CHAPTER - II

LITERATURE REVIEW
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2. Chlorophyrum borivilianum San. and Fren. (SAFED MUSLI)

Drug consists of dried tubers of Chlorophyrum borivilianum, family Liliaceae

Plant Family:

Classification:
- Kingdom: Plantae
- Sub kingdom: Tracheobionta
- Superdivision: Spermatophyta
- Division: Magnoliphya
- Class: Monocotyledons
- Series: Coronariae
- Family: Liliaceae
- Genus: Chlorophyrum
- Species: borivilianum

VERNACULAR NAMES:
- Gujarati: Dholi Musli
- Marathi: Safed Musli
- Hindi (U.P): Khiruva
- Malayalam: Shedheveli
- Tamil: Tanravi Thang
- Arabic: Shaqaque
- Sanskrit: Shewta Musli
- Telugu: Tella Nela Tadi Gaddalu

2.1 DISTRIBUTION:

Chlorophyrum borivilianum San. and Fern. (Liliaceae) is a traditional perennial herbaceous medicinal plant commonly known as safed musli. It is an endangered species (Nayar and Shastry, 1988). About 256 species are distributed in tropical and sub tropical Africa. 17 species of chlorophyrum are known to occur in India, Chlorophyrum borivilianum is the most commercially exploited and widely growing species. Other species of commercial importance are C. arundinaceum, C. tuberosum, C. malabaricum,
C. attenuatum, C. breviscapum, etc. It is an evergreen herb, which grows in western and central regions in India.

The center of its origin lies in Tropical and Subtropical Africa. In India it is endemic to the subcontinent. It is mainly cultivated in Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, Andhra Pradesh and Karnataka.

2.2 DESCRIPTION OF THE PLANT (Pullaiah, 2002):
It is a small tuberous crop, growing up to 1.5ft high and the finger remains in the soil up to 10 inches deep. These fingers are facicled, sessile, cylindrical, up to 10-12 in number, brown to black skinned and white after peeling, and 3-10 cm long at maturity. The leaves are radical, spirally imbricate at the base, sessile, linear, ovate, acute at the apex and slightly narrowed at the base. The leaves are spread horizontally, their lowered surface is rough and the margins are wavy with parallel venation. The fruit is a loculicidal capsule, green to yellow, almost equal in length and width; the seeds are black in appearance with angular edges.

2.3 TRADITIONAL USES:
Safed musli in traditionally used for lack of libido, male impotency, oligospermia. It is also widely used as a general health promotive tonic and for delaying the ageing process. Varying its common use for health promotion, it is also used for increasing lactation, treating various gynecological disorders, arthritic conditions and to control diabetes mellitus.

2.4 GENERAL AND MODERN USES (Purohit et al, 2003):
- It has therapeutic application in Ayurvedic, Homeopathic, Allopathy and in Unani treatments.
- It is considered as an alternate to Artificial Viagra.
- Its aphrodisiac properties has proved very much useful for the people suffering from erectile dysfunction and to increase male potency.
- It has spermatogenic property and helpful in curing impotency as they are rich in glycoside.
- Its root powder is fried in ghee, chewed in case of aphthae of mouth and throat.
- It is a curative of natal and postnatal problems.
It is used as a demulcent, diaphoretic, aphrodisiac, galactogouge and stimulant. It is used as a powerful uterine stimulant. It is a cure for diabetic and arthritis. It is effective in curing of rheumatism and joint pains. It increases the general body immunity. The plant is of great economic importance as its dried roots are currently sold in the market at a price of Rs1500/- per kilogram. Due to indiscriminate collection of wild material and insufficient attempts either to allow its reestablishment or its cultivation, _Chlorophytm borivilianum_ is rapidly disappearing.

2.5 AGROTECHNOLOGY:

Safed musli can be propagated by both sexual and asexual methods. Since the seeds remain dormant for about 10-11 months vegetative propagation is preferred over seed propagation (Faroqui, 2004). The land is prepared well in the month of April-May with the addition of 10-15 trolley's farmyard manure per acre. Green manure as preceding crop can also be used to enrich the soil. Raised beds of suitable length are prepared to facilitate proper drainage and growth of tubers. Sowing is done in the month of June-July either through seeds or through fingers separated from old bunches of tubers. It must be ensured that some part of the crown or disc remains intact with all the fingers, which are to be used for sowing. Tubers with average weight (8-21g) are considered appropriate for the subsequent good yield of the crop. These fingers are planted at a distance of 6x6cm and a total of 60,000 fingers are required per acre with approximate weight of 400-500 kg. The fingers are sown at a depth of 2.5-3 cm. For better germination, the moisture level in the field must be maintained. _Chlorophytm borivilianum_ has been extensively investigated to increase the yield of tubers:

