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RESEARCH ARTICLE

IN VITRO PROPOGATION OF CURCUMA ANGUSTIFOLIA AS AN ECONOMIC EMPOWERMENT OF RURAL FARMERS IN MIDDLE KERALA

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ABSTRACT

India is a rich source of medicinal plants due to the diversity in soil, their altitudes and other eco-geographical conditions. Economic plants play a vital role in providing nutritional and economical security to the poormass in rural areas. Overexploitation and destructive harvesting have made many medicinal plants scarce in their natural habits and costly in the market. East Indian arrowroot (*Curcuma angustifolia*) is a nutritionally and medicinally important crop belongs to family Zingiberaceae. It is an important medicinal plant of tropical and subtropical India. Its medicinal usage has been reported in the Indian and British Pharmacopoeias and in traditional systems of medicine such as Ayurveda, Unani, and Siddha. As the multiple uses of this species have increased its commercial demand, resulting in over-exploitation. Hence the natural population of these plants is rapidly disappearing especially in Kerala, India. The micropropogation of the plant was achieved using MS medium supplemented with Indole Acetic Acid (IAA) and Kinetin, under the controlled room temperature and photoperiod. 0.2mg/L of IAA and 1.0mg/L Kinetin gave the highest rate of shoot and root generation and average length of the shoot The paper also explores the traditional knowledge of rural women in middle Kerala on processing of Koovapodi a rhizome based ethnic weaning food from *Curcuma aungustifolia*. The information on preparation is based on the preliminary discussions with medical practioners of traditional medicine and elderly rural women of middle Kerala.

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INTRODUCTION

Curcuma angustifolia is a nutritionally and economically important, but overexploited medicinal plant of middle Kerala, India. The present study is an attempt to develop tissue culture methods to increase the cultivation of the plant through micropropogation for industrial production. It also explores the indigenous knowledge pertaining to human health among our rural women (making of arrowroot powder from *Curcuma angustifolia*) as women especially in Kerala, have a profound knowledge of plants and herbal medicines. Further studies can also be designed to strengthen the post harvest handling of this crop so as to provide sufficient amounts of arrowroot powder to industries and hence it can be an additional source of income for farmers of middle Kerala. *Curcuma angustifolia* is a native medicinal plant, which is of high commercial demand, especially in middle Kerala, India. It is harvested on the verge of rainy season (May-June) and almost 40 to 70% of the crop is caught in rainy months (June-Aug) and hence lost. However, since some farmers do not get proper realization for the rhizomes and hence many times they do not bother even to harvest properly. Further, they are removing these precious and nutritionally rich plants and replacing by mango, cashew or coconut. It is therefore necessary to strengthen value chain of these crops which will help to meet the requirements for commercial cultivation, thereby conserving the species in its natural habitat. As a result it will become an assured and sustainable source of income to farmers and availability of healthy and nutritious products for consumers. In India, *Curcuma angustifolia* is most commonly found growing wild, especially in the north east and western coastal plains and hills. It is a perennial and flowering herb. *Curcuma angustifolia* is a perennial flowering herb growing wild commonly in north east and western coastal plains and hills of India (Ravindran *et al.,* 2012). *Curcuma angustifolia* produces edible rhizome rich in starch content. The plant grows wild in its natural habitat and usually perpetuates through vegetative reproduction. The rhizomes of *Curcuma angustifolia* is rich in starch. It grows wild in its natural habitat and propagates through vegetative reproduction. (Shukla *et al.,* 2007). The rhizome of *Curcuma angustifolia* is pale pendulous tubers useful in treating leprosy, burning sensations, dyspepsia, loss of taste, bronchitis, asthma, fever, thirst, jaundice, anaemia, leucoderma, stones in kidney and bladder, urinary dischargers, ulcers and diseases of blood The tubers were useful in treating leprosy, burning sensations,

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dyspepsia, lss of taste, bronchitis, asthma, fever, thirst, jaundice, anemia, leukoderma, stones in kidney and bladder, urinary discharge, ulcers and diseases of blood (Ravindran *et al.,* 2012). Rural women in Kerala are rich in ethnobiological knowledge which has been transmitted from one generation to another. One such knowledge is the traditional processing of weaning food *"koovapodi*" mainly prepared from the rhizomes of these plants. This study aims the development of an efficient micro propagation protocol which will play a significant role in meeting the requirements for commercial cultivation, thereby conserving the species in its natural habitat. It also aims to popularize the plant as these are recognized by very few young generation people and this traditional knowledge of preparation of "*koovapodi*" is also fading with time.

