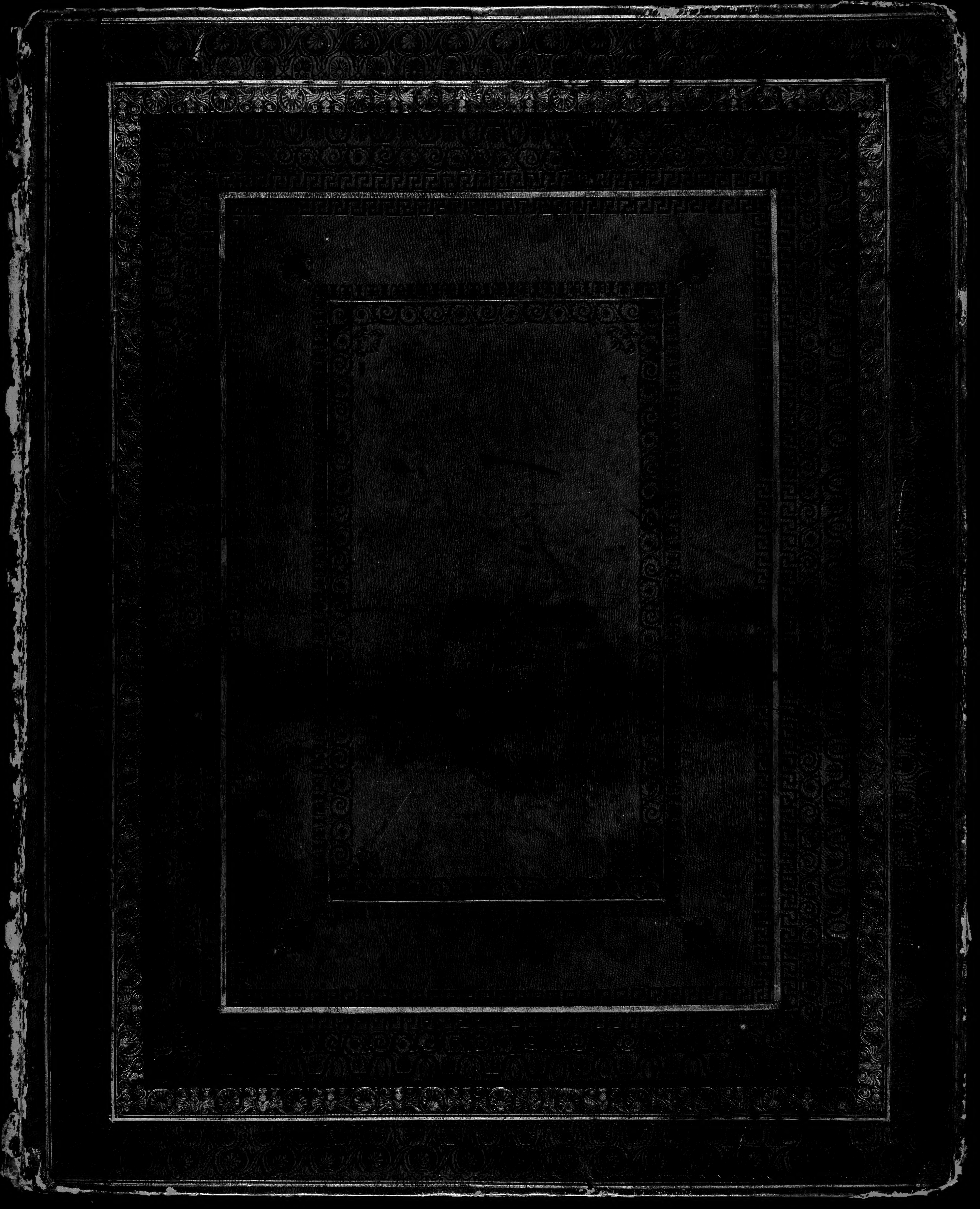
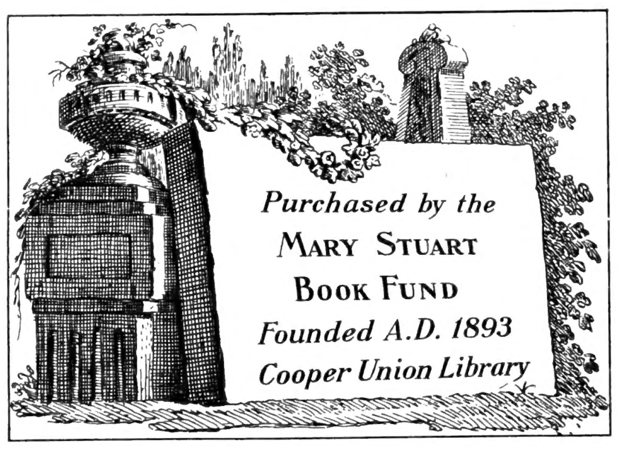




May 1923.

9

# A
# BRITISH
# TROPHY
# in
# HONOUR
# of
# Linnæus

Tomkins ſcr. Cooper ſculp.

ROBERT JOHN THORNTON, M.D.
Public Lecturer on Medical Botany.


Elmes, Archt. del.
W. Woolnoth sculp.

*Entrance into that most noble Public Charity and admirable Medical Establishment Guy's Hospital.*

*Ruſsell, R.A. Portrait painter to the King, pinx.*
*Bartolozzi, R.A. Engraver to the King, sculp.*

*London Published May 1.1799*

# NEW ILLUSTRATION
OF THE
# SEXUAL SYSTEM
OF
# Carolus Von Linnaeus:

COMPREHENDING

AN ELUCIDATION OF THE SEVERAL PARTS OF THE FRUCTIFICATION;

*A PRIZE DISSERTATION ON THE SEXES OF PLANTS;*

A FULL EXPLANATION OF THE CLASSES, AND ORDERS, OF THE SEXUAL SYSTEM;

AND THE

## Temple of Flora, or Garden of Nature,

BEING PICTURESQUE, BOTANICAL, COLOURED PLATES, OF SELECT PLANTS, ILLUSTRATIVE OF THE SAME, WITH DESCRIPTIONS.

> . . . . . . . . . . SHALL BRITONS, IN THE FIELD
> UNCONQUER'D STILL, THE BETTER LAUREL LOSE?—
> IN FINER ARTS AND PUBLIC WORKS SHALL THEY
> TO GALLIA YIELD? . . . . . . . . . . . . .
>
> THOMSON.

BY

**ROBERT JOHN THORNTON, M.D.**

MEMBER OF TRINITY COLLEGE, CAMBRIDGE;....ONE OF THE COUNCIL OF THE LONDON MEDICAL SOCIETY;....HONORARY MEMBER OF THE MEDICAL AND PHYSICAL SOCIETIES OF GUY'S HOSPITAL, OF BARTHOLOMEW'S HOSPITAL, AND OF THE LYCEUM MEDICUM LONDINENSE;....MEMBER OF SEVERAL LEARNED ACADEMIES AND SOCIETIES ABROAD;....LECTURER ON MEDICAL BOTANY TO THE UNITED HOSPITALS OF GUY AND ST. THOMAS;....LATE PHYSICIAN TO THE ST. MARY-LE-BONNE GENERAL DISPENSARY;.....AUTHOR OF THE PHILOSOPHY OF BOTANY;.....THE PHILOSOPHY OF MEDICINE;.....AND OF THE PHILOSOPHY OF POLITICS, &c.

LONDON:
PRINTED, FOR THE PUBLISHER, BY T. BENSLEY, BOLT COURT, FLEET STREET.
1807.

# DEDICATION.

MADAM!

In Eastern Language high and mighty Potentates are compared to lofty *Trees* which afford Food and Shade to the sun-burnt Traveller. In the more temperate Regions of the Earth, Kings and Princes are contemplated as the *Sun*, which sheds his benign Radiance every where, inspiring each Object with new Life and Refreshment: by the Concurrence, therefore, of all Nations, the great Attribute of Sovereignty is *Protection*; from conferring of which by Your Most Gracious Majesty, the Science of Botany in Great Britain chiefly owes its present Advancement; and this NEW ILLUSTRATION of the SEXUAL SYSTEM of the great LINNÆUS, its Foundation; which in Point of Magnificence is intended to exceed all other Works of a similar Nature on the Continent, and to be not only a National Honour, but an Eternal Memorial of that *Patronage* which is granted to Botany by Your Most Gracious Majesty. From the unbounded *Protection*, so liberally bestowed by an august King, and the best of Queens, all the uſeful and ornamental Sciences, with the pleasing Arts of Painting, and Engraving, have reached their pre-eminence; nor have the English Nation less reason now to be proud also of their superiority in Type and Paper.

Whilst the honourable Exertions of a great Nation have been lately concentrated to embellish and illustrate the Fancy of Poets, or Sacred and Historic Truth; the Science of Botany, advanced as it is by Linnæus, and subsequent authors, and by the glowing imaginations of modern Poets, who have improved on Ovidian Metamorphosis, seemed, likewise, to have a claim to enlist the fine Arts into her service.

In the humble hope, that this Work, which in its progress has received the smile of the munificent ALEXANDER, Emperor of Russia, will not be found altogether unworthy of your Majesty's countenance, and deeply impressed with the highest consideration of that Honour graciously conferred upon me by your Majesty's most generous *Patronage*,

I have the Honour to subscribe myself,

MADAM!

With the highest Gratitude, and profoundest Veneration,

Your Majesty's most obliged, devoted,

And dutiful Subject,

ROBERT JOHN THORNTON.

# PRELIMINARY
# OBSERVATIONS.

# PRELIMINARY OBSERVATIONS.

FLOWERS, although apparently so diversified, consist but of *five* PARTS:

I. The PISTILLUM, in the centre,[a]
II. The STAMEN, exterior to this.[b]
Both *projecting* bodies, being extensions according to Linnæus, the first of the *pith*, and the other of the *wood*.

The PISTILLUM is discriminated by a *swollen base*, which is the seed-vessel, or GERMEN, which being opened discloses the seeds. The STAMEN is discriminated by having a *part* which forms *the pollen*, or *coloured farina*, called an ANTHER by botanists.

A *perfect* PISTILLUM is composed of *three Parts*.[c]

1. The STIGMA, at top, rarely absent, though sometimes obscure.[d]
2. The STYLE, elevating the Stigma, not absolutely essential.[e]
3. The GERMEN, or *seed-vessel*, always present.[f]

A *perfect* STAMEN is composed of *two Parts*:

1. The ANTHER, at top, containing the *fertilizing pollen*, always present.
2. The FILAMENT, elevating the *anther*, not so essential, being absent in some flowers.[g]

For the protection and nourishment of the SEXUAL ORGANS of vegetables, (viz. the Pistilla and Stamina) Nature has furnished *two other Parts*.

III. The COROLLA, interior,
IV. The CALYX, exterior.[h]
Both *expanded bodies*, being expansions, according to Linnæus, the first of the *bark*, and the latter of the *rind*.

These are discriminated not only by their *respective situations*, but by the *greater delicacy* of the COROLLA compared with the CALYX, which last is usually green. These parts are not absolutely essential, some Flowers being destitute of one,[i] or both of them.

As an appendage to the Corolla,[k] there is found in some plants,

V. The NECTARIUM, for the secreting, and containing of honey.

VEGETABLE INPREGNATION is thus performed. The *farina* secreted by the *anthers* of flowers, passes on the *stigma* of the *pistillum*, and is there absorbed, and carried to the *seeds*, which it renders fertile, as is confirmed by numerous observations and experiments.

---

[a] The PISTILLUM is very conspicuous in the *White Lily*, and in the *Night-blowing Cereus*, as also in the *American Aloe*.

[b] The *six* STAMINA are seen extremely well in the *White Lily* and *Aloe*, as are also the *five* stamina in the *Blue Passion-flower*.

[c] The *White Lily* furnishes an example of a *perfect* PISTILLUM, as also the *Night-blowing Cereus*.

[d] As in the MEADIA. It is extremely distinct in the *Tulip*, *Lily*, and *Passion-flower*.

[e] Vide the plate of *Tulips*, where you will find a PISTILLUM in the centre without the STYLE, also the *Poppy*, whose STIGMA is like a *Parapluis*. The STYLE is very conspicuous in the *Lily*, *Cereus*, and *Passion-flower*.

[f] For THIS PART vide the *Aloe*, *Cereus*, *Lily*, and *Passion-flower*.

[g] Vide the plate of the *Canna*. The FILAMENT is very observable in the *Lily*, *Aloe*, *Cereus*, &c. as well as the ANTHER, with its POLLEN.

[h] These TWO PARTS are finely displayed in the *Blue Passion-flower*, the CALYX of that climbing plant having a *hook* at the extremity of the back of the five leaves, constituting the CALYX.—Vide also the *Meadia*, *Cereus*, &c.

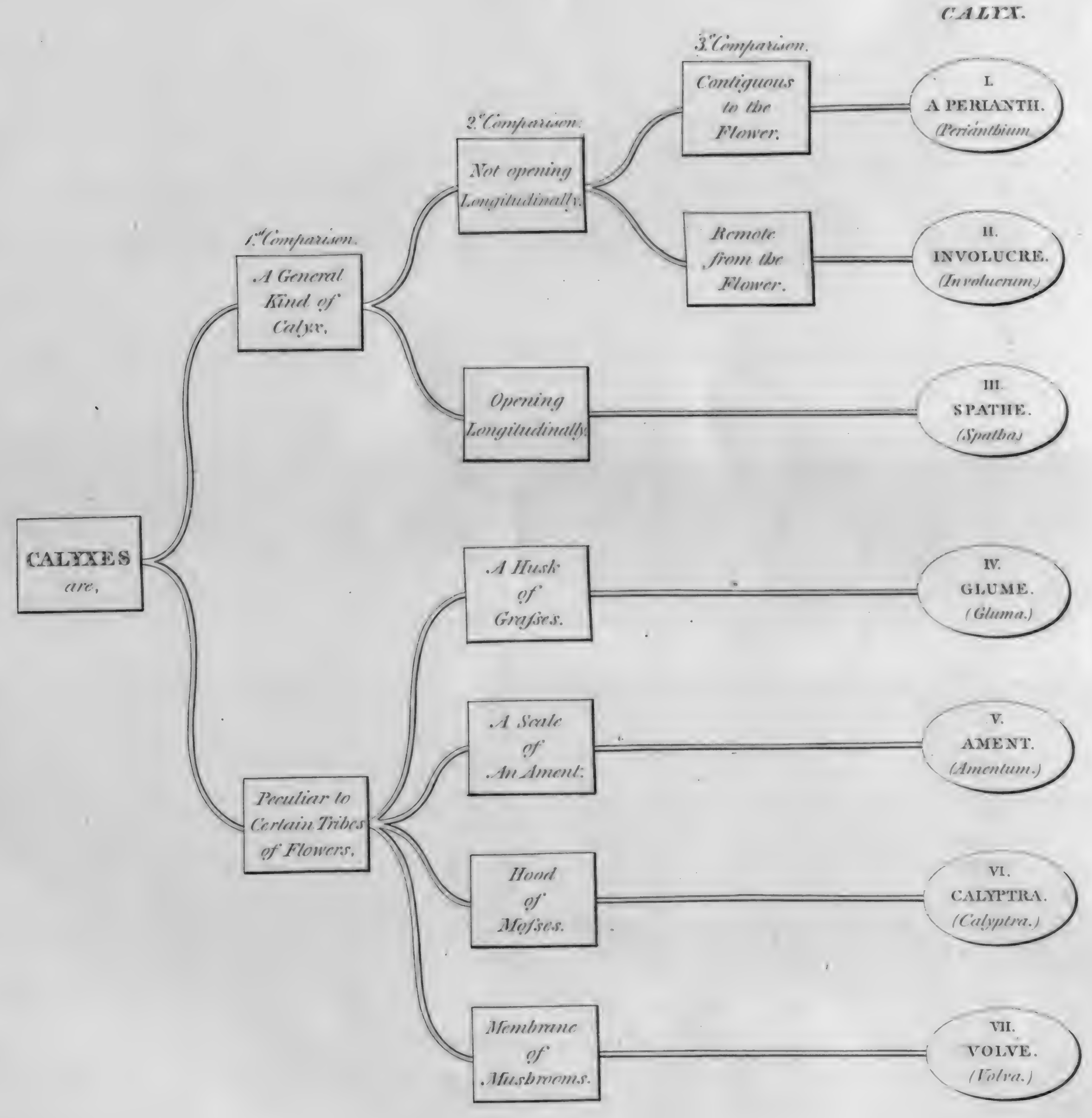
[i] The lilaceous tribe have no Calyx: see the *Superb Lily*; vide also the *Begonia*.

[k] The *radiance*, or *glory*, of the *Blue Passion-flower* is a fine example of the NECTARIUM; vide also the *cup* of the *Renealmia* and *Limodorum*.

# ANALYSIS,

or

## Division of Calyxes into their Several Kinds.



[illegible] London. Published by Dr. Thornton [illegible] [illegible] sculp.

# THE DIFFERENT KINDS OF CALYX.

The term Calyx, like our words, horse, bird, dog, habitation, is a generic word, including several distinct kinds, thus:

I. Perianth (*Perianthium*), is the outer expanded covering of a flower,...the most common kind of Calyx,...usually green,...sometimes coloured,...contiguous to the corolla,...protecting the organs for reproduction in their infant-state,...sometimes caducous,...often abiding with the fruit,...and sometimes even serving the office of pericarp,...usually single, ...occasionally double,...not unfrequently very obscure,...or wholly deficient.

II. Involucre (*Involucrum*), is a calyx remote from the flower,...most commonly stationed at the foot of a general, or partial, umbel.

III. Spathe (*Spatha*), a species of calyx, which first involves the infant-flowers like a sheath, and then opens longitudinally.

IV. Glume (*Gluma*), the outer valves, or husk of corn, or grass, enclosing one, or more, florets.

V. Ament (*Amentum*), small chaffy scales, protecting the florets placed on a thread-like common receptacle.

VI. Calyptra (*Calyptra*), the covering of a moss, placed over it, like a cap or bonnet.

VII. Volve (*Volva*), a membrane, which involves the fungus in its infant-state, and which afterwards appears in a lacerated form on the foot-stalk.

## *Botanical Terms* applicable to the Calyx.*

Peculiar (*Proprius*), belonging to a single flower....Common (*Communis*), common to several flowers....Beneath (*Inferus*), placed beneath the Germen....Above (*Superus*), above the Germen....Monophyllous (*Monophyllus*), consisting of one leaf....Diphyllous (*Diphyllus*), of two leaves....Triphyllous (*Triphyllus*), of three leaves....Tetraphyllous (*Tetraphyllus*), of four leaves, and so on to Polyphyllous (*Polyphyllus*), composed of many leaves. ...Intire (*Integer*), having the border, or edge of the leaf even....Toothed (*Dentatus*), cut into teeth....Partite (*Partitus*), divided into segments....Reflexed (*Reflexus*), bent back.... Imbricated (*Imbricatus*), having the leaves placed over one another like the tiles of a house.

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* All or most of these terms are illustrated in our "Picturesque Botanical Plates," and are more fully explained in our "Philosophy of Botany."

# THE DIFFERENT KINDS OF CALYX.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

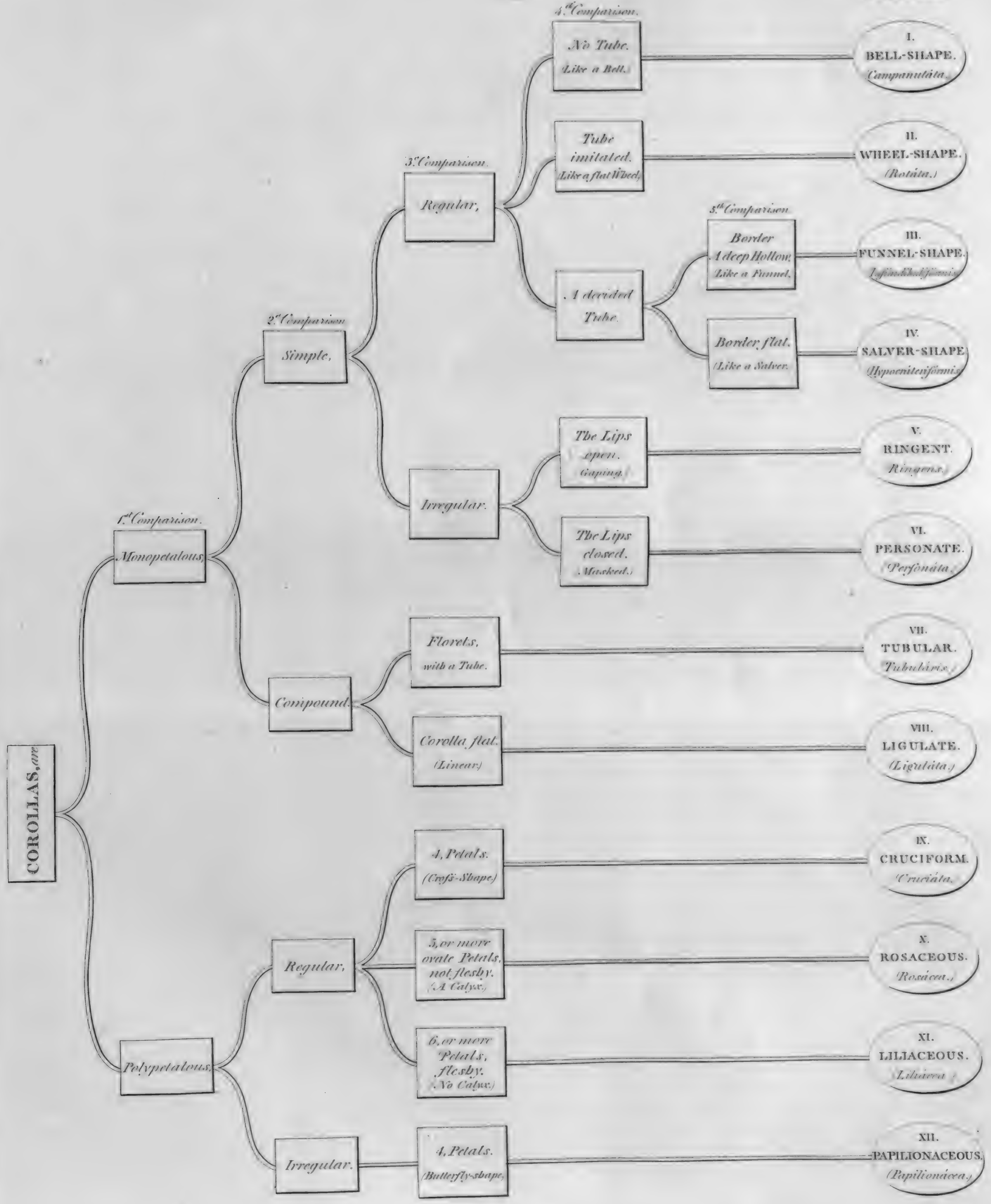
## [illegible] applied to the Calyx.

[illegible]

# ANALYSIS,

OF

Division of Corollas into their Several Kinds



Dr. Thornton inv.

London Published by Dr. Thornton, July 1st 1807

Halliwell sculp.

# DIFFERENT KINDS OF COROLLA.

THE term COROLLA is a compound idea, made up of several distinct notions, as

I. BELL-SHAPED (*Campanulata*), hollowed internally like a bell, often ventricose, or swollen at the sides, and without a tube.

II. WHEEL-SHAPED (*Rotata*), slightly hollow, or the border flat, and with so little tube as to resemble a wheel on the ground.

III. FUNNEL-SHAPED (*Infundibuliformis*), having the border of the Corolla like a cone, and placed upon a tube, so as to resemble a funnel.

IV. SALVER-SHAPED (*Hypocrateriformis*), having the corner of the Corolla flat, and placed upon a tube, resembling a salver.

V. RINGENT (*Ringens*), having the border of the Corolla like two lips, and these open, placed upon a tube, resembling a person gaping.

VI. PERSONATE (*Personata*), having the border of the Corolla like the lips, the mouth closed, greatly resembling the snout of an animal, also placed upon a tube.

VII. TUBULAR (*Tubularis*), when the floret of a compound flower ends in a tube, the border being five-cleft.

VIII. LIGULATE (*Ligulata*), when the Corolla of the floret is linear, i. e. resembles the strap of a shoe.

IX. CRUCIFORM (*Cruciata*), having four petals, placed like a St. Andrew's cross.

X. ROSACEOUS (*Rosacea*), having five, or more petals, not fleshy, orbicularly placed.

XI. LILIACEOUS (*Liliacea*), having six, or more petals, fleshy, placed also in a circle.

XII. PAPILIONACEOUS (*Papilionacea*), having four petals, of different shapes and sizes, placed so as to resemble a butterfly on the wing.

## *Botanical Terms applicable to the Corolla.*

MONOPETALOUS (*Monopetala*), composed of one petal only.... POLYPETALOUS (*Polypetala*), composed of two or more petals....SIMPLE (*Simplex*), not a compound flower....COMPOUND (*Composita*), made up of distinct florets on a common receptacle.... RAYED (*Radiata*), having tubular florets in the *disk* or center, and ligulate in the *ray* or circumference....TUBULAR (*Tubularis*), having florets ending in a tube....LIGULATE (*Ligulata*), having the petal linear like a strap...REGULAR (*Regularis*), with all the parts proportionate....IRREGULAR (*Irregularis*), having all the parts disproportionate....VENTRICOSE (*Ventricosa*), swollen at the sides....CONICAL (*Infundibuliformis*), like a cone....LINEAR (*Linearis*), having the sides parallel....TUBE (*Tubus*), the inferior narrow hollow part of a monopetalous corolla....CLAW (*Unguis*), the inferior narrow flat part of a polypetalous corolla....LIMB (*Limbus*), the upper part of a monopetalous corolla... LAMINA, or BORDER (*Lamina*), the upper flat part of a polypetalous corolla....BANNER (*Vexillum*), the upper petal of a papilionaceous flower....WINGS (*Alæ*), the side petals of ditto.... KEEL (*Carina*), the under petal, shaped like a boat, of ditto....TOOTHED (*Dentata*), the edge cut into teeth....CLEFT (*Fissa*), cut into small segments....PARTITE (*Partita*), cut into deep segments.....A SEGMENT (*Lacinia*), the cut portions of the corolla, larger than teeth.

# DIFFERENT KINDS OF NECTARIES.

The term Nectary, like the Corolla, is also a complex idea, like our words pigeon, dog, made up of many different individuals, here indeed too numerous and diversified, to be distributed under heads, for every singular appearance in different parts of the flower, even unconnected with the corolla, or whatever is not corolla, whether it secretes honey, or not, is called by botanists, the Nectary.

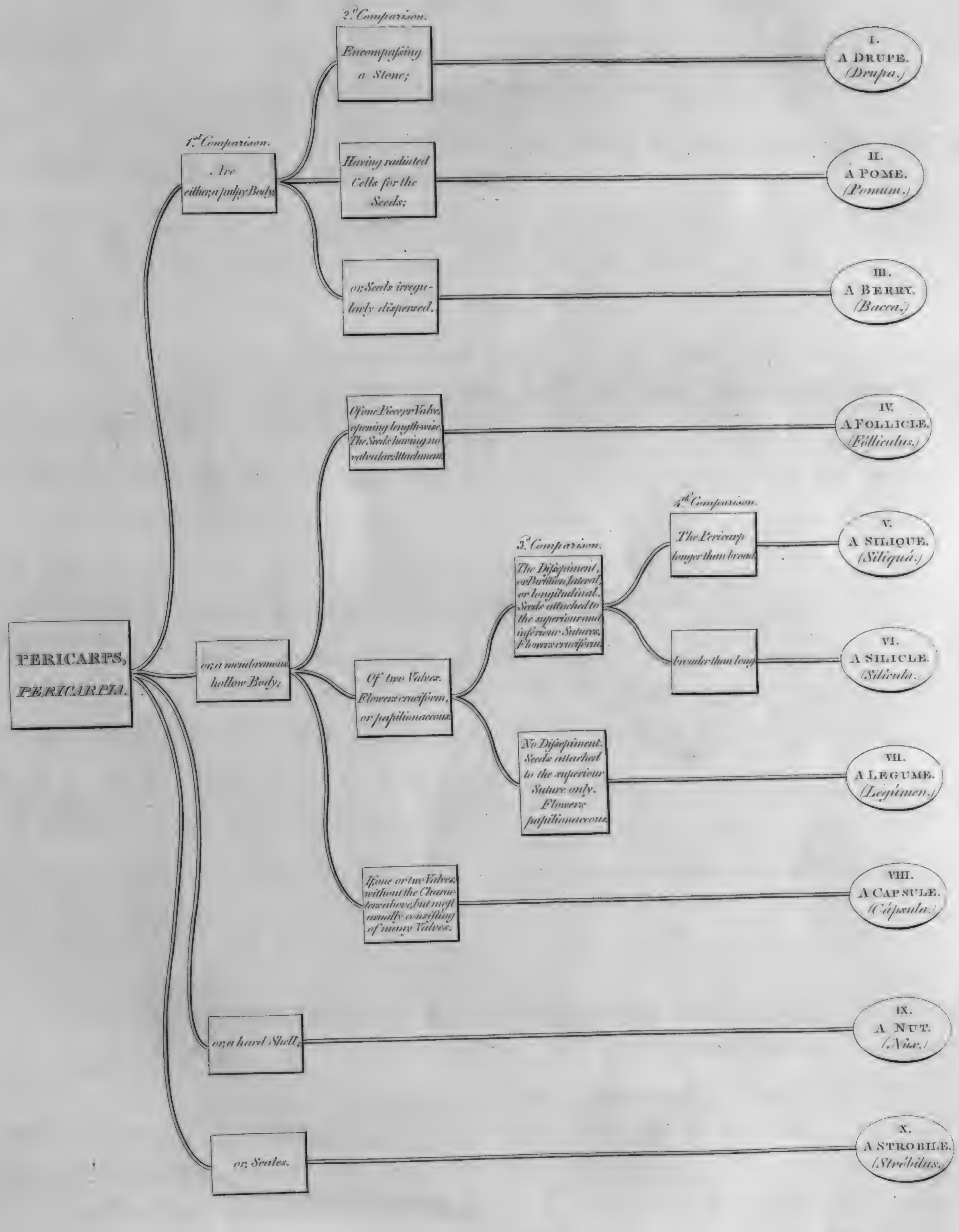
The following are among the more prominent examples.

1. A spur, or horn, (*Nect. corniculatum*), as in Larkspur (*Delphinium*).
2. A small open cup (*Cyathus apertus*), small hollow cups, circularly ranged in the interior of the flower, as in Hellebore (*Helleborus*).
3. A cup closed by a lid (*Cyathus clausus*), a similar arrangement of nectaries, as in the preceding, but closed with a lid, as in Devil in the Bush (*Nigella*).
4. Like the cut finger of a glove (*Nect. companulatum*), hollowed like the finger of a glove cut off, but depending, as in Renealmia, Limodorum.
5. Like a funnel (*Nect. infundibuliforme*), as in Narcissus.
6. Like a slipper (*Nect. calceiforme*), as in Lady's Slipper (*Cypripedium*).
7. A simple cavity (*Fovea excavata*), an excavation at the base of each petal, as in Crown Imperial (*Fritillaria*).
8. A naked channel (*Linea longitudinalis excavata*), an hollow longitudinal groove, in a petal, as in White Lily (*Lilium Album*).
9. Villous projections (*Nect. barbatum*), numerous villi placed upon the petal, as in some species of Iris.
10. Filaments without anthers, imitating stamina (*Filamenta sine antheris, veluti stamina*), filiform projections like stamina, each terminated with a clasper, as in Arum.
11. Petal-like (*Nect. petalum mentiens*), as in Snow-drop (*Galanthus*), and Trollius.
12. Resembling a nest of doves (*Columbulos referens*), five cornuted nectaries, the whole resembling much a nest of doves, as in Columbine (*Aquilegia*).
13. Resembling Dolphins (*Figuram Delphini repræsentans*), like a Dolphin elevated on a pillar or filament, as in Monkshood (*Aconitum*).
14. Like a tongue (*Veluti lingua*), as in Indian Reed (*Canna Indica*).
15. Resembling rays of glory (*Filamenta versicolorata in orbem posita*), projections in the form of rays of glory, as in the several Passion-flowers.
16. Giving the appearance of various animals (*Nect. formam animalium mentiens*), as in the several Orchises.
17. A naked scale (*Squama nuda*), as in Ranunculus and Willow.
18. A fringed scale (*Squama fimbriata*), as in Parnassia.
19. Glands upon the stamens (*Glandulæ filamentis adspersæ*), as in Dittany (*Dictamnus*).
20. Glands at the insertion of stamens (*Glandulæ filamentis positæ*), as in the Stock.

# ANALYSIS,

OR

## Division of Pericarps into their Several Kinds.



Dr. Thornton inv.t

London: Publiſhed Aug.t 1, 1799, for Dr. Thornton.

I. Girtin sc.t

# DIFFERENT KINDS OF PERICARPS.

TEN different sorts of PERICARPS, or SEED-VESSELS, are enumerated by botanists.

I. DRUPE (*Drupa*), is a pulpy seed-vessel...encompassing a stone, or nut.

II. POME (*Pomum*), is a pulpy seed-vessel...not enclosing a stone, or nut...in the middle of which are radiated cells for the reception of seeds.

III. BERRY (*Bacca*), is a pulpy seed-vessel...without radiated cells in the center...having the seeds irregularly dispersed throughout the pulp.

IV. FOLLICLE (*Folliculus*), is a membranous seed-vessel...of one valve...opening longitudinally, i. e. on the side...and having no apparent suture for fastening or attaching the seeds within it.

V. SILIQUE (*Siliqua*), is a membranous seed-vessel...of two valves, with a dissepiment intervening...seeds attached alternately to the upper and under sutures...seed-vessel longer than broad...flowers cruciform.

VI. SILICLE (*Silicula*), has the same definition as the last...except that the seed-vessel is rather broader than long.

VII. LEGUME (*Legumen*), is a membranous seed-vessel...of two valves...no dissepiment...seeds attached to the superior suture only...flowers papilionaceous.

VIII. CAPSULE (*Capsula*), is a membranous seed-vessel...varying in the number of valves... without the characters of Pericarps IV. V. VI. VII. as defined above...splits in a determinate manner into valves.

IX. NUT (*Nux*), a hard stone, or shell, enclosing a kernel...but without a pulpy covering, in which case it would be a Drupe.

X. STROBILE (*Strobilus*), is a seed-vessel composed of ligneous scales, which embrace the seeds within their bosom.

## *Terms applicable to the different Pericarps.*

VALVES (*Valvulæ*), the external pieces forming the sides of the seed-vessel...SUTURES (*Suturæ*), the edges, or margins, by which the valves are connected...COLUMN (*Columella*), a central point of union of the partitions in the seed-vessel...PARTITIONS (*Dissepimenta*), the divisions of the seed-vessel into cells...CELLS (*Loculamenta*), hollow places for the reception of the seeds...ONE-SEEDED (*Monospermus*)...TWO-SEEDED (*Dispermus*), and so on.

# DIFFERENT KINDS OF SEEDS.

THE SEEDS present so great a diversity of appearance, that they cannot, like the CALYX, COROLLA, or PERICARP, be grouped into distinct assemblages, but must be presented to the reader individually, of which the following are some of the most striking examples.

1. A DOUBLE SEED, EACH RESEMBLING A BOAT (*Semen duplex, naviculæ formam repræsentans*), as in the umbelliferæ.
2. KIDNEY-SHAPED, WITH HEPTAGON AND PENTAGON CELLS (*Reniforme, cellulis pentagonis et heptagonis*), as in POPPY-SEED (*Semen Papaveris*).
3. OVATE (*Ovatum*), shaped like an egg, as in EYE-BRIGHT (*Euphrasia*).
4. GLOBULAR (*Globosum*), as in the PEA (*Pisum*), and CORIANDER (*Coriandrum*).
5. SQUARE (*Tetragonum*), having four sides, as in FOXGLOVE (*Digitalis*).
6. TRIANGULAR (*Triangulare*), having three sides, as in TANSY (*Tanacetum*).
7. CYLINDRIC (*Oblongum*), oblong, as in ST. JOHN'S-WORT (*Hypericum*).
8. RESEMBLING A PARTICULAR SHELL (*Figuram conchæ mentiens*), as in WOOD-SORREL (*Oxalis*).
9. Ditto, as in PURSLANE (*Portulaca*).
10. Ditto, as in CINQUEFOIL (*Potentilla*).
11. RESEMBLING THE HEAD OF A MONKEY (*Figuram cynocephali repræsentans*), as in the COCOA-NUT.
12. A SINGLE CROWN (*Corona simplex*), as in RAGWORT (*Senecio*).
13. A DOUBLE CROWN (*Corona duplex*), as in HOLY THISTLE (*Centaurea Benedicta*).
14. A SHUTTLE-COCK (*Corona pennacea*), as in DANDELION (*Leontodon*).

## *Terms applicable to the Seed.*

ARIL (*Arillus*), the outer coat of the seed....EYE (*Hilum*), an oblong scar, marking the place where the seed was affixed by an umbilical cord to the seed-vessel....HEART (*Corculum*), the rudiment of the young plant within the seed....PLUME (*Plumula*), the ascending part of the corcule, or infant stem....RADICLE (*Radicula*), the descending part, or infant root....COTYLEDONS (*Cotyledones*), the side-lobes, furnishing nourishment to the corculum....SEMINAL LEAVES (*Folia Seminalia*), the first leaves of the plantule, serving the office of cotyledons, or lobes.... PAPPUS (*Pappus*), a feathery crown....STIPE (*Stipes*), a thread connecting the pappus to the seed.

# THE UNIVERSAL POWER OF LOVE.

Kirke pinx.

Ant Cardon sculp.

## MOTTO.

Hence,– *in bright leaves the sexual pleasures dwell,*
*And Beaux and Beauties crowd the blossom's bell,*
*With meeting lips and mingled smiles they sup*
*Ambrosial dew-drops from the nectar'd cup:*

*Delighted* Hymen *marks their whisperd vows*
*And binds his chaplets round their polish'd brows,*
*Guides to his altar, leads the flowery bands,*
*And as they kneel unites their willing hands.*

Tomkins scrip

Cooper sculp

Darwin.

# THE

# Prize

# DISSERTATION

# on the

# Sexes of Plants,

By

*Carolus Von Linnæus*;

WRITTEN,

Anno Domini,

1759

Tomkins Scripsit.

Halliwell & Co. Sculp.

### ON

# THE SEXES OF PLANTS.

It is certain that the *Sexes of Plants* could not altogether escape the observance of the most ancient investigators of Nature, and even must have struck some philosophers of modern times: for Nature has furnished this phænomenon to be contemplated in almost every plant; for it must be allowed, that scarce any one can be found devoid of it.

In the remotest period of time, the *Arabians* derived their principal support from the DATE-BEARING PALM, the *Persians* from the PISTACHIA NUT, the *inhabitants* of the *Archipelago* from the FIG, and those of *Chios* cultivated the MASTICH TREE. In all these it was necessary to attend to the *Sexual Distinction,* in order to promote the efficacy of the *male* as respects the *female flowers,* and hence they could not altogether be ignorant of a circumstance so exceedingly evident, certainly, as far as regards these trees.

But if truly we contemplate the fate of Botanical Science, we shall easily discover the reason why *this theory* continued so long obscured in darkness.

The writings of the ancients testify, that Botany was at a low ebb, when Mathematics and Astronomy had made considerable advancement.

After the regeneration of letters, it was the first endeavour of botanists to separate and investigate amongst the ruins the broken fragments of botanical science; in which endeavour, when they perceived that not much riches were to be collected, at length they turned their researches into Nature herself, and began to describe plants from actual observation, until they were so overwhelmed with their number, that they even despaired to number up the species growing in their own gardens, especially when both Indies poured in daily so great a profusion, that properly to name them all, no memory was sufficient.

At last, *Systematics* endeavoured to describe all plants, with regard to their *fructification,* and to arrange them into their several companies; nor have they ceased this attention even to the present time.

But when these systematic writers were particularly busy about the *Corolla,* which especially courts the eye, and the *Fruit,* which has the greatest use, it happened that they paid little attention to the *minuter parts* of plants, until they perceived that the *larger parts* were of themselves insufficient to discriminate so many plants, which daily increased the army of Flora.

This induced the more modern Botanists to investigate all *those parts* most *minutely,* which are to be met with in the *fructification,* and they esteemed their labours not unrepaid, if from thence they could construct true and convenient characters.

Amongst these the *Stamina* and *Pistilla,* although generally small bodies, and on that account neglected by former persons with contemptuous pride, were found so important, that there is no flower to be met with devoid of these parts.

Afterwards, these *corpuscules* were esteemed of great moment, and on them particular names were imposed; and, moreover, all the several parts of fructification were carefully described.

Exactly to pronounce who *first* discovered the *Sexes of Plants* would be a task of the greatest difficulty, and of no real utility. For many inventions have increased by degrees, just as a river, which at first springs from a small rivulet, several of which run into a single channel, till at length it becomes augmented so as to bear the largest ships.

This knowledge of *Sexual Distinction* cannot be denied to the *ancient cultivators* of PALMS,*

---

* Old Parkinson, who wrote his "*Theatre of Plants*" in 1640, speaking of the *Palm*, says, "the *Date* is the fruit of this tree, the best kinds are called *regiæ*, as being diet fit for kings. The ancient writers have set down many things of the *date-tree*, 'that there are *male* and *female*, and that to make them bear, they must be near each other, or else they will not bear,' but I *pray you* account *this* among the rest of their fables."

It is worthy of enquiry, whether the *ancients* really understood the *meaning* of the *distinction* of the *date-tree* into *male* and *female*, as it is *at present* understood. Quotations will, I think, settle fully this point.

Ὅταν ἀνθῇ τὸ ἄῤῥεν, ἀποτεμόντες τὴν σπάθην ἀφ' ἧς τὸ ἄνθος εὐθὺς ὥσπερ ἔχει, τόντε χνοῦν καὶ τὸ ἄνθος καὶ τὸν κονιορτὸν κατασείουσι κατὰ τοῦ καρποῦ τῆς θηλείας, κἂν τοῦτο πάθῃ, διατηρεῖ καὶ οὐκ ἀποβάλλει.

"When the *male* PALM is in vigour, the spatha is cut, whence the flowers proceed, as soon as it contains the down, flowers, and *dust*, and they shake this over the fruit of the *female tree*, and from that sprinkling, it turns out, that none drop their fruits, but all perfect them." THEOPH. HIST. PLANT. LIB. II. C. 9.

How near had PLINY hit the mark!

"Arboribus, immo potius omnibus quæ terra gignat, herbisque etiam, utrumque sexum esse, diligentissimi Naturæ scrutatores tradunt: nullis tamen arboribus manifestius quam *Palmis*. Sine maribus non gignere fœminas sponte edito nemore confirmant: circaque singulos plures nutare in eam pronas blandioribus comis. Illum erectis hispidum Afflatu Visuque ipso et Pulvere etiam reliquas maritare: hujus Arbore excisa viduas post sterilescere Fœminas. Adeoque est Veneris intellectus, ut Coitus etiam excogitatus sit ab Homine, ex Maribus Flore ac Lanugine, interim vero tantum Pulvere insperso Fœminis."

"All *trees*, or rather in all things which the earth produces, even in *herbs*, the most diligent enquiries into Nature report, 'there be *two sexes*;' but in none more evident than in *Palms*. It is confirmed, that the wild *female Palms* do not produce fruit without the assistance of the *male*, and for this purpose the *females* bend their boughs to him for mutual embrace. He also marries with the other *female* palms by gentle sighings, tender looks, and the dispersion of a *powder*. This *male tree* being cut down, the widowed females afterwards become sterile. This *love* in plants has been observed by men who imitate it, and by the scattering of flowers and down of the male, or even only by the dispersion of the *powder*, upon the *females*." PLINII NAT. HIST. LIB. XIII. C. 4.

Ὁ δὲ φοῖνιξ ἐρᾷ, καὶ δριμέως, ἑτέρου φοίνικος, ὡς Φλωρεντῖνος ἐν τοῖς Γεωργικοῖς αὐτοῦ φησὶ, καὶ οὐ πρότερον παύσεται τοῦ πόθου, ἕως ἂν αὐτὴν ὁ ἐρώμενος παραμυθήσαιτο. ἔστι γὰρ ἰδεῖν τὸ δένδρον ἐπικεκαμμένον καὶ μὴ φέρον τὴν ἰδίαν βάσιν, μηδὲ καρποφοροῦν. τοῦτο οὐ λανθάνει τὸν γεωργὸν, ἀλλ' ὅτι μὲν ἐρᾷ καὶ ἐρᾶται τεκμαίρεται, ἀγνοεῖ δὲ ποίου διὰ παραπτόμενος φοινίκων, πολλῶν, καὶ πάλιν ἐπὶ τὴν ἐρῶσα ἐπανιὼν, καὶ ἐφαπτόμενος τῇ χειρὶ, δοκεῖ φιλήματι ὥσπερ διακονεῖν. ποίου δὲ φοίνικός ἐστι κυτῇ πόθος σημαίνει τρόπον τινὰ τῇ τῶν παθῶν καὶ τῇ τῶν χειρῶν, ὡς ἄν τις εἴποι, νεύσει, πρὸς ἐκεῖνον γὰρ ἀποβλέπει, καὶ ἐπ' ἐκεῖνον πρόῤῥιζος ὥσπερ σπεύδουσα ἑαυτὴν ἐπιῤῥίπτει ἄκος οὖν γίνεται τῇ ἐρώσῃ, τοῦ γεωργοῦ συνεχῶς ἁπτομένου τοῦ ἄῤῥενος, καὶ τὰς χεῖρας αὐτοῦ προσπελάζοντος τῇ ἐρωμένῃ· μάλιστα εἰ τὴν ἄνθην ἐξελὼν ἀπὸ τῆς σπάθης τοῦ ἄῤῥενος, ἐνθήσει εἰς τὴν κεφαλὴν τῆς ἐρώσης. οὕτω γὰρ πραΰνει τὸν ἔρωτα, καὶ λοιπὸν ἡ φοῖνιξ ἀγλαϊζομένη κάλλιστον καρπὸν οἴσει.

"*Palm* trees possess the passion of *love*, and indeed most ardently, as FLORENTINUS delivers in his Georgics, nor can this passion be extinguished until *they* meet. The *female* in love droops *her* head, nor is the basis firm, nor does *she* then produce fruit. This the farmers notice, they are conscious *she* is in love, endeavour to console *her*, and when *she* meets with the *male* plant *she* loves, *she* elevates herself, and *they* appear to embrace by mutual kisses. And the *male* plant also displays *his* affections, extends *his* arms, and as it were gazes at the object of *his* love, extends *his* roots to hers, and thus embraces *her*. The cure of this *love*, when the *two* are at a distance, is applied by countrymen, who bring the arms or hands of the lover to his mistress, and thus the *male flowers* are placed on the head of the *female* tree. This mitigates the wastings from the flame of *love*, and the rejoicing *female* then bears fruit." GEOPONIC. LIB. X. C. 4.

Περὶ δὲ τῶν φυτῶν λέγουσι παῖδες σοφῶν, καὶ μῦθον ἔλεγον τὸν λόγον εἶναι, εἰ μὴ παῖδες ἔλεγον γεωργῶν. ὁ δὲ λόγος· ἄλλο μὲν ἄλλου φυτὸν ἐρᾶν. τῷ δὲ φοίνικι τὸν ἔρωτα μᾶλλον ἐνοχλεῖν. λέγουσι δὲ τὸν μὲν ἄῤῥενα τῶν φοινίκων, τὸν δὲ θῆλυν. ὁ ἄῤῥην οὖν τοῦ θήλεος ἐρᾷ, κἂν ὁ θῆλυς ἀπῳκισμένος εἴη τῇ τῆς φυτείας στάσει, ὁ ἐραστὴς ὁ ἄῤῥην αὐαίνεται. συνίησιν οὖν ὁ γεωργὸς τὴν λύπην τοῦ φυτοῦ· καὶ εἰς τὴν τοῦ χωρίου περιωπὴν ἀνελθὼν, ἐφορᾷ ποῦ νένευκεν. κλίνεται γὰρ εἰς τὸ ἐρώμενον· καὶ μαθὼν, θεραπεύει τοῦ φυτοῦ τὴν νόσον. πτόρθον γὰρ τοῦ θήλεος φοίνικος λαβὼν, εἰς τὴν τοῦ ἄῤῥενος καρδίαν ἐντίθησιν, καὶ ἀνέψυξε μὲν τὴν ψυχὴν τοῦ φυτοῦ. τὸ δὲ σῶμα ἀποθνῆσκον πάλιν ἀνεζωπύρησεν, καὶ ἐξανέστη, χαῖρον ἐπὶ τῇ τῆς ἐρωμένης συμπλοκῇ· καὶ τοῦτό ἐστι γάμος φυτῶν.

"As it respects *plants*, it is the opinion of *philosophers*, which otherwise would be esteemed a fable, to which also farmers subscribe, that plants are taken in *love* with one another, and feel all the disappointment of *love*. They report that there are *male* and *female*. The *female* tree desires the *male*, and if she happens to be at a distance from the *male*, she pines away. On which account the farmer understanding the malady, as a cure plants the *male* on a loftier spot, from which *he* looks down upon his beloved *female*, inclining to *her* his boughs; or he places on the highest branch a bough of the *male-tree* in flower, the sight of which recreates *her* mind, recruits *her* dying body, and revives *her* even by a partial embrace. Such are the *Nuptials of Plants*." ACHILLES. TATIUS. C. 17. p. 88.

Hence those much admired lines of CLAUDIAN, who most happily introduces a notice of this *Love betwixt Plants* in his description of the retreat of Venus into the Island of Cyprus.

> Vivunt in Venerem Frondes, omnisque vicissim
> Felix Arbor *amat*, nutant ad mutua PALMÆ
> Fædera: POPULEO suspirat POPULUS ictu:
> Et PLATANI PLATANIS, ALNOQUE assibilat ALNUS.
> CLAUDIAN. EPITH. p. 177.

As a confirmation how little the ancients understood the *true* doctrine of the sexes of plants, Theophrastus mentions a *male* and *female* PEONY and FERN, in which last certainly there could be no knowledge of the sexes in plants. He also expressly calls the fig, vine, and pomegranate, *female* plants in Book I. Chap IX. "Cur Feminæ magis Masculi augescunt." "Why female plants grow more than the male plants." ARISTOTLE and PLINY also say, "that the *male* plants differ only from the *female* plants in being *taller*, and more *vigorous withal!* It would be, therefore, absurd to attribute a knowledge of the *sexes of plants* to the *ancients*. "Ferat *Palmam* qui meruit."

Ficus. The Fig.

Henderson del.

Sutherland Sculp.

London Published 1810, by Dr. Thornton.

these persons equally understood the *Sexual Relationship* of the Fig,* and likewise in the

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* Theophrastus, in his Second Book " De Causis Plantarum," has Chapter XII. " De Caprificatione et culicibus," where this peculiar process, known by the name of Caprification, is given.

Heroditus, whom Cicero calls the father of history, mentions distinctly the *caprification* of the *fig*. Herod. Κλέιω.

Pliny also accurately describes the same process under the title " *De Caprificatione*," " *On Caprification*." Plinii Hist. Nat. Lib. XII. Cap. IV.

Plutarch, and other authors of antiquity, relate the same circumstances as are practised at this day in the Archipelago and in Italy. But the best account we have of this curious practice is from Tournefort, in a Memoir read before the Academy of Science at Paris in 1705, the substance of which is as follows.

" Of the thirty species or varieties of the domestic *fig-tree*, which are cultivated in France, Spain, and Italy, there are but two cultivated in the Archipelago. The first species is called *ornos*, from the old Greek *erinos*, which answers to *caprificus* in Latin, and signifies a wild fig-tree. The second is the domestic or garden fig-tree. The former bears successively, in the same year, three sorts of fruit, called *fornites*, *cratitires*, and *orni*; which, though not good to eat, are found absolutely necessary towards ripening those of the garden-fig. These fruits have a sleek even skin; are of a deep green colour; and contain in their dry and mealy inside several male and female flowers placed upon distinct foot-stalks, the former above the latter. The *fornites* appear in August, and continue to November without ripening: in these are bred small worms, which turn to a sort of gnats nowhere to be seen but about these trees. In October and November, these gnats of themselves make a puncture into the second fruit, which is called *cratitires*. These do not shew themselves till towards the end of September, The *fornites* gradually fall away after the gnats are gone; the *cratitires*, on the contrary, remain on the tree till May, and inclose the eggs deposited by the gnats when they pricked them. In May, the third sort of fruit, called *orni*, begins to be produced by the wild fig-trees. This is much bigger than the other two; and when it grows to a certain size, and its bud begins to open, it is pricked in that part by the gnats of the *cratitires*, which are strong enough to go from one fruit to another to deposit their eggs. It sometimes happens that the gnats of the *cratitires* are slow to come forth in certain parts, while the *orni* in those very parts are disposed to receive them. In this case, the husbandman is obliged to look for the *cratitires* in another part, and fix them at the ends of the branches of those fig-trees whose *orni* are in a fit disposition to be pricked by the gnats. If they miss the opportunity, the *orni* fall, and the gnats of the *cratitires* fly away. None but those that are well acquainted with the culture know the critical moment of doing this; and in order to know it, their eye is perpetually fixed on the bud of the fig; for that part not only indicates the time that the prickers are to issue forth, but also when the fig is to be successfully pricked: if the bud is too hard and compact, the gnat cannot lay its eggs; and the fig drops when the bud is too open.

" The use of all these three sorts of fruit is to ripen the fruit of the garden fig-tree, in the following manner. During the months of June and July, the peasants take the *orni*, at the time their gnats are ready to break out, and carry them to the garden fig-trees: if they do not nick the moment, the *orni* fall; and the fruit of the domestic fig-tree, not ripening, will in a very little time drop in like manner. The peasants are so well acquainted with these precious moments, that, every morning, in making their inspection, they only transfer to their garden fig-trees such *orni* as are well conditioned, otherwise they lose their crop. In this case, however, they have one remedy, though an indifferent one; which is, to strew over the garden fig-trees another plant in whose fruit there is also a species of gnats which answer the purpose in some measure."

