



V. Experiments upon the various species of cinchona

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To cite this article: M. Vauquelin (1807) V. Experiments upon the various species of cinchona , Philosophical Magazine Series 1, 27:105, 36-53, DOI: [10.1080/14786440708563549](https://doi.org/10.1080/14786440708563549)

To link to this article: <http://dx.doi.org/10.1080/14786440708563549>



Published online: 18 May 2009.



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cordingly*, exhaust the globe F, and proceed with the experiment as described by M. Van Marum.

An operation may be continued any length of time with this gasometer, without altering the pressure, by filling D and E with the requisite gas during the experiment, which is performed thus: the gas-holder V being charged, screw the cocks *v* and *z* on to *u* and *x*, and the water will run into V until the gas is exactly of the same density as that in D or E: shut *u* and *v*, and screw on to *t*; open *t*, *v*, *x*, and *z*; and the gas in V will be transferred into E, without altering the effective pressure. Proceed in the same manner with the gas intended for D.

V. *Experiments upon the various Species of Cinchona.* By
M. VAUQUELIN †.

§ I.

Physical Properties of Cinchona.

IN commerce, many different species of cinchona are known; the principal and most frequently employed species, however, are the following:

The first, antiently known by the vague name of Peruvian bark, appears to be that produced from the tree called by Linnæus *cinchona officinalis*. This species has a grayish colour externally, and a pale red internally; it is very thin, rolled inwards on the side which adhered to the wood; having a glossy and as it were a resinous fracture, sometimes slightly fibrous; an astringent and bitter taste. It yields a fawn-coloured powder mixed with gray.

* The effective pressure will always be as the height of the orifice H above that of the recurved tube *y*; and this pressure will continue uniform and precisely equal in both vessels, without regard to the quantity of water in A.

For the mode of filling A during an experiment, as well as for further particulars relative to the principles of this instrument, see description of the Hydrostatic Regulator, Phil. Mag. vol. xx. p. 289.—J. S.

See also Mr. Steevens's description of his Single Gasometer, vol. xxiv. p. 163.
—EDIT.

† From *Annales de Chimie*, tom. lix. p. 113.

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The second species, called *red cinchona*, and erroneously *cinchona pitton*, is of a deeper colour than the first, generally very thick, not rolled or but little so, presenting a fibrous and by no means a resinous fracture, having an astringent and slightly bitter taste.

Lastly, the third species, more recently discovered, and which ought not to be confounded with the bark of the *angustura*, as sometimes happens in laboratories, is designated by the name of *yellow cinchona*.

Its colour is of a pale yellow; its taste is bitterer and less astringent than that of the two former species; its fracture is partly ligneous and partly resinous; it is a little more or less rolled inwardly, according as it is more or less thick.

Such are the three most commonly known species of cinchona, and those most generally employed in medicine; but there are many other species which are confounded with them, the several varieties of which are perhaps regarded as different species. These varieties may be occasioned by the age, the soil, the climate, or the parts of the tree from which the bark has been taken*.

Although the bark called *angustura* is not a true cinchona; yet as it has some of the exterior characters of it, and as it may be easily confounded with it, it is right to make known its distinguishing properties. This bark is yellow, extremely bitter, by no means astringent, and not at all rolled up like the cinchonas.

§ II.

Are there any Characters by which to distinguish the good Species of Cinchonas from such as are bad, or as have been adulterated?

This is certainly an important object to attain for the success of this medicine in the treatment of intermittent fevers,

* M. Mutis distinguishes seven different species of cinchona; but the most of them are unknown in France. The only species known at Paris, besides those mentioned above, are thus denominated: *quinaquina rouge ordinaire*, *quinaquina gris canelle*, *quinaquina gris plat*, *quinaquina Santa-Fê*; but we are by no means certain that they belong to different species of trees. We shall see, a little further on, that several of them resemble each other in almost every point, and that others of them are not true cinchonas.

as well as for commercial people who deal in the article by wholesale.

If we had an accurate and simple method of ascertaining the best species of cinchona, or of distinguishing them from the false, or from such as had been any way adulterated, it would be wise in government, in my opinion, to institute a commission, formed of physicians and apothecaries, in every sea-port town, in order to examine all the cinchonas which arrive there, and to prevent from being circulated in commerce such as do not undergo the tests prescribed. But, unfortunately, the judgment hitherto formed upon the good or bad quality of this medicine has been made to depend upon some physical properties, often deceitful; such as the colour, smell, taste, fracture, compactness, &c.; qualities which are too arbitrary, because the senses and custom are the tests here employed.

