

The timing of Malvales evolution: incorporating its extensive fossil record to inform about lineage diversification

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Supporting File 1: Fossil information

The following is a list of the 80 fossils used in this study with information about structure, age and reference. Moreover, we indicate the analysis for which each fossil was used and the assignment (constraint) in the phylogeny. The criterion applied to assign a fossil to the crown, or the stem group of a certain clade is based on the synapomorphies of the fossilized structures. If the fossil has the synapomorphy(s) of extant species of a clade, the fossil is assigned to the crown group. In turn, if the fossil resembles extant species but it does not have the synapomorphy of this clade the assignment is in the stem group. Additionally, we assign a “score” to the fossils based on the type of study from which each fossil was obtained. From the highest ranked to the least, these are the categories: (3) morphological comparison with extant taxa; (2) morphological description and assumption of taxonomic affinities; (1) palynoflora. There would be a fourth rank corresponding to studies that investigate the position of the fossil with phylogenetic analysis of morphological characters, but in our fossil sampling there are no such cases.

Bixaceae

1. *Cochlospermum previtifolium* Berry
Structure: leaf
Locality: Rio Pichileufu, Patagonia, Chile
Stratigraphy: Paleocene
Absolute time: 66-56 Ma.
Reference: Berry 1935, 1938; Wilf et al. 2005; González 2009.
Analysis: ND14; FBD14; FBD50; FBD80.
Assignment: ND: clade including Bixaceae and Sphaerosepalaceae; FBD: Stem Bixaceae
Score: 2

Cistaceae

2. *Cistinocarpum roemeri*
Structure: fruit, flower
Locality: Germany
Stratigraphy: Middle Oligocene
Absolute time: 33.9-23.03 Ma.
Reference: Conwentz 1886.
Analysis: FBD80.
Assignment: Stem Cistaceae
Score: 2
3. *Cistoxylon europaeum*
Structure: wood
Locality: Helmstedt, Lower Saxony, Germany

Stratigraphy: Upper Eocene
Absolute time: 37.8-33.9 Ma.
Reference: Gottwald 1992; Gregory et al. 2009.
Analysis: FBD50; FBD80.
Assignment: Stem Cistaceae.
Score: 2

4. *Helianthemum* sp.
Structure: pollen
Locality: Mirabel, Coiron, Ardèche, France.
Stratigraphy: Upper Miocene
Absolute time: 11.63-5.33 Ma.
Reference: Naud & Suc 1975.
Analysis: ND14; FBD14; FBD50; FBD80.
Assignment: ND and FBD: clade including *Lechea*, *Helianthemum*, *Hudsonia*, *Crocianthemum*, *Cistus*, *Halmium* and *Tuberaria*.
Score: 1

5. *Tuberaria* sp.
Structure: pollen
Locality: Schleswig-Holstein, Germany
Stratigraphy: Pliocene
Absolute time: 5.33-2.58 Ma.
Reference: Menke 1976; Muller 1981; Hooghiemstra & van Geel 1998.
Analysis: FBD50; FBD80.
Assignment: Sister group of *Tuberaria*.
Score: 1

Dipterocarpaceae

6. *Albertipollenites kutchensis* Mandal & Rao
Structure: pollen
Locality: Matanomadh Formation, Kutch Basin, Gujarat, India
Stratigraphy: Early Eocene
Absolute time: 56-47.8 Ma.
Reference: Mandal & Rao 2001; Prasad et al. 2009; Mathews et al. 2013.
Analysis: FBD80.
Assignment: Clade including *Dipterocarpus costatus*.
Score: 1
7. *Dipterocarpoxydon arcotense* Awasthi
Structure: wood
Locality: Nungarh Sot, Kalagarh, Pauri Garhwal District, Uttar Pradesh, India
Stratigraphy: Middle Miocene
Absolute time: 15.97-11.63 Ma.

