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Common plants used against cancer

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ABSTRACT

The traditional knowledge of plants used as medicine is being passed on to future generations from centuries. Many diseases and illnesses have been cured by the secret of Vaidya's formulations. Cancer is comparatively a newer challenge for the world. The scientists all over the world are trying to fight this battle by using bioweapons, the medicinal flora. Researchers have extracted various phytochemicals from plants mentioned in old scriptures as well as discovered new species which might have a greater potential to destroy cancer cells. Here the authors attempted to document 15 plant species of different families which can act against different types of cancer as they contain diverse phenolic compounds and an account of most recent work ongoing in this field of Ayurveda.

INTRODUCTION

Cancer derived from the Latin word '*Cancer*' meaning 'crab or creeping ulcer' is a condition of uncontrolled growth of abnormal cells. Malignant tumour spreads rapidly by metastatic property of cancerous cells in a multi-step process: (i) local infiltration of tumour cells into the adjacent tissue, (ii) trans-endothelial migration of cancer cells into vessels known as intravasation, (iii) survival in the circulatory system, (iv) extravasation and (v) subsequent proliferation in component organs leading to colonization (Zijl et al. 2011). It is one of the leading causes of deaths worldwide. In developing countries, it is considered to be a curse on the patients and the family of patients itself. In countries like India, it is the second most common disease responsible for maximum mortality with about 0.3 million deaths per year (Ali et al. 2011). Every year millions of dollars are spent on treatment of cancer patients. Cancer once considered a rarity is

becoming very common and sedentary lifestyle, consumption of processed food etc. can be held responsible (Nemati 2019). According to WHO, "Around one-third of deaths from cancer are due to the five leading behavioural and dietary risks: high body mass index, low fruit and vegetable intake, lack of physical activity, tobacco use, and alcohol use." Over the last few decades, our dependence on chemicals has increased, be it in field of agriculture, pharmaceuticals or dairy and meat industry. These factors are known to increase the risks of developing cancer in adults and children. According to World Health Organization (WHO), it is recognized as a deadly disease killing one person every 8 minutes. India ranks third after China and the USA for the reported cancer cases. The increase in cancer burden by more than double in last 26 years which is very alarming (Smith et al. 2019). India being at such a high risk of cancer is hardly acceptable. Presently, most of the cancer treatments are a combination of surgery with chemotherapy and/or radiation therapy. There are many side effects when it comes to chemotherapy such as fatigue, loss of appetite, nausea, hair loss, memory issues, weakened nerves and muscles etc (Niklinska et al. 2001). A report was published in 2004 for 5-year survival rates in cancer patients which was found to be 63.4%. The analysis estimated that the contribution of curative and adjuvant cytotoxic chemotherapy to 5-year survival in adults was only 2.3% in Australia and 2.1% in the USA (Morgan et al. 2004). According to another report, herbal chemotherapy may yield an 85% success rate. It is an old proverb "Prevention is better than cure". If precautions and preventive measures are taken regularly, cancer can be beaten too. India has always inculcated the idea of healthy living in its culture in the form of Ayurveda. But our overdependence on the allopathy has made us forget about the pandora of medicinal plants and the knowledge of harvesting them (Palliyaguru et al. 2016). Here is enlisted a number of medicinal plants which can be used against cancer (Table 1; Plate 1).

1. ***Andrographis paniculata* (Burm.f.) Nees.**

***Syn**: Justicia paniculata* Burm. f.

***Local name**:* Bhuin nimba

***Description**:* It grows as an erect herb of 30-110 cm height in moist, shady places. The dark green stem is slender, square in cross-section with longitudinal furrows and wings along the angles. The small, pink, solitary flowers bear capsulated fruits.

***Distribution**:* It is an annual herbaceous plant in the family Acanthaceae, native to India and Sri Lanka. It is distributed in patches in tropical Asian countries. It grows in variety of habitats such as plains, hillsides, coastlines, roadsides, farms and wastelands (Morgan et al. 2004).

