Preserving the heritage of Mattu gulla – A variety of brinjal unique to Udupi District

Brinjal (*Solanum melongina* var. esculenta Nees) has been used as a vegetable in India since time immemorial. The classic *Ramayana* contains reference to brinjal. Early Buddhist and Jain works, sutras like *Uttaradhyana Sutra*, *Prajapana Sutra* and *Jatakas* also refer to brinjal[1]. The Indian subcontinent (Indo-Burma region, probably Assam) is considered as the origin of brinjal[2]. Various Sanskrit names for it, like Varthaku, Vrutanka, Vaantaki, Vantika or Vatinganah, are the source names in various languages such as Badhinjan in Persian and Al-badinjan in Arabic. The Arabs had carried brinjal to Europe around the 16th century. The Catalan nomenclature of albergia is the source of the French and British name, aubergine. In the North American continent, it is known as egg plant since the fruits of some early varieties were all white and looked like hen's eggs. The Kannada name 'badane' appears to be closer to the Persian Badinjan, rather than the Sanskrit name Vatinganah. The Tulu/Kannada name 'gulla' seems to have evolved independently.

In *Kashyapiyaneesha Sookthi*, an eighth century work, it is mentioned that white brinjal (egg plant) is poisonous. Probably this is the reason why it was forbidden traditionally for certain segments of the population to consume it. Brinjal is known to contain several anti-nutritional substances such as steroidal alkaloids (solasonine, solamargine and solasodine), trypsin inhibitors in fruit peel, phenols, amide proteins, etc. It also has high poly phenol oxidase activity and contains anthocyanins[3,4]. It may also induce skin ailments, such as itching, psoriasis, etc.[5].

Badane, commonly found all over India, is elongated or round, violet/pink/white/green in colour, while gulla found in the Udupi District, Karnataka is round and green in colour. Local preference varies considerably from region to region and even district to district. A variety with a particular colour and size of the fruits fetching a premium price in the market, may be totally rejected in another area. As a classic example, let us consider the two types, Mattu gulla and Perampalli gulla, marketed in Udupi District. Mattu or Mattu gulla is a unique variety of brinjal with small spines on the stalk grown in Mattu village, Udupi District. A similar variety but without spines on the stalk of the fruit and having a different taste is the Perampalli gulla (Perampalli is a village in the Shivalli Panchayath in Udupi Taluk). It is pertinent to note that a variety of brinjal available in Kolkata also has spines and is green in colour.

It is believed that the reformist seer, Saint Vadiraja had given special brinjal seeds to the people of Mattu village during the 15th century and so it is considered sacred. Mattu gulla dishes are invariably used for a festival held every alternate year in the Udupi Sri Krishna temple since the 15th century. Saint Vadiraja travelled all over the country and has written a treatise entitled *Teertha Prabandha*, describing the various places of pilgrimage in India. One such place is Gangasagar, Navadweepa, in present-day West Bengal, where the River Ganga joins the Bay of Bengal. It is possible that the brinjal grown there was brought by him to Udupi and the seeds given to villagers of Mattu, since the geography of Mattu closely resembles that of Gangasagar, i.e. river mouth joining the sea with bit of brackish-water area.

Sanskrit texts dealing with plant sciences like the *Brhutasamhita* of Varahamihira (6th century AD), *Sarangapaddahathi* of Sarangadhara (13th century) and the *Vrikshayurveda* of Surapala (composed anytime during 10–14th centuries) refer to issues such as nourishment of plant, organic fertilizers, their species specificity, etc. The ideal time for planting brinjal, organic fertilizers that could help produce seedless fruits of brinjal, the technique of producing brinjals of huge size, etc. find a place in these texts[6]. The 500-year-old system followed for producing brinjal in Mattu village, which is prevalent even today, viz. use of organic fertilizers from the local fish variety such as 'Bhuthai', leads us to believe that cultivation practices could have been influenced by these texts. The findings made in 2006 by Richard Bardgett and his colleagues, University of Lancaster and British Institute Grassland and Environmental Research, using modern radio isotopic techniques, that organic nitrogen can be directly taken up by plants and used differently by different species support the scientific validity of these ancient writings[7]. Thus the practice followed by the Mattu villagers in cultivation of Mattu brinjal stands scientific scrutiny.

The skin of Mattu gulla is thin, and virtually gets dissolved on boiling. It is less astringent than other varieties of gulla/badane. Seeds are less in number and are not bitter. After cooking the fruit pieces retain their firmness. Also it has smooth consistency and does not leave any fibrous material. It has a special flavour and is useful in traditional food preparations[8].

The ancient Greek concept of 'genius loci' or spirit of the place, refers to the sensory food quality, including smell, taste and appearance, which is specific to a particular location and which lends particular preference in the minds of users/consumers to the product/location. Mattu gulla is a good example for the traditional holistic approach of food quality compared to the modern reductionist approach where the concept of food quality is cleaved[9].

