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Abstract. Global climate change is sometimes beneficial for the growth and development of a plant. The bidara plant (*Ziziphus mauritiana*), usually grows and yield well in areas of origin with dry climates, deserts, low soil and air humidity with low rainfall per year, and is able to adapt well in wet tropical regions with low average daily temperatures and high humidity. The impact of ENSO in the last two years has caused *Z.mauritiana* plant cultivated in the wet tropics, of Bandung city, to be able to form fruits. The symplicia of the fruit and leaf organs of *Z. mauritiana* the was obtained through the maceration method and then screened various types of phytochemicals contained in the two organs using a GCMS chromatography tool of the Shimidzu brand type 2010 QP. The results of screening on fruit organs and *Z. mauritiana* leaf, it appeared that fruit organs were dominated by derivatives of compounds containing are acetic acid, malic acid, cinnamic acid, chlorogenic acid, silicic acid, and carbinol. The leaf organ of the identified bidara contains only carbinol and methane compounds.

1. Introduction

The bidara plant (*Ziziphus mauritiana*) until now can adapt to grow well in tropical and subtropical regions, although initially since approximately 1400 years ago, the plant can only grow well in desert climates, high temperatures and low humidity with low average daily rainfall capacity [1]. The middle east to central Asia region is the beginning of the dominance of *Z. mauritiana* plant, and geographically the region is composed of mountains, valleys, lowlands and deserts and is prone to storms [2]. Global climate change, which is characterized by the La Nina and El Nino phenomena that break normal climatic conditions, often has a negative impact on agricultural products, but sometimes has a positive effect on plant adaptability so that some types of plants are able to produce as in their home areas. Scientists call the phenomenon that is plaguing the world today with the El Niño-Southern Oscillation (ENSO) cycle [3], both of which can have a global impact on extreme weather changes, wildfires, ecosystems, and economies. The El Nino phenomenon that occurred in Indonesia in the first half of 2020, has caused an increase in average daily temperatures and decreased rainfall in most regions [4]. Both natural phenomena continue to recur over a time interval of 2 to 7 years. Since 2022, the ENSO phenomenon in Indonesia has disrupted the conditions of two wet tropical seasons in Indonesia, especially against the increase in temperature and rainfall patterns that shift not in the actual rainy season, as well as a decrease in rainfall intensity throughout the year with the peak of dry weather in July, August, and September in 2020, 2021, 2022, and 2023[5].

The ripe fruit of *Z. mauritiana* is one of the fruits that is quite popular in the central to south Asian region which has been used by the local community as a raw material for medicines and cosmetics [6], because it contains long-chain alcohol compounds that are identical to phenolic compounds and are able to act as antioxidant compounds [7]. The various types of antioxidant compounds contained in the body of plants are specifically by-products of the primary production of photosynthesis, or called secondary metabolites [8]. The results of the study by Muchuweti *et al.(*2005) [7] on *Z. mauritiana* fruit extract grown in the city of Zimbabwe, South Africa with an average daily temperature of 25ºC-29ºC identified only three types of phenolic compounds, while Memon et orce (2012) [9] reported that nine types of phenolic compounds were identified from *Z. mauritiana* fruit extract grown in the Hyderabad area, Pakistan with an average daily temperature of 39ºC-46ºC. The results of their study are in line with the opinion of Razi *et al.* (2013) [10] that the dominance of antioxidant compounds in *Z. mauritiana* fruit grown in dry areas is more antioxidant than that grown in wet or optimally irrigated areas even though the morphological conditions of the plant seem to grow more lush. Thus, differences in climate, soil type and fertility level, and type of *Z. mauritiana* variety have a real effect on the dominance and concentration of various phenolic compounds contained in *Z. mauritiana* plant organs.

It is known that the benefits of secondary metabolite compounds produced by a plant for human health, especially those classified as phenolic compounds and flavonoids, are able to act as antioxidants or ward off free radicals from the air, lower blood sugar levels, prevent premature aging, and prevent or inhibit the growth of tumor and cancer cells [11,12,13]. Antioxidant compounds contained in plant organs, generally capable of producing oxidative stress enzymes, which are enzymes located in the intracellular, play a role in maintaining the reactive oxygen levels of the species (ROS) to be at a low level [14, 15]. When ROS compounds are at a high level in the plant's body, they can be toxic to the plant, so compounds that act as antioxidants are needed, such as phenolic compounds [14]. The use of several organs of the *Z. mauritiana* plant, especially seeds and leaves, as traditional medicine has been carried out by the ancestors in the place where the plant grew since approximately 400 years ago, and the results are quite effective in curing various mild and chronic diseases [1].

