CHEMICAL STUDY OF TWO CHINESE DRUGS.*

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FANG FÊNG.

According to Stewart, "Chinese Materia Medica," fang fêng is obtained from *Siler divaricatum*, *Peucedanum rigidum* or *Peucedanum terebinthaceum*. It is found in most of the central and northern provinces. The stems are 2–3 feet high, the leaves are coriaceous and glabrous and the flowers are white and have five petals. Although all parts of the plant are used in medicine, the name chiefly refers to the root, which appears on the market in long, brownish yellow, irregularly branching pieces, often with some of the stem attached. It has a sweet, aromatic and mucilaginous taste.

The drug is given in all diseases due to damp and chill, in disorders of the circulation and in general debility, also to cure headache and dizziness attributed to chill. The name fang means "prevent" and fêng means "chill." It is also regarded as an efficient antidote in aconite poisoning.

The material employed in this investigation was bought in the open market. After being ground to a coarse powder, it was subjected to a proximate analysis by methods of the A. O. A. C. The results follow in per cent:

		II.	Average.
Volatile at 100° C.	11.81	11.86	11.84
Total ash	4.33	4.40	4.34
Reducing sugars	6.48	6.31	6.40
Sucrose by reduction	3.23	3.15	3.19
Pentosans	11.51	11.42	11.46
Starch by acid hydrolysis	2.27	2.16	2.21
Starch by diastase	1.71	1.50	1.60

Two samples of 10 Gm. each were introduced into Soxhlet extractors and submitted to selective action with several solvents for 18 hours each. The residues left after spontaneous evaporation of the solvents were dried to constant weight in a desiccator, then the volatile portion in the first two was estimated by heating again to constant weight at 110° C. The results follow in percentage of dried material:

	I.	II.	Average.
Petroleum ether, total	2.23	2.13	2.18
volatile	0.51	0.51	0.51
Ether, total	1.16	1.32	1.24
volatile	0.36	0.41	0.38
Alcohol	7.93	7.87	7.90
Water	13.23	14.31	13.77

Tannin.—The alcohol was evaporated from a fluidextract made according to Type A, U. S. P. X, and the residue was taken up with water and filtered. Portions of the yellowish brown solution were tested with neutral ferric chloride solution, with potassium ferricyanide and ammonia water and with lime water. Since none of the reagents gave a positive reaction, one can presume that tannins are absent.

Alkaloid.—A fluidextract was made from 50 Gm. of the drug, using as solvent

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an acidified mixture of alcohol and water (5:1). The filtered solution was made alkaline with ammonia and was extracted with ether-chloroform (2:1). The ethereal solution was then exhausted with normal sulphuric acid and this was treated with the following reagents: Scheibler's, Wagner's, Mayer's, Hager's, tannic acid T.S. and neutral tannin T.S. The first two gave slight precipitates which disappeared on standing, but the others gave none, indicating strongly that no alkaloid is present in the original drug.

Acids.—A mixture of 1 Gm. of the sample and 15 cc. of neutral alcohol was set aside for 24 hours and then filtered. The solution was titrated with tenth-normal sodium hydroxide using phenolphthalein as indicator. Calculated as acetic acid, the results were 1.77 and 1.85 per cent. An aqueous extraction in the same way gave 1.03 and 1.09 per cent. Tests of the distillate from the aqueous extraction showed that none of the acid is volatile. On the other hand, none of the water-soluble acid seemed to be withdrawn by ether. Silver sulphate gave only 0.13 per cent of precipitate, while silver nitrate was rapidly reduced in the cold to metallic silver. Attempts to precipitate the acid by calcium or barium were only partly successful, since the amount obtained was very small. The nature of the acid must remain for the time being undetermined.

Toxicity.—Several experiments were made on rats, using amounts of alcoholic and aqueous extracts equivalent to 1 Gm. of the drug per oral dose. In spite of this high amount, no abnormal symptoms could be observed during 12 hours after administration, and one is justified in assuming that the material is fairly safe.

