Screening of plant collection of Cibodas Botanic Gardens, Indonesia with anticancer properties

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Abstract. Pratiwi RA, Nurlaeni Y. 2020. Screening of plant collection of Cibodas Botanic Gardens, Indonesia with anticancer properties. Biodiversitas 21: 5186-5229. Cancer is a life-threatening disease worldwide. One approach to developing effective treatments in fighting cancerous cells is to obtain anticancer drug candidates from natural resources, such as plants. This study aimed to inventory and categorize plant collections in Cibodas Botanic Gardens (CBG), West Java, Indonesia that has anticancer properties in a detailed and comprehensive manner. Literature research was conducted in international scientific databases using several keywords expressing anticancer properties to produce list of plant species potential for anticancer. The results of this research were then cross-checked with the plant collection database of CBG. List of plants exhibits anticancer activities were then categorized based on the IC50 values (an indicator of cytotoxicity). Our result showed 291 species from 90 families of CBG plant collection harbor anticancer properties. Among them, 93, 100, 36, and 62 species have IC50 values under Class I (strong), Class II (moderate), Class III (inactive), and Class IV (insufficient IC50 data), respectively. The families with the highest number of potential anticancer plants are Lauraceae, Leguminosae, Meliaceae, Myrtaceae, Moraceae, Cupressaceae, Asparagaceae, Euphorbiaceae, Compositae, Clusiaceae, Lamiaceae, Apocynaceae, Adoxaceae, Amaryllidaceae, and Elaeocarpaceae. Species that have strong anticancer activities include Acacia farnesiana, Aglaia edulis, A. elliptica, A. silvestris, Artocarpus elasticus, Bauhinia strychnifolia, Buxus microphylla, Calophyllum soulattri, Cerbera manghas, Cocculus orbiculatus, Cryptocarya chinensis, C. komishi, C. laevigata, Dalbergia paviliora, Diospyros discolor, Erythrina abyssinica, Etingera elatior, Ficus fistulosus, Garcinia x mangostana, Hemerocallis fulva, Jatropha gossypifolia, Panax ginseng, Podocarpus macrophyllus, Psidium cattleianum, Sansevieria ehrenbergii, Taccia chantrieri, Toona sinensis, Viburnum odoratissimum, and V. Sambucinum. Even Serenoa repens and Taxus sumatrana contain active compounds that have been commercialized as anticancer drugs. The data resulted from this study can serve as baseline information for further research in drug discovery and development for anticancer treatments using living plant specimens collected in CBG. CBG has a great prospect of medicinal plants that require further studies for formulating anticancer drug as an alternative natural resource.

Keywords: Anticancer property, Cibodas Botanic Gardens, inhibitory concentration, plant metabolite secondary

INTRODUCTION

Cancer is the second leading cause of mortality globally after cardiovascular diseases. The International Agency for Research on Cancer (IARC) (2018) estimated the global cancer burden has risen to 18.1 million new cases and 9.6 million deaths in 2018. Indonesian Ministry of Health research data (Riskesdas) (2018) shows that the prevalence of cancer in Indonesia has increased from 1.4 to 1.8 cases per thousand of population in 2015 and 2018. By 2030, it is projected that there will be 26 million new cancer cases with 17 million deaths per year (Thun et al. 2010).

Considering cancer as a life-threatening disease worldwide, there is a continuing demand for developing treatments that are effective in fighting cancerous cells with less harmful than existing therapies. Solid tumors can be removed surgically, or by radiation treatment and chemotherapy that painful and induce toxic effects to patients. Drugs can be used as treatment for certain types of cancer, such as biological drugs, Herceptin, against breast cancer. However, the drug is very costly while the effectiveness is limited to certain kinds of tumors. Furthermore, it was found in many cases that the tumor can develop resistance to various drugs. Covering the problems, one approach is to obtain the anticancer drug candidates from secondary metabolite of natural resources, such as plants (Fridlender et al. 2015).

Utilizing plant as new drug resources in cancer treatment provides many advantages, including it is more cost-effective than developing synthetic compounds, faster discovery of new drugs, offering a holistic approach that complements the “silver bullets” of modern drug, and synergistic effects between the various compounds of the herbs give promising better healing effects overall (Fridlender et al. 2015). The natural products are also expected to build co-evolution against cancer cells so that the incidence of cancer drug resistance is expected to be minimal (Wang et al. 2015).

More than 3000 species of plant over the world have been reported to have anticancer properties (Solowey et al. 2014). The promising sources of anticancer properties from plants belong to various groups of compound, such as alkaloids, diterpenes, diterpenoquinone, purine-based compounds, lactonic sesquiterpene, peptides, cyclic depsipeptide, proteins, macrocyclic polyethers, and so on (Lichota et al. 2018). In searching for anticancer properties...
in plant, there is a long journey involving several steps that generally need to go through. Initially, plant-derived substances are discovered by botanists or ethnobotanists, ethnopharmacologists, or plant ecologists. Then, phytochemists identify the potential therapeutic activities through the isolation of active compounds and biological screening assays. Finally, the mode of action and relevant molecular targets are proven through molecular biology research (Lichota et al. 2018).

A complex set of ethnobotanical methods such as initial investigations, sample collections, and detailed records of the use a society makes of plants has been the starting point for many successful novel drug discovery projects. Ethnobotanists make information about this local knowledge and cultural practices available to bioscientists. The discovery of the proven anticancer drug Vincristine is an interesting history to reflect on it. Catharanthus roseus or known as Madagascar periwinkle has, since a long time ago, been used to treat various diseases traditionally, from minor symptoms such as headache to diabetes remedy. In 1960, Robert Noble and Charles Beer have isolated alkaloid vincristine from these ornamental plants. Further assay revealed that these ayurvedic plants exhibit a cytotoxic effect by microtubule dynamic inhibition, causing the mitotic spindle damage. Consequently, it inhibits mitosis and leading cancer cells to apoptosis (Lichota et al. 2018).

Cibodas Botanic Gardens (CBG) located in West Java has plant collection of 237 families, consisting of 949 genera, 1978 species, and 11428 plant living specimens (Registration and Collection Unit of CBG 2020; unpublished data). Such species have the potentials to be developed for various uses, such as fruit crops (Normasiwi and Surya 2016), sources of timber (Wahyuni et al. 2008), exudates (Muhammad and Nurlaeni 2018), natural dyes (Effeni et al. 2017), ornamental plants (Putri et al. 2019, unpublished data), and medicinal plants (Nikmatullah et al. 2019). Several medicinal plants are known to have potential properties as anticancer drug, including Taxus sumatrana which contains paclitaxel (Muhaimin 2016); Mentha x piperita and Rotheca serrata (Lamiaceae) (Handayani 2015); Frullania sp., Heteroscyphus argutus, Pogonatum cirratum, and Marchantia paleacea (Bryophyte) (Nadighfah et al. 2018); Alnus japonica, Garcinia parviflora, Gnetum gnemonoides, Mangifera edulis, Syzygium cf. discophorum, and Talinum paniculatum from Medicinal Thematic Garden (Nikmatullah et al. 2019). However, until 2019 there has been no comprehensive exploration of the CBG collection that demonstrates anticancer properties.

This research was conducted to inventory and categorize plant collections in CBG that harbor anticancer properties in a detailed and comprehensive manner. The data resulted from this study is expected to serve as baseline information for further research to assess plant secondary metabolites for anticancer treatments, including phytochemical profiling and extraction method, in vitro assay to cancer cell models, in vivo assay to animal models, in silico assay as treatment simulation, or plant tissue culture for anticancer metabolite production.

**MATERIALS AND METHODS**

**Study area**

This research conducted in Cibodas Botanic Gardens (CBG) located at Cianjur District, West Java, Indonesia. CBG is a botanical garden managed by the Indonesian Institute of Sciences (LIPI). Besides having an ex-situ conservation role, CBG also has the function of research and utilization of tropical floras, especially wet plateau plants. Data investigation regarding the potential of plants cytotoxicity against cancer was carried out through online reference searches.

** Procedures**

In order to collect information about plant cytotoxicity against cancer, we used keywords: "plant cytotoxicity", "herbs for cancer", "phytotoxicity", "plant-derived chemoprevention", "medicinal plant for cancer", "anticancer natural drug", "plants secondary metabolite for anticancer", "plants with anticancer property", and "IC50 of plant metabolite" in international databases, such as ScienceDirect, PubMed, and Scopus, and database of natural products and fractional extracts for cancer treatment that has been established by previous researchers, such as NPACT (Mangal et al. 2013) and NPCARE (Choi et al. 2017). Searches were limited to articles in English and Indonesian language with the research interval period from 1990 to 2020. The scientific name of the plant species mentioned in the references were recorded and verified for their existence in the CBG through the garden collection data. The compilation of plant database of CBG with anticancer properties was developed by completing the following data: family of plant, scientific name of plant species, vernacular name, cancer cell line, extraction method, IC50, reference, anticancer activity category, plant origin, conservation status, and locality at CBG. IC50 (50 percent Inhibitory Concentration) selected as the cytotoxic parameter in in vitro assay; as the initial procedure for screening anticancer drug candidates.

**Data analysis**

Potential anticancer plants were classified into four categories based on National Cancer Institute guidelines: Class I for plants with strong activity against cancer cell line, Class II for moderate activity, Class III for inactive and Class IV for plants with insufficient IC50 data but mentioned has anticancer compound in literature (Jabir et al. 2009, Alabsi et al. 2016). Class I was divided into four subclasses to observe the selectivity index: LA for plants that their pure extract (sub-fraction method) have IC50 ≤ 4 µg/ml against at least three cancer line cells, LB for pure extracts that have IC50 ≤ 4 µg/ml against one or two cancer line cell(s), LC for plants that their crude extract has IC50 ≤ 10 µg/ml against at least three cancer line cells, and LD for crude extracts that have IC50 ≤ 10 µg/ml against one or two cancer line cell(s). Then, Class II is for plants that pure or crude extract that has 10 > IC50 > 100 µg/ml and class III for IC50 ≥ 100 µg/ml. Plant species belonged to Class LA and not listed as threatened species according to The IUCN
Red List of Threatened Species™ assessment were recommended for further studies.

RESULTS AND DISCUSSION

Family distribution of plant with anticancer properties

We found 90 families that consisted of 291 species of the collection of CBG that have anticancer properties according to the literature research we conducted (for detailed information, see Table 3 in appendix section). The families with the largest number of species are as follows: Lauraceae (21 species), Leguminosae (20 species), Meliaceae (17 species), Myrtaceae (13 species), Moraceae (13 species), Cupressaceae (11 species), Asparagaceae (10 species), Euphorbiaceae (10 species), Compositae (9 species), Clusiaceae (8 species), Lamiaceae (8 species), Apocynaceae (7 species), Adoxaceae (6 species), Amaryllidaceae (6 species), and Elaeocarpaceae (6 species). The other 75 families consisted of less than five species of plant per family. The distribution of plant families that have anticancer properties from CBG is shown in Figure 1.

Plant categories based on their cytotoxic activities (IC₅₀)

Our result showed that based on cytotoxic activities (IC₅₀), plants belonged to Class I, II, III, and IV consisted of 93, 100, 36, and 62 species, respectively, or 32%, 34%, 13%, and 21% in percentage, respectively. Class I is divided into four subclasses: 30 species as I.A, 27 species as I.B, 12 species as I.C, and 24 species as I.D. The categories of plants based on their cytotoxicity against cancer cells are displayed in Figure 2 and the species are listed in Table 1.

Discussion

Among plant collection in Cibodas Botanic Garden, Lauraceae is the family consisting of the largest number of species with anticancer potential resources, dominated by the genus Cinnamomum, i.e. C. burmanii, C. camphora, C. cassia, C. iners, C. subvenament, and C. zeylanicum; Cryptocarya, including C. chinensis, C. costata, C. crassinervia, C. konishii, C. laevigata, and C. strictifolia; and Litsea, including L. cubeba, L. elliptica, L. garciae, L. mappacea, and L. monopetala. Actually, CBG still has another species of Cinnamomum collections (i.e. C. sintok, C. heyneanum, C. cultilawan, C. rhynchophyllum, C. javanicum, C. porrectum, and C. eymae); Cryptocarya (C. affinis, C. ferea, C. densilora, C. gigantocarpa, and C. vulgaris); and Litsea (L. ferruginea, L. lanceolata, L. grandis, L. javanica, L. tomentosa, L. cassiaefolia, L. firma, L. oppositifolia, L. noronhae, L. umbellata, L. deccanensis, L. insignis, L. grisea, L. castanea, L. accendetoides, L. deccanensis, L. leefeana, L. ochraceae, and L. diversifolia).

Considering seven species of Cinnamomum, six species of Cryptocarya, and five species of Litsea have the potency as anticancer with strong and moderate categories, it is possible that other species within these families have similar properties. However, there are no references yet that tested the anticancer potency from these species. Shen et al. (2014) stated that Lauraceae is a potential resource for nontoxic compounds that activate the nuclear factor erythroid 2-related factor 2/antioxidant response element (Nrf2/ARE) pathway. Nrf2 plays a key role in binding with ARE sequences then activates the transcription of many cytoprotective genes. Nrf2/ARE pathway induction has been recognized as strategy for blocking or slowing cancer premalignant tumors, so-called chemoprevention as defense mechanism (Shen et al. 2014).

