

Pollen Morphology of The Four Species *Asteraceae*

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Article History:

Submitted:

December 29th, 2024

Accepted:

March 2th, 2025

Published:

March 20th, 2025

Keywords:

Polen;;

Asteraceae;

Morphology

ABSTRACT

Asteraceae has many species and pollen shape varies. Pollen becomes one of the characteristics of the species and data on the morphological characteristics of pollen can help taxonomic data. This study aimed to determine the morphological character of pollen from four species of the *Asteraceae*. Pollen from *Tridax procumbens*, *Tagetes erecta*, *Zinnia angustifolia*, and *Z. elegans* was taken from the flower and smeared on a glass object and then dripped with distilled water. Fresh preparations were observed with a fluorescence microscope. The pollen shapes of the four species had monad prolate spheroidal (*T. erecta*, *Z. elegans*), monad subspheroidal (*Tr. procumbens*), and monad oblate-spheroidal (*Z. Angustifolia*). *Zinnia angustifolia* had microechinate pollen ornamentation while another species had echinate pollen ornamentation. The four species had aperture varies, i.e tricolpate (*T. erecta*, *Z. elegans*), tetracolporate (*Tr. procumbens*), and monocolpate (*Z. Angustifolia*). *Tagetes erecta* had the biggest diameter pollen (51,405 µm) than the pollen diameter of another species (30,618-36,043 µm). Pollen morphology could differentiate of the four species *Asteraceae* members.

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How to cite this article:

Karbela, D.N., Anggraini, D.N., Khoerunnisa, K., Lestari, W.P.D. & Priyanti. (2025). Pollen morphology of the four species *asteraceae*. *Rumphius Pattimura Biological Journal*, 7(1), 038-041. <https://doi.org/10.30598/rumphiusv7i1p038-041>

Journal Homepage: <https://ojs3.unpatti.ac.id/index.php/rumphius>

Journal E-mail: rumphiusbiojournal@gmail.com ; rumphius.journal@mail.unpatti.ac.id

Research Article: [Open Access](#)

INTRODUCTION

Asteraceae has more than 23,600 species, 1,620 genera and 13 subfamilies (Broholm et al., 2014). *Asteraceae* plants have a fairly high diversity of species, and their pollen has a variety of forms. Pollen is the means of dispersal and generative propagation of flowering plants, which has important significance in biology and ecology. Pollen morphology includes shape, size, aperture, and exine sculpture. This study aims to determine the morphology of pollen in *Asteraceae* plants. typical morphological character in *Asteraceae* is the structure of the inflorescence in the form of compound flowers called capitulum. The capitulum structure forms a pseudoanthium, which is a compound flower that resembles a single flower (Broholm et al., 2014).

Generally, members of *Asteraceae* have a tubular flower located at the centre of the capitulum and have a ray flower at the edge, although some species only have a tubular flower or a ray flower. The sepals are reduced to hairs or scales called pappus which are especially evident on ripe fruits. Members of *Asteraceae* have a fruit called achene which is classified as a dry fruit and has a single seed (Bohm and Stuessy, 2001). For the purpose of identification and classification of a plant, it is necessary to have data on flowers and pollen. With classification, a group of plants can be recognised and facilitate the dissemination of information about these plants (Jeffrey, 1982).

Palynological evidence is one of the traditional evidences used in the preparation of plant systematics. In addition to size and shape, pollen characteristics are the type, number and position of apertures and wall architecture. The morphological characteristics of the pollen are increasingly used in taxonomy, especially to re-correct the kinship relationship between one plant and other plants in taxon groups (Erdtman, 1969).

The results of this study can be used to identify plant taxonomy at various levels, and contribute to the understanding of the biology and ecology of *Asteraceae* plants. The study of pollen morphology of *Asteraceae* plants is important for understanding the diversity of these plants and its application in various aspects, such as taxonomy, phylogeny, and conservation.

