Study on Micropropagation and Secondary Metabolite Production of *Tecomella undulata* (Sm.) Seem.

**Introduction:**

*Tecomella undulata* (Sm.) Seem., belongs to the family *Bignoniaceae*, locally known as Rohida, is a medicinally and economically important plant that originated in India, Arabia. It is one of the co-dominant species of Drier parts of India in the desert of western Rajasthan and Gujarat. It is an important agro-forestry (Anonymous 2003), deciduous or nearly evergreen tree grows under natural conditions in wild, unprotected and highly exploited. It occurs on flat and undulating areas including gentle hill slopes and thrives very well on stabilized sand dunes. Leaves are narrow, lance-shaped, with wavy margins, 5-12 cm long. In spring time it produces beautiful tubular flowers in yellow, orange and red colours. Fruit is a long, thin, slightly curved capsule up to 20 cm long, with winged seeds (Chal et al. 2011). The plant has been included in the list of endangered plant species due to over exploitation. Indiscriminate felling for timber and fuel by the local population, coupled with poor regeneration has severely depleted the natural populations of this valuable tree, with an associated loss of valuable germplasm. The drug has been extensively used since ancient times for the treatment of human ailments. It posses anticancer activity (Ravi et al. 2011 and Sanjiiyani et al. 2012), hepatoprotective (Rana et al. 2008 and Khatri et al. 2008, Patel et al. and Singh and Gupta 2011 and Goyal et al. 2012), analgesic activity (Ahmed et al. 1994), antibacterial activity (Gehlot et al. 2007 and Parekh et al. 2005), mild relaxant, cardiotonic and chloretic activities (Khare et al. 2007) etc. The bark obtained from the stem contains certain secondary metabolites like tecomin, alkenes, alkanols, β-sitosterols, chromone glycosides, undulatoside, A and B, iridoid glucosides, tecomelloside, tecoside, lapachol, veratric acid (Nandkarni et al. 2000, Rastogi et al. 2006, and Ambasta et al. 2006) and is employed for the treatment of various diseases of skin, central nerves system, urinary disorders, enlargement of spleen, gonorrhoea, leucoderma, liver diseases, jaundice, diabetes, cancer and swellings. Seeds are used against abscess. Leaves shows significant antimicrobial activity and contains certain chemical constituents like triacontanol, betulinic acid, oleanolic acid and ursolic acid. Triacontanol is an effective plant growth regulator while both betulinic acid and ursolic acid is potent antihuman immunodeficiency virus (HIV) and are used in treatment of AIDS (Azam, M. M., 1999 and 2000). Flower is
used for Hepatitis. The plant constituted reputed drug of Ayurveda and its multiple uses have also been made to avoid their excessive exploitation for their in situ conservation.

The species has been designated as a “threatened” plant species in Rajasthan province of India (Tripathi and Jaimini, 2002). Moreover United Nations Environment Programmes (UNEP) and World Conservation Monitoring Centre (WCMC) Nairobi, Kenya, has included Tecomella into “Category 1- Indeterminate“ of their list of threatened plants to emphasize the status of Tecomella (WCMC, 2003, 2005) and despite the greater importance of the tree as economical, ethnobotanical and medicinally important make attempts for its conservation so there is an urgent need to formulate appropriate conservation to save this versatile tree.

Several work of Clonal propagation has been done in Rohida through tissue culture (Rathore T. S., et al., 1999) and In-vitro shoot multiplication from cotyledonary node explants of Tecomella has been also conducted (Nandwani D., et al., 1995) but no work has been reported in Clonal propagation and In-vitro shoot multiplication through indirect organogenesis. Assesment of genetic diversity in Tecomella has been done in Rajasthan (Bhau, B.S., et al. 2007) but no such work has been conducted in Gujarat. Variation in secondary metabolite production of in vivo and in vitro plant has not been studied at all in Tecomella so; this work has been selected for present study.

**Plant Tissue Culture**

The plant Tecomella undulata can be regenerated from any part like leaf and stem. The intact plant represents a highly organized and coordinated system in which correlative factors operate in an integrated way in the development of whole plant with its several organs such as leaves and nodal segments. Small segments of a plant organ or a group of cells (callus) are grown as an isolated system on a semi defined or defined nutrient medium solidified by agar (MS media) or maintained as agitated liquid suspensions under fungal and bacteria free and deliberately modified environmental conditions of temperature and light for indefinite periods of time. Tissue culture techniques are used for virus eradication, genetic manipulation, somatic hybridization and other procedures that benefit propagation, plant improvement and basic research. Tissue culture techniques are used for virus eradication, genetic manipulation, somatic hybridization and other procedures that benefit propagation, plant improvement and basic research.
**Pharmacognostical study**

Pharmacognostical study is the preliminary step in the standardization of crude drugs. The detailed Pharmacognostical evaluation gives valuable information regarding the morphology, microscopical and physical characteristics of crude drugs.

**Phytochemical study**

Plant *Tecomella undulata* is the source of major phytoconstituents such as alkaloids, flavonoids, glycosides, saponnins, tannins, phenolic compounds, quinones, anthroquinones, sterols and carbohydrates. The phytochemical constituents of plant are desirable, not only for the discovery of therapeutic agents, but also precursors for the synthesis of complex chemical substances.

**Antimicrobial activity**

Antibacterial activity refers to the ability to fight against bacteria and the infection caused by them. Plant *Tecomella undulata* has seen to antimicrobial activities due to various components present in various plant parts. Antimicrobial effect may be due to presence of secondary metabolite in plant. The presence antimicrobial and antifungal substance in the plant is well established as they have provided a source of inspiration for novel drug compounds as plant derived medicine have made significant contribution towards human health.

**Thin layer Chromatography (TLC)**

An application of TLC in analysis, a method based on adsorption chromatography. It is at present and important analytical tool for qualitative and quantitative analysis of a number of natural products. The TLC technique is useful in analysis of complex and derivatives and all bioconstituents.

**High Performance Thin layer Chromatography (HPTLC)**

HPTLC is rapidly gaining importance in biochemistry of natural products and in analysis of bio-fluids in the field of pharmacokinetics. It is very useful in qualitative and quantitative analysis of pharmaceuticals. The analytical profiles for alkaloids, glycosides, quinines, flavonoids, saponnins, Tannins, phenolic compounds, carbohydrates, steroids and lipids have been developed using the technique. HPTLC is now-a-days applied to obtain “Finger-print”
patterns of herbal formulations, quantification of active ingredients and also detection of adulteration.

**RAPD**

Polymerase chain reaction (PCR) techniques using random amplified polymorphic DNA (RAPD) markers are considered to be sensitive enough to detect the variations or genetic relationship among individuals between and within species (Carlson et al., 1991; Roy et al., 1992; Tripathi et al., 2007). RAPD markers have been successfully used to assess genetic stability and quality among micropropagated plants, thus ensuring the quality of tissue cultured plantlets. There are a number of molecular markers used for such assessment, however, RAPD is the cheapest and appear to be powerful tool for detection of genetic variability in plants.