Linnæus thus explains the *rationale of this practice*. "The *caprificus*, or wild fig, is the *male* plant, and the cultivated fig the *female*. The flowers are disposed within the cavity of the *receptacle*, which is so close shut, that often it will scarce admit the end of a common needle through the pore in its extremity. Now the fig-flies, which are of the *ichneumon* kind, being transformed, and furnished with wings, about the time the *farina* of the *male* fig is ripe, make their escape from those *male* figs, and being wholly covered with their *dust*, after copulation, they seek for a place to lay their eggs, and flying to every one of the *female* figs, they enter their cavities, which are filled with *pistilla* from all sides, by which means they must necessarily brush off that *farina*, or *male dust*, with which they were covered, and thus the *seeds* are impregnated." It is true, the *female* fig can ripen its fruit, though the *seeds* are not impregnated, because this fruit is not a *pericarpium*, or *seed vessel*, but only a *receptacle:* so also the hop, mulberry, strawberry, and blite, can produce fruit, even though their seeds do not ripen, because their fruit is nothing but *a receptacle* or *calyx*. Some botanists who were ignorant of this, seeing those trees produce fruit without previous impregnation. thought they had found an unanswerable argument against the generation of plants; but they did not consider, that the fruit of the fig is not a *seed vessel*, but a *common receptacle*. Yet it appears, that the fruit of the fig, if the seeds are impregnated, grow to a much larger size than those which are not; which Tournefort also observed; for he tells us, that a fig-tree, in Franche Comptè, where there is no caprification, produced every year only 25 pounds weight of figs; but that another of the same size in one of the islands of the Archipelago, produced yearly 280 pounds weight of figs, which is above ten times the quantity of the other. This age hath clearly refuted the opinion of Camerarius, who maintained that the seeds of figs *never* produced any plants. For Linnæus tells us, that fig trees are raised every year in Holland from the *seeds*, provided the fruit is brought from *Italy*. But if the fruit grew in France, England, Germany, or Sweden, where there are no *wild figs*, the *seeds produce nothing*; on the other hand, if those seeds are sown, which grew in *Italy* or the *Greek islands*, where the *male* fig abounds, the plants spring up with ease, putting forth leaves, which at first are like those of the mallow. The same experiment was tried with good success in the Upsal garden in the year 1744."

Yet still it would be a difficulty for us to imagine, that such refined knowledge was in the breasts of the ancients.
Tournefort, in explanation of this practice, says, " The prickers contribute to the maturity of the fruit of the garden fig-tree by causing them to *extravasate the nutritious juices*, the vessels inclosing which they tear asunder, or perhaps too, when depositing their eggs, they leave some sort of ferment, which gently agitates the milk of the fig."

This is also nearly the explanation of Theophrastus, to whom a knowledge of the sexes of plants is attributed, in his chapter " De Caprificatione," on *Caprification*. " Cum autem morsu crebro culices ora ficuum aperuerint, humorem absumunt supervacuum, et aditum liberum auris præbent, et omni poma spirantia efficiunt."

" By the numerous piercings of the flies, outlets are made in the figs, by which the *superfluous moisture* is drained, a free passage to the air afforded, and breathing pores effected." Theoph. B. II. C. XII.

Like some of our *modern* gardeners, who are in the habit of applying the *male* flowers to the *female* in the *cucumber* plant raised under glasses, in order to ensure a produce; so the *ancients* performed the like operation on their palms, pistachias, and figs, and in the same way, but without knowing, or even thinking, of the sexes in plants at the time.

Pistacia,[*] certainly as far as respects these trees, who always had the custom of suspending the *male* flowers over the *female* in order to obtain fruit.

Nor can it be denied that the most *ancient writers* have expressly made mention of the *Sexes in Plants.*[§] But how little true knowledge they possessed upon this subject, and upon what slender foundations it was built, appears from this, that they often mention *males* and *females*, as separate in plants, where *no such distinction existed.*[†]

Nay, after the revival of letters, even in the last century, Botanists had so imbibed this ancient error, that even eminent teachers of the art so badly discriminated the *Sexes*, that they often called that a *male* which was the *female* plant,[‡] which cannot better demonstrate their entire unacquaintance with the subject.

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[*] The *Turpentine Tree*, the Terebenthus Indica of Theophrastus, p. 401, is thus mentioned by Pliny. "Syria Terebinthum habet. *Mascula* est sine fructu. Fæminarum duo species; alteri fructus ruber lentis magnitudine, alteri pallidus."

"In Syria is produced the *turpentine tree.* The *male* bears no fruit. The *female* is of two kinds, the one has red grains of the size of peas, the other sort produces a pale fruit." Plin. Book XIII. Chap. IV.

This would be decisive, as proving Pliny's knowledge of the sexes of plants, but *unfortunately* for him, there is found in the same book, the following passage:

"Etiam Rhus Syriæ *mascula* fert. sterili fæmina."

"Also in Syria is produced the Rhus, or Sumach, the *male* of which *bears fruit*, but the *female* is *barren.*"

Bocconi, who wrote in 1697, notices the *male* and *female* Turpentine Tree. "E perche in sacca et in Agrigento osservai due albere di Pistacchi, differenti una dall altero, e distinti dai paesani contituto do *maschio* et *femina.*" "I observed in Agrigentum two trees of the Pistachia, or Turpentine Tree, differing from each other, which the peasants distinguish by the title of *male* and *female.*"

I shall produce now a modern authority.

"In the garden of the Austin Friars I saw several large Pistachia *nut-trees*, called in Sicilian, *Scornabecco*, and the fruit, *Fastugo.* These trees are of Linnæus's Class Diœcia, Order Pentandria, and produce *male* and *female flowers* upon different distinct plants. The latter prove barren and useless, unless rendered fruitful by the aspersion of the *farina* from a *male* plant, and, therefore, the purposes of fecundity can only be answered by trees of *different sexes* being set near each other. In these gardens are many of the *female* kind, and only one of the *male*, which has small, oblong, blunt leaves, of a dusky green, the flowers thick, and in bunches; the *female* blossoms are more scattered, the leaves larger, harder and rounder, and of a lighter colour. The *male* flowers first, and some gardeners pluck them when shut, dry them, and afterwards sprinkle the dust over the *female* tree. But the method usually followed in Sicily, when the trees are far asunder, is to wait till the *female* buds are open, and then to gather bunches of the *male* blossoms ready to blow; these are stuck into a pot of moist mould and hung upon the *female* tree, till they are quite dry and empty; this operation is called *Tuchiare*, and never fails to produce fructification." Swinburne's Travels, Vol. iii. p. 386. 2d Ed. 8vo. 1790.

Although I may seem to anticipate the train of reasoning of Linnæus, I cannot forbear relating here a story respecting the *Turpentine Tree* (Pistachia Terebinthus) recorded by Duhamel.

"In the garden of Mons. De la Serre, in the Rue de St. Jaque at Paris, there grew a *female* turpentine tree, which flowered every year, but which furnished him no fruit capable of vegetation. This was a very sensible mortification to the owner, who being ignorant of the doctrine of the sexes of plants, had laboured very hard to obtain an increase of that tree.

"Mess. Duhamel and Jussieu very properly took away all blame from the elements, and promised him they would soon procure him the pleasure he desired. They sent him a *male* turpentine tree, which was very much loaded with Blossoms. It was according to their direction planted near to the *female* turpentine tree. That year it produced a great quantity of fruit well conditioned, and such as, when planted, rose with facility. Being removed, his *female* turpentine tree became barren as before."

Some gardeners in Sicily, according to Swinburne, have ingeniously contrived the art of *budding* the *male* tree upon the *female*, by which means the two *sexes* are placed together upon the *same tree.*

[§] The *ancients* certainly had no *true* knowledge of the *Sexes of Plants*, as at this day understood, as I have proved in the *last note*, and *elsewhere*; this indeed Linnæus, in the very next passage, seems to admit. Although these facts were thus daily obtruded on their senses, inattentive to the structure of flowers, and ignorant of the offices of the several parts, they remained unacquainted with the true operations of Nature in this phænomenon, though daily presented to their observation.

[†] As the *male* Peony, *male* Cistus, *male* Fern, *male* Orchis, *male* Veronica, *male* Abrotanum, &c.

[‡] The Mercurialis Perennis, our common *Dog's Mercury*, is thus described by J. Bauhin. "Ex foliorum alis, *fœminæ* quidem ligulæ rectæ emicant, tenues, quas verticillatim seu in *spica* ambiunt flosculi glomerati muscosi, qui in quatuor foliola herbida sese explicantes, cirros apiculorum luteolorum aut herbidorum ostentant, *nullo succedento semine* pereuntes. *Mari* autem ex eisdem alis breves pediculi oriuntur, quorum singulis *testiculata bursala*, nonnihil compressa, hirsutaque insidet, gemina *semina includens.*" Our countryman *Ray* could not let this pass unnoticed, who, in vol. i. lib. iv, chap. v. "De Mercuriali," remarks, "In hac descriptione J. Bauhinus vulgarem opinionem sequitur, Mercurialem sterilem pro *fœmina*, et fertilem pro *mari* accipiens: cum e contra rationi consonum sit et aliarum rerum naturalium analogiæ, ut sterilis dicatur *mas*, fertilis *fœmina. Fœmina* enim est in omni genere quæ fætificat et fructum edit." "In this description John Bauhine follows the vulgar error, taking the barren Mercury for the *female*, and the fertile as the *male*: for it is contrary to sound judgment, and the analogy of other productions in nature, to call that which is *barren*, the *female*; and that which *produces*, the *male*. The *female* in all plants is that which swells, and produces seeds." Also in another chapter, when speaking of the *Spinach*, "vol. i. chap. iv. De Spinachia," he corrects again the vulgar error of making "the *spiked flowers* into the *female*, and the *sessile ones* into the *male*, also that the *male* and *female plants* were distinct *species.*" His words are "Spinachia *fœmina*, seu *sterilis*, perperam pro specie diversâ a Casp. Bauhino ponitur, cum ex eodem cum fertili semine proveniat."

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SIR THO$^{s}$. MILLINGTON, F.R.S.
Savilian Professor at Oxford;
President of the Royal College of Physicians.

*From a Portrait in the Hall of the Royal London College of Physicians copied by the liberal Permiſsion of the President and Fellows of the Royal College*

HIC PRIMUS ANTE OMNES FLORUM CONNUBIA VIDIT.

*London; Published by D$^{r}$. Thornton; March 1. 1807.*

The English report, that their MILLINGTON[*] was the *first true discoverer* of *this doctrine,*

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[*] Linnæus would not have so slightly mentioned this immortal discovery of the *Sexes of Plants* made by our illustrious countryman MILLINGTON, Savilian Professor (probably *Sedleian* Lecturer on Natural History) at Oxford, and afterwards President of the Royal College of Physicians (a name not even mentioned in the Encyclopædia Londinensis, or Biographia Britannica), but henceforth to be esteemed, like that of the memorable Harvey, or Jenner, had he been able to read the admirable account written in English of that important discovery, as it is given us by the learned Grew, in his " Account of the *Anatomy of Flowers*, prosecuted with the bare eye, and with the microscope," being a discourse read before the Royal Society Nov. 9, 1676, in which he thus clearly explains this matter.

" The Attire I find to be of two kinds, *Seminiforme* and *Florid*. That which I call *Seminiforme*, is made up of two general parts, *chives* and *semets*, one upon each chive. These semets (as I take leave to call them) have the appearance, especially in many flowers, of so many little seeds; but are quite another kind of body. For, upon enquiry, we find that these semets, though they seem to be solid, and for some time after their first formation, are entire; yet are they really *hollow*; and their side, or sides, which were at first entire, at length crack asunder: and that moreover the concave of each semet is not a mere vacuity, but filled up with a number of minute particles, in form of a powder. Which, though common to all semets, yet in some, and particularly those of a *tulip* or a *lily*, being larger, is more distinctly observable,

" These semets are sometimes fastened so, as to stand erect above their chive, as those of *larks-heel*. Sometimes, and I think usually, so as to hang a little down by the middle, in the manner and figure of a kidney, as in *mallows*. Their cleft or crack is sometimes single, but for the most part double: at these clefts it is that they disburse their powders; which as they start out, and stand betwixt the two lips of each cleft, have some resemblance to the common sculpture of a pomegranate with its seeds looking out at the cleft of its rind. This must be observed when the clefts are recently made, which usually is before the expansion of the flower.

" The particles of these powders, though like those of meal or other dust, they appear not easily to have any regular shape; yet upon strict observation, especially with the assistance even of an indifferent glass, it doth appear, that they are a congeries, usually, of so many perfect globes or globulets; sometimes of other figures, but always regular. That which obscures their figure is their being so small: in *dogs-mercury, borage*, and very many more plants, they are extremely so. In *mallows*, and some others, more fairly visible.

" Some of these powders are yellow, as in *dogs-mercury, goats-rue*, &c. and some of other colours: but most of them I think are white; and those of *yellow henbane* very elegant, the disbursed powders whereof, to the naked eye, are white as snow; but each globulet, through a glass, transparent as crystal; which is not a fallacy from the glass, but what we see in all transparent bodies whatsoever, lying in a powder or small particles together.

" The use of the *attire*, how contemptibly soever we may look upon it, is certainly great. And though for our own use we value the leaves of the flower, or the foliation, most; yet of all the three parts, this in some respects is the choicest, as for whose sake and service the other two are made. The use hereof, as to ornament and distinction, is unquestionable; but this is not all. As for distinction, though, by the help of glasses, we may make it to extend far; yet in a passant view, which is all we usually make, we cannot so well. As for ornament, and particularly in reference to the semets, we may ask, If for that merely these were meant, then why should they be so made as to break open, or to contain any thing within them? Since their beauty would be as good if they were not *hollow*; and is better before they crack and burst open, than afterwards.

" Other uses hereof therefore we must acknowledge, and may observe. One is, for food; for ornament and distinction to us, and for food to other animals. I will not say, but that it may serve even to these for distinction too, that they may be able to know one plant from another, and in their flight or progress settle where they like best: and that therefore the varieties of these small parts are many, and well observed by them, which we take no notice of. Yet the finding out of food is but in order to enjoy it: which, that it is provided for a vast number of little animals in the *attires* of all flowers, observation persuades us to believe. For why else are they evermore here found? Go from one flower to another, great and small, you shall meet with none untaken up with these guests. In some, and particularly the *sun-flower*, where the parts of the *attire*, and the animals for which they provide, are larger, the matter is more visible. We must not think, that Almighty God hath left any of the whole family of his creatures unprovided for; but as the Great Master, somewhere or other carveth out to all; and that for a great number of these little folk, he hath stored up their peculiar provisions in the *attires* of *flowers*; each flower thus becoming their lodging and their dining-room, both in one.

" Wherein the particular parts of the *attire* may be more distinctly serviceable, this to one animal, and that to another, I cannot say: or to the same animal, as a *bee*, whether this for the honey, another for their bread, a third for the wax: or whether all only suck from hence some juice; or some may not also carry some of the parts, as of the globulets, wholly away.

" But this is only the secondary use of the *attire*. But the PRIMARY and CHIEF USE of the *attire*" (anther) " is such, as hath respect to the plant itself; and so appears to be very great and necessary. Because, even those plants which have no flower or foliature, are yet some way or other attired; either with the seminiform, or the florid *attire*. So that it seems to perform its service to the seed, as the foliature, to the fruit. In discourse hereof with our learned Savilian Professor, Sir Thomas MILLINGTON, he told me, he 'conceived that the *attire* doth serve as the *male*, for the generation of the seed.'

Grew goes on. " When the SEMET" (*anther*) " ripens, it lets fall the contained POWDER" (*farina*), " which particles of POWDER" (*farina*) " themselves burst, and let loose a finer *powder*" (*pollen*), " which performs the office of *male*, and being carried to the SEED-CASE" (*germen*) " imparts to the SEEDS a *prolific virtue*." Vide *Grew's Anatomy*, p. 171. Nothing, therefore, can be clearer than that both MILLINGTON and GREW *first* perfectly knew the *sexes of plants*.

Doctor Pulteney also, in his " Historical and Biographical Sketches of the Progress of Botany," is willing to grant the merit of this great discovery to Grew *in preference* to Millington. Probably this high merit should be equally shared by both.

" Whether," says he, " the true idea of the Sexual Process originated with Sir Thomas Millington, to whom it has been usually ascribed, may justly admit of a doubt; since Sir Thomas has left no written testimony on the subject; and Dr. Grew's mention of him does not imply that he actually received the idea from him. Add to this, that Mr. Ray, in the summary view of all Grew's discoveries, which he has prefixed to his " History of Plants," does not mention Sir Thomas Millington's name. Interested as we must suppose Mr. Ray to have been, in every discovery relating to vegetables, and candid as he was in his general conduct to the learned, it is not likely that he should have failed, in this instance, to render praise where it was so justly due. When we further recollect, that Dr. Grew had been some years engaged in those microscopical experiments, on the anatomy of plants, which have rendered his name estimable with all posterity, that whilst he was thus employed in studying so intimately the organization of vegetables, and had observed, that in whatsoever parts the flower might be deficient, the *attire* is ever present, is it not strange that the true idea of its *use* should have been suggested to him?"

if it be allowed to call him an inventor, who *understands the thing*, but has not taught it in *writing*. They contend that about the year 1676, he saw the *whole mystery*; and, *in truth, not long after,** GREW and RAY,† both Englishmen, explained this matter farther.

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* It perhaps may be objected to Linnæus, that he did not clearly comprehend why this discovery is attributed to Millington, but it is a known fact, that Linnæus was unacquainted with the English language, and, therefore, could only receive his knowledge from the report of others. The whole story has been fully explained in the last note.

† Our illustrious countryman Ray was made, by the writings of Grew, a *complete convert* to the doctrine of the *Sexes of Plants*. In his "*Historia Plantarum*," "History of Plants," published in 1686, Book I. Chap. X. "*De floribus Plantarum, et primo de eorum Partibus*." "The Flowers of Plants and of their Parts." Speaking of the stamina, he expressly says, "Grevius noster non hunc tantùm usum stamina præstare opinatur, sed et pollinem illum seu globulos quibus apices prægnantes sunt, quósque per maturitatem effundunt, spermatis masculini instar seminibus fœcundandis inservire existimat; ac proinde maximam plantarum partem utriusque sexus participem esse. Quod non adeò incredibile videri debet, cum et in Animalium genere nonnulla androgyna observantur, ut v. g. Cochleæ terrestres; quamvis quidem in seipsis non generent, quo à plantis differunt. Nec obstat, quòd particulæ hæ (si modò sperma sint aut spermati analogæ) in uterum aut semina non penetrent, nam et in piscibus externè tantùm ovis jam editis inspergitur genitura, nec in ullo animalium genere, quod sciam, ovarium intrat, at nè uterum, quidem ipsum in plerisque, sed solus ejus halitus et effluvia subtilia sufficiunt ad ova fœcundanda, et embryon intus conclusum vivificandum.

"Hæc si ità sint, non similitudine aliqua duntaxat, sed revera et strictè loquendo sexu differunt plantæ illæ, quarum aliæ semen absque flore, aliæ (ab ejusdem plantæ semine ortæ) florem absque semine producunt. Tales sunt in Arborum genere *Palma dactylifera, Salices* pleræque ex nostra observatione, et secundùm Plinium etiam *Cedrus major:* in Herbarum, *Lupulus salictarius, Cannabis, Cynocrambe, Mercurialis, Phyllon, Urtica, Spinachia, Sesamoides* Clusii, aliáque non pauca.

"D. Grevii sententiam magnopere confirmant, quæ de Palma dactylifera à Veteribus et Recentioribus traduntur, nimirum fœminas non omnino fructificare, nisi mas juxta ipsas consitus fuerit: quin et pulverem maris fœminæ aspersum eam fœcundiorem reddere. Ni enim Ægyptii hoc fecerint (inquit Prosper Alpinus) sine dubio fœminæ vel nullos fructus ferent, vel quos ferent non retinebunt, neque hi maturescent. At inquies in arenosis et desertis, ubi nemo maris pulverem seu pollinem florum fœmineo fœtui aspergit, fœminæ nihilominus fœcundæ sunt. Immo verò ventorum beneficio, qui pulverem marium fœminis afflant."

"Our countryman Grew supposes the stamina to perform the office of the *male*, and that the *farina* with which the *anthers* are filled, and which separates from them when mature, serves the purpose of fructifying the *pistillum*, or female; and that the majority of plants are *bisexual*; that is, contain *both sexes* in the same *corolla*. Not that plants, like the snail, and some other species of animals, are *androgynous*, but are sufficient of themselves to produce their kind. Nor is there occasion, that the *farina* should pass into the *germen* to the *seeds*, but only an *halitus*, or *subtile effluvia*, which is capable of itself to vivify the included embrios.

"Besides *bisexual* flowers, there are also others strictly *unisexual*, having the *two sexes apart*, for from the *same sort of seed* there shall spring up two plants, whereof one shall bear only *stamens* or *males*, and the other only *pistils* or *females*. Of this kind are the *date-bearing palms*, according to Pliny the large *cedar*, and from *our own observation* many of the *willows*; and in herbs, the hop, hemp, mercury, nettle, spinach, and a great many others.

"What is reported by the ancients and moderns greatly *confirm* this opinion of Grew, respecting the *date-bearing palm*, that the *females* do not fructify, unless the *male* be placed near them, or the *farina* of the *male* be dispersed over the *female* flowers (Plin. Hist. Nat. Lib. 13. C. 4.) Unless the same was performed in Egypt, without doubt the *females* would produce no fruit, or what they had they would drop, or not ripen (Prosper Alpinus Lib. de Plant Ægypt.) It may be objected that dates are found in uninhabited spots, but here the *farina* is wafted to the *females* by means of the *wind*."

He, however, modestly ends with "Opinio autem hæc de usu pollinis prædicti ulteriori adhuc confirmatione indiget; nos ut verisimilem tantum admittimus." "This opinion of Grew, of the use of the *pollen* before mentioned, wants yet more decided proofs; we can only admit the doctrine as extremely probable." But this was only his cautious manner of writing, as in the following passage, Lib. iv. Hist. p. 156. where he treats of Herbs, "quarum fructus a floribus totis plantis distant, seu de Sexu distinctis." "On herbs, whose fruit is produced on plants separate from the male flowers, which are produced on other plants of the same kind," he writes "Plantæ hac sectione comprehensæ, si sexu reverà non differant, prout nos opinamur, umbram saltem aut similitudinem quandam sexûs obtinent, cùm in eadem specie nonnullæ naturâ steriles sint, et seminis infœcundæ; aliæ fertiles et semine prægnantes. Has nonnulli mares vocant, illas fœminas: alli rectiùs illas mares faciunt, has fœminas. Semina enim plantarum Animalium ovis respondent, quæ fœminæ pariunt, non mares. *C. Bauhinus* quas nos sexu tantùm diversas statuimus, specie distinctas facit: minùs rectè; cùm ex ejusdem plantæ semine utræque oriantur: æquo enim jure Virum et Fœminam species hominis distinctas facere potuisset."

"Plants comprehended in this section, if they do not differ in sexes, *a doctrine which we maintain*, nevertheless they possess at least the shade or similitude of *sexes*, since in the same species of plants some are found barren, *produce no seed*; whilst others are fertile, *producing seed*. The *latter* some have called *males*, the former *females:* others, of which number we are, more justly make the barren *males*, and the seed-bearing *females*. For the *seeds* of plants correspond to the *eggs* of animals, and what produces *these* are called *females*, not *males*. Caspar Bauhine has made into *distinct species*, what we have given as only *differing in sex*, and *badly*, for from the *same seed* both *sexes spring*; for with equal propriety might the man and woman be made distinct species."

"In his subsequent work, "*Synopsis Methodica Stirpium Britannicarum*." "A Methodical Synopsis of British Plants," published in 1689, p. 52. when making the same class of British plants, where the *sexes* are *distinct*, in the proem, he openly declares, "Hinc colligitur *stamina* non esse partem otiosam et superfluam, sed *potius* valde *utilem* et *necessariam*. Hinc enim *confirmatur* sententia opinantium *pulverem* in *apicibus staminum* contentum, spermatis masculini vicem præstare." Hence it may be collected, that the *stamina* are not an idle and superfluous part, but, on the contrary, very useful and necessary. This class of flowers confirms the opinion of those, who teach that the *dust* contained in the *anthers* of the *stamina performs the office of the male*."

I have been the more elaborate in this note to wipe away a very prevailing opinion, that our countryman Ray had doubts respecting the *sexes of plants*, because he hinted, as expressed above, that this doctrine should be established by *experiments*, as is here done by Linnæus. Ray's works throughout evince a *true* knowledge of the *Sexes of Plants*, and this doctrine owes much, as Linnæus allows, to both Grew and Ray.

VAIL-

NEHEMIAH GREW, M.D.
SECRETARY TO THE ROYAL SOCIETY

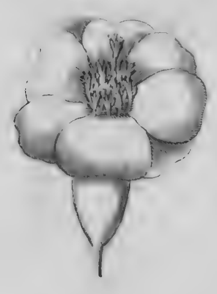
*Gresham College, where the first Meetings of the Royal Society were held.*

*C. Newton sculp.*

*London Published for Dr. Thornton, November 1st 1800.*

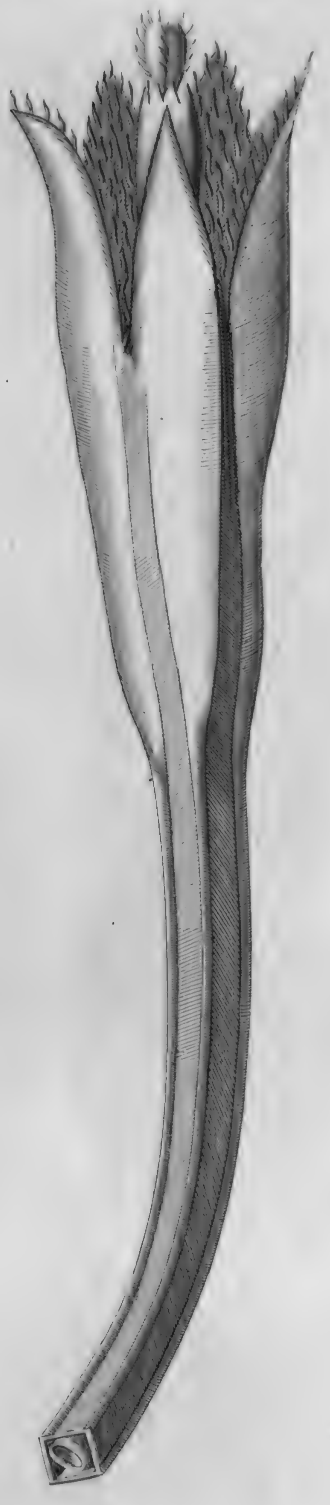
# A Plate from Grew's Anatomy of Plants, published in 1682.

1. Flower of Yellow Henbane,
(Marygold.)



2. One of the Florets magnified, of which there are 5.

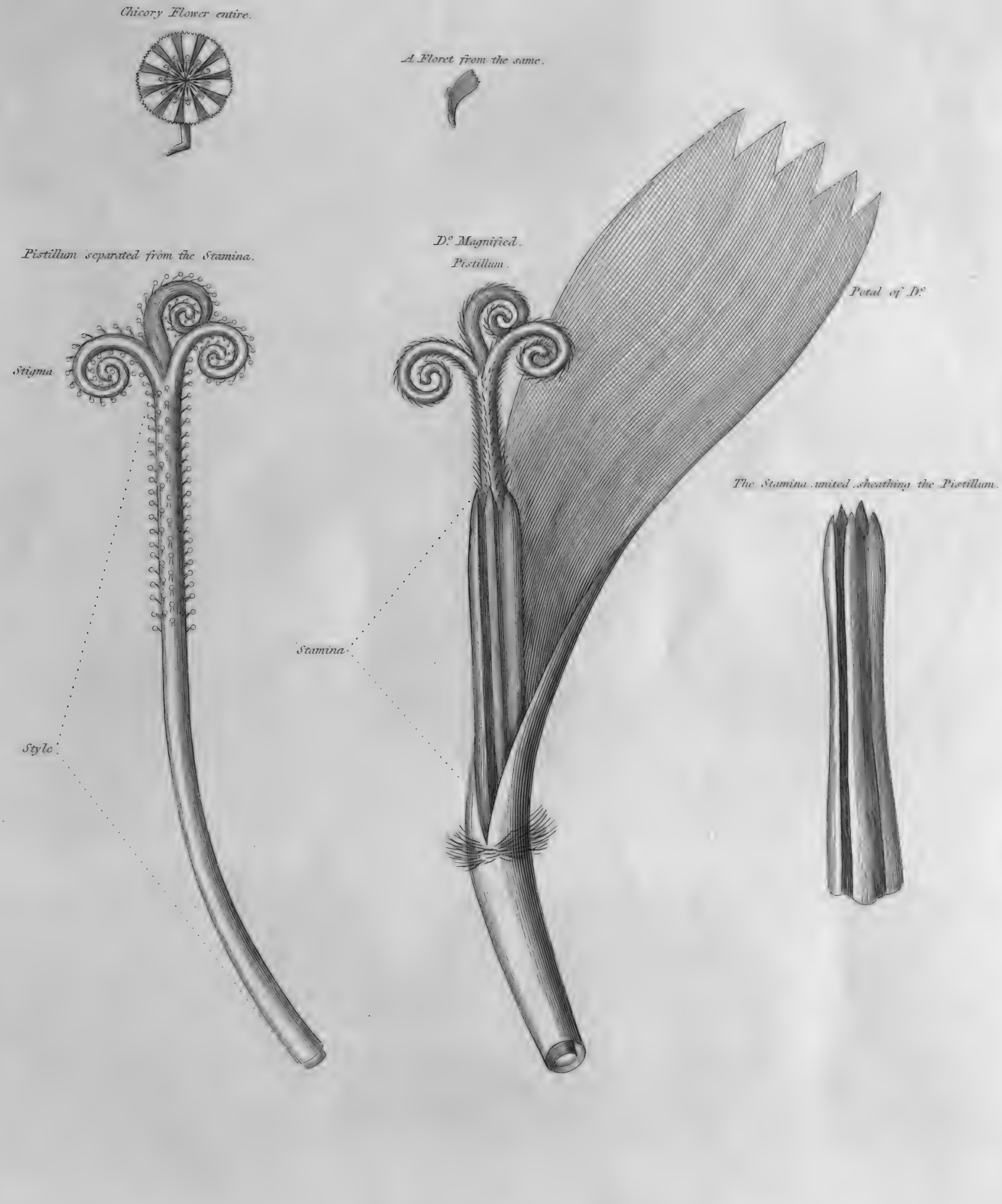
3. Dº in a more advanced State



4. Pistillum separated, covered with globules of Farina

London. Published by Dr. Thornton, Novr. 1 1809.

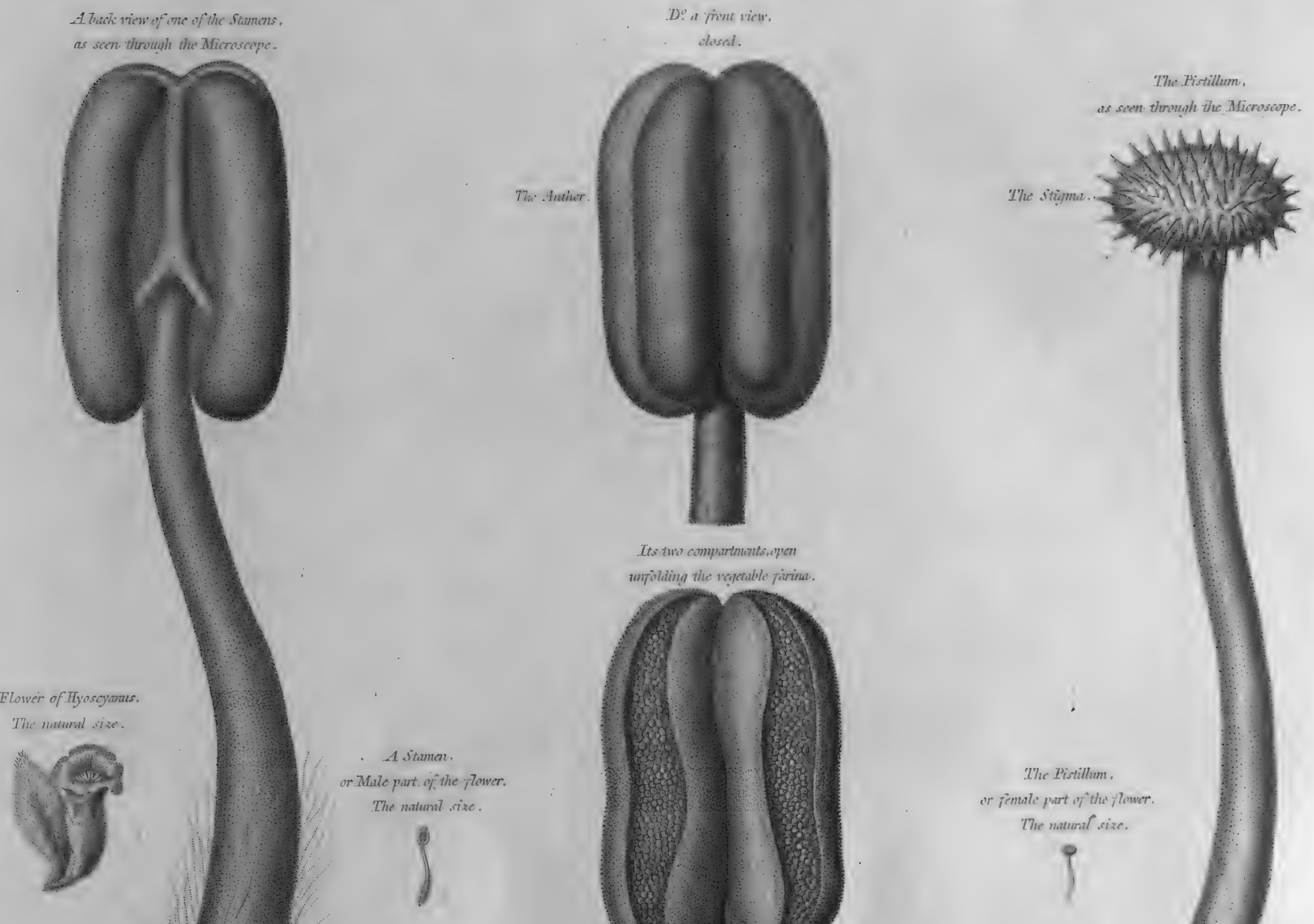
# A Plate from Grew's Anatomy of Plants, published in 1682.



Grew del. Warner sculp.

London. Published by Dr. Thornton, Septr. 1. 1809.

# A Plate from Grew's Anatomy of Plants, published in 1682.



Grew del. Warner sculp.

London, Published by D$^{r}$ Thornton, Feb$^{y}$ 1, 1803.

The Revd. JOHN RAY, A.M. F.R.S.
Author of Historia Plantarum.

Craig del. Holl sculp.

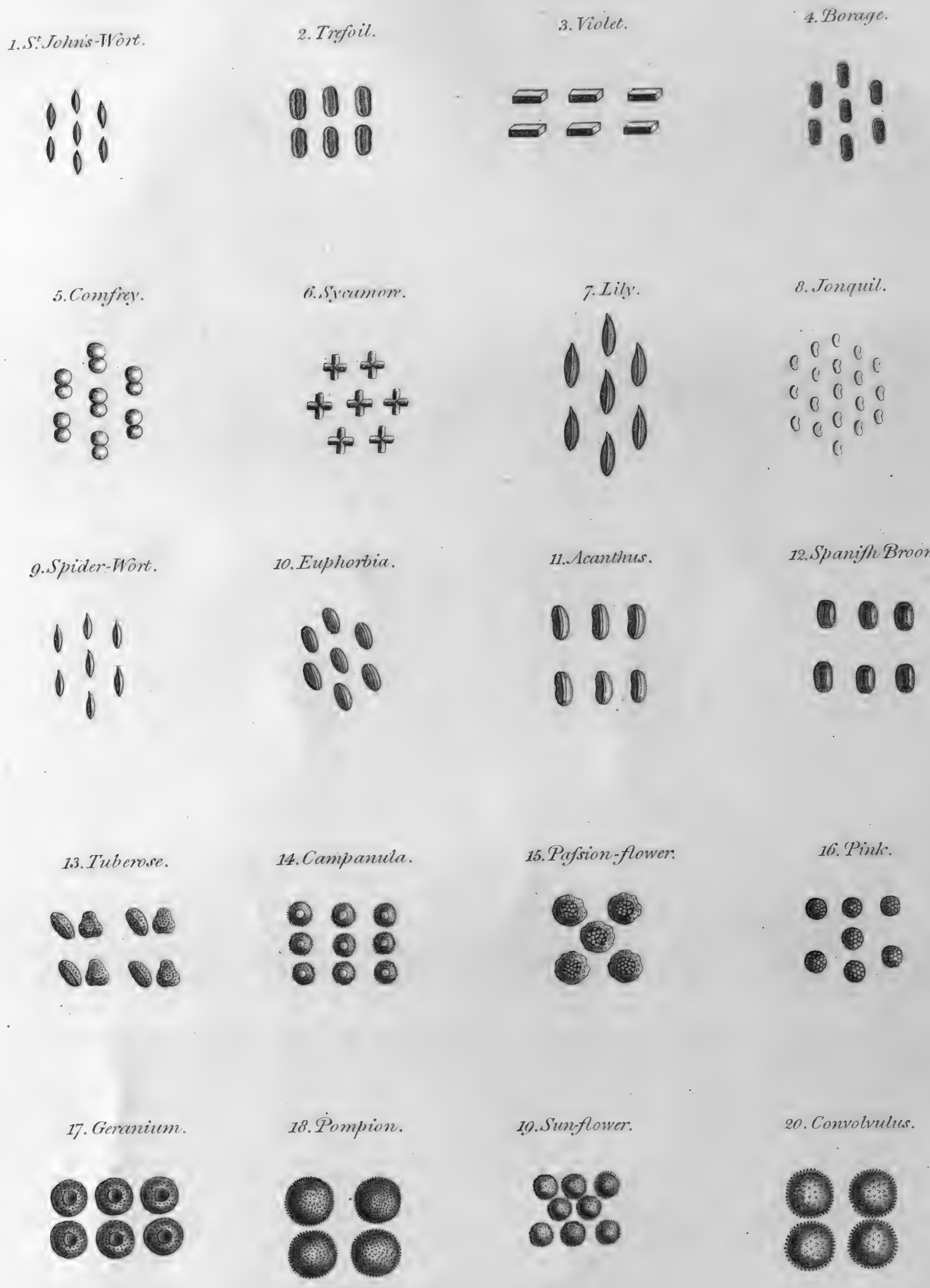
*Britannia crowning Ray as the Prince of English Botanists.*

*N.B. This Picture is in the British Museum.*

*Mrs. Beale pinx.* *Holl sculpt.*

*London: Published for Dr. Thornton, Augt. 1. 1804*

# Farina of Flowers, as observed by the Microscope. Published by Geoffroy in the Year. 1711.



Geoffroy del.

Mazel sculp.

London, Publiſhed by Dr Thornton, August 1807.

CAMERARIUS,[*] and several others after him,[†] have well explained this doctrine:

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[*] Camerarius, Professor at Tubingen, in his book "De Sexu Plantarum," "On the Sexes of Plants," published in 1694, acknowledges, "that he first became convinced of the truth of this doctrine by perusing what had been written on this subject by Grew, and afterwards by Ray, to whom he attributes the honour of establishing this important discovery." His experiments were only on the *Maize*, the *Mulberry*, the *Ricinus*, and the *Mercury*; the three first of which he deprived of the *stamen-bearing*, or *male* flowers, and the last he separated from its correspondent *female*, and found that the seeds produced in each instance *did not vegetate*.

[†] In 1703, Mr. Samuel Morland, desirous, as it should seem, of extending the Lewenhookian system of generation into the vegetable kingdom, produced a paper before the Royal Society, in which he advances—that the *farina* is a *congeries* of plants, one of which must be conveyed through the style into every *ovum*, or seed, before it can become prolific. He founded his opinion "from observing an opening in the arillus, or husk, of the bean, situate near where the plantule is found lodged, which he conceived was formed on purpose for the admission of a globule of the farina, which so disposed became the plantule." The refutation of this opinion will presently appear.

In 1711, was read, "A Dissertation on the Structure and Use of the Parts of Flowers," by Mons. Geoffroy, before the Royal Academy of Science at Paris, where several curious remarks on the Farina, and some experiments on the Sexes of Plants, are given.

Speaking of the farina, Mons. Geoffroy says, "It would be difficult to describe all the different figures of the farina; for however small, each corpuscle has a regular, determinate, and constant figure. In the general run this figure is oval, with a groove the whole length, resembling a grain of corn, or a seed of coffee, as in the Bryony, &c. But,

1. In that of the St. John's Wort, Hypericum Vulgare, of Caspar Bauhine's Pinax. (Hypericum Perforatum, Lin.) appear like oval bodies, pointed at their extremities, and swelled in the middle.
2. In that of the Trefoil, Melilotus officinarum Germaniæ, C. B. P. (Trifolium officinale, Lin.) like a cylinder, having a band running its length.
3. That of the Violet, Viola Montana tricolor odoratissima, C. B. P. (Viola grandiflora, Lin.) presents a prism with four irregular sides, transparent, and reflecting different forms.
4. That of the Borage, Borago floribus cæruleis, J. B. (Borago officinalis, Lin.) are likewise cylinders, but compressed in the middle, and shining in three different distinct spots.
5. That of the Comfrey, Symphytum, Consolida major, C. B. P. (Symphytum officinale, Lin.) represents two crystal balls attached together.
6. That of the Sycamore, Acer montanum candidum, C. B. P. (Acer Pseudo-Platanus, Lin.) presents a perfect cross.
7. That of the Lily, Lilium album vulgare, J. B. (Lilium candidum, Lin.) an oblong oval, pointed at both ends, and with a groove its whole length.
8. That of the Jonquil, Narcissus juncifolius, luteus, minor, C. B. P. (Narcissus Jonquilla, Lin.) have the form of a kidney.
9. That of the Spider-wort, Ephemerum Virginiacum, flore cærules majori, J. R. H. (Tradescantia Virginica, Lin.) resembles a barley-corn.
10. That of the Euphorbia, Tethymalus Characias angustifolius, C. B. P. (Euphorbia Characias, Lin.) and of the Palma Christi, Ricinus Vulgaris, C. B. P. an ovoid figure, with a rising its whole length.
11. That of the Acanthus, Acanthus rarioribus et brevioribus aculeis munitus, J. R. H. (Acanthus mollis, Lin.)
12. That of the Spanish Broom, Genista Juncea, J. B. (Spartium junceum, Lin.) are oblong, rounded at their extremities, and has two bands, being two luminous eminences.
13. That of the Tuberose, Hyacinthus Indicus, (Tuberosus, flore Hyacinthi orientalis, C. B. P. Polyanthes Tuberosa, Lin.) swelled in the middle, so as to make a prism with three sides.
14. That of the Campanula Campanula pyramidalis, altissima, J. R. H. are round transparent, with light eminences, and a luminous point in the center.
15. That of the Passion-flower, Granadilla Polyphyllos fructu ovato, J. R. H. (Passiflora cœrulea, Lin.) are nearly round, with small risings over the surface.
16. That of the Pink, Caryophyllus sylvestris calidarum regionum, J. R. H. are round, the surface a regular mosaic.
17. That of the Geranium, Geranium sanguineum maximo flore, C. B. P. round, with a kind of navel, as in the apple.
18. That of the Pompion, Melepepo compressus, C. B. P. (Cucurbita Melopepo, Lin.) are round, with short pointed eminences.
19. That of the Sun-flower, and Marsh Caltha, Caltha palustus, have the surface covered with hairs.
20. That of the Althea riretescens (Lavatera Olbia, Lin.) and the Convolvulus purpureus, C. B. P. (Convolvulus hederacius, Lin.) have the surface covered with very short eminences.

After many observations on the Sexes of Plants, he relates the following experiment.

I raised several plants of Maize, or Turkey corn, which on the summit of its branch produces male, or stameniferous flowers, and the fruit is enclosed in a leafy sheath.

I removed the stamina with all the care imaginable, as soon as they shewed themselves, and before the pistilliferous flowers appeared.

Upon most of these plants so served, the spike, after growing to a certain size, dried up, and the grains were withered, or only a few grains[a] attained its proper size, and these, but thinly scattered along the rachis, which might probably arise from imperfect castration.

The same event occurred to him with the Dog's Mercury.

As to the manner of the embryo being conveyed into the seed, he accords entirely with Morland. He says, "that the best microscopes can never discover the plantule, or embrio, in the early stage of the pistillum, nor even when more advanced, unless the farina has reached the stigma of the pistillum." His words are, "En effet, si l'on examine dans les plantes legumineuses, le pistile, ou cette partie qui devient la gousse, avant que la fleur soit encore éclose, et qu'après l'avoir débarrassée des feüilles et des étamines, on la regarde au Soleil avec un microscope, on y remarque très aisément les petites vesicules vertes et transparentes qui doivent devenir les graines placées dans leur ordre naturel, et dans lesquelles on ne distingue rien autre chose que l'enveloppe ou l'écorce de la graine. En continuant d'observer pendant plusieurs jours de suite dans d'autres fleurs à mesure qu'elles avancent, on remarque que ces vesicules grossissent et se remplissent d'une liqueur claire dans laquelle, lorsque les poussiéres se sont répandües et lorsque les feüilles de la fleur sont tombées, on commence à appercevoir un petit point ou

[a] It was a pity he had not tried the experiment of sowing these grains.

globule verdàtre qui y flotte librement. On n'apperçoit encore rien d'organisé dans ce petit corps, mais avec le temps et à mesure qu'il grossit, on y distingue peu à peu deux petites feüilles comme deux cornes. La liqueur se consomme insensiblement à mesure que ce petit corps grossit; et la graine étant devenüe tout à fait opaque, en l'ouvrant on trouve sa cavité remplie de la petite plante en raccourci, composée du germe ou de la plumule, de la radicule et des lobes de la Féve ou du Pois.

" Si au contraire dans les pivoines à fleurs doubles, qui sont tout à fait denuées d'étamines et de sommets, on examine les graines qu'elles produisent, soit qu'elles soient avortées ou qu'elles ne la soient pas; on les trouve vuides contenant seulement quelques membranes dissechées et sans aucune apparence de germe, semblables en cela à l'œuf d'une poule qui n'a point été fecondé. En effet, s'il y eût eû un germe dans ces membranes, n'auroit-il pas dû grossir à proportion de ces enveloppes, et devenir très sensible.

" En suivant cette conjecture, il n'est pas difficile de déterminer de quelle maniére le germe entre dans cette vesicule; car outre que la cavité du pistile s'étend depuis son extremité jusqu'aux embryons des graines, ces vesicules ont encore une petite ouverture près de leur attache qui se trouve à l'extrêmité du conduit du pistile; ensorte que le petit grain de poussiére peut tomber naturellement par cette ouverture dans la cavité ou espece de cicatricule reste encore assés sensible dans la pluspart des graines: on l'apperçoit très aisement sans le secours du microscope dans les Pois, dans les Féves et dans les Phaseoles.

" La racine du petit germe est tout proche de cette ouverture, et c'est par cette même ouverture qu'elle sort, lorsque la graine vient à germer."

Next in order follows the boastful BRADLEY, who published his " New Improvement in Planting and Gardening, both Philosophical and Practical," in 1721. He writes, " Mr. MORLAND has, in *Phil. Trans.* No. 287, anno 1703, given us to understand how the dust of the apices in flowers (i. e. the male sperm) is conveyed into the germen or *vasculum seminale* of a plant, by which means the seeds therein contained are impregnated. I then made it my business to search after this truth, and have had good fortune enough to bring it to demonstration by several experiments; since which, a gentleman of Paris has printed something of the same nature, in the *Hist. de l'Acad. de Sciences*, for the years 1711 and 1712, which were published about ten years ago.

" But to come to the point; the lily being a flower more generally known than any other, and its generative organs being large and exposed, I shall from thence endeavour to explain the method which nature makes use of to impregnate the seeds of that and every other plant, and by which means the several species of vegetables have been continued to the world.

" The flower of the lily has six leaves or petals, which are set on upon the summit of the footstalk; they serve to guard the parts of generation from the injuries of the weather; and as they are of no other use that I know of, so it is not necessary that I should place them in the figure.

" *B* is the mouth of the pistillum, or passage which leads into the germen *C*, in which are three ovaries filled with little eggs or rudiments of seeds, such as we find in the ovaria of animals; but these eggs will decay and come to nothing, unless they are impregnated by the *farina fœcundans* or male seed of the same plant, or one of the same sort.

" From *D* to *E* is a stamen of the lily, through which the male seed of the plant is conveyed to be perfected in the apex *F*, where, by the sun's heat, it ripens and bursts forth in very minute particles like dust; some particles of which powder falling upon the orifice *B*, is either conveyed from thence into the germen *C*, or by its magnetic virtue, draws the nourishment, with great force, from the other parts of the plant into the embryos of the fruit, and makes them swell.

" Now, that the *farina fœcundans* or male dust has a *magnetic virtue*, is evident; for it is that only which bees gather and lodge in the cavities of their hind legs to make their wax with; and it is well known, that wax, when it is warm, will *attract* to it any light body. But again, if the particles of this powder should be required by Nature to pass into the ovaries of the plant, and even into the several eggs or seeds there contained, we may easily perceive, if we split the pistillum of a flower, that Nature has provided a sufficient passage for it into the uterus, or germen.

" In the first figure I have only given a design of one stamen with its apex, to prevent mistakes in my explanation; but the flower of every lily has six of the same figure and use, which are placed round about the pistillum, or female organ; so that it is almost impossible it should escape from receiving some of the male dust (or *farina fœcundans*) falling upon it.

" In this and other flowers of the like nature, the pistillum is always so placed, that the apices (*anthers*) which surround it, are either equal in height with it, or above it; so that their dust falls naturally upon it. And when we observe it to be longer than the apices, we may then conjecture that the fruit has begun to form itself, and has no longer occasion for the male dust. And it is likewise observable, that as soon as this work of production is performed, the male organs, together with the leaves or covering, fall off, and the pipe leading to the germen begins to shrink.

" We may farther remark, that the top of the pistillum in every flower, is either covered with a sort of velvet tunick, or emits a gummy liquor, the better to catch the dust of the apices (*anthers*).

" And now, as we may find in the description I have given of the lily, that the germen is within the flower; so, on the other hand, the germen of a rose is without the flower, at the bottom of the petals or flower-leaves. And likewise in fruit trees, the cherries, plums, and some others, have their utricles within their flowers; and the gooseberry, currant, apples and pears, on the outside or bottom of their flowers. But farther; although Nature has designed the dust of the apices to fecundate the pistillum contained in the flowers of plants, yet we observe that in some plants, the male and female organs are remote from each other. As, for example, the *Gourd, Pompion, Melon, Cucumber*, and all of that race, have blossoms distinctly, male and female, upon the same plant. The male blossoms may be distinguished from the others, in that they have not any pistil rudiment of fruit about them, but have only a large thrum covered with dust in their middle: the female blossom of these has a pistillum within the petals or flower-leaves, and the rudiment of their fruit always apparent at the bottom of the flower before it opens: and so in like manner all nut-bearing, and, I think, mast-bearing trees, have their *catkins* or male blossoms remote from the female flowers.

" The oak, for example, which blossoms in May, has its male flowers distinct from the acorns; we find strings of little farinaceous flowers in great abundance, as in the second figure marked *G*, remote from the rudiments of the acorns or fruit, marked *H*. And so likewise in the *Walnut, Chesnut, Hazel, Pine, Cypress*, and even the *Mulberry, Aspen*, and others. I have observed that some sorts of *Willows* change their Sex every year, by producing only male blossoms or *catkins* one year, and the other following, strings of female blossoms, which, if they then happened to be near enough some flowering male, will produce seeds.

" When we view, with a good microscope, the male dust of any single plant, we find every particle of it to be of the same size and figure; but in some cases it is of three colours, as in the *tulip*, where it is yellow, green, and black; but as plants differ from one another in their figures and qualities, so are the figures of their several dusts greatly different from each other: a grain of the dust of *Geranium Sanguineum, maximo flore*, of *C. B. P.* is like a bead of a necklace with a hole through it.

" The

Tulip Roots covered with one Skin.

Dº opened.

1. The withered Stem on the outside of the Bulb, because the bulb of the last year in the center of which it grew is decayed away.

Horizontal Sections of the Bulbs A, and B;
Shewing the young Tulips in their Center.

An horizontal Section of an Hyacinth Bulb.
Shewing also the young Flower.

# Anatomy of the Tulip Root.

Henderson del.

Wm. Dunkarton Junr. sculp.

London. Published by Dr. Thornton. June 1.1809.

# A Plate to illustrate the Form Variety.
# Petals of Tulips.

1. LA MAJESTUEUSE.

*A blue purple band in the Center.*

2. GENERAL WASHINGTON.

*The border a red purple.*

3. EARL SPENCER.

*Much variegated with dark purple Stripes*

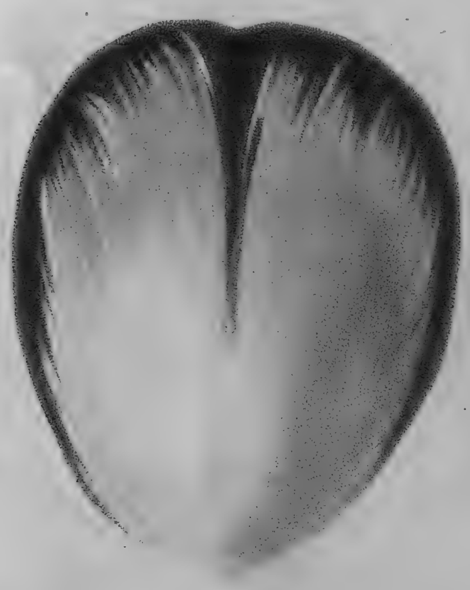
*A New Tulip, raised by Mason.*

4. TRIOMPHE ROYALE.

*Carnation Stripes.*

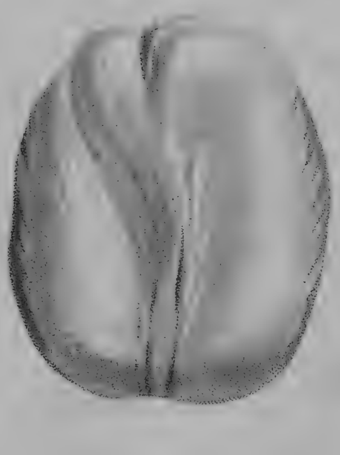
5. LOUIS XVI.

*Edged with black.*



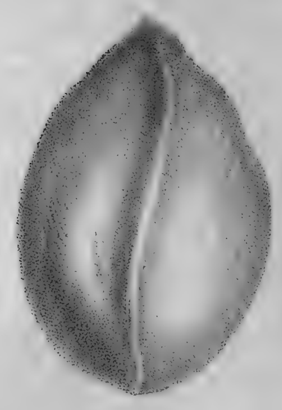
6. GLORIA MUNDI.

*A yellow Tulip.*



7. COMMON TULIP.

*The Petal lanceolate, of one colour.*



8. DUTCHESS of DEVONSHIRE.

*Yellow, with dashes of light purple*

*A New Tulip, raised by Davey.*

P. Reinagle Pinxt. London Published by Dr. Thornton May 1, 1799 H. Landseer Sculpt.

“ The farina of the *Corona Solis perennis, Flore et Semine maximis, Hort. Ludg. Bat.* is a globe set with thorns; that of the *Ricinus Vulgaris, C. B. P.* is of the figure of a grain of Wheat.

“ And the *Acer Montanum Candidum* of *C. B. P.* affords a dust of the figure of a cross: and in like manner does the farina of every plant differ in its shape from the rest.

“ The female organs of generation in plants are best seen in large fruits, without the trouble of the microscope; such as the fruit of the *Pompion* or *Melon,* where, with the natural eye, we may discover the vessels distinctly, which make the *tunic* or covering of each ovary: we may see how the seeds are joined to it, and by what end they receive their nourishment. And again, between the several ovaries enclosed in that fruit, we may very easily perceive the hollow, or passage, through which the *farina fœcundans* has passed to impregnate the seeds.

