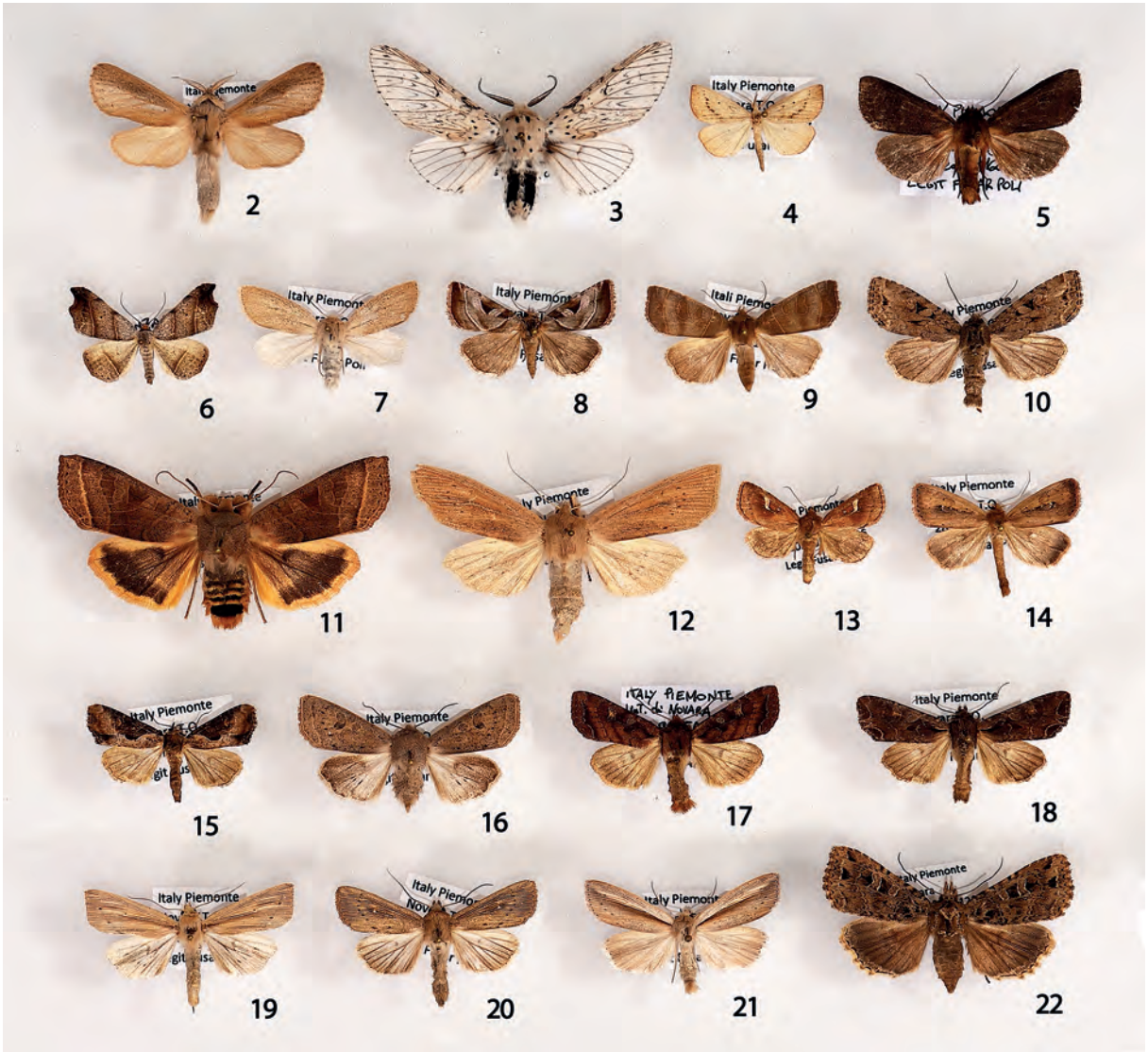
Dysgonia algira (Linnaeus, 1767)
Records. 19.V.2015 (1 ex.), 11.VIII.2016 (1 ex.), 25.V.2017 (1 ex.), 30.V.2018 (1 ex.), 31.V.2018 (2 exx.).

Eilema griseola (Hübner, [1800-1803])
RECORDS. 9.IX.2018 (1 ex.).

Euclidia glyphica (Linnaeus, 1758)
RECORDS. 1.VI.2017 (1 ex.).

Euproctis chrysorrhoea (Linnaeus, 1758)
RECORDS. 25.V.2016 (1 ex.), 29.V.2017 (1 ex.), 19.VI.2018 (1 ex.).

Grammodes bifasciata (Petagna, 1787)
RECORDS. 5.V.2015 (2 exx.), 10.V.2016 (1 ex.),



Figs. 2-22. Some notable moths from the Torrion Quartara site. 2) *Phragmataecia castaneae*; 3) *Cerura erminea*; 4) *Macrochilo cribrumalis*; 5) *Mythimna turca* (melanistic form); 6) *Laspeyria flexula*; 7) *Acronicta albovenosa*; 8) *Eucarta virgo*; 9) *Ipimorpha subtusa*; 10) *Apterogenum ypsillon*; 11) *Orbona fragariae*; 12) *Rhizedra lutosa*; 13) *Phragmatiphila nexa*; 14) *Archanara neurica*; 15) *Lateroligia ophiogramma*; 16) *Orthosia gracilis*; 17) *Lacanobia oleracea*; 18) *Lacanobia suasa*; 19) *Aletia straminea*; 20) *Leucania obsoleta*; 21) *Senta flammea*; 22) *Naenia typica*.

15.V.2016 (2 exx.), 20.V.2016 (1 ex.), 25.VIII.2016 (1 ex.), 20.VIII.2017 (1 ex.), 15.V.2018 (1 ex.), 20.IV.2020 (2 exx.), 25.IV.2020 (2 exx.), 6.V.2020 (3 exx.).

Grammodes stolida (Fabricius, 1775)
Records. 5.IX.2016 (1 ex.).

Herminia tarsicrinalis (Knoch, 1782)
Records. 29.V.2017 (1 ex.).

Hypena proboscidalis (Linnaeus, 1758)
Records. 25.V.2017 (1 ex.), 29.V.2017 (1 ex.), 15.V.2018 (1 ex.), 1.VI.2018 (1 ex.), 2.VII.2018 (2 exx.).

