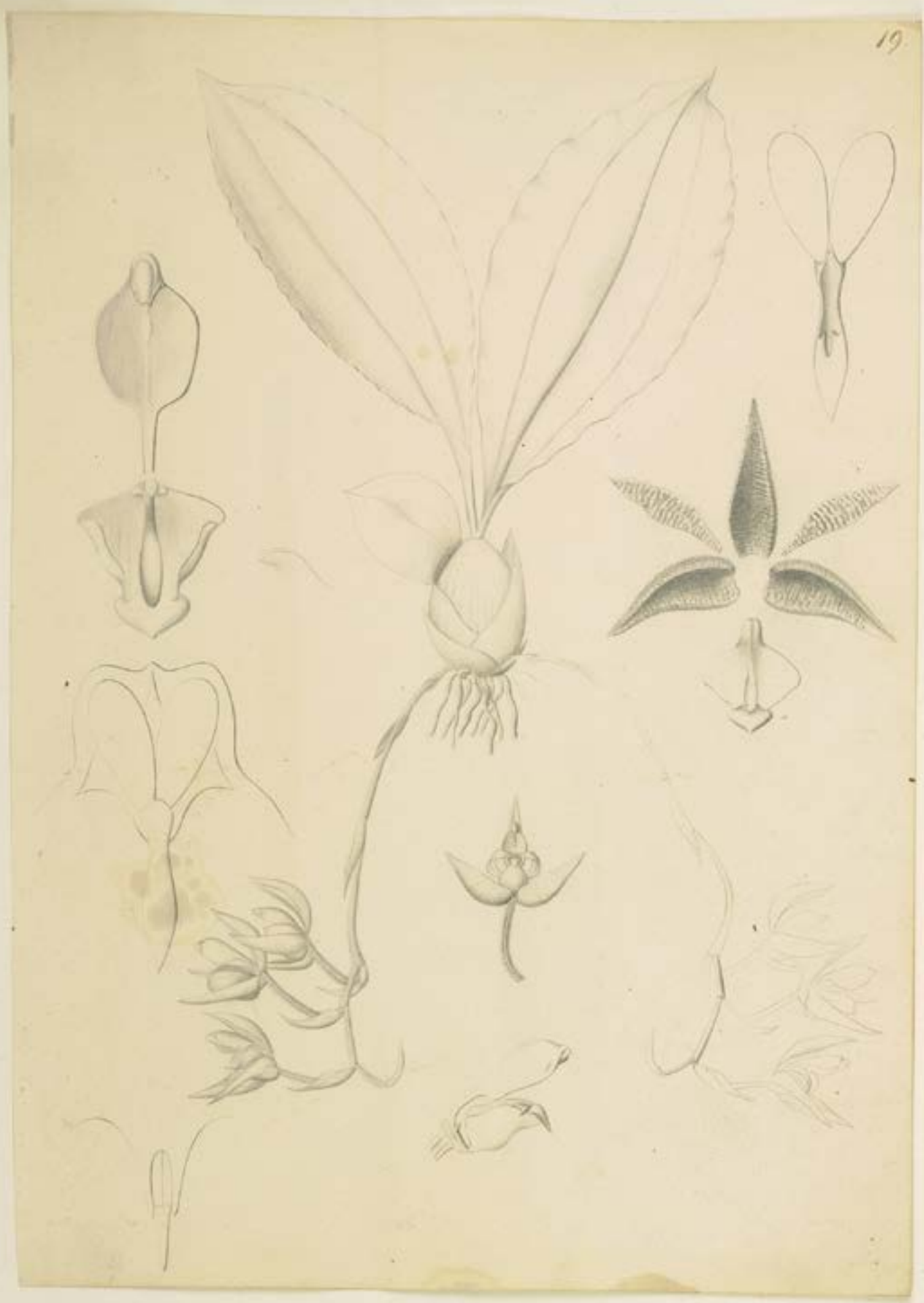


CHAPTER 4

Endrés as an illustrator

Franco Pupulin

According to the definition provided by Botanical Gardens Conservation International, "the main goal of botanical illustration is not art, but scientific accuracy". A botanical illustrator must portray a plant with enough precision and detail for it to be recognized and distinguished from another species, and the need for exactness is what fundamentally differentiates botanical illustration from more general flower painting. If, traditionally, the best botanical illustrators try to understand the structure of plants and to communicate that in an aesthetically pleasing manner, combining science and art, this was probably not the concern of Auguste R. Endrés when preparing his orchid illustrations in Costa Rica. He had, however, a remarkable artistic talent, and his activity was influenced by the great tradition of orchid painting. The results of his illustration work not only attain the highest levels of botanical accuracy, but set a new standard in orchid art and science.

As we will see, only because his masterful plates were lost among the forgotten materials of Reichenbach's venomous legacy, was Endrés' work prevented from having a major influence on the discipline of botanical illustration.

The golden age of botanical illustration in Europe

Beginning in the 17th century, and more frequently during the Enlightenment of the 18th Century, European artists and scientists undertook major projects for collecting and cataloguing nature in its amazing variety. 1613 saw the publication of the *Hortus Eystettensis*[1] (literally the Garden of Eichstätt), a landmark work in the history of botanical art and one of the greatest botanical sets ever created. Planned and begun at the close of the 16th century by the Prince-Bishop Martin von Schaumburg (1523–1590) to chronicle his garden at Willibaldsburg in Franconia, and enlarged by Johann Konrad Gemmingen (*ca.* 1561–1612), Prince-Bishop of Eichstätt, until his death in 1612, the catalogue was the largest and most magnificent florilegium ever made. It comprised a total of 367 copperplates, with 1,000 flowers representing 667 species. Entrusted to the Nuremberg apothecary Basilius (Basil) Besler (1561-1629), the work chronicles the garden through the four seasons. It has hundreds of mostly life-sized portrayals of shrubs and flowering plants, not only native

[1] Beseler, B. 1613. *Hortus Eystettensis, sive diligens at accurata omnium plamtarum, florum, stirpium, ex variis orbis terrae partibus, singulari studio collectarum, qaue in celeberrimis viridariis Arcem Episcopalem ibidem cingentibus hoc tempore conspiciuntur delineatio et ad vivum repraesentatio opera Basilii Besleri philiatri et pharmacopoei*. Nuremberg.

to Europe, but also exotic species from Asia, Africa and the Americas (FIG. 99–100). Even though *Hortus Eystettensis* is usually ascribed to Besler, it was the result of the work of a team of artists, among whom was a talented painter from a local family, Sebastian Schedel — a few of Schedel's drawings are still kept in the Royal Botanical Gardens at Kew. None of the other artists are known. Besler and his teams of artists and craftsmen worked on the *Hortus Eysttensis* for over sixteen years, both from dried specimens, and from previous illustrations. The original colour sketches were then passed to the workshop of Wolfgang Kilian (1581-1662) in Augsburg, where they were translated into black-and-white drawings, and the first copper plates engraved. Later on, the engraving process was moved to Nürnberg and given to a team of at least seven engravers[2]. The original copperplates were used to print a second edition in 1640 and a third one, dated 1713 but printed in parts until 1750; they were conserved at Eichstätt until around 1800 and disappeared after this date.

The popularity of florilegia like the *Hortus Eystettensis* grew from the 17th century onwards. The scientific interest in natural history and the aristocratic taste for plant collecting were stimulated by the discovery of exotic new species from hitherto unexplored regions of the globe. Before the end of the 17th century, more than forty different florilegia were published in Europe, including relations of travels, anatomical treatises, and plant monographs like Caspar Bauhin's *Pinax Theatri Botanici* (1623) and Robert Morison's *Plantarum Umbelliferum* (1672). Also, the first exotic, tropical orchid cultivated in Europe, *Brassavola nodosa*, was figured in seventeenth century florilegia: Leonard Plukenet depicted it in 1691 under the name of "*Viscum aboreum, Epidendron flore albo specioso Americanum, foliis forma siliquarum Nerii*" in his *Phytographia*[3], and Paul Hermann engraved the plant in his *Paradisus Batavus* (1698), where it received the name "*Epidendron Corassavicum folio crasso sulcato*"[4].

From woodcut to copper

The introduction of steel and copperplate engraving in the 17th century greatly enhanced the work of illustrators. The method involves cutting lines into the copper to hold the ink, rather than the raised surfaces in wood black printing. Shading is added by crosshatching the metal to achieve a greater sense of form and depth. During the seventeenth century, metal-engravings and wood-cuts existed side by side. Wood-engraving, however, gradually declined, and was to a large extent superseded by engraving on metal, which allowed a better dimensional illusion of the subject and its tonal qualities, and more accuracy in the delineation of details. The technical advances in printing processes, with the progressive eclipse of the traditional and often crude woodcut and its replacement by the copper engraving, were key elements in the new

[2] Barker, N. 1924. *Hortus Eystettensis*, The Bishop's Garden and Besler's Magnificent Book. New York, Harry N. Abrams.

[3] Leonard Plukenet. 1691. *Phytographia, sive stirpium illustriorum et minus cognitarum icones, tabulis aeneis summa diligentia elaboratae, quarum unaquaque titulis descriptoriis ex notis suis propriis et characteristicis desumtis insignita, ab aliis ejusdem sortis facile discriminantur.* London.

[4] Hermann, P. 1698. *Paradisus Batavus*. Leiden, Abraham Elzevier.

trend toward scientific honesty, opening an era of representational scientific illustration able to depict with clarity the findings of scientists and explorers.

In 1737 Johann Wilhelm Weinmann (1683-1741) began publishing his *Phytanthoza iconographia*, the first botanical book that applied so-called colour engraving, with 1,025 plates illustrating approximately 4,000 native and exotic flowers, fruits, and vegetables[5]. Through the plates of *Phytanthoza iconographia*, together with studies of domestic plants used in herbal remedies, Weinmann illustrated what to Europeans was the newly-discovered flora of the tropics. He worked with the famous botanical illustrator Georg Dionys Ehret (1708–1770) (FIG. 101), at that time still an apprentice, who painted the masters which were later put on copper by some of the most important engravers of the time. One of the finest plant illustrators of all time, Ehret, who was involved with the world's leading scientists, dominated the field of botanical illustration in the 18th century. With his friend and benefactor Christoph Jacob Trew, he produced two of the most beautiful botanical colour-plate works, *Plantae Selectae* (1750–1773) (FIG. 102) and *Hortus Nitidissimis* (1768–1786). Ehret also worked with Carolus Linnaeus and for some of the most distinguished patrons of gardening and art of his time, like the Dutch banker George Clifford, the royal physician Dr. Richard Mead (who commissioned him for drawings for *Transactions of the Royal Society*), Sir Hans Sloane, and Margaret Cavendish Bentinck, Duchess of Portland, among others.