“ It may perhaps be objected against this hypothesis, that there are many flowers which hang downwards, as the *Crown Imperial,* the *Cyclamen,* &c. and that their pistils cannot receive the *farina fœcundans* upon them: but if we observe that the pistils of these flowers are always more prominent, or somewhat longer than the dusty apices which surround them, we may easily conceive that the *glutinous matter* and *velvet covering* on the *extremities* of the pistils, may be capable enough of receiving and holding some of the powder as it falls; and whether the intromission of the *farina fœcundans* be requisite or not, its lodgment on the mouth of the pistillum may, by virtue of its attractive quality, *perhaps* fecundate the seeds contained in the germen: I am sure, in the production of animals, there are yet greater difficulties to encounter with; and it may be, if the analogy between plants and animals was more enquired after by the learned, they might discover many new things which would be serviceable to the preservation and benefit of animal bodies, as this knowledge will be to the improvement of the vegetable world.

“ I shall now proceed to what I call the *demonstrative part* of this system. I made my first experiment upon the *tulip,* which I chose rather than any other plant, because it seldom misses to produce seed. Several years ago I had the conveniency of a large garden, wherein there was a considerable bed of tulips in one part, containing about four hundred roots: in another part of it, very remote from the former, were twelve tulips in perfect health. At the first opening of the twelve, which I was very careful to observe, I cautiously took out of them all their apices (ANTHERS), before the *farina fœcundans* was ripe, or any ways appeared: these tulips being thus castrated, bore no seed that summer; while, on the other hand, every one of the four hundred plants, which I had let alone produced seed.”

Blair, in his “ Botanical Essays,” in that “ On the Generation of Plants,” has collected the opinions of all former writers, and added his own, in refutation of the embryo being constituted in the particles of farina. He has added no experiments of his own on the Sexes of Plants.

Next follows our illustrious MILLER, in the Gardener's Dictionary, published in 1730, under the word “ Generation.” After detailing the different sentiments and opinions advanced on this subject, he ends by relating his own experiments.

“ I shall conclude with mentioning a few experiments of my own, which I communicated to Dr. Patrick Blair, which he improved as a proof of his opinion of effluvia; and Mr. Bradley also, as a proof of the farina entering the germen in substance, and leave the curious enquirer to determine on that side of the question, which reason and experiment shall influence him.

“ I separated the male plants of a bed of *spinage* from the female, and the consequence was, that the seed did swell to the usual bigness; but when sowed, it did not grow afterwards: and searching into the seed, I found it wanted the *Punctum Vitæ.*

“ I set twelve *tulips* by themselves, about six or seven yards from any other; and as soon as they blew, I took out the stamina so very carefully, that I scattered none of the male dust; and about two days afterwards I saw bees working on a bed of *tulips,* where I did not take out the stamina; and when they came out, they were loaded with dust on their bodies and legs, and I saw them fly to the *tulips,* where I had taken out the stamina; and when they came out, I found they had left behind them sufficient to impregnate these flowers, for they bore good ripe seeds. But by a piece of gauze put over the flowers the experiment is found to answer.

“ In a letter communicated by Paul Dudley, Esq. to the Royal Society, wrote from New England, he mentions the interchanging of the colours of the *Indian wheat,* if the various colours are planted in rows near each other; but if they are planted separately, they constantly keep to their own colour: and this interchanging of colours has been observed, when the distance between the rows of corn has been several yards; though he says, if there happens to be a high board fence between the different coloured corns, the alteration of colours is entirely prevented.

*Cucumbers* do always produce male and female flowers upon different parts of the same plant: the male flower (which appears upon a slender footstalk, and has a slender column in the middle, covered with an orange-coloured farina) is by the gardeners commonly called *false blossoms,* and are sometimes by unskilful persons pulled off soon after they appear, supposing that they weaken the plants if suffered to remain, which is a very great mistake: for in order to try this experiment, I planted four rowss of *cucumber* plants in a place pretty far distant from any other; and when the flowers began to appear, I constantly pulled off all the male flowers from time to time before they opened: the consequence was, that all the young fruit dropt off soon after they appeared, and not one single fruit remained to grow to any size, though the vines were equally strong with those which I had planted in another place, where I suffered all the flowers to remain upon them, from which I had a great quantity of fruit.

“ From these, and many other experiments, it is very plain, that there is a neceſſity that the embryo of the female flower should be impregnated by the farina or male dust, in order to render the fruit perfect; but how, or in what manner it is performed, is what we can only guess at, since in the generation of animals, our greatest naturalists differ very much in their opinions, nor can any of them ascertain any particular method how it is performed.

“ Some persons have objected to the theory of the generation, as here laid down, because they have observed some female plants produce fruit, without having been impregnated by the male.

“ It is certain, that the female plants may produce fruit without the impregnation of the male; but it is not certain, that this fruit or seed will, if sown, produce another plant. What has been so often related by travellers and historians, of the necessity of the male palm-tree being near the female, in order to render it fruitful, hath been, it is supposed, fully refuted by Father Labat, in his account of Africa, where he has treated of the several sorts of palms: he says, that he observed, in Martinico, a large palm-tree, which grew by the side of a convent, which produced fruit in plenty, though there was no other palm-tree growing within two leagues of this; but he also observed, that none of these fruit would grow, though they had made many trials of them; so that they were obliged to procure some fruit from Barbary, in order to propagate these trees. He likewise adds, that the fruit which grew on this female tree, never ripened so perfectly, nor was so well tasted, as those which came from trees which had stood near some of the male. Therefore we may conclude, that the fruit or seed may be produced by the female plants of most kinds, without the assistance of the male sperm, which may appear to sight perfect, and fit to produce other plants; but if we examine the seeds, we shall find that most of them have not the germ, or little plant inclosed, nor will grow, if they are sown.

But none better than VAILLANT,‡ the great French botanist, who, in his academic

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"From a repeated number of experiments, in separating the male from the female plants, I have always observed, that where it has been done in time, and with proper care, so as that there could have been none of the *farina fœcundans* of the male plant scattered on the female; that though the female plants have produced sometimes fair seeds to appearance, yet, when they have been carefully sown, there has not been one plant produced from them.

‡ The honour of the discovery of the *Sexes in Plants* is always torn from our countrymen, and given by the French to VAILLANT. In that famous Poem,[a] published in Vaillant's "*Botanicon Parisiense,*" "*De Connubiis Florum,*" the poet gives this honour to VAILLANT.

"Callibus insistat veterum pede turba sequaci,
Vulgaresque animæ, servûm genus; at sibi stravit
Intactum VALIANTUS iter. Quâ callidus arte
Dirigat in flores etiam sua tela CUPIDO
Vidit, et herbarum detexit *primus* amores.
MACENCROE, M.D."

There are also other pieces of poetry which preface this work to the same effect:

"Omnibus in terris quæsitum ad Florea regna,
Et nemo in terris inveniebat iter;
At nunc si patuit, si flos hic *masculus*, ille,
*Fæmineus*, vel *mas fæmineusque simul*;
Arma viri melius si *stamina* credimus esse
*Pistillum* melius conjugis esse tubam,
Nec latet, inque tubas inque ova ut fulguris instar
Mane ferax rigidi staminis aura ruat;
Audiat Elysiis hæc TOURNEFORTUS in arvis:
*Inventum decus est hoc* VALIANTE *tuum.*
DEMETRIUS DE LA CROIX, M.D."

Another,

"L'ingenieux VAILLANT grand partizan de Flore,
Epia la Nature, et la prit sur le fait;
Par un souffle subtil it vit les fleurs éclore,
Et de leur tendre *amour* le mystere secret.
LOUIS BADON DE LA RIVIERE."

And, in order to fix this honour more permanently on VAILLANT, under his portrait is engraved,

"Hic *primus* ante alios *Florum Connubia* vidit."

We do not mean to deny the knowledge VAILLANT had of this subject, for he has presented us, in his discourse "De Structurâ Florum, horum Differentia, Usuque Partium," "On the structure of Flowers, their Variety, and the Uses of the component Parts," published in 1718, with a very florid description of the Marriage of Plants, and his particular observations on the PARIETARIA (*Pellitory of the Wall*), of which, for the sake of the curious and inquisitive reader, we shall make a short extract.

"Quoties autem accideret, ut in eâdem stirpe flores gerantur simul, quorum hi fœminina tantum, illi autem masculina et fœminina conjuncta, organa cingunt, arrectio, tumorque organorum masculinorum in hisce tam subitò contingit, ut lobuli gemmæ flosculosæ cedant illorum impetui, atque hinc inde semet expandant mirabili mehercule velocitate. Etenim eodem hocce momento libidinosa hæc ingenia nihil ardentiùs cogitant, nisi ut violentos luxuriei affectus expleant, neque citiùs libera se et expedita experiuntur, quin extemplò quàm vehementissimè fœcundam explodant, omnemque uno impetu ejaculentur, genituram, diffusà nimirum pulverulentâ nubeculâ spargente quaquaversùm fœcundationem arvi genitalis. Verùm, quàm rara, quàm mira, catastrophe! ipso hoc fœcundandi ardore adeò semet exhausta dolent, ut ipso, quo prolem vitam donant, momento sibimet mortem parant præsentissimam!

"Neque vel hic tamen Scena clauditur. Quid ergo? Vix venereus hic lusus absolutus est, quin ilicò florum labia, aut lobuli, ad se invicem accedant eodem quidem, quo à se mutuò recesserant, celeritatis impetu, veteremque ita formam statim renovent. Ita quidem, ut difficillimum foret credere, flores hosce ullam vim passos esse, nisi vel ipse actum hunc vidisset oculus, vel adhuc cerneret caduca sceleta magnanimorum heroum, qui hanc pugnaverant pugnam; clara quippe hæc gestæ fortiter rei monumenta supersunt aliquamdiu erecta in campo conflictûs, aut Aplustrium instar Jacularios experiuntur lusus volitantis Zephyri.

Apparatum huncce artificiosum facilè spectare datur in PARIETARIA. Sed accedas oportet horâ sacrâ Veneri! Aurora est, quæ favet et adspirat diversorum in plantis sexuum voluptatibus, congressibusque; ubi verò agere fortè renuunt satis opportunè ex voto Tui observantis, cogere vel sic poteris, aciculæ apice leniter modò stimules. Si enim matura jam hisce ætas lusibus, opus tantum erit quàm blandissimè unum elevare lobulorum, statimque spectaculo quàm jucundissimo oblectaberis; filamenta quippe, vel manubria staminum ex arcuato hactenus incurvoque flexu in erectum arriguntur situm, ut vi acta violentâ; tumque liquidò spectatur singulare quodque et tectum, quod in exercitio hocce peragitur venereo. Vaillant Sermo de Florum Structurà, p. 9." A property not less extraordinary has been discovered in other plants.

The learned Founder and President of the Linnæan Society, London, Dr. SMITH, read a paper "*On the Irritability in the Stamina of the Barberry, &c.*" before the Royal Society, Feb. 14, 1788.

"The stamina of such of the flowers of the BARBERRY (*Barberis Communis*) as were open were bent backwards to each petal, and sheltered themselves under their concave tips. No shaking of the branch appeared to have any effect upon them. With a very small bit of

[a] This very interesting Poem, containing 525 lines, was written by Dr. Grant, an Irish student at Paris, under a masked name. It has been since published alone by White, edited by Sir Richard Clayton, Bart.

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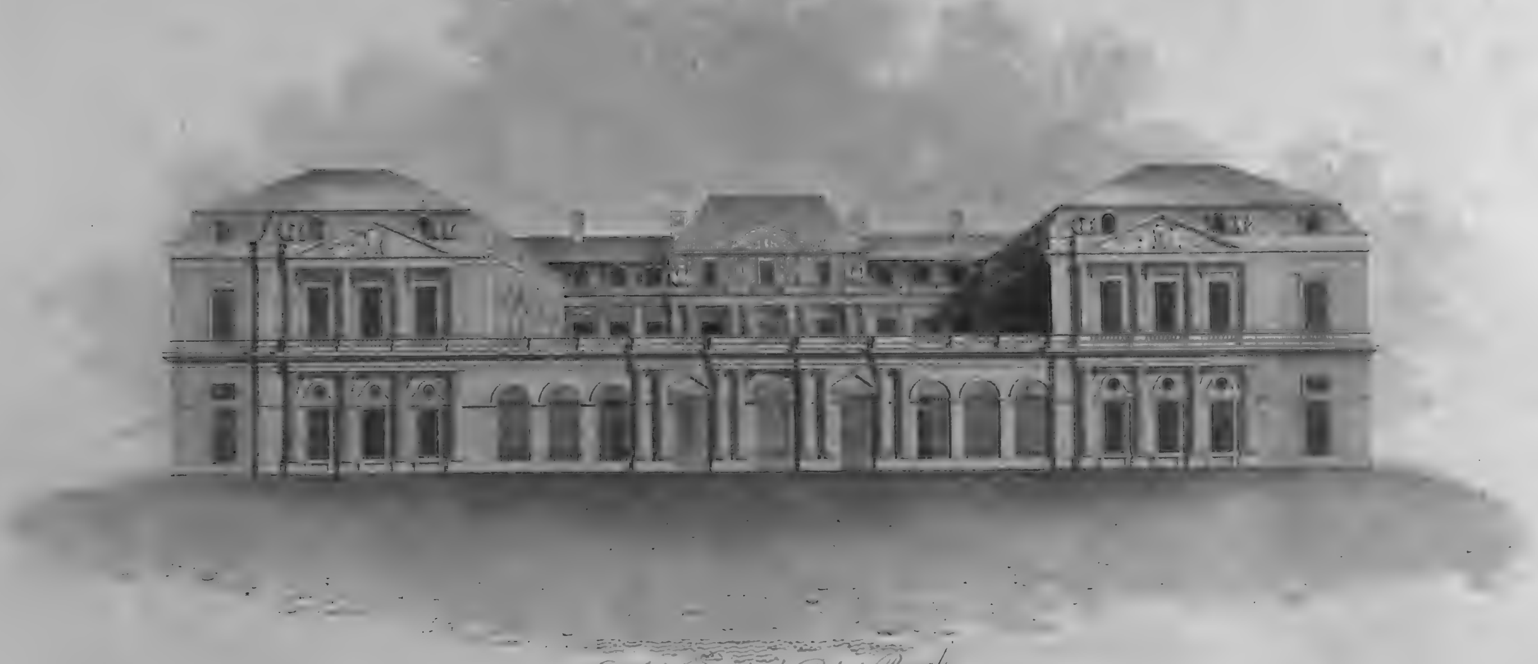
SEBASTIAN VAILLANT,
AUTHOR OF BOTANICUM PARISIENSE.



*A View of the Palais Royal.*

*Aubret pinxt* *Hopwood sculpt*

*London, Published by Dr. Thornton, November 1803.*

oration published by **Boerhaave**, shewed that he knew this thing *accurately*, although he has not demonstrated it by actual experiments.

From that period, that is from the year 1718, many have attempted to raise up this rock, especially the author of the *Sexual System*, who had supposed that the thing itself was clear, and already established from his various labours, although **Pontedera*** has indeed attempted to refute it.

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stick I gently touched the inside of one of the filaments, which instantly sprung from the petal with considerable force, striking its *anthera* against the *stigma*. I repeated the experiment a great number of times; in each flower touching one filament after another, till the anthers of all six were brought together in the center over the stigma.

"I took home with me three branches laden with flowers, and placed them in a jar of water, and in the evening tried the experiment on some of these flowers, then standing in my room, with the same success.

"In order to discover in what particular part of the filaments this irritability resided, I cut off one of the petals with a very fine pair of scissars, so carefully as not to touch the stamen which stood next it: then, with an extremely slender piece of quill I touched the outside of the filament which had been next the petal, stroking it from top to bottom; but it remained perfectly immoveable. With the same instrument I then touched the back of the anthera, then its top, its edges, and at last its inside; still without any effect. But the quill being carried from the anthera down the inside of the filament, it no sooner touched that part than the stamen sprung forwards with great vigour to the stigma. This was often repeated with a blunt needle, a fine bristle, a feather, and several other things, which could not possibly injure the structure of the part, and always with the same effect.

"To some of the antheræ I applied a pair of scissars, so as to bend their respective filaments with sufficient force to make them touch the stigma; but this did not produce the proper contraction of the filament. The incurvation remained only so long as the instrument was applied; on its being removed, the stamen returned to the petal by its natural elasticity. But on the scissars being applied to the irritable part, the anthera immediately flew to the stigma, and remained there. A very sudden and smart shock given to any part of a stamen would, however, sometimes have the same effect as touching the irritable part.

"Hence it is evident, that the motion above described was owing to an high degree of irritability in the side of each filament, next the germen, by which, when touched, it contracts, that side becomes shorter than the other, and consequently the filament is bent towards the germen. I could not discover any thing particular in the structure of that or any other part of the filament.

"This irritability is perceptible in stamina of all ages, and not merely in those which are just about discharging their pollen. In some flowers, which were only so far expanded that they would barely admit a bristle, and whose antheræ were not near bursting, the filaments appeared almost as irritable as in flowers fully opened; and in several old flowers, some of whose petals with the stamina adhering to them were falling off, the remaining filaments, and even those which were already fallen to the ground, proved full as irritable as any I had examined.

"From some flowers I carefully removed the germen, without touching the filaments, and then applied a bristle to one of them, which immediately contracted, and the stigma being out of its way, it was bent quite over to the opposite side of the flower.

"Observing the stamina in some flowers which had been irritated returning to their original situations in the hollows of the petals, I found the same thing happened to all of them sooner or later. I then touched some filaments which had perfectly resumed their former stations, and found them contract with as much facility as before. This was repeated three or four times on the same filament. I attempted to stimulate, in the midst of their progress, some which were returning, but not always with success; a few of them only were slightly affected by the touch.

"The purpose which this curious contrivance of Nature answers in the private œconomy of the plant, seems not hard to be discovered. When the stamina stand in their original position, their antheræ are effectually sheltered from rain by the concavity of the petals. Thus probably they remain till some insect, coming to extract honey from the base of the flower, thrusts itself between their filaments, and almost unavoidably touches them in the most irritable part: and thus the impregnation of the germen is performed; and as it is chiefly in fine sunny weather that insects are on the wing, the pollen is also in such weather most fit for the purpose of impregnation.

"The *Barberry* is not the only plant which exhibits this phænomenon. The stamina of *Cactus Tuna*, a kind of Indian Fig, are likewise very irritable. These stamina are long and slender, standing in great numbers round the inside of the flower. If a quill or feather be drawn through them, they begin in the space of two or three seconds to lie down gently on one side, and in a short time they are all recumbent at the bottom of the flower."

* Pontidera was professor of Botany at Pisa, and published, in 1772, his "Anthologia, sive De Floris Natura." "A Discourse on the Nature of Flowers." In his preface he expresses that his chief design in this publication was to repress the prevailing belief of the Sexes of Plants. "Quin etiam cum multos videam præclare indolis juvenes tum veterum, tum recentiorum potissimum traditionibus ita allici, ut perfacile imperita et infirmiora ingenia in iis ipsis rei Botanicæ principiis decipi possint, succurrendum esse, et totis viribus providendum, ne latius malum diducatur, judicavi. Quod sane et illis, quas in horto anno superiore habui, dissertationibus ex parte præstiti, auditores meos subinde monendo, ut ab illis opinionibus, quæ ingenii specie blandiuntur, caverent. Perfacile siquidem juvenilis etas inventiunculis, quæ novitate alliciunt, capitur, quibus semel imbuta per omne vitæ tempus sæpenumero eas servat. Et revera non video quid aliud huic potius timere debeamus, quam cum homines auctoritate eximia, ut animos rerum imperitos ad se convertant, et alliciant, ita loquuntur: esse stirpes in mares, in fœminas, in androgynas distributas; partesque illas, quas in deliciis habemus, floresque vocamus, nihil aliud esse, nisi generationis organa: dari in plantis, ut Plinii verbis utar, *Veneris intellectum, maresque afflatu quodam, et pulvere etiam fœminas maritare?* Quis istos, qui hæc se ab aliis non accepisse, sed vidisse profitentur, qui conjugii tempora tradunt, qui rationem, quæ frigidæ in Venerem stirpes solicitentur, docent, etiamsi iis non omnino assentiatur, tamen non legendos ediscendosque judicabit? Quo exemplo alii incitati illis sese adjicient. Quare eveniet, ut vel hujusmodi opinionibus sese obnoxios tradant, illisque perpetuo adhæreant, de quibus jam actum esse supra indicavimus; vel ut vanas et commenticias rejiciant, atque una totam rem Botanica in contemptu habeant. His itaque de causis maturandum esse cognovi. Quapropter libellum anno proxime elapso de hujusmodi rebus conscriptum."

His method of refuting the sexes of plants is too curious wholly to omit noticing. In Chapter XXVI. “ De Tubæ usu,” “ On the Office of the Style,” he gives us the following opinion: “ Tuba hoc præcipuum munus exhibere mihi videtur, ut per ipsam aer in fructus cavitatem delatus contentos succos in motum cieat, quo facilius complicati seminis partes subire valeant. Hoc autem ex eo patet, primum quod aer pernecessarius est, ut ob ipsius compressionem seminis angustias humores ingrediantur, deinde quod nihil aliud, nisi aer, in fructus cavitatem per tubas potest admitti. Nam, si apicum corpuscula juxta quorundam Philosophantium sententiam per tubas in uterum deferri conjiciamus, statim gummitiones illæ, pilorum ordines, fistulæ, et viarum angustia ab hac opinione revocant; si vero ad illos accedimus, qui non apicum corpuscula, sed volatilem succum in apicibus contentum excipi a tubarum fistulis tradunt, statim cur tanta machinatione via illa munita fuerit, menti obversatur. Idcirco, etiamsi apices, qui in plurimis plantis non reperiuntur, semper reperiri, et apicum succum ad semina fœcundanda per tubarum fistulas in fructus cavitatem, et ad embryonis principium penetrare ultro darem atque concederem, adhuc tamen de canaliculi munere inquirendum esset. Neque tamen Tournefortii sententia, qui inutiles partes secerni, et extra fructum amandari per tubas opinatus est, valeret. Nam, si lenti et resinati succi, pili, fistulæ, et tenuissimi canaliculi quidquid deorsum illabitur, sisti cogunt, quamvis corpora omia naturaliter suopte pondere deorsum ferantur, multo facilius, si quid sursum ascenderet, prohibitura nemo negabit. Accedit etiam, ut nullum corpus, nisi proprio motu cieatur, ut in animantibus contingit, tam facile sursum ferri valeat. Nihil igitur, nisi aer, per tubas aut ingredi aut egredi potest. Hinc itaque patet cur evulsa tuba sine maturitate contabescat fructus; nullus enim amplius partibus contractis, aeris ingressus fit, cujus ope seminis partes explicari possint. Evenit etiam sæpenumero ut tubarum extremitas vel maligno rore, vel nocturno frigore, aut pruinis, quæ primo vere aliquando contingunt, ita afficiatur, ut, contortis fibrillis, claudatur foramen. Tunc itaque tenelli embryones acerbi decidunt, et pars magna vindemiæ perit, inutilesque segetes metuntur. Quapropter, ne hoc tam crebro contingeret, crassiores in extremitate tubos fabrefecit natura, plurimis utriculis resinato succo refertis, quo frigoris vis retunderetur, circumpositis.”

“ That the office of the *style* is to convey air to the seeds, and cause a fermentation—that the *stigma* is filled with resinous juices to soften the severity of frost, and hinder insects from penetrating its pores—that the removal of the *style* causes the abortion of the seeds, or its decay by frost, only from want of the proper spiracula, for the admission of air.”

Speaking of the *stamina* he places their use “ as props to give a greater stability to the pistillum, and also that they form a nutritious fluid, which is prepared in the anthers, and which descends down the filaments, and so enters the germen.”

“ Sæpius Pistillum staminibus, apicibusque Natura fulcivit, atque circumsepsit, ut in Malva, Althæa, in Papilionaceis floribus, in quibus vel a vagina stamina excipiuntur tubæ, ut in flosculosis proprie dicto et lingulato, vel a petalo ut in semiflosculosis.” Chap. XXV.

He ridicules the notion that Nature leaves her productions to the chance of the winds. “ Why,” says he, “ should we fabricate new ways? Why have recourse to the unstable air? Why fly to the atmosphere? Why implore the assisting aid of winds? when a more natural explanation offers, a shorter and surer journey, by which the nutriment is conveyed to the fruit without the sportings of the winds? Indeed, it is not at all probable, that as the other parts of the flower are fabricated with so much skill and caution, that in her chief and principal concern, she should prove so extremely dull and thoughtless.”

“ Consideranti mihi sæpenumero, num naturæ expediret, si apicum corpuscula vel saltem apicum liquor per tubam ad embryonem transmitterentur, quod a nonnullis litteris proditum suo loco explicandum reservamus, cum multa occurrunt, tum potissimum staminum dispositio, quæ me, quo minus cum illorum opinione meam conjungam, etiam invitum abducunt. Non enim rationi consentaneum esse videtur, quod apicum corpuscula, medio aere, et ventis adjuvantibus, ad pistillum deferantur, et per pistillum ad embryonem, cum in omnibus floribus stamina ita disposita ac collocata videam, ut nullo negotio apicum succus ad embryonem per stamen, cui apices adhærent, transmitti possit. Cur enim nobis novas fingimus vias? Cur ad aerem confugimus? Cur ventorum manus imploramus, si naturalis, si brevissima via reperitur, per quam liquores nullum passi aeris, ventorumque ludibrium ad fructum afficiendum deferantur? Numquid dubitamus, quin potius ipsi pistillo, quam staminibus naturæ industria adhæsissent apices, si per pistillum illorum succus embryonem fuisset subiturus? Non enim verisimile est, cum cætera in flore et in plantis summa industria, consilioque summo constituisset, in re præcipua, et tam necessaria, adeo hebetem, inertemque fuisse naturam. Mihi contra quam maxime solors et industria videtur, cum hoc, quem videbimus, ordine stamina ita disposuerit, ut inde appareat, hoc opus nequaquam neglexisse. Nam in iis, quos in exemplum assumemus, floribus subest divinum ingenium, et vera naturæ vis, Quod quidem aperte demonstrat, hoc spectasse, et id egisse, non illud a veri similitudine alienum, quod multis laudibus nobis extulerunt. Principio itaque stamina vel embryonis receptaculo, vel ramulo, cui embryo adhæret, affixit, quo facilius apicum liquor ab utriculis egressus per stamen, purus, non aeris, non pluviæ, non roris inclementia male affectus ad embryonem evolvendum transiret. Deinde stamina mirabili consilio firmavit, munivitque, ne deorsum aut sinistrorsum inclinata canaliculos contraherent, liquoremque descendentem prohiberent, aut in via cogerent sisti. In omnibus igitur floribus monopetalis, quoniam hi in partes nequaquam secti firmiter receptaculo affiguntur, interiori florum parieti adhærent stamina per intervallum digesta, et una cum petalis receptaculo insident.

The argument drawn from the *mutilation* of the *stamen*, as well as the *pistillum* he has thus evaded.

He enters next upon more *slippery* ground, where the sexes of flowers are placed apart.

First of the Fructification of the Palms. He observes,

1. “ That these produce fruit in deserts, where no art is employed.”

“ Etsi satis superque id quod nunc proponimus, expositum atque explanatum sit, tamen, quoniam sæpe eo contingere videmus, quæ nulla ratione attingenda sunt, breviter adhuc inquirendum judico, num in aliqua regione *Palmæ* ita nascantur, ut nisi a sterilibus *Palmis* ipsarum embryones afficerentur, nunquam hi maturitatem haberent. Quare de *Palmis* in Ægypto et circumpositis provinciis nascentibus, et de portentosa illa *Palmarum* cultura est disserendum. Sed ante omnia illud explanare aggrediar, ut ostendam, *Palmas dactyliferas* extra Ægyptum sine illo cultu (quo scilicet sterilium *Palmarum* flores, hianti fœminæ spathæ inseruntur), nisi id regionis terræque conditione prohibeatur, palmulas ad maturitatem perducere. Nam quod in Græcia fructum ad maturitatem non perducant *Palmæ*, id hac de causa contingere judico, videlicet vel quod Græcia non ita calidiori plagæ subjecta sit, ut *Palmarum* natura requirit, vel quod in solo minus apto plantentur, vel denique quod cultus alienus adhibeatur. Etenim etiam cultum plurimum ad *Palmarum* fertilitatem conferre, auctorum monumenta testantur; et sæpe quæ steriles habitæ sunt, et propterea neglectæ jacebant, cum cultus accessisset, repente fœcundæ evaserunt, fructus quam uberrimos ferentes. Unde *Palma* illa in agro Hydruntino, postquam, recisis, quibus undequaque adumbrabatur, arboribus, aeris et Solis vim propius excepit, vegetior reddita fructus edere cœpit, cum antea neglecta sterilis permansisset. Hoc autem magis verisimile videtur, quam quod procerior facta, masculæ *Palmæ* Brundusii sitæ auram maritalem ex alto hausisset. Hanc historiam Pontanus ex vulgari opinione poetice illustravit ad hunc modum:

Brundusii latis longe viret ardua terris
   Arbor Idumæis usque petita locis.
Altera Hydruntinis in saltibus æmula Palmæ,
   Illa virum referens, hæc muliebre decus.
Non uno crevere solo, distantibus agris,
   Nulla loci facies, nec socialis amor.

Permansit sine prole diu, sine fructibus arbor
Utraque, frondosis et sine fruge comis.
Ast postquam patulos fuderunt brachia ramos,
Cœpere et cœlo liberiore frui,
Frondosique apices se conspexere, virique
Illa sui vultus, conjugis ille suæ
Hausere et blandum venis sitientibus ignem,
Optatos fœtus sponte tulere sua:
Ornarunt ramos gemmis, mirabile dictu,
Implevere suos melle liquente favos.

Verum ad hanc sententiam loqui solis Poetis conceditur. Cæterum mirifice libero et patulo non opaco solo coli gaudet Palma. Argumentum ex Suetonio Tranquillo in Augusti Imperatoris vita habemus de Palma in Mundæ saltibus reperta, quæ, recisis adumbrantibus arboribus, cum ipsa jam annosa fibras nimium contractas diducere non posset et crescere, tamen ut vegetior facta stolonem protruxit, qui citissime adolescens matrem superavit. 'Apud Mundam,' inquit, 'Divus Julius castris locum capiens, cum sylvam cederet, arborem Palmæ repertam conservari, ut omen victoriæ jussit. Ex ea continuo nata soboles adeo in paucis diebus adolevit, ut non æquipararet modo matricem, verum etiam obtegeret, frequentareturque Columbarum nidis: quamvis id avium genus duram et asperam frondem maxime vitet.' Evenit igitur, ut Palmæ etiam ob cultus negligentiam steriles sæpenumero habitæ sint.

Quare nos hoc in loco de Palmis quas peculiares regiones sponte ferunt, tantum dicere aggredimur. Ecquis itaque hujusmodi in desertis et vestæ solitudinis Arabiæ regionibus cultum illum qualis in Ægypto et circumpositis provinciis, Palmis adhibitum unquam meminerit? 'Haud credendam' (verba sunt Guilandini apud Prosperum Alpinum) 'istam Palmarum conceptionem, quæ fit arte a te narrata, arguere videntur innumeri dactyli, qui in Arabiæ desertis feruntur; in quibus sylvestrium Palmarum sylvæ reperiuntur, quæ sine hominum cultu optimos fructus ac copiosos producunt, retinent, ac maturant.' Hæc autem ita valida est ratio, ut impar ad refellendum Alpinus ad ventorum providentiam se se converterit. 'Arabes,' ait, 'Palmarum cultus periti respondebunt, Palmarum fœcunditatem in Arabiæ desertis, licet arte non fiat (quando in his locis hæ arbores, ut dictum est, sine ulla cultura fructus producant) adjuvare ventos, marium e ramis pulveres floresque ad ramos fœminarum asportantes.' Nam cur in Ægypto hoc sini cultu non fit? Numquid venti in cultis regionibus ita dociles non sunt, ut in desertis?"

II. "That the reason why art is usually employed, is to carry *flies* to the female flowers to pierce the *spathas* for the admission of air, or to convey the nutriment secreted in the anthers to the pistillum.

"That *caprification* is used, rests wholly on the authority of the father of history, Herodotus, in contradiction to all modern authorities.

"Nunc autem summam Dei Opt. Max. providentiam mirari subit, qui divino profecto beneficio illis populis ut esset, quo vitam sustentarent, succurrendum judicavit. Nam cum succus qui in peculiaria vascula colligitur vel ob partes quibus componitur, vel quod nimis crassus quam par est, ita affectus ad palmulas fortasse deferatur, ut palmulæ quidem explicentur, et crescant, sed ad maturitatem nulla ratione perduci possint, immaturæ ac inutiles ad terram delabuntur. Hinc itaque peculiare Culicum genus creatum fuisse opinor qui sterilium Palmarum floribus innascerentur: hi ad fructiferarum embryones delati eos terebrant, inutili succo viam aperiunt, aerem et solem quibus lenti crassique utriculorum succi subigantur, inferunt, partesque Medico veluti quodam morsu ita afficiunt, ut poma omnia retineantur, et perfectionem habeant. Quare Palmarum cultores, ut propius culices nascantur, inter fœcundas et fructiferas Palmas steriles et floriferas ordinare solent, siquæ longius sitæ sunt, funibus appensis, per quos Culices repere possint, conjungere, tum sterilium spadices abscissos per fructiferarum spathas distribuere, florumque pulverem atque una Culices super hiantes spathas discutere. Hanc Palmarum per Culices culturam vetustissimus Auctor Herodotus, dum per illas regiones iter faceret, diligentissime omnia rimando princeps deprehendit, litterisque ad hunc modum mandavit in Κλείω, ita liber inscribitur: εἰσὶ δέ σφι φοίνικες πεφυκότες ἀνὰ πᾶν τὸ πεδίον, οἱ πλευῶες αὐτῶν, καρποφόροι, ἐκ τῶν ϗ σιτία και οἶνον ϗ μέλι ποιεῦνται· τὺς συκέων τρόπον θεραπεύȣσι· τω.τε ἄλλα ϗ φοινίκων τὺς ἔρσενας ἕλληνες καλῦσι, τῦτον τὸν καρπὸν περιδέυσι τῆσι ϐαλανηφόροισι τῶν φοινίκων, ἵνα πεπαίνηται σφὶ ψὴν την βάλανον ἐσδυνων, και μὴ ἀπορρέῃ ὁ καρπός ὁ τῦ φοίνικος. Ψῆνα γαρ δὴ φέρυσι ἐν τῷ καρπῷ οἱ ἔρσενες, καθάπερ δή οἱ ὄλυνθοι. hoc est: 'In Babylonis agris Palmæ magna ex parte fructiferæ proveniunt, ex quibus non solum vinum, mel, cibum conficiunter, sed etiam eodem modo, quo Ficus, curantur. Harum uti aliarum arborum masculas Græci vocant, quarum fructus Palmæ fructiferæ alligant, ut earum fructus maturet Culex subiens, ne ex arbore is defluat; ferunt enim Palmarum mares Culices, quemadmodum Caprifici.' En itaque quo pacto sine apicum affectione, sine ullo conjugio Palmis fructiferis, ne palmulas ante maturitatem amittant, per hos ψῆνας succurritur. Quo profecto Herodoti testimonio confirmatum habemus, neque in Ægypto, et in circumpositis provinciis Palmas fructiferas a sterilibus affici. Neque Bodæi a Stapel sententia laudabilis apparet, qui Herodoti fidem derogans magis Theophrasto utpote Botanico, quam Herodoto Historico credendum esse statuit. 'Nemo,' inquit, 'facile negabit, Theophrasto hac in re majorem deberi fidem, quam Herodoto. Historicus Herodotus; Botanicus Theophrastus: cuilibet vero in sua arte credendum.' Numquid Historico mentiri licet, Botanico nequaquam? Mihi contra videtur fides quam amplissima esse Herodoto habenda, tum quod naturali modo caprificationis exemplo, qua et illa tempestate et hoc etiam tempore in tota Græcia nihil clarius percipitur, istam Palmarum culturam explicaverit, tum potissimum quod non ea quæ ab aliis percotando acceperat, sed quæ ipse viderat, scripta relinquerit. Theophrastus vero ex aliorum relatione ea Palmarum conjugia litteris mandavit, ut et ipse fassus est: ϗ γαρ, inquit, ἐν ϐαϐυλῶνί φασιν, ὅπȣ οἱ φοίνικες πεφύκασι. Quæ ad hunc modum redduntur: 'quippe apud Babylonem, ubi Palmæ nascuntur, sic esse affirmant.' Caprificantur itaque Palmæ in Ægypto, in Syria, et alibi, quemadmodum in Græcia Ficus, ut Culices qui masculæ Palmæ floribus innascuntur, ad fructiferæ poma delati ea terebrent, et ut ad maturitatem perducantur, præstant. Ideo etiam spathæ circunquaque abscinduntur, ut per vulnus succi pars egeratur, et sole ac aere molliusculi embryones facilius frui possint."

III. "That some of the Palms produce fruit, where there are no stamina, in corresponding plants, as the *Toddapanna*."

"Sed quid argumenta quæro, quando res clara et manifesta in Palmis quartæ differentiæ habetur? Toddapanna petalis apicibusque destituta fructus producit quotannis, neque tamen in eodem genere alia adest cognata et maritalis Palma, a quibus effluvia ad illam transmittantur."

This rests upon the authority of a bad figure and description in the Hortus Malabaricus, and several other plants in that work are represented without stamina, and yet made to produce fruit, probably from the painter's taking his picture of the flower when the stamina had fallen off. *Such* are the *futile objections* raised against this doctrine!

As some may feel curious to learn yet more the train of reasoning against the sexes of plants, I shall proceed on to his explanation of the other unisexual flowers.

"Quinque genera flore imperfecto instructa, quorum species aliæ fructum, aliæ apices ferunt, perpendenda aggredior, *Morum* nempe, *Juniperum, Ficum, Cannabim*, et *Lupulum*, in quibus hoc præstare conabor, ut sine cognatarum stirpium apicibus embryonem perfectum fieri ostendam. Hoc si exitu perfecero, de reliquis cunctis, quas brevitatis gratia prætermitto, id ostendisse pro certo habebo.

*Morus*

" *Morus* itaque perraro in eadem stirpe in qua fructus, ut constituit Tournefortius, amenta producit, (hoc enim in una tantum specie observavi) sed plerunque in peculiari planta, quæ præter apices nihil aliud gignit. Quæ vero *Morus* fructum producit, cum tuba tantum donatum habet. Cum porro *fructiferæ Mori* passim occurrant, *steriles* tamen stirpes infrequentes sunt, et plerunque quadraginta aut sexaginta stadiis distare eas inter se vidi. Nam, cum *sterilis* vermibus nutriendis minus aptas frondes producat, coloni qui sobolem propagari hac ratione ignorant, cum *fertilis Mori* stolones cum sua terra evulsos plantantes mergis utantur, ei non solum cultum aliquem non exhibent, sed vel extirpant vel in fœcundas inserunt. Quare perraro occurrit, neque in cultis, sed ut casu a *fertilis Mori* semine jacto nascitur, aut secus agrorum lacunas cernitur, aut inter vepreta. Ex iis itaque tam paucis *sterilibus Moris* innumerabilia corporum seminalium effluvia emanare necesse est, quibus magnum hoc circunfusi aeris spatium ita repleatur, ut non solum *Mori* quæ minori intervallo distant, sed etiam illæ quæ quam longissimo spatio seponuntur, eandem corpusculorum partem accipiant, et æqualiter fœcundentur. Ad quod præstandum non solum apices, sed neque ipsæ frondes, rami, truncus, et radix, si in apicum corpuscula abirent, sufficerent. Præterea cum in his regionibus *fertiles Mori* plures sint, ut *Morus alba* J. B. 1. 119, *Morus fructu albo, minori, ex albo purpurascente* Tournef. *Inst.* R. *Herb.* 589, *Morus fructu nigro* C. B. *Pin.* 459, *sterilis*, ut mihi hactenus compertum est, una tantum, qui fieri potest, ut apicum corpuscula, quæ eadem materia constant, paternumque (ut ita dicam) spiritum gerunt, dissimilibus speciebus nullam vim communicent, ex qua aliqua sequatur in fructu dissimilitudo? Semper enim eadem figura, colore, et magnitudine crescit? Quod fane in omnibus animantibus contra fit.

Sed de *Moro* jam satis: transeamus ad *Juniperum*, cujus genus inter eas quoque plantas est collocandum, quarum aliæ amenta producunt, aliæ fructum. Quæ agitur julos sive amenta gignit, ea primo vere fundit. *Fertilis* autem a vere fructum edere incipit, neque per æstatem cessat, sed novos semper fructus emittit. Nascitur autem promiscue in montibus utraque; sæpe tamen in hortos transferuntur, et seorsum magno adeo spatio cultas vidimus, ut sæpe inter *fertilem* et *sterilem* triginta stadiorum spatium aut quadraginta intercederet. Cum igitur *Juniperus fertilis* tota æstate baccis onusta reperiatur, quarum aliæ jam maturæ sunt, aliæ acerbæ, nonnullæ minores, multæ minusculæ, quæ tamen omnes subinde crescunt, et maturitatem habent, necesse est, ut seminalia *sterilis* effluvia a ventis jugiter subministrentur, quibus affecti embryones se se explicare possint. At unde hæc depromentur, cum *sterilis* primo vere floreat, et semel tantum, ejusque seminalis pulvisculus tum a ventis tum a pluviis dissipatus sit? Nullam itaque in *Juniperus* fieri apicum communicationem apparet, sed *Juniperus fertilis* ob eam, qua, ut indicaturus sum, oleosa et volatili materia referta est, suos explicat embryones, et ad perfectionem perducit.

Sequitur tertio loco de *Ficu* disputatio, in quo profecto genere non obscura est apicum natura; nam *Ficus sativa* (quam in tertio libro clarius et plenius exponemus) sine apicibus quibus privatur, poma producit, quæ semper maturitatem habent: at *Caprificus* grossos fert, in quibus stamina apicesque occultantur, qui tamen nunquam coqui, perficique possunt, Illud etiam accedit, ut tubæ in pomorum cavitate positæ sint, et ita carne undequaque circunsepiantur, ut clarissime appareat, naturam hoc potissimum spectasse, nequid crassioris corporis, viis undique interceptis, extrinsecus adveniens admitteretur. Nam, cum in aliis stirpibus tubarum oscula in aere patula reliquisset, ut facilius aer in fructus cavitatem ferretur, in *Ficubus* tubas ab aere subduxit, et in fructus cavitate seposuit, uno tantum relicto in fundo foramine, quà aer ingressus tubas embryonesque contentos liquores in motum cieret. Neque tamen apices adjecit, ut in *sylvestrium Ficuum* genere, ne fortasse apicum pulvisculo dulcissima caro male affecta gustatu minus grata evaderet. Quin eos in grossis collocavit, ne a ventis, quorum patrocinio tota hæc opinio innititur, ulla apicum corpuscula ad illa poma deferrentur. Quare sive *Ficus* apices gignentes spectemus, quæ sane perraro occurrunt, neque enim in Italia, ut in Græcia ficetis interseruntur; sive eas quæ apicibus privantur, ab apicibus embryones nequaquam affici manifestum relinquitur, certumque.

Nunc de *Cannabe* dicamus. Dividitur *Cannabis* in duas species, in *Cannabim marem* J. B. 3. 447, et in *Cannabim sterilem* Dod. *Pempt.* 535, quæ passim in agris cultæ occurrunt, non seorsum nascentes, ut de aliis demonstratum est, sed simul; nam ex *fertilis* semine jacto utraque nascitur. *Cannabis* porro *sterilis* citius quam *fertilis* fruticat, et utriculos, quibus apices includuntur, exhibet, deinde, nisi carpatur, contabescit. Quare coloni eam metunt, quoniam arescendo ineptior evadit, relictis fœcundis stirpibus, quæ facile, nondum etiam editis fructibus, viridiore colore, grandioribus ramis, densioribusque foliis internoscuntur. Hæ autem stirpes nullo *sterilis* pulvisculo affectæ quam uberrimos fructus producunt. Quin longo usu apud colonos exploratum esse accepi, cum *steriles Cannabes* fructiferis insertæ relinquuntur, cultoribus fructiferas mitius respondere; quoniam liberiore aere frui nequeunt, densissimæ siquidem hæ stirpes seminantur.

Restat *Lupuli* ratio. Duæ quoque in hoc genere occurrunt *Lupuli*, una quæ amenta producit, et vocatur *Lupulus fœmina* Cam. *Epit.* 934; altera sine amentis fructus ferens, quam *marem Lupulum* Casp. Bauhino auctore *Pin.* 298 nuncupant. Fœcundari autem *marem* a *sterilis Lupuli* pulvisculo tradunt. Qua autem ratione hoc contingeret, cum a nemine doceremur, extiterunt nonnulli, qui ad hunc modum fieri posse opinati sunt. Ex Insulis Sequanæ et Matronæ, in quibus *Lupulus sterilis* nascitur, ventorum ope apicum corpuscula ad Hortum Regium Parisiensem, in quo *Lupulus mas* colitur, deferuntur. Accedente vero aura maritali, *Lupuli* fructiferæ embryones qui naturaliter deorsum pendent, erigunt se se, et squamæ, quæ ita positæ sunt, ut illabentem pluviam hinc et hinc ab embryonibus declinent, se expandunt; tunc tubæ patentibus osculis hiant,

> ' Exceptantque leves auras, et sæpe sine ullis
> Conjugiis vento gravidæ (mirabile dictu!)'

fiunt. Sed hæ ex Philosophicis fontibus haustæ sententiæ non videntur. Nec enim his difficultatibus nobilissima naturæ opera involvenda sunt. Ego tamen hæc omnia, quæ nulla ratione fieri posse apparet, ultro darem atque concederem, si illud explanaretur, quod profecto me fugit, qua ratione ex suis involucris embryones protrudantur, quibus succis grandiusculi facti tubas explicent. Hæc enim seminalia corpuscula intra fructus cavitatem deferri non possunt, nisi per tubas; tubæ autem se se explicare nequeunt, nisi intra fructum succi ingrediantur. Quare, antequam ad embryones deferantur seminalia corpuscula, embryones esse jam fœcundos, necesse est ut fateamur, Verum hoc de *Palmis* agentes plenius et clarius explanabimus.

Concludatur itaque *Morum, Juniperum, Ficum, Cannabim, Lupulum* sine apicum pulvisculo fructus gignere, et ad maturitatem perducere. Si igitur hoc luce clarius esse ostendi, necesse est ut plantas sine apicibus fœcundari fateamur." To condense his reasoning.

His first argument is derived from the MULBERRY. He says, " There are *many kinds* of these, and if there was any truth in the marriage of plants, these by intermixing would give a *cross-breed,* whereas each sort always produces its *own kind.*"

Had Pontedera made the experiment, he would have found the *hybrid breed* he speaks against.

Of the JUNIPER he mentions, " that the female plant often produces at a very considerable distance from the male trees." Hence he concludes, " That the plant is so replete with volatile oily materials, that this is sufficient of itself to feed the embryos, without the assistance of the nutritive anthers, so necessary in other flowers."

A more careful observation, and direct experiment, would have shewn that the insulated Juniper-tree would not produce its berry.

Respecting the FIG, he makes *caprification* to depend upon the flies admitting air to the embryos, or to the conveyance from them, of the nutritive juices from the male, or wild fig.

Of the HEMP he denies " that the intermixture of the male and female plants has any effect."

And

## *The Two Sexes on different Plants.*

### SPINACH.

Henderson pinx

Caldwall sc.

London. Published for Dr. Thornton. 1804

## And this Doctrine, more recently yet, the learned Alston has endeavoured to overturn.*

Linnæus's direct experiment in this Essay proves the *fallacy* here. Of the Hop, he says, " that the female produces its *cones of flowers* equally well when separated from the *male* plant, as Tournefort found in the Royal Gardens of Paris." This arose from the cone of the hop being a *calyx*, which grows equally in both instances; but the seeds so produced have not been found to vegetate.

The reader now sees upon what flimsy ground the opposition to the sexes of plants is founded, and is enabled to form his own conclusion, as to the *truth* of *this doctrine*, so admirably *confirmed* as it has been by LINNÆUS.

Linnæus, in the Hortus Cliffortianus, page 441, however, does his opponent ample justice as an accurate botanist. " Clarissimus Pontedera, qui *oculatissimus* est auctor, et in examinando flores *nulli inferior*."

* The arguments against the sexes of plants, very similar to those of Pontedera, are collected by the ingenious Professor Alston, in his " *Tyrocinium Botanicum*," and in a Dissertation on the Sexes of Plants, to be found in the first volume of the " Edinburgh Physical and Literary Essays." In page 250 of that essay, Alston says, " I shall pass a variety of later authors who have treated on this subject; and come to the most strenuous defender of the sexes of plants, who has collected all the arguments for it that perhaps can be advanced, and pretends to have demonstrated it fully: I mean the famous and very learned Carolus Linnæus, professor of medicine and botany in the university of Upsal, fellow of a great many philosophical societies; and certainly one of the greatest botanists of this age. For this great man thus writes: " Antheras et stigmata constituere sexum plantarum, a palmicolis, Millingtono, Grewio, Rayo, Camerario, Godofredo, Morlando, Vaillantio, Blairio, Jussievio, Bradleyo, Royeno, Logano, &c. detectum, descriptum, et pro infallibili assumptum: Nec ullum, apertis oculis considerantem cujuscunque plantae flores, latere protest; quod demonstratum in Sponsalibus Plantarum, Upsaliæ 1746, in 4to." And elsewhere, " Generationem vegetabilium fieri, mediante pollinis antherarum illapsu supra stigmata nuda, quo rumpitur pollen, efflatque auram seminalem, quæ absorbetur ab humore stigmatis; quod confirmat oculus, proportio, locus, tempus, pluviæ, palmicolæ, flores nutantes, submersi, syngenesia; immo omnium florum genuina consideratio."

" Yet I cannot help thinking this doctrine not capable of demonstration, far less that the *genuina consideratio* of any flower can make it probable: Camerarius himself doubted of it; Tournefort disbelieved it; and Pontedera uses many arguments to refute it."

In order to do away all belief in the sexes of plants, he relates the following experiments.

1. " In the spring 1737, I transplanted three sets of the common *Spinage*, long before it could be known whether they were flowering or seed-bearing plants, from a little bed on which they were raised, into a place of the garden, full eighty yards distant, and almost directly south; there being two hawthorn and three holly hedges, all pretty thick and tall, between them and their seed-bed; and no other spinage in the garden, nor so near them by far: all the three proved fertile plants, and ripened plenty of seeds. I sowed them; they grew and prospered as well as any spinage-seed possibly could do. This, I own, made me at first call in question the sexes of plants, which I *formerly* too implicitly believed.

2. " The same year, a few plants of the common hemp, which I had raised for a specimen from the seed, being accidentally destroyed when very young; and finding afterwards, about the end of June, a pretty strong but late plant of *Hemp*, growing in the inclosure to the east of Holyrood-house, commonly called the Bowling-green, by itself: I caused great care to be taken of it, there not being that year any hemp raised within a mile of it, that I could find. This plant grew luxuriantly; and, though bad weather in the autumn made me pluck it up a little too soon, yet I got about thirty good seeds from it, which the succeeding spring produced as thriving male and female plants, as if the mother-hemp had stood surrounded with males. And,

3. " In the spring 1741, I carried two young seedling plants of the French *Mercury*, long before there was any in flower, from the city physic-garden, the only place where it was then to be found in this country, to the king's garden at the Abbey; which are more than seven hundred yards distant from one another, with many high houses, trees, hedges, and part of a hill between them: and planted one of them in one inclosure, where it was shaded from the sun the greatest part of the day; and the other, in another, twenty-five yards distant, exposed to the south and west. Both plants ripened fertile seeds; and the last shed them so plentifully, that it proved a troublesome weed for several years, though none of the species was to be found in that garden, for more than twenty years preceding."

In answer to such stubborn facts, it were to be wished, that the learned professor had continued from year to year these experiments, and multiplied them, and under different circumstances, and then he would have fixed conviction on the mind. As the case now stands, these experiments are contradicted by the experiments of Millar recorded in his Dictionary, under article Generation, also by those of Linnæus in this Essay.

His experiments on the *Spinach* and *Dog's Mercury*, (of the *Hemp* we shall speak when we come to Linnæus's experiment on that plant), were either defective as not being made sufficiently apart for the winds, or insects, to perform the office of bridegroom; or, as later observers remark, that even on Pistilliferous plants, *males* will occasionally appear, especially in the *Spinach*, and hence the fallacy of the experiments, when they turn out contrary to the Sexes of Plants.

Speaking of the *Spinach*, Baron De Gleichen, in his " Observations Microscopiques," says, " J'ai aussi fait avec cette plante l' experience ordinaire, en ôtant les plantes mâles, pour empêcher les plantes fémelles d'être fécondées. Dans ce dessein j'ai pris environ quarante grains de la semence herissée, et au lieu de les semer, je les ai mis en terre en rang piéce per piéce séparement, dans une distance assés considerable l'un de l'autre. Aussitôt que je decouvris une plante mâle, je l'arrachai, et l'ecartai, jusqu'à ce que mes plantes furent enfin reduites au nombre de douze, des quelles je fus bien assuré, que ce n'étoit que des fémelles. Je visitai bien souvent ces plantes, et j'ouvris de tems en tems quelques œufs seminaux, que j'examinai à l'aide du Microscope, et que je trouvai premiérement tous vuides, et bientôt après tous fécondés. Aussitôt je visitai mes plantes encore une fois bien soigneusement pour voir, s'il n'y avoit pas parmi elles quelque amant caché. Mais sans decouvrir une seule plante mâle, je fus bien surpris de voir, que presque la moitié de mes plantes étoient des Hermaphrodites, dont les vaisseaux de la poussière avoient poussé en grand nombre entre les fleurs fémelles. J'ordonnai d'abord à mon jardinier de chercher sur une grande couche d'un autre jardin, semée d'épinars, s'il y trouveroit plus de ces Hermaphrodites, et elles ne manquerent pas là non plus, et produirent de la semence meure, aussi bien que celles-là. Je la cueillis soigneusement, la semai l'année suivante et j'en retirai en plus grande partie des Diphytes avec quelques Hermaphrodites. J'aurois fait plûtôt cette decouverte, et par là je me serois dispensé de faire une experience superfluë, si je n'avois pas ignoré alors, ce que j'ai lû dans la suite dans la remarque à la Planche XL. de l'œuvre de Blakwell, savoir que Camerarius *avoit trouvé plus d'une fois, mais pourtant pas trop souvent, des Hermaphrodites parmi les plantes d'Epinars*. Cependant cette nouvelle experience sert à nous rendre plus attentifs, et à nous dessiler les yeux dans des pareils essais. Mr. Möller, qui s'est avisé de combattre le Systeme de fécondation, en appellant aussi à la semence féconde, qu'il avoit obtenuë d'une seule plante d'Epinars trouvée par hazard parmi les plantes de pastenade, n'auroit pas eu cette vaine joye, s'il avoit examiné cette plante plus souvent et avec plus d'attention, In order rightly to understand this subject, it is necessary properly to comprehend the *nature* of *vegetable bodies*.

