A REVIEW ON CULTIVATION AND PHYTOPHARMACOLOGICAL ASPECTS OF
CHLOROPHYTUM BORIVILIANUM

Gagandeep Kaur 1*

1. Assistant Professor, University Institute of Pharma Sciences, Chandigarh University, Gharuan, Mohali, Punjab-140413, India

*Corresponding author: gagandeep.e8179@cumail.in (Kaur)

Abstract
Safed Musli known as chlorophytum borivilianum is an herb which is rarely found in India but normally found in forest area but now these days its use in Ayurveda is increasing day by day, so currently it is being cultivated at large scale. The roots of this C. borivilianum have shown to be useful as aphrodisiac and adaptogenic compounds. Every so often, due to the coloration it is also known as white gold and its roots are found to possess active medicinal component. In C. borivilanum, the major constituents present are alkaloids, vitamins, proteins, magnesium, phenol, high saponin and polysaccharides content, the water extract appears to be the most active extraction, butfructans, and sapogenins act as a therapeutic agents. In Ayurvedic Material Medica, Chlorophytumborivilianum (CB) is an important herb with diverse therapeutic applications. Different parts of chlorophytumborivilianum has found to be shown various effects such as roots is used for its aphrodisiac effect that is beneficial effect on male sexual health), another part of chlorophytumborivilianum that is Rasayana shows its adaptogenic activity, and Balya has been found to be used as general stimulant. Firstly, it was documented in Rajanighantu,C. borivilianum has been widely used in clinical field and has plays very important role in male reproductive health. Previous studies revealed its importance in sexual behavior,immune stimulatory activity, effective in relieving stress and anti-oxidant activities. This review presents an overview on the botany, cultivation and current status of therapeutic uses of thisC.borivilianum.

Key Words: Phytochemistry, Botany, Phytochemistry

http://doi.org/10.36295/ASRO.2020.232021
How to cite this article: Kaur G (2020): A review of cultivation and phytopharmacological aspects of chlorophytumborivilianum, Ann Trop Med & Public Health; 23(S19): SP232021. DOI: http://doi.org/10.36295/ASRO.2020.232021

Introduction

Every pharmaceutical formulation or dosage form contains the active pharmaceutical ingredient, besides API (Active Pharmaceutical Ingreadient) it also contains various additives such as lubricating agent, flavoring agent, coloring agent, binding agent and so on to aid the formulation and to acquire the desired effect of API (1). The huge advancement in drug delivery approaches concomitantly hankering the discovery of novel excipients which are safe, efficacious and fulfill specific functions and directly or indirectly influence the bioavailability of the pharmaceutical dosage form (2).

From last few decades, the plant extracts or plant acquire gums mucilage fulfils the needs of pharmaceutical excipients because they are safe, efficacious, secured, readily accessible, economical and linked with less regulatory issues (3). So as to satisfy the needs of the population, these can be easily altered. The important characteristic of these plants (gums and mucilage’s) is that they are water loving and gel- forming in nature. Currently, the trend and increasing use of plant based products used as an alternative of synthetic compounds with natural ones, because they are considered to be safe and effective. The use of natural products in new drug delivery systems in increasing day by day, especially the polysaccharides, tannins and resins are most abundantly studies and used (1). Therefore the aim of this review is to provide information about the cultivation, phytochemistry, and pharmacology of Chlorophytum borivilianum.
The following table summarizes some of the official important plants yielding mucilage and gums

<table>
<thead>
<tr>
<th>Intra Cell Mucilage</th>
<th>Part</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orchids. sp</td>
<td>Corm</td>
</tr>
<tr>
<td>Agropyrum repens</td>
<td>Rhizome</td>
</tr>
<tr>
<td>Urgenia maritme</td>
<td>Bulb</td>
</tr>
<tr>
<td>Allium sp. (onion, garlic)</td>
<td>Bulb</td>
</tr>
<tr>
<td>Viola tricolor</td>
<td>Stem, leaf.</td>
</tr>
</tbody>
</table>

**CELL MEMBRANE MUCILAGE**

**SECONDARY WALL MUCILAGE**

<table>
<thead>
<tr>
<th>Source</th>
<th>Part</th>
</tr>
</thead>
<tbody>
<tr>
<td>Althaea officinalis</td>
<td>Root</td>
</tr>
<tr>
<td>Cinnamomum sp.</td>
<td>Bark</td>
</tr>
<tr>
<td>Rhamnus frangula</td>
<td>Bark</td>
</tr>
</tbody>
</table>
PLANT: *Chlorophytum borivilianum*

