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Lepidoptera recorded in the Val Piora (Canton Ticino, Switzerland). Summers 2009-2011

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Abstract: Fifty-four species of Lepidoptera (31 butterfly species including two species of skippers, 23 moth species) were recorded at Piora Centro di Biologia Alpina during July 2009 and July-August 2010 and 2011 by visiting students and faculty from Georgia Southern University, USA. Tabulated accounts including collection records are provided for each species. Thirty-nine (72%) of the recorded Lepidoptera taxa are considered to be alpine specialists; most of the remaining taxa are widespread in Europe. Some widespread species are represented by distinct alpine subspecies at Piora.

Key words: Lepidoptera, Val Piora, Ticino Canton, butterflies, moths, southern Swiss Alps, biodiversity

Lepidotteri della Val Piora (Canton Ticino, Svizzera). Estate 2009-2011.

Riassunto: Durante i mesi di giugno del 2009 e di luglio del 2010 e 2011, studenti di biologia della Georgia Southern University (U.S.A.) in visita al Centro di Biologia Alpina di Piora raccolsero 54 specie di lepidotteri (31 specie di farfalle e 23 di falene). Di queste, 39 (72%) sono specie associate all'ambiente alpino, mentre le altre sono diffuse in tutt'Europa. Alcune di queste specie diffuse, sono però rappresentate nella regione di Piora da sottospecie endemiche alpine.

Parole chiavi: Lepidoptera, Val Piora, Canton Ticino, farfalle, falene, Alpi svizzere meridionali, biodiversità.

INTRODUCTION

During July 2009 and July-August 2010 and 2011, students from the Department of Biology at Georgia Southern University (GSU), in Statesboro, Georgia, USA completed field projects at Piora under the direction of LB. Some of these projects involved Lepidoptera (butterflies and moths) and some specimens were recorded or collected as part of these studies. We report here on the Lepidoptera species recorded at Piora during these stays. Our work was originally not linked with the "Biodiversity Days" event which took place in Piora in Summer 2010. However, as we were able to collect several species of nocturnal Lepidoptera not reported by PALMI *et al.* (2012), we are presenting these data as a complement to their work.

MATERIALS AND METHODS

Specimens were collected either with aerial nets, sweep nets or with CDC light traps (with U.V. LEDs) at the following sites which are listed in Table 1:

- site 1: 46°32'16"N, 8°42'37"E; 1864 m asl;
- site 2: 46°32'30"N, 8°43'02"E; 1850 m asl;
- site 3: 46°32'40"N, 8°43'10"E; 1980 m asl;
- site 4: 46°33'45"N, 8°43'40"E; 1960 m asl;
- site 5: Lake Ritom Didactic trail (approximate rectilinear line between 46°32'03"N, 8°40'36"E and 46°32'33"N, 8°40'27"E);
- site 6: trail from Cadagno to Passo Colombe, ~2000-2280 m asl;
- site 7: 46°32'35.43"N, 8°43'25.90"E; ~1850 m asl.

Precise localities were not recorded in July 2009. Specimens were stored in glassine envelopes in the field so they could later be rehydrated ("relaxed"), pinned, spread and identified following standard techniques. Macrophotographs were prepared using a Visionary Digital BK Plus Lab system camera. Pinned, labeled specimens are deposited at GSU and vouchers will also be deposited at the Museo Cantonale di Storia Naturale (Lugano, Switzerland). The genitalia of some specimens were cleared in 10% potassium hydroxide, dissected away from other abdominal structures, and then slide-mounted.

RESULTS

Thirty-one species of butterflies (including two species of skippers) and 23 species of moths were recorded at Piora. Collection data for the 54 species of Lepidoptera are shown in Table 1. Representative specimens are depicted in Plate 1.

