The discovery and naming of Papaver orientale s.l. (Papaveraceae) with notes on its nomenclature and early cultivation

H. Walter Lack

Abstract

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Papaver sect. *Macrantha* Elkan is a widespread and common polyploid complex comprising the diploid *Papaver bracteatum* Lindl., the tetraploid *Papaver orientale* L. and the hexaploid *Papaver pseudo-orientale* (Fedde) Medw. All three species are restricted in their distribution to the Caucasus area in the wide sense including north-eastern Turkey and north-western Iran. *Papaver orientale* and *Papaver pseudo-orientale* were first collected by one of the members of the expedition headed by Joseph Pitton de Tournefort (1656–1708) and introduced into cultivation in the Jardin du Roi in Paris as early as 1702. From there living material of both taxa was quickly distributed to other botanical gardens in Amsterdam, Leiden and the Chelsea Physic Garden in London. For decades both species were known only from cultivated specimens. Due to hybridisation both in the field and in cultivation the relationships between the two taxa remained unclear and were further blurred by the introduction of *Papaver bracteatum* into cultivation which began in Gorenki near Moscow, Berlin and Chelsea around 1800. Based on ample evidence never studied before like unpublished illustrations kept in Paris and Vienna, Tournefort's unpublished field book, and seed lists this paper unravels this complex historical and taxonomic story. In addition, it presents an updated taxonomy including typifications and nomenclatural notes on all three species involved. The very late rediscovery of *Papaver orientale* and *Papaver pseudo-orientale* in the wild is seen in the context of the difficulties in access to the Ottoman Empire and the regions east and northeast of it in the eighteenth and first half of the nineteenth century.

Keywords

PAPAVERACEAE – *Papaver orientale* – Caucasus area – Tournefort – Botanical gardens – Nomenclature – Taxonomy

Address of the author:

Botanischer Garten und Botanisches Museum Berlin, Freie Universität Berlin, Königin-Luise-Str. 6–8, 14195 Berlin, Germany.
E-mail: **h.w.lack@bgbm.org**

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Introduction

Papaver sect. *Macrantha* Elkan (*Papaveraceae*) is a common and widespread polyploid complex native in the Caucasus area in its wide sense, in north-eastern Turkey and north-western Iran (sectional nomenclature according to Kiger, 1985). Because of their large and conspicuous flowers taxa belonging to this group have for more than three centuries been cultivated in temperate regions of the world as popular ornamentals with many cultivars exhibiting a wide range of petal forms and colours including orange, red, mauve, purple, pink and white. The species involved form a single clade (for molecular evidence: Carolan et al., 2006) and are closely related (Ojala et al., 1990), but their taxonomy and nomenclature have been in a state of chaos since their very discovery and introduction into cultivation. This applies both to the scientific (e.g., Popov, 1937) as well as to the horticultural literature (e.g., Grey-Wilson, 2000; Köhlein, 2003). Contributing factors were broad vs. more narrow species concepts and the fact that the plants involved were known for many decades only from specimens in cultivation.

Over the last years, *Papaver* sect. *Macrantha*, which may also be called the *P. orientale* L. complex or *P. orientale* s.l., has received considerable attention. In a comprehensive revision, which subsequently became the basis for later studies, three more narrowly circumscribed taxa were distinguished: the diploid *Papaver bracteatum* Lindl., the tetraploid *P. orientale* s.s. and the hexaploid *P. pseudo-orientale* (Fedde) Medw. (Goldblatt, 1974a). All three are perennials and grow in partly overlapping distribution areas, with *P. bracteatum* occupying the most northern and most eastern localities and *P. pseudo-orientale* the most western ones (Goldblatt, 1974a). Pollen diameters and stomata lengths also exhibit a considerable degree of overlap, the dominant alkaloids differ in the three taxa involved (Goldblatt, 1974a). Morphological characters to distinguish the three taxa include cauline leaves extending (or not) to the upper third of the stem, number of bracts, type of calyx bristles, colour of the petals, petals with mark near base or unmarked (Goldblatt, 1974a). As a rule plants with dark red petals with long blackish stripes from the base to the midline, 3–8 bracts and broad calyx bristles belong to *P. bracteatum*, while plants with few or no bracts, orange red ('scarlet') petals and slender calyx bristles are characteristic for *P. orientale* and *P. pseudo-orientale* (Goldblatt, 1974a). Cauline leaves extending to the upper third of the stem and petals with broad, dark marks, basal or near the base, and stout growth are characteristic for *P. pseudo-orientale*, while cauline leaves not extending to the upper third of the stem, unmarked or lightly marked petals and distinctly slender growth are typical for *P. orientale* s.s. (Goldblatt, 1974a). However, in herbarium specimens these distinctions are not always easily delineated and, coupled with the propensity for hybridisation of the three species both in the wild and in cultivation, leads to the manifestation of deviant specimens (Cullen, 2011). Hybrids found in the wild in Iran are intermediate in several characters and exhibit a high degree of pollen fertility (Goldblatt, 1974a).

Many of these findings were confirmed in a PhD thesis of very limited circulation (Wendt, 1976), which was based on more extensive herbarium material than the earlier revision (Goldblatt, 1974a), but had the disadvantage of not including field studies. Goldblatt's work led to a revised treatment of this group in the supplement to the *Flora of Turkey* (Davis et al., 1988), the second edition of the *Flora Europaea* (Mowat et al., 1993) and of the *European Garden Flora* (Cullen, 2011). These earlier findings were also corroborated in a comprehensive review on *Papaver bracteatum* (Nyman & Bruhn, 1979), a revision of *P.* sect. *Macrantha* (Novák, 1979) and a revision of the genus *Papaver* in Eastern Europe (Egorova, 1998). Cytological studies (Novák & Volf, 1979), cytological studies of interspecific crosses resulting in tri- and pentaploid progenies done in combination with analyses of alkaloid content (Ojala & Rousi, 1986; Ojala et al., 1990) as well as genetic studies (Milo et al., 1988) equally supported Goldblatt's results and so did isolated chromosome counts (e.g., Safonova, 1991). More recently the three taxa involved could be shown to be distinguishable by comparing the nucleotide sequences of the plastid *rpl16* gene and the *rpl16-rpl14* spacer region (Hosokawa et al., 2004). In addition, morphological, chemical and molecular data from accessions originating from the whole distribution area of *P. orientale* s.l. have been analysed (Parmaksiz & Özcan, 2011; Tavakkoli & Assadi, 2013; Alagöz et al., 2016). More conventional studies on a smaller spectrum of materials have also been published (Asatryan, 2002, 2010), the former stressing e.g. the variability of the dark mark in populations of *P. pseudo-orientale* in Armenia.

However, the discovery and naming of *P. orientale* s.l. as well as the distribution of the earliest herbarium specimens has never been analysed in any detail nor has the extremely early introduction into cultivation been studied. Based on evidence that has only partly and in some cases never been utilized before such as archival material, field drawings and early herbarium specimens from a range of botanical gardens, this complex situation is analysed and an updated taxonomy presented. All this is not of purely historic interest since apparently material belonging to *P. orientale* s.s. and *P. pseudo-orientale* was introduced simultaneously which was one of the reasons for the considerable confusion these plants caused for generations of botanists.

Tournefort, Gundelsheimer and Aubriet in the Ottoman Empire

Specimens of *Papaver orientale* s.l. were collected for the first time by one of the members of the famous expedition to the



Fig. 1. – *Papaver pseudo-orientale* (Fedde) Medw. Pen-and-ink drawing by C. Aubriet, 1701.
[MS 78, fig. 198; © Muséum national d'Histoire naturelle, Bibliothèque centrale, Paris]

Ottoman Empire headed by the physician/botanist Joseph Pitton de Tournefort (1656–1708) with the participation of the physician/botanist Andreas von Gundelsheimer (1668–1715) and the illustrator Claude Aubriet (c.1665–1742) (Lack, 2014). In the years 1700–1702 this party was travelling in what is now Greece, Turkey, Georgia and Armenia. Judging from Tournefort's posthumously published travelogue (Tournefort, 1717) and our current knowledge of the natural distribution of the three taxa involved, it is clear that the specimens could only have been gathered during the summer of 1702, and more specifically along the route from Trabzon via Erzurum, Kars, Tbilisi, Etchmiadzin [Vagharshapat] to Mount Ararat [Ağrı Dağı] and back via Erzurum to Erzincan, i.e. in what is now north-eastern Turkey, Georgia or Armenia (for further background information see, e.g., Guiral, 1957; Baytop, 2000; Burtt, 2001, 2003).

