

XIII. On *Boswellia* and certain Indian *Terebinthaceæ*. By Henry Thomas Colebrooke, Esq. F.R.S. and L.S.

Read April 4 and 18, 1826.

A DESCRIPTION of the tree which yields the Indian olibanum, (a gum-resin apparently undistinguishable from Arabian frankincense, though possibly the production of a different plant,) was inserted in the *Asiatic Researches** under the name of *Boswellia serrata*: and another species of the same genus, *Boswellia glabra*, which likewise affords a resin burnt as incense in Hindu temples, and employed with vegetable oil for the more useful purpose of marine pitch, has been described by Roxburgh in his third volume of *Indian Plants*†. In neither instance was the conformation of the seed particularly noticed. To supply that omission and furnish the carpology of this interesting genus, a full description of the fruit of the first-mentioned species is here subjoined. It is chiefly derived from the same source; that is, from my lamented friend Dr. Roxburgh's observations in aid of my own.

As the dissection of the germ shows the natural number of each cell to be two, that part of the generic character, as originally given, which specifies solitary seeds, may be modified; since they are single only by abortion. For this result is not to be invariably expected in all situations; though more than one

* Vol. ix. p. 377.

† Part I. t. 207.

ripe

ripe seed in a cell have not hitherto been observed in either of the described species.

The remarkable character of multifid and intricately folded cotyledons, which will be noticed, recurs in certain other plants of the same natural order, and especially in one which it is my purpose to describe in this essay, and which exhibits three-lobed contortuplicate cotyledons. It was first delineated solely from the flower; the fruit not having ripened on the trees where I observed the blossom. Dr. Wallich, having been more fortunate than myself in this respect, has since furnished me with a particular description of the ripe fruit, and has proposed the name of *Bursera serrata* for my plant. I had taken it, while unacquainted with its fruit, for an *Ailanthus*.

It certainly is akin to the *Marignia* of Commerson, which Lamarck introduced into the genus *Bursera*, with the specific name of *obtusifolia**; and which his continuator Poiret in one place remarks to have much affinity with Gærtner's *Dammara*, and in another says it appears to be the same†.

Gærtner himself, identifying his plant, of which the specimen was received from the Isle of Mauritius, with the *Dammara nigra* of Rumphius, indigenous in the Molucca Islands, remarked its near affinity to *Amyris*, and thought it possibly a genuine species of that genus‡. But it has the intricate foldings of the cotyledons which are remarked in *Bursera serrata*.

As the two genera of *Amyris* and *Bursera* are at present constituted, a botanist may well be still at a loss to which of them a new plant of the family is to be referred. The variable features of *Bursera gummifera*, and the early inaccurate descriptions of it, have led systematic writers to assign an essential character to the genus constructed on its type, which is very loose and uncer-

* *Encycl.* ii. 768.

† *Enc. Supp.* ii. 447 & 812.

‡ *Fruct. et Sem.* ii. 103.

tain: viz. "Polygamous; Dioicous: ♀ *Cal.* 3-, 4-, 5-toothed. *Cor.* 3-, 4-, 5-petalled. *Stam.* 6, 8, 10. *Styl.* 0. *Stigma* 3-lobed. *Caps.* 3-valved, 1-seeded. *Seed* arilled*." And it is further remarked concerning that generic description, that "the capsule is 2-, 3-, 4-, or 5-seeded; and that the genus differs from *Amyris* only in the sessile stigma and arilled seed†."

Yet Willdenow, whose remark it is, has annexed to *Amyris* all the *Icicus* of Aublet, in every one of which the seeds are enveloped in proper arilliform pulp; and the style is so obscure in those, as in several other species referred to *Amyris*, (particularly *A. polygama*, *A. pentaphylla*, *A. acuminata*, and *A. nana*, Roxb.), that the stigma may well be deemed sessile in divers plants of both genera.

The rest of the characters are not less indeterminate. *Amyris polygama*, as the name imports, has unisexual flowers. This indeed has been transferred to another genus (*Schinus dependens* of Ortega). But *Amyris Kataf* of Forskal appears also to be polygamous; and so do *A. acuminata* and *A. agallocha* of Roxburgh. While several *Burseras* exhibit no unisexual blossoms. *Amyris Zeylanica* is described as hexandrous: and *A. decandra*, as the specific name indicates, presents decandrous flowers; and so does another which I shall describe, and which I take to belong to the same family with the *Amyrides*, or at least with those of Roxburgh. More than one of the plants which have been referred to this genus are variable, like *Bursera gummifera*, in the number of stamina and their corresponding proportion of petals and calycine divisions.

