

CRITERION III – RESEARCH, INNOVATIONS AND EXTENSION

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4	M. Anuradha	<i>Camptothecin</i> and <i>Camptothecin</i> Producing Plants	Propagation of <i>Camptothecin</i> biosynthesizing plants	18-28
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8	M. Anuradha	<i>Camptothecin</i> and <i>Camptothecin</i> Producing Plants	Endophytes and <i>Camptothecin</i> production	



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ANTI-OXIDANT FOODS & DRINKS IN INDIA

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<p>Ms. Uttiya Jana</p> 	<p>Food value of a variety of sea fish (fatty fish)</p>	<p>Assistant Professor, Dept. of Food Science & Nutrition Management, J.D. Birla Institute, West Bengal, India.</p>
<p>Dt. Twinkle Dhiman</p> 	<p>Turmeric (<i>Curcuma longa</i>)</p>	<p>M.Sc. (Dietetics and Nutrition),</p>
<p>Dr. Sonali Gaikwad</p> 	<p>Kiwi fruit (<i>Actinidia chinensis</i>): Antioxidant fruit</p>	<p>Food Scientist (R&D/Food Safety)</p>
<p>Ms. Nadira Anjum</p> 	<p>Beetroot: its nutritional and bioactive characteristics</p>	<p>PhD Research Scholar (ICMR SRF), Division of Food Science & Technology, SKUAST Jammu, India.</p>
<p>Ms. Meenakshi Trilokia</p> 	<p>Aonla (<i>Emblica officinalis gaertn.</i> Syn. <i>Phyllanthus emblica</i>) (Indian momentous antioxidant and anti-inflammatory fruit)</p>	<p>PhD Research Scholar (ICMR SRF), Division of Food Science & Technology, SKUAST Jammu, India.</p>
<p>Er. Abhirami Panoth</p> 	<p>Ginger (<i>Zingiber officinale</i>)</p>	<p>Assistant Professor, Dept. of Food Processing, Padmashree Institute of Management & Sciences, Bangalore, Karnataka.</p>
<p>Er. Nickhil C.</p> 	<p>Orange (<i>Citrus sinensis. L</i>): portentous anti-oxidant and anti-inflammatory fruit</p>	<p>PhD scholar in Agricultural Processing & Structures, ICAR-IARI (outreach ICAR-CIAE Bhopal.</p>




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CHAPTER-12

GINGER (*Zingiber officinale*)

Abhirami Panoth



Introduction

Ginger (*Zingiberofficinale*), is a herbaceous perennial which belongs to Zingiberaceae family and genus Zingiber. The term ginger is derived from the Sanskrit word Singabera, which means horn shaped protrusions (Bhatt *et al*, 2013). The rhizome of which is commonly consumed or used as a spice with medicinal value and is often called as ginger roots even though it is not a root (White 2007). It is believed that ginger is indigenous to South east China from where it is spreaded over India and rest of Asian Countries (Santos Braga 2019). Ginger is a tropical plant, however it is adapted to grow even in subtropical climatic conditions such as in high ranges and is widely cultivated in Asia and Africa (Wang, 2020). In 2017, country produced 10.76 lakh tons of Ginger from 1.68 lakh hectares and ranks first in the production (FAOSTAT 2017). Ginger is cultivated in all states in the country however, the states such as Assam, Maharashtra, West Bengal, Gujrat, Kerala, Meghalaya, Mizoram together contribute 70% of country's production (APEDA, 2017)

Botanical characteristics

This monocotyledonous slender perennial plant grows about a meter height (60 -100cm). Two ranked long, elongated leaves (6-12 inches) are arise from smooth sheaths and cover the stems (Wang, 2020). The stem sticks produce yellow flowers. The consumed portion of the plant is called rhizome, which has been used since ancient times for various ailments including digestive problems.



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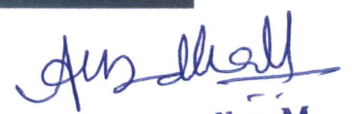
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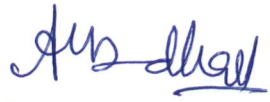
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Mung Bean



G. Mohan Naik, P. Abhirami, and N. Venkatachalapathy

Introduction

Mung bean (*Vigna radiata* L. Wilczek) popularly known as green gram, believed to be native crop of India, is a tiny circular shaped bean in green color widely cultivated throughout Asia, including India, Pakistan, Bangladesh, Sri Lanka, Thailand, Laos, Cambodia, Vietnam, Indonesia, Malaysia, South China, and Republic of Formosa. This short-term legume can grow in varying environmental conditions, and later it expands it reach to the USA, Australia, and Africa. In general, mung bean is a source of high-quality protein which can be consumed as whole grains, dhal, or sprouted form and is an excellent complement to rice in respect to balanced human nutrition. In addition to being the prime source of human food and animal feed, it plays an important role in maintaining the soil fertility by enhancing the soil physical properties and fixing atmospheric nitrogen.