M. Seguin has lately endeavoured, by experiments, to throw a light upon this subject more certain than what we have hitherto had. According to him, the aqueous infusion of the best sorts of cinchona possesses exclusively the property of precipitating an infusion of tan; while, on the contrary, the bad species precipitate a solution of animal gelatine: thus he not only judges of the absolute qualities of these substances, but he can also give the measure of the respective qualities of the different species of cinchona, by the greater or less abundance of the precipitates he obtains.

If the observation of M. Seguin held true in all the good cinchonas, and if the phænomenon which occasioned it was owing to the principle, which in this substance is a febrifuge, they would furnish a strong argument why government should adopt the measure above recommended.

But I shall have occasion, hereafter, to make some remarks upon the assertions of M. Seguin, in showing that there are several species of true cinchona which do not precipitate a solution of tan, but which, however, are capable of curing fevers.

§ III.

Treatment of different Species of Cinchona by Water; Manner in which their Maceration and their Decoction act upon the Re-agents.

I have compared, by physical and chemical properties, infusions of all the species of cinchona known in commerce, to which I joined the examination of some other vegetable substances which appeared to be analogous to cinchona, and which have been also resorted to in the treatment of fevers.

The infusions were prepared with the same quantities of water, the same quantities of bark at an equal temperature and during equal times; so that the differences we shall observe could not proceed from the mode of preparation.

First Species.—*Yellow Cinchona**.

1. 122 grammes (4 ounces) of this cinchona, infused for 24 hours in two litres of water at 12° (60° Fahr.), communicated a yellow colour to the water, a very bitter and slightly astringent taste.

2. This infusion formed a very abundant flaky white precipitate in a solution of isinglass.

3. It gave to a solution of sulphate of iron a green bile colour, and formed in it, some time afterwards, a precipitate of the same shade.

4. It precipitated, in yellowish white, the solution of tartarite of antimoniated potash.

5. The oxalate of ammonia produced a precipitate in it, which was oxalate of lime.

6. Lastly, this infusion reddened very sensibly the tincture of turnsole.

The infusion of cinchona of which I am now speaking, completely precipitated by the solution of glue and filtered, has no longer any colour, and hardly any astringency; but

* It was brought to Spain in 1788, where, having been employed for the royal family, it got the name of royal cinchona. According to M. Vestrumb it came from Moxos, in the south part of America, and is named by the Spaniards *calisaya*. They prefer it to the gray cinchona of Peru; it is yellowish brown, fibrous, large, flat, and easily reduced into fine powder.

it still preserves its bitter taste. Mixed in this state with a solution of sulphate of lime, it turns it green as before; alone, the colour inclines more to yellow. It precipitates the emetic solution with this difference, that the precipitate is whiter.

Another portion of the infusion of the same cinchona, completely precipitated by the emetic and filtered, still rendered turbid the solutions of glue and of sulphate of iron, but much less abundantly than formerly. The precipitate formed by the emetic became slightly green by the addition of some drops of sulphate of iron.

It would seem, according to these experiments, that the principle which precipitates emetic, glue, and sulphate of iron, is the same; and that, if the liquor still preserves the property of precipitating glue and sulphate of iron, it is because it retains some portions of the combination of this principle with antimony. This supposition, however, cannot be reconciled with the very abundant precipitation of glue by certain cinchonas, which by no means precipitate emetic. It therefore follows, that the principle which precipitates glue may be different from that which decomposes emetic.

Such are the phænomena which the infusion of yellow cinchona presented to me with the above re-agents.

I was desirous of ascertaining if this same cinchona, already exhausted by cold water, would present, by boiling it, any differences with the same substances. But I found an almost perfect analogy in this respect; its decoction was turbid upon cooling, and the precipitates which it furnished with the re-agents were more abundant, and were more promptly separated from the liquor.

I shall add, that this decoction precipitates, like the infusion, the solution of sulphate of copper in reddish yellow, and that of the acetate of lead in yellowish white.

Second Species.—*Cinchona of Santa-Fé.*

This species of cinchona, newly introduced into commerce, has been tried, with respect to its febrifuge effects,
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by several excellent physicians, who have obtained from it the happiest results.