The berry of *Amyris* varies as much in respect of the number of mature seeds contained in it, as the capsule of *Bursera*. Nor is the distinction of the pericarp, implied by those names, well founded in this instance. They are alike coriaceous and

* Willd. *Sp. Pl.* iv. 1119.

† *Ibid.* 1121.

pulpy,

pulpy, going to pieces when dry, but not opening by determinate valves: they contain, in one or more cells, solitary seeds; or, if all the ovules ripen, two, or possibly sometimes three in each cell. In fact, throughout this family the fruit is a berry, in which the natural number of cells, containing two, or sometimes three ovules, agrees with that of the petals and calycine divisions (*sepala*), and corresponds to twice as many stamina. Exceptions are to be admitted, if the plants have been rightly classed and described; for *A. acuminata* and *A. simplicifolia* of Roxburgh, in which the germ exhibits but two cells, and *A. Zeylanica* of Retzius, in which osseous seeds coalesce and present a trilocular nut. But all three should perhaps, on account of these deviations from the natural structure, be removed from their present place to other genera.

The staminiferous ring around the germ, which was assumed for a distinctive mark of the *Icica* as a separate genus, is not more characteristic according to Willdenow*: for it is found, more or less conspicuous, in divers species of *Amyris*, as it likewise is in those of *Bursera*: and the insertion of stamina, as well as petals, in it, is an important character pervading the whole family.

In truth, as long ago remarked†, the three genera *Amyris*, *Icica*, and *Bursera*, require to be thrown together and re-cast. The whole group comprises nearly forty species, including several yet unpublished; and is likely to receive further accessions. It may be expected to become unwieldy for a single genus; and it actually comprehends plants which do not assort well together. It should therefore be subdivided, and moulded anew into distinct genera. But for this purpose much the greater part of the species requires re-examination, with a view to the distribution of them by truly discriminative marks.

* *Sp. Plant.* ii. 338.

† *Juss. Gen. Pl.* 371. *Lam. Enc.* ii. 768.

If the attempt is to be at present made, the most obvious ground which could be immediately proposed, is that which was rejected by Willdenow; the presence and form of the nectary or disk encompassing the ovary. In many species of *Amyris* it is, as a nectary or glandular ring, wanting; being only shadowed or represented by a fleshy receptacle or continuous podogynium elevating the germ and receiving the filaments and petals inserted in its foot. In other instances the nectary is clearly present, consisting in a glandular ring, which girds the base of the germ, distinct from the receptacle beneath it, in which the stamina and petals are inserted. It is discriminated from that by a difference of form and appearance, or more simply separated by a contraction or intermediate strangulation. In some instances the annular receptacle of the germ or nectarial ring is crenulate; in others it is distinctly glandular; in a few it is merely protuberant.

The total absence of a nectary, and consequent restriction of the common receptacle of stamina and petals below and germ above to a simple podogynium, might serve to characterize one group in this family. Many species of *Amyris* belong to it: among them may be enumerated several Indian sorts, as *A. nana*, *A. acuminata*, and *A. pentaphylla* of Roxburgh.

A crenulate ring occurs in *Bursera serrata*; and this form of the nectary intimates analogy with *Boswellia*, which has a crenulate fleshy cup, in the exterior margin whereof the stamina are inserted. That analogy is strengthened by the examination of the seed, which exhibits in both instances multilobed and intricately folded cotyledons. The presence of a crenulate nectary, therefore, might be taken for the discriminative mark of one more group,—a link in the chain from the first-mentioned towards *Boswellia*.

Intermediately occurs another, in which the nectary is present

but most entire. For instance, *Amyris punctata*, *A. sumatrana*, and *A. heptaphylla* of Roxburgh. (This last is not to be confounded with Aublet's *Icica heptaphylla*, which is the *Amyris ambrosiaca* of Willdenow.) In all three the nectary is a large fleshy receptacle, separated from the receptacle of stamina and petals by a strangulation or contraction, which leaves an upper protuberance to uphold the germ, and a lower to receive the filaments and petals. The mature fructification of two of these plants has been observed and described. The seeds have no osseous covering, but a single tender integument. Their cotyledons are simple; flat on the contiguous sides, and convex, conform to the seed, on the outer surface.

