

Phyton (Horn, Austria)	Vol. 46	Fasc. 2	231–236	11. 6. 2007
------------------------	---------	---------	---------	-------------

Notes on Terminology for *Mimosaceae* Polyads, Especially in *Calliandra*

By

Herwig TEPPNER*)

Received November 3, 2006

Key words: *Mimosaceae*, *Calliandra*. – Apical grain, pollen adhesive, pollen-kitt, pollen sticker, polyad; basal grain, massula, pollinium, viscin body. – Morphology, terminology.

Summary

TEPPNER H. 2007. Notes on terminology for *Mimosaceae* polyads, especially in *Calliandra*. – *Phyton* (Horn, Austria) 46 (2): 231–236. – English with German summary.

In connection with the pollen grain groups of *Mimosaceae* and the special features of *Calliandra*, the terms polyad, apical grain and pollen adhesive are regarded as correct and are recommended. Furthermore, the reasons for the rejection of the terms pollinium, massula, basal grain and viscin body for the mentioned subjects are discussed.

Zusammenfassung

TEPPNER H. 2007. Anmerkungen zur Terminologie von *Mimosaceae*-Polyaden, speziell bei *Calliandra*. – *Phyton* (Horn, Austria) 46 (2): 231–236. – Englisch mit deutscher Zusammenfassung.

Im Zusammenhang mit den Pollenkorn-Gruppen der *Mimosaceae* und den Besonderheiten von *Calliandra* werden die Termini Polyade, apikales Korn und Pollenklebstoff als korrekt angesehen und empfohlen. Außerdem wird begründet, warum im vorliegenden Zusammenhang die Termini Pollinium, Massula, basales Korn und Viscinkörper verworfen werden.

1. Introduction

A paper on *Calliandra* polyads by R. GREISSL, in a recent issue of the journal *Flora* (201: 570–587, 2006), provokes many replies and rejoinders.

*) Pens. Univ.-Prof. Dr. Herwig TEPPNER, Institute of Plant Sciences, Division of Systematics and Geobotany, Karl-Franzens University Graz, Holteigasse 6, 8010 Graz, Austria, Europe; e-mail: herwig.teppner@uni-graz.at

Those concerning terminology are subject of this paper. I hope that, with the following paragraphs, I can help readers to avoid further confusion. To make these notes not too comprehensive, only selected literature is cited.

2. Polyad

The appropriate term for the groups of pollen grains (tetrads excluded) in *Mimosaceae* is polyad, coined by IVERSEN & TROELS-SMITH 1950: 44 and exactly defined as a dispersal unit of pollen containing more than four pollen grains ('Mehr als 4 Pollenkörner vereinigt'). In older times, before the availability of the term polyad, other terms or paraphrases, were necessary. So, ENGLER 1876: 275–291 used 'Pollengruppe' [pollen group], whereas TAUBERT 1891: e. g., 99, 101 writes 'Pollenpaket' (modern German orthography: Pollenpaket) [pollen package] and WODEHOUSE 1935: 429–437 compound grain (tetrads included).

Unfortunately the term pollinium was also in usage (e. g., ENDLICHER & UNGER 1843: 252, KERNER 1891: 96, GOEBEL 1933: 197, DNYANSAGAR 1958, PRAKASH 1987, in part). Pollinium denotes a coherent mass of all pollen grains of one whole theca (NUTTALL 1818: 188: 'masses of pollen'); massa pollinica of RICHARD 1818: 26. Compare also LINK 1824: 297, 299 and BRISCHOFF 1839: 155 for pollinarium what was more or less the same at that time. The differentiation between pollinium and pollinarium, which is common today, originated later (both mingled: PFITZER 1888: 67). In many definitions the possibility that this coherent mass can also be formed from each locule of the anther, seems to be neglected (correct, e. g., in WALKER & DOYLE 1975: 690). However, the term is not applicable to *Mimosaceae*, because here 2 to c. 500 (*Mimosa*, SELJO & SOLIS NEFFA 2004) polyads per locule are produced or 4 to c. 1000 per theca.