***Uses and reports against cancer**:* Its roots and leaves are used for medicinal purposes. The primary medicinal component of *Andrographis* is the diterpene andrographolide which shows cytotoxic activity against a variety of cancer cells. Andrographolide, described as a "diterpene lactone" due to its ring like structure, has a very bitter taste and has a colourless crystalline appearance. *Andrographis* leaves contain the highest concentration of andrographolide (~ 2.25%), while the seeds contain the lowest (Siripong et al. 1992).

2. *Boswellia serrata* Roxb. ex Colebr.

***Syn**: Boswellia glabra* Roxb.

***Local name**:* Salai

***Description**:* It is a moderate to large-sized branching tree, 3-5 m tall, but can grow upto 20 m tall, with ash coloured papery bark of 2.4 m in girth. It is sometimes greenish grey, yellow or reddish, fairly thick, smooth, exfoliating in thin, papery flakes and resinous inside. Indian Olibanum tree, on injury, exudates an oleo-gum-resin known as Salai or Indian Frankincense (Shashi et al. 2006).

***Distribution**:* Though endemic to India,it grows in dry mountainous regions of India, Northern Africa and the Middle East (Siddiqui 2011). In India, it especially grows in Western Himalayas, Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, Bihar, Odisha, Andhra Pradesh and all-over North-West India.

***Uses and reports against cancer**:* An isomeric triterpenediol comprising of isomeric mixture of 3α, 24-dihydroxyurs-12-ene and 3α, 24-dihydroxyolean-12-ene from *Boswellia serrata* induces apoptosis in various cancer cells (Bhushan et al. 2007, Syrovets et al. 2000). Studies demonstrate that triterpene diol produces oxidative stress in cancer cells that triggers self-demise by ROS and NO regulated activation of both the intrinsic and extrinsic signalling cascades (Kumar et al. 2008).

3. *Cedrus deodara* (Roxb. ex D.Don) G.Don.

***Syn**: Abies deodara* (Roxb. Ex D.Don) Lindl.

***Local name**:* Devadaru

***Description**:* It is a large evergreen coniferous tree reaching 40-50 m tall. The leaves are needle-like, mostly 2.5-5 cm long. The botanical name, which is also the English common name, derives from the Sanskrit term *devadāru*, which means "wood of the gods", a compound of *deva* "god" and *dāru* "wood and tree". Among hindus, it is worshipped as a divine tree(Niklinska et al. 2001).

***Distribution**:* It is native to western Himalayas in Eastern Afghanistan, Northern Pakistan, India, Southwestern Tibet and Western Nepal.

***Uses and reports against cancer**:* Bark of the *Cedrus deodara* is a good remedy in remittent and intermittent fevers, inflammation, rheumatoid arthritis, cancer, ulcers, diarrhoea and dysentery (Kirtikar et al. 1933). Cedarwood oil is used as an expectorant, catarrhal of respiratory tract, anti-ulcer, arthritis pain reliever, anti-diabetic, anti-inflammatory, and to cure skin diseases (Gulati 1989; Singh 2007). A lignan composition extracted from the stem wood of *Cedrusdeodara* exhibited cytotoxicity to a panel of human cancer cell lines (Shashi et al. 2006).

4. *Centella asiatica* (L.) Urb.

***Syn**: Hydrocotyle asiatica* L.

***Local name**:* Thalkudi

***Description**:* It is an herbaceous, frost-tender perennial plant in the flowering plant family Apiaceae. It has a slender, creeping stolon, green to reddish green in colour. The leaves are rounded and have a smooth texture with palmately netted veins. The flowers are white or pinkish to red in colour born in umbels (Niklinska et al. 2001).

***Distribution**:* It is native to wetlands of the Indian Subcontinent, Southeast Asia and South-eastern US.

***Uses and reports against cancer**:* The whole plant or its leaves are being

traditionally used for their therapeutic properties. *C. asiatica* extract contains a number of compounds such as asiaticoside, hydrocotyline, vallerine, pectic acid, sterol, stigmasterol, flavonoids, thankunosides (Srivastava et al. 1997) and ascorbic acid (Sharma et al. 2005). The mechanism underlying the antitumor activity of *C. asiatica* is suggested to be a direct inhibition of DNA synthesis.

