Butterfly communities in mountain ecosystem

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1. System studied

In this study we examined butterfly community composition and phenology at 6 sites (Tab.1) in the N-W Italian Alps (Saint Marcel, Aosta Valley), during 2010 and 2011.
We sampled butterflies by transect on specific surface, standardized on operative transect time, i.e. discounting time stops (about 30 minutes). Season was divided into weekly periods and recording was done from the last week of June (I period) untill the last week of August (X period), for a total of 10 sampling occasions in 2010 and 7 in 2011.

Id	Habitat	Altitude
T1	grassland	2280
T2	woodland clearing	1960
T3	grassland	1550
T4	grassland	1870
T5	wet grassland	2300
T6	*Rhododendron* heathland	2400

Tab.1. Study sites, with identification code, habitat and mean altitude (m a.s.l.).

2. Species richness

72 species were found. Of these, 31 were new records for the study area (Balletto 2007) and 4 are threatenend following Habitat Directive (92/43/CEE) and IUCN criteria.
They are: *Parnassius apollo* (Ann. IV, NT), *Euphydryas aurinia glaciegenita* (Ann. II, LC), *Maculinea rebeli* (NT), *Maculinea arion* (Ann. IV, EN).

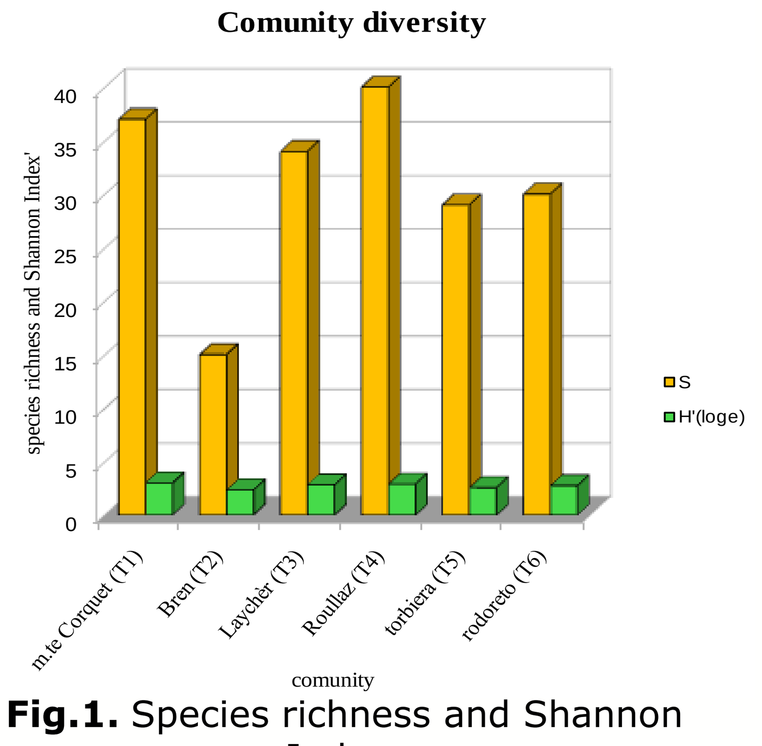

Fig.1. Species richness and Shannon Index.

Results show high biodiversity levels and numerically well structured communities (Fig.1), which can be treated as representative of good preserved mountain ecosystems.

3. Community composition

Results from cluster analysis (Fig.2) show between-year variability in community composition. High altitude sites (T1, T6) are more similar and stable.
Moreover, they are characterized by highly specialized species (strictly alpine) with low dispersal capability (Fig.3).