MATERIALS AND METHODS

Collection and preliminary studies of plant materials

Curcuma angustifolia: Fresh plants/rhizomes of *Curcuma angustifolia* were collected during April 2016 from Kerala Ayurveda Pharmacy Ltd., Aluva, Ernakulam District, Kerala, South India. Rhizomes of *Curcuma angustifolia* is planted on sand bed (Shukla *et al.,* 2007; Marcos Dquinta *et al.,* 2009). Sprouting of *Curcuma angustifolia* are observed within 5 to 10 days.

Traditional Preparation of Starch (*Koovapodi)*

For preparation of weaning food locally called *koovapodi*, the rhizomes of the plant were cleaned to remove soil and dirt, peeled, grated and soaked in water. The water turns milky white and strained to separate grated flakes of rhizome and was kept for 12 hours. Excess water was drained, again some water was added and left for 6 hours. This was repeated 2 times. Finally the excess water was drained out, and left over wet white dough was dried and crushed with hand to make fine powder. About 2 kg of rhizomes were required to prepare 250 gm of weaning food. *Koovapodi* is used as a weaning food all over Kerala which is generally cooked with milk or water (Anjali, 2012).

Study of tissue culture methods

Buds having length ranging from 0.5 to 1 cm were used as explants. The sprouted rhizomes were taken carefully from sand bed and washed thoroughly in running tap water to remove the sand and dirt. The shoot buds were excised from the rhizome under aseptic conditions and rhizomes were replanted for next cycle of sprouting.

Sterilization: The buds were rinsed in 0.1% Tween 20 and washed in running tap water for 30 minutes. Further sterilization was carried out using 0.1% mercuric chloride, and washed in sterile distilled water for 3 to 4 times. The explants were inoculated on Murashige and Skoog medium supplemented with IAA and Kinetin . The pH of media was adjusted to 5.4 prior to autoclaving at 121^{o}C for 15 minutes. Various concentrations of Indole Acetic Acid (1, 0.2 and 2 mg/L) and Kinetin (1, 1.5 and 0.1 mg/L) were used to observe its effect on shooting and rooting.

RESULTS AND DISCUSSION

Results obtained during the study takes the form of a table below (Table 1).

Table 1: Rate and nature of growth of rhizome buds

Parameters	*Curcuma angustifolia*
Root initiation	Takes approximately 7 days
Root elongation	Show roots with a length approximately 2 cm within 20 days.
Nature of root	With several root hairs
Shoot initiation	Within 3 days.
Leaf initiation	Within 7 days.

