International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2020; 8(1): 2180-2184

Received: 07-11-2019
Accepted: 09-12-2019

Shekhawat K
Department of Plant Breeding and Genetics SKN Agriculture University, Jobner, Rajasthan, India

Kumawat S
SKN University of Agriculture and Technology, Pantnagar, Uttarakhand, India

Rekha K
Department of Plant Breeding and Genetics, Bihar Agriculture University, Sabour, Bhaglpur, Bihar, India

Get S
Department of Plant Breeding and Genetics SKN Agriculture University, Jobner, Rajasthan, India

Choudhary R
Department of Plant Breeding and Genetics SKN Agriculture University, Jobner, Rajasthan, India

Jakhar ML
Professor, Department of Plant Breeding and Genetics SKN Agriculture University, Jobner, Rajasthan, India

Corresponding Author:
Shekhawat K
Department of Plant Breeding and Genetics SKN Agriculture University, Jobner, Rajasthan, India

A review on Guggulu [*Commiphora wightii* (Arn.) Bhand.]: *In vitro* propagation of critical endangered ayurvedic plant

Shekhawat K, Kumawat S, Rekha K, Get S, Choudhary R and Jakhar ML

DOI: https://doi.org/10.22271/chemi.2020.v8.i1ag.8590

Abstract
Guggulu has been a major component in the ancient Indian Ayurvedic system of medicine. Apart from its use in the medicinal and aromatic industries by Ayurvedic practitioners, it has been used extensively to treat many types of disorders. Guggulu is a gum or resin that is extracted from the plant *Commiphora wightii* (Arn.) Buffalo. (Syn. Commiphora mukul hook. Ex. Stocks) or Guggulu tree. Guggulu is a shrubby or small tree that belongs to the Bursaceae family. Guggulu contains volatile oils, gum resin, guggulipids, guggulsterones, guggulsterol, mucolol and other steroids. Guggulu is used extensively in Ayurvedic medicine as astringent, anti-septic, expectorant, aphrodisiac, carmenative, anti-spasmodic, emmenagogue. In Ayurveda, Guggulu is the best of the herbs used for Medorroga and Vata disorders. It is widely used for obesity and is also known as a fat burning agent throughout the world. It helps in lowering the levels of cholesterol and triglycerides. Guggulu is very effective in arthritis, gout and sciatica. It is one of the most important chemicals of Ayurveda. In addition it treats sluggish liver, stimulates libido, nervous diseases, bronchial congestion, cardiovascular and circulatory problems, weak digestion, bruises, boils, pimples, fractures, gynecological problems and various skin diseases. Guggulu is a very important and reliable herb in Ayurvedic medicine. Originally it is used in almost every type of disease due to its amazing healing power. This review is an attempt to describe the pharmacological activities of Guggulu and the variable uses of Guggulu.

Keywords: Guggulu, ayurvedic medicine, nervous diseases, bronchial congestion, cardiovascular

Introduction
India has a wealth of well-recorded and traditionally well-practiced knowledge on medicinal plants. More than 6000 plants are used in our traditional, folk and herbal system. India is endowed with a rich genetic resource of medicinal plants and is called the "Emporium of Medicinal Plants". *Commiphora wightii* (Arnot) is a medicinally important plant now considered as a critically endangered species of the family Bursaresi and has a chromosome number 2n = 26 (Sobti and Singh, 1961) [21]. It is an important medicinal plant of India's herbal heritage. It is known by names such as Guggul in Hindi, Gukkalu and Masakshi in Tamil, Guggulu in Sanskrit and Indian Bedellium in English. The genus Comiphora is widely distributed in tropical regions of Africa, Madagascar, Asia, Australia and the Pacific Islands (Good, 1974) [4]. In India, it is found in the rocky areas of Rajasthan and Gujarat Maharashtra and Karnataka (Kumar and Shankar, 1982) [12]. In Rajasthan it is found in Jaisalmer, Barmer, Jodhpur, Jalore, Sirohi, Ajmer, Sikar, Churu, Jhunjhunu, Pali, Udaipur, Alwar (Sariska Tiger Reserve), Jaipur (Ramgarh, Jhalana region), Bhilwara and Rajsamand. Guggul is a woody shrub with knot, crooked, brown hooves, leaves 1–3 leaves, cecal with serrated margins. Fruits are red in color, oval with two celled stones. Flowers small, brown, pink flowers Bisexual small, brownish red, fascinated polygamy Sexual distribution: Bisexual, female and male flowers. Their 3-4.5 mm long, usually reddish-white pink, appear on flowers in individual or in groups 2 or 3, fruit red drupe, elliptical, slender-shaped, 2-cell-type storey, rarely your four. Valve voids, when ripe will be red and split into two. The flakes exposed to the bark under the ash bark contain bark that closes into the thin papaya tolls. During April and May, there is a shrinking area in the winter for Guggul Gum extraction and the extraction of Guggul Gum. This major species in the arid areas of *Commiphora wightii*, Rajasthan and Gujarat states

