utilization and market demand have made continued reliance on wild resources unsustainable, while overharvesting has already caused serious depletion of some medicinal *Polygonatum* resources and exposed problems of germplasm degradation and unstable quality (Liao et al., 2023; Cheng et al., 2026). Artificial cultivation is therefore regarded as a feasible response to resource scarcity, and *Polygonatum* has increasingly been positioned as an understory economic crop or forest-based specialty industry with both ecological and economic relevance in southern China and other forest regions (Wang et al., 2023). Understory cultivation is attractive because it uses forest land, light, and heat resources efficiently and can contribute to forest resource protection, biodiversity maintenance, and sustainable forestry development. For example, intercropping *Polygonatum* cyrtonema in moso bamboo forests improved soil quality relative to monoculture bamboo, and an appropriate bamboo density increased tuber yield, suggesting that agroforestry systems can simultaneously support ecological restoration and product output (Xu et al., 2023). Likewise, under-forest wild-imitating planting methods for *P. kingianum* have been reported to reduce cultivated land use, lower pesticide and fertilizer residues, improve product quality, increase forest-land returns, and remain suitable for larger-scale corporate operation.

However, the transition from traditional use to large-scale industrial development requires more than simple expansion of planting area. Historically, *Polygonatum* utilization has centered on rhizomes as medicinal materials such as Huangjing and Yuzhu, derived mainly from *P. sibiricum, P. kingianum, P. cyrtonema,* and *P. odoratum*, while local food use has included direct consumption of rhizomes and, in some cases, longstanding intake of specific taxa by local communities (Cheng et al., 2026). Yet recent work shows that the edible value of *Polygonatum* is broader than traditional rhizome use alone: tender shoots of P. odoratum contain essential nutrients, amino acids, minerals, and bioactive compounds, and appropriate agronomic management can improve the quality of both edible aerial parts and underground medicinal parts (Zheng et al., 2025). Even so, several obstacles still constrain scale-up, including germplasm confusion, indiscriminate seedling introduction across regions, lack of elite varieties, immature technical systems, weak service and regulatory capacity, poor market alignment, and high trial-and-error costs in understory production (Liao et al., 2023; Guo et al., 2026). Biological and ecological matching also matters: *Polygonatum* species differ significantly in yield and medicinal composition, *P. cyrtonema* can reach 7.5 t/ha in Zhejiang under suitable conditions, and provenance, altitude, temperature, moisture, and tree species all influence growth, metabolite accumulation, disease incidence, and economic returns (Wang et al., 2023). Some germplasm, such as *P. kingianum* var. *grandifolium*, may also offer industrial advantages through shorter seedling periods, higher biomass, repeated sprouting, and adaptability to both forest canopy and open-field conditions.

This study explores the integrated development pathways linking the medicinal utilization, edible application, and understory cultivation of *Polygonatum*, considering these three aspects as an interconnected industrial system. From the perspectives of resource foundation, traditional utilization patterns, production organization, and ecological-industrial coupling, this study systematically analyzes the key components and optimization strategies for the development of the *Polygonatum* industry. In response to current research gaps, including insufficient systematic comparisons among different species and medicinal-food utilization pathways, incomplete understory cultivation technologies and standard systems, weak coordination between production and market demand, and limited research on the development of medicinal-and-edible plants within large-scale forest management systems, this study aims to establish an analytical framework for the efficient utilization of *Polygonatum* resources and coordinated industrial development.

The findings provide important references for the breeding of elite *Polygonatum* varieties, quality evaluation, and sustainable resource utilization. Previous studies have shown that *Polygonatum* quality formation is strongly influenced by provenance, and that growth traits are associated with the accumulation of medicinal components. Ecological cultivation, agroforestry system design, and rhizosphere microbiome regulation may further improve the quality of *Polygonatum* resources. Therefore, clarifying the integration pathways between