MATERIALS AND METHOD

This research was conducted on November 9, 2023 at the integrated laboratory center (PLT) of UIN Syarif Hidayatullah Jakarta. The tools used in this study include: microscope, object glass, cover glass, dropper pipette, camera and stationery. The materials used include pollen from flowers of *Tagetes erecta*, *Tridax procumbens*, *Zinnia angustifolia*, *Zinnia elegans*, aquades, and tissue.

Pollen analysis begins when the pollen sample has been prepared, then the pollen sample is taken sufficiently by applying it to the glass object and dripped with aquades as much as 1 drop. The glass object that has been dripped with distilled water is covered with a cover glass and observed under a microscope. Pollen preparations were observed with a light microscope equipped with an ocular micrometer with units of μm at a magnification of 400x and then photographic documentation of pollen grains was carried out.

RESULTS AND DISCUSSION

Members of the *Asteraceae* family have similar pollen morphological characteristics, namely monadic pollen units, and echinate ornamentation types, while the shape, size and aperture are different (Table 1). Perveen (1999) informed that members of the *Asteraceae* family have round to elongated round pollen shapes (Figure 1). The aperture type is generally tricolpate or tricolporate. It has echinate or spiny ornamentation type, usually short spines, thick at the base, and almost conical Erdtman (1954). This statement is also supported by previous research by Das and Mukherjee (2013) which the exine ornamentation of members of the *Asteraceae* family is echinate, which is formed like a thorn. The exine color of *Zinnia angustifolia* is the darkest than the others which it can be used as identification key.

Tagetes erecta also known as marigold. In addition to its reproductive role, marigold pollen has benefits in various fields, including traditional medicine, pharmacy and the domestic industry. *Tagetes erecta* has a prolate spheroidal and tricolpate shape and a flattened spherical shape longer in one axis than the other (Table 1; Figure 1A). Tricolpate pollen is one of several types of pollen structures that exist, and variations in this structure can help in distinguishing between different species or genera of flowering plants (Rashid M et al., 2013). *Tridax procumbens* is also known as Coat buttons and Tridax daisy in English, pollen has a monadic

unit. Monadic pollen is a pollen that is separate or free from each other (solitary) or separate from its tetrad (Gusmalawati, 2021). However, some dyads (two pollen) were found and were subsspheroideal. Based on size, it is classified in the small class (Pertiwi *et al.*, 2015). It has an ecinate ornament that looks to have spines (+_ 3,549 μm) around its surface with a tetra colporate aperture. The color of the pollen viewed from the microscope is bright yellow to brownish (**Table 1; Figure 1B**).

Table 1. Pollen morphology of four species

Characters	Species			
	<i>Tagetes erecta</i>	<i>Tridax procumbens</i>	<i>Zinnia angustifolia</i>	<i>Z. elegans</i>
Shape	Monad, prolate spheroidal	Monad, subspheroidal	Monad, oblate spheroidal	Monad, prolate spheroidal
Exine Ornamentatiom	Echinate	Echinate	Microchinate	Echinate
Exine color	Yellow green	Dark purple	Dark brown	Pale purple
Aperture	Tricolpate	Tetracolporate	Monocolpate	Tricolpate
Area (μm^2)	2075,398	942.252	1020,234	736,325
Perimeter (μm)	161,49	108,815	113,231	98,192
Diameter (μm)	51,405	34,637	36,043	30,618

Zinnia angustifolia is also known as the narrowleaf zinnia. The characteristics of pollen in *Z. angustifolia* having a monadic unit, include being monocolpate (having a single furrow or pore) and oblate-spheroidal in shape which means it is slightly flattened at the poles and bulging at the equator. This shape is typical of many plant species and helps the pollen grains move efficiently in the wind for fertilization, as well as the microechinate type of ornamentation. The pollen is typically small, and its color can vary depending on the specific cultivar or variety of the plant. In some cases, the pollen may be pale yellow, while in others, it may be darker brown or nearly black. The pollen color is similar with Boyle (1996) which 33% darkly-stained pollen grains (**Figure 1C**). In this study *Zinnia angustifolia* has a diameter of 36,043 μm with the area of 1020,342 μm^2 and the perimeter of 113,231 μm (**Table 1**).