5. *Crocus sativus* L.

***Syn**: Crocus pendulus* Stokes

***Local name**:* Kesara

***Description**:* It is commonly known as saffron crocus, a species belonging to the family Iridaceae. The plant has a corm, which holds leaves, bracts, bracteole, and the flowering stalk. The flowers are purple coloured and bloom in the autumn. The plant reaches up to 10 to 30 cm in height. It is a triploid plant with 24 chromosomes, thus, making it sterile. It is best known for producing the spice saffron or 'Kesar' from the filaments inside the flower (Niklinska et al. 2001).

***Distribution**:* It is thought to have appeared first in Southern Greece (Nemati et al. 2019) or on the Island of Crete. It is mainly grown in Iran, India, Spain, Greece, Italy, Pakistan, Morocco, and central Asian countries (Kafi et al. 2006).

***Uses and reports against cancer**:* Saffron is listed as a potential agent for a novel anti-cancer drug against hepatocellular carcinoma (Abdullaev et al. 2004; Gutheil et al. 2011; Amin et al. 2011). Saffron and its ethanolic extracts are also reported for the studies on human lung cancer (Samarghandian et al. 2010; Samarghandian et al. 2011), pancreatic cancer cell line (Bakshi et al. 2010), skin carcinoma (Das et al. 2010), colorectal cancer cells (Aung et al. 2007), and breast cancer (Chryssanthi et al. 2011). In general, crocetin affects the growth of cancer cells by inhibiting nucleic acid synthesis, enhancing anti-oxidative system, inducing apoptosis and hindering growth factor signalling pathways (Gutheil et al. 2011).

6. *Curcuma longa* L.

***Syn**: Curcuma domestica* Valeton.

***Local name**:* Haladi

***Description**:* Turmeric is a perennial herbaceous plant that reaches up to 1 m tall. Highly branched, yellow to orange, cylindrical, aromatic rhizomes are found. The leaves are arranged in two rows and are alternate. They are divided into leaf sheath, petiole, and leaf blade (Grieve 2017)

***Distribution**:* Belonging to the family Zingiberaceae, Turmeric is an important spice used in Indian households since centuries. The plant is native to the Indian subcontinent and Southeast Asia, that requires temperatures between 20 and 30 °C and a considerable amount of annual rainfall.

***Uses and reports against cancer**:* The active ingredient of this plant is curcumin, a polyphenol derived from the rhizome of the plant. Turmeric is used for both cancer prevention and treatment. The anticancer potential of curcumin is associated with its ability to inhibit proliferation in a wide variety of tumour cell types (Shao et al. 2002; Aggarwal et al. 2003). Curcumin and its derivatives demonstrated significant inhibition of VEGF and BFGF-mediated corneal neovascularization and directly inhibited angiogenesis *in vivo* and *in vitro* (Arbiser et al.1998; Niklinska et al. 2001).

7. *Dioscorea bulbifera* L.

Syn: *Dioscorea crispata* Roxb.

Local name: Pita aalu

Description: It is a perennial vine with broad and alternate leaves. It has two types of storage organs, bulbils and tubers. The bulbils are formed in the leaf axils of the twining stems while tubers grow beneath the ground. It produces small white flowers which are rarely seen (Kumar et al. 2011).

Distribution: It is native to Africa, Asia and northern Australia. It is widely cultivated in Latin America, West Indies and Southeastern US.

Uses and reports against cancer: Reports from literature showed that the anti-tumour-promoting effect of the ethanol extracted from the tubers using the neoplastic transformation assay of mouse epidermal JB6 cell lines (Gao et al. 2002). In another study, it was showed that *Dioscorea bulbifera* induced apoptosis through inhibition of ERK 1/2 and activation of JNK signalling pathways in HCT116 human colorectal carcinoma cells (Hidayat et al. 2018).

8. *Dioscorea hispida* Dennst.

Syn: *Dioscorea hirsuta* Bluma

Local name: Banya aalu

Description: It is a twining vine arising from tuberous roots, and reaching a length of several meters. Flowers borne in panicles; male flowers arise in dense clusters while female flowers spike solitary. Leaves are alternate and three foliate. Stem twins to the left and is hairless.

