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Identification of Plants from the Zingiberaceae and Euphorbiaceae Families in a Mini Herbal Garden Based on Halal in Sumberbrantas Village, Bumiaji District, Batu, East Java

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ABSTRACT

Indonesia is recognized for its rich biodiversity, particularly in herbal plants, with the Zingiberaceae and Euphorbiaceae families being prominent in traditional medicine. This study focuses on the identification and documentation of herbal plants from these families in Sumberbrantas Village, Bumiaji District, Batu, East Java, where the favorable climate and fertile soil support their growth. Despite the potential, there is limited documentation of these plants, which is crucial for optimizing their benefits and ensuring adherence to halal cultivation practices. The halal concept encompasses not only the end products but also environmentally friendly cultivation processes compliant with Islamic law, including seed selection, organic fertilization, and post-harvest processing. This research identifies key species such as ginger (*Zingiber officinale*), turmeric (*Curcuma longa*), and cassava (*Manihot esculenta*), highlighting their health benefits and economic potential. The study employs morphological observations and comparisons with botanical literature to ensure accurate identification. The findings reveal that all identified plants are cultivated according to halal principles, enhancing their marketability and sustainability. The results underscore the importance of halal-based mini herbal gardens as a model for integrated herbal plant management, promoting health, economic growth, and environmental sustainability within the local community. This research contributes to the understanding of herbal biodiversity in Indonesia and supports the development of sustainable agricultural practices aligned with halal standards.

Keywords:*Euphorbiaceae, Herbal plants, Halal Cultivation, Traditional Medicine, Zingiberaceae*

1 Introduction

Indonesia is known as one of the countries with high biodiversity, including in the type of herbal plants. Two plant families that are often utilized in traditional medicine are

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Zingiberaceae and Euphorbiaceae. The Zingiberaceae family includes plants such as ginger (*Zingiber officinale*), turmeric (*Curcuma longa*), and galangal (*Alpinia galanga*), which have various health benefits, such as anti-inflammatory and antioxidant properties. Meanwhile, the Euphorbiaceae family includes plants such as cassava (*Manihot esculenta*) and castor bean (*Jatropha curcas*), which are often used in herbal medicine as well as biofuel [1].

The utilization of plants from these two families is highly potential in Sumberbrantas Village, Bumiaji District, Batu, East Java. With its cool climate and fertile soil, this village provides an ideal environment for the growth of various types of herbal plants. However, the identification and documentation of herbal plants, particularly from the Zingiberaceae and Euphorbiaceae families, are still limited. This identification effort is important to optimize the potential benefits of the plants and ensure cultivation practices that adhere to halal principles [2].

The halal concept in the management of mini herbal gardens not only focuses on the end product but also involves an environmentally friendly cultivation process that complies with Islamic law. This includes the selection of seeds, the use of organic fertilizers, and the processing of the harvest. With a halal-based approach, the community of Sumberbrantas Village is expected to enhance the economic value of herbal plants while maintaining environmental sustainability [3].

Not all plants are automatically considered halal. In the context of Islam, the halal status of a plant not only depends on the type of plant itself but also on how the plant is processed and used. Plants that come from clear sources and are not contaminated with haram substances (for example, plants grown in soil or using fertilizers containing haram elements) are considered halal. Plants processed in a manner that complies with Islamic law (for example, not mixed with haram substances such as alcohol or other forbidden ingredients in food) will still be considered halal. Some plants may be used for specific purposes that could change their status. For example, if a plant is used for purposes contrary to Islamic teachings, such as for intoxicating or harmful products, it may become haram. Plants used in the food or pharmaceutical industries often need halal certification to ensure that they meet Islamic legal standards, both in terms of raw materials and the production process [21].

This research aims to identify plants from the Zingiberaceae and Euphorbiaceae families in mini herbal gardens in the yards of houses in Sumberbrantas Village. This identification not only provides insights into the existing biodiversity but also serves as an initial step to support the sustainable and halal cultivation of herbal plants [4].

