



Ethnobotany and Ethnopharmacology of Anticancer Plants

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SUMMARY

Ethnobotany and Ethnopharmacology have provided a foundational framework for drug discovery emphasizing the therapeutic potential of natural compounds extracted from plants. Indigenous phytotherapy has long been utilized to treat various diseases and associated symptoms through active phytocompounds from ethnomedical plants. As cancer is currently one of the most pressing global health issues, medicinal ethnobotany offers an invaluable source of plant-based anti-cancer research for drug discovery. This chapter encompasses the historical and cultural significance of traditional plants in cancer treatment, highlighting traditional practices from diverse cultures, including Egyptian, Indian, African, and Traditional Chinese Medicine. Here, key anti-cancer plant species such as *Nigella sativa*, *Catharanthus roseus*, *Panax ginseng*, *Zingiber officinale*, and *Curcuma longa* are discussed, that are widely recognized in existing or putative ethnopharmacological studies for their medicinal properties in addressing cancer. Extensive research identified promising bioactive compounds exhibiting anti-inflammatory, antiapoptotic, anticancer, and immune-boosting properties. Although ethnopharmacology and modern medicine have successfully collaborated, potential challenges persist, including the need for standardized research protocols, as well as the conservation of indigenous knowledge and plant diversity. Further research should focus on optimizing the therapeutic effects and dosages of indigenous plants and preserving traditional bio-cultural heritage. Collaborative efforts among medical scientists, traditional healers, and policymakers are crucial for advancing plant-based cancer treatments.

INTRODUCTION

Humans have been leveraging their knowledge of medicinal plants to treat their minor and major diseases since antiquity. The consumption of indigenous plants is deeply ingrained in various cultures, geographical regions and civilizations across the globe. Ethnobotany is the study of the interrelationship between plants and humans, encompassing their beliefs and traditional practices of how societies utilize plants for medicinal, nutritional, and cultural purposes (Tefaye et al., 2020). Ethnopharmacology is a sub-branch of ethnobotany which deals with the identification, description and experimental investigation of active phytochemicals present in indigenous plants (Heinrich et al., 2006). Ethnopharmacology is a cross-cultural study that integrates traditional knowledge of medicinal plants with modern scientific methods to identify and analyze bioactive compounds for therapeutic purposes. These studies play a fundamental role in drug discovery by documenting and preserving indigenous knowledge of plant usage while simultaneously serving as a tool to conserve indigenous cultures (Heinrich et al., 2006).

Cancer remains one of the most challenging health issues globally, transcending economic borders accounting for estimated 10 million mortalities in 2020 (Siegel et al., 2024).

It is estimated to cause 30 million cancer incidences and over 16 million mortalities in the next ten years. The most affected areas from cancer are developing countries accounting for 70 percent of cancer deaths due to multiple factors, i.e. limited financial resources, poor diagnosis and treatment options (Siegel et al., 2024). Patients tend to rely on traditional medication to cope with the symptoms of cancer, mutilation, and treatment side effects (Damery et al., 2011). The affordability and frequent availability of traditional and herbal medicines and their positive effects on health caused the resurgence of traditional medicines in both developed and undeveloped countries. Ethnobotanical research has documented various plant species that have been used by traditional practitioners for centuries (Aumeeruddy & Mahomoodally, 2021). Ethnopharmacological studies and surveys have proved that these plants show promising improvements in cancer ailments.

Ethnopharmacological studies show that bioactive compounds found in these plants potentially inhibit inflammation, induce apoptosis, and increase the immune response against cancer cells. Some herbal medicines have been reported to act on various stages of tumorigenesis having the potential to contribute to cancer fight (Ayele, 2018).

HISTORICAL CONTEXT: PLANTS AS HEALING AGENTS

Historical Perspectives

The use of traditional medicine is not new, humans have been consuming herbs and plants as disease prophylaxis since time immemorial. This long human relation with plants resulted in many remarkable remedies and cures which prompted scientists to research in this field and preserve this knowledge for optimal application (Aumeeruddy & Mahomoodally, 2021). This resulted in the emergence of a scientific field exclusively studying the medical practices of plants in different cultures and traditions called ethnobotany. This approach discovered many traditional therapeutic agents and herbs for various debilitating ailments, including respiratory diseases, reproductive complications, nervous disorders and cancer.

Ethnobotanists use different approaches to reach the traditional communities and document important ethnomedicinal information which may give a new perspective on the valorization of plants. Different cultures have different treatment options based on their diverse environmental fluctuation, i.e. temperature, weather and vegetation so thus the different herbs with varied treatment practices (Heinrich et al., 2006). Here we will explore important cultures which give us important cancer preventive drugs.

