INDIGO, or ANIL, Botany. See INDIGOPLUM.

From this plant is extracted a dyer's drug, of a deep blue colour, brought hither from the West Indies and America. It is also made in the East Indies, particularly in the dominions of the Great Mogul, the kingdom of Golconda, &c.

The ancients were acquainted with the dye, which we call indigo, under the name of "Indicum." Pliny knew that it was a preparation of a vegetable substance, though he was not sufficiently informed concerning the plant itself, and the process by which it was fitted for use. From its colour, and the country from which it was imported, it is denominated by some authors "Astramentum Indicum" and "Indicum nigrum." Even at the close of the 16th century it was not known in England what plant produced indigo. Gerard, in 1597, is wholly silent about it, and so is Johnston in 1627. Parkinson, however, in 1640, treats largely of it. He calls it "Indico or Indian woad," and gives a figure of the leaf from De Lact. He then describes it, first from Francis Ximenes in De Lact's description of America; and secondly, from Mr. William Finch, a London merchant, in Purchas's Pilgrims. Even in 1688 Mr. Ray says it was not agreed among botanists what plant it is from which indigo is made; but that the most probable opinion was, that it is a leguminose shrub, allied to Colutea. He describes it from Hernandez and Mayorga; and subjoins that of the "Ameri" from the Hortus Malabaricus. Nil or Anil is the American name. In Arabic it is Nile. The Portuguese have adopted their Anil or Anilera from the American. The other European nations generally call it Indigo. In Chinese it is Tan laum, which signifies sky-blue. Mr. Miller cultivated the dyer's indigo so long ago as the year 1731; and calls it Guatemala indigo, laying that with us it is an annual plant. Specimens of the Indigofera tinctoria, or dyer's indigo, from different parts of India, Madagascar, Java, Ceylon, &c. vary very much, if they are all really the same species. Linnaeus says that it is almost an exotic in Ceylon, but frequent in Palaeoita and Coromandel. According to Loureiro it is spontaneous in China and Cochinchina, and is cultivated all over those vast empires. Dr. Patrick Browne, besides the wild indigo already mentioned, has two others, which he calls the indigo, and the Guatemala indigo; the former yielding more of the dye than either of the others, is generally preferred, though subject to many more mischances.

It has been generally believed, that the indigo plant flourishes only in the climate of the torrid zone, and in those parts of the temperate zone which are near the tropics. But experiments lately made in Italy by Bradley, by order of government,
INDIGO.

government, have proved that, in a suitable soil and exposure, and with good feed, it may be cultivated in a southerly climate. Accordingly, he has obtained the indigo plant in the gardens of the Chateau de la Venerie, near Turin; and by submitting it to the processes employed at St. Domingo, he has extracted an indigo which might bear comparison with the finest indigo of the colonies. His plantations were made towards the end of February. M. Icard de Bataligni, another colono, cultivated the plant in 1865, in the department of Vaucluse, in France; and his results confirm the hopes formed with respect to the culture of indigo in Europe.

Labat has given a particular account of the culture of the plant, and the preparation of the indigo. The ground being thoroughly cleared from weeds (one of the principal points in the culture), and, we may add, drained, a number of flakes, ranged in a line, march across, making little trenches of the width of their hoes, and two or three inches deep, about a foot distance from one another every way; then, returning, they drop some seeds in each trench, and afterwards cover them with the earth taken out. The soil, if it is observed by others, should be free and rich, and the climate warm; and the feast of fowling should be rainy; as the earth must either already have imbibed water, or rain must speedily follow the fowling; otherwise the feed becomes heated, corrupts, and is lost, after all the labour it has occupied. During the process of vegetation the ground must be carefully weeded, in order to prevent any mixture of herbs, which would injure the indigo in its manufacture. In moist weather, the plant comes up in three or four days; and in about two or three months after, it is fit for cutting; if suffered to stand till it runs into flower, the leaves become too dry and hard, and the indigo obtained from them proves less in quantity, and less beautiful; the due point of maturity is known, by the leaves beginning to grow less supple, or more brittle. In rainy seasons, the cutting may be repeated every six weeks: cutting in dry weather kills the plant, which, if that is avoided, continues to afford fresh crops for two years.

