

# JOSEPH GAERTNER AND HIS CARPOLOGIA\*

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## SUMMARY

Joseph Gaertner (1732–1791) was the first to develop a carpological taxonomy in his book *De fructibus et seminibus plantarum* (1788–1791). The scope and background of this work are discussed; its history is sketched on the basis of the Banks correspondence at the British Museum; the main sources of material are listed. A brief outline of Gaertner's life is given, also mainly based on letters from him and his contemporaries to Joseph Banks.

The development of a natural system of classification of plants which took place in the course of the eighteenth century was mainly a French affair. It is sufficient to mention the names of Magnol, Gérard, Adanson, and Bernard and Antoine-Laurent de Jussieu to demonstrate the rôle played by French taxonomy in freeing taxonomy from its links with a scholastic past. The French botanists showed the importance of an unbiased approach to classification, finding facts primarily by direct observation unhindered by *a-priori* restrictions or weighting of characters. Among the attempts along these same lines outside France was, for instance, a listing of genera in "natural orders" by Linnaeus, but a discussion of this early phase lies outside the scope of the present paper. A later but extremely important contribution to this development was provided by the German Joseph Gaertner, who opened up an almost entirely new field by restricting himself to a thorough and intelligent comparative study of seeds, fruits and spores in his *De fructibus et seminibus plantarum* (1788–1791).

Joseph Gaertner was born in Calw, a small German town west of Stuttgart, on 12 March 1732. He had the misfortune to lose his parents at an early age and received his primary education from a friend of the family who was a theologian at Tübingen University. Originally meant to follow a similar vocation, Gaertner discovered at an early age that his calling was towards natural history. After a short interval in which he studied law in Tübingen (1750–1751) he went to Goettingen (1751–1753), where he became a pupil of Albrecht von Haller (1708–1777), then already in the heyday of his fame. Gaertner received the usual medico-botanical training of the period, took his medical degree at Tübingen in 1754, and followed this up with a grand tour of European scientific institutions in Italy, France (Lyon, Montpellier and Paris) and England. Back in Germany he settled in Calw as a medical practitioner but continued at the same time his studies in natural history, in mathematics, and especially in the optical sciences, building his own microscopes and telescopes.

\* Dedicated to Professor Dr. C. E. B. Bremekamp.

The summer of 1759 was spent in Leiden in order to finish his botanical education with Adriaan van Royen (1704–1779) and his nephew David (1727–1799), a contact which would later prove to be of great importance for the writing of his *Carpologia*. This visit was followed by another, to England, where he studied sea-weeds on long trips along the English shores and met some of the foremost English botanists. In 1761 he was appointed professor of anatomy at Tübingen, in 1768 professor of botany at St. Petersburg, as well as director of the botanic garden and the imperial natural history cabinet. In this capacity he made a trip to the Ukraine. Notwithstanding the advantageous financial and social circumstances and the favorable cultural climate of St. Petersburg in those days, however, Gaertner, for a variety of reasons, decided in 1770 to pursue his main object of research, that of the fruits and seeds, in the more relaxed atmosphere of his birthplace, Calw. Here, as a typical “Privatgelehrter” with modest means of his own, and within easy distance of the great centers of learning of the West, he could devote himself to his Carpology.

Even though he had already assembled some material for this purpose, he realized that he had to go abroad once more, mainly to Leiden and London, to obtain named specimens of fruits and seeds. In 1778 he was again in London, in first instance to visit Joseph Banks (1744–1820) who received him hospitably at the treasure-house in Soho square. Together with Daniel Solander (1736–1782), his later curator and librarian, Banks had joined Captain Cook on his first voyage on the Endeavour (1768–1771). The numerous collections made during this trip were liberally made available to Gaertner, who was allowed to take named specimens, often of new taxa that had so far been provided only with manuscript names by Banks and Solander. The same was true of fruits obtained from specimens grown at Kew, among which were plants brought back by Banks and Solander, and early introductions from South Africa by Masson. In October 1778 Gaertner was back in Leiden to stay with his friend David van Royen. He attended the sale of the famous Gronovius collections, bought books for Banks, acted as an intermediary between Banks and David van Royen for the exchange of specimens, and found important new fruits and seeds mainly from the East Indies in van Royen’s carpological cabinet and garden. Here again Gaertner was allowed to take home representative specimens: “...j’ai... aussi reçu plusieurs genres de fruits très rares des Indes, qui me manquaient encore” (letter to Banks, 20 Oct. 1778). In Leiden Gaertner also met Carl Peter Thunberg (1743–1828), who was then just back from the East and from the Cape; a meeting which again provided him with a useful contact, because Thunberg had brought home considerable South African and Japanese collections.