(northwest India), is now on the verge of extinction on most of its Indian border and is listed as endangered (IUCN 2010). The major reasons for its rapidly declining population are over-exploitation (exploitation of woody shoots for its ole-gum-resin), poor natural germination rate and slow growth rate. The resin extracted from the stem is considered by some as a cholesterol lowering agent and is therefore a favorite of the Ayurvedic medical industry. This has resulted in widespread indiscriminate exploitation of resin through this exploitation. The magnitude of the conservation problem facing Wighty is greatly outweighed by the fact that after tapping through deep cutting, one usually dies within two to six months of a single tapping episode (Bhatt *et al*, 1989, Paliwal 2010). It is not yet clear why plants die after taping. Guggul seeds are the major propagation source in nature. Flowers and seeds in Rajasthan and adjoining arid regions during successive winter seasons are produced by WITI. However, germination of seeds is poor, so large scale tree planting is not possible with this natural method. Therefore, considerable efforts are still required to find efficient efforts for *in vitro* methods for regeneration of this critically endangered medicinal plant. *In vitro* proliferation method can be used for production of active compound in cell germ, selected germplasm, genetic improvement, clonal proliferation. *In vitro* proliferation in wightii has been attempted through organogenesis and somatic embryogenesis methods by various researchers.

In vitro proliferation

***In vitro* propagation / clonal proliferation**: *In vitro* proliferation is the production of a whole plant from small sections of the plant such as stem tip, node, meristem, embryo or even a seed. The process of *in vitro* in Guggul involves 5 distinct steps.

Stage 1

In this stage elite maternal plants are selected which should be healthy (free from disease) and are prepared in such a way that they provide suitable and more sensitive exploration for establishment in contamination-free cultures.

Stage 2 Explant

For the response of tissue culture technique to callus initiation and regeneration, the selection of the investigator type is important. The quality of explorers mainly determines the establishment of *in vitro* culture (John and Murray, 1981) [7]. *In vitro* growth of explosives and degree of contamination can be influenced by seasonal conditions at the time of explosive collection. Barve and Mehta (1993) [1] investigated that Comipora wighty explosives were collected in the month of April – June, they responded well, while contamination rates were higher for culture during September – October.

Mishra and Kumar (2010). Developed reliable and reproducible protocols to obtain healthy and well-grown plants from juvenile seekers of weight. Fresh explorers consisting of leaf, embryonic and nodal segments of the wight were selected for *in vitro* callus initiation in MS medium, individually supplemented with 2, 4-D and kinetin and in combinations. Found effective for callus induction in WITI. The MS medium was individually supplemented with 2, 4-D (1.0 - 5.0 mg / l) and Kn for callus initiation. (1.0 - 5.0 mg / L) and in combination with 2, 4-D (1.0 - 5.0 mg. / L) with n. (0.1– 0.5 mg / l.). Callus is supplemented in MS medium in 2, 4-D and Kn individual and combination. However good callus initiation and growth were observed with a combination effect of 2, 4-D and Kn. Maximum 5.78 grams. Fresh callus biomass was obtained in treatment MS + 2, 4-D (5 mg / l) + Kn (0.5 mg / l).

Surface Sterilants

Successful disinfection of explants in *in vitro* culture is a pre-requisite and often includes a standard set of treatments. Deeply washing plant material in running tap water before the surface sterilization process. Mainly HgCl2 and NaOCl are used for surface sterilants.

Joshi and Mathur (2015) [8] found the fungicide Bavistin to be effective, when used with HGCL2, over different time periods. However, the surface of the surface sterilized with NaOCl (1%) and HgCl2 (0.1%) for different time intervals showed varying levels of% of contamination. However the sterilization of the apical bud and nodal explorer with 0.1% HgCl2 for 4 minutes was more effective than NaOCl (1%). Maximum contamination-free cultures were obtained when diluted with Bavistin with 0.1% HgCl2 for 4 min.

