Botany

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From the seventeenth-century onwards, the field of botany gradually emerged from the broader umbrella of natural history. Loosely defined as the study of plants, botany often coincides with horticulture (i.e., growing and caring for living plants), but not necessarily so. In the European tradition, botany in the early-modern period, in particular, had been responsible for some of the newly 'discovered' tropical plants being brought to Europe, unless they could afford the most cutting-edge botanical knowledge – and even with that equipment, success was far from guaranteed. Instead, botanists either had to travel to study the plants in situ, or else try to acquire a preserved specimen of a plant – which was usually a dried and pressed specimen.

The methods with which botanists have preserved plants has changed very little over the centuries. The main option has always been, and still is, to preserve plant specimens until they dried out, and then place or otherwise mount them on a page in a collection of such samples known as an herbarium. Occasionally some specimens that cannot be easily pressed are preserved in an enclosed jar of spirit (although this method is more commonly associated with zoology than botany). Since the mid-twentieth century, however, the field of botany has meant that traditionally messy botanists were also artists, or (for those without this skill) worked with specialist botanical artists. For example, according to his first voyage to the Pacific, Captain James Cook had hired a specialist botanical artist, Sydney Parkinson, and had him in order to help him study and capture plants while they were fresh. They had to move quickly, with the draftsman drawing the plant while Banks and Solander made a botanical description of it, before it wilted and decayed. Parkinson's work was then used to produce 'descriptions'. They studied each day 'from about 8a.m. to 2p.m.' taking a break to wait for the 'smell of food' to disappear, before continuing from around 4pm to about 8p.m. Cook's ship was not equipped for a botanical expedition, however, and the voyage had to demonstrate the importance of smell for botanists studying plants (Chambers: 2000).

As well as collecting plants to study, a vital part of botanic practice is to accurately identify them. There are several taxonomies for organizing plants into different groups (Kingdoms, Families, Genus, Species/Cultivars), including one of the earliest the ancient Greek physician Dioscorides (c.90-AD 40?). The first volume of Dioscorides' five-volume pharmacopoeia of medicinal plants, *De Materia Medica*, is dedicated to aromatics, indicating that smell was a significant factor in how the ancient Greeks (and later Romans generally) recognized the significance of smell to understanding plants. *De Materia Medica* remained in circulation from its creation (c.50-70AD) well into the seventeenth-century before it was finally supplanted by more modern botanical texts that included illustrations of the subject.

However, there was no agreed standardized approach to naming plants until the mid-eighteenth century, when Carl Linnaeus' binomial nomenclature system was published. It has since prevailed as the formal scientific naming system for naming and grouping plants – at least within academe. However, it is important to recognize that both before and since the Linnean binomial system took hold, there were (and still are) other systems for naming practice known among botanists, horticulturists, and gardeners.

Regardless of what taxonomic system a botanist uses, or what language(s) is/are used to name a plant, the main thing is to correctly identify a plant within whatever taxonomic system is being used. This is obviously still true today, but it was particularly crucial in an era when a plant could be the difference between life and death. Botanists had to be certain that they could identify with all their senses to ensure a correct identification – relying on sight alone could lead to misattribution – which could have potentially dire consequences in the form of poisoning or a lack of medicinal benefit.

The various smells of plants are almost endless, so this entry will limit itself to the smells related to identifying and studying plants (as opposed to simply commenting on a scent), as well as some of the smells surrounding the primary botanic practices – namely preserving specimens.

SMELLS

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The smells related to botany would be almost never-ending if we attempted to include every plant's smell. Indeed, one plant can and several smells depending on the stage in its life cycle, and the flower versus the leaves versus the roots versus the bark versus the fruit versus the seeds versus the sap, each different to change between flowering and fruiting, and each potentially offering information on a plant's identity, to preserve a written record of scents that are lost in the preservation process. A quick survey of the aforementioned herbarium records from the mid-to-late nineteenth-century demonstrates the variety of records that includes referenced to smell. For example, a record of Euchaetis longicornis (Williams' sage) has a note on its size and smell, followed by a note on the smell of Ceanothus (lilac) while another record of fresh redpad. Leaves smell strongly of Eucalyptus. Such information can be vital in correctly identifying plants, and is a loss that is rarely (if ever) considered when plants are dried and pressed for preserved.

