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Medicinal values of products and by products of sericulture.

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Abstract

In spite of global augmentation of by product value to overcome the cost benefit ratio, our country India has not kept pace in sericultural fronts. The by-products usually felt as wastes, can put to better use in producing the valuable products and thereby catapult the industry to a more profitable and economically viable spot. Since old days, Ayurveda and other literature have claimed the different medicinal properties against certain serious diseases. Various researches have been conducted in last decades on different medicinal plants and insects. The present review highlighted the potentiality of different medicinal properties of mulberry and silkworms. Therefore, the earlier concept of sericulture to produce only silk, now has changed into the functional sericulture of a new paradigm to relieve the patients as well as to increase the farmer's income dramatically. Those functional sericulture aspects are likely to be further developed and finally reborn into a real biotechnology-based sericulture in the future.

Keywords: By-products; Sericulture; Silk fabric; Silkworm; Mulberry; Patients Medicinal properties.

Introduction

Sericulture is an ancient industry in our country India, dating back to at least second century BC (Jadhav *et al.*, 2011) [7]. India is developing as leading silk producing country among many silk producing countries of the world. However, global silk industry, which had been focusing on silk production only, previously switched its market for supplying valuable supplements and raw materials for medicine. Since then, it has been producing products like; mulberry fruit juice to get rid of impurities from the body and to cure heart problems, dried fruit powder works as an anti-mutagen which can inhibit the mutation of healthy normal cells into cancerous cells, Silkworm's eggs processed into proteic extract having hepatoprotective action, silkworm pupal oil having anti-inflammatory and anti-tumefying like effects and so on. Keeping various attributes of sericulture under view, the present review highlighted the potentiality of different medicinal properties of mulberry leaves, fruits, bark, roots, silkworms, pupa, moths etc.

• General health benefits of mulberries

Different parts of the mulberry plants are used in different ayurvedic medicines like:

- From the leaves special type of tea is made which is used to control blood pressure.
- The root bark is used in laxative and anthelmintic medicines.
- The fruits juices are used to cure mouth ulcers, fever, heart, throat, digestive, eyesight, anaemia, dizziness, insomnia, hepatitis, constipations, etc like problems.
- Mulberry juices aid in weight loss, builds immunity, enhance appetite, increase hair growth, relieve tiredness and fatigue, control excessive thirst.

Medicinal uses of mulberry leaves, fruits, roots, bark etc

• Mulberry Leaves

Mulberry leaves are rich in calcium, phosphorus, magnesium, vitamins like B, C and K. They also contain antioxidants particularly the anthocyanins and the flavonoids quercetin and kaempferol. The leaves contain 18 amino acids viz ; phenylalanine, leucine, valine, tyrosine, proline, alanine, glutamic acid, glycine, serine, arginine, aspartic acid, cystine, threonine, sarcosine, gamma-amino-butyric acid, pipercolic acid, and 5-hydroxy pipercolic acid. The leaves are also a good source of ascorbic acid. The medicinal properties of mulberry leaf are recognized for its diuretic, blood sugar and blood pressure reducing effects. The leaf extract of white mulberry (*Morus alba*) has been studied against the Indian *Daboia russelii* venom induced local and systemic effects.

The extract completely abolished the *in vitro* hyaluronolytic and proteolytic activities of the snake venom (Chandrashekhara *et al.*, 2009) [2].

New pharmacological benefits of mulberry leaf against serious diseases like Alzheimer's disease, atherosclerosis, hyperlipidemia etc have been reported.

- **Against Alzheimer's disease, hyperlipidemia and Prevention of Atherosclerosis**

Lyengar in 2007 [11], suggested that mulberry extract provide viable treatment to Alzheimer's disease through inhibition of amyloid beta- peptide (1-42) fibril formation and attenuation of neurotoxicity induced by amyloid beta- peptide and further confirm that mulberry leaf contains anti-oxidative substance that helps to prevent atherosclerosis and some flavonoids that are effective in controlling hyperlipidemia.

- **Mulberry tea**

A special tea called mulberry tea is made from mulberry leaves. It is caffeine free. The tea is known to improve the function of liver and kidney and sharpen the hearing and brighten the eyes. Furthermore it relieves colds, coughs, throat infections, supposed to prevent oxidation of cholesterol consequently keeping the arteries free of fat deposits and hence hardening of arteries. In Iran, dried mulberries are used as a sweetener in black tea. After a sip of tea, dried mulberry fruits are eaten to sweeten the mouth (www.recipezaar.com, 2007 www.rawepicurean.net, 2009) [19, 20].