Hsiung Ch'iung.

Much confusion in names seems to have occurred with this drug, since various parts of the plant and different varieties are given separate designations in Chinese materia medica. The root, which is the usual drug, is also called Ch'uan Hsiung, Hsiang Kuo and Hu Ch'iung. It is derived from *Conioselinum univittatum Turcz.* (*Cnidium officinale Makino*), an umbelliferous plant which is best cultivated. The active ingredient is a volatile oil which has been examined repeatedly and whose chief constituent seems to be a lactone. The roots are recommended for a great variety of ailments, such as colds, headaches, anemia, menorrhagia, retained placenta, sterility, pains and aches of all kinds, rheumatism, etc.

A sample of the roots bought in the open market was first subjected to proximate analysis, with the following results in percentage:

	I.	II.	Average.
Volatile at 100° C.	10.87	10.77	10.82
Total ash	3.05	2.98	3.01
Reducing sugars	None	..	..
Starch by acid hydrolysis	28.39	29.51	28.95
Protein (N × 6.25)	2.47	2.04	2.26
Ether extract	9.54	9.78	9.66
Crude fibre	4.80	4.57	4.68
Tannin	0.34	0.42	0.38

Qualitative tests for alkaloid, made as before, were negative. Results from selective extraction were as follows:

	I.	II.	Average.	
Petroleum ether, total	7.58	7.48	7.53	Yellow
volatile	0.75	0.55	0.65	
Ether, total	8.29	8.31	8.30	Yellow
volatile	1.16	1.28	1.22	
Alcohol	15.83	15.63	15.73	Brown
Water	16.43	16.43	16.43	Brown

The most interesting feature of the drug is the large amount of fixed oil which it contains. In order to examine this more closely an ether extraction was made of about 500 Gm. and the volatile oil was removed by distillation. The collected fat was then dried and its constants were determined. They are: specific gravity at 25° C., 0.94672; index of refraction at 25° C., 1.4821; acid number, 31.5 and 31.9 saponification number, 205.2 and 200.4; ester number, 171.1; unsaponifiable residue, 1.55 and 1.64; iodine number, 70.34 and 71.2; Reichert-Meissl number, 0.1; Polenski number, 0.25; solid acids, 10.78; liquid acids, 89.22; titer test, 24.3° C. Several drying experiments showed that the oil is only about 80 per cent as efficient as raw linseed oil.

The free fatty acids were isolated by saponification from 75 Gm. of the fat, giving about 70 Gm. of dried material, which had an index of refraction of 1.4781 at 25° C. This was submitted to distillation at 10-mm. pressure. The first portion, coming over at 50–60° C. was solid and gave a titer test of 56–57° C. From 60° to 117° only 0.5 Gm. distilled and then decomposition set in. The residue had an acetyl value of 11.42, indicating a high per cent of hydroxy acids.

Phytosterols.—During ether extraction there separated from the solution a white substance amounting to 0.6 per cent of the drug. From this ethyl acetate extracted an apparently pure substance melting at 182–183°, from the residue alcohol or chloroform withdrew one with a melting point of 207–207.5° and ether gave still a third material melting at 214.5°. Careful repurification did not seem to alter the melting temperatures, but mixtures of them gave much lower values. All of them gave reactions of the phytosterols but well-defined acetates could not be obtained; the white solids resulting gave indistinct melting points between 147° and 156° C. From the unsaponifiable residue there was obtained still a fourth phytosterol in the form of needles melting at 137° C. Lack of material prevented any further examination of these interesting materials.

SUMMARY.

Fang fêng contains no alkaloids or tannin and has no appreciable effect on rats even in high dosage. The chief constituents appear to be sugars, gums and free acids.

Hsiung Ch'iung contains chiefly fixed and volatile oils. The former is of the drying class and has a high content of hydroxy acids. From this drug were isolated several phytosterols.

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