Back in Calw, however, in late 1778 or early 1779, Gaertner was struck by a serious disease which primarily affected his eyesight. From the detailed description of the symptoms which Gaertner gave after his recovery in a letter to Banks (28 June 1784), it is clear that the disease was not a simple nervous breakdown as stated by his – hitherto only – biographer DELEUZE (1802; but see also ASCHERSON 1878 and J. E. SMITH 1819) on the authority of Gaertner’s

son. Gaertner speaks of “une maladie opiniâtre de près de cinq années”, during which he despaired of ever being able to see again. The detached description of the symptoms of his very painful disease shows in a touching way the resignation of a great man; for an understanding of Gaertner’s character this letter is of fundamental importance. Recovery came suddenly, in a few days even, after heavy loss of blood. Though realizing the general delicacy of his constitution – his “asthmatic” troubles had already manifested themselves during his stay in St. Petersburg – he almost immediately took up his work again, arduously and feverishly. In this same letter Gaertner requests Banks to send additional material and announces the return of material obtained on loan. He recalls that Banks said to him, during his stay in London, seeing his drawings of plants, “I wish to see them on copper”. Congratulating Banks on his peerage, he writes, in his nice and delicate, though perhaps not always entirely correct French, “Ah l’heureux pays, où le mérite est distingué par le Prince et reconnu de ses semblables – ce n’est pas ainsi partout,” an obvious reflection on the relatively low regard in which the natural sciences were held in Germany at the time.

Engraving the 79 plates and printing the plates and the text took almost two years, but on 12 December 1788 Gaertner was able to inform Banks that the first volume was at last published and that he had sent him two copies. The volume was dedicated to Banks as a sign of respect and to thank him for “le généreux concours que vous m’avez prêté à mes dessins en me fournissant un si grand nombre de fruits rares et exotiques qui sont (or font, manuscript not clear) le principal ornement de mon ouvrage.” The second volume was almost ready in manuscript, but the publication – at his own cost – of the first volume had been so expensive that he would have to await income from sales before starting the printing of volume 2.

The publication of the first volume was decidedly a success in botanical circles, although perhaps not so much as far as sales were concerned. By 1791 only 200 copies had been sold, a quantity far below the author’s hopes.

Taking into account, however, the troubled times, the limited number of taxonomists and the inevitably rather high price of this finely illustrated volume, a sale of 200 between 1789 and 1791 cannot really be called disappointing.

A.-L. de Jussieu received a copy in April 1789, when his own *Genera plantarum* had already been printed except for the indexes and the introduction, but he was able to print in his appendix (p. 453) some flattering remarks and to cite a number of instances where the two works overlapped. Lamarck immediately used, in his *Illustrations des genres*, a great many of the data provided by Gaertner.

The publication resulted in a new stream of material to Gaertner, to be used for his second volume. Notwithstanding, or perhaps just because Gaertner felt that his forces were weakening, he accelerated his efforts to finish the second volume and even to prepare a third one in the shortest possible time. “Ainsi le voyageur fatigué redouble la vitesse de sa marche lorsqu’il craint d’être surpris par la nuit” is Deleuze’s touchingly apt comment. On 17 May 1790 Gaertner writes again to Banks “...on a enfin commencé à imprimer aussi le second

volume et... les deux premières ou la 6 et 7<sup>me</sup> centuries ont quitté la presse la semaine passée. J'aurai l'honneur de vous les envoyer aussitôt que les fabricants de Basle auront fourni le papier pour pouvoir imprimer les planches..." He mentions his illness and "la toux convulsive," adding "la jouissance de la vie est passée pour moi et je n'ai plus d'agréables moments si ce n'est quand je reçois quelque fruit rare et remarquable, car alors j'oublie au moins pour quelque tems, les maux, qui ne me quittent jamais."

