Chapter 7
Phytochemistry and Antigenotoxic Properties of Six Ethnobotanically Important Members From the Family *Zingiberaceae*

Anish Nag
Christ University (Deemed), Bangalore, India

ABSTRACT

Genotoxicity is considered as a potential cause of various diseases including cancer. During the last decade, herbal extracts attained a great deal of attention due to its safe and effective applications against various DNA damaging agents. However, the mechanism of DNA strand breaks by various mutagens and genotoxins is often correlated with the generation of Reactive Oxygen Species (ROS). Herbal extracts constitute a number of phytochemicals and those are reported to have considerable antioxidant properties, which are in turn capable of neutralizing ROS mediated DNA damage. The botanical family Zingiberaceae is reported to have significant antioxidant and antigenotoxic potential by various researchers. Among a number of species belonging to this family, six species, namely Alpinia galanga, A. zerumbet, Curcuma amada, C. caesia, Zingiber officinale, and Z. zerumbet, attract notable attention due to their remarkable ethnobotanical and medicinal importance. This chapter deals with phytochemical composition, antioxidant, and antigenotoxic properties of these six Zingiberaceous plant extracts.

INTRODUCTION

Considerable attention has been focused on dietary and medicinal phytochemicals that inhibit, reverse or retard diseases caused by oxidative and inflammatory processes. Among the various classes of phytochemicals, focus has been given on the anti-inflammatory and antioxidant properties of polyphenols found in various botanical agents. The family Zingiberaceae comprises of 53 genera and over 1,200 species. It is

DOI: 10.4018/978-1-7998-1320-0.ch007

considered to be the powerhouse of active phytochemicals. The rhizomes are used in traditional medicine and are consumed as condiment and spices. In this review, the phytochemical composition, antioxidant as well as cytotoxic and genotoxic properties of six important plants namely *Alpina galanga*, *A. zerumbet*, *Curcuma amada*, *C. caesia*, *Zingiber officinale,* and *Z. Zerumbet* of Zingiberaceae are discussed.

ETHNOBOTANICAL IMPORTANCE

Ethnobotanical importance of Zingiberaceae plants is acknowledged worldwide. In Japan, *A. zerumbet* is used as a staple diet along with rice. Rhizomes are used as to make seasonings and beverages (Victório 2011). On the other hand, *A. galanga* or galangal is traditionally used as a flavoring agent, anti-ringworm, tonic and vegetables (Daimei and Kumar, 2014). Ginger (*Z. officinale*) is utilized as traditional medicines against various ailments such as nausea, vomiting, asthma, cough, palpitation, inflammation, dyspepsia, loss of appetite, constipation, indigestion, pain, acute and chronic cough, common cold, fever, allergic rhinitis, sinusitis, bronchitis, respiratory troubles and headache (Grzanna, Lindmark & Frondoza, 2005; Khare 2007). *Z. zerumbet* (shampoo ginger) is commonly used as traditional medicine as cough, tonsil, constipation in the North-Eastern part of India (Devi, Das & Singh, 2017). *Curcuma* is another important member of Zingiberaceae. *C. amada* is also known as mango ginger due to its raw mango-like aroma. Mango ginger is extensively utilized as a stomachic, as to improve blood quality, carminative and topically for contusions and sprains (Jatoi, Kikuchi, Gilani & Watanabe, 2007). Similarly, *C. caesia* or black turmeric is used extensively as to treat smooth muscle relaxant activity, Hemorrhoids, Leprosy, Asthma, Cancer, Epilepsy, Fever, Wound, Vomiting, Menstrual disorder, Antihelmentic, Aphrodisiac, Inflammation, Gonorrhoeal discharges, etc. (Sasikumar 2005; Karmakar, Dolai, Saha, Sarkar, Bala & Haldar, 2011).

PHYTOCHEMICAL COMPOSITION

Phytochemical compounds are ubiquitous in the plant kingdom and studies on such compounds indicate their inherent pharmaceutical and nutraceutical values. The botanical family Zingiberaceae is reported to be the powerhouse of such chemicals. Various classes of Phyto-compounds such as phenolics, flavonoids, terpenoids, and curcuminoids are reported from the important members of this family such as *A. galanga*, *A. zerumbet*, *C. amada*, *C. caesia*, *Z. officinale,* and *Z. zerumbet*.

These phytochemicals especially the content of phenolics vary broadly depending on the plant sources, climate, geography, their parts or the procedures of extraction, polar solvents such as ethanol, methanol, water and non-polar solvents such as hexane, dichloromethane are the popular choices for the extraction of bioactive compounds from the plants. Polar solvents are reported to yield a comparatively higher amount of phenolic substances. For example, ethanolic extract of *A. galanga* rhizome contained the highest concentration of total phenolic compounds as 31.49 mg gallic acid equivalent (GAE)/g) and flavonoids as 13.78 mg catechin equivalent (CE)/g. The water extract contained the total phenolic content of 8.25 mg GAE/g and the total flavonoid content of 1.48 mg CE/g. Further, the essential oil had a total phenolic as 5.01 mg GAE/g and total flavonoid as 0.20 mg CE/g (Mahae and Chaiseri, 2009). To add on, methanolic extracts of *C. amada* and *C. caesia* rhizomes are reported to have total phenolic content as 37.64 and 44.33 mg tannic acid equivalents (TAE)/g dry materials, respectively (Krishnaraj, Manibhushanrao & Mathivanan, 2010). Similarly, *Z. officinale* rhizome extract contained 95.2 mg/g of