XXXV. *On the Origin and Development of the Pitchers of* Nepenthes, *with an Account of some new Bornean Plants of that Genus.* *By* J. D. Hooker, *M.D., F.R.S. & L.S. &c.*

Read June 16th, 1859.

In a paper read before the Linnean Society on the 16th June, 1857, and published in this volume of the 'Transactions' (p. 137), I mentioned, in a note, that I had examined and prepared drawings of the development of the pitchers of *Nepenthes*, from plants in the Royal Gardens at Kew, and that these confirmed Griffith's observation * that the pitchers are modifications of the excurrent midrib of the leaf. I have now the honour of laying before the Society the principal facts observed during the examination in question, which have further led me to the conclusion that the pitchers are modifications of a gland situated at the apex of the midrib of the leaf; and I have added the necessary illustrations. I shall also append to this paper an account of the most singular and gigantic plants of the Order, which have lately been discovered by H. Low, Esq., on the lofty mountain of Kina Balou in Borneo.

Part I.—*On the Development of the Pitchers of* Nepenthes.

At the earliest period at which I have examined the undeveloped leaf of the full-grown plant of *Nepenthes lævis* of our gardens †, I find it to consist of a minute, blunt, conical body, about $\frac{1}{100}$th of an inch long (Tab. LXXIV. fig. 1 *b*), with a slight longitudinal depression on the anterior surface, leading to a shallow oval cavity, which is placed immediately below the apex. At this period the cuticle is scarcely distinguishable, but the oval depression has a more shining appearance and less defined superficial layer of cells than any other part of the cone. On a vertical section carried down and through the groove and oval depression (fig. 2), the whole substance is found to be formed of a rather dense parenchyma, becoming looser, and as it were deliquescent at the oval cavity. This oval cavity is all that represents the future pitcher, and it is simply a subterminal gland.

The next period (as defined by a marked progress in specialization) is that at which there is an evident differentiation of the conical body into the lamina of the leaf and a superimposed body. At this stage (fig. 3) the cone is found to be prolonged upwards, and about $\frac{1}{30}$th of an inch long. The frontal groove is rather deeper, and has defined margins. There is an evident contraction about halfway between the base and apex, most marked on the edges of the groove. The apex of the cone projects forward and rather arches over the oval cavity, which has deepened, and is directed inwards and downwards. There is a

* In 'Calcutta Journal of Natural History,' vol. iv. no. xiv. July 1843, p. 231.

† It is the *N. gracilis*, Korth. I have to record my obligations to the Messrs. Low, of Clapton Nurseries, and Messrs. Veitch and Son, of the Exotic Nurseries, Chelsea and Exeter, for the liberal manner in which they have aided me by specimens of rare species in their establishments, for examination.

more evident cuticle to the whole surface of the cone, except over the gland, which now appears to be a secreting surface, and is rather pulpy or viscid.

At the next succeeding period, when the whole body is about $\frac{1}{10}$–$\frac{1}{20}$th of an inch long, a considerable further change has taken place (fig. 4). The contraction towards the middle has greatly lengthened and forms a neck, which separates an elongated conical base (the future lamina) from an oblong terminal body (the future pitcher). The groove is still shallow on the intermediate portion (the excurrent midrib) and on the pitcher above it, but is deepened into a canal with incurved edges on the lamina below it. The gland is now a deep cavity, with a large quadrangular orifice, over which hangs the incurved apex (the lid of the future pitcher) of the original conical body. A vertical section (fig. 5) through the centre shows a narrow pale line ascending close to the dorsal margin, curving over the apex and terminating in the incurved apex; this line indicates the position of the future vascular bundles. At fig. 4 a minute conical body is seen at the base of the groove, and is a nascent second leaf.

At the next following marked stage, the lamina, excurrent midrib, and pitcher are externally very well defined, and the lid of the pitcher differentiated. The lamina is still a cone, but much elongated, and presents a cylindrical groove with the edges slightly turned in, representing the earliest appearance of that organ in its involute condition of vernation. The contracted portion above it (the excurrent midrib) has elongated more in proportion than the lamina or pitcher, and its frontal groove is less marked. The apex of the pitcher has grown upwards and backwards; the incurved portion, again, has so grown downwards as to close the orifice of the cavity. On a vertical section (fig. 7) the cavity is seen to be prolonged downwards as a sac parallel to the walls of the pitcher, whilst the incurved portion or lid has both grown downwards over the mouth of the cavity, and inwards towards its dorsal face; its protuberant inner surface is more papillose than any part of the sac. As the pitcher enlarges, the apex, which points upwards and backwards, elongates, at first considerably more than the lid itself, and becomes the styliform process at the junction of the lid and pitcher. On a vertical section (fig. 8) the vascular bundle is seen to run up to the apex of this process, which thus continues to be the true organic apex of the whole foliar organ.

The succeeding stages of growth were examined in *N. Rafflesiana* and *phyllamphora*?, and present few external characters but what have been previously observed. In the former species the terminal process often spreads and divides, and, together with the whole pitcher, is covered with appressed hairs. These hairs point upwards everywhere except on the young lid, where they either project or point in the opposite direction. On a vertical section at this time, the lid is found to have reached the lower portion of the orifice, and it afterwards closes the mouth of the pitcher (fig. 10); and one or two recurrent fascicles of vessels are found to originate in the principal vascular bundle in its course towards the apex of the young styliform process, which bundles enter the substance of the lid, and ramify in it.

The vernation of the leaf in *Nepenthes* is well known to be involute, the opposite margins being each rolled in towards the midrib. This curious arrangement, which is not peculiar to the genus, appears to me to be a secondary one, or rather an induced con-

dition; for in some very young leaves of *N. Rafflesiana* I observed, that as the frontal groove which represents the anterior (or upper) surface of the leaf deepened and its margins expanded, these margins decidedly overlapped (fig. 11), thus forming a convolute vernation; but that, owing to a more rapid growth of the overlapping hemiphyll, which still retained its initial tendency to curve inwards towards the midrib, it eventually formed a cylindrical roll parallel to, and in contiguity with, the originally overlapped hemiphyll.

If these observations should receive confirmation, they will tend to prove that the *involute* vernation of leaves may be, in some cases at any rate, a modification of the more frequent *convolute* condition of these organs.

