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Review Article

ANTI-CANCER PLANTS AND THEIR THERAPEUTIC USE AS SUCCULENT BIOMEDICINE CAPSULES

Shibabrata Pattanayak*

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ABSTRACT: Cancer is a slow-developing non-communicable disease that causes a high rate of morbidity and mortality among the sufferers. Apart from genetic predisposition, the main reasons for cancers are following the wrong lifestyle and food habits. The contemporary treatments of cancer target to increase the life span of the sufferers and to reduce the severity of the disease, but such efforts are having many serious side effects. Along with the correction of lifestyle, regular intake of selected succulent fruits, vegetables, and parts of anti-cancer plants as some medicine can combat almost all cancers. The succulent parts of every medicinal plant contain an enormous number of metabolites that act cumulatively together following various pathways inside the body. The nature-gifted succulent biomedicines that are considered edible in traditional uses have a far lesser chance of showing toxic effects than synthetic chemicals; isolated phytochemicals or their structural analogs obtained from any plant have actual characteristics like synthetic chemicals. There is possibly in-home neutralization of side effects and potentiation of activities of each other by the metabolites present in the succulent plant parts. Anticancer medicinal plants can be used therapeutically for the prevention and cure of cancers at their succulent stages after some adoptive research of dose and toxicity. To avoid the problems of regional and seasonal availability of medicinal plants and other problems in their direct use as medicines, bio-preservative added, and bio-encapsulated succulent biomedicines can be produced, either singly or as some mixtures of the selected biomedicines. An outline of the production, storage, and global transportation of such anti-cancer biomedicines is displayed and a list of 934 anticancer plants (including 124 edible fruits, 124 edible vegetables, and 114 other possibly non-toxic plant parts) with various details regarding their nature and efficacies are described in this article.

Key words: Anti-cancer plants, Herbal treatment of cancer, Succulent biomedicines, Lifestyle modification.

INTRODUCTION

The non-communicable diseases (NCD) cause 74% of all premature global deaths, of which 22.68 percent are only due to cancer (WHO 2022).

Cancer is not a single disease, but rather a group of more than 100 diseases with different etiologies, symptoms, and tissues involved. Cancer develops when the normal growth, development, and death cycle of tissues change due to mutation in the genes of the cells. The uncontrolled growth of cells usually leads to the formation of a mass of tissues, called tumors. Some tumors remain localized and are named benign tumors. These tumors generally do not cause any serious harm to the body. But some others can spread to other parts of the body and bring serious problems in the body system. These are called malignant tumors or cancers.

In some other cases, cancerous cells never form any solid mass but can spread to other parts of the body (such as leukemias, many lymphomas, and myomas) (Cancer.net 2019, National Cancer Institute 2021).

Assistant Director, ARD (Vet. Res. Invest.), Govt. of West Bengal, India.
**Corresponding author. e-mail: pattanayak1966@gmail.com*

CLASSIFICATION AND STAGES OF CANCER

Depending upon the area of development inside the body, cancers can be categorized mainly into four types.

Carcinomas are the most common type of cancer that develop on the skin or the surfaces of different internal organs and glands. Cancers of the breast, lung, prostate, colon, rectum, etc. fall under this category. Sarcomas are cancer of connective tissues like muscles, tendons, nerves, joints, cartilage, bones, blood and lymph vessels, etc. as well as of the fat tissues.

Leukemias are uncontrolled growth of circulating blood cells or their precursors. Acute and chronic lymphocytic and myeloid leukemias are some examples. Lymphomas are the cancers of the lymphatic system affecting lymph glands, spleen, bone marrow, thymus, etc., and these can spread to many other organs of the body. Hodgkin and non-Hodgkin lymphomas are classified as those types of cancers. There are also some other types of cancers, like myeloma (specific blood cell cancer as B cell cancer), melanoma (cancer of pigment cells of the skin), and others (WCRF 2018, Cancer.net 2019, National Cancer Institute 2021).

The cancerous cells are generally carried through the bloodstream or lymphatic channel to different other parts of the body to establish a new set of growth of abnormal cells there. It is termed metastasis of cancers (Guamán-Ortiz 2018, Cancer.net 2019).

Most cancers can be divided into four different stages depending upon the factors like the location, size and spread of the cancers. At the initial stage of cancer, the cancerous cells are localized to the area of their initiation. These are also termed pre-cancers. Stage 1 cancers are not reached in the nearby lymph nodes or other tissues and these are localized in a small area. Stage 2 cancers are already grown to a bigger size but still have not spread. Stage 3 cancers are larger and already started spreading in the lymph nodes and other tissues. Stage 4 or advanced cancers are widespread cancers; metastasis has already worked and involved some other organ/s than the initial area (Sarkar *et al.* 2013, Walcher *et al.* 2020, Cancer Quest 2022).

DEVELOPMENT AND SPREAD OF CANCER

The risk factors of cancers are either biological or environmental in origin and many of which are only assumed. Among the biological factors, family history (genetic predisposition), obesity, lack of physical exercise, unhealthy and irregular lifestyle, sexual and reproductive ill health, etc. are important (Anand *et al.* 2008, Weiderpass 2010). The environmental factors include habits of taking wrong diet, radiation and sunlight exposure (midday sunlight and exposure to people with less melanocyte in the skin are important), use of tobacco, alcohol, and narcotics, and exposure to polluted air (Weiderpass 2010, Savithramma *et al.* 2014, WHO 2022), intake or absorption of toxic synthetic chemicals (food additives, plastics, and their additives, chemical drinks, exposure to asbestos, pesticides, dyes, etc.) (Saria 2018, Pattanayak 2021a, Pattanayak 2022c,), infection of cancer-causing microorganisms (as Human papilloma, Epstein-Barr, Hepatitis B, T-cell leukemia, etc. virus; *Schistosoma haematobium, Helicobacter pylori,* etc. bacteria), physical or mental stress, chronic inflammation, certain therapies (as hormone replacement therapy), etc. (Anand 2008, Multhoff *et al.* 2012, Saria 2018).

The cancer stem cells are tumor-forming (tumorogenic), and mainly responsible for the initiation, growth, and spread of cancers. The other cancer cells (non-tumourigenic cancer cells) are sensitive to the various cancer cell killing techniques, but the cancer stem cells are generally resistant to the effects of the chemo or radio-therapies (Kobayashi and Noronha 2015, Walcher *et al.* 2020, Cancer Quest 2022).

GENETIC INFLUENCE ON CANCER DEVELOPMENT

Nearly 30,000 genes are present in each cell of our body inside the chromosomes. They are some DNA sections that work to produce amino acids, the building blocks of proteins. Different proteins are required for the normal functioning of our body. These genes control the division, growth, and longevity of the cells.

But the mutation in the genes causes changes in the normal functioning of the cells that can lead to the development of different cancers.

Acquired mutations occur due to some damage to the genes. Sporadic cancers develop from that type of mutation. Different factors are identified to bring such mutations in the genes. Use of tobacco, ultraviolet and other radiations, infection of some viruses, higher ages, etc. are some identified factors. More than 80 percent of cancers develop due to these reasons (Anand *et al.* 2008).

The germline mutation of the genes cause inherited cancers and is responsible for 5-20% of all cancers. It occurs in the gonadal cells (sperm or egg cells) and is inherited from the parents. The mutated initial sperm or egg cell genes are copied into every cell of the body which can show cancerous effects later.

A mutation is not uncommon to happen inside the cells of the body, and the body is having its mechanism

to correct almost all such mutations regularly. Practically, no cancer can happen by any single mutation as generally such mutations are corrected; rather it is an outcome of multiple mutations together.

The genes that work during the development of cancers can be categorized under some broad headings.

The tumor suppressor genes are protecting the body from cancers by controlling cell growth, repairing the mismatched DNA as well as the apoptosis (cell death). They are also called DNA repair genes for their function of repairing of the damaged DNA. But mutation of the suppressor genes removes all such controls on the development of cancers. BRCA1, BRCA2, p53, TP53, etc. are some suppressor genes that can cause cancers after becoming mutated.

The oncogenes can convert normal cells to cancerous cells, if mutated. HER2 and RAS family of genes (KRAS, HRAS, NRAS, etc.) are examples of oncogenes. These genes produce proteins to disrupt the normal control of cell growth, cell death, and the communication pathways of the cells (Sarkar *et al.* 2013, Cancer.net 2018, WCRF 2018).

The chemicals that react with the DNA of the cells and can bring changes in them are called mutagens. When any mutagen can predispose cells to the development of tumors are termed, initiators. Some other chemicals that can stimulate tumor development without affecting DNA are called promoters. A compound that can act both as an initiator, as well as a promoter, is termed a carcinogen. Almost 70% of mutagens are carcinogens (Cancer Quest 2022).

Steps of cancer development and spread may be defined serially as mutagenesis, carcinogenesis, tumorigenesis, angiogenesis, and metastasis (Guamán-Ortiz 2018, Cancer.net 2018, Fares *et al.* 2020). Development of cancers is likely to involve mutations of multiple genes and may involve different factors together.

Researches on genome editing, gene slicing, targeted activation of gene expression by the techniques like CRISPR/Cas9 has got momentum in cancer research in recent times (Tripathi *et al.* 2023).

MANAGEMENT OF CANCERS

A. Treatment of cancers

Cancer is not considered a purely curable disease, at least in most cases. Before the selection of a specific treatment schedule for a cancer patient, the type and stage of cancer, condition of the patient, etc. are considered. Testing of the specific biomarkers for cancers can assist in this work. Various combinations of efforts are in practice to treat different cancers following different ways and means. The principal ways followed in cancer therapy are cutting (surgery), radiological burn (radiotherapy), and use of cell poisons (chemotherapy) (Dai *et al.* 2016, IARC 2018). Use of different anti-cancer drugs (chemotherapy), radiation, hormone therapy, immunotherapy, use of hyperthermia techniques, photodynamic therapy, stem cell transplantation, targeted therapy, vaccination against cancer-causing microbes, and surgery are the notable options available presently to treat different cancers, singly or in different combinations (IARC 2018, Amjad *et al.* 2022).

Cure for cancer can be achieved if treatment started at the initial stages. The targets are inhibition of cancerous cell proliferation leading to a reduction of the speed of invasion and metastasis of the cancerous cells, reduction of severity of the diseases along with giving relief to the patients from the pain and other associated physical problems and discomforts, etc. as well as reduction of the pace of the cancers towards reaching further stages (National Cancer Institute 2021, Lundqvist *et al.* 2015, Amjad *et al.* 2022).

All of the contemporary treatment systems are having some serious side effects on the patients. In chemotherapy, more than 650 anticancer drugs and vaccines are presently ready for use to treat cancers (Lundqvist *et al.* 2015, Pavlidis 2019, National Cancer Institute 2018), but all of them have different side effects. Pain, anemia, fatigue, anorexia, nausea and vomiting, throat and mouth problems, bleeding and bruising, development of flu-like symptoms, secondary bacterial infections, neutropenia, peripheral neuropathy, fertility problems, lymphedema, urinary and bladder problems, changes of the skin and nails, hair loss, memory and concentration problems, sleeping problems, delirium, etc. are common side effects (Pavlidis 2019, Amjad *et al.* 2022, National Cancer Institute 2018-2021)

Along with different chemical-derived anti-cancer drugs, some compounds are identified from plant sources and their synthetic analogs are also considered as some anti-cancer drugs. There are four classes of plant-sourced synthetic analog anticancer drugs available to us. These are vinca alkaloids (vinblastine, vincristine), epipodophyllotoxins (etoposide, teniposide, etc.), taxanes (paclitaxel, docetaxel, etc.) and camptothecin derivatives (camptothecin, irinotecan, etc.) (Desai *et al.* 2008).

In searching for potential anticancer drugs from plant sources, Desai *et al.* (2008) listed names of 28 chemical compounds available from 28 commonly

used plants, 45 isolated compounds from dry part extracts of 39 plants shown by Kaur *et al.* (2011). Ashraf (2020) listed the name of 68 chemical compounds with sources of 54 medicinal plants with their possible therapeutic uses on different cancers as per the available reports. A total of 346 compounds from 57 Chinese plants are marked as potent anticancer materials by Dai *et al.* (2016). Anti-cancer laboratory study reports of different compounds having the source from more than 140 plants and that are listed by Iqbal *et al.* (2017). There are many such studies performed on the structural analogs of different isolated phytochemicals for the detection of their anti-cancer activities, but only a few of them are available in the market. As these are actually like the compounds of chemical synthesis origin, different side effects are shown by them like such other anti-cancer drugs of synthetic origin.

B. Prevention and control of cancer

Cancer is a mainly preventable disease. Only by practicing a healthy diet and a controlled lifestyle, at least 30-50 percent of cancers can be prevented, as per the reports of the World Cancer Research Fund (WCRF) and International Agency for Research on Cancer (IARC) (WCRF 2018, Li *et al.* 2020a, Zhang *et al.* 2020a). The various ways to control cancers are required to be analyzed to get the correct ways to combat that dreadful disease. As per some reports, among the total death due to different cancers, 25-30 percent are due to tobacco, 30-35 percent are linked to wrong food and drinks, 15-20 percent are due to infection of microorganisms, and the rest 15-30 percent are due to other factors (Anand *et al.* 2008, Katzke *et al.* 2015).

1. Contemporary concepts of cancer prevention

i) Sufficient physical activity: As per Rock *et al.* (2020), children and adolescents should have moderate to vigorous physical activity for at least one hour per day, and adults should have 150-300 minutes of moderate physical activities daily. There should be a limitation on all sedentary behaviors like continuous sitting, lying down, watching television, engage in different forms of screen-based activities (mobile, laptop, computer, etc.).

ii) Keeping body weight within the standard limit: The body mass index (BMI) is calculated by dividing body weight (in Kilogram) by the squire of height (Meter). The standard BMI of adult individuals is 18.5 - 25. Above that limit, there are chances of the development of many dangerous diseases including cancers (www.hsph.harvard.edu/nutritionsource/cancer/preventing-cancer/).

iii) Following of healthy eating pattern: Diet should supply optimum calories, nutrients and micronutrients, antioxidants, and important vitamins like vitamin D, B12, etc. (Rock *et al.* 2020, Pup *et al.* 2020); should have fiber-rich as well as leafy vegetables of different colors and types; beans and peas, different fruits as a whole, whole grain, etc. It should exclude red and processed meat, processed fish and dairy products, sugar and sugar-added foods, sweetened beverages, non-alcoholic chemical-added drinks, all processed and preserved foods, and refined grains (WCRF 2018, Rock *et al.* 2020).

iv) Staying away from alcohol (Rock *et al.* 2020), tobacco, and narcotics (Lima and da-Silva 2005, Weiderpass 2010) have a strong influence on the development of cancers.

These reasons are almost similar in increasing the risks of almost all types of cancers (Anand *et al.* 2008). Specifically, such reasons are pointed for colorectal cancer (Lima and daSilva 2005), breast cancer (Harvie *et al.* 2015, Pup *et al.* 2020), ovarian and endometrial cancers (Pup *et al.* 2020), prostate cancer (García-Perdomo *et al.* 2022), lung cancer (Weiderpass 2010), etc.

2. Limitation of the contemporary cancer management concepts

The initiation of cancers generally requires several years and factors like the following, as the wrong lifestyle, intake of different toxins, the habit of alcohol, tobacco, etc. work behind the development of such conditions. The present therapeutic efforts can bring good results like complete recovery from cancers only if it is diagnosed at an early stage and the treatment is started immediately. But in most cases, cancers are detected after the expression of symptoms by the patient, which generally happens in the later stages. Treatment started in such stages is targeted mainly to increase the life span of the patient and to reduce the associated suffering of the patients by causing delay, hampering, or in some cases stopping the growth of cancer cells (Dai *et al.* 2016, Chen *et al.* 2021). Staying away from cancer-causing reasons like abstaining from wrong lifestyle or habits, etc. is having very limited value after a late diagnosis of cancer.

3. Conceptual change - an urgent need in cancer management research

Presently, following a lifestyle causing continuous stimulation of the genetic predisposition toward cancer as well as acquiring mutations in the genes is not given

proper importance. The ongoing calculation of key factors behind cancers and many other lifestyle diseases does not want to include the factors like making the human body a mixing vessel of thousands of synthetic chemicals to act as some cocktail of unknown combinations and then the physical expressions of the failure of the body's disease protective mechanisms. The treatment of the diseases is tried by the use (addition in the body-system) of some other synthetic chemicals (drugs) after the laboratory-based diagnosis, procedures of which are having detrimental effects on health in many cases (Dai *et al.* 2016). So, the use of the so-called cut-burn-poisoning technique for cancer treatment is of very limited value, particularly after the expression of identifiable symptoms and then the diagnosis of the disease.

Huge amounts of money are expended in cancer research, particularly for their prevention and treatment. The National Cancer Institute of the United States collected around 80,000 samples of plant origin, 20,000 samples from the origin of marine algae and invertebrates, and 16,000 samples related to different microbes in their repository for anti-cancer efficacy study (DTP 2021). But almost all the studies are confined only to the efforts of identification of active principles/ compounds and their synthetic analogs to manufacture some marketable drugs.

For evaluation of anticancer activitiy of even plants, either *in vitro* test by evaluating the direct activities of the isolated plant compounds/synthetic analogs on the cultures of cancerous cells (may be cell lines) or *in vivo* animal trial by observing the effect on the artificially created cancers or alike conditions of the laboratory animals are performed (Sharma *et al.* 2011).

But such evaluation procedures are not outside of criticism. A single medicinal plant part contains a huge number of phytoconstituents in its natural condition, many of which are perhaps not detectable by the tools and techniques available in modern analytical science. These phytoconstituents act together after their digestion and metabolism and there may be influence of activities of each other when they are used at the nature-derived condition. That does not happen during the testing of one or a few isolated phytochemicals or their analogs, which are having a character like the synthetic chemicals, and so having a very high chance of showing toxicity in the therapeutic doses (Pattanayak *et al.* 2016b, Pattanayak 2020, Pattanayak 2021b).

So, a change in that century-old disease creation and herbal medicine research concepts are required to counter cancers and many other dangerous diseases of human beings.

4. Important lifestyle factors demand consideration in effective cancer prevention plan

For modification of lifestyle to prevent cancers and many other serious diseases in the true sense, the following points need to be considered

Category 1: Abstaining from cancer provocating food, drinks, healthcare materials, cosmetics, etc.

Efforts should be targeted to stay away from the following items and practices:

a) All processed foods,

b) All deeply fried/microwave-heated foods,

c) All synthetic colors, synthetic flavors, and all other agents of synthetic origin mixed with food or food products,

d) All beverages added with any synthetic chemical (from sweetened carbonated beverages to ice creams, synthetic chemical made or added fruit juices), etc.

e) All products/ brands of alcohol, tobacco, and narcotics,

f) All food adulterants, added chemicals, and unhealthy food items - from basic food items (as in different vegetable oils, or trans-fat-containing hydrogenated oils, etc.) to finished products (as commonly encountered in different ready-to-sale milk, meat, eggs, and their products) (Pattanayak 2014, Pattanayak 2017, Pattanayak 2019a),

g) Isolated compounds collected from any natural material and all nature-identical material added with food, drinks, healthcare products, cosmetics, etc.

h) Synthetic chemicals as well as structural analogs of all-natural material/ compound added with any dietary or cosmetic item (Pattanayak 2019b, 2019c),

i) All food or drinks packed or kept in any plastic containers at any stage - to stay away from plastic additives, micro and nano plastic particles (Pattanayak 2018, Pattanayak 2022b, 2022c),

j) Mass-scaled or doubtfully manufactured/produced foods and drinks without any quality control pressure, like loosely sold tea dust (non tea-leaf materials added with synthetic flavor, etc.), unpacked and doubtful milk products (casein products - as non-milk derived artificial and chemical added paner, cheese, etc., milk fat products - butter, ghee, etc.), milk from unknown sources (may be added with many chemicals from urea to formaldehyde or may be synthetic milk of detergent base), etc. (Pattanayak 2014, Pattanayak 2017, Pattanayak 2019a),

k) Locally made fruit juice, food items without proper quality control (as saccharine added fruit juice, keeping sugarcane in some polluted water overnight before pressing, excess sodium bicarbonate added in many so-called fermented foods, etc.),
l) Polluted drinking water, containing any kind of synthetic organic, inorganic, or other substances that act as slow poisons (Pattanayak 2016a),
m) All food items having traces of synthetic chemicals used during their preparation, storage, and transportation (Pesticides used in foodgrains, pulses, vegetables, fruits, etc; chemicals added for preserving vegetables, used for artificial ripening of vegetables like tomato, or fruits like mango, papaya or banana; waxes used on the surface of fruits like apple, etc.) (Pattanayak 2014, Pattanayak 2021a, Pattanayak 2022b).

Category 2: Other lifestyle factors

Many other lifestyle practices give entry to different toxic principles inside the body by absorption through the skin or other body parts or following various other ways.

a) Irregular and repeated radiations (X-ray, C.T. Scan, etc.) without considering their actual necessity and related side effects on health.

b) Different advertisement-inspired practices like the use of body spray, lipstick or guard, different screening lotions, moisturizers, cleansers, chemical washers, bleaching, painting and filling materials on skin or body parts for cosmetic purposes, etc. prepared solely or partially using synthetic chemicals.

c) Hair colorants nail colorants, eyelids and other body parts colorants made by synthetic chemicals are to be avoided. Many alternatives yet effective substitutes for chemical-made shampoos, skincare, and hair care materials, etc. are already available in nature and ready for their effective use (Pattanayak 2019c).

d) Use of advertisement-induced daily care FMCG products (fast-moving consumers' goods) such as toothpaste, mouthwashes, hand washes, shampoos, magic medicines, etc., should not be used without considering their actual composition, effects, and possible ill-effects, as these may open the way of entry of many unwanted chemicals (like detergents, steroids, fluoride, antimicrobial agents, etc.) to the body system.

e) Any synthetic chemical in any form should not be used as some medicine unless its necessity is felt by the physicians as unavoidable.

Even skin or lung absorption in trace amounts of toxic chemicals can cause dangerous harm by working on a cumulative basis along with many such others reaching the body system from different other sources. (Pattanayak 2021a, Pattanayak 2022a, Pattanayak 2022b).