Perhaps another division might be proposed for such plants as have a nectary distinctly glandular. For example, *Commiphora Madagascariensis* of Jacquin, the same with Roxburgh's *Amyris Agallocha*. Its nectary consists of as many glands as there are stamina, situated at the insertion of these. But the fruit of this species has not been yet inspected, nor even the hermaphrodite flower. Roxburgh, as well as Jacquin, was unable to find any besides male flowers.

It does not, however, appear in other instances, where the complete fructification has been examined, that those differences in the nectary precisely correspond with primary differences observable in the mature fructification, on which, as I apprehend, reliance is to be ultimately placed for a main ground of generic distinction. Yet it is material to attend to the nectarial character in this group of plants. If the staminiferous disk be connected, as in my view it is, with the germ rather than with the calyx, it determines the hypogynous insertion of the stamina; and consequently shows the necessity of disjoining these plants from the perigynous order of *Terebinthaceæ*, with which they have been associated. In this remark I rely on the maxim,
that

that the presence of a podogynium always indicates an hypogynous insertion*: for the nectarial receptacle of the stamina seems to me to be clearly a distinct podogynium.

I have weighed on this point, because a new plant (*Pegia nitida*), which I am about to describe as belonging to the group under consideration, has traits which induced a distinguished botanist, Dr. Francis Buchanan Hamilton, whom I consulted shortly after making the delineation of it, to refer it to *Chalcas*, (a genus which might be revived for the reception of this plant); and because I perceive an affinity with it in a number of species which Roxburgh placed under *Amyris*, and likewise in one which Dr. Hamilton considered to be a *Bergera*, but which appears on minute examination of the germ and mature fruit, to be distinct from that genus and allied to Roxburgh's *Amyrides*. For the sake of rendering this quite evident, I shall subjoin a particular description of the fruit of the true *Bergera* (Kœnig's) copied from Roxburgh's manuscripts; the carpology of that genus being yet unpublished. It will be seen that they belong to distinct natural orders.

BURSERA SERRATA. Wall.

TAB. IV. Fig. 1.

A very large tree, native of forests bordering on Bengal, near Gwalpara and the Garrow hills; whence it was introduced by seed into the Botanic Garden at Calcutta in 1808 by Dr. F. Buchanan Hamilton; and young plants in 1810 by Mr. R. Kyd.

The timber of this species is close-grained and hard; and is much esteemed and used for furniture by the inhabitants of Asham. It is as tough as oak, and heavier.

Its vernacular name is *Najor* or *Neyor*.

* A. Richard, Elem. Bot. 235.

The arilliform pulp has a pleasant subacid taste, and, like the skin, a weak scent of anise, of which the young leaves likewise partake.

Trunk arboreous, straight. *Bark* gray, scabrous, studded with oblong ochraceous specks; bursting when old. *Branches* scattered, spreading. *Young shoots, petioles, pedicels and calyces*, downy.

Leaves alternate, decussate, unevenly pinnate. *Leaflets* 3—5 pairs, with an odd one; broad-lanceolate, obtusely acuminate, serrulate; the largest 5 to 6 inches long, and 2 to 3 broad.

Petioles round, thicker at the base, pubescent.

Stipules none.

Panicles axillary, shorter than the leaves, open.

Flowers very small, yellowish-green.

Bractes at the base of pedicels, solitary, ovate.

Perianth inferior, flattish, five-toothed, downy. *Toothlets* obtuse.

Petals five, ovate to lanceolate, spreading, exteriorly downy, longer than the stamina.

Nectary a crenulate, narrow fleshy ring, girding the base of the germ.

Filaments ten, subulate, alternately shorter, inserted below the nectarial ring. *Anthers* ovate, two-celled.

Germ ovate, downy, obsoletely five-angled, five-celled, with one to two ovules in each cell, attached to the upper part of the axis. *Style* very short. *Stigma* five-cornered.

