# 12 Assessment of the growth adaptability and seed quality of different pennycress (Thlapsi arvense) germplasm resources in Yunnan Province

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**Abstract:** 【**Background**】Pennycress (*Thlapsi arvense*) belongs to the Cruciferae family, which is a perennial herbaceous plant with strong growth ability. Due to the abundance of lipid and secondary metabolites in seed, pennycress has long been regarded as a dual-role plant for functional food and medical usages. China harbors a broad collection of pennycress germplasm resources, however the application is rather limited because of the deficiency in research and industrial development. By comparison, in US, pennycress has already become a special cash crop for the soil optimization and the alternative supplement for vegetable oil production. Hence, it would be of great importance to assess the applicability of the pennycress germplasm resources in China, in order to better exploit and harness the underlying advantage of this underrated plant. 【**Purpose**】To investigate the growth adaptability of different pennycress germplasms in Yunnan province, a total of eight pennycress cultivars were collected from regions with distinct ecological circumstances in China. It was anticipated that through comprehensively analyzing the growth and development of the experimental pennycress materials, as well as the seed components, fundamental information could be provided to support the future genetic improvement and engineering of the pennycress for more diversified resource utilization. 【**Method**】Critical agronomic traits including plant branching number, plant height, plant total biomass, seed setting rate, seed yield, biotic and abiotic resistance etc. have been recorded over the whole plant growth duration. The Gas Chromatography technology was applied to analyze the lipid content and fatty acid composition in the pennycress seed. Available metabolites were profiled through the non-target metabolomic methodology for characterization, and the RT-qPCR technique was conducted to verify the expression levels of the structural genes highly correlated with the formation of important traits. 【**Results**】(1) The maximum seed lipid content detected in the eight pennycress cultivars was 10.14mg/g on a dry weight basis, while the lowest was 6.21mg/g. Erucic acid (C22:1) was found to be the major fatty acid component (>60%) in the pennycress seed lipid. (2) Among the eight experimental materials, only four pennycress germplasms were successfully germinated (seed germination rate ranged from 6% to 80%) and displayed a normal growth status in Yunnan province. The other four materials could not be germinated in either the medium or soil despite multiple attempts.

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Analysis of the agronomic traits reflected that the pennycress coming from different areas not only presented discrepant morphological features, but had inconsistent growing rhythm, suggesting a potentially differentiated mechanism to adapt to the environment.(3) A total of 405 metabolites, which could be enriched into 47 KEGG metabolic pathways have been detected in the seeds of the four pennycress materials that could grow normally in Yunnan province. There were 95 differentially accumulated metabolites identified, and most of them could be categorized into the lipid, flavone, amino acid, carbohydrate and medicinal secondary metabolites (*e.g.* glycosides and indoles) groups. **【Conclusion】** The initial assessment of the growth adaptability of the eight pennycress cultivars collected from different parts of China in Yunnan province, plus the seed component characterization may provide helpful guidance for the future germplasm introduction, as well as the breeding innovation. Moreover, some of these germplasms have shown good potentials to be further modified as the plant chassis for the pennycress metabolic engineering and synthetic biology study, from which great values might ensue.