



OPPORTUNITIES AND CHALLENGES IN THE CULTIVATION OF ASHWAGANDHA {*Withania somnifera* (L.) DUNAL}

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Abstract- Winter cherry or Ashwagandha (*Withania somnifera*) is an important medicinal plant native to India. The roots are widely used in Indian systems of medicine for more than 4000 years. The roots are credited with several medicinal properties. Recent research suggests phytochemical withaferin A present in the leaves possess antitumor activity. It is drought tolerant annual, hence is cultivated under rainfed condition in marginal soils by small and marginal farmers of Madhya Pradesh, Rajasthan, Andhra Pradesh, Karnataka and other Indian states. The ease of cultivation and high price for the roots is attracting farmers for large scale cultivation. In addition to the roots, leaves and seeds are also marketed enhancing the profits of the farmers. The future is excellent for extending its cultivation and production of numerous value added products from its roots.

Keywords- Winter cherry, *Withania somnifera*, cultivation, value addition, uses

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Introduction

The plant winter cherry or Indian ginseng is popularly known as ashw(v)agandha and is recognized as an important medicinal plant in traditional systems of medicine for centuries. The Sanskrit name "ashva" meaning horse and "gandha" meaning smelling was given to this plant due to the smell of the roots resembling a sweating horse. Ashwagandha was first mentioned by sage Punarvasu Atreya over 4000 years ago. Subsequently the medicinal properties of this plant were mentioned in Ayurvedic treatises such as Charaka Samhita, Sushruta Samhita, Astanga Hridaya, Bhava Prakasha Nighantu etc. to mention a few. Currently around 200 traditional medicinal formulae are prepared in Ayurveda, Siddha and Unani systems using this plant. All the plant parts are credited with medicinal properties [5]. This plant is attracting the

attention of researchers from different parts of the globe and its future as a remedy for several diseases and demand for its parts and chemicals derived from them is steadily increasing.

Taxonomy

Ashwagandha ($2n=48$) belongs to the kingdom *Plantae*, sub-kingdom *Tracheobionata*, super division *Spermatophyta*, division *Angiosperma*, class *Dicotyledons*, order *Tubiflorae* (*Solanales*), family *Solanaceae*, genus *Withania* and species *somnifera* (L.) Dunal, meaning sleep inducing. The genus *Withania* with 26 species is widely distributed from southern Mediterranean to Canary Island to south and east Africa, Congo, Madagascar and from Palestine up to north India covering Israel, Jordan, Egypt, Sudan, Iran, Afghanistan, Baluchistan and Pakistan [5].

Common names

Ashwagandha is known by several names as mentioned in Table 1.

Table 1- Vernacular names of Ashwagandha in different languages

Language	Name
English	Winter cherry, Indian ginseng
Sanskrit	Ashvagandha (Horse smelling)
Hindi	Asgandh
Urdu	Asganda nagori
Punjabi	Aksan, Asgand
Haryanavi	Aksin
Gujarati	Ghodaakun, Asuth
Rajasthan	Sarvagandha
Marathi	Askandha, Kanchuki
Konkani	Fatarfoda
Bengali	Ashvaganda
Oriya	Asugandha
Assamese	Asgandhisrol
Kannada	Amangura, Sogadeberu
Malayalam	Amukkiram, Pevetti
Tamil	Amkulan-kalang, Achuvagandhi
Telugu	Penneru gaddalu

Botanical description

Withania somnifera is a small, erect, branched, evergreen, tomentose woody shrub that grows up to 150-170 cm tall and is found throughout the drier parts of India in waste places and on bunds. Roots are stout, fleshy and whitish brown in colour. Leaves simple, petiolate, elliptic-ovate to broadly ovate, entire, exstipulate, cunate or oblique, glabrous, up to 10 cm long, those in the floral region are smaller and opposite. Flowers inconspicuous, greenish or lubrid-yellow, pedicellate, 4-6 mm in diameter, axillary, umbellate cymes occurring in 5-25 clusters. Berries are small, globose, bright orange-red when mature, 5 mm in diameter, enclosed in the persistent calyx containing numerous seeds. Seeds are small, smooth, yellow, reniform, 2 mm long, 1.5-2 mm wide and 0.5 mm thick

Chemical constituents

Different parts of the plant contain a number of chemical compounds. Some of them are listed below:

- **Alkaloids**

ashwagandhine, anahygrine, anaferine, cuscohygrine, tropine, isopelletierine, pseudotropine, [3]-tigloyloxtropine, 3- tropylligloate, dlisopelletierine, hygrine, mesoanaferine, choline, somniferine, withanine, withananine, hentriacontane, visamine, withasomnine etc.

- **Steroidal compounds**

ergostane

- **Steroidal lactones**

withaferin A, withanolides A-Y, withasomniferin-A, withasomnidienone, withasomniferols A-C, withanone etc.