There is a need to register Mattu gulla under the Geographical Indications of Goods and Registration and Protection Act 1999 for protecting its unique geographic identity. Geographical Indication (GI) is a collective community right and not an individual right. Only an association of producers or an authority established under law can apply for GI registration. The registration filed this category has 10 years validity and can be renewed each time for a further period of ten years. Hence the Mattu Gulla Producers Association or the Department of Horticulture, Udupi District, can apply for GI registration.

The Indian Agricultural Research Institute (IARI) has developed a *Bt* brinjal with the gene *cry1Ab*. It is yet to reach the stage of commercialization. On the other hand, the multinational company Monsanto has evolved *Bt* brinjal containing a foreign gene *cry1Ac* derived from a soil bacterium *Bacillus thuringiensis*. This gene synthesizes a protein toxic to the fruit-and-shoot borer insect pest of brinjal. Its incorporation into brinjal kills the insect invader once it attacks the shoot and fruits of brinjal. Thus farmers can reduce spraying of insecticides to control the borer. The Indian company Maharastra Hybrid Seed Company (Mahyco)

sourced the *cry1Ac* gene construct for its *Bt* brinjal from Monsanto. Mahyco has done the entire transformation, i.e. fitting the gene construct in the right place of the brinjal genome. Mahyco has submitted a patent application for this unique event, EE1 with the patent authority. This event EE1 was integrated into eight of the company's own brinjal hybrids like MHB 4, 9, 10, 80, 99, 11, 39 and 111. In addition, it has supplied the event EE1 to University of Agriculture Sciences (UAS), Dharwad for backcrossing with their several popular varieties, including Udupi gulla. According to another report, UAS, Dharwad gave seeds of its promising brinjal varieties, including Udupi gulla to Mahyco, which has backcrossed them into a transgenic product and presented the backcrossed seeds under a USAID-funded project devised by Agriculture Biotechnology Support Programme II (ABSP II) team members at Cornell University, USA. UAS, Dharwad will conduct field trials and distribute the disease-resistant seeds to farmers on cost basis. Farmers can use these varieties over succeeding generations, unlike Mahyco's hybrids that have to be bought for every fresh sowing. Although this act apparently appears to be generous, there is a catch as is evident from the statement of the spokesperson of Mahyco that 'the question of royalty arises only if universities undertake commercial sales'. Thus what costs the farmers would have to pay for different varieties of *Bt* brinjal is yet unknown. Also there is the danger of indigenous Mattu gulla being contaminated with the *Bt* gene, once the commercial cultivation of Udupi gulla with backcrossed *Bt* gene begins in Mattu village.

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Leaf anatomical basis of woolly aphid resistance in sugarcane

Among various abiotic and biotic stresses, sugarcane woolly aphid, *Ceratovacuna lanigera* Zehenter has recently become a serious biotic constraint, threatening sugarcane cultivation, particularly in peninsular India and causing significant loss in cane yield and sugar recovery. Host plant resistance is one of the important components of integrated pest management, which is environmentally safe and ecologically stable. Leaf anatomical characters and biochemical contents of leaf are known to play a role in attributing resistance against insects.

The present study was envisaged to find the possible mechanism and basis of resistance for the woolly aphid involving two resistant clones, SNK 192 and SNK 754 and two susceptible clones, CoC 671 and Co 92920, through histological studies. Microscopic measurements for leaf anatomical parameters were recorded as mean value based on ten leaf samples collected from each clone. Further, each leaf sample was observed in five microscopic fields.

In the present study leaf thickness, measured as the distance between the lower and upper leaf epidermis, did not differ significantly between resistant and susceptible groups of clones (Table 1). Similarly, group mean distance between lower epidermis and phloem in resistant clones was more compared to susceptible clones, even though the group mean did not differ significantly. Hence it is likely that the presence of more number of cells and greater distance between the stomata of lower epidermis and phloem, make it difficult for the aphid to reach the phloem for gathering food in resistant clones. Similar observation was also reported in resistant cotton genotypes for sucking pest[1].

The distance between large and small, large and medium and medium and small vascular bundles varied significantly between the resistant (Figures 1 *a* and 2 *a*) and susceptible clones (Figures 3 *a* and 4 *a*). This distance indicates the free space between vascular bundles. The mean distance was more in susceptible clones indicating the presence of more free space compared to resistant clones. The space between vascular bundles adds either toughness or succulence to the internal leaf anatomy of clones. Further, phloem width was significantly more in resistant clones compared to susceptible clones, indicating availability of greater space for the aphid for sucking.

Parenchyma cells are important cells of the leaf, wherein vital metabolic activities take place. Significant difference was observed in the width of parenchyma cells around the bundle sheath between resistant and susceptible clones. For successful tapping of food, the aphid has to pierce its stylet either intracellularly or intercellularly to reach the phloem. It has been reported[2] that most of aphid species penetrate through their stylet intercellularly