2. Materials and methods

2.1 Materials

This research was conducted using supporting materials and tools to identify plants from the Zingiberaceae and Euphorbiaceae families. The materials used include herbal plants found in the mini herbal garden of the Sumberbrantas Village community, such as ginger (*Zingiber officinale*), turmeric (*Curcuma longa*), cassava (*Manihot esculenta*), and castor bean (*Jatropha curcas*). These plants were collected for direct observation.

The tools used include a digital camera for visual documentation, a magnifying loupe to observe the morphological structures of leaves, stems, and flowers. As a support, plant identification guides such as the book Flora of Java by Backer and van Steenis are used to ensure the accuracy of identification [5].

2.2 Methods

1. Research and Sampling Location

The research was conducted in a mini herbal garden owned by the community of Sumberbrantas Village, Bumiaji District. The location was chosen based on the high potential for biodiversity of herbal plants. Sampling was conducted purposively, specifically on plants belonging to the Zingiberaceae and Euphorbiaceae families. Plant morphological data, such as leaf shape, flowers, stems, and rhizomes, were observed and recorded for the identification process [6].

2. Morphological Observation

Observations were conducted on the main morphological characters that are characteristic of both families. In Zingiberaceae plants, the focus of observation includes the shape of the rhizome, flowers, and leaves. Meanwhile, for Euphorbiaceae plants, the observation covers the structure of the stem, leaves, and fruit. Morphological data were compared with descriptions in botanical literature and plant identification guides [7].

3. Data Analysis

The collected data were analyzed descriptively by matching the morphological characteristics of the plants with the literature and identification keys.

a. Observing Plant Characteristics in Detail

Begin by closely observing the plants in the Mini Herbal Garden. Focus on key features such as the shape of the leaves, flowers, stems, and fruits. Take note of prominent characteristics, including color, size, and texture.

b. Comparing with the Flora Identification Book

Use the *Flora Identification for Taxonomy* book as your primary reference. Match the observed plant characteristics with the information provided in the book. Be sure to examine the scientific descriptions, illustrated images, and plant classification categories.

c. Ensuring the Halal Status of Plants

Once the plant is identified, investigate its uses, particularly if it is intended for consumption or medicinal purposes. Halal plants typically do not contain harmful substances, are non-toxic, and comply with Islamic principles. This information can often be found in the book's notes on traditional usage or scientific studies.

The results of the analysis were then classified to determine the identified species. In addition, notes on the benefits of the plants and their economic potential were also collected as supplementary information [4].

2 Results and discussion

One type of form of biodiversity in the flora environment found in Indonesia is medicinal plants. Medicinal plants are materials derived from very simple, pure, uncontaminated, or unprocessed plants, which in their preparation process are merely picked and concocted, then directly consumed as natural medicine. In addition, medicinal plants have properties that are beneficial in the field of health, as well as for the prevention and treatment of various diseases, especially chronic diseases, degenerative diseases, and tumors [8].

The ancestors of the Indonesian people have long been deeply involved in traditional medicine by utilizing plants found in nature and the surrounding environment. This very valuable heritage has been passed down from generation to generation by the ancestors to the next generations [9].

Because of this, people tend to choose instant health treatments and also purchase medications from pharmacies without a doctor's prescription when experiencing ailments. In fact, chemically-based medicines have side effects. The people of Sumberbrantas village have expertise in cultivating various plants, including mentigi (*Vaccinium varingaefolium),* acacia (*Acacia decurrens*), and fennel (*Funiculum vulgare*), among others [10].

Most of the residents of Sumberbrantas Village are generally farmers who produce high-quality vegetables and horticultural products. The village, as its name suggests, has the Brantas River spring that flows through several regencies/cities in East Java. Due to its attractive natural conditions, Sumberbrantas Village also has two tourism sectors within it: an arboretum, which is the center of the Brantas River spring, and a natural hot spring bath tourism. Both places have great potential in attracting visitors or tourists to Sumberbrantas village. Where it is highly likely that in the future it can become one of the tourist destinations in the city of Batu [11].