Massula was also used to designate the pollen grain groups in *Mimosaceae* (e. g. WETTSTEIN 1907: 173, 362, WEBERLING 1981: 109, WAGENITZ 2003: 192). But the term massula was introduced by RICHARD 1818: 26, 35–36 for thoroughly connected, longitudinal halves of pollinia in some Orchids ('Unaquaeque binarum partium ex quibus longitudinaliter acumbentibus constant Massae sectiles et granulosa: unumquodque corpusculorum solidorum et numero semper pari definitorum, ex partitione singularum Massarum provenientium'). Compare also BRISCHOFF 1839: 121. Later the content of the term changed and it is used today for the granule-like subunits which are connected by elastoviscin to pollinia, as, e. g., in *Orchideae* (e. g., PFITZER 1888: 66, 89, JACKSON 1928: 224). Massulae within one and the same pollinium are variable and different in shape, size, and high numbers of PMCs and pollen grains, characteristics, which are not applicable to the very regular pollen grain groups in *Mimosaceae*. The term massula must remain restricted in its usual sense, for such examples as in some Orchids. The only other case, not homologous, but somewhat

similar to orchids, where the term *massula* seems to be applicable (since STRASBURGER 1873: 57) is *Azolla*; here the content of the sporangia is divided into four or more masses of an alveolar structure of tapetal origin, in which spores are embedded (e. g., SMITH 1955: 375–380).

Polyad for *Mimosaceae* is generally accepted today (e. g., FAEGRI & IVERSEN 1964: 171, ERDTMAN 1969: 242). For special cases with lower numbers of pollen grains additional terms are in usage more or less abundantly, e. g., bitetrad, ditetrad or octad (e. g., VAN CAMPO & GUINET 1961, SEJO & SOLIS NEFFA 2004) for 8-grained polyads or hexadecad for 16-grained ones (STRAKA 1975: 13). In the two review papers of GUINET 1981a, b, the terms *massula* and *pollinium* for *Mimosaceae* are abandoned and only polyad is used.

Thus, today, the usage of the terms *massula* or *pollinium* for the polyads of *Mimosaceae* – in our opinion – is wrong and a step backwards.

3. Apical Grain

In the asymmetric polyad of *Calliandra* one grain forms the acute end of the polyad. During polyad presentation in the open anther this end is oriented upwards and bears the drop of pollen adhesive. Thus, we prefer to name this grain the apical grain, as in PRENNER & TEPPNER 2005: 280. This term corresponds to basal grain or basally in, e. g., BARNEBY 1998:4 and foot grain at apex in NEVLING & ELIAS 1971: 79. This is one of the few points in which I agree with GREISSL 2006: 575, but we propose to prefer the use of ‘apical grain’ instead of ‘apical cell’ for the pollen grain at the tip of the polyad. Firstly, it is definitely a pollen grain; secondly, of the first two cells during the development of the polyad also one is apical, the other basal in position. Thus, the apical grain is one of the derivations of the apical cell. If the above proposal is followed, it would clear any confusion between the two cell-types.

4. Pollen Adhesive

Brief discussion, definitions and proposals concerning sticky substances in connection with pollen presentation and pollination are included in PRENNER & TEPPNER 2005: 270. Nevertheless, because of the new situation, it seems to be useful to discuss this once again.

The term *pollenkitt* is of general acceptance. It was established and applied in a broader sense by KNOLL 1930. In the restricted sense, e. g., of HESSE 1978: 192–193 (exclusion of viscin threads), the term is used for lipoid containing substances of tapetal origin (review: PACINI & HESSE 2005). A layer of *pollenkitt* covers single pollen grains, tetrads and polyads in *Mimosaceae* (e. g., GUINET & HERNANDEZ 1989: 16, TEPPNER & STABENTHEINER 2006).