A large quantity of the herb is put into a vat or cistern of strong mason work, with so much water as is sufficient to cover it; and some wood laid above to prevent its rising up. The matter begins to ferment, sooner or later, according to the warmth of the weather, and the maturity of the plant, sometimes in six or eight hours, and sometimes not less than twenty. The liquor grows hot, throws up a plentiful froth, thickened by degrees, and acquires a blue colour, inclining to violet. In proportion as the caloric increaseth, azote is disengaged, the herbaceous mucilage separates, the vegetable is decomposed, and the mixture absorbs oxygen. The fermenting fluid ranges from a green to a violet tinge, and this by degrees changes to a blue colour. The great art of the manufacturer is to check the fermentation at a proper degree. If the fermentation is too fecile or too brief, the plant remains impregnated with much efficient salt, which diminishes the quantity of indigo. If it be too long, the tender extremities of the plant undergo a putrefaction which destroys the colour. Some years ago, the following criterion was published at St. Domingo, for ascertaining invariably the correct fermentation of the indigo. It is only requisite to write on white paper with the matter to be examined. If this ink be of very high colour, it is a proof that the fermentation is not yet at its true point. The experiment is repeated every quarter of an hour, till it is perceived that the liquid has lost its colour. This was pronounced an infallible index to the true point of fermentation. Others, however, judge of the proper stage of fermentation by means of a silver cup, into which they throw the liquid, shaking it till grains are formed; by their quality, and that of the fluid, they judge of the fermentation. When the feuleaux particles begin to precipitate to the bottom of the cup, it is then judged, that the herbs have attained the true degree of maceration for obtaining indigo. It has been observed, however, that this procedure often led into error; and, therefore, five or six minutes after the liquid has been put into the cup, it was perceived to form round its sides a cordon of fécule, or sediment, at first of a green colour, and then blue. When the maceration is not at the requisite point, this cordon, or girdle, detaches itself with difficulty from the sides of the cup, but finally precipitates, and concentrates at the bottom, always towards the centre, and the water above it becomes limpid, though of a yellowish tinge. When these signs are perceived, they indicate infallibly the fécule of the first operation. At this time, without touching the herb, the liquor impregnated with its tincture is let out, by cocks in the bottom, into another vat placed for that purpose, so as to be commanded by the first. The first vat is called the "deeper;" the second and third are called the "beaters."

In the second vat, the liquor is strongly and incessantly heated and agitated, with a kind of buckets fixed to poles, till the colouring matter is united into a body. A good deal of nicety is requisite in hitting this point; if the beating is continued too soon, a part of the tinging matter remains dissolved in the liquor; if continued a little too long, a part of that which had separated is dissolved afresh. The exact time for discontinuing the process is determined by taking up some of the liquor occasionally in a little cup, and observing whether the blue fécule is dispersed to separate and fimbroid.

The facility with which the grain precipitates to the bottom of the beater, is an unequivocal sign that the beating has arrived at the correct point.

The whole being now suffered to rest till the blue matter has settled, the clear water is let off, by cocks in the sides at different heights; and the blue part discharged by a cock in the bottom, into another vat. Here it is suffered to settle for some time longer, then further drained in cloth-bags, or sacks, and exposed in shallow wooden boxes to the air, without exposing it to the sun, and carefully keeping it from the rain, till thoroughly dry.

Before it is perfectly dry, it is cut in small pieces of an inch square, which detach themselves readily from the box, when the indigo is entirely dry. Yet, however well drained and dried the indigo may be, it always experiences, in the first months of its fabrication, a diminution sufficiently evident to warrant a hallowing of the falc. It is customary to pack the indigo in barrels, and thus to circulate it in commerce. Indigo is packed in sacks of coarse linen, and the sack is covered with an ox’s hide, so hermetically fewed, that nothing can penetrate it. These packets are called ‘ceroons.’ They are much preferable to barrels, as they are more solid and more convenient for transportation. Two ‘ceroons’ make the load of one animal.

