

Opinion

Botanical terminology: new twists or tradition?

Alexander P. Dyachenko

Ural State Pedagogical University, 26 Cosmonavtov Avenue, Yekaterinburg 620017, Russia
Email: eadyach@yandex.ru

Received: 20 January 2016 | Accepted by Irina Belyaeva: 26 February 2017 | Published on line: 3 March 2017

Abstract

The use of the botanical terms “male,” “female,” “staminate,” “pistillate” and “carpellate” in old and recent botanical literature regarding their definition and concept is discussed. It is recommended that botanists should follow tradition in their use of this botanical terminology.

Keywords: botanical terminology, carpellate, female, male, pistillate, staminate

Here and there scientific publications appear in which the authors suggest refinements of botanical terminology. Quite often the suggested changes are reasonable but there are some that should be declined.

To the latter belong attempts to eliminate as inaccurate the long-used botanical terms “male” and “female” for descriptions of flowers that have respectively stamens or pistils only, or for dioecious plants that form staminate or pistillate flowers only (for example, Argus *et al.*, 2010; Kiger and Porter, 2001; Kostina *et al.*, 2017; Kovtonyuk & Belyaeva, 2015; Kuzovkina *et al.*, 2016a; Kuzovkina *et al.*, 2016b).

In the 4th Edition of the well-known book by Stearn (2005) it is stated that “all botanical terminology derives largely from the works of Carl Linnaeus, notably his *Philosophia Botanica* (1751)” and that “between 1755 and 1824 this book was re-issued eleven times. Every systematic botanist reads it... thus it established Linnean method and terminology.” Linnaeus used in his work (1750: 53 and 60) the terms ‘feminibus’ and ‘femina’ in connection with other elements of flowers such as ‘pericarpium,’ ‘pistillum,’ ‘styli’ and ‘stigmata,’ i.e. the structures of gynaecium. He defines anthers and pollen as male organs and structures, “143. ANTHERAS (140) esse plantarum *Genitalia Masculina*, & eorum POLLEN veram *Genituram*” (1750: 90) and “144. STIGMATA (140) Germiniubique adnexa (97) esse *Genitalia Feminina*.”

The Linnaeus terminology was adapted in English by Lee in ‘An introduction to botany’ (1760) and by Rose in ‘The elements of botany’ (1775). Lee defined the stamen as the “male part of the flower” in his latest (according to Stafleau and Cowan, 1976–1988)

edition of the book (1810: 7) and the pistil as the “female part of the flower” (1810: 8). He also called flowers that contain only pistils “*female*,” flowers that contain only stamens “*male*,” flowers that contain pistils and stamens “*hermaphrodite*” and flowers without pistils or stamens “*neuter*” (1810: 8). Rose (1775: 42) used the terms “male” and “female” flowers in his classification of plants to differentiate *Monoecia*, *Dioecia* and *Polygamia*.

In *Flora Europaea* (Tutin *et al.*, 1993, 1: 37) where, for the description of the plants of the family *Pinaceae*, the terms “male cones” and “female cones” have been used rather than “microsporangial cones” or “megasporengial cones.” In the same publication, on page 53, for the description of plants of the family *Salicaceae* the terms “male flowers” and “female flowers” were used. On page 64 when describing *Salix caprea* L. the terms “male catkins” and “female catkins” were used. On page 78 in the key for the genus *Humulus* L. the terms “male inflorescences” and “female inflorescences” were used. On page 5 one can read in the description of *Elodea canadensis* Michx., “In most parts of Europe male plants are rare or absent.”

In *Flora of North America* when describing *Elodea* there is the phrase: “Flowers unisexual, staminate and pistillate on different plants, or rarely bisexual,” in which the terms “sexual” and “asexual” are used in the description of flowers at the same time as “staminate” and “pistillate” (*Flora of North America Editorial Committee. (eds.), 1993+*). Table 1 illustrates the use and definitions of the terms “male,” “female,” “staminate,” “pistillate” and “carpellate” in old and current literature including some globally-used dictionaries.

Thus, one can see that the terms “male” and “female” have been used in fundamental botanical publications along with the terms “staminate” and “pistillate,” even when they are often presented in the same sentence. It is well-known that the male gametophyte (ripe pollen) and the female gametophyte (primary endosperm in gymnosperms and embryo sac in angiosperms) lost their autonomy and actually turned into something like sporophyte’s organs in seed plants. Therefore there is nothing wrong in calling flowers “male,” “female” or “bisexual.” These terms are, as are all other terms, just conditional and have every right to be used. However, some botanists decline these terms arguing that they are not correct and do not fit with reality.