Culture Media

The selected explorers are sterile on the surface and are suitably cultured as appropriate. Growth and morphology of plant tissue *in vitro* are largely controlled by the composition of culture media. Although the basic requirements of cultured plant tissue are similar to those of whole plants, in practice, the nutritional components that promote optimal growth of tissue under laboratory conditions may differ with respect to particular species. Media compositions are designed keeping in mind the specific requirements of a particular culture system. The selection or definition of a culture medium is critical for success with the *in vitro* process. The formation of inorganic salts can vary, but in most cases the MS medium is the most commonly used culture medium in plant tissue culture (MS, 1992).

Parmar and Kant (2012) [16] reported an effective process of Gugul micropropagation. Nodal sections were used as explorers. Responsive treatments in terms of bud break response were tried on different media types MS, B5 and WPM media for suitability of the most responsive nutrient medium to improve bud break response, length, and number of seedlings.

Stage 3 Cytokinin

Effective explorers from stage I, sub-cultured on a new medium. The time and concentration of auxin and cytokinin in the multiplication medium is an important factor affecting the extent of multiplication. Cytokinins are purine derivatives that support cell division. The two main types of cytokinin used in tissue culture are benzyl amino purine (BAP) and kinetin. The cytokinin signaling pathway represents a potential target for manipulating de novo shoot organogenesis and *in vitro* plant regeneration.

Kant *et al.* (2010) [9] reported an effective process of Guggul micropropagation. Cotyledonary nodes were used as an explorer and several microsysts were obtained on Murashige and Skoog, 1962 medium with 2.68 µM α-naphthalene acetic acid (NAA) and 4.44 µM 6-Benzylamino purine (BAP) And was supplemented with 2.68 µM NAA + 4000 BAP. With additives (glutamine 684.2 µM; thiamine 29.65 µM; activated charcoal 0.3%) and various other hormonal combinations. The elongation of the microshut was significantly observed on 2.46 µM indole-3-butyric acid (IBA) and 2.22 µM BAP supplemented MS medium.

Soni (2010) [22] observed multiple shoot bud formation in nodal exploitative when two cytokines (0.5 mg / l Kn and 3.0 mg / l BAP) with IBA (0.5 mg / l) were added to the growth medium. When the IBA was replaced with the IAA per year, the number of seedlings per explorer increased. Other plant growth regulators did not elicit any significant morphogenetic responses in Nodal Explorer alone or in combinations.

Tejowati et al. (2011) reported 40 singles as well as NAA (1.0–4mg / l), IBA (0.1–4mg / l), BAP, Kn (1–4mg / l) and gibberlic acid – GA3 (0.5–1.5mg). Studied the combination of L) tested, showed no shoot development on any cytokinin, auxin or GA3 supplemented medium. Similarly, low concentrations, in combination with BAP with IBA, failed to induce shoot growth from any investigator. However, in high concentrations of BAP (3.0mg / l) with IBA, shoot growth from both explosives was observed. MS with BAP (3.0mg / l) + IBA (0.2mg / l) gave better response (20%) followed by 3mg / l BAP + 0.3mg / l IBA (13%).

Stage 4 Rooting

Proliferated shoots are transferred to a routing medium. This phase is designed to inspire the establishment of fully developed plants. Auxins are primarily concerned with inducing cell division. The hormones of this group in nature are associated with activities such as stem, internodes, tropism, apical dominance, abscess and inertial functions. Various factors have been tried in favor of root initiation. Auxin IBA was found to be the most effective of all auxin types. In contrast, IAA was the least effective being natural because it was degraded due to light. The availability of IBA induces primary / secondary roots, where the NAA root induces hair. Normal root medium contains less salt. The last period is *in vitro* before the *in vitro* conditions are transferred to the former.

Singh *et al.* (2010) [18] supplementation of the MS half-strength medium with 2.0 mg / L IBA proved better with forty percent routing after 22 days of implantation. Most of the roots were long and healthy. Micropropagated plantlets were tightened and acclimatized. They were successfully transferred to pots containing sterilized soil and sand mixtures (1: 1) with a 60% survival rate under field conditions.

Micro-shoots of 2–3 cm in length were initially given a 24-hour treatment in medium supplementation with liquid MS and White. 4.92 µM IBA and 5.71 µM IAA were transferred to the dark state, followed by semi-solid semi-strength hormone-free MS and white. Medium supplemented with 2% sucrose and 0.5% activated charcoal. High (86.7%) percent germination was obtained after 4-5 weeks with 6.85 advent 0.5 6.46 ± 0.4 cm length of multiple adventitious roots. (Kumar and Tarun, 2012) [10].