Category 3: Lifestyle-related factors

Many other lifestyle-related subjects can act as predisposing factors for cancers or can trigger the genetic predisposition toward the development of cancers. As a condition of the development of our species through natural selection, we become a part of nature and so covered under some rules of nature. Regular violation of these rules can influence our immunity power of the body which can assist in the development of many other diseases including cancers. These include non-consideration of proper food-drink style, working-sleeping style, body clock maintenance, staying continuously under mental stress and anxiety, lack of ample physical exercise, staying away from nature like morning sunlight or lone walking, etc. (Lorenti *et al.* 2014, Pattanayak 2019c, De la Fuente *et al.* 2021).

Many lifestyle conditions and diseases (like diabetes, COPD, obesity, PCOS, thyroid problems, abnormal lipid profile, hormonal imbalance, etc.) are perhaps having some strong influence on overall body immunity leading towards the development of cancers (Pattanayak 2021b, Pattanayak 2022a, Pattanayak 2022b).

Exclusion of all the possible initiating or potentiating factors can reduce the chance of the development of cancers to a large extent.

5. Cancer prevention by immunomodulation

The immunological surveillance system of the body is always engaged to find out abnormal cells inside our body. After detection, such cells are killed by the surveillance soldiers like Natural Killer cells with the assistance of others (Guzman *et al.* 2020). The regular supply of cancer provocating substances to the body from different sources can influence that surveillance system in a negative way (Pattanayak 2017, Wang *et al.* 2022).

The cancer stem cells can bypass that natural preventive system of the body. So, proper modulation of the immunity system of the body can correct the failure of the surveillance system of the body. Such desired modulation can be tried in different possible ways. Regular dietary supply of different antioxidants, immunomodulators as well as other plant anti-cancer agents can protect us from cancers by acting on the immunity system of the body positively.

Observing the present advertisement-based global food and drink habits practiced by the people, the advice for direct regular intake of succulent fruits or succulent biomedicines can not be considered as any practical idea. The unpleasant smell, unpalatable taste, etc. of these may keep the younger generation of people away from such disease prevention schedules.

The bio-encapsulated and chemical preservative-free fruit pulp, fruit juices, and other food products as well as the succulent parts of the active medicinal plants can be arranged for their effective use throughout the globe (Pattanayak 2019c, Pattanayak 2020).

C. Use of succulent biomedicine capsules for the prevention and treatment of diseases - a novel concept

1. Modification of contemporary research concept - an urgent need

In the contemporary concepts followed in Modern medicine, Homoeopathy and Ayurveda, and all other related healthcare systems, only the dry parts of the medicinal plants are considered for analysis and preparation of medicines from them. The ancient problems of seasonal and regional availability of medicinal plants in succulent condition, their spoilage during storage, etc. perhaps lead to the development of the concept of the use of only dried parts of effective medicinal plants as some medicines (Pattanayak *et al.* 2016b, Pattanayak 2020, Pattanayak 2022a).

Such ancient problems are not relevant now. But still, the global research community and research administration are confined inside that old idea. Even for the validation of the efficacy of plant medicine, there is an urgent need for conceptual modernization. In almost all cases, the validated information related to the medicinal activities of succulent biomedicines is not available, as effective researches are not performed. Even for very well-known, widely used and well-studied plants like *Allium sativum*, *Azadirachta indica*, *Curcuma longa*, or *Zingiber officinale*, such information are not available.

2. Bio-encapsulation of succulent fruits, vegetables, and medicines - a demand of the day

Succulent plant parts contain the highest number and quantity of active phytochemicals in comparison to the dried or any other stages. The naturally dried medicinal plant parts (as the dried seeds) also fall under this category. Many succulent fruits and vegetables having important medicinal activities are eaten or can be eaten as such, but most of these are having seasonal as well as regional availability. So, to make them available to all persons around the globe throughout the year, bio-encapsulation and unspoiled transportation (without the addition of any non-natural material) are required (Pattanayak 2019b, Pattanayak 2020, Pattanayak 2021b).

The useful parts of the medicinal plants can be used effectively as some preventive and/or curative medicines, preferably in capsular form. As a principle, the capsular materials, and preservatives (if any) to be used for that purpose, should be of natural origin (Pattanayak 2019c).

3. Procedure of collection, bio-encapsulation, storage, transport, etc. of the succulent bio-medicines

Various parameters related to the cultivation of medicinal plants, collection of medicinal plant parts, their standardization, encapsulation, packaging, and possible global transportation up to the level of the consumers are already discussed in detail in some published articles (Pattanayak 2019c, Pattanayak 2020, Pattanayak 2022a). Flow diagrams for their pre-manufacture efficacy study and production steps are presented in Fig. 2 to Fig. 5.

D. Use of succulent biomedicines for prevention and cure of cancers

1. Anti-cancer plants and effective use of their relevant parts

From the review of different related literature, a total of 934 plants are identified with reports of their anti-cancer efficacies. These are listed with various other details regarding various aspects of their possible therapeutic uses. Separate labeling of the categories of anti-cancer medicinal plants is also added to the table. The categories are:

a) Reported as mainly curative or preventive, b) Expected to be safe at the therapeutic doses or require vigorous toxicity study, c) Reported for use generally in all cancers or specifically for any cancer, d) Either edible as fruit or as edible vegetable/spice/ others or can be categorized as directly non-edible, e) Whether reported as poisonous or not (Table 1).

The succulent, edible anti-cancer biomedicines are effective not only in combating cancers, but also to prevent and cure many other important diseases by sharing the additional activities of the same or the other phytoconstituents present in them (Pattanayak 2021b, 2022a).

The plants already identified and/or studied for their anti-cancer activities are enlisted in this article. But there is a possibility of missing some plants with various important anticancer effects, either due to the non-availability of study reports or some other reasons. Many plant species are available having very close similarities with some other related species of plant/s. Many varieties of crossbreds are developed and available in the same or different geographical areas. In these cases, it is expected that the related species or varieties of plants are having similar or related medicinal effects, though in every case, a separate study is required to characterize the concentration of their constituents and ultimate effects.

Group 1: Edible anti-cancer fruits (marked as X1 in Table 1).

All edible anti-cancer succulent fruits expected to be safe in possible therapeutic doses are placed under this category. Most fruits are having known activities like antioxidation, immunomodulation, supply of different important nutrients, etc. to the body. Many of them are also having the ability to supply specific phytoconstituents to induce protection of some important body system or to influence the body mechanisms positively. A total of 124 safe, edible fruits are listed for their anti-cancer capability in the table 1.

Group 2: Edible vegetables, spices, etc. with anti-cancer activities (marked as X2 in Table 1).

Like fruits, many edible succulent vegetables and spices are also commonly taken by some sections of human society. They can show their anti-cancer activities through various identified ways of antioxidation, immunomodulation, etc. along with various other unidentified ways. In Table 1, a total of 124 such plants/ plant parts are identified and listed.

Intake of chopped vegetable mixture and fruit mixture

The use of some medicine for a few days to combat a disease is the system generally followed in Modern medicine. But, regular intake of different antioxidants, micronutrients, immunomodulents, etc. is the basis of prevention of diseases as well as keeping the body system to be fit. So, separate mixtures of a few selected edible fruits, edible nuts, edible vegetables, etc. can be advocated for regular intake for the prevention of the dangerous diseases. The same principle can be applied to modulate the preventive power of the body to combat cancers. The logical mixture of small pieces of some selected succulent fruits (fruit salad) from the list of 124 fruits as pre-breakfast and a mixture of small pieces of some selected vegetables and spices (vegetable-spice salad) from the list of 124 vegetable and spices as the pre-lunch item can be started as an initial experiment of genetically predisposed or first two-stage cancer patients as well as directly on the cancer patients as a non-invasive, non-toxic treatment trial. The salad-type mixtures of tiny pieces of the ingredients may be converted to pastes as per the requirements and study reports and can be capsulated as some effective medicines.

Group 3: Anti-cancer plant parts expected to be safe at the therapeutic doses (marked as X3 in Table 1).

The plants under this category are not generally used as some fruits or vegetables but are expected to be safe at their therapeutic doses at their succulent stages as per the available reports. In this category, 114 plants/plant parts are listed in the table. *Catharanthus roseus* (L.) G. Don [Apocynaceae], the source of anti-cancer vinca alkaloids (vinblastine, vincristine) is under this category. The aerial parts of this plant are advocated for use at the succulent condition.

The plants listed in category 1 and category 2 as well as category 3 can be considered non-toxic at the possible therapeutic doses. So, succulent biomedicines can be easily prepared from them without following any rigid toxicity study. Thus, without the involvement of too many efforts, a total of 362 succulent biomedicines (a total of the three categories) can be prepared and used. Some adoptive research on the determination of doses, inter-medicine reactions, etc. may be required before their marketing.

Group 4: Poisonous medicinal plants

In Table 1, a total of 48 anti-cancer medicinal plants are listed under this category. If we consider the concept of Modern medicine, all drugs will act as poisonous above a certain dose. In reverse, all poisonous materials may have medicinal effects in smaller or selective doses.

Among these 48 reported poisonous plants, anti-cancer drugs are already developed from the isolated compounds of some of them (as from *Bleekeria vitiensis* (Markgr.) A.C.Sm. [Apocynaceae], *Euphorbia peplus* L. [Euphorbiaceae], *Podophyllum hexandrum* Royle [Berberidaceae], *Podophyllum peltatum* L. [Berberidaceae], *Taxus brevifolia* Nutt. [Taxaceae], *Taxus wallichiana* Zucc. [Taxaceae], etc.).

All the plants of the other categories require to some extent rigid toxicity study before their therapeutic use.

2. Possible anti-cancer mechanism of activity of succulent biomedicines

Contemporary research on anti-cancer medicinal plants is targeted toward the identification of active compounds for the development of marketable drugs. As a part of that, the secondary metabolites of the reported anti-cancer plants are identified at the first stage. Then the chemical nature of the compounds is identified (Polyphenols, Flavonoids, Brassinosteroids, etc.), and then other processes for drug development start (Savithramma *et al.* 2014, Greenwell and Rahman 2015). Such studies are not required for succulent biomedicines, as knowledge about the therapeutic efficacy and absence of toxicity at the therapeutic doses are the two parameters mainly required in this novel system of healthcare. A new set of steps may be followed for succulent biomedicines and may also be applicable to many other herb-based medical systems, as shown in Fig. 1.

The drug development further involves the isolation and identification of active compounds based on bio-activity in animal models or *in vitro* studies and then drug-designing procedures are initiated. Development of synthetic analogs, modification of chemical structure, etc. are performed for this. Then for the effective components, studies for identification of possible mechanism of action are performed (Lakshmi Priya *et al.* 2015, Khan *et al.* 2020).

The preventive effects of the anticancer medicinal plant parts are perhaps due to their activities like antioxidation and immunomodulation (Pattanayak 2020, Pattanayak 2021b). As per Sakarkar and Deshmukh (2011) and Savithramma *et al.* (2014), the anti-cancer plants possibly follow the steps like inhibiting the proliferation of cancer cells by stimulating macrophage phagocytosis and Natural Killer cell activities, stimulating cancer cell apoptosis by producing more interferons, interleukin 2 and modulating immunoglobulin production and complement activities in the blood. They may also work by inhibiting cancer-activating enzymes and hormones, stimulating DNA repair mechanisms, promoting the production of protective enzymes, etc. These are possibly assisted by causing necrosis of the tumor and by blocking the blood source of tumor tissues, closing the translocation as well as the spread of the tumor to other parts of the body. Increase the number of leukocytes and platelets by influencing the hemopoietic system, incurring reverse transformation of the tumor cells to normal, preventing carcinogenesis of normal cells, promoting metabolism, relieving other symptoms like pain, increasing sleep and appetite, etc. perhaps also act together.

It is already identified in the research of Modern medicine that cancers can be prevented by a diet containing vitamin C, vitamin B12, vitamin D, vitamin E, folic acid, selenium, carotenoids (carotene, lutein, lycopene, cryptoxanthin, anthocyanidins, etc.), and various other antioxidants. The positive effect of dietary intake of whole grains, vegetables, mushrooms, flaxseed, etc. is also reported in some limited scale study (Sasikumar and Eagappan 2014). But most of all such studies are performed on isolated compounds or on models. So, such reports can be considered just a small part of the total possible effects of different anti-cancer succulent phytomedicines.

A low or minute-level regular supply of vitamins, minerals, etc. is considered the right way to keep a person healthy, rather than a high-level supply of these for a brief period. The same concept is possibly acting behind the preventative as well as curative effects of all succulent phytomedicines active against cancers and other diseases.

But many areas are still not clear. It may be due to the reason that no systematic research is performed on succulent biomedicines and their possible anticancer effects. As one example, we can analyze the term 'antioxidant activity', used commonly in this regard. From contemporary research, we already know the presence of nearly 1000 'carotenoids' and over 400 flavonoids, and more than 8000 plant phenols under 'phenolic compounds' within known common plant resources having antioxidant activities (Paur *et al.* 2011, Cundell 2014).

Even single succulent biomedicine contains a very large number of phytochemicals and many of them possibly follow various known or unknown mechanisms to show their cumulative activities, so the components present in a few active anti-cancer succulent biomedicines can act by following a huge number of ways together through their metabolic products after digestion, absorption, and metabolism during their use. It is already reported that regular intake of different antioxidants is the only way to get good therapeutic benefits from them (Paur *et al.* 2011).

Presently practiced pattern followed for development of modern medicines from herbal source:

Diluent extraction/ chemical extraction from dry plant parts, other sources → active ingredient isolation → structural analogue manufacturing → safety and efficacy study → proceeding towards the development of marketable medicines.

↓ Shifting

A new pattern may be followed for Succulent bio-medicines:

Succulent bio-medicines → *in vivo* and/or in-patient study for validation of efficacy → dose and safety study → chemical composition analysis (if not already known) → proceeding towards the development of marketable medicines by bio-encapsulation.

Fig. 1. Conceptual shifting of study for validation of medicines for development of succulent biomedicines (Pattanayak 2020, 2022a).

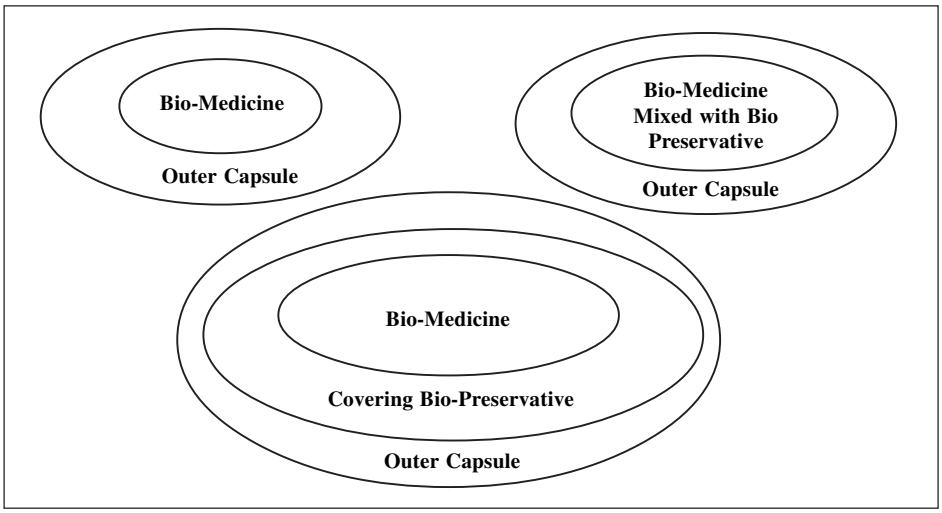

Fig. 2. Sample processes of succulent biomedicine encapsulation (Pattanayak 2021b, 2022a).

[From left to right: Bio-Medicine covered by bio-capsule; Bio-medicine mixed with bio-preservative and covered by bio-capsule; Bio-medicine coated with bio-preservative and covered by bio-capsule].

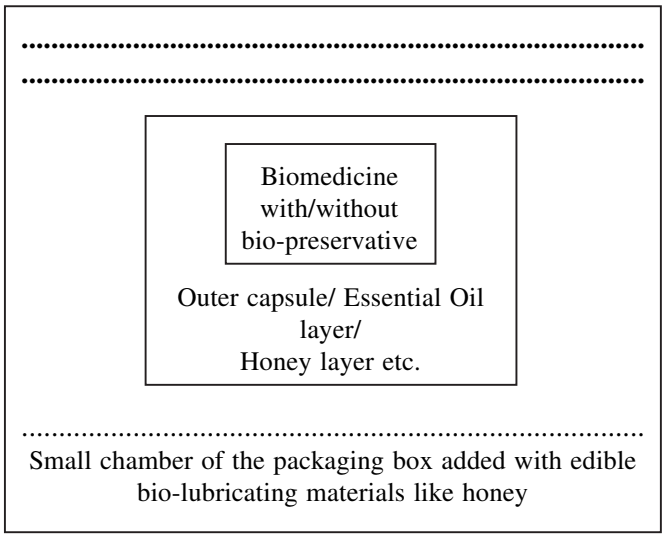

Fig. 3. A sample packaging technique for succulent biomedicines (Pattanayak 2021b, 2022a).

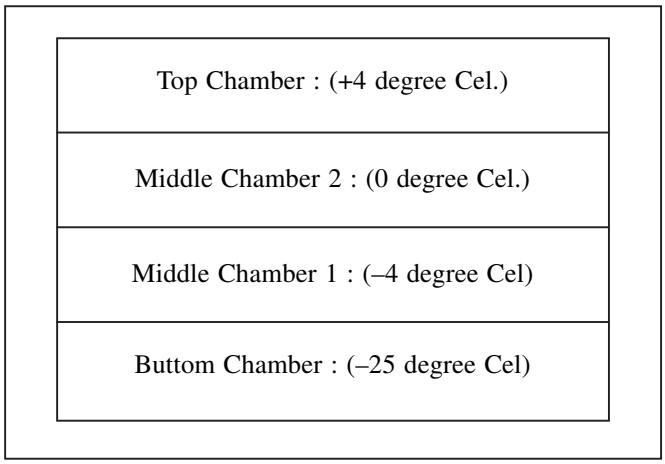

Fig. 4. A sample design of storage arrangement of succulent biomedicines (design of freezing chambers with different temperatures to stock succulent biomedicines) (Pattanayak 2021b, 2022a).

Identification of the effective plants to get succulent biomedicines for the intended purpose/es

↓

Validation of reported activities of the medicinal plant/ plant parts by *in vivo* models or directly on patients

↓

Standardization of dose and measurement of toxicity level, mainly on models or by using animals

↓

Preparation of database about the main phytoconstituents present in plant parts and preparation of a standard chart of it from the available resources for each effective plant medicines

↓

Standardization of packaging related parameters like bio-preservatives, bio- encapsulation, spoilage indicator, etc. for each medicine

↓

Planning for production of the medicines at a large scale

↓

Cultivation of plants in their near-natural environment and soil

↓

Collection of succulent pant parts/fruits/dry seeds, etc.

↓

Quality testing and calculation of quantity per dose by measuring main constituents available in each lot/ batch of raw materials by comparing with standard chart and then mixing of raw materials of different sources as per the requirement

↓

Preparation of pulp-paste or extraction of juice of succulent plant parts or fruits/ preparation of powder of dry seeds, etc.

↓

Concentration or dilution of the pressure extracts (juice)/ mixing of a few biomedicines together/ making block or capsule of powders prepared from the dry biomedicines/ addition of the bio-vehicle/s with the medicines, etc. (as per requirement)

↓

Addition of bio-preservative/ bio-coating in/on the biomedicines (as per requirement)

↓

Encapsulation of the medicine (pulp/juice/powder etc.) inside digestible/ harmless biological capsular materials for oral use

↓

Addition of spoilage indicator/s on the packets of the biomedicines (as Vaccine Vial Monitor chemicals)

↓

Transportation through the cold chain (at different temperatures at different stages) up to the patient level

↓

Intake of the biomedicines at encapsulated condition or after removal of covering and bringing the temperature of the medicines near to 25ºC just before use by use of warm water, etc.

Fig. 5. Production and transport of proposed succulent biomedicines (Pattanayak 2021b, 2022a).

Table 1. Plants having reported ability to prevent or curat cancers.

(A = Reported mainly as preventive, B = Reported mainly as curative; X = Expected to be safe in therapeutic dose, Y = Require vigorous toxicity study; m = Lukaemia, n = Carcinonas, o = Other cancers p = General effect on all cancers; 1 = Edible as fruit, 2 = Vegetable, spices or other edible materials, 3 = Other succulent biomedicines; T = Reported as poisonous).

