

POPULATION BIOLOGY / ECOLOGY II

Abstracts

BREEDING SYSTEM AND POLLINATION OF *ABRONIA AMMOPHILA* GREEN (NYCTAGINACEAE), A NARROW WYOMING ENDEMIC

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We examined the breeding system, reproductive output, and pollination ecology of *Abronia ammophila* (Nyctaginaceae), a rare and highly restricted endemic of Yellowstone National Park, Wyoming, USA. In controlled hand-pollination treatments, we found no significant difference among pollination treatments (automatic self-pollination, geitonogamy, or xenogamy). These results, along with pollinator observations, suggest that *A. ammophila* exhibits a mixed-mating system characterized by an ability to self-pollinate with or without a pollen vector, as well as to cross-pollinate. The species maintains a long reproductive season with high reproductive output, and despite an apparently low pollinator visitation rate, exhibits seemingly high seed set. Reproductive output of individual plants appeared highly dependent on microsite conditions. Several orders of insects were found to visit *A. ammophila*. Noctuid moths were the most abundant pollinators, and other Lepidopterans and bumblebees were less frequent pollinators. Other moth-pollinated plants that co-occur with *A. ammophila*, such as *Phacelia hastata* and *Phlox mutiflora*, may facilitate the reproductive success of *A. ammophila* by supporting moth populations in the area.

Keywords: *Abronia ammophila*, *breeding system*, *pollination*, *moth pollination*

THE APPLICATION OF METAPOPOPULATION AND METACOMMUNITY CONCEPTS TO DRY FOREST OPENINGS IN SOUTHERN ILLINOIS

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An understanding of regional dynamics of plant species is important, since suitable habitat for many species is becoming increasingly fragmented, making interconnection between fragments necessary for the survival of populations. A metapopulation consists of several local populations within an inhospitable matrix interconnected by dispersal, and acting as one population. A metacommunity is a group of local communities connected by dispersal. A forest opening is defined as an area within a forest that has at least 20% canopy openness and species indicative of a xeric habitat. We used an incidence function model to determine if any species followed a metapopulation pattern in dry forest openings within Giant City State Park and McClure School Shale Barrens in southern Illinois. We also used two programs, the Nestedness Temperature Calculator (NTC) and a series of macros by Liebold and Mikkelsen (LMM), to determine if the forest openings exhibited sufficient order to be considered metacommunities. The incidence

function model showed that 5 species out of ~75 examined at both sites exhibited patterns consistent with those of metapopulations. The NTC showed that McClure School Shale Barrens was significantly more ordered than random, but the LMM showed that both sites were significantly more ordered than random. Future studies will examine reproductive characteristics of species showing metapopulation dynamics to ascertain which characters are correlated with a tendency to form metapopulations, and to investigate whether metapopulation species remain as metapopulations in subsequent years.

Keywords: *metapopulation, metacommunity, forest openings, model*

THE EFFECTS OF VARYING SPECIALIST APHID HERBIVORE DENSITY ON THE GROWTH AND CHEMICAL DEFENSE OF THE HOST PLANT

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The induction of chemical defenses by the neo-tropical milkweed, *Asclepias curassavica*, in response to herbivory directs carbon from growth and reproduction to the development of cardenolides, non-volatile Na⁺/K⁺-ATPase inhibitors. In the case of the milkweed-specialist herbivore, *Aphis nerii*, this increase in production of cardenolides allows for an increased sequestration level and greater protection from their natural enemies. A reduction of cardenolide levels on low aphid density plants were previously found, leaving the aphid less well-defended, followed by a subsequent induction above constitutive levels. Our objectives were to determine the effect of varying cardenolide levels on aphid populations. Initial populations were separated into low and high densities and considered at eight different four-day time intervals over twenty days. Plant fitness was considered with wet/dry weights and surface area, and defensive investment by cardenolide production. Herbivore fitness was considered with wet/dry weights, body fat, overall number, and defensive investment by cardenolide sequestration. We hypothesize that the variation of host plant cardenolide levels will be represented in the aphid population, and that increased cardenolide levels should negatively affect aphid population growth rates and plant growth rates.

Keywords: *milkweed, Aphis nerii, herbivore, cardenolides*

WHY IS FRUIT SET LOW IN *ACACIA BREVISPICA*?

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Species of *Acacia* (Leguminosae: Mimosoideae) dominate the woody vegetation in many semi-arid regions of East Africa, where they play critical ecological roles as food sources for mammalian herbivores. Like many other mimosoid legumes, acacias yield few fruits compared to the number of flowers produced. Although this phenomenon has been studied extensively in Australian acacias, little information is available for African acacias. Our work focuses on *Acacia brevispica*, a widespread species in East Africa. To begin to test the hypothesis that low fruit set results from low pollination success, we collected 5-10 inflorescences from each of 40 trees in three populations around Mpala Research Center, Laikipia, Kenya. Five pistils were extracted from each inflorescence, and presence or absence of polyads in the stigmas was examined using perarosaniline staining microscopy. The data suggest that fewer than 10% of the stigmas were

pollinated and of these, nearly all contained only a single polyad. We are continuing this work by using five highly polymorphic microsatellite markers to assess levels of multiple paternity within mature fruits. These markers yield an exclusion probability of 0.99. To date, genotypes have been obtained from about 136 seedlings, representing 28 fruits from four maternal trees. Preliminary analysis of these data suggests very low levels of multiple paternity.

Keywords: *Acacia, fruits, paternity, pollination*

THE IMPORTANCE OF RAINFALL ON THE DYNAMICS OF PLANTS, RODENTS, AND
PREDATORS: RESULTS FROM A LONG TERM STUDY OF A SEMIARID COMMUNITY OF
NORTH-CENTRAL CHILE

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A large-scale, long-term study was conducted in a semiarid region of Chile involving experimental and observational data on the three trophic levels of the community. This region is characterized by extreme variations in the amount of rainfall which are generally associated with El Niño Southern Oscillation. During the 16 years of study there have been three high rainfall episodes differing in duration and intensity. They all triggered dramatic increases in the amount of vegetation, and marked growth of small mammal and predator populations with varying time lags. During the intervening dry years, increased competition for scarce resources resulted in declines of small mammal numbers and emigration of many predator species. A statistical modeling approach, including time series analysis and multivariate regression, was used to determine the relative importance of abiotic factors (rainfall) and biotic factors (competition, predation) in the dynamics of the main food web components. Overall, the dynamics of the community are mainly dominated by bottom-up forces (i.e., resource limitation) rather than being controlled by top-down forces (i.e., predation). Rainfall was the factor that explained most of the variation in the changes of the rodent populations. Additionally, the dynamics of certain species were also influenced by a lagged effect of the previous year's rainfall. On the other hand, predator densities had only weak effects and do not appear to be an important regulatory factor for rodent populations. The insights gained from these results may be crucial for applied issues such as management and conservation of key species and anticipating consequences of El Niño events on potential agricultural pests and disease reservoirs. This is particularly important given the predicted increased in frequency of ENSO events associated with global climatic change.

Keywords: *Population dynamics, El Niño, Climatic factors, Predator-prey interactions*