"The evolution of combined versus separate sexes in *Bryonia* and *Ecballium* (Cucurbitaceae), using phylogenetic and phylogeographic approaches"

(Summary of DFG-funded project)
To study the evolution of separate and combined sexes in plants, we have selected a small Eurasian clade of Cucurbitaceae that exhibits several instances of within-species sexual system switches, apparently depending on habitat. The genera *Ecballium*, with one species, and *Bryonia*, with four to 12 species, are close relatives and have received much attention from ecologists and geneticists, starting with Correns (1903) who worked out the formal genetics of the inheritance of sexual dioecy using two species of *Bryonia*. Correns chose *Bryonia* (and Galán, 1946, *Ecballium*) because species in these genera can be monomorphic, with populations consisting of plants with male and female flowers on every individual, or dimorphic, with populations consisting of plants with male and female flowers on separate individuals (dioecious populations). Most species of *Bryonia* are consistently dioecious, however. The closest relatives of *Bryonia* and *Ecballium* appear to be *Schizopepon*, *Biswerea*, *Edgaria*, and *Herpetospermum* with together 11 species in the Himalayas and China that are dioecious, monoecious, or androdioecious (with male plants and hermaphroditic plants). The proposed study will answer questions about (1) the frequency, direction, and timing of sexual system switches, (2) selective factors favoring such switches, and (3) the evolution of sex-linked DNA regions and of sex chromosomes. It has three components that use chloroplast and nuclear DNA sequences, amplified fragment length polymorphisms (AFLPs), and sequence-characterized amplified regions (SCARs) in a combined phylogenetic and population genetic approach. The ultimate goal of this work is to contribute to a better understanding of the evolution of separate and combined sexes and of sex-determination in plants.