Auxin polar transport of etiolated epicotyls of ageotropum pea seedlings is not affected by gravistimulation: Relevance to automorphosis-like growth and development

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Both true microgravity conditions in space (STS-95 space experiment) and simulated ones on a three-dimensional (3-D) clinostat have been demonstrated to induce automorphosis in etiolated pea (*Pisum sativum* L. cv. Alaska) seedlings represented as epicotyl bending as well as changes in root growth direction and inhibition of hook formation, and to alter the activities of auxin polar transport of epicotyls. The fact that the application of inhibitors of auxin polar transport phenocopied automorphosis together with the result of detail kinetic analyses of epicotyl bending on the 3-D clinostat suggests that automorphosis of etiolated pea epicotyls is due to suppression of a negative gravitropic response on 1 $g$conditions, and graviresponse of etiolated pea seedlings under 1 g conditions requires normal activities of auxin polar transport. To study the role of auxin polar transport in graviresponse in early growth stage of etiolated pea seedlings, effect of gravistimulation on auxin polar transport in epicotyls of Alaska pea seedlings was studied in comparison with that of the agravitropic pea mutant "ageotropum" seedlings. Dry pea seeds, whose embryo axes were set in a horizontal position (referred to as horizontal position) or an inclinational one to the gravity vector (referred to as inclinational position), allowed to germinate and grow in the dark for 2.5 days. Epicotyls of etiolated Alaska pea seedlings grown under horizontal position showed negative gravitropisum due to relatively larger elongation in the proximal side to the cotyledons. Under inclinational position, relatively larger elongation in the distal side of epicotyl was induced by gravistimulation, resulting in its negative gravitropisum. On the other hand, ageotropum pea epicotyls showed agravitropic response, resulting in automorphosis-like morphology. Asymmetrical activities of auxin polar transport in the proximal and the distal sides of epicotyls of etiolated Alaska pea seedlings grown in a horizontal position were observed, those in the proximal side being much higher than those in the distal ones. When etiolated Alaska pea seedlings were grown under inclinational position, the activities of auxin polar transport in the proximal side to the cotyledons were substantially reduced, but those in the distal side were little affected, resulting in differential activities of auxin polar transport. Also in ageotropum pea mutant the activities of auxin polar transport in proximal side of

epicotyls were quite higher than those in the distal one, however, these activities were little affected by the gravistimulation. These results suggest that the negative gravitropic response of epicotyls in early growth stage requires changes in asymmetrical distribution of auxin polar transport activity in the proximal and the distal sides of epicotyls. Based on these results, possible mechanisms to induce automorphosis will be also discussed.