

# Collection and Data-Mining of Bioactive Compounds with Cancer Treatment Properties in the Plants of Rutaceae Family

Balan, V. Saravanan, K. and Umarani, B  
PG & Research Department of Zoology, Nehru Memorial College (Autonomous)  
Puthanampatti – 621 007, Tiruchirappalli, Tamilnadu, India.

**Abstract:** The traditional medicinal plants are used for treating various diseases including cancer because of their non toxic effect of normal cells and cytotoxic effect on cancer cells. Plant derived compounds have been used in treatment of cancer for many years. India has vast number of herbal plants, in which ayurvedics system of medicine has developed rapidly and enlightens the field of medicine. Currently compounds from medicinal plants have become the important source of drug discovery in research for treating many forms of diseases including cancer. In this research data were emphasized to explore the phytochemicals from medicinal plants with potent anticancer activity.

**Index terms:** Medicinal plants, anticancer, cancer preventive, antitumour, anticarcinogenic

## 1. INTRODUCTION

Cancer is a disease which has been a constant battle throughout the world with a lot of development in the treatments and preventive therapies. It is characterized by loss of cell control and continually dividing with the inability to be controlled or stopped. As a result, tumors are formed with the potential to be invading nearby tissues (Ochwang et al., 2014). Currently various treatments are available including chemotherapy, radiotherapy, immunotherapy and chemically synthesized drugs. But treatments such as chemotherapy can give a lot of strain and further damage the patient health. Therefore, there is a need to find alternative treatments and therapies against cancer (Cancer research, 2015). From ancient times herbal medicines have been used for a treatment of many diseases and are used as the primary source of medical treatment in developing countries. Thus, research has developed to investigate the potential properties and uses of herbal plants extracts for developing drugs for diseases including cancer (Sivaraj et al., 2014). This article aims to take an overview of current plant derived compounds that have anticancer therapeutic properties and their developments in the field.

## 2. MATERIALS AND METHODS

**Data-mining of phytochemicals:** Phytochemicals which have potential of cytotoxic effect were manually mining from publically available phytochemical databases (Dr. Duke's phytochemistry and ethnobotanical database ([www.ars-grin.gov/duke](http://www.ars-grin.gov/duke))). The literatures related to anticancer, antitumor cancer preventive activities of phytochemical were collected from research papers.

## 3. RESULT AND DISCUSSION:

Rutaceae family comprises of 160 genera and about 2070 plant species, among them 3 plant species were reported to possess cancer treatment activity. The plant species are *Aegle marmelos*, *Citrus sinensis* and *Citrus limon*. These 3 plant species possessed totally 63 phytochemicals related to anticancer, antitumor anticarcinogenic and cancer preventive effects. Among these, 12 compounds were found to be possessed anticancer activity, 45 compounds possessed cancer preventive activity, 7 phytochemical compounds possessed antitumor activity, and 1 phytochemical compound possessed anticarcinogenic activity (Table 1).

***Aegle marmelos:*** *Aegle marmelos* is a medium to large sized deciduous, glabrous, and armed tree which is commonly called as Bael fruit. In this plant, totally 9 cancer treatment bioactive compounds were identified in different parts of plant. Among them, 3 phytochemical compounds possessed anticancer activity, total 9 phytochemical compounds possess cancer preventive activity and 5 compounds possessed antitumor activity. The compounds Beta-carotene, Citral and Tannin possessed 3 combined activity viz anticancer, cancer preventive and antitumour, and the compounds Fiber and Psoralen possessed combined activity of cancer preventive and antitumour. The hydroalcoholic extract of *A. marmelos* leaves has shown *in vivo* anticancer and antitumour effect in Ehrlich ascites carcinoma (Jagetia et al., 2005). This plant extract exhibits cytotoxicity against tumor cell lines in brine shrimp lethality assay and methyl thiazolyl tetrazolium (MTT) based assay (Costa-Lotulo et al, 2005).

***Citrus sinensis:*** It is a small, shallow- rooted evergreen shrub or tree. It is commonly called sweet orange. In this plant, totally has 44 phytochemicals. Among them 11

compound possessed anticancer activity, 36 compounds possessed cancer preventive activity, 16 compounds possessed antitumor activity, and 4 compound possessed anticarcinogenic activity. From these, 5 compounds have 3 combined activity viz anticancer, cancer preventive, and antitumour. The compound caffeic acid which possessed all 4 cancer treatment potential. The compound ferulic acid possessed 3 combined activity of cancer preventive, antitumour and anticarcinogenic. The compound neohesperidin possessed combined activity of cancer preventive and anticancer. 4 compounds possessed combined activity of cancer preventive and antitumor. The compound caffeine have combined effect of antitumor and anticarcinogenic and the compound butyric acid have combined effect of anticancer and antitumour. D-Limonene is a major constituent of citrus plant, which recognized as a potential chemotherapeutic agent because it can induce human colon cancer cell apoptosis via the mitochondrial death pathway and suppress the PI3K/Akt pathway [Jia et al., 2013]. Perillyl alcohol, an oxygenated monoterpene constituent of citrus essential oil, has a good effect in clinical treatment of patients with malignant brain tumors [Chen et al., 2015]. Blood orange essential oil could inhibit angiogenesis, metastasis and cell death in human colon cancer cells [Murthy et al., 2012].