The earliest appearance of tumor has been substantiated by fossilized osteosarcoma, femur of *Homo erectus*, proliferating mass on human skull from Ice Age in Switzerland, Egyptian manuscripts and in some preserve mummies (Capasso, 2005). The oldest narration of human carcinoma can be found in Egyptian papyri from 1550 BC. The Hindu scripture *Ramayana* was documented in 200 BC on palm leaves which discussed the medical practices in ancient times (David & Zimmerman, 2010).

Ancient Cultures and their use of Medicinal Plants

Prehistoric humans shared the instinct of consuming different botanical species as biomedical cure and psychotherapeutic purposes with apes and monkeys. It has been documented that these higher mammals also consume these plants repeatedly which have chemical properties to act as analgesics, antidiarrheal, antiasthmatic, reproductive modulator, antispasmodic and immunity stimulator (Newton, 1991). This suggests that early inhabitants were well aware of the plant-body connection and importance of various chemicals in health restoration and rehabilitation. The earliest documented written records of the medicinal substances dated back three to six thousand years to ancient Egyptians. Egyptian doctors used to prepare the plant extracts and administer it through vapor inhalation and fumigation (Capasso, 2005). They also used opium, marijuana, wine and mints in different therapeutic drugs and these drugs were later proved to be medicinally effective in modern studies. Later, ancient Greece practiced plant-based treatments and compiled the proper use and importance of over six hundred curative plants and wrote 24 detailed books under the title “*De Materia Medica*” (David & Zimmerman, 2010). China and India have also been using

different plant extracts from one to two thousand years. Ancient Aztec practitioners used 132 medicinal herbs, to cure different diseases from epilepsy to pimples. They also used combination of different herbal products to address respiratory and gut infections.

TRADITIONAL HEALING PRACTICES AND CULTURES

Egyptian Medicine

Egyptians were the first who detected tumor and documented its symptoms in papyrus, they also practiced herbal medicines to cure the symptoms of different melanomas. “Ebers Papyrus” is the most prominent evidence of how Egyptians were well aware of their local flora (Capasso, 2005). Egypt has a rich bio-cultural diversity encompassing diverse healing practices. Famous Egyptian plants that were ethno-pharmacologically evaluated showed anticancer, and anti-inflammatory effects Table 1. The most commonly used local Egyptian plants in traditional treatment are *Philodendron bipinnatifidum*, *Calotropis procera*, *Balanites aegyptiaca*, *Solenostemma argel* (argel), *Colocasia antiquorum* (taro), and *Beta vulgaris* (beet) plants (Nassr-Allah et al., 2009a).

India (Ayurveda)

Indian traditional medicinal practices use different terms to describe cancer or cancer like ailments i.e. Karpavippuruthi (blood or pus discharge from Uterine), Kuvalaivippuruthi (Swelling and pain in genitalia), Vathavippuruthi (Tongue-shaped lumps and fever) (Lekha et al., 2018). The traditional Siddha system use three Humour (Vali, Azhal, Iyyam) to diagnose the disease and their imbalance is characterized as tissue damage or lump formation. In case of imbalance the treatment is maintained by cleansing therapies and lifestyle approaches along with drug administration to improve physical condition (Lekha et al., 2018). Some local plants have been mentioned in Table 2 which are frequently used in different cancer treatments across Egypt. The Himalayan plants are documented to be most effective in cancer treatment and lump treatment due to their resilient nature against extreme conditions (UV radiation and drought) (Umadevi et al., 2013). Most commonly used Himalayan plants in ayurvedic treatments for cancer treatment and its related complications are *Mimosa pudica* (Thottarchurunki), *Asparagus racemosus* (Shatavari), *Semecarpus anacardium* (Cherankottai), *Taxus baccata* (Thalisabathari), *Allium sativum* & *cepa* (Garlic and Onion), and *Punica granatum* (Pomegranate) (Lekha et al., 2018).

African Ethnomedicine

Africa has a rich and diverse heritage; the healers believe in physical and spiritual treatment and herbal medicine for chronic diseases. Many practitioners claim that they can treat cancer using traditional medicines Table 3. An ethnobotanical study in Ethiopia documented 35 traditional anticancer plants. The most frequently utilized plants are *Acmella caulirhiza* (Asteraceae), *Clematis simensis* (Ranunculaceae), *Croton macrostachyus* (Euphorbiaceae), and *Dorstenia barnimiana*

Table 1. Traditional Egyptian medicinal plants with anticancer properties

Scientific Name	Common Name	Area	Plant Part	Cancer Type	Reference
Beta vulgaris	Beetroot	Western Desert, Egypt	Leaves	Breast Cancer, Cervical Cancer	Romero et al., 2021; Tan & Hamid, 2021
Pancratium maritimum L.	Sea Daffodil	Mediterranean Coast, Egypt	Flowers, Fruit	Leukemia, Colon Cancer, Lung Cancer	El-Seedi et al., 2021
Annona cherimolia Miller	Cherimoya	Giza Governorate, Egypt	Leaves	Lung Cancer	Khalifa et al., 2013
Alstonia scholaris	Blackboard Tree or Devil's Tree	-	-	Liver Cell Line	El-Askary et al., 2012
S. argel Del.	Arghel or Camel Hay	New-Valley area in the West desert, Egypt	Hayne, Leaves	Acute myeloid leukemia	Nassr-Allah et al., 2009b