Miraculously the field book from this part of the expedition with entries by Tournefort and Gundelsheimer has survived in the Bibliothèque Centrale [BC] of the Muséum National d'Histoire Naturelle in Paris (BC: MS 996). Though badly water-stained, it is possible to read: "Le 7 juin nous parti [illegible] […] de la pointe du jour passant dans des petites vallées, sans bois, mais assez agreables, avec des ruisseaux et de prairies remplies de plantes […] nous arrivames sur le heures du matin a un village appellé Grefi" [on 7 June we left […] at day break passing through little valleys, without forests, but very pleasant, with rivulets and meadows full of plants […] we arrived in the morning hours at a village called Grefi] (BC: MS 996: f. 60v). On the next page of the field book we find a convincing plant description: "*Papaver foliis Papaveris Rhoeadis seu hirsutissimis magno flore,* Les tiges sont hautes d'un pied et demi ou deux […] accompagnées des feuilles longues d'un pied decomposées come celui du […] nous contames six feuilles large de 2'2 pouces […] avec une tache purpur […] vers la bas Les etamines est [sic] le pistils nous paroient semblables a ceux des Pavots des jardins" [The stems are one and a half foot to two feet high […] with leaves one foot long divided like that […] we counted six large leaves, i.e. petals, 2'2 thumbs long […] with a purple mark […] towards the base. The stamens and pistil seemed to us similar to those of the garden poppies] (BC: MS 996: f. 61v). Apparently at a later moment "Arm" [for armenum] has been added between the words "Papaver" and "foliis" (BC: MS 996: f. 60v). The locality "Grefi" probably stands for Grezi or Kırzı, c. 15 km northwest of Bayburt in north-eastern Turkey (Baytop, 2000).

Furthermore MS 996 (BC) contains two lists: the first gives all the seeds collected in 1701 where we find *"Papaver Ponticum hirsutissimum foliis Papaveris Rhoeadis magno flore"* (f. 77 r) and the second all the drawings prepared by Aubriet in 1701 listing *"Papaver armenum hirsutissimum magno flore"* (f. 86 r). MS 995, also pertaining to Tournefort's expedition and conserved in the BC, has a conspectus "Etat des dessins de plantes et animaux que Mr Aubriet a fait lan 1701 depuis notre depart de Constantinople" which has the entry *"Papaver armenium hirsutissimum angustifolium"* associated with the note "Pl. 484 (f. 198)" (Hamonou-Mahieu, 2006).

This pen-and-ink drawing over pencil annotated *"Papaver Armenium* [sic] *hirsutissimum, maximo flore"* (MS 78: f. 198; Fig. 1), undated and unsigned, has survived in the BC and shows what is now understood as *P. pseudo-orientale*; it has one separate petal with its dark blotch unequivocally drawn. At least two points stand out: (1) in Tournefort's field description a purple spot is explicitly mentioned and (2) Aubriet unequivocally documented the dark spots in his drawing.

In our context another aspect is relevant: for almost one century no westerner seems to have encountered this poppy in the wild again. However, as will be shown in the next chapter, Tournefort's party had collected seed material of more than one taxon of what he called in his field book *"Papaver foliis Papaveris Rhoeadis seu hirsutissimis magno flore"*. This is not unexpected for two reasons: firstly *P. orientale* and *P. pseudo-orientale* occur sympatrically (Goldblatt, 1974a; Parolly, pers. comm.), secondly Tournefort, Gundelsheimer and Aubriet crossed the natural distribution area of both species (updated distribution map in Wendt, 1976: fig. 38) in June and again in autumn 1701. The hypothesis that Tournefort's party might have collected seed of both taxa has been tentatively put forward earlier (Goldblatt, 1974a), albeit offering only rather limited evidence. The full, and much more complex story is presented in the following chapters.

Tournefort and Aubriet in Paris

Back in Paris Tournefort (1703) published the polynomial *"Papaver Orientale, hirsutissimum, flore magno"* in his *Corollarium* though for the time being he refrained from proving any further information, such as locality data. This polynomial was very quickly taken up in the third volume of *Historia Plantarum* (Ray, 1704). Tournefort also seems to have arranged for the annotation of the specimen now in P [P-TRF1883] by a scribe who noted on the label *"Papaver Armenium* [sic] *hirsutissimum, foliis Papaveris rhoedas* [sic], *magno flore"*. For the interpretation of the polynomial cited above a more reliable specimen exists in the Pre-Linnaean herbarium at G (previously known as the "Burman herbarium"; see Wijnands et al., 2017): G-PREL [G00818239]). It is labelled "*Papaver orient. hirsutissimū fl. magno* Cor. T.R.H.17" in Tournefort's hand (cf. Dandy, 1958: no.72), the abbreviation standing for "*Corollarium Tournefortii Rei Herbariae* p. 17", where indeed this name had been published. The specimen kept in G-PREL is in agreement with the notes in Tournefort's field book and with Aubriet's field drawing because it distinctly shows the blotches mentioned. The same



Fig. 2. – *Papaver orientale* L. Copper engraving by Pieter Sluyter based on an anonymous drawing.
[from the 1716 reissue of COMMELIN, 1706: tab. 34; © Library of the Real Jardín Botánico Madrid (CSIC)]

is true for a specimen in BM annotated on the reverse of the sheet "*Oriens Tournefort*".

Tournefort also adapted his travel reports sent *en route* to key figures at court in Versailles for publication, but this book, the *Relation d'un voyage du Levant* [*Voyage*] (Tournefort, 1717), appeared only posthumously. One of Tournefort's letters had been directed to Louis II Phélypeaux de Pontchartrain (1643–1727), grand chancellor of France, and contained a detailed description of his oriental poppy accompanied by an anonymous, though simplified copper engraving based on MS 78: f. 198 (BC) and annotated: "*Papaver Orientale hirsutissimum, flore magno Coroll* Inst. Rei herb. 17". The respective text in the *Voyage* starts: "Nous observâmes aux environs de cette ville une tres-belle espece de Pavot que les Turcs & les Armeniens apellent Aphion, de même que l'Opium commun; cependant ils ne tirent pas d'Opium de l'espece dont nous parlons, mais par ragoût ils en mangent les têtes, quoiqu'elles soient fort acres & d'un goût brulant" [We observed in the fields about this city, a very fine species of poppy, which the Turks and Armenians call aphion, as they do the common opium: yet they do not extract opium from the kind we now speak of; but as a stew they eat the heads [buds] of it when they are green, though very acrid, and of a hot taste]. The subsequent description is extremely detailed, and contains as key statement: "une grosse tache à l'ongle, laquelle est aussi plus ou moins obscure" [with one blotch on the nail, which is at the same time more or less obscure]. However, whereas Aubriet had shown a large blotch near the base on the outer surface of three of the petals of the right hand flower and on the detached petal (Fig. 1), the mirror-imaged copper engraving shows no detached petal and a clearly circumscribed blotch near the base only on the outer surface of a single petal of the left hand flower. Possibly the engraver was influenced by the text and misled by "une grosse tache" [one big blotch]. In any case the printed illustration, of poor quality, misleading and self-contradictory, was one of the causes of subsequent problems in identification.

The introduction into cultivation in Paris, Amsterdam and Leiden

Well before his death Tournefort must have made arrangements for the cultivation of his plants in the Jardin du Roi in Paris. In the Vaillant herbarium there is a specimen of *Papaver pseudo-orientale* [P03166807] which could have been raised from seeds collected by Tournefort following an annotation on the sheet by Gérard Aymonin (1934–2014). In addition, two images seem to indicate the cultivation of *Papaver orientale* s.s. in the Jardin du Roi: (1) The famous Collection des Vélins (comprehensive modern treatment: Heurtel & Lenoir, 2016) which is based on specimens cultivated in the Jardin du Roi in Paris and living animals in the Ménagerie de Roi in Versailles has one albeit undated and unsigned bodycolour on vellum labelled: "*Papaver Orientale, hirsutissumum, flore magno* Coroll Inst R. Herb. 17" (BC: Vélins 41: f. 47), which remained unpublished (cf. Desfontaines, 1807, 1808); (2) The illuminated manuscript *Plantes du Jardin Royale Etably a Paris* kept in the Department of Manuscripts of the Österreichische Nationalbibliothek in Vienna [ÖNB] has an undated self-impression annotated: "*Papaver Orientale hirsutissimum, flore magno* Cor. Inst 17 Pavot d'Orient tres – velu, à grand fleurs" (Cod. Min. 35, 4: f. 4; cf. Lack, 2001; Lack, 2016). This manuscript had been produced by Jean-Nicolas de la Hire (1685–1727), who was like Tournefort a physician and member of the Académie Royale des Sciences in Paris, and therefore a person who had direct access to the rarities and novelties cultivated in the Jardin du Roi. Very little is known about De la Hire's method in producing monochrome self-impressions which subsequently were corrected and added to by hand, mainly with opaque white; in our case the representations of the petals and the buds were added. Cod. Min. 35 has been provisionally dated c. 1720 (Lack, 2001).