Sometimes terms such as pollen coatings, sticky coatings, pollen-coat materials, pollen-coat substances etc. are used synonymous to *pollenkitt* (e. g. KNOX 1984: 218, KNOX & al. 1975).

In addition to pollenkitt, in *Calliandra* a sticky mucilage of extra-tapetal origin is produced (PRENNER & TEPPNER 2005) in approximately hemispherical cavities (mucilage chambers) of the transversal septum by lysis of cells derived from the middle layers (own observation). Before the anther opening the content of the mucilage chambers is carried to the apical grain of the polyads. Lately the vague term pollen adhesive (original: 'Klebstoff' of TROLL 1928: 328, 343, 'Klebstoff' and 'Pollenklebstoff' of KNOLL 1930: 610) in phrases such as 'accessory pollen adhesive' or 'pollen adhesive of extra-tapetal origin' etc., has been used increasingly, especially also in the summary of VOGEL 2002. PRENNER & TEPPNER 2005: 270 proposed to abbreviate these phrases to the term 'pollen adhesive', because this alone would be sufficient to differentiate between sticky substances of tapetal and extra-tapetal origin. As an encompassing term for pollenkitt and pollen adhesive the term pollen sticker was proposed (TEPPNER in PRENNER & TEPPNER 2005: 270). Eventually even the electrostatic forces (review: VAKNIN & al. 2000) could be comprised within this term as a third type of adherence.

Unfortunately, GREISSEL 2006 creates 'viscin body' for the drop of pollen adhesive, which will lead to many confusions and therefore this term should be strictly avoided. The terms viscin and viscin threads have been proposed by KERNER 1891: 100–101 for *Ericaceae* and *Onagraceae* pollen and are used today in the same sense for structures of tapetal origin consisting of sporopollenin (e. g., HESSE 1984), two reasons why the term can not be applied to *Calliandra*. Elastoviscin (formerly viscin) in orchid pollinia is also of tapetal origin (SCHILL & WOLTER 1986 a, b) and thus not applicable. The word 'body' in the cited term is also unpleasant because it suggests a solid structure. The assumption of GREISSEL 2006: 582 that the drop begins in a solid state, is wrong (own observations). In reality, the viscous fluid holds the rounded form on the tip of the polyad from the beginning, as any drop would, only by the surface tension and only as long as no contact with anything takes place. The inadequate old German term 'Klebkörper' (TROLL 1928: 331, GOEBEL 1933: 1891) can not be an argument for the use of 'body' in this connection.

5. Acknowledgements

Many thanks to Dr. Erich KLEIN (Purgstall near Graz) for a copy of RICHARD 1818. Sincere thanks also to Mag. P. HARVEY (Graz) for the careful check of the language.

6. References

- BARNEY R. C. 1998. Silk Tree, Guanacaste, Monkey's Earring. A generic system for the synandrous *Mimosaceae* of the Americas. Part III. *Calliandra*. – *Memoirs New York botanical Garden* 74(3): 1–223.