Regenerated individual shoots of 1-2 cm of Comifora witty for root induction were initially treated in liquid MS media and White's medium was stained with 0.5 mg / L IBA in a dark condition for 2 days, then they were Are transferred to light in a semi-solid. Half-strength hormone-free MS media and White's medium supplemented with 2% sucrose and 1% activated charcoal. It was observed that continuous blackening during the rooting inductive phase increases peroxidase activity resulting in higher rooting rate. (Joshi and Mathur, 2015) [8]

Stage 5

Hardening: Hardening refers to the process of elevating plants from indoor temperatures to outdoor levels. Hardening of *in vitro* raised plantlets is necessary for better survival and successful establishment. Transferring the plant directly from the tissue culture to the field is not possible due to very high humidity, high rates of fossil environments with diverse lighting and temperature conditions and being protected from attack by microorganisms and other agents.

Kant *et al.* (2010) [9] developed well-rooted plants and transferred them quarter-level in glass jam jars with vermiculite and wetted with Hogaland's solution. After 4-5 weeks when the plantlets showed new growth, the plastic cap of the glass jar was slowly removed over a period of 2-3 days to reduce the relative humidity in the jar, then finally the whole of the jar from the third day. Caps were removed as such. Plantlets were then transferred to thermocol cups moistened with Högaland solution at intervals of one week. These plants were kept in a mist chamber. After two weeks these were then transferred to soil: FYM 1: 1 mixture in plastic plantation bags (poly-bags) size 9x9x36 cm (2916 cm 3). In the Mist Chamber, a 90-second mist was given at ten-minute intervals to maintain relative humidity between 85 and 95%. The temperature of the mist chamber was maintained between 28–30 °C. Poly-bagged plantlets were transferred one month after the transfer under a green-50% agronate shed and after two weeks were transferred to the area, where they are growing well and have begun to flower and seed. set on. Development data of plants grown in the area is being collected.

Benefits of spreading *in vitro* in Guggul

- The technique of *in vitro* propagation is an alternative approach to traditional methods of vegetative propagation, with an increased rate of multiplication.
- Millions of shoot tips can be obtained from a small, microscopic piece of plant tissue within a short period of time and space.
- The advantage in this type of propagation is that shoot multiplication usually has a short cycle (2–6 weeks) and each cycle results in a logarithmic increase in the number of shoots.
- Stock of germplasm can be maintained for many years using this method.
- This method is more applicable where disease free spread is desired. This *in vitro* technique helps to grow and maintain these pathogen-free plants.
- A major advantage of *in vitro* proliferation is to place the minimum growing space required in commercial nurseries. Thousands to millions of plants can be planted within culture vials.
- This method is more helpful in case of slow growing plants where seeds are produced after a long time and the seed is the only propagation. This method can overcome the difficulty of obtaining publicity.
- Genetically identical offspring are not always possible through seed production. But the *in vitro* proliferation method will help maintain genetic homogeneity in propagules.

Chemical ingredient

The chemical ingredient is volatile oil, resins, gum, and a bitter compound in its chemical composition. Five types of guggul sterols, z-guggul sterone, e-guggulsterone, guggul sterols - I, II, III, sesamine, cholesterol, mucol and other steroids are also found. Monocyclic diaperpene-alpha - camphorin and sembrin are separated from the resin; allylcembrol is isolated from the plant and is characterized (Chem Abstr. 1972, 77, 111554 t). Three new steroids -

guggulsterol I, II, III have been isolated from gum resin (tetrahedron 1972, 28, 2341). Cembrene isolated and characterized by a resin (Tetrahedron 1973, 29, 341). Isolation and structure elucidation of two aliphatic tetrols - 1, 2, 3, 4 and eicosan - 1, 2, 3, 4 - tetrol from gum resin (Tetrahatron 1973, 29, 1595). Guggulsterol VI and Z - Guggulsterol isolated from gum resin (tetrahedron 1982, 38, 2949) 24.

Traditional / ethnographic uses of Guggulu

The plant has been used for centuries in traditional Ayurvedic medicine as a weight loss agent in a variety of disorders, most notably arthritis and obesity. Other traditional uses include treatment of liver problems, tumors, ulcers and wounds, urinary complaints, intestinal worms, inflammation and seizures, and as a heart tonic. In 1986, Guggul was approved for marketing as a cholesterol-lowering agent in India. Guggulu, a commercial product considering cholesterol-lowering properties.

