offer the following judicious observations
are the most proper to be
made in a severe frost, that the weather is
so cold, and cleared away, they are
often on the ground, from whence they
sometimes come in, as the
ground is so cold, and then eat
sometimes they
eat the skin, and sometimes all
the skin of many
from the seed of a
That I do not
I have been so long
about some
instances, I
interference
the skin of
penetrated
not warm, they
the bone
the froth of a
when the
and clean, covered
and having been
turned into
but if the
Natives
could

Physical
TRACTS

RELATIVE TO

BOTANY,

TRANSLATED

FROM

Different Languages.

ILLUSTRATED BY NINE COPPER PLATES,

AND

OCCASIONAL REMARKS.

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ON THE ORGANS OF PERSPIRATION
OF PLANTS.

BY J. HEDWIG.

[Translated from the German.]*

NO one who has attended to the phenomena of vegetation, can doubt that plants perspire as well as animals. It has been ascertained by many experiments, that this function is performed chiefly by the leaves, or other parts of the plant analogous to them; and principally by their under surface. A number of experiments made by HALE, DU HAMEL, and more especially BONNET†, have demonstrated, that both in animals and vegetables, the same pores by which they perspire serve to absorb moisture from

* Sammlung von Abhandlungen über botanisch-ökonomische Gegenstände. Leipzig. 1793.

† Recherches sur l'usage des feuilles dans les plantes, et sur quelques autres sujets relatifs à l'histoire de la végétation, à Leyde. 1754.

the atmosphere. From this, Bonnet adopted an opinion which has since prevailed, that water constituted the chief nutriment of plants, and that they received it by means of the leaves as well as the roots.

Without examining whether these great philosophers have been sufficiently accurate in their experiments, and the inferences drawn from them, I shall only observe, that, though all who have written upon this subject have never omitted mentioning these pores, yet from the description they have given of them, I am inclined to doubt of their having actually seen them.

With a view to direct the attention of the physiological botanist to the use which vegetable œconomy derives from these organs, I shall give a more particular description of what has fallen under my immediate observation.

I pretend no claim, however, to the honor of being the first who saw them; for that is due to Mr. VON GLEICHEN,* who, in searching for the

* It appears from this, as well as from some other passages occurring in this paper, that the candid author was a stranger to a pamphlet of SAUVSURE, "Observations sur l'écorce des feuilles & des pétales, à

male parts of fructification of the common polypody, and soon after of the wall-rue, discovered under the cuticle of their leaves, (whether fruit-bearing or not) oval bodies; containing a sort of granulated matter, and each having an aperture, with which vessels communicated. These bodies, however, he mistook for the male organs of ferns; and afterwards gave a long description of them, and of their method of impregnating the females, together with a good figure; in his *New Botanical Discoveries*.*

Geneve 1762. 12°:" which, being very scarce, and containing much observation unconnected with theory, deserves the more to be reprinted. It was not VON GLEICHEN, but this ingenuous philosopher of Geneva, who first pointed out the remarkable structure of the membranes that cover the leaves and petals of plants. What he calls *ecorce* he found to consist of two distinct membranes, the undermost of which was stiled by him *Reseau cortical* or *l'ecorce proprement dite*, to distinguish it from the upper cuticle, adhering so closely to it, that a separation can seldom be effected either by boiling or maceration. The latter, which he calls *epidermis* in the strict sense, and to which also HEDWIG alludes, is, according to his observations, unorganized, perfectly transparent, and analogous to the epidermis or scarf skin of the human body; while the subjacent membrane, which perhaps may be compared to the organized cutis in man, he found provided with those ducts and oblong bodies (his *glandes corticales*) which Gleichen and Hedwig discovered after him, and which constitute the subject of the above dissertation. T.

* Das neueste aus dem Reiche der Pflanzen, &c. i. e. New discoveries in the vegetable kingdom, by W. Fr. Von Gleichen, 1764. fol. p. 24—30. T.

The appearance, contents, structure and situation of these bodies seeming completely to warrant the opinion their discoverer entertained, I was induced to adopt it myself, as soon as I observed them. Before I had heard of the prize question proposed by the Imperial Academy of St. Petersburg, respecting the sexual parts of cryptogamous plants in general, my attention had already been directed to this particular point upon the musci frondosi & hepaticæ; as to the remaining families of cryptogamia, I had only examined them cursorily in this regard: but having resolved to attend to them generally, I investigated more minutely the ferns and their male organs of fructification, as described by Mr. Von Gleichen.

A portion of the cuticle immersed in water presented to me exactly what he had seen and described; but I also observed the same in such parts of the plant, as were only found at an early period, and when the first rudiments of the fruit beneath the covering membrane were yet very minute. This made me suspect that the parts which Mr. Von Gleichen took for the male

organs, were not such; especially as they also appeared upon the old leaves with ripe fruit, in the same state of vigour as upon young ones, at a time when a new crop of female organs was not to be expected. Such a circumstance was in direct contradiction to a universal law of vegetable procreation, according to which the male organs, not only (as happens in animals) become flaccid after having performed their office, but even drop off before the fruit arrive at maturity. This last circumstance has never yet attracted the notice of physiologists; though, in my opinion, it affords the only incontestible character by which the plant is to be distinguished from the animal.*

In pursuit of my experiments, I also separated the cuticle from the leaves in other plants, and, examining it in the same manner, I as regularly found the same parts which were discovered and

*The difficulty of establishing characteristic distinctions for the animal and vegetable kingdoms, arises, no doubt, from plants and animals obeying equally the laws of vitality, though differently modified, and therefore both possessing the most essential character in common with each other. Of all discriminating definitions given of vegetable and animal productions, that of LINNÆUS has become the most universal and still prevails with most writers on natural history. According to him

considered as male organs by Von Gleichen ; even the very seed lobes, and many parts taken for trunk or stalk, were not destitute of them.

But as the cuticle cannot be taken off from all leaves with equal facility (in several of them it is impossible) nor its component parts observed with equal facility in all states, I shall previously say something on the best method of treating and observing it.

Mr. Von Gleichen observes, that he easily raised the epidermis or cuticle of the common polypody with a pin, but in the wall-rue he was only able to perform this operation close to the covering of the seeds. The reason of this was, that the old leaves of the former plant begin in autumn (the season in which he made his expe-

vegetables grow and live ; animals grow, live and feel. But even if it were possible to conceive the existence of totally senseless life, the idea would be too abstract for the foundation of distinctive characters. If so, the above suggestion of Hedwig will merit at least the attention of the naturalist. According to him, animals would be such organized bodies as retain their sexual parts after their function has been performed, and repeat it with the same ; vegetables would, on the contrary, be organized bodies, which, loosing their sexual organs after impregnation, must bring forth new ones for the reiteration of it. The chief objections against this definition, however, seem to be those animals which propagate once only before they die. T.

riments) to separate from their lower membrane; which in this plant, as also in the leaves of *Buxus sempervirens*, is found entirely detached by the spring—a circumstance at no season incident to the wall-rue.

In cases in which it is difficult to perform the operation, the following method succeeded best with me: I introduced a very thin sharp-pointed knife, its edge turned towards me, for several lines beneath this tender membrane, and cutting it, I took hold of the detached part with a pair of small pliers, and drew it softly upwards.—If it still proved inseparable, even by this method, or too great a portion of the parenchyma of the leaf adhered to it, recourse was had to maceration.

The epidermis of some plants is so very fine and tender, that, when detached, it collapses and appears a mucilaginous mass; in others, more elastic, it rolls up immediately after separation. Frequently, the membrane already detached, losing its natural means of expansion, becomes wrinkled, by which, in addition to the moisture that usually remains, the minuter objects contained in it appear but in-

distinctly under the microscope, or not at all. To avoid this, I put, with the handle of a small dissecting knife, two or three drops of clear water upon the glass-slider, in which I immersed the portion of membrane. When treated thus, the whole appears distinct, and in its natural state; ducts or vessels are perceived communicating with rings, or squares; and in the middle of each of the latter, an aperture, or dark line.

These ducts, which I shall call the lymphatic vessels of the cuticle, are constantly met with in the epidermis both of the upper and lower surfaces; nor are those of the other parts of the plants entirely without them.

Their direction, which is not the same in every plant, is usually very different from that pursued by the vessels of the net in the leaves. In some plants they run directly upwards, and communicate by means of transverse ducts; particularly in the grasses and bulbous plants. (Pl. I. Fig. 5.) In Indian Wheat (*Zea Mays*), the ascending ducts are slightly serpentine, and the communicating horizontal ones, straight. (Ib. Fig. 6.) The cuticle

of many exotic succulent plants, as the different species of aloe, &c. displays united pentagons or hexagons. In the generality of plants the ducts maintain no precise order in their direction, but are curved in various ways. (Ib. Fig. 1, 2, 3.)

They will remain not only when the cuticle is gently detached, but will bear the friction of a hair-pencil, even when the leaf has undergone putrefaction. In my collection of skeletons of leaves, I preserve the membranes of both surfaces; which, in order to cleanse them, I have handled rather roughly without any injury to the vessels; a strong proof of the firmness of their texture, and their intimate connexion with the membrane itself.

It frequently happens, in separating the cuticle from the fresh leaf, that some portion of the parenchymatous matter still adheres to the sides of the ducts or to their interstices. Such particles appear under the microscope like small orbicular bodies or grains. (Fig. 1. & 4.)

The lymphatic vessels are not only found on the leaves, and leaf-like appendages of the stem and

and branches, but also in the seed lobes, (Pl. 1. Fig. 1. 2.) and in the outer and inner covering of flowers, generally called corolla and calyx.

I now come to the perspirative pores connected with the ducts just described. Those which I had an opportunity of seeing were all oblong; but when closed, their form was sometimes changed. They all agree, however, in this circumstance, that they occupy a variously shaped area, marked out at least by a very faint line. This area is sometimes round, as in the leaves of the pink, sometimes oval (Fig. 1. 2. 3. 4.), or rhomboidal, as in the Indian corn, or square, as in the variegated and other aloes, in *Cactus curassavicus*, &c.

These, as also their oblong apertures, generally take the longitudinal direction of the leaves, with this exception, that where the lymphatic vessels do not pursue direct routes (as mentioned above) deviations will take place with respect to them also. In such cases, they will incline more or less to the left or right, and sometimes even assume an horizontal position.

The above-mentioned adhering portions of the

parenchyma are often observed in these areas, in greater or less quantities; but are never found in this case to extend so far as to the circumference of the area, from which they are separated by a light coloured streak that resembles one of the communicating ducts, and the inner side of which is more closely covered with them. In many cases no grains at all appear in the areas (Pl. 1, Fig. 1. 2. 5. 6.); nor do they form a constituent part of these organs, for they are not, as it appeared to Von Gleichen, incorporated with, but only adhering to the inner surface.

The number of the lymphatic vessels, or perspirative ducts, communicating with the areas, are subject to variation; but there are generally four (as appears from the figures) or only two, as in the leaf of the pink. Those that are irregular in their direction, vary also in this respect; so that for instance in areas which should have four of them, three, two, or one only, are found inserted. This last case, however, is very rare.

The place of their insertion is generally at the sides of the oval bodies; or, if there be but two

(as in the pink) precisely in the middle of the opposite sides ; but I have also observed communications of these vessels, with the upper and lower extremities of the areas,

In some plants these areas are, comparatively speaking, of a considerable size ; as for instance in the common and male polypody, in the red lily, (*Lilium bulbiferum*) &c. The leaves of these plants, especially their under surfaces, when seen through a magnifier of but moderate power, exhibit them in the shape of elevated points, or in the appearance of small glittering pearls. If the separation of the cuticle be well performed, the lateral shades upon it, which may be observed by the help of a good microscope, will discover an elevation of the central part of the areas, and the margin of the oblong aperture will appear to have a considerable microscopical latitude. From this circumstance, I conclude that the two laminæ of the cuticle in the area do not lie close together, as is the case in the interstices of the ramifications of the ducts, but form a kind of receptacle for the perspirable matter ; for, that the tender covering of

the leaves is composed of two distinct laminæ, is not only proved by the presence of its vessels, but particularly by the above-mentioned circumstance, viz. that I was not able to dislocate these vessels by the continued friction of a hair pencil.

Having already mentioned the oblong shape of the aperture contained in the middle of each receptacle, I shall now give a fuller account of my observations upon these organs. Their closing and opening, Mr. Von Gleichen has already noticed in the ferns. On examining a small portion of this membrane under water upon the glass-slider of a compound microscope, it is found, that the light reflected by the mirror, makes this opening appear as splendidly illuminated as the water about it. Now as this is not found upon any other part of the surface, it is a sufficient proof of the completeness of these apertures.

Each of them when shut, represents a dark coloured line, broader or narrower; but when open, the two extremities run out into acute angles, which make it appear like a fissure with sides forming an arch.

From the first three figures (Pl. I.) it appears that the acute angles of the apertures do not extend so far as to touch the margin of the area; which is the case in most plants I have examined. In the Indian corn (Fig. 6.) however, they come very near to the upper and lower corner of the quadrangular receptacle. In the grasses, these apertures are longer than in other plants, at least in proportion to the receptacles; for they extend to the very limits of the areas. This is, perhaps, the reason why they have two different ways of opening and closing; for they are either contracted in the middle, and remain open at both ends, (as represented in the Indian corn, Fig. 6.), or their ends are contracted, while the fissure remains open in the middle for about one-fourth of its length; as I observed in the leaves of oats.

I have before observed, that lymphatic vessels are found in both surfaces of the leaves, and such parts as are analogous to them; but, with respect to the described apertures and areas it is quite otherwise. They indeed are often, though not universally, found in annual and biennial plants on both

surfaces of the leaves ; but the upper surface of perennial plants is seldom furnished with them ; nor was I able to discover them on the inner surface of the calyx of the red lily, but the lower and outer one of these parts was constantly supplied with them. They appear in great abundance upon the whole exposed surface of all leafless succulent plants from warmer climates.

The number of these organs in a given space of a leaf may easily be found out ; for as the real size of each of the represented particles was $\frac{1}{43}$ of a square line, and as that of the red lily (Fig. 3.) contains thirteen and a half of these apertures, we may calculate from this, that their number in a square line will amount to about 577. From this calculation, an idea may be formed of the prodigious number existing in the total of the leaves of a plant ; particularly when both surfaces are provided with them.

That there must also be a difference with respect to their number and size, according to the different vegetables and the different parts of the same plant, requires no demonstration, but

may be seen in the figures; for it is evident that the areas in the seed lobes of *Perilla ocymoides*, (Pl. I. Fig. 1.) are more numerous and larger than those in the stock gilly-flower, *Cheiranthus incanus* (Fig. 2.); and the calyx of the red lily (Fig. 4.) contains fewer of them than the leaves of its stalk. (Fig. 3.)

Though the observations here given on the ducts and apertures in the cuticle of different parts of plants are but few, yet they seem clearly to prove that these organs are calculated for the purpose of vegetable perspiration. The circumstance that the apertures alluded to are always found abundantly on the lower surface of the leaves, and indeed in many plants exclusively so, seems to throw some light on several phenomena; as for instance, why the leaves with their upper surface turned downward, always regain their former direction; why those leaves which Bonnet covered with oil, soon turned black,—and why a shower of rain, or an imitation of it, is so very beneficial to plants. With respect to the last mentioned circumstance, it seems probable to me, that

by the numerous subtilè particles floating in the air, or perhaps also by a sediment of the matter of perspiration, obstructions may take place in these organs; and indeed, even within a small microscopical compass, several apertures are observed to be entirely filled up with a dark coloured matter. There can be no doubt, but that free perspiration is, in most vegetables, as necessary to their health, as to that of the animal creation.

That moisture may likewise be conveyed through the described passages into the different parts of vegetables, can scarcely be denied; but whether this moisture contributes to the nourishment of plants, or not, remains a subject for future examination. Indeed our knowledge in the physiological part of botany being still so very limited, and the erroneous notions carried along with it, so numerous, it is to be wished that those botanists who have it in their power to examine the productions of the vegetable kingdom, but whose minds are engrossed by terminology and rage for system, would divert some part of their attention to the physical department of their

science. By so doing, the vague, and sometimes erroneous ideas of many botanists, respecting the different parts of plants and their functions, would be cleared up; they would then better understand the value of the characters; bestow proper, and consequently lasting, denominations upon vegetable organs; and many doubts in theoretical botany might be removed.

ADDITION OF THE TRANSLATOR.

SINCE the publication of Hedwig's dissertation, some other observations have been made on this subject, which it may not be improper to mention here. Mr. FRANCIS BAUER of Kew, who, besides his distinguished excellence in botanical painting, is well skilled in microscopic investigation, has made accurate drawings (not yet published) taken from both the surfaces of the separated cuticle of various leaves, when strongly magnified. He has depicted the above described oval bodies, and their, as he thinks, supposed

ducts, as they appeared to him in several species of *Dianthus*, *Begonia nitida*, *Crassula umbellata*, *Orchis mascula*, and *Massonia scabra*; which exhibit great variety in their construction. But what merits particular attention are his figures of pieces of cuticle of *Doryanthes hastata* Corrêa* and of a species of *Hæmanthus*, which being of a thicker texture, exhibit a cellular substance of two or three stories, not unlike a part of a honeycomb. Each of the above described orbicular receptacles communicates with another beneath it, but no further communication with other receptacles is to be seen. What appear to be vessels or ducts, as described by Saussure and Hedwig, are, in Mr. Bauer's opinion, nothing more than the edges or remaining parts of the dissepiments of the cells in the cuticle. He therefore denies the existence of vessels going to the orbicular receptacles, unless they are supposed to be within the substance of the upper edge of the dissepiments.

How far these observations are correct, and if

* A new liliaceous plant, above 15 feet high, from New Holland, described in the Transact. Linn. Soc. Vol. 6, p. 211.

correct, whether the same construction be found in all plants, or only in some of the succulent, the future researches of Mr. Bauer, or other naturalists, cultivating this interesting part of phytology, will determine.

M. DECANDOLLE, well known by his work upon succulent plants, has also written an instructive paper upon those orbicular bodies, which he calls *les pores de l'écorce des feuilles**. According to him, they are never met with upon the nerves, where the meshes of the net are narrower and more elongated than in other places†. The hairs, on the contrary, are always placed upon the nerves or their ramifications. He is of opinion that the fibres of which the leaf-stalk consists, spreading within the surface of the leaf, have their last ramifications connected with the described pores. As a proof of this he refers to the leaves of

* Extrait d'un memoire sur les pores de l'Ecorce des Feuilles par le Citoyen Decandolle, lu à la classe physique & mathématique de l'Institut national. Journ. de Physique Vol. 52. p. 130.

† In a drawing which Mr. Bauer has made of the cuticle of the leaves of *Massonia hespida*, the thornlike excrescences appear to be without those orbicular bodies, but furnished with the same net nearly up to their tops, the meshes becoming gradually narrower.

Grassula punctata, *lactea*, *Cotyledon*, &c. which have their surfaces covered with round points visible to the naked eye. Upon raising the cuticle, he observed each of these points to be formed by a pencil of fibres terminating here, after having traversed the parenchyma of the leaf. In plants with leaves very fibrous, such as *Camellia japonica*, and *Celastrus buxifolius*, &c. he found about sixty pores in the space of two square millimetres (about a square line) while there appeared only from five to eight within the same extent on the cuticle of several succulent plants, that have leaves much less fibrous.

In general, no such pores are to be found upon the stalks, except in such as are of a soft texture, approaching to that of most leaves; and upon several of those which have no leaves, as the species of *Ephedra*, *Stapelia*, &c. There are none to be seen upon the leaves of *Cuscuta europæa*, which singular plant, when immersed in water, according to the observations of M. Decandolle, affords no gas whether exposed to light or darkness.

The roots have no pores, nor have the scales of the bulbs of liliaceous plants. The stipules and bractes, the membranous excepted, and such as drop off very quickly, are furnished with them as well as the leaves. They have not been discovered on fleshy fruits, such as pears, peaches, gooseberries, though found on several pericarps not succulent (as in those of Coluteas, &c.) and upon the fruits of most of the monocotyledonous plants. There are none upon the membrane covering the seeds, but upon all seminal leaves, except the fleshy seed-lobes of beans, peas, and the like.

M. Decandolle further observes, that those plants which are really acotyledonous, such as Fungi, Lichens, Hepaticæ and Fuci, are totally destitute of cortical pores. Indeed, according to him, these vegetables are without any *ecorce*, and perhaps even without the fine epidermis: which he thinks may account for a number of the Fungi decaying so very fast. Hence it is also that the Hepaticæ fill themselves with water as soon as immersed, and that coloured liquors are so easily

introduced into the substance of Lichens through their surfaces.

M. Decandolle adopts it as a principle that such pores are never found but on those parts of vegetables, exposed to the influence of air and light. He has not been able to find them on those parts of the stalk of grasses which are covered by the sheaths of the leaves, nor on the inner surface of these sheaths. The same is the case with the inner surface of the calycular scales of the *Compositæ*.

No part of such plants as live constantly in the water are furnished with these pores; neither are they observed on the immersed leaves, nor the lower part of the stalk in *Callitriche*, *Sparganium*, *Polygonum amphibium*; while on the other hand all the upper parts above the water are covered with them. The under surfaces of the leaves in *Nymphæa*, in *Menyanthes nymphoides*, and in *Hydrocharis*, which float upon the water, have none, while the upper surface is furnished with them. But plants entirely destitute of pores, while living in the water, regain them when growing out

of it, and vice versâ. These observations M. Decandolle has made with *Ranunculus aquaticus*, and other water plants. *Mentha viridis*, cultivated in a garden, has about 1800 pores on the under surface of one single leaf; but a stalk of this plant, immersed in water, and left there for some time, will produce new shoots and leaves without pores. The blanched plants (*plantes etiolées*) are also without them. M. Decandolle has counted about 250 pores upon each surface of the seminal leaves of *Sinapis alba* and *Lepidium sativum*, cultivated in the open air; while those of several plants of the same species, raised in the dark, did not show a single pore. In a cellar lighted by six lamps he raised some plants from the seeds of the two species last mentioned, but could not discover more than 150 upon each surface of the seminal leaves.

Some naturalists have been of opinion that these organs or pores served to elaborate the glaucous dust which covers the leaves of certain plants; but no such pores are observed on the fleshy fruits, as plums, which, however, are furnished

with this dust; and several succulent plants have a great abundance of it, though the number of their pores is inconsiderable.

M. Decandolle believes them to be organs of insensible perspiration, which is common to all vegetables; aquatic and submersed plants perhaps excepted, in which pores in fact are not found. The succulent plants, which have very few, perspire but little.—He conceives it also probable that the pores in certain cases serve to absorb moisture.

EXPLANATION OF PLATE I.

Fig. ** Scale of the relative magnitude, each part being enlarged 62 times in its linear dimensions.

Fig. 1. The $\frac{1}{43}$ part of a line of the cuticle on the lower surface of a seed-lobe of *Perilla ocymoides*.

Fig. 2. The same of the seed-lobes of the stock gillyflower (*Cheiranthus incanus*.)

Fig. 3. The same of a leaf of the red lily (*Lilium bulbiferum*.)

Fig. 4. Of the corolla or calyx of the same plant.

Fig. 5. The same of the common onion (*Allium Cepa*.)

Fig. 6. Of a leaf of Indian Corn (*Zea Mays*.)

SOME MATERIALS FOR THE ILLUSTRATION
OF THE
BOTANICAL GEOGRAPHY
OF THE
SOUTH-WESTERN PARTS OF EUROPE,
BY PROFESSOR LINK.

[Translated from the 'German']*

IF it is important to the mineralogist to know what fossils he is to expect in any particular place, it may be supposed of equal importance to the naturalist, who wishes to form a judgment of the climate of a particular country, and of its present or possible productions, to become acquainted with the plants of it, whether they be indigenous or exotic. Botanical geography forms a distinguished but hitherto neglected branch of geology. What I have to offer are mere fragments

* From H. F. LINK's Beiträge zur Naturgeschichte. Vol. 2. 1801. p. 187.

and materials to assist in the future completion of the subject.

I shall review in this point the North of Germany, France, Spain, Portugal, and the South of England; and shall begin by enumerating such plants as are found in the greatest part of Europe, from the 54th to the 38th degree of Northern latitude. They are the following:

Aphanes arvensis.

Chara vulgaris, and some other species of this genus, *Zanichellia palustris*, and all species of *Callitriche*.

Veronica agrestis and *arvensis*.

Gratiola officinalis and *Utricularia vulgaris*.

Lycopus europæus, *Verbena officinalis*.

Orchis latifolia, *Morio*.

Several species of *Lemna*,

Salix triandra, *alba*, *decipiens* and *vitellina* are, indeed, found occasionally throughout the West of Europe, but become scarcer and scarcer towards the South.

Fraxinus excelsior.

Iris Pseud-Acorus, *Sparganium erectum*, *Typha*
latifolia and *angustifolia*.

Plantago coronopifolia.

Galium palustre, *uliginosum*.

Sherardia arvensis.

Several species of *Potamogeton*.

Urtica urens, but not *U. dioica* LINN

Parietaria officinalis. *Echium vulgare*

Myrica. *Gale*. *Betula* *Alnus*.

Lithospermum arvense.

Myosotis palustris & *arvensis*.

Convolvulus arvensis, *sepium*.

Datura Stramonium, *Hyoscyamus niger*.

Solanum nigrum, *Dulcamara*.

Lonicera periclymenum.

Hedera Helix.

Illecebrum verticillatum.

Gentiana *Centaureum*, but with many varieties.

Chenopodium viride, *album*, *murale*, *maritimum*.

Herniaria glabra, but more frequently *H. hirsuta*.

Eryngium maritimum, *Hydrocotyle vulgaris*.

Heracleum Spondylium.

Tordylium Anthriscus.

Conium maculatum.

Alsine media.

Linum Radiola.

Statice Armeria.

Atriplex hastata.

Juncus conglomeratus, *effusus*; but less frequently
in the South; *Juncus aquaticus* & *sylvaticus*.

ROTH.

Peplis Portula.

Rumex Acetosa and *R. Acetosella*.

Alisma Plantago.

Erica vulgaris. *Polygonum aviculare.*

Butomus umbellatus.

Dianthus prolifer.

Arenaria serpyllifolia, *marina.*

Sedum album.

Spergula arvensis and *pentandra.*

Agrostemma Githago.

Oxalis corniculata.

Agrimonia Eupatoria. *Reseda lutea.*

Euphorbia Peplus, *helioscopia*, *exigua.*

Prunus spinosa.

Cratægus Oxyacantha, *monogyna.*

Spiræa Filipendula.

Rosa canina. *Rubus fruticosus*.

Tormentilla erecta.

Papaver hybridum. *Chelidonium majus*, but less frequently in the South of Europe.

Nymphæa alba & *lutea*.

Delphinium Consolida.

Ranunculus Ficaria. There is, however, a much larger variety of this in the Southern countries.

Ranunculus repens, *Flammula*, *arvensis*, *heterophyllus*, *aquaticus* and *fluviatilis*.

Zostera marina.

Myriophyllum spicatum.

Poterium Sanguisorba.

Lamium purpureum, *amplexicaule*.

Digitalis purpurea. It is not found in the Northernmost parts of Germany.

Clinopodium vulgare. Only found in the South of Europe, in cool places.

Cochlearia Coronopus.

Thlaspi Bursa pastoris.

Arabis thaliana.

Bunias Cakile.

Geranium Robertianum, *molle*, *rotundifolium*,
cicutarium.

Polygala vulgaris.

Ulex minor. But less frequently in the North.

Ononis spinosa.

Lathyrus palustris. *Vicia sativa*.

Trifolium arvense, *procumbens*, *pratense*. The
latter is much less frequently seen in the South
of Europe.

Cichoreum Intybus.

Sonchus oleraceus lævis.

Eupatorium cannabinum.

Bidens tripartita, *cernua*.

Chrysanthemum segetum.

Arnica montana.

Erigeron canadense.

Senecio vulgaris.

Anthemis arvensis, *Cotula*.

Aster Tripolium. *Iasion montana*.

Viola canina, *arvensis*.

Anthoxanthum odoratum.

Cyperus flavescens, *fuscus*.

Scirpus palustris, *lacustris*, *setaceus*, *maritimus*.

Carex paniculata.

Phalaris arundinacea. Is becoming rarer in the southern countries.

Panicum glaucum, *sanguinale*; are likewise becoming more rare in the southern countries; as also *Phleum pratense*.

Aira canescens, *caryophyllea*.

Poa pratensis ROTH, (*trivialis* WILLD.) annua.

Briza media.

Festuca ovina, *fluitans*, *procumbens*.

Bromus mollis, *secalinus*, *pinnatus*.

Arundo arenaria, *Phragmites*.

Lolium temulentum. *Hordeum murinum*, *secalinum*.

Triticum repens (but much less frequent in southernmost Europe) *T. junceum*.

Osmunda regalis.

Polypodium vulgare. *Pteris aquilina*.

Polytrichum juniperinum, *piliferum*.

Leersia pulvinata.

Dicranum perpureum, *varium*.

Tortula subulata, *ruralis*.

Barbula muralis, *rigida*.

Didymodon rigidulum.

Bryum argenteum.

Fissidens bryoides.

Leskea complanata, *sericea*.

Hypnum purum, *cupressiforme*, *prælongum*.

Fontinalis antipyretica.

Jungermannia tamariscifolia, *complanata*.

Verrucaria confluens, *Glaucoma*, *geographica*, *arenaria*, *immersa*, *scruposa*, *punctata*, *tessellata*, *pertusa*, *Perella*, *Ruscorum* (*Psora* HOFFM.) *purpurascens*, *farinosa*, *petræa*. The following are much less frequently met with in the most southern than in the most northern parts of Europe; *V. pallida*, *rubra*, *atra*, *subfusca*.

Lobaria lentigera, *aculeata*, *citrina* (this is more frequently found in the South of Europe), *olivacea*, *centrifuga*, *parietina*, *ciliata*, *prunastri*.

Peltigera canina. *Umbilicaria pustulata*.

Collema crispum.

Cladonia rangiferina, *pyxidata*, *foliacea*.

Usnea hirta, *florida*.

Lepraria antiquitatis, *flava*, *rubens*, *botryoides*.

Opegrapha atra.

Geastrum stellatum.

Tremella Nostoc, mesenteriformis.

Agaricus campestris (but less frequently in the South of Europe) *arvensis*, *Bulliardi*, *procerus*, *porcellaneus*.

Boletus igniarius, edulis, versicolor.

Helvella Mitra.

Peziza cochleata, hirta.

Phallus impudicus.

Sphæria clavata, deusta, virescens, uda, corylea, acuta.

Stemonitis typhina, fusca.

Ulva intestinalis.

Conferva bullosa, amphibia, capillaris, glomerata, corallina, and most of the *Fuci*.

From the above, the following conclusions may be drawn :

1. Plants which grow in swamps and standing waters are the most general. The reason why they are less common in the south-west part of Europe in particular, is merely because swampy places are there less frequent. In the swamps in Portugal or the South of Spain, very few plants are found peculiar to the most southern parts of Europe.