The author above-mentioned, from whom the greatest part of the foregoing account is extracted, observes further, that the goodness of the indigo depends greatly upon the age of the plant; that before it has grown fully ripe, the quantity it yields is less, but the colour proportionately more beautiful; that probably the secret of those whole indigo has been moly elminated, is no other than cutting the herb at the time when it yields the finest colour; that the superiority of some
Some of the indigos of the East Indies to those of America, is perhaps owing to the former being prepared more curiously from only the leaves of the plant; and that by beating the herb in the steeping-vat, which has been practised by some with a view to increase the quantity, great part of the substance of the leaves and bark is blended with the water along with the colouring matter, and the indigo extremely debauched. It is said that lime, or lime-water, is sometimes employed in the beating-vat, to promote the separation of the tinging particles from the water; and that the hardnefs or thinnefs of some sorts of indigo is owing to an over proportion of this addition.

Pomet says, that the Indians of the village of Sarqueffe, near Amadabat, use only the leaves of the indigo, and throw away the plant and branches; and from thence the most esteemed indigo is brought.

Indigo is commonly divided, from the colour which it exhibits upon breaking, into three kinds, copper-coloured, purple, and blue. It is said that the dyes ufe chiefly the first; and the callico-printers (for this drug gives a durable stain to linen as well as woolen) the last. On what particular circumstances these different appearances depend, we know not; nor is it certainly known whether the real quality of the indigo has any connection with them. The deepkel and liveliet blue indigo, rubbed with the nail, appears like polished copper; and solutions of all the sorts, made in alkali liquors, affume alike a copper-coloured skin upon the surface.

Good indigo is moderately light, breaks of a thinning surface, and burns almost wholly away upon a red-hot iron. It is quickly penetrated by water, and reduced into a kind of paste; a considerable part is at the same time diffused through the liquor, and very slowly subsides. This is probably what Labat and Helloit mean by its dissolving in water; for no part of the indigo really dissolves; it cannot indeed be expected that it should, from the processes by which it is obtained.

Indigo requires an equal quantity or more of fixed alkaline salt, to render it totally soluble in water. On digesting the indigo with a gentle heat, in the solution of the alkali salt, a thinning copper-coloured skin begins to appear, and gradually covers the whole surface: on agitating the matter, a large blue flower or trufh arises, and the liquor underneath appears of a deep green. If woolen cloth, without any other preparation than moistening it with warm water, be dipped in this hot liquor, it comes out perfectly green, and changes almost instantly in the air to a fine blue. This is the common process of dyeing blue.

Mr. Helloit describes two indigo vats with urine; one of which is used hot, like the foregoing, and the other cold. The hot vat consists of equal parts of indigo, alum, and tartar, digested in urine till the liquor becomes green. The cold one is prepared, by digesting powdered indigo with vinegar for twenty-four hours, in the proportion of four pounds to about three quarts; then mixing the matter with about fifty gallons of urine, and stirring the whole together every night and morning, till the liquor turns green, and gathers a head like the common vat.

Indigo is fitted for printing on linen. By diluting it with water into the consistence of a syrup; then adding some powdered pearl-ashes, green vitriol, and lime newly slaked; with so much water, occasionally, as will reduce them into the consistence of thin paint; mixing the whole thoroughly together, and stirring the matter every now and then, till it gains a copper colour on the surface. The proportions used by the workmen are, two parts of indigo, one of pearl-ashes, three of vitriol, and two of lime. The same composition, diluted with a sufficient quantity of water (about six gallons to a pound of indigo), and boiled, gives a durable blue to tanned skins, whether dipped in hot or cold.

Indigo digested in a moderate heat with different volatile alkaline spirits, gave only yellowish and brownish red tinctures; with rectified spirit of wine, a reddish one; to lime-water, and to water acidulated with the vitriolic, nitrous, and marine acids, it gave no tincture at all. The concentrated vitriolic acid unites with it into a smooth paste, especially if the indigo is previously well ground with powdered glass, sand, or other like subsultes. The indigo is thus rendered soluble in boiling water along with the acid, so as to pass through the pores of a filter; the solution, whilst hot, appears of a deep bright green colour, like that made by fixed alkalies, but fades as it grows cold, and changes at last to a brownish. These experiments, which were many times repeated with the same event, seem to overturn Mr. Helloit's ingenious theory, which deduces the green colour of solutions of indigo from the common property of blue juices being turned green by alkalies; and the blue colour which the cloth acquires soon after it is taken out of the vat, from a separation of the alkali. We have found, that a green solution of this concrete is obtainable by the strongest of the acids, and that with volatile alkalies it discovers no tendency to greenness.