Structure of Mung Bean

Mung bean is an annual crop that is highly branched and is about 60–76 cm tall (Oplinger et al. 1990) with a slight tendency of twinning in upper branches. The central stem of this crop is roughly erect, but the side branches are semi-erect. The leaves of the plant are trifoliate, and it is deep-rooted. Clusters of 12–15 flowers are situated at the top of the plant, and eventually these flowers will develop into small cylindrical pods. The pods of this fully fertile and self-pollinated crop are linear,

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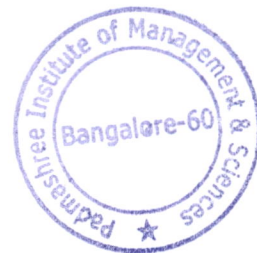


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LABOUR MIGRATION: POST COVID 19

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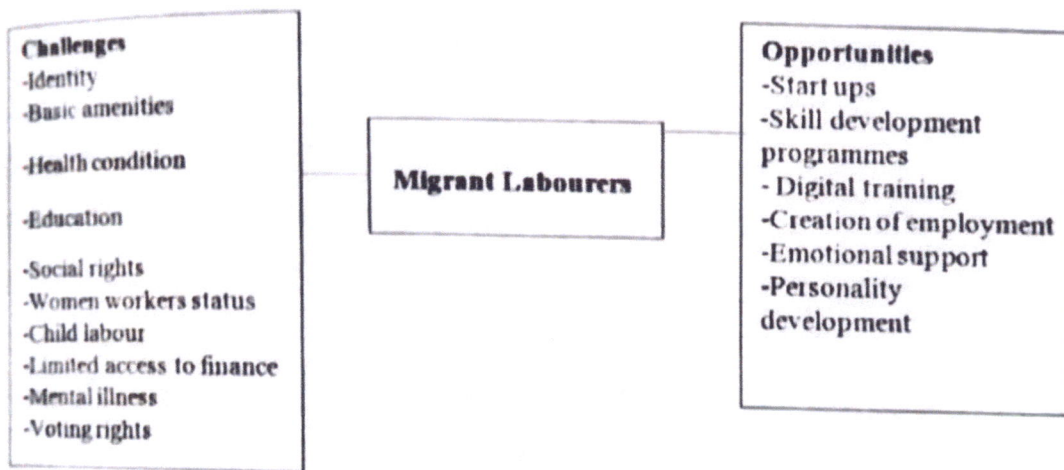
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LABOUR MIGRANTS-CHALLENGES AND OPPORTUNITIES. POST COVID 19. ARE THEY REALLY SAFE? DO WE HAVE TRUE CONCERN FOR THEM?-A QUALITATIVE REVIEW

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Introduction

Labour Migrants are people who face challenges not only in pandemics but all through their normal life. They migrate from place to place in search of basic amenities. Earning food and shelter is the basic objective of their life. The decision to migrate is often accompanied by several pre-conceived expectation, especially which of acceptance by hosts, but with forced migration, the decision is often abrupt, to escape death, famine, and many other fatal conditions (Haug, 2008). The period it takes a migrant to adapt to the new surroundings determines how soon to realize integration with the society. A quantity of migrants tend to change sooner than others, all the way through social interaction and engagement in economic

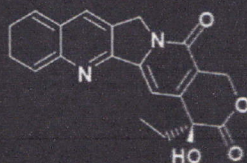
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CAMPTOTHECIN AND CAMPTOTHECIN PRODUCING PLANTS

Botany, Chemistry, Anticancer Activity, and Biotechnology



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CHAPTER 5

Propagation of camptothecin biosynthesizing plants

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Abbreviations

BA	N6-benzyladenine
BAP	6-Benzylamino-purine
DVS	Dual vessel system
GA₃	Gibberellic acid
HPLC	High-performance liquid chromatography
HP TLC	High-performance thin layer chromatography
IAA	Indole-3-acetic acid
IBA	Indole-3-butyric acid
Kn	Kinetin
MS	Murashige and Skoog
NAA	α-Naphthalene acetic acid
PGR	Plant growth regulator
PPF	Photosynthetic photon flux
TIS	Temporary immersion system
SV	Sand and vermiculite
SSV	Sand, soil, and vermiculite

5.1 Introduction

The prevalent use of plants for various needs of humankind from times immemorial added to the loss of many precious species from the globe. Practice of cultivation is restricted to food and to some extent timber left the medicinal plants in a lurch leading to its indiscriminate collections. Even today many species are collected or uprooted from the wild for want of biologically active phytoconstituents. This industry has far and wide applications in pharma and allied sectors such as nutraceutical, cosmeceutical, and food industries. This contributed in massive destruction of their natural habitat, steering to red listing of many species. To avoid this, the only alternative left is domestication and cultivation of plants. Understanding the barriers and glitches in the reproductive system of the plants along with optimizing propagation methods is the first and foremost requirement. Development of sustainable technologies, including the development of an