2. Next to these in point of generality, are those plants peculiar to the sands of the sea shore ; for most of those that grow in the North are also found in the South. But then many are found on the southern shores that are not to be met with on the northern.

3. Mosses (*Musci frondosi & hepatici*) are far from being frequent in the South of Europe, and but few of them it has in common with the North. Lichens are, however, very general ; fungi the least so.

4. There are many plants that grow in all parts in great abundance, as *Veronica agrestis & arvensis*, *Urtica urens*, *Solanum nigrum*, *Chenopodium viride*, *album*, *Alsine media*, *Erica vulgaris*, *Thlaspi Bursa*, *Geranium molle*, *Trifolium procumbens*, *Senecio vulgaris*. But it may be laid down as a rule, that the above enumerated species are more frequent in the northern than in the southern countries ; except the following, which are perhaps more abundant in the South : *Plantago coronopifolia*, *Linum Radiola*, *Rumex*

Acetosella, *Oxalis corniculata*, *Rubus fruticosus*,
Scirpus setaceus, *Aira canescens*.

5. Although some plants peculiar to corn-fields, as *Chrysanthemum segetum*, *Agrostemma Githago*, *Bromus secalinus*, *Lolium temulentum*, are also indigenous in the South of Europe, yet this is not the case with all. *Centaurea Cyanus* is often found in the gardens of the most southern parts of Europe, but not in the corn-fields.

That swamps and stagnant waters produce the same kind of plants under different latitudes, is, I think, the natural consequence of the small difference in the temperatures in which they exist. In the northern climates, a covering of ice is their protector during the winter; in hotter regions they are cooled by the exhalations increased during summer. Hence also it proceeds that the above remark applies only to swamps and stagnant waters, but does not extend to peat-bogs. These last, being filled up with moss, and freezing to a considerable depth, do not permit the roots of the plants to penetrate so deep, which are therefore more exposed to the action of the frost.

That plants peculiar to the sea-coast, and growing in the sand, are also to be found in the South, seems to arise from their being habituated during the summer even of the northern countries to sustain a considerable degree of heat, as well as from the air during winter being rendered considerably milder by the sea-water which remains unfrozen. The Floras of northern shores are often graced with flowers, which belong only to warmer climes. But we must except from the rule above laid down, the succulent plants of the dry part of the sea-shore. Sea-weeds, as fuci, are also very general; but here we should distinguish between those that grow actually on the rocks and stones of the place, and such as are merely thrown on the shore by the tide, and are the produce of many different waters.

Mosses are scarce in the South of Europe, because moist, shady, cool spots are very seldom to be found in those parts. Lichens on the contrary require drought and naked rocks, which they here find no want of. The fungi of northern and southern climes differ in some degree from each other, as in the one they are the produce of

moist forests, in the other of dry hills, and warm damp winters. All that are peculiar to dead putrid wood, must of course be scarce in the South of Europe.

As the greater number of those plants which are the most universal appear to be aborigines of the North, hence towards the South they are less frequent: and, indeed, plants of northern climates adapt themselves with greater facility to the southern regions than vice versâ. Hence it is, that plants, found in the greatest abundance in the most southern parts of Europe, take their rise but little farther towards the North. Nothing is more common in the South of Spain and Portugal than some species of *Cistus*, of which the North of Spain contains but very few.

This last observation proves, that the power of naturalization in plants has its fixed boundaries. Many plants growing with us in corn-fields are not become spontaneous in the South of Europe; *Centaurea Cyanus* of our corn-fields, for instance, is not to be met with in those parts.

Several species of plants are not, indeed, so universal as the above enumerated, but we find

two very nearly related species, the one in northern, the other in southern climates. These are often so closely a-kin, that they might be considered as originating from one species, but that they are never found to degenerate the one into the other. An accurate observation of such plants might lead to the discovery of the original effect of climate upon vegetables. I must, however, previously observe, that the limits of extension between these species are never distinctly drawn; but on the contrary, that there are countries which produce both. This again affords a ground for considering both as originally distinct. In the following catalogue I shall also introduce those that are varieties.

Salicornia herbacea and *fruticosa* are both found in the South of Europe; in the parts farthest South, the latter only.

Agrostis stolonifera does not grow in the most southern parts of Europe, but *A. alba* does. In the middle region both species are found together. *Agrostis hispida* does not appear in the most southern parts of Europe, but in its stead a new species, or else *A. capillaris*,

Avena elatior. is merely *A. bulbosa* in the most southern parts of Europe.

Bromus pinnatus, together with *B. ramosus*, in the South of Europe.

Bromus sterilis—in Portugal and Spain *B. madritensis*.

Dactylis glomerata—In the most southern parts of Europe, only the var. *D. hispanica*.

Poa bulbosa—not viviparous in the South of Europe.

Lolium perenne becomes annual in the South of Europe.

Juniperus communis in the North of Europe; *J. montana* WILLD. on the mountains, *J. Oxycedrus* upon plains of the South of Europe.

Teucrium Scordium in the northern, *T. scordioides* SCHREB. in the most southern parts of Europe.

Stachys germanica appears somewhat changed in Portugal. This also is the case with *Ballota nigra*.

Marrubium vulgare loses its scent in the South of Europe.

Instead of *Mentha aquatica*, *M. hirsuta* becomes more frequent in the South of Europe.

A shaggy variety of *Mentha Pulegium* becomes more frequent in Portugal.

The white variety of *Origanum vulgare* is only to be found in the southermost regions of Europe.

Scutellaria galericulata disappears in the South of Europe ; in its stead *S. minor*.

Euphrasia officinalis not in the most southern parts of Europe, but in its stead the somewhat different *E. latifolia*.

A very large variety of *Pedicularis sylvatica* is only met with in the most southern parts of Europe.

Instead of *Antirrhinum Elatine* of middle Europe, *A. spurium* is more frequent in the most southern parts.

Instead of *Antirrhinum Orontium*, *A. calycinum* Encyclop. is more prevalent in the South of Europe.

Plantago lanceolata is scarce in the South of Europe, but in its place the kindred species, *P. altissima*, *Serraria*, *argentea*.

A particular variety of *Scabiosa columbaria* in the South of Europe only.

With *Parietaria officinalis* a kindred annual species is found in Portugal.

Urtica dioica is not found in the most southern parts of Europe, but only *U. caudata* VAHL. Both these species are, however, sometimes found together on their respective boundaries.

Cuscuta europæa; in the South of Europe *C. Epithymum* is more frequent.

Anchusa officinalis in the North of Europe, *A. italica* in the South.

Echium vulgare is scarce in the South of Europe, instead of it other nearly related species, as *E. lusitanicum* and *angustifolium* LAMARK, are more plentiful.

Cynoglossum officinale is not found in the South of Europe; but *C. pictum* in its place.

Cynoglossum Omphalodes in the middle of Europe; a nearly allied species, called *Omphalodes lusitanicum* by TOURNEFORT, and transferred to *Cynogl. lusitanicum* by LINNÆUS, is found in Portugal.

Primula veris and *P. elatior* are not to be found in the most southern regions of Europe; but *P. acaulis*.

Verbascum thapsoides in the South of Europe ; not *V. Thapsus*.

Vinca minor in the North of Europe, *V. major* in the South.

Bupleurum rotundifolium in the North of Europe ; a nearly related new species with longer leaves, in the South.

Atriplex portulacoides is a shrub in the South of Europe.

Statice Armeria has many kindred species in the South of Europe ; so has *S. Limonium*.

Triglochin palustre ; var. *bulbosa* in the South of Europe.

Colchicum autumnale ; in the most southern parts of Europe a variety with spotted flowers, like *C. variegatum*.

Fumaria officinalis ; in the South of Europe *F. capreolata* only.

Instead of *Polygonum Hydropiper*, we find *P. angustifolium* more frequently in the South of Europe.

Spartium Scoparium ; in stead of this many very nearly related species in the South of Europe.

Ulex major ROTH more in the North, *U. minor* more in the South of Europe.

Trifolium angustifolium is more frequent in the South of Europe than *T. arvense*.

Lotus corniculatus varies very much in the South of Europe, where it has also many nearly related species.

Anthyllis Vulneraria flore rubro is more frequent in the South of Europe, than *A. Vuln. fl. luteo*.

Lathyrus sylvestris only in the North, *L. latifolius* in the South of Europe.

Pinus sylvestris only in the North, *P. maritima* GERARD in its stead in the South of Europe.

Mercurialis annua, not in the South of Europe, but in its place a nearly allied species, *M. polygama*.

Reseda Luteola has undulated leaves in the South of Europe.

Thalictrum flavum; a larger variety is only met with in the southern parts of Europe.

Ranunculus Ficaria. In the South of Europe this plant is much larger in all its parts.

Arum maculatum in the North, *A. italicum* in the South of Europe.

Just as for *Cynoglossum Omphalodes*, *Omphalodes lusitanicum* TOURN. is found in Portugal, so is *Doronicum plantagineum* TOURN. seen there instead of *D. Pardalianches*. Both the above Portuguese species stand in the same relation to the two of Switzerland, with respect to the form of their leaves, &c.

Bellis sylvestris CYRILL. with *B. annua* in the most southern parts of Europe, supply the place of *B. perennis*.

For *Chrysanthemum Leucanthemum* a new nearly related species is met with in Portugal.

From the above we may establish the following propositions :

1. Many plants are larger in all their parts in southern than in northern regions. This phenomenon was naturally to be expected from a more

favorable climate. However some grasses and mosses are exceptions to this rule.

2. Many species, which are smooth in the North of Europe, prove hairy in the South, as *Teucrium Scordium*, *Lotus corniculatus*, &c. A similar phenomenon is observed in alpine plants, and in the vegetables of the highest northern latitudes. Intense cold and intense heat in this instance produce similar effects.

3. Many plants, perennial in northern, are annual in southern regions. The heat and drought of the latter cause the roots to die away. I also find that many annual plants from the South of Spain and Portugal easily become perennial when kept in green-houses; but on the contrary, I know of no instance in which a plant, indigenous both to northern and southern regions, is annual in the former and perennial in the latter. *Ricinus* is often adduced as a case in point, but this is not a native of the North, and its extraordinary rapid growth seems to be the cause of its exception from the general rule. *Salicornia herbacea* is no exception, as it is found together with *S. fruticosa*.

I leave to others the deduction of further conclusions from similar analogies, and am contented with having offered the first materials. I now come to those plants which, in the North and middle of Europe, grow in plains, but which are found upon mountains or in cool places in the South.

Veronica officinalis, *serpyllifolia*, *Beccabunga*, *haederifolia* are only found in the mountainous cooler regions of Portugal and Spain; *V. Beccabunga* descends the lowest of them.

Nardus stricta; only met with on the highest northern mountain tops of Portugal. The same is the case with *Scirpus cæspitosus*.

Carex ovalis (*leporina* Autor.) *flava*, *distans*, *patula*, *panicea* only appear on very high mountains in Spain and Portugal.

Agrostis vinealis is attached to the cooler regions of the South of Europe.

Aira flexuosa upon the highest northernmost mountains in Portugal; *A. cæspitosa* on elevated spots.

Holcus lanatus & *mollis* prefer the cooler regions of the most southern parts of Europe.

Ajuga reptans; *genevensis* are only found in the cooler parts of the most southern Europe, as also *Betonica officinalis*, *Lamium maculatum*, *Clinopodium vulgare*, *Melittis Melissophyllum*, *Prunella vulgaris*.

Melampyrum pratense in Portugal and Spain, only upon high mountains.

Plantago major prefers cool places in the most southern parts of Europe; so do *Dipsacus sylvestris*, *Galium Aparine*, *G. Mollugo*, *Valantia cruciata*.

Betula alba is a rare tree in Spain, Portugal, the South, and even the middle of France. It is only found there upon high mountains, on the Estrella, the Gerez, &c.

Ilex Aquifolium very common in the middle of France, in Portugal and Spain, only found in the cooler parts.

Primula acaulis common in England and the middle of France, is only met with in the cooler parts of Portugal.

Lysimachia nemorum upon high mountains in the South of Europe.

Campanula Rapunculus in the North of Portugal and Spain.

Rhamnus Frangula on the side of brooks and rivers of the North of Portugal.

Viola canina agrees only with cooler places in the most southern parts of Europe; *V. odorata* inhabits mountains only.

Thesium pratense upon the high mountains in Portugal.

Sanicula europæa on elevated shady places in Portugal and Spain.

Linum catharticum in the South of Europe upon high and cool mountains.

Corylus Avellana, *Ulmus campestris*, *Humulus Lupulus*, in cooler parts of the South of Europe.

Sambucus nigra is, indeed, cultivated throughout the South of Europe, yet in its wild state is only found there on high and rude mountains.

Anthericum ossifragum is very abundant upon the high mountains of Portugal.

Lilium Martagon only upon high craggy mountains in the South of Europe.

Juncus nemorosus POLLICH, only upon high mountains in Portugal; *J. vernalis* EHRH. descends lower, but still belongs to mountains. *J. campestris* spreads yet lower down; *J. squarrosus* on the highest mountains in Portugal.

Convallaria Polygonatum by the sides of cool brooks in the South of Europe; *C. majalis* is not found there at all.

Epilobium grandiflorum, *parviflorum*, *tetragonum* are found near the brooks of Northern Portugal; *E. montanum*, *angustifolium* are not inhabitants of the most southern parts of Europe.

Vaccinium Myrtillus. This is the only species of *Vaccinium*, which extends pretty far towards the South; in Portugal, however, it is only met with upon high and craggy northern mountains.

Acer Pseudò-Platanus in the North of Spain and Portugal, but not *A. platanoides*.

Quercus longipedunculata and *brevipedunculata*. Both trees become rare in Spain, and are only found on the tops and sides of high mountains.

The former is still scarcer than the latter, and in the most southern regions of Europe disappears entirely.

Scleranthus annuus and *Saponaria officinalis* on high spots in the South of Europe.

Arenaria trinervia upon pretty high mountains in the South of Europe.

Stellaria Holostea is fondest of cool places in the South of Europe; *S. graminea* is only found there on mountains.

Lychnis Flos cuculi in cool places in southern Europe.

Taxus baccata is only found, in the South of Europe, on very high and craggy mountains.

Chelidonium majus is less frequent in the South than in the North of Europe, and chooses cool places only.

Hypericum quadrangulare in the cooler spots of southern Europe.

Fagus castanea. The chesnut tree is peculiar to the middle of France and the North of Italy. In Spain and Portugal it is only found on high mountains and in cool places. *Fagus sylvatica* be-

comes less frequent even in France ; in Spain and Portugal it is scarcely to be found at all.

Pyrus communis appears rather to belong to the South than the North of Europe.

Cratægus Aria & *Sorbus aucuparia* are only seen upon the highest and very craggy northern mountains of Portugal.

Aquilegia vulgaris in cool places in the South of Europe.

Rubus cæsius only upon high and cool mountains in the South of Europe ; but *R. fruticosus* every where.

Fragaria vulgaris in cool shady spots of the South of Europe.

Helleborus foetidus plentifully in middle Europe ; in the South, upon high mountains.

Sonchus oleraceus lævis every where in the most southern parts of Europe ; *S. asper* in cool places only.

Hieracium Pilosella as well as *H. sylvaticum* only upon very high mountains in the South of Europe.

Tanacetum vulgare only upon high mountains

in the South of Europe ; as also *Matricaria Parthenium*, *Chrysanthemum corymbosum*.

Solidago virga aurea upon high hills in the South of Europe, as also *Asclepias Vincetoxicum*.

Artemisia Absinthium and *A. vulgaris* in the North of Portugal and Spain.

Achillæa Millefolium on high mountains in the South of Europe ; as likewise *Asclepias Vincetoxicum*.

Polypodium Filix mas, *P. Filix foemina*, *P. fragile* are found only in the South of Europe in high mountainous regions ; but *P. vulgare* is common every where ; *P. aculeatum* descends the farthest into the plain, the most so towards the South.

Osmunda Spicanthus Linn. is more frequent in the woody and mountainous countries of South Europe than in the North.

The mosses which are only found in high mountains in the southern parts of Europe are, *Buxbaumia foliosa* ; *Sphagna* ; *Polytrichum commune* (*P. juniperinum* and *P. piliferum* being much more common), *P. nanum* ; *Orthotrichum affine*, *striatum*, *crispum* ; *Hedwigia ciliata* ; *Dicranum scoparium*, *glaucum* ; *Trichostomum lanuginosum*,

canescens; *Mnium cuspidatum*, *undulatum*, *fontanum*; *Fissidens taxifolia*, *polycarpos*; *Neckera crispa*, *curtipendula*; *Leskea complanata*, *lucens*; *Hypnum nitens*, *proliferum*, *squarrosus*; *Bartramia pomiformis*.

Most *Jungermannia* (with the exception of *J. tamariscifolia* and *complanata*) grow, in the South of Europe, upon high mountains only; as does also *Anthoceros*.

Lichens, which likewise, in the South of Europe, are only found on high mountains, are, *Verrucaria tatarica*, *grumosa*; *Psora decipiens*; *Lobaria farfaracea*, *saxatilis*, *fahlunensis*, *rigida*, *saxicola*, *verrucosa*, *ciliaris*, *cæsia*, *muralis*, *phylloides*; *Peltigera papyracea*, *sylvatica*; *Stereocaulon paschale*, *fragile*, *lanatum*.

This catalogue will be considerably enlarged, when all the mountains of the southern parts of Europe have been more closely examined.

I now come to the consideration of the particular Floras, and shall begin with the countries that are the farthest to the West of Europe.

Portugal has three Floras, that of the South, that of the middle country, and that of the North. The countries near the Tagus, and upon the South side of this river belong to the first, with the exception, as usual, of some high mountains. This tract of land, not being separated by any natural boundaries from Andalusia, has many plants in common with it, as might be expected; but, on the other hand, not so many by far with the middle of Spain, and still fewer with the South of France. Only Sicily and the most southern parts of Provence bear some, though not a very strong, resemblance to these tracts in their vegetable productions. The Floras of Andalusia and the South of Portugal are those that resemble the most that of the coast of Barbary.—Here are some instances of plants, which formerly were thought peculiar to the North of Africa, but which are also found in the southern parts of Portugal and vice versa: *Scirpus pubescens* DESFONT. Fl. Atl., *Iris alata* LAM. *Festuca phleoides* DESF. *Stipa paleacea* VAÏLL., *Thymus Cephalotes*, *Phelypea lutea* DESF. *Urtica caudata* VAHL. *Cynoglossum pictum* VAHL, *C. clandestinum*

DESF. Also most of the Cisti, which cover large tracts of land in the South of Portugal, are met with in the North of Africa. Many others will be shewn hereafter in the Flora Lusitanica.*

These North African plants are only found in the plains and hotter districts; the woody mountains, on the contrary, yield some vegetable productions, which have hitherto been detected only in Madeira, such as *Myrica Faya*, *Pteris arguta*, *Trichomanes canariensis*, and some others. The calcareous mountains, even those of Algarve, have fewer North African plants, but more of those that belong to the other regions of the South of Europe. There are a greater number of plants, peculiar to the South of France, in Algarve than in Alentejo; and it is well known in the country, that the former (with the exception of some spots) is not so hot as the latter. The proximity of the sea, and a chain of mountains which extends almost to the sea, are evidently the causes of this

* Count HOFFMANNSEGG, who is returned from his botanical travels in Portugal, is now employed upon a Flora Lusitanica, which it is expected will soon appear. T.

phenomenon. The highest mountains in this tract of land afford particularly plants belonging to the South of France, and to the North of Italy. Another class of mountains, for instance those round Mertola, bear some plants peculiar to the middle of Spain.

The Flora of Middle Portugal is composed of the foregoing, and of the northern Flora of the same kingdom. It contains indeed far more plants of northern Europe, particularly such as are very universal, and marks as it were the boundaries between both; in the more elevated parts the northern Flora immediately presents itself.

The Flora of the North of Portugal has many peculiarities. That it should be nearly the same with that of Gallicia might be expected from their mutual proximity. With that of Biscay, as well as with that of the Asturias, it corresponds in many respects; but not in so many as might have been expected. A material cause of this difference consists in the hills of North Portugal being of granite, whilst those of North Spain are calcarious.

In the deeper parts not many more plants of the North of Europe are perceived than in the middle of Portugal ; but on the contrary, on the high mountains, especially in shady and boggy spots, they appear in abundance. On the sunny exposures of high mountains we meet with plants belonging to the South of France and the Middle of Spain.

The South-West of England singularly corresponds with many parts of Portugal, and especially with the northern and cooler districts, in its vegetable productions. The white Dog-rose (*Rosa arvensis*), which has hitherto been found only in England, is not uncommon in the hedges of the North of Portugal. Moreover *Spergula subulata* SMITH, *Sibthorpia europæa*, *Scutellaria minor* are to be found on the rocks of North Portugal ; while *Pinguicula lusitanica* has been discovered in England. Perhaps further examination would prove a still greater concordance.

Many plants are peculiar to North Portugal as *Antirrhinum triornithophorum* and *Omphalodes lusitanicum* TOURNEF. two very common plants in

the hedges of the high county of Beira and Entre Minho e Douro.

Comparatively speaking, Portugal has no great number of plants in common with the rest of Europe; and the resemblance of its Flora even to those of Spain and the South of France, is not found to correspond with the opinion that has been entertained of it. And on the other hand, its correspondence with that of the North coast of Africa, and with that of the South-western districts of England, is much stronger than could have been suspected. Scarcely any resemblance, or at least much less than what might have been suspected, exists between it and that of the Levant. I scarcely know one oriental plant which is to be found in Portugal.

The Portuguese Flora, when united with that of a part of South Spain, displays great originality; which is chiefly owing to the extensive sandy heaths and barren slate rocks, which in other European countries are not of such extent. A considerable number of the larger species of *Cistus*, to which heaths only are congenial, and such like plants, are

here in their favourite situation. The following may serve as the foundation of a more complete botanical view of this country.

The chain of the Gerez mountains in North Portugal, is high, well watered, and shady, where *Quercus Robur* and *Q. pubescens* WILLD. with the olive, grow in the greatest abundance. In the more elevated regions the birch, yew, and *Sorbus aucuparia* are found, and on the banks of the rivers *Rhamnus Frangula*. The underwood is *Erica arborea*, *Prunus lusitanica* and *Arbutus Unedo*. The still higher, and especially the shady parts, are full of plants of North Europe; which, mixed with the Portuguese plants, ascend to considerable heights; hence an extraordinary medley is produced. Thus upon one of the highest levels are found *Scirpus cæspitosus*, *Nardus stricta*, along with *Betula alba*, *Scrophularia sambucifolia*, &c. The middle regions abound in *Cytisi*, *Genistæ*, *Spartia*, of which only *Genista alba* LAM. is known; on lower mountains several *Cisti* especially *C. hirsutus* LAM. *C. scabrosus* H. Kew. *C. cheiranthoides* are common.

The whole province of Entre Minho e Douro, consists of shady cultivated vallies, in which some plants of North Europe, grow along with many beautiful ones peculiar to Portugal. Here are seen *Antirrhinum triornithophorum*, *Omphalodes lusi-tanicum* Tourn. *Spergula subulata*, *Sibthorpia Europæa*, *Aquilegia vulgaris*. Upon arid mountains are found the above mentioned *Cisti*; on the heaths, *Erica umbellata*, *E. Daboecia*, *E. cinerea*. The more elevated districts of Beira, particularly the shady well cultivated spots about Coimbra, afford a similar Flora.

The chain of the Marão-mountains is for the most part dry and naked, and of course not so rich in plants as the Gerez-mountains. Plants of North Europe are but scarce on the naked spots, except *Hieracium Pilosella* and a few more round the village of Campeam, where there is a small wood of birch, oaks, and *Cytisi*. These latter, the largest and most abundant species of which is as yet a non-descript, here attain a considerable height.

The deep vallies of Traz-os-montes, for instance the valley of the Douro, are distinguished by the production of Spanish plants.

The mountains along the Douro as well as the Cape Estrella, are naked and dry. They produce some plants of Northern Europe, as *Scleranthus annuus*, *Achillea Millefolium*, &c. with some few belonging to middle Spain, and several that are exclusively their own.

The Estrella is not so well watered nor so shady as the Gerez. On its higher regions we find, indeed, birch and mountain-ash, but, upon the whole, fewer plants of the North of Europe than on the Gerez. The under wood consists of *Erica arborea*, and *australis*, with some *Cytisi*. Their naked summits and rocky parts produce several plants belonging to the South of France, but none belonging to the North of Europe. From this it appears, that it is the want of shade which principally prevents the extending of these plants.

The heaths of Middle Portugal are covered with *Pinus maritima* GERARD. The most common *Cisti* upon them are *C. Cheiranthoides*, *C. sambu-*

cifolius ; the usual heaths, *Erica cinerea* and *E. umbellata*. They have also many plants exclusively their own, as *Scilla unifolia*, *Hypericum linifolium* and several which are yet undescribed.

The hills on the borders of the Tagus, especially near Lisbon, which are composed of limestone and basalt, afford an uncommonly rich Flora. We find there many plants which are peculiar to North Africa ; many are common throughout the South of Europe, such as the *Trifolia*, *Medicagines*, &c. and finally an abundance of Portuguese plants and such as are peculiarly their own.

The Cintra chain of mountains produces some plants of North Portugal, some few of North Europe, and some peculiar to Madeira. Hence the Flora of these mountains is very complicated, but highly interesting.

The heaths of Alentejo are of two sorts ; those which consist of deep sand are rich in *Cisti*, and many other plants, peculiar to these parts or otherwise only to be found in North Africa. The dry heaths, which have a covering of granite gravel

are cloathed with *Cistus ladaniferus* and *monspeliensis*, and but poor in other plants ; though several rare vegetables, peculiar to Portugal, are there discovered. Serra da Arabida, a chain of calcareous mountains, strongly resembles those of Algarve, except that there are some shady spots in which are found some rare and mostly undescribed plants. The country bordering upon the Guadiana is full of vegetables peculiar to Spain.

Serra de Monchique has some few plants peculiar to North Europe, some to Madeira, and others to the South of France. *Rhododendron ponticum* is the common underwood on the sides of the brooks.

Spain in proportion as it is more extensive, is also more varied in its productions than Portugal. The first that presents itself for distinction is the Flora of the Pyrenees; this is rich in peculiar plants, that are not met with on the more elevated parts of those mountains, which constitute the branches of the Pyrenees, as for instance in Biscay and Catalonia; somewhat lower we come to plants indigenous to southern France.

The Flora of New and Old Castile, and of a part of Estremadura, is a singular and very distinct Flora from the rest. The plains of sand and gypsum, in these provinces, produce a medley of peculiar plants most exclusively their own. *Lœflingia*, *Queria*, *Minuartia*, &c. are well known; but a great number of them, even of those in the neighbourhood of Aranguez, are yet undescribed. The chain of mountains have also many that are peculiarly their own, although not in proportion to the plains. The excessive heat of the summer, the intense cold of the winters, the shadeless plains, and the gypscous soil, considered elsewhere as phænomena, are here in the order of nature.

The Flora of Valencia, especially that of the range of the calcareous mountains, which run through the whole of that province and part of Catalonia, has many peculiarities. The species of *Teucrium* are here in abundant diversity, as also *Cistus*, *Sideritis*, &c. Of *Cistus*, however, only the smaller species are found, the larger ones belong to the hot sandy heaths of Andalusia and Portugal.

The Floras of Galicia and Andalusia appear to harmonize with those of North and South Portugal.

South Germany, Northern and Middle France, and the South of England, have, altogether, great resemblance to each other; and it appears from mineralogical geography, how much they agree on the whole in their respective soils, and how widely these latter differ from the soil on the other side of the pyrenees. The South of France, that tract of land which Linnæus called *Gallia narbonensis*, perhaps the richest country of all Europe in the diversity of vegetable genera, has a Flora peculiar to itself; which only extends over the middle sized mountains beyond the pyrenees. Provence has plants peculiar to South France, but not in great abundance.

The following is a catalogue of plants which are frequent in North Europe, but not found in the South of Spain and Portugal:

Veronica Chamædris, *triphyllos*, *verna*.

Orchis bifolia, *mascula*.

Ophrys ovata.

Salix pentandra, *Caprea*, *acuminata*.

Valeriana officinalis, *dioica*.

Scabiosa succisa, *arvensis*.

Plantago major, *lanceolata*, *maritima*,

Galium verum, *sylvaticum*.

Asperula odorata.

Alchemilla vulgaris.

Cuscuta europæa. *Viscum album*.

Pulmonaria officinalis.

Lithospermum officinale. *Lycopsis arvensis*.

Asperugo procumbens.

Cynoglossum officinale. *Anchusa officinalis*.

Primula veris & *elatior*.

Menyanthes trifoliata. *Hottonia palustris*.

Verbascum Thapsus, *nigrum*.

Vinca minor.

Phyteuma spicata.

Campanula rotundifolia, *Trachelium*, *glomerata*.

Lonicera Xylosteum.

Rhamnus catharticus.

Omnes *Ribesii* species.

Evonymus europæus,

- Gentiana campestris*, *cruciata*.
Chenopodium bonus Henricus, *rubrum*, *glaucum*,
hybridum, *polyspermum*.
Bupleurum rotundifolium, *falcatum*.
Sium latifolium, *angustifolium*.
Aethusa Cynapium.
Chærophylum sylvestre.
Cicuta virosa. *Pastinaca sativa*.
Aegopodium podagraria.
Pimpinella saxifraga. *Carum Carvi*.
Viburnum Opulus.
Sambucus racemosa.
Parnassia palustris.
Drosera rotundifolia, *longifolia*.
Berberis vulgaris.
Allium Scorodoprasum.
Convallaria majalis, *bifolia*.
Ornithogalum luteum, *minimum* and all related
species.
Aristolochia Clematitis.
Trientalis europæa.
Vaccinium vitis Idæa, *uliginosum*, *Oxycoccus*.

Polygonum Bistorta.

Adoxa Moschatellina, *Paris quadrifolia*,

Mercurialis perennis.

Monotropa Hypopithys.

All species of *Pyrola*.

Ledum palustre. *Andromeda polifolia*.

Dianthus Carthusianorum, *Armeria, deltoideus*,
superbus.

Arenaria peploides.

Oxalis acetosella.

Prunus Padus. *Cratægus torminalis*,

Spiræa Ulmaria.

Rubus idæus.

Tormentilla erecta. *Potentilla Anserina*, *verna*,
argentea.

Geum urbanum, *rivale*.

Comarum palustre.

Anemone Hepatica, *pratensis*, *sylvatica*, *nemo-*
rosa, *ranunculoides*.

Ranunculus auricomus, *lanuginosus*.

Trollius europæus.

Calla palustris. *Arum maculatum*,

- Fagus sylvatica*.
Leonurus Cardiaca.
Galeopsis Ladanum, *Tetrahit*, *Galeobdolon*.
Stachys sylvatica, *palustris*, *recta*.
Nepeta Cataria.
Scutellaria galericulata.
Thymus Acinos.
Euphrasia officinalis, *odontites*.
Rhinanthus Crista galli.
Melampyrum cristatum, *arvense*, *nemorosum*,
sylvaticum.
Lathræa Squamaria.
Antirrhinum Linaria.
Draba verna. *Alyssum incanum*, *calycinum*.
Cochlearia Armoracia.
Thlaspi arvense.
Erysimum officinale, *Alliaria*.
Sisymbrium Sophia.
Brassica orientalis.
Turritis glabra.
Crambe maritima.
Pinus sylvestris, *Abies*, &c.