- **Saponins** containing an additional acyl group: sitoindoside VII and VIII

- **Withanolides** with a glucose at carbon 27: sitoindoside IX and X

- **Withanolide glycosides**

withanosides I, II, III, IV, V, VI and VII

- **Pyrazole derivatives**

pseudowithanine and ashwagandhine

Apart from these contents plant also contains chemical constituents like withaniol, acylsteryl glucosides, starch, reducing sugar, hantreacotane, ducitol, a variety of amino acids including aspartic acid, proline, tyrosine, alanine, glycine, glutamic acid, cysteine, tryptophan, and high amount of iron [5,6].

Pharmacological activities and uses

Different plant parts of this plant possess the following activities: abortifacient, amoebicide, anodyne, bactericide, contraceptive, diuretic, emmenagogue, fungicide, narcotic, pediculicide, sedative, spasmolytic, adaptogenic and tonic. In folk medicine preparations from this plant were used to treat arthritis, asthma, adenopathy, anthrax, bronchitis, cancer, candida, cold, cough, cystitis, debility, diarrhea, dropsy, dyspepsia, fever, gynecopathy, hiccup, hypertension, inflammation, lumbago, nausea, piles, psoriasis, ringworm, scabies, senility, small pox, sores, syphilis, tuberculosis, tumors, typhoid, uterosis and wounds. In traditional systems drugs made from Ashwagandha are used to treat general/sexual/nervine debility, stress, bone weakness, anxiety, high blood pressure, constipation, ageing, muscular weakness, insomnia and as an every day health supplement to cope with modern day stress. Leaves are used for curing fever, lesions, swelling, sore eyes and syphilitic sores. Green berries are used for treating ringworm infection, animal sores and horse's girth galls [5,6].

Opportunities for cultivation

The global interest in this plant and the high demand for its roots provide ample scope to cultivate this plant on commercial scale [1,2]. Other opportunities for cultivation include: Present price for roots is attractive, crop gives economically remunerative returns in comparison to traditional crops, ease of cultivation under rainfed condition, the crop can be integrated with traditional crops through crop sequencing, opportunities for marketing leaf and seed exist, bye-products can be profitably be utilized, value addition can increase profits, however, current exports are limited and large scale exports of roots and value added products need to be explored.

Cultivation practices for Ashwagandha

In India Ashwagandha is commercially cultivated as rainfed crop in Kota district of Rajasthan; Bhanpura, Manasa, Neemuch, Jawad tehsils of Mandsaur district of Madhya Pradesh; Anantapur, Kurnool, Mahabubnagar, Warangal and Prakasam districts of Andhra Pradesh. Cultivation has been initiated at few locations in Karnataka [1-4]. The cultivation details are given below:

Soil and climate

In India, it is distributed from 23° N-33° N, from 180-1700 m above mean sea level. The semi-arid tropical areas receiving 500-750 mm rainfall are suitable for cultivation of this crop. It requires dry season during its growing period. One or two late winter rains are conducive for proper development of roots. The crop grows well in well-drained sandy, sandy loam or light textured red/black soils having a pH of 7.5-8.0.

Varieties

Poshita and Rakshita are high yielding varieties released by CSIR-CIMAP, Lucknow. Jawahar 20 is cultivated in Madhya Pradesh. WSR is another variety released by CSIR-Regional Research Laboratory, Jammu. Nagori is a local variety with starchy roots [3, 4].

Seed rate and germination

The rainfed crop is generally sown by broadcasting the seeds (15-25 kg/ha) mixed with sand. Irrigated crop is sown in rows 20 cm apart maintaining 5-10 cm plant-to-plant distance (5-10 lakh plants/ha). Seeds germinate in 6-10 days after sowing, but sometimes the germination may be erratic. Treating the seeds with nitrogen salts improves germination, seedling vigour and root yield [1,2]

Sowing time

Rainfed crop is sown late in the rainy season in the month of August in Madhya Pradesh. In Andhra Pradesh it is sown during the rainy season. Seeds are sown when soil moisture is sufficient for good germination. A long break in the monsoon or heavy rains adversely affect germination. Seeds are treated with fungicides (Mancozeb or Thiram at 3 g/kg seed) prior to seeding to protect the seedlings from seed borne diseases [3, 4].

Thinning and weeding

Seedlings are thinned 25-30 days after planting if required and are manually weeded once. Well-grown crop can effectively suppress weeds by smothering them.

Fertilizer application

In Madhya Pradesh, farmers generally do not apply any fertilizers. Experimental evidences have also shown that the root yield is not influenced by fertilizer application in Madhya Pradesh. However, organically grown medicinal plants are commanding a good demand both in national and international markets. Therefore, application of 10-15 t/ha of farmyard manure or 3-5 t/ha of vermicompost along with biofertilizers such as phosphorus solubilizing bacteria is recommended for harvesting high root yields on a sustainable basis. Alternatively 65 kg urea, 200 kg single superphosphate and 50 kg muriate of potash/ha may be applied; P and K at planting and N in 2 splits at 30 and 60 days after planting [3].