Reference: Prasad 1993
Analysis: FBD50; FBD80.
Assignment: Clade including *Dipterocarpus costatus*.
Score: 2

8. *Dipterocarpus*-type

Structure: pollen
Locality: Northwest Borneo
Stratigraphy: Oligocene
Absolute time: 33.9-23.03 Ma.
Reference: Muller 1970
Analysis: FBD50; FBD80.
Assignment: Clade including *Dipterocarpus costatus*.
Score: 1

9. *Dipterocarpus zhengae* H. M. Li & G. L. Shi

Structure: fruit wing
Locality: Fotan Group, Zhangpu County, Fujian Province, China.
Stratigraphy: Middle - Late Miocene
Absolute time: 15.97-5.33 Ma.
Reference: Shi & Li 2010.
Analysis: FBD50; FBD80.
Assignment: Clade including *Dipterocarpus costatus*.
Score: 1

10. *Dipterocarpuipollenites retipilatus* Kar & Jain

Structure: pollen
Locality: Matanomadh Formation, Kutch Basin, Gujarat, India
Stratigraphy: Early Eocene
Absolute time: 56-47.8 Ma.
Reference: Mandal & Rao 2001; Prasad et al. 2009; Mathews et al. 2013.
Analysis: FBD50; FBD80.
Assignment: Clade including *Dipterocarpus costatus*.
Score: 1

11. Fossil resin

Structure: resin, wood, pollen
Locality: Vastan mine, Cambay Shale Formation, Gujarat, India
Stratigraphy: Early Eocene (Ypresian)
Absolute time: 56-47.8 Ma.
Reference: Rust et al. 2010; Dutta et al. 2011.
Analysis: ND14; FBD14; FBD50; FBD80.
Assignment: ND: Clade including Dipterocarpaceae and Sarcolaenaceae; FBD: Stem Dipterocarpaceae.

Score: 2

12. *Foveotricolpites alveolatus* Mandal & Rao

Structure: pollen

Locality: Matanomadh Formation, Kutch Basin, Gujarat, India

Stratigraphy: Early Eocene

Absolute time: 56-47.8 Ma.

Reference: Mandal & Rao 2001; Prasad et al. 2009; Mathews et al. 2013.

Analysis: FBD80.

Assignment: Clade including *Dipterocarpus costatus*.

Score: 1

13. *Hopenium pondicherriense* Awasthi

Structure: wood

Locality: Nungarh Sot, Kalagarh, Pauri Garhwal District, Uttar Pradesh, India

Stratigraphy: Middle Miocene

Absolute time: 15.97-11.63 Ma.

Reference: Prasad 1993.

Analysis: FBD50; FBD80.

Assignment: Sister group of *Hopea hainanensis*.

Score: 2

14. *Parashorea pseudogoldiana* (Holl.) Wolfe

Structure: leaf

Locality: Kushtaka and Kulthieth, Alaska, USA; Ketavik Formation, Alaska, USA; Chumstick Formation, Washington State, USA.

Stratigraphy: Eocene

Absolute time: 56-33.9 Ma.

Reference: Wolfe 1977; Evans 1991; Parrish et al. 2010.

Analysis: FBD50; FBD80.

Assignment: Stem Dipterocarpaceae.

Score: 2

15. *Shorea albida*-type

Structure: pollen

Locality: Belait Formation, Berakas, Brunei.

Stratigraphy: Miocene

Absolute time: 23.03-5.33 Ma.

Reference: Anderson & Muller 1975.

Analysis: ND14; FBD14; FBD50; FBD80.

Assignment: ND: Clade including *Shorea robusta* and *Parashorea chinensis*; FBD: Clade including *Shorea robusta*.

Score: 1

16. *Shorea maomingensis* Feng, Kodrul & Jin
Structure: fruit wing
Locality: Maoming Basin, Guangdong Province, Shouth China.
Stratigraphy: Late Eocene
Absolute time: 41.2-33.9 Ma.
Reference: Feng et al. 2013
Analysis: FBD80.
Assignment: Stem Dipterocarpaceae.
Score: 3
17. *Shoreoxylon evidens* Eyde
Structure: wood
Locality: Ghogra River Section, Siang District, Arunachal Pradesh, India.
Stratigraphy: Late Miocene - Early Pliocene
Absolute time: 7.24-3.6 Ma.
Reference: Mehrotra et al. 1999.
Analysis: FBD50; FBD80.
Assignment: Sister group of *Shorea robusta*.
Score: 2

Malvaceae s.l.