As the above example shows, many plants have scents that are uncommon (often even to botanists) and consequently have to be described through similes. For example, with regards to the aforementioned redpad, saying that it smells of Eucalyptus requires knowing what that smell is like, and help anyone who was not already familiar with the plant, whereas saying it smells like redbud and eucalyptus is more likely to be understood. However, there are some smells that have been used in one way or another for their scent for millennia, and are comparatively very familiar. Rom spices, the cloves and cinnamon, have been used in one form or another for millennia (Dalby: 2000). In the nineteenth-century French perfumer G. M. Septimus Piesse published his work, The Art of Perfumery, in 1857. This book contained a number of recipes for perfumes and scents, and also a guide to which essential oils could be used in order to create a scent, many that would be equally well-known today as the instance of Eau de Cologne (the citrusy zesty fragrance which was originally created by the Italian perfumer Giovanni Maria Farina in 1709). Septimus notes that plants/scents have been used to represent a wide variety of people by over-complicating it by including all the animalists of Linnée's Bonfire, such as 'violetthe, hyacyn, anise, juniper, rosemary, lavender, fennel, cumin, cardamom, nutmeg, coriander, angelica, cloves, lavendar, camphor, balm, peppermint, galanga, lemon thyme, &c. &c. &c.' (Piesse: 1857). John Lindley (1799-1865) published several tents on botany and the ways in which it could be used, including specific best Septimus is referring to (if he is at all), but the point here is that Septimus is satirizing the complicated and incomprehensible that botany is claiming to have created by reducing botanical terms – less a crisis, it seems, when it comes to aromatics.

While humans regularly derive scents from plants and flowers for their own use in perfumes, the scents emitted from plants are not for our benefit. While many plants emit smells that are intended to attract pollinators and are also pleasant to human noses, some pollinators (insects) plants emit smells that are intended to attract their prey, and these are usually perceived as unpleasant to human noses. From at least the eighteenth century, scientists began to publish on the connection between the smells and insect attraction, as with the example of the Arum Maculatum that Linnaeus gives in his Supplementum Plantarum (Arum Maculatum Species description):

The flower has the smell of carrion; by which the flies are invited to lay their eggs in the chamber of the flower, but in vain endeavour to escape, being prevented by the hairs pointing inwards and thus perish in the flower, whence its name of fly-water (Darwin: 1793).

Darwin also reflected on how the 'odoriferous essential oils of several flowers' seem to protect them from 'the depredations of insects' (Darwin: 1793). While this is true to some instances, it is more often the case that the smell flowers emit is intended to entice insects to them in order to pollinate them.

PLACES

'Herbarium' is also, confusingly, the term given to the storage facilities of herbarium records. For botanists, such places are crucial and perhaps just as informative as studying plants in the wild.

Dr William Willison, head of Kew's Tropical America team, describes the herbarium at Kew Gardens as 'Now to coding wooden cupboards, boxes and bundles of specimens arranged in newspaper from the four corners of the globe, and the elusive odour of innumerable exotic dried plants.'(which gives the sensation of smelling kaka in new Zealand, ibid.). Millions commence every year the reality of preserved plants as opposed to their living counterparts – the scent of these plants is elusive and has to be carefully preserved in order to be studied, and the smell of the newspaper packaging is strong enough to pin-point back into the past. Similarly, in a blog post for the Royal Botanical Gardens of Edinburgh, Alan Elder commented on 'the comforting smell of dusty old plant specimens' to be found upon entering an herbarium (2016). Adjusting to the smell of the herbarium being not that of plants, but of the materials used to preserve them.

Therefore, the smell of an herbarium is informed by the plants kept in them, but perhaps not in the way we would expect. The odour of the plants themselves is elusive and overpower we are left with the smell of the mummified 'dusty' plants, and the accompanying materials necessary for preserving and storing them – paper and newspaper, wooden cupboards and boxes, and bundles of string.

