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主　論　文　の　要　旨

論文題目　Mechanism for the patterning of constitutive aerenchyma formation in roots of *Zea nicaraguensis*（*Zea nicaraguensis* の根における恒常的通気組織形成のパターン化機構）

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論　文　内　容　の　要　旨

Excess water causes oxygen deficiency in the soils, negatively impacting the yields of upland crops such as maize (*Zea mays* spp. *mays*). Wetland plants, including rice (*Oryza sativa*), strongly tolerate waterlogging stress because they have several flood-adaptive traits. The formation of constitutive aerenchyma (CA), created by cortical cell death, is one of the important flood-adaptive traits for enhancing oxygen diffusion from the shoot to the root tips. *Zea nicaraguensis* is a wild relative of maize, which can form CA. However, the mechanisms underlying CA formation in *Z. nicaraguensis* remain unclear. In Chapter 2, the effects of endogenous auxin (indole-3-acetic acid; IAA) and/or auxin transport inhibitor (N-1-naphthylphthalamic acid; NPA) on CA formation were investigated. An age-dependent comparison revealed that aerenchyma formation was suppressed by IAA, while it was stimulated by IAA when co-treated with NPA. These results indicate that longitudinal auxin flux is essential for CA formation in the nodal roots of *Z. nicaraguensis*. In Chapter 3, gravistimulation (root rotation) experiments revealed the contrasting patterns of CA formation and lateral root

(LR) formation in the nodal roots of *Z. nicaraguensis*. Although LR formation on the convex side is known to be stimulated by auxin in the pericycle, the auxin distribution pattern in the cortex was unknown. Subsequent cortex-specific expression analysis of the auxin-responsive genes suggested that the auxin level was higher in the cortex on the concave side than on the convex side. Thus, this asymmetric auxin distribution contributes to establishing the contrasting patterns of CA formation and LR formation. In Chapter 4, the auxin-related genes, whose expression levels were significantly different in the cortex of the nodal roots of *Z. nicaraguensis* and a maize inbred line Mi29, were selected as candidate genes involved in CA formation. As a result, several genes encoding AUXIN/IAA proteins and AUXIN RESPONSE FACTOR (ARF) transcription factors were identified. This suggests that AUX/IAA- and ARF-dependent auxin signaling is involved in CA formation in *Z. nicaraguensis*. The findings in this thesis provide a novel insight into the mechanism of CA formation in *Z. nicaraguensis*, which can be useful for improving the waterlogging tolerance of upland crops.