

# Biodiversity of *Zingiber officinalis*

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**Abstract:-** *Zingiber officinale* is a very important plant is a type of old-world crop which had a Mediterranean center of origin. It has originated in Tropical South-East Asia. India and China were the first countries to grow it. It was later carried to Asia Minor. It was introduced in Europe early in the Middle Ages. It is now widely grown in the tropics. The main countries which growing ginger are China, India, Australia, Japan, Jamaica, Indonesia, Sierra Leone, Malaysia, and other island of West Indies. It also has several ethno medical uses like decoction of dried rhizome is used to make relief from the menstrual pain and nutritional values and world widely used as spice as a flavoring agent. Phytochemical extract of root leaves and rhizome of *zingiberofficinale* reveals the presence of biologically active compound like flavonoids, phenolic acid, volatile and essential oil as a major component. Then we discuss about the conservation strategy of the *zingiber officinalis* due to overexploitation. It also has various economical uses also like pickled in salts, it is largely used in Indian homes.

**Keywords:-** *Zingiber officinalis*, Ethnobotany, Phytochemistry, Conservation, Economical uses.

## I. INTRODUCTION

Ginger, which is scientifically known as *Zingiber officinale*, their distribution is one which cover all the tropical area of the world which is grown through vegetative propagation through rhizome. It is the most important valuable crop because it is used as flavoring agent in food, used in medicines because of their antimicrobial activity, anti-inflammatory activity and anticancer activity also and also used for the extraction of various ginger oil like zingiberene, zingiberol, chavicol, cineole, graniol, d-camphene etc. These are highly esteemed as a spice due to their characteristic odour and worm pungent taste. It is used by the poor people as a source of livelihood.

In 2012, India produced 703 000 tonnes of ginger out of a total global production of approximately two million tonnes of ginger, making India the world's primary producer, consumer, and exporter of ginger. Ginger is primarily produced in the states of Kerala, Odisha, Karnataka, Assam, Arunachal Pradesh, West Bengal, Sikkim, and Madhya Pradesh. The two most popular types of Indian ginger in the world are Colchine ginger and Calicut ginger.

## II. METHODOLOGY OF THE REVIEW

The review's literature survey was conducted utilising an electronic search for peer-reviewed journals, published books, and the thesis. Google scholar, Scopus, and PubMed were employed as online search engines.

## III. TAXONOMICAL, VERNACULAR NAMES, DISTRIBUTION, HABITAT AND ETHNO MEDICAL USES

### A. Taxonomical and Morphological Description

The *zingiber officinale* belongs to the family zingiberaceae which is famous family for its medicinal

properties and uses as spices also. *Zingiber officinale* is an erect perennial herb. It possesses thick, robust palmately branched rhizome. The stem is covered with small scale leaves and fine fibrous roots. The stems attain a height of 3 ft. and is also surrounded by a sheathing base of leaves. The rhizome are pale yellow externally and greenish yellow from inside. The leafy shoots are annual and erect. The linear lanceolate alternate leaves are 20cm long. The leafy shoot is annual erect usually 60- 90 cm tall and are closely covered by the sheathing leaf bases.

The flowers are borne at the tip of the stem in a dense spike with greenish yellow bracts supporting the yellow flower with purple tip. The rhizome contains starch, gums, and oleoresin and an essential oil as well. The plant is propagated by the portion of the rhizome, when each portion contain at least one viable bud.

For this purpose, rhizomes can be dug after the aerial parts of the plants have withered.

### B. Local / Vernacular names

In India ginger is also name as dry ginger or adrak or sonth. In India, there is spoken various types of languages like Malayalam, tamil, Gujarati etc. So, the local name of this plant is different in various languages. In Tamil languages ginger is known as Injee, Allam, lakottai, Inji. In Punjabi ginger is also known as Adi, Adrak. In Kannada language it is known as Alla, Hasishunti. In Sanskrit language ginger is known as Katubhadra, Srngavera.

### C. Distribution and Habitat

It was one among the first eastern spices known to Europeans, having been bought through Arab traders by the Greeks and Romans. In 2012, India produced 703000 tonnes of the world's total ginger output of around 2 million tonnes, followed by China (462500 tonnes), Nepal (255208 tonnes), Nigeria (156000 tonnes), and Thailand (150000 tonnes). Ginger is grown in Japan, Indonesia, Australia, and the West Indies, among other places. India is the world's primary producer, consumer, and exporter of ginger, with the majority of it produced in the states of Kerala, Odisha, Karnataka, Assam, Arunachal Pradesh, West Bengal, Sikkim, and Madhya Pradesh - the former being the largest producer, accounting for nearly 33% of India's production.