Variation and correlation coefficient was studied in terms of root yield and biochemical traits of safed musli. A high difference in the genotype and phenotype coefficient was noted which lowered the yield of constituents like carbohydrate and protein content, and high production of tubers (Chetali et al., 2003, Singh et al., 2005). Germplasm, morphological and variability pattern was studied for high performance of the plant by testing it with the use of manures. It was found to be significant in production of tubers.
with respect to its size, thickness and yield (Kothari, and Singh, 2003). Cytological studies revealed a new chromosome number and presence of polyploids in the population, responsible to alter the phenotype of the plant in terms of better yield of Chlorophytum (Geetha and Satyabrata, 2004). The reproductive biology studies generated information about the inflorescence pattern of the plant, which helped in its proper identification. (Geetha and Maiti, 2001). A high increase in the steroidal content was found in the tubers when farmyard manure was mixed with vermicompost (Paturde, 2002). The crop is prone to root-knot disease, which adversely affects the size of tubers leading to deformities as a whole, when they are infected by an organism Hololaimus indicus (Rakesh Pandey, 2003). The yield of the tubers and the saponin content is significantly affected by the biodiversity of the plant (Jat and Sharma, 1996, Aparbal et al., 2003 b, Aparbal et al., 2003 a, Singh et al., 2005, Ram Chandra et al., 2003).

Cultivation and processing technologies of safed musli (Chlorophytum borivilianum) was investigated for the production of high yield of the crude drug, which can fulfill the demand in the market due to its medicinal values (Aparbal et al., 2004, Singh et al., 2003).

The natural regeneration of this herb is through tuberous roots that have become scarce in nature. Seed germination is only 14-16% (Jat and Bordia, 1990, Shrivastava et al., 2000). The medicinal plant is prone to leaf-eating caterpillars, which defoliate the plants at an early stage of the crop and the white grubs damage the underground roots resulting in the stunted growth of the plants (Farooqui, 2004). Leaf-blight and red-spot diseases severely affect the leaves of the plant, ultimately destroying the crop. Chlorophytum borivilianum has a very short life cycle (90-100 days).

2.6 PHYTOCHEMICAL STUDIES:

Chlorophytum borivilianum contains proteins (8-9%), carbohydrates (41%), root fibers (4%), saponins (2-17%), minerals and vitamins. Saponin is the chief medicinal compound present in the roots. Saponins and alkaloids present in the plant are the primary source of its significant medicinal properties. The root is a rich source of pharmaceutically active compounds like steroids, stigmasterol (Tandon, 1990), glycosides, oligofuro and spirostanosides (Sharma and Sharma, 1984) and phenols.
The petroleum ether extract of fruits yielded β-sitosterol, sarsasapogenin and doisgenin (Sharma et al., 1980). The methanolic extract was found to contain spirostanol glycosides [Asparnin A(1)and B(2) (Fig. 1)] and furostanol glycosides [Asparoside A(1) and B(2) (Fig. 2)]. The methanolic extract of the leaves yielded two oligofurostanosides, [Adscendoside A (3) and Adscendoside B (4) (Fig. 3)] and spirostanosides, [Adscendin A (1) and Adscendin B (2) (Fig. 4)] (Sharma and Sharma, 1984). β – sitosterol-β-D glucoside was extracted from the roots of Chlorophyllum borivilianum (Tandon et al., 1990 and Sharma et al., 1982). A saponin as sarsasapogenin was found to be present in root (Rao 1952). Saponins of stigmasterol (Fig. 5 and 6) and sarsasapogrin (Fig. 7) with sugars as xylose, arabinose and glucose were extracted from the methanolic fraction of the leaves (Tandon et al, 1990).
1 \( R_1 = H \)
2 \( R_1 = -L\text{-Rha(Pyr)} \)

Fig. No: 1 Asparnin A (1) and B (2)

1 \( R_5 = \alpha\text{-L-Rha (pyr)} \) \( R_2 = \text{Me (Asparoside A)} \)
2 \( R_5 = \alpha\text{-L-Rha (pyr)} \) \( R_2 = H \) (Asparoside B)

Fig. No: 2
Fig. No: 3 Adscendoside A (3) and Adscendoside B (4)

3 $R = \text{Me, } R^1 = R^2 = \text{ - L-rha(Pyr)}$

4 $R = \text{H, } R^1 = R^2 = \text{ -L-rha(Pyr)}$

Fig. No: 4 Adscendin A (1) and Adscendin B (2)

1 $R^1 = \text{H, } R^2 = \text{ -L-rha(Pyr)}$

2 $R^1 = R^2 = \text{ -L-rha(Pyr)}$
Fig. No: 5 3-β-α- [β-D-2-tetraosylxylopyranosyl]-stigmasterol

Fig. No: 6 3-β-α- [β-D-glucopyranosyl (1-2)-α-L-arabinopyranosyl]-stigmasterol
Fig. No: 7

Sarsasapogenin
2.7 PHARMACOLOGICAL STUDIES:

Presently, many pharmacological activities are being carried out on different extracts of the plant.