It is gray externally, red within, thick, little rolled, having an astringent and slightly bitter taste. Its infusion has a much redder colour than that of yellow cinchona. Subjected to the same experiments with the above infusion, it presented the following effects :

It precipitated the solution of glue in reddish flakes ; the infusion of yellow cinchona, in very abundant red ones : this last effect, which as far as I know has not been announced by any person, is worthy of remark.

It produced no change in the emetic solution : this establishes a difference between this and the yellow bark, which, as we have seen above, precipitates very abundantly this metallic salt.

It precipitates the solution of sulphate of iron in a fine deep green ; sensibly reddens tincture of turnsole ; is precipitated by oxalate of ammonia in oxalate of lime, but much less abundantly than the infusion of yellow cinchona.

It precipitates acetate of lead and sulphate of copper in reddish brown.

On comparing the phænomena produced by the cinchona of Santa Fè with those of the yellow bark, we find among them some analogies and several differences. They both precipitate a solution of glue ; but the infusion of the yellow cinchona precipitates emetic, and that of the cinchona of Santa-Fè does not precipitate it : from this it may be concluded, that, both of them precipitating the other metallic solutions, the principle which precipitates copper, iron, lead, &c. is not the same as that which precipitates the emetic ; and that, consequently, the yellow cinchona contains a substance which is not to be found in the Santa-Fè bark.

It is evident besides, that, if these infusions were perfectly similar, no turbidness would follow their reciprocal mixture : there are therefore in each of these infusions different substances, which by combining become insoluble.

Decoction of Santa-Fè Cinchona.

This decoction produced the same effects with the reagents

agents as its infusion; but the latter differs from the decoction of yellow cinchona in not becoming turbid during cooling: thus the Santa-Fè bark not only does not contain the matter which precipitates emetic, but is also deficient in the quantity of the principle which precipitates the other metallic solutions; for I am assured that the deposit formed in the decoction of cinchona, upon cooling, is the substance which in this species precipitates iron green, lead yellow, copper brown, &c.; and that it has no action upon emetic. Thence we may presume, at least, that it would be necessary to employ in intermittent fevers a greater quantity of this than of the yellow bark.

Third Species.—*Gray Cinchona, called Superior Cinchona.*

The infusion of this kind of bark is almost colourless; its taste is bitter and astringent.

It precipitates very abundantly the solution of glue white; the infusion of tan red; the solution of emetic white, and very abundant; sulphate of iron a very fine emerald green: it produces no change in the infusion of yellow cinchona.

Fourth Species.—*Gray Cinnamon Cinchona.*

The infusion of this bark has a deep red colour, a bitter and astringent taste.

In solution of glue it yields a fawn-coloured precipitate, and communicates a green colour to solution of sulphate of iron, but does not precipitate the emetic solution like the gray and yellow cinchona. It occasions no change in the infusion of superior gray cinchona.

This species differs, therefore, from the yellow and superior gray cinchona, in so far as it does not seem to contain that principle which precipitates the emetic; and in this respect it resembles that of Santa-Fè.

The infusion of this bark yields a very abundant fawn-coloured brown precipitate in an infusion of yellow cinchona, and does not precipitate the infusion of tan.

These vegetable infusions, precipitated the one by the other as completely as it is possible, have no effect upon emetic; whence it follows, that the principle which in the yellow

low bark precipitates the emetic, is combined with a certain substance found in the gray cinnamon cinchona and in tan : but these infusions, thus mutually precipitated, still precipitate abundantly the solution of glue ; whence again it follows, that the principle which in these two cinchonas precipitates glue is not the same as that which decomposes the emetic : what confirms this opinion is, that the infusion of the yellow cinchona, precipitated as completely as possible by glue, and afterwards filtered, still precipitates the emetic, —a little less abundantly, however.

We cannot attribute the precipitation of the emetic to the excess of glue, for this animal substance causes no change whatever in emetic.

The precipitate which is formed by the infusions of the yellow and gray cinnamon cinchonas, mixed together, is brown ; it dries easily, bubbles up by heat, exhales a smoke which has no pungency, and which has some analogy with that of animal matters : it leaves a spongy and light charcoal.

Sixth Species.—*Gray Cinchona* *.

It was in very slender and rolled barks, and must have been taken from the branches, or from very young trees. It would seem to be of the species of the *loxa cinchona*, which will be described in the course of this memoir.