Medicinal use of Guggulu

Medicinal use "Nirasa" means the gum-olio resin of the Guggulu plant, which is used for medicinal purpose, internally as well as externally.

Sthaulaya (obesity)

In Hat obesity, the use of Rasanjana, Brahat Panchamool, Guggulu, Shilajatu and Agnimantha is beneficial. If obesity is reduced, then the person should regularly use Shilajatu, Guggulu, Gomutra, Triphala, Loha-Bhasma, Rasanjana, Honey, Barley, Mudga, Kodarava, Shyamak, Vanakadravas etc. which are thick and fat reduce.

Udararoga

One should use Guggulu as Shilajatu is used i.e. use of Guggulu with milk is beneficial in abdominal diseas. Use of Shilajatu, Gomutra, Guggulu, Triphala, and Snui latex reduces abdominal disease.

Shotha (Edima)

Gomutra should be used with Gomutra or decoction of Pannava. Guggulu or Haritaki should be used with Gomutra. Guggulu destroys edema taken with the decoction of Punarnava, Devadaru Shunthi or Gomutra or Dasamula decoction. People suffering from edema should use Guggulu with go-mutra or pippali milk or mixed with jaggery in Haritaki or Shunthi.

Vatavyadhi

It is especially beneficial to use all the chemicals of Shilajatu and Guggulu with milk. Guggulu is the best remedy for Vata covered by Madas.

Gridhasi (sciatica)

Rasna 40 grams and Guggulu 200 grams are mixed with ghee and made into tablets. It reduces sciatica.

Krotsushirsha (arthritis of the knee joint) in krotshirshirsha, guggulu or guduchi with Triphala decoction or take Vriddaruka with castor oil or milk.

Urustambha

Guggulu Urustambha with Good Gomutra is a good measure of.

In Urustambha, one should take Shilajatu or Guggulu or Pippali or Shunthi with a decoction of Gomutra or Dashmularishta.

Amavata (Arthritis)

One should regularly use Haritaki, Guggulu and Shilajatu with Go-Mutra.

The intake of Guggulu with equal amounts of Trikatu, Chitraka, Musta, Triphala, and Vidanga destroys all the disorders caused by Medus, Kapa and Amavata.

Gout

Diseases can be controlled by regular use of its Shilajatu, Guggulu and honey.

It is beneficial to use all the chemicals especially with Shilajatu and Guggulu with milk.

Viraadhi (absence)

Ugg patient should use Shilajatu, Guggulu, Shunthi, and Devadaru along with decoction of the group of medicines according to the (main) of Dosha.

In all types and conditions of abscesses, Guggulu should be used with appropriate decoction (according to Dosha). Alike Shilajatu should be used.

Guggulu or castor oil should be taken in the boils caused by Vata. In case of Kapahaja Vidhi, one should take Guggulu with Triphala, Shigru, Varuna, Dasamool or decoction.

Wound

Great Guggulu and Triphala is one of the great combinations in healing, orally, non-healing chronic wounds.

The anti-inflammatory and antiseptic properties of Are Guggulu are beneficial in cleaning and healing wounds and reducing edema. For this way, its gum paste is applied in cases of gout, rheumatic joints, inflammation of the glands and even hemorrhoids.

Vriddhi Garg (Great Growth)

Guggulu or castor oil should be taken with Gomutra, by this, the growth of old scrotum caused by Vata is destroyed.

Frothy ears

Fumigation with Ulu Guggulu is a good solution.

Asthma

Shalki, Guggulu, Aguru and Padmaka are used by mixing sufficient quantity of ghee.

Amlapitta

The use of Guggulu with the decoction of Nasa, Nimba, Patola, Triphala and Guduchi controls Amalpitta's dominance of Kapah. According to Apathya Bhavamishra, those who consume Guggulu should avoid Amla dravya, Takshan dravya, Ajiran Bhajan, Vavaya, Shrama, Atma Sin, item, fury.

Conclusion

From this paper it has been observed that Guggulu is one of the oldest and best known herbs in Ayurvedic medicine. Guggulu is a multi-purpose medicine and because of its magical properties it is very beneficial in many diseases. Guggulu has many uses that are supported by various research conducted by researchers around the world. These findings may open a new window on the use of this plant in Ayurveda. In the present study we focus on the development of an

efficient micro propagation protocol from various inventors of Guggul.

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