18. *Apeiba* sp.
Structure: leaf
Locality: Aycross Formation, Wind River Basin, Wyoming, USA
Stratigraphy: Middle Eocene
Absolute time: 47.8-37.8 Ma.
Reference: MacGinitie 1974; Taylor 1990; Graham 1999.
Analysis: FBD80.
Assignment: Sister to *Apeiba tibourbou*.
Score: 2
19. *Bernoullia* sp.
Structure: pollen
Locality: Collazo Quebrada, San Sebastian Formation, Puerto Rico
Stratigraphy: Middle Oligocene
Absolute time: 33.9-23.03 Ma.
Reference: Graham & Jarzen 1969
Analysis: FBD50; FBD80.
Assignment: Sister to *Bernoullia flammea*
Score: 1
20. *Bombacacidites annae* (Van der Hammen) Germeraad
Structure: pollen
Locality: Arcillas de El Limbo Formation, Piñalerita section, Colombia

Stratigraphy: Paleocene
Absolute time: 66-56 Ma.
Reference: Jaramillo & Dilcher 2001; Graham 2010.
Analysis: FBD50; FBD80.
Assignment: Stem Bombacoideae.
Score: 1

21. *Bombacidites baculatus* Muller
Structure: pollen
Locality: Santa Sofía, Mocagua and Los Chorros sections, Solimoes Formation, Colombia
Stratigraphy: Miocene
Absolute time: 23.03-5.33 Ma.
Reference: Hoorn 1994
Analysis: FBD50; FBD80.
Assignment: Stem tribe Adansonieae.
Score: 1

22. *Bombacidites bellus* Colmenares
Structure: pollen
Locality: Misoa Formation, Lake Maracaibo Basin, Venezuela
Stratigraphy: Middle Eocene
Absolute time: 47.8-37.8 Ma.
Reference: Colmenares 1988; Graham 2010.
Analysis: FBD80.
Assignment: Stem Bombacoideae.
Score: 1

23. *Bombacidites bombaxoides* Couper
Structure: pollen
Locality: Kapuni Formation, Taranaki Basin, New Zealand
Stratigraphy: Early to Middle Eocene
Absolute time: 56-41.2 Ma.
Reference: Pocknall 1989, 1990.
Analysis: FBD50; FBD80.
Assignment: Stem Bombacoideae.
Score: 1

24. *Bombacidites qaidamensis* Zhu, Wu, Xi, Song & Zhang
Structure: pollen
Locality: Upper Ganchaigou Formation, China
Stratigraphy: Oligocene
Absolute time: 33.9-23.03 Ma.
Reference: Song et al. 1999 cited in Song et al. 2004
Analysis: FBD50; FBD80.

Assignment: Stem Bombacoideae.

Score: 1

25. *Bombacidites* sp.

Structure: pollen

Locality: Manning Formation, Jackson Group, Texas, USA

Stratigraphy: Upper Eocene

Absolute time: 37.8-33.9 Ma.

Reference: Elsik & Yancey 2000

Analysis: FBD50; FBD80.

Assignment: Stem Bombacoideae.

Score: 1

26. *Bombaciphyllum opacum* Engelhardt

Structure: leaf

Locality: Curanilahue Formation, Arauco-Concepción, Chile

Stratigraphy: Miocene

Absolute time: 23.03-5.33 Ma.

Reference: Berry 1922; Graham 2010.

Analysis: FBD80.

Assignment: Stem Bombacoideae.

Score: 2

27. *Bombacoxylon langstoni* Wheeler & Lehman

Structure: wood

Locality: Aguja Formation, Big Bend, Texas, USA

Stratigraphy: Late Campanian

Absolute time: 83.6-72.1 Ma.

Reference: Wheeler & Lehman 2000

Analysis: FBD80.

Assignment: Stem Malvaceae *s.l.*

Score: 3

28. *Bombapollis texensis* Elsik

Structure: pollen

Locality: Crockett and Yegua formations, Claiborne group, Texas, USA

Stratigraphy: Middle Eocene

Absolute time: 47.8-37.8 Ma.

Reference: Elsik & Yancey 2000

Analysis: FBD50; FBD80.

Assignment: Stem Bombacoideae.

Score: 1

29. *Bombax* sp. (fossil 1)

Structure: pollen
Locality: Collazo Quebrada, San Sebastian Formation, Puerto Rico
Stratigraphy: Middle Oligocene
Absolute time: 33.9-23.03 Ma.
Reference: Graham & Jarzen 1969
Analysis: FBD80.
Assignment: Stem tribe Adansonieae (*Catostemma*, *Scleronema*, *Adansonia*, *Cavanillesia*, *Ceiba*, *Neobuchia*, *Pachira*, *Rhodognaphalon*).
Score: 1

30. *Bombax*-type

Structure: pollen
Locality: Navesink Formation, Atlantic Highlands, New Jersey USA
Stratigraphy: Maastrichtian
Absolute time: 72.1-66 Ma.
Reference: Wolfe 1975; Muller 1981; Taylor 1990; Graham 2010.
Analysis: ND14; FBD14; FBD50; FBD80.
Assignment: ND: Clade including Bombacoideae, Malvoideae and *Chiranthodendron*, *Fremontodendron* and *Septotheca*; Stem Bombacoideae.
Score: 1

31. *Burretiodendron parvifructum* Anberrée et al.