This will be best understood, if we trace downwards the great *Chain of Nature*; that is, if we begin with man, next consider quadrupeds, then birds, fishes, reptiles, worms, insects, and lastly, *descend* to *vegetables*.

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que probablement il n' a pas fait. Il est aussi vraisemblable, que ce qui arrive ici parmi les plantes d'Epinars, arrive plus souvent parmi les Diphytes, et je ne crois pas me tromper, en supposant, que ma plante de Chanvre XCVIII. que j'avois quittée fémelle et trouvée mâle quelque tems après, a été sujette à la même metamorphose. Nous avons vû en son lieu la même chose dans les Monophytes, comme dans le Mays et dans la noisette, où ce changement de sexe est plus concevable, que celui des Diphytes, puisque dans celles-là il peut dependre d'une confusion ou d'une distribution irréguliére de la seve mâle et fémelle et des organes sexuels, qui se trouvent ensemble dans la même plante, mais dans celles-ci, c'est à dire dans les Diphytes, où chaque plante est pourvue de ses propres vaisseaux et de ses organes sexuels, ce changement devient un enigme du quel j'abondonne l'explication aux Botanistes, que leur métier oblige à instruire le monde là dessùs. Aussi jugeront-ils cette peine très necessaire, s'ils considérent les consequences importantes, qu'on en peut tirer au sujet de la génération, et que Mr. Linnæus nous a fait entrevoir par sa conjecture. Car ce Savant a soupçonné, que le sexe originaire de toutes les plantes ètoit celui des Hermaphrodites."

SPALANZANI, a philosopher of the highest character, after numerous experiments on *bisexual* flowers, where he found that removing the anthers produced always barrenness of the seeds, proceeded upon those plants which staggered ALSTON. Like that professor, he experienced a contradiction to the general doctrine, but confesses an accident not very uncommon in the unisexual flowers, viz. the occasional production of stamina amongst the females. "It has been observed," says Spalanzani, "by Linnæus, Haller, Duhamel, and others, that male flowers are not very infrequently found upon female individuals: a root of spinach, of which I shall speak below, furnished me with a remarkable instance; and the hemp in question is subject to the same accident, as I was informed by Mr. Bonnet, in a letter dated August 15, 1778. The letter gave me notice of an experiment which he undertook upon hemp, after I had communicated mine to him. The paragraph to which I allude is the following: "I began this year some experiments upon hemp. I have followed the method which I employed for rearing the insects on plants in solitude. My plants were covered with large tubes of glass, hermetically sealed at the top, and with the bottom sunk in the earth. But fortune did not favour me—instead of a female I had a male plant in one instance, and in another a plant of great expectation, after putting forth many flowers with pistils, produced some with stamina, close to the former, which totally disconcerted the experiment."

Speaking of the *spinach* he found the same thing. "In one of my daily visits to my three plants, I perceived upon one individual an unexpected conjunction of male and female flowers, growing close together, and forming very elegant groups. The blossoms with pistils were very conspicuous, but those with stamina were so little advanced, that they could not be distinguished by the naked eye. Both sorts appeared to be equally numerous, but the union extended only to two branches—all the rest bore female blossoms only. I may here incidentally remark, that the *great abundance* of the male flowers, in the present case, is a very singular phænomenon. I have read in botanical writers, that a few male flowers are sometimes found in company with females, but never that they amount to an equal number, a circumstance that excited my admiration with respect to this individual; for I counted two hundred and seventy-five male buds."

But all his experiments on the *Dog's Mercury*, or *French Mercury*, turned out according to the now prevailing opinion.

"The next and last plant producing male and female individuals, on which I made experiment, is the MERCURIALIS ANNUA (*French Mercury*). Five very small plants were removed from a garden, on the 22d of August, into five pots. They were managed in the same manner as the spinach during the winter (XXXII), and were all so far advanced at the beginning of spring, that there was no difficulty in distinguishing the males from the females; of the latter there were three, and these alone were preserved. By the 24th of March blossoms with pistils appeared upon several branches, growing out of the axillæ of the leaves, and in a few days more the number was exceedingly increased. They were borne upon short flower-stalks, and, as usual, consisted of two small seeds or spherical anthers. They were of a green colour and hairy. But here the event was just contrary to what happened in hemp and spinach. The greater part of the blossoms dropped prematurely; of the few that remained the seeds grew for some time, but fell before they were ripe, and when sown, *they did not spring*. As this took place before the male plants in the gardens and the fields about Pavia were in flower, I began to suppose mercury to be one of those numerous vegetables, which cannot propagate the species without the powder of the stamina. Meanwhile my three plants continued to put forth new branches, and the old ones, instead of withering, vegetated with great vigour; but still the seeds dropped prematurely. This gradual evolution and production of fresh branches, was of such long continuance, that they shewed no tendency to decay, but were producing blossoms with pistils when the mercury in the fields was in flower. I therefore began to entertain hopes, that the seeds now put forth, and those which should follow, would succeed better than the earlier seeds, more especially as the pots were exposed to the open air upon a window, and looked into a garden, in which grew several male individuals of this species. But my expectations were disappointed: as long as the three plants continued to thrive, the seeds dropped almost as soon as they appeared; nor did one of those that were sown *ever come up*. I repeated the experiment *two succeeding years* with the same event.

"It therefore became necessary to vary the mode of conducting it. Being more confirmed in my suspicion, that the sterility arose from want of pollen, which, though it was at no great distance, did not reach my plants, I determined to bring it nearer; without, however, setting individuals of the different sexes in the same place. Two *male* plants of mercury, reared the next year in two pots, were placed on the outside of a window, and two *females* growing likewise in pots, were set on the outside of another window. Both windows belonged to one room, and had the same aspect. The four roots of mercury were nearly of the same age, and of the same size. And I waited with great anxiety to see whether the *females*, on account of their vicinity, would be impregnated by the *males*. The seeds were constantly falling, but not in such abundance as in the former experiment, when the *males* were at a much greater distance. Those which adhered went on thriving, and seemed as if they would ripen; and they did accordingly arrive at maturity, and, what is of more consequence, were more productive; for soon after I had sown them in a pot, I had the pleasure of seeing *them spring*. It therefore appeared probable, that the vicinity of the males to the females had been instrumental in occasioning fecundation: their influence could scarce be derived from any source, besides the action of the contiguous pollen.

"This experiment obviously required another: it was proper to bring the different individuals *nearer* to each other; I accordingly placed two *males* and two *females* upon the same window. It now became manifest, how much influence the *approximation* of the two sexes has upon fecundation. The two females retained *almost all* the seeds which were produced at this time, exceeding an hundred. The seeds grew perfectly ripe, and when put into the ground, were unfolded into as many plants."

CHARLES BONNET, F.R.S.
Author of the Contemplation of Nature

The CHAIN of NATURE.

Caldwall sculp.t

London: Published by D.r Thornton May 1.1802.

In the more *perfect* animals are many instruments, and various senses, which are denied to the lower tribes of animated beings.

Thus SERPENTS and FISHES have *no feet.*

There is *no nose* in INSECTS and WORMS.

There are many WORMS without *eyes.*

Thus the farther we descend in this chain,* the more simple the last links will appear; so that in worms, as the *Tænia, Gordius,* and *Lumbricus,* many parts are wanting which appear in higher animals, hence called perfect, and in the remotest limits of the animal kingdom, we observe the *Zoophyta* nearly approaching the *vegetable,* having diffused branches, radical at the base, unfolding into *flowers,* in one word, more like to a *plant* than an *animal,* unless in this they approach the higher order of animals, that by means of *nerves* they have *voluntary movement,* hence these *animal flowers* have sensation, and vibrate without the medium of the external air, which affords motion to plants, some of these being placed in

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* For a full account of the "Chain of Nature," vide the admirable "*Contemplation of Nature,*" by the Philosopher BONNET, who has ably discussed this subject. But the different functions of animated beings will be seen at one view in the following table.

### A TABLE OF THE FUNCTIONS, OR GRADATION, OF LIVING BODIES.

| | | | | |
|---|---|---|---|---|
| 1. DIGESTION. | Living Bodies | which have | One or more *stomachs,* easily distinguishable from the *œsophagus* and *intestinal canal*........ | Man.<br>Quadrupeds.<br>Cetaceous animals.<br>Birds.<br>Crustaceous animals. |
| | | | A *stomach* distinguishable only by *certain expansions* from the *œsophagus* and *intestinal canal*.... | Oviparous quadrupeds.<br>Serpents.<br>Cartilaginous fishes.<br>Fishes, properly so called. |
| | | | An alimentary canal, *not distinguishable* into œsophagus, stomach, and intestines........ | Insects.<br>Worms.<br>Zoophytes. |
| | | | Neither *stomach* nor *intestines* ... | PLANTS. |
| 2. NUTRITION. | Living Bodies | whose nutricious juices are absorbed. | By *vessels* beginning from *internal cavities*.................. | Man.<br>Quadrupeds.<br>Cetaceous animals.<br>Birds.<br>Oviparous quadrupeds.<br>Serpents.<br>Cartilaginous fishes.<br>Fishes, properly so called.<br>Insects.<br>Crustaceous animals.<br>Worms. |
| | | | By *vessels* opening on the *external surface*.................... | PLANTS. |
| 3. CIRCULATION. | Living Bodies | with blood | Having a *heart* with *two ventricles* and *two auricles*............ | Man.<br>Quadrupeds.<br>Cetaceous animals.<br>Birds. |
| | | | With *one ventricle* divided into several cavities and *two auricles*.. | Oviparous quadrupeds.<br>Serpents. |
| | | | With *one ventricle* and *one auricle* | Cartilaginous fishes.<br>Fisbes, properly so called. |
| | | with a whitish fluid | Whose *heart* is formed of one longitudinal vessel, tuberous and contractile, in which there is a *whitish fluid* instead of *blood*... | Crustaceous animals.<br>Insects.<br>Worms.<br>In some crustaceous animals there is observed something resembling a heart. |
| | | with juices | In which *no heart* has been yet observed, but only vessels filled *with juices of a nature different from that of blood*.......... | Zoophytes.<br>PLANTS. |
| 4. RESPIRATION. | Living Bodies | which respire | By *lungs* free from all adhesion, and spungy................ | Man.<br>Quadrupeds.<br>Cataceous animals. |
| | | | By *lungs* free from all adhesion, vesicular and muscular ....... | Oviparous quadrupeds.<br>Serpents. |
| | | | By *lungs* adhering to the ribs, and provided with appendages..... | Birds. |
| | | | By *gills* of different forms....... | Cartilaginous fishes.<br>Fishes, properly so called.<br>Crustaceous animals. |
| | | | By *stigmata,* or holes in *different rings*.................... | Insects.<br>Earth-worms. |
| | | | By an opening called *trachea,* or by *external fringes*.......... | Aquatic-worms. |
| | | | By *tracheæ*.................. | PLANTS. |
| | | | In which there have been discovered neither stigmata nor tracheæ.................... | Polypes. |
| 5. SECRETION. | Living Bodies | | There are no bodies in which secretions are not carried on. | All having animation. |
| 6. OSSIFICATION. | Living Bodies | whose skeleton is | *Internal* and *osseous*.......... | Man.<br>Quadrupeds.<br>Cetaceous animals.<br>Birds.<br>Oviparous quadrupeds.<br>Serpents.<br>Fishes, properly so called. |
| | | | *Internal* and *cartilaginous*...... | Cartilaginous fishes. |
| | | | *External* and *corneous*......... | Perfect insects.<br>Lithophytes. |
| | | | *External* and *cetaceous*........ | Crustaceous animals.<br>Shell-fish.<br>Madrepores.<br>The greatest part of Zoophytes. |
| | | | *External* and *ligneous*......... | Plants. |
| | | | Which have no *skeleton*........ | Insects in their first state.<br>Worms.<br>Polypes. |
| 7. GENERATION. | Living Bodies | which are | *Viviparous*................. | Men.<br>Quadrupeds.<br>Cetaceous animals. |
| | | | *Oviparous,* whether the evolution of the eggs takes place within or without the female.......... | Birds.<br>Oviparous quadrupeds.<br>Serpents.<br>Cartilaginous fishes.<br>Fishes, properly so called.<br>Insects.<br>Crustaceous animals.<br>Worms.<br>Plants. |
| | | | Which propagate also by *slips*... | Worms.<br>Polypes.<br>PLANTS. |
| 8. IRRITABILITY. | Living Bodies | which have | A body wholly *muscular* or *contractile*................... | Greatest part of insects in the first state of their transformation.<br>Worms.<br>Polypes. |
| | | | *Muscles* covering the *skeleton*.... | Man.<br>Quadrupeds.<br>Cetaceous animals.<br>Birds.<br>Oviparous quadrupeds.<br>Serpents.<br>Cartilaginous fishes.<br>Fishes, properly so called. |
| | | | A *skeleton* covering the *muscles*... | Perfect insects.<br>Crustaceous animals. |
| | | | *No muscular power*........... | PLANTS. |
| 9. SENSIBILITY. | Living Bodies | which have | *Nerves* and *brain* easily distinguishable from the *spinal marrow*... | Man.<br>Quadrupeds.<br>Cetaceous animals.<br>Birds.<br>Oviparous quadrupeds.<br>Serpents.<br>Cartilaginous fishes.<br>Fishes, properly so called. |
| | | | Nerves and brain *scarcely distinguishable* from the spinal marrow..................... | Insects.<br>Crustaceous animals.<br>Worms. |
| | | | In which there have not yet been discovered *nerves, brain,* or *spinal marrow*.................. | Zoophytes.<br>PLANTS. |

the abysses of the sea, as the *Serratula,* which has been so admirably illustrated in the works of Ellis.

*Plants* so nearly approach the lower tribe of *Zoophyta,* that it is hardly possible to distinguish the one from the other.

*Plants* have no stomach or intestinal tube, but absorb fluids by their roots, and also throughout their whole surface. Hence a small cutting of a branch placed in water imbibes nourishment at its several pores. So neither the *stomach* nor *intestines* of the *Sertulariæ* or *Polypi* have yet been demonstrated. *Plants* have no heart, yet they have vessels in which flows the sap, which rises to the extreme branches, so neither can any *heart* be discovered in this *lower tribe* of *animals.*

Hence it appears, that the *vegetable kingdom* only differs from the *animal* in having *no nerves* for *voluntary* movement.*

He who inquires into the *generation* of *plants,* should also consider what passes in the *animal* kingdom. We see *insects* undergo a *metamorphosis,* and when this is accomplished, these become *sexual.* And when these have undergone this change, for example, the *butterflies,* they are not more *dissimilar* from their *eruca,* or *larva,* than *flowers* are to their *plants.*

The *moth* of the *silk-worm* has *no mouth,* and after its *metamorphosis* its whole employment is to *propagate* its kind.†

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* In the "*Philosophia Botanica,*" Linnæus makes the same discrimination, "*Lapides* crescunt. *Vegetabilia* crescunt et vivunt. *Animalia* crescunt, vivunt et *sentiunt.*" That is, *Minerals* grow. *Vegetables* grow and live. *Animals* grow, live, and feel. The perceptivity, or feeling of plants, has been maintained by some writers, as Dr. Percival and the Bishop of Landaff. Vide the learned Bishop's "*Chemical Essays,*" vol. v. p. 158; also the "*Philosophy of Botany,*" chapter "On the *supposed* Perceptivity of Plants."

† Caterpillars may be easily distinguished from worms or maggots, by the number of their feet; and by their producing butterflies or moths. When the sun calls up vegetation, and vivifies the various eggs of insects, the *caterpillars* are the first that are seen, upon almost every vegetable and tree, eating its leaves, and preparing for a state of greater perfection. They have feet both before and behind; which not only enable them to move forward by a sort of steps made by their fore and hinder parts, but also to climb up vegetables, and to stretch themselves out from the boughs and stalks, to reach their food at a distance. All of this class have from eight feet, at the least, to sixteen; and this may serve to distinguish them from the worm tribe. The animal into which they are converted, is always a *butterfly* or a *moth*; and these are always distinguished from other flies, by having their wings covered over with a painted dust, which gives them such various beauty. The wings of *flies* are transparent, as we see in the common flesh-fly; while those of *beetles* are hard, like horn; from such the wing of a *butterfly* may be easily distinguished; and words would obscure their differences.

The *life* of a caterpillar seems one continued succession of *changes*; and it is seen to throw off one skin only to assume another; which also is divested in its turn: and thus for eight or ten times successively. We must not, however, confound this changing of the skin with the great *metamorphosis* which it is afterwards to undergo. The throwing off one skin, and assuming another, seems, in comparison, but a slight operation among these animals; this is but the work of a day; the other is the great adventure of their lives. Indeed, this faculty of changing the skin, is not peculiar to caterpillars only, but is common to all the insect kind; and even to some animals that claim a higher rank in nature. We have seen the lobster and the crab out-growing their first shells, and then bursting from their confinement, in order to assume a covering more roomy and convenient.

With respect to caterpillars, many of them change their skins five or six times in a season; and this covering, when cast off, often seems so complete, that many might mistake the empty skin for the real insect. Among the hairy caterpillars, for instance, the cast skin is covered with hair; the feet, as well gristly as membraneous, remain fixed to it; even the parts which nothing but a microscope can discover, are visible in it; in short, all the parts of the head; not only the skull, but the teeth.

In proportion as the time approaches in which the caterpillar is to cast its old skin, its colours become more feeble, the skin seems to wither and grow dry, and in some measure resembles a leaf, when it is no longer supplied with moisture from the stock. At that time, the insect begins to find itself under a necessity of changing; and it is not effected without violent labour, and perhaps pain. A day or two before the critical hour approaches, the insect ceases to eat, loses its usual activity, and seems to rest immoveable. It seeks some place to remain in security; and no longer timorous, seems regardless even to the touch. It is now and then seen to bend itself and elevate its back; again it stretches to its utmost extent: it sometimes lifts up the head, and then lets it fall again; it sometimes waves it three or four times from side to side, and then remains in quiet. At length, some of the rings of its body, particularly the first and second, are seen to swell considerably, the old skin distends and bursts, till, by repeated swellings and contractions in every ring, the animal disengages itself, and creeps from its inconvenient covering.

How laborious soever this operation may be, it is performed in the space of a minute; and the animal, having thrown off its old skin, seems to enjoy new vigour, as well as having acquired colouring and beauty. Sometimes it happens that it makes a new appearance, and colours very different from the old. Those that are hairy, still preserve their covering; although their ancient skin seems not to have lost a single hair; every hair appears to have been drawn, like a sword from the scabbard. However, the fact is, that a new crop of hair grows between the old skin and the new, and probably helps to throw off the external covering.

The caterpillar having in this manner continued for several days feeding, and at intervals casting its skin, begins at last to prepare for its

THE REV.D D.R STEPHEN HALES, F.R.S.

AUTHOR OF VEGETABLE STATICS.

Coates R.A. pinx.t

Hopwood sculp.t

London, Published by D.r Thornton Dec.r 1.1800.

In the same manner all *plants* undergo a *metamorphosis*, they shake off their *larva* state, and

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change into an AURELIA. It is most probable that, from the beginning, all the parts of the *butterfly* lay hid in this insect, in its reptile state; but it required time to bring them to perfection; and a large quantity of food, to enable the animal to undergo all the changes requisite for throwing off these skins, which seemed to clog the *butterfly* form. However, when the *caterpillar* has fed sufficiently, and the parts of the future *butterfly* have formed themselves beneath its skin, it is then time for it to make its first great and principal change into an AURELIA, or a CHRYSALIS, as some have chosen to call it; during which, as was observed, it seems to remain for several days, or even months, without life or motion.

Preparatory to this important change, the *caterpillar* most usually quits the plant, or the tree on which it fed; or at least attaches itself to the stalk or the stem, more gladly than the leaves. It forsakes its food, and prepares, by fasting, to undergo its transmutation. In this period, all the food it has taken is thoroughly digested; and it often voids even the internal membrane which lined its intestines. Some of this tribe, at this period also, are seen entirely to change colour; and the vivacity of the tints in all, seem faded. Those of them which are capable of spinning themselves a web, set about this operation; those which have already spun, await the change in the best manner they are able. The web or cone, with which some cover themselves, hides the AURELIA contained within from the view; but in others, where it is more transparent, the caterpillar, when it has done spinning, strikes into it the claws of the two feet under the tail, and afterwards forces in the tail itself, by contracting those claws, and violently striking the feet one against the other. If, however, they be taken from their web at this time, they appear in a state of great languor; and, being incapable of walking, remain on that spot where they are placed. In this condition they remain one or two days, preparing to change into an AURELIA; somewhat in the manner they made preparations for changing their skin. They then appear with their bodies bent into a bow, which they now and then are seen to straiten: they make no use of their legs; but if they attempt to change place, do it by the contortions of their body. In proportion as their change into an AURELIA approaches, their body becomes more and more bent; while their extensions and convulsive contractions become more frequent. The hinder end of the body is the part which the animal first disengages from its caterpillar skin; that part of the skin remains empty, while the body is drawn up contractedly towards the head. In the same manner they disengage themselves from the two succeeding rings; so that the animal is then lodged entirely in the fore part of its caterpillar covering: that half which is abandoned, remains flaccid and empty; while the fore part, on the contrary, is swollen and distended. The animal, having thus quitted the hinder part of its skin to drive itself up into the fore part, still continues to heave and work as before; so that the skull is soon seen to burst into three pieces, and a longitudinal opening is made in the three first rings of the body, through which the insect thrusts forth its naked body, with strong efforts. Thus at last, it entirely gets free from its caterpillar skin, and for ever forsakes its *reptile form*.

The caterpillar, thus stripped of its skin for the last time, is now become an AURELIA; in which the parts of the future *butterfly* are all visible; but in so soft a state, that the smallest touch can discompose them. The animal is now become helpless and motionless; but only waits for the assistance of the air to dry up the moisture on its surface, and supply it with a crust capable of resisting external injuries. Immediately after being stripped of its caterpillar skin, it is of a green colour, especially in those parts which are distended by an extraordinary afflux of animal moisture; but in ten or twelve hours after being thus exposed, its parts harden, the air forms its external covering into a firm crust, and in about four-and-twenty hours, the *aurelia* may be handled without endangering the little animal that is thus left in so defenceless a situation. Such is the history of the little pod or cone that is found so common by every path-way, sticking to nettles, and sometimes shining like polished gold. From the beautiful and resplendent colour, with which it is thus sometimes adorned, some authors have called it a CHRYSALIS, implying a creature made of gold.

Such are the efforts by which these little animals prepare for a state of *perfection*; but their care is still greater to provide themselves a secure retreat, during this season of their imbecility. It would seem like erecting themselves a *monument*, where they were to rest secure, until Nature had called them into a new and more improved existence. For this purpose, some spin themselves a cone or web, in which they lie secure till they have arrived at maturity: others, that cannot spin so copious a covering, suspend themselves by the tail, in some retreat where they are not likely to meet disturbances. Some mix sand with their gummy and moist webs, and thus make themselves a secure incrustation; while others, before their change, bury themselves in the ground, and thus avoid the numerous dangers that might attend them. One would imagine that they were conscious of the precise time of their continuance in their AURELIA state; since their little sepulchres, with respect to the solidity of the building, are proportioned to such duration. Those that are to lie in that state of existence but a few days, make choice of some tender leaf, which they render still more pliant by diffusing a kind of glue upon it; the leaf thus gradually curls up, and withering as it enfolds, the insect wraps itself within, as in a mantle, till the genial warmth of the sun enables it to struggle for new life, and burst from its confinement. Others, whose time of transformation is also near at hand, fasten their tails to a tree, or to the first worm-hole they meet, in a beam, and wait in that defenceless situation. Such caterpillars, on the other hand, as are seen to lie several months in their aurelia state, act with much greater circumspection. Most of them mix their web with sand, and thus make themselves a strong covering: others build in wood, which serves them in the nature of a coffin. Such as have made the leaves of willows their favourite food, break the tender twigs of them first into small pieces, then pound them as it were to powder; and, by means of their glutinous silk, make a kind of paste, in which they wrap themselves up. Many are the forms which these animals assume in this helpless state.

The AURELIA, though it bears a different external appearance, nevertheless contains within it all the parts of the *butterfly* in perfect formation; and laying each in a very orderly manner, though in the smallest compass. These, however, are so fast and tender, that it is impossible to examine without discomposing them. When either by warmth, or increasing vigour, the parts have acquired the necessary force and solidity, the *butterfly* then seeks to disembarrass itself of those bands which kept it so long in confinement. Some insects continue under the form of an aurelia not above ten days; some twenty; some several months; and even for a year together.

The *butterfly*, however, does not continue so long under the form of an AURELIA, as one would be apt to imagine. In general, those caterpillars that provide themselves with cones, continue within them but a few days after the cone is completely finished. Some, however, remain buried in this artificial covering for eight or nine months, without taking the smallest sustenance during the whole time: and though in the caterpillar state no animals were so voracious, when thus transformed they appear a miracle of abstinence. In all, sooner or later, the *butterfly* bursts from its prison; not only that natural prison which is formed by the skin of the aurelia, but also from that artificial one of silk, or any other substance in which it has enclosed itself.

The efforts which the *butterfly* makes to get free from its AURELIA state, are by no means so violent as those which the insect had in changing from the caterpillar into the aurelia. The quantity of moisture surrounding the *butterfly* is by no means so great as that attending its former change; and the shell of the aurelia is so dry, that it may be cracked between the fingers.

If the animal be shut up within a cone, the *butterfly* always gets rid of the natural internal skin of the aurelia, before it eats its way

through

are seen *naked* in the *flower*, whose only business then is to *increase* and *multiply its kind:* for the exit of the *butterfly* from the *larva*, and the *evolution* of *flowers* is accomplished in the same way.

The *outer bark* (CORTEX) splits, and is converted into a permanent CALYX, which becomes the *outer covering* of the *flower*, and protects the *tender fruit.*

The *inner bark* (LIBER) more pliant, and diaphanous, is further extended into the COROLLA adorned with colours, which placed like the wings of the butterfly, through the medium of the air, vibrates and flutters, which motion otherwise it would not be able to procure.

But the principal parts of the flowering body are the STAMINA and PISTILLA, so much so, that no flower can be said to be without them. This appears to be the case up to the present time, in the examination of so many thousands of flowers, so that there exists no true flower, which does not possess these two organs.

The STAMINA derive their origin from the *ligneous substance* (CORTICAL PART), which was formerly the *inner bark* (LIBER).

This appears most evident in the ASARUM (*asarabacca*), whose *twelve stamina* proceed from twelve fibres found in the composition of the *inner bark.*

Flowers with a plenitude of *corolla* (double flowers) illustrate this doctrine, where the *stamina*, by receiving too much nutriment, are so softened and dissolved, that these become actual *petals*, for the ligneous substance in them is thereby converted into the soft nature of the *liber*, whence petals were, as we saw before, derived.

All *stamina* possess vessels containing *farina*, which indeed they discharge, but not without the strictest observance of the laws of Nature.

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through the external covering which its own industry has formed round it. In order to observe the manner in which it thus gets rid of the aurelia covering, we must cut open the cone, and then we shall have an opportunity of discovering the insect's efforts to emancipate itself from its natural shell. When this operation begins, there seems to be a violent agitation in the humours contained within the little animal's body. Its fluids seem driven, by an hasty fermentation, through all the vessels; while it labours violently with its legs, and makes several other violent struggles to get free. As all these motions concur with the growth of the insect's wings and body, it is impossible that the brittle skin which covers it should longer resist: it at length gives way, by bursting into four distinct and regular pieces. The skin of the head and legs first separates; then the skin at the back flies open, and dividing into two regular portions, disengages the back and wings: then there likewise happens another rupture in that portion which covered the rings of the back of the aurelia. After this, the *butterfly*, as if fatigued with its struggles, remains very quiet for some time, with its wings pointed downwards, and its legs fixed in the skin which it had just thrown off. At first sight the animal, just set free, and permitted the future use of its wings, seems to want them entirely: they take up such little room, that one would wonder where they were hidden. But soon after, they expand so rapidly, that the eye can scarce attend their unfolding, From reaching scarce half the length of the body, they acquire, in a most wonderful manner, their full extent and bigness, so as to be each five times larger than they were before. Nor is it the wings alone that are thus increased: all their spots and paintings, before so minute as to be scarce discernible, are proportionably extended; so that, what a few minutes before seemed only a number of confused, unmeaning points, now become distinct and most beautiful ornaments. Nor are the wings, when they are thus expanded, unfolded in the manner in which earwigs and grasshoppers display theirs, who unfurl them like a lady's fan: on the contrary, those of *butterflies* actually grow to their natural size in this very short space. The wing, at the instant it is freed from its late confinement, is considerably thicker than afterwards; so that it spreads in all dimensions, growing thinner as it becomes broader. If one of the wings be plucked from the animal just set free, it may be spread by the fingers, and it will soon become as broad as the other, which has been left behind. As the wings extend themselves so suddenly, they have not yet had time to dry; and accordingly appear like pieces of wet paper, soft, and full of wrinkles. In about half an hour they are perfectly dry, their wrinkles entirely disappear, and the little animal assumes all its splendor.

Those aurelias which are enclosed within a cone, find their exit more difficult, as they have still another prison to break through: this, however, they perform in a short time; for the *butterfly*, freed from its aurelia skin, butts with its head violently against the walls of its artificial prison; and probably with its eyes, that are rough and like a file, it rubs the internal surface away; till it is at last seen bursting its way into open light; and, in less than a quarter of an hour, the animal acquires its full perfection.

Thus, to use the words of Swammerdam, we see a little insignificant creature distinguished, in its last birth, with qualifications and ornaments, which man, during his stay upon earth, can never even hope to acquire. The *butterfly*, to enjoy life, needs no other food but the dews of heaven; and the honeyed juices which are distilled from every flower. The pageantry of princes cannot equal the ornaments with which it is invested; nor the rich colouring that embellishes its wings. The skies are the *butterfly's* proper habitation, and the air its element: whilst man comes into the world naked, and often roves about without habitation or shelter; exposed, on one hand, to the heat of the sun; and, on the other, to the damps and exhalations of the earth; both alike enemies of his happiness and existence.—A strong proof that, while this little animal is raised to its greatest height, we are as yet, in this world, only candidates for perfection!

Of these vessels, which are called *anthers*, the figures, the cells, the modes of opening, are no less accurately defined, than the capsules of fruits, and the *farina*, like seeds, has its precise magnitude, colour, and figure.

The PISTILLUM derives its origin from the medullary substance in plants, and therefore is placed in the center of each flower; and in this part are always found the rudiments of the seed, which advances by degrees into a fruit.

This part is called the *Germen*, to which is always affixed another part, which is named *Stigma*, and is most in vigour at the period of flowering.

The *medullary*, is the most essential part in vegetables, and is multiplied and extended *ad infinitum*, so that whenever this is lost, the plant of necessity must die.

When considering this subject, we must carefully avoid being led into error by two seeming objections; *first*, as regards the culms of grasses, and other hollow stems, where the medullary part will be found to line the inner part of the bark; and, *secondly*, in large trees, where the trunk is altogether solid, but here the extreme branches have their necessary medulla.

Thus *vegetables*, like *insects*, are changed by a *metamorphosis*, and with this distinction only, that *flowers* remain fixed to one spot, nor are they furnished with *chylopoietic viscera*, as with most insects, and these are also fed by the *parent plants* to which they are *attached*.

Thus it is, that the CORTEX is changed into the CALYX; the LIBER into the COROLLA; the WOOD into the STAMINA; and the MEDULLA into the PISTILLUM.*

Thus it is, that the *fructification* exhibits the common parts of plants *naked* and *unfolded*.

Thus it is, that *fructification* puts an end to growth in that part where it springs, otherwise it would have shot forward into branches, and so on, *ad infinitum*, but now becomes expended here by explicating new and distinct animated bodies, with their seeds.

And since the *seeds* are the *medulla naked* in the *germen*, and *this medulla* requires to be *fed* and *increased* by the *cortical substance*, (whence all nourishment and growth proceeds in plants, as well as animals), hence these *seeds* cannot advance a step without this necessary aid from that active supporter of life, which these have become separated from.

Hence the *medullary seeds* require to receive the *cortical covering* from the *farina* in the *anthers*, which, as we have proved before, is derived from the CORTEX (*outer bark*). How *this investment* takes place has been variously explained.

MORLAND † and others assert, led to it by the doctrine of LEUWENHOOK, that the *farina* enters by the *stigma*, passes along the *style*, and then pervades the tender rudiments of the *seeds*.

That this doctrine is not founded in fact, appears from several observations.

A most evident contradiction is furnished by the AMARYLLIS FORMOSISSIMA (*Jacobean Amaryllis*), which explains this mysterious circumstance.

The flower of the AMARYLLIS, when produced in the hot-house, has its *pistillum* pointing downwards, when from its *stigma* there oozes about midday a *limpid clear drop*, which shortly increases to such a size, that one expects every instant to see it fall.

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* This doctrine of Linnæus is considered at full in our "*Philosophy of Botany*," to which we refer the reader.

† The arguments of Morland are stated at length in our "*Philosophy of Botany*."

By degrees, about three or four o'clock, it is reabsorbed into the *style,* and entirely vanishes, until the following day, about ten o'clock, when it again begins to appear, and attains its full perfection about midday; and afterwards a second time, by a scarce perceptible decrease, it returns whence it originated.

Now each particle of *farina* possesses, enclosed by an elastic membrane, a fine *aura,* which escapes oftentimes with a vehement explosion, when this farina is made to fall on warm water, although so subtile in its nature, as nearly to escape detection by the naked eye.

Hence it is, if we agitate some of the *anthers* over the *stigma* of this AMARYLLIS, so that their contained *farina* shall meet this limpid drop, we shall soon see, as I have often experienced, the globules of the *farina* lose their determinate shape, assume irregular broken forms, and the *clear fluid* on the *stigma* become clouded and yellow, and even *opake streaks* may be observed running along the *style* towards the *embryo-seeds.* Immediately after this the whole liquid drop on the *stigma* entirely disappears.

Another evident example is furnished also by the MIRABILIS (*Marvel of Peru*), whose *farina* is so very coarse, that each globule nearly exceeds the dimensions of the *style* itself, along which therefore, only the subtle *aura,* or *pollen,* can pass, leaving behind the *reliquiæ* of the *farina,* or membranous covering, in broken fragments on the *stigma,* as in the former instance.*

When the plants are in flower the *farina* falls from the *anthers,* and is dispersed, just as seeds escape from their plants, the fruit being ripe.†

At the time of flowering, or what is the same, when the *farina* is shedding, the *stigma* appears on the *pistillum* most vivid, and moistened with dew, certainly at some part of the day.

The *stamina* either surround this *stigma,* or, if the flowers nod, the *pistillum* curls upwards,‡ so that the *farina* may the more readily fall upon the *stigma,* upon which it is not only affixed by its *dew,* but in that moisture split, and made to discharge the fructifying *aura,* or *pollen.* This mixing with the lymph of the *stigma,* is then absorbed, and carried down to the *embryo-seeds.*

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* GREW had before explained this in the same way as LINNÆUS, " In discourse hereof with Sir Thomas Millington, I observed, that it was very credible that the powder, or farina, by falling upon the pistillum did communicate to the seeds a prolific virtue, that they did not enter in gross substance, but only some subtile and vivific *effluvia,* to which the visible powder is but *a vehicle.*"

† Some of these have the remarkable property, like the seed-vessel of the *noli me tangere* (balsam), the wood sorrel, &c. to ejaculate their farina to a distance. The *kalmias* have their stamina enclosed in nitches of the corolla, and hence the filaments are curled like a bow, so that when the curve is at the utmost, the anthers are liberated from their cells, and the farina spirted over the pistillum.

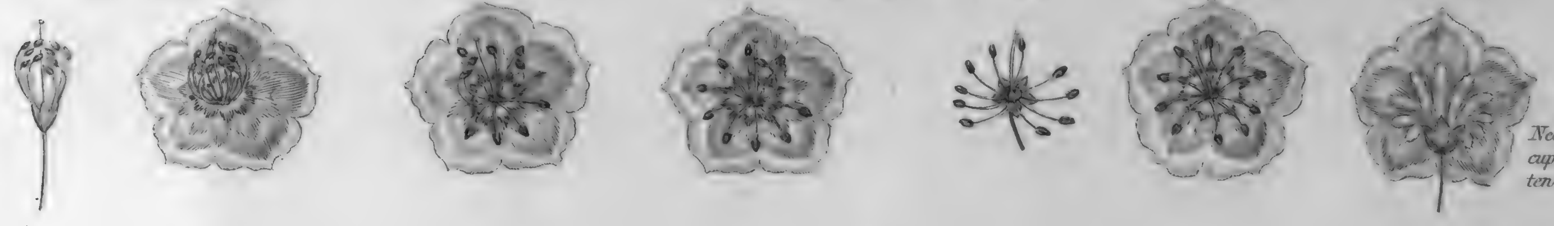
The stamina of the *Parietaria* are also held in such a constrained curved position by the leaves of the calyx, that as soon as the latter become fully expanded, or are by any means removed, the stamina, being very elastic, fly up, and throw their pollen about with great force. I have lately, says Doctor Smith, observed a similar circumstance in the flowers of *Medicago falcata.* In this plant the organs of generation are held in a straight position by the carina of the flower, notwithstanding the strong tendency of the infant germen to assume its proper falcated form. At length when the germen becomes stronger, and the carina more open, it obtains its liberty by a sudden spring, in consequence of which the pollen is plentifully scattered about the stigma. The germen may at pleasure be set at liberty by nipping the flower so as gently to open the carina, and the same effect will be produced.

‡ This motion of the pistillum in every stage of the flower is beautifully illustrated in our Picturesque Botanical Plate of the LILIUM SUPERBUM (*Superb Lily*), one of the Martagore lilies. But in no example does it appear more evident than in the GLORIOSA SUPERBA (*Superb Lily*), where the *pistillum* bends at right angles in order to approach nearer the *anthers.* Also in the SPARTIUM SCOPARIUM (*Common Broom*) the *pistillum* bends itself spirally, like a French horn, in order to approach nearer to the *males.* Vide our Account and Plate of the MEADIA (*American Cowslip*).

LINNÆUS might have noticed here the contrivances of Nature, where the *pistilla* rise above the *stamina.* These may be beautifully observed in our superb plate of the PASSIFLORA CŒRULEA (*Common Passion-flower*), where the three upright stigmata curl downwards till they come into contact with the stamina. The same may be observed in the NIGELLA (*Devil in the Bush*), and the EPILOBIUM (*Rosebay Willow-herb*), &c.

# Anatomy of the Kalmia.

A Cutting.



Leaf of the Narrow-leaved Kalmia.

Do of the Broad-leaved Kalmia.

Henderson del.

Wetton sculp.

London, Published by Dr Thornton, Octr 2, 1809.

Gloriosa Superba; or Superb Lily.

Miller del.

London, Published by Dr. Thornton Dec.r 1.1808.

Warner sculp.

### FIRST EXPERIMENT.

*In the month of January of this year the Antholyza Cunonia (*Scarlet-flowered Antholyza*) flowered in a pot placed in the window of my dining-room, but it produced me *no fruit*, because the confined air had not power to waft the *farina* to the *stigmas*.

Observing about midday *one of the stigmas* very *dewy*, I plucked off, by means of a fine pair of forceps, an *anther*, and gently brought it into contact with it. The spike remained eight or ten days longer adorned with flowers.

Then, indeed, cutting the stem in order to preserve it as a specimen in my herbarium, I observed a *fruit* in *that single flower*, over which I had placed the *anther*, which had swollen to the size of a bean.

### SECOND EXPERIMENT.

The Ixia Chinensis (*Chinese Ixia*) flowered in the stove, the windows being shut, and all the flowers had *abortive fruit*.

I therefore took away the *anthers* from the flowers of another Ixia, and with these I sprinkled *two of the flowers*, and the following day only *one stigma* of a *third flower*.

The *germina* remained only in these *three flowers*, which swelled and bore *seed*; but, indeed, the *fruit* was in *one* of these three matured only in *one cell*.

### THIRD EXPERIMENT.

The exterior *petals* of the Ornithogalum (*Star of Bethlehem*) so closely connive, that although they admit air to the germen, they scarcely suffer the intrusion of the farina arising from another flower. This daily presented new flowers furnishing fruit, nor did fœcundation fail in any one instance. I therefore carefully, with a bent hook, removed the *anthers* from a *single flower*, and, as I had expected, it happened, that *this single flower proved abortive*.

After eight days I repeated the same experiment, and with a similar result.

### FOURTH EXPERIMENT.

The Nicotiana fruticosa (*Shrubby Tobacco*) was growing in a garden-pot, and produced flowers and fruit most abundantly.

From a flower newly opening, I extracted the *anthers* which had not yet burst, and removed at the same time all the other flowers.

The *germen* here neither produced a fruit, nor swelled.

### FIFTH AND SIXTH EXPERIMENTS.

The Asphodelus fistulosus (*Onion-leaved Asphodel*) growing in an urn, I removed to one corner of the garden, and from one of the flowers which opened on that same day, I withdrew the *anthers*.

Hence that *germen* proved *abortive*.

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* This dissertation is divided into heads, or sections; and the first section relates to the Bisexual Flowers, or flowers where the two sexes are in the same corolla.

On another day I repeated the same experiment, and by using a flower furnished from another quarter of the garden, I sprinkled the *pistillum* of this with its *farina.*

Hence this *germen* proved *fruitful.*

### SEVENTH AND EIGHTH EXPERIMENTS.

From a CHELIDONIUM CORNICULATUM (*Scarlet-horned Poppy*) growing in a remote quarter of the garden, I removed all the *anthers* in a flower which first appeared, and then carefully plucked away all the rest of the flowers.

On another day I made a similar experiment, but over the pistillum of this last I sprinkled the farina taken from another flower of the same species.

The result was, that the *first flower* produced *no seed.*

From the *second experiment* I obtained *perfect fruit.*

### CONCLUSION FROM THESE EXPERIMENTS.

These EXPERIMENTS decisively prove that the *Anthers* are the *male organs* in plants, and perfectly disprove the opinion of some who have taught, that the *Stamina* are those parts of the fructification, which only separate excrementitious matter.[*]

### PROOFS TAKEN FROM OBSERVATIONS.

### FIRST OBSERVATION.

What might have convinced them on the contrary, is the universal appearance of the *Stamina* and *Pistilla* in all flowers, for none want these organs, although many flowers are devoid of *Calyx*, and many even have neither *Calyx* or *Corolla*, as the *Hippuris.*[†]

### SECOND OBSERVATION.

All farmers know, that when rain falls upon the *rye in flowers,*[‡] it washes off the *Farina* on the *Anthers,* and hence occasions many glumes in the spike to be empty of seeds.

### THIRD OBSERVATION.

Even gardeners remark the same every year in their *fruit-bearing trees.* The flowers, by long exposure to rain, from this cause disappoint the expectation of fruit.[§]

### FOURTH OBSERVATION.

*Aquatic plants* at the time of flowering rise above the water, for no other purpose than that the *Farina* may reach the *Stigma* unimpaired, for after impregnation they dip under water.[‖]

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[*] This is levelled against the illustrious Tournefort, who held this doctrine, as did Alston.

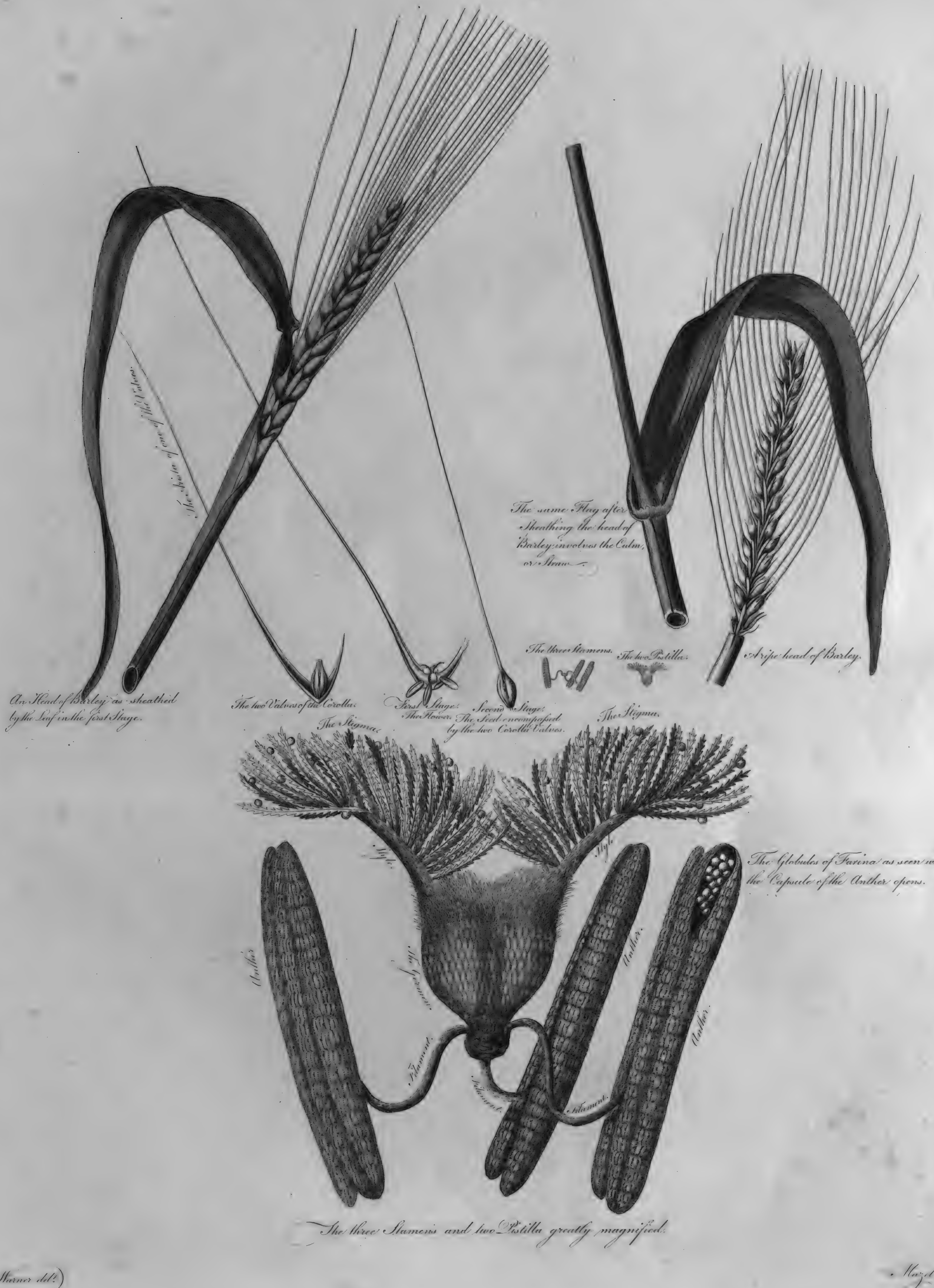
[†] This is also an argument in favour of the Sexes of Plants used by RAY. "The flowers of plants may want their *ornamental parts,* as the *calyx* and *Petals,* but none are found to want the *apices*" (stamina), SYLLOGE STIRP EXTRA BRITAN.

[‡] The anthers of *rye* hang out beyond the flower, and if rain falls while it is in flower, the dust is clotted, and hence the husbandmen do truly predict a bad crop; but the same holds not with barley, where the anthers lie close within the husk.

[§] This especially applies to the *cherry,* whose anthers become mature all at once; but in the apple and pear the numerous anthers ripen at different periods. Hence gardeners are disappointed of fruitful seeds, who at this time make much use of the watering pot, unless they apply the water in a pan beneath, as many are in the habit of doing.

[‖] Vide our account of the *Nymphæa Nelumbo.*

# Barley.



The three Stamens and two Pistilla greatly magnified.

Warner del.

Mazel sculp.

London Publiſhed by Dr. Thornton August 1st 1803.

# Pear Bloſsom.

Henderson del.

Dunkarton Jun$^{r}$ sculp.

London, Published by D$^{r}$ Thornton Dec$^{r}$ 1 1809.

Green Ixia: Ixia spectabilis; seu maculata viridis.

Henderson del.

London. Published by Dr. Thornton Octr. 1st 1808.

Wm. R. Dunkarton sculp.

The NYMPHÆA ALBA (*White Water-Lily*) every day in the morning rises from the water and opens its flower, so that at midday it rises above the surface, by means of its peduncles, nearly three inches.

In the evening it is entirely closed, and shut up, when it sinks into its watery bed.

It is about four o'clock in the evening when it first contracts its flower, and it passes the whole night under water, which was observed two thousand years back, in the time of *Theophrastus*, who observed this in the NYMPHÆA LOTUS, a plant so resembling our NYMPHÆA, that it scarcely can be distinguished from it, unless in its foliage, which is toothed in the LOTUS.

Thus *Theophrastus* hath written in his History of Plants (Book 4. Chap. 10.) concerning the LOTUS.

" They report, that its head and flowers sink into the *Euphrates*, and descend even to the middle of the night, and sink to that depth, that even at daybreak it cannot be reached with the extended arm; then it returns, and emerges out of the waves, and opens its flowers more and more to the rising sun, advancing through the day, and the flower being completely expanded, it even then rises higher, so that at length it reaches to a considerable height above the water."

The same is nearly the custom of our WHITE NYMPHÆA.*

## FIFTH OBSERVATION.

Many flowers are closed at night and before the coming on of rain; but the *farina* being shed, they remain afterwards always open.†

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* It is still open to doubt, whether this beautiful history of the NYMPHÆA LOTUS be not a fable. (Vide the Account of our Picturesque Botanical Plate of the NYMPHÆA NELUMBO). Might not the dipping of the flowers *after* impregnation; with their closing in the evening, being then covered by an unattractive calyx, *before* fecundation; give birth to the belief, that the *full-blown flowers* of the NYMPHÆAS do actually immerse, and rise again for several successive mornings? Still, however, it cannot fail to strike the observer, that the peduncles, or flower-stalks, hang at right angles to the root, and thus elevate themselves so as to reach different heights, so that the flowers shall be above the water, however swollen.

But the greatest prodigy in this way, is the *Vallisneria*, which grows plentifully in the rivers of Italy. The *female* plant, for the *sexes* are upon different plants, has a *spiral* stem, like a *screw*, which it contracts or unwinds, according to the depth of the currents it inhabits. The *male* has a short stalk, which snaps asunder, and the *male flowers* being liberated from the plant then expand, and swim on the surface of the water, and are conveyed in this way often to distant brides, with whom they celebrate their nuptials.

† Several plants, especially those with compound yellow flowers, nod, and during the whole day turn their flowers towards the sun; to wit, to the east in the morning, to the south at noon, and to the west toward evening; which is very observable in the *sonchus arvensis*, the sow-thistle. And I believe every body knows, that a great part of plants in a serene sky expand their flowers, and, as it were, with cheerful looks behold the light of the sun; but before rain they shut them up; *e. g.* the Tulip. The flowers of the *Draba Alpina*, Alpine whitlow grass, the *Parthenium foliis ovatis crenatis*, bastard fever-few with egg-shaped crenated leaves, and the *trientalis*, or wintergreen, hang down in the night, as if the plants were asleep, lest rain or the moist air should injure the fertilizing dust. The trefoils, and one species of wood-sorrel, shut up or double their leaves before storms and tempests, but in a serene sky expand or unfold them, so that the husbandman can pretty clearly foretell tempests from them. And it is well known that the *Bauhinia*, or mountain ebony, sensitive plants, and *Cassia*, observe the same rule. The flowers of goats-beard open in the morning at the approach of the sun, and shut about noon; hence it is called John-go-to-bed-at-noon. *Parkinsonia*, tamarind tree, *Æschynomene*, or bastard sensitive plant, and several others of the *diadelphia* class, in serene weather, expand their leaves in the day-time, and contract them in the night. The tamarind tree is said, by Alpinus and Acosta, to enfold within its leaves the flowers or fruit every night, to guard them from cold or rain.

Hence the HOROLOGE, or *Botanical Watch*, is formed from numerous plants, of which the following are those most common in this country. LEONTODON TARAXACUM, *Dandelion*, opens at 5—6, closes at 8—9. HIERACIUM PILOSELLA, *Mouse-ear Hawkweed*, opens at 8, closes at 2. SONCHUS LÆVIS, *smooth Sow-thistle*, at 5 and at 11—12. LACTUCA SATIVA, *cultivated Lettice*, at 7 and 10. TRAGOPOGON LUTEUM, *yellow Goatsbeard*, at 3—5 and at 9—10. LAPSANA, *Nipplewort*, at 5—6 and at 10—1. NYMPHÆA ALBA, *white water Lily*, at 7 and 5. PAPAVER NUDICAULE, *naked Poppy*, at 5 and at 7. HEMEROCALLIS FULVA, *tawny Day-lily*, at 5 and at 7—8. CONVOLVULUS, at 5—6. MALVA, *Mallow*, at 9—10, and at 1. ARENAREA PURPUREA, *purple Sandwort*, at 9—10, and at 2—3.

### SIXTH AND SEVENTH OBSERVATIONS.

In what manner the Parnassia and Saxifrage approach their *Anthers* to the *Stigmas* is well known.*

### EIGHTH OBSERVATION.

The Ruta Graveolens (*Common Rue*), a very familiar plant, moves one of its *Anthers* every day over its short *Pistillum*, until each of them, in order, has deposited its *Farina*.†

### NINTH OBSERVATION.

The Ornithogalum Nutans (*Neapolitan Star-flower*) has six broad *Stamina* conniving in the form of a bell, of which the three exterior are shorter than the others by one half, so that it would appear that the *Anthers* of these could never pass their *Farina* over the *Stigma*, but Nature, with admirable wisdom, has turned the anthers inwards towards the bell, the shorter ones becoming first mature, so that they do actually accomplish their office.‡

II. A day would sooner fail me than examples,§ but I pass these by, and hasten to the consideration of the *unisexual flowers*.

### FIRST EXPERIMENT.

Several species of Momordica (*Cucumbers*) which are cultivated with us, like other *Indian vegetables*, in close stoves, have there very frequently produced *female flowers*, and these, although at first very flourishing, in a short time have begun to wither, nor have they produced seed, until I instructed the gardener, as soon as he should discover a *female flower*, to pluck a *male*, and place it over the *female flower*. By this art, for a certainty, we have produced fruit,

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Anagallis, *Pimpernel*, at 7—8. Portulaca hortensis, *garden Purslain*, at 9—10, and at 11—12. Dianthus prolifer, *proliferous Pink*, at 8, and at 1. Cichoreum, *Succory*, at 4—5. Hypochæris, at 6—7, and at 4—5. Crepis, at 4—5, and at 10—11. Picris, at 4—5, and at 12. *Field Calendula*, at 9, and at 3. *African Calendula*, at 7, and at 3—4.

So in almost all sorts of flowers we see how they expand or open by the heat of the sun, but in the evening, and in a moist state of the air, they close or contract their flowers, lest the moisture getting to the dust of the *antheræ* should coagulate the same, and render it incapable of being blown on the *stigmata*: but (which is indeed wonderful!) when once the fecundation is over, the flowers neither contract in the day, in the evening, nor yet against rain.