In the first half of 18th century almost 50 new florilegia were published, and another 50 saw the light of day before the end of the century. The visual culture of science during the second half of the1700s was influenced by a profound change in scientists' approach to nature, which became more and more the result of direct knowledge of natural things observed on their own travels, often accompanied by skilled illustrators. Botanical illustration was no longer aimed solely at the simple naturalistic portrayal of living plants, but became a way of producing models and idealized images to communicate the typical features of species. Analyses of flowers, often greatly augmented, are a characteristic innovation of the botanical illustrations of the Enlightenment, when compared to the predominant models of previous centuries.

Improved microscopic techniques in the second half of the eighteenth century also allowed unprecedented views of plant details. This was made particularly evident by the work of Austrian microscopist and botanical artist Franz (later Francis) Andreas Bauer (1758-1840). He was the son of Lucas Bauer, court painter to the Prince of Liechtenstein, and brother of two other painters, Josef Anton and Ferdinand Bauer. While employed by Count Dietrichstein as a flower painter in Vienna, Franz illustrated works by the Baron Nikolaus Joseph von Jacquin and his son, with whom he moved to London. In 1790, recognizing his extraordinary talent, Sir Joseph Banks gave him a position as the first botanical illustrator at the Royal Botanic Gardens, Kew, where he remained for the rest of his life. At Kew, he tutored Queen Charlotte, Princess

[5] Weinmann, J. W. 1737-1745. *Phytanthoza iconographia, sive, Conspectus aliquot millium: tam indigenarum quam exoticarum, ex quatuor mundi partibus longâ annorum serie indefesoque studio*. Ratisbonae [Regensburg], Hieronymum Lentzium.

Elizabeth and William Hooker in the art of illustration, produced detailed paintings and drawings of flower dissections, often at microscopic level (FIG. 103–104), and hand-coloured the lithographic copies of his work[6]. His legacy is to be found in such splendid publications as *Delineations of Exotic Plants*[7], and in his collaboration with Lindley's *Illustrations of Orchidaceous Plants*[8].

Artists such as Pierre-Joseph Redouté (1759–1840) — frequently referred to as the greatest botanical illustrator in history — reached a fame and public recognition comparable to modern music stars. In 1825 Redouté became a Chevalier of the Légion d'honneur, the highest French recognition. His greatest works, *Les Liliacées*[9], with 486 watercolour masterpieces (FIG. 105) and *Les Roses*[10] , with 169 stunning watercolours, painted for Empress Joséphine and his other patroness, the Duchesse de Berry, are probably the most renowned flower paintings in history, even though they were printed in limited quantity. Few other flower books have endured so much popularity. Although not a botanist, Redouté gave to each painting an exceptional detail. In particular, his volumes on liliids went far beyond the Liliaceae family to include hundreds of other specimens that could not be well preserved by drying in herbaria The accuracy of the paintings provided reference for study and further cultivation of these plants throughout the 19th century.

The advent of lithography

Printing and botanical illustration techniques were revolutionized again in the 1800's with the birth of lithography. Invented in 1797 by Bavarian actor Alois Senfelder (1771–1834) (FIG. 106), and kept a secret until about 1818, lithographic printing is a planographic process based on the antipathy of water and grease. The images are drawn (etched) into a coating of wax or other oily substance covering a lithographic stone or metal 'plate'. When ink is applied to the 'plate' it is repelled by the wax and adheres only to the etched areas. The plate is then the medium to transfer the inked drawing to paper. Soon, in 1837, colour lithography, or chromolithography, was also developed, using separate stones and drawings for each colour. The advent of lithography in the early nineteenth century brought about a surge in the production of botanical books aimed at both scientific and popular audiences.

We have already discussed in the previous chapter the impact that the introduction of new, breathtaking species of flora from around the world had, first on the wealthy and then on the public at large, in the second half of 19th century. The lower costs of lithographic printing also opened the way to the popularization of journals and illustrated books on plants, which reached the highest peak of their quality and diffusion around this time. In a few years around the middle of the century glorious books on orchids appeared,

[6] Stewart, J. & W. T Stearn. 1993. *The Orchid Paintings of Franz Bauer*. The Herbert Press, London.

[7] Bauer, F. A. 1796 [-1797]-1803. *Delineations of Exotick Plants cultivated in the Royal Garden at Kew.... published by W.T.Aiton*. London, W. Bulmer & Co.

[8] Bauer, F. A. & J. Lindley. 1830. *Illustrations of Orchidaceous plants*. Part 1. London, J. Ridgway and Sons.

[9] Redouté, J. P. 1802–1816. *Les Liliacées*, 8 vols. Paris, chez l'auteur, au Palais National des Sciences et Arts, Imprimerie de D. Jaune.

[10] Redouté, J. P. 1817–1824. *Les Roses*, 3 vols. Paris, Imprimerie de F. Didot.

Figure 99. Title page of the first edition of *Hortus Eystettensis*, by Basilius Beseler, published in Nuremberg in 1613.

Figure 100. Lilium byzantinum flore multiplici and Lilium album, from Beseler's *Hortus Eystettensis* (1613).

Figure 101. Georg Dionys Ehret, engraving by Johann-Jakob Haid after a portrait by Anton Heckell for Christoph Jacob Trew's *Plantae Selectae* (Nuremburg, 1750–1773).

Figure 102. George Dionys Ehret. *Selenicereus grandiflorus*, plate 31 from Christoph Jacob Trew, *Plantae selectae*, 1750.

Figure 103. Franz A. Bauer. *Cypripedium calceolus*, watercolour from "British Orchids" (1792–1817).

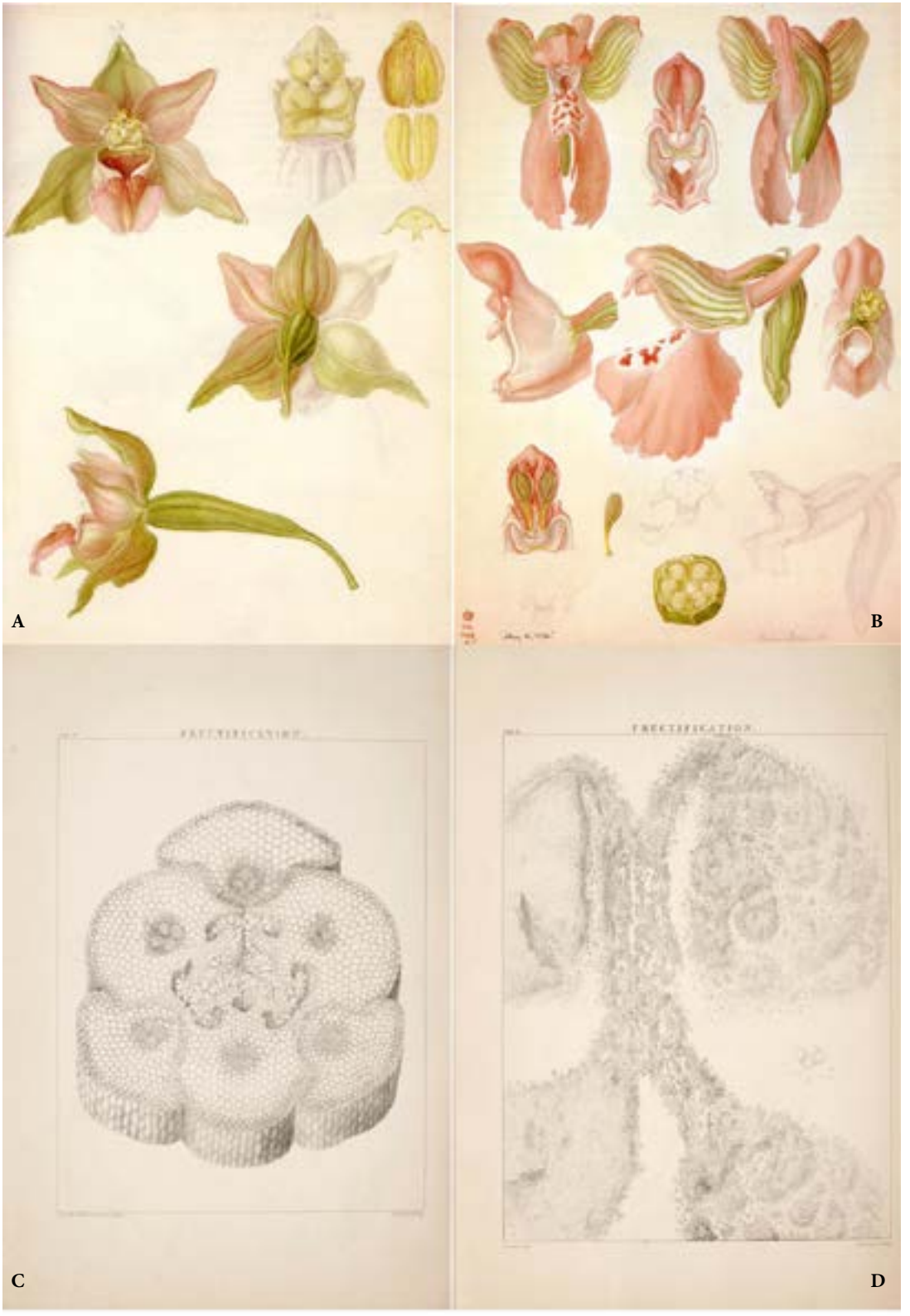


Figure 104. Orchid illustrations by Franz Andreas Bauer. A, B, from Lindley, 1830. C, D. From Bauer & Lindley, 1830.

Figure 105. Jean-Pierre Redouté. *Tigridia grandiflora*, as *Tigridia pavonia*, from *Les Liliacées*, 1802.

Figure 106. Alois Senefelder, the inventor of lithographic printing. Lithograph by Joseph F. Knappl. Library of Congress Prints and Photographs Division, Washington.

such as *The Orchidaceae of Mexico and Guatemala* by J. Bateman (1837–1843), Lindley's *Sertum Orchidaceum* (1838), *A century of orchidaceous plants* that W. J. Hooker selected from *Curtis's Botanical Magazine* (1849), followed by *A Second Century...* in 1867, P*axton's flower garden* (1850–1853), the *Hortus Lindenianus* by J. Linden (1859), and Robert Warner's *Select Orchidaceous Plants* (a series started in 1862).