Ginger grows best in soil that is wet, rich, and well-drained. The majority of the carbon and vital nutrients in the rainforest are locked up in the live flora, dead timber, and decomposing leaves. As organic matter decomposes, it is recycled so fast that little nutrients reach the soil, rendering it essentially sterile.

### D. Ethno medical uses

Food (Herb and Spice: An important component of many Asian meals, the fresh rhizome is frequently used as a spice in Indian and Chinese cuisines, for example. Western cuisine, on the other hand, loves the dried powdered version of the spice in sweet delicacies like gingerbread. Crystallized ginger, a classic Christmas delicacy as well as a popular Asian delicacy, can also be made using ginger and sugar.

(Medicinal) Ginger is quite soothing on the stomach and is commonly used to treat indigestion and stomach pain. It's also great for relieving diarrhoea and nausea. Ginger contains a chemical that can reduce fever and illness. Aside from utilising the rhizome's juice or crushed rhizome, the leaves can be eaten, pounded and used as a poultice, or the juice collected from the leaves can be administered topically. Ginger oil and preserved ginger, which is made by boiling the rhizome in sugar syrup, were both utilised for medical

purposes. It should be noted, however, that ginger is known to trigger allergic responses in some people when applied to the skin. Ginger should be used with caution by pregnant women as well.).

[Others]: Ginger oil is a frequent element in perfumes and cosmetics, in addition to being used in drinks and medicine. It was formerly considered that the ginger plant could protect against invading tigers.

#### E. Biological activities

S.NO	Biological use	Description	References
1	Antimicrobial activity	Ginger inhibits the growth of other microorganisms such as gram-positive, gram-negative bacteria, and fungus. Except for water extract, all ginger extracts show antibacterial action. Among all ethanol extracts, ethanol extract has the highest antibacterial activity. The antibacterial activity of <i>Z. officinale</i> organic extracts alone and in combination with honey (methanol extract, ethanol extract, Honey, Honey+ methanol extract, Honey+ ethanol extract) has been studied. Antimicrobial activity against <i>Staphylococcus aureus</i> , <i>Escherichia coli</i> , <i>Salmonella typhi</i> , <i>Bacillus cereus</i> , <i>Klebsiella pneumoniae</i> , and <i>Pseudomonas aeruginosa</i> was demonstrated by all five formulations.	Malu, S., Obochi, G., Tawo, E., & Nyong, B. (2009). Antibacterial activity and medicinal properties of ginger ( <i>Zingiber officinale</i> ). <i>Global Journal of Pure and Applied Sciences</i> , 15(3). <a href="https://doi.org/10.4314/gjpas.v15i3-4.48561">https://doi.org/10.4314/gjpas.v15i3-4.48561</a>
2	Anti-diabetic activity	Diabetes is treated using <i>Z. officinale</i> . The juice of <i>Z. officinale</i> has been shown to help treat type I diabetes. In <i>streptozotocin</i> -induced type I diabetic mice, treatment with <i>Z. officinale</i> juice resulted in a considerable rise in insulin levels and a drop in fasting glucose levels. In diabetic rats, <i>Z. officinale</i> therapy reduced serum cholesterol, triglyceride levels, and blood pressure.	Akhani, S. P., Vishwakarma, S. L., & Goyal, R. K. (2004). Anti-diabetic activity of <i>Zingiber officinale</i> in streptozotocin-induced type I diabetic rats. <i>Journal of Pharmacy and Pharmacology</i> , 56(1), 101-105. <a href="https://doi.org/10.1211/0022357022403">https://doi.org/10.1211/0022357022403</a>
3	Nephroprotective activity	This ethanol extract action was initially observed in mice. The ethanol extract of <i>Z. officinale</i> , alone or in combination with $\alpha$ -tocopherol, substantially and dose-dependently protected against cisplatin-induced nephrotoxicity. <i>Z. officinale</i> (250 mg/kg body weight) was shown to be more protective than $\alpha$ -tocopherol (250 mg/kg body weight). When compared to their 250 mg/kg alone treated groups, the combination of <i>Z. officinale</i> (250 mg/kg) and $\alpha$ -tocopherol (250 mg/kg) provided superior protection.	Ajith, T., Nivitha, V., & Usha, S. (2007). <i>Zingiber officinale</i> Roscoe alone and in combination with $\alpha$ -tocopherol protect the kidney against cisplatin-induced acute renal failure. <i>Food and Chemical Toxicology</i> , 45(6), 921-927. <a href="https://doi.org/10.1016/j.fct.2006.11.014">https://doi.org/10.1016/j.fct.2006.11.014</a>
4.	Anticancer activity	<i>Z. officinalis</i> ethanol and chloroform extracts were tested for cytotoxicity against human cervical carcinoma (HeLa) and mouse fibroblast (L929) cell lines. These extracts were shown to have substantial cytotoxic action against the test cell types. The chloroform extract inhibited L929 and HeLa cells with IC50 values of 87.28 g/ml and 74.32 g/mL, respectively, whereas the ethanol extract had IC50 values of 101 g/ml and 33.78 g/mL. Habib et al. (2008) investigated the	Habib, S. H. M., Makpol, S., Hamid, N. A. A., Das, S., Ngah, W. Z. W., & Yusof, Y. A. M. (2008). Ginger extract ( <i>Zingiber officinale</i> ) has anti-cancer and anti-inflammatory effects on ethionine-induced hepatoma rats. <i>Clinics</i> , 63(6). <a href="https://doi.org/10.1590/s1807-59322008000600017">https://doi.org/10.1590/s1807-59322008000600017</a>