In the above description I have used the term adopted by Griffith, of "excurrent midrib;" but I need hardly say that the intermediate organ, or stalk of the pitcher, is no more an excurrent portion of the lamina, than is the petiole in those species where that organ is developed: it is a body more or less strictly analogous to the terminal cirrhus of the leaf of *Gloriosa*, *Flagellaria*, various species of *Convallaria*, &c.; and though the development of a gland at its apex into a pitcher is very anomalous, and possibly unique*, the existence of terminal glands in the leaves of plants, which is physiologically the most important feature, is by no means so unusual a fact as may at first sight appear. They are very conspicuous at the apex of the leaf of *Limnocharis*, *Caladium*, and other genera, both of monocotyledonous and dicotyledonous plants. In young *Limnocharis Plumieri*, especially, a gland is placed at the apex of the midrib, and being hollow, resembles the early condition of the *Nepenthes* pitcher.

Since the above observations were made, I have had the opportunity of examining some seedling *Nepenthes*, for which I am indebted to Hugh Low, Esq., of the Nursery, Clapton, and which are both extremely singular in themselves, and throw much light on the whole subject. One of these (species unknown) is figured of the natural size in Tab. LXXIV. fig. 19, and magnified at fig. 20. The first pair of leaves (fig. 20 *a* & 21), the cotyledonary, are opposite, lanceolate and acute; the following at once bear ascidia at their apices, of a size, form, and in a position that cause the whole leaf strikingly to resemble that of *Sarracenia*. The youngest leaves I have examined, namely those immediately succeeding the cotyledonary, have a more or less dilated lamina, and a hollowed-out upper half of the midrib, partially closed with a small ciliated lid; as the leaf grows, the lamina dilates upwards on each side, so as to become cuneate, and finally obcordate and bilobed at the apex, with the pitcher in the sinus. When fully developed, these leaves are about $\frac{1}{4}$–$\frac{3}{4}$ inch long; they present on the upper surface a shallow mesial groove, leading up to a triangular, slightly tumid area towards the apex, which area answers to the anterior face of the pitcher; beyond the apex the neck of the pitcher protrudes, with its lid; the margins of the leaf are carried up as wings along the sides of the neck of the pitcher to near its orifice, where they meet, and form a transverse, reflexed, ciliate membrane.

Looking at the under surface of the leaf, the midrib appears very stout below, and gradually bulges as it advances towards the apex of the leaf, forming the belly of the pitcher.

* I have not yet satisfied myself as to the origin of the pitcher in *Cephalotus* and *Sarraceniaceæ*.

The examination of these remarkable seedling plants suggests the following observations :—

1. The difference in the development of the leaf and pitcher in these seedling plants, and in the full-grown ones previously described, is very great, and at first sight anomalous. In the full-grown plant, the lamina, petiole, excurrent midrib, and pitcher are very independently differentiated, and the pitcher itself is first developed in the most rudimentary conceivable condition, that of a simple naked gland. In the seedling plant, on the other hand, the pitcher and lid appear to be developed in the earliest discernible condition of the leaf, which is that of a hollow midrib open at the apex and there closed with a lid, along each side of which midrib the lamina becomes developed in one plane (not with a convolute or involute vernation). As the plant grows, the upper part of the hollowed midrib of each succeeding leaf becomes more and more inflated, its apex protrudes beyond the lamina, as the neck of the pitcher, and the orifice and lid of the latter assume the usual highly organized condition of these parts in the genus.

2. The position of the pitcher, occupying chiefly the underside of the leaf, is very remarkable, the appearance of the whole being not that of a pitcher with foliaceous margins, but of a leaf with a pitcher partly adnate to its under surface; and the larger the leaf is, the more independent does the pitcher appear to be, and the more confined to the apex of the leaf; so that I expect that in more advanced states of the seedlings of this species, the pitcher will be found to be wholly free from the lamina of the leaf, though continuous at its base with the midrib *. When the plant arrives at such a stage of growth that the lamina of the leaf becomes a larger and more important organ than the pitcher, then the vernation of the leaf will assume the normal condition which obtains in the old plant.

3. The horizontal development of the lamina on the sides of the pitcher, and the prolongation of the margins of the lamina on the neck of the pitcher, at first sight seem to suggest the view that in the old plant the lamina of the leaf is represented by the wings of the pitcher, and that the apparent lamina is only a winged petiole. But in the seedlings the produced margins of the lamina do not reach the mouth of the pitcher; on the contrary, they converge, and form a transverse membranous wing below its orifice; and the older the leaf is, the longer is the neck of the pitcher produced beyond this transverse lamina: and if the oldest of these seedling leaves be compared with that of a full-grown *Nepenthes*, it would appear possible that the transverse lamina is the true apex of the leaf, which in the old plant forms an elevated ridge on the anterior face of the base of the stalk of the pitcher †. This ridge, though generally small in most full-grown leaves, is often very prominent, so much so in *N. Rajah* (Tab. LXXII.) that the stalk of the pitcher is there peltately attached to the back of the leaf.

* Since the above observations were made, I have received from Messrs. Veitch more advanced seedlings, which confirm this—the pitchers being wholly free from the lamina, but continuous at their base with the midrib. (October, 1859.)

† These more advanced seedlings do not confirm this idea: it appears that the anterior wings of the old pitcher do answer to the produced edges of the lamina in the seedling pitcher, and that the transverse process becomes evanescent. The annulus of the young pitchers is not developed in the youngest leaves of the seedling plants, and in the more advanced it occupies the whole space between the mouth of the pitcher and the transverse lamina.

4. In my description of the development of the leaves in full-grown plants of *Nepenthes*, I have stated that the gland which is developed into a pitcher occupies a position towards the apex of the nascent leaf; the examination of the seedling plants would tend to show that the position of the gland indicates the organic apex of the future midrib, and no doubt it does so (as may be seen in *Limnocharis Plumieri*). Such glands often occur on the margins, midribs, veins or petioles of leaves, and are most frequent at the anastomoses of the veins, as at the base of the lamina (*Cucurbitaceæ*, *Leguminosæ*, &c.), or at the serratures where the lateral nerves meet the marginal (*Aurantiaceæ*, *Myrsineæ*, &c.), or where the lateral veins finally converge at the apex of the midrib (as in *Nepenthes*, *Limnocharis*, &c.).