Table 1 - List of species collected in the Piora Valley, with collection data. * = Alpine specialist or endemic taxa; M = male(s), F = Female(s); n/e = not established; n/r = not recorded; site coordinates are given in the text. Nomenclature and larval foodplants follow Vorbrodt (1931), Higgins & Riley (1970), Tolman & Lewington (1997), Chinery (1998), Skinner (1998), Leraut (2006, 2007, 2009) and Robineau (2007).

family	species	date	collection method	site	number (sex)	larval foodplant(s)
Papilionidae	* *Parnassius apollo* (L., 1758)	Jul, 2009	filmed	site 8	3 (n/e)	*Sedum* spp.
Pieridae	*Aporia crataegi* (L., 1758)	28 Jul, 2010	net	site 1	1 (n/e)	*Prunus* spp.
Pieridae	* *Artogeia bryoniae* (Hübner, 1806)	Jul, 2009; 26-28 Jul, 2010	net	site 1	4 M	Brassicaceae
Pieridae	*Artogeia napi* (L., 1758)	Jul, 2009	net	n/r	1 M	Brassicaceae
Pieridae	*Artogeia rapae* (L., 1758)	Jul, 2009	net	n/r	2 F	Brassicaceae
Pieridae	*Colias crocea* (Fourcroy, 1785)	Jul, 2009	net	n/r	1 M	Fabaceae
Pieridae	* *Colias palaeno* (L., 1761)	Jul, 2009	net	n/r	1 M, 1 F	*Vaccinium uliginosum*; *V. myrtillus*
Pieridae	* *Colias phicomone* (Esper, 1780)	3 Aug, 2010	net	site 4	1 F	*Hyppocrepis comosa*; *Trifolium repens*; *Lotus corniculatus*
Lycaenidae	* *Lycaena hippothoe eurydame* (Hoffmannsegg, 1806)	Jul, 2009; 3 Aug, 2010	net	site 4	4 M, 1 F	*Polygonum bistorta*, *Rumex acetosa*
Lycaenidae	* *Lycaena tityrus subalpinus* (Speyer, 1851)	4 Aug, 2010	net	site 1	1 F	*Rumex* spp.
Lycaenidae	* *Eurymedon eumedon* (Esper, 1780)	Jul, 2009	net	n/r	1 F	*Geranium* spp.
Lycaenidae	*Cupido minimus* (Fuessli, 1775)	Jul, 2009; 3 Aug, 2010	net	site 3	12 (n/e)	*Anthyllis vulneraria*
Lycaenidae	* *Plebejus argus aegidion* (Meisner, 1818)	3 Aug, 2010	net	sites 3, 4	1 M, 3 F	Fabaceae
Lycaenidae	* *Polyommatus eros* (Ochsenheimer, 1808)	Jul, 2009	net	n/r	1 M	*Oxytropis halleri*; *O. campestris*
Nymphalidae	* *Boloria pales palustris* (Frühstorfer, 1909)	Jul, 2009; 3 Aug, 2010	net	sites 1, 4	4 (n/e)	*Viola calcarata*
Nymphalidae	* *Boloria titania cypris* (Meigen, 1828)	4 Aug, 2010	net	site 1	1 (n/e)	*Polygonum bistorta*
Nymphalidae	*Brentis ino* (Rottemburg, 1775)	3 Aug, 2010	net	sites 1, 3	2 (n/e)	*Filipendula ulmaria*
Nymphalidae	*Clossiana euphrosyne* (L., 1758)	28 Jul, 2010	net	site 1	1 M, 1 F	*Viola* spp.
Nymphalidae	* *Euphydryas aurinia debilis* (Oberthür, 1909)	Jul, 2009	net	n/r	2 (n/e)	*Gentiana* spp.; *Primula viscosa*
Nymphalidae	*Vanessa cardui* (L., 1758)	Jul, 2009	net	n/r	1 (n/e)	various plant families and species
Nymphalidae	* *Coenonympha darwiniana* (Staudinger, 1871)	Jul, 2009; 3 Aug, 2010	net	sites 1, 3	5 M, 1 F	Grasses?
Nymphalidae	* *Erebia alberganus* (de Prunner, 1798)	Jul, 2009	net	n/r	1 M, 2 F	*Festuca ovina*; *Anthoxanthum odoratum*
Nymphalidae	* *Erebia euryale adyte* (Hübner, 1822)	26-31 Jul & 1-3 Aug 2010	net	sites 1, 2, 3, 4	12 M, 4 F	various grasses
Nymphalidae	* *Erebia melampus* (Fuessli, 1775)	1 Aug, 2010	net	n/r	1 (n/e)	various grasses
Nymphalidae	* *Erebia meolans* (de Prunner, 1798)	31 Jul & 1-3 Aug, 2010	net	sites 3, 5, 6	3 (n/e)	various grasses
Nymphalidae	* *Erebia mnestra* (Hübner, 1804)	Jul , 2009	net	n/r	1 M	*Festuca* spp.; *Sesleria varia*