In recognition of both the growing interest in horticulture throughout Europe and the extraordinary discoveries of the plant hunters worldwide, the 19th century also saw the birth of several botanical periodicals that aimed to document and illustrate, through splendid lithographs, the beauty of botanical treasures from around the globe. When he assumed the editorship of *Curtis's Botanical Magazine* in 1826, William Hooker brought to the journal the artist Walter Hood Fitch (1817–1892), who became the magazine's principal artist for forty years. He was succeeded by Matilda Smith, brought to the magazine by Joseph Dalton Hooker, who followed his father in becoming the Director of Kew Gardens and editor of its magazine. Smith drew over 2,300 plates for *Curtis's* in almost 45 years of service, and was made an associate of the Linnean Society — the second woman to have achieved this honorary position.

In 1815 Sydenham Edwards started the publication of *The Botanical Register*, which, under John Lindley's leadership, became the first botanical magazine mostly devoted to orchids, of which it depicted 440. The beautiful illustrations were prepared by Edwards himself, John Lindley (15 plates), M. Hart, Mrs. Augusta Withers (the artist to Queen Adelaide and the illustrator for Bateman's "Orchidaceae of Mexico and Guatemala"), and Miss E. Drake, who depicted 325 over sixteen years at the *Register*[11].

George Loddiges and George Cooke began publishing *The Botanical Cabinet* in 1818. Probably the first publication aimed solely at gardeners, it ran until 1833, with most of the plates drawn by Loddiges himself with others by his daughter Jane and his brother William, as well as Cooke's brother William and his son Edward. Joseph Paxton published his *Magazine of Botany and Register of Flowering Plants* between 1834 and 1849. From 1836 to 1842 Benjamin Maund published the celebrated periodical *The Botanist*, featuring several orchids *The Gardeners' Chronicle* was first published in 1841. Started by Joseph Paxton, Charles Wentworth Dilke, John Lindley and William Bradbury, it ran for over 150 years.

In Ghent, a team of taxonomists and growers founded, in 1845, *Flore des Serres et des Jardins de L'Europe,* which eventually published more than 2000 coloured plates. In 1854, Jean-Jules Linden began the publication of *Pescatorea: Iconographie des Orchidees*, issued in 12 monthly fascicles. It would be followed in 1891 by the gorgeous *Lindenia: Iconographie des Orchidées*, printed in seven folio volumes until 1897. Benjamin Samuel William's *Orchid Album*, also completed in 1897, in 11 volumes with 528 plates, was one of the most important periodic journals on orchids to be published during the nineteenth century. It was magnificently illustrated with coloured plates of the highest quality by John Nugent Fitch (1840-1927), the nephew of the equally-prolific botanical artist Walter Hood Fitch and a member of the greatest family of British 19th-century botanical artists.

[11] Cribb, P. 1991. Introduction. Pp. 9-13 *in*: S. Sprunger (ed.), Orchids from the *Botanical Register* 1815—1847. Vol. 1. The Illustrations. Basel-Boston-Berlin, Birkhäuser Verlag.

The years of Endrés' formation coincided with this golden age of plant and orchid illustration. It is not easy, however, to find among the great engravings of his time, a single author or style which may serve to explain the model employed by Endrés to illustrate his Costa Rican plants.

Scientific orchid illustration today

Contemporary botanical illustration, even when expertly done, is essentially focussed on capturing and somewhat "idealizing" the characteristic features of plant species. Modern floras are illustrated in such a way that black and white plates (which are less expensive to reproduce in print) convey to the reader every aspect of the depicted taxon, including not only the habit of the plant and the flowers, but any detail that can be useful in identifying it and telling it apart from closely related species. These critical details vary, of course, for the different taxonomic groups, and skillfull illustrators are trained to recognize and to emphasize them in their plant portraits. Looking at modern floristic and monographic treatments of orchids, one can easily appreciate — even within the limits of the artists' personal styles — a general and accepted "model" of illustration. Plates intended for taxonomic purposes, such as those printed in floras and monographs, are usually composite drawings in ink, showing the habit of the plants with enlarged, taxonomically relevant structures -- the flower or an enlarged section of the inflorescence (when flower organization is crucial), and several sections of the flower to uncover those details in reproductive organs that could lead to proper identification. The shades are mostly rendered in stippling (more rarely in the difficult-to-master cross hatching), a technique that simulates varying degrees of solidity or shading by using small dots. Stippling became popular in producing illustrations for publication, because they could be reproduced in simple black ink. In biological illustration in particular, stippling does not interfere visually with the structures being illustrated.

Among modern orchid illustrators, a special place is occupied by Galfrid Clement Keyworth "Stalky" Dunsterville (1905—1988), who over a 17 year period (1959—1976) illustrated the rich orchid flora of Venezuela in more than one thousand magnificent black-and-white plates[12] (FIG. 107). Dunsterville's work has served as the inspiration for three generations of botanists and illustrators, and his orchid plates are the model against which most of the illustrations intended for contemporary orchid floras are compared. The usefulness of having most of the orchids of a single country comparably illustrated, being able to see to which plant the name was applied, was immediately obvious, and something similar was envisioned for orchids of other regions. The detailed orchid drawings by Dunsterville were instrumental also in the birth of the long-running series of *Icones Plantarum Tropicarum*, which started in 1980 at the Marie Selby Botanical Gardens under the directorship of Calaway H. Dodson. It has continued since 1989 with the second series by the Missouri Botanical Garden, and

[12] Dunsterville, G.C.K. & L.A. Garay. 1959-1976. *Venezuelan Orchid Illustrated*, vol. 1-6. London, Andre Deutsch.

has prompted the development of other analogous series like *Icones Orchidacearum*[13], *Icones Orchidacearum Peruvianarum*[14], and *Icones Orchidacearum Brasilienses*[15]. The *Icones Plantarum Tropicarum* concept was the application of the idea that "a picture is worth a thousand words", and the simple realisation that much confusion in botanical taxonomy had resulted from confusing terminology and a shortage of illustrations[16]. It is interesting trying to understand where and when this particular model emerged and how it evolved to present day standards.

If we look back at the botanical treatises of eighteenth and early nineteenth centuries, we would find nothing similar to "modern" botanical illustrations. Several factors probably influenced the style of plant portraiture until the mid 19th century, the most important of which were technical difficulties relative to printing — which make detailed illustrations difficult to achieve and expensive to print — and to properly enlarging the subjects for a clear understanding of their diagnostic details. Even though it might seem strange today, emphasis on flower morphology is a relative recent trend in botany. It was made possible on the one hand only by the appearance of better instruments, and was made necessary on the other hand by the Linnean system of classification, based on the sexual system of flowers, which was imposed progressively from the end of eighteenth century. Furthermore, a finer view of critical plant features, enabling botanists to distinguish similar species from each other, was more and more important as the number of known plants continued to increase through the exploration of tropical floras.

Orchid illustration, at least until the seventeenth century, was largely schematic. In botanical diagnoses, a few words were often enough to convey the salient features of a new species and the critical differences between species of the same genus. Similarly, in botanical illustration, a view of the entire plant and the flowers was usually sufficient to distinguish between allied species. As the knowledge of orchid diversity increased, these schematic representations, both verbal and visual, simply became insufficient to describe the subtle differences that distinguish one species from another. The accuracy of illustration of plant details increased in parallel with the need for scientific precision in distinguishing between similar, but nevertheless distinct, organisms. In the tenth edition of his *Systema Naturae* for 1758-1759, Carl von Linné (FIG. 108) recognized 7,700 species of plants[17]. This is less than 2% of the present day estimate of around 400,000. It is therefore logical to assume that the actual tendency toward high accuracy would emerge only within the framework of a mature model of science, committed to revealing

[13] Hágsater, E. (ed.). 1990—2011. *Icones Orchidacearum*, vol. 1—13. Asociación Mexicana de Orquideología y Herbario AMO, México, D.F.

[14] Bennett Jr., D.E. & E.A. Christenson. 1993-2001. *Icones Orchidacearum Peruviarum*, pl. 001–800. A. Pastorelli de Bennett, Lima.

[15] Castro Neto, V.P. (ed.). 2001—2006. *Icones Orchidacearum Brasilienses*, vol. 1—2. Coordinadoria das Asociações Orquidofilas do Brasil, São Paulo.

[16] Dodson, C.H. 1996. Foreword to *Icones Plantarum Tropicarum* and *Icones Orchidacearum*, CD-ROM version (1st edition). San Francisco, Lightbinders, Inc.

[17] Linnné, C. 1758-1759. *Systema naturæ per regna tria naturæ, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Editio decima, reformata*. Stockholm, Salvius.

the complexity in life which began to be appreciated in its real diversity only in the 19th century. The use of exploded details to depict minute aspects of the subjects would largely improve the understanding of the accompanying texts. This also allowed the non-scientific audience to go some way in identifying species, and widened the interest in natural history and horticulture. Consistent use of this technique, however, only made its appearance during the nineteenth century, when the diffusion of optical instruments of good quality and reasonable price allowed a more general use of microscopy in natural sciences. In the second half of 19th century, the time was ripe for a new era in the field of botanical illustration, and Endrés was ready to accept the challenge.

