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ILLUSTRATIONS

OF

ORCHIDACEOUS PLANTS;

BY

FRANCIS BAUER, ESQ. F.R.S.; L.S. & H.S.

WITH NOTES AND PREFATORY REMARKS

BY

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PREFACE.

The Plates, which form the principal part of this Work, have been entirely prepared from drawings made by Mr. Francis Bauer. They form but a small part of the invaluable materials illustrating Vegetable Anatomy and Physiology, to the execution of which Mr. Bauer's long and active life has been devoted.

To make the whole of such splendid specimens of art public by means of engravings capable of expressing the beauty of the originals, would be an object worthy of a liberal Monarch and an enlightened Government; to a private individual the large expense must necessarily prove an insuperable impediment. To publish a selection of such as throw the greatest light upon structure is all that so humble an individual as myself could venture to undertake, and even this the little encouragement given to such undertakings has obliged me to extend through a period of some years.

It has been found indispensable to represent Mr. Bauer's drawings by means of lithography instead of engraving on copper; and unfortunately the former art, even in the most skilful hands, is seldom adapted to high finish or delicate touch; when executed by a mere amateur (as part of the plates has been) it is still less calculated for such an object. It is however hoped that the principal facts explained by the drawings have been faithfully represented, and that the defects of some of the plates as works of art will not be prejudicial to them as illustrations of science.

The sketches were commenced by Mr. Bauer in 1791, and have been continued at intervals up to the present time; a great part, particularly those of the European plants, was executed between 1791 and

1798, and all the more important illustrations of physiological facts before the latter period. They were made with a view to determine both the distinctive characters of genera, and the anatomy and physiology of the organs of fructification of the singular plants they represent. Explaining in the clearest manner the real structure of the anther and pollen, with all the extraordinary apparatus that is peculiar to those organs—shewing the exact anatomy of the stigma, the stigmatic canal, the ovarium, the fruit and the seed—and hence illustrating the mode in which fructification is effected, and the relation the several parts bear to each other—they demonstrate the existence, in the whole tribe, of a unity of design and a simplicity of structure which may seem incomprehensible to the observer who has only examined an Orchis or a Malaxis, but which daily experience assures us is never departed from by Nature in any of her works.

In this, as in all other parts of the Sciences of Observation, discovery has been slowly progressive. In some cases one observation has led directly to another; in others, discoveries appear to have been accidental and their importance not understood by their authors, who probably were not even aware that they had made them. It was once my intention to trace such matters chronologically; but as this would have occupied a great deal of time, and led to differences of opinion of no public importance, I have abandoned the design. Should the reader take an interest in such investigations I refer him to the dates of Mr. Bauer's drawings, and by comparing them with the dates of other publications he can judge for himself to what amount of credit this most admirable and original observer is entitled.

In drawing up the following view of the organization of Orchidaceæ, I have of course availed myself of whatever I could find in the writings of those who have treated upon the same subject; but I have not thought it necessary to quote authorities except when other observers entertain views different from my own or those of Mr. Bauer.

University College, London, December, 1837.

PREFATORY REMARKS.

The natural order called Orchidaceæ consists of plants extremely dissimilar in habits, appearance, and structure, but agreeing in being organized upon the type of Endogens, in having gynandrous flowers, and an inferior polyspermous ovary. Of these three characters there is an infinite number of modifications, the nature of which it is the purpose of the following general description in part to explain.

In habit they are terrestrial or growers in the earth, epiphytal or growers upon the surface of trees, rocks, stems, and other bodies, or apparently true parasites. While however it seems probable that such plants as Neottia, Corallorhiza, and Gastrodia are of the latter kind, there is no direct evidence of the fact.

Reticulated cellular tissue is common in all the foliaceous organs; and raphides, collected in cubical bundles, occur in every part, except in those immediately connected with the act of impregnation. They have been found by Dr. Brown in the stigma, but I have not seen them in the conducting tissue of that organ, although they undoubtedly occur in the styles

The roots are of the following kinds. Firstly, annual slender fibres, simple or branched, of a succulent nature, incapable of extension, and burrowing under ground, as in the genus Orchis; secondly, annual fleshy tubercles, round or oblong, simple or divided, as in the various species of the same genus: they are always combined with the first, and appear, from their containing amylaceous granules in large quantity, to be intended as receptacles of matter fit for the nutrition of the plant: tubercles of this kind always have a bud at their extremity, and may be con-

sidered the principal inferior prolongation of the axis; thirdly, fleshy simple or branched perennial bodies, much entangled, tortuous and irregular in form, as in Corallorhiza, Neottia, &c. or nearly simple and resembling tubers as in Gastrodia; and fourthly of perennial round shoots, simple or a little branched, capable of extension, protruded from the stem into the air, adapted to adhering to other bodies, and formed of a woody and vascular axis covered with cellular tissue, of which the subcutaneous layer is often green and composed of large reticulated cells. The points of these roots are usually green, but sometimes red or yellow. In a very few instances of leafless species, as Chiloschista usneoides, they become entirely green, and then appear to perform the functions of leaves.

The STEM is found in its most simple state in the terrestrial Ophrydeæ, where it is only a growing point, surrounded by scales and constituting a leaf-bud when at rest, which eventually grows into a secondary stem or branch, on which the leaves and flowers are developed This kind of stem usually forms every year a lateral bud with a tubercular root at its lower end, and, having unfolded its flowers and ripened its fruit, perishes, to be succeeded by the stem belonging to the lateral bud previously prepared; hence those species to which this kind of stem belongs have always a pair of tubercles, one shrivelling and in progress of exhaustion, the other swelling and in progress of completion. It is sometimes found that the successive formation and destruction of annual tubercles takes place beneath an equal number of skins, the new bud and tubercular root being always formed within the axil of a scale-like coating belonging to the parent; this takes place in the genus Thelymitra and elsewhere. Sometimes such a stem, instead of forming a new bud upon its side, pushes out a slender subterranean root-like runner, which, after growing to some length, is arrested in its growth, and then forms at its extremity a new bud, which lengthens at its base into a tubercle. In such instances as this a kind of locomotion may be correctly said to take place, the plant shifting its place yearly, and to such a distance as may be determined by the length of the runner, which separates the parent plant that perishes from the young offspring which is generated. Instances of this are common in terrestrial genera. A modification of it is when the tubercles are buried deep under ground, and always emit

a root-like stem upwards, which produces true roots until it reaches the light and then only developes leaves. This occurs in Corysanthes and elsewhere.

In other cases the growing point becomes perennial, thickens, is scarred with the remains of leaves which once grew upon it, and assumes the state of a short, round, or ovate, perennial stem or pseudo-bulb. In such a case it commonly emits from its base a short shoot, which creeps along the ground, or over the surface of a branch if the species is an epiphyte, and becomes a woody rhizoma, covered with scales which represent undeveloped leaves; after having advanced to a length which varies in different species, the rhizoma ceases to grow, and forms a new pseudo-bulb at its end. The latter subsequently protrudes a new horizontal rhizoma, which again terminates in a pseudo-bulb, and thus by degrees large masses of pseudo-bulbs are formed by a single individual, and literally pave the place upon which they grow. Such pseudo-bulbs are entirely analogous to the scaly bud found upon the end of the tubercular root of an Ophrydea, and the rhizoma in like manner is of the same nature as the runner that connects the old tubercle with the new one in such a plant; but pseudo-bulbs, in consequence of their perennial nature, are more completely formed, often have a woody texture, generally a hard cuticle, assume various angular or other figures, and develope a definite number of leaves from their points. This is the common mode of growth of the genera Maxillaria, Stanhopea, and many others. Pseudo-bulbs of this kind are always composed of cellular tissue, containing a great quantity of mucilage (and, sometimes, amylaceous granules,) traversed by simple fibro-vascular cords, and hollowed into an infinite number of minute chambers. In Pholidota imbricata the pseudo-bulb is pierced by a plexus of large brown laticiferous vessels, in which I have not remarked a cyclosis, but whose particles have an active motion on their own axis. In other cases the rhizoma, instead of having pseudo-bulbs, forms short stems which are terminated by one or more leaves, as in Pleurothallis and its allies, and in the genus Cattleya and others; these differ from the pseudo-bulbous species only in the thickness and form of their axis. The formation of tubercles and terminal buds, or of creeping rhizomata and pseudo-bulbs, is the most common tendency of the order, but not the only one; in Eulophia,

Bletia, and others, the rhizoma assumes simply the form of an ordinary tuber, and in Vanilla, Dendrobium, Vanda, and others of a similar nature there is no rhizoma, but the stem lengthens as in common plants, from which there is nothing to distinguish it; some of the species of Dendrobium are remarkable for having the pseudo-bulbous form at one end of their stem, and the common state at the other, as in D. crumenatum, &c. When such plants as Dendrobium Pierardi grow very fast, in an atmosphere which suits them, their stems will frequently branch, when the new branches throw out roots in abundance from their base; in such cases the original branches are equivalent to the rhizoma of the pseudo-bulbous species, and the secondary branches to the pseudo-bulbs themselves.

The LEAVES are variable in many points of structure. Among the terrestrial species it is most common for them to be thin, flat, and distinctly traversed with strong parallel veins proceeding at equal distances from the base to the apex, and sometimes giving them a ribbed appearance; they sheath the stem by their base, which is sometimes dilated into a cup capable of holding water. But from this the variations are extremely great; the leaves are exceedingly succulent and cellular in many species, especially those inhabiting the Cape of Good Hope; in Oberonia their faces grow together and render them equitant; in Brasavola, Luisia and others they roll up and grow together in such a manner as to become terete; in most epiphytal kinds they are coriaceous without any external appearance of veins; in the supposed parasites they are reduced to mere scales. In all the ephiphytal species they are distinctly articulated with the stem, from which they are thrown off when dead; in most terrestrial kinds this articulation is very imperfect. It is common for the leaves of epiphytes to have their ends oblique and notched; this structure is not found in the terrestrial species. Most commonly they sheath the stem more or less perfectly by their base; but in Vanilla and many others there is no sheath whatever. In all the terrestrial species the leaves form sheaths in the first instance, and bracts afterwards, by the nondevelopement of the lamina, so that gradations may be traced between the most highly developed leaves, and mere scale-like bracts; this is particularly evident in numerous Ophrydeæ.

The INFLORESCENCE is in all cases either terminal or axillary; but it often seems not to be so. Thus in some of the genus Dendrobium the flowers appear in racemes springing from the back of the leaves at the base; in this case the inflorescence pierces through the sheath of the leaf, which is pressed so close to the stem that there is no room for the flowers to develope in the ordinary way. In other instances the flowers are described as radical; they are, however, in all such cases formed in the axil of a scale or leaf stationed near the root. When, as in Cycnoches, Catasetum sometimes, and others of like nature, the flowers spring from the naked sides of the stem, they are not the less axillary on that account, but merely appear after the fall of the leaves to which they belong. It is frequently the nature of these plants to direct their flower-stems downwards, so that if planted in the ground they bury their flowers in the earth; this arises from their being naturally inhabitants of the branches of trees, from which their flowers hang down freely in the air.

Their FLORAL ENVELOPES are constructed irregularly upon a ternary type, and consist of three exterior and three interior pieces.

The *exterior pieces* are usually nearly equal, and less brightly coloured than the interior; but the two lateral ones are often of a somewhat different form from the other, which is anterior as the flower is placed upon the inflorescence when young, but which often becomes posterior when the flower is expanded, in consequence of the flower-stalk being twisted, or curved; these parts are occasionally united by their edges into a long tube, as in Masdevallia, or the lateral ones adhere to the unguis of the lip in various degrees, or two of them are consolidated into one, as in Corycium and many others. Occasionally the intermediate piece is prolonged at the back or base into one or two hollow spurs, as in the genera Satyrium and Disa; still more rarely the lateral pieces are also spurred, as in Disperis. Various other less important modifications of the exterior pieces occur, but in all cases the whole number three is present.

The *interior pieces* are usually three, never more; but in the instances of Monomeria and Aviceps the intermediate one only is present.

They are generally unequal, the two lateral pieces corresponding in form and size, while that between them, called the *lip*, is of some other form and size; in the genus Thelymitra, however, and in Paxtonia, they are all alike. Nothing can be more variable than the proportions they bear to each other and to the exterior pieces. It is only a few of their modifications which it seems important to notice. The lateral pieces are occasionally bifid, as in certain species of Habenaria; in Megaclinium falcatum they are glandular at the apex; in most cases they are distinct from the column, but in Lepanthes, Gongora, Disa, and some others, they are adnate to that organ; in no instance are they spurred or saccate. The *lip* is either distinct from the column or united to it, stalked at its base or dilated there, and often extended into a bag or spur, which is sometimes, as in certain species of the genus Epidendrum, consolidated with the ovary; very rarely it has two spurs, as in Diplocentrum. In the instances of Camarotis and Acropera it is saccate at the point. Its form is infinitely varied, the extremes of variation being Paxtonia for simplicity, and Coryanthes or Stanhopea for complexity; these and all other complicated forms may without difficulty be reduced to a three-lobed type, the simple form of which is found in Maxillaria, Bletia, and many Cattleyas. The lip is often so slightly articulated with the column as to swing to and fro upon the least disturbance, on which account it sometimes seems as if it were endowed with a power of spontaneous motion; this is particularly apparent in certain species of Pterostylis. There is a frequent tendency in the lip to produce tubercles or lamellæ upon its surface, the latter are always confined to the veins, the former are principally found near the base of the lip, and do not appear to have any relation to the veins; it is in the genus Oncidium, Eria, and Zygopetalum that these bodies, the use of which is unknown, are most conspicuous. Not unfrequently the lip is hairy, convex, and so marked and coloured as to bear no little resemblance to an insect.

It is usual to call the exterior series of the floral envelopes, calyx, and the interior, corolla, and it is convenient so to consider them for purposes of description. It is however probable, both from the analogy of Marantaceæ and Zingiberaceæ, and for other reasons, that the so called sepals are really the petals, and that the so called petals are an outer row of sterile stamens. It is clear that the supposed calyx is not the most

exterior of the floral envelopes, not only because in Epistephium there is an obscurely three-lobed cup still more external, but especially because in Bolbophyllum bracteolatum there are two scales or rudimentary sepals alternate with the so called sepals on the outside. That the supposed petals are sterile stamens is rendered probable, 1°. by the general tendency of one of them to become three-lobed, in which case the middle lobe may be regarded as equivalent to the connective, and the lateral lobes to the cells of the anther; 2°. by the glandular termination of these parts in Megaclinium falcatum and elsewhere, a common sign among other plants of the suppression of an anther, and thirdly because they have all been seen transformed into stamens by His and Brown. It is however remarkable, that the last-mentioned botanist does not consider such monstrous cases as good evidence of the so called petals being modified stamens, and that he regards the additional part in Epistephium to be analogous to what is termed a calyculus in some Santalaceæ, a few Proteaceæ, and perhaps Loranthaceæ. It might however be argued that the so called calyx of those orders is really corolla.

The centre of the flower is occupied by a body called the COLUMN, which is formed by the consolidation of the style and true stamens. In the greater part of the order there is but one stamen present, and it is in that case placed opposite the intermediate sepal, and consequently alternate with the lateral petals; when, as in Cypripedium there are two stamens present, then the usual stamen remains in its customary position, in a sterile state, and the two perfect stamens are additional and placed right and left of it. It is supposed that in those species which have but one anther there are two other stamens present in an incomplete condition, and consolidated with the other; and from the evidence offered by monstrous formations, it is thought that such sterile stamens are represented in Orchis and its allies by two tubercles, one on each side of the column, in Burlingtonia by two auricles near the apex of the column, and by other signs in other cases. This theory is in some degree confirmed by the genus Zygostates, in which what appear to be the sterile stamens are present in a perfectly distinct state, while there are no lateral appendages of any kind upon the column. But on the other hand it is invalidated by a monster of Platanthera bifolia, described by Dr. Brown, in which three stamens were developed, each

with its lateral auriculæ. Upon the supposition that the so called petals are really the external series of the andrœceum, it becomes almost necessary to consider all the stamens ever present in Orchidaceæ, as belonging to one and the same series, of which the central stamen is complete in the majority of the order, and the two lateral ones in Cypripedium, and this seems to be confirmed by the triandrous monster of Platanthera already referred to, in which Dr. Brown describes the additional stamens as opposite the lateral sepals. Nevertheless this acute observer is of opinion that the one perfect stamen in the monandrous genera, and the two of Cypripedium, belong to different series. This theory is founded partly upon the position of the stamina in Apostasia, a genus which cannot be considered actually to belong to the order, and in which of three stamens, two are described as being perfect and opposite the lateral petals, while one is sterile and opposite the intermediate sepal, and partly upon an appendage of the labellum found in Glossodia, Epiblema, &c., to which Zygostates may now be added. But in the first place an argument relating to a question of this kind must be regarded with much suspicion, if founded upon the condition of the parts in a genus not belonging to the order, and secondly, I do not see how it is possible to affirm with confidence to which division of the perianthium the perfect anthers are really opposite in Apostasia; had not so very careful a botanist as Dr. Brown asserted that they are opposite the sepals I should have described them as being opposite the lateral petals, in which case they would correspond with the supposed position of the absent stamina in Orchidaceæ. With regard to the supposition that the appendage of the labellum, so common in many genera, and so remarkable in those already mentioned, is a sterile stamen, it may be observed that there is no proof of its being of such a nature; and it is quite conceivable that it may be a mere superficial dilatation of the labellum, the lamellæ and varicose veins of which afford frequent evidence of a great tendency to the formation of superficial appendages, which I should rather regard as analogous to the corona of Silenaceæ, or more correctly to the bearded crest of Iris. It may be added that the relation born by the carpels to the stamens is unfavourable to the supposition of there being more than one series of the latter within the so called petals, as will be explained hereafter.

In the greater part of the order a single ANTHER terminates the column. This is usually two-celled, but often has its cells divided into two or four other cavities, by the extension of the endothecium between the lobes of the pollen masses, or is occasionally more or less completely one-celled by the absorption of the connective. In Ophrydeæ it is erect, with a distinct connective and with the bases of the cells either parallel or diverging, and then its cells dehisce along their face. In Neottieæ it is also erect, but appears to be dorsal instead of terminal, in consequence of the stigma being placed before it for its whole length. In the remainder of the order it falls prone upon the head of the column or the clinandrium, like a lid, and often is easily detached; sometimes this kind of anther originates from the margin of the clinandrium, sometimes from within the margin, in which case it is occasionally covered as by a hood, as in Cryptarrhena and other genera.

The POLLEN consists of lenticular or spheroidal grains, either single or cohering in pairs, threes, or fours, or in larger masses in indefinite number. The grains are usually held together by an elastic filamentous substance, which in all Ophrydeæ, and many others, forms an axis round which the grains or masses of grains are arranged, and which in a very large part of the order assumes the appearance of a strap or caudicula. This body either contracts an adhesion with a gland originating on the margin of the stigma, as in Ophrydeæ, Neottieæ and Vandeæ, or it is folded upon the pollen masses as in Epidendreæ, or it terminates in an amorphous dilatation as in many Malaxideæ. In all cases it consists of cellular tissue, sometimes very lax and large and thin-sided as in Polystachya ramulosa, more generally very compact, tough, and thick-sided; towards the end which adheres to the stigmatic gland the tissue becomes elongated, but otherwise it is more or less lenticular. In Ophrydeæ the caudicula is extended towards the base of the anther-cells; but in all the other divisions of the order, the caudicula, when present, is lengthened in the direction of the apex of the cells.

The pollen grains are filled with spherical molecules, having a motion on their own axis when suspended in water, and of unusually large size. Mr. Bauer generally represents them as escaping from the

grains by means of an opening in the sides of the latter; an observation which I have not succeeded in repeating. I find that the pollen-grains have been correctly described as extending into a pollen-tube, after being applied to the surface of the stigma, and it appears to me that the active granules pass out of the pollen-grains into those tubes.