Hypena rostralis (Linnaeus, 1758)
Records. 26.III.2017 (1 ex.), 17.IV.2018 (3 exx.).

Hyphantria cunea (Drury, 1773)
Records. 25.V.2015 (1 ex.), 10.V.2016 (3 exx.), 1.VI.2016 (2 exx.), 20.V.2017 (5 exx.), 29.V.2017 (2 exx.), 5.V.2018 (1 ex.), 8.V.2018 (2 exx.), 16.V.2018 (1 ex.), 20.V.2018 (3 exx.), 25.VII.2018 (1 ex.), 23.V.2019 (1 ex.), 19.V.2020 (1 ex.).

Laspeyria flexula ([Denis & Schiffermüller], 1775) (Fig. 6)
Records. 10.V.2016 (1 ex.).

Leucoma salicis (Linnaeus, 1758)
Records. 5.VII.2015 (1 ex.), 22.VIII.2016 (1 ex.), 5.IX.2016 (5 exx.), 4.VII.2018 (1 ex.), 9.IX.2018 (6 exx.), 8.IX.2019 (5 exx.).

Lithosia quadra (Linnaeus, 1758)
Records. 25.V.2017 (1 ex.), 9.IX.2018 (2 exx.).

Lygephila craccae ([Denis & Schiffermüller], 1775)
Records. 2.X.2017 (1 ex.), 10.X.2017 (1 ex.).

Lymantria dispar (Linnaeus, 1758)
Records. 27.IX.2016 (1 ex.), 1.X.2018 (1 ex.), 25.IX.2019 (8 exx.).

Macrochilo cribrumalis (Hübner, 1803) (Fig. 4)
Records. 1.VI.2017 (1 ex.).

Minucia lunaris ([Denis & Schiffermüller], 1775)
Records. 6.IV.2016 (1 ex.), 20.V.2018 (1 ex.).

Ocneria rubea ([Denis & Schiffermüller], 1775)
Records. 20.VIII.2017 (1 ex.).

Orgyia antiqua (Linnaeus, 1758)
Records. 29.VI.2015 (1 ex.), 1.IX.2017 (1 ex.).

Pelosia muscerda (Hufnagel, 1766)
Records. 1.IX.2017 (2 exx.), 9.IX.2018 (1 ex.).

Phragmatobia fuliginosa (Linnaeus, 1758)
Records. 25.V.2017 (1 ex.), 1.IX.2017 (1 ex.), 20.IV.2018 (1 ex.), 10.VI.2018 (1 ex.), 21.VIII.2019 (1 ex.).

Polypogon tentacularia (Linnaeus, 1758)
Records. 28.V.2017 (2 exx.).

Rivula sericealis (Scopoli, 1763)
Records. 14.V.2016 (1 ex.), 7.V.2017 (1 ex.), 28.V.2017 (1 ex.), 20.VI.2018 (1 ex.).

Scoliopteryx libatrix (Linnaeus, 1758)
Records. 20.V.2015 (1 ex.), 25.V.2017 (1 ex.), 1.VI.2018 (1 ex.).

Spilosoma lubricipeda (Linnaeus, 1758)
Records. 5.VI.2015 (1 ex.), 20.V.2017 (2 exx.), 20.IX.2018 (1 ex.).

NOLIDAE

Bena bicolorana (Fuesslin, 1775)
Records. 15.V.2016 (2 exx.), 20.V.2016 (1 ex.), 6.VII.2016 (1 ex.), 19.V.2020 (1 ex.).

Earias clorana (Linnaeus, 1761)
Records. 19.V.2020 (1 ex.).

Meganola strigula ([Denis & Schiffermüller], 1775)
Records. 10.V.2015 (1 ex.).

Nycteola revayana (Scopoli, 1772)
Records. 25.V.2015 (2 exx.).

Pseudoips prasinana (Linnaeus, 1758)
Records. 20.IV.2016 (2 exx.), 24.IV.2016 (2 exx.), 10.V.2016 (1 ex.).

NOCTUIDAE

Abrostola triplasia (Linnaeus, 1758) (Fig. 24)
Records. 15.V.2015 (1 ex.), 30.V.2015 (1 ex.), 10.VI.2015 (1 ex.), 15.VI.2015 (1 ex.), 25.VI.2015 (4 exx.), 1.VI.2017 (1 ex.).

Acantholeucania loreyi (Duponchel, 1827)
Records. 28.X.2016 (3 exx.), 12.VIII.2017 (1 ex.), 30.X.2017 (4 exx.), 15.X.2018 (2 exx.).

Acontia trabealis (Scopoli, 1763)
Records. 1.VI.2016 (1 ex.), 29.VI.2016 (1 ex.), 29.V.2017 (1 ex.), 20.V.2018 (1 ex.), 23.V.2018 (1 ex.), 10.VI.2018 (2 exx.), 20.IX.2018 (1 ex.), 20.IX.2019 (1 ex.), 8.V.2020 (1 ex.), 15.V.2020 (2 exx.), 17.V.2020 (1 ex.).

Acronicta albovenosa (Goeze, 1781) (Fig. 7)
Records. 11.IV.2017 (1 ex.).

Acronicta cuspis (Hübner, [1809-1813])
Records. 18.IV.2017 (1 ex.).

Acronicta euphorbiae ([Denis & Schiffermüller], 1775)
Records. 17.IV.2016 (1 ex.), 1.V.2017 (1 ex.).

Acronicta megacephala ([Denis & Schiffermüller], 1775)
Records. 25.IV.2017 (1 ex.), 1.V.2017 (1 ex.).

Acronicta psi ([Denis & Schiffermüller], 1775)
Records. 20.VI.2016 (1 ex.), 15.VI.2017 (1 ex.).

Acronicta rumicis (Linnaeus, 1758)
Records. 25.VI.2015 (1 ex.), 1.IX.2015 (1 ex.), 10.V.2016 (1 ex.), 25.VIII.2016 (2 exx.), 5.IX.2016 (1 ex.), 25.IV.2017 (1 ex.), 17.IV.2018 (1 ex.), 27.IV.2018 (1 ex.).

Actinotia hyperici ([Denis & Schiffermüller], 1775)
Records. 20.VI.2018 (1 ex.).

Actinotia polyodon (Clerck, 1759)
Records. 10.VI.2018 (1 ex.).