Distribution: It is found in Himalayas from Nepal to Sikkim, from South India to Taiwan, Philippines and New Guinea.

Uses and reports against cancer: The extract from the leaves of *Dioscorea hispida* is reported to possess anticancer activity due to the presence of saponins and phenolic compounds in higher content (Kumar et al. 2011).

9. *Dioscorea pentaphylla* L.

Syn: *Dioscorea triphylla* L.

Local name: Panja sanga

Description: It is a prickly vine that twines counter clock wise around other plants and objects. It may reach up to 10 m in length. The leaves are alternately arranged and compound, divided into 3 to 5 leaflets each up to 10 cm long. Flowers are borne in spikes.

Distribution: It is native to southern and eastern Asia (China, India, Indochina, Indonesia, Philippines etc.) as well as New Guinea and Northern Australia.

Uses and reports against cancer: *D. pentaphylla* has been shown to have antigenotoxic effects which may be alternative to prevention of cancer. Some of the polyphenols and flavonoids might be responsible for such activity (Prakash et al. 2014).

10. *Dioscorea puber* Blum.

Syn: *Dioscorea anguina* Roxb.

Local name: Kukaisanga

Description: The stems twins to the right and is densely pubescent. Root stock is woody and produces cylindrical tuber of 35-50 cm long. Bulbils are axillary, and potato like with greenish skin. Leaves are opposite, broadly ovate or sub orbicular. Winged seeds are found (Ummalyma et al. 2019).

Distribution: Widely distributed in northern India and southern India

Uses and reports against cancer:*D. puber* has been shown to have chemo preventive or therapeutic effect against cancers of several organs and this has established the

high importance of the molecule as a potential antitumor agent.

11. *Phyllanthus amarus* Schumach. & Thonn.

***Syn**: Niruris indica* Raf.

***Local name**:* Bhuin aonla

***Description**:* It grows 50–70 cm (20–28 in) tall and bears ascending herbaceous branches. The bark is smooth and light green. It bears numerous pale green flowers which are often flushed with red. The fruits are tiny, smooth capsules containing seeds (Wang et al. 2012).

***Distribution**: Phyllanthus amarus* occurs on all island groupings in the Bahamian Archipelago as well as tropical and subtropical regions of the entire world.

***Uses and reports against cancer**:* The whole plant, leaves, roots and shoots are reportedly used for their medicinal values. *P. amarus* contains various lignans, flavonoids and tannins, and evidence suggests that *P. amarus* extract may exert antitumor effects (Rajeshkumar et al. 2002). The chemoprotective properties of this plant may be related to its ability to inhibit metabolic activation of carcinogenic compounds, induce cell cycle arrest and interfere with DNA repair (Rajeshkumar et al. 2002).

12. *Tinospora cordifolia* (Willd.) Miers.

***Syn**: Cocculus verrucosus* Wall.

***Local name**:* Guduchi

***Description**:* It is a climbing shrub belonging to the family Menispermaceae with several elongated twining branches. Leaves are simple, alternate and has broadly ovate lamina. Small, unisexual flowers can be seen appearing on separate plants.

***Distribution**:* This herbaceous vine is indigenous to the tropical areas of Bangladesh, India, Myanmar and Sri Lanka.

***Uses and reports against cancer**:* The most commonly used part of the shrub is the stem, but roots are also known to contain important alkaloids such as choline, tinosporin, columbin, isocolumbin, palmatine, tetrahydropalmatine and magnoflorine (Sultana et al. 2007). *T. cordifolia* effectively kills HeLa cells *in vitro*, suggesting its potential as an anticancer agent (Jagetia et al. 1998).

13. *Withania somnifera* (L.) Dunal

***Syn**: Physalis somnifera*L.

***Local name**:* Ashwagandha

***Description**:* Indian ginseng or Ashwagandha is a short, tender perennial shrub belonging to the family Solanaceae. The plant, particularly its root powder, has been used for centuries in traditional Indian medicine. The name, *Ashwagandha*, is a combination of the Sanskrit words *Ashva*, meaning horse, and *Gandha*, meaning smell, reflecting that the root has a strong horse-like odour. Dull green leaves are elliptic growing up to 10-12 cm long. The flowers are small, green and bell-shaped. The fruit is orange-red when ripened (Wang et al. 2012).

