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expressed by the flavonoid variation from the northern populations. The PCA analysis of data from all twenty six populations showed the Yukon populations to be intermediate in their flavonoid compositions compared to the eastern and western populations to the south, although the bulk of the variation was expressed within the populations, and no geographic boundaries were discernible.

#### 524

PATTERSON, ROBERT. Department of Biological Sciences, San Francisco State University, San Francisco, CA 94132. - Flavonoid diversification in Hawaiian species of *Scaevola* (Goodeniaceae).

The primarily Australian Goodeniaceae is represented in the Hawaiian Islands flora by nine species of *Scaevola*. These species are cited by authors as being good examples of adaptive radiation. Different species occur in such diverse habitats as coastal bluffs, dry ridges, old lava flows, and wet montane forests. *Scaevola taccada* is a wide-ranging species distributed throughout the southwestern Pacific and Indian Oceans. The other species are endemic to the Hawaiian Islands. *Scaevola glabra* is a tetraploid, while the others are diploids. Recently, flavonoid information was gathered to examine further the patterns of distribution and evolution of *Scaevola* in Hawaii. Data collected support the existence of three distinct lines in the genus, each corresponding to a separate dispersal event of *Scaevola* to Hawaii: 1) *S. taccada*; 2) *S. glabra*; 3) a form ancestral to the diploid endemics. Flavonoid data appear to be of minimal value in delineating relationships among the diploid endemic species, since these taxa show little flavonoid diversification.

#### 525

PHILBRICK, C. THOMAS. Biological Sciences Group, U-43, University of Connecticut. Storrs, CT. 06268. - Pollen tube growth through vegetative tissue in *Callitriche*. Fruit production in morphologically underdeveloped flowers of *Callitriche* has previously been attributed to apomixis. Data from pollen tube growth studies suggest an alternative explanation. Self-fertilization is effected in the monoecious *C. heterophylla* and *C. palustris* by the production of tubes from pollen in unopened anthers. They then grow down through the filament and across vegetative tissue to the pistillate flower. The pollen tubes then enter the ovary through its base and grow up to the ovules. Self-fertilization also occurs between flowers in opposite leaf axils and at different nodes via tube growth across and up the stem respectively. In both cases the pollen tubes grow within the stem tissues. This unusual form of self-fertilization occurs on plants that are either completely submerged or that grow out of water on mud banks. In such plants staminate and pistillate flowers remain morphologically underdeveloped (scarcely developed stamens with 4-12 microspores, and styles represented by short projections lacking stigmas) but functionally mature. In contrast fully mature (morphologically and functionally) flowers occur in the axils of floating leaves. In this condition the stigmas develop and become receptive at the apex of elongate styles and the filaments elongate considerably, while the anthers contain ca. 1700 microspores and typically dehisce. The potential for outcrossing seems to exist in fully mature flowers but not in morphologically underdeveloped forms. The immediate environment of the plants appears to regulate the outcrossing potential via the extent of morphological development of the flowers.

#### 526

PROKSCH, PETER\* and CURTIS CLARK. Botanisches Institut, Universität zu Köln, D-5000 Köln 41, West Germany and Biological Sciences, California State Polytechnic University, Pomona CA 91768, U.S.A. - New chromenes and benzofurans from the *Encelia* alliance (Asteraceae: Heliantheae) and their systematic significance.

*Encelia*, a genus of dominant shrubs of southwestern North America, forms a natural group with *Enceliopsis* and *Geraea*. We have isolated several new chromenes (benzopyrans) and benzofurans from the group. The presence of this class of compounds

appears to be an ancestral feature; the presence in some species of unique compounds and the absence in others of the entire class has proven to be useful in the study of phylogeny in these genera, especially since phylogenies derived from chemical data are highly congruent with those based on morphological characters.