The infusion of this species had a red colour like Malaga wine, and an astringent and bitter taste : it precipitated abundantly glue in white ; infusion of tan in reddish yellow ; infusion of yellow cinchona in gray ; emetic in flakes of yellowish white ; sulphate of iron in green ; and acetate of lead in white. It did not precipitate sulphate of copper nor an infusion of Santa-Fè cinchona. This bark possesses the febrifuge property in a very high degree.

Seventh Species.—*Flat Gray Cinchona* †.

The infusion of this species of bark has a red colour like

* This species was transmitted to me by M. Bouillon-Lagrange.

† This seems to be the white cinchona of Santa-Fè, brought by M. Humboldt, which will be afterwards described.

Malaga wine, a fetid taste, without astringency or bitterness.

It precipitates abundantly the infusion of yellow cinchona in brown flakes ; it gives to the solution of red sulphate of iron a fine green colour, and produces therein, some moments afterwards, a precipitate of the same colour.

Emetic, glue, cinnamon cinchona, experience no change by the infusion of this bark.

These phænomena seem to announce that this bark is not a true cinchona, or, if it does belong to this class of vegetables, that it has none of their chemical properties : from this we may presume that it does not possess the same medicinal virtues, because it has neither the bitterness nor the astringency proper to all cinchonas in a greater or less degree : if we add to this, that it does not precipitate either glue, emetic, or infusion of tan, properties which belong to the best species of cinchona, we may be almost certain that it is not a febrifuge.

Eighth Species.—Yellow Cinchona. (Cinchona pubescens of Walh.)*

100 grammes of this cinchona in fine powder, macerated for 24 hours in distilled water, yielded a transparent liquor of a golden-yellow colour, very bitter, and becoming frothy on agitation. Tried by the re-agents, this liquor presented the following effects :

Gallated alcohol formed an abundant precipitate, which an excess of this alcohol redissolved, and which the addition of water reproduced : this proves that it is not a purely animal matter which the tannin separates from it.

It precipitates the solutions of emetic and of nitrate of mercury in yellowish-white, and causes a solution of sulphate of iron to assume a very decided green colour, without precipitating any thing from it.

Solution of size effects no change on it : it does not redden turnsole tincture. During the evaporation, this li-

* The physical description of this cinchona has been made by Walh and other medical botanists.

quor deposited a red substance upon the sides of the pan : when reduced to the consistence of a syrup, it still deposited, upon cooling, a new quantity of matter of a chestnut-brown colour. The filtered liquor was still coloured, and contained the salt proper to cinchonas, which we shall presently describe.

This brown substance, washed with a small quantity of cold water, is completely soluble in warm water and in alcohol ; it is very little soluble in cold water ; its taste is very bitter.

In the aqueous solution of this deposit, gall-nuts form an abundant precipitate. Emetic and nitrate of mercury produced the same effects in it as in the infusion. The sulphate of iron is turned green by it. The oxymuriatic acid loses its smell, and soon forms a flaky precipitate with the solution of this substance.

Glue produces no more effect than in the infusion : the sulphuric and acetic acids cause no change in it. Diluted with caustic potash, it does not exhale any ammoniacal smell.

225 grammes of this substance dry, submitted to distillation, yielded plenty of water, a sensible quantity of ammonia, and a purple oil, which loses this colour on being dissolved in alcohol, but which resumes it in proportion as its solvent, when exposed to the air, is dissipated.

It left in the retort 11 decigrammes of charcoal, which on combustion yielded a decigramme of ashes soluble with effervescence in the muriatic acid, and the solution of which furnished lime and iron.

It is evident, from what has been stated, that it is this bitter coloured substance, which, in the maceration of the species of cinchona now under consideration, produces with the re-agents all the phænomena we have remarked above. This substance seems to hold the middle place, by its nature and properties, between vegetable and animal substances. It is probably the substance which is the efficacious principle in the cure of intermittent fevers. The liquor separated from this substance was treated by alcohol, which took up the colouring part, and it was nothing else than a portion of the

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the same matter retained by water. The portion not soluble in the alcohol was of the consistence of thick mucilage, and had no longer any taste or colour; it was abundantly dissolved in water, and its solution yielded, on spontaneous evaporation, lamellous crystals slightly coloured with a salt, which we shall afterwards describe.

The seventh maceration of the same quantity of cinchona still precipitating with gall-nuts, it was thought that cold water had not dissolved the whole of the principle which produced this effect: the refuse of this cinchona was therefore boiled, and we obtained a liquor which presented all the characters of the infusion, except that it did not precipitate the emetic solution; probably because it was too much diluted with water.