Juniperus communis.

Fumaria cava, solida.

Orobus vernus, tuberosus, niger.

Lathyrus pratensis, sylvestris, tuberosus.

Vicia sepium.

Astragalus glycyphyllus.

Medicago falcata.

Tragopogon pratense.

Leontodon autumnale, hispidum.

Prenanthes muralis.

Hieracium paludosum, sabaudum, umbellatum.

Sonchus arvensis.

Lapsana communis.

Carlina vulgaris. Cnicus oleraceus,

Carduus crispus, acaulis.

Onopordon Acanthium.

Serratula tinctoria.

Gnaphalium dioicum, arenarium, sylvaticum,

Chrysanthemum Leucanthemum,

Erigeron acre.

Cineraria palustris.

All species of *Tussilago*.

Achillea ptarmica.

Centaurea Cyanus, *Jacea*.

Schoenus compressus.

Scirpus sylvaticus.

Eriophorum polystachion.

Alopecurus pratensis, *geniculatus*, *arvensis*.

Agrostis vulgaris, *hispida*.

Aira aquatica.

Poa aquatica, *trivialis* autor. (*pratensis* WILLD.)

is at least very scarce in the South ; *compressa*,
angustifolia, *nemoralis*, *cristata*.

Cynosurus cristatus.

Avena elatior, *pubescens*.

Elymus arenarius.

Carex dioica, *pulicaris*, *remota*, *digitata*, *praecox*

IACQ. pallescens, *Pseudocyperus*, *vesicaria*, *hirta*.

Ophioglossum vulgatum. *Osmunda Lunaria*.

All species of *Lycopodium* to be met with in the
Northern parts of Europe.

Polypodium Thelypteris, *Dryopteris*, *phegopteris*.

All species of *Phascum* ; *Gymnostomum ovatum* ;

Tetraphis pellucida ; *Leersia vulgaris* ; *Grimmia*
apocarpa ; *Orthotrichum anomalum* ; *Leskea*

polyantha; Hypnum triquetrum, serpens, abietinum, crista castrensis; Webera pomiformis.

Marchantia polymorpha.

Bacomyces vulgaris.

Lobaria pulverulenta, stellaris, pulmonaris, fraxinea.

ON THE NATURE AND MODE OF PRODUCTION
OF
AGALLOCHUM OR ALOES-WOOD.

BY I. DE LOUREIRO.

[Translated from the Portuguese.]*

WE find by the works of DIOSCORIDES, ORIBASIIUS, and P. AEGYNETA, that the vegetable production, commonly called Aloes-wood, has been known time immemorial, and that it was in use among the Greeks under the name of Agallochon, in latter times under that of Xylaloe. The Romans called it Lignum Aloes and Agallochum. PLINY mentions it under the name of Tarum. The Arabian naturalists adopted the greek denomination and called it Agalugin. Of these AVI-

* Memorias da Academia Real das Sciencias de Lisboa, Vol. I.
p. 402—415.

CENNA, SERAPIAS, RHASIS, ISAAC, and AVERROES are particular in their mention of it.

Before the Portuguese had in the fifteenth century with a perseverance truly heroic, by doubling the Cape of Good Hope, opened to the world the direct commerce of India (where only it is to be found), it had been imported thence to Arabia and afterwards by way of Suez to Cairo and Alexandria; from which port it was brought by the Venetians to Europe. But previous to this, and even before the Christian era, it was carried, with other valuable Asiatic commodities, from the East to the West, by the merchants of Tyre and Phœnicia; who, in those times, were of all nations the most skilled in the arts of navigation and commerce.

The tree which yields this valuable material, is a native of that part of India, which lies beyond the Ganges, and there only in some places not far removed from the Equinoctial line, as in the kingdoms of Cochin China, Laos and Siam. In the kingdom of Tonquin it is only found in small quantity,

and of an inferior quality. Some seem to think that it exists likewise in China, but this I doubt; for that which is sold at Canton, and thence distributed over the whole empire, and also over Japan, Malacca, Surate, and Arabia, appears evidently to have been bought in the ports of Cochin China. We find that when by the devastation of continued wars, which were only ended in the year 1773, in which the tyrant Nhai revolted, this kingdom no longer possessed a sufficient number of hands to collect the aloes-wood in the deserts and on the mountains of the western regions; the sale of this valuable article then also ceased in the emporium of China.

In the islands of Borneo, Macassar, the Moluccas, Sumatra, at Malabar, Pegu, and in the territories of Malacca, are also found some sweet-scented sorts of wood, which I have seen and which have been by some authors called Páo de Aguila (Aloes-wood) but they are far inferior both in scent and virtue, and are sold at a much cheaper rate.

But however distinct from each other, the trees are, which afford these species of wood, the ignorance of travellers, and the avarice of the druggists, suffer them all to go under the appellation of true Aloes-wood.

Among these substitutes, that species which is found (and really taken by some for the genuine one) in the Malacca Territory, where it is known according to RUMPHIUS* by the name of Garo Malacca, appears to be the best. But then Rumphius, who, in the year 1693, received some branches with both leaves and fruit, gives a figure of the latter† which is made to resemble a small plum; the inner side is divided into two or four cells with as many seeds. Hence I infer, that this tree is not the true *Agallochum*, the fruit of which (as will be hereafter shewn) is a sort of woody monospermous pod.‡

* Rumph. Herbar. Amb. 2 cap. 12.

† L. c. tab. 10.

‡ Though the figure mentioned in *Herbarium Amboinense* is not exactly like Loureiro's plant in the Banksian herbarium, yet from the description of Rumphius and some allowance necessary to be made for the stiffness of almost all the figures of that work, it appears that both

Those authors who have endeavoured to obtain correct information of this vegetable on the spot, and whose descriptions (though neither clear nor scientific) come nearest to truth, are the above Rumphius and the famous Portuguese naturalist GARCIA DE HORTA, the latter of whom describes it in his treatise on spices*, which appeared first in Portuguese and was afterwards translated into other languages. Many other authors, ancient and modern, mention the Aloes-wood as an object of profit to merchants, as an article used in temples, as a perfume, &c. ; but as relative to Botany it has not hitherto been sufficiently attended to. It was known to be the produce of a tree, but the tree itself and the manner in which it produces the Aloes-wood was unknown. Some attempted to describe the plant without having seen

are the same. As for the fruit, the representation in Rumph. Herb. Amb. certainly does not agree with the description, the author of the above paper gives of it, but approaches nearer to the figure of Cavanilles (Dis. Botan. t. 224) given from a fruit which was brought from India by Sonnerat. Rumphius owns that the fruit which he represented had not been found growing upon the branch of the tree which he received, but only tied to it. T.

* Garc ab Storto de Arom. l. 1. c. 16.

it, and consequently were wide of the truth; others passed it over in silence, because they knew nothing of it. Among these is LINNÆUS, who has not introduced it in his *Systema Plantarum*; being, however, obliged to mention it in his *Materia Medica*,* he describes it as a poisonous, corroding, inebriating plant, belonging to *Ficus*, and lactescent; which is contrary to truth.† Afterwards, indeed, BERGIUS‡ quoted WEDEL, who considers it as an excellent medicine not at all violent in its operation.

I had opportunity of seeing and of examining it during many years, while employed in the mission to Cochin China, its native country;

* Linnæi *Materia Medica*, Amst. 1749, p. 184.

† Linnæus, mentioning the *Agallochum* in his *Materia Medica* as a poisonous drug, does not allude to the plant of Loureiro, but to that which he himself afterwards called *Excoecaria Agallochum*, and which, according to Rumphius (*Herb. Amboin. Vol. 2. p. 237*) yields likewise a substance scarcely to be distinguished from the true *Agallochum*. That Linnæus referred it to *Ficus* in the mentioned work, was a mistake, which (not knowing the true plant producing the drug) he seems to have been led into by the analogy of the milky juice of *Excoecaria*. Mr. von Schreber in his editions of Linnæus's *Materia Medica* suggests, indeed, his doubts of its belonging to that genus. T.

‡ Bergii. *Mat. Med. e regno veget. Vol. II. p. 993.*

and where it is found more plentifully and of better quality than in any other part of the world. But even there to acquire a thorough knowledge of, and to become intimately acquainted with its history; much assiduity and labour is requisite, as these trees are only to be met with at a great distance from the inhabited parts of the country, on elevated and chiefly deserted tracts, extending for more than eleven degrees in the direction of N. W. inclining to W. and separating the kingdom of Laos from those of Tonquin, Cochin China and Champá.

The tree which gives us the true Aloes-wood is of considerable size and its branches ascending. Its bark is smooth, consisting of strong, flexible, threadlike fibres, resembling those of hemp.

The wood is white, not very hard, and destitute of coloured veins. Leaves alternate, lanceolate, coriaceous, smooth, flat and undivided. Flowers terminating the branches in small corymbi. Each has a calyx of four acute, hairy, deciduous leaflets; the under one curved, bent inward, crescent-

shaped, and almost double the length of the rest. Corolla of six unequal petals, longer than the calyx. Filaments distinct, ten. Style simple. Fruit an oblong, acuminate, crescent-shaped, ligneous pod, with a single seed of the same form, surrounded by an aril.

From the examination of its flowers, it appears to constitute a new genus, belonging to Decandria Monogynia of Linnæus, and which I have distinguished by the names of *Aloexylum verum*, the first of them meaning the same as Xylo-Aloe or Aloeslignum, a name by which it was already known.

But why is the wood of the *Aloexylum* white, even, and destitute of coloured veins, as the pieces of *Agallochum* are uneven, dark-coloured and with large veins? Why is no oily and resinous matter perceivable in the former, since the latter abounds with it? Why is the mother-tree insipid and scentless, as the *Agallochum* is remarkable for its bitter taste, and strong pleasing scent, in which its virtue and consequent value reside? This physical metamorphosis, displaying such distinct

qualities, and affording such unforeseen results in the same subject, I shall now explain from the observations I have made.

The manner in which *Agallochum* is formed within its mother-tree, is analogous to that by which scirrhus tumours, consequent gangren, and mortification are produced in animal bodies; which, unless checked in their progress by art, prove fatal. Now it often happens in various parts of the trunk or branches of the *Aloexylum*, that its alimentary juices, rising in an unconcocted state, (hence too thick or too viscous for the slender and confined passage afforded by the vertical vessels) form these obstructions, which are constantly increasing by the accumulations of others that continue to be impelled towards them from the root; and whilst the more subtle parts exhale by the lateral vessels and pores in the bark, the thicker and oily ones remain behind, and in the course of time are coagulated into a resinous mass. This when accumulated to a sufficient degree, extends and bursts the vessels and channels in which it

was contained, and then presents a shapeless, hard, dark coloured, fragrant mass, full of coarse veins, called Agallochum.

Thus this substance, however precious, is the immediate result of disease, and often contains a *Teredo* and a brown species of *Meloe*; which, by gnawing and penetrating into the interior of the stem, give it the rugged appearance we perceive in the pieces, and bore them full of holes. The disease having spread far into the stem, the upper part at least loses its communication with the lower part through which it received its support and aliment; while the sound parts of the tree decay, and yield their precious perfume, by the production of which it had paved its way to its own destruction; and, as *OVID* sings of the *Phœnix*:

Se super imponit finitque in odoribus ævum.

As the Agallochum-trade is very lucrative in the East, the natives of those regions go every year in search of it, at the expence of much hazard and labour, among the mountains; for which purpose they keep together in bodies of ten, twenty or

more, with provisions for a month, and with arms for defence against the wild beasts ; such as tigers, rhinoceroses, elephants and snakes, which abound in those parts; and with implements requisite for cutting the wood. They traverse the distant parts of forests, and examine every *Aloexylum*-tree they find. Such as are very healthy and have green leaves they pass by ; those on the other hand, which are either already dead, or have their leaves of a pale yellow hue (a symptom of approaching dissolution), they immediately fell, cut them open in a longitudinal direction with their hatchets, and discover the object of their pursuit. They sometimes find it accumulated into large pieces, one Arroba or more in weight, sometimes only into smaller ones of a few pounds, according to the length of time the tree may have been deceased.

The traders distinguish three sorts of true *Agallochum* produced by the *Aloexylum*-tree. The first the Europeans call Calambá ; the natives of Cochin China, Kì-nam. This is the most valuable and rare, being found in Cochin China only ; and there, only upon those mountains which lie towards

the west from the province of Binh-Khang, formerly a part of the kingdom of Siampa in the latitude 30° North.

The Calambá is of a brown or dark yellow colour, mixed with black; it consists of coarse fibres, intermixed with numerous veins of resin; so that when placed over a fire, it evaporates almost entirely, and sheds a most sweet and permanent perfume. Newly gathered, it is softish, but becomes gradually harder. Those who fetch it annually from the forests, find it in very small quantities, and are obliged, under the penalty of death, to deliver the whole of it to their king, who applies it to his own use in the palace, and gives away some few ounces to his favourites, and but seldom sells it.

The second species, which is commonly called Páo de Aguila by the Portuguese, Frâm-huong by the natives, has the same scent as the former, but neither so penetrating or delicate; and is therefore far less valuable. Upon being evaporated, it leaves more residuum, and does not show those coarse threads and resinous veins so remarkable in

the Calambá, except when counterfeited by the external application of hot irons, which the druggists use, to give it the appearance of the genuine Calambá. That Páo de Aguila which is the heaviest, and sinks in water, is esteemed the best; though I have found pieces of less specific gravity, and not so dark coloured, which had however a very strong and pleasant smell.

There is one sort of a pale hue, which is taken from trees, long perished, and which have by exposure to the weather, lost much of its fragrance and virtue; this is called by the natives *Huong-tu*, or dead Aloes-wood. Another sort of an ash-colour, called *Huong-sinh*, or living Aloes-wood, is superior to this; being obtained from trees still living, or newly dead, and consequently in better preservation.

A third species, called by the natives simply *Huong* (perfume), is the least valuable, as well in regard to specific gravity, as in scent and virtue; it is taken from trees in which it had scarcely begun to form. This species is entirely white inside, as is the sound part of the tree, or it con-

tains some small black knots which have just begun to form. The outside, however, is often found of the same colour and shape as that of the best *Agallochum*, which it owes to the black colour, wax, and hot irons employed by the druggists to impose upon unexperienced purchasers. It has some smell, but a weaker and less agreeable than the other two species, and therefore sells much cheaper.

In some parts of the East, the *Agallochum* is frequently used as a corroborant, and in some degree astringent medicine. Its smoke revives the animal spirits, and is efficacious in vertigo from debility; but not in that kind which proceeds from hysterical affections. Taken in the form of powder or pills, it promotes digestion, checks vomiting and diarrhœa.

As for the economical uses of the *Aloexylum*-tree, the natives of Tonquin and Cochin China make writing paper of it. To do this, they macerate the bark in water for some days, and having reduced it, by beating, into a pulp, they put it into

moulds. The paper thus prepared is not so white as common European paper, but thinner and more durable.

The perfume of Agallochum, especially that called Calambà, is very much esteemed in all parts of the East. In their temples the natives burn it upon their altars, either unmixed or formed into lozenges with other odoriferous ingredients, as sandel-wood, benzoin or musk. The princes of Japan, China, Cochin China, and Siam, have censers of gold or silver for this purpose; these are nearly filled with pure sifted ashes, upon which a live coal, without flame, or smoke, is placed to receive the Calambá. The vessel is so placed and arranged, that the smoke, which rises in a fine white thread-like stream, inclines towards and perfumes the guest on whom they wish to bestow honor or attention. The Chinese and Japanese use this ceremony when they take their tea, the Turks and Persians at their coffee or sherbet.

In Indostan, they generally embalm their dead

bodies with compositions of sandel-wood and other precious odoriferous substances, but for kings and princes the Agallochum is used, the fragrance of which keeps for a longer time and extends farther.

ON THE GENERA OF ORCHIDEÆ,
AND THEIR SYSTEMATICAL ARRANGEMENT.

By PROF. O. SWARZ.

[Translated from the Swedish.]*

THE Orchideæ have been considered, ever since MORISON's time, as belonging to a proper natural family, easily distinguished by the following characters; leaves undivided, and generally reticulately veined; flowers mostly polyphyllous, situated above the germ, and having one of the petal-like leaflets differently shaped from the others; fruit unilocular, opening, when ripe, by three valves, and scattering its seeds as fine as dust; a peculiar smell, proceeding either from the root or from the inner parts of the flower. But in defining and distinguishing the various genera from one another,

* Kongl. Vetenskaps Academiens nya Handlingar. 1800. p. 115. seq.

each founder of a system has pursued a different method.

TOURNEFORT was the first who undertook this task; it was not, however, from the peculiar figure or internal structure of the flower, but from the habit of the whole plant, that he constructed the generic characters of his *Nidus avis*, *Limodorum*, *Ophrys*, *Orchis*, *Helleborine*, and *Calceolus*. RAY, RIVINUS, and BOERHAAVE followed him in this. C. KNAUT and KRAMER took their characters (though not with great success) from the spur and other external parts, and partly even from the root. WEDEL gave six petal-like leaflets to the flowers of Orchideæ; three of which he termed the calyx, and distinguished his genera by the difference of the lip. LUDWIG defined them (as did also HALLER at first) by the form of the root. MICHELI also made use of this part for the forming of some genera of this natural order.

LINNÆUS, endeavouring to extract better characters than those given by his predecessors, distinguished the plants of his twentieth class (*Gynandria*) from the others, by their male parts

being situated upon the style, or upon an elongated receptacle analogous to it, bearing both pistil and stamens. All the genera of the first order (to which his Orchideæ belong) were required to be diandrous. The essential characters of the different genera he borrowed from the external parts of the flower, partly from the *Labium nectarii* (or *nectarium*, as he sometimes calls it), and partly from the spurs, when present. These characters appeared for the first time in the *Genera plantarum*; in a subsequent edition he still retains them, and in the fifth changes a part, and gives up some genera, the species of which he transfers to others, and finally establishes the characters of Orchideæ as follows: *Filamenta semper duo brevissima; stylus vix distinctus; antheræ binæ nudæ tunica carentes, cellulis tectæ quæ deorsum aperiuntur, &c.* Further experience has shewn how uncertain and insufficient this was.

While these improvements, or rather changes, were making, HALLER, by his assiduous examination of more than fifty species of Orchideæ growing wild, was enabled to propose characters,

which (in his opinion) were sufficient for distinguishing the different genera. From the changes to which the lip and spur are subject, this naturalist endeavoured (perhaps with reason), to demonstrate the insufficiency of the Linnean arrangement of Orchideæ, and therefore founded his own upon the parts peculiarly belonging to fructification, or what he calls *machina staminifera, in qua fovea unguinosa est, quæ ad ovaria videtur ducere*.^{*} His method, however, has not been so generally adopted as that of Linnæus, though CRANTZ endeavoured to give it additional strength, and SCOPOLI adopted it in his Flora Carniolica, as well as ALLIONI in his Flora of Piedmont.

In the mean time ADANSON had given an arrangement, comprehending seven of the eight Linnean genera; founding it, however, on such uncertain characters, as *petala convoluta, pendencia, &c.* it would not merit to be mentioned, were it not for his having first guessed, that the Orchideæ had only a single bilocular anther; on which I shall presently remark further.

^{*} Act. Helv. T. 4. p. 91.

Others (as GLEDITSCH, &c.), though authors of systems distinct from that of LINNÆUS, have retained the essential characters, which this naturalist had prefixed to his genera of Orchideæ.

JUSSIEU, in his excellent work, *Genera plantar. secund. Ord. nat. disposita*, ranking the Orchideæ among his "*Monocotyledones staminibus epigynis*," certainly adopts a new principle of definition in the order; but in establishing its genera he mostly makes use of the same characters as Linnæus, viz. *Cornu* and *Labellum*, or what he calls *lacinia inferior calycis*.

THUNBERG, who has carefully examined many Cape-species, which in fact possess still greater peculiarities than the European ones, has given,* together with his general observations on the natural order, his arrangement of its genera, which is taken, like that of Linnæus, partly from the *cornu nectarii*, and partly from the *labellum* and *corolla*.

GAERTNER and NECKER must likewise be mentioned here. In the unparalleled work of the

* Tranfact. Soc. reg. Stockh. 1786. p. 254.

former, the fruits of *Epidendrum* and *Serapias* are very well represented. The essential characters of these two genera, he appears to have taken from the interior parts of the flower, as well as of the fruit, in which he has followed HALLER; though, with regard to the nature of these parts, both naturalists seem to be of different opinions. NECKER, the all-changing author of *Phytozoologia philosophica*, has founded his *species naturales sinarmophytæ** (as he calls them), as well upon the difference in the lip and spur (the whole of which he terms *productum*), and the nature of the fruit, as upon the situation of the flower, and the conformation of the root.

From what I have said, it appears that most attention has been paid to the exterior of the flower, and indeed, I think, that good characters taken from parts easily to be discovered, ought in general to be preferred; but as those of the Orchideæ do not always unite species naturally related, it will perhaps be necessary to find out

* Elem. bot. T. 3. p. 125.

others which are certain, without doing violence to nature.

It is with this view, that I propose giving the outlines of a new systematical arrangement of the whole order of Orchideæ. This I may perhaps be the more justified in attempting, as I have had the advantage of examining a considerable number of these singular vegetables in their native climate, the West-Indies; and, through the kindness of Prof. THUNBERG, SPARRMANN and AFZELIUS, of many African Orchideæ, brought by them from that part of the globe. Nor is the number of those considered European ones, which have fallen under my examination, by any means inconsiderable; in short, after having minutely examined more than two hundred different species, I think it incumbent upon me to communicate the results of my observations to the botanical world.

It will be found that I have often changed the generic, and more frequently still the specific, characters; adding several genera, and removing others to very different places, which, in my opinion, they ought to occupy. Perhaps I shall be

reproached for having too much multiplied the genera, since HALLER and CRANTZ justly diminished the number of those established by LINNÆUS; but as I have examined four times more species than these botanists were acquainted with, I hope to meet the approbation of those who know how necessary, in an artificial system, it often is, for the sake of facilitating the determination of plants and preventing confusion, to separate species which *seem* to be naturally allied, provided that good distinguishing characters can be found. This necessity will be still more evident, when we consider how many remain undiscovered. The authors of the new *Flora Peruviana et Chilensis* call the region of the Cordilleras the country of Orchideæ; and state, that more than a thousand distinct species of them may there be found within a very small tract of country.

Previous to my proposing the changes I have made with respect to the generic characters of the Orchideæ, I think it necessary to say something of the manner in which the fructification of these

plants is performed, and of the very differently constructed parts that are instrumental to it.

One part belonging to the flowers of Orchideæ is a leaf, larger or less, situated beneath the germ, of each flower, and generally of a thinner texture than the other leaves of the plant. This LINNÆUS called *spatha*, and to the whole he gave the name of *spadix*. Compared with those of other plants, these leaves are in fact nothing else than *bractææ*, as Linnæus himself calls them in his description of several Orchides.

However irregular and various in the shape of their flowers, all the Orchideæ agree in their habit.* The flower consists of a calyx, generally called *corolla*, situated above the germ, and consisting of several leaflets, two, three or five of which are apparently placed outside; but two of them are constantly found placed within the outer, with which they alternate. In some few the outer leaflets cohere at the base, the inner being entirely free (*Stelis*, *Lepanthes*); in others, both the inner and outer cohere at their bases (*Satyrium* Thunb.);

*Hence a botanical term, *flos orchideæ*.

and the calyx of *Orchis Burmannia* has a real tube. In this latter, it might as well be called quinquepartite; but this case is very rare, the calyx being generally pentaphyllous. Both in flowers that entirely expand, and in those that connive, and are as it were ringent or vaulted, that leaflet of the calyx which is situated behind the back of the style, and is generally broader, forms, either alone or unitedly with the two inner lateral ones, a helmet or fornix, beneath which the parts of fructification are situated. These leaflets are generally coloured, particularly the inner ones; whence, by some (though without reason), a pentapetalous corolla has been attributed to the *Orchideæ*. Other botanists (as WEDEL), observing the outer leaflets to be commonly larger, thicker, less coloured, remaining longer after fructification, and surrounding the two inner ones; and these, on the other hand, together with the third (generally called lip or nectary) appearing later, thinner, and, in certain genera, rather unlike the former, more shining and differently coloured,—attributed to the plants of this order, a three leaved

calyx, and a corolla of three petals. But these characters, far from being universal, can perhaps only be applied to some few plants of this natural order. We generally find those leaflets which principally constitute the flower, to be *cuticulæ germinis continua s. adnata*, by which the calyx may in most cases be distinguished from the corolla. The two inner lateral leaflets have, indeed, often a more immediate connexion with the parts of fructification; but, being partly or entirely united by means of the outer surface of their bases with those of the outer leaflets, they cannot be considered as true petals, except in some few where they communicate (as well as the lip) with the style, nay are even placed upon the body of it. (*Disa melaleuca*.)

Owing to the above-mentioned variations, the character given by the great French botanist to the Orchideæ, *Calyx sexpartitus, laciniis quinque superioribus, sexta inferiore majore & dissimili*, is not to be admitted, as both the number and situation of the leaflets are subject to change; and what he calls the sixth I consider as the corolla of these singular

flowers. My reasons for this I shall give hereafter. Mean time, I consider the Orchidæ as an exception in this respect to the rest of Monocotyledonous plants, which are destitute of a corolla.

The lowermost third inner leaflet, situated between and within the two outer leaves of the calyx, and fixed opposite the uppermost outer one, to the lower or upper end of the style, has been called either the nectary itself or its under lip, *labium inferius nectarii*, by some; and considered by others as a part properly belonging to the corolla. I have the same idea, as I find this part to have a similar insertion with other petals; and, like a corolla, to be connected with the parts of fructification. Nor can I consider it as a continuation of the cuticle of the germ; not to mention the remarkably anomalous form and construction I generally find it possessed of. There are, indeed, genera in which it is not unlike the leaf of the calyx, as in *Thelymitra* and others, which have the divisions of the calyx united with

* BORKHAUSEN'S botanisches Wörterbuch (botanical dictionary)
v. 100. 2. 70.

it at the base, and seem to confirm what JUSSIEU says of its inseparability from the calyx; but in fact their separate insertion may easily be distinguished.* And genera also occur in which this petal is situated upon the upper part of the style itself, without the least connexion with the germen or calyx (as in *Pterygodium*, *Corycium*), which is a further confirmation that this part of the flower is distinct from the others. I know but one single genus, in which it is wanting; and in this the deficiency appears to be supplied by two small petals inserted at the sides of the sexual parts (*Lepanthes*).

From the situation and form of this part of the flower, I have been induced to call it the lip (labellum). It is found of different forms, many-parted, fringed, cut, inflated, coloured, and often the whole beauty of the flower consists in it. Sometimes it is furnished at its insertion, but very seldom at the upper extremity (as in *Aerides*),

* In some *Epipactides* (as *Nidus avis*) this petal, though fixed to the style, appears to be united by its under surface with the skin of the germen. The same is the case with the hinder part of the spur in several *Orchideæ*. But this is not a general rule.

with something that might properly be called nectarium. This consists of a longer or shorter, pointed or blunt spur, sometimes in the form of a purse, pit, &c;* sometimes entirely empty, at other times filled with a small quantity of liquid. In some genera it is not found at all, though the lip be not wanting (Ophrys, &c.). It is therefore not consistent to consider the labellum as a part of the nectarium, which some botanists have thought necessarily to belong to the Orchidæ; or as the nectarium itself, which has been done by others. This is so much the more obvious as such spur- or purse-like elongations are also found (and sometimes double) upon the back-part of the upper vaulted leaf of the calyx, situated opposite the labellum (*Disa*, *Satyrion*). Sometimes, however, when these excrescencies are wanting both upon the helmet and lip, the lateral leaves of the calyx themselves are pursed or concave (*Corycium*, *Pterygodium*, *Disperis*). That in several Orchidæ any nectareous liquid should be secreted at the lower part of the lip, I can deny.

* This might be called with a general name *Calcar* instead of *Cornu*.

But, however analogous the outer parts of the flower of Orchideæ may be to those of other orders, they differ widely with regard to those that are peculiarly allotted to the office of fructification; the sexual parts of the Orchideæ being constructed in the most anomalous manner.

The germ (germen or ovarium), as we have before noticed, is always situated beneath the corolla; round or oblong, angulated, frequently somewhat twisted (for which reason the position of the flower is different before and after the development), generally sessile, sometimes pedunculated, (as in *Arethusa gentianoides*), and often, especially before impregnation, so small, that it resembles a peduncle. From its upper end ascends, within the corolla, a fleshy, thick, roundish, pointed or blunt, straight or incurved style, channelled in front, and bearing on its upper extremity the male organs without filaments.

These male organs consist of masses of pollen, and a containing membrane. LINNÆUS, (who says that the lip, his *labium inferius nectarii*, was, in those species which he examined, united or cohe-

rent on the other side with the style, and considers both these parts of the nectary), calls that small part, which is situated upon the style, either fixed or moveably, *labium superius*; the two apertures or loculaments of which he describes as a *duplicatura bilocularis*, formed by the same upper lip for the covering of the pollen-masses contained within, and to which he gave the name of Anthers.

This part is no more deserving the name of *labium superius nectarii* than that of *labium superius corollæ*. Of all the Orchideæ yet known to me, *Cypripedium bulbosum* Linn. is the only one which really has such an upper lip fixed to the base of the style, and opposite the upper leaf of the calyx. To discover the real use of this pretended upper lip, we have only to observe its structure and insertions, and that it is often deciduous, particularly in the Indian and Cape genera. We see that it is nearly wanting in the genus *Corycium*, where the anther, in form of a *saccus didymus*, is situated beneath the lip itself, and at the sides of the style nearly as in *Cypripedium calceolus*, which on the other hand has two very distinct bilocular

anthers; and do not these constitute an upper lip in that genus, or can one deny them to be the anthers? In *Lepanthes*, the flower of which has no labellum at all, the scarcely visible membranaceous integument, covering the pollen, and soon dropping, cannot be considered as an upper lip, since two distinct petals appear at the sides of the style.

The upper lip therefore, as it is called, does not belong to the corolla, but rather to the parts of fructification, and is to be considered as the true and only anther, to be met with in all the species hereafter to be mentioned, *Cypripedium* only excepted, which has two of them; all the other genera hitherto known are monandrous. ADANSON was the first who formed this opinion, afterwards adopted by JUSSIEU, SCHREBER and SALISBURY.

Besides the above-mentioned, many other names have been given to this anther; such as fungus, glans, cucullus, squama, operculum, and other vague appellations,

This part is found to differ very much in the different Orchidæ, with regard to form as well as insertion. In *Orchis* and *Ophrys*, for instance, it is

almost upright, connate with the upper part of the style, but in such manner that the part where it joins, is visible, fleshy behind, with two oblong cells, each of which has a membranous valve at the front that opens and emits the pollen.* The same is the case in *Disa*; but here the anther reclines, assumes an horizontal position, and is concealed in the helmet.