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CHAPTER 6

In vitro camptothecin production from plants: prospects and challenges

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6.1 Introduction

Cancer, a leading cause of global deaths, is a major life-threatening non communicable disease. In the next two decades the estimated cancer cases would increase by 75% and may reach approximately 25 million worldwide (Alwan et al., 2010). Every system of medicine is looking for management and cure of various types of cancers. Most of the cancer therapies in the World still depend on natural resources, especially plants. Camptothecin (CPT), a plant-derived monoterpene indole alkaloid, found to kill cancer cells is discovered in a breakthrough collaborative research work done by Dr. Wall and Dr. Wani. This was initially isolated from *Camptotheca acuminata* and has an unique activity of inhibiting topoisomerase I (Wall et al., 1966; Hsiang et al., 1985). Later, CPT and 9-methoxy-CPT were isolated from *Nothapodytes nimmoniana* also by Govindachari and Viswanathan (1972). CPT after its discovery as a potent anticancer agent is subjected to various clinical trials. Further clinical evaluation resulted in the approval of two CPT analogs, topotecan and irinotecan for cancer therapy. Topotecan is approved for the treatment of recurring ovarian cancer, small-cell lung cancer, and in combination with cisplatin used to treat cervical cancer, whereas irinotecan has been prescribed for advanced cancers of the large intestine and rectum (Huryn and Peter, 2008). In addition, CPT is also known to inhibit retroviruses such as human immunodeficiency virus and equine infectious anemia virus (Priel et al., 1991). Due to its potential medicinal benefits this compound attracted the interests of various scientists in different fields and resulted in vast literature.

There is an estimative existence of only less than 4000 trees of *C. acuminata* in the wild. Because of the popularity of CPT derivatives, it has been estimated that at least 100 million young Happy trees will be needed to meet the demands (Lorence and Nessler, 2004). Production from natural resources, however, will be problematic because of the uncertainty of cultivation due to such as weather, pests, and disease. Therefore the extraction of CPT from limited natural plant resources may result in


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CHAPTER 8

Endophytes and camptothecin production

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8.1 Introduction

Camptothecin (CPT) is most prominent anticancer drug, isolated mainly from *Camptotheca acuminata* and *Nothapodytes foetida*. CPT from plant sources is the basic raw material used for the semisynthesis of water-soluble clinically effective derivatives. The supply of this phytochemical depends primarily on the availability of aforesaid plants. Since the plant-derived CPT could not support the huge demand from the global market, there are efforts for identifying novel sources or method for the production of CPT. Production of CPT by in vitro culture methods, yield enhancement by precursor feeding, elicitation being most discussed options, however the success rate is meagre and till today there are no commercialization efforts made at the reactor level. As discussed, CPT and its related compounds are presently obtained by extraction from bark, roots, and other parts of *C. acuminata* and *N. foetida*. Both being trees, if exploited indiscriminately the existence of these precious plants may be in question. With this scenario CPT-biosynthesizing endophytes may be an efficient source which is a sustainable alternative. Endophytic microbes, living inside the host plant tissues without causing visible symptoms of disease, are known to occur ubiquitously in plants. Existing in a mutualistic association with their host plants, they have been shown to enhance the plant's ability to tolerate abiotic and biotic stresses. In culture, many endophytic species have been shown to produce several important secondary metabolites including anticancer, antidiabetic, antifungal, and immunosuppressant compounds, which are many times specific to host plants. Many of these compounds closely mimic those produced by the respective host plants, suggesting that the microbe could in fact potentially serve as an alternative source of plant secondary metabolites. Although bacterial endophytes also inhabit healthy tissues of all terrestrial plant taxa, they occasionally produce host-specific compounds.




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CAMPTOTHECIN AND CAMPTOTHECIN PRODUCING PLANTS

Camptothecin and Camptothecin Producing Plants: Botany, Chemistry, Anticancer Activity, and Biotechnology provides comprehensive information on discovery, diversity of camptothecin biosynthesizing plants, biochemistry, biogenesis of camptothecin, pharmacology, clinical studies, and biotechnological aspects. The major focus is camptothecin yielding plants, challenges for their utility, and their exploitation and sustainable utilization.

Chapters of this book thoroughly reviewed the anticancer properties of camptothecin, mechanism of action, other derivatives, and their medicinal properties. This is a valuable resource for cancer biologists, researchers, biomedical scientists, biotechnologists, and herbal drug manufacturers. Alternative resources and sustainable utilization of current sources are also deliberated.

Key Features

- Provides information on camptothecin producing plants, distribution, biochemistry, and scientific basis for the anticancer plants
- Camptothecin and other derivatives of camptothecin, their other pharmacological properties
- Propagation, alternative strategies for the CPT production, biotechnology, and recent developments

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