Aside from herbaria, the other obvious places associated with botany are botanic gardens. Physic gardens have existed for millennia, as a means of studying medicinally significant plants. However over time, the desire to study all plants (not only those with known medicinal properties) slowly developed into the variety of botanic and consequently botanic gardens that proliferated throughout the modern period. Aside from their use to botanists, botanic gardens are usually open to the public. A survey of Tripadvisor reviews for various botanic gardens from around the world reveals how often scent factors into the enjoyment of these spaces – the difference being that for the by visitor, it is the overall scent of the place, not the smell of a specific plant. For example, of the Botanic Gardens of Adelaide, one of the particular plants (in the area that is featured is perhaps some kind of lilac). Botanic gardens strive to cultivate and curate collections of plants from all over the world in one space – the challenges of creating different climates have largely been mediated through improvements in various garden technologies, especially hothouses and conservatories – early examples of which can be seen in this early twentieth-century depiction of Oxford Botanic Garden (Harris: 1904). Modern day hothouses/ buildings to create varying levels of both humidity and warmth further create different smellscapes within the botanic garden – for example, a rainforest house another is cactus house or a arid house.

On the other hand, when we think of the outdoor places associated with botany, we're really thinking of any place in the world where plants can grow. There are examples of herbaceous borders in almost every farm and flora of different parts of the world, but some are perhaps more diverse than others, like South Africa.

The whole country affords a fine field for botany, being smeathed with the greatest number of flowers I ever saw, of exquisite beauty and fragrance (Mason: 1776).

Additionally, many plants can only be truly understood if studied in their natural climate, with the right environmental factors at hand. For example, the Cape Fynbos of South Africa and Cloudiness are indeed all key but warm to grow in, and perhaps unique in their fragrance (Thomas: 1960).

Another example is that of the plant that Erasmus Darwin refers to as 'Nyctanthes, or Arabian Jasmine', whose flowers give out a most delicate perfume during the night, and not in the day, but this happens specifically in the native country. Darwin observes that 'Indian travellers have not yet explained this wonderful property; but perhaps the plant sleeps during the day as some animals do; and its odoriferous glands only emit their fragrance during the expansion of the pelals, that is, during its waking hours (Darwin: 1793).

PRACTICES

Whilst sight has always been essential in identifying plants, olfaction is sometimes not enough to distinguish between different plants that look similar. Aside from this, knowing what a plant looks like is one thing, but is understanded its potential benefits (or dangers) appealed using the other senses are often also necessary.

For example, the system for categorizing plants designed by Carl Linnaeus, the 'father' of modern botany, entailed eight things that were necessary to determine in a plant's description. Richard Pulteney translated it into English in 1805:

The method pursued in Linnaeus's Materia Medica(1) is as follows, viz.

1. His own specific character of the plant.
2. Bauhin's synonym, or of the plant was unknown to that author, the synonym of the first discoverer.
3. The country where the plant is produced. In the same line is expressed, by a single epithet, whether it be a back, shrub, or tree whether it be annual, biennial, or perennial also, whether it be indigenous, or, if not, whether it thrive well by common cultivation in gardens, or require defence from the cold of the winter in Sweden, or whether it will endure that climate.
4. The Swedish vernacular name plant is in use, or what preparation of it, if any, and the doses of them.
5. The sensible quality of the plant, whether bitter, aromatic, acid, astringent, &c. whether fragrant, fœtid, or troublesome whether gaming, noxious, or mild. Its reputed qualities, whether innocent, well known, and approved, or whether to be cautiously used. Whether chiefly used in medicine, or for culinary purposes.
6. Its reputed effects on the human body, whether cathartic, emetic, diuretic, &c.
7. The diseases for which it is most frequently prescribed.

As can be seen, number five moves from the linguistic identification (largely based on visual identification) to the sensory of tentative qualities of a plant – namely smell and taste. Knowing this was vital in answering numbers six, seven, and eight – i.e. how it affects the body and, by extension, how this might be taken advantage of for medicinal reasons (when prescribed). This knowledge is consequently inextricable from knowledge of the plants' uses, benefits, and dangers.

In his translation and collation of Linnaeus' works, Pulteney explained that Linnaeus sought to outline the 'natural or artificial orders to be observed, and the sensible properties of plants which are to lignement in character and qualities. This includes the detailed rules' which are mostly directed, the author observes, to the sensible properties of plants, that is, to those properties of which our senses are animated – particularly those which are, or seem, to be of use to the human kind. (Pulteney: 1805: 185). There is a little bit of horticultural information wrapped up in this – to get the desired aromatic quality from these plants, they must be grown somewhere dry. This also demonstrates that this whole group of plants were primarily valued for their smell.