		anticancer efficacy of <i>Z. officinale</i> extract in rats with methionine-induced hepatoma.	
5.	Antioxidant activity	Antioxidant chemicals are commonly utilised to combat free radicals, which cause oxidative stress in the cell. Natural sources of antioxidant chemicals, such as plants, can be used. The presence of flavones, isoflavones, flavonoids, anthocyanin, coumarin lignans, catechins, and isocatechins in plants contributes to their antioxidant activity. <i>Z. officinale</i> has been shown to have antioxidant action against a wide range of free radicals. DPPH radical scavenging activity was used to demonstrate <i>Z. officinale</i> 's antioxidant function. The total phenolic content of the alcoholic extract of <i>Z. officinale</i> dried rhizome was 870.1 mg/g dry extract. With an IC50 concentration of 0.64 g/ml, the extract displayed 90.1 percent DPPH radical scavenging activity.	STOILOVA, I., KRASTANOV, A., STOYANOVA, A., DENEV, P., & GARGOVA, S. (2007). Antioxidant activity of a ginger extract ( <i>Zingiber officinale</i> ). <i>Food Chemistry</i> , 102(3), 764-770. <a href="https://doi.org/10.1016/j.foodchem.2006.06.023">https://doi.org/10.1016/j.foodchem.2006.06.023</a>
6.	Toxicity	The ginger has been listed in the US FDA's "Generally Recognized as Safe" (GRAS) document. A dosage of 0.5 – 1.0 g ginger powder, taken 2-3 times per day for 3 months to 2.5 years, had no negative effects. Ginger has no known side effects, according to the British Herbal Compendium.	1. Langner E, Greifenberg S, Gruenwald J, Ginger: History and use, <i>Adv Ther</i> , 1998, 15, 25-44.. 2. Bradley P, British Herbal Compendium. I Vol, British Herbal Medical Association, Bournemouth, Dorset, UK, 1990, 112-114. 3. Wu H, Ye D, Bai Y, Zhao Y, Effect of dry ginger and roasted ginger on experimental gastric ulcers in rats, <i>Zhonghu Zhong Yao Za Zhi</i> , 1990, 15(5), 278-280, 317- 318.

#### IV. PHYTOCHEMISTRY

By doing the extensive study of peer- reviewed journal we concluded that the fresh rhizome of ginger contains various phenolic compound, essential oil, flavonoids, carbohydrates, glycosides, proteins, alkaloids, steroids, saponins, terpenoids and tannins as the major phytochemical group. These phytochemicals play an important role in the medicinal property of ginger. List of Chemicals are:-

[6]- gingerols	1Dehydro-3-dihydro- [10]-ginger-di-one	Methyl di acetoxy- [10]-gingerdiol
[8]- gingerols	Acetoxy-6-dihydroparadol	1-Dehydro- [3]-gingerdione
[10]-gingerols	[4]-Iso gingerol	Acetoxy- [4] gingerol
1,7-bis-(40-Hydroxy-30-methoxyphenyl)-3,5-heptadione	[8]-Shogaol	[8]-Paradol
5-Methoxy- [6]-gingerol	[10]-Shogaol	[9]-Paradol
Methyl di acetoxy- [4]-gingerdiol	[12]-Shogaol	[10]-Paradol
[4]-Shogaol	[6]-Paradol	[11]-Paradol
[6]-Shogaol	[7]-Paradol	[13]-Paradol
1-(40-Hydroxy-30-methoxyphenyl)-7-octen-3-one	beta-sitosterol palmitate	Hexacosanoic acid 2,3-dihydroxypropyl ester
1-(40Hydroxy-30-methoxyphenyl)-7-decen-3-one	isovanillin	maleimide-5oxime
1-(40-Hydroxy-30methoxyphenyl)-7-dodecen-3-one	glycol monopalmitate	p-hydroxybenzaldehyde
1-(omega-ferulyloxygeratyl) glycerols		