The OVARY adheres firmly to the tube of the calyx, and is often so twisted, when the flower is about to expand, that its back and the floral envelopes belonging to it is turned to the front. It consists of three perfect carpels, stationed alternately with the stamens, opposite the petals, and bearing the placentæ in their axis, and of three other pieces alternate with the first, destitute of placentæ, and eventually separating from them when the fruit is ripe. These pieces may be either regarded as the united margins of the carpels, or as imperfect carpels; the principal objection to the latter hypothesis consisting in the intermediate pieces being external with regard to the undoubted carpels. Dr. Brown takes a different view of the position of the carpels (*On the sexual organs, &c. in Orchideæ and Asclepiadeæ, p.* 12). He considers them to be stationed opposite the sepals; consequently the intermediate pieces above described must be in his mind representations of the dorsal sutures of the carpels, and he must regard each placenta as of a double nature, half belonging to one carpel and half to another. To this opinion he appears to have been led both by his own theoretical views of the general structure of an Orchidaceous flower, and also by supposing in common with all other Botanists at that time, that placentæ must necessarily alternate with stigmata. But the evidence of Orobanchaceæ shews, as I have elsewhere explained, that in this respect the theories of Botanists were unsound; and that placentæ are beyond all doubt produced by the axis of carpels as well as by their margins.

The STIGMA is a viscid excavation in front of the anther, and just below it. In most cases it is quite simple, merely terminating in a glandular dilatation of the upper margin, called the rostellum. It is lined with a lax tissue composed of minute ascending jointed hairs, and has a direct communication with the cavity of the ovary, either open or but imperfectly closed up. The glandular dilatation, in all Vandeæ and Ophrydeæ, and in many genera, separates from the stigma and adheres

to the pollen masses, but it is also, in numerous other genera, at all times inseparable from it. In Bonatea, in Habenaria, and in some other genera of Ophrydeæ, there are two arms to the upper edge of the stigma, each arm being channelled for the reception of the caudicula of a pollen-mass, and terminating in a separable gland; between these lies a membrane, very variable in size, sometimes merely a connecting web, sometimes a distinct plicature or lobe, and occasionally fornicate and extended in the middle into a mucro. In these genera, on the lower edge of the stigmatic excavation are two processes, long, narrow, channelled, lined with stigmatic hairs, free at the points, united to the labellum at the base. Dr. Brown regards the two upper arms and intervening web of the superior edge of the stigmatic excavation as belonging to one carpel, and the two imperfect processes adhering to the base of the labellum, as the styles of the two other carpels; this view of their nature is the necessary consequence of assuming that the carpels of which the ovary is composed, are placed opposite the sepals. But it appears more probable that in such plants the double placentæ are connected with a two lobed style to each carpel; a structure which would be analogous to what occurs in this and in other Iridaceous plants, to which Orchidaceæ are very nearly allied. Upon this supposition one arm of each of the fertile styles must be regarded as suppressed, or united with the contiguous imperfect arm into a plicature or mucro, and the two sterile processes will belong to the carpel which is opposite the labellum. That the stigmatic arms are opposite the petals is manifest in most of the genera where they are found, and especially in such plants as Disa, Penthea, &c. in which the third and sterile stigma forms a tubercle at the base of the labellum. That the connecting web of the fertile arms is of a double nature is also shewn by its lobed condition in Diplomeris hirsuta, Bonatea flexuosa, and others. It results from the preceding statements, that the theoretical structure of an Orchidaceous flower is as follows:—*Sepals* 3, usually suppressed. *Petals* 3, commonly called sepals. *Stamens* 6, in two series, of which the *outer* is sterile, and commonly called petals, and the *inner* is consolidated into a column: the two stamens of this series, which are opposite the so called sepals, being usually abortive. *Ovary* inferior, composed of 3 carpels, having double polyspermous placentæ in their axis, and

placed opposite the so called petals. *Styles* 3, opposite the so called petals, often 2-lobed, and unequally united, those only which are opposite the lateral so called petals being fertile : all, in most cases, consolidated so as to be undistinguishable.

Opinions are divided as to the manner in which impregnation occurs in this order. Mr. Bauer adduces a great many facts to show that it does not take place, as in other plants, by actual contact between the pollen and the stigmatic secreting surface, but that it is effected by absorption of fecundating matter by the stigmatic gland from the pollen through the caudicula. In Tab. III. Fig. 4, Fructification, a supposed contrivance to effect this purpose by means of foramina in the pouches of the stigma is represented in Orchis mascula. Plates V, XII, XIII, XIV, of Fructification, and XVII, XVIII, XIX and XX of Genera, are particularly intended to illustrate the progressive developement of the organs of fructification, and Mr. Bauer's opinions regarding fecundation. The result of which appears to amount to this; that in an early period of growth there is no communication between the pollen and stigma; that by degrees this communication is effected by the extension of the caudicula till it reaches the stigmatic gland, to which it firmly adheres; up to this time the grains of pollen are closed up, and the stigmatic surface firm, smooth, dry, and of a waxy texture; that after a union is effected between the caudicula of the pollen masses and the stigmatic glands (which precedes the expansion of the flower), the pollen grains lose their granular contents, while the stigmatic glands and surface simultaneously become covered with a thick mucus; that by the time the flower is expanded, the pollen is dry and empty of granular matter, and the stigma less mucous than it was; finally, that, with these changes, alterations take place in the surface of the stigmatic excavation, which is at first composed of a loose plexus of cellular tissue, and is eventually broken up into a stratum of slender utriculi, each containing from 1 to 3 nuclei; these utriculi are represented as being at first empty, but as presenting, after the supposed act of impregnation has taken place, the appearance of grumous matter in their interior. To all this it may be added, that care seems to have been taken by nature to prevent the usual contact

between the pollen and stigma, by enclosing the former in an anther, from which it can only be released by the action of some external stimulus, such as might be received from a bird or an insect.

On the other hand Dr. Brown, M. Adolphe Brongniart, and others, suppose that impregnation is effected here as elsewhere by contact between the pollen and stigma. It is alleged that pollen-tubes are emitted by the pollen after it has adhered to the stigma, that these tubes descend the stigmatic canal, and mix themselves among the ovules over the surface of the placentæ, and that in some cases the pollen-tubes have been traced into the foramina of the ovules. The latter is a remark of Dr. Brown's, whose skill and faithfulness as an observer are above all question.

For a long time I adopted the views of Mr. Bauer, but additional experience, a careful observation of Orchidaceæ in a state of cultivation, and a verification of some of the facts last described, have caused me to alter my opinion, to acquiesce in the conclusions of Dr. Brown, and to regard the phenomena represented by Mr. Bauer as connected with circumstances not belonging to impregnation. It is now well known that cultivated Orchidaceæ, which rarely fruit if unassisted, may be made to bear fruit with certainty, if they are artificially impregnated. The effect of such impregnation is firstly to hasten by many days the decay of the flower, and secondly, to fill the stigmatic canal with pollen tubes, which may be traced without difficulty even up to the very maturation of the fruit.

The determination of this point does not however diminish the value of Mr. Bauer's observations; it only leaves the facts he describes still to be accounted for; and it is a most curious subject of enquiry to investigate the exact uses of so singular and peculiar a sexual apparatus as that with which Orchidaceæ are furnished.

The SEEDS are generally enveloped by a loose cellular testa, which is frequently open at the lower end, at the period of maturity. They contain a nucleus, whose apex is directed towards the base of the seed, and which is either covered by two extremely thin membranes, frequently

prolonged at the point into a tube*, or is coated by a brittle crustaceous integument. At that end of the nucleus which is next the apex of the seed, is uniformly found a very distinct chalaza of a deep brown, or a bright brown colour. The interior of the nucleus is a cellular fleshy homogeneous body, and must be regarded as an embryo destitute of albumen.

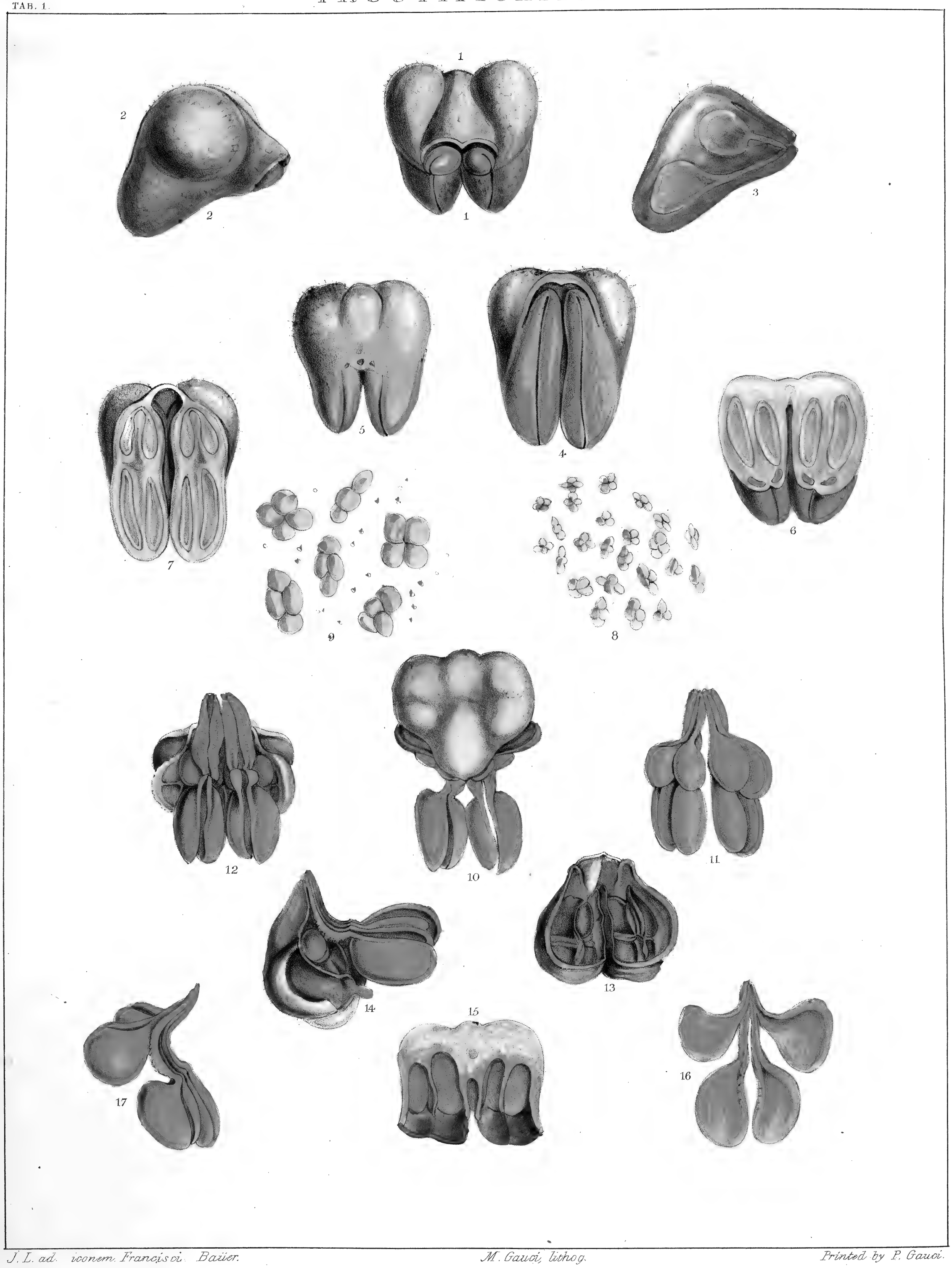
Nothing certain is known of the germination of Orchidaceæ.

University College, London, Oct. 24th, 1838.

* This is represented at Plate XI, Fructification, figs. 4, 6, 7, 8, and 9, and elsewhere, as if it were the funiculus of the nucleus.

TAB. 1.

FRUCTIFICATION.



J. L. ad. iconem Francisci Baüer. M. Gauci, lithog. Printed by P. Gauci.

FRUCTIFICATION.

Tab. I.

The anther and pollen-masses of Bletia Tankervilliæ; from sketches by Mr. Bauer in August 1801. This plate illustrates the structure of the Tribe called Epidendreæ.

1. A young anther seen in front; magnified 8 times.
2. A side view of the same.
3. A vertical section of one of the lobes of the same, shewing the early formation of pollen in the solid substance of the anther, and the origin of the filaments or straps by which the masses are finally connected.
4. A view of the face of the lobes of the anther; magnified 8 times.
5. A back view of fig. 1. shewing that there are three vascular cords that pass out of the column into the anther.

6. 7. Transverse and vertical-tangental sections of the young anther, shewing that the pollen-masses are all originally secreted in different parts of the substance of the anther, which at first is a solid mass.

8. 9. Grains of pollen magnified; fig. 8, 100 times, fig. 9, 200 times; to shew that they cohere in threes or fours, and are themselves composed of more minute particles, as is apparent from fig. 9.

10. A full-grown anther dropping out its pollen-masses; magnified 8 times.

12. A view of the underside of the same.

14. A side view of the same.

13. A view of the interior of the anther, shewing the eight cells for the reception of the same number of pollen-masses; magnified 8 times.

11. 16. 17. Various views of the pollen-masses, shewing that the eight lobes are all connected by filaments or straps, which unite at the apex of the anther.

15. A section of the anther, shewing the thickness of the connectivum and the space occupied by the masses of pollen. All these figures are magnified 8 times in diameter.

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FRUCTIFICATION.

Tab. II.

The column and sexual apparatus of Brassia maculata; from a drawing by Mr. Bauer made in May 1807. This plate illustrates the structure of the Tribe called Vandeæ.

1. 2. Front and side views of the column of an unexpanded flower; magnified 6 times; these shew the early formation of the gland, the vertical position of the anther, and the nature of the stigmatic cavity.
3. 4. Side and front views of the same, the anther being turned back; and the clinandrium laid bare, to shew that at this period the gland and the caudicula are separable from the pollen-masses, which are still enclosed within the cells of the anther.
5. A transverse section of a young anther, shewing the early formation of the pollen; magnified 6 times.
6. A front view of an anther after the pollen has dropped, shewing the membranous valves; magnified 6 times.
7. A vertical section of the same.
8. 9. Two half profile views of the upper end of the column, having the gland and the caudicula in a very young state, no adhesion with the pollen-masses being perceptible; magnified 12 times.
10. A front view of the column of an expanded flower, the anther being removed, and the pollen-masses, gland and caudicula in their natural position; magnified 6 times.
11. 12. Front and side views of the same, with the anther not removed.
13. A side view of the two pollen-masses, their caudicula, and gland; magnified 12 times.
14. A back view of the same, with one of the pollen-masses removed, and the other drawn a little off the caudicula and cut across, so as to shew the hollow centre which communicates with the external fissure.
15. A side view of No. 10.
16. A front view of No. 13.
17. A back view of the same, shewing the fissures in the pollen-masses.
18. The grains of pollen, cohering in threes or fours; magnified 200 times.
19. The ultimate particles of pollen; magnified 200 times.

TAB. 2.

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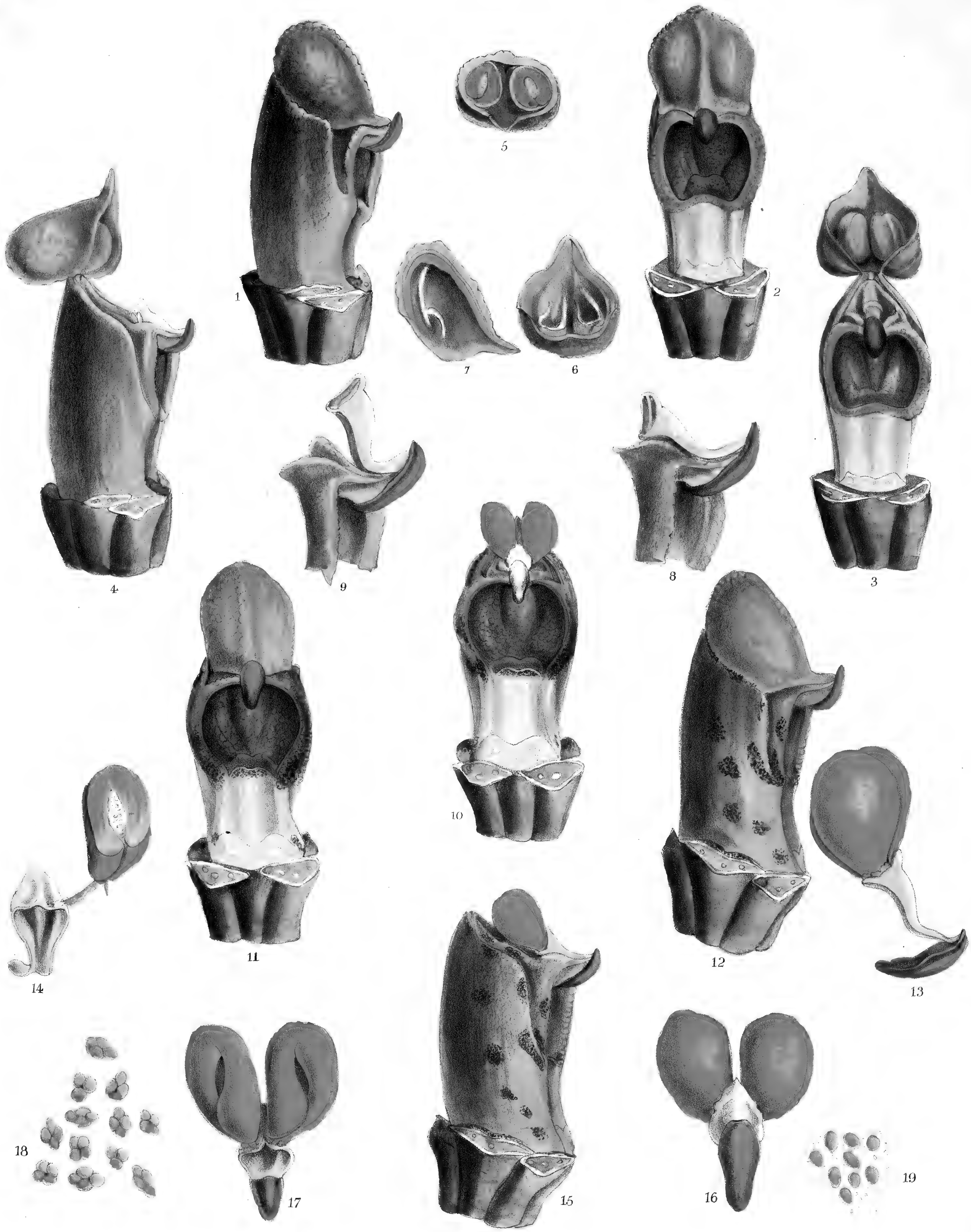

Franciscus Baüer, del.t *M. Gauci, lithog.* *Printed by P. Gauci.*

TAB. 3.

FRUCTIFICATION.

J. L. ad. ic. ex. Franciscus Baiier.

M. Gauci, lith.

Printed by P. Gauci.

FRUCTIFICATION.

Tab. III.

The sexual apparatus of Orchis mascula, &c. from a drawing by Mr. Bauer in May 1792. This plate illustrates the structure of the Tribe called Ophrydeæ.

1. A front view of the column of Orchis mascula with the base of the labellum, shewing the position of the anther, with its pouch, the cells of the former being partially open, so as to shew the pollen within; on each side of the anther are seen two granular tumours, which are the rudiments of stamens; magnified 15 times.
2. A back view of the same; the orifice of a section of the ovarium being shewn above the mouth of the spur, a section of which occupies the centre of the figure; the spur is seen to be hairy inside.
3. A front view of the anther with the cells opened, so as to exhibit the pollen-masses inside in their natural position; magnified 15 times. The pouch in which the glands of the pollen-masses are confined is forced a little down.
4. The same viewed from beneath and behind. The back of the pouch is visible, with two foramina which communicate with the glands of the pollen-masses, and establish a communication between them and the stigma. In an unexpanded state the back of the pouch is pressed down close upon the stigma, and at that time the influence of the pollen is conducted to it through these foramina; after expansion the pouch and foramina are separated from the stigma by so considerable a space, that no communication can be established between them. See fig. 16.
5. A transverse section of fig. 3; magnified 15 times. In this the inner structure of the cells of the anther is exhibited, and the pouch is in its natural position.
6. A pollen-mass with its caudicula and gland, taken out of the anther; magnified 15 times.
7. The same; magnified 15 times; its pollen forcibly stretched asunder, and many of the granulations torn away.

8. A pollen-mass of Ophrys apifera with its caudicula and gland magnified 15 times; the gland is in the act of parting with the fecundating matter of the pollen.

9. A view of the upper surface of the gland, with the mode of insertion of the caudicula.

10. A view of the under surface of the same, shewing a cavity which communicates with the foot of the caudicula.

11. A section of the pouch, shewing the positions of the gland, the caudicula and the foramen.

12. A portion of the granules of the pollen-mass of Orchis mascula; magnified 50 times. This shews that all the granulations cohere by the means of a common elastic web, which is shewn forcibly distended, and that each granulation is composed of a number of series of particles of pollen.