Based on the table (Table 1), it is known that there are 4 types of plants in the Zingiberaceae family that are used as medicine by the people of Sumberbrantas Village. According to [12], it is explained that Zingiberaceae is a family of ginger-like plants in the form of perennial herbs with rhizome roots. There are 4 types of plants in that family that are utilized as traditional medicine in Sumberbrantas Village, namely *Alpinia galanga* (Galangal), *Curcuma longa* (Turmeric), *Kaempferia galanga* (Kencur), and *Zingiber officinale* (Ginger) [13]. According to [14], the Zingiberaceae family contains many active compounds, including flavonoids, saponins, and essential oils. In addition, the Zingiberaceae family is a type of rhizomatous plant that has a distinctive-smelling rhizome. Plants from the Zingiberaceae family are very commonly found in the Indonesian region. This is because Indonesia has a tropical climate that is very suitable for the growth of various types of plants, one of which is the Zingiberaceae family [15]

Figure 1. Family of Zingiberaceae

Figure 2. Family of Euphorbiaceae

According to [16], the Euphorbiaceae family is a family of flowering plants with 300 genera and around 7,500 species. This family is commonly found in tropical regions, with most of its species in the Indo-Malay and tropical American regions. Species in the Euphorbiaceae family have been used by local populations in various countries in traditional medicine as remedies for several diseases and ailments such as cancer, diabetes, diarrhea, heart disease, hepatitis, eye diseases, and scabies. Based it is known that there are 4 types of plants in the Euphorbiaceae family used as medicine by the people of Sumberbrantas Village. The plants from that family consist of *Acalypha hipsida* (Cat's tail), *Euphorbia pulcherrima* (Poinsettia), *Excoecaria cochinchinensis* (Blood sambang), and *Manihot esculenta* (Singkong). Based on the results of the literature study, the antibacterial activity of plants from the Euphorbiaceae family shows broad-spectrum antibacterial activity against both Gram-positive and Gram-negative bacteria, characterized by the formation of inhibition zones. The group of secondary metabolite compounds contained in plants of the Euphorbiaceae family that act as antibacterial agents includes alkaloids, flavonoids, saponins, tannins, steroids, and terpenoids. Additionally, plants of the Euphorbiaceae family contain compounds such as hydroxylamine, hesperidin, kaempferol, quercetin, rutin, apigenin, and phyllanthin [17].

Table 1. Results of the identification of plants from the Zingiberaceae and Euphorbiaceae families

No	Local Name	Species Name	Family	Determination Key	Habitus	Sampling Location	Parts Used
1	Turmeric	*Curcuma longa*	Zingiberaceae	1b – 2b - 3b – 4b – 6b – 7b – 9b – 10b – 11b – 12b – 13b - 14a – 15a – 109b (group 8, plants with simple, scattered leaves) – 119b – 120b – 128b – 129a – 130b – 132a -32 Zingiberaceae- (characterized by yellow fruit and greenish-yellow leaves - *Curcuma longa*)	Herb	Home garden	Rhizome
2	Ginger	*Zingiber officinale*	Zingiberaceae	1b – 2b - 3b – 4b – 6b – 7b – 9b – 10b – 11b – 12b – 13b - 14a – 15a – 109b (group 8, plants with simple, scattered leaves) – 119b – 120b – 128b – 129a – 130b – 132a -32 Zingiberaceae- (The ginger stem is a pseudostem, 30 to 100 cm tall, with rhizomes having yellow to reddish flesh and a pungent odor - *Zingiber officinale*)	Herb	Garden, forest	Rhizome
3	Galangal	*Alpinia galanga*	Zingiberaceae	1b – 2b - 3b – 4b – 6b – 7b – 9b – 10b – 11b – 12b – 13b - 14a – 15a – 109b (group 8, plants with simple, scattered leaves) – 119b – 120b – 128b – 129a – 130b – 132a -32 Zingiberaceae- (Large, thick, cylindrical rhizomes, 2-4 cm in diameter, reddish-	Herb	Garden, forest	Rhizome

