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Review Article

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Solanum betaceum: An Underutilized but Potential Tree Species with Anticancer Activity

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The North-East India is rich in fruit diversity and contains more than one-third of the country's total diversity. Tamarillo or tree tomato (*Solanum betaceum*) is a small tree, underutilized but potential crop, cultivated for its edible fruit. It is a neglected, fast-growing, small fruit tree produces edible fruits with high content of vitamins, minerals, phenolic and carotenoids compounds as well as low carbohydrates content. In India, tamarillo grows in the hilly regions of north eastern states, hilly areas of West Bengal and Maharashtra, including Uttarakhand, Himachal Pradesh and Nilgiri hills because of the cool climatic condition in which the crop can sustain. Tamarillo is a new source of pectin with potential applications as thickeners/gelling agents depending on solvent or applied processes. This adds commercial value to the fruit and promotes further application for its pectin as a food additive. Amongst the fruits, only tamarillo mesocarp contains both polar (anthocyanins) and non-polar (carotenoids) pigments. The ability to retain both polar and non-polar pigments in the mesocarp is related to the unique properties of its hydrocolloids. High content of carotenoids found in tamarillo fruits with 4.4 mg/100 g. The current market value of commercially used carotenoids is estimated at nearly $1.2 billion in 2010, with a chance to grow to $1.4 billion in 2018 with a compound annual growth rate of 2.3%. Purple red variety of tamarillo is endowed with antioxidant phytochemicals, which provide protection against oxidative stress induced diseases. FT-IR analysis revealed the presence of alkanes, carboxylic acid, phenol, alkanes, carboxylic acids, aromatics and nitro compounds. Supercritical fluid extracts from tamarillo epicarp is used as protectors against lipid oxidation of cooked beef meat. This extract is displayed as an option of use for this agroindustrial residue, which provide added value to the fruit, helping to strengthen its supply chain. The tamarillo shows selective cytotoxicity towards liver hepatocellular carcinoma ($HepG_2$) and non-hormone dependent breast carcinoma (MDA-MB-231) but not on normal mouse fibroblast cells ($_3T_3$) suggests that tamarillo is potentially a good anti-cancer agent since it is non-toxic towards normal cells. It also acts as a cytotoxic agent against selected cancer cell lines. Tamarillo contains lectins which are a group of proteins of non-immune origin that bind carbohydrates specifically and non-convalently. The

flavonoids in tamarillo are of great importance, since they act as antioxidants with the ability to scavenge radicals by an electron transfer process. The scavenging effect of tamarillo is attributed to its superior total phenol content. It has an antinociceptive effect on the visceral inflammatory pain related model. Type-I arabinogalactans (polysaccharides) is responsible, at least in part, by the anti-inflammatory and antinociceptive activities observed in folk medicine for the tamarillo fruit. The fruits contain Vitamin (A, B_6, C, and E), carotenoids, flavonoids, terpenoids, steroids, saponins, alkaloids, polyphenols, tannins, and fiber. The major dietary polyphenols are flavonoids and the most anticancer compounds of which are catechins, curcumin, resveratrol and genistein. These phenolics substances have been shown to hinder cancer progression by interfering with each of the stage of carcinogenesis. The most flavonoid in tamarillo is anthocyanins. It has antioxidant activity, cardioprotective capacity, and inhibit the initiation stage of chemical reactions that cause carcinogenesis. It contains relatively high levels of soluble sugars and organic acids and remarkable levels of carotenoids and phenolics. It also contains high levels of K, with values similar to those of banana. The galactoarabinoglucuronoxylan present in the pulp of tamarillo promotes analgesic effects through anti-inflammatory mechanisms. This exotic fruit is low in fat and calories. The levels of vitamins B_6, C and E and the levels of trace elements such as iron, magnesium, copper and potassium present in one tamarillo fruit supply over 5% of the RDI (recommended daily intake) of these nutrients. In folk medicine, the leaves and fruits of tamarillo are used in the treatment of sore throat, inflamed tonsils and gums. With respect to the content of carbohydrates, the fruits of tamarillo contain low levels of sugars (fructose, glucose and sucrose) compared to other tropical fruits and they contain approximately 3% of fiber. Moreover, tamarillo seeds contain high lipid content, and a high content of unsaturated fatty acids. The consumption of unsaturated fatty acids helps to prevent heart disease, cancer, and contribute to maintaining healthy skin. Golden-yellow tamarillo contain higher levels of esters and terpenes, with alpha-terpineol, methyl hexanoate, ethyl octanoate, ethyl hexanoate, and 1,8-cineole being the major volatile compounds. The subtilisin like alkaline serine protease (tamarillin) is used in food applications, such as cheese-making or other applications which require alkaline pH environments. Both crude extract and purified protease called as tamarillin from tamarillo fruit exhibit broad hydrolysis on bovine casein proteins. Tamarillo hydrocolloids act as a prebiotics. The exceptional emulsifying properties of tamarillo hydrocolloids suggest their potential applications as food emulsifiers and bile acid binders. Water-extracted tamarillo hydrocolloid utilize as an alternative to low methoxyl pectin. Recently, tamarillo extract as a dye is using in dye sensitized solar cell (DSSC). Thus, this underutilized fruit provide unlimited opportunities for using as a potential phyto-medicine as they are known to possess an array of bio-chemical diversity. Hence, the planting of these trees should be promoted in all the NE states of India for conservation of natural resources and improving the livelihood of hill farmers in the region.

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