Aedia leucomelas (Linnaeus, 1758)
Records. 10.VI.2018 (2 exx.).

Agrochola circellaris (Hufnagel, 1766)
Records. 28.X.2016 (1 ex.), 10.X.2017 (4 exx.), 17.X.2017 (2 exx.), 30.X.2017 (1 ex.), 4.XI.2019 (1 ex.).

Agrochola lota (Clerck, 1759)
Records. 30.X.2017 (1 ex.).

Agrochola lychnidis ([Denis & Schiffermüller], 1775)
Records. 10.X.2017 (1 ex.), 25.X.2017 (1 ex.).

Agrotis exclamationis (Linnaeus, 1758)
Records. 15.IV.2015 (1 ex.), 17.V.2015 (1 ex.), 27.V.2015 (1 ex.), 1.X.2015 (1 ex.), 23.V.2019 (1 ex.), 19.V.2020 (1 ex.).

Agrotis ipsilon (Hufnagel, 1766)
Records. 25.V.2015 (3 exx.), 10.VI.2015 (1 ex.), 13.IV.2017 (3 exx.).

Agrotis puta (Hübner, [1800-1803])
Records. 28.X.2016 (1 ex.).

Agrotis segetum ([Denis & Schiffermüller], 1775)
Records. 27.IV.2018 (2 exx.).

Agrotis trux (Hübner, [1823-1824])
Records. 1.X.2015 (1 ex.).

Aletia pallens (Linnaeus, 1761)
Records. 30.IV.2016 (1 ex.).

Aletia straminea (Treitschke, 1825) (Fig. 19)
Records. 1.VI.2014 (1 ex.), 20.V.2016 (2 exx.), 29.VI.2016 (1 ex.), 10.V.2017 (1 ex.), 25.V.2017 (1 ex.), 4.VI.2017 (1 ex.), 12.VIII.2017 (1 ex.), 30.V.2018 (1 ex.), 1.VI.2018 (2 exx.), 30.VI.2018 (1 ex.).

Aletia vitellina (Hübner, [1803-1808])
Records. 20.V.2015 (1 ex.), 29.VI.2016 (1 ex.), 28.V.2017 (1 ex.), 10.IX.2017 (1 ex.), 29.V.2018 (1 ex.), 1.VI.2018 (1 ex.), 2.VII.2018 (1 ex.).

Allophyes oxyacanthae (Linnaeus, 1758)
Records. 17.XI.2016 (2 exx.), 30.X.2017 (1 ex.).

Amphipyra berbera (Rungs, 1949) (Fig. 23)
Records. 10.VI.2015 (1 ex.), 20.VI.2015 (1 ex.).

Amphipyra pyramidea (Linnaeus, 1758)
Records. 15.VI.2017 (1 ex.).

Anapoma riparia (Rambur, 1829)
Records. 5.IX.2016 (1 ex.), 29.V.2017 (1 ex.), 25.VI.2017 (1 ex.), 2.VII.2018 (1 ex.).

Anorthoa munda ([Denis & Schiffermüller], 1775)
Records. 10.III.2017 (2 exx.), 14.III.2017 (1 ex.), 18.III.2017 (2 exx.).

Apamea crenata (Hufnagel, 1766)
Records. 5.IX.2016 (1 ex.).

Apamea lithoxylaea ([Denis & Schiffermüller], 1775)
Records. 1.VI.2017 (1 ex.), 31.V.2018 (1 ex.).

Apamea monoglypha (Hufnagel, 1766)
Records. 10.VI.2018 (1 ex.).

Apamea unanimis (Hübner, [1809-1813])
Records. 20.VIII.2017 (1 ex.), 27.VIII.2017 (1 ex.).

Apamea scolopacina (Esper, 1788)
Records. 15.V.2017 (1 ex.), 8.V.2018 (1 ex.).

Aporophyla lueneburgensis (Freyer, 1848)
Records. 10.X.2017 (2 exx.), 17.X.2017 (1 ex.).

Apterogenum ypsillon ([Denis & Schiffermüller], 1775) (Fig. 10)
Records. 30.V.2015 (2 exx.), 25.VI.2015 (2 exx.), 13.V.2017 (1 ex.), 23.V.2018 (1 ex.).

Fig. 23. *Amphipyra berbera* from the Torrion Quartara site.

Archanara neurica (Hübner, [1803-1808]) (Fig. 14)
Records. 10.VI.2017 (5 exx.), 23.V.2018 (1 ex.), 10.VI.2018 (1 ex.).

Arenostola phragmitidis (Hübner, [1800-1803])
Records. 29.V.2018 (1 ex.).

Athetis hospes (Freyer, [1831])
Records. 1.VI.2016 (2 exx.), 1.VI.2017 (4 exx.), 29.V.2018 (1 ex.), 25.VII.2018 (1 ex.).

Autographa gamma (Linnaeus, 1758) (Fig. 36)
Records. 10.V.2015 (1 ex.), 19.V.2015 (1 ex.), 5.V.2016 (2 exx.), 22.VIII.2016 (1 ex.), 30.IV.2017 (1 ex.), 23.V.2018 (2 exx.).

Axylia putris (Linnaeus, 1761)
Records. 10.V.2015 (1 ex.), 24.IV.2016 (1 ex.), 16.V.2016 (1 ex.), 1.VI.2016 (1 ex.), 23.V.2017 (1 ex.), 28.V.2017 (2 exx.), 20.IV.2018 (2 exx.), 20.V.2018 (3 exx.), 1.VI.2018 (1 ex.), 5.VI.2019 (1 ex.).

Bryophila raptricula ([Denis & Schiffermüller], 1775)
Records. 20.VIII.2017 (1 ex.).

Bryopsis muralis (Forster, 1771)
Records. 20.VI.2017 (1 ex.).

Callopistria juventina (Stoll, 1782)
Records. 25.V.2015 (2 exx.), 6.VII.2016 (1 ex.), 15.VI.2017 (2 exx.), 18.VI.2018 (1 ex.).

Caradrina morpheus (Hufnagel, 1766)
Records. 15.V.2017 (1 ex.), 29.V.2017 (1 ex.), 1.VI.2017 (1 ex.).

Chrysodeixis chalcites (Esper, 1789) (Fig. 26)
Records. 20.X.2015 (3 exx.), 28.X.2016 (2 exx.).