5. The sudden transition from the simple cotyledonary leaves of a seedling *Nepenthes*, to the pitcher-bearing leaves immediately contiguous to them, is extremely remarkable. There is, in the species I have examined, no transitionary stage of development whatever. This renders the formation of the pitchers of *Sarracenia* and *Cephalotus* (which, so far as I have observed, never present the appearance of ordinary leaves) less anomalous, than if a seedling *Nepenthes* presented a graduated series of more and more highly organized leaves connecting the simple cotyledonary with the fully developed pitcher-bearing ones.

The resemblance between the pitcher of a seedling *Nepenthes* and that of *Sarracenia purpurea* is very close, and leaves little doubt in my mind that that organ is strictly homologous in the two genera. I have never seen seedlings of *Sarracenia*, nor of *Cephalotus*, but a comparison of young leaves of the latter with those of *Nepenthes* presents several curious similarities. In *Cephalotus* the ordinary leaves are perfectly simple, and similar to the cotyledonary leaves of *Nepenthes*; and the pitcher-bearing leaves are at once developed as such, having the cavity and ciliated lid in their earliest discernible condition: though these occur both above and below the ordinary leaves, and in immediate contiguity with them, there are no intermediate stages whatever, the transition from cauline leaf to pitcher being as sudden and abrupt as from cotyledonary leaf to pitcher in seedling *Nepenthes*. The appearance, too, of the young *Cephalotus* pitcher and stalk is that of a stout petiole, with a hollowed-out terminal head obliquely adnate to its lower surface. If the analogy with *Nepenthes* holds good, the stipes of the *Cephalotus* pitcher represents the midrib of a leaf on whose sides no lamina is developed.

PART II.—*Notes on the Bornean Species of* Nepenthes, *with descriptions of the new ones.*

The want of any important characters in the flowers and fruit of *Nepenthes* is a very remarkable feature of these plants. The leaves differ considerably in insertion, and in being more or less petioled. The pitchers of most, when young, are shorter, and provided with two ciliated wings in front; more mature plants bear longer pitchers, with the wings reduced to thickened lines. The glandular portion of the pitcher remains more constant than any other, and the difference between the form of old and young pitchers is often chiefly confined to the further development of the superior eglandular portion into a neck or tube.

Nepenthes.

§ I. *Ascidia magna, ore lamellis latis disciformibus annularibus remotis instructo.*

1. Nepenthes villosa, H. f. (Hook. Ic. Pl. t. 888). Ascidia magna turgida late pyriformia coriacea 5″ longa 3½″ lata, alis anticis mediocribus grosse dentatis, ore aperto annulo maximo! lamellis annularibus distantibus disciformibus rigidis 1″ diam., cristatis posticis in spinas rigidas ½″ longas fundum ascidii spectantibus productis, collo elongato erecto, operculo orbiculato intus densissime glanduloso dorso basi longe cornuto. (Tab. LXIX.)

Hab. Borneo (*Lobb*). Kini Balou, alt. 8000–9000 feet (*Low*).

This most remarkable pitcher resembles that of *N. Edwardsiana* in so many respects, especially in the size, form, and disposition of the distant lamellæ of the mouth, that I am inclined to suspect that it may be produced by young plants of that species, before it arrives at a stage when the pitchers have elongated necks.

The whole inner surface of the pitcher is glandular, except a very narrow area beneath the mouth at the back.

2. Nepenthes Edwardsiana, Low, MSS. Foliis (6″ longis) crasse coriaceis longe petiolatis ellipticis, ascidiis magnis crasse pedunculatis cylindraceis basi ventricosis 8–18″ longis, ore lamellis annularibus distantibus rigidis magnis cristato, collo elongato erecto, operculo cordato-rotundato, racemo simplici, rachi pedicellisque ferrugineo-tomentosis. (Tab. LXX.)

Hab. Kina Balou, north side, alt. 6000–8000 feet (*Low*).

Mr. Low desires that this magnificent plant should bear the name of the Honourable George Edwardes, Governor of Labuan, who has materially assisted him in his expeditions. Under *N. villosa*, I have stated my suspicions that this may be the more mature form of that plant with elongated pitchers. The leaves, ascidia, and pitchers sent by Mr. Low are all old, and nearly glabrous; but the young parts—rachis, peduncles of the panicle, and the calyx—are covered with ferruginous tomentum. One of the pitchers sent is 18 inches long from the base to the apex of the erect operculum; it is 2½ inches in diameter below the mouth, 1½ at the narrowest part (about one-third distant from the base), and the swollen part above the base is about 2 inches in diameter. The beautiful annular discs which surround the mouth are ¾ inch in diameter.

§ II. *Ascidia magna, curva, basi inflata, medio constricta, dein ampliata, infundibuliformia; ore maximo, latissimo, annulo* 0.

3. Nepenthes Lowii, H. f. Caule robusto tereti, foliis crasse coriaceis longe crasse petiolatis lineari-oblongis, ascidiis magnis curvis basi ventricosis medio valde constrictis, ore maximo ampliato, annulo 0, operculo oblongo intus dense longe setoso. (Tab. LXXI.)

Hab. Kina Balou, alt. 6000–8000 feet (*Low*).

A noble species with very remarkable pitchers, quite unlike those of any other species. They are curved, 4–10 inches long, swollen at the base, then much constricted, and suddenly

dilating to a broad, wide, open mouth with glossy shelving inner walls, and a minute row of low tubercles round the circumference; they are of a bright pea-green, mottled inside with purple. The leaves closely resemble those of *Edwardsiana* and *Boschiana* in size, form, and texture, but are more linear-oblong.

I have specimens of what are sent as the male flower and fruit, but, not being attached, I have not ventured to describe them as such. The male raceme is 8 inches long, dense-flowered. Peduncles simple. Perianth with depressed glands on the inner surface, externally rufous and pubescent. Column long and slender. *Female* inflorescence: a very dense oblong panicle; rachis, peduncles, perianth, and fruit covered with rusty tomentum. Capsules $\frac{2}{3}$ inch long, $\frac{1}{6}$ broad.