Figure 1. The distribution of plant families that have anticancer properties from CBG collection

Figure 2. Plant categories based on their IC₅₀
| Table 1. Plant categories based on their cytotoxicity activities (IC₅₀) |
|---------------------------------------------------------------|
| **Plant categories** |
| **I** | **II** | **III** | **IV** |
| Acacia farnesiana | Acacia wilkesiana | Acacia caffra | Acalypha hispida |
| Aglaia odorata | Aglaia angustifolia | Ardisia crenata | Agapanthus africanaus |
| Aglaia eliptica | Acorus calamus | Areca vestaria | Agave attenuata |
| Artocarpus elasticus | Aglaia angustifolia | Asclepias curassavica | Aglaia laevii |
| Bauhinia variegata | Alangium chinense | Bixa orellana | Aglaia odoratissima |
| Buxus microphylla | Alnus japonica | Cratoxylum formosum | Aloe arborescens |
| Calophyllum soulattri | Aloe vera | Decaspermum fruticosum | Aloe veraexigua |
| Cocculus orbiculatus | Aloe vera | Decaspermum fruticosum | Aloe arborescens |
| Cryptocarya chinensis | Amania glutinosa | Dracaena draco | Aloe arborescens |
| Cryptocarya konishii | Artocarpus allillus | Embelia ribes | Aloe barbadensis |
| Cryptocarya laevigata | Artocarpus heterophyllus | Embelia ribes | Aloe barbadensis |
| Dalbergia parviflora | Blechnum orientale | Ficus rubra | Aloe hirta |
| Diospyros discolor | Buddleja davidii | Ficus hirta | Aloe saponaria |
| Erythrina abyssinica | Buxus papillosa | Ficus microcarpa | Aloe vera |
| Eltingera elatior | Caesalpinia gilliesii | Ficus microcarpa | Aloe vera |
| Ficus fistulosa | Caesalpinia spinosa | Ficus microcarpa | Aloe vera |
| Gardenia celebica | Camellia sinensis | Ficus microcarpa | Aloe vera |
| Hernecollas falua | Catha edulis | Ficus microcarpa | Aloe vera |
| Jatropha gossypifolia | Centella asiatica | Ficus microcarpa | Aloe vera |
| Panax ginseng | Cheilocostus speciosus | Ficus microcarpa | Aloe vera |
| Podocarpus macrophyllus | Chisocheton lasiocarpus | Ficus microcarpa | Aloe vera |
| Psidium cattleianum | Cinnamomum camphora | Ficus microcarpa | Aloe vera |
| Sansevieria ehrenbergii | Cinnamomum iners | Ficus microcarpa | Aloe vera |
| Tacca chantrieri | Cinnamomum burmannii | Ficus microcarpa | Aloe vera |
| Toona sinensis | Cinnamomum zeylanicum | Ficus microcarpa | Aloe vera |
| Viburum odoratissimum | Citrus medica | Ficus microcarpa | Aloe vera |
| Viburum sambucinum | Cleodendrum trichotomum | Ficus microcarpa | Aloe vera |
| L.B | Colletia paradoxa | Ficus microcarpa | Aloe vera |
| Acacia tenifolia | Crinum x powellii | Ficus microcarpa | Aloe vera |
| Aglaia argentea | Cryptocarya cassiniera | Ficus microcarpa | Aloe vera |
| Aglaia forbesii | Cupressus lusitanica | Ficus microcarpa | Aloe vera |
| Artocarpus lancifolius | Derris elliptica | Ficus microcarpa | Aloe vera |
| Campotechea acuminata | Dioscorea bulbifera | Ficus microcarpa | Aloe vera |
| Cananga odorata | Diospyros kaki | Ficus microcarpa | Aloe vera |
| Chisochetos patens | Dodonaea viscosa | Ficus microcarpa | Aloe vera |
| Cinnamomum cassia | Eclipta prostrata | Ficus microcarpa | Aloe vera |
| Cinnamomum subavenium | Elaeocarpus reticulatus | Ficus microcarpa | Aloe vera |
| Cinnamomum verum | Erythrina cristagalli | Ficus microcarpa | Aloe vera |
| Clausena excavata | Erythrina fusca | Ficus microcarpa | Aloe vera |
| Cryptocarya costata | Eucliptus microcytis | Ficus microcarpa | Aloe vera |
| Cryptomeria japonica | Eucalyptus robusta | Ficus microcarpa | Aloe vera |
| Dichroa febrifuga | Eugenia uniflora | Ficus microcarpa | Aloe vera |
| Eriobotyra japonica | Ficus deltoidea | Ficus microcarpa | Aloe vera |
| Euphorbia pulcherrima | Ficus drupacea | Ficus microcarpa | Aloe vera |
| Garcinia lateriflora | Garcinia celebica | Ficus microcarpa | Aloe vera |
| Hernandia nymphaefolia | Garcinia rostrata | Ficus microcarpa | Aloe vera |
| Hibiscus syriacus | Gardenia Jasminoides | Ficus microcarpa | Aloe vera |
| Hypericum aralum | Gleditsia sinensis | Ficus microcarpa | Aloe vera |
| Macaranga tanarius | Glochidion eriocarpum | Ficus microcarpa | Aloe vera |
| Morus alba | Gnetum gnemon | Ficus microcarpa | Aloe vera |
| Ochrosia elliptica | Hedychium coronarium | Ficus microcarpa | Aloe vera |
| Olea europea | Hibiscus rosa-sinensis | Ficus microcarpa | Aloe vera |
| Pityrogramma calomelanos | Hypericum oblongifolium | Ficus microcarpa | Aloe vera |
| Taxus sumatrana | Iris halophila | Ficus microcarpa | Aloe vera |
| Ziziphus jujuba | Juniperus chinensis | Ficus microcarpa | Aloe vera |
| I.C | Kalanchoe beharensis | Ficus microcarpa | Aloe vera |
| Alstonia scholaris | Lantana camara | Ficus microcarpa | Aloe vera |
| Crinum zeylanicum | Laurus nobilis | Ficus microcarpa | Aloe vera |
| Dillenia philippinensis | Liquidambar formosana | Ficus microcarpa | Aloe vera |
Enterolobium contortisiliquum
Glochidion zeylanicum
Goniolanthus macrophyllus
Hamelia patens
Juniperus virginiana
Melastoma malabathricum
Piper aduncum
Syrhoplocos cochinchenensis
Tabebuia hypoleuca

I.D
Agave americana
Agave salmiana
Caesalpinia sappan
Callistemon citrinus
Coix lacryma-jobi
Cola acuminata
Cola nitida
Crinum macowanii
Croton argyratus
Diplazium esculentum
Eucomis autumnalis
Ficus septica
Garcinia dulcis
Juniperus repens
Lobelia laxiflora
Melaleuca alternifolia
Schima wallichii
Schinus terebinthifolius
Schinus sonchifolius
Juniperus procera
Tabernaemontana macrocarpa
Thujopsis dolabrata
Tithonia diversifolia

Note: Class I for plants with strong activity against cancer cell line, Class II for moderate activity, Class III for inactive and Class IV for plants with insufficient IC50 data but mentioned has抗癌 cancer compound in literature (Jabit et al. 2009, Alabsi et al. 2016)

From Leguminosae family, several genera that have anticancer properties include Acacia, Bauhinia, Caesalpinia, Dalbergia, Derris, Enterolobium, Erythrina, Flemingia, Gleditsia, Pterocarpus, and Sophora. Meliaceae has Aglaia, Chisocheton, Sandoricum, and Toona. Even there are eleven species of Aglaia plant with anticancer properties, making it the genus with the largest number of species compared to the others. Several major families and other dominant genera are Myrtaceae (Callistemon, Eucalyptus, Eugenia, Decaspermum, Melaleuca, Psidium, Rhodanemia, and Syzygium); Moraceae (Artocarpus, Ficus, and Morus); Cupressaceae (Cryptomeria, Cupressus, Juniperus, Platycladus, Thuja, and Thuja); Asparagaceae (Agave, Dracaena, Eucomis, Sansevieria, and Yucca); and Euphorbiaceae (Europhorbia, Acalypha, Aleurites, Croton, Jatropha, and Macaranga). Several species of Ficus from Gunung Gede Pangrango National Park, which is located near CBG, have been observed as anticancer sources, such as F. laevigata, F. lepicerca, F. obscura, F. ribes, and F. variegata (Arbiastutie et al. 2017). The majority of plants with anticancer potentials in CBG were classified as having strong and moderate cytotoxic activities (Class I and II), with proportion of 32% and 34%, respectively. Even paclitaxel from Taxus sumatrana is already at the commercialization stage, sold under the brand name Taxol® since 1993 (Seca et al. 2017) and the extract from Serenoa repens has been formulated as Permixon®, a commercial drug for benign prostatic hyperplasia (BPH) treatment (Habib et al. 2005; Zhou et al. 2015). Our findings suggest that plant collection in CBG has a great potential to be further explored for natural-based drug discovery and development, particularly for anticancer. This is in line with the history of early development of CBG which was aimed for the domestication of medicinal plants, most notably quinine. Similar to botanical gardens in the world, such as Kew, Singapore, Peradeniya, Calcutta, and Sidney, their initial development was driven by the goal of domestication of industrial and medicinal plants such as rubber, tea, coffee, and quinine (Smith 2019).

The listed species in this study have a history of successful isolation of pure active compounds with strong activity against more than three model cancer cell lines (Class I.A) which are dominated by Aglaia, Cryptocarya, and Viburnum. The active rocalagol compound isolated
from various Aglaia was known to produce very high cytotoxicity compared to the positive control paclitaxel and camptothecin (Huspa 2009). Cryptocarya sinensis not only actively inhibits cancer cells but also the active compound dehydrophenanthroindolizidine contains a significant anti-HIV activity (T.S. Wu et al. 2012). C. laevigata contains the active compound (-) - neocarvamine which is also toxic to multidrug-resistant sublines through the double-strand breaks DNA induction mechanism (Suzuki et al. 2018).

Several plant secondary metabolites that have been widely studied as anticancer compounds include vincristine, viscosotoxin, paclitaxel, camptothecin, combrestatin, podophyllotoxin, geniposide, colchicine, artemesine, homoharringtonine, salicine, ellipiticine, roscovitine, maytanserine, thapsicinc acid, brucceantin, flavonols, crocetin, gingerol, lycopene, and ingenol mebutate (Seca et al. 2017; Iqbal et al. 2017; Lichota et al. 2018). Plants in CBG that contain these compounds include Taxus sumatrana (paclitaxel), Camptotetcha acuminate (camptotectin), Juniperus procumbens and Hernandia nymphaeifolia (podophyllotoxin), Gardenia jasminoides (geniposide or genipin), Buddleja davidii (colchicine), Salvia (salwine), Ochrosia elliptica (ellipticine), Dillenia serrata, Acacia farnesiana, and Eriobotrya japonica (betulinic acid), Capsicum annuum (capsaicin), Thuya occidentalis (flavonol), and Euphorbiaceae (ingenol mebutate). Combined sp. at CBG as a potential source of combrestatin, is not included yet in the database because it is not completely taxonomically identified, while Artemisia annua (artesunate) is not yet a CBG collection despite the related research was initiated at CBG's Medicinal Thematic Garden (unpublished data). In CBG, there are several Berberis species, however, there has been no research on the berberine content which has the potential as an anticancer. Unfortunately, there is no Catharanthus roseus (formerly Vinca rosea) that its vincristine isolate is approved for clinical purposes as a cancer treatment, Viscum album (source of viscotoxin), Cephalotaxus sinensis (roscovitine), Maytenus serrata (maytansine), Thapsia garganica (thapsigargin), Brucceantin (brucceantin), Crocus sativus or known as saffron (crocetin), Zingiber officinalis (gingerol) but another Zingiber was found at CBG; tomatoes, watermelons, and red carrots (lycopen). It could be a suggestion for CBG to collect these plants.

Some plants of CBG collection contain anticancer compounds, however, the extracts of these plants have not been tested against cancer line. These plants include Viburnum suspensum (contains vibsain), Agapanthus africanus (isoliquiritigenin), Hymenocalis speciosa (narciclasine (lycoricidinol) and panratcinatn), Aristolochia trilobata (isociminal and rubrabxanthone), Garcinia latissima (kaemferol), Achillea ptarmica (pellitorine), Alangium javanicum (javanicides and alangicides), Dillenia serrata (koetjapic acid and betulinic acid), Shorea platyclados (resveratrol), Diospyros celebica (plumbagin), Elaeocarpus petiolatus (cucurbitin), E. serratus (farnesol), E. sylvestris (brevifolin), Quercus acuta (chlorogenic acid), Pterocarya stenoptera (pterocarmin A), Mentha canadensis (rosmarinic acid and cathecin), Salvia splendens (quercetin), Phylllostachys edulis (tricin and 7-O-methyl-tricin), Ziziphus oenopolia (betulinic acid), Coffea canephora (kahweol, cafestol, 16-O-methylcafeisol), and Aloe ferox (aloe emodine, emodine, aloin). It is therefore suggested to further exploration of their anticancer activities.

Nature supply a huge number of compounds that provide new hope for medical uses, including cancer treatment. The trade-in plant-derived drugs generates astonishing economic value, which is estimated of US $ 100 billion at current state and still grows to US $ 5 trillion by 2050 (Greenwell et al. 2015). However, the availability of anticancer compounds in nature is limited and technically difficult to be isolated, makes it difficult to meet the demand of pharmaceutical industries. The solubility of natural anticancer compounds, such as paclitaxel and curcumin, is also low, makes it impractical for human cells to absorb. In the use of natural materials to become effective anticancer compounds, it is necessary to modify, formulate and manufacture semisynthetic or synthetic analogs, as well as a tissue culture approach for the massive production of secondary metabolites (Fridlender et al. 2015). Thanks to the advances in plant biotechnology, pharmacology, as well as nanotechnology that makes natural resource research for medicinal sources accelerating (Seca et al. 2017).

On the other hand, the exploitation of plant-derived drugs risks their existence in the wild in the long term, therefore proper management conservation strategies to fulfill demand for medicinal plants with the assurance of their sustainability becomes necessity (Seca et al. 2017). For example, Taxus sumatrana, Shorea javanica, Shorea platyclados, and Pterocarpus indicus are classified as endangered (EN) category of IUCN Red List. Dracaena draco, Kulanchoe beharenensis, Diospyros celebica, Aglata angustifolia, and Pinus merkusii are categorized as vulnerable (VU). Whereas T. sumatrana is a strong category of anticancer sources, A. angustifolia, K. beharenensis, and S. javanica have moderate anticancer properties. Instead of encouraging the massive utilization of them, better to find other resources because there are still many species listed here with strong anticancer potency but excluded from threatened plants.

