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Medicinal Properties and Seed Germination Behaviour of Withania somnifera- A Review

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Introduction

W. somnifera, (Family: Solanaceae) also known as Indian winter cherry and Indian ginseng, is an evergreen shrub upto 150 cm in height. It is commonly found in drier regions upto an elevation of 1700 m amsl. *Withania* requires dry season during its growing period. It has been found growing in a temperature range of 10 – 38 ^{o} C. Leaves are simple, petiolate, glabrous about 10 cm long and flowers are yellowish in colour. Fruit is a berry which is reddish in colour (Fig 1 A, B). Fruit encloses 25-30 minute seeds which are pale yellow in colour. *W. somnifera* has been traditionally known since ancient times in India for its numerous beneficial health activities (Vaidya, 2000). The leaves, roots, stems and flowers bear medicinal values with 29 common metabolites derived from the leaves and root extracts [Mirjalili et al., 2009; Rai et al., 2016). *W.somnifera* is one of the most important herbs in Ayurveda, which has been used for >3000 years in stress management, energy elevation and improving cognitive health (Pratte et al, 2014) and to lower inflammation, blood sugar levels, cortisol, anxiety, tumour and depression along with organ-protective and neuroprotective effects have been studied extensively by researchers (Pingali et al., 2014; Montalvan et al, 2015; Gupta et al, 2021). The scientific evidence supports the prophylactic effect of *W. somnifera* to maintain immune homeostasis in inflammatory and infectious diseases (Minhas et al., 2011). The study of literature suggests that *W. somnifera* have important molecular and pharmacological characteristics to act as a therapeutic adjuvant for prophylaxis and treatment of COVID-19 (Saggam et al., 2021).

(A) (B)

Fig 1: Photographs of *W. somnifera.* in natural habitat (A) and fruits (B)

Pharmacological properties

The active chemical constituents responsible for the pharmacological properties are attributed to the steroidal lactones, withanolides and withaferins (Mishra et al., 2000; Singh et al., 2010). The important chemical constituents (Withanolides) are present in roots, leaf and berries. The dried roots of ashwagandha have been employed as valuable source of active medicinal ingredients in Indian traditional systems of medicine. It forms essential constituent or whole of 100 medicinal formulations of traditional pharmacies like Ayurveda, Unani and Sidha (Tuli and Sangwan, 2009). The roots of the plant are categorized as rasayanas, functions as a tonic for vitality and longevity (Singh et al., 2010). Root extract of *Withania* has proved effective in improving sexual functions in female (Dongre et al., 2015). *Withania* have also been used as antioxidant, adaptogen, aphrodisiac, liver tonic, anti-inflammatory agent, astringent and more recently to treat ulcers, bacterial infections, venom toxins, senile dementia, hiccups, bronchitis, rheumatism, dropsy, several female disorders, stomach and lung inflammation, skin diseases, asthma, emaciation, insomnia, neurological disorders, Parkinson's disease (Paul et al. , 2021).

Table 1. Benefits of individual part of Ashwagandha herb

Plant part	Active constituent	Uses
Roots and leaves	Withaferin-A, Withanone, Withanolide -A, Sitoindosides	Regarded as a tonic, aphrodisiac, narcotic, diuretic, anthelmintic, astringent and stimulant. It is commonly used in emaciation of children (when given to children along with milk, it is the best tonic), debility from old age, rheumatism, vitiated conditions of vata, insomnia, nervous breakdown, goiter, leucoderma, constipation, etc
Leaves	Withanoside IV, Withanoside X	Leaves taste bitter and are indicated in painful swellings and fever
Fruits	Fatty acids, Sterols, Tocopherols	Flowers are depurative, diuretic and aphrodisiac, astringent. Seeds are anthelmintic and in combination with rock salts are useful in removing white spots from the cornea

Seed germination behaviour

W. somnifera is known to possess very low germination capacity. Study of literature reveals that germination in *W. somnifera* is initiated after 14 days of incubation in the different varieties (Subhas and Sachin, 2012). Review of literature on seed germination of *Withania* suggests that the germination percentage can be improved by the application of various pre-sowing chemical treatments (Vakeswaran and Krishnasamy, 2003). Rate of seed germination in *W. somnifera* is found to vary in different varieties and locations. Exogenous application of GA_3, KNO_3 and scarification have proved effective in improving germination percent and seedling parameters of *Withania* (Niyaz et al., 2014; Krishna, 2014; Sapra et. al 2020). Thorat et al., (2021) noticed positive effects of red laser on the germination of *W. somnifera* seeds, growth characters and withanolide contents. Intercropping with red gram has

also found to increase yield of *Withania* (Ahirwar et al 2019).

Discussion

The extensive review of literature reveals that *Withania somnifera* is an important source of many pharmacologically important chemicals, such as withaferins, sito-inosides and various useful alkaloids. Role of *Withania* as antioxidant, adaptogen, memory enhancing, anti-parkinsonian, anti-inflammatory, immune-modulation, hypolipidemic, aphrodisiac, anti-diabetic has been well established.

Seed germination is the first and foremost prerequisite in assessing the quality and optimizing yields from a seed lot. So, there is an urgent need to study on germination aspect of this plant. In order to have better germination and seedling quality parameters of Ashwagandha, it is necessary to conduct germination treatments for breaking the dormancy. The enzymatic and hormonal mechanism stimulates metabolic process such as sugar mobilization, protein hydrolysis, oxidation etc., which leads to increase in seedling fresh weight and seedling dry weight. Stimulation of growth by proline is usually attributed to the nitrogen content of this amino acid. Priming of seeds with inorganic salts like KNO_3 and GA_3 may alter enzyme activity which has direct or indirect effects on seed germination and seedling growth and development (Narindera et al 2012; Shabaq et al 2015).

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