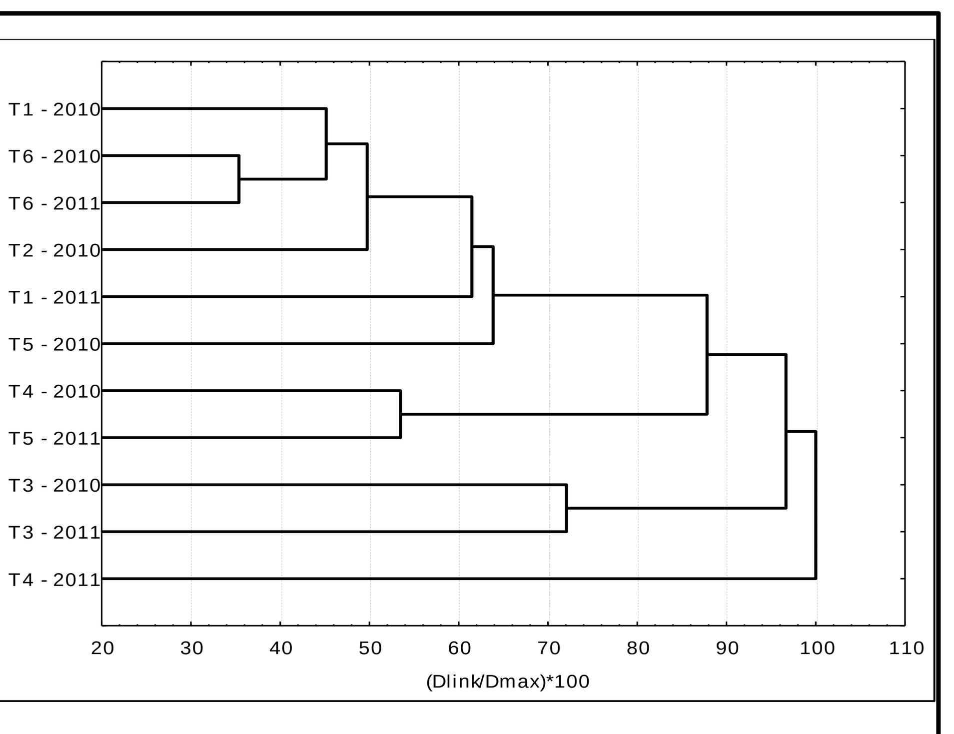

Fig.2. Cluster analysis with data on community composition (UPGA, Euclidean distance).