Zinnia elegans as known as zinia grace has the characteristics of monadic unit pollen including tricolpate, and is slightly flattened round at the poles. The pollen morphological in this study is similar with previous research Oktavia *et al.* (2015) and Patma *et al.* (2018). In other characteristics, it has ecinate ornaments and has spines around its surface with a tricolpate aperture. The pollen is small in size with the color viewed from a microscope is bright yellow-green. This characteristic form of pollen is commonly found in the *Asteraceae* plant species (**Table 1; Figure 1D**).

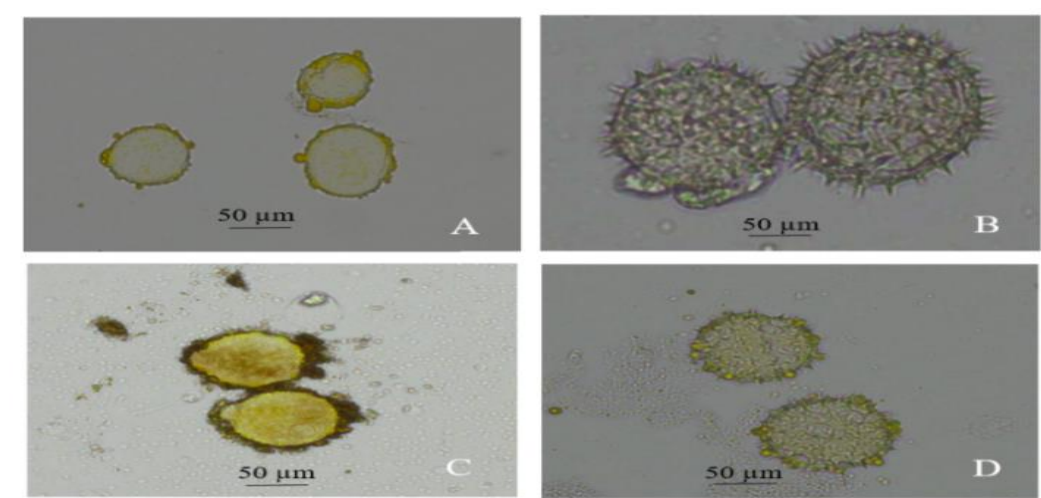


Figure 1. Pollen shape (magnification 400x). A: Pollen of *Tagetes erecta*, B: Pollen of *Tridax procumbens*, C: Pollen of *Zinnia angustifolia*, D: Pollen of *Z. elegans*

CONCLUSION

Pollen from four species of the *Asteraceae* flowers had many spines on the pollen surface. Pollen characteristics in *Asteraceae* flowers are seen from the shape, exine ornamentation, exine color, and aperture. The four species had several pollen shapes, i.e. monad prolate spheroidal, monad subsphreoidal, and monad oblate-spheroidal while the ornaments are echinated and micro-echinate. The pollen had the tetra colporate, tricolpated, and monocolpate aperture.

AUTHORS CONTRIBUTION

Dawa Nure Kabela designed and conducted the research, analysed and interpretation the data. and wrote the draft of manuscript. Dina Novita Anggraini designed and conducted the research, analysed and interpretation the data. and wrote the draft of manuscript. Keisya Khoerunnisa designed and conducted the research, analysed and interpretation the data. and wrote the draft of manuscript. Wulan Putri Dina Lestari designed and conducted the research, analysed and interpretation the data. and wrote the draft of manuscript. Priyanti designed the research, analysed and interpretation the data, reviewed the draft of manuscript, and supervised all the process.

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