- BISCHOFF G. W. 1839. Wörterbuch der beschreibenden Botanik ... – Schweizerbart, Stuttgart.
- CAMPO M. VAN & GUINET P. 1961. Les pollens composés. L'exemple des Mimosacées. – Pollen et Spores 3(2): 201–218.
- DNYANSAGAR V. R. 1958. Embryological studies in the *Leguminosae*. VIII. *Acacia auriculaeformis* A. CUNN., *Adenanthera pavonina* LINN., *Calliandra hemocephala* HASSK., and *Calliandra grandiflora* BENTH. – Lloydia 21(1): 1–25.
- ENDLICHER S. & UNGER F. 1843. Grundzüge der Botanik. – Gerold, Wien.
- ENGLER A. 1876. Beiträge zur Kenntnis der Antherenbildung der Metaspermen. – Jahrb. wiss. Bot. 10: 275–316, 5 plates.
- ERDTMAN G. 1969. Handbook of palynology. Morphology, Taxonomy, Ecology. – Munksgaard, Copenhagen.
- FAEGRI K. & IVERSEN J. 1964. Textbook of pollen analysis, 2nd. ed. – Munksgaard, Copenhagen.
- GOEBEL K. 1933. Organographie der Pflanzen insbesondere der Archegoniaten und Samenpflanzen, 3(2), 3. Aufl. – G. Fischer, Jena
- GUINET P. 1981a. Comparative account of pollen characters in the *Leguminosae*. – In: POLHILL R. M. & RAVEN P. H. (eds.), Adv. Leg. Syst. 2: 789–799.
- 1981b. *Mimosoideae*: the characters of their pollen grains. – In: POLHILL R. M. & RAVEN P. H. (eds.), Adv. Leg. Syst. 2: 835–857.
- & HERNANDEZ H. M. 1989. Pollen characters in the genera *Zapoteca* and *Calliandra* (*Leguminosae*, *Mimosoideae*). Their systematic and phylogenetic relevance. – Pollen et Spores 31(1–2): 5–22.
- HESSE M. 1978. Der Feinbau der Pollenklebstoffe: Präparative Probleme bei der Strukturhaltung, Grundfragen zur Nomenklatur und zur Begriffsabgrenzung. – Linzer biol. Beitr. 9(2): 181–201.
- 1984. An exine architecture model for viscin threads. – Grana 23: 69–75.
- IVERSEN J. & TROELS-SMITH J. 1950. Pollenmorfologiske definitioner og typer. Pollenmorfologische Definitionen und Typen. – Danm. geol. Undersøgelse, R. IV, 3(8): 1–54, 16 plates.
- JACKSON B. D. 1928. A glossary of botanic terms with their derivation and accent. 4th ed. – Hafner, New York. (Reprint 1971, Unwin, Surrey, England).
- KERNER A., VON MARILAUN 1891. Pflanzenleben. 2. Geschichte der Pflanzen. – Bibliogr. Inst., Leipzig und Wien.
- KNOLL F. 1930. Über Pollenkitt und Bestäubungsart. Ein Beitrag zur experimentellen Blütenökologie. – Zeitschr. Bot. (Jena) 23: 609–675.
- KNOX R. B. 1984. The pollen grain. – In: JOHRI B. M. (ed.), Embryology of Angiosperms, p. 197–271. – Springer-Verlag, Berlin, Heidelberg, New York.
- , HESLOP-HARRISON J. & HESLOP-HARRISON Y. 1975. Pollen-wall proteins: Localization and characterization of gametophytic and sporophytic fractions. – In: DUCKETT J. G. & RACEY P. A. (eds.), The biology of the male gamete. – Biol. J. linn. Soc., 7, Suppl.1: 177–187, 2 plates. – Academic Press, London.
- LINK H. F. 1824. Elementa philosophiae botanicae. – Berolini. (Citation after WAGENITZ 2003).
- NEVLING L. I. & ELIAS T. S. 1971. *Calliandra haematocephala*: History, morphology, and taxonomy. – Journal Arnold Arboretum 52: 69 – 85.