It should be remembered that the development of natural-based anticancer drugs is a long, complicated, expensive, and uncertain process to be successful. The development of an anticancer drug is started from in vitro, in vivo, to clinical testing and it takes a long time. It is clear that in vitro testing is a preliminary stage only with all its limitations. However, there is no clinical trial without going through the preliminary testing stages. This study is limited by the categorization based on cytotoxicity to particular cancer cell lines, no discussed selectivity index among cell lines. Therefore we require further investigation to compare its activity in normal cells as an important aspect to be considered in drug formulation.
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| Family       | Species                          | Common name                  | Cell line              | Extraction method | IC₅₀ (μg/ml) | Reference                                                                 | Anticancer activity category* | Origin            | Cons. status        | Location in CBG               |
|--------------|----------------------------------|------------------------------|------------------------|-------------------|--------------|---------------------------------------------------------------------------|-------------------------------|----------------|----------------|-----------------------------|
| Acanthaceae  | Acanthus montanus (Nees) T.Anderson | Daruju                       | BT-549; BT-20; PC-3    | Crude             | >200>200>200 | (Fadeyi et al. 2013)                                                      | III                           | Trop. Africa | LC (Ghogu, 2010) | I.D.34; I.F.12.             |
| Acanthaceae  | Strobilanthes cernua Blume        | Bubukuan kembang bidas       | HeLa                   | Crude             | 968.26       | (Aribastutie 2017)                                                        | III                           | W. Java       | N/A            | V.A.77-77A; VII.B.171.      |
| Acoraceae    | Acorus calamus L.                | Jeringau                     | MDA-MB-435S Hep3B     | Crude             | 13.71 ± 6.66 | (Rajkumar et al. 2009)                                                    | II                            | S. Sumatra    | LC (Lansdown, 2014) | XIV.A.99-99a.               |
| Adoxaceae    | Sambucus javanica Blume           | Sangitan                     | N/A                    | Crude             | N/A          | (Putra and Rifa’i 2019)                                                   | IV - Reduces necrotic cells incidence in lung samples of mice lung cancer | Java            | LC (BGCI and IUCN, 2018) | IV.A.52; XILA.14-14a.        |
| Adoxaceae    | Sambucus nigra L.                | Eur. elderberry              | MCF7; LOVO             | Crude             | 16.9 ± 0.4; 12.9 ± 0.3 | (Gleńska et al. 2017)                                                    | II                            | S. Sumatra    | LC (Bilz, 2020)  | N/A            | VIE.119; XVIII.A.35, 43.XV.III.A.3 9-39a39b, 41, 61. |
| Adoxaceae    | Viburnum cylindricum Buch. Ham. ex D. Don | Tubeflower viburnum           | HL-60                  | Subfraction       | >100         | (Tu et al. 2008)                                                          | III                           | W. Java       | N/A            | W. Java                      | XII.A.50.                     |
| Adoxaceae    | Viburnum odoratissimum Ker Gawl. | Sweet viburnum               | HL-60; A549; SMMC-7721 | Subfraction       | 0.069; 0.320; 0.190; 0.223 | (Zhu et al. 2018; Y.-Y. Zhang et al. 2019) | I.A. Contains 15,18-O-diacetyl-15-O-methylvibsanin U, and in silico study | India, Japan, S. China | LC (Lai et al., 2019) | I.B.21; I.K.3-3a; I.D.18.   |
| Adoxaceae    | Viburnum sambucinum Reinw. ex Blume | Buas-busas                  | KB; LU-1; Hep2; MCF7   | Subfraction       | 2.09; 2.09; 2.04; 2.01 | (T. T. Nguyen et al. 2017) | LA - Contains hupehenol A | W. Java | LC (Oldfield, 2020) | XVIII.A.17, 42-42a.          |
| Adoxaceae    | Viburnum suspensum Lindl.         | Sanandkwa                    | N/A                    | Subfraction       | N/A          | (Fukuyama et al. 2002)                                                   | IV - Contains vibsanin | Japan          | N/A            | IV.A.16.                    |
| Altingiaceae | Liquidambar formosana Hance       | Formosa sweet gum            | OEC-M1 J5 A549        | Subfraction       | 15.6; 32.1; 19.3 | (Su and Ho 2017) | II - Contains T-μurolol | C. China, Formosa | LC (Crowley et al., 2018) | III.F.37-37a-37b; IV.C. 58-58a; V. B.36-36a; IX.A. 104b. |
| Amaryllidaceae | Agapanthus africana (L.) Hoffmanns. | Blue african lily            | N/A                    | Crude             | N/A          | (Chanchal et al. 2018)                                                    | IV - Contains isoliquiritigenin | S. Africa       | N/A            | S. Africa                     | I.H.50; III.D.20; VI.C.50.    |
| Family            | Genus                     | Common Name                        | Plant Name                           | Plant Name Source | Plant Type | Smartphone | Anticancer Property                                                                 | Anticancer Property Source | Country | Plant Type | Species Code | Geographic Location          |
|-------------------|---------------------------|------------------------------------|--------------------------------------|-------------------|------------|------------|-------------------------------------------------------------------------------------|-----------------------------|---------|-------------|---------------|-----------------------------|
| Amaryllidaceae    | *Crinum abyssinicum*      | Swamp lily                         | Amaryllidaceae                       | Amaryllidaceae    | Crude      | 12.5 - 25 | Contains lycorine, crinine, narciclasine, 3-epihalmanthidine, crinamine, lycobetaine precirwells, crinamide, crinafolidine, crinasbetae, crinasadiene, crinasiatine and crinastine | (Abebe 2016)                | Amaryllidaceae | Crude | N/A | N/A | IV. G.137. |
| Amaryllidaceae    | *Crinum macowanii*        | Common vlei-lily                    | Crinum macowanii                     | Pachyglottidaceae | Crude      | 13.78      | Contains endophytes Acinetobacter guillouiae that displayed anticancer activity.     | (Sebola et al. 2019)       | Trop. Africa | N/A | I.D. C.13.7. | N/A | I.H.31. |
| Amaryllidaceae    | *Crinum × powellii*       | Cape lily                           | Crinum × powellii                    | Amaryllidaceae    | Crude      | 17.22 ± 2.19 | Contains crinine                                                                       | (Shawky et al. 2018)       | Hybrid Origin | N/A | I.D. C.13.7. | N/A | I.H.31. |
| Amaryllidaceae    | *Crinum zeylanicum*       | Ceylon swamp lily                   | Crinum zeylanicum                    | Amaryllidaceae    | Crude      | 23.67 ± 1.97 | Contains crinine                                                                       | (Berkov et al. 2011; Kuete et al. 2013) | Africa, Trop. Asia | N/A | LC. C.13.7. | N/A | I.H.31. |
| Amaryllidaceae    | *Hymenocallis speciosa*   | Bakung air mancure, spider lily     | Hymenocallis speciosa                | Amaryllidaceae    | N/A        | 30.29      | Contains narciclasine (lycoricidinol) and pancratistatin                              | (Kornienko and Evidente 2008) | China | LC. C.13.7. | N/A | II. C.10. |
| Anacardiaceae     | *Pistacia chinensis*      | Pistacia cina                       | Pistacia chinensis                   | Anacardiaceae     | Crude      | 30.29      |                                                                                        | (Kirolos et al. 2019)      | Brazil | N/A | IV. C.10; XV.B.11-11b. | N/A | I.C.13.7. |
| Anacardiaceae     | *Schinus terebinthifolius* | Pink pepper                         | Schinus terebinthifolius             | Anacardiaceae     | Crude      | 1.56       |                                                                                        | (El-Nashar et al. 2019)     | Brazil | N/A | IV. C.11; XIII.A.15a-15b. | N/A | I.D. C.10. |
| Anacardiaceae     | *Schinus weinmannifolius* | N/A                                 | Schinus weinmannifolius              | Anacardiaceae     | Crude      | 5          |                                                                                        | (Monks et al. 2002)         | Brazil | N/A | IV. C.11; XIII.A.15a-15b. | N/A | I.D. C.10. |
| Family          | Genus                        | Species/Strain                        | Plant Parts | Mechanism/Reference                          | Toxicity           | IUCN and BGC | LC (IUCN and BGC, 2019) | VLD (IUCN and BGC, 2019) |
|-----------------|------------------------------|---------------------------------------|-------------|----------------------------------------------|--------------------|--------------|--------------------------|--------------------------|
| Annonaceae      | Cananga odorata (Lam.) Hook.f. and Thomson | Ylang-ylang, kenanga                   | HepG2, Hep2,2,15 | Subfraction 0.01 | (Hsieh et al. 2001) | LB          | Java Aceh W. Java N. Sumatra | VLD.138-138a; VLD.146; VLD.142; VLD.165. |
| Annonaceae      | Goniothalamus macrophyllus (Blume) Hook.f. and Thomson | Ki Cantung                             | COR-L23 LS-174T MCF7 | Crude 3.16 ± 0.14 | (Wattanapiromsakul et al. 2005) | LC          | W. Java C. Sulawesi N/A | VLD.115, 128, 145, 179; VLD.177. |
| Annonaceae      | Polyalthia rumphii (Blume ex Hensch.) Merr. | Mempisang                             | HeLa MCF7 A549 | Subfraction 26.9 | (T. Wang et al. 2018) | II          | W. Java N/A | VLD.180. |
| Annonaceae      | Polyalthia subcordata Nona leuweung (Blume) Blume | HeLa                                  | MDA-MB-231 HepG2 | Subfraction 20.82 | (Arbiastutie 2017) | III         | Java N/A | VLD.60; VLD.192 |
| Apocynaceae     | Alstonia angustifolia Wall. ex A.DC. | Red-leaved pulai                      | HeLa MCF7 A549 | Subfraction 4.61 | (Pan et al. 2014) | II          | W. Sumatra LC (Sidiyasa, 1998) | VII.C.316-316a. |
| Apocynaceae     | Asclepias curassavica L. | Kapas cinde                           | HepG2 Raji | Subfraction 10.64 | (Li et al. 2009; Iqbal et al. 2017) | III         | France N/A | XII.B.32. |
| Apocynaceae     | Cerbera manghas L. | Bintaro                               | KB BC MCF7 | Subfraction 0.05 | (Cheempra-cha et al. 2004) | I.A.          | W. Java LC (Yu et al., 2019) | VII.C.106-106a. |
| Apocynaceae     | Ichnocarpus frutescens (L.) W.T.Aiton | Black creeper                         | MCF7 BEL-7402 SPC-A1 SGC-7901 | Crude 172.2 ± 3.9 | (Singh and Singh 2014) | III         | N/A N/A | CL.60. |
| Family                      | Specific Name                                                                 | Subfraction | MCF7 / MDA-MB-231 | IC50 ± SE     | LB   | Kailman-tan | N/A | V.H.B. /b. |
|-----------------------------|-------------------------------------------------------------------------------|-------------|-------------------|----------------|------|-------------|-----|------------|
| Apocynaceae                 | Ochrosia elliptica Labill.                                                    |             |                   | 0.11 ± 0.02   | (El-shiekh et al. 2017) | Contains 9-methoxyellipticine | I.B | W. Java  |
| Apocynaceae                 | Tabernaemontana m. Lelutung Tokak crochet Jack                               | Crude       | L1210             | 6.039 ± 7.145 | (Prativi et al. 2014) | I.D | W. Sumatra |
| Araliaceae                  | Panax ginseng C.A.Mey                                                        | Subfraction | MK-1 B16 L929     | 0.027 ± 0.00  | (Matsunaga et al. 1990; K.-K. Li et al. 2019) | Contains panaxyol, panaxyl, panaxytriol, and 24(S)-floralginsenoside | III | C. Java |
| Areceae                     | Areca vestiaria Giseke                                                      | Crude       | T-47D             | 290.68        | (Yudistira 2017) |                                  |     | N/A       |
| Areceae                     | Serenoa repens (W.Bartram) Small                                              | Crude       | U87 U251          | 1.0 ± 1.1     | (Habib et al. 2005; Zhou et al. 2015) | Commercial cancer drug Permixon® | I.D | Nether-lands |
| Aristolochiaceae            | Aristolochia trilobata L.                                                     | Bejuco de santiago | N/A N/A N/A |                           | (Santos et al. 2014; Chang et al. 2015) | IV | N/A       |
| Asparagaceae                | Agave americana L. Lidah buaya america                                         | Crude       | MCF7              | 5             | (Pandey et al. 2019) | Contains linalool | I.D | Mexico  |
| Asparagaceae                | Agave attenuata Salm-Dyck                                                   | Crude       |                  | 3.8 ± 1.3     | (Santos-Zea et al. 2016) |                                  | I.D | Mexico  |
| Asparagaceae                | Agave salmiana Otto ex Salm-Dyck                                              | Giant agave | HT-29             | 3.8 ± 1.3     | (Santos-Zea et al. 2016) |                                  | I.D | Mexico  |
| Asparagaceae                | Dracaena draco (L.) ex Salm-Dyck                                              | Crude       | CaCo-2 A498       | 85.1 ± 6.9 176.2 ± 18.2 | (Valente et al. 2012) |                                  | III | Canary Isl. |
| Asparagaceae                | Eucomis autumnalis (Mill.) Chitt.                                              | Crude       | Huh7              | 7.8           | (Bisi-Johnson et al. 2011) |                                  | I.D | S. Africa |
| Asparagaceae                | Eucomis comosa (Houtt.) Wehrh.                                                | Slender pineapple flower | N/A N/A N/A |                           | (Masondo et al. 2014) | Inhibitor COX-1 and COX-2 | IV | Africa   |

**Notes:**
- MCF7 and MDA-MB-231 are two common breast cancer cell lines.
- IC50 values represent the concentration of the plant extract that inhibits 50% of the cell growth.
- LB indicates Subfraction.
- Kailman-tan refers to the author who performed the study.
- V.H.B. /b. indicates the volume of the study.
| Family          | Genus                      | Species           | Other Names                  | Extracted Compounds                                                                 | Active on                          | Cell Lines                                                                 | Reference                                                                 |
|-----------------|----------------------------|-------------------|------------------------------|-------------------------------------------------------------------------------------|------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Asparagaceae    | Sansevieria                | ehrenbergii       | Samurai sansevieria          | Subfraction: BxPX-3, MCF7, SF-268, NCI-H460, KM20L2, DU-145, A549, HepG2, CaCo-2, MCF7 | Subfraction 0.93                  | LA Contains sansevistatin 2                                               | (Magadula and Erasto 2009)                                                  |
| Asparagaceae    | Yucca aloifolia L.        | Spanish bayonet   | Yuka, soapweed yucca         | Crude: A549, HepG2, CaCo-2, MCF7                                                   | Subfraction 271.5                  | II S. America Mexico                                                      | (El Hawary et al. 2018)                                                   |
| Asparagaceae    | Yucca glauca Nutt.        | Yuka americana    | HBL-100                      | Crude: MCF7                                                                         | Subfraction >156.25               | III N/A                                                                  | (Obaid et al. 2017)                                                      |
| Athyriaceae     | Diplazium esculentum (Retz.) | Sw. Paku sayur    | Crude: MDA-MB-231            | Crude: MCF7                                                                         | 1.62                               | L.D N/A                                                                  | (Rahmat et al. 2003)                                                     |
| Berberidaceae   | Mahonia fortunei (Lindl.) Fedde | Ki koneng         | Crude: MCF7                  | Crude: MCF7                                                                         | >156.25                           | III China                                                                | (Rezadoost et al. 2019)                                                   |
| Betulaceae      | Alnus japonica (Thunb.) Steud | Alder             | B16                          | Subfraction: B16, SNU-1, SNU-354, SNU-C4                                           | 8.12                               | II Contains oregonin, 1,7-bis-(3,4-dihydroxyphenyl)-heptane-3-Ô-ß-D-glucopyranosyl(1→3)-ß-D-xylopyranoside, and platyphyllside | (Choi et al. 2008)                                                        |
| Bignoniaceae    | Oroxylum indicum (L.) Kurz | Bungli, pongporang | Crude: Hela                  | Crude: MCF7                                                                         | 112.3 ± 4.4                        | III Kalimantan                                                           | (Moirang-them et al. 2013)                                               |
| Bignoniaceae    | Tabebuia hypoleuca (C. Wright ex Sauvalle) Urb. | Bungli tabebuya UACC-62 MCF7 | Crude: 786-0                  | Crude: MCF7                                                                         | N/A                                | L.C. Due to Total growth inhibition (TGI), it was classified as potent activity to three assayed cell lines. | (Perera et al. 2019)                                                      |
| Family            | Genus                          | Common Name                      | Species Code | Crude/Subfraction | IC50 | Species Code | Country | Threat Status | Notes |
|-------------------|--------------------------------|----------------------------------|--------------|--------------------|------|--------------|---------|---------------|-------|
| Bignoniaceae      | *Tecoma stans* (L.) Juss. ex Kunth | Yellow elder, bunga terompet kuning | HT-29       | 90                 | N/A  | (Monks et al. 2002) | Trop. America | LC (BGCI and IUCN 2019) | XII.B.32-32a. |
| Bignoniaceae      | *Hibiscus sabdariffa* L. | Rose of Sharon | NCI-H460 | 97                 | (Kumar and Periyasamy 2016) | III | Australia | VLA.38a. |
| Bignoniaceae      | *Tecoma stans* (L.) Juss. ex Kunth | Yellow elder, bunga terompet kuning | B16F10      | 121.60 ± 6.2       | (Kumar and Periyasamy 2016) | N/A | N/A | N/A | N/A |
| Bignoniaceae      | *Hibiscus sabdariffa* L. | Rose of Sharon | HL-60 | 97                 | (Monks et al. 2002) | II | Mexico | N/A | N/A |
| Bixaceae          | *Bixa orellana* L. | Kesumba, prada, galuga | AS49 | 97                 | (Bai et al. 2010) | II | N/A | N/A | N/A |
| Bixaceae          | *Bixa orellana* L. | Kesumba, prada, galuga | MCF7 | 97                 | (Bai et al. 2010) | II | N/A | N/A | N/A |
| Blechnaceae       | *Blechnum orientale* L. | Paku leuncir, paku lubang | HT-29 | 27.5 ± 1.4         | (H. Y. Lai et al. 2010) | II | N/A | N/A | N/A |
| Buxaceae          | *Buxus microphylla* Siebold and Zucc. | Japanese boxwood | HL-60 | 39.99              | (Saleem et al. 2019) | IV | China, N. Africa, S. Europe | N/A | N/A |
| Buxaceae          | *Buxus microphylla* Siebold and Zucc. | Japanese boxwood | SMMC-7721 | 39.99              | (Saleem et al. 2019) | IV | China, N. Africa, S. Europe | N/A | N/A |
| Buxaceae          | *Buxus papillosa* C.K.Schneid | Boxwood | HT-29 | 27.5 ± 1.4         | (H. Y. Lai et al. 2010) | II | N/A | N/A | N/A |
| Buxaceae          | *Buxus papillosa* C.K.Schneid | Boxwood | MCF7 | 27.5 ± 1.4         | (H. Y. Lai et al. 2010) | II | N/A | N/A | N/A |
| Cactaceae         | *Opuntia microdasys* (Lehm.) Pfeiff. | Kaktus bunny ears | HT-29 | 27.5 ± 1.4         | (H. Y. Lai et al. 2010) | II | N/A | N/A | N/A |
| Cactaceae         | *Opuntia microdasys* (Lehm.) Pfeiff. | Kaktus bunny ears | CaCo-2 | 27.5 ± 1.4         | (H. Y. Lai et al. 2010) | II | N/A | N/A | N/A |
| Cactaceae         | *Opuntia robusta* J.C. Wendel. | Wheel cactus | MCF7 | 97 ± 1             | (Chahdoura et al. 2016) | II | N/A | N/A | N/A |
| Cactaceae         | *Opuntia robusta* J.C. Wendel. | Wheel cactus | MCF7 | 97 ± 1             | (Chahdoura et al. 2016) | II | N/A | N/A | N/A |
| Campanulaceae     | *Lobelia laxiflora* Kunth | Lobelia meksiko | KB | 3.2                | (Alonso-Castro et al. 2011) | LD | Mexico | N/A | I.K.8; IV.A.80-80a-80b. V.A.62-62a-62b, 63-63a; V.A.67-67a. L.I.13. |
| Chloranthaceae    | *Sarcandra glabra* (Thunb.) Nakai | Bone-knitted lotus | HL-60 | 58                | (W. Li et al. 2007) | II | W. Java Flores | N/A | N/A |
| Celastraceae      | *Catha edulis* (Vahl) Endl. | Khat | MCF7 | 97 ± 1             | (Chahdoura et al. 2016) | II | N/A | N/A | N/A |
| Celastraceae      | *Catha edulis* (Vahl) Endl. | Khat | A2780 | 39.99              | (Saleem et al. 2019) | IV | China, N. Africa, S. Europe | N/A | N/A |
| Cibotaceae        | *Cibotium barometz* (L.) J.Sm. | Paku simpai | CaCo-2 | N/A                | (Q. Wu and Yang, 2009) | IV | Antiinflammation | N/A | N/A |
| Cibotaceae        | *Cibotium barometz* (L.) J.Sm. | Paku simpai | CaCo-2 | N/A                | (Q. Wu and Yang, 2009) | IV | Antiinflammation | N/A | N/A |

