

## The significance of pollen morphology in the taxonomy of the genus *Eugenia* Linn. (Family: Myrtaceae)

Noorma Wati Haron<sup>1</sup> and David M. Moore<sup>2</sup>

<sup>1</sup>Department of Botany, University of Malaya, 59100 Kuala Lumpur, Malaysia

<sup>2</sup>Department of Botany, Plant Science Laboratories, University of Reading, Whiteknights, Reading RG6 2AS, England

**ABSTRACT** The pollen grains of *Eugenia* species from both the Old and New World were examined. They are more or less uniform although slight differences can be detected. In some instances, it is possible to distinguish the grains from the two areas. The width of colpus, exine thickness and exine sculpture may be taxonomically useful in distinguishing the species. Findings of the study show that the structure of colpus is not a significant taxonomic character in identifying the pollens from the two geographical areas.

**ABSTRAK** Satu kajian terhadap debunga spesies-spesies *Eugenia* dari Dunia Baru dan Dunia Lama telah dijalankan. Walaupun debunga ini hampir serupa, terdapat sedikit perbezaan yang boleh digunakan untuk mengenali debunga dari kedua-dua kawasan tersebut. Lebar kolpus, ketebalan eksin dan rupabentuk eksin mungkin berguna dari segi taksonomi untuk membezakan spesies-spesies berkenaan. Kajian ini menunjukkan struktur kolpus bukanlah ciri taksonomi yang bermakna untuk membezakan debunga *Eugenia* dari dua kawasan geografi tersebut.

(Myrtaceae, *Eugenia*, pollen grains, taxonomic significance)

### INTRODUCTION

The taxonomic value of the study of pollen grains is well established [1, 2, 3, 4, 5, 6, 7, 8] and the study of pollen morphology has advanced knowledge in morphological botany or has supplemented the taxonomic description of plants. Erdtman [1] has long been the foremost proponent of the concept that the science of palynology can be a valuable tool to systematics. Pollen grains have various morphological characteristics which are of considerable taxonomic value and may aptly be used to differentiate and establish relationships among taxa ranging from families to species.

The present work was undertaken to survey, compare and discuss the pollen morphology of both the Old and New World representatives of *Eugenia*, particularly with regard to recent delimitation and definition of taxa.