Berry globular, obtuse, sitting on the enlarged pedicel: purple with white dots: size of a damson: 1—3-celled.

Partition thick, dilated in the middle into a short, fleshy placenta.

Pulp

Pulp fibrous, arilliform, closely adherent to the shell of the pyrene, especially to the umbilical chink.

Pyrene single in each mature cell, size of a cherry-stone, roundish, with gibbous back and flat belly; greenish-yellow.

Shell stony, thick: swollen at the umbilical chink.

Seed solitary, oblong, concave on one side, convex on the other.

Integument single, crustaceous, white: barely marked with the rhaphe.

Perisperm none.

Embryo inverse, slightly bowed, greenish-white, brittle amygdaloid.

Cotyledons foliaceous, thin, intricately folded, chrysaloid. *Radicle* superior, cylindric, obtuse, thick.

Plumule obscure.

Seminal leaves of the germinating plantule, ovate, three-lobed, denticulate.

BOSWELLIA SERRATA. Roxb. C. As. Res. ix. p. 377, cum tab.

TAB. V. Fig. 1.

Germ superior, conical, three-sided, three-celled, with two ovules in each cell attached to the top of the axis.

Style cylindric. *Stigma* three-lobed.

Capsule three-sided; sides oval, three-celled, three-valved, opening spontaneously at the edge; *valves* smooth, hard, brown.

Seeds solitary; the second ovule in each cell being abortive: broad-cordate, with a fine membranaceous wing all around.

Perisperm none.

Embryo conform to the seed, inverse, pale-yellow. *Cotyledons* intricately folded, multifid. *Radicle* superior, short, conical.

PEGIA

PEGIA C.

ESSENT. CHAR. *Cal.* five-parted. *Cor.* pentapetalous, spreading. *Berry* one-seeded.

PEGIA NITIDA. C.

Indigenous in Silhet, where it blossoms towards the close of the cold season, and ripens its seed in the middle of the hot. Its name, in the vernacular dialect of the province, is *Pégí*.

Stem shrubby, said to be scandent?

Leaves alternate, unevenly pinnate. *Leaflets* five to seven pairs, with an odd one, gradually larger, subopposite, cordate, acuminate, remotely serrate, chiefly on the anterior margin; posterior lobes small, entire. *Young leaves* covered with down on both surfaces. Length of *leaflets* 2 to 3 inches: breadth 1 to $1\frac{1}{4}$.

Petioles channelled on the upper edge, thickening at the base; villous. *Petiolules* very short.

Stipules none.

Panicles axillary and terminal, branched, ovate.

Peduncles villous.

Bractes at the base of pedicels, solitary; ovate, villous.

Flowers pale green, with an agreeable odour; numerous, very small.

Perianth inferior, five-parted, minute, persistent. *Segments* round.

Petals five, oval, spreading.

Nectary a plano-concave, fleshy ring encompassing the germ, and surrounded by the stamina inserted in its base.

Filaments ten, nearly the length of the corol, alternately shorter, subulate. *Anthers* round, two-lobed.

Germ

Germ superior, round, half immersed in the nectary. *Style* short, conical. *Stigma* simple.

Berry globular, sitting on the permanent calyx; black, size of a currant, one-celled.

Pyrene solitary, oval, compressed, of a honey-colour, wrinkled.

Shell bony, fragile.

Seed solitary. *Integument* membranaceous, thin.

Perisperm none.

Embryo conform to the seed, white, inverse. *Cotyledons* oval, turgid, large, almond-fleshy. *Radicle* superior, minute, roundish.

AMYRIS HEPTAPHYLLA. *Roxb.*

TAB. V. Fig. 2.

Native of mountains bordering on Silhet. Its leaves when bruised smell strongly of anise.

Stem shrubby. *Branches* suberect. *Bark* smooth, dark-coloured.

Leaves alternate, unevenly pinnate. *Leaflets* alternate short-petioluled; three to four pairs, with an odd one; obliquely lanceolate, entire, marked with transparent dots.

Panicles terminal; *ramifications* trichotomous, divergent.

Flowers numerous, small, whitish-yellow.

Perianth inferior, small, five-toothed.

Petals four, oval, spreading, concave, inserted by claws in the base of the nectary.