However, both images are not entirely convincing since they do not document a detached petal but only lateral views of the flower. In short, in the early years of the eighteenth century both *P. pseudo-orientale* and *P. orientale* apparently were in cultivation in the Jardin du Roi.

Other living material from his expedition must have been sent by Tournefort to the *Hortus Medicus Amstelodamensis* in Amsterdam. There is evidence that material of *P. orientale* s.s. was included, since Tournefort noted in his *Voyage:* "Cette belle espèce de Pavot se plaît fort au Jardin du Roy, & même en Hollande où nous l'avons communiquée à nos amis. Mr Commelin tres habile Professeur de Botanique à Amsterdam, en a donné la figure" [This beautiful poppy species is very happy in the Jardin du Roy [in Paris] and even in Holland where we have sent it to our friends. Mr. Commelin, a very capable professor of botany in Amsterdam, has given its figure] (Tournefort, 1717). Tournefort gave the environs of "cette ville" [this city, i.e. Erzerum] as place of origin (Tournefort, 1717), not 'Grefi' (see above).

Tournefort's statement concerning the transfer of living material is indeed correct, since Caspar Commelin (1668–1731) had given in his *Horti medici Amstelaedamensis plantae rariores* (Commelin, 1706) a description and an illustration of a specimen of *P. orientale* s.s., clearly differing from *P. pseudo-orientale* in the lack of blotches on the petals and a more slender growth from the taxon illustrated by Aubriet. In short, what was cultivated in Amsterdam differed from what had been depicted in the field by Aubriet. A specimen labelled: "*Papaver Orientale hirsutissimum flore magno* T. Commel Rar" in G-PREL [G00818238] seems to document this report and so does a specimen labelled: "*Papaver orientale hirsutissimum magno flore perenne* T. Inst. R. H. Cor. 17 Commel. Rar. 14" in the Herbier Joseph Quer (1695–1764), in G [G00418266]



Fig. 3. – *Papaver orientale* L. Specimen annotated by P. Miller, (top line), undated.
[Hortus Siccus 294, f. 70; © Natural History Museum, Department of Biology, London]

(Briquet, 1919). Both specimens lack the typical blotches on the petals.

By contrast no water colour documenting this very specimen has been located in the Moninckx Atlas kept in the Universiteitsbibliotheek Amsterdam (Wijnands, 1983). Probably it was precisely this image which was used as exemplar for the copper engraving prepared by Pieter Sluyter (Goldblatt, 1974b) annotated: "*Papaver or: hirsutissimum flore magno*" (Commelin, 1706: tab. 34; Fig. 2). This situation differs from the fate of the image documenting *Pentapetes phoenicea* L.; in this case the water colour by Jan Monicks (†1701) and published by Commelin survives in Amsterdam (Wijnands, 1987).

Adding to the detailed description of *Papaver orientale, hirsutissimum, flore magno* and the copper engraving based on Aubriet's drawing (Tournefort, 1717: 127–129) a reference to Commelin's description and illustration (Commelin, 1706: 34, fig. 34) established a link which was uncritically accepted by all subsequent authors except the monographer (Goldblatt, 1974a).

Among the works which followed Tournefort in this point is the *Index alter plantarum* (Boerhaave, 1727) though it is unclear if this was based on tradition or on the comparison of the pre-existing data with living material cultivated in the Leiden Botanical Garden. In any case Herman Boerhaave (1668–1738) could have received living material either from Tournefort or from the Amsterdam Botanical Garden. However, no specimen of this accession seems to have survived. The same link between Tournefort and Commelin is found in the *Florae Leydensis Prodromus* (van Royen, 1740), though in this case a specimen in the Herbier de Daniel De la Roche in G [G00418265] (Burdet, 2008) could be located which is labelled: "fait au jard. de Leyde sous van Royen" [prepared in the Leiden Botanical Garden under van Royen]. It seems to be correlated with the entry in the catalogue cited above. This material provided with blotches on the petals belongs to what is now understood as *P. pseudo-orientale*. The cultivation of this taxon or rather of a hybrid (see below) in the Leiden Botanical Garden seems to be confirmed by an undated, incomplete specimen annotated: "*Papaperis* [sic] *oriental*" collected by Nicolaas Meerburg (1734–1814) and kept in L (G. Thijsse, pers. comm.). It was recently published in a work on botanical illustration (Tancin, 2016) and also shows a blotch on each petal, though not near its base thus exhibiting characters reminiscent of the recently described artificial cross *P. pseudo-orientale* ×*P. orientale* (Ojala et al., 1990). Although it has been claimed that the Meerburg specimen has been catalogued by Linnaeus (Tancin, 2016), this is quite unlikely, because of the handwriting and the context, i.e. the urn (type: f) and the ornamental label (type: e) attached to the herbarium sheet (cf. Thijsse, 2018).

The introduction into cultivation in London

By then living material of *Papaver orientale* s.l. had crossed the Channel with James Petiver (1658–1718) reporting its cultivation in the Chelsea Physic Garden for the first time in 1714 (Petiver, 1714–1716). By the year 1722 this garden was under the care of Philipp Miller (1669–1771) (Britten, 1913), who mentioned the plant in the first edition of his *Gardeners Dictionary* as: "*Papaver orientale, hirsutissimum, flore magno* T. Cor." (Miller, 1731), thus, like Petiver, referring to Tournefort's *Corollarium*. An undated specimen annotated by Miller "*Papaver Orientale hirsutissimum flore magno* T. Cor. 17" and given by him to Sir Hans Sloane (1660–1753) is kept in BM in the Sloane herbarium (BM-SL) (Fig. 3) (H.S. 294, f. 70; Dandy, 1958), another specimen with the date 1756 is in the general herbarium of BM. Both belong to *P. orientale* s.s. The latter specimen has the identical text, but is provided with the number 1740 which refers to the number of the specimen provided from the garden according to the deed of conveyance of 1722, by which Sloane had given the Society of Apothecaries control of their "Physick Garden at Chelsey" in perpetuity (Stungo, 1993). One of the stipulations of this arrangement required the Society of Apothecaries to deliver annually for the next forty years fifty named herbarium specimens of plants cultivated in their garden to the Royal Society; in 1781 this society had these specimens deposited in the British Museum, now BM. The specimen No. 1740 was delivered in 1756 (Stearn, 1972) and was listed subsequently in the *Philosophical Transactions* (Wilmer, 1758). The eighth edition of Miller's *Gardeners Dictionary* – published in 1768 and the first one to make use of binomial nomenclature – has an entry of *P. orientale* which perfectly agrees with the two specimens in the Sloane and the General Herbarium. There is also a pencil tick, probably by Daniel Solander (1733–1782), in the copy of Miller's *Gardeners Dictionary* formerly belonging to Sir Joseph Banks which according to a note (Britten, 1913) makes us assume that another Miller specimen had existed, but this is currently not traceable (J. Wayer, pers. comm.; for the general background see Stearn, 1971).

Nothing demonstrates more convincingly the cultivation of both *P. orientale* s.s. and of *P. pseudo-orientale* in European gardens in the late eighteenth century than two coloured copper engravings: An image of the former appeared in the *Thesaurus rei herbariae hortensisque* (Knorr, 1750–1771: tab. R14a; mirrored copy in Buchoz, 1773–1778: 11 tab. 9) published in Nürnberg and possibly based on a water colour by Georg Wolfgang Knorr (1705–1761) (Ludwig, 1998). An image of the latter taxon based on an anonymous water colour appeared in the Botanical Magazine (Curtis, 1788: tab. 57) where nothing is said about the provenance of the material. Both works contain explicit references to Tournefort's publications (Tournefort, 1703, 1717). Interestingly Curtis had been between 1773 and 1777 one of the successors of Isaac Rand



Fig. 4. – *Papaver bracteatum* Lindl. Specimen cultivated in the Berlin Botanic Garden raised from seeds received from the Marburg Botanical Garden which had been collected in Iran, Prov. Mazandaran, Elburz Mountains, Lar Valley, c. 2300 m.
[Acc. nº AKZ 078-10-12-40] [Photo: G. Parolly, 26.V.2016]

(†1743) as director of the Chelsea Physic Garden and only later founded his botanical garden in Lambeth, now part of London (Curtis, 1941). As a consequence we must assume that both *P. orientale* and *P. pseudo-orientale* were in cultivation for some time in the Chelsea Physic Garden, just like they had been in the Jardin du Roi in Paris. It is not difficult to image that from these two gardens seeds of both taxa were distributed to other botanical institutions in Europe.