Nymphalidae	* *Erebia pandrose* (Borkhausen, 1788)	31 Jul, 2010	net	site 6	2 M	various grasses
Nymphalidae	* *Erebia pharte* (Hübner, 1804)	31 Jul & 3 Aug, 2010	net	sites 4, 6	5 (n/e)	various grasses
Nymphalidae	* *Oeneis glacialis* (Moll, 1783)	31 Jul, 2010	net	site 6	1 F	*Festuca ovina*
Hesperiidae	* *Pyrgus alveus* (Hübner, 1803)	3 Aug, 2010	net	site 1	1 (n/e)	*Potentilla* spp.; *Helianthemum* spp.
Hesperiidae	*Pyrgus serratulae* (Rambur, 1839)	Jul, 2009	net	n/r	2 (n/e)	*Potentilla* spp.
Zygaenidae	* *Adscita alpina* (Alberti, 1937)	1 Aug, 2010	net	site 5	2 (n/e)	*Rumex* spp.
Zygaenidae	* *Zygaena exulans* (Hohenwarth, 1792)	Jul, 2009	net	n/r	2 (n/e)	*Astragalus, Rumex, Polygonum, Vaccinium, etc.*
Zygaenidae	* *Zygaena transalpina transalpina* (Esper, 1780)	1-3 Aug, 2010	net	site 4, 5	2 (n/e)	*Lotus, Coronilla, Hippocrepis*
Crambidae	*Catoptria* sp.	Jul, 2009; 31 Jul, 2010	sweep net	site 6	2 (n/e)	Grasses?
Crambidae	* *Udea alpinalis* (Denis & Schiffermüller, 1775)	Jul, 2009; 1 Aug, 2010	sweep net	site 1	1 (n/e)	*Senecio* spp.
Crambidae	* *Udea rhododendronalis* (Duponchel, 1834)	1 Aug, 2010	sweep net	site 5	2 (n/e)	*Rhododendron* & other plants
Crambidae	* *Udea uliginosalis* (Stephens, 1834)	29 Jul, 2011	sweep net	n/r	1 (n/e)	*Senecio* spp.
Lasiocampidae	* *Trichiura crataegi ariae* (Hübner, 1824)	29 Jul, 2011	CDC U.V. trap	site 7	1 M	Various shrubs & trees
Arctiidae	* *Setina aurita ramosa* (Fabricius, 1793)	Jul, 2009	net	n/r	1 (n/e)	Lichens
Geometridae	* *Aplocera praeformata* (Hübner, 1826)	3 Aug, 2010	net	n/r	1 (n/e)	*Hypericum perforatum*
Geometridae	* *Crocota pseudotinctaria* (Leraut, 1999)	Jul, 2009; 28-31 Jul & 1-3 Aug, 2010	net	sites 1, 2, 3, 5, 6	11 M	*Taraxacum officinale*
Geometridae	*Dysstroma citrata* (L., 1761)	29 Jul, 2011	CDC U.V. trap	site 7	1 (n/e)	*Salix* spp.; *Betula* spp.; *Vaccinium* spp.
Geometridae	* *Entephria caesiata* (Denis & Schiffermüller, 1775)	Jul, 2009; 3 Aug, 2010; 29 Jul, 2011	CDC U.V. trap	site 7 (2011 only)	7 (n/e)	*Salix* spp.; *Vaccinium* spp.
Geometridae	* *Epirrhoe molluginata* (Hübner, 1813)	28 Jul, 2010	sweep net	site 1	1 (n/e)	*Galium* spp.
Geometridae	*Eupithecia pusillata* (Denis & Schiffermüller, 1775)	3 Aug, 2010	CDC U.V. trap	n/r	1 (n/e)	*Juniperus* spp.
Geometridae	* *Glacies alpinata* (Scopoli, 1763)	31 Jul, 2010	sweep net	site 6	1 (n/e)	*Leontodon* spp.; *other plants*
Geometridae	* *Macaria brunneata* (Thunberg, 1784)	1-3 Aug, 2010	net	site 4, 5	4 (n/e)	*Vaccinium* spp.
Geometridae	* *Perizoma minorata* (Treitschke, 1828)	3 Aug, 2010	CDC U.V. trap	n/r	1 (n/e)	*Calluna*, *Euphrasia*
Geometridae	* *Psodos quadrifaria* (Sulzer, 1776)	Jul, 2009	net	n/r	1 (n/e)	various low-growing plants
Geometridae	* *Eulithis populata fuscata* (Meves, 1914)	29 Jul, 2011	CDC U.V. trap	site 7	1 (n/e)	*Calluna*, aspen, poplar, willow, etc.
Geometridae	*Xanthorhoe fluctuata* (L., 1758)	29 Jul, 2011	CDC U.V. trap	site 7	1 (n/e)	various low-growing plants
Geometridae	*Xanthorhoe montanata* (Denis & Schiffermüller, 1775)	Jul, 2009; 26-28 Jul, &; 3 Aug, 2010	net	1, 2, 3, 4	12 (n/e)	various low-growing plants
Geometridae	*Xanthorhoe decoloraria* (Esper, 1806)	3 Aug, 2010	CDC U.V. trap	n/r	1 (n/e)	*Alchemilla* & other low-growing plants