**TAXONOMY**

Vernicular Name³

<table>
<thead>
<tr>
<th>Sanskrit:</th>
<th>Swethamusli.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hindi:</td>
<td>Safedmusli, Hazarmuli, Satmuli</td>
</tr>
<tr>
<td>Gujrati :</td>
<td>Ujlimusli, Dholimusali</td>
</tr>
<tr>
<td>Malyalam:</td>
<td>Shedeveli, Shedheveli.</td>
</tr>
<tr>
<td>Marathi :</td>
<td>Safedmusli, SufedMusli, Kuli.</td>
</tr>
<tr>
<td>Tamil :</td>
<td>Tannirvittang, Tannirvittan-Kizhangu, Vipurutti, Taniravithang</td>
</tr>
<tr>
<td>Telgu :</td>
<td>Tsallogadda, Swethamusli.</td>
</tr>
</tbody>
</table>

**Cultivation**

*C. borivilianum* is found in various countries but mostly in the forest area. In India, it is cultivated in various parts but found abundantly in Gujarat, Maharashtra, Rajasthan, Madhya Pradesh, Uttar Pradesh, Chhattisgarh, Karnataka, and Haryana⁴). It is found in areas with high altitude and grown in about 400 hectares of land for root tubers in tropical and sub-tropical climates⁵. In India, the jungles the climatic conditions are suitable so it grows naturally. If the climatic conditions are suitable for its growth such as range of temperature and rainfall conditions, this plant can grow well⁶. The ideal requirements for its production is a sandy loamy soil with suitable drainage, on the other hand for the growth of good tuber, The pH required for its growth is in the range of 6 to 7, farmyard with decomposed manure and drainage days
facilities should also be good. The requirement of soil for the growth of \textit{C. borivilianum} is the soil rich in organic matter and the presence of bright sunlight. In the month of April/may its cultivation usually begins. With the onset of monsoon, safed musli is sown after preparing the field. Each of bavastin treated fingers is planted apart from each other and within each row the distance should be 25 cm. It weighs approximately 400-500 Kg and per hectare, the density of planting is about 80,000 fingers per hectare\textsuperscript{7}. After 3 months, the color of the leaves turn yellow and fall off but for some time they are left in the field for ripening purpose. The moisture content is maintained properly so that it preserves its medicinal properties. In the month of January-February the skin of the tubers turn dark brown and harvesting is done. Tubers are dug out when they mature; after this, long healthy fingers detach form the tubers. After detachment, with the help of stainless steel knife tubers are processes by peeling off and sun drying for 3-4 days. Packaging is done in plastic wrap after drying and is ready for marketing.\textsuperscript{(12)}

**Botany - Origin and distribution**

\textit{C. borivilianum} originates centrally from tropical and subtropical Africa and in India it was introduced from South Africa. In late eighties, \textit{C. borivilianum} species came into prominence. Plants belong to rhizomatous family represent almost 300 species represents from the genus Chlorophytum, is widely spread in tropical and sub tropical forests of the world up to 1500 meters altitude \textsuperscript{(4, 5,6,7)}. It has been reported in Genera Plant arum that in Asia, tropical Africa and Australia about 40 species of Chlorophytum spreads \textsuperscript{(8)}. It has been reported that in India, 6-7, out of 13 species of \textit{C. borivilianum} occur and they are used in indigenous system of medicine \textsuperscript{(9)}

**Plant description**\textit{C. borivilianum} (Family: Asparagaceae; sub family: Anthericoideae)\textsuperscript{(10)} has 6-16, radical, 13-23 cm x 1-2.5 cm in size, spirally imbricate at the base, sessile, linear ovate leaves; green-yellow coloured, bear 3-12 seeds in each fruit and small, black, angular in shape, endospermic seeds \textsuperscript{(11,12,13,14)}
MORPHOLOGY

*C. borivilianum* is a herb which is tiny and it grows once in year with altitudes up to 1500m. Usually it grows in tropical and sub-tropical climates. The maximum range of height is 1.5ft and depth is of 10 inches.