Linnaeus, Willdenow and Fischer

Like Tournefort (1717) in his *Voyage*, Linnaeus (1737) subscribed to the broad concept of *P. orientale* in his *Hortus Cliffortianus*. He linked the references to Tournefort (1703, 1717), Commelin (1706) and Boerhaave (1727) and regarded his plant as belonging to an infraspecific taxon under *"Papaver foliis pinnatifidis hispida, fructu subrotundo"*. Later, in his *Hortus Upsaliensis* (Linnaeus, 1748) the references to Tournefort (1703, 1717), Commelin (1706) and Boerhaave (1727) are placed under *"Papaver caule unifloro scabro subfolioso, foliis pinnato-sinuatis"*. The note "*Hospitatur sub dio, perennis*" (Linnaeus, 1748) seems to indicate that Linnaeus had indeed seen living material, possibly cultivated in the Uppsala Botanical Garden under his care. When Linnaeus (1753) validated the name *Papaver orientale* in his *Species Plantarum*, he added two more references, i.e. van Royen (1740) and Linnaeus (1748) plus the note: *"Stigmata 16. Setae in caule sparsae, cauli adpressae, basi prominula asperae",* the latter again indicating that he might have studied a living plant.

The treatment of *Papaver orientale* s.l. in the fourth edition of *Species Plantarum* (Willdenow, 1799) is largely based on the second edition (Linnaeus, 1763); however, references to new literature (Knorr, 1750–1771; Miller, 1756–1759; Houttuyn, 1778) were added and more importantly the note "v.v." which indicates that Willdenow had seen a living plant, possibly in the Royal Botanic Garden in Schöneberg near Berlin. This is corroborated by a later entry in an inventory of this garden (Willdenow, 1809). In his herbarium the blue folder annotated in Willdenow's hand: *"Papaver orientale capsulis glabris caulibus unifloris scabris foliosis, foliis pinnatis serratis* Lin syst ed 2 T 2 p. 574" contains three specimens, i.e. B-W [B-W10086/1, B-W10086/2, B-W10086/3] all undated.

Of these only the last one has a label annotated: *"Papaver orientale"* which indeed is in agreement with the current narrow concept of this taxon. By contrast B-W 10086/1 and 10086/2, both not provided by a label, belong to *P. bracteatum*, a taxon which had not yet received a name. Who could have made this material available to Willdenow? The most plausible source is Friedrich August [Fjodor Kondratovič] Freiherr Marschall von Bieberstein (1768–1826). He had travelled in 1798, 1802 and 1805 along the northern slopes of the Caucasus, collected plants e.g. on Beschtau, a mountain near Pjatigorsk (now Region Stavropol, Russian Federation), and near the town of Mosdok (now Republic North Ossetia – Alania, Russian Federation) (Marschall von Bieberstein, 1808; see also below) and sent 440 specimens to Willdenow (Hiepko, 1972). B-W-10086/1 and B-W-10086/2 could have been collected by Bieberstein in the wild and left unlabelled, or could have been cultivated in the Royal Botanic Garden in Schöneberg from seeds either sent by Bieberstein or removed from a herbarium specimen sent by him, which would have been the standard practise of the time. Apollos Apollosovič Graf Mus[s]in Puschkin (1760–1805), who was Willdenow's source for further specimens collected in the Caucasus region (Lack, 2018), or Michael Friedrich Adams (1780–1838) who had accompanied the former in his Caucasian travels (Raskin, 1981), would have been alternative sources for Willdenow.

Meanwhile *P. orientale* s.l. was cultivated also in two private botanical gardens, one in Orbe, Helvetic Republic (now Switzerland), the second in Gorenki east of Moscow. The former garden had been in the possession of Edmund Davall (1762–1798), a correspondent of James Edward Smith (1759–1828), in whose herbarium a specimen annotated 'Hort. Davall 1802' in LINN [Herb. Smith nº 921.12] survives (the note '1802' apparently refers to the date of accession in Smith's herbarium, cf. Kennett, 2016); this specimen belongs to *P. orientale* s.s. The latter garden was the property of Alexei Kirillović Count Razumovsky (1748–1822) and had as its director since 1809 Friedrich Ernst Ludwig Fischer (1782–1854, Fedor Bogdanovic Fischer) (Elina, 2007). The specimen annotated: "Mt. Caucasus. Dr. Fischer 1811" in LINN [Herb. Smith nº 921.11.2] with blotches near the base of the petals may be at least indirectly connected with Bieberstein (see below). Fischer is not known to have collected in the Caucasus (Reichenbach, 1855), but he could well have received living material from Bieberstein or subsequent travellers in the Caucasus area and had it cultivated in Gorenki. Indeed, a "Papaver orientale" is recorded in four of the five inventories of this botanical garden (Redowsky, 1803, 1804, 1805; Fischer, 1808, 1812). In any case the specimen in the Smith herbarium in LINN belongs to *P. bracteatum*, a species which in 1811 was still in need of a name (see below). In this context a specimen of *P. bracteatum* in W, annotated "*ad calcem Caucasi trans Terekem ex* [...] *oppiduli Mosdok*" but not provided with a date or the name of the collector is of interest: it had been given by Peter Simon Pallas (1741–1811) to Nicolaus Joseph Freiherr von Jacquin (1727–1817), but may well have been gathered by Bieberstein since Pallas is not known to have collected along the Terek river (Wendland, 1992).

Soon after the publication of the treatment of the genus *Papaver* in the fourth edition of the *Species Plantarum* (Willdenow, 1799) a detailed description of the plant cultivated in the Jardin des Plantes in Paris, previously the Jardin du Roi, appeared. Its author explicitly noted the "pétales […] tachés à leurs base" [petals […] with markes at their base] (Poiret, 1804) which would imply that a specimen of *Papaver pseudo-orientale* was cultivated. The long list of references is identical to that given in the former work, the two specimens in the Herbarium Lamarck are immature and cannot be identified. The cultivation of *P. pseudo-orientale* in Europe at that time is also reflected by an entry in another garden dictionary (Dumont de Courset, 1804) where "une tache noirâtre à la base des pétales" [blackish blotch at the base of the petals] is explicitly noted.

Fischer who continued as the director of the private garden at Gorenki until its dissolution after Razmuvosky's death also sent seeds of his *P. orientale* s.l. to the Chelsea Physic Garden (Lindley, 1821) where they were raised by William Anderson (1766–1846) who was head gardener from 1814 to 1846 (J. Compton, pers. comm.) and communicated specimens to John Lindley (1799–1865). The latter was the first to recognize this material as belonging to a species new to science and validated the name *P. bracteatum*, clearly stating that Dr. Fischer had sent it: "in 1818 under the name *Papaver orientale speciosum*: secondly in 1819 by the name *Papaver orientale pulcherrimum*: and thirdly in 1821 as *Papaver orientale grandiflorum*" (Lindley, 1821). Only a few months later a second description and illustration of the new species was published (Edwards, 1822); the plant had been cultivated in the Colvill Nursery in King's Road, London, evidently from the progeny of seeds: "sent from Moscow to the Physic Garden at Chelsea, by Dr. Fischer" (Edwards, 1822).