I believe, if one is targeted to amend all terms recklessly just based on whether the terms do not fit with reality, the results could be deplorable. Then we would have to decline binary nomenclature in favor of polynomial because, for instance, the name *Buxbaumia aphylla* Hedw. describes the characteristics of the plant not as precisely as the

Table 1. Botanical terms and their definition

Year	Author	Used term	Definition
1917	Harris	Male	Pertaining to or designating any plant organ or reproductive body which accomplishes fertilization or fecundation, or the plant which bears such organs; as male gamete, a male gametophyte, a male willow. With respect to seed plants, male is loosely used as an equivalent of staminate. In Bot., the male sex is indicated by the symbol of Mars (♂)
		Female	a).Pertaining to or designating any reproductive organ or portion of a plant body in which relatively large, nonmotile gametes (eggs or oöospheres) are organized, requiring fertilization by smaller, often motile, gametes before they are capable of development into a new individual. b).By analogy, pertaining to or designating any plant organ or reproductive body which produces, or is concerned in the production of, fruit, after fecundation; - hence applied to the plant which bears such organs; as the female hemp. On seed plants, loosely, pistillate.
		Staminate	Having or producing stamens; specif., of diclinous flowers, having stamens but no pistils.
		Pistillate	Furnished with, or producing, a pistil or pistils; specif., of diclinous flowers, having pistils but no stamens.
		Carpellate	Having carpels.
1805	Lamarck and Candolle	Male and female flowers	
1928	Fisher	Staminate flowers	
		Pistillate flowers, inflorescens	
1968	Skvortsov	Male and female flowers (Russian equivalents)	
1979	Hanks <i>et al.</i>	Female	(of reproductive organs, such as ovary and carpel) capable of producing female gametes; (of flowers) lacking, or having non-functional, stamens; female plant.
		Male	(of reproductive organs, such as testis or stamen) capable of producing male gametes; (of flowers) bearing stamens but lacking a functional pistil; male plant.
		Staminate	Having stamens; having stamens but not carpels; male.
		Pistillate	Having pistils but no anthers; having or producing pistils.
1983	Kirkpatrick	Male	Produces relatively small gametes: staminate.
		Female	Plant of the same sex as woman; of the sex that produces fructifications or seeds.
		Staminate	Having stamens but no carpels.
		Pistillate	Having a pistil but no (functional) stamens, female.
1984	Blackmore and Tootill	Male	Describing either reproductive parts or a whole organism that bears the microspore-producing apparatus and does not nurture the developing embryo.
		Female	Describing either reproductive parts or a whole organism that bears the megaspore-producing apparatus. After fertilization the female may nurture the developing embryo.
		Staminate flower	A flower possessing male parts (stamens) but no female parts, as in male flowers of holly (<i>Ilex aquifolium</i> L.)
		Pistillate flower	A flower possessing female parts (pistils) but no male parts.

Year	Author	Used term	Definition
1993	Schwarz	Male	Produces relatively small gametes; staminate.
		Female	Produces (structures containing) spores or seeds.
		Staminate	Having stamens but no carpels, male.
		Pistillate	Having a pistil but no (functional) stamens, female.
		Carpellate	(of a flower) female; flower containing carpels.
1999	Bailey	Male	Describing either reproductive parts or a whole organism that bears the megaspore-producing apparatus and does not nurture the developing embryo. More strictly, the term applies to the gametophyte that produces antheridia.
		Female	Describing either reproductive parts or a whole organism that bears the megaspore-producing apparatus. After fertilization the female may nurture the developing embryo. More strictly, the term applies to the gametophyte that produces archegonia.
		Staminate flower	A flower possessing male parts (stamens) but no female parts.
		Pistillate flower	A flower possessing female parts (pistils) but no male parts.
2001	Kiger and Porter	Staminate	Having functional stamens but no functional pistils, thus unisexual and male. Limitation: inflorescens, flower, floret.
		Pistillate	Having functional pistils but no functional stamens, thus unisexual and female. Limitation: flower, gynoeceium.
		Carpellate (not recommended)	Deemed to have or to consist of the numbers of carpels; having functional pistils but no functional stamens, thus unisexual and female. Limitation: flower, gynoeceium, pistil, ovary, fruit.
2001	Pearsall and Hanks	Male	(of a plant or flower) having stamens but lacking functional pistils.
		Female	(of a plant or flower) having a pistil but no stamens.
		Staminate	(of a plant or flower) bearing stamens but lacking functional pistils.
		Pistillate	(of a plant or flower) having a pistil but no stamens.
2002	Judd <i>et al.</i>	Staminate flower	Flower with androecium (stamen or stamens) but not a functional gynoeceium (carpel or carpels).
		Carpellate flower	Flower with gynoeceium (carpel or carpels) but no functional androecium (stamens).
2005	Soltis <i>et al.</i>	Staminate and carpellate flowers; staminate inflorescence.	
2005	Stearn	Male	Mars; iron; ♂
		Female	Venus; copper; ♀
2006	Heywood <i>et al.</i>	Male flower	A flower containing functional stamens, but no carpels.
		Female flower	A flower containing functional carpels, but no stamens.
		Staminate	Having stamens (male organs), but no carpels (female organs).
		Pistillate	A flower that has only female organs.
2015	Cronk <i>et al.</i>	Male and female inflorescences; staminate and pistillate flowers; female and male plants	