Plant name [Family]	Common Name	Parts used	Category	Reference of use
Abelmoschus esculentus (L.) Moench [Malvaceae]	Okra	Fruit	AXp2	Omara *et al.* 2020
Abelmoschus moschatus Medik [Malvaceae]	Musk okra	Seed, unripe pod, new, shoot	AXp3	Jain *et al.* 2016
Abrus precatorius L. [Fabaceae]	Rosary pea	Leaf, seed, root	BYn3	Desai *et al.* 2008 Sofi *et al.* 2013
Acacia auriculiformis A. Cunn. [Fabaceae]	Ear leaf acacia	Root barks, latex	AYp3	Kintzios 2006
Acacia confusa Merr. [Fabaceae]	Small Philippine acacia	Root barks	AYp3	Kintzios 2006
Acacia catechu (L.f.) P.J.H.Hurter & Mabb. [Fabaceae]	Kher	Root barks	AYp3	Kintzios 2006
Acacia farnesiana (L.) Willd. [Fabaceae]	Sweet acacia	Young leaf, flower, seed, pod	AXp2	Pratiwi and Nurlaeni 2020
Acacia macrostachya Rolfe [Fabaceae]	--	Root barks	AYp3	Sawadogo *et al.* 2012
Acacia nilotica (L.) Willd. [Fabaceae]	Babul	Root barks, latex	AYp3	Kintzios 2006
Acacia victoriae Benth. [Fabaceae]	Bardi bush	Root barks	AYp3	Kintzios 2006
Acalypha indica L. [Euphorbiaceae]	Indian Copper	leaf Aerial parts	BYn3	Manoharan and Kaur 2013
Acalypha wilkesiana Müll.Arg. [Euphorbiaceae]	Copperleaf	Whole plant	AYp3	Sawadogo *et al.* 2012
Acampe praemorsa (Roxb.) [Orchidaceae]	Banded button Orchid	Leaf	AYp3	Œliwiñski *et al.* 2022
Acanthospermum hispidum DC. [Asteraceae]	Goat's head	Flowering shoots, Whole plant	AYp3	Sawadogo *et al.* 2012, Nataru *et al.* 2014
Acanthus ilicifolius L. [Acanthaceae]	Holy mangrove	Aerial part	AYp3	Sultana *et al.* 2014
Achillea wilhelmsii C. Koch [Asteraceae]	Yarrow	leaf	AYp3	Kooti *et al.* 2017
Achyranthes aspera L. [Amaranthaceae]	Prickly chaff	flower Aerial parts	AYp3	Om Prakash *et al.* 2013
Achyranthes bidentata Blume [Amaranthaceae]	Ox knee	Root	AYp3	Dai *et al.* 2016
Acronychia baueri Schott [Rutaceae]	--	Bark	AYp3	Sultana *et al.* 2014
Acronychia oblongifolia (A.Cunn.) Endl. [Rutaceae]	White aspen	Leaf, baek, stem, fruit	Fruit: AXp1 Others: AYp3	Kintzios 2006
Acronychia pedunculata (L.) Miq. [Rutaceae]	Ankenda	Leaf, baek, stem, fruit	Ripe fruit & tender leaf: AXp3 Others: AYp3	Kintzios 2006
Acronychia porteri Hook.f. [Rutaceae]	--	Leaf, baek, stem, fruit	AYp3	Kintzios 2006
Acorus calamus L. [Acoraceae]	Sweet flag	Rhizome	AYp3	Jain *et al.* 2016
Actaea racemosa L. [Ranunculaceae]	Black snakeroot	Rhizome, root	AYq3	Ashraf 2020
Actinidia chinensis Planch. [Actinidiaceae]	Golden Kiwifruit	Fruit	AXp1	Sakarkar and Deshmukh 2011

Anti-cancer plants and their therapeutic use as succulent biomedicine capsules

Plant name [Family]	Common Name	Parts used	Category	Reference of use
Adiantum venusutum Don. [Pteridaceae]	Himalayan maidenhair	Leaf, stem rhizome	AYp3	Jain *et al.* 2016
Adenanthera pavonina L. [Fabaceae]	Red Lucky Seed	Leaf, seed	AYp3	Kuruppu *et al.* 2019
Aegle marmelos (L.) Corrêa [Rutaceae]	Bengal quince	Leaf, root, stem bark	AXp3	Jain *et al.* 2016
Aeridis odarata Lour. [Orchidaceae]	Cat's-tail orchids	Leaf	AYp3	Œliwiñski *et al.* 2022
Aerva lanata (L.) Juss. ex Schult. [Amaranthaceae]	Mountain knotgrass	Leaf, root	AXp2	Das *et al.* 2020
Aesculus hippocastanum L. [Sapindaceae]	Horse chestnut	Seed	AYp3T	Jain *et al.* 2016
Aesculus indica (Wall. Ex Cambess.) Hook. [Sapindaceae]	Himalayan horse chestnut	Leaf	AYp3	Tariq *et al.* 2015
Agapanthus africanus (L.) Hoffmanns. [Amaryllidaceae]	African lily	Bulb	AYp3	Kaur *et al.* 2011
Agave americana L. [Asparagaceae]	American aloe	Leaf	AYp3	Sharma *et al.* 2011
Ageratum conyzoides L. [Asteraceae]	Goatweed	Leaf	AYp3	Nataru *et al.* 2014
Aglaia edulis (Roxb.) Wall. [Meliaceae]	Kapuri	Fruit	AXp1	Pratiwi and Nurlaeni 2020
Aglaia elliptica Blume [Meliaceae]	Segera	Fruit, bark	Fruit: AXp1 Bark: local application	Pratiwi and Nurlaeni 2020
Aglaila sylvestris (M.Roemer) Merr. [Meliaceae]	--	Fruit	AYp3	Om Prakash *et al.* 2013
Agropyron repens (L.) P.Beauv. [Poaceae]	Couch grass	Rhizome	AXp3	Sharma *et al.* 2011
Agrimonia pilosa Ledeb. [Rosaceae]	Hairy agrimony	Aerial parts	AYp3	Sharma *et al.* 2011
Ailanthus altissima (Mill.) Swingle [Simaroubaceae]	Tree of heaven	Bark	AYp3	Sharma *et al.* 2011
Ailanthus excelsa Roxb. [Simaroubaceae]	Tree of heaven	Root bark	AYp3	Nataru *et al.* 2014
Akebia quinata (Houtt.) Decne. [Lardizabalaceae]	Five-leaf chocolate vine	Fruit	AXp3	Sharma *et al.* 2011
Alangium salviifolium (L.f.) Wangerin [Cornaceae]	Sage-leaved alangium	Seed, flower, root, leaf	AXp3	Jain *et al.* 2016
Albizia coriaria (Welw. Ex) Oliver [Fabaceae]	--	Bark	AYp3	Omara *et al.* 2020
Albizia julibrissin Durazz. [Fabaceae]	Pink silk tree	Flowers and stem bark	AYp3	Dai *et al.* 2016
Albizia lebbeck (L.) Benth. [Fabaceae]	Lebbek tree	Leaf, root	AYp3	Desai *et al.* 2008 Tariq *et al.* 2015
Ailanthus excelsa Roxb. [Simaroubaceae]	Tree of heaven	Leaf	BXp3	Said *et al.* 2010
Allium cepa L. [Amaryllidaceae]	Bulb onion	Bulb	AXp2	Abu-Darwish and Efferth 2018
Allium sativum L [Amaryllidaceae]	Garlic	Bulb, Bud, leaf	AXp2	Kooti *et al.* 2017 Omara *et al.* 2020
Allium wallichii Kunth [Amaryllidaceae]	Himalayan onion	Whole plant	AXp2	Iqbal *et al.* 2017
Alnus nepalensis D.Don [Betulaceae]	Nepalese alder	Bark	AXp3	Pradhan *et al.* 2021
Aloe vera (L.) Burm.f. [Asphodelaceae]	Indian aloe	Leaf	AYp3	Saranya *et al.* 2019
Alpinia galanga (L) Willd. [Zinziberaceae]	Blue ginger	Rhizome	AXp2	Sharma *et al.* 2011
Alstonia scholaris (L.) R.Br. [Apocynaceae]	Devil's tree	Root, bark	AYp3	Das *et al.* 2020
Amaranthus paniculatus L. [Amaranthaceae]	Red amaranth	Leaf	AXp2	Sultana *et al.* 2014
Amaranthus spinosus L. [Amaranthacea]	Prickly amaranth	Leaf	AXp3	Nataru *et al.* 2014
Amaranthus tricolor L. [Amaranthaceae]	Edible amaranth	Leaf, stem	AXp2	Nataru *et al.* 2014

Plant name [Family]	Common Name	Parts used	Category	Reference of use
Amaryllis belladonna L. Amaryllidaceae	Jersey lily	Bulb	AYp3	Dai *et al.* 2016
Amelanchier alnifolia Nutt. [Rosaceae]	Juneberry	Fruit	AXp1	Lachowicz *et al.* 2017
Ammi majus L. [Apiaceae]	Bishop's weed	Aerial parts		Kooti *et al.* 2017
Ammi visnaga (L.) Lam. [Apiaceae]	Toothpick-plant	Fruit, aerial part	AXp3	Kooti *et al.* 2017
Amoora rohituka (Roxb.) Wight & Arn. [Meliaceae]	Pithraj tree	Stem bark	AYp3	Jain *et al.* 2016
Anacardium occidentale L. [Anacardiaceae]	Cashew tree	Apple, leaf	AXp3	Desai *et al.* 2008
Ananas comosus (L.) Merr. [Bromeliaceae]	Pine apple	Fruit, leaf, stem	Fruit: AXp1 Others: AXp3	Sakarkar and Deshmukh 2011
Andrographis paniculata (Burm. F.) Nees [Acan thaceae]	Creat	Leaf/whole plant	AXp3	Om Prakash *et al.* 2013
Anemopsis californica (Nutt.) Hook. & Arn. [Saururaceae]	Yerba mansa	Whole plant	AXp3	Jain *et al.* 2016
Angelica acutiloba (Siebold & Zucc.) Kitag. [Apiaceae]	Toki	Root	AYp3	Kintzios 2006
Angelica archangelica L. [Apiaceae]	Wild celery	Root, fruit, seed	AYp3	Kintzios 2006
Angelica edulis Miyabe [Apiaceae]	--	Root, fruit, seed	AYp3	Kintzios 2006
Angelica gigas Nakai [Apiaceae]	Giant angelica	Root, fruit, seed	AYp3	Kintzios 2006
Angelica japonica A.Gray [Apiaceae]	--	Root, fruit, seed	AYp3	Kintzios 2006
Angelica keiskei Ito [Apiaceae]	Ashitaba	Root, fruit, seed	AYp3	Kintzios 2006
Angelica sinensis (Oliv.) Diels [Apiaceae]	Female ginseng	Root	AYp3	Kintzios 2006, Sakarkar and Deshmukh 2011
Anisomeles indica (L.) Kuntze [Lamiaceae]	Catmint	Leaf	AYp3	Nataru *et al.* 2014
Anisomeles malabarica (L.) R.Br. [Lamiaceae]	Malabar catmint	Whole Plant	AYp3	Nataru *et al.* 2014
Annona bullata A.Rich. [Annonaceae]	--	Stem bark, leaf	BYn3	Kintzios 2006
Annona chrimola L. [Annonaceae]	Custard apple	Stem bark	AYp3	Kintzios 2006
Annona crassiflora Mart. [Annonaceae]	Marolo	Leaf	AYp3	Iqbal *et al.* 2017
Annona coriacea Mart. [Annonaceae]	--	Seed	AYp3	Iqbal *et al.* 2017
Annona muricata L. [Annonaceae]	Soursop	Leaf, bark	AYp3	Saranya *et al.* 2019 Omara *et al.* 2020
Annona reticulata L. [Annonaceae]	Wild sweetsop	Leaf	AYp3	Dai *et al.* 2016
Annona senegalensis Pers. [Annonaceae]	African custard -apple	Stem bark, leaf	AYp3	Sawadogo *et al.* 2012
Annona squamosa L. [Annonaceae]	Sugar apple	Flower, leaf, seed	AYp3	Saranya *et al.* 2019 Tariq *et al.* 2015
Anoectochilus formosanus Hayata [Orchidaceae]	Marbled jewel orchid	Whole plant	AYp3	Sliwinski *et al.* 2022
Anthriscus sylvestris (L.) Hoffm. [Apiaceae]	Cow parsley	Aerial part	AXp3	Kintzios 2006
Antiaris africana Engl. [Moraceae]	Upas tree	Stem bark	AYp3T	Jain *et al.* 2016
Apium graveolens L. [Apiaceae]	Celery	Aerial part, seed	AXp2	Karthikeyan *et al.* 2016
Arachnis flos-aeris (L.) Rchb. f. [Orchidaceae]	Spider Orchid	leaf, stem, root	AYp3	Œliwiñski *et al.* 2022
Aralia taibaiensis Z.Z.Wang & H.C.Zheng [Araliaceae]	--	Root bark	AYp3	Dai *et al.* 2016
Aralia elata (Miq.) Seem. [Araliaceae]	Japanese angelica tree	Shoot	AYp3	Dai *et al.* 2016
Arbutus andrachne L. [Ericaceae]	Greek strawberry tree	Fruit	AXP1	Abu-Darwish and Efferth 2018

Anti-cancer plants and their therapeutic use as succulent biomedicine capsules

Plant name [Family]	Common Name	Parts used	Category	Reference of use
Arctium lappa L. [Asteraceae]	Greater burdock	Root	BYp3	Sakarkar and Deshmukh 2011
Ardisia japonica (Thunb.) Blume [Primulaceae]	Marlberry	Leaf	AYp3	Dai *et al.* 2016
Argemone gracilenta Greene [Papaveraceae]	Sonoran prickly poppy	Whole plant	AYp3	Iqbal *et al.* 2017
Argemone mexicana L. [Papaveraceae]	Mexican poppy	Milky juice and roots, leaf	AYp3	Tariq *et al.* 2015
Arisaema erubescens (Wall.) Schott [Araceae]	Blushing cobra lily	Root	AYp3	Tariq *et al.* 2015
Arisaema flavum (Forssk.) Schott [Araceae]	Yellow cobra lily	Leaf	AYp3	Tariq *et al.* 2015
Aristolochia contorta Bunge [Aristolochiaceae]	Northern pipevine	Root, fruit	AYp3	Sharma *et al.* 2011
Aristolochia elegans Mast [Aristolochiaceae]	Calico flower	Whole plant	AYp3	Kintzios 2006
Aristolochia fontanesii Boiss. & Reut. [Aristolochiaceae]	--	Root	AYp3	Iqbal *et al.* 2017
Aristolochia indica L. [Aristolochiaceae]	Common birdwing	Whole plant	AYp3	Nataru *et al.* 2014
Aristolochia longa L. [Aristolochiaceae]	Sarrasine	Root	AYp3	Saranya *et al.* 2019
Aristolochia ringens Vahl. [Aristolochiaceae]	Gaping Dutchman's pipe	Root	AYp3	Saranya *et al.* 2019
Aristolochia versicolor S. M. Hwang [Aristolochiaceae]	--	Tuber	AYp3	Kintzios 2006
Arnebia euchroma (Royle) I.M. Johnst [Boraginaceae]	Pink Arnebia	Whole plant	AYp3	Dai *et al.* 2016 Tariq *et al.* 2015
Arnebia guttata Bunge [Boraginaceae]	Spotted Arnebia	Aerial part	AYp3	Dai *et al.* 2016
Arnebia nobilis Rech. f. [Boraginaceae]	Ratanjot	Root	AYp3	Jain *et al.* 2016
Aronia arbutifolia (L.) Pers. [Rosaceae]	Red chokeberry	Fruit	AXp1	Gill *et al.* 2021
Aronia melanocarpa (Michx.) Elliott [Rosaceae]	Black chokeberry	Fruit	AXp1	Gill *et al.* 2021
Aronia prunifolia (Marshall) Rehder [Rosaceae]	Purple chokeberry	Fruit	AXp1	Gill *et al.* 2021
Artemisia capillaries Thumb. [Asteraceae]	Wormwood	Leaf	AYp3	Sultana *et al.* 2014
Artemisia absinthium L. [Asteraceae]	Grand wormwood	Leaf	AYp3	Kooti *et al.* 2017
Artemisia annua L. [Asteraceae]	Sweet Wormwood	Leaf	AYp3	Omara *et al.* 2020
Artemisia argyi H.Lév. & Vaniot [Asteraceae]	Silvery wormwood	Aerial part	AYp3	Tariq *et al.* 2015
Artemisia indica Willd. [Asteraceae]	Indian wormwood	Leaf	AYp3	Das *et al.* 2020
Artocarpus altilis (Parkinson) Fosberg [Moraceae]	Breadfruit	Fruit	AXp2	Jalal *et al.* 2022
Artocarpus elasticus Reinw. ex Blume [Moraceae]	Terap	Fruit	AXp1	Pratiwi and Nurlaeni 2020
Artocarpus heterophyllus Lam. [Moraceae]	Jackfruit	Fruit	AXp1	Ruiz-Montañez *et al.* 2015
Arum dioscoridis Sm. [Araceae]	Spotted arum	Leaf	AYp3	Abu-Darwish and Efferth 2018
Arum maculatum L. [Araceae]	Adam and Eve	Leaf, bulb	AYp3	Abu-Darwish and Efferth 2018
Arum palaestinum Boiss. [Araceae]	Black calla	Leaf	AYp3	Abu-Darwish and Efferth 2018
Arundina graminifolia (D.Don) Hochr. [Orchidaceae]	Bamboo Orchid	Aerial parts	AYp3	Œliwiñski *et al.* 2022
Asclepias curassavica L. [Apocynaceae]	Tropical milkweed	Aerial parts	AYp3	Tariq *et al.* 2015
Asimina triloba (L.) Dunal [Annonaceae]	Paw paw	Fruit	AXp1	Coothankandaswamy *et al.* 2010
Asparagus curillus Buch.-Ham. ex Roxb [Asparagaceae]	Shatawar	Root	AYp3	Dai *et al.* 2016
Asparagus racemosus Willd. [Asparagaceae]	Shatavar	Root	AYp3	Desai *et al.* 2008
Aspidosperma tomentosum Mart. [Apocynaceae]	--	Twigs, aerial part	AYp3	Jain *et al.* 2016
Asplenium nidus L. [Aspleniaceae]	Nest fern	Whole plant	AXp2	Saranya *et al.* 2019
Aster tataricus L.f. [Asteraceae]	Tatarinow's aster	Whole plant, root	AYp3	Sharma *et al.* 2011

Plant name [Family]	Common Name	Parts used	Category	Reference of use
Astragalus brachycalyx Fisch. [Fabaceae]	Manna	Root	AYp3	Aslanipoura *et al.* 2017, Razini *et al.* 2023
Astragalus cytosus L. [Fabaceae]	Milkvetch	Root	AYp3	Kooti *et al.* 2017
Astragalus gummifer Labill. [Fabaceae]	Gum tragacanth milkvetch	Root	AYp3	Yusufoglu *et al.* 2014, Ionkova *et al.* 2022
Astragalus hedysarum L. [Fabaceae]	Alpine sainfoin	Root	AYp3	Om Prakash *et al.* 2013
Astragalus membranaceus (Fisch.) Bunge [Fabaceae]	Mongolian milkvetch	Root	AYp3	Sakarkar and Deshmukh 2011, Li *et al.* 2020b
Astrodaucus orientalis (L.) Drude [Apiaceae]	--	Root, aerial parts	AYp3	Kooti *et al.* 2017
Atractylodes lancea Thunb. [Asteraceae]	--	Root	AYp3	Sultana *et al.* 2014
Averrhoa bilimbi L. [Oxalidaceae]	Tree sorrel	Fruit, leaf	AXp3	Saranya *et al.* 2019
Averrhoa carambola L. [Oxalidaceae]	Star fruit	Fruit	AXp1	Singh *et al.* 2014
Avicennia officinalis L. [Acanthaceae]	Indian mangrove	Leaf, Bark	AYp3	Sultana *et al.* 2014
Avicennia marina (Forssk.) Vierh. [Acanthaceae]	Grey mangrove	leaf	AYp3	Kooti *et al.* 2017
Azadirachta indica A. Juss. [Meliaceae]	Indian lilac	Leaf, seed	AXp3	Saranya *et al.* 2019
Baccaurea motleyana Müll.Arg. [Phyllanthaceae]	Rambi	Fruit	AXp1	Debnath *et al.* 2021
Bacopa monnieri (L.) Pennell [Plantaginaceae]	Water hyssop	Aerial parts	AXp2	Nataru *et al.* 2014
Baileya multiradiata Harvey & A.Gray [Asteraceae]	Desert marigold	Flower	AYp3	Dai *et al.* 2016
Balanites aegyptiaca (L.) Delile. [Zygophyllaceae]	Egyptian balsam	Kernel, gall	AYp3	Nataru *et al.* 2014
Barleria grandiflora Dalz. [Acanthaceae]	Grand Barleria	Leaf	AYp3	Saranya *et al.* 2019
Barleria prionitis L. [Acanthaceae]	Porcupine flower	Leaf, bark, root	AYp3	Panchal *et al.* 2018
Bauhinia purpurea L. [Fabaceae]	Orchid tree	Leaf, flower	AYp3	Nataru *et al.* 2014
Bauhinia racemosa Lam. [Fabaceae]	Bidi leaf tree	Leaf, stem bark	AYp3	Kintzios 2006
Bauhinia strychnifolia Craib [Fabaceae]	--	Stem, root	AYp3	Yuenyongsawad *et al.* 2013, Pratiwi and Nurlaeni 2020
Bauhinia variegata (L.) Benth. [Fabaceae]	Orchid tree	Bark, flower, root	Flower: AXp3 Others: AYp3	Das *et al.* 2020, Umadevi *et al.* 2013
Beberis aristata DC. [Berberidaceae]	Tree turmeric	Root, stem, fruit	Fruit: AXp1 Others: AYp3	Saranya *et al.* 2019
Berberis brandisiana Ahrendt. [Berberidaceae]	Himalayan Barberry	Root, stem	BYq3	Tariq *et al.* 2015
Berberis libanotica Ehrenb. ex C.K.Schneid. [Berberidaceae]	--	Fruit, Root	Fruit:AXp1 Root: AXp3	Rasool *et al.* 2015
Berberis lyceum Royle [Berberidaceae]	Indian barberry	Fruit, root, bark, leaf	Fruit: AXp1 Others: AYp3	Tariq *et al.* 2015
Berberis vulgaris L. [Berberidaceae]	Common barberry	Fruit, root, stem, bark	Fruit: AXp1 Others: AYp3	Iqbal *et al.* 2017
Bergenia ciliate (Haw.) Sternb. [Saxifragaceae]	Winter begonia	Leaf, rhizome	AYp3	Tariq *et al.* 2015
Begonia malabarica Lam. [Begoniaceae]	Malabar begonia	Whole plant in blood cancer	AYp3	Tariq *et al.* 2015
Beta vulgaris L. [Amaranthaceae]	Beetroot	Bulb	AXp2	Omara *et al.* 2020
Betula pubescens Ehrh. [Betulaceae]	Downy birch	Leaf, bark, bud	AYp3	Rasool *et al.* 2015
Betula utilis D.Don [Betulaceae]	Himalayan birch	Bark	AYp3	Jain *et al.* 2016
Bidens pilosa L. [Asteraceae]	Black-jack	Whole plant	AXp3	Om Prakash *et al.* 2013, Tariq *et al.* 2015