Endrés' microscope

At the time of Endrés' work in Costa Rica, the microscope was already a refined, sophisticated and quite common instrument in scientific work (FIG. 109). In 1872, a few years after Endrés had drawn his first Costa Rican orchid, Ernst Abbe, then research director of the Zeiss Optical Works, wrote a mathematical formula called the "Abbe sine condition", which provided calculations that allowed for the maximum possible resolution in microscopes. Compound microscopes, which use a series of lenses to fix aberrations and achieve higher magnifications, were available from both European and North American makers, and their quality was in many cases comparable to that of contemporary instruments. Good grade microscopes, such as research microscopes, were, however, quite expensive tools, as is the case today. According to the catalogue of J. Zentmayer (based in Philadelphia) for 1879, his "American Centennial Binocular", a research grade instrument with 5 eyepieces, 3 objectives, achromatic condenser, stage micrometer, and camera lucida, was priced $765.00. A price list of Bausch & Lomb for 1875 gives the cost of the Professional model, equipped with three periscopic eye-pieces and four objectives, as $200.00. Simple microscopes, primarily used for dissection and for field work, were, however, much less expensive. A dissecting microscope basically consisted of a biconvex lens moved up and down by an adjustment screw which brought the object in sharp focus, while the light was focussed with the help of a concave mirror. Full objects could be seen under it. Good dissecting microscopes were usually made entirely of brass and consisted of a stout pillar (mounted on a circular base or, more commonly, on the same wooden box used to store the microscope) supporting a commodious stage with a recessed circular opening holding a glass disk; a plane mirror, frequently with an opaque white back for modified illumination; lenses, held by a socket in a jointed arm affixed to an upright bar. Focus was achieved through a rack and pinion gear mechanism that moved the stage up and down on the pillar. These microscopes were normally furnished with two or three single lenses, forming by combination a doublet (or triplet) giving amplifications from ten to twenty diameters (FIG. 110). If the lenses were of a high quality, the image quality produced by a simple dissecting microscope could be surprisingly good, although it was impossible to obtain very high levels of magnification. This is not, however, a mayor impediment for botanical work, where low magnifications are generally preferred in order to observe the entire flower. Well adapted for minute

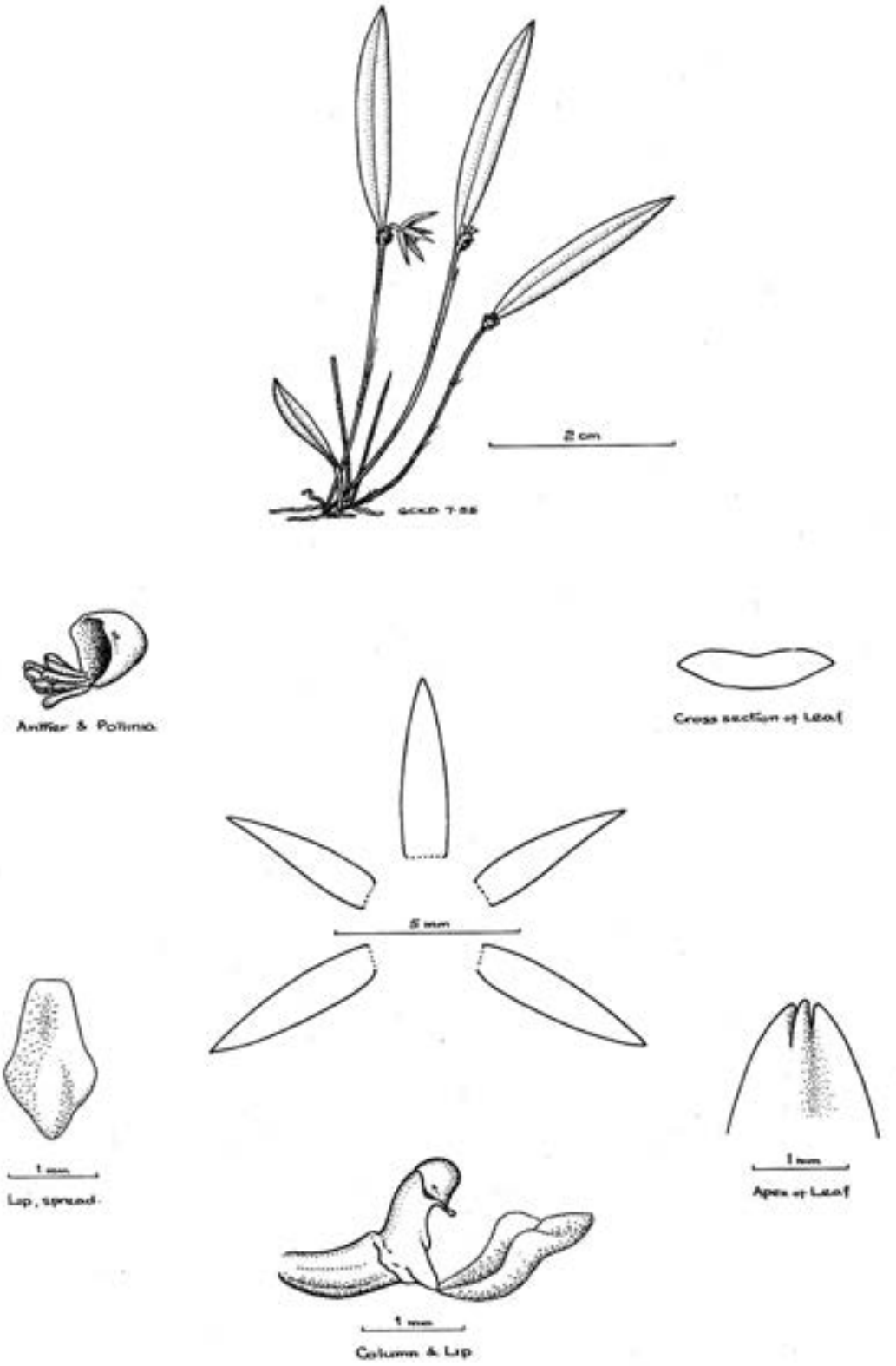


Figure 107. *Octomeria deltoglossa*, illustrated by G. C. K. Dunsterville for his series on the orchids of Venezuela (1969).

Figure 108. Carl von Linné (1707–1778), oil on canvas by Alexander Roslin (1718–1793). Swedish National Museum ("Nationalmuseum").

Figure 109. Some microscopes of Endrés' times. Clockwise, the original cheap student's microscope (1853), the binocular microscope made by Mr. Collins, Swift's dissecting microscope, Professor Queckett's dissecting microscope (with accessories), and the traveling microscope of Messrs Powell and Lealand. From L.S. Beale, 1880. *How to work with the microscope*. Philadelphia, Lindsay and Blakiston.

Figure 110. Botanical microscopes of Endrés' times. 1 – Dollond, London, ca. 1830. 2 – Deleuil simple microscope, Paris, 1835. 3 – A. Ross, London, 1850. 4 – Baker, dissecting simple microscope (with three magnification lenses), London, ca. 1860. 5 – J. W. Queen "Student's microscope", ca. 1870. 6 and 7 – J. Zentmeyer dissecting microscope, 1879.

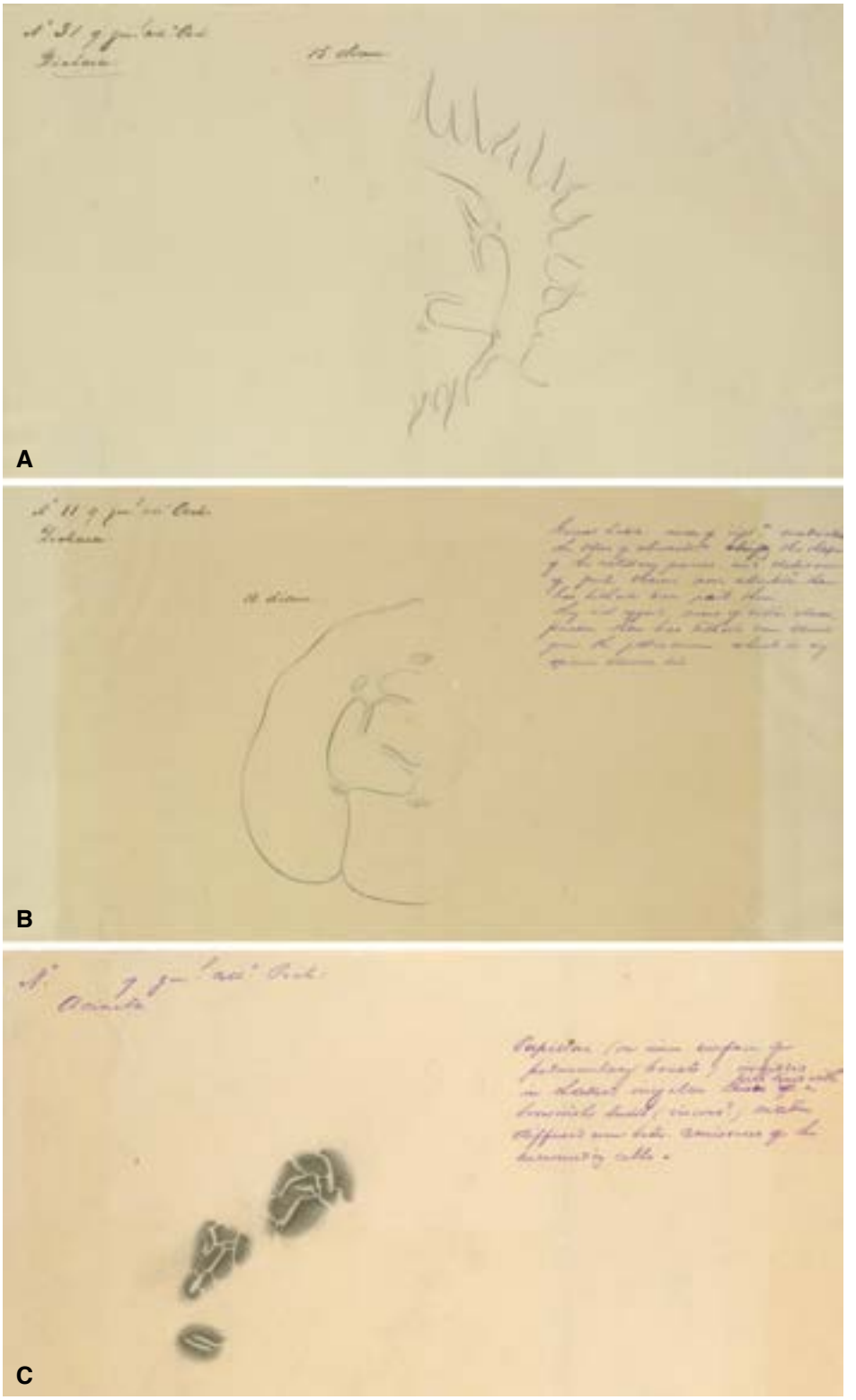


Figure 111. Microscopic drawings by Endrés. A – Section through the ovary of *Dichaea fragrantissima* subsp. *eburnea* (W0019171). B – Section through the ovary of *Dichaea trulla* (W0019172). C – Epidermal indumentum of the inflorescence bracts in *Acineta densa* (W0018986).