- NUTTALL T. 1818. The genera of North American plants, and a catalogue of the species to the year 1817, 2. – Philadelphia (Reprint: Hafner, New York 1971. Online: <http://gallica.bnf.fr>).
- PACINI E. & HESSE M. 2005. Pollenkitt – its composition, forms and functions. – *Flora* 200: 399–415.
- PFITZER E. 1888. *Orchidaceae*. – In: ENGLER A. & PRANTL K. (eds.), Die natürlichen Pflanzenfamilien 2(6/Lief. 22): 52–96. – Engelmann, Leipzig.
- PRAKASH N. 1987. Embryology of the *Leguminosae*. – In: STIRTON C. H. (ed.), *Adv. Leg. Syst.* 3: 241–278.
- PRENNER G. & TEPPNER H. 2005. Anther development, pollen presentation and pollen adhesive of parenchymatous origin in *Calliandra angustifolia* (*Leguminosae-Mimosoideae-Ingeae*). – *Phyton* (Horn, Austria) 45(2): 267–286.
- RICHARD L. C. 1818. De Orchideis Europaeis annotationes. – *Mém. Mus. Hist. natur.* 4: 23–61, 1 plate. (Preprint Paris 1817).
- SCHILL R. & WOLTER M. 1986a. Ontogeny of elastoviscin in the *Orchidaceae*. – *Nordic J. Bot.* 5(6): 575–580.
- & — 1986b. On the presence of elastoviscin in all subfamilies of the *Orchidaceae* and the homology to pollenkitt. – *Nordic J. Bot.* 6(3): 321–324.
- SELJO J. G. & SOLÍS NEFFA V. G. 2004. The cytological origin of the polyads and their significance in the reproductive biology of *Mimosa bimucronata*. – *Bot. J. linn. Soc.* 144: 343–349.
- SMITH G. M. 1955. *Cryptogamic Botany, 2, Bryophytes and Pteridophytes*. – McGraw-Hill Book Company, New York, Toronto, London.
- STRAKA H. 1975. Pollen- und Sporenkunde. Eine Einführung in die Palynologie. – In: *Grundbegriffe der modernen Biologie*, 13. – G. Fischer Verlag, Stuttgart.
- STRASBURGER E. 1873. Ueber *Azolla*. 86 pages, 7 plates. – Jena.
- TAUBERT P. 1891. *Leguminosae*. – In: ENGLER A. & PRANTL K. (eds.), Die natürlichen Pflanzenfamilien 3(3/Lief. 63): 70–112. – Engelmann, Leipzig.
- TEPPNER H. & STABENTHEINER E. 2006. *Inga feuillei* (*Mimosaceae-Ingeae*): Anther opening and polyad presentation. – *Phyton* (Horn, Austria) 46(1): 141–158.
- TROLL W. 1928. Über Antherenbau, Pollen und Pollination von *Galanthus* L. – *Flora* (Jena) 123: 321–343.
- VAKNIN Y., GAN-MOR S., BECHAR A., RONEN B. & EISIKOWITZ D. 2000. The role of electrostatic forces in pollination. – *Plant Syst. Evol.* 222: 133–142.
- VOGEL S. 2002. Extra-tapetal pollen adhesives: Where they occur and how they function. – In: SCHÖNENBERGER J., BALTHAZAR M. V. & MATTHEWS M. (eds.), *Flowers, diversity, development & evolution*. – Zürich Meeting 5 – 7 July, p. 48.
- WAGENTZ G. 2003. Wörterbuch der Botanik, 2nd ed. – Spectrum Acad. Verl., Heidelberg, Berlin.
- WALKER J. W. & DOYLE J. A. 1975. The bases of Angiosperm phylogeny: Palynology. – *Ann. Miss. bot. Garden* 62(3): 664–723.
- WEBERLING F. 1981. *Morphologie der Blüten und Blütenstände*. – Ulmer, Stuttgart.
- WETTSTEIN R. R. v. 1907. *Handbuch der systematischen Botanik*, 2(2/1): 161–394. – Deuticke, Leipzig und Wien.
- WODEHOUSE R. P. 1935. *Pollen grains. Their structure, identification and significance in science and medicine*. – McGraw-Hill Book Company, New York and London.

ZOBODAT - www.zobodat.at

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Phyton, Annales Rei Botanicae, Horn](#)

Jahr/Year: 2007

Band/Volume: [46_2](#)

Autor(en)/Author(s): Teppner Herwig

Artikel/Article: [Notes on Terminology for Mimosaceae Polyads, Especially in Calliandra. 231-236](#)