Fig. 1: 0th day of *Curcuma angustifolia*

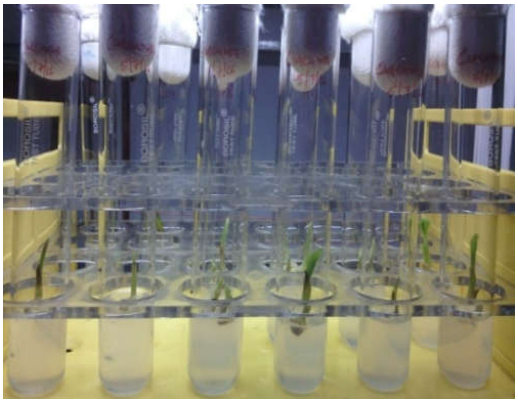

Fig. 2: 2nd week of *Curcuma angustifolia*

Fig. 3: 3rd week of *Curcuma angustifolia*

Fig. 4: 4th week -Acclimatization

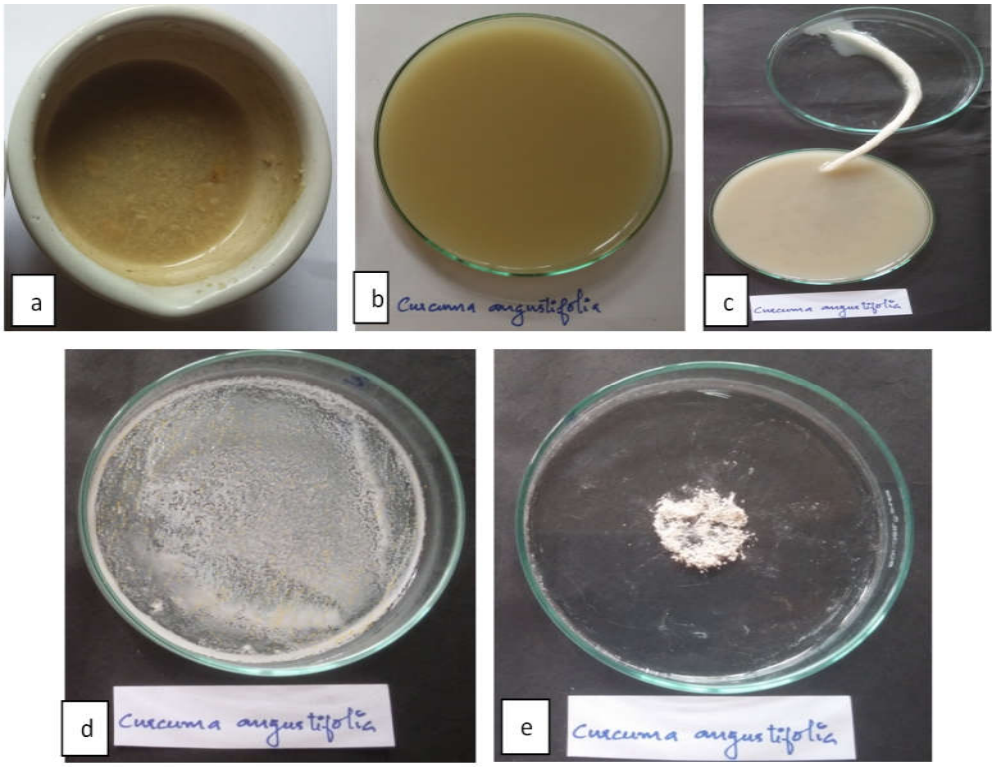

Figure 5: Traditional method of arrowroot processing: a-cleaned rhizome macerated; b-filtered; c-traditional way of starch extraction; d-dried; e-starch powder

In this study the successful plantlet formation was obtained by using Murashige and Skoog (MS) medium supplemented with Indole Acetic Acid (IAA) (0.2 mg/L) and Kinetin (1.0 mg/L) at 26 +/- 2^{o}C under the condition of 16/8 hour photoperiod. During the study it was observed that *Curcuma angustifolia* shows positive response in the in vitro propagation. The parameters root initiations, root elongation, nature of root, leaf initiation are taken for the above study. Shoot buds from rrhizomes were cultured in Murashige and Skoog medium supplemented with different concentrations of Indole Acetic Acid (IAA) and Kinetin. Best results were observed in medium containing 0.2mg/L IAA and 1.5mg/L Kinetin.

Traditional Preparation of Starch (*Koovapodi) (Pilot study)*

Conclusion

Curcuma angustifolia is propagated through rhizomes in nature. Propagation rate is low through the underground rhizomes. The micropropogation of the plant was achieved using MS medium supplemented with Indole Acetic Acid (IAA) and Kinetin, under the controlled room temperature and photoperiod. 0.2mg/L of IAA and 1.0mg/L Kinetin gave the highest rate of shoot and root generation and average length of the shoot. The sterilization method was also acceptable. It has been observed that the traditional knowledge on wild food plants like *Curcuma aungustifolia* and its ethnic preparations is on sharp decline. The sedimentation and decantation process diminish the sourness/bitterness of the starch and improve the whiteness of the product (Patel *et al*., 2015). Our present study also showed the similar result. Unless efforts are made to educate the younger generations about their importance, it may be lost in near future. Efforts should make from every end to improve the food security and improvement of nutritional status in rural areas. Steps are needed to undertake extensive education about the importance of "*koovapodi*" as a nutritionally balanced weaning food and as a direct and indirect source of income particularly for the poor farmers.

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