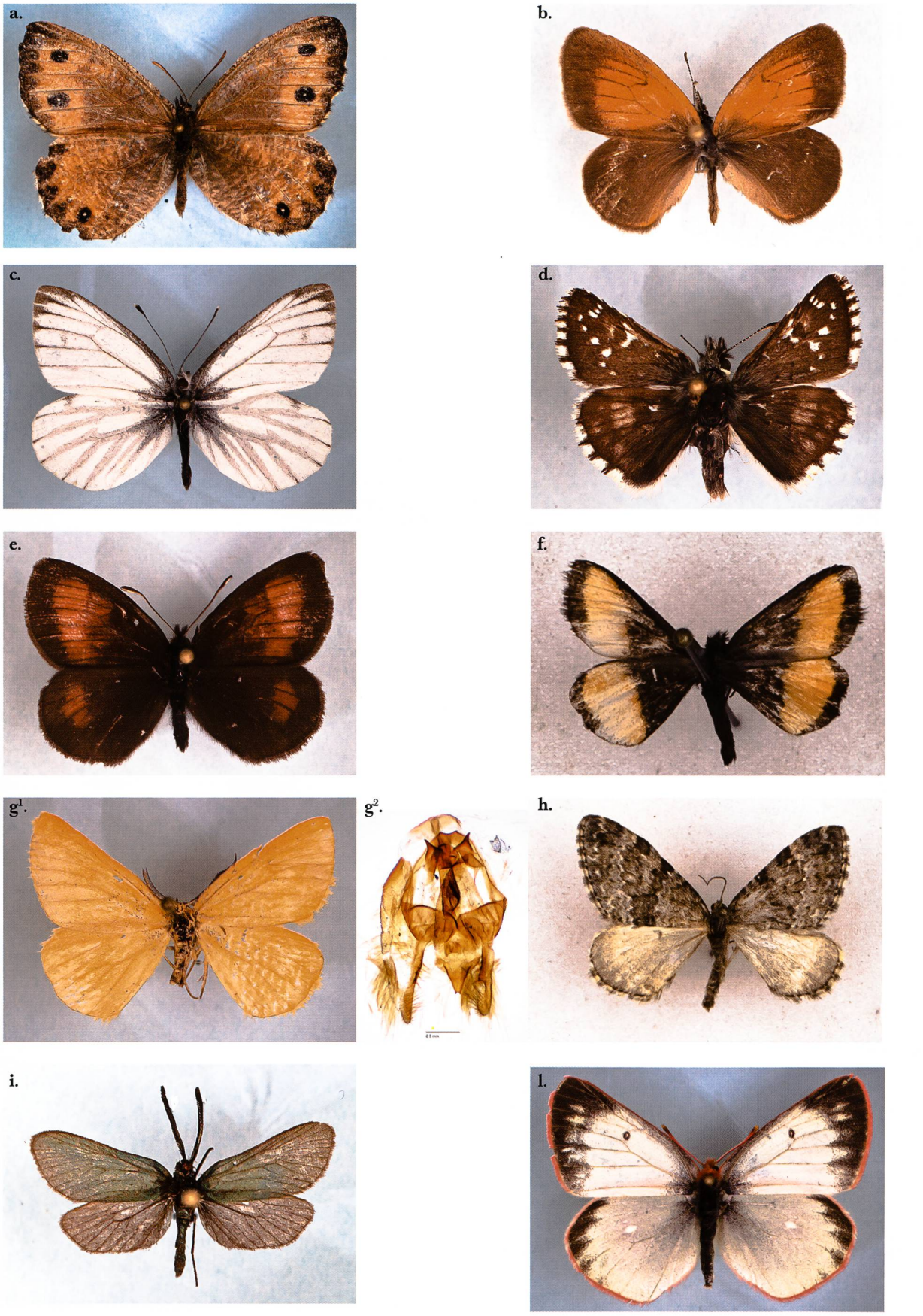

Plate 1: Representative specimens. **a.** *Oeneis glacialis* (Moll, 1783); **b.** *Coenonympha darwiniana* (Staudinger, 1871); **c.** *Artogeia bryoniae* (Hübner, 1806); **d.** *Pyrgus serratulae* (Rambur, 1839); **e.** *Erebia mnestra* (Hübner, 1804); **f.** *Psodos quadrifaria* (Sulzer, 1776); **g1.** *Crocota pseudotinctaria* (Leraut, 1999); **g2.** *Crocota pseudotinctaria* (male genitalia); **h.** *Entephria caesiata* (Denis & Schiffermüller, 1775); **i.** *Adscita alpina* (Alberti, 1937); **l.** *Colias palaeno* (L., 1761).

DISCUSSION

The Lepidoptera collection records presented here must be considered to include only a fraction of the species present at Piora. More in-depth collecting and recording protocols would be required to more thoroughly document this fauna including bait, pheromone and light trapping especially for moths. Because GSU students mostly worked in the field during the day time using hand-held insect nets, most of the records reported here involved using those techniques. However, running a CDC light trap provided records for some nocturnal and also for some typically diurnal moths. Although our butterfly records for Piora are similar to those reported by PALMI *et al.* (2011), we report 11 species not included in their list [*Parnassius apollo* (L., 1758), *Lycaena hippothoe* (L., 1761), *Lycaena tityrus* (Poda, 1761), *Eurymedon eumedon* (Esper, 1780), *Polyommatus eros* (Ochsenheimer, 1808), *Plebejus argus*, *Clossiana euphrosyne* (L., 1758), *Erebia mnestra* (Hübner, 1804), *Erebia meolans* (de Prunner, 1798), *Oeneis glacialis* (Moll, 1783) and *Vanessa cardui* (L., 1758)] and they recorded 18 species that we did not [*Papilio machaon* L., 1758, *Aricia