Cirrhia ocellaris (Hufnagel, 1766)
Records. 17.X.2016 (1 ex.), 28.IX.2017 (1 ex.), 10.X.2017 (1 ex.), 25.X.2017 (2 exx.), 30.X.2017 (1 ex.), 28.X.2019 (1 ex.).

Colocasia coryli (Linnaeus, 1758)
Records. 28.VII.2015 (1 ex.), 17.IV.2017 (1 ex.), 1.VI.2017 (1 ex.), 23.IV.2018 (1 ex.), 27.IV.2018 (1 ex.).

Conistra erythrocephala ([Denis & Schiffermüller], 1775)
Records. 10.X.2017 (1 ex.).

Conistra rubiginea ([Denis & Schiffermüller], 1775)
Records. 28.X.2016 (1 ex.), 10.X.2017 (1 ex.).

Cosmia trapezina (Linnaeus, 1758)
Records. 28.VIII.2015 (1 ex.), 5.IX.2016 (1 ex.), 1.VI.2017 (1 ex.).

Craniophora ligustri ([Denis & Schiffermüller], 1775)
Records. 20.VIII.2015 (1 ex.), 20.VIII.2017 (1 ex.).

Cucullia verbasci (Linnaeus, 1758)
Records. 15.V.2002 (3 exx.).

Deltote pygarga (Hufnagel, 1766)
Records. 25.VI.2013 (1 ex.), 6.VII.2016 (1 ex.), 1.VI.2017 (1 ex.).

Diachrysia nadeja (Oberthür, 1880) (Fig. 35)
Records. 23.VIII.2017 (1 ex.).

Diachrysia stenochrysis (Warren, 1913) (Figs. 32-34)
Records. 10.V.2015 (4 exx.), 10.V.2016 (3 exx.), 31.VII.2016 (1 ex.), 5.IX.2016 (1 ex.), 23.V.2017 (2 exx.), 25.V.2017 (1 ex.), 2.VII.2018 (1 ex.), 9.IX.2018 (1 ex.), 23.V.2019 (1 ex.), 24.IX.2019 (2 exx.).
Reputedly difficult to distinguish from f. *juncta* Tutt, 1892 of its sibling *Diachrysia chrysitis* (Linnaeus, 1758), though statistically significant spectral differences have recently been noted between the two taxa (Dyba *et al.*, 2022). Our specimens have all been tentatively assigned to *D. stenochrysis* as no typical *D. chrysitis* was observed.

Diachrysia zosimi (Hübner, [1819-1822]) (Figs. 28-31)
Records. 17.V.2015 (1 ex.), 25.V.2015 (1 ex.), 7.V.2016 (1 ex.), 20.V.2016 (1 ex.), 25.V.2016 (1 ex.), 25.VIII.2016 (2 exx.), 5.IX.2016 (2 exx.), 25.IV.2017 (1 ex.), 13.V.2017 (1 ex.), 23.V.2017 (1 ex.), 25.V.2017 (1 ex.), 29.V.2017 (1 ex.), 8.V.2018 (1 ex.), 2.VII.2018 (2 exx.), 5.VII.2018 (1 ex.), 8.IX.2019 (1 ex.), 20.V.2020 (1 ex.).

Dypterygia scabriuscula (Linnaeus, 1758)
Records. 25.V.2015 (2 exx.), 25.V.2017 (1 ex.), 15.VI.2017 (1 ex.), 30.V.2018 (1 ex.), 5.VII.2018 (2 exx.), 25.VII.2018 (1 ex.).

Elaphria venustula (Hübner, [1800-1803])
Records. 29.V.2017 (1 ex.), 9.V.2018 (1 ex.).

Eucarta virgo (Treitschke, 1835) (Fig. 8)
Records. 30.V.2015 (3 exx.), 28.V.2017 (1 ex.), 1.VI.2017 (4 exx.), 20.V.2018 (5 exx.), 29.V.2018 (1 ex.), 19.V.2020 (1 ex.).

Euplexia lucipara (Linnaeus, 1758)
Records. 18.III.2017 (1 ex.), 7.V.2017 (1 ex.), 25.V.2017 (2 exx.), 1.VI.2017 (3 exx.).

Eupsilia transversa (Hufnagel, 1766)
Records. 30.X.2017 (1 ex.).

Hadula trifolii (Hufnagel, 1766)
Records. 24.IX.2019 (1 ex.).

Helicoverpa armigera (Hübner, [1803-1808])
Records. 26.VIII.2016 (2 exx.), 28.X.2016 (2 exx.), 15.X.2017 (2 exx.).

Heliothis viriplaca (Hufnagel, 1766)
Records. 28.VIII.2016 (1 ex.), 5.IX.2016 (1 ex.), 2.VII.2018 (3 exx.), 28.VII.2018 (1 ex.).

Hoplodrina ambigua ([Denis & Schiffermüller], 1775)
Records. 25.V.2015 (1 ex.), 18.V.2016 (1 ex.), 29.V.2017 (1 ex.), 1.VI.2017 (2 exx.), 20.V.2018 (1 ex.).

Hoplodrina octogenaria (Goeze, 1781)
Records. 18.V.2015 (1 ex.), 20.V.2018 (1 ex.).

Hoplodrina respersa ([Denis & Schiffermüller], 1775)
Records. 20.VI.2015 (1 ex.).

Hyphilare albipuncta ([Denis & Schiffermüller], 1775)
Records. 27.V.2015 (2 exx.), 2.VII.2015 (1 ex.), 26.VIII.2016 (1 ex.), 25.V.2017 (3 exx.), 1.VI.2017 (1 ex.), 10.X.2017 (2 exx.), 17.X.2017 (2 exx.), 20.V.2018 (2 exx.), 1.VI.2018 (2 exx.), 2.VII.2018 (1 ex.).

Hyphilare congrua (Hübner, [1814-1817])
Records. 25.V.2015 (1 ex.), 13.V.2016 (3 exx.), 25.V.2016 (1 ex.), 1.VI.2016 (1 ex.), 26.VIII.2016 (1 ex.), 17.X.2016 (2 exx.), 25.V.2017 (3 exx.), 12.VIII.2017 (2 exx.), 19.V.2020 (1 ex.).

Hyphilare ferrago (Fabricius, 1787) (Fig. 5)
Records. 25.V.2015 (1 ex.), 1.IX.2016 (1 ex.).