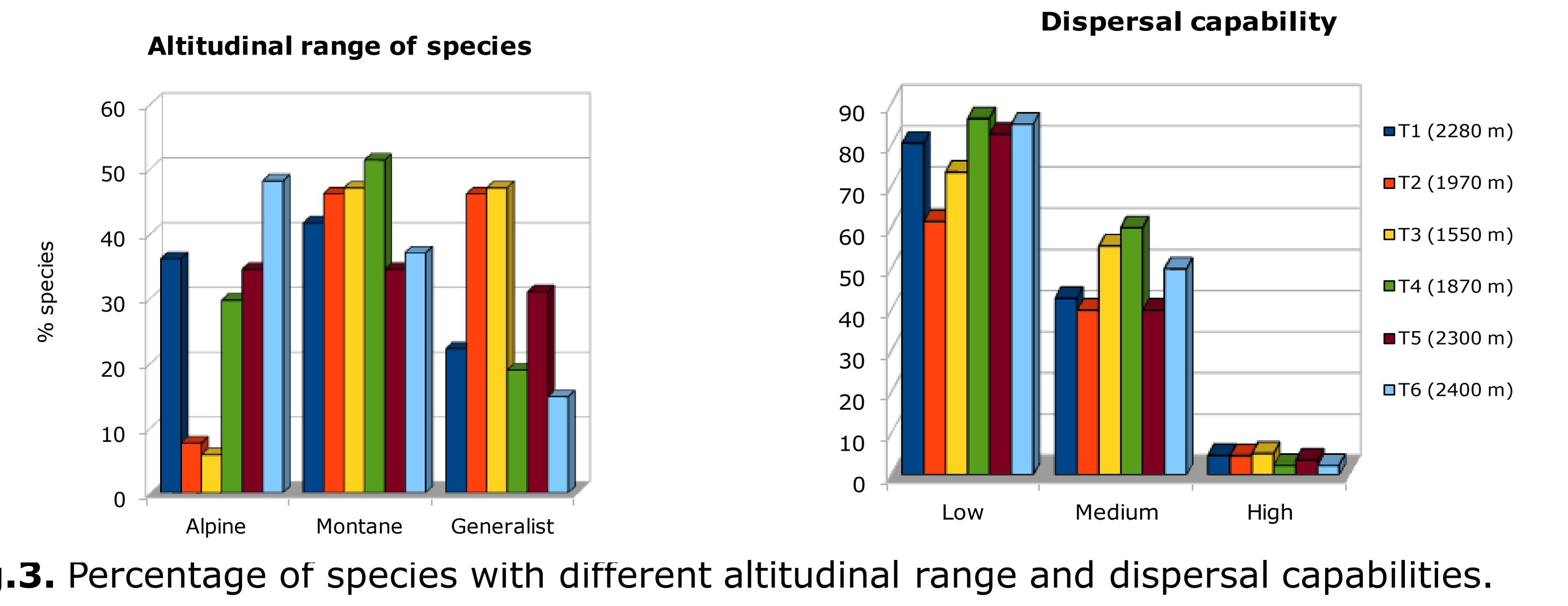

Fig.3. Percentage of species with different altitudinal range and dispersal capabilities.

4. Phenological pattern of coenosis

In both years, highest number of species and individuals were recorded in July.
Cumulative number of species increase smoothly, reaching an asymptote by the second half of August (VIII sampling occasion).

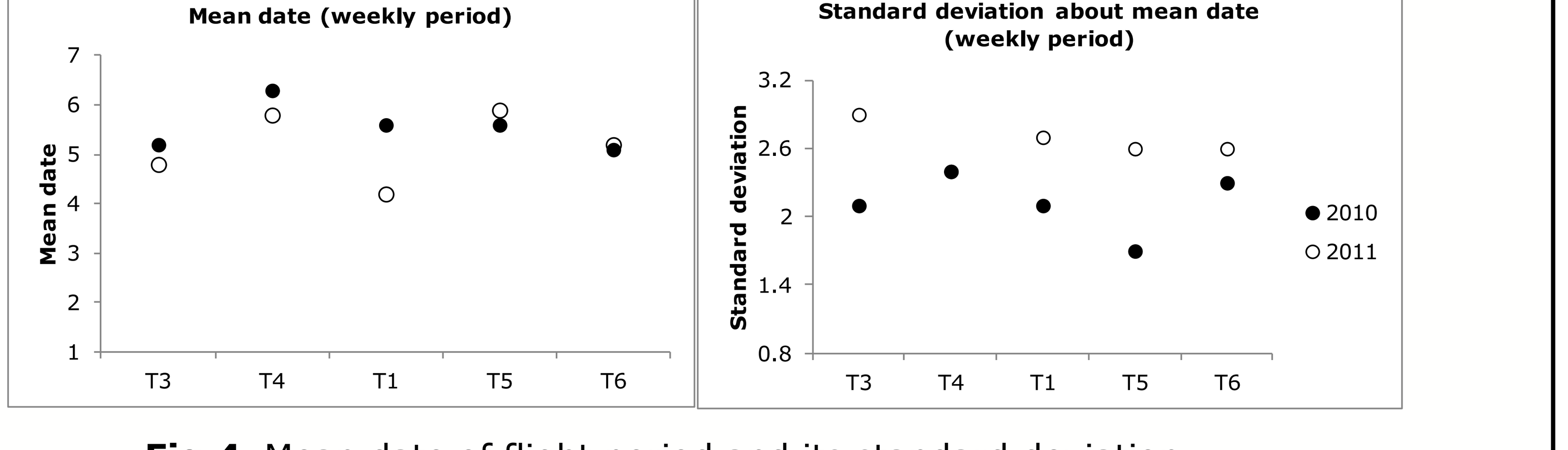

Fig.4. Mean date of flight period and its standard deviation.

