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The structure of flower visitation webs: how morphology and abundance affect interaction patterns between flowers and flower visitors

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Acknowledgements

Pollination ecology is a very attractive scientific field to study. It is not only fascinating to observe the interactions between flowers and flower visitors, it is also a pleasure to make other people enthusiastic about it. And this is not very difficult indeed. Most people love flowers but only a few have taken a closer look. To invite them to explore the functioning of a flower gives a lot of satisfaction. How flowers advertise and present the resources that their pollinators are keen to exploit; how flowers are able to manipulate who will visit them and how these visitors behave in a flower; and how flower visitors for their part try to trick flowers. All of this is often surprising, very ingenious and a joy to discover. With the pollination syndromes, a classification system that uses characteristic combinations of flower traits such as form, colour and scent, one gets an uncomplicated tool at hand for predicting who visits whom. It invites one to play a game. I once started this game at the beginning of my, already long lasting, interest in pollination biology. All the people who listened to my stories about this game – some of them are nature guides, others followed nature courses or attended nature excursions – I want to thank for their interest, enthusiasm and often surprising ideas and observations. Education was and is for me an important source of motivation to do science.

The system of pollination syndromes, however, has clear limitations. Looking closer at the relationship between flowers and flower visitors during different scientific studies, especially when studying whole plant – flower visitor communities, this system is not very helpful. So I began to search for alternative possibilities to describe and analyze the interaction patterns between flowering plants and their pollinators. I did this not by

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my own. Together with other people, with some of them I closely cooperated during a number of years, I discussed a lot of possibilities to find better ways to describe and analyze interaction patterns at the community level. I want to thank my former colleagues Christian Westerkamp and Werner Kreisch at the University of Berlin for stimulating discussions about the classification of flowers. And I want to thank in particular Bodo Schick, University of Berlin and later University of Kassel, for sharing his knowledge about the history of pollination biology and his deep insights into the functional morphology of flowers. This opened for me a new way to approach the enormous morphological diversity of flowers. The result was the index of floral complexity that I developed to make this approach operational and testable. This index uses the traits which make up the functional morphology of flowers and quantifies the ability of a flower to restrict the behaviour of the flower visitors by trying to get to the rewards. The index is inspired by the description of the structural flower types given by Faegri and van der Pijl in their famous book on pollination published in 1979 and profited much from the work of the nineteenth century pollination biologists such as Hermann Müller, Ernst Loew and Paul Knuth. The classification system of Ernst Loew, for example, is largely based on the accessibility of nectar and provided an important starting point for me. Overall, these early pollination biologists were very good observers and had a very stimulating way of describing their findings, largely inspired by the evolutionary theory of Charles Darwin.

I tested this index in real communities together with a number of students at Leiden and Groningen. I want to thank these students for their enthusiasm and their critical thoughts on the index during the ecological field courses, especially Jan de Jonge, Sietse van der Linde, Simon Maes, Anne Marieke Wagenaar, Bram van Vliet, Jeroen Zouterdijk, Marijke Langeveld and Nicolette Snijders. I also discussed the index and the results of the field studies with Manja Kwak from the University of Groningen, whom I want to thank very much for her friendship and the stimulating and encouraging discussions throughout a long number of years. And I want to thank Frank Hoffmann, also from Groningen, for the discussions about pollination biology at the level of the community. From our trips to the meetings of the Scandinavian Society of Pollination Ecologists we always went home highly motivated and with fresh ideas.

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The index was the first and important step into the direction of the study of this thesis. In fact, I went a step backwards and decided to choose only part of the traits I incorporated in the index, i.e. nectar tube depth and width. I did this in order to simplify the analysis and make it even more operational than the index in its whole. I am very happy that I made this step, even this simplification is complex enough to handle in simulation models. The inspiration to do this is largely the result of doing research within the Plant Ecology Group at Leiden. It is a pleasure for me to thank the members of this group for their inspiration, their critical discussions of my community-level approach, but also the confidence in my sometimes complex ideas, and the possibility to test these ideas together with students during the field courses of ecology and my work in Spain. It was and is very pleasant and stimulating to be a researcher in this group.

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