§ III. *Ascidia magna, ore mediocri, annulo latissime explanato, dense lamellato v. costato.*

4. NEPENTHES VEITCHII, H. f.

N. villosa, Bot. Mag. t. 5080; non Ic. Plant. t. 888.

Hab. Borneo (*Lobb*), alt. 1000 feet. Gunoong Mooloo, alt. 3000 feet (*Low*).

5. NEPENTHES RAJAH, H. f. (Frutex 4-pedalis, *Low.*) Foliis maximis 2 pedalibus oblongo-lanceolatis petiolo costaque crassissimis, ascidiis giganteis (cum operculo 1–2 pedalibus!) ampullaceis ore contracto, stipite folio peltatim affixo, annulo maximo lato everso crebre lamellato, operculo amplissimo ovato-cordato ascidium totum æquante! (TAB. LXXII.)

Hab. Borneo, north coast, on Kina Balou, alt. 500 feet (*Low*).

This wonderful plant is certainly one of the most striking vegetable productions hitherto discovered, and in this respect is worthy of taking place side by side with the *Rafflesia Arnoldii*; it hence bears the title of my friend Rajah Brooke, of whose services in its native place it may be commemorative amongst botanists. Mr. Low describes it as a shrub 4 feet high; and the pitchers being of that short ampullaceous form which sometimes denotes that the plant producing them is immature, it is possible that, at a different season, it may attain a greater stature and bear different pitchers.

I have only two specimens of leaves and pitchers, both quite similar, but one twice as large as the other. Of these the leaf of the larger is 18 inches long, exclusive of the petiole, which is as thick as the thumb; and 7–8 broad, very coriaceous and glabrous, with indistinct nerves. The stipes of the pitcher is given off below the apex of the leaf, is 20 inches long, and as thick as the finger. The broad ampullaceous pitcher is 6 inches in diameter and 12 long; it has two fimbriated wings in front, is covered with long rusty hairs above, is wholly studded with glands within, and the broad annulus is everted and 1–$1\frac{1}{2}$ inch in diameter. Operculum shortly stipitate, 10 inches long and 8 broad.

The inflorescence is hardly in proportion. Male raceme 30 inches long, of which 20 are occupied by the flowers; upper part and flowers clothed with short rusty pubescence. Peduncles slender, simple or bifid. Fruiting raceme stout. Peduncles $1\frac{1}{2}$ inch long, often bifid. Capsule $\frac{3}{4}$ inch long, $\frac{1}{3}$ broad, rather turgid, densely covered with rusty tomentum.

6. NEPENTHES BOSCHIANA, Korth.; Miquel, Flora Ned. Ind. i. 1074, cum syn.

Hab. Borneo (*Korthals*). Mount Mooloo, alt. 3000 feet (*Low*). Also (*var.* β) found in Sumatra.

Pitchers 15 inches long. Plant 15–20 feet high.

7. NEPENTHES RAFFLESIANA, Jack; Miquel, Flora, i. 1070, cum syn. &c.

Hab. Labuan (*Mottley*). Kina Balou, alt. 3500 feet (*Low*). Also found in Sumatra, Malacca, and Sincapore.

8. NEPENTHES PHYLLAMPHORA, Willd.; Miquel, Flora, i. 1069, cum syn.

Hab. Labuan, alt. 2500 feet; very rare (found by *Mr. T. Lobb*) (*Low*). Also found in Malacca, Sincapore, Java, New Guinea, and China.

I have no Bornean flowering or fruiting specimens of this species, which may be known by its stout terete stem, long petioled ciliated leaves (when young), and cylindrical pitchers, which are swollen at the base, and have a contracted mouth surrounded with a broad flat annulus. Its foliage resembles that of *N. fimbriata*, from which it differs chiefly in the broad annulus.

§ IV. *Ascidia cylindracea, ore mediocri, annulo angusto creberrime costato v. striato v. sublævi.*

9. NEPENTHES REINWARDTII, Miq. Flora, *l. c.*

Hab. Mount Mooloo, alt. 3000 feet (*Low*).

Apparently chiefly differs from *N. gracilis* in the pitcher bulging at the base.

10. NEPENTHES GRACILIS, Korth.; Miquel, Flora, i. 1071, cum syn. &c.

N. lævis, Hort.

Hab. Borneo (*Korthals*). Common along the N.W. coast (*Low*).

β. *elongata*. Borneo (*Low*). Also Malacca and Sincapore.

Varies much in size, and in the length of the decurrent part of the leaf.

11. NEPENTHES FIMBRIATA, Blume, Mus. Lugd. Bat. ii. p. 7; Miquel, Flora, i. 1072.

Hab. Borneo (*Korthals*). Also found in New Guinea and the Louisiade Archipelago.

Apparently differs from *N. gracilis* chiefly in the narrower annulus.

12. NEPENTHES ALBO-MARGINATA, Hook. MSS. Glaucescens, caule tereti apice foliis subtus et inflorescentia rufo-tomentosis, foliis anguste lanceolatis basi longe angustatis vix petiolatis coriaceis acuminatis, ascidiis cylindricis, annulo angusto minute creberrime striato margine lato albo-tomentoso circumdato, racemo tenui, pedicellis subternis filiformibus, floribus parvis. (TAB. LXXIII.)

Hab. Borneo (*Lobb*). Maritime rocks near the mouth of the Lokotan and Tanjong-poe Rivers (*Low*). Also found at Sincapore, *Lobb*.

Species pulcherrima, distinctissima, colore pallido, foliis angustis non decurrentibus, ascidiis plerumque tomentellis, annulo angusto late albo-marginato.

This very beautiful species is sent by Lobb both from Borneo and Sincapore. The

pitchers are usually covered with a short white tomentum, and the broad white velvety band surrounding the narrow polished brown annulus affords a very marked character. The pitchers of the Sincapore specimen are (when dry) of a beautiful rose-colour blotched with purple.

13. NEPENTHES MELAMPHORA, Reinwardt; Miquel, Flor. i. 1072, cum syn. &c.

β. lucida, Blume, Mus. Lugd. Bat. ii. p. 8.

Hab. Southern Borneo (*Korthals, Mottley*). Also found in Eastern Bengal and Java.