The end was near, and although Gaertner saw the publication of the greater part of his second volume (*decuriae* 6–9), he did not live to see its completion. The German botanist from Strasbourg, Thomas Lauth (1758–1826), who visited him during his last days, wrote to Banks on 21 April 1791 that Gaertner was weakening. It had proved impossible to stop him from working; he was "his own doctor" and fully convinced that he was dying. Rightly so: on 14 July 1791 Joseph Gaertner died at the age of 59 years. The acceleration of his steps had not been in vain; he left to botany one of its finest publications.

Joseph Gaertner's son, Karl Friedrich (1772–1850), saw the second volume to its completion and sent a copy of it to Banks on 4 June 1792. Gaertner filius took his medical degree at Tübingen in 1796. He settled also at Calw, as a practicing physician, and undertook the publication of the *Supplementum carpologiae*, which constitutes the third volume of *De fructibus et seminibus plantarum* (1805–1807). The text of fascicle 1, part 1 (pp. 1–56) was still written for the greater part by Joseph Gaertner, but the rest of the work (pp. 57–256) was written by K. F. von Gaertner alone. In doing so he followed his father's example and travelled in 1802 to the large western European centers of learning. In England he could consult again the Banksian collections, as well as those of A. B. Lambert. At Paris he could use the collections at the *Muséum d'histoire naturelle* and the private herbaria of A.-L. de Jussieu, R. L. Desfontaines, Benjamin Delessert, and A. P. de Candolle. Through the latter Gaertner could also consult the herbarium of the late Charles Louis l'Héritier de Brutelle. Like his father, Gaertner suffered from eye-trouble. After writing the *Supplementum* he had to abandon work which involved the use of a microscope. In later years he published important studies on fertilization and hybridization of plants – studies which did much to make these concepts generally accepted. Brief biographies of Gaertner filius are given by an anonymous author in *Flora* (1851) and by ASCHERSON (1878).

#### SCOPE AND BACKGROUND

The space allotted to this brief essay in honour of C. E. B. Bremekamp does not allow a discussion of the merits of Joseph Gaertner's *Carpologia*, as he himself often called it in correspondence. (See e.g. SACHS 1892, SCHULTZ 1832 and STEARN 1961.) From the point of view of present day taxonomy, the circa 100 new genera are of great direct importance. They are often based on material from Cook's first voyage brought home by Banks and Solander, on collections – unused at the time – from the East Indies obtained from Leiden, and on plants

from Japan and the Cape given to him by Thunberg. Many of Gaertner's genera and species are discussed extensively by HALLIER (1918). Furthermore, the book gives a wealth of detail not only on the fruits and seeds, but very often also on critical characteristics of the flowers of over a thousand genera. The structural analyses of many of the seeds and fruits still stand unsurpassed. Gaertner recognized the endosperm (or perisperm; he obviously did not distinguish between the two), used the term "embryo" for the young plant including its cotyledons, showed that the indehiscent dry fruits of labiates and other groups were not seeds, defined with precision the pericarp, and made a distinction between the spores and seeds in recognizing the absence of an embryo in the former. The use of the term "embryo", agreeing with Adanson, and not that of *corculum seminis*, with its scholastic overtones (see e.g. BREMEKAMP 1953 for a discussion of this concept), is just one small proof of Gaertner's unbiased and inductive approach to nature. From the point of view of the history of botany – of morphology and taxonomy in particular – the book is remarkable because of its profound theoretical introductions, outlining the use of further sets of characters for the development of the natural system, its clear morphological analysis, and its modern terminology. Special branches of plant taxonomy abound nowadays: chemotaxonomy, cytotaxonomy, serotaxonomy, to mention only a few; Gaertner's carpological taxonomy was one of the first. It is therefore the more remarkable that Gaertner stressed that a natural classification could be achieved only by taking into account as many characters as possible, and should certainly not be based on characters derived from fruit and seed alone. Two botanists profoundly influenced his botanical philosophy: his countryman and friend Joseph Gottlieb Koelreuter (1733–1806), who had just published his epoch-making studies on sexuality and fertilization in plants, and a man known to him only through his published work, Michel Adanson (1727–1806). The latter's influence is evident not only from the many times he is quoted approvingly, but also from Gaertner's theoretical considerations, views on the natural system, and terminology.