13. One of the granulations in its natural state; magnified 100 times.

14. The same partially dissolved in water, its component particles separating in threes, fours, pairs, and very minute simple molecules.

15. A back view of the double pouch of the column of Ophrys apifera shewing the wide foramina at the back of each pouch for maintaining the communication between the pollen-masses and the stigma; magnified 15 times.

16. A section of fig. 1, shewing the relative position of the anther, pouch, gland, stigma, and ovarium of Orchis mascula when the flower is expanded.

FRUCTIFICATION.

Tab. IV.

The parts of the flower of Spiranthes speciosa, illustrating the Tribe Neottieæ; from a sketch by Mr. Bauer in 1794.

1. A side view of the ovary, column, and lip, the other parts being removed; magnified 8 times.
2. The same, with the lip and a part of the ovary cut away; magnified 8 times.
3. A back view of the column of a bud, shewing the anther and the back of the stigmatic gland; magnified 8 times.
4. The stigmatic gland, seen from the front; magnified 16 times.
5. The same, from the back, with two perforations, corresponding with the adhesion of the pollen-masses; magnified 16 times.
6. A back of the column of an expanded flower, with the anther attached; magnified 8 times.
7. The same, with the anther removed, shewing the pollen-masses and stigmatic gland in their places.
8. The same, with the pollen-masses and the stigmatic gland removed.
9. The two pairs of pollen-masses, attached to the back of the stigmatic gland; magnified 8 times.
10. The same seen in front.
11. An anther, after the pollen-masses have fallen out, seen in front; magnified 8 times.
12. A transverse section of the same.
13. Four of the pollen grains; magnified 400 times.
14. A mass of the pollen adhering to the mucilaginous tissue; magnified 100 times.

TAB. 4.

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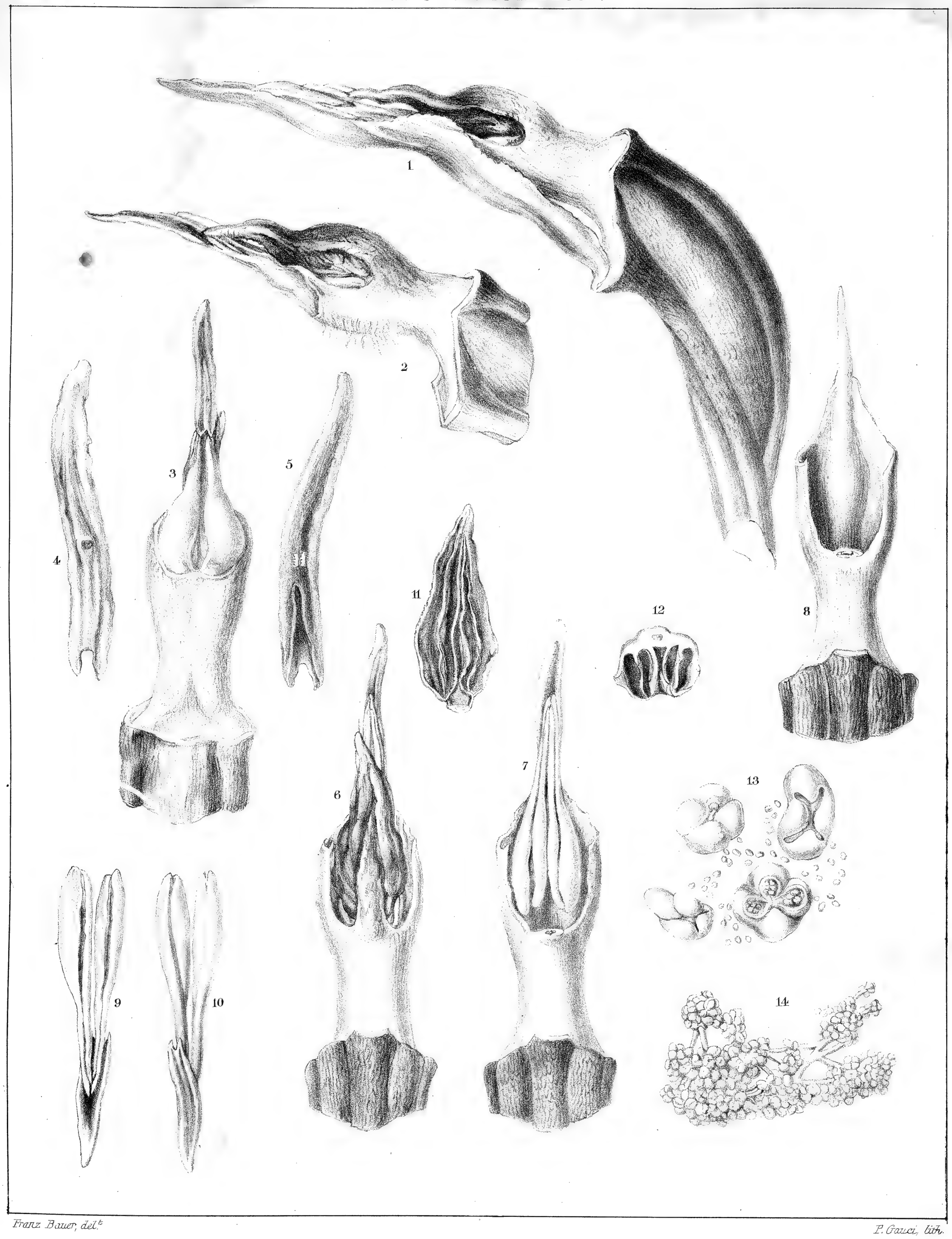

Franz Bauer, del.t

P. Gauci, lith.

FRUCTIFICATION.

Tab. VI.

Anatomical views of the stigma and stigmatic surface of Bletia Tankervilliæ; from a sketch by Mr. Bauer in 1802.

1. A section of the anterior lip of the clinandrium, the stigma, and a portion of the stigmatic canal before impregnation, if viewed under water; magnified 24 times. The stigma, which occupies the upper extremity of the figure, is a close sac of cellular tissue: the stigmatic canal is composed of an extremely loose plexus of cellular tissue fringed by minute hairs.
2. The same after impregnation. The stigma is discharging the matter it contains; and the plexus lining the stigmatic canal (*a*) is converted into a mass of loose separable oblong bodies, having their free extremities pointing upwards.
3. Some of the same bodies magnified 200 times. They are perfectly transparent, and appear to be cellules of an oblong or fusiform figure, with one, two, or three granular, more opaque, greenish yellow specks, looking like young seeds of an Orchis in the midst of loose reticulated testa.
4. Longitudinal section of a portion of the surface of the upper part of the stigmatic canal represented at fig. 2; magnified 100 times. This is seen under water.
5. Transverse section of a portion of the dense mucous substance lining the stigmatic canal, when viewed after having been kept a few minutes under water; magnified 200 times.

TAB. 6.

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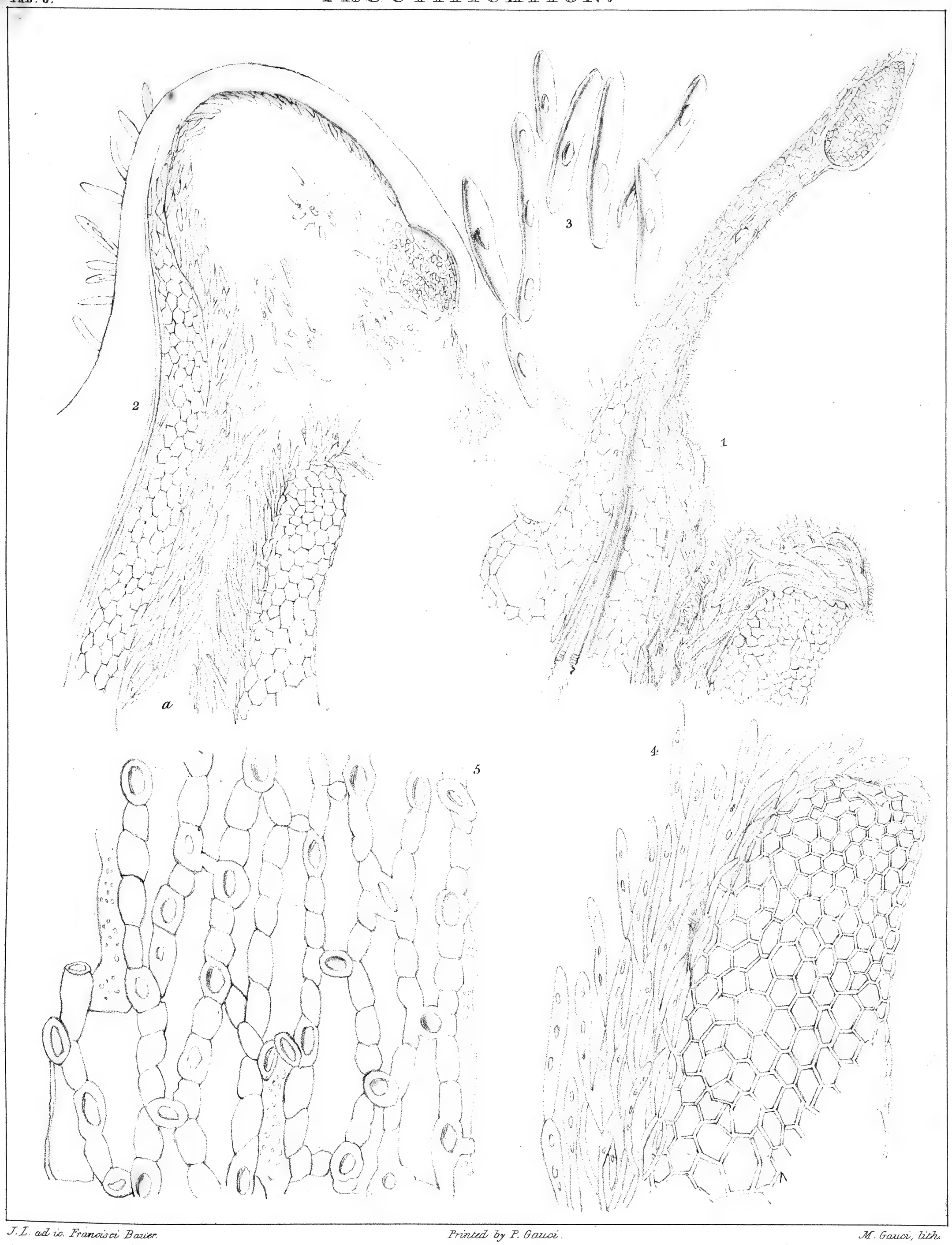

J.L. ad ic. Francisci Bauer. Printed by P. Gauci. M. Gauci, lith.

FRUCTIFICATION.

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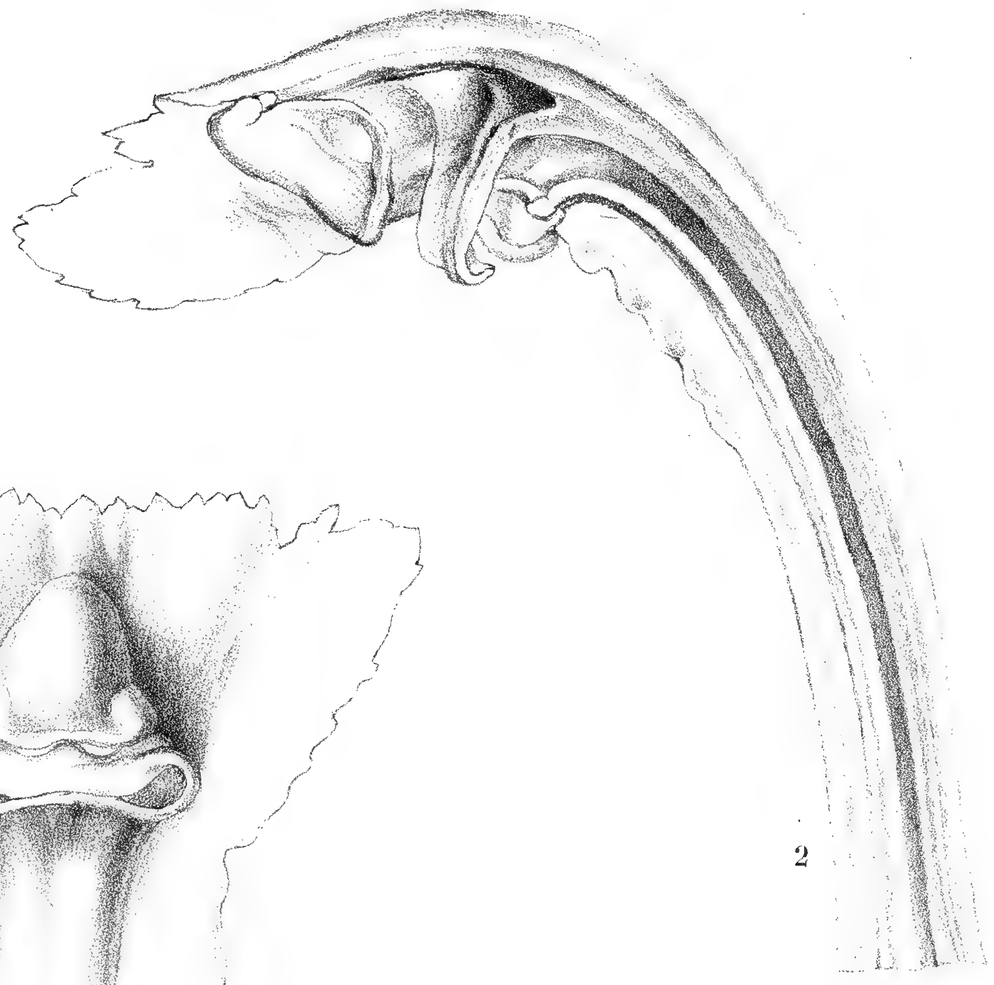

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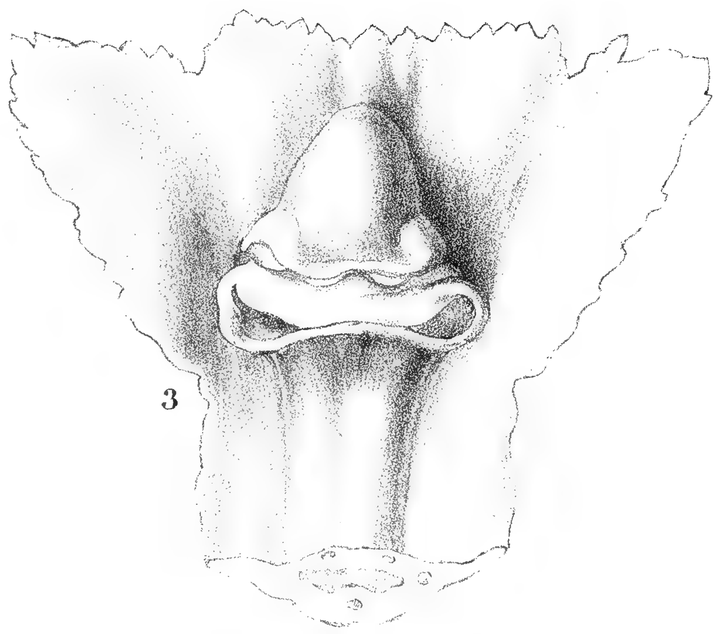

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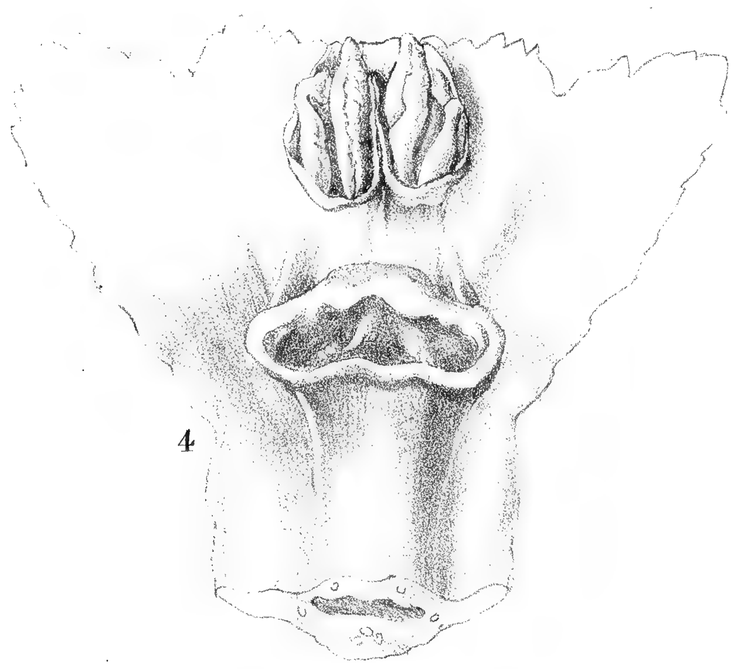

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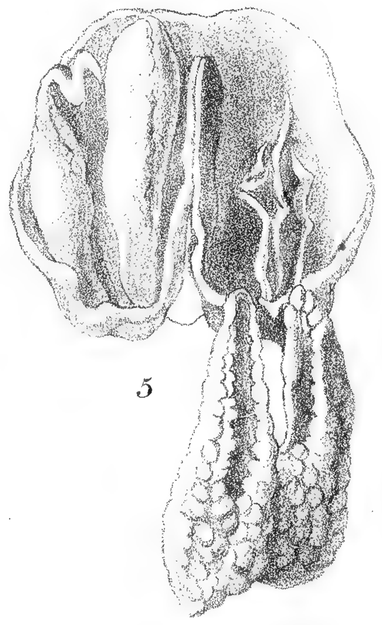

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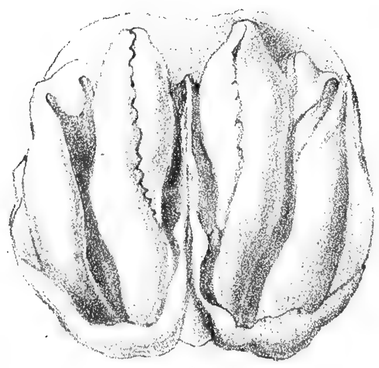

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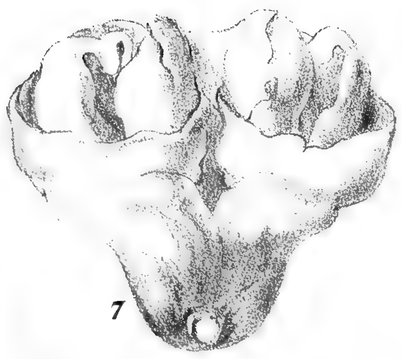

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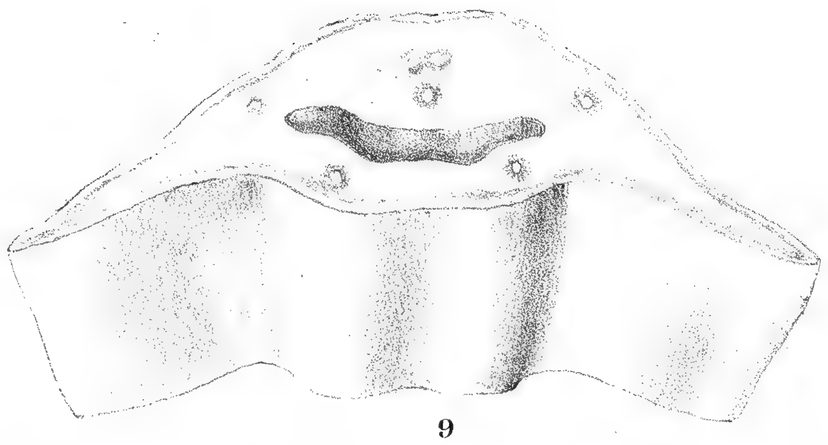

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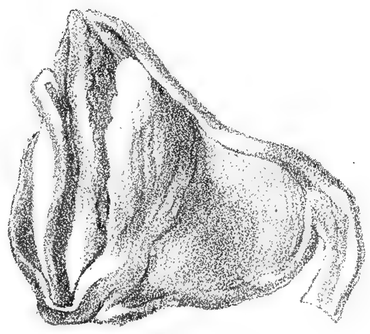


8

Franz Bauer, del.t

F. Gauci, lith.

FRUCTIFICATION.