This species of cinchona, therefore, is not the same as that which has been examined above under the same name.

Ninth Species.—*Cinchona officinalis*.

Eighty-four grammes of this bark, treated like the *cinchona pubescens*, yielded a liquor less coloured and more mucilaginous than the latter, although equally bitter. This infusion slightly reddened the tincture of turnsol; tried by the re-agents it presented phænomena similar to those of *cinchona pubescens*.

All the waters of maceration, when evaporated, furnished a deposit, the properties of which were so confounded with that obtained from the *cinchona pubescens* that it was thought they might be mixed together; but the liquor floating above, containing the essential salt of cinchonas, was submitted separately to evaporation and to the spontaneous crystallization: after having separated from it the colouring matter by means of alcohol, it furnished crystals after a few days. Here, therefore, are two species of cinchona which do not precipitate glue, and which, consequently, are deprived of the principle to which this effect is owing in other kinds; according to M. Seguin, they would be ranked among the best kinds.

After several washings in cold water, the last washings always precipitating by gall-nuts, the husks were treated by
warm

warm water, which acquired a deep enough colour; it was less bitter than the water of maceration, and it was still more mucilaginous than the decoction of *cinchona pubescens*.

It precipitated gall-nuts and nitrate of mercury, and greened the sulphate of iron; but neither emetic nor glue produced any change upon it. This species, therefore, is not the same as that which has been above examined under the name of *gray cinchona*, called *superior*.

Tenth Species.—*Cinchona magnifolia*.

100 grammes of this bark, reduced into a fine powder, and macerated for 24 hours, yielded a solution which passed through the filter with difficulty; it was of a ruby red, little mucilaginous, of a slight bitterness, and a very decided astringency.

The tincture of turnssole was not reddened by this solution; neither gall-nuts nor emetic formed any precipitate in it; the solution of glue precipitated it abundantly; the sulphate of iron made it assume the green colour of oxide of chrome, which the oxymuriatic acid turned into a dirty green.

It also precipitated the maceration of *cinchona pubescens* and of *cinchona officinalis*.

It is necessary to remark, that the second washing of this cinchona, made with cold water, did not precipitate glue.

The macerated aqueous extracts of this cinchona, evaporated to the consistence of extract, while still hot were treated with alcohol, which acquired a very fine colour. This alcoholic solution, diluted with water, and tried by the reagents which had been made use of for the first macerated extracts, presented the same results. Thus the matter which produced the effects above announced is soluble in alcohol.

The part not soluble in alcohol was of an ochre red, which was blackened by the air; it was redissolved in water; its solution would neither precipitate glue nor gall-nuts, but it precipitated emetic and nitrate of mercury, and turned sulphate of iron green.

Ten grammes of this substance, insoluble in alcohol, being distilled,

distilled, yielded ammonia, and a charcoal weighing 41 centigrammes.

Tenth Species.—*Cinchona which was sold to me without any Name* *.

100 grammes of this bark, macerated for 24 hours, gave a less deep colour to water than the *cinchona magnifolia*; but it was more bitter and less astringent. It reddened perceptibly the tincture of turnsole; it neither precipitated the emetic nor gall-nuts; but it precipitated glue, and nitrate of mercury, and greened the sulphate of iron.

In general, this species presented all the characters of the *cinchona magnifolia*, and ought to be ranked in the same class.

The decoction of the husks of this cinchona presented no difference on maceration, nor did it precipitate emetic.

Eleventh Species.—*True Pitton Cinchona*.

This species of bark, which was given me by M. Solomè, apothecary at Paris, has a good deal of resemblance, in colour and bitterness of taste, to the cinchona of St. Domingo, which M. Fourcroy analysed about fifteen years ago.

100 grammes of this cinchona, treated like the other species, communicated to water a blood red colour. Its taste was more bitter and disagreeable than that of the others. Gallated alcohol, emetic, nitrate of mercury, and sulphate of iron, produced abundant precipitates with this solution; glue produced no change in it. The oxymuriatic acid precipitated it, which no other acid effected.

The infusion evaporated left a residue which was partly dissolved in alcohol, and communicated to it a fine red colour. The portion insoluble in alcohol had a gray colour and an earthy appearance: that which was dissolved presented the same phenomena as the infusion from which it was produced. This substance yielded ammonia upon distillation.