#### DATES OF PUBLICATION

For full documentation with respect to the material underlying the dates of publication as given below, reference may be made to earlier publications (STAFLEU 1963, 1967).

volume	part	centuria	pages	plates	dates
1	–	1–5	1–384	1–79	Dec. 1788
2	1	6–7	1–184	80–119	late Sep.–Nov. 1790
	2	8–9	185–352	120–156	Apr.–May 1791
	3	10	353–504	157–180	Sep.–Dec. 1791
	4	–	505–520	–	Jan.–June 1792
3 (suppl.)	1(1)		1–56	181–190	Jan.–June 1792
	1(2)		57–128	191–202	26 June 1805
	2		129–256	203–225	May 1806
					1807

The first two volumes were re-issued by the publisher Richter at Leipzig in 1801 (vol. 1) and 1802 (vol. 2). These re-issues consist of the old sheets with a new title-page (cancel), and differ therefore in no other respect from the original issues.

## HERBARIUM AND TYPES

Joseph Gaertner's own collection of fruits and seeds is (at least for the greater part) at the Institut für spezielle Botanik und Pharmakognosie der Universität Tübingen (TUB) in Germany. Karl Friedrich Gaertner added to these collections and had, in addition, a herbarium; this is also at Tübingen. Joseph Gaertner is not known to have had a herbarium. He checked his material with the herbarium material in Banks's and van Royen's cabinets on his travels, and depended also on the identifications provided by his correspondents. It should be realized that Gaertner also received material on loan (e.g. from Banks, in addition to the more numerous specimens which he was allowed to keep) and that his types will not always be found in the Tübingen collections. A number of types are in the carpological collection of the Rijksherbarium at Leiden (L); others are in the Banksian herbarium (BM). In later years Karl Friedrich Gaertner added material to these collections with his own determinations, often of taxa described by his father. This material is therefore not authentic. The information on the labels is often very restricted, and care should be taken to distinguish between the handwriting of the father and that of the son. The Gaertner collections were presented to Tübingen University in 1860 by Emma Gaertner, daughter of Karl Friedrich. The location of the original drawings, however, is unknown.

Apart from material collected by Joseph Gaertner himself during his European travels, his main sources of material were the following: *Botanic gardens*: AMSTERDAM ("e seminar. hort. Amstelod."); HOHENHEIM ("ex horto ducali Hohenheimensi," the short lived castle and garden at Hohenheim in Württemberg, built in 1782 by Karl Eugen von Württemberg for his prospective second wife Franziska Theresia (1748–1811); castle and gardens were of the Versailles type, but the splendour did not last beyond Karl's death in 1793; the garden was later resuscitated as part of the Landwirtschaftliche Hochschule); KEW ("ex horto regio Kewensi," and from its head-gardener William AITON); LEIDEN ("ex horto Leydensi" and "e collect. sem. hort. lugdb," a fruit and seed collection still extant, many collectors); STUTTGART ("ex horto botanici Stuttgart."). *Private natural history cabinets*: Sir JOSEPH BANKS ("e collectione Banksiana," "ex herbario Banksiano," "hort. sicc. Banks"; with the Leiden seed collection, the most frequently cited source of material); M. HOUTTUYN (physician at Hoorn and Amsterdam); DAVID VAN ROYEN ("à cl. Dav. v. Royen," professor of botany at Leiden and friend of Gaertner); GOTTLIEB KONRAD CHRISTIAN STORR (professor at Tübingen; "e musaeo Storriano"); C. P. THUNBERG ("ex dono Cl. Thunbergii," etc.; professor of botany at Uppsala and correspondent of Gaertner).

*Private individuals:* W. AITON (head-gardener at Kew); JOH. LE FRANCO VAN BERKHEY (Lector of Natural History at Leiden); KAROLINE VON BADEN (Karoline Luise von Hessen-Darmstadt, first wife of Karl Friedrich von Baden, cited as "Carolina March. Bad.," provided material from Madagascar); GEORGE FORSTER (then at Kassel); JOH. HERMANN ("Pr. arg.," professor of medicine at Strasbourg); P. HERMANN (through the Leiden carpological collection; the type of *Psydrax dicoccos*, 1: 125, however, was collected by J. G. Koenig); W. HUDSON (Chelsea garden, London); J. G. KOENIG (from India, through Banks); LANG (apothecary at Stuttgart); MARTINY (Stuttgart); P. MILLER (Chelsea garden, London); J. J. ROEMER (Zürich); J. C. D. SCHREBER (Erlangen); WIEDEMANN (Stuttgart).