Table 2: Traditional Indian medicinal plants used for cancer treatment

Scientific Name	General Name	Cancer Type	Part of Plant	Origin of Cultivation	Reference
<i>Mimosa pudica</i>	Thottarchurunki	Breast cancer (MCF-7 cell lines)	Whole Plant	Tropical regions, native to South America	Lekha et al., 2018
<i>Asparagus racemosus</i>	Thannirvittan	Colonic preneoplastic conditions	Roots	Indian Subcontinent	Karole et al., 2017
<i>Plumbago indica/ Plumbago zeylanica</i>	Kodiveli	Breast, prostate cancer	Roots	Tropical and subtropical regions of Asia	Gbadamosi & Erinoso, 2016
<i>Semecarpus anacardium</i>	Cherankottai	Leukemia, breast, and colon cancer	Seeds	Indian Subcontinent	Vaidya et al., 2010
<i>Taxus baccata</i>	Thalisabathari	Various solid and hematological cancers	Bark, needles	Temperate forests, Europe, Asia	Lekha et al., 2018
<i>Vitex negundo</i>	Nochi	Cytotoxic cancer cells (animal models)	Leaves	Indian subcontinent, Southeast Asia	Chitra et al., 2009; Lekha et al., 2018
<i>Glycyrrhiza glabra</i>	Athimathuram	Breast cancer	Roots	Mediterranean, West Asia	Lekha et al., 2018; Rathi et al., 2009
<i>Allium sativum & Allium cepa</i>	Garlic and Onion	Chemoprevention in various cancers	Bulbs	Central Asia	Lekha et al., 2018
<i>Punica granatum</i>	Pomegranate	Prostate cancer	Fruit	Mediterranean region	Shaygannia et al., 2016
<i>Ocimum gratissimum</i>	Rama Thulasi	Lung adenocarcinoma	Leaves	Tropical Asia, Africa	Vaidya et al., 2010

Table 2. Traditional African medicinal plants used for cancer treatment

Scientific Name	Common Name	Parts of Plants	Cancer Type	Area of Cultivation	Reference
<i>Nigella sativa</i> L.	Black Seed	Seeds, Oils	breast cancer, Ovarian Cancer,	Morocco, Algeria	Ahmad et al., 2013
<i>Trigonella foenum-graecum</i> L.	Fenugreek	Seeds, leaves	liver cancer and cervical cancer	Mediterranean region	Bahmani et al., 2016
<i>Aristolochia longa</i>	Birthwort	Root, Rhizome	General	Nigeria, Morocco, Brazil	Kabbaj et al., 2012
<i>Cassia absus</i>	pig's senna	Seed	General	Morocco	Aumeeruddy & Mahomoodally, 2021
<i>Origanum compactum</i>	compact oregano	Leaves	gum cancer, Stomach cancer	throughout Mediterranean region	Aumeeruddy & Mahomoodally, 2021
<i>Marrubium vulgare</i> L.	White Horehound	Rod, Leaves	Stomach cancer	North Africa, Europe	Kabbaj et al., 2012

(Moraceae) (Tesfaye et al., 2020). Most of the reported plants were from three families Asteraceae, Fabaceae, and Lamiaceae as they are most commonly found in Ethiopia. The *in vivo* and *in vitro* studies showed the antineoplastic activity of these plants (Tesfaye et al., 2020).

Traditional Chinese Medicine (TCM)

Traditional Chinese Medicine is reportedly one of the most ancient health practices dating back practices dated back to 3000 years ago (Nestler, 2002). The most prominent and old modalities of classic Chinese medicine are acupuncture, herbal formulas, herbal poultices (herbal paste application with wet cloth to reduce inflammation) and moxibustion (Cohen et al., 2002). The diversity of Chinese medicine can be comprehended by classic compilations of China, “the Huang Di Nei Jing” (The Yellow Emperor’s Classics of Internal

Medicine) (Nestler, 2002). The traditional practices focus on the tonification of the whole body in spite of focusing on the inflicted organ or a specific organ system. Various Chinese herbal medicines have proved to be effective tonics against cancer. Ginseng (*P. ginseng*), Reishi (*Ganoderma lucidum*), licorice (*Glycyrrhiza glabra* L.) are the most frequently used herbs for cancer treatment (Patel, 1986).