Structure: fruit
Locality: Xiaolongtan Formation, Wnshan and Maguan, China
Stratigraphy: Upper Miocene
Absolute time: 11.63-5.33 Ma.
Reference: Anberrée et al. 2015.
Analysis: FBD80.
Assignment: Sister to *Burretiodendron esquirolii*.
Score: 3

32. *Byttneriopsis* Kvacek et Wilde

Structure: leaf
Locality: Messel, Germany
Stratigraphy: Middle Eocene
Absolute time: 47.8-37.8 Ma.
Reference: Kvacek & Wilde 2010
Analysis: FBD50; FBD80.
Assignment: Stem Malvaceae s.l.
Score: 3

33. *Catostemma* sp.

Structure: pollen
Locality: Collazo Quebrada, San Sebastian Formation, Puerto Rico

Stratigraphy: Middle Oligocene
Absolute time: 33.9-23.03 Ma.
Reference: Graham & Jarzen 1969
Analysis: FBD50; FBD80.
Assignment: Clade including *Catostemma fragans* and the fossil *Jandufouria seamrogiformis*.
Score: 1

34. *Chattawayia paliformis* Manchester

Structure: wood
Locality: Nut Beds, Clarno Formation, Oregon, USA
Stratigraphy: Middle Eocene
Absolute time: 47.8-37.8 Ma.
Reference: Manchester 1980
Analysis: FBD80.
Assignment: Stem Dombeyoideae.
Score: 3

35. *Craigia oregonensis* (Arnold) Kvacek, Buzek et Manchester

Structure: fruit valves
Locality: Anadyrka River, Napana Formation, Kamchatka, Russia
Stratigraphy: Late Paleocene – Early Eocene
Absolute time: 61.6-47.8 Ma.
Reference: Kvacek et al. 2005
Analysis: FBD50; FBD80.
Assignment: Sister to *Craigia yunnanensis*.
Score: 3

36. *Discoidites borneensis* Muller

Structure: pollen
Locality: Sarawak, Bungo area, Plateau Sandstone Formation, Malaysia
Stratigraphy: Paleocene
Absolute time: 66-56 Ma.
Reference: Muller 1968; Mandal & Rao 2001; Mathews et al. 2013
Analysis: FBD80.
Assignment: Stem Brownlowioideae
Score: 1

37. *Eriotheca prima* Duarte

Structure: flower
Locality: Fonseca Formation, Quadrilátero Ferrífero, Minas Gerais, Brazil
Stratigraphy: Late Eocene
Absolute time: 41.2-33.9 Ma.
Reference: Duarte 1974; Lima & Salard-Cheboldaeff 1981.
Analysis: ND14; FBD14; FBD50; FBD80.

Assignment: ND: Crown tribe Adansonieae; FBD: Stem tribe Adansonieae

Score: 2

38. *Florissantia ashwillii* Manchester

Structure: flowers and fruits

Locality: Sheep Rock Creek Oregon, USA; Sumner Spring, Gray Butte, Oregon, USA; Goshen flora, Oregon, USA.

Stratigraphy: Late Eocene – early Oligocene

Absolute time: 37.8-27.82 Ma.

Reference: Manchester 1992

Analysis: FBD50; FBD80.

Assignment: Stem Malvaceae *s.l.*

Score: 3

39. *Florissantia quilchenensis* (Mathews & Booke) Manchester

Structure: flowers and fruits

Locality: Quilchena, British Columbia, Canada; Green River Formation, Wyoming, USA; Republic flora, Washington, USA.

Stratigraphy: Middle Eocene

Absolute time: 47.8-37.8 Ma.

Reference: Manchester 1992

Analysis: FBD80.

Assignment: Stem Malvaceae *s.l.*

Score: 3

40. *Florissantia speirii* (Lesquereux) Manchester

Structure: flowers and fruits

Locality: Florissant Formation, Colorado, USA; John Day Formation, Dugout Gulch, Oregon, USA; Clarno Formation, West Branch Creek, Oregon, USA.