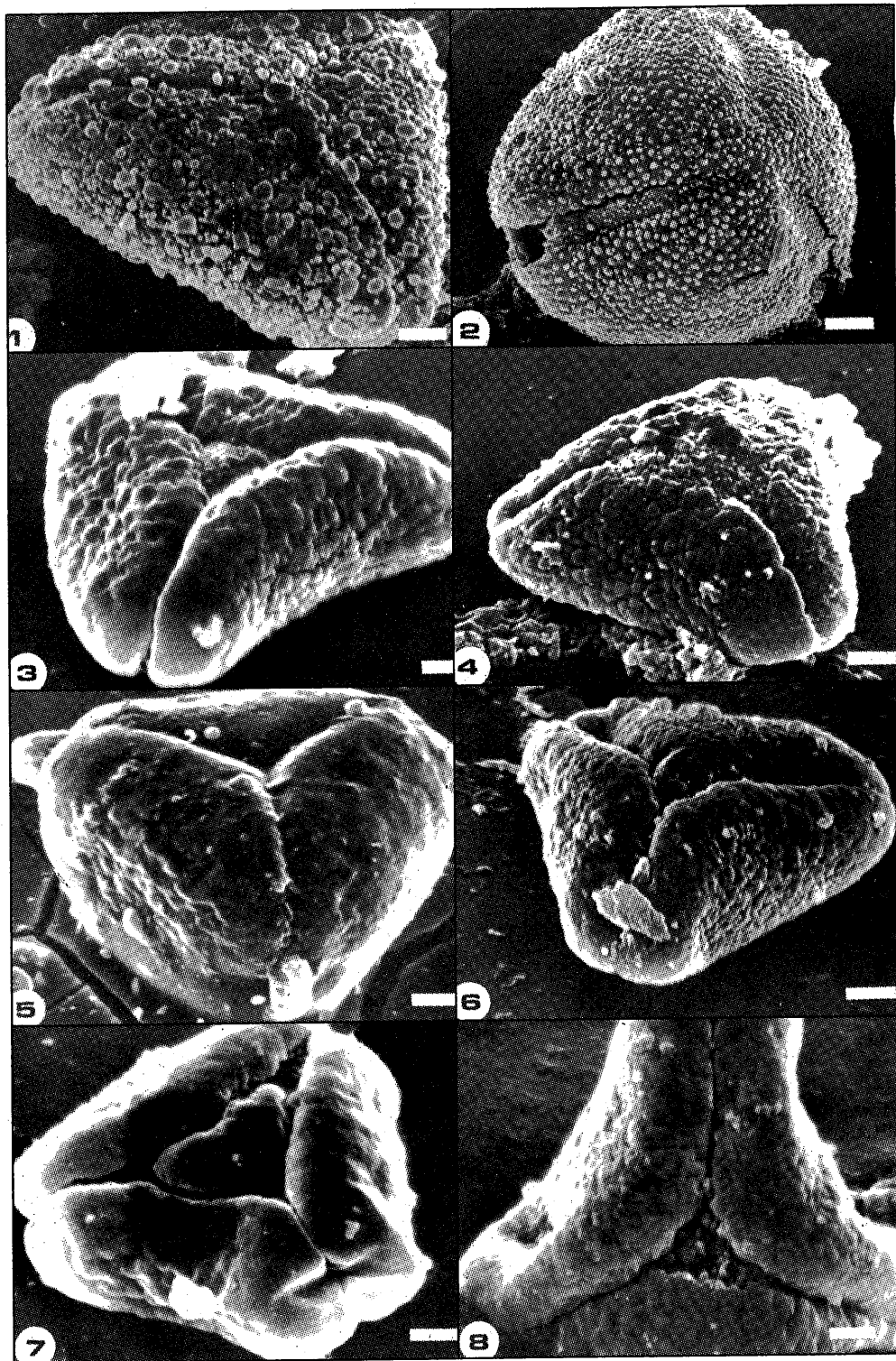
### MATERIALS AND METHODS

The pollen of both Old and New World species of *Eugenia* was examined by light (LM) and scanning electron microscopy (SEM). The Old World (Malaysian) species examined were *E. castanea* Merr., *E. fastigiata* (Bl.) Koord. & Valet., *E. cerasiformis* (Bl.) DC., *E. spicata* Lamk., *E. malaccensis* Linn., *E. grandis* Wight., *E. virens* (Korth.) Koord & Valet., *E. leucocoxylon* Korth. and *E. papillosa* Duthie. Representatives from the New World (South American) were *E. prasina* Berg., *E. mugiensis* Berg., *E. koepperi* Standl., *E. axillaris* (Sw.) Willd., *E. choapamensis* Standl., *E. doubledayi* Standl., *E. glomerata* Spreng. and *E. hirta* Berg. Specimens examined were from Kew (K), Leiden (L), Kepong (KEP), Sandakan (SAN), Sarawak (SAR) and Singapore (SING). Mature anthers were treated according to Erdtman's acetolysis method [1].