I have received Bornean specimens of this plant, collected by Mottley at Banjarmassing, on the south coast of Borneo, where it was first detected by Korthals. The originally described form grows at an elevation of 3000–5000 feet in Java.

I take the East Bengal *Nepenthes* to be the same species; it was sent from that country* by Carey to Europe, and published by Graham in the 'Botanical Magazine' (t. 2798) as the Ceylon *N. distillatoria,* L. (from which it is very different). It has also been gathered by Griffith in the same place, and by Dr. Thomson and myself near Amwee, on the Jyntea Hills—the eastern continuation of the Khasia Mountains and north of Silhet, whence probably all the specimens were sent, as the plant and that particular habitat are well known to the natives of those districts. The figure in the 'Bot. Mag.' well represents the Bengal plant in every respect; but the dried raceme in Herb. Hook., from which the drawing was made, is much more tomentose than any specimens gathered by Thomson, Griffith, or myself, or by Korthals, Blume, or Reinwardt in Java. One of Griffith's Bengal specimens is in this respect intermediate between ours and those of the Edinburgh Gardens. Korthals' figure is not characteristic, except of a small half-starved-looking form.

I have a pitcher of what I take to be this species upwards of a foot long; it was grown in Mr. Rollisson's Nursery.

§ V. *Ascidia brevia, ore contracto, annulo lato creberrime sulcato, operculo parvo.*

14. NEPENTHES AMPULLARIA, Jack; Hook. Comp. Bot. Mag. i. 271; Miq. Flora, i. 1076, cum syn. &c.

Hab. Borneo (*Lobb, Low, Mottley*). Also found in Malacca and Sumatra (*Jack, Cuming, Korthals*).

EXPLANATION OF THE PLATES.

TAB. LXIX.

Nepenthes villosa, H. f.

Fig. 1. ♂ raceme; nat. size. Fig. 2. ♂ flower. Fig. 3. ♀ flower. Fig. 4. Fruit. Fig. 5. Portion of under surface of lid:—all magnified.

* From the Circar Mountains in N.E. Bengal, Bot. Mag. *l. c.* The Khasia Mountains are those meant here—the Circars being in the Peninsula.

Tab. LXX.

Nepenthes Edwardsiana, Low.

Fig. 1. Fruit. Fig. 2. Portion of under surface of pitcher:—both magnified.

Tab. LXXI.

Nepenthes Lowii, H. f.

Fig. 1. Portion of ♂ raceme, and Fig. 2. of ♀; both nat. size. Fig. 3. ♂ flower. Fig. 4. Young fruit. Fig. 5. Portion of under surface of pitcher:—all magnified.

Tab. LXXII.

Nepenthes Rajah, H. f.

Fig. 1. ♂ flower. Fig. 2. Portion of fruiting raceme. Fig. 3. Ripe fruit. Fig. 4. Portion of under surface of pitcher:—Figs. 1, 3 and 4 magnified.

Tab. LXXIII.

Nepenthes albo-marginata, Hook.

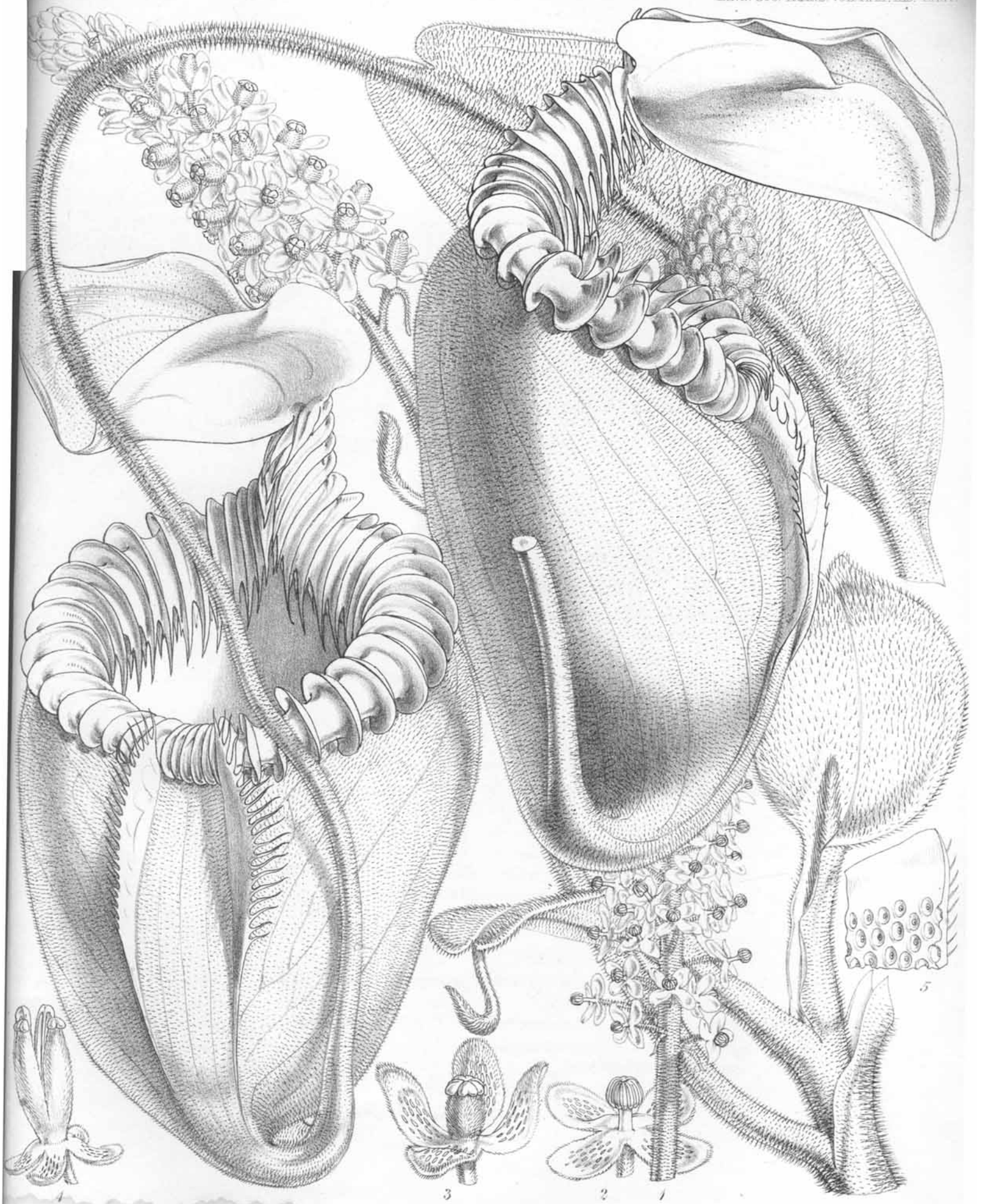
Fig. 1. ♂ flower. Fig. 2. ♀ flower. Fig. 3. Portion of under surface of pitcher:—all magnified.