				brown outer skin, white interior - *Alpinia galanga*)			
No	**Local Name**	**Species Name**	**Family**	**Determination Key**	**Habitus**	**Sampling Location**	**Parts Used**
4	Aromatic Ginger	*Kaempferia galanga*	Zingiberaceae	1b – 2b - 3b – 4b – 6b – 7b – 9b – 10b – 11b – 12b – 13b - 14a – 15a – 109b (group 8, plants with simple, scattered leaves) – 119b – 120b – 128b – 129a – 130b – 132a -32 Zingiberaceae- (Light brown rhizome skin, yellow rhizome flesh - *Kaempferia galanga*)	Herb	Forest, garden	Rhizome
5	Cat's Tail	*Acalypha hispida*	Euphorbiaceae	1b-2b-3b-4b-6b-34b-37a-67. Euphorbiaceae- (Flowers are unisexual, cylindrical, 1-1.5 cm in diameter, 20-50 cm long, red, resembling a cat's tail - *Acalypha hispida*)	Shrub	Forest, garden	Leaves, fruit, flowers, seeds
6	Poinsettia	*Euphorbia pulcherrima*	Euphorbiaceae	1b-2b-3b-4b-6b-34b-37a-67. Euphorbiaceae- (Large succulent stem with spines resembling cactus - *Euphorbia pulcherrima*)	Tree	Forest, garden	Leaves, stem
7	Bloodleaf	*Excoecaria cochinchinensis*	Euphorbiaceae	1b-2b-3b-4b-6b-34b-37a-67. Euphorbiaceae- (Dark green leaves on the upper side, reddish underside - *Excoecaria cochinchinensis*)	Shrub	Garden	Leaves, flowers, tubers, stem

No	Local Name	Species Name	Family	Determination Key	Habitus	Sampling Location	Parts Used
8	Cassava	*Manihot esculenta*	Euphorbiaceae	1b-2b-3b-4b-6b-34b-37a-67. Euphorbiaceae- (1-4 m tall, leaves with long petioles, palm-shaped, 3-8 lobes per leaf, petioles can be yellow, green, or red - *Manihot esculenta*)	Tree	Garden	Stem, flowers, leaves

The halal principle in herbal plant cultivation is very important to ensure that the products produced are not only beneficial for health but also comply with Islamic principles that regulate the halal status of a product [19]. In this study, all stages in the process of herbal plant cultivation are carried out with attention to the established halal standards, from material selection, plant management, to post-harvest processing. One of the main steps is the selection of organic fertilizers that do not contain substances prohibited by Islamic law, such as chemicals or pesticides that can harm the environment and pose health risks. The fertilizers used in the cultivation of herbal plants can come from various types, such as organic fertilizers, inorganic fertilizers, or biofertilizers. Organic fertilizers are typically compost, manure, or processed organic waste. Inorganic fertilizers are synthetic fertilizers containing specific nutrients, such as nitrogen, phosphorus, and potassium. Meanwhile, biofertilizers contain microorganisms that naturally enhance soil fertility. To ensure the fertilizers used meet halal criteria, attention must be given to the raw materials and the production process. Halal fertilizers must not contain haram or impure elements, such as waste derived from pigs or prohibited alcohol. Additionally, organic fertilizers made from animal waste must be verified to come from animals slaughtered in accordance with Islamic law. Therefore, before using fertilizers, it is essential to check the labels, halal certification (if available), or consult with experts familiar with halal criteria, such as halal certification bodies or Islamic scholars. By using fertilizers that comply with halal standards, the resulting herbal plants can fully support the principles of halal.The organic fertilizers used are sourced from natural and environmentally safe materials and provide long-term benefits for soil fertility [18].