descriptive phrase “*Muscus capillaceus aphyllus capitato crasso bivalve*” which had been in use for this plant before binary nomenclature was established. We would be forced to call

mammals more precisely: “Mammals and their sexual partners” taking into account the fact that the male individuals do not feed their babies with milk. The “North Polar Circle” would have to be renamed in more precise terms as “North Circumpolar Circuit restricted by 66°33'44” of Northern Latitude, etc.

I would like to warn the specialists from this pseudoscientific path and to remind them of the definition, “term” is a word used in a specially understood or defined sense (Schwartz, 1993). I would like to emphasise the word ‘defined’. For this purpose, it is not necessary to educate people in the use of terms but in the concept in which they are used. Terms and terminology are invented for a concise designation of different concepts. The terms “male” and “female” which are disputed by some biologists belong to the category of well-established and traditionally-used words in botanical literature (Table 1). All specialists easily understand the meaning of these words. However, we have to teach non-specialists not by providing just the terms but by also using concepts and established educational programmes.

Apropos, supporters of the terms “staminate” and “pistillate” should think about how they will call “male cones” and “female cones” in dioecious gymnosperms which do not have stamens or pistils. The terms “staminate” and “pistillate” have a very narrow use – only for flowers which have stamens and pistils, not for catkins or plants and trees as shown in Table 1.

In conclusion, people who would like to improve botanical terminology often do not have sufficient experience in this part of science and their conclusions are lacking any logic. There is an opinion that flowers cannot be called female because the whole sexual reproductive process is hidden deep in the seed. However, it is a well-known fact that a seed is the result of sexual reproductive process that occurred in the embryo sac inside an ovule. Thereafter, there is no sexual reproductive process inside the seed. It is also not correct to call a mature pollen-grain (pollen) a microspore. It is also known that spores of higher plants are one-cell structures while the pollen of seed plants contains as a minimum two cells that are different in their structure and function. Therefore, a mature pollen-grain is already a germinated microspore, i.e. a male gametophyte.

The International Code of Nomenclature (McNeill *et al.*, 2012) recommends following the botanical tradition when there is doubt in the naming of plants in Latin and the same should be true for botanical terminology as well.

Acknowledgements

The author is grateful to the reviewers and editors for their helpful comments and advice.

References

- Argus, G.W., Eckenwalder, J.E., Kiger, R.W.** 2010. Salicaceae – The Willow Family. In: Flora of North America Editorial Committee (eds.). Flora of North America North of Mexico. Oxford and New York: Oxford University Press, 7: 2–3.
- Bailey, J. (ed.)**. 1999. The Penguin Dictionary of Plant Sciences. London: Penguin Books Ltd.
- Blackmore, S. and Tootill, E. (eds.)**. 1984. The Penguin Dictionary of Botany. London: Allen Lane.
- Cronk, Q.C.B., Needham, I. and Rudall, P.J.** 2015 Evolution of Catkins: Inflorescence Morphology of Selected Salicaceae in an Evolutionary and Developmental Context. *Front. Plant Sci.* 6:1030. doi: 10.3389/fpls.2015.01030
- Fisher, M.J.** 1928a. The morphology and anatomy of the flowers of the Salicaceae I. *Am. J. Bot.* 15, 307–326. doi:10.2307/2435831
- Fisher, M.J.** 1928b. The morphology and anatomy of the flowers of the Salicaceae II. *Am. J. Bot.* 15, 372–394. doi:10.2307/2435831
- Flora of North America Editorial Committee. (eds.)** 1993+. Flora of North America North of Mexico. 20+ vols. New York and Oxford. [On-line version](#) (accessed 23 Feb 2017).
- Hanks, P., Long, T.H. and Urdang, L. (eds.)**. 1979. Collins Dictionary of the English Language. London and Glasgow: Collins.
- Harris, W.T. (ed.)**. 1917. Webster's New International Dictionary of the English Language. Springfield, Massachusetts, U.S.A.: G. & C. Meriam Company.
- Heywood, V.H., Brummitt, R.K., Culham, A., and Seberg, O.** 2006. Flowering Plant Families of the World. Kew: Kew Publishers.
- Judd, W.S., Campbell, C.S., Kellog, E.A., Stevens, P.F. and Donoghue, M.J.** 2002. Plant Systematics. A Phylogenetic Approach. Sunderland, Massachusetts, U.S.A.: Sinauer Associates, Inc. Publishers.
- Kiger, R.W. and Porter, D.M.** 2001. Categorical Glossary for the Flora of North America Project. Pittsburg, Penn.: Hunt Institute for Botanical Documentation.
- Kirkpatrick, E.M., (ed.)**. 1983. Chambers 20th Century Dictionary. Edinburgh: Chambers.
- Kostina, M.V., Puzyryov, A.N., Nasimovich, J.A. and Parshevnikova, M.S.** 2017.