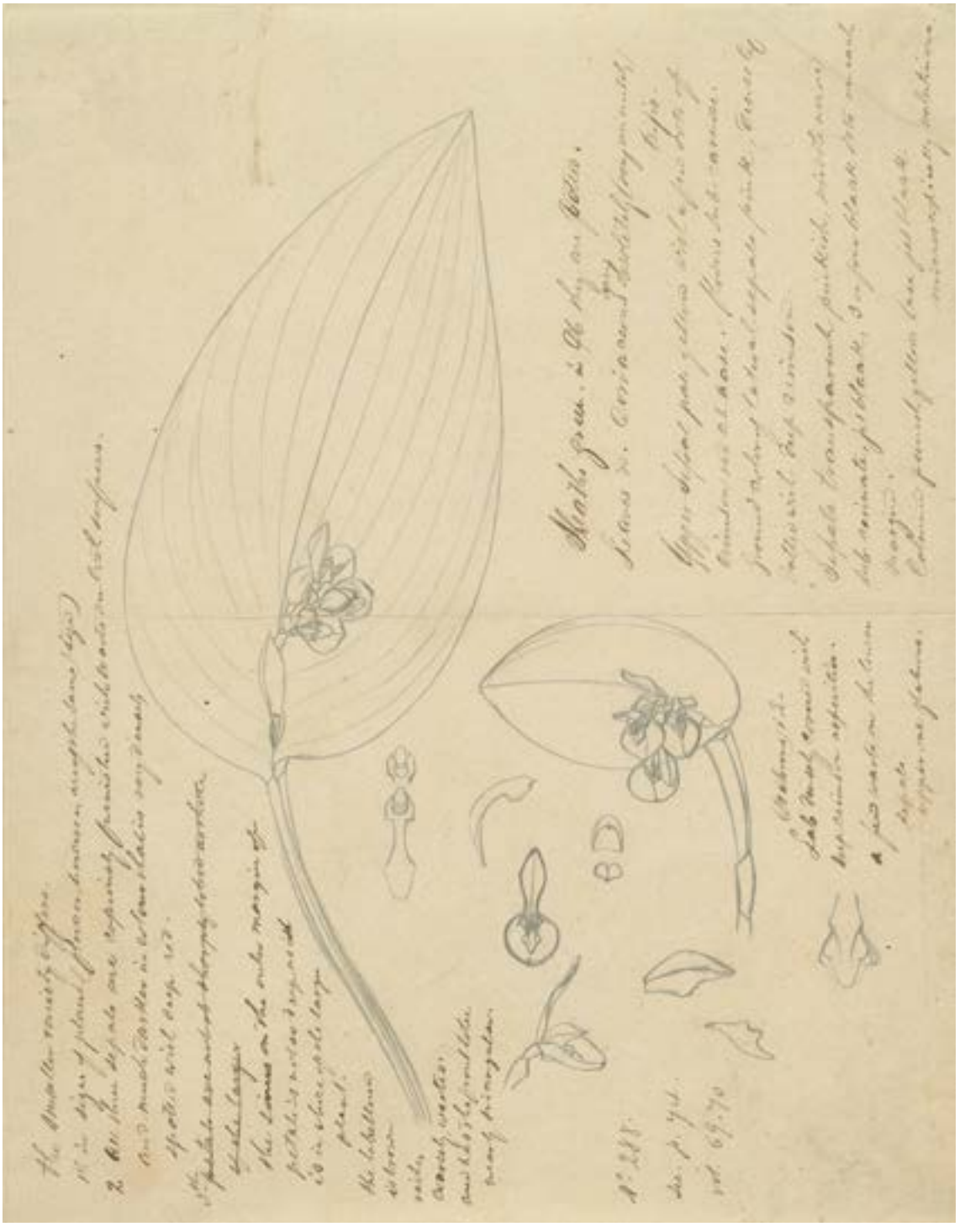


Figure 112. Endrés' preliminary sketch of *Acianthera cogniauxiana* (W0020248).

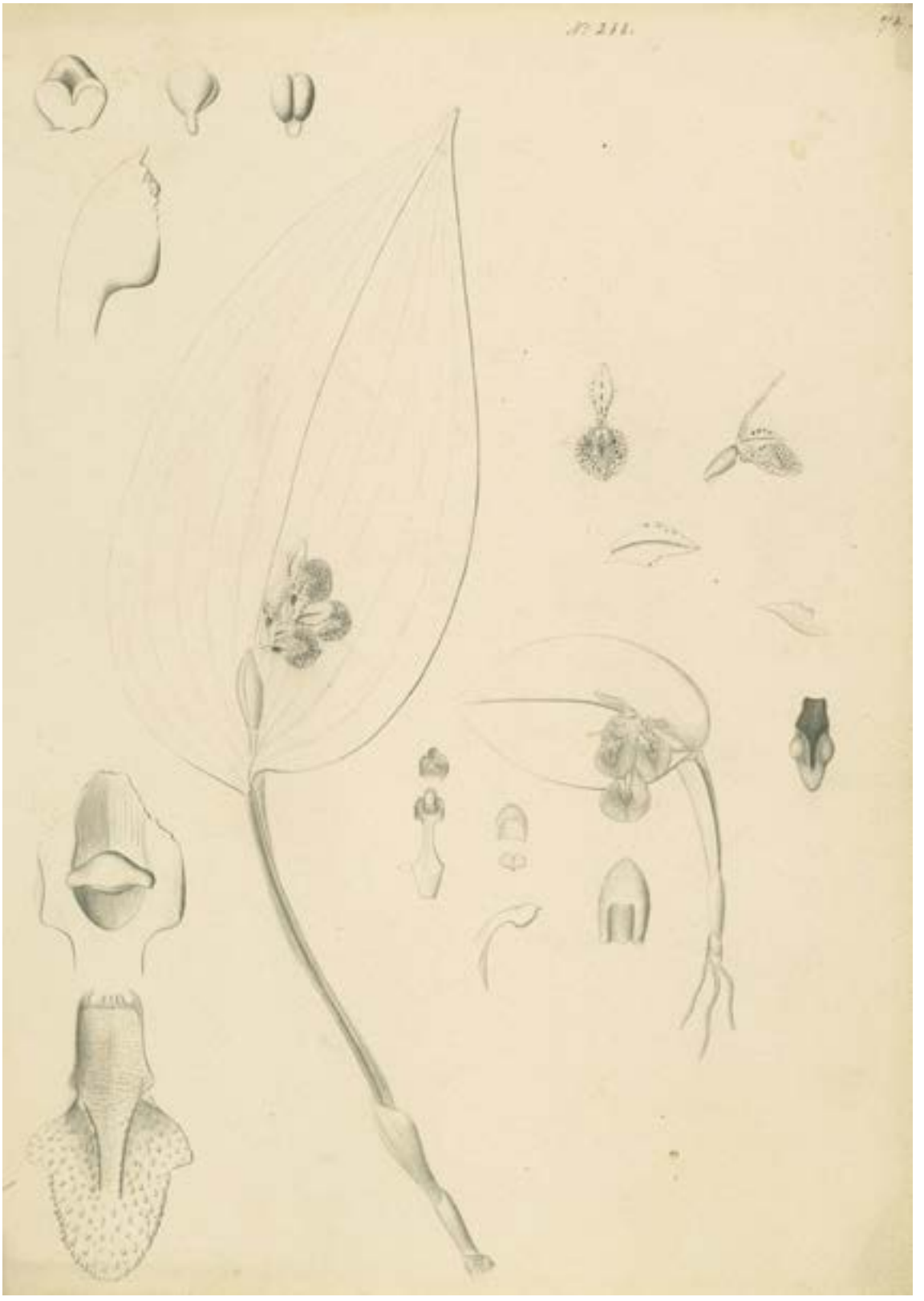


Figure 113. Endrés' fair copy illustration of *Acianthera cogniauxiana* (W0020253).

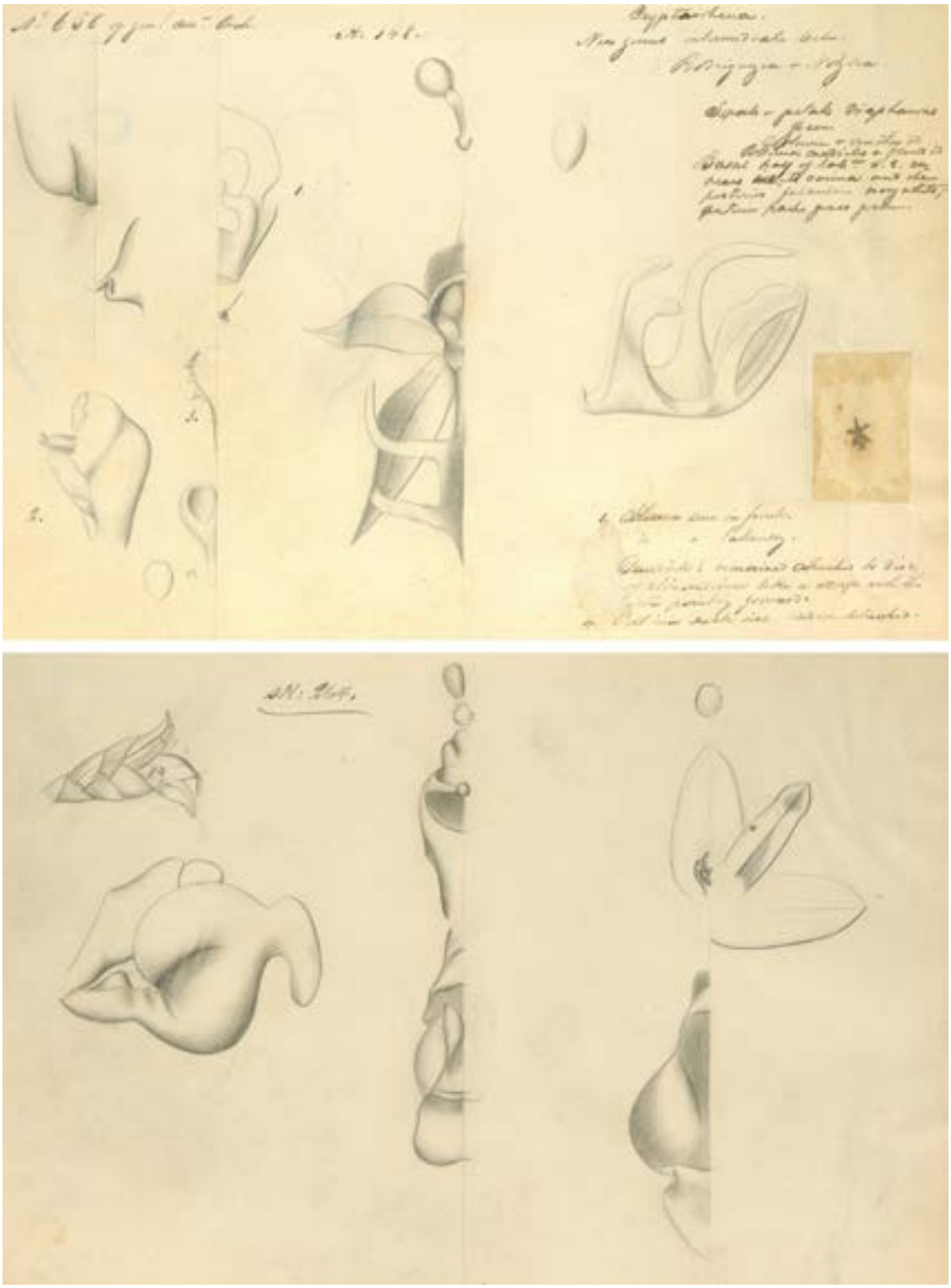


Figure 114. Examples of Endrés' use of "symmetrical drawing". A – *Cryptarrhena guatemalensis* (W0018848). B – *Camaridium* aff. *stenophyllum* (W0018637).