* It is a pleasing sight to see the *stamina* in many flowers advance over the pistillum. In the Parnassia, and Saxifrage, the stamina regularly rise, but after impregnation the *stamina* fall back in a circle. I have often witnessed this in the several Sempervivums (*houseleeks*), where the six more mature *stamina* advance to the central females, then they retreat, and the remaining six next advance, as regular as with a troop of horse, and then the whole twelve fall back in a circle.

† I examined, says the illustrious Dr. Smith, the Ruta Chalepensis (*African Rue*), which differs very little from the common Rue, and found many of the stamina in the position which Linnæus describes, holding their antheræ over the stigma; while those which had not yet come to the stigma were lying back upon the petals, as well as those which, having already performed their office, had returned to their original situation. Trying with a quill to stimulate the stamina, I found them all quite devoid of irritability. They are stout, strong, conical bodies, and cannot, without breaking, be forced out of the position in which they happen to be. The same phænomenon has been observed in several other flowers; but it is no where more striking, or more easily examined, than in the Rue. Vide *Tracts on Natural History*, p. 174.

‡ Where there are several *stamina* in a flower, these are often of a disproportionate size, and then the lower tier become first mature, and embrace the young pistillum, which increasing in growth, in a few days after celebrates her amours with the taller beaux. Thus the Lychnis Flos Cuculi (*Meadow Lychnis*) has ten *stamina*, of disproportionate sizes, five of which arrive at their maturity before the other five. The same may be seen in our common *Blue Bell* (Hyacinthus). The *position* of the *anthers* on their *filaments* as respects the pistillum, is worthy also of observation. Vide our Picturesque Plate of the Rhododendron Ponticum (*Pontic Rhododendron*) which illustrates both these observations.

§ The reader will find a great many other examples among our *Select Plants*.

*Lychnis Flos Cuculi; or Ragged Robin.*

*Henderson del.*

*Caldwall sculp.*

*London. Published by Dr. Thornton, Decr. 1, 1808.*

and such is our present confidence, that we could pledge ourselves to make *any female flower* fixed upon, *fertile*.*

## SECOND EXPERIMENT.

In the month of April I sowed HEMP-SEED (*Canabis*) in *two* pots.

The young plants came up in such abundance, that each pot contained thirty, or forty, plants.

I placed *both* to the light on a window-seat, but in opposite parts of the house, so that all communication was necessarily prevented.

In both situations the HEMP flourished greatly.

In *one* of the pots I suffered the *male* and *female* plants to grow together, to flourish, and produce fruit, which was ripe in the month of June, and afterwards being macerated in water, and committed to the earth, shot up within twelve days.

But in the *second* I plucked up all the *male plants* as soon as they had advanced, so that I could discern the *anther-bearing males* from the *pistil-bearing females*.

The surviving *females* indeed flourished, and copiously presented their long pistils, but the flowers remained a very long time, as if all that length of time in expectation of marriage; so that in the mean time in the *other pot* the fruit had reached maturity, and the *pistils*, in a quite different way, had instantly faded, after the *males* had discharged their *farina*.

Undoubtedly this is a pleasing sight, and very much to be admired, that the *unmarried* females in so opposite a way retained their *pistilla* green and flourishing, nor first allowed these

to

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* The *Cucumber* affords a familiar example of the *Sexes of Plants*, for it produces on the same trailing branches flowers *male* and *female*; that is, some of the flowers have only *stamina* (no pistillum), and others again only the *pistilla*, without the *stamens*, and being cultivated under glass for early produce, it is a known fact, that gardeners are obliged to pluck the *males*, or *stameniferous* flowers, and place them in the corollas of the *females*, or *pistilliferous* flowers. This process is thus celebrated by the illustrious COWPER in his poem called "The Garden."

> *Plants* have their *sexes*, and when *Summer* shines
> The BEE transports the *fertilizing meal*
> From flower to flower, and e'en the *breathing air*
> Wafts the rich prize to its appointed use.
> Not *so* when *Winter* scowls. *Assistant art*
> *Then acts in Nature's office, brings to pass*
> *The glad espousals, and ensures the crop.*

It is curious to observe, that all *stameniferous*, or *male* flowers, produce *honey*.

One of the most singular ways of the fecundation of plants through insects, we have in the ARISTOLOCHIA CLEMATITIS (*Common Birthwort*). It has a linguiform corolla, which at its inferior part is spherical, towards the top it becomes long and tubular, and its margins end in a flat and spearpointed extremity. The *pistil* is placed in the round cavity of the corol, the *germen* of which is surrounded by *six anthers*, which are *shorter* than the germen itself. The germen has no style, but is provided with an hexagonal stigma, which is very shallow, and on its upper surface has imbibing pores. *The anthers cannot empty the pollen upon the stigma, as the flower stands always straight upright during the period of flowering.* The *pollen* therefore must necessarily fall to the bottom of the flower without being used, if *no insects* come near the flower. And indeed if it be tried, and all insects kept from the flower by a thin, but firmly closed piece of gauze, no seeds will be formed. It happens indeed not unfrequently, that as it is a particular insect which impregnates the flowers, when it is wanting or not able to find the flower, this last withers without having a single seed. This insect is the TIPULA PENNICORNIS. The round bottom of the flower is, in its interior, quite smooth, but the tubular extremity is lined with dense hair, every one of which is turned towards the interior, so as to form a kind of funnel, through which the insect may very easily enter; but cannot without great difficulty return, and is obliged to remain in the cavity. Uneasy to be confined in so small a space, it creeps constantly to and fro, and so deposits the pollen on the stigma. After this is done, the flower sinks, the hair, which obstructed the passage, shrinks and adheres closely to the sides of the flower; by which means the insect gets free. Who but must admire the wise provision of Nature in fecundating this seemingly trifling flower!

to collapse, before that they had been a very long while exposed for the access of the *male farina.*[*]

And, lastly, when these *virgin* plants began to be affected with age, I diligently searched along with several botanists for all the calyxes, and I found these large and flourishing, but the *seeds*, as many as were found, were yellow, compressed, membranaceous, dry, not exhibiting the slightest trace of cotyledons or pulp.[†]

## THIRD EXPERIMENT.

The Clutia Pulchella (*Broad-leaved Clutia*) was also, during the months of June and July, kept in the same window of my room.

The *male* and *female* plants were in different pots.

The *female* in consequence abounded in fruit, and indeed, not a single flower dropt abortive.

Then I separated the pots to different windows in the same room, nevertheless, all the female flowers produced perfect fruit.

I lately removed the *male* altogether, and only left the *female plant*, having first removed all the former, and newly expanded, flowers.

From the axilla of each leaf there daily appeared fresh ones, which remained for the space of eight or twelve days, but afterwards the peduncles turning yellow, they fell off empty of fruit.

A friend, a botanist, who was delighted with this experiment with myself, one day persuaded me, that I should bring a *single male flower* from the stove in the garden, which he

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[*] Linnæus elsewhere observes, " The act of flowering seems greatly to exhaust the living principle. In the moth and butterfly it may be observed, how after marriage the wings droop, and life expires. But if this butterfly be confined like a nun in a convent, it will survive many months. So annual plants will become biennial; if they do not happen to blow the first year, they will resist the cold of winter, as the pinks, lychnises, &c. even to the third winter, but once having blown, they soon after perish.

The Musa (*Plantain*) often lives to an hundred years: but having once opened its flowers, no art or experience teaches how to save this superb plant from perishing that same year.

The Corypha (*Fan Palm*) was sterile for thirty-five years, and grew to the height of seventy feet, and in four months it rose to thirty feet in height, and produced fruit that same year, which being accomplished, the whole plant died. Hort. Cliff. 482.

The Lavatera Arborea (*Tree Lavatera*) rises to the height of a pear-tree, supporting readily the colds of winter, but having once put forth any blossom, neither the friendly hand of the gardener, nor stoves, nor attention, can save it from perishing in the coming winter. Lin. Amæn. Acad. Tom. i. 375.

The same remark holds good as respects the Agave Americana (*American Aloe*); vide the description accompanying our Picturesque Botanical Plate of that superb plant.

Hence it is that all double flowers last so much longer than single, and that *tulips* deprived of their *anthers* retain for a great while their corolla-leaves.

[†] This experiment of the *Hemp* has been repeated by Spalanzani, and a contrary conclusion drawn; but the plants grew in places where *cordage* was made, and where *Hemp* was cultivated in the neighbourhood--but in *sequestered spots* in the country, where I have prosecuted these experiments, the results have been exactly as recorded by Linnæus. Vide our " *Philosophy of Botany*," where the experiments of Spalanzani, and the confutation of them, will be recorded at considerable length. Care, however, must be taken, that on the *female Hemp* no *males* are found interspersed amongst the *female flowers*, a common *Lusus Naturæ*; and even it has been experienced, that a *female plant* has in course of time produced only *male flowers*, and *vice versâ*. John Bauhine (Hist. Plant. tom. i. p. 351.) describes the whole fructification of a *Palm*, which he saw growing at Montpelier, and which not only produced branches of *male* flowers, but also *female* ones bearing dates. Ray tells us in his History of Plants, (vol. ii. p. 1354.) that he himself saw, many years after, this same remarkable tree mentioned by Bauhine. This variety in the fructification has been noticed by several other authors. The learned Jungius, in his Doxoscopia (Chap. iv. p. 145.), mentioning that class of trees which are male and female in different parts of the same tree, says, " That such kind of trees, when they have for many years produced flowers without fruit, afterwards sometimes will produce fruit without flowers. This," he thinks, " should be farther enquired into." This, since Jungius's time, has been done, and it has been found, that sometimes the trees of this class are wholly *male*, while young; but as they advance in age, they have flowers of *both sexes*, and afterwards become entirely *female*. This fact Miller has frequently himself observed in the *Mulberry-tree*; and the Chevalier Rathbeg, a gentleman excellently versed in whatever relates to botany, has observed, that a large Lentiscus (*Mastich Tree*) in his garden, for *thirty years* had produced only *male flowers*, but that for *three years* past, it had also produced plenty of fruit.

*Male & Female Flowers on the same Plant.*

# *The Imperial Jatropha.*

*Named in honor of the wise, magnanimous, and munificent Alexander, Emperor of Rufsia.*

Henderson del. Caldwall sculp.

London, Published by Dr. Thornton, Feby. 1805.

placed in contact with a *female* flower recently open, and tied this flower with a piece of red silk to know it again.

The next day I removed the male flower, and this *one germen* indeed remained, and produced fruit.

After the experiment, I took *another male flower* from the stove, and by means of a slender forceps, I removed from it one of its *Anthers*, and having scratched it gently with the knib of a pen, I took care that a little of its *farina* might fall upon one of the *Stigma*, having guarded the remaining two *stigmata* by a cap made by an hollow roll of paper.

This *Germen* also grew to a fruit of the ordinary size, and afterwards being transversely dissected, it *alone* produced a large seed in one of the three cells, the *other two* being empty.

The other flowers, not having suffered impregnation, every one of them, becoming withered, dropt.

The repetition of this experiment is also as readily to be repeated as the former.

## FOURTH AND FIFTH EXPERIMENTS.

The JATROPHA URENS (*Stinging Jatropha*) flowers every year in my hot-house, but the *female flowers* have preceded the *males*, and before eight days they lost their petals, and faded, before the *male flowers* were expanded.

Hence not only they produced *no fruit*, but the *flowers* themselves *dropt*.

Thus it happened that, until the year 1752, we could obtain *no fruit* of the JATROPHA.

But in this year, the *male flowers* were in vigour upon a taller tree, at the precise time the *females* appeared on a small JATROPHA growing in a pot.

This pot I placed under the tree producing *male flowers*, and in this manner I accomplished, that the *female flowers* produced *seed*, which, being sown in the earth, grew.

Two years after I placed these *male flowers* under a piece of paper, until the *Farina* had fallen upon it, which I preserved rolled up, if I recollect right, for four or five weeks, when this same JATROPHA on another branch produced *female flowers*.

Then I sprinkled that *Farina* so long preserved in paper upon *three flowers*, the only ones at that time expanded.

These *three* female flowers *only* became *fruitful*, whereas *all the other flowers* which appeared in the same corymbus fell off *abortive*.*

I have frequently since amused myself by taking the *male Farina* from one plant, which by sprinkling upon the *females* of another, I have always found the seeds thereby rendered fruitful.†

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* The same experiment was made on the JATROPHA IMPERIALIS (*Imperial Jatropha*), and with exactly the same result. The *male* flowers usually occupy the upper part of the plant, and are soon to be distinguished from the *females*.

† A similar experiment was made on the BEGONIA NITIDA (*oblique-leaved Begonia*), which forms one of our Picturesque Botanical coloured plates, where the *male* and *female* flowers are very readily distinguished from each other, even at their first appearance, the *males* having a corolla consisting of four petals, the *females* of five, which gave the same confirmation of the Sexual Hypothesis.

## SIXTH EXPERIMENT.

The DATISCA CANNABINA (*Smooth-stalked Bastard Hemp*) was raised from seed about ten years ago in my garden.

It abounded in flowers, but these being *females,* therefore proved abortive.

In order to obtain a *male plant* I procured some seeds from Paris.

These also grew well, but what vexed me was, they all proved *females,* and, therefore, produced me also flowers without fruit.

At length, in the year 1757, I procured other seeds.

Out of these some plants were *males,* and in the year 1758 flowered.

These I removed into a border very remote from the *females.*

Therefore, when the *male flowers* were mature for shedding their *Farina,* I held a [*]paper under them, and gently agitated the loose spike of flowers with my finger, until the whole surface was nearly covered with yellow *Farina.*

I carried this to the *female flowers,* which were produced in another part of the garden, and sprinkled it over them.

The result was, these *female flowers* alone ripened their fruits where I had dispersed the *Farina,* and their seeds attained their due magnitude; but in all the rest, being fertilized by no *Farina,* there appeared not a vestige of any seeds.[†]

## SEVENTH EXPERIMENT.

The PHŒNIX DACTYLIFERA (*Date-bearing Palm*) a long time flowered at *Berlin,* but produced no fruit.

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[*] KOELREUTER, a famous experimental botanist, sent, from *Karlsruhe* to GLEDITSH, the *farina* of the *male* CHAMÆROPS HUMILIS by post, with which, by means of a camel's-hair brush, he impregnated a *female plant* in his garden, and, for the first time, obtained ripe seeds, from which he raised young plants.

[†] Sometimes, however, under such circumstances, the seeds arrive at their due magnitude, but, as was long since observed, are barren.

"Mr. Jacob Bobart, overseer of the Physic Garden at Oxford, about thirty-eight years ago, which was before the doctrine of the different sexes of plants was well understood, herborising in the country, observed a plant of the *Lychnis Sylvestris simplex,* whose flowers, though they had stamina, yet there were no apices; and finding this not in one, but in all the flowers upon the same plant, this made him imagine it might be a new species, and therefore he marked the plant, and took care to have it preserved till the seeds were ripe; and he at length procured them full hard and firm, and to outward appearance *Remplis des germe* (as Mr. Geoffroy has it). He failed not to sow them in his garden next season in a proper place, but there was never a plant which sprung up.

I had this account from the celebrated Dr. Sherard, at whose desire I have inserted it, and both of them being persons of such esteem, and so good credit, I may venture to say it sets the opinion of the different sexes of plants upon another footing than it is received by most of our modern authors; for this imports that it is not the nourishment of the gross substance of the seed itself, which is hereby meant, nor the increase of the seed-vessel, which is thereby designed, for, as is observed, a hen can lay an egg without previous congress with the cock, and this shall be the same for colour, taste, (when new-laid) smell, bigness, with another egg which has the tread (as they call it), i. e. that has been fecundated by the *Materies Seminalis Masculina*; but the difference appears when both are put under the hen to be hatched, the one shall pullulate or chit, and the other shall become fetid and rot.

The LYCHNIS DIOICA (*Wild Red Lychnis*) being made by me the subject of experiment, gave additional confirmation of the Sexes of Plants." Vide Blair on the Generation of Plants, in his Botanical Essays.

The learned Dr. Hope, late professor of botany in the university of Edinburgh, a strenuous advocate for the sexes of plants, made the following experiment. He found of this Lychnis dioica two kinds, the white and the red; and he was convinced (as are since this time Professor Martyn and Mr. Curtis) that these are not varieties, but distinct species, and that the white never produces naturally red flowers. He placed under the same bell the red and the white Lychnis Dioica, the one a *male* and the other a *female* plant, and the bell terminated in a tube for the admission of air, but filled with moss, to hinder the access of any other farina; and from this *white* female Lychnis he obtained seeds, which produced him some *red* Lychnises. Vide Note * in the description of the Carnation to our Picturesque Plate, where the doctrine of the Sexes of Plants is further confirmed by observations on that flower.

The Two-housed Lychnis.

Henderson del.^t

Caldwall sculp.^t

London, Published by D.^r Thornton, Oct.^r 1. 1805

Some of the *male flowers*, from a tree flourishing at *Leipsic,* were sent by the post, and in this way fruit was obtained, and some of these I planted in my own garden, and they germinated, and at this present time are in a very flourishing state.[*]

KÆMPHER has long since reported, how necessary it was found by the nations in the East, who live by the fruit of the PALM-TREE, and are the true *Lotophagi,* to plant a few *male plants* amongst the female trees, if they expected any harvest; hence, upon an invasion, they were led to cut down the *males,* that the enemy might feel a want of provisions, and sometimes this destruction was made as a vengeance upon a resisting country.[†]

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[*] This curious account of the date-bearing Palm is to be met with in the Philosophical Transactions, vol. xlvii. p. 169, including a letter which was read to that society May 2, 1751, with some ingenious observations on that subject by one of the members of that learned society, Doctor Watson, to whom it was addressed.

Professor MYLIUS's letter to Dr. WATSON, dated at Berlin, Feb. 20, 1750—51. "The Sex of Plants is very well confirmed, by an experiment that has been made here on the *Palma major foliis flabelliformibus.* There is a great tree of this kind in the garden of the Royal Academy. It has flowered and bore fruit these thirty years, but the fruit never ripened, and, when planted, it did not vegetate. The palm-tree, as you know, is a *Planta Diœcia,* that is, one of those in which the male and female parts of generation are upon different plants. We having therefore no male plants, the flowers of our female were never impregnated with the farina of the male. There is a male plant of this kind in the garden at Leipsic, twenty German miles from Berlin. We procured from thence, in April 1749, a branch of male flowers, and suspended it over our female ones; and our experiment succeeded so well, that our palm-tree produced more than an hundred perfectly ripe fruit; from which we have already eleven young palm-trees. This experiment was repeated last year, and our palm-tree bore above two thousand ripe fruit. As I do not remember a like experiment, I thought it convenient to mention it to you; and, if you think proper, be pleased to communicate it to the Royal Society."

[†] As Linnæus aimed at brevity in this dissertation, we have here, as concisely as possible, commented upon his text, hoping that our readers will not feel fatigued by our enlarging a little upon so very curious a topic by renewing again the subject of the Palm.

"The *palm-tree* grows very high forming one stem.—A sort of bough shoots out and bears the fruit in a kind of sheath, which opens as it grows. The *male* bears a large bunch something like millet, which is full of a white flower, and unless the young fruit of the *female* is impregnated with it, the fruit is good for nought; and to secure it they tie a piece of this fruit of the male to every bearing branch of the female. Strabo observes that the *palm-tree* in Judea *did not bear fruit,* as at present; which probably may be owing to their not having the *male tree*; concerning which I could get no information. But the fruit of the *female tree,* without the male, drops off, or comes to no perfection." Vide Pocock's Description of the Eaſt, vol. i. 206.

"On the morning of the 21ſt, I had the pleasure of seeing from my window one of the most remarkable sights in nature. A *female* palm (Phœnix dactylifera Linnæi) had in the night put forth its blossoms from the spatha; I went thither at sun-rise to see it, whilst the dew was yet falling. I saw a gardener, the proprietor of the palm, climbing up the palm, which equalled our largest firs in height. He had a bunch of *male flowers* with which he powdered the female, and by these means fecundated them." Vide Hasselquist's Voyages and Travels in the Levant, English Transl. p. 112.

"The first thing I did after my arrival in Egypt, was to see the *Date-tree,* the ornament and a great part of the riches of this country. It had already blossomed, but I had, nevertheless, the pleasure of seeing how the *Arabs* assist its fecundation, and by that means secure to themselves a plentiful harvest of a vegetable, which was so important to them, and known to them, many centuries before any botanist dreamed of the different sexes in vegetables. The gardener informed me of this before I had time to inquire, and would shew me, as a very curious thing, the *male* and *female* of the *Date* or *Palm-tree*; nor could he conceive how I, a Frank, lately arrived, could know it before; for, says he, all who have yet come from Europe to see this country, have regarded this relation either as a *fable* or a *miracle.* The Arab, seeing me inclined to be further informed, accompanied me and my French interpreter to a *Palm-tree,* which was very full of young fruit, and had by him been wedded or fecundated with the *male,* when both were in blossom. This the Arabs do in the following manner: when the *spadix* has a *female flower* that comes out of its *spatha,* they search on a tree that has *male flowers,* which they know by experience for a *spadix* which has not yet burst out of its *spatha*: this they open, take out the *spadix,* and cut it lengthways in several pieces, but take care not to hurt the flowers. A piece of this *spadix,* with *male flowers,* they put lengthways between the small branches of the *spadix* which hath *female flowers,* and then lay a leaf of a Palm over the branches. In this situation I yet saw the greatest part of the *spadices* which bore their young fruit; but the *male flowers* which were put between were withered. The Arab besides gave me the following anecdotes: FIRST, unless they, in this manner, *wed and fecundate the Date-tree, it bears no fruit.* SECONDLY, they always take the precaution to preserve some unopened *spathæ* with *male flowers,* from one year to another, to be applied for this purpose, in case the *male flowers* should miscarry or suffer damage. THIRDLY, if they permit the *spadix* of the *male flowers* to burst or come out, it becomes useless for fecundation: it must have its *male dust,* (these were the words of the Arab), which is lost in the same moment the blossoms burst out of their case. Therefore the person, who cultivates Date-trees, must be careful to hit the right time of assisting their fecundation, which is almost the only article in their cultivation. FOURTHLY, on opening the *spatha,* he finds all the *male flowers* full of a liquid, which resembles the finest dew; it is of a sweet and pleasant taste, resembling much the taste of fresh dates; but much more refined and aromatic: this was likewise confirmed by my interpreter, who hath lived thirty-two years in Egypt, and therefore had opportunities enough of tasting both the nectar of the blossoms, and the fresh dates.

"Thus much have I learned of this wonderful work of Nature, in a country where it may be seen every year. I shall have the honour to give a relation of the use, and divers other qualities of the Date-tree, at some other opportunity." Vide Hasselquist's Letters to Linnæus.

"In one of our excursions we had an opportunity of observing a curious process in the vegetable world. It has already been observed by naturalists, but is too uncommon to be known to readers of every class. The *Date-trees* were now in blossom; and we remarked the Arabs to be busied about the branches. It is necessary to ingraft all fruit-trees to obtain good fruit; but the propagation of the Date is in another

## EIGHTH EXPERIMENT.

The experiments on the MAIZE related by LOGAN are perfectly conclusive.*

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manner, and intimately resembles that of the animal creation. There is a *male* as well as a *female* Date-tree, which are distinguished from each other by the colour and shape of the blossoms. The *male-tree* yields no fruit; but the gardener must be careful, every spring, to cull as many blossoms from the *male* as will serve his purpose. One of these at least he must inwrap and bind up in the blossom of the *female-tree*; without which she will prove as barren as the *male*." Vide Irwin's Series of Adventures in the Course of a Voyage up the Red Sea. 8vo. Edit. 1787.

SONNINI, the latest traveller in Egypt, gives us the following account of the uses of the Date-tree.

" Among the trees of Egypt there is none more widely dispersed than the *Date-tree*: it is every where to be found, in the Thebaïs and in the Delta; in the sands as well as in the cultivated districts. Although it requires little culture, it yields a considerable profit, on account of the immense consumption of its fruit. The date varies in quality; that which is produced in the environs of Rosetta is delicious, and boats are laden with it for the market of Cairo.

" To climb trees which have no branches but at their top, and the straight and slender stem of which cannot support a ladder, the Egyptians employ a sort of girth fastened to a rope, that they pass round the tree. On this girth they seat themselves, and rest their weight; then, with the assistance of their feet, and holding the cord in both hands, they contrive to force the noose suddenly upwards, so as to catch the rugged protuberances with which the stem is symmetrically studded, and formed at the origin of the branch-like leaves, that are annually cut. By means of these successive springs, the people of this country reach the top of the *Date-tree*, where, sitting, they work at their ease, either impregnating the females, or gathering the clusters of fruit: they afterwards descend in the same manner.

" The *dates* are not the only produce of this species of Palm-tree; from hard beating its bark, its branch-like leaves, as well as the rind of its clusters of fruit, threads are obtained, from which are manufactured ropes and sails for boats. The leaves serve likewise for making baskets and other articles. The very long rib of the branches, or leaves, is called in Arabic *dsjerid*. From its combined lightness and solidity, it is employed by the Mamalûks, in their military exercises, as javelins, which they throw at each other from their horses when at full speed." Vide Sonnini's Travels into Egypt, 4to. Ed. 1800. p. 400.

* His book is entitled, " Experiments and Reflections on the Generation of Plants, by JAMES LOGAN, President of the Council, and Chief Justice of the Province of Pensilvania," and was published in 1739. From this Essay I shall extract what the ingenious author has related respecting the Maize, or Indian Corn.

" As several doubts had formerly occurred to me in respect to the generation both of plants and animals, when I first heard of the *Farina fœcundans*, or impregnating male dust, I conceived great hopes that these would be easily solved, and the whole of this intricate affair receive considerable light from the discovery. And as I had long ago observed, with surprise, the singular way of growth of our Indian Wheat or Maize, I judged it, of all the plants I had seen, or perhaps of any that Nature produces, the most proper one for experiments of this kind.

Indian Wheat grows to the height of six, eight, and sometimes ten feet. At the top of the stalk it bears a thready tuft or tassel (called by MALPIGHI, *Muscarium*) furnished with *apices*, which yield the *farina*. From the joints of the stalk below, the ears grow out, which are six, eight, ten, and sometimes even twelve inches long. These consist of a pretty solid substance, about an inch thick, set quite round with grains regularly disposed in rows, in a very beautiful manner. Generally there are eight such rows, often ten, sometimes twelve; and I once saw sixteen: there are commonly forty grains in each row, more or less; which, in their first rudiments, and whilst the stalk they grow upon is soft and tender, may justly be called the *ova* or eggs: to each *ovum* there adheres a white, fine, smooth filament, which, excepting that it is hollow, resembles a thread of silk. These filaments are disposed one by one in order, betwixt the rows from that end where the ear rises from the stalk to the other, where they creep from under the case that incloses the ear, and make their appearance, in the open air, in a bundle or skein: their colour in this part is mostly whitish, though sometimes a little yellow, red, or purple, according to the nature of the plant they grow from: these filaments, as I formerly suspected, are the real styles of the eggs.

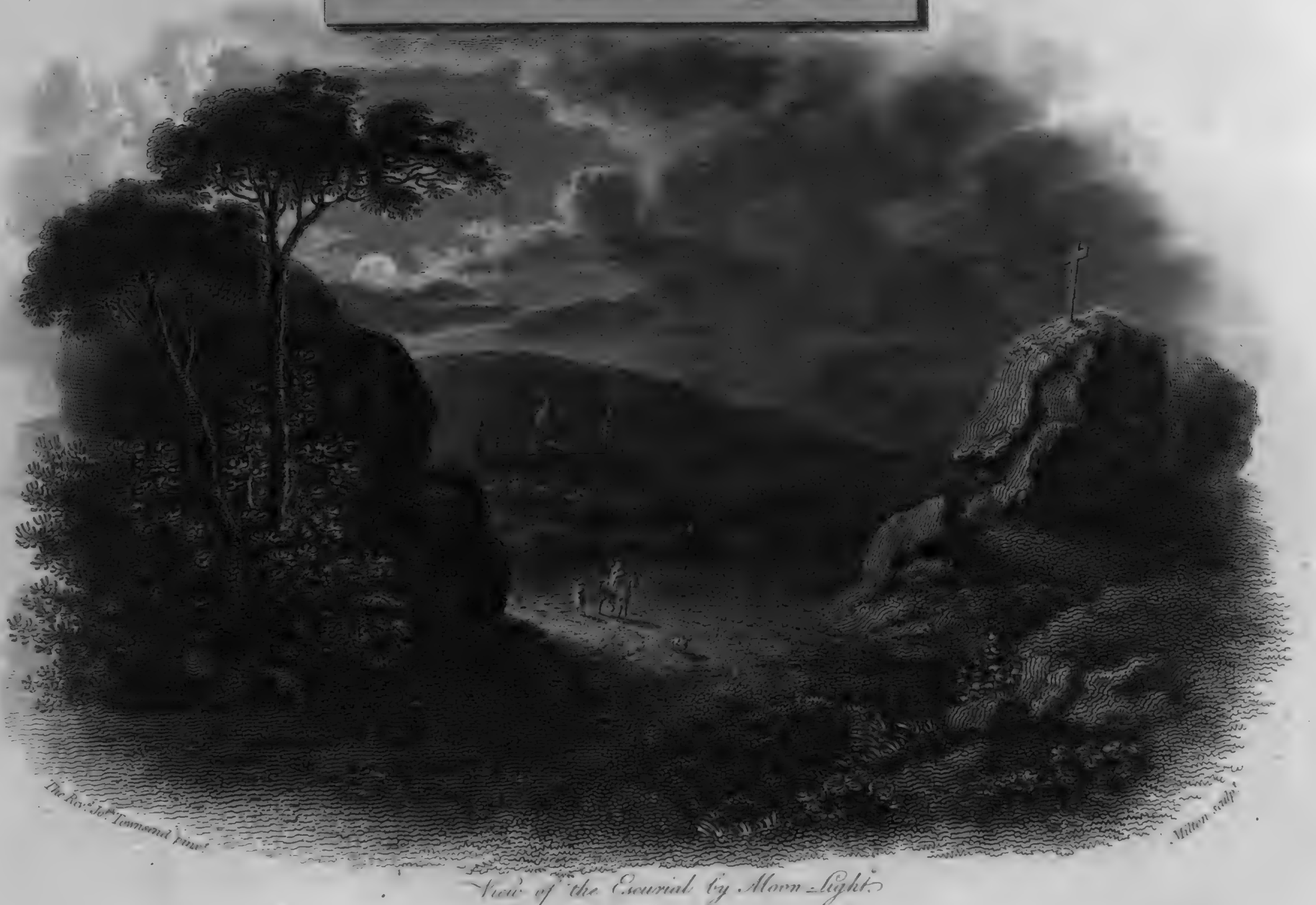
Intending therefore to make some experiments on this plant, towards the end of April I planted four or five grains on hillocks, as is usual in sowing maize, in each corner of a little garden I had in town, which was about forty feet wide, and eighty long. About the beginning of August, when the plants were full grown, and the tufts on the top, and the ears on the stem, had acquired their full extent, I cut off these tufts from every plant on one hillock. On another, without meddling with the tufts, I gently opened the leaves that covered the ears, and cut away from some all the styles, and then closed the leaves again; from others a quarter part, from others one half, and from others three quarters, and left the rest untouched. I covered another ear, before the skein of styles appeared out of the case, with a piece of very fine and soft muslin, but so loosely, that its growth could not be injured; and whilst the furzy texture of the muslin suffered it to receive all the benefit of the sun, air, and showers, the *farina* was effectually secluded. I left the plants on the fourth hillock, as I did these, except in the circumstances above-mentioned, unmolested, till they were fully ripe.

After the beginning of October, when it was time to inquire into the success of my experiments, I made the following observations. In the first hillock, where I had cut off all the tufts, the ears, whilst they remained covered with their husks, looked indeed very well, but were small, and felt light when handled; and not one perfect grain to be found in them, except in one large ear, which grew out somewhat farther from the stalk than usual, and on that side too which faced another hillock in a quarter from whence our strongest winds most commonly blow: in this ear alone I found about twenty grains which were full grown and ripe. I attributed this to some *farina* brought by the wind from a distant plant. In those ears from which I had plucked off some of the styles, I found just so many ripe grains as I had left styles untouched. In those covered with muslin, not one ripe grain was to be seen: the empty or barren eggs were nothing but mere dry husks.

From these experiments, which I made with the utmost care and circumspection, as well as from those made by a great many other persons, it is very plain that this *farina*, emitted from the summits of the stamina, is the true male seed, and absolutely necessary to render the grain fertile. A truth which, however certain, yet was unknown till the present age: the discoverer of this grand secret of Nature, therefore, ought ever to be remembered with due applause. Sir Thomas MILLINGTON, sometime Savilian Professor, seems first to have taken notice

of

The REV.D JOSEPH TOWNSEND, M.A.
Author of a Journey through Spain.



The Rev.d Jo.s Townsend pinx.t

Milton sculp.t

View of the Escurial by Moon Light

Opie R.A. pinx.t Ætat.s suæ XIX.

Hall sculp.t

London. Published by D.r Thornton Dec.r 1805.

To relate more examples would fatigue the reader unnecessarily.*

All Nature proclaims the truth of this doctrine, and every flower of every sort† might be adduced as a witness in its favour. The day would sooner fail me than matter.

III. Leaving innumerable other proofs behind, from both *bisexual* and *unisexual flowers*, I hasten to the consideration of *hybrid*, or *mule plants*, a subject indeed meriting every attention.

Some have ascribed every thing to the *female*, after HARVEY.

Others again to the *male*, after LEWENHOCK.

As for myself, I ascribe the offspring to *both*, which the production of *mules* does confirm.

To instance this, there are *two different kinds* of *mules*.

From the *mare* and *male ass* proceeds the most useful *mule*, which in its gentle nature resembles its mother; but in its mane and tail, and cross on its back, the ass. This animal, which fetches an high price in Spain, is called HINNUS.‡

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of it, before or about the year 1676, according to the account which Dr. GREW gave, in a lecture read before the Royal Society the 9th of November the same year. (See GREW's Works, p. 161, 171.) MALPIGHI no where, that I know of, mentions its use. And GREW himself, though he allows it necessary for fecundation, yet did not suspect that it entered the *germen*: but M. MORLAND, about twenty years after, asserted that it entered the *germen* through the canal of the style. (See Phil. Trans. No. 287.) I once only saw a small grain in the middle of this canal; nor is it to be doubted, but that stricter inquiries will discover more of them passing the same way."

This doctrine by Morland has been refuted by Linnæus, from his observations on the Amaryllis and Marvel of Peru, before recorded. Such as may be curious to see the reasonings upon which Morland founded this opinion, will please to consult our "Philosophy of Botany."

* The reader will call to mind, that the author of the prize dissertation was required to produce chiefly new facts. The Question was Pro Præmio proposita "Sexum Plantarum argumentis et experimentis novis, præter adhuc jam cognita, vel corroborare, vel impugnare, præmissa expositione historica et physica omnium Plantæ partium, quæ aliquid ad fecundationem et perfectionem seminis et perfectionem seminis et fructus confeme creduntur." So that the beautiful proofs of the Sexes of Plants, which were before known, he could not properly introduce into this dissertation, which will form an apology for the number and length of some of our Notes. The subject is considered more at large in our "Philosophy of Botany."

† It has always been an interesting subject of enquiry, to all philosophical admirers of the Sexual System, whether the numerous and intricate tribes of plants, which, on account of the obscurity of their fructifications, were all put together by Linnæus into the class called *Cryptogamia*, were really endowed with flowers and seeds, like other vegetables, or totally destitute of both. Much has been written on the subject of Mosses. Many botanists denied their having any flowers, or sexual organs, as TOURNEFORT, ADANSON, and NECKER. The last-mentioned author writes in a very singular and decisive style concerning them. "Whatever," says he, "has been, or can in future be said of the sexes and copulation of Mosses, we are determined to consider as a fiction and a dream." LINNÆUS and DILLENIUS, more philosophical than this writer, judged from observation and analogy, that Mosses were neither destitute of flowers or seed; they even thought they had discovered both, but proved to be mistaken. MICHELI was the first who observed the real stamina and pistilla in Mosses, but his observations were neglected, and scarcely credited by subsequent authors, till the truly ingenious and accurate Dr. HEDWIG, of Leipsic, published his History of Mosses in 1782, in which he demonstrates the parts of fructification of a large number of Mosses, in so satisfactory a manner, and illustrates the structure and economy of these minute plants so completely, that there cannot be a doubt remaining on the subject. He proves that the *capsula* of DILLENIUS, (the *anthera* of LINNÆUS) which both those authors considered as producing the impregnating pollen, is in fact the fruit, and the powder which it contains, the seed; and that the male flowers are what LINNÆUS and others took for the female. The celebrated SCHREBER had before suspected this to be the case. See his Dissertation on the *Phascum*.

"This opinion is now adopted by all scientific botanists; and it has been anxiously wished that Dr. HEDWIG would prosecute his enquiries through the other orders of the Cryptogamia. This he has been employed in doing; and we are happy to communicate, upon the best authority, some account of his discoveries, published in a prize dissertation at Petersburgh, which has not yet reached this kingdom. In this work Dr. HEDWIG illustrates the fructification of *Filices*, *Algæ*, *Muſci*, and *Fungi*, in thirty-seven plates. The *Equisetum* is referred by him to the class *Tetrandria Monogynia*. The *antheræ*, or male organs of the Agaric, he found on the inside of the *volva*, which covers the *lamellæ* while the fungus is young, and afterwards generally becomes an *annulus* round the stem. The *pistilla* are situated in the *lamellæ*. The *scutellæ* of the Lichens, he is persuaded, are capsules of the seed, and that the *tubercula* of the *Lichenes tuberculati* have been first *scutellæ*; in which opinion every one who has studied this genus of plants will probably agree with him. The *cilia* of *Lichex ciliaris* he believes to be roots; probably those of many other species which resemble it are so likewise. His favourite axiom is "*Omnis planta ex semine*," as that of HARVEY was '*Omne animal ex ovo*.'" Dr. SMITH.

‡ In the Rev. Mr. TOWNSEND's "Journey through Spain," a work replete with useful science and agreeable remarks, and in every part perfectly to be depended upon, speaking of these mules, he entertains us with the following observations.

"I prolonged my stay at the *Escurial*, chiefly for the purpose of being present at the *Batida*, or royal hunt, of which there are four every year. This was ordered for the 28th of November, previous to the departure of the court.

"On the day appointed, Mr. Liston had the goodness to place me with the Neapolitan ambassador, who, as representing one of the family, gave a sumptuous repast upon the occasion; and in his carriage I proceeded to the scene of action. It was an extensive plain, with a rising ground commanding it, and, at the distance of about half a mile from this eminence, rose a little wood, in which the king, with his three

From the *female ass* and *horse* the other kind of mule is engendered, with a disposition as obstinate as the ass, but the beauty and outward appearance of the horse.

Experience also shews us, that if the *male goat of Angora* marries with the *she goat*, the *kid*, the offspring of that intercourse, will inherit the external structure and *valuable coat* of its *father*; whereas, if the marriage is reversed, the kid so produced will have the *vile, worthless hair* of its *father*.

The breed from *Spanish* rams and *Swedish* ewes will resemble the *Spanish* sheep in wool, stature, and external form; and have the hardiness of *Swedish* sheep. An *English* ram without horns, and a *Swedish* horned ewe, will produce sheep without horns.

I shall now call the attention of my readers to only three or four vegetable *mules*, the origin of which I have witnessed myself.

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three sons, were hid, attended by their servants. For many days previous to this, two thousand men had been dispersed in parties over the whole country to disturb the game, and to drive it towards the common centre, by patroling night and day, and constantly, yet slowly, drawing nearer to each other. Soon after we had occupied our station on a rising ground, we began to see the deer at a vast distance bounding over the plain from every quarter, and making towards the fatal spot. As they approached, we heard, faintly at first, then more distinctly, the sound of guns, and saw the confusion of the game, moving quick in all directions, but changing their course at every instant, as if uncertain where to look for safety. When the scouring parties (usually about two thousand) came first in sight, they appeared to be separated by intervals, and to confine the game merely by their shouts and by the firing of their arms; but as they advanced upon the plain they formed a wall, and as they drew nearer, they strengthened this by the doubling of their ranks, compelling thus the game to pass in vast droves before the royal marksmen. Then began the carnage; and for more than a quarter of an hour the firing was incessant. Some of the deer, who had either more discernment than the rest, or a better memory; who were actuated by stronger fears, or, perhaps, by more exalted courage, absolutely refused to proceed, when they approached the ambuscade; and, making a quick turn, notwithstanding the shouts, the motions, and the firing of the guards, they leaped clean over their redoubled ranks, and escaped into the woods.

"When the firing ceased, the carriages all advanced towards the wood, and the company alighted to pay their compliments, and to view the game. We found part of it spread in two rows upon the field of battle, and the king, with his sons, surveying it. The game-keepers were returning loaded with such as had been mortally wounded, but had yet escaped to a considerable distance; and, as fast as they arrived, they deposited the spoil at the sovereign's feet. Having the curiosity to count the numbers, I found one hundred and forty-five deer, with one wild boar. Whilst thus engaged, I heard a murmur, and saw every one in motion. Directing my attention to the spot to which all were pressing, I saw at a distance a little company coming with a boar tied neck and heels together, and flung upon a pole. As they approached; the monarch and his sons, arming themselves afresh, drew up in a line, and standing at a convenient distance, the burthen was deposited; the cords, one after another, were cut; and the poor crippled animal was assaying to move, when a well directed volley freed him from his fears.

"The expence of that day's sport was reckoned at three hundred thousand reals, or, in sterling, three thousand pounds.

"In the evening the game, as usual, was all deposited in the room where the king took his supper, and there the family ambassadors attended to pay their compliments. By family ambassadors are understood those of Naples, Portugal, and France, who having more free access, and being expected to pay more minute attention, think it incumbent upon them to express their interest in every thing which gives him pleasure, and not only congratulate him upon these great occasions, but each night, whilst he is at supper, make inquiries, and afterwards inform their friends what the king has killed.

"Mr. Liston, desirous of quitting the Escurial previous to the departure of the court, ordered a *Coche de Colleras* to be ready the day after the BATIDA. This precaution is taken by the foreign ministers to secure *mules*, because, when the court is in motion, no less than *twenty thousand* being required for their use, the whole country is laid under an arrest, and neither horse nor mule can be obtained for any other purpose.

"In this little journey I was exceedingly diverted and surprised with the docility of the *mules* and the agility of their drivers. I had travelled all the way from Barcelona to Madrid in a *Coche de Colleras*, with seven mules, and both at that time, and on subsequent occasions, had been struck with the quickness of understanding in the *mule*, and of motion in the driver; but till this expedition I had no idea to what extent it might be carried. The two coachmen sit upon the box, and, of the six *mules*, none but the two nearest have reins to guide them; the four leaders being perfectly at liberty, and governed only by the voice. Thus harnessed, they go upon the gallop the whole way, and when they come to any short turning, whether to the right or to the left, they instantly obey the word, and move all together, bending to it like a spring. As all must undergo tuition, and require frequently some correction; should any one refuse the collar, or not keep up exactly with the rest, whether it be, for example, Coronela or Capitana; the name pronounced with a degree of vehemence, rapidly in the three first syllables and slowly in the last, being sufficient to awaken attention, and to secure obedience, the ears are raised, and the *mule* instantly exerts her strength. But, should there be any failure in obedience, one of the men springs furious from the box, quickly overtakes the offending *mule*, and thrashes her without mercy; then, in the twinkling of an eye, leaps upon the box again, and calmly finishes the tale he had been telling his companion. In this journey I thought I had learnt the names of all the *mules*, yet one, which frequently occurred, created some confusion, because I could not find to which individual it belonged, nor could I distinctly make out the name itself. It sounded like *Cagliostra*, and led me to imagine that the animal was so named after the famous impostor Cagliostro, only suiting the termination to the sex, because the mules in harness are usually females. In a subsequent journey the whole difficulty vanished, and my high estimation of the *mule*, in point of sagacity, was confirmed. The word in question, when distinctly spoken, was *aquella otra*; that is, *you other also*; and then supposing *Coronela* and *Capitana* to be pairs, if the coachman had been calling to the former by name, *aquella otra* became applicable to the latter, and was equally efficacious as the smartest stroke of a long whip; but if he had been chiding *Capitana*, in that case, *aquella otra* acted as a stimulus to *Coronela*, and produced in her the most prompt obedience."

The Aconite, or Monk's Hood.

London. Published for Dr. Thornton. Decr. 1801. Caldwall sculpt.

The Bee Larkspur.

An Hybrid Plant, from the intercourse of the Larkspur & Monkshood.

Henderson pinx.t

Caldwall sculp.t

London. Published by Dr. Thornton Jan.y 1st 1805.

## FIRST EXAMPLE.

The VERONICA SPURIA (*Bastard Veronica*) is derived from the VERONICA MARITIMA (*Sea Veronica*) for its *mother*, and the VERBENA OFFICINALIS (*Officinal Vervein*) for its *father.*

It agrees with its *mother* in *fructification*, and in *foliage* it resembles the *father.*

It is not to be raised by seeds, but may easily be produced by means of layers.

## SECOND EXAMPLE.

The DELPHINIUM HYBRIDUM (*Hybrid Larkspur*) was produced in that quarter of the garden where the DELPHINIUM ELATUM (*Bee Larkspur*) and ACONITUM NAPELLUS (*Common Monk's-hood*) grew together.

It resembles its *mother* most in the *fructification*, (the Larkspur,) and its *father* in its stately form, and appearance of its *foliage.*

Owing its origin to plants so nearly allied to each other, it is easily propagated by seeds.

## THIRD EXAMPLE.

The HIERACIUM HYBRIDUM (*Mule Hawkweed*) was gathered in 1763 in our Alps by Dr. SOLANDER.

From its thick brown woolly *calyx*; from the *bracteæ*, as well as in every other part of the fructification, it so perfectly resembles its *mother* the APARGIA TARAXICI (*Alpine Apargia*) that no tyro but would at once perceive the plant; but in the smoothness of the *leaves*, by its teeth, and whole structure, it so manifestly resembles the *father*, the LEONTODON (*Dandelion*), that no one can hesitate whence the same was derived.

## FOURTH EXAMPLE.

The TRAGOPOGON HYBRIDUM (*Hybrid Goat's-beard*) after two years appeared in the garden, where the TRAGOPOGON PRATENSE (*Common Goat's-beard*), and TRAGOPOGON PORRIFOLIUS (*Purple Goat's-beard*) grew together.

Last year, as the TRAGOPOGON PRATENSIS (*Common Goat's-beard*) was in flower, I castrated the flowers in bloom, and sprinkled their widowed *pistilla* with the *farina* obtained from the TRAGOPOGON PORRIFOLIUS (*Purple Goat's-beard*) and I obtained seeds, that being sown produced, in 1759, the TRAGOPOGON HYBRIDUM (*Bastard Goat's-beard*), as before described, the seeds of which I now send.

## FIFTH EXAMPLE.

He who has once seen the ACHYRANTHUS ASPERA (*Rough Achyranthus*), its spike, the parts of the flower, its peculiarly formed nectary, and fructiferous reflexed calyxes, would readily believe, that no one could be mistaken in naming the same the ACHYRANTHUS INDICA (*Indian Achyranthus*); but seeing its broad obtuse, undulated foliage, before flowering, the same person would as positively have pronounced the same to be the XANTHIUM STRUMARIUM (*Small Burdock*).

I could

I could name, unless I had chosen to adopt brevity, a multitude of other *hybrid* plants.*

It is more than probable, that Nature at first created but a few species, and by the intermixture of these arose the extensive genera, or families of plants, and even by the union of nearly allied genera, other kinds were produced: for Nature proceeds " from simple to more compound."

The *variety* of plants arises, I think, chiefly from sexual intercourse: for, unless this were the case, when removed into different quarters, and changed in their soil, the *variety* of the Species would return to their original appearance; but nothing of this sort takes place, as is daily seen in our most esteemed varieties of culinary plants.

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* Koelreuter, who for thirty years made experiments upon plants, performed what he calls " a complete metamorphosis of one natural species of plants into another;" which shews, that in seeds as well as in buds, the embryon proceeds from the male parent, though the form of the subsequent mature plant is in part dependent on the female.

M. Koelreuter impregnated a stigma of the Nicotiana Rustica (*Common English Tobacco*) with the farina of the Nicotiana Paniculata (*Panicled Tobacco*), and obtained prolific seeds from it.

With the plants, which sprung from these seeds, he repeated the experiment, impregnating their pistilla with the farina of the Nicotiana Paniculata.

As the mixed plants, which he thus produced, were prolific, he continued to impregnate them for many generations with the farina of the Nicotiana Paniculata, and they became more and more like the male parent, till he at length obtained six plants in every respect perfectly similar to the Nicotiana Paniculata, and in no respect resembling their female parent the *Nicotiana Rustica.*

This ingenious experimentalist took the farina of the Digitalis purpurea (*Purple Foxglove*), and impregnated the pistillum of the Digitalis lutea (*Small Yellow Foxglove*), and he obtained an *hybrid*, which, instead of being either *purple* or *yellow*, was *striped*, and proved *perennial*, although its father is a biennial plant. *Vide Memoir in the Transactions of the Academy of Petersburgh, for the year* 1782.

The *Mule* Plants which have been ascertained are extremely numerous.

| | |
|---|---|
| Mother, Arctotis tristis<br>Father, Calendula pluvialis | *Bastard, Arctotis Calendula.* |
| M. Asclepias Vincetoxicum<br>F. Cynanchum Acutum | *B. Asclepias Nigra.* |
| M. Primula Integrifolia<br>F. Cortusa Mathioli | *B. Primula Cortusoides.* |
| M. Papaver Rhæas<br>F. Chelidonium Corniculatum | *B. Chelidonium Hybridum.* |
| M. Dracocephalum Thymiflorum<br>F. Nepeta Sibirica | *B. Dracocephalum Nutans.* |
| M. Brassica Eruca<br>F. Sinapis Alba | *B. Brassica Vesicaria.* |
| M. Actæa Spicata<br>F. Rhus Toxicodendron | *B. Actæa Spicata Alba.* |
| M. Trifolium Repens<br>F. Trifolium Pratense | *B. Trifolium Hybridum.* |
| M. Rhus Toxicodendron<br>F. Rhus Copallium | *B. Rhus Vernix.* |
| M. Tussilago Petasites<br>F. Tussilago Alba | *B. Tussilago Hybrida.* |
| M. Urtica Pilulifera<br>F Urtica Dioica | *B. Urtica Balearica.* |
| M. Thalictrum Aquilegifolium<br>F. Thalictrum Minus | *B. Thalictrum Contortum.* |
| M. Alchimilla Alpina<br>F. Alchimilla Vulgaris | *B. Alchimilla Hybrida.* |
| M. Veronica Spicata<br>F. Veronica Officinalis | *B. Veronica Hybrida.* |
| M. Mentha Spicata<br>F. Mentha Aquatica | *B. Mentha Crispa.* |
| M. Menyanthes Trifoliata<br>F. Nymphæa Lutea | *B. Menyanthes Nymphæides.* |
| Mother, Poterium Sanguisorba<br>Father, Agrimonia Eupatoria | *Bastard, Poterium Hybridum.* |
| M. Saponaria Officinalis<br>F. Gentiana Aliqua | *B. Saponaria Hybrida.* |
| F. Aquilegia Vulgaris<br>M. Fumaria Sempervirens | *B. Aquilegia Canadensis.* |
| F. Blitum Capitatum<br>M. Chenopodium Rubrum | *B. Blitum Virgatum.* |
| M. Cochlearia Officinalis<br>F. Brassica Orientalis | *B. Cochlearia Glastifolia.* |
| M. Arundo Epigejos<br>F. Elymus Arenarius | *B. Arundo Arenaria.* |
| M. Helianthus Annuus<br>F. Helianthus Tuberosus | *B. Helianthus Multiflorus.* |
| M. Cyanus Orientalis<br>F. Centaurea Aliqua | *B. Centaurea Moschata.* |
| M. Carduus Oleraceus<br>F. Carduus Serratuloides | *B. Carduus Tataricus.* |
| M. Dipsacus Fullonum<br>F. Dipsacus Pilsous | *B. Dipsacus Laciniatus.* |
| M. Pyrola Rotundifolia<br>F. Pyrola Secunda | *B. Pyrola Minor.* |
| M. Thalictrum Minus<br>F. Thalictrum Flavum | *B. Thalictrum Angustifolium.* |
| M. Iris Graminea<br>F. Iris Sibirica | *B. Iris Spuria.* |
| M. Carduus Crispus<br>F. Carduus Nutans | *B. Carduus Acanthoides.* |
| M. Dryas Octopetala<br>F. Geum Aliquod | *B. Dryas Pentapetala.* |
| M. Urtica<br>F. Parietaria | *Urtica Alienata.* |

One of the most extraordinary *hybrids*, unless it can be better referred to some of those very remarkable sportings of Nature, is seen in the Peloria.

This *hybrid* is so named from the Greek word πελορια, *wonder*, or *astonishment*, for when first presented to Linnæus by one of his students in botany, he was greatly surprised to see an Antirrhinum Linaria (*Common Toad-flax*) in the shape of its leaves, its manner of growth, in its peculiar smell, but its flowers, instead of being personate, with one spur-like nectary, and four unequal stamina, had five equal stamina, five spur-like nectaries, a corolla formed like an inverted funnel, with the neck of it revolute, more nearly, therefore, resembling Erica (*Heath*) in its fructification, but yet differing from this as to the number of stamina.

Being a *mule* from distinct genera, it cannot be propagated by seeds, but only by cuttings.

The *Quadrangular Passion-flower* appears to us to be an offspring betwixt the *Winged* and the *Common Blue Passion*, hence it most resembles its father the *Winged Passion-flower* in its *foliage*, but its mother the *blue* in its *flower*. Vide our Picturesque Botanical Plates of the several Passion-flowers, and description.

Vide also our Notes to the description of the *Carnation*, where a *Mule Pink* is in one of the notes particularly mentioned.

Here

# Nicotiana, Tobacco.

Henderson del.
Caldwall sculp

London, Published by Dr Thornton, July 1, 1805.

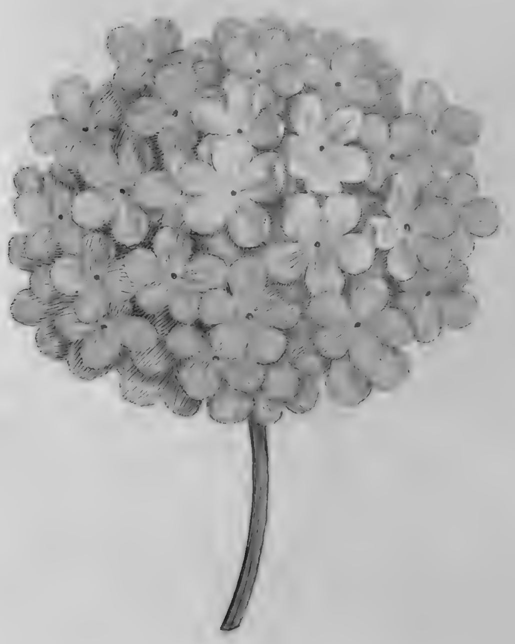
# Peloria or The Wonder.