TRADITIONAL MEDICINAL METHODS FOR CANCER

Infusion

Infusion is a method of extracting chemical compounds from delicate herbs and plants. The infusion is prepared in a solvent like water, oil or alcohol similar to making a cup of tea. In the preparation water or the solvent is boiled and poured

over the desired herb and let it simmer for ten to fifteen minutes. The herbal quantity and water ratio depend on the formula or recipe of the remedy and on the form of herb either its powdered or freshly cut herb. Usually, the dosage of the infusion is measured in teacups which are six to eight ounces (Matowa et al., 2020a). Many recipes in the traditional medicine use infusion to prepare the medicine for instance the infusion of *Bersama abyssinica* is used in Ethiopian tradition to cure many forms of cancer. The infusion of roots and leaves of *Bulbinella floribunda*, *Asparagus africanus*, *Cannabis sativa*, leaves and bark roots of *Heteromorpha trifoliata*, calyses and leaves of *Hibiscus sabdariffa*, corms of *Hypoxis hemerocallidea*, fruits, leaves and roots of *Kigelia africana* (sausage tree) have been used in traditional medicine practices (Ayele, 2018).

Decoction

Decoction is the method preferred for more fibrous plants and its hard parts including roots and stems. In this method the herb is boiled into the water for a long period of time, this method is used to extract water-soluble constituents of the herb (Matowa et al., 2020a). One to two teaspoons of the herb is boiled in eight ounces of water in a tight fitted pot and then cold water is added depending on the preferential amount of drug required. If powdered herbs are used for decoction, the boiling time is generally shorter than with fresh herbs (Ogbonna et al., 2012). In traditional cancer therapy decoction is the most common and prevalent method of drug administration, accounting for about 66% of cases. (Matowa et al., 2020b). In traditional chemotherapy decoctions of *Asparagus africanus*, *Burkea africana*, *Cannabis sativa*, *Heteromorpha trifoliata*, *Lantana rugosa*, *Prunus persica*, *Pseudolachnostylis maprouneifolia*, *Ricinus communis*, *Steganotaenia araliacea* are frequently used in Ethiopian and Zimbabwe. Mukono/Buikwe community has been reported to consume decoction of the *Euclea natalensis* A. DC. to treat colorectal cancer, while *Ficus dawei* Hutch. for the treatment of breast cancer (Tugume et al., 2016).

Tinctures

Tincture is a hydroethanolic extract, which is used to extract the essence of the herb which is insoluble in water. The plant parts are soaked in alcohol or oils and are preserved for long term usage. The proper storage and preparation of tincture may ensure that they retain their potency for a longer duration. The alcohol content in the tincture is responsible for its longer shelf-life. Some tinctures preparation consumes water and alcohol in an absolute ratio for the extraction of both water soluble and alcohol soluble constituents. The tincture of *Heliotropium indicum* leaves is used to treat skin cancer, breast cancer, prostate cancer, stomach cancer, and throat cancer in different areas of the Ghana (Agyare et al., 2018). In some areas of Africa, indigenous people treat stomach, prostate, joint, breast, liver and throat cancers by consuming tincture prepared from stem, leaves, root, and fruit of *Turraea heterophylla* Sm (Agyare et al., 2018).

KEY PLANT SPECIES WITH ANTICANCER PROPERTIES

Nigella sativa (Black Seed)

Nigella sativa is commonly known as black seed and locally “Kalonji” in Asia, 'Habbatul Barakah' in Arabian culture (Ahmad et al., 2013). It has been widely used in traditional medicine systems including Ayurvedic, Tibb, traditional European Medicine (TEM) and Siddha. Its regular consumption has been recommended in Tibb-e-Nabwi (Arabic Medicine) due to its ameliorating effect as antiseptic, antidiarrheal, analgesic, anti-inflammatory, gastroprotective and anti-cancer (Khalife et al., 2016). The black seed has been documented in Avicenna's book “The canon of Medicine” as energy stimulator and suggested to cure fatigue and dispiritedness (Ahmad et al., 2013). *Nigella sativa* has been used in Indian, Arabic, European and African folk medicine to cure respiratory disorders and inflammatory diseases. For internal use a tincture of black seed is administered to cure digestive distress, skin diseases and promote wound healing, while roasted black seed is given to stop vomiting. Locally many practitioners use black seed oil as an antiseptic and local anesthetic (Ahmad et al., 2013).

Ethnopharmacological studies showed that *N. sativa* (black cummin) has various bioactive compound which are responsible for its miraculous effects including thymoquinone (oil) (Malik et al., 1995), alpha-hederin, and saponin (seed) (Al-Jassir, 1992) which have shown anticancer effects in different organisms. These compounds inhibit tumor growth and carcinoma. Human administration of *N. sativa* showed cytotoxic effects in Breast Cancer (Bumidin et al., 2018), antagonistic effect in Ovarian cancer (Shokoohinia et al., 2018), and antiproliferative effect in HeLa cell (Ahmad et al., 2013). Its oil, seed and pulp have exhibited antioxidant, anti-proliferative and anti-inflammatory effects (G. Tan, 2018).

