Chemistry. — *"On the presence of quinine in the seed of Cinchona Ledgeriana Moens."* By P. VAN LEERSUM.

According to the description by MOENS[1]) the seeds of the genus *Cinchona* are compressed, flat, with an elongated kernel, which is completely surrounded by a membranous wing, having a toothed edge. The embryo lies in the axis of a fleshy albumen; the cotyledons are entire and egg-shaped.

The seeds vary in size and shape according to the species. Thus for instance those of *C. officinalis* are 4—7 m.m. long and 2—4 m.m. broad, those of *C. Ledgeriana* measure $4^1/_2$ m.m. by 1 m.m., those of *C. succirubra* 7—10 m.m. by 2—3 m.m.

A kilogramme of the seed of *C. officinalis* consists of 1400000 seeds, for *C. succirubra* and *C. Ledgeriana* the corresponding figures are 9000000 and 3500000.

With due precautions, *Cinchona* seeds can be preserved for from 6 to 7 months without loss of germinating power. For this they should be perfectly ripe; they should be dried in the wind and completely freed from adherent portions of the capsule and funicle and then placed in an air-tight tin box or in a bottle with ground stopper.

The batch of seed which has contributed most to directing attention to the Cinchona plantations of Java is that which was bought from GEORGE LEDGER of London in 1865. G. LEDGER had obtained this seed from his brother CHARLES LEDGER, who in his turn received it from his servant MANUEL INCRA MAMANI, an Indian native of the Jungas of Bolivia.

Little is known about the chemistry of *Cinchona* seed. According to MOENS it would contain no alkaloid, but on the other hand he states that there is fat, to the extent of 6.13 % in the seed of *C. Ledgeriana*, 13.3 % in that of *C. officinalis* and 9.50 % in that of *C. succirubra*.

In the Annual Report of the Government Cinchona culture for 1905 I have already stated that there are alkaloids in the seed, and not only the so called amorphous alkaloid, but also cinchonine.

In order to investigate how and under what conditions the chief alkaloid i.e. quinine, is formed in *Cinchona*, it is necessary to know first whether the seed itself contains quinine.

My previous investigations of the seed had already pointed to this being the case, but there was no certainty. I found that the

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[1]) De Kinacultuur in Azië.

sulphuric acid solution of the alkaloids from 50 grammes of seed was fluorescent, but only so slightly, that error was not completely excluded. Moreover quinidine also fluoresces in sulphuric acid solution.

In order to obtain certainty a kilogramme of Ledgeriana seed was powdered and sieved (B 40). In quantities of 20 grm. the powder was mixed with 5 grm. of calcium hydroxide and then 6.5 grm. of 5 % sodium hydroxide and 9.5 grm. of water were added and the mixture was stirred for about 2 hours until a suitable granular mass was obtained. This mass was extracted with benzene in a Soxhlet apparatus.

After distilling off the benzene there remained in the flask, in addition to the alkaloids and other impurities, so much of an oily liquid that it was impossible to estimate the alkaloids directly in the residue.

It was found necessary first to free the seed from the oil contained in it before an accurate estimation of the alkaloidal content could be undertaken.

A preliminary experiment showed that petroleum ether is most suitable for this purpose, since it dissolves the oil, but not the alkaloids.

The finely powdered seed was first completely extracted with petroleum ether; the mass was dried, powdered again and sieved.

Of this powder quantities of 20 gr. were thoroughly mixed with slaked lime, caustic soda, and water and the mass was then extracted with benzene as described above.

After extraction and before distilling off the benzene, 10 c.c. of $^{N}/_{20}$ hydrochloric acid were added. In this way I finally obtained an almost colourless solution of the hydrochlorides of the alkaloids. After filtering through cottonwool and washing, a drop of a 0.5 % solution of methylred in alcohol was added, the liquid was heated on a waterbath and then titrated back with $^{N}/_{20}$ sodium hydroxide.

The average result of a few dozen fairly concordant analyses was 0.380 % of total alkaloid, calculated for seed containing fat, but no water. These titrated neutral solutions were mixed and evaporated to about 50 c.c., after adding a further small quantity of $^{N}/_{20}$ sodium hydroxide, so that the liquid was slightly alkaline.

After cooling, the liquid was freed from suspended impurities by filtration into a separating funnel. It was then washed, and after it had been made strongly alkaline, it was extracted several times with ether.