Stratigraphy: Late Eocene – early Oligocene

Absolute time: 37.8-27.82 Ma.

Reference: Manchester 1992

Analysis: FBD50; FBD80.

Assignment: Stem Malvaceae *s.l.*

Score: 3

41. *Grewioxylon indicum* Prakash & Dayal

Structure: wood

Locality: Mahurzari, Deccan Intertrappean beds, Nagpur, Maharashtra, India

Stratigraphy: Eocene

Absolute time: 56-33.9 Ma.

Reference: Prakash & Dayal 1963

Analysis: FBD80.

Assignment: Stem Grewioideae.

Score: 2

42. *Hoheria* sp.

Structure: pollen

Locality: Crockett and Yegua Formations, Claiborne group, Texas, USA

Stratigraphy: Late middle Eocene

Absolute time: 41.2-37.8 Ma.

Reference: Elsik & Yancey 2000

Analysis: FBD50; FBD80.

Assignment: Clade including *Asterotrichion*, *Plagianthus*, *Hoheria* and *Lawrencia*.

Score: 1

43. *Jandufouria seamrogiformis* Germeraad

Structure: pollen

Locality: La Capacha, Venezuela.

Stratigraphy: Late Eocene

Absolute time: 41.2-33.9 Ma.

Reference: Colmenares et al. 1993

Analysis: FBD50; FBD80.

Assignment: Clade including *Catostemma fragans*.

Score: 1

44. *Javelinoxylon multiporosum* Wheeler, Lehman & Gasson

Structure: wood

Locality: Javelina Formation, Texas, USA

Stratigraphy: Maastrichtian

Absolute time: 72.1-66 Ma.

Reference: Wheeler et al. 1994

Analysis: FBD80.

Assignment: Stem Malvaceae s.l.

Score: 3

45. *Javelinoxylon weberi* Estrada-Ruiz, Martínez-Cabrera & Cevallos-Ferriz

Structure: wood

Locality: Olmos Formation, Coahuila, Mexico

Stratigraphy: Late Campanian – early Maastrichtian

Absolute time: 77.85-69.05 Ma.

Reference: Estrada-Ruiz et al. 2007

Analysis: ND14; FBD14; FBD50; FBD80.

Assignment: Stem Malvaceae s.l.

Score: 3

46. *Laria rueminiana* (Heer) G. Worobiec & Kvacek

Structure: leaf

Locality: Belchatow Lignite Mine, Kleszczow Graben, Poland
Stratigraphy: Late Miocene
Absolute time: 11.63-5.33 Ma.
Reference: Worobiec et al. 2012
Analysis: FBD50; FBD80.
Assignment: Clade including *Reevesia thyrsoidea*.
Score: 3

47. *Luehea divaricatiformis* Fittipaldi, Simoes, Diulietti & Pirani
Structure: leaf
Locality: Itaquaquecetuba Formation, Sao Paulo Basin, Brazil
Stratigraphy: Late Eocene
Absolute time: 41.2-33.9 Ma.
Reference: Fittipaldi et al. 1989
Analysis: FBD50; FBD80.
Assignment: Sister to *Luehea*.
Score: 2

48. *Malvacarpus guinazui* Berry
Structure: fruit
Locality: Ventana Formation, Río Pichileufu, Argentina
Stratigraphy: Early Miocene
Absolute time: 23.03-15.97 Ma.
Reference: Berry 1938
Analysis: FBD80.
Assignment: Stem Eumalvoideae (excluding *Howittia*, *Lagunaria*, *Camptostemon*, *Radyera*, *Uladendron*, *Pentaplaris*, *Matisia*, *Phragmothea* and *Quararibea*).
Score: 2

49. *Malvacarpus octolobus* Berry
Structure: fruit
Locality: Belen Flora, Peru
Stratigraphy: Early Oligocene
Absolute time: 33.9-27.82 Ma.
Reference: Berry 1929 cited in Graham 2010; Manchester et al. 2012.
Analysis: FBD50; FBD80.
Assignment: Stem Eumalvoideae.
Score: 2

50. *Malvaciphyllum macondicus* M. Carvalho
Structure: leaf
Locality: Cerrejón Formation, Ranchería Basin, Colombia
Stratigraphy: Middle – Late Paleocene
Absolute time: 61.6-56 Ma.

Reference: Carvalho et al. 2011

Analysis: ND14; FBD14; FBD50; FBD80.