Catharanthus roseus (Madagascar periwinkle)

C. roseus is a widely used herbal plant known as Madagascar periwinkle which is native and endemic to Madagascar but later distributed throughout the world as ornamental plant or medicinal herb. *C. roseus* has been used as a traditional medicine in Ayurvedic medicine to treat diabetes, gastrovascular disorder, hepatic disorder, and kidney diseases (Kumar et al., 2022). The stem leaves, flowers and roots are commonly used for the treatment of diabetes, respiratory disorder, toothache in India, eye infection, menorrhagia, dermal infection in Brazil, China, Philippines, and Africa (Umadevi et al., 2013). In Chinese medicine it is used in the treatment of blood cancer and ulcer treatment (Kumar et al., 2022).

C. roseus has been employed as potential anticancer drug due to the presence of bisindole alkaloids in both traditional and modern treatment. Vinblastine and Vincristine have been isolated from stem and leaves of *C. roseus*, which are widely used in cancer chemotherapy. The practitioners use this herb mainly to cure the side effects of cancer and its irritant symptoms to give patient relief (Kumar et al., 2022). The whole plant is used to prepare infusion in Kenya which is used

for the treatment of throat cancer, gastric cancer, skin cancer and esophageal cancer. Half a glass of the infusion is taken orally twice a day for three consecutive weeks. Additionally, the infusion can be pounded and applied topically. It is also reported to be consumed in combination with the whole plant of *Sesbania sesban* Merr (Ochwang'i et al., 2014).

***Panax ginseng* Meyer (Ginseng)**

Ginseng (*P. ginseng* Meyer) is a native Chinese medicinal plant frequently used in China, Korea and Siberia. In Vietnamese medicine it is referred as “Magic Medicine”. The roots of the plant are used to prepare tonic, which is administered to strengthen the weak, which has the potential anti-inflammatory, anti-fatigue, anti-aging and aphrodisiac activities (Patel, 1986). A study showed that the inhabitants of Korea who routinely consumed ginseng had the 60% lower probability of cancer death especially pulmo-carcinoma and stomach cancer. The combined administration of ginseng with other chemotherapeutic drugs in lung cancer treatment resulted three to seventeen years extended life span than average. An exclusive study on two thousand individuals showed that regular consumption of ginseng reduces the probability of developing multiple cancer types (Patel, 1986).

***Zingiber officinale* (Ginger)**

Z. officinale is an Asian traditional herb from family Zingiberaceae commonly called ginger. Like other members of the family Zingiberaceae, ginger is used as a local spice, flavor enhancer and a traditional medicine. The rhizome of the plant is consumed of which red ginger is reported to be frequently used to treat gastrointestinal, esophageal carcinoma and liver cancer. Ethnopharmacological studies found a bioactive compound gingerol which is converted to anticancer chemotherapeutic molecules shogaol, paradols and zingerone.

***Curcuma longa* (Turmeric)**

Curcuma longa is commonly known as turmeric is another member of ginger family (Zingiberaceae), it is used in spice, flavoring agent in Indian cuisine and frequently used in ayurvedic medicine. This is a tuberous rhizome which is rich in curcumin, antioxidant, anti-inflammatory and anti-cancerous compound (Agyare et al., 2018). Ethnobotanical reports demonstrates that this plant is used in the traditional medicines especially in Indian culture in the form of raw, decoctions, juices, infusions and paste in the treatment of various ailments. *C. longa* is used in Brazil and India to cure skin cancer. In different communities Indians are reported to drink turmeric juice twice a day prepared by mixing turmeric with bitter vine (*Mikania micrantha*). Jaradat et al., (2016) documented the use of turmeric infusion in the treatment of breast cancer in Palestine. In other parts, the decoction is prepared by adding one teaspoon of powdered *C. longa* roots in apple peel decoction and consumed one cup daily until recovery. The same study recorded that one teaspoon of both honey and grinded turmeric root is eaten daily before breakfast. The turmeric is also used in the treatment of various carcinomas in Palestinian traditional medicine, a decoction of turmeric rhizome is used to treat Prostate cancer, bladder and hepatic cancers (Aumeeruddy & Mahomoodally, 2021). The

decoction is prepared by boiling 500 grams of ground dry rhizome in one liter of water for thirty minutes, the 300ml decoction is orally administered three times a day (Jaradat et al., 2016).