In recognizing *P. bracteatum* (Fig. 4) Lindley had followed a more narrow species concept than his contemporary Augustin-Pyramus de Candolle (1778–1841) who adhered to the old view of *P. orientale* s.l. (Candolle, 1821) and even had a specimen which belongs to *P. bracteatum* included which had been collected between Beschtau and the Nartsana spring and sent to him by Fischer in 1819 (G-DC [G00148615]). It was only in the treatment of *Papaveraceae* for his later *Prodromus* that Candolle recognized *P. bracteatum* as a separate species though still not distinguishing *P. orientale* s.s. from *P. pseudo-orientale* (Candolle, 1824). It is possible that Candolle had arranged for seeds of the specimen received from Fischer sown in the Geneva botanical garden, because in the *Prodromus* he added: "*v.v. in h. Genev.*" to his entry for *P. bracteatum* (Candolle,



Fig. 5. –*Papaver orientale* L. Specimen cultivated in the Berlin Botanic Garden raised from seeds received from the MNHN Paris which had been collected in Turkey, Kars Province, Subatan, on calcareous scree. [Acc. nº AKZ 048-35-09-14] [Photo: G. Parolly, 26.V. 2016]



Fig. 6. – *Papaver pseudo-orientale* (Fedde) Medw. Specimen cultivated in the Berlin Botanic Garden raised from seed collected in Turkey, A8 Artvin, Kaçkar Daglari, 2150 m.
[*G. Parolly 7394*, Acc. nº AKZ 197-30-00-10] [Photo: G. Parolly, 17.VI.2014]

1824: 118). In short, the long-known *P. orientale* and *P. pseudo-orientale* as well as the recently discovered *P. bracteatum* were by then in cultivation in several botanical gardens in Europe. However, the first two had apparently not yet been collected again in the wild.

The rediscovery of P. orientale and P. pseudo-orientale in the wild

The first report of the rediscovery of *Papaver orientale* s.l. in the wild is connected with the expansion of the Russian Empire southwards under Empress Catherine II and her son Emperor Paul which lead to several expeditions into scarcely known territory. One of them included Johann Anton Güldenstädt (1745–1781) whose travelogue was later edited by Peter Simon Pallas and published posthumously (Güldenstädt, 1787, 1791). In late June 1773, towards the end of the fifth Russo-Turkish war, Güldenstädt had visited the mountains Beschtau and Baralik (also near the modern town of Pjatigorsk), but his finding (Güldenstädt, 1791: 20, 25) is not supported by a specimen and therefore impossible to interpret. By contrast the report of "*Papaver orientale*" from Beschtau in the *Flora taurico-caucasica* (Marschall von Bieberstein, 1808; Stafleu, 1973) is substantiated by an undated specimen kept in the Bieberstein Herbarium in LE (Fiche 75/A1; Geltman, 1995a) which has several conspicuous bracts and clearly belongs to *P. bracteatum*. In the supplement to this work Bieberstein indeed realised that his plant differs from that represented in Curtis's Botanical Magazine (Marschall von Bieberstein, 1819), i.e., *P. pseudo-orientale*. For another specimen of *P. bracteatum* tentatively associated with Bieberstein see above.

The first specimen of *P. orientale* s.s. found in the wild after Tournefort seems to be a collection by Samuel Gottlieb Gmelin (1744–1774) and Carl Ludwig Hablitz (Karl Ivanovich Gablitz, 1752–1821) kept in LE (Wendt, 1976), originating from their expedition in 1769–1774 to the western shores of the Caspian Sea and Gilan [NW Iran] (Gmelin, 1784; Fischer, 2008). Carl Koch (1809–1879) travelled in the Caucasus area only after the fifth Russo-Persian war had come to a conclusion (Edmondson & Lack, 1977; Lack, 1981). He did not report that he had either observed or collected *P. orientale* s.l. during his first expedition (Koch, 1843), no treatment of *Papaveraceae* appeared in his subsequent *Beiträge* (Koch, 1848–1851) which deal in more detail with the plants of his first and second expedition to the Caucasus area. Furthermore the bulk of his specimens was lost when major parts of the herbarium of the Botanical Museum Berlin-Dahlem were destroyed in 1943. Moreover, on his second expedition Koch travelled in the western part of the distribution area of *P. orientale* (Fig. 5) and *P. pseudo-orientale* (Fig. 6) in autumn 1843 and therefore had missed these spectacular plants, known for their short flowering time (E. Vitek, pers. comm.). By contrast, K. Koch was at far too low altitudes to come across the two species in spring 1844 when further east.

The first specimen of *P. pseudo-orientale* found in the wild after Tournefort seems to be a collection by Charles Paulus Bélanger (1805–1881), the newly appointed director of the botanical garden in Pondicherry (today Puduncherry, India), kept in P and annotated 'Perse' (Goldblatt, 1974a). Following his instructions he was travelling over land from Paris via Tiflis to Bushehr, a harbour on the Persian Gulf, and thereby passed in the year 1826 through the distribution area of *P. pseudo-orientale* (Belanger, 1834). Johann Nepomuk Szovits (1805–1830) who travelled on the order of Paul I, Emperor of Russia, and under the protection of the Russian army (Lamond, 1973) collected this species again two years later with the specimen kept in LE (Wendt, 1976). Neither

Bélanger, Gmelin, Hablitz nor Szovits published their findings, Gmelin and Szovits for a simple reason – both died *en route*, the former of ill treatment in captivity in Achmedkent (now Republic Dagestan, Russian Federation) on 27 July 1774 (Fischer, 2008), the latter from cholera in Kutaisi (now Georgia) on 30 August 1830 (Lamond, 1973).

Lectotypifications and a nomenclatural misfortune

The name *P. orientale* was first properly lectotypified with a specimen in LINN [Herb. LINN nº 669/10] by Goldblatt (1974a), adding "*cult. Uppsala*". However, this provenance is at best an hypothesis, since the specimen is annotated in Linnaeus's hand "8 orientale" only (Savage, 1945). The number refers to the running number in Linnaeus (1753)'s *Species plantarum*, but the additional note "HU" in Linnaeus's hand standing for *Hortus Upsaliensis* as found in Herb. LINN nº 669/8 and nº 669/9 is lacking on this specimen. Goldblatt's lectotypification has recently been confirmed and a photograph of LINN nº 669/10 published (Jarvis, 2007). This limits the application of the name *P. orientale* s.s. to the slender plant with unmarked petals.

For the sake of completeness it should be noted that neither *Flora SSSR* (Popov, 1937) nor *Flora of Turkey* (Cullen, 1965) contain an effective lectotypification of the name *P. orientale* although this has been stated both for the former (Micheev, 1993) and the latter work (Wijnands, 1983). The reasons differ: while in the case of *Flora of Turkey* a specimen collected by Tournefort was selected as lectotype which Linnaeus could not have seen (Jarvis, 2007), the expression "type" or its equivalents have not been used in the *Flora SSSR*. In case the latter lectotypification (Micheev, 1993) is considered as independently published from *Flora SSSR* it stands in conflict with ICN (Turland et al., 2018: Art. 9.19) and has to be ignored.

As a consequence of Goldblatt's lectotypification the stout plants with blotched petals needed a name. The first to publish one had been Alphonse de Candolle (1806–1893), Augustin-Pyramus' elder son. Based on a specimen of unknown origin cultivated in the Geneva Botanic Garden he published *P. intermedium* A. DC. (Candolle, 1836), albeit illegitimate because of the older homonym *P. intermedium* Becker. A similar nomenclature misfortune happened when Jakob Sergejevitch Medwedew (1847–1923) created the combination *P. pseudo-orientale* based on *P. bracteatum* var. *pseudo-orientale* Fedde, illegitimate because of the older homonym *P.* ×*pseudo-orientale* E.G. Camus (Goldblatt, 2011). This losing streak continued: when Goldblatt (2011) coined the new name *P. setiferum* Goldblatt to replace the illegitimate *P. pseudo-orientale*, he created a name, which is evidently confusable with *P. setigerum* DC. As a consequence the *euro+med plantbase* (Aghababian, 2011) used for what had previously been called *P. pseudo-orientale* the later heterotypic synonym *P. lasiothrix* Fedde. However, this is incorrect because this name had been lectotypified with *Bornmüller 6094*, a specimen collected in what is now Iran and clearly belonging to *P. bracteatum* (Goldblatt 1974a: 285; Wendt, 1976). The argument that this lectotypification is incorrect because the proposing author had not indicated the herbarium in which the specimen is conserved does not stand since Art 9.22 applies only for a lectotypification published after 1 January 1990 (Turland et al., 2018).

Although *P. setiferum* Goldblatt has already been accepted in the *Konspekt Flory Kavkaza* (Micheev, 2012) and in *Flora of Iran* (Tavakkoli & Assadi, 2017), a proposal to conserve the name *P. pseudo-orientale* has been submitted to the Committee of Vascular Plants with the decision still pending (Lack, in press). Among the arguments put forward is the fact that both *P. setiferum* Goldblatt and *P. setigerum* DC. occur in the Caucasus area. In any case the type of the former name is the specimen *Sintenis 5989* collected on 20.VI.1894 on Argyridagh [mountain near Ilya Dagh] in the Gümüşane province in northeastern Turkey (Cullen, 1963) and not far away from Tournefort's collecting locality in 1701.