Root

The odour of safedmusli is characteristic and the root color is from pale brown to white color. It is tasteless in nature. Tubers of the root are fascicled and fleshy. Root tubers are directly originated from stem disc. The thickness and length on the average is 0.9 cm and 8 cm and the shape were cylindrical.

Leafs

*C. borivilianum* is a herb with lanceolate leave. There are radical leaves in number 6-13, the leaves at the base are spirally imbricate, sessile in nature, with acute apex and less than 30cm long. There is horizontally spreading of leaves of safed musli, having smooth surface, margins are wavy with parallel venation.

Flowers and fruit

White color flowers, bracteats, pedicillate, zygomorphic flowers are usually arranged in alternate clusters, each and every cluster*C. borivilianum* comprises of three parts. On the upper part of the scape, the flower clusters are dense; bracts are linear, purplish, 1.0 -10.5cms long; 6 -10 mm long. It bears fruit which is in green yellowish color and is equal in length and breadth. Small size black seeds are enclosed in the holes.

MICROSCOPY
Fresh tuberous of entire *C. borivilianum* shows various microscopic characters. Without cuticle epidermis is present and many unicellular root hairs are present in stomata. Cortex possesses parenchymatous cells with intercellular spaces. Starch is not present. Below the cortex barrel shaped closely arranged parenchymatous cell lies which are shown in Endodermis (50μm thick) and forms a ring. Pericyclic cells are single layered and are present below the endodermis which are uniseriate and made up of thin walled parenchymatous cells. Xylems composed of a single layered round metaxylem towards the pith, protoxylem towards the periphery. Phloem composed of companion cells and phloem parenchyma (15, 16).

**PHYTOCHEMISTRY**

In *C. borivilianum* various biochemical constituents are present but major are carbohydrates 42%, protein 10%, fibres 20 - 30%. But saponins and alkaloids possess therapeutic activities. It is a rich steroids, saponins, potassium, calcium, magnesium, phenol, resins, mucilage and polysaccharides and also contains high quantity of simple sugars, mainly sucrose, glucose.

**PHARMACOLOGICAL ACTIVITY OF *C. Borivilianum*:**

**Healing power and curative properties**

**Impotency**

The dried roots of asparagus were found to be effective as aphrodisiac in Ayurveda. It has been reported that on regular use of *C. borivilianum* it is found to be effective in premature ejaculation and impotency (12).

**Aphrodisiac activity**

All the extracts of *C. borivilianum* show significant results but the aqueous extract derived from the *C. borivilianum* roots is found to be effective spermatogenic agent and aphrodisiac activity (17, 18).
**Aphrodisiac activity** After extraction, aqueous extract of *C. borivilianum* from the roots is found to be effective in aphrodisiac and spermatogenic. A study demonstrated that aphrodisiac activity by evaluating this effect in male Wistar albino rats that were orally treated with *C. borivilianum* and after 3 hrs later using a receptive female their sexual behavior was monitored. The treatment was further continued in all groups for sperm count for 60 days. It shows significant aphrodisiac action at 125mg/kg\(^{(19)}\). After 2 month, there was a significant increase in sperm count in both the groups treated with *C. borivilianum*. There was very low weight loss (effects on diabetes and its associated effects on sexual functionality)\(^{(20)}\).

**Immunomodulatory activity**: By fractionation, Polysaccharide fraction of *C. borivilianum* has immune modulating activity. A study revealed the immune modulatory activity in which *C. borivilianum* polysaccharide is derived from hot water extraction of *C. borivilianum* (Cb), and CBP comprises of about ~31% inulin-type fructans and ~25% acetylated mannan. Furthermore, its effect on NK cells (in vitro) was evaluated. From whole blood, human peripheral blood mononuclear cells were isolated and tested for the modulation of cytotoxicity of NK cells towards K562 cells\(^{14}\). In Previous study, preliminary toxicity to cell was evaluated against P388 to find out the different concentrations of different fractions which are nontoxic. Significant stimulation of NK cells has shown that the activity is to be due to the CBP of C. borivilianum. Evaluation was carried on Wistar strain albino rats for humoral response to sheep red blood cells and immunoglobulin level determination using enzyme-linked immunosorbent assay (ELISA), exhibited an effectiveness of *C. borivilianum* aqueous extract in improving immune function\(^{(21)}\).