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Plant name [Family]	Common Name	Parts used	Category	Reference of use
Biophytum sensitivum (L.) DC. [Oxalidaceae]	Little tree plant	Leaf, fruit, berry	AYp3	Jain *et al.* 2016
Bixa orellana L. [Bixaceae]	Achiote	Seed	AXp2	Nataru *et al.* 2014
Bleekeria vitiensis (Markgr.) A.C.Sm. [Apocynaceae]	--	Leaf	AYp3	Kaur *et al.* 2011
Blighia unijugata Baker [Sapindaceae]	Unijugata	Bark	AYp3	Omara *et al.* 2020
Blumea lanceolaria (Roxb.) Druce [Asteraceae]	Chapa	Leaf	AYp3	Tariq *et al.* 2015
Boehmeria nivea (L.) Gaudich. [Urticaceae]	Ramie	Root	AYp3	Dai *et al.* 2016
Boerhavia diffusa L. [Nyctaginaceae]	Punarnava	Root	AYp3	Kuruppu *et al.* 2019
Boesenbergia rotunda (L.) Mansf. [Zingiberaceae]	Finger root	Root	AXp2	Om Prakash *et al.* 2013
Bolbostemma paniculatum (Maxim.) Franquet [Cucurbitaceae]	Tu Bei Mu	Bulb	AYp3	Om Prakash *et al.* 2013
Bongardia chrysogonum (L.) Spach [Berberidaceae]	Golden Lady's Nightcap	Tuber	AYp3	Abu-Darwish and Efferth 2018
Borassus flabellifer L. [Arecaceae]	Ice Apple, Taal	Fruit seed (unripe), pulp (ripe)	AXp1	Banu *et al.* 2022
Borreria hispida L. [Rubiaceae]	Shaggy button weed	Seed	AYp3	Nataru *et al.* 2014
Boswellia serrata Roxb. [Burseraceae]	Indian frankincense	Resin	AYp3	Kooti *et al.* 2017
Brassica oleracea var. italica Plenck [Brassicaceae]	Broccoli	Flower	AXp2	Chaudhary *et al.* 2018
Brassica rapa var. rapa L. [Brassicaceae]	Turnip	Root	AXp2	Jan *et al.* 2018
Broussonetia papyrifera (L.) Vent. [Moraceae]	Paper mulberry	Fruit, leaf, bark	AYp3	Iqbal *et al.* 2014
Broyonia dioica Jacq. [Cucurbitaceae]	Red bryony	Root	AYp3T	Om Prakash *et al.* 2013
Brucea antidysenterica J. F. Mill. [Simaraubaceae]	Waginos	Leaf, stem bark	AYp3	Kaur *et al.* 2011 Kintzios 2006
Brucea javanica (L.) Merr. [Simaroubaceae]	Macassar kernels	Fruit	AYp3	Dai *et al.* 2016
Bryophyllum pinnatum (Lam.) Oken. [Crassulaceae]	Life plant	Leaf	AYp3	Ashraf 2020 Tariq *et al.* 2015
Bucida buceras L. [Combretaceae]	Black olive tree	Leaf	AYp3	Kintzios 2006
Bupleurum falcatum L. [Apiaceae]	Sickle-leaf hare's ear	Root	AYp3	Dai *et al.* 2016
Bupleurum scorzonerifolium Willd. [Apiaceae]	Hare's ear root,	Root	AYp3	Dai *et al.* 2016
Bupleurum smithii H. Wolff [Apiaceae]	Bupleuri radix	Rhizome	AYp3	Dai *et al.* 2016
Bursera klugii J.F.Macbr. [Burseraceae]	--	Leaf	AYp3	Kintzios 2006
Bursera microphylla Gray [Burseraceae]	Elephant tree	Stem, resin, leaf	AYp3	Kintzios 2006 Kaur *et al.* 2011
Bursera morelensis Ramírez [Burseraceae]	Aceitillo	Bark	AYp3	Kintzios 2006
Bursera permollis Standl. & Steyerm. [Burseraceae]	--	Stem bark	AYp3	Kintzios 2006
Bursera schlechtendalii Engl. [Burseraceae]	--	Bark, leaf	AYp3	Kintzios 2006
Bursera simaruba (L.) Sarg. [Burseraceae]	Copper wood	Bark, resin	AYp3	Kintzios 2006
Butea monosperma (Lam.) Taub. [Fabaceae]	Flame-of-the -forest, Palash	Leaf, flower, bark	AYp3	Das *et al.* 2020 Tariq *et al.* 2015
Buxus microphylla Siebold & Zucc. [Buxaceae]	Little boxwood	leaf Aerial parts	AYp3T	Pratiwi and Nurlaeni 2020
Caesalpinia bonducella (L.) Fleming NJJ [Caesalpiniaceae]	Fever nut	Seed, leaf	AYp3	Jain *et al.* 2016
Caesalpinia sappan L. [Caesalpiniaceae]	Indian redwood	Leaf	AYp3	Saranya *et al.* 2019

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Caesaria sylvestris Sw. [Salicaceae]	Guacatonga	Leaf	AXp3	Kintzios 2006
Cajanus cajan (L.) Millsp.[Fabaceae]	Pigeon pea, Arhar dal	Leaf	AXp3	Sawadogo *et al.* 2012
Calendula officinalis L. [Asteraceae]	Common marigold	Flower	AXp3	Nataru *et al.* 2014
Calligonum comosum L'Hér. [Polygonaceae]	Fire bush	Whole plant	Flower:AXp3 Others:AYp3	Saranya *et al.* 2019
Calophyllum inophyllum L. [Calophyllaceae]	Oil nut	Aerial parts	AYp3T	Nataru *et al.* 2014
Calophyllum soulattri Burm. f. [Calophyllaceae]	Mintak	Fruit, stem bark	AYp3	Pratiwi and Nurlaeni 2020
Calotrophis gigantea (L.) Dryand. [Apocynaceae]	Crown flower, Madar	Leaf paste, latex	AYp3	Das *et al.* 2020 Tariq *et al.* 2015
Calotropis procera Aiton [Apocynaceae]	Sodom apple	Aerial parts, latex, Root	AYp3	Om Prakash *et al.* 2013, Manoharan and Kaur 2013
Calvatia caelata (Bull.) Morgan [Agaricaceae]	Mosaic puffball mushroom	Fruiting bodies	AYp3	Ashraf 2020
Camellia sinensis (L.) Kuntze [Theaceae]	Green Tea	Leaf	AXp3	Om Prakash *et al.* 2013, Kooti *et al.* 2017
Campotheca acuminata Decne [Nyssaceae]	Cancer tree	Bark, stem	AYp3D	Kaur *et al.* 2011
Camptotheca lowreyana S. Y. Li [Nyssaceae]	Cancer tree	Bark, stem	AYp3	Li 1997
Campsis grandiflora (Thunb.) K.Schum. [Bignoniaceae]	Chinese trumpet vine	Flower, whole plant	AYp3	Dai *et al.* 2016
Canarium schweinfurthii Engl. [Burseraceae]	African olive	Fruit, leaf, stem bark	Fruit: AXp3 Others: AYp3	Omara *et al.* 2020
Canavalia esniformis (L) DC. [Fabaceae]	Jack bean	Seed, pod	AYp3	Om Prakash *et al.* 2013
Cannabis sativa L. [Cannabinaceae]	Cannabis	Leaf	AYp3	Omara *et al.* 2020
Capparis sepiaria L. [Capparaceae]	Hedge caper	Bark	AYp3	Nataru *et al.* 2014
Capparis spinosa L. [Capparaceae]	Caper bush	Fruit, flower	AXp2	Abu-Darwish and Efferth 2018
Capsella bursa-pastoris (L.) Medik. [Brassicaceae]	Shepherd's purse	Whole plant	AXn2	Tariq *et al.* 2015
Capsicum annuum L. [Solanaceae]	Pepper	Fruit	AXp2	Ashraf 2020
Capsicum frutescens L. [Solanaceae]	Wild pepper	Fruit	AXp2	Omara *et al.* 2020
Cardiospermum halicacabum L. [Sapindaceae]	Balloon plant	Leaf	AYp3	Nataru *et al.* 2014
Carica papaya L. [Caricaceae]	Papaya	Leaf	AYp3	Omara *et al.* 2020
Carissa carandas L. [Apocynaceae]	Bengal currant, Karamcha	Fruit, leaf	Fruit: AXp1 Leaf: AYp3	David and Karekalammanavar 2015, Khatun *et al.* 2017
Carissa spinarum L. [Apocynaceae]	Bush plum	Ripe fruit, stem	Fruit: AXp3 Stem: AYp3	Tariq *et al.* 2015
Carthamust inctorius L. [Asteraceae]	Sunflower	Flower	AYp3	Nataru *et al.* 2014
Cassia auriculata L. [Caesalpinaceae]	Tanner's Cassia	Root	AYp3	Umadevi *et al.* 2013
Cassia fistula L. [Caesalpinaceae]	Golden shower	Flower, seed	AYp3	Nataru *et al.* 2014 Jain *et al.* 2016
Cassia leptophylla Vogel. [Caesalpinaceae]	Gold medallion tree	Leaf	AYp3	Kintzios 2006
Cassia pudibunda Mart. ex Benth. [Caesalpinaceae]	--	Leaf	AYp3	Kintzios 2006
Cassia senna L. [Caesalpinaceae]	Senna	Leaf	AYp3	Umadevi *et al.* 2013
Cassia tora L. [Caesalpinaceae]	Sickle senna	Leaf	AYp3	Jain *et al.* 2016
Cassia torosa Cav. [Caesalpinaceae]	Senna coffee	Seed	AYp3	Kintzios 2006
Cassytha filiformis L. [Lauraceae]	Love-vine	Stem	AYp3	Nataru *et al.* 2014

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Catharanthus roseus (L.) G. Don [Apocynaceae]	Cape periwinkle	Aerial parts	AXp3	Omara *et al.* 2020 Tariq *et al.* 2015
Cattleya tigrina A. Rich. [Orchidaceae]	Cattleya orchid	Whole plant	AYp3	Œliwiñski *et al.* 2022
Cedrus deodara (Roxb.) G.Don. [Pinaceae]	Himalayan cedar	Bark, stem,Wood	AYp3	Saranya *et al.* 2019
Celastrus paniculatus Willd. [Celastraceae]	Intellect tree	Seed, whole plant	AYp3	Nataru *et al.* 2014
Celtis australis L. [Cannabaceae]	European nettle tree	Leaf	AYp3	El-Alfy *et al.* 2011
Celtis occidentalis L. [Cannabaceae]	Common hackberry	Fruit, leaf	Fruit: AXp1 Leaf: AYp3	El-Alfy *et al.* 2011
Cenchrus ciliaris L. [Poaceae]	Buffel-gras	Aerial parts, roots	AYp3	Saranya *et al.* 2019
Centaurea antiochia Boiss. var. praealta (Boiss & Bal) Wagenitz [Asteraceae]	--	Aerial parts	AYp3	Saranya *et al.* 2019
Centaurea ainetensis Boiss. [Asteraceae]	--	Aerial part	AYp3	Om Prakash *et al.* 2013
Centaurea hyalolepis Boiss. [Asteraceae]	Eastern Star-thistle	Flower	AYp3	Abu-Darwish and Efferth 2018
Centaurea montana L. [Asteraceae]	Mountain cornflower	Flower, seed	AYp3	Om Prakash *et al.* 2013
Centaurea nerimaniae Kültür [Asteraceae]	--	Aerial parts	AYp3	Saranya *et al.* 2019
Centaurea schischkinii Tzvelev [Asteraceae]	--	Seed	AYp3	Om Prakash *et al.* 2013
Centella asiatica (L.) Urban [Apiaceae]	Gotu kola	Aerial parts	AXp2	Jain *et al.* 2016
Cephalotaxus harringtonia (Forbes) K. Koch [Taxaceae]	Japanese plum-yew	Leaf, stem	BYm3	Jain *et al.* 2016
Cerbera manghas L. [Apocynaceae]	Sea mango	Fruit, leaf	AYp3T	Pratiwi and Nurlaeni 2020
Cestrum nocturnum L. [Solanaceae]	Night-blooming jasmine	Leaf	AYp3	Dai *et al.* 2016
Chamaecyparis lawsonianna (A.Murray bis) Parl. [Cupressaceae]	Port Orford cedar	Aerial part, resin	AYp3	Kintzios 2006
Chelidonium majus L. [Papaveraceae]	Greater celandine	Aerial part, latex	AYp3	Kintzios 2006
Chenopodium album L. [Amaranthaceae]	Bethua	Leaf	AXp2	Khoobchandani *et. al.* 2009
Chimaphila umbellata (L.) Barton [Ericaceae]	Umbellate wintergreen	Whole plant	AYp3	Sharma *et al.* 2011
Chlorella pyrenoidosa Chick [Chlorellaceae]	Freshwater algae	Whole plant	AYp3	Sakarkar and Deshmukh 2011
Chrysanthemum coronarium (L.) E.H.L. Krause [Asteraceae]	Edible chrysanthemum	Aerial parts	AXp2	Saranya *et al.* 2019
Cicer arietinum L. [Fabaceae]	Chick pea	Seed	AXp2	Iqbal *et al.* 2017
Cimicifuga dahurica Maxim [Ranunculaceae]	Bugbane	Root	BYn3	Dai *et al.* 2016
Cimicifuga foetida L. [Ranunculaceae]	Foetid Bugbane	Rhizome	AYp3	Dai *et al.* 2016
Cinnanomum camphora (L.) J.Presl. [Lauraceae]	Camphor tree	Leaf and other parts	AYp3	Kintzios 2006
Cinnamomum cassia (L.) J.Presl [Lauraceae]	Chinese cinnamon	Bark	AXp2	Nataru *et al.* 2014
Cinnamomum zeylanicum J.Presl [Lauraceae]	True cinnamon	Bark	AXp2	Jain *et al.* 2016
Cirsium japonicum DC. [Asteraceae]	Plum thistle	Leaf	AYp3	Jain *et al.* 2016
Cirsium scabrum (Poir.) Bon & Bar [Asteraceae]	Rough thistle	Leaf	AYp3	Sahli *et al.* 2017
Citrullus lanatus (Thunb.) Matsum. & Nakai [Cucurbitaceae]	Watermelon	Fruit	AXp1	Adetutu *et al.* 2015
Citrus aurantium L. [Sapindales]	Bitter orange	Fruit	AYp3	Nataru *et al.* 2014
Citrus limon (L.) Osbeck [Rutaceae]	Lemon	Fruit	AXp2	Tariq *et al.* 2015
Citrus maxima Merr. [Rutaceae]	Pomelo/Batwi lebu	Fruit, Leaf	Fruit:AXp1 Leaf:AYp3	Sultana *et al.* 2014

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Citrus medica L. [Rutaceae]	Lemon	Fruit juice, Root	Fruit: AXp1 AXp2	Umadevi *et al.* 2013
Citrus medica var. sarcodactylis (Siebold ex Hoola van Nooten) Swingle [Rutaceae]	Buddha's Hand, Fingered citron	Fruit	AXp2	Chan *et al.* 2017
Citrus paradisi Macfad. [Rutaceae]	Grapefruit	Fruit	AXp1	Gyawali and Kim 2014
Citrus reticulata Blanco. [Rutaceae]	Mandarin orange	Fruit, Flower, Root	Fruit:AXp1 Other: AYp3	Omara *et al.* 2020
Citrus sinensis (L.) Osbeck [Rutaceae]	Sweet orange	Fruit	AXp1	Gyawali and Kim 2014
Citrullus colocynthis (L.) Schrad. [Cucurbitaceae]	Bitter apple	Fruit	AYp3	Kooti *et al.* 2017
Claoxylon khasianum Hook.f. [Euphorbiaceae]	--	Root paste	AYp3	Tariq *et al.* 2015
Clausena lansium (Lour.) Skeels [Rutaceae]	Fool's curry leaf, wampee	Leaf, seed, stem bark	AXp1	Jain *et al.* 2016, Iqbal *et al.* 2017
Cleistanthus collinus (Roxb.) Benth. [Phyllanthaceae]	Oduvanthalai	Root	AYp3T	Kaur *et al.* 2011
Clematis flammula L. [Ranunculaceae]	Fragrant virgin's bower	Flower	AYp3	Abu-Darwish and Efferth 2018
Clematis manshrica Rupr. [Ranunculaceae]	--	Leaf, flower	AYp3	Iqbal *et al.* 2017
Cleome gynandra L. [Cleomaceae]	Shona cabbage	Whole plant	AXp3	Jain *et al.* 2016
Clerodendrum infortunatum L. [Lamiaceae]	Hill glory bower	Leaf, root	AXp3	Tariq *et al.* 2015
Clerodendrum serratum (L.) Moon [Lamiaceae]	Blue-flowered glory Tree	Leaf, root	AYp3	Nataru *et al.* 2014
Clinacanthus nutans (Burm.f.) Lindau [Acanthaceae]	Sabah snake grass	Leaf	AYp3	Lin *et al.* 2021
Coccinia grandis (L.) Voigt [Cucurbitaceae]	Ivy gourd	Leaf/unripe fruit	Leaf: AXp3 Fruit: AXp2	Iqbal *et al.* 2017
Cocculus hirsutus (L.) Diels [Menispermaceae]	Broom creeper	Aerial parts	AXp3	Saranya *et al.* 2019
Cocculus orbiculatus L. (DC) [Menispermaceae]	Queen coralbead	Stem, root	AYp3	Pratiwi and Nurlaeni 2020
Coix lachryma jobi L. [Poaceae]	Job's tears	Seed	AYp3	Sharma *et al.* 2011
Cola nitida Schott & Endl. [Malvaceae]	Kola nut	Nut	AXp3	Jain *et al.* 2016
Colchicum autumnale L. [Colchicaceae]	Autumn crocus	Whole plant	AYp3T	Abu-Darwish and Efferth 2018
Colchicum luteum Baker [Colchicaceae]	Yellow colchicum	Seed	AYp3	Sakarkar and Deshmukh 2011
Colchicum speciosum Steven. [Colchicaceae]	Autumn crocus	Whole plant	AYp3T	Kintzios 2006
Combretum caffrum (Eckl. & Zeyh.) Kuntze [Combretaceae]	South African bush willow	Bark, kernal and fruit	AYp3	Kaur *et al.* 2011
Conyza canadensis (L.) Rupr. [Asteraceae]	Horseweed	Root	AYp3	Jain *et al.* 2016
Conyza blinii Levi. [Asteraceae]	--	Aerial parts	AYp3	Dai *et al.* 2016
Coptis chinensis Franch. [Ranunculaceae]	Chinese goldthread	Rhizome	AYp3	Khan *et al.* 2020
Corda dichotoma G.Forst. [Boraginaceae]	Fragrant manjack	Leaf, seed	AYp3	Saranya *et al.* 2019
Coriandrum sativum L. [Apiaceae]	Coriander	Root, leaf	AXp2	Halder *et al.* 2020
Corydalis incisa (Thunb.) Pers. [Papaveraceae]	Incised fumewort	Leaf	AYp3	Dai *et al.* 2016
Coscinium fenestratum (Goetgh.) Colebr [Menispermaceae]	Yellow vine	Root, stem	AYp3	Om Prakash *et al.* 2013
Cotynus coggygria Scop. [Anacardiaceae]	European smoketree	Leaf	AYp3	Saranya *et al.* 2019
Crataegus azarolus L. [Rosaceae]	Mediterranean medlar	Seed	AYp3	Abu-Darwish and Efferth 2018
Crataegus microphylla K. Koch [Rosaceae]	--	Leaf	AYp3	Saranya *et al.* 2019

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Cremastra appendiculata (D. Don) Makino [Orchidaceae]		Tubers	AYp3	Œliwiński *et al.* 2022
Crinum asiaticum L. [Amaryllidaceae]	Poison bulb	Bulb	AYp3T	Kintzios 2006
Crocus sativus L [Iridaceae]	Saffron crocus	Flower, Stigma	AXp2	Kooti *et al.* 2017 Iqbal *et al.* 2017
Croton caudatus Geiseler [Euphorbiaceae]	--	Leaf, root	AYp3	Saranya *et al.* 2019
Croton lechleri Müll.Arg. [Euphorbiaceae]	Dragon's blood	Sap	AYp3	Kaur *et al.* 2011
Croton tiglium L. [Euphorbiaceae]	Purging croton	Leaf, root	AYp3T	Tariq *et al.* 2015
Croton macrobotrys Baill. [Euphorbiaceae]	Dragon's blood	Leaf	AYp3	Jain *et al.* 2016 Iqbal *et al.* 2017
Cryptocarya chinensis (Hance) Hemsl. [Lauraceae]	Chinese cryptocarya	Leaf, bark	AYp3	Pratiwi and Nurlaeni 2020
Cryptocarya concinna Hence [Lauraceae]	--	Root	AYp3	Chang *et al.* 2016
Cryptocarya konishii Hayata [Lauraceae]	--	Wood	AYp3	Kurniadewi *et al.* 2010
Cryptocarya laevigata Blume [Lauraceae]	Red-fruited laurel	Stem bark	AYp3	Suzuki *et al.* 2017
Cucumis melo L. [Cucurbitaceae]	Muskmelon/ Futi	Fruit	AXp1	Zhang *et al.* 2020b
Cucumis sativus L. [Cucurbitaceae]	Cucumber	Fruit	AXp2	Tuama and Mohammed 2019
Cucurbita maxima Duchesne [Cucurbitaceae]	Squash	Fruit	AXp2	Sultana *et al.* 2014
Cucurbita moschata Duchesne ex Poir. [Cucurbitaceae]	Squash	Fruit	AXp2	Kintzios 2006
Cuscuta reflexa Roxb. [Convolvulaceae]	Giant dodder	Whole plant	AYp3	Jain *et al.* 2016
Curcuma amda Roxb. [Zingiberaceae]	Mango ginger	Rhizome, Whole plant	AXp2	Manoharan and Kaur 2013
Curcuma longa L. [Zingiberaceae]	Turmeric	Rhizome	AXp2	Kuruppu *et al.* 2019
Curcuma zedoaria (Christm.) Roscoe [Zingiberaceae]	White turmeric	Whole plant	AXp2	Sultana *et al.* 2014
Cyclamen coum Mill. [Primulaceae]	Eastern sowbread	Flower	AYp3	Abu-Darwish and Efferth 2018
Cyperus alatus (Nees) F. Muell [Cyperaceae]	--	Rhizome	AYp3	Omara *et al.* 2020
Cyperus rotundus L. [Cyperaceae]	Nut grass	Rhizome	AXp3	Jailson *et al.* 2022
Cymbidium faberi Rolfe [Orchidaceae]	Faber's cymbidium	Root	AYp3	Œliwiński *et al.* 2022
Cymbidium finlaysonianum Lindl [Orchidaceae]	Finlayson's Cymbidium	Whole plant	AYp3	Œliwiński *et al.* 2022
Cymbopogon citratus (DC) Stapf [Poaceae]	Lemon grass	Leaf	AXp3	Omara *et al.* 2020
Cynara syriaca Boiss. [Asteraceae]	--	Leaf	AYp3	Sultana *et al.* 2014
Cynara cardunculus L. [Asteraceae]	Artichoke thistle	Leaf	AXp3	Sultana *et al.* 2014
Dalbergia parviflora Roxb [Fabaceae]	Heart wood	Stem	AYp3	Pratiwi and Nurlaeni 2020
Daphne mezereum L. [Thymelaeaceae]	Spurge laurel	Berry	AYp3T	Om Prakash *et al.* 2013
Daucus carota L. [Apiaceae]	Carrot	Root	AXp2	Omara *et al.* 2020
Debregeasia saeneb (Forssk.) Hepper & J.R.I. Wood [Urticaceae]	Ajilai	Aerial parts	AYp3	Ashraf 2020, Tariq *et al.* 2015
Delphinium staphisagaria L. [Ranunculaceae]	Stavesacre	Seed	AYp3T	Saranya *et al.* 2019
Dendrobium aurantiacum var. denneanum (Kerr) Z.H. Tsi [Orchidaceae]	--	Leaf	AYp3	Œliwiński *et al.* 2022
Dendrobium brymerianum Rchb.f. [Orchidaceae]	Brymer's dendrobium	Whole plant	AYp3	Œliwiński *et al.* 2022
Dendrobium candidum Wall. ex Lindl. [Orchidaceae]	Cane orchids	Whole plant	AYp3	Œliwiński *et al.* 2022