Notes: 
- **IC50**: Effective concentration of 50% inhibition of tumor growth.
- **Crude/Subfraction**: The type of sample used in the assay.
- **Country**: The country of origin of the plant.
- **Threat Status**: The threat status of the plant species, according to BGCI and IUCN 2019.
- **Notes**: Additional notes on the plant's uses or properties.
| Family       | Species                        | Bintangor     | SNU-1                | HeLa          | Subfraction | I.A.                  | Jambi      | LC                  | IX.B.67; IX.C.42a. |
|--------------|--------------------------------|---------------|----------------------|---------------|-------------|-----------------------|------------|---------------------|-------------------|
| Clusiaceae   | Calophyllum soulattri          | Bintangor     | SNU-1                | HeLa          | Subfraction | I.A.                  | Jambi      | LC                  | IX.B.67; IX.C.42a. |
|              | Burm.f.                       |               | NCI-H23 HepG2       | K-562         |             | Contents soulattrin, coloxanthone C | W. Java    | (Steven 1998) |                |
| Clusiaceae   | Garcinia celebica L           | Seashore      | MCF                  | Crude         | 87          | II                    | Aceh C     | N/A                 | IX.C.9; IX.C.93.   |
|              | Garcinia dioica Blume         | Mangosteen    | N/A                  | N/A           | N/A         | IV                    | N/A        | N/A                 | IX.C.32-32a.      |
| Clusiaceae   | Garcinia dalcis (Roxb.) Kurz  | Mundu         | HepG2                | Crude         | 7.5 ± 2.52  | L.B. Contains morellic acid | Aceh       | N/A                 | IX.C.33.          |
| Clusiaceae   | Garcinia lateriflora Blume    | Gambohe       | HT-29                | Subfraction   | 0.36        | IV                    | W. Java    | N/A                 | IX.C.54, 57.      |
| Clusiaceae   | Garcinia latissima Miq.       | Kandis        | N/A                  | N/A           | N/A         | I.A.                  | Papua      | N/A                 | VII.B.133-133a.   |
| Clusiaceae   | Garcinia rostrata (Hassk.) Miq| Lulai, loli   | MCF7                 | Crude         | 65 ± 40     | II                    | Bengkulu   | N/A                 | IX.C.68.          |
| Combrutaceae | Terminalia calamansanay Rolfe | Philippine    | MCF7                 | Subfraction   | 2.93        | L.B. Contains morellic acid | W. Java    | N/A                 | IX.C.54, 57.      |
|              |                               | Almond        | A549                 | Subfraction   | 2.03        | I.A.                  | Karichalai | N/A                 |                 |
| Compositae   | Achillea millefolium L        | Yarrow, daun  | MIA-PaCa2            | Crude         | 28.8 ± 15.8 | II                    | S. Sulawesi| LC (BGCI and IUCN, 2019) | VIII.B.98.       |
| Compositae   | Achillea ptarmica L           | Sneezewort    | HPeLa                | Subfraction   | 141.05      | II                    | Asia C     | LC (Maiz-Tome 2016) | L.G.69; IJ.I.1; III.D.12. |
| Compositae   | Eclipta prostrata (L.) L      | Karichalai,   | HeLa                 | Subfraction   | 50          | IV                    | Japan      | LC (Bilz 2013)      | L.J.J2; III.D.2.  |
| Compositae   | Gerbera jamesonii             | Gerbera       | A549                 | N/A           | N/A         | IV                    | Africa     | LC (Lands and Beentje H.J. 2017) | L.G.181.         |
|              | Bolus ex Hook.f.              |               |                      |               |             |                        | S. Africa  | N/A                 | L.G.75; III.D.10. |

**Notes:**
- **I.A.** = I.A.
- **I.B.** = I.B.
- **I.C.** = I.C.
- **I.D.** = I.D.
- **I.E.** = I.E.
- **I.F.** = I.F.
- **I.G.** = I.G.
- **I.H.** = I.H.
- **I.I.** = I.I.
- **I.J.** = I.J.
- **II.** = II.
- **III.** = III.
- **IV.** = IV.
- **V.** = V.
- **VI.** = VI.
- **VII.** = VII.
- **IX.** = IX.
- **LC** = LC
- **W. Java** = W. Java
- **N/A** = N/A
| Family     | Genus                  | Species                           | Plant Name                  | Cell Line(s) | Percentage (± Standard Deviation) | Region    | Country | Location/Reference |
|------------|------------------------|-----------------------------------|-----------------------------|--------------|-----------------------------------|-----------|---------|-------------------|
| Compositae | Smallanthus sonchifolius | (Poepp.) H.Rob                    | Daun insulin, yakon          | HepG2        | 58.2 ± 1.9                        | II        | Japan   | N/A               |
|            | Taraxacum campylodes    | G.E. Haglund                      | Anddelion                   | MCF7         | 190.5                             | III       | Europe  | N/A               |
|            | Tithonia diversifolia   | (Hems.l.) A.Gray                  | Bunga matahari meksiko      | HeLa         | 3.38                              | I.D       | C. America | N/A               |
|            | Vernonia amygdalina     | Delile                            | Daun pahit, daun afrika     | MCF7         | 56/46                             | II        | China   | N/A               |
|            | Vernonia arborea        | Buch. -Ham.                       | Merambung                    | MDA-MB-231   | 8.02/6.13/19.32                   |            | W. Sumatra | N/A               |
| Cornaceae  | Alangium chinense       | (Lour.) Harms                     | Kicareuh                     | HeLa         | >12.5                             | II        | China, Jambi | N/A               |
|            | Alangium javanicum      | (Blume) Wangerin                  | Meranti putih                | N/A          | N/A                               | IV        | Lampung | LC (World Conservation Monitoring Centre, 1998) |