To assess whether all stages of herbal plant cultivation are carried out with attention to established halal standards, it is essential to evaluate each phase of the cultivation process, from planting to harvesting, and ensure that all practices comply with Islamic principles [22]. Here's how you can assess these processes:

1. **Selection of Seeds or Planting Material**: Ensure that the seeds or planting materials used are sourced from halal-certified suppliers. The plants should not have been grown in contaminated soil or with the use of non-halal substances, such as animal-based fertilizers from haram sources

2. **Soil and Fertilization**: Assess the fertilizers and soil treatment used in the cultivation process. Organic fertilizers such as compost or manure should come from halal-certified sources. Avoid fertilizers derived from animals that are not slaughtered according to Islamic law, like pigs or animals that died naturally. Synthetic fertilizers should also be checked to ensure they do not contain any prohibited ingredients.
3. **Watering and Irrigation**: Ensure that the water used for irrigation is clean and not contaminated with impurities or substances that are considered haram. Water from sources that are not tainted by prohibited elements should be used.
4. **Pest and Disease Control**: The use of pesticides and herbicides should be evaluated to ensure they do not contain haram ingredients. Natural or organic pest control methods are preferable, and any chemical treatments used should be checked to verify that they comply with halal standards.
5. **Harvesting**: The harvesting process should be carried out without the use of any tools or machinery that may have been previously exposed to non-halal substances. Additionally, it is important to ensure that the plant is harvested in a way that aligns with Islamic ethics, avoiding any harm or disrespect to the plant.
6. **Processing and Packaging**: Once the plants are harvested, the processing methods should be halal-compliant. This includes ensuring that no alcohol or forbidden substances are used in the extraction or processing of herbal products. Packaging materials should also be free from any haram substances.
7. **Halal Certification**: If the plants are being sold or used commercially, obtaining halal certification from a recognized certification body is essential. This ensures that all processes, from cultivation to processing, meet halal requirements.

In addition, transparent logging of agricultural activities becomes an important part of the halal assurance system. With clear documentation, every step of the cultivation process, such as seed selection, planting, maintenance, and harvesting, can be tracked and monitored. One notable dissertation examines the development of Islamic gardens as a global phenomenon, highlighting their adaptation in various parts of the world, including Europe and North America. The study focuses on three contemporary Islamic gardens: the Mughal Garden in Bradford, UK; the Bakewell Ottoman Garden in St. Louis, US; and the Aga Khan Park in Toronto, Canada. This ensures that each stage is carried out in accordance with halal principles. Avoidance of harmful chemicals, such as synthetic pesticides or unauthorized preservatives, is also a priority. The products produced from this mini herbal garden are not only safe for consumption but also free from substances that could harm health or contradict the teachings of Islam [20].

To assess whether each stage of the herbal plant cultivation process aligns with halal principles, it is necessary to establish a detailed evaluation and monitoring system at every stage, including seed selection, planting, maintenance, and harvesting [23]. Here's how you can assess these processes:

1. Seed Selection

Source Verification: Ensure that the seeds used are sourced from halal-certified suppliers. This ensures that the seeds have not been contaminated by non-halal substances, such as those grown in contaminated environments or using non-halal fertilizers.

2. Documentation

Maintain a record of where and how the seeds are sourced, and ensure that they meet halal certification standards.

3. Planting

Verify that the soil used is free from contamination and that only halal-certified organic fertilizers or soil treatments are used. This could involve checking for the absence of animal-based fertilizers from non-halal animals or other prohibited substances. Document all soil treatments and fertilizers used, ensuring that no synthetic chemicals, such as those containing haram elements, are applied.

4. Maintenance and Growth

Ensure that the water used is clean, uncontaminated, and sourced from halal-compliant sources. There should be no introduction of harmful substances during irrigation. Evaluate the pesticides and herbicides used to ensure they do not contain any haram ingredients. Preferred methods should include natural, organic pest control rather than chemical treatments that may contain forbidden substances.