**Anti-helmintic activity**- For centuries, parasites have been of great concern to the medical field and the helminthes still cause considerable problems for human beings and animals. Now days, reoccurrence is one of the leading issue and most of the pharmaceutical dosage form available in the market are not effective. Currently, the main focus of clinicians is on drugs obtained from plants because they found to be more effective and safe. A study has revealed the evaluation of anthelmintic activity on Indian earthworm, *Eiseniafoetida* due to its resemblance with intestinal roundworm of human beings in terms of physiological and anatomical\(^{(21, 22)}\).
**Anti-oxidant activity**- Almost all the *C. borivilianum* extract was found to be very effective against free radicals. A study has shown antioxidant activity by using an assay named as free radical scavenging and lipid per oxidation assay. A significant inhibition in the levels of free radicals of DPPH and thiobarbituric acid reactive substances, in a dose dependent manner\(^\text{(23)}\). When the Aqueous extract of *C. borivilianum* was used in graded-dose (25 to 1000 µg/ml), it shows excellent anti oxidant activity, and in mitochondrial fractions it suppressed the oxidation of lipids\(^\text{(24)}\).

**Anti-stress activity**- It was reported that from *C. borivilianum*, different extracts were isolated and different extracts show different activities. Recently, a study has shown anti-stress activity in rat model using chronic cold restraint. Also there was significant increase in adrenal gland weight was found as compare to control. It was found that all these effects are reverted by giving pretreatment with aqueous extract of *C. borivilianum* at both dose levels (125 and 250 mg/kg)\(^\text{(25)}\).

**Anti-tumour and anti-mutagenic activity**- Extracts of *C. borivilianum* has shown effective in Cancer and mutagenic activities. But the roots were found to be effective in cancer patients and the chemicals which found to be effective are steroidal glycosides which are toxic to cellsasaponinchloromaloside-A and spirostanolpentaglycosides embracing beta-apiofuofranose\(^\text{(26,27)}\). From the roots of *C. borivilianum*, aqueous extract shows anti-tumour and anti-mutagenic property and studies states a significant reduction in papilloma and has also shown anti tumor activity\(^\text{20}\).

**Anti-diabetic activity**- A fructo-oligosaccharide extract was found to be effective in diabetics. A study has revealed that this extract after isolation from *C. borivilianum* was found to be effective and is potent anti-diabetic\(^\text{(26)}\).

**Antimicrobial activity**- Different extracts of *C.borivilianum*was found to be efficacious against various pathogens. A study has revealed *C. borivilianum*was screened for antimicrobial potential. It was tested using micro broth dilution assay, against 8 types of bacteria and pathogenic fungi.
MIC was calculated, lowest concentration of the extract which was used by checking the inhibition of microbial growth with p-iodo-nitrotetrazolium violet after treatment. After extraction, in the range of 75-1200 µg/ml water extract showed antimicrobial activity\(^{(27)}\).

**Larvicidal activity**—Safed musli has been found to be effective against larvicides such as poisonous agents, poisons which affect stomach, growth regulators or biological control agents. But the saponin extract especially methanolic, crude saponin, and purifies saponin extract) is effective against various species of mosquitoes such as Anophelis stephensi, and *Aedes aegypti* on the basis of Lethal dose 50 and effective dose 50. A study revealed that every extract of *C. borivilianum* was found to effective against larvicides but the saponin extract was found to more effective.\(^{(28)}\) Laterly, some more studies revealed that *C. borivilianum* extract has also shown potent anti-viral activity against BHV-1 virus\(^{(29)}\). As per that study, using cup diffusion method different extracts of *C. borivilianum* was tested against 4 types of bacteria *Staphylococcus aureus*, *E. coli*, *Pseudomonas aeruginosa*. Antibacterial activity against four bacteria was found to be very effective by acetic acid extract according to their sensitivity.\(^{(30)}\)

**CONCLUSION**—It would not be an overemphasis to say that *C. borivilianum* is distinctive present to humans. In India, Ayurvedic system of medicine has emerged out to be a precious gift of nature. *C. borivilianum* is known to be very popular herb in India and is widely used in traditional medicine use. Its ingredients are using in over a hundred formulations of Ayurveda and is very potent and effective herb. As it has tremendous properties and it is utilized for various conditions such as immunomodulator, anti-diabetic, anti-thelmintic, larvicidal activity and so on. So, it has been found to be a true medicinal plant with excellent therapeutic effect.

**References**