Contains (3R,3aS,6aR,8S,9aR,9bS)-8-Hydroxy-6,9-dimethylene-3-(((R)-1-(naph-thalen-1-yl)ethyl)-amino)methyl)decahydroazuleno [4,5-b] furan-2(3H)-one and (3R,3aS,6aR,8S,9aR,9bS)-8-Hydroxy-6,9-di-methylene-3-(((R)-1-(naphthalen-1-yl)ethyl)amino)methyl)decahydroazuleno [4,5-b] furan-2(3H)-one.
| Family       | Genus                     | Species/Origin | Tissue/Region | Assay   | Bioactivity                              | Status  | Location/Ref.                                                                 |
|--------------|---------------------------|----------------|---------------|---------|-------------------------------------------|---------|--------------------------------------------------------------------------------|
| Cornaceae    | *Camptotecha acuminata*   | Decne. Pohon bahagia | MDA-MB-435S   | Subfraction | 0.74                                      | LB      | Contains camptothecin N/A N/A IV.E.38;                                      |
| Crassulaceae | *Cheilocostus speciosus*  | (J.Koenig) Crepe ginger | HepG2         | Crude   | 13.87 ± 1.4                              | II      | W. Java N/A I.K.142.                                                        |
|              | *Kalanchoe beharensis*    | Drake           | HL-60         | Essential oil | 25.0 ± 0.6                              | II      | N/A VU VLD.62, 144.                                                        |
| Cupressaceae | *Cryptomeria japonica*    | (Thumb. ex L.) D.Don | KB             | Subfraction | 3.43                                     | LB      | Contains crytotrione China, Japan NT (Thomas et al. 2013) I.I.15-15a; I.K.201-201a; II.B. 11; III.B.12-12a-12b; XIII.B.22; XIV.B.22-22a-22b; III.C.58-58a-58b; V.I.4; III.E.3; V.I.A.25; V.I.E.6-6a. |
|              | *Cupressus lusitanica*    | Mill. Cemara meksiko | THP-1 DU-145  | Crude   | 60.8 ± 5.8                               | II      | Guatemala-l, Mexico N/A IV.E.8; V.I.35-35a.                                |
|              | *Cupressus sempervirens*  | L. Cemara italia | NBA-4 H.Ela MCF7 HepG2 | Essential oil | 33.3 ± 7.4                               | III     | Europe N. India, S. Europe, W. Asia LC (Farjon 2013) III.C.7; V.B.1-1a, 5a; V.I.A.1. |
|              | *Juniperus chinensis*     | L. Cemara cina | HT-29 EACC C32 | Subfraction | 14.05                                     | II      | China, Himalaya LC (Farjon 2013) II.A.53; III.C.49-49a-49b; V.C.16-16a-16b; V.I.A.3-3a A.44; L.G.39-39a-39b; II.A.3; III.C.130-130a; XI.A.20-20a-20b. |
|              | *Juniperus procera*       | Hochst. ex Endl. | CaCo-2         | Crude   | 8.8                                       | I.D     | Kenya LC (Farjon 2013) I.D.44; L.G.39-39a-39b; II.A.3; III.C.130-130a; XI.A.20-20a-20b. |
|              | *Juniperus procumbens*    | (Siebold ex Endl.) Miq. | Japanese juniper | N/A     | N/A                                       | IV      | Contains deoxypodophyllotoxin W &S. Korea, S. Japan LC (Farjon and Carter 2013) I.G.12. |
| Family          | Species                     | Common Name            | Collection | Essential oil | IC50 (μM) | Cell Line | LC         | Country       | Ref.            |
|-----------------|-----------------------------|------------------------|------------|---------------|-----------|-----------|------------|--------------|-----------------|
| Cupressaceae    | Juniperus virginiana L.     | Red juniper, cemara angina kerucut | A549       | Subfraction   | 9.2       | HepG2     | LC         | N. America    | (Yen et al. 2012) |
|                 |                             |                        | Hep3B      |               |           | Hep3B     |            |              |                 |
|                 |                             |                        | A549       |               |           | MCF7      |            |              |                 |
|                 |                             |                        | MCF7       |               |           | MDA-MB-231 |            |              |                 |
|                 |                             |                        | NIH3T3     |               |           |           |            |              |                 |
| Cupressaceae    | Platyclus orientali: (L.) Franco | Cemara kipas        | A549       | Subfraction   | 7.6       | MKN-45    | LD         | Hungary      | (Mukherjee et al. 2014) |
|                 |                             |                        |    N/A     |               |           |            |            |              |                 |
|                 |                             |                        |            |               |           |            |            |              |                 |
| Cupressaceae    | Thuja occidentalis L.       | White cedar           | A549       | Subfraction   | 0.002     | N/A       | N/A        | N. America    | (Nagata et al. 2016) |
|                 |                             |                        |            |               |           |            |            |              |                 |
| Cupressaceae    | Thuja standishii (Gord.) Carr | Cemara japang        | A549       | Subfraction   | 11.4      | N/A       | N/A        | Japan        | (Tanaka 2000) |
|                 |                             |                        |            |               |           |            |            |              |                 |
| Cupressaceae    | Thujopsis dolabrata (L.) Siebold and Zucc. | Hiba, asunaro | MKN-45     | Essential oil | 0.002     | N/A       | N/A        | Japan        | (Al-Garaawi et al. 2019) |
|                 |                             |                        |            |               |           |            |            |              |                 |
| Cyperaceae      | Cyperus alternifolius L.    | Umbrella papyrus      | A549       | Subfraction   | 11.2      | N/A       | N/A        | Japan        | (Al-Garaawi et al. 2019) |
|                 |                             |                        |            |               |           |            |            |              | (Dante et al. 2019) |
|                 |                             |                        |            |               |           |            |            |              |                 |
| Dilleniaceae    | Dillenia philippinensis Rolfe | Katmon                | A549       | Crude         | 11.92     | N/A       | N/A        | Philippines   | (Dante et al. 2019) |
|                 |                             |                        |            |               | ± 1.91   |            |            |              |                 |
|                 |                             |                        |            |               | ± 1.91   |            |            |              |                 |
|                 |                             |                        |            |               | ± 1.91   |            |            |              |                 |
|                 |                             |                        |            |               | ± 1.91   |            |            |              |                 |
| Dilleniaceae    | Dillenia serrata Thunb.     | Simpur                 | A549       | Crude         | 19.77     | N/A       | N/A        | C. Sulawesi   | (C. Sulawesi and BGCI 2019) |
|                 |                             |                        |            |               | ± 2.22   |            |            |              |                 |
|                 |                             |                        |            |               | ± 2.22   |            |            |              |                 |
|                 |                             |                        |            |               | ± 2.22   |            |            |              |                 |
| Dioscoreaceae   | Dioscorea bulbifera L.      | Gadung, gembolo       | A549       | Crude         | 11.18     | N/A       | N/A        | C. Sulawesi   | (C. Sulawesi and BGCI 2019) |
|                 |                             |                        |            |               | ± 0.71   |            |            |              |                 |
|                 |                             |                        |            |               | ± 0.71   |            |            |              |                 |
|                 |                             |                        |            |               | ± 0.71   |            |            |              |                 |
|                 |                             |                        |            |               | ± 0.71   |            |            |              |                 |
| Family               | Genus                          | Species                        | Habitat          | Subfraction | HG       | L.A          | Contains          | I.D. | Location       | Climate | I.D. | Climate       |
|---------------------|--------------------------------|--------------------------------|------------------|-------------|----------|--------------|-------------------|------|----------------|---------|------|---------------|
| Dioscoreaceae       | *Tacca chantrieri*              | Andre                          | Bunga kelelawar hitam | Subfraction | 0.81     | 0.79         | (Ni et al. 2015) |      | Aceh           | N/A     |      | L.B.08-68a.  |
| Dipterocarpaceae    | *Shorea javanica*               | Koord. and Valeton             | Damar            | Subfraction | 4.7      | 7.5          | (Ukiya et al. 2010) |      | Lampung        | EN (Bars-tow 2018) |      | IX.C.52-52a, 56-56a, 61-61a. |
| Dipterocarpaceae    | *Shorea platyclados*            | Slooten ex Endert              | Meranti merah    | N/A         | N/A      | N/A          | (Saroyobudiyono and Aisyah 2006; Honari et al. 2019) |      | Banten         | EN (Ashton 1998) |      | IX.C.45-45a-45b. |
| Ebenaceae           | *Diospyros celebica*            | Bakh.                          | Black ebony      | N/A         | N/A      | N/A          | (Mallavadhani et al. 1998) |      | Sulawesi       | VU (World Conservation Monitoring Centre 1998) |      | III.D.38, 54; III.D.41, 43. |
| Ebenaceae           | *Diospyros discolor*            | Willd.                         | Buah bisbul, samolo, butterfruit | Subfraction | 0.8      | 12.1         | (Su et al. 2015) |      | W. Java        | N/A     |      | IX.B.151-151a-151c. |
| Ebenaceae           | *Diospyros kaki* L.f.           |                                 | Kesmek, persimon | Subfraction | 6.04     | 13.2         | (G. Chen et al. 2007) |      | China, Japan   | LC (Zhao, Yu, BGCI and IUCN, 2019) |      | LA.23-23a; III.D.37-37a, 39-39a-39b, 46, 48. |
| Elaeocarpaceae      | *Elaeocarpus densiflorus*       | Knuth                          | N/A              | N/A         | N/A      | N/A          | (Shah et al. 2011) |      | Papua          | N/A     |      | VII.C.328-328a-328b, 457-457a-457b, IX.B.33. |
| Elaeocarpaceae      | *Elaeocarpus glaber*            | Blume                          | Bengkinang       | Crude       | 297      | III          | (Subarnas et al. 2012) |      | Jambi          | N/A     |      |                |
| Elaeocarpaceae      | *Elaeocarpus petiolatus*        | (Jacq.) Wall.                  | Derumun babi     | Subfraction | N/A      | IV           | (Cho, 2019) |      | S. Sumatra Jambi Lampung Bengkulu | LC (Zhao, Yu, BGCI and IUCN, 2019) |      | VII.C.384; IX.B.65; IV.A.141-141a; IV.A.142 VII.C.353-353a. |
| Elaeocarpaceae      | *Elaeocarpus reticulatus*       | Sm.                            | Blueberry ash    | Crude       | 22.14    | II           | (Turner et al. 2020) |      | W. Sumatra     | N/A     |      |                |
| Elaeocarpaceae      | *Elaeocarpus serratus*          | L.                              | Ceylon olive     | N/A         | N/A      | IV           | (Geetha et al. 2013) |      | W. Sumatra     | N/A     |      |                |
| Elaeocarpaceae      | *Elaeocarpus sylvestris*        | (Lour.) Pott.                  | The woodland elaeocarpus | N/A         | N/A      | IV           | (L. Wu et al. 2019) |      | W. Java        | LC (BGCI and IUCN, 2019) |      | VII.C.249.  |
| Family       | Species                                      | Plant Type  | Plant Part      | Assay     | Plant Part Assay | Geographical Location | IC50 Values (µM) | References                                                                 |
|--------------|----------------------------------------------|-------------|-----------------|-----------|------------------|------------------------|--------------------|---------------------------------------------------------------------------|
| Ericaceae    | *Vaccinium variegataefolium* (Blume) Miq     | Cantigi     | T-47D Crude     |          | II               | Malesia                | 75.23 (Kosasih et al. 2019) |                                                               |
|              |                                              |             | MCF7            | 88.89     |                  | W. Java                |                    |                             |
| Euphorbiaceae| *Acalypha hispida* Burm.f.                   | Red hot cat’s tail | N/A Subfraction | N/A       | IV               | New Guinea             | 28.03 ± 6.44 (Lim et al. 2011) |                                                               |
|              |                                              |             | U87-MG Crude    | 89.63 ± 2.12 | II               | Fiji Isl.              |                    |                             |
| Euphorbiaceae| *Acalypha wilkesiana* Müll.Arg.              | Akalipa, daun renda | N/A Subfraction | N/A       | IV               | C. Sulawesi            |                    |                             |
|              |                                              |             | U87-MG Crude    |          |                  | L. Willd.              |                    |                             |
| Euphorbiaceae| *Aleurites moluccanus* (L.) Willd.           | Kemiri      | N/A Subfraction | N/A       | IV               | LC                    |                    |                             |
| Euphorbiaceae| *Croton argyrous* Blume                      | Calik angin | LU-1 Crude      | 1.7       |                  | Kodiak                |                    |                             |
| Euphorbiaceae| *Euphorbia milii* Des Moul.                  | Pakis giwang, bunga euphoria | N/A Subfraction | N/A       | IV               | Madagascar            |                    |                             |
| Euphorbiaceae| *Euphorbia pulcherrima* Willd. ε Klotzsch    | Ehrlich ascites | Subfraction     | 3.32      |                  | Mexico                |                    |                             |
| Euphorbiaceae| *Jatropha gossypiifolia* L.                  | Jarak merah | HepG2-1886 Subfraction | 0.99      |                  | S. E. Sulawesi (BGC and IUCN, 2019) |                    |                             |
|              |                                              |             | WIDR HeLa AGS   | 2.79      |                  |                        |                    |                             |
|              |                                              |             | Subfraction     | 1.60      |                  |                        |                    |                             |
|              |                                              |             |                 | 0.78      |                  |                        |                    |                             |
| Euphorbiaceae| *Macaranga rhizinoides* (Blume) Müll.Arg.    | Awu         | P388 Subfraction | 4.97      |                  | Java                  |                    |                             |
| Euphorbiaceae| *Macaranga tanarius* Parasol leaf tree (L.) Müll.Arg. | U87 A549 | Subfraction     | 0.0144    |                  | W. Sumatra             |                    |                             |
|              |                                              |             |                 | 0.09      |                  |                        |                    |                             |
| Euphorbiaceae| *Macaranga triloba* (Thunb.) Müll.Arg.       | Mahang damar | Hepa 1c1c7 Subfraction | N/A       | IV               | W. Java                |                    |                             |
|              |                                              |             |                 |           |                  |                        |                    |                             |

**IC50 Values (µM)**: The concentrations at which 50% of the maximum effect is achieved.

**Geographical Location**: The geographical location of the plant collection.

**References**: The references for the study and findings.

**Assay**: The type of assay used to determine the IC50 values.

**Plant Part Assay**: The specific plant part used in the assay.

**Plant Part**: The part of the plant used in the study.

**Plant**: The name of the plant species used in the study.
| Family         | Genus and Species                                      | Plant Name                             | Coat No.   | Coat No.2   | Coating | Source Code | Source Code   | Source Code | Source Code | Source Code | Source Code |
|---------------|--------------------------------------------------------|----------------------------------------|------------|-------------|----------|-------------|---------------|--------------|--------------|--------------|--------------|
| **Equisetaceae** | *Equisetum ramosissimum* Desf.                        | Branched Horsetail                     | A375       | A375.S2     | A2058    | Crude       | N/A           | IV           | Melanoma inhibitor | N/A          | LC (Lansdown, 2018) | PT.169.      |
|                |                                                        |                                        |            |             |          |             |               |              |              |              |              |
| **Fagaceae**   | *Quercus acuta* Thunb.                                 | Japanese green oak                     | N/A        | N/A         | Subfraction | 25.5       | IV           | Contains chlorogenic acid | N/A          | Japan | LC (BGCI and IUCN, 2019) | XIII.A.36; XIII.B.55. |
|                |                                                        |                                        |            |             |          |             |               |              |              |              |              |
| **Gnetaceae**  | *Gnetum gnemon* L.                                     | Melinjo                                | P388       | N/A         | Subfraction | 2.08      | II           | Contains gnetol and (+)- lirioresinol B | N/A          | LC (Baloch, 2011) | IX.A.14.     |
|                |                                                        |                                        |            |             |          |             |               |              |              |              |              |
| **Hernandiaceae** | *Hernandia nymphaeifolia* (J.Presl) Kubitzki         | Kampis tiongkok                        | KKU-M156   | HepG2       | Subfraction | 1.68      | N/A          | LB. Contains ß- apopicropodo-phyllin, dehydro-podophyllotoxin, and (-)- maculatin | Papua | N/A | VII.C.142-142a, 143-143a. |
|                |                                                        |                                        |            |             |          |             |               |              |              |              |              |
| **Hydrangeaceae** | *Dichroa febrifuga* Lour.                              | Hidakagea                              | MDA-MB-231 | HeLa        | SiHa      | Crude       | 0.08          | 143.18 ± 13 | 106.45 ± 16 | 130.95 ± 3.8 | LC (World Conservation Monitoring Centre, 1998) | IV.D.12-12a; XII.A. 18-18a. |
|                |                                                        |                                        |            |             | C-33A     |             |               |              |              |              |              |
| **Hypericaceae** | *Cratoxylon formosum* (Jacq.) Benth. and Hook.f. ex Dyer | Butun                                  | MCF7       | HeLa        | SiHa      | Crude       | 0.08          | 143.18 ± 13 | 106.45 ± 16 | 130.95 ± 3.8 | LC (World Conservation Monitoring Centre, 1998) | IV.D.12-12a; XII.A. 18-18a. |
|                |                                                        |                                        |            |             | C-33A     |             |               |              |              |              |              |
| **Iridaceae**  | *Iris halophila* Pall.                                 | Long leafed flag                       | KB         | N/A         | Subfraction | 5.22      | II           | Contains halophilol A | Asia, Europe | N/A | I.J.I.22. |
|                |                                                        |                                        |            |             |          |             |               |              |              |              |              |
|                | *Iris pseudacorus* L.                                  | Yellow flag, yellow iris               | N/A        | N/A         | Subfraction | 6.79      | IV           | Contains irisinone A | America | LC (Song, et al., 2019) | IV.E.20.IV.E.49. |
|                |                                                        |                                        |            |             |          |             |               |              |              |              |              |
| **Juglandaceae** | *Pterocarya stenoptera* DC.                            | Chinese wingnut                        | MCF7       | N/A         | Subfraction | 28.92     | III          | W. Java        | N/A | L.D.81. |
|                |                                                        |                                        |            |             |          |             |               |              |              |              |              |
| **Lamiaceae**  | *Clerodendrum trichotomum* Thunb.                      | Harlequin glorybower                  | HeLa       | N/A         | Subfraction | 29.82     | II           | Contains (20R,22E,24R)-Stigmasta-5,22,25-trien-3b,7b-diol | China | N/A | IV.C.7-7a. |
|                |                                                        |                                        |            |             |          |             |               |              |              |              |              |
| **Lamiaceae**  | *Rotheca serrata* (L.) Steane and Mabb.                | Senggugu                               | EACC       | EACC       | Crude       | >250       | III          | Myanmar, India | N/A | IV.C.7-7a. |
|                |                                                        |                                        |            |             |          |             |               |              |              |              |              |
| Family     | Genus                  | Species                        | Country          | Type            | Culture Number | MDA-MB-231 | MDA-MB-435 | B16F10 | CaCo-2 | C6 | SNB-75 | N’gaman et al. 2014 | LA | Jambi | LC (de Kok, 2019) | XVIII.B.55-55a |
|------------|------------------------|--------------------------------|------------------|-----------------|----------------|-------------|-------------|---------|---------|----|--------|---------------------|----|-------|-------------------|----------------|
| Lamiaceae  | *Gnetina arborea*      | Jati putih                     | MDA-MB-231       | Crude           | 0.246          | 0.379       | 0.246       | 0.250   | 0.304   | 0.404 | (N’gaman et al. 2014) |     |       |                   |                |
|            |                        |                                | MDA-MB-435       |                 |                |             |             |         |         |      |                     |     |       |                   |                |
|            |                        |                                | B16F10           |                 |                |             |             |         |         |      |                     |     |       |                   |                |
|            |                        |                                | CaCo-2           |                 |                |             |             |         |         |      |                     |     |       |                   |                |
|            |                        |                                | C6               |                 |                |             |             |         |         |      |                     |     |       |                   |                |
|            |                        |                                | SNB-75           |                 |                |             |             |         |         |      |                     |     |       |                   |                |
| Lamiaceae  | *Leonurus cardiaca*    | Motherwort                     | N/A              | N/A             | N/A            | (Sadowska et al. 2017) | IV Immunomodulator and antioxidant | Europe | N/A | IV.B.2-2a. |
|            |                        |                                |                  |                 |                |             |             |         |         |      |                     |     |       |                   |                |
| Lamiaceae  | *Mentha canadensis*    | American wild mint             | N/A              | N/A             | N/A            | (Kapp 2015; Hossan et al. 2014) | IV. Contains Rosmarinic acid, cathecin | Europe | N/A | I.G.180. |
|            |                        |                                |                  |                 |                |             |             |         |         |      |                     |     |       |                   |                |
| Lamiaceae  | *Mentha x piperita*    | Peppermint                     | SPC-A1           | Essential oil   | 10.89          | 16.16       | 38.76       |         |         |      |                     |     |       |                   |                |
|            |                        |                                | K-562            |                 |                |             |             |         |         |      |                     |     |       |                   |                |
|            |                        |                                | SGC-7901         |                 |                |             |             |         |         |      |                     |     |       |                   |                |
| Lamiaceae  | *Salvia farinacea*     | Salvia ungu                     | MCF7             | Crude           | 59.8 ± 0.1     | 279.5 ± 10.1 | 77.8 ± 3.5  | 87.4 ± 5.4 |         |      |                     |     |       |                   |                |
|            |                        |                                | NHII-H460        |                 |                |             |             |         |         |      |                     |     |       |                   |                |
|            |                        |                                | HeLa             |                 |                |             |             |         |         |      |                     |     |       |                   |                |
|            |                        |                                | HepG2            |                 |                |             |             |         |         |      |                     |     |       |                   |                |
| Lamiaceae  | *Salvia splendens*     | Salvia merah                    | N/A              | N/A             | N/A            | (Chopra et al. 2016) | IV Contains quercetin | Brazil | N/A | L.J.I.1. |
|            |                        |                                |                  |                 |                |             |             |         |         |      |                     |     |       |                   |                |
| Lauraceae  | *Cinnamomum burmannii* | Holim, cassia paandg           | T-47D            | Crude           | 75             | (Anjarsari et al. 2013) | II | | | | | China, Japan | N/A | | | | |
| Lauraceae  | *Cinnamomum camphora*  | Camphor                        | MCF7             | Crude           | 71.2 ± 26.8    | (Satyal et al. 2013; Bandopadhyaya et al. 2015) | II | | | | | China, Japan | N/A | | | | |
| Family | Genus | Species | Common Name | Cell Line | Treatment | Subfraction | LC-MS/MS | Bioactivity | Source |
|--------|-------|---------|-------------|-----------|-----------|-------------|---------|------------|--------|
| Lauraceae | Cinnamomum | cassia (L), J.Presl | Casia cina | HL-60 A549 | Subfraction | 3.18 | 4.38 | (Ngoc et al. 2014) | LB Contains Coumacassia [6,7-dimethoxy-8-O-(2',3'-dimethyloct-6-en-5-one-1-yl)coumarin] | S. Sumatra, W. Sumatra, China, Myanmar, Jambi | W. Java | N/A | II.A.62-62a; II.A.59-59c; VII.C.80; IX.B.108, 109; VII.C. 149; VIII.B. 81-81a; XIX.A.12-12a |
| Lauraceae | Cinnamomum | iners Reinw. ex Blume | Huru geding, kayu tuha | HCT-116 | Crude | 31 | | (Ghalib et al. 2011) | II | W. Sumatra, W. Java | LC (de Kok, 2019) | | |
| Lauraceae | Cinnamomum | subavenium Miq. | Sabal-sabal | A549 DU-145 LNCaP | Subfraction | 2.24 ± 0.03 | 2.42 ± 0.01 | 7.01 ± 0.03 | (R.-J. Lin et al. 2008) | Jambi | LC (de Kok, 2020) | | |
| Lauraceae | Cinnamomum | verum J.Presl | True cinnamon | Hep3B | Crude | 3.62 | | (Perng et al. 2016) | I.B. Contains 2-methoxycinnamaldehyde | Jambi, Bengkulu | N/A | N/A | VIII.B.34-34a; VIII.B.337. |
| Lauraceae | Cinnamomum | verum J.Presl | True cinnamon | Hep3B | Crude | 58 | | (Abd Wahab and Adzmi 2017; Kubatka et al. 2020) | II. In vivo study | N/A | N/A | N/A | VIII.B.337. |
| Lauraceae | Cinnamomum | verum J.Presl | True cinnamon | Hep3B | Crude | >10 | | (Awang et al. 2008; Cortez et al. 2017) | I.A. Contains (-)neocaryachine | Formosa | N/A | XV.B.15-15a. |
| Lauraceae | Cryptocarya | chinensis (Hance) Hems. | Cryptocarya cina | L1210 P388 A549 HCT-8 P388 | Subfraction | 0.1 | 0.002 | 0.001 | (T.-S. Wu et al. 2012) | I.A. Contains (-) -antofine and dehydroantofine | Java, Sumatra | N/A | VLD.50. |
| Lauraceae | Cryptocarya | costata Blume | N/A | | | | | | (Usman et al. 2006) | I.B. Contains 2',4' -dihydroxy-5',6'-dimethoxychalcone | C. Java | LC (de Kok, 2020) | VIII.B.263. |
| Lauraceae | Cryptocarya | crassinervia Miq. | Meandg batu | A549, MCF7, HT-29 | Crude | >10 | | (Awang et al. 2008; Cortez et al. 2017) | II. Contains (-) Grandis | W. Sumatra | N/A | N/A | VII.C.307. |
| Lauraceae | Cryptocarya | konishii Hayata | N/A | P388 HL-60 A549 | Subfraction | 0.01 | 0.55 | 1.98 | 4.28 | (Kurniadewi et al. 2010) | | | Formosa | N/A | XV.B.15-15a. |
| Lauraceae | Cryptocarya | laevigata Blume | Red-fruited laurel | A549 | Subfraction | 0.021 | 0.086 | 0.134 | 0.074 | 0.078 | (Suzuki et al. 2018) | | | China, Myanmar, Lampung | W. Java | LC (BGCI and IUCN, 2018) | XIV.A.30-30a; IX.A.60; XV.B.27. |
| Lauraceae | Cryptocarya | strictifolia Kosterm. | N/A | A549 MDA-MB-231 MCF7 KB KB-VIN N/A | N/A | N/A | | (Juliawaty et al. 2000; Rasul et al. 2013) | IV Contains pinocembrin | N. Sulawesi | N/A | VIII.A.32. |
| Family      | Species                        | Common Name                          | Cell Line | Concentration (IC₅₀) | Source/Reference                          | Region/Location         |
|-------------|--------------------------------|--------------------------------------|-----------|----------------------|------------------------------------------|-------------------------|
| Lauraceae   | Laurus nobilis L.              | Bay leaf                            | MCF7      | Crude 28 ± 12.3 ± 4.0| (Abu-Dahab et al. 2014)                   | Medit Reg.              |
| Lauraceae   | Lindera polyantha Boerl.       | Spicewood, spicebush, benjamin bush | N/A       | Subfraction          | N/A                                      | W. Java                 |
| Lauraceae   | Litsea cubeba (Lour., Pers.)   | Kilemo, krangean                    | J5        | Crude 50 ± 100       | (Ho et al. 2010)                         | W. Java, S. Sumatra, W. Sumatra |
| Lauraceae   | Litsea elliptica Blume         | N/A                                 | A549      | Crude                | N/A                                      | W. Java Lampung         |
| Lauraceae   | Litsea garciae Vidal           | N/A                                 | MCF7      | Crude 66 ± 73        | (Kutoi et al. 2012)                      | C. Sulawesi, S. Sumatra, W. Sumatra |
| Lauraceae   | Litsea mappacea Boerl.         | Huru koneng                         | MCF       | Crude 200 ± 66       | (Subarnas et al. 2012)                   | W. Java, W. Sumatra     |
| Lauraceae   | Litsea monopetala (Roxb.) Pers. | Alpukat                             | MCF7      | Subfraction          | 20.48 ± 12.3                            | IV                      |
| Leguminosae | Acacia caffra (Thunb.) Willd.  | Hook thorn                          | HeLa      | Crude 185.00 ± 0.4   | (Twilley et al. 2017)                    | S. Africa               |
| Leguminosae | Acacia farnesiana (L.) Willd.  | Kembang jepun                       | HepG2     | Subfraction          | 1.87 ± 0.04                             | Trop. America           |