5. *Tracking the Methods*

Keep detailed records of any pest control or disease management methods used, ensuring they align with halal standards. If chemical agents are used, they must be verified for halal compliance.

6. Harvesting:

Ensure that the tools and equipment used in the harvesting process have not been exposed to non-halal substances. This includes verifying that machinery and tools are cleaned and used only for halal purposes.Record the harvesting techniques to ensure that they comply with halal ethics, such as avoiding harm to the plants and treating them with respect according to Islamic guidelines.

7. Processing and Packaging

Ensure that no alcohol, non-halal preservatives, or other prohibited substances are used in the extraction, processing, or packaging of the plant products. Verify that the processing facility is halal-certified and follows halal standards in handling and processing plant materials. Packaging materials should also be free from haram substances.

8. Regular Monitoring and Auditing

Internal audits regularly audit the cultivation process, including all steps of planting, maintenance, harvesting, and processing, to ensure compliance with halal standards. Obtain certification from recognized halal certifying bodies to ensure that all stages are compliant with Islamic law. This helps provide assurance that the entire process, from planting to packaging, adheres to halal requirements.

The adoption of halal principles in herbal plant cultivation aligns with the increasing demand for halal products, both in domestic and international markets. The global market increasingly prioritizes products that meet halal standards, which are not only viewed from the safety aspect but also from sustainability and production ethics. Therefore, the implementation of halal principles in herbal plant cultivation not only provides health benefits but also opens up broader market opportunities, both for consumers who prioritize halal aspects and for industries focused on environmentally friendly and sustainable products [3].

3 Conclusion

This research successfully identified various plants from the Zingiberaceae and Euphorbiaceae families growing in a halal-based mini herbal garden in the Sumberbrantas Village, Bumiaji District, Batu, East Java. Plants from the Zingiberaceae family found include *Curcuma longa* (turmeric), *Zingiber officinale* (ginger), *Alpinia galanga* (galangal), and *Kaempferia galanga* (kencur), all of which have high potential as herbal medicines and health benefits. Similarly, plants from the Euphorbiaceae family, such as *Acalypha hispida* (cat's tail), *Euphorbia pulcherrima* (poinsettia), *Excoecaria cochinchinensis* (bloodwort), and *Manihot esculenta* (cassava), also have economic and health potential, both as medicinal plants and food resources.

All the plants identified in this study are managed according to halal principles, from seed selection, cultivation processes, to post-harvest processing. The application of halal standards in the cultivation of these herbal plants not only ensures product safety and sustainability but also meets the increasing market demand for halal products. This strengthens the potential of mini herbal gardens as a model of environmentally friendly, sustainable, and economically beneficial agriculture for the local community.

Overall, the existence of halal-based mini herbal gardens in Sumberbrantas Village can serve as a good example of integrated herbal plant management, supporting health, the economy, and sustainability principles in daily life.

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References

[1] Von Rintelen, Kristina, Evy Arida, and Christoph Häuser. "A review of biodiversity-related issues and challenges in megadiverse Indonesia and other Southeast Asian countries." *Research Ideas and Outcomes* 3 (2017): e20860.

[2] Alzeer, Jawad, Ulrike Rieder, and Khaled Abou Hadeed. "Good agricultural practices and its compatibility with Halal standards." *Trends in Food Science & Technology* 102 (2020): 237-241.

[3] Saad, Bashar, and Omar Said. *Greco-Arab and Islamic herbal medicine: traditional system, ethics, safety, efficacy, and regulatory issues*. John Wiley & Sons, 2011.

[4] Noor, Najihah Mohd, et al. "Navigating the halal food ingredients industry: Exploring the present landscape." *Halalsphere* 3.2 (2023): 32-43.

[5] Van Steenis, C. G. G. J. "Bignoniaceae." *Flora Malesiana-Series 1, Spermatophyta* 8.1 (1974): 114-186.

