Lab Report 2: Plant Biodiversity

I. What is biodiversity?

Biodiversity can be simply defined as "the totality of genes, species, and ecosystems in a region." (Wikipedia, "Biodiversity") This definition encompasses all organisms, from complex eukaryotic plants to simple unicellular bacteria, found in a particular geographical area or habitat. When discussing the biodiversity of an area, ecologists often attempt to quantify the amount of biodiversity present in one particular area using one of several indices. From these indices, it has been shown that biodiversity is not evenly distributed throughout the world. For instance, biodiversity is much higher in tropical regions, where there is the highest number of endemic, or native, species. In contrast to the tropics, polar regions, such as Antarctica, have much fewer species present, and therefore contain a lower amount of biodiversity.

Since biodiversity is not constant throughout the Earth, one may wonder what factors influence the amount of biodiversity in a region. However, this question has been the topic of debate among many scientists. Scientists have begun to argue against the prevailing theory that geographical isolation via climate change is the one factor that impacts biodiversity the most. Instead, researchers have recently found that the variable evolutionary rate of species is one of top determining factors of biodiversity. (Butler 2005) Because of the increasing loss of biodiversity in biomes around the world, ecologists have also outlined the factors that have led to this decrease in biodiversity. One of the main influences is the presence of human activity, such as deforestation, overpopulation, and pollution.

II. Diversity within the Family Moraceae, Genera *Ficus* and *Dorstenia*

The increase in biodiversity within a region usually requires the formation of mechanisms to adapt to a specialized habitat, such as tropical rainforests. Because of this, many plant families are found in one specific biome. However, there are a few instances in which a plant family has species that inhabit more than one biome. One such example is the Moraceae family, a diverse group comprising approximately 40 genera and 1,000 species. Species from this family are characterized by a milky sap and may be either monoecious, having both male and female flowers on the same plant, or dioecious, having male and female flowers on the separate plants of the same species. The Moraceae flowers are generally small and densely aggregated on the plant. (Burns, Honkala, "Glossary") (Carr, "Moraceae") The species in this family are known for their economic importance as fruit producers; significant products include figs, mulberries, breadfruit, and jackfruit. (Watson, Dallwitz, "Moraceae Link") While the majority of species in this family are found in tropical biomes, a few species are indigenous to temperate biomes.

Tropical biomes are characterized by a non-arid climate whose average temperatures remain above 18°C year-round. Tropical biomes include rain forests, monsoon climates, and wet or dry savanna habitats. The tropics are also sometimes referred to as 'aseasonal', meaning that they do not have great differences in average monthly temperatures or amount of daylight hours throughout the year. Areas that are known for having a tropical climate include Central and South America, Hawaii, and many south Asian countries, such as the Philippines, Malaysia, and Indonesia. (Wikipedia, "Köppen climate classification")

Temperate biomes, on the other hand, include a broader range of climates. These mesothermal biomes are characterized by average temperatures above 10°C during warm months and average temperatures between 0°C and 18°C during cold months. There is no typical average yearly rainfall for temperate biomes; amount of precipitation can be anywhere from dry winters to dry summers to significant precipitation during all seasons. Compared to tropical biomes, temperate biomes are distinct in that they have definite seasons; for instance, there are generally large differences in average monthly temperatures throughout the year. Because this category is so expansive, habitats such as Mediterranean, Humid Subtropical, Maritime Temperate, and Maritime Subarctic are all included under the definition of temperate biome. (Wikipedia, "Köppen climate classification")

A tropical representative species of the Moraceae family is *Dorstenia gigas*. This particular species has large succulent leaves and a fleshy receptacle containing flowers attached to a thick stem. (Carr, "Moraceae") It is endemic to the Socotra Islands, near the coast of Yemen in the Indian Ocean, and requires a minimal average temperature of about 55°C for growth. This species is not self-fertile, and thus requires two plants, a male and female, to produce seeds. One distinguishing feature of this species is its pollination mechanism. Once seeds become ripe, pressure builds and the seed pod explode, expelling the seeds. Seeds ripen year round. (Faucon, "Dorstenia gigas") Since its habitat is generally a dry savanna habitat, the succulent, fleshy leaves serve the purpose of water storage for the plant. However, the leaves of *Dorstenia gigas* are not as succulent as those of desert biome cacti, to whom water retention and hydration is much more important.

In contrast, *Ficus carica*, commonly known as the fig tree, is an example of a Moraceae species that is found in temperate biomes. Characteristics for this particular species include growth into shrub or low-spreading deciduous tree forms and large non-succulent lobed deciduous leaves attached to medium stems and trunks, in contrast to the thick pachycaulous trunks of *Dorstenia gigas*. This species can grow in temperatures down to -12°C, and can thus tolerate the frost of some temperate climates. (Faucon, "Fig (Ficus carica)") The fig tree also has a noteworthy mechanism of reproduction and pollination. Unlike *Dorstenia*, *Ficus* is self-fertilizing and depends on the use wasps to transfer pollen from a kind of *Ficus* flower called a caprifig (one which does not lead to a fig fruit) to a non-pollen-producing flower that leads to an edible fig. (Faucon, "Fig (Ficus carica)") Given that temperate biomes have distinct seasons, *Ficus carica* trees produce fruit and flowers during the warm summer months. Also as a result of its temperate habitat, *Ficus carica* is dormant during the cold winter months, and often resprouts from its roots, so that it may produce fruit in the summer. (Christman, "Ficus carica")

III. Conclusion and Future Directions

As can be seen, a range of biodiversity can be found around the world and is dependent of several factors. Since plants are often specially adapted for their specific biomes, it is not common to find a plant family that includes member species in more then one biome. However, the Moraceae family is an example of this; the genus *Ficus* includes a species that inhabits the temperate zone, while the genus *Dorstenia* is found only in tropical climates. Given that these species of the Moraceae family have thrived in their respective biomes for a significant amount of time, one can surmise that the species

will be maintained in the future, as long as their environments do not drastically change. Finally, it is also likely that plant species of other families will follow the example of Moraceae. In the future, genera and species of a single family may become more diverse and occupy several biomes as they adopt specific structures that allow them to adapt to varied climates.

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