Papaver bracteatum Lindl., Coll. Bot.: sub tab. 23. 1821.

Lectotypus (designated by Goldblatt, 1974a: 285): **[Unknown]:** cult. in the Chelsea Physic Garden, s.d., *Anon. s.n.* (K).

= *Papaver pollakii* Kerner in Wiener Ill. Gart.-Zeitung 13: 272. 1888. **Lectotypus** (designated by Goldblatt, 1978: 775): **[Iran]:** cult. in the Vienna Botanical Garden [raised from seed collected in northern Iran by Jakob Eduard Pollak], 1886, *Anon. s.n.* (WU-039731!).

= *Papaver lasiothrix* Fedde in Engl., Pflanzenr. 40: 366. 1909. **Lectotypus** (designated by Goldblatt, 1974a: 285; second-step designated here): **Iran:** "in valle Lur montium Elburs occid. ad pagum Getschesar", s.d., *J. & A. Bornmüller 6094* (W-1904-0001502!).

For further synonyms see Goldblatt (1974a).

Note. – According to a pencil note on WU039731 referring to the acquisition number the type specimen of *P. pollakii* has been cultivated in the garden of Schönbrunn, the summer residence of Emperor Franz Joseph I on the western fringe of Vienna.

A second-step lectotypification (in the sense of Turland et al., 2018) is necessary for *P. lasiothrix* because the herbarium in which *J.A. Bornmüller 6094* is kept has not been indicated in the original lectotypification (Goldblatt, 1974a: 285).



Fig. 7. – Lectotype of *Papaver orientale* L. in LINN.
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Papaver orientale L., Sp. Pl.: 508. 1753.

Lectotypus (Goldblatt, 1974a: 288): **Sine loco:** Herb. LINN nº 669/10 (Fig. 7).

= *Papaver monanthum* Trautv. in Bull. Acad. Imp. Sci. Saint-Pétersbourg 10: 393. 1866. ≡ *Papaver orientale* var. *monanthum* (Trautv.) Trautv. in Trudy Imp. S.-Peterburgsk. Bot. Sada 4: 346. 1876. **Lectotypus** (designated by Micheev, 1993: 118): **Georgia:** "Schambobell – Geb.", 9.VII.1865, *Radde 117* (LE image seen, Fiche 75/C1 in Geltman, 1995b); isolecto-: LE image seen, Fiche 75/B8 in Geltman, 1995b).

= *Papaver orientale* var. *paucifoliatum* Trautv. in Trudy Imp. S.-Peterburgsk. Bot. Sada 4: 346. 1876. ≡ *Papaver paucifoliatum* (Trautv.) Fedde in Engl., Pflanzenr. 40: 366. 1909. **Lectotypus** (designated by Goldblatt, 1974a: 289): **Georgia:** "ad lacum Tabizchuri", 1875, *Raddi 73* (L; isolecto-: LE image seen, Fiche 75/C7 in Geltman, 1995b).

For further synonyms see Goldblatt (1974a).

Notes. – The isolectotype of the name *P. orientale* var. *paucifoliatum* Trautv. in LE has not been mentioned in the original lectotypification (Goldblatt, 1974a: 289). Although stated (Micheev, 1993), this name has not been lectotypified in *Flora SSSR* (Popov, 1937) because the expression "type" or its equivalents have not been used in this treatment.

Papaver pseudo-orientale (Fedde) Medw. in Izv. Kavkazk. Muz. 11: 204. 1918 [nom. illeg.] [non E.G. Camus] [nom. cons. prop.].

≡ *Papaver bracteatum* var. *pseudo-orientale* Fedde in Engl., Pflanzenr. 40: 365. 1910. ≡ *Papaver setiferum* Goldblatt in Novon 21: 182. 2011 [nom. illeg.] [non *P. setigerum* DC.].

Lectoypus (designated by Goldblatt, 1974a: 292): **Turkey:** "Armenia turcica. Szandschak Gümüschkhane, Argyridagh", 20.VI.1894, *Sintenis 5989* (B [B 010 0294948]!; isolect-: BM [BM000551491]!, BP, BR [BR0000005281107]!, E [E00062052]!, FI [FI010083]!, G [G00341842, G00341843]!, K [K000653188]!, JE!, LD [LD1803363, LD1808290, LD1816097, LD1817410, LD1820162, LD1820226, LD1821153]!, P [P00738944, P00738946, P00738948, P02471236]!, S, WU) (Fig. 8).

= *Papaver intermedium* A. DC. in Mém. Soc. Phys. Genève 7: 301. 1836 [nom. illeg.] [non Becker]. **Lectotypus** (designated by Goldblatt, 1974a: 292): **[Unknown]:** "Jard. de Genève" [cult. in the Geneva Botanical Garden], 2.VI.1828, *Anon. s.n.* (G [G00341844]!).

Epilogue

For the initiated the rediscovery of a plant in the wild which had been for a long time in cultivation and whose origins had become obscure or lost is always a sensation. However, *P. orientale* s.s., rediscovered in the wild by Gmelin and Hablitz c. 70 years after Tournefort, and *P. pseudo-orientale*, rediscovered in the wild by Bélanger 125 years after Tournefort, are neither records nor isolated cases. The first record of the lilac (*Syringa vulgaris* L.) in cultivation dates from the 1570s, but the plant was rediscovered in the wild only in 1794 and the first report on its finding in the wild appeared in print as late as 1828 (Lack, 2000). The first record of a cultivated horse-chestnut tree (*Aesculus hippocastanum* L.) dates from 1557 and was published in 1561. However, this most impressive tree was first found in the wild only in 1795, the first report on its finding in the wild appeared in 1809, and it took another 71 years until this finding was confirmed (Lack, 2000). The two oriental poppies, the lilac and the horse-chestnut tree have something in common: they are largely restricted in their natural distribution to what had for centuries been the Ottoman Empire: the lilac and the horse-chestnut to the Balkan peninsula, the two poppies to the Caucasus area in the broad sense, including the most northern and western provinces of the empire ruled by the Safavids and their successors on the throne. For a very long time access to this vast region was difficult and dangerous, but the few plants from the Ottoman Empire and the adjacent countries to the northeast and east which were introduced into cultivation in Central Europe became a lasting sensation for botanists, gardeners and plant lovers alike. They were highly appreciated by very many, with *Papaver orientale* and *P. pseudo-orientale* no doubt among the most spectacular ones.

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Fig. 8. – Lectotype of *Papaver pseudo-orientale* (Fedde) Medw. in B.
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Unpublished sources

BC: Bibliothèque Centrale, Muséum national d'Histoire naturelle, Paris: MS 78, 995, 996; Collection des Vélins 41.

ÖNB: Österreichische Nationalbibliothek, Handschriftenabteilung, Wien: Cod. Min. 35.

References

Aghababian, M. (2011). Papaveroideae. *Euro+Med Plantbase – the information resource for Euro+Mediterranean plant diversity*. [https://ww2.bgbm.org/EuroPlusMed/query.asp]

Alagöz, Y., T. Gürkök, I. Parmaksiz & T. Ünver (2016). Identification and sequence analysis of alkaloid biosynthesis genes in Papaver section Oxytona. *Turk. J. Biol.* 40: 174–183.

Asatryan, A.T. (2002). K biosistematičeskemu isučeniju krupnozvetkovych makok Armenii (Papaver, sekz. Macrantha, Papaveraceae). *Fl. Rastitel'nost' Rastiteln'nye Resursy Armenii* 14: 43–47.

Asatryan, A.T. (2010). Novye materialy isučeniju mnogoletnich makov (Papaver L., sekz. Macrantha Elkan, Papaveraceae). *Biologičeskie Nauki* 9: 10–15. [https://http://www.expeducation.ru/ru/article/view?id=1035]

Baytop, A. (2000). Joseph Pitton de Tournefort (1656–1708) ve Doğu Seyahatnamesi'nin Botanik Değeri. *Herba Medica* 7: 8–17.

Belanger, C. (1834). *Voyages aux Indes-Orientales. Historique.* 2 vol. Paris.

Boerhaave, H. (1727). *Index alter plantarum quae in horto academico Lugduno Batavo aluntur*. Vol. 1. Leiden.

Briquet, J. (1919). Les collections botaniques du botaniste espagnol José Quer. *Ann. Cons. Jard. Bot. Genève* 20: 465–478.

Britten, J. (1913). Philip Miller's plants. *J. Bot. (London)* 51: 132–135.

Buchoz, P.J. (1773–1778). *Histoire universelle du règne végétal.* 12 vol. Paris.