In *Satyrium* it resembles a scrotum, and is attached near the summit of the elongated style.

Corycium and *Pterygodium* have an anthera didyma, the cells of which constitute, as it were, two anthers, at the sides of the style, but join at the back part of this organ.

Disperis has a simple upright anther covered in front, the integument having two cells, formed by two cartilaginous twisted side-lobes.

In *Neottia*, *Cranichis*, and *Diuris*, it is fixed to the back-part of the style, upright, acuminate,

* At the front of the base, beneath the anther, above the stigma projects a blunt point, which CRANTZ calls *clitoris*; SPRENGEL, *Klappchen*; LINNÆUS took it for the stigma. In many species both of *Orchis* and *Disa*, there appears another small point projecting between the cells of the anther, over the above-mentioned blunt one, which HALLER called *spinula*. Its use is unknown.

with two cells, between which and the corresponding cavities of the style, the pollen masses are found.

In *Epipactis* it is fixed to the hinder part of the upper end of the elongated style.

In *Cymbidium*, *Epidendrum*, and in all the genera which I shall hereafter notice, as having an *anthera opercularis mobilis*, the style is generally elongated. The anther in these is like a convex, fleshy, or membranous lid, slightly fastened, as if by an articulation, to the edge pointing towards the back part. This is lifted up and often drops off, as soon as the pollen issues from the one, two, or three cells, which open opposite the cavity at the top of the style.

Now as an anther consists of a loculament or membrane in which the pollen is contained or prepared, that part which I have just described must be considered as such, and indeed as a single anther, in all the *Orchideæ* except in *Cypripedium*.

The pollen, or that impregnating substance which in the anthers of the *Orchideæ* appears, as it were, to constitute a distinct part, displays a

singular diversity, both with regard to its composition, and the manner in which it is lodged within the anthers of the different genera. In many, as for instance in *Orchis*, *Ophrys*, &c. it resembles two club-shaped masses, which are supported by means of a fine transparent thread-like pedicle, furnished with a small orbicular gland, above the stigma, at the sides of the above-mentioned blunt-topped point. These masses, which, till mature, remain concealed within the cells of the anthers, appear to be composed of an infinite number of oblong vesicles tapering downwards, and imbricate at their narrower extremities. They are transparent, yellowish, white or green, and filled with a fluid into which they seem almost to dissolve when they come in contact with the stigma. To this fluid their chain-like connexion, which appears in separating them from one another, is likewise owing. No less remarkable is the elasticity of these masses, particularly in those of the different species of *Orchis*; in which, when they have been forcibly extended to four times their length, being left to themselves, they immediately

return to their former shape. In some genera (as *Epipactis*), the masses appear to be surrounded by a thin membrane, perhaps belonging to the inner surface of the cell. This they either lose in the course of time, or it remains, and may then be separated longitudinally into two or more coherent parts; which, when the elastic masses protrude from the cells in the anthers, easily adhere to one another or to different parts of the flower, by means of the gland which is situated there, and which appears at first dry, but afterwards becomes juicy. This is what NAUENBURG and SCHKUHR call the emigration of the males, or the infidelity of the males to their females.*) The former author has observed this only in *Orchis bifolia*, but I also found it in *Orchis maculata*, in the beautiful *Orchis habenaria*, and in some species of *Epidendrum*.

Disa Corycium, and a few other genera, have masses of pollen resembling those of *Orchis*; but in *Thelymitra*, *Cranichis*, *Neottia*, *Diuris*, *Arethusa*, &c. they do not separate so easily from the

* USTERI'S neue Annalen, No. 2. SCHKUHR bot. HANDBUCH, No. 21.

anther and resemble more the pollen of the generality of plants; the microscope shows, however, that they consist of numberless transparent globules. In the *Epidendra*, the masses consist of uniform, round, flattish bodies closely united, and covered by a fine membrane; they may be divided, but all their parts are upon a common pedicle. We find eight of them in *Limodorum Tankervilliae*; four, or two pair upon one footstalk in *aerides flor aëris*, &c; *Lepanthes cochlearifolia* has but a single one in its anther.

Unless examined in a fresh state, one might, with regard to the last mentioned genera, think with GAERTNER, not indeed that each mass of pollen, as he imagines, is an anther, but that these masses are to be considered as solid. In his opinion these supposed anthers are “*ex uniformi substantia subcornea s. carnosae formatae*.” This is however not the case; for they really consist of a granulated substance, as may be easily seen by help of water, and a magnifying glass.

That these masses lie as it were loose, in their proper cells, having at the same time the

habit of dissolving, proves clearly that they ought not to be considered as the anthers themselves, as they hitherto have been ; but as the genitua, or impregnating substance analogous to pollen. With regard to their nature and the humour contained in them, they have some resemblance to the *Asclepiadeæ*, the male parts of which display a construction equally uncommon.

The style ascends, as it is before said, from the germ, within the corolla, bearing the male parts fastened to or connate with it ; and therefore it is to be considered as the common receptacle of both the sexual parts. On account of its remarkable thickness and shape, as well as the singularity and situation of the stigma, it deserves a peculiar denomination distinct from stylus.*

The stigma of the *Orchideæ*, a part as important as the germ, has been but little understood. Linnæus's idea of it I venture to pronounce erro-

* That many botanists have been of the same opinion, appears from the numbers of names given to this part ; such as tuba ; scapus stamineus, spermaticus, tubæ ; machina staminea, fructificationis, prolifera, seminalis, foecundans ; columna staminum, staminifera, genitalium, foecundans ; machinula, &c.

neous, as he took for this part, that blunted point which in orchis is found projecting beneath the cells of the anther, and above the real stigma. In cases of entire deficiency of this projecting point (as in *Ophrys*, &c.) he made use of the expression stigma obsoletum, &c. KÔLREUTER imagined the whole inner surface of the cells of orchis, containing the pollen-masses, to be the stigma which absorbed the fructifying substance, by which means it was conducted to the ovarium ; but this theory is not better grounded than that of Linnæus.—SPRENGEL and SCHKUHR* have certainly hit upon the right part.** It is distinctly to be seen in *Orchis* below the anther, and behind the opening into the spur ; as also in *Ophrys*, though the spur be wanting in this genus. In *Disa* it is spherical, and situated at the base of the style ; in *Epipactis* at the end of the style, facing the anther ; in *Satyrion* (Thunb.) above ; and in *Corycium* behind it. *Neottia* and *Diuris* have it upon the front of the style towards

* SPRENGEL'S entdecktes Geheimniss der Natur, &c. p. 402.

** HALLER and CRANTZ mention it in several species described by them under the name of pectus unguentarium, or fovea unguinosa.

the lip, as also *Epidendrum*, *Arethusa*, &c. but in these latter before the anther, perhaps also beneath it. In *Cypripedium*, the stigma is more distinct than in any other; it is crooked, hollow, and proboscis-like, and situated at the end of the style.

The moisture issuing from the stigma renders it shining and visible. The small particles, globules or vesicles of the pollen-masses, accumulate and dissolve upon it. These particles I have seen upon the stigmas of several species of *Disa*, and in great abundance deep down the singular channel of the calyx of *Orchis burmannia* L. (*O. pectinata* Thunb. Capens.) the stigma of which is situated near the upper end of the germ. They dissolve upon the viscid stigma; by which perhaps is caused the peculiar smell that the sexual parts of even the well scented *Orchideæ* diffuse when touched; and which is even to be perceived, many years after, in their flowers, if soaked in warm water.

The mode of fructification in these plants is not less remarkable than the organs employed in it. Schkuhr and Sprengel have already communicated

something concerning this operation, in those species which have fallen under their inspection. In orchis, and those genera, the pollen-masses of which are furnished with a thread-like pedicle, these are ejected, on the unfolding of the flower, out of their cell, and, either by elasticity, or (according to SPRENGEL) by the assistance of insects, find their way to the stigma. In *Epipactis*, *Neottia*, *Cranichis*, and others that have no pedicles to the pollen, the pointed ends of the masses are stuck to the opposite gland, and thus brought nearer to the stigma. But in those genera that have a moveable anther situated upon the top of the style, as *Arethusa*, *Epidendrum*, *Cymbidium*, &c. it is lifted up backwards like a lid, by which means the pointed parts of the pollen-masses, fixed to the foremost and projecting upper part of the style, remain in the cavities beneath the anther, and thus find the way, without difficulty, to the neighbouring stigma. In *Cypripedium*, the sexual parts of which are still more distinct, the dilated stigma stoops towards the anthers, which are situated underneath at the sides of the style. Those species, the floral parts

of which are particularly large, as for instance, *Limodorum Tankervilliae*, the style, when opened longitudinally, distinctly shows slender ducts, running from the upper end of the stigma down to the germ; and when put into water and slightly pressed, the absorbed fluid soon appears to issue out of the stigma.

The fruit, of which GAERTNER has given a complete description, is almost the same in all Orchideæ, except as to size and external form. It consists of an unilocular capsule, with three projecting angles, along which it at last opens, with three valves, connected at their bases. The seeds, the receptacle of which is an elevated, shaggy, or hairy ridge, are in immense number, small, globular, and surrounded each by a membranaceous, transparent, white, veined and channelled aril, closed at one end. The genus of *Vanilla*, however, differs from the rest by having a seed-vessel which, though a capsule, yet approaches nearer in form to a pod, and contains, within a succulent matter, an immense number of subtle, roundish seeds, covered by a glittering, brittle integument, but without a proper aril.

From the before-mentioned it is evident, that the sexual parts widely differ in the several genera of Orchidæ; yet in those species, which appear nearest related, the resemblance is very close. Hence I have been induced to look for the principal characters (as HALLER did also), among those organs that have as yet been least attended to. Of all parts of the flower of Orchidæ, both inner and outer, I consider the anther as the most to be depended upon. From its situation and insertion, therefore, I have taken the primary distinctions; the rest have been furnished by the outer parts of the flower, as appears in the annexed table.

But, besides the characters derived from the insertion of the anther, there is another principal one, which must not be overlooked, viz. the qualities of the pollen-masses. In the Orchidæ of the first division, which have the anther intimately connected with the style, these pollen-masses are furnished with a long thread-like pedicle, and are composed of small vesicular grains, which adhere closely. In those which have the anther fixed to the back of the style, the pollen-masses are with-

out a pedicle, and of such fine grains, that they resemble a farinaceous substance. In those of the last division, with deciduous anthers, the pollen-masses consist of round, and often divisible globules, but never acquire the mealy appearance of the former. The anthers of the second division, when unripe, resemble indeed those of the third, but never drop off. These circumstances seem to give additional weight to the proposed arrangement.

As all the genera I have given are founded upon the results of my own observations, I did not choose to take up the several new ones of the *Prodromus floræ Peruvianæ & Chilensis*; most of them being known to me by figures only. *Gongora*, *Masdevallia*, and perhaps *Anguloa* appear to be distinct from the genera established by me, though it is certain, that they all belong to the third division.

O R C H I D E Æ.

Anthera subterminali, stylo brevissi- mo connata; Calcare floris	Postico; <i>Calyce.</i>	Antico	{ resupinato; galea unicalcarata	Orchis																
					{ ringente; galea bicalcarata	Disa														
							{ foliolis lateral. exterior. horizontalibus concavis	Satyrium												
									{ foliolis lateral. exterior. horizontalibus calcaratis	Pterogodium										
											{ 4—phyllis, foliolis lateralibus erectis, basi ventricosis	Disperis								
													{ foliolis omnibus subpatentibus	Corcyum						
															{ foliolis omnibus conniventibus	Ophrys				
																	{ foliolis lateralibus basi antice productis	Serapias		
																			{ resupinato; labello galeato	Neottia
{ 7—phyllis; foliolis 2 anter. elongatis labello suppositis	Thelymitra																			
		{ subringente	Diuris																	
				{ subpatente	Arethusa															
						{ resupinato; labello adscendente	Epipactis													
								{ labello concavo	Malaxis											
										{ labello plano	Cymbidium									
												{ labello erecto, inferne stylo connexo	Oncidium							
														{ labello subcucullato; capsula ecarinata	Epidendrum					
																{ labello lamina saccata	Vanilla			
																		{ labello basi calcarato	Aerides	
{ labello a foliol. <i>calyc.</i> anter. basi productis incluso	Limodorum																			
		{ labello foliol. <i>cal.</i> conformi; exteriorib. basi coalitis	Dendrobium																	
				{ labello nullo	Stelis															
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GENERA AND SPECIES OF THE NATURAL ORDER
OF THE
ORCHIDÆ.

BY PROF. O. SWARZ.

Character generalis Orchidearum.

FLOS irregularis, ringens s. patens. Pl. 3, seq.

CALYX superus, 4-5-7-phyllus. (Vid. fig. E.G.M.)

Foliola conniventia s. patentia, colorata, marcescentia ;

Exteriora duo (G. c.), tria s. quinque (M. a.) quorum *unum* semper *superius & posterius* (nisi flos resupinatus) sæpe fornicatum, subinde postice calcaratum (B. a. C. a.) ; *duo* s. *quatuor* (C. b.) *lateralia anteriora*.

Interiora duo *lateralia* exterioribus alternantia, petaloidea, cum postico superiore interdum connexa galeam formantia. (A. a. b.)

COROLLA : *Petalum* unicum sive *Labellum*, foliolo calycis superiori oppositum, inter foliola *lateralia exteriora* *Stylo* ad basin, medieta-tem s. apicem insertum, basi planum,—ex-

cavatum—concavum—calceiforme—subtus
carinatum s. calcaratum :

Lamina fornicata (K. d. e.) s. foliolis calyci-
nis interioribus conformis (L. a.) s. lobata
(D. b.)-multifida ; disco plana (Q. a. b.)-
depressa ; situ adscendens—horizontalis—
dependens.

STAM. *Filamentum* nullum. *Anthera* unica, (raris-
sime duæ) stylo adnata s. inserta, oblonga
(A. c.)-subrotunda-didyma (C. e.) ; termi-
nalis erecta-incumbens (B. c.) ; s. postica,
lateralis stylo parallela (I. d.) ; s. tantum
margini postico apicis styli operculi instar
inserta ; fixa s. mobilis ; persistens (O. c. d.)
s. decidua ; 1-2-4-locularis.

Pollen in s. sub loculis antheræ liberum con-
globatum e congerie granulosa simplici s.
partibili pedicellata (A-H.) s. sessili ; matu-
rum ex anthera erumpens, in stigmate deli-
quescent.

PIST. *Germen* inferum, sessile s. pedicellatum, line-
are-cylindraceum-oblongum-subrotundum-
costatum, sæpe leviter tortum.

Stylus brevissimus (A. f.) s. elongatus (C. c. e.)
crassus, teres s. angulatus, antherifer.

Stigma convexum-concavum-globosum; basi
(A. c. B. c.) s. apice (C. c.) antice s. pos-
tice (E. e. G. g.) stylo insidens.

PER. *Capsula* forma diversa, 1-locularis, trivalvis,
plerumque carinata, sub angulis dehiscens,
basi & apice cohærens.

Semina receptaculis ternis parietibus capsulæ
adnatis adhærentia, minutissima, plurima :
Arillo scobiformi membranaceo tubulato
obvelata; s. rarius nuda, in pulpa carnosâ
nidulantia.

N. B. In *Statyrium*, all the leaflets of the calyx,
as also the Labellum, are connected at the
base.

In *Orchis Burmanniana* the calyx is tubular
below.

Stelis & *Masdevallia* have the outer leaflets
of the calyx connected; but the inner ones
are distinct.

Lepanthes has no Labellum, but in its place
the upper or under part of the style has
two lateral petal-like lobes.

Character differentialis Orchidearum.

Monocotyledones.

Flos superus, irregularis,

Genitalia coalita.

Capsula unilocularis, trivalvis, polysperma.

Habitus.

Radix tuberosa s. fibrosa; simplex s. divisa.

Caulis herbaceus, simplex, rarissime divisus s.
scandens, foliosus s. subnudus, vaginatus.

Folia simplicia, basi vaginantia s. sessilia.

Inflorescentia uniflora, spicata-paniculata-sub-
racemosa,

Flores sessiles, rarius pedunculati.

Bracteæ floribus subjectæ.

*I. Orchideæ with one Anthera.**1. ORCHIS. Pl. 2. A.*

Char. essent. *Calyx* ringens, foliolo superiore
fornicato.

Labellum basi subtus calcaratum.

Anthera terminalis adnata.

Char. naturalis.

Calyx irregularis, ringens, 5-phyllus :

Foliola 3 *exteriora*, quorum unum posterius fornicatum; duo *lateralia anteriora*. Duo *interiora* *lateralia*, superiore *exteriore* *plerumque* *conniventia* in *galeam*.

Cor. *Labellum* a latere inferiori stylo antice adnexusum, diversæ formæ, patens, basi *tubo* *calcariformi* subtus porrecto.

Genit. *Stylus* e *Germine* infero oblongo contorto brevis, columnaris.

Anthera magna, oblonga, terminalis, stylo adnata, erecta, dorso gibba subcarinata, bilocularis : *loculis* antice dehiscentibus.

Massæ pollinis clavato-pedicellatæ, s. granula oblonga vesiculosa, imbricatim pedicellis insidentia basi glandulosis ad sinus inferiores loculorum insertis.

Stigma infra antheram pone meatum in calcar, convexum, obliquum.

Per. *Capsula* oblonga, unilocularis, tricarinata, trivalvis, sub carinis trifariam dehiscens, apice & basi cohærens.

Semina numerosa, minima, subrotunda, *arillo*
scobiformi induta.

Species.

a. *Radic. indivisis.*

O. <i>Susannæ</i> L.	O. <i>hispidula</i> Th.
<i>ciliaris</i> L.	<i>secunda</i> Th.
<i>bifolia</i> L.	<i>viridiflora</i> Rotul.
<i>habenaria</i> , L.	<i>cucullata</i> L.
<i>Monorrhiza</i> Sw.	<i>ornithis</i> Jacq.
<i>japonica</i> Th.	<i>globosa</i> L.
<i>speciosa</i> L.	<i>pyramidalis</i> L.
<i>foliosa</i> Sw.	<i>coriophora</i> L.
<i>plantaginea</i>	<i>cubitalis</i> L.
Roxb. Cor.	<i>morio</i> L.
<i>pectinata</i> Th.	<i>mascula</i> L.

O. foliosa : labello lineari obtuso, denticulo filiformi ad basin utrinque, caule vestito, foliis ovatis acutis.—E Cap. b. sp.

SPARRMAN.

O. viridiflora : labello tripartito, laciniis linearibus, lateralibus patentibus, inter-

O. ustulata L.	rubra* Jacq.
militaris L.	pallens Jacq.
fusca Jacq.	palustris Jacq.
variegata Jacq.	hircina.
foetens Hall.	Satyrium hir-
moravica Jacq.	cinum Linn.
papilionacea L.	

b. *Radic. palmatis.*

latifolia L.	flava L.
cruenta Fl. dan.	viridis
sambucina L.	Satyrium viri-
incarnata L.	de L.
maculata L.	nigra.
odoratissima L.	Satyrium ni-
conopsea L.	grum L.

medio obtuso deflexo ; foliis radica-
libus ensiformibus. Ex India Orient.

ROTTLER.

* *Orchis rubra* and *Ophrys crucigera* of JACQUIN (pl. rarior. Vol. I. tab. 183 and 185) are both to be considered as nonentities. They were drawn by the juvenile pencil of a now eminent botanical painter, from the dry mutilated specimens, and the verbal description given to him by the Rev. NORBERT BOCCIUS, who had found them in the vicinity of Rome. T.

c. *Radic. fasciculatis.*

fuscescens L.	hirtella Fl. ind. occ.
strateumatica L.	plantaginea. Saty-
albida.	rium Linn.
Satyrium albi-	hyperborea L.
dum Linn.	fimbriata H. Kew.

d. *Radic. nondum cognitis.*

sancta L.	dentata Sw.
psycodes L.	Ichneumonea Afz.
spectabilis L.	procera Afz.
tipuloides L.	membranacea Afz.

e. *dubiæ.*

calcarata Walt. car.	aphylla Forfk.
lata Walt.	viridis Forfk.
ophioglossoides W.	batrachites Schrank.
longicornis Poir.	vomeracea Hall.
elata Poir.	macrophylla Col.
Kœnigii Fl. dan.	holosericea Hall.
suaveolens Villars	

O. dentata : radicibus—; labello tripartito, laciniis lateral. oblongis dentatis, intermedia lineari obtusa integra; calcare germine duplo longiore. E China.

N. B. Among the species of the first four divisions only *O. birtella* & *plantagenea* are an exception in regard to the Anthers. They have, like *Neottia*, a lateral anther and farinaceous pollen. If more such species should be discovered they ought to be separated from *Orchis*. They have also a peculiar foliation.*

2. DISA. Pl. 2. B.

Char. essent. *Calyx* resupinatus, subringens :
Foliolo posteriore dorso unicalcarato ;
interioribus stylo accretis.
Labellum ecalcaratum.
Anthera Orchidis.

Character naturalis.

Calyx subringens, plerumque resupinatus, 5-phyllus.

* All species printed in *italics* are new ; those marked *Afxel.* are from Africa, and will hereafter be described by this naturalist.

Foliola tria exteriora, quorum unum *posterius* (situ sæpissime *anterius*), erectiusculum, concavum s. fornicatum, basi s. medio *Calcare* postice exserto; duo *anteriora* erectiuscula.

Duo *lateralia interiora*, minora, diversæ figuræ, styli columnæ ad latera utrinque adnatæ.

Cor. *Labellum* inter foliola *lateralia* *majora* antè basin styli insertum, rarius divisum; ecalcaratum.

Genit. *Stylus* e *germine* infero oblongo, brevissimus.

Anthera oblonga, stylo adnata, erecta s. incumbens cum foliolis cal. interioribus in galea reclinata; bilocularis.

Pollen ut in *Orchide*.

Stigma globosum prope basin.

Per. ut in *Orchide*.

N. B. The length of the spur is different in different species, being very long in some, and quite short in others. In *Disa Melaleuca* and *patens* it appears to be entirely

wanting, but still the hindermost leaflet of the calyx is convex, and the other parts agree perfectly with the generic characters.

Species.

a. *Calcare longiore.*

D. grandiflora L.	D. cornuta.
Satyrium grandi-	Orchis L.
florum. Th.	Satyrium Th.
	<i>macrantha</i> Sw.
	longicornis Th.

D. *grandiflora*: galea acuta erecta, calcare conico nutante; labello lineari obtuso; caule subbifloro.

D. *cornuta*: galea obtusa, calcare conico deflexo; foliolis inter. bidentatis; labello obovato velutino plano; spica laxa.

D. *macrantha*: galea acuta erecta, calcare conico porrecto; foliolis inter. retusis; labello oblongo acuto carinato. E C. b. sp.

D. *longicornis*: galea obtusa supina, calcare germine longiore deflexo; labello lanceolato obtuso; caule unifloro.

D. draconis.

Orchis L.

Satyrium Th.

rufescens.

Satyrium Th.

D. ferruginea.

Satyrium Th.

porrecta Sw.

D. *draconis* : galea obtusa erecta, apice dilatata, calcare subulato germine longiore nutante ; labello lineari obtuso ; spica fastigiata ; bracteis reticulato-nervosis.

D. *rufescens* : galea obtusa erecta, calcare subulato germine longiore nutante ; labello lanceolato obtuso ; spica laxa ; foliis ensiformibus.

D. *ferruginea* : galea acuminata dorso conica, calcare subulato deflexo ; foliolis inter. cuspidatis ; labello lanceolato obtuso ; spica ovata multiflora.

D. *porrecta* : galea obtusa dorso conica, calcare subulato porrecto ; foliolis inter. bidentatis ; labello oblongo undulato ; spica ovata multiflora. c C. b, sp. SPARRMAN.

D. cernua.

D. chrysostachya Sw.

Satyrium cer-

num β . γ . Th.

bracteata Sw.

physodes.

Satyrium cer-

num α . Th.

D. cernua: galea acuta, calcare oblongo compresso nutante; foliolis inter. acuminatis; labello lineari; foliis lanceolatis basi subequitantibus.

D. physodes: galea obtusa, calcare subrotundo inflato; foliolis inter. retusis emarginatis; labello lineari; foliis lineari-lanceolatis.

D. chrysostachya: galea obtusa, calcare oblongo deflexo; foliolis inter. obovatis; labello lineari; spica longissima; bracteis apice reflexis. c C. b. sp. SPARRMAN.

D. bracteata: galea obtusa, calcare oblongo; labello lineari apice latiore; spica cylindrica, bracteis erectis floribus longioribus. c C. b. sp. SPARRMAN.

*D. torta*Satyrium tor-
tum Th.

Orchis flexuosa

Lin. suppl.

Orchis biflora

sp. pl.

D. flexuosa.

Satyrium Th.

Orchis flexuosa.

Amœn. Acad.

p. 108.

bifida.

Satyrium Th.

tenella.

Satyrium Th.

Orchis. Suppl.

D. torta: galea acuminata, calcarẽ obtuso adscendente; foliolis inter. 2-dentatis; labello oblongo apice subulato convoluto; caule flexuoso.

D. flexuosa: galea obtusiuscula, calcare obtuso porrecto; foliolis inter. apice linearibus acutis; labello ovato acuminato crispo; caule flexuoso.

D. bifida: galea obtusa, calcare adscendente apice bifido; foliolis interior. labelloque lanceolatis acutis.

D. tenella: galea acuta, calcare porrecto acuto; foliolis inter. rhombeis; labello lineari obtuso; foliis subfiliformibus flexuosis.

D. sagitalis.

Satyrium Th.

Orchis. Suppl.

D. barbata.

Satyrium Th.

Orchis Suppl.

lacera. Sw.*b. Calcare conico abbreviato porrecto obtuso.**D. maculata.* Th. L.*secunda.*

Satyrium Th.

Disa racemosa L.

D. sagittalis : galea apice dilatata triloba calcare nutante subulato ; labello lanceolato undulato.

D. barbata : galea acuta basi conica, calcare subporrecto acuto ; labello ovato, margine multifido laciniis linearibus ; foliis setaceis.

D. lacera : galea obtusiuscula ; calcare porrecto ; labello oblongo concavo, apice laciniato.
e C. b. Sp. SPARRMAN.

D. maculata : galea obtusiuscula supina saccata ; foliolis inter. linearibus ; labello lanceolato-obtuso ; caule unifloro.

D. secunda : galea acuta erecta ; labello subfiliformi ; caule flexuoso, floribus secundis.

D. excelsa.

Satyrium Th.

Orchis tripeta-
loides L.*venosa* Sw.*D. spathulata*

Satyrium Th.

Orchis L. Suppl.
cylindrica

Satyrium Th.

D. excelsa: galea suberecta acuta; foliolis int.
apice dentatis; labello oblongo; caule
multifloro, foliis lanceolatis.

D. venosa: galea erecta acuta venosa; foliolis
inter. lanceolatis integris; labello subfili-
formi; caule paucifloro, foliis lanceolatis
glaucis. e C. b. sp. SPARRMAN.

D. spathulata: galea erecta acuta; labello
petiolato, apice dilatato trifido; caule pau-
cifloro, foliis linearibus.

D. cylindrica: galea obtusa, labello lineari apice
latiori obtuso; spica cylindrica; foliis ob-
longis nervosis.

D. melaleuca	D. patens
Serapias Th.	Serapias Th.
Ophrys bivalvata	Orchis filicornis
Suppl.	Suppl.
<i>tenuifolia</i> Sw.	
Ophrys patens Suppl.	

3. SATYRIUM. (THUNB.) Pl. 2. C.

Char. essent. Calyx ringens : *foliolo* superiore for-
nicato, postice bicalcarato, ceteris
labelloque basi coalito.

D. *malaleuca* : galea acuta subreclinata concava
ecalcarata ; labello lineari obtuso ; spica
fastigiata ; foliis lineari-lanceolatis.

D. *tenuifolia* : galea acuminata erecto-patens
concava ecalcarata ; labello filiformi ; caule
subbifloro, foliis setaceis.

D. *patens* : galea acuminata erecto-patens con-
cava ecalcarata ; labello filiformi ; spica
ovata multiflora ; foliis lineari-lanceolatis.

Anthera stylo elongata adnata sub
Stigmate terminali.

Charaeter naturalis.

Calyx ringens, 5-phyllus :

Foliola omnia basi coalita. Tria *exteriora*
quorum *unum* superius s. posterius maxi-
mum, fornicatum, basi calcaria duo variæ
longitudinis postice exserens; *duo* antèri-
ora, lanceolato-linearia.

Duo interiora minora stylo foliolisque exterio-
ribus basi accreta.

Cor. Labellum foliolis interiorib. conforme illisque
basi connatum, indivisum. /

Genit. Stylus e *Germine* infero, oblongo, con-
torto erectus, elongatus, superne gibbus,
sub galea reconditus.

Anthera globosa, didyma, versus apicem dila-
tatum styli adnata, bilocularis : *loculis*
superne hiantibus.

Pollen ut in præcedentibus, sed pedicelli ad
sinus superiores loculorum inserti.

Stigma supra antheram ! concavum.

Per. Capsula priorum.

N. B. The *labellum* is not with five divisions (Amœn. Acad. p. 109.) but simple, connected at the base with the leaves of the calyx.

The situation of the *stigma* above the anthera is peculiar to this genus.

The generic name of *Satyrrium* is, according to THUNBERG, reserved for Orchides with the spurs attached behind; the Linnean species of *Satyrrium* find their place in the genus *Orchis*.

Species.

S. cucullatum *S. membranaceum* Sw.
Orchis bicornis L.

S. cucullatum: foliis radicalibus binis cordato subrotundis concavis, caulinis remotis cucullatis subretusis; floribus cernuis.

S. membranaceum: foliis radicalibus binis cordato ovatis, caulinis vaginæformibus approximatis membranaceis retusis; floribus cernuis; foliolis cal. serrulatis. C. b. sp.
 SPARRMAN.

<i>S. coriifolium</i> Sw.	<i>S. striatum</i> Th.
<i>erectum</i> Sw.	<i>bicallosum</i> Th.
<i>parviflorum</i> Sw.	<i>bracteatum</i> Th.
<i>foliosum</i> Sw.	<i>Ophrys bracteata</i>
<i>pumilum</i> Th.	Suppl.

S. coriifolium: foliis ovatis acuminatis subreflexis vaginantibus coriaceis, margine membranaceo-crenatis, floribus galeaque cernuis.—
Orchis lutea caule purpureo maculato.
BUXB. Cent. 3. t. 10. e. Cap. b. sp.
SPARRMAN.

S. erectum: foliis radicalibus ovatis, caulinis approximatis cucullatis carinatis membranaceis; floribus galea calcaribusve subrectis. Cap. b. sp.

S. parviflorum: foliis radicalibus ovato-lanceolatis, caulinis latere apertis, floribus subrotundis cernuis. C. sp.

S. foliosum: foliis ovatis acutis concavis approximatis, basi cucullatis, floribus bracteisque erectis. C. b. sp. THUNBERG.

dubia :

Orchis carnea Hort. Kew.