The weighted mean date of flight period is reached around the V sampling (23-29 July); SD about mean date range from 1.7 to 2.9 weekly period (Fig.4).
In 2011 we observed a slight anticipate mean flight date (differences between years NS; paired-sample *t*-test; t=1.285; df=4; p=0.268) and a significantly higher SD about mean flight date (paired-sample *t*-test; t=-3.141; df=4; p=0.035), which means a longer flight period and a less synchronization between species in the assemblages.

5. Species traits and phenological parameters

We investigated relationships between species traits (overwintering stage, altitudinal range, thermal preferences, larval diet breadth) and phenological parameters (mean date, standard deviation, and their variation between years).

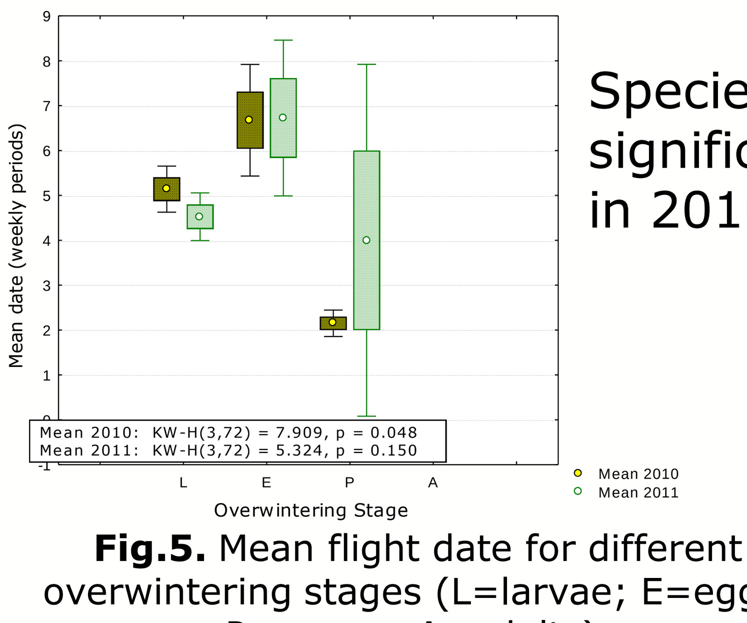

Fig.5. Mean flight date for different overwintering stages (L=larvae; E=eggs, P=pupae; A=adults).

Species overwintering as pupae show a significantly lower mean flight date only in 2010 (Fig.5).

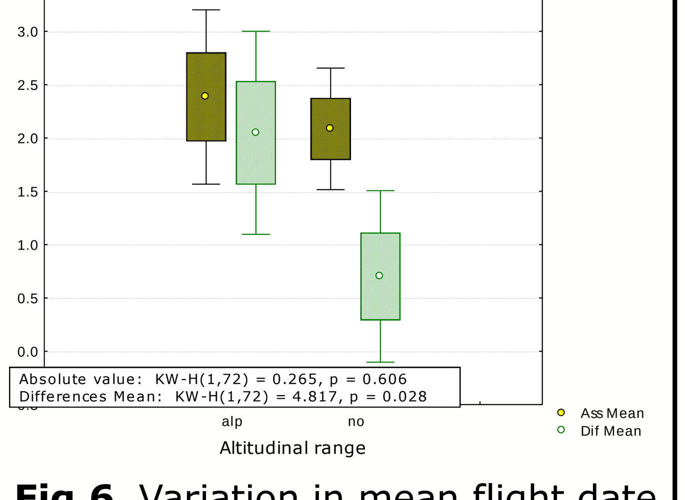

Fig.6. Variation in mean flight date for alpine species (alp) vs. more generalist one (no).

Alpine species showed overall greater between-year variability in mean flight dates and more homogeneity in response (Fig. 6).

6. Final remarks

a) Some of the phenological differences can be explained by between-year weather variability. In 2011 we had higher spring temperatures (in particular during April-May), followed by lower July temperatures.
b) Mountain ecosystems host many highly specialized species, prone to suffer from weather variability and changes in climatic parameters. More studies are still needed, in particular to identify species traits that determine such influences.

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