Tab. LXXIV.

Illustrations of the Development of Nepenthes *pitchers.*

Fig. 1. Conical terminal bud of *N. gracilis*, Korth. (*N. lævis*, Hort.) (*a*, nat. size).
Fig. 1 *b*. Apex of the same rather more advanced, representing a leaf in its earliest state.
Fig. 2. Longitudinal section of the same.
Fig. 3. More advanced condition of ditto, showing the differentiation of the lamina below, and excurrent midrib and pitcher above.
Fig. 4. Still further advanced state of terminal bud and leaf. *a*. is a second leaf.
Fig. 5. Vertical section of apex of the same.
Fig. 6. Apex of leaf after the lamina, excurrent midrib, and pitcher are all differentiated.
Fig. 7. Apex of pitcher from the same, cut vertically.
Fig. 8. Vertical section of young pitcher of *N. Rafflesiana*.
Fig. 9. Further developed pitcher of ditto.
Fig. 10. Vertical section of pitcher of ditto.
Fig. 11. Convolute vernation of rudimentary lamina of leaf of *N. Rafflesiana*.
Fig. 12. More highly developed pitcher of ditto, cut vertically.
Fig. 13. Very young pitcher of *N. phyllamphora*?
Fig. 14. Vertical section of ditto.
Fig. 15. Further advanced pitcher of ditto.
Figs. 16 and 17. Vertical sections of still further developed pitchers of ditto.
Fig. 18. Vernation of very young leaf of *N. Rafflesiana*.
Fig. 19. Seedling *Nepenthes* from Borneo, from Mr. Low's Nursery:—nat. size.
Fig. 20. Ditto magnified. *a*, cotyledonary leaves.
Fig. 21. Cotyledonary leaf of ditto.
Figs. 22–25. Various views of leaves of ditto.

All the above figures but fig. 19 are more or less highly magnified.