4. PTERYGODIUM Sw. Pl. 3. E.

Char. essent. *Calyx* subringens : foliolis lateralibus *exterioribus* horizontalibus concavis.

Labellum medio stylo inter loculos
Antheræ remotos insertum.

Stigma posticum.

Character naturalis.

Calyx subringens 5-phyllus :

Foliola tria exteriora ; unum *superius* erectum, concavum, carenatum cum *duobus* lateralibus *interioribus* obovatis patulis connexum, galeam formans. *Duo anteriora* ovato-lanceolata, horizontaliter patentia, concava.

Côr. *Labellum* variæ figuræ, stylo inter loculos
Antheræ insertum, replicatum, patens.

Genit. *Stylus* e *germine* infero oblongo erectus, brevis, apice obtusus s. acuminatus.

Anthera medio stylo adnata, didyma, bilocularis: *loculis* (in diversis speciebus) diversiformibus, ad latera divergentibus.

Massæ genituræ Orchidis.

Stigma posticum (versus galeam) ad basin dorsi antheræ, convexum.

Per. Congenerum.

N. B. The name is taken from the Greek *πτερυγώδης alatus: cui scapulæ apertæ alarum in modum extant*, as the leaflets forming the helmet, and the two lateral ones.

The cells of the anthera being distant from each other, one could suspect two anthers in this genus; but the partitions have but one cell each, and are connected with one another at the sides of the style.

Species:

P. alatum

P. catholicum

Ophrys alata L.

Ophrys catholica
L. sp.

Ophrys alaris	P. cafferum
Lin. suppl.	Ophrys caffa L.
P. volucris	inversum
Ophrys volu-	Ophrys inversa L.
cris L.	atratum.
Ophrys triphyl-	Ophrys atrata L.
la Th.	

5. DISPERIS Sw. Pl. 3. F.

Char. essent. Calyx ringens: foliolis lateralibus exterioribus horizontalibus subcalcaratis.

Labellum e basi styli, erectum, genitalibus connexum.

Anthera velo tecta, lacinias duas antice circumflexas exserente.

Char. naturalis:

Calyx ringens, 5-phyllus:

Foliola tria *exteriora*, quorum *unum* superius erectum fornicatum, cum duobus *interioribus* lateralibus illo contiguis galeam erectam s. incumbentem efficiens. Duo *lateralia anteriora* horizontaliter exstantia; utroque

perula s. calcare brevi obtuso deorsum spectante.

Cor. Labellum e basi styli erectum, inferne attenuatum, genitalibus adnexum, apice sub galea reflexum.

Genit. - *Stylus* brevissimus e *Germine* infero oblongo-cylindraceo.

Anthera stylo apice adnata erecta s. reclinata, oblonga, bilocularis: tecta *velo* margine utroque lacinulam cartilagineam recurvato-circumflexam antice exserente.

Massæ Pollinis Orchidis similes, pedicellis apicibus lacinularum veli adglutinatis.

Stigma anticum, prope Antheram.

Per. præcedentium.

N. B. Name from *dis* (bis) and *πῆρα* (pera), as both the horizontal lateral leaflets are furnished with a small bag or short spur.

This genus comes nearest to the foregoing, but is distinguishable from it by the spurs of the lateral leaflets, by the insertion of the labellum, the structure of the anther, and the situation of the stigma.

Species.

<i>Disperis capensis.</i>	<i>cucullata</i> Sw.
Arethusa ca-	fecunda.
pensis L.	Areth. secunda Th.
villosa.	Ophrys circum-
Arethusa vil-	flexa. L.
losa.	<i>cordata</i> Sw.

D. capensis : caule diphylo unifloro ; foliis lanceolatis.

D. villosa : caule diphylo unifloro bractea germineque villosa ; foliis cordato-ovatis subtus glabris margine ciliatis.

D. cucullata : caule diphylo unifloro, germine glabro, foliis oblongis bracteaque subtus pubescentibus. e C. b. sp. SPARRMAN.

D. secunda : caule diphylo multifloro, foliis linearibus ; floribus secundis.

D. cordata : caule diphylo multifloro, foliis cordatis glabris ; floribus distinctis. Ex Ins. MAURITII.

6. CORYCIUM S. Pl. 3. G.

Char. essent. Calyx ringens, 4-phyllus; foliolis erectis, lateralibus basi ventricosis.

Labellum stylo supra Antheram adnatam insertum.

Char. naturalis.

Calyx. ringens, 4-phyllus :

Foliola erecta : duo *exteriora*, quorum unum *superius* angustius cum duobus lateralibus *interioribus* majoribus retusis, basi concavo-ventricosis connexum, galeam referens.—
Alterum exterius inferius obovatum.

Cor. Labellum basi attenuato apici styli supra antheram insertum, lamina replicata, patente.

Genit. Stylus e Germine infero oblongo torto erectus, brevissimus, basi angustior, apice obtusus alatus : alis ad latera deflexis.

Anthera medio stylo sub labello adnata, didyma, bilocularis : *loculis* remotiusculis, ab alis styli postice tectis.

Massæ genituræ Orchidis, pedicellis ad sinus superiores loculorum, lacinulis propriis insertis.

Stigma posticum, convexum (versus galeam) infra loculos.

Per. Congenerum.

N. B. This genus, which derives its name from *Κάρυκος* (*galea, cassis*) on account of the structure and position of the flower, is easily to be distinguished from the rest, by its four-leaved calyx. The insertion of the *Labellum* and the two small wing-shaped leaflets at the upper end of the *style*, hanging down behind the anthera, represent as it were an inverted orchideous flower. These wings seem to be of the same nature with the two inner leaflets, which are commonly met with in the flowers of the Orchideæ.

Species.

Corycium Orobanchoides.

Satyrrium Orobanchoides L. Th.

C. crispum.

Arethusa crispa Th.

vestitum.

Ophrys Volucris Th.

bicolorum.

Ophrys bicolor Th.

7. OPHRYS L. Pl. 2. D.

Char. essent. Calyx subringens : *foliolis* patentibus.

Labellum e basi styli, ecalcaratum,
patens.

Anthera Orchidis.

Character naturalis.

Calyx subringenti-patens, 5-phyllus :

Foliola tria *exterioria* : unum *superius* concavum, cum *duobus* lateralibus *interioribus* angustioribus connivens. Duo *lateralia anteriora* patentia.

Cor. Labellum basi styli antice adnexum, subtus ecalcaratum, sæpe carinatum ; *lamina* indivisa f. partita, patente.

Genit. Stylus e Germine infero, oblongo, torto brevissimus, erectus.

Anthera stylo apice adnata, erecta, magna, gibba, bilocularis : loculis antice hiantibus.

Massæ Pollinis clavatæ ut in *Orchide*, pedicellis basi glandulosis ad sinus inferiores loculorum insertis.

Stigma infra Antheram, anticum, convexum, latum.

Per. præcedentium.

N. B. This genus distinguishes itself by the absence of the spur at the *labellum*, from *Orchis*, which it resembles however in regard to the other parts of the flower.

Species.

<i>Ophrys</i> Monorchis L.	<i>O. lancea</i> Th.
alpina L.	crucigera Jacq.*
anthropophora L.	Myodes L.
	fuciflora.

O. lancea: scapo nudo; labello sublineari deflexo trifido, lacinia media obsoleta. e Java. THUNBERG.

* See the note, page 127.

O. arachnites.
lutea Cav.

O. scolopax Cav.

dubiæ :

O. trifolia Walt.
fimbriata Walt.
barbata Walt.

8. SERAPIAS L. Pl. 3. H.

Char. essent. Calyx ringens: foliolis conniventibus.
Labellum ecalcaratum, lamina de-
flexa. Anthera stylo elongato adnata.

Character naturalis.

Calyx ringens :

Foliola 5. acuminata, erecta. Tria exteriora,
duo interiora angustiora, omnia conniven-
tia in galeam.

Cor. Labellum concavum, lamina acuminata de-
flexa.

Genit. Stylus e Germine infero oblongo erecta,
elongata.

Anthera ovata, adnata, erecta, postice gibba,
bilocularis.

Pollen Orchidis.

Stigma anticum sub & prope *Antheram*,
concavum.

Per. Congenerum.

Species.

Serapias cordigera L.

lingua L.

Huc referendæ plures forsân distinctæ species
ex *Orchidibus Etruriæ* secundum *B. Tozzi*
a *Petiverio* in *Oper. hist. nat. spect. T. II.*
delineatæ.

9. NEOTTIA. JACQ. Pl. 4. I.

Char. essent. *Calyx* ringens: *foliol. lateral. exte-*
rioribus antice circa basin *labelli*
ventricosam connexis.

Anthera stylo parallela, postice in-
ferta.

Character naturalis.

Calyx ringens, 5-phyllus:

Foliola tria exteriora, duo *interiora*, conniventia
sed apice patula.

Exteriora lateralia basi antice producta, sæpe connexa s. in formam calcaris ad basin labelli utrinque decurrentia.

Cor. Labellum basi attenuatum subventricosum, foliolis calyc. lateral. amplexum: *lamina* erecta, patula.

Genit. Stylus e *Germinibus* infero, oblongo, 3-gono erectus, cylindraceus, apice scarioso acuminato.

Anthera stylo postice adfixa, illoque parallela, erecta, acuminata, bilocularis.

Massæ Pollinis pulvereo-granulatæ, lineares, in sulcis binis longitudinalibus styli, loculis *Antheræ* oppositis, semiinclusæ.

Stigma anticum, versus apicem styli obliquum, convexum.

Per. Capsula 1-locularis, trivalvis, &c.

N. B. The generic name is taken from JACQUIN, who re-established it, having been given before to some of the *Ophrydes* Linn. The dissections of the flower of *Neottia speciosa* in Jacquin's Icon. rar. Vol. III. charac-

terize this genus tolerably well, but for the stigma, which is not well represented.

Species.

Neottia speciosa Jacq. *N. cernua*.

elata.

Ophrys cernua L.

N. minor. Jacq.

adnata.

Satyrium elatum Sw. pr.

Sat. adnatum Sw.

spiralis.

Orchioides.

Ophrys spiralis L.

Satyr. orchioides Sw.

repens.

Sat. repens L.

tortilis.

calcarata Fl. Ind. occ.

Satyrium spirale Sw. pr.

polystachya Fl. Ind. occ.

flava Fl. Ind. occ.

dubiæ :

Ophrys peruviana.

Aristotelia spiralis.

Aubl.

Lour.

Limodorum lanceolatum. *Aubl.*

Epipactis Nuil.

Feuill.

10. CRANICHIS. S. Pl. IV. K.

Char. essent. Calyx. resupinatus, subringens.

Labellum fornicatum.

Anthera Neottia.

Character naturalis.

Calyx resupinatus, subringens, 5-phyllus :

Foliola tria *exteriora*. Duo *lateralia* superiora, *unum* anterieus inferius ; subæqualia, erecta, patentia.

Duo *lateralia interiora* vix minora.

Cor. Labellum (situ supremum) inter *foliola calycis* *lateralia* superiora, fornicatum, ovatum, subcarinatum, basi sæpe bifidum, tenerum, genitalia tegens.

Genit. Stylus e *Germine* infero ovato, obliquo, erectus, medio dilatatus, apice membranaceus, acuminatus.

Anthera stylo parallela, postice adfixa erecta, acuminata, bilocularis.

Massæ Pollinis oblongæ, subsessiles, pulveræ.

Stigma anticum (versus labellum) concaviusculum.

Per. Capsula obovata, basi attenuata, 3-gona, &c.

N. B. This new genus has already been adopted by VON SCHREBER ; but the generic character is here given more completely.

*Species.**Cranichis* aphylla Flor. Ind. occ.

diphylla — —

oligantha — —

stachyodes — —

muscosa — —

pauciflora — —

*dubia :*Galeola nudifolia *Loureiro.*

II. THELYMITRA. FORST. Pl. 4. L.

Char. essent. Calyx subregularis, patens.*Labellum* foliol. calyc. conforme.*Genitalia* cucullo 2-penicillato cincta.*Char naturalis.**Calyx*, subregularis, 5-phyllus :*Foliola* ovato-lanceolata, concava, patentia.*Tria exteriora* vix s. paullo maiora, postico
erecto. *Duo interiora.**Cor. Labellum* magnitudine & figura fol. cal.
interioribus conforme, genitalia antice basi
amplectens, erectiusculum.

Genit. Stylus e Germine infero, oblongo erectus, cucullo membranaceo superne retuso s. plicato-crenato amplexus, *lacinulis* duabus lateralibus erectis, penicillato-barbatis.

Anthera sinu cuculli inserta, erecta, stylo postice parallela, stigmatе contigua, acuminata, bilocularis.

Massæ Pollinis subtilissime granulosæ.

Stigma anticum, obtusum, infra apicem scarioso-bifidum styli.

Per. Capsula clavato-turbinata, &c.

Cetera congenerum.

Species.

Thelymitra Forsteri.

Thelymitra Forst. Gen. n. 49.

Serapias regularis Forst. prodr.

Ixioides.*

12. DIURIS. SMITH. Pl. 4. M.

Char. essent. Calyx subringenti-patens, 7-phyllus :

Foliola duo anteriora elongata Labello ecalcarato supposita.

Anthera Neottiae.

* Ex nova Hollandia, communicata a Ccl. SMITH.

Char. naturalis.

Calyx subringens, 7-phyllus :

Foliola quinque *exteriora*, quorum unum *superius* sessile subfornicatum ; duo *lateralia superiora* unguiculata, ovata, erecta ; duo *anteriora* pedicellata, elliptica, patentia, *labello* supposita.

Duo *interiora* *lateralia*, rhomboidea, sessilia.

Cor. Labellum e basi styli subunguiculatum ealcaratum ; *lamina* ovata, convexa, lateribus deflexa.

Genit. Stylus e *Germine* infero, oblongo, contorto erectus, gibbus, acuminatus.

Anthera *lateralis*, stylo parallela, postice inserta, erecta, acuminata, bilocularis.

Massæ Pollinis oblongæ, pulvereæ, sessiles, apici lateris oppositi styli adfixæ.

Stigma anticum, subterminale, obliquum, obtusum.

Per. Congenerum.

N. B. The flower of this genus consists of eight petal-like leaflets, the labellum in-

cluded, not of nine, which are attributed to it in the Transact. of the Lin. Soc. Vol. 4. p. 222.

Of the two species of *Diuris*, which are taken up, we expect a farther description from the celebrated owner of the Linnæan Collections.

13. ARETHUSA L. Pl. 5. O.

Char. essent. Calyx subringens: foliolis subconniventibus.

Labellum ecalcaratum.

Anthera opercularis, persistens.

Pollen pulvereo-granulatum.

Character naturalis.

Calyx subringens, basi angustior, 5-phyllus:

Foliola tria exteriora, duo interiora, erecta, subconniventia.

Cor. *Labellum* erectum, basi attenuato canaliculato stylum amplexans; *lamina* dilatata, patente, longitudinaliter sulcata, plerumque barbata.

Genit. *Stylus* e *Germine* infero tereti-oblongo erectus, parum gibbus, antice concavus.

Anthera terminalis, opercularis, subrotunda, bilocularis, non decidua.

Pollen pulvereo-granulatum.

Stigma anticum, in parte concava styli infra Antheram.

Per. *Capsula* oblongo-ovata, &c.

Species.

<i>Arethusa</i> bulbosa L.	<i>A. gentianoides</i> Sw. Fl.
ophioglossoides L.	Ind. occ.
	<i>trianthophoros</i> Pluk.
divaricata L.	<i>petraea</i> Afzel.
biplumata L.	

14. EPIPACTIS. HALL. Pl. 5. N.

Char. essent. *Calyx* erecto-patens.

Labellum ecalcaratum.

A. trianthophoros : caule remote vaginato aphyllis subquadrifloro, vaginis foliaceis ; pedunculis florum elongatis. Ex America sept. Communicata ab Ill. SCHREBER.

Anthera opercularis, persistens.

Pollen pulvereo-granulatum.

Char. naturalis :

Calyx 5-phyllus :

Foliola erecto patentia, concava; tria *exteriora*; duo *interiora* parum minora.

Cor. Labellum e latere inferiore styli, basi attenuatum s. concavum s. carinatum, calyce longius; *lamina* concava s. plana, deflexa, integra s. fissa.

Genit. Stylus e *Germine* infero oblongo-erectus, teretiusculus, apice subbifidus.

Anthera margini postico apicis styli inserta, ovata, erectiuscula s. incumbens, non (s. rarius) decidua, bilocularis.

Massæ genituræ oblongæ, pulvereo-granulatæ subindè partibiles.

Stigma anticum, obliquum, convexum, dorso adscendenti, cujus facies concava *Antheræ* incumbit.

Per. ut in congeneribus.

N. B. *Epipactis* is very like the foregoing genus (*Arèthusa*), but the peculiar form of the flower in particular, as well as the manner of growth by which the genus is distinguished, do not admit of their being united. This genus is one of HALLER's, and most of the species, which he refers to it, are also retained here. The difference in the *anther* distinguishes it from the genus *Ophrys*.

Species.

a. *labello lamina integra.*

<i>Epipactis</i> latifolia L.	<i>S. lancifolia</i> Ehrh.
<i>Serapias</i> latifolia L.	<i>E. ensifolia.</i>
palustris	<i>Ser. grandiflora</i> var. L.
<i>Serapias</i> longi-	<i>Ser. ensifolia.</i> Ehrh.
folia L.	rubra
microphylla	<i>Serapias rubra</i> L.
<i>Serapias</i> micro-	erecta
phylla L.	<i>Serap. erecta</i>
pallens	Th. jap.
<i>Serapias</i> grandi-	
flora L.	

E. falcata	E. ovata
Serapias falcata	Ophrys L.
Th. jap.	<i>Convallarioides</i> Sw.
b. <i>labello lamina fissa.</i>	Camtschatea
E. nidus avis	Ophrys L.
Ophrys L.	<i>porrifolia</i>
cordata	Ophrys unifolia
Ophrys L.	Forst.

15. MALAXIS S. Pl. 5. P.

Char. essent. Calyx patens, resupinatus :

Labellum concavo-patulum, adscen-
dens.

Anthera opercularis.

E. *Convallarioides* : caule bifolio, foliis cordato-subrotundis acutis, labello oblongo apice dilatato obtusè bilobo.—E *Terra Nova* Amer. Sept. communicata a cl. amico S. TÔRNER.

E. *porrifolia* : scapo tereti, folio fistuloso acuto lævi vaginato ; labello apice bilobo.

Char. naturalis :

Calyx resupinatus, 5-phyllus :

Foliola tria *exteriora* : duo *superiora*, unum *inferius* s. *anterius* ; lanceolata, obtusa, patentia.

Duo *interiora* *lateralia* linearia.

Cor. *Labellum* basi concavo *stylum* amplexans, calyci incumbens, adscendens ; *lamina* obtusa s. acuta, erecta s. subreflexa.

Genit. *Stylus* e *Germine* infero teretiusculo, obovato erectus, parum gibbus, antice apiceque excavatus.

Anthera terminalis, opercularis, hæmisphærica, bilocularis, oblique insidens, decidua.

Massæ pollinis sessiles, oblongæ, globulares, margini anteriori apicis styli incumbentes solitariæ.

Stigma anticum (situ posticum) infra *Antheram*, versus *labellum*, concavum.

Per. *Capsula* pedicellata oblonga s. obovato, &c.

N. B. This genus approaches to the next, but besides the situation of the flowers which

are turned upside down, the species belonging to it have a peculiar habit, which distinguishes them from all the other Orchideous plants.

Species :

Malaxis spicata. Flor. Ind. occ.

umbellulata - - -

monophyllos.

Ophrys monophyllos L.

M. spicata : foliis binis ovatis ; scapo 4-gono racemifero ; labello subtrilobo, medio acuminato.

M. umbellulata : foliis binis ovatis ; scapo 5-gono, floribus umbellulatis ; labello subtrilobo, medio acuminato.

M. monophyllos : folio subsolitari-ovato acuto ; scapo triquetro ; labello concavo acuminato.

M. *Rhedii* Sw.

Epidendrum resupinatum *Forst.*

Basaala poulou maravara *Rheed. mal.*

12. t. 27.

paludosa.

Ophrys paludosa L.

liliifolia.

Ophrys liliifolia L.

Læselii.

Ophrys Læselii L.

M. *Rhedii*: foliis pluribus lanceolato-ovatis acutis plicatis; scapo triquetro; labello concavo obtuso crenulato.

M. *paludosa*: foliis subquaternis apice scabris; scapo 5-gono; labello concavo acuto.

M. *liliifolia*: foliis binis ovato lanceolatis, scapo 3-quetto; foliol. cal. intern. reflexis discoloribus; labello concavo obovato, apice acuto.

M. *Læselii*: foliis binis ovato-lanceolatis; scapo 3-gono; labello apice ovato recurvato.

M. nervosa.

Ophrys nervosa Th. fl. jap.

Epidendrum nervosum Th. ic. jap.

dubiæ.

Katou ponnam marawara. *Rheed.* mal. 12. t. 28.

Bela pola *Rheed.* mal. 11. t. 38.

Epidendrum caudatum. L.

Limodorum nutans. *Roxb.* Cor. t. 40.

N. B. *Malaxis Liliifolia*, *Loeselii*, & *nervosa*, which formerly (Act. Soc. Scient. Ups. 6. p. 76.) I transferred to *Cymbidium*, ought not to be separated from *Malaxis*. Though the flowers of these species have not completely that resupinate position like the rest, yet they are so much turned, that the lip is not directed outwards, but generally towards the scapus, and adscending.

M. nervosa : foliis pluribus ovatis acutis ; scapo angulato ; labello ovato sulcato subreflexo, basi bicallosa.

THUNBERG calls the lip of *M. nervosa*, *petalum supremum*; the flowers, therefore, are distinctly resupinate.

16. CYMBIDIUM Sw. Pl. 6. R.

Char. essent. *Calyx* erectus s. patens.

Labellum basi concavum, ecalcaratum; *lamina* patula.

Anthera opercularis, decidua.

Pollen globosum.

Character naturalis.

Calyx 5-phyllus rarius 4-phyllus:

Foliola erecta s. patentia. *Tria exteriora*; duo *interiora* plerumque parum minora.

Cor. *Labellum* basi concavum (nec stylo marginibus adnatum) ecalcaratum; *lamina* patula, indivisa s. lobata, erecta s. deflexa.

Genit. *Stylus* e *Germine* infero, oblongo s. ovato erectus, semicylindricus, sæpe gibbus, antice concavus.

Anthera opercularis, hæmisphærica, 2-4-locularis, decidua.

Massæ Pollinis globulosæ, solitariae s. geminae s. partibiles, pedicello insidentes apici styli antice adglutinato.

Stigma anticum, prope antheram & apicem styli, concavum s. convexum.

Per. Capsula oblonga s. ovata, 3-6-carinata, 1-locularis, trivalvis, secundum costas dehiscens, fenestrata.

Semina numerosa, minima, arillo scobiformi induta; sulcis elevatis valvularum villosis adsidentia.

Species.

A. *Parasitica.*

a *Calyce erectiusculo.*

Cymbidium coccineum.

Epidendrum L.

C. coccineum : subcaulescens, foliis terminalibus aliisque radicalibus bulbo innatis, subensiformibus obtusis, scapis filiformibus axillaribus unifloris.

*C. tripterum.**C. echinocarpum.*

Epidendr. Smith
vestitum Fl. I. occ.
proliferum.

Limodorum pen-
dulum Aubl.
muricatum Fl. I. oc.

C. tripterum: acaule, foliis bulbo innatis radicalibus vaginatis multifloris; germine trialato. *Obs*: Receptaculo pollinis instruitur, quod negavit Cel. SMITH.

C. vestitum: caule dichotomo, vaginis undique imbricato, apice axillisque bulbiferis, bulbis monophyllis, floribus confertis e vaginis caulinis.

C. proliferum: caule adscendente prolifero, foliis distichis ovato lanceolatis floribus axillaribus sessilibus, bulbis e vaginis foliorum diphyllis.—Proveniunt in India occidentali.

C. echinocarpum: caule compresso, decumbente, pendulo imbricato, foliis bifariis ovatis acuminatis, capsulis muricatis.

C. muricatum: caule compresso erectiusculo imbricato, foliis bifariis oblongis acutis lineatis, capsula muricata.

C. trichocarpum Fl. I. oc. *C. testæfolium* Fl. I. occ.

glaucum - - - *lineare*.

graminoides - - - *Epidendrum Linn.*

equitans.

Epidendr. Forst.

C. trichocarpum : caule tereti-compresso radicante imbricato, foliis bifariis linearibus subreflexis, capsulis pilosis.

C. glaucum : caule compresso erectiusculo imbricato, foliis bifariis lato-lanceolatis subtus glaucis; capsulis nudis.

C. graminoides : caule compresso assurgente multifloro imbricato, foliis bifariis lineari-lanceolatis remotiusculis; capsulis glabris, pedicellis elongatis.

C. testæfolium : caule repente, foliis incumbentibus subrotundis acutis convexo-concavis carinatis, floribus sub foliis sessilibus.

C. lineare : caule simplici erecto; foliis distichis linearibus obtusis, apice emarginatis, floribus terminalibus subspicatis.—Habitat in India occidentali.

C. nodosum.

Epidendrum L.

scriptum.

Epidendrum L.

cucullatum.

Epidendrum L.

C. aphyllum.

Limodorum Roxb.

Aloifolium.

Epidendrum Roxb.

C. nodosum: caule simplici monophyllo tuberculo radicato, folio semicylindraceo subulato, lamina lab. integra.

C. scriptum: foliis bulbo innatis ovato lanceolatis trinerviis, scapo multifloro, petalis maculatis.

C. cucullatum: caule simplici unifloro diphylo foliis subulatis sulcatis, lamina lab. ciliata. Incolunt insulas Ind. Occ.

C. aphyllum: caule simplicissimo aphylo teretiparticulato, floribus lateralibus subsessilibus, labello basi convoluto.—Generis Dendrobii adsine. Patria Bengala.

C. Aloifolium: foliis radicalibus lato-linearibus canaliculatis carnosiss apice retusis, scapis multifloris erectis.

C. pendulum.

C. præmorsum.

Epidendrum Roxb.

Epidendrum Roxb.

tessellatum.

flabelliforme Fl. I. oc.

Epidendrum Roxb.

subulatum.

C. *pendulum*: foliis radicalibus distichis lato-linearibus apice retusis concavis; scapis declinato-pendulis multifloris. Utrumque ex Malabaria.

C. *tessellatum*: caulescens, foliis imbricato distichis lineari-canaliculatis carnosis, apice tridentatis, racemo axillari.

C. *præmorsum*: caulescens, foliis remotiusculis distichis lato-linearibus canaliculatis apice præmorsis, spicis oppositifoliis. Patria Malabaria, Coromandel.

C. *flabelliforme*: foliis radicalibus basi attenuatis compresso carinatis, superne planis ovato-lanceolatis nervosis, scapis abbreviatis unifloris.

C. *subulatum*: foliis subulatis sulcatis racemisque radicalibus.

C. triquetrum.	Limodorum tube-
pusillum.	rosus L.
Epidendrum L.	C. verecundum.
B. <i>Terrestria</i> .	Limodorum altum
pulchellum.	Jacq.

C. triquetrum: foliis radicalibus subtriquetris canaliculatis recurvatis, marginibus dorso apiceque compressis, scapo multifloro, floribus 4-petalis, labello basi cordato.

C. pusillum: foliis radicalibus ensiformibus basi equitantibus, scapis paucifloris, labello basi angustiore, lamina triloba.

C. pulchellum: foliis radicalibus ensiformibus nervosis, scapo paucifloro, labello erecto basi attenuato, lamina expansa, disco concavo piloso. Habitat in America septentrionali.

C. verecundum: foliis radicalibus lato-lanceolatis plicato-nervosis, scapo multifloro, foliolis calycis interioribus conniventibus, labello ventricosus, lamina emarginata crispa sulcata.

*C. diurnum.**C. giganteum.*Limodorum *Jacq.*Limodorum *Th.*

utriculatum Fl. I. Oc.

Satyrium *Linn.*

suppl.

C. diurnum: foliis radicalibus lineari-lanceolatis carinatis, scapo paniculato, foliolis calicis patentibus, labello erecto, lamina triloba.

C. utriculatum: foliis radicalibus geminis lanceolato-ovatis scapoque multifloro vagina inflata basi cinctis, fol. cal. subconniventibus, radice maxima tuberosa.—Cum præcedentibus in Amer. merid.

C. giganteum: foliis radicalibus equitanti-ensiformibus subrecurvis, scapo tereti, floribus remotis; labello hastato, lacinia intermedia ovato-plicata.

Obs. Labellum hastatum nec sagittatum basi subtus gibbum nec cornutum, laciniis baseos deltoideis prominentibus, intermedia 5-lamina magna oblonga integra primum concava demum convexa, carinata, disco longitudinaliter plicato, limbo undulato.

*C. tabulare.*Satyrium *Linn.*

suppl.

Serapias *Thunb.*

pedicellatum.

Satyrium capense

Linn. Sp. pl.

Satyrium pedicel-

latum *Suppl.*

Serapias pedicel-

lata *Thunb.**C. aculeatum.*Satyrium *Linn.*

suppl.

Serapias *Thunb.*

squamatum.

Ophrys squamata

Forst.

corallorrhizon.

Ophrys corallhor-

rhiza *L.*

C. tabulare: folio radicali lineari, scapo erecto paucifloro, lamina labelli trifida, laciniis ovatis integris.

Obs. folia nulla caulina, nec lacinia media. labelli emarginata. Radix bulbosa.

C. pedicellatum: folio radicali lineari-lanceolato nervoso, scapo angulato, floribus subpedicellatis nutantibus, cal. foliol. erectis.

C. aculeatum: foliis radicalibus subternis ensiformibus, scapo vaginato, spica ovata.

Radix in utroque bulbosa. Scapus illius lon-

*C. grandiflorum.**C. boreale.*Limodorum *Aubl.*

Cypriped. bulbosum L.

gissimus, hujus digitalis vaginis foliaceis vestitur. Calix erectus. Labellum basi gibbum, lamina trifida, lacinia intermedia superne muricata.

Omnia in Africa australi vigent.

C. grandiflorum: scapo subtrifloro vaginato, vaginis remotis foliaceis ovato-lanceolatis, labello trilobo, intermedio emarginato. Incolit Americam meridionalem.

C. boreale: folio radicali unico ovali acuto, scapo tereti unifloro, corolla bilabiata, labio inferiore subinflato, lamina replicata, fauce barbata. Hab. in Lapponia, Siberia, Terra Nova, Amer. Sept.—Columna genitalium ut in Cymbidio monandra; minime Cypripedii, cui Antheræ duæ distinctæ.