* It had all the characters of the *cinchona magnifolia*.

Cinchonas brought to Europe by Messrs. Humboldt and Bonpland.

Twelfth Species.—*Cinchona of Loxa, coming from Branches of two Years of Age, and made use of in the Laboratory of the King of Spain.*

It is gray externally, yellowish within, very thin, rolled up, and has a bitter and astringent taste.

Eight grammes of this bark, infused in 150 grammes of water for 24 hours, at the temperature of 15° (60° Fahr.), yielded a reddish yellow slight-coloured liquid, having a slight musty smell and a bitter taste: it precipitated gall-nuts, emetic, and acetate of lead, in yellowish-white; iron in blueish-green; oxalate of ammonia, white; and glue in large glutinous white flakes. The precipitates formed by glue and by emetic are redissolved in an excess of warm infusion.

According to these properties, this cinchona ought to be accounted an excellent febrifuge.

Thirteenth Species.—*White Cinchona of Santa-Fè.*

This bark has a yellow colour, rusty externally, deeper internally: it is flat and thick; its fracture resembles that of beech bark; its taste is neither bitter nor astringent, like that of other cinchonas.

Eight grammes, infused for 24 hours in 150 grammes of water, gave a deeper yellow colour than the cinchona of Loxa: this infusion does not precipitate gall-nuts, emetic, nor glue: it turns solution of iron green, and precipitates the acetate of lead in brownish yellow. According to these properties, this is not a true cinchona.

Fourteenth Species.—*Orange Cinchona of Santa-Fè.*

This species, which was brought to Europe by Messrs. Humboldt and Bonpland, has a yellow colour like cinnamon: as this bark has no epidermis, it is thick, and its fracture extremely fibrous; the thinnest pieces are rolled up within each other; the thickest are flat, and it is by no means astringent; its infusion, made as above directed, is almost colourless; its taste is decidedly bitter; it gives in

tannin and emetic an abundant white precipitate, but no precipitate in glue, and a slightly green colour with iron ; it does not make the infusion of *Loxa cinchona* turbid. This differs from the *Loxa cinchona*, and, it would seem, does not possess the properties of a febrifuge in any remarkable degree.

Fifteenth Species.—*Common Cinchona of Peru.*

This species is gray externally, of an ochre red internally, and its surface is wrinkled ; it is rolled, and of various thickness ; its taste is bitter and astringent.

Eight grammes, infused for 24 hours in 150 grammes of water, communicated a slight yellow colour to it, and a bitter and astringent taste. This infusion precipitates emetic, glue, and tannin, in yellowish-white, and sulphate of iron in green. It reddens turnsole paper.

This species of cinchona seems to be the same as the gray cinchona called *superior*. According to the properties it presented to me, it ought to be excellent for fevers.

Sixteenth Species.—*Red Cinchona of Santa-Fè.*

It did not seem to differ perceptibly from that which we described above by the name of Santa-Fè cinchona.

Eight grammes of this cinchona, infused like the preceding, gave to the water a red colour like Malaga wine, and a taste not very bitter, but astringent. It precipitates glue in brown, but neither emetic nor tannin ; it greens the sulphate of iron, and reddens slightly turnsole paper. These chemical properties agree with those of the Santa-Fè cinchona above described.

Seventeenth Species.—*Yellow Cinchona of Cuença ; Branches of four or six Years of Age*.*

This cinchona is gray externally, covered with a white moss, yellowish-brown internally, having a fibrous fracture and hardly any taste ; its maceration is neither bitter nor astringent ; precipitates neither emetic, glue, nor tannin ; it merely greens sulphate of iron, and precipitates acetate of lead. This cinchona does not seem to have any febrifuge virtue.

* It seemed to have been adulterated.

Table of the Effects produced by the Cinchonas brought by Messrs. Humboldt and Bonpland, with the Re-agents marked against them.

Species.	Glue.	Tannin.	Iron.	Emetic.	Observations.
1. Common gray cinchona of Peru.	Abundant precipitate.	Ditto.	Green colour.	Abundant precipitate.	Taste bitter and astringent, and it reddens turnsole.
2. Red cinchona of Santa-Fè.	Abundant precipitate.	0	Green colour.	0	Colour red, like Malaga wine; taste not very bitter, but astringent.
3. Yellow cinchona of Cuença.	0	0	Green.	0	It is neither bitter nor astringent; it precipitates acetate of lead.
4. Loxa cinchona, Royal Spanish.	Abundant precipitate.	0	Green.	Abundant precipitate.	Colour reddish, a little deep; a bitter mouldy smell.
5. White cinchona of Santa-Fè.	0	0	Green.	0	Deep yellow colour, neither bitter nor astringent; it precipitates acetate of lead.
6. Yellow cinchona of Santa-Fè.	0	Abundant precipitate.	Green.	Abundant precipitate.	Very decided bitter taste; little astringency; liquor very little coloured.