Aside from using smell to identify a plant whose qualities were already widely known, some were still relatively understanded. For example, Erasmus Darwin refers to the 'Mysie Sae', meaning that he understands a particular plant to match to this name, but he also notes 'its agreeable aromatic smell, which is preserved in the dry state, and communicates it to the tea, which it improves' (Darwin: 1793). Therefore, the smell of a plant could sometimes indicate (rightly or wrongly) that a plant might have a hitherto-unrecognized medicinal potential.

Smell could also be employed by botanists as a means of gauging whether something might be safe to eat although its unknown how reliable a system this was/is. For example, in 1776 John Hope from the Edinburgh Botanic Garden reported to the Royal Society on some seeds he'd managed to get hold of that were purportedly mulberry. He was generally somewhat sceptical on this, since other seeds could easily be substituted or otherwise smuggled. However, he was pleased to report that the plants that grew from the seeds did indeed smell like mulberry, and he concluded that, since no ill effects had yet arisen, 'there gave him the confidence to taste it, doing so, he is critically thinking that it smelled and nourished, but 'even discovered exactly the taste of the best foreign mulberi' (Hope: 1776).

Erasmus Darwin wrote of the Glycine over whether fung should be classified as animals or vegetables (i.e. plants). This confusion stems from the fact that despite being plants in most senses, they have an 'animal' smell and tests when burnt and when they rot (Cinnamon) that the Phallus impudicus has gained the name of stink-horn (Darwin: 1793). This is an interesting glimpse into how the subjectivity of smell could aid least botanists astray, and how, perhaps, the whole structures of nomenclature is broken up far more fragile than we like to think.

Finally, thinking about exactly how to smell a plant can vary too. Sometimes, for example, the plant's scent needs to be released by rubbing or scratching a leaf. And in other ways, being able to recall what the scent actually is might, at times, elude even a trained botanist, as in the case of Bradford Torrey in his 1894 account of the flora and fauna to be found in Florida:

'Here was a pretty shrub. Perhaps I could tell what it was by crushing and smelling a leaf? No; it was something familiar, I settled, and looked hooks, and after all he had to tell me its name—sassafras' (Torrey: 1894).

In an 1862 issue of The Atlantic Monthly, the American botanist Henry David Thoreau recalled his reaction upon first finding a rare orchid species: 'I was touched it and smelled it, and scented a lingering corpse of flowers for (his) herbarium' (Thoreau: 1862).

By 'scented' we can assume he means he put the corpsh of flowers either to a press or between the pages of a book (which over-yield use as a makeshift press). The process of the mummification of transition between a living specimen and a preserved specimen. The smell present initially will be dissipated as the moisture is pressed out of it, leaving a specimen that will not rot (unless it gets wet).

Indeed, herbarium samples can appear in stark contrast with their living counterparts, as the scent surrounding them quickly becomes that of the apparatus for preserving and mounting them (paper, glue, wood etc). Looking again to The Atlantic Monthly, this time in 1861, an easy estimate' The Utility and Futility of Aphrodisiac written by William Rossiter Notes that 'Many plants are sought for their fragrance, but even discovered exactly the taste of the best foreign mulberi (Hope 1776).

'It is beyond the reach of some authors to do justice to the sweetness of the fragrance of the flowers, and yet, perhaps, it is not a matter of much importance, since the fragrance of the flowers is not the first quality of an aphrodisiac. The emphasis here (initially from a writer rather than a botanist) is that herbaria contain the petrifications of plants rather than the real thing. Consequently, it is important to remember that it is living plants that are full of bloom and fragrance; opening up herbarium which has been carefully arranged and preserved, and which has been mummified in newspaper, and expecting to find the same smell as one intended, dusty and crumbling to the touch. Similarly, another author quoted in the same issue of the Atlantic Continental Monthly described an herbarium as 'rather faded and seedy', again emphasizing the dusty and somewhat sorrow-ridden reality that these plants are not truly preserved, and herbaria are only places to keep their corpses (Wolcott: 1862).

