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An overview of Ashwagandha: Medicinal crop for dryland horticulture

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Abstract
Ashwagandha (*Withania somnifera*), is a member of the Solanaceae family. Ashwagandha is referred to as a "royal herb" because of its multifarious rejuvenative effects on the human body. Over 35 chemical constituents are identified, extracted and isolated and various chemical constituents such as steroidal lactones, alkaloids, flavonoids, tannin etc. are identified, extracted and isolated. At nearby, more than 12 alkaloids, 40 withanolides and several sitoindosides (a Withanolide containing a glucose molecule at C-27) are reported from aerial parts, roots and berries of *Withania* species. It's all parts i.e. roots, branches, leaf, flowers and fruits are used due to its wide range of health benefits and consumptions. In markets the value added products prepared by Ashwagandha root powder are more acceptable. Hence, there is a need to standardize and develop more value added products of Ashwagandha root powder based so, as to promote its health beneficial effects because despite of possessing great therapeutic value Ashwagandha cannot be consumed in raw form due to its bitter taste. So there is a need to develop more blended value added products having overall acceptability for wide utilization of this crop.

Keywords: Ashwagandha, health, alkaloids, root powder, value added

Introduction
Ashwagandha (*Withania somnifera)*, is a member of the Solanaceae family. It is commonly known as Indian Ginseng or Winter Cherry, Ajagandhaand and Kanaje in Hindi. The literal meaning of the word "Ashwagandha" is "smell of horse". Ashwagandha is a woody shrub or herb whose various parts (berries, leaves and roots) are used as traditional remedies in India. The herb is so named for two reasons. One reason is that the fresh roots of the herb emit the smell of horse. The second reason is that there is a commonly held belief that a person consuming extracts of the herb may develop the strength and vitality similar to that of a horse. This herb has a central and prominent place in Ayurvedic medicine. Ashwagandha is referred to as a "royal herb" because of its multifarious rejuvenative effects on the human body. This herb has been studied as adaptogenic, antioxidant, anticancer, anxiolytic, antidepressant, cardioprotective, thyroid modulating, immunomodulating, antibacterial, antifungal, anti-inflammatory, neuroprotective, cognitive enhancing and hematopoietic agent. Ashwagandha contains a range of constituents like withanolides, sitoindosides and other alkaloids that are pharmacologically and medicinally important. These chemicals protect cells from oxidative damage and disease.

Table 1: Medicinal use of different parts of *W. somnifera* Dunal

S. No.	Disorders	Part used	Description
1.	Digestive disorder	Roots	It corrects disorders processes of digestion.
2.	Rheumatism	Roots	3 g/day in rheumatic arthritis
3.	Female sterility	Roots	6 g/day with milk for 5 to 6 successive nights after menstruation
4.	Skin disorders, painful swelling	Leaves	Ointment and cream of leaves is useful in
5.	inside the skin and syphilitic sores	Leaves	ulcers and swelling
6.	Sore eyes	Leaves	Fermented leaves can be applied to get relief
7.	Brain tonic	Roots	Regular use improves stress tolerance and restores memory
8.	General debility	Roots	2 g/day
9.	Tuberculosis	Roots	Decoction of roots is used with long pepper and honey, in the treatment of scrofula (tuberculosis of lymph glands especially in the neck
10.	Insomnia	Roots	Produce deep sleep
11.	Cough and cold	Roots	3 g/day in the form of decoction
12.	Weak immune system	Roots extract	Immunomodulatory
13.	Aging	Roots	Antioxidant