Figure 115. A – *Lycaste leucantha* drawn by Endrés (W0019548). B – *Lycaste plana* (as *L. macrophylla*) drawn by M. Drake, from *Edwards's Botanical Register* n.s. 29: plate 35. 1843. C – *Pleurothallis* (*Specklinia*) *picta* drawn by Endrés (W0020190). D – *Pleurothallis grobyi* drawn by M. Drake, from *Edwards's Botanical Register* 21: plate 1797. 1836.

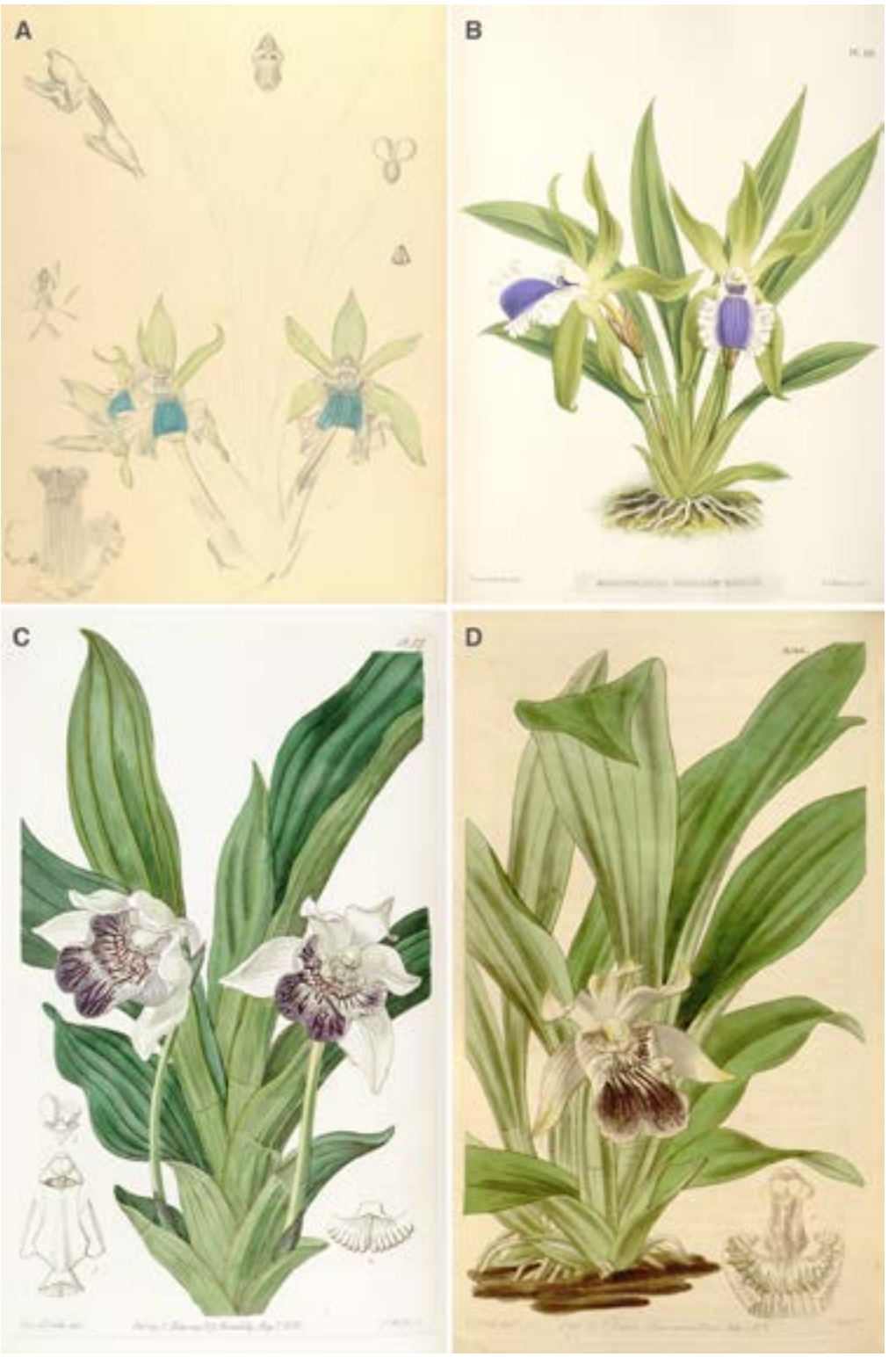


Figure 116. A – *Cochleanthes aromatica* drawn by Endrés (W0018823). B – The same species (as *Warscewiczella wendlandii*) drawn by J. N. Fitch, from the *Orchid Album*, plate 126. 1884. C – *Cochleanthes flabelliformis* (as *Zygopetalum cochleare*) drawn by S. Drake, from *Edwards's Botanical Register* 22: plate 1857. 1836. D – The same species (as *Zygopetalum cochleare*) drawn by W. H. Fitch, from *Curtis' Botanical Magazine* 64: pl. 3585. 1837.

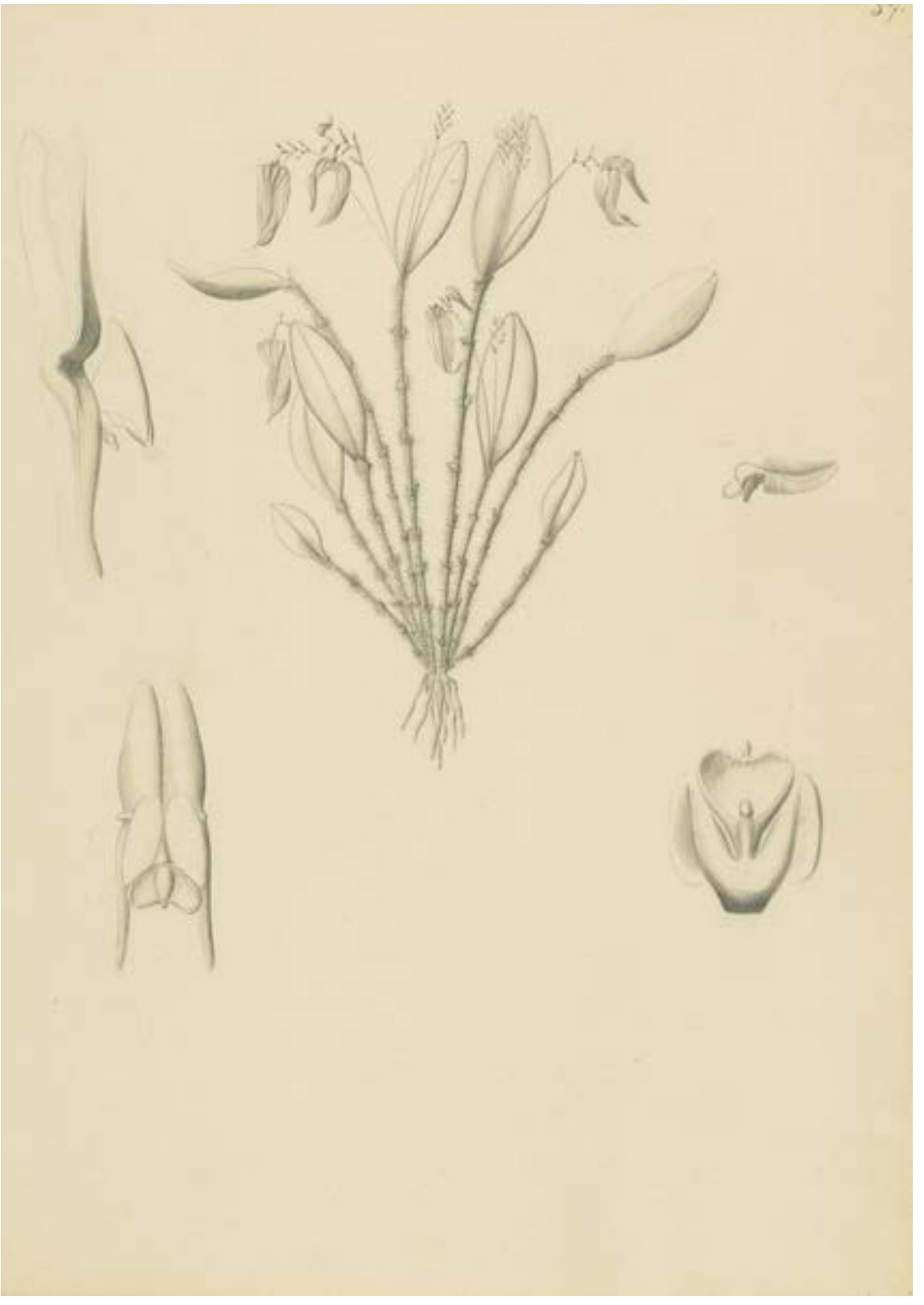


Figure 117. Endrés' illustration of *Lepanthes horrida* (W0019359).

Figure 118. Endrés' illustration of *Lepanthes* species. A – *L. candida* (W0019680). B – *L. helleri* (W0019364).

Figure 119. Endrés' illustration of *Lepanthes* species. A – *L. fimbriata* (W0019392). B – *Lepanthes* cf. *turrialbae* (W0019301).