Plant name [Family]	Common Name	Parts used	Category	Reference of use
Dendrobium chrysanthum Wallich ex Lindley [Orchidaceae]	Golden yellow-flowered dendrobium	Leaf	AYp3	Œliwiński *et al.* 2022
Dendrobium crepidatum Lindl. & Paxton [Orchidaceae]	Shoe-lipped dendrobium	Leaf	AYp3	Œliwiński *et al.* 2022
Dendrobium densiflorum Lindl. [Orchidaceae]	Pineapple Orchid	Whole plant	AYp3	Œliwiński *et al.* 2022
Dendrobium draconis Rchb.f [Orchidaceae]	--	Stem	AYp3	Œliwiński *et al.* 2022
Dendrobium falconeri Hook. f. [Orchidaceae]	Falconer's Dendrobium	Aerial parts	AYp3	Œliwiński *et al.* 2022
Dendrobium findlayanum Par. & Rchb.f [Orchidaceae]	Findlay's dendrobium	Stem	AYp3	Œliwiński *et al.* 2022
Dendrobium infundibulum (Lindl.) Kuntze [Orchidaceae]	Small-funnel-lipped dendrobium	Whole plant	AYp3	Œliwiński *et al.* 2022
Dendrobium lasianthera J.J. Sm [Orchidaceae]	Sepik blue orchid	Leaf, stem, root	AYp3	Œliwiński *et al.* 2022
Dendrobium moniliforme (L.) Sw. [Orchidaceae]	Japanese stone orchid	Leaf	AYp3	Œliwiński *et al.* 2022
Dendrobium nobile Lindl. [Orchidaceae]	Noble dendrobium	Stem	AYp3	Œliwiński *et al.* 2022
Dendrobium signatum Rchb. f. [Orchidaceae]	Marked Dendrobium	Whole plant	AYp3	Œliwiński *et al.* 2022
Dendrobium offcinale Lindl. [Orchidaceae]	--	Whole plant	AYp3	Œliwiński *et al.* 2022
Dendrobium plicatile Lindl. [Orchidaceae]	Flickingeria fimbriata	Aerial parts	AYp3	Œliwiński *et al.* 2022
Dendrobium thyrsiflorum Rchb.f. [Orchidaceae]	Pinecone-like raceme dendrobium	Whole plant	AYp3	Œliwiński *et al.* 2022
Dendrobium venustum Teijsm. & Binn. [Orchidaceae]	Lovely Dendrobium	Whole plant	AYp3	Œliwiński *et al.* 2022
Dendrobium williamsonii J. Day & Rchb.f. [Orchidaceae]	Williamson's dendrobium	Whole plant	AYp3	Œliwiński *et al.* 2022
Dendropanax arboreus (L.) Decne. & Planch. [Araliaceae]	--	Leaf, root	AYp3	Kintzios 2006
Derris scandens Roxb. (Benth.) [Fabaceae]	--	Stem, vine	AYp3	Sultana *et al.* 2014
Detarium microcarpum Guill. & Perr. [Fabaceae]	Sweet detar	Stem bark, root, fruit, leaf	AXp3	Sawadogo *et al.* 2012
Dianthus superbus L. [Caryophyllaceae]	Fringed pink	Root	AXp3	Tariq *et al.* 2015
Dillenia indica L. [Dilleniaceae]	Elephant apple	Fruit	AXp2	Nataru *et al.* 2014
Dillenia pentagyna Roxb. [Dillenaceae]	Dog teak	Stem bark, fruit, seed	AXp3	Saranya *et al.* 2019
Dimocarpus longan Lour. [Sapindaceae]	Dragon's eye	Fruit	AXp1	Nagendra Prasad *et al.* 2009
Dioscorea collettii Hook.f. [Dioscoreaceae]	--	Rhizome	AYp3	Jain *et al.* 2016
Diospyros discolor A.DC. [Ebenaceae]	Velvet apple	Fruit	AXp1	Pratiwi and Nurlaeni 2020
Diospyros kaki Thunb. [Ebenaceae]	Oriental persimmon	Fruit, Calyx, Leaf	Fruit: AXp1 Calyx, Leaf: AYp3	Jo *et al.* 2011, Butt *et al.* 2015, Kim *et al.* 2020
Diospyros lotus L. [Ebenaceae]	Date-plum	Fruit	AXp1	Loizzo *et al.* 2009
Diospyros lycioides Desf. [Ebenaceae]	African Diospyros	Leaf	AYp3	Bagla *et al.* 2016
Diospyros nigra (J.F.Gmel.) Perrier [Ebenaceae]	Black sapote	Fruit	AXp1	Johanna and Samuel 2018
Diospyros oleifera Cheng [Ebenaceae]	Chinese persimmon	Fruit	AXp1	Sewlani and Johanna 2022, Patel 2022
Diospyros texana Scheele [Ebenaceae]	Black persimmon	Fruit	AXp1	Anon 1980, Patel 2022
Diospyros virginiana L. [Ebenaceae]	American persimmon	Fruit	AXp1	Sewlani and Johanna 2022, Patel 2022

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Plant name [Family]	Common Name	Parts used	Category	Reference of use
Dimocarpus longan Lour [Sapindaceae]	Longan fruit/ dragon's eye	Fruit pulp	AXp1	Elengoe and Suhaibun 2022
Diphylleia grayi F.Schmidt [Berberidaceae]	Skeleton flower	Fruit	AYp3	Kaur *et al.* 2011
Diphylleia sinensis Li [Berberidaceae]	Umbrella leaf	Leaf, rhizome	AYp3	Dai *et al.* 2016
Dorstenia psilirus Welw. [Moraceae]	--	Rhizome, Root	AYp3	Sawadogo *et al.* 2012
Dracocephalum tanguticum Maxim [Lamiaceae]	--	Whole plant	AYp3	Jain *et al.* 2016
Dregea volubilis (L. f.) Benth. ex Hook. f. [Asclepediaceae]	Juktiphool	Leaf, flower	Flower: AXp2 Leaf: AYp3	Hossain *et al.* 2012
Dryopteris crassirhizoma Nakai [Polypodiaceae]	Thick stemmed wood fern	Rhizome	AYp3	Sharma *et al.* 2011
Durio zibethinus L. [Malvaceae]	Durian fruit	Fruit	AXp1	Saminathan and Doraiswamy 2020
Dysosma pleiantha (Hance) Woodson [Berberidaceae]	Many-flowered Chinese mayapple	Rhizome	AYp3T	Kintzios 2006
Dysoxylum binectariferum Hiern. [Meliaceae]	Akil	Leaf, bark	AYp3	Kaur *et al.* 2011
Ecballium elaterium (L.) A. Rich [Cucurbitaceae]	Squirting cucumber	Whole plant	AYp3	Abu-Darwish and Efferth 2018
Echinacea angustifolia DC. [Asteraceae]	Black Sampson echinacea	Root	AYp3	Sakarkar and Deshmukh 2011
Echinops giganteus A.Rich [Asteraceae]	--	Rhizome	AYp3	Sawadogo *et al.* 2012
Echinops setifer Iljin. [Asteraceae]	--	Whole plant	AYp3	Sharma *et al.* 2011
Eclipta alba (L.) Hassk. [Asteraceae]	False daisy	Leaf	AXp3	Nataru *et al.* 2014
Ehretia microphylla Lam [Boraginaceae]	Philippine tea tree	Leaf	AYp3	Sharma *et al.* 2022
Elaeagnus parvifolia Wall. Ex Royle [Elaeagnaceae]	Autumn olive	Fruit	AXp1	Tariq *et al.* 2015
Elaeagnus rhamnoides L. [Elaeagnaceae]	Sea-buckthorn	Fruit	AXp1	Tariq *et al.* 2015
Elusine coracana Gaertn. [Poaceae]	Finger millet	Seed	AXp2	Iqbal *et al.* 2017
Emblica officinalis Gaertn. [Phyllanthaceae]	Indian gooseberry	Fruit	AXp1	Jain *et al.* 2016
Emilia sonchifolia (L.) DC. ex Wight [Asteraceae]	lilac tassel	flower Whole plant	AXp3	Jain *et al.* 2016
Enterolobium contortisiliquum (Vell.) Morong. [Fabaceae]	Pacara earpod tree	Seed	AYp3	Iqbal *et al.* 2017
Ephedra alata Decne. [Ephedraceae]	--	Whole plant	AYp3	Abu-Darwish and Efferth 2018
Equisetum arvense L. [Equisetaceae]	Horsetail	Leaf	AXp3	Alexandru *et al.* 2007 Bhat *et al.* 2020
Eriobotrya japonica (Thunb.) Lindl. [Rosaceae]	Loquat	Fruit	AXp1	Dai *et al.* 2016
Erthyrina suberosa Roxb. [Fabaceae]	Corky coral tree	Stem bark, fruit, flower	AYp3	Desai *et al.* 2008
Ervatamia divaricata (L.) Burkill [Apocynaceae]	Pinwheel flower	Root, leaf, flower	AYp3	Kintzios 2006, Saranya *et al.* 2019
Ervatamia heyneana (Wall.) T.Cooke [Apocynaceae]	--	Root, leaf	AYp3	Kintzios 2006
Ervatamia microphylla (Pit.) Kerr. [Apocynaceae]	--	Root, leaf	AYp3	Kintzios 2006
Erysimum cheiranthoides L. [Brassicaceae]	Wormseed mustard	Seed, root	AYp3	Dai *et al.* 2016
Erythrina abyssinica Lam. ex DC. [Fabaceae]	Red hot poker tree	Bark, root	AYp3	Omara *et al.* 2020
Erythrina variegata L. [Fabaceae]	Indian coral tree	Bark, leaf	AYp3	Desai *et al.* 2008

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Erythronium americanum Ker-Gawl. [Liliaceae]	Yellow trout lily	Whole plant	AYp3	Sharma *et al.* 2011
Erythroxylum pervillei Baill. [Erythroxylaceae]	--	Root	AYp3	Kaur *et al.* 2011
Etlingera elatior (Jack) R.M.Sm. [Zingiberaceae]	Torch ginger	Young flower shoot	AXp2	Jackie *et al.* 2011
Euclea natalensis A.DC. [Ebenaceae]	Natal guarri	Bark	AYp3	Omara *et al.* 2020
Eulophia macrobulbon (C.S.P.Parish & Rchb.f.) Hook.f. [Orchidaceae]	Corduroy orchids	Root	AYp3	Œliwiñski *et al.* 2022
Eulophia nuda Lindl. [Orchidaceae]	Grass Orchid	Tuber	AYp3	Œliwiñski *et al.* 2022
Euonymus alatus (Thunb.) Siebold [Celastraceae]	Burning bush	Whole plant	AYp3	Sharma *et al.* 2011
Eupatorium altissimum L. [Asteraceae]	Tall thoroughwort	Aerial parts	AYp3	Kintzios 2006
Eupatorium cannabinum L. [Asteraceae]	Hemp-agrimony	Whole plant	AYp3	Sharma *et al.* 2011
Eupatorium rotundifolium L. [Asteraceae]	Roundleaf thoroughwort	Leaf	AYp3	Dai *et al.* 2016
Eupatorium semiserratum DC [Asteraceae]	Smallflower thoroughwort	Leaf	AYp3	Dai *et al.* 2016
Euphorbia amygdaloides L. [Euphorbiaceae]	Wood spurge	Aerial parts	AYp3T	Kintzios 2006
Euphorbia helioscopia L. [Euphorbiaceae]	Sun spurge	Aerial parts	BYn3T	Kintzios 2006
Euphorbia hirta L. [Euphorbiaceae]	Asthma-plant	Leaf, root	AXp3	Jain *et al.* 2016, Tariq *et al.* 2015
Euphorbia hirsute L. [Euphorbiaceae]	--	Leaf	AYp3	Kintzios 2006
Euphorbia lathyris L. [Euphorbiaceae]	Caper spurge	Aerial parts	AYp3T	Kintzios 2006
Euphorbia peplus L. [Euphorbiaceae]	Cancer weed	Milky juice	BYn3T	Abu-Darwish and Efferth 2018
Euphorbia semiperfoliata Viv. [Euphorbiaceae]	Spurge	Aerial part	AYp3	Patel 2019
Euphorbia tirucalli L. [Euphorbiaceae]	Indian tree Spurge	Leaf, stem	AYp3T	Saranya *et al.* 2019
Eurycoma harmadiana Pierre [Simaroubaceae]	---	Leaf, root	AYp3	Kintzios 2006
Eurycoma longifolia Jack [Simaroubaceae]	Longjack	Root	AXp3	Kintzios 2006
Euterpe oleracea Mart. [Arecaceae]	Açai Berries	Fruit	AXp1	Alessandra-Perini *et al.* 2018
Fagara macrophylla (Oliv.) Engl. [Rutaceae]	East African satinwood	Bark	AYp3	Kintzios 2006
Fagonia indica Burm f. [Zygophyllaceae]	Indian fagonia	Aerial parts	AYp3	Abu-Darwish and Efferth 2018
Fagopyrum cymosum (Trevir.) Meisn. [Polygonaceae]	Tall buckwheat	Aerial parts	AYp3	Sultana *et al.* 2014
Fagopyrum esculentum Moench [Polygonaceae]	Common buckwheat	Leaf, seed	AXp2	Sakarkar and Deshmukh 2011
Ferula asa-foetida L. [Apiaceae]	Asafoetida plant	Resin, seed	AYp3	Kooti *et al.* 2017, Nataru *et al.* 2014
Ferula gummosa Boiss. [Apiaceae]	Galbanum	Shoot	AYP3	Halder *et al.* 2020
Ficus beecheyana Hook. & Arn. [Moraceae]	--	Root	AYp3	Saranya *et al.* 2019
Ficus carica L. [Moraceae]	Fig	Fruit, leaves, sap	Fruit:AXp2 Others: AYp3	Saranya *et al.* 2019
Ficus dawei Hutch. [Moraceae]	Loquat-leaved fig	Bulb	AYp3	Omara *et al.* 2020
Ficus fistulosa Reinw. ex Bl. [Moraceae]	Common yellow stem fig	Leaf, syconia	AXp2	Pratiwi and Nurlaeni 2020
Ficus natalensis Hochst. [Moraceae]	Natal fig	Root	AYp3	Omara *et al.* 2020
Ficus racemosa L. [Moraceae]	Cluster fig	Fruit	AYp3	Saranya *et al.* 2019

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Flacourtia indica (Burm.f.) Merr. [Salicaceae]	Governor's plum	Fruit, aerial parts	Fruit: AXp1 Aerial parts: AYp3	Park *et al.* 2014, Tiwari 2017
Fragaria ananassa Duchesne [Rosaceae]	Strawberry	Fruit	AXp1	Ansary *et al.* 2021
Fragaria vesca L. [Rosaceae]	Wild strawberry	Leaf and fruit	Fruit:AXp1 Leaf:AYp3	Sharma *et al.* 2011
Fritillaria thunbergii Miq. [Liliaceae]	--	Whole plant	AYp3	Sharma *et al.* 2011
Furcraea watsoniana Sander [Asparagaceae]	Green-aloe	Leaf	AYp3	Hafeez *et al.* 2020
Galium aparine L. [Rubiaceae]	Catchweed	Aerial parts	AYp3	Sharma *et al.* 2011
Garcinia hunburyi Hook.f [Clusiaceae]	Hanbury's garcinia	Resin, fruit	AYp3	Kintzios 2006
Garcinia indica Choisy [Clusiaceae]	Kokum	Fruit	AXp2	Khan *et al.* 2020
Garcinia mangostana L. [Clusiaceae]	Purple mangosteen	Fruit	AXp1	Nauman and Johnson 2022
Garcinia oblongifolia Champ. ex Benth. [Clusiaceae]	Lingnan garcinia	Fruit	AYp2	Khan *et al.* 2020
Gardenia gummifera L.f. [Rubiaceae]	Gummy gardenia	Resin	AYp3	Nataru *et al.* 2014
Ginkgo biloba L. [Ginkgoaceae]	Ginkgo	Leaf	AXp3	Iqbal *et al.* 2017
Gleditsia sinensis Lam. [Fabaceae]	Chinese honey locust	Thorn	AYp3	Dai *et al.* 2016
Glinus oppositifolius (L.) Aug. DC. [Molluginaceae]	Indian Chickweed	Leaf	AXP2	Chakraborty *et al.* 2017
Glochidion zeylanicum (Gaertn.) A.Juss. [Phyllanthaceae]	Neeru	Fruit	AYp3	Sultana *et al.* 2014
Gloriosa superba L. [Liliaceae]	Flame lily	Root	AYp3	Goel *et al.* 2022, Ionkova *et al.* 2022.
Glycine max (L.) Merr. [Fabaceae]	Soyabean	Seed	AXp2	Sakarkar and Deshmukh 2011
Glycyrrhiza glabra L. [Fabaceae]	Liquorice	Root	AXp3	Kintzios 2006, Kooti *et al.* 2017
Glycyrrhiza inflata Batalin [Fabaceae]	Chinese licorice	Root	AXp3	Kintzios 2006
Glycyrrhiza uralensis Fisch. ex DC. [Fabaceae]	Chinese liquorice	Root	AXp3	Kintzios 2006, Ashraf 2020
Glyptopetalum sclerocarpum M.A. Lawson [Celastraceae]	--	Stem bark, pericap	AYp3	Kintzios 2006
Gmelina asiatica L. [Lamiaceae]	--	Root	AYp3	Jain *et al.* 2016
Goniothalamus amuyon (Blanco) Merr. [Annonaceae]	Amúyon	Fruit, seed, stem bark, leaf	AYp3	Kintzios 2006
Goniothalamus gardneri Hook.f. & Thomson [Annonaceae]	Katu kera	Root	AYp3	Kintzios 2006
Goniothalamus giganteus Hook.f. & Thomson [Annonaceae]	--	Leaf, root	AYp3	Kintzios 2006
Goniothalamus macrophyllus (Blume) Zoll. [Annonaceae]	Penawar Hitam	Root	AYp3	Sultana *et al.* 2014
Goodyera schlechtendaliana Reichb.f. [Orchidaceae]	Schlechtendal's Goodyera	Whole plant	AYp3	Œliwiñski *et al.* 2022
Gossypium herbaceum L. [Malvaceae]	Levant cotton	Seed oil, Whole plant	AYp3	Om Prakash *et al.* 2013, Iqbal *et al.* 2017
Gossypium hirsutum L. [Malvaceae]	Mexican cotton	Seed oil, Whole plant	AYp3	Om Prakash *et al.* 2013, Iqbal *et al.* 2017
Gossypium indicum Lam. [Malvaceae]	Tree cotton	Seed oil, Whole plant	AYp3	Om Prakash *et al.* 2013, Iqbal *et al.* 2017

Plant name [Family]	Common Name	Parts used	Category	Reference of use
Grewia asiatica L. [Malvaceae]	Phalsa, Indian Sherbet berry	Fruit	AXp1	Qamar *et al.* 2022
Grewia hirsuta Vahl [Malvaceae]	Nagabala	Leaf	AYp3	Nataru *et al.* 2014
Grifola frondosa (Dicks.) Gray [Meripilaceae]	Hen of the woods	Edible part of the mushroom	AYp3	Zhao *et al.* 2021
Gunnera perpensa L. [Gunneraceae]	River pumpkin	Leaf, rhizome, root, stem	AYp3	Kaur *et al.* 2011
Gymnema sylvestre R. Br. [Apocynaceae]	Gurmer	Leaf	AYp3	Nataru *et al.* 2014
Gynostemma pentaphyllum (Thunb.) Makino [Cucurbitaceae]	Poor man's ginseng	Whole plant	AXp3	Dai *et al.* 2016
Gyrophora esculenta Miyoshi [Umbilicariaceae]	Rock tripe	Aerial part	AYp3	Sakarkar and Deshmukh 2011
Hackelia uncinata (Benth.) C.E.C.Fisch. [Boraginaceae]	Hooked stickseed	Flower	AYp3	Tariq *et al.* 2015
Hannoa chlorantha Engl. & Gilg. [Simaroubaceae]	---	Stem bark	AYp3	Kintzios 2006
Hannoa kleineana Pierre & Engl. [Simaroubaceae]	---	Stem bark	AYp3	Kintzios 2006
Hedera nepalensis K. Koch [Araliaceae]	Himalayan ivy	Leaf	AYp3	Tariq *et al.* 2015
Hedyotis diffusa Willd. [Rubiaceae]	White flower snake -tongue grass	Whole plant	AYp3	Jain *et al.* 2016
Helicteres isora L. [Malvaceae]	Indian screw tree	Whole plant	AXp3	Saranya *et al.* 2019
Helianthus annuus L. [Asteraceae]	Sunflower	Flower, seed	AXp3	Nataru *et al.* 2014
Hellenium hoopesi A.Gray [Asteraceae]	Owl's claws	Blossoms	AYp3	Kintzios 2006
Hellenium microcephalum DC [Asteraceae]	Smallhead sneezeweed	Root	AYp3	Kintzios 2006
Hemerocallis fulva (L.) L. [Asphodelaceae]	Orange day-lily	Flower, leaf, tuber	AXp2	Pratiwi and Nurlaeni 2020
Hemidesmus indicus (L.) R.Br. [Apocynaceae]	Indian sarsaparilla	Root	AXp3	Kuruppu *et al.* 2019
Heracleum persicum Desf. ex Fisch. [Apiaceae]	Persian hogweed	Seed	AXp2	Jain *et al.* 2016
Herba epimedii Yinyanghuo [Berberidaceae]	YinYang Huo	Leaf	AXp3	Iqbal *et al.* 2017
Hibiscus calyphyllus Cav. [Malvaceae]	Lemon yellow rosemallow	Aerial parts	AYp3	Saranya *et al.* 2019
Hibiscus deflersii Schweinf. ex Cufod. [Malvaceae]	--	Aerial parts	AYp3	Saranya *et al.* 2019
Hibiscus micranthus L.f. [Malvaceae]	Tiny flower Hibiscus	Aerial parts	AYp3	Saranya *et al.* 2019
Hibiscus mutabilis L. [Malvaceae]	Confederate rose	Seed, pepper	AYp3	Jain *et al.* 2016
Hibiscus rosa-sinensis L. [Malvaceae]	China rose	Flower	AXp2	Goldberg *et al.* 2016
Hibiscus sabdariffa L. [Malvaceae]	Roselle	Leaf, flower	AXp2	Umamaheswari and Govindan 2007
Holarrhena floribunda (G.Don) T.Durand & Schinz [Apocynaceae]	Kurchi bark	Stem	AYp3T	Sawadogo *et al.* 2012
Holoptelea integrifolia (Roxb.) Planch [Ulmaceae]	Indian elm	Leaf	AYp3	Nataru *et al.* 2014
Hydrastis canadensis L. [Ranunculaceae]	Yellow puccoon	Whole plant	AXp3	Sharma *et al.* 2011
Hygrophila spinosa T.And. [Acanthaceae]	Marsh barbell	Leaf	AXp2	Anisha *et al.* 2022
Hypericum drummondii Torr. & A. Gray. [Hypericaceae]	--	Whole plant	AYp3	Om Prakash *et al.* 2013 Kintzios 2006
Hypericum kotshcyanum Boiss. [Hypericaceae]	--	Aerial parts	AYp3	Sharma *et al.* 2011

