PHARMACOLOGICAL SCREENING OF SOME WEST INDIAN MEDICINAL PLANTS

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A systematic pharmacological examination has been made of 55 Jamaican plants, most of which have a local reputation as medicinals. A number of interesting, but no outstanding, activities were observed. The results are tabulated.

THE use of local plants for medicinal purposes is still widespread in the West Indies and in view of the revived interest in medicinal plants over the past few years we have undertaken a pharmacological examination of some West Indian medicinal plants. Asprey and Thornton (1953, 1954, 1955) have reviewed the use of some 200 botanically identified plants in folk-medicine in Jamaica and we have used their lists as a guide to our work.

In Jamaica the medicinal plants are used as beverages ("bush teas") prepared by steeping either the leaves or the whole plant in hot water and this method of preparation influenced our choice of extraction procedure.

This report covers the first fifty-five plants examined.

EXPERIMENTAL

Plant Extractions

Two extracts (A and B) were used in the pharmacological tests, an aqueous extract (A) and an aqueous extract from which high molecular weight material had been precipitated with ethanol (B).

Extract (A). Freshly collected, botanically identified plant material (500 g. leaves and succulent stems) was macerated in a Waring Blendor and boiled with water (2·5 litre) for 1 hr. The extract was filtered through calico and the procedure was repeated with the residue. The filtrates were combined and evaporated under reduced pressure to 500 ml.

Extract (B). Extract (A) (500 ml.) was diluted with ethanol (1,500 ml.) and left to stand for 3 hr. at 4°. The precipitate was removed by filtration or centrifuging and the filtrate was evaporated under reduced pressure to a volume of *ca.* 100 ml. This solution was diluted with distilled water (*ca.* 400 ml.) to give Extract (B) (500 ml.).

Pharmacological Testing

The following tests were applied routinely to the extracts.

Acute Toxicity

The extract was injected intraperitoneally into mice weighing 20–35 g. Two mice were used at each dose level. The minimum dose which killed both the animals within 24 hr. was used to give a measure of the toxicity.

Effect on Isolated Organ Preparations

Guinea-pig ileum. The terminal ileum was suspended in oxygenated Ringer's solution at room temperature (28–30°) in a 30 ml. bath and the extract was introduced to test for spasmogenic effect and also for inhibition of the spasm induced by acetylcholine, histamine and barium. Test for ganglionic-blocking activity was also performed by testing the inhibitory effect of the extract against contraction induced by nicotine on guinea-pig ileum.

Rat uterus. A segment of uterus from adult rat was suspended in a bath similar to that used in a guinea-pig ileum preparation and under similar conditions. The extract was introduced to test for spasmogenic effect and also for inhibition of the spasm induced by oxytocin and 5-HT.

Rat hind limb flow. Both the descending aorta and inferior vena cava of the rat were cannulated with polythene tubes. The tips of the tubes were fastened just above the femoral bifurcations of these vessels. The arterial side was perfused with oxygenated Ringer's solution containing 0·5–4·0 μg./ml. of noradrenaline. Fluid was collected from the venous side and the volume was recorded through a phototransistor drop recording assembly.

Rat diaphragm phrenic nerve. The electrically stimulated diaphragm-phrenic nerve preparation of the rat described by Bülbring (1946) was used. The extract was tested for its effect on the muscular contraction initiated by the electrical stimulation of the diaphragm both directly or via the nerve.

Rat stomach fundus. The preparation of the rat fundus for 5-HT assay as described by Vane (1957) was used. The extract was introduced to test for its 5-HT like activity.

Rabbit duodenum. A segment of rabbit duodenum was suspended in 30 ml. of tyrode solution gassed with 95 per cent oxygen and 5 per cent CO_2 at 37° and the extract was tested for the effect on the spontaneous pendulum movements and the tone of the duodenum.

Isolated rabbit heart. The Langendorff preparation of the isolated rabbit heart was perfused with Ringer's solution. The extract was tested for its effect on the rate, the amplitude, and the rhythm of the heart.

Dog respiration and blood pressure. The dog was anaesthetised with pentobarbitone sodium intravenously. The trachea was cannulated and connected to a respiratory tambour. The carotid artery was cannulated and connected to a mercury manometer. The effect of the extract on respiration and main arterial pressure were recorded. The extract for testing was injected intravenously through the femoral vein. The weight of the dogs varied from 8 to 16 kg.