Irrigation

It is generally raised as a rainfed crop. However, where irrigation facilities exist, light irrigations once in 15-20 days encourage good crop growth and produce high root yield.

Pests and diseases

A number of leaf eating pests (mites, aphids, beetles) and diseases (seedling blight, leaf blight, die back etc.) are reported on Ashwagandha. A combination of 0.5% Malathion and 0.3% Kelthane foliar sprays at 15 days intervals controls the pests. Similarly, seed treatment with Thiram/Mancozeb and spraying of 0.3% Mancozeb or Copperoxychloride control the fungal diseases. Organically grown plants are sprayed with botanical pesticides such as neem products, custard apple leaf decoction, cow urine, garlic + chillies extract etc. as a prophylactic measure to protect the crop

from pests and diseases [3, 5].

Harvesting

The crop is ready for harvest 180-210 days after planting. In some regions 150-180 days old crop is harvested. Drying out of leaves and reddening of berries judge the maturity of the crop. The entire plant is pulled out and cutting the stem 1-2 cm above the crown, separates the roots. The roots are cleaned and either cut into 7-10 cm long pieces and dried or dried as a whole in the sun and stored. Berries are hand plucked, dried, threshed and the seeds are stored for the next crop [3-5]

Grading of roots

The dried roots are beaten with a club to remove adhering soil and to break off thin, brittle, lateral rootlets. Lateral branches, root crown and stem remains are carefully trimmed with a knife. Root pieces are then sorted out into following grades.

1) A grade

Root pieces up to 7 cm in length, 1-1.5 cm in diameter, solid cylindrical with smooth external surface and pure white from inside.

2) B grade

Root pieces up to 5 cm in length, 1 cm or less in diameter, solid, brittle and white from inside.

3) C grade

Solid root pieces up to 3-4 cm in length, 1 cm or less in diameter.

4) D grade

Small root pieces, semisolid or hollow, very thin, yellowish inside and < 1 cm in diameter.

of late farmers are grading the roots into 7 or more grades.

Yield and profits

The crop produces 400-1200 kg/ha dried roots and 200-500 kg seeds/ha. Good quality roots are selling at a price of Rs.100-150/kg and seeds at Rs.40-100/kg. The cost of cultivation works out to Rs. 15000-25000/ha. The net profit ranges from Rs. 25000-155000/ha. Additional returns can be earned by selling seeds and leaves.

Value addition

Value added products from Ashwagandha include root powder, capsules, root extract, herbal beer etc. in addition to the traditional drugs made from this plant. Health drinks, herbal tea, functional foods, nutraceuticals and cosmeceuticals are some of the value added products on which enterprises can be set up.

Side effects

No significant Ashwagandha side effects are reported in the medical literature, but long term studies are required. A very high dose of Ashwagandha could create irritability and insomnia. A mild Ashwagandha side effect could include sleepiness or lethargy.

Precautions

Liquid preparations of Ashwagandha may contain sugar and/or alcohol. Caution is advised for patients with diabetes, alcohol dependence or liver disease. Consulting doctor or pharmacist about the safe use of Ashwagandha is advocated. Ashwagandha is not recommended for use during pregnancy. Consulting doctor before using Ashwagandha is necessary. Because of potential risk

to the infant, breast-feeding while using Ashwagandha is not recommended. Doctor consultation is advised before breast-feeding.

Patents

About 8 patents have been filed in India by Indian and Japanese organizations. Another 12 mentioning Ashwagandha in the patent documents have been filed by Indian and American companies/institutes in India and USA indicating the interest shown by overseas companies on this plant. This is a challenge that needs to be addressed immediately.



Fig. 1- Ashwagandha: Field view of 2 months old crop



Fig. 2- Ashwagandha: Field view of 5 months old crop

Challenges and conclusion

The challenges for Ashwagandha cultivation and business are: Market exploitation of farmers by middlemen, price fluctuations of roots, demand-supply fluctuations of roots, limited exports, patenting by foreign companies, changing climatic conditions, long duration of the crop, low root yields, high fibre content of the roots in some locations, pests and diseases infections reducing yield and resulting in plant mortality, labour problems (high cost, non-availability during peak season, unreasonable demands by labourers), lack of knowledge about post harvest technology and problems associated with long term storage of roots.

Ashwagandha is a potential medicinal plant that can generate

global business to India Inc.

Scientific studies on this crop need to be increased by many folds urgently to effectively counter patenting of technologies based on this crop by transnational companies and to put its several medicinal uses by India to the maximum use. Opportunities exist for large scale commercial cultivation of this crop in many districts of Andhra Pradesh and other States of India.

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