[6] Cope, James S., et al. "Plant species identification using digital morphometrics: A review." *Expert Systems with Applications* 39.8 (2012): 7562-7573.

[7] Wäldchen, Jana, and Patrick Mäder. "Plant species identification using computer vision techniques: a systematic literature review." *Archives of computational methods in engineering* 25 (2018): 507-543.

[8] Sun, Wenli, and Mohamad Hesam Shahrajabian. "Therapeutic potential of phenolic compounds in medicinal plants—Natural health products for human health." *Molecules* 28.4 (2023): 1845.

[9] Sumarni, W., S. Sudarmin, and S. S. Sumarti. "The scientification of jamu: A study of Indonesian's traditional medicine." *Journal of Physics: Conference Series*. Vol. 1321. No. 3. IOP Publishing, 2019.

[10] Cooper, Richard J. "'I can't be an addict. I am.'Over-the-counter medicine abuse: a qualitative study." *BMJ open* 3.6 (2013): e002913.

[11] Muttaqin, Tatag. "Erosion Rate Toward Utility Change Of Protection Forest Area Inagricultural Of Sumber Brantas Village, Bumiaji District, Batu." *Research Report* 2 (2016).

[12] Sommano, Sarana Rose, and Tibet Tangpao. "Aromatic profile of rhizomes from the ginger family used in food." *Aromatic Herbs in Food*. Academic Press, 2021. 123-165.

[13] Nuari, Doni Anshar, Asman Sadino, and Suci Hilwa Ainaya. "The Safety Evaluation of Some Plants of the Zingibereceae Family." *Buletin Farmatera* 8.1 (2023): 43-63.

[14] Destryana, R. A., T. Estiasih, and D. Pranowo. "Zingiberaceae Rhizome Essential Oil: A Review of Chemical Composition, Biological Activity, and Application in Food Industry." *IOP Conference Series: Earth and Environmental Science*. Vol. 1299. No. 1. IOP Publishing, 2024.

[15] Windarsih, Gut, Dwinita Wikan Utami, and Siti Yuriyah. "Morphological characteristics of Zingiberaceae in Serang District, Banten, Indonesia." *Biodiversitas Journal of Biological Diversity* 22.12 (2021).

[16] Islam, Md Shahidul, et al. "A review on medicinal uses of different plants of Euphorbiaceae family." *Universal journal of pharmaceutical research* (2019).

[17] Shi, Qing-Wen, Xiao-Hui Su, and Hiromasa Kiyota. "Chemical and pharmacological research of the plants in genus Euphorbia." *Chemical reviews* 108.10 (2008): 4295-4327.

[18] Bhatt, Manoj Kumar, Rini Labanya, and Hem C. Joshi. "Influence of long-term chemical fertilizers and organic manures on soil fertility-A review." *Universal Journal of Agricultural Research* 7.5 (2019): 177-188.

[19] Latiff, Johari AB. "Halal Certification Procedure in Malaysia and Indonesia: A Study on Criteria for Determination of Halal Pharmaceutical Products." *PETITA* 5 (2020): 121.

[20] Koshkaki, Mahmoud Rahmanian. "Herbal medicines and their effects on the psyche from the Islamic teachings perspective." *Archives of Pharmacy Practice* 11.4-2020 (2020): 40-48.

[21] Herdiana, Yedi, et al. "Towards halal pharmaceutical: Exploring alternatives to animal-based ingredients." *Heliyon* 10.1 (2024).

[22] Rajendran, Salini Devi, Nitty Hirawaty Kamarulzaman, and Azmawani Abd Rahman. "The mediating role of halal supply chain integrity in enhancing performance for halal herbal-based food SMEs." *Journal of Islamic Marketing* 15.12 (2024): 3621-3648.

[23] Kunle, Oluyemisi Folashade, Henry Omoregie Egharevba, and Peter Ochogu Ahmadu. "Standardization of herbal medicines-A review." *International journal of biodiversity and conservation* 4.3 (2012): 101-112.