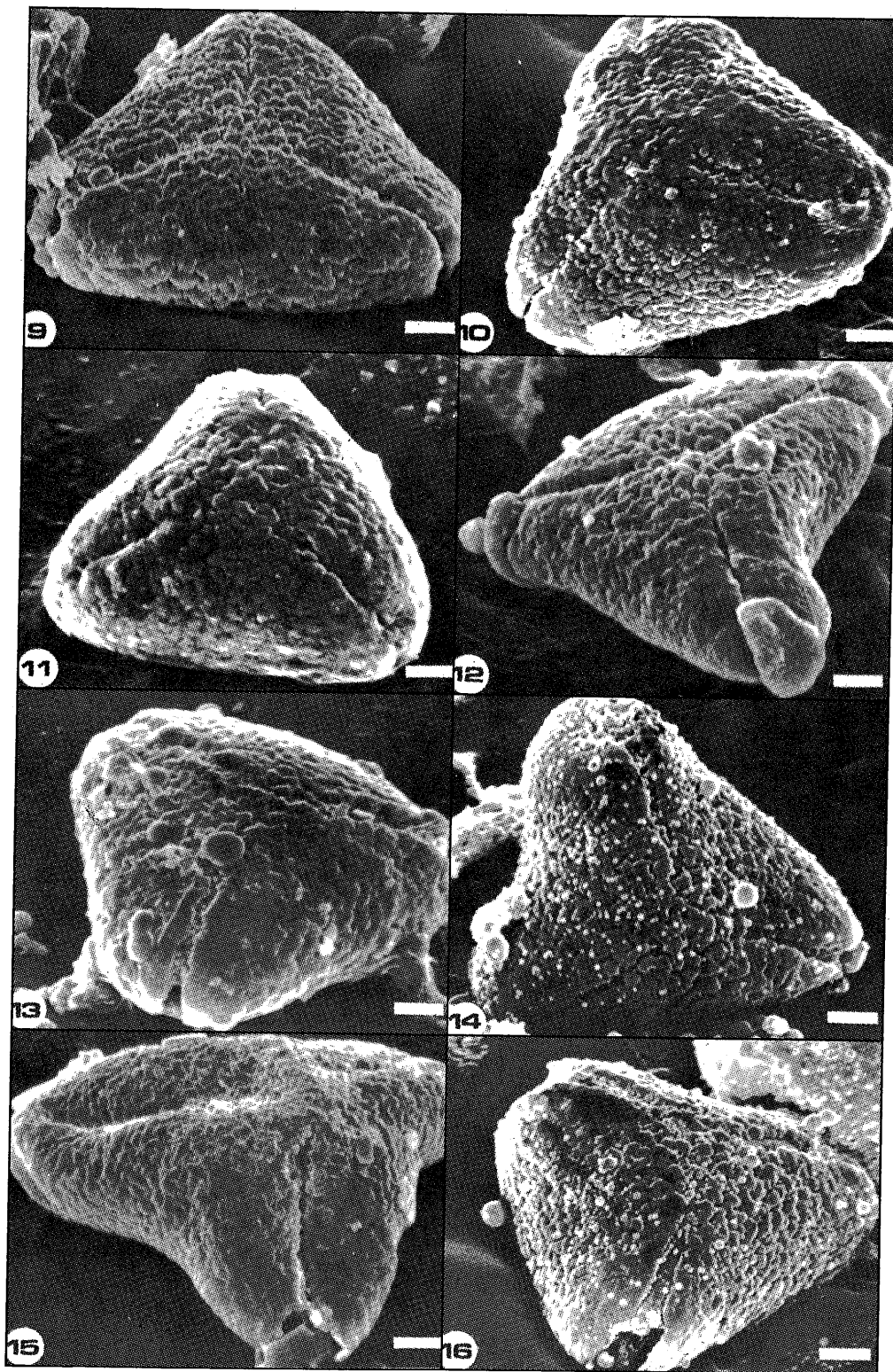
### RESULTS AND DISCUSSION

Table 1 shows main morphological characters between pollen of the Old and New World species. Illustrations from both scanning electron and light microscopy are presented in Figs. 1-32. In general, the pollen grains are small, isopolar, radially symmetrical, tricolporate and syncolpate. The colpi are well-defined in all species examined, and are wider among the Old World as compared to the New World (Table 1). Patel *et al.* [9] recognized three main types of grain in his study on some taxa of the Myrtaceae, i.e. longicolpate, syn- or parasyncolpate and brevi- or brevissimicolpate. In the present study, only syncolpate grains were observed.