## V. ECONOMIC BENEFITS

- Ginger is esteemed due to its characteristic aroma, pungency, and low fibre content. Two important grades of ginger are scraped/peeled ginger (uncoated ginger) and unscraped/ coated ginger.
- For preparing preserved ginger, rhizomes are harvested at immature stage. These are then dried, boiled, scraped, and boiled with sugar.
- Dry ginger contains moisture, protein, fat, fibre, carbohydrates, calcium, phosphorus, sodium, potassium, vitamins, and ash.
- Ginger's distinct scent is attributed to the presence of an essential oil, ginger oil (volatile oil). The pungent taste is due to the oleoresin and gingerin (non – volatile oil).
- Unpeeled ginger constitutes the best source of extracting the essential oil and oleoresin.
- Ginger is used in culinary preparation such as puddings, pickle, soups, gingerbread, ginger cocktails, cakes, cookies and as an ingredient of curries.
- Ginger possesses antioxidant properties. It is used to preserve edible oils and fats against oxidative rancidity.
- Ginger is used in cookery mainly as a flavouring agent. Because of their distinctive odour and extremely strong flavour, they are highly valued as a spice. It is used as a condiment rather than a spice..
- Pickled in salt, it is largely used in Indian homes.
- Oleoresin extracted from Dried ginger is mainly used for flavoring soft drinks and beverages such as gingerale (USA)T ginger beer (UK) and ginger wine.
- Ginger oil is often used in fragrance.
- Chocolate manufactures used ginger preserve for eurobing.
- It is also use in medicinal and veterinary preparations particularly in India and the far east.
- It is used as a digestive stimulant
- It is used in preparation of several pharmaceutical product.
- It is use in many tonics and stimulating remedies due to aphrodisiac nature.

## VI. CONSERVATION STATUS

All societies whether developing or developed, whether single crop or few crop, economy depend on sustainable resources. Greater diversity and flexibility of economy result in less dependence on sustainability of source. Overexploitation of this resources leads to imbalance and adverse effect on other biota.

Ginger is not listed as threatened as it is a common agricultural plant. According to the IUCN red list criteria, ginger is of the least concern.. So, in India there are no current threats to the ginger plant.

## VII. PROPAGATION AND CULTIVATION

### A. Propagation

#### Basic Requirements

- Warm and Sunny climate

- Well drained soil which is high in organic matter concentration.
- Optimum ph. of soil is 6.0 -6.5
- Temperature needed for propagation is 15.5°C
- Annual Rainfall of between 250-300cm is needed for optimum growth

Ginger is a modified underground stem which is propagated through rhizome not through leaf and roots of ginger plant. Propagation is mainly done from small sections of the rhizome called sets. Sets are made by cutting the living rhizome into 3-6 cm small pieces. Each small piece contain at least one living bud which will produce shoot. The sets should be planted in early springs. During planting the temperature should not fall below 25°C.

### B. Cultivation

There are mainly four steps in ginger cultivation

- **Land preparation:** - During land preparation less tillage operation take place. Lime should be added to the soil during planting due to which ph. of the soil should be adjusted.
- **Plantation:** - While planting sets should be mixed with cattle manure or manure with Trichoderma may be put in shallow pits and covered with thin layer of soil.
- **Irrigation:** - We should arrange proper irrigation system during ginger farming and also have a proper drainage channels for the stagnant water.
- **Fertilization:** - Ginger plant require heavy dose of manuring. Cow dung or compost well suited for fertilization

## VIII. CONCLUSION

Ginger is a very important plant in India due to its commercial, pharmaceutical, medicinal importance. The principal constituents of ginger oil are zingiberene, zingiberol, chavicol, cineole, graniol, d-camphene which give its characteristics aroma. Ginger also had ethno medical uses and also have anti-oxidant and antibacterial properties. There are also several economic benefits of ginger also by which it is useful for human being. So due to its importance conservation of this plant is also important in India.

## REFERENCES

- [1.] Kumar, G., Karthik, L., & Bhaskara Rao, K. (2011). A Review on Pharmacological and Phytochemical Properties of Zingiber officinale Roscoe (Zingiberaceae). Retrieved 1 July 2011, from <https://www.researchgate.net/publication/215802856>
- [2.] Adebayo, S., Amoo, S., Mokgehle, S., & Aremu, A. (2021). Ethnomedicinal uses, biological activities, phytochemistry and conservation of African ginger (*Siphonochilus aethiopicus*): A commercially important and endangered medicinal plant. *Journal of Ethnopharmacology*, 266, 113459. doi: 10.1016/j.jep.2020.113459
- [3.] Biology, D. (2021). Zingiber officinale | Biology. Retrieved 30 November 2021, from <https://biology.uiowa.edu/facilities/greenhouse/plant/zingiber->