*C. ensifolium.**C. striatum.**Epidendrum* L.*Limodorum* Th. Jac.*Species dubiæ.**Epidendrum tuberosum* Linn.*Epidendrum caudatum* L. *Malaxis* forte
species.*Epidendrum tenuifolium* L.*Epidendrum furvum* L.*Epidendrum ovatum* L.*Epidendrum juncifolium* L.*Epidendrum guttatum* L.*Epidendrum Cebolleta* Jacq.*Epidendrum violaceum* Jacq.*Epidendrum Clypeolum* Forst.*C. ensifolium* : foliis radicalibus ensiformibus nervosis, scapo tereti paucifloro, labello ovato, subrecurvato, maculato.*C. striatum* : foliis radicalibus ensiformibus nervosis, scapo angulato paucifloro, labello oblongo, lamina plana trifida.

Proveniunt in China, Japonia.

Epidendrum triste *Forst.*

Epidendrum Calceolarix *Retz.*

Epidendrum plantaginifolium *Retz.*

Epidendrum Lycopodioides *Retz.*

Limodorum floridum *Salisb.*

Limodorum altum *Linn.*

Helleborine radice arundinacea. *Plum.*

Epipactis flore virescente, vulgo Piquichen
Feuill.

Epipactis amplo flore lateo, vulgo Gareilu
Feuill.

Bletia Flor. peruv. & chil. prodrom.

Sobralia Flor. peruv. et chil. prodr.

Fernandezia? Flor. peruv. & chil. prodr.

Chichiltic Tepetlauchpochitl *Hernand.*

Tzaupochitl *Hernand.*

Helleborine foliis rigidis angustis *Plum.*

Thrixspermum Centipeda *Loureiro.*

Renanthera coccinea *Loureiro.*

Angræcum nervosum *Rumph.*

Herba supplex prima *Rumph.*

Angræcum terrestre primum *Rumph.*

N. B. The foregoing species, being of a polymorphous habit, might perhaps hereafter require a further subdivision. With regard to the characters taken from the anther and lip they all appear to agree.

17. ONCIDIUM Sw. Pl. 5. A.

Char. essent. Calyx patens.

Labellum planum, basi tuberculosum.

Anthera opercularis, decidua.

Character naturalis :

Calyx 4-5-phyllus :

Foliola patentia, subunguiculata; tria *exteriora*; duo *interiora* majora, plana, subrepanda; s. duo *exteriora*, duo *interiora* (si *calyx* 4-phyllus.)

Cor. Labellum e basi styli, patens, lobatum, lobo medio magno, disco superne gibbis duobus elevatis.

Genit. Stylus e *Germine* infero, subtereti, lineari erectus, antice excavatus, marginibus apicis alatis.

Anthera subrotunda, opercularis inter alulis
apicis styli, bilocularis, decidua.

Massæ Pollinis globulares, binæ, pedicello
communi junctæ.

Stigma infra antheram, concavum.

Per. præcedentium.

N. B. This genus, which derives its name from
ὄγκιον (*Tuberculum*) on account of the
form of the labellum, distinguishes itself,
not only by its flowers, but its stalk being
of a harder and less herbaceous nature
than that of the other Orchidææ, and
divided something like a *Thyrus*.

Species.

Oncidium carthaginense.

Epidendrum Jacq.

altissimum.

Epidendrum Jacq.

quadripetalum.

Epidendrum Jacq.

O. variegatum.

Cymbidium Fl. Ind. occ.

Cebolleta.

Epidendrum Jacq.

18. EPIDENDRUM L. Pl. 7. U.

Char. essent. Calyx patens.

Labellum basi tubulatum, stylo antice
adnexum, ecalcaratum.

Anthera opercularis, decidua.

Char. naturalis.

Calyx 5-phyllus :

Foliola subæqualia, patētia. Tria *exteriora*
duo *interiora*.

Labellum basi turbinatum, stylo connexum,
ealcaratum; *lamina* erecta, patens, indi-
visa s. lobata.

Genit. }
Per. } ut in *Cymbidio*.

Species.

Epidendrum cochlea-	E. bifidum Fl. Ind. occ.
tum L.	polybulbon - -
fragrans Fl. Ind. occ.	labiatum - - -

E. cochleatum : foliis geminis oblongis bulbo innatis, scapo elongato, lamina labelli cordata, obtusa.

E. fragrans : folio lanceolato bulbo innato; scapo abbreviato multifloro, lamina labelli cordata acuta.

E. bifidum : foliis subternis lanceolatis bulbo innatis; scapo ramoso, lamina labelli 3-partita, lobo intermedio reniformi bifido.

E. polybulbon : caule repente bulbifero, bulbis diphyllis unifloris, flore pedunculato, lamina labelli cordata.

E. labiatum : foliis radicalibus oblongis, bulbo medio solitario monophyllo, scapis paucifloris, lamina labelli obovato-incrassata.

Cum præced. in India occid. provenit.

E. amabile L.

E. verrucosum Fl. Ind. oc.

patens Fl. Ind. occ.

punctatum L.

E. amabile: foliis radicalibus lato-lanceolatis, scapo subdiviso, cal. fol. lateralibus orbiculatis, lamina lab. tripartita: lacinia intermedia hastata, apice bifida.

Hab. in Ind. Orientali.

Obs. Labium basi angustissimum nec columna ut in ceteris connatum; glandula tamen magna bifida ad basin laminæ inserta, apice columnæ connexa antheramque tegens.

E. patens: caule simplici, foliis oblongis, panicula terminali simplici diffusa, lamina labelli triloba, lobo intermedio bipartito.

E. verrucosum: caule simplici folioso verrucoso, foliis lanceolatis nervosis; scapo paniculato corollisque impunctatis.

E. punctatum: caule simplici vaginis imbricato, foliis lanceolatis nervosis; scapo paniculato corollisque punctatis.

E. nutans Fl. Ind. occ. *E. ramosum* Jacq.

umbellatum - - rigidum - -

diffusum - -

E. nutans : caule simplici foliis ovato lanceolatis amplexicaulibus, floribus subspicatis nutantibus, lamina lab. triloba, lobo intermedio tridentato.

E. umbellatum : caule simplici, foliis oblongis subemarginatis, floribus in sinu folii terminalis confertis, lamina lab. triloba, lobo intermedio emarginato.

E. diffusum : caule simplici ancipiti, foliis oblongis, panícula terminali ramosissima; lamina lab. cordata acuminata.

E. ramosum : caule ramosissimo, foliis linearibus obtusis emarginatis, spicis terminalibus laxis, floribus distichis.

E. rigidum : caule simplici, foliis oblongis, obtusis, spica terminali laxa ancipiti, floribus distichis, lamina lab. cordato-ovata acuta.

E. bifarium Fl. Ind. oc. *E. secundum* L.

nocturnum L.

fuscatum *Smith.*

ciliare L.

E. bifarium : caule simplici, foliis cordato-lanceolatis horizontalibus, spica terminali laxa ancipiti, floribus distichis, lamina labelli triloba.

E. nocturnum : caule simplici, foliis oblongis aveniis, floribus terminalibus, lamina lab. tripartita integra, lacinia intermedia lineari-elongata.

E. ciliare : caule simplici, foliis binis oblongis aveniis, lamina lab. 3-partita, lacinia intermedia lineari.

E. secundum : caule simplici, foliis oblongis emarginatis, pedunculo terminali longissimo, spica laxa secunda, columna longitudine petalorum.

E. fuscatum : caule simplici, foliis oblongis acuminatisve, pedunculo terminali elongato, spica globosa, columna petalis brevior.

E. elongatum Jacq.

Species dubiæ.

E. vomiforme. Fl. Ind. occ.

E. angustifolium. Fl. Ind. occ.

E. liliifolium. Retz.

E. sessile. Retz.

Helleborine floribus atropurpureis. Plum.

Helleborine amplissimo flore vario. Plum.

19. VANILLA. PLUM. Pl. 7. T.

Char. essent. Calyx patens.

Labellum basi subcucullatum, ecalcaratum ; *lamina* patentē.

Anthera opercularis, decidua.

Capsula siliquæformis, carnosâ.

E. elongatum : caule simplici, foliis oblongis, pedunculo terminali elongato, spica laxa, lamina lab. dentato ciliata. Omnia parasitica Ind. Occid.

Char. naturalis.

Calyx 5-phyllus.

Foliola subæqualia, patentia. Tria *exteriora*, duo *interiora*.

Cor. Labellum basi subventricosum stylum amplexans, ecalcaratum; *lamina* dilatata patula, apice convoluta, deflexa.

Genit. Stylus e *Germine* infero, longo, cylindraceo, 3-gono erectus, trigonus, gibbus, antice planiusculus.

Anthera magna, opercularis, convexa, bilocularis, decidua.

Massæ Pollinis globulares, bipartibiles.

Stigma anticum versus apicem styli, convexum.

Per. Capsula elongata, cylindracea s. oblonga, obsolete trigona, 1-locularis, carnosa, tribus-lineis notata.

Semina numerosissima, lenticularia, nuda, in pulpa nidulantia.

Species :

Vanilla aromatica—Epidendrum L.

claviculata—Flor. Ind. Occ.

Sp. dubiæ.

V. flore violaceo, fructu brevior rubro. *Plum.*

V. flore albo, fructu brevior corallino. *Plum.*

Angurek Warna. *Kämpf.*

Visco-aloes quinta *Kamel.* ex Luzonia *Ray.*

20. LIMODORUM TOURNEF. Pl. 6. S.

Char. essent. Calyx subpatens.

Labellum e basi postice in *Calcar*
productum. *Lamina* patula.

Anthera opercularis, decidua.

V. *aromatica* : foliis ovato-oblongis nervosis capsulis cylindraceis longissimis.

V. *claviculata* : foliis lanceolatis acutis concavis recurvatis rigidis, capsulis subellipticis.

Epidendr. claviculatum Sw. prodr.

Char. naturalis.

Calyx 5-phyllus, plerumque patens, rarius resupinatus.

Foliola tria *exteriora*, duo *interiora*, sæpe minora.

Cor. Labellum basi concavum, postice in calcar variæ figuræ & longitudinis prominens.

Lamina patula indivisa s. lobata.

Genit. } ut in *Cymbidio*, *Epidendro*.
Per. }

Species.

Limod. Tankervilliae. Hort. Kew.

Phayus *Lour.*

striatum *Banks.*

L. Tankervilliae: foliis radicalibus ovato lanceolatis nervosis, scapo simplici multifloro, labello cucullato integro, cornu abbreviato.

L. striatum: foliis radicalibus lato lanceolatis nervosis, scapo simplici, lamina labelli triloba, cornu germine breviorē.—Habitant in China Japonica.

L. virens *Roxb.*

recurvum *Roxb.*

triste *Thunb.*

L. capense *Berg.*

Satyr. triste *Linn.*

falcatum

Orchis falcata *Th. jap.*

L. virens : foliis radicalibus linearibus acutis concavis, scapo ramoso punctato, labello concavo, cornu abbreviato.

L. recurvum : foliis subradicalibus lato-lanceolatis nervosis scapo duplo longioribus, spica globosa recurva, cornu brevissimo.

L. triste : foliis radicalibus ensiformibus erectis, scapo ramoso, floribus subcampanulatis, cornu obtuso germine brevior. Promont. bonæ spei.

L. falcatum : foliis subradicalibus equitanti-ensiformibus falcatis, scapis paucifloris, cornu filiformi longissimo.

L. longicorne <i>Thunb.</i>	L. fasciola
Epidendrum ca-	Epidendrum <i>Forst.</i>
pense L.	barbatum <i>Thunb.</i>
funale Flor. Ind. oc.	Serapias capensis L.
filiforme	

L. longicorne: foliis radicalibus equitantibus latolinaribus obtusis, floribus scapi secundis, cornu filiformi longissimo. Hab. ad promont. b. sp.

L. funale: aphyllum, radicans, pedunculo bifloro, labello bilobo, cornu subulato longissimo.

L. filiforme: aphyllum, radicans, pedunculis subtrifloris, labello ovato, cornu apice capitato. Hab. in Jamaica.

L. fasciola: aphyllum, radicans, pedunculis multifloris, labello integro, cornu compresso obtuso. Hab. in Ins. societatis maris pacifici.

L. barbatum: foliis radicalibus equitanti ensiformibus subfalcatis, scapo flexuoso vaginato, floribus approximatis, cornu obtuso germine brevior, lamina labelli subtriloba.

<i>L. hians</i> <i>Thunb.</i>	<i>abortivum.</i>
<i>Satyrium hians</i> L.	<i>Orchis abortiva</i> L.
	<i>Limodorum</i> <i>Tourn.</i>

L. hians: foliis radicalibus equitantibus linearibus, scapo paucifloro, corollis cernuis hiantibus, cornu longitudine germinis, labello trilobo, intermedio subobcordato.

Obs. Petala 5 subæqualia absque galea. Cornu e basi labelli nec posticum.—Flos ante florescentiam resupinatus, unde labellum pro galea calcarata perperam habitum.

L. abortivum: aphyllum, scapo vaginato, petalis erectis, labello ovato undulato, cornu subulato germinis longitudine:

Habitus, fol. calic. situs, & imprimis figura columnæ genitalium pristinum *Limodorum* CLUSII & TOURNEFORTII ab Orchide ablegant.—Provenit in Europa australi.

Obs. Labellum minime bifidum sed trilobum; lobis lateralibus minoribus medio ovato, disco striato subbarbato.

L. <i>Epipogium</i> .	L. <i>cucullatum</i> . Afz.
Satyrion L.	<i>bidens</i> . Afz.
<i>cristatum</i> Afzel.	<i>emarginatum</i> . Afz.

Species dubiæ :

Epidendrum spathulatum Linn.

Epidendrum orchideum Retz.

Epidendrum pusillum R.

Epidendrum complanatum R.

Epidendrum clavatum R.

Epidendrum subulatum R.

Epidendrum bidentatum R.

Serapias *Epidendræa* R.

Calista amabilis Loureiro.

L. *Epipogium* : aphyllum, scapo vaginato paucifloro, floribus pendulis resupinatis, labello trilobo concavo, cornu adscendente ovato.

Calice patente (licet resupinato) et columna *Limodoro* proximum. Ex Alp. austr. Helvet.

Helleborine aphyllous flore luteo *Plum.*

Flos triplicatus *Rumph.*

Orchis triplicata Willemet. Ust. Ann. bot. 18.

p. 52.

Katu-Kaidu-Marawara *Rheed. Limod. virenti*
affine.

21. AERIDES LOUR. Pl. 8. Y.

Char. essent. Calyx patens.

Labellum ecalcaratum : lamina sac-
cata.

Anthera opercularis, decidua.

Char. naturalis :

Calyx 5-phyllus, patens.

Foliola subæqualia, subinde repanda s. apice
latiora.

Cor. Labellum foliol. calycinis brevius, e basi
styli ortum; *lamina* in saccum depressa,
super genitalia sæpe reversa.

Genit. }
Per. } ut in Limodoro, &c.

*Species.**Aërides* retusa.*A. coriacea.*Epidendr. retu-
sum L.Limodor. coria-
ceum *Th. mus.**arachnites.*

latifolia.

Epidendr. flos
aëris L.Limodor. latifo-
lium *Th. mus.*Limodorum Act.
ups. VI.*dubiæ :**Aërides* odorata *Loureiro.*Biti maram maravara *Rheed.*

A. retusa : foliis subradicalibus linearibus apice bifariam retusis, racemis longissimis axillaribus. Habitat in Malabaria.

A. arachnites : caule subramoso radicante, foliis lanceolatis, petalis apice dilatatis, sacco labelli antice bifido, processu erecto bidentato. Hab. in Japonia.

A. coriacea : foliis caulinis ovatis acuminatis subcoriaceis lineatis, apicis paniculatis. Provenit in Madagascar.

22. DENDROBIUM S. Pl. 8. V.

Char. essent. *Calyx* erecto patens; in quibusdam resupinatus. *Foliola* lateralibus exteriora circa basin *labelli* ecalcarati conniventia s. connata, sæpe calcar mentientia.

Anthera opercularis, decidua.

Charaēter naturalis.

Calyx 3-phyllus; in aliquot speciebus resupinatus:

Foliola tria exteriora oblonga, erecto patentia; duo interiora lateralibus frequenter minora.

Lateralibus exterioribus ad latera styli inferne prominentis antice basi producta, conniventia s. coalita, sæpe calcar mentientia.

Cor. *Labellum* a foliolis calycinis lateralibus basi inclusum illisque subinde connatum, ecalcaratum. *Lamina* subrecurvata, concava s. plana, integra s. divisa.

Genit. } ut in *Limodoro*.
Per. }

N. B. When the flower is turned upside down, the calyx appears to consist of four leaves only, but then the two outer leaves are larger than the rest and connected, so as to form a sort of helmet, beneath which the labellum is fixed in a pendent situation. Though remote from the *Style*, it, however, communicates with it by means of a keel running from it to the end of the connected leaves of the calyx. Thus the flower of this genus appears almost like that of *Cranichis*.

Species.

a. floribus rectis.

D. palmifolium Fl. Ind. *D. Barringtoniæ*.

occ. *Epidendrum Smith.*

D. palmifolium: foliis lato lanceolatis nervosis, singulis bulbo innatis, scapis radicalibus multifloris.

D. Barringtoniæ: foliis pluribus bulbo innatis latioribus, scapis subunifloris.

D. sanguineum Fl. Ind. oc. D. utricularioides Fl. I. oc.

Myosurus. testiculatum - - -

Epidendr. Forst. corniculatum - - -

D. *sanguineum* : foliis geminis oblongis bulbo innatis, scapo subdiviso, petalis lateralibus in formam cornu, germi adnati, decurrentibus. Hab. in Ind. Occidentali; Jamaica.

D. *Myosurus* : fol. lanceolatis linearibus canaliculatis subemarginatis, scapis nudis, spica filiformi nutante. Ex Ins. Soc. mar. austr.

D. *Utricularioides* : foliis lanceolatis lineatis planis, scapo paniculato, petalis lateralibus sub labello magno obcordato in cornu brevissimo basi unitis.

D. *testiculatum* : fol. tereti subulatis, scapo simpliciusculo, cal. basi antice didymo-ventricosis.

D. *corniculatum* : caule brevissimo, folio cuneato-oblongo subpetiolato, pedunculo unifloro, cal. acuminato curvo.

D. Lanceola	- - -	D. alpestre	- - -
sertularioides-	- - -	laxum	- - -
racemiflorum	- - -	ruscifolium	- - -

Epidendrum *Lim.*

D. *Lanceola* : caule brevissimo, folio lanceolato subpetiolato, pedunculo bifloro.

D. *sertularioides* : caule communi filiformi repente radicante, partialibus erectis monophyllis brevissimis, foliis lanceolatis subpetiolatis, pedunculis unifloris.

D. *racemiflorum* : caule elongato, folio ovato, racemo foliis longiore erecto, floribus secundis acuminatis tetragonis.

D. *alpestre* : caule elongato, folio ovato lanceolato, racemis laxis, carinis capsularum muricatis.

D. *laxum* : caule elongato, folio oblongo acuminato, racemis laxis, capsulis nudis.

D. *ruscifolium* : caule elongato, folio ovato-lanceolato, floribus in sinu folii aggregatis.

b. *floribus resupinatis.*

D. biflorum,

D. moniliforme.

Epidendrum *Forst.*Epidendrum *L.**anceps* Sw.*crumenatum* Sw.

D. *biflorum* : caule tereti simplici, foliis distichis lineari-lanceolatis planis, pedunculis binis oppositifoliis e basi vaginarum brevissimis.

D. *anceps* : caule ancipiti simplici, foliis distichi scalpelliformibus planis, pedunculis binis e basi vaginarum brevissimis. Ex India orient.

D. *moniliforme* : caule tereti simplici basi tuberoso, foliis lineari-lanceolatis, spicis erectis, floribus remotis alternis solitariis, processibus obtusis.

D. *crumenatum* : caule subramoso compressiusculo basi tuberoso, foliis ovato-lanceolatis, spicis erectis, floribus remotis alternis geminatis, processibus acuminatis. Angræcum crumenatum RUMPH.

c Java GRONDAHL.

D. polystachion Sw.

D. javanicum Sw.

Epidendrum mi-

linguæforme Sw.

nutum Aubl.

reptans Sw.

crispatum.

Epidendr. Forst.

D. polystachion: foliis subradicalibus lato lanceolatis, scapo ancipiti, spicis pluribus alternis secundis.

Ex Amer. Africa & Asia.

D. crispatum: caule ramoso virgato, foliis cylindraceis filiformibus subincurvis, racemis lateralibus simplicibus.

D. javanicum: caule radicante, foliis petiolatis erectis lato-lanceolatis obtusis, scapis e basi vaginarum petiolorum multifloris.

E Java THUNBERG.

D. linguæforme: caule radicante, foliis sessilibus ovatis carnosius, scapis e basi foliorum multifloris. Ex insulis maris pacifici. Communicavit cel SMITH.

D. reptans: caule radicante bulbifero, bulbis diphyllis, foliis ovatis, scapis radicalibus. *Cymbidium reptans.* Act. ups. VI.

D. galeatum Afzel.
pumilum Afz.

D. paniculatum Afz.
roseum Afz.

dubiæ :

Epidendrum carinatum L.

Maxillaria Fl. per. & chil. prodr.

Ceraja simplicissima Lour.

Lincea *Hernand.*

Epidendrum graminifolium L.

Epidendrum concretum Jacq.

Angræcum flavum vel *septimum* Rumph.

Angræcum nonum Rumph.

Angræcum caninum Rumph.

Herba supplex secunda Rumph.

Herba supplex quinta Rumph.

23. STELIS S. Pl. 8. W.

Char. essent. Calyx subduplex : Foliola exteriora
 basi coalita : interiora labello
 conformia, apice subfornicata su-
 pra stylum.

Anthera opercularis, decidua.

Character naturalis.

Calyx sub 5-phyllus, s. subduplex :

Foliola tria *exteriora* basi coalita, triangularia, planiuscula ; duo *interiora* minuta, stylo contigua, erecta, obcordata, apice subfor-nicata.

Cor. *Labellum* figura foliol. cal. interiorum, erectiusculum.

Genit. *Stylus* e *Germine* infero ovato insidens, brevissimus, foliol. inter. & labello am-plexus, apice dilatatus, excavatus, triden-tatus.

Anthera subrotunda, opercularis, antice bifida, bilocularis, decidua.

Massæ Pollinis globulares, solitariæ.

Stigma anticum, prope antheram, convexum.

Per. *Capsula* ovalis, trigona, trisulca, sulco su-periore carinata, 1-ocularis, trivalvis.

N. B. *Stelis*, vox græca, significat *viscum quod arbori innascitur*, quæ natura hujus generis est.

Species.

- Stelis ophioglossoides* - Epidendrum Jacq. Lin.
micrantha. - - - - Dendrobii sp. Act. Ups. VI.
 N. B. To this the whole genus *Humboltia* Flor.
 peruv. & chil. t. 27. is to be referred.

24. LEPANTHES S. Pl. 8. X.

Char. essent. Calyx sub 5-phyllus, patens : *foliola*
exteriora basi subcoalita ; duo
interiora difformia.

Labellum nullum, sed *Stylus* basi
 s. apice alatus.

Anthera opercularis, decidua.

S. ophioglossoides : caule unifolio, folio oblongo
 lanceolato racemum subæquante, floribus
 trigonis.

S. micrantha : caule unifolio elongato, folio
 lato-lanceolato racemo brevior, floribus
 hexagonis. Habitat in Ind. Occ. & Amer.
 meridionali.

Character naturalis.

Calyx sub 5-phyllus :

Foliola tria *exteriora*, cordata, ovata, acuta, patentia, basi subcoalita. Duo *interiora* minuta, variæ figuræ, ad basin styli utrinque adnata, exterioribus incumbentia.

Cor. Labellum nullum.

Genit. Stylus e *Germine* infero subrotundo 3-gono erectus, cylindraceus; *Alulis* s. *lobis* duobus minutis lateralibus oppositis, ad basin s. apicem styli insertis.

Anthera opercularis, subrotunda, 1-2-ocularis, decidua.

Massæ Pollinis globulares, solitariæ.

Stigma intra antheram ad apicem styli, concavum.

Per. Capsula pedicellata, subrotunda, 3-6-gona, 3-sulca, 1-ocularis.

Species.

Lep. concinna. Fl. Ind. occid.

Epidendr. ovale Sw. prodr.

pulchella.

Epidendr. pulchellum Sw. pr.

tridentata.

Epidendr. tridentatum Sw. pr.

cochlearifolia.

Epidendr. cochlearium Sw. pr.

L. concinna: folio ovato acuminato, cal. foliolis subrotundatis acutis: interioribus postice obtusis.

L. pulchella: folio subrotundo acuto, cal. fol. acuminatis ciliatis: interioribus utrinque acutis postice cruciatis.

L. tridentata: folio ovato acuto marginato apice tridentato, floribus basi triquetris, cal. foliolis acuminatis, aliis styli erecto incurvis.

L. cochlearifolia: folio orbiculato convexo concavo. Omnes in India Occidentali vigent.

II. *Orchideæ with two Anthers.*

25. CYPRIPEDIUM L.

Char. essent. Calyx 4-phyllus, patens.

Labellum ventricosum, calceiforme.

Character naturalis.

Calyx 4-phyllus :

Foliola patentia, quorum *supremum* erectum,
infimum dependens, *lateralia* subdeflexa.

Cor. Labellum inflatum, calceiforme, obtusum.

Genit. Stylus c *Germinis* infero pyriformi, gibbo,
basi attenuato, contorto, sexangulari erectus,
cylindraceus, *lobo* subterminali, pedicellato,
diversæ formæ, subtus carinato, plano s. lateribus deflexo dorso auctus.

Antheræ duæ, distinctæ laterales, subsessiles,
biloculares, *lacinula* lanceolata utrinque
subjecta.

Massæ Pollinis pulvureo-granulosæ.

Stigma terminale, cernuum, inter antheras
lobo styli tectum, dilatatum, fovea triangulari
umbilicatum.

Per. Capsula obovata, obtuse trigona, tricarinata, &c.

Semina receptaculo lineari singulæ valvulæ longitudinaliter adnata, adsidentia.

Species.

<i>C. calceolus</i> Linn.	<i>C. spectabile</i> Salisb.
<i>parviflorum</i> Salisb.	<i>humile</i> Salisb.
-

C. calceolus : lobo styli ovali concavo subtus canaliculato carinato, labello petalis brevior compresso.

C. parviflorum : lobo styli sagittæformi basi deflexo, labello petalis brevior compresso.

C. spectabile : lobo styli ovali basi retuso concavo subtus obtuse carinato, labello petalis longior grosso. *C. album* H. Kew.

C. humile : lobo styli rhomboideo acuminato, lateribus deflexo, labello petalis longior antice fisso, foliis binis radicalibus. *C. acaule* H. Kew.

C. ventricosum.

C. guttatum.

macranthos.

japonicum Thunb.

C. ventricosum: lobo styli sagittato concavo, labello petalis brevior ventricosus, antice fissus. E Sibiria.

C. macranthos: lobo styli cordato-acuminato sessili, labello petalis longior, ore contracto crenato. E Sibiria.

C. guttatum: lobo styli ascendente ovali apice emarginato, labello petalis longior, ore patulo plano. GMEL. Sib. E Sibiria.

C. japonicum: lobo styli subsessili ovato apice acuminato reflexo, labello petalis brevior antice fissus foliis binis, caulinis suboppositis subrotundis. THUNB. ic. Jap.

EXPLANATION OF PL. 2—8.

Pl. 2. *A.* represents *Orchis mascula* L. *a.* the flower in its natural size. *b.* magnified. *c.* male parts on the body of the style. * pollen-masses coming out of their cell above the stigma. *d.* the pollenmasses separating. *e.* one of those bodies of which the pollen-masses consist, greatly magnified. *f.* a back view of the style with the anther.

B. a. a flower of *Disa cornuta*, natural size. *b.* the same with the helmet drawn back, to see the inner leaves. *c.* anther and stigma. * magnified. *d.* flower of *Disa maculata* in its natural size. * the inner leaflets within the helmet. *e.* flower of *Disa tenella*. *f.* its inner parts magnified.

C. a. flower of *Satyrium cucullatum* nat. size. *b.* a front view of the same, with helmet drawn back, and the foremost leaflets bent down. *c.* style with its anther and stigma. * above, magnified. *d.* natural size. *e.* a front view of the same, magnified. *f.* flower of *Satyrium striatum*. *g.* front view of the same. *h.* back view, magnified. *i.* style with its anther. *k.* pollen-mass.

D. a. a flower of *Ophrys Myodes* natural size. *b.* magnified. *c.* sexual parts with a part of the germ and lip.

Pl. 3. *E.* a flower of *Pterygodium inversum* closed and in nat. size. *b.* the same open. *c.* a back view of it, rather magnified. *d.* the sexual parts with the lip viewed in front. * pollen-mass. *e.* back view of the sexual

parts. * the stigma. *f.* the same of *Pier. atratum* viewed from before. * from behind. * the stigma—all magnified.

F. a. Front view of a flower of *Disperis capensis* in its natural size. *b.* back view of the same. *c.* sexual parts with the lip, greatly magnified. *d.* integument covering the anther in front. *e.* anther separated. *f.* view of one of the cavities in the integument with the spiral lobe.

G. a. b. a flower of *Corycium orobanchoides* viewed from both sides, natural size. *c.* the same opened, and magnified with its different parts displayed. *d.* one of the lateral leaflets still more magnified. *e.* front view of the sexual parts with the side-lobes and lip. *f.* back view of the same. *g.* the same with the stigma. *h.* one of the pollen-masses—all greatly magnified.

H. a. a flower of *Serapias cordigera* nat. size. *b.* the same expanded. *c.* lateral view of the sexual parts. *d.* front view. *e.* pollen-mass, magnified.

Pl. 4. *I. a.* a flower of *Neottia Orchioides* nat. size. *b.* front view of the opened flower. *c.* sexual parts with lip, rather magnified. *d.* the same without lip, magnified.

K. a. a flower of *Cranichis aphylla* nat. size. *b.* magnified. *c. d.* flower of *Cranichis diphylla*. *e.* still more magnified, to show the sexual parts, particularly the situation of the stigma. *f.* the lip separated. *g.* sexual parts. *h.* front view of the same, with the anther bent downward. *i.* pollen-masses. *k.* front part of the style with stigma—all magnified.

L. a. flower of *Thelymitra Ixioides* nat. size. *b.* sexual parts of the same. *c.* of *Thel. Forsteri*, magnified. *d.* the part on which the anther is situated, in an ex-

panded state. *e.* the part on which the stigma appears, separated. *f.* anther. *g.* pollen—all magnified.

M. a. flower of *Diuris* nat. size. *b.* the same, the four outer leaflets being removed, magnified. *c. d.* sexual organs. *e.* anther separated, greatly magnified.

Pl. 5. *N. a.* flower of *Epipactis palustris* nat. size. *b.* the same of *E. Nidus*. *c.* sexual parts of the former, with the stigma in front. *d.* anther. *e.* pollen. *f.* sexual parts of the latter—all magnified.

O. a. flower of *Arethusa ophioglossoides* *L.* nat. size. *b.* the same somewhat expanded. *c. d.* a lateral and front view of the sexual organs. *e.* anther viewed from the under side. *f.* pollen—all greatly magnified.