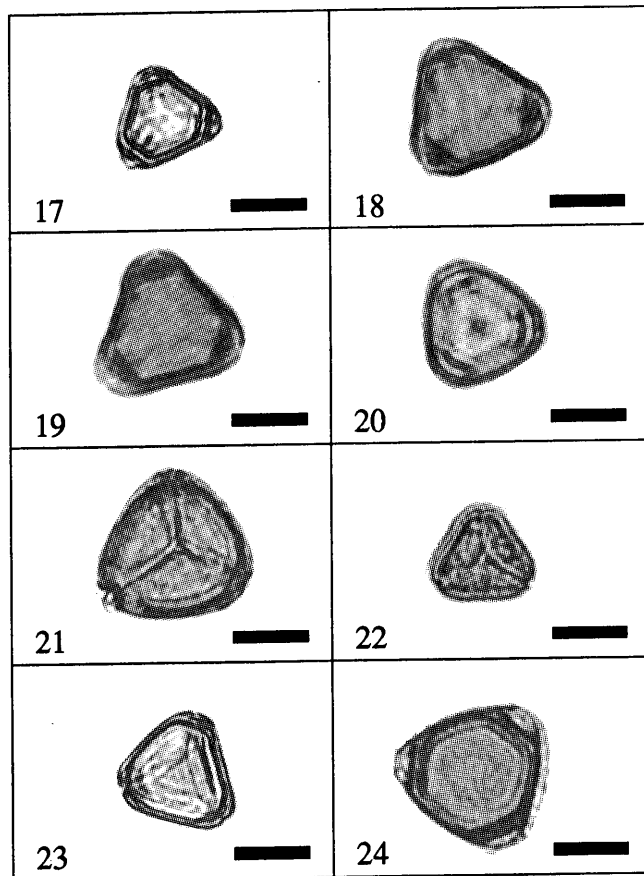
Pike [10] used the nature of the colpi as a generic character. Species from the Old World had either syncolpate or parasyncolpate pollen while the other group had longicolpate pollen. The present results do



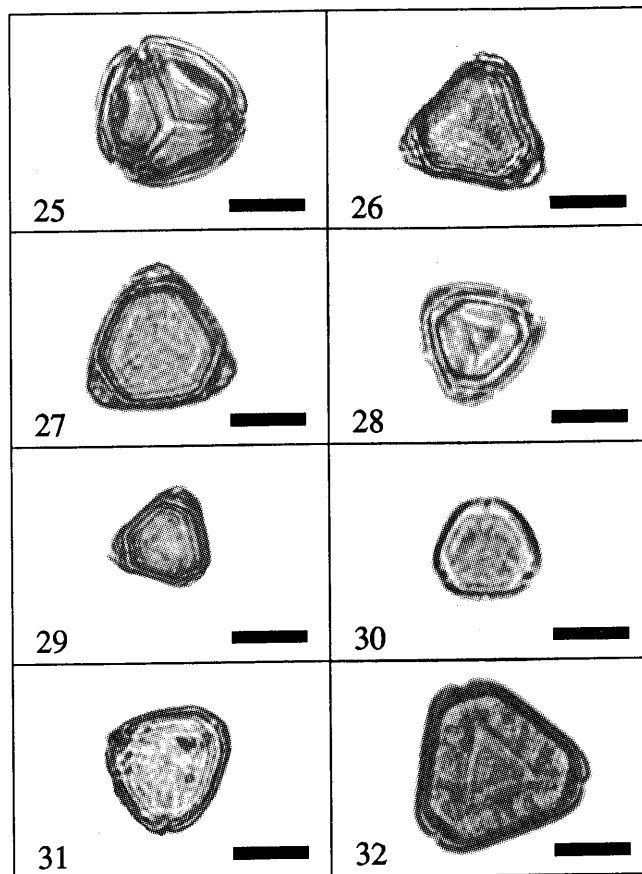
**Figures 1-8.** Scanning electron micrographs showing pollen grain shapes and surface sculpturing in Old World *Eugenia* species. Fig. 1. *E. fastigiata*. Fig. 2. *E. papillosa*. Note the granular surface sculpturing. Sides of amb are convex in *E. papillosa*. Fig. 3. *E. cerasiformis*. Fig. 4. *E. castanea*. Sides of amb almost straight and the grain surface is rugulate. Fig. 5. *E. leucoxylon*. Fig. 6. *E. spicata*. Fig. 7. *E. virens*. Note the triangular apocolpium which is not connected to the mesocolpium. Fig. 8. *E. malaccensis*. Sides of amb concave and the grain surface is rugulate. Intercolpar concavities are distinct in Figs. 3, 4, 7 and 8. Scale bars: Fig. 2 = 1.9  $\mu\text{m}$ . Figs. 1, 3-8 = 0.9  $\mu\text{m}$ .