In order to acquire some more light upon the nature of the principles of the cinchonas, I examined comparatively several other vegetable substances which seemed to have analogies with them, and the composition of which is a little less known; such as gall-nuts, oak bark, the angustura, and some others.

Gall-Nuts.—The infusion of this substance gave in a solution of glue an abundant white precipitate; with iron, a blue; with emetic, a yellowish-white precipitate; with infusion of yellow cinchona, dirty white flakes; with copper, yellowish-brown; and with lead, a yellowish-white precipitate.

It did not precipitate the infusion of Santa-Fè cinchona, nor the infusion of tan.

The infusion of gall-nuts, therefore, comprehends, like

the yellow cinchona, the principle which precipitates glue along with that which precipitates emetic; and in this respect these two substances resemble each other: but they differ in respect of the bodies which act upon tan and upon iron, since this metal is precipitated green by cinchona, and blue by gall-nuts; they also differ in another respect, as they mutually precipitate each other.

Tan Bark.—The infusion of this substance, made as carefully and with the same quantity of water as cinchona, gives in the solution of glue a yellow precipitate; with iron, a blue; with copper, a brown precipitate: but it did not cause any change in the solution of Santa-Fè cinchona, nor in the emetic solution: it reddens the tincture of turnsole, and is precipitated by the oxalate of ammonia.

We see by this that oak bark does not contain, like gall-nuts, yellow cinchona, and some others, that substance which precipitates emetic; and that, although both of them precipitate glue, yet they differ in this respect.

Bark of the Cherry Tree.—This bark, which has been sometimes fraudulently substituted for cinchona, has nothing in common with the latter, except the property of giving a green precipitate with a solution of sulphate of iron. It produces no change upon glue, emetic, nor decoction of tan. It is therefore very doubtful if the cherry tree bark possesses any febrifuge property.

Centaurium and Chamædrys.—These two plants furnished the same results as the cherry tree bark, and it is equally doubtful if they can cure fevers.

Bark of the White Willow.—This bark, to which febrifuge virtues were formerly attributed, certainly possesses some of the chemical properties of some species of cinchonas; it precipitates glue, sulphate of iron green, and the acetate of copper brown. Thus, as it unites bitterness and astringency, it may be a febrifuge.

Angustura.—The infusion of this bark does not precipitate glue; but it precipitates abundantly the infusion of gall-nuts and infusion of yellow cinchona, but not at all that of Santa-Fè cinchona; it only produces a slight turbidness in it.

It

It precipitates iron, emetic, copper, lead, and infusion of tan, all in yellow.

This bark differs, as we see, from several cinchonas and other substances examined by comparison, in so far as it does not precipitate animal gelatine: it has no astringent taste, and yet it has an extremely bitter one. There is reason to believe that the principle which in this substance precipitates the metallic solutions is not entirely similar to that of the cinchonas, at least the colour of the precipitates which it furnishes is very different. Nevertheless, according to these properties, the bark of the angustura may be a very good febrifuge.

[To be continued.]

VI. *On the Culture of Turnips by the Drill and by the Broad-cast Method, showing the Superiority of the former.* By CHARLES LAYTON, Esq., of Reedham Hall, Norfolk *.

SIR,
I BEG leave to send you an account of an experiment on the comparative culture of turnips; and have the honour to be

Your very humble servant,

CHARLES LAYTON.

To Dr. C. Taylor,
Secretary to the Society of Arts, &c.

Being desirous of ascertaining, by experiment, the best mode of cultivating turnips, I prepared, in 1805, 20 statute acres of land well calculated for such trial. The whole spot was level, and the soil similar in every part. By manuring it equally with ten cart loads per acre of rotten farm-yard dung, after it had been properly summer tilled, it was fit, by the 24th of June, for the reception of the seed. In order

* From *Transactions of the Society of Arts, &c.* vol. xxiv.—The silver medal of the Society was granted to Mr. Layton for this communication.