Climate change due to the ENSO phenomenon over the past four years, has caused Z. mauritiana plants cultivated in Lengkong district, Bandung City, Indonesia with a relatively low average daily temperature (19ºC-29ºC) and high soil moisture, have succeeded in forming fruits. The fruits that are form Bandung, relatively small size (1-2 cm in diameter). The *Z.mauritiana* cultivated in Pakistan and India, the fruits are larger in size with a diameter of 4–5 cm [6]. Whether the fruit and leaf organs of *Z. mauritiana* cultivated in the medium plains that have a wet tropical climate type of the city of Bandung also yield a type of secondary metabolite compound similar to those cultivated in dry tropical climates, and the results of various phytochemical screenings obtained are the ultimate goal of this study.

2. Materials and methods

The research has been carried out from August to September 2023 at the Plant Physiology Laboratory, Faculty of Agriculture, Insan Cendekia Mandiri University, the Integrated Chemistry Application Laboratory, Padjadjaran University, and the Instrument Chemistry Laboratory, Universitas Pendidikan Indonesia. The three laboratories are located in the city of Bandung, West Java, Indonesia. The ingredients needed are ripe fruits and leafs of *Z. mauritiana* cultivated in Lengkong district, Bandung city which has a wet tropical climate with a very dry climate that occurs in July, August, September 2023 as a result of the ENSO cycle [15].

The research was carried out through three phased series of activities with each using a different method, that are drying fine dry matter, making simplicia, and screening for phytochemicals of *Z. mauritiana* fruits and leafs.

2.1. Preparation of fine dry materials

The first stage is to dry the ripe fruits and old leaves of *Z. mauritiana* with a drying oven at 70ºC for 8 hours (for leaves), and 3 x 8 hours (for fruits) [17]. The two types of dry ingredients are mashed into flour, then filtered until they pass through a 3 mm diameter sieve. The preparation of dry materials was

carried out at the Plant Physiology Laboratory, Faculty of Agriculture, Insan Cendekia Mandiri University.

2.2. Preparation of extraction into symplicia

The second stage is to prepare flour ingredients from Z. mauritiana fruits and leafs to be distilled and made into wet symplicia using the maceration method [18]. Starting with fruit and leaf flour *Z. mauritiana* dissolved in a 96% methanol organic solvent in a room with a temperature of 25°C for 5 x 24 hours, until a clear maserate is obtained. The two types of maserate are each vacuumed, evaporated using a rotary vacuum device at a temperature of 50°C until a concentrated extract is obtained. Then the two types of concentrated extracts are evaporated with a drying device at a temperature of 40°C for 3 x 24 hours. The process to obtain symplicia from ripe fruits and leafs of *Z. mauritiana* was carried out at the Integrated Chemistry Application Laboratory, Padjadjaran University.

2.3. Screening of types and dominance of phytochemicals

The results of symplicia of bidara fruit and *Z. mauritiana* leaves were identified by using GCMS brand Shimidzu type QP-2010 at the Instrument Chemical Laboratory, Pendidikan Indonesia University.

3. Results and discussion

The results of the screening of various phytochemicals contained in ripe fruits and leaves of *Z. mauritiana* are presented in the form of tables and chromatograms. Then compared with the types of phytochemicals obtained by previous researchers who were cultivated in different growing areas with this experiment.

Table 1. Various types of phytochemicals identified in the fruits and Leafs of *Z. mauritiana*

Phytochemicals variety	Wet tropical regions, Bandung, Indonesia[a]		Dry tropical regions, Hyderabad, Pakistan[b]	
	Fruits	Leaf	Fruits	Leaf
Carbinol	√	√		√
Chlorogenic acid	√		√	
Acetic acid	√			
Ferulic acid			√	
Coumaric acid			√	
Venylic Acid			√	
Benzoic acid			√	
Silicic Acid	√			
Cinnamic acid	√		√	
Malic acid	√		√	
Palmitic acid	√			
Methane		√		√

Source: [a]Author's document (2023) and [b]Memon *et al.* (2017)

Based on Table 1. It appears that the results of phytochemical screening identified in the ripe fruits of *Z. mauritiana* plants are obtained of slightly different types, but there are four types of similar phytochemicals, namely carbinol compounds, chlorogenic acid, cinnamic acid, and malic acid. Carbinol compounds are classified as a type of phenolic compound that is often found in green vegetable plants. The leafs of the *Z. mauritiana* plant were identified with types of carbinol and methane compounds, both cultivated in wet tropical regions and those cultivated in dry tropical regions. The France Crick Institute (2022) [19] has researched the effectiveness of carbinol compounds, namely as anticarcinogenic compounds, especially in inhibiting the development of lung cancer cells. Chlorogenic acid compounds have been researched by William *et al.* (1995) [20] is a type of secondary metabolite