***Distribution**:* It is cultivated in many of the drier regions of India. It is also found in Nepal, China (Pandit et. al. 2012) and Yemen. It extends through Canary Islands, Mediterranean region, Africa, Middle East and Sri Lanka.

***Uses and reports against cancer**:* It has been extensively used in many indigenous preparations for its anti-ageing, aphrodisiac, cardiotonic, thyro-regulatory, anti-peroxidative, anti-inflammatory,

antitumor, anti-stress, anti-oxidant, immuno-modulatory, hemopoietic, and rejuvenating properties (Malik et. al. 2007). Withaferin A, a chemical constituent of *W. somnifera*, is distributed mostly in leaves and produces rapid apoptosis in cancer cells. It has been shown to induce cell cytotoxicity in several human cancer cell lines (Malik et. al. 2007). The suggested mechanisms of cytotoxicity include activation of both intrinsic and extrinsic apoptosis signalling cascades, triggered by augmented generation of reactive oxygen species (ROS) and nitric oxide (NO) in cancer cells (Singh 2007).

***14. Zingiber officinale* Roscoe.**

***Syn**: Amomum zingiber* L.

***Local Name**:* Ada

***Description**:* Common ginger is an herbaceous perennial which grows annual pseudo stems (false stems made of the rolled bases of leaves) about one-meter tall bearing narrow leaf blades. The inflorescences bear pale yellow with purple flowers and arise directly from the rhizome on separate shoots (Sutarno et al. 1999).

***Distribution**:* Ginger is a true cultigen originated from Island Southeast Asia (Ravindran et al. 2016). It is widely cultivated in South and Southeast Asia, Tropical Africa, Latin America, the Caribbean and Australia.

***Uses and reports against cancer**:* Gingerol is the active component of fresh ginger with distinctive spiciness. Gingerol has been studied for its anti-cancerous effects for the tumors in colon (Jeong et al. 2009), breast and ovarian (Rhode et al. 2007; Lee et al. 2008) and pancreas (Park et. al. 2006).

***15. Ziziphus jujuba* Mill.**

***Syn**: Rhamnus jujuba* L.

***Local name**:* Bara koli

***Description**:* It is a small deciduous tree or shrub reaching a height of 5–12 metres (16–39 ft), usually with thorny branches. The leaves are shiny-green, ovate-acute with three conspicuous veins at the base, and a finely toothed margin.The fruit is an edible oval drupe 1.5–3 centimetres (0.59–1.18 in) deep; when immature it is smooth-green, maturing brown to purplish-black, and eventually wrinkled, looking like a small date.

***Distribution**:* It is native of southern China, Afghanistan, Malaysia and Australia. It is widely cultivated throughout India.

***Uses and reports against cancer**:* Guo et al. (2009) identified 10 triterpenic acids, that is, ceanothic, alphitolic, zizyberanal, zizyberanalic, epiceanothic, ceanothenic, betulinic (BA), oleanolic (OA), ursonic, and zizyberenalic acids, and two triterpenes, that is, ziziberanalic acid and ursolic acid (UA), in the dried jujube fruit.Among all the compounds found in the dried jujube fruit, a few have cytotoxic effects: BA, OA, and UA.

CONCLUSION

The bioactive compounds extracted from various medicinal plants have shown a great potential against cancerous cells. The side effects of allopathic treatments could be minimised by the application of medicinal plants having anti-cancer activities. Extensive research in this field promises a greater outcome in treating and preventing cases of cancer worldwide through herbal products. It needs to reach the common people which will thereby reduce the mortality rates due to cancer.

REFERENCES

Ali I, Wani W A and Saleem K (2011). Cancer scenario in India with future perspectives. Cancer Therapy. 8(8):56-70.