Burdet, H.M. (2008). *Collections de Candolle: catalogue des collecteurs botaniques, une documentation. I: catalogue.* Genève.

Burtt, B.L. (2001, 2003). Tournefort in Turkey (1701–1703). *Karaca Arboretum Mag*. 6: 45–62, 137–146.

Candolle, A.-P. de (1821). *Regni vegetabilis systema naturae*. Vol. 2. Paris.

Candolle, A.-P. de (1824). *Prodromus systematis naturalis regni vegetabilis*. Vol. 1. Paris.

Candolle, A. de (1836). Papaver intermedium. *In:* Candolle, A.-P. de & A. de Candolle, Septième notice sur les plantes rares cultivées dans le jardin de Genève. *Mém. Soc. Phys. Genève* 7: 301–302.

Carolan, J.C., I.L.I. Hook, M.W. Chase, J.W. Kadereit & T.R. Hodkinson (2006). Phylogenetics of Papaver and related genera based on DNA sequences from ITS nuclear ribosomal DNA and plastid trnL intron and trn L-F intergenic spacers. *Ann. Bot.* 98: 141–155.

Commelin, G. (1706). *Horti medici Amstelaedamensis plantae rariores.* Leiden.

Cullen, J. (1963). The Turkish collections of Paul Sintenis. *Notes Roy. Bot. Gard. Edinburgh* 25: 31–39.

Cullen, J. (1965). Papaver L. *In:* Davis, P.H. (ed.), *Fl. Turkey* 1: 219–236.

Cullen, J. (2011). Papaver Linnaeus. *In:* Cullen, J. et al. (ed.), *The European Garden Flora. Flowering Plants* ed. 2, 2: 522–526. Cambridge.

Curtis, S. (1941). *William Curtis 1746–1799. Fellow of the Linnean Society. Botanist and entomologist.* Winchester.

Curtis, W. (1788). Papaver orientale. *Bot. Mag.* 2: sub tab. 57.

Dandy, J.E. (1958). *The Sloane herbarium.* London.

Davis, P.H., R.R. Mill & K. Tan (ed.) (1988). *Fl. Turkey* 10.

Desfontaines, L. (1807, 1808). Choix des plantes du corollaire de Tournefort, publiées d'après son herbier et gravées sur les dessins d'Aubriet. *Ann. Mus. Hist. Nat.* 10: 218–229, 294–306, 427–433; 11: 51–57, 136–143, 160–169, 273–282, 376–383, 438–446; 12: 52–60, 111–118.

Dumont de Courset, G.L.M. (1804). *Le botaniste cultivateur* ed. 2, 4. Paris.

Edmondson, J. & H.W. Lack (1977). The Turkish and Caucasian collections of C. Koch I: Turkey. *Notes Roy. Bot. Gard. Edinburgh* 35: 321–344.

Edwards, S. (1822). Papaver bracteatum. *Bot. Reg.* 8: tab. 658.

Egorova, T.V. (1998). Rod Papaver L. (Papaveraceae) vo flore Vostočnoj Evropy. *Novosti Sist. Vyssh. Rast.* 31: 92–120.

Elina, O.Y. (2007). Private botanical gardens in Russia: Between noble culture and scientific professionalization (1760–1917). *In:* Kokowski, K. (ed.), *The Global and the Local: The history of science and the cultural integration of Europe. Proceedings of the 2nd ICESHS (Cracow, Poland, September 6–9, 2016):* 579–585. The Press of the Polish Academy of Arts and Sciences, Cracow. [http://www.2iceshs.cyfronet.pl/proceedings.html]

Fischer, D. (2008). *Samuel Gottlieb Gmelin (1744–1774). Das Schicksal eines deutschen Arztes in Russland im Jahrhundert der Aufklärung.* Aachen.

Fischer, F.E.L. von (1808, 1812). *Catalogue du Jardin des Plantes, de S. E. Monsieur le Comte Alexis de Razoumoffsky à Gorenki près de Moscou* ed. 1, ed. 2. Moscou.

Geltman, D.V. (1995a). *Marschall von Bieberstein Herbarium. Komarov Botanical Institute, St. Petersburg.* IDC.

Geltman, D.V. (1995b). *The Caucasian Herbarium. Komarov Botanical Institute, St. Petersburg.* IDC.

Gmelin, S.G. (1784). *Reise durch Rußland zur Untersuchung der drey Natur-Reiche*. Vol. 4. St. Petersburg.

Goldblatt, P. (1974a). Biosystematic studies in Papaver section Oxytona. *Ann. Missouri Bot. Gard.* 61: 264–296.

Goldblatt, P. (1974b). Eastern poppies. *Ann. Missouri Bot. Gard.* 61: 538.

Goldblatt, P. (1978). The identity of Papaver pollakii Kerner. *Ann. Missouri Bot. Gard.* 65: 775.

Goldblatt, P. (2011). A new name for Papaver pseudo-orientale (Papaveraceae). *Novon* 21: 182.

Grey-Wilson, C. (2000). *Poppies. A guide to the poppy family in the wild and in cultivation* ed. 2. Batsford, Portland.

Guiral, P. (1957). Tournefort et son voyage au Levant. *In:* Becker, G. et al. (ed.), *Tournefort:* 77–96. Muséum national d'Histoire naturelle, Paris.

Güldenstädt, J.A. (1787, 1791). *Reisen durch Rußland und im Caucasischen Gebirge.* 2 vol. St. Petersburg.

Hamonou-Mahieu, A. (2006). *Claude Aubriet (vers 1665–1742): peintre d'histoire naturelle.* Université de Rennes.

Heurtel, P. & M. Lenoir (ed.) (2016). *Les vélins du Muséum national d'Histoire naturelle*. MNHN, Citadelles & Mazenod, Paris.

Hiepko, P. (1972). Introduction / Einführung. *In:* Hiepko, E. (ed.), *Herbarium Willdenow. Alphabetical index:* vii-ix. IDC.

Hosokawa, K., T. Shibata, I. Nakamura & A. Hishida (2004). Discrimation among species of Papaver based on plastid rpl16 gene and the rpl16-rpl14 spacer sequence. *Forensic Sc. Intern.* 139: 195–199.

Houttuyn, M. (1778). *Handleiding tot de plant- en kruidkunde*. Vol. 9. Amsterdam.

Jarvis, C. (2007). *Order out of chaos. Linnaean plant names and their types.* National History Museum & Linnean Society of London.

Kennett, T. (2016). *The Lord Treasurer of Botany. Sir James Edward Smith and the Linnaean Collections.* Linnean Society of London.

Kiger, R.W. (1985). Revised sectional nomenclature in Papaver L. *Taxon* 34: 150–152.

Knorr, G.W. (1750–1771). *Thesaurus rei herbariae hortensisque universalis / Allgemeines Blumen- Kräuter- Frucht- und Garten-Buch.* Nürnberg.

Koch, C. (1843). Catalogus plantarum quas in itinere per Caucasum, Georgiam Armeniamque annis 1836 et 1837 legit Dr. C. Koch. *Linnaea* 17: 31–50.

Koch, C. (1848–1851). Beiträge zu einer Flora des Orients. *Linnaea* 21: 289–443, 609–736; 22: 177–338, 597–752; 23: 577–713; 24: 305–480.

Köhlein, F. (2003). *Mohn und Scheinmohn. Papaver, Meconopsis und andere Papaveraceae.* Ulmer, Stuttgart.

Lack, A. (2016). *Poppy.* Reaction Books, London.

Lack, H.W. (1981). The Turkish and Caucasian collections of C. Koch II: Caucasia. *Notes Roy. Bot. Gard. Edinburgh* 37: 79–94.

Lack, H.W. (2000). Lilac and horse-chestnut: discovery and rediscovery. *Curtis Bot. Mag.* ser. 6, 17: 109–141.

Lack, H.W. (2001). *A garden Eden. Masterpieces of botanical illustration/ Ein Garten Eden. Meisterwerke der botanischen Illustration / Un jardin d'Éden. Chefs-d'œvre de l'illustration botanique*. Taschen, Köln.

Lack, H.W. (2014). Die botanische Erforschung der Kaukasusländer – ein Rückblick / The botanical investigation of the Caucasian area: a review. *In:* Parolly, G. et al. (ed.), *Kaukasus. Pflanzenvielfalt zwischen Schwarzem und Kaspischem Meer / Caucasus. Plant diversity between Black and Caspian Seas:* 60–65. Botanischer Garten und Botanisches Museum Berlin-Dahlem.