Crude extract of safed musli produced an increase performance of swimming in rats and also protected the animals against blood pressure (Dua et al., 1992). Antifertility was observed when seeds were administered orally in albino rats (Sethi et al., 1990). Antimicrobial and anthelmintic activity was screened in aqueous, ethanolic and hexane extracts (Naqvi et al., 1991). Antiviral activity was seen in ethanolic extract (Dhawan et al., 1986). In vitro antioxidant activity of ethanolic extract of *Chlorophytum borivilianum* was studied by DPPH, hydroxy radical, ferryl bi-pyridyl complex at 100μ/ml concentration was found to be considerably significant (Govindarajaiir et al., 2005). An aqueous extract of *Chlorophytum borivilianum* was shown to induce a significant non toxic, 19-248% increase in glucose dependent insulino tropic actions in the clonal pancreatic β – cell line, the extract also produced 81% increase in glucose uptake in 3T3-L1 adiposites, which revealed the presence of insulino tropic and insulin-enhancing activity of the plant (Mathews et al., 2006). Cytotoxicity activity of *Chlorophytum borivilianum* was studied (Nutan, 2005). Potential antifilarial activity of roots of *Chlorophytum borivilianum* was studied against *Setaria cervi* by in vitro technique and found spontaneous movements of worms against the NM preparations (Singh et al., 1997).

2.8 TISSUE CULTURE WORK REPORTED:

Due to high economic value, efforts have been directed to use plant tissue culture biotechnology for conservation and commercial cultivation of this herb (Purohit et al., 1994 a; Suri et al., 1999; Dave et al., 2003).

Initial experiments using somatic embryogenesis were carried out for plantlet regeneration of *Chlorophytum borivilianum* on callus cultures initiated on MS (Murashige and Skoog) media supplemented with 2,4 –D (2,4-Dichloro Phenoxy Acetic Acid) and Kn (Kinetin) (Arora et al., 1999). Purohit et al., 1994 b regenerated plantlets from immature zygotes inoculated on MS medium supplemented with 2,4-D. Plantlets were recovered from 20% of embryos on auxin free MS medium. Precocious germination of somatic embryos and profused rooting was observed. They also developed in vitro
conservation strategies for the medicinal plants by inoculating the zygotic embryos on ¾ MS medium supplemented with IBA (Indole Butyric Acid) and 2,4-D.

Micropropagation of *Chlorophytum borivillianum* was achieved by using various explants: Purohit et al., (1994 c) reported the rapid in vitro clonal propagation by inoculating young shoot bases on MS medium supplemented with BAP (Benzyl Adenine Purine). Shoots multiplied at a rate of 4 fold every three weeks and 67% of the micropropagated plants were successfully established in pots. Suri, 1999 established a high frequency protocol for regeneration of plantlets and tuberous root formation in B5 medium supplemented with BAP and Adenine.

The scaling up production and field performance of micropropagated safed musli was achieved on MS media supplemented with BAP. More than 1500 plantlets could be produced in 20 weeks. Plantlets subjected to hardening under agro shaded conditions during the monsoon months of high humidity showed better survival rate and growth compared to plantlets hardened in vitro (Dave et al., 2003). Pudake and Dhumele, 2003 also developed a large scale multiplication of the plant through shoot base and stem disc culture on MS media supplemented with BAP with different combinations of IBA and NAA (Naphthalene Acetic Acid) 90% plantlets could be established in pots by hardening treatments.

Indirect regeneration of the plantlets was achieved by callus induction on seedling, roots, stem disc and leaf on MS media (Gaiakwad et al., 2003). Dave et al., 2004 propagated the plant by encapsulated shoot buds on MS medium supplemented with BAP. Shoot buds encapsulated in 3% sodium alginate matrix polymerized by 100 milimolar solution of Calcium chloride yielded best results. Dark stored (4°C) encapsulated shoot buds showed more than 90% sprouting after seven days of storage. Sharma and Mohan (2006) developed a novel method, for in vitro clonal propagation from immature floral buds along with inflorescence axis. Maximum numbers of shoots were observed on MS medium supplemented with 2, 4-D and IBA.
REFERENCES