Ansari JA, Rastogi N, Ahmad MK, Mahdi AA, Khan AR, Thakur R, Srivastava VK, Mishra DP, Fatima N, Khan HJ and Waseem M. (2017). ROS mediated pro-apoptotic effects of *Tinospora cordifolia* on breast cancer cells. Frontiers in Bioscience. 9:89-101

Desai AG, Qazi GN, Ganju RK, El-Tamer M, Singh J, Saxena AK, Bedi YS, Taneja SC and Bhat HK. (2008). Medicinal Plants and Cancer Chemoprevention. Current Drug Metabolism. 9 (7):581-591.

Hidayat AFA, Chan CK, Mohamad J and Kadir HA. (2018). *Dioscorea bulbifera* induced apoptosis through inhibition of ERK 1/2 and activation of JNK signaling pathways in HCT116 human colorectal carcinoma cells. Biomedicine & Pharmacotherapy. 104: 806-816.

Kafi M, Koocheki A and Rashed MH. (2006). Saffron (*Crocus sativus*) Production and Processing. Science Publishers.

Kumar P, Murthy P, Suresh A, Suresh V, Kumar S and Raviashankar HG. (2011). Evaluation of antitumour activity and antioxidant status in *Dioscorea hispida*, Dennst. Leaves on Ehrlich Ascites Carcinoma in Swiss Albino Mice. International Journal of Drug Development and Research. 3(2):203-210.

Kumar S, Das G, Shin H and Patra J K (2017). *Dioscorea* spp. (A wild edible tuber): A study on its ethnopharmacological potential and traditional use by the local people of Similipal Biosphere Reserve, India. Frontiers in Pharmacology. 8:52.

Kuttan R, Bhanumathy P, Nirmala K and George MC. (1985). Potential anticancer activity of turmeric (*Curcuma longa*). Cancer letters. 29(2): 197-202.

Lee SH, Jaganath IB, Wang SM and Sekaran SD. (2011). Antimetastatic effects of *Phyllanthus* on human lung (A549) and breast (MCF-7) cancer cell lines. PloS one. 6 (6):e20994.

Morgan G, Ward R and Barton M. (2004). The contribution of cytotoxic chemotherapy to 5-year survival in adult malignancies. Clinical Oncology. 16:549-560.

Naidoo DB, Chuturgoon AA, Phulukdaree A, Guruprasad KP, Satyamoorthy K and Sewram V. (2017). *Centella asiatica* modulates cancer cachexia associated inflammatory cytokines and cell death in leukaemic THP-1 cells and peripheral blood mononuclear cells (PMBCs). BMC Complementary and Alternative Medicine. 17:377-377.

Nemati Z, Harpke D, Gemicioglu A, Kerndorff H, Blattner FR. (2019). Saffron (*Crocus sativus*) is an autotriploid that evolved in Attica (Greece) from wild *Crocus cartwrightianus*. Molecular Phylogenetics and Evolution.136.14-20.

Okhuarobo A, Falodun J E, Erharuyi O, Imieje V, Falodun A and Langer P. (2014). Harnessing the medicinal properties of *Andrographis*

paniculata for diseases and beyond: a review of its phytochemistry and pharmacology. Asian Pacific Journal of Tropical Disease. 4(3):213-222.

Palliyaguru D L, Singh S V and Kensler TW. (2016). *Withania somnifera:* from prevention to treatment of cancer. Molecular Nutrition and Food Research. 60(6):1342-1353.

Pandit S, Chang K and Jeon J. (2012). Effects of *Withania somnifera* on the growth and virulence properties of *Streptococcus mutans* and *Streptococcus sobrinus* at sub-MIC levels. Anaerobe. 19:1-8.

Prakash G, Hosetti BB and Dhananjaya BL. Antimutagenic effect of *Dioscorea pentaphylla* on genotoxic effect induced by methyl methanesulfonate in the Drosophila wing spot test. Toxicology International. 21(3):258-263.

Ravindran P and Nirmal BK. (2016). *Ginger: The Genus Zingiber*. Boca Raton: CRC Press.

Siddiqui MZ. (2011). *Boswellia serrata*, a potential anti-inflammatory agent. Indian Journal of Pharmaceutical Sciences. 73(3):255-261.