Photochemistry

Phytochemistry of *W. somnifera* is extensively studied, over 35 chemical constituents are identified, extracted and isolated and various chemical constituents such as steroidal lactones, alkaloids, flavonoids, tannin etc. are identified, extracted and isolated. At nearby, more than 12 alkaloids, 40 withanolides and several sitoindosides (a withanolide containing a glucose molecule at C-27) are reported from aerial parts, roots and berries of *Withania* species. The major chemical constituents of *Withania* species, withanolides are mainly contained in leaves. Withanolides are a group of naturally occurring C-28 steroidal lactones built on an intact ergostane structure, in which C-22 and C-26 are oxidized to form a six-membered lactone ring. Withaferin A (Figure 1) was the first member of withanolides, isolated from *W. somnifera*. Withanolides are main chemical constituents responsible for multiple medicinal applications of ashwagandha. It stimulates activation of immune system cells such a lymphocytes. It inhibits inflammation and restores memory. At present, more than 125 withanolides from Solanaceae genera are well known, generally occurring in free form, but in a few cases present as glycosides Leaves are reported to contain five unidentified alkaloids (0.09%), chlorogenic acid, calystegines, withanone, tannin and flavonoids. Four types of peroxidases is purified and characterized from *W. somnifera* roots. Different chemical constituents present in *Withania* species are anaferine (alkaloid), anahygrine (alkaloid), beta-sisterol, chlorogenic acid (in leaf only), cysteine (in fruit), cuscohygrine (alkaloid), iron, pseudotropine (alkaloid),scopoletin, somniferinine (alkaloid), somniferiene (alkaloid), tropanol (alkaloid), withanine (alkaloid), withananine (alkaloid) and withanolides A-Y(steroidal lactones).