**Citrus limon (L.):** *Citrus limon* is a small tree originated in Asia. It is commonly called lemon. In this plant contains 42 phytochemical compounds. Among them, 17 compounds have anticancer property, 34 compounds possessed cancer preventive activity, 18 compounds possessed antitumour activity and 5 compound possessed anticarcinogenic activity. From these, 4 compounds have effects of anticancer, cancer preventive and antitumour activities. The compound caffeic acid has 4 combined activity anticancer, cancer preventive, antitumour and anticarcinogenic. 6 compounds possessed combined activity of cancer preventive and antitumour. 3 compounds possessed combined activity of cancer preventive, antitumor and anticarcinogenic. Citrus fruits exerts many beneficial effects that improve human health, including mainly anti-oxidant, anti-inflammatory, anti-microbial and anticancer effects, as well as protection against cardiovascular and nervous system injury (Lv et al., 2015; Mandalari et al., 2017).

#### CONCLUSION

The present study was carried out to explore phytochemicals with potential of cancer prevention. Recently, much attention has been directed towards isolation of biologically active compounds from herbs. Medicinal plants play a vital role in basic health issues and treatment of some diseases in developing countries. From this study we can conclude that all of these herbal plants *Aegle marmelos*, *Citrus sinensis*, *Citrus limon*, *Amomum*

*xanthioides*, *Curcuma longa* and *Zingiber officinale* can be used as the source of drugs for cancer treatment and also recommended can add to their diet to reduce disease risk.

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**Table1: List of compounds with effects of Anticancer, Cancer preventive, Antitumour and Anticarcinogenic from 3 plant species.**

S.No	Anticancer activity	Cancer preventive	Antitumor	Anticarcinogenic activity
1	Beta-carotene	Ascorbic acid	Butyric acid	Diosmin
2	Citral	D-limonene	Caffeine	
3	Tannin	Fiber	Caryophyllene	
4	Alpha-carotene	Niacin	Citric acid	
5	Alpha-terpineol	Psoralen	Malic- acid	
6	Alpha-tocopherol	Riboflavin	Alpha-humulene	
7	Caffeic acid	Alanine	Caryophyllene-oxide	
8	Limonene	Alpha-linolenic- acid		
9	Naringenin	Alpha-pinene		
10	Rutin	Beta-sitosterol		
11.	Neohesperidin	Carvone		
12.	Vicenin-2	Ferulic-acid		
13		Geraniol		
14		Glycine		
15		Linoleic acid		
16		Methionine		
17		N-methyl -tyramine		
18		Naringin		
19		Neohesperidin		
20		Oleic acid		
21		P-coumaric acid		
22		Pantothenic acid		
23		Pectin		
24		Scutellarein		
25		Selenium		
26		Serine		
27		Sinapic acid		
28		Stigmasterol		
29		Succinic acid		
30		Synephrine		
31		Tangeretin		
32		Tyrosine		
33		Bergapten		
34		Caffeine		
35		Decan-1-al		
36		Diosmetin		
37		Imperatorin		
38		Isopimpinellin		
39		Isorhanetin		

40		Isovitexin		
41		Luteolin		
42		Mucilage		
43		Quercetin		
44		Scopoletin		
45		Umbelliferone		
<b>Total</b>	<b>12</b>	<b>45</b>	<b>7</b>	<b>1</b>

**Table 2: Percent Distribution of Cancer Treatment Phytochemical Compounds In 3 Plant Species**

S.No	Plant name	Total No. of cancer treatment compounds	Percentage
1.	<i>Aegle marmelous</i>	9	20
2.	<i>Citrus sinensis</i>	44	97.7
3.	<i>Citrus limon</i>	42	93.3

**Table 3: Percentage distribution of cancer treatment properties compounds**

S.NO	Cancer treatment properties	Total no of compounds	Percentage
1.	Anticancer	12	19
2.	Cancer preventive	45	71.4
3.	Antitumor	7	11.1
4.	Anticarcinogenic	1	1.5