INNOVATIONS IN ETHNOPHARMACOLOGY

Phytochemicals are frequently used as potential therapeutic agents due to their remarkable bioactive compound that have been proposed to inhibit tumorigenesis and its associated inflammation mechanisms (Fig. 1). More than 60% commercially available cancer drugs are obtained from natural resources (Aliarab et al., 2018). Paclitaxel, vincristine, vinblastine and etoposide are frequently used anticancer bioactive compounds that are isolated from *Taxus brevifolia* Nutt. (Taxaceae), *Catharantus roseus* G.Don (Apocynaceae), *Podophyllum peltatum* (Berberidaceae) (Heinrich et al., 2006). In recent years, Ethnopharmacological and Ethnobotanical studies have made groundbreaking advancements and have marked numerous milestones by developing new drugs derived from traditional plant-based remedies. One of the successes is the development of Vergen, in April 2008, FDA approved clinical use of Sinecatechins, a drug derived from partially purified water extract of green tea leaves (*Camellia sinensis*) for the treatment of external genital and perianal warts (Miyoshi et al., 2020). Another milestone was achieved in January 2013, when the FDA approved the prescription of Crofelemer, a botanical drug extracted from dragon's blood latex (*Croton lechleri*) tree of South America, as an anti-diarrheal agent. It is used for symptomatic relief of diarrhea in HIV-AIDS patients. (Gao et al., 2017). Although these both drugs do not directly target cancer, but they represent potential and significant steps forward, paving the way for future developments in cancer therapies

In cancer-related botanical research, the formulation of “PHY906” has emerged as a promising adjuvant to chemotherapy, marking a significant success in the intersection of ethnopharmacology and modern medicine. It is a pharmaceutical grade of TCM herbal formulation named Huang-Qin-Tang (HQT) based on four herbal plants. HQT has been used traditionally in the treatment of gastrointestinal distress and vomiting (Liu & Cheng, 2012). *In vivo and in vitro* studies showed its efficacy and safety in multiple carcinomas i.e. hepatocellular carcinoma (HCC) (Lam et al., 2015), colorectal cancer (CRC) (Saif et al., 2014), and chemotherapy-induced intestinal toxicity. It is anticipated that ongoing phase III clinical trials will mark another milestone for complementary and alternative medicine in cancer treatment.

Multiple plant derived agents have been used in more than 60% anti-cancer drugs, Taxol is the prominent agent used in ovarian cancer and breast cancer. Another notable phytocompound is Podophyllotoxin, which was used to develop Etoposide, a chemotherapeutic agent administered in the treatment of small-cell lung and testicular cancer (Motyka et al., 2023). Other widely used phytochemicals in cancer treatment include vincristine for leukemia and lymphoma (Dhyani et al., 2022), vinblastine for advanced testicular carcinoma (Dhyani et al., 2022), colchicine for lung cancer (Oh et al., 2022), and ellipticine for breast cancer (Hou et al.,

2024). Emerging research practices are documenting the therapeutical efficacies of esoteric (uncommon) plants. These plants hold immense potential for cancer treatment and other medicinal applications, accentuating the significance of future systematic exploration (Dhyani et al., 2022). As innovation in ethnopharmacology advances, they highlight the potential role of ethnobotanical and ethnopharmacological knowledge in addressing modern health challenges, including oncology (Tesfaye et al., 2020).

CHALLENGES AND ETHICAL CONCERNS

The collaboration between ethnobotany and modern drug discovery has the potential to cure chronic and fatal diseases but this partnership has to overcome challenges to foster

success. The complex focus of two fields have been a major barrier as ethnobotany exclusively focus on the cultural meaning of plant and its usage practices however pharmacology focuses on the chemical composition of plants or chemicals to access the potential drugs or cure for a certain disease. Bioprospecting has shifted the focus of ethnobotanists towards studying human populations, encompassing the full spectrum of plant usage in communities and its associated environments.

These cultures and their specialist knowledge are intellectual property which needs to be protected through international legal framework. The knowledge of the indigenous communities should be appreciated and recognized on the international platform for unbiased distribution of