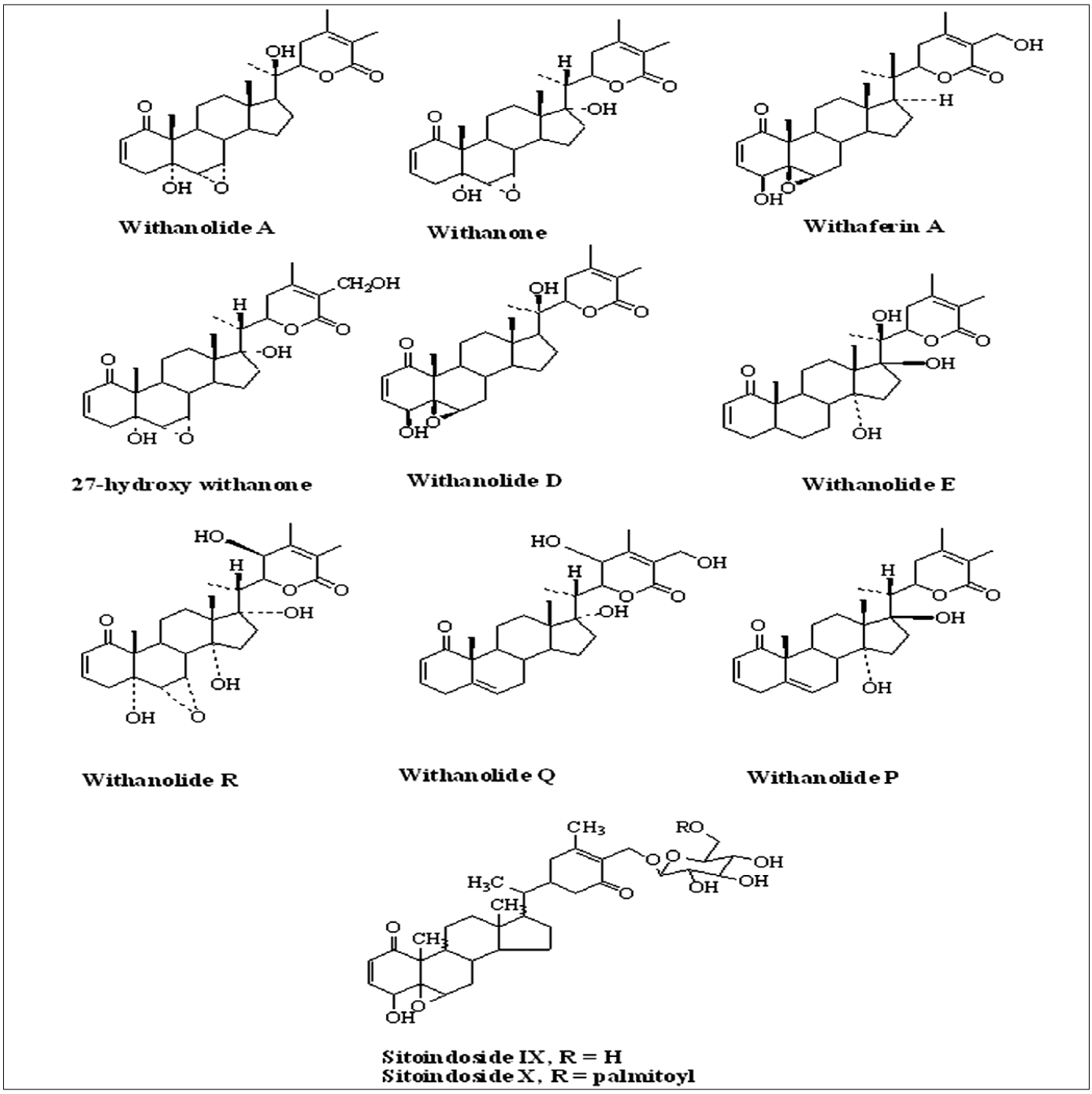

Fig 1: Chemical Structures of Active Constituents of *W. somnifera*

Botanical Description

Kingdom	:	*Planate*
Subkingdom	:	*Tracheobionta*
Super division	:	*Spermatophyta*
Division	:	*Magnoliophyta*
Subclass	:	*Magnoliopsida*
Order	:	*Solanales*
Family	:	*Solanaceae*
Genus	:	*Withania*
Species	:	*Withania somnifera*

Cultivation and Harvesting

Ashwagandha is commonly grown in moderate and drought condition and it is found in almost all region of India. *Withania somnifera* is a plant of moderate environmental conditions especially semitropical region. Indian farmers also trying to cultivate these types of medicinal crops which are mainly cultivated in the moderate drought soils conditions (Rajasthan, Gujarat, Uttar Pradesh, Madhya Pradesh and Haryana etc.). It is grown as late rainy season (kharif) crop. The semi-tropical areas receiving 500 to 750 mm rainfall are suitable for its cultivation as rainfed crop. If one or two winter rains are received, the root development improves. The crop requires relatively dry season during its growing period. Ashwagandha grows well in sandy loam or light red soil having pH 7.5 to 8.0 with good drainage. Black soils or such heavy soils are suitable for cultivation.

The mature seeds of Ashwagandha are used for the cultivation in ending of summer and starting of rainy season. The neutral pH, nitrogen rich soil is suitable for the growth of Ashwagandha plant. The organic and nitrogen rich fertilizer is used for the formation of good quality and quantity roots of Ashwagandha plant. The plant is harvesting in starting month of April. Now a day it is cultivated around whole part of World. It's all parts i.e. roots, branches, leaf, flowers and fruits are used due to its wide range of health benefits and consumptions**.**

Maturity of the crop is judged by drying out of leaves and yellow-red berries. Flowering and bearing of fruits start from December onwards. The crop is harvested for roots by digging in January to March i.e. 150 to 180 days after sowing. There should be moisture in soil at the time of digging. Roots are dug out or ploughed using power tiller or a country plough. The tap root should be carefully pulled out not damaging even the small lateral roots.

On an average, the yield from 1 hectare of commercial cultivation is approximately 3 to 5 quintal of dry roots and 50 to 75 kg of seeds. A maximum yield can be procured upto 6.5 to 7.0 q/ha. There are instances where farmers have achieved root yields as high as 1 tonne. Commercially, 6 to 15 mm diameter and 7 to 10 cm length root species are better. Alkaloid percentage in roots ranges from 0.13 to 0.31%.

Ashwagandha Root and Leaf Incorporated Products

Extrudates

Choudhury *et al*., (2014) [5] developed Ashwagandha fortified snacks and found more antioxidant as compared to control. The comparison of extrusion cooking of herbal snacks with traditional cooking process of dried products, the resulting of extrusion cooking was found more retention of bioactive compounds. The value addition processing of herbal antioxidant is promising area which is needed to be explored for commercial application.

Juices and Beverages

Choudhury *et al.,* (2014) [5] done trial to develop a functional ready to serve (RTS) beverage blend using *Withania somnifera* (Ashwagandha) and *Solanum nigrum* (Makoi) separately with orange juice (*Citrus sinensis* L.). Both Ashwagandha fortified beverage blend and makoi fortified beverage was found more or less comparable quality characteristics both in fresh and in stored samples. The developed products were acceptable till 90 days when stored at room temperature. The results were found by researcher that antioxidant rich Ashwagandha (AFBB antioxidant activity: 899±22.4 µmol TE/100 gms) and *Solanum nigrum* (MFBB antioxidant activity: 750±21.8 µmol TE/100 gms) could be successfully utilized to develop functional fruit beverage to improve quality of nutrition in today's way of life.