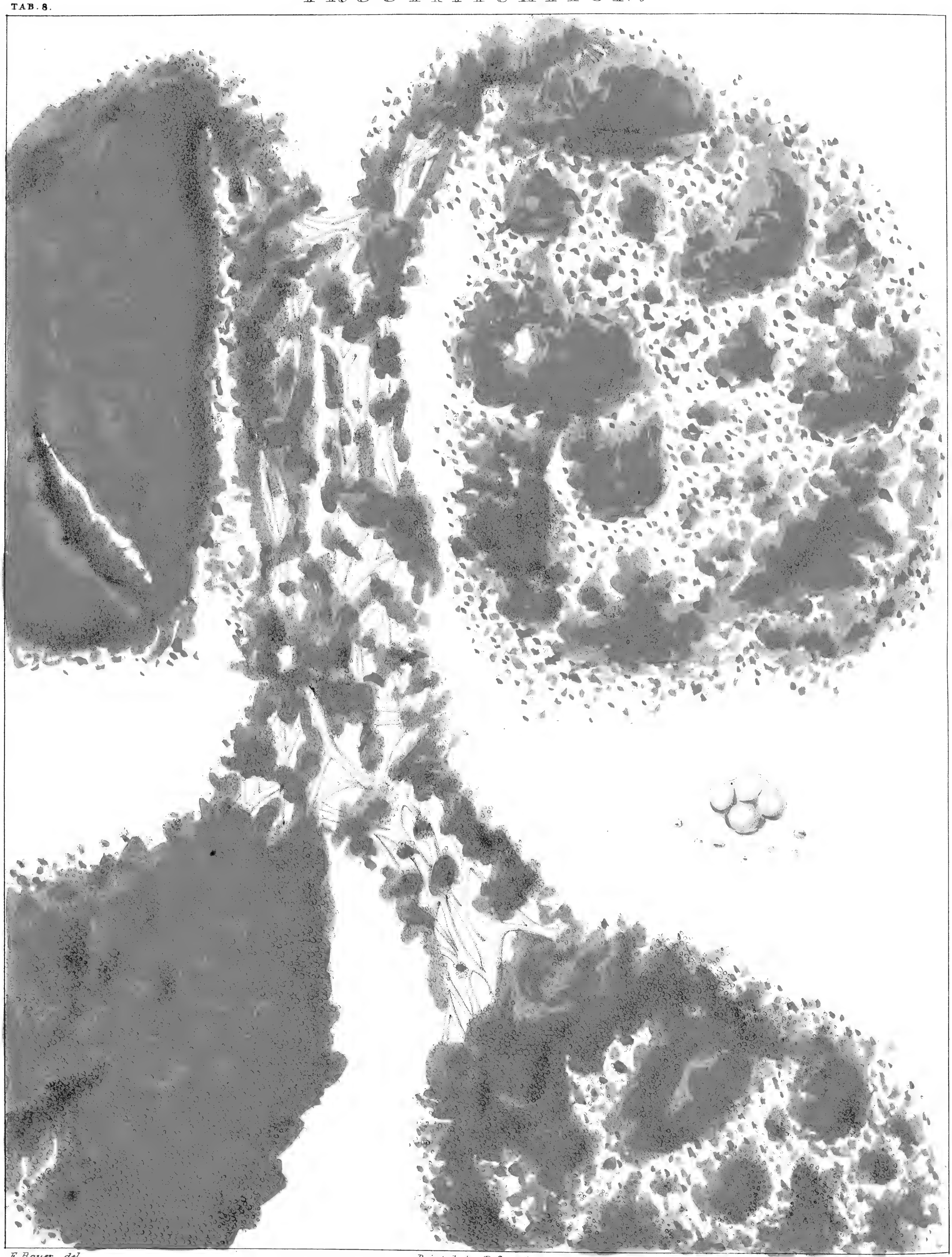
Tab. VII.

The parts of the flower of Arethusa bulbosa; illustrating the Tribe called Arethuseæ; from a sketch by Mr. Bauer in 1794.

1. A front view of the top of the column, with the anther in its place; magnified 10 times.
2. A vertical section of the same.
3. The tip of the column with its membranous border turned up, the anther and stigma being in their true position with respect to each other; magnified 10 times.
4. The same, with the anther turned back to shew the stigma and pollen-masses.
5. The face of an anther, with two of the pollen-masses dropping out; magnified 20 times.
6. The same, with the pollen-masses in their places.
7. An end profile of the last.
8. A side profile of a vertical section of the same.
9. A transverse section of the column; magnified 20 times.

TAB. 8.

FRUCTIFICATION.



F. Bauer, del. Printed by P. Gauci. M. Gauci, lithog.

FRUCTIFICATION.

Tab. VIII.

A view of the pollen-masses of Bletia verecunda dissolved in water; from a sketch by Mr. Bauer in 1801.

This figure is to shew the real nature of the waxy pollen masses of Orchideous plants. When examined as represented in this figure they are found to consist of innumerable particles of pollen cohering in pairs, threes, or fours, by means of a delicate, transparent, elastic web. The central part which connects the four lobes is what appears under the form of connecting filaments or straps, which are found from this figure to be a mere plexus of this elastic web, with a small quantity of loosely cohering grains of pollen scattered among it. Magnified 100 times.

The separate figure, of a grain and some granules of pollen, is magnified 400 times.

FRUCTIFICATION.

Tab. IX.

A transverse section of the ovarium of Bletia verecunda; from a sketch by Mr. Bauer in 1801.

This explains the plan upon which the ovarium of all Orchideæ is formed. It consists of six unequal pieces; of which three are smaller than the rest, and opposite the sepals; the three others opposite the petals; the latter only bear the placentæ, which are two-lobed, and covered with an infinite multitude of ovula. The axis of each piece of the ovarium is occupied by a bundle of vessels. Magnified 60 times.

TAB. 9.

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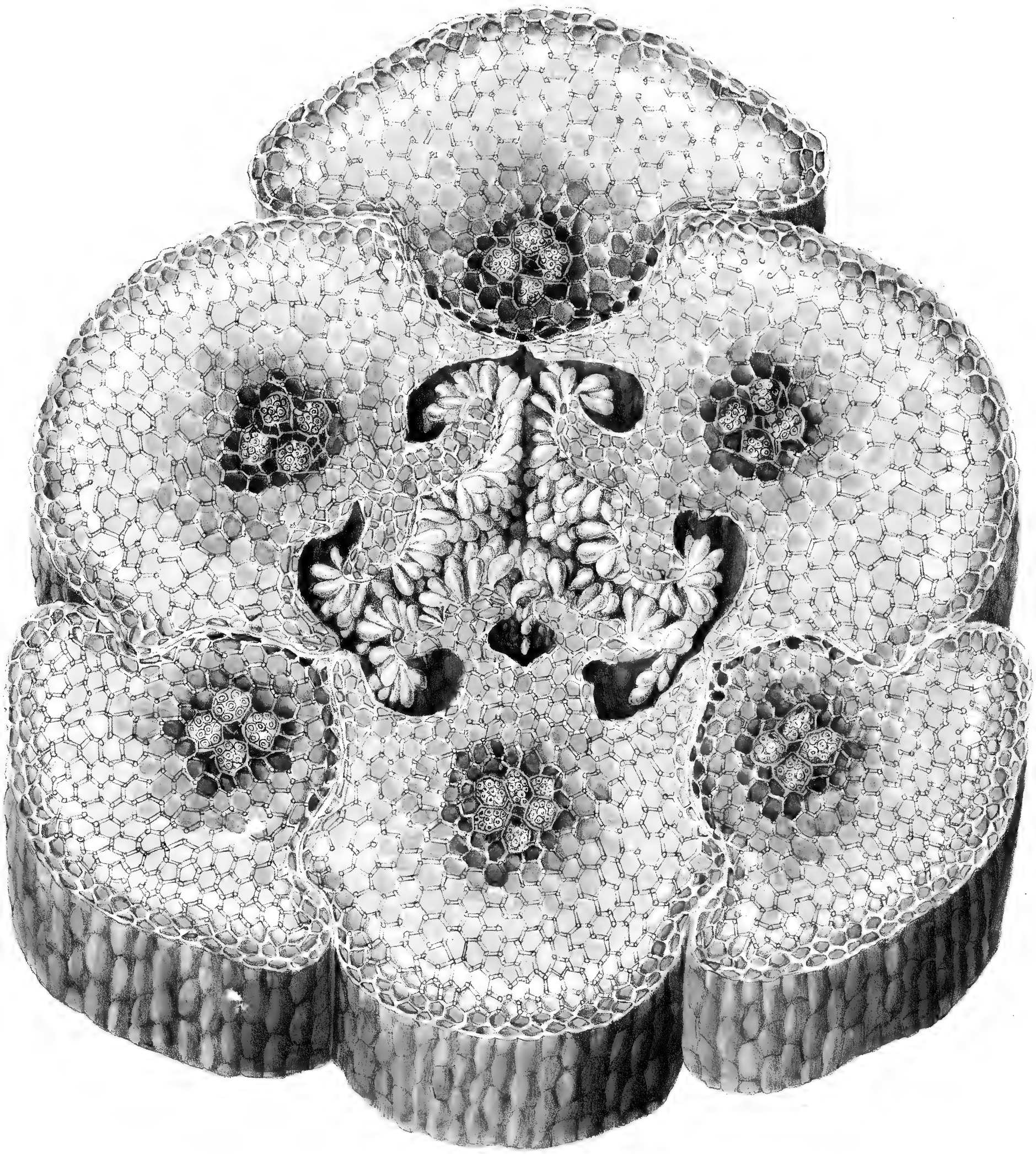

J. L. ad iconem Francisci Bauer.

Printed by P. Gauci.

M. Gauci, lithog

TAB. 10.

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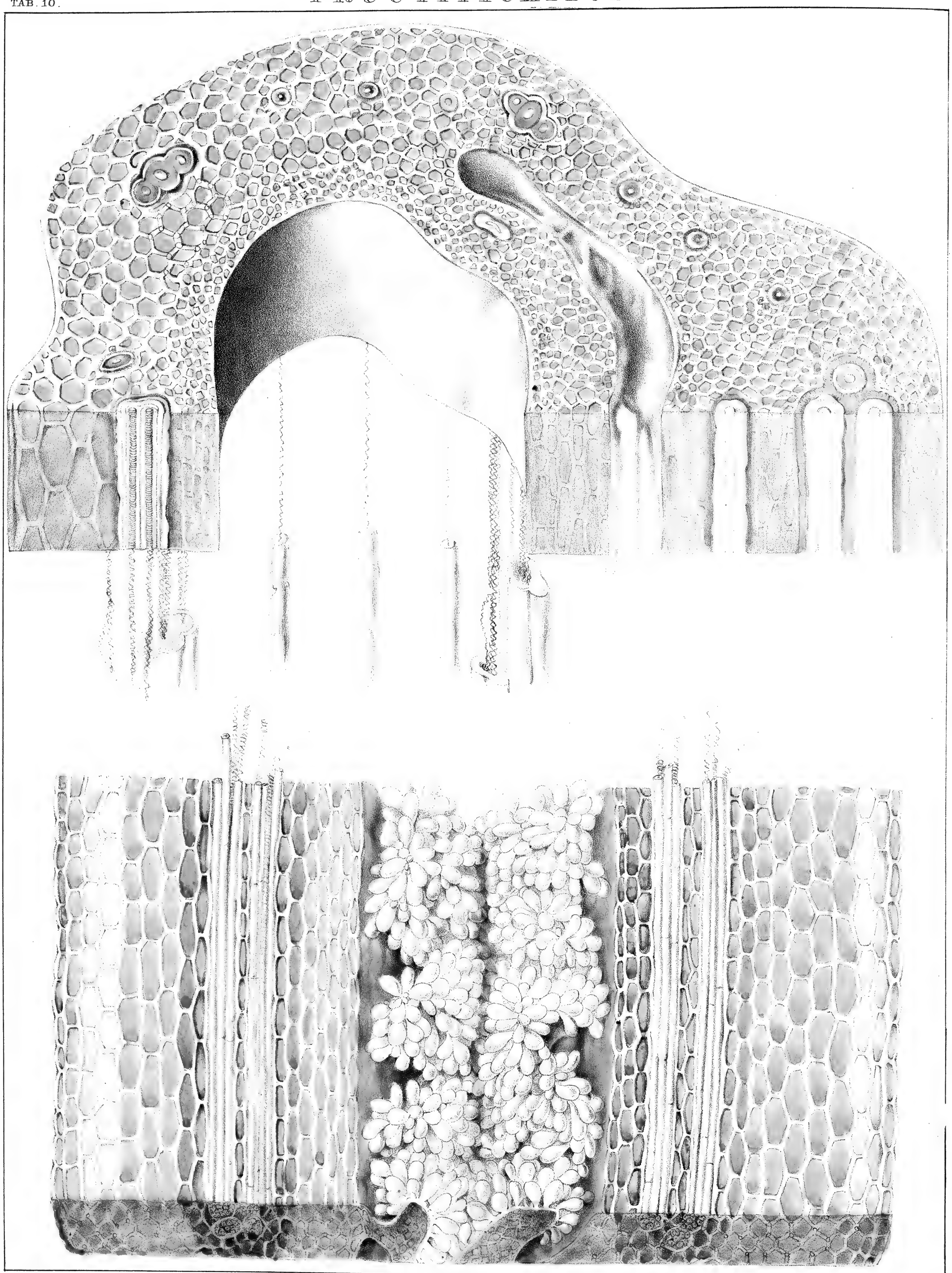


F. Bauer del.t

M. Gauci, lith.

Printed by P. Gauci.

FRUCTIFICATION.

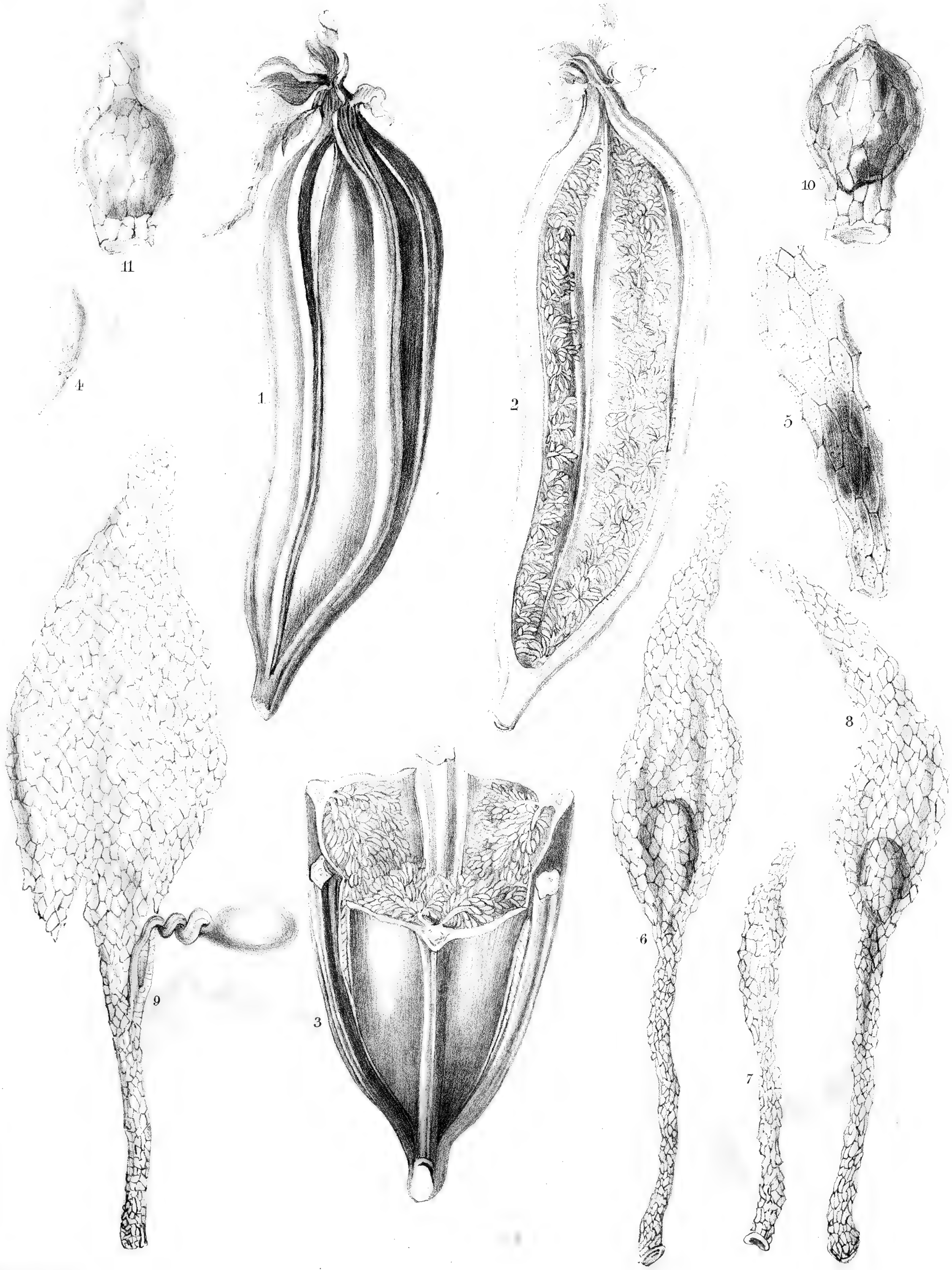
Tab. X.

Views of the anatomical structure of a column and ovarium; from sketches by Mr. Bauer in 1793.

The upper figure represents a transverse and vertical section of the column of Epidendrum ciliare. The larger cavity is that formed by the union of the labellum and column; the smaller represents the stigmatic canal, with its mucous lining. The mass of the column consists of hexagonal cellular tissue, among which are distributed various bundles of spiral vessels encased in very dense woody fibre; magnified 60 times.

The under figure is a vertical section of the portion of the ovarium of Bletia verecunda represented in Tab. IX. Magnified 60 times.

FRUCTIFICATION.



Franz Bauer, del.t

P. Gauci, lith.

FRUCTIFICATION.

Tab. XI.

The ripe fruit and seeds of various species; from sketches by Mr. Bauer in 1803.

1. The capsule of Ophrys apifera; magnified 4 times.
2. The same, cut vertically, shewing one placenta and a half.
3. A transverse section of the same, shewing the three placentiferous and the three sterile valves.
4. A nucleus of the seed of Ophrys apifera; magnified 100 times.
5. A complete seed of the same, with its tunic.

6. 7. 8. Seeds of Epidendrum elongatum in different states, with their tunic; magnified 100 times.

9. The same, with the tunic opened so as to shew the nature of its attachment to the nucleus; magnified 100 times.

10. 11. Seeds of Pterygodium atratum; magnified 100 times.

GENERA.

Tab. I.

The parts of Fructification of Malaxis paludosa (*Gen. and Sp. of Orchid. Pl. p.* 24); from a sketch made by Mr. Bauer in July 1801.

1. A front view of the expanded flower, shewing the relative position of the petals, sepals and column; magnified 15 times.
2. A side view of the same; the bractea seen at the foot of the ovarium; magnified 15 times.
3. A back view of the same, shewing the form of the ovarium and the twisted state of the peduncle; magnified 15 times.
4. A side view of the ovarium, column, and labellum of the unexpanded flower, the sepals and lateral petals having been removed; the anther is seen laterally, reposing upon the thin anterior lip of the column; the pollen masses not yet visible; magnified 15 times.
5. A back view of the column of an unexpanded flower, shewing the position of the anther with regard to the anterior lip of the column; magnified 30 times.
6. A side view of the same, shewing the relative proportion and position of the anther, the anterior lip of the column, and the prominence which occupies the face of the same part; magnified 30 times.

6* A transverse section of the anther of the same, shewing the existence at this period of a separation in each cell in the middle of the pollen, which finally causes it to appear in the form of four incumbent masses, as seen at fig. 13 and 14; magnified 30 times.

7. A front view of the column in the same state; this shews that the true form of the anterior lip of the column is two-lobed, with a marginal tumour between the lobes; this tumour is the true stigma. In front is the same prominence as is seen laterally at fig. 6; from which it appears that its superior extremity forms the anterior margin of the stigmatic cavity, and that at its lower extremity it is continuous with the labellum, the scar caused by the separation of which is distinctly shewn; magnified 30 times.

8. A back view of the column and anther after the expansion of the flower. This represents the advanced state of fig. 5; the parts have all acquired a greater firmness; the form of several is altered, and the case of the anther has contracted, leaving the pollen-masses exposed in their true position: that is, incumbent upon each other, not lying side by side; magnified 30 times.