Singh SK, Shanmugavel M, Kampasi H, Singh R, Mondhe DM, Rao JM, Adwankar MK, Saxena AK and Qazi GN. (2007). Chemically standardized isolates from *Cedrus deodara* stem wood having anticancer activity. Planta Medica. 73(6):519-26.

Smith RD and Mallath MK. (2019). History of the growing burden of cancer in India: from antiquity to the 21st Century. Journal of Global Oncology. 5:1-15.

Sutarno H, Hadad EA and Brink M. (1999). "Zingiber officinale Roscoe". Plant resources of South-East Asia: no. 13: Spices. Backhuys Publishers. 238-244.

Tahergorabi Z, Abedini MR, Mitra M, Fard MH and Beydokhti H. (2015). "*Ziziphu sjujuba*": A red fruit with promising anticancer activities. Pharmacognosy Reviews. 9(18):99-106.

Ummalyma SB, Devi RS and Kumar S. (2019). *Dioscorea puber* Blume (Dioscoreaceae): a new addition to the flora of Manipur. Advances in Plants & Agriculture Research. 9(1):58-59.

Wang H, Khor TO, Shu L, Su Z, Fuentes F, Lee J and Kong AT. (2012). Plants Against Cancer: A Review on Natural Phytochemicals in Preventing and Treating Cancers and Their Drug ability. Anti-Cancer Agents in Medical Chemistry. 12(10):1281-1305.

Zijl FV, Krupitza G, Wolfgang M. (2011). Initial steps of metastasis: Cell invasion and endothelial transmigration. Mutation Research. 728(1-2):23-34.

Table 1: Some common plants used against cancer

Name	Local name	Family	Type of cancer	Source
Andrographis paniculata (Burm.f.) Nees. (Plate 1f)	Bhuinnimba	Acanthaceae	Human epidermoid carcinoma, Colon and Breast	Okhuarobo et al. (2014)
Boswellia serrata Roxb. ex Colebr.	Salai	Burseraceae	Breast and Colon	Wang (2012)
Cedrus deodara (Roxb. ex D.Don) G.Don	Devadaru	Pinaceae	Cervix and Breast	Singh et al. (2007)
Centella asiatica (L.) Urb. (Plate 1c)	Thalkudi	Aniaceae	Breast and Liver	Naidoo et al. (2017)
Crocus sativus L.	Kesar	Iridaceae	Lung, Pancreatic, Skin carcinoma, Colorectal and Breast	Wang et al. (2012)
Curcuma longa L.	Haladi	Zingiberaceae	Breast, Bowel, Stomach and Skin	Kuttan et al. (1985)
Dioscorea bulbifera L. (Plate 1a)	Pita aalu	Dioscoreaceae	Breast	Hidayat et al. (2018)
Dioscorea hispida Dennst.	Banyaaalu	Dioscoreaceae	Pancreatic and Lungs	Kumar et al. (2011)
Dioscorea pentaphylla L. (Plate 1b)	Panjasanga	Dioscoreaceae	Breast	Prakash et al. (2014)
Dioscorea puber Blum. (Plate 1e)	Kukaisanga	Dioscoreaceae	Liver	Ummalyma et al. (2019)
Phyllanthus amarus Schumach. and Thonn	Bhuinaonla	Phyllanthaceae	Lung and Breast	Lee et al. (2011)
Tinospora cordifolia (Willd.) Miers. (Plate 1d)	Guduchi	Menispermaceae	Breast	Ansari et al. (2017)
Withania somnifera (L.) Dunnal	Ashwagandha	Solanaceae	Liver and Breast	Palliyaguru et al. (2016)
Zingiber officinale Roscoe.	Ada	Zingiberaceae	Colon, Breast, Ovarian and Pancreatic	Wang et al. (2012)
Ziziphus jujuba Mill.	Barakoli	Rhamnaceae	Breast and Ovarian	Tahergorabi et al. (2015)