Sweets products

A study reported that addition of 0.5 per cent *Withania Somnifera* powder to shrikhand has improved the organoleptic quality and the product was self stable and acceptable up to 52 days at refrigeration temperature. Choudhury *et al.,* (2014) [5] was developed the cereal-legume based Ashwagandha root powder incorporated sweet *ladoo* and studied the sensory characteristics and nutritional composition such as crude fat, crude fiber, total dietary fiber and mineral content. The *ladoos* exposed that the variation in proportion of cereal-legume affected the sensory scores of the *ladoos* more than the level of Ashwagandha root powder incorporation it was a sweet product and minor bitter taste. The taste of Ashwagandha root powder was masked by sweetness of jaggery. As per sensory score i.e. overall acceptability of the *ladoos* adversely and incorporation of Ashwagandha root powder till the level of 5% was acceptable. The shelf life study indicated that the ladoos days. The shelf life of these ladoos can be further increased by increasing the jaggery and fat content. The results of nutritional evaluation exposed that Ashwagandha root powder supplementation improved the nutritional as well as shelf-life of developed product. The study as a result suggest that Ashwagandha root powder supplementation can be used effectively as a source of value addition in sweet preparations to increase the fat, fiber and mainly the micronutrient content in addition to imparting beneficial medicinal properties.

Bakery and Cereal products

Sensory evaluation of the developed products by semi trained panels revealed that 1.5% level of incorporation of *Withania Somnifera* powder in sweet and salt biscuits and customer assessment exposed that 2.5% level of incorporation of *Withania Somnifera* powder was used in sweet and salt biscuits (blend of sorghum and wheat flour). The result of developed product was found by Sowmya, Narayan, satisfactory. However the addition of 5% level of Ashwagandha powder in Namakpara, Muruku, Pappu chakalu, and upto 10% in Missi roti and Chutney powder was acceptable. Anita *et al.,* (2017) [1] worked on the development of herbal based functional food using Ashwagandha leaf powder and found the developed product have high nutritional value as compared to the control sample. The Ashwagandha based cookies was good source of number of bioactive components which will be helps in the improvement of overall health. Indu and Awasthi, (2018) [5] was studied and prepared the cereals- legumes incorporated biscuits using Ashwagandha root powder at different proportions (3%, 4% and 5%) and best combination was found at the level of 5 percent addition. The study was showed that enriched biscuits were rich of energy, minerals, fibers, protein and enhancing the medicinal properties. The Ashwagandha root powder (2%) added in the baked products such as flat bread and thepla and

reported the lower down glycemic index which also lowers down the diabetes mellitus.

The Nutrients calculation of prepared products (Cheela and Cookies) showed that the protein, fat, crude fiber, energy, carbohydrate, iron, calcium and vitamin C content of the prepared products were increased by the incorporation of medicinal root powder with besan in cheela and with refined wheat flour in cookies. The antioxidant content such as total polyphenol and anti radical scavenging activity was also increased significantly in cheela and cookies. As the incorporation level of the dehydrated medicinal herbs leaves increased, the cost of prepared products decreased.

Dairy products

Ashwagandha extract in liquid or powder form may be added in dairy products and it provides the nutraceutical function. Pawar *et al.*, (2014) [11] studied the incorporation of Ashwagandha powder, vidarikand and shatavari was found highest antioxidant properties among the herbs. Arjuna herb incorporated ghee was developed by National Dairy Research Institute (NDRI) Karnal, India. The developed ghee functionality and stability against oxidation of fat was found better as compared to traditional ghee. The medicinal properties of Arjuna extract is effective against cardiovascular disease. Sharma and Sansthan (1998) [12] was studied the *Withania somnifera* are steroidal lactones, sitoindosides and steroidal alkaloids it is a immune boost application and most important herbal tonic in plant kingdom.

Conclusions

It is a multipurpose herb that acts on various systems of the human body: the neurological system, the immune system, the energy- production system, the endocrinal system and the reproductive system. Food is components which fulfill our daily energy needs and nutrition. The food products are fortified by natural herb (Ashwagandha) and its bioactive compounds effective in prevention and treatment of numerous diseases. In markets the value added products prepared by Ashwagandha root powder are more acceptable. Hence, there is a need to standardize and develop more value added products of Ashwagandha root powder based so, as to promote its health beneficial effects because despite of possessing great therapeutic value Ashwagandha cannot be consumed in raw form due to its bitter taste. So there is a need to develop more blended value added products having overall acceptability for wide utilization of this crop.

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