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Potential of Paulownia Leaves and Flowers for Nutrition, Health Care and Animal Feeding

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Summary

The paper provides a short survey of nutrition, health care and animal feeding possibilities of the Smaragdfa™ hybrid result of repeatedly performed cross-breeding. Based on 31 references, the Sections of this short communication provide.

- main metric characteristics of the plant, its leaves and flowers;
- the ways how the leaves can be applied for feeding animals;
- some information on preparing honey for human consumption;
- detailed list of chemical components to subtract for improving human health.

Introduction

Although the Smaragdfa™ we examine is grown primarily for energy production and carbon dioxide sequestration, it has many other valuable properties. In this study, we present the role that the Smaragdfa™ plays in nutrition, health care and animal feeding.

The Smaragdfa™ belongs to the family of Paulownia trees. More closely, Smaragdfa™ is a Paulownia species-based, cross-breeded hybrid of Paulownia Furtunei, but free from Paulownia Tomentosa. It is perfectly unifying its parents' multipurpose qualities. This way of obtaining new plant generations excludes the danger of genetic modification in mass production.

They are deciduous trees native to China with an average height of 20-30 m (Innes, 2009). They might grow as tall as 50 m (Navroodi, 2013) in their place of origin. Their diameter reaches approximately two meters (Innes, 2009; Navroodi, 2013) by the end of their 24-30 years of the life cycle.

Leaves in the maturated tree reach a length of 15 – 30 cm and a width of 10-12 cm (Innes, 2009), with smooth and weaved sides (Zhao-Hua et al., 1986). The rare leaves create a cylindrical crown or an umbrella shape (Zhao-Hua et al., 1986). Paulownia produces C4-type photosynthesis with a high level of organic matter in their leaves (Woods, 2008). Paulownia leaves are utilized as green fertilizer as compost. (Yadav et al., 2013). A tree aged 8 – 10 years produces ca. 100 kg of green compound (leaves), about 2.8 – 3 % N and 0,4% K (Woods 2008).

Nutrition for animals

Leaves of Paulownia are an excellent source of fats, sugars and proteins for cattle nourishment. They have the same nutritious values as alfalfa. They are suitable for cattle nutrition, primarily sheep and goats, especially in combination with wheat straw or silage (Woods 2008; Angelov 2010). The nitrogen compound of the Paulownia leaves can be compared with that of several leguminous family plants.

Paulownia species are rich in phenolic substances distributed in different parts and tissues of the tree (Smejkal et al., 2007; Si et al., 2013). Each of these parts contains one or more bioactive components, e.g. ursolic acid and matteucinol, in the leaves (Ting et al., 2016).

Paulownia leaves are reported to have a similar feeding value to lucerne. They are suitable for combining with wheat straw or hay to feed cattle, sheep or goats. After one year's

growth in China, when Paulownia was cut down, the leaves were offered to pigs and sheep (Zhaohua, 1987).

The leaves of Paulownia can be used as an alternative feed ingredient for different animals because of their various biochemical properties (Zhu 1987). According to El-Showk and El-Showk (2003), leaves are rich in minerals such as calcium (2.1%), phosphorus (0.6%), zinc (0.9%), and iron (0.6%). Koleva et al. (2011a) reported that leaves contain 15.1% cellulose and 8.8% crude protein. Koleva et al. (2011b) suggested that Paulownia leaves could be used as a feed ingredient for some monogastric animals and ruminants.

Food for humans

Phytochemical sources have been widely used as reducing agents for the synthesis of nanoparticles. Paulownia hybrids have economic and scientific relevance but have no use as food. For that reason, Pontaza-Licona et al. (2019) conducted a study on the synthesis of silver nanoparticles (AgNPs) using hydro-alcoholic extracts from its leaves.

In addition to the above arguments on the possibility of preparing food for humans, it is also stated that from the flowers of Paulownia, precious honey can be obtained: a plantation can produce over 500 kg of honey per hectare (Paulownia Italy 2021). The flowering of Paulownia trees is strongly affected by environmental factors. If the conditions are ideal, Paulownia trees might bloom twice a year in just six months after planting. The extended blooming period of Paulownia trees is an excellent opportunity for producing a high amount of honey (Yadav et al., 2013; Woods, 2008). Due to the availability of this plant source, honey production might result in 700 kg honey/ha annually (Bikfalvi, 2013).

Supporting human health

Paulownia trees have many advantages for human health. According to traditional literature, the flowers and the leaves are usually cooked and occasionally consumed to treat fever and skin ailments or mitigate severe pain. Furthermore, it is also used specifically to cure respiratory diseases affecting the lungs and treat many digestive system problems (Angelov, 2010).

In the study of Uğuz and Kara (2019), content analysis was carried out to determine the antioxidant content of the Paulownia tree. According to this, the most catechin was found in the general phenolic content of the plant (24035.90 µg/g in the leaf extract). The least amount of chlorogenic acid was (34.863 µg/g in the leaf extract) found. The β-carotene was obtained as 7716.00 µg/g in leaf content. The most common phenolic substance in the Paulownia is the catechin component stored in its leaves and flowers. One month after transferring to incubators, the seedlings had 12-13 leaves (Renata and Adriana 2016).

The naphthoquinone plumbagin has been detected in the leaves and fruit of Paulownia (Babula et al. 2009). It has been used in traditional systems of medicine since ancient times (Pile et al., 2013). Six iridoids: 7-b-hydroxyharpagide, paulownioside, catalpol, aucubin, tomentoside and 7-hydroxytomentoside have been isolated from the leaves (Adriani et al. 1981; Franzyk et al. 1999). Seven phytosterols have been separated from leaves: ursolic acid (Zhu et al. 1986; Zhang and Li 2011), 3-epiursolic acid, pomolic acid, corosolic acid, maslinic acid, b-sitosterol, and daucosterol (Zhang and Li 2011). Most of these show various biological activities are potentially helpful in treating Alzheimer's disease (because of their ability to block the interactions of the amyloid b-CD36) (Wilkinson et al. 2011). It can prevent the monocyte recruitment that accelerates atherosclerosis, a significant complication of diabetes in mice (Ullevig et al. 2011). It also possesses antibacterial (Wong et al. 2012), anti-trypanosomal, and anti-leishmanial properties (Bero et al. 2011). More than 40 compounds with modified prenyl or geranyl side chains attached at C-6 of the flavonoid skeleton have been isolated from Paulownia's flowers, fruit, and leaves.

It is one of the most valuable medicinal plant species; tablets and injections derived from leaf, fruit and wood extracts are effective for bronchitis, relieving cough and reducing phlegm and blood pressure. These plants are endangered due to their extensive use in the medicine, food and beverages industry.

A robust and flavorful vanilla scent characterizes the flowers of the Paulownia species. They are often used as fresh flowers or dried materials to prepare high-quality teas or extracts. These numerous forms of the Paulownia flower provide several physiological advantages in our everyday lives. For instance, the tea and the syrup extracted from the flowers positively affect liver and spleen problems and respiratory diseases such as bronchitis (Angelov, 2010).

Nowadays, you might see Paulownia trees standing beside various streets and roads. At the same time, it is also one typical decoration of parks. For instance, old specimens of six Paulownia species can be found in gardens around the United Kingdom and across northwestern Europe (Monumental Trees, 2016).

Finally, we can conclude that these advantages and unique characteristics make Paulownia trees the "urban lungs" of the air-polluted crowded cities while providing a cooling refuge for city dwellers (Jensen, 2016).

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