9. A view of the parts represented at fig. 7, in the state in which they appear when the flower is expanded; the stigmatic cavity is enlarged, and the true stigma is smaller and more acute; magnified 30 times.

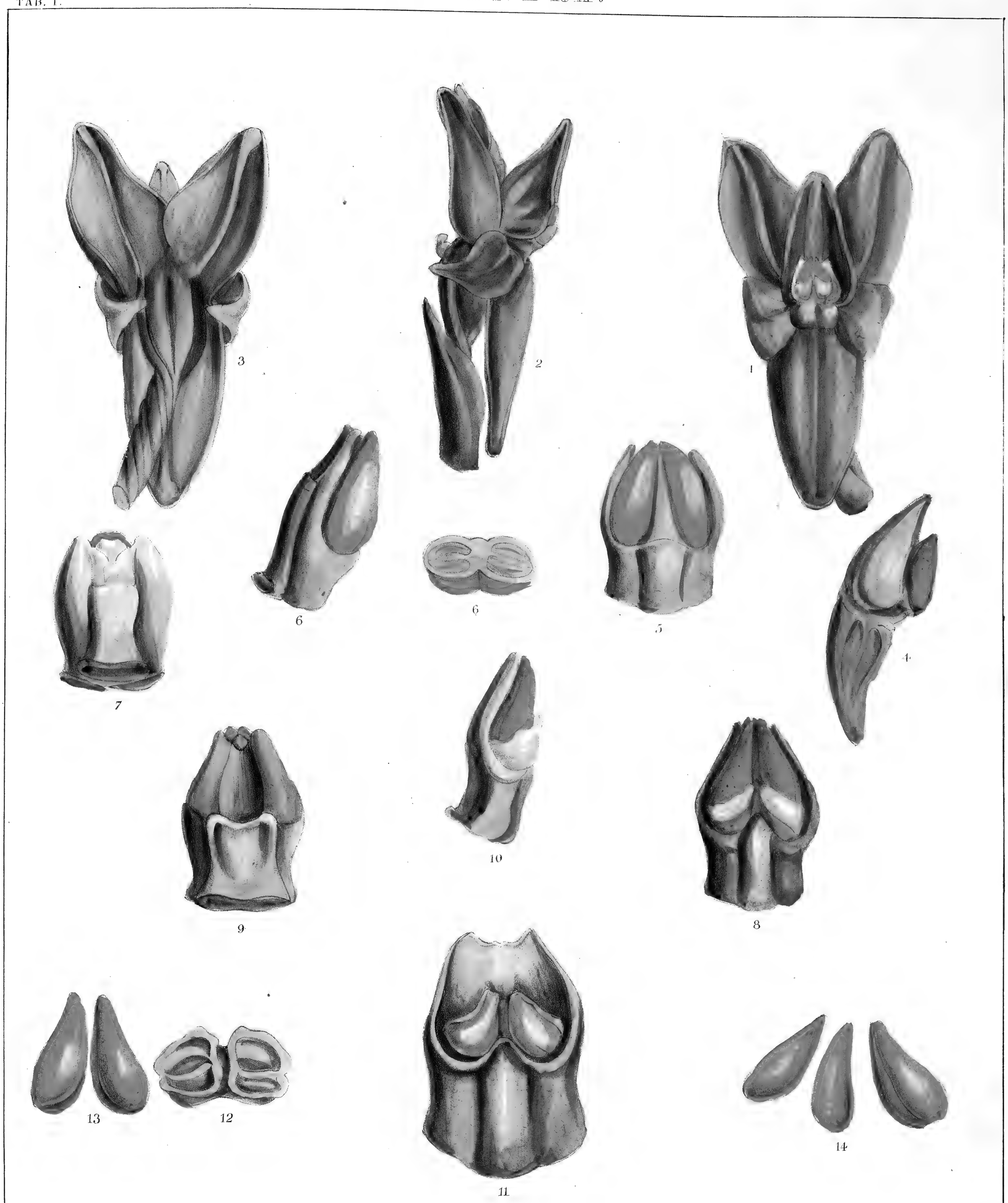
10. A side view of the same; answering to fig. 6; magnified 30 times.

11. A back view of the column; the pollen-masses having fallen out; this explains the figure of the clinandrium or cavity in which the anther lies, and shews the form of the anterior lip of the column after fecundation; magnified 30 times.

12. A view of the face of the anther after the pollen-masses have fallen out; the lobes are seen to be incompletely two-celled, and to be distinctly separated by the connectivum; magnified 30 times.

13. 14. Different views of the pollen-masses at the time they separate from the anther; magnified 30 times. From this it is apparent that they are, at that time, destitute of all trace of caudicula, gland, or other process, and lie loose in the cells of the anther; thus constituting the principal distinctive character of Malaxideæ among Orchideous plants with waxy pollen.

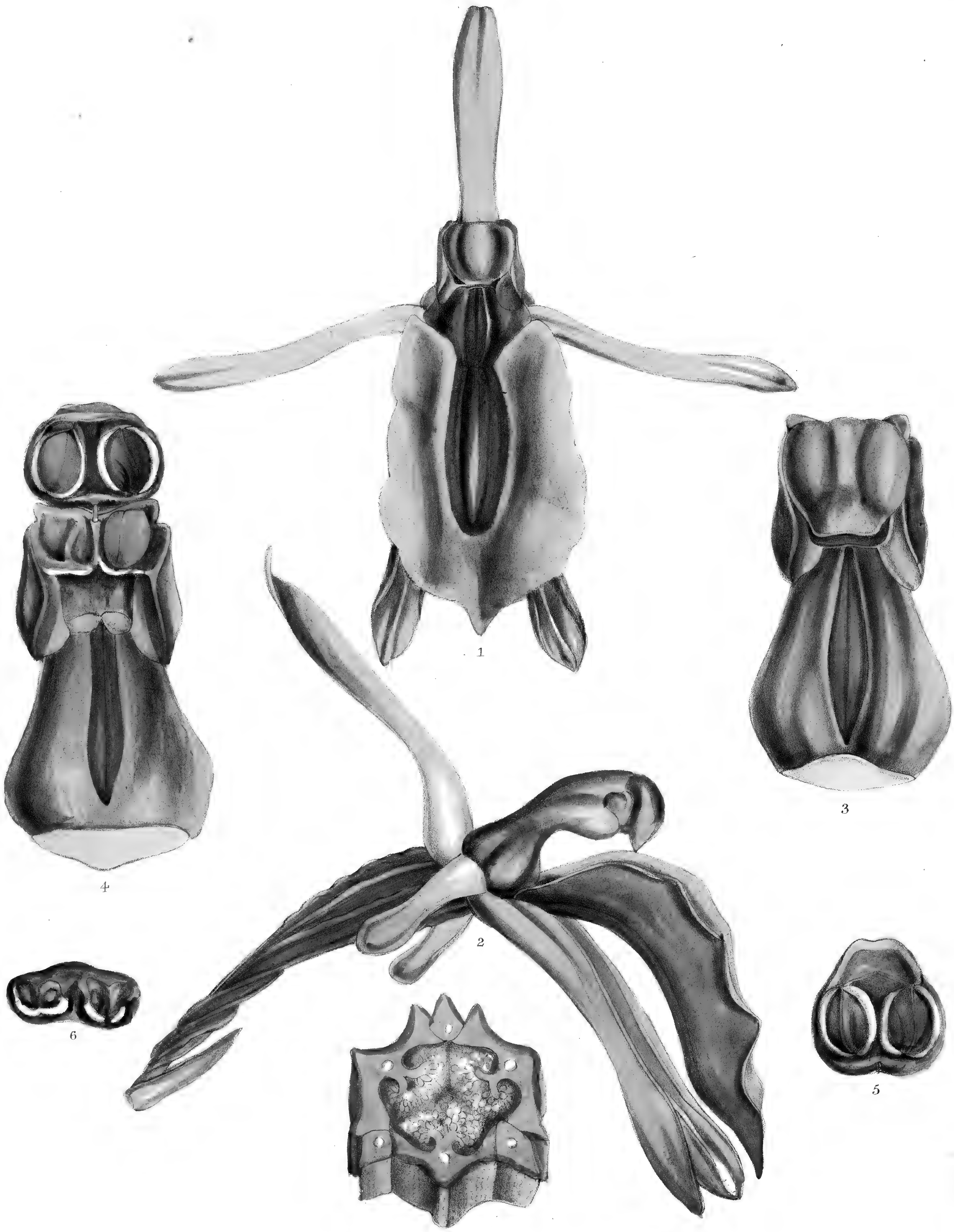
GENERA.



Malaxis Paludosa.

J. L. ad iconem Francisci Baiier. M. Gauci, lithog. Printed by P. Gauci

GENERA.



Liparis Löselii.

J.L. ad iconem Francisci Bauer.
M. Gauci, lith.
Printed by P. Gauci

GENERA.

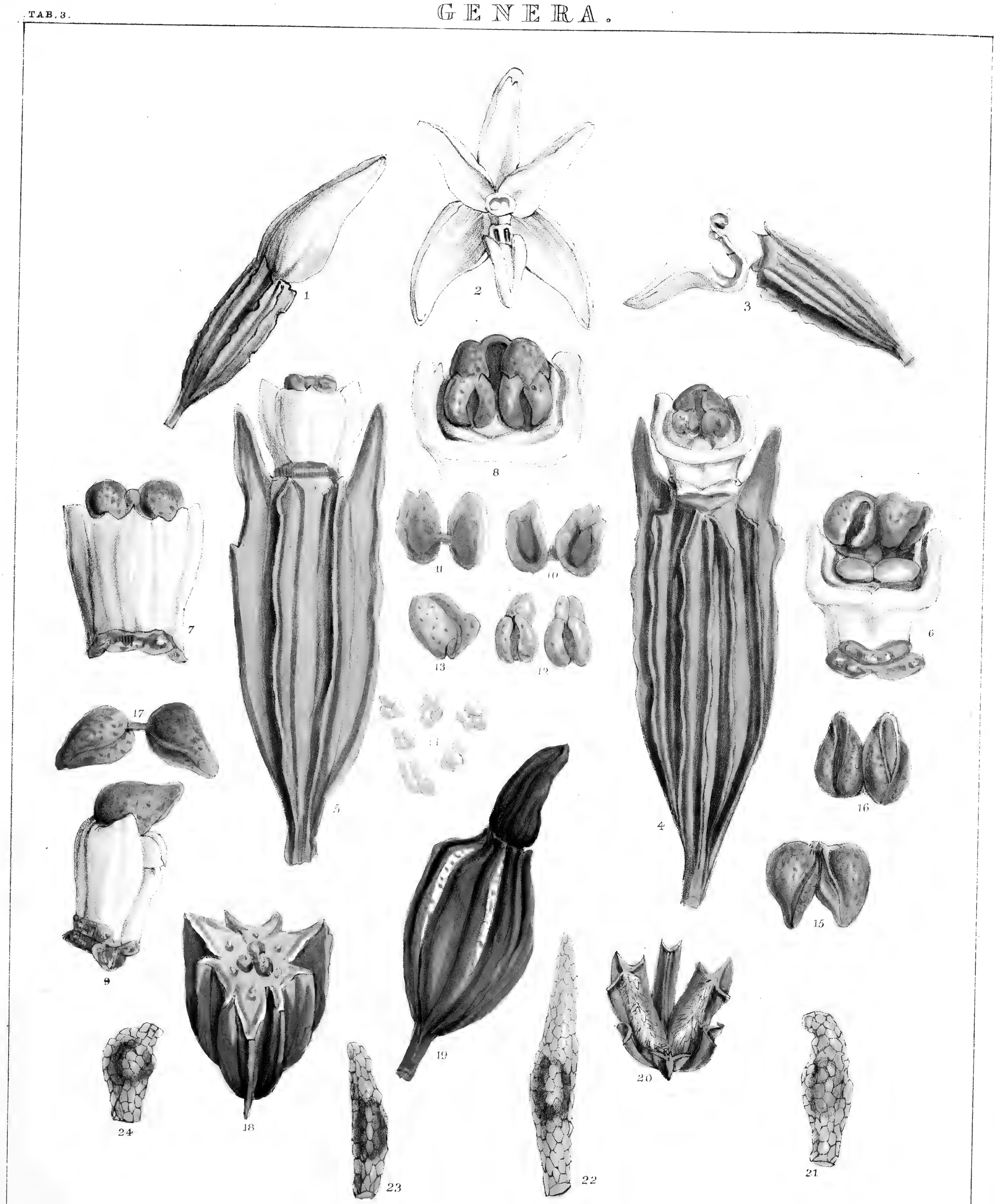
Tab. II.

The parts of Fructification of Liparis Löselii *Gen. and Sp. of Orchid. Pl. p.* 28); from a sketch made by Mr. Bauer in 1801.

1. A front view of the expanded flower, shewing the relative position of the petals, sepals, and column; magnified 10 times.
2. A side view of the same.
3. A front view of the column of an expanded flower; magnified 20 times. In this figure is shewn the true position of the anther, with regard to the stigmatic cavity; the clinandrium is seen to have two obtuse teeth at the back, and the column to have two fleshy ears or lobes towards its summit, and a longitudinal furrow in its face. At an earlier period there are two distinct tubercles at the foot of the column, and the longitudinal furrow is shallower. Before impregnation the anther is not incumbent upon the clinandrium, but so much erect that the cells are distinctly visible nearly their whole length, when the column is viewed from the front without disturbing the anther. At this period the true stigma is found to consist of two transparent, contiguous, but distinct, round glands, which afterwards disappear.
4. Represents the same column with the anther turned back, so as to lay naked the clinandrium and to expose the stigmatic cavity and pollen-masses. From this it appears that the two fleshy ears or lobes at the upper end of the column form the two sides of the quadrangular stigmatic surface, that the clinandrium is at right angles with the axis of the column, and that the position of the pollen-masses in the cavities of the anther is side by side, and not incumbent.
5. Is a view of the face of the anther without its pollen; magnified 20 times. The position of its lobes will be found upon comparison with tab. 1. fig. 12. to be the reverse of that of Malaxis.
6. A transverse section of the last.

7. A section of the ovarium; magnified 20 times. This shews that the six valves into which the fruit finally separates exist distinctly in the ovarium, and have each their own vascular axis; the larger valves, from the face of which the two-lobed placenta proceeds, are opposite the petals, and the smaller ones without ovula are opposite the sepals.

GENERA.



Cœlia Baueriana.

J. L. ad ic. Francisci Bauer.

Printed by P. Gauci.

M. Gauci, lith.

GENERA.

Tab. III.

The parts of Fructification of Cœlia Bauerana (*Gen. and Sp. of Orch Pl. p.* 36); from a sketch by Mr. Bauer in February 1810.

1. A side view of the unexpanded flower; magnified 4 times.
2. A front view of an expanded flower; magnified 4 times.
3. A side view of the same, shewing the relative position of the column and labellum, the sepals and lateral petals having been removed.
4. A front view of the ovarium and column of an expanded flower; magnified 8 times. This represents the appearance of the ribs of the ovarium and their relative position.
5. The same seen from behind.
6. A front view of the column and anther; magnified 16 times. This shews the exact form and position of the clinandrium and anther before impregnation. The two elevated spaces below the anther are the stigma, which by reclining upon the anterior edge of the clinandrium almost closes up the stigmatic cavity.
7. A back view of the same.
8. A view of the clinandrium and anther after impregnation, with the pollen-masses falling out of the anthers; magnified 16 times. (In this figure the two sides of the column are represented of unequal size; this was inadvertently drawn upon the stone, but is not to be found in Mr. Bauer's sketch.
9. A side view of the column before impregnation; the stigma is seen in front in the form of an ovate lobe, upon which the closed anther reclines.
10. A front view of the expanded anther; magnified 16 times.
11. A back view of the same.
12. 13. Two views of the pollen-masses fallen out of the anther, shewing their dilated extremities and the manner in which they curve outwards, so that each pair forms a sort of hollow case; magnified 16 times.

14. Grains of pollen separated by force; magnified 200 times. This shews that the pollen coheres in fours or threes.

15. 16. 17. Different views of the anther before expansion, shewing the narrow neck or connectivum by which the lobes are united, and the true figure of the latter; magnified 16 times.

18. A transverse section of the ovarium; magnified 16 times. From this it appears, that of the nine wings of that body three only belong to the placentiferous valves; of the remaining six two belong to each of the sterile valves.

19. A capsule bursting; shewing the manner in which all the segments of the perianthium cohere, so as to prevent the valves from opening entirely; magnified 4 times.

20. A transverse section of the same.

21. 22. 23. 24. Different views of seeds; magnified 25 times.

GENERA.

Tab. V.

The parts of fructification of Dicrypta Baueri; from a sketch by Mr. Bauer in 1806.

1. A profile of a flower; magnified 3 times.
2. A front view of the same.
3. A profile of a flower, with the column and lip alone remaining.
4. A front view of a column, with the top of the ovarium, and the anther in its place; magnified 6 times
5.* The clinandrium and stigmatic aperture, with the anther lifted up, and the pollen-masses exposed; magnified 10 times.
6.* A side view of the same.
7. A view of the inside of the lip; magnified 3 times.
8. A transverse section of the ovary; magnified 8 times.
9. A vertical section of a column; magnified 6 times.
10. A transverse view of the capsule when nearly ripe; magnified 6 times.
12.* The two pairs of pollen-masses separated; magnified 10 times.

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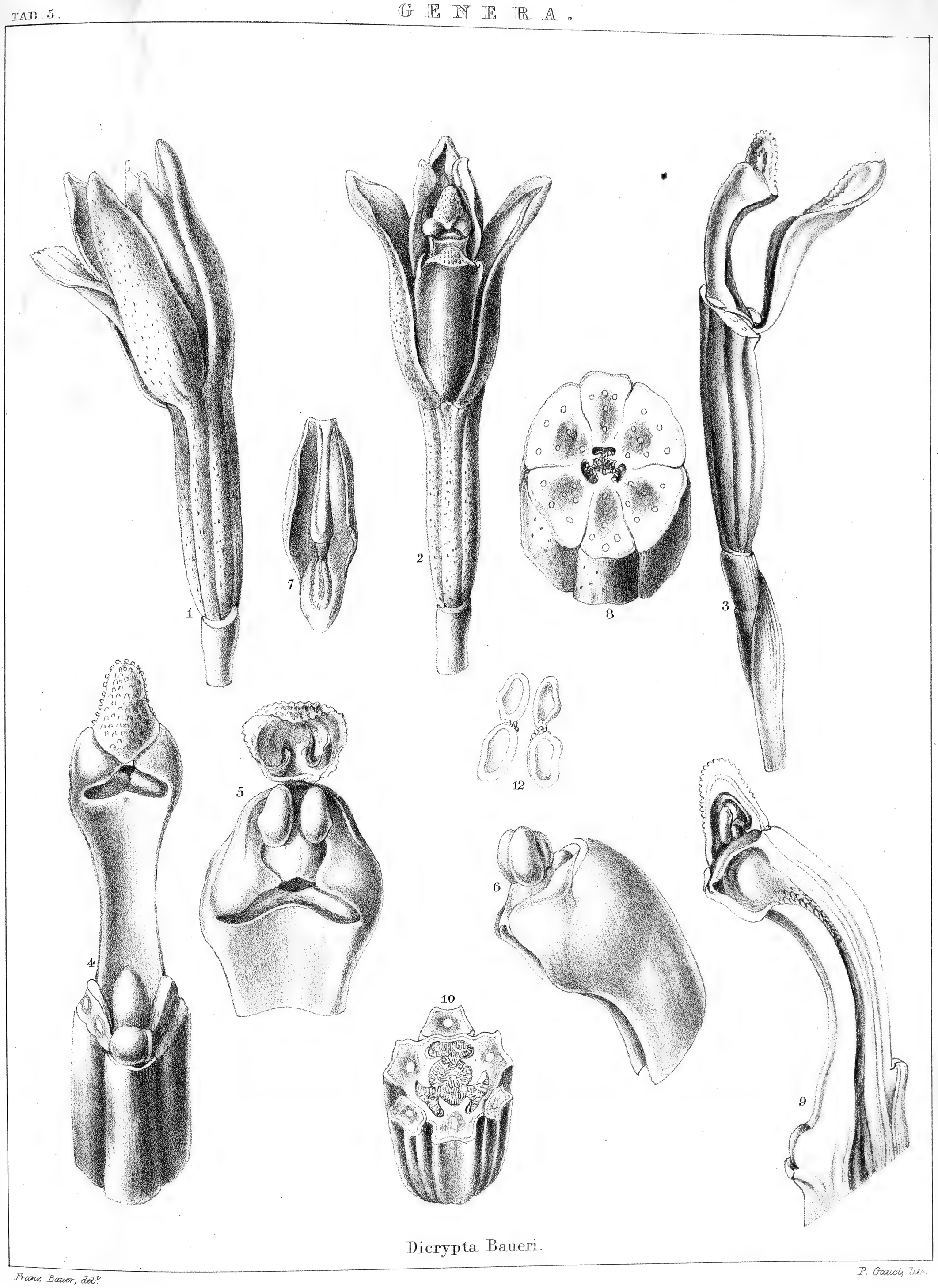
* Subsequent to the engraving of the Plate having been made, Mr. Bauer has ascertained that the specimen from which this drawing was taken was imperfect, and that the pollen-masses in fact adhere to a thin elastic transparent gland; the figures are otherwise correct.