RESULTS

The results are tabulated in Table I with the following exceptions. Since no significant effects were found with any of the extracts in the tests for the neuromuscular blocking action and the 5-HT like activity, the results of these two tests were not included in the Table. Only extracts 41B, 13A, 21A, 46A, 11A and 53B showed some ganglionic

TABLE I RESULTS OF INVESTIGATION

Plant No.	Plant: Family	Plant: Botanical name	Ext.	Mouse toxicity	G.P. ileum	Rat uterus	Rat limb flow	Rabbit heart	Rabbit duodenum	Dog B.P.
1	Acanthaceae	*Andrographis paniculata* Nees	A	++	O	O		O	− −	O
			B	+	O	O	+++	O	−	O
2	Agavaceae	*Agave angustifolia* Haworth	A	+	++	O		− − −	O	O
			B	+	++	O	− − −	− −	O	O
3	Amaranthaceae	*Achyranthes indica* Mill.	A	++	++	O		− −	O	O
			B	O	++	O	++	O	O	O
4	Annonaceae	*Annona muricata* L.	A	+	++++	++++		O	−	P
			B	O	++++	++++	++++	O	−	P
5	Apocynaceae	*Forsteronia floribunda* (Sw.) A.DC.	A	++	++++	++++		O	−	O
			B	++	++++	++++	− − − −	−	O	O
6	Araceae	*Dieffenbachia seguine* Schott	A	+	+++	++++		O	++	O
			B	O	+++	O	− −	O		O
7	Bignoniaceae	*Spathodea campanulata* Beauv.	A	+	O	O				O
			B	O	O	O	++			O
8	Boraginaceae	*Cordia globosa* (L.) H.B.K.	A	+++	− −	O		?	−	O
			B	++	− −	O	+++	O	+	O
9	Bromeliaceae	*Bromelia pinguin* L.	A	++	− −	O		−	+	O
			B	+	− −	O	++	?		O
10	Burseraceae	*Bursera simaruba* Sarg.	A	++	− −	O		−	O	O
			B	O	− −	O	++	O	+	O
11	Cactaceae	*Rhipsalis cassutha* Gaertn.	A	+	+++	O				O
			B	+	+++	O	− −			O
12	Commelinaceae	*Zebrina pendula* Schnizl	A	+	++	O		O		O
			B	O	++	O	++	O	O	O
13	Compositae	*Pluchea carolinensis* (Jacq.) (G. Don	A	++	++	O		O	O	O
			B	+	++	O	+++	O	O	O
14	Compositae	*Eupatorium odoratum* L.	A	O	++	O		O	−	O
			B	O	+	O	?			O
15	Convolvulaceae	*Cuscuta americana* L.	A	++	+++	O		− − −	+	O
			B	O	++	O	O			O
16	Crassulaceae	*Bryophyllum pinnatum* Kurz.	A	+	++++	O		− −	O	O
			B	+	++++	O	O	−		O
17	Cucurbitaceae	*Sechium edule* Sw.	A	O	++	O		+	O	O
			B	O	++	O	+++	O	O	O
18	Cucurbitaceae	*Cayaponia racemosa* Cogn.	A	O	+++	O		O	O	O
			B	O	+++	O	− − − −	O	O	O
19	Euphorbiaceae	*Euphorbia hirta* L.	A	+	O	O		−	O	O
			B	O	− −	O	+++	+		O
20	Euphorbiaceae	*Euphorbia hypercifolia* L.	A	+	++	O				O
			B	O	+++	O	++	− − −	+	O
21	Euphorbiaceae	*Euphorbia lasiocarpa* Klotzsch	A	++	O	O		?	O	O
			B	++	O	O	− −			O
22	Euphorbiaceae	*Croton linearis* Jacq.	A	+	+++	++++		−	O	O
			B	O	+++	++++	− − −		O	O
23	Gesneriaceae	*Rhytidophyllum tomentosum* Mart.	A	+	+++	O		O	+	O
			B	O	+++	O	++	O	O	O
24	Gramineae	*Digitaria decumbens* Stent	A	+	++	O		O	O	O
			B	O	++	O	++	O	O	O
25	Labiatae	*Hyptis suaveolens* Poit	A	+	+	O		O	O	O
			B	O	+	O	++	O	O	O
26	Labiatae	*Leonotis nepetaefolia* R.Br.	A	+	+++	O		O	O	O
			B	O	+++	O	++++	O	+	O
27	Lauraceae	*Persea americana* Mill.	A	++	+++	++++		O	O	O
			B	++	++	+++	+++	−	−	O
28	Papilionaceae	*Andira inermis* H.B.K.	A	O	+	O				O
			B	O	++	O	O	O	O	O