FEELINGS AND NOSES

In 1740 Dr Lawrence Gardn submitted a report to the Royal Society (via Dr Hans Sloane) on the cypress tree, Cupressus sempervirens, and its supposed medicinal properties. Gardn's report, which included an excellent example of how smell could serve as a useful tool to botanists in identifying plants, Gardn notes that the ancients, like Theophrastus, Dioscorides, and Pliny all wrote with esteem of the Cypress (sic) and noted how highly it was valued, largely for its 'fine smell'. Gardn, however, found that in the countries where they grow naturally, as in Egypt, Syria, Arabia, Persia &c' (Gardn: 1740). It was biblical significance, having been mentioned in the Song of Solomon twice, and Gardn notes, it was used by perfumers in old times' to make a precious ointment of that was used for various things, but mainly for anointing people to give them 'a grateful odour' (Gardn: 1740). Furthermore, he records that Reverend observes that people from countries where it grows 'cultivate this Plant with Care, and even keep it in Pots, on account of the Smell of the Flowers, which they esteem very delicate. They keep these Pots in Women's Chambers or Closets to preserve the Plants from Cold' (Gardn: 1740).

The distinctive smell, which is intrinsically associated with the plant and means that Gardn is able to say that other botanists have gotten it wrong in misattributing the name to plants that do not smell a scent linked with all cypress plants has this distinctive scent, which he says that those that grow in 'Malabar' (an area in southwest India) and other countries where it rains a lot, have an even stronger scent as a result of the rain, as opposed to dryer countries in Persia and Arabia (Gardn: 1740). Gardn relies on the knowledge of indigenous communities, who refer to the plant as 'Kanna', by examining a cypress tree in Hyde Park in Cameron, he is able to corroborate their claims and confirm that and the same. It is essentially on account of this fine smell of the flowers that he is able to confirm that this is in fact a cypress – right and language alone are not enough to identify a plant.

A similar example comes from the observations of the nineteenth-century Scottish botanist, Isaac Bayley Balfour (1853-1922). In 1874 he accompanied a scientific expedition to Socotra on the Mauritian island of Rodrigues and used this as an opportunity to do fieldwork and report on the local flora there. His account was published by the Royal Society in 1881 and gives an insight into how important smell can be in identifying some plants. In the instance of Considerantum tenuifolium, Balfour observes that it is difficult to dry and press, but that it has a very distinctive smell, and a disagreeable odour, which has occasioned its popular name (Balfour: 1881). He notes that those who are very settle and close-grained meaning it would be the best wood for carpenters to use, but they instead only use it burning due to the stench. Balfour is confident that this smell is what Lagut refers to when he writes of the 'nasty tree which 'stinks so, that it makes all the places about 'it smell of it, and the smell is very offensive.' While some people have (logically) noted the significance of this trait, Balfour (Fretella-machine, Lam.), the aptly named 'stinking wood', Balfour contends that while the odour from that tree is 'disagreeable to a degree, it is only apparent when the stems open it, making it 'evanescent', unlike the 'persistent odour' which the Bois cadet emits (Balfour: 1881). In this instance, Balfour uses his nose to differentiate between two species that look very similar, and he encourages his Mauritius by recognizing that one permanently smell, while the other only smell in the right weather conditions.

The smells to be found from studying plants are manifold, and so too are the feelings that they elicit. Several are greatly enjoyed and appreciated, with distillation and enfleurage being horticulture developed as a means of extracting and preserving the scents of flowers, so desirable are they, the perfume Piesse refers to the bucolic pleasure derived from smelling fragrant flowers, and this is a feeling shared by many (Piesse: 1857).

Sometimes the feelings of pleasure derived from smelling a plant is less about its specific scent, and more due to the indication of its significance in some other sense. For example, when John Hope wrote about trying to successfully grow the mulberi in Edinburgh Botanic Garden, he referred to the 'fine smell, colour and purgative qualities' of the plants that he had grown as being confirmation that he'd succeeded [ibid.]. Hope thought of the smell as a sign of success, and the significance of this trait 'has reasonably entertain the agreeable expectations of his proving a very important acquisition to Britain' (Hope: 1776). Consequently, the smell related to botany are not only valued but significant in understanding plants and their uses.

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