A Mule Plant, so named by Linnæus on account of the Astonishment that this Hybrid production created, when it was first shewn to Him.

Henderson del.
London, Published by Dr. Thornton March 1. 1801.
Warner sculp.

# A Vegetable Monster.

all the Flowers barren.



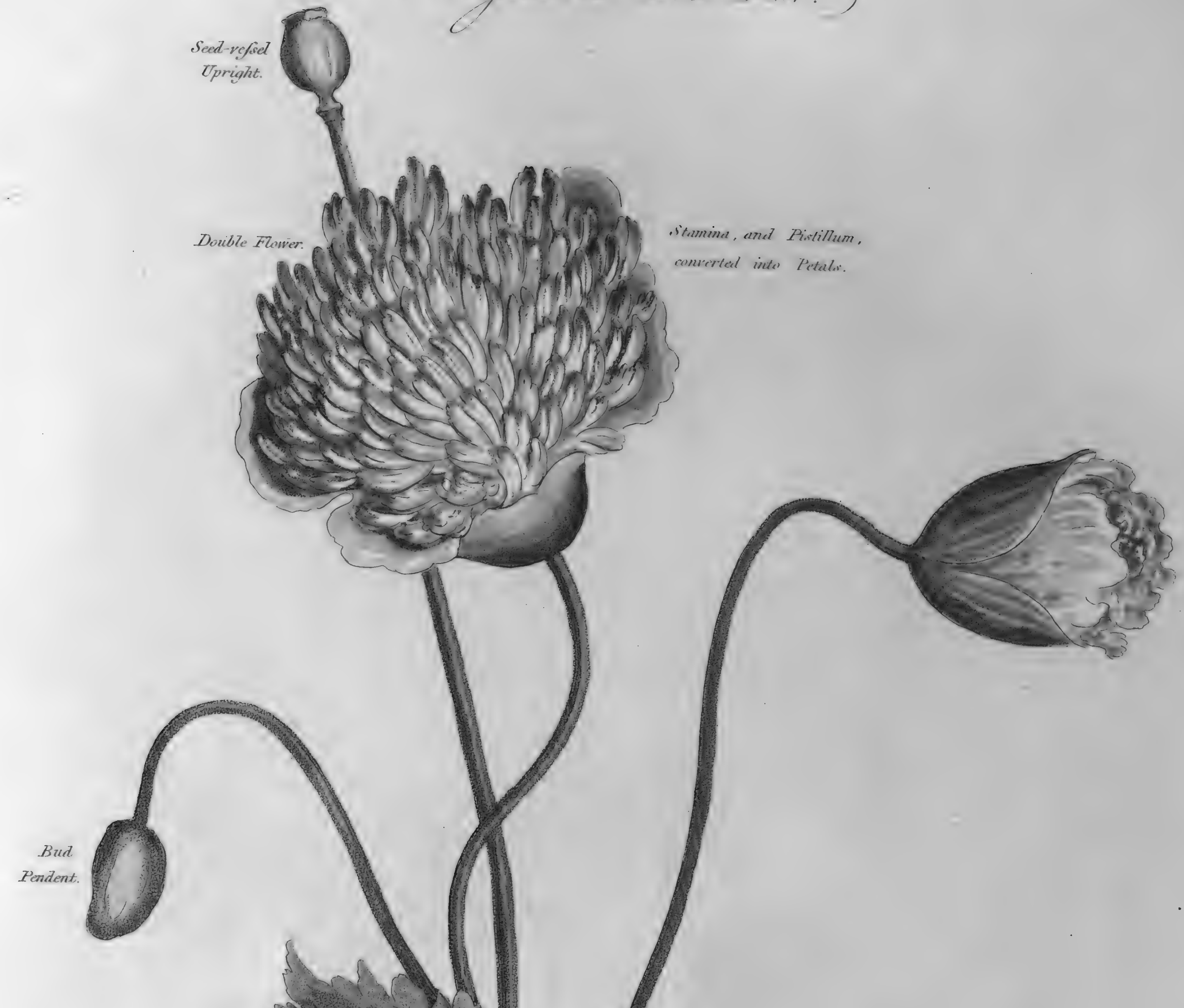
Flowers in the Center fertile. in the Circumference barren.

Spiræa opulifolia; or Currant-leaved Gelder Rose.

Henderson del. Wetton sculp.

London, Published by Dr. Thornton. May 1 1809.

# A Vegetable Monster.



Henderson del.

Garden Poppy.

Warner sculp.

# Vegetable Monsters.

Henderson del. Hopwood ſculp

London Published by Dr. Thornton Feby. 1. 1802.

Here then is a new field open for botanists, and a number of *new varieties* may be raised by *artificial impregnation,*[†] and if what I have written meets with your approba-

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[†] A *new* cabbage is described in the Bath Agriculture, Vol. I. Art. 4. which is said to fatten a beast six weeks sooner than *turneps.* It is there said, " that the sort of cabbage principally raised, is the *tallow-loaf,* or *drum-headed cabbage*; but it being *too tender* to bear sharp frost, I planted some of *this sort* and the *common purple-cabbage* used for pickling, (it being the *hardiest* I am acquainted with) alternately; and when the seed-pods were perfectly formed, I cut down the *purple,* and left the other for seed. This had the desired effect, and produced a *mixt stock* of a *deep green colour* with *purple veins,* retaining the *size* of the *drum head,* and acquiring the *hardiness* of the *purple.*"

In another curious paper of the Bath Society, Vol. V. p. 38. Mr. Wimpey relates, that he planted a field with garden-beans in rows about three feet asunder in the following order, *mazagan, white-blossom, long-podded, Sandwich-toker,* and *Windsor-beans.* The mazagan and white-blossom were thrashed first, when to his great surprise he found many new species of beans; those from the mazagan were mottled black and white; the white blossoms were brown and yellow instead of their natural black; and they were both much larger than usual.

Mr. Knight has given a curious experiment of his impregnating the stigmas of the pea-blossoms of one variety with the farina of another. He says, Vide his Treatise on the Apple and Pear, p. 42, " Blossoms of a small white garden-pea, in which the males had previously been destroyed, were impregnated with the farina of a large clay-coloured kind with purple blossoms. The produce of the seeds thus obtained were of a dark grey colour, but these having no fixed habits, were soon changed by cultivation into a numerous variety of very large and extremely luxuriant white ones; which were not only much larger and more productive than the original white ones, but the number of seeds in each pod was increased from seven or eight, to eight or nine, and not unfrequently to ten. The newly made grey kinds I found were easily made white again by impregnating their blossoms with the farina of another white kind. In this experiment the seeds, which grew towards the point of the pod, and were by position first exposed to the action of the male, would sometimes produce seeds like it in colour, whilst those at the other end would follow the female.

" In other instances the whole produce of the pod would take the colour of one or other of the parents; and I had once an instance in which two peas at one end of a pod produced white seeds like the male, two at the other end grey ones like the female, and the central seeds took the intermediate shade, a clay colour. Something very similar appears to take place in animals, which produce many young ones at a birth, when the male and female are of opposite colours. From some very imperfect experiments I have made, I am led to suspect that considerable advantages would be found to arise from the use of new or regenerated varieties of wheat, and these are easily obtained, as this plant readily sports in varieties, whenever different kinds are sown together."

This practice of the very ingenious Mr. KNIGHT is not, however, a new one, for it was recommended by BRADLEY as far back as 1736.

" By this knowledge," says Bradley, " we may perhaps alter the property and taste of any fruit, by impregnating the one with the *farina* of another of the same class: as, for example, a *Codlin* with a *Pearmain,* which will occasion the *Codlin* so impregnated to last a longer time than usual, and be of a sharper taste; or if the winter fruits should be fecundated with the dust of the summer kinds, they will decay before their usual time: and it is from this accidental coupling of the *farina* of one with the other, that in an orchard where there is variety of *apples,* even the fruit gathered from the same tree differ in their flavour and times of ripening: and moreover, the seeds of those *apples* so generated, being changed by that means from their natural qualities, will produce different kinds of fruits, if they are sown.

" It is from this accidental coupling, that proceeds the numberless varieties of fruits and flowers which are raised every day from seed. The yellow and purple *Auriculas,* which were the first we had in England, coupling with one another, produced seed which gave us other varieties; which again mixing their qualities in like manner, has afforded us, by little and little, the numberless variations which we see at this day in every curious flower-garden; for I have saved the seeds of near a hundred plain *Auriculas,* whose flowers were of one colour, and stood remote from others, and that seed I remember to have produced no variety: but on the other hand, where I have saved the seed of such plain *Auriculas* as have stood together, and were differing in their colours, that seed has furnished me with great varieties, different from the mother plants. I believe I need not explain how the male dust of plants may be conveyed by air from the one to another, by which this generation and production of new plants is brought about; but I shall hint by the bye, to such as plant orchards for cyder, that they ought to plant only one sort of *apple* in those orchards; and that such plantations be likewise remote from other kinds of *apples,* whose *farina* would else certainly spoil the cyder-fruit, by ripening some sooner, and others later, which would occasion almost a continual ferment in the liquor, and never permit it to settle or grow fine.

" Moreover, a curious person may, by this knowledge, produce such rare kinds of plants, as have not yet been heard of, by making choice of two plants for his purpose, as near alike in their parts, but chiefly in their flowers or seed-vessels: for example, the *Carnation* and *Sweet William* are in some respects alike; the *farina* of the one will impregnate the other, and the seed so enlivened will produce a plant differing from either, as may now be seen in the garden of Mr. Thomas Fairchild of Hoxton, a plant neither *Sweet William* nor *Carnation,* but resembling both equally, which was raised from the seed of a *Carnation* that had been impregnated by the *farina* of the *Sweet William.* These couplings are not unlike that of the *mare* with the *ass,* which produces the *mule*; and in regard to *generation,* are also the same with *mules,* if of different kinds, not being able to multiply their species, no more than other monsters generated in the same manner.

" We may learn from hence, that the fruit of any tree may be adulterated as well by the *farina* of one of the same sort, which perhaps may be sickly, and of a dwarf kind, as by the dust of some other kind near akin to it, and worse than itself. Now, as such couplings may be very frequent in common woods, so would I recommend the choice of seed to be made only from such plants or timber-trees as excel in greatness, or other good qualities, and are far distant from others of meaner sorts, which might degenerate their seeds, and cross our expectations when they come to grow up; and this is as necessary to be observed among *vegetables,* to maintain their good qualities in the young plants they are to produce, as it is in the breeding of *game-cocks, spaniels,* or *running-horses.*"

There is an apple described in Bradley's work, which is said to have one side of it a sweet fruit, which boils soft, and the other side a sour fruit, which boils hard. This Mr. Bradley so long ago as the year 1721 ingeniously ascribes to the farina of one of these apples impregnating the other; which would seem the more probable, if we consider, that each division of an apple is a separate womb, and may therefore have a separate impregnation, like puppies of different kinds in one litter. The same is said to have occurred in oranges and lemons, and grapes of different colours.

I have seen myself a curious instance of a *Nectarine Tree* produce its fruit half *Nectarine* half *Peach.*

tion, I shall consecrate the remainder of my days to making these experiments, so much recommended from their agreeable results.

Duhamel has also greatly extended our knowledge on this curious and interesting subject.

" On sait que la plupart des fruits que les Jardiniers appellent *nouveaux*, ne paroissent être que des composés de fruits plus anciens. Le *Colmar*, par exemple, qui passe chez les Jardiniers pour être venu d'un pepin de bon-chrétien, paroît effectivement être composé du bon-chrétien et de la bergamotte d'automne.

" Je suis persuadé que si l'on goûtoit avec une grande attention les fruits d'especes nouvelles, on trouveroit plusieurs exemples de pareils *métifs*: j'avoue néanmoins qu'il se trouve des fruits d'un goût et d'une forme tellement extraordinaire, qu'il seroit difficile d'en assigner l'origine; mais ces exemples rares ne sont pas capables de détruire ma conjecture, puisque ces bizarreries peuvent être occasionnées par un mélange des deux seves; d'autant plus que dans les animaux, entre les chiens par exemple, la même incertitude arrive frequemment.

" Le contraire de cette observation se présente dans certains fruits, où les especes sont assez distinctes pour qu'on puisse manger un quartier d'un fruit séparément de celui avec lequel il est joint lors de la fécondation. Tel est, par exemple, dans les oranges, l'espece que l'on nomme improprement *monstre*, qui sur le même arbre produit des bigarades, des citrons, et des balotins séparés, ou même rassemblés par quartiers dans le même fruit: telle est aussi cette espece de raisin qui produit sur un même cep des grappes rouges et des grappes blanches, et sur une même grappe des grains rouges et des grains blancs; ou d'autres, *dont les grains sont par moitié, ou même par quartiers rouges et blancs.* Je crois pouvoir attribuer ces variétés au mélange des poussieres des étamines. Il arrive très-fréquemment que dans la même portée, une chienne met bas des petits dont les uns tiennent entiérement de leur mere, les autres du pere, et d'autres tiennent de tous les deux; ou tellement confondues, qu'aucune de leurs parties ne ressemble exactement aux mêmes parties ni du pere ni du la mere, ni d'une façon assez distincte pour qu'une partie de leur corps ressemble au pere, et l'autre à la mere: ce que je puis assurer, c'est que j'ai tenté sans succès tous les moyens que les Auteurs proposent comme propres à opérer ces bizarreries de la nature.

" Je pense donc qu'on peut avoir recourse à la même conjecture, pour rendre raison des variétés infinies que fournissent certains genres de plantes; puisqu'elles sont d'autant plus fréquentes, que les différentes especes d'un même genre se trouvent rassemblées en plus grand nombre: au lieu que les plantes d'un même genre qui croissent à la campagne, étant en quelque façon isolées, ne donnent aucune variété. Je vais en rapporter des exemples.

" Personne n'ignore que tous les *Coquelicots* qui croissent naturellement dans les campagnes, portent des fleurs rouges; que les *Primeveres* des prés ont des fleurs couleur de citron; et que ces mêmes plantes transplantées dans nos jardins nous fournissent une quantité prodigieuse de variétés. D'où peut venir cette différence? Je l'attribue à cette fécondation d'une plante par une autre; et je vais rapporter une expérience qui pourra convaincre que cette cause existe réellement dans la nature.

" Je suppose qu'on leve dans un pré une talle de ces *Prime-veres*, qui ne portent constamment que des fleurs couleur de citron; qu'on divise cette talle en deux, qu'une moitié soit plantée dans un lieu élogné de toute autre espece de *Prime-veres*, et l'autre dans un jardin, au milieu d'une plate-bande où l'on aura élevé une grande suite de Primeveres de toutes couleurs: il est certain que ces deux talles produiront, comme dans les prés, des fleurs couleur de citron; mais si l'on ramasse ensuite les graines que fourniront ces deux talles, et qu'on les seme séparément; on remarquera 1°. Que les pieds qui viendront des semences qui auront été produites par le pied qui étoit resté isolé, ne donneront que des fleurs jaunes pareilles à celles des prés, parce que ces graines n'auront pû être fécondées que par elles-mêmes; au lieu que les pieds qui viendront de la talle qu'on aura élevée dans la plate-bande, produiront quelques variétés; par la raison que quelques semences auront pu être fécondées par d'autres pieds voisins. Je dis qu'on n'aura que quelques variétés, parce que la plûpart des embryons auront été fécondés par les étamines de la plante même; et que d'ailleurs plusieurs qui auront été fécondés par les pieds voisins, conserveront néanmoins une disposition à tenir de la nature du pied qui les aura produits.

" Je crois qu'on peut attribuer à une pareille cause, le succès qu'ont eu quelques Fleuristes qui se sont procuré par le moyen des semences de belles variétés; puisque rien n'est plus propre à les occasionner que le soin particulier que prennent certains curieux de mêler les especes dans leurs planches de Tulippes, d'Oreilles d'ours, de Semi-doubles, &c. Leur intention est, à la vérité, de frapper la vûe par une diversité et un émail qui est toujours plus agréable qu'une uniformité dans les couleurs; mais ils se procurent, sans le savoir, un avantage qu'ils ont souvent attribué à différentes infusions dans lesquelles ils avoient mis tremper leurs graines, à quelques couleurs qu'ils mêloient dans la terre de leur jardin, à des objets différemment colorés qu'ils présentoient à leurs plantes, ou enfin, à une faveur singuliere du hazard qu'ils se croyoient personnelle. J'ai essayé sans succès ces infusions et ces mélanges de couleurs, et j'ai cru qu'il n'étoit pas besoin d'expériences pour détruire les deux autres moyens.

" Les Observateurs attentifs peuvent trouver dans les potagers beaucoup d'exemples des variétés dont nous venons de parler, et cesser d'attribuer à la nature de leur terrein, ces changements qu'ils experiment en disant, que leurs plantes dégénerent. J'en vais rapporter un exemple qui est sans doute bien frappant.

" Nous cultivons dans nos potagers, la *Rave-corail*, qui est cette rave rouge qu'on éleve aux environs de Paris: nous cultivons aussi une rave blanche et moins délicate, qu'on nomme *Raifort à Orléans*; enfin, des Radix blancs et des Radix gris. Quand nous semons des graines de ces plantes que nous tirons des pays où elles sont communément cultivées, nous recueillons ces racines très-parfaites chacune dans leur espece; mais comme nous avons souvent remarqué que les semences que nous recueillons dans nos potagers nous donnoient des métifs qui tenoient plus ou moins de ces différentes racines, nous avons pris le parti de planter fort éloignés les uns des autres, les pieds que nous destinons à nous fournir de la graine; au moyen de quoi nos especes se conservent plus constamment les mêmes: cette observation que nous avons pareillement faite sur les *Carottes* pâles, jaunes et rouges, confirme bien fortement ce que nous avons dit qui peut résulter du mélange des poussieres.

" Après cela, il est très-facile de concevoir quelle prodigieuse multitude de variétés doit naître de ces différents mélanges: en effet lorsque la poussiere des étamines d'une OREILLE-D'OURS *rouge* aura fécondé une OREILLE-D'OURS *blanche*, la graine qui en viendra doit nécessairement produire des pieds dont lés pétales seront non-seulement rouges ou blancs, ou panachés de rouge et de blanc, mais encore dont les embryons et les poussieres des étamines participeront de l'un et de l'autre pied; ensorte qu'une de ces plantes n'a plus besoin, pour êtra panachée, d'être dans la suite fécondée par une autre, puisqu'elle se trouvera posséder non-seulement la disposition des parties propres à produire le rouge et le blanc, mais encore celle d'opérer différents mêlanges de ces deux couleurs, lesquelles combinées ensemble pourront faire différentes coupes de nuances fort agréables à la vûe.

" Je

I shall not tire your patience any longer, having, I hope, demonstrated the *Sexes of Plants** by every kind of argument, even by that of *Hybrid Plants,* which I hold to be the most conclusive.

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" Je pourrois faire l'application de ce que je viens de dire au jaune, au bleu, au rouge et au verd; mais je crois en avoir assez dit pour faire entendre que la multitude des variétés est aussi étendue que peuvent l'être les combinaisons qui résultent de ces différents mêlanges; et rien n'est plus conforme à ce que l'on peut observer dans la multiplication des animaux. J'ai eu chez moi des paons bleus, qui, à chaque couvée, donnoient des paons blancs et des paons bleus, parce que cette race avoit été produite par un paon blanc et une paone bleue. J'ain vû chez M. le Marquis de Gouvernet, un paon d'une beauté admirable, dont le plumage étoit en partie blanc, et en partie bleu. Enfin, comme je l'ai déja dit, deux chiens de différente espece produiront des métifs: ces métifs en produiront d'autres; et ces divers mêlanges occasionneront par la suite une prodigieuse quantité de variétés."

* This question on the Sexes of Plants, so honourably proposed by the Imperial Academy, was destined to end this controversy, and much to the honour of that great Nation, SIGESBECK, who had furiously written against the Sexual System, and was Professor of Botany at Petersburgh, not being able to reply, was rejected from among the Members of the Imperial Academy, and afterwards humbly solicited Linnæus to become a superintendant, or head gardener, at Upsal. Linnæus, who never wished to triumph over a fallen enemy, named a plant *Sigesbeckia,* in honour of this fallen Professor.

# PART
# SECOND.

Hoffman Pinx.t

London, Published by D.r Thornton, June 1 1805.

LINNÆUS IN HIS LAPLAND DRESS.

*From an original Picture in the Poſseſsion of D.r Thornton.*

Dunkarton Sculp.t

# LINNÆUS EXPLORES LAPLAND.

Fir'd by the charms of Nature's reign,
View the bold sage advent'rous stray:
Rude storms around him rage in vain,
And torrents cross his dang'rous way.

Alone beside the roaring main
'Mid shelving rocks he loves to roam,
Where craggy cliffs, and caverns wide,
Re-bellow to the whitening foam.

Nor flies the fowl, nor mid the deeps
Swim in bright maze the silver brood,
Nor springs the plant, nor insect creeps,
That can his piercing glance elude.

New scenes his raptur'd sight surveys
Amid Lapponia's peaceful soil;
And while with ardent zeal he strays,
Fair science crowns his pleasing toil.

Through many a forest dark and drear,
O'er many a desert's trackless side,
With fearless foot he ranges round
With Heaven and Nature for his guide.

Now to yon mountain's airy height
With look elate behold him rise,
And view with still increas'd delight
A midnight sun illume the skies.

The simple swain with wond'ring eye
Beholds him spring with eager bound;
Chase with fleet steps the noxious fly,
Or pore upon the moss-clad ground.

Now down Lulea's haunted stream
His vent'rous bark pursues its way,
While round the waving meteors gleam,
And cataracts urge their dashing spray.

Hail Nature's boast! triumphant sage!
Whom distant cent'ries shall admire;
Whose name, rever'd through ev'ry age,
Shall never but with time expire!

Shaw.

# ORIGIN OF THE SEXUAL SYSTEM.

LINNÆUS was ushered into the world in the month of May, 1707, and, as this great Naturalist observes in his Diary, " his parents received their first-born with joy, and devoted the greatest attention to impressing on his mind the love of virtue, both by precept and example. The same thing that is said of a poet, ' *Nascitur non fit*,' may be, without impropriety, applied to the subject of this memoir. From the very time that he first left his cradle, he almost lived in his father's garden, which was planted with some of the rarer shrubs and flowers; and thus were kindled, before he had well left his mother's arms, those sparks, which afterwards produced such a blaze." As he advanced in youth, it is mentioned in the Diary, " that he never ceased harassing his father with questions about the names, qualities, and nature of every plant he saw, and often used to enquire more than even his father, who was an expert botanist, was able to answer." " Whilst at school," the Diary continues, " he employed his play hours hunting after plants," hence he was called " The Little Botanist." He had made an Herbarium " at this early period," and " his plants were classed after the system of TOURNEFORT." From school he went to " the university of Lund." Thence he removed to the famous university of " Upsal." Here an accident brought him early into notice. " In the autumn of the year 1729, LINNÆUS was examining very intensely some plants in the Academic Garden, when CELSUS, a venerable Divine, happened to have repaired thither for the same purpose. They fell into conversation, and CELSUS was so struck with admiration at the vast knowledge of plants discovered by LINNÆUS, that he requested him to bring his Herbarium along with him, which was even then very rich, and live with him free of every expense." LINNÆUS frankly observes in his Diary, " that in the library of CELSUS he first saw a review in the *Leipsic Commentaries* of VAILLANT'S ' Discourse on the Structure of Flowers,' which strongly inculcates *the Sexes of Plants*,* and that this induced him to be more attentive to the Stamina and Pistilla in flowers, and that after minute and diligent examination, he found them to vary even as much as the Petals themselves; upon which last circumstance the famous system of TOURNEFORT is founded." The result of this extended enquiry LINNÆUS committed to writing, and CELSUS was so pleased with this manuscript treatise on the Sexes of Plants, that he sent it to RUDBEC, the Professor of Botany at Upsal, who expressed much approbation, and in consequence desired LINNÆUS to be sent to him. The result of their meeting was the appointment of LINNÆUS as lecturer in the room of RUDBEC, who was now too far advanced in years to continue lecturing. LINNÆUS, therefore, gave his first public lecture in that university in the spring of 1730, and although only *twenty-three years of age*, was received by the pupils with every flattering mark of approbation; and RUDBEC appointed him also tutor to his sons, and he enjoyed, in the house of the aged professor, every

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* The discovery of *the Sexes of Plants* is often arrogated by the French to VAILLANT, but justly belongs to our own countryman, Sir THOMAS MILLINGTON. Vide a note to our translation of Linnæus's " *Dissertation on the Sexes of Plants*," where the time and manner of this discovery is given.

opportunity of further improvement. Rudbec had formerly travelled over *Lapland* in the year 1679, at the command of Charles XI. but his journal was destroyed by the great fire at Upsal in 1702; but the ancient professor, with the garrulity of old age, would often discourse with him of his " young encounters," what he had seen, the new plants he had discovered, and he kindled up an ardent desire in the youthful mind of Linnæus to visit those regions. Providence appears always to have interfered for his advancement. Gustavus Adolphus, the reigning monarch, had directed the *Royal Academy* of *Sweden* to appoint some person to explore the natural productions of the Arctic Regions. Every eye was on this occasion naturally turned towards Linnæus, and, notwithstanding the sacrifice, even Rudbec wished to see his former labours revive by those of his successor. Linnæus had even at this period planned out his *Sexual System*, but no body of plants had been arranged under it, which was another great stimulus to the active enterprizing mind of Linnæus to accept the lure of ambition held out by the *Royal Academy*. Accoutred as he appears in our painting, he visited the whole of Lapland in the year 1732.

> Solus Hyperboreas glacies, Tanaimque nivalem,
> Arvaque Rhipæis nunquam viduata pruinis
> Lustrabat...............
>
> Virg. Georg.

This gave origin to his first immortal work, the " *Flora Lapponica*," where Linnæus relinquished all former systems, and arranged the Northern Plants he had collected according to their Sexes, which greatly excited the attention of the botanist, and the world, towards THE SEXUAL SYSTEM.*

This system at first had to encounter the opposition of men of the highest literary eminence in every country. In *Russia* it met with a most violent and bigotted opposition from Sigesbeck; in *Germany*, the envious resentment of Heister; in *France*, the ridicule of Buffon; in *Switzerland*, the enlightened, but still prejudiced, rejection of Haller; in *Italy*, the decided and laborious opposition of Pontedera; and in *England*, the sarcastic and futile objections of Alston; whilst at home it was much opposed from the general envy of merit. But it soon triumphed over every obstacle, and notwithstanding the celebrated works of a Tournefort and a Jussieu, it is, even at this day, received as the predominant system in *France*, a country justly celebrated for the number of its learned men, and the general thirst after real knowledge, and great encouragement to science, and men of letters, but suspected of being extremely *national*; whilst in *Russia*, *Germany*, *Switzerland*, *Italy*, and *England*, although there are *fifty-two* different systems of Botany, and we can boast of a Ray, yet the Sexual one is the only System that is *universally* adopted.

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* The reader must feel gratified at being informed, that " *A View of the Life and Writings of Linnæus*," was some time back published by the late learned Dr. Pulteney, of which admirable performance a new edition has lately appeared, with very considerable additions and improvements, by his very ingenious and no less learned nephew, Dr. Maton, Vice-President of the Linnæan Society, in which the *Diary* complete, from the MS. of Linnæus, may be seen, which cannot fail to interest every person who has any taste for science, or regard for extraordinary talents, and pre-eminent virtue. For further, and full particulars, respecting the life of so transcendent a genius, we must beg leave to refer to that excellent work, and also to " *Travels into Lapland*," a translation of which, from Linnæus's MS. will shortly be published by the illustrious President of the Linnæan Society, Dr. Smith.

CAROLUS LINNÆUS, KNIGHT OF THE POLAR STAR, FIRST PHYSICIAN TO THE KING, PROFESSOR OF BOTANY IN THE UNIVERSITY AT UPSAL &c. &c.

*From the Original Picture in the Possession of Aylmer Bourke Lambert Esq. Vice President of the Linnæan Society.*

*Hoffman pupil of Linnæus pinx. ad viv. Bartolozzi R.A. exaravit* London, Published by Dr. Thornton May 1 1806 *J. Meyer sculpt.*

JOSEPH PITTON TOURNEFORT, M.D.
Author of the Institutes of Botany.

*A Zephyr disclosing to an astonished world, the System of Tournefort.*

*Hopwood sculp.t*

*London Published August 1.1802, by D.r Thornton from an original French picture in the poſseſsion of the family.*

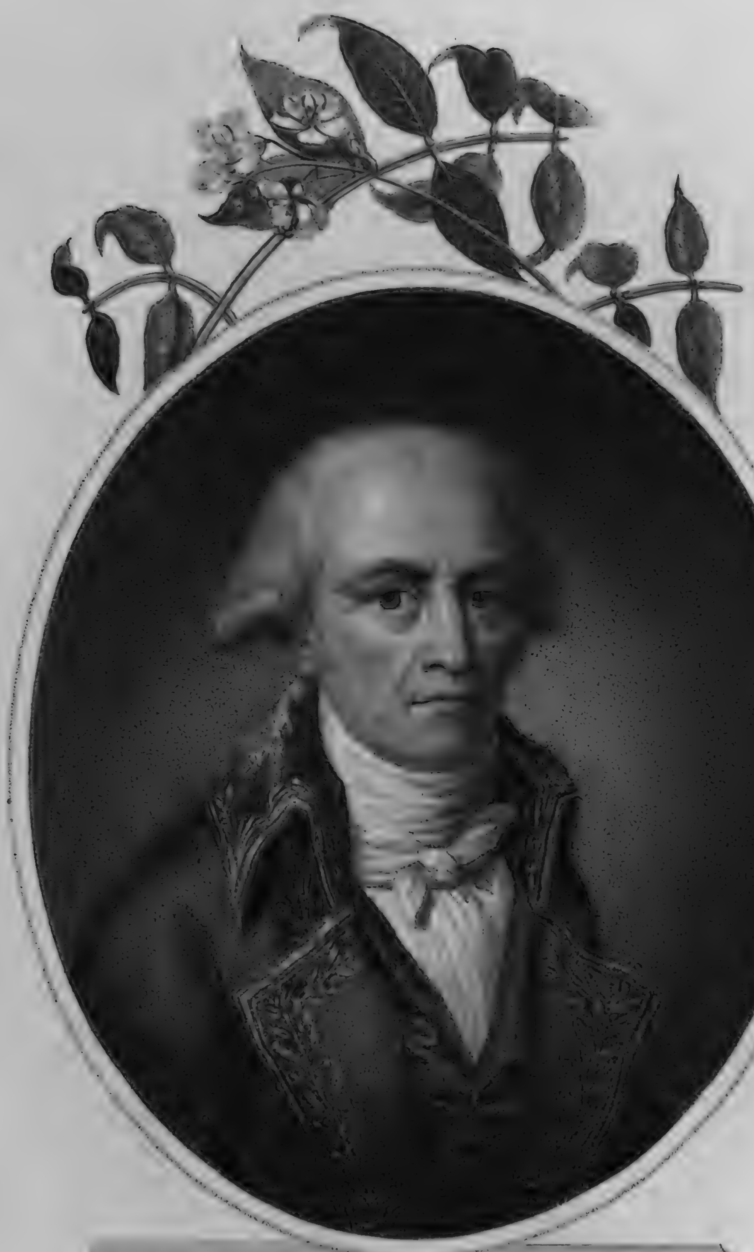
ANTOINE DE JUSSIEU, N.I.

Profeſsor of Botany of the National Inſtitute.

*View of the Thuilleries at Paris.*

*Thevenin pinx$^{t}$* *Evans sculp$^{t}$*

*London, Published by D$^{r.}$ Thornton, March 1, 1808.*



M. LE CHEVALIER DE LAMARCK,
Profeſsor of Botany of the National Inſtitute.

*The Pantheon at Paris*

*David pinx.t* *Hopwood sculp.t*

*London, Published by D.r Thornton, Dec.r 1805.*

J. J. ROUSSEAU,
AUTHOR OF LETTERS ON BOTANY, &c.

The Tomb of Jean Jaque Rouſseau

Ramsay, Portrait Painter to the King, pinx.ᵗ        Caldwall sculp.ᵗ

London: Published July 1. 1801, by D.ʳ Thornton, Hinde Street

SIR JOHN HILL, M.D.
KNIGHT OF THE POLAR STAR,
First Superintendant of the Royal Gardens at Kew.

A View of the Royal Palace in Kew Gardens.

Coates R.A. pinx.t

Vendramini sculp.t

London Published for D.r Thornton, Nov.r 1. 1799.

EARL of BUTE
[illegible]

An Allegorical Representation of the Prosperity of Great Britain under Lord Bute's Administration

*Ramsay, Portrait Painter to the King, pinx.t*

*Caroline Watson, Engraver to her Majesty, sculp.t*

*London, Published by D.r Thornton, March 1.st 1805.*

The Revd. THOMAS MARTYN, B.D. F.R.S.

Regius Professor of Botany in the University of Cambridge.

*View of King's College Chapel, the Public Library, and Senate House.*

*Russell R.A. Portrait Painter to their Majesties, pinxt.* *Vendramini sculp.*

*London, Published for Dr. Thornton, June 1. 1799*

THE REV? D? COLIN. MILNE, F.R.S.
Author of the Botanical Dictionary.

A View of Greenwich Hospital.

Ruſsell. R.A. Portrait Painter to their Majesties, pinx.t

Hall sculp

London. Published for Dr Thornton, 1804.

WILLIAM WITHERING, M.D. F.R.S.
FELLOW OF THE LINNEAN SOCIETY.

*Dr. Withering analyzing the Queen's Bath at the request of the Court of Portugal.*

*Breda, Portrait Painter to the King of Sweden, pinxt.* *Ridley sculpt.*

*London Published by Dr. Thornton, Novr. 15, 1801.*

WILLIAM CURTIS, F.L.S.
AUTHOR OF THE FLORA LONDINENSIS

*The Frontispiece to Mr. Curtis' Flora Londinensis.*

*Evans sculp.*

*London Published by Dr. Thornton, March 1. 1802*

JAMES EDWARD SMITH M.D. F.R.S
PRESIDENT OF THE LINNÆAN SOCIETY

*The Purſuit of the Ship containing the Linnæan Collection by order of the King of Sweden.*

*Ruſsel R.A. Portrait Painter to their Majesties pinx$^{t}$* *Ridley sculp$^{t}$*

*London, Published for D$^{r}$. Thornton, March 25, 1800.*

AYLMER BOURKE LAMBERT Eſq.r F.R.S.
Vice-President of the Linnæan Society.

Reinagle A.R.A. ornavit
Landseer, Engraver to the King, sculp

Ruſsel, R.A, Portrait Painter to their Majesties, pinx
Holl sculp

London, Published by Dr. Thornton April 10th 1805.

DANIEL RUTHERFORD, M.D. F.L.S.

Profeſsor of Botany in the Univerſity of Edinburgh

A distant View of Edinburgh

Raeburn pinx^t.

Holl sculp^t.

London Published by D^r. Thornton, June 1. 1804.

WILLIAM WOODVILLE, M.D., F.R.S.

Author of Medical Botany, &c.

*View of the inoculating Hospital at Pancras.*

London, Published by Dr. Thornton, August 1, 1806.

GEORGE SHAW. M.D. F.R.S.
AUTHOR OF GENERAL ZOOLOGY.

*Back View of the British Museum.*

*Ruſsell. R.A. Portrait Painter to their Majesties pinx$^{t}$* *Holl sculp$^{t}$*

*London Published by D$^{r}$. Thornton, Sep$^{t}$. 1, 1803.*

ERASMUS DARWIN, M.D. F.R.S.
AUTHOR OF THE LOVES OF THE PLANTS.

*Rawlinson pinx. ad viv:* *Holl sculp.*

*London, Published by Dr. Thornton, No. 1, Hinde St. Manchester Sq. February 1, 1803.*

# ANALYSIS of the Sexual System OF Carolus Von Linnæus.

## Symbolical Representation of the Sexual System.

### Notes.

(a) Stamina and Pistilla perceptible. (b) Stamina and Pistilla not discernible. (c) Stamina and Pistilla in the same Corolla. (d) Flowers having the Stamina and Pistilla in separate Corollas. (e) Unisexual flowers also Bisexual. (f) As fowls have their toes webbed. (g) It should be added; or fixed upon a pillar elevating the Pistillum.

(h) A slice of Cork stands for a Corolla or Calyx. | a Pin for a Stamen. Do. with a Piece of Cork at the point for a Pistillum.

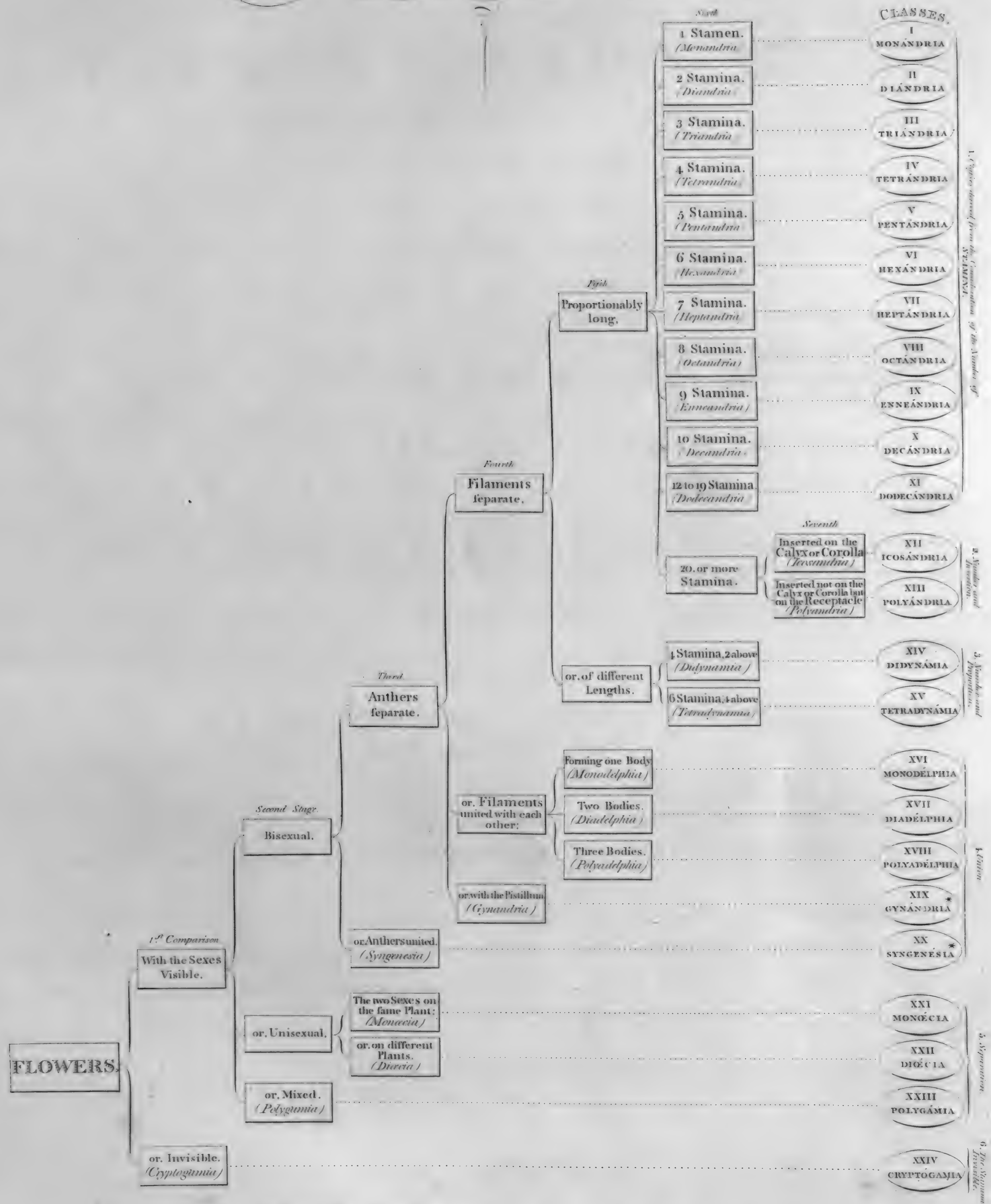
Dr. THORNTON invent. TOMKINS scr. — COOPER sculp.

London Published by Dr. Thornton January 3 1807

# THE
# Sexual System
# of
# CAROLUS VON LINNÆUS

TOMKINS ſcript. COOPER ſculpt.

# ANALYSIS OF THE Sexual System.



** IN LINNÆUS'S EXPOSITION, SYNGENESIA COMES BEFORE GYNÁNDRIA. VIDE SYNTHESIS, PAGE XXXIII.

*London. Published by Dr. Thornton. March 1. 1805.*

# EXPLANATION OF THE ANALYSIS[*]

OF THE

# SEXUAL SYSTEM

OF

# CAROLUS VON LINNÆUS.

THE method of ANALYSIS is called by *Logicians*, THAT OF INVENTION, for it is the mode in which knowledge is acquired, and shews the progressive steps by which we advance in the acquisition of *complex ideas*. Here we are taught to *compare*, to *reason*, to *determine*, to *adopt*, and *separate*; and, finally, in this way we arrive at certain conclusions, or *truth*. It is a mode admirably calculated for the exercise and strengthening of our reasoning powers, being the same also as that pursued by *Mathematicians*.

Thus then is the *systematic study of Botany* one of the best books of logic, or reasoning, in the world; or, as some persons might wish to degrade it, a *manly sort* of PUZZLE, but surely as *instructive* as it is *amusing!*

A person who is in the pursuit of the CLASS and ORDER of any *unknown flower* may be said to be upon a BOTANICAL JOURNEY, and the plant being his *Directory*, if he can read the botanical characters impressed on it by the pen of Nature, he will certainly, following *system*, very soon arrive at his journey's end.

In our first start we have two '*Comparisons*' to make,

I. Whether the Sexes are 'VISIBLE,' or
II. Whether the Sexes are 'INVISIBLE.'

That is, *whether* the *naked eye* can *discern* the *Pistillum* and *Stamina*, or *not*.

If 'THE SEXES ARE NOT VISIBLE,' he has already reached the object of his destination, the plant, whose fructification he holds in his hand, comes under Class XXIV. 'CRYPTOGAMIA' of Linnæus.

If, on the reverse, 'THE SEXES WERE VISIBLE,'....that is, the *Stamina* and *Pistilla* apparent to sight....he has now three *Comparisons* to make, which may be called the '*second stage*' of his Journey. He has carefully to examine

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[*] Vide Plate of the Analysis of the Sexual System.

I. Whether

I. Whether the flowers are ‘ Bisexual,’
II. Whether the flowers are ‘ Unisexual,’ or
III. Whether the flowers are ‘ Mixed.’

By ‘ Bisexual’ plants are underſtood such, whose *flowers* have their *Stamina* and *Pistilla* (the *male* and *female parts* of *Plants*) inclosed within the *same corolla.*

By ‘ Unisexual,’ such as produce *flowers* with the *Stamina* and *Pistilla* placed in *different corollas*

Lastly, by ‘ Mixed,’ is understood a *mixture* of the *two kinds of flowers,* ‘ Bisexual,’ and ‘ Unisexual.’

Having made tho necessary examination, if the Sexes are ‘ mixed,’ he is at once arrived at his journey's end, his plant is of the Class XXIII. POLYGAMIA.

If ‘ Unisexual,’ he has one of two roads to take,

I. The two Sexes are either ‘ on the same plant,’ or
II. The two Sexes are ‘ on different plants.’

That is, Stamen-bearing flowers (*male* flowers) and Pistil-bearing flowers (*female* flowers) are in the former instance to be found on the *same* plant, produced from the *same* root,...and in the latter case, the correspondent *male* and *female* flowers, are found on *different* plants, produced on *different* roots.

His plant being as the directing post, he reads the botanical inscription, and discovers his plant to come either under the Class XXII. ‘ DIŒCIA,’ or Class XXI. ‘ MONŒCIA.’

But if the flower was Bisexual, he has another course to take, and he has to see,

I. Whether the ‘ Anthers’ are ‘ separate,’ or
II. Whether the ‘ Anthers’ are ‘ united.’

If he finds five ‘ Anthers united’ round the *Pistillum,* he has reached the object of his destination, namely Class XX. ‘ SYNGENESIA.’

If the ‘ Anthers’ were ‘ separate,’ he has to advance a ‘ *fourth stage,*’ and to see,

I. Whether the ‘ Filaments’ are ‘ separate,’ or
II. Whether the ‘ Filaments’ are ‘ united with each other,’ or,
III. Whether the ‘ Filaments’ are ‘ united with the pistillum.’

If the *Filaments arise* from *any part* of the *Pistillum,* or from a *pedicle* (column) *elevating the Pistillum,* the plant is then of Class XIX. ‘ GYNANDRIA.’

If the ‘ Filaments are united with each other,’ (these being joined together with a membrane), they are either,

I. All of them united, ‘ forming one body,’ or,
II. Divided into ‘ two parcels,’ making two bodies, or,
III. Divided into ‘ three, or more parcels,’ each parcel being united.

If united together, but forming ‘ three, or more parcels,’ the flower falls under the Class XVIII. ‘ POLYADELPHIA,’...if forming ‘ two bodies,’ under Class XVII. ‘ DIADELPHIA,’ ...and only ‘ one body,’ Class XVI. ‘ MONODELPHIA.’

But if the ‘ Filaments’ were ‘ separate,’ he has to examine,

I. Whether these are ‘ proportionably long,’ or,
II. Whether these are of “ different lengths.’

Of

Of DIFFERENT LENGTHS relate only to four or six stamina...If his flower has 'SIX STAMINA,' and of these he finds 'FOUR LONG and TWO SHORT, he has reached his destination, Class XV. 'TETRADYNAMIA,'...if 'FOUR STAMINA,' 'TWO' of these 'BEING LONG and 'TWO SHORT,' he discovers his plant to be of the Class XIV. 'DIDYNAMIA.'

If his flower falls under none of the former considerations, he has an easy task now assigned him, only count 'NUMBERS;' but if these amount to 'TWENTY OR MORE STAMINA,' he has also to attend to '*insertion*.'

I. Whether 'INSERTED ON THE CALYX OR COROLLA, or,
II. Whether 'INSERTED ON THE RECEPTACLE.'

If 'INSERTED ON THE RECEPTACLE,' the Class is XIII. 'POLYANDRIA,'...and if on the calyx or corolla, Class XII. 'ICOSANDRIA.'

The other comparisons are equally easy, as Class XI. 'DODECANDRIA, TWELVE TO NINETEEN STAMINA.'...Class X. 'DECANDRIA, TEN STAMINA.'...Class IX. 'ENNEANDRIA. NINE STAMINA.'....Class VIII. 'OCTANDRIA, EIGHT STAMINA.'....Class VII. 'HEPTANDRIA, SEVEN STAMINA.'...Class VI. 'HEXANDRIA, SIX STAMINA.'...Class V. 'PENTANDRIA, FIVE STAMINA.'.....Class IV. 'TETRANDRIA, FOUR STAMINA.'....Class III. 'TRIANDRIA, THREE STAMINA.'....Class II. 'DIANDRIA, TWO STAMINA.'....Class I. 'MONANDRIA, ONE STAMEN.'

After this *Analysis* or *Separation*, the student should take the classes in the reverse order, commencing with Class I. MONANDRIA, and ending with Class XXIV. CRYPTOGAMIA.*

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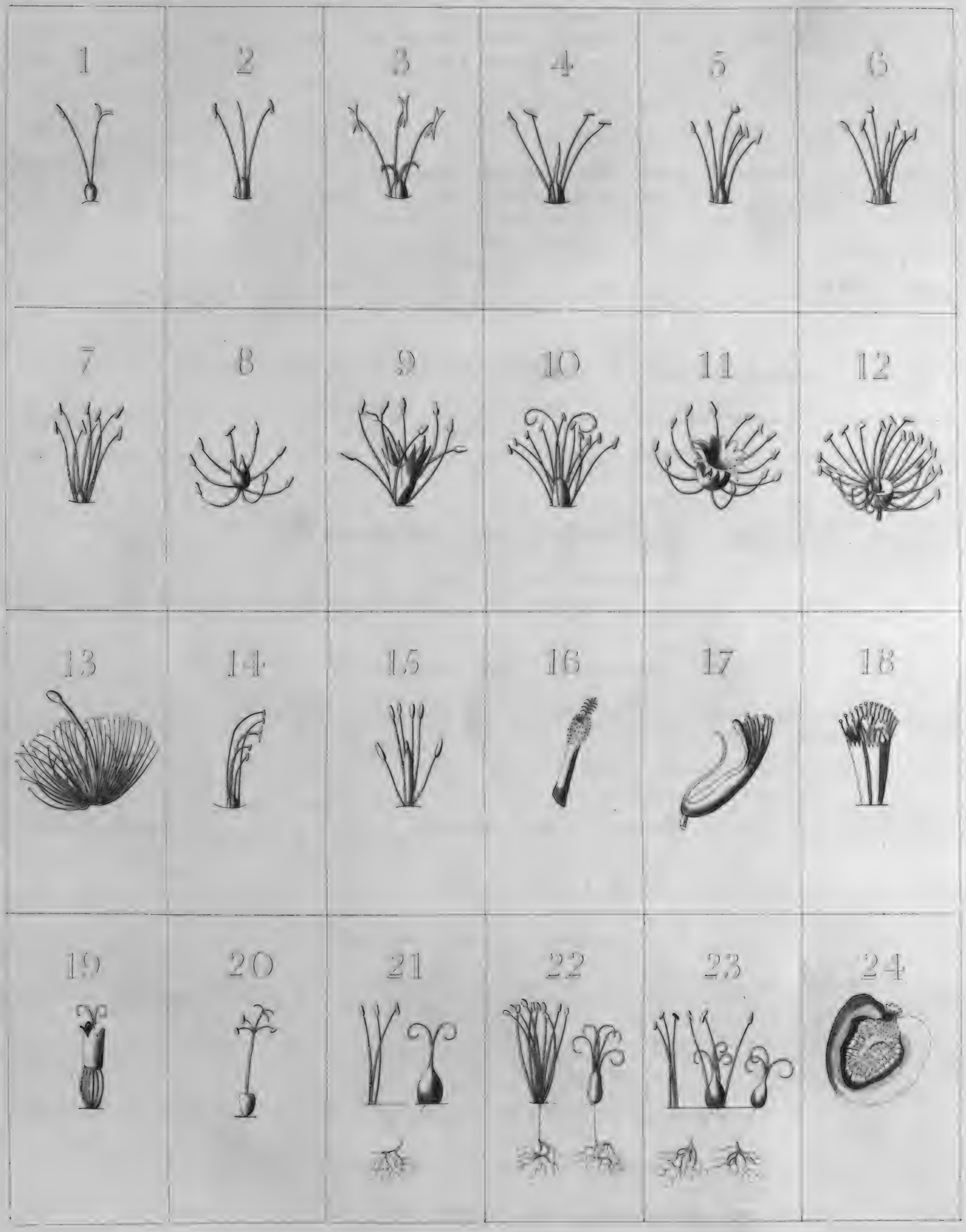
* Vide our *Synthesis* of the CLASSES and ORDERS of the SEXUAL SYSTEM, immediately following the Table of *Analysis*.

# The Sexual System

(As illustrated by Linnæus in his Botanical Works.)