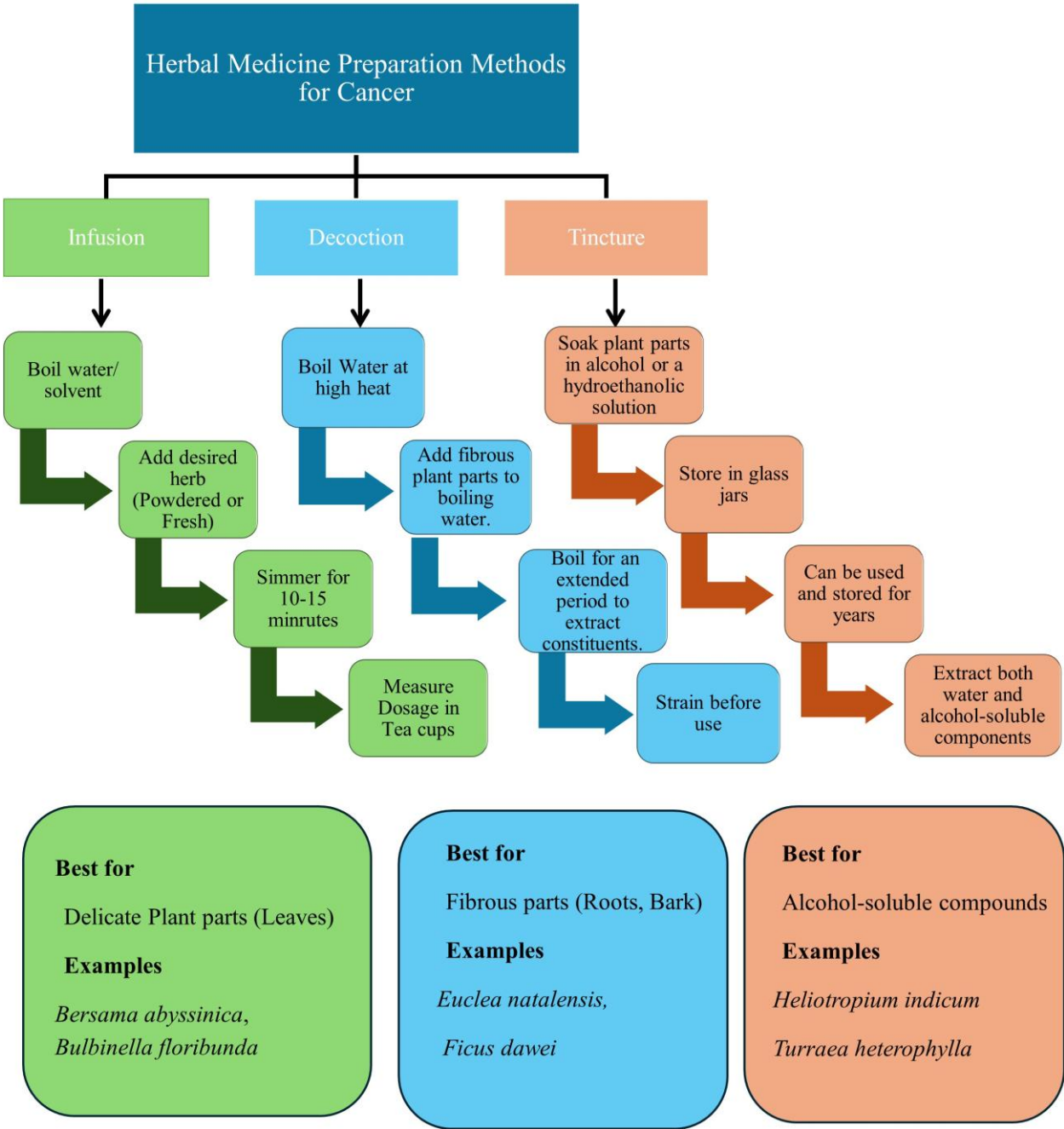


Fig 1. Summary of the major medicine preparation methods used in traditional cancer treatments

benefit. The proper training of the ethnobotanists is necessary to make them aware of ethical and social issues as they are the bridge between social and biological sciences. Medicinal plant research has its drawbacks on plant population or biodiversity as their increased consumption may threaten their survival. Scientists and legislators should assist local communities to conserve their biodiversity through the introduction of advanced technology, infrastructure growth, community-based educational and vocational programs and policy negotiations (Salick et al., 2009).

The indigenous medicines are considered to be safe which is a falsified assumption as some herbs have phytotoxins, or toxic constituents that can impose life threatening conditions and even death if improperly utilized. In developing countries, these herbal medicines are introduced in the market without any biological assay or toxicological evaluation. Due to the complexity of theories and no means to confirm why a specific herb is used in certain diseases in folklore medication, causes further difficulties for effective scientific evaluation of these crude materials. The folk medicine practitioners do not select plants based on biochemical activity but actually entrenched on the practices and spiritual beliefs of people. To gain a comprehensive understanding, ethnobotanists should collaborate closely with cultural medicine practitioners to fully grasp the cultural context of plant use and identify clues of bioactivity. This includes prevention during therapy, potential

side effects, correct dosage, adjuvant therapies, and the risks of overdose. Such an approach can help identify toxidromes (Fig. 2).

CONCLUSION

Throughout human history, plants have been used in medicinal practices and healing traditions of most cultures. Ethnobotany and ethnopharmacological research have provided extensive insights into traditional practices, pharmacological effects, dosage methodologies, and the potential of medicinal herbs as future antitumor and chemotherapeutic agents. The main focus of ethnobiology is to validate and upgrade traditional knowledge including remedies, herbal formulations, potential side effects, methods of disease identification. The quality of ethnobotanical and ethnopharmacological research can be significantly improved by establishing systematic, standardized research protocol and conducting clinical trials to evaluate the effectiveness of traditional herbs. It is indispensable for scientists, traditional medical practitioners, and regulatory agencies to collaborate for development of improved research frameworks, studies, and trials aimed at uncovering novel phytomedicines and botanical therapeutics. The ethnomedicinal studies showed that indigenous global communities rely traditional plants for the treatment of different cancers and malignancies. They are well aware of the importance and application of plants.