Assignment: ND: Clade including Eumalvoideae and *Howittia* and *Lagunaria*; FBD: Stem Eumalvoideae.

Score: 3

51. *Mortoniodendron* sp.

Structure: pollen

Locality: Gatuncillo Formation, Alcalde Díaz, Panama

Stratigraphy: Upper Eocene

Absolute time: 37.8-33.9 Ma.

Reference: Graham 1985

Analysis: FBD80.

Assignment: Sister to *Mortoniodendron guatemalense*.

Score: 1

52. *Parabombacaceoxylon magniporosum* Wheeler, Lee & Matten

Structure: wood

Locality: McNairy Formation, Black Powder Hollow, Alexander County, Illinois, USA

Stratigraphy: Maastrichtian

Absolute time: 72.1-66 Ma.

Reference: Wheeler et al. 1987

Analysis: FBD50; FBD80.

Assignment: Stem Malvaceae s.l.

Score: 3

53. *Pterospermumocarpon kalviwadiensis* R. Srivast., R.K. Saxena & Gaurav Srivast.

Structure: fruit

Locality: Sindhudurg Formation, Kalviwadi Village, Sindhudurg District, Maharashtra, India

Stratigraphy: Miocene

Absolute time: 23.03-5.33 Ma.

Reference: Srivastava et al. 2012

Analysis: ND14; FBD14; FBD50; FBD80.

Assignment: Clade including *Corchoropsis*, *Dombeya*, *Trochetia*, *Eriolaena*, *Helmiopsiella*, *Helmiopsis*, *Melhaniania*, *Ruizia*, *Paramelhaniania*, *Trochetiopsis* and *Pentapetes*.

Score: 3

54. *Reevesia japonoxyla* K. Terada & M. Suzuki

Structure: wood

Locality: Hachiya Formation, Hida River, Kawabe Dam, Kawabe-machi, Kamo-gun, Gifu Prefecture, Japan

Stratigraphy: Lower Miocene

Absolute time: 23.03-15.97 Ma.

Reference: Terada & Suzuki 1998

Analysis: FBD80.
Assignment: Clade including *Reevesia thyrsoides*.
Score: 3

55. *Reevesia hurnikii* Kvacek

Structure: fruits, leaves, winged seeds
Locality: Most Basin, Bilina, North Bohemia, Czech Republic
Stratigraphy: Miocene
Absolute time: 23.03-5.33 Ma.
Reference: Kvacek 2006
Analysis: FBD80.
Assignment: Clade including *Reevesia thyrsoides*.
Score: 3

56. *Reevesiapollis reticulatus* (*Ungeria*) (Couper) Krutzsch

Structure: pollen
Locality: Papakaio Formation, Hakataramea Valley, Otago, New Zealand
Stratigraphy: Early Eocene
Absolute time: 56-47.8 Ma.
Reference: Pocknall 1990; Raine et al. 2011
Analysis: FBD50; FBD80.
Assignment: Clade including *Reevesia*, *Ungeria*, *Helicteres*, *Mansonia* and *Triplochiton*.
Score: 1

57. *Retitricolporites firmianoides* Ke et Shi.

Structure: pollen
Locality: Shahejie Formation, Dongying Sag, China
Stratigraphy: Eocene
Absolute time: 56-33.9 Ma.
Reference: Song et al. 1999 cited in Song et al. 2004
Analysis: FBD80.
Assignment: Stem Sterculioideae.
Score: 1

58. *Sphinxia ovalis* Reid & Chandler

Structure: fruit, seeds
Locality: Sheppey and Harne Bay, London Basin, London Clay, England
Stratigraphy: Early Eocene
Absolute time: 56-47.8 Ma.
Reference: Reid & Chandler 1933
Analysis: FBD50; FBD80.
Assignment: Stem Dombeyoideae.
Score: 2

59. *Sterculia patagónica* Berry

Structure: leaf

Locality: Río Pichileufu, Carilaufquen Basin, Argentina

Stratigraphy: Late Cretaceous

Absolute time: 72.1-66 Ma.

Reference: Berry 1938

Analysis: FBD80.

Assignment: Stem Sterculioideae.

Score: 2

60. *Sterculiaephyllum australis* Dutra

Structure: leaf

Locality: Zamek Formation, Baranowski Glacier Group, Zamek Hill, Admiralty Bay, King George Island, Antarctica

Stratigraphy: Late Cretaceous

Absolute time: 72.1-66 Ma.

Reference: Dutra & Batten

Analysis: FBD80.