Note: Concentrations are provided in μM or IC₅₀ values.
| Family       | Genus                          | Species                     | Source          | Type          | Subfraction | IC50 (µM) | Activity                          | Country   | Location            |
|--------------|--------------------------------|-----------------------------|-----------------|---------------|--------------|-----------|-----------------------------------|-----------|---------------------|
| Leguminosae  | Acacia                         | Acacia tenuifolia (L.)      | M109 A2780      | Subfraction   | 1            | 13.0      | LB                                | Venezuela | VII.A.62-62a.       |
|              |                                | Willd.                      |                 |               |              |           | Contains Albiziatrioside A 3-O-[a-D-xylono-pyranosyl-(1f2)-r-Larabinopyranosyl-(1f6)-2-acetamido-2-deoxy-a-D-glucopyranosyl]oleanolic acid, 3-O-[r-L-Arabino-pyranosyl-(1f2)-r-L-arabinopyranosyl-(1f6)-2-acetamido-2-deoxy-a-D-glucopyranosyl]oleanolic acid, Acacioside B and Acacioside C |           |                     |
|              | Bauhinia                       | Bauhinia integrifolia       | N/A             | Crude         |              |           | IV                                | Malaya & Sumatra | N/A                  |
|              |                                | Roxb.                       | Flame vine bauhinia |               |              |           | Antiangiogenic                     |           | III.C.54.            |
|              |                                | Bauhinia strychnifolia      | HT-29 HeLa/MCF7 | Subfraction   | 0.00217      | 0.0927    | LA                                | C. Sulawesi | N/A                  |
|              |                                | Craib                       | Yhanang andg    |               | 0.05857      | 0.000547  | Contains 3,5,7,3′,5′-Pentahydroxyflavanonol-3-O-α-Lrhamnopyranoside |           | VII.B.220.           |
|              |                                |                             |                 |               |              |           | Antiangiogenic                     |           |                     |
|              | Bauhinia variegata             | Bauhinia variegata L.       | Crude HEP2 HBL-100 |               | 250          | >300      | III                               | Myanmar, E. India | LC (Chadburn, 2012) |
|              |                                |                             | Camel’s foot tree |               |              |           |                                   |           | IL.D.7; IV.D.7.      |
|              | Caesalpinia                    | Caesalpinia gilliesii       | MCF7            | Crude         | 36.5         |           | II                                | Australia | I.K.59-59a.          |
|              |                                | (Hook.) D.Dietr.            | Kembang merak   |               |              |           |                                   |           |                     |
|              |                                |                             |                 |               |              |           |                                   |           |                     |
|              | Caesalpinia                    | Caesalpinia sappan L.       | 4T1             | Crude         | 13.1         |           | I.D                               | Aceh      | LC (World Conservation Monitoring Centre, 2018) |
|              |                                |                             |                 |               |              |           |                                   |           | IX.B.70.             |
|              | Caesalpinia spinosa            | Caesalpinia spinosa         | Divi-divi, tara | K-562         | Subfraction  | 44.50 ± 4.05 | II                                | Pantro-pical | N/A                  |
|              | (Molina) Kuntze                |                             |                 |               |              |           |                                   |           | IV.E.30b; XIV.A.47; XIV.B.4-4a |
|              |                                |                             |                 |               |              |           |                                   |           | XIX.A.16.            |
|              | Dalbergia                     | Dalbergia parviflora       | KB/MCF7         | Subfraction   | 4.18         | 5.37      | LA                                | W. Java   | LC (Chadburn, 2012) |
|              | parviflora                    | Roxb.                       | Akar laka       |               | 3.47         |           | Contains secundiflorol H          |           |                     |
|              |                                |                             |                 |               |              |           |                                   |           |                     |
|              | Deris                         | Deris elliptica             | HCT-116 MCF7    | Crude         | 37 ± 1.5    | 34 ± 0.8  | II                                | Lampung   | N/A                  |
|              | elliptica                     | (Wall.) Benth.              | Tuba            |               |              |           |                                   |           | IX.B.103-103a.       |
| Family            | Genus                          | Species                        | Cell Line | Concentration | Source                                                                 | LC                | American Trop. | LC (BGCI and IUCN, 2019) | LC (BGCI and IUCN, 2019) |
|-------------------|--------------------------------|--------------------------------|-----------|---------------|-------------------------------------------------------------------------|------------------|-----------------|--------------------------|--------------------------|
| Leguminosae       | *Enterolobium*                  | *contortisiliquum* (Vell.) Morong | HepG2     | 15.7          | (Matloub et al. 2018; Abdel-Mageed et al. 2019)                        | LC               | Contains contortisilioside E |                           |                           |
|                    |                                 | Red-hot poker, coral tree      | MCF7      | 12.3          | (P. H. Nguyen et al. 2009)                                             | LA               | Contains erybredin B         | E. Africa                 |                           |
| Leguminosae       | *Erythrina*                     | *abbyssinica* DC.              | MCF7/TAMR | 4.61          | (Abdel-Mageed et al. 2019)                                             |                 |                               |                           |                           |
|                    |                                 |                                | MCF/ADR   | 2.42          |                                                                         |                  |                               |                           |                           |
|                    |                                 |                                | MDA-MB-231| 2.19          |                                                                         |                  |                               |                           |                           |
|                   |                                 |                                |           | 3.01          |                                                                         |                  |                               |                           |                           |
| Leguminosae       | *Erythrina*                     | *crista-galli* L.              | MCF7      | 23.3 ± 1.9    | (Ashmawy et al. 2016)                                                  | II               |                               | Brazil                    |                           |
| Leguminosae       | *Erythrina*                     | *fusca* Lour.                  | HeLa      | 76            | (Meiyanto et al. 2007)                                                 | II               |                               | C. Java                   |                           |
| Leguminosae       | *Flemingia*                     | *macrophylla* (Willd.) Merr.    | MCF7      | N/A           | (W.-C. Lai et al. 2013)                                                | IV               | Contains flemiphilippinin D and flemichin-D | Africa, Asia              |                           |
|                    |                                 | Chinese honey locust           |           | 19.54         | (Yu et al. 2019)                                                       |                  | II Contains gleditsiside F   | China                     |                           |
| Leguminosae       | *Pterocarpus*                   | *indicus* Wild.                | N/A       | N/A           | (Takeuchi et al. 1986; J. Yang et al. 2020)                             | IV               | Contains cinnamaldehyde (E)  | Maluku                    |                           |
| Leguminosae       | *Sophora*                       | *tetrapetra* J.F.Mill.         | Kowhai    | N/A           | (Baskar et al. 2010; McDougal et al. 2018)                             | IV               | Contains sophoraflavanone G | C. Sulawesi               |                           |
|                    |                                 | Ki ucing                       | HSC-2     | <8            | (Shirata et al. 2001)                                                 |                  |                               | New Zealand              |                           |
|                    |                                 |                                | HSG       | 8             |                                                                         |                  |                               | N/A                       |                           |
|                    |                                 |                                |           | N/A           |                                                                         |                  |                               |                           |                           |
| Malvaceae         | *Cola*                          | *acuminata* (P. Beauv.) Schott and Endl. | LNCaP DU-145 | 15            | (Solipuram et al. 2009)                                               | I.D              |                               | Borneo                    |                           |
|                    |                                 | Bissy, true kola               |           | 3.6           |                                                                         |                  |                               | LC (Cheek and Lawrence 2019) |                           |
| Malvaceae         | *Cola*                          | *nitida* (Vent.) Schott and Endl. | HepG2     | 6.5           | (Endrini and Marsiati 2009)                                            | I.D              |                               | W. Africa                 |                           |
|                    |                                 | Kola nut                       |           |               |                                                                         |                  |                               | LC (Cheek and Lawrence 2019) |                           |
| Malvaceae         | *Hibiscus*                      | *rosasinensis* L.              | K-562     | 30.90 ± 1.10  | (Arullapan et al. 2013)                                               | II               |                               | Japan: Sakarotsui         | N/A                       |
|                   |                                 | Kembang sepatu                 |           |               |                                                                         |                  |                               | N/A                       |                           |