For the method of preparing Saxen blue and Saxen green from indigo, see those articles.

Indigo is sometimes used among the painters for paper-hangings, and such gross ufses, who grind and mix it with white to make a blue colour; for without that mixture it would paint blackish.

They also mix it with yellow to make a green colour. It is also used in dyeing, and by the laundresses, to give a blue colour to their linen.

In the Hortus Indus Malabaricus is an account of the plant whence indigo is drawn; the decoction of whose root is said to be excellent against nephritic colics; its leaves, applied to the abdomen, good to promote urine; and the indigo itself is said to be of good use in drying of tumours.

Some physicians have recommended indigo in the quantity of a drachm, while others look upon it as a poison; and in Saxony the internal use of it is prohibited.

Indigo, Ecballium. See Amorpha.

Indigo Mills. For the purpose of effecting the solution and union of indigo with the liquid used along with it, for the purposes of dyeing, mills of various constructions are in use. In this process trituration or friction is as much as possible avoided, and the pulverization is effected merely by bruising. For this two very sufficient reasons may be assigned; the first, in point of economy, and the second, to avoid chemical inconvenience. On whatever substance the indigo was triturated or rubbed, a certain proportion of the stuff would be mixed or incorporated along with the pulverized indigo, and that proportion of indigo which was absorbed by this stuff would be either totally lost, or brought into union with another substance which might prove useless, and probably injurious in the subsequent process of dyeing. If the former only was the case, the absorbed indigo would be totally lost; if the second took place, the whole process might be utterly spoiled by the combination. In the appropriate plate, fig. 1., represents the ground or horizontal plan of such an indigo mill as is generally used in small dye-works, and which is occasionally turned by a man's or boy's hand. This is tedious and laborious, for the operation must be continued for a very long time before the indigo is sufficiently mixed with the liquid to be fit for use, and only a small
small quantity can be put into the vessel at once. Fig. 2, is an elevated section of the same mill.

In this machine the pulverization or granulation of the indigo is effected by the prodding of a number of smooth cast-iron balls, like those used for the shot of great guns, which, being rolled among the indigo, press it into a paste by their weight, until it unites with the liquid by which it is to be held in solution.

In fig. 1, A represents the bottom and rim of the vessel which contains the indigo, and which is of a cylindrical form. B is an upright spindle, which, in this figure, does not appear. Upon the spindle B is fixed a wheel CC, with a convenient number of arms projecting round the vessel, like the radii of a circle; and below each of these arms are projecting pieces of iron, like the pins or teeth of a harrow, for moving the balls. When this wheel C is moved round its axis, the balls in the vessel A are set in motion, and, by rolling over the indigo, gradually press it, until it unites with the water or liquid with which it is surrounded. If the bottom of the cylinder be flat, a very small part of the surface of each ball can act upon the indigo; but by calling circular hollow grooves, as represented in fig. 2, nearly the diameter of the ball will press upon the stuff. The mill is moved by a handle D, fig. 2, which acts in motion the small bent wheel E, and this wheel acting upon the horizontal wheel F, fixed upon the spindle B, falls into motion, and consequently the wheel CC is moved round its axis, and all the balls roll round upon the indigo. G is a crosh shaft upon the top of the spindle B, loaded at each end with a heavy ball. There is generally another shaft placed at right angles to this, when they afford in regulating and equalizing the motion in the same manner as any other fly wheel. When the indigo is found to be sufficiently dissolved, and united with the water, the liquid thus formed is drawn off into any other vessel for use by means of a vent and spigot placed in any convenient part of the bottom of the vessel.