artaxerxes* (Fabricius, 1793), *Plebejus idas* (L., 1761), *Plebejus optilete* (Knoch, 1791), *Plebejus orbitulus* (de Prunner, 1798), *Polyommatus coridon* (Poda, 1761), *Polyommatus semiargus* (Rottemburg, 1775), *Argynnis aglaja* (L., 1758), *Argynnis niobe* (L., 1758), *Boloria napaea* (Hoffmannsegg, 1804), *Erebia epiphron* (Knoch, 1783), *Erebia gorge* (Hübner, 1804), *Erebia montana* (de Prunner, 1798), *Erebia tyndarus* (Esper, 1781), *Melitaea athalia* (Rottemburg, 1775), *Vanessa atalanta* (L., 1758), *Hesperia comma* (L., 1758) and *Pyrgus cacaliae* (Rambur, 1839)].

Despite the preliminary nature of the lists reported here, we can deduce some significant information from the data. Firstly, our Lepidoptera samples from Piora show a distinctly alpine influence with 39 (72%) of 54 recorded taxa being alpine specialists. These taxa (species or subspecies) do not occur at low elevations and while some of them are widely distributed in Europe, several are only known from the Alps. Others have even more restricted distributions at particular elevations or regions within the Alps. For example, *Parnassius apollo* is a montane species that occurs (as differently recognized subspecies or forms in many cases) on mountains across much of mainland Europe (HIGGINS & RILEY 1970), whereas *Lycaena hippothoe eurydame* (Hoffmannsegg, 1806), *Oeneis glacialis*, and *Adscita alpina* (Alberti, 1937) are widely distributed in, but confined to the Alps, and *Coenonympha darwiniana* (Staudinger, 1871) and *Setina aurita ramosa* (Fabricius, 1793) are confined to certain sites within the Alps (TOLMAN & LEWINGTON 1997; LERAUT 2006, 2007, ROBINEAU 2007). In this respect, our record of *Erebia meolans* from the southern Alps is noteworthy.