Nectary fleshy, contracted in the middle; the lower swelling receiving the petals and stamina, the upper supporting the germ.

Filaments eight, enlarged below, concave according to the convexity of the nectary and germ, shorter than the corol.

Anthers oval.

Germ nearly square, crowned with four round glands, four-celled,

celled, containing two ovules in each cell attached to the axis. *Style* length of the stamina. *Stigma* truncated.

Berry oblong, pale straw-colour, marked with minute, greenish glandular dots, one-celled.

Seed solitary, conform to the berry. *Integument* single, thin, white.

Perisperm none.

Embryo inverse, straight. *Cotyledons* conform to the seed, pale yellow, marked with small greenish dots. *Plumule* two-lobed. *Radicle* oval, superior.—*Roxb. Mss.*

AMYRIS PUNCTATA. *Roxb.*

TAB. V. Fig. 3.

Native of Chittagong.

Trunk arboreous. *Branches* spreading. *Bark* smooth, ferruginous.

Leaves alternate, unevenly pinnate. *Leaflets* alternate, short petioluled; ten to twenty pairs, with an odd one; obliquely oblong, crenulate, marked with glandular dots: the largest leaflets in the middle of the common rachis, 3 to 4 inches long, 1 broad.

Stipules none.

Petioles and *petiolules* round, somewhat scabrous and hairy.

Panicles terminal, oval, erect. *Peduncle* and its subdivisions hairy.

Bractes minute.

Flowers numerous, small, white.

Perianth inferior, small, four-toothed.

Petals four, oval, spreading, concave, inserted by claws in the base of the nectary.

Nectary, a large, fleshy receptacle, contracted at the middle, receiving the petals and filaments inserted in the lower swelling, and supporting the germ with the upper.

Filaments

Filaments eight, much enlarged below, concave within, according to the convexity of the nectary and germ, shorter than the corol. *Anthers* oval.

Germ four-sided, four-celled, with two or three ovules in each cell, attached to the top of the axis. *Style* thick, four-sided, straight, length of the stamina. *Stigma* truncated, obsoletely four-pointed.

Berry oblong, size of a field-bean, smooth, dotted, of a pale straw-colour, one-celled.

Seed solitary, conform to the berry.

Integument single, white, thin, tender.

Perisperm none.

Embryo inverse. *Cotyledons* conform to the seed, green, often unequal. *Plumule* two-lobed, hairy. *Radicle* hemispherical, hairy, inferior.—*Roxb. Mss.*

BERGERA INTEGERRIMA. *Buch.*

Indigenous in countries east of the Megna River in Bengal.

Trunk arboreous. *Branches* numerous.

Leaves alternate, unevenly pinnate. *Leaflets* subalternate, short-petioluled, obliquely lanceolate, entire, waved, acuminate, smooth above, villous underneath: exterior largest, 6 inches long, 2 broad.

Petioles round, villous.

Corymbs terminal, decom pound.

Flowers short-pedicelled, erect, numerous, white, emitting a strong offensive smell.

Bractes very minute.

Perianth five-toothed.

Petals five, lanceolate, expanding.

Nectary a fleshy receptacle elevating the germ.

Stamina ten, alternately longer.

Germ above, oval, five-celled, with two ovules in each cell, attached to the upper end of the axis. *Style* clavate. *Stigma* subrotund.

Berry size of a large pea, oval, yellow, rarely more than two-seeded.

Seed solitary (sometimes two or more ripen) conform to the berry.—*Roxb. Mss.*

BERGERA KÆNIGII. *Linn. Mant.* p. 563. *Roxb. Corom.* ii. p. 9. t. 112.

TAB. V. Fig. 4.

Germ oval, a little compressed laterally, two-celled, containing one ovule in each cell, attached from its middle to the middle of the partition: a cellular enlargement above containing a limpid liquid.

Berry obliquely oval, smooth, size of a black currant, purple, marked with numerous pellucid cells; one-celled, by abortion of the second.

Seed solitary, conform to the berry. *Integument* single, white, rather thin.

Perisperm none.

Embryo inverse, green. *Cotyledons* conform to the seed, notched on the external side below the summit, and there united with the neck of the embryo by the bottom of the fissure.

Plumule two-lobed. *Radicle* superior, cylindric, villous.—*Roxb. Mss.*

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