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Hypericum perforatum L. [Hypericaceae]	St. John's Wort	Aerial parts	AXp3	Om Prakash *et al.* 2013 Kintzios 2006
Hypoxis argentea Harv. ex Baker. [Hypoxidaceae]	Small yellow stars	Underground part	AXp3	Sharma *et al.* 2011
Hypoxis colchicifolia Baker [Hypoxidaceae]	Broad leaved Hypoxis	Underground part	AYp3	Kaur *et al.* 2011
Hypoxis hemerocallidea Fisch. Mey. & Avé-Lall. [Hypoxidaceae]	African potato	Underground part	BXq3	Matyanga *et al.* 2020
Hyptis fasciculata Benth. [Lamiaceae]	--	Leaf, bark	AYp3	Nataru *et al.* 2014
Hyptis martiusii Benth. [Lamiaceae]	Cidreira brava	Leaf	AYp3	Kintzios 2006
Hyptis verticillata Jacq. [Lamiaceae]	John Charles	Leaf, stem	AXp3	Kintzios 2006
Ichnocarpus frutescens (L.) W.T.Aiton [Apocynaceae]	Black creeper	Root	AYp3	Nataru *et al.* 2014
Illicium verum Hook.f. [Schisandraceae]	Star anise	Fruit pericap	AXn2	Asif *et al.* 2016
Imperata cylindrica (L.) P.Beauv. [Poaceae]	Cogongrass	Root	AYp3	Sawadogo *et al.* 2012
Indigofera linnaei Al. [Fabaceae]	Nine-leaved indigo	Aerial part	AYp3T	Jain *et al.* 2016
Indigofera tinctoria L. [Fabaceae]	True indigo	Whole plant	AYp3	Kaur *et al.* 2011
Inonotus obliquus (Ach. ex Pers.) Pilát [Hymenochaetaceae]	Chaga mushroom	Aerial part	AYp3	Sultana *et al.* 2014
Inula helenium L. [Asteraceae]	Elecampane	Root	AXp3	Dai *et al.* 2016
Inula japonica Thunb. [Asteraceae]	Geumbulcho	Flower	AXp3	Dai *et al.* 2016
Inula racemosa Hook. f. [Asteraceae]	Puskarmool	Root, rhizome	AXp3	Tariq *et al.* 2015
Inula viscosa (L.) Aiton [Asteraceae]	False yellowhead	Flower	AYp3	Abu-Darwish and Efferth 2018
Ipomoea aquatica Forssk. [Convolvulaceae]	Water spinach	Leaf and spft stem	AXp2	Sasikala *et al.* 2022
Ipomoea batatas (L.) Lam. [Convolvulaceae]	Sweet potato	Root	AXp2	Iqbal *et al.* 2017
Ipomoea obscura (L.) Ker Gawl. [Convolvulaceae]	Small white morning glory	Flower, leaf, stem	AXp3	Nataru *et al.* 2014
Jasmium sambac (L.) Aiton [Oleaceae]	Arabian jasmine	Flower	AYp3	Saranya *et al.* 2019
Jatropha curcas L. [Euphorbiaceae]	Poison nut	Whole plant, Leaf, seed	AYp3T	Kintzios 2006, Umadevi *et al.* 2013
Jatropha gossypiifolia L. [Euphorbiaceae]	Black physicnut	Aerial parts	AYp3T	Félix-Silva *et al.* 2014
Jatropha macrorhiza Benth [Euphorbiaceae]	Jirawilla	Whole plant	AYp3	Kintzios 2006
Junchus effuses L. [Juncaceae]	Common rush	Whole plant	AXp3	Sharma *et al.* 2011
Juniperus chinensis L. [Cupressaceae]	Chinese juniper	Fruit, stem, root, resin	AYp3	Kintzios 2006
Juniperus virginiana L. [Cupressaceae]	Red ceder	Fruit, leaf	AYp3	Kintzios 2006
Justicia procumbens L. [Acanthaceae]	Water willow	Leaf, root	AYp3	Kaur *et al.* 2011
Khaya senegalensis (Desr.) A.Juss. [Meliaceae]	African mahogany	Stem bark	AYp3	Sawadogo *et al.* 2012
Kigelia africana Lam. Benth. [Bigoniaceae]	Sausage tree	Root, bark	AYp3T	Omara *et al.* 2020
Knowltonia capensis (L.) Huth [Ranunculaceae]	Blistering leaves	Leaf	AYp3	Sharma *et al.* 2011
Kochia scoparia (L.) Schrad. [Amaranthaceae]	Ragweed	Seed	AYp3	Dai *et al.* 2016
Koelreuteria henryi Dummer [Sapindaceae]	Flamegold rain tree	Root, bark, twig leaf	AYp3	Kintzios 2006
Lactuca sativa L. [Asteraceae]	Lettuce	Leaf	AXp2	Qin *et al.* 2018
Lagenaria siceraria Standl [Cucurbitaceae]	Bottle gourd	Fruit	AXp2	Kooti *et al.* 2017

Plant name [Family]	Common Name	Parts used	Category	Reference of use
Lansium domesticum Corrêa [Meliaceae]	Langsat	Fruit	AXp1	Manosroi *et al.* 2012
Lantana camara L. [Verbenaceae]	Common lantana	Whole plant	AYp3T	Sharma *et al.* 2011
Lantana ukambensis (Vatke) Verdc. [Verbenaceae]	--	Whole plant	AYp3T	Sawadogo *et al.* 2012
Larrea divaricata Cav. [Zygophyllaceae]	Chaparral	Leaf	AYp3	Sultana *et al.* 2014
Larrea tridentata (DC.) Coville [Zygophyllaceae]	Creosote bush	Whole plant	AYp3	Sharma *et al.* 2011
Lavandula angustifolia Mill. [Lamiaceae]	Common lavender	Flower	AXp3	Saranya *et al.* 2019
Lavatera cashmeriana Camb [Malvaceae]	Kashmir Mallow	Seed	AYp3	Iqbal *et al.* 2017
Lawsonia inermis L. [Lythraceae]	Henna	Bark	AXp3	Sharma *et al.* 2011
Leea indica (Burm.f.) Merr. [Vitaceae]	Bandicoot berry	Leaf	AYp3	Jain *et al.* 2016
Lens culinaris Medik. [Fabaceae]	Lentil	Seed	AXp2	Iqbal *et al.* 2017
Lentinula edodes (Berk.) Pegler [Omphalotaceae]	Shiitake mushroom	Fruiting bodies	AXp2	Sakarkar and Deshmukh 2011
Lepidium sativum L. [Brassicaceae]	Garden cress	Whole plant	AXp2	Jain *et al.* 2016
Lilium brownii F.E.Br. ex Miellez [Liliaceae]	Hong Kong lily	Bulb	AYp3	Dai *et al.* 2016
Limonia acidissima L. [Rutaceae]	Wood Apple		AXp1	Pradhan *et al.* 2012
Limonium densiflorum Kuntze [Plumbaginaceae]	--	Shoot	AYp3	Saranya *et al.* 2019
Linium album Kotschy ex Boiss. [Linaceae]	--	Aerial part	AYp3	Kaur *et al.* 2011
Linum usitatissimum L. [Liliaceae]	Flax seed	Leaf, flower, seed	AXp2	Sakarkar and Deshmukh 2011
Liparis nervosa (Thunb. ex A. Murray) Lindl. [Orchidaceae]	Veined Liparis	Whole plant	AYp3	Œliwiñski *et al.* 2022
Liriodendron tulipifera L. [Magnoliaceae]	Tulip poplar	Root bark, stem	AYp3	Jain *et al.* 2016, Iqbal *et al.* 2017
Litchi chinensis Sonn [Sapindaceae]	Litchi	Fruit	AXp1	Jain *et al.* 2016
Lithospermum erythrorhizon Siebold & Zucc. [Boraginaceae]	Purple gromwell	Root	AYp3	Dai *et al.* 2016
Lonicera japonica Thunb. [Caprifoliaceae]	Japanese honeysuckle	Whole plant	AXp3	Sharma *et al.* 2011, Kaur *et al.* 2011
Loranthus parasiticus Merr. [Loranthaceae]	Sang Ji Sheng	Aerial parts	AYp3	Khan *et al.* 2020
Lovoa trichilioides Harms [Meliaceae]	African walnut	Bulb, seed, leaf	AYp3	Omara *et al.* 2020
Luffa cylindrica M. Roem. [Cucurbitaceae]	Sponge gourd	Aerial parts	AXp2	Saranya *et al.* 2019
Luisia zeylanica Lindl. [Orchidaceae]	---	Leaf	AYp2	Œliwiñski *et al.* 2022
Lycium barbarum L. [Solanaceae]	Goji berries	Fruit	AXp1	Wawruszak *et al.* 2021
Lycopersicum esculentum Mill. [Solanaceae]	Tomato	Leaf	AYp3	Sultana *et al.* 2014
Maclura pomifera (Raf.) Schneid. [Moraceae]	Osage orange	Fruit, root	AYp3	Sua *et al.* 2017, Orazbekov *et al.* 2018
Magnolia grandiflora L. [Magnoliaceae]	Southern magnolia	Seed	AYp3	Kooti *et al.* 2017
Magnolia officinalis Rehder & Wilson [Magnoliaceae]	Houpu magnolia	Bark, root	AYp3	Kooti *et al.* 2017
Magnolia virginiana L. [Magnoliaceae]	Sweetbay magnolia	Bark, fruit	AYp3	Kooti *et al.* 2017
Malaxis rheedii Sw. [Orchidaceae]	Rushabha	Whole plant	AYp3	Œliwiñski *et al.* 2022
Malus domestica Borkh. [Rosaceae]	Apple	Fruit	AXp1	Nataru *et al.* 2014
Mallotus philippensis (Lam.) Müll.Arg. [Euphorbiaceae]	Kumkum tree	Fruit, seed coating	AYp3	Jain *et al.* 2016 Tariq *et al.* 2015
Mangifera indica L. [Anacardiaceae]	Mango	Flower, leaf, fruit	Fruit: AXp1 Others: AYp3	Om Prakash *et al.* 2013

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Plant name [Family]	Common Name	Parts used	Category	Reference of use
Manilkara hexandra (Roxb.) Dubard [Sapotaceae]	Khirni, Rayan	Fruit	AXp1	Mondal *et al.* 2022
Manilkara zapota (L.) P.Royen [Sapotaceae]	Sapote	Fruit, flower	Fruit: AXp1 Flower: AYp3	Saranya *et al.* 2019
Markhamia lutea (Benth.) K. Schum. [Bignoniaceae]	Nile tulip	Fruit	AYp3	Omara *et al.* 2020
Marsilea quadrifolia L. [Marsileaceae]	Four leaf clover	Aerial part	AXp2	Ripa *et al.* 2009
Matricaria chamomilla L. [Asteraceae]	Chamomile	Flower, Whole plant	Flower: AXp3 Others: AYp3	Jain *et al.* 2016, Iqbal *et al.* 2017
Maytenus boaria Molina [Celastraceae]	Mayten	Leaf, seed	AYp3	Kintzios 2006
Maytenus emarginata (Willd.) Ding Hou [Celastraceae]	Kankera	Root, bark, leaf, fruit	AYp3	Kintzios 2006
Maytenus guangsiensis C.Y.Cheng & W.L.Sha [Celastraceae]	--	Root, bark, leaf	AYp3	Kintzios 2006
Maytenus ovatus Schweinf. [Celastraceae]	--	Root, bark, leaf	AYp3	Kintzios 2006
Maytenus senegalensis (Lam.) Exell [Celastraceae]	Spike thorn	Root, bark, leaf	AYp3	Kintzios 2006
Maytenus wallichiana (Spreng.) D.C.S.Raju & Babu [Celastraceae]	--	Root, bark, leaf	AYp3	Kintzios 2006
Medicago sativa L. [Fabaceae]	Alfalfa	Leaf, seed	Leaf:AXp2 Seed: AYp3	Kooti *et al.* 2017
Medicago scutellata (L.) Mill. [Fabaceae]	Snail medick	Seed	AYp3	Iqbal *et al.* 2017
Melaleuca alternifolia (Maiden & Betche) Cheel. [Myrtaceae]	Tea tree	Aerial part, oil	BYp3	Clark *et al.* 2021
Melia azedarach L. [Meliaceae]	Chinaberry tree	Leaf, stem root	AYp3	Kintzios 2006
Melissa officinalis L. [Lamiaceae]	Lemon balm	Leaf	AXp2	Sultana *et al.* 2014
Mentha pulegium L. [Lamiaceae]	Pennyroyal	Leaf	AYp3T	Kooti *et al.* 2017
Mentha longifolia (L.) Huds. [Lamiaceae]	Horse mint	Leaf	AXp3	Yassin *et al.* 2020
Merwilla plumbea (Lindl.) Speta [Asparagaceae]	Blue mountain lily	Bulb	AYp3	Sharma *et al.* 2011
Mikania micrantha Kunth [Asteraceae]	Bitter vine	Leaf	AYp3	Tariq *et al.* 2015
Mimosa pudica L. [Fabaceae]	Touch-me-not	Whole plant	AYp3	Umadevi *et al.* 2013
Mimusops elengi L. [Sapotaceae]	Spanish cherry,	Fruit, leaf Bakul	Fruit:AXp1 Leaf: AYp3	Kar *et al.* 2012, Korkmaz *et al.* 2020
Mirabilis jalapa L. [Nyctaginaceae]	Four o'clock flower	Aerial parts, root, stem	AYp3	Saranya *et al.* 2019
Mollugo pentaphylla L. [Molluginaceae]	Khet papra	Aerial part	AXp3	Jagatheesh *et al.* 2011
Momordica balsamina L. [Cucurbitaceae]	Balsam apple, Uchhey		AXp2	Sarala *et al.* 2021
Momordica charantia L. [Cucurbitaceae]	Bitter melon, Karela	Leaves, Roots, green fruit	AXp2	Iqbal *et al.* 2017, Kintzios 2006
Momordica dioica Roxb. ex Willd. [Cucurbitaceae]	Spiny gourd	Fruit, leaf, root	Fruit: AXp2 Others: AYp3	Jadhav and Kumble 2022
Morinda citrifolia L. [Rubiaceae]	Noni	Root, fruit	Fruit:AXp1 Root: AYp3	Sharma *et al.* 2011, Umadevi *et al.* 2013
Moringa oliefera Lam. [Moringaceae]	Drumstick tree	Leaf, flower, root,bark, fruit	Leaf, flower, fruit:AXp2 Bark, root: AXp3	Jain *et al.* 2016, Omara *et al.* 2020

Plant name [Family]	Common Name	Parts used	Category	Reference of use
Morus alba L. [Moraceae]	White mulberry	Leaf	AXp3	Khan *et al.* 2020
Morus nigra L. [Moraceae]	Black mulberry	Leaf, fruit	Fruit: AXp1 Leaf: AYp3	Saranya *et al.* 2019
Munronia pinnata (Wall.) Theob. [Meliaceae]	Binkohomba	Aerial part	AYp3	Kuruppu *et al.* 2019
Murraya koenigii (L.) Sprengel [Rutaceae]	Curry tree	Leaf	AXp2	Noolu *et al.* 2013
Musa acuminate Colla [Musaceae]	Red Banana	Fruit	AXp1	Srinivas *et al.* 2021
Myrtus communis L. [Myrtaceae]	Common myrtle	Leaf, fruit	Fruit: AXp2 Leaf: AYp3	Kooti *et al.* 2017
Narcissus tazetta L. [Amaryllidaceae]	Chinese sacred lily	Aerial parts, flower	AYp3	Saranya *et al.* 2019
Nardostachys jatamansi (D.Don) DC. [Caprifoliaceae]	Muskroot	Root and rhizome	AXp3	Chaudhary *et al.* 2015
Nauclea orientalis L. [Rubiaceae]	Bur tree/Kadam	Ripe fruit	AYp3	Kintzios 2006
Nelumbo nucifera Gaertn. [Nelumbonaceae]	Indian lotus	Rhizome, seed, leaf	Rhizome, seed: AXp3, Leaf:AYp3	Jain *et al.* 2016
Nepeta italica L. [Laminaceae]	--	Aerial parts	AYp3	Saranya *et al.* 2019
Nephelium lappaceum L. [Sapindaceae]	Rambutan	Fruit	AXp1	Perumal *et al.* 2021
Nerium indicum Mill. [Apocynaceae]	Oleander	Flower, leaf	AYp3T	Dai *et al.* 2016
Nervilia concolor (Blume) Schltr. [Orchidaceae]	Tall shield orchid	Whole plant	AYp3	Œliwiñski *et al.* 2022
Nervilia fordii (Hance) Schltr. [Orchidaceae]	--	Aerial part	AYp3	Om Prakash *et al.* 2013
Neurolaena lobata (L.) R.Br. ex Cass. [Asteraceae]	Jackass bitters	Leaf	AYp3	Kintzios 2006
Nicotiana tabacum L.[Solanaceae]	Tobacco	Leaf	AYp3	Umadevi *et al.* 2013
Nigella sativa L. [Ranunculaceae]	Black cumin	Seed	AXp2	Kooti *et al.* 2017, Abu-Darwish and Efferth 2018
Nothapodytes foetida Wight [Icacinaceae]	Stinking tree	Leaf, shoot, root, bark	AYp3	Rasool *et al.* 2015
Ochrosia ellipitica Labill. [Apocynaceae]	Elliptic yellow wood	Trunk bark	AYp3T	Om Prakash *et al.* 2013
Ocimum basilicum L. [Lamiaceae]	Great basil	Leaf	AXp2	Nataru *et al.* 2014
Ocimum sanctum L. [Lamiaceae]	Holy basil	Leaf	AXp2	Jain *et al.* 2016
Oldenlandia corymbosa L. [Rubiaceae]	Diamond flower	Whole plant	AYp3	Saranya *et al.* 2019
Olea europaea L. [Oleaceae]	Olive tree/ Jalpai	Leaf, fruit	AYp3/AXp1	Saranya *et al.* 2019
Ononis hirta Poir. [Fabaceae]	--	Aerial parts	AYp3	Saranya *et al.* 2019
Ononis sicula Guss. [Fabaceae]	--	Aerial parts	AYp3	Saranya *et al.* 2019
Ononis viscosa L. [Fabaceae]	--	Whole plant	AYp3	Abu-Darwish and Efferth 2018
Onopordum cynarocephalum Boiss. [Asteraceae]	Artichoke Cotton-thistle	Fruit	AYp3	Abu-Darwish and Efferth 2018
Onosma paniculatum Bur. & Franch. [Boraginaceae]	--	Root	AYp3	Dai *et al.* 2016
Operculina turpethum (L.) Silva Manso [Convolvulaceae]	St. Thomas lidpod	Stem	AYp3	Jain *et al.* 2016
Ophiorrhiza mungos L. [Rubiaceae]	Mongoose plant	Leaf, root	AYp3	Jain *et al.* 2016
Oplopanax elatus Nakai [Araliaceae]	--	Root	AYp3	Dai *et al.* 2016
Opuntia ficus-indica (L.) Mill. [Cactaceae]	Prickly pear Cactus	Fruit, leaf	Fruit:AXp1 Leaf: AYp3	Omara *et al.* 2020