W. Fitch, del. et lith.

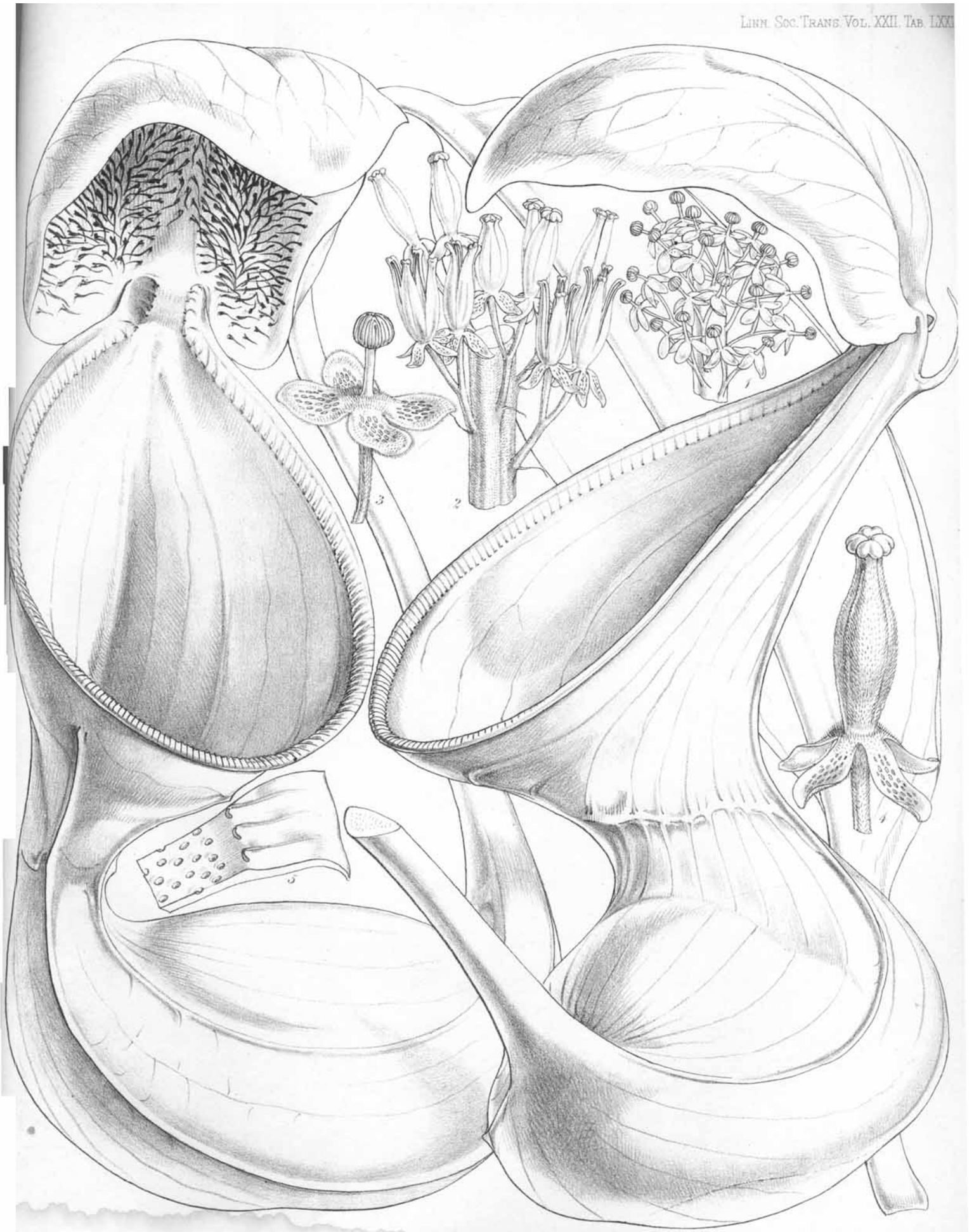
NEPENTHES VILLOSA, *H. f.*

Day & Son, Lith.rs to the Queen

W. Fitch, del et lith.

NEPENTHES EDWARDSIANA, *Low.*

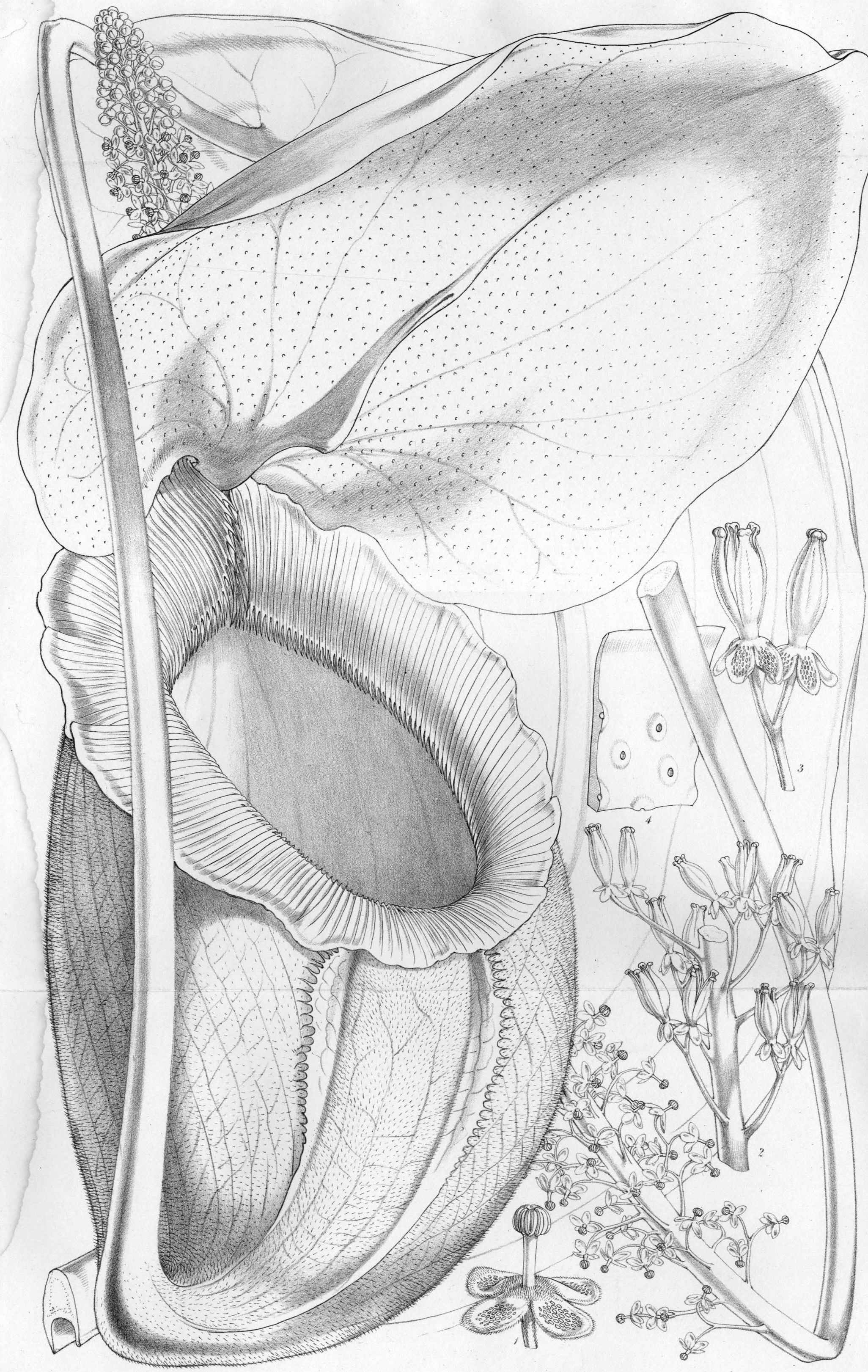
Day & Son, Lith.rs to the Queen.