compound of the flavonoid group that actively acts as an antiviral for Hepatitis B. Malic acid compounds are quite high in ripe fruits of *Z. mauritiana* cultivated in the city of Bandung (3.31%), malic acid is a common type of compound derived from fruit extracts and is often used in the cosmetics industry because of its elastic effect that can delay premature aging of skin cells [15]. Cinnamic acid was identified in fairly high levels in *Z. mauritiana* fruits cultivated in the dry tropics, Hyderabad area while in the wet tropics, the city of Bandung was identified in relatively low levels. Cinnamic acid is classified as a phenolic compound that is able to act as an antioxidant, antitumor, and antimicrobial compound. The cinnamic acids have higher levels of reactive oxygen scavenging activity [21]. Acetic acid and palmitic acid were both identified in the ripe fruit of *Z. mauritiana* from Bandung with relatively large levels (3.28% and 3.58%). Acetic acid is an organic compound of the alkanoic group, while palmitic acid is a saturated fat compound where both types of acids are the most common compounds found in fruiticulture extractsganic compounds bound to silicon elements were identified in the ripe fruit simplycia *Z. mauritiana* in the city of Bandung even though it was in a very low concentration (< 1%).

The old leafs of *Z. mauritiana* were identified to contain only organic compounds of carbinol and methane. Methane compounds are simple hydrocarbon compounds, formed through the process of decomposition of organic matter from the anaerobic environment, are residual compounds from photosynthesis activities that are easily subject to oxidation and hydroxylation processes so that they turn into tannin metabolite compounds [15]. *Z. mauritiana* leaves are used by residents in the *Z. mauritiana* distribution area as a traditional external medicine in the form of a paste to heal wounds and treat acne [11, 15].

The following Figure 1, Figure 2, and Figure 3 illustrate explain the result are organic compounds identified in the ripe fruit of *Z. mauritiana*.

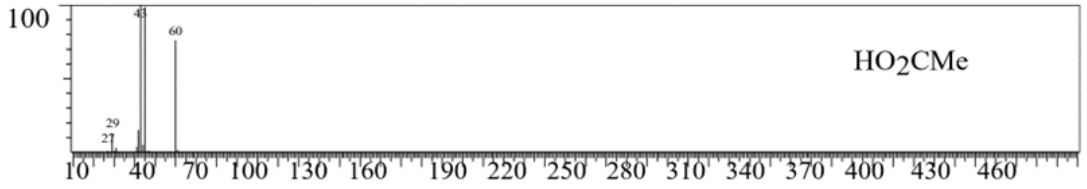

Figure 1. Acetic acid compounds in *Z. mauritiana* fruit

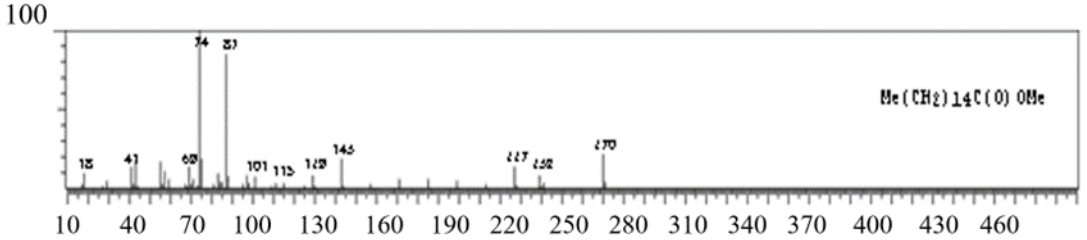

Figure 2. Palmitic acid compounds in *Z. mauritiana* fruit

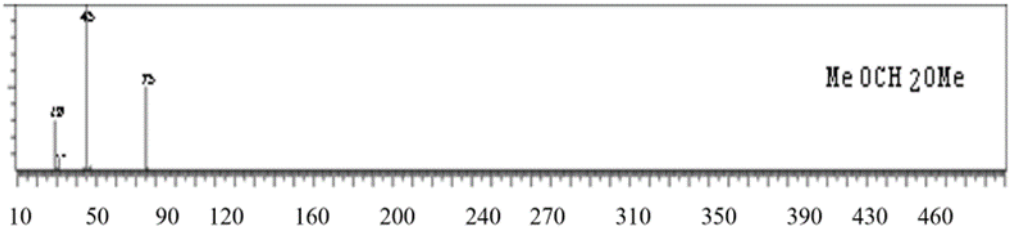

Figure 3. Methane compounds in *Z. mauritiana* leaf

Overall, the results of the screening carried out in this experiment can inform that the cultivation of *Z. mauritiana* plants in wet tropical areas during the very dry months has adapted well enough so that it is able to produce perfect fruit that is composed of several organic compounds from the secondary metabolite group that are beneficial for the plant itself and for human health, especially to be used as a source of raw materials for drugs and cosmetics [22].

4. Conclusions

The impact of the ENSO cycle in the form of weather changes in the city of Bandung which has a wet tropical climate, especially with the increase of very dry months and increasing daily average temperatures, has succeeded in forming fruits (for the previous four years it was unable to form fruits, only able to flower). The ripe fruits and old leaves of the *Z. mauritiana* plant after being screened by the GCMS method, also contain various phytochemicals from the group of phenolic compounds i.e chlorogenic acid, silisic acid, and malic acid which are secondary metabolite compounds.

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