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Plant name [Family]	Common Name	Parts used	Category	Reference of use
Opuntia humifusa (Raf.) Raf. [Cactaceae]	Eastern prickly pear	Fruit	AXp1	Hahm *et al.* 2015
Origanum majorana L. [Lamiaceae]	Marjoram	Leaf	AXp1	Kintzios 2006
Origanum sipyleum L. [Lamiaceae]	--	Aerial parts	AXp1	Saranya *et al.* 2019
Origanum vulgare L. [Lamiaceae]	Oregano	Leaf	AXp1	Kintzios 2006
Oroxylum indicum (L.) Benth. ex Kurz [Bignoniaceae]	Sonapatta	Seed, root bark, leaf	AYp3	Om Prakash *et al.* 2013
Ouratea hexasperma (A.St.Hil.) Baill. [Ochnaceae]	--	Leaf, stem	AYp3	Kintzios 2006
Ouratea semiserrata (Mart. & Nees) Engl. [Ochnaceae]	--	Leaf, stem	AYp3	Kintzios 2006
Oxalis acetosella L. [Oxalidaceae]	Common wood sorrel	Whole plant	AXp2	Tariq *et al.* 2015
Oxalis corniculata L. [Oxalidaceae]	Creeping woodsorrel	Leaf	AXp2	Omara *et al.* 2020
Ozoroa insignis Delile [Anacardiaceae]	Currant resin tree	Stem, root	AYp3	Sawadogo *et al.* 2012
Paederia foetida L. [Rubiaceae]	Stinkvine	Leaf	AXp2	Pradhan *et al.* 2019, Pouyfung *et al.* 2022
Paeonia lactiflora Pall. [Paeoniaceae]	White peony	Root	AYp3	Kintzios 2006
Paeonia suffruticosa Andrews [Paeoniaceae]	Mûdân	Root bark, seed	AYp3	Kintzios 2006, Iqbal *et al.* 2017
Paepalanthus latipes Silveira. [Eriocaulaceae]	--	Aerial part	AYp3	Kintzios 2006
Panax bipinnatifidum Seem. [Araliaceae]	Feather-leaf bamboo ginseng	Root	AXp3	Dai *et al.* 2016
Panax japonicus C. A. Mey. [Araliaceae]	Japanese Ginseng	Root	AXp3	Dai *et al.* 2016
Panax ginseng C.A.Mey. [Araliaceae]	Ginseng	Root, leaf	Root: AXp3 Leaf: AYp3	Dai *et al.* 2016
Panax notoginseng (Burkill) F.H.Chen [Araliaceae]	Notoginseng.	Root	AXp3	Dai *et al.* 2016
Panax pseudoginseng Wall. [Araliaceae]	Himalayan ginseng	Root	AXp3	Iqbal *et al.* 2017
Panax quinquefolius L. [Araliaceae]	American ginseng	Root	AXp3	Kintzios 2006
Panax vietnamensis Ha & Grushv. [Araliaceae]	Vietnamese ginseng	Root	AXp3	Kintzios 2006
Paphiopedilum callosum (Rchb.f.) Roots [Orchidaceae]	Venus slipper Orchid	Root	AYp3	Œliwiñski *et al.* 2022
Paphiopedilum godefroyae (God.-Leb.) Stein [Orchidaceae]	Lady's slipper orchid	Root	AYp3	Œliwiñski *et al.* 2022
Paris polyphylla Smith [Melanthiaceae]	Himalayan paris	Rhizome	AXp3	Jain *et al.* 2016 Dai *et al.* 2016
Parthenium hysterophorus L. [Asteraceae]	Famine weed	Leaf, flower	AYp3T	Saranya *et al.* 2019, Sultana *et al.* 2014
Parkia biglobosa (Jacq.) R.Br. ex G.Don. [Fabaceae]	African locust bean	Stem bark	AYp3	Sawadogo *et al.* 2012
Passiflora caerulea L. [Passifloraceae]	Common passion flower	Flower, fruit	Fruit: AXp1 Flower: AYp3	Ashraf 2020
Passiflora edulis Sims. [Passifloraceae]	Passion fruit	Fruit	AXp1	He *et al.* 2020
Patrinia heterophylla Bunge [Caprifoliaceae]	Mu-Tou-Hu	Whole plant	AYp3	Sharma *et al.* 2011
Patrinia scabiosaefolia Fisch. ex Trev. [Caprifoliaceae]	Golden lace	Whole plant	AYp3	Sharma *et al.* 2011
Peaderia foetida L. [Rubiaceae]	Skunkvine	Leaf	AXp3	Desai *et al.* 2008
Peganum harmala L.[Nitrariaceae]	Wild rue	Root	AYp3T	Kooti *et al.* 2017
Peperomia pellucida Kunth [Piperaceae]	Pepper elder	Leaf	AXp3	Nataru *et al.* 2014

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Pereskia bleo (Kunth) DC. [Cactaceae]	Rose cactus	Leaf	AYp3	Zareisedehizadeh *et al.* 2014
Perilla frutescens (L.) Britton [Lamiaceae]	Beefsteak plant	Leaf, oil	AXp3	Jain *et al.* 2016
Periploca aphylla Decne. [Apocynaceae]	Leafless silk flower shrub	Plant juie on skin tumors	AYp3	Tariq *et al.* 2015
Peristrophe bicalyculata (Retz) Nees [Acanthaceae]	Panicled foldwing	Aerial parts	AYp3	Jain *et al.* 2016
Persea americana Mill. [Lauraceae]	Avocado	Fruit	AXp1	Falodun *et al.* 2013
Pfaffia paniculata (Mart.) Kuntze [Amaranthaceae]	Brazilian ginseng	Root	AXp3	Sultana *et al.* 2014
Phagnalon rupstre (L.) DC. [Asteraceae]	Foddia	Aerial parts	AYp3	Saranya *et al.* 2019
Phaius mishmensis Rchb. [Orchidaceae]	--	Whole plant	AYp3	Œliwiñski *et al.* 2022
Phaleria macrocarpa (Scheff.) Boerl. [Thymelaeaceae]	God's crown	Fruit	AYp3	Sharma *et al.* 2011
Phaseolus acutifolius A.Gray [Fabaceae]	Tepary bean	Seed	AXp2	Iqbal *et al.* 2017
Phaseolus vulgaris L. [Fabaceae]	Kidney Breans	Bean, seed	AXp2	Jain *et al.* 2016
Phoenix dactylifera L. [Arecaceae]	Date palm	Fruit	AXp2	Abu-Darwish and Efferth 2018
Pholidota chinensis Lind. [Orchidaceae]	--	Whole plant	AYp3	Œliwiñski *et al.* 2022
Phyllanthus acuminatus Vahl [Phyllanthaceae]	Jamaican gooseberry	Fruit	AXp2	Kintzios 2006
Phyllanthus amarus Schumach. & Thonn. [Phyllanthaceae]	Seed on the leaf	Root, aerial part	AYp3	Desai *et al.* 2008
Phyllanthus emblica L. [Phyllanthaceae]	Indian gooseberry	Fruit	AXp2	Kuruppu *et al.* 2019, Saranya *et al.* 2019
Phyllanthus urinaria L. [Phyllanthaceae]	Stone breaker	Root, aerial part	AYp3	Kintzios 2006
Phyllanthus polyphyllus Willd. [Phyllanthaceae]	--	Leaf	AYp3	Nataru *et al.* 2014
Physalis alkekengi L. [Solanaceae]	Bladder cherry	Fruit	Ripe fruit: AXp1 Unripe fruit: AYp3	Kooti *et al.* 2017
Physalis peruviana L. [Solanaceae]	Goldenberry	Friut	AXp1	Yu *et al.* 2021
Phytolacca americana L. [Phytolaccaceae]	American pokeweed	Whole plant	AYp3T	Dai *et al.* 2016
Picrorhiza kurroa Royle ex Benth. [Plantaginaceae]	Kutki	Rhizome	AXp2	Saranya *et al.* 2019
Piper betle L. [Piperaceae]	Betel	Leaf	AXp2	Manoharan and Kaur 2013
Piper capense L.f. [Piperaceae]	African long pepper	Berry	AXp2	Sawadogo *et al.* 2012
Piper longum L. [Piperaceae]	Long pepper	Fruit	AXp2	Saranya *et al.* 2019
Piper regnelli (Miq.) C.DC. [Piperaceae]	Pariparoba	Fruit	AXp2	Saranya *et al.* 2019
Piper nigrum L. [Piperaceae]	Black pepper	Fruit	AXp2	Jain *et al.* 2016
Pisum sativum L. [Fabaceae]	Pea	Fruit	AXp2	Iqbal *et al.* 2017
Pithecellobium dulce (Roxb.) Benth [Fabaceae]	Monkeypod tree	Fruit	AXp2	Dhanisha *et al.* 2022
Plantago major L. [Plantaginaceae]	Broadleaf plantain	Whole plant	AXp3	Tariq *et al.* 2015
Plantago lanceolata L. [Plantaginaceae]	Narrowleaf plantain	Leaf	AXp3	Abu-Darwish and Efferth 2018
Plumbago zeylanica L. [Plumbaginaceae]	Wild leadwort	Whole plant	AYp3	Jain *et al.* 2016
Platycodon grandiflorus (Jacq.) A.DC. [Campanulaceae]	Balloon flower	Root	AYp3	Jain *et al.* 2016
Plectranthus stocksii Hook. f. [Lamiaceae]	--	Leaf, stem	AYp3	Saranya *et al.* 2019
Pleurotus sajor-caju (Fr.) Fr. [Polyporaceae]	--	Fruiting bodies	AYp3	Iqbal *et al.* 2017

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Plumeria rubra L. [Apocynaceae]	Red-jasmine	Leaf, bark, flower	AYp3T	Kintzios 2006
Podocarpus macrophyllus (Thunb.) Sweet [Podocarpaceae]	Buddhist pine	Fruit, stem bark	Fruit: AXp1 Stem bark: AYp3	Pratiwi and Nurlaeni 2020
Podophyllum hexandrum Royle [Berberidaceae]	Himalayan may apple	Root, rhizome, leaf	AYp3T	Sakarkar and Deshmukh 2011, Tariq *et al.* 2015
Podophyllum peltatum L. [Berberidaceae]	American mandrake	Leaf, Rhizome	AYp3T	Ashraf 2020, Umadevi *et al.* 2013
Polanisia dodecandra (L.) DC [Cleomaceae]	Clammy weed	Aerial part	AYp3	Kintzios 2006
Polianthes tuberosa L. [Asparagaceae]	Tuberose, Rajanigandha	Leaf, tuber	AYp3	Hafeez *et al.* 2020
Polyathia barnesii Merr. [Annonaceae]		Leaf, flower, fruit, bark	AYp3	Kintzios 2006
Polygala vulgaris L. [Polygalaceae]	Common milkwort	Aerial part, root	AYp3	Kintzios 2006
Polygonum aviculare L. [Polygonaceae]	Common knotgrass	Aerial part	AYp3	Kooti *et al.* 2017
Polygonum cuspidatum Siebold & Zucc. [Polygonaceae]	Japanese knotweed	Whole plant, root	AYp3	Sharma *et al.* 2011
Polygonum multiflorum Thunb. [Polygonaceae]	Chinese knotweed	Root	AYp3	Sultana *et al.* 2014
Polygonatum kingianum Coll. & Hems [Asparagaceae]	Orange solomon's seal	Rhizome, root	AYp3	Dai *et al.* 2016
Polygonatum multiflorum (L.) All. [Asparagaceae]	Solomon's seal	Whole plant	AYp3	Sharma *et al.* 2011
Polygonatum odoratum (Mill.) Druce [Asparagaceae]	Scented Solomon's seal	Rhizome	AYp3	Tariq *et al.* 2015
Polygonatum verticillatum (L.) All. [Asparagaceae]	Whorled Solomon's seal	Rhizome	AYp3	Tariq *et al.* 2015
Populous alba L. [Salicaceae]	Silver poplar	Flower	AYp3	Saranya *et al.* 2019
Portulaca oleracea L. [Portulacaceae]	Pursley	Aerial part	AXp2	de Souza *et al.* 2022
Potentilla chinensis Ser. [Rosaceae]	Chinese cinquefoil	Whole plant	AYp3	Sharma *et al.* 2011
Potentilla fulgens Wall. ex Hook. [Rosaceae]	Himalayan Cinquefoil	Root	AYp3	Tariq *et al.* 2015
Pouteria sapota (Jacq.) H. E. Moore & Stearn [Sapotaceae]	Mamey sapote	Fruit, Leaf	Fruit: AXp1 Leaf: AYp3	Torres *et al.* 2011, Prabhu *et al.* 2018
Prunella vulgaris L. [Lamiaceae]	Common self-heal	Aerial part	AXp2	Dai *et al.* 2016
Prunus africana (Hook.f.) Kalkman [Rosaceae]	African cherry	Leaf, bark	AYp3	Sharma *et al.* 2011, Omara *et al.* 2020
Prunus armeniaca L. [Rosaceae]	Armenian plum, Apricot	Plum	AXp1	Khan *et al.* 2020
Prunus avium L. [Rosaceae]	Wild cherry	Fruit	AXp1	Fonseca *et al.* 2021
Prunus cerasus L. [Rosaceae]	Sour cherry	Fruit	AXp1	Sheikh *et al.* 2022
Prunus domestica L. [Rosaceae]	European plum, Alubokhra	Fruit	AXp1	Sharma *et al.* 2011
Prunus persica (L.) Stokes [Rosaceae]	Peach	Fruit	AXp1	Ravi Kant *et al.* 2018
Prunus virginiana L. [Rosaceae]	Bitter-berry	Fruit	AXp1	Téllez-Pérez *et al.* 2020
Psidium cattleianum Sabine [Myrtaceae]	Cherry guava	Fruit	AXp1	Roy and Bharadvaja 2017
Psidium guajava L. [Myrtaceae]	Common guava	Fruit	AXp1	Manoharan and Kaur 2013

Plant name [Family]	Common Name	Parts used	Category	Reference of use
Psoralea corylifolia L. [Fabaceae]	Babchi	Seed	AYp3	Ashraf 2020
Pseudolarix kaempferi Gordon [Pinaceae]	Golden larch	Bark	AYp3	Kintzios 2006
Psychotria rubra (Lour.) Poir. [Rubiaceae]	Chacruna	leaf, root, bark rhizome	AYp3	Kintzios 2006
Psychotria forsteriana A.Gray [Rubiaceae]	--	Leaf	AYp3	Kintzios 2006
Pteris multifida Poir. [Pteridaceae]	Spider brake	Whole plant	AYp3	Sharma *et al.* 2011
Pterocarpus marsupium Roxb. [Fabaceae]	Indian kino	Bark, lesf, flower	AYp3	Chakraborty *et al.* 2010, Sufiyan 2016
Pterocephalus pulverulentus Boiss. [Caprifoliaceae]	--	Aerial parts	AYp3	Saranya *et al.* 2019
Pulsatilla chinensis (Bunge) Regel [Ranunculaceae]	Bái tóu wêng	Aerial part	AYp3	Dai *et al.* 2016
Pulsatilla koreana Nakai ex Mori. [Ranunculaceae]	Korean pasque flower	Flower	AYp3	Kintzios 2006
Pulicaria crispa Forssk. [Asteraceae]	Githjath	Aerial parts	AYp3	Abu-Darwish and Efferth 2018
Punica granatum L. [Lythraceae]	Pomegranate	Fruit	AXp1	Abu-Darwish and Efferth 2018, Ghosh *et al.* 2020
Pupalia lappacea (L.) Juss. [Amaranthaceae]	Forest burr	Aerial parts	AYp3	Nataru *et al.* 2014
Pyrus communis L. [Rosaceae]	Common pear	Fruit	AXp1	Kolniak-Ostek *et al.* 2020
Pyrus malus Mill. [Rosaceae]	Wild apple	Fruit, Bark	Fruit: AXp1 Bark: AYp3	Sharma *et al.* 2011
Quercus calliprinos Webb [Fagaceae]	Common oak	Bark, fruit	AYp3	Abu-Darwish and Efferth 2018
Rabdosia rubescens (Hemsl.) H.Hara [Lamiaceae]	Dong Ling Cao	Root	AYo3	Khan *et al.* 2020
Rabdosia macrophylla (Migo) C.Y.Wu & H.W.Li. [Lamiaceae]	--	Root, aerial part	AYo3	Kintzios 2006
Rabdosia ternifolia (D.Don) H.Hara. [Lamiaceae]	Three leaf isodon	Aerial part	AYo3	Kintzios 2006
Rabdosia trichocarpa (Maxim.) H.Hara [Lamiaceae]	--	Leaf	AYo3	Kintzios 2006
Raphanus raphanistrum L. [Brassicaceae]	White charlock	Leaf	AXp2	Abu-Darwish and Efferth 2018
Raphanus sativus L. [Brassicaceae]	Radish	Whole plant	AXp2	Pocasap *et al.* 2017
Rhizophora apiculata Blume [Rhizophoraceae]	Bakhaw lalaki	Whole plant	AYp3	Jain *et al.* 2016
Rhazya stricta Decne. [Apocynaceae]	--	Aerial parts, seeds	AYp3T	Abu-Darwish and Efferth 2018
Rhinacanthus nasutus (L.) Kurz [Acanthaceae]	Snake jasmine	Seed, root, leaf	AYp3	Roy and Bharadvaja 2017
Rhodiola rosea L. [Crassulaceae]	Golden root	Leaf, shoot, root	Leaf, shoot: AXp2 Root: AYp3	Sharma *et al.* 2011
Rhus chinensis Mill. [Anacardiaceae]	Nutgall tree	Gall, leaf	AYp3	Nataru *et al.* 2014
Rhus coriaria L [Anacardiaceae]	Sumac	Fruit	AXp2	Gabr and Alghadir 2021
Rhus succedanea L. [Anacardiaceae]	Wax tree	Leaf	AYp3	Kintzios 2006
Ribes rubrum L. [Grossulariaceae]	Red currant	Fruit	AXp1	Ç?nar Ayan *et al.* 2021
Ricinus communis L. [Euphorbiaceae]	Castor oil plant	Seed	AYp3	Abu-Darwish and Efferth 2018
Rosa damascena Mill [Rosaceae]	Damask rose	Flower, seed	AYp3	Kooti *et al.* 2017, Saranya *et al.* 2019

Plant name [Family]	Common Name	Parts used	Category	Reference of use
Rosa roxburghii Tratt [Rosaceae]	Chestnut rose	Fruit, flower	Fruit: AXp1 Flower: AYp3	Sultana *et al.* 2014
Rosmarinus officinalis Spenn. [Lamiaceae]	Rosemary	Leaf	AXp2	Jain *et al.* 2016
Rubia akane Nakai [Rubiaceae]	--	Whole plant, root	AYp3	Kintzios 2006, Sharma *et al.* 2011
Rubia cordifolia L. [Rubiaceae]	Indian madder	Root	AYp3	Jain *et al.* 2016, Kintzios 2006
Rubus aboriginum Rydb. [Rosaceae]	Garden dewberry	Fruit	AXp1	George *et al.* 2017
Rubus armeniacus Focke [Rosaceae]	Himalayan blackberry	Fruit	AXp1	Singh *et al.* 2023
Rubus chamaemorus L. [Rosaceae]	Cloudberries	Fruit	AXp1	Päivärinta 2017
Rubus chingii Hu [Rosaceae]	Raspberry	Fruit	AXp1	Dai *et al.* 2016
Rubus ellipticus Sm. [Rosaceae]	Golden Himalayan raspberry	Leaf, root, fruit	Fruit: AXp1 Others: AYp3	George *et al.* 2015, Karn *et al.* 2022
Rubus fruticosus L. [Rosaceae]	Blackberry	Fruit	AXp1	Verma *et al.* 2014
Rubus idaeus L. [Rosaceae]	Red raspberry	Fruit, root, leaf	Fruit: AXp1 Others: AYp3	Sharma *et al.* 2011
Rubus occidentalis L. [Rosaceae]	Black raspberry	Fruit	AXp1	Kula and Krauze-Baranowska 2016
Ruta graveolens L. [Rutaceae]	Common rue	Leaf	AXp2	Saranya *et al.* 2019
Salvia hispanica L. [Lamiaceae]	Chia	Seed, leaf	Seed: AXp2 Leaf: AYp3	Om Prakash *et al.* 2013
Salvia hypargeia Fich. & Mey. [Lamiaceae]	Turkish mountain sage	Aerial parts	AXp2	Saranya *et al.* 2019
Salvia miltiorrhiza Bunge [Lamiaceae]	Red sage	Root	AXp2	Om Prakash *et al.* 2013
Salvia officinalis L. [Lamiaceae]	Common sage	Leaf, stem	AXp2	Saranya *et al.* 2019
Salvia pinardi Boiss. [Lamiaceae]	--	Aerial parts	AYp3	Saranya *et al.* 2019
Saliva przewalskii Maxim [Lamiaceae]	Sage Przewalskii	Rhizome	AYp3	Kintzios 2006
Salvia sclarea L. [Lamiaceae]	Clary sage	Leaf, oil	Leaf:AXp2 Oil: AYp3	Kintzios 2006
Sambucus nigra L. [Adoxaceae]	Elderberry	Fruit	AXp1	Banach *et al.* 2021, M³ynarczyk *et al.* 2018
Sanguisorba officinalis L. [Rosaceae]	Great burnet	Leaf, flower, root	AYp3	Dai *et al.* 2016
Sansevieria ehrenbergii Schweinf. ex Baker [Asparagaceae]	East African wild sisal	Leaf, fruit	AYp3	Pettit *et al.* 2005
Saraca indica L. [Fabaceae]	Asoka tree	Leaf, bark	AXp3	Manoharan and Kaur 2013
Saussurea lappa (Decne.) Sch.Bip. [Asteraceae]	Indian costus, Kuth	Root	AXp3	Jain *et al.* 2016
Sarcopoterium spinosum (L.) Spach [Rosaceae]	Thorny burnet	Root	AYp3	Abu-Darwish and Efferth 2018
Saururus chinensis (Lour.) Baill. [Saururaceae]	Asian lizard's tail	Root	AYp3	Saranya *et al.* 2019
Schizophyllum commune Fr. [Schizophyllaceae]	Split gill	Fruiting bodies	AYp3	Ashraf 2020
Scilla natalensis Planch. [Hyacinthaceae]	Blue hyacinth	Bulb	AYp3	Sharma *et al.* 2011
Scilla peruviana L. [Hyacinthaceae]	Portuguese squill	Bulb	AYp3T	Kintzios 2006
Scilla scilloides (Lindl.) Druce [Hyacynthaceae]	Japanese jacinth	Bulb	AXp3	Kintzios 2006
Scrophularia nodosa L. [Scrophulariaceae]	Common figwort	Aerial part	AYp3	Sharma *et al.* 2011