Assignment: Stem Sterculioideae.

Score: 2

61. *Sterculia coloradensis* Brown

Structure: leaf

Locality: Green River Shale, Colorado, USA

Stratigraphy: Middle Eocene

Absolute time: 47.8-37.8 Ma.

Reference: MacGinitie 1969

Analysis: FBD50; FBD80.

Assignment: Stem Sterculioideae.

Score: 2

62. *Sterculia washburnii* Berry

Structure: leaf

Locality: Río Pichileufu, Carilaufquen Basin, Argentina

Stratigraphy: Late Cretaceous

Absolute time: 72.1-66 Ma.

Reference: Berry 1938

Analysis: FBD50; FBD80.

Assignment: Stem Sterculioideae.

Score: 2

63. *Sterculinium foetidense* Prakash

Structure: wood

Locality: Siwalik beds, Kanandoo sot, Kalagarh, Pauri Garhwal District, Uttar Pradesh, India

Stratigraphy: Middle Miocene
Absolute time: 15.97-11.63 Ma.
Reference: Prasad 1993
Analysis: ND14; FBD14; FBD80.
Assignment: ND: Crown Sterculioideae; FBD: Clade including *Sterculia*.
Score: 2

64. *Sterculinium kalagarhense* (Trivedi & Ahuja) Guleria
Structure: wood
Locality: Siwalik beds, Hathia sot, Kalagarh, Pauri Garhwal District, Uttar Pradesh, India
Stratigraphy: Middle Miocene
Absolute time: 15.97-11.63 Ma.
Reference: Prasad 1993
Analysis: FBD50; FBD80.
Assignment: Clade including *Sterculia*.
Score: 2

65. *Tilia sp.*
Structure: pollen
Locality: Rynolds Creek, Gabriola Formation, British Columbia, Canada
Stratigraphy: Maastrichtian
Absolute time: 72.1-66 Ma.
Reference: Rouse et al. 1970
Analysis: FBD50; FBD80.
Assignment: Stem Tilioideae.
Score: 1

66. *Tilia parvulifolia* H. V. Smith
Structure: leaves, bracts, flowers, fruit and pollen
Locality: Geertson Formation, Lemhi River, Idaho, USA
Stratigraphy: Late Oligocene – Early Miocene
Absolute time: 27.82-20.44 Ma.
Reference: Hall & Swain 1971
Analysis: FBD80.
Assignment: Clade including *Tilia*.
Score: 2

67. *Tilia gigantea* Ettingshausen
Structure: leaf
Locality: Bechlejovice, Usti Formation, Ceske stredohori Mountains, Czech Republic
Stratigraphy: Oligocene
Absolute time: 33.9-23.03 Ma.
Reference: Kvacek & Walther 2004
Analysis: ND14; FBD14; FBD80.

Assignment: ND: Crown Tilioideae; FBD: Clade including *Tilia*.

Score: 3

68. *Triplochitoxylon oregonensis* Manchester

Structure: wood

Locality: Nut Beds, Clarno Formation, Wheeler County, Oregon, USA

Stratigraphy: Middle Eocene

Absolute time: 47.8-37.8 Ma.

Reference: Manchester 1979

Analysis: ND14; FBD14; FBD80.

Assignment: ND and FBD: Clade including *Triplochiton*, *Mansonia* and *Helicteres*.

Score: 3

69. *Triumfetta ovata* MacGinitie

Structure: leaf

Locality: Green River Formation, northwestern Colorado and northeastern Utah, USA

Stratigraphy: Middle Eocene

Absolute time: 47.8-37.8 Ma.

Reference: MacGinitie 1969 cited in Graham 1999.

Analysis: ND14; FBD14; FBD50; FBD80.

Assignment: ND and FBD: Clade including *Corchorus*, *Pseudocorchorus*, *Heliocarpus* and *Triumfetta*.

Score: 2

70. *Wataria miocenica* (Watari) K. Terada & M. Suzuki

Structure: wood

Locality: Atsumi Formation, Iragawa, Atsumi-machi, Nishitagawa-gun, Yamagata Prefecture, Japan

Stratigraphy: Lower Miocene

Absolute time: 23.03-15.97 Ma.

Reference: Terada & Suzuki 1998

Analysis: FBD80.

Assignment: Stem Helicterioideae.