Representatives of the sections *Aigeiros* Duby and *Tacamahaca* Spach (genus *Populus* L., Salicaceae) and their hybrids in cities of central and eastern European Russia. [Skvortsovia](#) 3(3): 97–119.

Kovtonyuk, N. and Belyaeva, I. 2015. Nomenclatural and taxonomic notes on the names published by M.G. Popov in *Salix* L. and *Populus* L. (Salicaceae). [Skvortsovia](#) 2(2): 126–140.

Kuzovkina, Y., Epantchintseva, O. and Belyaeva, I. 2016a. The application of scientific names to plants in cultivation: *Salix ×cottetii* Lagerer ex A.Kern. (Salicaceae). [Skvortsovia](#), 2(3): 32–43.

Kuzovkina, Y.A., Dodge, M. and Belyaeva, I.V. 2016b. Clarifying affiliations of *Salix gracilistyla* Miq. cultivars and hybrids Hortiscience 51(4): 334–341.

Lamarck, J.B.A.P.M. and Candolle, A.P. 1805. [Flore Française, ou Descriptions Succinctes De Toutes Les Plantes Qui Croissent Naturellement En France. Ed. 3.](#) 3. Paris

Lee, J. 1760. An introduction to Botany. London.

Lee, J. 1810. [An introduction to the science of botany chiefly extracted from the works of Linnaeus, to which are added several new tables and notes and a life of the author.](#) London.

Linné, C. 1751. [Philosophia Botanica: in qua explicatur fundamenta botanica cum definitiotibus](#)

McNeill, J., Barrie, F.R., Buck, W.R., Demoulin, V., Greuter W., Hawksworth D.L., Herendeen, P.S., Knapp, S., Marhold, K., Prado, J., Prud'homme van Reine, W.F., Smith, G.F., Wiersema, J.H. and Turland, N.J. 2012. [International code of nomenclature for algae, fungi, and plants \(Melbourne Code\)](#) adopted by the eighteenth International Botanical Congress Melbourne, Australia, July 2011. Kögelnstein: Koetz Scientific Books.

Pearsall, J. and Hanks, P. (eds.). 2001. The New Oxford Dictionary of English. Oxford: Oxford University press.

Rose, H. 1775. [The elements of botany: containing The HISTORY of the SCIENCE](#) : with accurate Definitions of all the Terms of Art, exemplified in Eleven Copper-Plates; The Theory of Vegetables; The scientific Arrangement of Plants, and names used in Botany; Rules concerning the general History, Virtues, and Uses of Plants. Being a translation of the *Philosophia Botanica*, and other Treatises of the celebrated Linnaeus. London.

Schwarz, C. 1993. The Chambers Dictionary. Edinburgh: Chambers Harrap Publishers Ltd.

Skvortsov, A.K. 1968. Ivy SSSR. Sistematicheskii i Geograficheskii Obzor [Willows of the USSR. A Taxonomic and Geographic Revision]. Moskva: Nauka (Moscow: Science Publisher]. (In Russian)

Soltis, D.E., Soltis, P.S., Endress P.K. and Chase, M.W. 2005. Phylogeny and Evolution of Angiosperms. Sunderland, Massachusetts, U.S.A.: Sinauer Associates, Inc. Publishers.

Stearn, W.T. 2005. Botanical Latin. Bath: Timber Press.

Stafleu, F.A. and Cowan, R.S. (1976–1988). Taxonomic Literature. (2nd ed.) Bohn: Scheltema & Holkema, Utrecht. <http://www.sil.si.edu/DigitalCollections/tl-2/>

Tutin, T.G., Burges, N.A., Chater, A.O., Edmondson, J.R., Heywood, V.H., Moore, D.M., Valentine, D.H., Walters, S.M. and Webb, D.A. (eds.). 1993 Flora Europaea, vol. 1. Cambridge University Press, Cambridge.