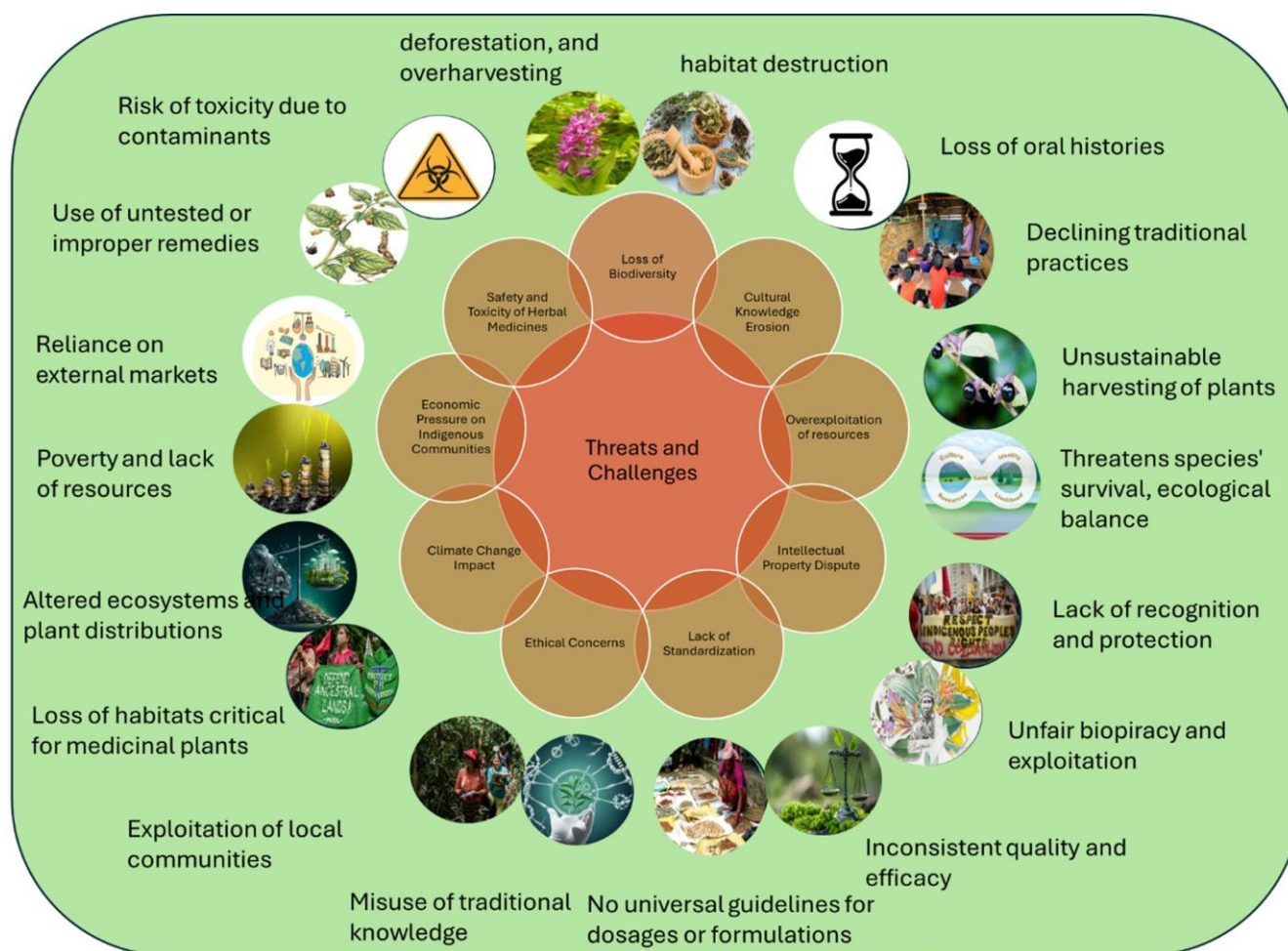


Fig 2. Threats and challenges of ethnobotany and ethnopharmacology

Different plant species are utilized in various cultures for treating the same cancer types, influenced by their availability and the traditional therapeutic beliefs of each culture. The mechanisms of action and therapeutic effects of these medicines need further study, and the optimal dosage of herbal medicines should be carefully considered, as certain plant parts may cause serious side effects. In addition, the conservation of ethnobotanical data and biodiversity need serious attention as various valuable wild plants are threatened due to habitat destruction, overharvesting and climate change.

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