

medicinal-and-edible development and understory cultivation of *Polygonatum* will not only contribute to wild resource conservation and the stable supply of high-quality raw materials but also promote coordinated development of the traditional Chinese medicine industry, functional food industry, and understory economy within a sustainable forestry framework.

2 Foundations and Current Status of Medicinal and Edible Development of *Polygonatum*

2.1 Nutritional components and bioactive compounds of *Polygonatum*

Polygonatum has a strong medicinal-and-edible material basis because its rhizomes and some aerial parts contain both nutritional substances and multiple classes of bioactive compounds. Reviews across the genus identify polysaccharides, saponins, flavonoids, alkaloids, lectins, and phenylpropanoids as major constituents, and recent summaries report that as many as 501 compounds have been identified in *Polygonatum* species (Liu et al., 2024). Among these, polysaccharides are most consistently described as the primary functional components and one of the key active ingredients supporting both nutritional and health value (Hu et al., 2023; Yang et al., 2025). *Polygonatum* is also increasingly recognized by nutrition researchers because it performs well as a nutrient source, and *P. sibiricum* and *P. odoratum* have been included in China's Medicinal Food Directory due to their high safety profile (Gong et al., 2023). In *P. cyrtoneura*, rhizomes have historically served as a famine food because of high carbohydrate content comparable to staple crops, showing that *Polygonatum*'s value is not limited to pharmacological activity alone (Cheng et al., 2026).

Current evidence links these compounds to broad bioactivities, especially immunomodulatory, antioxidant, anti-inflammatory, anti-fatigue, hypoglycemic, hypolipidemic, neuroprotective, and anti-osteoporotic effects (Zhao et al., 2018; Gong et al., 2023). Mechanistic reviews focused on diabetes further indicate that *Polygonatum* polysaccharides, flavonoids, and saponins act through pathways such as improving insulin resistance, promoting insulin secretion, regulating intestinal microecology, inhibiting advanced glycation end-product accumulation, suppressing carbohydrate digestion and absorption, and modulating gluconeogenesis. Species-level studies add that *Polygonatum* extracts show strong antioxidant activity linked to flavonoids and polyphenols, while saponins appear especially important in regulating intestinal flora and lipoprotein metabolism, and polysaccharides contribute substantially to anti-inflammatory effects through cytokine regulation (Liu et al., 2024). Beyond rhizomes, tender shoots of *P. odoratum* are rich in essential nutrients, complete amino acids, mineral elements, and bioactive components, indicating that the edible resource base of *Polygonatum* can be expanded from underground organs to aerial tissues (Zheng et al., 2025).

2.2 Current status of medicinal and edible product development of *Polygonatum*

The current medicinal-and-edible product development of *Polygonatum* is characterized by a transition from traditional herbal use toward functional food and diversified industrial utilization. Across the literature, *Polygonatum* species are described as long-used tonic herbs and dual-use plants whose rhizomes are consumed as medicines, vegetables, teas, foods, and functional foods, with more than 2 000 years of application history in some species such as *P. odoratum* (Bi et al., 2023). Recent reviews emphasize that the genus has already entered the pharmaceutical, functional food, and cosmetic industries, and that research attention is shifting from medicinal application alone to integrated food-sector development (Li et al., 2024). This trend is supported by the low toxicity reported after proper processing and by the broad expectation that *Polygonatum* can serve as a raw material for health-oriented products (Shu et al., 2026).

At the product level, current development remains centered on rhizome-based medicinal materials and processed foods, but the resource spectrum is widening. Huangjing and Yuzhu are the canonical medicinal products derived from official *Polygonatum* sources, while *P. kingianum* var. *grandifolium* has long been consumed locally as food and is already circulated in the market as *Polygonati Rhizoma* (Cheng et al., 2026). Reviews on food applications argue that *Polygonatum* should be developed both as an ingredient and as a whole food, and polysaccharide-focused studies specifically highlight opportunities in functional foods, eco-friendly carriers, and