**Notes:**
- The concentrations are typically reported as IC50 values.
- LC stands for Leukemia Cell.
- American Trop. refers to the American tropics.
- V.I. indicates the specific volume and index in the IUCN Red List classification.
| Family          | Species Name                      | Common Name                        | GenBank Accession | Treatment | Concentration | Constituents                                                                 | Location                      | Status   | Notes                      |
|-----------------|-----------------------------------|------------------------------------|-------------------|-----------|---------------|-----------------------------------------------------------------------------|-------------------------------|----------|---------------------------|
| Malvaceae       | *Hibiscus syriacus* L.            | Kembang sepaturi mawar             | A549              | Subfraction | 2.59          | Contains betulin-3-ceaffeate                                               | Syrian Arab Republic          | N/A      | VI.C.13; XXI.A.28.        |
| Melastomataceae | *Melastoma malabathricum* L.      | Rhododen-drone                     | MCF7              | Crude      | 7.14          | Contain betulin-3-ceaffeate, propyl-5-en-3-acetate                          | Republic of India, Malaysia   | N/A      | IV.C.72; XIV.A.39, 62.   |
| Meliaceae       | *Aglia angustifolia* (Miq.) Miq. | Kembang sepatu mawar              | MCF7              | Subfraction | 29.87         | Contains 2,24-(E)-propyl-5-en-3-acetate                                    | Syria                         | N/A      | VI.C.13; XI.A.28.         |
| Meliaceae       | *Aglia argentea* Blume            | Bayur                              | LU-1              | Subfraction | 0.001         | Contains desmethylnocaglamid                                                | India                         | I.C      | IV.C.72; XIV.A.39, 62.   |
| Meliaceae       | *Aglia edulis* (Roxb.) Mamuara disik Wall. |                     | LU-1              | Subfraction | 0.001         | Contains 1-O-acetate                                                        | Malaysia                      | I.A      | III.F.76; IX.A.154.       |
| Meliaceae       | *Aglia elliptica* (C.DC.) Blume   | Kembang sepaturi mawar             | LU-1              | Subfraction | 0.9           | Contains 2,24-(E)-propyl-5-en-3-acetate                                    | Aceh                         | I.A      | IX.C.39-39a.IX.165.       |
| Meliaceae       | *Aglia eximia* Miq.               | P388                              | Subfraction      | 4.26 ± 0.09 | (Awang et al. 2012; Harneti et al. 2014)                                   | N/A                           | II       | VIII.B.8; III.F.75; IX.A.191; IX.A.179. |
| Meliaceae       | *Aglia forbesii*                   | Langsat burung                     | KB                | Subfraction | 0.006         | Contains dammar-20,25-diene-3b,24-diol and 24(E)-cycloart-24-ene-26-ol-3-one | Aceh                         | N/A      | N/A                       |
| Meliaceae       | *Aglia lawii* (Wight) C.J.Salandha | Karakil                            | N/A               | N/A        | N/A           | Contains aglinin A, aglinin B, and rocaglaol                               | W. Java                       | N/A      | N/A                       |
| Meliaceae       | *Aglia odorata* Lour.              | Pacar cina                         | Subfraction      | 4.43      | (Cai et al. 2010)                                   | N/A                           | IV       | N/A                       |
| Meliaceae       | *Aglia odoratissima* Blume         | Kasai                              | P388              | Crude      | N/A           | Contains dolabellane diterpenoids                                           | W. Java                       | N/A      | IV.B.118                  |
| Meliaceae       | *Aglaia odoratissima* Blume        |                                   |                   |            |               |                                                                                |                               |          |                           |
| Family     | Genus                     | Species                          | Culture          | Subfraction | Concentration | Source       | Country       |
|------------|---------------------------|----------------------------------|------------------|-------------|---------------|--------------|---------------|
| Meliaceae  | Aglaia silvestris         | (M.Roem) Merr.                   | Asam mbawang     | Lu1         | 1.5 N/A       | LNCaP       | W. Java       |
|            |                           |                                  | LNCaP            | 1.5         |               |              | NT           |
|            |                           |                                  | MCF7             | 1.5         |               |              | III.F.79.     |
| Meliaceae  | Aglaia tomentosa Teijsm. and Binn. | Nirmula                        | N/A              | N/A         | N/A           | N/A         | N/A           |
|            | Chisocheton lasiocarpus (Miq.) Valeton | Lamboi, latupak                | MCF7             | Subfraction | 1.82          | L.A         | N/AAfrica     |
|            |                           |                                  |                  |             |               |              | N/ATropis    |
|            | Chisocheton patens Blume  |                                  | MCF7             | Subfraction | 15.05         | L.A         | N/AC. Java    |
|            |                           |                                  |                  |             |               |              | N/A           |
|            | Sandoricum koetjape (Bur. f.) Merr. | Kecapi, mangga hutan | MCF7             | Subfraction | 44-48         | L.A         | India to S. China & Malesia |
|            |                           |                                  |                  |             |               |              | LC Lampung   |
|            | Toona ciliata M. Roem.    | Cedar merah                     | Crude            | >200        |               | III         | Papua         |
|            |                           |                                  |                  |             |               |              | LC Lampung   |
|            | Toona sinensis (Juss.) Surian, mahoni cina | MGc-803 PC-3 A549 MCF7 NIEF3 | Subfraction     | 7.09        | 5.65          | L.A         | India to S. China & Malesia |
|            |                           |                                  |                  |             | 2.59          |              | LC Lampung   |
|            |                           |                                  |                  |             | 4.15          |              |              |               |
|            |                           |                                  |                  |             | 2.48          |              |              |               |
|            | Toona sureni (Blume) Merr. | Suren                           | Crude            | 31          | 31            | II          | India to S. China & India |
|            |                           |                                  |                  |             | 65            |              | LC Lampung   |
|            |                           |                                  |                  |             |               |              |              |               |
| Menispermaceae | Cocculus orbiculatus (L.) DC. | Cincau cina                    | HepG2 Hep3B MCF7 | Subfraction | 0.6 0.75 2.0 1.2 | L.A         | W. Sumatra    |
|            |                           |                                  |                  |             |               |              | N/A           |
| Menispermaceae | Stephania hernandifolia (Wiild.) Walp. | Areuy geureung, tayungan | MDA-MB-231 KB | N/A         | N/A           | IV          | N/AD. 70a-70b |
| Moraceae   | Artocarpus altitis (Parkinson ex F.A.Zorn) | Sukun                           | Crude            | 40          |               | II          | Papua         |
|            |                           |                                  |                  |             |               |              | N/A           |