Different mulberry tea's



- **Mulberry fruits**
- **Anti-obesity mulberry fruit drink**

A super fruit drink, full of antioxidants is prepared from pure fresh mulberry fruits. It is a good source of resveratrol which is considered to be beneficial for heart health. The drink suppresses the appetite, which is why it has been reported as a useful drink against obesity (Fairjuice, 2008) [4].

- **Mulberry fruit powder**

Mulberry fruit powder promotes healthy cholesterol and controls carbohydrate digestion in the human body (www.yourhealthyourherbs.com, 2009) [18]. It is believed to prevent heart disease, cancer and many other serious diseases. It works as an anti-mutagen which can inhibit the mutation of healthy normal cells into cancerous cells (Hou, 2003) [6].

- **Mulberry fruit wines**

Mulberry wine is obtained from Over-ripened and sour mulberry fruits (Ehow, 2009) [3]. The wine has a sweet taste. It has been found that a glass of mulberry wine a day helps get rid of oxides and faecal residue from the body which can help make the body slim. The wine made by immersing the mulberry in grape wine works as medicine for weakness after diseases that can also be used to tonify masculine vitality. Furthermore it is believed that small dose of the wine protects against heart and stomach diseases (Alakbarov and Aliyev, 2000) [1]. In Europe mulberry fruit wine is very popular as a ladies drink.

- **Fruit pigments as dietary modulators**

Recently, Wrolstad, in 2001 [17] found that Mulberry fruits contain anthocyanins like cyaniding-3-rutinoside and cyaniding-3- glucoside. He found that these pigments hold potential for use as dietary modulators, besides this they are easily extractable and incorporated into the aqueous food systems, so, they are also used as natural food colorant.

- **Mulberry fruits in pharmaceutical industry**

The mulberry fruits are used for many medicinal purposes such as for balancing internal secretions and enhancing immunity (Venkatesh Kumar and Chauhan, 2008) [10-16]. Besides this they are also used to treat urinary disorders, tinnitus, dizziness, constipation, sore throat, fever etc. The fruits of *M. alba* have a cooling and laxative property and are used in throat infection, dyspepsia and melancholia (Jain and De Filippis, 1991) [8]. Fruit juices check thirst, cools the blood, reduces high fever and works as a good appetizer. Fruits are also used for loss of appetite, flatulence and for controlling intestinal parasites like tapeworm.

Mulberry fruits are reported as antidiabetic with antioxidative properties (Kim *et al.*, 1998) [9]. Hong *et al.* (2004) [5] found that mulberry fruit strengthens the antioxidative defence system and reduces damaging oxidative substances in the erythrocytes of diabetes induced rats.

- **Mulberry Stem**

Mulberry stem can also be used in medicines. The stems are antirheumatic, hypotensive, diuretic etc. Singh and Ghosh in 1992 [14] reported that the stem bark of mulberry is having purgative and vermifuge like properties. A tincture of the bark is used to relieve toothache.

- **Mulberry Root**

Mulberry roots are one of the important constituents of drug named, "*Glucosidase*" which is used in high blood pressure, besides the roots are used in medicines having cathartic and anthelmintic properties. In 1995, Shivkumar *et al.*, [13] reported that root juices of mulberries agglutinates the blood and is very useful in killing the worms in digestive tract.

Root bark of black mulberries (*Morus nigra*) contain calcium malate, tannins, fatty acids phytobaphenes, sugar, phytosterol, ceryl alcohol, and phosphoric acid. So, because of these very properties bark possess purgative and vermifuge like properties, besides it reduces the blood sugar level in diabetic patients. The root bark extract of black mulberries (*Morus nigra*) contain Deoxyjirimycin (DNJ), an alkaloid which is said to have active against AIDS virus. On the other hand, root bark of *M. alba* is used in traditional Chinese medicine named as "Sang bai Pi, which is used to cure cough, asthma and many other diseases. The ethanolic extract of "Sang Bai Pi" have been reported to contain flavnoids viz; Morusin,

Mulberrofuran D, G, K and Kwanon G, H., of which Morusin and Kwanon H showed positive activity against HIV (Shi-De *et al.*, 1995) [15] and Morusin inhibits tumor promotion (Shigeru *et al.*, 1989).



Mulberry processing products

• **Utility of Silk**

Silk which is regarded to be the queen of fibres is discovered in China between 2600 and 2700 BC. It is obtained from pupal nests or cocoons spun by larvae known as silkworm and is considered to be a natural product which due to its fineness, strength, shine, softness, elegance, durability, feel and tensile properties has captured the imagination of humanity since times immemorial. Silk is actually a natural protein fibre, composed of two main proteins viz; fibroin (73.5%) and sericin (22.28 %), besides it contains some waxes (3.02%), minerals and ash (1.11%) and negligible amount of ether and alcohol extract. Research has found that silk proteins have moisture retention and UV ray blocking properties, because of these very properties they are utilized in different cosmetics like:

• **Silk Lotion**

Silk lotion contains rich silk proteins and silk peptides, which are good moisturizers to keep the skin soft and moist. The lotion is meant for all types of skins.