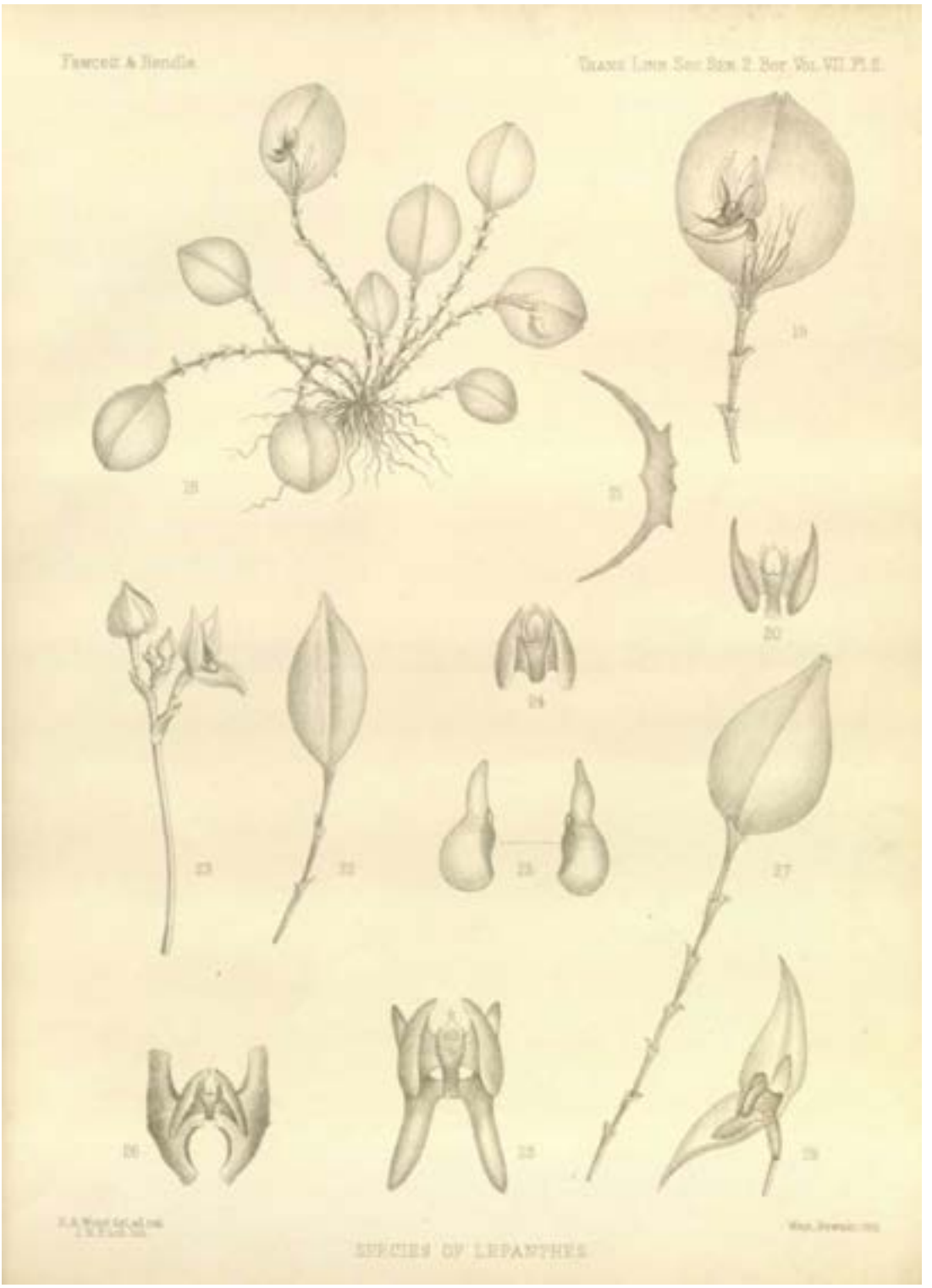
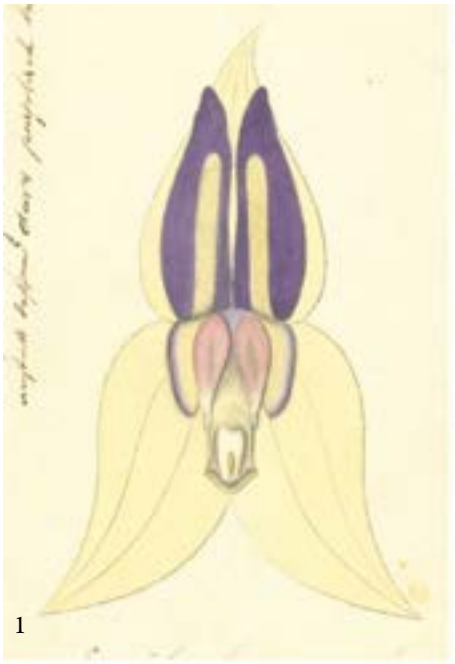


Figure 120. Species of *Lepanthes* from Jamaica, drawn by Miss H.A. Wood. Transactions of the Linean Society of London, 2nd series: Botany 7(1): t. 1. 1904.

●✦ Figure 121. Endrés; coloured sketches of *Lepanthes* flowers. 1 – *L. guardiana*. 2 – *L. horichii*. 3 – *L. excedens*. 4 – *L. mystax*. 5 – *L. erinacea*. 6 – *L. elegans*. 7 – *L. horrrida*. 8 – *L. deformis*. 9 – *L. edwardsii*.


1


2

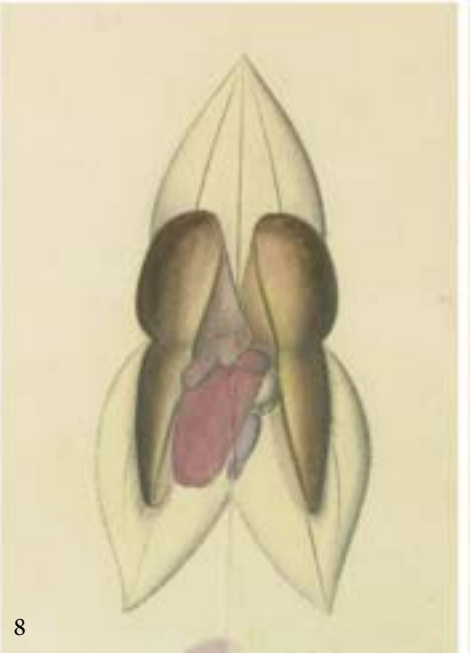

3


4

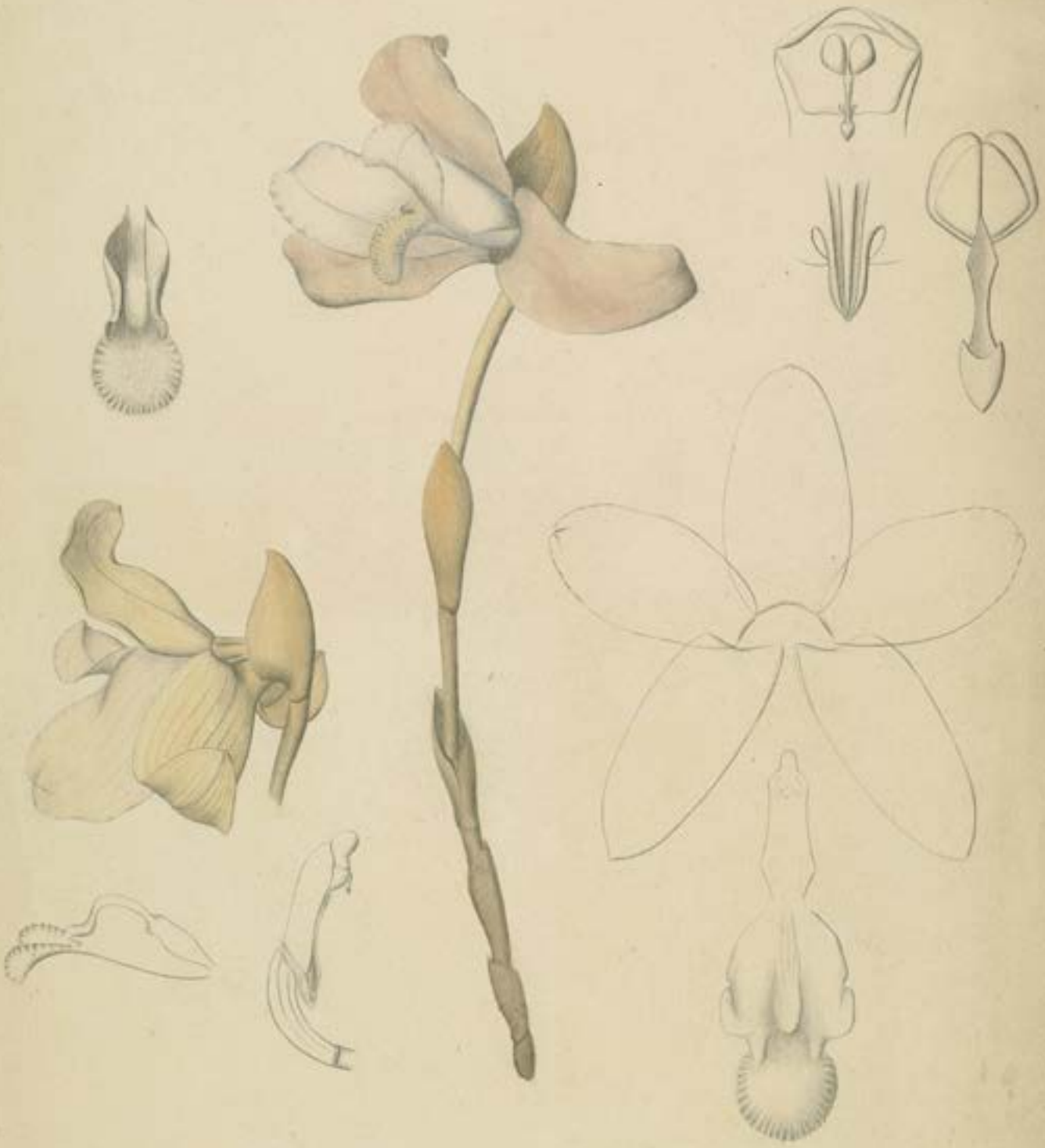

5


6


7


8


9



dissections, the simple dissecting microscopes, also known as "botanical microscopes", were in circulation from, at least, the mid eighteenth century. In Zentmayer's price list for 1879, they were quoted at $14.00 to $30.00.