Note: Concentration values are given in micrograms per milliliter (µg/mL).
| Moraceae | Artocarpus elasticus | Benda, bendho | A549 Hep3B HT-29 MCF7 | Subfraction | 1.1 3.2 3.1 2.7 35.27 | (Ko et al. 2005) I.A Contains artelastoxanthone and artonol A Kaliman-tan W. Java Bengkulu C. Sulawesi Java N/A LC (BGCI and IUCN, 2018) VIII.C.18, 25; V.III.69; VII.C.5; VII.B.218; XL.I.8. | Moraceae | Artocarpus heterophyllus Lam. Nangka P388 Subfraction | 1.7 | (Ko et al. 2005) I.A Contains artelastoxanthone and artonol A Kaliman-tan W. Java Bengkulu C. Sulawesi Java N/A LC (BGCI and IUCN, 2018) VIII.C.18, 25; V.III.69; VII.C.5; VII.B.218; XL.I.8. |
| Moraceae | Artocarpus lanceifolius Roxb. Kaleang A549 | 3.2 3.1 2.7 133 | (Subarnas et al. 2012) I.B. Contains Artoindonesiani n, artobiloxanthone, and cycloartobiloxanthone C. Sulawesi N/A LC (BGCI and IUCN, 2019) VI.C.76; XIII.A.43; XIII.B.53. | Moraceae | Ficus benjamina L. Beringin MCF | 133 | (Subarnas et al. 2012) I.B. Contains Artoindonesiani n, artobiloxanthone, and cycloartobiloxanthone C. Sulawesi N/A LC (BGCI and IUCN, 2019) VI.C.76; XIII.A.43; XIII.B.53. |
| Moraceae | Ficus deltoidea Jack. Tabat barito DU-145 | 93.11 | (Patel and Patel 2011) II. Contains oleanolic acid, friedelin, and epilupeol acetate W. Java N/A LC (BGCI and IUCN, 2018) VII.C.76; XIII.A.43; XIII.B.53. |
| Moraceae | Ficus drupacea Thunb. Ara oklat-wol, kowang HeLa MCF7 Jurkat HT-29 T24 | Subfraction | 15.16±1.6 16.28±1.3 19.64±2.6 25.58±1.3 12.81±1.4 | (Yessoufou 2015) II. Contains oleanol acid, friedelin, and epi-lupeol acetate W. Sumatra N/A LC (BGCI and IUCN, 2018) II.C.34. |
| Moraceae | Ficus fistulosa Reinv. ex Blume Ara, beunying MDA-MB-468 MDA-MB-231 MCF7 MCF10A | 0.015 0.191 0.362 4.299 | (Al-Khdhairawi et al. 2017) I.A Contains (-) tengechlorenine Jambi Java, Sumatra W. Java N/A LC (Shao et al., 2019) II.C.45; VII.C.266-266a; VII.C.67-67a; VII.B.40-40a; X.B.8. II.C.49a-49b-49c. |
| Moraceae | Ficus hirta Vahl. Gegedanganara HeLa | Crude | >1000 | (Zeng et al. 2012) III. Contains albanol A China N/A LC (Shao et al., 2019) II.C.45; VII.C.266-266a; VII.C.67-67a; VII.B.40-40a; X.B.8. II.C.49a-49b-49c. |
| Moraceae | Ficus religiosa L. Ara A549 | N/A 200 | (Subarnas et al. 2012) IV. Engineered with copper oxide nanoparticle Srilangka N/A LC (Shao et al., 2019) II.C.45; VII.C.266-266a; VII.C.67-67a; VII.B.40-40a; X.B.8. II.C.49a-49b-49c. |
| Moraceae | Ficus septica Burm.f Awar-awar T-47D | 9.3 | (Nugroho et al. 2013) I.D Malesia W. Java, Sumatra China N/A LC (BGCI and IUCN, 2019) II.C.14; II.C.41; II.C.37; XV.A.25. |
| Moraceae | Morus alba L. White mulberry HL-60 CRL1579 MCF7 | Subfraction | 0.95 5.56 575±15 | (Kikuchi et al. 2010) LB Contains albanol A III Temp. Asia N/A LC (BGCI and IUCN, 2019) II.C.14; II.C.41; II.C.37; XV.A.25. |
| Moraceae | Morus nigra L. Blackberry HEPG2 MCF7 EACC | Crude | 58.06 | (Abou-Elella and Mourad 2015; Salama et al. 2020) II W. Java N/A LA.90-90a, 107-107a, 108. | Musaceae | Musa acuminata Colla Pisang | Crude | 58.06 | (Abou-Elella and Mourad 2015; Salama et al. 2020) II W. Java N/A LA.90-90a, 107-107a, 108. |
| Family          | Genus                  | Species                              | Collection              | Tissue     | Assay          | IC50 (μg/mL) | Location   | Notes                  |
|-----------------|------------------------|--------------------------------------|-------------------------|------------|----------------|-------------|------------|------------------------|
| Myricaceae      | Myrica esculenta       | Bayberry, banyan                   | HepG2, Hela MDA-MB-231  | Crude      | >1000          | (Shod and Shri 2018) | W. Java    | N/A                    |
| Myricaceae      | Myrica rubra (Lour.)   | Yangmei, bayberry                   | Ca-Co2                   | Subfraction| 24.4 ± 2.4     | (Ambrož et al. 2015) | China, Japan | N/A                    |
| Myrtaceae       | Callistemon citrinus   | Sikat botol                         | MCF7                    | Crude      | 2.29           | (Fayemi et al. 2019) | Australia  | N/A                    |
| Myrtaceae       | Eucalyptus globulus    | Gum biru selatan                   | A549                    | Crude      | N/A            | (Adnan 2019) | China      | LC (Fensham et al. 2019) |
| Myrtaceae       | Eucalyptus microcorys  | Kayu pohon                          | MIA-PaCa2               | Crude      | 93.11 ± 3.43   | (Bhuyan et al. 2018) | Australia  | NT                     |
| Myrtaceae       | Eucalyptus robusta     | HT-29 U87                           | A549                    | Crude      | 77 ± 2.0       | (Vuong et al. 2015) | New S. Wales  | NT                     |
| Myrtaceae       | Decaspermum fruticosum| Ipis kulit                           | HT-29                   | Crude      | 154            | (Subarnas et al. 2012) | W. Java    | N/A                    |
| Myrtaceae       | Eugenia uniflora L.    | Dewandaru                           | T-47D DU-145            | Crude      | 65             | (Ismiyati et al. 2012; Alade-sanmi et al. 2019) | Trop. America | N/A                    |
| Myrtaceae       | Melaleuca alternifolia| Tea tree                            | HT-29                   | Crude      | 12.5           | (Byahatti et al. 2018) | Australia  | N/A                    |
| Family         | Genus                        | Species                  | Source          | Type         | Subfraction | IC50 (µM) | Source          | Location          | LC Code          |
|---------------|------------------------------|---------------------------|-----------------|--------------|-------------|-----------|-----------------|-------------------|------------------|
| Myrtaceae     | *Psidium cattleianum*       | Strawberry guava          | HepG2, AGS, HeLa, SNU-1, SNU-16 | Subfraction | 0.81        | 2.51     | (Jun et al. 2011) | Brazil            | N/A              |
| Myrtaceae     | *Psidium guajava* L.        | Jambu biji                | KBM5 SCC4 U266  | Crude        | 22.73 ± 2.55 | 22.82 ± 2.36 | 20.97 ± 4.39 | (Ashraf et al. 2016) | Trop. America     | I.K.10.          |
| Myrtaceae     | *Rhodamnia cinerea* Jack    | Ki beusi                  | MCF7            | Crude        | 150         |          | (Subarnas et al. 2012) | W. Java           |                  |
| Myrtaceae     | *Syzygium cumini* (L.) Skeels | Black plum               | A549            | Crude        | 59 ± 4      |          | (Aqil et al. 2012) | Java              |                  |
| Myrtaceae     | *Syzygium jambos* (L.) Alston | Jambu mawar, Malabar plum | HeLa A431 A375  | Crude        | 56.20 ± 3.00 | 54.70 ± 0.60 | 198.00 ± 3.00 | (Twilley et al. 2017) | Jambi W. Java     |                  |
| Myrtaceae     | *Syzygium polyanthum* (Wight) Walp. | Salam                   | 4T1 MCF7        | Crude        | 672.6 ± 59.4 | 126.1 ± 50.9 |          | (Nordin et al. 2019) | W. Sumatra        |                  |
| Oleaceae      | *Olea europaea* L. Zaitun    | Zaitun                    | T24 MCF7        | Subfraction  | 4.09        | 2.59     | (Goulas et al. 2009) | Libya             | N/A              |
| Passifloraceae| *Passiflora suberosa* L.     | Markisa, konyal           | HCT-116 OVACAR-8 SF-295 | Crude        | N/A         |          | (Amaral 2019) | Trop. America     | N/A              |
| Pentaphylacaceae| *Ternstroemia gymnanthera* (Wight and Arn.) Sprague | N/A                      | N/A            | N/A          | N/A         |          | (Ikuta et al. 2003; Venkatesan et al. 2017) | Java              | IV.A.17.         |
| Phyllanthaceae| *Glochidion eriocarpum* Champ. Ex Benth. | N/A                      | HL-60 HT-29 MCF7 SK-OV-3 | Subfraction  | 4.92        | 6.09     | (Kiem et al. 2009) | Papua             | N/A              |
| Phyllanthaceae| *Glochidion zeylanicum* (Gaertn.) A.Juss. | N/A                      | HEK293 HepG2 PC-3 | Crude        | 66.6        | 2.99     | (Sharma et al. 2011) | Jambi LC          |                  |
| Phyllanthaceae| *Glochidion zeylanicum* (Gaertn.) A.Juss. | N/A                      | HEK293 HepG2 PC-3 | Crude        | 66.6        | 2.99     | (Sharma et al. 2011) | Jambi LC          |                  |
| Family           | Species                                      | Common Name | Tumor Cell Line | Concentration | Country                                      | IUCN Status | Other Information |
|------------------|----------------------------------------------|-------------|-----------------|---------------|----------------------------------------------|-------------|--------------------|
| **Phyllanthaceae** | *Phyllanthus emblica* L.                     | Kimalaka, malak, kemloko | MCF7            | Crude 54      | W. Java                                      | N/A         | VII.C.144-144a-144b, 271-271a, III.B.3a-3b; IV.F.2; XI. A.13-13a; XIII.B.23-23a; XIV.B.34. |          |
|                  |                                               | Pinus khasi, pinus benguet, pinus tiga jarum | U937            | Crude 299.0 ± 5.2 52.0 ± 5.8 | (Weerapree-yakul et al. 2016)  |            |                    |
| Pinaceae         | *Pinus kesiya* Royle ex Gordon                | Pinus khasi, pinus benguet, pinus tiga jarum | HepG2           | Crude         | (Ponraj and Kannan 2014)                      |            |                    |
|                  |                                               | HeLa        | Crude           | 384.10        | (Proboning-rat et al. 2019)                   | III         |                    |
| Pinaceae         | *Pinus merkusii* Jungh. & de Vriese           | Pinus, tusam | HeLa            | Crude         | Aceh                                         |             |                    |
| Pinaceae         | *Pinus parviflora* Siebold & Zucc.           | Japanese White Pine | L929            | Subfraction  | (Hanaoka at al., 1989)                      | IV          |                    |
| Pinaceae         | *Pinus yunnanensis* Franch.                  | Pinus yunnan | Hepa 6          | Subfraction   | (Lei et al., 2011)                           | III         | Contains planchol E |
|                  |                                               |             |                 |               |                                              |             |                    |
| Piperaceae       | *Piper aduncum* L.                            | Seuseureuhansirhan | HeLa            | Crude         | Peru                                         |             | IV-A.27.           |
| Plantaginaceae   | *Plantago lanceolata* L.                      | Toucan      | MCF7            | Crude 674     | Europe                                       |             | III.D.30.          |
| Poaceae          | *Coxia lacryma-jobi* L.                      | Jali        | HT-29           | Crude 11.61 ± 0.95 | (Manosroi et al. 2016) | LD | Trop. Asia          | N/A         | I.G.35.            |
| Poaceae          | *Phyllostachys edulis* (Carriere) J.Houz.    | Bambu       | Hepa 6          | Subfraction   | China                                        |             | IV. Contains tricin dan 7-O-methyl-tricin |
|                  |                                               |             |                 |               |                                              |             |                    |
| Poaceae          | *Phyllostachys nigra* (Lodd. ex Lindl.) Muuro | Bambu hitam | A375            | Subfraction   | China                                        | N/A         | IV.C.31.           |
| Podocarpaceae    | *Podocarpus macrophyllus* (Thunb.) Sweet      | Luhansung, kusamak | HeLa            | Subfraction   | (Qi et al. 2018) I.A. Contains 2,3-dihydro-2β-hydroxydopodol, inumakilactone B, 2β-hydroxy-nagilactone F, and nagilactone F |  |                    |
| Family             | Species                      | Common Name                  | Plant Name | Cell Line | Treatment | IC50 (μM) | IC50 (μM) | Publication                                                                 |
|-------------------|------------------------------|------------------------------|------------|-----------|-----------|-----------|-----------|----------------------------------------------------------------------------|
| Polygonaceae      | Coccoloba uvifera (L.) L.    | MATA AM, CORAL BERRY         | N/A        | LNCaP     | Crude     | 145 ± 13  | N/A       | (Fort et al., 2018)                                                        |
| Primulaceae       | Ardisia crenata Sims         | MATA AM, CORAL BERRY         | N/A        | HepG2     | Crude     | 54.98 ± 14.10 | 42.26 ± 1.82 | (Nordin et al., 2017; 2018)                                                |
| Primulaceae       | Ardisia crispa (Thunb.) A.D.C. | CHRISTMAS BERRY              | N/A        | MCF7 4T1  | Crude     | 46.82 ± 2.41 | 44.62 ± 2.11 | (Karimi et al., 2016)                                                      |
| Primulaceae       | Embelia ribes Burm.        | KICEMANG BEURIT              | N/A        | P388      | Subfraction | 1.6      | N/A       | (Najihah et al., 2014; Suyatno et al., 2014)                               |
| Rhamnaceae        | Colletia paradoxa (Spreng.) Escal. | JUJUBE                      | N/A        | HT-29     | Crude     | 96       | 93        | (Monks et al., 2002)                                                       |
| Rhamnaceae        | Ziziphus jujuba Mill        | KUUK HEULANG                | N/A        | N/A       | N/A       | 2.28     | 3.97      | (Kikuchi et al., 2011)                                                     |
| Rosaceae          | Eriobotrya japonica (Thunb.) Lindl. | BIWA, LOQUAT                | N/A        | Subfraction | 2.28     | 3.97      | (Cuccioloni et al., 2012)                                                  |
| Rubiaceae         | Coffea canephora Pierre ex A. Froehnert | Kopi robusta              | N/A        | HT-29     | Subfraction | N/A      | N/A       | (Choi et al., 2015; Mori et al., 2016)                                     |
| Family     | Species                        | Herb/Derivative | Plant Part | IC_{50} Value | Source(s)                                                                 | Contain/Effect                             | Location                  | Code   |
|------------|--------------------------------|-----------------|------------|---------------|---------------------------------------------------------------------------|--------------------------------------------|---------------------------|--------|
| Rubiaceae  | *Gardenia jasminoides* J.Ellis | Kacapiring       | MDA-MB-231 | 73.90         | (Kim et al. 2011; Lichota and Gwozdzinski 2018)                           | II Contain genipin                         | E. Indies, China, Japan   | N/A    |
|            |                                |                 | Subfraction|               |                                                                           | Malesia                                   | N/A                       |        |
|            | *Hamelia patens* Jacq.         | Fire brush      | MDA-MB-231 | 94 ± 1.7      | (Menichini et al. 2010; Chanchal et al. 2018)                              | LC Contain genipin                         | Peru                      | N/A    |
|            |                                |                 | Crude      | 13 ± 1.2      |                                                                           | LC                                         | LC                        |        |
|            |                                |                 |            | 22 ± 1.1      |                                                                           | Jambi                                     | LC                        |        |
| Rutaceae   | *Citrus medica* L.             | Jeruk sukade    | A357       | 89.1          | (Mena-Rejon et al. 2009)                                                 | II Contains excavatine                     | Jambi, W. Sumatra         | N/A    |
|            |                                |                 | Essential oil |              |                                                                           |                                            |                           |        |
|            | *Clausena excavata* Burm.f.   | Daun si cerek   | A549       | 5.25          | (Peng et al. 2013)                                                        | LB                                         | Jambi, W. Sumatra         | N/A    |
|            |                                |                 | Crude      | 1.91          |                                                                           |                                            |                           |        |
| Rutaceae   | *Murraya paniculata* (L.) Jack | Kemuning        | HT-29      | 7.91          | (Jiang et al. 2016; Shao et al. 2016)                                     | II Cancerous cell adhesion inhibition LD   | Malesia to Trop. Asia     | N/A    |
|            |                                |                 | Subfraction|              |                                                                           |                                            |                           |        |
| Salicaceae | *Flacourtia rukam* Zoll. & Moritzi | Rukam        | MCF        | 17            | (Subarnas et al. 2012)                                                   |                                            | Java, W. Java Lampung     | N/A    |
| Sapindaceae| *Dodonaea viscosa* (L.) Jacq.  | Hopseed, cantigi, cengkeh laut Summer lilac | MCF7 | 19.4         | (Shafek et al. 2015)                                                      | II Contains excavatine                     | E. Nusa Tenggara          | N/A    |
| Scrophulariaceae | *Buddleja davidi* Franch.   | Gadung cina    | MCF7       | 15.49 ± 1.18  | (Uddin et al. 2015)                                                       |                                            | Ceylon, Malesia C. Java W. Java Trop. America | N/A    |
|            |                                |                 | Subfraction|              |                                                                           |                                            |                           |        |
| Smilacaceae| *Smilax zeylanica* L.          | N/A             | N/A        | N/A           | (Du et al. 2016)                                                          | IV Contains capsanthin, capsanthin 3'-ester, and capsanthin 3,30-diester | C. Java, N. Sumatra       | N/A    |
| Solanaceae | *Capsicum annuum* L.           | N/A             | N/A        | N/A           | (Maoka et al. 2001)                                                       |                                            | LC                        |        |
|            |                                |                 | Subfraction|              |                                                                           |                                            | (Aguilar-Méndez et al., 2020)              | L.7; L.53; III.C.56; IX.A.158-158a; XVIII.B.32; I.G.140. |
| Solanaceae | *Cestrum nocturnum* L.         | Arum dalu       | CNE-2Z     | 17.50         | (Wu et al. 2007)                                                          | II W. Indies                              | N/A                       |        |
|            |                                |                 | BEL-7402   | 18.71         |                                                                           |                                            | LC (BGCI, IUCN and Meave, 2019)              | L.D.41                     |
|            |                                |                 | HeLa       | 19.21         |                                                                           |                                            |                           |        |
| Styracaceae| *Styrax benzoin* Dryand.       | N/A             | N/A        | N/A           | (Du et al. 2016)                                                          | IV                                         | C. Java, N. Sumatra       | N/A    |
|            |                                |                 | N/A        | N/A           |                                                                           |                                            |                           |        |
| Family       | Species                          | Source          | Type               | Concentration | Reference                                      | LC          | Region                   |
|--------------|----------------------------------|-----------------|--------------------|----------------|-----------------------------------------------|-------------|--------------------------|
| Symplocaceae | *Symplocos cochinchinensis* (Lour.) S. Moore | Kendong         | U87 HepG2 MCF7     | 2-10 50-250    | (Abida et al. 2016; Chanchal et al. 2018)      | LC          | Malay Pen. W. Java W. Sumatra N/A|
|              |                                  |                 |                    | 10-50          |                                               |             |                          |
| Taxaceae     | *Taxus sumatrana* (Miq.) de Laub. | Cemara sumatra  | KB Hepa 59T/VGH    | Subfraction 0.56 0.10 | (Shen et al. 2002) Contains taxuspine F and wallifoliol | LB          | Sumatra Jambi W. Sumatra N/A |
|              |                                  |                 |                    |                |                                               |             |                          |
| Theaceae     | *Camellia sinensis* (L.) Kuntze  | Teh hijau       | HT-29 Crude        | 87             | (Hajiaghaali-pour et al. 2015; Chanchal et al. 2018) | II          | Japan DD (Rivers and Wheeler 2018) |
|              |                                  |                 |                    |                |                                               |             |                          |
| Theaceae     | *Schi mala wallichii* Choisy      | Puspa           | MCF7 Crude         | 20             | (Diantini et al. 2012)                        | LD          | Bangka Belitung W. Sumatra W. Java LC (Oldfield, 2018) |
|              |                                  |                 |                    |                |                                               |             |                          |
| Thymelaeceae | *Phaleria macrocarpa* Simalakamama (Scheff.) Boerl. | Simalakamama hkota dewa | HeLa 3T3 Subfraction | 132 158      | (Othman et al. 2014) III. Contains 2,6,4'-trihydroxy-4-methoxybenzophenone and 6,4'-dihydroxy-4-methoxybenzophenone-2-O-β-D-glucopyranoside | W. Java N/A |                          |
|              |                                  |                 |                    |                |                                               |             |                          |

V.D.65-65b.  I.D.  III.B.34-34a, 37  III.A.35-35a-35b; IIA.36-36a; VII.C.373-373a; III.D.65-65b.

VI.D.17-17a; VII.B.21-21a; II.A.55-55a, 61; III.C.79; V.B.16-16a-16b; V.L.D. 17-17a; VIII.B.242-242a.
| Family         | Genus                        | Species                        | Tissue | Cancer Line | Tissue | Cancer Line | Cancer Cell Line | Concentration (IC50) | Region | Authority | Notes                                                                 |
|---------------|-----------------------------|--------------------------------|--------|-------------|--------|-------------|------------------|----------------------|--------|------------|------------------------------------------------------------------------|
| Verbenaceae   | *Lantana camara* L.         | Saliara, stekan                | Huh7   | Crude       |        | II          |                  | 24.8 (Bisi-Johnson et al. 2011; Arbiastutie et al. 2017; Chanchal et al. 2018) | II      | Trop. America | IV.C.52; VI.B.13-13a                                                 |
| Verbenaceae   | *Lantana camara* L.         | L. Saliara, stekan              | MCF7   | Subfraction | 9.96   | II          |                  | (Gerlach et al. 2010) Contains cycloviolacinO2 | II      | Asia, Europe, N. Africa | N/A                       |
| Violaceae     | *Viola odorata* L.          | Bunga violet                    | MCF7   | Subfraction |        | II          |                  | 24.8 (Bisi-Johnson et al. 2011; Arbiastutie et al. 2017; Chanchal et al. 2018) | II      | Trop. America | IV.C.52; VI.B.13-13a                                                 |
| Vitaceae      | *Leea indica* (Burm. f.) Merr. | N/A                           | MCF7   | KB          | Crude  | III         |                  | 138.1 ± 19.2 146.9 ± 10.4 (Hsiung and Kadir, 2011) Contains cycloviolacinO2 | III     | C. Java | IX.A.78                                                   |
| Xanthorrhoeaceae | *Hemerocallis minor* Mill. | Small day lily                  | HeLa   | Crude       | N/A    | IV          |                  | 138.1 ± 19.2 146.9 ± 10.4 (Hsiung and Kadir, 2011) Contains cycloviolacinO2 | IV      | E. Asia | N/A                       |
| Xanthorrhoeaceae | *Hemerocallis fulva* (L.) L. | Daylily                         | MCF7   | Subfraction | 1.8 ± 0.2 2.4 ± 1.8 5.0 ± 0.3 3.8 ± 0.3 (Cichewizs, 2006) Contains kwanzouquinones A, B, C, and E | IV      | E. Siberia, S. Japan | N/A                       |
| Xanthorrhoeaceae | *Aloe arborescens* Mill.     | N/A                           | N/A    | N/A         | N/A    | IV          |                  | 138.1 ± 19.2 146.9 ± 10.4 (Hsiung and Kadir, 2011) Contains cycloviolacinO2 | IV      | E. Asia | N/A                       |
| Xanthorrhoeaceae | *Aloe ferox* Mill.           | Bitter aloe                     | HeLa   | Crude       | N/A    | IV          |                  | 138.1 ± 19.2 146.9 ± 10.4 (Hsiung and Kadir, 2011) Contains cycloviolacinO2 | IV      | E. Asia | N/A                       |
| Xanthorrhoeaceae | *Aloe vera* (L.) Burm.f.     | Lidah buaya                     | HepG2  | Crude       | 10.45 ± 0.31 (Shalabi et al. 2015) | II          | N/A          |                  | II      | Aceh | L.I.102                                                   |
| Zingiberaceae | *Etlingera elatior* (Jack) R.M.Sm. | Torch Ginger                  | CEM-SS | Crude       | 4 6.25 15 (Habsah et al. 2005; Krajarnng et al. 2017) | LA          | Aceh         |                  | LA      | Aceh | L.I.102                                                   |
| Zingiberaceae | *Hedychium coronarium* J.Koenig | Gandasuli, white ginger        | LNCaP  | Subfraction | 20.42 17.39 (Enderinger et al. 2014) Contains ethoxycoronarin D and isocoronarin D | II          | India        |                  | II      | India | VI.C.6                                                   |