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Scorzonera tomentosa L. [Asteraceae]	--	Aerial parts	AYp3	Saranya *et al.* 2019
Scurrula parasitica L. [Loranthaceae]	Cinnamon Mistletoe	Leaf	AYp3	Khan *et al.* 2020
Scutellaria baicalensis Georgi [Lamiaceae]	Baikal skullcap	Root	AYp3	Roy and Bharadvaja 2017
Scutellaria barbata D.Don. [Lamiaceae]	Barbed skullcap	Whole plant	BYp3	Sharma *et al.* 2011
Scutellaria integrifolia L. [Lamiaceae]	Helmet skullcap	Leaf, stem, root	AYp3	Om Prakash *et al.* 2013, Nataru *et al.* 2014
Scutellaria lateriflora L. [Lamiaceae]	Blue skullcap	Leaf, stem, root	AYp3	Kintzios 2006
Scutellaria ocmulgee Small [Lamiaceae]	Ocmulgee Skullcap	Leaf, root	AYp3	Kintzios 2006
Scutellaria scandens Buch-Ham [Lamiaceae]	Climbing skullcap	Leaf, stem, root	AYp3	Kintzios 2006
Sechium edule (Jacq.) Sw. [Cucurbitaceae]	Choko	Fruit	AXp2	Salazar-Aguilar *et al.* 2017
Selenicereus costaricensis (F.A.C.Weber) S.Arias & N.Korotkova [Cactaceae]	Red-fleshed pitaya/ dragon fruit	Fruit	AXp1	Ibrahim *et al.* 2018
Selenicereus megalanthus (K.Schum. ex Vaupel) Moran [Cactaceae]	Yellow pitahaya/ Dragon fruit	Fruit	AXp1	Joshi and Prabhakar 2020
Selenicereus undatus (Haworth) D. R. Hunt [Cactaceae]	White-fleshed pitahaya/dragon fruit	Fruit	AXp1	Luu *et al.* 2021
Semecarpus anacardium L. [Anacardiaceae]	Marking nut	Nut	AYp3T	Sharma *et al.* 2011, Tariq *et al.* 2015
Senecio scandens Buch.-Ham. ex D. Don [Asteraceae]	Climbing senecio	Leaf	AYp3	Saranya *et al.* 2019
Serenoa repens (Bartram) J. K. Smal [Arecaceae]	Saw palmetto	Berries	AXp1	Pratiwi and Nurlaeni 2020
Seseli mairei H. Wolff. [Apiaceae]	--	Aerial part	AYp3	Kintzios 2006
Silybum marianum (L.) Gaertn. [Asteraeae]	Milk thistle	Aerial part	AXp3	Kooti *et al.* 2017
Sinapis arvensis L. [Brassicaceae]	Wild mustard	Leaf	AXp2	Abu-Darwish and Efferth 2018
Smilax aristolochiifolia Mill. [Smilacaceae]	Mexican sarsaparilla	Root	AYp3	Sharma *et al.* 2011
Smilax aspera L. [Smilacaceae]	Common smilax	Root	AYp3	Sharma *et al.* 2011
Smilax china L. [Smilacaceae]	China root	Rhizome	AYp3	Sharma *et al.* 2011
Smilax glabra Roxb. [Smilacaceae]	Sarsaparilla	Rhizome	AYp3	Sharma *et al.* 2011
Smilax ornate Lem. [Smilacaceae]	Jamaican sarsaparilla	Rhizome	AYp3	Sharma *et al.* 2011
Smilax zeylanica L. [Smilacaceae]	Kumarika	Root, leaf	AYp3	Kuruppu *et al.* 2019
Solanum aculeastrum Dunal [Solanaceae]	Poison apple	Root bark, leaf, fruit	AYp3	Sharma *et al.* 2011
Solanum betaceum Cav. [Solanaceae]	Tamarillo	Fruit	AXp1	Das *et al.* 2019
Solanum indicum L. [Solanaceae]	Poison berry	Root	AYp3	Tariq *et al.* 2015
Solanum khasianum Clarke [Solanaceae]	Nightshad	Fruit	AYp3	Saranya *et al.* 2019
Solanum lycopersicum L. [Solanaceae]	Tomato	Fruit	AXp2	Ashraf 2020
Solanum lyratum Thunb. [Solanaceae]	Lyreleaf nightshade	Whole plant	AYp3	Sharma *et al.* 2011
Solanum nigrum L. [Solanaceae]	Black nightshade	Leaf, berry	AYp3	Ashraf 2020, Tariq *et al.* 2015
Solanum pseudocapsicum L. [Solanaceae]	Jerusalem cherry	Fruit, leaf, bark	AYp3T	Kintzios 2006
Sophora flavescens Aiton [Fabaceae]	Shrubby sophora	Root	AYp3T	Sharma *et al.* 2011, Jain *et al.* 2016
Sophora subprostrata Chun & H.Y.Chen. [Fabaceae]	--	Root	AYp3	Sharma *et al.* 2011
Spondias dulcis L. [Anacardiaceae]	Ambarella, Indian hog plum	Fruit	AXp1	Pechyen *et al.* 2022

Plant name [Family]	Common Name	Parts used	Category	Reference of use
Spondias mombin L. [Anacardiaceae]	Yellow mombin	Fruit	AXp1	Metibemu *et al.* 2020
Stachys cretica subsp. vacillans Rech.f. [Lamiaceae]	--	Aerial parts	AYp3	Saranya *et al.* 2019
Stellera chamaejasme L. [Thymelaceae]	Wolf poison	Root	AYp3T	Kintzios 2006
Stevia rebaudiana (Bertoni) Bertoni [Asteraceae]	Sugarleaf	Leaf	AXp3	Iqbal *et al.* 2017
Strobilanthes crispa Blume [Acanthaceae]	Pokok pecah kaca	Leaf	AXp3	Yap *et al.* 2017
Strophanthus divaricatus (Lour.) Hook. & Arn. [Apocynaceae]	--	Seed, leaf	AYp3	Dai *et al.* 2016
Strychnos nuxvomica L. [Loganiaceae]	Strychnine tree	Seed	AYp3T	Om Prakash *et al.* 2013
Swertia chirayita (Roxb. ex Fleming) H. Karst. [Gentianaceae]	Chirayta	Leaf, stem	AXP3	Saha *et al.* 2004, Ahmad *et al.* 2021
Syringa emodi Wall. [Oleaceae]	Himalayan lilac	Leaf	AYp3	Tariq *et al.* 2015
Syringa vulgaris L. [Oleaceae]	Common lilac	Aerial parts, seeds	AXp3	Saranya *et al.* 2019
Syzygium aromaticum (L.) Merr. & L.M.Perry [Myrtaceae]	Clove	Flower	AXp2	Nataru *et al.* 2014
Syzygium cumini (L.) Skeels [Myrtaceae]	Black plum	Fruit, seed, young leaf	Fruit: AXp1 Others: AXp3	Saranya *et al.* 2019
Syzygium jambos L. (Alston) [Myrtaceae]	Rose apple, Golap jaam	Fruit	AXp1	Kintzios 2006
Tabebuia avellanedae Lorentz ex Griseb. [Bignoniaceae]	Pink trumpet tree	Bark	AYp3	Jain *et al.* 2016
Tacca chantrieri Andre [Dioscoreaceae]	Black bat flower	Tuberous root	AYp3	Pratiwi and Nurlaeni 2020
Tamarindus indica L. [Fabaceae]	Tamarind	Leaf, fruit	AXp2	Kintzios 2006
Taraxacum mongolicum Hand.-Mazz. [Asteraceae]	Dandelion	Whole plant	AXp2	Sharma *et al.* 2011, Tariq *et al.* 2015
Taraxacum officinale (L.) Weber ex F.H. Wigg. [Asteraceae]	Common dandelion	Whole plant	AXp2	Jain *et al.* 2016
Taverniera spartea (Burm.f.) DC [Leguminosae]	--	Aerial part	AYp3	Kooti *et al.* 2017
Taxus baccata L. [Taxaceae]	Common yew	Bark, leaf	AYp3T	Kooti *et al.* 2017
Taxus brevifolia Nutt. [Taxaceae]	Pacific Yew	Bark	AYp3T	Sharma *et al.* 2011
Taxus marei (Lemée & H.Lév.) S.Y.Hu [Taxaceae]	Maire's yew	Leaf, bark	AYp3	Kintzios 2006
Taxus sumatrana (Miquel) de Laub. [Taxaceae]	Taiwan yew	Bark	AYp3	Darmin *et al.* 2020
Taxus wallichiana Zucc. [Taxaceae]	Himalayan yew,	Leaf and stem bark extrat	AYp3T	Jain *et al.* 2016, Tariq *et al.* 2015
Tecoma stans (L.) Juss. ex Kunth [Bignoniaceae]	Yellow elder	Leaf, flower	AYp3	Saranya *et al.* 2019
Terminalia arjuna (Roxb.) Wight & Arn. [Combretaceae]	Arjun tree	Bark	AXp3	Kintzios 2006
Terminalia chebula Retz. [Combretaceae]	Chebulic myrobalan	Fruit pericap	AXp3	Om Prakash *et al.* 2013
Teucrium polium L. [Lamiaceae]	Felty germander	Leaf, stem, aerial parts Seed	AYp3	Abu-Darwish and Efferth 2018, Saranya *et al.* 2019
Teucrium sandrasicum O.Schwarz. [Lamiaceae]	--	Aerial parts	AYp3	Saranya *et al.* 2019
Thalictrum minus L. [Ranunculaceae]	Lesser meadow-rue	Leaf, root	AYp3	Dai *et al.* 2016

Plant name [Family]	Common Name	Parts used	Category	Reference of use
Thespesia populnea (L.) Sol. ex Corrêa [Malvaceae]	Indian tulip tree	Bark, leaf	AYp3	Kuruppu *et al.* 2019
Thuja occidentalis L. [Cupressaceae]	Arborvitae	Whole plant	AYp3	Sharma *et al.* 2011
Thujopsis dolabrata (Thunb.) Siebold & Zucc. [Cupressaceae]	False arborvitae	Leaf	AYp3	Kintzios 2006
Tillandsia recurvata L. [Bromeliaceae]	Small ballmoss	Whole plant	AYp3	Saranya *et al.* 2019
Tinospora cordifolia (Thunb.) Miers [Menispermaceae]	Giloy	Stem, leaf	Stem: AXp3 Leaf: AYp3	Kuruppu *et al.* 2019
Tinospora crispa (L.) Hook. f. & Thomson [Menispermaceae]	Banndol Pech	Stem, root, leaf	AYp3	Ahmad *et al.* 2016
Tinospora sinensis (Lour) Merr. [Menispermaceae]	Chinese tynospora	Stem, leaf	BYn3	Badavenkatappa gari *et al.* 2023
Thymbra spicata L. [Lamiaceae]	Mediterranean thyme	Aerial part	AXp2	Kooti *et al.* 2017
Thymus vulgaris L. [Lamiaceae]	Common thyme	Whole plant	AXp2	Saranya *et al.* 2019, Sharma *et al.* 2011
Toona sinensis (A.Juss.) M.Roem. [Meliaceae]	Chinese mahogany	Young leaf	AXp2	Pratiwi and Nurlaeni 2020
Trapa natans L. [Lythraceae]	Water caltrop	Fruit kernels	AXp1	Tariq *et al.* 2015
Trichelia emetica Vahl. [Meliaceae]	Natal mahogany	Leaves, root, stem bark	AYp3	Sawadogo *et al.* 2012
Tridax procumbens L. [Asteraceae]	Coat buttons	Leaf	AXp3	Vishnu priya and Rao 2015
Trifolium pratense L. [Fabaceae]	Red clover	Flower	AXp3	Sharma *et al.* 2011
Trifolium stellatum L. [Fabaceae]	Star clover	Aerial parts	AYp3	Abu-Darwish and Efferth 2018
Trigonella foenum-graecum L. [Fabaceae]	Fenugreek	Seed, leaf	AXp2	Kooti *et al.* 2017
Tripterygium wilfordii Hook.f. [Celastraceae]	Thunder god vine	Root	AYp3T	Khan *et al.* 2020
Triumfetta rhomboidea Jacq. [Malvaceae]	Diamond burbark	Leaf	AXp3	Nataru *et al.* 2014
Tropaeloum majus L. [Tropaeolaceae]	Garden nasturtium	Leaf, flower	AXp3	Kintzios 2006
Tulbaghia violacea Harv. [Amaryllidaceae]	Society garlic	Bulb, leaf, flower	AXp3	Sharma *et al.* 2011
Tussilago farfara L. [Asteraceae]	Colts foot	Leaf	AXp3	Khan *et al.* 2020
Tylophora indica (Burm. f.) Merr. [Asclepiadaceae]	Indian ipecac	Leaf, bark, kernel, fruit, root	AYp3	Kooti *et al.* 2017, Umadevi *et al.* 2013
Urtica dioica L. [Urticaceae]	Common nettle	Leaf	AXp2	Kooti *et al.* 2017, Abu-Darwish and Efferth 2018
Urtica pilulifera L. [Urticaceae]	Roman nettle	Leaf	AXp2	Abu-Darwish and Efferth 2018
Urtica urens L. [Urticaceae]	Small nettle	Leaf	AXp2	Abu-Darwish and Efferth 2018
Vaccinium bracteatum Thunb [Ericaceae]	Asiatic bilberry	Fruit	AXp1	Tsuda *et al.* 2013
Vaccinium corymbosum L [Ericaceae]	Highbush blueberry	Fruit	AXp1	Pan 2019
Vaccinium macrocarpon Aiton. [Ericaceae]	Large cranberry	Fruit	AXp1	Jain *et al.* 2016, Kintzios 2006
Vaccinium myrtillus L. [Ericaceae]	Bilberry	Fruit	AXp1	Karakaº *et al.* 2022
Vaccinium oldhamii Miq. [Ericaceae]	Japanese blueberry	Fruit	AXp1	Tsuda *et al.* 2013
Vaccinium oxycoccos L. [Ericaceae]	Small cranberry	Fruit	AXp1	Masoudi and Saiedi 2017
Vaccinium smallii A.Gray. [Ericaceae]	--	Fruit, leaf	Fruit: AXp1 Leaf: AYp1	Kintzios 2006
Vaccinium stamineum L. [Ericaceae]	Deer berry	Fruit	AXp1	Umadevi *et al.* 2013
Vaccinium virgatum Aiton [Ericaceae]	Rabbit-eye blueberry	Fruit	AXp1	Tsuda *et al.* 2013, da Silveira 2022

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Plant name [Family]	Common Name	Parts used	Category	Reference of use
Vaccinium vitis-idaea L. [Ericaceae]	Lingonberry	Fruit	AXp1	Zhu *et al.* 2022
Varthemia iphionoides Boiss. [Asteraceae]	--	Leaf	AYp3	Abu-Darwish and Efferth 2018
Vanda cristata Wall. ex Lindl. [Orchidaceae]	Comb Vanda	Aerial parts	AYp3	Œliwiñski *et al.* 2022
Vanda tessellata Hook. Ex G.Don [Orchidaceae]	Grey orchid	Root	AYp3	Œliwiñski *et al.* 2022
Verbascum sinaticum Benth. [Scrophulariaceae]	Mullein	Flowers, aerial parts	AXp3	Saranya *et al.* 2019
Verbascum thapsus L. [Scrophulariaceae]	Great mullein	Leaf, flower	AXp3	Tariq *et al.* 2015
Vernonia amygdalina Delile [Asteraceae]	Bitter leaf	Leaf	AXp3	Om Prakash *et al.* 2013
Vernonia cinerea (L.) Less. [Asteraceae]	Little ironweed	Whole plant	AYp3	Tariq *et al.* 2015
Viburnum odoratissimum Ker Gawl [Adoxaceae]	Sweet viburnum	Seed, leaf, flower	AYp3	Pratiwi and Nurlaeni 2020
Viburnum sambucinum Reinw. ex Blume [Adoxaceae]	--	Leaf	AYp3	Pratiwi and Nurlaeni 2020
Vicia faba L. [Fabaceae]	Faba bean	Seed	AXp2	Iqbal *et al.* 2017
Vigna unguiculata (L.) Walp. [Fabaceae]	Cowpea	Seed	AXp2	Iqbal *et al.* 2017
Viola odorata L. [Violaceae]	Common violet	Flower	AXp3	Kintzios 2006
Viola tricolor L. [Violaceae]	Wild pansy	Aerial part	AXp3	Kooti *et al.* 2017
Viscum album L. [Santalaceae]	Common mistletoe	Leaf, fruit	AYp3T	Iqbal *et al.* 2017
Viscum alniformosanae Hayata. [Santalaceae]	--	Berry, leaf, stem	AYp3	Kintzios 2006
Viscum cruciatum Sieber ex Boiss. [Santalaceae]	Red-berry mistletoe	Leaf	AYp3T	Abu-Darwish and Efferth 2018
Vitellaria paradoxa C.F.Gaertn. [Sapotaceae]	Shea tree	Seed, root, stem bark	Seed: AXp3 Others: AYp3	Sawadogo *et al.* 2012
Vitex agnus-castus L. [Verbenaceae]	Chaste tree	Leaf, tender stem, flower, ripening seed	AXp3	Abu-Darwish and Efferth 2018
Vitex fischeri G¨urke [Lamiaceae]	--	Leaf	AYp3	Omara *et al.* 2020
Vitex negundo L. [Lamiaceae]	Nisinda	Whole plant, fruit	AXp3	Das *et al.* 2020
Vitex rotundifolia L.f. [Lamiaceae]	Roundleaf chastetree	Whole plant	AXp3	Sharma *et al.* 2011
Vitex trifolia L. [Lamiaceae]	Simple leaf chastetree	Leaf	AYp3	Umadevi *et al.* 2013
Vitis vinifera L. [Vitaceae]	Grape vine	Stem, seed, fruit	Fruit: AXp1 Others: AYp3	Saranya *et al.* 2019
Wedelia chinensis (Osbeck) Merr. [Asteraceae]	Bhringaraj	Aerial part	AXp3	Khan *et al.* 2020
Wikstroemia indica (L.) C.A.Mey. [Thymelaceae]	Indian stringbush	Aerial part	AYp3T	Kintzios 2006, Kaur *et al.* 2011
Wikstroemia uva-ursi Gray [Thymelaceae]	Bearberry	Aerial part	AYp3	Kintzios 2006
Withania coagulans (Stocks) Dunal [Solanaceae]	Vegetable rennet	Fruit, flower, leaf	AYp3	Saranya *et al.* 2019
Withania somnifera (L.) Dunal [Solanaceae]	Ashwagandha	Leaf, root	AYp3	Abu-Darwish and Efferth 2018, Saranya *et al.* 2019
Woodfordia fruticosa (L.) Kurz [Lythraceae]	Fire flame bush	Flower, Leaf	Flower: AXp2 Leaf: AYp3	Sultana *et al.* 2014, Tariq *et al.* 2015
Xanthium strumarium L. [Asteraceae]	Rough cocklebur	Root	AYp3T	Ashraf 2020, Tariq *et al.* 2015

Plant name [Family]	Common Name	Parts used	Category	Reference of use
Ximenia americana L. [Olacaceae]	Yellow plum	Bark, leaf, root	AYp3	Sawadogo *et al.* 2012
Xylocarpus granatum K.D.Koenig [Meliaceae]	Cedar mangrove	Leaf, fruit	AYp3	Dey *et al.* 2021, Darmadi *et al.* 2021,
Xylopia aethiopica (Dunal) A. Rich. [Annonaceae]	Ethiopian pepper	Bark, fruit	Fruit: AXp2 Bark: AYp3	Sawadogo *et al.* 2012
Xylopia aromatica (Lam.) Mart. [Annonaceae]	Monkey pepper	Fruit, leaf, flower, bark	AYp3	Kintzios 2006
Yucca filamentosa L. [Asparagaceae]	Adam's needle and thread	Leaf, root	AYp3	Hafeez *et al.* 2020
Zanthoxylum chalybeum Engl. [Rutaceae]	--	Root, bark	AYp3	Omara *et al.* 2020
Zhumeria majdae Rech.f. & Wendelbo [Lamiaceae]	--	Whole plant	AYp3	Abu-Darwish and Efferth 2018
Zea mays L. [Poaceae]	Maize	Leaf	AYp3	Saranya *et al.* 2019
Zieridium pseudobtusifolium L. [Rutaceae]	--	Aerial part	AYp3	Kintzios 2006
Zingiber officinale Roscoe [Zingiberaceae]	Ginger	Rhizome	AXp2	Kooti *et al.* 2017 Kuruppu *et al.* 2019
Ziziphus mauritiana Lam. [Rhamnaceae]	Indian plum/ Ber	Leaf, bark, fruit	Fruit: AXp1 Others: AYp3	Iqbal *et al.* 2017
Ziziphus nummularia (Burm.f.) Wight & Arn. [Rhamnaceae]	Wild jujube	Fruit	AXp1	Desai *et al.* 2008
Ziziphus rugosa Lam. [Rhamnaceae]	Zunna berry	Pericarp, seed	Pericsap: AXp1 Seed: AYp3	Ashraf 2020
Ziziphus spina-christi (L.) Desf. [Rhamnaceae]	Christ's thorn jujube	Leaf, flower, fruit	Fruit: AXp1 Others: AYp3	Abu-Darwish and Efferth 2018
Ziziphus jujuba Mill. [Rhamnaceae]	Red date	Fruit, seed, leaf	Fruit: AXp1 Others: AYp3	Iqbal *et al.* 2017

CONCLUSION

Cancer is a slow-developing disease. The development of a suitable environment inside the body for cancers is perhaps a pre-requisite for at least most cancers, if not all. So, prevention of the development of a favorable environment for the development of cancers (and perhaps also for almost all other non-communicable as well as most communicable diseases) should be the main target to combat them.

The artificially synthesized chemicals can never be equal to or better than the natural ones, rather may be harmful in the long run. As the chemicals of synthetic origin and their companions are having chemical structures unknown to the body system throughout the evolutionary stages, so the body system may fail to recognize them properly, and more importantly, may fail to clear them effectively from the body completely in many cases. These may have a chance to gather at the tissue level, at least partially, and may act cumulatively to spoil the environment inside the body to make it suitable for the development of cancers, other NCDs as well as many communicable diseases.

To prevent the slow deterioration of a good body condition to a bad one, following of preventive measures on a regular basis is the most important way.

Following some designed lifestyle (excluding wrong food-drink-sleeping-working etc. style and addition of nature-based beneficial styles) is of utmost importance in this regard. Regular intake of plant-derived succulent fruits, nuts and edible succulent immunomodulators (vegetables, spices, etc.) in original or bio-encapsulated form, use of only actual herb-based healthcare products, etc. can prevent chances for the development of cancers. For more active prevention and treatment, the use of capsules of succulent biomedicines is perhaps the only option with nil or negligible side effect.

The succulent biomedicines can act as reverse to the synthetic chemicals and can also assist to alter the detoriated condition of the body to reduce the chance of development and progression of cancers to a large extent.

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