Even the lowest price range for a microscope was not insignificant for Endrés' finances. According to the census of 1880, American people in the manufacturing labor force reported they earned $116 per year. The average male teacher at that time earned less than $72 a year; women educators like Endrés' sister earned just $54.50 annually[18], or the equivalent of a couple of mid-range botanical microscopes. Salaries were almost equivalent in Costa Rica, where, in 1880, general labourers were paid less than 1 peso (about half a dollar) a day[19].

As noted by Carlyle A. Luer, "for drawing, he utilized [...] a strong source of magnification. [...] He drew the flowers magnified in a front view, with additional views of the more magnified lip."[20] Among Endrés' drawings in Vienna, only a few make mention of the relative magnification at which they were drawn, and in these rare cases they were magnified "10 times" [e.g.. his *Lepanthes tabarciae* (= *excedens*) W 19352], or "10 diam" and "15 diam", as in the cross-sections through the ovary of *Dichaea* species (W 19172, W 19171, respectively) (FIG. 111). Considering the difficulty of clearly appreciating very minute details, like the appendix at the apex of a *Lepanthes* lip, at only 10× magnification (we currently draw them through the zoom of our stereoscopes set at 60×, which is sometimes just barely sufficient), I think Endrés used at least a doublet of 20×. Lenses capable of such a magnification are usually quite small in diameter, in the order of 5 millimeters, and require some skill to be properly used.

From a letter he wrote to his friend Captain Dow, we know that in December, 1870, four years after his arrival in Costa Rica, Endrés still did not have a microscope to hand.

> *"The small amount I forwarded to my sister has been peremptorily refused, under pretext of not needing it. Said sister is teacher of calligraphy in the public schools of Cincinnati and a younger one who will graduate in about a year shall follow her example. Moreover, two younger brothers have found employment and so they have jointly resolved to exempt me from all contributions at least for the duration of my travels. I have therefore written to my sister to employ part of those means in the purchase of a microscope and I am anxiously awaiting the arrival of this instrument"*[21].

Considering the time necessary for the purchase and the shipment of the microscope to Costa Rica, it is likely he didn't receive his desired instrument from Cincinnati until the second half of 1871. But, which kind of microscope did he get? Simple dissecting

[18] Williamson, S. H. 2011. Seven Ways to Compute the Relative Value of a U.S. Dollar Amount, 1774 to present. *MeasuringWorth*, March 2011; Derks, S. (ed.) 1999. *The Value of a dollar; prices & incomes in United States; 1860-1999*. Grey House Publ., Lakeville.

[19] Chacón Hidalgo, M. 2003. *Historia de la moneda de Costa Rica* (on-line). San José: Fundación Museos del Banco Central. Consulted on November, 2011.

[20] Luer, C. A. 1995. New species of Lepanthes (Orchidaceae) from Costa Rica. *Lindleyana* 10(3): 133-175.

[21] Letter from A. R. Endrés to Capt. J. M. Dow, San Ramón, December 19, 1870. Cornell University.

◆● Figure 122. Endrés' coloured illustration of *Lycaste leucantha* (W0019548).

microscopes did not only attain the relatively low range of magnifications required for botanical work, but were also affordable and, perhaps more importantly, they were easy to transport safely. Looking at Endrés' drawings of plants that are difficult to grow, like many miniature orchids only found in the windy and cool Costa Rican highlands, there is no doubt that he needed a solid instrument he could transport by mule on long trips, in order to do at least some illustrations in the field.

Endrés' own style

Let now us examine Endrés' drawing style more in detail. His illustrations are quite uniform in the parts of plants shown, as well in their arrangements. Plates usually include the following: the plant habit with flowers (normally more than one); an enlargement of the flower when small; a lateral view of the column and the attached lip; the lip in natural position or spread at a greater enlargement; enlargements of the petals; a ventral view of the gynostemium, most commonly with and without the anther cap and sometimes with added details (more often a closer view of the rostellum); strong enlargements of the pollinarium (in adaxial, abaxial, and, when possible, in lateral views) and the anther cap. Even when compared to contemporary work done with a top-class stereomicroscope and the aid of a drawing tube (a *camera lucida*), the precision and fidelity of the flower details drawn by Endrés are simply amazing.

With the exception of a few coloured illustrations, Endrés' drawings were only made with quite a hard pencil. In the first drafts, he usually just drew the contours of his subjects, often marking with stronger strokes the more important outlines, and sometimes providing faint indications of the shadows (FIG. 112). For these preliminary sketches, Endrés used several kinds of papers, mostly of low-quality, sometimes squared, and ranging in colour from grey to beige to pale blue. Taking advantage of the bilateral symmetry of orchid flowers, in several of his preparatory sketches Endrés only drew half of the flower and certain details, folding the paper along the hypothetical middle section, and completing the entire drawing only in the final, fair copy. From at least 1871, probably overwhelmed by the enormous amount of labour needed to accomplish his ilustrations, Endrés began introducing the "symmetrical drawing" also in the illustrations ready for the print (FIG. 113). As he drew with a hard pencil, some of the early sketches are very light and the thin strokes are sometimes slightly faded and difficult to capture with a scanner.

Shadows, to convey relief, were added in more advanced stages of the illustrations and completed only in the final plates, which he considered ready for engraving and marked as numbered sketches ("Sk") (FIG. 114). These were done on a paper of much better quality, stronger and smoother, with a very fine texture. Two main formats of paper were used, according to the size and arrangement of the subjects. Shading effects were done with the same hard pencil and the simple technique of smooth shading, achieved by just controlling the pencil pressure. Even though shades and highlights blend into each other smoothly, he apparently did not use a blending stick. Following the standard convention in botanical illustration[22], he provided the lighting from the upper left corner of the subject, with the

low and right areas and margins in shadow, facing away from the light source. Endrés' hand was very light and precise, and his drawings are never overshaded but have a distinctive and pleasant light rendering, even when the dark values of the final illustration reach almost the darkest black possible with the pencil.

As we saw in earlier paragraphs, this style of composite plate is perhaps the commonest in today's botanical illustration, but in order to understand the "modernity" of Endrés' drawings, we have to compare them side by side with the work of other great orchid painters contemporary with him. The illustrations made by Endrés are invariably richer in detail and, moreover, they conform to a general scheme that makes it easier to see the subtle differences between species when put side by side. Compare, for example, his illustrations of *Lycaste leucantha* (FIG. 115A) and *Pleurothallis* (*Specklinia*) *picta* (FIG. 115C) with those of *L. macrophylla* and *P. grobyi* painted three decades before my Miss S. Drake for the *Botanical Register* (FIG. 115B, 115D); or his *Cochleanthes aromatica* (FIG. 116A) with the illustration of the same species prepared by J. Nugent Fitch for the *Orchid Album* for 1884; or the plates of *C. flabelliformis* (FIG. 116B) published by Miss Drake and by Walter H. Fitch in 1836 and 1837 respectively (FIG. 116C–D). Endrés included several diagnostic details in his drawings rarely illustrated by other artists, which make the plates intended for his major work a perfect identification guide even for the modern botanist. But, without any doubt, it is in the large series of sketches, drawings and plates he devoted to the Pleurothallid orchids, and in particular to the species of the genus *Lepanthes*, where Endrés expressed his talents as the finest scientific orchid illustrator of his time. It is evident that Endrés was only marginally interested in the artistic side of his botanical work: his plates are intended for plant identification, and, for this purpose, they are as useful today as when he made them 150 years ago. Looking at the illustrations of any of the *Lepanthes* species he drew in Costa Rica (FIG. 117–119), they are fully comparable, in my opinion, to those painted in Jamaica by Miss H.A. Wood thirty years after to illustrate Fawcett and Rendle's account of the island's species of *Lepanthes*[23] (FIG. 120).

Endrés made only rarely use of the colour in his orchid drawings, and coloured sketches are uncommon among the plates conserved in Vienna. Apart from the rich series devoted to the genus *Lepanthes*, of which he painted almost 50 flowers (FIG. 121), Endrés left only a few coloured drawings, among which are *Barkeria lindleyana* var. *centerae*, *Cochleanthes aromatica*, *Coeliopsis hiacynthosma*, *Cyrtochiloides panduriformis*, *Epidendrum laucheanum*, *Lycaste dowiana*, the beautiful illustration of *Lycaste leucantha* (FIG. 122), *Oncidium cariniferum*, *Oncidium obryzatoides*, *Oncidium stenoglossum*, *Restrepiopsis reichenbachiana*, *Sigmatostalix integrilabris*, *Sobralia pendula*, *Ticoglossum krameri*, *Trichocentrum pfavii*, and *Zootrophion endresianum*.

While in most of cases the pigments seem to be watercolours or a very diluted tempera,

[22] "To shade a drawing properly, a specimen should be placed in a light coming from the upper left and at an angle of about 45°." Ridgway, J. L. 1930. *Scientific illustration*. Stanford Universtiy Press. See also: Hodges, E. R. S. (ed.). 2003. *Guild of Natural Science Illustrators (U.S.)*. 2nd edition. Hoboken, John Wiley.

[23] Fawcett, W. & A. B. Rendle. 1904. An Account of the Jamaican species of *Lepanthes*. *Transactions of the Linean Society of London*, 2nd series: Botany 7(1): 1–13.

with which Endrés was able to obtain particularly uniform surfaces, for some finer details or for bold colours he used a rather dense tempera with a matte effect. Shading was mostly obtained by painting a delicate layer of colour over the shadows previously made in pencil; in some cases, however, Endrés also obtained a three-dimensional effect through the use of several layers of colour, using a classic watercolourist's technique.

It is worthy of note that he never painted the showiest orchids that he so accurately illustrated, like, for example, *Miltoniopsis warszewiczii*, *Rossioglossum schlieperianum* or *Trichopilia suavis*, and that, with the exception of *Lepanthes*, colours were mostly used just to emphasize some critical details or some parts of the flowers. It is clear that he thought of colour as a tool to improve the scientific accuracy of his illustrations, rather than as a way to represent his subjects artistically. As a matter of fact, there was no reason for painting them as many of the showiest orchids from Costa Rica had been previously illustrated in colour — and often with more attention to the esthetic than the botanical components — by other artists in the horticultural journals of the time. But, as we saw, Endrés was in Costa Rica to do something totally new.