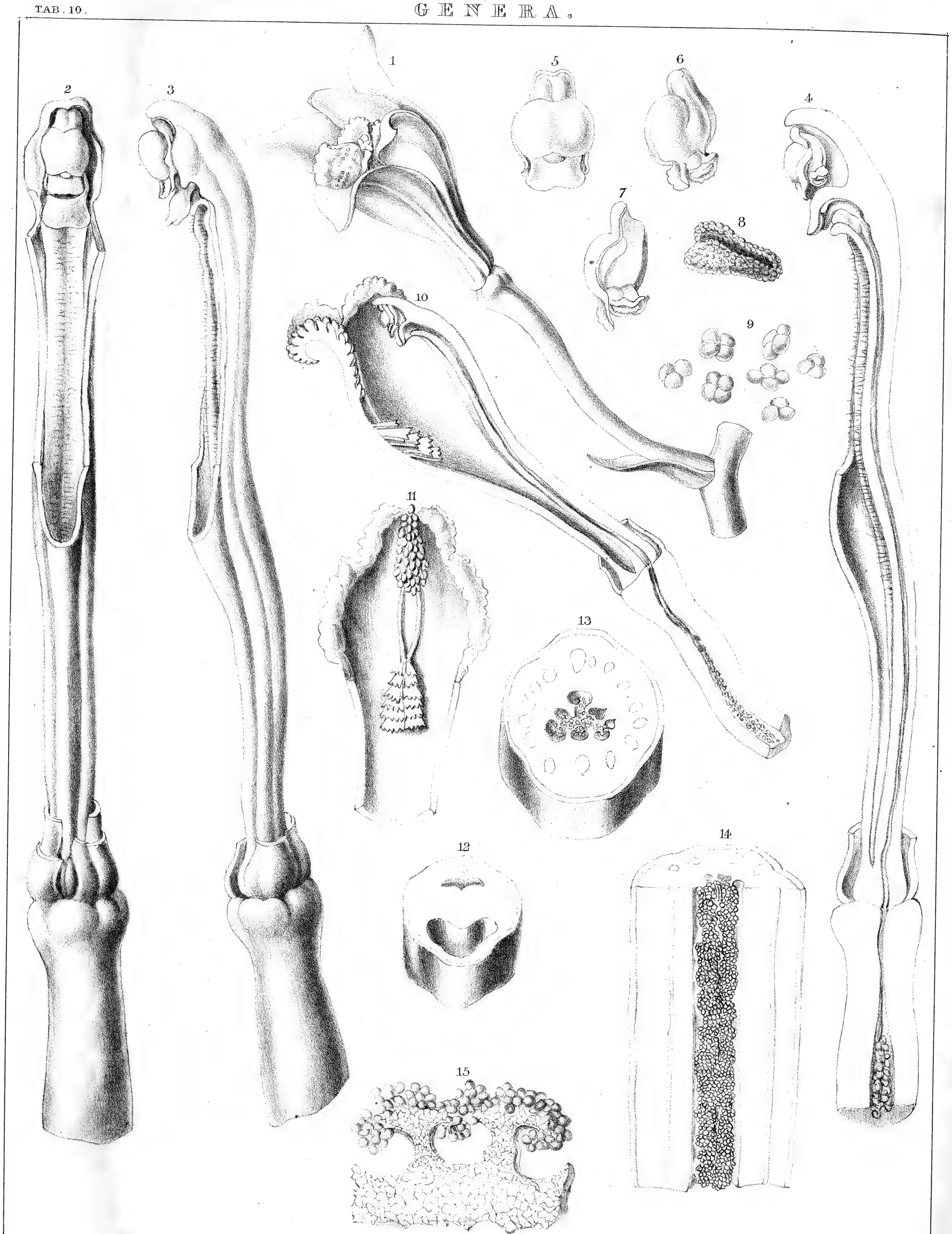


Dicrypta Baueri.

Franz Bauer, del.t

P. Gauci, lith.

GENERA.



Vanilla planifolia. A.

Franz Bauer, del.t

P. Gauci, lith.

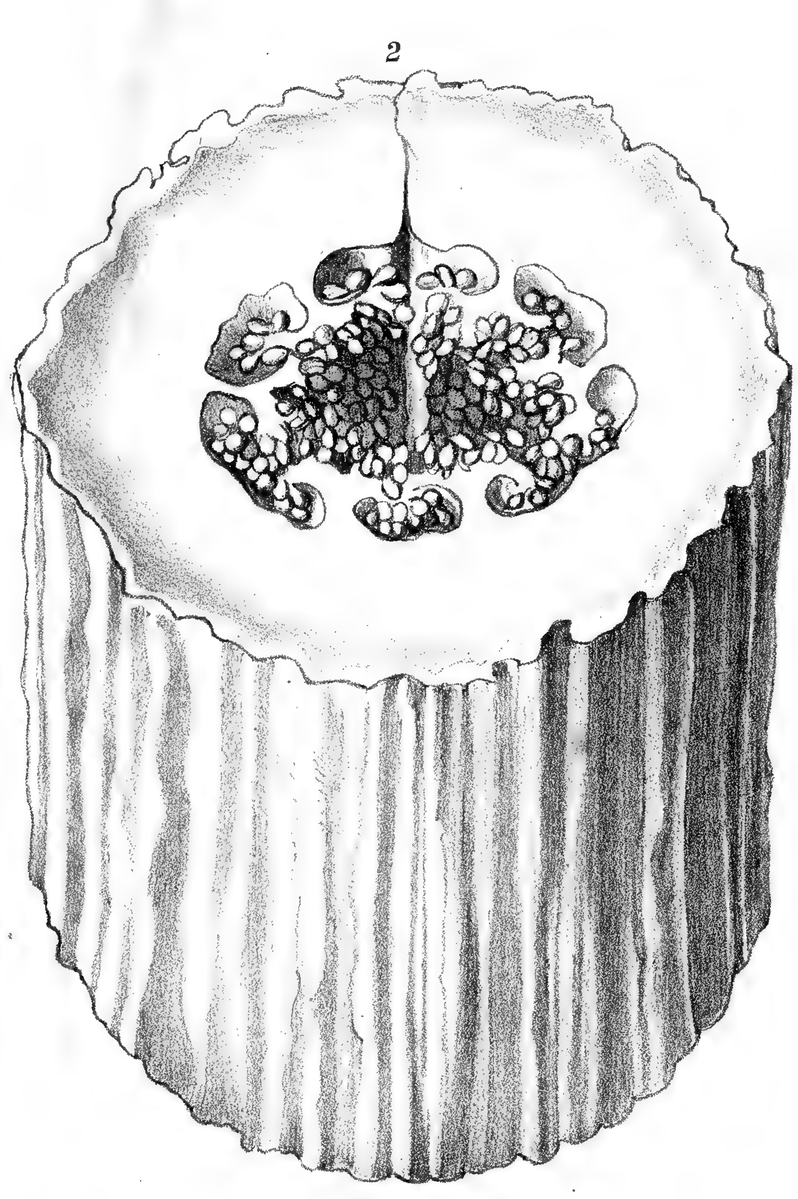
GENERA.

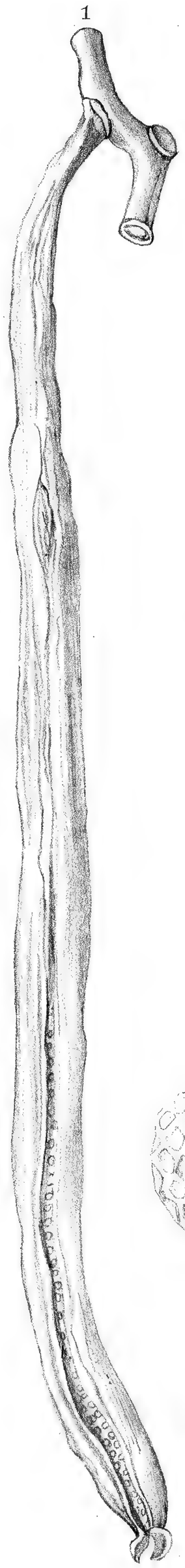
Tab. X.

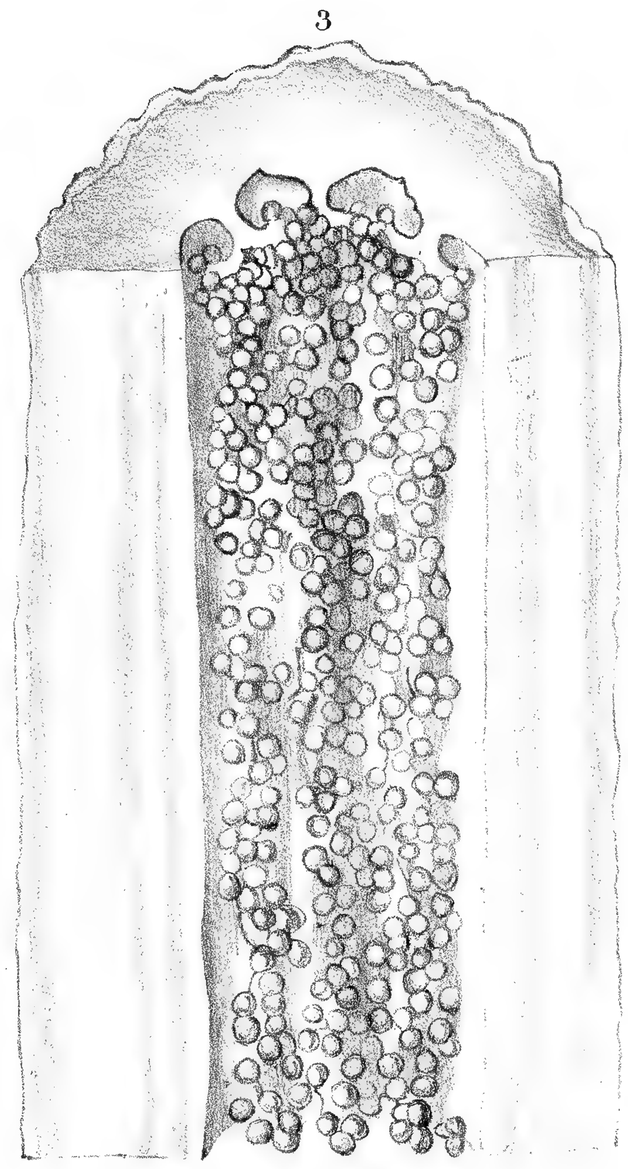
The parts of the flower of Vanilla planifolia; from a sketch by Mr. Bauer in 1807. This and the next plate illustrate the structure of Vanilleæ.

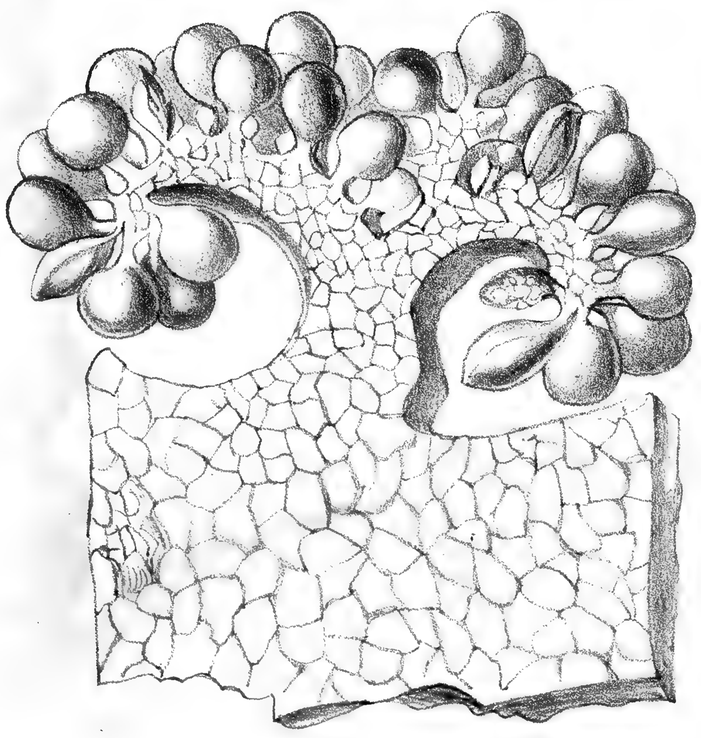
1. A side view of an expanded flower of Vanilla planifolia; natural size.
2. Front view of the parts of fructification of the same flower; magnified 4 diameters.
3. A profile view of the same; magnified 4 diameters.
4. A profile view of a longitudinal section of the same; magnified 4 diameters.
5. Front view of an anther; magnified 6 diameters.
6. A profile view of the same; magnified 6 diameters.
7. Longitudinal section of the above; magnified 6 diameters.
8. The pollen-mass of one cell of the anther; magnified 20 diameters.
9. Several pollen grains; magnified 200 diameters.
10. Side view of a longitudinal section of the parts of fructification and the labellum; magnified 2 diameters.
11. The end of the labellum expanded by itself; magnified 2 diameters.
12. Transverse section of a portion of the column, and the tube formed by its adhesion to the labellum; magnified 6 diameters.
13. Transverse section of a portion of the ovarium; magnified 8 diameters.
14. Longitudinal section of a portion of the ovarium; magnified 8 diameters.
15. Longitudinal section of the two-lobed placenta; magnified 25 diameters.

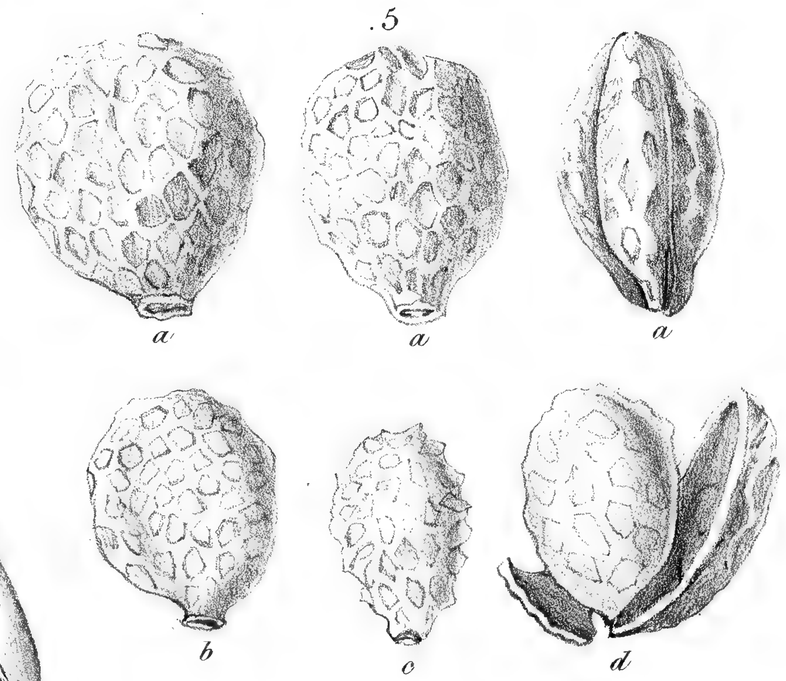
GENERA.











Vanilla planifolia.B.

Franz Bauer, del.t

F. Gauci, lith.

GENERA.

Tab. XI.

The parts of the fruit of Vanilla planifolia; from a sketch by Mr. Bauer in 1807.

1 A ripe seed-pod of Vanilla planifolia; natural size.

2. Transverse section of the same pod; magnified 6 diameters.

3. Longitudinal section of a portion of the same; magnified 6 diameters.

4. Longitudinal section of one lobe of the placenta; magnified 25 diameters.

5. Several seeds: at *a a a* perfect ripe seeds; at *b* an unripe seed; at *c* an abortive seed; and at *d* the outer shell is bruised, to bring the nucleus in sight, the seed being too small for dissection; magnified 200 diameters.

GENERA.

Tab. XII.

Parts of the unexpanded flower of Bonatea speciosa; from a sketch by Mr. Bauer in 1824.

1. A bud of Bonatea speciosa, about one month before the expansion of the flower; natural size.
2. A front view of the parts of fructification; magnified 4 diameters.
3. Side view of the same; magnified 4 diameters.
4. A longitudinal section of the same; magnified 4 diameters.
5. The labellum forcibly expanded, to shew that the four additional lobes are connected with the base of the labellum; magnified 4 diameters.
6. A transverse section of the anther; magnified 8 diameters.
7. Some pollen grains; magnified 200 diameters.
8. A front and a side view of the stigmatic glands, in their virgin state; magnified 8 diameters.
9. Some gelatinous irregularly formed corpuscles found in the fluid of the stigmatic glands; magnified 200 diameters.
10. A longitudinal section of one of the protruding lobes of the stigma; magnified 8 diameters.
11. Some of the utricular tubes or vessels, the lining of the same lobe, in the virgin state; magnified 200 diameters.
12. A bud of the same plant, about two weeks before expansion, when the act of fecundation is going on; natural size.
13. A side view of that bud; the left sepal, and half of the helmet removed to show the natural position of every internal part of the flower; magnified 4 diameters.
14. The same figure, but both sepals, the helmet and both petals removed, and one of the additional lobes, and one lobe of the labellum cut away, to expose the parts of fructification, and to show the stigmatic glands immersed in the spoon-like terminations of the stigmatic lobes; magnified 4 diameters.

15. All the envelopes removed and the parts of fructification longitudinally cut through; magnified 4 diameters.

16. The pollen-mass of one cell of the anther, with its whole caudicula, and the stigmatic gland adhering to it; magnified 4 diameters.

17. A transverse section of the anther; magnified 8 diameters.

18. One scale of the pollen-mass; magnified 25 diameters.

19. Some pollen-grains; magnified 200 diameters.

20. A front view of one of the stigmatic glands, in the state of fecundation; magnified 8 diameters.

21. Some of the gelatinous corpuscles found in the fluid of that gland; magnified 200 diameters.

22. A front view of the spoon-like termination of one of the stigmatic protruding lobes; magnified 8 diameters.

23. A side view of the same, with the stigmatic gland immersed in it, in the act of fecundation; magnified 8 diameters.

24. A longitudinal section of one of these stigmatic lobes; magnified 8 diameters.

25. Some of the utricular vessels, the linings of the above lobe, in the state they appear during fecundation; magnified 200 diameters.

