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Contribution of flowering synchrony to species richness in dry meadows

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Facilitative interactions among species may increase the diversity of a community. Such enhancement can be produced through facilitation via shared pollinators among co-flowering entomophilous species.
Indirect positive interactions are well known from trophic cascades, but remain poorly understood for species within trophic levels.
We investigated the role of flowering synchrony in ruling species richness at the community level in calcareous dry grasslands (*Festuco-Brometea*).

HYPOTHESIS

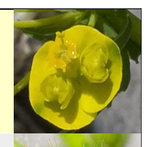
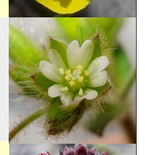
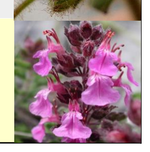
1. Is there a non-random flowering pattern at the community level?
2. Do the presence and percentage cover of insect-pollinated species increase with increasing synchrony?
3. Does the number of rare plant species increase with increasing synchrony? Rare species were arbitrarily defined as those species present in at most half of the plots but in more than one.

The study was carried out in the Euganei Hills district in NE Italy (45 plots randomly placed, side 2x2m). Data on species richness and percentage cover were collected.
Flowering phenology of all entomophilous species was monitored every 10 days during the growing season (April, 1st to September, 30th 2013).

To estimate flowering time overlap at the community level a mean Co-flowering index (V score; *Lepš & Šmilauer*, 2003) was calculated in species x time interval matrix. The significance of the flowering overlap pattern was tested using a null model.

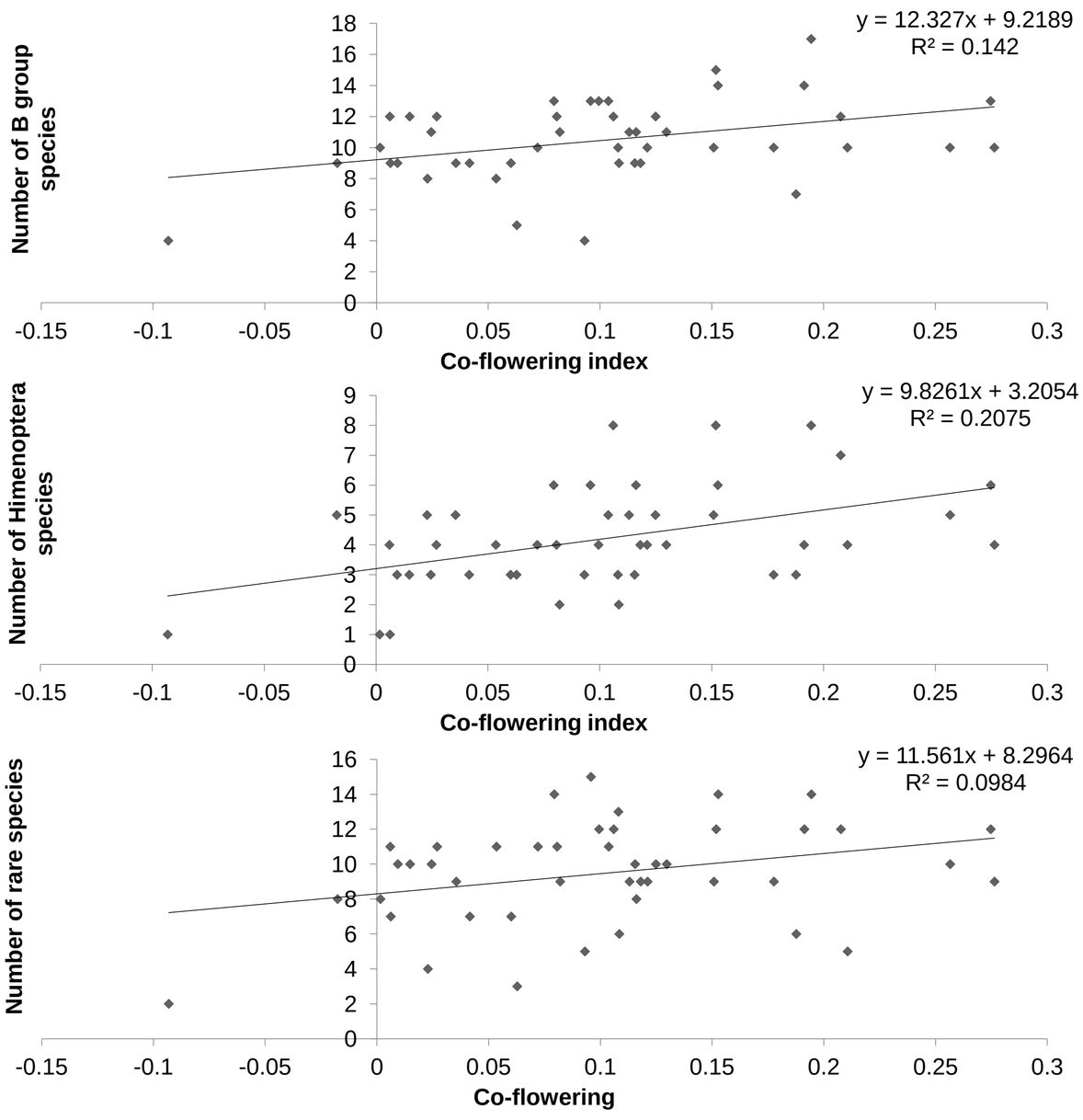
Successively a Co-flowering index was computed for each plot. Spearman's rank correlation was used to test for a relationship between the Co-flowering index and:

- the number of insect-pollinated species per plot. Entomophilous species were classified in three major groups according to Müeller's (1881) classification (*www.biolflor.de*). Furthermore flowers belonging to the group **B**, with smaller pollinator range, were split in*: Hymenoptera flowers* (**H**) and *Lepidoptera flowers* (**F**).
- the number of rare plant species per plot.

FLOWER CLASS AFTER MÜLLER		
	A - FLOWERS WITH OPEN NECTAR	
	AB - FLOWERS WITH PARTLY HIDDEN NECTAR	
	B - FLOWERS WITH TOTALLY HIDDEN NECTAR	

RESULTS AND DISCUSSION

1. A non random flowering pattern was observed at the community level ($P_{Vscore\ obs>Vscore\ exp}<0.001$).



	r_s (number of species)
A	-0.198 (p=0.191)
AB	0.227 (p=0.132)
B	**0.303 (p=0.016)**

2. Richness of group B species turned out to be positively related to Co-flowering index.

	r_s (number of species)	r_s (percentage cover)
H	**0.421 (p=0.003)**	**0.346 (p=0.019)**
F	0.009 (p=0.950)	-0.109 (p=0.629)

Both richness and coverage of *Hymenoptera flowers* turned out to be positively related to Co-flowering index.

3. Richness of rare plant species turned out to be positively related to Co-flowering index (r_s=0.313; p=0.035).

Our results suggest that facilitative interactions mediated by flowering synchrony increase richness and coverage of some groups of species at the community level in dry meadows.

Lepš, J. & P. Šmilauer. (2003). Multivariate Analysis of Ecological Data using CANOCO. Cambridge: Cambridge University press.
Müller, H. (1881). Alpenblumen, ihre Befruchtung durch Insekten und ihre Anpassungen an dieselben. Engelmann, Leipzig.