London Published by Dr. Thornton June 1. 1806

# SYNTHESIS OF THE SEXUAL SYSTEM.

## I. *Classes derived from the Consideration of the Number of Stamens.*

| | | |
|---|---|---|
| Class I. | Monandria | Order I. *Monogynia.* Order II. *Digynia.* |
| Class II. | Diandria | Order I. *Monogynia.* Order II. *Digynia.* Order III. *Trigynia.* |
| Class III. | Triandria | Order I. *Monogynia.* Order II. *Digynia.* Order III. *Trigynia.* |
| Class IV. | Tetrandria | Order I. *Monogynia.* Order II. *Digynia.* Order III. *Tetragynia.* |
| Class V. | Pentandria | Order I. *Monogynia.* Order II. *Digynia.* Order III. *Trigynia.* Order IV. *Tetragynia.* Order V. *Pentagynia.* Order VI. *Polygynia.* |
| Class VI. | Hexandria | Order I. *Monogynia.* Order II. *Digynia.* Order III. *Trigynia.* Order IV. *Tetragynia.* Order V. *Polygynia.* |
| Class VII. | Heptandria | Order I. *Monogynia.* Order II. *Digynia.* Order III. *Tetragynia.* Order IV. *Heptagynia.* |
| Class VIII. | Octandria | Order I. *Monogynia.* Order II. *Digynia.* Order III. *Trigynia.* Order IV. *Tetragynia.* |
| Class IX. | Enneandria | Order I. *Monogynia.* Order II. *Trigynia.* Order III. *Hexagynia.* |
| Class X. | Decandria | Order I. *Monogynia.* Order II. *Digynia.* Order III. *Trigynia.* Order IV. *Pentagynia.* Order V. *Decagynia.* |
| Class XI. | Dodecandria | Order I. *Monogynia.* Order II. *Digynia.* Order III. *Trigynia.* Order IV. *Pentagynia.* Order V. *Dodecagynia.* |

## II. *Classes derived from the Consideration of Number and Insertion.*

| | | |
|---|---|---|
| Class XII. | Icosandria | Order I. *Monogynia.* Order II. *Digynia.* Order III. *Trigynia.* Order IV. *Pentagynia.* Order V. *Polygynia.* |
| Class XIII. | Polyandria | Order I. *Monogynia.* Order II. *Digynia.* Order III. *Trigynia.* Order IV. *Tetragynia.* Order V. *Pentagynia.* Order VI. *Hexagynia.* Order VII. *Polygynia.* |

## III. *Classes derived from the Consideration of Number and Proportion.*

| | | |
|---|---|---|
| Class XIV. | Didynamia | Order I. *Gymnospermia.* Order II. *Angiospermia.* |
| Class XV. | Tetradynamia | Order I. *Siliculosa.* Order II. *Siliquosa.* |

## IV. *Classes derived from the Consideration of Union.*

| | | |
|---|---|---|
| Class XVI. | Monadelphia | Order I. *Triandria.* Order II. *Pentandria.* Order III. *Octandria.* Order IV. *Enneandria.* Order V. *Decandria.* Order VI. *Endecandria.* Order VII. *Dodecandria.* Order VIII. *Polyandria.* |
| Class XVII. | Diadelphia | Order I. *Pentandria.* Order II. *Hexandria.* Order II. *Octandria.* Order IV. *Decandria.* |
| Class XVIII. | Polyadelphia | Order I. *Pentandria.* Order II. *Icosandria.* Order III. *Polyandria.* |
| Class XIX. | Gynandria | Order I. *Diandria.* Order II. *Triandria.* Order III. *Tetrandria.* Order IV. *Pentandria.* Order V. *Hexandria.* Order VI. *Decandria.* Order VII. *Dodecandria.* Order VIII. *Polyandria.* |
| Class XX. | Syngenesia | Order I. *Polygamia æqualis.* Order II. *Polygamia superflua.* Order III. *Polygamia frustranea.* Order IV. *Polygamia necessaria.* Order V. *Polygamia segregata.* Order VI. *Monogamia.* |

## V. *Classes derived from the Consideration of Separation.*

| | | |
|---|---|---|
| Class XXI. | Monœcia | Order I. *Monandria.* Order II. *Diandria.* Order III. *Triandria.* Order IV. *Tetrandria.* Order V. *Pentandria.* Order VI. *Hexandria.* Order VII. *Heptandria.* Order VIII. *Polyandria.* Order IX. *Monadelphia.* Order X. *Syngenesia.* Order XI. *Gynandria.* |
| Class XXII. | Diœcia | Order I. *Monandria.* Order II. *Diandria.* Order III. *Triandria.* Order IV. *Tetrandria.* Order V. *Pentandria.* Order VI. *Hexandria.* Order VII. *Octandria.* Order VIII. *Enneandria.* Order IX. *Decandria.* Order X. *Dodecandria.* Order XI. *Polyandria.* Order XII. *Monadelphia.* Order XIII. *Syngenesia.* Order XIV. *Gynandria.* |
| Class XXIII. | Polygamia | Order I. *Monœcia.* Order II. *Diœcia.* Order III. *Triœcia.* |

## VI. *A Class derived from the Consideration of Concealment.*

| | | |
|---|---|---|
| Class XIV. | Cryptogamia | Order I. *Filices.* Order II. *Musci.* Order III. *Algæ.* Order IV. *Fungi.* |

# The Sexual System as represented by modern Authors.

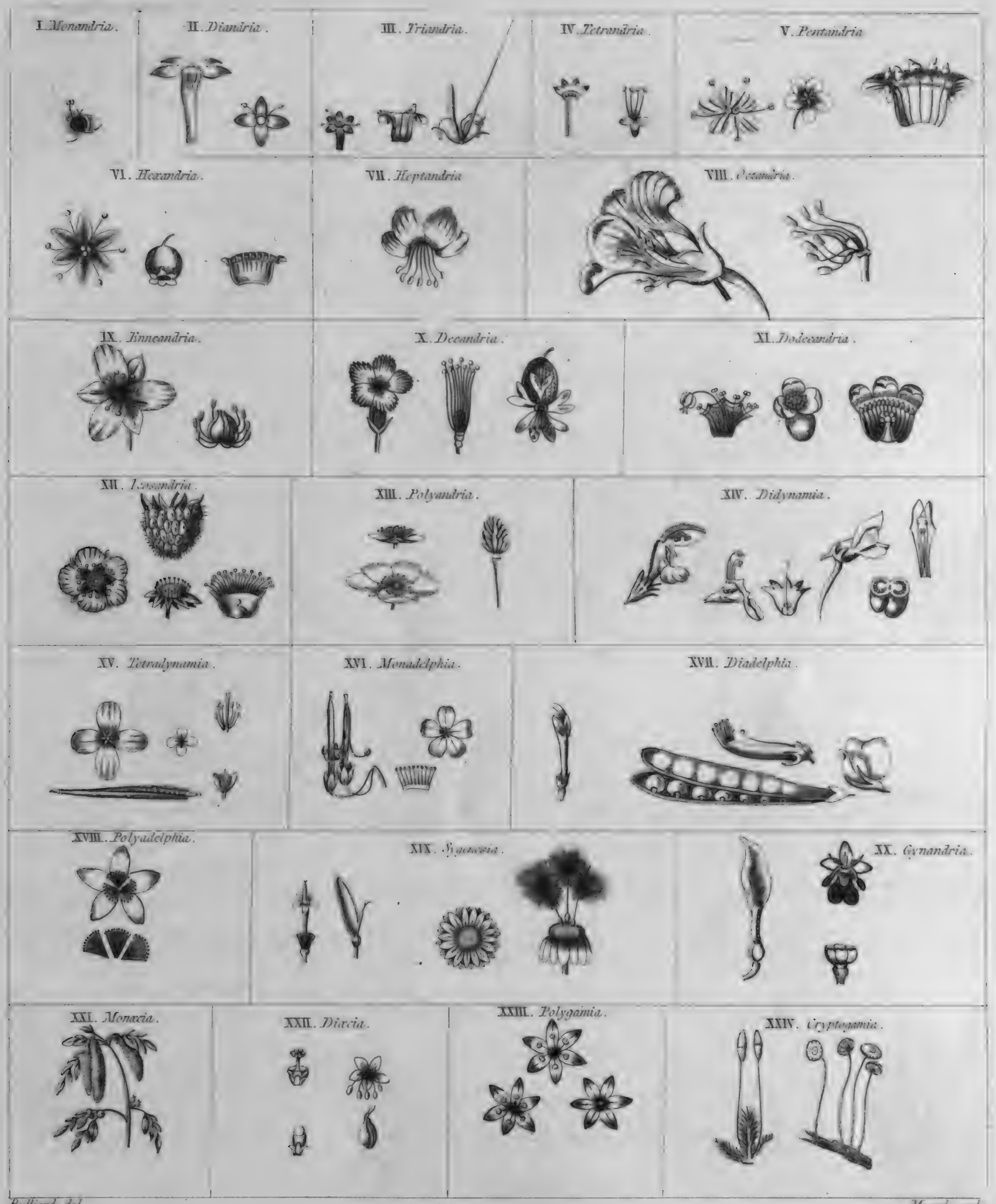
## CLASSES.

[illegible] del.

Mitan sculp.

London Published by [illegible]

# Claſses of the Sexual System from Dr. Darwin's Botanic Garden.



Bulliard del. Mazel sculp.

London, Published by Dr. Thornton, Decr. 1 1808.

# ORDERS

## *of the*

# Sexual System.

*TOMKINS ſcrip.t*

*COOPER ſculp.t*

## TABLE.

SECTION I. THE ORDERS *of the following thirteen Claſses,* I. MONÁNDRIA, II. DIÁNDRIA, III. TRIÁNDRIA, IV. TETRÁNDRIA, V. PENTÁNDRIA, VI. HEXÁNDRIA, VII. HEPTÁNDRIA, VIII. OCTÁNDRIA, IX. ENNEÁNDRIA, X. DECÁNDRIA, XI. DODECÁNDRIA, XII. ICOSÁNDRIA, XIII. POLYÁNDRIA, *are taken from the* NUMBER *of* PISTILLA, *and terminate in* GYNIA, *as the Claſses did in* ANDRIA, *with the Greek Numerals preceeding; thus,*

| *Orders.* | | *EXPLANATION.* |
|---|---|---|
| I. | MONŌGYNIA, | *One Pistillum.* |
| II. | DÌGYNIA, | *Two Pistilla.* |
| III. | TRIGYNIA, | *Three Pistilla.* |
| IV. | TÈTRAGYNIA, | *Four Pistilla.* |
| V. | PENTĀGYNIA, | *Five Pistilla.* |
| VI. | HEXÀGYNIA, | *Six Pistilla.* |
| VII. | HEPTÀGYNIA, | *Seven Pistilla.* |
| VIII. | OCTÒGYNIA, | *Eight Pistilla.* |
| IX. | ÈNNEÀGYNIA, | *Nine Pistilla.* |
| X. | DÈCÀGYNIA, | *Ten Pistilla.* |
| XI. | DODĔCÀGYNIA, | *Twelve Pistilla.* |
| XII. | POLỲGYNIA, | *Many Pistilla.* |

SECTION II. *Claſs.* XIV. DIDYNÁMIA *has the* ORDERS, *taken from the* SITUATION *of the* SEEDS.

| *Orders.* | | |
|---|---|---|
| I. | GYMNŌSPERMIA | *Naked Seeds.* |
| II. | ANGIŌSPERMIA, | *Covered Seeds (Seeds Capsuled.)* |

SECTION III. *Claſs* XV. TETRADYNÁMIA, *has its* ORDERS, *from a* DIFFERENCE *in the* SHAPE *of the* SEEDVESSEL.

| *Orders.* | | |
|---|---|---|
| I. | SILICULÓSA, | *Pod a Silicle (a broad Pod.)* |
| II. | SILIQUÓSA, | *Pod a Silique (a long Pod.)* |

SECTION IV. *Claſses,* XVI. MONODELPHIA, XVII. DIADELPHIA, XVIII. POLYADELPHIA, *(for Claſs* XIX *vide* SECT. V.) *also Claſs.* XX. GYNANDRIA, *have their* ORDERS *taken from the* NUMBER *of* STAMINA; *thus,*

| *Orders.* | | |
|---|---|---|
| I. | PENTANDRIA, | *Five Stamina.* |
| II. | HEXANDRIA, | *Six Stamina.* |
| III. | OCTANDRIA &c. | *Eight Stamina & so on* IV. ENDECANDRIA, V. ICOSANDRIA *to* |
| VI. | POLYÁNDRIA, | *Twenty or more Stamina, as inserted on the Receptacle* |

NOTE. *For here the Pistilla, Seed, or Seedveſsel furnished no subdivisions, hence the neceſsity of having recourse to the* NUMBER ALONE, *and* NUMBER *with* INSERTIONS *of the* STAMINA,

SECTION V. *Claſs* XIX SYNGENÉSIA, *has its* ORDERS *taken from the* NATURE *of the* FLOWER, *and to understand this well it will be neceſsary to point it out by an* ANALYSIS.

*FLOWERS*

- *Compound, Composed of* FLORETS *having* FIVE ANTHERS *Conniving.*
  - *Each* FLORET *having* NO PECULIAR CALYX.
    - *all the* FLORETS THE SAME (BISEXUAL.) — *Orders.* I. POLYGÁMIA ÆQUÁLIS.
    - FLORETS DIVERSIFIED, *(some* BISEXUAL, *others* UNISEXUAL.)
      - *Bisexual in the Disk,* PERFECT, *(The Pistil producing Seed.)*
        - *Pistil-flowers in the Ray,* PERFECT — II. POLYGÁMIA SUPÉRFLUA.
        - *Pistil-flowers in the Ray,* IMPERFECT — III. POLYGÁMIA FRUSTRÁNEA.
      - *Bisexual in the Disk,* IMPERFECT: *Florets in the Ray,* PERFECT — IV. POLYGÁMIA NECESSÁRIA.
  - *Each* FLORET *having* A PECULIAR CALYX — V. POLYGÁMIA SEGREGÁTA.
- NOT *Compound, but having the Character of the Claſs,* FIVE ANTHERS *conniving* — VI. MONOGAMIA.

*as explained in our Analysis of the Claſses, thus*

SECTION VI. *Claſses.* XXI MONŒCIA. XXII DIŒCIA. *take their* ORDERS *from the* NUMBER, *and other* PECULIARITIES, *of the* STAMINA,

| *Orders.* | | |
|---|---|---|
| I. | MONANDRIA. | *One Stamen.* |
| II. | DIÁNDRIA. | *Two Stamina, those Claſses subdividing the preceeding Claſses down to* |
| III. | GYNÁNDRIA. | *Stamina arising from the Pistillum.* |
| IV. | SYNGENÉSIA. | *5 Anthers united.* |

NOTE. *For as we descend with the* CLASSES, *they have the preeminence of those placed above them, and hence what would otherwise have been* CLASSES, *become* ORDERS, *with the Claſsical Appellation. This seeming and perplexing incongruity is obviated in our* REFORMED SEXUAL SYSTEM, *for a full explanation of which, Vide our* PHILOSOPHY OF BOTANY, *and* PRACTICAL BOTANY.

SECTION VII. *thus in Claſs* XXIII. POLYGÁMIA, *we have* ORDERS.

| *Orders.* | | |
|---|---|---|
| I. | MONŒCIA | *One Habitation.* |
| II. | DIŒCIA. | *Two Habitations.* |
| III. | TRIŒCIA. | *Three Habitations.* |

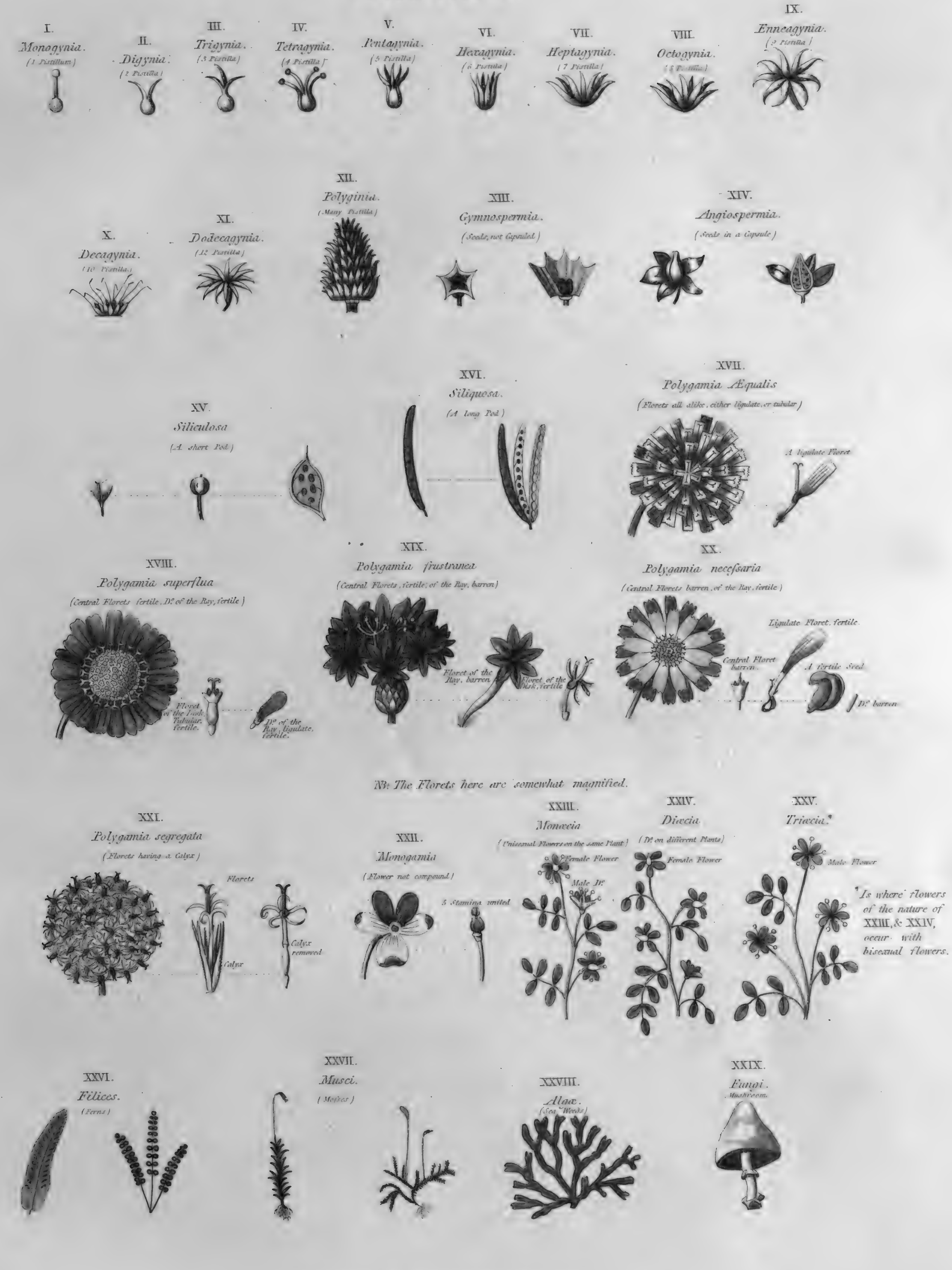
SECTION VIII. *Claſs* XXIV CRYPTOGAMIA. *has four* ORDERS.

| *Orders.* | | |
|---|---|---|
| I. | FILICES. | *Ferns.* |
| II. | MUSCI | *Moſses.* |
| III. | ALGÆ, | *Sea-Weeds.* |
| IV. | FUNGI, | *Funguses.* |

*London, Published by Dr. Thornton Sept. 1 1810.*

*Dr. Thornton invent.*

# ORDERS.



NB: The Florets here are somewhat magnified.

NB. The Claſses are also occasionally used as Orders.

Curtis del. Author of the Flora Londinensis.

Mazel sculp.

London, Published by D^r. Thornton Sept^r. 1. 1809.

# A
# New
# ILLUSTRATION
# of the
# Sexual System
# OF
# Linnæus

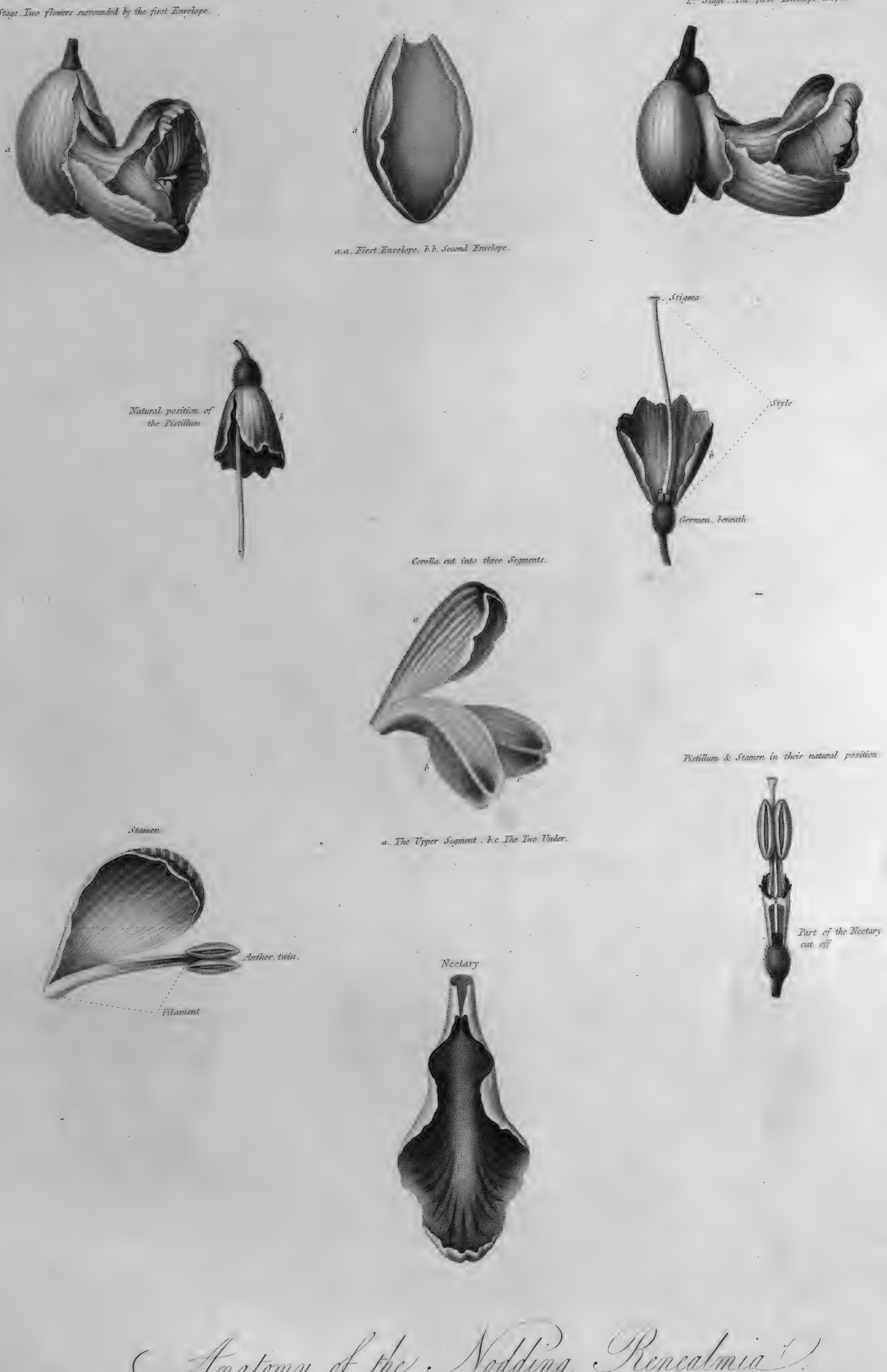
Tomkins Script. Vincent Sculpt.

# First Stage of the Renealmia

Henderson pinx.

London, Published Dec.r 1. 1802, by Dr. Thornton.

[illegible] sculp.



Anatomy of the Nodding Renealmia.

Henderson del.

Caldwall sculp

London, Published by Dr. Thornton, April 1. 1810.

A Flower.

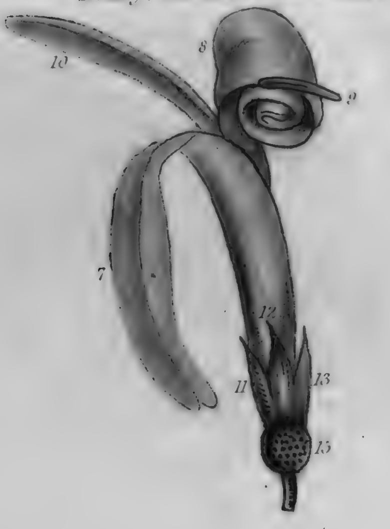
EXPLANATION.

1. 2. 3. The three upright broad Petals of the Corolla
4. 5. 6. The three upright narrow Petals of the Corolla.
7. 8. The two curled Leaves, constituting the Nectary.
9. The Anther inserted on the margin of one
of the Leaves of the Nectary
10. Stigma of the Pistillum.
11. 12. 13. Leaves of the Calyx:
14. Two scales enclosing the Germen.
15. Germen.

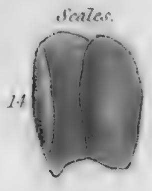
Petals of the Corolla.

Petals of the Corolla.

Nectary, Stamen, Pistillum & Calyx.



Scales.



Anatomy of the Canna Glauca, or Yellow Indian Reed.

Henderson del.

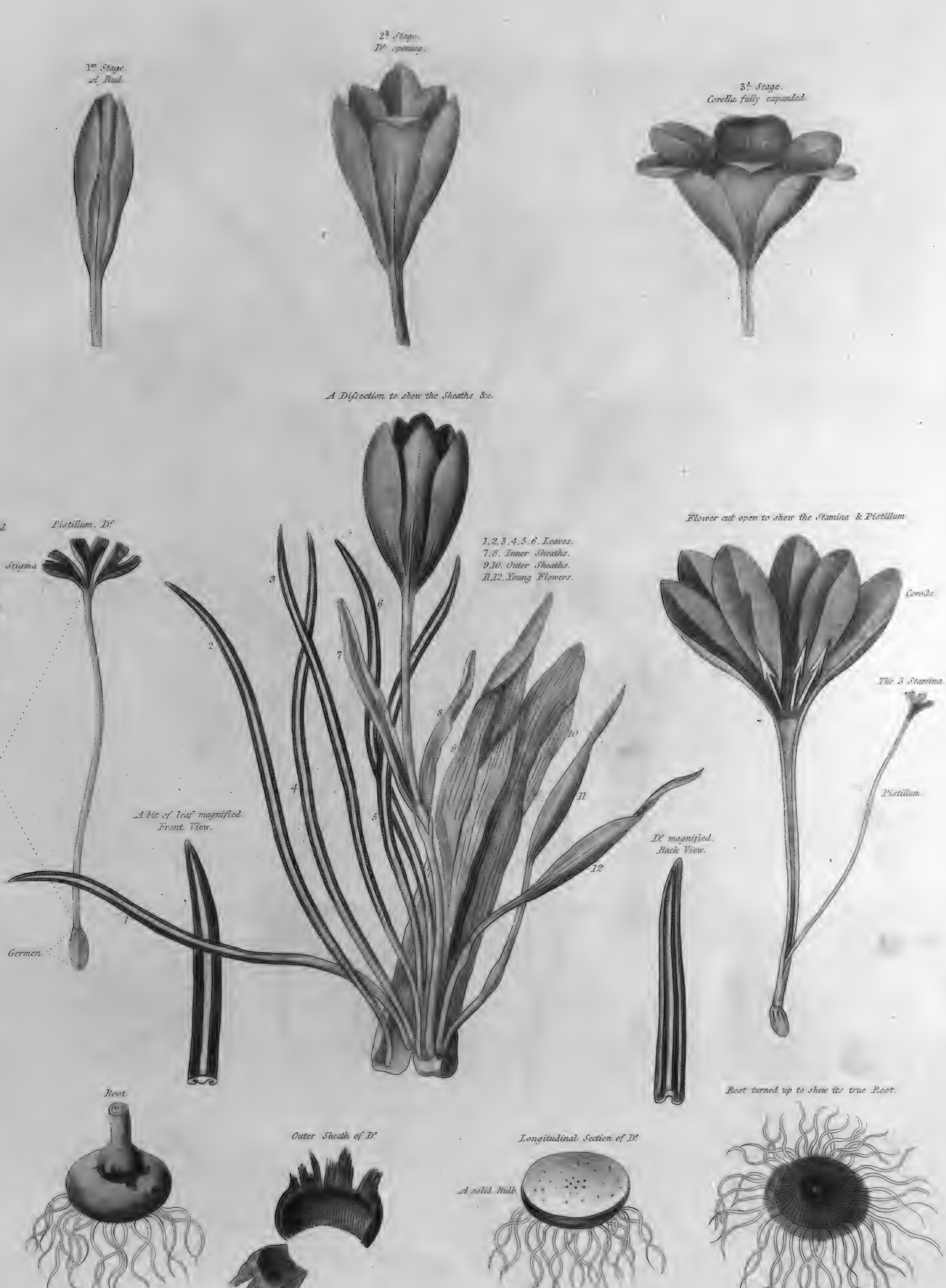
London, Published by Dr. Thornton April 2. 1810.

Sutherland sculp.

Henderson pinx.

*Jasminum. The Jasmine.*

Wetton sculp.



Anatomy of the Crocus.

Henderson del.

W. Dunkarton Junr sculp

London. Published by Dr Thornton, May 1.1809.

An exact Copy from the Hortus Cliffortianus of Linnæus.

Gladiolus angustus; or narrow-leaved Gladiolus.

G.D. Ehret del. Mazel sc.

London, Published by Dr. Thornton, Decr. 1. 1808.

4 Stamina. 1 Pistillum.

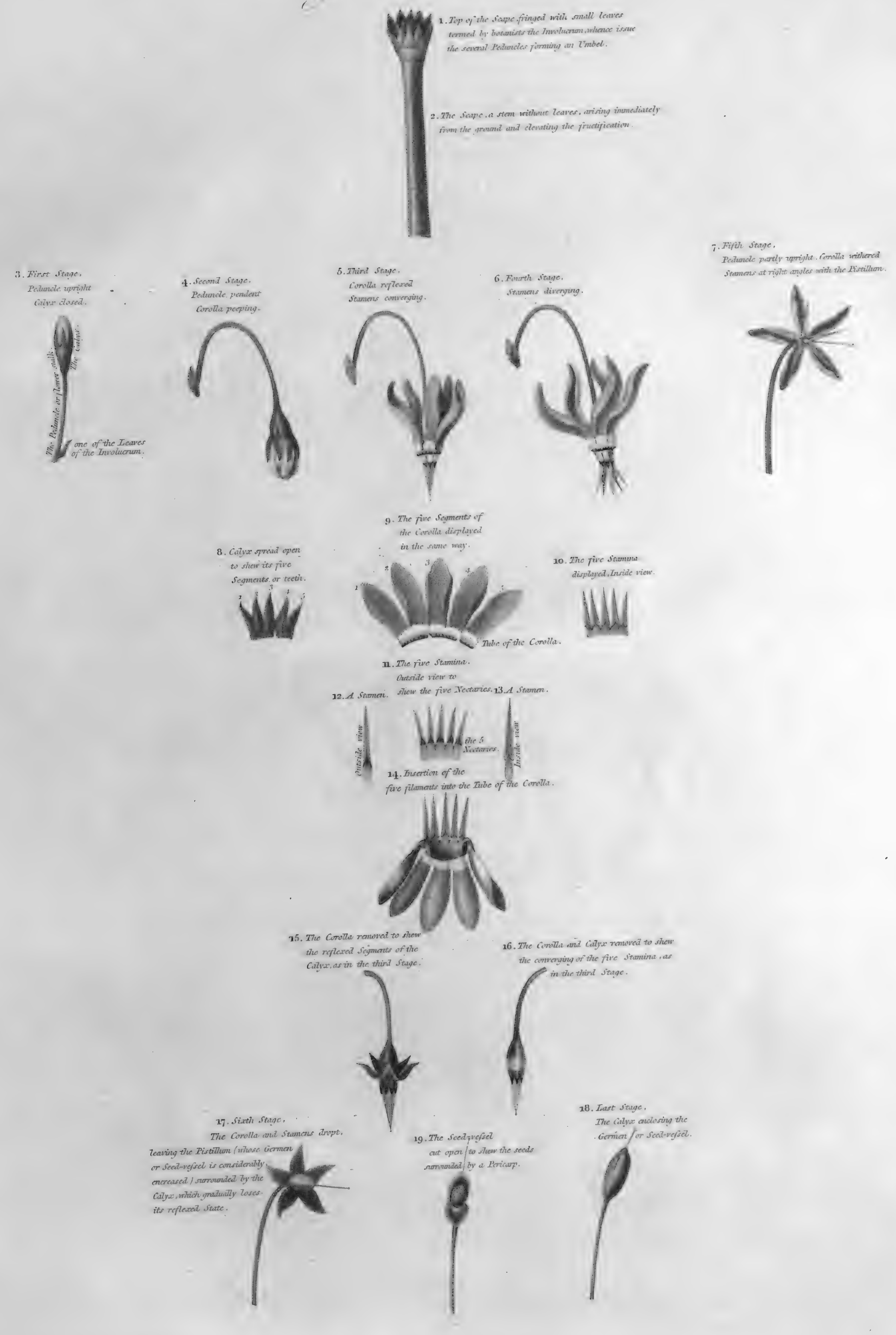
Plantago Lanceolata; or Ribwort Plantain.

Edwards del.

London. Published by Dr. Thornton. Decr. 1. 1808.

Warner sculp.

# Anatomy of the Meadia.



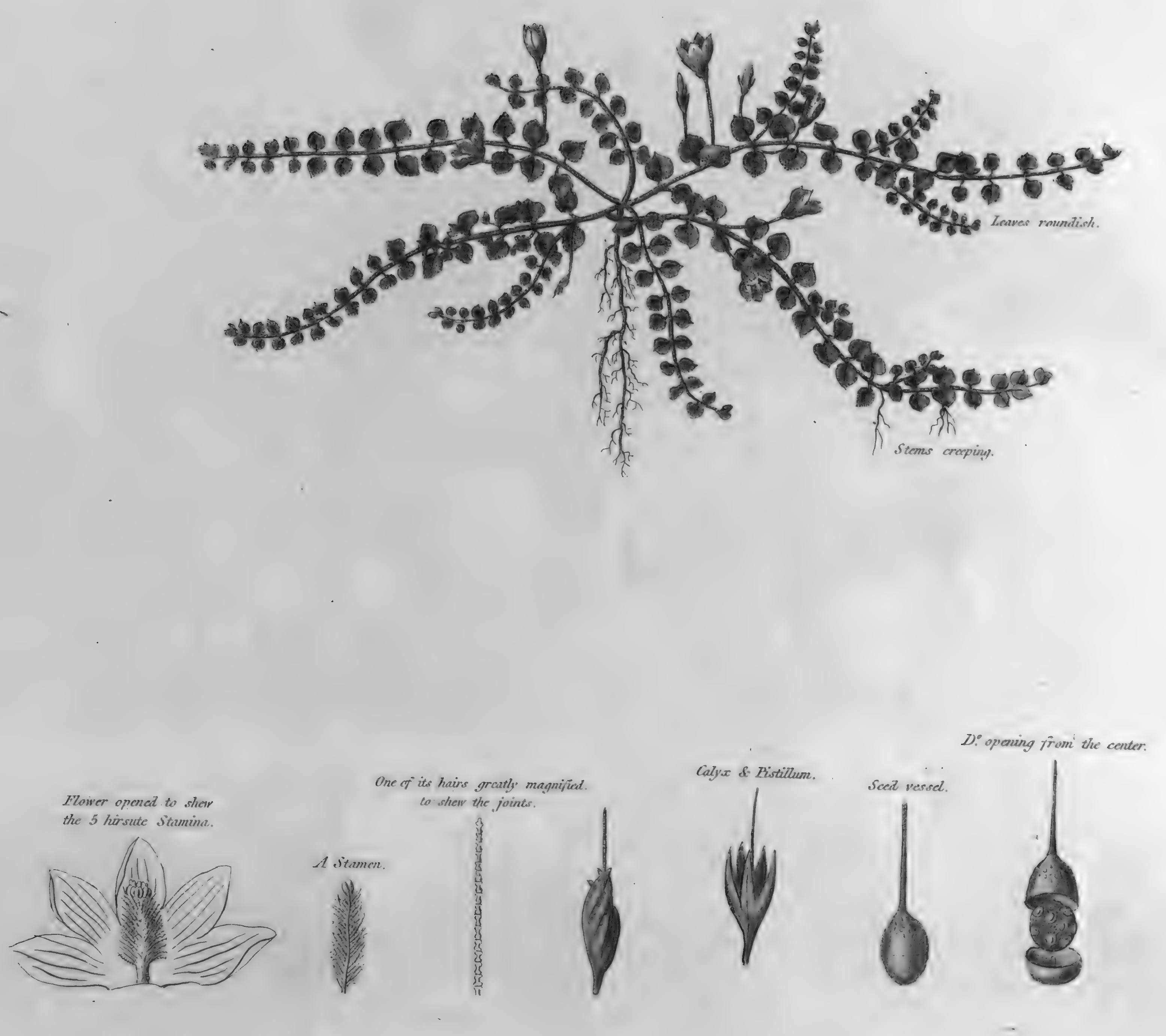
Henderson del.

Hopwood sculp.

London, Published by Dr. Thornton, May 6th 1802.

Anagallis Arvensis; or Old Man's Weather-glaſs.

Edwards del. London, Published by Dr. Thornton, Nov.r 1.1806 Warner sculp



Anagallis Tenella; or Bog Pimpernel.

Edwards del.

Warner sculp.

London, Published by Dr. Thornton, Decr. 1 1808.

Coffea Arabica; or Arabian Coffee-tree.

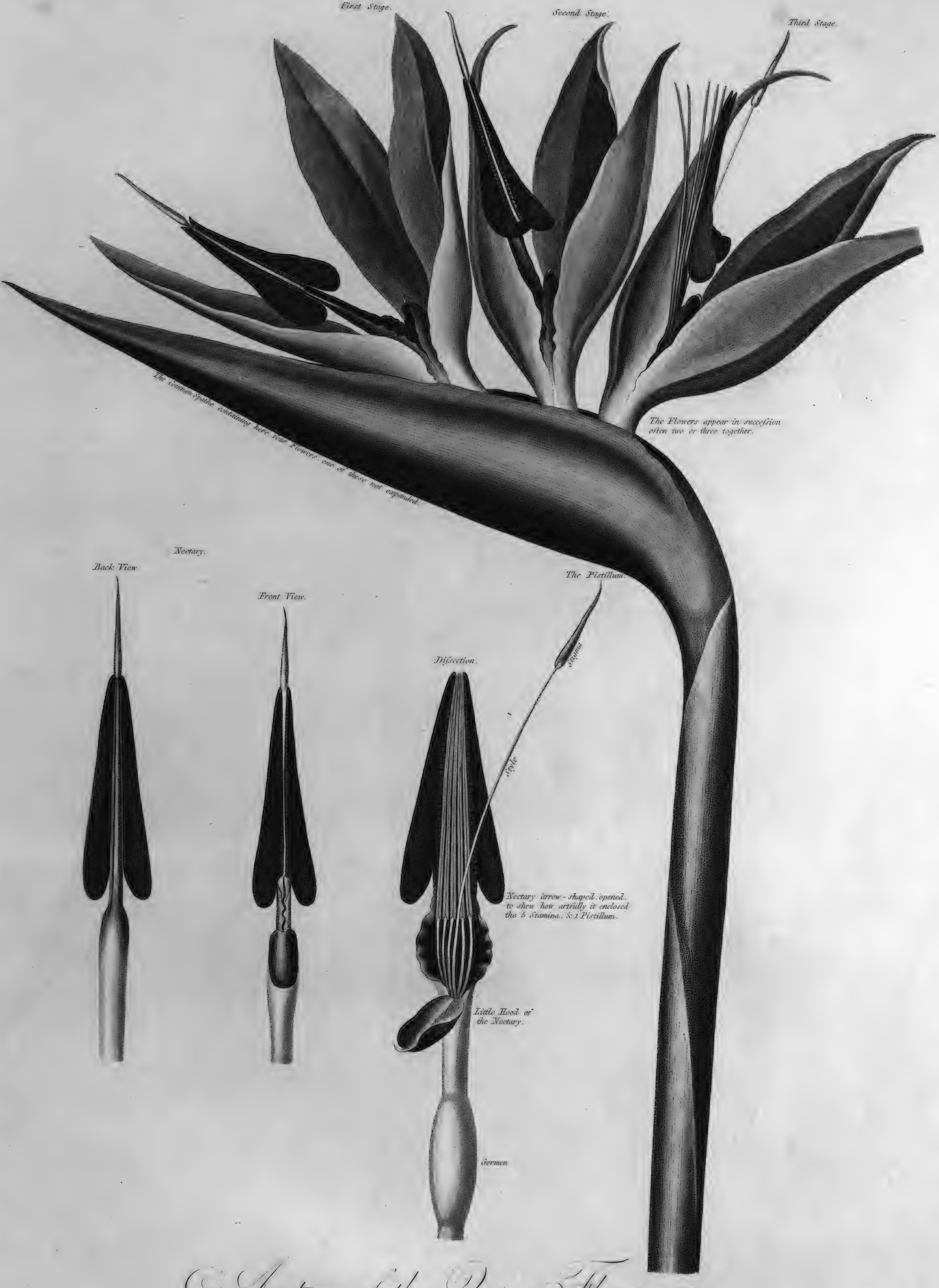
London, Published by D^r. Thornton, Dec^r. 1. 1808.

The Egg Plant.

Henderson delt.

Warner sculp.

London, Published by Dr. Thornton, June 1. 1803.



Anatomy of the Queen Flower.

Henderson del.

Caldwall sculp.

London, Published by Dr. Thornton Jany. 2. 1809.

1. 2. 3. The three Corolla Leaves.
4 5. Two of the Flowers removed.
6. A fourth Flower found involved in a sheath.
7. 8. Two other Sheaths.
9 10. Similar Sheaths, which like sheath 6 accompanies each Flower.
11. The large external Spatha.

Diſsection of the Queen Flower.

Henderson del.

London, Published by Dr. Thornton Jan.y 2.1809.

Caldwall sculp.

## A Corymbus.

Scilla Peruviana; or Peruvian Hyacinth.

Miller del.

London. Published by D.r Thornton. Oct.r 2 1809.

Warner sculp.

## No Universal Involucre, but a Partial Involucre.

Chærophyllum Sylvestre; or Wild Cervil.

Edwards del.

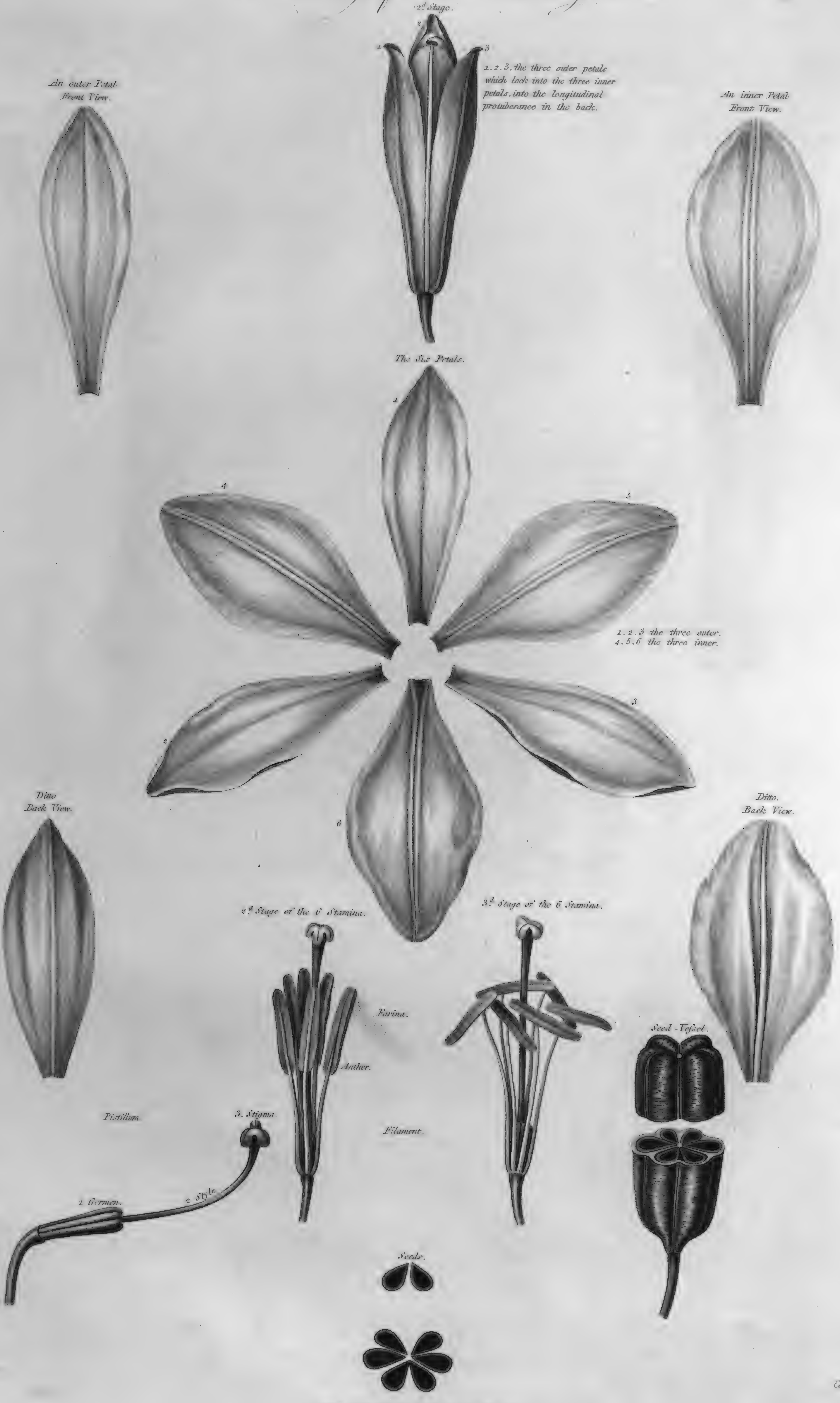
Warner sculp.

London, Published by Dr. Thornton, Decr. 1. 1808.

Æthusa Cynapium, or Fool's Parsley.

Henderson del.
London, Published by Dr. Thornton, Octr. 2. 1809.
Warner sculp.

# Anatomy of the White Lily.



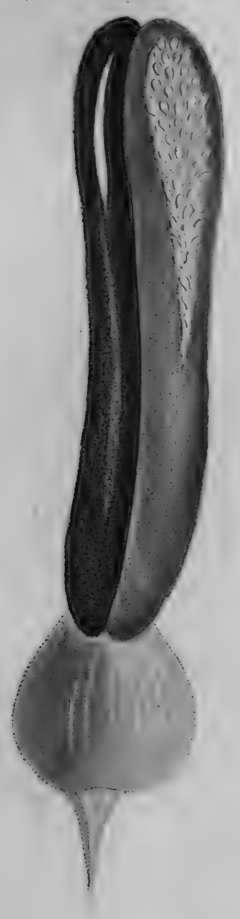
Henderson pinx.

Caldwall sculp.

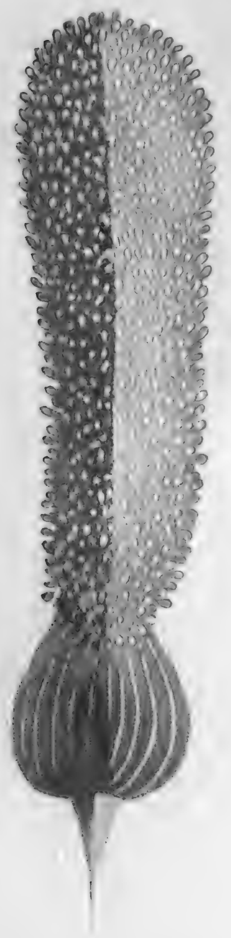
London. Published by Dr. Thornton Augst. 1. 1808.

A Stamen of the natural size.

1st Stage.
Anther, consisting of two cells, opening to liberate the Farina.



2d Stage.
Do. all covered with Farina.



The Farina as it appears from the Microscope.

1st Stage.
Stigma of the Pistillum.

2d Stage.
Do. covered with globules of Farina.

# Anatomy of the Hyacinth.

Henderson del.

Sutherland sculp.

London. Published by Dr. Thornton Augt. 1. 1809.

# Anatomy of the Agave, or American Aloe.

1. *First Stage.*
*Petals closed.*

2. *Second Stage.*
*Anthers peeping*
*Filaments curled downwards.*

3. *Third Stage.*
*Filaments taking their position.*

4. *Fourth Stage.*
*Filaments erect.*

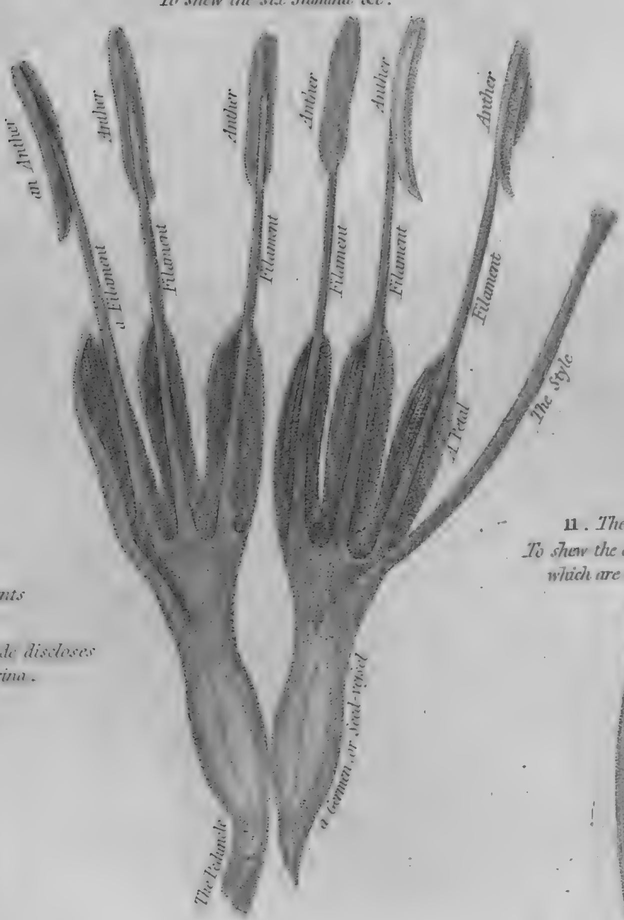
5. *Fifth Stage.*
*Pistillum peeping.*

6. *Sixth Stage.*
*Pistillum nearly the height of the Stamina*
*Flower in Perfection.*

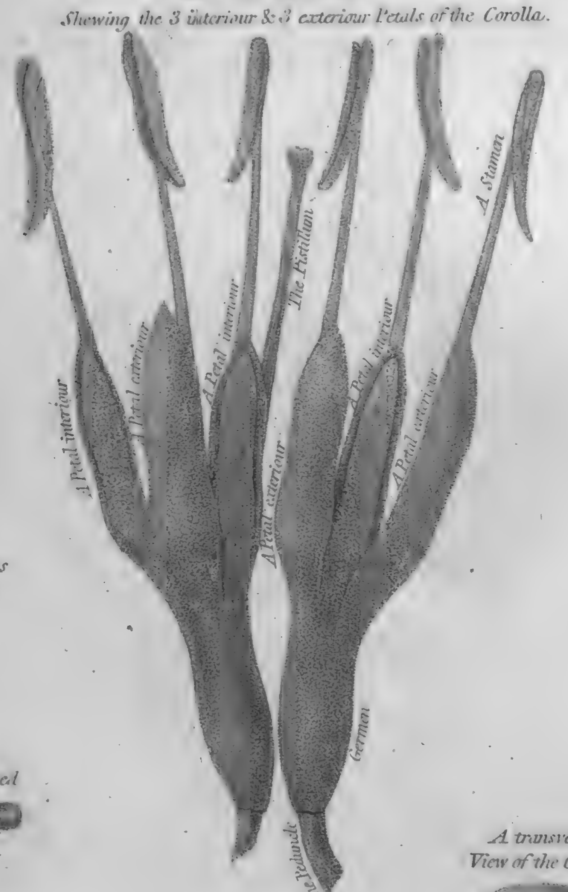
7. *Seventh Stage.*
*The impregnated Pistillum elongated*
*The Stamina drooping.*

8. *Eighth Stage.*
*All except the Germen*
*decayed.*

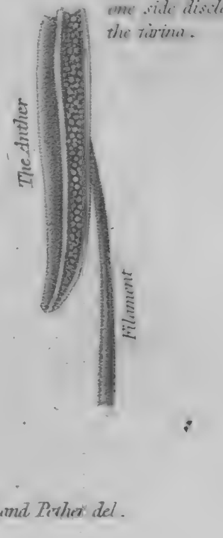
9. *Front View.*
*To shew the six Stamina &c.*



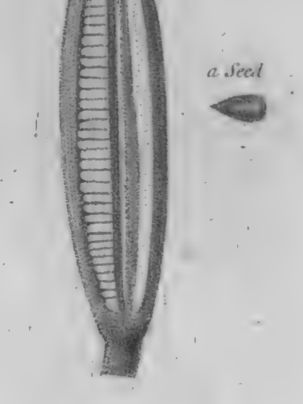
10. *Back View.*
*Shewing the 3 interiour & 3 exteriour Petals of the Corolla.*



12. *The Anther, and Filaments*
*enlarged.*

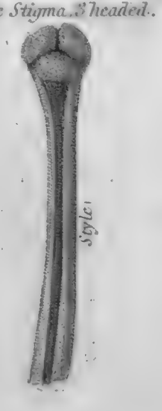


11. *The Germen magnified*
*To shew the disposition of the Seeds*
*which are removed on one side.*



*A transverse*
*View of the Germen.*

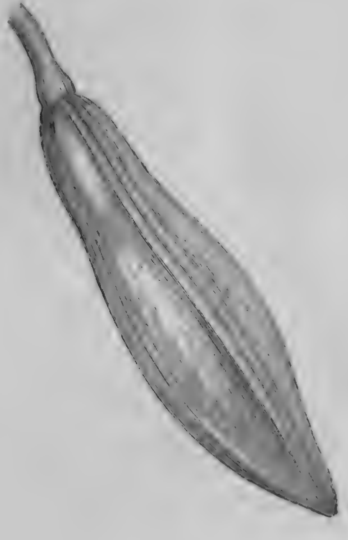
13. *Pistillum enlarged*
*The Stigma 3 headed.*



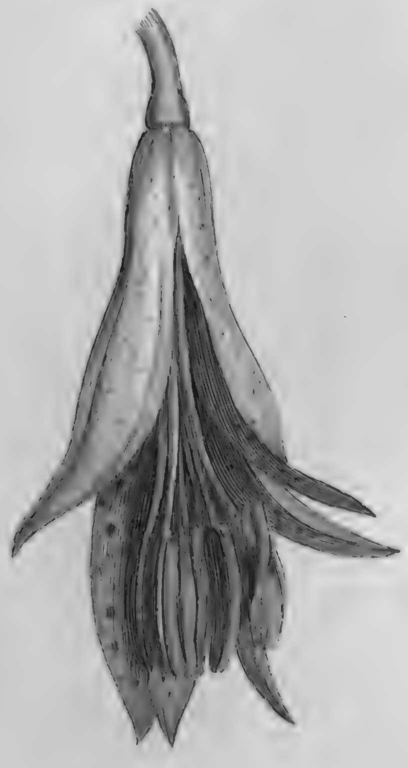
*Reinagle and Pether del.* *Warner sculp.*

*London. Published by Dr. Thornton. May 1. 1801.*

1st Stage.
A Bud, drooping.



2d Stage.
Some of the Petals curling back
Pistil not seen.



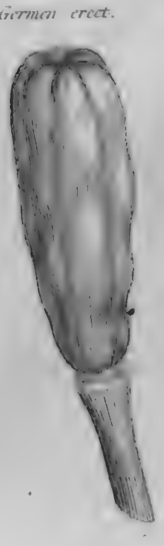
3d Stage.
Petals all curled back
Pistil seen amongst the Anthers.

4th Stage.
Petals yet more curled
Anthers rolling back to give out their Farina.

5th Stage.
Anthers decaying
Pistil rising above the Anthers.

6th Stage.
Corolla & Stamina fallen
Germen encreased. Style more curved.

7th Stage.
Stigma & Style dropt off
Germen erect.



8th Stage.
Germen a Pericarp, opening by 3 Valves.

9th Stage.
Six Rows of Seeds.

## Anatomy of the Superb Lily

Reinagle pinx

Wetton sculp

London. Published by Dr. Thornton. May 2.1809

# A Plate to illustrate the Word Genus

Long-tubed Marvel of Peru

Henderson del.

Mazel sculp

London, Published by Dr. Thornton March 6 1805.

Æsculus Hippo-Castanum, or Common Horse-Chesnut.

Miller del.

