DEPARTMENTAL NOTES

CHEMICAL NOTES No. 18 PYRETHRUM

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IN this note, the more important chemical aspects of pyrethrum are detailed. The results of analysis of Pyrethrin content of Ceylon flowers indicate that material of good quality could be produced at an elevation of nearly 6,000 ft. under dry south-west monsoon conditions.

Pyrethrum is the name given to three varieties of *Chrysanthemum cinerariaefolium*–natural order Compositae–whose flowers are recognised as having insecticidal properties. Like most discoveries this was found by chance. It was Anna Rosaver of Ragusa (Dubronik) who used pyrethrum flowers for decorative purposes and threw the faded bouquet in a corner of a room where insects were later found dead (1).

The active principles in pyrethrum flowers are termed " pyrethrins ". Spectrographic examinations indicate the presence of two pyrethrins only and these are called prethrin I and pyrethrin II—there is no other active constituent (2).

The pyrethrins are amongst the most potent insecticides particularly against flies and mosquitoes, but are harmless to man. For these reasons, pyrethrum extracts are largely used in antimalarial work in Ceylon. Consequent on the loss of supplies from Japan many attempts have been made at obtaining a substitute for the pyrethrins. These have resulted in the discovery of the synthetic insecticide, D. D. T or Gesarol, the active ingredient of which is 2·2 bis parachloro diphenyl 1·1·1 trichloroethane—also called dichloro–diphenyl–trichlorethane—which tends to rival pyrethrum. However, as pyrethrum could be grown rather easily in this country at elevations of about 6,000 ft. and because extracts of it are efficient at lower concentrations than D. D. T., it is likely to remain the foremost mosquitocide in Ceylon.

Pyrethrin I is the ester (organic salt) of the ketonic alchol pyrethrolene and chrysanthemum monocarboxylic acid (mol. wt. 330) while pyrethrin II is the ester of pyrethrolene and methyl chrysanthemum dicarboxylic acid—(mol. wt. 374) However, pyrethrin I, as might be expected, is more toxic than pyrethrin II, although in some cases the difference in toxicity is not very marked, *e.g.*, pyrethrin II has been shown to have a toxicity at least 77 per cent. of that of pyrethrin I on specially bred flies (3).

Both pyrethrins are rather soluble in chloroform, in petroleum ether of low boiling point and to a lesser extent in kerosene, in all which solvents they retain their toxicity for many months if stored with reasonable care. Powdered flower heads are less stable than whole dried material while solid

extracts being unstable lose their toxicity very rapidly on being exposed to sun-light and air. For these reasons it is necessary that pyrethrum flowers should be dried avoiding undue sunlight. The material should thereafter be preserved as whole flowers of moisture content not much above 10 per cent. Alternatively, an extract should be obtained and the best way of doing so is by repeated intermittent percolation with one of the solvents mentioned. If this is not possible, the dried flowers should be crushed and steeped in kerosene for 48 hours using 1 lb. of flowers to $\frac{1}{3}$ gallon of kerosene, which solvent is thereafter strained through fine cloth. The process is repeated twice and the extracts combined. The residual flowers before being discarded may be steeped again in about a gallon of kerosene, that could be used for subsequent extractions. The combined extract may be expected to contain not less than ·09 per cent, of total pyrethrins if obtained from flowers of reasonable quality. It would be as efficient as such preparations as pyrocide 20 mixtures. As little as 5·5 mls of it per room space of 1,000 cubic feet would normally be sufficient to produce a 100 per cent. kill of many types of insects.

A suitable spray for killing mosquitoes could be prepared as follows :—

10 gallons of kerosene-pyrethrum extract.
5 pints of liquid coconut oil potash soap (40 per cent. solid soap).
$4\frac{3}{8}$ gallons of water.

The emulsion, which is fairly stable, need only be given a shaking just before use.

Normally, sprays should have a minimum strength of about ·05 per cent. pyrethrins to be fairly effective but extracts of even lower concentration have sufficed in certain instances. Thus the Entomologist working with extracts equivalent to 5 per cent. flower heads, *i.e.*, approx. ·005 per cent. pyrethrins has obtained a 100 per cent. kill of aphids and with half that concentration the percentage mortality was between 80 per cent and 90 per cent.

Concentrated pyrethrum extracts contain 2 per cent. W/W of pyrethrins. It is necessary to dilute these before use—$3\frac{1}{2}$ ozs. being made up to one gallon with kerosene so that the final concentration is a little above ·04 per cent.

Since the beginning of this year a number of samples of pyrethrum flowers obtained from the Department pyrethrum station at Mahacudagala, where 50 acres have already been cultivated with seed from Kenya, has been analysed for pyrethrin content following the method employed at the Imperial Institute, London.

The results of examination are tabulated below :—

No.	Per Cent. Moisture.	Per Cent. Pyrethrin I.	Per Cent. Pyrethrin II.	Per Cent. Total Pyrethrins.
1	8·77	·487	·766	1·253
2	9·36	·446	·736	1·182
3	12·35	·622	·821	1·443
4	Air dried	·566	·864	1·430
5	9·90	·599	·657	1.256
6	10·37	·461	·782	1·243
7	7·04	·531	·779	1·310
Average	—	·530	·772	1·302

It will be seen that the average percentage for all these determinations is 1·30 total pyrethrins—the values ranging from 1·18 per cent. to 1·44 per cent.

This average figure is very much higher than that for Japanese flowers and it is also definitely better than that for Assam (1·13 per cent.) and Kasmir and Punjab samples (about ·96 per cent.) (4) but somewhat lower than for grade I Kenya pyrethrum. It has, however to be mentioned that the flowers examined were from young unselected plants and, therefore by means of selection, the prospects of producing flowers of exceptional quality appear to be bright.

REFERENCES

(1) Journal of Economic Entomology, Vol. XXXVI. April, 1943, p. 320.
(2) Chemical Abstracts May 10, 1944, Col. 1979.
(3) The Analyst Vol. LV., 1930, p. 645.
(4) Chemical and Engineering News, November 25, 1943, p. 1918.