W. Fitch, del et lith.

NEPENTHES LOWII, *Hf.*

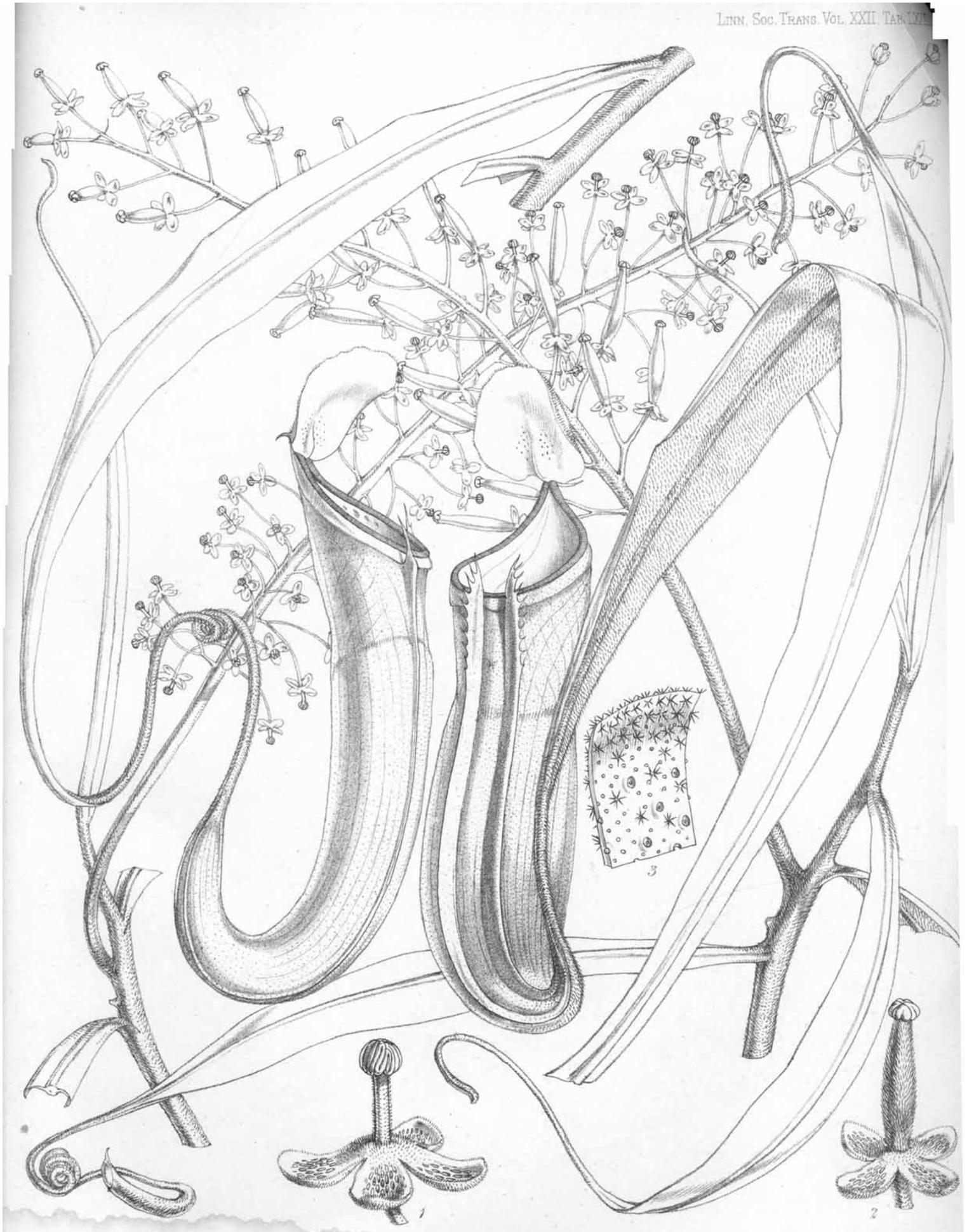
Day & Son, Lith^rs to the Queen.



W. Fitch, del et lith.

NEPENTHES RAJAH, *Hook. fil.*

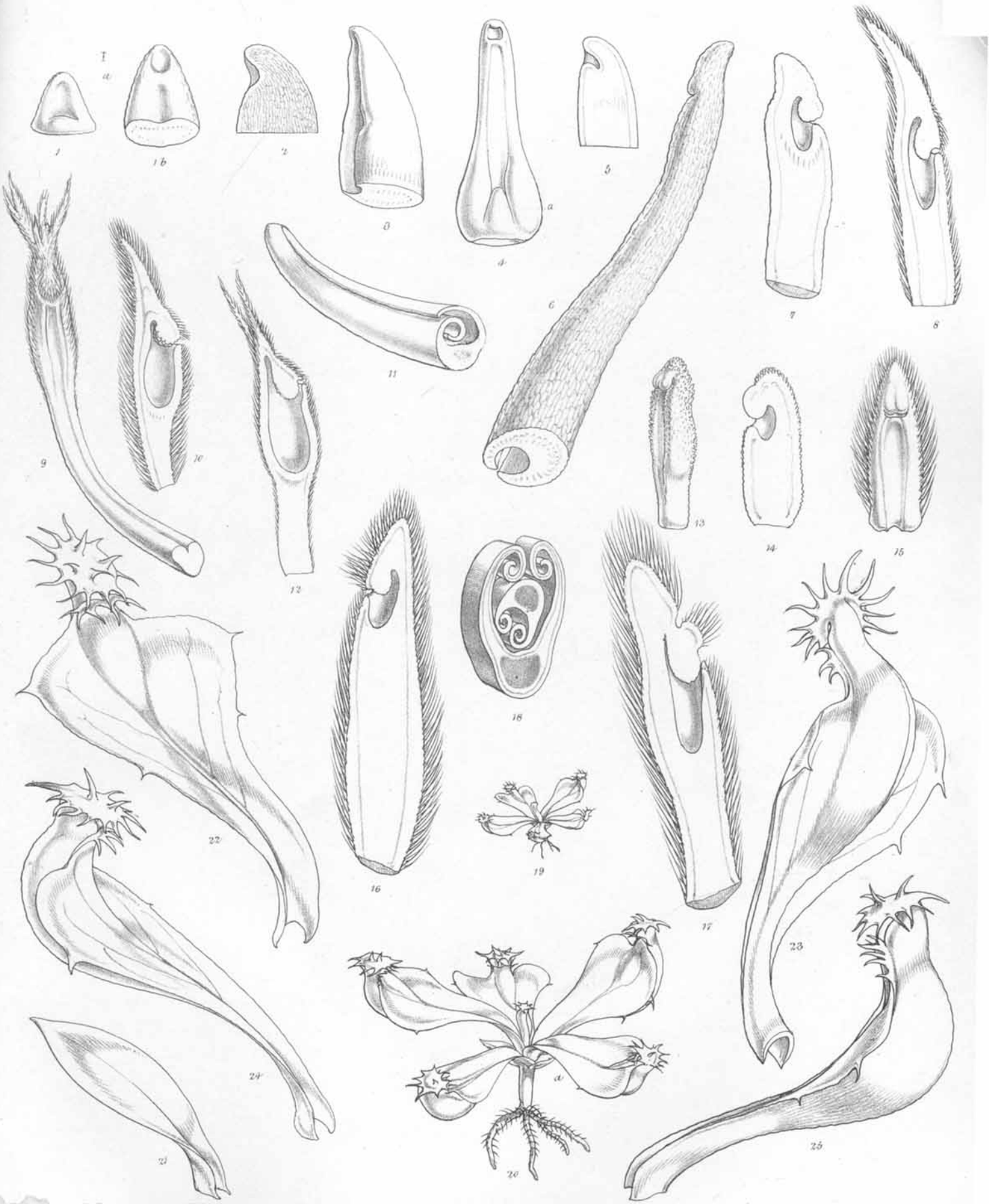
Day & Son Lith^rs to the Queen.



W. Fitch, del et lith.

NEPENTHES ALBO-MARGINATA, *Hook*

Day & Son, Lith^rs to the Queen



Development of Nepenthes leaves.