• **Silk Cream**

Silk Cream is a natural beauty cream. It contains all silk's eighteen amino acids which are absorbed instantly to nourish the skin and make it moist. The cream protects the skin from windburn, sunburn and is especially suitable for sensitive skin.

• **Silk Night Cream**

Silk Night Cream contains- Aloe Vera, Jojoba Oil, Silk Amino Acids, and Silk peptides. It regulates moisture balance during the night to nourish and rejuvenate the skin besides it also assists the fight against wrinkles.

• **Silk Hand Cream**

It is non-greasy cream and contains rich silk essence which gives rough hands a silky, soft and smooth feel.

• **Silk Baby Cream**

This baby cream is made from high quality nutritional elements, natural silk peptide and raw greasy lanolin which

work together to protect the baby's delicate skin.

• **Silk toothpaste**

Silk toothpaste contains the surface growth factors of the activated natural material EGF and silk proteins. Thus it helps cells grow, diminish inflammation, prevent bleedings and heal mouth wounds.



5.The utility of Silkworm cocoon and silk



Silk cosmetic

• **Silk worm eggs**

The silkworm eggs contain albumin, fats, sugars, glycoproteins, B1 and B2 vitamins etc. The eggs are processed into proteic extract which in turn is used in the pharmaceutical industry for the preparation of medicines having hepatoproteanic, hypolipidic and hypoglycaemic action, serving as male sexual stimulator and are also in the food industry. This extract is sold in Romania as the Humanofort B product.

In some countries like Bulgaria some people believe that the silkworm eggs, if eaten by alcohol drinkers, give up drinking completely because, they start feeling alcohol disgust. But fact has not been proved scientifically.



Silkworm eggs



Proteic extract

• **Silk worm larvae**

The silkworm larvae besides spinning cocoon are used in the

pharmaceutical industry for the preparation of medicines having anti diabetic action or in the food industry as supplementary nutraceutical. Besides this, a special type of thread is obtained from its gut which is used in surgical purposes.

A research conducted by Korean scientist Ryu *et al.*, in 1997 [12], proved that the silkworms have maximum blood-glucose lowering effect and the substances were found to be the four blood glucose-lowering substances as well as the major component, DNJ (1-deoxynojirimycin), which are nitrogen compounds.



Silk worm pupae

Silk worm pupae contain 50-60% proteins, 25-35% fats, 8-10% sugars, few vitamins like- B1, B2 & E, minerals like-calcium, phosphorous, copper, iron etc.

Silk worm pupae is either directly used in different purposes, like-poultry feed, fish feed etc or a special oil is obtained from them which in turn is used in different products.

Pupa oil

Silkworm pupal oil are now a days used in medicines having anti- inflammatory and anti-tumefying like effects, besides treating sinusitis, otitis, bronchitis, asthma, tuberculosis and urinary infections. The silkworm pupae due to their high fat content (over 30%), are used as chrysalis oil to obtain soaps, lotions and emulsions. Varnishes and dyes used in the textile and tannery industry, are also obtained. The residue formed during the chrysalis oil's extraction is used as natural organic fertilizer and as food for poultry birds, pigs, fish etc.

In some countries like China, Japan, Thailand etc, the silkworm pupae are used as delicious human food.



Silk worm moths/butterflies

Another type of special oil (75% fatty oils) is obtained from the silkworm moths. The oil can be used to obtain textile dyes and superior soaps. The extraction residue can be used as fodder. The moths can also yield Cellular Cytochrome C, uric acid and few hormones for pharmaceutical use.



The remaining materials from silkworm rearing like -excreta can be used as organic fertilizer, as chlorophyll source (by alcoholic extraction) or as drug for heart diseases in the traditional Chinese medicine. Similarly residuum of silkworm rearing composed of vegetable mulberry remnants can be used as compost as organic fertilizer, or fodder for animals during winter.



Conclusion

From the above discourse, it becomes amply clear that sericulture industry now ceases to be thought of the industry which is only concerned with the production of silk yarn for fabric making but the tremendous uses of various products and by products to supplying functional food supplements for human medicinal use, silk as cosmetics etc. Therefore, the sericulture to produce only silk fabric now has been changed into the functional sericulture of a new paradigm to relieve the patients. Those functional aspects of sericulture will be further developed and finally reborn into a real biotechnology-based sericulture in the future which is bound to add value to industry as a whole.

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