**Figure 9-16.** Scanning electron micrographs showing pollen grain shapes and surface sculpturing in the New World *Eugenia* species. Fig. 9. *E. choapamensis*. Fig. 10. *E. glomerata*. Fig. 11. *E. axillaris*. Fig. 12. *E. doubledayi*. Fig. 13. *E. koepperi*. Fig. 14. *E. prasina*. Fig. 15. *E. mugiensis*. Fig. 16. *E. hirta*. The surface sculpturing is verrucate in Figs. 9, 11 and 12. In Figs. 10, 13-16 the surface is verrucate granular. All scale bars = 1.3  $\mu$ m.



**Figures 17-24.** Light micrographs showing pollen grain shapes and sizes in the Old World *Eugenia* species. Fig. 17. *E. fastigiata*. Fig. 18. *E. papillosa*. Fig. 19. *E. cerasiformis*. Fig. 20. *E. castanea*. Fig. 21. *E. leucoxydon*. Fig. 22. *E. spicata*. Fig. 23. *E. virens*. Fig. 24. *E. malaccensis*. All scale bars = 19  $\mu$ m.



**Figures 25-32.** Light micrographs showing pollen grain shapes and sizes in New World *Eugenia* species. Fig. 25. *E. choapamensis*. Fig. 26. *E. glomerata*. Fig. 27. *E. axillaris*. Fig. 28. *E. doubledayi*. Fig. 29. *E. koepperi*. Fig. 30. *E. prasina*. Fig. 31. *E. mugiensis*. Fig. 32. *E. hirta*. All scale bars = 19  $\mu$ m.

**Table 1.** Comparison of main morphological characters between pollen of the Old and the New World *Eugenia* species.

Character	Old World Species	New World Species
Polarity	Isopolar	Isopolar
Symmetry	Radial	Radial
Size:		
(a) Equatorial diameter	13 $\mu$ m - 20 $\mu$ m	15 $\mu$ m - 20 $\mu$ m
(b) Polar diameter	13 $\mu$ m - 20 $\mu$ m	14 $\mu$ m - 19 $\mu$ m
(c) P/E x 100	96 - 130	92 - 111
Shape	Oblate spheroidal to prolate spheroidal	Oblate spheroidal
Amb./outline	Goniotreme, very rarely peritreme	Goniotreme
Aperture type	Tricolporate	Tricolporate
Colpus pattern	Syncolpate	Syncolpate
Width of colpus	2 $\mu$ m - 8 $\mu$ m	1 $\mu$ m - 2 $\mu$ m
Exine thickness	1.4 $\mu$ m - 2.3 $\mu$ m	1.2 $\mu$ m - 1.5 $\mu$ m
Exine sculpture	Rugulate, occasionally granulate	Verrucate-rugulate

not justify her concept. Distinct intercolpar concavities with a verrucate-granular surface are observed in the Old World species. The amb is triangular while the sides of the amb are concave to slightly convex or occasionally straight, goniotreme and with acute or obtuse corners. The grain size ranges from 13  $\mu$ m to 20  $\mu$ m (both equatorial and polar diameters) in the Old World species while in the New World species it varies from 15  $\mu$ m to 20  $\mu$ m (equatorial diameter) and 14  $\mu$ m to 19  $\mu$ m (polar diameter). Based on Erdtman's [1] size classification, the pollen grains fall in the minuta group, which ranges from 10  $\mu$ m to 25  $\mu$ m.

On the basis of their numerous stamens and production of copious pollen, the flowers of *Eugenia* may be classified as typical Papaver type [11]. The odour produced by *Eugenia* pollen grains and/or anthers may play a role in the recognition and detection of the flowers by pollinators such as honeybees. Lipid-

rich pollen grains are particularly common in species where pollen is the only floral reward offered to pollinators [12].

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