Hyphilare l-album (Linnaeus, 1767)
Records. 10.V.2017 (1 ex.), 15.V.2017 (1 ex.).

Ipimorpha subtusa ([Denis & Schiffermüller], 1775) (Fig. 9)
Records. 25.V.2015 (2 exx.), 30.V.2015 (1 ex.), 10.VI.2015 (2 exx.), 17.X.2016 (1 ex.), 25.V.2017 (1 ex.), 28.V.2017 (2 exx.).

Lacanobia oleracea (Linnaeus, 1758) (Fig. 17)
Records. 25.V.2017 (5 exx.), 28.V.2017 (3 exx.), 23.IV.2018 (2 exx.).

Lacanobia splendens (Hübner, [1803-1808])
Records. 25.V.2015 (1 ex.), 10.VI.2017 (1 ex.).

Lacanobia suasa ([Denis & Schiffermüller], 1775) (Fig. 18)
Records. 25.IV.2017 (1 ex.), 25.V.2017 (1 ex.), 1.VI.2017 (5 exx.).

Lacanobia w-latinum (Hufnagel, 1766)
Records. 28.V.2016 (2 exx.).

Lateroligia ophiogramma (Esper, 1793) (Fig. 15)
Records. 1.VI.2017 (1 ex.), 10.VI.2017 (1 ex.), 15.VI.2017 (2 exx.), 20.V.2018 (1 ex.).

Leucania obsoleta (Hübner, [1800-1803]) (Fig. 20)
Records. 20.V.2016 (2 exx.), 25.V.2016 (2 exx.), 29.VI.2016 (1 ex.), 13.V.2017 (2 exx.), 1.VI.2017 (1 ex.), 17.X.2017 (1 ex.), 1.VI.2018 (1 ex.), 3.VI.2018 (1 ex.), 23.V.2019 (1 ex.).

Macdunnoughia confusa (Stephens, 1850) (Fig. 27)
Records. 5.V.2015 (1 ex.), 15.VI.2015 (1 ex.), 22.VIII.2016 (1 ex.), 30.IV.2017 (1 ex.), 1.VI.2017 (1 ex.), 17.IV.2018 (1 ex.), 20.VI.2018 (3 exx.), 2.VII.2018 (2 exx.).

Mamestra brassicae (Linnaeus, 1758)
Records. 20.V.2015 (3 exx.), 20.VIII.2016 (3 exx.), 25.VIII.2017 (2 exx.).

Mesapamea secalella Remm, 1983
Records. 25.VI.2015 (1 ex.), 25.VIII.2015 (1 ex.), 25.VI.2016 (1 ex.), 11.VI.2017 (1 ex.*), 10.VI.2018 (2 exx.).

Moma alpium (Osbeck, 1778)
Records. 10.V.2015 (1 ex.), 26.VIII.2016 (1 ex.), 15.IV.2017 (1 ex.), 20.IV.2018 (1 ex.).

Mormo maura (Linnaeus, 1758)
Records. 10.VI.2015 (6 exx.), 20.VI.2016 (2 exx.), 1.VI.2017 (1 ex.), 2.VII.2018 (1 ex.).

Mythimna turca (Linnaeus, 1761)
Records. 18.V.2015 (2 exx.), 27.V.2015 (1 ex.), 1.V.2017 (2 exx.), 23.V.2017 (1 ex.), 1.VI.2017 (3 exx.), 1.VI.2018 (5 exx.), 19.V.2020 (2 exx.).

Naenia typica (Linnaeus, 1758) (Fig. 22)
Records. 1.VI.2015 (1 ex.), 20.V.2017 (3 exx.), 1.VI.2017 (1 ex.), 31.V.2018 (1 ex.), 1.VI.2018 (2 exx.), 25.V.2020 (1 ex.), 27.V.2020 (1 ex.).

Noctua fimbriata (Schreber, 1759)
Records. 31.V.2018 (1 ex.), 25.V.2020 (1 ex.).

Noctua janthina ([Denis & Schiffermüller], 1775)
Records. 5.VI.2015 (1 ex.), 10.VI.2015 (3 exx.).

Noctua pronuba (Linnaeus, 1758)
Records. 28.V.2017 (1 ex.), 29.V.2017 (1 ex.), 23.V.2018 (2 exx.).

Ochropleura leucogaster (Freyer, [1831])
Records. 12.IV.2018 (1 ex.), 25.V.2018 (1 ex.).

Ochropleura plecta (Linnaeus, 1761)
Records. 10.VI.2015 (1 ex.), 16.V.2016 (1 ex.), 27.VI.2016 (1 ex.), 7.VIII.2017 (1 ex.), 8.V.2018 (1 ex.), 10.VI.2018 (1 ex.), 30.IV.2019 (1 ex.), 23.V.2019 (1 ex.).

Oligia latruncula ([Denis & Schiffermüller], 1775)
Records. 27.V.2015 (1 ex.), 23.V.2017 (1 ex.*), 1.VI.2017 (2 exx.), 20.VI.2017 (2 exx.), 8.V.2018 (1 ex.), 10.VI.2018 (2 exx.), 19.V.2020 (1 ex.*).

Orbona fragariae (Esper, 1794) (Fig. 11)
Records. 14.III.2017 (1 ex.).

Orthosia cerasi (Fabricius, 1775)
Records. 17.III.2017 (3 exx.), 16.III.2018 (5 exx.), 7.IV.2018 (2 exx.), 2.IV.2019 (1 ex.).

Orthosia cruda ([Denis & Schiffermüller], 1775)
Records. 19.V.2015 (1 ex.), 4.III.2017 (1 ex.), 14.III.2017 (5 exx.), 18.III.2017 (3 exx.), 16.III.2018 (1 ex.).

Orthosia gothica (Linnaeus, 1758)
Records. 10.III.2016 (3 exx.), 18.III.2017 (2 exx.), 20.III.2017 (3 exx.), 6.IV.2018 (3 exx.), 2.IV.2019 (1 ex.).

Orthosia incerta (Hufnagel, 1766)
Records. 10.III.2015 (2 exx.), 13.III.2016 (2 exx.), 17.III.2017 (4 exx.), 27.III.2018 (2 exx.).

Orthosia populeti (Fabricius, 1787)
Records. 16.III.2018 (1 ex.).