Karl Friedrich von Gaertner's sources for the Supplementum carpologiae were the following:

*Botanic gardens and institutions:* Royal Botanic Gardens, KEW; seed collection of the LEIDEN botanic garden; seed collection of the PARIS Muséum national d'Histoire naturelle; the private botanic garden and nursery of J. P. M. CELS.

*Private herbaria and natural history cabinets:* Sir Joseph BANKS (London); Sebald Justinus BRUGMANS (Leiden); Augustin-Pyrame de CANDOLLE (Paris, later Genève); Benjamin DELESSERT (Paris, later Genève); René-Louiche DESFONTAINES (Paris, later Florence); Antoine-Laurent de JUSSIEU (Paris); Aylmer Bourke LAMBERT (London); Charles Louis L'HÉRITIER de BRUTELLE (Paris, in herb. de Candolle); Carl Pehr THUNBERG (Uppsala).

*Private individuals:* Louis-Augustin Guillaume BOSCH (material from North America, in herb. Desfontaines); Johannes COLSMANN (various; Copenhagen); Antonio Jose CAVANILLES (material from Spain and South America through Jussieu); Philibert COMMERSON (Voyage around the world, through Jussieu and Delessert; also from unpublished illustrations by Commerson at the Paris Muséum); Alire Raffeneau DELILE (material from Egypt); DUPUIS (various, botanist at Paris); Johann Reinhold FORSTER (from Cook's second Voyage, through A. B. Lambert); Joh. HERMANN (various; professor of medicine at Strasburg); Jacques-Julien Houtton de LABILLARDIÈRE (Syria); Pierre-Antoine POITEAU (Hispaniola); Johann Jakob ROEMER (various; botanist at Zürich); Kurt SPRENGEL (various; botanist at Halle); Christian Friedrich (?) STROMEYER (from the Pyrenees; physician and botanist at Goettingen); Étienne-Pierre VENTENAT (various; botanist at Paris).

#### REFERENCES AND SOURCES

- ANONYMOUS (A. E. FÜRNRÖHR) (1851): Dr Carl Friedrich v. Gärtner. *Flora* 34: 135-143.  
 ASCHERSON, P. F. A. (1878): Joseph Gaertner, *Allg. Deutsche Biographie* 8: 377-380.  
 — (1878a): Karl Friedrich von Gaertner. *Allg. Deutsche Biographie* 8: 382-384.  
 BREMEKAMP, C. E. B. (1953): A reexamination of Cesalpino's classification. *Acta bot. Neerl.* 1 (4): 580-593.  
 DAWSON, W. R. (1958): *The Banks letters*. British Museum (Natural History), London.  
 DELEUZE, J. P. F. (1802): Notice sur la vie et les ouvrages de Gaertner. *Ann. Mus. Hist. Nat.* 1: 207-233 (English translation *Ann. Bot. ed. König and Sims* 1: 73-99. (1805).

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HALLIER, H. (1918): Ueber Gaertner'sche Gattungen und Arten unsicherer Stellung. *Rec. Trav. Bot. Néerl.* **15**: 27-122.

SACHS, J. VON (1875): *Geschichte der Botanik*. München.

SCHULTZ, K. H. (1832): *Natürliches System des Pflanzenreiches nach seiner innern Organisation*. Hirschwald-Berlin.

SMITH, J. E. (1819): Joseph Gaertner. *Rees Cyclopaedia* **15** (ord. alph.).

STAFLEU, F. A. (1963): Dates of botanical publications 1788-1792. *Taxon* **12**: 43-87.

— (1967): *Taxonomic literature*. Int. Bur. Plant Tax. Utrecht (*Regnum vegetabile* **52**).

STEARNS, W. T. (1961): Botanical gardens and botanical literature in the eighteenth century. *Catal. Bot. Books Hunt* **2**(1): ciii.

*Unpublished sources*

Letters from Joseph Gaertner and Thomas Lauth to Sir Joseph Banks at the British Museum (Bloomsbury). For catalogue see DAWSON (1958).

Letters from K. F. v. Gaertner to A. P. de Candolle at the Conservatoire botanique, Genève.