TABLE I—*continued*

Plant No.	Plant: Family	Plant: Botanical name	Ext.	Mouse toxicity	G.P. ileum	Rat uterus	Rat limb flow	Rabbit heart	Rabbit duodenum	Dog B.P.
29	Caesalpiniaceae	*Cassia occidentalis* L.	A	O	++	++		+	O	D
			B	O	+	++	-----	+	—	D
30	Mimosaceae	*Samanea saman* Merrill	A	+++++	O	— —		—	—	D
			B	+++	O	— —	++++		+	D
31	Caesalpiniaceae	*Tarmarindus indica* L.	A	O	—	O		— —	O	O
			B	O	— —	O	+++			O
32	Loranthaceae	*Oryctanthus occidentalis* Eichl	A	++	O	++				
			B	++	O	++	++			D
33	Loranthaceae	*Phoradendron rubrum* Griseb.	A	+++++	+	+++		O	O	D
			B	+++++	+	+++	----	O	O	D
34	Loranthaceae	*Phoradendron wattii* Kr. and Urb.	A	++	+++	— —		— —	—	P
			B	++	+++	— —	------	+++	—	P
35	Malvaceae	*Gossypium* Spp.	A	++	++++	++				
			B	+	++++	++	+++			
36	Meliaceae	*Cedrela odorata* L.	A	+++	O	O		O	O	
			B	+	O	O	+++	O	O	D
37	Menispermaceae	*Cissampelos pareira* L.	A	+	— — —	— —		+++	— — —	D
			B	+	— — —	— —	------			D
38	Moraceae	*Artocarpus incisa* L.	A	O	++	O				O
			B	O	++	O	++	O	O	O
39	Moraceae	*Cecropia peltata* L.	A	+++	+++	O		O	—	
			B	+	+++	O	?			
40	Palmae	*Cocos nucifera* L.	A	+++	++	O				D
			B	+	++	O	?			
41	Papaveraceae	*Argemone mexicana* L.	A	O	++	O		O	+	D
			B	O	++	O	+++	— —	+	D
42	Rhamnaceae	*Gouania lupuloides* Urb.	A	+	++	O				O
			B	O	++	O	++			P
43	Piperaceae	*Piper amalago* L.	A	+	----	O				P
			B	+	----	O	------			D
44	Piperaceae	*Piper auritum* H.B.K.	A	O	+	+++				
			B	O	+++	+++	++			D
45	Portulacaceae	*Portulaca oleracea* L.	A	+	+++	++++		+++	----	D
			B	O	+	+++	------	+++	----	D
46	Rubiaceae	*Morinda royoc* L.	A	O	++	O		O	—	O
			B	O	+++	O	?			
47	Rutaceae	*Zanthoxylum flavum* Vahl.	A	+	+++	O				
			B	O	+++	O	+++			D
48	Sapindaceae	*Serjania mexicana* Willd.	A	++	++	O				O
			B	+	++	O	?			
49	Simarubaceae	*Picraena excelsa* Lindl.	A	++	++	— —				
			B	O	++	O	++			
50	Simarubaceae	*Picramnia pentandra* Sw.	A	+	++	O				
			B	+	+	O	+++			
51	Solanaceae	*Solanum ficifolium* Ortega	A	O	++	O		O	O	D
			B	O	+++	O	O	— —	O	D
52	Turneraceae	*Turnera ulmifolia* L.	A	O	+	O				
			B	O	++	O	++			
53	Verbenaceae	*Stachytarpheta jamaicensis* Vahl.	A	+++	+++	O		O	O	O
			B	+++	++	O	----	+	O	O
54	Verbenaceae	*Stachytarpheta mutabilis* Vahl.	A	+++	+++	O		O	O	O
			B	+++	++	O	----	+	O	O
55	Zygophyllaceae	*Tribulus cistoides* L.	A	+	++	O		----	+	D
			B	+	++	O	— —			D

blocking activity on the guinea-pig ileum. These results also were not included in the Table.

Expression of results. Since the activity observed was obtained from various dose levels rather than from a definite dose, the Table was compiled in a semi-quantitative manner by using pluses and minuses to indicate their relative activity. This system of expression also facilitates the reading of a lengthy tabulation.

Acute toxicity. The minimum dose (volume of extract per animal) required to kill all the animals was used as the toxic dose level. The relative toxicity of the extracts is expressed as follows:

$+ = 1{\cdot}0$ ml., $++ = 0{\cdot}5$ ml., $+++ = 0{\cdot}1$ ml., $++++ = 0{\cdot}05$ ml., and $+++++ = 0{\cdot}001$ ml.

Isolated organ preparation. The activity was expressed as the dose level (volume of extract per preparation) required to stimulate (plus) the spontaneous activities or to induce activities on a quiescent preparation by the extract, or to inhibit (minus) the spontaneous activities or to inhibit drug-induced activities of the preparation by the extract. In the case of rat hind limb flow, plus indicated the increase and minus indicated the decrease of the volume flow. The relative activity of the extracts is expressed as follows: 1·0 ml. (+), (−); 0·1 ml. (++), (−−); 0·01 ml. (+++), (−−−); 0·001 ml. (++++), (−−−−); 0·0001 ml. (+++++), (−−−−−).

Dog respiration and blood pressure. It is difficult to express the blood pressure response quantitatively without detail. It was decided that the effect of the extract on the blood pressure should be expressed simply as pressor (P) or depressor (D) when the extract (0·1 ml. or less of plant extract per kg. body wt.) gave a definite response. No significant effect on respiration was found with the extracts, and the results were not included in the Table.

Discussion and Conclusion

A pharmacological examination of 55 medicinal plants of Jamaica has been made. Although no outstanding pharmacological activity was observed, a number of plants did show interesting results, but it is too early to say whether the plants which have a local reputation as medicinals do show significantly different pharmacological properties as a group from plants without such a reputation. Guided by these results some plants have been selected for detailed chemical and pharmacological studies. In the following paper we present the isolation and identification of substances which have been responsible for the cardiovascular activities observed in some of the plants. Preliminary reports on the pharmacological activities of the crude alkaloids from the bark of No. 30 (Leonard, 1961) and the identification of (−)-noradrenaline in No. 45 (Feng, 1961) have been presented elsewhere. Further work on the isolation of substances of chemical or pharmacological interest, or both, is in progress.

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