Orthosia gracilis ([Denis & Schiffermüller], 1775) (Fig. 16)
Records. 5.IV.2018 (2 exx.), 6.IV.2018 (2 exx.), 17.IV.2018 (3 exx.).

Orthosia miniosa ([Denis & Schiffermüller], 1775)
Records. 14.III.2017 (1 ex.), 26.III.2017 (1 ex.), 6.IV.2018 (2 exx.), 24.III.2019 (2 exx.), 26.III.2019 (2 exx.).

Papestra biren (Goeze, 1781)
Records. 23.V.2017 (1 ex.).

Parastichtis suspecta (Hübner, [1814-1817])
Records. 27.V.2015 (1 ex.).

Peridroma saucia (Hübner, [1803-1808])
Records. 1.X.2017 (1 ex.).

Phlogophora meticulosa (Linnaeus, 1758)
Records. 25.V.2015 (1 ex.), 16.V.2016 (1 ex.), 13.V.2017 (1 ex.), 15.IV.2018 (1 ex.), 25.IV.2018 (2 exx.), 6.V.2018 (1 ex.), 29.V.2018 (1 ex.), 31.V.2018 (1 ex.), 2.VII.2018 (1 ex.), 19.V.2020 (1 ex.).

Phragmatiphila nexa (Hübner, [1803-1808]) (Fig. 13)
Records. 5.IX.2016 (1 ex.), 12.VIII.2017 (2 exx.).

Plusia festucae (Linnaeus, 1758) (Figs. 37-39)
Records. 17.V.2015 (1 ex.), 10.VI.2015 (1 ex.), 15.VI.2015 (2 exx.), 20.VI.2015 (2 exx.), 19.IX.2016 (3 exx.), 17.X.2016 (1 ex.), 12.VIII.2017 (2 exx.), 21.VIII.2019 (1 ex.).

Pseudaletia unipuncta (Howarth, 1809)
Records. 28.V.2018 (1 ex.), 12.X.2015 (3 exx.), 29.VI.2016 (1 ex.), 26.VIII.2016 (1 ex.), 12.VIII.2017 (1 ex.), 10.X.2017 (1 ex.), 17.X.2017 (2 exx.), 2.VII.2018 (1 ex.).

Pyrrhia umbra (Hufnagel, 1766)
Records. 20.VI.2015 (2 exx.), 25.VI.2015 (1 ex.), 20.X.2015 (1 ex.), 22.VIII.2016 (1 ex.), 29.V.2017 (1 ex.), 1.VI.2017 (1 ex.).

Rhizedra lutosa (Hübner, [1800-1803]) (Fig. 12)
Records. 10.X.2017 (1 ex.), 24.X.2017 (1 ex.).

Sablia sicula (Treitschke, 1835)
Records. 5.V.2016 (1 ex.).

Senta flammea (Curtis, 1828) (Fig. 21)
Records. 11.IV.2017 (2 exx.), 13.IV.2017 (1 ex.), 21.IV.2017 (2 exx.), 25.IV.2017 (2 exx.), 27.IV.2017 (1 ex.), 30.IV.2017 (2 exx.), 10.V.2017 (2 exx.), 25.V.2017 (1 ex.), 21.IV.2018 (1 ex.), 23.IV.2018 (1 ex.).

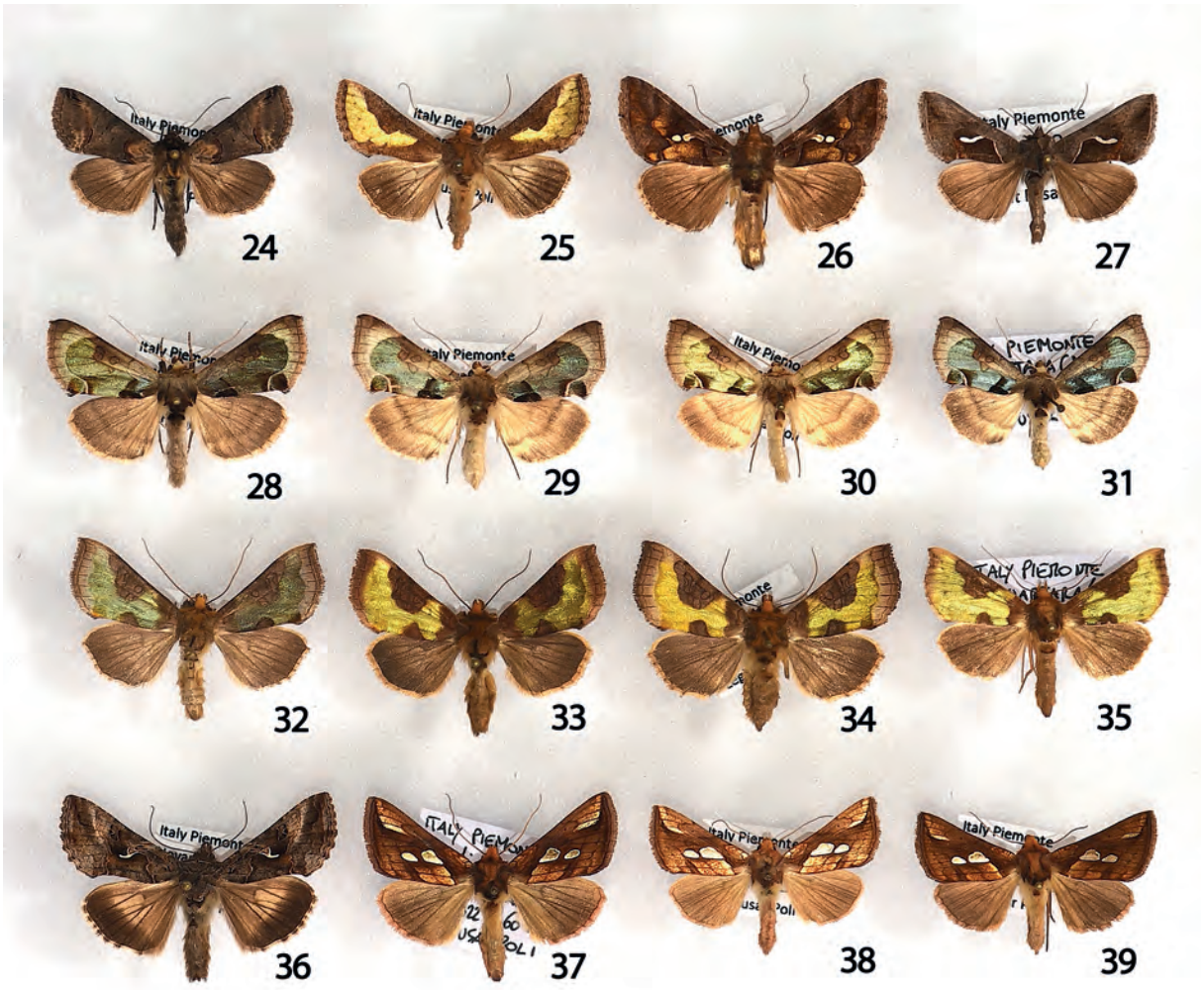
Sideridis rivularis (Fabricius, 1775)
Records. 25.IV.2018 (1 ex.), 27.IV.2018 (1 ex.), 8.V.2018 (1 ex.).