The great labour and time which it requires, and the small quantity of stuff which can be prepared at once by a machine of this kind, renders it ill adapted for the use of large works where much indigo is consumed, and where they have generally a horse-power water-wheel, or steam-engine, for moving water, cutting madder, and other purposes necessary in extensive works. Fig. 3, represents an elevated cross section of one of these machines, driven by any moving power, and capable of preparing a very great quantity of indigo at all times, as it requires no attendance, excepting to empty the vessel when the indigo is wanted, and add a fresh supply. H is a semi-circular vessel of cast-iron, placed upon a strong wooden frame O, and of any convenient length. I is a cover made in two pieces, with a circular aperture to admit the upright shaft K working upon the centre, or pivot P. At Q, the upright P is joined to a horizontal shaft of wood M, the other end of which is connected by the joint R, with a crank fixed on the end of a horizontal shaft N driven by the moving power. The circular motion of the shaft and crank N communicates an alternate, or reciprocating motion, by means of the horizontal connecting shaft M, to the upper end of the upright shaft K, which vibrating upon the centre joint P, sets in motion the iron cylinders L, L, in the body of the vessel, which press upon the indigo, and produce the same effect, but to a much greater extent, as the balls in the machine first described. The cylinders L, L, may be made of any diameter or length which is found convenient. The greater mafs of iron that they contain, the quicker and more effectual will be their operation upon the stuff, provided there is a sufficient power to drive them. The frame under the joint P extends the whole length of the semi-circular vessel H, which may be any length, according to the extent of the power and quantity of work required. As this machine requires no attention whatever, it is found very useful in large dye works, as, by means of it, they can constantly command a large supply of prepared indigo, which may be drawn off when wanted, for the longer it is under the preparing process, the better in every respect, and fresh indigo may be added as the supply gets low.


Gen. Ch. Coll. Perianth of one leaf, spreading, almost flat, five-toothed. Cor. papilionaceous; standard rounded, reflexed, emarginate, spreading; wings obtuse, obtuse, spreading at the lower margin, of the shape of the standard; keel obtuse, spreading, deflexed, marked on each side by a hollow awl-shaped point. Stam. Filaments rounded. Stamens inserted into a cylinder, ascending at their tips; anthers dispoted roundish. Pyl. German cylindrical; style short, ascending; stigma obtuse. Persic. Pod roundish, long. Seeds numerous, kidney-shaped.


Obi. Till within the last century it was but imperfectly made out what plants produced the dye known to the Romans by the name of Indicum. Mr. Miller, however, cultivated the Indiogera to early as 1731; but he was acquainted with only five species of it; which fame number Linnaeus imperfectly described. Prosfior Martyn enumerates thirty-five species, and Wilhelmi fiftie-one; but since this genus is particularly known and esteemed for its utility in the arts, and that most of its species yield the blue dye, as well as many other plants of the same natural family, we shall merely give a general outline of the genus, without entering into a long systematic arrangement of the species.

The genus Indigofera is composed of herbs and herbs, whose leaves are, in certain cases, simple, more generally ternate, but most frequently unequally pinnate. The leaflets in some species are jointed and awned at the base. Stipulas distinct from the leaf-blade. Peduncles axillary, generally many-flowered, in spikes or bunches. Many species are natives of the Cape of Good Hope; for instance, I. filifolia, f. scabra, d. pretia, ovata, f. floridites, candidissima, munsii, incisa, pruinaea, amara, aquatica, f. floridites, f. scabra, angulifolia, and capitata.—The root are either from the East or West Indies, Arabia Felix, New Holland, and the coast of Guinea.

It is said that Pliny was aware that Indicum was a preparation from a vegetable substance, though he was ill-informed both concerning the plant itself, and the process by which it is made fit for use. The following is a curious anecdote to shew that at the close of the 16th century it was unknown in England what plant produced Indigo, for in a book entitled "Remembrances for Master S. by Richard Hakluyt," written in 1582, Master S. is instructed "to know if a malle that coloureth blue, be a natural commodity of Turkey, and if it be compounded of an herb, to send the seed or root with the order of owing, &c.—that it may become a natural commodity.
commodity in the Realm, as woad is (Isatis tinctoria), that
the high price of foreign woad may be brought down.

I. tinctoria, Dyer's Indigo, is a native of the East and West
Indies, Madagascar, Ceylon, Java, &c. Its stem is suffrut-
---Loureiro says it is cultivated all over the vast empires of
China and Cochin-china. It is figured under the name of
Ameri in the Hortus Malabaricus, v. r. 101. t. 54.