Lack, H.W. (2018). The discovery and naming of Lomelosia caucasica (Dipsacaceae) with notes on its nomenclature and its early cultivation. *Willdenowia* 48: 185–194.

Lack, H.W. (in press). Proposal to conserve the name Papaver pseudo-orientale (Fedde) Medw. against P. ×pseudo-orientale E.G. Camus. *Taxon* 68.

Lamond, J.M. (1973). The Transcaucasian and Iranian collections of J. N. Szovits. *Notes Roy. Bot. Gard. Edinburgh* 32: 239–245.

Lindley, J. (1821). Papaver bracteatum. *Coll. Bot.:* tab. 23. London.

Linnaeus, C. (1737). *Hortus cliffortianus.* Amsterdam.

Linnaeus, C. (1748). *Hortus upsaliensis*. Vol. 1. Stockholm.

Linnaeus, C. (1753). *Species plantarum*. Stockholm.

Linnaeus, C. (1763). *Species plantarum* ed. 2. Stockholm.

Ludwig, H. (1998). *Nürnberger naturgeschichtliche Malerei im 17. und 18. Jahrhundert.* Basilisken-Presse, Marburg an der Lahn.

Marschall von Bieberstein, F.B. (1808, 1819). *Fl. Taur.-Caucas.* 2, 3.

Micheev, A.D. (1993). Obsor vidov semejstva Papaveraceae flory Kavkasa. *Bot. Zhurn. (Moscow & Leningad)* 78(5): 115–124.

Micheev, A.D. (2012). Papaveraceae. *In:* Tachtadžjan, A.L. (ed.), *Konspekt Flory Kavkaza* 3(2): 109–119. KMK Scientific Press, Saint-Petersburg.

Miller, P. (1731). *The gardeners dictionary*. London.

Miller, P. (1756–1759). *The gardeners dictionary* ed. 7. London.

Milo, J., A. Levy, G. Ladizinsky & D. Palevitch (1988). Phylogenetic and genetic studies in Papaver section Oxytona: cytogenetics, isozyme analysis and chloroplast DNA variation. *Theor. Appl. Genet.* 75: 795–802.

Mowat, A.B., S.M. Walters & J.W. Kadereit (1993). Papaver L. *In:* Tutin, T.G. et al. (ed.), *Fl. Europaea* ed. 2, 1: 297–301.

Novák, J. (1979). Taxonomická revize sekce Macrantha rodu Papaver. *Preslia* 51: 341–348.

Novák, J. & F. Volf (1979). Chromosomové počty druhů sekce Macrantha Elk. rodu Papaver L. *Sborn. Vysoké Školy Zeměd. Praze Fak. Agron.,* A 31: 33–40.

Nyman, U. & J.G. Bruhn (1979). Papaver bracteatum – a summary of current knowledge. *Planta Medica* 35: 97–117.

Ojala, A. & A. Rousi (1986). Interspecific hybridization in Papaver. 1. F1 hybrids of P. somniferum with perennial species of sect. Oxytona. *Ann. Bot. Fennici* 23: 289–303.

Ojala, A., A. Rousi, E. Lewing, H. Pyysalo & C.-J. Widén (1990). Interspecific hybridization in Papaver. III. F1 hybrids between species of sect. Oxytona. *Heriditas* 112: 221–230.

Parmaksiz, I. & S. Özcan (2011). Morphological, chemical and molecular analyses of Turkish Papaver accessions (Sect. Oxytona). *Turk. J. Bot.* 35: 1–16.

Petiver, J. (1714–1716). Botanicum hortense IV. Giving an account of divers rare plants observed the last summer A.D. 1714 in several curious gardens about London, and particularly the Society of Apothecaries Physick-Garden at Chelsea. *Phil. Trans.* 29: 229–244, 269–284, 353–364.

Poiret, J.L.M. (1804). *Encyclopédie méthodique. Botanique*. Vol. 5. Paris.

Popov, M.G. (1937). Makovye – Papaveraceae B. Juss. *In:* Šiškin, B.K. (ed.), *Flora SSSR* 7: 573–717.

Raskin, N.M. (1981). *Apollos Apollosovič Musin-Puškin: vice-prezident Berg-Kollegii, chimik i mineralog 1760–1805.* Nauka, Leningrad.

Ray [Raius], J. (1704). *Historia plantarum*. Vol. 3. London.

Redowsky, J. (1803, 1804, 1805). *Enumeratio plantarum quae in horto Excellentissimi Comitis Alexii a Razumowsky in pago Mosquensi Gorinka vigent* ed. 1, ed. 2, ed. 3. Sine loco.

Reichenbach, H.G.I. (1855). Friedrich Ernst Ludwig von Fischer. *Bot. Zeit. (Berlin)* 13: 124–127.

Safonova, I.N. (1991). Čisla chromosom nekotorych vidov semejstva Papaveraceae. *Bot. Zhurn. (Moscow & Leningrad)* 76: 904–905.

Savage, S. (1945). *A catalogue of the Linnaean herbarium.* Linnean Society of London.

Stafleu, F.A. (1973). Marschall von Bieberstein and the Flora taurico-caucasica. *Taxon* 22: 126–128.

Stearn, W.T. (1971). Miller's Gardeners dictionary and its abridgement. *J. Soc. Bibliog. Nat. Hist.* 7: 125–141.

Stearn, W.T. (1972). Philip Miller and the plants from the Chelsea Physic Garden presented to the Royal Society of London, 1723–1796. *Trans. Bot. Soc. Edinburgh* 41: 293–307.

Stungo, R. (1993). The Royal Society specimens from the Chelsea Physic Garden 1722- 1799. *Notes Rec. Roy. Soc. London* 47: 213-224.

Tancin, C. (2016). Carl Linnaeus. *Plant. Exploring the botanical world:* 63. Phaidon Press, London.

Tavakkoli, Z. & M. Assadi (2013). Comparison of morphological and micromorphological studies in Papaver sect. Oxytona (Papaveraceae) and interspecific hybrids. *Iran. J. Bot.* 19: 235–249.

Tavakkoli, Z. & M. Assadi (2017). Papaveraceae. *In:* Assadi, M. & A.A. Massoumi (ed.), *Fl. Iran* 127.

Thijsse, G. (2018). A contribution to the history of the herbaria of Georg Clifford III (1685–1760). *Arch. Nat. Hist.* 45: 134–148.

Tournefort, J.P. de (1703). *Corollarium institutionum rei herbariae in quo plantae 1356 munificentia Ludovici Magni in orientalibus regionibus observatae recensentur.* Paris.

Tournefort, J.P. de (1717). *Relation d'un voyage du Levant fait par ordre du Roy.* Paris.

Turland, N.J., J.H. Wiersema, F.R. Barrie, W. Greuter, D.L. Hawksworth, P.S. Herendeen, S. Knapp, W.W. Kusber, D.-Z. Li, K. Marhold, T.W. May, J. McNeill, A.M. Monro, J. Prado, M.J. Price & G.F. Smith (2018). International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017. *Regnum Veg.* 159.

Van Royen, A. (1740). *Florae Leydensis Prodromus exhibens plantas quae in horto academico Lugduno – Batavo aluntur.* Leiden.

Wendland, F. (1992). Peter Simon Pallas (1741–1811). Materialien zu einer Biographie 1. *Veröff. Hist. Kommiss. Berlin* 80(1).

Wendt, N. (1976). *Beiträge zur Sippenstrukturforschung an der Gattung Papaver L., Sektion Pilosa Prantl, Sektion Pseudopilosa Popov ex Günther und Sektion Oxytona Bernh.* Ph.D. Thesis, Humboldt University Berlin.

Wijnands, D.O. (1983). *The botany of the Commelins.* A.A. Balkema, Rotterdam.

Wijnands, D.O. (1987). The Hortus medicus amstelodamensis – its role in shaping taxonomy and horticulture. *Bot. Mag.* ser. 7, 4: 78–91.

Wijnands, D.O., J. Heniger, J.F. Veldkamp, N. Fumeaux & M.W. Callmander (2017). The botanical legacy of Martinus Houttuyn (1720–1798) in Geneva. *Candollea* 72: 155–198.

Willdenow, C.L. (1799). *Species plantarum*. Vol. 2. Berlin.

Willdenow, C.L. (1809). *Enumeratio plantarum horti regii botanici berolinensis.* Berlin.

Wilmer, J. (1758). A catalogue of the fifty plants from Chelsea garden, presented to the Royal Society by the Worshipful Company of Apothecaries, for the year 1756. *Phil. Trans.* 50: 236–240.