THE ANALYSIS OF DATURA STRAMONIUM LINNÉ.

L. E. SAYRE AND H. V. CADWELL, UNIVERSITY OF KANSAS.

The sudden cessation of foreign chemical manufacture and importation from European countries, notably Germany, has caused considerable discomforture in American chemical and pharmaceutical circles, since many of the common drugs used so generally here are manufactured abroad. A conspicuous example of the rapid rise in price of these drugs was cited in the Public Health Reports.[1] Thymol increased from $2.00 a pound to $15.00 a pound in three months. Many of these drugs are found in great abundance in the common weeds of this country.[2] The European monopoly of the drug trade has existed chiefly on account of the better established factories there, but since the prices have advanced to the present figure, the American manufacturer can well afford to equip his factory to handle the drug trade of this country.

It was with the idea of utilizing the American stramonium for the commercial production of the valuable narcotics of the belladonna series that this analysis was undertaken.

The Datura Stramonium L, commonly called "Jimson Weed," it is well known, grows profusely throughout the United States, Europe and Asia. It has a varying alkaloid-content when uncultivated, which has been found to range between 0.13 percent[3] and 0.62 percent[4], with a general average of about 0.30 percent. With cultivation the alkaloid-content is increased to a considerable degree, Miller and Meader[5] finding an alkaloid-content of from 0.46 percent to 0.55 percent in plants raised in Indianapolis with cultivation.

The sample of leaves for this analysis was gathered from a hog lot at Fox, Kendall County, Illinois, just after the period of the full flower. After drying in an attic they were ground to pass a 100-mesh sieve. The analysis was made according to a modification[6] of Dragendorff's method of plant analysis, such that the first principal steps could be carried out in a Soxhlette extractor and the succeeding determinations could be made on the one sample.

Moisture.—Samples of from 2 to 3 grammes were dried in a Soxhlette drying oven for six hours at 100° C. The oven was equipped so that a rapid current of air was passing through it all through the interval.

Ash.—The ash determinations were run on samples of about two grammes at as low a heat as possible, finishing the oxidation with the addition of a little ammonium nitrate. The ash was then extracted with water and later with dilute hydrochloric acid.

Nitrogen.—The nitrogen was determined by the well-known Gunning modification of the Kjeldahl method, the albuminoids being calculated by the use of the factor 6.33.

Chloroform-Soluble Constituents.—About five grammes of the finely powdered leaves were placed in a Soxhlett extractor, having all glass connections, and extracted for eight hours with pure chloroform. This procedure brought into solution the alkaloids, glucosides, organic acids, chlorophyll, resins, fats, waxes, camphors, fixed oils and volatile oils.

The volatile oils were determined by evaporating the extract to dryness at the lowest possible temperature, then adding about 10 cc. of water and evaporating at 100° C. The difference in weight gives the amount of volatile oils.

The fixed oils were extracted with petroleum ether and determined directly.

The alkaloids, glucosides and organic acids were then extracted with water and determined directly. Qualitative tests for alkaloid with Mayer's reagent gave a pronounced reaction and for glucoside with Fehling's solution only a slight reaction after prolonged boiling with acidulated water.

Camphors, resins and chlorophyll were determined directly by extracting with 80 percent alcohol.

A residue remained, consisting of a green, gummy mass having a strong herbaceous odor.

Constituents Soluble in 80 Percent Alcohol.—The residue from the chloroform extraction was again extracted in the Soxhlett extractor with 80 percent alcohol for eight hours. The extract was then dried and extracted with water and the water extract divided into three portions. One portion was precipitated with copper acetate, another with neutral lead acetate and the third with basic lead acetate. The copper acetate precipitate consisted largely of tannic acid, the neutral lead acetate of tannic acid and some coloring matter and the basic lead acetate of the coloring matter.

Constituents Soluble in Water.—The residue from the alcoholic extraction was macerated in cold water for two days. This procedure brought the gums and pectin bodies into solution.

Constituents Soluble in Dilute Acid.—The residue from the water extraction was boiled for two hours with a 10 percent solution of hydrochloric acid which brought the starches and some albuminoid matter into solution. The extract was neutralized with potassium hydroxide, which precipitated some of the albuminoid matter. The remainder of the solution was boiled with Fehling's solution to determine the percentage of starch through the reducing sugars.

Soluble in Dilute Alkali.—The residue from the acid extraction was boiled for two hours with a two percent potassium hydroxide solution. This solution contained albuminous matter, humus and pectic acid. Hydrochloric acid precipitated a considerable amount of this matter.

Crude Fiber.—The residue from the alkali treatment was oxidized with bromine water and ammonia to remove the insoluble coloring materials from the cellulose.

Cellulose.—The residue from the crude fiber treatment consisted of cellulose and what mineral matter that had escaped extraction in the previous processes. The amount of cellulose was then determined by burning the residue from the mineral matter. The ash left was called the residual ash in the analysis.

The resulting analysis of stramonium was:

Moisture		7.37%
Chloroform soluble		9.71%
Soluble in 80 percent alcohol		17.29%
Soluble in water		9.37%
Soluble in dilute acid		34.24%
Soluble in dilute alkali		15.84%
Crude fiber extract		.54%
Cellulose		4.64%
Residual ash		1.00%
Total		100.00%
Total ash		17.02%
Water soluble ash	58.60%	
Soluble in hydrochloric acid	31.89%	
Residue	9.51%	
Total	100.00%	
Nitrogen as albuminoid matter		6.33%
Alkaloid assay		.28%

Constituents of the chloroform soluble material:

Volatile oils	20.30%
Fixed oils	15.30%
Alkaloids, glucosides and organic acids	25.00%
Camphor, resin and chlorophyll	12.00%
Residue	27.40%
Total	100.00%

Constituents of the 80 percent alcohol portion:

Tannic acids ppt. by copper acetate	18.58%
Tannins ppt. by neutral lead acetate	7.40%
Coloring matter ppt. by basic lead acetate	33.75%
Material not examined	40.28%
Total	100.00%

Constituents of the dilute acid extracts:

Precipitated by KOH	21.75%
Starch	1.45%
Not examined	76.80%
Total	100.00%

Constituents of the dilute alkali extracts:

Precipitated by acid	28.43%
Not precipitated by acid	71.72%
Total	100.00%

REFERENCES.

[1] Public Health Reports, Vol. 29, No. 41. The Source and Supply of Medicines. By Martin I. Wilbert.
[2] Farmers' Bulletin No. 188, U. S. Department of Agriculture.
[3] Vanderkleed: Proc. Penn. Pharm. Ass'n., 1908, 88.
[4] Vanderkleed: Proc. Penn. Pharm. Ass'n., 1907, 90.
[5] F. A. Miller and J. W. Meader: VIIIth Inter. Cong. App. Chem., Vol. XVI, 57.
[6] Sayre and Havenhill: Outline of Proximate Plant Analysis (in use at the University of Kansas).
[7] Dragendorff.