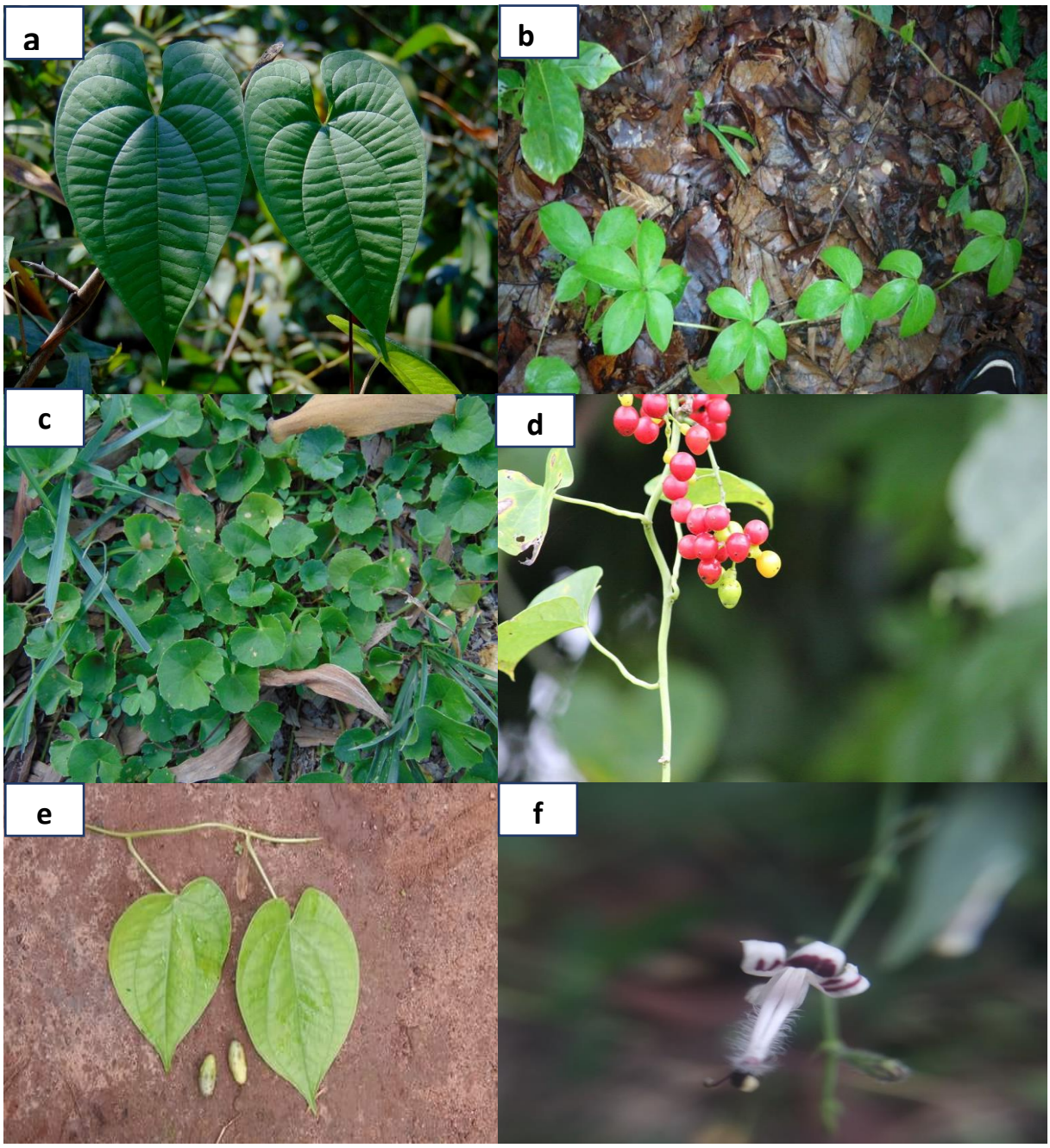

Plate 1. Some common plants have anti-cancer activity, a) *Dioscorea bulbifera*, b) *Dioscorea pentaphylla*, c) *Centella asiatica*, d)*Tinospora cordifolia*, e) *Dioscorea puber*, f) *Andographis paniculata*