P. a. flower of *Malaxis monophyllos* nat. size. *b.* magnified. *c.* sexual organs. *d.* the same, situated on a part of the germ, with anther bent downward and pollen-masses fixed near the stigma. *e.* anther and pollen-masses. *f.* stigma situated on the front part of the style. *g.* flower of *Malaxis Læselii* in its natural size and situation. *d.* the sexual parts of the same, magnified.

Q. a. flower of *Oncidium variegatum* nat. size. *b.* back view. *c.* the tubercles on the lip, greatly magnified. *d.* the sexual organs. *e.* the same with anther dropped. *f.* anther. *g.* pollen-masses, with their pedicle—all strongly magnified.

Pl. 6. *R. Cymbidium.* *a.* the flower of several species of this genus. *b.* the lip and style of *Cymb. ensifolium* nat. size. *c.* the flower of *Cymb. Læselii*, rather magnified. *d.* the lip of *C. echinocarpum* nat. size. *e.* the flower of *C. pusillum*.

S. a. the flower of *Limodorum funale* nat. size. *b.* the resupinate flower of *Limod. Epipogium* nat. size.

Pl. 7. *T. a.* the flower of *Vanilla claviculata* nat. size. *b.* the capsule of *V. aromatica*, with one valve opened and cut off. *c.* the seeds of *Vanilla* both nat. size, and magnified.

U. a. the flower of *Epidendrum fragrans* with entire lip. *b.* flower of *E. bifarium* with three-lobed lip, both nat. size. *c.* three-carinated capsule. *d.* seeds in their nat. size, and magnified, covered by the aril.

Pl. 8. *V. a.* flower of *Dendrobium Barringtoniae* and *D. palmifolium*. *b.* the flower of *D. moniliforme* opened in front to show the insertion of the lip, &c.

W. a. the flower of *Stelis ophioglossoides* nat. size. *b.* the same magnified. *c.* flower of *S. micrantha* magnified. *d.* the same laid open. *e.* the inner leaves of the calyx, lip and style. *f.* lip separated. *g.* style with anther.

X. a. the flower of *Lepanthes cochlearifolia* nat. size. *b.* the same greatly magnified. *c.* flower of *L. pulchella* *d.* the same magnified.

Y. a. the flower of *Aërides flos aëris* nat size. *b.* the lip divided in the middle. *c.* style with anther drawn backwards. *d.* pedicled pollen-masses. *e.* flower of *A. coriaceum* nat. size. *f.* the sac of the lip fixed to the style, nat. size.

SOME BOTANICAL OBSERVATIONS

BY DR. M. B. BORKHAUSEN.

[Translated from the German.*]

AMONG the various charges brought forward with a view to disparage the merits of the great Swedish naturalist, we find it imputed to him, that he has often neglected the study of nature, and not only formed many spurious genera, but, what is deemed still more detrimental to the science, many spurious species, and, on the other hand, that he has sometimes degraded real species into varieties. Subsequent botanists, therefore, have taken great pains to correct these Linnean errors, by searching for those plants reduced into varieties, and reinstating them in their specific rights.

* RÖMER'S Archiv für die Botanik, vol. I. p. 45.

However great the merit of such exertions when properly applied, it should always be remembered, that the examination of a plant, to ascertain whether it be a species or variety, ought to be made in its natural situation, and never from specimens preserved in herbariums. The dubious plants should not only be observed in different soils, but also in the different regions of air, which a mountain traverses, or through which a whole tract of country, with all its diversity of soil, ascends, to see whether or not they will retain their distinguishing characters in the combination of many different circumstances. I shall here communicate some cases, in which this careful examination has been neglected, and species have been established, which, according to my own observation, are mere varieties.

1. *Orobus tenuifoliis* ROTH *Beytr. Zur Bot.* I. p. 78. n. 7. *EjUSD. fl. Germ.* I. p. 305. & II. 2. p. 170.

Orobus pannonicus JACQ. *Vind. Fl.* p. 128.

Orobus austriacus CRANTZ *Stirp. Austr.* p. 374. tab. 1. fig. 1.

Having observed this plant for several years in various soils, in high and low situations, the result of all my observations has been, that it is merely a variety of *Orobis tuberosus*. All the above distinguishing characters which the authors attribute to it, and which indeed are chiefly taken from relative qualities, such as length and width, are not sufficient to establish it as a species. I am possessed of specimens of all shapes, with leaves broad-lanceolate, nearly oval, going over by slow degrees to very narrow and nearly capillary, so as to make it impossible for words to convey a clear idea of the different gradations. Several observations made by me upon the *Bergstrass-mountains* (which from the foot to the highest summits are equally covered with a stratum of fine argillaceous earth, producing this plant in abundance), have proved the truth of this assertion. At the foot of these mountains it is found with lanceolate, and nearly oval leaves; as we ascend higher, the leaflets are seen to become gradually longer and narrower, and the stalk more delicate; upon the summits of the *Knotenheimer Höhe*, an elevation of about 1800 feet above the

Rheintal, I observed none but with weak and decumbent stalks, and leaves very long and capillary. The specific character taken from the stipules, as being toothed in *O. tenuifolius*, and without teeth in *O. tuberosus*, is not less inconstant than that taken from the leaves. I observed them on the same plants, nay upon the same stalk, both with and without teeth. The stalk of *O. tuberosus* as well as of *O. tenuifolius* is four-cornered below, two-edged or winged above, and in both sometimes quite simple, sometimes branched and divaricate at the base. According to these observations, therefore, the character of *Orobis tuberosus*, as comprising both varieties, would be as follows;

Orobis radice tuberosa, caule inferne quadrangulo, superne ancipiti alato, foliis pinnatis.

Var. a. foliis bi- et trijugis, lanceolatis et linearibus.

b. stipulis denticulatis et integerrimis.

c. caule simplici et basi ramoso diffuso.

2. *Polygala amara, vulgaris & monspeliaca.*

LINNÆUS and all subsequent botanical writers

separate these three plants into so many species, which, however, appear to be mere varieties. The distinguishing characters attributed to each of them are not so constant or exclusively their own, as to entitle them to the rank of real species. According to the difference of soil the plant varies very much; with stalk upright or trailing, simple or branched below; with root-leaves alternate or opposite, obovate or oval, cauline leaves lanceolate or linear. The soil most favourable to its growth, and in which it attains the most intense bitterness, appears to be a fine argillaceous soil, covered with bog-earth, such as is found on the Bergstrass-mountains. Here the plant always appears as *Polygala amara*, varying, however, frequently, both with respect to the stem, which is either simple or branched below, and to the root-leaves which are generally opposite, but also alternate, even on the same specimen. As the argillaceous soil is gradually mixed with gravel, and at last becomes entirely gravelly, the plant loses more and more of its luxuriant appearance, both the radical and cauline leaves become narrower,

the stalk more ligneous, rigid, and upright, and thus it is converted into *Polygala monspeliaca*. In dry meadows and poor grass-plots, in woods, the plant generally appears as *Polygala vulgaris*, though, according to the different quality of the soil, the stalk is either entirely decumbent or somewhat adscending, the root-leaves more or less crowded, opposite or alternate, and it gradually runs both into *Polygala amara* and *monspeliaca*, that no limits can be drawn.

3. *Scabiosa Columbaria* and *ochroleuca* L. (*S. tenuifolia* Roth.)

I very much doubt whether these plants be distinct species, having seen them in many forms both in the same and in different soils. In good, rather moist ground, the stem is slender and smooth, with long tender branches, and flowers rather nodding; in a gravelly and stony ground, on the contrary, the plant becomes more rigid, the branches are shorter, and, as well as the stem, more or less rough with hairs, in proportion to the greater or less barrenness of the soil. In the

rough as well as in the smooth variety, both the radical and cauline leaves are subject to variation, so that I have never been able to find distinct specific characters for *Scabiosa Columbaria* and *tenuifolia* (*ochroleuca* L.) In that which I consider as the smooth variety, I found the following diversities;

a. root-leaves obovate, crenate; cauline leaves pinnate; leaflets lanceolate or linear.

b. root-leaves obovate, deeply notched or cut; the lower cauline leaves pinnatifid; the upper

α. pinnate: leaflets entire, lanceolate.

β. pinnate: leaflets lanceolate, gashed, sometimes partly pinnatifid.

γ. doubly-pinnate: the last leaflets very narrow and pointed.

c. root-leaves pinnatifid, the odd segment very large (nearly as in *Erysimum Barbarea*) and notched or deeply cut; the lower cauline leaves pinnate: leaflets narrow, sharp-pointed; the upper doubly pinnate, or also simple.

d. root-leaves and lower cauline leaves pinnate; leaflets pinnatifid; upper cauline leaves doubly pinnate, as in No. c.

In the rough variety I met with the following diversities;

- a. leaves as in No. b, of the smooth variety.
- b. as in No. c, of the same.
- c. as in No. d, of the same.
- d. root-leaves and lower cauline leaves doubly pinnate; the last leaflets entire, the upper cauline leaves simply pinnate; leaflets linear, entire.
- e. all leaves doubly pinnate: the last leaflets entire.
- f. leaves as in No. d, the last leaflets with distant teeth.

In both these varieties I found the flowers of a blue, pale, violet, pale red, yellowish-white, and white colour.

47. *Viola tricolor et arvensis*.

LINNÆUS made both plants varieties of the same species, but other botanists, thinking themselves better informed, accused him of a great error, and again dissolved this pretended *species composita* into two, with the above names.

Every unbiassed observer, however, comparing both plants in nature, will find, that LINNÆUS was perfectly in the right; they very gradually run into one another, and it frequently happens that both these varieties are found upon the same stalk.

5. *Pimpinella Saxifraga* LINN. and *P. dissecta* RETZ. & ROTH.

LINNÆUS united both plants under the common name of *Pimpinella Saxifraga*; RETZIUS and ROTH separated them, and endeavoured to find a specific difference in the root-leaves. But in observing these plants at a spot where they grow in abundance so many gradations and varieties offer with regard to habit, proportion and partition of the leaves, as to make often utterly impossible to decide, whether a specimen belong to *Pimpinella Saxifraga* or *P. dissecta*. I myself saw the root-leaves of the following plants.

- a. pinnate : leaflets roundish, acutely serrated.
- b. pinnate : leaflets roundish, gashed.
- c. pinnate : leaflets pinnatifid.

d. doubly pinnate : last leaflets entire.

e. doubly pinnate : last leaflets toothed or gashed.

f. doubly pinnate : last leaflets pinnate, gashed.

In the first year when the stalk of the plant is not yet much divided, I constantly found the root-leaves simple, with roundish serrated leaflets ; the next year, on the other hand, I often observed different leaves from one root.

6. *Hieracium murorum* and *pilosissimum*
SCHRANKII.

Both plants, which former botanists, as TABERNÆMONTANUS, BARRELIER, &c. had considered as two distinct species, LINNÆUS united under the name of *Hieracium murorum* ; but Mr. SCHRANK, in his Bavarian Flora, again divides them into two species, to which, according to my own observations, they are no way intitled. The characters assigned to them by this latter botanist are not sufficiently distinctive and exclusive, but both plants gradually run into each other in such a manner as to preclude all possibility of fixing their

boundaries. In both the single cauline leaf is sometimes perfectly formed and distinctly petiolated; sometimes it appears stopped in its growth, and often more resembles a stipule than a leaf. The radical leaves are sometimes, in one and the same plant, nearly orbicular or oval, sometimes they are perfectly entire, sometimes rather undulated at the margin, not seldom obsolete, but as often distinctly and sometimes deeply toothed. This circumstance, as well as the greater or less pubescence, is merely owing to the greater or less sterility of the soil. Those leaves which are entirely without teeth, are the most hairy of all, and the deeper they are toothed, the more they lose in hairiness. This hairiness is also different at the different ages of the plant. The young leaf, which has not yet arrived at maturity, is the most hairy, but in proportion as it grows, the pubescence becomes gradually thinner, and at last disappears entirely. Mr. SCHRANK thinks he has found a constant character for his *Hieracium pilosissimum* in the persisting wool of the leaf-stalks; but according to what I have observed, this character is as

liable to change as others; the leaf-stalks as well as the leaves being very variable with respect to their pubescence.

7. *Hieracium sylvaticum* et *maculatum*.

SCHRANK.

All the characters mentioned by Mr. Schrank, though variously modified, are found in either of these plants, and the liver-coloured spots are of no moment, as in both the varieties, nay even sometimes in *Hieracium murorum*, they appear more or less intensely displayed.

According to these observations, the four above-mentioned species of *Hieracium* of Mr. Schrank might be reduced into two, *Hieracium murorum* and *Hierac. sylvaticum*. But are even these really different from each other? In both, as I have mentioned above, the liver-coloured spots are visible on the leaves, which of itself betrays some affinity of their interior structure. *Hieracium murorum* and *H. Sylvaticum* are said to be distinguished from each other by the stalk being either aphyllous, or only monophyllous in the former, and polyphyllous in the latter. But also in this case

there are many modifications and approximations, which make it often very doubtful, whether a plant belong to the one or the other. I observed the stalk—1. entirely without leaves. 2. with a leaf not grown out and resembling a stipula. 3. with leaf completely grown. 4. with a leaf and a stipule. 5. with a broad petiolated leaf, and another narrower and sessile. 6. with two distinct leaves, the lower petiolated, the upper sessile, and another not grown out, and resembling a stipule. 7. with three complete leaves, the lower petiolated, the two upper sessile. In both, when in a young state, I observed the leaves to be hairy, as in *Hieracium murorum*; which pubescence disappeared from the upper surface when the plants were on the decline. Should not these observations warrant the inference, that also *Hieracium murorum* and *H. sylvaticum* are mere varieties of the same species?

ACCOUNT OF THE
ÚLE-TREE, (CASTILLA ELASTICA),

AND OF OTHER TREES PRODUCING THE ELASTIC GUM,

By DON VICENTE DE CERVANTES,

PROF. OF BOT. IN MEXICO.

[Translated from the Spanish*]

WHEN we cast a view over the great variety of remarkable natural productions, which decorate the fertile plains of New Spain, our attention is particularly arrested by that valuable plant, which the ancient inhabitants of Mexico called *Holguabeitl*† and which is now known to the natives by the name of *Arbol del Ule*. Previous to giving a circumstantial account of this tree and its produce,

* Suplemento a la gazeta de literatura. Mexico. 2 de Julio de 1794.

† FRANCISCI HERNANDEZ nova plantarum, animalium et mineralium Mexicanorum historia ed. Rom. 1651. fol. pag. 50. (edit. matritens. cur. Prof. ORTEGA, Vol. 2. p. 336.)

the elastic gum, or *Ule* of the Mexicans, it will not be foreign to my purpose to say something of several other South and North American vegetables, which likewise yield this substance.

The *Jatropha elastica* of the younger LINNÆUS* (called *Pao-Siringa* by the Portuguese of Brazil; *Jeve* by the inhabitants of the province of Esmeraldas, and *Caoutchor* by the Mainas-Indians, inhabiting the borders of the Amazone river) produces the elastic gum in so great abundance, that several travellers have been inclined to believe, this tree provided all Europe with it. The hotter parts of the kingdom of Mexico produce several species of the same genus, such as

* This is the plant of which AUBLET has given a figure in his *Plantes de la Guiane françoise*, under the name of *Hevea*. As this author has not represented the flower, which he never saw, but only the fruit, the younger LINNÆUS was induced, from the general appearance of the latter, to refer this plant to *Jatropha*; a genus, into which, indeed, many plants of the order of *Euphorbiæ* have been thrown, that cannot be properly said to belong to it. RICHARD, who had an opportunity of examining the flowers of the *Hevea*, in Cayenne, afterwards communicated the description of the sexual parts, together with a representation, in the *Journal de Physique*, Vol. 27. p. 138, from which SCHREBER established the generic character of his *Siphonia*; a name corresponding with that of *Pao-Siringa* or siringe-wood of the Portuguese, and given to it, because the natives of Brazil, among other commodities, fabricate syringes of the substance yielded by this tree. T.

Jatropha urens, commonly called *mala muger* (the wicked woman), *J. Curcas* L. and other new species* described in the *Flora Mexicana*, all

* *JATROPHA peltata*: floribus caliculatis, foliis peltatis. Flor. Mex. cum icone.

J. edulis: floribus caliculatis, foliis cordatis integerrimis sublobatisque. Flor. Mex. cum icone.

J. ciliata: floribus caliculatis, foliis cordatis ovatis ciliato denticulatis. Fl. Mex. cum icone.

J. dioica: floribus caliculatis dioicis, foliis oblongo spathulatis. Flor. Mex. cum icone.

J. palmata: floribus caliculatis, foliis cordatis lobatis denticulato-ciliatis. Flor. Mex.

J. triloba: floribus excaliculatis, foliis trilobis acuminatis, integerrimis. Flora Mexicana. Hucipochotl HERNANDEZ edit. Roman. 61. Matritens. Tom. 2. p. 361.

J. quinqueloba: floribus excaliculatis, foliis quinquelobis oblongo ovatis integerrimis. Flora Mex.

which, especially *J. ciliata*, afford a great quantity of a milky juice, from which probably some resinous parts might be extracted.

The *Cecropia peltata*, L. called *Coylotapala* and *Yarumba* by the Indians of Jamaica, and *Ambayba* by those of Brazil, likewise produces a similar substance; so do *Ficus nymphæi-folia* L.* (the elastic gum of which is known in Mexico by the name of *Texcalama*), *Ficus Benamina* L. and *F. indica* L. Perhaps all the true species of this genus agree in this quality, differing however in the quantity and elasticity of the resinous† substances: a circumstance observable in the *Texcalama*, which is inferior in this respect.

Besides the above-mentioned plants, which we find in the works of both old and modern bota-

J. octandra: floribus excaliculatis octandris, foliis palmatis, lobis intermediis hastatis. Flor. Mex. cum icone.

* HERNANDEZ hist. ed. Rom. p. 81. ed. Matritens. tom. I. p. 166.

† We use the term of the author; it ought however to be remembered that the elastic substance has no analogy to resin. T.

nical writers, there are some other trees not so well understood, that produce the substance in question, such as those of which Mr. FRESNAU, whilst engineer at Cayenne, communicated the descriptions to the academy of sciences at Paris, who published them in their memoirs for the year 1751.

Among these we find the *Mapa* or *Amapa*, of which, however, no description is given by Mr. Fresnau, except that it is a very lofty tree of considerable thickness, with smooth bark and leaves resembling those of the Dutch lime-tree, but rather larger.

The juice of this tree, mixed in equal quantities with that of *Comacay*, a species of *Ficus*, produces, according to Mr. Fresnau, a sort of leather; a similar result, he says, takes place in mixing three parts of the juice of the same *Comacay*, with two parts of the milk from a sort of pear-tree, called *Couma* by the Portuguese of Para.*

* This is certainly a species of *Ficus*, as the fruit represented in the *Memoires de l'academie roy. des sciences* 1751. pl. 19. fig. 4. clearly shows; but whether it be PLUMIER's *Ficus folio citrei acutiore, fructu viridi*, or some other of the unsettled species of this genus, requires further investigation. T.

The *Pao comprido* of the Portuguese of Para is another tree, discovered by the same gentleman, producing a milky juice, which, when inspissated, without any addition, very much resembles the elastic gum. This tree he describes as very lofty, and proportionably thick, with branches, at the top only, forming a roundish head. Its leaves are tapering towards both extremities, smooth on the upper surface, and rough on the under, of a light green colour, inclining to yellow. The fruit is about the size of the little finger, of a straw-colour when come to maturity, and including a large hard nut.

From such an imperfect description it is impossible to determine the genus to which this tree belongs, though it is beyond doubt, that it cannot be *Jatropha elastica* L. or the *Pao siringa* of the Portuguese, since its fruit appears to be a drupe, while that of the *Jatrophas* is a tricoccous capsule.*

* A sketch of probably this same tree, which though rudely done, still expresses the above character, is preserved among the drawings in the Banksian library. From an annexed observation we learn, that "this tree,

Lastly Mr. Fresnau acquaints the Royal Academy of his having found in Aprouage, and on the banks of the Maturini river, a great quantity of the true *Poa Siringa*, which, from his more circumstantial description, can be no other than *Jatropha elastica* of Linnæus.

From this digression I return to the *Ule-tree*, which, in commemoration of the merits of the late indefatigable DON JUAN DEL CASTILLO, I have named *Castilla*.*

NATURAL CHARACTER OF CASTILLA.

MASCULI FLORES.

Cal. Perianthium hemisphæricum monophyllum imbricatum, squamis ovatis acutis.

"a native of Brazil particularly Para, is called *Massaradub*; that the
 "Indians extract from it, by incisions in the bark, a viscous white substance like what comes from fig-trees, which they receive into earthen
 "moulds to make squirts to play with in carnival time, as also boots,
 "hats, figures of animals, &c." The sketch is taken from a drawing in the possession of Mr. WHITEHEAD, which was sent from Brazil. T.

* Don JUAN DEL CASTILLO, a native of Jaca in the kingdom of Aragon, was sent to Porto-Rico, when 27 years of age, as first botanist to the Royal Hospital, in this island. This province he held with great exertion for seventeen years, when government appointed him, together with other naturalists, to examine the natural productions of Mexico, where he died the 26th of July, 1793, having attained the age of 49 years.

Cor. nulla.

Stam. Filamenta plurima filiformia intus calycis parieti inserta, exteriora gradatim longiora. Antheræ simplices subrotundæ.

FŒMINEI FLORES in eodem ramo masculis alterni.

Cal. ut in masculis, squamulis paululum latioribus et crassioribus, persistens; fructibus perfectioribus expansus.

Cor. nulla.

Pist. Germina plurima (15 ad 20) ovata. Styli duo raro tres divergentes persistentes. Stigmata simplicia revoluta.

Per. Drupæ 15—20 basi connatæ, obsolete triangulares, apice excavatæ.

Sem. Nux ovata unilocularis. Nucleus conformis.

The Castilla elastica is one of the loftiest and most luxuriant of the trees which adorn the hot N. E. coasts of Mexico, and greatly resembles at first view the *Annona muricata*, generally called by the Spanish *Cabeza de negro* (negro-head.)

Its *stem* is from three to four yards (*varas*) in circumference, and very straight.

Bark smooth, soft, from three to four lines thick, cinereous and of a bitter nauseous taste, as is the milky juice, issuing from every wounded part.

Branches alternate, horizontal, round, flexible, and furnished at the upper end with stiff hairs.

Leaves alternate, a foot and half long, and seven inches broad, strongly sinuate at the base, generally terminating in a point, pubescent on both surfaces, entire, though appearing toothed at first sight, especially the younger leaves, in consequence of the villous brushes formed by the pubescence at the margin of the leaves, and disposed at equal distances from each other; the upper part obliquely striated in the direction of the greater veins with an intermediate network; leaf-stalks thick, round, hairy, and somewhat more than half an inch long.

Stipules at both sides of the younger leaf-stalks, oblong, becoming gradually narrower from the middle to the point, membranaceous, generally falling off before the leaf has attained its full size.

Flowers axillary to the leaves, the female solitary and sessile, the male on a very short pedicle, two or more, seldom three together, alternate with the female flowers at the lower part of the branches; at the top are male flowers only, generally solitary.

Calyx both of the male and female flowers imbricated, with hemispherical straw-colored membranaceous scales; at the time of fecundation, those of the male usually lengthen out and split to let out the stamens, and those of the female extend in proportion to the growth of the germ. The small pedicle that supports the male flowers, and which scarcely exceeds the length of two lines, is like the calyx, covered with minute scales.

Stamens white, and though the outer ones are gradually longer, and all of them appear to become more extended at the time of fecundation, yet they scarcely exceed the length of the last scales of the calyx. *Anthers* roundish, and of a deep yellow color.

Fruit: from five to twenty oval drupes obsoletely triangular, somewhat larger than a pea, fixed with

their bases to the extended calyx, and with their sides adhering to one another; orange-coloured when ripe, mucilaginous and almost tasteless.

EXPLANATION OF PLATE IX.

- a. a. male flowers.
- b. b. female flowers.
- c. back view of the calyx of the female flowers.
- d. the stamens.
- e. the drupaceous fruit.
- f. the same cut transversely to shew the kernel.
- g. the kernel.
- h. a branch cut, from which the Ule distils.

OBSERVATIONS ON THE GENERA
JUGLANS, FRAXINUS, AND QUERCUS,
IN THE NEIGHBOURHOOD OF
LANCASTER, IN NORTH AMERICA,

BY THE REV. H. E. MÜHLENBERG,
WITH THE REMARKS OF PROF. C. L. WILLDENOW.

[Translated from the German.*]

PROPOSING to communicate to the friends of dendrology some of my observations upon the trees that grow in the neighbourhood of Lancaster, I shall begin with the genera Juglans, Fraxinus, and Quercus, as these stand peculiarly in need of a more accurate examination.

JUGLANS.

I arrange the species growing with us under two divisions; the first, containing the common

* Neue Schriften der Berl. Naturforschenden Freunde. Vol. 3. 1801.

walnut, exactly corresponds with the characters LINNÆUS has given of *Juglans*; the second, comprehends several species of what the inhabitants call Hickery-trees. In the flowers of the latter I never found more than four square anthers, and I leave it to others to decide whether on this account they ought to be separated into a new genus. The species I observed are the following :

A. 1. *Juglans nigra* L. Universally known by the name of the black walnut, and so well described and figured by WANGENHEIM, that any addition would be superfluous. It flowers here in the beginning of May, having twenty or more square anthers and two pistils. The buds are axillary in the Spring, but during Summer appear above the axils. The nut is in most cases perfectly round, but sometimes oblong; without any concomitant difference in the tree.

2 *Juglans cinerea* WANGENH. This species is well known by the name of white walnut or butternut. The description and figure of Wangenheim are very accurate. I have no doubt but that this is

the same with *Juglans oblonga* of MILLER; but whether LINNÆUS has considered it as a variety of *I. nigra* only, or whether it be *J. cinerea* of this naturalist, I am unable to decide. It is easily distinguished by its whitish bark, and by the viscidty of its leaf stalks and nut shells. The small buds are (as in the foregoing species) simple and axillary in the Spring, but during Summer there issue others above the axils. On account of its medicinal quality it is called *Juglans cathartica* by CUTLER. If this species required a new name I should call it *J. viscosa*.*

B. 3. *Juglans alba* L. By this Linnæus probably means the commonest kind of hickery, known by several names in this country, such as black Hickery, mountain H. &c. It is the *Juglans alba acuminata* MARSHALL, *Juglans alba* WALTER. The shells of the nut are variously shaped, more

* *Juglans cinerea* WANGENH. is certainly the same which LINNÆUS has described under this name, and of which JACQUIN (Misc. 2. p. 7. Icon. rar. I. tab. 192.) has given a good description and figure. The number of the leaflets varies very much; I have counted from 12 to 17 on the leaves of one and the same tree.

or less oval, but easily distinguished from the others by their four edges. Another distinguishing character is the wool covering the under surface of the leaves, their stalks, and peduncles. This species might be called *J. villosa*.*

4. *Juglans compressa*. This approaches to the foregoing, but may easily be distinguished by its bark being very much furrowed and ridged. The leaves and their stalks are pubescent, as are also the young branches. The nut is very well represented by GAERTNER under the name of *J. compressa*. In this country it is known by the name of Shell bark, and sold in the markets. I cannot believe it to be the same with *J. ovalis* of WANGENHEIM, but it certainly is *J. ovata* of

* LINNÆUS, as is proved by the authors he has quoted, has brought several species under his *Juglans alba*, considering them as varieties, which, however, is contrary to experience. It is difficult to decide, which is his original *J. alba*. It appears to me most probable, that he means the same described by KALM in the Transactions of the Swedish Academy for the year 1769, which also corresponds with Mr. MÜHLENBERG'S *J. alba*. As the Hickery species are but little known, I shall attempt giving the specific characters of those which were examined by me.

J. alba: foliolis septenis oblongis acuminatis subtus pubescentibus scabris, fructibus sub-quadrangulis lævibus.

MARSHALL and MILLER. I have observed 3, 5, 7 leaflets.*

5. *Juglans amara*. This is *J. cinerea* of WALTER, but I cannot decide whether also of LINNÆUS. It is universally known in this country by the name of Bitter-nut, Hog-hickery, white Hickery. MARSHALL calls it *J. alba minima*. It is easily distinguished by its compressed leaf stalk and the leaflets, which are 7—12 and smaller; but more particularly by its rough and furrowed nut, containing a bitter kernel. *Juglans cordiformis* WANGENH. appears to be different from *J. amara*; but the description and figure of *Juglans sulcata* WILLD.† agree very well with it. The wood of this species is not esteemed so good fuel as that of the two former.‡

• *J. compressa*: foliolis septenis oblongo-lanceolatis acuminatis subtus pubescentibus mollibus, nucibus obliquis compressis.

† WILLDENOW's *Berlinische Baumzucht* (description of the trees in the neighbourhood of Berlin) Berlin 1796. 8. pag. 145. tab. 7.

‡ *J. sulcata*: foliolis subseptenis lanceolatis acuminatis subtus pubescentibus, fructibus subrotundis quadrisulcatis.

This appears not to be *J. cinerea* L. though it has sometimes 11 leaflets.

6. *Juglans glabra*. To this belong at least three varieties, all possibly distinct species :*

a. A very lofty tree, with bark rather ridged, thick branches, and very small nuts, easily cracked. Leaflets five, sometimes seven, with both surfaces smooth. *J. glabra* WANGENH. comes nearest to it. In this part of the country it is known by the name of the red Hickery, a great part of the inside of the wood being red. It is also called Pigent.

b. A variety with exactly oval nuts, and likewise easily cracked. They do not seem to vary in any other respect. The lower surface of the leaves in both species are furnished with many yellow resinous points, whence the specific name of *odorata* given to it by MARSHALL.—It seems to be *J. ovalis* WANGENH.

c. Perhaps more than a mere variety, being a tall tree with smooth bark and slender branches. Known in this neighbourhood by the names of *Besen-Hickery*, *Herz-Hickery*, (Broom H., Heart H.) Leaflets from five to six, quite smooth. Nut ob-

* *J. glabra*: foliolis septenis ovatis acuminatis utrinque glabris subtus resinoso punctatis, nucibus oblongis.

cordate, without angles. This species is slower in arriving at maturity. It is probably mistaken by WANGENHEIM for *J. glabra*. In my *Index Floræ Lancast.* I have called it *J. obcordata*.*

7. *Juglans Pecan* MARSHALL, does not grow here, but in the back-country. It is *Juglans rubra* of GAERTNER, as far as I am able to judge from the fruit. *Juglans illinoensis* WANGENH. has no sort of relation to it either as to its leaves or fruit.†

FRAXINUS.

Of the ash I have observed three different species in this part of the country, and several varieties.

* *J. obcordata*: foliolis septenis ovatis acuminatis utrinque glabris punctatis, nucibus obcordatis lævibus.

This appears to be a distinct species, though nearly related to the foregoing, but as I had a few leaves only to compare, I cannot decide whether they be constant in their form. They differ from those of the foregoing species by their leaflets being tapering at their base, and doubly-toothed towards the point; the base of the leaflets of the other species, being, on the contrary, very unequal, tapering at the upper, and blunt at the lower end; teeth simple. Perhaps the latter characters may be subject to change, but that of the nut is constant.

