

Novel insights on the structure and composition of pseudostomata of Sphagnum

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Abstract

- **Premise of the study:** The occurrence of stomata on sporophytes of mosses and hornworts is congruent with a single origin in land plants. Although true stomata are absent in early-divergent mosses, *Sphagnum* has specialized epidermal cells, pseudo- stomata, that partially separate but do not open to the inside. This research examined two competing hypotheses that explain the origin of pseudostomata: (1) they are modified stomata, or (2) they evolved from epidermal cells independently from stomata.
- **Methods:** Capsule anatomy and ultrastructure of pseudostomata were studied using light and electron microscopy, including immunolocalization of pectins.
- **Key results:** Cell walls in pseudostomata are thin, two-layered, and rich in pectins, similar to young moss stomata, including the presence of cuticle on exterior walls. Outer and ventral walls have a thick cuticle that suggests that initial separation of ventral walls involves cuticle deposition as in true stomata. Further mechanical separation between ventral walls does not form a pore and occurs as the capsule dries.
- **Conclusions:** As in moss stomata, pseudostomata wall architecture and behavior facilitate capsule dehydration, shape change, and dehiscence, supporting a common function. The divergent structure and fate of pseudostomata may be explained by the retention of *Sphagnum* sporophytes within protective leaves until nearly mature. Ultrastructural and immunocytological data suggest that pseudostomata are related to stomata but do not conclusively support either hypothesis. Solving the relationship of early land plants is critical to understanding stomatal evolution. Pseudostomata are structurally and anatomically unique, but their relationship to true stomata remains to be determined.

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