Thysanoplusia orichalcea (Fabricius, 1775) (Fig. 25)
Records. 17.X.2016 (1 ex.).

Trachea atriplicis (Linnaeus, 1758)
Records. 25.V.2015 (5 exx.), 7.V.2017 (1 ex.), 1.VI.2017 (3 exx.), 20.V.2018 (2 exx.), 29.V.2018 (1 ex.), 2.VII.2018 (1 ex.).

Tyta luctuosa ([Denis & Schiffermüller], 1775)
Records. 25.VI.2015 (1 ex.), 2.VII.2018 (1 ex.), 11.V.2019 (1 ex.), 12.V.2020 (1 ex.), 15.V.2020 (2 exx.).

Xestia c-nigrum (Linnaeus, 1758)
Records. 24.IV.2015 (1 ex.), 27.V.2015 (1 ex.), 24.IV.2016 (1 ex.), 16.VII.2016 (2 exx.), 7.V.2017 (1 ex.), 19.V.2020 (5 exx.).



Figs. 24-39. Species of Plusiinae (Noctuidae) from the Torrion Quartara site. 24) *Abrostola triplasia*; 25) *Thysanoplusia orichalcea*; 26) *Chrysodeixis chalcites*; 27) *Macdunnoughia confusa*; 28-31) *Diachrysia zosimi*; 32-34) *Diachrysia stenochrysis*; 35) *D. nadeja*; 36) *Autographa gamma*; 37-39) *Plusia festucae*.

Discussion

Despite our sampling was not standardized, as we avoided the use of stationary light traps to expressly avoid impacting the moth populations, we consider its duration over a time span of 6 years (2015-2020) with 228 visits, plus four spot visits before 2015 (totaling 6 specimens), to have been as extensive enough as to smoothen statistical fluctuations, thus allowing us to draw some general figures from the survey. However, this remains always a semi-quantitative one, which partly explains for the comparatively low absolute figures of individuals recorded, as compared to standardized quantitative trapping that makes use of killing chemical agents, in addition to the fact that the study area stands as a restricted ecological island in a landscape deeply affected by agricultural practices.

As already noted above, we recorded 214 macromoth species of 12 families, overwhelmingly Noctuidae, that with 115 species scored over the half (53.7%) of the site's richness, followed by Erebidae (N=32, 15%), Geometridae (N=26, 12.1%), Notodontidae (N=12, 5.6%), Sphingidae (N=9, 4.2%), Nolidae

and Drepanidae, with 5 species each (2.3%), Lasiocampidae and Cossidae, with 3 species each (1.4%), Saturniidae (N=2, 0.9%), and Psychidae and Hepialidae, with one species each (0.5%) [percentages rouded up to the first decimal] (Tab. 1). In terms of individuals, these were 1,032, but the abundance of Noctuidae was even more evident, with 646 specimens recorded (62.5%). The ranks of Erebidae and Geometridae based on individuals remained the same as that with species richness, second and third respectively, although with a marked decrease in the abundance of the latter (Tab. 1). In general, there was a set of five families, namely Geometridae, Notodontidae, Sphingidae, Drepanidae and Cossidae, that were observed all with a range of specimens comprised between 36-42. For the last two families, this contrasts with the low number of species present and was due to the relatively high presence of characteristic species of humid zones such as *Habrosyne pyritoides* and *Phragmataecia castaneae*. In fact, the average number of specimens per species (ratio N_{exx}/N_{spp} in Tab. 1) has been among the highest for these two families, 7.6 and 12, respectively. In contrast, the lowest such values, which may be viewed as a measure of how monotonous (high)/heterogeneous (low) the families are in the environment, have been noted for the Geometridae (1.615) and Hepialidae (1), but the datum for the latter family is non-significant, having been recorded after only one specimen.

A subset of 732 individuals was sexed, 429 of which turned out to be males (M) and 303 females (F), which returned a sex ratio (M : F) of 1.42 : 1, which is far less skewed therefore towards males with respect to results obtained with strictly quantitative sampling in pure wetlands (cf. Zilli *et al.*, 2014). Such an outcome has likely to be ascribed to the influence of other search methods in addition to light trapping in the results of the sampling.

The temporal distribution of occupancy of the study site by species at the adult stage ("monthly species richness" in Fig. 40) revealed a clear peak during months of middle-late spring (and first summer decade) (years cumulated), that is April-June, with 51

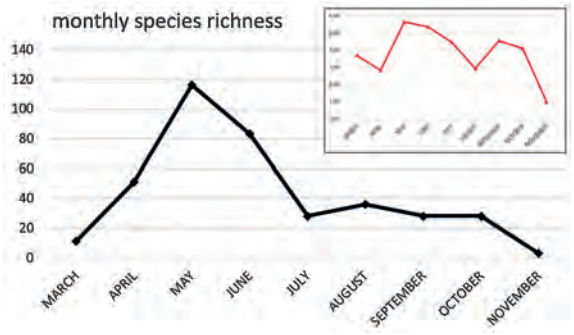


Fig. 40. Number of species on the wing observed per month (years cumulated) in the study area. In the inset, the values have been averaged per number of visits spent during the various months.

Tab. 1. Results from the survey on macromoths from the surroundings of Torrion Quartara.