Score: 3

71. *Wataria oligocenica* (M. Suzuki) K. Terada & M. Suzuki

Structure: wood

Locality: Tsuyazaki Formation, Koinoura, Tsuyazaki-machi, Fukuoka Prefecture, northern Kyushu, Japan

Stratigraphy: Lower Oligocene

Absolute time: 33.9-27.82 Ma.

Reference: Terada & Suzuki 1998

Analysis: FBD50; FBD80.

Assignment: Stem Helicterioideae.

Score: 3

72. *Wataria parvipora* K. Terada & M. Suzuki

Structure: wood

Locality: Hachiya Formation, Minamihora, Kawabe-machi, Kamogun, Gifu Prefecture, Japan

Stratigraphy: Lower Miocene

Absolute time: 23.03-15.97 Ma.

Reference: Terada & Suzuki 1998

Analysis: FBD50; FBD80.

Assignment: Stem Helicterioideae.

Score: 3

73. *Wheeleroxylon atascosense* Estrada-Ruiz, Martínez-Cabrera & Cevallos-Ferriz

Structure: wood

Locality: Olmos Formation, Atascoso Ranch, Múzquiz Municipality, Coahuila, Mexico

Stratigraphy: Late Campanian – early Maastrichtian

Absolute time: 77.85-69.05 Ma.

Reference: Estrada-Ruiz et al. 2010

Analysis: FBD80.

Assignment: Stem Malvaceae s.l.

Score: 2

Muntingiaceae

74. *Muntingiophyllum calaburoides* Pons

Structure: leaf

Locality: Mesa Formation, Department of Tolima, Colombia

Stratigraphy: Pliocene

Absolute time: 5.33-2.58 Ma.

Reference: Pons 1977 cited in Graham 2010.

Note: Paratype located at Collection de Paléobotanique de l'Université Pierre et Marie Curie, Paris, France.

Analysis: FBD50; FBD80.

Assignment: Sister to *Muntingia calabura*.

Score: 2

Thymelaeaceae

75. *Daphne septentrionalis* (Lesquereux) MacGinitie

Structure: leaf

Locality: Florissant Formation, Colorado, USA

Stratigraphy: Early Oligocene

Absolute time: 33.9-27.82 Ma.

Reference: MacGinitie 1953 cited in Graham 1999.

Analysis: FBD50; FBD80.

Assignment: Clade including *Daphne*, *Thymelaea*, *Dendrostellera*, *Diartrhon*, *Stellera* and *Wikstroemia*.

Score: 2

76. *Pimelea* sp.

Structure: pollen

Locality: Murray Basin, Australia

Stratigraphy: Pliocene

Absolute time: 5.33-2.58 Ma.

Reference: Macphail 1999; Raine et al. 2011.

Analysis: FBD50; FBD80.

Assignment: Sister to *Pimelea physodes*.

Score: 1

77. *Retimultiporopollenites qiongbeiensis*

Structure: pollen

Locality: Liushagang Formation, Fushan Sag, Beibuwan Basin, China.

Stratigraphy: Eocene

Absolute time: 56-33.9 Ma.

Reference: Song et al. 1999 cited in Song et al. 2004

Analysis: ND14; FBD14; FBD80.

Assignment: ND and FBD: Clade including *Daphne*, *Thymelaea*, *Dendrostellera*, *Diartrhon*, *Stellera* and *Wikstroemia*.

Score: 1

78. *Thymelaeaspermum bournense* Chandler

Structure: seeds

Locality: Bournemouth Marine Beds, Boscombe Sands, Highcliff Sands, Hampshire Basin, England

Stratigraphy: Eocene

Absolute time: 56-33.9 Ma.

Reference: Chandler 1964

Analysis: FBD50; FBD80.

Assignment: Stem Thymelaeaceae.

Score: 2

79. Thymelaeoideae gen. indet. 1

Structure: pollen

Locality: Florissant Fossil Beds, Colorado, USA.

Stratigraphy: Late Eocene

Absolute time: 41.2-33.9 Ma.

Reference: Bouchal et al. 2016

Analysis: FBD80.

Assignment: Stem Thymelaeaceae.

Score: 1

Sarcolaenaceae

80. *Xyloolaena*-type

Structure: pollen tetrads

Locality: Elandsfontyn Formation, Noordhoek, Southwestern Cape, South Africa

Stratigraphy: Early Miocene

Absolute time: 23.03-15.97 Ma.

Reference: Coetzee & Muller 1984

Analysis: FBD50; FBD80.

Assignment: Stem Sarcolaenaceae.

Score: 1

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