26. A small portion of the inner surface of the arched part of the stigma; magnified 100 diameters.

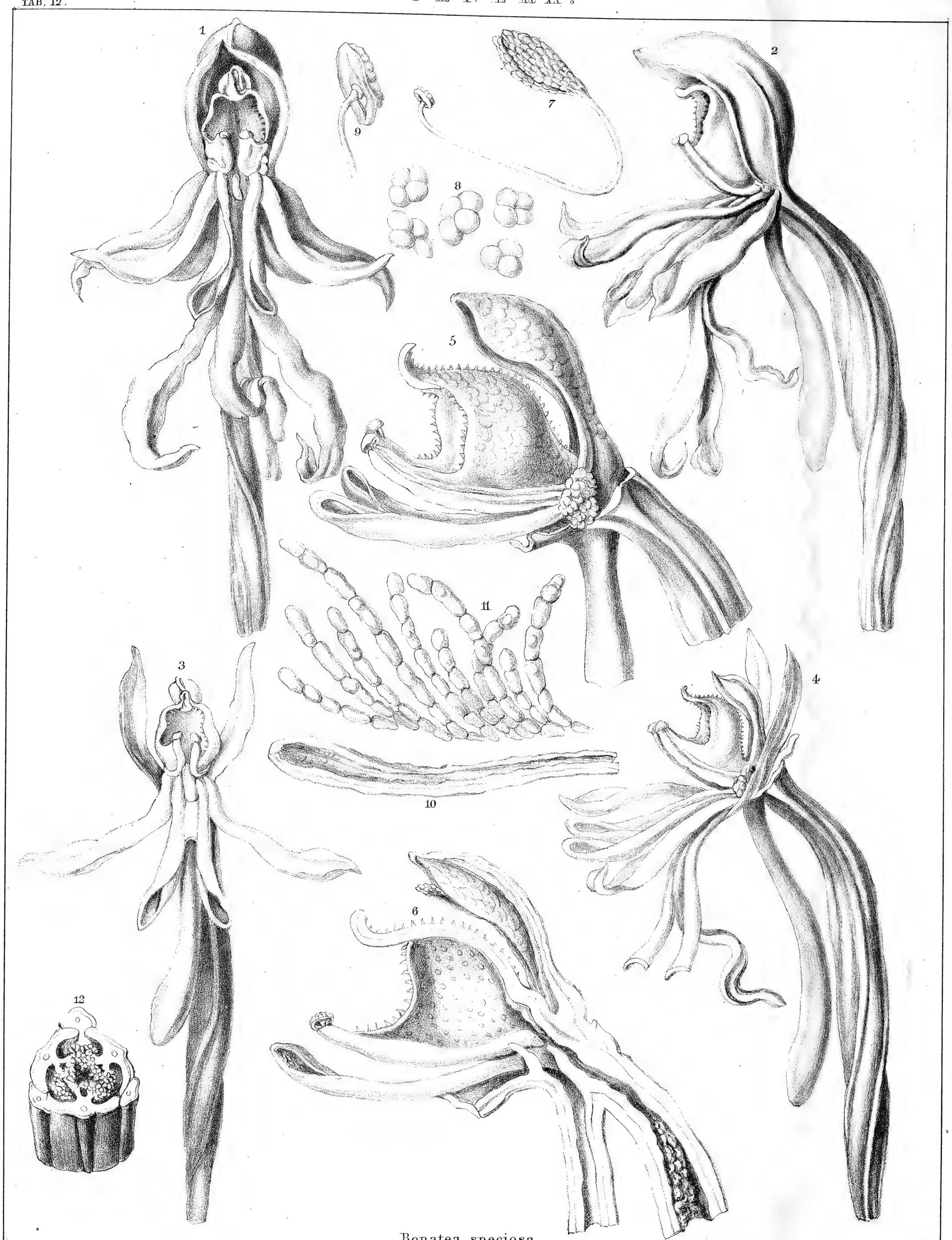
27. Transverse section of one of the additional lobes or parts, which Mr. Bauer thinks may perhaps be considered as sterile filaments; the section is made below the middle, up to which runs a cord of vessels like filaments; magnified 16 diameters.

28. An inside view of one of the lateral sepals; magnified 2 diameters.

29. A small portion of the epidermis of the outer surface of the sepals, with the cuticular glands, which are the same as on the outside of the leaves; magnified 100 diameters.

30. Transverse section of the ovarium; magnified 4 diameters.

GENERA.



Bonatea speciosa.

Franz Bauer, del.t

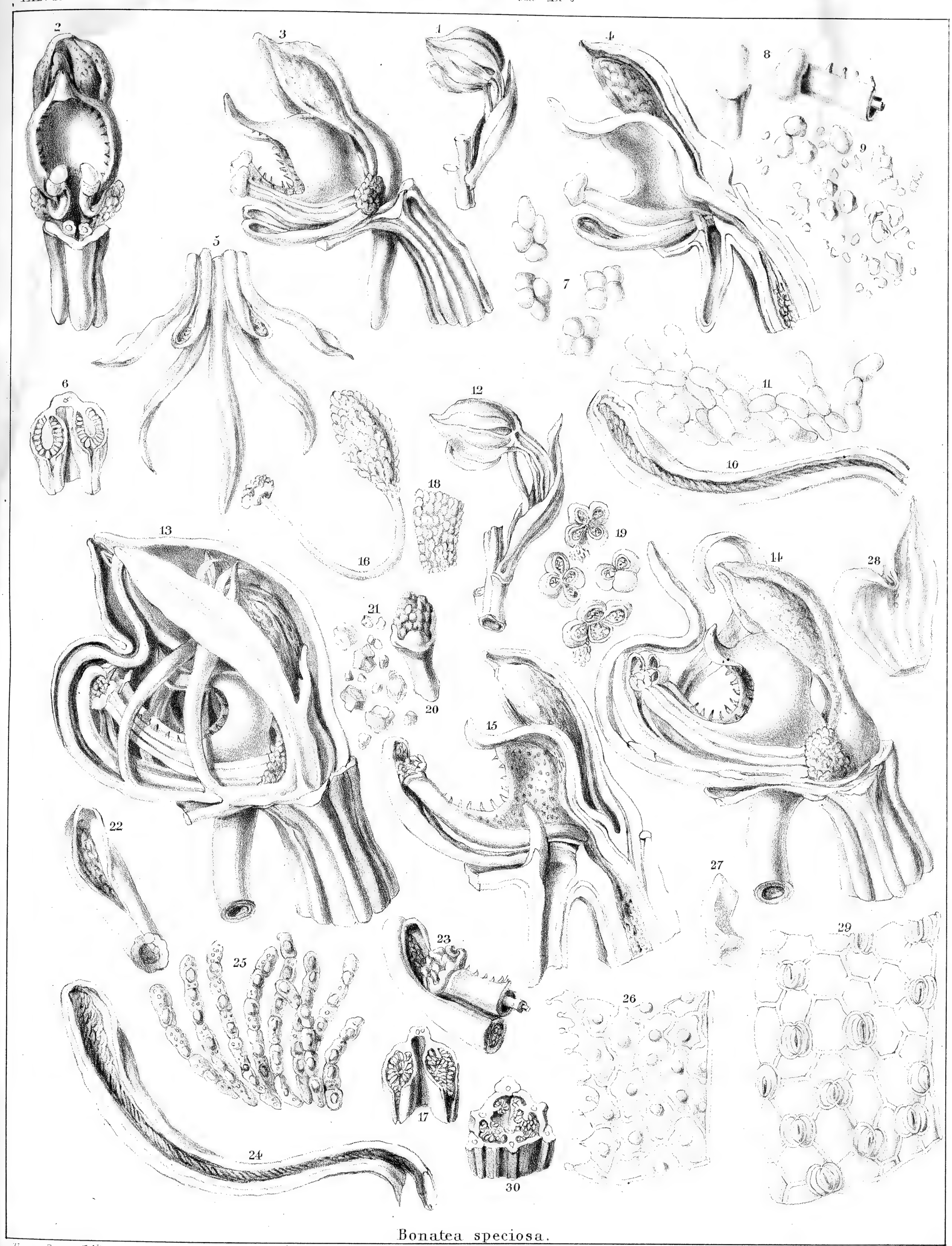
P. Gauci, lith.

GENERA.

Tab. XIII.

Parts of the expanded flower of Bonatea speciosa; from a sketch by Mr. Bauer in 1824.

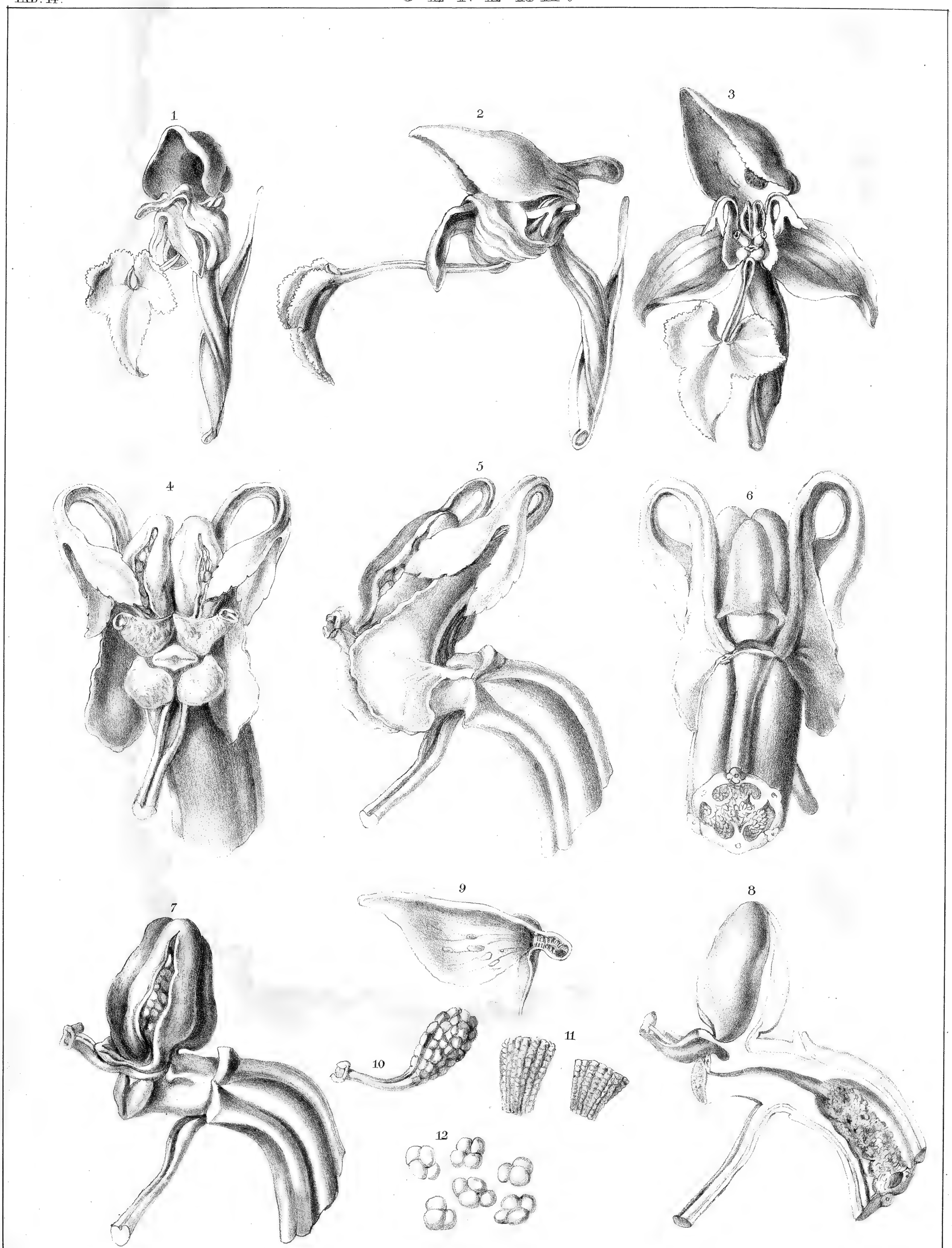
1. Front view of a fully expanded flower of Bonatea speciosa; magnified 2 diameters.
2. Side view of the same; magnified 2 diameters.
3. A front view of the same, with the three sepals removed, and the labellum cut off; magnified 2 diameters.
4. Side view of the same; the side lobe of the labellum only cut off; magnified 2 diameters.
5. A side view of the parts of fructification; magnified 4 diameters.
6. Longitudinal section of the same; magnified 4 diameters.
7. The pollen-masses of one cell of the anther, with its caudicula and stigmatic gland; magnified 4 diameters.
8. Some pollen-grains; magnified 200 diameters.
9. One of the stigmatic glands, adhering to a portion of the caudicula of the anther; magnified 16 diameters.
10. Longitudinal section of one of those protruding lobes, which are a continuation of the edge of the lower lip of the stigma; magnified 8 diameters.
11. A portion of the utricular lining of the above lobe, which is the same as that of the stigmatic canal; magnified 200 diameters.
12. Transverse section of a portion of the ovarium; magnified 5 diameters.



Bonatea speciosa.

Franz Bauer, del.

P. Sauci, lith.



Disa spathulata.

Franz Bauer, del.t

P. Gauci, lith.

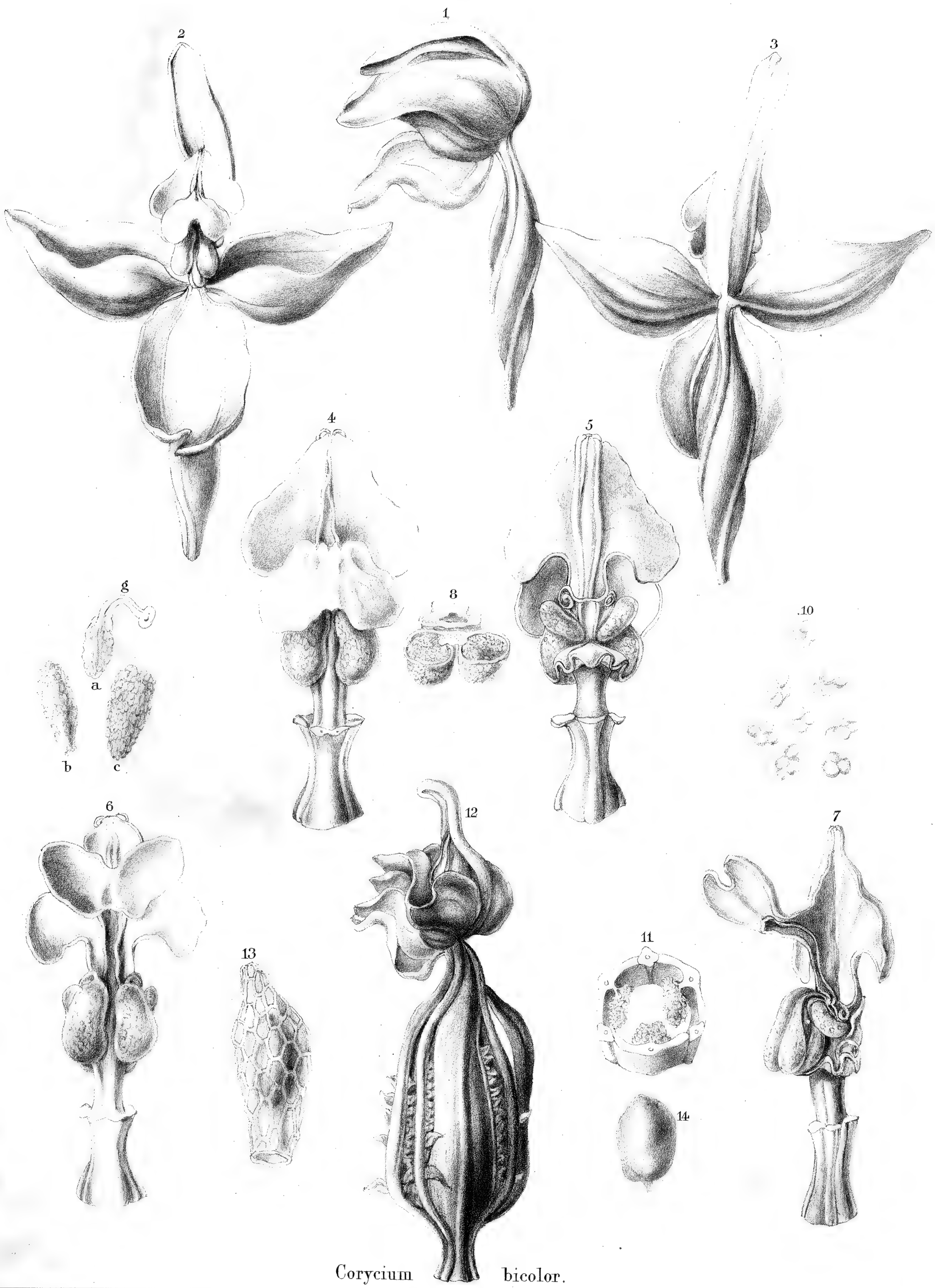
GENERA.

Tab. XIV.

The parts of the flower of Disa spatulata; from a sketch by Mr. Bauer in 1804.

1. Front view of the flower of Disa spatulata; magnified 3 diameters.
2. Side view of the same; magnified 3 diameters.
3. Front view of the same flower expanded; magnified 3 diameters.
4. Front view of the parts of fructification of the same flower, encompassed in the two petals; magnified 10 diameters.
5. Side view of the same; magnified 10 diameters.
6. Back view of the same; magnified 10 diameters.
7. Side view of the parts of fructification, the column and part of the ovarium, with the petals removed; magnified 10 diameters.
8. Longitudinal section of the same; magnified 10 diameters.
9. Longitudinal section of the upper sepal, with the spur; magnified 10 diameters.
10. The pollen-mass of one cell of the anther, with its caudicula and gland; magnified 10 diameters.
11. Two scales separated from the above pollen-mass; magnified 100 diameters.
12. Some individual pollen-grains; magnified 200 diameters.

GENERA.



Corycium bicolor.

Franz Bauer, del.t

P. Gauci, lith.

GENERA.

Tab. XV.

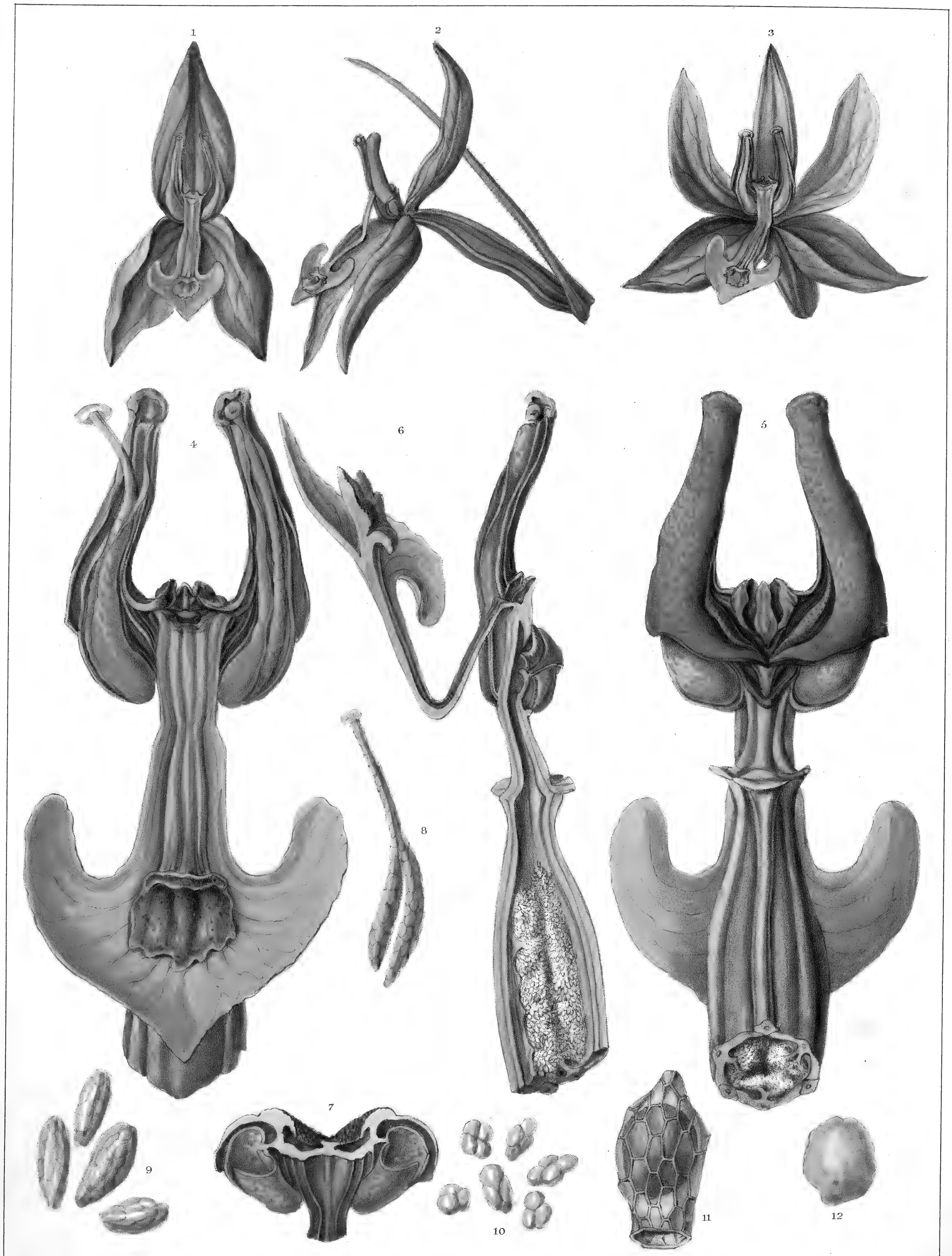
The parts of the flower of Corycium bicolor; from a sketch by Mr. Bauer in 1804.