The distribution of the diurnal geometrid moth *Crocota pseudotinctaria* (Leraut, 1999) within the Alps also appears to be quite restricted (REZBANYAI-RESER 2002, LERAUT 2009). This moth was described in 1999 when morphological analyses of the genitalia readily distinguished it from the phenotypically similar *Crocota tinctaria* (Hübner, 1799) which was described 200 years earlier. Both moth species are more or less confined to the Alps where they are patchily distributed but could occur sympatrically at some sites. In order to determine if one or both species occurred in our collections from Piora, we cleared the genitalia of all 11 specimens in 10% potassium hydroxide, dissected them away from other abdominal structures and then slide-mounted them. Microscopical examinations of these slides showed that all 11 specimens were males of *C. pseudotinctaria.*

Additional Lepidoptera species we recorded at Piora, such as *Colias palaeno* (L., 1761), *Boloria titania* (Esper, 1793), *Erebia pandrose* (Borkhausen, 1788), *Zygaena exulans* (Hohenwarth, 1792) and *Macaria brunneata* (Thunberg, 1784) occur at lower elevations in northern Europe but occur at progressively higher elevations with decreasing latitude in more southern montane habitats, such as the Alps, because of habitat and climate similarities (TOLMAN & LEWINGTON 1997, CHINERY 1998, SKINNER 1998, LERAUT 2009).

Some of the Lepidoptera species we recorded at Piora, also occur at lower elevations but as distinct phenotypes that are currently treated as different subspecies. Included in this category are the lycaenids *Lycaena hippothoe eurydame* and *Lycaena tityrus subalpinus* (Speyer, 1851), females of which have uniformly dark upper wing surfaces in alpine habitats, compared to the mostly orange upper wings of the lowland nominate subspecies *Lycaena hippothoe hippothoe* (L., 1761) and *Lycaena tityrus tityrus* (Poda, 1761), respectively (TOLMAN & LEWINGTON 1997). Similarly, the alpine nymphalid *Euphydryas aurinia debilis* (Oberthür, 1909) is smaller, much darker and has a more hirsute abdomen and thorax than the lowland nominate subspecies *Euphydryas aurinia aurinia* (Rottemburg, 1775) (TOLMAN & LEWINGTON 1997, CHINERY 1998). Having hirsute body segments is also a trait of other alpine lepidopterans (ROBERTS, 2001) (e.g., *Parnassius apollo*) and presumably serves to insulate them from cold night-time temperatures and to retain heat as they warm their flight muscles in the morning sun.

Some of the alpine species we recorded at Piora require more than one season to complete their life cycle largely because larval feeding and development can only occur during the growing season or during periods of frost-free days, both of which are progressively shorter with increasing elevation. Included in this category are some of the satyrine nymphalids such as *Erebia pandrose* (Borkhausen, 1788), *Erebia pharte* (Hübner, 1804) and *Oeneis glacialis*, all of which have two-year life cycles (TOLMAN & LEWINGTON 1997, CHINERY 1998). If only one population cohort exists for each of these species at certain localities, this could lead to the adults occurring at two-year intervals in those sites. However, it is likely that different cohorts and local populations partially overlap so that adults of these species should occur each year. Future research could address this issue. Some Lepidoptera recorded at Piora, such as *Euphydryas aurinia debilis* and *Erebia mnestra*, can apparently switch from a one-year life cycle at lower elevations to a two-year life cycle

at higher elevations (TOLMAN & LEWINGTON 1997). This somewhat parallels the situation with the ticks *Ixodes ricinus* (L., 1758) (in Europe) and *Ixodes scapularis* (Say, 1821) (in North America) both of which can have three, two or one year life cycles depending on climate (DURDEN & OLIVER 1999).

Overall, our data show that Piora has a predominantly alpine Lepidoptera fauna exhibiting elevationally modified morphological or biological traits in some taxa, mixed with a lower percentage of generalist species that are typically widely distributed from sea level to alpine habitats. The alpine Lepidoptera fauna is made up of a mixture of species that are endemic to the Alps, others that occur on several European mountain ranges, some that also occur at lower elevations in northern Europe, and some that occur as different subspecies at lower elevations. Clearly, the Lepidoptera fauna of Piora is unique and intriguing. Future studies at this field site will add further details to this fascinating fauna.

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