† This species is entirely unknown to me. W. (It is *Juglans angustifolia* Hort. Kewens. T.)

1. *Fraxinus sambucifolia* WILLD. This species has different names in common with others, as white ash, black ash, &c. It is but small, and stands generally in or near the water; and is best distinguished by its sessile serrated leaflets, with woolly ribs, and by its linear seeds. I find constantly male flowers upon some, and hermaphrodite upon other stems. They have neither calyx nor corolla, and the anthers are blunt at the upper end. This species of ash is *F. nigra* of MARSHALL and of PORT*, excluding the synonym of *F. excelsior* of KALM.

2. *Fraxinus pubescens* WILLD. This is easily known by the lower surface of the leaves, the leaf-stalks and peduncles being furnished with soft hairs. Male and female flowers upon different trees. Anthers 2-4, pointed at the upper end. The seed is the longest of all the species that grow in this country, and elongated into a point. Corolla none. Calyx of five divisions. It is very well described

* J. P. DU ROY's Harbkesche wilde Baumzucht. Second edition in 3 vols. (enlarged) by Dr. PORT of Brunswic, 1800.

by MARSHALL under the name of *Fraxinus pennsylvanica*.

3. *Fraxinus americana*. Is distinguishable by its smooth leaf- and flower-stalks. Leaflets entire or slightly serrated, petiolated, upper surface rather glossy, lower surface sea-green, with brown wool with near the midrib; the rest smooth, or furnished with white soft hairs when young; male flowers diœcious. Anthers tapering upwards. Fruit round below, flat from the middle to the upper end.

By this, and the preceding species, varieties are produced, which partake of the characters of both, so that it cannot be determined to which they belong. Between *Fraxinus caroliniana* and *F. americana* of MARSHALL there is hardly any specific difference.

As to the œconomical uses of these species of *Fraxinus*, No. 2 & 3 are reckoned very good fuel, and are used promiscuously for that purpose. No. 1 is scarcely good for any thing but for making brooms and baskets. When used for the latter purpose the wood is previously beaten, whence the

name of *Pachgammak* (beaten-wood) given to it by the Indians.

QUERCUS.*

Of the oak I shall only here notice those species

* Of all trees and shrubs, oaks and willows prove the most difficult of botanical investigation; the former because their leaves vary very much according to the soil, the situation, and climate in which they grow; the latter because the observer has not always an opportunity of comparing both sexes, and because they are apt to produce hybrid offspring; to which may be added, that the form of their leaves is likewise subject to change from the soil, and the different periods of their growth. As for the oaks, it is so much the more difficult to distinguish species from varieties, as they have been but little observed in their native countries. Of such of the above species as I have had an opportunity of examining, I shall attempt giving the specific characters. W.

Since the publication of this paper, M. MICHAUX, a native of Charleston, in South Carolina, and well known as an indefatigable traveller in the service of Flora, has published a work of great utility on the same subject, under the title, *Histoire des Cènes de l'Amerique ou description et figures de toutes les especes et variétés de cènes de l'Amerique septentrionale. à Paris, 1801. fol.* Aware of the great confusion in which the North American species of this difficult genus were involved, this botanist has sown and cultivated, during his residence in America, all the species he had an opportunity of procuring. By this means he became, indeed, enabled to mark the multiplied variations through which they pass, until they arrive at their full growth, and to discover their mutual affinities; but on the other hand he found it a matter of great difficulty to distinguish and define many of them by true and constant specific characters. Finding that neither the structure of the sexual parts, nor that of the acorns and their cups proved sufficient for his purpose, he finally had recourse to their leaves. The leading character taken from these, is their being with or without terminating bristles. A subordinate character is derived from the time that intervenes between the first appearance of the flowers, and the fruit's arrival at maturity. Some ripen their fruit within six, others not in less than eighteen months. Of the former the fruit is perma-

that are common in the neighbourhood of Lancaster.

MARSHALL has the following divisions.

A. *White Oaks*.

1. *Quercus alba*. This is very common, and has been often figured.

I have only to add, that the scales at the cup of the acorn are round, and that the cup has a foot-stalk half an inch long.*

2. *Quercus alba minor*; grows generally upon hills, and, when in richer soil, approaches very near to the original species. WANGENHEIM describes it under the name of *Quercus stellata*. BARTRAM in his journal mentions it as *Q. lobata*.

nently axillary, of those that require two years to arrive at maturity, it is only so during the first year, as in the second it is left naked by the leaves falling off; though some of these last are, from the concomitant permanency of their leaves, also permanently axillary, as *Quercus coccifera* L. and *Q. virens* Hort. Kew.—The number of the species with their varieties described in this work is twenty. To those species of the above paper, as could clearly be traced, we have subjoined their specific character given by MICHAUX; referring the reader for their more minute investigation to the work itself. T.

* *Quercus alba*: foliis oblongis sinuatis glabris, junioribus subtus tomentosis, lobis lanceolatis obtusis indivisis.

This is the Linnean species, which also varies, the divisions of the leaves being sometimes linear, sometimes lanceolate.

This tree is frequently dwarfish and stunted, when it is called *Grund-Eiche* (ground oak.)*

3. *Quercus alba palustris* is a genuine species, but very subject to vary. Leaves wedge-shaped below, denticulated, under surface tomentose; often approaching very near to those of the white oak. This species is easily distinguished from others by its acorn having a very long foot-stalk, and the scales of the cup being almost prickly. In this neighbourhood it is called swamp white oak.†

There is a variety of this species that never

* *Quercus stellata*: foliis oblongis sinuatis subtus pubescentibus, lobis obtusis, superioribus bilobis. W.

This is *Q. obtusiloba* of MICHAUX (N. I. Pl. I.) who gives its specific character as follows:

Q. obtusiloba: foliis subtomentosis profunde sinuato lobatis, lobis retusis, basi acute cuneata; fructu mediocri; cupula craterata, glande breviovata. T.

† It is new and as yet undescribed. I call it *Quercus bicolor*: foliis oblongis subsinuatis subtus tomentosis, lobis obtusis apice callosis.

Leaves more or less sinuate, sometimes coarsely toothed only; the middle rib of each lobe projecting over its blunt point, and forming a cartilaginous projection. The lower surface of the leaves is constantly clothed with a white cotton. W.

This appears to be *Q. lyrata* of WALTER, figured (Pl. 4) by MICHAUX, who defines it thus:

Q. lyrata: foliis subsessilibus glabris lyrato sinuosis, summitate dilatata divaricato-triloba, lobis acutangulis, terminali tricuspide: cupula depresso-globosa, muricato-scabrata; glande subtectâ. T.

exceeds the height of four feet, but bear abundance of acorns.

B. The *chesnut-leaved oaks* ought to stand nearest to the white oak, having a similar bark. *Q. alba palustris* is the intermediate species.

4. *Quercus Castanea* mihi. Resembles the former, and when growing in a moist soil, is often scarcely to be distinguished from it; but in a dry one it approaches more to *Q. prinus*, and from MILLER's and WANGENHEIM's descriptions, I suspect it to have been considered as a mere variety of the latter. Its cups are sessile.*

5. *Quercus prinus humilis* MARSHALL. Is perhaps only a variety of the former, with an abundance of small fruit.†

6. *Quercus prinus* is very well known; it grows on dry ground in company with *Fagus Castanea*. The acorns are of the largest kind, and fall off

* *Quercus Castanea*: foliis oblongo lanceolatis acuminatis subtus tomentosis, grosse dentatis, dentibus subæqualibus dilatatis apice callosis. W. Appears to be *Quercus Prinus* var. *palustris* of MICHAUX, n. 5. pl. 6.

† A new species, different both from the last and the following. I call it

Quercus prinoides: foliis obovatis obtusis glabris, grosse dentatis, dentibus subæqualibus dilatatis apice callosis. W. MICHAUX considers it as a variety of *Q. Prinus*: *Querc. Pumila* n. 5. pl. 9. T.

early. Cups upon footstalks half an inch long, not scaly. The wood of this species is very durable.*

C. *Red oaks*, or such as have long, white, smooth and broad streaks in the bark, and deeply sinuated leaves, the points of which are terminated by bristles. To this division I refer :

7. *Quercus rubra maxima* MARSH.—*Q. latifolia* Hort. Kew. It is known here by the name of the broad leaved Spanish Oak, and may easily be distinguished by its short shallow cups, and large acorns.†

* *Quercus Prinus* : foliis ovato-ellipticis obtusis subtus pubescentibus grosse dentatis, dentibus subæqualibus dilatatis apice callosis.

In autumn the leaves turn smooth on their lower surface. W.

Q. Prinus : foliis oblongo-ovalibus acuminatis acutisve subuniformiter dentatis deciduis; cupula craterata subsquamosa; glande ovata. MR-CHAUX. T.

† It is difficult to mark out by distinct characters the species of North American Red Oaks, unless such be taken from the size of the leaves and fruit, the depth of the incisions, and the different angles of the leaves. But magnitude being a relative quality, ought not to be admitted as a character, except when the proportion of one part to the other be expressed at the same time. The oaks mentioned above under No. 7, 8, 9, and 11, only differ with regard to the size of their leaves and fruit, which may, however, be subject to change. I know from experience, that the obtuse and acute angles of the leaves as well as the depth of their incisions are very liable to variation; and therefore do not venture to establish the oaks described under the above-mentioned numbers as distinct species, particularly as they all agree in the following characters;

8. *Quercus rubra ramosissima* MARSH. is *Q. palustris* WANGENH. & DU ROI t. 5. fig. 4. Its leaves are comparatively small, as are the cups of the acorns.*

9. An Oak very similar to the latter, with regard to its leaves, is that which they call here Black Jack. It never attains any remarkable height; but its wood is considered as very good fuel. As it does not grow in any place nearer to me than the islands of the Susquehanna, I have not as yet been able to ascertain whether it be any more than a mere variety. The wood of No. 8 and 9 is not good for fuel.

10. *Quercus coccinea*, the Scarlet Oak, is distinguished from No. 7 and 8 by its leaves turning to a scarlet-red color before they fall off. The cups of the acorns are not flat at the base, but

Q. rubra: foliis oblongis sinuatis glabris, lobis divaricatis apice dentatis acutis setaceo-mucronatis, calycibus fructus basi planis.

* The specific character MICHAUX gives of it is as follows:

Q. palustris: foliis longe petiolatis, profundius 7-lobis sinubus latis, lobis oblongis, acute subdivisis; fructu parvo; cupula scutellata, lævi; glande subglobosa.—Mich. n. 19. pl. 33. 34. 'T.

tapering. WANGENHEIM has given a figure of it.*

What I take to be a variety of this, with leaves deeper indented, smaller, and not shed before spring, grows upon the mountains.

D. Black Oaks. So I call those that have a blackish bark, by which they may be distinguished at a distance. To this division I refer.

11. *Quercus rubra* WANGENH. p. 14. Fig. 7. and Du Roi Pl. 5. Fig. 2. is certainly distinct from *Quercus rubra maxima*, by its bark and fruit. Leaf-stalks very smooth, long; leaves also smooth on both surfaces, except within the angles of the nerves. Is universally known here by the name of the black oak.

12. *Quercus nigra* WANGENHEIM, MARSHALL, Du Roi. This varies very much in its leaves, and sometimes can scarcely be distinguished from the foregoing, whence it is generally considered here as a variety of it. Whether it really be

*This should be separated from the red oaks. Its specific character is,

Quercus coccinea: foliis oblongis profunde sinuatis glabris, lobis distantibus divaricatis apice dentatis acutis setaceo-mucronatis, calycibus fructus basi attenuatis.

Quercus discolor Hort. Kew. remains still to be ascertained.*

13. *Quercus marilandica* GRONOV. Fl. Virg. 140. *Q. nigra pumila* MARSH. is very well figured by DU ROI, Pl. 6. Fig. 2. and WANGENHEIM, Pl. 5. 13. Leaves very much variable. Grows upon dry hills only.†

E. Of willow-leaved oaks there are none in this neighbourhood; but about Philadelphia the narrow-leaved *Quercus phellos* grows in abundance, and in the back countries another which MARSHALL calls *Q. phellos latifolia*. The leaves of the latter (probably a distinct species) are oblong, veined, and woolly on the lower surface.

F. *Water Oaks*.—*Quercus aquatica* Hort. Kew. is not to be met with in this neighbourhood. *Quercus uliginosa* of Wangenheim I have seen in a dry state, as also some others with leaves cottony

* It is the true *Quercus discolor* Hort. Kew. to which I give the following specific character :

Q. discolor : foliis obovato oblongis sinuatis subtus pubescentibus, lobis oblongis obtusis dentatis setaceo-mucronatis.

† I take this to be *Q. nigra* L. which I distinguish thus :

Q. nigra : foliis cuneiformibus glabris basi subcordatis subtrilobis, lobis divaricatis intermedio brevioribus, dentibus setaceo-mucronatis.

below, and perhaps belonging to *Q. discolor*, or else to the following species : *

G. Grund-Eichen (Ground oaks) I call such which are constantly of a dwarfish size. They delight in situations exposed to the sun and dry ground. When intermixed with large trees, they die, being impatient of shade. To this division several oaks are referred not properly belonging to it: *Quercus alba pumila* becomes lofty, as also does *Quercus prinus humilis*. The only one in this country which I always found small-sized, is

14. *Quercus rubra nana* of MARSHALL, *Q. ilicifolia* of WANGHENEIM and WILLDENOW. This species is pretty well known in Europe. Whether

* *Quercus aquatica* Hort. Kew. certainly contains several species described by Wangenheim, which deserve to be more closely examined. The above mentioned with leaves cottony below, and which Mr. MÜHLENBERG takes to be *Q. discolor* Hort. Kew. is a non-descript. I define it :

Q. elongata: foliis trilobis subtus tomentosis, lobis divaricatis, intermedio duplo longiore trifido, apice setaceo-mucronatis.

The leaves are very distinctly divided into three lobes, the middle of which, being subdivided into three smaller ones, is double the length of the two lateral ones, which form right angles. Lower surface of the leaves cottony; upper surface dark-green, shining. The flowers and fruit I had not an opportunity of examining. W.

Is it *Q. falcata* of Michaux? T.

the specific name of *ilicifolia* be very characteristic, I leave to the decision of other botanists* ; *Q. nana* is the old name. It bears fruit in abundance, as does also the variety No. 3. Both of them would deserve to be cultivated, but for their roots spreading so very far, and impoverishing the soil.

Perhaps it may be worth the attention of the botanist to know what colours the leaves of different oaks assume before they fall off. The following are my observations on some of them :

Q. alba of a brownish red (cottony at the flowering time).

Castanea yellowish:

Prinus brownish red.

Q. rubra max. yellowish (cottony at the time of flowering).

rubra cocc. scarlet-red.

rubra 11. yellowish.

nigra 12. brown, brownish red, and sometimes yellow.

* In my opinion the specific name of *ilicifolia* of Wangenheim is very proper. I have described this species in my *Berliner Baum Zucht.* p. 275.

OBSERVATIONS ON THE PLANT
CALLED
ERICA DABOECIA,
SHEWING THE NECESSITY OF REFERRING IT TO A
DIFFERENT GENUS AND ORDER.

By PROF. JUSSIEU.*

TOURNEFORT was the first who pointed out this vegetable, under the name of *Erica cantabrica flore maximo, foliis Myrti subtus incanis*,† and described it as a plant with a low and woody stem, not unlike that of a heath, to which, as far as general habit, it bears great resemblance. RAY‡ afterwards mentioned it under the same generic name, adding, that by the inhabitants of Ireland it was called St. Dabeoc's heath. LINNÆUS, to whom the plant was but imperfectly known from

* Annales du Muséum National I^r. Cahier, 1802.

† Instit. rei herb. pag. 603.

‡ Dendrologia, pag. 98.

these accounts, placed it, in the second edition of his *Species plantarum*, pag. 509, at the end of the Genus *Erica*, as *E. Daboecia*; not, however, without suggesting his doubt as to the propriety of this position. When this naturalist afterwards received, from COLLINSON, the description of the flower and fruit, he called it *Andromeda daboecia*, in the twelfth edition of his *Systema*, pag. 300; where he observed, its habit required this translation, though in regard to the number of the parts, it shewed greater affinity to the heaths. This change was adopted by MURRAY and REICHARD; but THUNBERG, in his "*Dissertatio de Erica*," returned it to that genus under its former name; in which he has been followed by LAMARCK, GMELIN, WILLDENOW.

Such fluctuation among botanists as for generic determination, proceeds either from not attending sufficiently to *the whole* of the sexual parts of plants, or from overlooking characters as unimportant, which really are far from being so. The followers of systematic order often think, for instance, that they have given a complete idea of

a capsular fruit by pronouncing it of four locuments, many seeded and opening by four valves; but the observer of natural affinities, not satisfied with this character, inquires into the form and structure of the valves, their mode of union, the situation and insertion of the seeds; and by combining these several observations, derives more accurate results, and is thus often enabled to fix immutably the place which a plant ought to occupy in the natural order.

The plant in question is a very striking instance of what has been advanced. In the present series of Dicotyledones with monopetalous and perygynous corolla (or corolla attached to the calyx), we find two families, which formerly were united in one, and adulterated besides by the introduction of other genera in the *Ordines naturales* of LINNÆUS,* in the family of *Vaccinia* of ADANSON, and also in the series of orders in the garden of Trianon. These two families, which of late have been determined by characters no ways ambiguous, but sufficiently distinct to keep them for ever separate,

* Ordo xviii.

are the *Rhododendra* and the *Ericæ*; both adopted in the "Genera plantarum," published by me in 1789. The fruit of the former is a capsule, of which each valve, folding itself so as to make its edges approach inwardly, forms a complete loculament, absolutely separate from, and independent of, the loculament formed by the neighbouring valve (*valvæ introflexæ loculum proprium constituentes*). The edges of the valves are attached to a central receptacle, bearing numerous minute seeds.

The valves constituting the capsule of the heaths are of quite a different structure. Each of them bears along its middle a septum (*valvæ medio septifera*), which, being applied against the central seed-bearing column, forms a separate loculament, produced by two valves, conjointly contributing each its half. This distinction, as it affords (even without other distinctive characters) an invariable line of partition between these two orders, is now adopted by the followers of the natural system, and has enabled M. VENTENAT to shew, that the *Epigæa*, arranged by me among the *Ericæ*, must be transferred to the *Rhodo-*

dendra, having *valvæ introflexæ*, each forming a loculament by itself.

DR. SMITH,* guided by the same circumstances, has referred to the *Rhododendra* his *Menziesia*, a genus, which, with the characters of a fourleft pitcher-shaped corolla, of eight perigynous stamens, of an ovarium liberum furnished with a style and stigma, unites that of a capsule with four valves introflected exactly in the manner of those of *Rhododendrum* and *Epigæa*.

On examining the capsule of *Erica Daboecia*, the same structure will be perceived as in the *Rhododendra*, viz. four retroflected valves; from which circumstance it is naturally to be inferred, that this plant, so far from remaining allied to the genera *Erica* or *Andromeda*, must even be entirely detached from the Order of *Ericæ*, and transferred to the neighbouring one. The inspection of its other characters, as derived from form and number of its several parts, moreover proves that it must belong to the genus *Menziesia*,† from which it

* *Plantarum icones hactenus ineditæ*. Fasc. III. pag & tab. 56.

† Also Mr. SALISBURY, in his edition of 'THUNBERG's *Dissertatio de Erica*, printed at Featherstone, 1800, mentions the circumstance of

cannot be separated, though there does exist some difference in the habit of the two plants. As the leaves of this species bear great resemblance to those of *Teucrium polium* L. and of *Andromeda polifolia*, I propose to call it *Menziesia polifolia*. The specific character may be given as follows :

Menziesia polifolia : foliis alternis, ovatis, revolutis, supra viridibus, glabris, passim pilosis, subtus tomentosis, incanis ; floribus racemosis, terminalibus.

And that of Dr. SMITH's species, which he has called *M. ferruginea*, thus :

Menziesia ferruginea : foliis terminalibus, fasciculatis, lanceolatis, denticulatis, non revolutis, supra pilosis, subtus lævibus ; floribus inter folia pariter fasciculatis, singulis longe pedicellatis.

A third species of this genus may, perhaps, be found in the *Azalea pilosa* of MICHAUX, which LAMARCK* quotes, as a dubious species, at the

the fruit of *E. Daboecia* being that of *Menziesia*, to which genus he refers this plant in his *Species Ericarum*. Linn. Trans. Vol. 6. T.

* Tableau encyclopédique et méthodique, &c. pag. 494.

end of *Azalea*, from which it differs in the number of its stamens, which are eight instead of five. As the author has made an *Azalea* of it, we may suppose that the structure of its capsule is similar to that of *Menziesia*; the number of stamens points out that of the valves to be four, instead of five: and from these two considerations results a real approximation of that species to *Menziesia*; which is confirmed by its corolla being oval, according to the description of LAMARCK.

BOTANICAL OBSERVATIONS

BY

FREDERIC EHRHART.

[Translated from the German.*]

VERONICA Teucrium and Veron. prostrata Linn. are rather to be considered as varieties; it is often impossible to distinguish them from one another.

Monarda capitulis terminalibus, caule obtusangulo MILL. Fig. p. 122. t. 183. f. 1. is not *Monarda fistulosa* of LINNÆUS, but *Monarda didyma* of this botanist.

Monarda floribus capitatis subdidynamis, caule acutangulo, Mill. Fig. p. 123. t. 183. f. 2. is not *Monarda didyma* of LINNÆUS, but his *M. fistulosa*.

Unless the synonym of MILLER, quoted by

* *F. Ehrhart's Beiträge zur Naturkunde, &c. Hanov. 1787—92.*

LINNÆUS for his *Salvia paniculata*, be wrong, *Salvia africana* Mill. dict. ed. 8. is nothing else than *S. paniculata* L. and therefore the synonym of Miller is either improperly applied to *S. africana* Reichh. Syst. vol. 1. p. 69. Hottuyn Pfl. Syst. vol. 3. p. 42. Etling. Salv. p. 21, &c. or both the mentioned species are one and the same plant.*

Crocus has a spatha monophylla according to LINNÆUS, but I have always found a spatha duplicata in *Crocus vernus*. The outer one is a tube, which, opening at the top at one side, lets out the flower; the inner is awl-shaped, nearly surrounding the tube of the flower, and inclosed by the outer spatha as far as the top. Both are opposite each other like the glumes of the grasses.†

Schoenus fuscus L. is not a variety of *Schoenus albus*, as HUDSON thinks, but a distinct species.

* The plant figured by Miller, (ic. tab. 225. fig. 1.) appears to be *Salvia africana* L. and therefore REICHARD'S and ETLINGER'S references are right. In WILLDENOW'S edition of the species plantarum, both *S. africana* and *S. paniculata* are referred to Miller's figure. T.

† The same observation has been made before by JACQUIN, in his Fl. austr. V. pag. 48. where he describes *Crocus vernus* :

"*Apprimi hæc (folia) flori solent spathis paginantibus, obsolete albescentibus, ternis quandoque quaternis, ut nesciam cur Linnæus dixerit spatbam univalvem radicalem?*" T

The latter is a diandrous plant, has *stylum glumâ pauco longiorem* ♂ *setas receptaculi decem*; *Schoenus fuscus*, on the contrary, is a triandrous plant, *stylo glumâ duplo longiore* ♂ *setis receptaculi tribus*, *semine multo longioribus*, &c.

Cyperus palustris hirsutus minor, paniculis albis Moris. hist. Vol. 3. S. 8. t. 9. f. 39. is *Schoenus albus*, though Linnæus refers to this figure at his *Juncus niveus*.

Schoenus Mariscus L. cannot belong to the other Linnean species of *Schoenus*, or to the *Marisci* of HALLER, being diandrous, and its fruit a nut, containing a four-winged kernel.

Eriophorum polystachium is sometimes a polygamous plant.

Cornucopiæ is not a good generic name, and *Cornucopia* is worse.

Saccharum arundinaceum RETZ. appears not to have trivalved corollæ, but two-flowered glumes, as several of the polygamous grasses have. The outer floret (*flosculus*) is generally one-valved.

Phalaris is a compound genus, some species

having two-valved flowers, others of three, four, five, and six valves.

Agrostis pumila L. which I gathered, in company with my late friends, LINNÆUS and GRÜNO, near the Linnean villa Hammarby, and which both acknowledged to be a distinct species, is nothing, according to my own observations, but a diseased *Agrostis stolonifera*. I preserve specimens which are half *Agrostis stolonifera*, half *A. pumila*.*

Cynosurus cristatus has not *bractea pinnatæ*, but *pinnatifidæ*.

Cynosurus echinatus has not a bifid style, but is truly digynous.

The *Cynosuri digitati* do not properly belong to the rest of *Cynosuri* of Linnæus, but constitute a proper genus. With regard to the situation of the locustæ they approach to *Capreola* of ADANSON, and to *Andropogon barbatus* and *polydactylon*.

Bromus secalinus, *squarrosus*, *hordeaceus*, *arvensis* and *tectorum* Linn. are, indeed, very nearly

* In *Agrostis pumila*, the flowers, as a consequence of the disease, appear constantly smutty, and display, when dissected, a great number of small blackish globules, resembling minute seeds. T.

related, but far from being one and the same species. Such species as *Bromus polymorphus* of SCOPOLI are what other botanists call “divisions.”

The same may be said of *Avena pilosa* SCOPOLI Carn. ed. 2. n. 124.

Avena Lœflingia GORT. sept. n. 110. is *Avena præcox* Linn.

Elymus caput Medusæ and *Hordeum jubatum*, in my opinion, belong to one and the same genus.

The synonym of BAUHIN and MORISON which LINNÆUS and other editors of the species plantarum have given to *Hordeum vulgare*, ought to be *Hordeum polystichum hibernum*.

The second synonym of *Hordeum spica subdisticha calyce folioso setaceo, floribus omnibus hermaphroditis, longe æristatis* HALL hist. n. 1533. is not right, but ought to be as follows: *Hordeum polystichum hybernum* BAUH. theatr. p. 438. MORIS. hist. V. 3. p. 206. S. 8. tab. 6. fig. 3.

Hordeum polystachyum hibernum BAUH. theatr. p. 439. which, by REICHARD and HOUTTUYN, in their Syst. plantarum, is taken up for a synonym of *Hordeum hexastichum*, ought to be erased.

The Bauhinian synonym of *Hordeum spica polysticha, floribus omnibus hermaphroditis, longe aristatis* HALL. hist. n. 1534. should be changed to *Hordeum polystichum vernum* Bauh. theatr. p. 439. Moris. hist. Vol. 3. p. 206.

Triticum hibernum & *æstivum* of Linnæus, I consider as varieties, as does also Haller.

WILLDENOW attributes a quadrilocular capsule to the genus *Sagina*; to me it appears unilocular.

Not all *Cynoglossa* have a funnel-shaped corolla; *Cynoglossum linifolium*, for instance, is furnished with a wheel-shaped, and *Cynogl. apenninum* with a tubulous corolla.

Cerithe has not a *perianthium quinquepartitum laciniis æqualibus*, but a *calyx pentaphyllus foliolis inæqualibus*—*Anthæræ serrulatæ basi bisetæ*—*Germen didymum*—*Nuces duæ biloculares : loculis monospermis*.

The situation of the bractes ought not to be neglected in the arrangement of *Convolvuli*. *Convolvulus sepium*, for instance, has *Bracteas flori approximatas*; *C. purpureus* *bracteas ad basin pedicellorum*.

Atropa physalodes L. has a five-celled berry;

the essential character which Linnæus gives to the genus, is therefore not applicable to this species.

The corolla of *Phyteuma spicata* does not open from the top to the bottom, but from the bottom to the top. Sometimes its laciniae are separated near the base a whole day before they begin to disengage themselves at the top. Out of each of the lateral openings issues a stamen, which gives a singular appearance to the flower. Probably the whole process of fructification is completed before the flower be entirely open.

Rapunculus umbellatus latifolius BAUH. pin. p. 92. is not *Phyteuma orbicularis* of LINNÆUS, but his *Campanula glomerata*. Neither does *Rapunculus umbellatus angustifolius* BAUH. pin. p. 92. belong to it, but to *Campanula Cervicaria* L.

Ribes grossularia L. and *Ribes uva crispa* L. cannot be considered as distinct species.

Linnæus, in his *Gen. plantar.* Ed. 6., ascribes *petala caduca* to *Vitis*; in his *Systema Naturæ*, ed. 14. I find *petala emarcida*. The former appears to be more correct.

None of the Linnean species of *Chenopodium* ought to be considered as varieties, except *Chenopodium album* & *viride*, which do not appear to be distinct species.

SCOPOLI is of opinion that *Drosera rotundifolia* and *D. longifolia* L. degenerate into each other. I for my part never observed this to be the case either in Swiss, German, or Swedish specimens of these plants; nor did I ever find it a matter of difficulty to distinguish them.

Aloe perfoliata Var. i. Linn. sp. ed. 2. 458.* or *Aloe africana caulescens perfoliata* ♂ non spinosa CAMMEL. prælud. p. 74. t. 23. is *Crassula perfoliata* L.

MURRAY and WEIGEL think HALLER in the wrong, for taking his *Juncus caule brachiato, foliis setaceis, floribus funiculatis ad ramos sessilibus* (HALL. hist. n. 1320.) and *Juncus bulbosus* of the first edition of LINNÆUS' *Species plantarum* pag. 327, for one and the same plant. The synonyms and figures quoted by Linnæus prove, however, that Haller was not mistaken. That Linnæus originally

* *Aloe perfoliata* Var ♀ WILLD. sp. pl. Vol. 2. p. 186. T.

meant Haller's *Juncus* by his *J. bulbosus*, appears also from the trivial name, which is by no means applicable to the present *Juncus bulbosus* L.*

Hyacinthus is not the only genus in *Hexandria Monogynia* which has *pori melliferi*; *Asphodelus* and several other genera are likewise furnished with them.

Berberis vulgaris has no spines (*spinæ*), unless one would also give this appellation to the prickles of *Rosa*, *Ribes*, &c.

The generic name of *Disandra* ought to be *Distandra*, as it is not derived from *dis* (*bis*) but from *δισταζω* (*dubito*).

Rosa pimpinellifolia and *R. spinosissima* L. are one and the same species; nor do *Rosa alpina* and *R. pendulina* L. appear to be two distinct species.

Prunus Padus L. has not "*folia basi subtus glandulifera*" but *supra*.

Prunus Cerasus aproniana is, by LINNÆUS and his followers, erroneously called *Pr. Ceras. caproniana*.

* The above mentioned *Juncus* of Haller is *Juncus uliginosus* of SMITH Fl. Brit. p. 380. T.

London : Printed by W. Phillips,
Coburg Yard, Lombard Street, 1804.

ad pag. 1. seq.

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Pl. 1

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6

Hedwig del.

E. Sarsford sculp.

Publ. 7 ad. by Phillips & Fardon, May, 1803.

ad pag. 267. seq.

Disa

Satyrium Th

Ophrys

Pl. 9.