1. Side view of a perfect flower of Corycium bicolor in its natural position; magnified 10 diameters.
2. Front view of the same flower forcibly expanded; magnified 10 diameters.
3. Back view of the same; magnified 10 diameters.
4. Front view of all the parts of fructification in their natural position; magnified 20 diameters.
5. Back view of the same; magnified 20 diameters.
6. Front view of the same, with the appendage of the labellum lifted up; magnified 20 diameters.
7. Lateral view of the same; magnified 20 diameters
8. Front view of a transverse section of the anther and part of the column; magnified 20 diameters.
9. *a*, the pollen-mass of one cell of the anther, with its caudicula and gland; magnified 20 diameters.

9.* *b* and *c*, two scales separated from the pollen-mass; magnified 100 diameters.

10. Some individual pollen-grains of the same; magnified 200 diameters.
11. Transverse section of a portion of the ovarium; magnified 20 diameters.
12. Side view of a ripe seed-vessel, with the shrivelled flower at its apex; magnified 10 diameters.
13. A single ripe seed within its tunic; magnified 100 diameters.
14. The seed without its tunic; magnified 100 diameters.

GENERA.



Ceratandra chloroleuca Ecklon.

Franz Bauer, del. 1803. *M. Gauci, lithog.* *Printed by P. Gauci.*

James Ridgway & Son's, Piccadilly, Dec.r 1.st 1837.

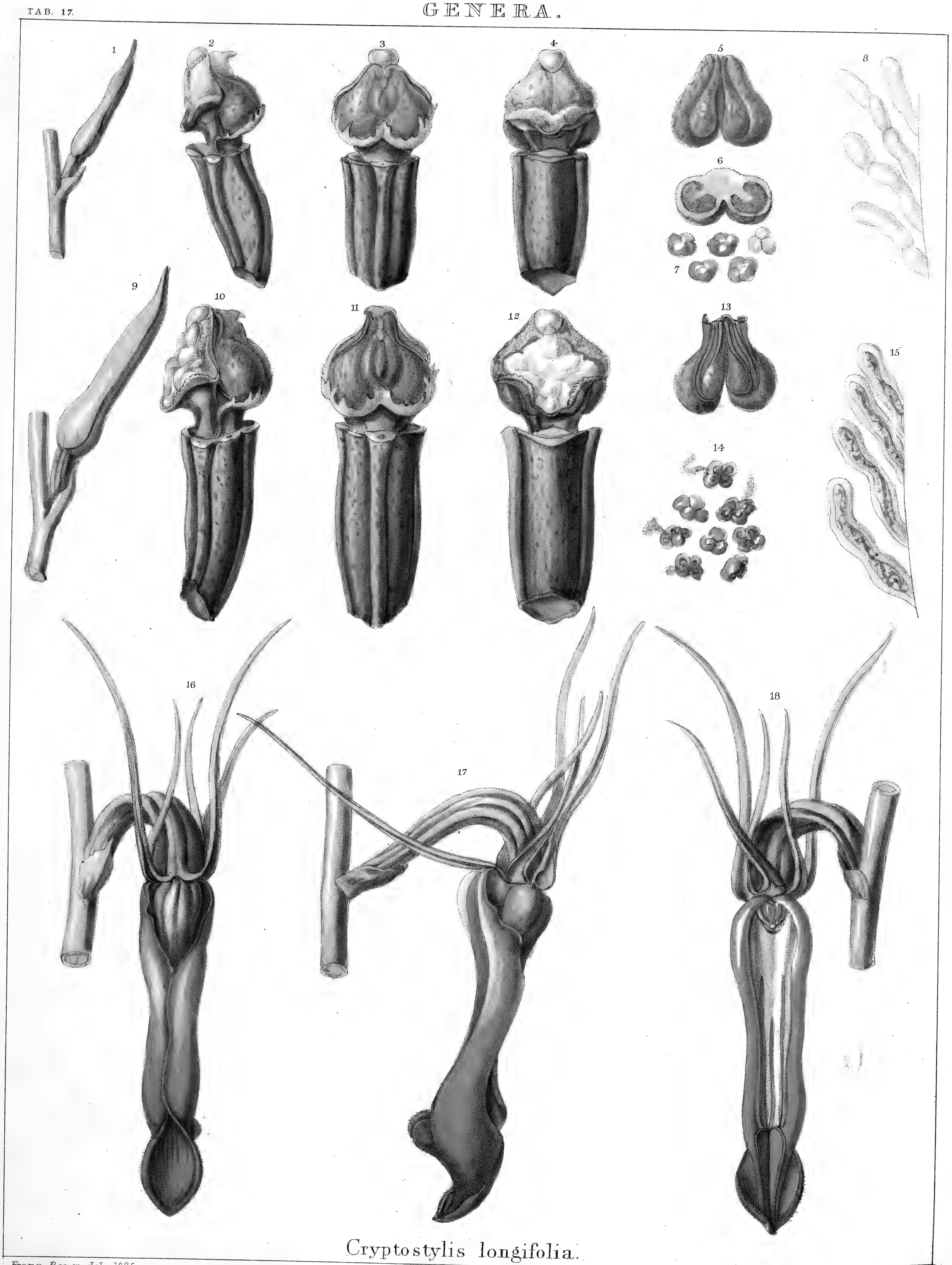
GENERA.

Tab. XVI.

Parts of the expanded flower of Ceratandra chloroleuca; from a drawing by Mr. Bauer in 1803.

1. Front view of a half expanded flower; magnified 3 times in diameter.
2. A side view of the same; magnified 3 diameters.
3. A front view of a forcibly expanded flower; magnified 3 diameters.
4. A front view of the parts of fructification, and the labellum bent downwards; magnified 10 diameters.
5. A back view of the same; magnified 10 diameters
6. A side view of a longitudinal section; magnified 10 diameters.
7. Transverse section of the parts of fructification; magnified 10 diameters.
8. The pollen masses of one cell of the anther, with the stigmatic gland adhering to it; magnified 10 diameters.
9. Some separated scales or segments of the above pollen masses; magnified 100 diameters.
10. A group of pollen grains; magnified 200 diameters.
11. A seed in its arillus; magnified 100 diameters.
12. A nucleus extracted from its arillus; magnified 100 diameters.

GENERA.



Cryptostylis longifolia.

Franz Bauer, del. 1825. *Gauci lithog.* *Printed by P. Gauci.*

James Ridgway & Son's Piccadilly, Dec.r 1st 1837.

GENERA.

Tab. XVII.

Parts of the unexpanded flower of Cryptostylis longifolia; from a drawing by Mr. Bauer in 1825.

1. A young bud about three weeks before the expansion of the flower; natural size.
2. A side view of the parts of fructification of the same bud; magnified 8 diameters.
3. A front view of the same; magnified 8 diameters.
4. A back view of the same; magnified 8 diameters.
5. Front view of the anther of the same flower; magnified 8 diameters.
6. Transverse section of the same; magnified 8 diameters.
7. A group of pollen grains of the same; magnified 200 diameters.
8. Some of the utriculi of the lining of the stigmatic canal, in a virgin state, of the same bud; magnified 200 diameters.
9. A bud of the same plant, about 10 days before expansion; natural size.
10. A side view of the parts of fructification of the above bud; magnified 8 diameters.
11. A front view (from above) of the same; magnified 8 diameters.
12. A back view (from below) of the same; magnified 8 diameters.
13. A front view of a bursting anther; magnified 8 diameters.
14. A group of pollen grains of the same anther; magnified 200 diameters.
15. Some utriculi of the stigmatic channel, at the time of fecundation; magnified 100 diameters.
16. A back view of the expanded flower, and after fecundation; magnified 2 diameters.
17. A side view of the same; magnified 2 diameters.
18. A front view of the same; magnified 2 diameters.

GENERA.

Cryptostylis longifolia

Franz Bauer, del. 1825.

M. Gauci lithog.

Printed by P. Gauci.

James Ridgway & Son's, Piccadilly, Dec.r 1.st 1837.

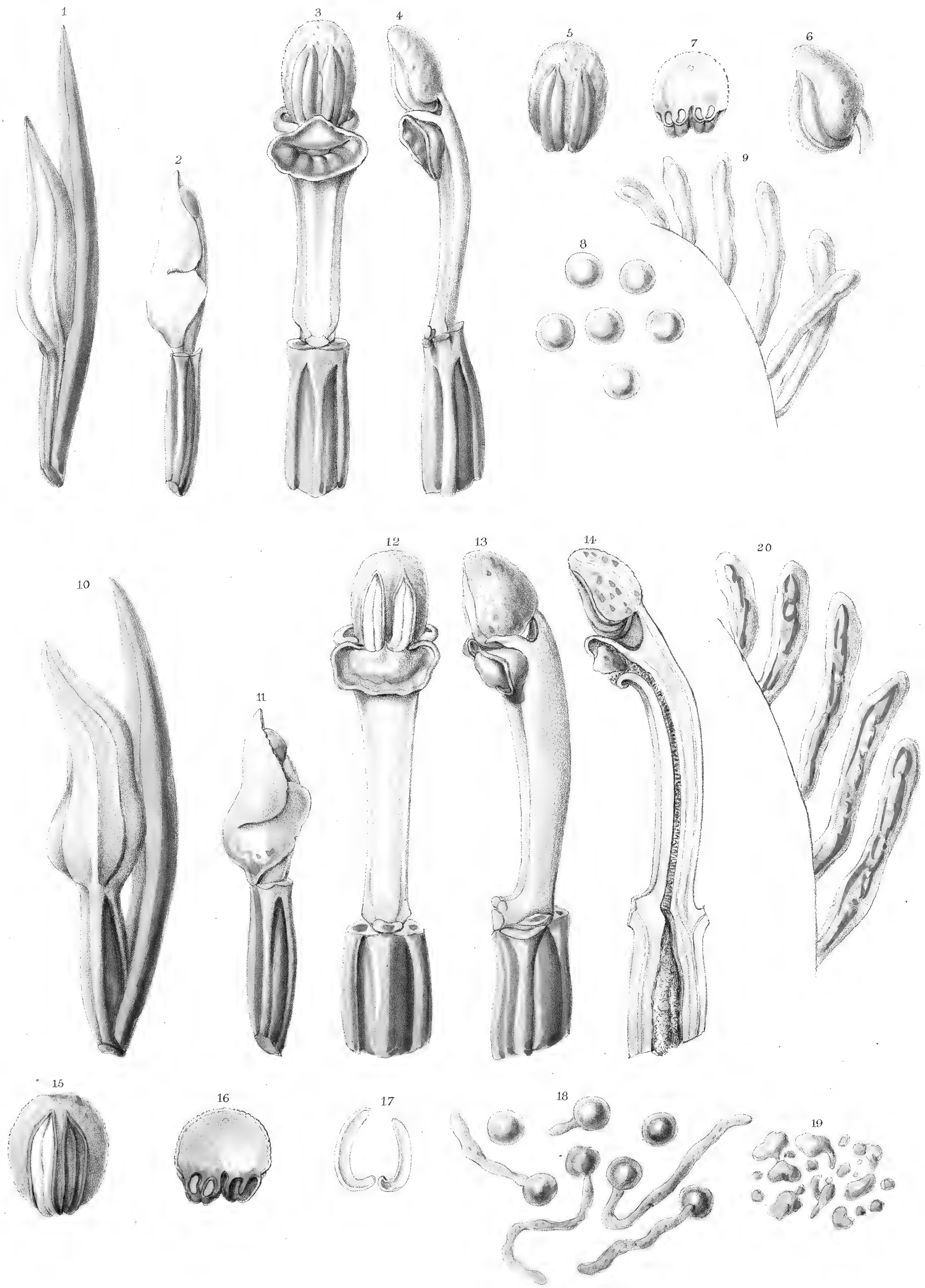
GENERA.

Tab. XVIII.

Parts of the expanded flower of Cryptostylis longifolia; from a drawing by Mr. Bauer in 1825.

1. A side view of a longitudinal section of all the parts of fructification, and the labellum, of an expanded flower; magnified 4 diameters.
2. The parts of fructification of the same flower, seen from above; magnified 8 diameters.
3. The same parts with the anther lifted up, to show the natural position of the pollen-masses after fecundation; magnified 8 diameters.
4. Side view of the parts of fructification; magnified 8 diameters.
5. Longitudinal section of the same; magnified 8 diameters.
6. The pollen masses with the stigmatic gland, seen from below; magnified 8 diameters.
7. A group of pollen grains from the same flower; magnified 200 diameters.
8. A portion of the ovarium with the column and stigma, seen from below; magnified 8 diameters.
9. Some utriculi from the lining of the stigmatic canal; magnified 200 diameters.
10. Transverse section of the ovarium of the same flower; magnified 8 diameters.
11. A ripe and burst capsule of the same plant; natural size.
12. A nucleus in its arillus; magnified 100 diameters.
13. The nucleus extracted from its arillus; magnified 100 diameters.

GENERA.



Epipactis grandiflora.

Franz Bauer, del. 1801. *M. Gauci lithog.* *Printed by P. Gauci.*

James Ridgway & Son's, Piccadilly, Dec.r 1.st 1837.

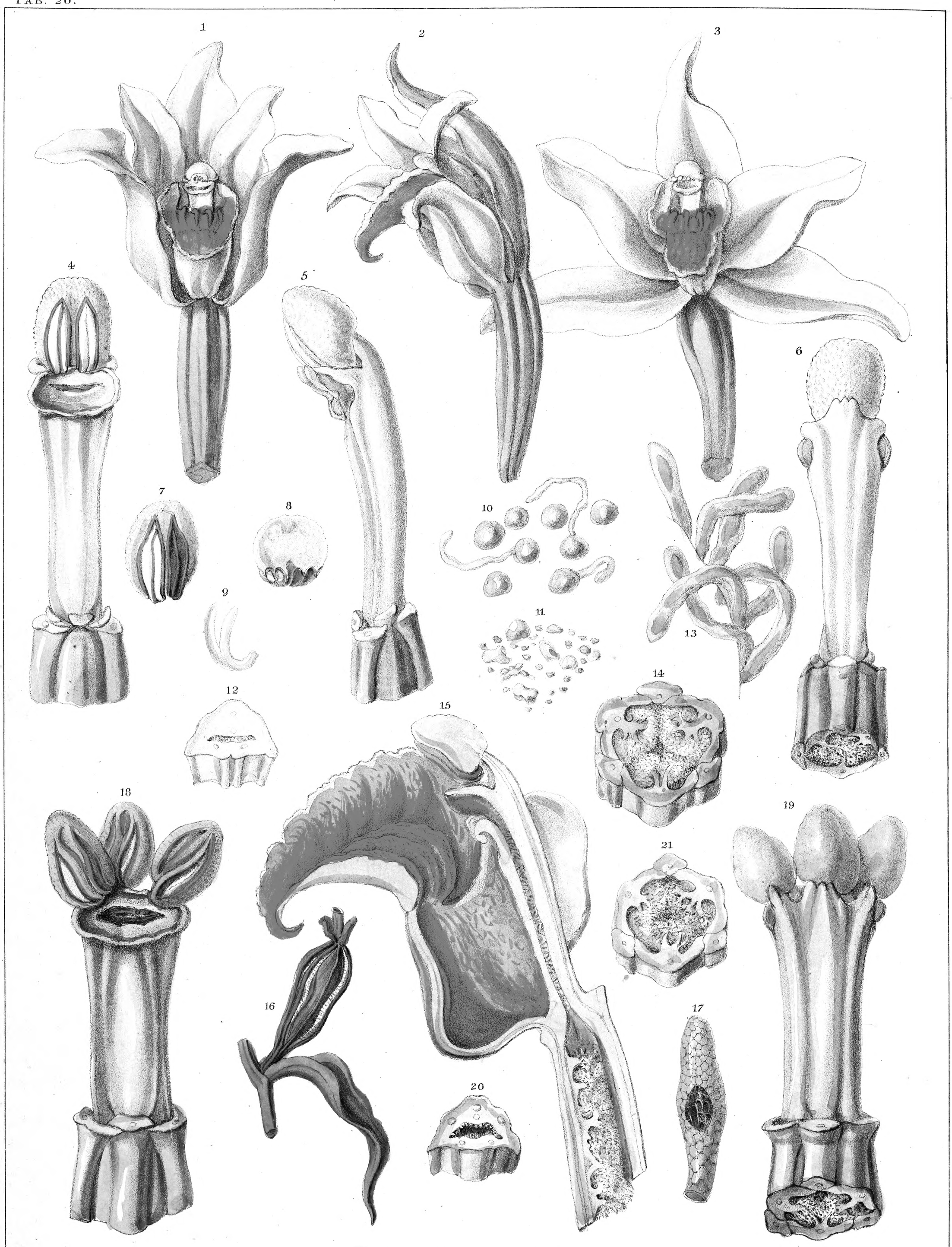
GENERA.

Tab. XIX.

Parts of the unexpanded flower of Epipactis grandiflora; from a drawing by Mr. Bauer in 1801.

1. A side view of a young bud with its bractea, about a month before fecundation; magnified 4 diameters.
2. The same bud, with its sepals and petals removed, the labellum only enclosing the parts of fructification; magnified 4 diameters.
3. Front view of the parts of fructification of the same bud; magnified 8 diameters.
4. Side view of the same; magnified 8 diameters.
5. Front view of the separated anther; magnified 8 diameters.
6. Side view of the same; magnified 8 diameters.
7. Transverse section of the same; magnified 8 diameters.
8. Some pollen grains of the same anther, which in this species are perfectly spherical; magnified 200 diameters.
9. Some utriculi of the lining of the stigmatic channel in the virgin state; magnified 200 diameters.
10. Side view of the bud of Epipactis pallens, with its bractea, about 10 days before expansion of the flower; magnified 4 diameters.
11. The same bud with the labellum only; magnified 4 diameters.
12. Front view of the parts of fructification of the same bud; magnified 8 diameters.
13. Side view of the same; magnified 8 diameters.
14. Longitudinal section of the same; magnified 8 diameters.
15. Front view of a ripe and bursted anther of the same bud, at the time of fecundation, the pollen masses of one cell of the anther extracted; magnified 8 diameters.
16. Transverse section of the same anther; magnified 8 diameters.

GENERA



Epipactis grandiflora.

Franz Bauer del 1801. *M. Gauci lithog.* *Printed by P. Gauci*

James Ridgway & Sons, Piccadilly, Dec.r 1.st 1837.

GENERA.

Tab. XX,

Parts of the expanded flower of Epipactis grandiflora; from a drawing by Mr. Bauer in 1801.

1. Front view of a fully expanded flower; magnified 3 diameters.
2. Side view of the same; magnified 3 diameters.
3. Front view of the same flower forcibly expanded; magnified 3 diameters.
4. Front view of the parts of fructification of the above flower; magnified 6 diameters.
5. Side view of the same; magnified 6 diameters.
6. Back view of the same; magnified 6 diameters.
7. An anther separated, and the pollen mass removed from one cell; magnified 6 diameters.
8. Transverse section of the anther; magnified 6 diameters.
9. The pollen mass of one cell of the anther; magnified 6 diameters.
10. A group of pollen grains; magnified 200 diameters.
11. Some particles of the mucous substance of the stigma; magnified 200 diameters.
12. Transverse section of the column; magnified 8 diameters.
13. Some utriculi from the lining of the stigmatic channel; magnified 200 diameters.
14. Transverse section of the ovarium; magnified 8 diameters.
15. Side view of a longitudinal section of the parts of fructification and the labellum; magnified 6 diameters.
16. A ripe capsule with its bractea; natural size.
17. A ripe nucleus within its arillus; magnified 100 diameters.

18. Front view of the monstrous parts of fructification of a flower of Epipactis grandiflora, having three perfect anthers on one column; a very rare case; magnified 6 diameters.

19. A back view of the same; magnified 6 diameters.

20. Transverse section of the column of the same monstrosity; magnified 6 diameters.

21. Transverse section of the ovarium of the same; magnified 6 diameters.

DIRECTIONS TO THE BINDER.

1. Cancel the Prospectus in Part I. dated Nov. 1830.
2. Place the Note at the beginning of Part II. immediately after the letter press of FRUCTIFICATION, Tab. III.
3. In arranging the plates, let those headed FRUCTIFICATION, precede those headed GENERA; there are 15 of the former and 20 of the latter: each with a leaf of letter press.