Public Abstract
First Name:Eden
Middle Name:Alexandra
Last Name:Johnson
Adviser's First Name:Paula
Adviser's Last Name:McSteen
Co-Adviser's First Name:
Co-Adviser's Last Name:
Graduation Term:SP 2017
Department:Biological Sciences
Degree:MA
Title:EVOLUTION AND DEVELOPMENT OF THE PAIRED SPIKELET TRAIT IN MAIZE AND OTHER GRASSES (POACEAE)

Meristems are composed of groups of tightly-regulated cells that coordinate the number of stem cells in the central zone of the meristem with the number of cells migrating to organ primordia in the peripheral zones of the meristem. Mutations disturbing this balance can cause significant changes to the resulting plant structure. In order to buffer the meristem against drastic changes, it is necessary to have overlapping pathways regulating meristem maintenance and meristem determinacy. Furthermore, components and functions of these pathways are often conserved between plant lineages. While flowering in Arabidopsis occurs from the direct transition of the shoot apical meristem to a floral meristem, the grasses develop numerous axillary meristems that specify several different structures (i.e. inflorescences, branches, and grass spikelets), making the maintenance and identity of these meristems interesting areas of research. Thus, my first chapter reviews the mechanisms by which meristems are initiated and maintained through the complex organization of meristem size and determinacy pathways in plants.

Members of the grass family develop inflorescences composed of spikelets, which house the inconspicuous grass flowers. One compelling difference between grass species is that, while the majority of the approximately 12,000 taxa develop single spikelets, there are also a significant number of species that produce paired spikelets. It is widely acknowledged that the subfamily Panicoideae contains many paired spikelet species, namely within three tribes that include significant crop species (i.e., maize, sorghum, setaria, and switchgrass). However, there are many cereal crops (i.e., wheat and rice) which develop single spikelets, indicating that the paired spikelet trait may be important to study as a way to increase yield in single spikelet species.

My research into the semi-dominant maize mutant *Suppressor of sessile spikelet1 (Sos1)* investigated the developmental basis behind the paired spikelet trait. While maize plants normally bear paired spikelets, *Sos1* mutants develop single spikelets in the tassel inflorescence and alternating rows of single kernels in the ear. A previous study examined this mutant early in development and revealed that the mutant inflorescence meristems were smaller than normal, which suggested a potential role for the *sos1* gene in meristem maintenance. The objective of my second chapter was to summarize what is known about the *Sos1* mutant, and uncover the role of the *sos1* gene in meristem maintenance. Double mutants were generated between *Sos1* and members of the *CLAVATA* signaling pathway, which is a well-known pathway shown to be critical for maintaining meristem size in maize, Arabidopsis, and other plant systems. Analysis of these double mutants indicated that *sos1* functions in this important meristem maintenance pathway.

Research into the *Sos1* maize mutant also prompted a more in-depth investigation into the evolution of the paired spikelet trait in the grasses, which was previously only assumed to occur in three tribes of the Panicoideae subfamily. The objective of my third chapter was to determine if the paired spikelet trait evolved multiple times in the grasses. My analysis highlighted the fact that the paired spikelet trait originated before the Panicoideae subfamily. This study uncovered that species developing paired spikelets are prevalent in more grass lineages than previously shown, and highlights a pattern of repeated losses and origins of the paired spikelet trait throughout the family.