

MURRAYA KOENIGII

A MULTIPURPOSE PLANT FOR SALINE AREAS

By

NAMRATA PATHAK

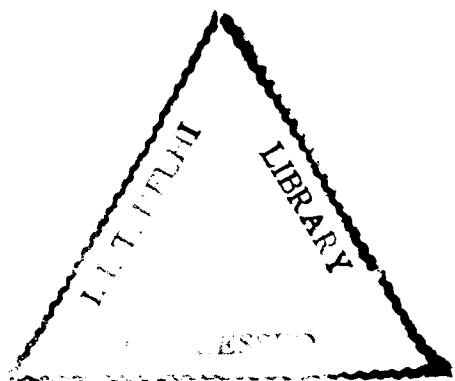
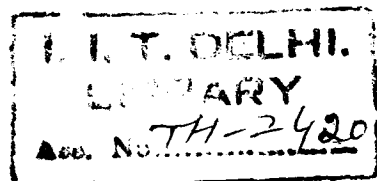
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CENTRE FOR RURAL DEVELOPMENT AND TECHNOLOGY
INDIAN INSTITUTE OF TECHNOLOGY, DELHI
NEW DELHI 110 016, INDIA

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CERTIFICATE

This is to certify that the thesis entitled "***Murraya Koenigii: A multipurpose plant for saline areas***" submitted by **Miss Namrata Pathak** has been prepared under my guidance and supervision in conformity with the rules and regulations of Indian Institute of Technology, Delhi, for the award of the degree of **Doctor of Philosophy**. The research report and results presented in the thesis have not been submitted in part or full for any degree or diploma in any other University / Institution.

Padma Vasudevan
(**Prof. Padma Vasudevan**)

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Namrata Pathak
(Namrata Pathak)

ABSTRACT

Dependence of Indian rural population on biomass is inevitable as this is a resource readily accessible and affordable. Biomass meets nearly all the needs for sustaining life in the rural sector. In the context of sustainable development, technologies based on biomass production, conversion and utilization are considered highly appropriate as they are environmentally compatible and socio-culturally acceptable.

In rural areas, a variety of plants which can be grown without much inputs even on wastelands can be of direct value to the poor for providing food, fuel, fodder and other materials. Plants which are traditionally used must be screened for exploiting their full economic potential. In addition, it is important to integrate the utilization aspects into a closed system in which the waste of one process becomes the starting material for another.

India has about 175 mha of land which are wastelands. Out of this about 7 million hectares of area is occupied by salt affected soils. Wastelands have been generated due to natural or manmade causes which include deforestation, overgrazing, overcultivation and industrialization. In view of this, selection of plants must be based not only on economic production but also on the feasibility of soil reclamation and acceptance within the traditional practices.

Present thesis is a study of a popular shrub, *Murraya koenigii* (curry leaf plant) with focus on its potential for cropping on saline soil. The saline area around

Farrukhnagar village, Gurgaon district, Haryana State, was chosen as a site typical of wastelands in the country. Analysis of salinity and alkalinity of soil and water samples from the site was done in terms of EC, pH and major cations and anions found in such lands. These data were used to simulate salinity conditions at the laboratory level. Also where needed, field level experiments were done in this area.

Murraya koenigii, a perennial, is a member of citrus family Rutaceae. It is very prolific in its growth and is propagated mainly by seeds and root suckers. The shrub requires very little agricultural inputs for its growth. The biomass yield is of the order of 40 tonnes / hectare / year. This is large enough to make its cropping economically viable if good market support is available.

Seed viability was checked in hydroponics and in pot experiments and the effects of various salts individually and in mixes were observed. Ca^{2+} and Mg^{2+} had positive influence compared to Na^+ on the viability of *Murraya koenigii* seeds. The growth of the seedlings was measured in terms of increase in height, number of leaflets and number of leaves as a function of time in months. The plants were tolerant and even thrived upto a soil EC of 10 mmho/cm. The leaves of seedlings grown in saline soils, showed sodium accumulation thereby having a ^{tive} ameliora_k influence on saline soils by absorbing sodium ions from the soil. Effect of various biotechnological inputs on the seed sprouting and sapling growth was checked. 100 percent viability was noticed with Vermicompost + cowdung + earthworm treatment.

The shrub is rich in Vitamin A and essential amino-acids. It is also used for its medicinal value and the whole plant as such is a storehouse of a number of phytochemicals. In the present study, the volatile oil was extracted by hydro-distillation and various solvents and evaluated for its antimicrobial, insecticidal and pesticidal value. It was found effective against (*Pseudomonas*, *Staphylococcus aureus*, *Bacillus subtilis*, *Pleurotus sajor caju*, *Odontotermes* spp. (termite) and *Callosobruchus chinensis* (stored grain pest)).

The residue left after hydro-distilling leaves was used as a substrate for the growth of an edible mushroom *Pleurotus sajor-caju*. The biological efficiency was 10.52%. The stem can be used as a fuel for direct burning (Calorific value ~ 4500 K Cal/Kg). The hydro-distilled leaves were used for biomethanation, (1 kg dry residue yielded 88 liter biogas with methane content of 56%). The NPK content (%) of the slurry was 2.46, 0.32 and 1.80 respectively. Also the residue was used for vermicomposting using *Eisenia foetida*. The duration of composting was 30 days and NPK content of the compost was 1.89, 0.41 and 2.0% respectively. The biogas slurry and vermicompost would be highly valuable as a fertiliser rich in N and K.

Thus the shrub can bring multiple benefits to the rural people. It is not only ecologically compatible to saline soils, but also has an ameliorating effect on the soil by absorbing Na^+ ions. Leaf and its oil can bring value addition to rural economy. After the oil has been extracted from the leaves, the residue left could be utilized in different ways by recycling various nutrients in the waste. *Murraya koenigii* can therefore contribute to sustainable development of rural sector.

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