Families by N_{spp} rank	**N_{spp}**	**%**	**N_{exx}**	**%**	**Rank by N_{exx}**	**Ratio N_{exx}/N_{spp}**
Noctuidae	115	53.7	646	62.5	1	5.6
Erebidae	32	15.0	156	15.0	2	4.9
Geometridae	26	12.1	42	4.1	3	1.6
Notodontidae	12	5.6	39	3.8	5	3.3
Sphingidae	9	4.2	40	3.9	4	4.4
Nolidae	5	2.3	14	1.4	8	2.8
Drepanidae	5	2.3	38	3.7	6	7.6
Lasiocampidae	3	1.4	6	0.6	10	2
Cossidae	3	1.4	36	3.5	7	12
Saturniidae	2	1.0	4	0.4	11	2
Psychidae	1	0.5	10	1.0	9	10
Hepialidae	1	0.5	1	0.1	12	1

N, number; exx, specimens; spp, species; %, percentage.

(April), 116 (May), and 83 (June) species on the wing. However, considering that the sampling effort has been very different between the months if the above results are normalized after the number of visits performed during each month (years cumulated), a bimodal trend becomes evident, with a main peak still in spring that however extends from May into middle summer and, following a trough in August, a second peak from late summer to middle autumn (inset frame in Fig. 40).

An analysis of chorotypes of 212 species occurring in the area, *Samia cynthia* and *Hyphantria cunea* having been excluded in that introduced from the Eastern Palaearctic and Nearctic regions, respectively, returned the percentage breakdown illustrated in Fig. 41, from which the marked prevalence of Asiatic-European (ASE: 35.8%), Palaearctic (PAL: 11.8%) and European (EUR: 9%) elements can be drawn. These figures, compared to the low incidence of Mediterranean elements (*e.g.*, Mediterranean-MED + Afrotropico-Mediterranean-AFM + Turano-Mediterranean-TUM = 2.8%), evidently reflect the continental eco-geographic conditions of the Torrion-Quartara district, though the ingression of thermo-Mediterranean species is expected to increase should current trends of global warming proceed any further. A number of thermophilous vagrant species has in fact already been recorded in the site, *e.g.*, *Grammodes stolida*, *Dysgonia algira*, *Thysanoplusia orichalcea* and *Amphipyra berbera* (Fig. 23) which shows exposure of the area to immigration of elements from the south.

The local moth assemblage is characterized by a remarkably high incidence of hygrophilous elements. These may be broadly sorted between strict marshland species associated with helophytes and elements characteristic of either riparian woods with rich undergrowth of herbaceous plants or of open humid meadows. Among the former one finds, to name just some, *Acronicta albovenosa*, *Archanara neurica*, *Macrochilo cribrumalis*, *Phragmataecia castaneae*, *Phragmatiphila nexa*, *Rhizedra lutosa* and *Senta flammea*, while as examples of the second group *Actinotia polyodon*, *Aletia pallens*, *Apamea unanimis*, *Apterogenum ypsillon*, *Cerura erminea*, *Eucarta virgo*, *Lacanobia splendens*, *Mythimna turca*, *Naenia typica*, *Plusia festucae* and *Smerinthus ocellata* may be noted.

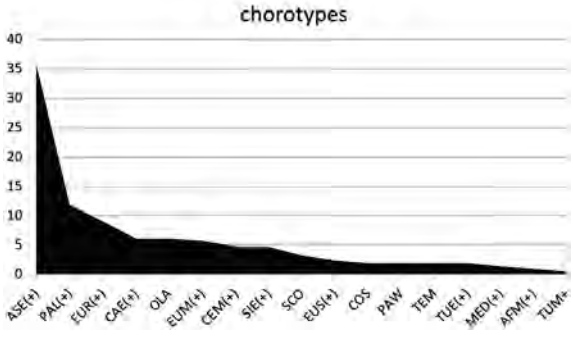


Fig. 41. Percentage breakdown of the chorotypes of species sampled in the study site, where the symbol "+" refers to extra-limital extensions of the main chorotype (acronyms and definitions after Parenzan, 1994).

The richness of such components points to the area as one still retaining a remarkable environmental quality, a circumstance that is further evidenced by the comparatively low presence, both in terms of taxa and individuals, of species characteristic of coltural habitats such as *Hadula trifolii*, *Helicoverpa armigera* or *Mamestra brassicae*.

Noteworthy for their scarceness in the Po Valley, when not in Italy overall, are some species characteristic of extremely localized lowland (sub)humid habitats that are threatened by farming and urban developments, *i.e.*, *Diachrysia nadeja* and *D. zosimi*, whose populations are nowadays markedly scattered in North Italy and often settled in 'microareas' of the dramatically low surface. These are members of the noctuid subfamily Plusiinae, which with nine species turned out to be particularly well represented in the biotope (Figs. 24-39). In particular, *D. nadeja* is a so-called 'transpalaearctic' species occurring in Europe in very isolated areas with continental temperate features, known in Italy only from Friuli-Venezia Giulia (Deutsch, 2009; Huemer & Morandini, 2006) and only generically from Piedmont (Hellmann & Parenzan, 2010). Essentially similar distribution and ecological requirements are those of *D. zosimi*, a species whose larvae primarily feed on *Sanguisorba officinalis* L. (Kasy, 1953), of which very few localized populations exist in Northern Italy and that had been recorded in Piedmont only from Dogliani (CN), Costanzana-Saletta (VC) and Miasino (NO) (Cabella & Fiori, 2010; Ghiliani, 1852; Hellmann & Parenzan, 2010). Notable was also the abundance of *D. zosimi* and other localised species such as *Proserpinus proserpina*, the latter included in the EU Habitat Directive.

Conclusions

Our survey of macromoths at Torrion Quartara led to the identification of a number of species that is not extraordinarily high, compared for example to the species richness expressed by mountain prairies, but analyzing the faunal composition and the ecological preferences of the individual species occurring in the area the local presence of a remarkably rich, highly specialized meso-hygrophilous fauna becomes evident. In this respect, the site appears as a unique remnant of the mosaic of lowland temperate continental woodland and humid environments that were once more widespread in the Po Valley. Both the overall faunal assemblage and particular species present call therefore for the accurate preservation of this environmental 'gem' in the Novara province. The high concentration of rare species characteristic of cool temperate habitats seems to locally match the climatic 'rarity' of the area in the current landscape and be thus in agreement with predictions set by Ohlemueller *et al*. (2008), who also stressed the special vulnerability of such ecosystems to climate change.

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