The ethereal solution containing all the alkaloid from a kilogramme of seed, was evaporated to dryness, and the residue was dissolved

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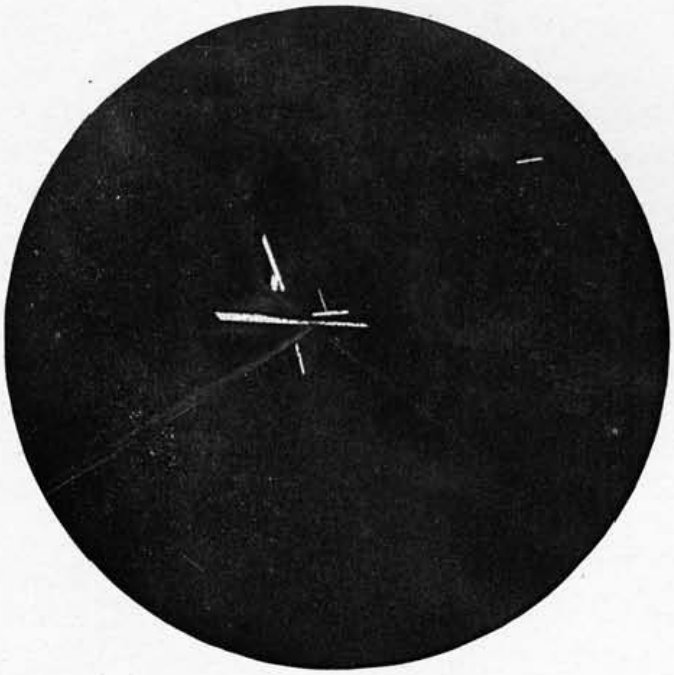

Fig. 1.

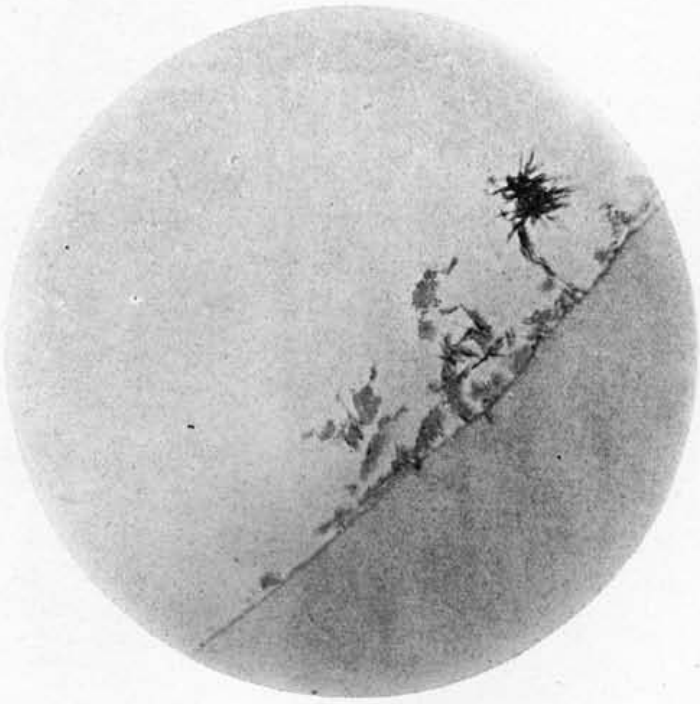

Fig. 2.

in the minimum quantity of water, acidulated with sulphuric acid. This acid alkaloidal solution was washed repeatedly with ether until the latter removed no more colouring matter. The solution was then rendered alkaline and again shaken with ether; the ethereal solution was separated and evaporated to dryness and the residue was again treated in the way described above, in order to obtain the alkaloid finally in as pure a condition as possible.

This dry alkaloid, which had been purified several times, was now dissolved in water containing a trace of hydrochloric acid, and the faintly acid solution was evaporated to dryness in a dessiccator; the residue was dissolved in a few drops of water, and after filtration the solution was placed on a microscope slide.

A platinum wire which had been moistened with a solution of sodium tartrate, was placed in the previously warmed solution and the latter was allowed to cool slowly under a double watchglass.

After some time needles separated (fig. 1).

These needles could be: quinine tartrate, cinchonidine tartrate or a mixture of the two.

In order to determine whether we were indeed concerned with quinine, the needles were washed a few times very carefully with a little water, so that they remained on the slide.

Then a trace of dilute sulphuric acid was added and a little of a mixture of equal parts of alcohol, of water, and of acetic acid coloured pale yellow by means of a potassium triiodide solution. After a short time there appeared at the edges of the preparation the very fine dichroïtic leaflets of HI iodine-quinine sulphate (fig. 2), a reaction which is so characteristic of quinine, that the presence of this alkaloid in the seed of *C. ledgeriana* can no longer be doubted.

Finally I may add that the seed investigated contained 18.6 % of a pale greenish yellow oil, having a specific gravity of 0.930 at 18° and a rotation of —26° at 20° C. in a tube of 20 c.m.

Physics. — "*The red lithium line and the spectroscopic determination of atomic weights.*" By Prof. P. ZEEMAN.

In a former communication I showed that the red lithium line 6708 is a close doublet. The distance between the components was found by a rough measurement to be of the order of a quarter Ångström. I now have been able to photograph the mentioned line in the second order spectrum of a large ROWLAND grating. Using an iron-arc spectrum in the third order violet, coinciding with the