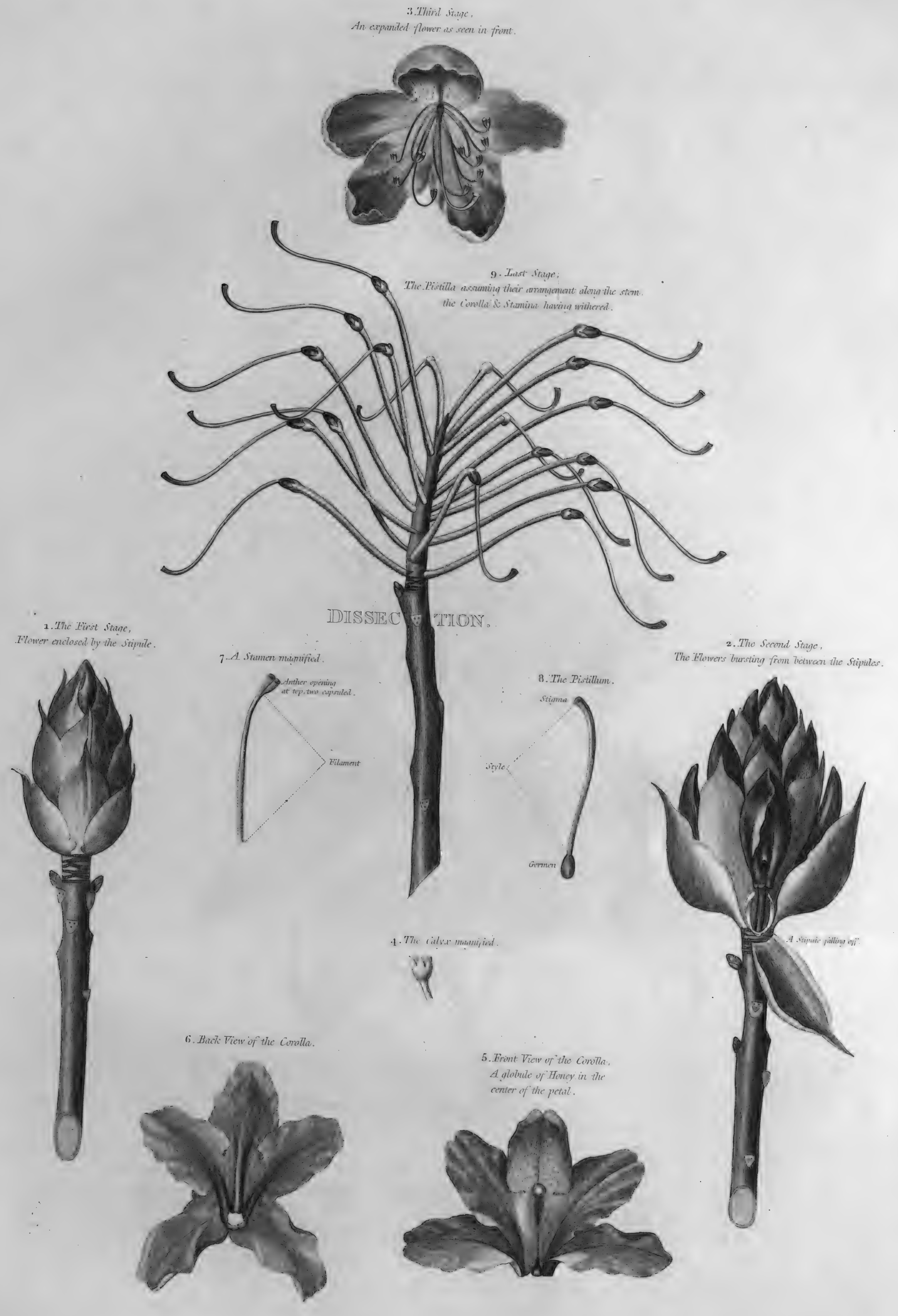
London Publiſhed by Dr. Thornton, May 1.1810.

Sutherland ſculp.

Butomus umbellatus, or Flowering Rush.

Henderson del. Eves sculp

London, Published by Dr. Thornton June 1. 1810.



Anatomy of the Pontic Rhododendron.

Henderson del.

London. Published by Dr. Thornton, March 1, 1803.

Mazell sculp.

Arbutus Andrachne; or Oriental Strawberry Tree.

Ehret del.

Warner sculp.

London. Published by D.r Thornton Nov.r 1. 1808.

Cerastium Aquaticum; or Marsh. Mouse-ear.

Edwards del.

London, Published by Dr. Thornton Novr. 1. 1808.

Warner sculp.

*Lythrum Salicaria; or Purple-spiked Willow-herb.*

Edwards del. Warner sculp.
London, Published by Dr. Thornton, Decr. 1.1808.

Calla Ethiopica, or African Calla &c.

Henderson del.

London, Published by Dr. Thornton May 2 1809.

Wm. Dunkarton Junr. sculp.

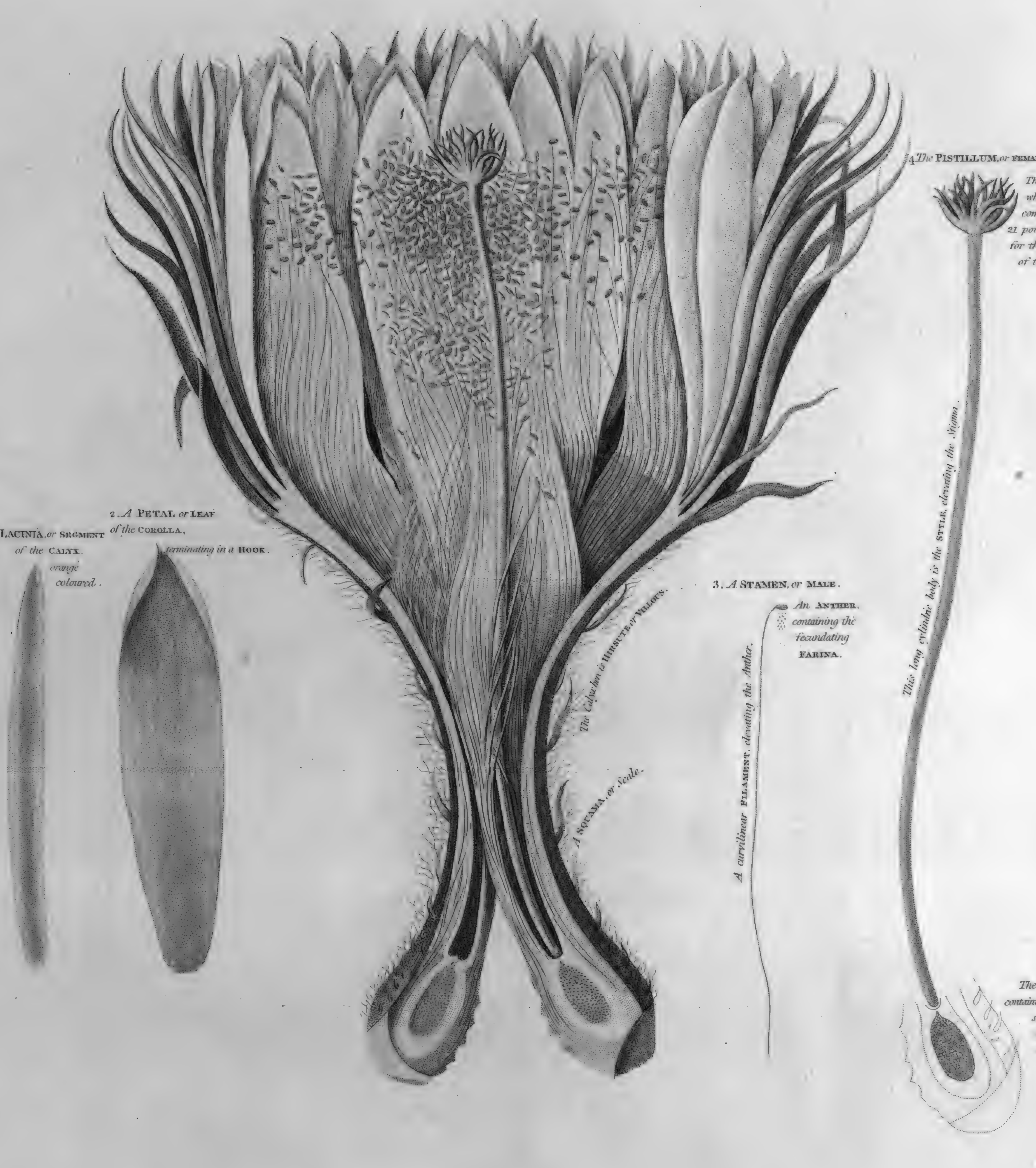
# The Dog Rose.

## Anatomy of the Rose.

Edwards pinx. Wetton sculp.

London, Published by Dr. Thornton, May 2.1809.

# Anatomy of the Night-blowing Cereus:
# or
# Cactus Grandiflora of Linnæus.



1. *A* LACINIA, *or* SEGMENT *of the* CALYX.

2. *A* PETAL *or* LEAF *of the* COROLLA,

3. *A* STAMEN, *or* MALE.

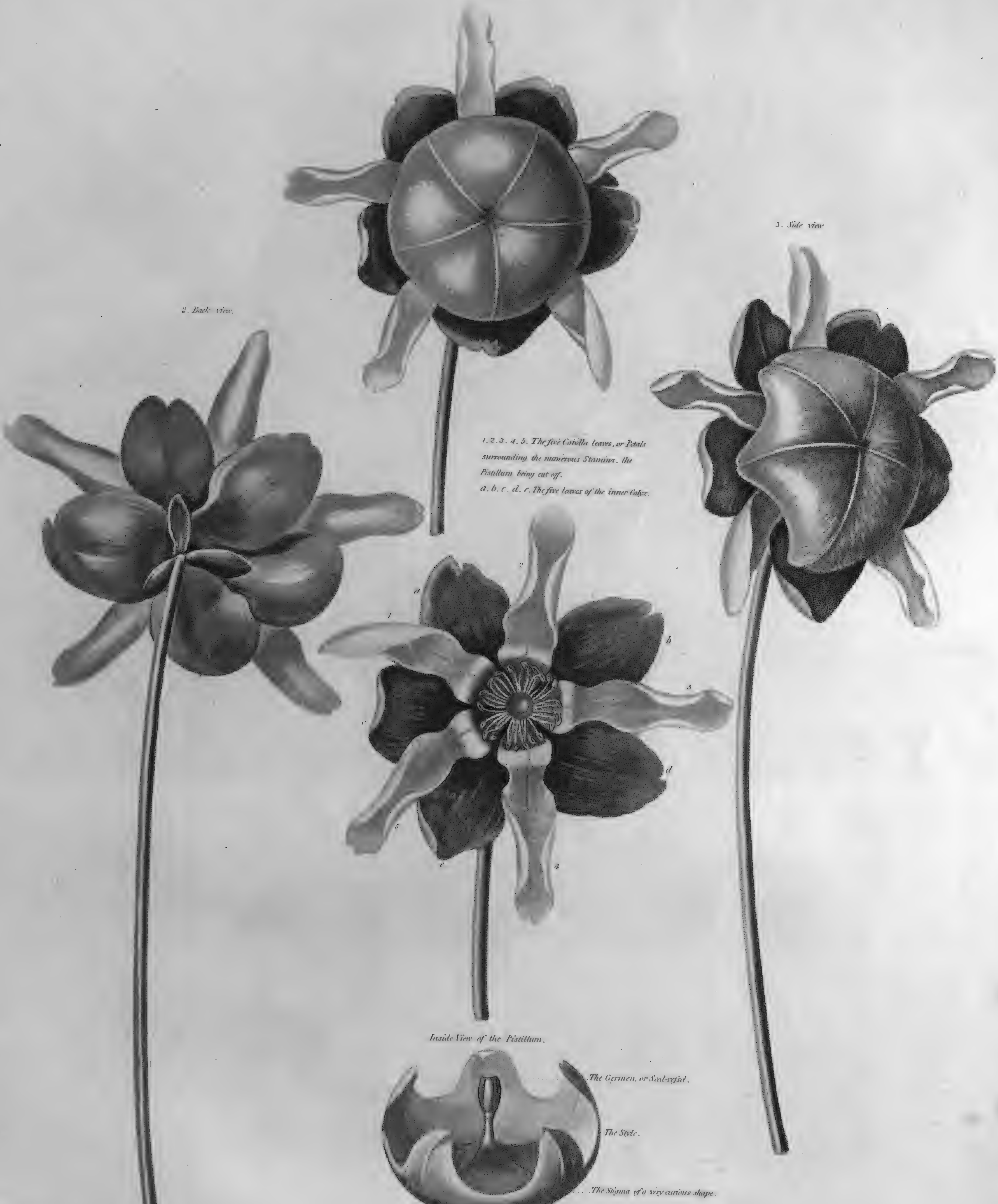
4. *The* PISTILLUM, *or* FEMALE.

Reinagle pinx.

London, Published by Dr. Thornton, May 1. 1801.

Warner sculp.

# *Anatomy of the Sarracenia*
# or
# PITCHER PLANT.



*1. 2. 3. 4. 5. The five Corolla leaves, or Petals surrounding the numerous Stamina, the Pistillum being cut off.*

*a. b. c. d. e. The five leaves of the inner Calyx.*

*Henderson pinx.*

*London, Published by Dr. Thornton, August 1. 1802*

*Lewis sculp*

# Anatomy of the Blue Egyptian Water-Lily

I. Calyx.

II. Corolla.

III. Stamina.

A Stamen Magnified.

IV. Pistillum.

V. Pericarp.

Henderson pinx.t

London, Published by Dr. Thornton, Feb.y 1.st 1805.

Elmes sculp.t

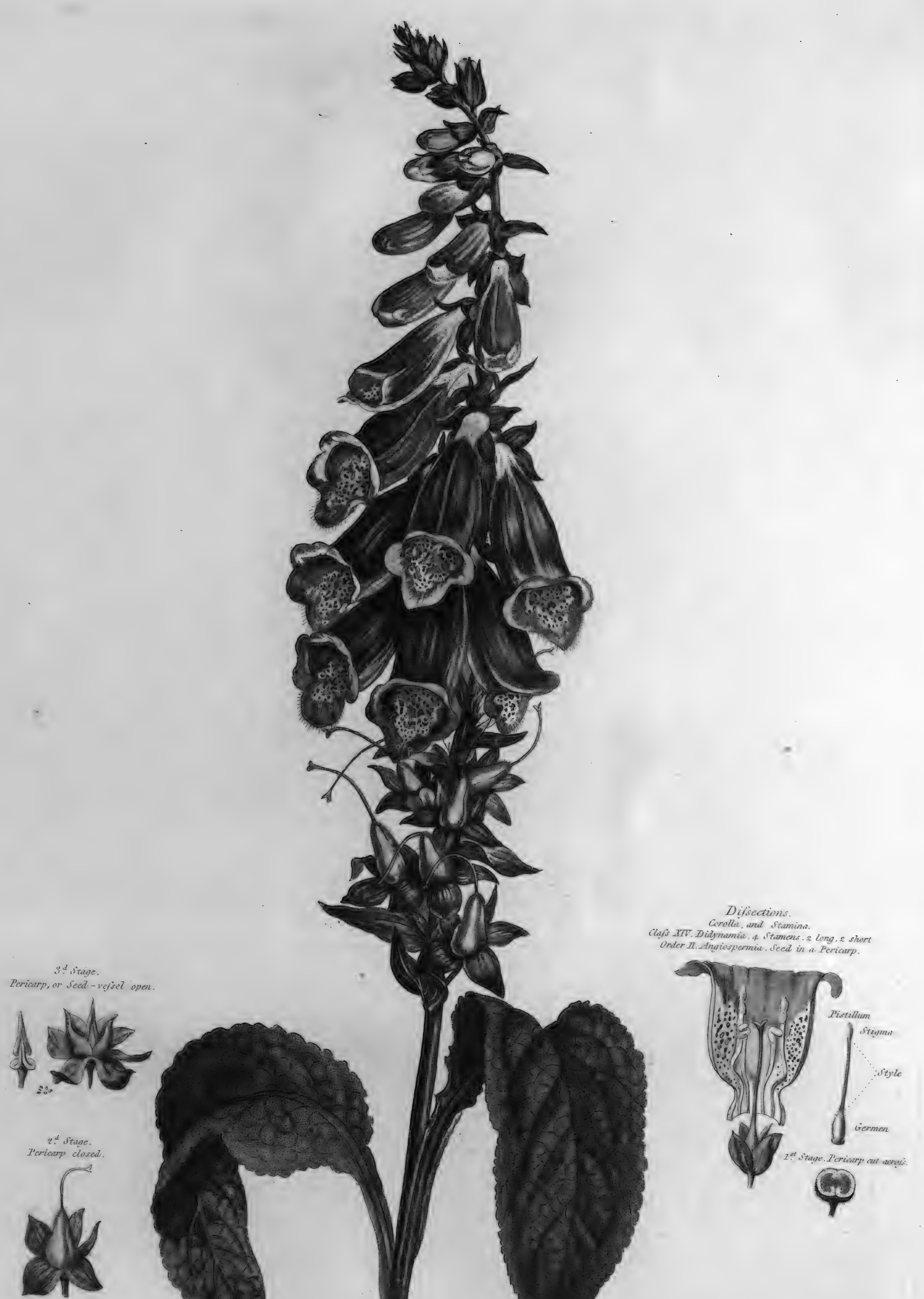
Myrtle

Variety Broad-leaved.

Henderson pinx.

Wm. Dunkarten sculp.

London. Published by Dr. Thornton March 1.1809.



Edwards pinx.

Digitalis; or Foxglove.

W.m Dunkarton sculp.

Antirrhinum. Major; or Great. Snap-Dragon.

Henderson del.
Dunkarton. sculp.
London, Published by Dr. Thornton. May 1.1809.

*Cardamine Praténsis; or Common Ladies-smock.*

Edwards del.

London, Published by Dr. Thornton, Decr. 1, 1808.

Warner sculp.

Lunaria. Honesty.

London Published by Dr. Thornton, May 1.1810.

Henderson pinx. *Ferraria Tigrida.* Dunkarton sculp

London. Published by Dr. Thornton. May 1 1809.

Horse-shoe Geranium.

Henderson del.

London, Published by Dr. Thornton, Decr. 1 1808.

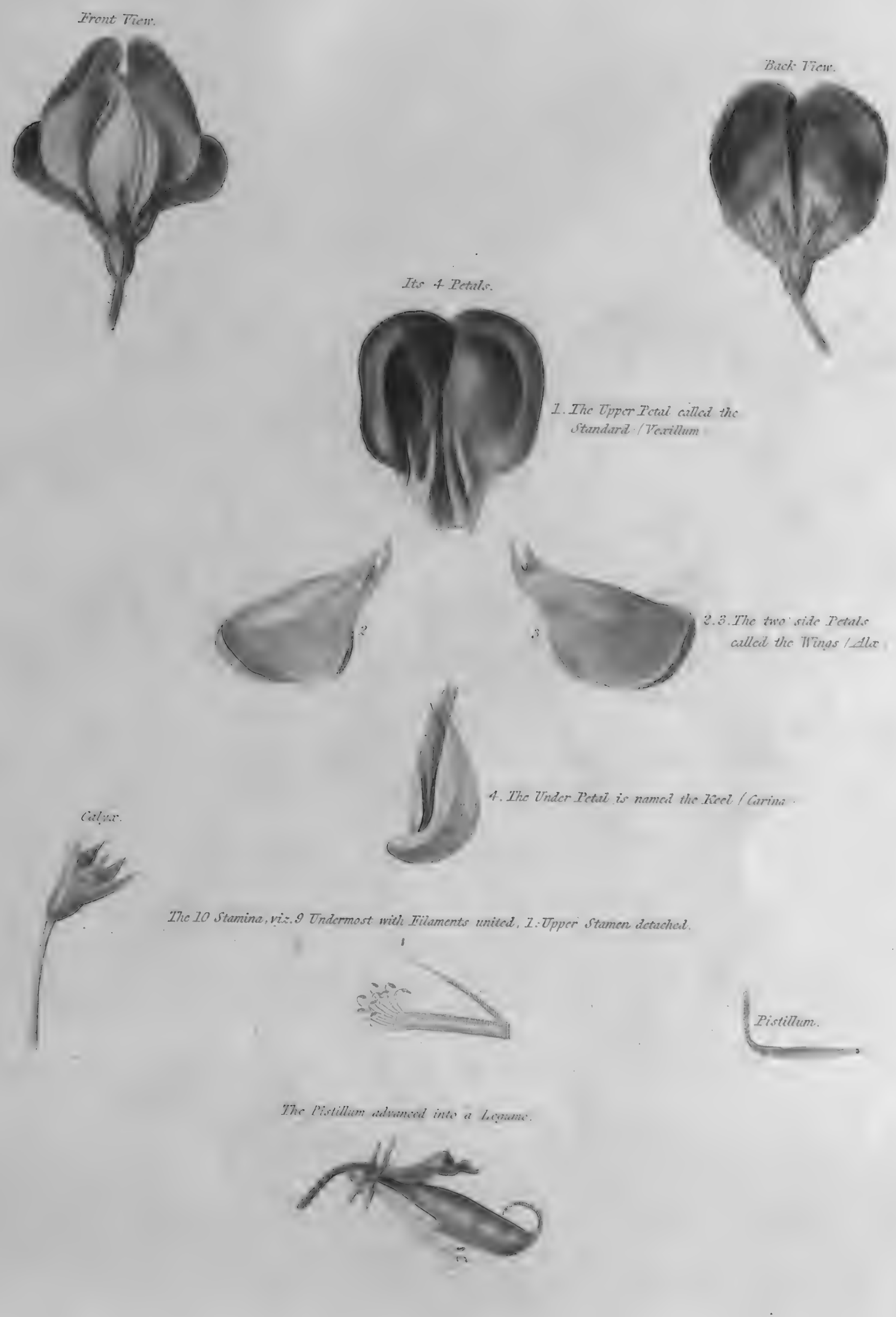
Warner sculp.

The Sweet Pea

Henderson del.

London, Published by D^r. Thornton, Nov^r. 1, 1800.

Dunkarton Jun^r. sculp.



Anatomy of the Sweet Pea

Henderson pinx.

London. Published by Dr. Thornton. June 1.1809.

Wm. Dunkarton Junr. sculp

*Lotus Corniculatus; or Common Bird's-foot Clover.*

Edwards del.

Warner sculp.

London. Published by Dr. Thornton. Decr. 1. 1808.

*Melaleuca Ericifolia, or Heath-leaved Melaleuca.*

Henderson del.

Caldwall sculp.

[illegible]

*Hypericum Perforatum; or Perforated St. John's Wort.*

*Miller del.* *Warner sculp.*

*London, Published by Dr. Thornton, Decr. 1. 1808.*

Orange.

Miller pinx.

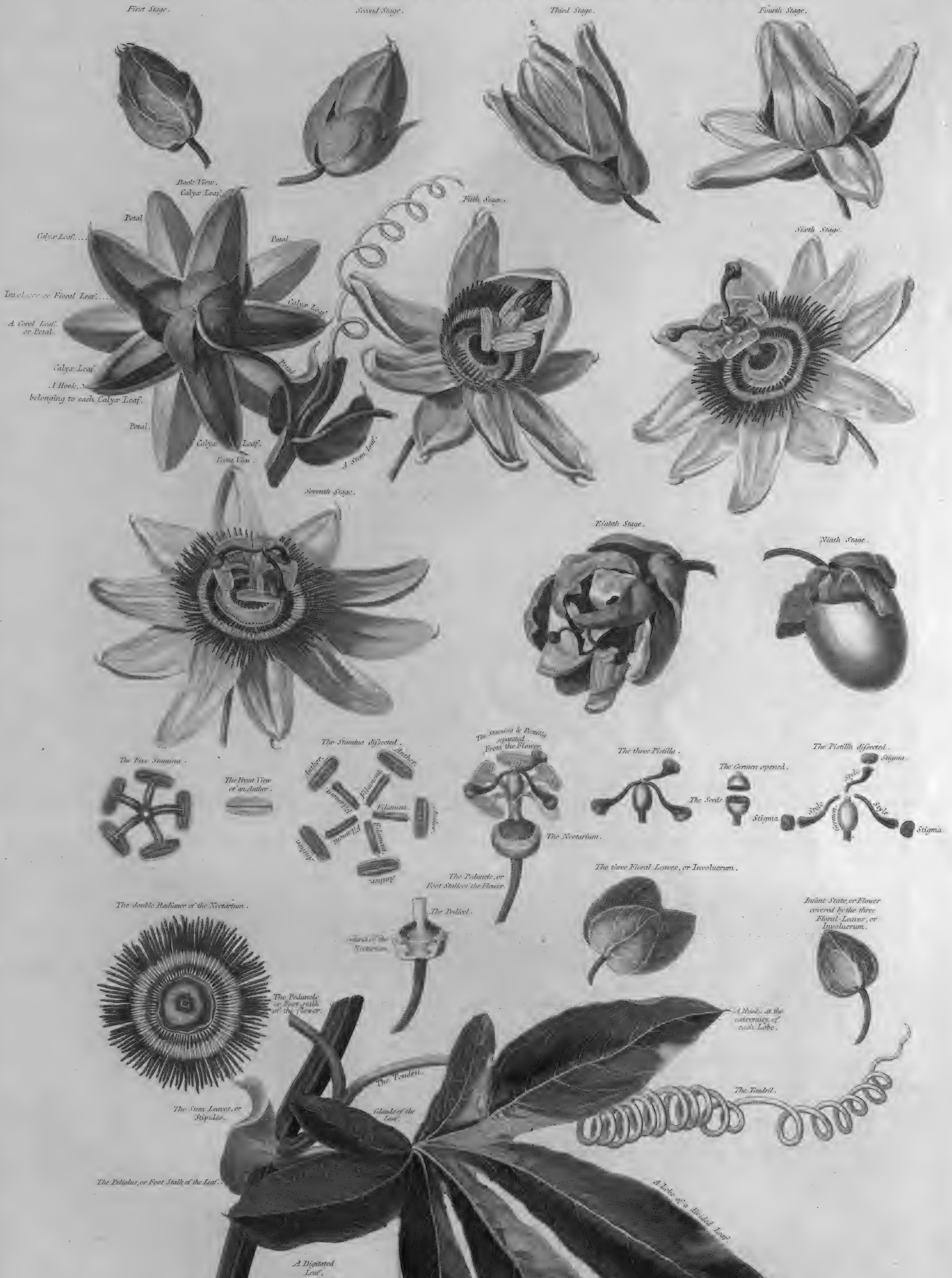
Warner sculp.

London. Published by D$^{r}$ Thornton. Sept$^{r}$ 1. 1809.

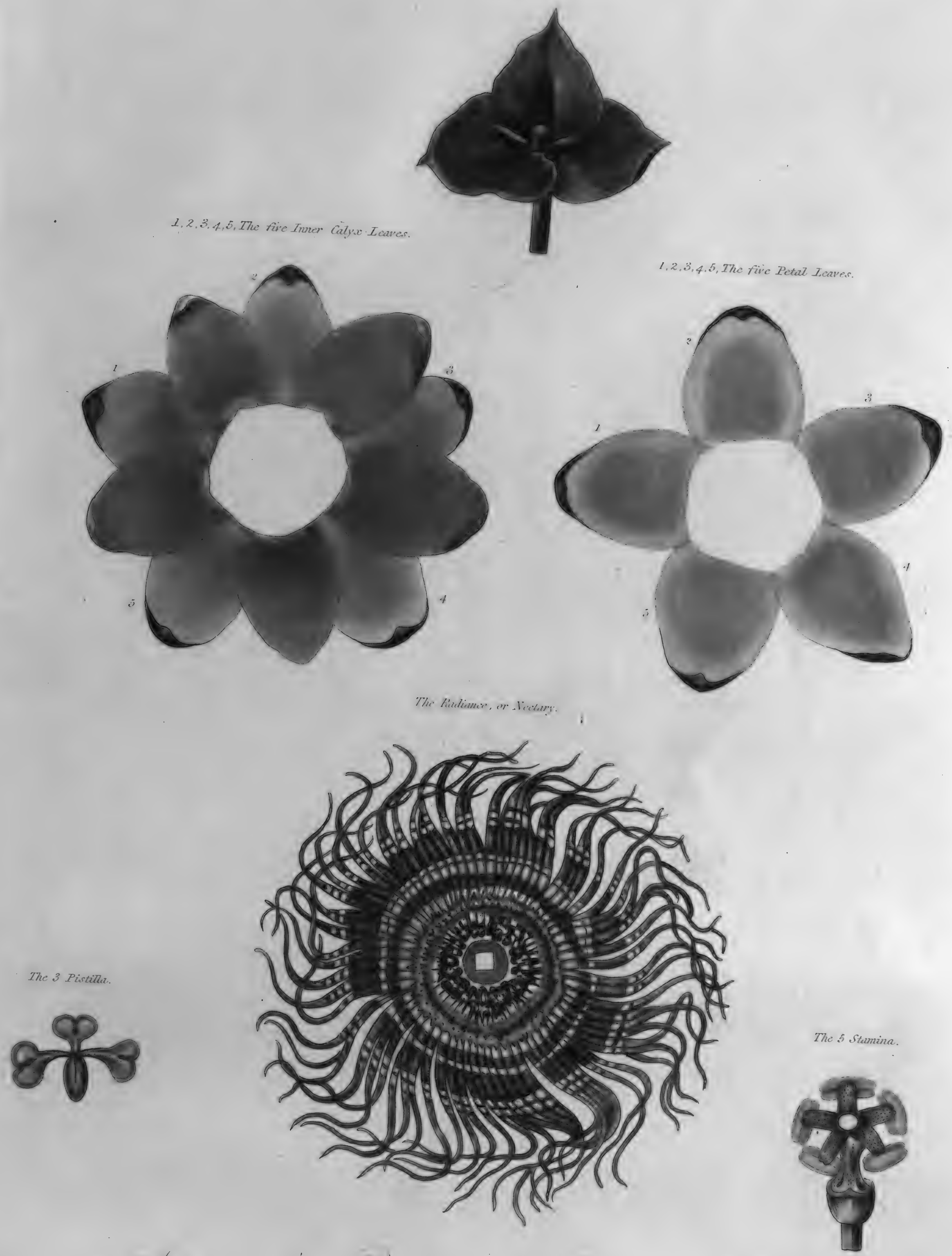
Cypripedium, Ladies Slipper.

Henderson pinx.
Dunkarton sculp.
London, Published by Dr. Thornton, May 1.1809.

# ANATOMY of the BLUE PASSION FLOWER.



P. Reinagle Pinx.t London Published by Dr. Thornton May 1 1799. J. Caldwall Sculp.t



Outer Calyx, or Involucre.

1, 2, 3, 4, 5, The five Inner Calyx Leaves.

1, 2, 3, 4, 5, The five Petal Leaves.

The Radiance, or Nectary.

The 3 Pistilla.

The 5 Stamina.

Anatomy of the Quadrangular Paſsion Flower.

Henderson pinx.

Dunkarton sculp.

London; Published by Dr. Thornton, May 1.1809.

# Three Species of Paſsion flowers.

**THE DOTTED,**
*Dots in the Leaves.*

**THE CORK,**
*Stem Cork.*

**THE SERRATED,**
*Edges of the Leaf toothed like a saw.*

*Bishop pinx!*

*London Published by Dr. Thornton June 1. 1803.*

*Warner sculp.*

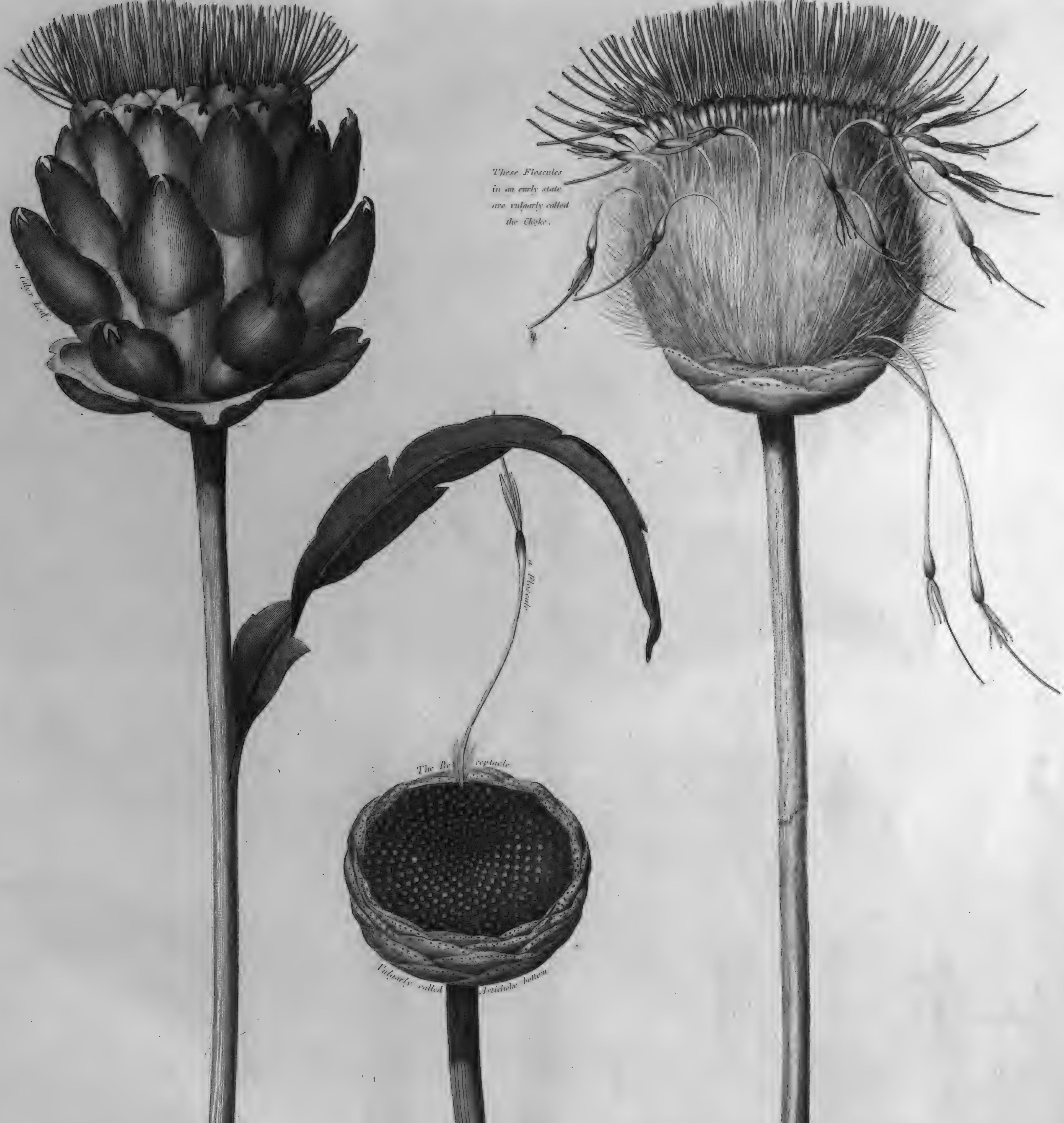
# Anatomy of the Dragon Arum
## A poisonous Plant.

Henderson pinx.
London. Published by D^r. Thornton. May 6. 1802.
Stadler sculp.

Dandelion; in French Dens de Lion; in Latin Dens Leonis; in Greek Leontodon.

Reinagle pinx.t
London. Published by Dr. Thornton Octr. 1st. 1808.
Wm. R. Dunkarton sculp.

# Artichoke in Flower.



Henderson del.

Thomson sculp.

London, Published by Dr. Thornton April 2,1804.

Anatomy of the Sunflower.

Henderson del.
Caldwall sculp.
London Published by Dr Thornton, Octr 1. 1808.

# Ripe Sunflower.

1. Seeds, shed.
Receptacle like an honey-comb.

A single Membrane of the Receptacle.

2. Seeds within the Membrmes
of the Receptacle.

A Seed.

NB. Each seed is embraced by four Membranes.

Henderson delt.

London, Published by Dr. Thornton, Jany. 2, 1804.

Mazel [illegible]

The Sweet Violet.

Edwards del.

Warner sculp.

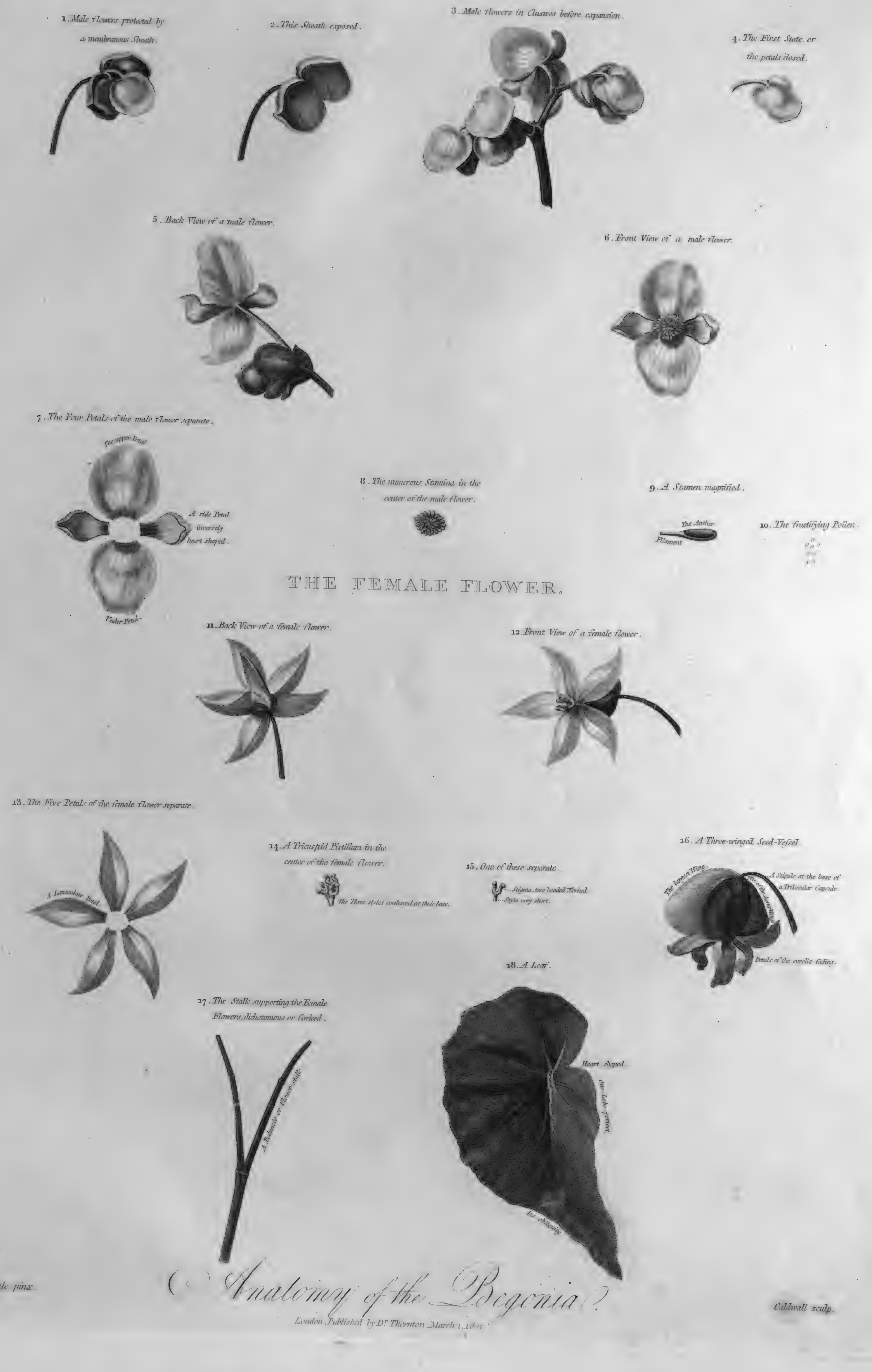
London, Published by Dr. Thornton, Nov.r 1. 1809.

Echinops spærocephalus; or Great Globe Thistle.

Henderson del.

Wetton sculp.

London, Published by Dr. Thornton, Octr. 2. 1809.



Reinagle pinx.

Anatomy of the Begonia.

Caldwall sculp.

London, Published by Dr. Thornton March 1. 1801.

Sowerby del. Wetton sculp.

*Ricinus Communis, or Common Palma Christi.*

Male & Female Flowers on the same Plant.

Tripsacum Dactiloides; or Jointed Tripsacum.

Miller del.

Warner sculp.

London. Published by Dr. Thornton. Decr. 1.1808.

Male & Female Flowers on the same Plant.

Carex Pendula; or Great Pendulous Carex.

Edwards del.

Warner sculp.

London, Published by Dr. Thornton, Novr. 1.1808.

*Male & Female Flowers on the same Plant.*

Henderson del. *Sparganium simplex; or smaller Bur-reed.* Warner sculp.

Bisexual Flower, having 6 Stamina and 3 pistilla.

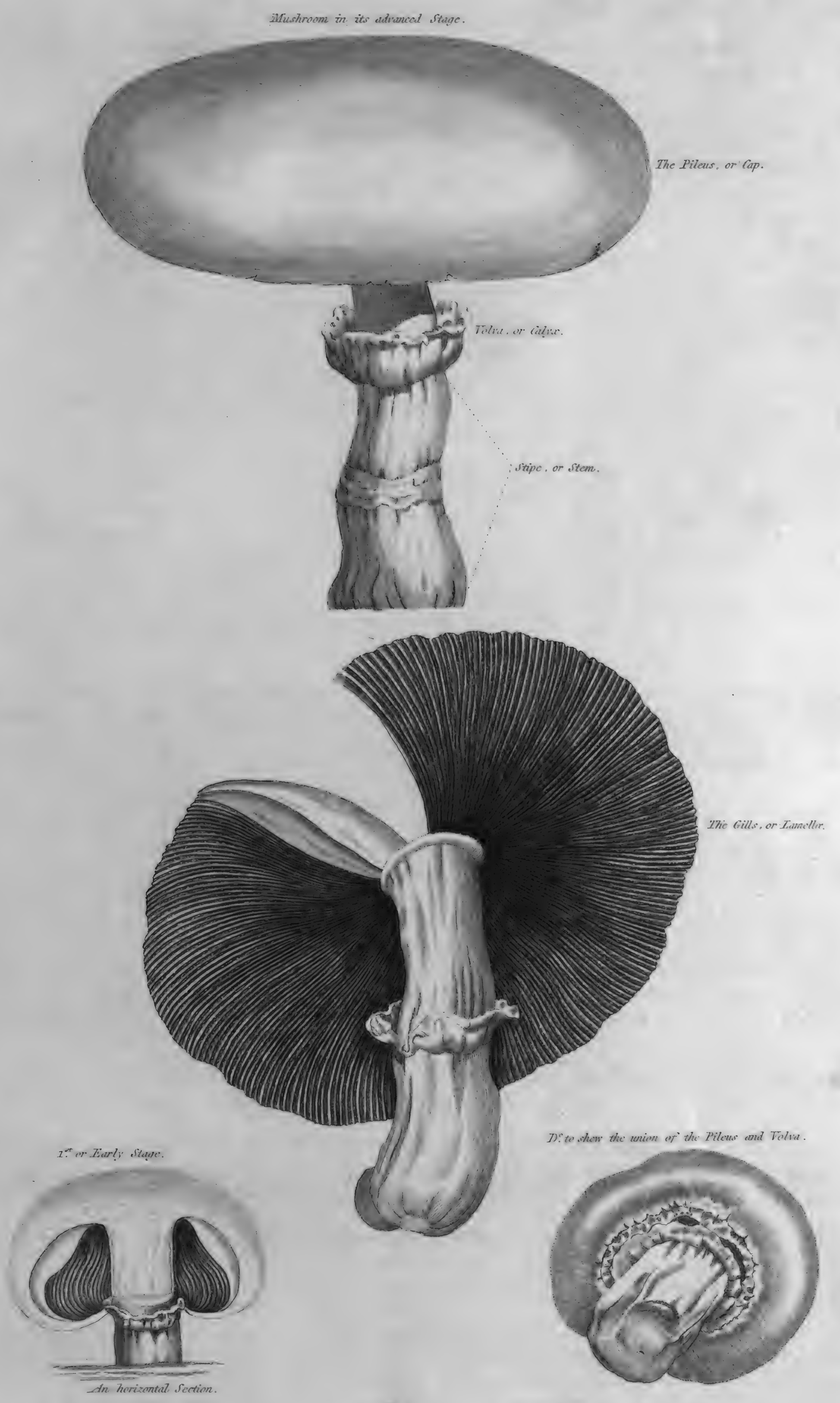
Unisexual Flower, having only 6 Stamina.

Veratrum album, or White Hellebore.

Henderson del.

London, Published by Dr. Thornton, June 1 1810.

Eves sculp.



Agaricus Campestris; or Common Field Mushroom.

Miller del.

Mazel sculp.

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# THE REFORMED SEXUAL SYSTEM.

## CLASSES.

| | | |
|---|---|---|
| I. | MONANDRIA | one Stamen. |
| II. | DIANDRIA | two Stamina. |
| III. | TRIANDRIA | three Stamina. |
| IV. | TETRANDRIA | four Stamina. |
| V. | PENTANDRIA | five Stamina. |
| VI. | HEXANDRIA | six Stamina. |
| VII. | HEPTANDRIA | seven Stamina. |
| VIII. | OCTANDRIA | eight Stamina. |
| IX. | ENNEANDRIA | nine Stamina. |
| X. | DECANDRIA | ten Stamina. |
| XI. | DODECANDRIA | twelve to nineteen Stamina. |
| XII. | POLYANDRIA | twenty or more Stamina. |
| XIII. | CRYPTOGAMIA | concealed Stamina. |

## ORDERS.

I. *Orders taken from the Number of Pistilla.*

| | | |
|---|---|---|
| I. | *Monogynia* | one Pistillum. |
| II. | *Digynia* | two Pistilla. |
| III. | *Trigynia* | three Pistilla. |
| IV. | *Tetragynia* | four Pistilla. |
| V. | *Pentagynia* | five Pistilla. |
| VI. | *Hexagynia* | six Pistilla. |
| VII. | *Heptagynia* | seven Pistilla. |
| VIII. | *Octogynia* | eight Pistilla. |
| IX. | *Enneagynia* | nine Pistilla. |
| X. | *Decagynia* | ten Pistilla. |
| XI. | *Dodecagynia* | twelve to nineteen Pistilla. |
| XII. | *Polygynia* | twenty, or more Pistilla. |

II. *Orders taken from some curious particularity in the Stamina.*

| | | |
|---|---|---|
| XIII. | *Didynamia* | four Stamina, two long, two short. |
| XIV. | *Tetradynamia* | six Stamina, four long, two short. |
| XV. | *Icosandria* | twenty, or more Stamina, inserted on the Calyx or Corolla. |
| XVI. | *Monadelphia* | filaments united in one body. |
| XVII. | *Diadelphia* | filaments united, forming two bodies. |
| XVIII. | *Polyadelphia* | filaments united, forming three or more bodies. |
| XIX. | *Syngenesia* | five anthers united. |
| XX. | *Gynandria* | Stamina arising from the Pistil. |
| XXI. | *Monœcia* | Stamina apart from the Pistil on the same plant. |
| XXII. | *Diœcia* | Stamina apart from the Pistil on different plants. |
| XXIII. | *Polygamia* | bisexual flowers, and unisexual. |

Class CRYPTOGAMIA has the natural orders, I. *Filices.* II. *Musci.* III. *Algæ.* IV. *Fungi.*

REMARKS.

I. The Class IV. TETRANDRIA, being a numerous one, LINNÆUS chose to separate it into two, and an opportunity presented itself from the consideration of the differences which occur in plants having four stamina, from the *proportion* of these. DIDYNAMIA expresses this difference; and the flowers are either *ringent* or *personate,* a *natural tribe.* But as all the *ringent* flowers are not included in the class DIDYNAMIA, some coming under Class II. DIANDRIA, there can be no good reason for not making this real division of a class into *an Order.* The System hence becomes more *easy* and *regular,* and in fact *frequently, more natural.*

II. The Class VI. HEXANDRIA, also readily separates into two parts, from the like consideration of the *proportion* in the stamina, and TETRADYNAMIA contains the *natural tribe* of *cruciform* plants.

III. The Class XIII. POLYANDRIA, also readily divides into two parts, from the consideration of the *insertion* of the stamina, and one of these, the ICOSANDRIA, of Linnæus, possesses *many edible fruits,* but as it is not altogether a *natural class,* therefore no one can regret seeing this part distinguished as an *order.*

IV. In the MONADELPHIA of Linnæus, many of the numerical names, which had been used to characterize the Classes, are employed to distinguish the Orders, or subdivisions, as *Pentandria, Decandria,* &c. and hence arises a confusion unavoidably perplexing to the young student, and which our Method, as is evident, completely removes. The same observation applies to the Classes *Diadelphia, Polyadelphia, Gynandria, Monœcia, Diœcia,* where the same (may I call it so) impropriety occurs. This class in LINNÆUS is *not natural,* but being made into orders, many of them then become *natural* as *orders,* as the COLUMNIFERÆ.

V. The *Papilionaceous Flowers,* as they are generally termed, form the Order *Decandria* in the Class DIADELPHIA of Linnæus; but the author, unwilling, as it would seem, to make any breach in so natural an assemblage of plants, has so far deviated from the principles of his System, as to refer to that Class several genera, which strictly belong to the preceding Class, being in fact *Monadelphious.* This inconvenience is entirely obviated in the present scheme, where *Monadelphia* and *Diadelphia* constitute two successive Orders in our Class X. *Decandria.*

VI. POLYADELPHIA is a small, and, as Doctor SMITH observes, "*rather an unnatural class.*" Most persons are shocked to see CITRUS, the orange, in this class, and not in the *Icosandria* class; for LINNÆUS describes it of the Class XVIII. POLYADELPHIA, Order III. *Icosandria.* Now in our *Reformed Sexual System,* it comes under Class XIII. POLYANDRIA, Order *Icosandria,* in juxta-position with other edible fruits, in the subdivision POLYADELPHIA.

VII. Class V. PENTANDRIA, a very numerous class, is subdivided by SYNGENESIA, and so formed into two classes by LINNÆUS, the latter of which, however, as containing an order *Monogamia,* is not therefore altogether a *natural class.* We obviate this by making *Syngenesia* an order, and the subdivision *Polygamia* to contain the natural tribe of *compound flowers;* whilst, under another subdivision, *Monogamia,* many plants, not having compound flowers, arrange themſelves.

VIII. Against GYNANDRIA, which Doctor SMITH calls, "an odd and miscellaneous class," there lies the same objection, as we observed above, as against the Class DIADELPHIA, the numerical names of Classes being applied to Orders. In our scheme, Class II. DIANDRIA, has an Order *Gynandria,* which contains the *natural tribe* of ORCHISES; and thus the mind is delighted to see a *natural assemblage* embraced in an order, if not in a class. The separation of the remainder cannot be regretted, as not possessing amongst each other the smallest affinity.

IX. MONŒCIA is a miscellaneous class, and borrows the names of its secondary divisions from most of the other classes, as *Monandria, Diandria,* &c. nay even from *Monadelphia, Syngenesia,* and *Gynandria;* for all these become, in LINNÆUS'S *Sexual System,* Orders. In our scheme, Class TRIANDRIA, Order *Monœcia,* contains mostly grasses, hence we retain this *natural assemblage* in the same class *at least,* if not in the same order.

X. DIŒCIA. The same remarks apply here, as in MONŒCIA.

XI. POLYGAMIA subdivides the classes *Monœcia* and *Diœcia;* therefore in the logic of science it is in reality an order.

# APOLOGY.

PASCITUR IN VIVIS LIVOR, POST FATA QUIESCIT
TUM SUIS EX MERITIS CUIQUE TUETUR HONOS.

SOME apology is certainly necessary, after any endeavour to reform so celebrated and established a System, as the Sexual System of the illustrious LINNÆUS. Many alterations in this system have been attempted. The enlightened pupil of Linnæus, THUNBERG, abolished the classes XX. *Gynandria,* XXI. *Monœcia,* XXII. *Diœcia,* and XXIII. *Polygamia.* GMELIN, Professor at Gottingen, to the alterations introduced by Thunberg, in publishing a new edition of Linnæus's Systema Naturæ, added the abolition of Class XII. *Icosandria*; and the no less celebrated Dr. SMITH, preserving the rest of the System entire, has abolished Order V. *Monogamia* in Class IX. *Syngenesia,* and Class XIII. *Polygamia.* "To his Class Polygamia," says Dr. Smith, "many students of tropical plants *justly* objected in his lifetime, and he, as well as his son, listened to their observations." Dr. WITHERING, in his Arrangement of British Plants, has followed the system of Gmelin. Professor MARTYN, speaking of the changes introduced by SCHREBER, in his new edition of Linnæus's Genera Plantarum, says, that his reduction of Class XX. *Gynandria,* appears "*reasonable,*" yet the singularity of the Order *Diandria* surely demanded a separate place to itself. But when he comes to mention the incorporation by GMELIN of the Class *Icosandria* into the *Polyandria,* he declares this change to be "*abominable.*"

I am aware, that venturing to reform in such a degree the Sexual System, as I have done, will bring upon me, with some, much severe reproach. I am conscious, indeed, as well as others, that the credit of the *Sexual System* of Linnæus, as an *invention,* surpasses all power of praise, and hence has found enthusiastic admirers; and with timid hands I have ventured to take to pieces the *superstructure* he raised, and build up from the *old materials,* which I have *carefully* and *religiously* preserved, a NEW EDIFICE, suited to modern improvement and convenience; hoping, however, that those who may, hereafter, publish the works of Linnæus, will edite the Sexual System as delivered by himself, and not bring forward, in the works said to be those of Linnæus, what he never either thought or wrote. For a full defence of the *Reformed Sexual System* vide my "Practical Botany, being a New Illustration of the Genera of Plants, with dissections of each Genus," where this subject has been particularly considered and discussed.

In a word, as by system is only meant a plan to *facilitate* the acquirement of the knowledge of plants, the more easy this is contrived to accomplish the proposed end, the better such a system will be accounted; and I have endeavoured so to contrive this, that I hope no longer any very great obstacles can arise in the way of the student, and that this will plead my excuse with a discerning and indulgent public for venturing to step out of the beaten path, to attempt the *reformation* of a system which has conferred immortal honour upon the inventor, and received the general plaudits and admiration of the learned throughout Europe. It appeared to me more advisable to *reform* the whole, than to make any *partial amendments*; either to adopt the system as delivered to us by Linnæus, or to have the present system, as erected out of the materials of the old; a *system* which I hope may not moulder, like the other systems,* into the sand of which they were composed, but resemble the youthful PHŒNIX arising from the ashes of its parent, or as a rock in the midst of the ocean, may remain until "the wreck of matter and the crush of worlds."

It is certainly a great satisfaction for me to find, that although the learned and venerable Professor MARTYN has long openly disapproved of the changes made in the Sexual System by the several Reformers, yet he writes to me—

### EXTRACT OF A LETTER TO DR. THORNTON, FROM THE REV. $M^R$ MARTYN.

"I by no means *disapprove* of *your new* attempt to render the Sexual System, by the manner in which you have done it, an *easier medium* of attaining *a knowledge of Plants*; and have been long convinced in my own mind, that we strive in vain to unite a *natural* with an *artificial arrangement.* Upon *your plan,* I see *no impropriety* in bringing the ORCHIDEÆ into the *Second Class*; nor can I even *object* to your *altering,* as you have done, the separated classes of Linnæus, ICOSANDRIA and POLYANDRIA. Your *method* is ably considered throughout; for along with *you* I hold our great Master's System as *sacred,* and can never approve of those *greater alterations*" (he might have said *mutilations*) "which some of his pupils have made, so differently is to be estimated the conduct of persons engaged in the same object."

The Rev. Doctor MILNE, the learned author of "*A Botanical Dictionary,*" writes to me—

### EXTRACT OF A LETTER TO DR. THORNTON, FROM THE REV. $D^R$ COLIN MILNE.

"Your *Reformed Scheme* of the *Linnæan System* has my *entire approbation.* It possesses all the admirable and elegant simplicity of that of RIVINUS, which has always been a great favourite with me, from the steady adherence of the author to the Principles of his Method, and is eminently adapted for *practice.* Your remarks respecting the *Sexual System* are truly excellent; your *New Illustration* admirable."

Doctor SHAW, of the British Museum, a gentleman not less eminent as a botanist, than a naturalist, declares, "that he believes, had LINNÆUS been alive, the *Reformed Sexual System* would be that which he himself would have instantly adopted."

Similar are the flattering opinions also of several other *distinguished botanists,* who have expressed their approval of the *Reformed Sexual System.* But with extreme diffidence I ſubmit it to the judgment of the world.

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* Not less than fifty-two systems of Botany have been published, several of them of very considerable merit, but not *practically* good, hence most of them are now forgotten.