Chapter 4
Assessment of Anticancer Properties of Plumbago zeylanica

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ABSTRACT

Plumbago zeylanica is a member of the Plubaginaceae family and well known for its pharmacological properties attributed to secondary metabolites such as phenolics, alkaloids, and saponins. Notably, the root extracts of this plant contain a compound called "plumbagin (PLB)," which has been responsible for its anti-cancer activity. PLB is a naturally forming naphthoquinone found in plant roots. Numerous researchers have stated the anti-cancer activity of PLB against various cell lines of cancer that include squamous cell carcinoma, gastric cancer, cholangiocarcinoma, adenocarcinoma, prostate cancer, oral squamous cell carcinoma, melanoma, brain tumor, lung cancer, breast cancer, kidney lymphocyte carcinoma, osteosarcoma, canine cancer, tongue leukemia, esophageal cancer, and hepatoma. In this chapter, we comprehend a review of the studies published till now related to the anticancer properties of Plumbago zeylanica, examining both recent advances and existing limitations in understanding of its potential in cancer treatment.

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1. INTRODUCTION

Plumbago zeylanica is classified under the plumbaginaceae family (Soltis et al., 2019). *Plumbago zeylanica*, also referred to as Ceylon leadwort, white leadwort, or Chitrack (because of its spotted appearance). It is a herbaceous plant characterized by its ascending and prostrate globous stems. The plant leaves have either petiolate or sessile characteristics. The blades of these objects exhibit a variety of forms, such as ovate, lance-elliptic, or spatulate. The inflorescences are characterized by their glandular and viscid rachises. Moreover, the leaves have attenuate bases and apexes characterized by acute, acuminate, or obtuse shapes. *Plumbago zeylanica* exhibits heterostyly in its floral structure, wherein the flowers are distinguished by the presence of white corollas and tubes. The capsules of this plant are comprised of elongated seeds that exhibit a spectrum of colors ranging from reddish to dark brown. The plant's unique characteristics are of considerable importance in its categorization within the botanical family plumbaginaceae (G., Miller, Anthony, 1988). Given their widespread occurrence across tropical regions. The plant is generally grown in many regions characterized by tropical, sub-tropical, monsoon forests, and vine thickets. The plant in question has a wide range of adaptability, as it is capable of thriving in various altitudes, ranging from sea level to as high as 900 m (Whiffen; Kerrigan, 2020).

The secondary metabolites synthesized by *Plumbago zeylanica* are of considerable importance in the field of natural product therapies and are implicated in several therapeutic applications (Shailja et al., 2021). The bioactive substances discussed herein have historically employed in traditional herbal medicine and possess potential pharmacological attributes that may confer on human health (Tarannum, 2022). The plant under investigation may include distinct secondary metabolites such as alkaloids, flavonoids, and other phytochemicals, which are believed to have a prominent application in its medicinal qualities and possible therapeutic applications (Bertin et al., 2003).

The component "naphthoquinone", derived from *Plumbago zeylanica's* root part and occurs naturally. This substance is not only an analog of vitamin K3 but also functions as a pro-oxidant. Sand et al., 2012, the prooxidant characteristics of naphthoquinone render it capable of eliciting oxidative stress and potentially influencing several cellular mechanisms. PLB is a botanical compound belonging to the class of naphthoquinones, mostly sourced from three prominent plant families: aceae, Droseraceae, and Ebenaceae. The exploration of the compound's many uses, including its potential utilization in traditional and contemporary medicine, has been prompted by its natural presence in several plant groups. The cited studies have reported many actions of the substance, including anti-inflammatory, anticancer, antidiabetic, antioxidant, antibacterial, antifungal, anti-atherosclerosis, and analgesic properties (Zheng et al., 2019; Shao et al., 2019; Gwee et al., 2014; Kaewbumrung & Panichayupakaranant, 2014; Sharma et al., 1991; Luo et al., 2010; Kanta et al., 2010).

Undoubtedly, the investigation into the anticancer properties and underlying processes of PLB has emerged as a prominent area of study, garnering significant interest from researchers and scientists (Arpita, 2021). In 2014, a group of researchers undertook a thorough examination of the progress made in comprehending the mechanisms behind tumor suppression and molecular processes. The evaluations frequently function as significant assets in the process of synthesizing knowledge and gaining a deeper understanding of the possible application of PLB as an agent for combating cancer (H Qiao, T. Y. Wang, & T.T. Tang, 2014), as well as the cytotoxic capabilities and pharmacological significance of cancer therapy (Tripathi et al., 2019).

Currently, a considerable number of researchers have been devoting their endeavors to examining the PLB anti-cancer characteristics on many cancer types through in vitro and in vivo studies (Rajashree